SYLVANIA NEWS

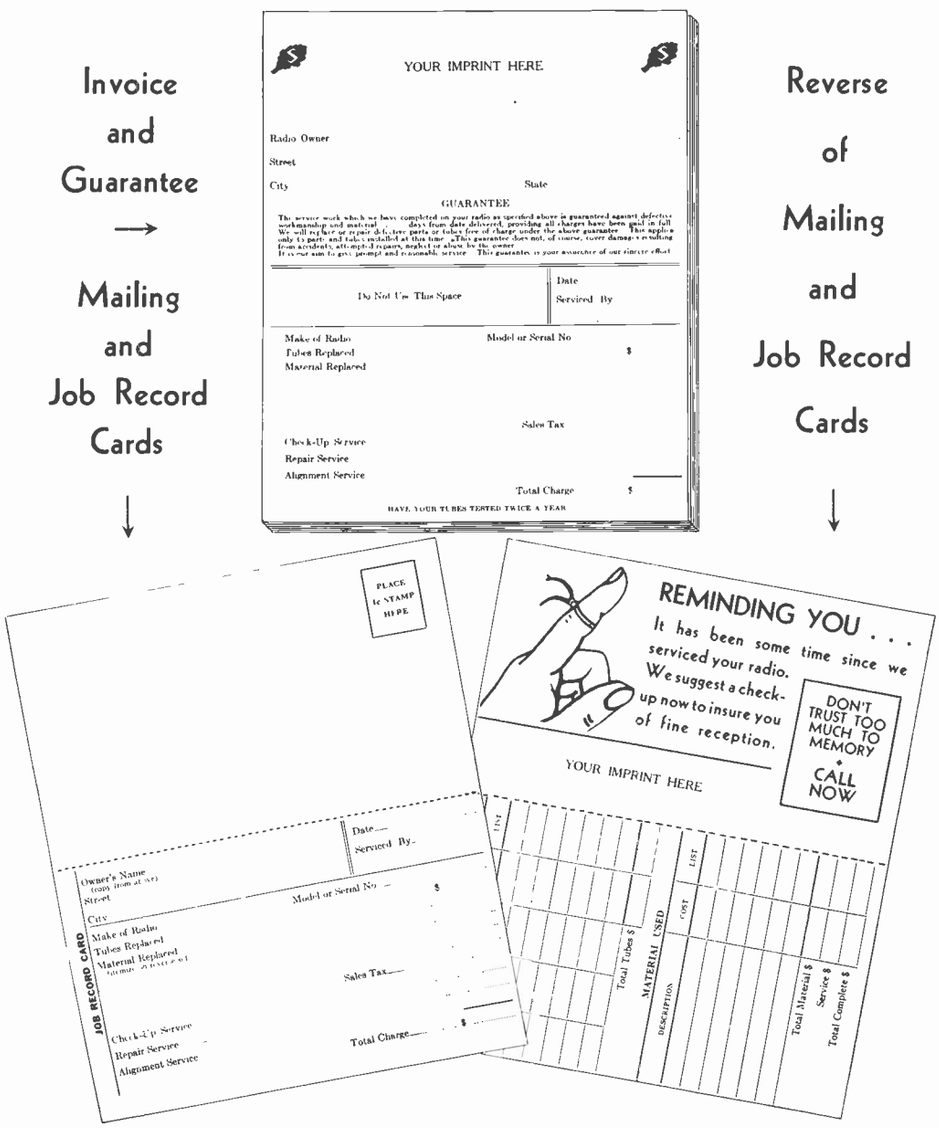
TECHNICAL SECTION

January-February, 1939 EMPORIUM, PENNA. Vol. 8, No. 1

SYLVANIA 3 in 1 SERVICE FORM

Invoice and Guarantee →

Mailing and Job Record Cards ↓



Reverse of Mailing and Job Record Cards ↓

Some would say that an invoice and guarantee, job record card, and a promotional follow-up card for mailing, could hardly be combined so that this complete service transaction might be handled in one operation. But the Sylvania "3 in 1 service form," printed in duplicate on 6" x 5" stock, is built just that way, as shown above. The original of the form, illustrated at the top of the photo, is printed on standard weight paper, and, when imprinted with your name and address, becomes the customer's invoice and guarantee, as a complete record of the service job. The duplicate is printed on card stock, and, by use of carbon paper, the customer's name and address are transferred to the imprinted mailing card section; and the service record to the job card section—which are separated by a perforation. The combination mailing card and job record card may then be separated, and filed, in respective Sylvania Card Index Files. The mailing card is complete with address, ready for follow-up mailing at the proper time, to be determined by you. The address side of the mailing card, and the job record card, are illustrated in the lower left—and the reverse of each, in the lower right of the photo. This is a business form that service men will welcome. The complete form is in two colors—green copy, with black imprint. It is available in pads of 25 sets each, and a sample may be had upon request. Order from Hygrade Sylvania Corp., Emporium, Pa., at the following prices by using the coupon on page 4 of the Main Section; 100—$1.50, 250—$2.50, 500—$4.00.

NEW TUBES

SYLVANIA LOCTALS

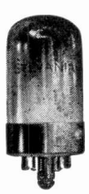
The popularity of the new type of construction embodied in the Sylvania Type 1231, announced in Technical Section, Volume 7, Number 9, has lead to the demand for additional types. At this time eight new Sylvania tubes having physical characteristics and appearances comparable to the Sylvania 1231, are announced.

The group of eight tubes consists of six types for 6.3 volt operation with a nominal heater voltage rating of 7.0 volts, and two types for 32 volt operation with a nominal heater voltage rating of 35 volts. In a-c service the 7.0 volt rating corresponds to a 130 volt line condition. It is also the nominal voltage for auto receivers.

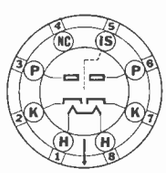
The "Loctal" type of construction employed in these new tubes is the same as that of the Sylvania 1231. It consists of an all-glass tube without the familiar bakelite base. The contact pins are sealed into the glass bottom, thus eliminating soldered connections. The Loctal type of construction provides compactness, suitable shielding, and a lock-in feature as well as the "single ended" feature which eliminates the top cap connection. The lower portion of the tube is fitted with a metal shell and guide pin. This unit acts as a shield and makes possible the lock-in feature by employing a groove around the bottom of the locating pin which fits into a catch on the socket.

The locking arrangement holds the tubes in the sockets very tight, assuring good contact at all times. Removal of these tubes from the sockets is difficult when done in a direct upward pull. With a slight off side pressure, the socket lock releases and removal is very easy.

Because of the difference of construction these new Loctal tubes obviously are not intended as, nor can they be used as, replacement tubes for any other types having different type numbers. Characteristics and operating conditions follow.



Type 7A6
Duodiode



7-AJ

Sylvania Loctal Type 7A6 is a duodiode having two plates and two cathodes, each brought out to individual base pins. The tube construction is the "all-glass" type, the same as described in the writeup above.

The two diode sections of the 7A6 are shielded from each other by an internal shield connected to base pin number 5.

This new tube is similar to Sylvania Type 6H6 and 6H6G except for the heater current which is reduced to 150 milliamperes. In application the tube may be employed the same as the 6H6G; for a-v-c, for low current rectification, or for detector service.

The heater is designed for either series or parallel operation. For a-c service the 7.0 volt heater rating corresponds to a 130 volt line condition. It is also the nominal voltage for auto receiver service.

(Continued on Page 2)

NEW TUBES

TYPE 7A6—Continued

CHARACTERISTICS

Heater Voltage (Nominal)	7.0 Volts
Heater Current (Nominal)	0.160 Ampere
Maximum Over-all Length	2 15/16 Inches
Maximum Diameter	1 3/16 Inches
Bulb	T-9F1
Base	7-AJ

Direct Interelectrode Capacitances,

Plate to Plate	0.05 μμf Max.

Operating Conditions and Characteristics:

Heater Voltage	6.3 Volts
A-C Voltage per Plate (RMS)	150 Max. Volts
D-C Output Current	10 Max. Ma.
Voltage Drop (per side) at 10 Ma.	8.0 Volts

NOTE: The maximum ratings are design centers for a line voltage of 117 volts with household receivers. In auto receiver service the design centers are 85% of the values indicated, using a battery terminal voltage of 6.6 volts.

Type 7A7 Triple Grid Amplifier

8-V

Type 7A7 is a new triple grid super control amplifier of new design suitable for r-f or i-f service in a-c, ac-dc and auto receivers.

All of the grids terminate at base pins, thus providing a super-control r-f amplifier without top cap; a feature heretofore impossible with simplified tube construction. An internal cage-like shield connected to pin number 5 is effective in making possible a tube with small grid to plate capacity.

The electrical characteristics and applications of the 7A7 are very similar to those for type 6K7G. The principal difference is the increased value of mutual conductance for type 7A7.

CHARACTERISTICS

Heater Voltage (Nominal) AC or DC	7.0 Volts
Heater Current (Nominal)	0.32 Ampere
Maximum Over-all Length	2 15/16 Inches
Maximum Diameter	1 3/16 Inches
Bulb	T-9F1
Base	8-V

Direct Interelectrode Capacitances:

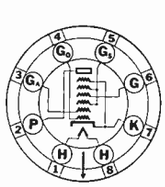
Grid to Plate	0.005 μμf
Cg (F+K+G2+G3)	6.0 μμf
Cp (F+K+G2+G3)	7.0 μμf

Operating Conditions and Characteristics:

Heater Voltage	6.3 Volts
Plate Voltage	250 Max. Volts
Screen Voltage	100 Max. Volts
Grid Voltage	−3 Min. Volts
Suppressor	Connect to Cathode
Plate Current	8.6 Ma.
Screen Current	2.0 Ma.
Plate Resistance	0.8 Megohm
Mutual Conductance	2000 μmhos
Amplification Factor	1600
Grid Voltage for Mutual Conductance of 10 μmhos.	−35 Volts

NOTE: The Maximum and Minimum ratings are design centers for a line voltage of 117 volts with household receivers. In auto receiver service the design centers are 85% of the values indicated, using a battery terminal voltage of 6.6 volts.

Type 7A8 Octode Converter



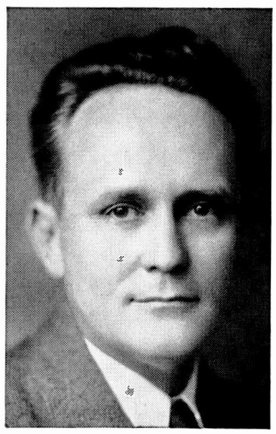
8-U

The Sylvania Type 7A8 Octode Converter is a new loctal converter tube for service in a-c, ac-dc and auto receivers. Compactness, short connections to the electrodes and simplified shielding are some of the features of this new tube. All external connections are made to eight contact pins; no top cap being required.

The electrical characteristics and applications are similar to those for the Sylvania Type 6D8G Pentagrid Converter. The principal differences appear in the values of the interelectrode capacitances. The uses of the 7A8 parallel those of any Sylvania Pentagrid converter, therefore, reference

(Continued on Page 4)

A CHAT WITH ROGER WISE



Chief Tube Engineer
Hygrade Sylvania Corporation

With the current announcement of a number of types of improved glass tubes, a number of important features of advanced tube design are now made available to set manufacturers. In a previous discussion the advantages of single-ended construction were mentioned, and this improvement is available in all of the new converters, r-f pentodes, and double diode triode types.

Additional features include short lead length for connections to the electrodes, elimination of insulating material other than glass around the tube pins, compact size and simplified shielding. Consideration has been given to the voltage overloads imposed on the tubes in automobile service in the adoption of a nominal rating of 7 volts for the types corresponding to present 6.3 volt tubes. This does not mean that the tubes cannot be used in parallel with 6.3 volt types, but does call the attention of set designers to the fact that it is no longer desirable to design around a voltage lower than 6.3, as has been the tendency in many instances in the past. Heater operating temperatures have been lowered so that no difficulty is experienced in the range between 6.3 and 8.0 volts. Thus the range of battery voltages between 5.8 and 8.0 volts does not adversely affect those tubes, and by avoiding extremely low filament voltages in household sets, a gain through narrowing of the total spread of heater voltages can be realized.

The importance of this matter to tube manufacturers can best be realized when we recall that some 6.3 volt types have been used in sets where heater voltages as low as 4.8 volts were encountered. To design a tube which will operate satisfactorily at this low voltage and still withstand voltages as high as 8.0 volts or even slightly above this value has taxed the ability of tube engineers. Anything that can be done to narrow this spread is very helpful in improving tube uniformity, making it possible to manufacture a tube better suited to average industry requirements.

TESTER LIMITS

In continuation of the service inaugurated in the last Technical Section tester, limits are given below for late types of tubes in Supreme Testers.

SUPREME MODEL 85 TESTER

Type	Fil. Volt Selector	Adapter	Quality Selector	Buttons	Remarks
1A5G	1.5	B	71.0	3	New Tube Setting
1A7G	1.5	B	76.0	3	" " "
1C5G	1.5	B	53.8	3	" " "
1G5G	2.0	B	61.0	3	Correction
1H5G	1.5	B	72.0	3	New Tube Setting
1J5G	2.0	B	73.0	3	" " "
1N5G	1.5	B	63.8	3	" " "
6AC5G	6.3	B	48.0	2	" " "
6J8G	6.3	B	33.0	2	" " "
6K8	6.3	B	27.0	2	" " "
6P5G	6.3	B	52.0	2	" " "

SUPREME MODEL 89 TESTER

Type	Fil. Volt Selector	Fil. Return Selector	Quality Selector "R" Pot	Quality Selector "S" Pot	Buttons	Remarks
1A5G	1.5 (D)	7	74.0	70.0	F	New Tube Setting
1A7G	1.5 (D)	7	74.5	75.0	F	" " "
1C5G	1.5 (D)	7	70.0	56.0	F	" " "
1G5G	2.0 (D)	7	75.0	66.0	F	" " "
1H5G	1.5 (D)	7	74.0	72.0	F	" " "
1J5G	2.0 (D)	7	74.0	68.0	F	" " "
1N5G	1.5 (D)	7	71.0	66.5	F	" " "
6J8G	6.3 (D)	7	54.0	43.0	8	" " "
6K8	6.3 (D)	7	44.0	31.0	8	" " "
6P5G	6.3 (D)	7	70.0	56.0	8	" " "

SUPREME MODEL 400 TESTER

Type	Sectional Test	Fil. V. Selector	Fil. Ret. Selector	Switches Up	Meter Cir. Sel.	Quality Sel.	Remarks
1A5G	All	1.5	7	2	C	22.0	New Tube Setting
1A7G	All	1.5	2	7	C	24.5	" " "
1C5G	All	1.5	2	7	C	15.0	" " "
1G5G	All	2.0	2	7	E	31.0	" " "
1H5G	All	1.5	2	5–7	C	29.0	" " "
1J5G	All	2.0	2	7	C	16.0	" " "
1N5G	All	1.5	2	7	C	15.5	" " "
6AB6	All	6.3	2	7–8	E	62.0	" " "
6AC5G	All	6.3	2	7–8	E	11.0	" " "
6P5G	All	6.3	2	7	..	12.0	" " "

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.

Car Radio Receiver Dials (Old Type). When dials become warped, place between damp cloths, then place between two thin sheets of asbestos. Put in a warm oven and weight it down evenly. Let it bake for about 10 minutes and then let cool.—Mr. Wm. B. Miles, Altoona, Penna.

* * *

Don'ts That Lead to Successful Servicing.

1. Don't guess at specifications, use factory data.
2. Don't use worn or cheap instruments in the repair of radios, use those made or authorized by the Manufacturers. Use instruments, don't guess.
3. Don't use unknown parts. The saving of a few pennies on parts may mean dollars due to comebacks. Genuine parts are a lot cheaper in the long run.
4. Don't do patch up work, do a complete overhaul job on the radio that has been in service two or more years.
5. Don't fail to attend Jobbers and Manufacturers meetings, they mean information to you.
6. Don't attempt to repair a stage in a radio until you know what is wrong with it, and then know when it is in complete repair permanently.
7. Don't attempt to cause the radio to operate by merely working on it in a slipshod manner. Al Brzuck, Detroit, Michigan.

* * *

Novel Sylvania Sign. Any dealer or serviceman can utilize a sign which can be a flasher type or just illuminated. The sign was devised and made with the Sylvania decalcomania. I had a local woodworker construct a funnel shaped box with grooves in the front inside walls for a sliding glass. The front of the box is 7" x 10", the back 6" square and the depth, front to back is about 6" to 8". I purchased a 7" x 10" piece of glass about ⅛" thick and applied the Sylvania transparency as you would on a window. I slid this glass into the slots in the box opening, then rigged up a socket with a switch in the back wall of the box (use a flasher if you wish) and used a 25 watt bulb. It clicks. It can be used as a window display, counter or self display, or fixed up with Sylvania cartons makes a striking display. You can use other displays with this sign by changing the ad in the opening. If the transparency is small use paper with contrasting colors.—M. Planovsky, Cleveland, Ohio.

* * *

Philco Model 38-8. Oscillation and feedback, when the volume control is set to its maximum position, can be eliminated by adding a .0005 mfd. condenser from the 6K5G first audio plate to ground. We have made this addition to several of these models with the above complaint.—Joseph S. Napora, Uniontown, Pa.

* * *

Philco Model 38-8. To increase the sensitivity of the shadow meter on this model it is necessary to make this change—remove resistor No. 12, 10,000 ohms, replace with 13,000 ohm resistor, 3 watt rating. Remove condenser No. 17, .05 mfd., replace with .25 mfd. condenser. To improve and provide uniform oscillator circuit performance, connect a 20 ohm resistor in series with the cathode of the 6A8G detector-oscillator tube.

To increase the audio response in the higher frequencies, remove condenser No. 40, .008 mfd. and replace with condenser .004 mfd.—M. J. Planovsky, Cleveland, Ohio.

* * *

Philco Model 809 Auto Set. Oscillation accompanied with audio howl over the entire tuning range. The first r-f cathode by-pass condenser part No. 30-4227 sometimes breaks loose due to vibration against the bottom lid of the set. The best remedy is to strap it down to the chassis. A. B. Chismar, Streator, Ill.

* * *

Public Address Amplifier. A satisfactory small public address system can be made from a Majestic 90 receiver using the original parts. In my case, I made the amplifier without tearing up the set and it still remains in the original cabinet. Leave the detector as it is but reduce the bias resistor. Use one of the r-f stages as an input stage, resistance coupled to the original detector. Use 50,000 ohms for the plate, 100,000 ohms for the detector grid, an .01 coupling condenser and a 250,000 ohm input volume control. With either a carbon mike or magnetic pickup it has plenty of output without noticeable distortion.—Eslick's Radio Shop, Norwich, Kans.

* * *

RCA Models (1939). After dialing electric tuning on the RCA 1939 sets to station the condenser gang continue to work back and forth for a few seconds. It does not come to a complete stop, which makes the set very noisy. I have found the counter weight on the end of the motor shaft is usually loose. Tighten the set screw and the trouble will be overcome.—John Kalisty, Beacon, New York.

* * *

RCA Victor Models 13K and 15K. Blowing fuses is traceable to intermittent shorts in the 5Z4 tubes not noticeable on a tube tester but occasioned vibrations from the speaker. Use two Sylvania 5Y3G tubes as replacements.—Leo Zimmer, Canisteo, N. Y.

* * *

Radio Noise from Lamps. A very bad source of radio noise has been found in several of the new indirect lighting lamps now in style. It seems that the switch unit used in these lamps are rated for a few amperes only, and the heat caused by the high lamp current causes the switch contacts to open producing an arc. Replace with a heavy duty unit rated about 6 to 8 amperes.

I have had three cases where large lamps with high wattage rating (indirect lighting lamps) caused hum in a radio while both were in use at the same time. The simple remedy is to either change the AC cord from the set to another outlet or change the lamp cord to another socket plug or outlet. In most cases you will find the lamp and radio plugged in at the same outlet.—M. J. Planovsky, Cleveland, Ohio.

* * *

Silver Marshall Model 37. This set uses a dynamic speaker with two separate field coils. One is used as a filter choke in the positive side of the power supply, while the other is used as a bias resistor. Leakage and partial breakdown often occur between the windings causing erratic and intermittent operation. The trouble is such that it occurs only with a high potential between the two coils and an ohmmeter fails to disclose the condition. In addition, voltages are not greatly affected. The two field coils may be replaced or wired in series (being sure that they do not buck each other) and used as a filter choke. Then connect a 750 ohm 10 watt resistor from filament center tap to ground. This latter method is usually satisfactory since the difference in potential is not high enough to cause break down. Robert K. Seigle, St. Louis, Mo.

* * *

Stewart Warner Tuning Eye. Since the narrowing of the eye depends upon the strength of the signal received, it will be effective on powerful nearby stations while less effective on distant stations. The eye will not close normally if there is a short or no aerial. Check tubes and alignment in all early models if the eye does not work normally and is not affected by the above reasons. On the later 1495 models the circuit has been improved to aid the eye on weaker signals. You can determine if a change has been made by tuning in a local and removing the 6H6 tube, located next to the 6C5, this should cause the radio signal to get louder or distort. On later sets, this causes the eye to narrow or even disappear. If removing the 6H6 causes the shadow to widen to its full width, change the wiring as follows; place wiring of the eye grid wire which is the green and white wire in the eye cable. This wire is connected to the blank pin terminal on the 6H6 socket, adjacent to the 6C5 tube. Disconnect this lead and re-connect to the blank pin terminal on the 6H6 socket nearest to the 6J7 tube. Realign the i-f, a-v-c, and B.C. trimmers. Refer to R-149 circuit diagram for proper connections.—M. S. Planovsky, Cleveland, Ohio.

* * *

Speaker Protectors. Safety First—When chassis and speaker are brought in for service or the speaker is otherwise out of the cabinet while working on the chassis, bolt a piece of wood over the front of the speaker to protect the cone. I keep on hand two pieces 8" and 12" square for auto and home radios using one ¼ inch hole in each for mounting on the speaker.—Wayne Storch, Beecher, Illinois.

* * *

Starting Nuts. One of the most exasperating and annoying things in the service trade is the starting of a nut on a bolt, stud, etc. Here is a trick I use regularly. Use an ordinary ice pick and put the nut over the pick, holding the nut to the top of the pick, then place pick in center of bolt. Release nut and it will slide down ice pick to starting point of the threads. Take a long pointed instrument or tool to start the nut. Once started the rest is easy with a socket wrench.—Geo. F. Kloor, Alexandria, La.

* * *

U. S. Apex Model 7-A. This set had several servicemen fooled, and had me guessing also for some time. After checking tubes, voltages, condensers and resistors and finding them all OK, with the set operating between 1000 and 1600 k-c I gave it a more thorough checking and found that the third tuning condenser had about 6 ohms resistance between the bottom stator support and the top support. By running an insulated wire from the bottom to the top trimmer, all the trouble was cured.—A. R. Eberts Radio Service, Troy, Ohio.

* * *

Zenith 5902 Chassis. Oscillation or an audio howl, especially on short waves can be corrected by the following method—ground the 56 detector cathode directly at the socket contact. Remove the original black ground wire. Re-route the second i-f plate wire from the aeroplane type lug around the 8 mfd. and connect to the plate the other side of the choke. This changes the circuit in no way, only reduces stray capacities.—E. R. Cornelius, Dallas, Texas.

SPECIAL OFFER

During the month of February two Sylvania receiving tubes will be given for each Service Hint accepted dealing with Coin Operated Phonographs. The Hints may apply to the mechanical, electrical or selling end of these machines.

NEW TUBES

(Continued from Page 2)

may be made to the Sylvania Technical Manual for any detailed application data required.

CHARACTERISTICS

Heater Voltage (Nominal) AC or DC	7.0 Volts
Heater Current (Nominal)	0.160 Ampere
Maximum Over-all Length	2 5/32 Inches
Maximum Diameter	1 3/16 Inches
Bulb	T-9F1
Base	8-U

Direct Interelectrode Capacitances:

Grid G to Plate	0.15 μμf. Max
Grid G to Grid Ga	0.12 μμf.
Grid G to Grid Go	0.12 μμf.
Grid Go to Grid Ga	0.60 μμf.
Grid G to all Electrodes (r-f input)	7.5 μμf.
Grid Ga to all Electrodes Except Go (Osc. Output)	3.4 μμf.
Grid Go to all Electrodes Except Ga (Osc. Input)	3.8 μμf.
Plate to all Electrodes (Mixer Output)	9.0 μμf.

Operating Conditions and Characteristics:

Heater Voltage	6.3 Volts
Plate Voltage	250 Max. Volts
Control Grid Voltage (G)	-3.0 Min. Volts
Screen Voltage (Gs)	100 Max. Volts
Anode Grid Voltage (Ga)*	250 Max. Volts
Oscillator Grid Resistor (Go)	50,000 Ohms
Plate Current	3.0 Ma.
Screen Grid Current	2.8 Ma.
Anode Grid Current	4.5 Ma.
Oscillator Grid Current	0.40 Ma.
Cathode Resistor	300 Ohms
Plate Resistance	700,000 Ohms
Conversion Conductance	600 μmhos
Control Grid Voltage for 2 μmhos Conv. Cond.	-30 Volts

*Applied through 20,000 ohm dropping resistor.

NOTE: The Maximum and Minimum ratings are design centers for a line voltage of 117 volts with household receivers. In auto receiver service the design centers are 85% of the values indicated, using a battery terminal voltage of 6.6 volts.

Type 7B7 Triple Grid Amplifier

8-V

Type 7B7 is a new triple grid super-control amplifier of the new loctal design suitable for r-f or i-f service in a-c, ac-dc and auto receivers.

All of the grids terminate at base pins, thus providing a super-control r-f amplifier without top cap; a feature heretofore impossible with simplified tube constructions. An internal cage-like shield connected to pin number 5 is effective in making possible a tube with small grid to plate capacity.

The electrical characteristics and applications of the 7B7 are very similar to those for types 7A7 and 6S7G. Reference may be made to those types for application notes.

CHARACTERISTICS

Heater Voltage (Nominal) AC or DC	7.0 Volts
Heater Current (Nominal)	0.160 Ampere
Maximum Over-all Length	2 5/32 Inches
Maximum Diameter	1 3/16 Inches
Bulb	T-9F1
Base	8-V

Direct Interelectrode Capacitances:

Grid to Plate	0.005 μμf
Cg (F+K+G2+G3)	5.0 μμf
Cp (F+K+G2+G3)	7.0 μμf

Operating Conditions and Characteristics:

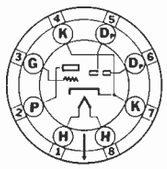
Heater Voltage	6.3 Volts
Plate Voltage	250 Max. Volts
Screen Voltage	100 Max. Volts
Grid Voltage	-3 Min. Volts
Suppressor	Connect to Cathode
Plate Current	8.5 Ma.
Screen Current	2.0 Ma.
Plate Resistance	0.7 Megohm
Mutual Conductance	1700 μmhos
Amplification Factor	1200
Grid Voltage for Mutual Conductance of 10 μmhos	-40 Volts

NOTE: The Maximum and Minimum ratings are design centers for a line voltage of 117 volts with household receivers. In auto receiver service the design centers are 85% of the values indicated, using a battery terminal voltage of 6.6 volts.

Maximum and Minimum Ratings

The maximum and minimum ratings for all Sylvania Loctal Tubes shown are design centers for a line voltage of 117 volts with household receivers. In auto receiver service the design centers are 85% of the values indicated, using a battery terminal voltage of 6.6 volts.

Type 7C6 Doudiode Triode



8-W

Sylvania Type 7C6 is a duodiode high-mu triode in the group of new Loctal tubes. The electrical characteristics are quite similar to those for type 75, except for the heater ratings.

The diodes are substantially the same as those employed in other Sylvania duodiode high-mu triode types and therefore are suitable for conventional circuit applications.

The triode section should not be employed with fixed bias. A high value of grid resistor is required and the triode operated essentially under zero bias conditions. With a plate supply voltage of 250 volts, the plate load resistor should be approximately 0.25 megohm. For special applications this value may be varied to suit the conditions.

It will be noted from the base diagrams that the cathode is connected to two contact pins, numbers 4 and 7. Pin number 4 is used as a mount support for the cathode, therefore, the potential of pins 4 and 7 is the same.

CHARACTERISTICS

Heater Voltage (Nominal) AC or DC	7.0 Volts
Heater Current (Nominal)	0.160 Ampere
Maximum Over-all Length	2 5/32 Inches
Maximum Diameter	1 3/16 Inches
Bulb	T-9F1
Base	8-W

Direct Interelectrode Capacitances:

Grid-Plate	1.4 μμf. Max.
Cg(F+K)	2.4 μμf.
Cp(F+K)	3.0 μμf.

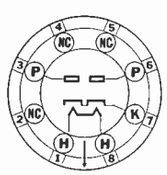
Operating Conditions and Characteristics:

Heater Voltage	6.3 Volts
Plate Voltage	250 Max. Volts
Grid Resistor	10 Megohms
Plate Current	1.3 Ma.*
Plate Resistance	0.1 Megohm
Mutual Conductance	1000 μmhos
Amplification Factor	100

*This is a rating value only and not an operating point with coupling resistor. Refer to writeup above.

NOTE: The maximum ratings are design centers for a line voltage of 117 volts with household receivers. In auto receiver service the design centers are 85% of the values indicated, using a battery terminal voltage of 6.6 volts.

Type 7Y4 Full-Wave Rectifier



5-AB

Sylvania Type 7Y4 is a new full-wave rectifier included in the group of new Loctal tubes. This new tube is suitable for rectifier service in auto receivers and compact a-c receivers. The operating conditions and characteristics are very similar to those of Sylvania Type 84. The conventional full-wave circuit may be used and for half-wave service the two plates may be tied together at the socket.

CHARACTERISTICS

Heater Voltage (Nominal) AC or DC	7.0 Volts
Heater Current (Nominal)	0.53 Ampere
Maximum Over-all Length	2 5/32 Inches
Maximum Diameter	1 3/16 Inches
Bulb	T-9F1
Base	5-AB

Operating Conditions and Characteristics

FULL-WAVE
Condenser or Choke Input to Filter

Heater Voltage*	6.3 Volts
A-C Voltages per Plate (RMS)	350 Max. Volts
D-C Output Current	60 Max. Ma.
Max. Peak Inverse Voltage Allowable	1000 Volts
Max. Peak Plate Current Allowable	250 Ma.

HALF-WAVE
Pins 3 and 6 tied together.
Condenser or Choke Input to Filter

Heater Voltage*	6.3 Volts
A-C Plate Voltage (RMS)	350 Max. Volts
D-C Output Current	75 Max. Ma.
Max. Peak Inverse Voltage Allowable	1000 Volts
Tube Voltage Drop at 60 Ma. per plate	19 Volts

*The d-c potential difference between heater and cathode must not exceed 450 volts.

Type 35A5 Output Amplifier

6-AA

Sylvania Type 35A5 is a beam power tube of the Loctal style, intended especially for use in the output stage of ac-dc and d-c receivers.

The constructional design of the electrodes is similar to that of other beam power tubes in which directed electron beams are employed. By careful arrangement of the tube elements potential fields are set up which confine the electrons into beams of high density. High power output is obtained with good sensitivity and high efficiency.

Transformer or impedance coupling devices may be used for the input circuit. If fixed bias is employed the grid circuit resistance should not exceed 0.1 megohm. The maximum resistance with self-bias is 0.5 megohm.

CHARACTERISTICS

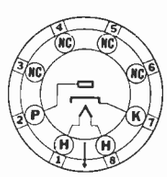
Heater Voltage (Nominal) AC or DC	35.0 Volts
Heater Current (Nominal)	0.160 Ampere
Maximum Over-all Length	3 5/32 Inches
Maximum Diameter	1 3/16 Inches
Bulb	T-9F1
Base	6-AA

Operating Conditions and Characteristics:

Heater Voltage	32.0 Volts
Plate Voltage	110 Max. Volts
Screen Voltage	110 Max. Volts
Grid Voltage	-7.5 Min. Volts
Plate Current	35 Ma.
Screen Current	2.8 Ma.
Plate Resistance	25,000 Ohms
Mutual Conductance	5500 μmhos
Load Resistance	2500 Ohms
Self Bias Resistor	200 Ohms
Power Output	1.4 Watts
Total Harmonic Distortion	10 Per cent

NOTE: The maximum ratings are design centers for a line voltage of 117 volts with household receivers.

Type 35Z3 Half-Wave Rectifier



4-Z

Type 35Z3 is a high vacuum half-wave rectifier of the Loctal style for use in compact receivers, especially those designed for the 35A5 output tube. The heater rating is the same as that of the 35A5, thereby permitting series operation. The high voltage, low current rating of these two tubes makes possible compact receiver design with a minimum amount of heat dissipation.

The conventional half-wave circuit is suitable for this new tube. A-C input voltages in excess of 125 volts requires the use of a 100 ohm resistor in series with the plate.

CHARACTERISTICS

Heater Voltage (Nominal) AC or DC	35.0 Volts
Heater Current (Nominal)	0.160 Ampere
Maximum Over-all Length	3 5/32 Inches
Maximum Diameter	1 3/16 Inches
Bulb	T-9F1
Base	4-Z

Operating Conditions and Characteristics:

Heater Voltage*	32.0 Volts
A-C Plate Voltage (RMS)	250 Max. Volts
D-C Output Current	100 Max. Ma.
Max. Peak Inverse Voltage Allowable	700 Volts
Max. Peak Plate Current Allowable	400 Ma.
Tube Drop at 200 Ma.	22 Volts

*The d-c potential difference between the heater and cathode must not exceed 300 volts.

NOTE: The maximum ratings are design centers for a line voltage of 117 volts with household receivers.

New Interchangeable Tube Chart

A new revised Sylvania Interchangeable Tube Chart listing over 400 types of tubes is available. See your Sylvania jobber or write Hygrade Sylvania Corporation, Emporium, Pa.

SYLVANIA NEWS

TECHNICAL SECTION

March-April, 1939 EMPORIUM, PENNA. Vol. 8, No. 2

GUARANTEE SERVICE PLAN

A TRIPLE PLAY FOR SATISFIED CUSTOMERS

Have you read "Three Strikes on the Serviceman's Pocketbook", Page 2, Main Section? Sylvania offers a triple play to protect you against two of these troubles. The plan works like this: 1. Frame the large Guarantee Certificate (8½ x 11) shown above, and hang it where everybody who glances into your shop can see it. 2. When you complete a service job fill out the Guarantee and Check-up form, and hand it to your customer. Both sides of this form are shown above. 3. Keep old customers, bring in new ones, by mailing out the Guarantee Promotion Folder, shown on Page 4 of the Main Section. The three pieces work together, and are offered as a complete "Guarantee Radio Service Plan". The kit consists of one large Certificate, and equal quantities of the promotion folder and the check-up form, all printed in attractive green and black. The coupon on Page 4 shows prices for various quantities. Order yours today.

NEW TUBES

Type 7B5 Output Amplifier

6-AE

Type 7B5 is a Loktal tube of pentode design having characteristics identical with those of Sylvania types 6K5G and 41, except for the nominal heater rating. Therefore, circuit applications for this new type are the same as for the above mentioned types. Type 7B5 like the equivalent type, will furnish a large power output with low distortion at a relatively small input signal voltage.

When used in a-c service the 7 volt heater rating of this new tube corresponds to a 130 volt line condition. In auto receiver service it is also the nominal heater voltage.

CHARACTERISTICS

Heater Voltage (Nominal)	7.0. Volts
Heater Current (Nominal)	0.425 Ampere
Maximum Over-all Length	3½ Inches
Maximum Diameter	1⅜ Inches
Bulb	T9-F
Base	6-AE

Operating Conditions and Characteristics

Heater Voltage	6.3	6.3	6.3	6.3 Volts
Plate Voltage	100	135	180	250 Max. Volts
Screen Voltage	100	135	180	250 Max. Volts
Grid Voltage	−7	−10	−13.5	−18 Volts
Plate Current	9.0	12.5	18.5	32 Ma.
Screen Current	1.6	2.2	3.0	5.5 Ma.
Mutual Conductance	1450	1600	1850	2200 μmhos
Amplification Factor	150	150	150	150
Load Resistance	12000	10400	9000	7600 Ohms
Power Output*	0.33	0.75	1.5	3.4 Watts

*Total Harmonic Distortion for Rated Power Output 10%.

Type 7B6 Duodiode Triode

8-W

Sylvania type 7B6 is a duodiode high-mu triode in the group of new Loktal tubes. The electrical characteristics are identical with those for type 75.

The diodes are substantially the same as those employed in other Sylvania duodiode high-mu triode types and therefore are suitable for conventional circuit applications.

It will be noted from the base diagrams that the cathode is connected to two contact pins, numbers 4 and 7. Pin number 4 is used as a mount support for the cathode, therefore, the potential of pins 4 and 7 is the same.

CHARACTERISITCS

Heater Voltage (Nominal)	7.0 Volts
Heater Current (Nominal)	0.32 Ampere
Maximum Over-all Length	2 25/32 Inches
Maximum Diameter	1⅜ Inches
Bulb	T9-G
Base	8-W

Direct Interelectrode Capacitances

Grid-Plate	1.5 μμF
Grid-Cathode	3.0 μμF
Plate-Cathode	3.0 μμF

(Continued on Page 4)

Testing Loktal Tubes

With the wide distribution of Loktal tubes in the field, many requests have been received for testing information and adapter data. Inasmuch as most tester manufacturers have made adapters or modernization kits available for their respective testers, there will be no Sylvania adapters for these new tubes. Thus, all requests for such units should be made to your instrument jobber or manufacturer.

For those who cannot obtain adapters, units can be made from a Loktal socket and a "G" type base. By referring to the base diagram for each tube, no trouble should be encountered in making the proper connections. The Loktal socket may be wired to the "G" base to correspond to a similar type of tube, i.e. 7A8 socket wired to a 6D8G base pin arrangement. With such a hook-up it will only be necessary to set the tester controls at the points specified for the "G" type of tube. Of course, meter limits for the Loktal tubes usually vary from the similar "G" types and it will be necessary to set new limits. This may be done by testing a few Loktal tubes of each type and determining the proper setting for the load control.

Listed below are the Loktal tubes and the similar "G" types. This listing may be of some help in determining adapter connections, tests, etc. On types 7B6 and 7C6 it will be noted that the cathode is connected to two contact pins, numbers 4 and 7. This double connection must be taken into consideration in the adapter design, otherwise a short will show on the tester.

SIMILAR LOKTAL AND "G" TYPES

Loktal Type	Similar G Type	Loktal Type	Similar G Type
7A6	6H6G	7B8	6A8G
7A7	6K7G	7C5	6V6G
7A8	6D8G	7C6	6T7G
7B5	6K5G	7Y4	6X5G
7B6	6Q7G	35A5	25L6G
7B7	6S7G	35Z3	25Z6G*

*One diode section of 25Z6G similar to 35Z3.

Obviously there are several other means of making connections, depending upon the type of tester, etc. However, additional suggestions for making connections will not be made, since the variation depends upon the application.

Interchanging Loktal Tubes

The interchanging of certain types of Loktal tubes in auto sets has been practiced in the field since the introduction of receivers employing these new tubes. The main reason for this practice was due to the fact that a complete stock of all types was not available at the time the receivers were introduced. There has been some misunderstanding on the interchangeability of these tubes; so to clarify any questions you may have, the following comments are given:

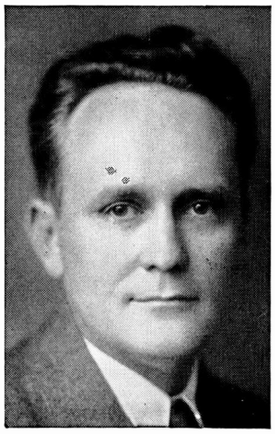
Interchangeable Types

The Loktal types that have been interchanged are mainly the 300 mil types with the 150 mil types and vice versa. These are types 7A7, 7B6, 7B8 respectively interchanged with types 7B7, 7C6, 7A8 and vice versa. This is possible in most auto receivers and in house receivers having parallel filament circuits. Measurements show the receiver performance practically the same. But the interchanging of these types is **not** possible in midget receivers and the like, which have series filament circuits.

Types to Carry in Stock

Now that all types of Loktal tubes are in jobbers' stocks it is recommended that the replacement of tubes in the receivers be made with tubes carrying the same type numbers as specified by the receiver layout. Thus, the types for servicemen to carry in stock should be those necessary for the replacements required for the receivers popular in his territory.

A CHAT WITH ROGER WISE



Chief Tube Engineer
Hygrade Sylvania Corporation

The recent testimony by Dr. Jewett of the Bell Laboratories in the T. N. E. C. hearings resulted in an unusual amount of publicity. Licensed tube manufacturers might have been led to believe that valuable information was being withheld from them, since it was indicated that a long-lived tube was being withheld from the market. Subsequent corrected reports indicate that the information generally available is substantially correct and that the first reports were unduly exaggerated.

In this "Chat" I will cover only one or two of the more important items to which Dr. Jewett's testimony referred.

A reasonable amount of information has been available for a number of years on special alloys and coating processes used in telephone repeater tubes. Such tubes are used in continuous service in telephone repeater stations, where they are operated under carefully controlled voltage conditions well within the normal operating limits of the tubes.

When so operated the importance of continuity of service is paramount, and the cost of the tube itself is, therefore, comparatively speaking, a minor factor. Examination of the construction employed on some of these tubes reveals the fact that comparatively wide interelectrode spacings are used, and particular emphasis is placed on the rigidity and accuracy of alignment of the parts.

Since the operating conditions are known within very close limits, it is possible to conduct life tests which are fully representative, and, therefore, to determine the average life of such tubes within very narrow limits.

It is most difficult to find any basis of comparison between telephone repeater tubes and radio receiving tubes because in the case of the latter types the manufacturer, in the first place, is unable to determine under what voltage conditions the tubes will be used. In household sets they are subject to line voltage variations in any given locality, also to operation in different parts of the country where the normal line voltage varies over extremely wide limits. It is no longer general practice to supply line voltage taps, so that line voltage conditions frequently run from 15% above the normal rated value to 15% below. Furthermore, the transformer found in the various receivers will be designed to supply a secondary voltage which the set designer thinks is satisfactory; and this may be conservative, or he may disregard the tube manufacturers' recommendations and actually exceed the maximum recommended value.

When faced with such a wide variation in operating conditions the tube manufacturer must test the tubes at maximum rated plate voltage with the filament or heater set at the center voltage, and also run check tests with the heater voltage adjusted to the highest probable voltage encountered; other check tests being conducted under low voltage conditions.

Obviously it is an impossible task to say what the average operating conditions imposed on the tubes in service might be, or to arrive at any accurate estimate of the "average" life.

Because radio tubes are used by the million, it is necessary to life test large quantities of tubes. Unlike lamps, it is not practical to life test radio tubes on any accelerated schedule. It is customary to run average tests for periods of 1000 hours. To run life tests even this length of time it is necessary to keep thousands of tubes on our racks. For design checks radio tubes are tested for periods of 2000, 3000, or even 5000 hours but it is customary to speak of 1000-hour life as the standard requirement, since a design which will stand up for this period of time is considered commercially acceptable.

As a matter of actual experience, we know that receiving tubes quite frequently last as long as the receiver for which they are designed is kept in service. Sometime ago we had a type 37 tube returned to us from a telephone sub-station in Ohio with the report that it had burned 21,000 hours in continuous service.

It is incorrect to consider the life of present-day radio tubes as being limited to 1000 hours or as being one year. It is generally agreed that the average number of replacement tubes sold is about one tube per receiver per year. Since the average number of tubes in a set is close to six, this would indicate that the average life is much longer than one year—especially since some of the replacements are made because of failure of component parts, which results in tube overload.

In the corrected press reports—which, unfortunately, did not attain the prominence given the earlier comments—Dr. Jewett mentioned the difference between telephone repeater tubes and radio receiving tubes. This difference is most important, as indicated above; and there is a further difference in cost, the repeater tubes generally costing several times as much as the radio receiving tubes.

It should also be noted that the repeater types are, generally speaking, filament type tubes. Practically all of the tubes used in household receivers are heater type tubes. As far as is known, no great difference in life of heater tubes designed by the Bell Laboratories has been achieved as compared with radio tubes produced by tube manufacturers.

Servicemen may have attention called to the claims made for the "long life" telephone tubes, and, when this question does arise, the above considerations can be pointed out to refute any false ideas which may have been generated by the erroneous reports. Radio manufacturers will have no difficulty in defending their contention that they have given the public very excellent value for the money expended for their product.

In a later discussion additional comments will be given on policies followed by Hygrade Sylvania with respect to tube quality.

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.

Coronado Model 864, Series A12. A wiring error that causes distortion which sounds like an off center speaker cone has been found in these sets. The trouble is caused by the difference in the plate and screen grid voltages applied to the output tubes. The plate voltage is 350 volts while the screen is 250 volts. The center tap of the output transformer is connected to the wrong point at the speaker plug. When this connection is made to the 250 volt terminal, proper operation will be restored.—Donald Slattery, Chadron, Nebraska.

* * *

Fabric Dial Belts. The woven fabric dial belts usually have an idler pulley pressing against them, causing them to stretch. When this happens, the tuning slips. If a new belt is not on hand, a temporary repair may be made by putting a layer of white adhesive tape on each pulley. This gives better traction and takes up the slack. E. N. Christner, Middletown, Ohio.

* * *

Goodyear Radios. Distortion in a Goodyear or any other make of radio having a beam power tube in the output, even though the tubes and voltages check normal, in most cases is due to the 500,000 ohm resistor in the grid circuit of the output tube. If you check the line voltage and find it to be ten or more volts above normal, it will be necessary to either change this grid resistor to 100,000 ohms which is advised, or reduce the line voltage to normal. In either event it is still advisable to replace the 500,000 ohm resistor with one of 100,000 ohms. You will find reasons for this change in the Sylvania Technical Manual covering the 26L6, the tube usually used in these sets.—Wilbert L. Misner, Vintondale, Pa.

* * *

General Electric Model B-52. For weak reception on all stations with all voltages checking OK, check control grid lead of the 6B7 for short to ground. This lead enters the i-f shield can at the bottom. The shield can is a screw on type and often tightens and cuts through the insulation of the grid lead. To prevent further trouble spot solder the outer shield.—A. E. Ebberts Radio Service, Troy, Ohio.

* * *

Grunow Model 6C. This General Household Utilities radio may get a hum in it which sounds exactly like a bad filter condenser. However a check of the filters will show that they are good. The trouble will usually be traced to an open condenser connected between the junction of the two 250,000 ohm resistors connected to the control grid of the 42 tube and ground. This is a .075 mfd. condenser and must be duplicated exactly if all the hum is to be removed. Any other value of condenser at this point will cause a hum.—Eugene Kingrey, Dayton, Ohio.

* * *

Oldsmobile Radio (1939). Sticking dial mechanism is caused by outside of the dial drum rubbing against the enclosed shell. The scale is held on the drum by studs which project from the drum Careful grinding off of these studs will allow the drum to turn freely and will restore proper operation. Almost every Oldsmobile radio (1938) will develop this trouble.—Donald Slattery, Chadron, Nebraska.

* * *

Philco Model 39-25. This radio played when using instant tuning and became dead when switched to manual tuning. The trouble is a broken lead between tuning condenser stator section and chassis. A visual check will often eliminate useless work with testers.—Dan E. Hinich, Chicago, Illinois.

RCA Model R-99. To cure an unbearable distortion in this instrument, check the C9 (.05 mfd) coupling condenser between the 6L7 and 6C5 for a low insulation resistance. This faulty insulation apparently allowed some of the plate potential of the 6L7 to leak through it to the grid of the 6C5, causing distortion. The .05 mfd. condenser was changed and the Electrola resumed its excellent performance.—M. Margossian, Oakland, Calif.

* * *

RCA Models (1936-37). Have found several of these sets to come in with the complaint fading. A little questioning will disclose the additional information that the set is also distorted when it fades. The trouble is in the Volume Control. The controls that cause the trouble are all of the same make.—P. Ilowite, Long Island City, N. Y.

* * *

RCA, 1939 Models. If the tuning rocks back and forth when the buttons are depressed, and the usual tightening of the set screw in the fly wheel or loosening, as the case may be, does not help, place a small spring behind the fly wheel. It should be placed between the motor and the washer, behind the fly wheel so that when the current is interrupted the motor will disengage. This spring can be made from a piece of spring taken from a carbon brush such as is used on small motors. Usually a spring of two or three turns is sufficient.—J. G. Cooney, St. Louis, Missouri.

* * *

Stromberg Carlson Model 60. If this set oscillates or distorts, check the grounding of the 6B7 shield can. This tube serves as the i-f amplifier, second detector and A.V.C. This tube must be well shielded as the i-f section does not receive avc bias and therefore, operates at full sensitivity regardless of the strength of the signal being received. To insure good grounding, remove the shield base and scrape the finish from the chassis, then rivet or bolt the shield base back in place.—L. T. Anstine, Woodlawn, Md.

* * *

Stewart Warner R-116. If filtering is OK and hum has a hollow sound, check the volume control. In one case the resistance was found to have increased to 3 times normal or (1,500,000 ohms). Take a medium soft pencil and rub on face of resistance strip beyond track where moving contact runs until resistance is down to proper value. See that edge of strip is kept clean. This clears the trouble but a new control is more certain and more profitable.—C. T. Vermillion, Baltimore, Md.

* * *

Speakers. When testing radios on the work bench, the speaker is usually removed from the cabinet and when left without a baffle it does not sound as it should. To provide a baffle, bore enough holes in a ten or twelve inch circle to allow sound to go through. Fasten a piece of screen over this to prevent small articles from dropping through. When the speaker is placed over this section a more life-like reproduction will be had. The holes should be at least 1½ inches in diameter. A large hole can be cut in the bench which will fit all speakers, but I believe the series of small holes are better as they do not weaken the work bench and any size speaker can be placed over them.—S. M. Douglass, Tallahassee, Fla.

* * *

Speaker Field Coil Replacements. Here is a trick I used when I was unable to get a field coil in a hurry for a speaker with a deep pot; coil being about two inches high with an inside diameter of one inch. By using two universal type field coils with an inside diameter of one inch and connecting them in series, they served the purpose without overheating. Of course, the resistance of the coils had to be half of the original coil. That combination may be used if the field coil has to be tapped and by using coils of different resistances, various sizes may be worked out. The coils must be phased so that they don't buck each other.—H. S. Keller, Chicago, Illinois.

* * *

Wireless Phono Players. When poor tone is encountered it may be caused by overmodulation. To cure, shunt the present grid resistor with about 100,000 ohms.—Victor Power, St. Louis, Mo.

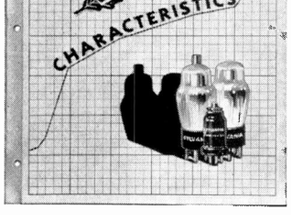
* * *

Wurlitzer Model 450. When this set comes in dead and the speaker field heats considerably, look for a short circuit between the primary and the secondary of the first intermediate frequency transformer, which is located between the two 58 tubes. Remove the coil and separate the leads from the top half of the coil where they touch the bottom half. These leads short at this point and thus short the field of the speaker, cutting all the voltage off from the plates of all tubes.—Roy Gresens, Rochester, N. Y.

* * *

Zenith Model 6D311. Set plays but has much distortion. Remove back chassis bolts. These bolts are long enough to make contact with a filament prong on the output tube and may cause the cathode resistor to blow. This also applies to other '39 Zenith AC-DC sets. Kenneth C. Jewell, Mt. Vernon, Ohio.

Characteristic Sheet Revised



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 for 287 types of Sylvania tubes including data on the new loktal and cathode-ray tubes recently announced. Base diagrams and bulb views for all types are shown.

The lay-out is on a 12 page booklet form suitable for 8½x11 binder use, or when folded it is a convenient size for the pocket or service kit.

A revised Sylvania Wall Base Chart, showing enlarged base views for all Sylvania tubes, is also available. 97 base views and cross indexes for 287 tubes are shown.

The new Sylvania Characteristic Sheet and new Base Chart are free to all who have use for them. They can be obtained from your Sylvania jobber, or by writing to Hygrade Sylvania Corporation, Emporium, Pa.

NEW TUBES

Type 7B6—Continued

Operating Conditions and Characteristics

Heater Voltage	6.3 Volts
Plate Voltage	250 Max. Volts
Grid Voltage	−2 Volts
Plate Current	1.0 Ma.
Plate Resistance	91000 Ohms
Mutual Conductance	1100 μmhos
Amplification Factor	100

Type 7B8 Pentagrid Converter

8-X

The Sylvania type 7B8 is a new Loktal converter tube for service in a-c, ac-dc and auto receivers. Compactness, short connections to the electrodes and simplified shielding are some of the features of this new tube. All external connections are made to eight contact pins; no top cap being required.

The electrical characteristics and applications are similar to those for the Sylvania type 6A8G Pentagrid Converter. The principal differences appear in the values of the interelectrode capacitances. The uses of the 7A8 parallel those of any Sylvania Pentagrid Converter, therefore, reference may be made to the Sylvania Technical Manual for any detailed application data required.

CHARACTERISTICS

Heater Voltage (Nominal) AC or DC	7.0 Volts
Heater Current (Nominal)	0.32 Ampere
Maximum Over-all Length	2 5/32 Inches
Maximum Diameter	1 5/16 Inches
Bulb	T9-G
Base	8-X

Direct Interelectrode Capacitances

Grid G to Plate	0.15 μμF. Max.
Grid G to Grid Ga	0.16 μμF.
Grid G to Grid Go	0.12 μμF.
Grid Go to Grid Ga	0.80 μμF.
Grid G to all Electrodes (r-f input)	10.7 μμF.
Grid Ga to all Electrodes Except Go (Osc. Output)	3.4 μμF.
Grid Go to all Electrodes Except Ga (Osc. Input)	4.6 μμF.
Plate to all Electrodes (Mixer Output)	7.5 μμF.

Operating Conditions and Characteristics

Heater Voltage	6.3	6.3 Volts
Plate Voltage	100	250 Volts Max.
Screen Voltage	50	100 Volts Max.
Anode Grid Voltage	100	250* Volts Max.
Control Grid Voltage (G)	−1.5	−3.0 Volts Min.
Oscillator Grid Resistor (Go)	50000	50000 Ohms
Plate Current	1.1	3.5 Ma.
Screen Grid Current	1.3	2.7 Ma.
Anode Grid Current	2.0	4.0 Ma.
Oscillator Grid Current	0.25	0.4 Ma.
Cathode Resistor	300	300 Ohms
Plate Resistance	0.6	0.36 Megohm
Conversion Conductance	360	550 μmhos
Control Grid Voltage (Approximate) For 6 μmhos Conversion Conductance	−35	Volts
For 3 μmhos Conversion Conductance	−20	— Volts

*Applied through 20,000 ohm dropping resistor.

Type 7C5 Output Amplifier

6-AA

The 7C5 is a beam power tetrode of the Loktal style which provides high power output, power sensitivity, and efficiency with a low percentage of third and higher order harmonics. The electrical characteristics are similar to those of type 6V6 and 6V6G.

The constructional design of the electrodes is similar to that of other beam power tubes in which directed electron beams are employed. By careful arrangement of the tube elements potential fields are set up which confine the electrons into beams of high density.

CHARACTERISTICS

Heater Voltage (Nominal) AC or DC	7.0 Volts
Heater Current (Nominal)	0.45 Ampere
Maximum Over-all Length	3 1/2 Inches
Maximum Diameter	1 5/16 Inches
Bulb	T9-F
Base	6-AA

SYLVANIA PANEL LAMPS

A complete line of Sylvania Panel Lamps, especially designed for radio dials. tuning meters, flash-tuning arrangements, and the like, is now available. A market for some types of these lamps will also be found in flashlights, parking lights, auto panel boards, record players, pinball machines, and wherever a miniature lamp of this style is required.

The early types of panel lamps were used primarily as on-or-off indicators in radio receivers. Present day panel lamps must be constructed to withstand speaker vibrations, have noise free operation, current drain within the required limit (particularly when used in ac-dc receivers and battery receivers), and to provide shadowless illumination. The Sylvania line of radio panel lamps have been constructed for all these requirements.

The replacement of panel lamps should be made with lamps having the same type number. This is particularly true in tuning meters, battery, and ac-dc receiver replacements. Sylvania type S47 is the same as other lamps marked 40A. Lamps marked 49A may be replaced with Sylvania type S49. Type S292 is mainly for use in 2.5 volt receivers where the line voltage is high and regular 2.5 volt lamps will not stand up.

The filament wires of all standard panel lamps are mounted through a small colored glass bead located above the bulb press. If the markings on the lamp to be replaced are not legible, the bead color may be used as identification, since the color identifies the lamp type. The bead color of each lamp is shown in the tabulated data below and it will be noted that, in some cases, the bead colors identify more than one particular type of lamp. In these cases other means of identification will be required such as comparison of bulb, base, and circuit voltage.

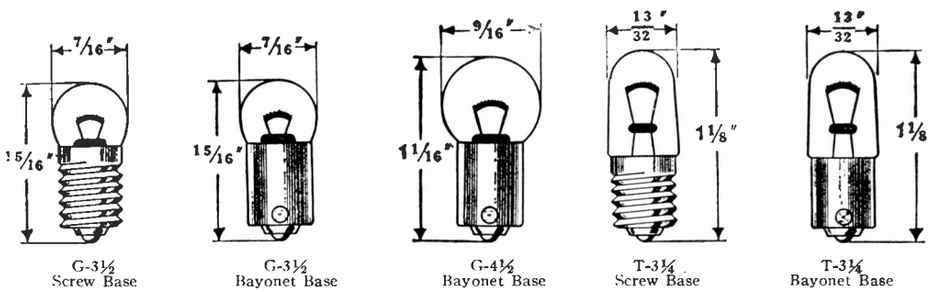
It is recommended that complete replacement of all panel lamps be made on a receiver at one time. Additional profit and a satisfied customer will be the result. The average life of panel lamps is considerable, but unpredictable, because of varying applications and conditions. Therefore, because of the low unit cost, complete replacement is recommended whenever convenient.

CHARACTERISTICS

Type No.	Circuit Volts	Design Volts	Design Ampere	Bead Color	Bulb Style	Miniature Base	Usual Service	Type No.
S40	6–8	6.3	0.15	Brown	T-3¼	Screw	Radio Dials	S40
S41	2.5	2.5	0.50	White	T-3¼	Screw	Radio Dials	S41
S42	3.2	3.2	0.35	Green	T-3¼	Screw	Radio Dials	S42
S43	2.5	2.5	0.50	White	T-3¼	Bayonet	Radio Dials and Tuning Meters	S43
S44	6–8	6.3	0.25	Blue	T-3¼	Bayonet	Radio Dials and Tuning Meters	S44
S45	3.2	3.2	0.35	White	T-3¼	Bayonet	Radio Dials	S45
S46	6–8	6.3	0.25	Blue	T-3¼	Screw	Radio Dials and Tuning Meters	S46
*S47	6–8	6.3	0.15	Brown	T-3¼	Bayonet	Radio Dials	*S47
S48	2.0	2.0	0.06	Pink	T-3¼	Screw	Battery Set Dials	S48
*S49	2.0	2.0	0.06	Pink	T-3¼	Bayonet	Battery Set Dials	*S49
S50	6–8	7.5	0.20	White	G-3½	Screw	Auto Sets, Flash Lights	S50
S51	6–8	7.5	0.20	White	G-3½	Bayonet	Auto Sets, Auto Panels	S51
S55	6–8	6.5	0.40	White	G-4½	Bayonet	Auto Sets, Parking Lights	S55
S292	2.9	2.9	0.17	White	T-3¼	Screw	Radio Dials	S292

*Sylvania Types S47 and S49 are interchangeable with Types 40A and 49A, respectively, in other brands.

Bulb Illustrations and Dimensions



G-3½ Screw Base | G-3½ Bayonet Base | G-4½ Bayonet Base | T-3¼ Screw Base | T-3¼ Bayonet Base

Type 7C5—Continued

Operating Conditions and Characteristics

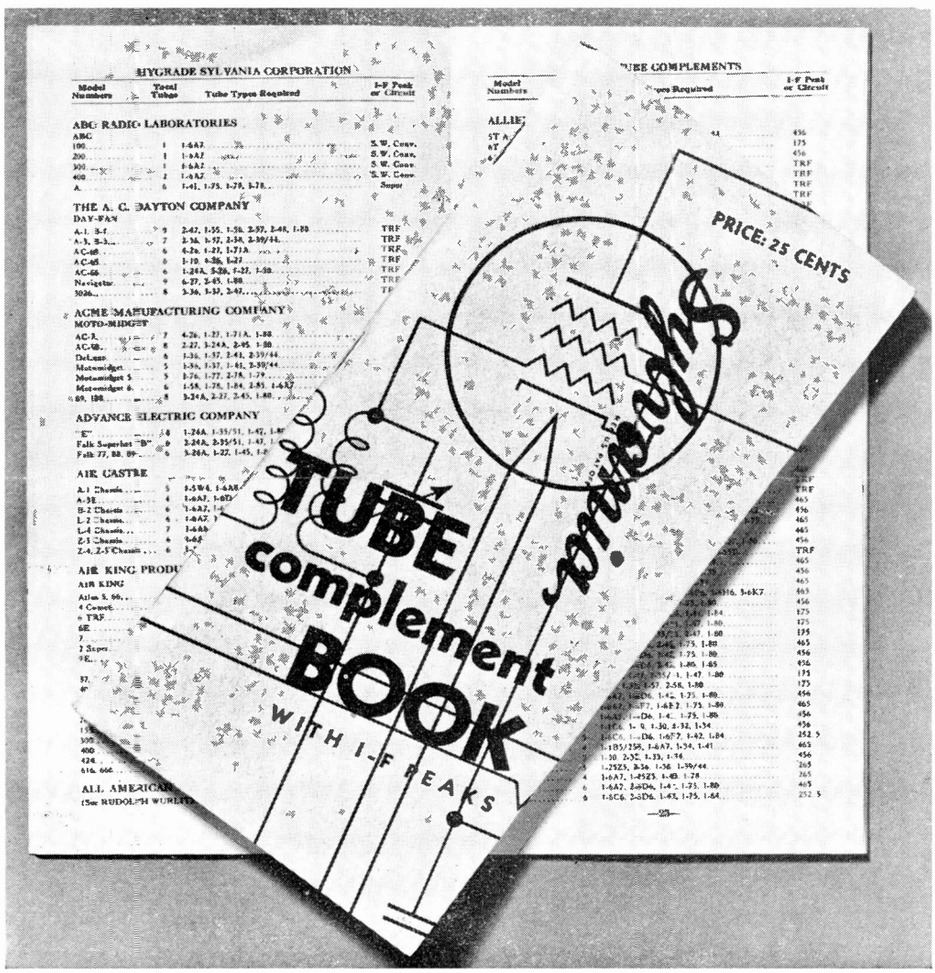
	Class A1 Amplifier (One Tube)		Class AB1 Amplifier Push-Pull (Values are for two tubes)
Heater Voltage	6.3	6.3 Volts	6.3 Volts
Plate Voltage	180	250 Max. Volts	250 Volts Max.
Screen Voltage	180	250 Max. Volts	250 Volts Max.
Plate and Screen Dissipation		12.5 Watts Max.	
Grid Voltage	−8.5	−12.5 Volts	−15 Volts
Amplification Factor	210	218	
Mutual Conductance	3500	4100 μmhos	
Peak Input Signal	8.5	12.5 Volts Approx.	21.2 Volts
Plate Current (Zero Signal)	29	45 Ma.	70 Ma.
Plate Current (Maximum Signal)	30	47 Ma.	79 Ma.
Screen Current (Zero Signal)	3	4.5 Ma.	5 Ma.
Screen Current (Maximum Signal)	4	6.5 Ma.	12 Ma.
Load Resistance	5500	5000 Ohms	10000 Ohms (Plate to Plate)
Total Harmonic Distortion	6.0	6.0 Per Cent	4 Per Cent
Second Harmonic Distortion	5.5	4.5 Per Cent	
Third Harmonic Distortion	2.5	3.5 Per Cent	3.5 Per Cent
Power Output	2.0	4.25 Watts	8.5 Watts

SYLVANIA NEWS

TECHNICAL SECTION

MAY-JUNE, 1939 EMPORIUM, PENNA. Vol. 8, No. 3

TUBE COMPLEMENTS UP-TO-DATE



The first edition of the Sylvania Tube Complement Book was hailed by servicemen as the only complete compilation of hard-to-get information on tube complements for practically every make and model of radio receiver manufactured since 1925. Since it was published hundreds of new models have appeared. To bring this valuable information up to date Sylvania now offers a 1938-1939 supplement which may be inserted in your copy of the Tube Complement Book. The price is ten cents.

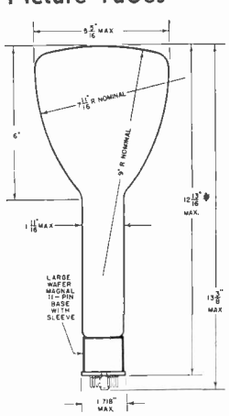
For the convenience of those who prefer a new copy, or who do not have the first edition, the Sylvania Tube Complement Book with the 1938-'39 supplement bound in is also available, at twenty-five cents.

Your Sylvania jobber has copies of the Supplement and of the complete book with Supplement bound in. If his supply is temporarily exhausted, either style may be ordered from Hygrade Sylvania Corporation, Emporium, Pa.

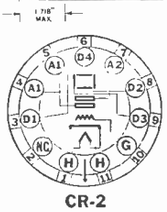
Sylvania Picture Tubes

Television news is breaking fast, Servicemen are watching developments with interest, and gaining valuable practical knowledge of television problems through experimental work. Sylvania is up-to-the-minute on every new development, and will keep servicemen informed through publication of technical data on new television tubes as they are made available. Following are data on new Sylvania 5-inch Cathode-ray Picture Tubes.

TYPES
5AP1/1805-P1, 5AP4/1805-P4
Cathode-Ray Picture Tubes



Sylvania Types 5AP1/1805-P1 and 5AP4/1805-P4 are cathode-ray picture tubes for television use, having 5-inch viewing screen. The structural design of the two tubes is the same; the only difference in the two types is in the fluorescent screen material used. These new picture tubes are of the electro-static deflection type quite similar to the Sylvania 1802-P1 and 1802-P4 although shorter in over-all length.



The branding of 5AP1 and 5AP4 is in accordance with the new RMA numbering system recently adopted. Inasmuch as there are similar tubes in the field without this new numbering system, but with the 1805-P1 and 1805-P4 numbers, all Sylvania tubes are branded with the double numbers 5AP1/1805-P1 and 5AP4/1805-P4. This indicates that the tubes will directly replace any 1805-P1 and 1805-P4 or any 5AP1 and 5AP4 tubes.

Characteristics

Heater Voltage	6.3 Volts
Heater Current	0.6 Ampere
Maximum Over-all Length	13⅜ Inches
Maximum Diameter	5⅛ Inches
Base No.	CR-2
Direct Interelectroue Capacitances:	
Control Electrode to all Electrodes	6 μμf
Deflecting Plates D_1 to D_2	0.8 μμf
Deflecting Plates D_3 to D_4	0.5 μμf
D_1 to all Electrodes	7 μμf
D_2 to all Electrodes	5 μμf
D_1 to all Electrodes Except D_2	5 μμf
D_2 to all Electrodes Except D_1	4.5 μμf
D_3 to all Electrodes Except D_4	5 μμf
D_4 to all Electrodes Except D_3	4 μμf

Maximum Ratings

Heater Voltage	6.3 Volts
Second Anode Voltage	2000 Max. Volts
First Anode Voltage	1200 Max. Volts
Control Grid Voltage	Never Positive
Peak Voltage Between Second Anode and any Deflecting Plate	500 Max. Volts
Screen Power Density per Sq. Cm.	10 Max. Mw.

Continued on Page Four

TUBE MYSTERIES EXPLAINED

By Walter R. Jones

In the open forums held after Sylvania Service Meetings, servicemen in all parts of the country bring up the same problems regarding tubes. There appears to be some mystery in the way these tubes act in tube testers and in actual operation, and servicemen who have experienced this trouble have had considerable difficulty in finding the true answer.

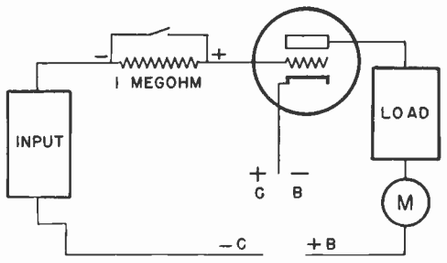
Some of these problems are: 1. Why does a power output tube test OK in some types of testers and still not sound good, while replacing the power output tube with a new one cures the poor tone quality? 2. Why does a rectifier tube test OK in a tester and yet the plate voltage available to the set is low until replaced by another rectifier? 3. Why do tubes test OK in tube checkers and yet cause the set to stop playing after a few minutes of operation?

1. A power amplifier tube requires a fairly large plate current in order to operate properly. If the proper emission is not available to supply this plate current, then poor quality may result. Many so-called emission testers give an indication of "good" for power output tubes if an emission current of only a very few milliamperes flows. This is obviously much less than is drawn in set operation. Thus, the serviceman does not replace tubes which actually need replacing. Although high current is required for power output tubes it is very important that not too much current flows when testing diodes and low plate current tubes or else they will be impaired. Most of the newer testers of this general type employ various loads for use in the circuit to limit the current to a safe value. The proper load is indicated on the chart covering settings for testing the various tubes. If any doubt exists as to whether the tube tester is testing power output tubes properly, a simple check may be made by connecting a d-c milliammeter in series with the cathode of the tube being tested. This meter will read the total cathode current. It should correspond approximately to the rated plate current for the tube operating under rated conditions.

2. A rectifier tube often tests "good" in some testers when it actually delivers voltages much lower than normal. This is also caused by lack of sufficient emission to support normal plate current. The tester may require only a small amount of plate current to test "good" and this amount is much lower than required for satisfactory operation in the receiver. The same sort of test, as recommended above, may be made to determine if everything is as it should be. The meter should read so that the current passed is comparable with that required in a normal receiver.

3. Considerable difficulty is experienced in the field with receivers refusing to play after being in operation for a short while. This may be due to gassy tubes. It is necessary for the tubes to become thoroughly warmed before this difficulty will show up. Some tube testers are provided with a gas test but most are not. A very simple one which will locate gassy tubes is shown. This can be connected to any tube in the receiver or a separate unit may be constructed. When self-bias is employed, the indication will not be as sharp as when fixed bias is employed.

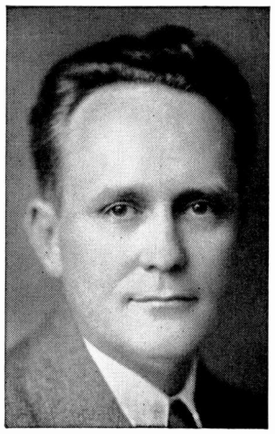
The circuit essentially is shown to the right. Input and output systems are indicated in block form as these may vary depending on the circuit the tube is used in. The supply voltages for the plate and grid are indicated as +B and —C.



A meter is connected in the plate circuit so as to read plate current. A one megohm resistor is connected in the grid circuit so it may be shorted out. The operation simply consists of opening and closing the switch across the one megohm resistor and noting the change in plate current. A gassy tube or bad tube will show a greater change than will a good one. In fact, most good tubes should not cause much, if any, change in plate current. This test is equally good for power output tubes or any other type. It is important that the tubes be warmed before being tested for gas, especially if they are power output types.

The theory involved in this test is simple and might be of some interest. If any gas current is present in the tube, this current flowing through the resistor will produce a voltage which will subtract from the bias, resulting in an increase in plate current. If one microampere of gas flows, this will decrease the bias by one volt when the switch is opened. If the mutual conductance of the tube is 1000 micromhos this one volt change of grid bias will increase the plate current by one milliampere.

A CHAT WITH ROGER WISE



Chief Tube Engineer
Hygrade Sylvania Corporation

In a previous discussion the "long life" telephone repeater tubes were reviewed, and the differences in construction and in service requirements between radio tubes and repeater tubes were described. The concluding comment was to the effect that in a subsequent article additional comments would be given on the policies followed by Hygrade Sylvania Corporation with respect to tube quality.

At times we hear comments from individuals interested only in building sales volume to the effect that radio tube life is far too long, as the tubes at times outlive the radio receiver in which they are used. With that is often coupled the inquiry as to whether or not it would be possible to design a much more efficient tube, but one having only a life of 1000 hours (or some similar fixed figure). Such a condition would result in a much more stable renewal sales volume and would therefore help the industry as far as manufacturing costs are concerned, since fluctuations in demand are very difficult to meet without incurring expensive layoffs, extensive stocking programs, etc. Thus the consumer might gain enough in saving in cost of operation of his receiver (if the tubes were actually made much more efficient) and in lower initial cost, to offset the expense of more frequent tube renewal. Also, his receiver might conceivably be kept in much better average operating condition as there might be less change in tube operating characteristics during the shorter life span.

Our answer to any such discussion is always the same, and is as briefly outlined below:

(1) We believe we owe it to our customers to build the best and longest lived tube it is possible for us to manufacture. We know of no way to increase the efficiency of a radio tube and at the same time secure more stable operation over any given period of operation such as 1000 hours.

(2) It is so difficult to determine a representative set of life test conditions that we must manufacture tubes having a probable life on the order of 5000 hours in order to secure reliable performance and freedom from service complaints when the tubes are used under severe service conditions.

(3) We have worked steadily and unceasingly to build up the ideal of "quality first" in the minds of our entire organization. We believe that any attempt to limit tube life would tend to break down the established spirit and morale of the Hygrade Sylvania organization—to the permanent detriment of "Sylvania Quality Standards."

Dicontinuance Of Tube Types

TYPE 6U5/6G5 FOR TYPES 6G5, 6T5 AND 6U5

To simplify the problems involved in the multiplicity of type numbers, Sylvania type 6U5/6G5 is announced as a direct replacement for tuning indicator types 6U5, 6G5 and 6T5.

Types 6U5 and 6G5 are identical in electrical characteristics, the only difference being in the size of bulb used. The new Sylvania type 6U5, 6G5 is contained in a T-9 bulb as was the original 6U5.

The 6T5 was announced early in 1937 with electrical characteristics the same as the 6U5 and 6G5 except that the visual indication was of the circular pattern rather than fan-shaped. Therefore, the Sylvania 6T5 is being discontinued and direct replacement may be made with type 6U5/6G5. When replacing the 6T5 with this later tube, it is suggested that the customer be instructed in the difference of the visual indication.

TYPE 1E5GP FOR 1E5GT

As explained in Sylvania News Technical Section, Volume 7, Number 3, Sylvania tube type 1E5GP (the suffix "P" designating Pentode construction) will satisfactorily replace types 1E5GT or 1E5G in all requirements. In the future only the one type, the 1E5GP, will be listed on Sylvania price literature. Replacement of the 1E5G series with the Sylvania type 1E5GP may be made directly without any loss in performance.

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 62-203. Loose shaft bearing of the manual tuning control caused loud crackling noise through speaker when tuning to stations. Take a small coil spring about two inches long, loop one end over this control shaft on outside of chassis pan; pass the spring through the nearby hole, which hole is already stamped in chassis, and then loop the other end of coil spring over the shaft on inside of chassis pan. This holds shaft tight against one side of its bearing surface, thereby eliminating the noise.—Fred P. Steinmetz, Chandler, Ind.

* * *

Clarion Model 220. No reception can often be traced to the control grid cap, on the 24A detector oscillator tube. This wire connects to the tuning condenser and is a 1000 ohm resistance wire inside a sheath. Place a 1,000 ohm ½ watt resistor in series with control grid and the condenser. This makes a good repair job.—Geo. Baer, Roslindale, Mass.

* * *

Crosley Model 566. This 2 volt battery receiver often goes into a sort of motor-boating as the volume control is advanced. It can be stopped and the tone improved with the addition of a 25 mfd. 25 volt electrolytic condenser. Connect the plus terminal of the condenser to "B" minus terminal, within the chassis and condenser minus to chassis.—Fred P. Steinmetz, Chandler, Indiana.

* * *

DuMont Type 164-3 Inch Oscillograph. When the focus control has to be run at 100 and the intensity control runs low, around 14, and the trace or spot is not sharp, check R10 the 750,000 ½ watt resistor as it has no doubt increased to 1 or 1.5 megohms. Replace with a Centralab 1 watt, 750,000 ohm unit and your scope will be as good as ever. Be sure to pull the a-c plug before you pull the scope from the case and while you are working on the scope because of danger from high voltages.—P. H. Bent, Rockford, Ill.

* * *

Emerson AX Models. In these 5 tube AC-DC models we have had several sets with blown cathode leads in the 25Z6GT rectifier, caused by shorted dual filter condensers. Due to the compact assembly an exact duplicate is recommended. The a-c resistor cord is a common source of service revenue in that the set owner usually shortens or otherwise tampers with same. Check the resistance of this cord.—Joseph S. Napora, Uniontown, Penna.

* * *

Gloritone Model 99. When this receiver does not operate at the low frequency band of the dial look for a defective 3000 ohm resistor or a .01 mfd. condenser in the cathode circuit of the first detector oscillator tube.—Geo. Baer, Roslindale, Mass.

* * *

32 Volt Farm Receivers. The best method of operating a six volt set from a 32 volt farm lighting plant is to connect a six volt battery to the set in the usual manner. A 32 volt 25 watt bulb connected in series with one side of the 32 volt line supplies a trickle charge to the battery. This gives a continuous charge of approximately .7 or .8 ampere. This does away with vibrator hash, distortion, hum, etc.—Franks Radio Shop, Lonsdale, Minn.

* * *

Modernizing Supreme 89 Tube Tester. A modernization job on this instrument can easily be made so the new Loktal tubes can be tested. All that is required is one universal socket, one loktal socket, and one SPST switch.

Remove the 4 and 5 contact sockets and replace with the universal socket. This will give you a space for the loktal base socket. A SPST toggle switch is necessary to check the 7C6 tube, due to the internal cathode connections of pins 4 and 7. This connection will show a short on the neon bulb. The switch can be mounted in the lower right hand corner just right of T.C. button and below volt pin jack.

Wire the loktal socket from the octal socket in the following manner. Loktal pin number to octal pin number:—1 to 2, 2 and 3 to 3. 4 to 4 (insert toggle switch in series), 5 to 5, 6 to 6, 7 to 8 and 8 to 7.

Tube	Voltage	Fil.	Quality Ret.	Tube Selec.	Button
7A6	6.3 D	7			8
7A7	6.3 D	7		40.5	8
7A8	6.3 D	7		53.0	8
7B7	6.3 D	7		51.5	8
7C6	6.3 D	7		50.0	8*
7Y4	6.3 D	7		34.5	8
35A5	25 D	7		36.5	8
35Z3	25 D	7		30.5	8

*SPST switch must be opened for this test. E. P. Howard, Richmond, Virginia.

* * *

Philco (1937). In some '37 Philco receivers, r-f oscillations appear at various frequencies. This is due to the close proximity of the shadow meter and its wiring leads to the r-f unit. Such oscillations can be eliminated by grounding the meter housing.—Franks Radio Shop, Lonsdale, Minn.

* * *

Philco Model 37-641. Pilot light burnouts in this Philco receiver are due to excessive voltage. A resistor of 33 ohms shunted across the pilot lights will remedy the trouble. It has been found that this resistor is missing in some of these sets.—Franks Radio Shop, Lonsdale, Minn.

* * *

RCA Models 44, 46, 47. Should it ever be necessary to replace the plate detector choke; the one under the detector tube, make sure the small bolts do not protrude through so far as to make contact with cathode prong. This will cause a direct ground and reduce volume.—Geo. Baer, Roslindale, Mass.

* * *

RCA Model R-89. The amount of reverse amplification provided in this instrument is such that on records having very "heavy" modulation, there may be a tendency to block or produce a choking type of distortion. This condition can be removed by reducing the value of R-9 from 10 megohms by shunting it with a 1 megohm unit. This resistor is in the grid return circuit of the 6F5.—Dan E. Hinich, Chicago, Illinois.

* * *

RCA Model 98K. The motor driven automatic-tuning as used in early 98-K receivers required very careful adjustment of the flywheel on the motor armature shaft to correct a complaint of a "rocking dial." The results obtained with the above adjustment are very uncertain. The "dial rocking" can be eliminated by installing the following:

1. New motor with a rubber nose on the armature shaft.

2. Cover plate for chassis opening, formally occupied by the old motor.

3. Replace fiber gear with angled toothless gear.

Consult your Parts Distributor.

The above changes are listed as they were made on later production runs of the 98-K model.—Joseph S. Napora, Uniontown, Pa.

* * *

RCA Models (1939). I would like to correct a hint in Volume 8, No. 1 given by Mr. Kalisty on a particular trouble that occurs in the RCA 1939 models. It is true that after dialing electric tuning on the RCA 1939 sets to station, the condenser gang continues to work back and forth for a few seconds, which makes the set very noisy. The counter weight on the end of the motor shaft has two set screws, located on opposite sides, and they work against springs which create a friction on the shaft for the purpose of causing the motor to come to a stop. When these sets fail to stop correctly, the proper procedure is to adjust these two set screws, in or out, until the motor actuates properly, one screw controls the motor in one direction and the other screw controls the motor in the other direction. It is possible that Mr. Kalisty happened to tighten one of said screws a little and it was just what the set needed to correct the fault, but I thought the article was misleading and that some serviceman could make a mistake if he tightened these screws up tight.—L. V. Richmond, New Milford, Conn.

* * *

Service Lamp. Here is a good method to use in finding which wire coming through the hole in the floor is aerial and which is ground, without going to the basement. Use a 10 watt or similar lamp, connecting one wire to an attachment plug which is then plugged into the electric outlet. The other wire from the lamp is touched to each of the wires coming through the floor. The one causing the lamp to light is ground. If neither connection lights the lamp reverse the attachment plug in the electric outlet and test each wire again. If lamp still does not light, look for bad ground. If both wires light the lamp then the aerial is grounded.—A. D. Teall, Milan, Michigan.

* * *

U. S. Radio & Television Chassis 12B. This receiver will not play unless Q control is on full, then only on strong signals and will break in and out if Q control is retarded at all. The cathode and suppressor on the Q AVC tube are tied together and connected between 850 and 5000 ohms on candohm voltage divider. Change this connection to the opposite end of the 5000 section.—Clarence M. Doyle, Utica, New York.

* * *

Zenith Tone Improvement. Many of the Zenith radios built in the last three years may be greatly improved in tone and volume by substituting 6L6G Sylvania tubes for the 6F6 original tubes. We have made this change in about 100 cases and have not had a 6L6G go bad. It makes a nice sale as well as pleases the customer. Many of these sets are marked for either tube.—Clarence M. Doyle, Utica, New York.

* * *

Zenith Models. When tuning in one direction a trouble is noticeable that sounds like shorted plates in the tuning gang. The fly wheel or driving pulley on the tuning shaft, when rotated in one direction, catches on one of the tuning eye leads, twists the leads around binding them enough to wear and cut the insulation, thus grounding the eye lead. When tuning in the other direction this does not happen. To correct, slip spaghetti insulation over the injured lead. Pull all eye leads up through chassis grommet and slide clip down to hold leads snugly, thus eliminating further wear.—Earl L. Pittsley, Binghamton, N. Y.

* * *

Zenith Models 6-S-193, 6-S-194. Here are some hints for the general improvement of the above receivers.

1. Add 250M ohm resistor in series with grid of the 6Q7 tube.

2. If set "tweets" be sure a-v-c volts connects to the low end of R^1 at the low end of the antenna coil.

3. In case of "hash" remove condensers between the plates and cathode of the rectifier tube. Woodrow Wayne, Wayne, Michigan.

SYLVANIA PICTURE TUBES

Continued from Page One

Operating Conditions

Heater Voltage	6.3	6.3 Volts
Second Anode Voltage	1500	2000 Volts
First Anode Voltage*	430	575 Volts Approx.
Grid Voltage † #	Varied to Control Spot Intensity	

Deflection Sensitivity:

Plates D_1 and D_2	0.23	0.17 mm/Volt DC
Plates D_3 and D_4	0.28	0.21 mm/volt DC

*Adjustable for ± 20% of values shown.

†–Approximately 15% of First Anode Voltage is required for current cut-off.

#Maximum grid circuit resistance limited to 5 megohms.

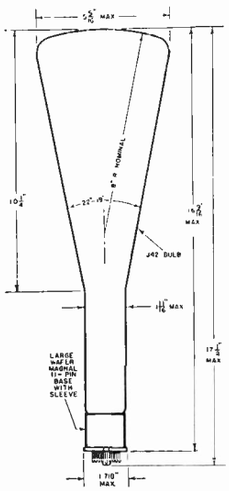
Screen

Type	Fluorphor	Color
5AP1/1805-P1	No. 1	Green
5AP4/1805-P4	No. 4	White

TYPES 1802-P1, 1802-P3, 1802-P4

CATHODE RAY PICTURE TUBES

Sylvania Types 1801-P1, P3 and P4 are cathode-ray picture tubes of the electrostatic deflection type for television use, having 5-inch fluorescent viewing screens. The structural design of the three tubes is the same; the only difference is in the fluorescent screen material used. The number 1802 is the designating type number, while the suffixes P1, P3 and P4 respectively, designate green, yellow and white screens. This tube is of particular interest since a larger image and a sharper definition is possible with no greater voltage required than that used with a 3-inch tube.



Characteristics

Heater Voltage	6.3 Volts
Heater Current	0.6 Amperes
Maximum Over-all Length	17⅛ Inches
Maximum Diameter	5⅛ Inches
Bulb	J-42
Base No.	CR-2

Direct Interelectrode Capacitances:

Control Electrode to all Electrodes	9 μμf
Deflecting Plates D_1 to D_2	1.2 μμf
Deflecting Plates D_3 to D_4	0.8 μμf
D_1 to all Electrodes	14 μμf
D_3 to all Electrodes	8.5 μμf
D_1 to all Electrodes Except D_2	13 μμf
D_2 to all Electrodes Except D_1	12 μμf
D_3 to all Electrodes Except D_4	8 μμf
D_4 to all Electrodes Except D_3	7 μμf

Maximum Ratings

Anode No. 2	2000 Volts Max.
Anode No. 1	1000 Volts Max.
Control Grid Volts	Never Positive
Peak Voltage between Anode No. 2 and any Deflecting Plate	500 Volts Max
Screen Power Density per sq. cm.	10 Mx. Max.

Operating Conditions

No. 2 Anode Voltage	1200*	1500	2000 Volts
No. 1 Anode Voltage**	250	310	425 Volts Approx.

Control Grid Voltage@# Varied to control spot intensity.

Deflection Sensitivity:

Plates D_1 and D_2	0.50	0.40	0.30 mm/volt d.c.
Plates D_3 and D_4	0.55	0.44	0.33 mm/volt d.c.

*Recommended only for Types 1802-P1, and 1802-P3.

**Adjustable for ± 20% of values shown.

@Approximately 20% of First Anode Voltage is required for current cut-off.

#Maximum grid circuit resistance limited to 5 megohms.

OPERATION OF TYPE 906

Sylvania Types 906-P1, P3 and P4 are high vacuum electrostatic deflection cathode-ray picture tubes with three inch screens. Structurally the three tubes are identical; the only difference being in the fluorescent screen material used. The number 906 is the designating type number, while the suffixes P1, P3 and P4 respectively, designate green, yellow and white screens.

In this type of cathode ray tube electric fields between the parts of the electron gun act on the electron beam from the cathode to focus it to produce a small spot on the screen. Likewise, electric fields between the companion deflection plates serve to control the position of the spot on the screen as desired.

Figure 2 is a schematic sectional perspective diagram of the 906 electron gun and deflection plates. While common usage has designated the parts of the gun partly from their functions and partly from the applied voltages, the voltage on the various elements is designated according to their position with respect to the cathode. Thus the grid, nearest the cathode, is the current controlling element while the first anode is the positive electrode nearest to the grid and cathode. The grid voltage is expressed as E_1, the first anode voltage as E_2, etcetera. By convention the deflection plates D_3 and D_4 are those nearest the electron gun.

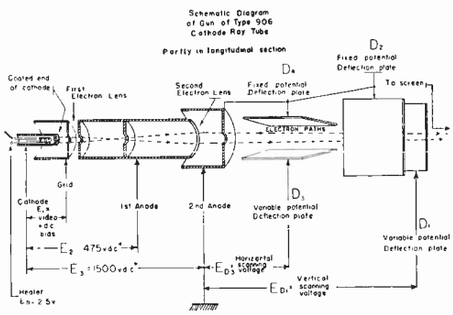


FIGURE 2

One speaks of "focusing" the electron beam to form a fine spot on the screen of a cathode ray tube because the electric fields between the various parts of the electron gun, act on the electron beam just as optical lenses do on light beams. In Type 906 there are two electron lenses. The first is formed between the grid and the first anode and the other between the first and second anodes.

The strengths, or focal lengths, of such lenses are determined by the potentials applied to the two electrodes; while in light optics this is determined by the physical dimensions of the lenses. In light optics, also, one slides lenses back and forth to obtain the desired focus. Obviously in a cathode ray tube this is not a practical method of focusing; but it is easy to achieve the desired focus with electron lenses by changing their focal length by adjusting the potentials applied to the electrodes. With the Type 906, it is usual to focus the spot on the screen by changing the potentials E_2 on the first anode. This varies the strength of the first lens in direct proportion to the magnitude of E_2 and the strength of the second lens inversely.

In order to deflect the spot over the screen area, two sets of deflection plates at right angles to each other are provided as indicated in Figure 2. The deflection caused by either of the pairs of plates is nearly proportional to the voltage difference between the two plates of the pair but varies inversely with the voltage applied to the second anode, E_3. Accordingly the deflection may be expressed:

$$\text{Deflection} = D_{1,2} = (\text{constant}) \frac{E_{D_1} - E_{D_2}}{E_3}$$

Of course the same formula would apply to plates D_3 and D_4 with a different constant. In Type 906 the constant for plates D_1 and D_2 is 330 and for plates D_3 and D_4 it is 350, when the deflection of the spot is measured in millimeters. It will be noted that the constant divided by E_3 gives the published deflection sensitivity for the tube.

Although the deflection sensitivity can be increased by reducing E_3, the corresponding brilliance of the spot as well as its diameter are affected adversely. Accordingly, it is usually preferable to operate the tube with E_3 near the maximum limit.

The action of the grid on the current in the beam is much like that in a tetrode or pentode receiving tube. A typical characteristic curve is shown in Figure 3. In operation, the current from the second anode I_3 (screen current) should not exceed 40 microamperes with the Type 906 tube. This avoids the effect in the television picture known as "blooming" when the grid voltage approaches zero and part of the electron beam passes through the edges of the lenses with a resultant large spot with fuzzy edges.

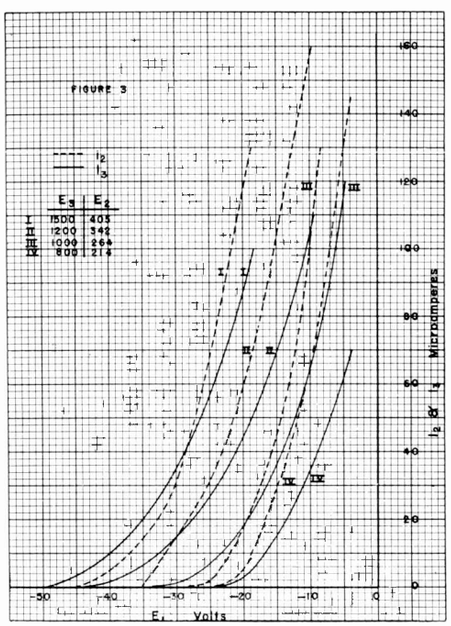


FIGURE 3

CHARACTERISTICS

Heater Voltage	2.5 Volts
Heater Current	2.1 Amperes
Maximum Overall Length	11⅞ Inches
Maximum Diameter	3⅛ Inches
Bulb	J-24
Base	Medium 7 Pin

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.
Peak Voltage between Anode No. 2 and any Deflecting Plate	600 Volts Max.
Screen Power Density per sq. cm.	10 Milliwatts Max

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 D_1 and D_2	0.55	0.41	0.33	0.22	mm/volt d.c.
Plates D_3 and D_4	0.58	0.44	0.35	0.23	mm/volt d.c.

With approximately 400 volts (to focus) on first anode

** For focus

SYLVANIA NEWS

TECHNICAL SECTION

JULY-AUGUST, 1939 EMPORIUM, PENNA. Vol. 8, No. 4

Binders With Complete File for ( ) Technical Section, 50 Cents

SOS FOR BACK NUMBERS

SOS signals are still coming in for the V-T-V-M and A-V-C articles and circuits published in the Sylvania News Technical Section in 1937 and 1938. These articles and hundreds of valuable service hints, tube characteristics, technical data and other articles by radio engineers are still available in complete files of the Technical Section, bound in a sturdy loose leaf binder with plenty of room for future issues. It's the handiest and most efficient way to keep this gold-mine of information for servicemen. Send fifty cents for binder and complete back file to Hygrade Sylvania Corporation, Emporium, Penna.

NEW TUBES

Type 6AC7/1852 Television Amplifier Pentode

Sylvania Type 6AC7/1852 is a television amplifier pentode of single-ended construction for use in video amplifiers and similar applications. As indicated below, operation under self-bias conditions with cathode resistor of approximately 160 ohms is preferable to the use of fixed bias, and the following comments apply only to the self-bias conditions. It is recommended that the d-c resistance in the grid circuit should not exceed 0.25 megohm when the screen voltage is obtained from a fixed source. When a series screen resistor is used, the d-c resistance in the grid circuit should not exceed 0.5 megohm. The voltage between heater and cathode should be kept as low as possible. Feedback in r-f and i-f stages can be minimized by grounding the suppressor. Type 6AC7/1852 is not recommended for use as a high gain audio amplifier unless the heater is operated from a battery supply. The combined plate and screen dissipation should not exceed 3.4 watts, and the screen dissipation must be limited to 0.38 watt or less. Conditions I and II prefer to fixed screen supply and series screen resistor respectively; the latter giving a more extended cut-off in applications where the gain is controlled by grid-bias variation.

CHARACTERISTICS

Heater Voltage AC or DC	6.3 Volts
Heater Current	0.45 Ampere
Bulb	8G-1
Base—Small Octal 8-Pin	8-N
Mounting Position	Any

Direct Interelectrode Capacitances:
(With shell connected to Cathode)

Grid to Plate	0.015 $\mu\mu$f Max.
Input	11 $\mu\mu$f
Output	5 $\mu\mu$f

Operating Conditions and Characteristics:

Condition	I	II
Heater Voltage	6.3	6.3 Volts
Plate Voltage	300	300 Volts Max.
Screen Supply Voltage	150	300* Volts Max.
Suppressor Voltage ▲	0	0 Volt
Screen Series Resistor	...	60,000 Ohms
Cathode Bias Resistor#	160	160 Ohms Min.
Plate Current	10	10 Ma.
Screen Current	2.5	2.5 Ma.
Plate Resistance (Approx.)	0.75	0.75 Megohm
Mutual Conductance	9000	9000 μmhos
Amplification Factor	6750	6750

*Screen Supply voltage in excess of 150 volts for Type 6AC7/1852 requires the use of a series dropping resistor to limit the voltage at the screen to 150 volts with normal plate current of 10 ma.

#The cathode bias resistor should be adjusted to give a plate current of 10 ma.

▲In r-f and i-f service the suppressor should be connected to ground to minimize feedback.

(Continued on Page Four)

Performance of 1.4 Volt Tubes In Portable Receivers

The introduction of Sylvania low current 1.4 volt tubes opened a new field in radio entertainment and greatly increased the servicemen's potential business. For years the heavy current drain of battery tube filaments has kept portable radio sets in a quiet corner. Bulky A, B and C batteries anchored them. These new tubes have taken pounds off the portable radio sets.

With the opening of this field, thousands of portable radios have been put into use and servicemen have been given a new source of income; that of replacing tubes and batteries for these sets. In servicing these new receivers, servicemen should make unusually close tests on the condition of the tubes and batteries, since it is the combination of these two, properly matched, that makes this type of radio possible. In using Sylvania 1.4 volt tubes, servicemen may be assured of tubes that give the utmost in performance over the wide variation in battery voltages found in these new receivers.

When Sylvania engineers designed the low current, 1.4 volt line of tubes, one of the important requirements for all types was that of good performance over a comparatively wide range of A and B battery supply voltages.

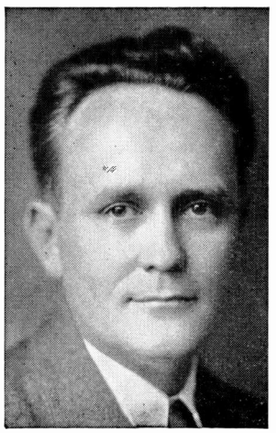
It is well known that the terminal voltages of batteries, particularly those of the dry type, decrease as the batteries are discharged. For best tube performance and battery power conservation it is desirable that the discharge characteristic curve be as flat as possible, for a given current drain, over the range of terminal voltages for which the tubes are designed to operate.

The most useful range of 1.5 volt dry batteries, suitable for filament supply voltage for 1.4 volt tubes, extends down to approximately 1.2 volts. Beyond this value the voltage falls off rapidly as the battery is discharged. These figures are based upon a total A battery drain of 250 milliamperes and daily discharge periods of 4 hours, since these values are representative of the operation of current battery receivers which employ the new tubes.

A corresponding percentage reduction in voltage of a 90 volt B battery would give an approximate value of 68 volts. Since it is highly desirable that the voltages of the A and B batteries decrease at the same rate (this being governed primarily by the ampere hour capacity and discharge characteristics of the batteries) it is thought that 68 volts should be considered as the approximate end of B battery voltage life. If care was taken in the receiver design to provide ample tolerances so that reasonable receiver performance is obtainable at 68 volts B supply and 1.2 volts on the filament, the battery voltages may be allowed to drop to these points, or possibly even lower, depending on the power output requirement. However, a higher voltage limit might be set for the replacement of batteries for top radio performance. If the receiver performance is still satisfactory to the owner then the fact that new batteries may soon be required should be brought to his attention and a record made of a prospective customer sometime in the near future.

The accompanying graph should be of interest. It shows power output, distortion, plate current and screen current data taken on Sylvania Type 1A5G tubes which had been life tested for 500 hours. The solid lines on the graph shows data for the tubes operated with new A and B batteries. Data for the same tubes operated at the suggested end of life voltages, namely, 68 volts and 1.2 volts are shown on the graph in dotted lines. From the comparison curves it can be seen that there is a wide difference in the performance of these tubes with new batteries and with batteries considered at the end of life. Tubes which had been tested at 500 hours were used so that a true picture might be obtained. Data were also taken showing the same type of operation with new tubes without any hours of service. The difference between the new tubes and those used 500 hours was so small that no noticeable difference could be shown on the curve. This indicates the quality which has been put into Sylvania 1.4 volt tubes.

A CHAT WITH ROGER WISE



Chief Tube Engineer
Hygrade Sylvania Corporation

With our production of Loktal tubes steadily increasing it is perhaps timely to mention some of the precautions taken in connection with this development to avoid difficulties so often experienced with new products. It is frequently found that since the exhaustive experimental work required to be absolutely sure about a new item takes a great deal of time, short cuts are taken which may or may not be successful. No such short cuts were taken in this case, and the first field tests were started two years after the development was undertaken. During this period many materials and types of construction were investigated, with tests of initial performance and life tests on the more promising ones made as a matter of routine.

Only a few items can be mentioned in this brief summary, but they serve to illustrate our methods and policies in developmental programs.

A most vital point in the Loktal tube is the glass header, which also serves as part of the base of the finished tube. Investigations on this header included determination of the best pin size to use, also physical dimensions of the glass as regards outside diameter, spacing of pins, and size of boss around pins. It was necessary to test out various materials which might be suitable for use as pin material to make sure that the metal-to-glass seal would be satisfactory, to develop reliable methods of making the required seal, and to make sure that the conductivity, both electrical and thermal, would be satisfactory. After a suitable pin material was found, considerable experimental work was necessary on the glass, and special glasses were investigated to find one exactly suited to the purpose.

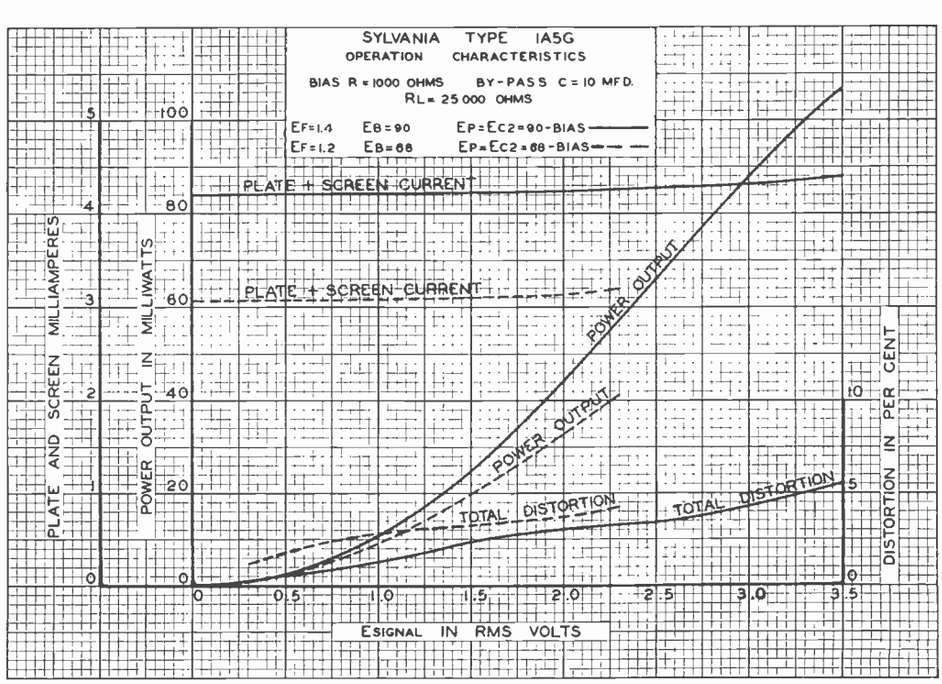
While the investigation of the header was in progress, tubes were made up using the most likely materials and processes, and were carefully tested to make sure that the vacuum would be retained initially and during life—the headers also being subjected to extreme cold and extreme heat to make sure that even under abnormal conditions no impairment of vacuum would occur.

Other items included the investigation of possible methods of bringing out the grid lead at the bottom of the tube, which requires very careful arrangement of shielding both as regards internal and external shielding leads.

It was necessary to develop special methods of sealing, and the type of seal finally decided upon was the so-called "butt" seal. In making this seal the glass bulb is cut off to the required length before it is placed on the mount for sealing, thus being quite different from the previously used type of seal in which the bulb is longer than necessary and a collet of glass is required—the weight of this collet facilitating the making of a seal at the proper point.

Even after all of the preliminary work on the many different items was completed, it was necessary to repeat all of the extensive series of tests on finished tubes embodying all of the desired features. Laboratory tests and life tests were then followed by field tests, and it was only after small scale field tests had revealed no unexpected difficulties that the tubes were released for production on a substantial scale.

No substantial changes were found necessary in going into large scale production, although minor improvements have been made and further changes will be incorporated as experimental work is finished.



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 62-425. When these sets "give the birdies" (break into oscillation) accompanied with a very slight hum, check the electrolytic condenser C9 for intermittent opening. Replace it with an 8 mfd. 450 volt rating condenser. The original 200 volt rating does not seem to be safe enough. If the rating is not increased to 450 volts, the trouble will occur within a few months.—M. Margossian, Oakland, Calif.

* * *

A.K. Models 89, 89-F, 89-P. Motorboating around 900 to 1500 k-c when all parts in detector and a-f check OK is a common trouble. If by placing your finger or aerial on control grid cap of r-f tube or removing shield can, set operates OK, make a careful resistance check of all choke coils in the r-f system. A short in any one of the chokes will cause this trouble. Moapolski Bros., Duryea Penna.

* * *

Brunswick Model 16A. In this receiver and similar models in which the tuning, volume and tone controls all work on the same shaft the volume control is hard to replace due to the small space in which it fits. It is also difficult to get exact replacements. If the exact replacement is obtained the control usually does not work very well on the stronger signals. By making a few changes in the circuit the standard 500,000 ohm replacement control can be used satisfactorily. The shaft of the control can easily be turned on a lathe to the correct size and length. A 250 ohm resistor is connected in place of the old volume control and the new one connected as follows: The lead going to the grid cap of the 24 first audio tube is now connected to the end lug and the central lug goes to the grid cap of the 24 tube. The other end lug goes to the chassis. This will result in smooth volume control action. If any distortion is noticed on the stronger stations, increase the 250 ohm resistor to 300 ohms or more.—J. Moller, Cincinnati, Ohio.

* * *

Crosley Model 648. Frequently when this set is turned on and has warmed up, it will not start to play until the switch is turned off and on several times. If the 6A8 is replaced the trouble may clear up for a while but will return again when the tube ages a little. The trouble is in the 60,000 ohm resistor which is connected from the 6A8 oscillator grid to the chassis. This should be replaced with a good resistor of about 75,000 ohms.—J. Moller, Cincinnati, Ohio.

* * *

General Electric. This hint is for G. E. sets with the color-light tuning system. In areas of very high signal strength, one set of lights burns out after a short time. The best remedy is to remove the short brown wire on the terminal strip above the lights. This wire runs from the third lug on the right to the end lug, and should be replaced by a 35 ohm, 10 watt resistor. This will protect both sets of lights from high voltage but will not interfere with their operation. In some cases the lights fail to work at all. If the 6K7 tuning tube is ok, then the reactor transformer plate winding is probably open. Check the resistance from the B plus to the plate of the 6K7. If it does not read less than 8000 ohms it indicates that the winding is open. There is a resistor of 8200 ohms across this winding which at first may lead one to believe that the winding is ok. J. Moller, Cincinnati, Ohio.

* * *

Gulbranson Model 872. Distortion and very poor tone quality may usually be found in checking condenser C7, plate circuit of second detector from junction of R5 and R6 to ground, for high resistance leak. This is a mean one to find as the distortion shows up in the i-f section as well as in the audio.—Clarence M. Doyle, Utica, New York.

* * *

Intermittent Condenser Test: Many intermittent receivers have a nasty habit of clearing up at the slightest shock to the circuits, so that testing condensers by the substitution method just can't be done.

To make these tests without shocking the circuits we bridge the suspected condensers one at a time with a new one connected in series with the center and right hand terminal of a 500,000 ohm volume control, used as a rheostat. Turn this to the counter clockwise position and turn the receiver on. When it cuts off, the substitute condenser may be eased in or out of the circuit without the shock, which would temporarily heal the defective unit.

This method proves especially effective when several by-pass units are placed in one container and the leads cannot be probed.—A. D. Teall, Milan, Michigan.

* * *

Lyric Model S-8. When replacing either the tone control or the audio transformer, (both usually burn out at the same time) it is advisable to rewire the circuit as follows: One side of the primary goes to the ground, the other side is connected to a condenser (0.05, 600 volts). The other side of the condenser goes to the plate of the 27 first audio tube, and the plate voltage fed to this tube through a 50,000 ohm, 2 watt resistor. The secondary is wired in the usual manner to the grids of the 47's. The tone control should be a 250,000 volume control, used as a variable resistor in series with a 0.01 condenser and connected across the grids of the 47's. By making this change in the circuit there is a great improvement in tone range and quality and less chance for transformer failure than there would be if the original circuit were followed.– J. Moller, Cincinnati, Ohio.

* * *

Philco Model 38-116 Code 121. Corrections on Schematic diagram—Make note:—(A) Add ground connection to A-1 at the point where No. 2 connection of antenna transformer No. 5 is connected. (B) The screen grid of the 6L7G tube should be connected to resistor No. 63 instead of the point as shown on diagram. (C) Remove connection from resistor No. 29 and condenser No. 46X and reconnect between resistor No. 28 and condenser No. 46X. (D) Remove connection from resistor No. 29 and condenser No. 46X then reconnect No. 46X between resistor No. 28 and range switch connection J9.—M. J. Planovsky, Cleveland, Ohio.

* * *

RCA Models 101, 104. When these sets develop motor interference or vibrator hash after a few months of service, it is caused by the breaking of the shielded antenna leads directly at the set. To remedy, slip a short piece of shielding over the lead and solder directly to the clip provided on the set.—Chas. Marusak, Cleveland, Ohio.

* * *

Silver Marshall Model 37. This set uses a dynamic speaker with two separate field coils. One is used as a filter choke in the positive side of the power supply, while the other is used as a bias resistor. Leakage and partial breakdown often occur between the windings causing erratic and intermittent operation. The trouble is such that it occurs only with a high potential between the two coils and an ohm meter fails to disclose the condition. In addition, voltages are not greatly affected. The two field coils may be replaced or wired in series (being sure that they do not buck each other) and used as a filter choke. Then connect a 750 ohm 10 watt resistor from filament center tap to ground. This latter method is usually satisfactory since the difference in potential is not high enough to cause break down. Robert K. Seigle, St. Louis, Mo.

* * *

Stromberg-Carlson Models 140-P, 145-P, 145-SP, 160-P. We have received a number of requests asking if it were possible to install a crystal pick-up in the above-mentioned combinations which are regularly equipped with magnetic pick-ups.

This is now possible. Two package assemblies Pc. 29504 for the 140-P and Pc. 29006 for the 145-P, 145-SP and 160-P have been prepared. These package assemblies contain the base, arm, crystal pick-up and three prong plug which are required to make this conversion, together with complete installation instructions.

The Change is a very simple one. It is only necessary to remove two screws, disconnect two wires, remove the old unit and replace with the new unit. Of course, some adjustments of the mechanism are necessary after the change has been made, but complete instructions for making these adjustments, as well as for the actual change-over, are included in every package assembly.

As you know, crystal pick-ups are the latest thing in phonograph reproduction, making possible an extremely faithful reproduction of all recordings. They are of the high impedance type and, therefore, no matching transformer is required; instead they are connected directly to the radio chassis. Considering the importance of this change, the prices, which are available upon request, are extremely reasonable.

Don't overlook the opportunity to provide your customers with even better phonograph reproduction than they have enjoyed to date and, at the same time, to get some additional profitable business for yourself—Stromberg-Carlson Service Bulletin.

* * *

Zenith Models 6-S-193, 6-S-194. Here are some hints for the general improvement of the above receivers.

1. Add 250M ohm resistor in series with grid of the 6Q7 tube.

2. If set "tweets" be sure a-v-c volts connects to the low end of R1at the low end of the antenna coil.

3. In case of "hash" remove condensers between the plates and cathode of the rectifier tube. Woodrow Wayne, Wayne, Michigan.

* * *

FLUORESCENT LAMP RADIO INTERFERENCE

The Hygrade Lamp Division of Hygrade Sylvania Corporation tells us that considerable work has been done on the subject of radio interference from fluorescent lamps. It now appears that if fluorescent lamps are properly installed and used with good auxiliary equipment, they will not cause serious radio interference in broadcast receivers provided that the receivers are properly installed. Broadcast receiving sets give best performance and are most free from interference when properly installed. This usually includes proper grounding.

Proper installation of the fluorescent lamps means that the auxiliary unit should be enclosed in an iron or steel channel that the fixtures should preferably be grounded that the wiring connections are all tight, and that the lamps make good contact in the sockets. Auxiliaries now marketed by several companies contain a small condenser connected across the automatic switch to reduce radio interference.

The Operation of High Mu Triodes

By Walter R. Jones

The use of high mu triodes such as types 75, 6Q7G, 6F5G, etc., as audio amplifier tubes following a diode detector often results in very bad grid circuit overloading which gives rise to poor quality and high distortion. This is frequently caused by improper filtering of the audio input to the grid, resulting in i.f. being also applied to the grid. A high mu triode usually operates with very little bias on its grid. For this reason, only a very small signal can be applied to the grid before overloading takes place. A filter designed to remove the i.f. from the signal applied to the grid is very necessary. This filter is shown as C_1, R_1, C_2, in Figures 1, 2, 3. Where such a filter has not been already included in a receiver, the addition of these parts will probably improve the quality considerably.

There are three types of circuits in which high mu tubes are generally used. They are fixed bias as indicated in Figure 1; self bias as indicated in Figure 2, and zero bias operation as indicated in Figure 3. The first two types of operation have been used for some time. Within the past year the use of zero bias operation for high mu triodes has become quite popular.

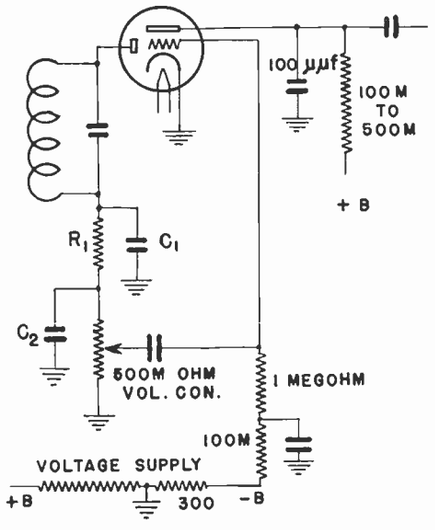


Fig. 1

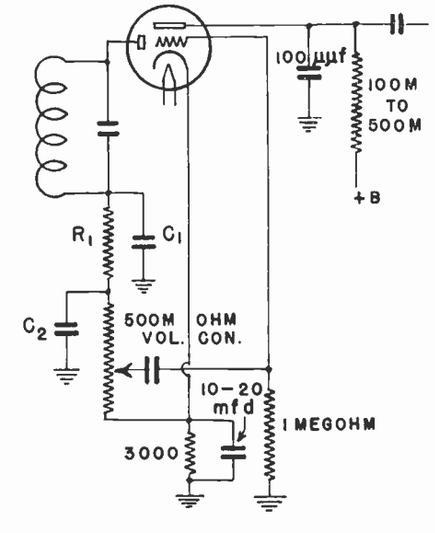


Fig. 2

There are two things which must be kept in mind in attempting to use this latter system. (1) A resistor must be used in the plate circuit to limit the plate current to a safe value. (2) The grid resistor must be high in value—on the order of 10 megohms. The filter in the input should still be included. A plate by-pass condenser of 100 mmfd. should always be used with any high mu triode to by-pass any i.f. which might get through to the plate.

The tone quality of receivers employing high mu triodes can be improved by adding a filter in the input circuit. In some instances zero bias operation may still further improve performance.

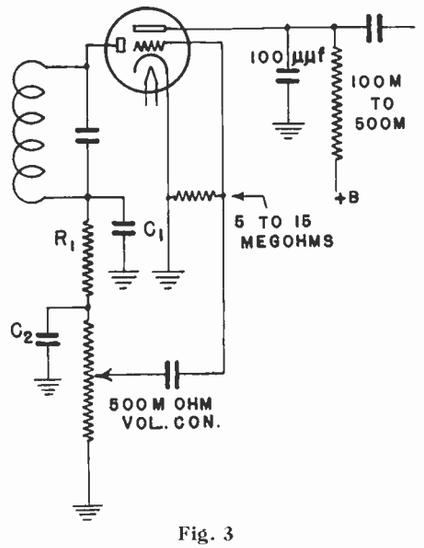
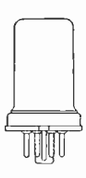


Fig. 3

• • •

NEW TUBES

(Continued from Page One)



Type 6AB7/1853 Television Amplifier Pentode

Sylvania Type 6AB7/1853 is a single-ended amplifier similar to Type 6AC7/1852 except that it is of the remote cut-off construction. The grid bias may be obtained from a cathode bias resistor having a minimum value of 190 ohms. The combined plate and screen dissipation and the screen dissipation of 4.4 watts and 0.65 watts respectively, must not be exceeded. Otherwise, the notes given for Type 6AC7/1852 are applicable.

Characteristics

Heater Voltage AC or DC	6.3 Volts
Heater Current	0.45 Ampere
Bulb	8G-1
Base—Small Octal 8-Pin	8-N
Mounting Position	Any

Direct Interelectrode Capitances:

(With shell connected to Cathode)

Grid to Plate	0.015 μμf Max.
Input	8 μμf
Output	5 μμf

Operating Conditions and Characteristics:

Condition	I	II
Heater Voltage	6.3	6.3 Volts
Plate Voltage	300	300 Volts Max.
Screen Supply Voltage	200	300* Volts Max.
Grid Voltage	—3	—3 Volts Min.
Suppressor Voltage ▲	0	0 Volt
Screen Series Resistor		30,000 ohms
Plate Current	12.5	12.5 Ma.
Screen Current	3.2	3.2 Ma.
Plate Resistance (Approx.)	0.7	0.7 Megohm
Mutual Conductance	5000	5000 μmhos
Amplification Factor	3500	3500
Grid Voltage (50 μmhos Mut. Cond.)	—15	—22.5 Volts

*Screen supply voltage in excess of 200 volts for Type 6AB7/1853 requires the use of a series dropping resistor to limit the voltage at the screen to 200 volts with normal plate current of 12.5 ma.

▲In r-f and i-f service the suppressor should be connected to ground to minimize feedback.

NEW TUBES

At the time of going to press, several new Sylvania tube types have been released and are available for Renewal business. These tube types are listed below with descriptions. Technical information for these will be shown in future issues of the News and other pieces of Sylvania technical literature.

Type	Description
1E4G	Triode
1G4G	Triode Voltage Amplifier
1G6G	Class B Power Amplifier
1N6G	Diode Power Amplifier
1P5G	R-F Pentode
1Q5G	Beam Power Amplifier
2A4G	Argon Filled Thyratron
6AD6G	Tuning Indicator
6AE6G	Triode Amplifier
6AF5G	Triode Voltage Amplifier
6F5GT	High-Mu Triode
6H6GT	Duodiode
6J5GT	Super Triode Amplifier-Detector
6K6GT	Intermediate Power Amplifier
6K8G	Triode Hexode Converter
6K8GT	Triode Hexode Converter
6P5G	Amplifier Detector
6X5GT	High Vacuum Full Wave Rectifier
7A4	General Purpose Amplifier
7A5	Beam Power Amplifier
7C7	Triple Grid Amplifier and Detector
7E6	Duodiode High-Mu Triode
12A8G	Pentagrid Converter
12A8GT	Pentagrid Converter
12B8GT	Triode Pentode
12C8	Duodiode Pentode
12F5GT	High-Mu Triode
12J5GT	Super Triode Amplifier-Detector
12J7GT	Triple Grid Amplifier and Detector
12K7G	Triple Grid Amplifier
12K7GT	Triple Grid Amplifier
12Q7G	Duodiode High-Mu Triode
12Q7GT	Duodiode High-Mu Triode
12SA7	Pentagrid Converter
12SC7	Double Triode
12SJ7	Triple Grid Amplifier and Detector
12SK7	Triple Grid Amplifier
12SQ7	Duodiode High-Mu Triode
25A7GT	Rectifier-Pentode
25AC5G	Power Amplifier Triode
25B8GT	Triode Pentode
25C6G	Power Amplifier
32L7GT	Diode Tetrode
35L6G	Power Amplifier
35L6GT	Power Amplifier
35Z4GT	Half-Wave Rectifier
35Z5G	Half-Wave Rectifier
35Z5GT	Half-Wave Rectifier
50Z7G	Ballast & Doubler
70L7GT	Power Amplifier
117Z6G	Full-Wave Rectifier
1232	Triple Grid Amplifier

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METAL TUBES AS "GT" REPLACEMENTS

Many inquiries have been received asking if Sylvania metal tubes may be used to replace like "GT" tubes. In practically all cases, metal tubes may be used to directly replace any "GT" tubes having identical characteristics (Example: 6X5G will replace a 6X5GT). In tubes used in r-f circuits it may be found that a slight realignment of tuned circuits will be required when using certain types, but usually the differences in capacities of the two groups of tubes is very small and realignment will not be required. In physical size the metal tubes are practically the same size as the "GT" types, therefore, there are no problems as regards the space available in the receiver. From the standpoint of performance, no differences should be noted when using metal types in place of "GT" types and the average life of the tubes should be equally satisfactory.

SYLVANIA NEWS

TECHNICAL SECTION

SEPTEMBER-OCTOBER, 1939 EMPORIUM, PENNA. Vol. 8, No. 5

Binders With Complete File for Technical Section, 50 Cents

NEW TECHNICAL MANUAL

264 Pages

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Data On 334 Types

•

Panel Lamp Information

•

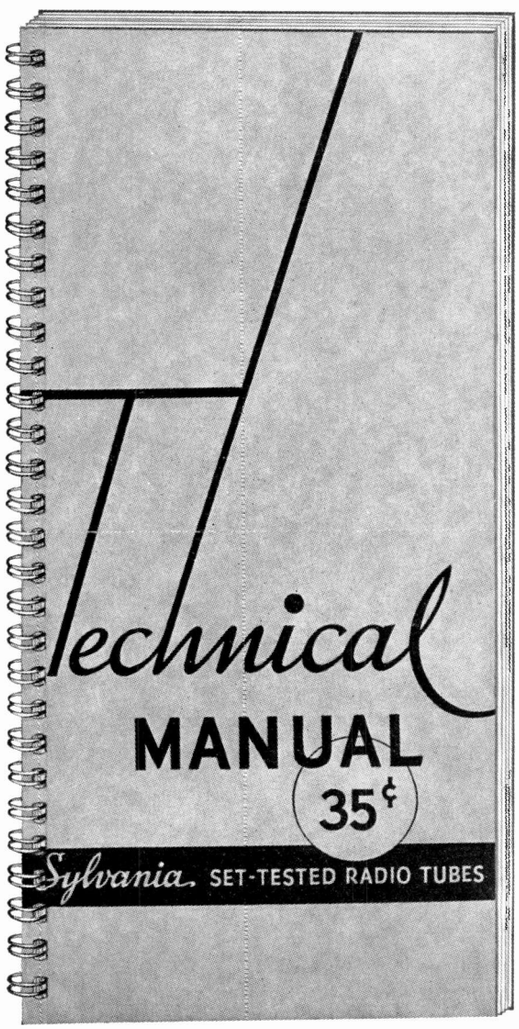
Service Data

•

Set Circuits

•

Wire-O Binding



The fifth edition of the Sylvania Technical Manual is the largest and most complete tube manual available from any manufacturer today, having 264 pages of vital tube information, prepared under RMA standards.

It contains operating conditions, ratings, characteristics, and circuit applications for 344 types, including standard glass tubes, G types, Loktal, Metal, Majestic, Television and Special types, and full information on Sylvania's complete line of panel lamps.

Also included are new typical receiver circuits, complete bias resistor charts, data on interchangeable tubes, separate pages of bulb outlines and dimensions, and a wealth of indispensible service data. Tube types are arranged in easy-to-read numerical-alphabetical order.

The popular style of wire-o binding is continued, permitting the book to lie perfectly flat when opened.

Due to the greatly increased number of pages, increasing printing and transportation costs, the Sylvania Technical Manual is now priced at 35c. Servicemen may obtain copies from any Sylvania jobber, or direct from Emporium. Use Coupon On Page 4, Main Section. Shipment of back orders for the Technical Manual will be made immediately.

NEW TUBES

Sylvania Type 1LA4 Power Output Pentode

Sylvania Type 1LA4 is a Loktal power output pentode tube designed especially for use in low drain battery operated receivers. This type is extremely economical because the A and B current drains are unusually low. For additional circuit application notes, refer to Type 1A5G.

CHARACTERISTICS

Filament Voltage DC	1.4 Volts
Filament Current	0.050 Ampere
Bulb	T9-G
Base—Loktal 8-Pin	5-AD
Mounting Position	Any

Operating Conditions and Characteristics:

Filament Voltage	1.4	1.4 Volts
Plate Voltage	85	90 Volts Max.
Screen Voltage	85	90 Volts Max.
Grid Voltage (Neg. Fil. Return, Pin 8)	−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	25000	25000 Ohms
Power Output	100	115 Mw.
Total Harmonic Distortion	10	7 Per Cent

Sylvania Type 1LA6 Pentagrid Converter

Sylvania Type 1LA6 is a Loktal pentagrid converter tube designed especially for service in low drain battery operated receivers. Its applications are similar to other pentagrid converters, such as Types 1A7G and 1C7G, but the difference in characteristics and operating conditions must be taken into account to secure optimum performance. For additional circuit notes, refer to Type 1A7G.

CHARACTERISTICS

Filament Voltage DC	1.4 Volts
Filament Current	0.050 Ampere
Bulb	T9-G
Base—Loktal 8-Pin	7-AK
Mounting Position	Any

Direct Interelectrode Capacitances:*

Grid G to Plate	0.4 μμf
Grid G to Grid Ga	0.3 μμf
Grid G to Grid Go	0.15 μμf
Grid Go to Grid Ga	0.6 μμf
Grid G to all Electrodes (R-F Input)	7.7 μμf
Grid Ga to all Electrodes Except Go (Osc. Output)	3.3 μμf
Grid Go to all Electrodes Except Ga (Osc. Input)	2.9 μμf
Plate to all Electrodes (Mixer Output)	5.0 μμf

*With tube shield connected to negative filament, Pin No. 8.

(*Continued on Page 2*)

NEW TUBES

(Continued from Page One)

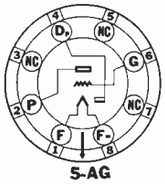
Operating Conditions and Characteristics:

Filament Voltage DC	1.4 Volts
Plate Voltage	90 Volts Max.
Screen Voltage**	45 Volts Max.
Anode-Grid Voltage	90 Volts Max.
Control-Grid Voltage (G)†	0 Volt
Oscillator-Grid Resistor (Go)	200000 Ohms
Plate Resistance	0.75 Megohm
Plate Current	0.55 Ma.
Screen Current	0.6 Ma.
Anode-Grid Current	1.2 Ma.
Oscillator-Grid Current	0.035 Ma.
Conversion Conductance	250 μmhos
Control Grid Voltage at −3 Volts	10 μmhos

**Obtained preferably by using a properly by-passed 70,000 ohm resistor in series with a 90 volt supply.

†A resistance of at least 1 megohm should be in the grid return to negative filament.

Sylvania Type 1LH4 Diode-Triode



5-AG

Sylvania Type 1LH4 is a Loktal diode-triode designed especially for use in low drain battery operated receivers. It is one of the types having a 1.4 volt filament rating. Type 1LH4 may be employed as a combined diode detector and triode audio amplifier and for securing the required voltage for automatic volume control. The triode section should be resistance coupled to the diode using an ordinary coupling condenser and high resistance grid leak. No C battery is required for bias voltage but the grid return should be made to the negative filament terminal. For additional circuit application notes refer to Type 1H5G.

CHARACTERISTICS

Filament Voltage DC	1.4 Volts
Filament Current	0.050 Ampere
Bulb	T9-G
Base-Loktal 8-Pin	5-AG
Mounting Position	Any

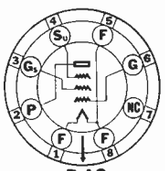
Operating Conditions and Characteristics:

Filament Voltage	1.4 Volts
Plate Voltage	90 Volts Max.
Grid Voltage*	0 Volt
Plate Current	0.15 Ma.
Plate Resistance	240000 Ohms
Mutual Conductance	275 μmhos
Amplification Factor	65

*Negative filament return, Pin No. 8.

NOTE: Diode plate location at negative end of filament.

Sylvania Type 1LN5 R-F Pentode



7-AO

Sylvania Type 1LN5 is a Loktal r-f pentode designed especially for service in low drain battery operated receivers as an r-f, if, or a-f amplifier. This tube can be used satisfactorily in a-v-c circuits since it has a medium cut-off characteristic. Type 1LN5 is a high impedance tube and should be worked into a high impedance if maximum r-f amplification is to be attained. Additional circuit application notes are given under Type 1N5G.

CHARACTERISTICS

Filament Voltage DC	1.4 Volts
Filament Current	0.050 Ampere
Bulb	T9-G
Base—Loktal 8-Pin	7-AO
Mounting Position	Any

Direct Interelectrode Capacitances:

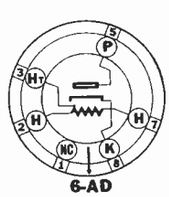
Grid to Plate (with tube shield)	0.007 μμf Max.
Grid to all Electrodes except Plate	3.5 μμf
Plate to all Electrodes except Grid G	9.0 μμf

Operating Conditions and Characteristics:

Filament Voltage	1.4 Volts
Plate Voltage	90 Volts Max.
Screen Voltage	90 Volts Max.
Grid Voltage*	0 Volt
Plate Current	1.6 Ma.
Screen Current	0.35 Ma.
Plate Resistance	1.1 Meg. Approx.
Mutual Conductance	800 μmhos
Amplification Factor	880
Mutual Conductance at −4.5 Volts (Approx.)	10 μmhos

*Negative filament return, Pins No. 8 and 5.

Sylvania Type 35Z5G Half-Wave Rectifier



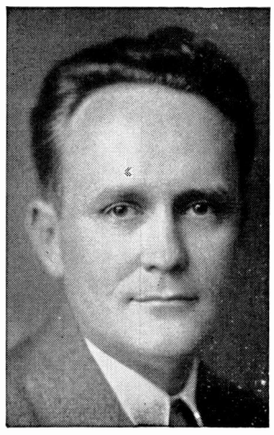
6-AD

Sylvania Type 35Z5G is a half-wave high vacuum rectifier designed for use in ac-dc and dc line operated receivers. The 35-volt heater is tapped to permit operation of a Sylvania S40 or S47 panel lamp across Pins 2 and 3. Conventional half-wave rectifier circuits are applicable.

A peak limiting resistor of at least 25 ohms must be used in series with the plate and a surge limiting resistor should be placed in series with the heaters of the other tubes in the heater circuit.

(*Continued on Page 4*)

A CHAT WITH ROGER WISE



Chief Tube Engineer
Hygrade Sylvania Corporation

According to early reports from England, the outbreak of actual hostilities has resulted in sudden stimulation of radio receiver sales, thus forming a marked contrast with the dullness of the radio market during and after the crisis earlier this year. Portable sets are in particular demand now because of the need for means of listening to air raid instructions in locations where wired power is not available.

While receivers using 1.4 volt tubes of American design were introduced in that country earlier in the year, the demand was not large due to the fact that electrification is fairly complete even in rural districts. It is expected now that the demand for portable receivers will continue, particularly if air raids occur with any frequency at later stages of the conflict. In such receivers 1.4 volt tubes have outstanding advantages in making possible the continued operation for long periods of time from batteries of a given size. British battery tubes take more filament current than American types, and in many cases this current has been supplied from small storage batteries to avoid the extra cost of dry battery operation. Such batteries are not well suited to portable receivers, and with lower drain tubes now available, dry battery operation costs are brought down to a satisfactory level.

The substantial operating economies obtained in the design of the 1.4 volt tubes as developed by Hygrade Sylvania can be best realized by comparing them with the 2.0 volt types. The general purpose 2-volt tubes require 60 milliamperes filament current, and the power consumption (best expressed in milliwatts) is therefore 120 milliwatts. The 1.4 volt tubes requiring 50 milliamperes take 70 milliwatts, or approximately 60% as much power. An even more important consideration is the fact that two dry cells must be connected in series to operate the 2-volt tubes, so that the initial voltage is slightly above 3 volts, thus representing a power consumption of 180 milliwatts—the excess power being consumed in a ballast tube or resistor. The 1.4 volt tubes can be operated directly from a single dry cell, so that the filament current does increase slightly with a fresh dry cell, the power consumption being approximately 80 milliwatts—or only 45% of the power consumed by the 2-volt tube. The saving is even more substantial in the case of some of the special-purpose types, particularly power output tubes. Furthermore, the "B" drain has been cut down in spite of improved characteristics, so that a substantial saving in "B" current is also made possible.

As a natural result of these savings in power consumption it can be understood why the portable set market in this country has been stimulated so markedly by introduction of the 1.4 volt tube. Fortunately we do not have to fear that portable sets will be needed for the same purpose for which they are being used in England—at least in the immediate future; however, the desire to keep up-to-date on war news does mean that additional portable sets are being sold.

Experience obtained in our plants in producing the required types of Sylvania battery tubes in unusually large volume is making it possible to maintain excellent records as regards quality and reliability, both initially and in service under the most severe operating conditions.

Technical Section Binders

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The demand for the Technical Section Binder offered in the last issue of Sylvania News was so great that our supply of back issues is exhausted. It is now necessary to order reprints, and unfortunately reprinting makes necessary an increase in price. The Technical Section Binder, containing all back issues (33 issues to date) is now $1.00. Orders already placed and received before October 15 will be filled at the old price of 50 cents.

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 62-305. Whistles when volume control is turned up more than half way. Open condenser No. 119-22 which is connected between one side of candohm resistor and terminal 5 of 1D5G tube.—T. Henshaw, Marysville, Kansas.

* * *

Clough Brengle Model 79C Oscillator. Intermittent operation on one or more frequency settings caused by bus bar wire from stator of tuning condenser rubbing slightly on rotor. Bending bus bar away from rotor will cure this condition.

Loss of output together with slight loss of high frequency response is caused by open two megohm resistor (runs through shield partition near 6J5 fixed and variable oscillator tubes). Replace with one watt value.

Lack of sensitivity on magic eye tube caused by a slightly high value 2½ megohm resistor in series with condenser to 6E5 grid. Replace with **accurately measured** 2½ megohm one watt rating.—Harry Beecher, Milltown, N. J.

* * *

Colonial Model 33, 34 and 35A.C. A marked improvement in tone can be effected in these models by the addition of a ½ watt, 0.15 megohm resistor connected conveniently at the socket of the 24A detector tube from plate to screen grid.

To avoid shorting sections of the main tuning condensers by the trimmers, it is advisable to glue thin strips of mica on the stator sections of each trimmer condenser. Many cases of "intermittents" are thus avoided.—Phil Rosenblatt, Hoboken, N. J.

* * *

Loop Antenna Hint. This applies to all radios that use the built-in Antenna. Radios using this antenna that are not near a local station, will usually be rather weak and slightly distorted. The remedy is to remove the cardboard covering from the loop antenna, disconnect the one turn that goes directly to the antenna lead and solder on enough wire to make two extra turns around the loop, in the same direction, and solder the end back on the antenna lead-in post. If the set is an AC-DC, connect a small condenser from the ground side of the loop to the chassis. (The ground side usually has a black wire running out the back for an external ground which, of course, isn't connected directly to the chassis.) This ground to loop condenser is not necessary on the a-c sets as the loop starts at ground. I have fixed several sets in this manner and obtained surprising results.—R. D. Beam, Warrenton, N. C.

* * *

Mantola Model 5Z. The speaker in this model has an 1800 ohm field which furnishes bias. The half wave center tap from the transformer goes through the field to voltage divider to ground. The winding wire that goes to the center of the core of the field is not insulated, other than enamel, and will short when in use several months, causing distorted and low volume. Remove the field coil and insulate. This usually will not show up by ordinary resistance test.—R. D. Beam, Warrenton, N. C.

* * *

Motorola 1939 Auto Radios. On the Model 9-44 (with Boost-A-Matic aerial coupler) be sure that the control wire for tuning the aerial coil does not bind. This wire is moved by an eccentric which is coupled to the tuning condenser shaft by a woven cable. If the control wire binds, or is bent too sharply, this cable breaks which means that the antenna coil is not tuned, thus efficiency is seriously impaired.

In the electric tuning models (9-49, 9-69 and several of the custom-built sets) the cams will not release from the condenser shaft properly. When this occurs, replace the latch release spring located beneath the electric tuning assembly on the condenser shaft.—George Kinkade, Wilmington, Del.

* * *

Musicaire Model 421 (Sentinel). For hum when stations are tuned to resonance, check the ground. Hum which is not noticeable when speaker is out of cabinet and additional filter condensers do not help, may be cured by moving speaker back 1 to 2 inches from baffle. The same chassis (except speaker) used in a table model is not bothered with this trouble.—Clifton S. Krumling, Blue Earth, Minn.

* * *

Parmak 1938 Masterpiece. Very slight distortion of high notes at times is due to increase of volume control resistance or partial opening of same. To remedy, connect a ½ megohm resistor across outside terminals of volume control. This gives new control performance.—T. Henshaw, Marysville, Kansas.

* * *

Philco Model 16 Code 121. Oscillator failure at the high end of the broadcast band can be cured by changing the oscillator cathode resistor (500 ohms) to a 300 ohm unit. Check the 76 tube before making this change as the tube may have ceased to oscillate. Replace with a Sylvania 76 for best results.—Jack Darr, Mena, Arkansas.

* * *

Philco Models 38-4, 38-5, 38-7. To reduce frequency drift on the high frequency end of B. C. band, or tuning range, of models 38-4 and 38-5, replace compensator No. 16 (1500 KC) with a new compensator part No. 31-6206 and two fixed condensers part No. 30-1097 connected in parallel with the new unit.

To improve performance of the oscillator circuit on the short wave bands, change original resistor No. 19 (70,000 ohms) to 51,000 ohms.

To eliminate frequency drift on Model 38-7, use the same procedure as used on models 38-4 and 38-5, only the compensator changed on this model is No. 7A.—M. J. Planovsky, Cleveland, Ohio.

* * *

Philco Model 38-116. To improve the holding characteristics of the magnetic circuit (tuning) a condenser part No. 30-1097, 5 mfd. should be connected from grid No. 2 of the 6J5G discriminator tube to ground.—M. J. Planovsky, Cleveland, Ohio.

* * *

Philco Model 630, 635. Oscillation with increased setting of volume control and high setting of tone control: To remedy, keep control grid lead of 75 tube away from the 42 power tube. Have this lead enter the 75 grid near the i-f tube side.—L. C. Dunker and Jos. Garami, Astoria, L. I., N. Y.

* * *

RCA Victor Volume Controls. Most of the '36 and '37 RCA's had volume control trouble and it is best to replace them with a good make of replacement control instead of trying to repair the original as many servicemen advise. The same trouble will return just as many times as you can repair them. Free service calls make the serviceman no money, and satisfied customers do.—Leo Zimmer, Canisteo, N. Y.

* * *

RCA Model 120. Motorboating. Check for an open condenser located in the 3 section electrolytic block at the left of the gang condenser. The best remedy is to renew all of these condensers at very little expense.—Mr. Wm. B. Miles, Altoona, Penna.

Silvertone Model 4589. When this set works at the lower broadcast frequencies up to 770 kilocycles, and then cuts out completely, check the .0041 condenser bypassing the oscillator coil to ground. I have replaced this unit with a .005 condenser in several of these receivers and have had no further trouble.—Lyell Cook, Streator, Ill.

* * *

Stewart Warner Model 139A. This set may check and play OK after it has been switched on for a short time, then it will stop. The .02 condenser between the grid of the 1B5/25S and the center tap on the volume control is intermittently defective. A new condenser is the answer.—S. B. Thompson, Jr., Olanta, S. C.

* * *

RELATIVE PERFORMANCE OF LOOP AND LINE ANTENNA SETS

In an effort to simplify radio reception as much as possible by eliminating outside aerials, radio manufacturers have developed a number of special built-in antenna systems. The two most important of these are the built-in line antenna and the loop antenna.

It is not possible to state that either one is definitely superior to the other in all cases. Both have their advantages and disadvantages. Since you are selling both types, it is important that you know under which conditions they provide their best performance.

A set having a built-in line antenna uses one side of the power line as the antenna and the other side as ground. In rural locations, where the wiring may be open, and not in steel conduit, a line antenna provides very good signal pick-up and will almost invariably prove vastly superior to the loop. In a city home, which uses enclosed conduit wiring, there may not be very much difference in pick-up between the line antenna and the loop. If there is some exposed wiring such as extension cords, pickup with the line antenna may be quite good even if most of the house wiring is in conduit. On a dealer's floor, where all the wiring is shielded, and a number of sets use the same wiring circuit, the line antenna will probably work very poorly.

A very important characteristic of the loop antenna is that it is directional and that either the set or aerial must be rotated so as to point to the station. This will prove an inconvenience, particularly in the case of non-portable sets, so that usually the radio owner won't do it, to the detriment of certain stations that are in the direction of minimum pick-up. On the other hand, the directional feature may be of advantage in reducing interference in some cases.

If more than one set is used on the same line, and at least one of the sets is not of the line antenna type, the line antenna set will usually show up very poorly, since many sets make use of a buffer condenser across the line, which acts as a short circuit for the line antenna set and prevents any signal from getting through to it.

Although the relative pick-up of the loop and line antennas will depend very considerably on such local conditions as described above, the situation is entirely different when an outside aerial is used. **A line antenna set, when used with an outside aerial, is definitely superior to a loop antenna set of equal sensitivity when used with the same outside aerial.**—Service Department, Stewart Warner Corp.

NEW TUBES

(*Continued from Page 2*)

Type 35Z5G

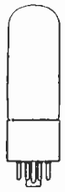
CHARACTERISTICS

Heater Voltage (Pins 2 and 7, entire heater).....35.0 Volts
Heater Current (Entire heater)....0.150 Ampere
Panel Lamp Section (Pins 2 and 3).. 7.5 Volts
Bulb.....ST-12
Base—Small Octal 6-Pin.....6-AD
Mounting Position.....Any

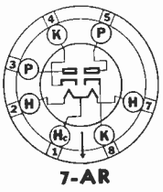
Operating Conditions and Characteristics:
Condenser Input

Heater Voltage.....35.0 Volts
A-C Plate Voltage (RMS)..... 125 Volts Max.
D-C Output Current*..... 50 Ma. Max.
D-C Output Current..... 100 Ma. Max.**
Max. Peak Inverse Voltage Allowable..... 700 Volts
Max. Peak Plate Current Allowable..... 600 Ma.
Series Plate Resistor..... 25 Ohms Min.
Tube Voltage Drop at 200 Ma..... 21 Volts**

*With rectified plate current through the panel lamp section of the heater shunted by a 6.3 volt, 0.150 ampere panel lamp, (Sylvania Panel Lamp S40 or S47)
**Panel Lamp not connected



Sylvania Type 117Z6G Full-Wave Rectifier



7-AR

CIRCUIT APPLICATION

Sylvania Type 117Z6G is a heater type, high vacuum full-wave rectifier designed for operation directly across a 117-volt line. The center tap of the heaters is brought out to Pin 1 so that it is possible to operate the heaters in parallel on 58.5 volts. With this connection the heater current is 150 milliamperes.

Conventional rectifier circuits may be employed but care should be taken to insure that the maximum current and voltage ratings are not exceeded.

CHARACTERISTICS

Heater Voltage	**58.5**	**117 Volts**
Heater Current	**0.150**	**0.075 Ampere**
Bulb		**T9-B**
Base—Small Octal 7-Pin		**7-AR**
Mounting Position		**Any**

Ratings:

Heater Voltage	**58.5**	**117 Volts**
Heater Current	**0.150**	**0.075 Ampere**
D-C Heater to Cathode Potential	**350**	**350 Volts**
Peak Inverse Voltage	**700**	**700 Volts**
Tube Voltage Drop (120 Ma. per Plate)	**15.5**	**15.5 Volts**

Operating Conditions and Characteristics:
Voltage Doubler

Heater Voltage..... 117 Volts
A-C Voltage per Plate (RMS)..... 117 Volts Max.
D-C Output Current..... 60 Ma. Max.
Peak Plate Current..... 350 Ma. Max.
Plate Supply Impedance per Plate (Min.)..... *

Half-Wave Rectifier

Heater Voltage	**117**	**117**	**117 Volts**
A-C Voltage per Plate (RMS)	**117**	**150**	**235 Volts Max.**
D-C Output Current per Plate	**60**	**60**	**60 Ma. Max.**
Plate Supply Impedance per Plate	**0**	**40**	**100 Ohms Min.**

*Sufficient impedance to limit maximum steady-state peak plate current to value shown

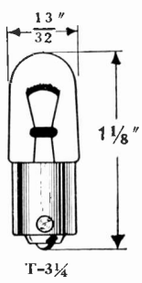
BE SURE TO SEE THE NEW SYLVANIA SHOP COAT SHOWN ON PAGE FOUR OF THE MAIN SECTION

NEW SYLVANIA PANEL LAMPS

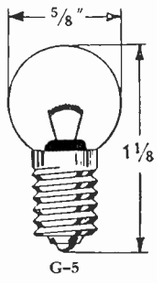
Sylvania Panel Lamps for use in radio receivers, were announced in Technical Section, Volume 8, No. 2. Acceptance of these lamps has been gratifying, and demand has been made for additions to the line. Three new Sylvania panel lamps, Types S292A, S1455 and S1455A are now made available. The S292A is identical to Type S292, previously announced, except for the style of base. This lamp is used mainly in pin game machines and in 2.5 volt receivers where the line voltage is high and where regular 2.5 volt lamps will not give satisfactory life. Types S1455 and S1455A each have 18 volt filaments at .25 ampere and are for use in coin machines and toy trains. Characteristics for these three new panel lamps are given below.

CHARACTERISTICS

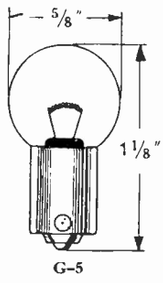
Type No.	Circuit Volts	Design Volts	Design Amp.	Bead Color	Bulb Style	Miniature Base	Usual Service	Type No.
S292A	2.9	2.9	0.17	White	T-3¼	Bayonet	Radio Dials & Coin Machines	S292A
S1455	18.0	18.0	0.25	Brown	G-5	Screw	Coin Machines	S1455
S1455A	18.0	18.0	0.25	Brown	G-5	Bayonet	Coin Machines	S1455A



T-3¼



G-5



G-5

Modernization of Radiola 80 and 82, Westinghouse WR-6 and General Electric H-31 Receivers.

The Radiola 82, Westinghouse WR-6 and General Electric H-31 are electrically equivalent receivers first offered in 1930, at prices varying from $142 to $179, according to the type of cabinet employed. They employ nine tubes in a well-designed superhetrodyne circuit, and are capable of giving excellent tone quality by virtue of having a good loud speaker and pushpull Class A triode output tubes.

Some of the outstanding features of this chassis include the use of a band-pass type of pre-selector, a separate oscillator tube, a local-distance switch which effectively alters the selectivity characteristic of the i-f amplifier in addition to changing its gain, and a very efficient power-supply filter system which keeps the a-c hum at an extremely low level without the use of any electrolytic capacitors. In short, the modernization of one of these receivers will provide a job of which both the owner and the serviceman may well be proud. Incidentally, the mechanical arrangement of the chassis in two units of more than ample size makes the necessary changes relatively easy to make. thus reducing the time required for modernization and making the job a really profitable one.

The first step is to replace the type 27 second detector with a type 55. This requires a change in the tube socket and the rearrangement of the connections to the detector socket as indicated on the accompanying circuit diagram. The new 2500-ohm bias resistor R1 is by-passed by a 10 mfd. capacitor C1, and the 110,000-ohm bleeder resistor R2 is no longer necessary. The new 0.5 megohm volume control potentiometer R3 serves as a grid leak for the triode grid of the type 55 tube, and is so connected that a phonograph pick-up may be used merely by opening the connection between terminals 1 and 2 of the terminal block and connecting the pick-up to terminals 2 and 3. The 0.0024 mfd. capacitor C2 between the plate of the 27 second detector is no longer necessary, and is removed to prevent possible attenuation of the high audible frequencies.

The next step is to replace the type 24A r-f and first i-f tubes with type 35/51 variable mu tubes. This does not necessitate a socket change. These tubes are provided with individual 6000-ohm bias resistors, each of the cathodes being by-passed to ground with a 0.1 mfd. capacitor C6. The original volume control potentiometer R4 and 170-ohm initial bias resistor R5 are discarded but care must be taken to see that the 18000-ohm screen-voltage bleeder R6 resistor is connected to ground. The second i-f tube operates at fixed grid voltage which is developed across the original 2000-ohm cathode resistor R7, one end of which is to be grounded instead of being connected to terminal 1 of the terminal block.

The final step is to provide a means whereby the direct-current voltage which is developed across the diode load resistor may be applied to the control grids of the type 35/51 tubes. This is most conveniently done by employing 2.0 megohm grid leaks R8, R9 and 500-mmfd. C3, C4 blocking capacitors for each of these tubes, the grid leaks in turn being connected through individual resistor-capacitor filters to the AVC line, which is provided with a 1.0-megohm series resistor R10 and a 0.1 mfd. shunt capacitor C5 to produce a suitable time constant. It will be found that the voltage drop across the type 35/51 tube cathode resistors is sufficient to counteract the bias voltage of the type 55 tube and provide the proper initial bias voltage when no signal is being received.

It will be noted that the terminals 3 and 4 of the terminal block are marked "T.M." on the circuit diagram. This means that a tuning meter may be connected to these terminals for alignment purposes or whenever it is desired to observe the action of the AVC. A 0-25 voltmeter is suitable for this purpose. and under normal line-voltage conditions it should show about 21 volts (terminal 4 being positive) when the antenna and ground posts are short-circuited. The set should be aligned with the local distance switch in the distance (more selective) position, but the set will provide best reception of strong local stations if the switch is in the local position. Although designed more than seven years ago, the frequency range extends to above 1550 KC, thus permitting excellent reception of the high-fidelity experimental broadcast stations operating on or near this frequency if the set is carefully aligned at the high-frequency end.

The changes above described are foolproof and can be made with complete confidence that they will be successful. The experienced serviceman, however, may wish to improve the range of the AVC, which is somewhat limited by the fact that only two tubes are controlled, by applying the control to a type 35/51 first detector and perhaps a portion of the control voltage to the second i-f tube. Such modifications are believed to be entirely feasible, but unnecessary to provide an entirely satisfactory job and likely to introduce complications not encountered in the straightforward arrangements here outlined. The changes outlined may be made at a very reasonable cost for parts and tubes and such a job properly done easily brings $18 or $20. Therefore, there appears to be little reason for attempting further refinements in the average case.—Albert R. Hodges 183 Union Street, Ridgewood, New Jersey.

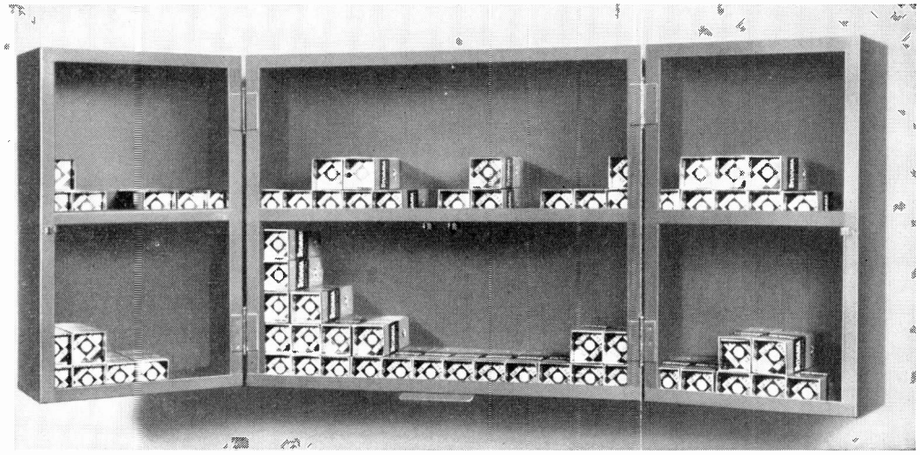
SYLVANIA NEWS

TECHNICAL SECTION

NOVEMBER-DECEMBER, 1939 EMPORIUM, PENNA. Vol. 8, No. 6

FOLDING "STOCK BOY"

Keep Your Stock Fit and Handy . . .



An "open and shut case" that answers the radio serviceman's problem of keeping stock in a neat, convenient way. With this opening type of construction a double row of tubes can be kept in the same amount of space ordinarily taken up by a single deep bin cabinet. Also, when it is closed, a minimum amount of dirt and dust has a chance to collect and spoil the appearance of tube cartons.

This new folding style metal cabinet easily accommodates more than 250 tubes. There are two hinges on each movable part sturdily supporting the free swinging compartments whether open or closed. It measures 18" high by 21¾" wide and 11½" deep when closed, is olive green with the Sylvania script logotype lettered across the front in silver white, and has the Sylvania oak leaf on each side. It is designed for hanging on wall, and for easy mounting, teardrop slots have been punched in the back to slip on to broad head screws or hook brackets which should be firmly anchored to the wall.

Every particular serviceman who is conscious of his store appearance and of stock convenience and has not yet worked out a modern solution of properly housing his tube stock will want one or more of these cabinets. Get your tubes out of those unreachable places and into the compact, accessible Sylvania folding Stock Boy cabinet.

Ask your Sylvania Jobber—Today—How to obtain this attractive, durable utility cabinet.

NEW TUBES

Sylvania Type 12K7G Triple Grid Amplifier

Sylvania Type 12K7G is a triple grid super-control amplifier tube identical in characteristics with Type 6K7G except for heater rating and capacitances. For characteristics other than those shown below, and circuit applications, refer to Type 6K7G.

CHARACTERISTICS

Heater Voltage AC or DC	12.6 Volts
Heater Current	0.150 Ampere
Bulb	ST-12C
Cap.	Miniature
Base—Small Octal 7-Pin	7-R
Mounting Position	Any

Direct Interelectrode Capacitances:

Grid to Plate (With tube shield)	0.007 μμf Max.
Input	5.0 μμf
Output	12.0 μμf

Operating Conditions and Characteristics:

CLASS A1 AMPLIFIER

Heater Voltage	6.3	6.3	6.3	6.3 Volts
Plate Voltage	90	180	250	250 Volts
Screen Voltage	90	75	100	125 Volts
Grid Voltage	−3	−3	−3	−3 Volts
Suppressor	Tie to Cathode			
Plate Current	5.4	4.0	7.0	10.5 Ma.
Screen Current	1.3	1.0	1.7	2.6 Ma.
Plate Resistance	0.3	1.0	0.8	0.6 Megohm
Mutual Conductance	1275	1100	1450	1650 μmhos
Grid Bias for Mutual Conductance = 2 μmhos	−38.5	−32.5	−42.5	−52.5 Volts

Operating Conditions with Variable Bias:

MIXER

Heater Voltage	6.3 Volts
Plate Voltage	250 Volts
Screen Voltage	100 Volts
Grid Voltage† (Approx.)	−10 Volts
Suppressor	Tie to Cathode

†The grid bias shown is minimum for an oscillator peak voltage of 7 volts.

Sylvania Type 35L6G Beam Power Amplifier

Sylvania Type 35L6G is a beam power amplifier designed for use in the output stage of ac-dc receivers. This type is somewhat similar to 25L6G and additional application notes may be obtained by referring to this type.

Transformer or impedance coupling devices are recommended for the input circuit. If fixed bias is employed the grid circuit resistance should not exceed 0.1 megohm. The maximum resistance with self-bias is 0.5 megohm.

CHARACTERISTICS

Heater Voltage AC or DC	35.0 Volts
Heater Current	0.150 Ampere
Bulb	ST-12
Base	7-AC
Mounting Position	Any

(Continued on Page Two)

NEW TUBES

(Continued from Page One)

Operating Conditions and Characteristics:
Class A Amplifier

Heater Voltage	35.0 Volts
Plate Voltage	110 Volts Max.
Screen Voltage	110 Volts Max.
Grid Voltage	-7.5 Volts
Plate Current	40 Ma.
Screen Current	3 Ma.
Plate Resistance	13800 Ohms
Mutual Conductance	5800 μmhos
Load Resistance	2500 Ohms
Power Output	1.5 Watts
Total Harmonic Distortion	10 Per Cent

Sylvania Type 50Z7G Voltage Doubler

Sylvania Type 50Z7G is a high vacuum rectifier designed for operation as a voltage doubler or as a half-wave rectifier in ac-dc or dc receivers. The 50-volt heater is tapped to provide suitable voltage between Pins 6 and 7 to operate a Sylvania S292 or S292A panel lamp. The heater current rating for the entire heater is 150 milliamperes.

When used as a half-wave rectifier the two plates are connected together and likewise the two cathodes. Resistors of at least 25 ohms must be used in series with each plate. An alternative is to use 25 ohms common to both plates, resulting in slightly less output voltage.

When Type 50Z7G is employed in a voltage doubler circuit it is essential to use peak limiting resistors of at least 25 ohms in series with each plate. If a series doubler circuit is used then a line resistor of 30 ohms may be substituted in place of the foregoing arrangement.

It is recommended that a surge limiting resistor be used in series with the heaters of the other tubes in the heater circuit.

CHARACTERISTICS

Heater Voltage (Pins 2 and 7 entire heater)	50.0 Volts
Heater Current (Entire heater)	0.150 Ampere
Panel Lamp Section (Pins 6 and 7)	2.0 Volts
Panel Lamp Voltage (RMS)	2.5 Volts Max.
Bulb	ST-12
Base—Small Octal 7-Pin	8-AN
Mounting Position	Any
Tube Voltage Drop (130 Ma. per Plate**)	21 Volts

**Panel lamp not connected.

Operating Conditions and Characteristics:
Voltage Doubler

Heater Voltage (Entire heater)	50.0 Volts
A-C Plate Voltage per Plate (RMS)	117 Volts Max.
D-C Output Current*	65 Ma. Max.
Peak Plate Current	400 Ma. Max.
Plate Supply Impedance per Plate (Min.)	†25 ohms Min.

†Sufficient to limit the maximum steady-state peak plate current to value shown Additional impedance may be required when a filter of more than 40 mfd. is used.

Half-Wave Rectifier—Condenser Input

Heater Voltage	50.0 Volts
A-C Plate Voltage	117 Volts Max.
D-C Output Current per Plate*	65 Ma. Max.
Peak Plate Current per Plate	400 Ma. Max.
Impedance per Plate	25 Ohms Min.

*With rectifier plate current through the panel lamp section of the heater shunted by a 2.9 volt, 0.170 ampere panel lamp, (Sylvania Panel Lamp S292 or S292A)

● ● ●

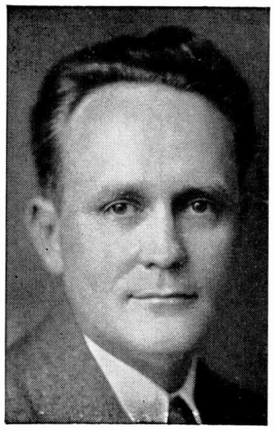
CERAMIC BASED TUBES

A group of tubes equipped with ceramic bases is now available in the Sylvania line. These tubes are identical in characteristics with standard types and the regular type number is shown with the letter "X" added. The only difference between these new tubes and the original tubes is in the type of base supplied. Types immediately available from your Sylvania Jobber are:

Type	Characteristics same as
6A6X	6A6
6J5GX	6J5G
6L6GX	6L6G
6V6GX	6V6G
210T	10

The type 210T shown above has been available in the Sylvania line for some time, but is shown above to complete the line.

A CHAT WITH ROGER WISE



Chief Tube Engineer
Hygrade Sylvania Corporation

As additional stations designed to transmit frequency modulated waves go into operation, more interest in receivers capable of reproducing such programs will develop. One question which the trade will ask is "Will additional types of tubes be required for F-M receivers?"

Fortunately, there is already a wide variety of receiving tube types, including those that have been developed for television service. These types should cover all F-M circuit requirements, at least for the immediate future. It is probable that one or more types now available but not widely used may be incorporated in these receivers. This, of course, will not greatly complicate the tube problem.

The first F-M receivers supplied on a commercial basis combine circuits for the reception of present standard broadcast programs with additional circuits for F-M reception, and utilize types of tubes already familiar and generally available.

One feature of frequency-modulation that has been stressed in early reports from experimenters is the quality of reception, particularly with regard to freedom from "man-made" and natural static, thus allowing a wider audio range with consequent increase in fidelity. Another reported improvement is the freedom from inter-station interference. Experimental evidence along this line will be tested as soon as additional F-M stations go into operation in adjacent locations.

While improvement in inter-station interference is important, the general public will be more interested in the novelty of almost complete freedom from static—the old bugbear of radio reception.

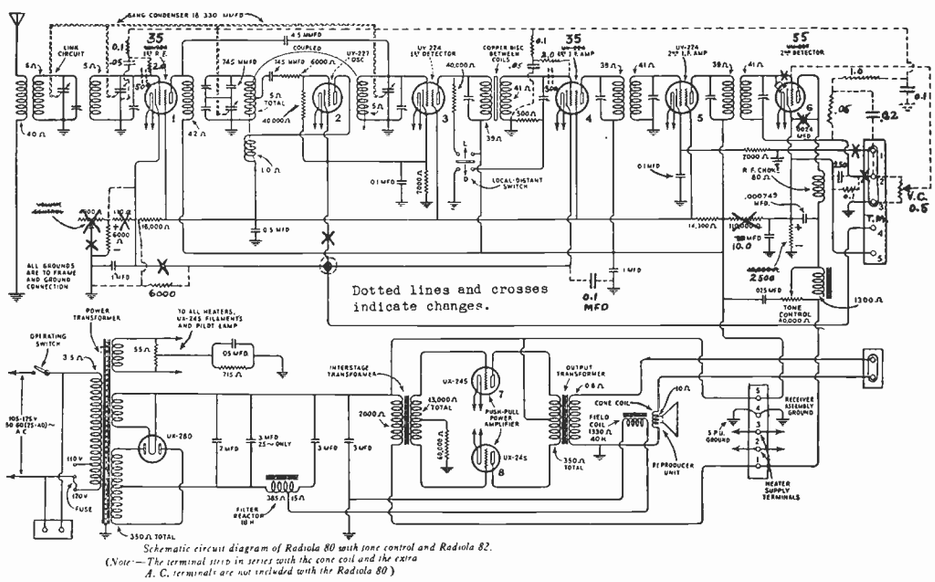
If frequency-modulation becomes available on anything like a nation wide basis, and is as desirable as early reports indicate, there is no doubt that the radio trade will experience an upturn in radio buying and listener interest. In fact, it may exceed anything that has happened since the early days of scheduled broadcasting.

MODERNIZATION CIRCUIT

Through an oversight the circuit diagram for the Radiola Model 80 modernization article, in the last Technical Section was not shown. In one way we are glad since it showed the reader interest in this type of article. Every day since the last issue was mailed requests have been received for the modernization circuit. To handle these numerous requests we are presenting the modernized circuit herewith. Below is given the correlation of various receiver models using identical chassis.

Radiola	Westinghouse	G.E.	Graybar
80	WR-5	H-31	GB-700
82	WR-6	H-51	GB-700
86	WR-7	H-71	GB-900

Anyone corresponding directly with Mr. Hodges, the author of the article, should note that his new address is 521 Oakdale Drive, Fort Wayne, Indiana.



Schematic circuit diagram of Radiola 80 with tone control and Radiola 82. (Note:—The terminal strip in series with the cone coil and the extra A. C. terminals are not included with the Radiola 80.)

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.

Breting Model 12A (Communications Receiver). In this set, the bypass condensers kept continually shorting, both old ones and the ones which were replaced. The trouble was finally remedied by drilling eight 1" holes in the bottom of the receiver for ventilation. It seems that the heat generated was melting the wax out of the condensers rather than intense voltage causing the condensers to break down. I have serviced two of these sets this way and have not had a complaint from them now for over a year.—Herman L. Hepp, Columbus, Ohio.

* * *

Delco 1936 Auto Radios. Loud intermittent hum can often be cured by soldering a piece of copper braid from the clamp holding the electrolytic condenser to the chassis. Rivets holding this clamp to the chassis often become loose, causing poor contact.—James Green, Duluth, Minn.

* * *

Emerson BW Model 231. After operating for a while this set often begins to hum at intervals becoming very annoying at times. The trouble is found in the terminal strip mounted on the back underside flap of the chassis which appears to be perfectly soldered but will often have a poor electrical connection. Resoldering will remedy the hum.—Leonard H. Johnson, South Boston, Va.

* * *

Ford Radios. 1939 Models: Oscillation between 550 Kc and 900 Kc on this model may be eliminated by shielding the grid lead that passes in front of the tuning condenser from the untuned transformer to the grid of the detector-oscillator tube.

1940 Models: When the dial slips, the only solution that I have found is to remove the tuning control completely, and wrap adhesive tape on the small shaft that turns the dial and consequently the tuning condenser. This is a tedious job and sounds simple, but must be handled with care so as not to break the fine wires in the push button tuning.—Leonard H. Johnson, South Boston, Va.

* * *

Grunow Model 1191, 1291. Crackling and frying in these models is usually traced to either the plate coil feeding from the 6K7 r-f tube, or the plate coil of the oscillator section of the 6A8. These coils are easily rewound by carefully unsoldering the leads after first making a diagram and then removing the defective plate winding and using a like amount of wire rewind in the same direction as the original. Realignment is necessary after rewinding any of the coils. The same symptoms sometimes are caused by a defective 47,000 ohm resistor connected from the B voltage to the screen or No. 2 grid of the 6A8. A dead set is usually caused by the .05 mf condenser in the plate return to B of the second i-f tube. This also burns up the little 2,000 ohm resistor connected to the condenser then to the B feed line.—Leo Zimmer, Canisteo, N. Y.

* * *

Knight Model B-10563. Static-like noise which mysteriously disappears when set is taken out of cabinet for inspection. The cause of the noise is due to the dial escutcheon rubbing against the innocent looking tinfoil inlaid paper dial on the chassis. To remedy, solder a piece of wire to the brass dial escutcheon in the cabinet, grounding the other end to the chassis. Louis Wiech, New Castle, Penna.

* * *

Kolster Models K20, 22, 27. Impossible to stop oscillation when new tubes are installed. Remove thick washer in detector condenser mounted on end of variable gang condenser and replace with thin mica washer so that capacity of condenser can be increased enough to stop oscillation.—Kenneth A. Trites, Melrose, Mass.

* * *

Marking Wrenches. Most of my wrenches all have the same kind of handles, making it necessary to dig around in the tools to get the wrench I want. To overcome this trouble I paint the wrenches different colors. I used red for the ¼ inch, blue for the 11/16 inch and white for the 5/16 inch size. All I have to do is glance into the tool box and get the right wrench the first time —Wayne Storch, Beecher, Ill.

* * *

More Bass Response. A great many of the smaller console type receivers and practically all of the table model receivers are seriously lacking in bass response. This defect may be remedied by the insertion of an LC resonant circuit in series with the B plus lead to the first audio frequency amplifier tube. Such a circuit consists simply of a 300 Henry iron core audio choke shunted with a fixed condenser of about 0.02 to 0.04 mfd. connected in series with the B plus lead between the power supply and the audio transformer or the coupling resistor whichever is used.

Practically all midget receivers employ very small capacity coupling condensers in the audio frequency circuits. Replacement of these condensers with a capacity of at least 0.1 mfd. will do wonders in improving the tone quality of these receivers.—Milburne O. Sharpe, Galveston, Texas.

* * *

Philco Model C-1708. If this radio loses volume, check the Skyway antenna for a short. Water enters this antenna easily and shorts both the antenna and the lead in.

When installing the speaker in this set the mounting studs may not enter the holes in the instrument panel. Take a self-tapping screw and screw into the hole until the self threading end of the speaker mounting stud will enter. D. H. Gordon, De Land, Fla.

* * *

RCA Victor Models R-11, R-21. All manners of ineffectual remedies have been prescribed for these receivers, particularly a-v-c cures. Still they keep bouncing back to the shop because of intermittents and internal noise. Whenever one of these receivers come in, I remove the entire filter block which houses the 14 filter and a-v-c by-pass condensers and replace same with individual capacitors. Advantage is taken of increasing the capacity of the original 2 and 4 mfd. filters to 8 mfd. each, for complete hum elimination.—Joseph E. Rose, The Bronx, New York

* * *

Silvertone Model 4500A. In this set the 1V rectifier tube frequently shorts causing the resistor in series between the transformer and plate of the tube to burn out The original resistor is a small wire wound unit In repairing I use a 100 ohm, 10 watt resistor in place of the original and replace the tube with a Sylvania type 1V These changes remedy future troubles inasmuch as the Sylvania tube is less apt to short out and if it does the resistor being of high wattage will not burn out —Walter F. Grogan, Scranton, Penna.

* * *

Super Skyrider Models SX-16, SX-17. These receivers are subject to a very objectionable amount of oscillator frequency drift while they are warming up. Replacement of the moulded bakelite cased fixed trimmer condensers which are connected across the oscillator coils with the new silver-mica type condensers of equivalent capacity will eliminate practically all drift. A further improvement is noted by replacement of the type 6J5G oscillator tube with a new Sylvania type 6J5GT tube.—Milburne O. Sharpe, Galveston, Texas.

* * *

Zenith Model 6D116. If this set lacks the pep that it needs for the particular location, try a 300 ohm bias resistor in place of the one used in the i-f stage.—Herman L. Hepp, Columbus, Ohio.

* * *

THE EFFECT OF HIGH VOLTAGE ON CAR RADIOS

To compensate for the heavy load placed on the electrical systems of automobiles by modern accessories, such as radios, heaters, and defrosters, car manufacturers in recent years have had to step up the charging capacity of their generators. This results not only in a higher charging rate, but also in higher voltage which the voltage regulator does not in all cases maintain at a constant value.

To be specific, automobile storage batteries are rated at slightly over 6 volts, but many cars have been checked wherein the output of the heavy duty generator is very nearly 9 volts, an increase of 50%.

Car radios being designed for 6 volt operation, take a lot of punishment when installed in cars which subject them to that terrific overload. For example, the average car radio of good performance and sensitivity will have an average maximum plate voltage of about 300 volts at the output of the rectifier. This value is normal for 6 volt operation. If the input is increased to 9 volts (50%) all voltages throughout the receiver will be increased in direct ratio. Therefore, at 9 volts input, the maximum plate voltage will go up to 450 volts.

Component parts which have a large margin of safety at 300 volts, have a very slim safety factor at 450 volts. It is therefore not surprising that tubes, vibrators, and condensers fail at frequent intervals. The wonder of it is that they stand up as well as they do.

A good radio man would never think of plugging a 115 volt home radio into an AC line that delivers 170 volts, yet that is an exact comparison of what happens when a car radio is operated at 9 volts.

The answer to this problem is **not** to design the car set to operate on the higher voltage. That might be a solution if **all** cars delivered 9 volts at the ammeter with the motor running; but they do not, since some have better voltage regulation than others. If a receiver, designed to operate on 9 volts, were operated instead on 6 volts, the sensitivity would be so poor that it "wouldn't get out of town."

The real solution lies in the installation. A good installation man will actually measure the voltage obtainable at the ammeter or the ignition switch, where the radio is usually connected, and if he finds it to be excessive when the generator is charging, he will extend the "A" lead and make the connection direct to the storage battery terminal or to the starter switch, for at neither of these points will the full charging force be felt and the maximum voltage will never greatly exceed the rated voltage of the battery. Standard "A" lead extensions are available at a small cost.

Remember—All cars do not require this treatment. Some of them have good voltage regulation. The "A" lead extension, however, is a real solution for the fellow who has to come back every two or three weeks with burned out tubes or vibrator.—Motorola Service Department.

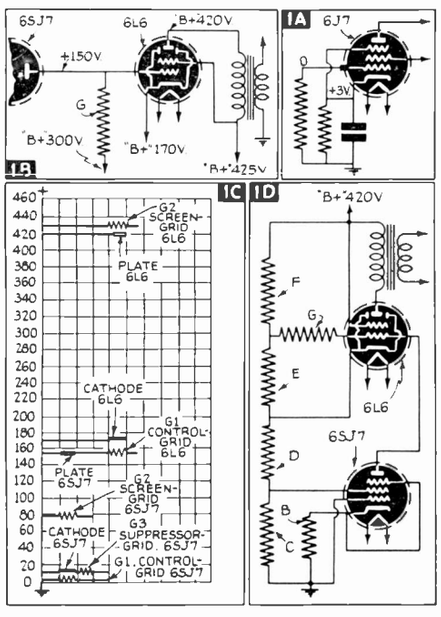
PUSH-PULL DIRECT-COUPLED AMPLIFIER

For many years the advantages of a direct-coupled amplifier have been known, but until recently these advantages could not be realized without the use of a complicated circuit arrangement. The following article, by Mr. A. C. Shaney, Amplifier Company of America, 37 West 20th Street New York City, describes a unique direct-coupled 10-watt amplifier. Additional data required may be obtained by referring directly to Mr. Shaney.

The usual objection to direct-coupled amplifiers are:—1 Tricky circuits, 2 Instability, 3 High voltages required, 4 Critical hum balancing. 5 Variation of characteristics in similar types of tubes affect voltage distribution within the amplifier. All of these objections have been eliminated in this amplifier design. These problems have been solved as outlined throughout this article.

Fundamental Direct-Coupled Circuit

To really understand the operation of a direct-coupled amplifier, it is necessary to realize that its basic principle depends upon the direct connection of the plate of an input tube to the grid of an output tube. Both of these elements have the same applied potential, but suitable corrections are applied to the output tube so that the effective bias and plate voltages are in conformance with standard ratings. To understand this condition, let us analyze a conventional bias circuit (as shown in Fig. 1A) in a 6J7 pentode



tube. For a bias of −3 volts, a resistor is usually inserted in series with the cathode circuit, so that a positive potential is developed at the cathode. In actuality, there is a zero potential at the grid (as measured from ground), and a plus 3 volts from ground to cathode.

We say that a bias of −3 volts is applied to the grid. However, if an analysis of this circuit is made, the following conditions are apparent:

If we look into the tube from the cathode to the grid, we "look down 3 volts," so that the voltage distribution within the tube is of such a nature, that it may be construed as −3 volts on the grid (as compared with the cathode). If, however, we look into the tube from the grid to the cathode, it may be construed as +3 volts on the cathode (as compared with the grid). This might appear to be a tricky circuit to one who is unfamiliar with this type of biasing. The average radio man, however, takes this circuit for granted, and probably gives it no thought.

In the same way, voltages are distributed within a direct-coupled circuit (as illustrated in Fig. 1B). It will be noted that 150 volts is applied to both the plate of the input tube, as well as to the grid of the output tube, but 170 volts is applied to the cathode of the output tube so that the effective bias (looking from cathode down to the grid) is 20 volts. Although the plate potential is 420 volts (from ground) its effective potential is only (420 − 170) 250 volts, as measured from cathode to plate.

Initial Design Considerations

The first step in the design of the Direct-Coupled Amplifier, is to determine (a) power output required, (b) highest voltages desired in the filter supply, and (c) the necessary gain. Let us assume that our specifications call for the following conditions:

Power Output: 10 watts with less than 2% total harmonic distortion, Filter Supply Voltage: Not to exceed 450 volts (to avoid excessively high voltages, and assure adequate safety factor of any filter design: High Gain Input: 90 db. (to operate in conjunction with medium-level microphones):

Medium Gain Input: 70 db. (for crystal pickup or radio set).

A cursory examination of available tubes would lead us to select two 6L7's for the output stage, operating with 250 volts on the plate and screen which according to ratings, will develop approximately 14 watts at 2%.

Allowing for a 5-volt drop in the filter choke, a 5-volt drop in the output transformer, plus a 250-volt drop in the output tube, and an additional 20-volt bias drop to grid, there is available approximately 150 volts for the plate of the input tube. A 6SJ7, operating as a pentode with approximately 150 volts on the plate and 75 volts on the screen, will satisfy our conditions for gain.

For medium gain, an additional attenuator is placed in the output circuit to drop the input signal 20 db., so that a crystal pickup can be easily accommodated.

If we list the tubes and their corresponding applied potentials, we have the essence of our Direct-Coupled Amplifier.

Electrode	6SJ7	Operating Conditions for 6L6 (or 6L6G)
Plate Volts (Ep)	150	250
Control-Grid (Ec1)	−3	−16
Screen-Grid (Ec2)	75	255*
Suppressor-Grid (Ec3)	0	...
Av. Plate Current (Ib)	1.5 Ma.	65 Ma.
Screen-Grid Current (Ic2)	0.5 Ma.	6.5 Ma.

(*We anticipate a 5-volt drop in the output transformer, so that the screen potential will actually be 5 volts higher than its plate. This normal condition does not affect the performance of the amplifier in any manner.)

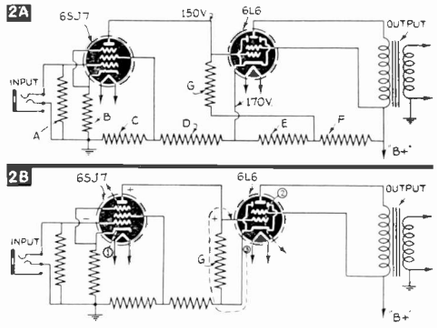
Although we will finally develop a push-pull amplifier, the element potentials are the same as a single-ended job, in accordance with the voltages listed above.

Figure 1C shows a graphic voltage distribution of the amplifier. The ordinates are plotted at the right of the various elements which have been arranged in order of their applied potentials, in accordance with the above tabulation. Here, too, it will be graphically noted, that although approximately 150 volts are applied to the plate of the 6SJ7 **(and to the control-grid of the 6L6),** a negative bias is applied to this grid by making the cathode approximately 20 volts higher (at 170 volts from ground). All other element potentials are likewise distributed. Figure 1D shows the fundamental circuit arrangement to obtain the potential distribution plotted in Figure 1C. Each resistor used, has been identified so as to make it easy to follow its position during the step-by-step development of the amplifier. If Fig. 1D is redrawn to conform with standard circuit design, Fig. 2A results.

It will be noted, that resistors E and F are used across high "B+" and cathode of the 6L6 to obtain the plate potential for the 6SJ7's. This simple expedient avoids objectionable "trigger action," which was predominant in early direct-coupled amplifier designs. Inasmuch as the grid potential of the 6L6 is lower than the cathode potential, the original designers were tempted to obtain this voltage directly from the cathode, as illustrated in Fig. 2B. This circuit is greatly susceptible to "trigger action," because of the following sequence of events:

(1) When an instantaneous negative potential appears on the grid of the input tube, less plate current flows, and a smaller voltage drop takes place in the plate resistor G, so that the plate potential of the 6SJ7 tends to rise. Naturally, the grid potential of the 6L6 also rises, which in turn, decreases the effective bias of the output tube, and (2) increases its plate current, so that higher potential appears at the cathode, (3) which in turn raises the potential (through resistor G) on the output grid.

This cycle of events continues until plate current becomes excessive and the tube is thrown off its Eg-Ip curve, and maintains itself in a blocked position. This effect is popularly known as "trigger action." By employing resistors E and F (Fig. 2A), the plate potential of the input tube is independent of the plate current of the output tube.



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