January 1938

EMPORIUM, PENNA.

Vol. 7, No. 6

BACK TECHNICAL SECTIONS

NEW TUBES

Type 6AC5G is a Class A power amplifier triode which may be used for a positive grid potential operation and which may employ a tube of the 6CG5 type as a driver.

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

The 25,000 ohm resistor shown in the circuit is to prevent a current surge while the 6AC5G is warming up. The total resistance in the grid circuit of the type 6CG5 should not exceed 1.0 megohm.

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

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

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

A CHAT WITH ROGER WISE

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

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

THE VACUUM TUBE VOLTMETER AS A SERVICE TOOL

In the last issue of the Sylvania News Technical Section, you learned that the vacuum tube voltmeter properly used is one of the most valuable and versatile measuring instruments available. The instrument has very little value, however, if the service man does not know how to apply it and "weigh" its readings. This fact accounts for the limited number of vacuum tube voltmeters in use for radio service work. There has not been sufficient information published on this instrument to demonstrate to the serviceman its true value, or to show him how to employ it to advantage in service work. This work of articles is intended to supply that information.

The diode, or two element type of V.T.V.M. was discussed last month. The following article covers many of the more important basic types of triode vacuum tube voltmeters, and discusses their advantages and disadvantages.

PART II

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

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

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

The three types of V.T.V.M. circuits mentioned so far (the Grid rectifying, Slide-back and Reflex) are the most important basic ones using a triode type of tube. There are three other types, however, which will include here because they are interesting from a circuit standpoint and very useful for special applications.

INVERTED TRIODE TYPE V.T.V.M.

As the name implies, the inverted type V.T.V.M. employs the plate of the triode as the control element and the grid is used as the electron accumulating element. The instrument employs a low drain filament type tube with a 0.200 or 0.500 microammeter. A small positive potential is applied to the grid as shown in figure 2E, and the rheostat is adjusted to give a zero signal grid current of 200 or 300 microamperes. This also adjusts the filament voltage to the correct value. If an unknown d-c voltage is now applied to the plate with the plate connected to the negative terminal of the unknown voltage source, this negative potential will prevent some of the electrons from reaching the grid and will thus reduce the grid current. The use of a series condenser and high resistance leak from plate to ground will also permit this type of V.T.V.M. to be used for measuring d-c voltages.

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INFINITE IMPEDANCE DIODE V.T.V.M.

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

In next month’s issue of Sylvania News Technical Section, complete construction data will be given for a reflex type V.T.V.M. that may be built very economically, requires no meter, has a voltage range of from 0.1 to 200 volts a.c. or d.c., and which may be calibrated on 60 cycle voltages and will be accurate on frequencies above 60 megacycles.
Airline Models 62-105, 62-104, 62-103. These three models have serviced 2,000 of these sets in the past two years, and in practically every case the trouble is the same. There is no screen voltage on the 6DG7. The correct voltage is open in the screen voltage dropping resistor. This is a tapped unit, mounted on the rear panel of the chassis. Referring to Rider's manual, I have found set No. 4, this is R-13. Replace with a 17,500 ohm 10 watt unit. The trouble indicates a shorted screen by-pass condenser, 25 mfd., C-3 in Rider's manual, but I have never yet found one of them that was shorted. I believe that the defect is in too low current carrying capacity of R-13. However, I always replace C-3 to be sure that I won't have a return call.—Spencer Ohlin, Richfield, Utah.

Airline Model 62-254. This is a four tube hopped oscillator type that has a a persistent magnet type speaker with three leads, two of them hot. From the pin-type jack on the terminal strip of the speaker, the two hot leads go directly to the speaker frame to the high-impedance dual coils of the speaker. These wires are not particularly well insulated, and I have found that one of these sets with one or both of these leads shorting the speaker frame. The trouble generally shows up in the operation. If not corrected, the “B” batteries may discharge rapidly during the periods of non-operation, when the set is turned off. Uninsulated leads and spitting spaghetti tubing over them. Secure the leads in place with a little speaker cement, work so they will not interfere with the speaker armature.—Spencer Ohlin, Richfield, Utah.

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

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

Emerson Model H-5. Bad hum when the condenser and tubes check perfect, may be due between the first audio and the output is not leaky. The receivers under this model number have one common trouble, the noise disappears. Look over the covers and you will find a paper sheet pasted on the under side. If any part of this is unglued so that it can come in contact with the parts in the set it will cause this trouble. Reglue the paper and the trouble will be over.—Walter K. Whitcomb, Waupun, Wisconsin.

Radiola Model R-82. The volume on this receiver could not be controlled below a certain point, with the aid of the volume control switch. The volume control and its shunt resistor (4000 and 600 ohms, respectively) was checked OK. The trouble was found to be in a 1 watt resistor supposedly 18,000 ohms, that was open. This resistor is the one on the extreme left end of the resistor-mounting strip on the rear of the chassis. Replacing this part with one of proper resistance and volume control action to normal, and the set played fairly well, but after realigning all circuits, oscillation was encountered at high frequency end of the dial. The trouble was found to be the improper placement of the group of wires extending from the rear of the transformer to the underside and about the center of the set. This group includes those leads going to the volume control. They had apparently been pulled and incorrect distances found that unless they are grouped and tied close to the metal sub-panel, this will oscillate without regard to maximum sensitivity.—Spencer Ohlin, Richfield, Utah.

G. E. Pilot Light Failures. A cure for pilot lights that get very hot. In this case the lights is the placing of a 150 ohm resistor in the line cord to the neon transformer. This cured the interference much to the pleasure of the group of wires extending from the rear of the transformer to the underside and about the center of the set. This group includes those leads going to the volume control. They had apparently been pulled and incorrect distances found that unless they are grouped and tied close to the metal sub-panel, this will oscillate without regard to maximum sensitivity.—Spencer Ohlin, Richfield, Utah.

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

Stewart Warner 900 Series. Intermittent fading in this model is usually caused by the 25 mfd. 1 glove bypass condenser. This condenser is in a can with the plate current resistor, and has a green lead. Replace with a new condenser.—Charles Ertz Jr., Burlington, Iowa.

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

Bill Wants Advice. Wm. O. Sullivan, 130 S. Main St., South Norwalk Conn. requests help from other servicemen on an odd predicament. Says Bill has a mystified some dirty radios, but they could always be cleaned. Yesterday a customer brought in a set that is full of cockroaches. The con-Whoever has this problem is advised to check the volume control and stick all over the set. I would like to know if any of the readers of Sylvania News can tell me how to clean them out. I would like information on this as soon as possible.”
REVISED JOB RECORD CARD

The Last Word in Efficiency

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

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

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

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

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

Ask for Your Revised Technical Section Index

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

Type 1J6G Power Amplifier

Type 1J6G is a power output tube designed for use in battery operated receivers. The elements are enclosed in an ST-14 bulb and are connected to an octal type base. The characteristics are identical to those of type 950, used in some of last season's receivers. Since type 950 is not included in the Sylvania line, this new type 1J6G can be used as a replacement for type 950 provided an octal style of socket is used.

Characteristics

<table>
<thead>
<tr>
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<th>Filament Voltage</th>
<th>2.0 Volts</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Filament Current</td>
<td>0.120 Amp</td>
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<tr>
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<td>Maximum Over-all Length</td>
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<td></td>
<td>Maximum Diameter</td>
<td>1.14 inches</td>
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<td></td>
<td>Bulb</td>
<td>8-X</td>
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<tr>
<td>Base</td>
<td>Medium &quot;G&quot; Type Octal 8-X</td>
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| Operating Conditions and Characteristics

<table>
<thead>
<tr>
<th>Filament Voltage</th>
<th>2.0 Volts</th>
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</thead>
<tbody>
<tr>
<td>Plate Voltage</td>
<td>158 Volts</td>
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<tr>
<td>Grid Voltage</td>
<td>-13.6 Volts</td>
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<tr>
<td>Screen Voltage</td>
<td>135 Volts</td>
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<tr>
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<tr>
<td>Screen Current</td>
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<tr>
<td>Plate Resistance</td>
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<td>Screen Voltage</td>
<td>125,000 Ohms</td>
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<td>Mutual Conductance</td>
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<td>Amplification Factor</td>
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<tr>
<td>Load Resistance</td>
<td>15,000 Ohms</td>
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<tr>
<td>Power Output</td>
<td>575 Watts</td>
</tr>
</tbody>
</table>

Type 6J8G Triode-Heptode Converter

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

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

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

In some cases this new tube may be used directly in place of a type 6AK5 with only slight realignment required. However, the tube is not intended for that service and for maximum performance a circuit especially designed should be used.

Characteristics

| Heater Voltage | 6.3 Volts |
| Heater Current | 0.150 Ampere |
| Maximum Over-all Length | 4½ inches |
| Maximum Diameter | 1¼ inches |
| Bulb | ST-14 |
| Base | Small "G" Type Octal 8-H |

Operating Conditions and Characteristics

| Plate Voltage | 250 Volts Max. |
| Plate Current | 7.0 Ma. |
| Plate Resistance | 10,000 Ohms |
| Plate Screen | 250 Volts Max. |
| Plate Current | 1.5 Ma. |
| Plate Screen | 3.0 Ma. |
| Heptode Grid | 175 Volts Max. |
| Heptode Screen | 250 Volts Max. |
| Heptode Grid | 8.8 Ma. |
| Heptode Screen | 2.0 Ma. |
| Amplification Factor | 120 |

Triode Section Only

| Plate Voltage | 158 Volts |
| Plate Current | 7.0 Ma. |
| Plate Resistance | 10,000 Ohms |
| Amplification Factor | 125 |

Type 6W7G Triple Grid Amplifier

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

| Grid Voltage | 6.3 Volts |
| Plate Voltage | 158 Volts Max. |
| Plate Current | 7.0 Ma. |
| Plate Resistance | 10,000 Ohms |
| Amplification Factor | 125 |

A CHAT WITH ROGER WISE

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

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

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

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

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

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

Type 5T4 Replacement

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

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

| Grid Voltage | 6.3 Volts |
| Plate Voltage | 250 Volts Max. |
| Plate Current | 7.0 Ma. |
| Plate Resistance | 10,000 Ohms |
| Amplification Factor | 120 |

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

Any Receiver. When a customer complains of a high light bulb check condenser from one side of the chassis to the other, you will find the local is audible. This is true on most models. The squeal appeared only when the tone control was turned. A new volume control produced normal operation.

The drain on B's when set is turned off.

Richfield, Utah.

Fairbanks Morse Model 42TS-2, Steady drain on B's when set is turned off. The drain is caused by the supply filter. For satisfactory service, remove the 20,000 ohm resistor from menu 165 G to ground.—Harold Gillogly, Bonners Ferry, Idaho.

Gentlemen:

Bill isn't seen nothin' yet. Down in these parts we think nothing's wrong if a set for repair hasn't at least one cockroach in the I. F. cans and usually not less than two or three. The new owners will have a choice assortment of fifteen roaches, three dead mice and a black widow spider. If the set hasn't been disturbed for some time we can always count on a scorpion or two in the speaker. There really is very little Bill can do about it, except move to a new place with a small yard. Oh yes, he can try cleaning out the dead roaches and spraying insect dope gently but firmly under the chassis to discourage the living. Our cockroaches, familiarly known as Florida Eagles, are about the size of a young mouse, twice as lively on the hoof and prone to eat the-insulators of the circuits. Dead mice are harmless but smelly. Black widow spiders and scorpions are always interesting to the servicemen. They make use of the I. F. cans and usually one from the Long Grass district is found. If surprised in the act, they will soften waxes and any other parts which may require it. This cleaning solutionizes all waxes on the socket and any other parts which may require it. I have used "ENOL LIGHTER FLUID" exclusively for this purpose for a couple years with perfect results, it having very little effect on any wax used so far. The same treatment may be applied to the chassis, volume and tone controls and any other parts which may require it.

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

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

Paul V. Zevn, West Mifflin, Pa.

The WAY OF ALL COCKROACHES

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

Gentlemen:

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

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

John Hettrich
Philadelphia, Pennsylvania

SIRS:

We have had our set fixed by your serviceman Mr. Sullivan in Vol. 7, No. 6, is an every day occurrence here in Biloxi, Miss. Roaches are plentiful in the area and I have used this for the past three years very successfully.

Verne K. Vance, Biloxi, Mississippi

SIRS:

That Roach problem spoken of by Wm. Sullivan in Vol. 7, No. 6, is an every day occurrence here in Biloxi, Miss. Roaches are plentiful in the area and I have used this for the past three years very successfully.

Paul V. Zevn, West Mifflin, Pa.
THE VACUUM TUBE VOLTMETER AS A SERVICE TOOL

By GEORGE C. CONNOR

PART III

The Electric Eye Vacuum Tube Voltmeter

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

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

The frequency range of the instrument is from below 60 cycles per second to some higher frequency which will depend upon the length of the leads from the prod tube to the voltage source, the capacitance between these leads and the impedance across which the voltage is being measured. To eliminate the effect of standing waves on the input leads and the capacity between them the prod tube is placed on the end of a cable so that the tube may be used very close to the voltage source with correspondingly short leads and low r-f loss. This permits voltages on the order of 500 volts to be measured under average service conditions for the reasons indicated above.

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

CIRCUIT DETAILS

The V.T.V.M. consists of a power supply; simple resistance-capacitance filter, voltage divider network, electric eye indicator tube, calibrated potentiometer and 6F5 prod tube mounted on the end of a 5 wire cable. The power transformer consists of a primary; 6.3 volt secondary to supply 0.6 ampere of current for the 6F5 and 6E5 heaters; 5 volt secondary for the type 80 rectifier tube and a 6.3 volt center tapped high voltage secondary rated at 40 ma. This is the standard 4-tube midget transformer and because only 50% of its maximum power capabilities is used it will run very cool in operation. The two 8 MFD. use electrolytic capacitors shown in the diagram should be rated at 450 working volts to insure long life and good performance. The filter resistor may be either a 2-watt carbon or wire wound type. The 20,000 ohm resistors in the voltage divider network should also be rated at 2 watts. The two 1 megohm and the 5 megohm resistors may be of the 1/2 or 3/4 watt carbon type. Wire wound potentiometers should be used to insure long life and accuracy of the voltage calibration. The two 100 µf mica condensers used at the socket of the prod tube must be soldered to the proper terminals with the shortest possible leads, to eliminate high frequency error. These two shunts keep the high frequency signal out of the 5-wire cable and make it unnecessary to use a shielded cable.

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

FIGURE 3A

the photograpic illustrations concerned with the chassis were included to test out a method of line voltage regulation concerning which more will be said in a later installment.

The calibration of this instrument on both a-c and d-c voltages will be discussed in the next issue of the Sylvania News.
DID IT EVER HAPPEN TO YOU?

BY WALTER R. JONES

Sam Serviceman recently received a call from a customer who complained that his AC-DC "Cigar Box" receiver refused to operate. Accordingly, Sam went to the customer's home and brought the receiver back to his shop. Upon making his tests, he found that there was no plate voltage or speaker excitation. Examination of the 25Z5 tube showed that neither cathode tabs were the small metal connection strips between the cathode sleeves and the cathode return wires in the glass press. They will fuse when a current much in excess of 1/2 ampere flows for any length of time. These tabs cannot readily be made heavier since if they are, they will conduct so much heat away from the cathode sleeve that proper operating temperature will not be obtained, thus greatly reducing the output of the rectifier.

This difficulty, which usually appears in the case of 25Z5 or 25Z6G tubes, shows up in the form of burned out or fused cathode tabs. These tabs are the small metal connection strips between the cathode sleeves and the cathode return wires in the glass press. They will fuse when a current much in excess of 1/2 ampere flows for any length of time. These tabs cannot readily be made heavier since if they are, they will conduct so much heat away from the cathode sleeve that proper operating temperature will not be obtained, thus greatly reducing the output of the rectifier.

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

Similar Troubles in Other Receivers

New receivers that have been in warehouse storage, or receivers that have not been in use for several months may give similar trouble and perhaps have been perplexed as to just what happened. The rectifier tube and the filter condenser in a power supply system are so intimately tied up that usually failure of one will cause failure of the other. Consequently, before replacing a defective rectifier tube, it is wise to make certain that the filter condenser is in satisfactory working condition. If this is not done then the rectifier tube may blow immediately, or a short time after the receiver goes into service. The electrolytic condenser, remembering that it was subjected to some unusual operating conditions and becoming "sore," the memory will again act up and another rectifier tube will "pop."

It is very important, therefore, whenever a rectifier tube "fuses" to make certain that the filter condensers are satisfactory and that no shorts exists elsewhere in the filter circuit.

This difficulty, which usually appears in the case of 25Z5 or 25Z6G tubes, shows up in the form of burned out or fused cathode tabs. These tabs are the small metal connection strips between the cathode sleeves and the cathode return wires in the glass press. They will fuse when a current much in excess of 1/2 ampere flows for any length of time. These tabs cannot readily be made heavier since if they are, they will conduct so much heat away from the cathode sleeve that proper operating temperature will not be obtained, thus greatly reducing the output of the rectifier. A precaution against the fusing of these tabs is the installation of a 50 ohm resistor in series with each plate or a 25 ohm resistor in series with both plates. This will limit the current to a safe value so that ordinarily, the tabs will not blow. This protection is being used by the manufacturers in some AC-DC receivers.

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

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

Sylvanian NEWS

A CHAT WITH ROGER WISE

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

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

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

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

Did it Ever Happen to You?

Continued from Page One

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

In the case of type 80 rectifiers or similar types, the difficulty usually shows up in a blown filament about 1/2 of the way down from the top of the filament so that a "V" shaped piece of filament wire is loose in the tube, although the welds at the bottom of each leg are intact.

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

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

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

THE SERVICE EXCHANGE is a Sylvania cooperative exchange service. All information is contributed by Sylvania service exchange members. The Sylvania Service Exchange assumes no responsibility with respect to results. Each hint accepted entitles the writer to his choice of one Sylvania product. Please specify tube choice.

The information presented in the Sylvania Service Exchange is contributed by those service men who have had experience in the radio field. Each Hint is subjected to careful checking before being accepted, and we believe it to be correct and authentic. However, we assume no responsibility with respect to results. Each hint entitles the writer to his choice of one Sylvania product. Please specify tube choice. Don't send routine or generally known information. Please specify tube choice.

All Wave Antennas Loss. I have found in many cases that the loss of selectivity was caused by the twisted lead insulation on the twisted leads being deteriorated by weather to such an extent that the bare wires shorted. To overcome the above cause, when replacing twisted pair or installing new antenna, dip the wire in 10% neoprene dope. This will work like new again. — C. Daniels, Daniels Bros., Everett, Pa.

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

Stewart Warner Model 301-A-S.W. When this set goes dead on the front band and everything else checks OK, look for a defective toggle switch which operates on this band. If a duplicate switch is not available, replace the original and drive out the pins which hold the sides and simpanjar the roller, and replace the set. — J. Planovsky, Cleveland, Ohio.

The tone is improved by this wiring... — J. Planovsky, Cleveland, Ohio.

Philo Model 586. The complaint on this receiver is often that of noisy or sputtering reception, while the car is in motion, but disappears entirely when the car is not in motion, but any long, left, feel the right when the reconnection is complete. These cars are held by means of spring clips to the chassis. When they become worn, or lose their tension, the reconnection is made. — R. Whitcomb, Waupun, Wis.

Philo Model 378. Groove this. Solder the top clip to the shield can and to the chassis will stop the trouble. — W. W. Whiting, New York, N. Y.

Majestic Model 500A. This set is often found dead with no voltages. A shorted condenser is the most likely cause. Check the set for 6.3 volt, and observe the lead point on the chassis. If the lead points are not present, replace the 6.3 volt condenser. — E. B. Johnson, Newfield, N. J.

RCA Victor Models C-111-1, T-10-1. Cutting off. Disconnect the green wire on the volume control and connect a 30,000 ohm resistor (10 or 20 mfd.) between the volume control and the chassis. The tone is improved by this wiring change. — Leo Zimmer, Canisteo, N. Y.

Silverstone Battery Receivers. We dealer in small towns and rural communities find that people who own Sears battery sets are disappointed to learn that the A battery is a large flat type and that some tubes are of odd type that are not sold by us dealers. I have found that the flat type of A battery used on some of these battery sets, can be replaced very easily and profitably by removing the cardboard container surrounding the old battery and placing in its place a regular type or radio type dry cells. These must be connected in two banks of four in parallel and these two banks in series. All connections should be soldered. This gives the 3 volts which is the same as the original. In considering the replacement, most dry cells are rated at 35 amperes. The total life can be figured after determining the total filament drain. — Leo Zimmer, Canisteo, N. Y.

Victor Automatic Electrola Model GE29. Directly under the turntable and motor board is a round plate with a notch in it. Into this notch fits a narrow arm which when engaging, stops the cycle of the mechanism and allows the record to play through. The plate and arm are both narrow, and the arm is bent slightly out of position the mechanism cycle will repeat indefinitely. This trouble is often intermittent, and very difficult to find. The remedy is to bend arm slightly so that it is exactly the same plate as the plate. — Alton D. Edwards, Newfield, N. J.

Zenith 8S 154. Zenith 8S 154 and all 1937 Zenith radios using the target tuner. When the target tuner is replaced, it will work right. Then if the target tuner fails, try a new 6CG3 Sylvania tube. Do not use seconds in this socket, they won't work right. — Albert W. Williams, New York, N. Y.
THE VACUUM TUBE VOLTMETER AS A SERVICE TOOL

By GEORGE C. CONNOR

Continued from last issue

The V. T. V. M. can be used to test a circuit as shown in figure 4A. A standard 6E5 target voltmeter is used with the low voltage secondaries connected in series, and half of the high voltage secondary is used. In connecting the secondaries in series, be sure they are connected so that the voltages add instead of bucking each other. As in the case of the d-c calibration, start with 0.1 volt steps and allow larger voltage steps between calibration points as the scale becomes crowded.

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

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

Your Question Answered

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

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

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

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

Question 3. Many receivers are encountered in our service work having defective rectifier tubes such as SY3G, SZ4, etc. As fast as we replace these tubes the new ones also become defective. What do you suggest for this?

Answer: There is only one definite way to determine whether replacement of rectifier tubes can be made without damage to the tube and that is by actually testing the rectifier circuit before the replacement is made. In many cases, the electrolytic condenser may become defective during a momentary short at which time the original tube became defective. Such condenser defects are caused by a-c being directly impressed across the condenser due to the short. Obviously, the electrolytic condenser should be disconnected and replaced if found. It is suggested to all servicemen that they make it a rule to always test the rectifier circuit before connecting the electrolytic condenser before replacing a defective rectifier tube. (See article by Walter Jones on front page.)
SYLVANIA ANNOUNCES TYPE 1231

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

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

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

**Type 1231**

**Triple Grid Amplifier**

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

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

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

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

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

**Characteristics**

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<th>Pentode</th>
<th>Tetrode</th>
<th>Triode</th>
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<td>6.3 Volts</td>
<td>6.3 Volts</td>
<td>6.3 Volts</td>
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<tr>
<td><strong>Heater Current</strong></td>
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<td>0.45 Ampere</td>
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<td>2½ Inches</td>
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<td>Special</td>
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<td>No. 8-8</td>
<td>No. 8-8</td>
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</table>

**DIRECT INTERELECTRODE CAPACITANCES:**

(As Pentode)

- Grid to Plate: 0.015 µuf Max.
- Grid to all other elements: 5 µuf
- Plate to all other elements: 5 µuf

**Operating Conditions and Characteristics**

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<th>Triode</th>
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<td>6.3 Volts</td>
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<tr>
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<td>(to plate) Volts</td>
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<td>130 Ohms</td>
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<td>Na.</td>
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Whose Face Is Red? A Chat With Roger Wise

By WALTER R. JONES

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

The next morning he removed all the tubes from his receiver (and marked it so he could get them back correctly, we hope), and took them to a shop where he remembered seeing a "Tubes Tested Free" sign. Here the verdict, delivered by serviceman "B," was that 3 were bad. That made our hero smell a rat. The radio wasn't that bad.

Again he gathered up his property and departed to find another shop. Here serviceman "C" told him that 5 were bad and only 2 were good. By this time Mr. Public was ready to work on the theory that a "certain percentage" of properly functioning servicemen are to be expected, determined to carry on to the bitter end. In the next shop serviceman "D" said, "4 OK, 3 bad." Our hero then decided that he might as well stay with this shop, and here serviceman "E" said, "5 OK, 2 bad."

It is now about nine o'clock, and John Q. goes to work. All day over the valley, he is being bombarded by the tactics of servicemen. He is convinced that at least three out of the five were trying to "pull a fast one." So he decides to be probably honest, and certainly dumb, because he made no attempt to sell more than one tube. Only serviceman "E" is left, and he decides that our hero now must decide whether or not the new tubes tested too. At the end of the day the hero returns to "E," ready to buy two new tubes.

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

Imagine the embarrassment of "E" and the utter disgust of John Q. Public when those new tubes tested 54, and 48 respectively, and that the old tubes which he has been told test defective. These two situations—lack of correlation between tube testers used by different servicemen, and lack of absolute correlation between different makes of tubes of the same type, happen every day, all over the country. Yet all servicemen are not bad. Perhaps you have been embarrassed by the same type of thing, and that you carry showed up on your tester as "worse" than normal. Perhaps you have been embarrassed by the same type of thing, and that you carry showed up on your tester as "worse" than normal. Perhaps you have been embarrassed by the same type of thing, and that you carry showed up on your tester as "worse" than normal. Perhaps you have been embarrassed by the same type of thing, and that you carry showed up on your tester as "worse" than normal. Perhaps you have been embarrassed by the same type of thing, and that you carry showed up on your tester as "worse" than normal.

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There is a great deal to be learned from these two situations—lack of correlation between tube testers used by different servicemen, and lack of absolute correlation between different makes of tubes of the same type, happen every day, all over the country. Yet all servicemen are not bad. Perhaps you have been embarrassed by the same type of thing, and that you carry showed up on your tester as "worse" than normal. Perhaps you have been embarrassed by the same type of thing, and that you carry showed up on your tester as "worse" than normal. Perhaps you have been embarrassed by the same type of thing, and that you carry showed up on your tester as "worse" than normal. Perhaps you have been embarrassed by the same type of thing, and that you carry showed up on your tester as "worse" than normal. Perhaps you have been embarrassed by the same type of thing, and that you carry showed up on your tester as "worse" than normal.

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The next morning he removed all the tubes from his receiver (and marked it so he could get them back correctly, we hope), and took them to a shop where he remembered seeing a "Tubes Tested Free" sign. Here the verdict, delivered by serviceman "F," was that 3 were bad. That made our hero smell a rat. The radio wasn't that bad.

Also gather up his property and departed to find another shop. Here serviceman "G" told him that 5 were bad and only 2 were good. By this time Mr. Public was ready to work on the theory that a "certain percentage" of properly functioning servicemen are to be expected, determined to carry on to the bitter end. In the next shop serviceman "H" said, "4 OK, 3 bad." Our hero then decided that he might as well stay with this shop, and here serviceman "I" said, "5 OK, 2 bad."

It is now about nine o'clock, and John Q. goes to work. All day over the valley, he is being bombarded by the tactics of servicemen. He is convinced that at least three out of the five were trying to "pull a fast one." So he decides to be probably honest, and certainly dumb, because he made no attempt to sell more than one tube. Only serviceman "I" is left, and he decides that our hero now must decide whether or not the old tubes which he has been told test defective.

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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 checked before being accepted, and there is no liability assumed in 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 type.

G. E. Model 51, RCA Model 118, 211. Intermittent hum not seriously affecting volume. The 16L4 to the 1E7G using three volts on the grid. This is caused by the fact that some 6L6's of other brands will vary quite consistently several years ago, but here's how I solved the problem. During the sales of tubes in my shop, all that are low are thrown into a dump, with the exception of rectifier tubes. Usually open diode coupling condenser. Replace. -Howard Siebold, Berkeley, Cali.

Model 57. The customer complained of a humming sound of station W7O (76 K.C.) and WKRC (90 K.C.) being over all the dial. The broad tuning was attributed to the oscillator circuit not functioning. The oscillator circuit is coupled to the first detector circuit by a pair of twisted wires. Remove one of these wires and replace with another about one inch longer. This will cure the oscillator trouble. The frowning noise was caused by the tension screw on the roller getting too tight. The tension screw on the insulated can of the filter unit. Remove by placing a cardboard container over the unit or applying friction tape. -James Robinson, Cincinnati, Ohio.

Model 37-33, 28-33 Battery Sets. There are very few servicemen except those who live in cities who haven't worried over some of these sets not having enough volume. The remedy is to change the audio circuit from phase to a 1J6G with no change in wiring. -Henry Reising, New York, N. Y.

Model 112. Replace all bypass and coupling condensers. -Howard Siebold, Berkeley, Cali.

Model 600. Replace the twin 09 mf condenser part No. 498913G in the screen circuit of the 77 and 6A7 tubes. -Howard Siebold, Berkeley, Cali.

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

Recent Problem Solved

Gentlemen: Notice with interest the article by Walter R. Jones: "Dick, it ever happen to you." Indeed it did, quite consistently several years ago, and here's how I solved the problem. During the sales of tubes in my shop, all that are low are thrown into a dump, with the exception of rectifier tubes. Such low tubes should be equally valuable for high fidelity than for push-pull class A service. It may be used on all dynamic speakers but is more effective on woofers. -Tommy Birdwell, Iowa Park, Texas.

Zenith Model 4B-131. When used several months, this model may start picking up a code signal and will have some hiss when passing through stations while dialling. The hiss is also noticeable when the volume control is turned. This trouble can be eliminated by twisting the wire leading from the cathode of the 73 tube around the condenser leading from the first filter to the volume control. This leads go to the volume control. This hint also pertains to other models. -Bailey's Radio Service, Hammond, La.

Rectifier Problem Solved

On the 25A7G, for the rectifier section of the tube should connect to pin #1 and the cathode for the pentode section should connect to pin #8. The editors agree that it is much better to admit the error than to redesign the tube. So below we are showing the correct base view and the wrong title. Our mistake can be easily hidden by pasting the diagram below over the one shown in the last issue.

Airline Model 62-413, Wells-Gardner Model 2DL. Intermittent sizzling, scratching and crackling may occur persistently once a day. Caused by poor connection in condensers for bias of a-c and video tubes. First audio coupling condenser. If any attempt is made to pinch tighter, insert extra insulation strips under arm. Otherwise install 156.5 ohms between 6C3 first audio and 6C5 a-c condensers to replace defective section. -Howard Siebold, Berkeley, Cali.

Model 65. Common failure is the detector plate bias resistor. Replace. Model 89. Check double bypass unit No. 8174B in the r-f plate and detector cathode circuits. Check oscillator coil for high resistance joints. Replace or high resistance joints. Replace oscillator coil resistor from 15,000 to 10,000 ohms.

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

Model 95-96. Replace the condenser from the low side of the volume control part No. 3754. Also check audio coupling condenser part No. 7855A.

Model 110. Check first audio screen resistor, first i-f primary for open joints. Replace the twin .09 mfd condenser part No. 375413G in the screen circuit of the 77 and 6A7 tubes. -Howard Siebold, Berkeley, Cali.

Philco Model 37, 37A, 37AD, 37A-10. Tighten all shields, making sure they have clean contact. Run soldering iron over joints. Test with not over 25 volts input from battery or power supply. Usually the audio coupling condenser. Replace. -Philco part No. 3615AD.

Model 10. Tighten all shields, making sure they have clean contact. Run soldering iron over joints. Test with not over 25 volts input from battery or power supply. Usually the audio coupling condenser. Replace. -Philco part No. 3615AD.

Model 17. Check first audio screen resistor, part No. 4049, also the audio coupling condenser part No. 39003L.

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

Model 38. If condensers check okay, tighten all shields, making sure they have clean contact. Change the oscillator coil resistor from 6,000 ohms to 2,000 ohms.

Model 45. The wave trap frequently opens. Try a lot of iron over joints. Check oscillator coil resistor from 6,000 ohms to 2,000 ohms.

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

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

Wilton-Gay Model 58-A. On this model the dirt will get in and get down between the voice coil and the pole piece with the result that it sounds terrible. To remedy this, remove the speaker, cut a piece of soft leather just a little larger than the diameter of the voice coil and glue it over the voice coil opening. When it gets dry you will get a handful of sand on it and the tone will not be affected. I have used this a number of times and it gives excellent results, especially on the horizontal type mounted speaker. It may be used on all dynamic speakers but shows the best results on the speakers that are mounted behind a grille cloth. -Howard Siebold, Berkeley, Cali.

The editors agree that it is much better to admit the error than to redesign the tube. So below we are showing the correct base view and the wrong title. Our mistake can be easily hidden by pasting the diagram below over the one shown in the last issue.

Zenith Models 4Z31, 4B132. Such low tubes should be equally valuable for high fidelity than for push-pull class A service. It may be used on all dynamic speakers but is more effective on woofers. -Tommy Birdwell, Iowa Park, Texas.

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THE VACUUM TUBE VOLTMETER AS A SERVICE TOOL

By GEORGE C. CONNOR

Continued from last issue

The vacuum tube voltmeter is one of the most versatile and useful instruments for laboratory and service work. It is a testing tool that can be used without regard for its limitations, or the results may be subject to serious error. It is essential that the beginner be shown how to use the various types of meter measuring high impedances and at radio frequencies—necessitates more care and knowledge in its application than the simple d-c meter. For this reason this series of articles is offered with due regard for the correct use of the V. T. V. M. in service work.

In addition to the study of this material, the serviceman in the future is likely to have occasion to use several different types of radio sets known to be in good working condition so that he will be familiar with the operation of several different types of radio receivers known to be working properly, before an attempt is made to diagnose (with the newly acquired V. T. V. M.) other types of radio sets known to be in poor working condition. The following stage by stage measurements will show how this end of the receiver may be analyzed toward cut-off and cause distortion.

1. TESTING 2ND DETECTOR CIRCUIT:

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

(1) I-F Filter

The purpose of the 50,000 ohm resistor and 100 μfd. condenser ahead of the diode load resistor is to filter the i-f signal from the audio and a-c voltage to prevent this i-f voltage from reaching the grid of the 6Q7G tube. If any quantity of i-f signal reaches the grid, it will change the plate to grid capacitance at the point where it encounters the diode. The following stage by stage measurements will show how this end of the receiver may be analyzed toward cut-off and cause distortion.

(2) A-F Blocking Condenser:

Assuming that the a-f filter is satisfactory, remove the 250 μfd. condenser from the plate terminal of the 6Q7G. This will indicate the amount of any a-c voltage that may be leaking through the 0.1 μfd. coupling condenser.

(3) Stage Gain:

The .02 mfd. condenser and 2 megohm resistor comprise the r-f filter to prevent any a-c signal from being fed back through the a-c circuit. The effectiveness of this filter can be checked by connecting the V. T. V. M. prod tube grid through an 0.1 μfd. paper condenser to the grid of the 6C8G tube. A leakage of one tenth this value is as great as we should expect. If any a-c voltage is fed back through the filter, a leaky condenser should be replaced because a leaky condenser is apt to cause trouble at a later date.

(4) Plate to Grid Coupling Capacitor

To check the .004 coupling capacitor for leaks, leave the a-c signal on the grid of the 6Q7G grid as before and move the V. T. V. M. 0.5 mfd. condenser to the grid terminal of the 6C8G tube. A leakage of 0.5 volt into the grid circuit from the a-c line is recommended to avoid the possibility of wave form errors that may result from a poor wave form from a test oscillator. The output of the tube division will be a d-c signal that will cause the stage gain. The 0.5 mfd. condenser recommended is to be checked in series with the V. T. V. M. grid to avoid the effect of the d-c plate voltage. The volume control should of course be on "maximum" during these tests.

(5) Plate to Grid Coupling

Conductor Leakage

To test the d-c leakage of the .004 mfd. condenser, connect the V. T. V. M. prod tube grid direct (without the 0.5 mfd. blocking condenser) to the grid of the 6CG7 tube, and remove the 6Q7G tube from the socket. Removing the 6Q7G tube from the socket does two desirable things; it eliminates any noise, hum, or signal, that may be picked up by the receiver, from reaching the V. T. V. M., and it removes the r-f drop from the signal, which is caused by the 0.0001 μfd. plate capacitor. If any voltage appears on the V. T. V. M. the conductor is leaky. As an example, suppose the N supply is 300 volts, the leakage current through the .004 mfd. condenser one microampere, the current flowing in the 1 megohm resistor will be .00001 x 1,000,000 ohms = 1 volt. Such a leakage biasing the condenser may not cause any trouble, but will limit the unidirectional signal level that could be amplified, and unbalance the phase inverter circuit. So far as the voltage of course this value is as much as should be permitted.

Concluded next issue.

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

Sylvania Type 906 is a high vacuum cathode-ray picture tube with a three-inch screen. This new Sylvania Tube is designed for use in small television receivers and other similar applications. Due to its size (approximately 12"x9") and the brilliance obtainable, it is especially suitable for use in compact equipment.

An indirectly heated cathode supplies the electron current in the 906. The "electron gun" used for projecting a beam of electrons upon the fluorescent screen consists of the cathode, control electrode, and focusing electrode. The focusing electrode also acts as an accelerating control electrode, and focusing electrode. The electrostatic field of each pair of plates deflects the beam parallel to the axis of the field.

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

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

Sylvania 906 may be used to replace any cathode-ray tube bearing the same type number, as well as types 117-2 and 2004.

PIN CONNECTIONS:

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

Characteristics
Heater Voltage
2.5 Volts
Heater Current
2.3 Amperes
Maximum Overall Length
11 1/2 Inches
Maximum Diameter
2 1/4 Inches
Bulb
F-24
Base
Medium 7 Pin
Price
$18.50

Maximum Ratings
Anode No. 2
1760 Volts Max.
Anode No. 1
1350 Volts Max.
Control Grid Voltage
250 Volts Max.
Positive Grid Volts for current cut-off
-60 Volts Approx.
Plate Voltage between Anode No. 2 and any Deflecting Plate
660 Volts Max.
Screen Power Density per sq. cm.
16 Milliwatts Max.

(Continued on Page Two)

KNOW YOUR TUBE TESTER

BY WALTER R. JONES

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

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

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

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

This type of checker usually requires an additional control to set the meter to zero. Otherwise two readings must be taken to obtain the difference in plate current caused by shifting the bias. In order to properly test all types of tubes a variable grid bias...
Low Current Battery Tubes—1A5G, 1A7G, 1C5G, 1H5G, 1N5G

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

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

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Class</th>
<th>Base</th>
<th>Bulb</th>
<th>Filament Rating</th>
<th>Use</th>
<th>Plate Voltage</th>
<th>Negative Grid Voltage</th>
<th>Screen Voltage</th>
<th>Plate Current</th>
<th>Screen Current</th>
<th>Plate Resistance</th>
<th>Mutual Conductance</th>
<th>Amplification Factor</th>
<th>Omps Load</th>
<th>Uninsulated Power Output</th>
<th>Milliwatts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A5G</td>
<td>Pentode</td>
<td>6-X</td>
<td>T-9</td>
<td>1.4 0.05</td>
<td>Power Amp.</td>
<td>85  4.5 85.0</td>
<td>4.5 0.7 800.0</td>
<td>800  240</td>
<td>7.5 Ma.</td>
<td>0.47 0.8 500.0</td>
<td>500.0  1.550</td>
<td>1.55 0.8 180</td>
<td>180  240</td>
<td>75  0.05 0.25 0.35 0.45 0.55</td>
<td>250  250</td>
<td>115</td>
</tr>
<tr>
<td>1A7G</td>
<td>Heptode</td>
<td>7-Z</td>
<td>T-9</td>
<td>1.4 0.05</td>
<td>Converter</td>
<td>90  0.00 45.0</td>
<td>0.5 0.6 600.0</td>
<td>600.0 250</td>
<td>7.5 Ma.</td>
<td>0.47 0.8 500.0</td>
<td>500.0  1.550</td>
<td>1.55 0.8 180</td>
<td>180  240</td>
<td>75  0.05 0.25 0.35 0.45 0.55</td>
<td>250  250</td>
<td>115</td>
</tr>
<tr>
<td>1C5G</td>
<td>Pentode</td>
<td>6-X</td>
<td>T-9</td>
<td>1.4 0.10</td>
<td>Power Amp.</td>
<td>83  7.0 83.0</td>
<td>7.0 1.6 115.0</td>
<td>115.0 180</td>
<td>7.5 Ma.</td>
<td>0.47 0.8 500.0</td>
<td>500.0  1.550</td>
<td>1.55 0.8 180</td>
<td>180  240</td>
<td>75  0.05 0.25 0.35 0.45 0.55</td>
<td>250  250</td>
<td>115</td>
</tr>
<tr>
<td>1H5G</td>
<td>Diode-Tr.</td>
<td>5-Z</td>
<td>T-9</td>
<td>1.4 0.05</td>
<td>Det. Amp.</td>
<td>90  0.00 90.0</td>
<td>0.5 1.6 115.0</td>
<td>115.0 180</td>
<td>7.5 Ma.</td>
<td>0.47 0.8 500.0</td>
<td>500.0  1.550</td>
<td>1.55 0.8 180</td>
<td>180  240</td>
<td>75  0.05 0.25 0.35 0.45 0.55</td>
<td>250  250</td>
<td>115</td>
</tr>
<tr>
<td>1N5G</td>
<td>Pentode</td>
<td>5-Y</td>
<td>T-9</td>
<td>1.4 0.05</td>
<td>R-F Amps.</td>
<td>90  0.00 90.0</td>
<td>0.5 1.6 115.0</td>
<td>115.0 180</td>
<td>7.5 Ma.</td>
<td>0.47 0.8 500.0</td>
<td>500.0  1.550</td>
<td>1.55 0.8 180</td>
<td>180  240</td>
<td>75  0.05 0.25 0.35 0.45 0.55</td>
<td>250  250</td>
<td>115</td>
</tr>
</tbody>
</table>
Know Your Tube Tester

Continued from Page One

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

At the present time the so-called "emission" type tester and its modifications is most popular. This type of tester usually connects all the elements of the tube, except the grid, and therefore is applied between the cathode and the other elements. A meter is supplied to read the required current which flows through the measured circuit resistance of the tube.

The cost of this type of tester is comparatively low since only one value of a-voltage is usually supplied, in addition to the filament. Since the elements are all connected together, a minimum number of sockets are required for testing. The tester has the further advantage of requiring very few changes to adapt it to new tubes. It is obvious that such tests do not approximate operating conditions. Consequently, a set of limits must be run for each type of tube, and perhaps for each make of tube as well.

Most of the difficulty which arises because of failure of tube testers to agree in the past has been due to failure of the various makes of emission testers. This is not hard to understand when one realizes that no two makes of emission tester will give the same voltages between the cathode and the other elements, or the same circuit impedences. However, only one value of circuit resistance was employed, which meant either that both tubes were tested with a very low emission current or that each tube was tested separately. We have found that several of these resistors that opened up, resulting in defective "Eye" performance.—Joseph S. Napor, Uniontown, Pa. * * *

Chevrolet Model 985284 (1937). Several complaints have been vibrator noise on all stations. When all condensers, vibrator, shield can connections and rectifier are found to be OK, change the 6FP6 to a metal Sylvania 686 and the noise will completely disappear. We have tried this on several of these sets and have had great results. —W. L. Spaulding, Cornersville, Indiana.

Crosley Model 160. This is an old receiver but there are still plenty of them around. When you get one that doesn't have much pickup and all parts check OK, look for the trouble in the audio coupling condenser. You should find that the cathode resistor which is a 20,000 ohm resistor can be replaced by a 200,000 ohm unit. This will restore the reception to normal.—Leonard Johnson, South Boston, Va. * * *

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

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

Majestic Model 1250. Several Majestic Radio and Television receivers of this model have been found to have a high volume. They performed excellently at high volume, but with the volume control reduced to low volume, there was a howling. There was only one thing that I found to remedy this trouble. The audio coupling condenser coupling the carrier grid to the first detector tube was noisy. This coupling condenser coupling the first detector grid to the volume control was noisy. By removing this condenser and placing a 0-1000 ohm resistor in parallel with the tube and grid and then placing a 2 megohm resistor from grid to ground, I found that the tone of the set was excellent from the lowest to the highest degree of rotation of the volume control.—Leonard Johnson, South Boston, Va. * * *

Noisy Volume Controls. Quite frequently the service section has to replace volume controls of the carbon strip variety because they are noisy. For a quick repair I have found that if the element is lifted up and a strip of rubber eraser under the noise can be overcome. Be sure to use a soft eraser because a hard one will make the surface of the carbon strip rough and cause more noise. I have done this quite often and find it helpful in place of the ordinary eraser. —Charles A. Shott, San Francisco, Calif. * * *

Spartan Equaasome Models. Very weak signals. In models that have the detector tube section on top of gang condensers, the coupling jack between the input tube (first stage) and the tube (tube box and gang condenser, wears out from vibration. Renew this. —Wm. B. Miles, Altoona, Penna. * * *

Avon Model 927. If the 6G5 Magic Eye doesn't work, do not check the A-V-C network until the 1.0 megohm resistor contained within the 6G5 tube is replaced. We have found that several of these resistors that opened up, resulting in defective "Eye" performance.—Joseph S. Napor, Uniontown, Pa. * * *

Oldsmobile 1938 Deluxte Radio. This receiver, when first installed, had a habit of blowing fuses with no apparent cause. After much searching, the trouble was traced to a cold cathode rectifier to be at fault. After trying several different makes of rectifiers with the same trouble we wired in a Sylvania type 6X5G rectifier and have had no trouble since. It is only necessary to run a hot lead to one of the lug terminals on the socket as the other lead is already grounded to the chassis. —Leonard Johnson, South Boston, Va. * * *

Philo model 38-116 Code 125 and Model 38-690. To prevent parasitic oscillations and improve performance of the oscillator circuit at 180 M.C. in Model 38-116 Code 125, connect a 100 ohm resistor between the 6AG8 oscillator anode and the +125V line. The resistor replaces the original brown wire which should be removed. —M. J. Flasnovsky, Pickford, Ohio.

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

RCA Victor Model 9K1. By adding a 25mfd. low voltage electrolytic to the 6L6 cathode circuit the set's audio system will be appreciably improved.—Louis Weiss, New Castle, Pa. * * *

Sonora Model 705. If set hums and the volume control does not affect the volume or correct the trouble, look for an open 8 mfd. electrolytic condenser located under the resistor-condenser bank. Try replacing it with one having a rated voltage of 300 volts.—Lee White, Jr., New Orleans, La. * * *

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

Stewart Warner Model 1845. When dial pointer and tuning condensers do not move and motors run when selector button is pressed, the trouble is in the clutch assembly. This can be repaired by removing the 1 shaped spring and using smaller brass gear and collar.—Walnuttian Radio Service, Northfield, Minnesota. * * *

Zenith Model 780. If impossible to get signals below 700 k-c yet they will come in OK above 700 k-c, check the selector button and plate circuit. Re-
THE VACUUM TUBE VOLTMETER AS A SERVICE TOOL

By GEORGE C. CONNOR
Continued from last issue

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

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

(7) Plate Circuit Decoupling Filter:
The 40,000 ohm resistor and 4 mfd. condenser in the plate circuit of the 6Q7G forms an additional filter in the supply to help eliminate hum. To test its effectiveness, measure the a-c voltage appearing between the B supply end of the 40,000 ohm resistor and ground—using an 0.5 mfd. condenser in series with the prod tube grid of the V. T. V. M. to apply d-c voltage. The a-c voltage appearing on the V. T. V. M. should be very small. Then measure the a-c voltage appearing under the same circumstances, appearing across the 4 mfd. condenser. It should be so small as to be unmeasurable with the V. T. V. M. If an a-c voltage is detected, this indicates leakage in the 4 mfd. condenser. If the reading of the V. T. V. M. prod tube to eliminate the d-c voltage normally across the filter condenser. It should be very small and be replaced.

(8) Decoupling Condenser Leakage:
To test the 1.5 mfd. condenser for leakage, remove the 6Q7G tube from the socket, and measure the plate voltage between each end of the 40,000 ohm resistor and ground. If there is no leakage in the 4 mfd. condenser the voltage will be the same at both ends of the resistor. With an electrolytic condenser some small leakage is to be expected, and the two voltages will therefore not be equal. Since the "R" supply voltage is higher than the range of the V. T. V. M. it will be necessary to connect a 20 megohm resistor in series with the probe tube grid of the V. T. V. M. This 20 megohm resistor in series with the 5 mfd. resistor already in the circuit between prod tube grid and ground will provide a voltage divider network ahead of the V. T. V. M. and the reading of the V. T. V. M. may be multiplied by 20 when reading the voltage. A little experience in testing various makes of electrolytic condensers will indicate the amount of leakage to be expected as normal with each make.

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

II. TESTING PHASE INVERTER CIRCUIT:
The phase inverter circuit shown depends for its correct operation on the fact that an a-c voltage in the plate circuit of a vacuum tube is 180 degrees out of phase with the a-c voltage in the grid circuit. This is one fact in our tests that we may safely assume to be correct (although it too may be tested with a V. T. V. M.). To get the two output tube grids 180 degrees out of phase with each other, the signal from the top output tube is put through an extra tube (or one section of a tube triode, as in this case). Naturally we want the a-c voltage appearing on the two output tube grids to be equal in amplitude as well as being 180 degrees out of phase with each other. To secure this result, only a portion of the signal applied to the top output tube grid is applied to the second section of the duo triode. The ratio of the voltage applied to the phase inverter tube compared with the total voltage available should equal the voltage amplification of the tube being used as a phase inverter. The voltage amplification may be found by actually measuring the gain of the top section of the 6Q7G tube. The test we are most interested in however is to find if an equal voltage is being fed to each output tube grid. This may be determined by any one of four measurements if all other parts are known to be good. The result of these tests should show that:
A. The a-c signal between each grid of the 6Q7G tube and ground should be equal.
B. The a-c signal between each plate of the 6Q7G tube and ground should be equal.
C. The a-c signal between each grid of the output tubes and ground should be equal.
D. The a-c signal between each plate of the output tubes and ground should be equal.

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

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

<table>
<thead>
<tr>
<th>Capacity</th>
<th>4</th>
<th>8</th>
<th>12</th>
<th>16</th>
<th>20</th>
<th>24 mfd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-C voltage across condenser:</td>
<td>52</td>
<td>26</td>
<td>18</td>
<td>15</td>
<td>10</td>
<td>8 volts</td>
</tr>
</tbody>
</table>

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

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

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

Servicemen
Don't miss reading page one of the Main Section. Lots of good dope on shop modernization and a big list of prizes for photos of modernized shops.
Sylvania Model Service Shop Booklet now available.
Every Radio Serviceman and Tube Dealer has the problem of storing parts and keeping stock. Here is the perfect answer—a specially designed all-steel portable cabinet. Built strongly—it combines display shelves for tube stock and storage space for service parts. This cabinet is ideal equipment for shop or store because stock and parts are always well-ordered and convenient. Dimensions: Height 59\(\frac{1}{2}\)", Width 22", Depth 12".

The two top shelves accommodate 125 tubes each. For your small parts—two easy-sliding drawers with 21 compartments in each one. For larger parts—the lower drawer has 4 roomy compartments, 6x10x5\(\frac{1}{2}\)". In the bottom compartment you will notice the generous size storage bin for service kit or wire and other heavy articles.

Two New Features

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

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

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

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

NEW TUBES

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

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

**Type 1A5G**

**Output Pentode**

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

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

**Charateristics**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>1A5G</th>
<th>1A7G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filament Voltage (Nominal)</td>
<td>1.4 Volts</td>
<td>1.4 Volts</td>
</tr>
<tr>
<td>Filament Current (Nominal)</td>
<td>0.03 Ampere</td>
<td>0.03 Ampere</td>
</tr>
<tr>
<td>Maximum Overall Length</td>
<td>3 5/8&quot;</td>
<td>3 5/8&quot;</td>
</tr>
<tr>
<td>Maximum Diameter</td>
<td>1 5/8&quot;</td>
<td>1 5/8&quot;</td>
</tr>
<tr>
<td>Base—Small Octal 7-Pin</td>
<td>6-x</td>
<td>6-x</td>
</tr>
</tbody>
</table>

**Operating Conditions and Characteristics**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>1A5G</th>
<th>1A7G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Voltage</td>
<td>85</td>
<td>3.3</td>
</tr>
<tr>
<td>Screen Voltage</td>
<td>85</td>
<td>90 Volts</td>
</tr>
<tr>
<td>Grid Voltage</td>
<td>1.5</td>
<td>5.0 Va.</td>
</tr>
<tr>
<td>Grid Current</td>
<td>0.5</td>
<td>0.9 Ma.</td>
</tr>
<tr>
<td>Plate Resistance</td>
<td>0.5</td>
<td>0.9 Ohm</td>
</tr>
<tr>
<td>Mutual Conductance</td>
<td>500</td>
<td>300 Ohm</td>
</tr>
<tr>
<td>Amplification Factor</td>
<td>250</td>
<td>255</td>
</tr>
<tr>
<td>Load Resistance</td>
<td>25,000</td>
<td>25,000</td>
</tr>
<tr>
<td>Power Output</td>
<td>108</td>
<td>115 Mw.</td>
</tr>
<tr>
<td>Total Harmonic Distortion</td>
<td>10</td>
<td>7 Per Cent</td>
</tr>
</tbody>
</table>

*S* Negative Filament return.

Type 1A7G

**Pentagrid Converter**

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

A 90 volt B battery is required for the plate, and anode grid supply voltages. It is recommended.
SYLVANIA NEWS

A CHAT WITH ROGER WISE

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

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

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

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

The filament is rated at a normal voltage of 1.4 volts and 100 milliamperes. However the tube may be operated directly from a suitable 1.5 volt dry battery with the use of a half-watt tube since the design provides satisfactory performance over the useful voltage range normally encountered during the life of the battery. Other forms of A batteries are applicable if the proper circuit arrangements are provided.

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

Sylvania Type 1H5G is a diode-triode designed especially for use in low drain battery operated receivers. It is one of the types of tubes having a low filament rating.

The single diode plate is located at the negative end of the filament, base pin No. 7.

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

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

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

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<thead>
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<th>0.05 Ampere</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Voltage</td>
<td>90 Volts</td>
<td></td>
</tr>
<tr>
<td>Screen Voltage</td>
<td>90 Volts</td>
<td></td>
</tr>
<tr>
<td>Grid Voltage*</td>
<td>90 Volts</td>
<td></td>
</tr>
<tr>
<td>Plate Current</td>
<td>0.14 Ma.</td>
<td></td>
</tr>
<tr>
<td>Mutual Conductance</td>
<td>225 mhos</td>
<td></td>
</tr>
<tr>
<td>Amplification Factor</td>
<td>65</td>
<td></td>
</tr>
</tbody>
</table>

*Sodium Filament return.

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<td></td>
</tr>
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</table>

*Sodium Filament return.
sets there is a complaint of too much hum.

Chevrolet Model 364441 (United Motors Radio). Several of these sets have been served for very weak, intermittent, and no signal from about 840 Kc. to the high end of the dial. This trouble has been overcome by lowering the high end of this choke and chassis in order to bypass hum.—N. E. Nelson, Mayville, N. D.

Belmont Model 660 Auto Radio. When installing new vibrators in these sets, be sure to include a .02 mfd. 1500 volt condenser across the tuning unit having worked through the paper insulation under it and occasionally touching the lamp socket, the capacity and losses being detrimental.—Ed. Glaser, Bellmore, N. Y.

Buick Model B-D-908389 Auto. Failure of the set to operate over the entire broadcast band is due to failure of the bias resistor connected between the second 36 tube cathode and ground. Replace with a 1 watt resistor. I used a 13,000 ohm resistor across the old cathode which gave the right bias and put the set in operation with perfect results.—A. R. Eberts, Troy, Ohio.

Crosley Model C-174 (1938 Chevrolet Auto Radio). If this set becomes noisy when jarred, it may be due to the solder lug on the automatic tuning switch not being worked through the paper insulation under it and occasionally touching the motor frame. Do not bend this lug up as it will then touch the lug. The best thing to do is replace the insulating paper with as thick a piece as will easily go under the lug.—J. M. Miller, Cincinnati, Ohio.

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

Ford Phlio. Objectible ignition noise on all types of cars. A common cause is a leaky connection at the starter contact in the unit going through the top. This shows up on an ohmmeter test. To remedy this, I take the field coil housing bolted to the cone frame, moving the rivet through antenna rod and cleaning and lubricating the connection.—W. E. Brown, S. Moorhead, Minn.

Grunow Super Teleaid (Any Model). When the set is turned off and the tremolo switch located, slip off the dial and check the reeds on the station stop. Careful inspection of the reeds and moving them with an insulated rod will show up the trouble as defective mica spacers. Replace with new spacers.—Francis J. Knest, Allentown, Pennsylvania.

Indicator For R-F Oscillator. The 60 ma., 2 volt grid leak test lamp is a very reliable indicator for r-f oscillation, taking only 0.12 watts for full brilliance and glowing at only 40 milliwatts. Several of these sets have been serviced with a single turn of wire for short waves and two or three turns for broadcast waves and coupling to the oscillator circuit. We have a very useful r-f indicator, the lamp may be mounted permanently behind a jewel with the proper amount of coupling for full brilliance. The lamp is almost a blessing when playing with small tubes on centimeter waves where the power is too low to be detected by the brain. For these quantities, it is not advisable to use a lamp socket, the capacity and losses being detrimental.—Fred E. Berry, Olive Hill, Ky.

Motorola Auto Receivers. This tip is based on distorted reception in Motorola auto receivers, but would be applicable to any bias cell job. This was an intermittent complaint was intermittent distortion especially when the car was in operation extremely well, the 2 grid coupler on the 3 grid coupler was unbalanced which occurred due to imperfections in the contact on the surface of the bias cell. It is very easy to check with the Magic Eye V. T. V. M., which we have been using since the circuit was first released in Sylvania News.—Chet Aydelotte, East Gary, Indiana.

Motorola Models 44, 55, 77. Excessive hum in these models is generally due to audio oscillation. Remedies: Insert a small r-f choke in the plate circuit as high as possible output from the synchronous type vibrator. Be sure to connect a condenser of about 51 p.f. 600 volts to the proper amount of coupling for full brilliance. This job can be done in a few minutes while an hour or so would be considered for determining the cone.—Al Anderson, Flagstaff, Arizona.

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

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

RCA Model 86T. I find that by connecting a 600 ma. condenser, larger, from the antenna connection to the oscillator tuning condenser stator plates, there is a marked increase in volume, about 25%.—J. S. Jackson, Jr., Bowling Green, Kentucky.

RCA Model 86V. Realignment of Speakers. The majority of later type speaker units have the cone cemented to the cone frame making it a difficult job to remove the cone for voice coil air gap cleaning. I usually find that by connecting a 6 volt battery to the field coil housing bolted to the cone frame, making a simple mastic to dismantle same for easy cleaning. The only disadvantage being that it is hard to properly center the air gap plate. This is readily overcome by ticking, with a little solder and a small file, the field coil housing at each edge after lining up in its correct position. This keeps the gap from becoming a misalignment to the speaker frame. This job can be done in a few minutes while an hour or so would be considered for determining the cone.—Al Anderson, Flagstaff, Arizona.

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

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

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

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

This beats all thosecockroach stories.

** Revised Characteristic Sheet **

The Sylvania Characteristic Sheet, which is one of the most popular items of technical literature for servicemen, has been completely revised. The new chart contains complete operating characteristics on all Sylvania radio tubes (including new types recently announced). Base diagrams and bulb dimensions for all types are shown. The layout has been changed to an 8 page booklet form which is adaptable for 3 ring binder use. Because of the large amount of data shown, the booklet style proves ideal for servicemen’s use. The sheet also folds down to convenient size for use in the service kit case.

This new Sylvania Characteristic Sheet is free to all who have use for it and can be obtained from your Sylvania jobber, or use the enclosed advertising order form.
The operation of the antenna coil, r-f stage and converter circuits are very important for proper receiver performance. It is these circuits that give the receiver much of its gain, all of its image suppression, and a large percentage of its selectivity. But equally as important, these circuits determine the noise-to-signal ratio of the receiver.

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

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

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

 A two stage r-f amplifier can be built very easily using plug-in coils to change frequency range. The two stages are each built into a separate box, and are connected across the antenna coil primary, and then moved the V.T.V.M. connection to the secondary and measure the voltage. If, for example, a reading of 4 volts is obtained, the gain of the coil is 4 divided by 0.2 or 20. This measurement would be made in a few minutes from the top of the chassis.

### Testing Wave Trap Circuit

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

### Measuring Stage Gain

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

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

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

### Measuring A-V-C Voltage

- When measuring d-c voltages the prod tube of the V.T.V.M. is normally applied to the positive terminal of the load. For a-v-c voltages, which are negative with respect to ground, the prod tube should touch the load in the grid of the tube to be measured. The voltage generated by the discriminator in an a-f-c circuit will be zero when all circuits are properly aligned. The V.T.V.M. furnishes a means of reading this voltage without in any way disturbing the circuit. This is accomplished exactly in the same way that an a-v-c voltage is measured except that the discriminator may be either positive or negative so that it may be necessary to use both the 50,000 ohm and 3,000 ohm calibrated potentiometer to read the voltage. In most cases, however, it is not necessary to know how much voltage is developed but only whether the opposing voltages are in or out of balance.

The prod tube grid for this test is connected to the lead connecting the discriminator and oscillator control tube to the grid cap of the oscillator control tube.

### Conclusion

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

Size remains in convenient pocket style

Eighty Pages

Now ready Completely New

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

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

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

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

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

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

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

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

Continued on Page Two
NEW TUBES

TYPE 0A4G—Continued

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

CHARACTERISTICS

Maximum Over-all Length. 2 3/4 Inches
Maximum Diameter. 1 1/4 Inches
Base. Small G Type Octal No. 6-V
Anode to Cathode Breakdown
Voltage (A) 225 Volts Min.
Starter-Anode to Cathode Breakdown Voltage (B) 70 Volts Min.
Starter-Anode Current for Transition of Discharge to Peak 100 ma. Max.
Starter-Anode to Cathode Operating Voltage Drop 50 Volts Approx.
Anode to Cathode Operating Voltage Drop 70 Volts Approx.
Anode to Cathode Current continuous 25 ma. Max.
Starter-Anode to Cathode Operating Voltage Drop 60 Volts Approx.
Sum of A-C and R-F Starter-Anode Voltage (Peak) 350 Volts Max.
Anode Voltages (Peak) 250 Volts Max.
Anode Supply Voltage (RMS) 105-130 Volts
Typical Operating Conditions (A-C Supply):
A-C 105-130 Volts
Typical Operating Conditions (R-F Supply):
R-F 100 Volts Max.

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

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

From external appearances the Sylvania 0Z4 is the same as other metal tubes, but the metal shell is not the container for the permanent gas. The shell acts only as a shield and protector for a glass bulb used to hold the gas and to insulate it from the exterior atmosphere. Types 0Z4 and 0Z4G are interchangeable in most cases; however, the 0Z4 metal tube may be preferred in circuits where a small glass bulb is objectionable.

Operating Conditions and Characteristics:

Heater Voltage AC or DC. 6.3 Volts
Heater Current. 0.5 Ma.
Screen Voltage. 30 Volts
Screen Current. 0.5 Ma.
Plate Voltage. 250 Volts
Plate Current. 100 ma.
Grid Voltage. 30 Volts Approx.
Amplification Factor. 50
Modulator or First Detector
Heater -8 V.
Plate -65 V.
Gridded Output. 6.3 V.

The introduction of screened grid tubes more than a decade ago brought with it one feature which has a nuisance to tube manufacturers ever since—the top cap connection for the control grid. Recent announce-

ments of ‘‘single-ended’’ R-F pentodes and similar types indicate that we may finally eliminate this item in newer designs, and thus gradually eliminate the bulb tubing, top sealing and top capping operations except for renewal types and a few special types.

In the case of metal tube types it is only necessary to revise the shielding of the mount structure and add shielding in the base to make top cap elimination practi-

able. With glass types, especially the shorter types with the conventional ‘‘press’’ as capacity between leads brought through this press is excessive. This change was made in Sylvania Type 1231, the first ‘‘single-ended’’ glass type to be made generally available for experimental use. The wide separation between lead-in tubes in the stem of this tube makes it possible to provide adequate metallic shielding, the shell type base, also of metal, being an important factor in this design as it co-operates with internal shielding and is grounded by a socket connection.

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

We anticipate that in time chassis design will be entirely cleared of top cap connec-

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

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

CIRCUIT APPLICATION

Biased Detector

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

Radio Frequency Amplifier

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

The plate circuit load should be as high as is practicable. A tuned impedance load will be satisfactory for intermediate-frequency ampli-

fiers operating at a fixed frequency. The capacity per stage can be made as high as 200 or more with ordinary care in design. For other applications requiring uniform sensitivity over a wide-band of radio frequencies, coupling devices to meet the specific requirements will be necessary.

Modulator or First Detector

The 1223 may be employed as a superhetero-
dyne first detector but a tube having super-

control characteristics is to be preferred if signals of large magnitude are to be received, and if in supplementary volume control is to be obtained in this stage.

Plate Load—250,000 ohms or 500 h. choke shunted by 0.25 megohm. For resistance load plate supply voltage will be voltage at plate plus voltage drop in load caused by specified plate current.
**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 for results. Each hint accepted by the reader is taken at his own risk.

By the choice of one Sylvania receiving tube. Please indicate preference when submitting hints. Don't send routine or generally known information. Please specify tube choice.

**Audioola Model 346 (Auto).** Check the a-c-v circuit of these sets closely as they have found several wired incorrectly. The symptoms are poor reception and very irregular reception. The errors are easily found so they need not be noted. However, the two changes which improve this condition are to use a 150 ohm across watt blocking resistor, bypassed with a 0.1 mfd. 200 volt condenser to ground, in the r-f grid return. Also a 12 volt, 3.5 watt resistor, bypassed with a 0.1 mfd, 400 volt condenser to ground, in the anode grid return circuit of the 6A7 tube, for the 50,000 ohm resistor.—Henry Berg, Pittsburgh, Pa.

**Crosley Model 183 Auto Radio.** If set oscillates on portions of the dial, it can often be remedied by soldering the ground strap from the gang condenser to the case.—Oliver F. Klein, Milwaukee, Wis.

**Crosley Model B-425 (Battery).** If reception can be obtained from the rear of the car, it will kink the wire exposed to make it stiff. This functions as a portable aerial which can be used to locate the source of motor noise on any car with a great saving in time. Just plug the one end in the auto radio and hunt down the noise with the other.—Donald W. Miller, Jr., Chardon, Ohio.

**Crosley Model 630 (Auto Set).** The 61B tube in this receiver is a hard working tube and in replacing it, a non-microphonic and noise-free tube is needed. About the only thing to do is to try several different tubes and select the one least microphonic. One method of cure is to sacrifice the sensitivity by moving the small piece of insulated wire on top of the gang. This wire is some 1/32 inch from the center of the middle section and lies over near the stator for the purpose of introducing regeneration in the circuit and far enough away to clear up the microphonic. Sylvania type 1211, a special non-microphonic 6C6 may be used satisfactorily for this condition. If no change in the circuit will be required.—J. Moller, Cincinnati, Ohio.

**Ford Majestic (Auto).** When the 6Y5 tube fails after replacement and complete test of all apparatus up to the 400,000 ohm 0.1 mfd condenser across the plates is most likely the cause of the trouble as it loses its resistance under heat and load.—Henry Berg, Pittsburgh, Pa.

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

**Grunow Model 1841.** When this set is intermittent or dead check the 2,000 ohm resistor located in the plate circuit of the 6K7 A.F.C. amplifier and plate of 6K7 second i-f tube.

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

**General Electric Model K66.** Motorboating at low volume may be remedied by changing the 4, mfd. filter condenser connected from ground to the plate of the 6C5, dry electrolytic condenser.—R. A. Graef, Detroit, Mich.

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

**Majestic Model 66 (Auto Radio).** Dampness due to the rain penetrated into the interior of these sets through the ribbed opening in the cover, causing damage to the 10,000 ohm screen grid resistor with the screens of the r-f oscillator and i-f tubes. This is a wire wound resistor located directly above the oscillator socket on the under side of the set, and seated in the side wall of the chassis. When the set is in use, one can tell immediately if the trouble is caused by the fault by checking for a clicking sound by making intermittent contact on the control grid of the i-f tube.—Harold B. Cook, Wichita, Kans.

**Motorola Dual-Six.** When set howls and motorboats so badly that reception is impossible with the volume control turned on 3/4 full on local stations, do not waste any time making tests or realigning chassis as this will not remedy the trouble. The quickest way to remedy this trouble is to mount the speaker in a separate metal case. The trouble is caused by the speaker setting up mechanical vibration causing the tuning condenser to vibrate by moving the face of the plates. The tone is improved 50% by placing the speaker in a separate case.—E. D. Pernoff, Buffalo, N. Y.

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

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

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

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

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

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

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

For you servicemen who like the headaches and joys that go with building your own tube testers, follow are some of the tests built by Lewis C. Heise, Kensington, Kansas. Let's put Mr. Heise tell us in his own words about his tests.

"Since seeing in Volume 7, No. 10 of Sylvania News, 'Know Your Tube Tester' by Walter R. Jones, I can't stand it any longer and just have to send you a photo of my Tube and Radio Tester; a Vacuum Tube Voltmeter Tube Tester. It works entirely different from other Tube testers, surely tests the tubes, especially those trick tubes, uses no Neon bulb—uses a 6E5 in conjunction with meter—much more sensitive than Neon bulb.

"Tests each element separate. Also tests emission, shows target on 6E5 type tubes, tests cold rectifier and can test tubes without knowing number, or any new tube coming on the market. It is contained in a case 16 1/2 x 12 1/2 and weighs 21 1/2 pounds." Inquiries on this instrument should be addressed directly to Mr. Heise.
### Sylvania News

**TUBE LIMITS FOR TESTERS**

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

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

Tester manufacturers now have systems set up whereby tester limits are supplied when sufficient quantity of information is available. Some tester companies supply such data to their regular mailing list, whereas others supply it on request.

The owner of a tester should remember that to get the most out of his tester, he must have charts by tester manufacturers.

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

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**TUBING NEWS**

The October (X) Socket. Shows shorted at 5.

**TRIPELITE ELECTRICAL INSTRUMENT CO.**

**Model 210-A Tester**

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**Models 1502, 1503 Testers**

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**WESTON ELECTRICAL INSTRUMENT CORPORATION**

**Models 270, 271 Testers**

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**WESTON ELECTRICAL INSTRUMENT CORPORATION**

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<td>6Z7G</td>
<td>42 BC  1F</td>
</tr>
</tbody>
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**Notes:** **Use Socket “A”**.

**PRECISION APPARATUS CORPORATION**

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

**JACKSON ELECTRICAL INSTRUMENT COMPANY**


**BENDIX DAYRAD**

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