SYLVANIA NEWS

TECHNICAL SECTION

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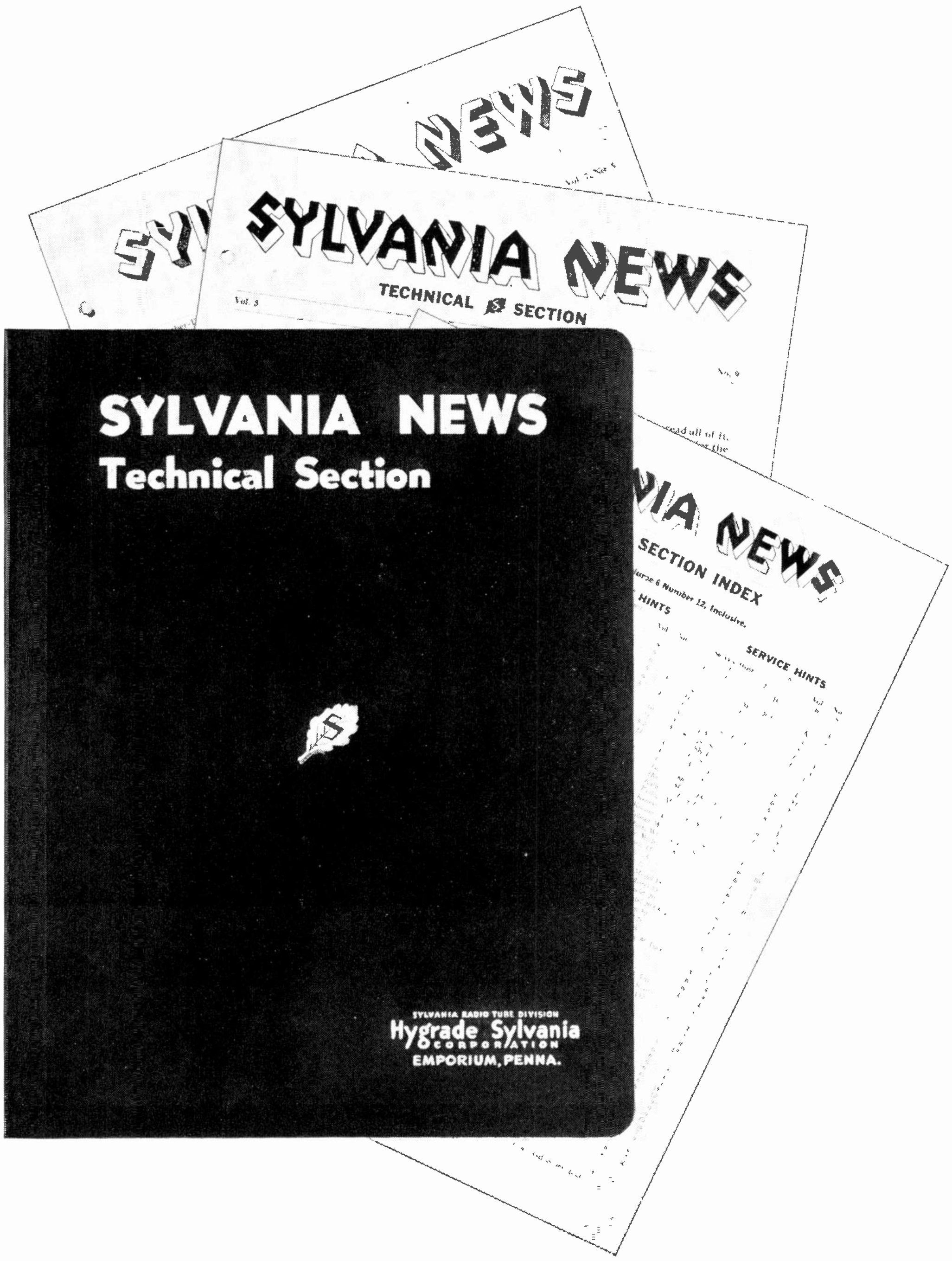
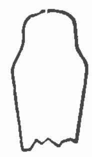
BACK TECHNICAL SECTIONS



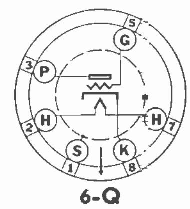
Due to many inquiries from new readers of Sylvania News about back issues of the Technical Section, we repeat the offer made some months ago.

All back issues of the Technical Section to date, in a sturdy loose leaf binder which will accommodate a large number of future issues, is available for fifty cents. Orders should be addressed to the Advertising Department, Hygrade Sylvania Corporation, Emporium, Pa.

NEW TUBES



Type 6AC5G Power Amplifier

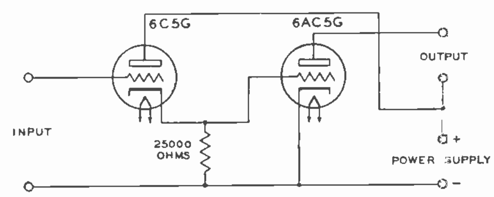


Type 6AC5G is a Class A power amplifier triode which may be used for a positive grid potential operation and which may employ a tube of the 6C5G type as a driver.

Although the positive grid characteristics of this new tube makes it applicable in Class B circuits, the tube was designed to give optimum performance in a Class A dynamic coupled circuit as shown below.

The 25,000 ohm resistor shown in the circuit is to prevent a current surge while the 6AC5G is warming up. The total resistance in the grid circuit of the type 6C5G should not exceed 1.0 megohm.

The sale of this new tube does not carry any implied license under patents covering special coupling circuits, and Hygrade Sylvania Corporation assumes no liability for use of this tube in unlicensed circuits.



Characteristics

Heater Voltage A-C or D-C	6.3 Volts
Heater Current	0.4 Ampere
Maximum Over-all Length	4¼ Inches
Maximum Diameter	1 9/16 Inches
Bulb	ST-12
Base	Small G Type Octal No. 6-Q

Operating Conditions and Characteristics

CLASS A AMPLIFIER

Heater Voltage	6.3 Volts
Plate Voltage	250 Volts Max.
Grid Voltage	+13 Volts
Plate Current	32 Ma.
Grid Current	5 Ma.
Plate Resistance	36,700 Ohms
Mutual Conductance	3,400 μmhos
Amplification Factor	125

CLASS A DYNAMIC-COUPLED POWER AMPLIFIER WITH TYPE 6C5G AS DRIVER

Heater Voltage	6.3 Volts
Plate Supply Voltage	250 Volts Max.
Grid Voltage*	* Volts
Plate Dissipation	10 Watts Max.
Plate Current	32 Ma.
Plate Current of Driver	5.5 Ma.
Input Signal to Driver	16.5 Volts RMS
Load Resistance	7000 Ohms
Total Harmonic Distortion	10 Per Cent
Power Output**	3.7 Watts

CLASS B POWER AMPLIFIER

Plate Voltage	250 Volts Max.
Peak Plate Current Per Tube	110 Ma. Max.
Plate Dissipation	10 Watts Max.
Typical Operation—Two Type 6AC5G Tubes:	
Heater Voltage	6.3 Volts Max.
Plate Voltage	250 Volts Max.
Grid Voltage	0 Volts
Peak Input Signal (Grid to Grid)	70 Volts
D-C Plate Current (Zero Signal)	5 Ma.
Load Resistance (Plate to Plate)	10,000 Ohms
Power Output#	8 Watts Approx.

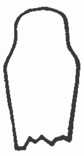
*—Bias voltage for both the 6AC5G and the driver is

Continued on Page Two

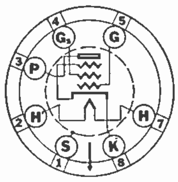
NEW TUBES

Continued from Page One

developed automatically by the dynamic-coupled connection shown in the circuit above.
**—It is possible to obtain a power output of 4.3 watts if the driver is operated up to the point of grid current flow. Under these conditions the distortion is approximately 16 per cent.
#—With peak input of 950 milliwatts grid to grid.



Type 6G6G Power Amplifier



7-S

Type 6G6G is a power amplifier pentode with a 150 milliampere heater. It is intended to be used in power output stages where maximum efficiency is desirable and high power output is not required. This type is not recommended for automotive service.

Transformer or impedance coupling methods are recommended. If resistance coupling is used, the d-c grid resistance should be limited to 0.5 megohm for both self-bias and fixed-bias operation under the 135 plate voltage condition. For the 180 plate voltage condition the d-c grid resistance should not be more than 0.5 megohm for self-biased operation and 0.05 megohm with fixed-bias.

The heater voltage should never exceed the rated value by more than 10 per cent, and the voltage between heater and cathode should be as low as possible if direct connection is not made.

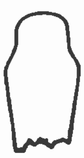
Characteristics

Heater Voltage A-C or D-C	6.3 Volts
Heater Current	0.15 Ampere
Maximum Over-all Length	4¼ Inches
Maximum Diameter	1 9/16 Inches
Bulb	ST-12
Base	Small G Type Octal No. 7-S

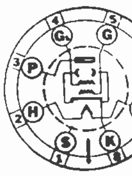
Operating Conditions and Characteristics

ONE TUBE—CLASS A

Heater Voltage	6.3	6.3 Volts
Plate Voltage	135	180 Volts Max.
Screen Voltage	135	180 Volts Max.
Grid Voltage	−6.0	−9.0 Volts
Plate Current	11.5	15.0 Ma.
Screen Current	2.0	2.5 Ma.
Plate Resistance	170,000	175,000 Ohms
Mutual Conductance	2,100	2,300 μmhos
Amplification Factor	360	400
Load Resistance	12,000	10,000 Ohms
Self-Bias Resistor	440	510 Ohms
Power Output	0.6	1.1 Watts
Total Harmonic Distortion	7.5	10 Per Cent



Type 6Y6G Power Amplifier



7-AC

Type 6Y6G is a new power amplifier tube embodying the same general principles of design as those incorporated in types 6L6G and 6V6G. It is intended primarily for use in a-c operated receivers where economy in B-supply is essential since the maximum operating voltage for the plate and screen is 135 volts.

Characteristics

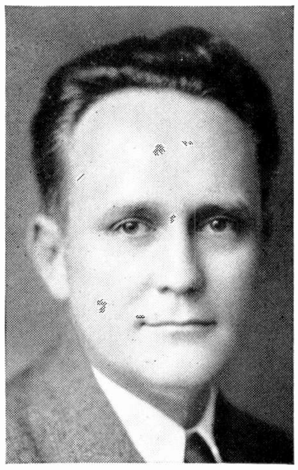
Heater Voltage A-C or D-C	6.3 Volts
Heater Current	1.25 Ampere
Maximum Over-all Length	4 21/32 Inches
Maximum Diameter	1 13/16 Inches
Bulb	ST-14
Base	Medium G Type Octal No. 7-AC

Operating Conditions and Characteristics

CLASS A AMPLIFIER

Heater Voltage	6.3 Volts
Plate Voltage	135 Volts
Screen Voltage	135 Volts
Grid Voltage	−13.5 Volts
Plate Current (zero signal)	58 Ma.
Plate Current (maximum signal)	60 Ma.
Screen Current (zero signal)	3 Ma.
Mutual Conductance	7000 μmhos
Load Resistance	2000 Ohms
Power Output	3.6 Watts
Second Harmonic Distortion	2.5 Per Cent
Third Harmonic Distortion	9 Per Cent

A CHAT WITH ROGER WISE



Chief Tube Engineer
Hygrade Sylvania Corporation

The present business recession so noticeable in the radio industry has made it possible for us to increase our engineering efforts along the lines of quality improvement. With the experience of a very busy year behind us we are preparing for a prompt renewal of production activities on an increased scale by analyzing reports of performance of tubes in the more complex circuits being incorporated in present-day receivers, making sure that any refinements necessary in materials or processing are incorporated. In some cases life test conditions are being increased in their severity and data obtained on the improvements necessary to assure fully satisfactory life under those more severe conditions.

While 1937 was a very successful year from the standpoint of freedom from field complaints on Sylvania tubes, this showing has not influenced our Management to ask for curtailment of quality checking or reduction in our efforts to maintain Sylvania quality at the highest industry standard.

THE VACUUM TUBE VOLTMETER AS A SERVICE TOOL

In the last issue of the Sylvania News Technical Section, you learned that the vacuum tube voltmeter when properly used is one of the most valuable and versatile measuring instruments available. The instrument has very little value, however, if the serviceman does not know how to apply it and "weigh" its readings. This fact accounts for the limited number of vacuum tube voltmeters in use for radio service work. There has not been sufficient information published on this instrument to demonstrate to the serviceman its true value, or to show him how to employ it to advantage in service work. This series of articles is intended to supply that information. The diode, or two element type of V.T.V.M. was discussed last month. The following article covers many of the more important basic types of triode vacuum tube voltmeters, and discusses their advantages and disadvantages.

PART II

The Grid Rectifying Triode V.T.V.M.

One of the most sensitive triode types of V.T.V.M. is the grid leak detector type shown in figure 2A. This type of detector was very popular before the introduction of the power detector and the more recent diode detector. It may be considered a combination diode detector followed by a d-c amplifier. When an a-c signal is applied to the grid, rectification takes place during the positive half cycle, and the rectified grid current flowing through the grid leak biases the grid negative. This negative grid bias reduces the plate current and a milliammeter in the plate circuit may be calibrated to read the a-c voltage appearing on the grid. It is one of the most sensitive types of V.T.V.M. besides having the advantage that the meter in the plate circuit reads maximum with no signal applied, and therefore the meter cannot be damaged by the application to the grid of too large an a-c signal. The grid leak may be made very large (on the order of 5 to 10 megohms) so that the loading on the circuit under test will be small. A further advantage derived from the use of a high resistance grid leak is that the grid condenser may be smaller in capacity and therefore also smaller physically. This type of V.T.V.M. is usually equipped with a single pole double throw switch so that the grid leak may be used in parallel with the grid condenser for measuring d-c voltages, or between grid and ground for a-c measurements. When the grid leak is connected from grid to ground, the condenser will block d-c voltages and permit only a-c voltages to reach the grid. The main disadvantages of this type are that it does load the circuit under test somewhat; it has to a small extent frequency discrimination (due to the use of R and C in the input circuit); and it has a rather limited voltage range unless a voltage divider circuit is used ahead of it, and this of course introduces further undesirable features both mechanically and electrically.

The condenser Cp shown in the plate circuit of all triode type vacuum tube voltmeters is very necessary for two reasons. First, it reduces the effective capacity reflected back into the circuit across which the vacuum tube voltmeter is being used; and, second, it prevents the reactance of the meter from introducing frequency discrimination.

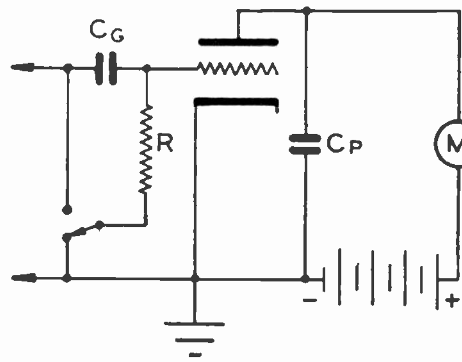


FIG. 2A

THE SLIDE-BACK TYPE V.T.V.M.

The slide-back V.T.V.M. circuit has long been a favorite in radio laboratory and radio service work because it is self-calibrating and does not impose an added load on the circuit under test. The circuit shown in figure 2B is one of the many variations possible with this type. This particular circuit employs only one meter to read plate current and slide-back voltage. In operation the input circuit is first short circuited and with the meter switch thrown to the "B" position the slide back potentiometer is adjusted to give some convenient plate current value such as 1 ma. The meter switch is then thrown to the "A" position and the grid bias voltage is measured. The a-c voltage to be measured is now applied across the test prods and with the switch in "B" position the potentiometer is adjusted until the meter again reads 1 ma. The switch is then thrown to the "A" position and the new bias voltage read. The difference between the first and second bias voltages is the value of peak a-c voltage across the test prods. Resistor Rm is the meter multiplier resistance. Complete details on a somewhat different type of slide-back V.T.V.M. was published in Sylvania News Volume 5, numbers 9, 10 and 11 by Walter R. Jones.

In general the slide back V.T.V.M. may be considered the best of those types that do not require calibration. Its major disadvantage is that a relatively large slide-back voltage must be

THE VACUUM TUBE VOLTMETER AS A SERVICE TOOL

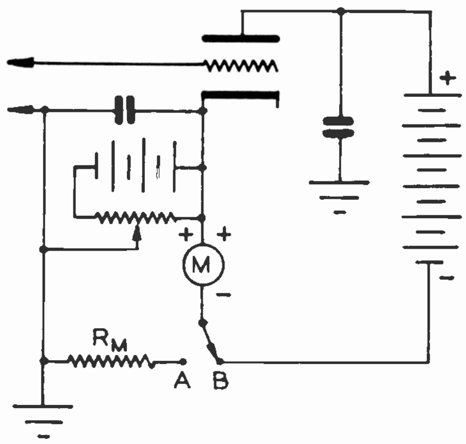


FIG. 2B

provided if the instrument is to be used for radio service work, and this requires an additional switching system to insert different values of meter multiplier resistors in the circuit if good meter accuracy is to be realized. A-C and d-c voltages between .25 and 15 volts may be measured with the circuit shown in figure 2B with good accuracy.

The plate current variation for a given input voltage on the grid is proportional to the mutual conductance of the tube type used. In choosing the tube type for this purpose other factors such as shielding, input capacity, plate to grid capacity and position of the grid lead must be considered. Electrical and mechanical factors lead to the conclusion that a metal tube such as a type 6F5, 6Q7 or 6R7 with a grid connection on the top is the best type available. Screen grid types such as the 6J7, 6K7 and 6B8 may also be used as triodes by connecting plate, screen and suppressor grids together.

THE REFLEX TYPE V.T.V.M.

The circuit shown in figure 2C will be more familiar to servicemen as the power detector in which connection it was used very extensively as a detector for t-r-f sets and as a second detector for early model super-heterodyne receivers between 1927 and 1931. It is called a "Reflex type V.T.V.M." because the plate current is made to return to the cathode through a resistor which is common to both the grid and plate circuits. The effect of this resistor is to increase the bias with an increase in plate current. As a consequence the instrument as a V.T.V.M. or as a second detector can handle a larger signal without overloading or drawing grid current. This is valuable in a V.T.V.M. because it gives the instrument a greater voltage range without recourse to the use of voltage divider resistors. If the proper type of tube is used it will add very little capacity and no resistance load to the circuit under test. The cathode resistor and the plate must be well by-passed to ground with paper or mica condensers large enough to have very small reactance at the lowest frequency to be measured—usually 30 cycles per second.

The reflex type V.T.V.M. circuit shown in figure 2D has provision in the plate circuit to reduce the no signal plate current to zero. This permits the use of a more sensitive meter and

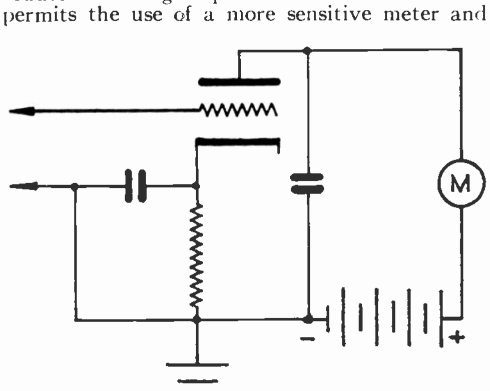


FIG. 2C

makes it possible to read smaller plate current changes, which means that smaller voltages may be measured with the instrument. With a 0-200 microammeter in the plate circuit, a-c voltage as low as 0.1 volt applied to the grid will produce a 1 to 5 microampere plate current change—depending upon the type of tube used. The plate current change with applied a-c grid voltage is not uniform over the entire meter range, so consequently this type of V.T.V.M. must be calibrated. It has so many other advantages, however, that it is probably the most popular type of V.T.V.M. circuit in use today. A large number of circuit variations are possible with this basic type and in next month's Sylvania News complete data will be given on a low cost modification of this type that is easy to build and very well suited for general service work.

The three types of V.T.V.M. circuits mentioned so far (the Grid rectifying, Slide-back and Reflex) are the most important basic ones using

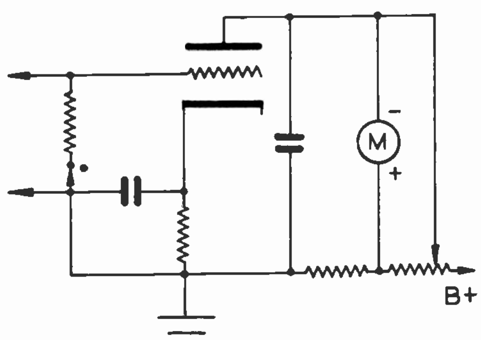


FIG. 2D

a triode type of tube. There are three other types, however, which we will include here because they are interesting from a circuit standpoint and very useful for special applications.

INVERTED TRIODE TYPE V.T.V.M.

As the name implies, the inverted type V.T.V.M. employs the plate of the triode as the control element and the grid is used as the electron accumulating element. The instrument employs a low drain filament type tube with a 0-200 or 0-500 microammeter. A small positive potential is applied to the grid as shown in figure 2E, and the rheostat is adjusted to give a zero signal grid current of 200 or 300 microamperes. This also adjusts the filament voltage to the correct value. If an unknown d-c voltage is now applied to the plate with the plate connected to

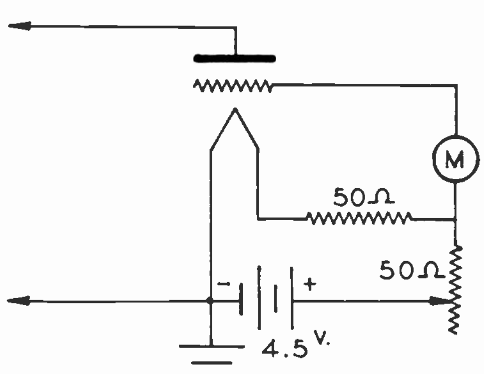


FIG. 2E

the negative terminal of the unknown voltage source, this negative potential will prevent some of the electrons from reaching the grid and will thus reduce the grid current. The use of a series condenser and high resistance leak from plate to ground will also permit this type of V.T.V.M. to be used for measuring a-c voltages.

The necessity of using a sensitive meter in the grid circuit of his type of instrument

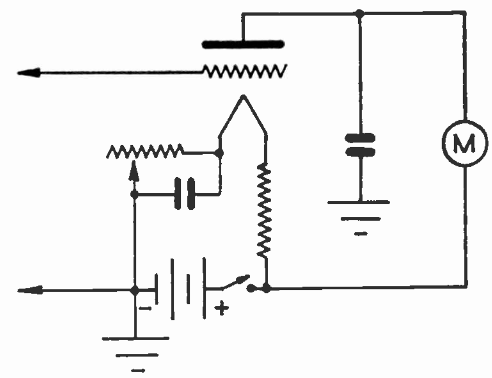


FIG. 2F

is a serious disadvantage for service work. It must of course be calibrated before it can be used.

THE MOULLIN TYPE V.T.V.M.

One of the earliest types of V.T.V.M. to become popular was the Moullin type, the circuit of which is shown in figure 2F. It was for some time the standard for laboratory use and the term "Moullin Voltmeter" was used to indicate vacuum tube voltmeters in general. Although it requires too sensitive a meter to be useful for general radio service work, it has the advantages common to the inverted type of V.T.V.M.—i.e., adjusting the meter to zero with the rheostat automatically adjusting both the filament and plate voltages to the correct value. The response of the plate current meter to applied grid voltages is linear for most of the scale, but the effect of the tube's space charge introduces non-linearity at the low voltage end that makes it necessary to calibrate the instrument. The effective plate voltage is usually on the order of one or two volts, so that the voltage range of the V.T.V.M. is rather limited.

INFINITE IMPEDANCE DIODE V.T.V.M.

The infinite impedance diode V.T.V.M. shown in figure 2G is really another version of the reflex type or power detector circuit. The main difference between the reflex type and the infinite impedance diode is that the by-pass condenser is eliminated from the cathode. This permits a large degree of degeneration since the cathode resistor is really the plate load, and being common to both plate and grid circuits permits the tube to handle very large input signals without overloading. This advantage is secured by sacrificing some of the low voltage sensitivity of the instrument, however. Another disadvantage is the fact that there exists a-c currents in the cathode circuit, (these are eliminated by the by-pass condenser in the reflex type V.T.V.M.) that makes it very difficult, if not impossible, to use the tube on the end of a cable so that the tube may be used with very short leads for high frequency work. This fact must be kept in mind if the V.T.V.M. is to be useful for television work.

In next month's issue of Sylvania News Technical Section, complete construction data will be given for a reflex type V.T.V.M. that may be built very economically, requires no meter, has a voltage range of from 0.1 to 200 volts a.c. or d.c., and which may be calibrated on 60 cycle voltages and will be accurate on frequencies above 60 megacycles.

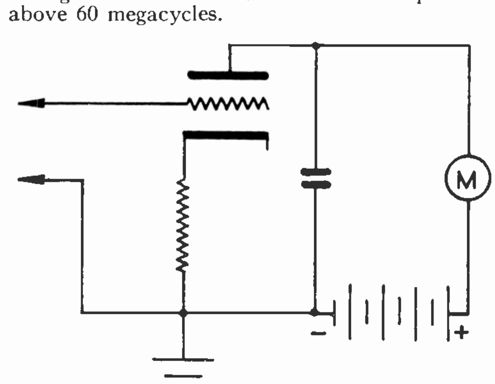


FIG. 2G

THE SERVICE EXCHANGE

THE information presented in the Sylvania Service Exchange is contributed by servicemen as the result of practical experience. It is very carefully considered before being accepted, and we believe it to be correct and authentic. However, we assume no responsibility with respect to results. Each hint accepted entitles the writer to his choice of one Sylvania receiving tube. Please indicate preference when submitting hints. Don't send routine or generally known information. Please specify tube choice.

Airline Models 62-103, 62-105. I have serviced 20 or 30 radios of these models in the past two years, and in practically every case the trouble is the same. There is no screen voltage on the 6D6's and the 6C6's. The cause is an open in the screen voltage-dropping resistor. This is a tapped unit, mounted on the rear panel of the sub-base. Referring to Rider's manual No. 4, this is R-13. Replace with a 17,500 ohm 10 watt unit. The trouble indicates a shorted screen by-pass condenser, .25 mfd., C-3 in Rider's manual, but I have never yet found one of them that was shorted. I believe that the defect is in too low current-carrying capacity of R-13. However, I always replace C-3 to be sure that I won't have a return call.—Spencer Ohlin, Richfield, Utah.

* * *

Airline Model 62-254. This is a four tube battery-operated set. It uses a permanent magnet type speaker with three leads, two of them hot. From the pin-type jacks on the terminal strip of the speaker, the two hot leads go around the speaker frame to the high-impedance dual coils of the speaker. These wires are not particularly well insulated, and I have found several of these sets with one or both of these leads shorting the speaker frame. The trouble generally shows up as intermittent operation. If not corrected, the "B" batteries may discharge rapidly during the periods of non-operation, when the set is turned on. I recommend unsoldering the leads and slipping spaghetti tubing over them. Secure the leads in place with a little speaker cement or they may work loose and interfere with the speaker armature.—Spencer Ohlin, Richfield, Utah.

* * *

American Bosch (All 1937 Models). A very common trouble with these sets is broken voice-coil leads. The wire with which the voice-coil is wound is simply cemented to the cone at the point of its emergence from the coil, a length of insulation slipped over it, and then led up about 4 or 5 inches to the output transformer terminals. The wire is not flexible enough, and eventually breaks inside the tubing, causing non-operation. The trouble is simple but if not properly corrected will soon reoccur. To correct remove the cone from the speaker, using thinner to loosen the rim, then cement to the cone, new leads of special flexible voice-coil lead wires. Replace and recenter the cone.—Spencer Ohlin, Richfield, Utah.

* * *

Clarion 160 Series. Intermittent reception. If this set plays very well for about 20 minutes, then cuts off the trouble may be found in the .00005 mfd. mica condenser in the grid of the 27 oscillator tube. Replace with a new condenser.—Charles Ertz, Jr., Burlington, Iowa.

* * *

Emerson Model H-5. Bad hum when the condensers and tubes check perfect, may be due to the following. If the line ballast is the type where the resistance element is clamped in a metal holder with asbestos as an insulator between the two, place the set in operation and check for a-c leakage from any tap on the ballast to chassis. If an indication is present insulate the ballast from the chassis or replace same.—A. H. Urbansky, Newark, N. J.

* * *

Fada Model 66 KY. Distortion: See that the blocking condenser or coupling condenser between the first audio and the output is not leaking. Squeals when tuning.—Look for open bias condenser 3-1271MS located on one end of the chassis.—Wm. J. Yahnke, Albion, N. Y.

* * *

Fairbanks Morse Battery Set 42. If you are having trouble keeping "B" and "C" batteries on this receiver, trace out and remove entirely from the set, the 20,000 ohm ¼ watt resistor that goes from minus 16½ volts C direct to ground. We have done this on several of these sets and have noticed no drop in the performance of the set, but have increased our battery life more than 100% in most cases.

Explanation: The switch in this set is on the negative lead, A, B and C plus and as this resistor is from C minus 16½ volts to ground, there is a direct lead from "B" through to the "C" battery through the 20,000 ohm resistor to ground even though the switch is open, and as the "B" minus circuit is returned to ground through a filter condenser and a high resistance resistor circuit, the circuit is therefore complete enough to allow from 1 Ma. to 2½ Ma. of "B" and "C" current to drain at all times which will shorten the life of the "B" and "C" batteries considerably. Before we started to remove this resistor our batteries were only lasting a few days for the Eveready No. 772, to a few weeks for the Eveready No. 486's. We now actually get months of operation from the No. 772 "B" batteries.—O. M. Haire, Hagerstown, Md.

* * *

G. E. Pilot Light Failures. A cure for pilot lights burning out in 1937 G. E. with colorama lights is the placing of a 150 ohm resistor in the center tap of the high voltage winding. Also a 15 ohm resistor should be used with the colored lamps. This will offset high line voltages.—Alvin Morgan, Somerset, Ky.

* * *

Neon Interference. On a set which I repaired and installed in a local business place, I noticed a constant buzz on all stations. The owner told me they were always troubled with the noise and that others in the neighborhood had also complained of it. Two neon signs in the windows were operating at the time. Turning off each sign separately, the noise was localized to one sign. As most servicemen know, there is a third wire coming out of the line cord to the neon transformer. This wire extends only a few inches beyond the plug and is supposed to be grounded. Grounding is usually effected by connecting it to the fixture into which the cord is plugged. In the case in question this had been done. The wire was connected to the metal ring on the fixture from which the globe was hung, but in this case the fixture was porcelain, so the ring was thoroughly insulated. An additional length of wire was soldered to the neon grounding wire and a solid contact was made on the BX cable. This cured the interference much to the pleasure of the set owner and to the great satisfaction of people in the neighborhood.—Charles Pieper, Oceanside, L. I., N. Y.

* * *

Noise Elimination. This does not apply to any radio receiver but because it causes considerable interference on radios it may be of interest. The complaint of internittently noisy reception on several receivers in the business district was traced to the compressor unit of a Monarch refrigerator. A careful examination showed the unit to be in good condition. The trouble was found to be in the V type belt used to drive the compressor. When the pulleys were clean no noise could be heard in the receivers. As soon as the pulleys became dirty the noise appeared. This was cured by replacing the V-belt, which was found to be full of small cracks.—Walter R. Whitcomb, Waupun, Wis.

* * *

Philco Model CT-11. The receivers under this model number have one common trouble, that of a roar drowning out all signals. When the covers are removed to check the receiver the noise disappears. Look over the covers and you will find a paper sheet pasted on the under side. If any part of this is unglued so that it can come in contact with the parts in the set it will cause this trouble. Reglue the paper and the trouble will be over.—Walter R. Whitcomb, Waupun, Wisconsin.

* * *

Radiola Model R-82. The volume on this receiver could not be controlled below a certain point, even with the aid of the local-distance switch. The volume control and its shunt resistor (4000 and 6000 ohms, respectively) checked OK. The trouble was found to be in a 1 watt resistor supposedly 18,000 ohms, that was open. This resistor is the one on the extreme left end of the resistor-mounting strip on the rear of the chassis. Replacing this part with one of proper value restored the volume control action to normal, and the set played fairly well, but after realigning all circuits, oscillation was encountered on the high frequency end of the dial. The trouble was found to be in improper placement of the group of wires extending from the rear to the front of the chassis, underneath and about the center of the set. This group includes those leads going to the volume control. They had apparently been pulled up and apart and I found that unless they are grouped and tied close to the metal sub-panel, this set will oscillate when adjusted to maximum sensitivity.—Spencer Ohlin, Richfield, Utah.

* * *

RCA Victor Models (1938—Electric Tuning). Skipping of the electric tuning mechanism is usually traced to the knobs being pushed on too far. Cure:—remove both tuning knobs and place felt washers between the large knob and the cabinet and between the knobs. Stopping at one end is eliminated by loosening the two hex-nuts holding the motor-reversing switch on the back of the condenser gang and moving it down a little in the slots provided and re-tightening the nuts. Most servicemen do not realize this adjustment is present. Sputtering in tuning electrically on early models—take very fine sand-paper and brush off the tuning adjustment disc in the rear of the set then apply a little Nujol oil on a cloth to them. The noise is caused by arching as the discs turn.—Leo Zimmer, Canisteo, N. Y.

* * *

Stewart Warner 900 Series. Intermittent fading in this model is usually caused by the .25 mfd. r-f cathode bypass condenser. This condenser is in a can with the other bypasses and has a green lead. Replace with a new condenser.—Charles Ertz, Jr., Burlington, Iowa.

* * *

Stromberg Carlson Model 33. This receiver may become noisy after it has been in use over a year. The first time I repaired one of these receivers I had considerable difficulty in tracing the noise to the guilty component. All the tube elements were receiving their correct voltages and the tubes were new. Finally tracing the noise stage by stage from the first tube of the receiver I located the trouble in the plate circuit of the final intermediate frequency stage. Examination showed that while plate current flowed continuously through the plate circuit winding of the last i-f transformer the noise was present. Electrolysis had caused this trouble in the transformer even though the plate received the proper voltage.—Walter R. Whitcomb, Waupun, Wis.

* * *

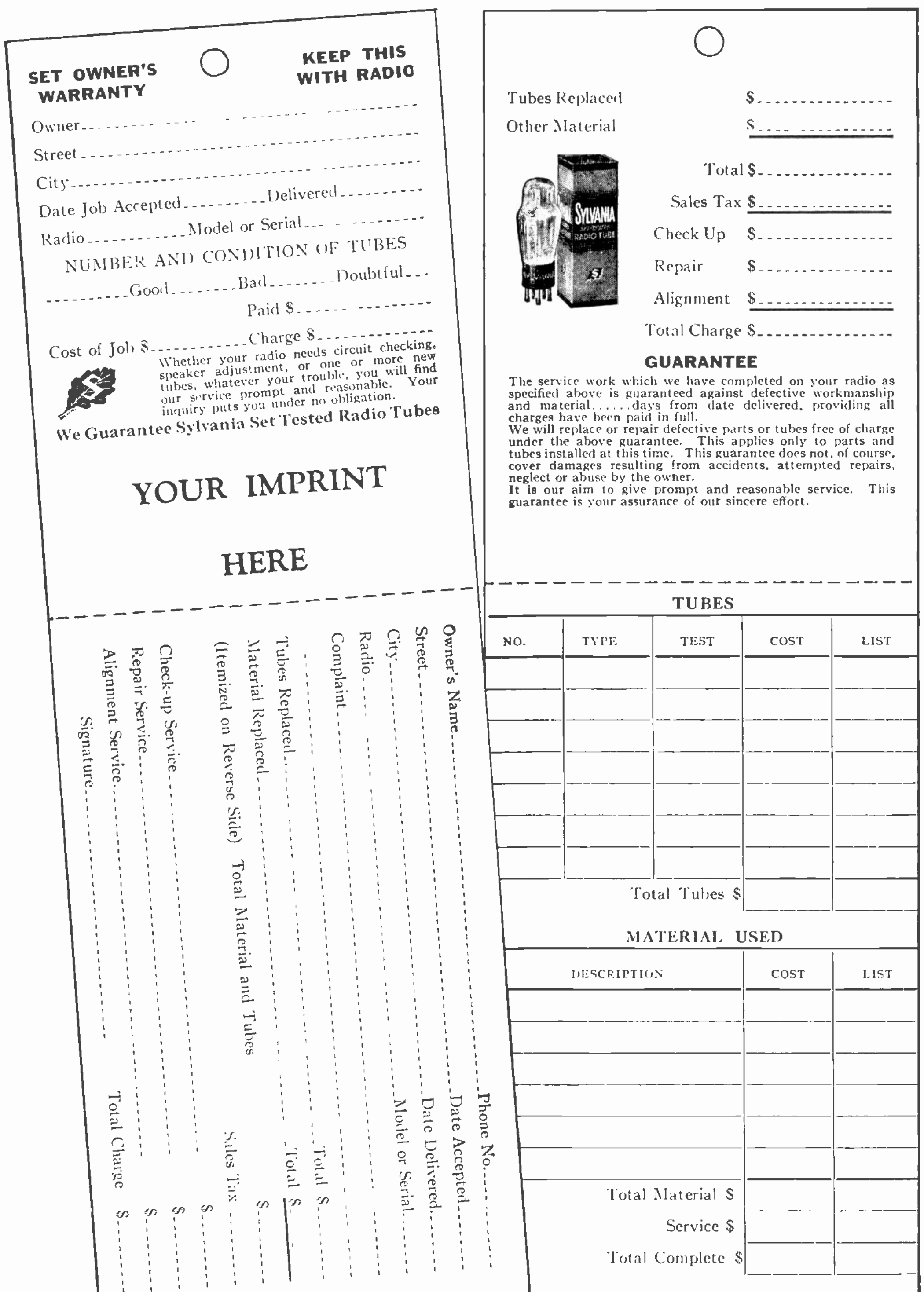
Bill Wants Advice. Wm. O. Sullivan, 130 S. Main St., S. Norwalk Conn. requests help from brother servicemen on an odd predicament. Says Bill: "I have seen some dirty radios, but they could always be cleaned. Yesterday a customer brought in a set that is full of cockroaches. The coils are full of dead ones and they are also packed in the volume control and stuck all over the set. I would like to know if any of the readers of Sylvania News can tell me how to clean them out. I would like information on this as soon as possible."

SYLVANIA NEWS

TECHNICAL SECTION

February-March, 1938 | EMPORIUM, PENNA. | Vol. 7, No. 7

REVISED JOB RECORD CARD



SET OWNER'S WARRANTY — KEEP THIS WITH RADIO

Owner

Street

City

Date Job Accepted ... Delivered

Radio ... Model or Serial

NUMBER AND CONDITION OF TUBES

... Good ... Bad ... Doubtful

Paid $

Cost of Job $ ... Charge $

Whether your radio needs circuit checking, speaker adjustment, or one or more new tubes, whatever your trouble, you will find our service prompt and reasonable. Your inquiry puts you under no obligation.

We Guarantee Sylvania Set Tested Radio Tubes

YOUR IMPRINT HERE

Owner's Name ... Phone No.

Street ... Date Accepted

City ... Date Delivered

Radio ... Model or Serial

Complaint ... Total $

Tubes Replaced ... Total $

Material Replaced ... Sales Tax $

(Itemized on Reverse Side) Total Material and Tubes $

Check-up Service $

Repair Service $

Alignment Service $

Signature ... Total Charge $

Tubes Replaced $

Other Material $

Total $

Sales Tax $

Check Up $

Repair $

Alignment $

Total Charge $

GUARANTEE

The service work which we have completed on your radio as specified above is guaranteed against defective workmanship and material......days from date delivered, providing all charges have been paid in full.

We will replace or repair defective parts or tubes free of charge under the above guarantee. This applies only to parts and tubes installed at this time. This guarantee does not, of course, cover damages resulting from accidents, attempted repairs, neglect or abuse by the owner.

It is our aim to give prompt and reasonable service. This guarantee is your assurance of our sincere effort.

TUBES

NO.	TYPE	TEST	COST	LIST
		Total Tubes $		

MATERIAL USED

DESCRIPTION	COST	LIST
Total Material $		
Service $		
Total Complete $		

The Last Word in Efficiency

It is always possible to make a good thing better, and suggestions from many servicemen have been used in making a revision of the Sylvania Job Record Card. Radio servicemen are business men, and every serviceman who has used the Job Record Cards is enthusiastic in praise of this simplified efficient method of keeping his record of every job.

The top part of the card, which is detached and left with the customer, has space for imprinting name, address and phone number. It also gives the set owner all the information on the work done, the cost, the date, and the condition of the tubes. Note also the guarantee, which is liberal enough to give the customer confidence in the serviceman's ability, but makes no unreasonable offer of repairs or replacements due to the owner's negligence.

The lower part of the card, which the serviceman keeps, fits any standard 3x5 inch file. The Sylvania Card Index File (see Technical Section Vol. 7, No. 2,) is made to order for the purpose.

Sylvania Job Record Cards may be ordered through your Sylvania jobber, or direct from Hygrade Sylvania Corporation, Emporium, Pa.

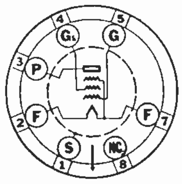
Price, plain or with imprint: 100—$1.00; 250—$1.75; 500—$3.00. If imprint is desired, please print information plainly.

Ask for Your Revised Technical Section Index

Owners of binders and back files of the Technical Section may obtain a revised index, listing all material from Vol. 5, No. 9 to Vol. 7 No. 7. It will be supplied free on request to Hygrade Sylvania Corporation, Emporium, Pa., and will be included in all binder files ordered after this date. Binder with all back issues .50¢

NEW TUBES

Type 1J6G Power Amplifier



6-X

Type 1J5G is a power output tube designed for use in battery operated receivers. The elements are enclosed in an ST-14 bulb and are connected to an octal type base. The characteristics are identical with those of type 950, used in some of last season's receivers. Since type 950 is not included in the Sylvania line, this new type 1J5G can be used as a replacement for type 950 provided an octal style of socket is used.

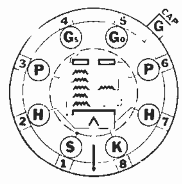
Characteristics

TYPE 1J5G	
Filament Voltage	2.0 Volts
Filament Current	0.120 Amp.
Maximum Over-all Length	4$^{11}/_{16}$ Inches
Maximum Diameter	1$^{13}/_{16}$ Inches
Bulb	ST-14
Base	Medium "G" Type Octal #6-X

Operating Conditions and Characteristics

Filament Voltage	2.0 Volts
Plate Voltage	135 Volts
Grid Voltage	-16.5 Volts
Screen Voltage	135 Volts
Plate Current	7.0 Ma.
Screen Current	2.0 Ma.
Plate Resistance	125,000 Ohms
Mutual Conductance	1,000 μmhos
Amplification Factor	125
Load Resistance	13,500 Ohms
Power Output	575 Mw.

Type 6J8G Triode-Heptode Converter



8-H

Type 6J8G is a new converter consisting of a triode unit and heptode unit in a single bulb. The cathode is common to both units. This new tube is essentially the combination of the well known triode-oscillator and pentagrid-mixer service. However, the combination in one bulb makes possible some circuit simplifications and improved performance at high frequencies.

Type 6J8G provides true electron coupling since the grid of the triode section is connected to an injector grid in the mixer section. The unusually high plate resistance of this tube results in very low plate loading, making it possible to use highly efficient i-f transformers to advantage. Compared to other existing types of converter tubes, type 6J8G has lower frequency drift which should be an attractive feature. Because of this high frequency stability it should be possible to reduce the filtering in the oscillator plate and not encounter the "fluttering" found in other converters.

It will be noted that the two plates and the heptode screen-grids are operated at the same d-c potential when using 100 volts. Thus, the screen-grid dropping resistor used with previous converters may be eliminated.

In some cases this new tube may be used directly in place of a type 6A8G with only slight realignment required. However, the tube is not intended for that service and for maximum performance a circuit especially designed should be used.

Characteristics

Heater Voltage AC or DC	6.3 Volts
Heater Current	0.3 Ampere
Maximum Over-all Length	4$^{17}/_{32}$ Inches
Maximum Diameter	1$^{9}/_{16}$ Inches
Bulb	ST-12
Base	Small "G" Type Octal No. 8-H

Direct Interelectrode Capacitances

Grid G to Heptode Plate*	0.01 μμf Max.
Grid G to Triode Plate*	0.015 μμf
Grid G to Grid Go*	0.13 μμf
Grid Go to Triode Plate	2.2 μμf
Grid G to all other Electrodes (R-F Input)	4.4 μμf
Triode Plate to all other Electrodes (Osc. Output)	5.5 μμf
Grid Go to all other Electrodes (Osc. Input)	11.7 μμf
Heptode Plate to all other Electrodes (Mixer Output)	8.8 μμf

*With standard tube shield (not close fitting).

Operating Conditions and Characteristics

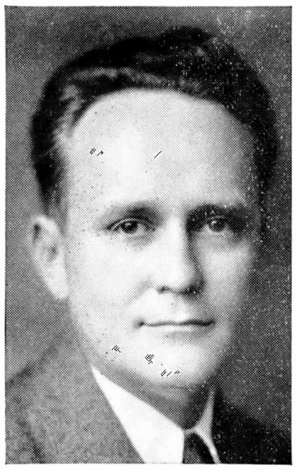
Heater Voltage	6.3	6.3 Volts
Heptode Plate Voltage	100	250 Volts Max.
Heptode Grid Voltage	-3.0	-3.0 Volts
Heptode Screen Voltage	100	100 Volts Max.
Heptode Plate Current	1.4	1.3 Ma.
Heptode Screen Current	3.0	2.9 Ma.
Heptode Plate Resistance (Approx.)	0.9	4.0 Megohms
Conversion Conductance	250	290 μmhos
Triode Plate Voltage (Oscillator)	100	250# Volts Max.
Triode Grid Resistor (Oscillator)	50,000	50,000 Ohms
Triode Plate Current (Oscillator)	3.0	5.0 Ma.
Triode Grid Current (Oscillator)	0.3	0.4 Ma.

#—Applied through 20,000 ohm dropping resistor.

Triode Section Only

Plate Voltage	100 Volts
Grid Voltage	0.0 Volts
Plate Current	7 Ma.
Plate Resistance	10,600 Ohms
Mutual Conductance (Approx.)	1,600 μmhos
Amplication Factor (Approx.)	17

A CHAT WITH ROGER WISE



Chief Tube Engineer
Hygrade Sylvania Corporation

In the course of our manufacturing experience over a period of several years we found that there was some disadvantage in having the tube type etch placed on the maximum diameter of the bulb. This position was originally chosen because of the easy visibility of the type etch when so placed. Experience showed that not only was there a tendency for the etch to be rubbed off, since the bulb rests against the packing material at this point, but it is more difficult in the manufacturing process to "burn in" the etch so thoroughly as to insure its withstanding normal handling.

A majority of the tube manufacturers have now agreed to place the bulb etch about half-way between the maximum diameter of the bulb and the base, and to use an octagonal-shaped border around the type number in place of the present circular border, thus conforming to the practice which has been followed by some manufacturers for a considerable period of time.

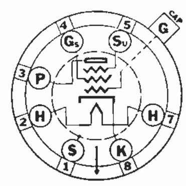
It is, of course, impossible to change over at once to the new style tube etch, as tubes in stock cannot be changed. It is, therefore, our plan to manufacture all tubes with this standardized bulb etch, while tubes in stock with the circular etch will be shipped first, as far as this is possible.

Since no change in characteristics is involved and the change has been made in the interests of improved appearance and permanence of the mark, it is evident that no significance should be attached to the appearance of tubes having either the octagonal or circular etch.

In addition to the change in bulb etching, a new style of brand etch is being adopted as experience and facilities permit. Instead of using a heated branding iron to mark the SYLVANIA name on the base, a process similar to ordinary printing is being adopted. In the future a rubber stamp will be used with a special branding ink or paint, thus making it possible to use a contrasting color against the black bakelite, resulting in a more legible and attractive marking. At the same time the words "Made in U.S.A." will be included in the base branding, and at a later date these words will be left off the bulb etch. This latter change is merely a matter of convenience, as it is desirable to have as few words as possible in the bulb etching mark.

It is obvious that our customers should disregard the changes referred to, as they have no significance and are being adopted only as rapidly as is convenient. Of course, the usual practice of using tubes out of stock in the order in which they are received should be followed.

Type 6W7G Triple Grid Amplifier



7-R

Type 6W7G is a new sharp cut-off pentode amplifier that has been added to the 150 milli-ampere group of tubes. The characteristics of this new tube are similar to those of type 6J7G, therefore, it may be used in similar circuit applications.

Type 6W7G may be used in a-c or d-c operated receivers, but it is not recommended for use in automobile receivers.

Characteristics

Heater Voltage	6.3 Volts
Heater Current	0.150 Ampere
Maximum Over-all Length	4$^{17}/_{32}$ Inches
Maximum Diameter	1$^{9}/_{16}$ Inches
Bulb	ST-12
Base	Small "G" Type Octal # 7-R

Operating Conditions and Characteristics

Heater Voltage	6.3 Volts
Plate Voltage	250 Volts Max.
Grid Voltage	-3 Volts
Screen Voltage	100 Volts Max.
Plate Current	2.0 Ma.
Screen Current	0.5 Ma.
Plate Resistance	1.5 Megohms Approx.
Mutual Conductance	1225 μmhos
Amplification Factor	1850 Approx.

Biased Detector

Heater Voltage	6.3 Volts
Plate Voltage	250 Volts Max.
Grid Voltage	-4.3 Volts Approx.
Screen Voltage	100 Volts Max.

Plate Load: 250,000 ohms resistor or 500 h. choke shunted by 0.25 megohm. For resistance load, maximum plate supply voltage will be 250 volts plus voltage drop in load resistor.

5T4 Replacement

Many requests have been received for a replacement tube for the metal type 5T4. For the servicemen who desire to make such a replacement the Sylvania type 5V4G may be used without making any changes in the rectifying circuit.

There is a slight difference in rating of the two tubes, but receiver tests have proven that the change can be made without any harm.

THE SERVICE EXCHANGE

THE information presented in the Sylvania Service Exchange is contributed by servicemen as the result of practical experience. It is very carefully considered before being accepted, and we believe it to be correct and authentic. However, we assume no responsibility with respect to results. Each hint accepted entitles the writer to his choice of one Sylvania receiving tube. Please indicate preference when submitting hints. Don't send routine or generally known information. Please specify tube choice.

Acratone Model 954. This model using metal tubes has been subject to service for shorted condensers. It is adviseable to replace all fixed condensers subject to high voltage with those of reliable make and high breakdown point.—Charles Pieper, Oceanside, L. I., N. Y.

* * *

Any Receiver. When a customer complains of a high light bill check condenser from one side of power cord to chassis. In some receivers this condenser is placed ahead of the switch. When a condenser in this position shorts, current flows through the meter even though the switch is turned off. When replacing, put condenser on transformer side of switch.—E. E. Youngkin, Altoona, Pa.

* * *

Brunswick Models 11A, 17, 24, 25. Nearly everyone of these I have serviced seem to have developed a slipping dial, i.e., the knob won't rotate the turret condenser. I've seen some terrible attempted repairs on them, hence this hint.

Remove the upper nut from the turret condenser, lift off the drive arm and dial assembly, and then remove the lower nut from the condenser shaft, being sure while doing this that you hold the shaft itself with another wrench, or you may break the solder and loosen the shaft on the rotor assembly and have another job on your hands.

After removing this second nut, place it in a vise and saw it in two about $\frac{2}{3}$ from one side, in such a way that when finished and with the burrs filed off, you have a nut of about $\frac{2}{3}$ the former thickness. Replace it on the condenser shaft. It's decreased height now allows the drive arm assembly to settle lower and mesh securely with the drive knob mechanism.

Before replacing the drive arm assembly, saw off about $\frac{3}{16}$ inch of the stop lug on the lower left end of the arm, or you may find that it bumps into the color-tone control as you rotate the dial, and prevent you from turning the dial above 1100 kc. Now replace the parts you have removed, and the dial will operate as smoothly and positively as it ever did.—Spencer Ohlin, Richfield, Utah.

* * *

Fairbanks Morse Model 42T5-B. Steady drain on B's when set is turned off. The drain is as high as $1\frac{1}{2}$ mills. For satisfactory service, remove the 20,000 ohm resistor from minus $16\frac{1}{2}$ C to ground.—Harold Gillogly, Bonners Ferry, Idaho.

* * *

Grunow Model 720. Signals weak and distorted, replace the screen bypass condenser on the audio amp. tube. It is not shorted, only leaky.

No signals with all tubes and voltages OK. This trouble is a partially open secondary in the last i-f transformer.—C. Daniels, Everett, Pa.

* * *

Philco (Late Models). Squealing:—After checking with analyzer and alignment test, I tried a new volume control. The squeal cleared. The squeal appeared only when the tone control was on the bass side which made me think it was the tone control, but a new volume control proved to be the correct remedy. This is true on most all late model Philco radios.—Sealy's Radio Service, Healdsburg, Calif.

* * *

Zenith Models 55-127, 55-150. A common complaint on these sets is that after a few minutes of operation they begin to fade until finally only the locals are audible. Sometimes it may take as long as half and hour to fade completely out. In either case, a repair can be effected by replacing the 6A8G cathode resistor. This unit is mounted directly at the tube socket toward the front of the chassis. Replace with 400 ohm $\frac{1}{2}$ watt resistor. We have repaired 12 jobs exactly like this.—Bernard Greene, Petersburg, Va.

THE WAY OF ALL COCKROACHES

In this issue we are using part of our Service Exchange page to print a few of the many letters received in answer to Bill Sullivan's call for help on the cockroach problem last month. It may be that some servicemen will not agree with us but we feel that temporary use of the space for this purpose is justifiable because of the help offered and the many methods suggested for the extermination of a radio pest about which we knew very little. These letters show the fine fellowship and cooperation that servicemen are willing to give to their fellows when they are afforded a means of exchange of ideas.

* * *

GENTLEMEN:

Bill ain't seen nothin' yet. Down in these parts we think something's wrong if a set for repair hasn't at least **one** cockroach in the I. F. cans and usually one from the Long Grass district will have a choice assortment of fifteen roaches, three dead mice and a black widow spider. If the set hasn't been disturbed for some time we can always count on a scorpion or two in the speaker.

There really is very little Bill can do about it, except **not** mention to the owner what he found. Oh yes, he can try cleaning out the dead roaches and spraying insect dope gently but firmly under the chassis to discourage the living.

Our cockroaches, familiarly known as Florida Eagles, are about the size of a young mouse, twice as lively on the hoof and prone to eat the insulation off B plus wires. If surprised in the act, they take refuge in the I. F. cans and amuse themselves by detuning the circuits. Dead mice are harmless but smelly. Black widow spiders and scorpions are always interesting to the servicemen; they divide us into two groups, the quick and the dead.

Trusting this will help Bill no end,

C. A. SERVICE, JR. Sarasota, Florida

* * *

GENTLEMEN:

I am giving you a duplicate of information sent to Mr. Sullivan of Norwalk, Conn., who asked in your last issue how to rid a radio of cockroaches. Place the set on a box in back of, or at the end of an auto exhaust pipe—out in the cold open air of course—and cover most of the radio and box with an old piece of canvas. Run auto engine and move the radio every few minutes so that it will present a different area to the exhaust gas. If required the chassis may be removed for similar treatment forcing exhaust gas to every part of it. I used this method on a set which had hundreds of roaches in it; some dead, most of them alive. The gas killed all the live ones and did no harm to the radio and kept my shop free of roaches.

Perhaps this information may help some other serviceman who is unfortunate enough to get a set in similar condition.

JOHN H. HETTRICH,
Philadelphia, Pennsylvania

* * *

Re: Wm. O. Sullivan, S. Norwalk, Conn.

SIRS:

My suggestion to Mr. Sullivan is that he apply a little of the well known elbow grease in the form of a thorough brushing with a small but rather stiff bristle brush inside the coils where it is possible to get to that portion and follow this with a cleaning fluid on the brush. **Do not use** carbon-tetra-chloride as it will soften waxes which may have been used to impregnate the windings of the coils against moisture. I have used "ENOZ LIGHTER FLUID" exclusively for this purpose for a couple years with perfect results, it having very little effect on any wax used so far on radio coils. The same treatment may be applied to the chassis, volume and tone controls and any other parts which may require it.

When it comes time to re-install the set prepare the cabinet by thoroughly brushing all cracks and corners and then liberaly dust the interior with "20 Mule Team Borax" which will effectively keep the roaches from nesting again in that radio cabinet.

Trusting that you will find the above of sufficient general interest to publish in the Service Exchange, I am,

PAUL V. ZEYN, West Milton, Pa.

* * *

DEAR SIRS:

In regards to the letter of Wm. Sullivan of Norwalk, Conn. which was published in January issue of Sylvania News, I would like to say that I have had in the shop in the past year a couple of radios full of cockroaches, also one with a mouse under the rectifier tube socket. We cleaned these sets with a small brush dipped in dry cleaning fluid and used an electric fan at the same time to blow away the loose dirt and dry the chassis. We also found this to a be great help when the set has been used in a restaurant and is very greasy. In certain cases it is necessary to use a rag.

Very truly yours,

PAUL BAHN, Marion, Indiana.

* * *

EDITOR OF TECHNICAL SECTION:

Subject:

The art of cleaning a radio domiciled with Radiobugs, (a polite name for roaches, bedbugs, ants, lice and all invisible Micro-coccuses).

Material used to complete the Operation:

A brush and a gasoline torch or Spray-gun, a gallon of cleaners-naphtha, and some sort of a compressed air unit with hose and nozzle.

Procedure:

Spray set well with cleaner-naphtha, then blow out with compressed air. Spray again and at the same time brush out and clean all parts while spraying with the fluid. Then finally dry out all the fluid with the compressed air.

Note:

This cleaning solvenizes all waxes on the sockets, cleans out the gang-condenser bearings of the dirt which causes high resistances, and in many cases makes the color of the wires much easier to trace. A little going over with a rag will make the set look like new from top to bottom. I have used this for the past three years very successfully.

ALEX BRZUCK, Detroit, Michigan

* * *

SIRS:

That Roach problem spoken of by Wm. O. Sullivan in Vol. 7, No. 6, is an every day occurance here in Biloxi, Miss. Roaches are plentiful and radios are first class rooming houses for them.

I have 150 lbs. of air pressure handy at all times and it does the work. Once in a while I have to scrape the chassis to get rust off afterwards, but air is my answer.

Hoping Bill finds a solution, I am,

VERNE K. VANCE, Biloxi, Mississippi

THE VACUUM TUBE VOLTMETER AS A SERVICE TOOL

By GEORGE C. CONNOR

PART III

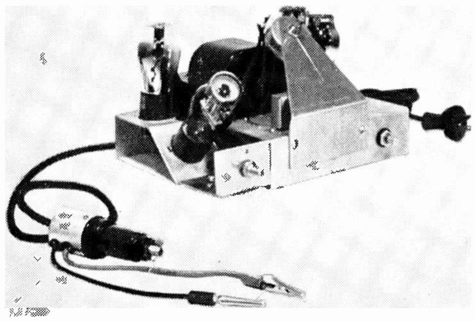
There are many good types of vacuum tube voltmeters on the market made by reputable manufacturers whose product would be a valuable addition to the test equipment of any radio service shop. These units are rather expensive, however, because good workmanship and a sensitive meter are necessarily costly. In order to make available to the serviceman an accurate, rugged low cost vacuum tube voltmeter which the serviceman can build and calibrate himself at a very low cost, the following constructional article is published. No meter is required for this instrument so it will withstand a great deal of abuse both electrically and mechanically with little fear of damage. Most of the parts required for this vacuum tube voltmeter are available from the average serviceman's parts stock. The time required to build this instrument is small and servicemen will find it a useful device to assist them in the diagnosis of many radio receiver troubles.

PART III
The Electric Eye Vacuum Tube Voltmeter

The vacuum tube voltmeter to be described is a modification of the reflex type employing a calibrated potentiometer and a type 6E5 tuning indicator tube in place of the usual microammeter. In addition to reducing the cost of construction, this circuit provides a very important advantage in that the low voltage end of the scale most used and where greatest accuracy is desirable is spread out so that the range from 0 to 3 volts occupies approximately one half the scale and the balance of the range occupies the other half.

The voltage range of the V. T. V. M. is from 0.1 volt to between 100 and 200 volts depending upon the plate voltage of the 6F5 tube. In service use it will be found more practical to make use of voltage divider resistors across the input of the tube to extend the voltage range, since the calibrations become crowded above 50 volts.

The frequency range of the instrument is from below 60 cycles per second to some higher frequency which will depend upon the length of the leads from the prod tube to the voltage source, the capacity between these leads and the impedance across which the voltage is being measured. To eliminate the effect of standing waves on the input leads and the capacity between them the prod tube is placed on the end of a cable so that the tube may be used very close to the voltage source with correspondingly short leads and low r-f loss. This permits voltages on the order of 18 to 20 megacycles to be measured with accuracy more than sufficient for general service work. At frequencies above this figure the loading effects of the tube's input capacity and the effect of election transit time will introduce an error that is a function of the voltage source impedance. For service work this error is not reasonably large, however, at any frequency encountered in radio receivers since in most instances the V. T. V. M. prod tube will be used across a tuned circuit to measure voltages in place of a tube having an equal loading effect. The upper frequency range of 60 mc. indicated in the last month's issue may not be attainable under



average service conditions for the reasons indicated above.

The photographs show front view, and the chassis view of an Electric Eye Vacuum Tube Voltmeter. The simplicity of the circuit together with the fact that the location of parts and leads is not critical makes it very easy to build this V. T. V. M. into any type of cabinet that may be at hand. R-F currents are confined to the prod tube and socket assembly so it is not necessary to employ a shielded case for the main unit. The sloping panel has much to recommend it from a standpoint of ease of operation and convenience in reading the calibration.

CIRCUIT DETAILS

The V. T. V. M. consists of a power supply; simple resistance-capacity filter, voltage divider net work, electric eye indicator tube, calibrated potentiometer and 6F5 prod tube mounted on the end of a 5 wire cable. The power transformer consists of a primary; 6.3 volt secondary to supply 0.6 ampere of current for the 6F5 and 6E5 heaters; 5 volt secondary for the type 80 rectifier tube and a 650 volt center tapped high voltage secondary rated at 40 ma. This is the standard 4-tube midget transformer and because only 50% of its maximum power capabilities is

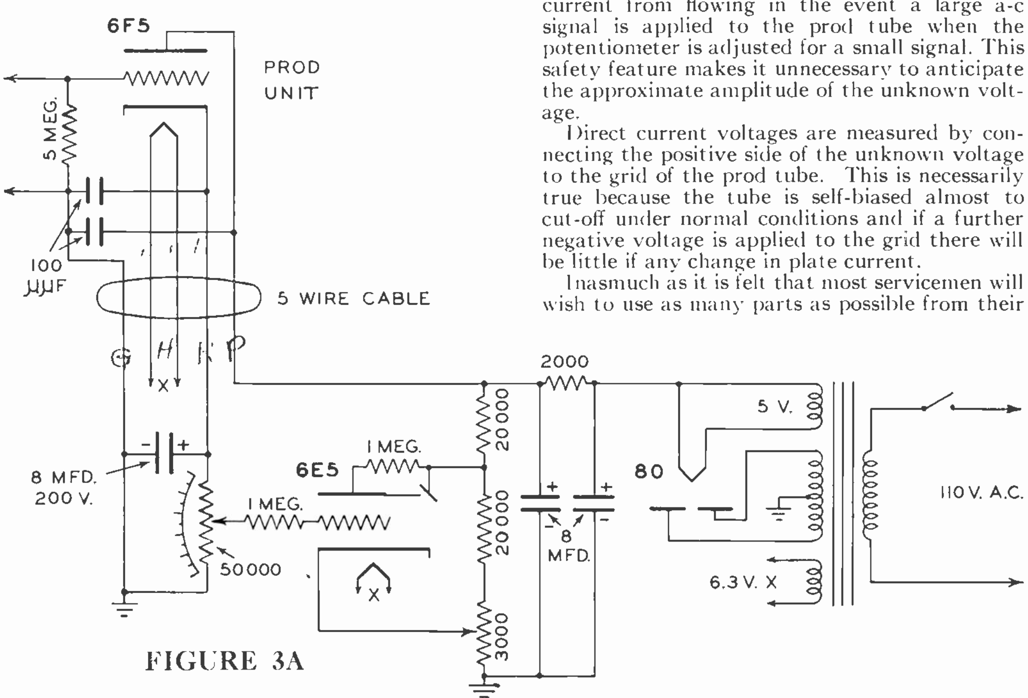
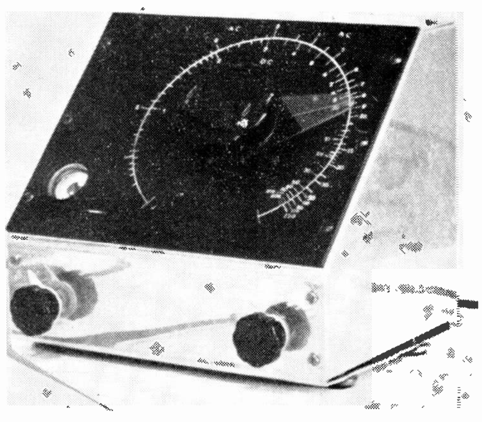


FIGURE 3A



being used it will run very cool in operation. The two 8 mfd. electrolytic condensers shown in the diagram should be rated at 450 working volts to insure long life and good performance. The filter resistor may be either a 2-watt carbon or wire wound type. The 20,000 ohm resistors in the voltage divider net work should also be rated at 2 watts. The two 1 megohm and the 5 megohm resistors may be of the ⅓ or ¼ watt carbon type. Wire wound potentiometers should be used to insure long life and accuracy of the voltage calibration. The two 100 μμf mica condensers used at the socket of the prod tube must be soldered to the proper terminals with the shortest possible leads, to eliminate high frequency error. These two condensers keep the high frequency currents out of the 5-wire cable and make it unnecessary to use a shielded cable.

THEORY OF OPERATION

When the instrument is first turned on the input leads to the prod tube are short circuited and the 6F5 cathode potentiometer is turned so that the sliding arm is adjacent to the 6F5 cathode. The pointer should then be at the lower left hand end of the scale if the potentiometer has been connected properly. The shadow of the 6E5 is then adjusted by varying the 3000 ohm potentiometer so that it just closes and leaves only a hair line of darkness between the two "wings" of light. Under these conditions the 6F5 plate current flowing through the 50,000 ohm cathode potentiometer will make the cathode 3.5 to 4.0 volts positive with respect to ground—the 6F5 grid will therefore have a 3.5 to 4.0 volt negative bias. We know that the 6E5 requires approximately 8 volts negative grid bias to close the "wings" and since it is connected to a potential source of say 4 volts positive the cathode of the 6E5 must then be 4 plus 8 or 12 volts positive. When the two test prods are connected across an a-c voltage source the 6F5 rectifies this a-c voltage and the average plate current increases. This produces a greater IR drop across the 50,000 ohm cathode potentiometer which reduces the negative bias on the 6E5 causing the wings to open. If the 6F5 potentiometer slider is now turned toward the grounded end a point will be found where the 6E5 grid will again receive a minus 8 volt bias and the wings will again close. If a known voltage (for example 2 volts) was applied to the grid of the 6F5 tube to cause this action, the point on the scale where the eye just closed can be marked 2 volts and thereafter when an unknown voltage makes it necessary to adjust the potentiometer to this point, the operator will know that a 2 volt signal is being measured. The purpose of the 1 megohm resistor in series with the grid of the 6E5 tube is to prevent excess grid current from flowing in the event a large a-c signal is applied to the prod tube when the potentiometer is adjusted for a small signal. This safety feature makes it unnecessary to anticipate the approximate amplitude of the unknown voltage.

Direct current voltages are measured by connecting the positive side of the unknown voltage to the grid of the prod tube. This is necessarily true because the tube is self-biased almost to cut-off under normal conditions and if a further negative voltage is applied to the grid there will be little if any change in plate current.

Inasmuch as it is felt that most servicemen will wish to use as many parts as possible from their present stock and will prefer to use many of their own ideas in the construction of this vacuum tube voltmeter no detailed layout specifications are made available. The photographic illustrations tell most of the story, however. The third knob seen in the front view is the on-off switch and the two extra tubes shown on the right hand side of the chassis were included to test out a method of line voltage regulation concerning which more will be said in a later installment.

The calibration of this instrument on both a-c and d-c voltages will be discussed in the next issue of the Sylvania News.

SYLVANIA NEWS

TECHNICAL SECTION

APRIL, 1938 EMPORIUM, PENNA. Vol. 7, No. 8

99.9197 PER CENT O. K.

Since we first announced the Sylvania Tube Complement Book in September 1937 12,000 copies have been sold, and one complaint has been received that the book did not contain the desired information. So, if you don't own a copy it's a 12,000 to 1 shot that you will find in it a big quarter's worth of information, that you'll have a hard time finding anywhere else.

You will find tube complements for practically any radio set, old or new, up to early 1938 models, now in use; information on tube replacements for approximately 75,000 sockets; the largest and most complete compilation of i-f peaks available. It gives trade names of 560 sets, with the names of the manufacturers; names and business addresses of 144 set manufacturers doing business in 1937. It contains many helpful articles on alignment, substituting new for older types of tubes, tube testers, panel and dial lights. Thousands of servicemen think it is worth a lot more than two bits. You can order it on the green sheet enclosed with this issue of Sylvania News or from your Sylvania Jobber.

DID IT EVER HAPPEN TO YOU?

By Walter R. Jones

Sam Serviceman recently received a call from a customer who complained that his AC-DC "Cigar Box" receiver refused to operate. Accordingly, Sam went to the customer's home and brought the receiver back to his shop. Upon making his tests, he found that there was no plate voltage or speaker excitation. Examination of the 25Z5 tube showed that neither cathode supplied current. Sam immediately replaced the 25Z5 tube with a new one from his stock. The result was a flash of light, after which this rectifier was as dead as the first one. Two more rectifiers went the way of this one, until finally Sam realized that perhaps something else, other than rectifiers, was wrong in the receiver. Investigation showed that the filter appeared to be shorted and later Sam discovered that the electrolytic condenser was defective. Replacement of the condenser and a new rectifier tube eliminated the difficulty, but obviously Sam lost money on the job.

Undoubtedly, you have experienced this same difficulty and perhaps have been perplexed as to just what happened. The rectifier tube and the filter condenser in a power supply system are so intimately tied up that usually failure of one will cause failure of the other. Consequently, before replacing a defective rectifier tube, it is wise to make certain that the first filter condenser is in satisfactory working condition. If this is not done then the rectifier tube may blow immediately, or a short time after the receiver goes into service. The electrolytic condenser, "remembering" that it was subjected to some unusual operating conditions and becoming "sore" at the memory will again act up and another rectifier tube will "pop." It is **very important,** therefore, whenever a rectifier tube failure appears in any receiver, to make certain that the filter condensers are satisfactory and that no short exists elsewhere in the filter circuit.

This difficulty, which usually appears in the case of 25Z5 or 25Z6G tubes, shows up in the form of burned out or fused cathode tabs. These tabs are the small metal connection strips between the cathode sleeves and the cathode return wires in the glass press. They will fuse when a current much in excess of ½ ampere flows for any length of time. These tabs cannot readily be made heavier since if they are, they will conduct so much heat away from the cathode sleeve that proper operating temperature will not be obtained, thus greatly reducing the output of the rectifier.

A precaution against the fusing of these tabs is the installation of a 50 ohm resistor in series with each plate or a 25 ohm resistor in series with both plates. This will limit the current to a safe value so that ordinarily, the tabs will not blow. This protection is being used by the manufacturers in some AC-DC receivers.

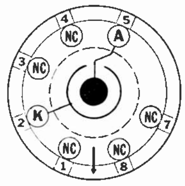
Similar Troubles in Other Receivers

New receivers that have been in warehouse storage, or receivers that have not been in use for several months may give similar trouble and should be put into operation cautiously. The initial surge of current which will flow through the first filter condenser when the receiver is first turned on may exceed the safe rating of the rectifier by several times. This is due to the fact that the electrolytic condenser may become "deformed" as a result of not being in use. The

Continued on Page Two

NEW TUBES

Type VR-150 Voltage Regulator



VR-4

VOLTAGE REGULATOR

Type VR-150 is a gas filled, cold cathode voltage regulator tube. The elements are mounted in an ST-12 bulb and the tube is equipped with a small octal type base. This new tube is characterized by a practically constant internal voltage drop across which a load requiring good voltage regulation may be connected.

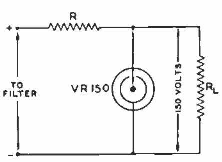
In appearance the tube is characterized by a cylindrical electrode which is the cathode, and an electrode centered in cathode which is the anode.

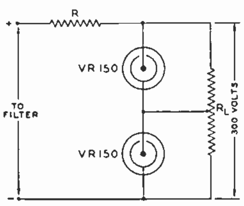
The diagram shows a current limiting resistor which should always be used in series with the tube and the line. The amount of current drawn by the load will of course determine the size of the resistor. It should be of such value as never to allow an operating current of more than 30 ma. to flow through the tube in case the load is disconnected.

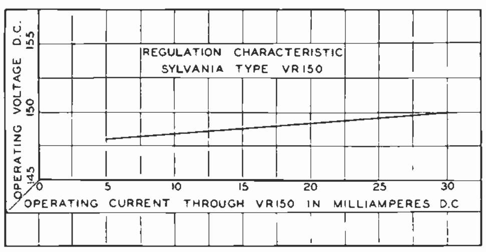
Characteristics

Minimum Starting Voltage		180 Volts
Operating Voltage		150 Volts
REGULATION		
Operating Current	5 Ma. Min.	30 Ma. Max.
Operating Voltage	148	150 Volts

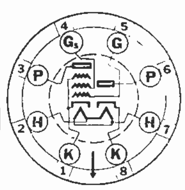
See Regulation Curve.







Type 25A7G Rectifier and Pentode



8-F

RECTIFIER AND PENTODE

Type 25A7G is a combined power amplifier pentode and rectifier contained in one bulb.

The principal use for this tube is in AC-DC receivers where space is at a premium. The power output from the pentode section is not as high as that from most pentodes, but is limited due to the low maximum plate voltages. It should be noted that the d-c load current of the rectifier section is limited to 75 milliamperes.

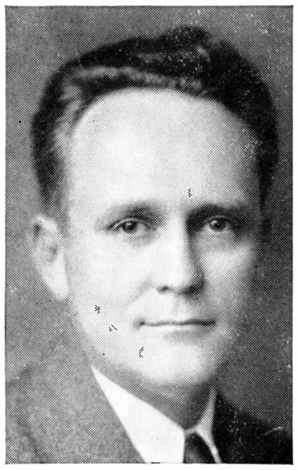
Characteristics

Heater Voltage AC or DC	25.0 Volts
Heater Current	0.3 Ampere
Maximum Over-all Length	4 17/32 Inches
Maximum Diameter	1 9/16 Inches
Base	Small "G" Type Octal No. 8-F

Operating Conditions and Characteristics

RECTIFIER SECTION	
Heater Voltage	25.0 Volts
A-C Plate Voltage (RMS)	125 Volts Max.
D-C Output Current	75 Ma. Max.
PENTODE SECTION	
Plate Voltage	100 Volts
Grid Voltage	-15.0 Volts
Screen Voltage	100 Volts
Plate Current	20.5 Ma.
Plate Resistance	30,000 Ohms
Mutual Conductance	1,800 Micromhos
Amplification Factor	90
Load Resistance	4,500 Ohms
Power Output	0.77 Watts

A CHAT WITH ROGER WISE



Chief Tube Engineer
Hygrade Sylvania Corporation

For a number of years our laboratories have been working steadily on the types of tubes which will be required for television reception. At one time we offered small cathode-ray tubes for experimental work, but found that at that time the interest was not great enough to make it desirable to continue. A steady increase in the number of inquiries for television tubes has been noted during recent months, and review of the technical literature shows that the editorial interest in television progress has been greatly stimulated by indications of commercial activities, which should, within a reasonable length of time, lead to more than experimental broadcasting of television progress.

As this interest increases, tubes especially designed for use in receivers will be made available. The Sylvania VR-150 regulator tube has been found useful in experimental receivers to stabilize the voltage supplied to critical circuit elements. A Sylvania rectifier designed to supply high voltage at low current is being standardized under the type designation 879. This tube makes it possible to obtain the screen voltage required for cathode-ray tube operation, and has been used for tubes requiring voltages up to 7000 volts d.c.

It seems likely that numerous changes will be made in the cathode-ray tubes used in the receiver, and that as such improvements are incorporated, the tubes standardized at early dates will become obsolete. It is, therefore, a matter requiring good judgment to decide when tubes of any given type should be offered for general use. It is our plan to offer one or more types of cathode-ray tubes within a reasonable length of time—probably by the middle of this year.

We do not feel that any undue encouragement should be given to experimenters who might be interested in building experimental television receivers. The problems involved in designing the circuits required and getting them to operate are extremely complex, and only those experimenters who have much better than average training can hope to secure the desired results with a reasonable amount of effort.

Tube Type Correction

The first tube type listed on page two of the last issue of the Technical Section was 1J6G according to the heading. This was an error as you will note in reading the descriptive data. The type number should have been 1J5G. Before you forget it change the type number on your file copy. Data for type 1J6G were shown in the Volume 6, Number 7 issue.

Did it Ever Happen to You?

Continued from Page One

result is that the rectifier tube may be destroyed because of this abuse.

In the case of type 80 rectifiers or similar types, the difficulty usually shows up in a blown filament about 2/3 of the way down on each leg of the filament so that a "V" shaped piece of filament wire is loose in the tube, although the welds at the bottom of each leg are intact.

It may be possible to avoid this by substituting a larger rectifier tube such as a 5Z3 in place of the type 80 during the first few minutes of operation, until the electrolytic condenser is completely formed. The regular rectifier may then be replaced. Another expedient, if a variable auto transformer is available, consists of applying about 60 volts to the power terminals and gradually increasing this voltage to normal over a period of perhaps 15 minutes. This will permit the electrolytic condenser to form properly without drawing more current from the rectifier tube than is safe.

If a serviceman will make it a point to check the condition of the first electrolytic filter section **whenever** defective rectifier tubes show up, he will be ahead of the game in several ways. In the first place, he will sell an electrolytic condenser and he will save the cost of several rectifier tubes which might have been destroyed before the defect was located. He will also save the cost of an extra service call which might have been necessary if the burn-outs had occurred after the receiver had been delivered to the customer's home.

The above suggestions are offered to help servicemen avoid losses due to a common difficulty which has not been completely understood.

THE SERVICE EXCHANGE

THE information presented in the Sylvania Service Exchange is contributed by servicemen as the result of practical experience. It is very carefully considered before being accepted, and we believe it to be correct and authentic. However, we assume no responsibility with respect to results. Each hint accepted entitles the writer to his choice of one Sylvania receiving tube. Please indicate preference when submitting hints. Don't send routine or generally known information. Please specify tube choice.

All Wave Antennas Loss. I have found in many cases that the loss of selectivity was caused by the twisted lead insulation on the twisted leads being deteriorated by weather to such an extent that the bare wires shorted. To overcome the above cause, when replacing twisted pair or installing new antennae, dip the wires in hot pitch to about 12 inches past the break in the insulation where taps or connections are made. Thus you do not need to tape the ends as the pitch protects the break better than any tape. You can overcome broken wires by using a length of loom over the twisted pair and under the knob.—M. J. Planovsky, Cleveland, Ohio.

* * *

Fada Model K. U. This set uses a system of screen bleeder and cathode variation for a volume control giving poor control at low volume. To remedy this proceed as follows: Remove old volume control, installing new 15,000 ohm control with taper for antenna and cathode bias. Ground center arm of new control, left arm goes to antenna post right arm goes to cathode bias resistor, then ground old wire leading from screen series resistor through 5,000 to 8,000 2 watt resistor. This completes the job and the volume control is now much smoother. This method can be used on other sets using the same method of volume control.—Al's Radio Service, Tonawanda N. Y.

* * *

Master Antennas, Etc. Many servicemen have had their share of headaches during these bad winter months when frequent snow and sleet covered everything. On several calls I had complaints that the radio was very weak on all stations. This was found to be caused by snow and sleet, which rendered the antenna system useless by shorting across the arrester contacts. A very simple remedy has been devised by covering the arrestor connection with a piece of rubber sheet (inner tube) or shield can. This will keep the arrester dry at all times and at the same time help eliminate some noise picked up by the arrester connections. I prefer a shield can, as it gives a professional appearance.—M. J. Planovsky, Cleveland, Ohio.

* * *

Majestic Model 500A. This set is often found dead with no voltages. A shorted condenser which is hard to find is the trouble. Look inside the i-f can for a small condenser and resistor assembly. The resistor will probably be burned out as it is only 1/5 watt.—Al's Radio Service, Tonawanda, N. Y.

* * *

Philco Models 38-1, 38-2. To eliminate parasitic oscillations, replace the 6U7G r-f tube with a 6K7G tube, also lengthen the green wire connecting the screen contact of the 6U7G tube and condenser No. 6. Then redress this wire around the 6U7G socket toward the front of the r-f unit and then back to condenser No. 6. Be sure that the wire is as close to the base as possible. Remove 250 mmfd. condenser entirely from 6U7G screen circuit. This change should be performed on all these models up to Run 4.—M. J. Planovsky, Cleveland, Ohio.

* * *

Philco Model 531. Those of you who have serviced this model for poor tone quality due to the speaker have found it almost impossible to correct. We have just changed one to use a dynamic speaker and are very pleased with the results. We chose an a-c speaker because the B voltage is extremely low in this model (about 200) and we didn't want to lower it by using a series field. First we changed the 71 to a 45 by wiring the filament terminals directly to the 27 socket. Then biased the tube with a 1500 ohm 5 watt resistor and bypassed this with a 10 mfd. 50 volt condenser. We removed the condenser which couples the tube to the old magnetic and discarded it. We then ran the leads from the output transformer to the highest voltage in the set and then directly to the plate of the 45. It works very nicely.—Bernard Greene, Petersburg, Va.

* * *

Philco Model 806. The complaint on this receiver is often that of noisy or sputtering reception, while the car is in motion, but disappears entirely when the car is not in motion. It may appear again when the set is shaken. This can be traced to a loose shield can on the second intermediate frequency transformer, but any loose shield in the set will cause the same trouble. These cans are held by means of spring clips to the chassis. When they become worn, or lose their tension the can will move when the receiver is shaken. Soldering the top clip to the shield can and to the chassis will stop the trouble.—W. R. Whitcomb, Waupun, Wis.

* * *

Philco Model 52. Often this set distorts and blasts with everything checking OK. Between the negative of the large filter condenser which is insulated from the chassis and grid resistor of the 47 audio tube, there is a yellow and black resistor (490,000 ohms). Replace this resistor with one of 200,000 or 250,000 ohms and the set is OK. This condition is caused by too much bias on the 47 tube and cannot be located with a voltmeter on account of high resistance in the circuit.—Al's Radio Service, Tonawanda, N. Y.

* * *

RCA Victor Models C-11-1, T-10-1. Cutting off. Disconnect the green wire on the volume control and connect a 30,000 ohm resistor (original was 27,000 R13 on RCA diagram) from this volume control tap to a .015 mfd. condenser, connecting the other terminal of the condenser to the ground. Disconnect the yellow wire from the other v. c. tap and connect a 9,000 ohm resistor (original 8,200) to the tap, connecting the other end to a .05 condenser and connecting the other end of the condenser to the chassis ground. Connect the mid-point of this condenser-resistor setup to the music-speech switch by removing the blue wire. The tone is improved by this wiring change.—Leo Zimmer, Canisteo, N. Y.

* * *

RCA Victor Model 9K, 9K1. Will not work at the 550 kc. end of the dial usually cutting off about 600. Replace the small condenser on top of the condenser gang going to the grid of the 6J7 oscillator tube. Use .0001 mfd.—Leo Zimmer, Canisteo, N. Y.

* * *

Silvertone Battery Receivers. We dealers in small towns and rural communities find that people who own Sears battery sets are disappointed to learn that the A battery is a large flat type and that some tubes are of an odd type that are not sold by us dealers.

I have found that the flat type of A battery used on some of these battery sets, can be replaced very easily and profitably by removing the cardboard container surrounding the old battery and place in it 8 regular type or radio type dry cells. These must be connected in two banks, of four in parallel and these two banks in series. All connections should be soldered. This gives the 3 volts which is the same as the original. In considering the life of this replacement most dry cells are rated at 35 ampere hours. The total life can be figured after determining the total filament drain.

Another kink on these sets is that the type 951 tube can be replaced with a Sylvania type 32 or 34 by changing the tube shield. The performance of the set seems much better with this type than with the original.—George W. Nikolai, Kissimmee, Florida.

* * *

Silvertone Model 1640. A noise that sounds like motorboating is caused by the set rapidly going in and out of oscillation, replace the screen by-pass condensers of the i-f amplifier.—C. Daniels, Daniels Bros., Everett, Pa.

* * *

Stewart Warner Model R-127A. An unusual case of distortion may be encountered in this model. We serviced one that had bad tone and whistled so that reception was impossible. After replacing the output tube, coupling condenser and the biasing resistors, the tone was still terrible. Finally the tone control was replaced and the tone cleared up and was as good as ever. One half the control had opened up, thus causing poor tone quality and audio oscillation.—Harry Schulze, Petersburg, Va.

* * *

Stewart Warner Model 301-A S.W. When this set goes dead on the lower band and everything else checks OK, look for a defective toggle switch which operates on this band. If a duplicate switch is not available, remove the original one and drive out the pins which hold the sides and sandpaper the roller, replace and the job is done. This converter can be greatly improved by removing the 24A tube and putting in a Sylvania type 57. All that is necessary is to remove the old socket and replace with a six prong socket tying the extra grid to the screen grid terminal of the socket.—Emil Mueller, Milwaukee, Wis.

* * *

Stromberg Carlson (Late Models). Crackling can often be traced to the Candohm voltage divider. Replacement is the only sure cure. Pinching the divider at each terminal with a heavy pair of pliers will restore temporary operation, but sooner or later the trouble will return.—Leo Zimmer, Canisteo, N. Y.

* * *

Tube Replacement. Several of the newer small sets use the 25B5 power tube which is a special tube and sometimes is hard to get at the proper time. These may be replaced temporarily by a Sylvania 43 tube until the 25B5 can be secured.—Al's Radio Service, Tonawanda, N. Y.

* * *

Vibrating Speakers and Incense. When speaker cones seem to vibrate too freely paint the entire cone with gasket shellac, this keeps the cone in a more rigid position.

Recently I spilled some liquid incense on a tube, when I turned the set on a most pleasing odor filled the room which pleased the customer very much. Since then I apply it on all jobs. It can be bought at 5 and 10 cent stores.—E. B. DeWell, Petersburg, Va.

* * *

Victor Automatic Electrola Model CE29. Directly under the turntable and motor board is a round plate with a notch in it. Into this notch fits a narrow arm which when engaging, stops the cycle of the mechanism and allows the record to play through. The plate and arm are both narrow, and if the arm is bent slightly out of position the mechanical cycle will repeat indefinitely. This trouble is often intermittent, making it difficult to run down. The remedy is to bend arm slightly so that it is on **exactly** the same plane as the plate.—Alton D. Edwards, Newfield, N. J.

* * *

Zenith 8S 154. Zenith 8S 154 and all 1937 Zenith radios using the target tuner. When the target tuner will not work try a new 6C5G Sylvania tube. Do not use seconds in this socket, they won't work right. Then if the target tuner fails to operate, reverse the meter and it will work like new again. Also check 700 ohm resistor in the cathode of 6C5G, or put a 1000 ohms resistor in the cathode of the 6C5G and the meter will tune better.—Charles Sovatsky West Nanticoke, Pa.

THE VACUUM TUBE VOLTMETER AS A SERVICE TOOL

By GEORGE C. CONNOR

Continued from last issue

The February-March issue of the Sylvania News described an electric-eye type of vacuum tube voltmeter that requires no meter and can be built by any serviceman in a few hours time. After the circuit is wired as shown in last month's installment, it must be calibrated before it can be used. A simple method of calibration is explained in the following article.

PART IV—SCALE DATA

The scale for the V. T. V. M. may be engraved on a hard rubber or aluminum panel, or a heavy paper card may be used and the calibration made with India ink. If the paper card is employed, it should be painted after calibration with clear lacquer or covered with a sheet of celluloid, to keep the scale clean. The diameter of the scale should be made as large as the panel of the instrument will permit to facilitate calibration and for ease in reading. A wire or celluloid pointer long enough to cover the calibration should be fastened to the 50,000 ohm potentiometer knob in such a manner that there is no possibility of it becoming loose and thus giving a false reading. A very easy method of insuring neat numbers on the scale (and also letters if you wish to have your name appear on the dial) is to purchase a set of rubber type from the stationery store and use this to stamp the numbers on the scale.

METHOD OF TESTING V. T. V. M.

Before starting the actual work of calibrating the scale of the V. T. V. M., make the following tests to be sure the instrument is working correctly:

1. Measure 6F5 plate voltage—any value between 270 and 350 volts will give satisfactory operation. Insert resistors in series with 5.0 and 6.3 volt secondaries, if necessary, to secure proper voltage on the tubes. Measure 6E5 target voltage and if necessary change values of voltage divider resistors to secure 180 to 250 volts on the target.

2. Ground 6F5 grid and turn 50,000 ohm potentiometer to extreme counter-clockwise position (zero voltage position on scale). This should place the sliding contact adjacent to the 6F5 cathode terminal, and it should be possible to "close" the electric eye by adjusting the 6E5 cathode (3000 ohm) potentiometer. Pick a 6E5 tube that gives a clean straight edge to the shadow.

3. With the eye closed as above, remove the ground connection from the 6F5 grid. Be sure the grid connection does not touch anything (except the 5 megohm resistor). The position of the two shadows on the 6E5 should change very little if at all. Try several 6F5 tubes if necessary to secure this result. Usually an old 6F5 that has been used several hundred hours in a radio set will give the most stable operation.

4. Connect the 6F5 grid lead to the positive terminal of a dry cell and the negative terminal of the battery to ground. The eye should open and it should take approximately a 60 degree turn of the 50,000 ohm potentiometer to close it.

5. With the above set-up and the eye within a hair's width of being closed, disconnect and then reconnect one terminal of the 8 mfd. condenser located in the cathode circuit of the 6F5. With a condenser having low leakage there should be very little change in the position of the 6E5 shadow.

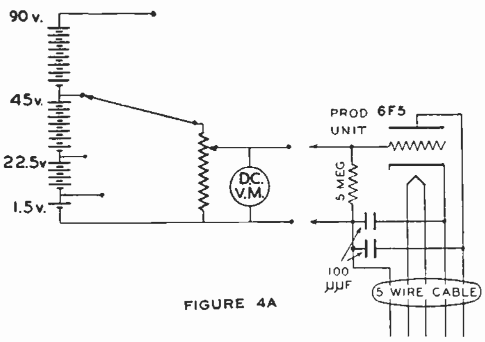


FIGURE 4A

CALIBRATING D-C SCALE

Connect a series of batteries to a 25,000 or 50,000 potentiometer and multi-range voltmeter as shown in figure 4A. A well filtered "B" supply may be used in place of the batteries, but if any a-c ripple appears on the d-c component a false reading will result—since the V. T. V. M. will measure the combination of the a-c and d-c voltages. Use the low voltage range of the d-c voltmeter and adjust battery potentiometer to give 0.1 volt reading on the d-c voltmeter. This will cause the eye to open if it has previously been adjusted to zero. Turn the 50,000 ohm potentiometer on the V. T. V. M. until the eye just closes and mark 0.1 on the scale under the pointer. Continue the calibration in 0.1 volt steps up to 5 volts, changing the battery tap and the meter scale when necessary. Calibrate every 0.2 volt up to 10 volts; then every .25 volts up to 15 volts; then every .5 volts up to 20 volts; then every 1.0 volts up to 40 volts; then every 2 volts up to 50 volts; then every 5 volts up to 70 volts; then every 10 volts up to 100 volts; and then every 25 volts up to the maximum voltage capability of the V. T. V. M.—which will depend upon the plate voltage of the 6F5 tube. The calibration for d-c voltage should be made on one side of a circular line previously drawn on the panel. The calibration marks should not be drawn so as to cross this line or they will interfere with the a-c calibration marks which are to be made on the other side of this line. In using the various meter scales on the d-c meter always use the scale that will permit the reading to be made as near full scale as possible, as this will give the best accuracy.

CALIBRATING A-C SCALE

The a-c scale is calibrated in the same manner as the d-c scale except a transformer is used across the a-c line as a voltage source, and of course an a-c meter must be used. A good arrangement is shown in figure 4B. A standard

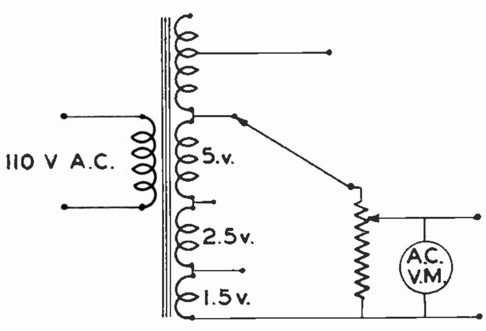


FIGURE 4B

power transformer is used with the low voltage secondaries connected in series, and half of the high voltage secondary is used. In connecting the secondaries in series, be sure they are connected so that the voltages add instead of bucking each other. As in the case of the d-c calibration, start with 0.1 volt steps and allow larger voltage steps between calibration points as the scale becomes crowded.

Line voltage variations, if severe, will cause some loss in accuracy. This can be reduced if the 6F5 grid is grounded and the 3000 ohm potentiometer adjusted to close the eye when the 50,000 ohm potentiometer is set at zero on the scale several times during the calibration period. This is also a good precaution during long periods of use.

Mark the d-c scale with the letters "D.C." to prevent possible mistakes in the future. A very good method of avoiding confusing the two scales is to use different colors for each—such as white for d-c and red for a-c.

Your Question Answered

Question 1. In certain receivers employing a type 6L6 power output tube we have found that the performance fails after about ten minutes of operation. If the receiver is turned off for a short time and then turned on again the same trouble is repeated. Observation and tests prove that the trouble lies in the 6L6 tubes or associated circuit which is resistance coupled. New tubes do not seem to help this condition very much. Can you give any suggestions as to what the cause of the trouble is and how it can be overcome?

Answer: Undoubtedly the value of the grid leak employed in the 6L6 grid circuit is of too high a value. Technical data on some makes of receivers show that this resistor is of 1 megohm value or thereabouts. Evidently the receivers you have been experiencing trouble in have a grid leak around this value. If this is true, then the resistor should be changed to one of 0.5 megohm value in order to prevent blocking. Most of the receivers also employ a 6Q7 ahead of the output circuit with a plate load of 250,000 ohms thus making it unnecessary for any changes there.

Question 2. The local stations give trouble with 6E5 tubes by closing the shadow completely. Can a 6G5 be used in place of the 6E5 to overcome this complaint?

Answer: In most cases the 6E5 can be replaced with a 6G5 and the trouble as explained will be corrected. However, the visual indications on distant stations with weak signals may not be very sharp and this should be explained to your customers. An article covering the use of the 6G5 in place of the 6E5 appeared in the Sylvania News Technical Section, Volume 6, Number 5 and 6. It is suggested that reference be made to that article for more complete data.

Question 3. Many receivers are encountered in our service work having defective rectifier tubes such as 5Y3G, 5Z4, etc. As fast as we replace these tubes the new ones also become defective. What do you suggest for this?

Answer: There is only one definite way to determine whether replacement of rectifier tubes can be made without damage to the new tube and that is by actually testing the rectifier circuit before the replacement is made. In many cases the electrolytic condenser has become defective during a momentary short at which time the original tube became defective. Such condenser defects are caused by a-c being directly impressed across the condenser due to the short. Obviously, the electrolytic condenser should be tested and replaced if found defective. *It is suggested to all servicemen that they make it a rule to always test the rectifier circuit, especially the electrolytic condenser before replacing a defective rectifier tube.*—(See article by Walter Jones on front page.)

SYLVANIA NEWS

TECHNICAL SECTION

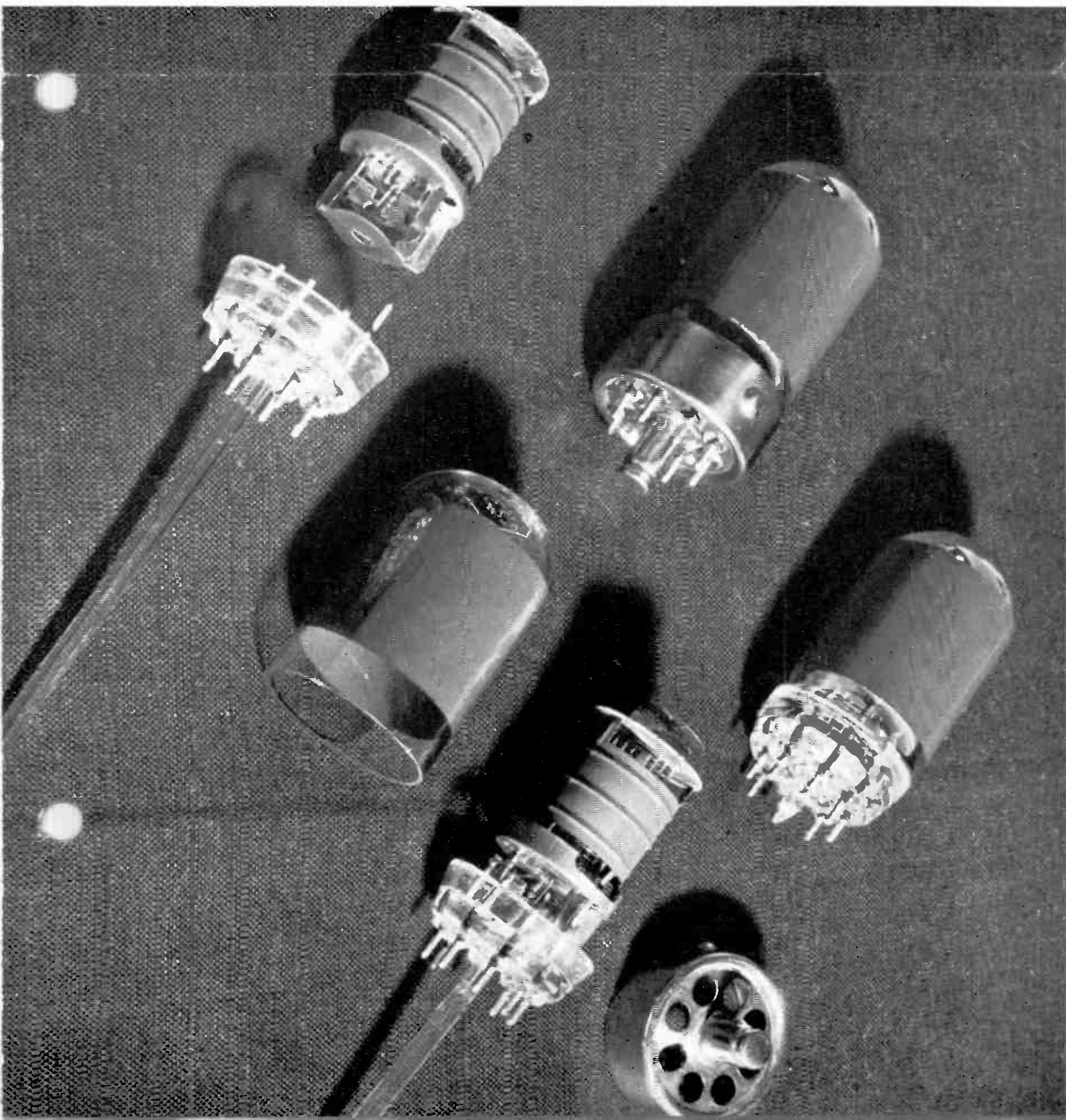
MAY-JUNE, 1938 | EMPORIUM, PENNA. | Vol. 7, No. 9

SYLVANIA ANNOUNCES TYPE 1231

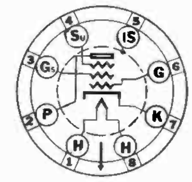
Type 1231, developed by the Sylvania Engineering Department, is an outstanding example of Sylvania's constant efforts to evolve new types and greater structural efficiency to meet future problems in the radio industry.

The photograph below shows plainly the interesting constructional features of the 1231. The most noticeable change is the elimination of the standard stem and bakelite base, and the use of a glass "seat", which is sealed to the bottom of the bulb. This permits a reduction in height to approximately 2½ inches when the tube is seated in the socket. The internal elements are mounted directly above the glass "seat", and the lead wires, which serve as contact pins, are brought out through it. Over this is fitted a metal shield (see lower right and top center) with a locating lug.

The development of Sylvania type 1231 required many months of preliminary research and experiment, and a long additional period of experimental production and testing in the Production Development Section—the "factory within a factory" which is an important part of the Sylvania Engineering Department.



Type 1231 Triple Grid Amplifier



8-8

The description and views of the Sylvania type 1231 tube given in the opposite columns indicate it as a tube with original and outstanding constructional features. This new Sylvania tube is a triple grid amplifier introduced primarily for use in television video amplifiers (picture signal amplifiers) and other similar applications.

The new type of construction incorporated permits very short leads to the electrodes, low interelement capacitances and low loss insulation throughout. The rigid lead wires which serve as contact pins and as supports for the tube mount result in minimizing the number of welds and entirely eliminates pin soldering.

The metal shell with guide pin is cemented around the lower portion of the tube with the top edges "rolled in". This metal shell also acts as a shield.

A short connection to the control grid is provided by carrying this element to one of the contact pins, eliminating the usual top cap. Ample shielding is provided for this grid connection inside the tube and the metal guide pin acts as a shield between the external grid and plate leads.

This new tube may be used as a pentode, tetrode or triode by making connections as shown in the tabulations below. Because of the differences in construction of type 1231, it obviously is not intended as, nor can it be used as, a replacement tube for any existing type.

Characteristics

Heater Voltage	6.3 Volts
Heater Current	0.45 Ampere
Maximum Over-all Length	2⅞ Inches
Maximum Diameter	1³⁄₁₆ Inches
Bulb	Special
Base	No. 8-8

DIRECT INTERELECTRODE CAPACITANCES:

(As Pentode)

Grid to Plate	0.015 μμf Max.
Grid to all other elements	8.5 μμf
Plate to all other elements	6.5 μμf

Operating Conditions and Characteristics

	Pentode	Tetrode	Triode	
Heater Voltage	6.3	6.3	6.3	Volts
Heater Current	0.45	0.45	0.45	Ampere
Plate Voltage	300	300	250	Volts
Screen Voltage	150	150	(to plate)	Volts
Cathode-Bias Resistor	200	200	400	Ohms
Suppressor	(to cathode)	(to screen)	(to plate)	
Plate Current	10.0	12.0	13.0	Ma.
Screen Current	2.5	0.5		Ma.
Plate Resistance	700,000	540,000	5,200	Ohms Approx.
Mutual Conductance	5500	6500	6300	μhmos
Amplification Factor	3850	3500	33	

Whose Face Is Red?

By WALTER R. JONES

One evening Mr. John Q. Public discovered that his radio wasn't working as well as it had when he bought it several years earlier. He thereupon decided that the trouble might be defective tubes, as he couldn't remember buying any new ones for a long time.

The next morning he removed all the tubes from his receiver (and marked it so he could get them back correctly, we hope), and took them to a shop where he remembered seeing a "Tubes Tested Free" sign. The serviceman, whom we will call "A", gave a verdict of 1 bad, 6 OK.

Mr. Public felt that one bad tube couldn't have had that much effect on his radio, so he gathered up all his tubes and marched on to another "Free Test" shop. Here the verdict, delivered by serviceman "B", was 3 OK and 4 bad. That made our hero smell a rat. The radio wasn't that bad!

Again he gathered up his property and departed to find another shop. Here serviceman "C" told him that 5 were bad and only 2 were good. By this time our hero, hot under the collar, determined to carry on to the bitter end. In the next shop serviceman "D" said, "4 OK, 3 bad." Our hero had time for one more call, and here serviceman "E" said, "5 OK, 2 bad."

It is now almost nine o'clock, and John Q. goes to work. All day he broods over the tricky tactics of servicemen. He is convinced that at least three out of the five were trying to "pull a fast one." Serviceman "A", he decides, was probably honest, and certainly dumb, because he made no attempt to sell more than one tube. Only serviceman "E" hit the mark that our hero now decides must be about right—namely, two bad tubes out of seven. At the end of the day he returns to "E", ready to buy two new tubes.

By this time, however, he is so suspicious of all servicemen that he insists on seeing the tests by which "E" determined that two tubes were defective. "E", being an obliging cuss, carefully shows him that the old tubes test 48, and explains that a new tube of the same type should test 72. Everything is pleasant, and "E" is about to wrap up the new tubes, when our hero cries "Whoa, there! I want to see those new tubes tested too. How do I know they are in good condition?"

Imagine the embarrassment of "E" and the utter disgust of John Q. Public when those new tubes tested 38—exactly ten points lower than the old tubes which he has been told test defective.

These two situations—lack of correlation between tube tests made by different servicemen, and lack of absolute correlation between different makes of tubes of the same type, happen every day. Perhaps you have wondered why some customers never came back after you made a careful test of his tubes. Perhaps you have been embarrassed when new tubes of the brand you carry showed up on your tester as "worse" than defective tubes of another brand. This is bad for your business. Careful consideration of the factors involved may help wide-awake servicemen to guard against such situations, to their own personal benefit and the benefit of the whole service profession.

In 1929 and 1930 the use of type 27 as a bias detector was quite common. It was discovered that some 27's worked better than others in certain applications. Investigation showed that there were over fifty different sets of operating conditions that the 27 had to meet in biased detector service. Tubes which were satisfactory in one circuit were not as good in others. Yet all of these tubes met normal specifications for type 27. In later years a similar situation has arisen in the use of type 36 as an autodyne. It is frequently necessary to try out several tubes before finding one that would give satisfactory performance in a certain receiver, yet the "unsatisfactory" tubes will work well in some other circuit with different requirements. It is obvious, from these examples, that although tubes test normal there are occasions when a selection must be made.

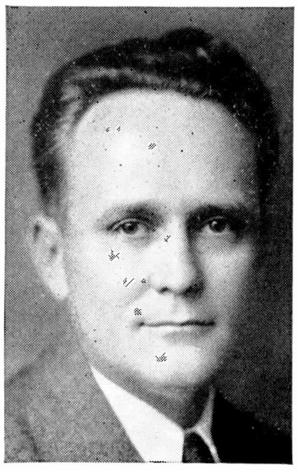
In a modern tube factory a score or more of different characteristics are measured with extreme accuracy. Test equipment frequently costs $1000 or more. It is to be expected that some compromise must be made in building a tube tester costing around $40.00. These testers can make only relatively few and simple tests. Yet, if the serviceman is willing to spend considerable time in learning the limitations of the tester he owns, his results can be surprisingly accurate.

Returning now to our hero's experience, the difficulty was probably due to the fact that each of these servicemen were equipped with a different make of tester. Each was sincere in his belief that he was giving the correct answer to the tube test. In spite of this, the variant results made the customer suspect that at least some of these servicemen were tricky or dishonest.

Further, the embarrassing results when "E" tested the new tubes was probably due to the fact that different makes of tubes, although of the same type, and in good operating condition, may give widely variant indications on the older emission type testers.

In the next issue of Sylvania News the reasons for variations in different makes of testers will be discussed. A discussion of the reasons for test variations between tubes of the same type but of different makes will follow in a later issue.

A CHAT WITH ROGER WISE



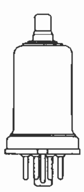
Chief Tube Engineer
Hygrade Sylvania Corporation

As radio set manufacturers reveal their plans for the current year a notable increase in the importance of radio tube design becomes evident. Small sets place a premium on compactness in radio tube design and have also increased the demand for more efficient tubes. The small size of metal tubes has been stressed from the time of their introduction and has been a factor in keeping interest in them alive. Some start has been made in the introduction of glass tubes affording similar advantages, with marked differences in the line of attack. Only time will tell which of the many designs under consideration will prove to be the most practical and satisfactory.

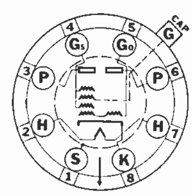
It is evident that lower wattage cathodes are favored to reduce the amount of heat dissipated in AC-DC compacts and to a somewhat lesser extent in other designs including AC household receivers and auto sets. In these latter services the heat coming from the cathodes is so much less than that dissipated in the plate and screen circuits, in resistors, filters and field coils that use of smaller cathodes will depend on such factors as cost and reliability. For that reason no guess as to the immediate trend is possible.

Some interest is evident in series operation of two volt battery tubes. The combination of two in series operated from three dry cells appears to have been satisfactory in service because of the improved quality of battery tubes. When so connected each tube is subjected to an initial voltage in excess of 2.3 volts, a value higher than the recommended maximum of 2.2 volts. The fact that the battery terminal voltage falls rather quickly to a value within the range recognized as satisfactory is no doubt an important factor in the practical results. Other tube design possibilities are opened by the improvements in filament wire and filament coatings now generally incorporated in Sylvania battery tube production.

NEW TUBE



Type 6K8 Triode Hexode Converter



8-K

Type 6K8 is a new metal tube containing a triode oscillator unit and a hexode mixer unit. The tube is intended primarily for converter service similar to that of types 6A7, 6A8, etc.

This new tube tends to have less frequency drift than previous converter tubes when used in conventional circuits.

It will be noted that the hexode plate, hexode screen and triode plate may be operated at the same voltage (110 volts) which results in design economics.

It may be possible, in some cases, to directly replace the metal 6A8 with this new converter with realignment required. However, the tube is not intended for that type of replacement and for maximum performance a circuit especially designed should be used.

Characteristics

Heater Voltage AC or DC	6.3 Volts
Heater Current	0.3 Ampere
Maximum Over-all Length	3⅛ Inches
Maximum Diameter	1 5/16 Inches
Bulb	All Metal
Base	Wafer Type Octal #8-K

DIRECT INTERELECTRODE CAPACITANCES:

(Approx. With Shell Connected to Cathode)

Grid G to Hexode Plate	0.03 μμf
Grid G to Oscillator Plate	0.01 μμf
Grid G to Grid G_o and Hexode Grid No. 1	0.1 μμf
Grid G_o and Hexode Grid No. 1 to Oscillator Plate	1.1 μμf
Grid G_o and Hexode Grid No. 1 to Hexode Plate	0.05 μμf
Grid G to all other Electrodes (R-F Input)	6.6 μμf
Oscillator Plate to all other Electrodes except Grid G_o and Hexode Grid No. 1 (Osc. Output)	3.2 μμf
Grid G_o and Hexode Grid No. 1 to all other Electrode except Oscillator Plate (Osc. Input)	6.0 μμf
Hexode Plate to all other Electrodes (Mixer Output)	3.5 μμf
Hexode Plate Voltage	250 Volts Max.
Hexode Screen Voltage	100 Volts Max.
Hexode Control Grid Voltage	-3.0 Volts Max.
Oscillator Plate Voltage	200 Volts Max.
Total Cathode Current	16 Ma. Max.

Operating Conditions and Characteristics

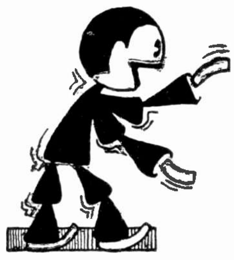
Heater Voltage	6.3	6.3 Volts
Plate Voltage (Hexode)	100	250 Volts Max.
Control Grid Voltage (Hexode Grid No. 3)	-3	-3 Volts Min.
Screen Voltage (Hexode)	100	100 Volts Max.
Oscillator Plate Voltage (Triode)	100	100 Volts
Oscillator Grid Resistor (Triode)	50,000	50,000 Ohms
Plate Current (Hexode)	2.3	2.5 Ma.
Screen Current (Hexode)	6.2	6.0 Ma.
Oscillator Plate Current (Triode)	3.8	3.8 Ma.
Oscillator Grid and Hexode Grid No. 1 Current (Triode)	0.15	0.15 Ma.
Plate Resistance (Hexode)	0.4	0.6 Megohm Approx.
Conversion Conductance	325	350 μmhos
Control Grid Voltage (Hexode) for 2 μmhos Conversion Conductance		-30 Volts
Oscillator Transconductance (Approx.)		3,000 μmhos

Typical Oscillator Performance

Oscillator Grid Current (Z_G to K = 1700 ohms)	75 Microamperes
Oscillator Grid Current (Z_G to K = 3400 ohms)	150 Microamperes

Z_G to K = Load Impedance Grid to Cathode.

The mutual conductance of the triode or oscillator section not oscillating, with triode plate voltage of 100 volts and triode grid voltage of 0, is approximately 3,000 μhmos.



THE SERVICE EXCHANGE

THE information presented in the Sylvania Service Exchange is contributed by servicemen as the result of practical experience. It is very carefully considered before being accepted, and we believe it to be correct and authentic. However, we assume no responsibility with respect to results. Each hint accepted entitles the writer to his choice of one Sylvania receiving tube. Please indicate preference when submitting hints. Don't send routine or generally known information. Please specify tube choice.

Airline Model 62-413, Wells-Gardner Model 2DL. Intermittent sizzling, scratching and crackling may occur persistently or once per day. Caused by poor connection in candohm resistor used for bias of a-v-c and audio tubes. First audio 6C5 cathode connection is at fault. If any attempt is made to pinch tighter, insert extra insulation strips under armor. Otherwise install 156.5 ohms between 6C5 first audio and 6C5 a-v-c cathodes to replace defective section.—Howard Siebold, Berkeley, Calif.

* * *

G. E. Model 51, RCA Model 118, 211. Intermittent hum not seriously affecting volume. The .05 mfd. condenser coupling 6B7 grid to volume control opens intermittently. Capacity remains enough to furnish audio. Replace.—Howard Siebold, Berkeley, Calif.

* * *

Philco Model 57. The customer complained of a frying noise and of stations WLW (700 K.C.) and WKRC (500 K.C.) being all over the dial. The broad tuning was attributed to the oscillator circuit not functioning. The oscillator circuit is coupled to the first detector circuit by a pair of twisted wires. Remove one of these wires and replace with another of about one inch longer. This will cure the oscillator trouble. The frying noise was caused by the tension screw on the roller bearing of the tuning condenser rubbing on the insulated can of the filter unit. Remedy by placing a cardboard container over the unit or apply friction tape.—James Robinson, Cincinnati, Ohio.

* * *

Philco Model 37-33, 38-33 Battery Sets. There are very few servicemen except those who live in cities who haven't worried over some of these sets not having enough volume. The remedy is to change the audio circuit from phase inversion to transformer type Class B, using the 1H4G phase inverter tube as a driver. The transformer is the only part that is extra. A Jefferson No. 467-404 will work very nicely. Change the grid condenser that runs from the plate of the 1H6G to the grid of the 1E7G to the grid of the 1H4G. Disconnect the condenser also the grid and plate resistors which run from the plate of the 1H4G tube to the other 1E7G grid. Connect the transformer in conventional form from the 1H4G to the 1E7G using three volts on the grid. Slightly better tone and a reduction of plate current can be secured by changing the 1E7G to a 1J6G with no change in wiring.—Henry Bennett, Dexter, Missouri.

* * *

Model 10. Tighten all shields, making sure they have clean contact. Run soldering iron over joints. Test with not over 5½ volts input from from battery or power supply.

Model 16. Usually open diode coupling condenser, Philco part No. 3615AD.

Model 17. Check first audio screen resistor, part No. 4409, also the audio coupling condenser part No. 39003L.

Model 18. Check first i-f primary for open or high resistance joints. Check AVC coupling condenser for open or intermittent joint.

Model 38. If condensers check okey, tighten all shield cans. Change the oscillator cathode resistor from 6,000 ohms to 2,000 ohms.

Model 45. The wave trap frequently opens. Try a hot iron over the lugs, or replace with improved part No. 39/5995.

Model 47. Check for short between the pilot light bracket and chassis. Also check audio coupling condenser.

Model 59. Check double by pass condenser in screens of the 77's. Tighten i-f and oscillator shields. Check trimmer leads for high resistance joints. Run a hot iron over joints, check the i-f transformers Replace the second detector with a new Sylvania tube.

Model 65. Common failure is the detector plate bypass condenser.

Model 89. Check double bypass unit No. 8174B in the r-f plate and detector cathode circuits. Check oscillator coil for high resistance joints. Replace fiber washers and the mica in the compensating condensers. Reduce the detector-oscillator bias resistor from 15,000 to 10,000 ohms.

Model 90. Clean condenser rotor. Tighten all connections and replace all bypass and coupling condensers.

Model 95-96. Replace the condenser from the low side of the volume control part No. 3754. Also the coupling condenser No. 3788A.

Model 112. Replace all bypass and coupling condensers.

Model 600. Replace the twin .09 mfd. condenser part No. 4989DG in the screen circuit of the 77 and 6A7 tubes.

Models 37/650, 660, 670. The 6K7G tubes have a tendency to break down in this model. Replace with new Sylvania metal 6K7 and ground lug No. 1 on socket if open.—Edward's Radio Service, Hoboken, N. J.

* * *

6L6 Output Systems. I have found slight distortion in high fidelity sets using 6L6's in push-pull class A service. This is caused by the fact that some 6L6's of other brands will vary as much as fifty per cent in plate current under the same operating conditions. Replace with two Sylvania 6L6G's as they are uniform.—Howard Siebold, Berkeley, Calif.

* * *

RECTIFIER PROBLEM SOLVED

GENTLEMEN:

Noted with interest the article by Walter R. Jones "Did it ever happen to you." Indeed it did, quite consistently several years ago, but here's how I solved the problem. During the sales of tubes in my shop, all that are low are thrown into a convenient box under the bench and finally dumped, with the exception of rectifier tubes such as 80, 84, 25Z5, etc. Such tubes while still OK are carefully labeled "Low for testing in radio only," and tucked away for the next job that shows up with a rectifier blown. It is then a simple matter to put one of these in, and if filter trouble caused the original tube to go west, only a worthless tube goes west for me and the resultant feeling is one of satisfaction over a quick painless analysis, instead of several minutes trying to figure out why we're such dumb clucks.

Such low tubes should be equally valuable for sets with unformed filters, as the initial surge would be limited by the low capacity of the old tube. Checking the condition of the first filter is an excellent idea, but takes time. We find blowing an otherwise useless tube faster, and another good way to dispose of used tubes.—Olsons Radio Service, Carrington, North Dakota.

* * *

PHILCO INTERMITTENT RECEPTION

The intermittent reception in Philco radios can usually be caught by following these hints. On stubborn cases always run an iron over all joints. Sets using types 36 or 39/44 tubes often develop shorts between filament and cathode, replace with new Sylvania's. Always check for loose rivets and screws at all grounded points as this cause of intermittent operation is often overlooked by servicemen.

* * *

Zenith Models 4Z31, 4B132. Here on the Eastern shore of Maryland the humidity is greater than in most parts of the country and on these models we have trouble with the i-f transformers opening up after a month or more of service. The coil forms absorb moisture and cause corrosion in the winding. To remedy this we have found that replacing these with i-f transformers that are wound on wood (impregnated with wax) is the best solution. On these sets the customers turn in complaints that their sets are inoperative from 710 KC down. We find upon checking them, that in some cases replacing the type 15 tube with a Sylvania 15 tube cures this trouble. In the more stubborn cases, we find that it is necessary to replace the oscillator coil assembly and also the type 15 tube. This coil absorbs moisture and when it does so, it is impossible to make the oscillator circuit track over the broadcast band.—Medford P. Keyser, Chestertown, Maryland.

* * *

Wilcox-Gay Model 50-A. On this model the dirt will sift in and get down between the voice coil and the pole piece with the result that it sounds terrible. To remedy this, remove the speaker and cut a piece of soft felt or soft leather just a little larger than the diameter of the voice coil and glue it over the voice coil opening. When it gets dry you can put a handful of sand on it and the tone will not be affected. I have used this a number of times and it gives excellent results, especially on the horizontal type mounted speaker. It may be used on all dynamic speakers but shows the best results on the speakers that are mounted horizontally or speakers shooting the voice and music upwards.—Tommie Birdwell Iowa Park, Texas.

* * *

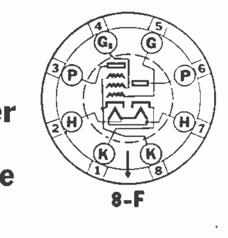
Zenith Model 4B-131. When used several months, this model may start picking up a code signal and will have some hiss when passing through stations while dialing. The hiss is also noticeable when the volume control is being turned quickly. This trouble can be eliminated by twisting the wire leading from the cathode of the 75 tube around the condenser leading from the control grid of the same tube. Both leads go to the volume control. This hint also pertains to several other models.—Bailey's Radio Service, Hammond, La.

25A7G

Base View Correction

In the last issue of the Technical section a mistake appeared in the connections of the base view of type 25A7G. If you haven't discovered the mistake, we suggest that you make the correction now so that you won't become confused at some later date when referring to that base view. The two cathode (K) connections should be reversed. The cathode for the rectifier secton of the tube should connect to pin #1 and the cathode for the pentode section should connect to pin #8. The editors agree that it is much better to admit the error than to re-design the tube. So below we are showing the correct base view along with the bulb view and title. Our mistake can easily be hidden by pasting the diagram below over the one shown in the last issue.

Type 25A7G Rectifier and Pentode



8-F

THE VACUUM TUBE VOLTMETER AS A SERVICE TOOL

By GEORGE C. CONNOR

Continued from last issue

The vacuum tube voltmeter is one of the most versatile and useful instruments for laboratory and service shop use. It is not, however, a tool that can be used without regard for its limitations, or the results may be subject to serious error. It is less simple and convenient to use for some types of voltage measuring than the moving coil type of voltmeter, and where this latter type of meter can be used, it is to be preferred to the V. T. V. M. For measuring d-c voltages across high resistance circuits where it is not permissible to use an instrument that will draw current from the circuit and for r-f measuring work, the V. T. V. M. is in a class by itself and is in many cases the only instrument that can be used.

It has been so long since most of us learned to use a d-c voltmeter that we tend to forget the number of times we used the wrong scale and either bent the pointer (if nothing worse happened) or got no reading at all, and the number of times we secured a reading that meant nothing to us because we did not know how to interpret it, lacking knowledge on what reading to expect as normal for the voltage condition we were trying to check. The V. T. V. M., by the very nature of its purpose—measuring voltages across high impedances and at radio frequencies—necessitates more care and knowledge in its application than the simple d-c meter. For this reason this series of articles is being concluded with data on the correct use of the V. T. V. M. in service work.

In addition to the study of this material, the serviceman is urged to experiment on several different types of radio sets known to be in good working condition so that he will be familiar with the results to expect when testing a questionable set. It is especially recommended that each suggested test described in the following paragraphs be actually made by servicemen on radio receivers known to be working properly, before an attempt is made to diagnose (with the newly acquired V. T. V. M., whether of the type described in past issues of Sylvania News or of some other type) a receiver in imperfect condition This will make it much easier to interpret the future readings secured with the aid of the V. T. V. M.

PART V—USES AND APPLICATION

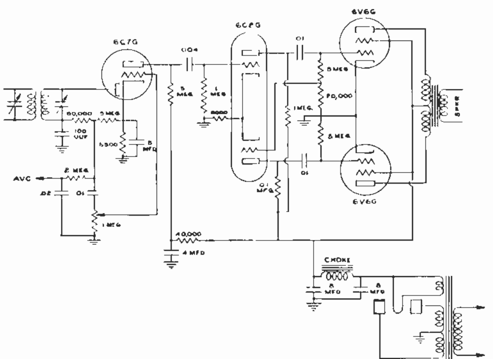
The audio frequency end of a radio receiver, because of the lower frequencies involved and the higher voltage available, presents the simplest point at which to start learning the proper use of the V. T. V. M. The circuit shown in figure 5A is typical of what may be encountered in a modern radio receiver, audio section. The following stage by stage measurements will show how this end of the receiver may be analyzed with a V. T. V. M.

I. TESTING 2ND DETECTOR CIRCUIT:

Diode Section: The diode rectifier separates the a-f component from the i-f carrier, and since we are interested in only the audio circuit for the time being, we wish to determine all possible sources of a-f loss and investigate each one in turn.

(1) I-F Filter:

The purpose of the 50,000 ohm resistor and 100 $\mu\mu$f. condenser ahead of the diode load resistor is to filter the i-f signal form the audio (and a-v-c voltage) to prevent this i-f voltage from reaching the grid of the 6Q7G tube. If any quantity of i-f signal reaches the 6Q7G grid, it will cause the tube to overload at low audio levels and cause distortion. Likewise, if any of the a-v-c voltage reaches the 6Q7G grid, it will bias the tube toward cut-off and cause distortion. To check the effectiveness of the i-f filter (50,000 ohm resistor and 100 $\mu\mu$f. condenser) connect the V. T. V. M. to the control grid of the 6Q7G—this demonstrates one convenience of the V. T. V. M. method of testing. Many tests can be made from the top of the chassis. Also, the most important reason for testing at the grid of the 6Q7G is because we want to know how much i-f signal is getting through to the grid. We could test at the junction of the 50,000 ohm resistor and the condenser, but even if we found some i-f at this point, it would not prove that the grid was getting i-f voltage because of the distributed



5-A

capacity of the wiring, .01 mfd. by-pass condenser and volume control might still be great enough to filter it out (as a matter of fact, in some low priced sets this distributed capacity is depended upon to do this very thing). An **unmodulated** signal from a test oscillator is tuned in on the receiver and any voltage appearing on the V. T. V. M. will be i-f voltage. It is well to listen to the speaker during this test to be sure there is no other signal such as hum or hiss coming through since these false signals will of course reach the grid of the 6Q7 and cause a false reading. This is one case where a shielded room is of great value. The effect of noise and hum can be reduced to a large extent by increasing the signal strength at the oscillator so that a large a-v-c voltage is built up to reduce the sensitivity of the receiver. The test prod grid (6F5) of the V. T. V. M. should be connected through a small mica condenser on the order of 250 $\mu\mu$f. capacity to avoid measuring any a-v-c voltage that may be leaking through the .01 mfd. coupling condenser.

(2) A-F Blocking Condenser:

Assuming that the i-f filter is satisfactory, remove the 250 $\mu\mu$f. condenser from the test prod grid of the V. T. V. M. and with a strong signal still applied to the input of the receiver, connect the test prod direct to the 6Q7G grid to see if any d-c voltage appears on the 6Q7G grid. The ground lead of the V. T. V. M. should be connected to the chassis in each case. To prevent a false reading due to noise, hum, etc., from effecting the readings, connect an 0.5 mfd. paper condenser known to be free from leakage across the input of the V. T. V. M. This will by-pass any a-c and if a few seconds are allowed for the condenser to charge up before a reading is attempted, the d-c voltage will not be affected. A leaky condenser will make the wings of the V. T. V. M. electric eye overlap because the a-v-c voltage will be negative. Even if the leakage is small the condenser should be replaced because a leaky condenser is apt to cause trouble at a later date.

(3) A-V-C Network, A-F Filter:

The .02 mfd. condenser and 2 megohm resistor comprise the a-f filter to prevent any a-f voltage from being fed back along the a-v-c circuit. The effectiveness of this filter can be checked by connecting the V. T. V. M. prod tube grid through an 0.1 mfd. paper condenser to the junction of the .02 mfd. condenser and 2 megohm resistor with a strong **modulated** signal fed into the receiver from a test oscillator. No voltage should appear on the V. T. V. M. under normal conditions.

Triode (or Pentode) Section

(1) Cathode Resistor and Condenser:

The voltage drop across the cathode resistor may be checked by either a d-c voltmeter or the V. T. V. M. This will indicate the amount of grid bias on the 6Q7G tube. The condenser across this resistor may be very easily checked without removing it from the circuit. The purpose of this condenser is to by-pass all audio frequency signals that the 6Q7G is expected to amplify. To check this condenser we need only connect the V. T. V. M. across it and feed a low frequency signal into the grid of the 6Q7G tube. A low frequency is specified because a condenser is less effective at the lower frequencies and therefore if the condenser tests satisfactory at the low frequencies it is sure to be effective at the higher frequencies in the a-f band. An easily secured low frequency source is a voltage divider across the 6.3 volt heater winding of the power transformer. Apply a 60 cycle voltage equial to about 50% of the d-c bias to the grid of the 6Q7G. For example, with the constants shown in figure 5A an a-c signal of 0.8 to 1.0 volts is satisfactory and the voltage may be fed to the grid through an 0.5 mfd. condenser to avoid any complications due to the fact that the heater may be operated above d-c ground potential for some biasing purposes. Because we do not want the d-c voltage drop across the cathode resistor to appear on the V. T. V. M. prod tube an 0.5 mfd. condenser should be connected in series with the grid of the V. T. V. M. prod tube. If the cathode by-pass condenser is effective no voltage will be readable on the V. T. V. M.

(2) Screen Grid By-Pass Condenser:

If instead of a 6Q7G tube we have a 6B7 or 6B8G tube as a second detector the screen by-pass condenser may be tested in the same way with the same set-up, since its function is the same; to by-pass any a-c voltage that may appear on the screen grid.

(3) Stage Gain:

Returning to a consideration of the 6Q7G circuit, we can test the gain of this stage by introducing a measureable a-c voltage—such as 0.5 volt into the grid circuit from the a-c line just as we did for testing the cathode by-pass condenser, and measuring the a-c voltage appearing across the plate load resistor. A voltage from the a-c line is recommended to avoid the possibility of wave form errors that may result from a poor wave form from a test oscillator. The output voltage divided by the input voltage is the stage gain. The 0.5 mfd. condenser recommended in the previous test should be used in series with the V. T. V. M. grid to avoid the affect of the d-c plate voltage. The volume control should of course be on "maximum" during these tests.

(4) Plate to Grid Coupling Condenser Capacity:

To check the .004 coupling condenser for capacity, leave the a-c signal on the 6Q7G grid as before and move the V. T. V. M. 0.5 mfd. condenser from the plate terminal of the 6Q7G to the grid terminal of the 6C8G. The gain should be very nearly the same (within 10 to 20 per cent, usually) on most receivers. If a larger condenser is substituted for the .004 mfd. unit to increase the low frequency gain, it may be necessary to place a larger filter condenser in the power pack to keep the overall receiver hum within reasonble limits.

(5) Plate to Grid Coupling Condenser Leakage:

To test the d-c leakage of the .004 mfd. condenser, connect the V. T. V. M. prod tube grid direct (without the 0.5 mfd. blocking condenser) to the grid of the 6C8G tube, and remove the 6Q7G tube from the socket. Removing the 6Q7G tube from the socket does two desirable things; it eliminates any noise, hum or signal, that may be picked up by the receiver, from reaching the V. T. V. M., and it removes the IR drop from the 0.5 megohm resistor caused by the 6Q7G plate current. If any voltage appears on the V. T. V. M. the condenser is leaky. As an example, suppose the B supply is 300 volts, the leakage current through the .004 mfd. condenser one microampere, the voltage drop across the 1 megohm resistor will then be .000001x1,000,000 ohms = 1 volt (E = IxR). Such a leakage biasing the 6C8G grid positive by 1 volt would seriously limit the undistorted signal level that could be amplified, and unbalance the phase inverter circuit. A leakage of one tenth this value is as much as should be permitted.

Concluded next issue.

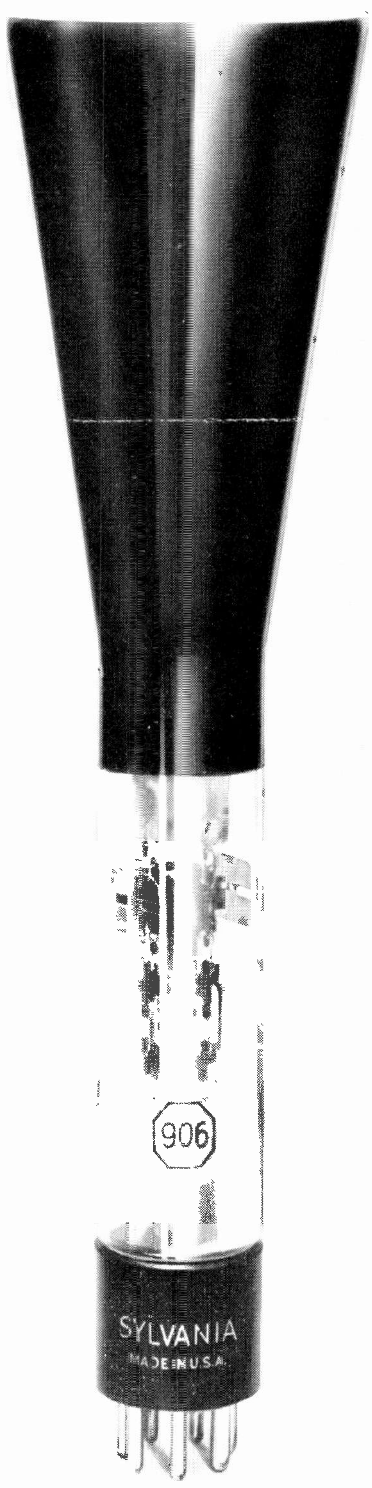
The next issue of the Technical Section will have the conclusion of this article on the uses and applications of the V. T. V. M. The following issue will conclude the series of articles with a discussion of the tests that can be made on the r-f and i-f end of a receiver.

SYLVANIA NEWS

TECHNICAL SECTION

JULY-AUGUST, 1938 | EMPORIUM, PENNA. | Vol. 7, No. 10

SYLVANIA CATHODE—RAY PICTURE TUBE



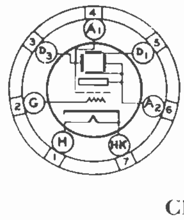
Sylvania Type 906 is a high vacuum cathode-ray picture tube with a three-inch screen. This new Sylvania Tube is designed for use in small television receivers and other similar applications. Due to its size (approximately 12"x3") and the brilliance obtainable, it is especially suitable for use in compact equipment.

An indirectly heated cathode supplies the electron current in the 906. The "electron gun" used for projecting a beam of electrons upon the fluorescent screen consists of the cathode, control electrode, and focusing electrode. The focusing electrode also acts as an accelerating electrode. The resulting luminous spot on the screen has a greenish hue (on special request other fluorescent colors are available) and can be regulated as to intensity and size by the choice of electrode voltage. Two sets of electrostatic plates are located in the neck of the bulb to provide for the deflection of the electron beam. The electrostatic field of each pair of plates deflects the beam parallel to the axis of the field.

Type 906 will be found useful where a cathode-ray tube of medium size is desired. This field includes radio manufacturers, broadcasting stations, experimental laboratories, radio amateurs, radio experimenters, radio servicemen, colleges, radio trade schools—wherever television is under consideration or development.

A series of descriptive and constructional articles on the building of a compact television receiver using the 906 was given in QST magazine starting in the December 1937 issue and concluded in the May 1938 issue. The April issue particularly covered the use of the three-inch cathode-ray tube. A similar series of articles appeared in Short-Wave & Television magazine from March 1938 to July 1938 inclusive.

Sylvania 906 may be used to replace any cathode-ray tube bearing the same type number, as well as types H7-2 and 2003.



PIN CONNECTIONS:

1&7—Heater
2—Grid
3—No. 3 Deflecting Plate
4—No. 1 Anode
5—No. 1 Deflecting Plate
6—No. 2 Anode, No. 2 and No. 4 Deflecting Plates

Characteristics

Heater Voltage	2.5 Volts
Heater Current	2.1 Amperes
Maximum Overall Length	11⅞ Inches
Maximum Diameter	3 1/16 Inches
Bulb	J-24
Base	Medium 7 Pin
Price	$13.50

Maximum Ratings

Anode No. 2	1500 Volts Max.
Anode No. 1	550 Volts Max.
Control Grid Volts	Never Positive
Grid Volts for current cut-off*	—60 Volts Approx.
Plate Voltage between Anode No. 2 and any Deflecting Plate	600 Volts Max.
Screen Power Density per sq. cm.	10 Milliwatts Max.

(Continued on Page Two)

KNOW YOUR TUBE TESTER

By Walter R. Jones

When Sam the Serviceman decided that a modern tube tester would be good for his business he went to the nearest city to visit parts jobbers and select the best piece of equipment within his means. He knew that there are several kinds of tube testers, but he was somewhat surprised to learn that there are various subdivisions of each type, and that each has its advantages and disadvantages. After his visit Sam no longer wonders why customers claim that tube testing does not always appear to tell the truth. Last month's article told of one customer's experience, and one serviceman's embarrassment. Sam's problem now is to decide how to spend his money to obtain the best results. Among the things that he learned were the following:

Generally speaking tube testers may be divided in three general types: those which apply direct current voltages of approximately correct values to the various elements under test; those which apply a-c voltages to the various elements with correct phasing of grid and plate; and those which connect all elements together except the cathode and apply an a-c voltage between the cathode and the other elements, commonly referred to as emission testers. The cost of these instruments decreases in the order named.

The d-c style of instrument requires a rectifier and filter together with a voltage divider to apply proper voltages to the various elements of the tube being tested. This test more closely approximates service conditions and hence is likely to be more accurate than others. This type of tester is usually called a "mutual conductance" type. The indication is obtained either by changing the grid bias and reading the change in plate current, or by introducing an a-c signal on the grid of the tube and reading the signal component of the plate current. The definition of mutual conductance is the change in plate current produced by a change in grid voltage, so that either of the above systems meets the requirements. Obviously this type of tester is more difficult to keep up to date, since new tubes may have added elements and will require added controls or sockets.

The next type of tester mentioned is that which employs a-c voltages on the various elements of the tube, but with proper phase relations so that the grid is negative when the plate is positive. With a tester of this type the indication is usually obtained by changing the grid bias and reading the corresponding plate current change. This is generally known as a grid-shift type of tester. This change is somewhat proportional to mutual conductance; but since a-c voltages are applied, and since the values are not the same as those employed in receiver service, the indications usually do not mean as much as a true mutual conductance reading. This fact is largely overcome, however, by supplying a calibration for various types of tubes with the tester. Intelligent use of this calibration as well as a complete check of the performance of the tester with the different makes of tubes will usually permit quite accurate readings to be obtained. This type of checker usually requires an additional control to set the meter to zero. Otherwise two readings must be taken to obtain the difference in plate current caused by shifting of the bias. In order to properly test all types of tubes a variable grid bias

(Continued on Page Three)

TYPE 906

(Continued from Page One)

Operating Conditions

Heater Voltage..........	2.5	2.5	2.5	2.5	Volts
No. 2 Anode Voltage.....	600	800	1000	1500	Volts
No. 1 Anode Voltage**...	170	230	285	475	Volts Approx.
Control Grid Voltage	Varied to control spot intensity				
Deflection Sensitivity:					
Plates D1 and D2......	0.55	0.41	0.33	0.22	mm/volt d.c.
Plates D3 and D4......	0.58	0.44	0.35	0.23	mm/volt d.c.

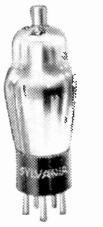
* With approximately 400 volts (to focus) on first anode
** For focus

Screen

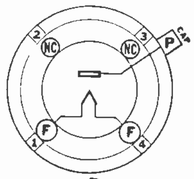
Fluorophor .... Color
No. 1................................Green
No. 2................................Yellow

(others available)

Fluorophor No. 1 furnished unless otherwise specified.
Note: If sharply defined spot is not required 400 volts may be used on No. 2 Anode with a proportional reduction in No. 1 Anode voltage.



Type 879 Half-Wave Rectifier



4-P

Sylvania Type 879 is a high-voltage low-current rectifier tube used primarily with cathode-ray tubes in television work. The tube is constructed with a coated type filament and a single plate. The plate connection is brought out to a top-cap. A standard four-pin base is used with pins #1 and #4 used for the termination of the filament leads.

In service type 879 will supply rectified current to equipment requiring high-voltage low-current operation. During operation the bulb becomes quite hot, therefore, adequate ventilation should be provided.

Type 879 will generally replace types H2-10 and 1431) rectifiers. Price $3.00.

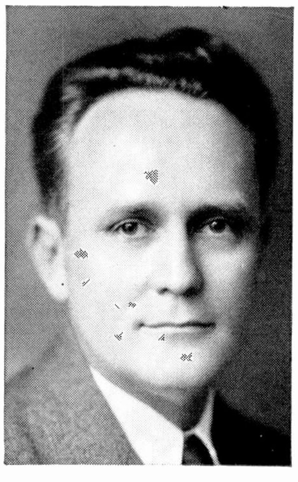
Characteristics

Filament Voltage...............2.5 Volts
Filament Current..............1.75Amperes
Maximum Over-all Length......4 17/32 Inches
Maximum Diameter............1 9/16 Inches
Bulb...........................ST-12C
Base...........................Small 4-pin, No. 4-P

Operating Conditions and Characteristics

Filament Voltage...............2.5 Volts
A-C Plate Voltage (RMS) Max...2650 Volts
Peak Inverse Voltage Max...7500 Volts
Peak Plate Current Max... 100 Ma.
D-C Output Current (continuous) Max............7.5 Ma.

A CHAT WITH ROGER WISE



Chief Tube Engineer
Hygrade Sylvania Corporation

The group of battery tubes recently announced, comprising types 1A5G, 1A7G, 1C5G, 1H5G and 1N5G, are especially interesting because of the excellent operating characteristics secured in spite of the sharp reduction in filament power, also in "B" current drain. A comparison with earlier types is interesting and in making such comparison it is convenient to consider the R-F Pentode, type 1N5G, as contrasted with r-f pentodes and tetrodes previously available.

Type 22 was the first dry battery tetrode introduced. The thoriated tungsten filament of this tube required .132 ampere at 3.3 volts, a power consumption of .436 watts or 436 milliwatts. To secure this voltage three dry cells connected in series were needed, and best performance was obtained only when a rheostat and voltmeter were provided so the voltage could be adjusted to 3.3 volts and held there as the battery terminal voltage dropped. The "B" current required by this tube was 3.7 milliamperes and the mutual conductance secured with this fairly high drain was 500 micromhos.

Next in the series was type 32, a much more efficient tube requiring 60 milliamperes at 2.0 volts, or 120 milliwatts of filament power. The oxide coated filament was much less critical as to operating temperature, the rheostat and voltmeter combination being eliminated, in most cases, by provision of a ballast tube to take care of the voltage change when dry cell batteries were used. The plate efficiency was substantially increased, the mutual conductance being centered at 650, with plate current less than half that of type 22, 1.7 milliamperes.

Type 1B4 superseded type 32 without much change in characteristics, but was manufactured in a smaller bulb, the ST-12 size, with a supressor grid added.

Type 1E5G was introduced to permit use of the octal base with characteristics same as type 1B4.

The new tube 1N5G is greatly changed in appearance and characteristics, with the filament rated at 1.4 volts, 50 milliamperes, or a filament power of only 70 milliwatts. Since it can be operated directly from a single dry cell, the saving in "A" power is more than 50% when compared with types 32, 1B4 and 1E5G. Plate current is reduced to 1.2 milliamperes and in spite of this reduction, the mutual has been increased to 750. Also, interelectrode capacities are lower, an advantage in circuit applications. Operation at zero bias is permissible and a further convenience. A straight-sided bulb, the T-9 size, is used.

The other new types included in this group of 1.4 volt tubes are: a converter, a diode-triode, and two power output pentodes, each of which represents a similar improvement in efficiency over the corresponding previous types as regards "A" and "B" power consumption and operating efficiency.

Low Current Battery Tubes—1A5G, 1A7G, 1C5G, 1H5G, 1N5G

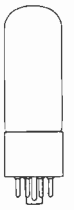
A forward step in the design of tubes for use in battery operated receivers has been made by the announcement of SYLVANIA types 1A5G, 1A7G, 1C5G, 1H5G and 1N5G. These new tubes have a nominal filament rating of 1.4 volts at 50 milliamperes, except type 1C5G, which has a 100 milliampere rating. With such low voltage and current operating conditions, it is possible to operate these new tubes directly from a suitable 1.5 volt dry battery. Other types of "A" batteries may also be used if proper circuit arrangements are provided, and the regular type of "B" battery supply may be used. The unusual economy in battery power obtained from the use of these new types is an interesting feature for rural and portable receivers.

These new SYLVANIA tubes are designed not only for economy of power supply, but also for the saving of space. Each of the five types is enclosed in the T-9 bulb. As shown by the designating type numbers, these types belong to the "G" group, having an octal base with locating lug.

The five types in the group consist of an r-f pentode, a diode-triode, a pentagrid converter and two power output pentodes. The applications of these new types closely parallel those of other similar types. Characteristics and operating conditions for the complete group are given below.

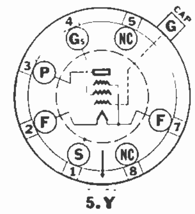
Type	Class	Base	Bulb	Filament Rating Volts	Filament Rating Amps.	Use	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resistance Ohms	Mutual Conductance Micromhos	Amplification Factor	Ohms Load for Stated Power Output	Undistorted Power Output Milliwatts
1A5G	Pentode	6-X	T-9	1.4	0.05	Power Amp.	85	4.5	85.0	3.5	0.7	300,000	800	240	25,000	100
							90	4.5	90.0	4.0	0.8	300,000	850	255	25,000	115
1A7G	Heptode	7-Z	T-9C	1.4	0.05	Converter	90	0.0	45.0	0.55	0.60	600,000	250 ▲	(G²=90 V.	Max.,	1.2 Ma.)
1C5G	Pentode	6-X	T-9	1.4	0.10	Power Amp.	83	7.0	83.0	7.0	1.6	110,000	1,500	165	9,000	200
							90	7.5	90.0	7.5	1.6	115,000	1,550	180	8,000	240
1H5G	Diode-Trio.	5-Z	T-9C	1.4	0.05	Det., Amp.	90	0.0	..	0.15	...	240,000	275	65	....	....
1N5G	Pentode	5-Y	T-9C	1.4	0.05	R-F Amp.	90	0.0	90.0	1.2	0.3	1.5 Meg.	750	1,160	....	....

▲—Conversion Conductance.

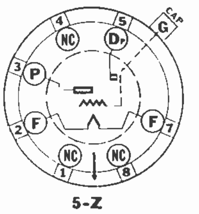


T-9

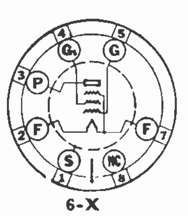
T-3C



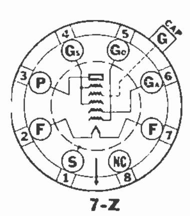
5.Y



5-Z



6-X



7-Z

Know Your Tube Tester

Continued from Page One

must be provided, which increases the cost of the tester and also further complicates the operation. If, however, these devices are provided it is not difficult to keep the tester up-to-date as new tube types are announced.

At the present time the so-called "emission" type of tester or one of its modifications is most popular. This type of tester usually connects all the elements of the tube, except the cathode, and a-c voltage is applied between the cathode and the other elements. A meter is supplied to read the required current which flows each time the elements are positive with respect to the cathode. The cost of this type of tester is comparatively low since only one value of a-c voltage is usually supplied, in addition to the filament. Since the elements are all connected together, a minimum number of sockets are required for testing. The tester has the further advantage of requiring very few changes to adapt it to new tubes. It is obvious that such tests do not approximate operating conditions. Consequently a set of limits must be run for each type of tube, and perhaps for each make of tube as well.

Most of the difficulty which arises because of failure of tube testers to agree has in the past been due to lack of correlation between various makes of emission testers. This is not hard to understand when one realizes that no two makes of tube tester necessarily employ the same voltages between the cathode and the other elements, or the same circuit impedances. Originally, only one value of circuit resistance was employed, which meant either than most tubes were tested with a very low emission current or a very high value. In the first case this meant that tubes which normally require a large current for satisfactory operation, such as output tubes and rectifiers, might test satisfactorily in the emission tester while actually the cathode was unable to supply the required amount of plate current. If the later condition, that of drawing a very high emission current, was used, then tubes requiring only very small emission current for satisfactory operation, such as 2 volt and some of the early 5 volt tubes such as the 01A, would be ruined if kept in the tube tester for any length of time.

During the past few years the R.M.A. Tube Committee has given considerable thought to these problems. Standard circuits for emission testers have been recommended, so that all emission testers would give the same indication for the same type of tube, whatever the make. The Committee has also specified different load resistances for different types of tubes, so that power output and rectifier tubes may be tested for high emission current, while tubes requiring moderate amounts of emission are tested with a a larger load resistor, and battery tubes and diodes are tested with a still greater load resistor to limit the current to a safe value comparable to that required in service.

As a result of his fact-finding tour, Sam sensibly concluded that, whatever type of tester he decided to buy, his first job was to become thoroughly familiar with it. He realized that it is just as important to learn what it will not do as what it will do. Before Sam uses his new tester on a customer's tubes he will know, for example, whether it draws a very small current from rectifier and power output tubes. If this is the case, he may miss some sales on tubes that really need replacement.

On the other hand, if the tester draws a large current from all types of tubes, care must be exercised in testing battery types. Otherwise, not only tubes brought in for testing may wrongly show defective, but Sam may be embarrassed by a "bad" test on new tubes from his own shelves, which he hopes to sell a customer watching the test.

Ten minutes a day spent in studying the performance of any tube tester, new or old, will bring out many unsuspected variations in results, and will undoubtedly increase your ability to obtain accurate and correct tests. In the long run this will pay both in better tube sales and in your customer's faith in your honesty and technical ability.

THE SERVICE EXCHANGE

THE information presented in the Sylvania Service Exchange is contributed by servicemen as the result of practical experience. It is very carefully considered before being accepted, and we believe it to be correct and authentic. However, we assume no responsibility with respect to results. Each hint accepted entitles the writer to his choice of one Sylvania receiving tube. Please indicate preference when submitting hints. Don't send routine or generally known information. Please specify tube choice.

Arvin Model 927. If the 6G5 Magic Eye doesn't work, do not check the A-V-C network until the 1.0 megohm resistor contained within the 6G5 socket assembly tests OK. We had several of these resistors that opened up, resulting in defective "Eye" performance.—Joseph S. Napora, Uniontown, Pa.

* * *

Chevrolet Model 985254 (1937). Several complaints have been vibrator noise on all stations. When all condensers, vibrator, shield can connections and rectifier are found to be OK, change the 6F6G to a metal Sylvania 6F6 and the noise will completely disappear. We have tried this on several of these sets and have had success in all cases.—W. L. Spaulding, Connersville, Indiana.

* * *

Crosley Model 160. This is an old reciever but there are still plenty of them around. When you get one that doesn't have much pickup and all parts check OK, look for the trouble in the oscillator circuit. I have found that the cathode resistor which is a 20,000 ohm resistor can be replaced with a 5,000 ohm unit. This will restore the reception to normal.—Leonard Johnson, South Boston, Va.

* * *

Dictograph A-C, D-C 91-134. No signal in Mystic Ear. Check motor coil for short or open in molded case of Mystic ear for the trouble.—Wm. B. Miles, Altoona, Penna.

* * *

Ford Philco 1935, 1936. If the set is intermittent and the tubes are good, tap and wiggle the .01 condenser that hooks to the volume control. The trouble with this unit has occurred a number of times in sets we have serviced.—Leonard J. Casson, Shafter, Calif

* * *

Majestic Model 1250. Several Majestic Radio and Television receivers of this model have come into my shop for the same trouble. They performed excellently at high volume, but with the volume control reduced to low there was a great deal of distortion. There was only one thing that I found to remedy this trouble. The audio coupling condenser coupling the 6F5 triode with the detector diode came between the diode return and the volume control. By removing this condenser and placing it in the grid circuit of the tube, (between the volume control and grid) and then placing a 2 megohm resistor from grid to ground, I found that the tone of the set was excellent from the lowest to the highest degree of rotation of the volume control.-Leonard Johnson, South Boston, Va.

* * *

Noisy Volume Controls. Quite frequently the serviceman has to replace volume controls of the carbon strip variety because they are noisy. For a quick repair I have found that if the element is brushed with a soft rubber eraser the noise can be overcome. Be sure to use a soft eraser because a hard one will make the surface of the carbon strip rough and cause more noise.

I have done this quite often and find it helpful in putting a set into satisfactory operation when a new control is not available.—David Alley, Williamsport, Pa.

* * *

Sparton Equassone Models. Very weak signals. In these models that have the detector tube sitting on top of gang condensers, the trouble has been traced to the grid leak of this tube, located underneath the socket of this tube (485). The coupling pin jack between the tube box and gang condenser, wears from vibration. Renew this.—Wm. B. Miles, Altoona, Penna.

Oldsmobile 1938 DeLuxe Radio. This receiver, when first installed, had a habit of blowing fuses with no apparent cause. After much checking I found the OZ4G cold cathode rectifier to be at fault. After trying several different makes of rectifiers with the same trouble, I wired the rectifier socket for a Sylvania type 6X5G rectifier and have had no trouble since. It is only necessary to run a hot lead to one of the filament prongs on the socket as the other lead is already grounded to the chassis.—Leonard Johnson, South Boston, Va.

* * *

Philco Model 38-116 Code 125 and Model 38-690. To prevent parasitic oscillations and improve performance of the oscillator circuit at 180 M. C. in Model 38-116 Code 125, connect a 100 ohm resistor between the 6A8G oscillator anode and the 6N7G plate. This resistor replaces the original brown wire which should be removed.

To prevent oscillations and improve performance at 18 M. C. in Model 38-690, use same procedure as given for Model 38-116 Code 125.—M. J. Planovsky, Cleveland, Ohio.

* * *

Push Button Tuning. If you have trouble with the push buttons sticking in an automatic tuning radio, it's because the radio is kept where there is too much sun or heat. The heat swells the buttons so that they stick on the sides. Also the springs often lose their tension. Remove the buttons that stick and sand the high spots down. If the springs cause the trouble, stretch them for better tension or replace with new ones. If the buttons are replaced they should be of some material other than bone or rubber then they will not warp. New springs should be of stronger steel for better tension.—George Baer, Roslindale Park, Mass.

* * *

RCA Victor Model 9K3. By adding a 25mfd. low voltage electrolytic to the 6L6 cathode circuit the set's audio system will be appreciably improved.—Louis Wiech, New Castle, Pa.

* * *

Sonora Model 70S. If set hums and the volume control does not reduce the volume correctly, look for an open 8 mfd. electrolytic condenser located under the resistor-condenser bank. This condenser should be replaced with one having a rated voltage of 300 volts.—Lee White, Jr., New Orleans, La.

* * *

Soldering Resistance Wire. Have had many dismal failures in attempting to solder resistance wire until I tried aluminum solder. This solder will take to resistance wire as well as rosin core solder takes to brass or copper. This works very well in the repairing of wire wound resistors, etc.—Leo W. Brandt, Maybee, Mich.

* * *

Stewart Warner Model 1845. When dial pointer and tuning condensers do not move and motor runs when station selector button is pressed, the trouble is in the clutch assembly. This can be repaired by removing the U shaped spring washer which fits between gears and collar.—Walquartain Radio Service, Northfield, Minnesota.

* * *

Zenith Model 870. If impossible to get signals below 700 k-c yet they will come in OK above, check for shorted or leaky .01 mfd. 400 volt condenser and oscillator plate circuit. Replace with a new .01 condenser.—Clarence DeGraff, Muskegon, Mich.

* * *

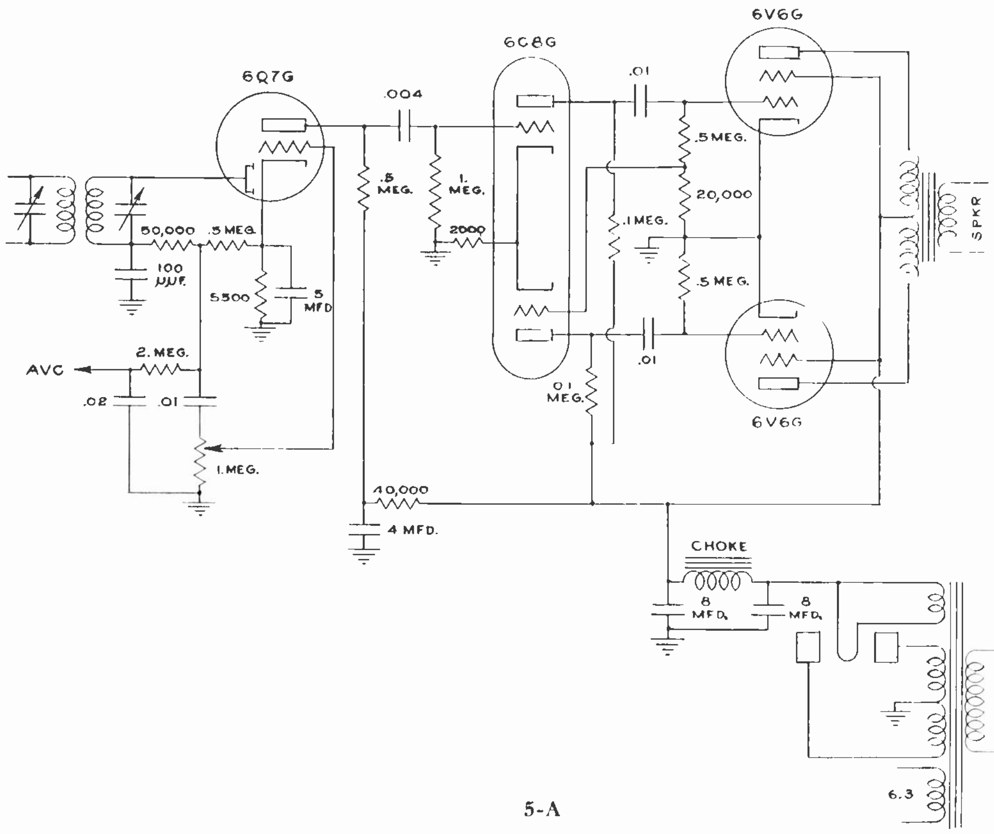
Zenith Model 6D117. To eliminate squeals on the low frequency end of the dial, wind about five widely spaced turns of small size cotton covered wire around the grid lead of the 6K7G tube. The end nearest the chassis should be grounded leaving the other free and insulated from the grid clip.-Louis Wiech, New Castle, Pa.

THE VACUUM TUBE VOLTMETER AS A SERVICE TOOL

By GEORGE C. CONNOR

Continued from last issue

Last month's issue of Sylvania News Technical Section contained an article on the "Uses and Applications of the Vacuum Tube Voltmeter." Because of limited space it was impossible to give the complete article in that issue. Thus, the conclusion is given below. You will note that the schematic 5-A is the same as used with last month's article, but of double column size. In reviewing the article the enlarged schematic should be more convenient to follow.



5-A

(6) D-C Plate Voltage:

To measure the d-c voltage on the plate of the 6Q7G tube, turn the volume control to "minimum" and connect the V. T. V. M. from plate to ground and read the d-c voltage direct on the V. T. V. M. The 6Q7G tube must be in the socket during this test.

(7) Plate Circuit Decoupling Filter:

The 40,000 ohm resistor and 4 mfd. condenser in the plate circuit of the 6Q7G forms an additional filter in the B supply to help eliminate hum. To test its effectiveness, measure the a-c voltage appearing between the B supply end of the 40,000 ohm resistor and ground—using an 0.5 mfd. condenser in series with the prod tube grid of the V. T. V. M. to eliminate the B supply d-c voltage. The a-c voltage appearing on the V. T. V. M. should be very small. Then measure the a-c hum voltage under the same circumstances appearing across the 4 mfd. condenser. It should be so small as to be unmeasureable with the V. T. V. M. If an a-c voltage is detected, the 4 mfd. condenser is defective or of too low a value and should be replaced.

(8) Decoupling Condenser Leakage:

To test the 4 mfd. condenser for leakage, remove the 6Q7G tube from the socket, and the 0.5 mfd. condenser from the prod tube grid, and measure the d-c voltage between each end of the 40,000 ohm resistor and ground. If there is no leakage in the 4 mfd. condenser the voltage will be the same at both ends of the resistor. With an electrolytic condenser some small leakage is to be expected, and the two voltages wll therefore not be equal. Since the "B" supply voltage is higher than the range of the V. T. V. M. it will be necessary to connect a 20 megohm resistor in series with the grid of the prod tube of the V. T. V. M. This 20 megohm resistor in series with the 5 megohm resistor already in the circuit between prod tube and ground will provide a voltage divider network ahead of the V. T. V. M. and the reading of the V. T. V. M. must be multiplied by 5 to secure the proper reading. A little experience in testing various makes of electrolytic condensers will indicate the amount of leakage to be expected as normal with each make.

A glance at the schematic diagram in figure 5A will show that we have now tested every part of the 6Q7G circuit under actual operating conditions without removing them from the circuit. The various parts used in the 6C8G phase inverter circuit should next be tested in exactly the same way.

II. TESTING PHASE INVERTER CIRCUIT:

The phase inverter circuit shown depends for its correct operation on the fact that an a-c voltage in the plate circuit of a vacuum tube is 180 degrees out of phase with the a-c voltage in the grid circuit. This is one fact in our tests that we may safely assume to be correct (although it too may be tested with a V. T. V. M.). To get the two output tube grids 180 degrees out of phase with each other, the signal from the top output tube is put through an extra tube (or one section of a duo triode, as in this case). Naturally we want the a-c voltage appearing on the two output tube grids to be equal in amplitude as well as being out of phase with each other. To secure this result, only a portion of the signal applied to the top output tube grid is applied to the second section of the duo triode. The ratio of the voltage applied to the phase inverter tube compared with the total voltage available should equal the voltage amplification of the tube being used as a phase inverter. The voltage amplification figure may be found by actually measuring the gain of the top section of the 6C8G tube. The test we are most interested in however is to find if an equal voltage is being fed to each output tube grid. This may be determined by any one of four measurements if all other parts are known to be good. The result of these tests should show that:

A. The a-c signal between each **grid** of the 6C8G tube and ground should be equal.

B. The a-c signal between each **plate** of the 6C8G tube and ground should be equal.

C. The a-c signal between each **grid** of the output tubes and ground should be equal.

D. The a-c signal between each **plate** of the output tubes and ground should be equal.

Only one of the above tests need be made and No. C is to be recommended as this tells us just what we want to know. A difference of 10 per cent or less in the two a-c output tube grid voltages may be considered as satisfactory since even a 10 per cent unbalance will not cause a noticeable increase in distortion.

III. POWER SUPPLY:

Aside from the B-plus and heater supply voltages, which may be measured with the moving coil type of voltmeter, we are most interested in measuring the amount of a-c ripple appearing across the two filter condensers since this is an indication of their effectiveness. An 0.5 mfd. condenser should be used in series with the grid of the V. T. V. M. prod tube to eliminate the d-c voltage normally across the filter condensers. The a-c voltage appearing across each filter condenser will vary from one make of set to another due to differences in the inductances of the choke coil, power transformer, high voltage secondary voltage and current drain through the choke coil so that experience must be acquired from testing many receivers before this test will be of maximum value. As an example of what a-c voltage may be expected across the filter condenser nearest the rectifier, a typical power supply was measured with different size electrolytic condensers in the first condenser position, and the results are tabulated below:

Capacity of 1st condenser:	4	8	12	16	20	24 mfd.
A-C voltage across condenser:	52	26	18	13	10	8 volts

The second condenser in the above test was 8 mfd., the B-plus voltage 350 d-c volts and the current through the choke was 110 milliamperes d-c. The a-c voltage measured across the second filter condenser will of course be very much less under normal conditions.

Next month's issue of the Sylvania News will conclude this series of articles on the V. T. V. M. with a discussion of tests that can be made on the r-f and i-f end of a receiver.

◆ ◆ ◆

Tips on New Receivers

You have undoubtedly met some interesting and unusual service problems in connection with the various new developments in radio sets, such as automatic tuning, A-F-C, all-wave, and trick circuits. How did you solve them? We want tips and discoveries that are original, and that will help other servicemen to diagnose and repair troubles in modern sets. We are not interested in routine information which every competent serviceman knows. Mention your choice of tube for each tip accepted.

Servicemen

◆

Don't miss reading page one of the Main Section. Lots of good dope on shop modernization and a big list of prizes for photos of modernized shops.

Sylvania Model Service Shop Booklet now available.

SYLVANIA NEWS

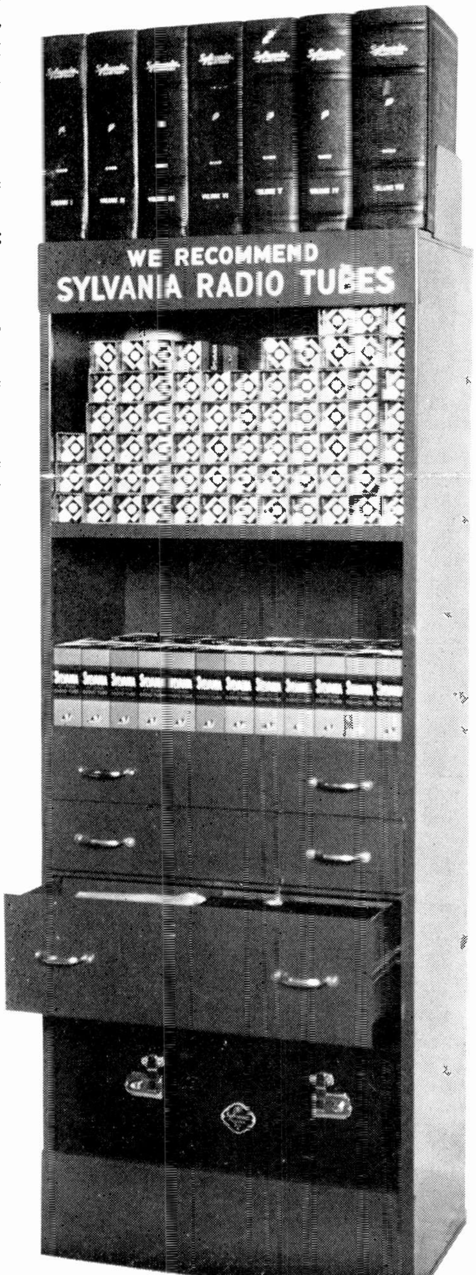
TECHNICAL SECTION

September, 1938 EMPORIUM, PENNA. Vol. 7, No. 11

"STOCK BOY"

with Two New Features

Every Radio Serviceman and Tube Dealer has the problem of storing parts and keeping stock. Here is the perfect answer—a specially designed all-steel portable cabinet. Built strongly—it combines display shelves for tube stock and storage space for service parts. This cabinet is ideal equipment for shop or store because stock and parts are always well-ordered and convenient. Dimensions: Heighth 59½," Width 22", Depth 12".



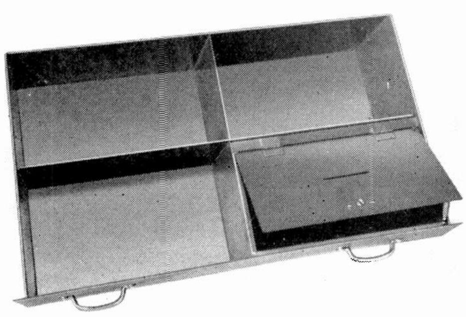
The two top shelves accommodate 125 tubes each. For your small parts—two easy-sliding drawers with 21 compartments in each one. For larger parts—the lower drawer has 4 roomy compartments, 6x10x5½". In the bottom compartment you will notice the generous size storage bin for service kit or wire and other heavy articles.

Two New Features

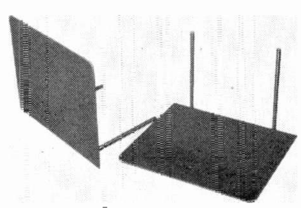
Two useful new accessories are now available at slight additional cost, either or both of which may be ordered with the cabinet.

1. One compartment of the large drawer can be supplied with a strong built-in cash box with a modern positive lock.

2. A set of sturdy steel bookends for the top of the cabinet (see photo above) will permit use of this space for manuals or other technical books. These book ends can be purchased for installation on Stock Boys already in use. Installation is made by drilling two 3/16" holes on either side of the cabinet just below the top edge.



No. 1



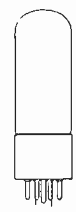
No. 2

ASK YOUR SYLVANIA JOBBER about the "Profit Plan" on this attractive Utility Cabinet.

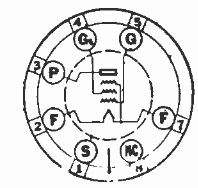
NEW TUBES

In last month's issue of the Technical Section, we tabulated data for the new Sylvania 1.4 volt tubes. Given below are additional data on this new group.

These tubes have a nominal filament voltage rating of 1.4 volts at 50 milliamperes, except type 1C5G which is rated at 100 milliamperes. These tubes may be operated directly from 1.5 volt dry batteries without the use of ballast tubes, since the design provides satisfactory performance over the useful voltage range normally encountered during the battery life. Other forms of A batteries are applicable if the proper circuit arrangements are provided.



Type 1A5G Output Pentode



6-X

Sylvania Type 1A5G is an output pentode tube designed especially for use in low drain battery operated receivers. This type proves to be extremely economical because the A and B current drains are unusually low.

A 90 volt B battery is required for the plate and screen supply voltages. It is preferable to operate type 1A5G with self-bias since the grid voltage will be reduced accordingly as the B voltage drops with battery life. No C battery would therefore be required for a receiver equipped with 1.4 volt types, since the grid returns for the r-f tubes and second detector may be made directly to the negative filament terminals. Under these operating conditions a power output of 100 Mw. is available from the 1A5G.

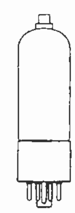
Characteristics

Filament Voltage (Nominal)	1.4	Volts
Filament Current (Nominal)	0.05	Ampere
Maximum Over-all Length	3 27/32"	
Maximum Diameter	1 3/16"	
Bulb	T-9	
Base—Small Octal 7-Pin	6-X	

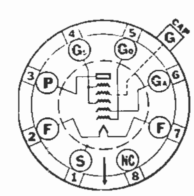
Operating Conditions and Characteristics

Filament Voltage	1.4	1.4	Volts
Plate Voltage	85	90	Volts
Screen Voltage	85	90	Volts
Grid Voltage*	−4.5	−4.5	Volts
Plate Current	3.5	4.0	Ma.
Screen Current	0.7	0.8	Ma.
Plate Resistance	0.3	0.3	Megohm
Mutual Conductance	800	850	μmhos
Amplification Factor	240	255	
Load Resistance	25,000	25,000	Ohms
Power Output	100	115	Mw.
Total Harmonic Distortion	10	7	Per Cent

*Negative Filament return.



Type 1A7G Pentagrid Converter



7-Z

Sylvania Type 1A7G is a pentagrid converter tube designed especially for service in low drain battery operated receivers. Its application is similar to other pentagrid converters, such as Types 1C7G and 1D7G, but the differences in characteristics and operating conditions must be taken into account to secure optimum performance.

A 90 volt B battery is required for the plate, and anode grid supply voltages. It is recom-

Continued on page two

NEW TUBES

Continued from page one

mended that the screen voltage be obtained by using a 70,000 ohm dropping resistor in series with the 90 volt supply. The screen, of course, must be adequately by-passed. Although no grid bias voltage is required the grid return should be made to the negative filament terminal.

Characteristics

Filament Voltage (Nominal)......	1.4 Volts
Filament Current (Nominal)......	0.05 Ampere

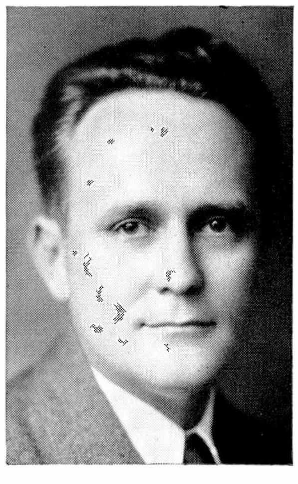
Direct Interelectrode Capacitances

Grid G to Plate*..............	0.40 μμf
Grid G to Grid Ga*...........	0.25 μμf
Grid G to Grid Go*...........	0.12 μμf
Grid Go to Grid Ga...........	1.5 μμf
Grid G to all other Electrodes (R-F Input)...............	7.5 μμf
Grid Ga to all Electrodes except Go (Osc. Output)..........	4.0 μμf
Grid Go to all Electrodes except Ga (Osc. Input)...........	3.2 μμf
Plate to all other Electrodes (Mixer Output)............	10.0 μμf
*With tube shield.	
Maximum Over-all Length........	$4\frac{3}{16}''$
Maximum Diameter.............	$1\frac{3}{16}''$
Bulb............................	T-9
Cap............................	Miniature
Base—Small Octal 8-Pin..........	7-Z

Operating Conditions and Characteristics

Filament Voltage................	1.4 Volts
Plate Voltage....................	90 Volts
Control Grid Voltage (Grid G)....	0 Volts
Screen Grid Voltage (Grid Gs)....	45 Volts
Anode Grid Voltage (Grid Ga).....	90 Volts
Oscillator Grid Resistor (Grid Go).	200,000 Ohms
Plate Current....................	0.55 Ma.
Screen Grid Current..............	0.60 Ma.
Anode Grid Current...............	1.2 Ma.
Oscillator Grid Current..........	35 μamp.
Total Cathode Current............	2.40 Ma.
Plate Resistance.................	0.6 Megohm
Conversion Conductance.........	250 μmhos
Conversion Conductance at −2.0 Volts (Approx.)...........	50 μmhos
Conversion Conductance at −3.0 Volts (Approx.)...........	5 μmhos

A CHAT WITH ROGER WISE

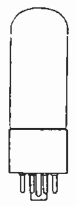


Chief Tube Engineer
Hygrade Sylvania Corporation

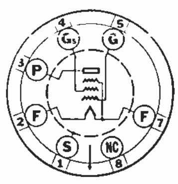
At the present writing very little is being heard in the radio industry about standardization of characteristics of regular receiving types. This is far from being a bad sign and is not an indication that tube manufacturers are doing very little along such lines. On the contrary, cooperation in establishing and maintaining standards is receiving more attention now than was the case in the recent past.

The interest on the part of set manufacturers in minor changes in tubes to realize some advantage in circuit design has greatly diminished—in fact has practically disappeared. The advantages of complete interchangeability among standard makes of receiving tubes is now so well understood that when some question regarding tube characteristic centers arises, the only question to settle is whether or not an approved rating has been established. In cases where none has been published through RMA sub-committee activities, very little difficulty has been experienced in getting into agreement on a suitable value for the industry.

No doubt the attitude taken by servicemen, dealers and distributors has been helpful. Their attitude has been uniformly favorable toward as complete standardization as possible—even the tendency to look for tubes on the "high" side of the center values has been decreasing with the realization that sets should be designed to operate properly with average tubes rather than with tubes near the upper limit (or in some cases near the lower limit), and that sets so designed cause a minimum amount of service trouble. We must keep servicing of this type simplified in order to maintain and increase radio popularity.



Type 1C5G Output Pentode



6-X

Sylvania Type 1C5G is an output pentode belonging to the 1.4 group of tubes designed for use in low drain battery receivers. It will be noted that the filament current and power output of this tube is twice that of the 1A5G, the other output pentode of the 1.4 volt group.

The filament is rated at a nominal voltage of 1.4 volts and 100 milliamperes. However the tube may be operated directly from a suitable 1.5 volt dry battery without the use of a ballast tube since the design provides satisfactory performance over the useful voltage range normally encountered during the life of the battery. Other forms of A batteries are applicable if the proper circuit arrangements are provided.

A 90 Volt B battery is required for the plate and screen supply voltages. It is preferable to operate type 1C5G with self-bias since the grid voltage will be reduced accordingly as the B voltage drops with battery life. No C battery will therefore be required for a receiver equipped with 1.4 volt types, since the grid return for the r-f tubes and second detector may be made directly to the negative filament terminals. Under Class A operating conditions with a plate and screen voltage of 83 volts and with the grid self-biased to −7 volts, a power output of 200 milliwatts is available.

Characteristics

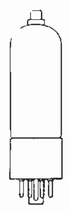
Filament Voltage (Nominal)......	1.4 Volts
Filament Current (Nominal)......	0.10 Ampere
Maximum Over-all Length........	$3\frac{27}{32}''$
Maximum Diameter..............	$1\frac{3}{16}''$
Bulb..............................	T-9
Base—Small Octal 7-Pin..........	6-X

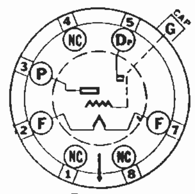
Operating Conditions and Characteristics

Filament Voltage.........	1.4	1.4	Volts
Plate Voltage............	83	90	Volts
Screen Voltage...........	83	90	Volts
Grid Voltage*............	−7.0	−7.5	Volts
Plate Current............	7.0	7.5	Ma.
Screen Current...........	1.6	1.6	Ma.
Plate Resistance..........	110,000	115,000	Ohms
Mutual Conductance.....	1500	1550	μmhos
Amplification Factor.....	165	180	
Load Resistance.........	9000	8000	Ohms
Power Output............	200	240	Mw.
Total Harmonic Distortion	10	10	Per Cent

*Negative Filament return.

Type 1H5G Diode-Triode





5-Z

Sylvania Type 1H5G is a diode-triode designed especially for use in low drain battery operated receivers. It is one of the types of tubes having a 1.4 volt filament rating. The single diode plate is located at the negative end of the filament, base pin No. 7.

Type 1H5G may be employed as a combined diode detector and triode audio amplifier and for securing the required voltage for automatic volume control. The amplification factor of the triode is considerably higher than for any other standard battery triode tube. The triode section should be resistance coupled to the diode using an ordinary coupling condenser and grid leak. No C battery is required for bias voltage but the grid return should be made to the negative filament terminal.

Characteristics

Filament Voltage (Nominal)......	1.4 Volts
Filament Current (Nominal)......	0.05 Ampere

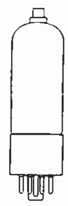
Direct Interelectrode Capacitances

Grid to Plate..................	1.1 μμf
Grid to Filament...............	0.35 μμf
Plate to Filament.............	4.0 μμf.
Diode Plate Location, At Negative End of Filament	
Maximum Over-all Length........	$4\frac{3}{16}''$
Maximum Diameter.............	$1\frac{3}{16}''$
Bulb...........................	T-9
Cap............................	Miniature
Base—Small Octal 7-Pin..........	5-Z

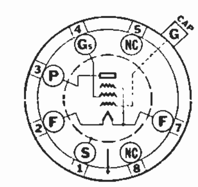
Operating Conditions and Characteristics

Filament Voltage................	1.4 Volts
Plate Voltage...................	90 Volts
Grid Voltage*...................	0 Volt
Plate Current...................	0.14 Ma.
Plate Resistance................	240,000 Ohms
Mutual Conductance............	275 μmhos
Amplification Factor............	65

*Negative Filament return.



Type 1N5G R-F Pentode



5-Y

Sylvania Type 1N5G is an r-f pentode designed especially for service in low drain battery operated receivers as an r-f, i-f or a-f amplifier. This tube can be used satisfactorily in a-v-c circuits since it has a medium cut-off characteristic. Type 1N5G is a high impedance tube and should be worked into a high impedance if maximum r-f amplification is to be attained.

A 90 volt battery is required for the plate and screen supply voltages. No C battery is necessary since the grid return should be made directly to the negative filament terminal.

Characteristics

Filament Voltage (Nominal)......	1.4 Volts
Filament Current (Nominal)......	0.05 Ampere

Direct Interelectrode Capacitances

Grid to Plate (With tube shield)	0.007 μμf Max.
Grid to all Elements except Plate.....................	2.2 μμf
Plate to all Elements except Grid G...................	9.0 μμf
Maximum Over-all Length........	$4\frac{3}{16}''$
Maximum Diameter.............	$1\frac{3}{16}''$
Bulb............................	T-9
Cap............................	Miniature
Base—Small Octal 7-Pin..........	5-Y

Operating Conditions and Characteristics

Filament Voltage................	1.4 Volts
Plate Voltage...................	90 Volts
Screen Voltage..................	90 Volts
Grid Voltage*...................	0 Volts
Plate Current...................	1.2 Ma.
Screen Current..................	0.3 Ma.
Plate Resistance................	1.5 Megohms Approx.
Mutual Conductance............	750 μmhos
Amplification Factor............	1160
Mutual Conductance at −3.2 Volts (Approx.)...........	50 μmhos
Mutual Conductance at −4 Volts (Approx.)............	5 μmhos

*Negative Filament return.

THE SERVICE EXCHANGE

THE information presented in the Sylvania Service Exchange is contributed by servicemen as the result of practical experience. It is very carefully considered before being accepted, and we believe it to be correct and authentic. However, we assume no responsibility with respect to results. Each hint accepted entitles the writer to his choice of one Sylvania receiving tube. Please indicate preference when submitting hints. Don't send routine or generally known information. Please specify tube choice.

Arvin Model 618. In a number of these sets there is a complaint of too much hum. In some sets the hum is present all the time and in others it is intermittent. The trouble is due to the soldering lug that is riveted to the chassis at the 6Q7 socket not making good enough contact. This connection usually checks okay, but is found by running a wire from the lug and soldering it to the chassis. I find this trouble on about every third model of this receiver.—James L. Smith, Moscow, Idaho.

* * *

Belmont Model 660 Auto Radio. When installing new vibrators in these sets, be sure to include a .02 mfd. 1500 volt condenser across the rectifier tube plates, otherwise the new vibrator may be damaged.—Al's Radio Service, Tonawanda, N. Y.

* * *

Buick Model B-O-P 908393 Auto. Failure of this set to operate over the entire broadcast band is due to failure of the bias resistor connected between the second 36 tube cathode and ground. Replace with a 1 watt resistor. I used a 13,000 ohm resistor across the old candohm which gave the right bias and put the set in operation with plenty of volume.—A. R. Ebberts, Troy, Ohio.

* * *

Chevrolet Model 364441 (United Motors Radio). Several of these sets have been serviced for very weak, intermittent, and no signal from about 840 Kc. to the high end of the dial. This trouble has been overcome by lowering the value of the 4200 ohm cathode resistor in the oscillator circuit. I have found that by paralleling 3000 ohms with the 4200 ohm resistor the correct value is obtained for satisfactory performance with all makes of tubes. Fred E. Berry, Olive Hill, Ky.

* * *

Crosley Model C-178 (1938 Chevrolet Auto Radio). If this set becomes noisy when jarred, it may be due to the solder lug on the automatic tuning unit having worked through the paper insulation under it and occasionally touching the motor frame. Do not bend this lug up as it will then touch the lid. The best thing to do is to replace the insulating paper with as thick a piece as will easily go under the lug.—J. Moller, Cincinnati, Ohio.

* * *

Electric Lamp Bulb Interference. I would like to give more information on how to find an electric lamp bulb causing interference. Put all the lights on, then switch the main entrance switch off and on several times and look for a burned out bulb. I have found as many as three bad ones in a home. We also get this type of interference from our street lights. After checking the house lights and finding nothing, I have the power company switch the street lights off and on. One street light usually goes out and the noise stops.—Frank G. Oppold, Panama, Iowa.

* * *

Ford Philco. Objectionable ignition noise on all models using turn-down antennas is caused by dirty connections at the slider contact in the unit going through the top. This shows up on an ohmmeter test. To remedy, take apart by removing the rivet through antenna rod and cleaning and lubricating the connection.—W. E. Brown, S. Moorhead, Minn.

* * *

Grunow Super Teledial (Any Model). When this set cuts off and the trouble cannot be located, slip off the dial and check the reeds on the station stop. Careful inspection of the reeds and moving them with an insulated rod will show up the trouble as defective mica spacers. Replace with new spacers.—Francis J. Kmetz, Allentown, Pennsylvania.

Indicator For R-F Oscillator. The 60 ma., 2 volt pilot lamp makes an excellent indicator for r-f oscillation, taking only 0.12 watts for full brilliancy and glowing at only 40 milliwatts. Connecting the lamp in series with a single turn of wire for short waves and two or three turns for broadcast waves and coupling to the oscillator coil, we have a very useful r-f indictaor. In mounted homemade oscillators, the lamp may be mounted permanently behind a jewel with the proper amount of coupling for full brilliance. The lamp is almost a blessing when playing with small tubes on centimeter waves where the power is so minute no other cheap indicator is available. For these quantities, it is not adviseable to use a lamp socket, the capacity and losses being detrimental.—Ed. Glaser, Bellmore, N. Y.

* * *

Motorola Auto Receivers. This tip is based on distorted reception in Motorola auto receivers, but would be applicable to any bias cell job. The complaint was intermittent distortion especially when the car was in operation over extremely rough roads. I found that the 75 grid was unbiased when this occurred due to imperfect contact on the surface of the bias cell. It is very easy to check with the Magic Eye V. T. V. M. which we have been using since the circuit was first released in Sylvania News.—Chet Aydelotte, East Gary, Indiana.

* * *

Motorola Models 44, 55, 77. Excessive hum in these models is generally due to audio oscillation. Remedy:—Insert a small r-f choke in series with "B" positive output from the synchronous type vibrator. Be sure to connect a condenser of about .01 μf 600 volts to the low potential end of this choke and chassis in order to bypass hum.—N. E. Nelson, Mayville, N. D.

* * *

RCA Model 8M, 9M. Installation instructions suggest hooking the back bolt of the case to the bulkhead of the car with a strip of metal which is provided for this purpose. Instead of tying this to the bulkhead on a horizontal line and in lots of cases having the strip 6 or 8 inches long, run this strip perpendicular and tie it to the top of the bulkhead. This will make a much tighter job.

The cases of these sets are made of very thin material and the back bolt pulls loose. If this happens to one of your installations weld it back on with a piece of metal 3 inches square and put the set back with the strip perpendicular.—Walter G. Inman, Kansas City, Mo.

* * *

RCA Model 86T. I find that by connecting a .0001 condenser, or larger, from the antenna connection to the oscillator tuning condenser stator plates, there is a very marked increase in volume; about 25%.—J. S. Jackson, Jr., Bowling Green, Kentucky.

* * *

Realigning Speakers. The majority of later type speaker units have the cone cemented to the cone frame making it a difficult job to remove the cone for voice coil air gap cleaning. I usually find that this type of speaker has the field coil housing bolted to the cone frame, making it a simple matter to dismantle same for easy cleaning. The only disadvantage being that it is hard to properly center the air gap plate. This is readily overcome by tacking, with a little solder and a hot iron, the plate to the field housing at each edge after lining up in its correct position. This keeps the gap correct when assembling to the speaker frame. This job can be done in a few minutes while an hour or so would be consumed loosening and recementing the cone.—Al Anderson, Flagstaff, Arizona.

Screws. If you have trouble keeping a washer on a screw while putting the screw through a hole, just slip a piece of paper over the screw and it will hold the bushing in place.—J. S. Jackson, Jr., Bowling Green, Ky.

* * *

Windchargers. If the windcharger doesn't charge, check first the position of the third brush which many times moves out of its position which should be one segment of the commutator away from the nearest brush. On the later models this trouble can be corrected while the head is still mounted.—Wayne Storch, Beecher, Illinois.

* * *

Wells Gardner Series 052 Fading or weak reception may be caused by corroded contacts on the wave change switch. To remedy this the switch should be taken apart and the contacts cleaned with fine emery cloth or sandpaper.—Tim W. Shaw, Vernon, Texas.

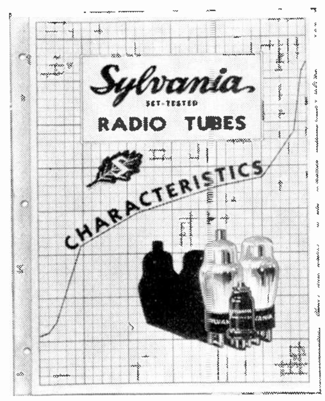
* * *

Complaint: Intermittent Rattles

J. R. McGinnis, Hygrade Lamp salesman, says he heard this over KRLD, Dallas. It seems a man in Gladwater, Texas got pretty well fed up with his radio set, which had developed a strange case of intermittent rattles In fact, it sometimes rattled even when not turned on. The local serviceman who got the job of repairing it was more than a little "rattled" himself when he discovered inside the cabinet a thirty-inch Texas rattlesnake We didn't learn how he got it out. If he reads this item, maybe he'll pass on the dope.

This beats all those cockroach stories.

Revised Characteristic Sheet



The Sylvania Characteristic Sheet, which is one of the most popular items of technical literature for servicemen, has been completely revised.

The new chart contains complete operating characteristics on all Sylvania radio tubes including new types recently announced. Base diagrams and bulb dimensions for all types are shown.

The lay-out has been changed to an 8 page booklet form which is adaptable for 3 ring binder use. Because of the large amount of data shown, the booklet style proves ideal for servicemen's use. The sheet also folds down to convenient size for pocket or service kit use.

This new Sylvania Characteristic Sheet is free to all who have use for it and can be obtained from your Sylvania jobber, or use the enclosed advertising order form.

THE VACUUM TUBE VOLTMETER AS A SERVICE TOOL

By GEORGE C. CONNOR

Continued from last issue

Last month's issue of Sylvania News discussed a few of the many uses of a vacuum tube voltmeter in analyzing audio frequency and power supply circuits. This, the concluding article of this series, will deal with the use of the V. T. V. M. at radio and intermediate frequencies. If the user has had some experience on audio frequency measuring work with the V. T. V. M., he should have little trouble at higher frequencies providing due care is exercised to keep the V. T. V. M. leads short.

PART VI

Testing Oscillator Voltage

The local or heterodyning oscillator in a superheterodyne receiver is very easy to test from the top of the chassis by connecting the control grid of the V. T. V. M. prod tube to the stator plates of the gang condenser oscillator section. While the V. T. V. M. is connected, rotate the gang condenser and check the voltage continuously on each band. There will be some variations on each band and between bands—this is normal. If a point is observed where no voltage exists or an extremely small voltage is found, the oscillator circuit should be inspected for coupling between coils, for dampness, shorted turns, or other defects. In a few special oscillator circuits a d-c voltage will also be present between the gang condenser stator plates and ground. In these instances it will be necessary to use a mica condenser in series with the V. T. V. M. grid.

For further details on oscillator performance and circuit details, refer to the article entitled "Oscillator Performance in Superheterodynes" in Sylvania News Volume 6 No. 12 to and including Volume 7 No. 4.

Measuring Antenna Coupler Gain

The operation of the antenna coil, r-f stage and converter circuits are very important for proper receiver performance. It is these circuits that give the receiver much of its gain, all of its image suppression, and a large percentage of its selectivity. But equally as important, these circuits determine the noise-to-signal ratio of the receiver.

Improper alignment or low efficiency in this end of the receiver will cause the signal to be received with so much hiss that it can not be enjoyed. When this condition exists and proper alignment will not correct it, it will usually save time to start at the antenna and measure the antenna coil gain, r-f stage gain, and converter gain to locate the exact seat of the trouble.

If a test oscillator is connected to the antenna and ground leads of the antenna coil, a voltage can be measured across the secondary if the gang condenser is tuned to the oscillator frequency. This will not give us an idea of the voltage step up in the coil unless we know the voltage appearing across the primary. If we attempt to measure this primary voltage, it will usually be so small that an accurate reading can not be secured.

It is obvious that we either need a higher output from the test oscillator or an amplifier on the V. T. V. M. If we place a t-r-f amplifier ahead of the V. T. V. M. we will find that the gain of this stage will vary with frequency and cause error. A t-r-f amplifier following the test oscillator to build up the output voltage, however, can vary with frequency and it will not affect our results because in every case we will measure the voltage after it has passed through the oscillator amplifier. A further advantage of such an arrangement is that the amplifier will filter out the harmonics of the oscillator.

A two stage r-f amplifier can be built very easily using plug-in coils to change frequency ranges with 6K7 or equivalent type of tubes. The attenuator on the test oscillator will serve as a volume control and with this set-up we can put a convenient value such as 0.2 volts across the antenna coil primary, and then move the V. T. V. M. connection to the secondary and measure the voltage at that point. If, for example, a reading of 4 volts is obtained, the gain of the coil is 4 divided by 0.2 or 20. This measurement can be made in a few minutes from the top of the chassis.

Testing Wave Trap Circuit

Most receivers that operate without an r-f stage use a wave trap in the antenna circuit to reduce the interference caused by unwanted signals at the i-f frequency. If the resonant frequency of this circuit changes, it will not only allow these interfering signals to pass, but may resonate near a desired signal and reduce or eliminate it. To test this circuit use the test oscillator with the t-r-f amplifier connected between the antenna and ground leads of the receiver and the V. T. V. M. connected across the antenna coil secondary. As the test oscillator and t-r-f amplifier are tuned through the i-f frequency of the receiver, the voltage on the V. T. V. M. should go to minimum. If the minimum response is found to be at some other frequency than that of the i-f stage, the wave trap should be retuned so that the proper effect is secured.

Measuring Stage Gain

Stage gain is measured from the grid of one tube to the grid of the succeeding tube. To measure the gain of the r-f stage in a receiver, for example, a predetermined signal such as 0.2 volts may be introduced into the grid circuit of the r-f tube by connecting the test oscillator across the antenna coil secondary. The V.T. V. M. is then connected in place of the converter tube and the resulting voltage at this point, divided by the initial voltage (.2 volts), is equal to the gain of the stage at the frequency to which the test oscillator and receiver are tuned.

Because the test oscillator is not loaded appreciably by this type of test, the average test oscillator will furnish sufficient voltage output to be measured by the V. T. V. M. and the t-r-f amplifier will not be necessary. Because the converter tube is not in the circuit during this test, no a-v-c voltage will be built up to reduce the gain of the r-f stage and the resonant frequency of the circuit will not be changed since the input capacity of the V. T. V. M. is essentially the same as the converter tube.

To measure the stage gain of the converter or of the i-f stage, the same procedure is followed. A time saving procedure is to use the t-r-f amplifier with the test oscillator and introduce a known voltage in the antenna coil primary and connect the V. T. V. M. in place of the converter tube. The gain of the complete r-f portion of the receiver can then be taken at the same time the tuned circuits are being aligned to agree with dial calibration.

Measuring AVC Voltage

When measuring d-c voltages the prod tube of the V. T. V. M. is normally applied to the positive terminal of the voltage source. For a-v-c voltages, which are negative with respect to ground, this would require connecting the V. T. V. M. prod tube grid to ground and the frame of the V. T. V. M. to the a-v-c distribution network. This, however, impresses a 60 cycle voltage on the a-v-c network due to leakage and capacity currents in the power transformer windings of the V. T. V. M. and receiver power supplies. To overcome this source of error the grid of the V. T. V. M. prod tube should be connected to the a-v-c distribution network and the chassis of the V. T. V. M. connected to the chassis of the receiver. A negative a-v-c voltage will cause the V. T. V. M. electric eye to overlap. It can be opened to normal (i.e. with the two shadows just separated by a hair's width of darkness) by turning the zero adjustment 3,000 ohm potentiometer. During this test the 50,000 ohm calibrated potentiometer is not used but left in the zero position.

The 3,000 ohm potentiometer used for this test must be calibrated if an accurate determination of the a-v-c voltage is desired and this is accomplished along the same lines as the previous calibration of the 50,000 ohm potentiometer. Since the 3,000 ohm potentiometer is now serving two purposes, the calibration must be on a sliding disc held in place with a felt washer under the knob. When an a-v-c voltage is to be read the 50,000 ohm potentiometer pointer is placed on "zero", the test prods are short circuited, and the 3,000 ohm potentiometer is adjusted to just close the electric eye.

The calibrated scale under the 3,000 ohm potentiometer knob is now rotated until the zero position is under the index of the knob. If the test prods are now placed across the a-v-c network the eye will overlap. Turning the 3,000 ohm potentiometer will open the eye to normal position and the voltage can be read on the calibration.

During this test the 5 megohm resistor in the input circuit of the V. T. V. M. should be disconnected for greatest accuracy. For further details of the a-v-c circuits, refer to Sylvania News technical sections Volume 6 No. 9 and No. 10.

Measuring AFC Voltage

The voltage generated by the discriminator in an a-f-c circuit will be zero when all circuits are properly aligned. The V. T. V. M. furnishes a means of reading this voltage without in any way disturbing the circuit. This is accomplished in exactly the same way that a-v-c voltages are measured except that the a-f-c voltage from the discriminator may be either positive or negative so that it may be necessary to use both the 50,000 ohm and 3,000 ohm calibrated potentiometers to read the voltage.

In most cases, however, it is not necessary to know how much voltage is developed but only whether the opposing voltages are in or out of balance. The prod tube grid for this test is connected to the lead connecting discriminator and oscillator control tube or to the grid cap of the oscillator control tube.

Testing R. F. Efficiency of Fixed Condensers

There are many fixed condensers in the r-f and i-f sections of a radio receiver whose function is to by-pass r-f currents to ground. Examples of these are condensers from the low potential end of r-f and i-f coils to ground; across cathode resistors; between screen grid and ground and between a-v-c or a-f-c distribution network and ground. They all have one thing in common and that is their function—to furnish an easy path to ground for the r-f and i-f energy. They can be tested in exactly the same way that was described in last month's article on testing a-f bypass condensers.

The V. T. V. M. is connected across the condenser under investigation with a small condenser in series with the V. T. V. M. grid and a large signal is introduced into the grid of the stage in which the condenser appears. If the capacity of the condenser is too small or if the condenser is open a voltage will appear on the V. T. V. M. A short condenser will show up when the d-c voltage across the condenser is measured.

CONCLUSION:

The purpose of this series of articles will have been served if the reader has gained a better understanding of the potential service that a V. T. V. M. can render in radio service work. There are many other tests and measurements possible with this instrument that will suggest themselves to the user as he becomes more familiar with it. As the ever expanding field of electronics develops more fully, it is anticipated that the V. T. V. M. will grow in usefulness and convenience with it. Any comments on this series of articles or suggestions for future articles will be appreciated.

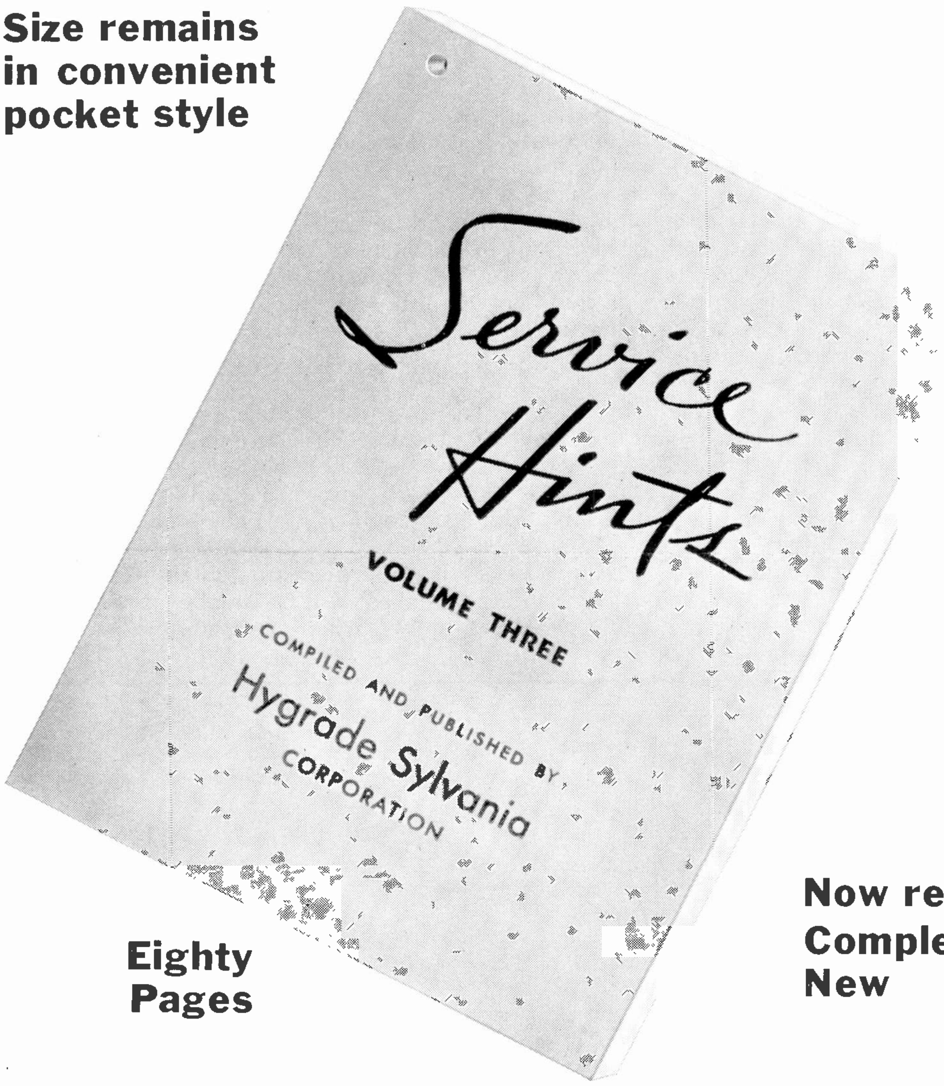
SYLVANIA NEWS

TECHNICAL SECTION

November-December, 1938 EMPORIUM, PENNA. Vol. 7, No. 12

Service Hints Volume III

Size remains in convenient pocket style



Eighty Pages

Now ready Completely New

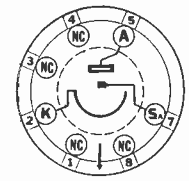
If there is a single serviceman in the United States who doesn't treasure copies of Sylvania Service Hints, Volumes 1 and 2, we don't know who he is. We are prepared for just as big a demand for Volume 3, just off the press. It contains eighty pages of brand-new service hints, formulas, equations and tables for working out the everyday engineering problems encountered in radio servicing, useful table of hard-to-get data, and a correlation of tube types never before available in this convenient form. The service hints, contributed by practical servicemen, cover practically all types of receivers. There are also many miscellaneous tips to make the hard and "fussy" jobs easier.

If we put a stiff price on this book we believe it would be a Best Seller. But we stick to our guns, and our policy of helping good servicemen to be better servicemen. Service Hints, Volume 3, is Free. See Coupon page four, main section.

(Sorry, we can't fill requests for Volume 1 or Volume 2. Our supply is exhausted.)

NEW TUBES

Type 0A4G Cold Cathode Control Tube

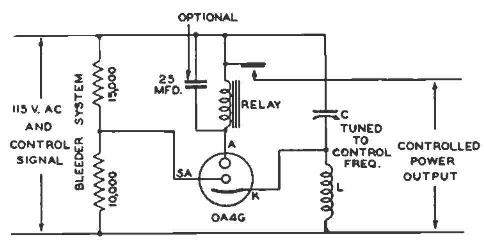


4-V

Type 0A4G is a gas filled, cold cathode type of tube for use in the remote control of line operated units. This is made possible by transmitting radio frequency impulses over the power line. The tube may also be used as a voltage regulator and as a relaxation oscillator.

The tube consists of a cathode, anode, and starter-anode. Its characteristics are such that with no voltage on the starter-anode a relatively large voltage (A) is required between the cathode and anode to cause the tube to start.

The application of a proper signal voltage (B) to the starter-anode will cause a cathode to starter-anode current (C) to flow. This will produce a glow discharge and reduce the voltage (D) for breakdown between cathode and anode to the point where the tube will conduct at normal line voltage. Therefore, there need be no stand-by current flowing while the circuit is inoperative.



REMOTE CONTROL RELAY

The accompanying circuit of a remote control relay is a typical application of the Type 0A4G in a-c service. It will be noted in the circuit that full line voltage is applied between the anode and cathode and that a bleeder system is used to maintain a voltage on the starter-anode just below that required for breakdown. The capacity and inductance, C and L, is a high-Q tuned circuit for r-f signals. When an r-f signal is transmitted on the power line a resonant voltage appears across the inductance and capacity. The voltage across condenser C increases the negative potential peaks on the cathode and increases the potentials between the cathode and starter-anode. A discharge between the cathode and starter-anode is started by these peaks. This discharge produces free ions which enable the discharge to transfer to the anode when sufficient starter-anode current flows. After this transfer occurs, current flows through the relay.

Precautions should be taken in the application of the Type 0A4G so that at high line voltages the a-c applied to the starter-anode will not be great enough to reach the breakdown point. Precautions should also be taken so that at low line voltages the carrier voltage will be large enough to make up for the lowest line voltage. Therefore, a minimum r-f starter-anode voltage of 55 volts should be provided.

Continued on Page Two

NEW TUBES

TYPE 0A4G—Continued

The Type 0A4G may be operated from d-c power lines. However, after the tube has started to conduct through the application of a signal it will continue to conduct even after the signal is removed, since the voltage supply on the anode circuit is continuous. Therefore, to reset the tube for a further operation to a non-conducting state, it will be necessary to remove the anode voltage or drop it below 60 volts, instantaneously, after the signal has been removed. Current List Price $2.25.

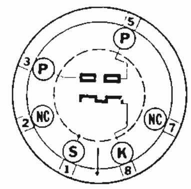
CHARACTERISTICS

Maximum Over-all Length	4⅛ Inches
Maximum Diameter	1 9/16 Inches
Bulb	ST-12
Base	Small G Type Octal No. 4-V
Anode to Cathode Breakdown Voltage (A) (Starter-Anode tied to Cathode)	225 Volts Min.
Starter-Anode to Cathode Breakdown Voltage (B)	70 Volts Min.
	90 Volts Max.
Starter-Anode Current for Transition of Discharge to Anode at 140 Volts, Peak (D).	100 μamps. Max. (C)
Starter-Anode to Cathode Operating Voltage Drop	60 Volts Approx.
Anode to Cathode Operating Voltage Drop	70 Volts Approx.
Anode to Cathode Current continuous	25 Ma. Max.
Instantaneous	100 Ma. Max.

Typical Operating Conditions (A-C Supply):

Anode-Supply Voltage (RMS)	105-130 Volts
Starter-Anode Voltage (Peak) A-C	70 Volts Max.
Starter-Anode Voltage (Peak) R-F	55 Volts Min.
Sum of A-C and R-F Starter-Anode Voltages (Peak)	110 Volts Min.

Type 0Z4 Full Wave Rectifier



4-R

Sylvania Type 0Z4 is a metal full-wave rectifier of the gas-filled type. No heater supply is required since the tube is of the ionic-heated cathode design. This feature makes it popular as a rectifier tube for auto receivers where the economy of battery current is a factor. The operating characteristics are the same as those for Sylvania Type 0Z4G.

Type 0Z4, like its "G" counterpart, will handle high peak current in service with a constant drop. One characteristic of this type of rectifier is the r-f interference that may be radiated unless the metal shell is properly grounded and proper filtering is provided. The conventional filtering used with gas-filled, and vapor type of rectifiers is adequate.

From external appearances the Sylvania 0Z4 is the same as other metal tubes, but the metal shell is not the container for the permanent gas. The shell acts only as a shield and protector for a glass bulb used to hold the gas and to insulate it from the shell when grounded.

Types 0Z4 and 0Z4G are interchangeable in most cases; however, the 0Z4 metal tube may be preferred in some receivers where shielding is necessary. Current List Price, $1.50.

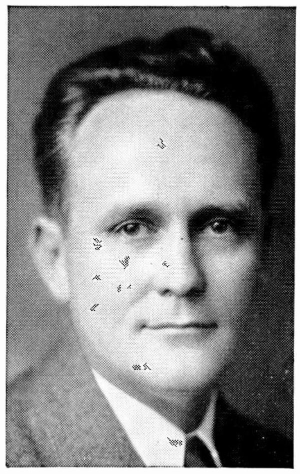
Characteristics

Maximum Over-all Length	2⅝ Inches
Maximum Diameter	1 5/16 Inches
Bulb	Metal No. 8 A-2
Base	6 Pin Octal No. 4-R

Operating Conditions and Characteristics:

No Heater Voltage Supply Required.	
Starting Peak Voltage	300 Volts Min.
Peak Plate-To-Plate Voltage	1000 Volts Max.
Peak Plate Current	200 Ma. Max.
D-C Output Voltage	300 Volts Max.
D-C Output Current	30 Ma. Min. / 75 Ma. Max.
Average Dynamic Voltage Drop	24 Volts

A CHAT WITH ROGER WISE



Chief Tube Engineer
Hygrade Sylvania Corporation

The introduction of screened grid tubes more than a decade ago brought with it one feature which has been a nuisance to tube manufacturers ever since—the top cap connection for the control grid. Recent announcements of "single-ended" R-F pentodes and similar types indicate that we may finally eliminate this item in newer designs, and thus gradually eliminate the bulb tubulaing, top sealing and top capping operations except for renewal types and a few special types.

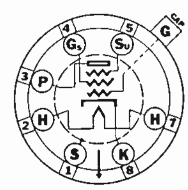
In the case of metal tube types it is only necessary to revise the shielding of the mount structure and add shielding in the base to make top cap elimination practical. With glass types it is first necessary to dispense with the conventional "press," as capacity between leads brought through this press is excessive. This change was made in Sylvania Type 1231, the first "single-ended" glass type to be made generally available for experimental use. The wide separation between lead-in wires in the stem of this tube makes it possible to provide adequate metallic shielding, the shell type base, also of metal, being an important factor in this design as it co-operates with interna shields and is grounded by a socket connection.

It might be thought that it would be difficult to wire up high gain r-f and i-f stages with grid and plate leads brought out to the same socket (although on opposite sides of the socket). This has not been proved to be the case; and while small box-like shield cases can be provided around grid or plate leads for maximum protection, it is usually possible to provide sufficient protection by merely taking care to run the ground wire connection adjacent to the lead which requires protection and spaced from it to a reasonable degree.

We anticipate that in time chassis design will be entirely cleared of top cap connectors, which at present do not contribute to the good appearance of the set due both to the need for extra length to allow insertion and removal of, the tube and to the "short cuts" required to keep the exposed length as short as possible. With the top surface of the chassis freed from wandering grid cap leads, a more clean-cut design will be secured.

It will pay servicemen to give the base connection diagrams extra study, filing them for easy reference, as the entire checking of the set will become a job which will most often be done on the underside of the sub-panel, when the leads are accessible only from that position.

Type 1223 Special Non-Microphonic Pentode



7-R

Sylvania Type 1223 is a sharp cut-off pentode with low microphonic response. It is identical in characteristics to type 1221, except for the "G" base. Because of special design features this new tube is recommended especially for use where a tube of low microphonic response is necessary.

Characteristics

Heater Voltage AC or DC	6.3 Volts
Heater Current	0.3 Ampere

Direct Interlectrode Capacitances:

Grid to plate (with tube shield)	0.010 μμf Max.
Input	5.0 μμf
Output	6.5 μμf
Maximum Over-all Length	4⅞ Inches
Maximum Diameter	1 9/16 Inches
Bulb	ST-12C
Cap	Miniature
Base	7-Pin Octal No. 7-R

Operating Conditions and Characteristics:

AMPLIFIER

	Triode	Pentode	
Heater Voltage	6.3	6.3	6.3 Volts
Plate Voltage	250	100	250 Max. Volts
Grid Voltage	-8	-3	-3 Volts
Screen Voltage		100	100 Max. Volts
Suppressor	Tie to Cathode		
Plate Current	6.5	2.0	2.0 Ma.
Screen Current		0.5	0.5 Ma.
Plate Resistance	0.01	1.0	1.5 Min. Megohms
Mutual Conductance	1900	1185	1225 μmhos
Amplification Factor	20	1185	1500 Min.

Operating Conditions as Biased Detector

DETECTOR

Heater Voltage	6.3	6.3 Volts
Plate Voltage	100	250 Volts Max.
Grid Voltage	-1.8	-4.3 Volts Approx.
Screen Voltage	30	100 Volts Max.

Plate Load—250,000 ohms or 500 h. choke shunted by 0.25 megohm. For resistance load plate supply voltage will be voltage at plate plus voltage drop in load caused by specified plate current.

CIRCUIT APPLICATION

Biased Detector

The 1223 is particularly useful as a biased detector because of its ability to deliver a large audio-frequency voltage with little distortion when a small radio-frequency signal is applied to the control grid, provided the coupling device is satisfactory.

Radio Frequency Amplifier

Type 1223 may be used satisfactorily in applications where the r-f signal applied to the grid is relatively low, that is, of the order of a few volts. In such cases either screen or control grid voltage (or both) may be varied to control the receiver volume. When larger signals are involved, a super-control amplifier tube should be employed to prevent the occurrence of excessive cross-modulation distortion.

The plate circuit load should be as high as is practicable. A tuned impedance load will be satisfactory for intermediate-frequency amplifiers, operating at a fixed frequency. The gain per stage can be made as high as 200 or more with ordinary care in design. For other applications requiring uniform sensitivity over a wide band of radio frequencies, coupling devices to meet the specific requirements will be necessary.

Modulator or First Detector

The 1223 may be employed as a superheterodyne first detector but a tube having super-control characteristics is to be preferred if signals of large magnitude are to be received, and if supplementary volume control is to be obtained in this stage.

THE SERVICE EXCHANGE

THE information presented in the Sylvania Service Exchange is contributed by servicemen as the result of practical experience. It is very carefully considered before being accepted, and we believe it to be correct and authentic. However, we assume no responsibility with respect to results. Each hint accepted entitles the writer to his choice of one Sylvania receiving tube. Please indicate preference when submitting hints. Don't send routine or generally known information. Please specify tube choice.

Audiola Model 346 (Auto). Check the a-v-c circuit of these sets closely as we have found several wired incorrectly. The symptoms are poor sensitivity and very irregular reception. The errors are easily found so they need not be noted. However, the two changes which improve the sets most is the insertion of a ¼ megohm, ¼ watt blocking resistor, bypassed with a 0.1 mfd. 200 volt condenser to ground, in the r-f grid return. Also a 12,000 ohm ½ watt resistor, bypassed with a 0.1 mfd., 400 volt condenser to ground, in the anode grid return circuit of the 6A7 tube for the 50,000 ohm resistor.—Henry Berg, Pittsburgh, Pa.

* * *

Crosley Model 103 Auto Radio. If set oscillates on portions of the dial, it can often be remedied by soldering the ground strap from the gang condenser to the case.—Oliver F. Klein, Milwaukee, Wisc.

* * *

Crosley Model B-425 (Battery). If reception can be obtained only when the 22½ volt "C" battery is disconnected, check the 2,000 ohm flexible wire wound resistor on the volume control for an open. This trouble develops in this model after being in use for some time. It is advisable to make a notation in your Sylvania service file to replace this resistor any time this model comes in for repairs.—Joseph S. Napora, Uniontown, Pennsylvania.

* * *

Crosley Model 630 (Auto Set). The 6D6 tube in this receiver is a hard working tube and in replacing it, a non-microphonic and noise-free tube is needed. About the only thing to do is to try several different tubes and select the one least microphonic. One method of cure is to sacrifice the sensitivity by moving the small piece of insulated wire on top of the gang. This wire is soldered to the stator of the middle section and lies over near the stator of the first section for the purpose of introducing regeneration in the circuit. Move it just far enough away to clear up the microphonism. Sylvania type 1221, a special non-microphonic 6C6 may be used satisfactorily for this type of trouble and no changes in the circuit will be required.—J. Moller, Cincinnati, Ohio.

* * *

Ford Majestic (Auto). When the 6Y5 tube fails after replacement and complete test of all associated units, the 500,000 ohm resistor across the plates is most likely the cause of the trouble as it loses its resistance under heat and load.—Henry Berg, Pittsburgh, Pa.

* * *

Ford Majestic Model 3. Attempts to cut down control cables usually result in a ruined cable or a ragged job. The correct way is to sweat solder into the cable at the desired length. Square the cable with a few blows of a hammer. Next clamp the cable in a vice and saw carefully with a hacksaw. If there is a loop or a sharp bend in the cable, probably where it turns up the steering column from the rear of the car, it will kink when force is applied to the control wire. The best way of curing this is to slip a piece of copper tubing over the cable and shape it into a gradual curve.—Harold B. Cook, Wichita, Kans.

* * *

Grunow Model 1541. When this set is intermittent or dead check the two 2,000 ohm resistors part No. 31860 located in the plate circuit of the 6K7 A.F.C. amplifier and plate of 6K7 second i-f tube.

Interference from code, amateur or police while listening to broadcast band: I have found a wave trap to save a lot of time and do a good job in the elimination of it at a reasonable price.—OK Radio Service, Milwaukee, Wis.

General Electric Model K66. Motorboating at low volume may be remedied by changing the 4. mfd. filter condenser connected from ground to S. G. of the 58 i-f to an 8 mfd., dry electrolytic condenser.—R. A. Graef, Detroit, Mich.

* * *

Locating Interference in Car Radios. Obtain a seven foot length of shielded lead-in for auto use and equip one end with regular aerial plug. Strip the shielding and insulation back from the other end for about one foot. Tin the wire exposed to make it stiff. This functions as a portable aerial which can be used to locate the source of motor noise on any car with a great saving in time. Just plug the one end in the auto radio and hunt down the noise with the other.—Donald W. Slattery, Chadron, Neb.

* * *

Majestic Model 66 (Auto Radio). Dampness during rainy weather finds its way into the interior of these sets through the ribbed opening in the cover, causing damage to the 10,000 ohm screen grid resistor in series with the screens of the r-f oscillator and i-f tubes. This is a wire wound resistor located directly above the oscillator socket on the under side of the set, and riveted to the side wall of the chassis. When the set ceases to function after it has become wet, one can tell immediately if the screen grids are at fault by checking for a clicking sound by making intermittent contact on the control grid of the i-f tube.—Harold B. Cook, Wichita, Kans.

* * *

Motorola Dual-Six. When set howls and motorboats so badly that reception is impossible with the volume control turned on ¾ full on local stations, do not waste any time making tests or realigning chassis as this will not remedy the trouble. The quickest way to remedy this trouble is to mount the speaker in a separate metal case. The trouble is caused by the speaker setting up mechanical vibration causing the tuning condenser to vibrate by moving the face of the plates. The tone is improved 50% by placing the speaker in a separate case.—H. L. Fornoff, Buffalo, N. Y.

* * *

Philco Model 70A. This job has a dual volume control with one section in the antenna and the other one, a 200 ohm section, in the bias network. Replace this with a 50,000 ohm unit, connected in place of the original antenna section of the old control. Place a 200 ohm resistor across terminals on voltage divider where old bias section of volume control was connected. This will give smoother control of volume and better quality than before.—Jack Darr, Mena, Arkansas.

* * *

Pontiac Air Chief Model 544291 (Auto). A frequency shifting when tuning is due to slipping of the tuning clutch consisting of two gears fastened to the variable condenser shaft. Permanent cure is to first turn the two gears on the shaft so that the hole where the spring clip fastens to the gear aligns with the hole in the condenser shaft. Then solder the clutch assembly to the two gears and the shaft. Internal noise and cutting off and on of volume in this model is due to a loose clip compressed between the threaded brass piece on top of the stator plates of the variable condenser. Remedy is to solder this clip. or better yet all of them, permanently to the threaded brass part.—N. E. Nelson, Mayville, N. D.

* * *

RCA Victor Model M-34. If there is too much vibrator and motor noise, try soldering a jumper from the chassis to the shielding of the antenna lead and the cable running from set to the tuning unit. In cases when the vibrator sticks, and when volume would vary greatly, we have found the trouble to be due to the generator charging at too rapid a rate. When this was cut down to normal, the sets played satisfactorily.—Harold B. Cook, Wichita, Kans.

* * *

Stewart Warner Model 112. This mode Stewart Warner often picks up vibrator noise. It is not the fault of the vibrator itself, but the noise can be entirely done away with by making a good connection between the shield can and the chassis. If motor noise is bad, try shielding the tone control wire and the pilot light wire. The two wires are enclosed in one cable which runs from the receiver to the tuning unit.—Harold B. Cook, Wichita, Kans.

* * *

Truetone Model D745 Auto Radio. Complaint of noisy reception until the set goes completely dead. Always check the lead going from the end section of the tuning condenser gang to the top cap of the metal tube in the corner of the cabinet. This lead is short and breaks from strain and vibration. Replace with longer stranded wire.—Robert E. Dickerson, Louisville, Kentucky.

* * *

United Motors 1935 Models. When these sets become insensitive and have poor selectivity, it is almost certain that the intermediates need peaking. This condition of mis-alignment of the i-f is caused by wax which melted away from the coil and settled on the trimmer condenser, thus disturbing its original setting and changing its capacity.—Chas. Marusak, Cleveland, Ohio.

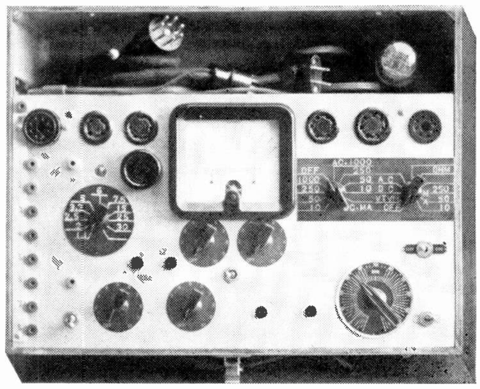
Now V. T. V. M. T. T.

For you servicemen who like the headaches and joys that go with building your own tube tester, we are showing below a tester built by Lewis C. Heise, Kensington, Kansas. Let's let Mr. Heise tell us in his own words about his tester.

"Since seeing in Volume 7, No. 10 of Sylvania News, 'Know Your Tube Tester' by Walter R. Jones, I can't stand it any longer and just have to send you a photo of my Tube and Radio Tester; a Vacuum Tube Voltmeter Tube Tester.

"It works entirely different from other Tube testers, surely tests the tubes, especially those trick tubes, uses no Neon bulb—uses a 6E5 in conjunction with meter—much more sensitive than Neon bulb.

"Tests each element separate. Also tests emission, shows target on 6E5 type tubes, tests cold rectifier and can test tubes without knowing number, or any new tube coming on the market It is contained in a case 16½x12½ and weighs 21½ pounds." Inquiries on this instrument should be addressed directly to Mr. Heise.



TUBE LIMITS FOR TESTERS

Through the cooperation of tester manufacturers we are inaugurating a new service to servicemen by supplying testing information on new types of tubes for tube testers now in use. This service will make it possible to keep testing charts up-to-date between the reprinting of charts by tester manufacturers.

Sylvania and the Tester Manufacturers feel that this service will be of mutual benefit to all concerned and will materially aid the serviceman in improving his service to his customers.

Tester manufacturers now have systems set up whereby tester limits are supplied when sufficient quantity of information is available. Some tester companies supply such data to their regular mailing list, whereas others supply it on request. The owner of a tester should remember that to get this service it is necessary to return the registration card supplied with the tester, advise of any change in address or to request the test data from the company who built the tester.

Test data for some of the later tubes are given below. This test information should be added to your test chart for convenience. Additional data will be given in the next issue. Your comments on this feature will be appreciated.

BURTON ROGERS COMPANY

Model 20 Tester

Tube	Filament	Selector	Plate
0A4G—No Test Due to Insufficient Voltage to Strike Tube.			
1A5G	1.5	C	63
1A7G	1.5	C	86 PEN
	1.5	D	100 OSC
1C5G	1.5	C	30
1H5G	1.5	B	50 TRI
	1.5	F	100 DIO
1N5G	1.5	C	40 S.G.
2X3	2.5	A	10 REC
	Shows Shorted at 5		
4A6G	2.0	D	100 TRI
	2.0	B	100 TRI
6AC5	6.3	B	80
6AD6G	6.3	F	0 VIS
6AE6G	6.3	A	100 TRI
	6.3	B	100 TRI
6AF6G	6.3	F	0 VIS
6F8G	6.3	B	75 TRI
	6.3	D	28 TRI
6G6G	6.3	C	30
6J8G	6.3	C	60 PEN
	6.3	D	55 TRI
6K8	6.3	C	75 PEN
	6.3	D	25 TRI
6P5G	6.3	B	37
6W7G	6.3	C	45
6X6	6.3	B	100 DIO
VIS	6.3	G	0 VIS

To secure 2nd Reading Tube must be inserted in the Octal (X) Socket. Shows shorted at 5.

Models 21, 22, 26 Testers

0A4G	...	E	REC	20
1A5G	1.5	C	S.G.	54
1A7G	1.5	C	S.G.	72
	1.5	F	TRI	100
1C5G	1.5	C	S.G.	25
1H5G	1.5	C	TRI	86
	1.5	E	DIO	100
1N5G	1.5	C	S.G.	80
2X3	2.5X	D	REC	12
4A6G	2.0X	C	TRI	70
	2.0X	F	TRI	70
6AC5G	6.3	C	TRI	65
6AD6G	6.3	E	REC (Visual)	0
6AE6G	6.3	C	TRI	77
	6.3	D	REC (2nd Tri)	80
6AF6G	6.3	E	REC (Visual)	0
6F8G	6.3	C	TRI	60
	6.3	F	TRI	23
6G6G	6.3	C	S.G.	24
6J8G	6.3	C	S.G.	50
	6.3	F	TRI	45
6K8	6.3	C	S.G.	65
	6.3	F	TRI	20
6P5G	6.3	C	TRI	32
6W7G	6.3	C	S.G.	40
6X6	6.3	C	TRI	95
VIS	6.3	F	REC	0
1851	6.3	C	S.G.	29
1852	6.3	F	TRI	40
1853	6.3	F	TRI	60

Model 25 Tester

0A4G	No Test		
1A5G	1.5	C	54
1A7G	1.5 PEN	C	72
	1.5 OSC	D	100
1C5G	1.5	C	25
1H5G	1.5 TRI	B	86
	1.5 DIO	F	100
1N5G	1.5	C	80
2X3	2.5 REC	A	10
4A6G	2.0 TRI	D	70
	2.0 TRI	B	70
6AC5G	6.3	B	65
6AD6G	6.3 VIS	F	0
6AE6G	6.3 TRI	A	79
	6.3 TRI	B	79
6AF6G	6.3 VIS	F	0
6F8G	6.3 TRI	B	60
	6.3 TRI	D	23
6G6G	6.3	C	24
6J8G	6.3 PEN	C	50
	6.3 TRI	D	45
6K8	6.3 PEN	C	65
	6.3 TRI	D	20
6P5G	6.3	B	32
6W7G	6.3	C	40
6X6	6.3 TRI	B	95
VIS	6.3 VIS	G	0
1851	6.3	C	29
1852	6.3	D	40
1853	6.3	D	60

To secure 2nd reading tube must be inserted in the Octal (X) Socket. Shows shorted at 5.

TRIPLETT ELECTRICAL INSTRUMENT CO.

Model 1210-A Tester

Tube	Fil. Volts	Load	Selector
1A5G	1.5	62	1
1A7G	1.5	76	1
1C5G	1.5	45	1
1H5G	1.5	69	1
1N5G	1.5	55	1
2S	2.5	62	1
4S	2.5	62	1
6AE6G	6.3	48	1
6C8G	6.3	38	1
6J8G	6.3	28	1
6K8	6.3	21	1
6P5G	6.3	37	1
6W5	6.3	30	4
6W5	6.3	21	1
6W7G	6.3	33	1
6Y6G	6.3	21	1
6Y7G	6.3	23	1
6ZY5G	6.3	26	1
(Press diode button for second plate)			
25Y5	25.0	36	9
(Press diode button for second plate)			

Models 1502, 1503 Testers

Tube	Fil. Volts	Load 1	Load 2	Socket	Selector
1A5G	1.5	65	21	H	3
1A7G	1.5	65	0	H	3
1C5G	1.5	62	0	H	3
1H5G	1.5	95	0	H	4
(Good tube reads above 4 DCV scale)					
1N5G	1.5	47	35	H	8
2S	2.5	36	45	F	1
(Switch in rectifier position)					
6AC5	6.3	98	0	H	2
6AE6G	6.3	83	10	H	3
6C8G	6.3	25	0	H	10
(Toggle Switch in rectifier position)					
6C8G	6.3	40	0	H	2
(Toggle switch in rectifier position)					
6F8G	6.3	36	0	H	1
6G6G	6.3	64	0	H	8
6J8G	6.3	43	0	H	8
6K8	6.3	41	0	H	8
6P5G	6.3	51	0	H	2
6T5	6.3	36	40	F	2
6U5	6.3	45	40	F	2
6W5	6.3	30	43	H	1
(Switch in rectifier position)					
6W7G	6.3	25	29	H	3
6Y6G	6.3	40	15	H	2
6ZY5G	6.3	9	60	H	2
(Switch in rectifier position)					
6Z7G	6.3	67	0	H	2

WESTON ELECTRICAL INSTRUMENT CORPORATION

Models 770, 771 Testers

Type	Fil. Sel.	Tube Sel.	"In" Pos.	2nd Plate
1A5G	1	20	BCD	
1A7G	1	19	BCDEF	
1C5G	1	25	BCD	
1H5G	1	23	BDE	
1N5G	1	23	BCE	
2E5	3	36	BCF	
4A6G	2	20	DF	
4A6G**	2	20	BC	
5U4G	5	42	C	F
6AB6G	6	31	BCD	
6AC5G	6	41	BD	
6AE6	6	40	BCE	
6F8G	6	42	BE	DF
6G6G	6	41	BCD	
6K8	6	44	BCDEF	
6L7	6	43	BCDE	
6P5G	6	40	BD	
6T5	6	36	BCF	
6V6	6	42	BCE	
6W7G	6	41	BCDE	
6Z7G	6	42	BC	DF
76	6	39	BC	

WESTON ELECTRICAL INSTRUMENT CORPORATION

Models 773, 775 Testers

Type	Fil. Sel.	Tube Sel.	"In" Pos.	2nd Plate
1A5G	1	20	BCD	
1A7G	1	19	BCDEF	
1C5G	1	25	BCD	
1H5G	1	23	BDE	
1N5G	1	23	BCE	
4A6G	2	20	DF	
4A6G**	2	20	BC	
2E5	3	36	BCF	
5U4G	5	42	C	F
6AB5	6	26	BCF	
6AB6	6	31	BCD	
6AC5G	6	41	BD	
6AE6G	6	40	BCDEF	
6A7	6	40	BCDEF	
6D6	6	41	BCF	
6F8G	6	42	BE	DF
6G6G	6	41	BCD	
6K8	6	44	BCDEF	
6L7	6	43	BCDE	
6N5	6	31	BCF	
6N6G	6	38	BCD	
6P5G	6	40	BD	
6T5	6	36	BCF	
6V6G	6	42	BCE	
6W5	6	44	BCDE	
6Y6	6	45	BCD	
25N6	9	40	BCD	
76	6	39	BC	
305E	6	43	BCEF	
306E	6	42	BCEF	
807	6	42	BCE	
954	6	40	BCD	Use Alden Adapter
955	6	43	BC	Use Alden Adapter
956	6	39	BCD	Use Alden Adapter
1603	6	40	BCEF	

Notes: **Use Socket "A".

PRECISION APPARATUS CORPORATION

Announces new tube test charts, available to owners of Precision Electronometers Series 500, 500A, 600 and 700. Give model and serial numbers of instrument when requesting chart.

JACKSON ELECTRICAL INSTRUMENT COMPANY

Announces new tube test charts, available to owners of Jackson Models 427A, 435A, 535, 580, 627, 630, 635 and 680. Give model and serial numbers of instrument when requesting chart.

BENDIX DAYRAD

The Dayton Acme Company, Cincinnati, Ohio, advises that they are carrying on the service work for Dayrad and Bendix units.