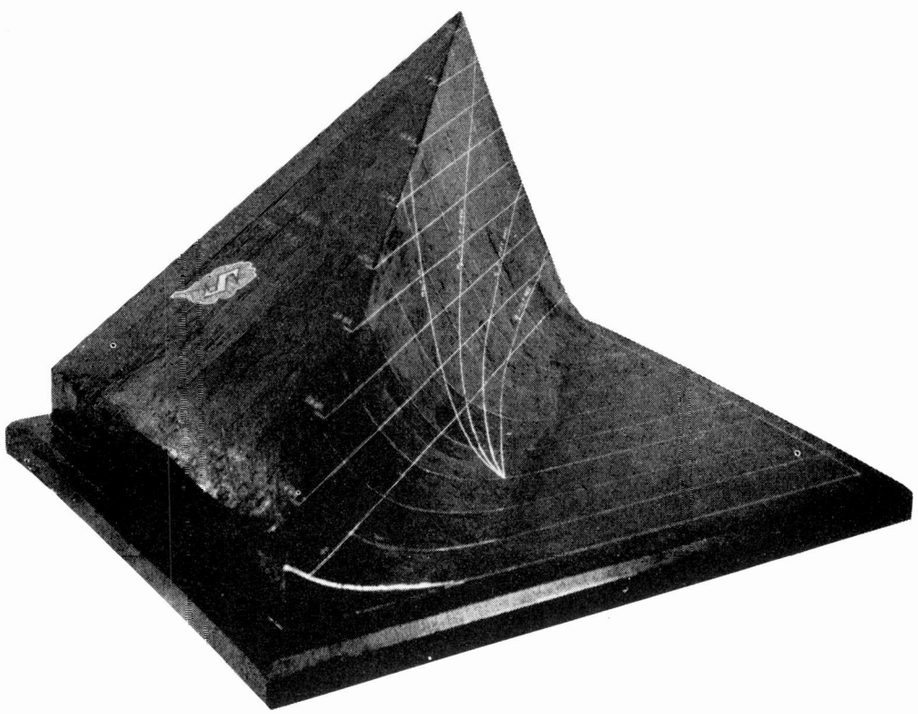
SYLVANIA NEWS

TECHNICAL SECTION

Vol. 6 EMPORIUM, PENNA. Jan 1936 No. 2

NO IT'S NOT GIBRALTAR



This mountainous-looking object is a three dimensional graph exhibited at the Rochester Fall meeting of the Institute of Radio Engineers. The graph or "solid curve" of type 6F5 characteristics attracted considerable interest. The graph was constructed by the Sylvania Tube Application Department in connection with studies on distortion. The three dimensional portrayal makes available much information on the operating characteristics of a tube more readily than with the conventional two dimensional graph. In fact, as it can be viewed from all directions, data which are not generally used becomes apparent and usable. So great is the advantage of such a solid in investigations involving adaptation of tubes to circuits that it is contemplated that more of them will be constructed as new types of tubes require study.

The three dimensional graph is not new to educational institutions but its application to practical engineering has not been as extensive as its usefulness merits.

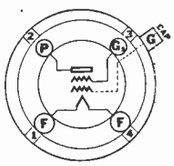
Greetings:

Best wishes for 1936 to our friends the service men, and many thanks for your help and interest in 1935.

The Editors,
J. M. DeVoe
R. S. Merkle

NEW TUBES

TYPE 1B4 TETRODE AMPLIFIER



Sylvania type 1B4 is a screen grid tube suitable for use as a radio-frequency amplifier, detector, and audio-frequency amplifier. Its chief use will be found as a radio-frequency amplifier and detector. Type 1B4 is similar to type 32, but is enclosed in a smaller bulb, ST-12 size. The circuit applications will therefore be substantially the same as those for type 32. Type 1B4 will find wide acceptance in the renewal tube business since it will directly replace type 951, which heretofore has been difficult to replace because of limited space in the receivers using that type.

TENTATIVE CHARACTERISTICS

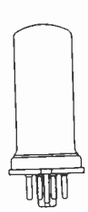
Filament Voltage	2.0 Volts
Filament Current	0.06 Ampere
Maximum Overall Length	4-17/32 inches
Maximum Diameter	1-9/16 inches
Bulb	ST-12C
Base	Medium 4 pin

DIRECT INTERELECTRODE Capacitances

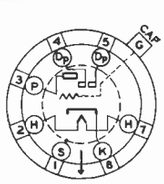
Grid to plate (Max.)	0.01 uuf
Input	4.6 uuf
Output	11.0 uuf

OPERATING CONDITIONS

Filament Voltage	2.0 Volts
Plate Voltage	180 Volts
Grid Voltage	−3 Volts
Screen Voltage	67.5 Volts
Plate Current	1.7 Ma.
Screen Current	0.4 Ma.
Plate Resistance	1 Megohm
Mutual Conductance	650 Micromhos
Amplification Factor	650
Grid Voltage for Plate Current Cut-off (Approx.)	−8 Volts



TYPE 6Q7 DOUBLE DIODE TRIODE



A new Sylvania metal tube, type 6Q7, has been developed in the Sylvania Laboratories and is now made available. The new tube embodies two diode units and a triode unit, being similar in design and characteristics to type 75 of the glass group. Type 6Q7 is the first metal tube of duplex design and makes available a tube offering greater circuit advantages to the metal tube group.

TENTATIVE CHARACTERISTICS

Heater Voltage AC or DC	6.3 Volts
Heater Current	0.3 Ampere
Maximum Overall Length	3-1/8 Inches
Maximum Diameter	1-5/16 Inches
Bulb	Metal
Base	7 Pin Octal Typ

Continued on Next Page

NEW TUBES

Type 6Q7—Continued

OPERATING CONDITIONS

(Triode Section)

Heater Voltage	6.3	6.3 Volts
Plate Voltage	100	250 Volts
*Grid Voltage	−1.5	−3 Volts
*Plate Current	0.35	1.1 Ma.
Plate Resistance	88000	58000 Ohms
Mutual Conductance	800	1200 umhos
Amplification Factor	70	70

*—These are rating values only and not operating points with coupling resistor. See "Circuit Application."

CIRCUIT APPLICATION

The diodes in this tube are substantially the same as those used in the Types 75 and 6B7 and can therefore be used in similar circuit applications. The triode section has a somewhat lower amplification factor than does the triode unit of Type 75. This lower value was chosen to enable the use of a larger signal input both at the 250 volt and 100 volt operating conditions before the grid swing reaches the grid current region. This same feature also renders the value of grid bias less critical than with a tube of higher amplification factor.

The triode section operated with a plate supply voltage of 250 volts and a plate load resistor of 100,000 to 250,000 ohms should have a negative grid bias of approximately 2.5 volts. When the triode is operated on a plate supply of 100 volts with a plate load resistor of 50,000 to 100,000 ohms, the negative grid bias should be of the order of 1.4 volts. For special applications these values may be varied to suit the conditions.

A CHAT WITH ROGER WISE

Chief Tube Engineer
Hygrade Sylvania Corporation

Now that type 6Q7, a double diode-triode of the high mu type, has been made available in the metal tube line, metal tubes are on a more evenly competitive basis with glass tubes than was previously the case. It was formerly necessary to use two metal tubes, a type 6H6 and a type 6F5, to secure performance equivalent to that given by one glass tube, type 75. This is no longer necessary, as type 6Q7 is the metal tube equivalent of type 75.

The amplification factor selected for the 6Q7 is 70, rather than 100, resulting in a more open characteristic, and is less critical as regards grid bias. The selection of the 6Q7 operating characteristics was made after careful studies in our laboratories on double diode-triode applications. The characteristics picked were those which assure more satisfactory operation with regard to distortion, biasing action and wider tolerances of circuit constants. The ability of the tube to handle greater signal voltages is an outstanding advantage over previous double diode-triode tubes.

The introduction of this new duplex tube indicates the progress being made in the metal tube line to make the metal group more complete for set manufacturers.

Continued progress with glass tubes is also being made as is evidenced by the introduction of a new 2 volt battery operated tetrode, type 1B4. This new tube is of sharp cut-off design and is a companion tube to type 1A4. The bulb size is smaller than that of other battery operated tetrodes and is in keeping with the trend toward the reduction of bulb sizes wherever it is feasible.

YOUR QUESTIONS ANSWERED

QUESTION 1.—We are building an amplifier using two Type 76 tubes to drive two Type 43 tubes in Class A triode operation. Will you please advise us the proper bias for the 43's, the load resistance, and the resulting output as well as the harmonic content when operated on 115 volts d-c?

ANSWER—By operating a pair of 43 tubes as triodes in Class A prime service with a plate voltage of 100 volts and a grid bias of 15 volts, a power output of 3.25 watts is obtainable. The plate to plate load should be 2,000 ohms. Under such operating conditions the distortion will be 9.7 percent.

Question 2.—In the Sylvania Metal Tube Manual I notice that Type 6D5 has been omitted. Isn't this type similar to Type 6C5 and is there any comparable Sylvania tube? Also, what are Types 6P7, 25Z5MG and 43MG, and are there any Sylvania tubes that can be used to replace them?

Answer—The Type 6D5 metal output triode was originally announced with the metal tube group but was withdrawn, making the group consist of nine types instead of ten types. The characteristics and operating conditions were similar to those for Type 45 of the glass group. Therefore, the characteristics of Type 6C5 are not similar since Type 6C5 characteristics are similar to Type 76 of the glass group

Type 6P7 is an octal type tube being similar in characteristics and applications to Type 6F7 of the glass group. There is no Sylvania tube available for replacement purposes. Types 25Z5MG and 43MG are the same as Types 25Z5 and 43, respectively, except that they belong to the metal-glass group, having octal type bases. At the present time there are no Sylvania tubes available for replacement service.

Question 3.—Can you supply me with complete technical information for metal tubes? Is it practical to replace glass tubes with the new metal types?

Answer—Complete technical information is available through the Metal Tube Technical Manual Supplement, which is given free upon request for such information Base views and average characteristics are also shown on our base charts and characteristics sheets.

It is recommended that no changes be made in glass tube receivers so that metal tubes might be incorporated. To make a change-over of this kind it would be necessary to replace all of the sockets and incorporate several other changes which would make the job quite costly. Considering these points, any such change-over would not be justified for any benefits received.

Question 4.—Will you please answer the following in your Question and Answer column of Sylvania News?

1.—What makes the mercury vapor in a Type 82 rectifier burn unevenly, i.e. on one side of the bulb?
2.—Will a Type 83V tube replace a Type 80?
3.—Do you recommend the use of adapters to change from one type of tube to another; for instance, the changing of a Type 45 to a Type 47, et cetera?

Answer—The mercury vapor in a Type 82 tube may be more noticeable on one side of the bulb than on the other, possibly due to the interior coating of the glass, or it is possible that the emission current of one filament leg is somewhat higher than the other filament leg, or that the vapor in the tube has shifted to one side of that tube. In most cases it is not indicative of a defective tube.

The 83V tube may be used to replace a Type 80 if the filtering system, such as condensers, chokes, resistors, etc.,' will stand an increase in voltage of approximately 25 to 60 volts. The 83V does have the feature of not delivering current until the cathode is completely heated, therefore, the surge voltage developed by the 80 heating before the other tubes is not so noticeable when using an 83V. If you want to use an 83V, we recommend that you first determine whether or not the filtering system will stand the increase in voltage.

In most cases an adapter can be used to change from one type of tube to another. The adapters produced by different manufacturers for this purpose are usually satisfactory and do not cause any erratic operation of the receiver. In a great many cases, the improvement is not great enough to warrant the change-over, but this must be determined by actually trying the adapters. If you have the time, and it is possible for you to change over sockets, we recommend this rather than the use of adapters.

Question 5.—Can you suggest some simple test which will enable service men to determine whether an output tube is provided with the proper load resistance or impedance?

Answer—The most satisfactory way of determining whether an output tube is provided with proper load resistance or impedance is to connect a load of the rated value across the primary of the output transformer with a meter, which will read the power output, connected in the voice coil. When the load is shunted across the primary of the transformer, the power read in the secondary support should drop to one-fourth its original value. This is the most simple way of determining proper loads.

No More Rider Manuals After December 30

Mr. John F. Rider has announced that on and after January 1, 1936, he will discontinue selling Rider Manuals except through his regular jobbers. Therefore, to our regret, we will be unable to supply these valuable manuals after that date. We feel sure, however, that every one will be in sympathy with Mr. Rider's desire to put his business on a basis that will eliminate any possible cutting of prices.

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, except the metal types. Please indicate preference when submitting hints. Don't send routine or generally known information.

AC Dayton Navigator. This radio was found to have good selectivity but no volume. After working on it for some time the trouble was found. It seems that the set was designed for Speed 27 tubes which were very high MU tubes. When the original tubes were replaced ordinary 27 tubes were used. The poor sensitivity was cured by replacing the 27 tubes with type 56 tubes, after which the set worked as good as new.—Eugene Kingrey, Kingrey Radio Service Co., Dayton, Ohio.

Airline Models 62-77, 62-99. These receivers will operate for a short time, then stop, but can be brought back by snapping the switch several times. When this occurs replace the type 32 Oscillator and first Detector tube with a new Sylvania type 32.—Daniels Brothers, Everett, Pa.

Airline Super Series 7D. This set uses the Wells-Gardner Series 7D Chassis. If the two section candohm 41,000 ohm wire wound resistor insists on burning out, replace the 25,000 ohm section with a 1 watt 25,000 resistor, and the 16,000 ohm section should be replaced with a 16,000 ohm 2 watt resistor. (The reader will please note that we emphasize the use of the best resistors for replacement. This is in conjunction with our policy of using only high quality material, and which accounts for our using Sylvnia tubes exclusively). If a 16,000 ohm 2 watt unit is not available, use one 25,000 ohm, and one 50,000 ohm 1 watt resistors in parallel. The result will be a 2 w resistor with a total resistance of 16,666 ohms. This will answer the purpose nicely. The original unit does not stand up in this model and the above change is recommended by the manufacturer. Credit for some of the above information is hereby given to Rider's "Successful Servicing", Sept. 1935, Page 6.—Joseph S. Napora. Uniontown. Pa.

American Bosch Model 242. If the set is noisy or goes dead when the chassis is jarred, examine the leads and lugs inside the i-f transformer cans for shorts to the cans. The leads in these cans are bare wire. All that is necessary is to bend them in.—Raymond Biedenbach Rochester, N. Y.

Clarion AC-40. Oscillation in this set can be eliminated by placing a .002 MFD condenser from one side of power line to the chassis of the Receiver.—Clifton Nix, Jackson, Miss.

Crosley Models 57, 58. When this Crosley comes in with the primary of the second or third r-f coil burnt out, a temporary repair may be made without putting in a new coil by wiring in across the primary terminals a choke of 16 M. H. or larger. This type of repair has proven satisfactory in every job I have tried it on.—Albert Rosenstein, Savannah, Ga.

Crosley Model 148. I have found that it is advisable to replace the condenser installed beween the a-c lead and ground with a .004 Mfd. unit. Interference is less with a condenser of this value. The condenser between the first r-f transformer and ground is also a common cause of trouble although it often tests okey.—Howard W. Melvin, Audubon, New Jersey.

DeWald Model 61 Auto Radio. If the set has a very bad tone accompanied by a loud vibrator noise, look for a short between the cathode lug of the 41 socket and the positive filament lug of the 37 socket. These lugs are barely an eighth of an inch apart and easily become shorted by a piece of solder or some other piece of metal in the chassis.—Raymond Biedenbach, Rochester, N. Y.

Earl Model 32. All tubes and voltages test O. K., but the signals are weak. Removing one of the r-f tubes makes no change in the volume. The trouble is found in one or more of the r-f coupling condensers, which is leaky due to the mica being cracked or the condenser collecting dust and moisture.—Daniels Brothers, Everett, Penna.

Ford Motor Noise 1935 Models. When all else fails, try grounding the hood. Scrape the paint off the underside of the hood where it fits on the cloth bead on the dash. Wrap bare copper aerial wire around the bead and ground at each speed screw that fastens the bead to the dash. The hood will then make contact on the bare wire, thus very effectively grounding the hood. This tip will work on any installation. —R. L. Kerley, Houston, Texas.

Frost Volume Controls. When Frost carbon volume controls of the type with the double roller contact become noisy they can be made to work like new by simply adding a washer or two. The roller wears two paths along the resistance strip. By removing the contact arm and placing a washer or two on the shaft and reassembling, the roller will make contact with the unused part of the strip.—E. E. Youngkin, Altoona, Penna.

G. E. Model K62. Prevent fading on these sets by using a power rheostat or by rewinding an old ballast from a Majestic 70 connecting it in series with the primary of the power transformer to reduce the voltage from 120 to 115 volts. Brooklyn supply voltage is usually 120 volts and this set operates best on 115 volts. —M. J. Ratigan, Brooklyn, N. Y.

Interference From Heaters. At this time of year complaints may be received that interference has developed in an auto radio installation. It is suggested that you look at the hot water heater installation. Persons making this installation often place rubber washers under the metal washers, thereby insulating the heater. Bond both heater pipes to assure a noise free job.—A. M. Sletting, Colfax, N. Dak.

Kennedy Model 63-A. Pilot light burns dim when switch is off. Look for shorted condenser from one side of switch to ground. This is a .01 condenser and if one of an increased value is used an improvement will be noticed if you are troubled with noisy reception coming from electrical interference.—Tim W. Shaw, Vernon, Texas

Majestic 15. For continuous crackling and popping noises with signals intermittent, look for corrosion in the i.f. primary coil which is located inside the oscillator coil assembly. Remedy: replace with a new i.f. transformer.—Earle Wohler, Sebastopol, Calif.

Majestic Model 15. If the set is dead and all voltages and tubes test O. K., change the 10,000 ohm bias resistor in the detector-oscillator cathode circuit to 5,000 ohms.—Raymond Biedenbach, Rochester, N. Y.

WANTED

Service hints on automatic phonograph and other coin operated instruments, covering both mechanical and electrical defects. There is a growing field of profit in the servicing of such machines, and not much information of a practical nature. Pass along your experiences and help your brother service men to cash in on this type of service work. Your choice of one Sylvania receiving tube, including metal tubes, for each hint accepted.

Majestic Model 50. To replace the dial bulb in this receiver much time can be saved by the following method: Remove the dial escutcheon, held by four small nails. Turn tuning dial to 1500 K.C. Remove end screw that holds dial strip. Raise dial strip and bulb is readily accessible. This eliminates removal of two knobs, screws, and bolts and can be done in ten minutes.—B. H. Sparks, Loveland, Ohio.

Philco Model 90 with One 47. This set often does not work properly after being aligned. Strong stations come in extremely weak and far from their correct dial settings. Although the Philco instructions give the i-f of this set as 260 K.C. some were built to align at 175 K.C. The i-f's will align at either frequency but the gang condenser will not. Realign at 175 K.C. and the set works fine.—Tom J. Davis, Cave Spring, Ga.

Soldering Resistance Wire. I realize that one can get solder for this purpose but it isn't always in stock.

I take a small piece of copper wire and tightly twist it around one end of the resistance wire, then solder the copper wire to the proper place. By allowing a little more solder on this connection than usual, you have a very good connection which I believe to be far superior to an eyeletted connection and it won't come loose and cause noise in the radio.

I've used connections like this on resistance wires carrying as high as 420 watts of current.—Wilbert L. Misner, Vintondale, Pa.

Stewart Warner R116-X. If oscillator in set refuses to function change oscillator plate resistor (21,000 ohms) to 20,000 ohms and replace .1 mfd condenser by passing this resistor. —Clifton Nix, Jackson, Miss.

Stewart-Warner R-131 Chassis Models 1311 to 1319, Truton Western Auto 743. If the set does not bring in anything from 550 to 720 KC replace 77 Detector and Oscillator tube. If noisy do the same thing. On the early models this will not always work, unless you change the suppressor grid resistor No. 38 to 8000 ohms instead of 10,000 ohms.—Geo. W. Leffler, Jr., Buffalo, N. Y.

Wells Gardner Model 052. This particular model is often found inoperative with screen voltage and cathode voltage high. This is all caused by the two 40,000 ohm resistors changing values. These two resistors are in the same can with the i.f. transformers, and are mounted on the terminal strip in same. Replace both resistors and volume control if necessary, and set is O.K.—C. De Wall Radio Service, San Antonio, Texas.

Zaney Gill Receivers. Oscillation over most of the dial even when the circuit and tubes are OK. The trouble is found in the by-pass condenser returns which are made to the rivets holding the wafer sockets. Soldering these rivets to the chassis will cure the trouble.—Daniels Brothers, Everett, Pa.

Philco 20. Set was dead to all but a high-powered local, and that one was barely audible. A peculiar symptom was that it would come in only when the VC was in the half-on position and vanish when advanced to full on. There was no noise and the quality of the tone was good in spite of the faintness. Suspicion pointed to the VC, but it proved O. K. as did everything else except the blocking condenser between the 24 detector and the 27 first audio. Replacing this condenser, numbered 3903-F, cured the trouble.—B. E. Wenstrom, Harmon Avenue, Ashtabula, Ohio.

SYLVANIA BALLAST TUBE DATA

Ballast tubes may be grouped into two major divisions based upon differences in construction and regulating characteristics. One type is employed mainly in battery operated receivers to maintain substantially constant current over a considerable range of battery voltage variation. The second type is used in AC-DC receivers and 32 volt sets where the voltage drop required may cover a wide range. Such a ballast tube affords some amount of regulation, but the characteristic is not as flat as for regulators intended for use in battery receivers.

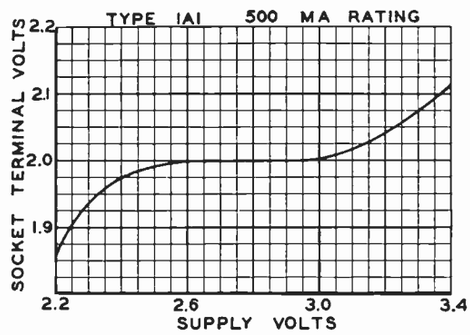
Characteristic curves on the battery group of Sylvania ballast tubes are shown below. The group used in AC-DC receivers will be shown in the next issue of Sylvania News.

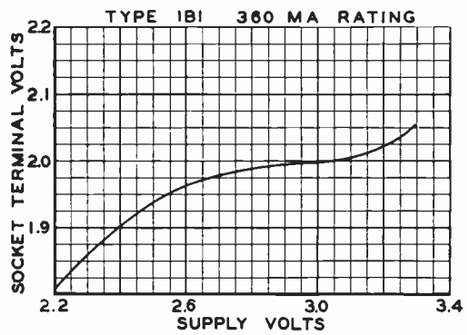
The tubes for use in battery sets include Types 1A1, 1B1, 1C1, 1D1, 1E1, 1G1, 1J1 and 6. The tubes are designed to permit the operation of 2 volt receiving tubes from a 3-volt battery source which may consist of two banks of dry cells in parallel, the banks being connected in series. The supply voltage varies from about 3.4 volts to 2.2 volts during the life of the batteries. For this range of supply voltage the types listed above will maintain the socket terminal voltage between 1.8 and 2.2 volts. During the major part of battery life the socket voltage remains very close to the rated value of 2.0 volts.

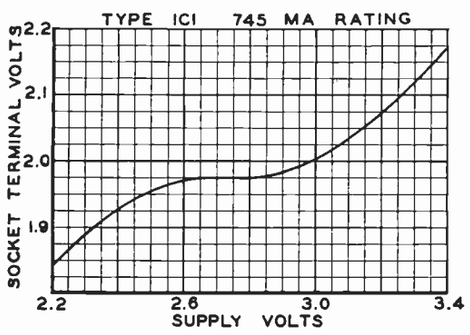
To determine the correct filament current load in series with the ballast tube it is necessary to include the total filament current drain of the receiver tubes plus the current drain of the dial light if the latter is employed. For example, a set using a Type 19, a Type 30, and 3 Type 34 tubes has a normal filament current drain of 500 milliamperes. The correct ballast tube would be a Type 1A1.

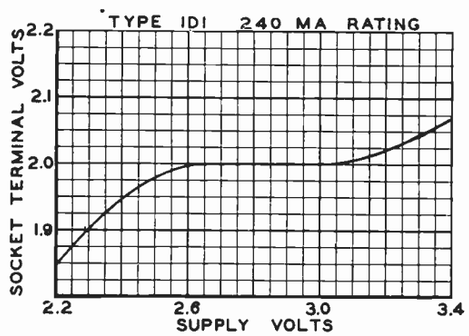
The accompanying summary table furnishes data on bulbs, bases and service. It will be noted that all types except the 46A1 and 46B1 have the 4-pin base. In every instance the base connections are the same. Pins other than the standard filament or heater pins are not connected. All bulbs are "inside frosted" and are either ST-12 or ST-16 size.

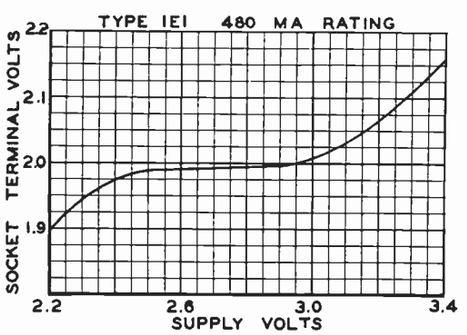
TYPE	BASE	BULB	MA. LOAD CURRENT	SERVICE
1A1	Sm. 4 pin	ST-12	500	Battery
1B1	Sm. 4 pin	ST-12	360	Battery
1C1	Sm. 4 pin	ST-12	745	Battery
1D1	Sm. 4 pin	ST-12	240	Battery
1E1	Sm. 4 pin	ST-12	480	Battery
1G1	Sm. 4 pin	ST-12	420	Battery
1J1	Sm. 4 pin	ST-12	620	Battery
6	Sm. 4 pin	ST-12	695	Battery

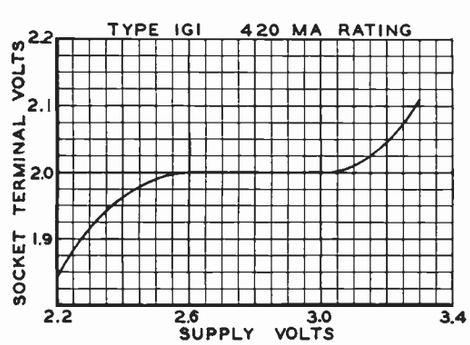


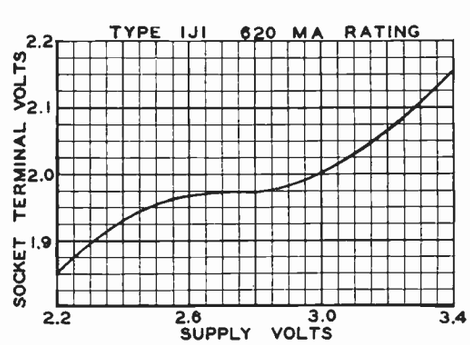


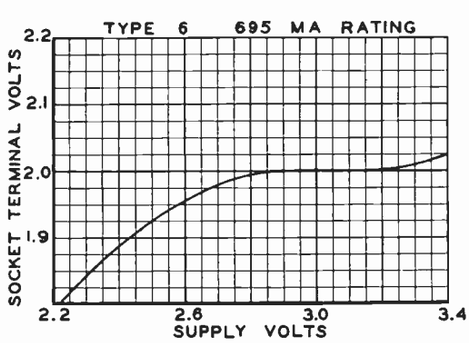












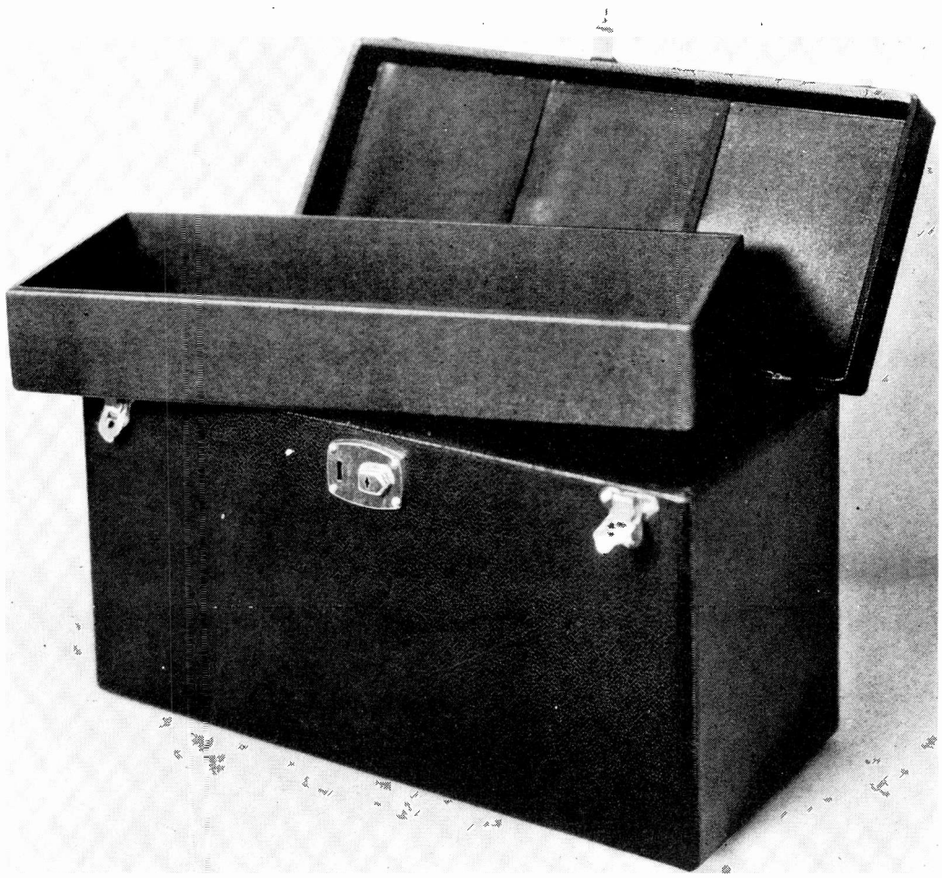
PRACTICAL BOOK FOR SERVICE MEN

As up-to-the-minute as a book on the ever-changing radio service business could be, Ghirardi's "Modern Radio Servicing" and the supplementary "Radio Field Service Data and Answer Book" by Ghirardi and Freed look like a boon to the radio service man who wants to keep up with radio's advance. Featured are complete descriptions and illustrations of 1935 testing equipment, including use of the cathode-ray oscillograph; service hints on over 750 models of receivers; data on location and elimination of electrical interference; intermediate frequency tables for 2790 models of superhets; explanation of all forms of AVC and QAVC circuits and special problems; sales and merchandising suggestions for better service profits; questions and answers, tables, numerical calculations, photographs and diagrams. Written in clear and simple language. Price $5.00 for both, if ordered together, or $4.00 for "Modern Radio Servicing", $1.50 for the Field Service book. Order from your jobber, or write Radio and Technical Publishing Co., 45 Astor Place, New York.

SYLVANIA NEWS

TECHNICAL SECTION

Vol 6 EMPORIUM, PENNA. No. 3



A CASE FOR THE SERVICEMAN

Above is pictured the Sylvania Service Kit, a piece of equipment that has been popular with Sylvania servicemen for several years. We are showing it because we feel that many servicemen who have joined the ranks since it was introduced do not know about it, and would find it very useful.

In the bottom compartment is ample space for 20 tubes, coils of wire, etc. The removable tray is handy for small parts and tubes, and the elastic straps under the cover will hold sales literature, bill heads, service data, charts, etc. The Kit is 17 inches long, 7 inches wide, 10 inches deep, ruggedly constructed, covered with durable black leatherette, and provided with lock and key.

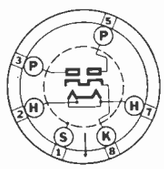
The Kit has many uses, as some of our servicemen have discovered. Wives have been known to "borrow" it to carry the baby's bottles and whatchucallems; but the oddest story comes from H. M. Carpenter, of Thurow Radio Distributors, Tampa, Florida. While visiting New York he was standing on the subway platform when a well-dressed lady came along carrying what he immediately recognized as a Sylvania Service Kit. She calmly set it down, opened it, and out jumped a tiny bull dog. After an important visit to the nearest pillar, he came back, jumped into the case, and with an air of great satisfaction the lady closed it, picked it up, and boarded the next train.

We don't recommend the Kit for any of these nonprofessional purposes, but we do recommend it to the serviceman who likes to look neat and professional, and who wants a convenient, easy-to-carry case in which his tools, radio tubes, manuals and spare parts can be kept together and easily accessible when on a service call.

Order the Sylvania Service Kit through your Sylvania jobber. The price is $3.00, which is below the actual cost from the manufacturer.

New Metal Tubes

TYPE 6X5
Full-Wave Rectifier



Type 6X5 is a metal tube designed for use as a rectifier for auto-radio receivers or for a-c operated receivers where the demand for rectified current is low. It is similar to the Type 84 and therefore usable in similar applications.

Tentative Characteristics

Heater Voltage (AC or DC)...	6.3	Volts
Heater Current.....	0.6	Ampere
AC Voltage Per Plate (RMS)...	350	Volts Max.
DC Output Current.....	75	Milliamperes Max.
Peak Inverse Voltage.....	1250	Volts
Peak Plate Current Per Plate...	375	Milliamperes Max.
Voltage between heater & cathode	400	Volts DC Max.
Operating Conditions: Condenser or Choke-Input to Filter		

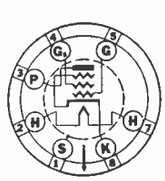
Circuit Application

In order to obtain satisfactory output and regulation from this tube, careful consideration should be given to proper filtering. Filter circuits of the condenser-input or the choke-input type are applicable.

The d-c output will be considerably greater with a condenser input filter than when the other type is used. Also, it will be true that higher peak plate currents will be encountered. The first condenser in the filter circuit, therefore, should not be too large in capacitance. It is not likely that the a-c input voltage will be a pure sine wave form so that the instantaneous peak values may be considerably greater than 1.4 times the r-m-s value. The voltage ratings of the condensers must be such as to handle the maximum peak values encountered.

When used with a vibrator and transformer combination as a source of AC, considerable care must be taken in the transformer design, as well as the filter design, to avoid exceeding any of the maximum ratings.

TYPE 25A6
OUTPUT PENTODE



Type 25A6 output pentode tube is the metal tube equivalent of the Type 43 and it can be used in the same circuit applications.

This new tube may be operated either singly or in push-pull Claass A circuits, in which case no power is required from the driver stage. Any tube which will deliver sufficient voltage to the grids may be used as the intermediate audio amplifier. As with other push-pull combinations, the load resistance per tube may be decreased somewhat, thereby reducing the third harmonic, while the second will cancel due to the push-pull circuit.

In cases where resistance coupling is employed for Type 25A6, the grid resistor value should not exceed 250,000 ohms.

Since the 25A6 will be used in a series filament

Continued on next page

NEW METAL TUBES
TYPE 25A6

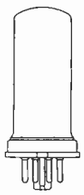
Continued from first page

circuit with other tubes, a high positive voltage may be impressed between the heater and cathode. This voltage may cause leakage currents which may be detrimental in some applications and care should be taken in laying out the circuit to prevent difficulties arising from this source.

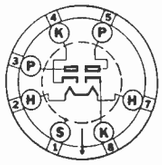
Tentative Characteristics

Heater Voltage.....	25	25	25	Volts
Heater Current.....	0.3	0.3	0.3	Amp.
Plate Voltage.....	95	135	180	Max. Volts
Screen Voltage.....	95	135*	132	Max. Volts
Grid Voltage.....	15	20	20	Volts
Plate Current.....	20	39	40	Ma.
Screen Current.....	4	8.5	8	Ma.
Plate Resistance....	45000	42000	40000	Ohms (approx)
Amplification Factor.	90	100	95	(Approx.)
Mutual Conductance	2000	2350	2400	Micromhos
Load Resistance.....	4500	4000	5000	Ohms
Self-Bias Resistor...	625	420	420	Ohms
Power Output.....	0.9	2	2.75	Watts
T'tl. Harmonic Distortion	11	9	10	Per cent

*Maximum voltage.



TYPE 25Z6
VOLTAGE DOUBLER RECTIFIER



Type 25Z6 is a metal tube rectifier, having a 25.0 volt, 0.3 ampere heater, for service in half-wave or voltage doubling circuits. The 25Z6 is the metal tube equivalent of the glass type 25Z5 and circuit applications for the two types are the same.

Tentative Characteristics

Heater Voltage (AC or DC).....	25.0 Volts
Heater Current.....	0.3 Ampere
Maximum Overall Length.....	3¼ inches
Maximum Diameter.....	1-15/16 inches
Base.....	7 pin poctal

Half-Wave Service

A-C Plate Voltage (R M S).....	*125 Volts Max.
D-C Output Current.....	* 85 Ma. Max.
Peak Plate Current.....	*500 Ma. Max.

Voltage Doubler Service

A-C Plate Voltage (R M S).....	*125 Volts Max.
D-C Output Current.....	85 Ma. Max.
Peak Plate Current.....	500 Ma. Max.

*Per Plate.

Half-Wave Circuit Operation

For this type of service it is necessary to connect the two plates together at the socket and, likewise, to tie the two cathodes so as to form a single element. A condenser-input filter is essential in order to obtain satisfactory d-c output voltages; the recommended capacitance is 16 mfd.

Voltage Doubler Operation

In this type of service the two diode units of the tube are arranged in series, one being reversed with respect to the other by means of suitable connections to two condensers connected in series across diode plate No. 1 and the cathode of diode No. 2. One side of the 110 volt a-c line is applied to the diode plate No. 2 and cathode No. 1, while the other side of the line goes to the common tap of the condensers. This scheme provides full-wave rectification and permits the condenser which is across one diode to discharge through the load and conducting diode during the period that the other diode is rectifying. The voltage across the load is the sum of the d-c output of the conducting half and the condenser discharge voltage, furnishing approximately twice the d-c voltage which a half-wave circuit would supply. More economical filtering is possible due to the doubled frequency of the output resulting from the rectification of each half of the a-c supply. Unlike the ordinary full-wave circuit, however, only two a-c connections are necessary so that the tube may be operated without a transformer.

A CHAT WITH ROGER WISE

Chief Tube Engineer
Hygrade Sylvania Corporation

There is every indication that 1936 will be a more normal year for radio tubes from the standpoint of both engineering and manufacturing than was the case in 1935. For that reason greater technical progress should be realized with less of the feverish activity which attended the introduction of metal tubes last year.

As far as the standard types of metal tubes are concerned, we have an adequate stock at present rates of consumption, making it possible to increase production gradually as the demand increases, and avoid the sudden jumps in production which taxed the facilities of our plants last year. The four newer types, 6X5, 6Q7, 25A6 and 25Z6 are now being produced on a schedule which is being stepped up as the demand increases. Other new types which are contemplated are being given exhaustive tests to make sure that they are perfect in every detail before their release is seriously considered.

Our record on metal tubes during 1935 was most satisfactory considering the extreme rush for production with which we were faced and the need for tubes in large quantities at a time when life test data was available only on small numbers of tubes. Quality with respect to freedom from gas, air leakers, and other difficulties which were so hard to avoid in the early stages of manufacture, has been most pleasing and has had the effect of bringing to us many unsolicited letters of commendation from our consumers. The difficulties which we encountered were corrected so promptly that nearly all types were entirely free from any "epidemic" of troubles, and in this respect we were more fortunate than the average. Life tests are, at this time, very uniform and excellent.

It is too early to determine whether many new types of glass tubes will be required in 1936. Cost remains a factor, since the metal tube is still more expensive to produce than the glass tube. If the anticipated reduction in cost can be realized promptly it should be possible to confine the major portion of new tube development to metal types.

YOUR QUESTIONS ANSWERED

Question 1.—Will the Sylvania 1A4 tube recently announced replace the 951 tube used in Silvertone receivers? What difference is there between the original 25S and the 1B5/25S now being furnished? Will the latter type replace the former?

Answer—The 1A4 cannot be used to replace Type 951 but Type 1B4, characteristics of which are shown in this issue of the News, can be used as a direct replacement for Type 951. Where space in the receiver permits, Type 32 may also be used to replace Type 951.

There is very little difference between the original 25S and the present 1B5/25S. The only noticeable difference may be in the structural design since the characteristics are the same for both tubes. During the past year Type 25S became quite popular and, with wider usage, the RMA numbering system of 1B4 was adopted In all cases, the two types are interchangeable.

Question 2.—I would like to get some information on the 6B5 tube when operated at low plate voltages. I would like to have power output and operating conditions on B supply voltages of 90, 135, and 180 volts?

Answer—The type 6B5 tube does not give very satisfactory results on lower plate voltage conditions. Some other type of tube would give much better performance and is recommended unless you have a particular reason for using type 6B5. The performance and operating conditions for the 6B5 on plate voltages lower than 250 are given below:

Voltage	Load Resistance	Total Plate Ma.	Watts P.O.	Distortion
180	8000	25.5	1.7	8.3%
135	9000	18.0	0.8	6.7%
90	11000	10.0	0.275	6.7%

Question 3.—I am of the opinion that the type 6J7 metal tube may be installed in old sets by using it as an untuned stage. Will you advise me on the practicability of this and give any suggestion you may have?

Answer—While it may be possible to couple a type 6J7 tube in the manner which you have indicated, it is felt that the various input circuits in most receivers will vary between different makes so much that not much benefit will be obtained by the addition of the extra tube, since an untuned stage will not contribute much to begin with. Particularly in the case of local stations, cross modulation is likely to develop. Then, in addition, if it is desired to couple the 6J7 tube into the antenna coil, practically every receiver will require different treatment in order to obtain any stepup ratio in the antenna coil, and unless great care is taken, generally it will be found that the extra tube will actually decrease the amplification rather than increase it.

In general, this practice is not to be recommended, but if you have plenty of time and good equipment, you may try changing over some receivers in this manner.

Question 4.—Will you please answer the following question for me? How much voltage amplification would it be advisable to use between a full wave diode detector and a pair of push-pull Class A 42's with 315 volts on the plates and screens to get full power output?

Answer—If you intend to use a pair of 42's with 315 volts on the plate, the bias required will be 22 volts. This means that if the input transformer has a one to one ratio, that 44 volts of signal must be supplied in the plate circuit of the preceding tube in order to obtain full power output. Since you will undoubtedly want to obtain about full power output when a 2 volt signal is applied to the input section of the first audio amplifier, a gain of 22 will be required. If you have a two to one step-up ratio input transformer, then a gain of only 11 will be necessary.

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. Good clear photographs of service benches or shops are also welcome.

A K All Wave Battery Receivers. The 8 mfd., 200 volt electrolytic condenser on the B plus of many of these sets give trouble after being in use for a considerable time. The symptoms are usually high battery drain, poor quality and at times oscillation troubles. Some condensers burst while others do not show much leakage when tested. A new 8 mfd. unit with higher operating ratings is recommended.—J. O. Roberts, St. Louis, Michigan.

* * *

Apex. On an Apex 7 tube set that is dead and has a negative screen grid voltage look for a defective 0.1 mfd. condenser in the screen circuit. This condenser is in a case with several others and evidently leakage develops through the condenser.—C. S. Ford, East Braintree, Mass.

* * *

Bosch Model 350. Drop in volume accompanied by hum such as caused by faulty tube cathode is a common fault. Check the rivets fastening down soldering lugs to grounded side of the filament. Loose rivets are often the cause of above mentioned fault.—O. A. Dowdy, Jr., Pittsburgh, Pa.

* * *

Brunswick Model S-14. A dropping off of volume may be overcome by replacing the .001 condenser between the grid and the plate of the 24A detector tube This condenser intermittently opens.—Gelmans Radio Repairs, Philadelphia, Pa.

* * *

Clarion Model 320. The second i-f coil in this receiver often opens and when an immediate replacement coil is not available the following temporary job may be done:

Resistance coupling may be employed being satisfactory on a variety of frequencies. The best substitution is: ¼ Megohm Resistor in the grid circuit, 50.000 ohms in the plate and .0001 mfd. coupling condenser.

The set will lose very little if any gain, quality will be satisfactory and the customer will be satisfied. That is, of course, only a temporary repair method.—John H. Showbrooks, Peabody, Mass.

* * *

Cleaning Hint. For cleaning dials, spring contacts, wire volume controls, etc. try Hoppe's No. 9 Powder Solvent. This is a very good cleaner and will not damage any part on which it is used. It may be purchased at any Sporting Goods Store or any place where ammunition is sold.—James F. Cochran, Westfield, N. Y.

* * *

Crosley Jewelbox Model 804. A trouble often encountered is that of the set being o.k. for about 20 minutes and then will distort until the program is hardly audible. It will usually be found that the bypass condenser connected from B plus cathode of the first a-f type 27 is leaky. Replace this with a .25 mfd., 400 volt condenser, and set will perform o.k. again.—Newark Radio Labs., Newark, N. J.

* * *

G. E. J125. Excessive a-c hum; dial light wires should be twisted and removed from vicinity of r-f choke which is located on top of the chassis.—Clyde A. Neth, Connellsville, Pa.

* * *

Knife Edge Pointers for Airplane Dials. Nearly every airplane type dial is hard to read accurately because the thick pointer is flat against the scale. The dial is more easily read by carefully twisting the pointer with a pair of pliers, so that it is perpendicular with the scale.—Bernard Croninger, San Francisco, Calif.

* * *

Majestic Model 20 Chassis. A frequent cause of trouble is the internal shorting of plate by-pass condensers in the i.f. stages. The set does not always go dead completely, but there is great difficulty in picking up stations, and volume is very low. These sets are so constructed that the plate by-pass condensers are part of the i.f. transformer assemblies, which are sealed in pitch. Analyzer indications of this type of trouble show up as very low voltages on the plates and screens of all the tubes ahead of the second detector. Resistance from plate of i.f. tube to chassis should ordinarily measure about 30,000 ohms. When either of these condensers are shorted, the resistance will read much lower, typical indications being zero ohms, 1000 ohms, or 1500 ohms.

To repair, remove the i.f. can from the chassis, unsolder the connections, pull the leads through the assembly eyelets, break out the eyelets with a screw driver and hammer, and replace one or two of the eyelets with screws to hold the assembly, so as to prevent it from falling into the pitch when heated. Heat the can carefully for a few minutes on a hot plate, electric iron, toaster, etc. When the pitch is soft, pull out the assembly. The condenser will be found on one end. Clip off the leads, and remove. Replace assembly in can. Remount the can on the chassis. Then connect a .1 mfd. condenser externally between the plate and chassis.

Probably no realigning will be necessary, but if it is, it is very simple. Tune in any station, and adjust for maximum response. The R.F. is usually out on these sets, so it is not a bad idea to adjust it.—Jack Bobrow, Brooklyn, N.Y.

* * *

Kolster Models 6, 7, and 8. The four gang condensers become hard to turn and remedies have been attempted by other service men by putting rosin on the dial cord. The proper method is to remove the front panel of the chassis and space the condenser shaft bushing on the opposite side of the frame partition next to the Drum Dial. The trouble here is a fiber washer expanding.—C. L. Fender, Anaheim, Calif.

* * *

Philco Model 16. If the set lacks the proper pep and you find the voltages all low, check the electrolytic filter condensers. If bad, replace with wet electrolytics as there is a high voltage surge on these condensers which the wet electrolytics seem to handle better.—George Curtis, Chicago, Illinois.

* * *

Philco Model 90—Correction. I have been informed by a fellow serviceman that Rider's manual gives the i-f of Philco Model 90 (1 '47) as 175 and hence my hint shown in the last Sylvania News is incorrect. On investigation I find that most of the Philco literature is correct. but that it is incorrect in giving the above i-f in "Instructions for Aligning All Models", this seemingly being the only time a slip was made. —Tom J. Davis, Cave Spring, Ga.

* * *

Pilot Dragon Model 10. If the set has an a-c hum which is hard to find, look for a ground at the reflector mounted behind the pilot light. There is a small piece of fiber insulation between the reflector and the dial. Sometimes the sharp corners of the reflector pierce the insulation and ground the filament.—James F. Cochran, Westfield, N. Y.

* * *

Radiola Model 60 or 62. Inability to reduce volume of strong signals with the volume control all the way off is caused by the 71-A tube being weak. If this tube is weak it upsets the bias on the r-f and i-f tubes. Replace with a new 71-A and the control is perfect.

If the volume continually rises and falls during operation look for an open secondary winding in the audio transformer. Also check the 20,000 ohm resistor in the power pack.—Eckert Baillio, Mineola, Texas.

* * *

RCA Victor Model 34 Auto Set. Vibrator noise over all the tuning range is often present after a new vibrator is installed. To overcome unsolder the leads and twist the primary leads together and re-solder. Then twist the secondary leads together and re-solder. Doing this will cure the hash.—A. R. Dayes, Brooklyn, N. Y.

* * *

REPLACING AUDIO TUBES

Replacing a 45 with a 46. To replace a 45 with a 46 it is only necessary to connect the grid adjacent to the plate, with the plate and replace the four prong socket with a five prong socket.

Replacing a 45 with a 2A5. To change from a 45 to a 2A5 it is necessary to connect a 410 ohm resistor from cathode to ground. A 10 mfd. condenser is placed in parallel with the 410 ohm resistor. The center tap of the filament resistor is connected direct to B plus. The 4 prong socket must be replaced with a 6 prong one.

Replacing a 27 with a 56. To replace a 27 with a 56 it is often necessary to replace the resistor from cathode to ground with one of correct value depending on the circuit employed.

Replacing a 71A with a 2A5. To change from a 71A to 2A5 it is necessary to connect a 410 Megohm resistor in series with the cathode. A 10 mfd. condenser is used in parallel with the resistor. The screen grid is connected direct to the B plus. A resistor is placed in series with the filament to reduce the voltage from 5 volts to 2½ volts. The 4 prong socket is replaced with a 5 prong socket.—Precision Radio Labs., Chicago, Illinois.

* * *

Service Bench Power Unit. I have a standard B supply unit on my work-bench which I use for power pack troubles. If I suspect the complete power pack is bad in a set to be repaired, I substitute it for the one on the bench. If the first part of the rectifying system is questionable I connect the first part of the standard rectifying system to the set's filter system and thus verify the doubt. Be sure to take out the set's rectifier tube when making such tests.—John Sulewski, Philadelphia, Pa.

* * *

Sparton Model 16. If this set has a tendency to drift off the station, becomes weak in volume and whistles, check the connections on the oscillator coil which is under a shield. One connection is made with a small bolt and in time is apt to work loose. It is a good idea to solder this bolt. —George Curtis, Chicago, Illinois.

* * *

Stewart-Warner AC 950. When this set shows trouble from intermittent operation, test for voltage on the plates of the r-f tubes while the set is inoperative. If voltage is lacking check the smaller section of the wire wound resistor, located under the condenser can. If defective replace with a ten watt 1000 ohm resistor. If certain stations fail to tune when set is in cabinet remove the wood in back of the dial plate where it has been recessed. I always replace the a-c line switch with a long neck toggle switch to avoid a callback as this switch often fails.—Dave Cern, Detroit, Michigan.

* * *

Tube Socket Cleaner. A good device for cleaning tube socket contacts may be made from an old tube base. By cutting the pins with a three cornered file or a hack saw so that saw teeth are made the base works very good as a cleaner. It is suggested that a handle be added to the base so that the cleaner may be easily moved up and down.—Pedro Sapojkin, S. Paulo, S. P. Brazil.

SYLVANIA BALLAST TUBE DATA

(Continued from last issue)

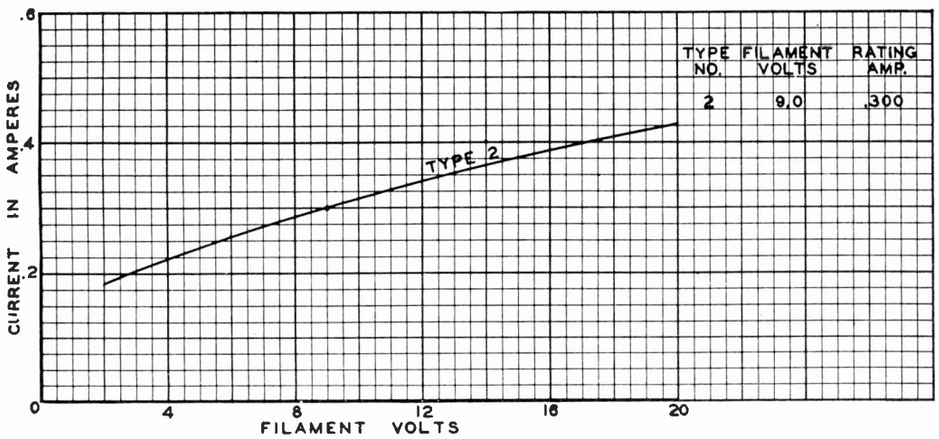
The last issue of Sylvania News contained data and characteristic curves on the battery group of Sylvania ballast tubes. The other group of ballast tubes, those for AC or DC receivers and 32 volt sets will be covered in this issue. This group of tubes is used where the voltage drop required may cover a wide range. Such ballast tubes afford some amount of regulation, but the characteristics are not as flat as for the ballast tubes used in battery receivers.

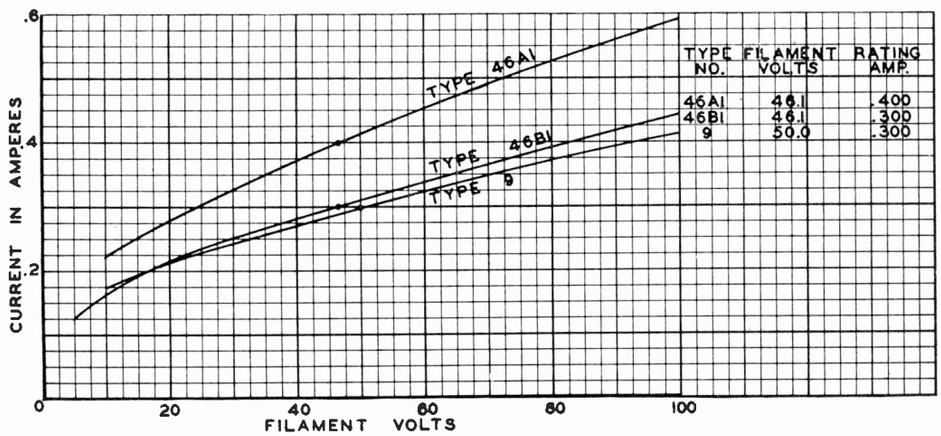
Data for the AC-DC group has been plotted to show the current in amperes as a function of the voltage drop across the ballast tubes. The curves are separated into three groups according to usage. The type 2 tube is employed in 32 volt receivers; Types 46A1, 46B1 and 9 are adaptable to AC-DC sets of 110 volt operation. The last five types, 3, 4, 5, 7 and 8, are used in 220 volt AC-DC radio receivers. The normal operating conditions are indicated by data on each curve.

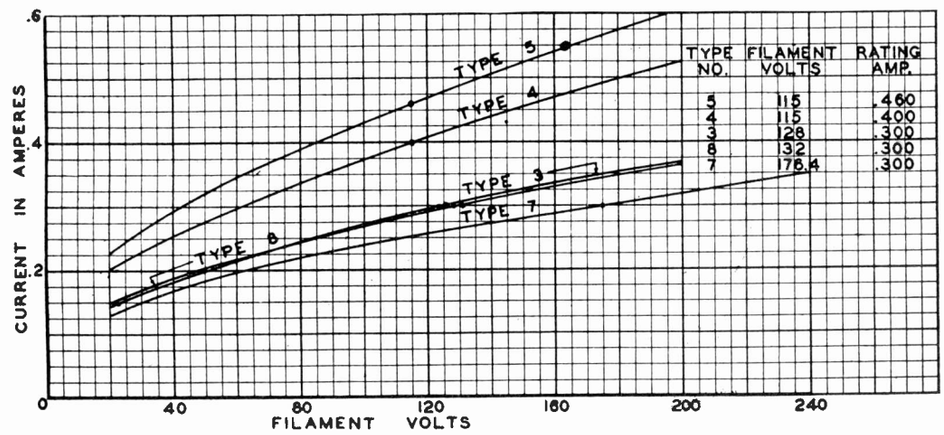
Ballast tubes belonging to this second general division should be operated as closely as possible to the standard ratings in order to realize the most efficient performance.

The summary table furnishes data on bulbs, bases and service. It will be noted that all types except the 46A1 and 46B1 have the 4-pin base. In every instance the base connections are the same. Pins other than the standard filament or heater pins are not connected. All bulbs are "inside frosted" and are either ST-12 or ST-16 size.

Type	Base	Bulb	Ma. Load Current	Service
2	Medium 4 pin	ST-16	300	32 Volt
3	Medium 4 pin	ST-16	300	220 Volt AC-DC
4	Medium 4 pin	ST-16	400	220 Volt AC-DC
5	Medium 4 pin	ST-16	400	220 Volt AC-DC
7	Medium 4 pin	ST-16	300	220 Volt AC-DC
8	Medium 4 pin	ST-16	300	220 Volt AC-DC
9	Medium 4 pin	ST-16	300	110 Volt AC-DC
46A1	Small 5 pin	ST-12	400	110 Volt AC-DC
46B1	Small 5 pin	ST-12	300	110 Volt AC-DC







SPECIAL TUBE APPLICATIONS

WALTER R. JONES

From time to time we run across tube applications which we feel would be of value to the service man. Usually, the only service tool which a service man thinks of, in connection with tubes, is a vacuum tube voltmeter. There are, however, several other pieces of equipment which may be used to greatly lighten work in the service field. It is our intention, in the next few issues of Sylvania News, to show some of these various applications. In our next issue a small peak voltmeter will be shown, which is very useful in measuring peak voltages that appear on filter condensers. This same device may also be used as an output meter and in other applications.

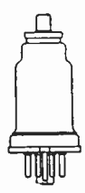
It is felt that undoubtedly several service men have run into similar test devices which they would like to pass on to their fellows. The technical section of Sylvania News will be very glad to act as a clearing house for such material and will be glad to publish those which seem of unusual interest, giving, of course, proper credit to the authors.*

*And not credit only, but also a free Sylvania tube for each one accepted for publication. (signed) The Editors.

A CORRECTION

In the last issue of the Technical Section an obvious mistake appeared in connection with the type 6Q7 write-up. If you haven't discovered the mistake, we suggest you make the correction now so that you won't become confused at some later date when referring to the write-up.

The bulb view shown with the 6Q7 data should have been of the top-cap type. The editors agree with the Sylvania design engineers that it was better for us to admit our error than to re-design the tube. So, we are showing below the correct bulb view along with the base diagram. Our mistake can easily be hidden by pasting the diagram below over the one shown in the last issue.



TYPE 6Q7
DOUBLE
DIODE
TRIODE

SYLVANIA NEWS

TECHNICAL SECTION

Vol 6 EMPORIUM, PENNA. No. 4

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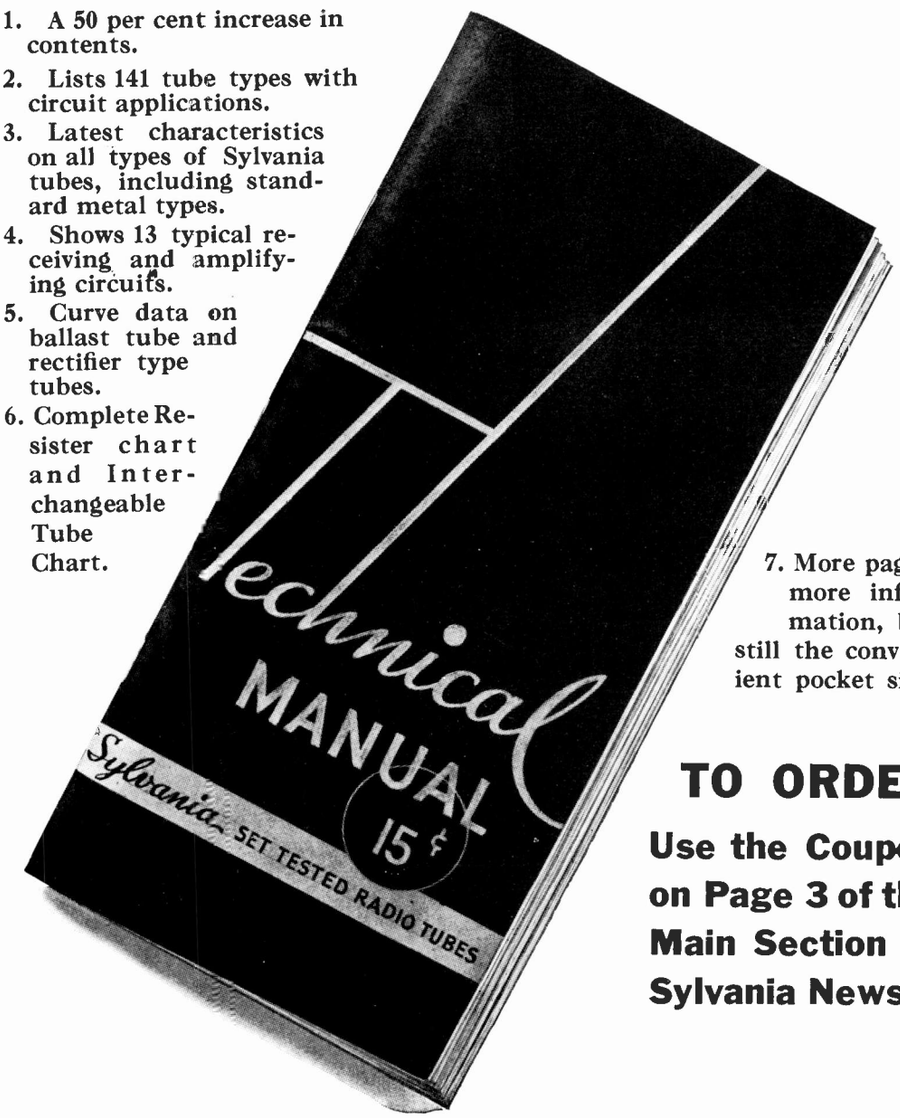

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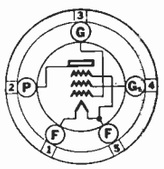
Up to the minute, from its new modern cover to the final word of information, we are proud to present the new Sylvania Technical Manual. We know that you will find it worth many times the fifteen cents it will cost you to own one. Thousands of servicemen have discovered how handy, and how full of valuable information, was the former Technical Manual. The new one, with half again as much "dope", is the last word on radio tube technicalities and applications.

For your convenience in ordering, there is a coupon on page 3 of the Main Section of this issue of Sylvania News. Don't put it off. We know how fast the orders will come piling in—and first come, first served. Orders previously received, and held for completion of the new Technical Manual will be filled immediately.

NEW TUBES

TYPE 1F4
POWER OUTPUT PENTODE



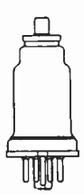
The Sylvania Type 1F4 is a new output tube designed for use in battery operated receivers. This tube has a high power sensitivity and will deliver considerable power output. These features, together with the low filament and plate current consumption, provide means for an economical output system. Where space in a receiver permits, this tube may be used as a direct replacement tube for Type 950.

Resistance coupling may be employed and the rated output obtained under Class A operation. The tube can also be transformer coupled to a suitable driver, thus permitting additional power output, with some increase in distortion, by driving the grid of the 1F4 into the region of positive grid potential. Push-pull operation may also be employed if desired.

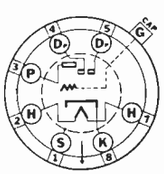
RATINGS AND CHARACTERISTICS

Filament Voltage	2.0 Volts
Filament Current	0.12 Ampere
Plate Voltage	135 Volts
Screen Voltage	135 Volts
Grid Voltage	−4.5 Volts*
Plate Current	8.0 Milliamperes
Screen Current	2.6 Milliamperes
Plate Resistance	200,000 Ohms
Mutual Conductance	1700 Micromhos
Amplification Factor	340
Load Impedance	16,000 Ohms
Power Output	340 Milliwatts**
Distortion	5 Per Cent

*Grid return to negative filament.
**With 3.5 volts r-m-s signal on grid.



TYPE 6R7
DOUBLE DIODE TRIODE



Type 6R7 is the second duplex tube in the metal tube group and is similar in design and characteristics to Type 85 of the glass group. However, the triode section has a higher mutual conductance and higher amplification factor than does Type 85.

In general, the circuit applications of this tube are the same as those for Type 85, although corrections for grid bias, load, et cetera, must be

(Continued on Next Page)

NEW TUBES—6R7

(Continued from Page One)

made so as to conform to Type 6R7 characteristics.

The diodes in this tube are substantially the same as those used in Types 6Q7 and 85 and can therefore be used in similar circuit applications. The diodes are well shielded from the triode section, insuring freedom from interaction between the respective circuits.

TENTATIVE RATINGS AND CHARACTERISTICS
(Triode Section)

Heater Voltage (AC or DC)	6.3 Volts
Heater Current	0.3 Ampere
Plate Voltage	250 Volts (Max.)
Grid Voltage	-9 Volts
Plate Current	9.5 Milliamperes
Plate Resistance	8500 Ohms
Mutual Conductance	1900 Micromhos
Amplification Factor	16

Type 59B Changeover

(REPRINT BY REQUEST)

Several requests have been received as to whether there is a Sylvania tube that will replace the Type 59B used in Majestic receivers. In a survey of the use of this tube it was found that it was employed in only a limited number of receivers. Also, the tube is very similar to a regular Sylvania 59 except that it is of the filament type rather than of the indirect heater type. In view of these facts, a special tube for replacement of the 59B would not merit production. Therefore, it is suggested that a regular Sylvania 59 may be used by making only one wiring change. The simplicity of this change can be made the source of income to service men through extra tube sales, as it is quite probable that in some sections of the country there is quite a demand for replacement of the original 59B.

The only change necessary to employ a Sylvania Type 59 is to connect the cathode terminal of the socket to the suppressor grid terminal, which is the adjacent contact terminal on the socket. This connection provides a return for the cathode back through the center tap of the filament. If it is desired, the cathode may be wired to the center point of the potentiometer across the filament circuit, but this is not necessary since the suppressor grid is at the same potential. Originally the cathode terminal of the socket was left open since the 59B did not contain a cathode but did employ a 7-pin base with the cathode pin open. No other change in the receiver is necessary as the characteristics of the Sylvania 59 when operated as in this circuit are practically identical with the original tube. The filament Type 59B was originally used because trouble with secondary emission was experienced when using a heater Type 59. Proper precautions have been taken in the Sylvania heater Type 59 to make it especially suitable as a replacement tube; therefore, satisfactory performance can be expected when making a substitution for the 59B.

BULBS AND BATTERIES FOR FLASHLIGHT SCREWDRIVERS

Several inquiries have been made as to replacements of bulbs and batteries for Flashlight Screwdrivers. Eveready battery no. 915 and Mazda bulb no. 112 are used. They may be purchased in any hardware or five-and-ten, and should not cost more than five cents each.

A SIMPLE PEAK VOLTMETER

By WALTER R. JONES

A simple peak voltmeter useful for measuring d-c, a-c, or pulsating voltages from about 10 volts up to any value desired is a valuable piece of service equipment. This article will describe such an instrument which can be made at a reasonable cost.

The accompanying schematic diagram shows a circuit of this voltmeter consisting of a type 84 tube together with a suitable transformer for lighting the filament and 16 microfarads of condenser which must have a voltage rating as high as the largest peak voltage which is to be measured.

A thousand ohm per volt voltmeter having the proper voltage range for the voltages to be measured is connected across the 16 microfarad condenser, which in turn is connected in series between the cathode of the tube and one side of the voltage which is to be measured. The voltmeter can be the one that is commonly used in service analyzers, providing it is of the 1000 ohm per volt type. The meter should not be used on a scale range less than the 100 volt scale. This should be done so that at least 100,000 ohms of resistance will always be shunting the electrolytic condenser. If the condenser is shunted with less than this value, a slight error will result. A pair of pin jacks can be provided across the terminals of the condenser into which the meter may be connected. It is to be remembered in measuring a-c voltages that the peak voltage will be 1.4 times the r.m.s. voltage as measured on an a-c voltmeter, if the wave form is sinusoidal. For example: if the line voltage measures 100 volts, the peak voltage will be 140 volts. This is the reading obtained when using peak voltmeter.

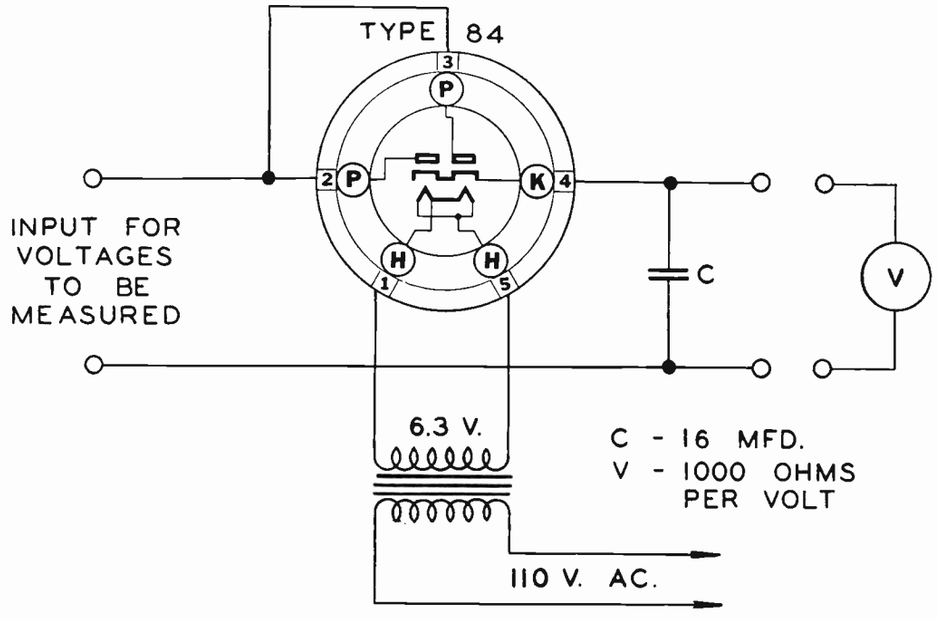
This device requires absolutely no adjustments, and is especially useful in measuring voltages developed across filter condensers, especially the first filter condenser. It is important that service men have an instrument to measure such voltages, since they are often called upon to make a replacement of condensers of unknown ratings. Unless the peak voltage across a filter system is known, a condenser with improper voltage rating may be used which will probably result in another defective condenser and a dissatisfied customer. The working voltage rating of a condenser should be somewhat higher than the voltage which is measured on this peak voltmeter.

The average serviceman will find a great many uses for this small voltmeter, not only as outlined above, but also for measuring a.v.c. voltages, screen grid voltages and other voltages where the drain of a voltmeter might give incorrect readings.

The unit is also very useful in measuring output voltages obtained from a receiver. It may be connected directly across the primary of the output transformer and will serve as a very fine output indicator.

It must be remembered that this unit will measure peak voltage and not r.m.s. voltages.

We plan to present descriptions of other small devices employing vacuum tubes which the average serviceman may employ without great cost and which will greatly simplify his service work. The next article on this subject will appear in an early issue of Sylvania News.



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. Good clear photographs of service benches or shops are also welcome.

Belmont Gamble Model 770 Series A, Model 777 Series B-C. In a few isolated cases, difficulty has been experienced with intermittent hum. This hum usually appears only after the receiver has been allowed to operate for some time and temporarily disappears upon snapping the line switch off and on. This difficulty is generally due to the opening up of the common lead of the dual condenser (.1—.25—220V—part No. 118—12), at the point of attachment of the lead to the condenser coil.

This condenser is indicated as C-18 and C-14 on the circuit diagram C-14 being the .1 mfd .x200V. screen bypass of the 6B7, while C-18 is a .25 mfd 200V. unit acting as a hum filter for the bias voltage of the type 42 tube. Examination of the circuit will show that when this occurs, the entire hum voltage of the filter is impressed on the screen of the type 6B7 tube. When the above difficulty occurs, it is generally advisable to replace the entire unit by two separate units of identical capacity and voltage rating as the components of the original unit. Sidney E. Keepers, Pierre, South Dakota.

* * *

Clarion Model 220. Trouble with this set is often in the form of no signal or a dead receiver. From the oscillator coil connected to the cathode of detector oscillator tube is a 4,000 ohm resistor, shunted with a .0001 mfd. mica condenser and then to ground. After much checking of resistances and Voltages. a new 4,000 ohm resistor was tried at this point with the set working satisfactory. This resistor will check okey, but a new 1 watt unit is often required, no doubt due to sliding resistance in the original resistor. —R. Willams, Schenectady, N. Y.

* * *

Crosley Model 8H1. To take out some of the excessive hissing between stations, change the 6F7 cathode resistor, which is a small flexible resistor mounted on the back of the chassis, from 500 to 250 ohms. Also shunt a 2000 ohm resistor across the cathode bias resistor of the 6D6 nearest the power transformer.—Roy E. Busse, Mankato, Minnesota.

* * *

General Electric Model K-62, R. C. A. Model R-11. To cure motorboating connect a 0.1 mfd. condenser across the resistor mounted inside of the antenna coil.—Roy E. Busse, Mankato, Minnesota.

* * *

General Electric Models H. 31, 51, and 71. R. C. A. Models 80, 81, and 82. Very poor sensitivity was traced to i-f transformer primaries raising from 39 ohm to over 400 ohms and in some cases higher. This does not affect Voltage at tube plate socket, but changing these transformers works wonders. This trouble has been found on several of these models.—R. Whillans, Schenectady, N. Y.

* * *

Locating Ignition Noise. By connecting an r-f choke coil across a set of headphones and using same as an exploring coil, it is a simple matter to locate ignition noises. etc. in car installations. By holding the coil close to the various wires under the dash, the ones causing the trouble can soon be located, and the annoyance eliminated by the use of a filter.—Dieckmann Radio Service, Brooklyn, N. Y.

* * *

Majestic Model 95, 105, 520. Intermittent reception is often caused by the oscillator stopping. To cure short out the resistor in the A minus lead, (R8 in the diagram). This can be done only when a 2 Volt storage cell is used.—Roy E. Busse, Mankato, Minnesota.

* * *

Majestic Model 90. If this set fades badly or has intermittent reception which is brought back by turning on a light in the house or touching the chassis or applying a test voltmeter to any of the circuits, look first for a defective cathode bypass condenser. In the majority of cases this is the trouble.—Fayne L. Rogers, Norcatur, Kansas.

* * *

Majestic Model 290, 300A. When the model 290 Majestic operates on only 1/5th turn of volume control, action is due to defective condenser No. C20 in Rider's Manual. Replace with .03 mfd. of 400 volt rating.

In the model 300A which operates only on one quarter turn of volume control, action is due to a defective condenser, No. c17. Replace with a .01 mfd. at 400 Volt rating.—Harry T. Schmidt, Hammond, Indiana.

* * *

Majestic Model 300. This model often has poor performance speakers after being repaired by someone not familiar with the dual speaker arrangement. Upon examining the dual speakers it may be found that they are improperly phased. By reversing the voice coil leads of one speaker, proper phasing can be obtained and the tone quality and volume restored.—Dieckmann Radio Service, Brooklyn, N. Y.

* * *

Oldsmobile Auto Radio. When finding a United Motors Oldsmobile Radio that does not give out any signals, not even tube hiss, in a new machine of this year's model, try a new Sylvania 6F7 tube. I have had several of these machines require a new tube of this type in new machines which have not been in use long.—Fayne L. Rogers, Norcatur, Kansas.

AUTO RADIO TIPS WANTED

The Auto Radio Service Booklet will soon be revised. We are anxious to receive Service Hints covering the latest Auto Radio sets, aerial installation on steel-top cars, and other up-to-date auto radio information. Your choice of one Sylvania receiving tube will be given for each hint accepted for publication. Your name will appear after your hint in the new Auto Radio booklet.

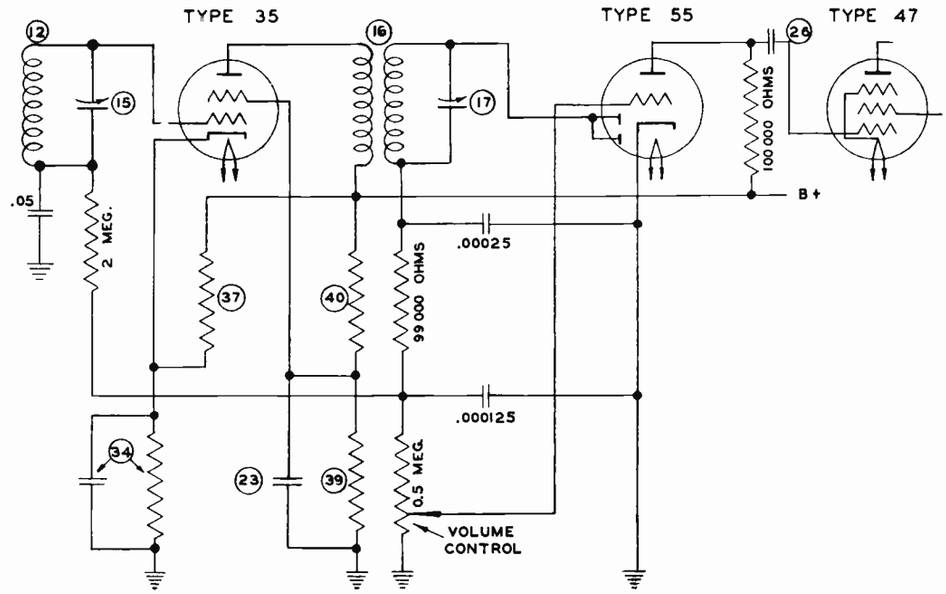
Remodernization

Remodeling Philco 51 and 52. These receivers may be remodernized easily by using a type 55 and making a very few changes. The changes are as follows:

Remove volume control (1) from the chassis leaving antenna connection direct to antenna coil, connect 5,000 ohm fixed resistor across antenna coil in place of volume control, ground resistor (34) so that the bias on the Type 35 i-f tube will never fall below the value for best operation of the tube. The original design Trummer condensers (15) and (17) and their respective coils are grounded direct to the chassis and must be insulated from the chassis. Condenser (17) is located at the front of the chassis near the volume control and is accessible for adjustment through a hole in the left hand corner of the rear of the chassis. Condenser (15) is in the rear of the chassis and is below and just to the right of the hole through which (17) is adjusted. These condensers may be insulated by enlarging the holes in the chassis, through which they are mounted, and using insulating washers on both sides of the chassis, or these condensers may be replaced with Philco compensating condensers part No. 04000A, or any other 5-59 micro-microfarad trimmers, whose fixed plate are not grounded to the mounting hole eyelet.

Resistors (18), (19), (21), and (25) are removed from the chassis. The condensers marked (23) in the diagram are all in one can. The second detector cathode, screen grid, and plate filter condensers are disconnected from the circuit. This leaves only two condensers in the can, which are connected in the circuit, these may be replaced by single units, using 0.5 mfd. for by-passing resistor (39) and 0.1 mfd. for by-passing resistor (33). Then the whole condenser block can be removed from the chassis. Remove condensers (20) and (22) from the chassis and disconnect all leads from the second detector tube socket, then remove the socket from the chassis and replace with a six prong socket. After this is done connect up as shown in the diagram below. The values of the new parts used are shown in the diagram.—J. H. Askew, Waldo, Arkansas.

CIRCUIT DIAGRAM



YOUR QUESTIONS ANSWERED....

Question 1.—What is meant by "Maximum Peak Inverse Voltage" as referred to in different rectifier characteristics?

Answer—"Maximum Peak Inverse Voltage" is the peak voltage known as the safe arc-back limit of a voltage in the opposite direction to that which a rectifier is intended to pass current.

In a full wave rectifier circuit the flow of current during one-half of the alternating cycle is from one plate of the tube to the filament, and during the other half of the cycle it is from the other plate to the filament since the plates are alternately made positive and negative by the a-c voltage applied. During the period that plate Number 1 is positive, the filament in turn is positive with respect to plate Number 2. The voltage between the filament and plate Number 2 is in inverse relation to that voltage causing current flow. This voltage is termed "Inverse Voltage" and the peak of this voltage is the highest value that the rectifier can safely stand so that break-down or arc-back does not occur. The resistance and the nature of the path between the positive filament and the negative plate, limits this peak value.

Question 2.—It is my understanding that the new Sylvania type 6B5 tube can be made interchangeable with type 42. Will you please advise me if this can be done?

Answer—In many cases it is possible to directly replace the Type 42 tube with the Type 6B5. When such changes are made, however, it is necessary to short out the cathode bias resistor, if the original 42's were self biased, or if biased through another means, it is necessary to make the grid-return directly to ground. Of course, the 6B5 tube should not be placed in circuits applying plate voltages higher than recommended in the operating characteristics.

From a practical standpoint such a change-over is not suggested since the only advantage which would be obtained in most cases would be the sale of a tube having a higher list price than Type 42. Service men, of course, will like this angle of such a change-over, but from a customer's angle, we doubt if any increase in performance would be apparent enough to satisfy them.

If you care to try this change-over for some of your accounts, whenever they ask for this type of tube, you may do so, thereby learning their reaction.

Question 3.—I have found in a certain receiver that uses a 36 oscillator tube that only one brand of 36's operate satisfactory. The more reputable brands do not perform satisfactorily in this respect. What is the reason for this?

I have also had trouble with the type 59 tubes in my amplifier due to short life, arcing and overall poor performance. This is true on all makes of the type 59. Can you help me with this?

Answer—The type 36 situation which you mentioned is not at all uncommon. Unless the cathode resistor for the type 36 oscillator tube is changed it usually requires the testing of several tubes before one is found which will work satisfactorily. This is not limited to any one make of tube although it is entirely possible that the sets might have been designed for the make of tube you had success with, which might not be exactly standard in this particular characteristic. At any rate most service men find it necessary to change the value of cathode resistor for this tube in order to obtain uniform performance. Once this is done all tubes seem to work the same.

Your second problem on type 59 tubes comes up every once in a while when the tubes are used so that abnormal high audio voltages are developed in the plate circuit or when parasitic oscillations are developed within the amplifier itself. We would suggest that you learn more about the particular amplifier in which these 59 tubes are employed and supply us with that information. So far we have never known this difficulty to arise when the tubes are operated according to rating.

Question 4.—What are the advantages of parallel and push-pull first audio tubes over a single tube?

When using type 45 output tubes in parallel push-pull, what will the power output be with between 250 and 300 volts on the plates? Is it possible to use resistance coupling in place of interstage transformers in all amplifiers?

Answer—The chief advantage employing a push-pull input stage is that the second harmonic distortion will be greatly reduced. The disadvantage, of course, is that twice as great an input signal must be supplied to the first audio stage as would be required if a single tube were used. Two tubes in a parallel arrangement would require the same signal as a single tube, but all of the distortion would add up and there would be no cancellation of second harmonic distortion.

Parallel first audio tubes are never required unless the output tubes are to be operated as Class B and A prime amplifiers, where considerable input power is required.

The power output of the type 45 tubes when operated with 275 volts on the plates and with a bias of 56 volts will be approximately 2 watts per tube. Under these conditions the plate current should be approximately 36 milliamperes per tube.

It is possible to use resistance coupling instead of interstage transformer coupling in any amplifiers providing the output tubes are not to be driven to grid current. When grid current flows in the output stages it is necessary that considerable power be supplied by driver stages as outlined in the above paragraph. Enough power can not be supplied by the driver stages when resistance coupling is used since the large value of d-c resistance in the plate circuit reduces the amount of power available to a useless value.

Push-Pull Parallel 6A6's

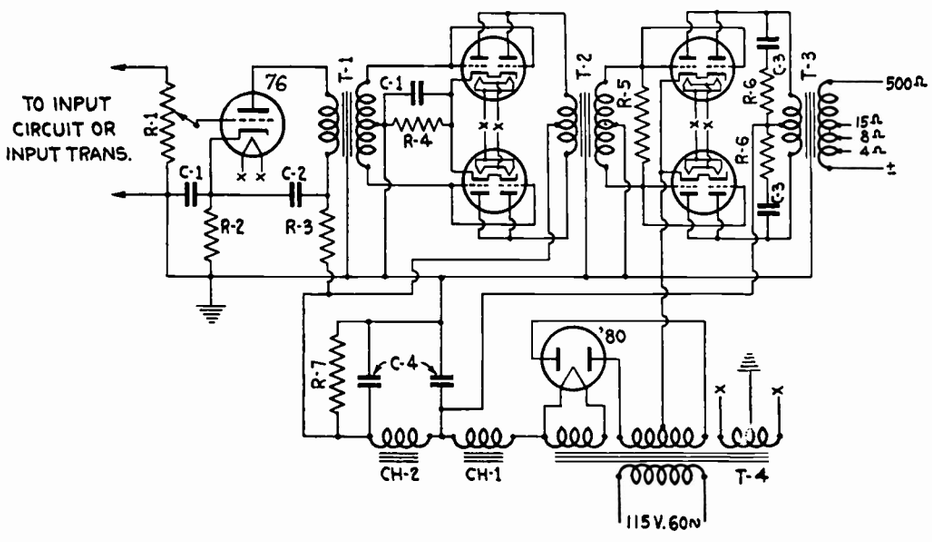
Many requests have been received for data and circuit information on the operation of the type 6A6 Class B output tube. Through the courtesy of the Thordarson Electric Manufacturing Company we are showing this type of tube in a Class B amplifier circuit in push-pull parallel arrangement. Approximately 16 watts power output is available with this arrangement. Type 53 tubes may be used in place of the 6A6's and a type 56 in place of the 76 providing a 2.5 volt filament operation is desired.

Two type 6A6 tubes in Class A push-pull parallel are used for the driver stage. A single type 76 tube transformer coupled forms the input stage. The transformers used are shielded with solder lugs and leads taken out of the bottom. This enables the constructor to mount all the parts on a metal base with all wiring out of sight.

Care should be taken when positioning the transformers to see that the input is located as far as possible from the power and output transformers. Such precautions help to eliminate the possibility of undue hum and feed-back. The material used for the base should be non-magnetic, such as Eraydo or aluminum.

The resistors and condensers shunting the primary of the output transformer tend to prevent distortion at the higher frequencies by holding the speaker impedance to a given value. All speaker systems increase their impedance as the frequency rises. With Class B amplifiers especially, this is not desirable. If it is found that there is insufficient high frequency amplification for a given installation, the condensers may be changed to a lower capacity. Likewise, if a lower amplification of the higher frequencies is wanted, larger condensers should be used.

The circuit does not provide current for the excitation of a dynamic speaker field. Usually a speaker field is substituted for one of the chokes in the filter supply. In this circuit, the current fluctuation is so great that satisfactory operation is impossible.



SYLVANIA TUBES

1—Type 76 4—Type 6A6 1—Type 80

THORDARSON EQUIPMENT

T-1	T-5741	Interstage Transformer
T-2	T-6790	Interstage Transformer
T-3	T-6752	Output Transformer
T-4	T-5604	Combination Plate and Filament Transformer
CH-k	T-5754	Input Choke
CH-2	T-1892	Filter Choke

MISCELLANEOUS EQUIPMENT

R-1	500,000-ohm volume control
R-2	2,500-ohm carbon resistor-1 watt
R-3	25,000-ohm carbon resistor-1 watt
R-4	475-ohm carbon resistor-3 watt
R-5	100,000-ohm carbon resistor-1 watt
R-6	3,500-ohm carbon resistor-3 watt
R-7	30,000-ohm wire wound resistor-10 watt
C-1	4-mfd. electrolytic condenser-25 volt
C-2	2 mfd. electrolytic condenser-450 volt
C-3	.03 mfd. paper condenser-400 volt
C-4	Dual 8-mfd. electrolytic condenser-450 volt

For Your Information

Mathematics of Radio Servicing, by M. N. Beitman, published by Supreme Publications, 3727 W. 13th Street, Chicago. Explains and interconnects arithmetic and elementary algebra to everyday radio problems. Examples taken from actual radio cases. Clearly written, the average service man should find it well worth the price—fifty cents. Order from the publisher.

* * *

Every Serviceman Should Know 417 things, according to A. A. Ghirardi. The entire list is available without charge from Radio and Technical Publishing Company, 45-R Astor Place, New York, N. Y.

* * *

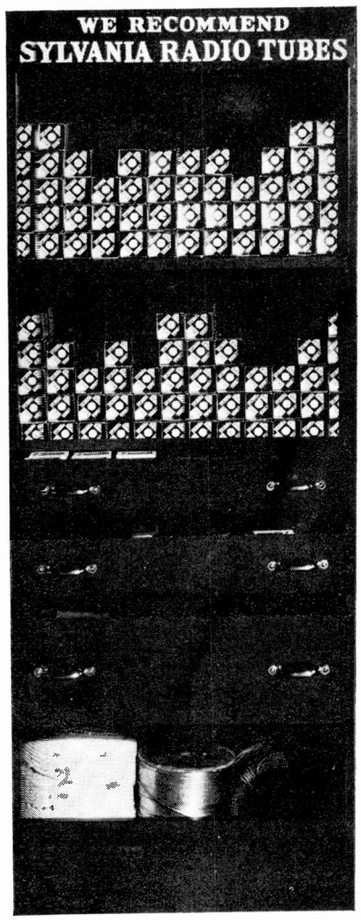
Short Wave Travel Tips, by H. G. Cisin, lists practically all short wave stations, except amateur, arranged by call letters, giving locations, kcs and meters, and best times to try. Also SW antenna and circuit information. Send ten cents handling charge to Allied Engineering Institute, 98 Park Place, New York, N. Y.

SYLVANIA NEWS

TECHNICAL SECTION

Vol 6 | EMPORIUM, PENNA. | Nos. 5 & 6

The New Sylvania REG U.S. PAT OFF "STOCK BOY" CABINET



SYLVANIA "STOCK BOY"
Height 59½", Width 22", Depth 12",
Color—Green

Another "Profit Plan" Open to All Sylvania Dealers and Servicemen

Here is a sturdy man's size all-metal portable cabinet that combines attractive tube display with convenient service parts storage—big enough to house and protect your Rider Manuals too.

The two top shelves accommodate 125 tubes each. For your small parts the two small easy sliding drawers have 21 partitions each, and the lower drawer 4 separations 6x10-x5½. And below that, note the generous size bin for wire and heavier articles.

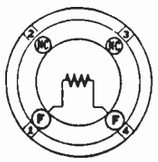
As a part of our regular cooperative service to Sylvania Retailers this modern Display-Service Cabinet is offered to you at HALF ITS ACTUAL VALUE

Ask Your Sylvania Jobber---Today

About the "Profit Plan" on this Attractive, Durable Utility Cabinet

NEW TUBES

BATTERY BALLAST Type 1K1



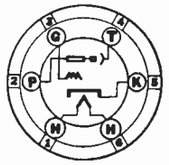
Sylvania type 1K1 is a new battery type of ballast tube rated at 550 milliamperes. This new tube will be found in use in some of the late model battery receivers and may be used as a direct replacement tube for types 5H1, 10AB and LLL25. In this latter service it will find wide acceptance in the renewal tube field.

Characteristics

Maximum Overall Length	4¼ inches
Maximum Diameter	1⅜ inches
Bulb	ST-12
Base	Small 4-Pin
Load Current	550 Ma
Average Voltage Drop*	1.0 Volt

*The voltage drop is for average operation and may vary according to the supply voltage.

Type 2E5 Tuning Indicator



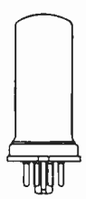
The Sylvania type 2E5 is a 2.5 volt tuning indicator tube identical with type 6E5 except for the filament rating. This new tube is being made available through a demand created by servicemen for a tuning indicator tube suitable for remodernization work and other applications in 2.5 volt circuits.

The characteristics and circuit applications for type 2E5 are the same as those for type 6E5. Any technical data required may be obtained by referring to type 6E5 in the Sylvania Technical Manual.

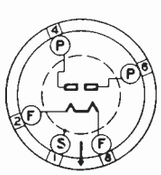
Characteristics

Heater Voltage AC or DC	2.5 volts
Heater Current	0.8 Ampere
Maximum Over-all Length	4¼ inches
Maximum Diameter	1⅜ inches
Bulb	ST-12
Base	Small 6-Pin

Operating Conditions and Characteristics Refer to Type 6E5



Type 5W4 Full Wave Rectifier



Type 5W4 is an all-metal filament type rectifier tube with characteristics similar to those of type 80. This new tube will be found in small and medium sized a-c receivers designed so that the maximum load current requirements will not exceed 110 milliamperes. Although the base pin arrangement is the same as that of type 5Z4, it is not recommended that this new tube be used as a replacement tube for type 5Z4, since it will deliver lower output voltages and the load current rating is somewhat lower.

Continued on Page Four

TUNING INDICATORS 6E5 vs 6G5

By Walter R. Jones

During the past season, the type 6E5 tube became quite popular as a visual tuning indicator. After the novelty of this type of tube wore off, it was found that the tube had some disadvantages over the regular tuning meter which had previously been employed, to indicate the visual tuning. These disadvantages mainly were that either the indication of weak signals was unsatisfactory or that on strong signals the shadow closed entirely.

This tube consists of a triode and a target and a deflecting plate. The triode is intended to function as a d-c amplifier. The electron ray section of the tube consists of a portion of the heated cathode as a source of electrons which are attracted to a target which has a positive potential on it. The shaded or unlighted sector which is used as the indicating means is produced by the shadow of a control electrode or deflecting plate which is attached to the plate of the triode.

By referring to the schematic diagram shown in figure 1 we will get a better picture of the action taking place when type 6E5 is used in circuit applications. We will assume Ec is variable by means of control A. If 250 volts is applied to the target, electrons will be attracted to it and will cause it to glow. The deflecting plate is connected to the triode plate as is indicated in the diagram. These two elements are connected to the target through a 1 megohm resistor. If we now apply zero bias to the triode, the maximum plate current will flow to the triode plate. This current flows through the 1 megohm resistor, producing a voltage drop between the target and the deflecting plate.

Since the plate is negative with respect to the target, it will reduce the number of electrons reaching the target. Because of the shape and location of the deflecting plate a shadow will be cast around the target. The shadow angle will be about 100 degrees. If the bias is increased slightly to approximately 2 volts, the plate current will decrease somewhat, decreasing the voltage difference between the target and the deflecting plate resulting in the shadow angle closing in since not as many electrons are repelled as before. After 2 volts bias is applied, the shadow angle change per volt bias applied to the grid increases somewhat and remains constant until about 6 volts bias is applied. From 6 to 8 volts the rate of change slows up somewhat but at 8 volts the shadow has usually entirely disappeared. Figure 2 shows how the shadow angles and the plate current of the triode vary if different bias voltages are applied to the triode section.

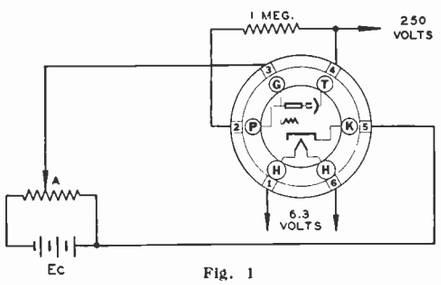


Fig. 1

In an ordinary superheterodyne receiver the d-c voltage developed across the diode load resistor in the A.V.C. circuit varies from zero volts at no signal input to a maximum of 25 volts or higher. If we refer to figure 2, it is evident that the largest bias which may be applied to the triode without completely closing the shadow is about 6.5 volts. This means we can utilize only a fraction of the developed A.V.C. voltage in order to prevent complete closing of the shadow on strong signals. By tapping a portion of the A.V.C. voltage, we reduce the indication for weak signals, since if we develop 3 volts of A.V.C., instead of applying it to the triode, we will use only the same fraction of voltage employed on strong signals, with the result that the indication is greatly reduced. It can readily be seen that this type of performance is not wholly satisfactory.

The Sylvania type 6G5 tube is being introduced at this time to correct the difficulties mentioned above. The triode grid has been changed somewhat so that the plate current cut-off occurs around −22 volts instead of −8 volts as in type 6E5. Figure 3 shows two grids on the 6G5 corresponding to those shown in figure 2 for the 6E5. It will be noted from the curves that it will be possible to use all of the developed A.V.C. voltage with this tube with the result that the indications of weak signals are as large as possible while the strongest signals will not quite close the shadow.

The 6G5 can be used to replace the 6E5 in nearly all present applications where difficulty is experienced due to the closing of the shadow. Usually no circuit changes will be required. Where the difficulty does not exist due to the closing of the shadow, increased weak signal indications can be obtained, if only a portion of the A.V.C. voltage is now being used, by applying the total A.V.C. voltage and substituting a Sylvania type 6G5.

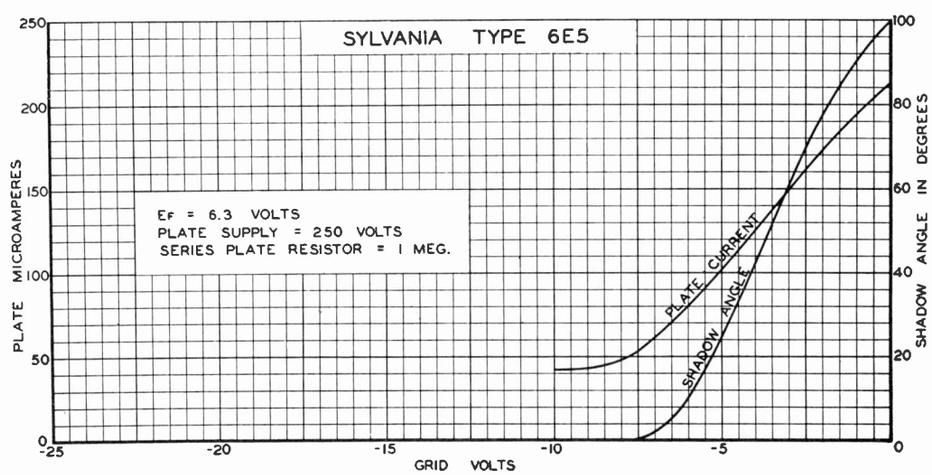


Fig. 2

Figure 3 Continued on Page Three

A CHAT WITH ROGER WISE

Chief Tube Engineer
Hygrade Sylvania Corporation

Reports from service men in various parts of the country indicate a full appreciation of the policies followed in Hygrade Sylvania factories with respect to quality. Reports from such sources are particularly important and informative, since it is the service man who attends the sick radio set and diagnoses its ills. He has first hand knowledge as to how tubes behave in receivers of various makes and models, under actual operating conditions in the homes or cars of his customers.

When adverse field reports are received, every effort is made by our Engineering Department to determine the cause of the difficulty and, if necessary, to set up additional safeguards in design specifications, production method, or testing, to prevent a possible repetition of the trouble.

At times tubes are used in receivers under voltage or plate current conditions which are on the high side of the ratings. If this happens the attention of the receiver manufacturer is called to the condition, with the suggestion that a service bulletin showing how to correct the set be issued. Such cooperation, in which service men can be very helpful, is necessary to insure trouble-free operation of radio receivers and other equipment using radio tubes.

At times it is difficult for service men to determine just why a receiver is giving trouble. Intermittent contacts sometimes cause great annoyance and may be of such a nature as to make it appear that tube trouble is developing, when other circuit elements are at fault. Changing tubes may temporarily restore the connection and cause it to hold until expansion of the chassis due to the heat developed in operation (or contraction from cooling) causes it to open up again. It is possible for such a condition to develop in a tube, and at times good "detective" work is essential to accurate diagnosis and permanent correction. In other cases a short may damage set parts and tubes, and it is then most difficult to trace back to the original cause of the trouble.

Within our factories a large percentage of our workers have no responsibilities except the important one of safeguarding quality and elimination of the possibility of trouble in operation. One important phase of this work is the testing of a very large quantity of Sylvania tubes which are operated continuously on our life test racks under maximum rated conditions. The results of such tests determine whether or not the production lots will be released for shipments.

While the number of new tubes being introduced continues to be high, such introductions are on an orderly basis, which makes it possible to maintain the required high Sylvania quality standards in every respect. Service men can feel safe in using and recommending Sylvania tubes for replacements of worn or defective tubes in their customers' receivers.

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. Good clear photographs of service benches or shops are also welcome.

Atwater-Kent Model 55 (Early). When this model comes in with the complaint of intermittent operation after running for a few minutes and gradually fading out with a buzz look for an open secondary in the second r-f transformer. The plate lead of the 24 tube comes through this transformer and due to this coil opening up intermittently it is sometimes difficult to hit the open period when you are checking the socket voltages The application of heat in the form of a 60 watt bulb held close to the coil will hasten the opening of the coil if such a condition exists.—Chas. C. Constantine, Northern Radio Service, 7 S. Linwood Avenue, Baltimore, Md.

* * *

Philco All Wave Aerials. It is often found in Philco, 1936 models, or any set using the Philco all-wave aerial, that the set will cut out, or will give very poor reception. The wire in the twisted lead-in often breaks loose inside of the insulation where it comes out of the aerial transformer. It can be taken apart and repaired.—Roy E. Busse, Mankato, Minnesota.

* * *

Replacing Speaker Felts. On old style speakers with felt pads around the edge of the cones the felt often becomes ragged and moth-eaten and a quick repair can be made with rubber weatherstripping. The strip I use is about ¼x¼ inches and comes in rolls which can be purchased at any auto supply store. I get a brand called Permatite and simply stick it on around the edge of the speaker. The strip has a tacky surface like tire tape and will stick to any material.—K. A. Trites, Trites Radio Service, Melrose, Mass.

* * *

RCA Model 60. Oscillation over the entire dial may be cured by placing a 05 mfd. condenser from the i-f B plus terminal in the power pack to chassis.—Clyde A Neth, 102 E Fayette St., Connellsville. Pa.

* * *

Steel Top Aerials. When installing an old type car radio in a new car that uses the metal top sheet for an aerial (as the '36 Dodge) put a small condenser in series with the ant. lead to balance the capacity. I find that .00015, .0002 or .00025 condensers are about the right size.—Ivan L. Crowe, Chicago, Illinois.

* * *

Stewart-Warner Hints. Tunable hum in Stewart-Warner model 111 or 115 was caused by condenser No. 15 opening up in the sets we serviced.

If you change condenser No. 34 in Stewart-Warner Model 111 be sure it has NO wax or tar filling. This chassis stands on end and heat from the 43 will cause it to run down and mess up the gang condenser and might mean a replacement of the gang.—Ivan L. Crowe, Chicago, Illinois.

* * *

Servicing Automatic Phonographs. I have a few service hints, that you may be able to pass on to other servicemen, regarding the servicing of Automatic Phonographs. It is my pleasure to service some 200 in this territory.

Before giving any of the hints, I would like to take this opportunity to say that it is advisable to use Sylvania tubes in making replacements for several reasons. Most of these coin operated phonographs are using as much as 350 volts d.c. on the plates of the 45 tubes and I have found that Sylvania Tubes are the only ones that will take it. Another reason is that they are usually played so loud that the output will vibrate the whole machine and cause any microphonic tube to cut up, and cause all kinds of trouble. Honestly, and I'm not saying it just because I happen to be writing you, I have lost 5 years of life looking for trouble, that has been caused by tubes.

Here are a few hints that you might pass along:

Wurlitzer Model P-400. When wiring in extra outside speaker, put the fields in series as the filaments of the two 30 tubes are lighted on the field return. If this is not done the 30 tubes will blow out as fast as you can put them in.

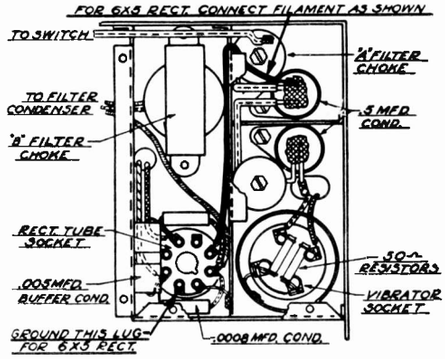
Wurlitzer Models P-10, P-12, P-30. All extra speaker fields should be wired in parallel for best results.

Rockolas. All models using 6B5 tubes in output—Intermittent squeaks and whines are caused by the 6B5 tube becoming too hot. Best remedy is to change tubes before it goes on location. Also change the small Bakelite cased condenser, in the tone control circuit, to a .001 tubular.—J. E. White Jr., White's Radio Service, Shreveport, La.

Intermittent Operation of the Golden Voice Models. Many requests have been received for information relative to replacing the 0Z4 tube with a Sylvania 6X5 rectifier. We are giving below a complete explanation on interchanging these types of tubes in the Golden Voice Motorola. The information is supplied through the courtesy of the Galvin Manufacturing Company, manufacturers of Motorola receivers. This same idea can be applied to other types of circuits incorporating the use of the 0Z4.

"Should you encounter a Golden Voice set that cuts out intermittently, or at times fails to come up to full power output, it will be found due to low battery voltage delivered to the radio. Check all connections between the car battery and the radio set to avoid undue voltage drop in the car wiring, as the 0Z-4 rectifier tube will fail to start and fail to operate on a battery voltage of less than 5½ volts.

"The 0Z-4 tube requires 15 milliamperes or more of drain to produce ionization and proper rectification in this tube, and on battery voltages of less than 5½ volts the plate current drain of



the receiver is insufficient to provide the 15 milliamperes starting current. Should the car wirings and the condition of the car battery indicate that at times the voltage may fall below 5½ volts, replace the 0Z-4 rectifier tube with a metal 6X5 filament type rectifier. With the exception of a few Golden Voice sets the filament contacts of the rectifier socket have been wired at the factory and the 6X5 rectifier may be plugged in the socket in place of the 0Z-4. This will completely eliminate the difficulty due to low battery voltage.

"On those Golden Voice sets not having the filament contacts of the rectifier socket wired, this wiring can be inserted by inverting the chassis and removing the cover from the hash compartment and connecting the filament contacts of the rectifier socket, as shown in the accompanying sketch. One contact to ground as indicated by the heavy arrow at the bottom of the socket and the other contact to the .5 mfd. condenser as indicated by heavy arrow at the top of the sketch. When replacing cover be sure that all screws are tight."—Galvin Manufacturing Company, From Installation and Service, Bulletin No. 27.

* * *

Auto Radio Tips Wanted. The Auto Radio Installation and Servicing booklet will soon be due for revision. In order to bring it up to the minute we are anxious to receive service hints covering the latest auto radio models, aerial installation on Steel-top cars, and other up-to-date auto radio information. Your choice of one Sylvania receiving tube will be given for each hint accepted for publication, and your name will appear after your hint in the new Auto radio booklet.

TUNING INDICATOR—6E5 vs 6G5—Continued from Page Two

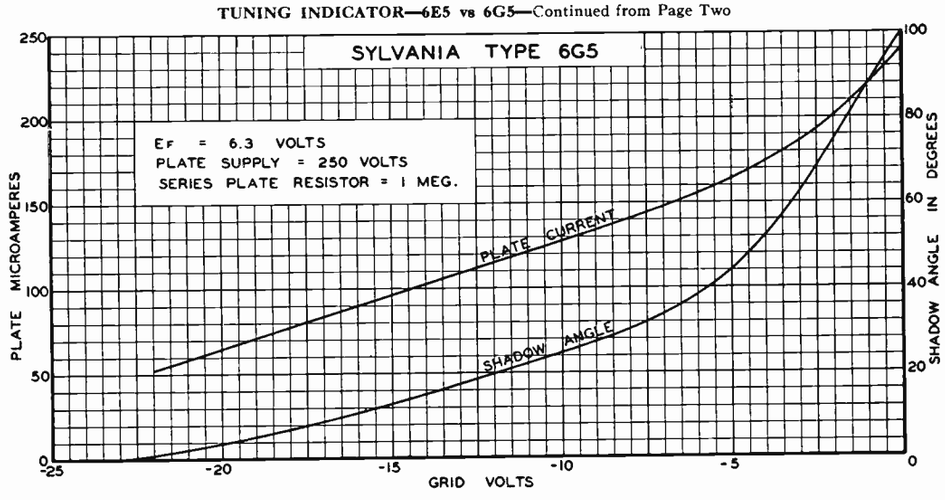


FIG. 3

NEW TUBES

Continued from Page One

TYPE 5W4—Continued

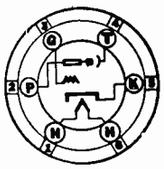
Characteristics

Filament Voltage	5.0 Volts
Filament Current	1.5 Amperes
Maximum Overall Length	3¼ inches
Maximum Diameter	1⅛ inches
Base	5 pin octal

Operating Conditions and Characteristics

Filament Voltage	5.0 Volts
A-C Voltage per Plate (R.M.S.)	350 Volts
D-C Output Current	110 Ma. Max

Type 6G5 Tuning Indicator



Type 6G5 is a tuning indicator tube similar in appearance and application to type 6E5. The triode grid of this new tube has been changed from that of the original tuning indicator so that the plate current cut-off occurs around minus 22 volts instead of minus 8 volts. This characteristic makes for a better tube in that it is possible to use all the developed AVC voltage. This results in a tuning shadow being indicated with weak signals which will be as large as possible while the strongest signals will not entirely close the shadow. A complete description of the improvements of the new tube over the 6E5 will be found on page 2 of this issue.

Type 6G5 may be used to replace the 6E5 in nearly all present applications with no circuit changes being necessary. Where difficulty is now experienced with complete closing of the shadow of the 6E5 it is recommended that the 6G5 be used. If no difficulty exists due to closing of the shadow from only a portion of the AVC voltage being used, increased indications on weak signals may be obtained by using a type 6G5 and applying the total AVC voltage.

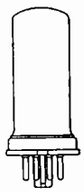
Characteristics

Heater Voltage AC or DC	6.3 Volts
Heater Current	0.3 Ampere
Maximum Over-all Length	4¼ Inches
Maximum Diameter	1⅛ inches
Bulb	ST-12
Base	Small 6-Pin

Operating Conditions and Characteristics

Plate Supply Voltage	250 Volts
Target Supply Voltage	250 Volts
Plate Current (Triode Unit)*	0.24 Ma. Max.
Target Current	3.0 Ma. Approx
Grid Voltage (Triode Unit)**	0.0 Volts
Grid Voltage (Triode Unit)***	-22.0 Volts
Triode Plate Resistor	1.0 Megohm

*With triode grid voltage of zero volts.
**For shadow angle of approx. 90 degrees.
***For shadow angle of approx. zero degrees.



Type 6N7 Class B Power Amplifier

Type 6N7 is the metal tube equivalent of Type 6A6. It is a heater type Class B output tube, consisting of two triode units in a single bulb.

Type 6N7 is used primarily as a Class B output tube in a-c operated receivers, and will also find application in automobile receivers properly designed for its characteristics.

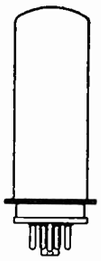
By connecting the triode elements in parallel Type 6N7 may be employed as a Class A tube, supplying sufficient power to drive another 6N7 in a Class B output stage. The driver plate load should be two to four times the plate resistance, the value depending upon the design of the Class B stage. The maximum d-c resistance in the grid circuit is 0.5 megohm, when the tube is self-biased. With fixed bias the value should be limited to 0.1 megohm.

Other special applications, such as its use as a cascade amplifier or combination voltage amplifier and phase inverter, are similar to those applying to Types 6A6 and 53.

Characteristics

Heater Voltage AC or DC	6.3 volts
Heater Current	0.8 Ampere
Maximum Over-all Length	3¼ inches
Maximum Diameter	1⅛ inches
Bulb	All-Metal
Base	8 Pin-Octal

Operating Conditions and Characteristics Refer to Type 6A6



Type 6L6 Power Amplifier

The Sylvania Type 6L6 is an all-metal power amplifier tube designed for use in the output stage of radio receivers, particularly in those designed to have a reserve of power capability. The tube provides high power output, power sensitivity and efficiency, with low percentage of third and higher order harmonics.

New design principles, responsible for the above features, involve the use of directed electron beams. These effects are produced by arranging the tube elements in such a manner that potential fields are set up which confine the electrons into beams of high density. Efficient suppressor action is produced by the space-charge effects formed between the screen and plate. Very little power is taken by the screen.

The second harmonic distortion is intentionally high in order to reduce the third and higher order harmonics to a minimum. Elimination of the second harmonic distortion can be obtained by using the 6L6 in a push-pull arrangement. If only one tube is used in a resistance coupled circuit, second harmonics can be reduced by generating out-of-phase second harmonics in preceding audio stages.

It is recommended that circuits be used which avoid the effects of loud speaker resonance and variable impedance.

Characteristics

Heater Voltage	6.3 Volts
Heater Current	0.9 Ampere
Maximum Over-all Length	4½ inches
Maximum Diameter	1⅛ inches
Bulb	All-Metal
Base	7 Pin Octal

Static and Dynamic Characteristics

Heater Voltage	6.3 Volts
Plate Voltage	250 Volts
Screen Voltage	250 Volts
Grid Voltage	-14 Volts
Plate Current	72 Ma.
Screen Current	5 Ma.
Plate Resistance	22500 Ohms
Mutual Conductance	6000 Micromhos
Amplification Factor	135

Operating Conditions and Characteristics: Class A_1 Amplifier (One Tube)

Heater Voltage°°			6.3	6.3	6.3		6.3 Volts
Plate Voltage			375	250	300		375 Max. Volts
Screen Voltage			125	250	200		250 Max. Volts
Plate and Screen Dissipation°°							24 Max. Watts
Bias	Fixed	Self	Fixed	Self	Fixed	Self	Fixed
Grid Voltage††	-9	-9†	-14	-13.5†	-12.5	-11.8†	-17.5 Volts
Peak Input Signal	8	8.5	14	14	12.5	12.5	17.5 Volts
Plate Current (Zero Signal)	24	24	72	75	48	51	57 Ma.
Plate Current (Max. Signal)	26	24.3	79	78	55	54.5	67 Ma.
Screen Current (Zero Signal)	0.7	0.6	5	5.4	2.5	3.0	2.5 Ma.
Screen Current (Max. Signal)	1.8	2	7.3	7.2	4.7	4.6	6 Ma.
Load Resistance	14000		2500		4500		4000 Ohms
Total Distortion	9		10		11		14.5 Percent
2nd Harmonic	8		9.7		10.7		13.5 Percent
3rd Harmonic	4		2.5		2.5		4.2 Percent
Power Output (Max. Signal)	4.2	4	6.5		6.5		11.5 Watts

Class AB_1 Amplifier (Push Pull) Values are for two tubes

Heater Voltage°°		6.3	6.3	6.3			6.3 Volts
Plate Voltage		400	400	400			400 Max. Volts
Screen Voltage		250	250	300			300 Max. Volts
Plate and Screen Dissipation°°							24 Max. Watts
Bias	Fixed	Fixed	Self	Fixed	Self		Fixed
Grid Voltage††	-20	-20	-19†	-25	-23.5†		-25 Volts
Peak Input Signal (Grid to Grid)	40	40	43.8	50	57		50 Volts
Plate Current (Zero Signal)	88	88	96	100	112		102 Ma.
Plate Current (Max. Signal)	126	124	110	152	128		156 Ma.
Screen Current (Zero Signal)	4	4	4.6	5	6		5 Ma.
Screen Current (Max. Signal)	9	12	10.8	17	16		12 Ma.
Load Resistance (Plate to Plate)	6000	8500		6600			3800 Ohms
Total Distortion	1	2		2			0.6 Percent
3rd Harmonic	1	2		2			0.6 Percent
Power Output (Max. Signal)	20	26.5	24	34	30		23 Watts

	Class A_1 Amplifier		Class AB_2 Amplifier	
	Fixed Bias	Self Bias	Fixed Bias	Fixed Bias
Heater Voltage°°	6.3	6.3	6.3	6.3 Volts
Plate Voltage	250	250	400	400 Max. Volts
Screen Voltage	250	250	250	300 Max. Volts
Plate and Screen Dissipation°°		24		24 Max. Watts
Grid Voltage††	-16	-16†	-20	-25 Volts
Peak Input Signal (Grid to Grid)	32	35.6	57	80 Volts
Plate Current (Zero Signal)	120	120	88	102 Ma.
Plate Current (Max. Signal)	140	130	168	230 Ma.
Screen Current (Zero Signal)	10	10	4	6 Ma.
Screen Current (Max. Signal)	16	15	13	20 Ma.
Load Resistance (Plate to Plate)	5000	5000	6000	3800 Ohms
Peak Input Power**			180	350 Milliwatts
Total Harmonic Distortion	2	2	2*	2* Percent
3rd Harmonic	2	2	2*	2* Percent
Power Output (Max. Signal)	14.5	13.8	40	60 Watts

Above values are for 2 tubes in push-pull.

Additional information pertaining to the reference marks which appear in the various tabulations of ratings and operation characteristics for Type 6L6 is given below:

The subscript "1" used in conjunction with the terms Class A and Class AB indicates that no grid current flows during any part of the input cycle. Likewise, a subscript "2" indicates that grid current does flow during some part of the input cycle.

The heater voltage rating for Type 6L6 is 6.3 volts. Precautions should be taken to prevent the heater voltage from exceeding a maximum value of 7.0 volts during line voltage fluctuations. A minimum potential difference between heater and cathode should be maintained.

°°The maximum plate and screen dissipation must not be exceeded. Provision should be made for line voltage changes, especially when fixed-bias operation is employed.

†Indicates zero signal.

††Transformer or impedance coupling devices are recommended and the resistance introduced in the grid circuit should be kept as low as possible. For fixed bias this resistance should not exceed 50000 ohms. The maximum grid circuit resistance when self-bias is employed may be 0.5 megohm if the heater voltage does not exceed 7.0 volts. See first note above.

*The plate circuit distortion does not exceed 2% with a zero impedance driver.

**For Class AB operation the driver stage should be designed so as to be capable of suppiying the required peak power with low distortion to the grids of the output stage.

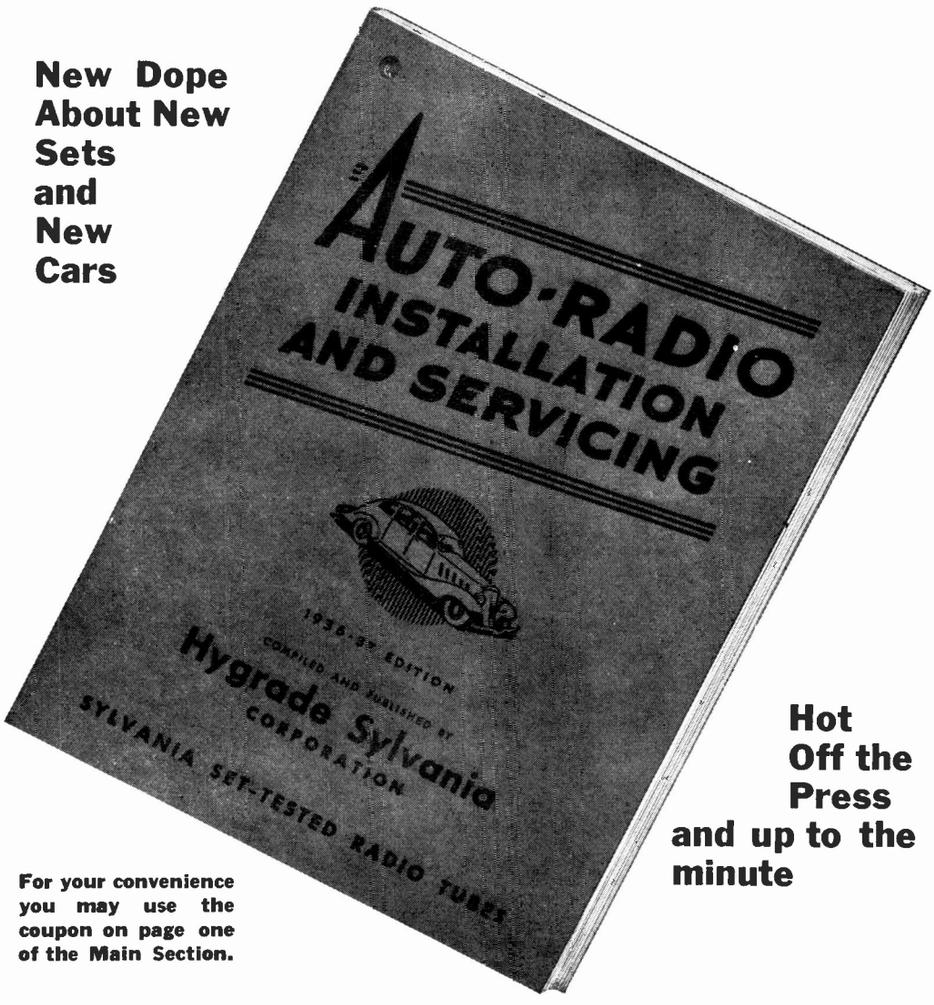
SYLVANIA NEWS

TECHNICAL SECTION

Vol 6 EMPORIUM, PENNA. No. 7

1936-1937 EDITION

New Dope About New Sets and New Cars



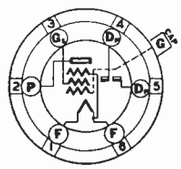
Hot Off the Press and up to the minute

For your convenience you may use the coupon on page one of the Main Section.

Here's the little book you've been waiting for—and it's "little" only because you can stick it in your pocket. Actually it's the biggest collection of brand-new service tips on auto radio installation and servicing you've ever seen, plus a section on eliminating motor interference for each make of car, plus a chart of tube complements for practically all models of automobile radio sets, with peak frequencies. You'll say it is worth its weight in crisp new dollar bills—but we're not selling it. It's free to any service man who can use it. Send your request to the Advertising Department, Hygrade Sylvania Corporation, Emporium, Pa., and please write your name and address plainly so that the mailing department won't have to do detective work and you won't be disappointed.

NEW TUBES

Type 1F6 Double Diode-Pentode



Type 1F6 is a double diode pentode for use in 2-volt battery receivers. This tube will find wide application as a combined diode detector and pentode amplifier, and for securing the required voltage for a.v.c. Conventional circuits for a pentode are applicable to the pentode section of Type 1F6 when employed as an r-f or i-f amplifier. As an a-f amplifier the pentode unit may be used in a resistance coupled circuit to provide high gain. The load resistance includes the plate resistor, coupling condenser, and grid resistor of the preceding tube. Detailed data for this service are given in ratings shown below.

Tentative Characteristics

Filament Voltage	2.0 Volts
Filament Current	0.06 Ampere
Direct Interelectrode Capacitances—Pentode Unit:	
Grid to Plate (With Tube Shield)	0.007 uuf. Max.
Input	4 uuf.
Output	9 uuf.
Maximum Overall Length	4 17/32 Inches
Maximum Diameter	1 1/4 Inches
Bulb	ST-12
Cap	Small Metal
Base	Small 6-Pin

Operating Conditions and Characteristics

Pentode Unit: R-F or I-F Amplifier

Filament Voltage	2.0 Volts
Plate Voltage	180 Volts
Screen Voltage	67.5 Volts
Grid Voltage	−1.5 Volts
Plate Current	2.0 Ma.
Screen Current	0.6 Ma.
Plate Resistance (Approx.)	1 Megohm
Amplification Factor (Approx.)	650
Mutual Conductance	650 umhos
Mutual Conductance: (at −12 Volts Bias)	15 umhos

Pentode Unit: A-F Amplifier (Resistance Coupled)

Plate Supply Voltage	135	135	135 Volts
Screen Supply Voltage	135	135	135 Volts
Plate Resistor	0.25	0.25	0.25 Megohm
Screen Resistor	1.0	0.9	0.8 Megohm
D-C Grid Voltage	−1.0	−1.5	−2.0 Volts
Peak A-F Grid Voltage	0.64	0.63	0.62 Volts
Plate Current (Esig = 0)	0.42	0.42	0.42 Ma.
Plate Current (Esig = Max.)	0.34	0.34	0.34 Ma.

"G" TUBES

A new group of glass tubes, termed "G" or "Metaglass" tubes has been added to the Sylvania line of receiving tubes. In most cases, these tubes are identical or similar to some of the more popular Sylvania tubes of the past season. The appearance of these new tubes is also similar to certain original glass tubes with the exception of the bases and top caps. The bases are of the octal type with locating lug and the top caps are of the miniature style, with the same diameter as the top caps on metal tubes. The ST type of bulb is used with the complete "G" group.

The characteristics, operating conditions and circuit applications of most of these new tubes are identical to certain equivalent or similar types. Reference, therefore, may be made to data on equivalent types for preliminary technical information on this group of "G" tubes. The complete group is listed in another section of this issue for your convenience in referring to equivalent types.

Following are descriptions of each type with information on base pin arrangements and interchangeability. It will be noted in the base pin

Continued on Page Two

"G" TUBES

Continued

arrangement of most types that pin number one is open, having no connection. It will also be noted that extra pins may be present on some of the bases but are not connected. The extra pins in these bases are not for use but are present for a uniformity in bases.

In interchangeing metal tubes, metaglass tubes or metal-glass tubes with "G" types it may be necessary to realign tuned circuits to obtain maximum performance.

Type 5V4G

Type 5V4G is a full wave high vacuum rectifier identical to type 83V except that it is equipped with an octal type base. The base pin arrangement of this tube is identical to that of the metal tube type 5Z4 with the exception of pin No. 1 which is open since the shield is commonly tied to this pin in metal tubes. If desired, type 5V4G may be used to interchange the 5Z4, 5Z4MG, or any other metaglass or metal-glass type 5Z4, where space permits. However, the 5Z4 should not be used to replace the 5V4G in receivers designed for the latter tube since the current drain on such receivers is usually too great for the 5Z4.

Type 5X4G

Type 5X4G is a high vacuum rectifier identical to type 5Z3 except it that is equipped with an octal base. The base of this tube contains all 8 pins although only four are connected. The pins which are connected are Nos. 3 and 5, plate connections, and 7 and 8, filament connections. This new tube is not interchangeable with any previously announced tubes.

Type 5Y3G

Type 5Y3G is a full wave high vacuum rectifier tube similar in appearance to type 80 but fitted with an octal type base. The type 5Y3G will be found in applications similar to those of the type 80. The basing arrangement of this new tube is identical to the metal tube, type 5Z4, except for pin No. 1, which, although present, is not utilized. This new tube may be used as a replacement tube for the metal tube 5Z4, the metal glass tube 5Z4MG, or the Coronet type 5Z4, although slightly lower output voltages may be obtained from the use of this new tube. Therefore the previously mentioned tube, type 5V4G should prove more satisfactory. The original type number of this tube was 5Y3 but due to some confusion in associating it with the "G" tubes the letter "G" was suffixed but characteristics remained the same.

Type 5Y4G

Type 5Y4G is a full wave high vacuum rectifier identical to type 80 except for the octal type of base used with the tube. The characteristics of this tube are the same as for type 5Y3G but the basing arrangement is different since the tube is used in special circuits and is based so that it cannot be replaced with a rectifier tube having higher output ratings. The base of this tube is equipped with all eight pins, but only four of these are connected, pin Nos. 3 and 5, plate connections, and 7 and 8, filament connections.

Type 6A8G

Type 6A8G is a pentagrid converter tube which is identical in characteristics to type 6A7 and is also similar in appearance with the exception of the base which is of the octal type having a locating lug. The base connections correspond to those for the metal tube, type 6A8 except for pin No. 1, which, although present, is not connected. Type 6A8G may be used as a replacement tube for type 6A8 or 6A8MG, but realignment of the circuit may be necessary and in some cases an external shield is required which should be grounded.

Type 6B4G

Type 6B4G is a power amplifier tube of triode construction and will be found in use in the output system of household receivers and public address systems. This new tube is identical in characteristics to those of type 6A3 and is also identical in appearance except for the octal type base which is used. This tube will not directly replace any previous tubes. The base pin connections are: Pins No. 1 and 7, filament, No. 3 plate and No. 5 control grid. The other pins included in the base are not connected.

Type 6B6

Type 6B6 is not being announced with the "G" group of tubes by Sylvania under this type number since the type 6Q7G is being made available, which may be used as a direct replacement for type 6B6. Wherever it is necessary to replace the type 6B6 tube, the new Sylvania type 6Q7G may be used without any changes in the circuit.

Type 6C5G

Type 6C5G is a triode amplifier tube that is substantially the same as the metal tube type 6C5 except for the glass bulb. The basing arrangement for type 6C5G is identical to that of type 6C5 with the exception of pin No. 1 which has the outer cage of the tube connected to it. This construction affords interelectrode capacities comparable with those of the metal type 6C5; therefore the two types are interchangeable. Type 6C5G may also be used as a replacement tube for all type 6C5MG tubes. In some cases slight realignment of the circuit may be necessary.

Type 6F5G

Type 6F5G is a high mu triode glass tube equipped with an octal type base having an outer cage connected to pin No. 1 of the base. The basing otherwise is identical to that of type 6F5 thus affording two tubes which are interchangeable since the interelectrode capacities are comparable. This new tube will also replace all type 6F5MG tubes.

Type 6F6G

Type 6F6G is a power output pentode identical with type 42 except for the octal type base which is used. This new tube has a basing arrangement the same as that of type 6F6 except for pin No. 1 which, although present, is not utilized. Type 6F6G and the metal tube, type 6F6 may be interchanged, if desired and it may be used also to replace any type 6F6MG.

Type 6H6G

Type 6H6G is a double diode tube, the structure of which consists of two diode plates shielded from one another with the shield connected to base pin No. 1. The other base connections are the same as those of the metal type 6H6 thus affording two tubes which are interchangeable, if desired. This new tube will also replace any type 6H6MG tube.

Type 6J5G

Type 6J5G is a new glass tube equipped with an octal type base. This new tube is a general purpose amplifier triode and will be found in use in circuits of conventional design as an amplifier, detector, or oscillator tube. The characteristics of this new tube are not identical with any other type of glass tube but in general parallel those of such tubes as types 76 and 6C5G. This new tube will not directly replace any previously announced tubes. The base pin connections are: Pins No. 2 and No. 7 heater, No. 3 plate, No. 5 control grid with the other pins on the base not connected.

Type 6J7G

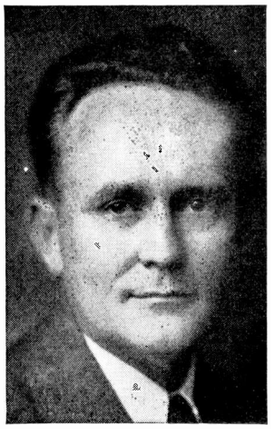
Type 6J7G is a triple grid amplifier and detector tube, identical in appearance to type 77 except that it is equipped with an octal type base. The characteristics of this new tube are practically the same as those for the metal tube 6J7 and the two tubes can be interchanged, but realignment of the circuit may be necessary. This new tube will also replace any type 6J7MG. The use of an external shield on the 6J7G may be required, which should be grounded. The basing arrangement for this new type corresponds to that of type 6J7 except that base pin No. 1 has an internal cage connected to it. This pin arrangement permits the cage to be connected to the screen grid terminal thereby providing a tube conforming to type 77, or if preferred, the cage may be grounded, providing improvement in shielding but reducing the mutual conductance slightly.

Type 6K5G

Type 6K5G is a new high mu triode glass tube equipped with an octal base. The characteristics

Continued on Page Four

A CHAT WITH ROGER WISE



Chief Tube Engineer
Hygrade Sylvania Corporation

With the demand for radio tubes at an unusually high level, and with the number of types increasing rapidly, it is gratifying to note that favorable comments on Sylvania quality are more frequent than ever.

Since it is out of the question to manufacture tubes which will give the highest possible reading on all types of tube testers and also perform satisfactorily under all circuit conditions found in different radio receivers, each tube manufacturer must carefully set his standards for all tube types. His endeavor is then to hold the entire production as close to the center or "bogey" value as possible. Tubes on the high side of the ratings are discarded just as quickly as tubes on the low side. Any other policy would be most unsatisfactory to the trade. If tube performance standards were allowed to go higher and higher because of a fairly general demand for "hot" tubes we could easily reach the point where the tubes would give excessive gain in receivers designed for the original types, with resultant difficulties such as instability or oscillation in the R.F. or I.F. circuits, or other similar troubles.

Makes of tubes which show unusually high initial readings but which slump off quickly after a few hours' service should also be avoided, even though they do not appear to change further after longer burning. Such performance is caused by improper exhaust or aging schedules which happen to give an abnormally active cathode surface during the first few hours of life. The danger lies in the fact that such conditions are quite variable, and too many tubes will not merely "slump"—they will drop on down to the point where they must be discarded early in life.

Properly centered exhaust and aging conditions will insure uniform performance during the useful life of the tube, assuming that sufficient care has also been exercised in the operations of parts manufacture and mounting.

Dealers and servicemen should give preference to tubes which run uniformly near the average values on test, realizing that these will give the most uniform and satisfactory results when used as replacements in well designed radio receivers.

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, except the metal type. Please indicate preference when submitting hints. Don't send routine or generally known information.

Motorola Model 100. Here are some tips to follow in overcoming low volume and poor sensitivity that may be apparent in this model of auto receivers. Remove the cathode resistor on the i-f stage and ground the cathode terminal direct. Also disconnect the suppressor grid from the chassis and either leave it free or tie it to the screen. In the r-f stage change the cathode resistor to one of lower value and if the set is used far from broadcasting stations ground the cathode to the chassis. I found that 350 ohms is suitable in this territory. Tie the suppressor of this tube to the cathode terminal. These changes do not lead to distortion as you might think but do increase the pick-up better than 50 per cent.

I have found that the tone of these receivers is either too high or too low so I replace the original tone control with a variable type. I use a 0.1 mfd. condenser in series with a ½ ohm variable resistor.—Frank G. Wiebel, Jr., Hagerstown, Md.

* * *

Philco Model 19—Code 129. When this set is dead and voltages are okey, check the 15,000 ohm ½ watt resistor on the resistor and condenser block. Apparently this resistor changes value when current is applied. Replace with a 15.000 ohm, 1 watt resistor.—Harry T. Schmidt, Hammond, Indiana.

* * *

Philco Model 60. When this set is dead and no "B" voltage on sockets terminal, this is no doubt due to a short from white "B" lead of 2nd i-f transformer to the clamp that holds the wood bobbin inside the can. Replace wire or put a good insulation sleeving over the wire. Voltage is 285. This trouble was found in at least four sets so far, and is often found only as arcs.—C. W. Hackenyos, Philadelphia, Pa.

* * *

Philco Model 660X. Symptoms: Excessive hum, which becomes more intense when one touches the black cardboard underneath chassis.

In some receivers this cardboard becomes warped so that it almost touches some of the parts and being painted with a black carbon paint conducts an induction current which causes a disturbing hum.

Remedy: Remove and turn over and if this does not eliminate, remove entirely.—W. W. Staats, Ripley, W. Va.

* * *

R. C. A. Victor Auto Radio Model M34. Vibrator noise in this auto receiver may be caused by the breaking away of the soldered bond between the chasses and the partition separating the power transformer from the rest of the set. Resoldering this partition will remedy this condition.—Dieckmann Radio Service, Brooklyn, N. Y.

* * *

RCA Victor 45 With Electrola. If the set is dead and the Electrola o.k. look for a defect in the dual volume control. An easy way to ascertain the trouble is to apply the signal to one of the 26 tube grids. If the trouble is as mentioned, the set will then operate, and the volume control seems to work nicely, but one of the dual sections will be found defective.—Louis Wiech, New Castle, Penna

* * *

RCA Model 120. If this set has a high-pitched whistle with the tone control set at treble, test the .005 mfd. condenser connected from plate to screen of 2A5 for open circuit. It seems that all sets using a diode-triode or diode-pentode detector and first audio have a whistle (audio oscillation), which is bypassed as described above.—Tom J. Davis, Cave Spring, Ga.

RCA Model 121. Oscillator not working set brings in static and shows every sign of playing but won't. Before tampering with the oscillator circuit or replacing the coil try cleaning the wiping contacts on the "Long and Short Wave" switch. I found that this puts the set back to normal working condition. Failure of the oscillator was caused by the high-resistance contacts of the dirty switch.—G. H. Wright, Wendell, N C.

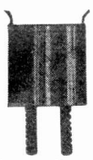
* * *

Refinishing Panels. It is sometimes necessary for the serviceman to renew or improve the finish of scratched, dulled, and marred panels or cases of servicing equipment.

For this purpose ordinary shoe polish is ideal and inexpensive. Black polish will make panels, dials, and practically all other parts of bakelite, hard rubber, black-finished wood or metal look like new. Brown polish will work wonders with parts of that color. Parts of most any color can be treated by this method, since polishes of many colors and shades are now generally available.

The "oil-paste" variety is the best kind to use, and when thinly applied in the usual manner and well polished with a dry soft cloth will not come off and soil fingers or clothes.—Edward W. Hill, Fitchburg, Mass

* * *



Tube Socket Cleaner. A good device for cleaning tube socket contacts may be made from an old tube base. By cutting the pins with a three cornered file or a hack saw so that saw teeth are made the base works very good as a cleaner. It is suggested that a handle be added to the base so that the cleaner may be easily moved up and down.—Pedro Sapojkin, S. Paulo, S. P. Brazil.

* * *

Replacing Audio Tubes. The following hints were in the Volume 6, No. 3 issue but since there were several typographical errors, we are listing the correct hints below:

Replacing "45" With A 2A5. To change from a "45" to a 2A5 it is necessary to connect a 410 ohm resistor from cathode to ground. A 10 mfd. condenser is placed in parallel with the 410 ohm resistor. The center tap of the filament resistor is connected direct to ground. The screen grid is connected direct to the B plus The 4 prong socket must be replaced with a 6 prong one.

Replacing a "71A" With A "2A5". To change from a "71A" to a 2A5 it is necessary to connect a 410 ohm resistor in series with the cathode. A 10 mfd. condenser is placed in parallel with the resistor. The screen grid is connected direct to the B plus. A resistor is placed in series with the filament to reduce the voltage from 5 volt to 2.5 volts. The 4 prong socket is replaced with a 6 prong socket.—Precision Radio Laboratories, Chicago, Illinois.

* * *

Studebaker Ignition Interference. While clearing up ignition interference in a 1936 Studebaker, I found that the exhaust pipe had to be grounded with a piece of shielding to the frame of the car. The ground had to be connected to car frame, near the lead-in of antenna. —Dieckmann Radio Service, Brooklyn, N. Y.

* * *

Zenith Hints. When the C band of the Zenith Model 5513 is weak; check the primary of the 16 meter coil. Part No. 10 in print. They sometimes open at soldered joints due to tension.

When there is a hum on stations in the Zenith Models 5621-5401-5903-5611 check the **Ant. Choke First.** They open up. They should be 1 microhenry.

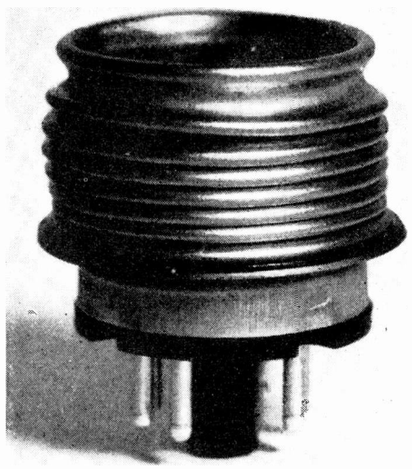
When the Zenith Model 5405 won't tune in the lower frequencies; check the 600 padder C2. Apply **Hot** iron to the outside plate (bottom of chassis). Any moisture content will change the capacity and make it drift as much as 300 K.C. There were several changes in this chassis and may not follow your print.—Ivan L. Crowe, Chicago, Illinois.

* * *

Zenith Model 52. Loud hum gets louder as set plays. After trying hints suggested in the Sylvania Service Hints book replace the 36 M.F. wet electrolytic condenser with a 36 M.F. dry one even though the old one tests good. The hum will disappear.—A. R. Dayes, 1418-81st St., Brooklyn N. Y

NEW

The Accordion Tube



So new that it hasn't yet received a type number, this is the tube that will revolutionize the radio industry. Compact, self-contained. calm, cool and collected, it stands alone—the proud product of skill, science and invention. The Sylvania Engineering Department gape with amazement and froth with envy, for it isn't their baby. It was developed solely by the seething brains of the Sylvania welding department. Look at it carefully, for there'll never be another one like it. They've forgotten what they did to produce it—but isn't it a honey? Next month, if luck is with them, they plan to announce the Harmonica or Mouth Organ tube

"G" TUBES

Type 6K5G—Continued

of this new tube are very similar to the triode section of the type 6Q7G but are not identical. This new tube is enclosed in an ST-12 bulb and uses the miniature type of top cap. This tube cannot be used for replacement of any tubes previously announced. The base pin connections are: Pins No. 1 and 7 heater, No. 3 plate, No. 8 cathode, top cap control grid. The other pins included on the base are not connected.

Type 6K6G

Type 6K6G is a pentode power output tube identical in characteristics to type 41. This new tube, in appearance. is the same as the type 41 except that it is equipped with an octal base with base pin connections corresponding to those of type 6F6G. This new tube may be used to replace the metal tube, type 6F6, providing the operating voltages applied at the socket do not exceed the ratings for the tube.

Type 6K7G

Type 6K7G is a triple grid super-control amplifier tube similar in appearance to type 78 except for the octal type base which is employed. The basing arrangement of the tube is the same as that for type 6K7 except for pin No. 1 which is not connected, thus providing two tubes which may be used interchangeably, but realignment of the circuit may be necessary to compensate for the differences in interelectrode capacities. This new tube may be used also as a replacement tube for any type 6K7MG, in which case it may be necessary to equip the tube with an external shield which should be grounded.

Type 6L6G

Type 6L6G is a power output tube enclosed in a glass bulb, equipped with an octal type base. This tube will be found in use in the output stage of radio receivers and amplifiers, particularly in those designed to have a reserve of power capacity. This new tube provides high power output, power sensitivity, and efficiency with a low percentage of distortion and higher order harmonics. This tube may be used interchangeably with the metal type 6L6, if desired. The base pin connections are the same as those for type 6L6 except for pin No. 1 which although present is not used.

Type 6L7G

Type 6L7G is a pentode mixer amplifier which is the glass counterpart of the metal tube 6L7 The elements of this tube are enclosed in an ST-12 bulb, being similar in appearance to type 6A7 with the exception of the base, which is of the octal type. The basing connections of this new tube correspond to that for the metal type 6L7 with the exception of pin No. 1 which is not connected. The interchanging of types 6L7G and 6L7 may be done, but adjusting will no doubt be necessary in the tuned circuit to compensate for the differences in the tubes. Type 6L7G may also be used to replace any type 6L7MG tube.

Type 6N6G

Type 6N6G is a power output tube consisting of two triode units in one bulb. This tube is identical to type 6B5 with the exception of the base which is of the octal type. This new tube will be found in circuit applications identical to those in which the 6B5 tube may be found. Type 6N6G may be used as a replacement tube for types 6N6 or 6N6MG, providing space permits.

Type 6N7G

Type 6N7G is a class B power output tube consisting of two triode units in a single glass bulb. This tube is identical in design, characteristics and appearance to type 6A6 with the exception of the octal type base which is used. The base arrangement corresponds to that for the metal tube type 6N7 except for pin No. 1 which, although present, is not connected. Type 6N7G and 6N7 therefore are interchangeable, if desired. This new tube will also replace any type 6N7MG tube.

Type 6Q7G

Type 6Q7G is a double diode high mu triode similar in appearance to type 75, of the standard glass group. This new tube is a glass counterpart of the metal tube, type 6Q7. The basing arrangement is the same as that for type 6Q7 except for pin No. 1 which is not utilized. The capacities of 6Q7G and 6Q7 are slightly different but the two tubes may be interchanged, if desired. This new tube will also replace any type 6Q7MG. This tube will also find wide application as a direct replacement tube for the Metaglass tube, type 6B6, which was popular in several of last season's receivers.

Type 6R7G

Type 6R7G is a double diode medium mu triode tube very similar in appearance and characteristics to type 85, of the standard glass group. This new tube is equipped with an octal base having base pin connections the same as type 6R7 and therefore may be considered interchangeable with the latter type. This new tube will replace any metal glass type 6R7MG.

Type 6X5G

Type 6X5G is a full wave high vacuum rectifier tube identical in design and characteristics to type 84. This tube is the same in appearance as the type 84 except that it is equipped with an octal base. The basing arrangement conforms to that for the metal type 6X5 and therefore this new tube is interchangeable with the metal type 6X5, or the metal glass type 6X5MG.

Type 25A6G

Type 25A6G is a power amplifier pentode identical in construction and characteristics to type 43 with the exception of the base employed which is of the octal type. This tube will be found in the output stage of Universal a.c.-d.c. receivers. The basing arrangement of type 25A6G is the same as that for type 25A6 except for pin No. 1 which is not connected. This new tube may be used interchangeably with types 25A6, 25A6MG and 43MG.

Type 25Z6G

Type 25Z6G is a high vacuum rectifier and voltage doubling tube identical to type 25Z5 with the exception of the octal type base used. The basing arrangement corresponds to that of the metal type 25Z6 although pin No. 1 is left open which is regularly the shell connection of the metal tube. Type 25Z6G may be used interchangeably, if desired, with types 25Z6 and 25Z6MG.

For Your Technical Manual

"G" Tube Characteristics

Many of the "G" tubes now made available by Hygrade Sylvania Corporation are identical with some of the more popular original Sylvania tubes. Characteristics and circuit applications for these tubes may be obtained by referring directly to the equivalent types. A few of the tubes in the "G" group do not have equivalent types but do have similar types. The characteristics and circuit applications for these tubes are the same as the similar types except where some slight change has been made in characteristics. Reference may be made to the similar types for preliminary technical data.

There are three tubes in the "G" group which are entirely new in characteristics. These are types 1E7G, 6J5G, and 6K5G.

The complete group of "G" tubes is listed below with equivalent and similar types shown The list may be used with your Sylvania Technical Manual as a quick reference for characteristics and circuit applications of "G" tubes. Descriptive information, base pin arrangements and interchangeability of these tubes may be found in another section of this issue.

"G" Type	Characteristics Same as	"G" Type	Characteristics Same as
1C7G	1C6	**6F5G**	See Below
1D5G	1A4	**6F6G**	42
1D7G	1A6	**6H6G**	See Below
1E5G	1B4	**6J5G**	*
1E7G	*	**6J7G**	77
1F5G	1F4	**6K5G**	*
1F7G	1F6	**6K6G**	41
1H4G	30	**6K7G**	78
1H6G	1B5/25S	**6L6G**	6L6
1J6G	19**	**6L7G**	See Below
5V4G	83V	**6N6G**	6B5
5X4G	5Z3	**6N7G**	6A6
5Y3G	80	**6Q7G**	See Below
5Y4G	80	**6R7G**	See Below
6A8G	6A7	**6X5G**	84
6B4G	6A3	**25A6G**	25A5
6C5G	See Below	**25Z6G**	25Z5

*New Characteristics—Refer to descriptive article in this issue.

**Except filament current (240 Ma.)

6C5G same as 6C5 except for capacities
6F5G " " 6F5 " "
6H6G " " 6H6 " " "
6L7G " " 6L7 " " "
6Q7G " " 6Q7 " " "
6R7G " " 6R7 " " "

SYLVANIA TWO-VOLT "G" TUBES

The following group of ten tubes is made available for use in 2 volt battery receivers. All these tubes, except type 1E7G are identical with some of the more popular 2 volt standard glass tubes with the exception of the bases and top caps. The bases of these new tubes are of the octal type using a locating lug and the top caps are of the miniature style, which is the same size as is used with metal tubes. This group of tubes has not been in use over a long period of time; therefore care should be taken in ordering these types since there will not be much of a demand until later in the season.

2 Volt "G" Types	Characteristics Same as	Base Pin Arrangement								Top Cap
		1	2	3	4	5	6	7	8	
1C7G	1C6	NC	F+	P	G3	G5	G1	G2	F—	NC	G4
1D5G	1A4	NC	F+	P	G2	NC	..	F—	NC	G1
1D7G	1A6	NC	F+	P	G3	G5	G1	G2	F—	NC	G4
1E5G	1B4	NC	F+	P	G2	NC	..	F—	NC	G1
1E7G**	See Below	NC	F+	P	G	G	P	F—	GS	..
1F5G	1F4	NC	F+	P	G2	G1	..	F—	NC	..
1F7G	1F6	NC	F+	P	D	D	GS	F—	NC	G
1H4G	30	NC	F+	P	NC	G1	..	F—	NC	..
1H6G	1B5/25S	NC	F+	P	D(+)	D(—)	G	F—	NC	..
1J6G*	19	NC	F+	P1	G1	G2	P2	F—	NC	..

*Filament Current 240 milliamperes as compared to 260 milliamperes for Type 19.

**Type 1E7G is a double pentode power amplifier designed especially for use in the output stage of battery operated receivers. This is a new type of output tube in the 2 Volt group, providing Class A push-pull operation with considerable power output at low distortion. The tube is characterized by its high power sensitivity, high power output, low distortion and low plate and screen current consumption.

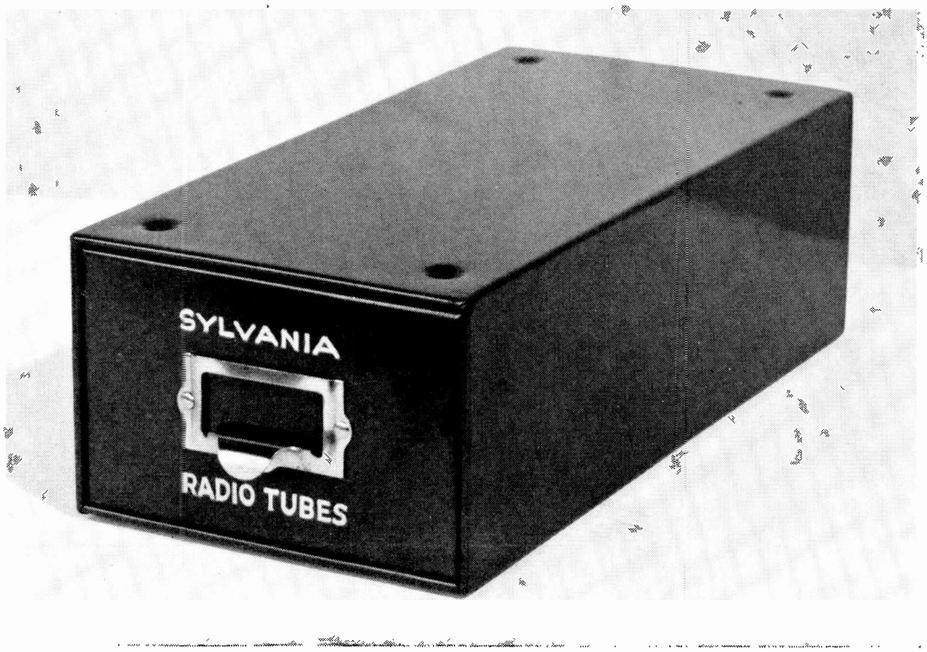
SYLVANIA NEWS

TECHNICAL SECTION

Vol. 6 EMPORIUM, PENNA. No. 8

Punch Marks for Technical Section Binder

BUSINESS SYSTEM FOR SERVICEMEN



The Sylvania Card Index File, pictured above, makes available to servicemen a business-like, systematic method of keeping job records, customer follow-up reminders, and other important data in convenient form for easy reference. It may also be used to file service hints and other technical information clipped from Sylvania News and other sources, and for keeping in order your own service ideas and discoveries.

The file is made of 22 gauge steel, a heavier quality than is usual in such equipment. The color is olive green, exactly matching the Sylvania Stock Boy Cabinet.

Each case is equipped with a card guide and set of index cards to permit filing information alphabetically, by the month, and by the day (numbered 1 to 31). Embossed recesses in the top, and small knobs in the bottom of each case permit stacking when more than one case is required. A card holder on the outside front may be used to carry information as to the contents of each file.

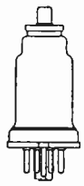
Dimensions: width, 5⅞ inches; height, 3¾ inches; length, 12 inches, to hold 1000 standard 3x5 file cards.

Sylvania Job Record Cards fit the Sylvania File Cases, and give complete records on every service job, with customer's name and space for follow-up information. A sample Job Record Card is included with each case.

The importance of a systematic method of keeping records for servicemen cannot be too greatly stressed. The combination of one or more of these Sylvania Card Files with the Stock Boy Cabinet equips your service shop with neat matching accessories for records and storage at a very moderate cost.

SEE YOUR SYLVANIA JOBBER FOR DETAILS ON HOW YOU CAN GET SYLVANIA CARD INDEX FILES. HE WILL ALSO GIVE YOU COMPLETE INFORMATION ON THE STOCK BOY CABINET AND SYLVANIA JOB RECORD CARDS.

NEW TUBES



TYPE 6B8 DUODIODE PENTODE

The Sylvania 6B8 is a metal type duodiode pentode with characteristics similar to those of Type 6B7. This tube may be utilized as an amplifier, detector and a-v-c tube. The pentode section may be used in conventional circuits as an r-f or i-f amplifier. As an a-f amplifier the pentode unit may be used in a resistance coupled circuit to provide high gain. The special application of reflex operation is similar to that applying to Type 6B7.

Tentative Characteristics

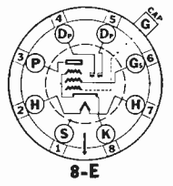
Heater Voltage AC or DC	6.3	Volts
Heater Current	0.3	Ampere
Direct Interlectrode Capacitances—Pentode Section		
Grid to Plate (with shell connected to cathode)	0.005	uuF
Input	6.0	uuF
Output	9.0	uuF
Maximum Overall Length	3⅛	Inches
Maximum Diameter	1 5/16	Inches

Operating Conditions and Characteristics
(Pentode Unit—Class A Amplifier)

Heater Voltage	6.3	Volts Max.
Plate Voltage	250	Volts Max.
Screen Voltage	125	Volts Max.
Grid Voltage	−3	Volts
Plate Current	10	Ma.
Screen Current	2.3	Ma.
Plate Resistance	0.6	Megohm Max.
Amplification Factor	800	Approx.
Mutual Conductance	1325	Micromhos
Grid Bias Voltage*	−21	Volts Approx.

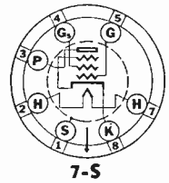
*For cathode current cut-off.

TYPE 6B8G DUODIODE PENTODE



Sylvania Type 6B8G is the glass counterpart of the metal tube, Type 6B8, shown above. This new tube is identical in appearance and characteristics to Type 6B7. The base pin arrangement corresponds to that of the metal tube 6B8 except for pin No. 1 which, although present is not connected. For characteristics and circuit applications, refer to Type 6B7.

TYPE 25B6G POWER AMPLIFIER



Type 25B6G is a new Sylvania amplifier pentode and like Types 25A6G and 43, is especially suitable for use in the output stage of universal AC-DC and d-c radio receivers. The tube has an octal base with connections identical to Type 25A6G.

The operating voltages are the same as those employed for the 95 volt operation of Types

Continued on page two

NEW TUBES

Continued from page one

TYPE 25B6G

25A6G and 43 but considerable differences exist in the tube characteristics. The plate current, mutual conductance and power output for Type 25B6G are approximately twice the corresponding values for the older types while the optimum load resistance is less than half the value recommended for those tubes.

In cases where resistance coupling is employed for Type 25B6G the grid resistor value should not exceed 0.25 megohm when self-biased, or 0.1 megohm with fixed bias.

Since this tube will be used in a series filament circuit with other tubes, a high positive voltage may be impressed between the heater and cathode. Such a voltage may cause leakage currents which may be detrimental in some applications and care should be taken in the circuit design to prevent difficulties arising from this source.

Tentative Characteristics

Heater Voltage AC or DC	25.0	Volts
Heater Current	0.30	Ampere
Maximum Overall Length	4 21/64	Inches
Maximum Diameter	1 13/16	Inches

Operating Conditions and Characteristics
(Class A Amplifier)

Heater Voltage	25.0	Volts
Plate Voltage	95	Volts
Screen Voltage	95	Volts
Grid Voltage	−15	Volts
Plate Current	45	Ma.
Screen Current*	4	Ma.
Screen Current**	12	Ma.
Plate Resistance	Subject to considerable variation	
Mutual Conductance	4000	umhos
Load Resistance	2000	Ohms
Power Output	1.75	Watts
Total Harmonic Distortion	10	Per Cent

*No signal.
**Maximum signal.

METAL TUBE DEMAND INCREASES

Keeping pace with the increased glass tube demand, sales of Sylvania metal tubes have shown a steady increase during the year, and are now about double the figure reached during the spring months of the year. The rearrangement of production facilities illustrated right is only a small indication of the many changes that have been made in order that Sylvania metal tubes may maintain the record of leadership established by Sylvania glass tubes over a period of years.

Fortunately, plans for increased demand for both glass and metal tubes were made last year, and the new radio tube factory at Salem has permitted maximum use of production facilities, together with improved floor layout, so that the unexpectedly large demand for Sylvania tubes of all types does not handicap Production and Engineering Departments in getting results. A number of types of glass tubes have been transferred to the Salem factory, allowing room for expansion of metal tube production in Emporium as required.

During recent months the personnel of the Metal Tube Section has been increased, the changes including assignment of Mr. C. R. Razey as Supervisor (formerly in charge of Parts Department) and M. D. Wilson as Section Engineer (formerly in charge of Engineering Standardizing Section). Both of these men are devoting their entire time to tube problems, especially the introduction of new and improved methods and equipment.

In the background of the photograph appears a new type of Sealex machine with an increased number of heads which is being installed for a trial run in the Metal Tube Department. Designed especially for metal tube production, it is expected to speed up the rate of exhaust materially, and at the same time permit quality to be improved, due to the greater number of positions allowed for filament lighting and bulb heating in the pumping positions.

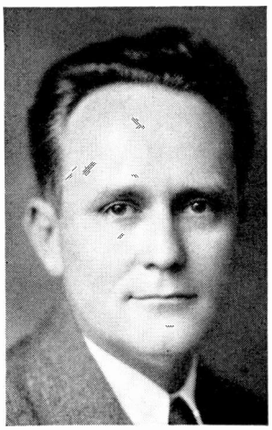
As metal tube quality is of paramount importance, particular attention has been paid to every phase of factory operations work which would give protection along these lines. Starting with the material which goes into the metal tube parts, the inspection and processing of the parts, no effort has been spared to see that they conform to the highest possible standards. More expensive materials are used where quality improvement can be shown, and a rigid time schedule is adhered to in processing of the parts to make sure that they are freshly treated according to the schedule which has been found most satisfactory through careful test.

In the Mounting Section operators have been given special training and have been taught to assemble parts with gloved fingers to prevent detrimental effects from fingerprints on delicate tube parts. Testing methods have been revised to provide the proper time of standing after initial test and before final test. This permits weeding out of any tubes which will change in characteristics when stored in stock.

The personnel of the Quality Department has been increased and additional facilities provided. The additional personnel includes a number of skilled operators who have had years of experience is glass tube work.

While some of the changes mentioned have been made only recently, the effect of the changes is already apparent, both in the daily production records and quality test records. The spirit of enthusiasm and teamwork has been characteristic of Sylvania metal tube production activities since their inception, and accounts in large measure for the rapid progress made in the early stages of metal tube manufacture.

A CHAT WITH ROGER WISE



Chief Tube Engineer
Hygrade Sylvania Corporation

Along with new and improved types of metal tubes introduced during the current season have come numerous important changes in the construction of the older types of tubes.

We now have more rigid mount structures, improved flexible dome supports to protect the mount without causing element rattle, and changes in getter flash arrangements to control the placing of the getter material. The latter change is effective in reducing the number of noisy tubes where the noise is caused by high resistance leakage paths from element to element or from lead wires to ground.

Changes of the kinds mentioned above have been very numerous during the past few months, and only the more important ones are mentioned. The number of minor ones is too great to list, but each one contributes to some extent in improving results obtained in the factory, and even more important, to the ruggedness and reliability of the tubes which are approved on test for shipment to our customers.

Recent "set tests" made under high line voltage conditions show that Sylvania metal tubes are fully capable of withstanding normal voltage overloads for long periods of time without detrimental effect.

The engineering staff devoted exclusively to metal tube problems has been expanded considerably during the past few months, giving us the assurance that Sylvania metal tube quality will meet highest standards.

PART OF SYLVANIA METAL TUBE DEPARTMENT

SYLVANIA TECHNICALS UP-TO-DATE

Available free of charge from Hygrade Sylvania, Emporium, Pa., are latest revisions of the Sylvania Tube Base Chart and Characteristic Sheet (both include G tubes) Auto Radio Tube Complement Chart (for latest set models), and the 1936-1937 Auto Radio Service Booklet, announced last month, and already in its second printing.

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, except the metal type. Please indicate preference when submitting hints. Don't send routine or generally known information.

Airline Models 62-70, 62-72. A defect often encountered with these receivers is intermittent fading. This defect proves very troublesome to find because the receiver will operate sometimes for hours at a time before fading away to almost nothing. Then the least jarring may bring the volume up to normal. This trouble is often found to be in the audio coupling condenser which couples the 56 second detector to the grid of the 47 output tube. This condenser has a capacity of .04 mfd. and is located below the 47 tube under the chassis where a great amount of heat is produced. This heat softens the wax in the condenser and makes the wires sag on the condenser leads often times causing an open.—Francis Jacobson, Eau Claire, Wisc.

* * *

Bosch Model 48 Remodernization. This set originally used 3 type 24 tubes in the r-f stages, 1 type 27 in the detector stage, 2 type 45 tubes in the a-f stage, and an 80 as a rectifier. After the change the set used 3 type 58 tubes in the r-f stages, 1 type 55 tube in the detector stage, 2 type 2A5 tubes in the a-f stage and an 80 as a rectifier.

The changes are very simple to make and not very much work involved. The most work is in the detector stage, here the 55 is used as a diode detector. Automatic volume control may be used by connecting the grid returns of all r-f stages through filters to the load resistance of the diode. In the p-p stage I got a new output transformer to match the 2A5 tubes and changed the grid bias resistor. In order to get 250 volts on the plates of the 58 tubes I moved the B plus terminal from the top of the voltage divider to the B plus terminal feeding the output stage. The 100 volts for the screens of the r-f tubes I got by adjusting the voltage divider, this voltage divider is a replacement of the electrad type.

By changing these tubes the volume is increased so much that it makes up for all the losses in the diode detector. By using 2A5 in the p-p stage hum is decreased and the maximum output of power is increased.—Andrew Ferencz, Monessen, Pa.

* * *

Clarion 160. Noisy reception in this model is often caused by the wire wound, metal clad, 1,000. 1st a-f and a-v-c bias resistor. Replace with two 1 W resistors. One 300 and one 700 unit. Consult your schematic diagram for further assistance.—Joseph S. Napora, Uniontown, Pa.

* * *

Crosley 725. Complaint set dead and smokes no voltage on plates electrolytics good, 2 10,000 resistors heated. Trouble was a shorted tuning meter. Replace tuning meter and 10,000 ohm resistors, set O.K.—Floyd Scripture, Sheridan, Indiana.

* * *

Dial Bulb Hint. Here is a gadget I find most useful in servicing many of the late model receivers in regard to replacement of hard to get at dial bulbs. To tighten, remove or replace new dial bulbs, obtain from a drug store a piece of common ⅜" rubber syringe hose about a foot long. This hose will fit very snugly over the glass bulb dial light and may be used as a flexible socket wrench to turn the bulb in any position.—D. E. Straube, Schoolcraft, Mich.

* * *

Earphones in Auto Radio. I had to make this installation on a 1936 auto radio for a lady who was hard of hearing. The volume control on the radio had to be turned up so high that the speaker volume was too high for other occupants of the car. Incidentally the lady was almost totally deaf. So I had to place a separate volume control across the voice coil winding to control the speaker volume.

On my installation on the ear phone, plug and volume control was placed on the instrument panel of the car. The speaker volume control is mounted in the speaker to one side of the tone control. After the volume ratio has been reached, between speaker and ear phones, the volume control on the radio will control the volume satisfactorily. This installation could be installed on any type of auto radio.—Jerry Clifford, West Los Angeles, Calif.

* * *

General Electric C-61. Set would oscillate—by replacing the .5 mfd. screen by-pass condenser, with one of higher voltage rating the trouble was eliminated.—Alexander Toth, Pittsburgh, Pa.

* * *

General Interference. After installing an auto radio, we found that we could not clear up the generator ripple which was very pronounced even after two condensers were attached to the generator. The cause of the trouble was that all the bolts were loose which mount the generator to the motor block. Take our tip fellows and check the generator mounting bolts when you install any auto radios in the future.—A. N. Hugner, Cheviot, Ohio.

* * *

Increased Selectivity of T.R.F. Sets. This suggestion applies to sets having two or more r-f stages. The volume control circuit should be rearranged so that it varies the bias on the first r-f tube and antenna shunt resistance only. Then the second r-f stage should be made regenerative, as follows: Connect a 400-ohm resistor in the cathode circuit of the second r-f tube, by-pass it with a 0.1 mfd. condenser to ground, as usual, connect it to a tap on the r-f coil secondary that runs to this tube. Two or three turns from the grounded end is usually about right. With the right adjustment, the selectivity is much better, and this method is far simpler than changing the set to a superheterodyne. I discovered the advantages of this arrangement after finding that regeneration cannot be used in the detector stage, if a biased detector is used, or bad distortion will result. If the first r-f tube is a 24-A, a 35/51 should be used instead. It makes no difference which tube is used in the second stage.—Robert Smith Olds, Iowa.

* * *

Kadette 5-Tube Battery Radio. A very puzzling trouble was found in one of these sets, in which the set would howl with the volume turned up loud, but no defective tubes or parts could be found. Finally it was found necessary to use a lower value of resistor in the grid return circuit of the 1A6 tube. This resistor is across the padding condenser, instead of connecting to the grid, as in most sets. The original value was found to be 250,000 ohms. When a 75,000 ohm resistor was substituted, reception was perfect, and the volume also increased slightly.

In this same model, intermittent reception may be found to be caused by a broken wire in the first i-f transformer. The fine wires are exposed where they come out to connect to the terminals, above the chassis, and liable to be broken when the owner changes tubes or dusts the radio, etc.—Robert Smith, Olds, Iowa.

* * *

Kellogg Models 523, 526. When a bad hum on stations, not objectionable between stations is found, install a .01 or .02, 600V condenser from the high voltage contact on 80 tube socket to ground. Try both contacts as one is more effective than the other. This will entirely remove the hum.—K. A. Trites, Melrose, Mass.

* * *

Philco 29 and 45. These receivers often develop intermittent oscillation and squeal when each station is tuned in. The trouble may be in the dual condenser No. 22 which shunts the "C" bias resistor for the 39/44 i-f tubes and also used as a by-pass for the screen grid tubes. This dual condenser has a capacity of 0.9 mfd. in each section.—Francis Jacobson, EauClaire, Wisc.

* * *

Philco Model 60. If the set cuts out entirely, or to a very low volume, try touching the grid cap of the 6A7 tube with one finger and any metal part of the chassis with another finger simultaneously. If this increases the volume or restores the sets operation, check for a high resistance or intermittent open in the secondary of the antenna transformer.

This defect is quite difficult to find as when the set is warmed up all voltages check OK and as soon as the power is shut off for ohmmeter check, the contact is back to normal.—Fred B. Honchock, Monessen, Pa.

* * *

Philco 76, 77. Hiss that is present on stations may be reduced or eliminated entirely by raising the value of the detector cathode resistor.—A. Ignal, Bronx, N. Y.

* * *

Philco Model 111. To improve reception and eliminate a few of the causes of intermittent reception simply remove the following parts: 3615L, 3615B (one near the front of the chassis) 3615C and 3615S. These parts are all black cased resistors and condensers and the parts numbers are plainly stamped on the side. The connections can be bridged and the parts left in the chassis, if desired. If the parts are removed, connect the wires together as each part is taken out.—K. A. Trites, Melrose, Mass.

* * *

R. C. A. Victor R-28, R-28 BW etc. When these sets oscillate over the entire dial, or most of it, the cause is usually found in the two mfd. condensers which form part of the filter circuit for the plate and screen voltages of most of the tubes. When these condensers lose capacity the amount of stray r.f. currents increases and causes oscillation. You will save the customer time and trouble by replacing both of these condensers at one time. They are in a box under the chassis directly under the power transformer.—Walter Neal Pike, Arden, N. C.

* * *

Silver Marshall 30. It is an awkward job to replace the dial cable on this model, as there is little room to work if the dial is left on the set, and the dial can only be removed by taking it apart. However, the job can be done as follows: Take the dial apart and remove it, then saw a slot to the hole in the front of the chassis, where the shaft goes through. Then the dial can be assembled and the new cable installed on it before it is put back on the set. When installing the cable, instead of putting it around the set screw at the center of the dial, cut the cable here and put in a small coil spring, and take a turn around the center part of the dial. This will take up slack and make the dial turn much smoother, and prevent the cable from slipping off the grooves. To replace the dial, loosen the screws that hold the variable condenser and move the condenser sideways enough to let the dial slip in place. Then replace the condenser, being sure that the wires are out of the way of the condenser blades.—Robert Smith, Olds, Iowa.

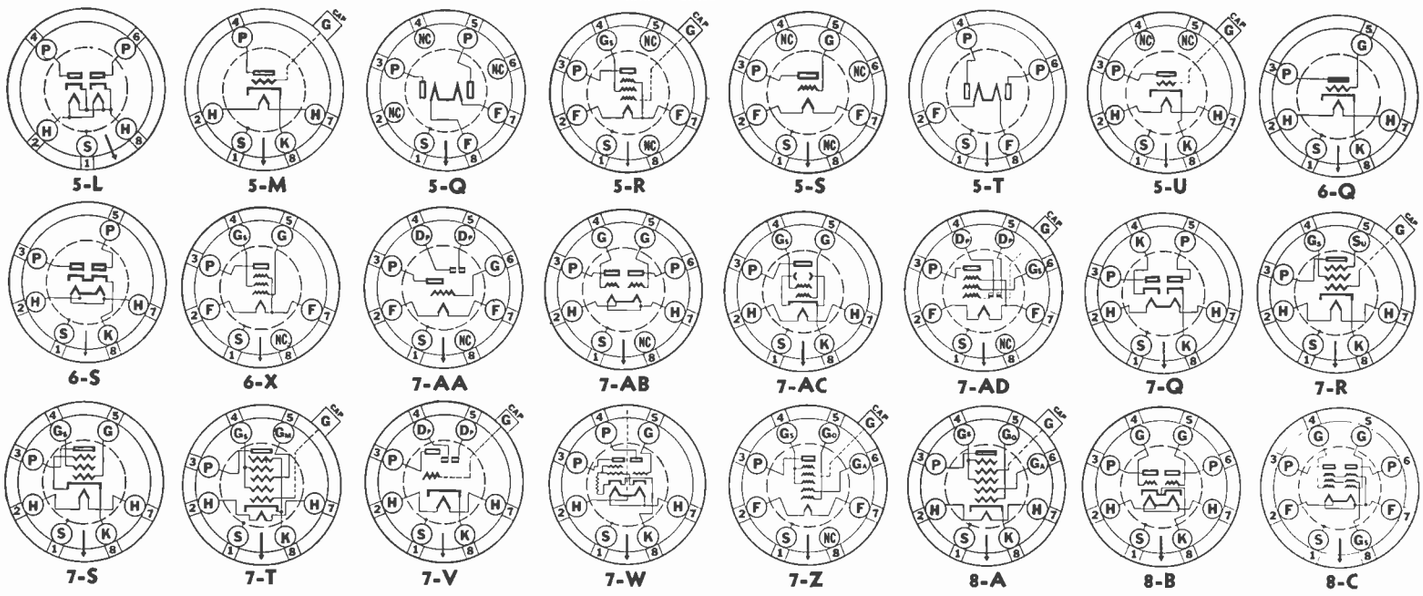
* * *

Wells-Gardner 5E Series Chassis. If this set is noisy replace the 50 mmf. condenser between the plate of the 34 i-f tube and the grid of the second detector. This is not a regular condenser but is a "Special Capacity Wire" type but can be replaced with a .0001 mica condenser. —D. Gordon, De Land, Florida.

G TUBE BASES

(Viewed from Bottom of Base)

RMA NUMBERING SYSTEM



SYMBOLS— F—Filament; H—Heater; P—Plate; K—Cathode; G—Control Grid; Gs—Screen Grid; Ga—Anode Grid; Go—Oscillator Grid; Gm—Modulator Grid; Su—Suppressor Grid; Dp—Diode Plate; Nc—No Connection; S—Metal Shell; ⟶Locating Pin.

TYPE	BASE	TYPE	BASE	TYPE	BASE	TYPE	BASE
1C7G	7-Z	1J6G	7-AB	6F5G*	5-M	6L7G	7-T
1D5G	5-R	5V4G	5-L	6F6G	7-S	6N6G	7-W
1D7G	7-Z	5X4G	5-Q	6H6G	7-Q	6N7G	8-B
1E5G	5-R	5Y3G	5-T	6J5G	6-Q	6Q7G	7-V
1E7G	8-C	5Y4G	5-Q	6J7G*	7-R	6R7G	7-V
1F5G	6-X	6A8G	8-A	6K5G	5-U	6X5G	6-S
1F7G	7-AD	6B4G	5-S	6K6G	7-S	25A6G	7-S
1H4G	5-S	6B8G	8-E	6K7G	7-R	25B6G	7-S
1H6G	7-AA	6C5G*	6-Q	6L6G	7-AC	25Z6G	7-Q

Notes on "G" Tube Base Views—All "G" tube base views except those asterisked (*) have pin No. 1 open but the pin is lettered "S" since most of the views also represent metal tube base connections in which case pin No. 1 is the termination of the metal shell. Some of the "G" or metal tubes may have extra pins on the bases. These extra pins are not connected and are to be disregarded since the only pin connections are those shown in the base views.

*Pin No. 1 has an internal cage construction connected to it for shielding purposes.

CK-5 AMPLIFIER

Through the courtesy of the United Transformer Corporation, 72 Spring Street, New York City, we are showing a 6B5 circuit designed around their CK-5 kit:

"The CK-5 kit has been designed especially for use with the new 6B5 power tubes. A novel circuit is employed wherein the plates of a 6A6 are cascaded so as to allow a very high voltage gain into the output 6B5 stage. Although three audio tubes are used in the amplifier proper an unusually high gain of approximately 100db is available. The 6B5 tube is noted for its high output power coupled with its economy of operation. All the advantages of the 6B5 tubes in pushpull are realized in this CK-5 circuit to make possible a peak power output of 22 watts and a normal output of 15 watts.

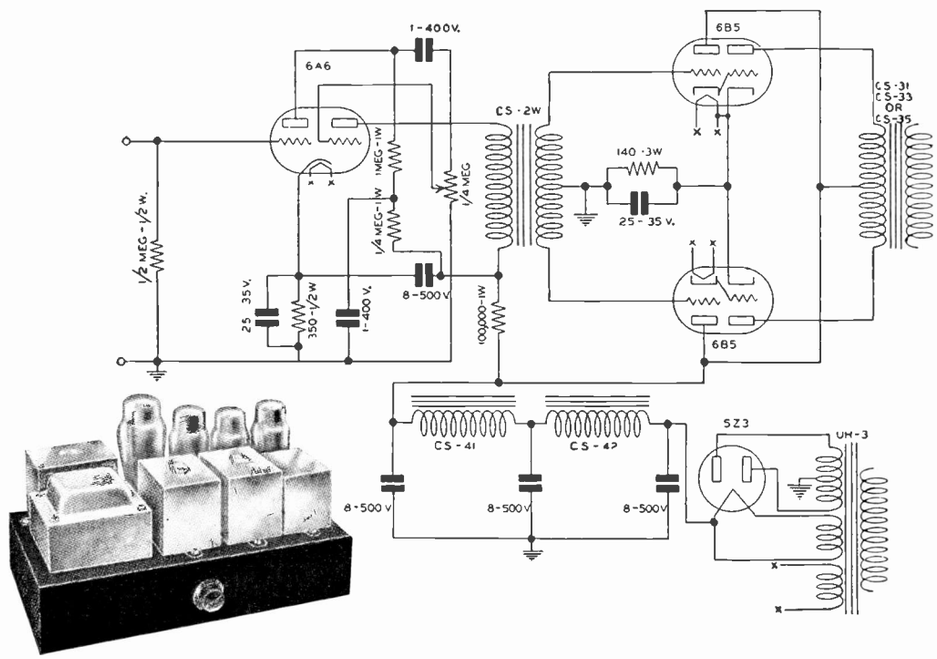
Many of these amplifiers are now out in the field and they are commended to the PA constructor because of their stability and ease of construction. It will be seen from the point to point circuit layout that the amplifier can be constructed by the veriest novice without any fear of running into difficulties.

The transformer and tubes are arranged on the chassis so that the entire amplifier will conveniently fit a leatherette case for portable or mobile use. Note the compact professional symmetry of the chrome plated transformers against the black telephone finish chassis.

The input circuit is arranged to match the new crystal microphones. However, by connecting a two button microphone input transformer externally, the input can also be arranged to match carbon mikes or 200 and 500 ohm lines. The output stage can be coupled to any of three types of transformers. The CS-31 will match voice coil impedances of 15, 8, 4, or 2 ohms. The CS-35 in addition to matching the aforesaid voice coil impedances will also match 500 ohm broadcast line. The CS-33 is designed to match r-f transmitter loads of 5000 or 3500 ohms. When using the CS-33 it is advisable to bypass the DC of the Class C Stage with the CS-40 choke.

TRANSFORMER COMPONENTS FOR THE CK-5 AMPLIFIER KIT

		LIST
CS-2W	Wide range input transformer from 6A6 plate to pushpull 6B5 grids	$3.50
CS-31	Push pull 6B5 plates to 15, 5, 4, or 2 ohms	3.25
CS-35	Push pull 6B5 plates to 500, 17, 7, 4, 2 ohms	3.75
CS-33	Push pull 6B5 plates to 5000, 3500 ohms	3.50
CS-42	Input filter choke	3.00
CS-41	Output filter choke	3.00
UH-3	6B5 plate and filament transformer	5.00
Drilled chassis for CK-5 kit		2.00
CK-5	Transformer kit with CS-35 output, list price $20.25. Accessory kit AK-5 includes all necessary resistors (specially selected for minimum noise radiation) condensers, sockets, terminal strips, a-c. cord and plug, hardware, all mounted ready to wire	9.50



SYLVANIA NEWS

TECHNICAL SECTION

Vol. 6 EMPORIUM, PENNA. No. 9

Punch Marks for Technical Section Binder

FOR NEATER SYMBOLS

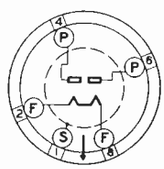
The new Sylvania Radio Symbol Guide, shown above, is one of those handy gadgets that servicemen and experimenters are always looking for and seldom find. In fact, it can't be found except through a Sylvania jobber. If you like to draw your own circuits and diagrams—and what dyed-in-the-wool radio man doesn't?—a glance at the symbols around the edge will show you what you can do with the Symbol Guide and a drawing pen. Green runners down each side prevent blurring of the ink.

The Symbol guide is made of celluloid, transparent so that you can see the work beneath while using it. It comes to you in a handy leather case, convenient for pocket carrying. A complete set of working instructions is provided with each Guide.

Remember—It can be obtained only through your Sylvania Jobber. He will be glad to tell you how you can get it.

NEW TUBES

Type 5U4G Full Wave Rectifier



Type 5U4G is a new full wave high vacuum rectifier with characteristics identical to those of the 5Z3 tube. This new tube will be found in the same type of service as type 5Z3. The basing arrangement tube is the same as that for type 5Y3G, but the two tubes should not be interchanged because of possible damage to the rectifying circuit due to higher output ratings or possible overloading in the case of using the 5Y3G.

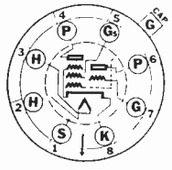
Characteristics

Filament Voltage AC	5.0 Volts
Filament Current	3.0 Amperes
Maximum Over-all Length	5⅜ Inches
Maximum Diameter	2⅛ Inches
Bulb	ST-16
Base	Small G Type Octal 5-T

Operating Conditions and Characteristics

Filament Voltage	5.0 Volts
A-C Voltage per Plate (RMS)	500 Volts Max.
D-C Output Current	250 Ma. Max.

Type 6P7G Pentode Triode



7-U

Type 6P7G is a new Sylvania tube that will find wide application as a replacement tube in last seasons receivers using the type 6P7. This new Sylvania tube is identical to the original 6P7, but the letter "G" has been suffixed merely to distinguish it as belonging to the "G" group of tubes.

The construction of the tube is that of a triode and a remote cut-off pentode enclosed in one bulb. The tube is identical with type 6F7 of the regular glass group except for the type of base used and the base pin connections. The circuit application notes given in the Sylvania Technical Manual for Type 6F7 may be referred to when such information is needed.

Characteristics

Heater Voltage AC or DC	6.3 Volts
Heater Current	0.3 Ampere

Direct Interelectrode Capacitances

Triode Section=Grid to Plate		2.2 μμf
	Grid to Cathode	2.3 μμf
	Plate to Cathode	1.8 μμf
Pentode Section=Grid to Plate (with tube shield)		0.008 μμf Max.
	Input	3.2 μμf
	Output	12.5 μμf
Maximum Over-all Length		4 17/32"
Maximum Diameter		1 9/16"
Bulb		ST-12
Cap		Small Metal
Base—Small G Type Octal		7-U

Continued on Page Two

NEW TUBES

Continued from Page One

TYPE 6P7G

Operating Conditions and Characteristics

	Triode Unit	Pentode Unit	
Heater Voltage..	6.3	6.3	6.3 Volts
Plate Voltage....	100	100	250 Volts Max.
Grid Voltage....	−3	−3	−3 Volts
Screen Voltage..	....	100	100 Volts Max.
Plate Current...	3.5	6.3	6.5 Ma.
Screen Current..	....	1.6	1.5 Ma.
Plate Resistance.	16,200	290,000	850,000 Ohms
Mutual Conductance	525	1050	1100 μmhos
Amplification Factor	8.5	300	900
Mutual Conductance at −35 Volts Grid Bias.		9	10 μmhos

Converter Service

	Triode Unit	Pentode Unit
Heater Voltage.....	6.3	6.3 Volts
Plate Voltage.....	100	250 Volts Max.
Grid Voltage.....	....	−10 Volts
Screen Voltage.....	....	100 Volts Max.
D-C Plate Current.....	2.4	2.8 Ma.
D-C Grid Current.....	0.15	0 Ma.
Screen Current.....	....	0.6 Ma.
Plate Resistance.....	....	2 Megohms
Oscillator Peak Input....	....	7 Volts
Conversion Transconductance		300 μmhos

Automatic Volume Control

CIRCUIT NOTES

Very little data have been published regarding automatic volume control circuits. Most of such data seem to try to impress upon the reader how complicated automatic volume control circuits are. In reality, the fundamental principles upon which an automatic volume control circuit functions are the same as those upon which the action of a Type 80 rectifier circuit depends. In the radio field the Type 80 circuits are considered to be among the simplest.

To simplify the discussion of automatic volume control in this article the a-v-c circuit has been stripped of all of its accessories in order to study the generator system, since that is the system which actually develops the bias. After the generator system has been analyzed, a study will be made of the distribution system, which is the network of resistors and capacities by means of which the bias voltage developed in the generator is applied to the grids of the tubes under control. It is felt that if these two separate functions of an a-v-c system are separated and studied independently, that the a v-c system will lose a great deal of its seeming complexity.

GENERATOR

The Type 80 rectifier tube and the principle upon which it operates is so well known that it furnishes an admirable basis upon which to explain the action of the diode detector used to generate a direct current for automatic volume control purposes. A glance at Figures 1 and 2 will show how nearly identical both circuits are for full-wave and half-wave operation. The principle is the same in each case. There are, however, three minor differences between the Type 80 rectifier circuits and the diode detector circuits. These are:

1—The Type 80 rectifier operates from the power line which furnishes a definite plate voltage at a frequency of 60 cycles. The diode detector operates from an i-f transformer at a much higher frequency (which we will assume to be 175 kc) and the voltage on its plates varies as the signal being received increases and decreases. Naturally the rectified direct current from the diode detector varies in proportion to the i-f voltage impressed on its plates.

2—The filter system employed to smooth out the rectified direct current is much smaller and simpler in the case of the diode detector because of the higher frequency involved. Usually only one small fixed condenser is necessary.

3—The negative side of the load is grounded in the Type 80 rectifier circuit and the positive side in the diode detector circuit, since in one case we want a positive voltage and in the other case a negative voltage.

By connecting the control grid return of a variable mu tube to the negative side of the diode load, it will be apparent that the bias on this grid will increase when a strong signal impresses a higher i-f voltage on the diode plates. As the grid bias increases on the control grid, the gain of the tube decreases. This is the basis of the a-v-c action.

Continued in Next Issue

A CHAT WITH ROGER WISE

Chief Tube Engineer
Hygrade Sylvania Corporation

The number of tube types now encountered in the field is so large as to make it desirable to be able to test used tubes with as simple a tester as possible. When receiver design or tube design is critical, it may be rather difficult to determine when the tube in question is satisfactory and when it is unsatisfactory. The policy being followed by Hygrade Sylvania with respect to engineering design and manufacturing practice is such as to contribute to the successful use of simplified tube testing methods. Some of the more important factors are the following:

Only one grade of radio tube is produced in our factories.

No sacrifices with respect to tube quality are permitted. Rigid quality control extends to inspection of incoming materials, to parts manufactured in our own plants, and in each step of manufacture.

The very adequate production facilities contribute a great deal to uniformity between tubes of the same type. The "Unit System" is followed in our manufacturing practice. Under this system each exhaust unit, consisting of mounting operators, sealing and exhaust machine, basing, aging and testing facilities, manufactures only one type of tube at a time. Many units continue in production on a single type of tube during the entire year, while the less popular types may be continued for a matter of a few weeks or a few days. The amount of attention that can be given to each type of tube is greater than is possible with a Departmental System, where the changes from type to type or for any one machine may be very frequent. The specialized production method permits greater individual skill, resulting in a more uniform, higher quality product.

Our test facilities are very adequate, including specialized factory test equipment, engineering test sets for complete characteristic check, adequate quality test sets for check on accuracy of factory tests, warehouse and customers' inspection test equipment. The Tube Application Laboratory affords further facilities for check on the performance of Sylvania tubes under operating conditions in receivers designed by all of the various set manufacturers. Our life testing facilities are quite adequate, and are supplemented by various special arrangements for field tests.

The tests to which Sylvania tubes are subjected include test of characteristics, mechanical inspection, shorts and noise. In addition, daily selections are tested for various special characteristics, such as interelectrode capacity, back emission, etc.

With the specialized manufacturing methods and thorough quality control policies in effect, a degree of uniformity can be secured which is sufficient to eliminate the need for specialized tests in the field. A simplified test circuit, such as that proposed for standardization by the Engineering Division of the Radio Manufacturers Association, becomes quite practical. The RMA proposals have been worked out in cooperation with tube manufacturers, and the circuit constants are such as to avoid unusual tube overload. These precautions, together with advanced manufacturing methods, make it possible to use simplified tube testers.

FIGURE 1—FULL-WAVE RECTIFICATION

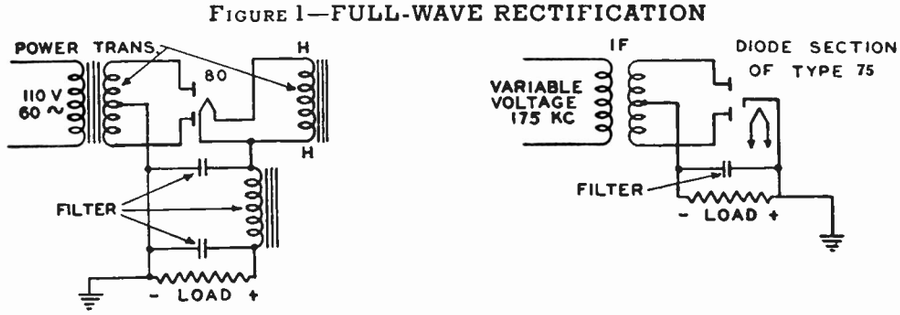
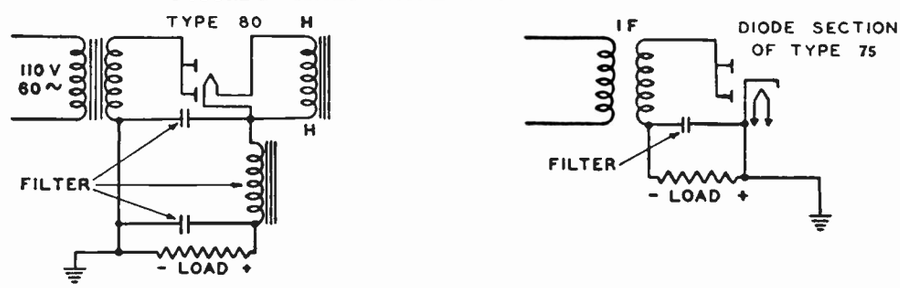


FIGURE 2—HALF-WAVE RECTIFICATION



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, except the metal type. Please indicate preference when submitting hints. Don't send routine or generally known information.

Apex Model 7A. When all the tubes test OK and the voltages are normal, but the set does not operate right, replace the first detector oscillator with a Sylvania 24A. I have found this is the answer to poor performance in several of these sets.—Pilgrims Radio Service, Spindale, N. C.

* * *

Clarion Jr. (Super) 5 Tube. A tone control and built-in antenna may be added to this receiver with very little difficulty. The control consists of a 50,000 ohm variable resistor and a 0.1-600 volt condenser. The 0.1 condenser is connected to the plate of the 47 to ground with the variable resistor in series with the grounded side of the condenser.

The built-in antenna consists of two 0.1 200 volt condensers connected to either side of the 110 volt line. One of the condensers is directly grounded while the other one is connected to the antenna post on the antenna coil.—Stoddard Radio Lab., Oak Park, Illinois.

* * *

Dial Belts. Have you ever been caught with a rush week-end job that required a really good dial-cord and no supply houses were open? The next time, just step down to the corner drugstore and get some surgical catgut. It works perfectly and stands up well.—Carl C. Drumeller, Colorado Springs, Colo.

* * *

Emerson 5A Auto Set. If local stations tune in and out suddenly with the usual volume, but no sensitivity between local stations, try a new 14,000 ohm cathode resistor in the 85 tube which may have changed to higher resistance increasing the bias on this tube which upsets the A.V.C. and permits only strong locals to come in.—M. Miller, Chicago, Illinois.

* * *

General Electric K-65. Several of the complaints on these receivers have been no pep and lack of the customary control of volume. All parts and voltages will check OK, but on careful inspection, trouble is found to be caused by the .00025 mfd. plate by-pass condenser on the 2B7 socket, touching the diodes of the same tube. Breaking the contacts results in a permanent cure.—Ladimer Ress, Cleveland, Ohio.

* * *

Increasing the Fidelity of Old Dynamic Speakers. By varnishing the speaker cone it is possible to increase the frequency range and also prevent rattles or cone distortion. Care should be taken not to get the varnish on the rim of the cone, since it reduces flexibility.—Bernard Croninger, San Francisco, Calif.

* * *

Lyric Model U-500. The series line resistors in these receivers are riveted to the chassis and the resistance wire is insulated from the retainer by asbestos. In time the asbestos will absorb moisture causing leakage, consequently a-c hum in the speaker. This trouble can be eliminated by insulating the resistor from the chassis by the use of fiber washers.—S. J. Wellenc, North Tonawanda, N. Y.

* * *

Majestic 90B. The most common complaint found on this model over a period of years is fading. In practically all cases this will be overcome by replacing four condensers. These are the two cathode by-pass, and two plate by-pass in the r.f. circuits. These are all .5 mfd., those used in the plate circuit should have a 400V working voltage.—Vito F. Daidone, Newark, N. J.

* * *

Oscillation. A frequent cause of oscillation in modern sets, which is not easily discovered, is the loosening of the contact of shields to ground by the expansion and contraction of the metal in warm and cold weather. A careful check on all the tube and coil shields and a tightening of all those which are a little loose will remedy this.—Angelo Giorgi, Syracuse, N. Y.

* * *

Ozarka-Viking Models 89, 90, 92. This set uses a Hammurland three gang condenser in which the movable plates were found shorted to the stators. Successive attempts to adjust the condenser proved futile. Close observation revealed minute cracks at each union of the movable blade with the metal alloy spacer located at the tip of the plates. The sum total of the spaces due to the cracks was sufficient to cause the end plates to wedge. A repair was effected by the careful removing of all spacers and the adjusting of each movable plate.—Williams Radio Shop, Iron Mountain, Mich.

* * *

Philco CT-14. When placed in turret top cars, these sets seem to be weak. Check the alignment and it will be found that the antenna section of the gang is out of line. To improve these sets over the entire band, remove the lead that goes from the first grid section of the gang to the coil away from all other leads and chassis. The improvement is surprising.—Allan F. Kinckiner, Philadelphia, Pa.

* * *

Pontiac Master Radio. Weak reception often gives trouble in this set. It usually indicates that the speaker field is not operating. This is caused by the speaker frame not making good contact to the chassis.—Bernard Croninger, San Francisco, Calif.

* * *

Philco Model T-11. The performance and tone of this set can be greatly improved by replacing the .05 tone condenser with a .01 unit. —V. E. Lee, Wichita, Kans.

* * *

Philco 116, 116X. When this set comes in with objectionable hum when turned down low, by-pass one side of the line (ac) to ground with a good grade paper or mica condenser, 0.1 mf. preferably, and the results will be amazing.—V. M. Moen, Tracy, Minn.

* * *

RCA 34 Auto Radio. The dial gears in the control head of this set are made of a composition and if they should become worn the best solution is to replace the head. When doing so the volume control may be put in the position of the tone control and another variable shaft may be used. This will eliminate a certain amount of interference and will also eliminate the heavy cable carrying the volume control leads.—Stoddard Radio Lab., Oak Park, Illinois.

* * *

Silvertone Models 1904X, 1954X. If the complaint is hiss, which is not very noticable, check the alignment and if it proves OK change the 6A7 tube, and notice the difference. Also, these sets have no bleeder resistor and often times the 6F6 draws less current after normal life. The voltage thus rises too high for the filter condensers. To correct this add a 50,000 or 75,000 ohm resistor from screen to ground. —Allan F. Kinckiner, Philadelphia, Pa.

* * *

Stewart-Warner Model 1172 (Auto Radio). Intermittent slow Put-Pat sound accompanied by no reception. To cure connect one end of a 0.1 condenser to the red wire that comes from the i-f transformer and ground other end. This i-f transformer is the one that connects to the plate of the 78 tube.—T. Henshaw, Marysville, Kansas.

* * *

Sparton Receivers. All series using 484's and 183's as output tubes. The trouble most frequently experienced on these models is fading and a marked decrease in sensitivity. Fading is due to opening of .6 ohm variable resistor in series with the 183 tubes. Only remedy is substitute of original part. The loss in sensitivity is due either to the .000024 condenser or the 2500 ohm resistor shunting it in the first r-f circuit. The condenser opens, while the resistor may be found to read about 6,000 ohms. The burning out of the 183's is due to the decrease in value of the 1250 ohms bias resistor. Replace the 1250 ohm resistor with a wire wound, 10 watt, and use Sylvania 183's as they will take the "gaff". —Vito F. Daidone, Newark, N. J.

* * *

Sparton Model 931. (Editors' Note:—This hint is very similar to the one above, but is printed below to show than Servicemen do find the same problems in different parts of the country which are attacked from different angles.)

In several sets of this type the complaint was pronounced fading of signal which, when investigated acted very much as if turns on the power transformer were shorting. A check of one of the chassis was then turned bottom side up and all lights in the shop switched off. After an observation for ten minutes a periodic arcing was noted in the 0.6 ohm potentiometer found in the filament circuit of the two 183's. A satisfactory repair was made in each case by removing the defective potentiometer, wiring the filaments of the two 183 tube sockets in series and using two type 45 tubes in place of the 183's. The bias resistor was also changed to the value of 800 ohms.—Williams Radio Shop, Iron Mountain Mich.

* * *

Wells Gardner 06A. This series of auto battery sets and also those from Montgomery Ward, using a 19 tube in the output seem to work OK when new with battery hookup given, but after being in use for some time the reception gets very poor as if heavily over biased. Changing the negative 6 volt C connection to negative 4½ brings back the original operation and makes very little difference in B drain.

I have found this condition in dozens of this model and the same simple change of C battery connection straightens it out.—Geo. Olsen Carrington, N. Dak.

* * *

Stewart-Warner Resistor and Condenser Color Code. All Stewart-Warner Radios commencing with the Model 102 use the Standard R.M.A. Color Code on all molded and flexible resistors. Inasmuch as the color coding has been extended to cover molded condensers and flexible resistors, it becomes desirable that each serviceman memorize the standard radio color coding so that he can identify the values of the parts marked in code practically at a glance. The color coding on resistors and condensers is outlined under the following readings:

COLOR CODE

Figure	Color	Figure	Color	Figure	Color
0	Black	3	Orange	6	Blue
1	Brown	4	Yellow	7	Violet
2	Red	5	Green	8	Gray
				9	White

Carbon resistor values are indicated by three colors. The main or body color indicates the first figure of the resistance value, the end or tip color indicates the second figure of the resistance value, and the color of the central dot indicates the number of zeros which follow the first two figures.

Molded and Flexible Resistors. Some new molded resistors look like small narrow mica condensers. These are ordinarily black and are marked with three colored dots. The dot colors are read in proper order the same as the body, end and dot colors on regular carbon resistors.

Flexible Resistors. Flexible fabric covered wire-wound resistors are coded the same as carbon resistors. Some have the colors woven

Continued on Next Page

COLOR CODE IDENTIFICATION

Continued from Page Three

into the fabric. The smallest thread color is read as the dot; the larger thread grouping as the end, and the body color as usual.

Mica Condenser Coding. Molded mica condenser values are expressed in micro-microfarads by the color code. A micro-microfarad (MMF.) is one millionth (.000001) of a microfarad (MF.) To convert MF. to MMF. move the decimal point six places to the right or to convert MMF. to MF. move the decimal point six places to the left. For example: .00025 MF. is 250 MMF. or 250 MMF. is .00025 MF.; .003 MF. is 3000 MMF. or 3000 MMF. is .003 MF.; .01 MF. is 10,000 MMF. or 10,000 MMF. is .01 MF.; and .000051 MF. is 51 MMF. or 51 MMF. is .000051 MF. Make sure you understand this relation before proceeding further.

In order to identify mica condenser values, the capacity in MMF. is marked on the cases by three colored dots. The first color indicates the first figure, the second color indicates the second figure, and the third color indicates the number of zeros.

In order to distinguish the sequence of reading the colors, some dots are pointed in the direction to be read, others have an adjacent arrow, while some have no clue to direction but the printing on the case.

By way of example, several typical values are shown below:

First Dot (1st Figure)	**Green (5)**	**Yellow (4)**	**Orange (3)**
Second Dot (2nd Figure)	**Brown (1)**	**Red (2)**	**Black (0)**
Third Dot (No. of Zeros)	**Black (No Zero)**	**Brown (1 Zero)**	**Red (2 Zeros)**
Capacity =	**51 MMF. or .000051 MF.**	**420 MMF. or .00042 MF.**	**3000 MMF or .003 MF.**

NOTE:—Some condensers have a fourth dot or stripe, as for example: orange, below the regular three dots. This indicates capacity tolerance, as in this case 3%. In other respects the value tolerance is the same as those given below under "Odd Value Resistors and Condensers".

NOTE:—Some capacity values cannot be expressed in code because of the very close tolerance as our 85400 fixed padding condenser which is stamped .00351 MF. on the case. (All our paper condensers are stamped MF.)

Odd Value Resistors and Condensers. All resistors and condensers necessarily are apt to vary somewhat from rated value. Parts are nominally held to plus or minus 10%. Some uses permit a wider tolerance of 20%. In order to distinguish the wide limit parts from the 10% limit parts, the second figure is increased by one in the wide limit parts. That is, a 100,000 ohm resistor would nominally be ± 10%, while a 110,000 ohm value would be ± 20%. The even values can, of course, be substituted for the wide limit odd values, but not vice versa. An odd value not in conformity with this practice, as 1200 ohms, is usually a close tolerance value and should be replaced with identical resistor. —From Stewart-Warner Service Bulletin No. 93.

New Addition of Ghirardi's Radio Field Service Data

Radio and Technical Publishing Company announce the publication of a second edition of Ghirardi's "RADIO FIELD SERVICE DATA". This handy reference book for the use of service men has been completely rewritten, greatly enlarging and bringing right up to the minute the various types of data contained. For example, the intermediate peak frequencies are given for over 4,000 models of receivers. Likewise the "Case Histories" have been increased to number over 1,000. The section of data on auto ignition systems has also been brought up to date, covering all models of American cars. Complete information is furnished on tubes, glass and metal. There is trouble-finding data for over 750 different models of common receivers. Other features include RMA standard color code data, auto interference data, magnet wire tables, and over 25 other reference tables and charts.

A convenient feature of the new edition is its loose-leaf arrangement, allowing for the insertion of supplements that will be issued periodically to keep the book up to date at all times. It is listed at $2.50, including supplement sheet service for one year. Further details from Radio and Technical Publishing Co., 45-R Astor Place, New York, N. Y.

6L6 AMPLIFIER

For 6 Volt DC or 110 Volt AC Operation

The Sylvania 6L6 beam amplifier tube has received much attention and has been used considerably as a power output tube since its introduction. As an output tube it has been used quite extensively in public address circuits. Many requests have been received asking for such a circuit, so in keeping with the policy of Sylvania News to give its readers data which is needed, a 6L6 amplifier circuit is shown herewith. The circuit as shown has been supplied through the courtesy of the Amplifier Company of America, 20 West 22nd Street, N.Y.C.

The amplifier as designed and built by that company has been proven and has an ideal circuit for a portable or stationary P. A. outfit. It has, as an outstanding feature, a novel universal power supply so designed as to be unrestricted in operating applications regardless of whether commercial power lines are available or not. This is accomplished through the use of a "chopper" which enables 6 volt d-c operation of the system through the use of the same power transformer and filter circuit as used for 110 volt a-c service.

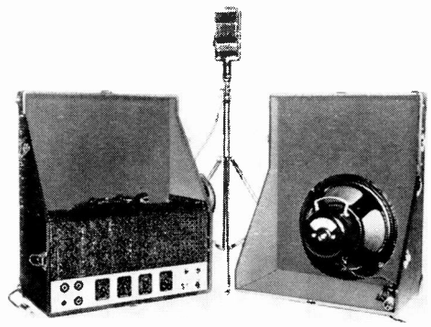
Another feature of the amplifier is the 32 watts power output available and the gain of 127 db (to input channels). The gain at the phono input channel is 64 db.

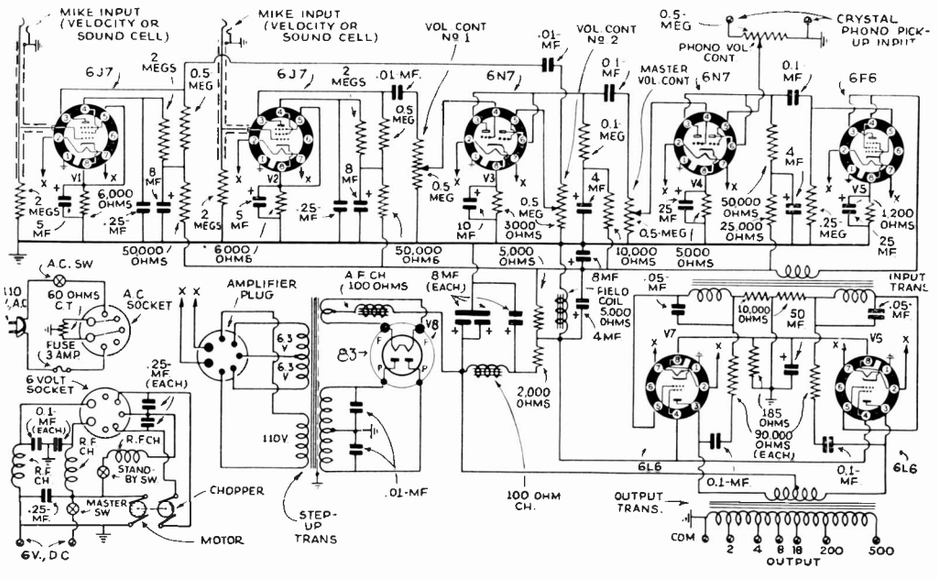
In a universal P.A. outfit economy of operation is a desirable feature. The "chopper" previously mentioned affords remarkable efficiency when operating on a 6 volt battery. Instant changeover from one type of voltage supply to the other can be quickly made through the use of a 7 prong plug and two 7 contact sockets. No internal wiring changes are necessary. The speaker field receives the same excitation from either the 6 volt or 110 volt sources.

Because of limited space complete operating and design data cannot be printed here but can be obtained by referring to the September issue of Radio Craft or by writing directly to Mr. A. C. Shaney, Mgr. Public Address Division; Amplifier Company of America, 20 West 22nd Street, N.Y.C. This company is willing to supply any of our readers with circuit diagrams of their amplifiers providing the requests are accompanied with a self-addressed, stamped envelope.

List of Parts

Two resistors, 6,000 ohms, 1 W.;
Three resistors, 50,000 ohms, 1 W.;
Four resistors, 2 megs., 1 W.;
Two resistors, 0.5-meg., 1 W.;
One resistor, 3,000 ohms, 1 W.;
Three resistors, 10,000 ohms, 1 W.;
One resistor, 1 meg., 1 W.;
Two resistors, 5,000 ohms, 1 W.;
One resistor, 25,000 ohms, 1 W.;
One resistor, 0.25 meg., 1 W.;
One resistor, 1,200 ohms, 1 W.;
Two resistors, 90,000 ohms, 1 W.;
One resistor, 2,000 ohms, 1 W.;
One Electrad resistor, 185 ohms, 10 W.;
One Electrad resistor, 60 ohms, center-tapped;
Four volume controls, 0.5-meg.;
Two condensers, 5 mf., 25 V.;
Two condensers, 0.25-mf., 400 V.;
Two condensers, 8 mf., 350 V.;
One condenser, 8 mf., 450 V.;
One condenser, 10 mf., 75 V.;
Two condensers, 4 mf., 350 V.;
Two condensers, 25 mf., 35 V.;
One condenser, 50 mf., 50 V.;
Two condensers, 0.01-mf., 400 V.;
Four condensers, 0.1-mf., 400 V.;
Two condensers, 0.01-mf., 1,000 V.;
Three condensers, 0.25-mf., 200 V.;
Three condensers, 8-mf., 600 V.;
Two condensers, 0.05-mf., 200 V.;
One dynamic reproducer, 5,000 ohms, type G-12;
One Amplifier Co. of America basic foundation kit, with complete hardware (sockets, switches, fuses etc.);
One Amplifier Co. of America kit of power and A.F. transformers;
One Amplifier Co. of America kit of A.F. and R.F. chokes;
One Amplifier Co. of America 2-section portable carrying case;
One Amplifier Co. of America rotary electric chopper;
One Sylvania type 6F6 tube;
Two Sylvania type 6J7 tubes;
Two Sylvania type 6H7 tubes;
Two Sylvania type 6L6 tubes;
One Sylvania type 83 tube.

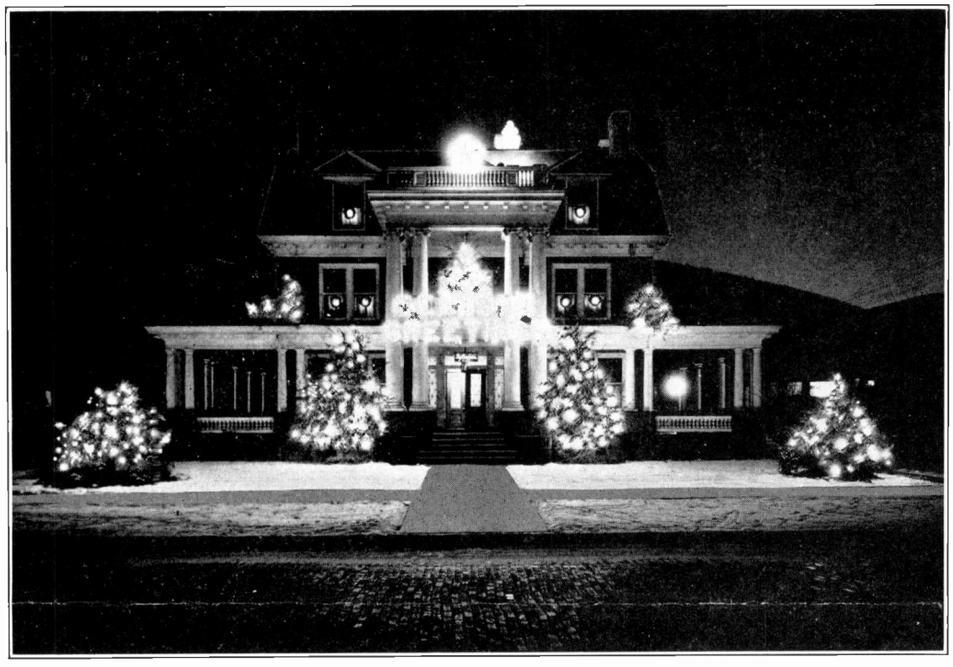




SYLVANIA NEWS

TECHNICAL SECTION

Vol. 6 EMPORIUM, PENNA. Dec 1936 No. 10



IN HOLIDAY MOOD

We wish that all of you who read Sylvania News might have been holiday guests at the Sylvania Club, but what a big bowl of egg nog we'd need for a crowd of fifty-five thousand. Some of you would have had to travel halfway around the world to get here, too. So, since we couldn't bring you all to Emporium, we're sending the Club to you, and hoping that your holiday was a merry one. Christmas weather here turned out to be more like early April, but remembering the January and February blizzards of last year, there'll be plenty of snow piled up on the lawn before spring.

Just a word of thanks for the hundreds of swell letters you've sent us during 1936. Keep up the good work. We like 'em. We'll mention only one, received a couple of weeks ago from T. S. Frye, White Pine, Tennessee. It was written on a fragment of the October issue of Sylvania News. In fact, there wasn't much left but the address label. All the rest, says Mr. Frye, had been clipped and filed in his service scrap book for future reference. We hope that most of you find it just as helpful, and we promise to work our heads off to make it better and better in 1937.

Meanwhile, we join Hygrade Sylvania Corporation in wishing you a happy, healthy and prosperous New Year.

Sincerely yours,

(Signed) The Editors,

J. M. DeVoe

R. S. Merkle

NEW TUBES

150 MILL TUBES

A new group of tubes for operation on 6.3 volts at 150 milliamperes is being made available in the Sylvania line. These new types are very similar to some of the more popular "G" tubes, the principal difference being in the filament current rating. This new group of tubes has been especially developed for six volt operation in battery receivers and will be found widely used in that service. No doubt many questions will arise as to the possibility of using these new types to replace some of the 300 milliampere tubes having similar characteristics. This is not recommended at this time because of similarity of characteristics and limitations in operating conditions. In AC-DC receivers using series filament circuits such a change cannot be made because of the difference in current rating. In AC receivers there are no advantages except in the filament current saving, which is not factor enough to make such changes. In auto receiver service there is the advantage of lower battery drain, but since these new tubes have very small cathodes, they are more delicate and are limited in filament voltage variations, thus replacement in auto receivers is not recommended. The point to be remembered is that all receivers are originally designed for certain types of tubes and therefore care should be used in replacing the original types with any different types of later design so as not to jeopardize the performance of the tubes and receiver. This new group of 150 mill tubes consists of types 6D8G, 6L5G, 6S7G, and 6T7G descriptions and characteristics of which follow.

Type 6D8G Pentagrid Converter

8-A

Type 6D8G is a new pentagrid converter tube with characteristics similar to those of types 6A7 and 6A8G. The principal difference is in the filament current rating, which is 150 milliamperes, just half that of the similar types. The base pin connections are the same as those for type 6A8G.

The circuit applications for this new type parallel those for types 6A7 and 6A8G. These applications are well known and will not be repeated here, but if information is needed, it can be obtained be referring directly to either type 6A7 or 6A8G.

Characteristics

Heater Voltage	**6.3 Volts**
Heater Current	**0.150 Ampere**
Maximum Over-all Length	**4 15/16 Inches**
Maximum Diameter	**1 9/16 Inches**
Bulb	**ST-12**
Base	**Small G Type Octal**

Direct Interelectrode Capacitances

Grid G to Plate (with tube shield)	**0.30 μμf**
Grid G to Grid G$_A$ (with tube shield)	**0.20 μμf**
Grid G to Grid G$_O$ (with tube shield)	**0.15 μμf**
Grid G$_O$ to Grid G$_A$	**1.0 μμf**
Grid G to all other electrodes (r-f input)	**7.0 μμf**
Grid G$_A$ to all other electrodes (Osc. Output)	**6.0 μμf**
Grid G$_O$ to all other electrodes (Osc. Input)	**7.0 μμf**
Plate to all other electrodes (Mixer Output)	**9.0 μμf**

Continued on Page Four

Punch Marks for Technical Section Binder

Automatic Volume Control Circuit Notes

Continued from Last Issue

Very little data on Automatic Volume Control have been available to servicemen. The following, when combined with the preceding installment, printed in the last issue of Sylvania News, should be helpful. We suggest preserving both articles for future reference.

THE DISTRIBUTION SYSTEM

The distribution system consists of the resistor capacity network necessary to apply the d-c voltage developed across resistor R_1 to the grids of the various tubes being controlled. There are four points to consider in checking the a-v-c distribution system of a receiver. These are: (1) Voltage distribution, (2) Filtering, (3) Time factor and (4) Cost. We will consider these in the order named.

1—Voltage Distribution. Referring to Figure 3, we will assume that the second detector is a Type 75 tube in which the diode plates are paralleled in the conventional half-wave circuit and used for developing both a-f and a-v-c voltages. The triode section of the Type 75 is used as a first audio stage, and to provide grid bias the cathode is raised above ground potential by 1.5 volts with resistor R_8. This makes the cathode 1.5 volts positive with respect to ground and, when no signal is being received, the control grids of the first three tubes are biased 1.5 volts positive also. To give the first three tubes a negative grid bias, a cathode resistor is placed in each cathode circuit—resistor, R_5, R_6 and R_7. The value of this resistor will, of course, depend upon the plate and screen grid currents of these tubes. We can figure the voltage required, however, by allowing 1.5 volts to make up for the 1.5 volts positive potential applied initially, then allow 1 volt for minimum grid bias and 2.0 volts to take care of any gas and/or grid emission present which would buck out an equal amount of grid bias. This gives us a required 4.5 volts that each cathode should be raised above ground potential. For maximum sensitivity, a lower bias is sometimes used and in some cases to eliminate excess gain, a higher bias is applied.

2—Filtering. In addition to the d-c a-v-c voltage appearing across R_1 (which is ordinarily about ½ megohm), an a-f voltage is also present. This a-f voltage is coupled to the grid of the 75 tube through condenser C_9 and is applied across resistor R_9, (which is also ordinarily about ½ megohm). To prevent this a-f voltage from feeding back to the preceding grids and causing distortion, particularly at low volume levels, resistor R_2 is made large with respect to R_9. If resistor R_2 is made at least 1 megohm, little or no trouble will result from a-f or i-f coupling between the second detector and the preceding tubes.

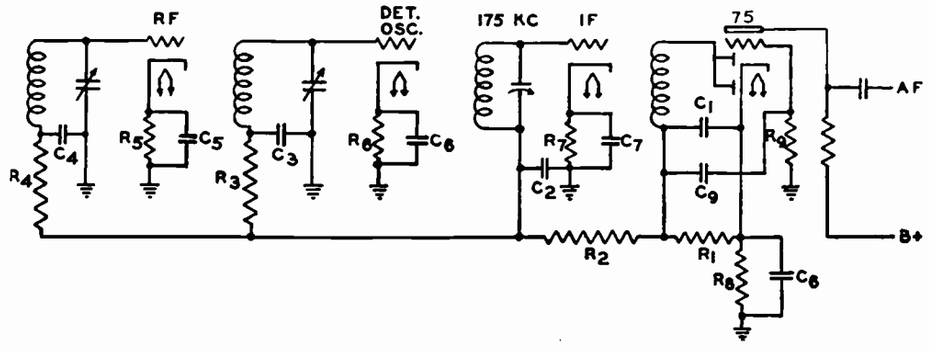
Resistors R_3 and R_4 may be on the order of 100,000 ohms and in conjunction with condensers C_2, C_3 and C_4 will prevent r-f and i-f voltages from feeding back to the preceding stage. Since condensers C_2, C_3 and C_4 complete the tuned circuits to ground, they must not be too small or some of the tuning range will be sacrificed. These condensers may be from .01 to .05 mfd. Condensers C_5, C_6 and C_7 by-pass r-f and i-f voltages across the cathode resistors and are ordinarily about .1 mfd. Condenser C_8 is by-passing a-f voltages and so must be about 2 to 5 mfd.

3—Time Factor. When a radio program stops for an instant after a burst of static, we say the a-v-c action has "time-lag." This is caused by resistor R_2 and/or condensers C_2, C_3 and C_4 being so large that it takes an appreciable time for the a-v-c voltage to charge condensers C_2, C_3 and C_4 through resistor R_2. For this reason, this resistor and the associated condensers must be considered together. When R_2 is 1 megohm, C_2, C_3 and C_4 may be as high as .05 mfd., but when R_2 is 2 megohms or more, C_2, C_3 and C_4 should not exceed .01 mfd.

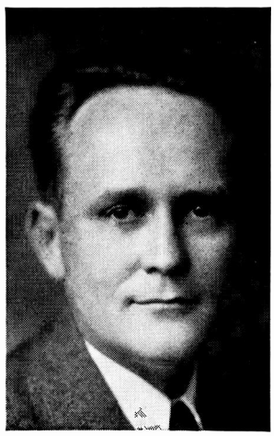
4—Cost. In low-priced sets where the number of parts must be kept to a minimum, condenser C_2 and resistor R_3 may be eliminated if a 1000 ohm cathode resistor is used, by returning the grid circuit of the i-f tube to ground and thus leaving this tube out of the a-v-c system. If an attempt is made to eliminate more parts by connecting the cathodes of the r-f and i-f tubes together and omitting R_7 and C_7, it will be found that a strong signal will so reduce the plate current in the r-f tube that insufficient bias will be developed for the i-f tube and overloading will result.

When the a-v-c system of a receiver is broken down into its two parts, as has been done in this article, it is possible to understand the functions of each part and to see exactly the relation each part bears to the other. It is also easy to see why certain precautions must be taken in order to prevent certain difficulties which will otherwise occur in service. It is hoped that this article will assist in clarifying the functioning of an automatic volume control system in an average radio receiver.

FIGURE 3—A-V-C DISTRIBUTION SYSTEM



A CHAT WITH ROGER WISE



Chief Tube Engineer Hygrade Sylvania Corporation

We close 1936 with a sincere feeling of gratitude, realizing that our earnest effort to reach higher standards of quality, to maintain prompt service on all types in spite of sudden and unusual demands, and to keep our development work geared to the changing industry demands, has been appreciated by our customers. It has been adequately expressed in the unprecedented increase in the demand for our product and an equal increase in the list of customers who prefer Sylvania tubes.

Our plans for the new year stress a continuation of those policies which have guided us successfully in the past, together with a review of any mistakes which have occurred and which can be avoided by proper precautions. Furthermore, we take active interest in measures which will improve industry conditions, and in particular stress more complete standardization in the tube field as an urgent need during 1937. The groundwork has been laid by past efforts—we need now a more general interest in the subject and a willingness on the part of the entire industry to pass up now and then some immediate minor advantages of an individual nature where such moves conflict with the more general criterion of industry welfare.

In the matter of tube types alone, one of the greatest reasons for minor variations has been circuit considerations. A set manufacturer may determine that some economy is possible in receiver production through the use of a slightly changed tube, but if the cost to the tube manufacturers and trade in making, listing, and stocking that type throughout the industry outweighs this advantage to the individual manufacturer, then it is obvious that the change is undesirable.

A greater willingness to make impartial decisions on such matters is already evident, and tube manufacturers are cooperating to foster this spirit.

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.

Apex Model 7. Intermittent reception may be encountered in these receivers. It is usually caused by the 3200 ohm cathode resistor on the 24 oscillator tube. This should be replaced with a good type of resistor, as the original one intermittently opens. I have had several cases of this and have found it difficult to find, as the resistor will always check OK.—John Bricker, Mantua, Ohio.

* * *

Atwater Kent Model 2. These receivers or any other battery models having the "off" and "on" switch controlling A and B voltages, will generally give a Radio Man a headache until he has found the "jinx".

The set will work along fine then suddenly quit, appearing to have thrown out of oscillation. Simply change the double pole double throw toggle switch for a new one and your troubles will be over. Almost all of these models develop this trouble sooner or later.—V. M. Moen, Tracy, Minn.

* * *

Balancing Receivers. In the balancing of most sets using the 6A8 as oscillator and detector, you will usually find two or three peaks on the detector section of the gang condenser. On the high frequency band there should be no images when tuning over the dial. To set this detector trimmer you must keep rocking the gang condenser and most always, the correct peak is the last one found, but keep in mind that you must keep rocking the gang condenser.

In my close experience with Grunow radios, I have found on these receivers that this procedure is the only way to bring sensitivity to normal. Also, upon changing the 6A8 it is necessary to check these condensers. This is only on high frequencies.—John Bricker, Mantua Ohio.

* * *

Cabinet Protector. I use cellophane to protect the fine finish on my sets that I sell or rent out. The sheet of cellophane is shaped according to the layout of the controls on the set. A small amount of cement placed in each corner of the cellophane holds it firmly in place. An arrangement of this type prevents finger nail scratches around the knobs and does not detract from the appearance of the radio.—Richard Dawson, The Dalles, Oregon.

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Clarion Model 60. You may find a Clarion model 60 with the Audio transformer primary open. This set has a 24 detector tube and an ordinary push-pull input transformer will not work. To repair the set, leave the transformer in and disconnect the primary connections. Put a 100,000 ohm resistor from the detector plate to the high voltage and a .01,600 volt condenser from the detector plate to one of the grids of the 45 tubes.—John Bricker, Mantua, Ohio.

* * *

Crosley 610. Fading in this model was found to be caused by loose rivets on the center tap filament resistors. Removing the resistors and clamping the rivets in a small vise effected a permanent repair. This trouble manifests itself by a somewhat increased hum level.—T. C. Bracken, Saint Albans, N. Y.

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Electrolytic Condensers. Often when servicemen hear an electrolytic condenser sizzle and sputter, they immediately believe the condenser faulty and replace it.

In many of these cases the condenser is really good and sputters only while it is forming. Therefore, in such cases it is a good policy to add a milliammeter in series with the condenser and check on the leakage after it has formed. If it is less than ¼ millamp. per microfarad the condenser is good.—Angelo L. Giorgi, Syracuse, New York.

Ford V-8, 1933-34-35-36. The antenna lead-in coupler on all Ford cars of these models, is grounded to the body with a piece of braid about four inches long. To reduce, or possibly entirely remove, motor noise, loosen the screw at the lower left end of the instrument panel and wind the braid around the screw as close to the coupler as possible, then tighten the screw. Also see that the coupler shell is tight. After this has been done, it may be possible to remove the spark plug suppressors. It is well to keep this in mind on any car-radio installation.—M. Boyd, Atlanta, Ga.

* * *

Interference Cure. Recently I encountered a case of interference caused by street cars. The radio was located in a corner house opposite a street car switch. The passing of a street car ruined reception for some time. I made a complete cure for this by connecting one wire of heavy braided cord to the aerial. The other wire was left open. This cord was run into the house and connected to the radio receiver; the aerial lead-in-wire to the aerial post, and the open wire to the ground post. This method of bringing in the signal completely eliminated the interference.—J. M. Behma, Milwaukee, Wisc.

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Loftin White Sun Glow. Weak reception may be caused by the wooden dowel supporting the antenna coil falling loose from the coil form. The dowel is secured to the inside of the vertically mounted coil form by a poor grade of wax. Clean wax off and replace, using a good grade of coil cement.—A. B. Chismar, Streator, Ill.

* * *

Majestic 15. This model appears to have defective volume control and develops dead spots on the lower half of the dial. Simply replace the G51 tube with a Sylvania 24A, ground the cathode of the 24A at its by-pass connection. More volume, smoother action and better performance will result.—V. M. Moen, Tracy, Minn.

* * *

Majestic 70 Series. To improve the tone of a Majestic 70 Series, put a ½ megohm resistor across the grids on the 71A tubes. Most of these sets emphasize the base. Loosen the speaker bolts and move the speaker back about an inch from the baffle and it will sound like a new set.—John Bricker, Mantua, Ohio.

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Motorola Model 60. During tuning, these receivers often cut off sharply on each side of resonance, accompanied by slight audio distortion when tuned to exact resonance. The trouble will be found in the volume control which has increased in resistance to several megohms. This destroys the original time constant of the A.V.C. circuit and the receiver is blocked for two or three seconds after tuning off a strong signal.

Two methods of repair are available. Either replace the volume control with one of the original value, or shunt the defective one with a 0.5 megohm carbon resistor, ¼ or ½ watt rating. The latter method is as effective as replacing the entire control.

I have experienced the same trouble in several other sets having the volume control as part of the A.V.C. load resistance. The friction causes wear on the carbon strip and its resistance increases. The same methods as outlined above can be used to put the set back in service.—Eckert Baillio, Grand Saline, Texas.

* * *

Philco Models 14L, 16. Signal drift in these receivers can usually be traced to dial-creeping. After these sets are turned on, the tuning of the station does not stay put for about thirty to sixty minutes. I have found that the tension sprung on the back of the gang condenser needs replacing. The shift is, no doubt, due to the heat affecting the spring material.—G. Hayslette, Covington, Va.

* * *

Philco Model 60. To cure motorboating in this model, cut the green lead from the by-pass can to the trimmer condenser. Replace with a 0.1 mfd. 600 volt condenser from trimmer to ground.—F. Raymond Kline, McKees Rocks, Pa.

* * *

Philco 118 (Intermittent Operation). Intermittent operation may often be traced to the .05 mfd. condenser connected to one lug of the volume control. This condenser at times will partially open causing loss of volume. Replace with Philco part No. 30-4020. Troublesome fading in this same set has been traced to a gassy 80 tube. Replace with a Sylvania tube, type 80. —Paul Grayson, Gastonia, N. Carolina.

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RCA Model 223-32 Volt. This RCA 32 volt model has a tendency to burn out too many ballast tubes to suit the average customer, and at the most inopportune time, when ballast tubes are scarce.

To correct this trouble, remove the glass envelope from the ballast tube and solder a pair of ten inch leads to the prongs. Run these leads to a porcelain socket nearby and insert a 125 Watt house lamp. This gives the rectifier and filament the correct voltage with the line at 40 volts.

We have changed over all of these models that have come in and they are proving very satisfactory.—V. M. Moen, Tracy, Minn.

* * *

Serenader 10 Tube. (Airline 1955). Intermittent cutting out of signals: Oscillator plate to grid .01 mfd. coupling condenser opens up intermittently thus stopping oscillation. Easily traced by testing for the oscillator signal.—A. B. Chismar, Streator, Ill.

* * *

Silver Marshall Model 724 A. C. Chassis. This Silver Marshall Chassis is marketed under various trade names and in many instances the cabinet bears no identification of any kind, however, the chassis can be easily identified by the tube shields etc. When this model comes into the shop with uncontrollable volume, check the 20,000 ohm resistor in the screen lead of the second i-f tube for a decreased value. This resistor is R9 in Rider's. This trouble generally shows up after a new set of tubes have been installed. Replace with a one watt 20,000 ohm metallized resistor.—F. Raymond Kline, McKees Rocks, Pa.

* * *

Stewart-Warner R-116X. Weak and distorted reception is often caused by a 0.1 mfd. condenser connected between the positive terminals of the electrolytic condensers. When this condenser shorts it does not greatly effect the plate voltages of the set, but does short out the speaker field. Replace with a 600 volt condenser of the same capacity.—Paul Grayson, Gastonia, N. Carolina.

* * *

Zenith 35 PX—Symptoms—Noisy and Poor Quality. This model uses 3 stages of a.f., 27 26, and 50 with five transformers to couple these stages. Noise will usually be found in these transformers, but replacement is very difficult.

Take out the old transformers and replace with two high grade, large core—1:3 ratio transformers and eliminate the 26 stage of audio. The result is, no noise, better quality and less hum, and a cheap and quick repair job. Don't skimp on the size of transformer used.—C. W Hackenyos, Philadelphia, Pa.

NEW TUBES

Continued from Page One

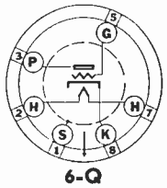
Type 6D8G Pentagrid Converter

Operating Conditions and Characteristics

Heater Voltage	6.3	6.3	Volts
Plate Voltage	100	250°	Volts
Control Grid Voltage (G)	-1.5	-3.0	Volts Min.
Screen Voltage (Gs)	50	100	Volts Max.
Anode Grid Voltage (Ga)	100*	250*	Volts
Oscillator Grid Resistor (Go)	50,000	50,000	Ohms
Plate Current	1.0	3.0	Ma.
Screen Grid Current	1.7	3.5	Ma.
Anode Grid Current	1.8	4.5	Ma.
Oscillator Grid Current	0.25	0.7	Ma.
Cathode Resistor	300	300	Ohms
Plate Resistance	0.55	0.32	Megohm
Conversion Conductance	300	500	μmhos
Control Grid Voltage for 2 μmhos Conversion Conductance	-20	-40	Volts (Approx.)

°Maximum.
*Anode grid supply voltage with 20,000 ohms in series with Ga.

Type 6L5G Triode Amplifier and Detector



6-Q

Type 6L5G is a triode tube equipped with an octal type base. The characteristics of this new tube are quite similar to those of types 76, 6C5 and 6C5G. The filament rating is 150 milliamperes at 6.3 volts which insures its popularity.

The 6L5G will be used widely as an amplifier, oscillator, or detector. The applications will parallel those for the 6C5G and 76 and reference may be made to those types for circuit applications.

Characteristics

Heater Voltage AC or DC	6.3 Volts
Heater Current	0.150 Ampere
Maximum Over-all Length	4¼ Inches
Maximum Diameter	1 5/16 Inches
Bulb	ST-12
Base	Small G Type Octal 6-Q

Direct Interelectrode Capacitances

Grid to Plate	3.0 μμf
Input	3.5 μμf
Output	3.5 μμf

Operating Conditions and Characteristics

Heater Voltage	6.3	6.3 Volts
Plate Voltage	100	250° Volts
Grid Voltage	-3	-9 Volts
Plate Current	4.0	8.0 Ma.
Plate Resistance	10,000	9000 Ohms
Mutual Conductance	1500	1900 μmhos
Amplification Factor	15	17

Type 6S7G Super Control Amplifier

7-R

Type 6S7G is a triple grid super control amplifier tube of the 150 milliampere group. In characteristics and appearance it is similar to type 6D6 of the regular glass group, except that it is equipped with the G type of octal base.

The design of this tube is such that it has remote plate current cut-off and is especially suitable for operation as an r-f or i-f amplifier or a first detector in superheterodyne receivers.

Characteristics

Heater Voltage	6.3 Volts
Heater Current	0.150 Ampere
Maximum Over-all Length	4 17/32 Inches
Maximum Diameter	1 5/16 Inches
Bulb	ST-12
Base	Small G Type Octal 7-R

Direct Interelectrode Capacitances

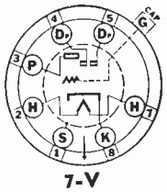
Grid to Plate (with tube shield)	0.010 μμf Max.
Input	4.7 μμf
Output	6.5 μμf

Operating Conditions and Characteristics

Heater Voltage	6.3	6.3 Volts
Plate Voltage	100	250* Volts
Grid Voltage	-3.0	-3.0 Volts Min.
Screen Voltage	100	100 Volts Max.
Suppressor	Connected to cathode at socket	
Plate Current	8.0	8.2 Ma.
Screen Current	2.2	2.0 Ma.
Plate Resistance	0.25	0.8 Megohm
Mutual Conductance	1500	1600 μmhos
Amplification Factor	375	1280
Grid Voltage**	-40	-40 Volts

*Maximum
**Grid Voltage for mutual conductance of 10 μmhos.

Type 6T7G Duodiode High Mu Triode



7-V

Type 6T7G is a new 6.3 volt dioduode high mu triode in which the heater current rating is only 0.150 ampere. The tube has characteristics quite similar to Type 6Q7G and resembles this type in general design as well as in its applications

The diodes are substantially the same as those employed in Types 6Q7G, 6B7 and 75 and can therefore be used in similar circuit applications.

The triode section operated with a plate supply of 250 volts and a plate load resistor of 100,000 to 250,000 ohms should have a negative grid bias of approximately 2.5 volts. When the triode is operated on a plate supply of 100 volts with a plate load resistor of 50,000 to 100,000 ohms, the negative grid bias should be of the order of 1.4 volts. For special applications these values may be varied to suit the conditions.

Characteristics

Heater Voltage	6.3 Volts
Heater Current	0.150 Ampere
Maximum Over-all Length	4 17/32 Inches
Maximum Diameter	1 5/16 Inches
Bulb	ST-12
Base	Small G Type Octal 7-V

Direct Interelectrode Capacitances (Triode Unit)

Grid to Plate	1.7 μμf
Input	1.8 μμf
Output	3.7 μμf

Operating Conditions and Characteristics Class A Amplifier (Triode Unit)

Heater Voltage	6.3	6.3 Volts
Plate Voltage	100	250 Volts
Grid Voltage*	-1.5	-3.0 Volts
Plate Current*	0.3	0.9 Ma.
Plate Resistance	95,000	65,000 Ohms
Mutual Conductance	680	1000 μmhos
Amplification Factor	65	65

*These are rating values only and not operating points with coupling resistor. See "Circuit Application".

Type 6V6G Beam Power Amplifier

7-AC

Type 6V6G is a beam power amplifier tube similar in design features to type 6L6G. The design features which involves the use of directed electron beams provides for a tube of high power output, power sensitivity and efficiency with a low percentage of third and higher order harmonics.

The second harmonic distortion is somewhat high in order to reduce the third and higher order harmonics to a minimum. Elimination of the second harmonic distortion may be obtained by using the 6V6G in a push-pull arrangement. If only one tube is used in a resistance coupled unit, second harmonic distortion can be reduced by generating out-of-phase second harmonics in preceding audio stages.

Type 6V6G should prove very desirable in applications where heater and plate current drain must be maintained at a minimum. In applications where such features are essential, this type should be more suitable than Type 6L6G because of the higher heater current and plate current characteristics of the latter type, with voltages of the order of 250 volts. Nevertheless, the type of operation will be very similar since the tubes involve the same design features.

The heater current rating of 0.45 ampere is rather low for a power tube having the power capabilities of Type 6V6G. Two 6V6G's may be employed in a push-pull arrangement whereby an output of 13 watts may be obtained when plate and screen are operated at 300 volts. For this type of operation the total heater current for the output tubes would be no greater than for a single 6L6G. Smaller household receivers and automobile radios could employ a single 6V6G and provide performance which would be superior to that obtained from a single output pentode. The 250 volt rating would be applicable for most automobile receivers.

TENTATIVE CHARACTERISTICS

Heater Voltage	6.3 Volts
Heater Current	0.45 Amperes
Maximum Over-all length	4 11/16 Inches
Maximum Diameter	1 3/16 Inches
Bulb	ST-14
Base	Small G Type Octal

Operating Conditions and Characteristics:

CLASS A1 AMPLIFIER (One Tube)

Heater Voltage	6.3 Volts
Plate Voltage	250 Volts Max.
Screen Voltage	250 Volts Max.
Plate and Screen Dissipation	12.5 Watts Max.
Grid Voltage*	-12.5 Volts
Self-Biasing Resistor**	240 Ohms
Peak Input Signal	12.5 Volts Approx.
Plate Current (Zero Signal)	45 Ma.
Plate Current (Max. Signal)	47 Ma.
Screen Current (Zero Signal)	4.5 Ma.
Screen Current (Max. Signal)	6.5 Ma.
Load Resistance	5000 Ohms
Second Harmonic	4.5 Per Cent
Third Harmonic	3.5 Per Cent
Power Output	4.25 Watts

CLASS AB1 AMPLIFIER (PUSH-PULL)

Values are for two tubes

Heater Voltage	6.3	6.3	Volts
Plate Voltage	250	300°	Volts
Screen Voltage	250	300°	Volts
Total Plate and Screen Dissipation (Per tube)		12.5	Watts Max.
Grid Voltage*	-15	-20	Volts
Peak Input Signal (Grid to Grid)	21.2	28.2	Volts Approx.
Plate Current (Zero Signal)	70	78	Ma.
Plate Current (Max. Signal)	79	90	Ma.
Screen Current (Zero Signal)	5	5	Ma.
Screen Current (Max. Signal)	12	13.5	Ma.
Load Resistance (Plate to Plate)	10000	8000	Ohms
Total Harmonic Distortion	4	4	Per Cent
Third Harmonic	3.5	3.5	Per Cent
Power Output	8.5	13.5	Watts

°*Maximum. "1" used in conjunction with the terms Class A and Class AB indicates that no grid current flows during any part of the input cycle.*
**Transformer and impedance coupling devices are recommended and the resistance introduced in the grid circuit should be kept as low as possible. For fixed bias this resistance should not exceed 50,000 ohms. The maximum grid resistance when self bias is employed may be 0.5 megohm.*
***The self bias resistor should be shunted with a suitable filter network to reduce degeneration.*

The maximum plate and screen dissipation must not be exceeded. Provisions should be made for line voltage changes, especially when fixed bias operation is employed. A minimum potential difference between heater and cathode should be maintained in all cases where direc connections are not possible.

Jones 1937 Radio Handbook

Jones Radio Handbook, 1937 Edition. (Formerly called THE "RADIO HANDBOOK"). $1.50 per copy. 368 Pages. Published by Pacific Radio Publishing Co., Inc., Pacific Building, San Francisco, California.

The 1937 edition of the Jones Radio Handbook is a comprehensive treatise of the design, construction and operation of short-wave amateur and commercial receivers and transmitters of every description from the simple one-tube sets for beginners to the largest de-luxe superheterodynes and telegraph-telephone transmitters for advanced amateurs. It contains 19 Chapters, including simplified theory on Cathode Ray Television and Radio Therapy (Diathermy). Outstanding Chapters cover new types of Jones Multi-Band Oscillators from which fundamental and harmonic operation can be secured from a single crystal and one tuned circuit. There are other Exciters which operate on 6 bands, from 160 to 5 meters. The Antenna Chapter is twice as large as in the previous edition. It covers the new types of directional arrays, tilt antennas, special 10 meter antennas and data on loading short antennas for small sea-going craft. Commercial and amateur antenna types are thoroughly covered. There are some good Antenna Feeder and Radiator Calculating Charts, particularly for Directive Antennas. The Receiver Chapter describes seven new Jones Receivers, with and without noise limiters. The Chapters on Radiotelephony, C.W., Ultra-High-Frequency Communication, Test Instruments and Practical Radio Theory are new. Vacuum tubes of both transmitter and Receiver types are analyzed by means of detailed Characteristics Tables and more than 100 block diagrams, from which the reader can learn what tube complement is needed for designing any type of c.w. or phone transmitter with power outputs from 10 watts to a kilowatt. These new tube tables and charts cover more technical data than is found in the Tube Manufacturers' Bulletins, in that numerous calculations were made in the author's laboratory.

The publishers also announce a SUPPLEMENT to the JONES RADIO HANDBOOK, which will be issued within several months, and which will supplement the data in the main Handbook. The purchaser of the Handbook likewise is entitled to a SUPPLEMENT with his purchase of the book.