SYLVANIA NEWS

TECHNICAL SECTION

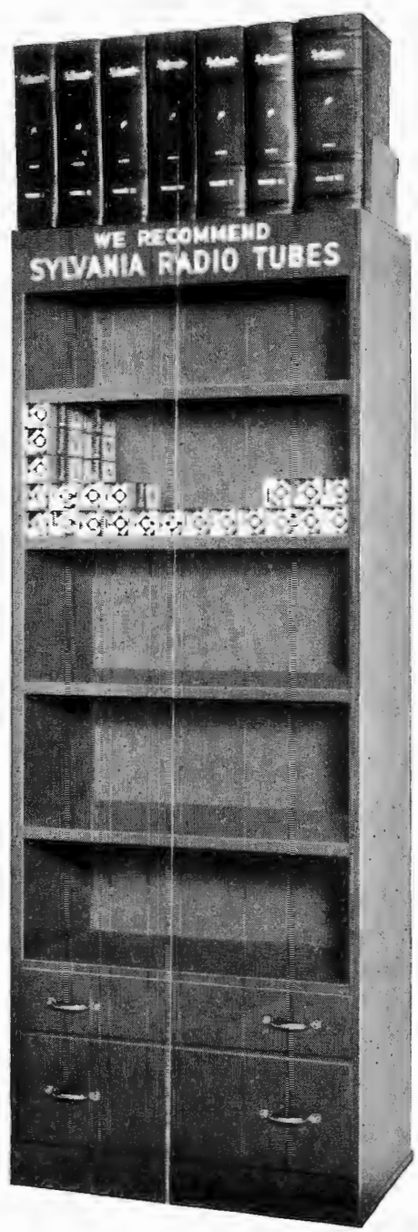
JANUARY-FEBRUARY, 1940 EMPORIUM, PENNA. Vol. 8, No. 7

Improved "Stock Boy"-Now Five Shelves for Storage of More Than 500 Tubes

The floor model "Stock Boy", always a popular item with servicemen, has been remodeled to keep it in line with present day stock requirements. Five shelves for storage of tubes and parts are now provided, with two drawers located in the base section of the cabinet. The shelves will accommodate 500 to 600 tubes. One drawer has twenty-one compartments for storing small parts, and the other drawer has four roomy compartments for bulky parts.

The overall dimensions are: height, 59½"; width, 22", depth, 12". The shelves are 21¾" wide and 11¾" deep, with 8¼" of space between shelves.

One compartment of the large drawer can be supplied as pictured below with a strong built-in cash box at a slight additional cost. Steel book-ends for the top of the cabinet may also be ordered at a small cost.



Your Sylvania Jobber will be glad to give you the "PROFIT PLAN" on this today.

DEGENERATION IN AUDIO AMPLIFIERS

By Walter R. Jones

A great deal of interest has been shown lately in the use of degeneration in audio amplifiers. As a result of this, an article covering some of the simple forms of this system follows.

In a degenerative or feed-back amplifier the amplifier is designed to have more voltage gain than is finally required, and a portion of the output voltage is then fed back to the input through a suitable feed-back circuit so that the phase and magnitude reduces the excess gain to the required value. The amplifier so treated acquires many improved operating characteristics. Some of these characteristics are:

1. Improved uniform gain independent of supply voltage variations.
2. Gain less dependent on tube variations.
3. Gain vs. frequency more constant or can be adjusted to desired characteristic by varying type and magnitude of feed-back.
4. Reduced distortion.
5. Reduced hum and noise.

It is the purpose of this article to show only the simplest form of degeneration for a single stage amplifier. Excellent results are obtained by applying feed-back over more than one stage.

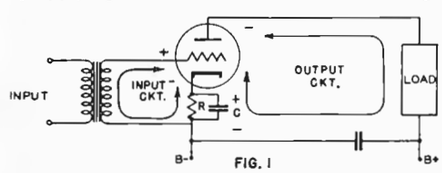


FIG. 1

Fig. 1 shows a typical single stage output tube with cathode bias. The input circuit consists of the end of the tube, the transformer secondary, and the cathode resistor R shunted with condenser C. The total signal voltage is applied between cathode and grid.

The output circuit consists of the cathode, cathode resistor, load and plate. Here again, if C is large, the voltage in the output circuit is divided between the tube and the load.

If we remove the condenser C from across the resistor R, then conditions in the output circuit are changed as follows: An audio voltage will appear across this resistance. Since the plate voltage at the instant the grid receives a positive signal is at its most negative point, the voltage drop across R is such that the cathode is plus. On the grid side the cathode will be minus so that actually the signal applied between grid and cathode will be the signal less the audio drop

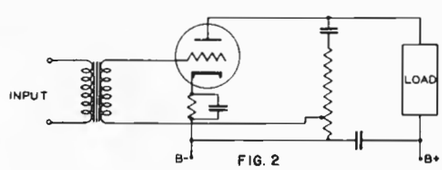


FIG. 2

across R. Thus, a smaller signal will actually be applied between grid and cathode. This voltage drop across R is known as a degenerative drop since it is subtracting from the original applied voltage. This represents degeneration in its simplest form.

(Continued on page 2)

DEGENERATION IN AUDIO AMPLIFIERS

(*Continued from page 1*)

Fig. 2 shows the form in which "feed-back" or degeneration is commonly applied to a single stage. Fig. 3 shows the same system applied to a push-pull stage.

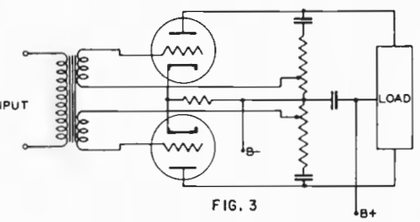


FIG. 3

"GT" CHARACTERISTICS

Given below are data for Sylvania "GT" tubes. In many of the Sylvania "GT" types the characteristics are the same, or practically the same, as their "G" or metal counter-parts, and of course circuit applications are identical. Wherever there exists a direct similarity with Sylvania "G" or metal types a cross reference is shown. The reference data may be obtained from the Sylvania Technical Manual or Characteristic Sheet. Base views, except the ones shown below, may be obtained by referring to the late Sylvania Characteristic Sheet.

A CHAT WITH ROGER WISE

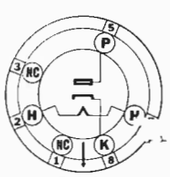
Chief Tube Engineer
Hygrade Sylvania Corporation

At this time considerable publicity is being given, in the radio industry, to a list of "Preferred Tubes" purported to cure all of the industry's ills. At first glance such a program might appear to be a wise move, but a thorough study of the tubes included in the preferred list indicates that this is far from the case. In the renewal tube business, in which jobbers, dealers, and servicemen are most interested, the two problems of vital importance—increased business and reduction of types to be carried in stock—would reflect little improvement from this "preferred list" set-up. Renewal tube sales, type for type, are not affected by any changes in receiver tube complements for some time. This is borne out by the fact that 51% of all renewal tube sales are from 17 types which were initially used prior to 1936. Obviously, the bulk of the renewal tube business comes from receivers which are still in use several years after they were purchased.

The publicized "preferred tube" selections have not been made in accordance with the requirements of the radio industry as a whole, and therefore do not represent the preferences of the industry. A move to reduce the number of types should be welcomed by the entire industry, but such a campaign can be made successful only by setting up a long-pull program through the cooperation of all manufacturers, and after careful study of all the factors involved. It is obvious that these include the manufacturers' problems of "tooling-up", inventories of stock, materials, etc., as well as the more difficult task of setting up such a program to the best advantage of jobbers, dealers and servicemen. It is not a task which can be done arbitrarily by one manufacturer, or over the period of a few weeks or months.

In the main section of Sylvania News you will find a statement by M. F. Balcom, Vice-President of Hygrade Sylvania Corporation, covering the preferred types problem. A thorough study of this statement is suggested so that you may be completely informed on the subject.

Type	Class	Base View See Type	Filament Rating Volts	Filament Rating Amps.	Use	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resistance Ohms.	Micromhos Trans-Conductance	Amplification Factor	Ohms Load for Stated Power Output	Undistorted Power Output Milliwatts
1A5GT	Pentode	1A5G	1.4	0.05	Power Amp.	Characteristics Same as Type 1A5G					.....	.....	.....	....	....
1A7GT	Heptode	1A7G	1.4	0.05	Converter	Characteristics Same as Type 1A7G					.....	.....	.....	....	....
1C5GT	Pentode	1C5G	1.4	0.10	Power Amp.	Characteristics Same as Type 1C5G					.....	.....	.....	....	....
1D8GT	Diode	8-AJ	1.4	0.10	Detector	Diode Located at Negative End of Filament, Pin 7					.....	.....	.....	....	....
	Triode	....	....	....	Triode Amp.	90	0.0	....	1.1	.....	43500	575	25	....	....
	Pentode	....	....	....	Power Amp.	90	9.0	90	5.0	1.0	.2 Meg.	925	.....	12000	200
1H5GT	Diode-Triode	1H5G	1.4	0.05	Det., Amp.	Characteristics Same as Type 1H5G					.....	.....	.....	....	....
1N5GT	Pentode	1N5G	1.4	0.05	R-F Amp.	Characteristics Same as Type 1N5G					.....	.....	.....	....	....
1Q5GT	Tetrode	1Q5G	1.4	0.10	Power Amp.	Characteristics Same as Type 1Q5G					.....	.....	.....	....	....
1T5GT	Tetrode	1Q5G	1.4	0.05	Power Amp.	90	6.0	90	6.5	1.4	.....	1150	.....	14,000	170
6A8GT	Heptode	6A8G	6.3	0.30	Converter	Characteristics Same as Type 6A8G Except Capacitances					.....	.....	.....	....	....
6F5GT	Triode	6F5G	6.3	0.30	Amplifier	Characteristics Same as Type 6F5G Except Capacitances					.....	.....	.....	....	....
6H6GT	Duodiode	6H6G	6.3	0.30	Duodiode	Characteristics Same as Type 6H6G					.....	.....	.....	....	....
6J5GT	Triode	6J5G	6.3	0.30	Amplifier	Characteristics Same as Type 6J5G Except Capacitances					.....	.....	.....	....	....
6J7GT	Pentode	6J7G	6.3	0.30	Det., Amp.	Characteristics Same as Type 6J7G Except Capacitances					.....	.....	.....	....	....
6K5GT	Triode	6K5G	6.3	0.30	Amplifier	Characteristics Same as Type 6K5G					.....	.....	.....	....	....
6K6GT	Pentode	6K6G	6.3	0.40	Power Amp.	Characteristics Same as Type 6K6G					.....	.....	.....	....	....
6K7GT	Pentode	6K7G	6.3	0.30	Amplifier	Characteristics Same as Type 6K7G Except Capacitances					.....	.....	.....	....	....
6K8GT	Tri-Hexode	6K8G	6.3	0.30	Mix., Osc.	Characteristics Same as Type 6K8G Except Capacitances					.....	.....	.....	....	....
6Q7GT	Duodiode Tri.	6Q7G	6.3	0.30	Detector	Characteristics Same as Type 6Q7G Except Capacitances					.....	.....	.....	....	....
6SA7GT	Heptode	*	6.3	0.30	Converter	Characteristics Same as Type 6SA7					.....	.....	.....	....	....
6SF5GT	Triode	6SF5	6.3	0.30	Amplifier	Characteristics Same as Type 6SF5					.....	.....	.....	....	....
6SK7GT	Pentode	6SK7	6.3	0.30	Amplifier	Characteristics Same as Type 6SK7					.....	.....	.....	....	....
6SQ7GT	Duodiode-Tri.	6SQ7	6.3	0.30	Detector	Characteristics Same as Type 6SQ7					.....	.....	.....	....	....
6V6GT	Tetrode	6V6G	6.3	0.45	Power Amp.	Characteristics Same as Type 6V6G					.....	.....	.....	....	....
6X5GT	Duodiode	6X5G	6.3	0.60	Rectifier	Characteristics Same as Type 6X5G					.....	.....	.....	....	....
12A8GT	Heptode	6A8G	12.6	0.15	Converter	Characteristics Same as Type 6A8G Except Capacitances					.....	.....	.....	....	....
12B8GT	Pentode Tri.	8-T	12.6	0.30	Pent. Amp.	100	3.0	100	8.0	2.0	.17 Meg.	2100	360	Pentode Section	Section
					Tri. Amp.	100	1.0	...	0.6	.....	73000	.....	110	Triode Section	
12F5GT	Triode	6F5G	12.6	0.15	Amplifier	Characteristics Same as Type 6F5G Except Capacitances					.....	.....	.....	....	....
12J5GT	Triode	6J5G	12.6	0.15	Amplifier	Characteristics Same as Type 6J5G Except Capacitances					.....	.....	.....	....	....
12J7GT	Pentode	6J7G	12.6	0.15	Det., Amp.	Characteristics Same as Type 6J7G Except Capacitances					.....	.....	.....	....	....
12K7GT	Pentode	6K7G	12.6	0.15	Amplifier	Characteristics Same as Type 6K7G Except Capacitances					.....	.....	.....	....	....
12Q7GT	Duodiode-Tri.	6Q7G	12.6	0.15	Detector	Characteristics Same as Type 6Q7G Except Capacitances					.....	.....	.....	....	....
12SA7GT	Heptode	*	12.6	0.15	Converter	Characteristics Same as Type 12SA7					.....	.....	.....	....	....
12SF5GT	Triode	6SF5	12.6	0.15	Amplifier	Characteristics Same as Type 6SF5					.....	.....	.....	....	....
12SJ7GT	Pentode	12SJ7	12.6	0.15	Amplifier	Characteristics Same as Type 12SJ7					.....	.....	.....	....	....
12SK7GT	Pentode	12SK7	12.6	0.15	Amplifier	Characteristics Same as Type 12SK7					.....	.....	.....	....	....
12SQ7GT	Duodiode-Tri.	12SQ7	12.6	0.15	Detector	Characteristics Same as Type 12SQ7					.....	.....	.....	....	....
25A7GT	Diode Pent.	25A7G	25.0	0.30	Rectifier Power Amp.	Characteristics Same as Type 25A7G					.....	.....	.....	....	....
25B8GT	Pentode Tri.	8-T	25.0	0.15	Pent. Amp.	100	3.0	100	7.6	2.0	185000	2000	370	Pentode Section	Section
					Tri. Amp.	100	1.0	....	0.6	.....	75000	1500	112.5	Triode Section	
25L6GT	Tetrode	25L6G	25.0	0.30	Power Amp.	Characteristics Same as Type 25L6G					.....	.....	.....	....	....
25Z6GT	Duodiode	25Z6G	25.0	0.30	Doubler	Characteristics Same as Type 25Z6G					.....	.....	.....	....	....
32L7GT	Diode, Tetrode	8-Z	32.5	0.30	Rectifier	125	RMS	....	60	.....	.....	.....	.....	....	....
					Power Amp.	110	7.5	110	40#	3.0#	15000	6000	81	2600	1000
35L6GT	Tetrode	35L6G	35.0	0.15	Power Amp.	Characteristics Same as Type 35L6G					.....	.....	.....	....	....
35Z4GT	Diode	5-AA	35.0	0.15	H-W Rect.	125	RMS	....	100	.....	.....	.....	.....	....	....
35Z5GT	Diode	35Z5G	35.0	0.15	Rectifier	Characteristics Same as Type 35Z5G					.....	.....	.....	....	....
50L6GT	Tetrode	25L6G	50.0	0.15	Power Amp.	110	7.5	110	49#	4.0#	10,000♦	8200	.....	1500	2100
						110	7.5	110	49#	4.0#	10,000♦	8200	.....	2000	2200
70L7GT	Diode-Tetrode	8-AA	70.0	0.15	Rectifier	125	RMS	....	70	.....	.....	.....	.....	....	....
					Amplifier	110	7.5	110	40#	3.0#	15000	7500	.....	2000	1800



*Base view 8-AD for 6SA7GT and 12SA7GT same as for 6SA7 and 12SA7, No. 8-R, except that grid number 5 is connected internally to the cathode instead of to the metal shell. #Zero signal. ♦Approximate.

THE SERVICE EXCHANGE

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

Battery Connections. I have installed a row of special battery sockets in my test bench which I find are very helpful in obtaining battery voltages. I have taken the sockets from dead batteries such as the Philco P9068, P968, etc., and other various special sockets which are used by battery suppliers. These are all connected to a power supply taken from an old receiver which had been junked, and the correct voltages wired to the proper socket terminals through the use of bleeder resistors. A pilot light has been installed behind a red jewel to tell me when the rig is turned on, and 2.5 volts a-c is brought out to binding posts which serve as a voice coil check which is very handy for aligning P-M speakers. I have an old filament rheostat in the circuit so that I can control the volume of the buzz.

I realize that there is nothing very original in this arrangement, but I have had it about three years and it has been worth the time it took to make it. It can be built at a cost of almost nothing.—Jack Darr, Mena, Arkansas.

* * *

38 Buick Centerline Radio (Delco Model 1304873). Much of the wheel static and motor noise so common on this model can be eliminated by the use of a side cowl type antenna. This set is built to use the running boards for the antenna, but one simple change will match it to a 66 inch whip.

Connect a .0001 mica condenser direct from antenna socket to ground, inside the set, without changing any other connections.—Fred Wickersham, Yakima, Washington.

* * *

Crosley Model 148. When this set cracks and sputters, place the antenna to ground to ascertain if the noise is coming through the aerial. Usually the noise is in the set. Remove the tuning condenser from its base, resolder connections and place insulating paper between condenser and its base, which is connected to chassis. This eliminates the sparking.—W. F. Onder, Kimmswick, Mo.

* * *

Fada Model F-55AT (1940). A high pitched whistle at mid-point volume setting, can be eliminated by winding approximately 25 turns of bare or insulated wire around the 12Q7GT grid lead and grounding this shielding to chassis.—J. S. Napora, Uniontown, Penna.

* * *

Midwest Model 11-36. Intermittent reception is often encountered in this receiver. It is usually due to the shields on the volume control wires touching the control terminals. This is not difficult to correct, but is usually overlooked when checking for this type of trouble.—Jesse J. Beczak, Pittsburgh, Penna.

* * *

Midwest Pentode Model 11. This set should have plenty of volume, however, it often times gives weak and poor reception. The diode resistor is bypassed with a .006 mfd. condenser. This should be changed to one not larger than an .0005 mfd. After changing this condenser, the set has all the volume that can be expected. I have found several other sets with this trouble and have made this change in all of them.—Herman L. Hepp, Columbus, Ohio.

* * *

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

Parabolic Baffles. On cheaper grades of P. A. parabolic speaker baffles, it will be found that when working in rain, water will seep in at the joint where the speaker housing connects to the bell. This can be remedied by stretching a piece of tire inner tube over this joint. A five inch piece cut from a 6.00 x 20 inner tube is ideal. This makes a neat job and does the trick nicely.—Wm. Lofstrom, Valdosta, Georgia.

* * *

Philco Models 14X, 19X, 71X, 89, 91X. One of the most common and frequent complaints on these receivers is an inoperative condition at either the low or high frequency end of the dial. In some cases reception is obtained when the dial is rotated one way and none when the dial is turned back. In other instances we may find dead spots in the middle of the band, where the receiver will be inoperative from 800 Kc to 1300 Kc, or 650 Kc to 900 Kc. This trouble is caused by the 36 tube, employed as a combination first detector and oscillator going "flat" (not oscillating) at certain frequencies or over the entire band. Ordinarily, the only solution is replacement. Where this does not help, it may be necessary to change the value of the oscillator cathode bias resistor from 15,000 ohms to 10,000 ohms. The Model 14X and 91X already have the later value so the change in these receivers should be 7,500 ohms.

In all the above models with the exception of the 89, a shadowgraph is utilized for the visual indication of signal resonance. This component is in the "B" plus circuit of the r-f and i-f tubes. A common trouble is a failure or an open circuit in the shadowgraph which will result in an inoperative receiver.—George Baer, Roslindale, Mass.

* * *

Philco Model 38, Code 123. Here is a remedy for noisy and sharp cut-off of the volume control on this battery receiver. We, in this territory, have had considerable trouble with this complaint. We remove the old control from the circuit and replace with a 20,000 ohm fixed resistor, connecting the coil lead that formerly went to the center tap of the control to the high side of the fixed resistor. Then the ½ megohm grid resistor of the type 30 a-f tube is removed and replaced by a ½ megohm audio control. This change does not alter the original circuit and gives smooth and silent operation of the volume.—J. P. Coles, Jr., Clayton, Alabama.

* * *

Pilot Dragon. When the short wave band becomes inoperative it may be due to slight changes in resistors or condensers or to the change of coil insulation through the action of the high frequency generated. To remedy, increase oscillator tickler winding.—James H. Johnston, Lakewood, N. J.

* * *

RCA Model M34 Auto Radio. When the volume control does not function, check for a defective 6B7 (short or leaky). This tube being bad may indicate a defective volume control.

To pep up this set, replace 400,000 ohm ¼ watt resistor on the resistor board with a 100,000 ohm resistor.—Kenneth A. Trites, Melrose, Massachusetts.

* * *

Slip On Knobs With Springs Missing. The end of an ordinary pen point that fits into the pen holder can be cut off at the desired length and inserted in the knob, making as good a spring as the original.—F. J. Kmetz, Allentown, Penna.

Silvertone Model 1986. If the rectifier tube in this particular model shorts, the power transformer usually burns out too. To make the repair, purchase a power transformer for a 6.3 volt set with a 5 volt filament winding for the rectifier. The heaters of the other tubes, of course, must be supplied with 6.3 and so the other winding will take care of them. An exact replacement transformer for this set is difficult to obtain and since the standard type works so well I have been using them with good results. A .05 mfd. 600 volt condenser should be connected from each side of the line to prevent hum modulation. F. J. Kmetz, Allentown, Penna.

* * *

Simplex Model "K" Under #116001. This set uses a 24A tube as first detector and oscillator and when it stops operating is usually discarded as beyond repair. The oscillator coil is in series with the plate i-f circuit and has no other windings for feed-back. Use an old i-f wooden core of ½" diameter and wind 30 turns of #32 enamel wire in the same direction as a coil winding. This new coil is suspended at the top end of the oscillator coil by drilling a small hole through the core and two holes in the edge of the coil and using a straight piece of bus-bar as small coil holder. Small bus-bar pins driven into holes in the core may be used as terminals.

Disconnect everything on the cathode terminal of the 24A autodyne detector. Bring a wire from this terminal through the opening in front of the chassis to oscillator coil; connect to one side of the coupling coil and bring the other side of this cathode coil to ground through a 6000 ohm ½ watt resistor shunted by a .001 mfd. condenser. All this is mounted inside the oscillator coil shield. If this connection does not work, reverse cathode coil connections. A roar or howl indicates too many turns. A failure to cover the whole band indicates too few turns.—S. Schiffman, Brooklyn, New York.

* * *

Stromberg Carlson Models 82 & 84. After playing normally for five to thirty minutes, a slight distortion of either a permanent or intermittent nature shows up. This is generally due to a slight leak in the electrolytic audio bypass connected between ground and the junction of the 6D6 or 6K7 first audio amplifier screen and the dropping resistor leading from the high voltage system. Remove the electrolytic and install a good quality 600 volt to 1000 volt .5 mfd. paper condenser.—Badger & Caskey, Indianapolis, Ind.

* * *

Zenith Model 11S474. In this receiver there is often distortion when the volume control is turned low. At first one would suspect the volume control of being defective, but that is not the trouble.

From the grid of the 6F5G first audio tube, there is a one megohm resistor connected to B minus through a 50 ohm resistor. Leave this as it is and connect another one megohm resistor from the same grid (6F5G) to ground and the trouble is permanently cured.—Frank Photiades, Highland Park, Michigan.

* * *

Zenith Model 52. There seem to be quite a few of these sets in use, yet, so maybe a hint on these would not be amiss. If there is a persistent hum after all the usual remedies have been tried, such as replacing filter condensers, etc., try replacing the 500,000 ohm resistor across the secondary of the push-pull input transformer. You may have to use a value smaller than this. However, I have found that 500,000 ohms usually works.—Herman L. Hepp, Columbus, Ohio.

PUSH-PULL DIRECT-COUPLED AMPLIFIER

BY A. C. SHANEY—Reprint Courtesy-Radio Craft

In the last issue of the News was shown the first part of this direct-coupled amplifier article. The first part and the parts that follow are printed through the Courtesy of Radio Craft, original publisher of Mr. Shaney's article.

PART II

Basic All-Push-Pull Direct-Coupled Circuit

The extreme simplicity of making an amplifier push-pull **throughout,** suggests itself as an ideal and simple manner to attain push-pull direct-coupled amplification without the use of any additional expensive components. In fact, **only two additional resistors are required,** as illustrated in Fig. 3, which is composed essentially of the basic direct-coupled circuit of Fig. 2A drawn with its "stereoisomer" (or mirror image) of the single-ended circuit.

If you will refer back to Fig. 4B and select any resistor in the "B+" or filter hum voltage network which may induce undesired hum into any grid circuit of the amplifier, it will be found that the same hum voltage is applied to its push-pull mate, and ultimately cancels in the output transformer.

It is for this reason, that the hum level of the amplifier can be brought down to —70 db. below maximum output, without the use of hum-balancing adjustments.

Automatic Compensation for Variations in Tubes

A large number (of the same type) of tubes were interchanged in the amplifier without noting any appreciable difference in performance. The apparent reason for this is evident by the additional study of Fig. 4B. Reasonable variations in plate or screen currents of the 6L6 output tube cancel at their cathode. Variations in the input 6SJ7 tube are likewise cancelled at the junction of their cathodes. It is obvious, of course, that any tube which will not operate satisfactorily in a standard amplifier should not be used in this unit.

(E) $\frac{130}{2(1.5—.5)\text{ Ma.}} = \frac{130}{0.004} = 32{,}500$ Ohms

(C) $\frac{75}{148—1} = \frac{75}{147} = 505$ Ohms

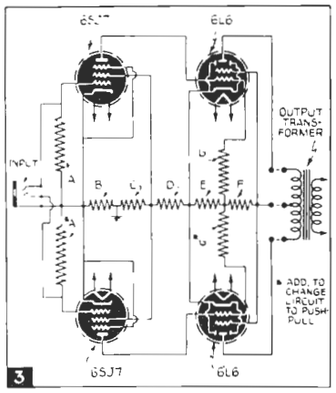
(D) $\frac{95}{2(65—6.5)—1—4\text{ Ma.}} = \frac{95}{0.148} = 640$ Ohms

(G) $\frac{150}{0.0015} = 100{,}000$ Ohms

(A) May be a conventional ½-meg. grid resistor.

The wattage rating of each of these resistors should be between 2 and 3 times its actual watts dissipation, so as to provide a minimum safety factor of 50%.

(*Continued Next Issue*)



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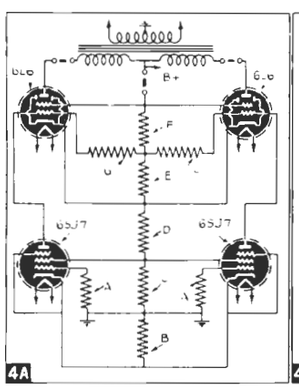
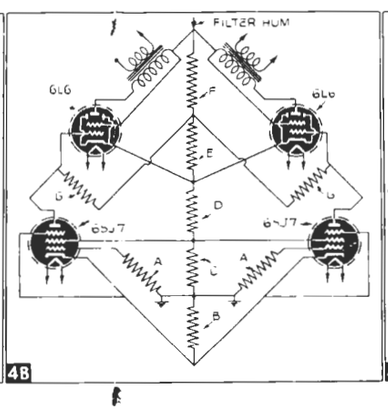
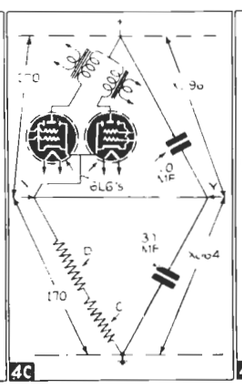


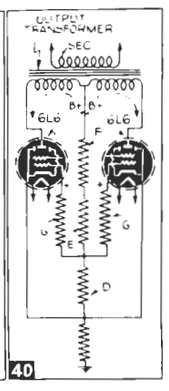
4A



4B



4C



4D

The remarkable simplicity and symmetry of this circuit can best be observed by redrawing Fig. 3 as it appears in Fig. 4A. Here we see the essential components of a high-fidelity amplifier which is composed of 9 resistors (less the output transformer). This basic circuit is capable of developing 15 watts with less than 5%, and 10 watts with less than 2% of total harmonics. While the circuit looks extremely simple from a construction and wiring standpoint, and it really is, there are a number of complex hum, signal, and voltage-balancing bridge circuits contained therein, which become apparent, only when the circuit is redrawn as shown in Fig. 4B.

Here you will find we have a complex diagram composed of 4 interlinked bridge circuits. These circuits all contribute to circuit stability independent of tube variations, and elimination of hum without the necessity of using critical hum-balancing adjustments. If a large filter hum is introduced at the apex of the circuit (marked "Filter Hum"), it will be noted that all hum potentials will be evenly distributed between each half of the bridge circuit, so that for any hum potential introduced in one-half of the circuit, there will be an identical potential (equal in phase and amplitude) in the other half of the circuit. As long as this condition exists, cancellation will take place in the output transformer. This is further clarified in Fig. 4D.

If a hum potential is applied at the junction of the resistors E-D and passed through resistor G to the respective grids of the output tubes, both output plate circuits will behave identically. If an instantaneous positive value is assured during the hum voltage cycle, both grids go positive at the same time. More plate current flows in each of the tubes, so that a voltage drop takes place at each plate terminal. Inasmuch as the primary winding of the output transformer is in opposite direction (which is a standard procedure for all push-pull output transformers), this hum voltage cancels itself in the primary, and no voltage appears in the secondary. This phenomenon, however, does not take place when a signal voltage is applied, for under this latter condition, one grid goes positive, while the other goes negative.

Another existing hum-cancellation bridge is noted in Fig. 4C which is the output stage and its associated filter condensers redrawn in a bridge circuit form. Here, it will be noted that the capacitative reactance of the 20 mf. condenser (which is approximately 96 ohms) and the 30 mf. condenser (approx. 64 ohms) is approximately proportional to the hum distribution in this portion of the filter network. The hum distribution may be considered proportional to the d-c voltage distribution. This type of an arrangement insures against excessive hum at points X and Y, regardless of the variable effects of the mu of the 6L6 screen-grids.

Calculation of Resistor Values

The design procedure necessary to calculate the values of the important 6 resistors required, makes use of an elementary application of Ohm's Law. There are only two design precautions which must be kept in mind, and these are:

(1) The voltage drop in the plate resistors G, should be made equal to the voltage drop in the plate circuit of the input tubes, i.e., 150 volts; which means that the voltage applied to the high-potential side of the G resistor should be 2 x 150=300 volts. This voltage should appear at the junction of resistors E and F.

(2) The bleeder current through resistor F should be exactly equal to the plate and screen-grid currents required by both input tubes, i.e., (1.5—0.5) x 2=4 Ma.

With these points in mind, it is extremely simple to calculate the values of all the resistors based on a voltage drop across, and current through, each one. The following tabulation indicates the formulas used:

Resistor

(B) $\frac{3}{0.004} = 750$ Ohms

(F) $\frac{125}{2[2(1.5—.5)]\text{Ma.}} = \frac{125}{0.008} = 15{,}600$ Ohms

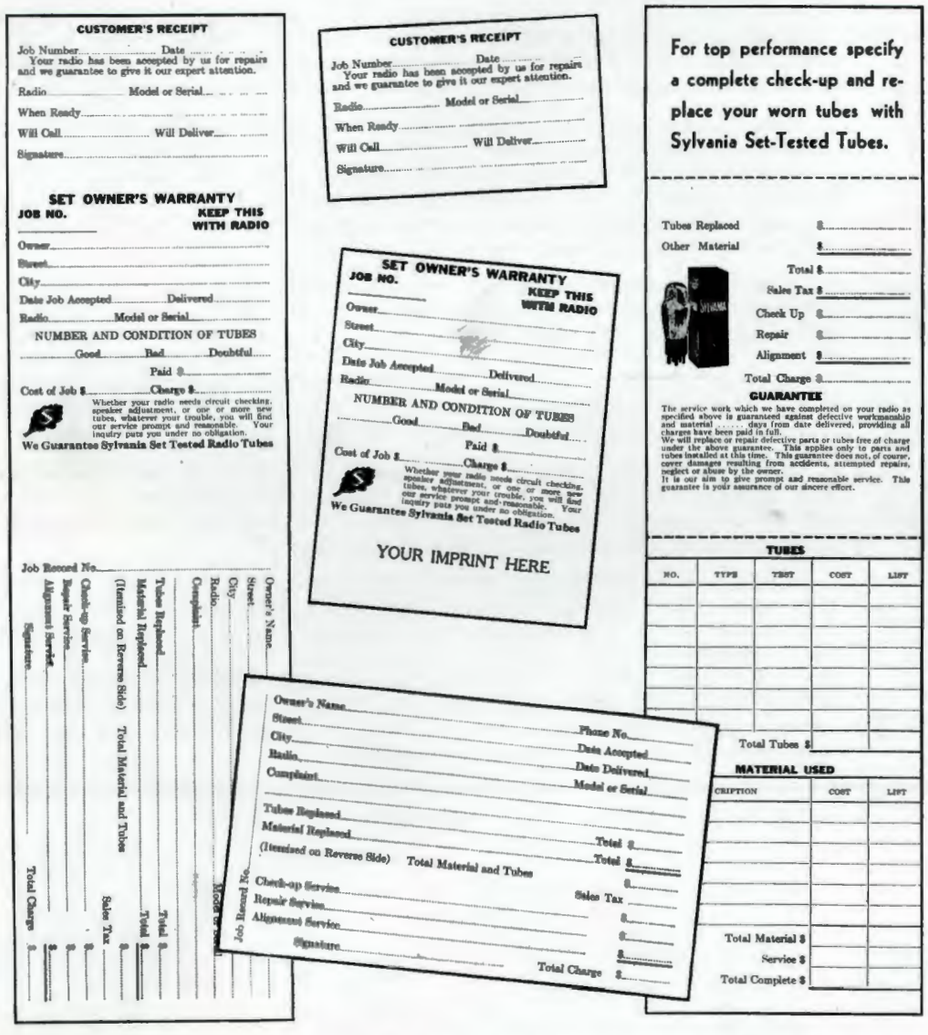
Vol. 8, No. 7
POSTMASTER: RETURN POSTAGE GUARANTEED

SYLVANIA NEWS

TECHNICAL SECTION

MARCH-APRIL, 1940 EMPORIUM, PENNA. Vol. 8, No. 8

CUSTOMER'S RECEIPT STUB ADDED TO JOB-RECORD CARD



You don't leave your watch to be repaired or your suit to be cleaned without getting a receipt to prove your ownership. Don't you think your customers feel the same about the radios they leave with you? The new Customer's Receipt Stub—an added feature of the Job Record Card—protects you and your customer when he brings a portable or a midget to your shop for repair.

We hardly need to remind you of the value of the Job Record Cards. If you are one of the few servicemen who are not using them, you can see for yourself how much valuable information you can put on the 3x5 card that you keep for your record, and what your customer gets. Perforations make it easy to separate into the three sections shown above.

To order, use the coupon on page 4 of the Main Section.

Price, including imprint: 100, $1.00; 250, $1.75; 500, $3.00

NEW TUBES

Type 1LB4 Power Output Pentode

5-AD

CHARACTERISTICS

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

Ratings:

Maximum Filament Voltage:	
Battery Operation—Voltage must never exceed	1.6 Volts
AC/DC Power Line Operation—Design Center	1.3 Volts
Plate Voltage	110 Volts Max.
Screen Voltage	110 Volts Max.
Cathode Current	6 Ma. Max.

Operating Conditions and Characteristics:

Filament Voltage	1.4	1.4	1.4	1.4	Volts
Plate Voltage	45	62.5	67.5	90	Volts
Screen Voltage	45	62.5	67.5	90	Volts
Grid Voltage	−4.5	−5.0	−6.0	−9.0	Volts
Plate Current	1.6	3.8	3.8	5.0	Ma.
Screen Current	0.3	0.8	0.8	1.0	Ma.
Plate Resistance (Approx.)	0.3	0.2	0.2	0.2	Megohm
Mutual Conductance	650	875	875	925	μmhos
Load Resistance	20000	16000	16000	12000	Ohms
Power Output	35	90	100	200	Mw.
Total Harmonic Distortion	10	10	10	10	Per Cent

CIRCUIT APPLICATION

Sylvania Type 1LB4 is a Loktal power output pentode designed especially for service in low drain battery operated receivers. This type is extremely economical because the A and B current drains are unusually low, particularly in view of the relatively large output available. Although the filament current is only 50 milliamperes, a power output of 200 milliwatts may be secured under Class A conditions operating with a B-supply of 90 volts.

A further desirable feature is the superior performance secured under reduced B-voltage conditions. Type 1LB4 will deliver approximately 35 milliwatts when the plate and screen are operated at 45 volts. This means that considerable power output is available during the entire life life of the B-batteries.

The filament is rated at a nominal voltage of 1.4 volts and 50 milliamperes. However, the tube may be operated directly from a suitable 1.5 volt dry battery without the use of a ballast tube since the design provides satisfactory performance over the useful voltage range normally encountered during the life of the battery. Other forms of A-batteries are applicable if the proper circuit arrangements are provided.

It is preferable to operate Type 1LB4 with self-bias since the grid voltage will be reduced accordingly as the B-voltage drops with increasing battery life.

24A TESTER READING

Recently reports have been received that new Sylvania 24A tubes have been testing lower than previous 24A tubes when used with certain tube testers. These lower test readings do not indicate a poor quality tube, but are due to a slight change in the screen grid of the 24A. The change was made to improve the receiver performance of the tube, but when used in some tube tester circuits the test readings are lower. This change has also been made on the Tetrode types 35/51 and 36 tubes.

All that is necessary to obtain correct readings is to re-set the original settings for the tester so that good tubes are tested somewhere near the mid-point of the "good" section of the meter.

The Precision Apparatus Company has given us data in connection with new test limits for their 900 series of electronometers. These changes are indicated below and are incorporated on present charts, but if they are not already included on your chart, we suggest that you make the changes now. Changes are also shown for several other types of tubes when tested in these same instruments. The revisions and corrections shown are for the roller tube data chart for series 910, 912, 915, 920 and 922, Precision electronometers.

Tube	Section-A	B	C	D	E	F	Depress
24A	7	3	**31**	**11**	**1**	1	BC
35/51	7	3	**32**	**10**	**1**	1	BC
35Z5	7	10	0	1	11	**9**	D
	(35Z5—Fil. Cont.—Depress **J** then B.)						
36	7	6	**20**	**17**	**1**	1	BC
45Z5	7	11	0	1	11	**9**	D
	(45Z5—Fil. Cont.—Depress **J** then B.)						
51	7	3	**32**	**10**	**1**	1	BC

The bold numerals and letters represent changes to be made on present charts if not already included.

• • •

PLENTY OF GRAVY

Radio sets fourteen years old are still in service in a few Indiana homes, and the average Hoosier set is 4.5 years old. Two families reported seven sets each, and many have three or four. The average is 1.02 per family, and fifteen percent own auto radios.

There figures, from a preliminary report issued during a survey being made by the "Hoosier Radio Workshop" of the University of Indiana, should bring both shouts of joy and pangs of remorse to radio dealers and servicemen.

Indiana, and by analogy, the whole United States, is far from saturation as a market for new sets. Many antiques should be replaced, and many families who own one or two sets could afford, and would enjoy, ownership of additional sets.

For servicemen, the story is plain as day. Remorse is due if this juicy market for service work and tube replacements has not been properly and thoroughly cultivated.

A CHAT WITH ROGER WISE

Chief Tube Engineer
Hygrade Sylvania Corporation

The continuous improvements made in tube characteristics seen in the announcement from time to time of types having higher mutual conductance, greater power output, or other similar "step up" in performance, do not in general result from any sudden invention or development. Most of the progress is based on unending study and effort to improve manufacturing technique, to design better tube parts and tube structures, and to control the variations in materials and processing with greater accuracy.

Some of the problems of tube design are not apparent to the eye, while others are readily seen. The extremely small clearance between cathode coating and the inner surface of the first grid—clearances as small as five to seven thousandths of an inch—can be noted in some of the newer types such as 7G7/1232, 6AC7/1852 and some battery types. At the same time the use of grids made from wire only one and one-half or two thousandths in diameter is becoming fairly common. At one time the use of such clearances and small wire sizes would have meant that the percentage of tubes rejected for shorts, for excessive variations in characteristics and other causes would have been excessive and would have made production on the present scale impossible.

One of the serious unseen problems is the limited range of materials which can be used in radio tube construction, together with the high temperatures to which the parts are subjected in manufacture, as well as in service. Materials which contain gas which cannot be pumped out quickly and completely must be discarded for obvious reasons. Materials which contain certain impurities cannot be used because of adverse effect on cathode or filament emission.

During exhaust the outer cage or plate element of a tube is heated by induction to a point just below the melting point of the material, and as a result, all parts of the tube are raised to temperatures much higher than those encountered in normal usage at this stage of manufacture. The structure must be so designed as to permit the parts of the tube to expand freely, as the materials are quite soft at these temperatures, so that if expansion is prevented warping will result, and shorted elements or a tube outside limits for characteristics will result.

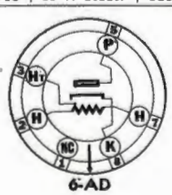
The problem of providing for free motion of parts to the extent necessary to prevent distortion of metal parts is complicated by the requirement that the tube must not "rattle" due to loose elements, and that the required close clearances must be held in spite of the dimensional changes in elements.

Taking the factors mentioned into consideration, and keeping in mind the fact that many other important considerations which have not been mentioned here must be checked by the tube designer, it is not surprising that tube manufacturers insist on the desirability and necessity of taking plenty of time to work out the design of new tube types. On the other hand, the relatively rapid improvement in tube characteristics over the course of the past two or three years should convince those interested in this subject that we have not been loafing on the job, and that progress has been as rapid as can be reasonably expected.

NEW SYLVANIA "GT" TUBES

Type	Class	Base View. See Type	Filament Rating Volts	Amps.	Use	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resistance Ohms.	Micromhos Mutual Conductance	Amplification Factor	Ohms Load for Stated Power Output	Undistorted Power Output Milliwatts	Type
1G4GT	Triode	1G4G	1.4	0.05	Amplifier	Chara	cteristics	Same as	Type 1G4	G	.....	.....	.....	....	....	**1G4GT**
3A8GT	Dio. Tri.-	8-AS	1.4	0.1	Tri.-Amp.	90	0.0	.....	0.15	.....	.24 Meg.	275	.....	.....	....	**3A8GT**
	Pentode		2.8	0.05	Pent.-Amp.	90	0.0	90	1.2	0.3	.6 Meg.	750	.....	....	....	
3Q5GT	Tetrode	7-AP	1.4	0.1	Power Amp.	90	4.5	90	9.5	1.6	.1 Meg.	2100	.....	8000	270	**3Q5GT**
	(Series Fil.	Opern.)	2.8	0.05	Power Amp.	90	4.5	90	8.0	1.0	.11 Meg.	1950	.....	8000	230	
6AC5GT	Triode	6AC5G	6.3	0.40	Amplifier	Chara	cteristics	Same as	Type 6AC	5G.....	.....	.....	.....	....	....	**6AC5GT**
6C5GT	Triode	6C5G	6.3	0.30	Amplifier	Chara	cteristics	Same as	Type 6C5	G Except	Capacitan	ces	.....	....	....	**6C5GT**
6H4GT	Diode	5-AF	6.3	0.15	Detector	100	....	.....	40	.....	.....	.....	.....	....	....	**6H4GT**
6P5GT	Triode	6P5G	6.3	0.30	Det.-Amp.	Chara	cteristics	Same as	Type 6P5	G Except	Capacitan	ces	.....	....	....	**6P5GT**
6SJ7GT	Pentode	6SJ7	6.3	0.30	Amplifier	Chara	cteristics	Same as	Type 6SJ7	Except Ca	pacitances	.....	.....	....	....	**6SJ7GT**
25A6GT	Pentode	25A6G	25.0	0.30	Power Amp.	Chara	cteristics	Same as	Type 25A	6G....	.....	.....	.....	....	....	**25A6GT**
25D8GT	Dio. Tri.	8-AF	25.0	0.15	Tri.-Amp.	100	1.0	.....	0.5	....	.....	1100	.....	....	....	**25D8GT**
	Pentode				Pent.-Amp.	100	3.0	100	8.5	2.7	.....	1900	.....	....	....	
40Z5/45Z5 GT	Diode	6-AD	45.0	0.15	H-W Rect.	125 R	MS	.....	100 Ma.	or 60 Ma.	with Panel	Lamp Con	nected	....	....	**405Z/45Z5GT**

5-AF



6-AD

7-AP

8-AF

8-AS

THE SERVICE EXCHANGE

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

Crosley Model 1117. Symptom: Low persistent, steady or intermittent hum, sometimes increasing or decreasing in volume. Cure: Check grounding of the 40 mfd. electrolytic. Install a lock washer on the top of the chassis under the electrolytic, and solder a heavy copper braid from condenser nut to chassis.—Curtis W. Winegar, Salem, Oregon

* * *

Detrola Warwick Model. A condition of poor or no reception of signals on the lower frequencies of the broadcast band can be remedied by replacing the voltage dropping resistor for the screen grid of the 57 detector-oscillator tube (50,000 ohms) with one of the 40,000 ohms resistance.—R. L. Gilmore, Ironton, Ohio

* * *

Dodge, 1939. In practically all 1939 Dodge auto radios, the pointer does not work after a short period of operation due to the dial cord jumping off the pulley. A sure repair is to remove the radio, take off the top and bottom covers, remove the front cover housing dial drive and take out two self tapping screws holding the dial drive. Remove dial drive, pointer dial and dial brace. Now, discard the old dial cord and the large brass pulley containing coil spring. Take a piece of light weight silk fishline and fasten it to the top drive pulley. Lead the cord around the drive pulley about three times, holding the pulley back in one position as far as it will go. Follow the coil under the drive pulley up over the top guide pulley and down around bottom guide pulley back to top drive pulley and after leaving a turn or so on the pulley, tie the end securely to the beginning of the cord. The brass pulley at the bottom which contained the spring is entirely eliminated.—Joseph N. Peckham, Auburn, New York.

* * *

Fada Model K. W. 48. Fading in this model, especially on the higher frequencies, which is due to oscillator drifting, can be completely cured by substituting the 27 oscillator tube for a 24A using the electron coupled circuit. This idea can be adapted to all superheterodyne receivers. Geo. Baer, Roslindale, Mass.

* * *

General Electric Model D-86. This model uses an a-v-c circuit with considerable noise when not tuned to a station. A simple remedy is to defer the a-v-c action by replacing the 2,200 ohm cathode resistor of the 6K7 first i-f tube with a 10,000 ohm unit. This retards the a-v-c until the signal becomes strong enough to overcome the added bias. Further retardation can be obtained by connecting the cathode of the r-f tube to the cathode of the first i-f tube. R. L. Gilmore, Ironton, Ohio

* * *

Hallicrafters Model S.X.9. Blocking on powerful short wave phone stations. A.V.C. with ¼ meg. resistor in place of the ½ meg. resistor.—T. L. Bender, Bonner Springs, Kansas

* * *

Philco Model 38-7. To reduce extreme bass response in these models change the following parts as follows:—Remove condenser No. 24, .01 mfd. replace with condenser .001 mfd. Remove resistor No. 32, 51,000 ohms ½ watt. Replace with 40,000 ohm ½ watt resistor. Remove condenser No. 38, .006 mfd., replace with condenser .01 mfd. This change will be greatly noticeable and worth the trouble with better all around response.—M. J. Planovsky, Cleveland, Ohio.

* * *

Philco Model 38-690 Code 125. To stabilize the oscillator circuit, shunt a 15,000 ohm resistor across the primary of range 4 section of oscillator transformer No. 37. Also to prevent hum, place or re-locate condenser No. 123 as far away as possible from the a-c switch of the audio bass control unit No. 221.—M. J. Planovsky, Cleveland, Ohio.

* * *

Philco Model 89 (Table Model) Short Wave Interference. Ship and S. W. amateurs signals (image) riding in on broadcast signals; remedy—bond wave switch and contact springs to chassis, use in series with antenna and ground a .0025 mfd. mica condenser.—Wm. B. Miles, Altoona, Penna.

* * *

RCA Model R11. When trouble is cutting off with only strong locals heard, look for a leaky bypass connected from the second detector plate to cathode. Replace with a good grade mica condenser. This condenser will invariably test OK when power is off.—Al's Radio Service, Tonawanda, N. Y.

* * *

RCA Model R-28, G. E. Model H-32. Intermittent and poor reception in both of these receivers is often traceable to the 14,000 ohm screen grid voltage dropping resistor. Unless this resistor is exactly right, replace it. I find that they often overheat and drop in resistance anywhere from 10,000 to 7,000 ohms. By replacing same the poor reception can be cured.—Leonard Johnson, South Boston, Va.

* * *

Stewart-Warner 1939 Series. When tracing the wiring in the 1939 Stewart-Warner radio chassis, you will find that apparently certain socket terminals are not connected to ground, even though the circuit diagram shows a ground connection. Actually such terminals are connected to a common grounding lug which is located between the two bakelite wafers of the socket. It is important to remember this fact when tracing the circuit wiring since if you do not know of these internal connections, the circuit wiring may seem to be incomplete.

Sockets with the internal connections can be identified by the grounding lug extending from the side of the socket. In the chassis this lug is always grounded.

Most Stewart-Warner 1939 A-C receivers use one or more of these special sockets, employing them wherever all three of the above terminals are to be grounded to the chassis. Of course, any wiring or other parts connecting to any of these three socket terminals are thus grounded by the internal socket connector.

Connections To Unused Tube Socket Terminals:—Another important point to remember when tracing wiring is that frequently wiring or parts are connected to tube socket terminals which ordinarily would be unused since no tube prong connects to these terminals. For example, a 6K7 tube has only 7 prongs, thus there is one unused socket terminal. In our sets we employ such unused terminals to anchor small parts such as resistors and condensers, also as junction points for two or more wires. Stewart-Warner Service Department.

* * *

Trouble Locator. I have a two-stage i-f amplifier with plug-in coils. A demodulator tube is also used. A test lead is used consisting of a low-loss shielded cable with a prod made of a .00005 condenser in series with a 50,000 ohm resistor. These are placed inside a small brass cylinder and the contact is a rather light brass pin coming through a bakelite insulator in the end of the brass tube. This combination will not upset any part of the i-f circuit, and we can listen in anywhere from the plate of the first detector through the i-f and to the grid of the demodulator. The i-f coils are mounted directly on 4-prong tube bases and are easily changed.

The second unit is made from the audio section of any good sounding used radio. All that is necessary is to convert the demodulator tube into a resistance coupled input circuit and use a shielded cable with the same type of test prod, but using a condenser of .03 capacity and no resistor. Both test leads have a ground lead with a clip for attaching to the chassis under test.—Clarence M. Doyle, Utica, New York.

DIRECT-COUPLED AMPLIFIER PARTS LIST

Below is a list of parts for the Push-Pull Direct-Coupled Amplifier described on Page 4 of this issue.

Basic Amplifier:
One Amplifier Co. of America power transformers, type PTL6 10 D.C., P.T.;
One Amplifier Co. of America filter choke, type 60CH, 125, Ch.
Two condensers, 10 mf., 450 V.
One condenser, 20 mf., 450 V.
One condenser, 30 mf., 450 V.
Two resistors, 2 megs., ½-W.
Two resistors, ¼-meg., ½-W.
Two resistors, ½ meg., ½-W.
Two resistors, 0.1-meg., ½-W.
One resistor, 15,600 ohms, 2 W.
One resistor, 750 ohms, ½-W.
One Hardwick, Hindle, Inc., resistor, 640 ohms, 30 W.
One Hardwick, Hindle, Inc., resistor, 505 ohms, 20 W.
One resistor, 32,500 ohms, 1 W.
One Amplifier Co. of America chassis and foundation kit
Two Sylvania type 6SJ7 or 6J7 tubes
Two Sylvania type 6L6 or 6L6G tubes
One Sylvania type 5V4G tube
One Amplifier Co. of America push-pull output transformer, 0TL6 10 D.C.; or
Two Amplifier Co. of America single output transformers, 0TL6, 5 D.C.
One dual shielded volume control, ½-meg.; or,
Two volume controls ½-meg.
One Amplifier Co. of America hum-bucking and shielded input push-pull transformer, 200 and 500 ohms; or,
One Amplifier Co. of America high-impedance hum-bucking and shielded input transformer;
One tone control, ½-meg.
One condenser, .003-mf.

Resistors and Condensers for Use with Output Transformer

Two condensers, 1 meg., ½-W., 600 V.
Two condensers, 0.003-mf., 600 V.
Two condensers, 0.006-mf., 600 V.
Two resistors, 5,000 ohms, 1 W.

CORRECTION

The last issue of the News had some of the + signs in the Direct-Coupled Amplifier Article formulae shown as − signs through a typographical error. The corrected formulae follow. We suggest you make the corrections in your copy.

$$(F)\quad \frac{125}{2[2(1.5+.5)]\text{Ma.}} = \frac{125}{0.008} = 15{,}000 \text{ Ohms}$$

$$(E)\quad \frac{130}{2(1.5+.5)\text{ Ma.}} = \frac{130}{0.004} = 32{,}500 \text{ Ohms}$$

$$(C)\quad \frac{75}{148-1} = \frac{75}{147} = 505 \text{ Ohms}$$

$$(D)\quad \frac{95}{2(65+6.5)-1+4\text{ Ma.}} = \frac{95}{0.148} = 640 \text{ Ohms}$$

PUSH-PULL DIRECT-COUPLED AMPLIFIER

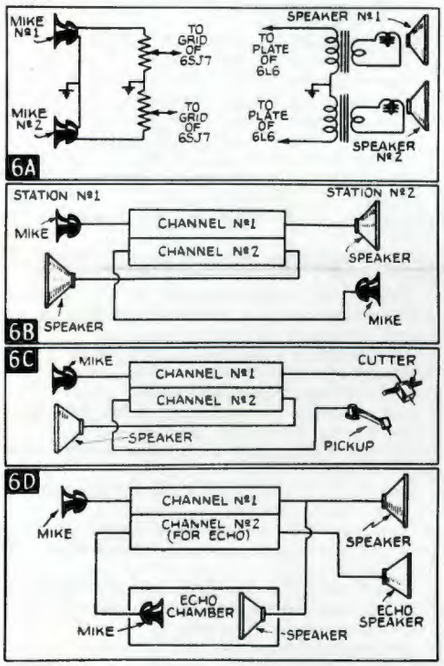
BY A. C. SHANEY, Amplifier Co., of America

PART III

Twin-Channel Operation

Figure 5 is a completed basic circuit of the All-Push-Pull Direct-Coupled Amplifier. The output transformer, volume control and tone control have been intentionally omitted, as there is a larger number of possible variations in these 3 elements, depending upon the final application of the amplifier. If a separate output transformer is used for each side of the circuit, and separate input signals are applied, **twin-channel amplification** is effected, making this unit admirably adapted for reproduction of sound in "auditory perspective."

If each one of 2 microphones is independently fed into each one of the 2 input circuits, as Fig. 6A, and 2 speakers are correctly placed in an auditorium, so as to bear the same relative positions as the microphones, amplification in auditory perspective will take place. For this application, two independent half-meg. potentiometers replace the (A) resistors. This same input and output set-up will also enable 2-way communication between any two remote points, without the use of talk-listen switches (see Fig. 6B).



The amplifier can also be used for recording and playback, or any other, similar duplex arrangement, without the necessity of switches. In the usual recording amplifier (with single input and single output) it is necessary to switch a number of circuits before playback can take place. In the twin-channel amplifier (see Fig. 6C) a microphone feeding into the 1st channel can operate the cutter (connected to the output of the 1st channel), and a crystal pickup (for playback) can be connected to the input of the 2nd channel. A speaker connected to the output of the second channel completes the playback system.

This same arrangement can also be used for introduction of "artificial reverberation," or **echo,** simply by providing a time delay in one of the amplifier circuits. This is illustrated in Fig. 6D. With this arrangement, part of the original amplified signal from channel No. 1 is sent through an echo chamber or other acoustic time delay unit, such as a long pipe. This sound is picked up and sent through channel No. 2, and is ultimately reproduced along with some part of the original signal, so that the effects of reverberation or echo are obtained.

For conventional push-pull operation, it is necessary to use a good push-pull output transformer, together with a twin half-meg. potentiometer, as illustrated in Fig. 7A. In order to obtain push-pull operation of the input tubes, it is necessary to feed a push-pull signal into the input of the amplifier. This is obtained by removing one of the phono pickup or microphone leads from ground.

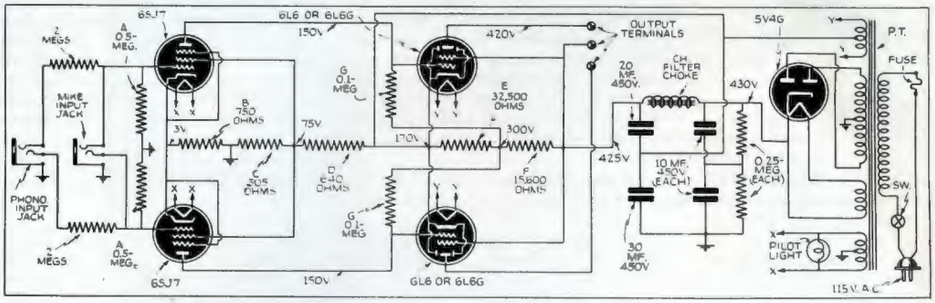
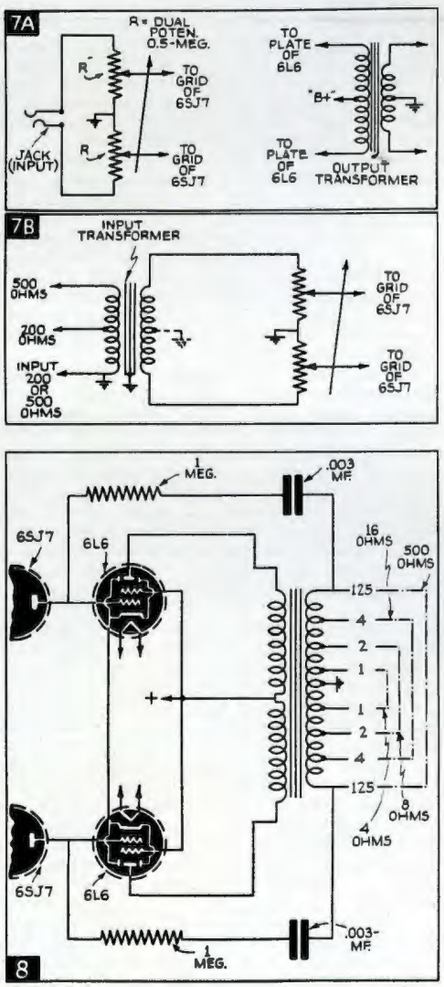


FIG. 5

Input and Output Transformers

Any phono pickup, either of the crystal or the magnetic type, may easily be adapted for push-pull operation by removing one of the phono pickup or microphone leads from ground, and connecting it through a two-wire shielded cable and a three way telephone type shielded plug, into the push-pull input of the amplifier. Microphones and pickups are easily obtainable for push-pull operation.

Most conventional diode type detectors normally used in radio receivers can easily be revamped to obtain a push-pull output by following the circuit of Fig. 10. The load resistor of the diode circuit is simply divided into two equal parts and the center is grounded. Each of the sections should be individually filtered. A suitable type of tandem volume control may be used as the load. This circuit will deliver two signals which are exactly 180 degrees out of phase.



If it is impossible to isolate one of the leads of the input signal from ground, or if a low-impedance (200- or 500-ohm) input device be connected to the amplifier, an input transformer must be used as per Fig. 7B. In order to attain true high-fidelity reproduction, this unit should employ an "electric metal" core, and should match the input device to the input of the amplifier (100,000 ohms, grid-to-grid). Hum-balancing construction should be utilized to avoid excessive hum pick-up.

Needless to say, it is impossible to design or construct transformers which will have a response comparable to that of the amplifier. In fact, a wide-range output transformer capable of passing 10 to 20,000 cycles with less than 1 db. variation, would cost approximately $20. In order to enable the use of a low-priced output transformer with this unusual amplifier, a special push-pull inverse feedback and compensating network circuit was employed, which is illustrated in Fig. 8. This circuit enables a $1.50 transformer to equal the performance of a $20.00 unit.

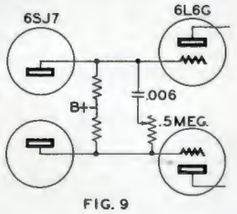


FIG. 9

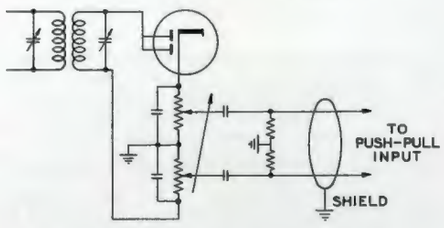


FIG. 10

Tone Control Circuit

It appears to be sacrilegious to add a frequency discriminating arrangement to this ideal amplifier. Nevertheless, existing deficiencies in speakers, transmission lines, microphones and pickups necessitate such an adaptation.

The frequency discriminating network should be connected in the input circuit across both grids of the 6SJ7 as per Fig. 9, or in series, or shunt, with the input device, depending upon the type of equalization desired. A standard tone control (of the high-frequency cut-off) is indicated in the List of Parts, although this type of circuit need not be followed, as any other form of equalization may be effectively employed.

The writer hopes that this discussion will bring to the front the hidden possibilities of the direct-coupled amplifier circuit; and he will gladly answer all questions relative to the adaptation of this or any other direct-coupled amplifier for any commercial or industrial application.

Parts List Shown on Page 3

SYLVANIA NEWS

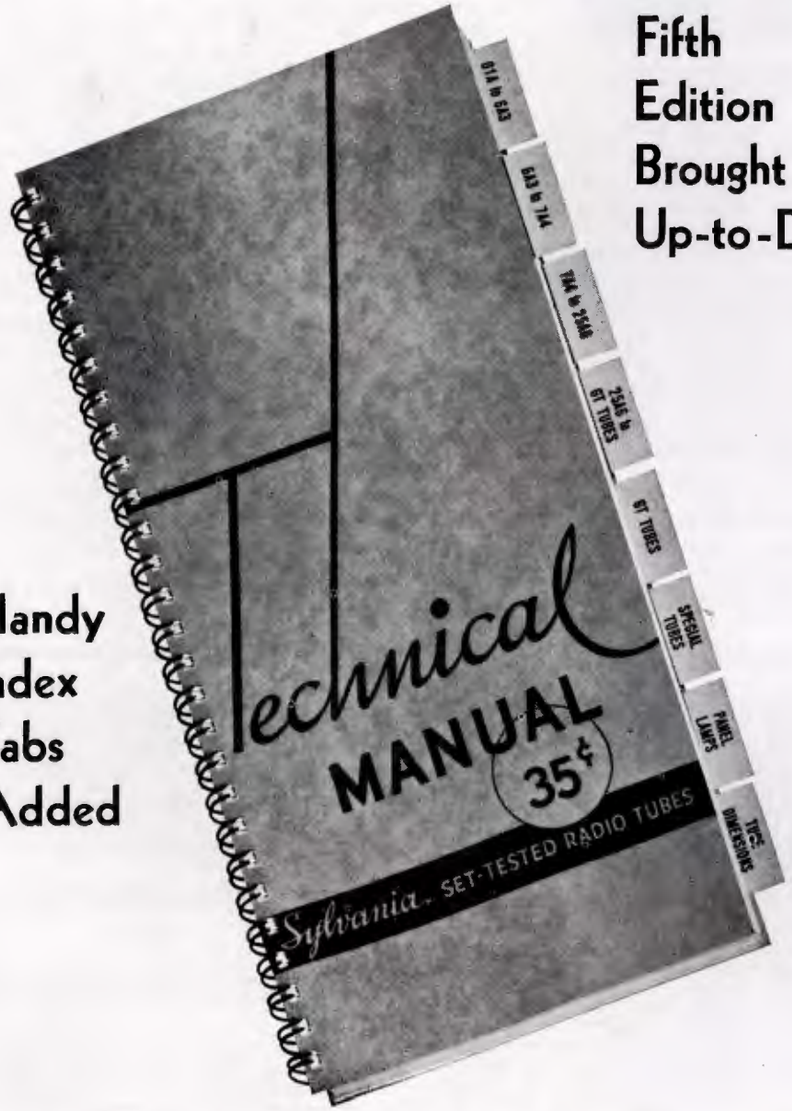
TECHNICAL SECTION

MAY-JUNE, 1940 EMPORIUM, PENNA. Vol. 8, No. 9

NEW TYPES IN TECHNICAL MANUAL

Fifth Edition Brought Up-to-Date

Handy Index Tabs Added



The fifth edition of the Sylvania Technical Manual, released last September, has been reprinted to include data on all new tube types to date. This addition brings you 272 pages packed with valuable information, in what is conceded to be the most up-to-date manual of its kind available.

To make it easier for you to locate quickly just the information you need, we have added a new feature—tab indexes, which indicate the most important sections of the manual.

The data arrangement remains the same, and there is no difference in size, appearance, or the handy wire-o binding, which permits the book to lie flat when opened. The price also remains the same—35c per copy. Your Sylvania Jobber has a supply of these revised Technical Manuals, or you may use the coupon on page 4 of the Main Section to order direct.

NEW TUBES

Sylvania Type 7B4 High-Mu Triode

5-AC

Sylvania Type 7B4 is a single-ended high-mu triode having electrical characteristics and applications similar to those for Type 6F5G.

The loktal construction employed in Type 7B4 provides compactness, suitable shielding, and the lock-in feature. For a-c service the 7-volt heater rating corresponds to a 130-volt line condition. It is also the nominal voltage for automotive receiver service. For household receivers, ratings marked Max. are design centers for a line voltage of 117 volts. For automotive service the design centers are 90% of the values indicated using a battery terminal voltage of 6.6 volts.

CHARACTERISTICS

Heater Voltage (Nominal) AC or DC	7.0 Volts
Heater Current (Nominal)	0.32 Ampere
Bulb	T9-G
Base-Loktal 8-Pin	5-AC
Mounting Position	Any

RATINGS:

Heater Voltage (Nominal) AC or DC	7.0 Volts
Heater Current (Nominal)	0.32 Ampere
Plate Voltage	300 Volts Max.

Operating Conditions and Characteristics:

Class A_1 Amplifier

Heater Voltage	6.3	6.3 Volts
Heater Current	0.3	0.3 Ampere
Plate Voltage	100	250 Volts
Grid Voltage	−1	−2 Volts
Plate Current	0.5	0.9 Ma.
Plate Resistance (Approx.)	85,000	66,000 Ohms
Mutual Conductance (Approx.)	1175	1500 μmhos
Amplification Factor	100	100

Sylvania Type 7L7 Triple Grid Amplifier

8-V

Sylvania Type 7L7 is a single-ended triple grid amplifier in loktal construction somewhat similar to Type 7G7/1232 except that the heater current has been reduced and spacings increased, making it more suitable for general use than Type 7G7/1232 which was designed for application where a higher value of mutual conductance was desirable.

Due to low operating bias required, it is recommended that same be obtained automatically by the use of suitable cathode biasing resistors, values of which are shown above.

Continued on page 4

THE MYSTERY OF THE BURNED-OUT TUBE

By WALTER R. JONES

Our friend, Sam Serviceman, has been in business for years and has run up against almost all kinds of radio headaches. He thought he knew every grief that goes with the service business, but this past winter something new popped up that had him stumped, as it had thousands of other servicemen like Sam.

Sam lives in the South, and it all started when the tourists began to arrive for the winter with the new 1.4 volt portables which could be plugged into the power line or operated on self-contained batteries.

One day a lady brought in one of these sets, with the old story that "It does not work". Sam checked the receiver thinking, "This will be easy". The batteries were worn out so he plugged it into the line before replacing them. To his surprise it did not operate, so Sam pulled out the plug, removed the tubes and checked them. He found one tube with an open filament.

Again, "This is easy," thought Sam. Without plugging in, he replaced the original good tubes, took a new tube from the shelf, tested it and put it in the remaining socket. FLASH! ! ! !

"What the heck?" muttered Sam, "I didn't even have it plugged in and no batteries. How could that happen?"

He plugged it in and again the set would not operate. Once more checked the tubes, and found one with an open filament.

He didn't really begin to worry until the same thing happened with several portables. Some times, after the mysterious flash, several or all of the tubes were burned out.

Let's leave Sam scratching his head, and try to explain what causes this peculiar condition.

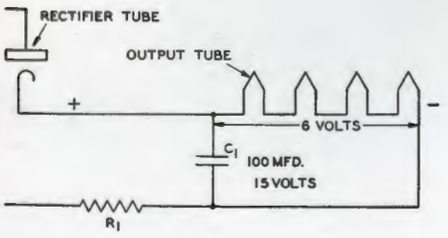


FIG. 1

Some receivers are built like the typical circuit shown in Figure 1. With this type of receiver, if a tube burns out, it will cause the electrolytic condenser "C" to fail, since the condenser has a 15 volt rating. When a tube filament opens up, approximately 150 volts is applied across "C", since there is no voltage drop across "R1".

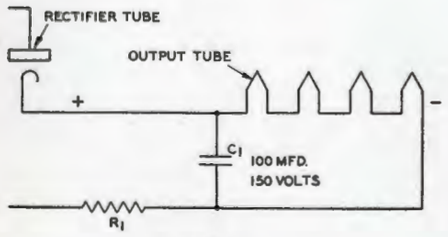


FIG. 2

Other receivers are built around circuits like that in Figure 2. Here the electrolytic condenser has a 150 volt rating. Therefore, if the filament of one of the tubes opens, the condenser does not fail, but has about 150 volts across it and accumulates a large charge because of its high capacity. It is important to remember that there is now 150 volts across the condenser. This condenser will hold its charge for a long time. If, now, a good tube is placed in the socket to replace the defective tube, even if the line cord is pulled, there will be 150 volts across the 4-tube filaments and the inevitable will happen—at least one, and possibly all the tubes will burn out. **This condenser must be discharged** before inserting a new tube.

Neither of these two circuits is very satisfactory as regards tube safety, since the output tube must always be located at the positive end of the filament string to obtain bias, which means that the plate and screen current for that tube must flow through all the other filaments. As a result, the other filaments are overloaded.

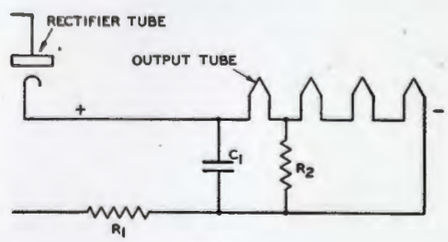


FIG. 3

Figure 3, shows how this defect has been overcome by providing a bleeder resistor "R2" to shunt the plate and screen current of the power output tube. As long as the output tube filament is intact, then "R2" also acts as a bleeder resistor across the condenser "C1" and will drop the voltage across "C1" to a low value. Thus, if any filament **except** the output tube filament opens, there will be no burnout when a tube is replaced. If, however, the output tube opens up, or is removed from the socket, then the condenser will be charged at maximum voltage and the new output tube may be promptly ruined.

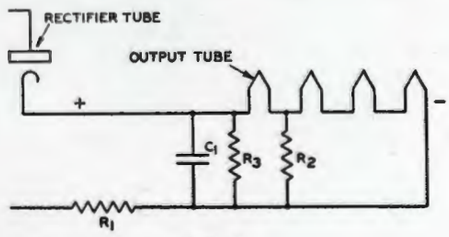


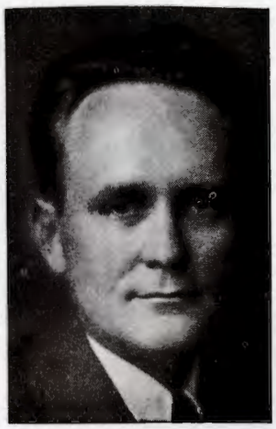
FIG. 4

It is very necessary to determine whether any of the typical circuits shown are employed, and if so, that proper precautions be taken to prevent failure of additional tubes. Even if a tube does not burn out, its emission may be badly impaired and the tube will test unsatisfactory. In some receivers it is always the same tube which burns out. In others, any tube may burn out, and often more than one. Figure 4, shows a fool-proof circuit since the condenser always has a bleeder across it.

Most receivers being built today have had the condition which is responsible for this trouble corrected.

BEFORE SERVICING ANY PORTABLE AC OPERATED RECEIVER, STUDY THE CIRCUIT DIAGRAM. IF NONE IS AVAILABLE, TRACE IT OUT BEFORE DAMAGE IS DONE TO GOOD TUBES.

A CHAT WITH ROGER WISE



Chief Tube Engineer
Hygrade Sylvania Corporation

A moderate number of new tube types have been introduced to meet set manufacturers' needs for the current season. The rate at which types are being added is less than half as great as it was a year ago, and most of the tubes released to date appear to fill a real need.

Last season the so-called "television amplifier" types of R-F pentodes became popular because of the very high value of mutual conductance which made it possible to realize high gain even with a broad band untuned amplifier. Type 7G7/1232 was used quite extensively with good results in this type of design. This year types 7L7 and 7H7 are two new types which will tend to replace some of the demand for 7G7/1232 as well as for 7A7 and 6SK7. A high value of Gm has been retained in these designs (on the order of 3000 to 4000), while the interelectrode spacings have been increased, making it possible to realize better uniformity and lower costs, with a better margin of safety as far as shorts or noise due to tube defects is concerned.

Type 7L7 has a sharp cut-off and comparatively low plate current. It is most desirable where maximum ratio of tube noise to signal is desired (by this reference to tube noise the "hiss" or steady noise inherent to some degree in all tubes is meant). The signal which can be applied to the grid is, of course, limited as compared with remote cut-off types.

Type 7H7 is similar in design to 7L7, but has a moderately remote cut-off and a higher value of plate current. The ratio of mutual to plate current is lower than in 7L7, but fairly high input signal amplitudes can be accommodated.

The trend toward lower "B" battery voltages in portable sets has necessitated addition of further types of battery tubes which give best performance in the range of 45 to 67 volts. It might appear that a single design could be worked out which would operate efficiently over the range of 30 volts minimum to 135 volts maximum, but there are a number of factors which make such a design impractical. One of the important ones is the limitation of plate current at high "B" voltages. The plate current cannot be allowed to increase rapidly with voltage, otherwise the emission limits of the filament would be exceeded and the "B" power wasted would be excessive. As a result of these considerations, and others inherent in tube design limitations, the introduction of additional battery types becomes logical and necessary.

Miscellaneous new types for various classes of service are appearing, some of these tubes having fairly wide application, but many of them being restricted to a relatively narrow field.

THE SERVICE EXCHANGE

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

Airline Model 62-196. In servicing several of these models with dual volume controls, I often find that the rear unit is generally burned or corroded while the front is usually OK. I disconnect the main wire from the rear unit and connect a resistor of near 200 ohms to this wire and ground the other end of the resistor. This gives the cathode a voltage of approximately 5 volts, which works satisfactorily. All sets I have repaired this way are still going strong. Keith Shelton, Florence, Kansas.

* * *

Arvin 1940 Car Radios. A very bad rattling sound from the speaker, sounding like an off-center voice coil has been found to result from speaker cables falling too close to the driver stage and the resultant feedback sounds very much like speaker trouble. Redressing the cables to the side of the chassis away from the driver is sufficient to eliminate the trouble.—R. K. McFall, Minot, North Dakota.

* * *

Crosley Fiver Roamio. Several cases have been encountered in which this set, even when it is shut off, has discharged batteries.

The A plus lead, or the hot lead, since a self-rectifying vibrator is not used, is led into the set on the lower left-hand corner. Just inside the frame is a metal plate, insulated from the chassis by fibre washers and sheet fibre. On this plate fastens the hot lead. In certain cases, it is found that moisture from the windshield can run down over the car panels and leak into the upper left-hand corner of these sets when they are installed to the left of the steering column. This moisture deteriorates the fibre sheeting and forms rust deposits between the anchoring plate and the chassis.

Although the set is fused, the amperage loss may be less than that required to blow the usual fuse. A careful check of all such sets for this leakage is advised.—R. K. McFall, Minot, North Dakota.

* * *

G. E. Model K-62, RCA Model R8. Crackling and weak reception may be in the first audio primary. There are two transformers sealed in a can with no room to mount another. Change to resistance coupling. Substitute 100,000 ohms for primary and 300,000 for secondary and couple detector plate to audio grid through a .05 mfd. condenser.—George Baer, Roslindale, Mass.

* * *

Holder for Small Parts. When in need of something on the service bench to hold small bolts, nuts and other small parts, get a few of the glass coasters that are used under chair, cabinet and table legs. I have found that they are the best thing available for small parts and containers on the bench.—Marion L. Rhodes, Knightstown, Indiana.

* * *

Majestic Treasure Chest (Chassis 381). In this set it is often impossible to get it near enough to the oscillation point to be sensitive. I have found that by removing the metal plate that is fastened on the chassis, the set will work much better and be more selective. It is very easy to get at by simply turning the set over and looking in the bottom. This plate is mounted on the top of the chassis, the chassis being mounted upside down in the cabinet.—Marion L. Rhodes, Knightstown, Indiana.

* * *

Philco Model 38-92. To eliminate considerable hum, redress the wiring as follows:— (1) Dress the green wire connecting the diodes of the 75 tubes to the second i-f transformer as far away as possible from the filament prongs of the 75 tube. (2) The brown wire connecting resistor 12 to the high side of the volume control should be dressed under the coil of i-f transformer No. 12. (3) The grid lead of the 75 tube should be dressed toward the back of the receiver and between the tube and the shield.—M. J. Planovsky, Cleveland Ohio.

* * *

Philco Model 116X, 116B. Poor shadowgraph action. Renew the 1 megohm carbon resistor in a-f screen grid circuit. — Wm. B. Miles, Altoona, Penna.

* * *

Replacing Hard-To-Reach Pilot Lights. A tool for replacing pilot lights may be made from an old fountain pen (celluloid or plastic). Remove the "works" then slit the open end with a hack saw for about 1½ inches. The tool has enough tension for removing or replacing the lamp.—John J. Okopinski, Mount Carmel, Pa.

* * *

RCA, G. E. & Stewart Warner (Using 6L6's). Popping and sputtering at high volume in receivers using 6L6 tubes, I believe is due to "arcing" over in the bases. New Sylvania 6L6G's cure this trouble. RCA, G. E. and Stewart Warner receivers seem to frequently have this trouble until 6L6G's are used.—Leo Zimmer, Canisteo, N. Y.

* * *

Silver Marshall Model V. A bad case of hum in this receiver which cannot be eliminated by usual methods such as replacement or addition of filter units, can usually be traced to the placement of dial light leads which are too close to the tuning meter leads. The cure is self-evident.— Frank J. Moch, Chicago, Illinois.

* * *

Silvertone Models 6134, 6152, 6155, 6156 6159. On these models considerable trouble has been experienced with the oscillator coil primary shorting out with the secondary due to the close spacing between each winding. A simple repair for this is to unsolder the coil from the band switch and take one turn of wire off the primary. This is taken off the end which is nearest the secondary winding. This will clear the short and will not affect the tracking of the set in the least. At the same time, there will be the additional spacing of the one turn removed which is sufficient to eliminate any further possibility of this trouble re-occuring. The 150 ohm resistor going to the injector grid of the 6A8G tube and also the tube itself will have to be replaced in most cases due to the high voltage that they are subjected to when the short occurs.—Vincent F. Filizola, Hollywood, California

* * *

Sonora Model A-11. This is a small four tube AC-DC set in a plastic cabinet which came out in 1938 and 1939. It is absolutely essential that the back of this set be taken off and left off. There is a line ballast in the set which is within 1½ inches from the filter condenser and unless ample ventilation is provided an inoperative receiver and a defective filter will result due to intense heat from the ballast as well as the heat from the 25Z5 tube. The holes in the bottom of the plastic cabinet should be made larger.

A noise that is found only when moving the tuning condenser is caused from the rotor plates of the variable condenser touching the metal shield of the 6D6 tube. A permanent remedy is to place a small piece of paper or cardboard between the tube base and socket on the side where it will tilt the tube enough to clear the condenser.

Intermittent reception in this model is often caused by the solder lugs on the volume control touching the chassis. The lugs of the control lay so close to the chassis that the best permanent cure is to place a large washer of insulating material between control and chassis. Be sure and tighten control locknut tight or control will turn and lugs will short to terminals of filter condenser.—Marion L. Rhodes, Knightstown, Indiana.

* * *

Stewart Warner Model 950 AC. Noisy volume control. When repeated cleaning and replacement fail to clear the trouble permanently, simply disconnect the antenna from the left hand end of the control. This isolates the antenna circuit from the control and any noise which developes will not be sent through the signal circuits. The control carries quite a heavy current, hence the noise.—William A. Locke, S. W., Huron, South Dakota.

* * *

Stromberg Carlson 400 Series. In case the dial pointer in any of the 400 series receivers becomes bent during transportation or handling, so that it rubs either against the background of the dial or the glass, it is a simple matter to correct this without removing the chassis from the cabinet.

Simply adjust the pointer so that it is approximately in the middle of the dial and reach in from behind and lift the slide, to which the pointer is attached, until it is just off the slide bar. Then, holding the slide between the thumb and first finger, bend it in the appropriate direction so that when it is replaced on the slide bar, the pointer will be in the proper operating position.—Stromberg Carlson Service Dept.

* * *

Zenith Model 6D-311. A very annoying form of oscillation when tuning or even adjusting volume, if not due to usual defects, may be traced to the speaker. The speaker is mounted in a manner which does not permit a good ground (if any) of the speaker frame. Grounding the frame securely will definitely eliminate the squeal.—Mr. Frank J. Moch, Chicago, Illinois.

* * *

VTVM-Wattmeter. Here is a hint regarding construction of a wattmeter which can be used in conjunction with Mr. Connor's VTVM as described in Sylvania News.

Obtain an old power transformer which still has its primary intact. Disassemble it and take off all windings except the primary, which is usually on the bottom. Over this winding and insulated from it wind 7 turns of #12 or #14 D.C.C. wire. Assemble unit and tighten carefully so it will not vibrate.

To calibrate, connect old primary winding to input of vacuum tube voltmeter. Our new winding consisting of 7 turns is now our primary and is plugged into the a-c line with a female receptical in series with one side of the winding. This receptical receives the load to be read. A cord with a male plug on one end and with three lamp sockets connected in parallel across it is made for the calibration job. Now, by inserting standard lamps of known wattage into these sockets and then turning the VTVM dial knob until eye just closes, recordings can be made on the dial in green ink specifying watts consumption. My VTVM is calibrated to read to 100 watts, but by using a voltage divider in place of the 5 meghohm resistor at VTVM input, higher wattage readings may be made. With the original 5 megohm resistor at input of VTVM, do not attempt to measure wattages in excess of 100 watts.

If this is not satisfactorily explained I will be glad to send anyone a more explanatory diagram if interested. I have also made a t-r-f two-stage amplifier to be used in conjunction with the VTVM when necessary.—Wm. Lofstrom, Valdosta, Georgia.

NEW TUBES

Continued from page 1

TYPE 7L7—*Continued*

CHARACTERISTICS

Heater Voltage (Nominal)	
AC or DC	**7.0 Volts**
Heater Current (Nominal)	**0.32 Ampere**
Bulb	**T9-G**
Base—Loktal 8-Pin	**8-V**
Mounting Position	**Any**
Direct Interelectrode Capacitances:*	
Grid to Plate	**0.01 μμf Max.**
Input: G to (F+K+Gs+Su+ Internal Shield)	**8.0 μμf**
Output: P to (F+K+Gs+Su+ Internal Shield)	**6.5 μμf**

*With Standard RMA Tube Shield connected to cathode and base shell.

RATINGS:

Heater Voltage (Nominal)	
AC or DC	**7.0 Volts**
Heater Current (Nominal)	**0.32 Ampere**
Plate Voltage	**250 Volts Max.**
Screen Voltage	**125 Volts Max.**
Screen Supply Voltage	**250 Volts Max.**
Plate Dissipation	**1.5 Watts Max.**
Screen Dissipation	**0.3 Watt Max.**

Operating Conditions and Characteristics:

Class A1 Amplifier

Heater Voltage	**6.3**	**6.3**	**Volts**
Heater Current	**0.3**	**0.3**	**Ampere**
Plate Voltage	**100**	**250**	**Volts**
Screen Voltage	**100**	**100**	**Volts**
Grid Voltage	**−1**	**−1.5**	**Volts**
Suppressor	**Tied to Cathode**		
Cathode Bias Resistor	**125**	**250**	**Ohms**
Plate Current	**5.5**	**4.5**	**Ma.**
Screen Current	**2.4**	**1.5**	**Ma.**
Plate Resistance (App.)	**0.1**	**1.0**	**Megohm**
Mutual Conductance	**3000**	**3100**	**μmhos**
Grid Voltage for Cathode Current Cut-off	**−4.5**	**−6**	**Volts (App.)**

Sylvania Type 12B7 Triple Grid Amplifier

8-V

Sylvania Type 12B7 is a single-ended triple grid super-control amplifier of loktal design suitable for r-f or i-f service in a-c, ac-dc and aircraft receivers.

All of the grids terminate at base pins, thus providing a super-control r-f amplifier tube without a top cap. An internal cage-like shield connected to Pin Number 5 is effective in providing a small grid to plate capacity.

The electrical characteristics and applications of the 12B7 are similar to those for Type 7A7.

The loktal construction provides compactness, suitable shielding and the lock-in feature. For a-c service the 14-volt heater rating corresponds to a 130-volt line condition.

CHARACTERISTICS

Heater Voltage (Nominal)	
AC or DC	**14.0 Volts**
Heater Current (Nominal)	**0.160 Ampere**
Bulb	**T9-G**
Base—Loktal 8-Pin	**8-V**
Mounting Position	**Any**
Direct Interelectrode Capacitances:*	
Grid to Plate	**0.005 μμf Max.**
Cg−(F+K+Gs+Su)	**5.5 μμf**
Cp−(F+K+Gs+Su)	**7.0 μμf**

*With Standard RMA Tube Shield Connected to Cathode.

RATINGS:

Heater Voltage (Nominal)	
AC or DC	**14.0 Volts**
Heater Current (Nominal)	**0.160 Ampere**
Plate Voltage	**300 Volts Max.**
Screen Voltage	**125 Volts Max.**
Plate Dissipation	**4.0 Watts Max.**
Screen Dissipation	**0.4 Watt Max.**
External Grid Bias Voltage	**0 Volt Min.**

Operating Conditions and Characteristics:

Heater Voltage	**12.6**	**12.6**	**Volts**
Heater Current	**0.150**	**0.150**	**Ampere**
Plate Voltage	**100**	**250**	**Volts**
Screen Voltage	**100**	**100**	**Volts**
Grid Voltage	**−3**	**−3**	**Volts**
Suppressor	**Connected to Cathode at Socket**		
Plate Current	**8.9**	**9.2**	**Ma.**
Screen Current	**2.6**	**2.4**	**Ma.**
Plate Resistance	**0.25**	**0.8**	**Megohm**
Mutual Conductance	**1900**	**2000**	**μmhos**
Grid Voltage for Mutual Conductance of 10 μmhos	**−35**	**−35**	**Volts**

35Z5G AND 35Z5GT TROUBLE

A large number of inquiries have been made relative to open filaments in types 35Z5G and 35Z5GT, before the tubes have been put into use. After a thorough investigation of this it has been found that the majority of the trouble is caused by improper testing in the field. This has been brought about by using improper settings on the testers and by inserting the tube before proper settings have been made.

This type of tube has a 35 volt heater which is tapped to permit the operation of a panel lamp across pins #2 and #3. Thus, it is very easy to apply improper voltages or to short this section of the heater, causing damage to it. **When making any tests on this tube, be sure the correct settings are made before inserting the tube in the tester.**

In receiver operation the heater tap on pin #3 is normally connected to pin #5 for the purpose of permitting the plate current to pass through the tapped section of the filament. This eliminates the initial surge voltage on the panel lamp when the receiver is first turned on and results in a higher level of illumination. Therefore, after the tube has been put into service there are certain precautions that should be followed. Short circuits in the B supply may cause a large drain on the rectifier, resulting in a burn-out in the panel lamp section of the tube. Any type of short to the panel lamp circuit should be avoided; or the use of an improper type of panel lamp is not recommended. Also a load current greater than that recommended should never be placed on the tube.

Tube tester manufacturers have been very cooperative in supplying complete test data on all their instruments that will test this type of tube. These data are shown below, and additional data will appear in the next issue of the Technical Section. If you do not have the correct tube tester settings for your tester, and they do not appear below, they may be obtained from the manufacturer. Check the figures below and make changes wherever there is a difference on your chart, as these are the correct current settings.

CLOUGH BRENGLE CO.

Model 225:

Fil.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**IN.**	**SH.**
m	F*	°H*	X*	R	:	:	:	:	:	91	9
Fil.				**IN**						**CIRCUIT**	

Model 125-B:

Mt	91	5-50

Model 125-R:

Mt	8	5-50

Caution: Do not use new addenda sheets in connection with testers which have not been modernized. (This caution is printed on the addenda sheets.)

DAYTON ACME CO.

Model 303:

Fil. & Cir.	**Sel. 1**	**Sel. 2**	**Sel. 3**	**Slide Switches**
..	10	32	9	AC*

*Note—Push A & C to "UP" position before placing tube in socket and do not return A & C to normal position until tube has been removed. This tube normally shows SHORTED.

Model 302:*

9-3	46	Q	..	..

*Switch A "UP"

Model 301:

J, 1 & 8	46	Q	..	..

Model 501:*

30	..	10	Q-3	..

*Sel. 1 at "G" before placing tube in socket.

Model 22C:

..	25.0	37	3	AC*

*Note—Toggles A & C must be thrown to "UP" position before placing tube in socket and left up until tube has been removed. This tube normally shows a SHORTED condition.

Model 200:

25.0	37	3	AC*

*Note—Toggles A & C must be thrown to "UP" position before placing tube in socket and left up until tube has been removed. This tube normally shows a SHORTED condition.

HICKOK ELEC. INSTRUMENT CO.

Models AC-51, 51-X, T-53, 510-X, 530:

A-11; B-1; Fil.—35; L-40—R-0. Press Rect. Standard Button. Testers having serial number below 500,000 which have not been modernized, set "L" on 76 instead of 40.

JACKSON ELEC. INSTRUMENT CO.

Advice from Jackson is that all late type testers which will test this tube have the correct data appearing on their charts. For new charts or data on modernizing, write directly to Jackson.

PRECISION APPARATUS CO.

Models 910, 912, 915, 920, 922:

A	**B**	**C**	**D**	**E**	**F**	**Depress**
7	10	0	1	11	9*	D

(Fil. Cont.—Depress J* then B.)

*Indicates changes made over original chart.

Precision advises that Series 500, 500-A, 510, 510-A, 600, 700, 800, 800-A, 815, 815-A, 900 and 900-A, have complete new test data available upon request. The latest supplement bears the date 2/15/40. Series 910, 912, 915, 920 and 922, all have test charts bearing the date 1/20/40 which supersedes all previous charts for this series.

SUPREME INSTRUMENTS CORPORATION

Model 385, 89 Series:

Fil. Volts	25
Fil. Return	7
But'n down	8
Qual. Sel. (R)	43
Qual Sel. (S)	30

Neon lamp glows on F & 3 12A5 & 12Z5 switch up.

Models 500, 505, 585:

Fil. Volts	25
Fil. Return	7
Switches Up	238
Met. Ckt.	C
Load Sel.	90
Shunt Sel.	3
Qual. Sel.	50

When making filament open test, neon bulb should light on both #2 and #3.

Model 400:

Fil. Volts	25
Fil. Return	7
Switches Up	238
Met. Ckt.	E
Qual. Sel.	4

When making filament open test, neon bulb should light on #2 and #3.

Model 594:

Fil. Volts	25
Fil. Term.	E
Meter Ckt.	A
But'n. Down	38
Qual. Sel.	75

#3 shows short.

Models 501, 502:

Fil. Volts	25
Fil. Return	7
Switches Up	5
Meter Ckt.	A
Qual. Sel.	37

When making filament open test, neon bulb should light on #2 and #3.

Models 503, 504:

Fil. Return I	7
Fil. Volts II	10
Qual. Sel. III	17
Meter Ckt. IV	3
Elements V	5

When making filament open test, neon bulb should light on #2 and #3.

Model 506:

Fil. Volts I	9
Fil. Return II	2
Fil. Return III	7
Meter Ckt. IV	0
Shunt Sel. V	7
Shunt Sel. VI	0
Shunt Sel. VII	0
Elements Out	3-8

Depress #3 when making leakage test. #3 shows short.

SYLVANIA NEWS

TECHNICAL SECTION

JULY-AUGUST, 1940 EMPORIUM, PENNA. Vol. 8, No. 10

FOR SHOP OR TRUCK--- A SERVICE BANNER

Here's a sign that will be seen

SIZE 46" x 28"

Have you a vacant space about four feet wide that could be put to work advertising your service business?

The new Sylvania Service Banner was designed to do just this job for you. Boldly printed in black and green on white, it is attractive and eye-catching. The size is 46 x 28 inches—just right for the side of a truck, over the door or window of your shop, as a window background, or hung inside where it can be seen from the street. You will find a spot, inside or outside, that seems just waiting for this piece of display advertising.

The material is a special "Duckine" fabric, sturdy and satisfactory for outdoor service. Six brass grommets provide extra reinforcement for fastening to a flat surface, or it may be hung like a banner from the top of a window, the edge of a shelf, or from the ceiling.

The price, 40c each or 3 for $1.00. We suggest two for your truck and one for your shop, to get maximum advertising value.

See your Sylvania Jobber, or use the coupon on Page 3 of the main section for convenience in ordering.

NEW TUBES

Sylvania Low Voltage Types

A new series of 1.4 volt battery tubes, for operation on reduced "B" voltage, has been designated for the Sylvania line. These tubes are of loktal construction with the lock-in and single-ended features. The performance range is excellent with "B" supply voltages between 45 and 90 volts. This new series includes an r-f pentode type 1LC5, a pentagrid converter type 1LC6, and a diode-audio pentode 1LD5.

The r-f amplifier of the series, type 1LC5, has the same applications as type 1LN5. It should be noted that there is little difference in mutual conductance with voltage supplies of 45 or 90 volts, as the screen is maintained at 45 volts for either plate voltage operation. This provides good operation for a wide range of battery voltages.

Type 1LC6, the pentagrid converter, is similar to type 1LA6 and has the same applications, but with the feature of performance at lower "B" supply voltages.

Type 1LD5 is the detector-audio tube of the series. It consists of a diode and pentode which have circuit functions the same as those for type 1LH4. The gain obtained from the pentode section at reduced plate voltages is appreciably higher than that of a triode.

An output tube of loktal construction not belonging, but suitable for service with this series, is type 1LB4. The only limitation is that of plate voltage supply. However, 60 or 75 volts on the plate will give satisfactory performance. With a plate voltage of 67.5 volts, about 85 milliwatts power output may be obtained with a total plate and screen drain of 4.8 milliamperes. Data for these new tubes follow:

Sylvania Type 1LC5 R-F Pentode

Sylvania Type 1LC5 is an r-f amplifier of loktal construction designed for service in low drain battery operated receivers. The outstanding feature of this new tube is its ability to function at reduced "B" voltages.

Type 1LC5 may be used satisfactorily in a-v-c circuits since it has a medium cut-off characteristic. Type 1LC5 is a high impedance tube and should be worked into a high impedance if maximum r-f amplification is desired. The conventional circuit applications are the same as those for Type 1LN5.

CHARACTERISTICS

Filament Voltage	1.4 Volts
Filament Current	0.050 Ampere
Bulb	T9-G
Base—Loktal 8-Pin	7-A0
Mounting Position	Any
Direct Interelectrode Capacitances:*	
Grid to Plate	0.007 μμf Max.
Grid to all Electrodes except Plate	3.2 μμf
Plate to all Electrodes except Grid G	7.0 μμf

*With standard RMA tube shield connected to negative filament.

(Continued on page 2)

NEW TUBES

(Continued from page 1)

TYPE 1LC5—*Continued*

RATINGS:

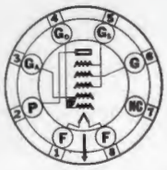
Maximum Filament Voltage:		
Battery Operation—Voltage must never exceed	1.6	Volts
AC/DC Power Line		
Operation—Design Center	1.3	Volts
Plate Voltage	90	Volts Max.
Screen Voltage	45	Volts Max.

Operating Conditions and Characteristics:

Filament Voltage DC	1.4	1.4	Volts
Filament Current	0.050	0.050	Ampere
Plate Voltage	45	90	Volts
Screen Voltage	45	45	Volts
Grid Voltage**	0	0	Volt
Plate Current	1.1	1.15	Ma.
Screen Current	.25	.20	Ma.
Plate Resistance	.7	1.5	Megohm Approx
Mutual Conductance	750	775	μmhos

**A resistance of at least 1 megohm should be used in the grid return to negative filament, Pin No. 8.

Sylvania Type 1LC6 Pentagrid Converter



7-AK

Sylvania Type 1LC6 is a pentagrid converter of loktal construction, designed especially for service in low drain battery operated receivers. The outstanding feature of Type 1LC6 is its ability to function at reduced "B" voltages, over the range of 45 to 90 volts.

The circuit applications are the same as for Sylvania Type 1LA6, but the difference in characteristics and operating conditions must be taken into account to secure optimum performance. In order to avoid oscillation difficulties with this tube, the screen voltage should be kept 10 volts lower than the oscillator anode voltage through the use of a properly by-passed voltage dropping resistor.

CHARACTERISTICS

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

Direct Interelectrode Capacitances:*

Grid G to Plate	0.28	μμf
Grid G to Grid Ga	0.38	μμf
Grid G to Grid Go	0.11	μμf
Grid Go to Grid Ga	0.6	μμf
Grid G to all other Electrodes (R-F Input)	9.0	μμf
Grid Ga to all Electrodes except (Go (Osc. Output)	4.8	μμf
Grid Go to all Electrodes except Ga (Osc. Input)	2.4	μμf
Plate to all other Electrodes (Mixer Output)	5.5	μμf

*With standard RMA tube shield connected to negative filament.

RATINGS:

Maximum Filament Voltage:		
D-C Battery Operation—Voltage must never exceed	1.6	Volts
AC/DC Power Line		
Operation—Design Center	1.3	Volts
Plate Voltage	90	Volts Max.
Screen (Grid Ga) Voltage**	35	Volts Max.
Anode-Grid (Grid Ga) Voltage	45	Volts Max.

Operating Conditions and Characteristics:

Filament Voltage DC	1.4	1.4	Volts
Filament Current	0.050	0.050	Ampere
Plate Voltage	45	90	Volts
Screen Voltage**	35	35	Volts
Anode-Grid Voltage	45	45	Volts
Control-Grid Voltage (G)¶	0	0	Volt
Oscillator-Grid Resistor (Go)	200,000	200,000	Ohms
Plate Resistance	300,000	650,000	Ohms
Plate Current	0.7	0.75	Ma.
Screen Current	0.75	0.70	Ma.
Anode-Grid Current	1.4	1.4	Ma.
Oscillator-Grid Current	0.035	0.035	Ma.
Total Cathode Currents	2.9	2.9	Ma.
Conversion Conductance:			
Control Grid Voltage at 0 Volt	250	275	μmhos
Control Grid Voltage at −2 Volts	50	50	μmhos
Control Grid Voltage at −3 Volts	5	5	μmhos Approx.

**Obtained preferably by using a properly by-passed voltage dropping resistor in series with B voltage supply. In order to avoid oscillation difficulties, the screen voltage must be at least 10 volts lower than the oscillator anode.

¶A resistance of at least 1 megohm should be used in the grid return to negative filament, Pin No. 8.

A CHAT WITH ROGER WISE

Chief Tube Engineer
Hygrade Sylvania Corporation

While the spotlight of publicity has been focused on midget or pocket portables and miniature tubes, the fact that substantial popularity is being achieved by a group of low voltage battery tubes manufactured in the T9 bulb should not be overlooked. The types recently introduced are 1LC6, a converter; 1LC5, an r-f and i-f amplifier; 1LD5, a diode pentode, and 1LB4, an output pentode.

All of the types mentioned are efficient in operation over a range of "B" voltages from 45 to 67.5 volts. In several cases they are more efficient at 45 volts than the corresponding miniature types. Type 1LD5, for instance, provides approximately twice the voltage gain obtained from the miniature type 1S5 when operated at the same plate voltage. In the case of the output pentode where the power output obtainable at a given "B" voltage is lowered, the compensating factor is a reduction of 50% in "A" drain and a substantial saving in "B" current as well, thus improving battery life or permitting a corresponding saving in battery size and weight.

It is practical to manufacture such tubes in shorter bulb lengths, and this change could be made if the reduction in size gained in this manner proves attractive to design engineers.

Present mount dimensions have been selected with the microphonic requirements in mind, and the tubes appear to be very satisfactory in this respect. It should be kept in mind, however, that entirely non-microphonic tubes cannot be manufactured at this time with clearances as small as those required for the efficient low voltage operation noted. Reasonable precautions to protect the tubes as much as possible from acoustic or other vibration are desirable, including, in extreme cases, flexible socket mounting.

Further improvements in tube characteristics are possible but it is not likely that additional new types will be introduced until the trends in consumer demand as regards set size are better established. Our present belief is that demand for reasonable battery life, good tone quality and good performance will take precedence over the quest for minimum size as regards both tubes and radio receivers.

Sylvania Type 1LD5 Diode-Audio Pentode

6-AX

Sylvania Type 1LD5 is a diode-audio pentode of loktal construction, designed for service in low drain battery operated receivers. This new tube has the feature of operation at reduced "B" voltage – 45 to 90 volts.

The circuit applications are the same as those for type 1LH4 except that the amplifier section is of pentode construction to take advantage of higher gain at low plate voltage, as compared with that of a triode. The diode plate is located at the negative end of the filament pin No. 8.

CHARACTERISTICS

Filament Voltage DC	1.4	Volts
Filament Current	0.050	Ampere
Bulb		T9-G
Base—Loktal 7-Pin		6-AX
Mounting Position		Any

Direct Interelectrode Capacitances:*

Grid G to Plate	0.18	μμf
Input (Grid G to F+G_2+G_3)	3.2	μμf
Output (Plate to F+G_2+G_3)	6.0	μμf

*With standard RMA tube shield connected to negative filament.

RATINGS:

Maximum Filament Voltage:		
Battery Operation—Voltage must never exceed	1.6	Volts
AC/DC Power Line		
Operation—Design Center	1.3	Volts
Plate Voltage	90	Volts Max.
Screen Voltage	45	Volts Max.
Diode Current with 10 volts D.C. applied	0.5	Ma. Min.

Operating Conditions and Characteristics:

Filament Voltage	1.4	1.4	Volts
Filament Current	0.050	0.050	Ampere
Plate Voltage	45	90	Volts
Screen Voltage	45	45	Volts
Grid Voltage	0	0	Volt
Plate Current	0.55	0.6	Ma.
Screen Current	0.12	0.1	Ma.
Plate Resistance	900,000	750,000	Ohms
Mutual Conductance	550	575	μmhos

Typical Operation as Resistance Coupled Amplifier

Plate Supply**	40.5	81	Volts
Screen Supply**	40.5	81	Volts
Grid Voltage	0	0	Volt
Load Resistor	1	1	Megohm
Series Screen Resistor	5	7	Megohms
Screen By-Pass Condenser	0.1	0.1	μf.
Grid Resistor	5	5	Megohms
Voltage Gain	70	120	Approx.

** B" supply voltage minus power output tube bias

▼ ▼ ▼

Type 117L7GT Rectifier-Beam Power Amplfier

Type 117L7GT is a combined beam power amplifier and rectifier contained in one bulb. The power output in the pentode section is limited by the low value of maximum permissible plate voltage. It should be noted that the d-c output current is limited to 75 milliamperes.

CHARACTERISTICS

Heater Voltage	117	Volts
Heater Current	.09	Ampere

Rectifier Section

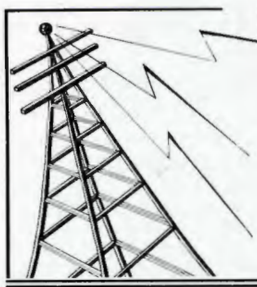
A-C Plate Voltage	117	Volts
D-C Output Current	75	Ma.
Peak Plate Current	450	Ma.
Tube Voltage Drop at 150 Ma.	16	Volts

Amplifier Section

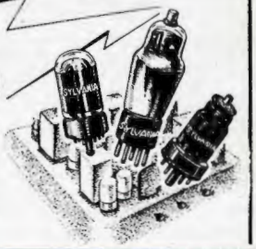
Plate Voltage	105	Volts
Screen Voltages	105	Volts
Grid Voltage	-5.5	Volts
Plate Current	45	Ma.
Screen Current	4.0	Ma.
Plate Resistance	20,000	Ohms
Load Resistance	4,000	Ohms
Power Output	.60	Watt
Total Distortion	5	Per Cent

Base Pin Connections (Bottom View)

1. Rectifier Cathode
2. Heater
3. Plate
4. Grid
5. Screen
6. Rectifier Plate
7. Heater
8. Amplifier Cathode



The SERVICE EXCHANGE



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

Arvin Model 618. For hum similar to that caused by an open filter condenser check all of the tube socket rivets which are used for grounding lugs. Many of these will make poor grounds although they will check OK on the voltmeter. For permanent repair, solder ground wire from chassis to each of these lugs.—E. H. Abel, Dallas, Oregon.

* * *

Atwater Kent Model 82. Noise when the chassis is tapped, similar to that of a microphonic tube is probably caused by the coil shield over the i-f transformer being loose. It must be absolutely tight. Drill these shields for an aligning tool and solder them to the chassis for a permanent cure. Check the alignment of i-f trimmers at 130 KC.—Marion L. Rhodes, Knight town, Indiana.

* * *

B. O. P. 393, 980. While this is quite an old set, it works well and has very good tone. I have had several of these which, after a year or two of operation, developed an annoying vibrator "hash," even though there was no objectionable hum. Replacing the two electrolytics located in the speaker case eliminates this hash.—E. Meinert, Sharpsburg, Penna.

* * *

Chevrolet Model 364441. If the original style of vibrator is not available for replacement in this radio, a Mallory 245 or Radiart 5413 synchronous vibrator may be used by making a few changes. Disconnect all wires to the type 84 tube socket and run the two secondary wires of the transformer to the filament terminals of the 84 socket, the center tap on power transformer to the in-put of filter choke. Run the two primary leads of transformer to cathode and plate terminals of the 84 socket leaving the center tap as is. Then place a buffer condenser of about .02 mfd., 2000 volts across the secondary of the transformer, (filament terminals on 5 prong socket-84). Then use a synchronous vibrator, plugging it in the original 84 socket. Make sure the vibrator case makes a perfect ground to chassis of set to eliminate vibrator hash.—Fred E. Berry, Olive Hill, Ky.

* * *

Chrysler Philco Model C-1708. To cure chassis noise pickup, install a choke in the hot field coil lead and hot voice coil lead just inside the case in the circuit between the junction of the 250 mmf. condensers and the two circuits. Install .05 mf. at the load side of the first "A" choke to ground, with the connections as short as possible. Bond the speaker lead shield to the case at the top right side, keeping the lead as close to the case as possible. Bond the end of the speaker lead shield to the speaker mounting screw nearest the plug with a heavy bond. Curtis W. Winegar, Salem, Oregon.

* * *

Electrolytic Condensers. When you get a small midget radio in with dual high capacity condensers in a round cardboard container, it is sometimes difficult to get the exact replacement.

Saw off the bottom of an old electrolytic condenser, leaving the top section the right length. Take miniature tubulars and place in the can after it is lined with fiber paper or other insulator and the job is done after the sealing compound is poured in.—Arleta Radio Service, Portland, Oregon.

* * *

Fada 55 Series. In Volume 8 No. 7, you showed a hint on the Fada 55 Series regarding high pitched whistle. To correct this, I have found it necessary to change the right hand side of speaker facing front of the set so that the leads will come out on the side of the 12A8 instead of being close to the 12Q7. Also a goat shield around the tube or a .01 condenser from plate to ground will work, but all these will cut sensitivity.—W. Mergenthal, St. Louis, Mo.

* * *

Ford Philco Model 1442. I have had several of these sets with the old complaint, "It plays fine for a while and then goes off and on." I find that replacing the condenser in the input circuit of the volume control remedies this complaint.—E. Meinert, Sharpsburg, Penna.

* * *

Philco Model 65. Set dead except locals; very low, or no plate and screen voltages on r-f tubes. Look for the shielded lead running from the first r-f tube plate to the r-f transformer under the shield that covers the entire second r-f stage. The rubber insulation on this lead breaks down and shorts to the flexible shield covering it. The short may be intermittent.—Earle W. Meredith, Rochester, N. Y.

* * *

Philco Model 80 A-C Four Tube. Two common noise troubles. Plate lead from i-f transformer to first 36 rubs coil base and insulation is punctured. Flashing over occurs.

Grid resistor (#20) first 42 tube lies close to 42 socket prong and when anyone walks or a heavy truck passes, it shorts to the tube. When servicing these sets check these two points.—George Baer, Roslindale, Mass.

* * *

Pontiac Air Chief Model 9830705. This model develops a trouble characterized by bad distortion and very low volume. Removing the phase inverter tube (6SF5) will give the volume a big boost and clear up reception to a marked degree. Before delving into the rather complex inverter circuit, and the type of inverse-feedback which is peculiar to this United Motors circuit, check the volume control closely. There is a tap at 250,000 ohms on the megohm control. The lug is so placed that under undue conditions of vibration or twisting of the control it may cut through the insulating paper which is provided and short to the chassis. This materially changes all voltages applied to the 6SQ7 second detector a-v-c audio stage and to the phase inverter, since the latter's cathode is tied into the cathode circuit of the 6SQ7. Removal of the phase inverter decreases the cathode-current of the common supply, and accordingly reduces the bias voltage on the 6SQ7, permitting increased gain and almost normal performance, except for the fact that the output stage then operates single-ended and none too efficiently.—R. K. McFall, Minot, North Dakota.

* * *

Stewart Warner Model 01-6B9. If you should receive a complaint that there is excessive needle scratch during phonograph operation of the Model 01-6B9, check the phonograph pick-up connections at the "Phono-Radio" switch under the top panel as described below:

1. First samples of this receiver had a 220,000 ohm resistor across the pick-up connections. In these sets, remove the 220,000 ohm resistor and connect a 68,000 ohm resistor (or 70,000 ohm if no 68,000 ohm unit is available) across the pick-up. Then connect a .003 mfd. condenser across this shunt resistor.
2. A few sets had the 68,000 ohm resistor connected across the pick-up, but no .003 mfd. condenser. In these sets, add the .003 mfd. condenser across the pick-up connections.
3. Most sets will have a 68,000 ohm resistor and a .003 mfd. condenser connected across the pick-up. These sets should not be changed but if there is excessive needle scratch, make sure the .003 mfd. condenser is not open-circuited.
4. Some sets using a slightly different pick-up have a 470,000 ohm resistor and a .001 mfd. condenser connected across the pick-up. These should not be changed although a slightly larger condenser would cut the high notes more and such a condenser could be used if the customer prefers the tone quality with the larger condenser.

IMPORTANT

If there is any "growling" during phonograph operation, be sure the chassis hold-down bolts are loosened sufficiently to permit the radio chassis to float on its rubber cushions. Also, if it is a very early chassis, make the change described in Section 1 of this hint. If this does not remove the growl, replace the 22,000 ohm resistor connected to the tap of the volume control with a 47,000 ohm resistor.

Stewart Warner Service Department

* * *

Zenith Model 6J230. Choked reception when one of the pilot lights is out can be traced directly to this pilot light. This is due to the fact that the filament circuit in this set is such that when one of the pilot lights are burned out, the voltage on the 1J6G tube is reduced to a little over 1 volt. Replacement of the pilot light again restores the set to its normal operation.—Frank R. Nutter, Milton, N. H.

▼ ▼ ▼

LONG LIFE

In Roger Wise's Chats in Sylvania News, Volume 8, No. 2, and Volume 8, No. 3, a thorough discussion of tubes built for especially long life was discussed. In that discussion it was mentioned that tubes used in telephone repeater service might be used over an unusual length of time. We have received a letter from a Sylvania booster who verifies the fact that Sylvania tubes are long lived, when used in this type of service. The letter from our Sylvania friend is given below:

Decatur, Illinois

Gentlemen:

Having sold and used Sylvania tubes for the last seven years in all types of equipment in which vacuum tubes are used, we are more than ever sold on Sylvania quality, dependability, and endurance.

One of our customers has operated a pair of Sylvania type 56 tubes in a telephone repeater circuit for over 40,000 hours of continuous service. These tubes were purchased November 18, 1934 and put in service at once and have operated 24 hours a day ever since.

This record and many others like it are the reasons why we are proud to sell and use Sylvania tubes at all times.

Adams Radio & Sound Service
(signed) R. W. Tackett, Service Mgr.

Technical Section Index

A new index for all issues of Sylvania News Technical Sections is now available, free on request. The index page is punched, suitable for insertion in the Technical Section binder.

35Z5G-35Z5GT TESTER LIMITS

The last issue of the Sylvania News Technical Section carried an article covering trouble encountered in testing the 35Z5G and 35Z5GT tubes. The article stated that additional data on other makes of testers would appear in this issue. Through the cooperation of the respective tester manufacturers, these promised data are shown below. The data shown provides the latest test conditions, but it should be kept in mind that to prevent possible damage to any tube, controls of the tester should not be changed while the tube is in the test socket.

EARL WEBBER COMPANY
Model 30, 30A

1	2	3
4	F	9

Must show short as BCH

Model 50

1	2	3	Socket
4	9	F	3

Must show short at BCH

Model 60, 85

1	2	3	Socket
4	9	F	5

Must show short at BCH

Model 70

Fil.	Ret.	Mas.	Sel.	Qual.
35	H	Rec.	2	18

Model 80, 80A Confidence Tester

1	2	3	Socket
9	0	10	10

Model 150

1	2	3	Socket	Test
14	J	8	6	Amp.

Model 200, 210

1	2	3	4	Socket	Load
18	K	6	D	6	W

MILLION RADIO & TELEVISION

	Models DF and BG	
Voltage	25	25
Selector	5	5
Load	2	2
Socket	4	—
Filament Selec.	—	7

Shows short on 3 and 8 as well as 2 and 10.

TRIPLETT ELECTRICAL INSTRUMENT CO.

Models 1610, 1611 (Serial over 11,000)

Load	A	B	C	D	E	F
16	4	2	7 & 9	5	2	—

Models 1610, 1611 (Serial under 11,000)

16 4 3 1 8 9 —

On short test keep button #6 in row "D" down at all times.

Models 1213, 1612, 1613

F	T	S	E	L
32	K	S	4	20

Good tube shows short on 5.

Model 1212

Fil. Volts	Tube Test	Short Test	Selector	Load
25	R	S	4	20

Model 1210-A

25 — — 1 16

Use special adapter R.

TRIUMPH MFG. COMPANY
Models 420, 430, 440, 443, 444,

Model	Fil.	Load	Sel.	Switch
420	10	A	44	C*
430	10	..	44	C*
440	10	..	44	C
443	9	..	44	C
444	9	..	44	C
Automatic Visograph	9	..	20.5	C

*Snap switch to "A" position.

STANDARD FIXED RESISTORS

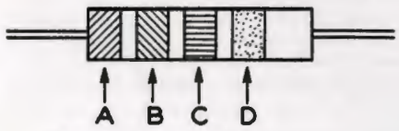
Given below is a list of RMA "Preferred Values of Fixed Composition Resistors". This list has been introduced and standardized by the Radio Manufacturers Association, so that the problems of initial supply and replacement for fixed resistors might be less involved.

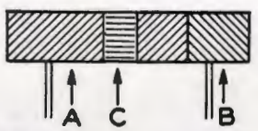
The preferred values shown below are divided into three tolerance groups, ±5%, ±10%, and ±20%. Where the voltage drop across resistors is somewhat critical, as in bias resistors, the 10% group is the most practical and economical. Only in special cases will the 5% group need to be used.

The application of Ohms law in determining the values of resistance used in vacuum tube circuits, often results in calculating odd values since the currents and voltages are determined largely by the operating characteristics of the tubes. Obviously, it is not feasible to design tube characteristics to suit pre-determined values of resistors. Thus, in using Ohms law to calculate a resistor value, it frequently occurs that the value is not on the preferred list. In such cases it is desirable to choose the resistor of nearest value, either larger or smaller, according to the characteristics of the circuit. For instance, if the value of a cathode resistor is calculated to be 110 ohms, it is found that the nearest values in the 10% tolerance group are 100 ohms and 120 ohms. If the plate and screen voltages are high, it is desirable to use the resistor that will provide more bias (in order to safeguard tube life and operating characteristics) and hence the 120 ohms unit should be used. Where the voltages tend to run low, the lower value resistor should be used. The same reasoning applies to the screen and plate resistance which are, in general, not as critical as cathode bias resistors. This reasoning applies to the resistor values shown with the Bias Resistor Chart in the Sylvania Technical Manual.

The group below furnishes a complete line of values which will meet the majority of circuit requirements. Adherences to the standardization eliminates the necessity of maintaining large stocks of resistors whose values are seldom used, and should simplify the replacement of resistors in servicing work.

Fixed Composition Resistors—Preferred Number Values





Preferred Values of Resistance (ohms)			Resistance Designation		
± 20% D-No Color	± 10% D-Silver	± 5% D-Gold	A	B	C
10	10	10	Brown	Black	Black
		11	Brown	Brown	Black
	12	12	Brown	Red	Black
		13	Brown	Orange	Black
15	15	15	Brown	Green	Black
		16	Brown	Blue	Black
	18	18	Brown	Gray	Black
		20	Red	Black	Black
22	22	22	Red	Red	Black
		24	Red	Yellow	Black
	27	27	Red	Violet	Black
		30	Orange	Black	Black
33	33	33	Orange	Orange	Black
		36	Orange	Blue	Black
	39	39	Orange	White	Black
		43	Yellow	Orange	Black
47	47	47	Yellow	Violet	Black
		51	Green	Brown	Black
	56	56	Green	Blue	Black
		62	Blue	Red	Black
68	68	68	Blue	Gray	Black
		75	Violet	Green	Black
	82	82	Gray	Red	Black
		91	White	Brown	Black
100	100	100	Brown	Black	Brown
		110	Brown	Brown	Brown
	120	120	Brown	Red	Brown
		130	Brown	Orange	Brown
150	150	150	Brown	Green	Brown
		160	Brown	Blue	Brown
	180	180	Brown	Gray	Brown
		200	Red	Black	Brown
220	220	220	Red	Red	Brown
		240	Red	Yellow	Brown
	270	270	Red	Violet	Brown
		300	Orange	Black	Brown
330	330	330	Orange	Orange	Brown
		360	Orange	Blue	Brown
	390	390	Orange	White	Brown
		430	Yellow	Orange	Brown
470	470	470	Yellow	Violet	Brown
		510	Green	Brown	Brown
	560	560	Green	Blue	Brown
		620	Blue	Red	Brown
680	680	680	Blue	Gray	Brown
		750	Violet	Green	Brown
	820	820	Gray	Red	Brown
		910	White	Brown	Brown
1000	1000	1000	Brown	Black	Red
		1100	Brown	Brown	Red
	1200	1200	Brown	Red	Red
		1300	Brown	Orange	Red
1500	1500	1500	Brown	Green	Red
		1600	Brown	Blue	Red
	1800	1800	Brown	Gray	Red
		2000	Red	Black	Red
2200	2200	2200	Red	Red	Red
		2400	Red	Yellow	Red
	2700	2700	Red	Violet	Red
		3000	Orange	Black	Red
3300	3300	3300	Orange	Orange	Red
		3600	Orange	Blue	Red
	3900	3900	Orange	White	Red
		4300	Yellow	Orange	Red
4700	4700	4700	Yellow	Violet	Red
		5100	Green	Brown	Red
	5600	5600	Green	Blue	Red
		6200	Blue	Red	Red
6800	6800	6800	Blue	Gray	Red
		7500	Violet	Green	Red
	8200	8200	Gray	Red	Red
		9100	White	Brown	Red

Preferred Values of Resistance (ohms)			Resistance Designation		
± 20% D-No Color	± 10% D-Silver	± 5% D-Gold	A	B	C
10000	10000	10000	Brown	Black	Orange
		11000	Brown	Brown	Orange
	12000	12000	Brown	Red	Orange
		13000	Brown	Orange	Orange
15000	15000	15000	Brown	Green	Orange
		16000	Brown	Blue	Orange
	18000	18000	Brown	Gray	Orange
		20000	Red	Black	Orange
22000	22000	22000	Red	Red	Orange
		24000	Red	Yellow	Orange
	27000	27000	Red	Violet	Orange
		30000	Orange	Black	Orange
33000	33000	33000	Orange	Orange	Orange
		36000	Orange	Blue	Orange
	39000	39000	Orange	White	Orange
		43000	Yellow	Orange	Orange
47000	47000	47000	Yellow	Violet	Orange
		51000	Green	Brown	Orange
	56000	56000	Green	Blue	Orange
		62000	Blue	Red	Orange
68000	68000	68000	Blue	Gray	Orange
		75000	Violet	Green	Orange
	82000	82000	Gray	Red	Orange
		91000	White	Brown	Orange
100000	100000	100000	Brown	Black	Yellow
		110000	Brown	Brown	Yellow
	120000	120000	Brown	Red	Yellow
		130000	Brown	Orange	Yellow
150000	150000	150000	Brown	Green	Yellow
		160000	Brown	Blue	Yellow
	180000	180000	Brown	Gray	Yellow
		200000	Red	Black	Yellow
220000	220000	220000	Red	Red	Yellow
		240000	Red	Yellow	Yellow
	270000	270000	Red	Violet	Yellow
		300000	Orange	Black	Yellow
330000	330000	330000	Orange	Orange	Yellow
		360000	Orange	Blue	Yellow
	390000	390000	Orange	White	Yellow
		430000	Yellow	Orange	Yellow
470000	470000	470000	Yellow	Violet	Yellow
		510000	Green	Brown	Yellow
	560000	560000	Green	Blue	Yellow
		620000	Blue	Red	Yellow
680000	680000	680000	Blue	Gray	Yellow
		750000	Violet	Green	Yellow
	820000	820000	Gray	Red	Yellow
		910000	White	Brown	Yellow
1.0 Meg.	1.0 Meg.	1.0 Meg.	Brown	Black	Green
		1.1 Meg.	Brown	Brown	Green
	1.2 Meg.	1.2 Meg.	Brown	Red	Green
		1.3 Meg.	Brown	Orange	Green
1.5 Meg.	1.5 Meg.	1.5 Meg.	Brown	Green	Green
		1.6 Meg.	Brown	Blue	Green
	1.8 Meg.	1.8 Meg.	Brown	Gray	Green
		2.0 Meg.	Red	Black	Green
2.2 Meg.	2.2 Meg.	2.2 Meg.	Red	Red	Green
		2.4 Meg.	Red	Yellow	Green
	2.7 Meg.	2.7 Meg.	Red	Violet	Green
		3.0 Meg.	Orange	Black	Green
3.3 Meg.	3.3 Meg.	3.3 Meg.	Orange	Orange	Green
		3.6 Meg.	Orange	Blue	Green
	3.9 Meg.	3.9 Meg.	Orange	White	Green
		4.3 Meg.	Yellow	Orange	Green
4.7 Meg.	4.7 Meg.	4.7 Meg.	Yellow	Violet	Green
		5.1 Meg.	Green	Brown	Green
	5.6 Meg.	5.6 Meg.	Green	Blue	Green
		6.2 Meg.	Blue	Red	Green
6.8 Meg.	6.8 Meg.	6.8 Meg.	Blue	Gray	Green
		7.5 Meg.	Violet	Green	Green
	8.2 Meg.	8.2 Meg.	Gray	Red	Green
		9.1 Meg.	White	Brown	Green
10.0 Meg.	10.0 Meg.	10.0 Meg.	Brown	Black	Blue

SYLVANIA NEWS

TECHNICAL SECTION

SEPTEMBER-OCTOBER, 1940 EMPORIUM, PENNA. Vol. 8, No. 11

SYLVANIA PANEL LAMP KIT WITH POPULAR ASSORTMENT

In response to many requests from Sylvania jobbers, reflecting the wishes of servicemen, Sylvania now offers a convenient assortment of panel lamps packed in a sturdy cardboard box, size 3¾ x 9¾ x 1¼ inches, small enough to fit into your pocket or Service Kit. Characteristics covering the complete Sylvania panel lamp line are shown on the inside of the cover. The corners of the kit are reinforced with metal, and the top opens back to display the contents.

Sixty lamps, in five assorted types, representing approximately 80% of the entire demand, are mounted on platforms the same size as in the regular ten-lamp carton. When the kit needs to be refilled, simply insert a new platform from a regular carton.

Servicemen who have searched through a drawer or a service kit for the proper panel lamp for a repair job, perhaps to find the needed type missing, will appreciate the convenience of this Panel Lamp Kit. All the needed types are easily available, and it is easy to see when refills of a particular type are needed.

GET THE PANEL KIT FROM YOUR SYLVANIA JOBBER

NEW TUBES

Sylvania Type 7H7 Triple Grid Amplifier

Sylvania Type 7H7 is a single-ended triple grid semi-remote cut-off amplifier of loktal construction, somewhat similar in characteristics to type 6AB7/1853, except that the mutual conductance and heater current are slightly different.

Type 7H7 is particularly adapted for r-f and i-f stages in television and frequency modulation receivers where, due to the low impedance of the circuits and inherent low gain, the use of a tube of this type is highly advantageous for securing better performance.

CHARACTERISTICS

Heater Voltage (Nominal) AC or DC	7.0 Volts
Heater Current (Nominal)	0.32 Ampere
Bulb	T9-G
Base—Loktal 8-Pin	8-V
Mounting Position	Any

Direct Interelectrode Capacitances:*

Grid to Plate	0.007 μμf Max.
Input	8.0 μμf
Output	7.0 μμf

*With standard RMA tube shield connected to cathode and internal shield.

RATINGS:

Heater Voltage (Nominal) AC or DC	7.0 Volts
Heater Current (Nominal)	0.32 Ampere
Plate Voltage	250 Volts Max.
Screen Voltage	150 Volts Max.
Screen Supply Voltage	250 Volts Max.
Plate Dissipation	2.5 Watts Max.
Screen Dissipation	0.5 Watt Max.

Operating Conditions and Characteristics:
Class A1 Amplifier

Heater Voltage	6.3	6.3 Volts
Heater Current	0.3	0.3 Ampere
Plate Voltage	100	250 Volts
Screen Voltage	100	150 Volts
Grid Voltage	-1	-2.5 Volts
Suppressor	0	0 Volt
Plate Current	8.2	9.5 Ma.
Screen Current	3.3	3.5 Ma.
Plate Resistance	0.25	0.8 Megohm
Mutual Conductance	3800	3800 μmhos
Grid Voltage for Mutual Conductance of 40 μmhos (Approx.)	-12	-19 Volts

Sylvania Type 7N7 Duotriode Amplifier

Sylvania Type 7N7 is a single-ended duotriode of loktal construction, designed especially for use as a phase inverter or as a voltage amplifier. The electrical characteristics for a single section closely parallel those of a Type 6J5G triode. Except for capacitances type 7N7 is electrically equivalent to type 6F8G. The plate, grid and cathode of each triode section are brought out separately thus permitting adaptations to special designs. The voltage between heater and

(Continued on page 2)

TESTING TYPE 117Z6G and 117Z6GT

When the 117Z6G and 117Z6GT were announced, the heater had a center tap brought out to a separate base pin (Pin No. 1) so that the tube could be operated with the heaters in parallel at 58.5 volts if necessary. Recently the Fire Underwriters ruled that this type of construction was not permissible in new equipment. With this ruling Sylvania, as well as all other tube manufacturers, discontinued this type of construction and provided a tube without the heater tap. All present shipments of Sylvania 117Z6G and 117Z6GT tubes are of the new style—without a center tap.

Some of the first tube testers providing test arrangements for the 117Z6G and 117Z6GT either paralleled the heaters or tested each half separately so that only the 50 volt filament tap on the tester was required. With such testers it is obvious that the new tube, without the center tap, cannot be tested unless changes are made in the tester. Owners of any testers that will not test the 117Z6G or 117Z6GT should write directly to the tester manufacturer for new testing date. In writing, be sure to give the model and serial numbers of the instrument for which the data is desired.

Some tester manufacturers have given data on this subject as shown below:

Hickok Electrical Instrument Co. The 117Z6G tube, whether it has a filament tap or not, can be tested on Hickok tube testers. When a test is made on the tube, the push button marked "GAS NO. 1" is pressed. The button is held down while the tube is heating. This button opens the filament tap if the tube is of older construction. Rated voltage is applied to filament.

Precision Apparatus Company. New charts are available for all current and past Precision models, listing new test data for the 117Z6 as well as test limits for many new tubes. Write for new chart, giving model and serial numbers.

Simpson Electric Company. On Testers 300, 350, 400, 450 and 500, throw switch one (1) to open position. This will provide tests for 117Z6 whether tapped or not.

On old testers that have been modernized (Models 220, 222, 325, 333 and 440) the new 117Z6 without the center tap can be tested by setting the filament return at "I"; Fil. Sel.—9.5; Load—1, Tube Sel.—46; Toggles: Test 1—B, Test 2—D. The short check, same as any tube listed with an asterisk (*).

Supreme Instruments Corporation. Testing data for the new 117Z6G and 117Z6GT for Supreme testers are quite extensive and will be shown in next issue. Write directly to Supreme for data needed before then.

Readrite; Triplett. The elimination of the center-tap on the 117Z6G and 117Z6GT, does not affect the test limits originally established.

Triumph Manufacturing Company. All testers released since the introduction of the 117Z6 tube, test both sections of the tube in series, thus necessitating no change for the tube without the center tap. These testers are Models 440 to 444, inclusive.

TYPE 117Z6GC

After discontinuing the 117Z6G with center-tap construction, several requests have been received for this tube for replacement use in equipment designed to use the center-tap connection. To comply with these requests we have made a stock of these tubes available for replacement purposes. The type number is 117Z6GC—the suffix "C" indicating center-tap construction. Since the demand is limited, the type 117Z6GC will not be placed on our regular price literature. It will be available on orders at the same list price as that of the regular 117Z6G—$1.60. The 117Z6GC should be used only for replacement in equipment requiring the center-tapped construction. Whenever the regular 117Z6G can be used it should be specified.

A CHAT WITH ROGER WISE

Chief Tube Engineer
Hygrade Sylvania Corporation

A few years ago all radio tubes for general service were of large size, with wide spacings and plenty of clearance. In such construction maintenance of quality standards was a comparatively simple matter. In the past few seasons there has been an increase both in the number of types of tubes, in tubes with highly complicated design and more exacting construction requirements and a trend to smaller tubes.

While the general public may take maintenance of quality as a matter of course, the question does not appear so simple to the radio trade. There are various factors, all the direct result of extensive research and study of the problems involved, which make it possible to meet present manufacturing requirements efficiently, and at the same time to hold fast to the quality standards always insisted upon in Sylvania tubes.

In Hygrade Sylvania factories, both lamp and tube, a great deal of emphasis has been placed on factory equipment. Modern, high speed machines have been purchased whenever available, and when not available, the required types have been constructed in our own machine shops by men trained in our work and therefore, competent to undertake the highly specialized tasks involved.

Many of the newer types of tubes require machine equipment not generally available. A recent addition to our stem department is a new type of header machine which is designed for higher speed operation with greater precision of workmanship than possible on the older standard machines. In other departments where new requirements are being encountered, similar additions are being made.

Only by attention to important items of this kind is it possible to keep up with the "March of Time," meeting new and higher quality standards, keeping costs under control, and providing adequate production to meet customer's requirements.

It is also true that improved equipment makes a "step up" in design limits possible and thus adds to progress in tube developments. Clearances between grids, or between a grid and the filament or cathode, are much smaller in late design "high G_m" types—in fact in many cases they are so small as to have been in the classification of "impossible" or at least "impractical" until very recently. Now many of such types of tubes are being produced in very large quantities with characteristics as uniform as was possible with widely spaced elements only a few years ago.

Such improvements are of more than academic interest, as the extension of the use of tubes to new and important fields has frequently depended upon such a process of evolution in manufacturing technique.

NEW TUBES

(*Continued from page 1*)

TYPE 7N7—*Continued*

cathode should be kept as low as possible if direct connection is not made.

For phase inverter service the effective plate voltage is the supply voltage minus the voltage drop in the plate resistor. The self-biasing resistor will not require a by-pass condenser when the 7N7 is utilized for phase inversion. The values given for voltage amplification are the voltages as measured from plate to plate for a signal of one volt applied to the grid of the input section. The maximum output voltage is also given for the entire tube, measured from plate to plate when the maximum peak signal is applied to the input grid.

The value of grid return resistance of the succeeding audio amplifier should be governed by the type of tube employed in that stage, but should never be less than twice the plate resistance of the 7N7 in order to avoid serious distortion.

Because of its dual features this tube tends to have a higher operating temperature than most tubes with the same bulb size. For this reason it is recommended that it be located in a well ventilated position. Where excessive heating is encountered due to insufficient ventilation special attention must be given to the grid bias and grid resistor values employed to restrict the possibilities of grid emission.

CHARACTERISTICS

Heater Voltage (Nominal) AC or DC	7.0 Volts
Heater Current (Nominal)	0.64 Ampere
Bulb	T9-G
Base—Loktal 8-Pin	8-AC
Mounting Position	Any

Direct Interelectrode Capacitances:*

	Triode (1)	Triode (2)
Grid to Plate	3.0	3.0 μμf
Grid to (F+K+Shield)	3.4	2.9 μμf
Plate to (F+K+Shield)	2.0	2.4 μμf
Plate (1) to Plate (2)	0.34	μμf
Grid (1) to Grid (2)	0.4	μμf
Grid (1) to Plate (2)	0.08	μμf
Grid (2) to Plate (1)	0.06	μμf

*With standard RMA tube shield connected to cathode.

RATINGS:

Heater Voltage (Nominal) AC or DC	7.0 Volts
Heater Current (Nominal)	0.64 Ampere
Plate Voltage	300 Volts Max.
Plate Dissipation per Plate	2.5 Watts Max.

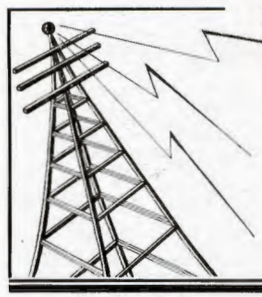
Operating Conditions and Characteristics:

Class A Amplifier

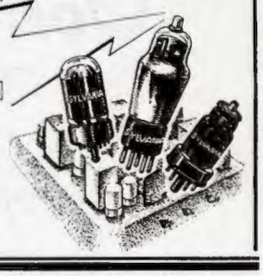
Heater Voltage	6.3	6.3 Volts
Heater Current	0.6	0.6 Ampere
Plate Voltage	90	250 Volts
Grid Voltage	0	−8.0 Volts
Plate Current	10.0	9.0 Ma.
Plate Resistance	6700	7700 Ohms
Mutual Conductance	3000	2600 μmhos
Amplification Factor	20	20

Typical Operation as Phase Inverter

Plate Supply Voltage	100	250 Volts
Grid Voltage	−2.25	−5.5 Volts
Plate Current per Section	1.5	2.4 Ma.
Plate Load Resistor per Plate	30000	50000 Ohms
Self-Biasing Resistor	750	1150 Ohms
Voltage Amplification (Approx.)	26	29
Maximum Output Voltage—RMS (Approx.)	20	65 Volts



The SERVICE EXCHANGE



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

Apex Receiver. Most all Apex receivers employ an 8 mfd., 275 volt condenser to filter the "B" supply to the detector tube. If this condenser opens up, the set will play perfectly except the volume cannot be brought to zero. The signal will pass around the first audio stage and actuate the primary of the input transformer. Check Apex Model 10 for reference—H. C. Buck, Detroit, Mich.

* * *

Arvin Model 44. A cure for a very bad case of vibrator hash in this auto set can be made by soldering a strip of shielding from the frame of the condenser gang to chassis (there are three small wires doing the same thing, but they seem ineffective). It appears that the hash enters the grid of the r-f tube.—Water Neal Pike, Hendersonville, N. C.

* * *

Detrola Model 3101. A few of these models employed a Candohm resistor enclosed in a perforated can. After these sets have been in service for a time, this resistor may slide down and short on one end to its metal casing. The casing is connected to the chassis which is not grounded. The oscillator section which is about the only portion of the receiver directly connected to the chassis, will pick up a 60 cycle hum.—H. C. Buck, Detroit, Mich.

* * *

Firestone Model 363-S-7402-6. This set would play perfectly on 110 volt line, but when switched to battery operation refused to operate. During the process of checking tubes, switch, batteries, etc., I noticed the pilot light was burned out. I installed a new pilot light and the set played perfectly.—T. Henshaw, Marysville, Kansas.

* * *

Ford Philco F-1740 (1940 Models). These sets often stop operating on the high frequency end of the dial and the trouble will be intermittent. New tubes in the set would seem to be the answer, but if the oscillator fails to operate replace the 25 mmf. condenser in the oscillator grid circuit. This trouble seems to affect only the high frequency end of the sets.—Leonard H. Johnson, South Boston, Va.

* * *

General Motor 1938 Models. In quite a number of General Motor's 1938, six tube single unit auto receivers of the serial numbers CA 24026, a bad hash noise between stations has been encountered.

I made a few experiments on these and found that by connecting a .002 mica condenser to the antenna lead just inside the set, where it connects to the antenna adjustable condenser, the hash noise was eliminated. With this change there was no loss in power on stations as far as San Francisco to Cincinnati. The sets worked just as well under all conditions as without this condenser and there was no hash between stations.—Edgar E. Landon, Oakland, Calif.

* * *

Grunow Model 4A. Of late I have had several of these receivers giving trouble and upon first investigation I found the output power tube to be defective. In making the replacements, I used Sylvania 42 tubes, but still I had complaints of distortion. I made a further investigation and found that after the receivers were in use about 20 to 30 minutes they would become very distorted. I found that the coupling condenser to the grid of the 42 tube would become leaky, and put a positive voltage on the grid of the 42, thereby ruining the output tubes. This coupling is directly over the power transformer and the heat from same causes the condenser to become bad. When making the condenser change it should not be put back over the transformer again, but to the side of it.

I did notice, however, that in some of the receivers which I replaced the power tube with a Sylvania make, before I found the cause of the trouble and that (distortion) after those Sylvania tubes ran with improper bias voltages, they were still good and were working OK after the receivers were repaired.—Thomas Feliney, Newark, N. J.

* * *

RCA Model R11. If it is difficult to tune in strong local stations at low volume without distortion, a slight change will correct it. Refer to the circuit of RCA Model R21 and change the a-v-c of Model R11 to correspond. Add a R20 resistor (500M ohms).—H. C. Buck, 929 Navahoe, Detroit, Mich.

* * *

Motorola Recorder Changer

The 1941 Wireless Recorder Changer has had a few changes made in adjustment since the early production models which makes it a great deal more service-free in the field. The adjustment information is listed below to help you in case you encounter difficulty in making adjustments.

Continues to Cycle—In a few cases, when a Changer goes through repeated cycles, instead of playing the records, the fault is due to too close an adjustment of the oscillating switch. You can always identify this trouble, however, by the "click" of the magnet, which indicates that the switch is making contact.

A more frequent condition is one wherein the pawl on the die cast cam wheel pushes the armature aside and rides on by it instead of being lifted by the armature at the end of a cycle, as it should be.

It has been found that this is caused by too much load on the pawl. That is, the pawl has to push too hard against the big gear, because there is too much friction in the cam. This friction has been reduced by removing the tension washer from under the cam wheel, and substituting instead a thin spacer washer, part No. 4A21491.

To make this change, first remove the long drive belt and then the large die cast pulley, exposing the cam wheel underneath it. Then remove the entire cam assembly by taking out the large screw which mounts it to the base plate, being careful that you do not disturb the relay or bend the switch leaves. Next remove the "C" washer and dismantle the cam assembly. When you put it back together, leave out the tension washer and substitute instead the spacer washer (4A21491).

Relay Adjustment—The relay is adjustable because one of its mounting holes is elongated. When the two Phillips screws, which hold it to the base plate, are loosened, the relay may be moved back and forth over an arc of several degrees. Set the relay at the point where it positively disengages the pawl at the end of the cycle and tighten the Phillips screws.

NOTE: Originally the relay adjustment was made with consideration to the setting of the secondary or "circuit breaker" switch. This method, however, results in a compromise between proper adjustment of both units and is no longer followed in the factory. See following paragraphs.

Secondary Switch—The secondary or circuit breaker switch is not absolutely essential to the operation of the record changes, and could be dispensed with by the simple expedient of short circuiting it. Its purpose is to reduce the length of time the relay remains energized, during which period it buzzes—a condition inherent in a-c relays. However, unless the relay "buzz" is extremely subdued, we recommend that the secondary switch be retained in the circuit. You must, however, make sure that it is operating properly.

To function as it should, the circuit breaker should be closed when the Changer is not cycling. (When a record is being played.) The switch is closed when the insulator is riding on the cam. (See Fig. 3 in Record Changer Service Manual). If the adjustment of the relay (to assure positive disengagement of the pawl), causes the cam to stop at a point where the circuit breaker has fallen off the step, (or is dangerously near the edge), then remove the circuit breaker switch from its mounting bracket and remount it one hole farther forward, using only one mounting screw.

The above procedure will assure the circuit breaker remaining closed until the cycle has positively started. It will eliminate all possibility that the cycle will fail to start when the needle is oscillating back and forth in the oscillating groove in the record.

Multiple "Clicks"—Two or more "clicks" occurring at the start of an automatic change cycle are not to be considered a defect, although a single "click" of the relay is preferable. Whether the relay "clicks" once or twice depends as much on the record as it does on the adjustment of the Changer.

A fairly close setting of the oscillating switch is desirable because it means a longer period of contact, but it must not be set so close that warpage in the record or a slight wobble in the turntable will cause it to make contact. Contact should be made only when the needle is in the oscillating groove.

Records can account for double "clicks" because of variations in oscillating grooves. The RMA is at the moment attempting to get all record manufacturers together on a set of standards, because these variations which occur in lead-in grooves, oscillating grooves, thickness, etc., have been a problem to all manufacturers of Record Changing equipment.

Positive Operation—The changes in adjustment procedure outlined in the foregoing paragraphs, have resulted in positive operation of the Record Changer. Properly made in the field, they will enable you to solve any service problems which may confront you.

Caution—You are cautioned against moving the tone arm except when it is "out of cycle." To do so, may result in improper indexing (failure to land the needle in the first groove). This simple precaution is necessary with practically all Record Changing equipment on the market.

Lubrication—The importance of proper lubrication in the Motorola Record Changer cannot be stressed too strongly. Whenever a unit is serviced, no matter for what reason, moving parts should be relubricated.

"Just any old grease" is not good enough. The average lubricant will wear out after a short period of service. Consequently, we turned the problem over to a firm of lubrication engineers, who developed a special lubricant that is exceptionally tough and has long wearing qualities. Record Changer grease should be used at the following points: (1) Turntable Bushing, (2) Idler Pulley Shaft, (3) Large Drive Pulley. Order—11M8952—Record Changer Lubricant.

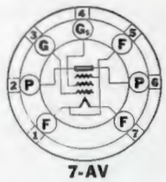
Use a light oil, such as 3-in-1, for the following items: (1) Pick-up Elevating Pin, (2) Record Release Pin, (3) Fulcrum Block.

Motorola Service Bulletin.

NEW TUBES

(Continued from page 1)

Sylvania Type 1S4 Power Output Pentode



7-AV

Sylvania Type 1S4 is a miniature type of power output pentode designed especially for service in compact, low drain battery operated receivers. With the maximum plate and screen voltage allowed, a power output of 180 milliwatts may be secured under class A_1 conditions. This means that considerable power output is available without the use of several "B" batteries.

CHARACTERISTICS

Filament Voltage DC	1.4 Volts
Filament Current	0.100 Ampere
Bulb	T5½
Base—Button 7-Pin	7-AV
Mounting Position	Any

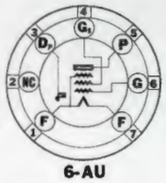
Ratings:

Maximum Filament Voltage: Battery Operation—Voltage must never exceed	1.6 Volts
AC/DC Power Line Operation—Design Center	1.3 Volts
Plate Voltage	67.5 Volts Max.
Screen Voltage	67.5 Volts Max.
Total Cathode Current (Max. Signal)	11 Ma. Max.
Total Cathode Current (Zero Signal)	9 Ma. Max.

Operating Conditions and Characteristics:

Filament Voltage	1.4	1.4 Volts
Plate Voltage	45	67.5 Volts
Screen Voltage	45	67.5 Volts
Grid Voltage	−4.5	−7.0 Volts
Peak A-F Grid Voltage	4.5	7.0 Volts
Plate Current (Zero Signal)	3.8	7.2 Ma.
Screen Current (Zero Signal)	0.8	1.5 Ma.
Plate Resistance (Approx.)	0.1	0.1 Megohm
Mutual Conductance	1250	1550 μmhos
Load Resistance	8000	5000 Ohms
Power Output	65	180 Mw.
Total Harmonic Distortion	12	10 Per Cent

Sylvania Type 1S5 Diode-Audio Pentode



6-AU

Sylvania Type 1S5 is a diode-audio pentode of miniature style containing a diode section and a pentode section in one bulb. The outstanding features of the 1S5 is its small size and its ability to provide high gain at low "B" voltages.

The circuit applications are the same as those for the Lock-In types 1LD5 and 1LH4. The diode plate is located at the negative end of the filament, pin No. 1, and is independent of the pentode section except for the common filament.

CHARACTERISTICS

Filament Voltage DC	1.4 Volts
Filament Current	0.050 Ampere
Bulb	T5½
Base—Button 7-Pin	6-AU
Mounting Position	Any

Ratings:

Maximum Filament Voltage: Battery Operation—Voltage must never exceed	1.6 Volts
AC/DC Power Line Operation—Design Center	1.3 Volts
Plate Voltage	90 Volts
Screen Voltage	90 Volts Max.
Total Cathode Current (Max. Signal)	3 Ma. Max.
Diode Current with 10 volts d-c applied	0.5 Ma. Min.

Operating Conditions and Characteristics:

	Resistance-Coupled		
Filament Voltage DC	1.4	1.4	1.4 Volts
Plate Voltage Supply	45	67.5	90 Volts
Screen Voltage Supply	45	67.5	90 Volts
Grid Voltage	0	0	0 Volt
Plate Load Resistor	1	1	1 Megohm
Screen Series Resistor	3	3	3 Megohm
Screen By-Pass Condenser	0.1	0.1	0.1 μf
Control Grid Resistor	10	10	10 Megohm
Voltage Gain (Approx.)*	30	40	50

*Obtained when the grid of the Pentode unit is fed from a source having an impedance of 1.0 megohm.

A CHAT WITH ROGER WISE

Chief Tube Engineer
Hygrade Sylvania Corporation

We receive comments and inquiries from time to time which indicate that dealers and service men are not generally aware of the arrangements made under RMA auspices for the assignment of new tube type designations. A word of explanation as to the numbering system used will perhaps facilitate this discussion.

About ten years ago a need for a new system of tube designation became apparent and after a long search for an ideal system the present RMA plan was devised—admittedly not ideal, but merely a practical, workable arrangement which has stood the test of time exceptionally well. Think of the unexpected flood of new types which followed the introduction of metal types. All the necessary numbering assignments were made without trouble and with only very minor departures from the original plan.

The RMA tube number has three elements, as follows:

(1) One or more digits to designate heater or filament operating voltage.
(2) One or more letters assigned arbitrarily in most cases.
(3) One digit to designate the number of useful elements in the tube.

In addition to the foregoing, letter subscripts have been added to differentiate between certain series of tubes such as "G", "GT" and others.

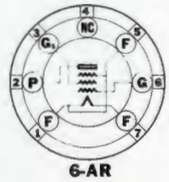
In designating filament or heater voltage, all voltages below 2.1 volts were designated arbitrarily by the digit "1", thus leaving the 2.5 volt group of tubes with the designation "2", this being desirable at the time of adoption of the system because the 2.5 volt group of tubes was especially large and popular. All cold cathode types use the digit "0" and the corresponding letter is avoided in the serial numbering. The letter "I" is also skipped to avoid confusion with the figure "1".

Increasing experience with the RMA system indicates that as the assignments are made more and more arbitrarily in accordance with the rules laid down, success in avoiding confusion at later dates becomes better assured. All tube type numbers are assigned to the tube manufacturer by the RMA Tube Data Bureau, under the direction of Mr. L. C. F. Horle. The assignment is made as requested by the sponsor except when preliminary data indicates the new tube may be similar to one for which a number is already reserved but not released. In that case assignment of the newer number is postponed until the indicated conflict is eliminated. This may be done by modification of one or both of the proposed designs so that a single new type replaces the proposed two types, or by other arrangements as dictated by circumstances. Needless to say, many unnecessary new types which might otherwise have appeared have been avoided by this cooperation through RMA

Pentode Characteristics:

Filament Voltage	1.4 Volts
Plate Voltage	67.5 Volts
Screen Voltage	67.5 Volts
Grid Voltage	0 Volt
Plate Current	1.6 Ma.
Screen Current	0.4 Ma.
Plate Resistance (Approx.)	0.6 Megohm
Mutual Conductance	625 μmhos

Sylvania Type 1T4 R-F Pentode



6-AR

Sylvania Type 1T4 is an r-f amplifier of miniature construction for service as an r-f or i-f amplifier in compact portable receivers. This new tube is very similar in electrical characteristics to the Lock-In type 1LC5. Thus, the same circuit applications apply. Internal shielding in the tube eliminates the necessity of an external overall shield, but if minimum grid to plate capacity is desired a socket with a shield should be used.

CHARACTERISTICS

Filament Voltage DC	1.4 Volts
Filament Current	0.050 Ampere
Bulb	T5½
Base—Button 7-Pin	6-AR
Mounting Position	Any

Direct Interelectrode Capatitances:

Grid to Plate	0.01 μμf Max.
Input	3.6 μμf
Output	7.5 μμf

Ratings:

Maximum Filament Voltage: Battery Operation—Voltage must never exceed	1.6 Volts
AC/DC Power Line Operation—Design Center	1.3 Volts
Plate Voltage	90 Volts Max.
Screen Voltage	67.5 Volts Max.
Total Cathode Current	5.5 Ma. Max.
Control Grid Voltage	0 Volt Min.

Operating Conditions and Characteristics:

Filament Voltage	1.4	1.4	1.4	1.4 Volts
Plate Voltage	45	67.5	90	90 Volts
Screen Voltage	45	67.5	45	67.5 Volts
Grid Voltage	0	0	0	0 Volt
Plate Current	1.9	3.6	2.0	3.7 Ma.
Screen Current	0.7	1.3	0.65	1.25 Ma.
Plate Resistance (Approx.)	0.35	0.25	0.8	0.5 Megohm
Mutual Conductance	700	875	750	900 μmhos
Grid Voltage for 10 μmhos	−10	−18	−10	−18 Volts

SYLVANIA NEWS

TECHNICAL SECTION

NOVEMBER-DECEMBER, 1940 EMPORIUM, PENNA. Vol. 8, No. 12

IT'S SMART TO BE NEAT

PROTECTIVE GARMENTS TO SUIT ALL SHOP NEEDS

SERVICE COAT

A well tailored practical garment made of serviceable double strength herringbone weave dungaree cloth in a green and white mixture, giving a tweed effect. Roomy pockets at arm's length for tools, wires, nuts and bolts and the accumulation of odds and ends that ingenious servicemen persistently pocket for probable use. A special button arrangement allows the tails to be buttoned in front, offering added pants protection; very convenient when kneeling, or working on auto radios. Available in five popular sizes, 36, 38, 40, 42 and 44. Price $1.95

This handy serviceman's shop apron is made of heavy green duck with two big roomy pockets for radio parts and tools and a smaller pocket for screw drivers, pencils, etc. Just the thing to slip on when working in your customer's home, keeps you neat and makes a good impression on house-wives. You can easily afford to have several of these aprons for your shop and a nice clean one to keep in your service kit. Price 25c.

SERVICE APRON

SERVICE JACKET

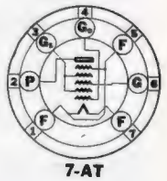
A jacket style garment of herringbone weave dungaree cloth—the same material and color used for the Service Coat. The jacket is of single breasted three button coat style, with three roomy pockets and full length sleeve. Its neat appearance makes it particularly useful as a protective garment for service calls, where testing or repair work is done in the customers' homes. Many servicemen also prefer a jacket style garment for shop use, as it gives a trim, well groomed appearance when customers call. Available in five popular sizes—36, 38, 40, 42 and 44. Price $1.75.

TO ORDER, USE COUPON ON PAGE TWO OF MAIN SECTION

NEW TUBES

Four new tubes of miniature size have been added to the Sylvania receiving tube line. These are all enclosed in a small bulb (2⅛" x ⅝") and the base is of the glass button style with the contact pins brought out through it. In electrical characteristics these tubes are essentially the equivalents of the Sylvania low voltage Lock-In types described in Technical Section, Volume 8, No. 10. These new Sylvania miniature types are intended especially for light-weight, compact portable equipment with a B-supply voltage of 45 to 90 volts. Data for these new tubes follow:

Sylvania Type 1R5 Pentagrid Converter



7-AT

Sylvania Type 1R5 is a pentagrid converter of miniature design intended especially for service in compact, low drain battery operated receivers. The outstanding features of the 1R5 is its small size and its ability to function at reduced "B" voltages, over the range of 45 to 90 volts.

This new tube is essentially the same as the Lock-In type 1LC6 in characteristics. In circuit applications it is the same as the 1LC6 and other similar pentagrid converters.

CHARACTERISTICS

Filament Voltage DC	1.4 Volts
Filament Current	0.050 Ampere
Bulb	T5½
Base—Button 7-Pin	7-AT
Mounting Position	Any

DIRECT INTERELECTRODE CAPACITANCES:

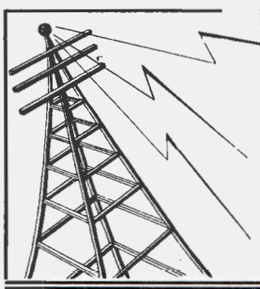
Grid G to all other Electrodes (R-F Input)	7.0 μμf
Plate to all other Electrodes (Mixer Output)	7.0 μμf
Grid G_5 to all other Electrodes	3.8 μμf
Grid G to Plate	0.4 μμf Max.
Grid G_5 to Grid G	0.2 μμf Max.
Grid G_5 to Plate	0.1 μμf Max.

Ratings:

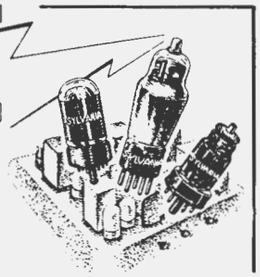
Maximum Filament Voltage:	
Battery Operation—Voltage must never exceed	1.6 Volts
AC/DC Power Line Operation —Design Center	1.3 Volts
Plate Voltage	90 Volts Max.
Screen Voltage	67.5 Volts Max.
Screen Supply Voltage	90 Volts Max.
Total Cathode Current (Grid G at 0)	5.5 Ma. Max.
Control Grid Voltage (Grid G)	0 Volt Min.

Operating Conditions and Characteristics:

Filament Voltage	1.4	1.4	1.4	1.4	Volts
Plate Voltage	45	67.5	90	90	Volts
Screen Voltage	45	67.5	45	67.5	Volts
Grid Voltage	0	0	0	0	Volt
Oscillator-Grid Resistor (G_5)	0.1	0.1	0.1	.01	Megohm
Plate Resistance (Approx.)	0.6	0.45	0.75	0.5	Megohm
Plate Current	0.7	1.5	0.8	1.7	Ma.
Screen Current	1.9	3.2	1.8	3.0	Ma.
Oscillator-Grid Current	0.15	0.25	0.15	0.25	Ma.
Total Cathode Current	2.75	5.0	2.75	5.0	Ma.
Conversion Conductance	235	280	250	300	μmhos
Grid Voltage for Conversion Conductance of 5 μmhos	−9	−15	−9	−15	Volts



The SERVICE EXCHANGE



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

Drive Belts. When the flat type of drive belt needs replacing, and no belts are handy, a suitable one can be made from a car radiator hose. Cut off the correct width and then with a sharp knife peal off the rubber, leaving a fabric belt which will work on most sets. I keep on hand size 1¼ up to 4½ inch hose and can make nearly any drive belt in short order.—J. C. McGuire, Washburn, North Dakota.

* * *

Emerson Models With "Q" Chassis. Volume and bass response can often be greatly improved by shunting the 25L6G cathode resistor with a 5 to 25 mfd. 35 volt electrolytic, picking the value that gives the most pleasing tone with the chassis in the cabinet. This cathode resistor is a small rectangular black affair mounted directly beneath the 25L6G socket. Connect the condenser positive to cathode and negative to chassis.—James E. Anderson, Yeadon, Penna.

* * *

Farnsworth Models ATL-50, AT51. A bad hum which is not filterable can be traced to the 6SQ7 grid lead in spring shielding. This lead is too close and parallel to the 15 mfd., 150 volt condenser (part #252-1). Lengthen lead on condenser and move two inches away from original position.—Irving G. Jackson, Eugene, Oregon.

* * *

G. E. Model E86. I recently encountered a case where electric power was being consumed after all fixtures, etc., had been turned off. Everything was eliminated until it was found that the radio was the cause of the trouble. With the line cord plugged in one way the condition was OK, but with it reversed, the electric meter went merrily on its way. It was found that the two leads running to the switch on the panel front are held down to the chassis by a clamp. One lead had a leakage to ground of 23 ohms. The cure was to place heavy fabric over each lead. With the number of sets of this type in use it is possible that this condition might be found quite often.—Henry J. R. Ross, Syracuse, New York.

* * *

Hallicrafter Sky Challenger II—Model SX-18. Poor tone quality, especially at low volume, was found to be due to incorrect volume control connections. The grid of the triode section of the 6Q7 instead of being connected to the movable arm of the control, is connected to the top end. The coupling condenser instead of being connected to the top end, is connected to the movable arm. Correcting these connections to comply with the service diagram corrects the objectionably bad tone quality. Marlin H. Thurmond, Hagerstown, Md.

* * *

Noise Locator. Internal noise in radio receivers can be located regardless of the source by a gadget I am using, and the set does not have to be turned on. It is a three tube amplifier. Noisy coils, transformers, condensers and even tubes will show up in this test, regardless of the amplitude of the signal. The circuit diagram will be sent to any one enclosing a three cent stamp. William Fretter, Allentown, Penna.

* * *

Philco Models 29, 29X, 45. If these models lack the wallop they should have, but still play with good tone, check the secondary of the second i-f transformer. Instead of the primary going out, as usual, this one sheds the secondary. The main sympton of this will be found as a lack of sharpness in the trimmer (nut) on the 2nd i-f can. (Screw is Pri. trimmer.)—Jack Darr, Mena, Arkansas.

Philco 41 Combinations—Using Light-Beam Phono. When performance is intermittent in phono position, check the connections on the small terminal board at the back. Remove the plastic cover from pickup head, check white wire to hot wire on PE cell. This is made to small lug on cell mounting. A pull on the wire will bend the lug back and short the PE cell against the housing. The remedy is to bend the lug forward to clear the case, insert a small piece of transparent cellotape to prevent recurrence and reassemble.—Jack Darr, Mena, Arkansas.

* * *

Pontiac Model 983679. A complaint of noise, and reception lowering and raising, also complete cutout of the signal can often be traced to the soldering lugs under the nuts that hold down the i-f cans. These cans are of a soft material, thus the lugs wear loose. Use flexible pigtail to bond lugs to the chassis.—C. A. Vaughn, Los Angeles, Calif.

* * *

RCA Victor Model BP10. This is their smallest battery portable. Complaints have been that the flashlight cell goes dead in a day or so, accompanied by distorted tone. This is usually due to the A plus lug on the switch grounding to the metal case. Place adhesive or friction tape on the case for insulation. Also insulate A leads to flashlight battery holder. Distortion is often caused by the flashlight cell in the holder having been placed backwards.—L. W. Krizan, Chicago, Illinois.

* * *

Radiola Model 80. For weak reception similar to a disconnected antenna, check continuity of antenna coil at antenna and ground terminals. If open, replace the bandpass coil assembly on top of the chassis with original make. Realign and note the difference. Also check for leakage (using d-c for this test) between 110V. cord terminals and chassis before using the set. If high leakage is found, the line bypass condensers must be replaced or the antenna coil may be ruined again. Life of the filter condensers may be prolonged and safeguarded by replacing the type 80 tube with a type 83V which is a heater type and does not apply voltage until other tubes have had a chance to heat sufficiently to draw current and hold down the surge voltage. James E. Anderson, Yeadon, Penna.

* * *

RCA Model 280. Distortion on resonance is often due to an open in the .003 mfd. a-v-c coupling condenser located inside the first i-f transformer. Lack of a-v-c voltage due to this open condenser is the cause of the distortion and replacement with another condenser of approximately the same capacity will eliminate the trouble.—Robert Ellias Radio Service, Jacksonville, Florida.

* * *

Repeat Service Getter: An effective method to obtain repeat calls for service on sets that have been brought in and repaired is to fasten on the back of the radio cabinet next to chassis where it can be seen by any person looking in back, the following self-addressed Government Postal Card.

My.....Model.....Is out of order and needs attention at once. Please give this card your prompt attention.

Name.....

Address.....

On the front you would place your address and phone number (in case they desired to phone you). The card should be fastened so that it could be taken off easily but still stay in place until used. You will find this a very good method of getting repeat calls.—Frank R. Nutter, Milton, N. H.

* * *

Signal Tracing. A rough-guess method of signal tracing for quickly locating defective stages, in sets which still play but have lost pep, can be used by connecting the oscillator and output meter to set. Put an audio signal through from 2nd detector grid. Note reading on the output meter. Switch oscillator, to i-f peak, change lead to last i-f grid. If reading on meter materially increases, that stage is OK. Adjust attenuator on oscillator to bring meter to low reading again and move lead to grid of the next i-f. Note the reading and if it does not increase, but drops off, there is a bad stage.

This method may be used all the way through a set and will locate defective stages very quickly. Gain readings may be taken from each stage and compared, although with very little practice the operator can judge the correct amount of gain almost instantly. The reading at osc.-converter grid and antenna lead may be compared to get the gain of the antenna transformer. After a short time of practice on this, it will prove to be quite fast and handy.—Jack Darr, Mena Arkansas.

* * *

Silvertone Model 7225. When the output becomes very badly distorted after ten or fifteen minutes playing, replace the 150 ohm cathode resistor in cathode circuit of 25L6G with a 2 watt carbon resistor. The original is wire wound on a flexible cable and changes in value after becoming heated.—Elliott J. Dullea, Philadelphia, Penna.

* * *

Soldering Leads to Crystal Cartridges. Crystals used in phonograph pick-ups and recorder heads are permanently damaged if they are subject to temperatures above 130° F. even for a very short interval of time. This makes it essential to use extreme care when soldering leads to crystal cartridges, so that they are not overheated and ruined. The following precautions must be observed to do a good soldering job.

1. **Use a hot iron.** If the iron is not hot enough, it will be necessary to hold it against the soldering lug for a relatively long time before the solder will flow. This long contact will permit heat to flow to the crystal, raising its temperature beyond the safe limit.
2. **Be sure the connecting wires are thoroughly clean.** If the connecting wires are old or dirty, the solder won't take immediately. The continued heating and application of solder may easily ruin the crystal. It is always a good idea to clean and tin the wire first so you will be sure the solder will take properly.
3. **Be sure your soldering iron tip is clean.** A heavily corroded soldering iron won't melt and flow solder properly.
4. **Work quickly.** If the iron is hot and clean, and the terminal wire properly tinned, all you need for a good job of soldering is a quick touch of iron and solder to the connection. Take the iron away just as soon as you see the solder flow.
5. **Never solder a lead to the case of the crystal cartridge** to serve as a ground. This will invariably raise the cartridge temperature above the safe limit.—STEWART-WARNER CORPORATION.

New Fluorescent Lamp Developments

HARRIS REINHARDT, Comm. Eng. Hygrade Lamp Division

In connection with the article on fluorescent lamps in the October issue of Sylvania News, it was pointed out that in order to keep our readers up to date it would be necessary to supplement this article with an account of some of the new developments in this rapidly growing field. First of all, however, we would like to say a few words regarding the cost of fluorescent lighting.

Cost of Fluorescent Lighting

Ever since the introduction of the fluorescent lamp there has been a constant demand for information regarding the comparative cost of fluorescent and incandescent lighting. The factors which enter into the cost of lighting vary so widely in different localities and in different organizations that it is impossible to give a general answer to this question. It might be pointed out, however, that the combined action of a number of factors have brought about some very significant reductions in the cost of fluorescent lighting within the past few months. These factors include increases in the life and lumen output of the lamps as well as reductions in the prices of the lamps, control units, and reflecting equipment. Cost comparisons between the two sources are usually based on an equal level of illumination from the two sources. It should be emphasized, however, that the lighting results cannot be regarded as "equivalent" on any other basis. In fact, many of the applications of fluorescent lamps have been made because of a desire to obtain the advantages of this type of lighting rather than as a more economical method of duplicating incandescent lighting. Now that the cost has become more attractive, however, the advantages of fluorescent lighting are being extended to numerous applications where it was previously felt that they could not be justified because of their cost. Moreover, the field of application is being further extended by various new developments which make possible further reductions in the cost and improvements in the convenience of fluorescent lighting. Some of the more important developments which have taken place within recent months are outlined below.

New Lamps

Developments in lamps include the addition of two new sizes—the 60 inch, 100 Watt lamp with a diameter of 2⅛ inches, and the 15 inch, 14 Watt which is 1½ inches in diameter. Both of these lamps are available in the Daylight and White colors.

The 100 Watt lamp is designed to provide a larger light source which makes possible definite economies in both commercial and industrial lighting applications where high levels of illumination are desired without the use of an excessively large number of separate lamps. Previous to the introduction of this lamp the largest available size was the 40 Watt, 48 inch lamp with an initial lumen output of 2100 lumens in the case of the White lamp. The 100 Watt, 60 inch lamp, in this color, has an initial lumen output of 4400 lumens. With this new lamp it is possible to extend the benefits of fluorescent lighting to high-ceiling interiors, and to obtain higher levels of illumination than have previously been practical in many other applications. The Miralume Division has available a two lamp trough type fixture for industrial lighting making another "first" for Hygrade in the fluorescent lighting field. Miralumes for other applications using these new lamps are being rapidly developed.

The 14 Watt, 15 inch lamp employs a new type of circuit as shown in Fig. 2 in which the lamps are burned, two in series on 110-125 volt alternating current circuits in conjunction with a special incandescent ballast lamp. The total wattage of the two

Hygrade 100 Watt Lamp

fluorescent lamps and the ballast lamp is 45 watts, the power loss in the ballast lamp being, therefore, 17 watts. Most applications consist of only a few lamps within easy reach, and instead of an automatic starter it is practical to use a simple type of manual starter located near the lamps.

The lamps are suitable for use under the shade of a floor lamp of the type which employs a 100-200-300 Watt incandescent lamp in a 10-inch diffusing bowl, and can be used to replace the three candle and diffusing cups frequently used on lamps of this type. Other applications, such as bathroom-mirror lighting, bed lamps, local lighting units for various applications as well as additional types of floor and table lamps, are being rapidly developed for this new lamp.

"Soft White" Fluorescent Lamp

To fill the demand for a lamp to be used in the display of meats and meat products, a new color known as "Soft White" has been made available. This new color may be described as a combination of daylight and pink colors. It supplies the red rays which are lacking in the daylight lamps and produces a color which is attractive not only for the display of meats but of many other products as well. The new color is also flattering to an individual's appearance and this fact will probably lead to its use in beauty parlors and similar applications.

Fluorescent Lighting Equipment

Through our activities in the development of fluorescent lamps and the Miralume line of lighting equipment the Hygrade Sylvania Corporation has played an important part in bringing this new light source to the public in a form readily adaptable for use on standard lighting circuits. Two recent developments which are doing much to increase the convenience of this new light source and insure the most satisfactory lamp performance are the Hygrade Mirastat starters and a new type of fluorescent lampholder.

Hygrade Mirastats

Mirastats are a replaceable type starter and are available in three sizes—the Mirastat #2 for use with the 15 and 20 Watt lamps, the Mirastat #4 for use with the 30 and 40 Watt lamps and the Mirastat #6 for use with the 100 Watt lamps.

They use the same type of socket as the glow types of starters and are interchangeable with them in fluorescent lamp circuits. The life performance of fluorescent lamps may be seriously affected if the starter does not provide adequate time for preheating the electrodes. An outstanding feature of the new starter is the use of two contacts—one for starting and the other for restarting in case the lamp is momentarily turned off. The design of the Mirastat insures adequate preheating of the electrodes, positive starting of the lamps, as well as positive restarting in case the lamp is momentarily turned off.

Objectionable flashing or "fluttering" of the lamps during the starting period, which may seriously affect their life performance, is effectively eliminated by the positive action and accurate timing of the starter elements. Rigid mounting of all the elements and the fact that no glass parts are used, make the Mirastat starters unusually sturdy in construction.

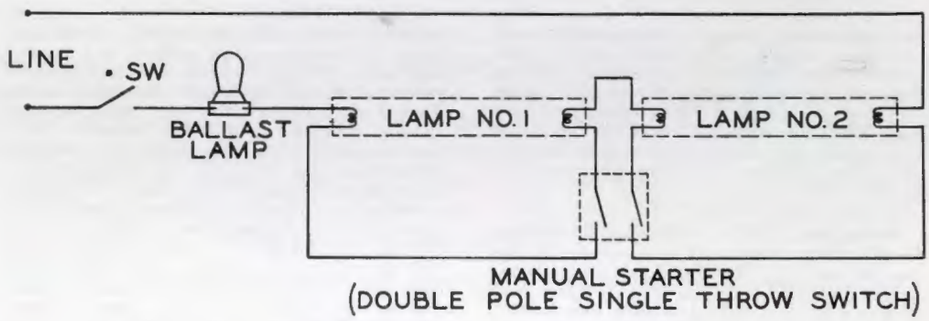
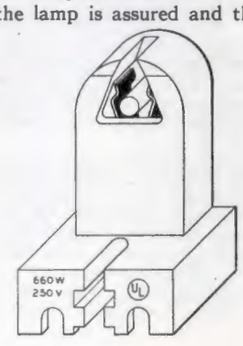


Fig. 2

Lampholders

In the Hygrade Lampholder the lamp pins are inserted into a triangular shaped opening and the lamp locked in position by turning it through one-quarter revolution. The design of the lampholder is such that positive holding of the lamp is assured and there is no danger of jamming the pins or causing chipping or breaking of the lampholder, when inserting or removing the lamp. A central pin or post in the triangular opening eliminates danger of touching the contacts when the lamp is not in position.



Operating Principles of Fluorescent Lamps

HARRIS REINHARDT, Comm. Eng., Hygrade Lamp Division

The fluorescent lamp is the most important light source which has been developed since the invention of the incandescent lamp. The Hygrade Sylvania Corporation has pioneered in the development of the fluorescent lamp and of the Miralume line of reflecting equipment, and it is felt that the readers of "Sylvania News" will be interested in a brief review of some of the more important characteristics of the lamps and their application, in order that they may better understand this important and rapidly growing branch of our company.

Operating Principle

Fluorescent lamps are tubular in shape and are available in several different sizes, as shown in the accompanying table which gives the essential technical details of the lamps. The lamps have a special type of bi-pin base at the ends and each of these is connected to a small oxide coated tungsten electrode which must be preheated during the starting period. The lamps are filled with mercury vapor at a low pressure and the electrical current flowing through this mercury vapor produces a rich supply of invisible ultraviolet rays having a wave-length of 2537 Angstroms. These invisible rays are converted into visible light through the action of fluorescent substances coated on the inside of the lamp.

The basic principle of the fluorescent lamp, i.e. the conversion of invisible radiant energy into visible light through the action of fluorescent substances, has been known to science for hundreds of years, but the use of this principle in a practical light source has had to wait for the solution of numerous technical problems. One of the most important of these has been the development of a method of applying the fluorescent materials, or phosphors as they are called, to the inside surface of the lamp. The Cox patent, awarded to the Hygrade Sylvania Corporation, covers a method of applying the phosphors in a sort of porous film, and has been a most important factor in bringing out the high efficiency of the fluorescent lamps.

The color of light produced in the fluorescent lamp depends upon the characteristics of the phosphor used on the lamp, and five colors—blue, gold, green, pink and red—are available in addition to the white and daylight lamps listed in the table.

The colored lamps are highly efficient sources of colored light and are finding wide application in decorative and display lighting where they open new possibilities for the use of color in lighting. The daylight lamp produces light which closely approaches natural daylight in color and is suitable for a variety of applications where light of this kind is required. The light from the white lamp resembles the light from the familiar incandescent lamp. Its efficiency of light production is slightly greater than that of the daylight lamp and it is usually preferred, both because of this and because of its warmer color for most applications except those where light of daylight color is needed. Their greater efficiency is indicated by the lumen output figures as given in the table. The figures are a measure of the total light produced by the lamps, and if they are compared with similar figures for incandescent lamps it will be found that the fluorescent lamps are between two and three times as efficient as incandescent lamps of comparable light output. In comparing the efficiency of the daylight lamp with incandescent lamps using daylight blue bulbs, or globes to filter the light, it should be kept in mind that these filters absorb a large percentage of the light so that the efficiency of the combination is quite low. A 150 watt daylight incandescent lamp, for example, produces 1700 lumens which may be compared to the lumen output of 1800 lumens for the 40 watt daylight fluorescent lamp. In any comparisons of this nature the wattage loss of the auxiliary or control equipment used in connection with the fluorescent lamp should be included. This will bring the total power consumption of the 40 watt lamp to about 50 watts and the total efficiency of the daylight fluorescent lamp is thus about three times as great as the efficiency of an incandescent lamp with daylight blue bulb or filter.

Auxiliary Equipment

Because of the characteristics of mercury vapor arc discharge in the fluorescent lamp, they must be burned in conjunction with suitable auxiliary equipment. The essential parts of a fluorescent lamp circuit are ballast and a starter, as shown in Fig. 1. The current limiting device consists of a small inductance or choke coil designed to limit the current taken by the lamp to the proper value. The purpose of the

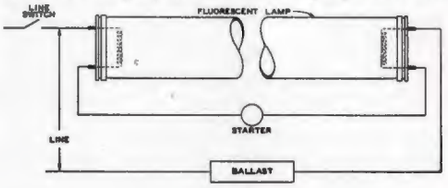


Fig. 1

starter is to act as a time delay switch which must be closed so that the two electrodes of the lamp are connected in series with the ballast during a short preheating period when the lamp is first turned on. It must then open the circuit in order that the arc may be established. In the earlier type of control units, starters of the thermal and magnetic type were mounted in the same case with the ballasts. This meant that the entire unit had to be discarded if the starter failed or got out of adjustment. The present practice, therefore, is to mount them separately with the starters in a readily accessible location, though control units of the older type are still available.

Modern fluorescent reflectors are supplied complete with control units for operating the lamps on alternating current circuits of standard voltage range, and the user of this equipment does not have to be familiar with all the details of the control equipment incorporated in the unit. It should be pointed out, however, that units of the two lamp type are to be preferred since they keep the wattage loss in the control units at a minimum and correct both the power factor and the stroboscopic effect.

Power Factor

When the fluorescent lamps were first introduced the available equipment was all of the single lamp type and the power factor of fluorescent lamp circuits was about 60 per cent. This meant that the current flowing in the wires used to supply these lamps was much greater than the wattage would indicate and led to considerable discussion of various means of bringing about power factor correction. The outstanding result has been the development of the two-lamp ballast.

The two-lamp ballast actually includes two separate choke coils—one having a condenser connected in series with it to accomplish the desired power factor correction. This is possible because of the fact that a condenser produces what is known as a "leading" power factor which offsets the lagging power factor of the inductive choke coils and produces an overall power factor of better than 90 per cent for the two fluorescent lamps.

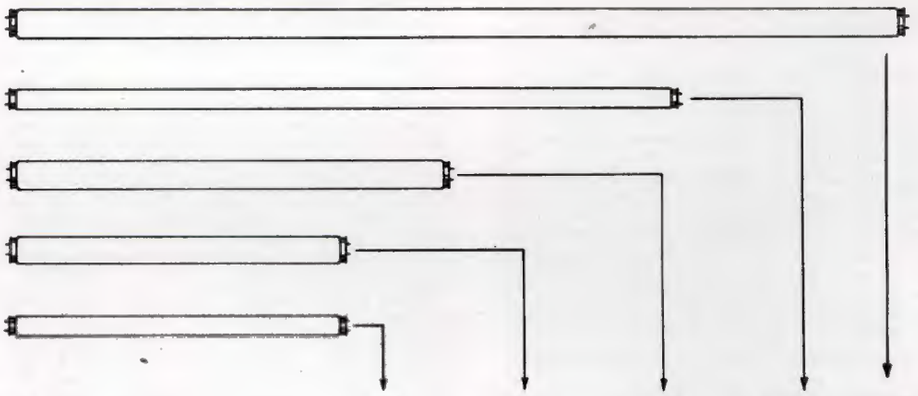
Where two-lamp ballast cannot be used or where it is desired to correct the power factor of an existing installation employing single lamp ballasts, separate condensers may be connected in the circuit. Condensers for correcting the power factor of a single lamp or larger units for correcting the power factor of several lamps are available. It is most desirable to have the power factor corrected at each individual reflector and the two-lamp ballast provides the ideal method of accomplishing this since it also eliminates the stroboscopic or flicker effect which might otherwise prove objectionable under certain circumstances.

Stroboscopic Effect

The light produced by a fluorescent lamp operating on a standard 60 cycle alternating current passes from a maximum to a minimum value 120 times in each second. The variation from the average value may amount to as much as 55 per cent in the case of the daylight lamp, and is about 35 per cent for the white lamp. While this variation is too rapid to be noticed by the eye, it may give use to what is known as a stroboscopic effect under certain conditions. Moving parts of machinery illumination by this light, for example, may appear to be moving in jerks and rotating parts may appear to be rotating much more slowly than their actual speed or even appear to be going in the reverse direction.

With the two-lamp ballast the light from one lamp is at a maximum when that from the other is at a minimum, so that this effect is to a large extent eliminated. Stroboscopic effect and power factor are no longer a cause for concern in considering the application of these lamps, since they are both satisfactorily corrected through the use of the two-lamp control unit.

The cost of fluorescent lighting and new developments in this field will be discussed in the next issue of the News.



Bulb	18″ T8	18″ T12	24″ T12	36″ T8	48″ T12
Bulb diameter	1″	1½″	1½″	1″	1½″
Nominal Lamp Watts*	15	15	20	30	40
Nominal Lamp Amperes	.30	.33	.35	.33	.42
Nominal Lamp Volts	56	48	62	103	108
Nominal Line Volts	110–125	110–125	110–125	110–125	110–125
				199–216	199–216
				220–250	220–250
Rated Average Life** (Hours)	2500	2500	2500	2500	2500
Approximate Initial Lumens***					
White	585	585	900	1450	2100
Daylight	495	495	760	1250	1800

*Wattage of lamp only. Wattage lost in auxiliary equipment must be included to obtain total wattage. **Life under specified test conditions. ***Approximate lumens under specified test conditions. Initial values apply after 100 hours of operation.