Sylvania News

January, 1945 EMPORIUM, PENNA. Vol. 11 No. 8

ANNOUNCING!

THE NEW SYLVANIA "AID TO WAR-TIME SERVICING" CHART

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FREE! FREE! FREE!

Months ago the editorial department started work on a new substitution chart as we realized that the small one published in the "News" from April to August 1943 was not complete enough for servicemen. There were many weeks when it looked as though it would not be completed before ample stocks of MR tubes were available. However, as explained by Bob Almy elsewhere in this issue, recent war developments and the resultant increase in military requirements mean that you servicemen can expect at least another six months of tube shortage and substitutions.

This new chart is too long to publish in the "News" as it consists of twenty pages 8½″ x 11″ size. There is a two-page article on resistor calculation for substitutions, fourteen pages containing over twelve-hundred separate substitution listings, and thirty-six adaptor circuit wiring diagrams for the more common substitutions.

This booklet is FREE. Get your copy from your Sylvania Distributor, or order direct from Sylvania Electric Products Inc., Emporium, Penna.

A REPORT ON ADAPTOR TROUBLE

We have heard complaints from a few servicemen that some adaptors sold with a resistor included in the base do not stand up. This resistor drops the voltage to that required by the suggested substitute tube and saves changing the circuit under the chassis. We believe it is an extremely difficult job to get a resistor small enough to place in the base which will be able to stand the heat required without overheating and shorting. A sample we saw had the resistance wire wound in the groove of the socket intended for the retaining ring and then coated with the cement used to hold the socket and base together. This seems like a very neat way to do the job and may work quite well if only 1 or 2 watts dissipation is required. In the sample we saw, 4 watts were being liberated in this space with the result that the insulation burned off and partially shorted the resistance. This is particularly bad because when initially installed in your shop all tube voltages will test OK but as soon as the customer has used it several hours consecutively, the short will occur and overload all tubes in the receiver (if it is the series type set) until the weakest one fails.

The only suggestion we have to offer is that when using adaptors which include the resistance, a heat run should be made on the test bench checking the voltages both before and after. Probably between 2 and 3 hours would be required to be reasonably sure they will stand up under average service.

WARNINGS ON TUBE SUBSTITUTIONS

This article is intended to assist radio servicemen in designing substitution circuits which require higher current tubes. Some circuits which we have seen recommended for this may cause trouble due to overheating. We hope the following article will help you avoid this type of trouble.

Taking the circuit of Fig. 1 as an example in which it is necessary to use a 25L6GT in place of the 50L6GT, we suggested in the July 1943 Technical Section that this be done as in Fig. 2. Here, the additional 150 milliamperes required for the operation of the 25L6GT (which is a 300 Ma. tube) is supplied by putting a shunt of 250 ohms around the three 12-volt tubes and a shunt of 233 ohms around the 35Z5GT. This makes the currents all in the correct proportion but another resistor R3 is required to bring the sum of the voltages up to normal line voltage. We believe this to be the best and not too difficult way to make the change.

This can, of course, be done by other methods, one of which is shown in Fig. 3.

We believe servicemen should be extremely reluctant to use this circuit because of the great amount of heat which may now be produced in some of the smaller sets. Unless this heat is released outside the cabinet, by use of a line cord resistor for instance, this would mean three times the heat in a small cabinet some of which were too hot to handle before. The change shown in Fig. 2 will release twice the normal heat and we recommended that the resistors be located as far as possible from condensers or other components which could be damaged easily.

Another possible way which is not recommended is shown in Fig. 4.

In this case there are no more watts to dissipate than in the method of Fig. 2. The objection is that the 12SQ7 and 12SA7 tubes are in parallel. Failure of either tube will cause the other to burn out almost immediately because the current will be doubled, which is many times worse than doubling the voltage.

The dotted connection sometimes added is of no assistance in preventing burnouts in a circuit like this.

Original and Recommended Circuits

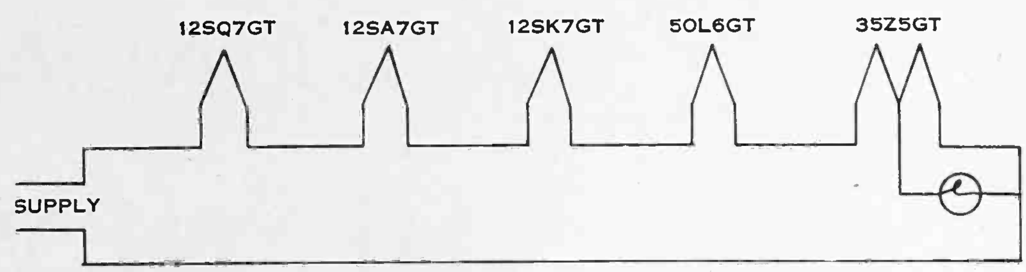


FIGURE 1

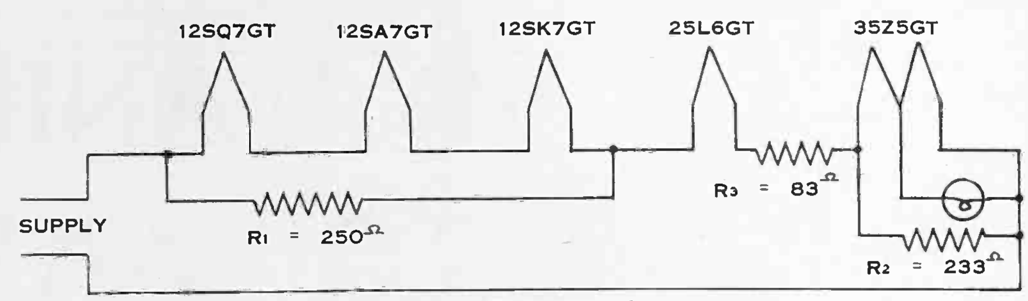


FIGURE 2

Circuits Not Recommended

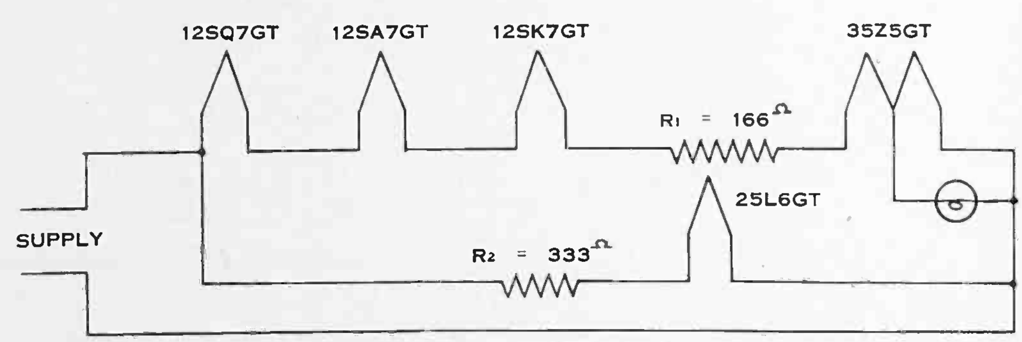


FIGURE 3

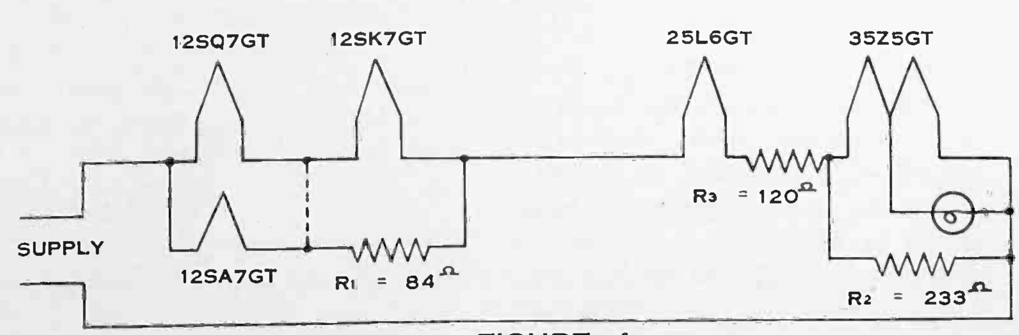


FIGURE 4

TUBE SUBSTITUTION PRECAUTIONS

The use of radio tube substitutions is becoming increasingly important to servicemen. There are certain precautions which should be observed. Be sure that the Tube Substitution Chart you follow takes into account the differences in heater current ratings which affect operation in series circuits, and are responsible for many of the troubles servicemen have experienced. Both the Sylvania old and the new charts have divided the types into battery, 150 Ma. and 300 Ma. groups so that there will be no mix up on this point. It may seem confusing to have the types separated in this manner, but any serviceman will realize how much it speeds up his work.

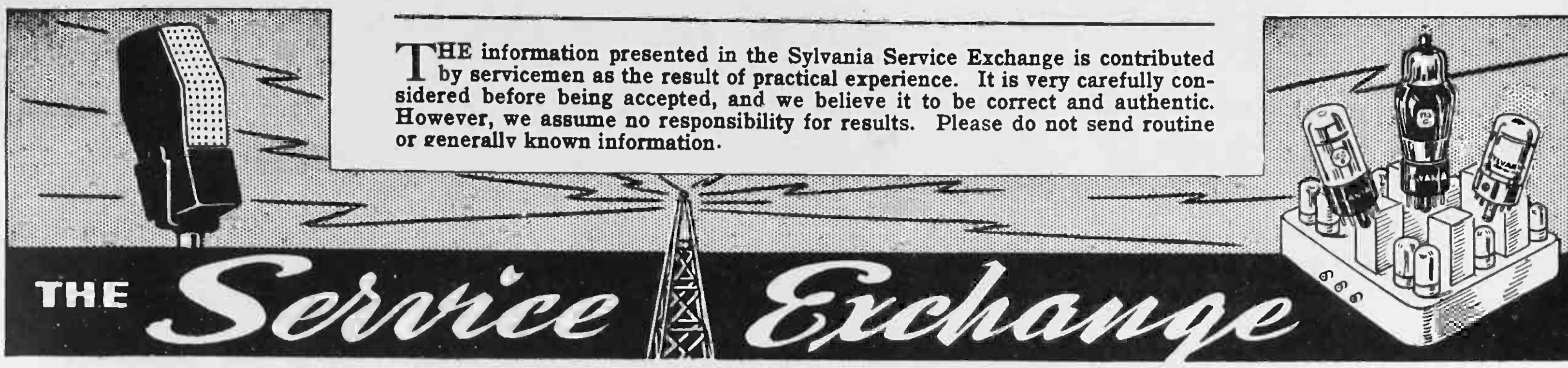
Listed below are a number of substitutions which may be made under certain conditions only.

THE FOLLOWING IS A LIST OF SUBSTITUTES SUGGESTED AND THE CONDITIONS UNDER WHICH EACH SHOULD NOT BE USED:

Type Req'd.	Substitutes	Precaution
1A5GT/G	1Q5GT, 1C5GT	Filament current higher—Do not use in series or in 2 & 3 way portables unless circuit is changed, or when filament supply is fed through a dropping resistor.
1A6	1C6	Filament current higher; ballast resistor may need adjusting.
1A7G	1B7GT	Filament current higher—Do not use in series or 2 & 3 way portables unless circuit is changed, or when filament supply is fed through a dropping resistor.
1B7G	1A7G	Filament current lower, should cause no trouble unless circuit is unusual.
1C5GT	1T5GT, 1A5GT	Filament current lower, should cause no trouble unless circuit is unusual.
1C6	1A6	Filament current lower, ballast resistor may require adjusting.
1C7G	1D7G	Filament current lower, ballast resistor may require adjusting.
1D7G	1C7G	Filament current higher. Ballast resistor may need adjusting.
1LB4	1LA6	Misprint. 1LA4 intended.
1Q5GT	1T5GT, 1A5GT	Filament current lower. Should cause no trouble unless circuit is unusual.
1T5GT	1Q5GT, 1C5GT	Filament current higher—Do not use in series or in 2 & 3 way portables unless circuit is changed, or when filament supply is fed through a dropping resistor.
6A8GT	6D8GT	Will burn out in AC-DC sets unless shunting resistor is used.
6AG5	6AK5	Will burn out in AC-DC sets unless shunting resistor is used.
6AK5	6AG5	No good in AC-DC sets unless all other tubes are shunted.
6B6G	6T7G	Will burn out in AC-DC sets unless shunting resistor is used.
6C5GT/G	6L5GT	Will burn out in AC-DC sets unless shunting resistor is used.
6D8G	6A8GT, 6J8G	No good in AC-DC sets unless all other tubes are shunted.
6J5GT/G	6L5GT	Will burn out in AC-DC sets unless a shunting resistor is used.
6J7GT	6W7G, 6S7G	Will burn out in AC-DC sets unless a shunting resistor is used.
6J8G	6D8G	Will burn out in AC-DC sets unless a shunting resistor is used.
6K7GT	6S7G, 6W7G	Will burn out in AC-DC sets unless a shunting resistor is used.
6L5G	6J5G, 6C5G	No good in AC-DC sets unless all other tubes are shunted.
6Q7GT	6T7G/6Q6G	Will burn out in AC-DC sets unless a shunting resistor is used.
6S7G	6K7GT, 6U7G	No good in AC-DC sets unless all other tubes are shunted.
6SJ7GT/G	6SS7	Will burn out in AC-DC sets unless a shunting resistor is used.
6SK7GT/G	6SS7	Will burn out in AC-DC sets unless a shunting resistor is used.
6SR7GT	6ST7	Will burn out in AC-DC sets unless a shunting resistor is used.
6SS7	6SK7, 6SJ7GT	No good in AC-DC sets unless all other tubes are shunted.
6ST7	6SR7GT	No good in AC-DC sets unless all other tubes are shunted.
6T7G	6B6G, 6Q7G	No good in AC-DC sets unless all other tubes are shunted.
6U7G	6S7G, 6W7G	Will burn out in AC-DC sets unless a shunting resistor is used.
6W7G	6J7GT, 6K7GT	No good in AC-DC sets unless all other tubes are shunted.
7A7	7B7, 7C7	Will burn out in AC-DC sets unless a shunting resistor is used.
7A8	7B8, 7S7, 7B7	No good in AC-DC sets unless all other tubes are shunted.
7B6	7C6	Will burn out in AC-DC sets unless a shunting resistor is used.
7B7	7A7	No good in AC-DC sets unless all other tubes are shunted.
7B8	7A8	Will burn out in AC-DC sets unless a shunting resistor is used.
7C6	7B6	No good in AC-DC sets unless all other tubes are shunted.
7C7	7A7	No good in AC-DC sets unless all other tubes are shunted.
7J7	7A8	Will burn out in AC-DC sets unless a shunting resistor is used.

Many of the types which are listed for use with adaptors will give similar trouble in series circuits, but since the basing connections will have to be looked up to make the adaptor, most servicemen would notice that the current is different so there is less chance of making a mistake.

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. Please do not send routine or generally known information.



Intermittent Oscillation of 12SK7 I-F Amplifier Tube was caused by poor connection between metal shell and #1 pin. Tube tested OK so I put a metal shield (type used on GT bantam tubes) over 12SK7 scraping the metal base if necessary to get a good contact and soldered a lead from the shield to chassis (or B- if chassis is above ground).—Al Santmier, Jr., Dolgeville, N. Y.

* * *

Motorola (Galvin 3A5.) Intermittent operation. With the set out of its case it functioned well but when returned to the case the set would go dead in about 20 minutes or so. Would play well again when removed from the case and after standing for a while. This action was cyclical and the cause was finally traced to the 4.7 megohm resistor in the screen grid lead of the 1S5 Det., a-v-c tube. If the multimeter test leads are placed across this unit when the set cuts out the chances are that the resistance of the meter will cause the set to start up again.—George D. Fowle, Philadelphia, Pa.

* * *

Philco 37-650, 37-670. A loud intermittent crackling which shows up after set is in operation about 10 minutes is due to defective R-F coil part #32-2105. This defect is found by isolating the noise in the R-F stage by removing the grid cap of either the 6K7G RF or 6A8 Det. Osc. A resistance measurement of the coil primary usually shows an increase of about 70 ohms over the original value of 130 ohms.—Leonard D. Chioma, Tarrytown, N. Y.

* * *

I find it a big help to have a tab for the circuit section of the Sylvania Manual. I just cut a piece of the same thin red card that the index tabs come attached to, and paste it on Page 246 between the spaces for the Supplement and the Tube Dimensions.—Wm. H. Newman, Los Angeles.

* * *

Philco #41-608-609. Radio section and short wave section played good, but phono section was weak. You would naturally think of a new cell or a new bulb if they were set up right. Replacing Type 7Y4 with a new one will give surprising results.—Alpheus Rounds, Philadelphia, Penna.

Crosley Models 62TA, Chassis 37. I have found in several of these sets that when distortion occurs after a few minutes operation, it is usually caused by leakage between the windings of the 1st I-F transformer, due to heat from the 35Z5 tube located next to it. The best remedy is to replace with a new transformer, but if none is obtainable, remove the coil from the can and coat with several layers of high-Q coil dope. Replace coil, and around the outside of the can, fasten a strip of asbestos with service cement. Allow the set to warm up for a few minutes, realign the I-F's carefully, and the trouble will be permanently eliminated. I have tried several different ways to remedy this trouble, but have found that the above described procedure is best for a permanent and satisfactory repair.—Arthur L. Johnson, Hutchinson, Kansas.

* * *

A Type 6F6G tube may be substituted for a 6AC5GT/G by tying the plate and grid together.—Andrew Janus, McKees Rocks, Penna.

* * *

Who has not had trouble with the Zenith tabs that hold the station identifications from falling out and disappearing? If you will slightly bend in the bottom edge, you will find that they will fit tight. By trial you can determine the correct amount to bend in.—C. A. Vaughn, Los Angeles, Calif.

* * *

RCA Model 5Q56. Fading in this model is often due to an intermittently open condenser, C-21 on the diagram, connected between the arm of the volume control and the grid of the 6SQ7 second detectors. By pulling condenser gently towards the rear of the set, defect will show up. Correct value is .005 mfd. Another common offender in this model is the screen grid bypass C-17 of .1 mfd. capacity.—Walter D. Cummings, Pittsburgh, Penna.

* * *

Zenith 8S432 Chassis 5810. Resistors R-8 (268 ohm units in series) are shown on the schematic to connect between the 6K7G IF tube cathode and B plus. They should be connected between the cathode and B negative.—Walter D. Cummings, Pittsburgh, Penna.

Emerson, AC-DC. Customer reported that when set was plugged in all lights on circuit went out due to fuse blowing. Inquiry developed that customer was on DC service and examination showed insulation on antenna lead under chassis had deteriorated due to heat and age shorting to chassis. Defect would not show up on AC operation. Installed new antenna lead protected by spaghetti and no further trouble in either case, one in service for some time.—Marcus H. Moses, New York City.

* * *

Philco AR-10 Auto Radio. Intermittent reception in this model may be caused by a defective .004 mfd. condenser (#33) which is connected from the grid of the 7C6 second detector to the volume control.—OK Radio Service, Dover, Pa.

* * *

Grunow 11G Noisy Reception. I have found that in several of this particular model a sporadic noise exists which is very difficult to locate. The noise is especially bad when the 6A8 converter tube is tapped, which would seem to indicate a defective tube. When several new tubes are tried and the trouble persists, replace the socket with a molded type and the noise will be cleared up. It seems that some of the wafer type sockets used in this set are held together by two rivets, and after some time they become conductive sufficiently to partially ground the oscillator grid and other elements through the rivets, thus resulting in erratic and noisy operation.

A similar noise in this set can also come from the r-f transformer. Examine this transformer carefully for indications of electrolysis, which corrodes the winding (primary) and causes the raspy reception. Replace with new coil, or remove old primary winding from coil, carefully clean and rewind with same size wire as removed. A coating of coil dope over and inside the coil will prevent recurrence of the trouble.—Arthur L. Johnson, Hutchinson, Kansas.

* * *

Philco 71. Distortion in this model is often caused by an increase in resistance of the 70,000 ohm detector plate resistance (#34). I have found these resistors to test between 1 and 2 megohms.—J. S. Gold, Glenside, Pa.

Sylvania News

February, 1945 EMPORIUM, PENNA. Vol. 11 No. 9

NEW POSITIONS FOR SYLVANIA EXECUTIVES

R. M. Wise and W. R. Jones Elevated To New Administrative Posts

The following changes within the Sylvania engineering organization were announced recently and will be of interest to our readers because both Mr. Wise and Mr. Jones have been frequent contributors to the "News", and from June 1942 to January 1945, Mr. Jones has been Associate Technical Editor, but because of the pressing duties of his new appointment he will delegate this assignment to others. We hope, however, that he will be able to take a few minutes occasionally to write us a paragraph on industry trends and their probable effect on your service business.

ROGER M. WISE ELECTED VICE-PRESIDENT IN CHARGE OF ENGINEERING

Mr. Roger M. Wise, formerly Director of Engineering, was elected Vice President in Charge of Engineering by the Board of Directors at its meeting December 19, 1944. Under the direction of Mr. Wise, Sylvania's engineering and research staff pioneered in the development of the 6.3 volt AC-DC type radio tube used in automobile radios, the equally important 1.4 volt tube used in battery sets and now the basis of much of the walkie-talkie military inter-communication systems, and the famous Lock-In type tube.

Mr. Wise came with the Company in 1929 as Chief Engineer of the old Sylvania Products Company then located in Emporium. Shortly after the formation of Hygrade Sylvania in 1931, he became Chief Engineer of the Company's radio division and in 1942 became Director of Engineering and a member of the Management Committee. In 1939 he visited Europe studying methods used there in radio tube manufacture and sale.

He spent two years with the Navy during World War I and helped install radio equipment on the four-motored flying boat NC-4 which made the first trans-Atlantic flight in May, 1919. In the course of this work he redesigned the inter-communication system introducing the now familiar speak-push button which superseded at that time the open line with its resultant noises from all microphones.

He is a member of Tau Beta Pi, a Fellow of the Institute of Radio Engineers, Radio Club of America and is active in RMA work. A son, Roger Jr., is a sergeant in the Army Air Corps now overseas. Mr. Wise makes his home at 7 Gracie Square in New York City and has offices at 500 Fifth Avenue, New York City.

ROGER M. WISE

WALTER R. JONES

WALTER R. JONES NEW GENERAL ENGINEERING MANAGER

Well Known To Radio Servicemen Throughout Country

Mr. Walter R. Jones, formerly Manager of Commercial Engineering, has been appointed to the newly-created post of General Engineering Manager, Radio Tubes. In this position, he will report to Mr. Roger M. Wise, and will have the direction of the engineering program for radio tubes including the design and development, commercial engineering, chemical, mechanical and standardizing section.

Walt Jones joined Sylvania in 1929 to set up its sales engineering laboratory; he directed extensive research on quality and customer use of tubes and inaugurated schools for radio servicemen throughout the United States which have made Sylvania a leader in the radio dealer field. He has spoken on radio subjects in all but one of the 48 states and is a Senior Member of the Institute of Radio Engineers and a Fellow of the Radio Club of America. He is a graduate of Cornell University, is married and has two sons and a daughter.

TYPE 7F8 LOCK-IN DOUBLE TRIODE

PHYSICAL SPECIFICATIONS

Style	Lock-In
Base	Lock-In 8-Pin
Bulb	T-9
Diameter	1 3/16" Max.
Overall Length	2 1/2" Max.
Seated Height	1 1/2" Max.
Mounting Position	Any

BASE PIN CONNECTIONS

	Section
Pin 1—Grid	2
Pin 2—Heater	
Pin 3—Plate	2
Pin 4—Cathode	2
Pin 5—Cathode	1
Pin 6—Plate	1
Pin 7—Heater	
Pin 8—Grid	1

RMA Basing—No. 8-BW-L-O

RATINGS AND CHARACTERISTICS

Heater Voltage (Nominal) AC or DC	7.0 Volts
Heater Current (Nominal)	0.320 Ampere
Maximum Plate Voltage	300 Volts
Maximum Plate Dissipation (Per Section)	3.5 Watts
Minimum External Control Grid Bias Voltage	0 Volt
Maximum Heater Cathode Voltage	300 Volts

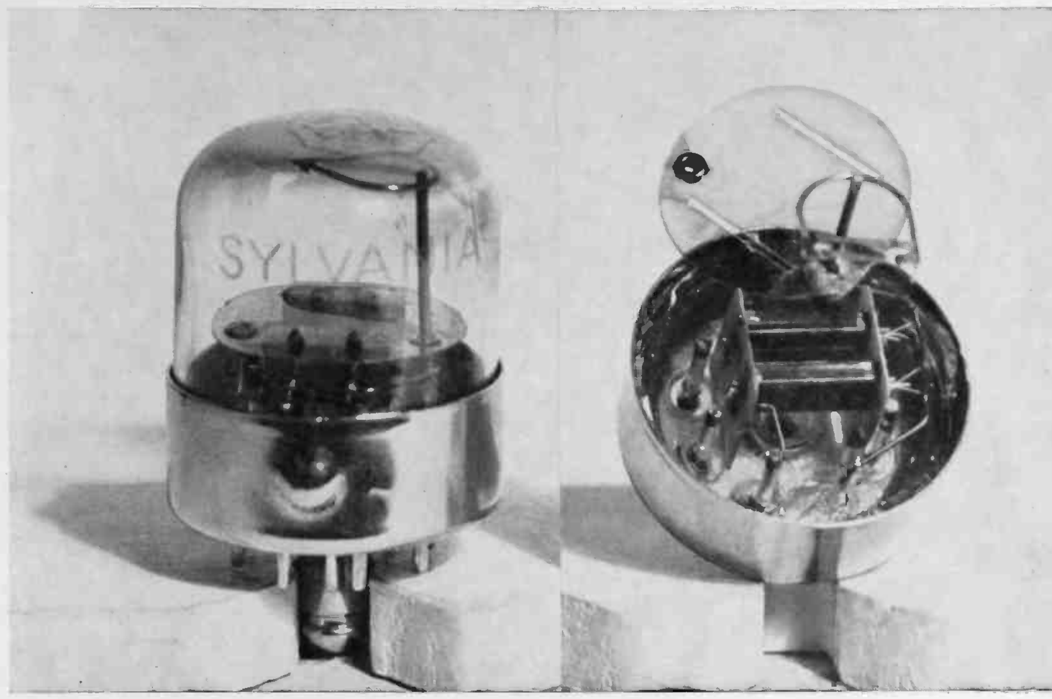
DIRECT INTERELECTRODE CAPACITANCES:* (Per Section)

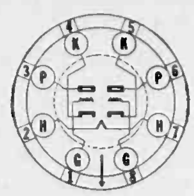
Cgp	1.2 μμf.
Cin	2.8 μμf.
Cout	1.8 μμf.
Grid to Grid	0.04 μμf.
Plate to Plate	0.30 μμf.
Heater to Cathode	3.6 μμf.

*With 1 5/16" diameter shield (RMA Std. M8-308) connected to cathode.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
(Per Section Except Heater)

Heater Voltage (AC or DC)	6.3	6.3	Volts
Heater Current	0.300	0.300	Ampere
Plate Voltage	180	250	Volts
Grid Voltage	−1.0	−2.5	Volts
Plate Current	12	10	Ma.
Mutual Conductance	7000	5000	μmhos
Amplification Factor	60	52	
Grid Voltage for 25 uAdc Ib	−7.0	−10.0	Volts
Grid Voltage for 1.0 uAdc (Max.) Ib	−20	−25	Volts





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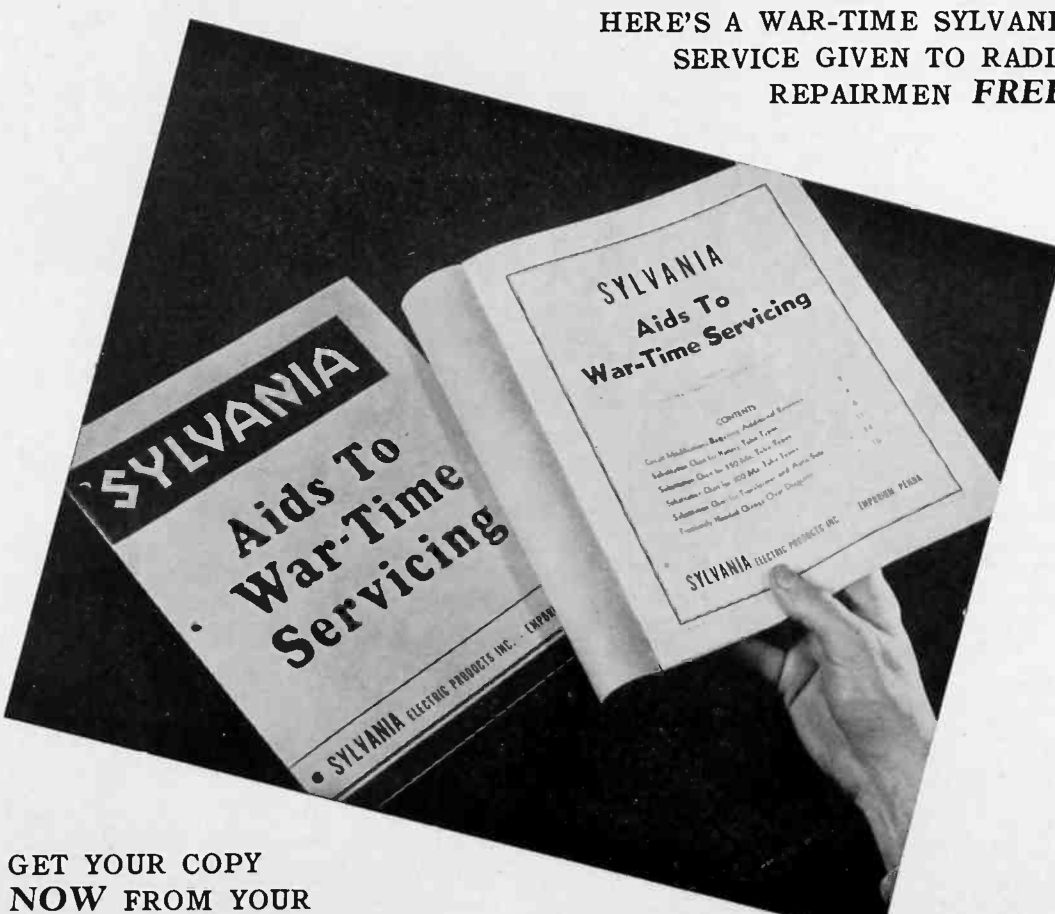
CIRCUIT APPLICATION

Sylvania Type 7F8 is a high mutual conductance double triode designed for use at frequencies up to 300 or 400 Mc.

With proper precautions the two sections may be used separately to effect savings in space and number of tubes required for a given performance since all the elements except the heaters are independent. The cascade operation thus made possible is useful in u-h-f grounded grid and cathode follower amplifier service. It may also be used as a high frequency converter or as a push-pull u-h-f amplifier.

SYLVANIA'S "AIDS TO WAR-TIME SERVICING" MANUAL ENTHUSIASTICALLY RECEIVED BY SERVICEMEN



GET YOUR COPY NOW FROM YOUR SYLVANIA DISTRIBUTOR.

HERE'S A WAR-TIME SYLVANIA SERVICE GIVEN TO RADIO REPAIRMEN *FREE!*

So enthusiastically has the "Aids to War-Time Servicing" booklet been received by servicemen and dealers that Sylvania is already in its second printing and indications are that a possible third printing will be needed.

Sylvania is, of course, pleased with your acceptance of this booklet, and feels confident that its contents will help your present day radio repair problems. The coverage of the booklet includes circuit modifications requiring additional resistors, substitution chart for battery tube types, substitution chart for 150 MA. and 300 MA. tube types, substitution chart for transformer and auto sets, and frequently needed change over diagrams.

This list is intended to be complete and reliable, but should not be followed blindly as many unusual circuits may be found which do not respond to any general treatment.

Here is another Sylvania service given FREE to radio servicemen and dealers. Get your "Aids to War-Time Servicing" booklet from your Sylvania distributor, or write to Sylvania Electric Products Inc., Advertising Department, Emporium, Pennsylvania.

WALKIE-TALKIES FOR EVERYONE?

As most of you know, the Radio Technical Planning Board (RTPB) was organized in September 1943 to submit a new plan for more efficient use of all radio channels and to provide "ether" space for the new developments which could be seen in the not too distant future. This board was organized at the request of the Radio Manufacturers Association and the Institute of Radio Engineers and is made up of members appointed by them as well as by similar associations, such as the American Radio Relay League, National Association of Broadcasters and others. This board was divided into thirteen committees, called panels, to study the needs of the various services.

Courtesy of Radio-Craft Magazine.
'Chuck de jewels, Spike and get dat 12SA7 outta da midget!"

The recommendations of the RTPB were based largely on the technical aspects of the problem such as band width, interference, coverage, etc., while the F.C.C. was to apportion the available frequencies among the various services. This Commission has now issued a Proposed Allocation Report based on the recommendations of the RTPB, the military requirements and on hearings held in Washington from September 28 to November 2, 1944. There will be further hearings and final ratification will require an international agreement but most of the allocations will probably not be changed and many will be of interest to servicemen. Some of you will be interested in the amateur assignments, others in the television bands and so on, but we believe you will all be interested in one new application which is called a "Highlight", the Civilian Walkie Talkie Service.

There have been illustrated articles on this in several non-technical publications which may arouse consumer interest, so we are quoting the following paragraphs directly from the F.C.C. report to give you as much information as possible to answer any inquiries from your customers.

THE F. C. C. PROPOSAL

"The development of light-weight portable short-range radio communications equipment of the "walkie-talkie" type has opened the door to a large variety of new private applications of radio. The success of such communications on the battlefront has been followed by many suggestions for peacetime use of low-power portable transceivers in the cities, on the highways, and in rural areas. To make possible the fullest practicable development of private radio communications within the limits set by other demands for assignments in the spectrum, the Commission on its own motion proposes to allocate the band from 460 to 470 Mc. to a new "Citizens Radiocommunication Service.

VARIED USES FOR "WALKIE-TALKIES"

"The possible uses of this service are as broad as the imagination of the public and the ingenuity of equipment manufacturers can devise. The citizens radiocommunications band can be used, for example, to establish a physicians' calling service, through which a central physicians' exchange in each city can reach doctors while they are enroute to their cars or otherwise not available by telephone. Department stores, dairies, laundries and other business organizations can use this service in communicating to and from their delivery vehicles. Similarly, it can be used in communicating to and from the trucks, tractors, and other mobile units operating in and around large industrial plants and construction projects—many of which spread over a number of square miles. It can be used on farms and ranches for communications to and from men in the fields; on board harbor and river craft; in mountain and swamp areas, etc. Sportsmen and explorers can use it to maintain contact with camps and to decrease the hazards of hunting, fishing, boating and mountain climbing. Citizens generally will benefit from the convenience of this service of utilizing two-way portable radio equipment for short range private service between points where regular communication facilities are not available. During emergencies when wire facilities are disrupted as a result of hurricane, flood, earthquake, or other disaster, the service, as has been demonstrated by the amateur service, will be of inestimable value.

"Common carrier operation in the Citizens Radiocommunication band will not be permitted, and no charge can be made for transmission of messages or use of the licensed facilities. The service will thus be for the private use of the licensee who will be responsible for the use of the facilities under the regulations to be promulgated by the Commission.

"The 460-470 Mc. band which the Commission proposes to allocate for this service is essentially adapted to short-range communications, and as such, is admirably suited to the uses proposed. The rules will permit the use of "booster" or automatic relay installations where necessary. It is anticipated that most transmitters on this band will be of low power and will not utilize extreme antenna heights. Higher power may be permitted in rural areas where no interference will result.

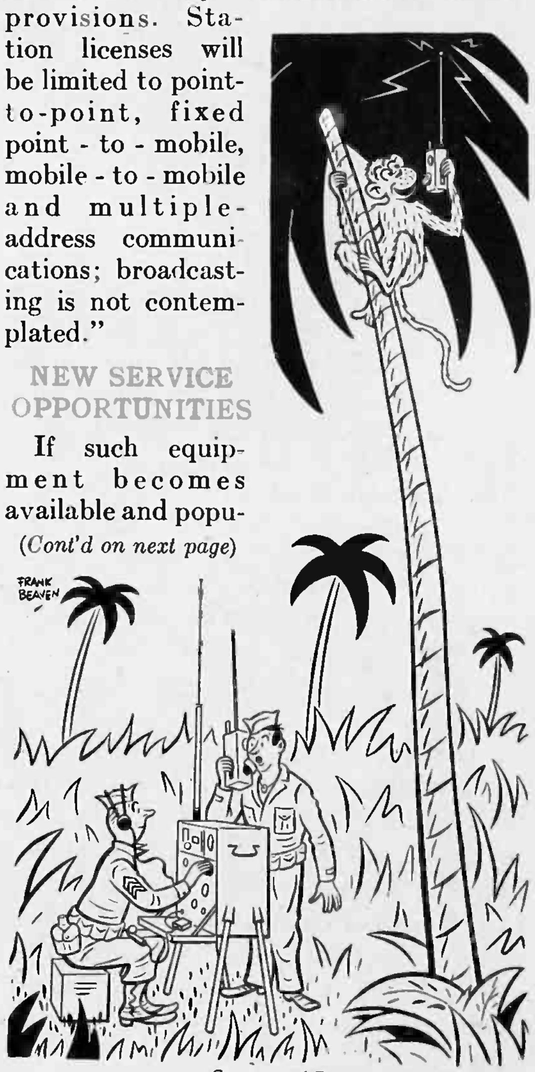
"The design of equipment for use in the citizens radiocommunication band should challenge the ingenuity of radio designers and engineers. A combination transmitter and receiver of reasonable weight can no doubt be mounted in a suitcase; a broadcast receiver, an alarm system, remote control systems, and other devices can perhaps be added to meet particular needs. By keeping the rules and regulations at a minimum, the Commission hopes to encourage ingenuity in design and in utilization.

"The essence of this new service is that it will be widely available. Accordingly, only the minimum requirements of the Communications Act plus a few minimum traffic rules will be set up. Operator licenses will be granted only to citizens of the United States. To procure such a license, an applicant need only show familiarity with the relevant portions of the Communications Act and of the simple regulations governing this service. No technical knowledge will be required. It is hoped that the license can be in the form of a small card, with the operator's license on one side and the station license on the other, and that these will remain in force for five years with simple renewal provisions. Station licenses will be limited to point-to-point, fixed point - to - mobile, mobile - to - mobile and multiple-address communications; broadcasting is not contemplated."

NEW SERVICE OPPORTUNITIES

If such equipment becomes available and popu-

(Cont'd on next page)



Courtesy of Radio-Craft Magazine.
It sounds Japanese, but I can't make out what he's saying.

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. Please do not send routine or generally known information.

THE Service Exchange

While this is not a Service Hint, I believe it will be interesting to servicemen. Owing to the gas rationing, with resulting few and short trips, I had trouble keeping my car battery charged until I hooked the radio up to operate as a trickle charger also. I broke the circuit between the rectifier filament and the choke, running the two wires into my basement garage. The wire from the filament goes to the positive terminal of the battery. A D.P.D.T. switch can be arranged to disconnect the leads to the battery and close the radio circuit when the car is out. One charging lead should go to the frame and the other to the terminal on the battery side of the generator cut-out. The trickle-charge rate will be about 100 Ma. and the six or 8-volt drop will not be noticeable in your radio reception. —H. W. Greer, Bradford, Pa.

Editor's Note: There would seem to be some danger of shock when using this circuit since the whole car would be about 300 volts above ground. Perhaps breaking the negative lead at the transformer HV center tap would be better since this will only be a few volts off ground. We do not recommend this for use on AC-DC sets.

* * *

Instead of putting up with a messy oil can on the bench get a small square bottom bottle with eye dropper and screw top. This makes a perfect means for oiling condenser gangs, volume control shafts, push button contacts, etc.—A. S. Magee, Bethesda 14, Md.

CORRECTION

Our attention has been called to a mistake in the circuit of Fig. 3 on Page 4 of the last issue. The value of R1 should be 333 ohms since a drop of 50 volts at 150 Ma. is required. This particular circuit was shown only as an example of a not recommended method so we hope it has not caused anyone trouble. Thanks again to those alert servicemen who noticed this and called it to our attention.

YOUR WAR-TIME SERVICE EXCHANGE IDEAS ARE A BIG HELP TO SERVICEMEN

Over the years the service exchange page has been very popular with our readers. New and easier ways of repairing radios has been the purpose of this page, and your contributions have gone far in aiding fellow servicemen with perplexing problems.

Today especially, here is a greater need for your contributions of ideas, and because of the lack of critical replacements you servicemen are resorting to ingenious methods of handling problems that once were of a cut-and-dried nature.

Sylvania News would appreciate hearing from you, and learning of your ideas. You will be doing a service in contributing your theories on how or how not certain work should be done for best results.

Address your material to Sylvania News, Sylvania Electric Products Inc., Emporium, Pennsylvania.

A Type 6F6G tube may be substituted for a 6AC5GT/G by tying the plate and grid together.—Andrew Janus, McKees Rocks, Penna.

Philco 1942 Automatic Record Changer. On this model irregular tripping at end of records is often caused by rubber snubber under moving contact sticking to contact and not allowing it to roll as it should. Remove all of this snubber and then check adjustments.—Sam Slymen, Los Angeles, California.

* * *

Emerson Model FV. If this set is dead on AC but the 117Z4GT tests OK, the trouble is probably in the female socket spring of the A-C receptacle mounted on the chassis. This has a spring shaped like the figure 7 which must make contact in order to complete the filament circuit. —E. L. Maneval, Wilkes-Barre, Pa.

* * *

Emerson Model FV. If this model cuts off and on or is very noisy on battery operation, one very probable cause is dirty contacts on the male plug which fits into the receptacle on the back of the chassis. Actual contact is made on the edges not on the flat surface so may easily be overlooked.—E. L. Maneval, Wilkes-Barre, Pa.

* * *

Philco Model 610. To improve the oscillator action at 6.0 M.C. remove resistor #17, (51,000 ohms) and #18 (25,000 ohms) and add a 32,000 ohm resistor from switch terminal side of condenser #7 to ground, also a 20 ohm resistor is connected from 6A7 cathode to ground.—M. S. Planovsky, Cleveland, Ohio.

WALKIE TALKIES FOR EVERYONE

(Continued from page five)

lar the servicing of them will become a large addition to the service business. This band is wide enough so that for telephone service over 3000 non-interfering channels will be available and since the range will be limited to a few miles there could be millions of such sets. You can see how far-sighted the plan is behind the reservation of this special frequency band.

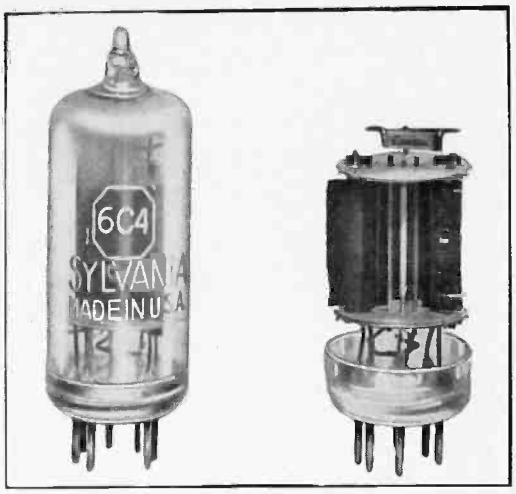
In order to avoid any possible misunderstanding however, we should mention the following points. Even if the Government sells as "surplus equipment" some of the "Walkie-Talkies" which are at present being used by the Armed Forces, these do not operate on the frequencies assigned for civilian service and it would be practically impossible to convert them to that service. The frequencies assigned have, to the best of our knowledge, not yet been employed by any portable equipment, and only very high cost tubes are, at present, rated for operation in this range. These frequencies are also too low for the special high frequency developments of the war which can be vaguely referred to only as "velocity-modulated tubes" and "magnetrons" or by such trade names as "klystrons" and "lighthouse tubes" on which you are all waiting impatiently for more information. This band is too high in frequency for conventional tubes, but the short leads of the Lock-In construction and the fact that many Lock-Ins are being used in similar service even if at lower frequencies lead us to believe that tubes similar to Lock-Ins in structure may give acceptable performance in this region.

We do not know how soon such equipment can be made available after the war, but we will keep you in touch with new developments so that you will be prepared.

MARCH, 1945 — EMPORIUM PENNA. — Vol. 11, No. 10

THREE NEW SYLVANIA TUBE TYPES

TYPE 6C4 — HIGH FREQUENCY POWER TRIODE



SYLVANIA TYPE 6C4

PHYSICAL SPECIFICATIONS

Style	Miniature
Bulb	T-5½
Diameter	¾" Max.
Overall Length	2⅛" Max.
Seated Height	1⅞" Max.
Mounting Position	Any

PIN CONNECTIONS

Pin 1	Plate
Pin 2	I. C. Do not use.
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Grid
Pin 7	Cathode
Basing	6-BG-0-0

RATINGS AND CHARACTERISTICS

Heater Voltage	6.3 Volts
Heater Current	0.15 Ampere
Maximum Plate Voltage	300 Volts
Maximum Plate Dissipation	5.0 Watts
Maximum Heater Cathode Voltage	90 Volts
Direct Interelectrode Capacitances:*	
Grid to Plate	1.6 μμf.
Input	1.8 μμf.
Output	1.3 μμf.

*With no external shield.

OPERATING CONDITIONS AND CHARACTERISTICS

	Class A1 A-F Amp.			R-F Osc. Amp. Class C
Plate Voltage	100	250		300 Volts Max.
Grid Voltage	0	−8.5	(1)	−27 Volts Max.
Plate Current	11.8	10.5		25 Ma. Max.
Grid Current (approx.)	—	—	(2)	7 Ma. D. C.
Amplification Factor	19.5	17		—
Plate Resistance	6250	7700		— Ohms
Transconductance	3100	2200		— μmhos
Plate Dissipation	—	3.5		5.0 Watts Max.
Driving Power (approx.)	—	—		0.35 Watts
Power Output	—	—		5.5 Watts

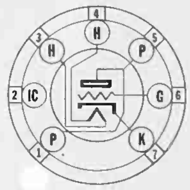
(1) Maximum grid circuit resistance 0.25 megohm with fixed bias; 1.0 megohm with self bias. Maximum Voltage −50.

(2) Maximum D-C grid current 8 Ma.

CIRCUIT APPLICATION

Sylvania Type 6C4 is a miniature high-frequency oscillator or amplifier. Its small size and high efficiency make it particularly useful in compact light weight portable equipment.

When used as an oscillator with 10,000 ohms grid leak, it will deliver approximately 2.5 watts at 150 megacycles and up to 5.5 watts at moderately high frequency with maximum rated input. For still higher frequencies, other Sylvania types such as 6J6, 7F8 and 7G8 employing the push-pull principle will give higher efficiency. For higher power at lower frequencies, Sylvania Type 7A4 may be employed.



Tube base diagram viewed from bottom of base

6-BG

TYPE 7K7 — DUO-DIODE HIGH-MU TRIODE

(With Diode Cathode Separate From Triode)

PHYSICAL SPECIFICATIONS

Style	Lock-In
Base	Lock-In 8-Pin
Bulb	T-9
Diameter	1 3/16"
Seated Height	2¼"
Overall Length	2 25/32"
Mounting Position	Any

BASE PIN CONNECTIONS

Pin 1	Heater
Pin 2	Triode Cathode
Pin 3	Triode Plate
Pin 4	Triode Grid
Pin 5	Diode Plate No. 2
Pin 6	Diode Plate No. 1
Pin 7	Diode Cathode & Shield
Pin 8	Heater
RMA Basing	8-BF-0-7

TENTATIVE RATINGS AND CHARACTERISTICS

Nominal Heater Voltage (ac or dc)	7.0 Volts
Nominal Heater Current	0.32 Amps.
Maximum Plate Voltage	250 Volts
Maximum Diode Drop for 0.8 Ma.	10 Volts
Maximum Heater Cathode Voltage	90 Volts
Maximum Plate Dissipation	1 Watt
Minimum External Grid Bias	0 Volt
Direct Interelectrode Capacitances:*	
Grid to Plate	1.8 μμf.
Input	2.6 μμf.
Output	3.0 μμf.
Diode 1 to Grid 1	0.01 μμf.
Diode 2 to Grid 1	0.10 μμf.

*With 1 5/16" diameter shield (RMA Std. M8-308) connected to cathode.

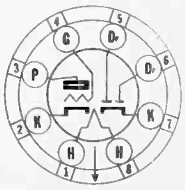
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

Heater Voltage (ac or dc)	6.3 Volts
Heater Current	0.3 Amp.
Plate Voltage	250 Volts
Grid Bias	−2.0 Volts
Amplification Factor	70
Plate Resistance (Approx.)	44,000 Ohms
Transconductance	1600 μmhos.
Plate Current	2.3 Ma.

CIRCUIT APPLICATION

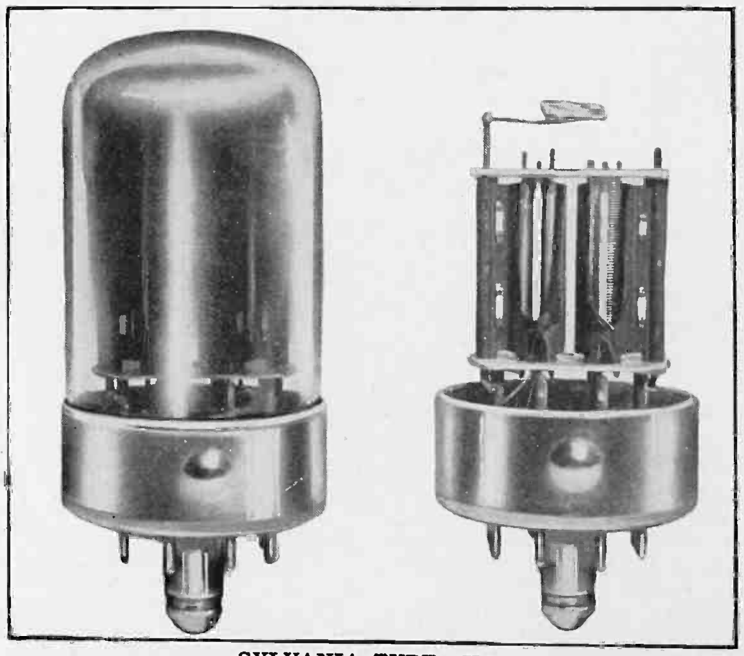
Sylvania Type 7K7 is a duo-diode high-mu triode differing from the usual diode-triode by having two separate cathodes, one for the triode and the other for the diodes. This difference permits the tube to be used as a discriminator.

The characteristics of the triode unit are identical with those of one section of Sylvania Type 7F7. The cut-away view shows that although the construction looks like a duo-triode the second plate is really a shield around the two diodes.



8-BF

Tube and base diagram viewed from bottom of base



SYLVANIA TYPE 7K7

TECHNICAL SECTION INDEX FROM VOL. 8, NO. 11 THROUGH VOL. 11, NO. 10

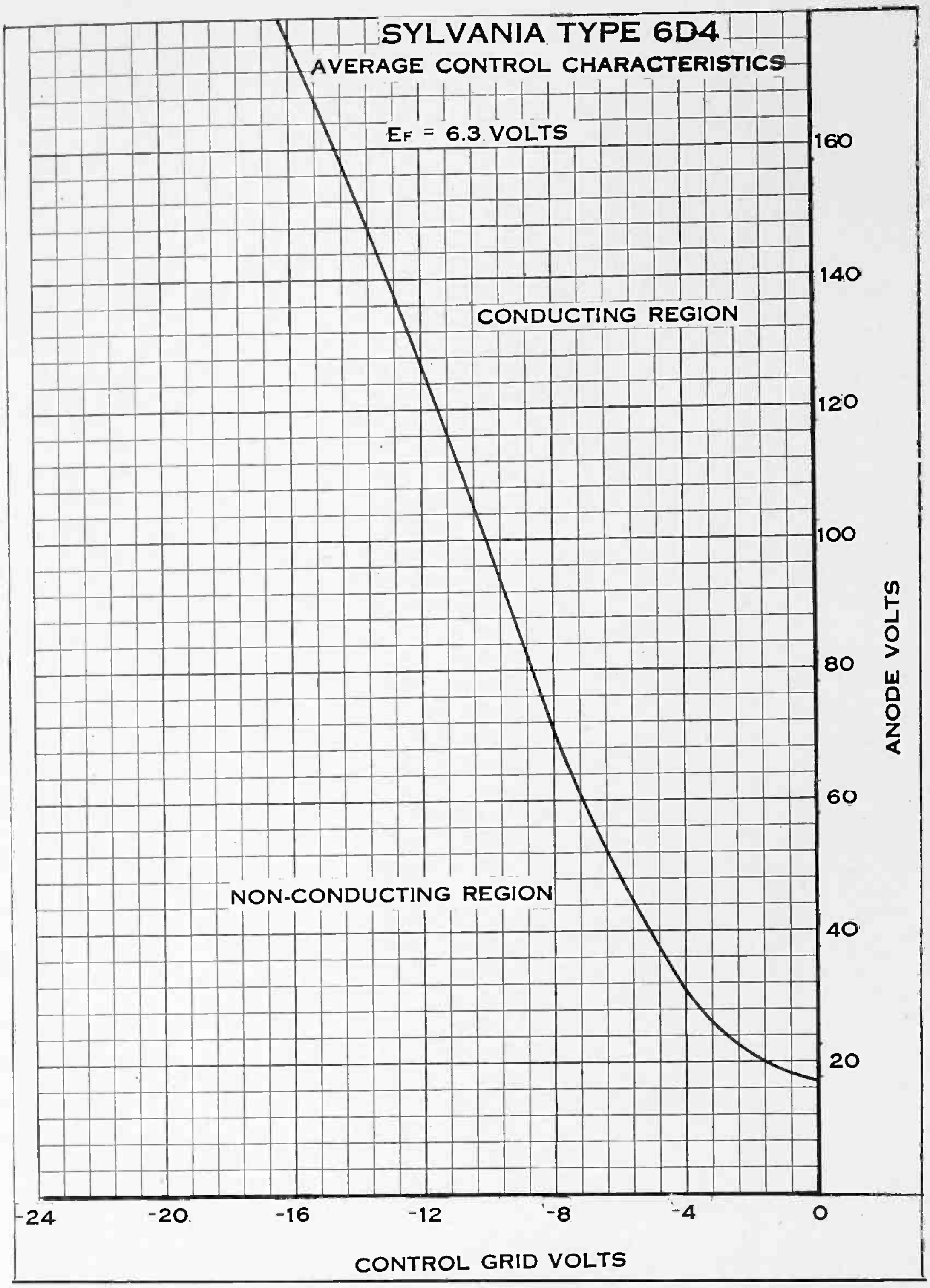
Every few years we take the time and space necessary to index the articles in the preceding issues for the convenience of those servicemen who keep their copies on file. Those of you who are not doing so may take the hint knowing that an index will be available as soon as the accumulated issues justify making one. Back copies are only available as a complete file with binder which may be obtained for $1.00.

ARTICLES

SERVICE HINTS

By Makes of Receivers

TYPE 6D4 MINIATURE THYRATRON



PHYSICAL SPECIFICATIONS

Style	Miniature
Base	Min. Button 7-Pin
Bulb	T-5½
Diameter	¾" Max.
Seated Height	1⅞" Max.
Overall Length	2⅛" Max.
Mounting Position	Any

BASE PIN CONNECTIONS

Pin 1	Grid
Pin 2	No Connection
Pin 3	Heater
Pin 4	Heater
Pin 5	Cathode
Pin 6	No Connection
Pin 7	Plate
RMA Basing	5AY-0-0

RATINGS AND CHARACTERISTICS

Heater Voltage	6.3 Volts
Heater Current	0.250 Ampere
Maximum Voltage between Elements	450 Volts
Heating Time*	30 Seconds
Peak Anode Current (Max.)	100 Ma.
Maximum Heater-Cathode Voltage	−100 Volts +25 Volts

*Heater voltage must be applied at least 30 seconds before application of anode voltage to allow the cathode to reach operating temperature.

TYPICAL OPERATING CONDITIONS

Relay and Grid Controlled Rectifier Service

Heater Voltage (AC or DC)	6.3	6.3 Volts
Heater Current	0.250	0.250 Ampere
Anode Voltage	50	125 Volts
Grid Voltage to start Conduction (Approx.)	−6	−12 Volts
Tube Voltage Drop at 25 Ma. (Approx.)	16	16 Volts
Average Anode Current	25	25 Ma.

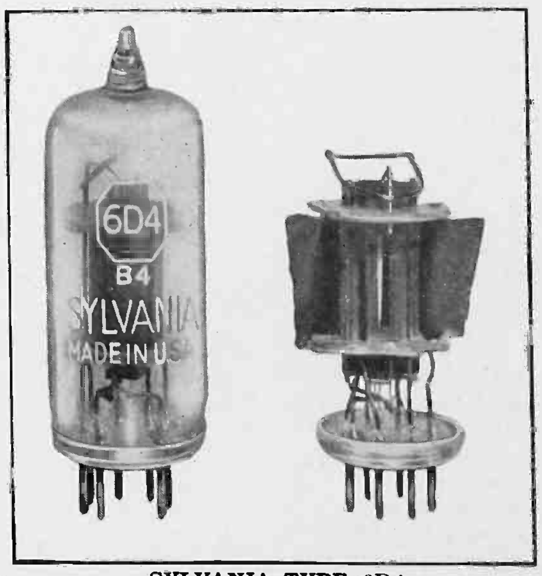
Averaged over period of not more than 30 seconds.

CIRCUIT APPLICATIONS

Sylvania Type 6D4 is a hot-cathode grid-controlled rectifier, or thyratron, designed for operation in compact, portable or light-weight equipment.

Characteristics are shown on the above curve from which the operating voltage for the grid at any desired anode voltage can be determined. In most applications the operating point is selected for the anode supply available, taking into account the probable variations of this supply. A signal (triggering) voltage superimposed upon the steady voltage will then cause the tube to start conducting, thus operating a relay or device in the anode circuit. Some adjustment of the steady bias for normal tube manufacturing tolerance and change due to use should be allowed for in the selection of circuit values, particularly when operation on very small signals is required.

Since argon gas is used to obtain the thyratron action, this tube is not sensitive to changes in ambient temperature.

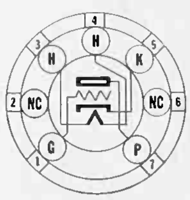


SYLVANIA TYPE 6D4

TECHNICAL SECTION INDEX

(*Continued from page Four*)

(*Continued on page Six*)



5-AY

Tube base diagram viewed from bottom of base

. . . . . THE . . . . . Service Exchange

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Atwater Kent Model 145, 325. I had considerable trouble finding the cause of intermittent reception in one of these sets. It was particularly confusing because tapping the volume control caused the set to start playing but the volume control itself was perfect. The trouble was finally located as the resistor marked R8A in the diagram (2 meg. — watt). It is located on top of the chassis in between the output tube and the tuning condenser and is fairly well hidden. This resistor is the grid feed to the 2A6 2nd detector tube. The original was the old type with composition ends one of which had become loose.—W. A. Gustafson, Milton, Mass.

Aid in Servicing AC-DC Battery Portables. I have had trouble servicing these models because when checking operation in the A-C position the battery leads always seem to short when the set is turned over. Sometimes this has burned out tubes and we cannot put up with that these days. To prevent this I now use a cardboard lead holder which keeps each lead in its proper place. A piece of corrugated cardboard about 2½″ x 7″ is used and I punch 8 or 9 holes in it with an ice pick, so that when the ends of the leads are shoved in they will be held securely. I hope this suggestion will help other servicemen.—Wm. Lebo, Chicago, Illinois.

Microphonism in Zenith Sets. I repaired a microphonic Zenith by cutting rubber washers from an old automobile inner tube. The mounting screws for the loudspeaker were removed and longer ones of smaller diameter were used with two or three of the rubber washers on each side of the speaker. If the same size screws must be used the holes in the speaker rim should be enlarged so that some of the rubber washer can squeeze in between to prevent contact of the speaker frame and bolt. This prevents vibrations from being transferred to the tubes.—Robert McNutt, Syracuse, N. Y.

TECHNICAL SECTION INDEX

(*Continued from page Five*)

MISCELLANEOUS HINTS

NEW TUBE DATA

TESTER LIMITS

By Tube Type

By Tester Manufacturer

TUBE SUBSTITUTIONS

Sylvania News

APRIL, 1945 EMPORIUM, PENNA. Vol. 11, No. 11

A CHAT WITH W. R. JONES

Considerable interest has been aroused regarding the possible shifting of F-M broadcast bands from 40-50 megacycles to 84-102 megacycles. At the time this is written, no definite decision has been made but it is thought worthwhile to point out some of the problems which may face the serviceman should this change finally be authorized.

During the recent hearings in Washington, it has been demonstrated that frequency converters could be built for a nominal sum so that present F-M equipment could operate satisfactorily on the new proposed channels. There has been considerable discussion as to whether or not these converters were really satisfactory. It is possible that the manufacturers who originally marketed the receivers for the present band will supply these converters to their customers. It is also possible that servicemen who are willing to learn the necessary "know-how" can provide "custom built" converters which might meet specific requirements. If this is done, it should net the serviceman an additional source of income. Should the customer purchase a converter offered by receiver manufacturers, the service man who sets himself up to become an expert in the F-M field can probably obtain the contract for installing this converter and seeing that it operates properly.

If the frequencies change, the antenna installations in many instances will have to be altered to a considerable extent in order that satisfactory signal strength may be obtained. It is quite probable that if antenna installations become "hand-tailored jobs" then the wide-awake serviceman may find himself in very great demand for this sort of work.

When other allocations proposed by the F.C.C. are considered, such as the Citizens' Radio Communication Service (discussed in the February "News,") the future possibilities in the radio business for wide-awake men almost stagger the imagination. It is also more than likely that bus lines, taxi cab systems, trucking companies and railroads will be provided with communication devices. The service work involved in keeping these systems in operation can afford many opportunities in the serviceman's territory for additional sources of revenue and service. There are many new things which must be learned and proper application on the serviceman's part will enable him to cash in on this to-be-greatly-expanded field.

NEW OPERATING CONDITIONS FOR SYLVANIA TYPES 7R7-14R7

Until recently the typical operating conditions shown for Types 7R7-14R7 have been at 1 volt bias both for the 100 volt and 250 volt conditions. For many applications this may introduce distortion if the signal is large enough that the peak value plus the usual 0.5 to 0.7 volts contact potential is greater than 1 volt. As the second stage of an i-f amplifier, it is quite probable that this amount of signal will be present.

For certain applications where a Gm of about 3400 is required and large signals are not encountered, the 1 volt operating conditions will give the desired performance. The lower mutual obtained at two volts bias will also prove satisfactory for other applications allowing greater versatility in the use of these types.

The new, as well as the old operating characteristics are shown below, along with the 28-volt ratings which have recently been standardized for aircraft and mobile service.

Heater Voltage	6.3 (7R7)			12.6 (14R7)		
Heater Current	0.300 (7R7)			0.150 (14R7)		
Plate Voltage	28	100	100	250	250	Volts
Screen Voltage	28	100	100	100	100	Volts
Grid Voltage	-0.75	-2.0	-1.0	-2.0	-1.0	Volts
Plate Current	1.0	3.4	5.5	3.5	6.2	Ma.
Screen Current	0.3	1.0	2.0	1.0	1.6	Ma.
Plate Resistance (approx.)	0.4	0.5	0.35	1.8	1.0	Megohms
Mutual Conductance	1500	2100	3000	2200	3400	μmhos
Grid Bias for Gm = 2 μmhos	....	-16	-16	-20	-20	

NEW PM LAMP DATA AVAILABLE

In the October 1943 issue of the "News," we published the ratings and curve data on the Sylvania Power Measurement Lamps from PM-3 to PM-8. A new lamp, PM-9, has now been added to this series. The range which it covers is .005 to .10 watts, 36 to 87 ohms with a voltage drop of 0.5 to 4 volts.

We do not believe that enough servicemen use these types to justify printing the new curves in the "News" but those of you who are interested may obtain the complete data on request to the Advertising Department in Emporium.

COMBINED SIGNAL TRACER AND V. T. VOLTMETER

By L. H. FERRISH, GLENDALE, CALIF.

Mr. L. H. Ferrish has taken the Type 6E5 Vacuum Tube Voltmeter described in our Equipment Hints Booklet, added an ohmmeter circuit and combined it with a simple signal tracer. Mr. Ferrish does not claim that it is as good as a commercial job but it does speed up his service work and required no priorities to build.

We hope it will meet the requirements of those of you servicemen who cannot buy the test equipment needed now.

There are many good types of vacuum tube voltmeters and signal tracers on the market made by reputable manufacturers whose products would be valuable additions to the test equipment of any service shop. These units are rather expensive and at the present time unobtainable to the average serviceman.

Here is a combination test unit which we built and found very useful. Most of the parts required are available from the average serviceman's parts stock or can be salvaged from an old receiver. If you do not have the tube types listed, substitutions may be used as the circuit is not critical.

The signal tracer has two resistance-coupled audio stages. The vacuum tube voltmeter is a modification of the reflex type employing a calibrated potentiometer and a Type 6E5 tuning indicator tube in the place of the usual microammeter. In addition to the low cost of construction and the ability of the unit to withstand a great deal of abuse both electrically and mechanically, this circuit provides a very important advantage in that the low voltage end of the scale most used and where accuracy is desirable is spread out so that the range of 0 to 3 volts occupies approximately one-half the scale and the balance of the range occupies the other half.

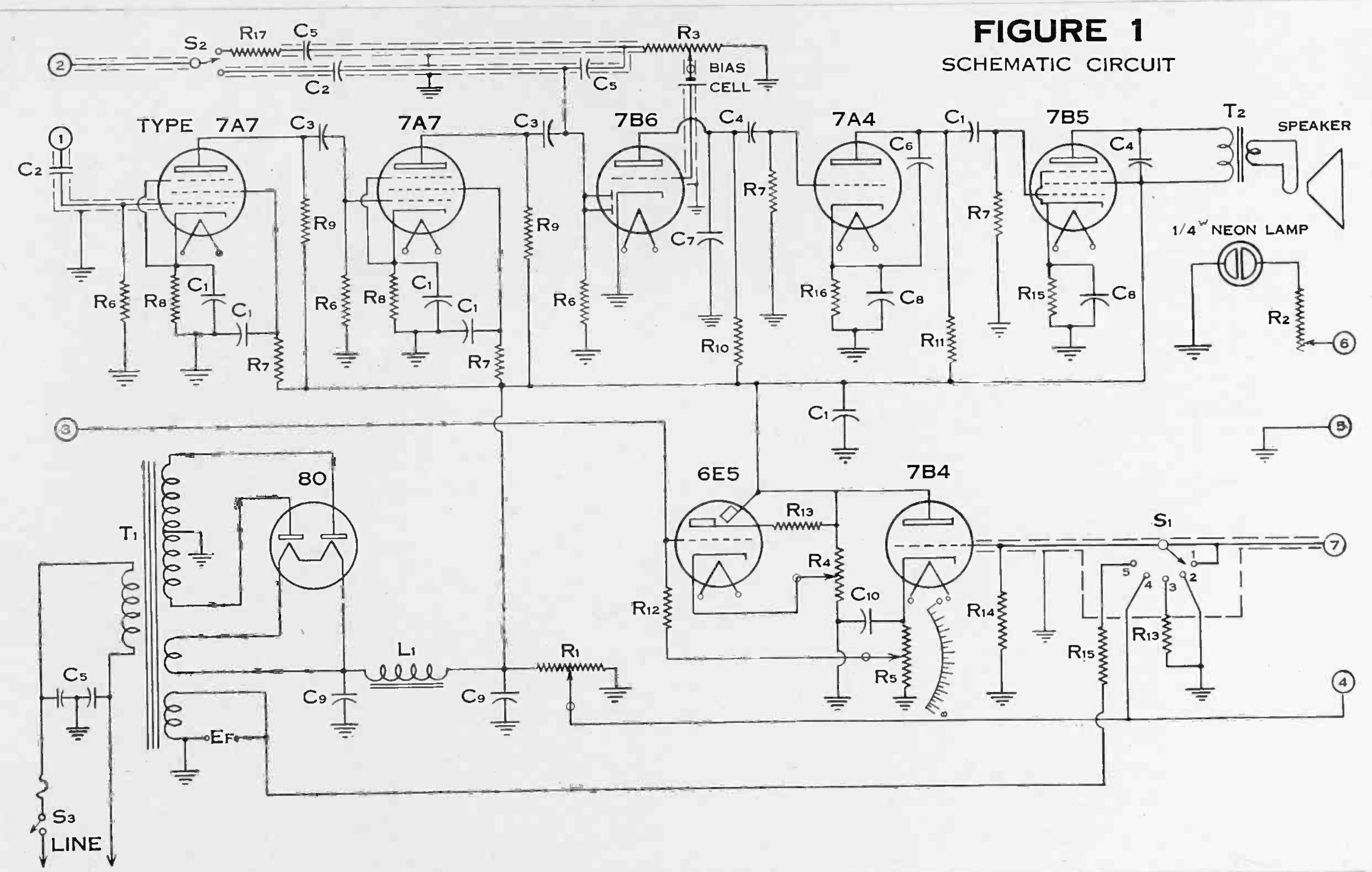
Vacuum Tube Voltmeter

The V.T.V.M. consists of a common power supply used by both the signal tracer and V.T.V.M., an electric eye indicator tube, a calibrated potentiometer and Type 7B4 amplifier tube, which may be either inside the unit or in a probe as described in the Radio Equipment Hints Booklet.

Editor's Note: The original article on page 32 of the Sylvania Equipment Hints Booklet used a type 6F5 in the probe, but since these are almost unobtainable a type 7B4 which is the same electrically may be used. This Equipment Hints booklet is still available on request.

When the instrument is first turned on, Switch No. 1 should be turned to position No. 2, the ground position, and the Type 7B4 cathode potentiometer R-5 is turned so that the sliding arm is adjacent to the 7B4 cathode. The R-5 pointer should then be at the lower left-hand end of the scale. The shadow of the 6E5 is then adjusted by varying the 75,000 ohm potentiometer R-4 so that it just closes and leaves only a hair line of darkness between the two bright portions of the target. Under these conditions the Type

FIGURE 1
SCHEMATIC CIRCUIT



PARTS LIST

R1	500,000 Ohms
R2	500,000 Ohms
R3	500,000 Ohms
R4	75,000 Ohms
R5 (wire wound)	50,000 Ohms
R6	60,000 Ohms
R7	100,000 Ohms
R8	400 Ohms
R9	2400 Ohms
R10	250,000 Ohms
R11	50,000 Ohms
R12	600,000 Ohms
R13	1 Megohm
R14	5 Megohm
R15	500 Ohms
R16	3500 Ohms
R17	50,000 Ohms

C1	0 1 mfd	450 Volt
C2	10 mfd	450 Volt
C3	100 mfd	450 Volt
C4	0 2 mfd	450 Volt
C5	0 1 mfd	450 Volt
C6	.005 mfd	450 Volt
C7	.001 mfd	450 Volt
C8	10 mfd	50 Volt
C9	20 mfd	450 Volt
C10	10 mfd	450 Volt

T1—Power Transformer 75 Ma at 250 V. Min.
T2—Output Transformer to fit speaker
Sp—P. M. Speaker 4"
L1—Choke 75 Ma. min. rating
S1—5 point selector switch
S2—2 point selector switch
S3—Line switch on R3

TERMINALS

1—R-F or I-F Test Terminal
2—I-F or A-F Test Terminal
3—A. V. C.
4—D-C Volts (for neon test)
5—Ground Connection
6—Neon Test
7—Volts and Ohms Test

COMBINED SIGNAL TRACER and V. T. VOLTMETER

(Continued)

FIGURE 2

PANEL LAYOUT

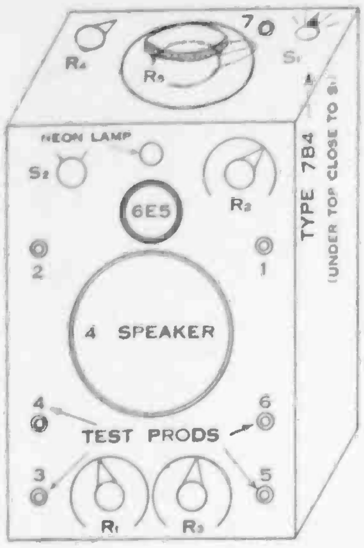
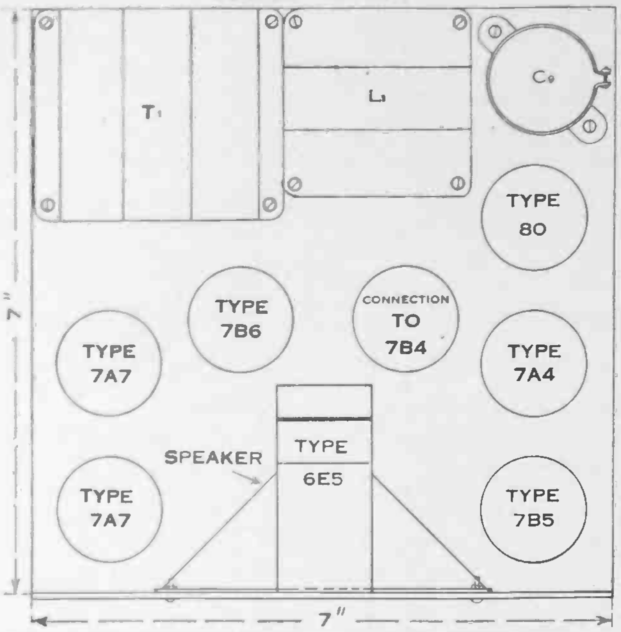


FIGURE 3

SOCKET LAYOUT



7B4 plate current flowing through the 50,000 ohm cathode potentiometer R-5 will make the cathode 3.5 to 4.0 volts positive with respect to ground. The Type 7B4 grid will therefore have a 3.5 to 4.0 volt negative bias. We know that the Type 6E5 requires approximately 8 volts negative grid bias to close the shadow and since it is connected to a potential source of say 4 volts positive the cathode of the Type 6E5 must be 4 plus 8 or 12 volts positive. When Switch No. 1 is turned to the voltage Position No. 1 and the two test prods numbers 5 and 7 connected across an A-C voltage source the Type 7B4 rectifies this A-C voltage and the average plate current increases. This produces greater IR drop across the 50,000 ohm cathode potentiometer R-5, reducing the negative bias on the Type 6E5, causing the shadow to open. If the Type 7B4 potentiometer R-5 is turned toward the grounded end, a point will be found where the Type 6E5 grid will be again receiving 8 volts minus and the shadow will again close. If a known voltage (for example 2 volts) is applied to the grid of the Type 7B4 tube to cause this action, the point on the scale where the eye just closed can be marked 2 volts and thereafter when an unknown voltage makes it necessary to adjust the potentiometer to this point, we know that a 2 volt signal is being measured. It is advisable that when a probe is not used, test prod 7 should be a shielded coaxial cable of not over 2½ feet in length to reduce strays and capacity effects. The purpose of the 0.6 megohm resistor in series with the grid of the 6E5 tube is to prevent excess grid current from flowing in the event a large A-C signal is applied to the 7B4 tube when the potentiometer R-5 is adjusted for a small signal. Also, it makes it possible to use the 6E5 to check A.V.C. while the signal tracer is being used. (See Paragraph—Automatic Volume Control Tester).

Direct current voltages are measured by connecting the positive side of the unknown voltage to the grid of the 7B4 through Terminal 7 with Switch 1 in Position 1. This is necessary because the tube is self-biased almost to cut-off under normal conditions and if a further negative voltage is applied to the grid there would be little if any change in plate current.

Calibration

To calibrate R-5 connect a series of batteries to a 25,000 to 50,000 ohm potentiometer and a multirange voltmeter. A well filtered "B" supply may be used in place of batteries if desired. Use the low voltage range of any good D-C voltmeter and adjust the battery potentiometer to give 0.1 volt reading on the D-C voltmeter. This will cause the eye to open if it has previously been adjusted to zero. Turn R-5 potentiometer on the V.T.V.M. until the eye just closes and mark 0.1 on the scale under the pointer. Calibrate every 0.2 volt up to 10 volts; every .25 volt up to 15 volts; every .5 volt up to 20 volts; every 1 volt up to 40 volts; every 2 volts up to 50 volts; every 5 volts up to 70 volts; every 10 volts up to 100 volts and then every 25 volts up to the maximum voltage of the V.T.V.M. —which will depend on the plate voltage on the 7B4 tube.

The A-C scale is calibrated in the same manner as the D-C scale except a transformer is used across the A-C line as a voltage source, and of course an A-C meter must be used.

Ohm Meter

It is possible to use the V.T.V.M. as an ohm meter by little or no change in the circuit. It was decided that 50 megohms would be the maximum resistance measurement necessary and 5 ohms would be the minimum. In order to obtain accurate readings, these were broken down into three scales: (1) 50 megohms to .1 megohm, (2) .2 megohms to 1,000 ohms, (3) 1500 to 5 ohms.

To calibrate for high ohms (.1 meg. to 50 megohms) turn Switch No. 1 to position No. 2, the ground position and the Type 7B4 cathode potentiometer Number R-5 to 0 volts. Turn R-4 so that the shadow of the Type 6E5 tube becomes only a hair line. (The above procedure is the same as for adjusting to 0 volts). Next, turn switch No. 1 to Position No. 3, High Ohms. Then connect test prods to Terminals No. 4 and 7 and connect together. Next, turn R-5 to 25 volts. At this point place a mark on the calibrated scale of R-5 to indicate zero ohms. Turn R-1 until the shadow of Type 6E5 tube again just closes. Calibrate the resistance scale by inserting known resistances from .1 meg. to 50 megohms in series with Terminals 4 and 7.

To calibrate for medium ohms turn Switch No. 1 to Position No. 2 and adjust R-5 and R-4 for zero volts. Then turn R-5 to 25 volts and Switch No. 1 to Position No. 4. Next, turn R-1 until the shadow of the 6E5 just closes. Mark this position on the scale R-5 as infinite ohms on the medium scale. Connect known resistances from 1,000 ohms to .2 megohms in series with test Terminals 5 and 7 and calibrate the medium ohm scale.

To calibrate for low ohms turn Switch No. 1 to Position No. 2 and adjust R-5 and R-4 for zero volts. Turn Switch No. 1 to Position No. 5 and readjust R-5 until the type 6ES eye just closes. Mark this position on the scale as infinite ohms. Next, connect known resistances from 5 to 1500 ohms in series with Terminals 5 and 7 and calibrate the low ohm scale.

Signal Tracer

The signal tracer consists of two resistance-coupled radio frequency or I-F stages, a detector and three resistance-coupled audio stages. Its main advantage lies in the fact that regardless of what radio frequency, I-F frequency or audio frequency tested there is nothing but a volume control to adjust.

The signal tracer may be tested by connecting a tuning condenser with a loop aerial to Terminals No. 1 and No. 5. Local stations should come in loud and clear. When used to check a receiver, the chassis of the signal tracer, Terminal No. 5 should be connected to the receiver under test. It is advisable to use a shielded wire with Terminal No. 1 because of the possible radio frequency pick-up. Turn up the gain control No. R-3 of the signal tracer to about half-way and connect Terminal No. 1 to the input grid of the receiver under test. Tune in a local station, or a signal generator, on the radio receiver under test. When the signal is tuned in, it should be quite audible in the four-inch speaker of the signal tracer. Proceed from grid to plate on through the R-F section, noting the gain, if any, until the I-F stage is reached. At this point it may be necessary to slightly retune the set under test, as the R-F stages are sensitive to even very minute changes in capacity. Once the I-F circuits have been reached, however, no such disturbance will be manifest. Proceed on with test to the second detector.

If it is desirable to check the second detector without any amplification from the signal tracer, test connection No. 2 should be used with Switch No. 2 toward C-2, the 10 mmf. condenser. This lead should also be shielded to reduce strays.

UP TO DATE DATA ON SIMPSON TESTERS

The following tables give the settings for testing many of the newer types of tubes on testers made by Simpson Electric Company. This information was furnished by them for readers of the "News", many of whom have Simpson Testers. Similar data have been requested from other tester manufacturers and will be published in later issues if received.

SUPPLEMENTAL TUBE DATA FOR MODELS 300, 350, 400, 450, 500.

Tube Type		Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test: Cath-Htr. Ckt. Sel.	Tog Up	Inter-Element Ckt. Sel.	Toggles up (Separately)	Quality Test: Ckt. Sel.	Toggles up (Together)
1A3		4	1	0	2	H	7	S	6	3	6
1SA6		4	2	35				S	3-4-6-8	2	3468
1SB6	Pen.	4	2	34				S	3-4-5-8	2	348
	Dio.	4	2	0						3	5
3B5		6	2	37	8			S	3-4-5	2	345
3S4		6	1	35	25			S	3-4-6	2	346
5R4-GY	P1	8	2	42				S	4-6	1	6
	P2	8	2	42						1	4
6AH7	Tri. 1	9	8	37		H	7	S	1-3-5-6	1	13
	Tri. 2	9	8	37						1	56
6SF7	Pen.	9	8	41		H	7	S	2-4-5-6	1	246
	Dio.	9	8	0						3	5
6SG7		9	2	46		H	7	S	4-6-8	1	468
6SH7		9	2	46		H	7	S	4-6-8	1	468
6SL7	Tri. 1	9	8	42		H	7	S	1-2-4-5	1	45
	Tri. 2	9	8	42						1	12
6SN7	Tri. 1	9	8	43		H	7	S	1-2-4-5	1	45
	Tri. 2	9	8	43						1	12
6SS7		9	2	42		H	7	S	3-4-6-8	1	3468
6ST7	Tri.	9	8	41		H	7	S	2-4-5-6	1	26
	Dio. 1	9	8	0						3	5
	Dio. 2	9	8	0						3	4
7R7	Pen.	9	1	46		H	8	S	2-3-4-5-6	1	256
	Dio. 1	9	1	0						3	3
	Dio. 2	9	1	0						3	4
7S7	Hep.	9	1	46		H	8	S	2-3-4-5-6	1	2456
	Tri.	9	1	40						1	34
7V7		9	1	46		H	8	S	2-3-4-6	1	2346
12AH7	Tri. 1	11	8	37		H	7	S	1-3-5-6	1	13
	Tri. 2	11	8	37						1	56
12H6	Dio. 1	11	2	0		H	7	S	3-5	3	5
	Dio. 2	11	2	0						3	3
12SF5		11	8	44		H	7	S	3-5	1	35
12SF7	Pen.	11	8	41		H	7	S	2-4-5-6	1	246
	Dio.	11	8	0						3	5
12SG7		11	2	46		H	7	S	4-6-8	1	468
12SH7		11	2	46		H	7	S	4-6-8	1	468
12SL7	Tri. 1	11	8	42		H	7	S	1-2-4-5	1	45
	Tri. 2	11	8	42						1	12
12SN7	Tri. 1	11	8	44		H	7	S	1-2-4-5	1	45
	Tri. 2	11	8	44						1	12
14A4		11	1	44		H	8	S	2-6	1	26
14A7/12B7		11	1	44		H	8	S	2-3-4-6	1	2346
14B8		11	1	43		H	8	S	2-3-4-5-6	1	23456
14C5		11	1	44		H	8	S	2-3-6	1	236
14C7		11	1	44		H	8	S	2-3-4-6	1	2346
14E6	Tri. 1	11	1	41		H	8	S	2-3-5-6	1	23
	Dio. 1	11	1	0						3	5
	Dio. 2	11	1	0						3	6
14F7	Tri. 1	11	1	43		H	8	S	3-4-5-6	1	34
	Tri. 2	11	1	43						1	56
14N7	Tri. 1	11	1	44		H	8	S	3-4-5-6	1	34
	Tri. 2	11	1	44						1	56
14R7	Pen.	11	1	46		H	8	S	2-3-4-5-6	1	256
	Dio. 1	11	1	0						3	3
	Dio. 2	11	1	0						3	4
14Y4	P. 1	11	1	43		H	8	S	3-6	1	3
	P. 2	11	1	43						1	6
35Y4		13	1	45	4	H	8	S	2	1	2
45Z3		15	1	45	2	H	7	S	6	1	6
50A5		16	1	47		H	8	S	2-3-6	1	236
117P7		22	2	45	8	H	7	S	3-4-5	1	345
117Z4		22	2	46		H	7	S	5	1	5
9001		9	3	42		H	4	S	1-5-6	1	156
9002		9	3	42	1	H	4	S	5-6	1	56
9003		9	3	42		H	4	S	1-5-6	1	156
Corrections to Original Data for Above Models											
1S4		4	5	37	16			S	2-3-4	2	234
7A6	Dio. 1	9	1	0		H	8	S	3-6	3	3
	Dio. 2	9	1	0						3	6

(*Continued from page 5*)

For audio frequency and hum search, connect the shielded test prod to terminal No. 2 and turn Switch No. 2 towards R-17, the 50,000 ohm resistor. Proceed with tests from grid to plate through the audio circuit under test, noting gain and hum in each stage.

Automatic Volume Control Test

The addition of terminal No. 3 connected to the grid of the 6E5 permits the A-V-C action of a set under test to be shown without making the changes in connections necessary to read a negative voltage. No calibration has been provided but with the voltage applied, approximately 8 volts A.V.C. will close the shadow on the 6E5 target. To use, connect terminal No. 3 to the A.V.C. circuit under test, set R-5 to the high voltage end of its scale and R-4 to the ground end of the dial

Neon Tester

A neon tester has been incorporated for use as a rough voltage and polarity indicator as well as condenser leakage tester.

To test for voltage: set the 500,000 ohm variable control R-2 to half scale. Use Terminals No. 5 and 6. To test for condenser leakage set the 500,000 ohm variable control R-2 to half scale and the 500,000 ohm variable control No. R-1 to full scale. Connect the condenser under test to Terminals 4 and 6. If the condenser is not shorted, gradually reduce the resistance of R-2 until 0 ohms is reached. This will show maximum leakage of the condenser under test at the voltage supplied. Of course, R-1 should be adjusted to a lower voltage when low voltage condensers are to be tested.

Supplemental Tube Data For Models 220, 222, 325, 333, 440 (Not Modernized)

Tube Type	Fil. Sel.	Load No.	Tube Sel.	Toggles: Test 1	Toggles: Test 2
1SA6	1	2	36	BCFG	
1SB6					
Pen.	1	2	34	BCG	
Dio.	1	3	0	D	
(G) 3B5	1	2	37	BCD	
(G) 5R4-GY	5	1	42	C	F
(G) 6AH7	6	1	35	BH	DF
(G) ▲ 6SF7					
Pen.	6	1	41	ACFI	
Dio.	6	3	0	D	
*6SG7	6	1	46	CFG	
*6SH7	6	1	46	CFG	
(G) 6SL7	6	1	42	AHI	CD
(G) ▲ 6SN7	6	1	43	AHI	CD
*6SS7	6	1	42	BCFG	
(G) ▲ 6ST7					
Tri.	6	1	41	AFI	
Dio.	6	3	0	C	D
*7R7					
Pen.	6	1	46	BFH	
Dio.	6	3	0	C	D
*7S7					
Tri.	6	1	40	CD	
Hep.	6	1	46	BDFH	
*7V7	6	1	46	BCDF	
(G) 12AH7	8	1	35	BH	DF
*12H6	8	3	0	B	D
(G) 12SF5	8	1	44	BD	
(G) ▲12SF7					
Pen.	8	1	40	ACFI	
Dio.	8	3	0	D	
*12SG7	8	1	46	CFG	
*12SH7	8	1	46	CFG	
(G) ▲12SL7	8	1	42	AHI	CD
(G) ▲12SN7	8	1	44	AHI	CD
*14A4	8	1	44	BF	
*14A7/12B7	8	1	44	BCDF	
*14B8	8	1	43	BCDFH	
*14C5	8	1	44	BCF	
*14C7	8	1	44	BCDF	
*14E6					
Tri.	8	1	41	BC	
Dio.	8	3	0	F	H
*14F7	8	1	43	CD	FH
*14N7	8	1	44	CD	FH
*14R7					
Pen.	8	1	46	BFH	
Dio.	8	3	0	C	D
*14Y4	8	1	43	C	F
● 35Y4					
(D)	6	Short Check		AI	
(I)	9			AD	ADB
(I)	9	1	46	ADB	
Correction to Data originally supplied for Model 333					
*7A6	6	3	0	C	F

Supplemental Tube Data For Models 220, 222, 325, 333, 440 (Modernized)

Tube Type	Fil. Sel.	Load No.	Tube Sel.	Toggles: Test 1	Toggles: Test 2
1SA6	1.0	2	36	BCFG	
1SB6					
Pen.	1.0	2	34	BCG	
Dio.	1.0	3	0	D	
(G) 3B5	1.0	2	37	BCD	
(G) 5R4-GY	3.0	1	42	C	F
(G) 6AH7	3.5	1	35	BH	DF
(G) ▲ 6SF7					
Pen.	3.5	1	41	ACFI	
Dio.	3.5	3	0	D	
*6SG7	3.5	1	46	CFG	
*6SH7	3.5	1	46	CFG	
(G) ▲ 6SL7	3.5	1	42	AHI	CD
(G) ▲ 6SN7	3.5	1	43	AHI	CD
*6SS7	3.5	1	42	BCFG	
(G) ▲ 6ST7					
Tri.	3.5	1	41	AFI	
Dio.	3.5	3	0	C	D
*7R7					
Pen.	3.5	1	46	BFH	
Dio.	3.5	3	0	C	D
*7S7					
Tri.	3.5	1	40	CD	
Hep.	3.5	1	46	BDFH	
*7V7	3.5	1	46	BCDF	
(G) 12AH7	4.5	1	35	BH	DF
*12H6	4.5	3	0	B	D
(G) 12SF5	4.5	1	44	BD	
(G) ▲12SF7					
Pen.	4.5	1	40	ACFI	
Dio.	4.5	3	0	D	
*12SG7	4.5	1	46	CFG	
*12SH7	4.5	1	46	CFG	
(G) ▲12SL7	4.5	1	42	AHI	CD
(G) ▲12SN7	4.5	1	44	AHI	CD
*14A4	4.5	1	44	BF	
*14A7/12B7	4.5	1	44	BCDF	
*14B8	4.5	1	43	BCDFH	
*14C5	4.5	1	44	BCF	
*14C7	4.5	1	44	BCDF	
*14E6					
Tri.	4.5	1	41	BC	
Dio.	4.5	3	0	F	H
*14F7	4.5	1	43	CD	FH
*14N7	4.5	1	44	CD	FH
*14R7					
Pen.	4.5	1	46	BFH	
Dio.	4.5	3	0	C	D
*14Y4	4.5	1	43	C	F
● 35Y4					
(D)	3.5	Short Check		AI	
(I)	5.0			AD	ADB
(I)	5.0	1	46	ADB	
*50A5	6.5	1	47	BCF	
*117Z4	9.5	1	46	D	
Correction To Data Originally Supplied For Model 333					
*7A6	3.5	3	0	C	F

Sylvania News

MAY, 1945 EMPORIUM, PENNA. Vol. 11, No. 12

SYLVANIA REFERENCE LIST OF RECOMMENDED RECEIVER TYPES

CLASSIFICATION	POWER RECTIFIERS	DIODE DETECTORS	CONVERTERS	VOLTAGE AMPLIFIERS: Triodes: Single	Triodes: Twin	Triodes: With Diodes	Pentodes: Sharp Cut-off: Low Gm	Pentodes: Sharp Cut-off: Hi Gm	Pentodes: Remote Cut-off: Low Gm	Pentodes: Remote Cut-off: Hi Gm	Pentodes: With Diodes	POWER AMPLIFIERS
Battery 1.4 Volt Lock-In			1LA6 1LC6	1LE3		1LH4	1LC5 1LN5				1LD5	1LB4 3LF4
Miniature			1R5				1L4		1T4		1S5	3S4
GT			1A7GT			1H5GT	1N5GT					3Q5GT
6.3 Volt Lock-In	7Y4 7Z4	7A6	7B8 7Q7 7S7	7A4	7N7 7F7	7B6 7E6	7C7	7W7	7A7	7H7	7R7	7B5 7C5
Miniature		6AL5		6C4		6AQ6		6AK5				
GT or G	5U4G 5Y3GT 6X5GT	6H6GT	6SA7GT	6J5GT	6SL7GT 6SN7GT	6SQ7GT	6SJ7GT	6SH7GT	6SK7GT			6K6GT 6V6GT 6L6GA
150 Ma. Lock-In	35Y4 35Z3	7A6	7A8 14Q7 14S7	14A4	14F7	7C6 14B6	7C7 14C7		7B7 14A7/12B7	14H7	14R7	35A5 50A5
Miniature				6C4		6AQ6						
GT	35Z5GT		12SA7GT	12J5GT	12SL7GT	12SQ7GT	12SJ7GT	12SH7GT	12SK7GT			35L6GT 50L6GT
Special	25Z6GT 117Z6GT 28Z5 OZ4G				7F8 7AF7	7K7 7X7/XXFM				1AB5		25L6GT 28D7

Compiled by COMMERCIAL ENGINEERING DEPARTMENT, SYLVANIA ELECTRIC PRODUCTS INC.

SYLVANIA'S STANDARDIZATION PROGRAM SIMPLIFIES RECONVERSION PROBLEMS

Last month Sylvania distributed copies of the above chart to Equipment Manufacturers. Confining production to fewer types of receiving tubes without handicapping designers in regard to performance has entered into our plans for postwar production. Reference lists are not new in the industry and Sylvania makes no claim to originality in using this one, but it does differ from other published lists by providing enough types so that the engineers and designers of radio equipment will have a reasonable choice of tubes and circuits.

Meaning to Servicemen

These types will be among the first manufactured after war orders have been cut back sufficiently to make civilian set production possible. Obviously the production of component parts and radio tubes must precede the assembly of radio sets for civilian use. By the same token when production of military equipment is cut back, the production of the component parts and tubes will be cut back in advance. Thus reconversion of the parts and tube manufacturers will take place earlier, except to the extent that production for necessary replacements will be required by the military services.

Most servicemen know enough about modern production methods to understand the improbability that large scale production runs of millions of a single type will be interrupted in order to produce a few thousand of any scarce type. Bob Almy, Manager of Distributor Sales recently pointed out that our Sylvania survey shows that servicemen want fewer types of tubes. This is one of the reasons for the preparation of the above list. It is felt that the tube complements of most immediate post war civilian receivers will be fundamentally the same as the pre-war models, and you will observe that except in very few instances, the types shown in the Reference List are pre-war types.

The Reference List has been divided into three main receiver classifications as follows: The "Battery 1.4 Volt" group which includes types for farm sets and portables. Three different tube designs are shown which should permit ample freedom in the design of these receivers. The "6.3 Volt" group lists those types that will find application in A-C receivers and mobile equipment. The "150 Ma" group shows those types used in AC-DC receivers, and aircraft equipment, particularly the 12 and 14 Volt series. The "Special" group was added to include those types which have had wide acceptance for use in special applications.

Other Possibilities

It should not be construed that the above indicates that other types of tubes both new and old will not be available. Some of the older types may come from surplus government stocks and no doubt others will be manufactured. It is generally known that many advances have been made in the radio art during the war, which for security reasons cannot be publicized at present. When these advances and improvements are released some new types will of necessity be needed. There is no indication as to when or how soon these new ideas can be incorporated in radio equipment for the general public. Sylvania News will endeavor to keep you posted on new developments as soon as they are released, as well as any new tube types announced.

A CHAT WITH W. R. JONES

During the war, manpower shortages have caused industry to cast about for all the labor-saving devices possible. Electronic devices for counting, sorting, inspecting and other similar operations have been used very extensively. The unerring preparation with which the job is done by these electronic devices makes it highly improbable that they will be replaced by human beings when we return to civilian production. Much more of this electronic equipment would have been in industrial usage if it would have been possible to procure the quantities desired. The possibility, therefore, is that the use of electronic equipment in industry will increase rather than decrease after the war.

The larger industries may have their own electronic maintenance department but many manufacturers will not be able to afford specialists who are only occasionally required for maintenance work. This then opens an additional field for radio servicemen since they can undoubtedly obtain a contract for the service work in connection with electronic devices in these plants. This income will supplement their regular income and will provide the maximum of trained skill to the manufacturing group employing only a relatively small amount of electronic equipment.

Some of the larger manufacturers of this equipment will no doubt provide field engineering service for the larger accounts but the advantage the local serviceman has in already being in the town where the plant is located will be very important in keeping the equipment in tip-top shape at all times. The wide-awake serviceman should take steps to acquaint himself with the various electronic devices used in his city and to invest enough time and money to learn the fundamental principles upon which the operation of the equipment is based. If this problem is approached realistically, probably most manufacturers of this equipment would welcome a field staff which would be located in every community in which their equipment has been sold.

The opportunities for the wide-awake serviceman postwar in other than radio communication fields will be numerous and will afford a variety of experience so that no one phase of his activities will ever become monotonous. Perhaps it will be possible to list some of these pieces of electronic equipment in a future issue of Sylvania News to serve as a guide in going after this extra business.

MODERNIZATION DATA ON PRECISION TESTERS

The following information has been supplied by the Precision Apparatus Company for the use of Sylvania News readers who have Precision Testers. Similiar data has been requested from other tester manufacturers and will be published in later issues when received.

ADAPTERS FOR PRECISION TESTERS (All Models)

Two simple adapters were available in normal times, which permitted all Lock-In and miniature button 7 pin tubes to be tested at the regular "M-2" octal socket. Unfortunately, material restrictions have necessitated their discontinuance. However, your local distributor may still have a few available: Amphenol part numbers 44-11WP and 44-17-8W for Lock-In and miniatures respectively. If the adapters are unobtainable, a Lock-In and button 7 pin socket may be conveniently mounted on a strip and then interwired to the octal "M-2" socket, as follows:

Lock-In	Octal "M-2"	Button 7
center	1	center
1	2	7
2	3	2
3	4	3
4	5	4
6	6	5
8	7	1
7	8	6
5	Grid Cap	

Naturally, (unless your instrument has been previously modernized) we realize this does not solve the problem for testing high voltage filament tubes from 45 to 117 volts. In addition, some of the early Series 500 and 600 Electronometers lacked provision for testing tuning indicators and gas type rectifiers. For this purpose, a complete factory modernization service was developed, which permitted such instruments to be economically brought fully up to date, including direct addition of Lock-In and miniature sockets.

Due to our country's war efforts, materials conservation has forced us to discontinue such service for the duration. However, precision's Customer Service Division will still be found eager to be of assistance in maintaining your equipment in full operating condition.

SUPPLEMENTARY TUBE TEST DATA FOR SERIES 500, 510, 600, 700, 800 and 815

(*) Check in "M-1" octal socket.

Tube No.	Tube Section	Fil.	Load	Shunt	Test Position
1B7	Amp.	1	13	52	BCDEG
1B7	Osc.	1	13	55	DE
1B8	Diode	1	14	70	F
1B8	Triode	1	13	56	EG
1B8	Pentode	1	13	52	BCD
1D8	Diode	1	14	70	F
1D8	Triode	1	13	57	EG
1D8	Pentode	1	13	53	BCD
1E4		1	13	52	BD
1G4		1	13	53	BD
1G6	Triode 1	1	13	54	DE
1G6	Triode 2	1	13	54	BC
1LA4		1	13	56	BCE
1LA6	Amp.	1	13	56	BCDEG
1LA6	Osc.	1	13	61	CD
1LB4		1	13	54	BCE
1LC5		1	13	54	BCDE
(1LC5—Do not short check A or G)					
1LC6	Osc.	1	13	63	CD
1LC6	Amp.	1	13	52	BCDEG
1LD5	Diode	1	14	70	D
1LD5	Pentode	1	13	52	BCE
1LE3		1	13	52	BE
1LH4	Diode	1	14	70	D
1LH4	Triode	1	13	56	BE
1LN5		1	13	53	BCDE
(1LN5—Do not short check A or G)					
1N6	Diode	1	14	70	E
1N6	Pentode	1	13	54	BCD
1P5		1	13	54	BCG
1Q5		1	13	49	BCD
1R5	Osc.	1	13	54	CD
1R5	Amp.	1	13	54	BCDF
(1R5—Do not short check A or E)					
1S4		1	13	51	BCDF
(1S4—Do not short check A, B, E, or F)					
1S5	Diode	1	14	70	C
1S5	Pentode	1	13	55	DEF
1SA6		1	13	52	BCEF
1SB6	Diode	1	14	70	D
1SB6	Pentode	1	13	58	BCF
1T4		1	13	53	BCF
(1T4—Do not short check A or E)					
1T5		1	13	52	BCD
2A4		3	12	27	BD
(2A4—Do not short check A or D)					
2W3		3	12	41	C
(2W3—Do not short check A or F)					
3A8	Diode	1	14	70	F
3A8	Triode	1	13	57	DE
*3A8	Pentode	1	13	56	CDG
(3A8—Do not short check A or B)					
*3B5		1	13	54	CDE
(3B5—Do not short check A or B)					
*3C5		1	13	50	CDE
(3C5—Do not short check A or B)					
*3LF4		1	13	48	CDF
(3LF4—Do not short check A or B)					
3Q4		1	13	52	BCDF
(3Q4—Must show short on A, B, E, F)					
*3Q5		1	13	49	CDE
(3Q5—Do not short check A or B)					
3S4		1	13	53	BCDF
(3S4—Must show short on A, B, E, F)					
6AB7		6	12	26	BCEF
6AC7		6	12	24	BCEF
6AD5		6	12	29	BD
6AD7	Triode	6	18	47	E
6AD7	Pentode	6	12	37	BCD
6AE5		6	12	27	BD
6AE7	Triode 1	6	12	32	BE
6AE7	Triode 2	6	12	32	BC
6AF5		6	12	28	BD
6AG7		6	12	25	CEF
6AL6		6	12	29	CDG
6H4		6	14	70	C
6R6		6	12	35	BDG
6SA7	Amp.	6	12	27	BCDF
6SA7	Osc.	6	12	27	CD
*6SC7	Triode 1	6	12	34	DE
*6SC7	Triode 2	6	12	34	BC
6SD7		6	12	28	BCEF
*6SF5		6	12	29	CE
*6SF7	Diode	6	14	70	E
*6SF7	Pentode	6	12	35	BDF
6SG7		6	12	25	CEF
(6SG7—Must show short on B and D)					
6SJ7		6	12	29	BCEF
6SK7		6	12	31	BCEF
*6SL7	Triode 1	6	18	45	B
*6SL7	Triode 2	6	12	32	DE
*6SN7	Triode 1	6	12	31	DE
*6SN7	Triode 2	6	12	36	AB
*6SQ7	Triode	6	12	31	BF
*6SQ7	Diode 1	6	14	70	E
*6SQ7	Diode 2	6	14	70	D
*6SR7	Diode 1	6	14	70	D
*6SR7	Diode 2	6	14	70	E
*6SR7	Triode	6	12	34	BF
6SS7		6	12	32	BCEF
6U6		6	12	27	BCD
6W6		6	12	24	BCD
7A4		6	12	29	BE
7A5		6	12	26	BCE
7A6	Diode 1	6	14	70	C
7A6	Diode 2	6	14	70	E
7A7		6	12	31	BCDE
7A8	Amp.	6	12	32	BCDEG
7A8	Osc.	6	12	37	CD
7B4		6	12	31	BE
7B5		6	12	31	BCE
7B6	Triode	6	12	31	BC

PRECISION TESTER DATA—Continued

Tube No.	Tube Section	Fil.	Load	Shunt	Test Position
7B6	Diode 1	6	14	70	G
7B6	Diode 2	6	14	70	E
(7B6—Do not short check D or F)					
7B7		6	12	31	BCDE
7B8	Amp.	6	12	32	BCDEG
7B8	Osc.	6	12	36	CD
7C5		6	12	30	BCE
7C6	Triode	6	12	36	BC
7C6	Diode 1	6	14	70	G
7C6	Diode 2	6	14	70	E
(7C6—Do not short check D or F)					
7C7		6	12	31	BCDE
7E7	Diode 1	6	14	70	G
7E6	Diode 2	6	14	70	E
7E6	Triode	6	12	34	BC
(7E6—Do not short check D or F)					
7E7	Diode 1	6	14	70	C
7E7	Diode 2	6	14	70	D
7E7	Pentode	6	12	39	BEG
7F7	Triode 1	6	12	32	CD
7F7	Triode 2	6	12	32	GE
7G7		6	12	24	BCDE
7H7		6	12	25	BCDE
7J7	Triode	6	12	38	CD
7J7	Hexode	6	12	31	BEG
7K7	Diode 1	6	14	70	E
7K7	Diode 2	6	14	70	G
7K7	Triode	6	12	32	CD
7L7		6	12	27	BCDE
7N7	Triode 1	6	12	29	CD
7N7	Triode 2	6	12	29	EG
7Q7	Osc.	6	12	28	CD
7Q7	Amp.	6	12	28	BCDEG
7R7	Diode 1	6	14	70	C
7R7	Diode 2	6	14	70	D
7R7	Pentode	6	12	25	BEG
7S7	Triode	6	12	34	CD
7S7	Hexode	6	12	25	BDEG
7V7		6	12	24	BCDE
7W7		6	12	24	BCEG
(7W7—Cathode Test-Depress Both D and F)					
7Y4	Plate 1	6	12	31	C
7Y4	Plate 2	6	12	31	E
7Z4	Plate 1	6	12	38	C
7Z4	Plate 2	6	12	38	E
12A6		8	12	32	BCD
12A8	Amp.	8	12	31	BCDEG
12A8	Osc.	8	12	33	DE
12B7		8	12	32	BCDE
12B8	Triode	8	12	28	DF
12B8	Pentode	8	12	24	BCG
12C8	Pentode	8	12	40	BEG
12C8	Diode 1	8	14	70	D
12C8	Diode 2	8	14	70	C
12E5		8	12	35	BD
12F5		8	12	30	CG
12G7	Diode 1	8	14	70	C
12G7	Diode 2	8	14	70	D
12G7	Triode	8	12		BG
12H6	Diode 1	8	14	70	B
12H6	Diode 2	8	14	70	D
12J5		8	12	29	BD
12J7		8	12	32	BCDG
12K7		8	12	32	BCDG
12K8	Triode	8	12	26	DE
12K8	Hexode	8	12	26	BCDG
12Q7	Triode	8	12	31	BG
12Q7	Diode 1	8	14	70	D
12Q7	Diode 2	8	14	70	C
12SA7	Amp.	8	12	27	BCDF
12SA7	Osc.	8	12	27	CD
*12SC7	Triode 1	8	12	34	DE
*12SC7	Triode 2	8	12	34	BC
*12SF5		8	12	29	CE
*12SF7	Diode	8	14	70	E
*12SF7	Pentode	8	12	35	BDF
12SG7		8	12	25	CEF
(12SG7—Must show short on B and D)					
12SJ7		8	12	29	BCEF
12SK7		8	12	31	BCEF
*12SL7	Triode 1	8	18	45	B
*12SL7	Triode 2	8	12	32	DE
*12SN7	Triode 1	8	12	31	DE
*12SN7	Triode 2	8	12	36	AB
*12SQ7	Triode	8	12	31	BF
*12SQ7	Diode 1	8	14	70	E
*12SQ7	Diode 2	8	14	70	D
*12SR7	Diode 1	8	14	70	D
*12SR7	Diode 2	8	14	70	E
*12SR7	Triode	8	12	34	BF
14A4		8	12	29	BE
14A5		8	12	26	BCE
14A7		8	12	31	BCDE
14B6	Diode 1	8	14	70	G
14B6	Diode 2	8	14	70	E
14B6	Triode	8	12	31	BC
(14B6—Do not short check D or F)					
14B8	Amp.	8	12	32	BCDEG
14B8	Osc.	8	12	36	CD
14C5		8	12	30	BCE
14C7		8	12	31	BCDE
14E6	Diode 1	8	14	70	G
14E6	Diode 2	8	14	70	E
14E6	Triode	8	12	34	BC
(14E6—Do not short check D or F)					
14E7	Diode 1	8	14	70	C
14E7	Diode 2	8	14	70	D
14E7	Pentode	8	12	39	BEG
14F7	Triode 1	8	12	32	CD
14F7	Triode 2	8	12	32	GE
14H7		8	12	25	BCDE
14J7	Triode	8	12	38	CD
14J7	Hexode	8	12	31	BEG
14N7	Triode 1	8	12	29	CD
14N7	Triode 2	8	12	29	EG
14Q7	Osc.	8	12	28	CD
14Q7	Amp.	8	12	28	BCDEG
14R7	Diode 1	8	14	70	C
14R7	Diode 2	8	14	70	D
14R7	Pentode	8	12	25	BEG
14S7	Triode	8	12	34	CD
14S7	Hexode	8	12	25	BDEG
14W7		8	12	24	BCEG
(14W7—Cathode Test-Depress both D and F)					
14Y4	Plate 1	8	12	31	C
14Y4	Plate 2	8	12	31	E
25AC5		9	12	31	BD
25B8	Triode	9	12	28	DF
25B8	Pentode	9	12	24	BCG
25C6		9	12	25	BCD
25D8	Diode	9	14	70	F
25D8	Triode	9	13	35	DE
25D8	Pentode	9	12	21	BCG
25Y4		9	12	25	D
25Z4		9	12	25	D
32L7	Amp.	10	12	29	BCD
32L7	Rect.	10	13	32	E
35A5		10	12	26	BCE
35L6		10	12	26	BCD
35Y4		8	12	25	B
(35Y4—Do not short check A or D)					
35Z3		10	12	25	B
35Z4		10	12	25	D
35Z5		8	12	25	D
(35Z5—Do not short check A or B)					
35Z6	Plate 1	10	12	24	B
35Z6	Plate 2	10	12	24	D
40Z5-45Z5		8	12	25	D
(40Z5-45Z5—Do not short check A or B)					
45Z3		11	12	27	BF
(45Z3—Must show short on B and F)					
50A5		11	12	24	BCE
50C6		11	12	25	BCD
50L6		11	12	24	BCD
50Y6	Plate 1	11	12	27	B
50Y6	Plate 2	11	12	27	D
50Z7	Plate 1	11	12	27	B
50Z7	Plate 2	11	12	27	D
(50Z7—Do not short check A or E)					
70A7		13	12	26	BCD
(70A7—Do not short check A or E)					
70L7	Rect.	13	13	24	F
70L7	Amp.	13	12	26	BCD
(Do not short check A or E)					
(Do not short check A or F)					
117L7	Rect.	17	13	20	E
117L7	Amp.	17	12	29	BCD
117M7	Rect.	17	13	21	E
117M7	Amp.	17	12	26	BCD
117N7	Rect.	17	12	25	A
117N7	Amp.	17	12	25	BCD
117P7	Amp.	17	12	27	BCD
117P7	Rect.	17	12	24	A
117Z4		17	12	25	D
*117Z6	Plate 1	11	12	25	C
(117Z6—Do not short check A or B)					
117Z6 (old type)	Plate 2	11	12	25	D
(117Z6—Plate 2—Test in—(M-2 socket)					
117Z6 (new type)	Plate 1	17	12	25	B
117Z6	Plate 2	17	12	25	D
884		6	12	30	BD
1231		6	12	24	BCDE
1232		6	12	24	BCDE
1851		6	12	24	BCDG
1852		6	12	24	BCEF
1853		6	12	26	BCEF
2050		6	12	25	BDE
2051		6	12	26	BDE
XXD	Triode 1	8	12	33	CD
XXD	Triode 2	8	12	33	EG
XXL		6	12	29	BE

Note: Some older "Precision" instruments will not provide for the testing of a few of the new single-ended octal tubes in the M-1 octal socket. The following instruments (unless already modernized) can be temporarily converted to test ALL single-ended tubes regardless of filament basing, through the simple expedient of clipping or removing the jumper that now connects contact #1 to contact #6 on the M-1 socket; then solder a new jumper from contact #1 of the M-1 socket to contacts #1 and #2 of M-2 socket.

This applies to: (Series 500A, Serial #1286 and up), (Series 510, Serial #1001 to 1401 inclusive), (Series 700, Serial #4575 and up), (Series 800, Serial #3001 to 3106 inclusive), (Series 815, Serial #210 to 456 inclusive), (Series 900, Serial #5001 to 5598 inclusive). This M-1 socket change effects its use for ballast testing.

Additional material on Precision Testers will be in a subsequent issue.

Former Technical Editor Now An Army Major

We are sure you will be as pleased as we were to hear that Ralph S. Merkel, a former Technical Editor of SYLVANIA NEWS, has been recently promoted to Major in the U. S. Army. Major Merkle entered the Armed Forces in June 1942 and has been attached to the office of the Chief Signal Officer in Washington, transferring to Signal Corps Offices at Fort Monmouth, and is now attached to the Procurement Section of the Signal Corps with offices in Philadelphia, Penna.

The Technical Section of the SYLVANIA NEWS takes this opportunity to congratulate Major Merkle and to extend best wishes for his continued success.

★ ★ ★ ★ ★ ★ ★ ★ ★

TO SYLVANIA NEWS READERS OF 1938

In the Nov.-Dec. 1938 issue of "Sylvania News" we showed a photograph and a news item on a home-made Vacuum Tube Voltmeter Tube Tester designed and built by Mr. Lewis C. Heise of Kensington, Kansas. All inquiries were to be referred to Mr. Heise, but we have recently been advised that he died last year. This appeal is to any of our old-time readers who obtained information from Mr. Heise at that time, particularly the circuit diagram and operating instructions. If you can help by forwarding this information to Sylvania, we will photostat or copy the material for distribution to those interested.

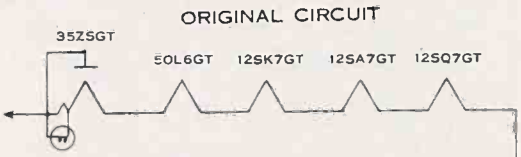
THE information presented in the Sylvania Service Exchange is contributed by servicemen as the result of practical experience. It is very carefully considered before being accepted, and we believe it to be correct and authentic. However, we assume no responsibility for results. Please do not send routine or generally known information.

Time Saver for Servicing AC-DC Sets. I keep a complete set of used tubes handy on the bench, 12SA7, 12SK7, 12SQ7, 35L6, 50L6 and 35Z5. When a set comes in for which a substitute seems necessary, I first try it out with its normal complement to be sure that there is nothing else wrong. This saves a lot of time when oscillation develops which at first is blamed on the substitution but which will eventually be found to be from some other cause—Geo. Ott, Jr., Meadville, Pa.

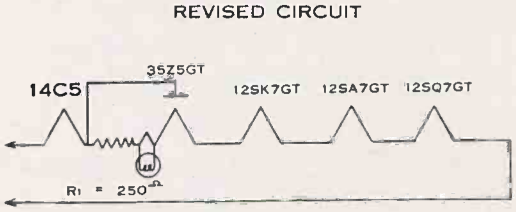
* * *

Use of Type 14C5 in 150 Ma. Series Sets. Some of you servicemen who have been disappointed in the performance of Types 6G6G and 12AH7 as substitutes for Types 35L6 and 50L6 should try this. The characteristics of Type 14C5 are quite similar, but the heater current of .225 ampere prevents it from being tried in AC-DC sets. It can be done by the simple change in circuit shown below and, in my opinion, works equally as well as the original tube. This utilizes the 60 to 75 Ma. total plate current of all the tubes in the set added to the heater current of the series string to get the 225 Ma. required by the Type 14C5. The voltage on the plate of the rectifier tube is decreased by 12 volts but this does not seem to affect the operation of the set. This makes a good substitute for the Type 35A5 since it also has the Lock-In base.—L. C. Motley, Danville, Va.

ORIGINAL CIRCUIT



REVISED CIRCUIT



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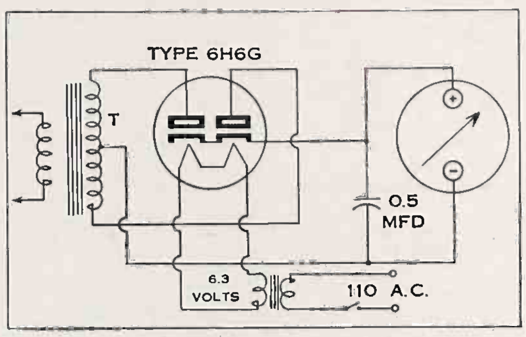
Quite often "B" batteries are found which show little or no voltage across the high voltage connections, but may show somewhere near normal voltage between the 22½ volt intermediate tap, and either the negative, or positive 45 volt taps. Remove battery from carton and check connections between cells for corrosion causing break in circuit, or for loose connections. Have had several such cases recently.—Paul L. Graham, Belgrade, Nebr.

* * *

Simple Output Meter. Any serviceman who has to get along without an output meter may be interested in making this simple indicator which requires only an output transformer, 6H6 tube, filament transformer and any meter movement of 1000 ohm per volt sensitivity or better.



I used a Stancor Output Transformer No. 3856 (T) as the 6 taps are a convenient adjustment for different outputs. The meter I had was a 150-volt Triplett 1000-ohm per volt meter with taps at 3 and 7.5 volts but these were not used. The condenser, which should have a paper dielectric, should be rated for 200 volts at least and is required only to keep the A-C ripple from damaging the meter.

In use, connection is made across the terminals of the speaker voice coil since the meter does not draw enough power to change the impedance match more than a slight amount.—Knight Radio Sales, Providence, R. I.

* * *

Tube Substitutions. When Type 1H6G tubes are unavailable, it is possible to use a Type 1J6G in battery sets and in some electric models. The procedure is as follows: Cut any wires connecting pins 4 and 5 on the socket. Move wires formerly on pin #6 to pin #4. Tie 5 and 6 using this as the diode.—Warren R. Davee, West Point, Nebraska.

Editor's Note: There is considerable difference in filament current between these two types, so if your set uses a series ballast or resistor, this will require changing also.

* * *

If you have trouble keeping the copper tip of your soldering iron tinned, try using aluminum solder for the tinning process. Due to higher melting point of this solder, it does a much better job of tinning than ordinary solder.—Paul L. Graham, Belgrade, Nebr.

Philco Model 610. I have found that these sets develop a high pitched whistle or squeal with the volume control at the half-way position and with the tone control in any position except Bass. A simple cure is to connect a .01 mfd. condenser from the tone control to ground on the set. The tone control is Philco Part No. 30-4332.—Geo. W. Doughman, Edgewood Arsenal, Md.

* * *

General Instrument 201, 202, 203. See that the small coiled spring operating pawl (28) in trip lever (26) has sufficient tension. This pawl has much play on its bearing-pin, and the spring likewise has play in its notch, the whole thing being a rather delicate affair. Place the changer in normal horizontal position, and blocked up five or six inches (or more) from surface of work-bench. Take a piece of #14 wire (or a slim screwdriver) and very slowly push the pawl back from the teeth of the sweep-lever (13); try this with the spring up against that wall of the notch giving least tension. Make your movements very snail-like; if the pawl fails to return the full distance every time, changer operation will be hesitant. As a final check, put a record on turntable and turn on the power. Lift the needle off the record and move the tone arm across by hand. When you near the cut-off grooves, move very slowly (almost microscopically) and try to bump the pawl out of the way of the sweep-lever teeth. Every time it returns to the teeth, try to bump it away again. If you succeed in getting it to hang freely without returning to the sweep-lever teeth, then the changer will not function properly; the tone-arm will oscillate back and forth in the cut-off grooves for some time before finally tripping. A record isn't essential for this test, but is put on as a safety measure in case you unconsciously lower the needle as far as the turntable felt while concentrating on the action of the pawl and its spring.—W. S. Arns, Kenmore, N. Y.

* * *

Distortion in Crosley Super 11, Model 1117. I had considerable trouble finding the cause of bad distortion in this set. After trying everything else I finally changed the 1 meg. volume control after which the set played as good as new.—Green Radio Service, Muncie, Indiana.

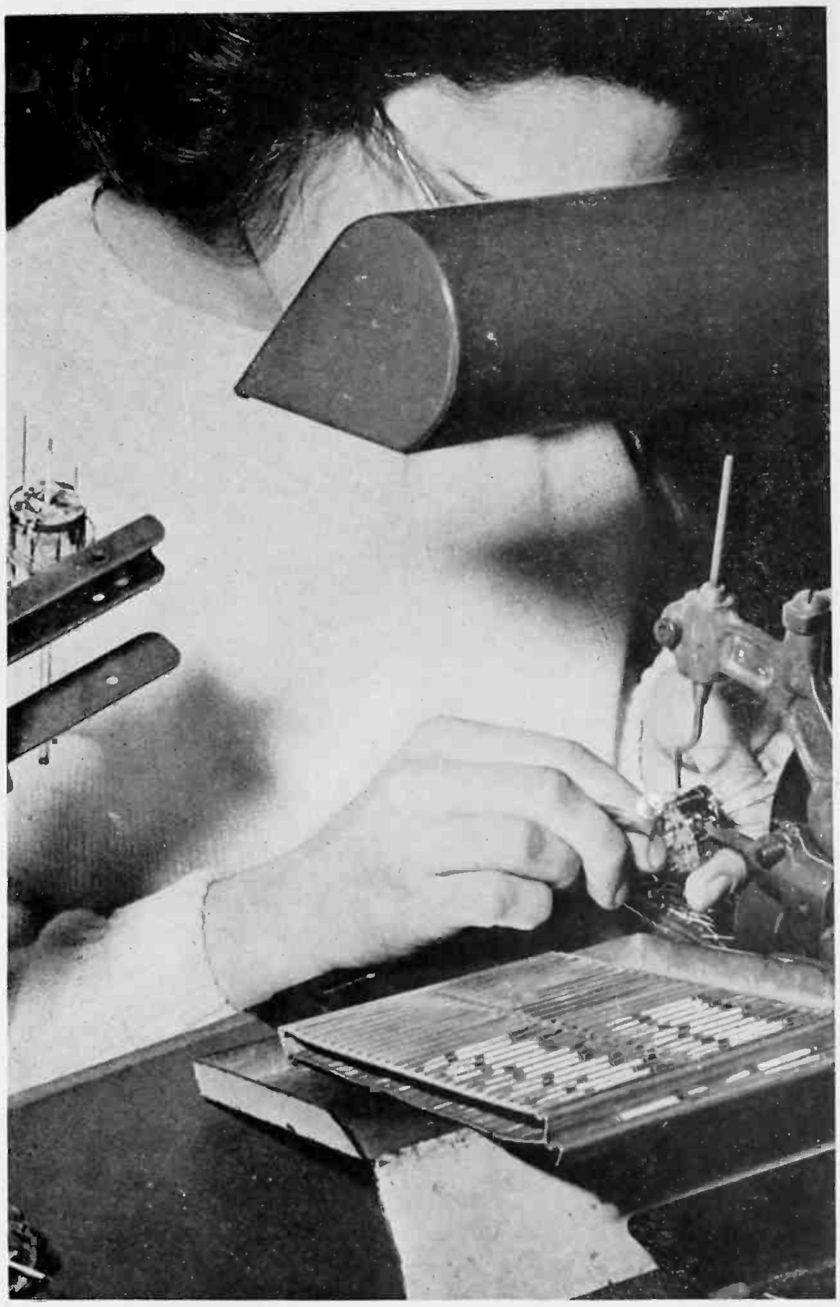
Sylvania News

JUNE, 1945 EMPORIUM, PENNA. Vol. 12, No. 1

HOW SYLVANIA RADIO TUBES ARE MOUNTED

Views in the Emporium Factory

The first operator starts with a stem assembly, welds on a few connecting tabs, the bottom shield and mica, then passes it to the girl on her right.



This operator welds the cathode and heater assembly in place, adds one mount support rod and the plate connector.

From time to time we have tried to give our readers a description of how tubes are made but as the Chinese say, "A picture is worth a thousand words." These pictures, just recently made available, show the various steps in the mounting of a Sylvania type EF50. A large number of this type was required for Lend-Lease and Sylvania was selected to manufacture them because of our long experience with lock-in tubes.

Visitors to our plant usually find the mounting operation most interesting but of course it may just be the operators! These are selected for their manual dexterity as this ability is of utmost importance in handling small parts quickly, accurately and without bending them out of shape.

HOW SYLVANIA TUBES ARE MOUNTED *(Continued)*

Next, the plate and top mica are put in position.

The third operator places all three grids in their proper positions but does not weld them.

MORE DATA ON PRECISION TESTERS

We are continuing with the modernization data supplied through the cooperation of the Precision Apparatus Co. for their testers. This issue lists the test settings for most of the unusual types you servicemen are getting these days.

SUPPLEMENTARY TUBE CHART FOR MODELS 910, 912, 914, 915, 920, 922, 954

Tube	Section	A	B	C	D	E	F	Depress
1A3	Diode	7	1	0	30	10	1	BF
(1A3—Must show short on "B", "E" and "F")								
1L4		9	1	17	37	3	1	BC
(1L4—Must show short on "E")								
3A4		4	1	15	26	3	5	BCF
(3A4—Fil. Cont. Depress A, J then BOTH A-J)								
(3A4—Must show short on "B" and "F")								
3A5	Triode 1	3	1	20	14	1	6	B
3A5	Triode 2	5	1	20	14	1	6	F
(3A5—Fil. Cont. Depress A, J, then BOTH A-J)								
5R4GY	Plate 1	7	5	0	6	11	1	C
5R4GY	Plate 2	7	5	0	6	11	1	E
(5R4GY—Fil. Cont. Depress "F")								
6AK5		1	6	14	28	6	6	EF
(6AK5—Fil. Cont. Depress "C")								
(6AK5—Cathode Test, Depress BOTH B-J)								
6J6	Triode 1	5	6	16	13	7	6	B
6J6	Triode 2	6	6	16	13	7	6	A
(6J6—Fil. Cont. Depress "C")								
6ST7	Triode	9	6	20	15	1	4	E
6ST7	Diode 1	7	6	0	35	10	4	D
6ST7	Diode 2	7	6	0	35	10	4	C
VT-25A		3	7	30	9	1	1	B
28D7	Section 1	6	9	26	11	3	1	CG
28D7	Section 2	2	9	26	11	3	1	CD
RK-33	Triode 1	7	6	29	9	1	1	C
RK-33	Triode 2	4	6	29	9	1	1	E
VT-67		3	2	27	13	1	1	B
*205D		3	5	32	10	1	1	B
259A		7	3	20	37	3	1	BC
262B		7	8	21	20	1	1	B
264C		3	1	26	18	1	1	B
271A		3	5	32	7	1	1	B
274A	Plate 1	7	5	0	7	11	1	B
274A	Plate 2	7	5	0	7	11	1	C
283A		7	8	22	28	3	1	BC
300B		3	5	40	4	1	1	B
310B		7	8	18	29	3	1	BC
801		3	7	30	10	1	1	B
802		4	6	24	25	3	1	CG
807-A/807		3	6	9	12	2	1	BG
816		4	3	0	1	11	1	C
837		4	8	20	23	3	1	CG
843		3	3	30	10	1	1	B
864		3	1	27	18	1	1	B
866 Jr.		7	4	0	2	11	1	B
2X2/879		7	3	0	21	1	1	G
*1276		3	5	35	4	1	1	B
1609		3	1	20	30	4	1	BD
1612	Input	7	6	25	11	1	1	C
1612	Output	4	6	12	50	3	1	BC
(1612—Output OK over ⅓ of scale)								
1613		4	6	25	18	3	1	BC
1619		4	3	12	15	3	1	BC
1621		4	6	25	18	3	1	BC
1624		3	3	12	15	2	1	BG
1625		4	8	9	12	3	1	CG
1626		4	8	30	6	1	1	B
1629	Triode	4	8	23	24	1	1	B
1629	Eye	7	8	0	0	2	1	(C-B)
(See instructions for eye test)								
1631		4	8	9	12	3	1	BC
1633	Triode 1	3	9	15	16	1	1	D
1633	Triode 2	8	9	15	16	1	1	J
9006	Diode	7	6	0	25	10	6	AE
(9006—Fil. Cont. Depress "C")								
(9006—Cathode Test Depress BOTH B-J)								
(9006—Plate Test Depress BOTH A-E)								

*NOTE: Types 205D and 1276 utilize a special base, but may nevertheless be tested provided the bayonet side pin points to the upper left corner of the instrument panel and the tube be properly held in the 4 prong socket.

GENERAL NOTE: Many tubes bear a suffix letter such as A, B, C, etc. In the greatest majority of cases, tubes of the same type number, but differing in the suffix letter, merely involve physical changes not affecting electrical characteristics. Accordingly, the test data shown for type 300B is equally applicable to the 300 A, etc.

Additional material on Precision Testers will appear in a subsequent issue.

WE DON'T HAVE A BELIEVE-IT-OR NOT COLUMN

300-YEAR GAS TUBE LED TO ELECTRONICS

DETROIT (U.P.)—Electronic tubes are far from being new—in fact, they are just about 300 years young.

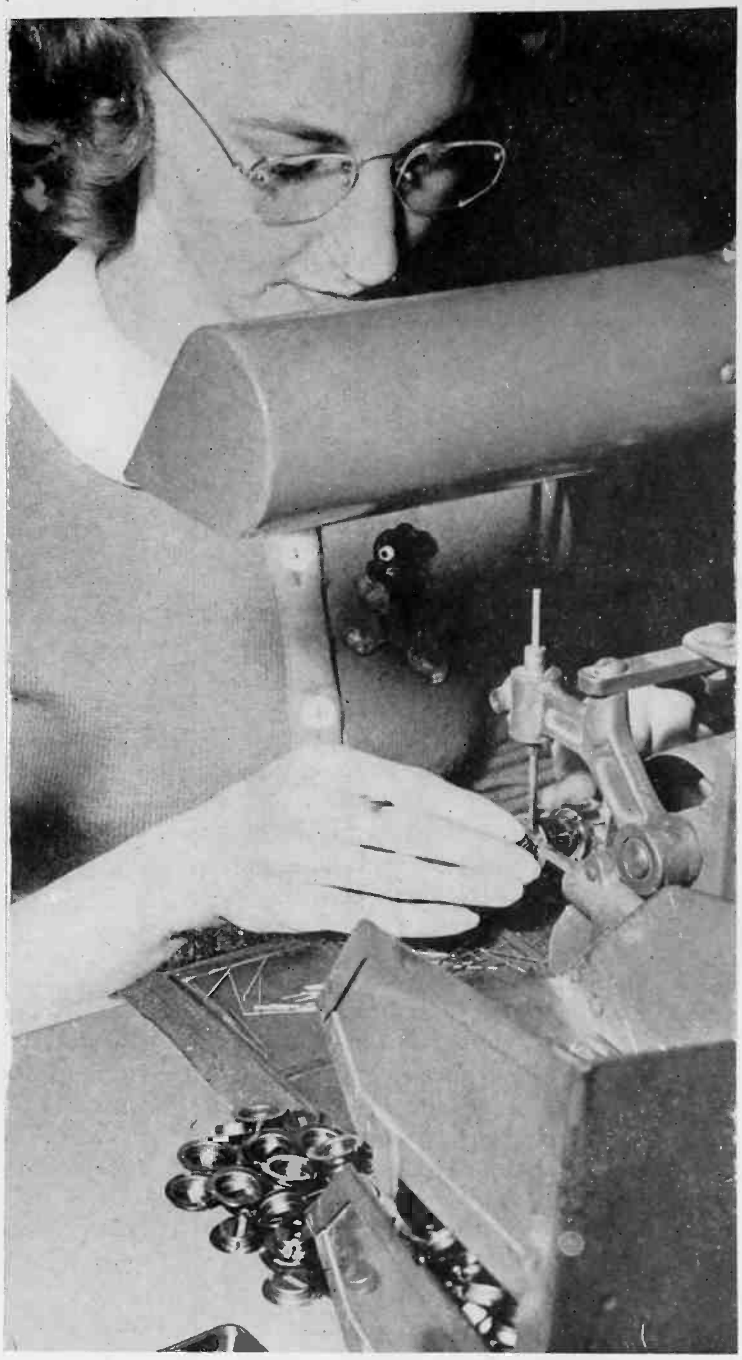
This startling disclosure about the tube which gives life to electronics, the youngest and lustiest branch of electrical engineering, was revealed recently by a Westinghouse engineer.

The forerunner of the tube dates back 300 years to the period of Otto von Guericke, who invented a primitive vacuum pump and electrostatic friction machine.

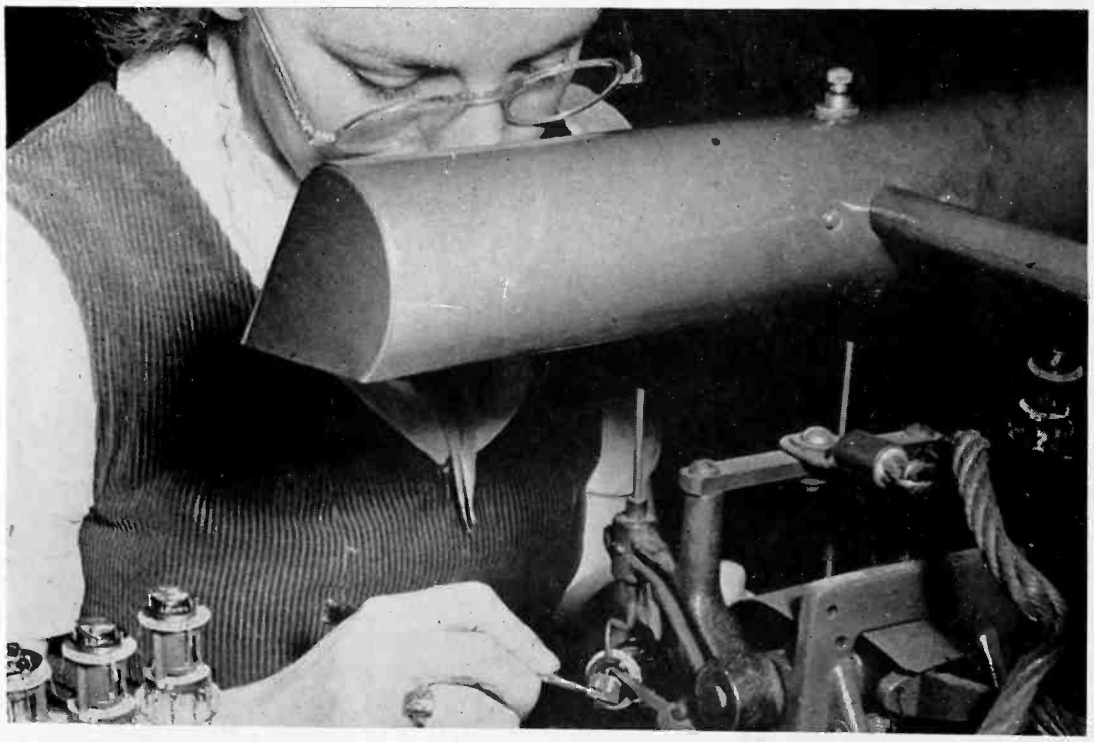
BUT WE COULDN'T RESIST THIS

HOW SYLVANIA TUBES ARE MOUNTED *(Continued)*

These unwelded parts are now all spot-welded in place with tiny "jumpers" of nickel plated steel ribbon (shown in the square boxes) connecting each element to the proper lead.



The top shield is now put in position and welded. The last mount support rod is also added.

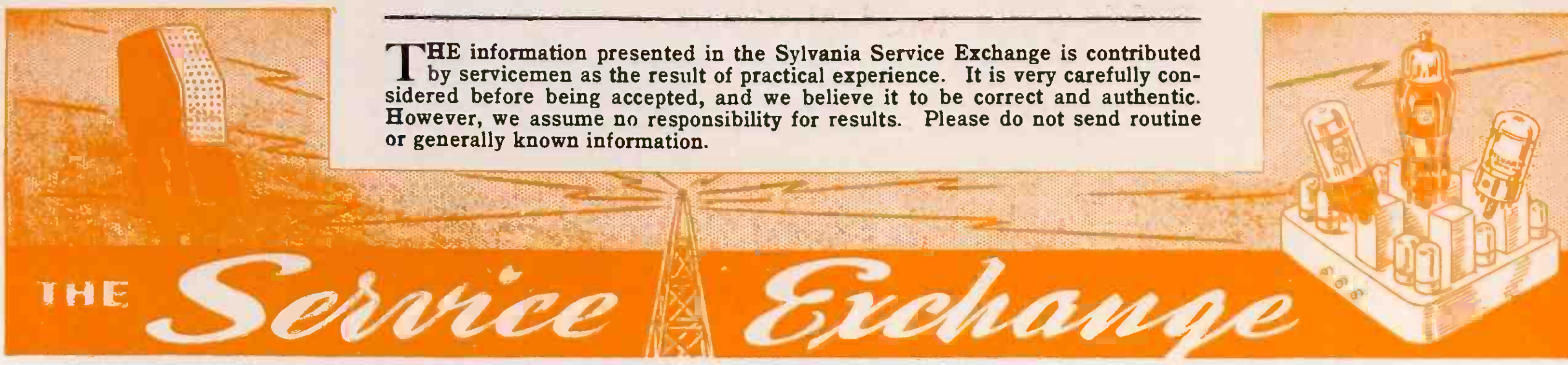


The last operator adds the getter flag and gives the complete mount a final inspection before it is **taken to the sealing and exhaust machine. This team of operators complete about 180 mounts per hour.**

TO SYLVANIA NEWS READERS OF 1938

We have received no answers yet to this appeal we ran last month. Can you help?

In the Nov.-Dec. 1938 issue of "Sylvania News" we showed a photograph and a news item on a home-made Vacuum Tube Voltmeter Tube Tester designed and built by Mr. Lewis C. Heise of Kensington, Kansas. All inquiries were to be referred to Mr. Heise, but we have recently been advised that he died last year. This appeal is to any of our old-time readers who obtained information from Mr. Heise at that time, particularly the circuit diagram and operating instructions. If you can help by forwarding this information to Sylvania, we will photostat or copy the material for distribution to those interested.



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. Please do not send routine or generally known information.

CORRECTION

Our attention has been called to a misprint in the Signal Tracer Article by Mr. L. H. Ferrish in the April "News." Condensers C2 and C3 should be 10 and 100 uufd respectively not mfd.

We hope this will not have caused any of you trouble.

* * *

Aligning Receivers with Built-In Loops. In cases where you have trouble aligning these receivers, particularly at the upper end of the dial, reception may be improved by shorting or connecting a fixed condenser (.002 to .02 mfd.) across the antenna and ground terminals provided for use with external antennae. Certain makes of receiver provide for this with a shorting bar. D. Menghini—Royalton, Ill.

* * *

Noisy Operation of Silvertone Model 100-363. Set would play and jarring would sound like a loose connection or bad tube. With set going into oscillation on strong local station coming in on any other station you happened to be tuned to. This was finally traced to 2nd I.F. which had a copper shield between I.F. can and chassis. This copper had tarnished not bad enough to show by just looking at it. Shorting around it with a knife or wire jumper made set play 100%. Can was tight. Remove can and polish copper shield running jumper from top of can to good ground on chassis.—E. F. Dietz, Buffalo, N. Y.

* * *

Noise in Philco 65. A Philco 65 had been serviced and installed in the cabinet in the customer's home. The set had played perfectly for two hours while on test and exhibited no noisy symptoms. If you walked around the floor the set would make static-like sounds which would vary with the setting of the volume control. It was a certainty that the trouble was not originating in the set. The water pipes were carefully separated with wooden wedges but to no avail.

Then a new trouble was noticed. When you stood near the set on a certain spot of the floor the volume would increase very noticably but if you stood on the same line but only a foot nearer the set the volume would decrease.

After several trips between the set and the cellar and shaking this pipe and that I noticed a small bunch of baleing wire tucked in between the braces of the rafters and also that the wire was making contact with a BX cable. I decided to remove it for I reasoned that the cable was grounded as were probably the pipes and through these grounds the scraping of the wire on the cable was a likely source of the trouble.

Upon removal of the baleing wire the troubles stopped. The set has been working perfectly ever since.—G. D. Fowle, Philadelphia, Pa.

* * *

FRANK A. LANGSTROTH NOW A MAJOR

We received notice just too late for the last issue of the News that Frank Langstroth had been promoted to the rank of Major.

Major Langstroth left Sylvania on a temporary leave of absence in October 1942 to serve as Expert Consultant on Electron Tubes. He was commissioned 1st. Lieut., Signal Corps, U. S. Army, February 1943 and was assigned to Fort Monmouth for Basic Training, after which he was assigned to the Signal Corps Standards Agency.

Frank was promoted to the rank of Captain in September 1943 and elected Chairman of the Joint Army-Navy Electron Tube Committee. In April 1945, he became Chief of the Electron Tube Staff of the Army Electronics Standards Agency. His work has taken him to Canada and Great Britain in the interests of Electron Tube standardization between Canada and the United States and also internationally.

Frank Langstroth is well known to hundreds of servicemen, having spoken to them at many Sylvania meetings and conventions. The News extends congratulations to Frank and best wishes for his continued success.

In our last issue we reported that Major Ralph Merkle, former Technical Editor Sylvania News, was attached to the Procurement Section of the Signal Corps, which is incorrect. Major Merkle is Tube Controller reporting to the Office of the Chief Signal Officer.

Alignment Trick. With the advent of electronic voltmeters, it has become common to use the AVC voltage as an output indication. To secure the same effect with a 1000 ohms per volt meter, connect the meter across the cathode bias resistor in an RF or IF stage which has its grid return connected to the AVC system. Maximum signal is indicated by MINIMUM voltage reading since an increase in AVC voltage reduces the plate current with a consequent decrease in meter reading. This method is just as sensitive and accurate for alignment work as an electronic voltmeter, besides indicating that the AVC system is working.—M. C. Sprinkle, Washington 16, D. C.

* * *

Tube Substitution. In making substitutions using an adaptor where single ended or lock-in types replace a type having a top cap I avoid the danger of shorts and extra wiring capacity as follows.

Make the adaptor in the usual way but do not run the control grid connection out the base with the others. Run the wire from the control grid along the side of the tube up to the top, solder to a top cap from a broken tube and cement the top cap in place. This is often easier than running a lead from the top of the tuning condenser or I. F. transformer back under the chassis to the socket and there is less chance of a short to ground.—F. H. Perkins, New London, Conn.

* * *

To Find Break in a Microphone Cable. A simple way of finding which end of a microphone cable has the break in it is by checking the capacity from the shield to the inner wire. The end having the least or no capacity will be the end where the break is.—R. A. Glenn, Riverside, Calif.

Sylvania News

JULY, 1945 EMPORIUM, PENNA. Vol. 12, No. 2

WHAT QUALITY CONTROL MEANS TO THE RADIO SERVICEMAN

By J. R. STEEN, Quality Control Manager

No two people are exactly alike, neither are two radio tubes of similar design even though they have been produced under conditions as nearly identical as possible in the same plant, on the same day, and under the supervision of the same people. Just as each person selected from a group of similar persons is unlike any other person in the group, so is each radio tube selected from a particular group different from every other tube in the group. As far as people are concerned these differences will occur in such characteristics as height, weight, shape, size, etc. As far as radio tubes are concerned these differences will occur in such characteristics as plate current, screen current, transconductance, power output, etc.

Precision of Measurements

It has been stated that the most consistent thing in this world is the inconsistency of everything in it. This is true not only of people and of radio tubes but of everything else with which we come in contact. Certain measurements may appear identical when measured with a rule graduated in inches but quite different if the rule is graduated in thousandths of an inch. Certain radio tube characteristics may appear identical also when measured with a meter graduated in amperes but quite different if the meter is graduated in thousandths of an ampere.

What has been said does not mean that the most accurate scales in the world should be used for all measurements of length. Neither does it mean that the most accurate instruments should be used for measuring the characteristics of all radio tubes. Appropriate measuring equipment and instruments are available, however, for making the type of measurements required with the necessary accuracy and precision. The problem of finding the right equipment for the job is one of common sense and economics.

It was stated previously that no two radio tubes are alike for any characteristic. While this statement is true theoretically, it turns out that in practice, minute differences are of insufficient importance to warrant their detection and consideration.

Experience tells us, however, that variations which exceed a certain predetermined value, are important and must be taken into consideration. The allowable magnitude of these variations depends usually upon two things. First, upon the application for which the tube is intended and second, upon the manufacturers ability to produce such a tube at a reasonable cost. Reasonable cost may be defined further as that cost which will allow a manufacturer to produce tubes at a reasonable profit and still be able to sell them in a competitive market.

A Company Policy

The quality of a radio tube or of any other product depends first of all on the company manufacturing the product. Once having decided to manufacture a quality product a company policy will be established. This policy will be a sort of guiding star for everyone in the organization. It will encourage the Engineering Department to prepare the best and most efficient designs. It will stimulate the Manufacturing Department to insist upon the best grade of material possible, to continually improve its manufacturing techniques and to promote the best possible working conditions for its employees.

Let's assume for the moment that a company has decided to manufacture and merchandise a quality product. Let's assume also that the best designs, best materials, most efficient manufacturing methods and most satisfactory employer-employee relations exist. If all this has been done and if acceptance specification limits have been set for the product based on its normal application and use, what more could be done? Based on the war experiences of innumerable manufacturers, the answer to this question is quite obvious. "Quality Control."

It has been proved beyond a reasonable doubt that systematic quality control benefits not only the producer but also the serviceman and the user. Benefits which accrue to the producer are in the form of improved shrinkage and a lower manufacturing cost. The benefits resulting from this cost reduction are then passed along to the serviceman and to the ultimate consumer in the form of a controlled product of uniform quality which will give long life and trouble free service.

Origin of Quality Control

At this point perhaps it would be well to stop and review briefly some of the fundamentals leading up to the two words "Quality Control." Quality control methods are not new. They were formulated over twenty years ago by Dr. Walter A. Shewhart, of the Bell Telephone Laboratories and have been used in connection with the manufacture of parts by the Western Electric Company for a great many years. Quality control methods have been used also by other organizations for a lesser period of time. It has been only recently, however, in fact since the war started, that American industry as a whole has adopted this powerful "tool" and has put it to work throughout our entire nation.

The quality control consciousness of American industry today, is the direct result of government sponsorship under the Office of Production Research and Development which arranged for some twenty-five to fifty intensive eight-day courses to be given throughout the country. This acted as a stimulus and manufacturers were quick to follow up with planned training courses. It is estimated that some 10,000 people have been trained to use systematic quality control methods and techniques during this period.

Chance Causes of Difference

As pointed out above differences exist between the various units which go to make up any similar group of tubes. If the conditions under which any group of tubes was manufactured are controlled conditions as they should be in any well organized factory, differences will exist still between individual units. These differences are due to chance and are so small that they cannot be detected and isolated individually. These numerous small chance causes are present in any repetitive operation resulting in a fundamental variability of the product. This is sometimes referred to as the "constant

(Continued on next page)

MORE DATA ON PRECISION TESTERS

We are continuing with the modernization data supplied through the cooperation of the Precision Apparatus Co. for their testers. This issue gives the proper settings for testing the newer types on another group of tester models.

SUPPLEMENTARY TUBE TEST DATA FOR SERIES 500, H or B, 510A, H or B, 600, H or B, 700, H or B, 800, H or B, 815A, H or B.

(*) Check with "R-X" switch in "X" position.

Tube No.	Tube Section	Fil.	Load	Shunt	Test Position
1B7	Amp.	1	13	52	BCDEG
1B7	Osc.	1	13	55	DE
1B8	Diode	1	14	70	F
1B8	Triode	1	13	56	EG
1B8	Pentode	1	13	52	BCD
1D8	Diode	1	14	70	F
1D8	Triode	1	13	57	EG
1D8	Pentode	1	13	53	BCD
1E4		1	13	52	BD
1G4		1	13	53	BD
1G6	Triode 1	1	13	54	DE
1G6	Triode 2	1	13	54	BC
1LA4		1	13	56	BCE
1LA6	Amp.	1	13	56	BCDEG
1LA6	Osc.	1	13	61	CD
1LB4		1	13	54	BCE
1LC5		1	13	53	BCDE
(1LC5—Do not short check A or G)					
1LC6	Osc.	1	13	63	CD
1LC6	Amp.	1	13	52	BCDEG
1LD5	Diode	1	14	70	D
1LD5	Pentode	1	13	52	BCE
1LE3		1	13	52	BE
1LH4	Diode	1	14	70	D
1LH4	Triode	1	13	56	BE
1LN5		1	13	53	BCDE
(1LN5—Do not short check A or G)					
1N6	Diode	1	14	70	E
1N6	Pentode	1	13	54	BCD
1P5		1	13	54	BCG
1Q5		1	13	49	BCD
1R5	Osc.	1	13	54	CD
1R5	Amp.	1	13	54	BCDF
(1R5—Do not short check A or E)					
1S4		1	13	51	BCDF
(1S4—Do not short check A, B, E, or F)					
1S5	Diode	1	14	70	C
1S5	Pentode	1	13	55	DEF
1SA6		1	13	52	BCEF
1SB6	Diode	1	14	70	D
1SB6	Pentode	1	13	58	BCF
1T4		1	13	53	BCF
(1T4—Do not short check A or E)					
1T5		1	13	52	BCD
2A4		3	12	27	BD
(2A4—Do not short check A or D)					
2W3		3	12	41	C
(2W3—Do not short check A or F)					
3A8	Diode	1	14	70	F
3A8	Triode	1	13	57	DE
*3A8	Pentode	1	13	56	BCG
(3A8—Do not short check A or F)					
*3B5		1	13	54	BCD
(3B5—Do not short check A or F)					
*3C5		1	13	50	BCD
(3C5—Do not short check A or F)					
*3LF4		1	13	48	BCE
(3LF4—Do not short check A or F)					
3Q4		1	13	52	BCDF
(3Q4—Must show short on A, B, E, F)					
*3Q5		1	13	49	BCD
(3Q5—Do not short check A or F)					
3S4		1	13	53	BCDF
(3S4—Must show short on A, B, E, F)					
6AB7		6	12	26	BCEF
6AC7		6	12	24	BCEF
6AD5		6	12	29	BD
6AD7	Triode	6	18	47	E
6AD7	Pentode	6	12	37	BCD
6AE5		6	12	27	BD
6AE7	Triode 1	6	12	32	BE
6AE7	Triode 2	6	12	32	BC
6AF5		6	12	28	BD
6AG7		6	12	25	CEF
6AL6		6	12	29	CDG
6H4		6	14	70	C
6R6		6	12	35	BDG
6SA7	Amp.	6	12	27	BCDF
6SA7	Osc.	6	12	27	CD
*6SC7	Triode 1	6	12	34	CD
*6SC7	Triode 2	6	12	34	BF
6SD7		6	12	28	BCEF
*6SF5		6	12	29	BD
*6SF7	Diode	6	14	70	D
*6SF7	Pentode	6	12	35	CEF
6SG7		6	12	25	CEF
(6SG7—Must show short on B and D)					
6SJ7		6	12	29	BCEF
6SK7		6	12	31	BCEF
*6SL7	Triode 1	6	18	45	F
*6SL7	Triode 2	6	12	32	CD
*6SN7	Triode 1	6	12	31	CD
*6SN7	Triode 2	6	12	36	AF
*6SQ7	Triode	6	12	31	EF
*6SQ7	Diode 1	6	14	70	D
*6SQ7	Diode 2	6	14	70	C
*6SR7	Diode 1	6	14	70	C
*6SR7	Diode 2	6	14	70	D
*6SR7	Triode	6	12	34	EF
6SS7		6	12	32	BCEF
6U6		6	12	27	BCD
6W6		6	12	24	BCD
7A4		6	12	29	BE
7A5		6	12	26	BCE
7A6	Diode 1	6	14	70	C
7A6	Diode 2	6	14	70	E
7A7		6	12	31	BCDE
7A8	Amp.	6	12	32	BCDEG
7A8	Osc.	6	12	37	CD
7B4		6	12	31	BE
7B5		6	12	31	BCE
7B6	Triode	6	12	31	BC
7B6	Diode 1	6	14	70	G
7B6	Diode 2	6	14	70	E
(7B6—Do not short check D or F)					

Tube No.	Tube Section	Fil.	Load	Shunt	Test Position
7B7		6	12	31	BCDE
7B8	Amp.	6	12	32	BCDEG
7B8	Osc.	6	12	36	CD
7C5		6	12	30	BCE
7C6	Triode	6	12	36	BC
7C6	Diode 1	6	14	70	G
7C6	Diode 2	6	14	70	E
(7C6—Do not short check D or F)					
7C7		6	12	31	BCDE
7E6	Diode 1	6	14	70	G
7E6	Diode 2	6	14	70	E
7E6	Triode	6	12	34	BC
(7E6—Do not short check D or F)					
7E7	Diode 1	6	14	70	C
7E7	Diode 2	6	14	70	D
7E7	Pentode	6	12	39	BEG
7F7	Triode 1	6	12	32	CD
7F7	Triode 2	6	12	32	GE
7G7		6	12	24	BCDE
7H7		6	12	25	BCDE
7J7	Triode	6	12	38	CD
7J7	Hexode	6	12	31	BEG
7K7	Diode 1	6	14	70	E
7K7	Diode 2	6	14	70	G
7K7	Triode	6	12	32	CD
7L7		6	12	27	BCDE
7N7	Triode 1	6	12	29	CD
7N7	Triode 2	6	12	29	EG
7Q7	Osc.	6	12	28	CD
7Q7	Amp.	6	12	28	BCDEG
7R7	Diode 1	6	14	70	C
7R7	Diode 2	6	14	70	D
7R7	Pentode	6	12	25	BEG
7S7	Triode	6	12	34	CD
7S7	Hexode	6	12	25	BDEG
7V7		6	12	24	BCDE
7W7		6	12	24	BCEG
(7W7—Cathode Test-Depress Both D & F)					
7Y4	Plate 1	6	12	31	C
7Y4	Plate 2	6	12	31	E
7Z4	Plate 1	6	12	38	C
7Z4	Plate 2	6	12	38	E
12A6		8	12	32	BCD
12A8	Amp.	8	12	31	BCDEG
12A8	Osc.	8	12	33	DE
12B7		8	12	32	BCDE
12B8	Triode	8	12	28	DF
12B8	Pentode	8	12	24	BCG
12C8	Pentode	8	12	40	BEG
12C8	Diode 1	8	14	70	D
12C8	Diode 2	8	14	70	C
12E5		8	12	35	BD
12F5		8	12	30	CG
12G7	Diode 1	8	14	70	C
12G7	Diode 2	8	14	70	D
12G7	Triode	8	12		BG
12H6	Diode 1	8	14	70	B
12H6	Diode 2	8	14	70	D
12J5		8	12	29	BD
12J7		8	12	32	BCDG
12K7		8	12	32	BCDG
12K8	Triode	8	12	26	DE
12K8	Hexode	8	12	26	BCDG
12Q7	Triode	8	12	31	BG
12Q7	Diode 1	8	14	70	D
12Q7	Diode 2	8	14	70	C
12SA7	Amp.	8	12	27	BCDF
12SA7	Osc.	8	12	27	CD
*12SC7	Triode 1	8	12	34	CD
*12SC7	Triode 2	8	12	34	BF
*12SF5		8	12	29	BD
*12SF7	Diode	8	14	70	D
*12SF7	Pentode	8	12	35	CEF
12SG7		8	12	25	CEF
(12SG7—Must show short on B and D)					
12SJ7		8	12	29	BCEF
12SK7		8	12	31	BCEF
*12SL7	Triode 1	8	18	45	F
*12SL7	Triode 2	8	12	32	CD
*12SN7	Triode 1	8	12	31	CD
*12SN7	Triode 2	8	12	36	AF
*12SQ7	Triode	8	12	31	EF
*12SQ7	Diode 1	8	14	70	D
*12SQ7	Diode 2	8	14	70	C
*12SR7	Diode 1	8	14	70	C
*12SR7	Diode 2	8	14	70	D
*12SR7	Triode	8	12	34	EF
14A4		8	12	29	BE
14A5		8	12	26	BCE
14A7		8	12	31	BCDE
14B6	Diode 1	8	14	70	G
14B6	Diode 2	8	14	70	E
14B6	Triode	8	12	31	BC
(14B6—Do not short check D or F)					
14B8	Amp.	8	12	32	BCDEG
14B8	Osc.	8	12	36	CD
14C5		8	12	30	BCE
14C7		8	12	31	BCDE
14E6	Diode 1	8	14	70	G
14E6	Diode 2	8	14	70	E
14E6	Triode	8	12	34	BC
(14E6—Do not short check D or F)					
14E7	Diode 1	8	14	70	C
14E7	Diode 2	8	14	70	D
14E7	Pentode	8	12	39	BEG
14F7	Triode 1	8	12	32	CD
14F7	Triode 2	8	12	32	GE
14H7		8	12	25	BCDE
14J7	Triode	8	12	38	CD
14J7	Hexode	8	12	31	BEG
14N7	Triode 1	8	12	29	CD
14N7	Triode 2	8	12	29	EG
14Q7	Osc.	8	12	28	CD
14Q7	Amp.	8	12	28	BCDEG
14R7	Diode 1	8	14	70	C
14R7	Diode 2	8	14	70	D
14R7	Pentode	8	12	25	BEG
14S7	Triode	8	12	34	CD
14S7	Hexode	8	12	25	BDEG
14W7		8	12	24	BCEG
(14W7—Cathode Test-Depress both D & F)					
14Y4	Plate 1	8	12	31	C
14Y4	Plate 2	8	12	31	E
25AC5		9	12	31	BD
25B8	Triode	9	12	28	DF
25B8	Pentode	9	12	24	BCG

Tube No.	Tube Section	Fil.	Load	Shunt	Test Position
25C6		9	12	25	BCD
25D8	Diode	9	14	70	F
25D8	Triode	9	13	35	DE
25D8	Pentode	9	12	21	BCG
25Y4		9	12	25	D
25Z4		9	12	25	D
32L7	Amp.	10	12	29	BCD
32L7	Rect.	10	13	32	E
35A5		10	12	26	BCE
35L6		10	12	26	BCD
35Y4		8	12	25	B
(35Y4—Do not short check A or D)					
35Z3		10	12	25	B
35Z4		10	12	25	D
35Z5		8	12	25	D
(35Z5—Do not short check A or B)					
35Z6	Plate 1	10	12	24	B
35Z6	Plate 2	10	12	24	D
40Z5-45Z5		8	12	25	D
(40Z5-45Z5—Do not short check A or B)					
45Z3		11	12	27	BF
(45Z3—Must show short on B and F)					
50A5		11	12	24	BCE
50C6		11	12	25	BCD
50L6		11	12	24	BCD
50Y6	Plate 1	11	12	27	B
50Y6	Plate 2	11	12	27	D
50Z7	Plate 1	11	12	27	B
50Z7	Plate 2	11	12	27	D
(50Z7—Do not short check A or E)					
70A7		13	12	26	BCD
(70A7—Do not short check A or E)					
70L7	Rect.	13	13	24	F
70L7	Amp.	13	12	26	BCD
(Do not short check A or E)					
117L7	Rect.	17	13	20	E
117L7	Amp.	17	12	29	BCD
117M7	Rect.	17	13	21	E
117M7	Amp.	17	12	26	BCD
117N7	Rect.	17	12	25	A
117N7	Amp.	17	12	25	BCD
117P7	Amp.	17	12	27	BCD
117P7	Rect.	17	12	24	A
117Z4		17	12	25	D
*117Z6	Plate 1	11	12	25	B
(117Z6—Plate 1—Do not short check A or F)					
117Z6	Plate 2	11	12	25	D
(Old Type)					
(117Z6—Plate 2—Test in-("R" position)					
117Z6	Plate 1	17	12	25	B
(New Type)					
117Z6	Plate 2	17	12	25	D
884		6	12	30	BD
1231		6	12	24	BCDE
1232		6	12	24	BCDE
1851		6	12	24	BCDG
1852		6	12	24	BCEF
1853		6	12	26	BCEF
2050		6	12	25	BDE
2051		6	12	26	BDE
XXD	Triode 1	8	12	33	CD
XXD	Triode 2	8	12	33	EG
XXL		6	12	29	BE

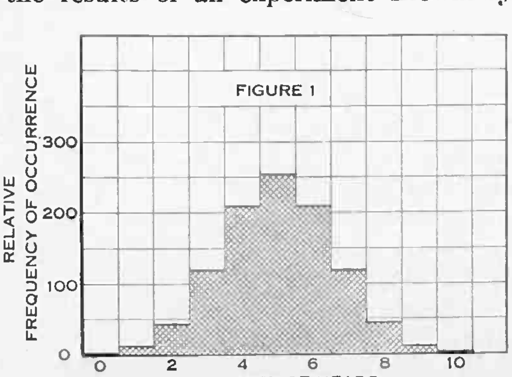
QUALITY CONTROL *(Continued)*

cause" system of variability. If anyone wishes to demonstrate this matter to his own satisfaction, it can be done by taking a pencil and making five small "a's" as nearly alike as possible. Examination will show all five to be different in some minor respects.

Causes of variation in a product may be classified in two ways. These are "chance causes," referred to above, and "assignable causes." Assignable causes are those which cause variability in a product greater than those attributable to chance causes alone. These assignable causes can be detected by means of a control chart technique described below.

Laws of Probability

In order to arrive at a better understanding of what the control chart is and how it is constructed, reference is made to the results of an experiment shown by



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A CHAT WITH W. R. JONES

The final frequency allocations from 42 - 108 mc. which are listed below have been announced recently. The assignments which have been made and which are expected to be permanent are of considerable interest to the progressive serviceman:

FM—Noncommercial educational, 88-92 mc; commercial 92-106 mc; interim allocation for existing transmitters pending transition, 42-4 mc.

FACSIMILE—106-108 mc. (facsimile eventually to move upwards, leaving 106-108 mc. for FM).

TELEVISION—Channel 1, 44-50 mc; channels 2-4, 54-72 mc; channels 5-6, 76-88 mc.

NON - GOVERNMENT Fixed and Mobile Services—42-44 mc. (when FM moves up); 72-76 mc.

The commercial band from 92-106 mc. will require the use of a frequency converter to adapt present FM sets to these bands. Three such converters have been described in recent publications. Two of these were built for the FCC and were used at hearings held to determine the final FM bands. Until transmitters are located in this new band, it will be difficult to determine how effective such converters will be. In addition to the possibility of installing these converters, the wide-awake serviceman can undoubtedly make arrangements with the various distributors in their area to specialize in new antenna installations which are almost certain to be required. When any receivers appear for these new bands, antenna installations will be very necessary for proper operation unless satisfactory built-in antennae are resorted to.

With the assignments of these new bands, many problems which as yet are not recognized, will appear and the wide-awake serviceman in the community can be of great assistance to the industry, in general, in making and recording observations and comments received from customers regarding the performance of FM equipment in these bands. The rapid development of AM broadcasting was due to some considerable extent to the excellent cooperation which existed between the radio serviceman in the field, the radio jobbers and the radio manufacturer. Obviously, receiver manufacturers could not afford to have field men stationed in every locality to report observed phenomena. The same kind of cooperation between the three interested parties in the frequency modulation program will be even more essential. While there have been many controversies regarding the placement of this band, it is hoped that the best possible results will be obtained so that frequency modulation will establish its place in the radio industry as an additional outlet for radio reception. Only by pooling the "know-how" and experience of the radio serviceman together with the manufacturer can the pioneering work in this new band best be carried out. It will be SYLVANIA'S aim to provide whatever helps are possible to further the work of the serviceman in this field.

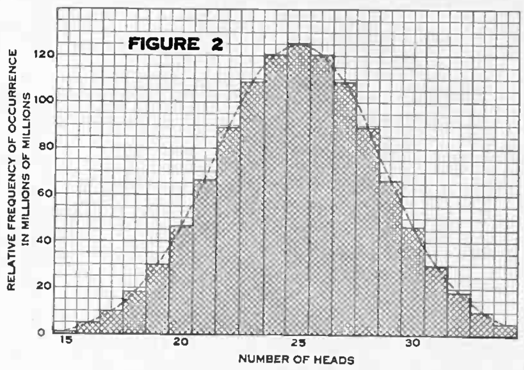
QUALITY CONTROL *(Continued)*

Figure 1. If ten coins are tossed simultaneously there are eleven possible results. No heads, one head, two heads, etc., up to ten heads. If a curve is plotted showing the relative frequency with which these various combinations occur the staircase curve of Figure 1 is obtained. This staircase curve which was determined in accordance with the laws of probability gives the following results:

Number of Heads	Number of Times in 1024 Trials
0	1
1	10
2	45
3	120
4	210
5	252
6	210
7	120
8	45
9	10
10	1
Total	1024

An examination of the table indicates that if ten coins are tossed simultaneously no heads and ten heads will appear once each in 1024 trials. One head and nine heads will appear ten times each in 1024 trials. Two heads and eight heads will appear 45 times each in 1024 trials, and so forth. This shows what the chances are of getting any particular combination of heads and tails.

Reference to Figure 2 indicates what will happen if 50 coins are tossed simultaneously instead of ten coins. Reference



to Figure 2 indicates also that as the number of coins increases, the stair steps become closer and closer together and the decrease in relative frequency of occurrence become more rapid with the result that the probability of obtaining less than 15 heads or more than 35 heads becomes very small indeed. The chance of finding all tails or all heads when 50 coins are tossed simultaneously comes out to be 1 in over 1000 million million; while the chance of finding 15 heads or 35 heads is approximately 1 in 500. If the number of coins tossed is increased gradually the step by step staircase curve results finally in the smooth dotted curve of Figure 2. This is called the "probability" curve or "frequency distribution" curve and is the fundamental principle on which are based all control chart techniques.

The Control Chart

This frequency distribution curve turns out to be exactly that required to represent the chance variations referred to above. Therefore, all variations due to chance causes alone will fall within the confines of such a curve. If a point falls outside this particular curve, it is evidence of an assignable cause of variation which is a warning signal that something has happened to the process which should be investigated by the engineering and/or manufacturing groups, and eliminated.

As an example let us assume that a group of 1024 tubes is selected at random from a large homogeneous lot and that each tube is read for plate current. If the average plate current of all tubes is exactly 10 mA and if they were produced under conditions which give a range of 7.5 mA to 12.5 mA and if the measuring instrument were calibrated to read in 0.5 mA steps we would expect to find the following distribution:

Plate Current in mA	No. of Tubes with this Plate Current
7.5	1
8.0	10
8.5	45
9.0	120
9.5	210
10.0	252
10.5	210
11.0	120
11.5	45
12.0	10
12.5	1
Total	1024

The above is similar to our previous tabulation on "Number of Heads" the only difference being that in the first column the number of heads has been

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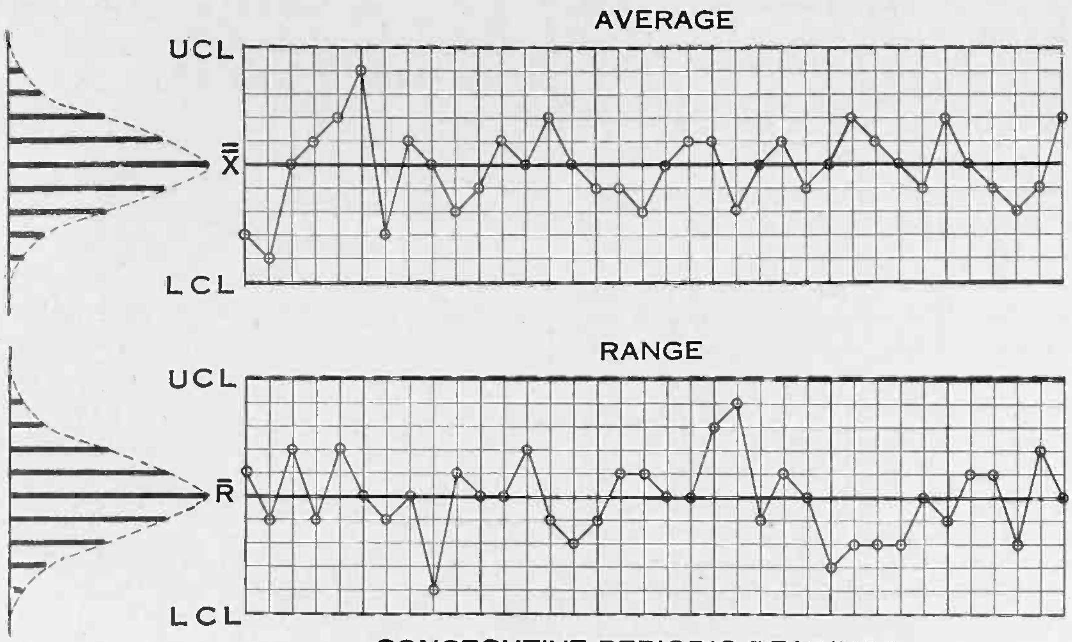
WHAT QUALITY CONTROL MEANS *(Continued)*

FIGURE 3

CONTROL CHART



CONSECUTIVE PERIODIC READINGS

replaced by proportionate values of plate current spread. This indicates that approximately 25% of the tubes will read 10 mA; that an additional 40% will be within ∓ 0.5 mA of center, that an additional 25% will be within ∓ 1 mA of center and so forth.

At this point reference is made to Figure 3 which portrays a typical control chart. The upper solid line designated $\bar{\bar{X}}$, indicates the average value of a tube characteristic as observed in the past. This line is projected into the future and control limits placed both above it and below it. These control limits are marked UCL and LCL meaning "Upper Control Limit" and "Lower Control Limit" respectively. These control limits are calculated as indicated above, that is, they are placed above and below the central line in such a manner that all variations of the product which are due to chance alone will fall between them. If these points are all projected to the left and added together as indicated by the heavy black lines, their boundary (shown dotted) will result in a normal frequency distribution curve. If an individual point falls either above the upper control limit or below the lower control limit it indicates an assignable cause of variation. As soon as one of these points falls outside the control limits, the matter is investigated and the disturbing factor eliminated.

The lower solid line on Figure 3 designated by $\bar{R}$ indicates the average range of the same group of tubes. Range is defined as the difference between the largest reading and the smallest reading in a particular group of tubes tested.

The chart for averages indicates the central tendency of a particular characteristic, that is whether it is running on the high side or on the low side or is well centered within specification limits. The chart for ranges on the other hand indicates the variability of the product, that is, the uniformity between one unit and the next. In some instances, it is quite important that the average of a characteristic be well centered, in other instances, it is important that the difference between units be small. In most instances, however, it is necessary that a characteristic maintain a central tendency and that the variation between units be as small as possible. In radio tube quality control work, emphasis is placed both on maintaining characteristics as close as possible to bogey, and on keeping variation to a minimum between one unit and the next.

Quality Control Benefits

Quality Control by the control chart method is firmly established now in all of our plants although the technique is relatively new as far as Sylvania is concerned. The benefits which have been derived to date indicate that quality control is here to stay, and it is certain that its use will increase tremendously in the post war era when competition really gets "tough." When this happens the serviceman in the most favorable position will be the one who recommends and uses "Quality Controlled" tubes produced by a manufacturer interested in supplying the best tube produced at the lowest cost. Under these conditions of operation some of the benefits gained can then be passed along both to the serviceman and to the user.

SERVICE HINTS

Majestic Model 310A. Usual failure in this receiver is opening of the primary winding of 2nd IF transformer. As a replacement transformer with a center-tapped secondary winding was unobtainable a 175 KC output was employed as follows:

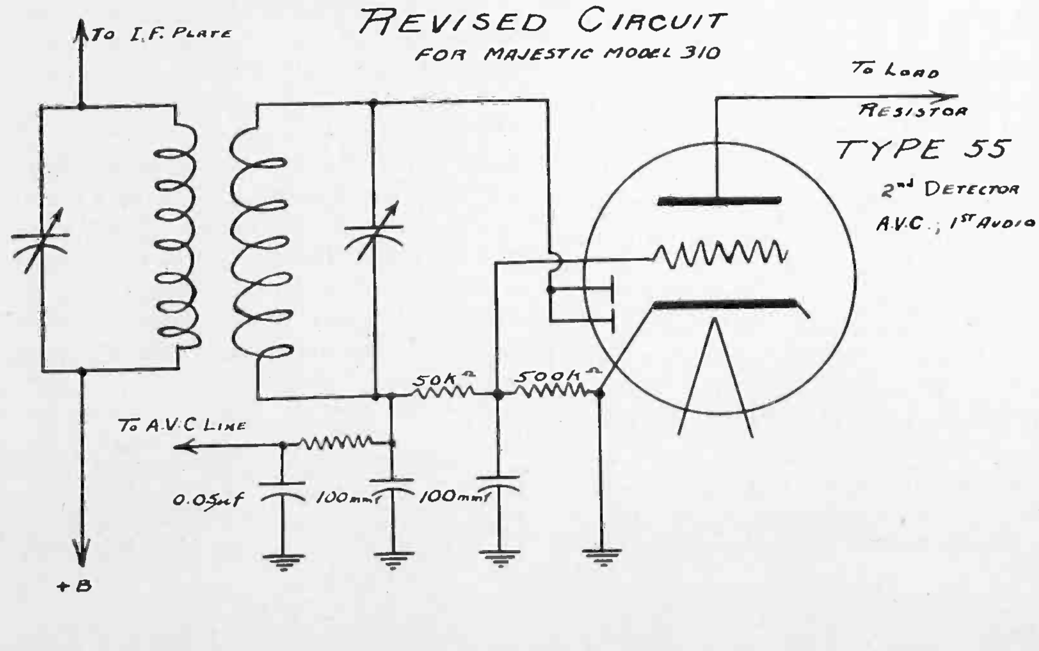
(a) Remove can, old transformer and trimmer on back of chassis. Install replacement over the hole in chassis. Connect diode plates of 55 tube together and use as half wave rectifier. Other transformer wiring is convenional.

(b) Remove 10,000 and 40,000 ohm diode load resistors. Leave white AVC line filter resistor in place. Install 50,000 ohm RF filter and 500,000 ohm load resistors. Use two 100 mmf mica capacitors in RF filter.

(c) Connect grid lead of 55 triode section to junction of 50,000 and 500,000 ohm resistors. The 55 is diode biased and supplied with signal by this means.

(d) Remove 0.5 mfd AVC line bypass capacitor and replace with 0.05 mfd. This is green wire to potted block in center of chassis. The old capacitor gives too long a time constant.

(e) Realign at 175 KC. The result is a receiver which performs better than when it was new. The revised connections are shown below.—M. C. Sprinkle, Washington 16, D. C.



Sylvania News

AUGUST, 1945 EMPORIUM, PENNA. Vol. 12, No. 3

SERVICEMEN CAN BUILD THIS 50 to 5,000 CYCLE AUDIO SIGNAL GENERATOR

By A. J. SHULTZ, Commercial Eng. Dept.

For the radio serviceman who may not be able to purchase an audio signal generator at the present time, or who may not wish to invest a great deal of money in such a piece of equipment, this oscillator may prove very useful. The cost of the parts necessary to build it is comparatively low and it can be calibrated with sufficient accuracy for normal requirements.

The oscillator is of the R-C type using a single tube (7N7 duo-triode). The frequency of such an oscillator depends primarily upon the values of resistance and capacitance in a series and a parallel combination (C_4, R_4, R_5 and C_6, R_2, R_3 in the diagram). Referring to the values in the series and parallel combinations as C_s, R_s, C_p and R_p then

$$f = \frac{1}{2\pi\sqrt{C_s \cdot R_s \cdot C_p \cdot R_p}}.$$

When $C_s = C_p = C$ and $R_s = R_p = R$ as is true in this case) then

$$f = \frac{1}{2\pi RC}.$$

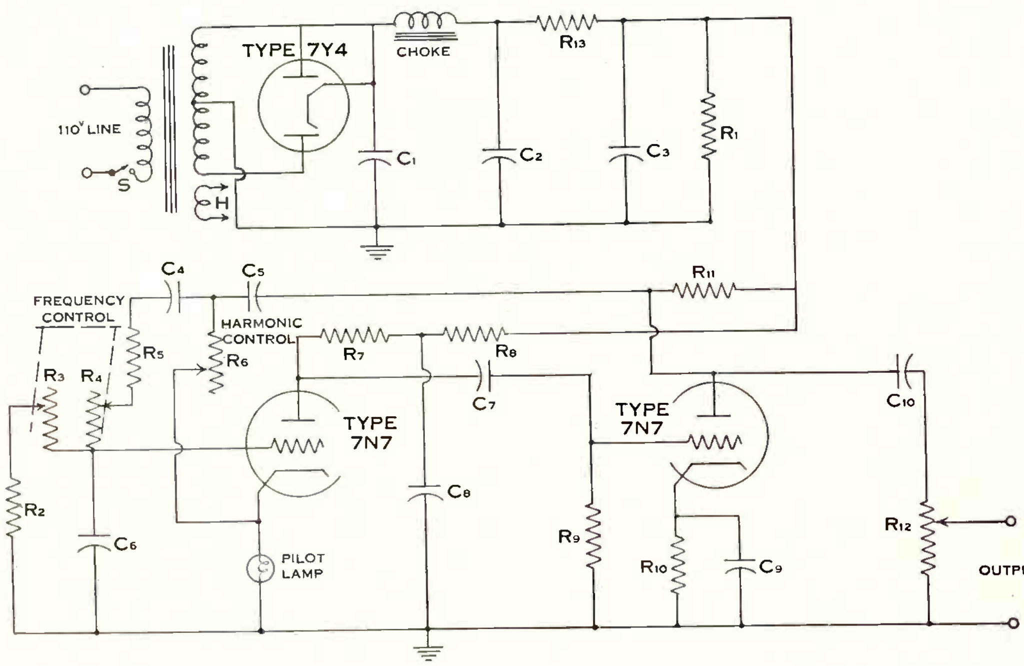
The resistances R_3 and R_4 are one megohm potentiometers, as nearly identical as possible with regard to taper and rotation. The two potentiometers are ganged together so that R_3 and R_4 are about equal at all times. The resistors R_2 and R_5 determine the upper frequency limit. When R_3 and R_4 equal zero, R_2 and R_5 serve as the resistance in the series and parallel combinations. They have very little effect at the low frequency end of the band as they are small compared to one megohm potentiometers. Due to variations in resistors, condensers, and tubes, the frequency range may be slightly different from that specified. If so, it can be corrected by a very small change in C_4 and C_6.

The second triode section serves as an amplifier. The output of this section

(Continued on page 5)

RESISTANCE-CAPACITY OSCILLATOR

RANGE 50 TO 5000 CYCLES HIGH HARMONIC CONTENT



Condenser	Capacity	Voltage	Tolerance
C1	8 mfd.	350 Volts	....
C2	16 mfd.	350 Volts	....
C3	16 mfd.	350 Volts	....
C4	.0035 uf.	Paper	±2%
C5	4 mfd.	Paper	....
C6	.0035 uf.	Paper	±2%
C7	0.1 mfd.	Paper	....
C8	8.0 mfd.	350 Volts	....
C9	10.0 mfd.	25 Volts	....
C10	1.0 mfd.	350 Volts	....

Transformer—250 Volts 60 Ma. H. V.
6.3 Volts 1.8 Amp. L. V.
Pilot Lamp —110 Volts 3 Watt (G. E.)
Choke —10 Hy. 55 Ma.

Resistor	Ohms	Watts	Tolerance
R1	20,000	10	....
R2	5,000	½	±1%
R3	1 megohm	..	±1%
R4	1 megohm	..	±1%
R5	5,000	½	±1%
R6	3,000	..	....
R7	100,000	1	....
R8	15,000	½	....
R9	250,000	½	....
R10	1,000	½	....
R11	10,000	5	....
R12	20,000	..	....
R13	5,000	10	....

INSTANT START FLUORESCENT LAMPS

EDITORS NOTE;
We are reprinting this article from the "Sylvania Lighting News" in order to keep servicemen up to date with advances in this field.

Circuit Differs from Ordinary Method

Ever since fluorescent lamps first became commercially available, there has been a demand for a circuit which would start them without the customary cathode preheating time as provided by a time delay switch called a starter. While there are several ways to accomplish this, the major problems have been to do it without appreciably affecting the life, light output and general performance of lamps, and without consuming too much power in the equipment.

The usual starting method involves cathode preheating for a few moments and then, as the starter opens the circuit, an inductive surge for an instant which may be in the order of 1000 volts. This inductive surge is sufficient to ionize the column of gas in the lamp so that current (as limited by the ballast) flows through it at 108 volts while the lamp remains lighted (40W lamp).

In the instant starting circuit there is no inductive surge since the circuit is not opened by a starter, but sufficient voltage must be applied to start the lamp. Such a starting voltage in a 40 watt lamp is approximately 440-450 volts. This is supplied by the instant starting ballast to start the lamp, after which the operating voltage is maintained at about 108 volts as in the standard circuits.

Under the starting conditions described in the previous paragraph, ordinary lamps may not start if humidity conditions are high. There may be some question as to the reasons for this, but it is well known that if a film of moisture of sufficient density exists on the outer bulb wall, it may prevent ionization and proper starting of the lamp if the impressed voltage is only 450 volts, as in the case of the instant starting circuit.

The inductive surge of the standard circuit, being about twice as much, is sufficient to overcome this condition. Thus the problem of instant starting is increased as humidity conditions are increased.

(Continued on next page)

MORE DATA ON PRECISION TESTERS

The following information has been supplied by the Precision Apparatus Company for the use of Sylvania News readers who have Precision Testers.

SUPPLEMENTARY TUBE TEST DATA FOR SERIES 900

(*)Check in "M-1" octal socket.

Tube	Section	A	B	C	D	E	Depress
1B7	Amp.	7	1	16	42	3	BC
1B7	Osc.	4	1	32	48	1	E
1B8	Diode	1	1	0	25	10	F
1B8	Triode	7	1	23	50	1	E
1B8	Pentode	4	1	20	21	3	BC
1D8	Diode	1	1	0	50	10	F
1D8	Triode	7	1	18	48	1	E
1D8	Pentode	4	1	23	26	3	BC
1E4		4	1	19	28	1	B
1G4		4	1	24	43	10	B
1G6	Triode 1	4	1	23	35	1	E
1G6	Triode 2	3	1	23	35	1	B
1LA4		5	1	10	34	3	BC
1LA6	Amp.	5	1	35	40	7	BG
1LA6	Osc.	4	1	9	48	1	C
1LB4		5	1	28	26	3	BC
1LB4		5	1	28	26	3	BC
1LC5		5	1	16	43	3	BC
(1LC5—Do not short check A or G)							
1LC6	Amp.	5	1	18	46	7	BG
1LC6	Osc.	4	1	30	46	1	C
1LD5	Pentode	5	1	27	29	3	BC
1LD5	Diode	1	1	0	30	10	D
1LE3		5	1	19	28	1	B
1LH4	Diode	1	1	0	25	10	D
1LH4	Triode	5	1	26	50	1	B
1LN5		5	1	21	46	3	BC
(1LN5—Do not short check A or G)							
1N6	Diode	1	1	0	30	10	E
1N6	Pentode	4	1	22	29	3	BC
1P5		7	1	21	46	3	BC
1Q5		4	1	19	18	3	BC
1R5	Osc.	4	1	22	47	10	C
1R5	Amp.	4	1	28	17	6	BCF
(1R5—Do not short check A or E)							
1S4		3	1	27	19	4	BDF
(1S4—Do not short check A, B, E, or F)							
1S5	Diode	1	1	0	25	10	C
1S5	Pentode	6	1	23	37	4	DE
1SA6		3	1	24	35	5	EF
1SB6	Diode	1	1	0	35	10	D
1SB6	Pentode	6	1	24	45	3	BC
1T4		6	1	25	36	3	BC
(1T4—Do not short check A or E)							
1T5		4	1	20	21	3	BC
2A4		4	3	0	38	10	B
(2A4—Do not short check A or D)							
2W3		1	3	0	37	10	C
(2W3—Do not short check A or F)							
3A8	Diode	1	1	0	25	10	F
3A8	Triode	4	1	25	50	1	E
*3A8	Pentode	7	1	27	42	4	CD
(3A8—Do not short check A or B)							
*3B5		5	1	16	14	4	CD
(3B5—Do not short check C or B)							
*3C5		5	1	19	21	4	CD
(3C5—Do not short check A or B)							
*3LF4		6	1	18	20	4	CD
(3LF4—Do not short check A or B)							
3Q4		3	1	26	30	4	BDF
(3Q4—Must show short on A, B, E, F)							
*3Q5		5	1	19	18	4	CD
(3Q5—Do not short check A or B)							
3S4		3	1	30	29	4	BDF
(3S4—Must show short on A, B, E, F)							
6AB7		3	6	15	29	5	EF
6AC7		3	6	4	31	5	EF
6AD5		2	6	37	14	1	D
6AD7	Triode	1	6	0	41	1	E
6AD7	Pentode	4	6	32	17	3	BC
6AE5		4	6	32	9	1	B
6AE7	Triode 1	5	6	34	11	1	B
6AE7	Triode 2	3	6	34	11	1	B
6AF5		4	6	27	10	1	B
6AG7		3	6	17	21	5	EF
6AL6		4	6	13	10	3	CG
6H4		1	6	0	33	10	C
6R6		7	6	20	32	2	BD
6SA7	Amp.	4	6	25	12	6	BCF
6SA7	Osc.	4	6	34	10	1	C
*6SC7	Triode 1	4	6	22	35	1	E
*6SC7	Triode 2	3	6	22	35	1	B
6SD7		3	6	8	35	5	EF
*6SF5		3	6	14	37	1	E
*6SF7	Diode	1	6	0	25	10	E
*6SF7	Pentode	2	6	25	28	4	DF
6SG7		3	6	12	34	5	EF
(6SG7—Must show short on B and D)							
6SJ7		3	6	19	31	5	EF
6SK7		3	6	21	30	5	EF
*6SL7	Triode 1	1	6	0	32	1	B
*6SL7	Triode 2	3	6	19	32	1	E
*6SN7	Triode 1	4	6	25	17	1	E
*6SN7	Triode 2	7	6	0	21	1	B
*6SQ7	Triode	2	6	18	38	1	F
*6SQ7	Diode 1	1	6	0	25	10	E
*6SQ7	Diode 2	1	6	0	25	10	D
*6SR7	Triode	2	6	23	20	1	F
*6SR7	Diode 1	1	6	0	25	10	D
*6SR7	Diode 2	1	6	0	25	10	E
6SS7		3	6	23	27	5	EF
6U6		4	6	7	9	3	BC
6W6		4	6	0	10	3	BC
7A4		5	6	17	19	1	B
7A5		5	6	11	9	3	BC
7A6	Diode 1	1	6	0	25	10	C
7A6	Diode 2	1	6	0	25	10	E
7A7		5	6	22	29	3	BC
7A8	Amp.	5	6	39	38	7	BG
7A8	Osc.	4	6	39	35	1	C
7B4		5	6	14	38	1	B
7B5		5	6	31	17	3	BC
7B6	Triode	3	6	19	36	1	B
7B6	Diode 1	1	6	0	25	10	G
7B6	Diode 2	1	6	0	25	10	E
(7B6—Do not short check D or F)							
7B7		5	6	24	26	3	BC
7B8	Amp.	5	6	45	43	7	BG
7B8	Osc.	4	6	39	28	1	C
7C5		5	6	19	12	3	BC
7C6	Triode	3	6	24	38	1	B
7C6	Diode 1	1	5	0	25	10	G
7C6	Diode 2	1	6	0	25	10	E
(7C6—Do not short check D or F)							
7C7		5	6	18	32	3	BC
7E6	Diode 1	1	6	0	25	10	G
7E6	Diode 2	1	6	0	25	10	E
7E6	Triode	3	6	19	25	1	B
(7E6—Do not short check D or F)							
7E7	Diode 1	1	6	0	25	10	C
7E7	Diode 2	1	6	0	25	10	D
7E7	Pentode	5	6	20	32	7	BG
7F7	Triode 1	4	6	17	38	1	C
7F7	Triode 2	7	6	17	38	1	E
7G7		5	6	8	37	3	BC
7H7		5	6	15	35	3	BC
7J7	Triode	4	6	23	24	1	C
7J7	Hexode	5	6	14	50	7	BG
(7J7—Hexode—O.K. over ½ scale)							
7K7	Diode 1	1	6	0	25	10	E
7K7	Diode 2	1	6	0	25	10	G
7K7	Triode	4	6	17	38	1	C
7L7		5	6	7	38	3	BC
7N7	Triode 1	4	6	17	19	1	C
7N7	Triode 2	7	6	17	19	1	E
7Q7	Osc.	4	6	34	10	1	C
7Q7	Amp.	4	6	25	12	5	BCE
7R7	Diode 1	1	6	0	25	10	C
7R7	Diode 2	1	6	0	25	10	D
7R7	Pentode	5	6	15	36	7	BG
7S7	Triode	4	6	25	22	1	C
7S7	Hexode	5	6	10	31	7	BG
7V7		5	6	15	35	3	BC
7W7		5	6	12	36	3	BC
(7W7—Cathode Test—Depress BOTH D & F)							
7Y4	Plate 1	1	6	0	31	10	C
7Y4	Plate 2	1	6	0	31	10	E
7Z4	Plate 1	1	6	0	34	10	C
7Z4	Plate 2	1	6	0	34	10	E
12A6		4	8	20	14	3	BC
12A8	Amp.	4	8	31	31	10	BCEG
12A8	Osc.	4	8	39	29	1	E
12B7		5	8	22	29	3	BC
12B8	Triode	6	8	11	40	1	D
12B8	Pentode	7	8	32	30	3	BC
12C8	Pentode	7	8	25	30	5	BE
12C8	Diode 1	1	8	0	25	10	D
12C8	Diode 2	1	8	0	25	10	C
12E5		4	8	18	23	1	B
12F5		7	8	14	38	1	C
12G7	Diode 1	1	8	0	25	10	C
12G7	Diode 2	1	8	0	25	10	D
12G7	Triode	7	8			1	B
12H6	Diode 1	1	8	0	25	10	B
12H6	Diode 2	1	8	0	25	10	D
12J5		4	8	17	19	1	B
12J7		7	8	10	39	3	BC
12K7		7	8	20	30	3	BC
12K8	Triode	4	8	30	39	10	E
12K8	Hexode	4	8	27	40	10	BCG
12Q7	Triode	7	8	16	36	1	B
12Q7	Diode 1	1	8	0	25	10	D
12Q7	Diode 2	1	8	0	25	10	C
12SA7	Amp.	4	8	25	12	6	BCF
12SA7	Osc.	4	8	34	10	1	C
*12SC7	Triode 1	4	8	22	35	1	E
*12SC7	Triode 2	3	8	22	35	1	B
*12SF5		3	6	14	37	1	E
*12SF7	Diode	1	8	0	25	10	E
*12SF7	Pentode	2	8	25	28	4	DF
12SG7		3	8	12	34	5	EF
(12SG7—Must show short on B and D)							
12SJ7		3	8	19	31	5	EF
12SK7		3	8	21	30	5	EF
*12SL7	Triode 1	1	8	0	32	1	B
*12SL7	Triode 2	3	8	19	32	1	E
*12SN7	Triode 1	4	8	25	17	1	E
*12SN7	Triode 2	7	8	0	21	1	B
*12SQ7	Triode	2	8	18	38	1	F
*12SQ7	Diode 1	1	8	0	25	10	E
*12SQ7	Diode 2	1	8	0	25	10	D
*12SR7	Diode 1	1	8	0	25	10	D
*12SR7	Diode 2	1	8	0	25	10	E
*12SR7	Triode	2	8	23	20	1	F
14A4		5	8	17	19	1	B
14A5		5	8	11	9	3	BC
14A7		5	8	22	29	3	BC
14B6	Triode	3	8	19	36	1	B
14B6	Diode 1	1	8	0	25	10	G
14B6	Diode 2	1	8	0	25	10	E
(14B6—Do not short check D or F)							
14B8	Amp.	5	8	45	43	7	BG
14B8	Osc.	4	8	39	28	1	C
14C5		5	8	19	12	3	BC
14C7		5	8	18	32	3	BC
14E6	Diode 1	1	8	0	25	10	G
14E6	Diode 2	1	8	0	25	10	E
14E6	Triode	3	8	19	25	1	B
(14E6—Do not short check D or F)							
14E7	Diode 1	1	8	0	25	10	C
14E7	Diode 2	1	8	0	25	10	D
14E7	Pentode	5	8	20	32	7	BG
14F7	Triode 1	4	8	17	38	1	C
14F7	Triode 2	7	8	17	38	1	E
14H7		5	8	15	35	3	BC
14J7	Triode	4	8	23	24	1	C
14J7	Hexode	5	8	14	50	7	BG
(14J7—Hexode—O.K. over ⅓ of scale)							
14N7	Triode 1	4	8	17	19	1	C
14N7	Triode 2	7	8	17	19	1	E
14Q7	Amp.	4	8	25	12	5	BCE
14Q7	Osc.	4	8	34	10	1	C
14R7	Diode 1	1	8	0	25	10	C
14R7	Diode 2	1	8	0	25	10	D
14R7	Pentode	5	8	15	36	7	BG
14S7	Triode	4	8	25	22	1	C
14S7	Hexode	5	8	10	31	7	BG
14W7		5	8	12	36	3	BC
(14W7—Cathode Test—Depress BOTH D & F)							
14Y4	Plate 1	1	8	0	31	10	C
14Y4	Plate 2	1	8	0	31	10	E
25AC5		4	9	27	18	1	B
25B8	Triode	6	9	11	40	1	D
25B8	Pentode	7	9	32	30	3	BC
25C6		4	9	14	8	3	BC
25D8	Diode	1	9	0	40	10	F
25D8	Triode	4	9	39	44	1	E
25D8	Pentode	7	9	40	33	3	BC
25Y4		1	9	0	30	10	D
25Z4		1	9	0	30	10	D
32L7	Rect.	1	10	0	9	1	E
32L7	Amp.	4	10	9	14	3	BC
35A5		5	10	11	9	3	BC
35L6		4	10	15	10	3	BC
35Y4		1	8	0	24	10	B
(35Y4—Do not short check A or D)							
35Z3		1	10	0	29	10	B
35Z4		1	10	0	29	10	D
35Z5		1	8	0	29	10	D
(35Z5—Do not short check A or B)							
35Z6	Plate 1	1	10	0	28	10	B
35Z6	Plate 2	1	10	0	28	10	D
40Z5-45Z5		1	8	0	29	10	D
(40Z5-45Z5—Do not short check A or B)							
45Z3		1	11	0	30	10	BF
(45Z3—Must show short on B and F)							
50A5		5	11	14	8	3	BC
50C6		4	11	14	8	3	BC
50L6		4	11	14	8	3	BC
50Y6	Plate 1	1	11	0	30	10	D
50Y6	Plate 2	1	11	0	30	10	B
50Z7	Plate 1	1	11	0	30	10	B
50Z7	Plate 2	1	11	0	30	10	D
(50Z7—Do not short check A or E)							
70A7		4	13	8	9	3	BC
(70A7—Do not short check A or E)							
70L7	Rect.	1	13	0	35	10	F
70L7	Amp.	4	13	8	9	3	BC
117L7	Rect.	1	17	0	21	10	E
117L7	Amp.	3	17	8	10	4	BD
117M7	Amp.	3	17	5	10	4	BD
117M7	Rect.	1	17	0	21	10	E
117N7	Amp.	3	17	5	10	4	BD
117N7	Rect.	1	17	0	30	10	A
117P7	Amp.	3	17	9	12	4	BD
117P7	Rect.	1	17	0	29	10	A
117Z4		1	17	0	29	10	D
*117Z6	Plate 1	1	11	0	29	10	C
(117Z6—Plate 1—Do not short check A or B)							
117Z6	Plate 2	1	11	0	29	10	D
(Old Type)							
(117Z6—Plate 2—Test in—(M-2 socket)							
117Z6	Plate 1	1	17	0	29	10	B
(New Type)							
117Z6	Plate 2	1	17	0	29	10	D
884		4	6	45	30	10	B
1231		5	6	6	32	3	BC
1232		5	6	8	37	3	BC
1851		7	6	6	18	1	BCD
1852		3	6	4	31	5	EF
1853		3	6	15	29	5	EF
2050		4	6	0	6	11	B
2051		4	6	0	6	11	B
XXD	Triode 1	4	8	27	15	1	C
XXD	Triode 2	7	8	27	15	1	E
XXL		5	6	26	13	1	B

INSTANT START FLUORESCENT LAMPS *(Continued)*

To overcome these various problems of instant starting, Sylvania has developed a 40 watt lamp which will have the following special features for operation on instant starting circuits:

1. The lamp will be identified as instant starting in the etching.
2. It will utilize cathodes designed specifically for instant starting characteristics.
3. The exterior surface of the glass tube will be coated with a hydrophobic coating which will prevent the formation of a moisture film. This coating cannot be detected visually, will not rub or scratch off, and in no way affects the light output of the lamp.
4. The base pins of this lamp will be short circuited inside the plastic base thus making possible the use of standard lampholders, but safety rules of the Underwriters' Laboratories require that the primary circuit be wired through lampholders as shown in the diagram at "A", so that the primary circuit is broken whenever either lamp is removed.

These instant start lamps will be available only in the 40 watt T-12 size at present. They are not interchangeable with standard lamps on

(Continued on next page)

A CHAT WITH W. R. JONES

Within the next few months, more parts may become available to the serviceman and, as a result, many more radio receivers can be repaired. Servicing these receivers may be much more complicated than was the case before the war. Since it became necessary to adopt many expedients during the past three years to utilize available tubes and materials, the serviceman is apt to be faced with radio receivers where the dial and the cabinet are about the only original parts left. The tube complement has been altered considerably either by circuit changes, socket changes, or by the use of adaptors. It will, therefore, pay to make a very thorough analysis of the receiver and note any changes which appear to have been made in the original circuit and tube complement. Unless this is done, considerably more time will ultimately be consumed before the receiver can be placed in a proper operating condition. The use of a card listing changes could readily be posted inside the cabinet together with the serviceman's name, address and phone number for the ready convenience of his customers as well as for himself the next time the same receiver comes in for repair.

* * *

During the past several months the writer has found very few auto radios that work. The wide-awake serviceman can undoubtedly put on an aggressive campaign to restore to service the many automobile radio receivers which are now inoperative for one reason or another. The serviceman with a well-equipped shop is in a position to offer analysis service to his customers, primarily to get equipment into operation; but secondarily, at least, to establish himself as a well-equipped and competent serviceman to whom any variety of problems can be referred. The establishment of such a reputation will be very important as FM, television and citizens' radio increase in importance, since the average layman must have a radio repairman to rely upon just as every family has its own doctor to whom it looks for repair of human ills. The next several months should provide the time to lay the future groundwork for establishing a large clientele of customers for all radio problems which may arise. The radio serviceman has an opportunity, such as has never occurred before and may never occur again, in establishing himself firmly as a necessity in the community in which he operates.

A 50-5000 CYCLE SIGNAL GENERATOR

(*Continued*)

is fed back to the oscillator section through the condenser (C_5) producing regeneration. Some of this signal is fed to the cathode of the oscillator section through the resistor (R_6) yielding degeneration for stability and good wave form. The three watt pilot lamp serves as a ballast tube for further stability. As the tube current changes, the resistance of the ballast tube undergoes a similar change. The resulting change in degeneration tends to bring the tube back to its normal operating point. To allow for varying the wave form a potentiometer is used for R_6. With this arrangement it is possible to vary the wave form from less than 5% distortion to one having a high harmonic content.

CALIBRATION

Calibrating the signal generator for ordinary use may be accomplished in several ways. By far the best way is to use a standard signal generator feeding into either the horizontal plates of an oscilloscope or into a speaker. The oscillator output can be fed into the vertical plates on the oscilloscope or into a second speaker (or even into the same speaker if only one is available). A single loop (a circle for a good sine wave) on the screen of the oscilloscope indicates that both generators are at the same frequency. Using the speakers, a beat note will be heard when the two signals approach the same frequency. As one signal is varied this beat note will reach a point of zero frequency and a further variation in the same direction will cause the beat note to again increase in frequency. At the point where the beat note disappears the two signals are at the same frequency. Care must be taken to be sure the fundamental of one signal is not beating with a harmonic of the other signal unless it is so desired. If a standard signal generator is not available the oscillator can be calibrated by checking several points of known frequency This too, can be done by the use of an oscilloscope or two speakers. The most common point for calibration is the 60 cycle line frequency. When using an oscilloscope the 120 and 180 cycle points can be checked by means of Lissajou figures. With the speaker system it may be possible to tune the oscillator to the second and possibly the third harmonic of the 60 cycle line frequency. It is also possible to pick off 120 cycle voltage from the cathode of the 7Y4 rectifier tube. This should contain enough distortion to calibrate the 240 and 360 cycle points.

For the higher frequencies the standard 440 and 4000 cycle signals from W.W.V. can be picked up with a short-wave receiver on 2.5, 5, 10, or 15 megacylces. The speaker on the receiver can be used to beat with the one on the oscillator, or the audio output of the receiver can be fed into the horizontal amplifier of an oscilloscope. In the latter case it would be possible to calibrate at 880 and 1320 cycles. If a pitch pipe of known frequency is handy, the output from the oscillator speaker can be beat against it establishing another known point. In this case it might be best to have a second person blowing the pitch pipe so the operator can determine the beats more clearly. The resistance $(R_2 + R_3) = (R_4 + R_5)$ can be measured at known frequency points and by use of the equation $f = \frac{1}{2 \pi R C}$. The value of (C) can be found accurately and used back in the equation with any desired frequency to find the correct value of (R) at that frequency. By again measuring $(R_2 + R_3) = (R_4 + R_5)$ and making this combination equal to the desired

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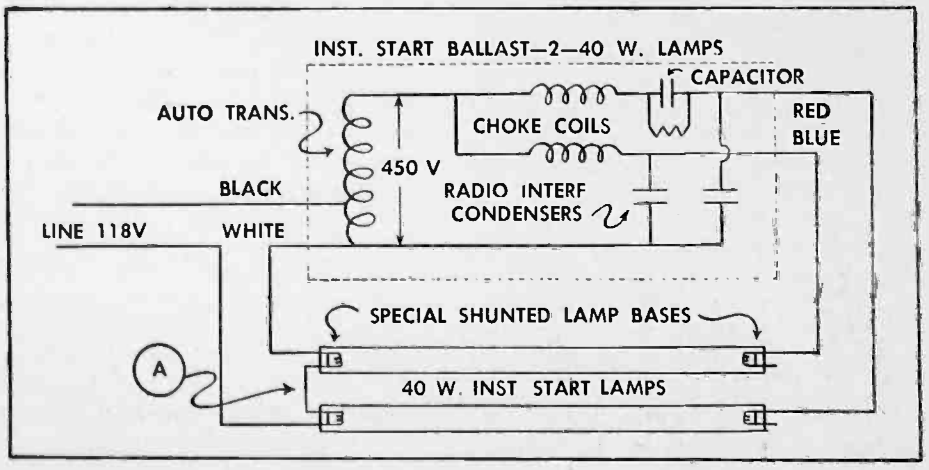
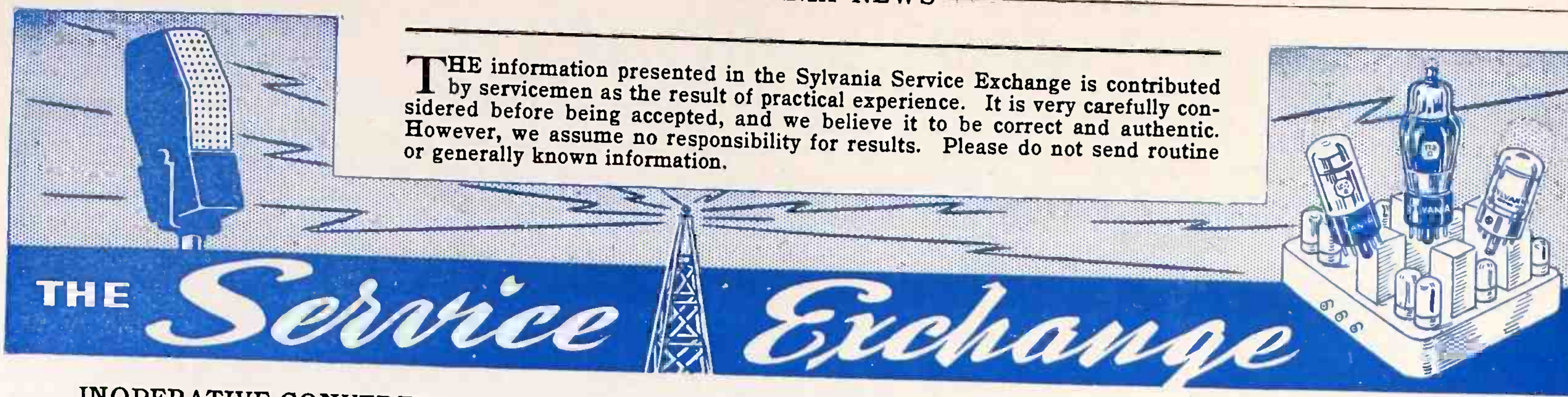


FLUORESCENT LAMPS

(*Continued from page 4*)

standard circuits. Their ratings will remain the same as standard lamps. Prices and other sales data will be released shortly through proper channels.

The diagram at the left shows the internal hook-up of a typical instant starting ballast. Some manufacturers reverse the identifying colors of the line leads indicated, or they may all be black. When making connections always be sure to check the wiring diagram usually printed on the ballast case.



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. Please do not send routine or generally known information.

THE Service Exchange

INOPERATIVE CONVERTER ON 3-WAY PORTABLES

Several times I have found that the type 1LA6, 1A7G, or 1LC6 will be inoperative when the set is connected for AC line operation. Six months ago I found that I could make them perform like new just by heating the base with a hot iron or small alcohol torch for a few minutes. Apparently this releases some gas in the tube but it certainly works and I have had no kicks yet.—A. H. Lane, New London, Connecticut.

NEW USE FOR V. T. VOLTMETERS

I have found that the type 6E5 vacuum tube voltmeter described in the Sylvania Radio Equipment Hints Booklet is very useful for locating trimmers, etc. when a layout is not available for the set being adjusted.

The high side of the oscillator trimmers and padders show oscillator AC voltage when switched in and the padders are easily distinguished from the trimmers. This leaves the remainder as R.F. trimmers which are not too hard to trace if necessary.

I believe the V.T. voltmeter is worth building for only one or two such troublesome jobs.—C. S. Walton, Wheatbridge, Colorado.

Locating Interference in Auto Sets. Using any good signal tracer, such as chanalyst, it is a very simple matter to trace automobile interference. Just probe with R. F. probe (on the frequencies of interference) and pin it right down to the particular plug, etc., which is causing trouble. Headphones, eye, or meters may be used. This saves hours of time. Of course a long AC cord is used.—R. N. Eubank, Richmond, Va.

Distortion in Zenith Models 6-J-230 & 257; 7-J-232 & 259. These sets have a peculiar pilot light circuit and distortion may be caused by burnout of the pilot lamp.

The filament of the output tube (1J6) is connected in series with the pilot lights and each pilot light is shunted by a 21 ohm resistor. Burnout of a pilot lamp doubles the series resistance reducing the filament voltage and causing distortion. This is another instance where replacement of the pilot lamp is of importance.—James N. Blair, Kansas City, Mo.

Philco Model 610. To improve the oscillator action at 6.0 M.C. remove resistor #17, (51,000 ohms) and #18 (25,000 ohms) and add a 32,000 ohm resistor from switch terminal side of condenser #7 to ground, also a 20 ohm resistor is connected from 6A7 cathode to ground.—M. S. Planovsky, Cleveland, Ohio.

Zenith Model 6-D-317. Fading. I have had several of these sets in which the cause of fading was difficult to find. In each case the defective part was the volume control but it does not show up on a routine test.—Phils Radio Service, Brooklyn, N. Y.

An ordinary 1000 ohm earphone, or an old magnetic speaker unit having a metal diaphragm can often be used as a microphone, for testing, and for voice amplification, when a regular microphone is lacking. Have had very good results using one in connection with a phonograph amplifier. No battery is needed—connect same as high-impedance phono pickup.—Paul L. Graham, Belgrade, Nebr.

REALIGNMENT OF 1R5 as a Substitute

When substituting the type 1R5 tube for the type 1A7 tube, either by adapter or by an actual socket and circuit change, trouble may be experienced in necessary realignment of the I. F. stages, due to oscillation as the I. F. resonance peak is neared. This oscillation does not respond to the usual treatment, such as careful shielding, shortened leads, etc., and is noticeably worse on the higher section of the broadcast band than the lower frequencies.

This difficulty is not as would be at first indicated in any part of the I. F. circuit, but originates in the oscillator-grid leak, the original resistor usually being of such a value as to cause the 1R5 tube to alternately "block" because of excessive developed negative voltage on the oscillator grid. The remedy is to reduce this value of the original resistor one-third to one-half, provided that its resistance does not fall below 35,000 to 40,000 ohms, as any value lower than this will impair the performance of the oscillator, if not prevent its operation entirely. It will then be found that the I. F. and R. F. adjustments will peak and perform satisfactorily without oscillation at any point on the dial.—Arthur L. Johnson, Rt. 2, Hutchinson, Kansas.

Majestic Model 886. I have found that lack of "pep" and inability of this set to line up properly is due to the fact that there is no opening in the 2nd i-f transformer can to allow adjustment of the trimming condenser on the secondary winding.

I removed the transformer from the can, drilled a hole for this adjusting screw, reassembled and peaked the I. F.

A 50-5000 CYCLE SIGNAL GENERATOR *(Continued)*

value of (R), the intermediate points can be fixed quite accurately. In this manner the oscillator can be calibrated fairly accurately. It must be remembered that a change in the negative feedback potentiometer (R_6) will cause a slight shift in frequency, so that the calibration of the oscillator should be done with the harmonic control set at one known position. Using an oscilloscope with good amplifiers and with a good sine wave applied to the horizontal plates, it is possible to adjust the harmonic control (for a circular pattern on the screen) so that the output wave will have less than five percent distortion. The best wave shape occurs when the negative feedback is such as to just allow oscillation with stable operation.

This circuit may be elaborated or changed in many ways. The output of the oscillator (as shown) is sufficient to drive a pair of earphones. If more power is desired a power amplifier tube can be installed to isolate the oscillator from the load. Reducing or shorting R_2 and R_5 will increase the upper frequency limit if such signals are needed. This happens, however, at the expense of sensitivity in selecting frequencies. Inversely, if greater sensitivity is desired with less band width, the resistors R_2 and R_5 can be increased thus lowering the upper frequency limit.

The power supply should be fairly well isolated from the oscillator to prevent it from "locking in" with the 60 cycle line frequency. This is true also for any amplifier tubes which might be added since undesirable regeneration might occur. The power pack is of the conventional design using a 7Y4 full wave rectifier. The output voltage is approximately 250 volts.

Sylvania News

September-October, 1945 EMPORIUM, PENNA. Vol. 12, No. 4

PORTABLE A-C VACUUM TUBE VOLTMETER

Complete Specifications With Parts List, Calibration Notes, and Construction Details

Vacuum Tube Voltmeters are extensively used in Radio Laboratories, Radio Manufacturing Plants, Electronic Industries and Research Laboratories. Some servicemen consider them to be an essential part of their test equipment.

Although used since 1895 when the Fleming valve was invented, they have not been in common use until the last few years. Many different types and circuits have been developed and made available although during the war it was somewhat difficult to obtain such equipment and some of the component parts have been almost unobtainable until recently.

Believing that many servicemen would be interested in a circuit which the Sylvania Commercial Engineering Department has found to be very satisfactory in routine dynamic testing, this Technical Section of Sylvania News is devoted entirely to describing this vacuum tube voltmeter.

This information is being published as another Sylvania service, but of course, no patent responsibility is assumed.

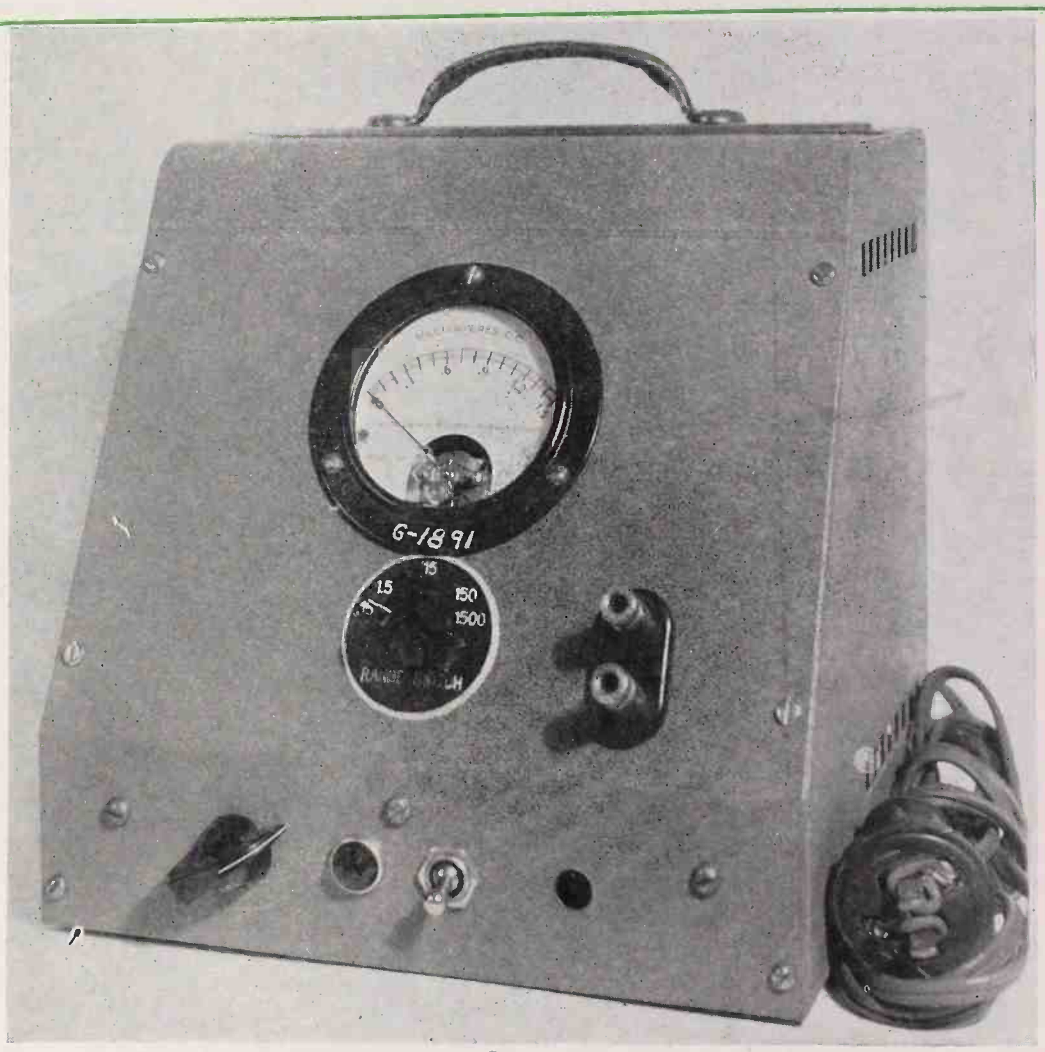


Fig. 1. The Completed Vacuum Tube Voltmeter.

Reference Material

For those readers who desire some general information on vacuum tube voltmeters or who wish to refresh their memory on the subject, reference may be made to the series of articles entitled "The VTVM as a Service Tool" by George C. Conner, which were published in Sylvania News Technical Sections Vol. 7 No's. 5, 6, 7, 8, 9, 10 and 11. The material presented covered theory of operation, basic types, construction, calibration and the use of the VTVM in service work. The construction details and specific calibration instructions given therein are related to a different instrument than the one featured in the present article.

Construction Details

A photograph of a completed unit is shown in Fig. 1. This is almost one-half actual size (8″x8″x8″). The VTVM weighs approximately 10 pounds. Additional pictures with the case removed are given on Page 6. Fig. 6 is a top view of the chassis indicating the compactness attainable with Lock-In tubes. Fig. 7 is a bottom view of the chassis and reveals the general placement of component parts and partial detail of the wiring and controls. Although designed for portability the front panel could easily be modified to meet specific requirements for permanent installation in a service bench.

Layout specifications for the chassis and front panel are given in Fig. 5 and Fig. 3 respectively. All essential details are indicated. Fig. 4 is a top view of the chassis and diagramatically is similar to the photograph on Page 4.

Component Parts Required

The parts list on Page 5 is based upon the circuit of Fig. 2 and the unit as built in the Sylvania laboratory. If identical components cannot be secured equivalent substitutes can of course be employed. This might require slight modifications in layout if physical sizes deviate from those specified. The meter and precision resistors are perhaps the scarcest items at the present time. The tube types required are among those generally available from Sylvania distributors.

(Continued on page 6)

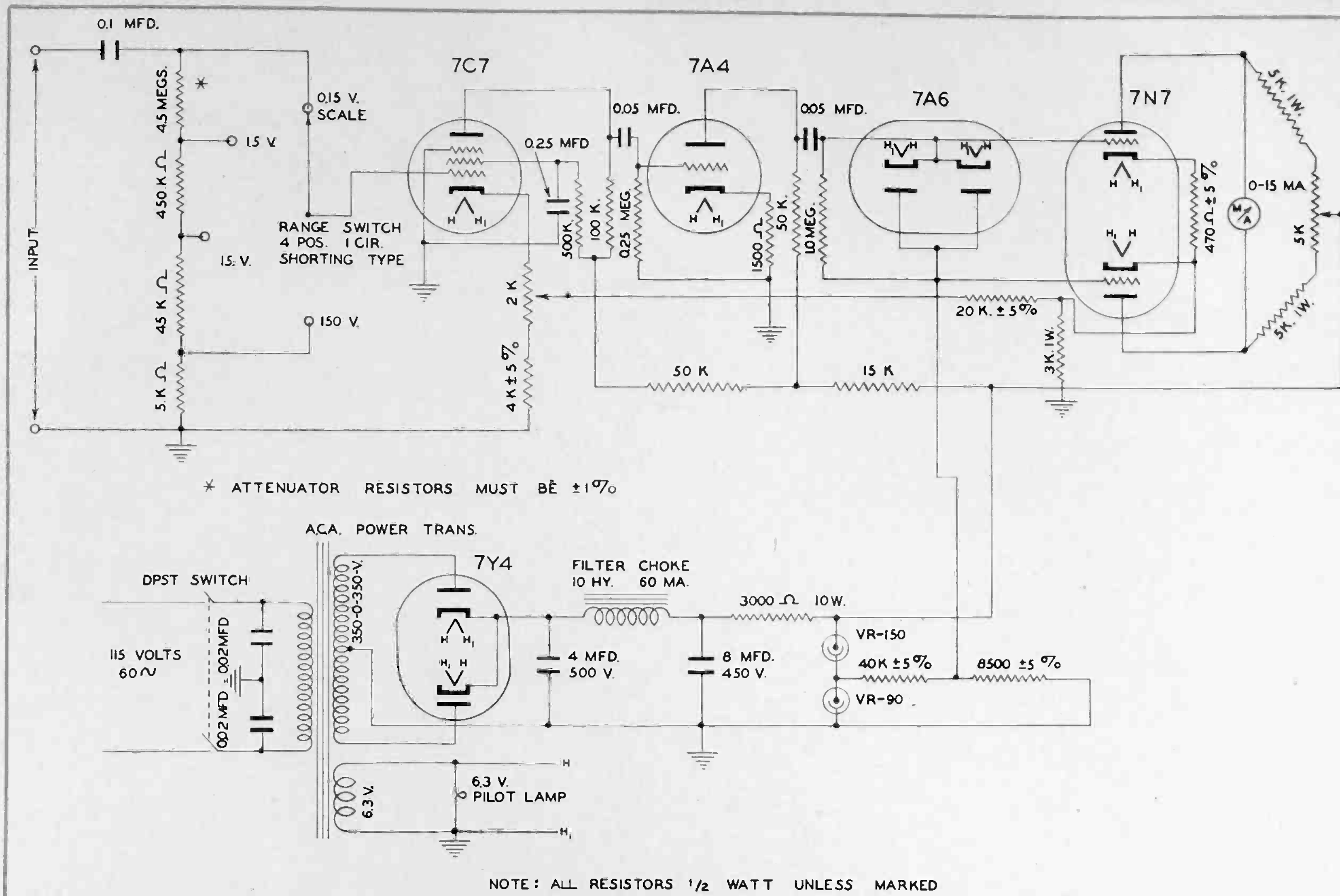


Fig. 2. Schematic Circuit Diagram of Sylvania VTVM.

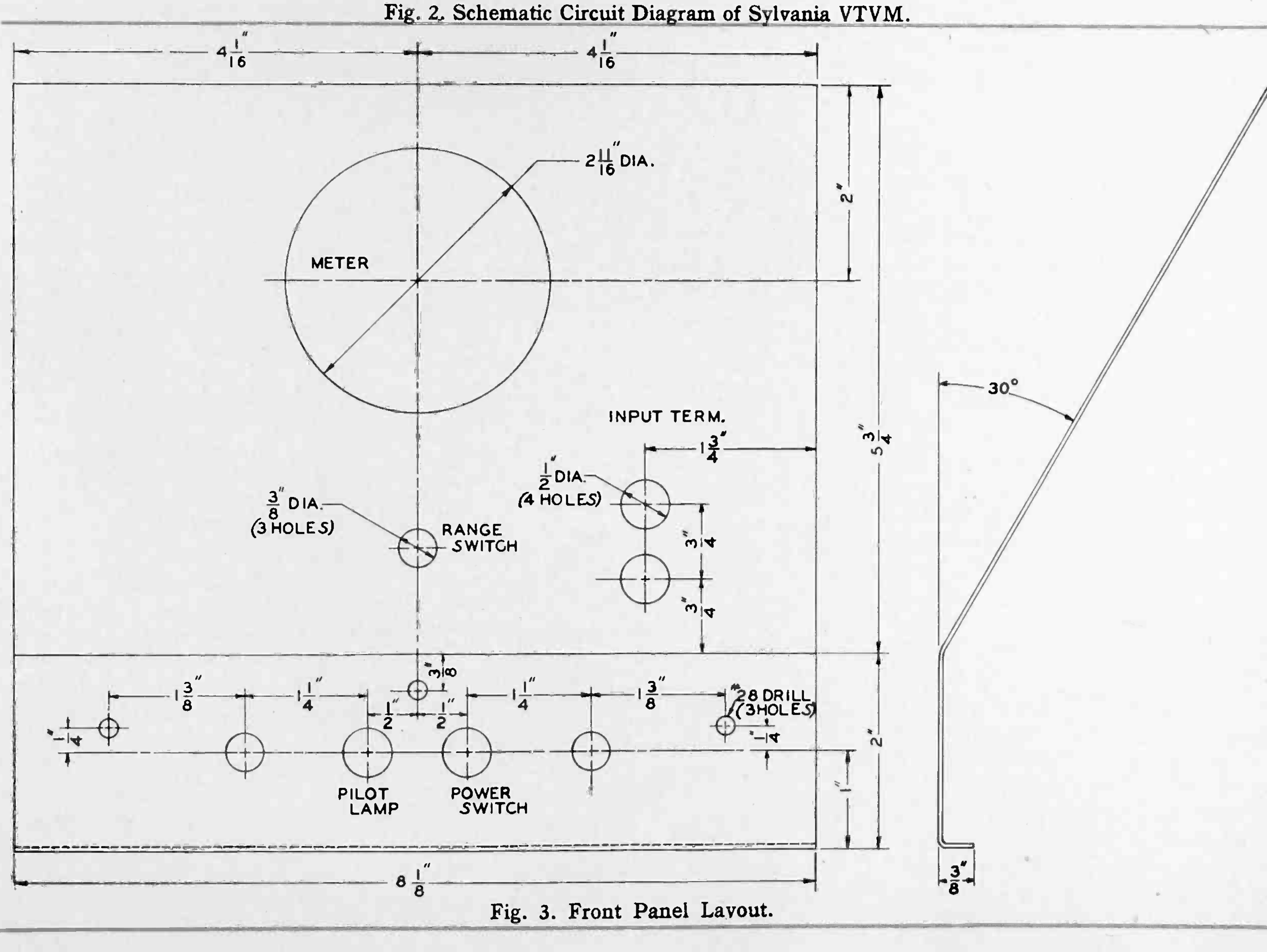


Fig. 3. Front Panel Layout.

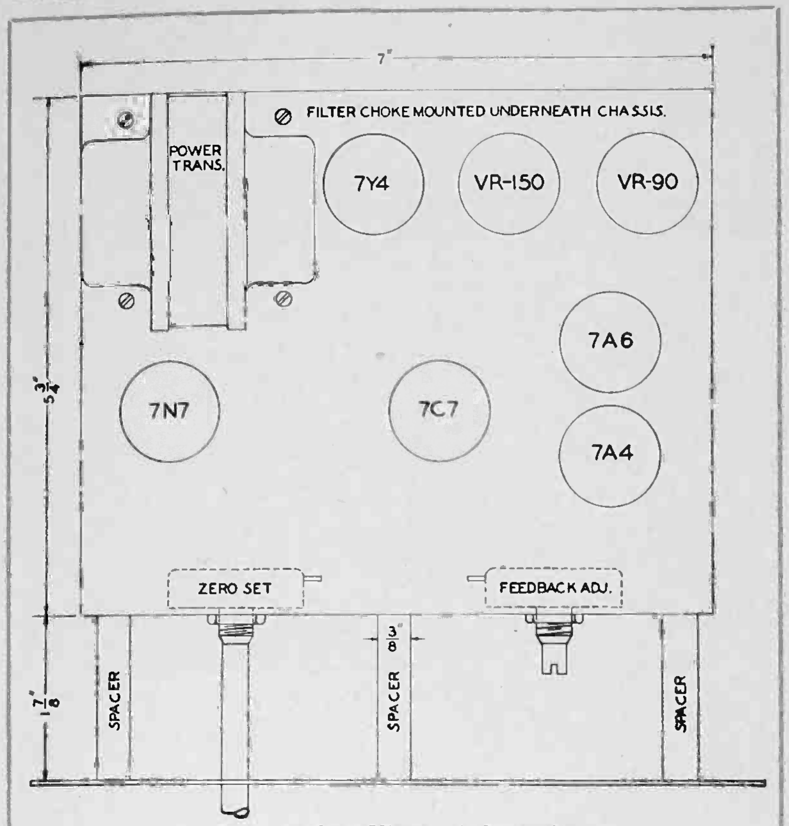


Fig. 4. Top View of Chassis.

PARTS LIST

Resistors

Value Ohms	No. Req'd.	Power Rating	Tolerance
4.5 Megs.	1	½ W.	± 1%
0.45 Meg.	1	½ W.	± 1%
45,000	1	½ W.	± 1%
5,000	1	½ W.	± 1%
470	1	1 W.	± 5%
4,000	1	1 W.	± 5%
3,000	1	1 W.	± 5%
85,000	1	½ W.	± 5%
20,000	1	½ W.	± 5%
40,000	1	½ W.	± 5%
1500	1	½ W.	±10%
3000	1	10 W.	±10%
5000	2	1 W.	±10%
15,000	1	½ W.	±10%
50,000	2	½ W.	±10%
0.1 Meg.	1	½ W.	±10%
0.25 Meg.	1	½ W.	±10%
0.5 Meg.	1	½ W.	±10%
1.0 Meg.	1	½ W.	±10%

Potentiometers

2000 W.W.	1	1 W.	I.R.C.
5000 W.W.	1	1 W.	I.R.C.

Condensers

Value		Voltage Rating	Type
0.1 µf	1	400 V.	Paper
0.05 µf	2	400 V.	Paper
0.25 µf	1	400 V.	Paper
4 µf	1	500 V.	Elect.
8 µf	1	450 V.	Elect.
0.02 µf	2	450 V.	Paper

Tubes

1 Sylvania 7C7
1 Sylvania 7A4
1 Sylvania 7A6
1 Sylvania 7N7
1 Sylvania 7Y4
1 Sylvania 0D3/VR-150
1 Sylvania 0B3/VR-90

Miscellaneous Parts

2—Octal Sockets.
5—Lock-In Sockets.
1—6.3 Volt Pilot Lamp, and Socket.
1—I.C.A. #3990 Cabinet, 8"x 8"x 8".

PARTS LIST—Miscellaneous—(Cont.)

1—Power Transformer ACA.-Sec.-700 V. ct. at 60 Ma. and 6.3 V. at 2.1 Amps.
1—5-10 hy. 60 Ma. Choke.
1—SPST. Switch 110 V. 5 Amps.
1—Single Pole 4 Pos. Switch, shorting type.
1—Panel Terminal Assembly GR Type 274Y.
1—0-1.5 Ma. Meter.

CONSTRUCTION AND OPERATION NOTES

1. Accuracy of VTVM: 2.0⅛ maximum error at any point on scale from 0.1 to 1.5.
2. Meter scale zero is blanked out and a new zero for the operation point is located 3½ scale divisions toward 0.1 ma. on scale.
3. Operation zero point is set by adjusting the 5000 ohm potentiometer. Full scale deflection at 0.15 volts r.m.s. sine wave calibrating voltage is set by adjusting the 2000 ohm feedback control.
4. Multiplication of scales is dependent upon accuracy of attentuator network. Refer to text.
5. Some interaction occurs between the zero set and feedback controls when the calibration is off considerably. It becomes negligible as the meter approaches correct calibration.
6. Meter scale is changed to read 0-1.5 volts.
7. Shielded test lead essential when making voltage measurements below 1.5 volts.
8. If 1500 volt range is incorporated the test leads employed must provide adequate insulation to insure proper protection.

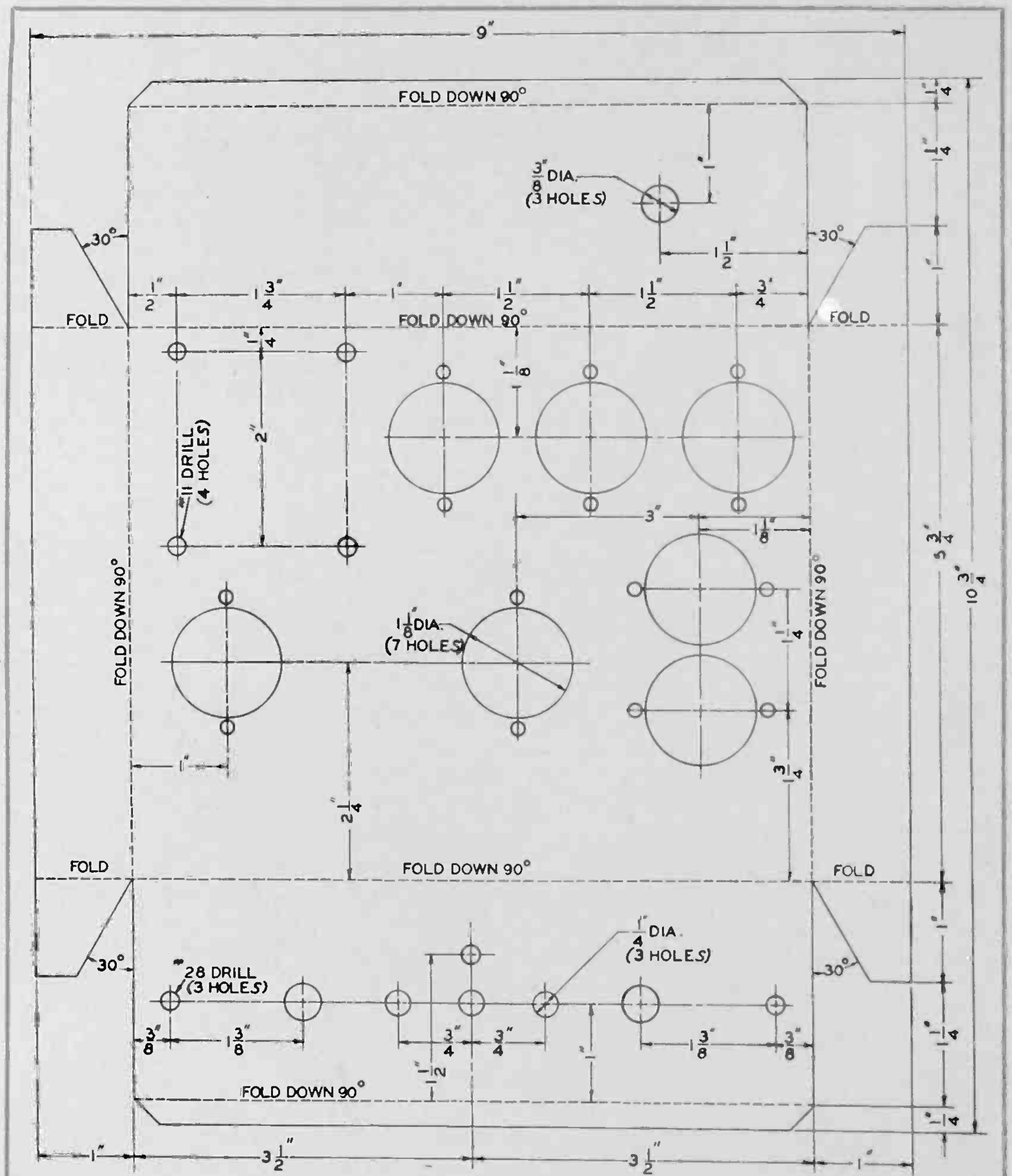


Fig. 5. Chassis Layout.

Fig. 6. Top View of Complete Chassis.

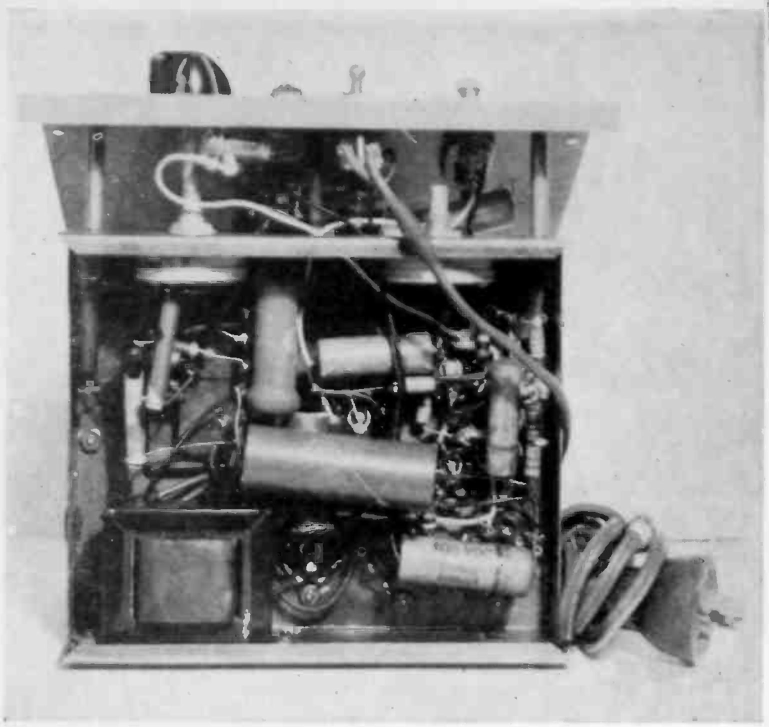


Fig. 7. Bottom View of Complete Chassis.

PORTABLE A-C VTVM

(*Continued from page 3*)

Design Features

The circuit employed is given in Fig. 2. This VTVM was designed to give accurate readings over the audio frequency range with a minimum of compensation and a high degree of stability.

On the 0.15 volt scale the VTVM is reasonably accurate to 40 Kc. and will give readable deflections sufficient to measure the stage gain of i-f stages to 500 Kc.

On the other scales some compensation may be necessary to give the desired accuracy to 20 Kc. or higher. The type of wiring used and the type and size of parts used in the attenuator network determine whether the compensation must be inductive or capacitive. In general, with ½ watt carbon resistors in the attenuator, the compensation required is as follows: for the 1.5 volt scale, a 3 to 30 $\mu\mu$f trimmer from the switch tap to ground, adjusted at full scale deflection: for the 15.0 volt scale a 50 to 300 $\mu\mu$f trimmer from the tap to ground: and for the 150 volt scale on 8 to 16 mh. r-f choke in series with the 5000 ohm resistor.

There are several parts of the circuit which are of particular interest. The screen grid by-pass on the Type 7C7 amplifier was kept small to give degeneration at low frequency and thus aid in leveling the response curve of that stage. The Type 7A4 cathode was unby-passed for the same reason.

Positive voltage was applied to the grids of the Type 7N7 tube to permit the use of a high cathode resistor and still operate the tube at normal current level and thus insure operation over the straight portion of its plate current vs. grid voltage curve. The high cathode resistor supplies sufficient voltage for feed-back control and decoupling.

The voltage dropping resistors to the amplifier stages were unby-passed to aid in the overall degeneration of the complete unit.

Calibration Procedure

Some explanation of the method of calibration may be necessary. Set the zero adjustment to read 0.06 ma. Set the range switch to the 15-volt scale and apply a 15-volt 60-cycle voltage to the input terminals. Adjust the full scale control until the meter reads 1.5 Ma. Remove the signal and re-set the zero adjustment to 0.6 ma. Re-check full scale and repeat above until interaction between zero adjustment and full scale adjustment disappears.

Check linearity by applying 15 volts and decreasing the signal in 1-volt steps to zero. If non-linear, set zero to .08 ma., re-adjust full scale and repeat above. Do this until the meter deflection becomes linear with respect to input voltage.

The zero of the VTVM should fall between 0.06 and 0.1 ma. deflection on the current meter. Blank out the meter zero and mark the zero point found by the calibration method.

In use the zero adjustment is set so that the meter hand rests on the new zero point. The meter then will read directly in volts from the ma. scale.

If precision resistors were used in the attenuator the meter scales will multiply correctly and will all be direct reading. If the scales do not multiply correctly, adjustments should be made in the attenuator network and not in the meter calibration.

Extended Range

Should one desire to extend the range to 1500 volts, as was done in the instrument shown in Fig. 1, the circuit is modified in the following manner. Replace the 5000 ohm precision resistor in the attenuator network with two precision resistors (½ watt) of 4500 ohms and 500 ohms and connect the tap at 500 ohms to point 5 on a 5-position range switch. Also, the 0.1 μf input condenser should have a 1000-volt rating.

Applications

The applications of a VTVM to radio measurements are very numerous and varied as voltage measurement is the fundamental electrical quantity involved. An instrument such as has been described will permit one to do better service work than would be the case if an ordinary voltmeter was the only kind of test equipment available. There are so many uses for a VTVM that space would hardly permit detailed descriptions; however, some of the more frequent applications might be mentioned to emphasize the desirability of having one of these meters for constant use in your servicing work:

Amplifier stage measurements.
Signal tracing.
Measuring transformer turn ratio.
Power supply measurements AC.
Low frequency impedance measurements.
Measuring inductance, capacity and resistance.
Measuring alternating currents.
Modulation indication.
Receiver stage measurements.
Testing phase inverter circuits.
Measuring the grid voltage of push-pull output stages for balanced input voltages.

CORRECTION

A draftsman's mistake slipped into the circuit of the audio oscillator described last month. The line just above the type number 7Y4 should be removed. There is not supposed to be any connection between plate and cathode of the rectifier tube.

Sylvania News

November, 1945 EMPORIUM, PENNA. Vol. 12, No. 5

INTERESTING FACTS ABOUT PROXIMITY FUSE TUBES

The general information given in the front section of the News last month probably made most servicemen and experimenters wonder about the tubes used. Information regarding these was not released in time for that issue but here at last is a picture of one and we give below the answers to many of the questions you are probably asking. Specific details of the circuits and frequencies used are still not available.

Q 1. Do these tubes have a descriptive name such as miniature, midget, etc.?

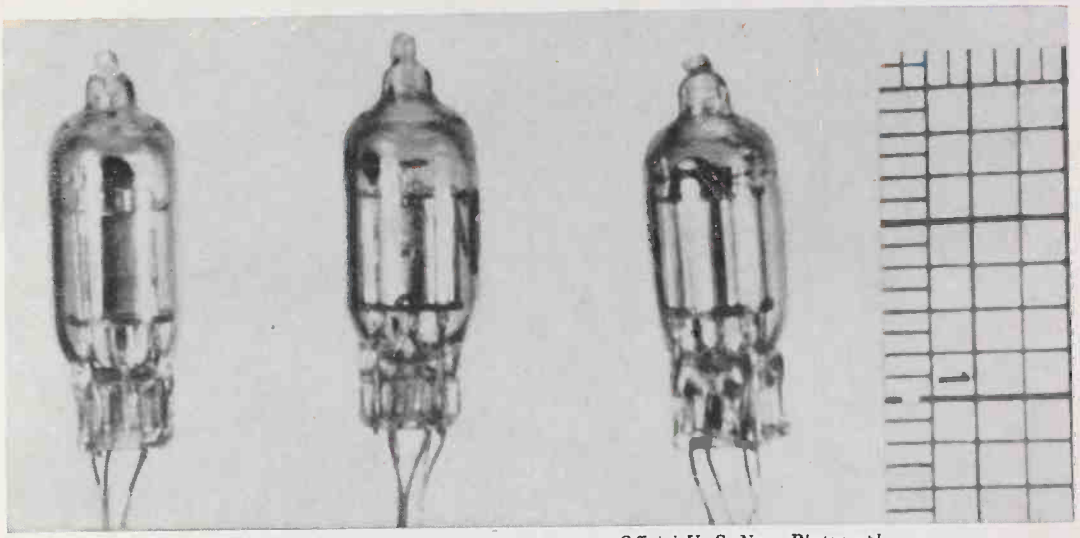
A 1. Until a trade name is selected for sales purposes we call them T-3's because they are ⅜ of an inch in diameter. They have also been called sub-miniatures.

Q 2. What voltages did the tubes operate on?

A 2. About the same as in many battery sets.

Q 3. Are the present tubes suited for peacetime applications?

A 3. No. Neither life nor characteristics would be suited for use in radios, hearing aids, etc.



Official U. S. Navy Photograph

This view shows clearly the small size of the T-3 tubes in comparison with the ruler. The scale shows that they are actually two-thirds the size shown.

Q 4. How much better were shells using these than the old type?

A 4. Statistics show that on the average the new proximity fuse shells were many times as effective as the old style shells. The exact comparison figures are not available because of their confidential status.

Q 5. Will tubes this size be available

(*Continued on page 5*)

This shows the complete fuse in which the tubes are used. The cut section does not go through one of the tubes but they are located beside the condensers and resistors in the compartment indicated by the arrow.

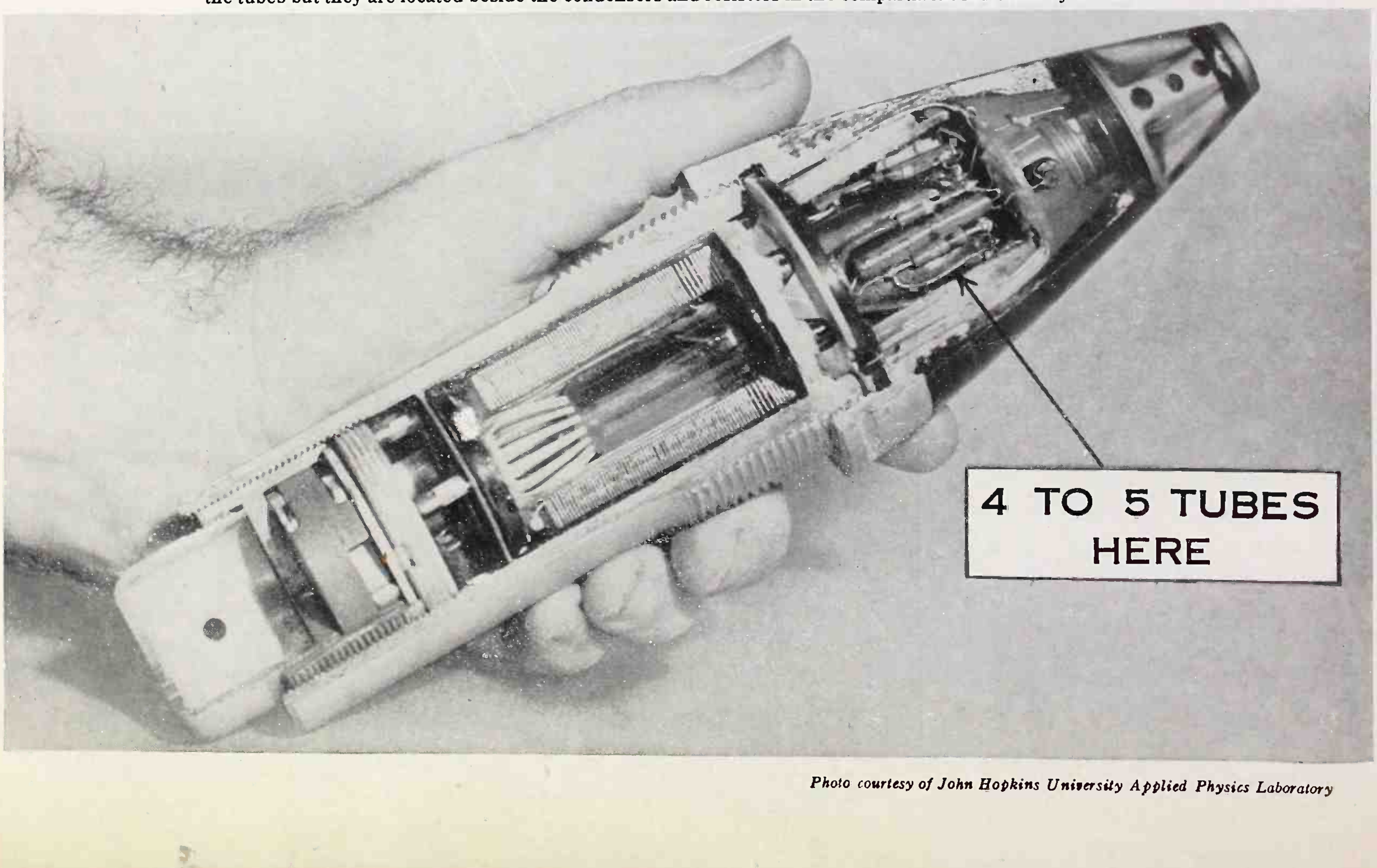


Photo courtesy of John Hopkins University Applied Physics Laboratory

MORE DATA ON PRECISION TESTERS

The following information has been supplied by the Precision Apparatus Company for the use of Sylvania News readers who have Precision Testesr.

SUPPLEMENTARY TUBE TEST DATA FOR SERIES 900 A, 900 H, 900 B

(*) Check with "R-X" switch in "X" position.

Tube	Section	A	B	C	D	E	Depress
1B7	Amp.	7	1	16	42	3	BC
1B7	Osc.	4	1	32	48	1	E
1B8	Diode	1	1	0	25	10	F
1B8	Triode	7	1	23	50	1	E
1B8	Pentode	4	1	20	21	3	BC
1D8	Diode	1	1	0	50	10	F
1D8	Triode	7	1	18	48	1	E
1D8	Pentode	4	1	23	26	3	BC
1E4		4	1	19	28	1	B
1G4		4	1	24	43	10	B
1G6	Triode 1	4	1	23	35	1	E
1G6	Triode 2	3	1	23	35	1	B
1LA4		5	1	10	34	3	BC
1LA6	Amp.	5	1	35	40	7	BG
1LA6	Osc.	4	1	40	48	1	C
1LB4		5	1	28	26	3	BC
1LC5		5	1	16	43	3	BC
(1LC5—Do not short check A or G)							
1LC6	Amp.	5	1	18	46	7	BG
1LC6	Osc.	4	1	30	46	1	C
1LD5	Pentode	5	1	27	29	3	BC
1LD5	Diode	1	1	0	30	10	D
1LE3		5	1	19	28	1	B
1LH4	Diode	1	1	0	25	10	D
1LH4	Triode	5	1	26	50	1	B
1LN5		5	1	21	46	3	BC
(1LN5—Do not short check A or G)							
1N6	Diode	1	1	0	30	10	E
1N6	Pentode	4	1	22	29	3	BC
1P5		7	1	21	46	3	BC
1Q5		4	1	19	18	3	BC
1R5	Osc.	4	1	22	47	10	C
1R5	Amp.	4	1	28	17	6	BCF
(1R5—Do not short check A or E)							
1S4		3	1	27	19	4	BDF
(1S4—Do not short check A, B, E, or F)							
1S5	Diode	1	1	0	25	10	C
1S5	Pentode	6	1	23	37	4	DE
1SA6		3	1	24	35	5	EF
1SB6	Diode	1	1	0	35	10	D
1SB6	Pentode	6	1	24	45	3	BC
1T4		6	1	25	36	3	BC
(1T4—Do not short check A or E)							
1T5		4	1	20	21	3	BC
2A4		4	3	0	38	10	B
(2A4—Do not short check A or D)							
2W3		1	3	0	37	10	C
(2W3—Do not short check A or F)							
3A8	Diode	1	1	0	25	10	F
3A8	Triode	4	1	25	50	1	E
*3A8	Pentode	7	1	27	42	3	BC
(3A8—Do not short check A or F)							
*3B5		4	1	16	14	3	BC
(3B5—Do not short check A or F)							
*3C5		4	1	19	21	3	BC
(3C5—Do not short check A or F)							
*3LF4		5	1	18	20	3	BC
(3LF4—Do not short check A or F)							
3Q4		3	1	26	30	4	BDF
(3Q4—Must show short on A, B, E, F)							
*3Q5		4	1	19	18	3	BC
(3Q5—Do not short check A or F)							
3S4		3	1	30	29	4	BDF
(3S4—Must show short on A, B, E, F)							
6AB7		3	6	15	29	5	EF
6AC7		3	6	4	31	5	EF
6AD5		2	6	37	14	1	D
6AD7	Triode	1	6	0	41	1	E
6AD7	Pentode	4	6	32	17	3	BC
6AE5		4	6	32	9	1	B
6AE7	Triode 1	5	6	34	11	1	B
6AE7	Triode 2	3	6	34	11	1	B
6AF5		4	6	27	10	1	B
6AG7		3	6	17	21	5	EF
6AL6		4	6	13	10	3	CG
6H4		1	6	0	33	10	C
6R6		7	6	20	32	2	BD
6SA7	Amp.	4	6	25	12	6	BCF
6SA7	Osc.	4	6	34	10	1	C
*6SC7	Triode 1	3	6	22	35	1	D
*6SC7	Triode 2	2	6	22	35	1	F
6SD7		3	6	8	35	5	EF
*6SF5		2	6	14	37	1	D
*6SF7	Diode	1	6	0	25	10	D
*6SF7	Pentode	6	6	25	28	3	CE
6SG7		3	6	12	34	5	EF
(6SG7—Must show short on B and D)							
6SJ7		3	6	19	31	5	EF
6SK7		3	6	21	30	5	EF
*6SL7	Triode 1	1	6	0	32	1	F
*6SL7	Triode 2	3	6	19	32	1	D
*6SN7	Triode 1	3	6	25	17	1	D
*6SN7	Triode 2	7	6	0	21	1	F
*6SQ7	Triode	6	6	18	38	1	E
*6SQ7	Diode 1	1	6	0	25	10	D
*6SQ7	Diode 2	1	6	0	25	10	C
*6SR7	Triode	6	6	23	20	1	E
*6SR7	Diode 1	1	6	0	25	10	C
*6SR7	Diode 2	1	6	0	25	10	D
6SS7		3	6	23	27	5	EF
6U6		4	6	7	9	3	BC
6W6		4	6	0	10	3	BC
7A4		5	6	17	19	1	B
7A5		5	6	11	9	3	BC
7A6	Diode 1	1	6	0	25	10	C
7A6	Diode 2	1	6	0	25	10	E
7A7		5	6	22	29	3	BC
7A8	Amp.	5	6	39	38	7	BG
7A8	Osc.	4	6	39	35	1	C
7B4		5	6	14	38	1	B
7B5		5	6	31	17	3	BC
7B6	Triode	3	6	19	36	1	B
7B6	Diode 1	1	6	0	25	10	G
7B6	Diode 2	1	6	0	25	10	E
(7B6—Do not short check D or F)							
7B7		5	6	24	26	3	BC
7B8	Amp.	5	6	45	43	7	BG
7B8	Osc.	4	6	39	28	1	C
7C5		5	6	19	12	3	BC
7C6	Triode	3	6	24	38	1	B
7C6	Diode 1	1	6	0	25	10	G
7C6	Diode 2	1	6	0	25	10	E
(7C6—Do not short check D or F)							
7C7		5	6	18	32	3	BC
7E6	Diode 1	1	6	0	25	10	G
7E6	Diode 2	1	6	0	25	10	E
7E6	Triode	3	6	19	25	1	B
(7E6—Do not short check D or F)							
7E7	Diode 1	1	6	0	25	10	C
7E7	Diode 2	1	6	0	25	10	D
7E7	Pentode	5	6	20	32	7	BG
7F7	Triode 1	4	6	17	38	1	C
7F7	Triode 2	7	6	17	38	1	E
7G7		5	6	8	37	3	BC
7H7		5	6	15	35	3	BC
7J7	Triode	4	6	23	24	1	C
7J7	Hexode	5	6	14	50	7	BG
(7J7—Hexode—O.K. over ½ scale)							
7K7	Diode 1	1	6	0	25	10	E
7K7	Diode 2	1	6	0	25	10	G
7K7	Triode	4	6	17	38	1	C
7L7		5	6	7	38	3	BC
7N7	Triode 1	4	6	17	19	1	C
7N7	Triode 2	7	6	17	19	1	E
7Q7	Osc.	4	6	34	10	1	C
7Q7	Amp.	4	6	25	12	5	BCE
7R7	Diode 1	1	6	0	25	10	C
7R7	Diode 2	1	6	0	25	10	D
7R7	Pentode	5	6	15	36	7	BG
7S7	Triode	4	6	25	22	1	C
7S7	Hexode	5	6	10	31	7	BG
7V7		5	6	15	35	3	BC
7W7		5	6	12	36	3	BC
(7W7—Cathode Test—Depress BOTH D & F)							
7Y4	Plate 1	1	6	0	31	10	C
7Y4	Plate 2	1	6	0	31	10	E
7Z4	Plate 1	1	6	0	34	10	C
7Z4	Plate 2	1	6	0	34	10	E
12A6		4	8	20	14	3	BC
12A8	Amp.	4	8	31	31	10	BCEG
12A8	Osc.	4	8	39	29	1	E
12B7		5	8	22	29	3	BC
12B8	Triode	6	8	11	40	1	D
12B8	Pentode	7	8	32	30	3	BC
12C8	Pentode	7	8	25	30	5	BE
12C8	Diode 1	1	8	0	25	10	D
12C8	Diode 2	1	8	0	25	10	C
12E5		4	8	18	23	1	B
12F5		7	8	14	38	1	C
12G7	Diode 1	1	8	0	25	10	C
12G7	Diode 2	1	8	0	25	10	D
12G7	Triode	7	8			1	B
12H6	Diode 1	1	8	0	25	10	B
12H6	Diode 2	1	8	0	25	10	D
12J5		4	8	17	19	1	B
12J7		7	8	10	39	3	BC
12K7		7	8	20	30	3	BC
12K8	Triode	4	8	30	39	10	E
12K8	Hexode	4	8	27	40	10	BCG
12Q7	Triode	7	8	16	36	1	B
12Q7	Diode 1	1	8	0	25	10	D
12Q7	Diode 2	1	8	0	25	10	C
12SA7	Amp.	4	8	25	12	6	BCF
12SA7	Osc.	4	8	34	10	1	C
*12SC7	Triode 1	3	8	22	35	1	D
*12SC7	Triode 2	2	8	22	35	1	F
*12SF5		2	6	14	37	1	D
*12SF7	Diode	1	8	0	25	10	D
*12SF7	Pentode	6	8	25	28	3	CE
12SG7		3	8	12	34	5	EF
(12SG7—Must show short on B and D)							
12SJ7		3	8	19	31	5	EF
12SK7		3	8	21	30	5	EF
*12SL7	Triode 1	1	8	0	32	1	F
*12SL7	Triode 2	3	8	19	32	1	D
*12SN7	Triode 1	3	8	25	17	1	D
*12SN7	Triode 2	7	8	0	21	1	F
*12SQ7	Triode	6	8	18	38	1	E
*12SQ7	Diode 1	1	8	0	25	10	D
*12SQ7	Diode 2	1	8	0	25	10	C
*12SR7	Diode 1	1	8	0	25	10	C
*12SR7	Diode 2	1	8	0	25	10	D
*12SR7	Triode	6	8	23	20	1	E
14A4		5	8	17	19	1	B
14A5		5	8	11	9	3	BC
14A7		5	8	22	29	3	BC
14B6	Triode	3	8	19	36	1	B
14B6	Diode 1	1	8	0	25	10	G
14B6	Diode 2	1	8	0	25	10	E
(14B6—Do not short check D or F)							
14B8	Amp.	5	8	45	43	7	BG
14B8	Osc.	4	8	39	28	1	C
14C5		5	8	19	12	3	BC
14C7		5	8	18	32	3	BC
14E6	Diode 1	1	8	0	25	10	G
14E6	Diode 2	1	8	0	25	10	E
14E6	Triode	3	8	19	25	1	B
(14E6—Do not short check D or F)							
14E7	Diode 1	1	8	0	25	10	C
14E7	Diode 2	1	8	0	25	10	D
14E7	Pentode	5	8	20	32	7	BG
14F7	Triode 1	4	8	17	38	1	C
14F7	Triode 2	7	8	17	38	1	E
14H7		5	8	15	35	3	BC
14J7	Triode	4	8	23	24	1	C
14J7	Hexode	5	8	14	50	7	BG
(14J7—Hexode—O.K. over ½ of scale)							
14N7	Triode 1	4	8	17	19	1	C
14N7	Triode 2	7	8	17	19	1	E
14Q7	Amp.	4	8	25	12	5	BCE
14Q7	Osc.	4	8	34	10	1	C
14R7	Diode 1	1	8	0	25	10	C
14R7	Diode 2	1	8	0	25	10	D
14R7	Pentode	5	8	15	36	7	BG
14S7	Triode	4	8	25	22	1	C
14S7	Hexode	5	8	10	31	7	BG
14W7		5	8	12	36	3	BC
(14W7—Cathode Test—Depress BOTH D & F)							
14Y4	Plate 1	1	8	0	31	10	C
14Y4	Plate 2	1	8	0	31	10	E
25AC5		4	9	27	18	1	B
25B8	Triode	6	9	11	40	1	D
25B8	Pentode	7	9	32	30	3	BC
25C6		4	9	14	8	3	BC
25D8	Diode	1	9	0	40	10	F
25D8	Triode	4	9	39	44	1	E
25D8	Pentode	7	9	40	33	3	BC
25Y4		1	9	0	30	10	D
25Z4		1	9	0	30	10	D
32L7	Rect.	1	10	0	9	1	E
32L7	Amp.	4	10	9	14	3	BC
35A5		5	10	11	9	3	BC
35L6		4	10	15	10	3	BC
35Y4		1	8	0	24	10	B
(35Y4—Do not short check A or D)							
35Z3		1	10	0	29	10	B
35Z4		1	10	0	29	10	D
35Z5		1	8	0	29	10	D
(35Z5—Do not short check A or B)							
35Z6	Plate 1	1	10	0	28	10	B
35Z6	Plate 2	1	10	0	28	10	D
40Z5-45Z5		1	8	0	29	10	D
(40Z5-45Z5—Do not short check A or B)							
45Z3		1	11	0	30	10	BF
(45Z3—Must show short on B and F)							
50A5		5	11	14	8	3	BC
50C6		4	11	14	8	3	BC
50L6		4	11	14	8	3	BC
50Y6	Plate 1	1	11	0	30	10	D
50Y6	Plate 2	1	11	0	30	10	B
50Z6	Plate 1	1	11	0	30	10	B
50Z7	Plate 2	1	11	0	30	10	D
(50Z7—Do not short check A or E)							
70A7		4	13	8	9	3	BC
(70A7—Do not short check A or E)							
70L7	Rect.	1	13	0	35	10	F
70L7	Amp.	4	13	8	9	3	BC
117L7	Rect.	1	17	0	21	10	E
117L7	Amp.	3	17	8	10	4	BD
117M7	Amp.	3	17	5	10	4	BD
117M7	Rect.	1	17	0	21	10	E
117N7	Amp.	3	17	5	10	4	BD
117N7	Rect.	1	17	0	30	10	A
117P7	Amp.	3	17	9	12	4	BD
117P7	Rect.	1	17	0	29	10	A
117Z4		1	17	0	29	10	D
*117Z6	Plate 1	1	11	0	29	10	B
(117Z6—Plate 1—Do not short check A or F)							
117Z6	Plate 2	1	11	0	29	10	D
(Old Type)							
((117Z6—Plate 2—Test in—("R" position)							
117Z6	Plate 1	1	17	0	29	10	B
((New Type)							
117Z6	Plate 2	1	17	0	29	10	D
884		4	6	45	30	10	B
1231		5	6	6	32	3	BC
1232		5	6	8	37	3	BC
1851		7	6	6	18	1	BCD
1852		3	6	4	31	5	EF
1853		-3	6	15	29	5	EF
2050		4	6	0	6	11	B
2051		4	6	0	6	11	B
XXD	Triode 1	4	8	27	15	1	C
XXD	Triode 2	7	8	27	15	1	E
XXL		5	6	26	13	1	B

REPORT ON MR. HEISS' HOME-MADE TUBE TESTER

We have had quite a few requests for information on this tester mentioned briefly in the Sylvania News issue of November-December, 1938. Mr. Wm. Anderson of the Bronx, N. Y., sent us a quotation from Mr. Heiss' letter to him, dated 12-15-38, in which he refused to divulge any information on the circuit until his patent application was acted upon. He also apparently hoped to make the information available to readers of Sylvania News.

Our letter to Mr. Heiss was returned by a cousin in a different town who was executer of the estate and knew nothing of any tube tester. We hoped that the serviceman who bought the equipment would come forward with the necessary information, but since no further information seems available, we propose to drop the matter.

For those who wish to build a tube tester, the following references to recent articles may be helpful.

Dynamic Tube Tester
Radio Craft—November, 1944—P. 94

Emission Type Tube Checker
C.Q.—June, 1945

GM Tube Tester
Radio Craft—September, 1945

USING YOUR VACUUM TUBE VOLTMETER

The use of vacuum tube voltmeters in service work was described on Pages 42 to 55 in the Radio Equipment Hints booklet. Balancing phase inverters, measurement of stage gain, checking A-V-C action, etc. are readily accomplished by any serviceman from the explanation given. The vacuum tube voltmeter, however, is such a versatile instrument that many other measurements may be made by the experimenter or advanced serviceman. A series of short articles each discussing a particular measurement is being prepared so that those who wish may get even more use from this equipment.

Since the characteristics of various makes of commercial and homemade meters cover a wide range, no particular instrument will be assumed but when the accuracy will be greatly influenced, the effect of these characteristics will be discussed.

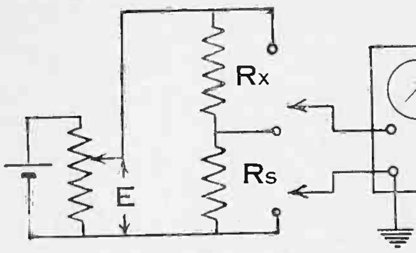


FIGURE 1

Measurement of Resistance

Many of the newer types of vacuum tube voltmeters have additional scales for reading resistances. A fundamentals circuit for this is shown in Figure 1. The source of voltage should be high enough to give nearly full scale deflection on the meter for the higher value resistor. The voltage across the known resistor is read and then the voltage across the unknown. The resistance will be

$$Rx = Rs + \frac{Ex}{Es}$$

Values of Rs should be selected between $^1/_5$ and 5 times the unknown resistor so as to read on the most accurate position of the scale.

This equation is good for any V. T. voltmeter which reads D. C. providing the resistance of the voltmeter is high with respect to the values of both resistors.

When an ohmmeter is designed into a vacuum tube voltmeter other methods can be used so that several ranges, all direct reading, can be used. Since the best method will be different for the various voltmeter circuits only the above general method can be covered here.

A method to use when you have a 10 meg. resistance in the voltmeter and desire to measure a resistance between 1 and 100 megohms may be of sufficient interest to describe here. The resistance of the meter should first be found if it has not been given by the manufacturer. An easy way to do this is shown in Figure 2.

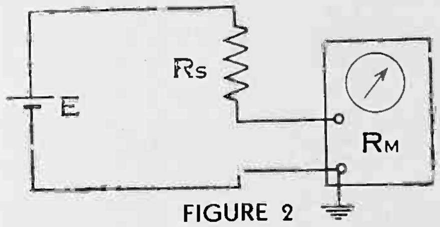


FIGURE 2

Rs is any known high value resistance in this range. E is a known voltage (measured with the V. T. voltmeter) E_1 is the voltage reading on the meter connected as shown. Resistor Rs can be considered a multiplier to the meter which gives the meter resistance $Rm = \frac{E^1 Rs}{E - E_1}$

Now Rx can be substituted for Rs and from E2 (the meter reading when the unknown resistor is in series)

$$Rx = \frac{Rm\ (E - E_2)}{E_2}.$$

Some commercial V. T. voltmeters read only A. C. but this need not prevent the measurement of resistance by the above methods. In Figure 1 and Figure 2, just use a low voltage winding on a power transformer in place of the battery. The value obtained will really be the impedance at the power line frequency but for everything except transformers, iron core chokes and probably speaker coils the difference will be negligible. The D-C resistance of these components cannot be measured without some kind of D-C meter.

The circuit of Figure 1 may also be used for reading high frequency resistance. Fortunately, the capacity of the vacuum tube voltmeter itself cancels out by this method but care must be taken to use an ungrounded R. F. source so that one side of the voltmeter can be grounded as shown. The voltmeter capacity should be as low as possible so as to reduce the load on the high frequency source. Above 40 megacycles experience suggests that a probe containing a tube designed for use at the required frequency is quite necessary. High frequency tends to be bypassed by the capacity in the resistor so that only the best ceramic resistors can be trusted as standards. Even with these the value should be 20,000 ohms or less to be reasonably accurate at 100 megacycles. Some resistor manufacturers publish tables giving the high frequency characteristics for their product and it is much easier to use this value than to try to measure it.

The time is coming when servicemen will need to know something about the behavior of high frequencies so that they can work intelligently with television and F-M circuits. This series of articles will try to show where measurements at these frequencies differ from those with which you are familiar.

PROXIMITY FUSES:

(*Continued from page 3*)

for peacetime use?

A 5. We hope so; but there has not been enough time since the end of the war to work out the necessary design changes.

Q 6. What is the life of these T-3 tubes?

A 6. As made for the Army and Navy, maximum performance and reliability in minimum size was more important than long life. Actual operating time was about 30 seconds, and life about five hours.

Q 7. How many different types were there?

A 7. There were approximately 10 different types in production at the end of the war, including triodes, pentodes and a thyratron.

Q 8. Why were so many types needed?

A 8. Fundamentally we needed only an oscillator, an amplifier, and a thyratron but so many applications were found that the various circuits required tubes with differing characteristics.

Q 9. Can the principle of operation be given?

A 9. Yes, an oscillator in the nose of the shell radiated a steady high frequency signal from a short antenna in the plastic nose. When this hit metal, water, or any solid body it was reflected back to the antenna and thus back to the same tube where, because of the Doppler Effect between moving bodies, the output was modulated at a difference frequency. This frequency was amplified by other tubes until the final signal was sufficient to "trigger" the thyratron which operated the fuse.

Q 10. Were these tubes used in other devices than shells?

A 10. Yes, they were either in use or being prepared for use also in bombs and rockets.

Q 11. What happened to a shell that didn't get close enough to a plane to explode?

A 11. The shell would eventually come down either to earth or sea and explode on proximity to that. A time device also was included to cause self-destruction in case of failure.

Q 12. Was this shell used against the V bombs?

A 12. A special modification designed for this purpose was so effective that on the last day the V-1 rocket bombs were used, 102 out of 104 sent over were brought down.

A CHAT WITH W. R. JONES

Here at SYLVANIA we have always been proud of the large number of technical helps which were available to the radio serviceman. During the war we found it difficult to maintain that same pace and still carry out the numerous military assignments which SYLVANIA was called upon to contribute toward Victory. We feel sure that you would not have had us do otherwise and would like to point out a few of the obstacles which brought about those conditions.

Up until 1941, Ralph Merkle, who is now a Major in the Signal Corps, was responsible for most of our servicemen's helps. Ralph was also Technical Editor of Sylvania News. When he went into the Service, Frank Langstroth took over Technical Publications. In October, 1942 Frank went to Washington, then with the Signal Corps where he is still serving as Major. Since that time, Dr. Ben Kievit, and more recently, A. V. Baldwin have served as Technical Editors of Sylvania News.

In addition to the rapid turnover of Technical Editors, we were faced with the fact that no one of draft age could be employed for technical publication work. This meant that it was necessary to comb the organization rather thoroughly to find men whose training and age qualifications fitted them for such work.

Shortly after war was declared, an acute shortage of receiving tubes for replacement purposes developed. It was very important that information be supplied to servicemen showing changes to be made in substituting tubes which were available. Two charts were devised, the first of which was entitled "Correlation of Tube Types For Substitution." This was issued in 1942. Later "Radio Tube Substitution Charts For War - Time Servicing" was published which listed the various changes required in order to substitute tubes that could be procured. This was issued in 1943. However, requests for both of these charts were so great that a further revision was made in 1945 under the title of "Sylvania Aids to War-Time Servicing." In addition to the large amount of work required for these publications, the Sylvania Characteristic Chart and the Base Chart were revised several times. Too, the Sylvania Technical Manual called for several supplements—not in the manner with which we were completely satisfied, but in the best manner possible considering manpower. A new edition of the Sylvania Tube Manual is in process and we hope it will make its appearance within the next few months. During all this time, Sylvania News has been issued and not one single issue has been made up without a Technical Section. We feel, therefore, that our achievements along technical publication lines under the most adverse conditions only serve to kindle our efforts to produce even better helps than have been available in the past.

As the secrecy bans are lifted, we are hopeful that we will be able to discuss some of the many Sylvania Developments which were carried on behind locked doors during the war.

At all times, we welcome your suggestions and constructive comments to improve the calibre of our technical publications.

HOW TO TEST TYPE XXFM

The Simpson Electric Co. has furnished the following information for testing Types XXFM Tubes in their testers. Type XXFM is now also known as Type 7X7.

XXFM Data for Models 300, 350, 400, 450 and 500 Simpson Tube Testers

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test					
					Cath.-Htr.		Inter-Element			
XXFM					Cir. Sel.	Tog. up	Cir. Sel.	Tog. up (Separately)	Cir. Sel.	Tog. up (Together)
Tri	9	1	41		H	8	S	2-3-5-6	1	23
Dio 1	9	1	0						3	5
Dio 2	9	1	0						3	6

XXFM Data for Models 220, 222, 325, 333, 440 (Modernized)

Tube Type	Fil. Sel.	Load No.	Tube Sel.	Toggles Test 1	Toggles Test 2
XXFM					
Tri	3.5	1	41	BC	
Dio.	3.5	3	0	F	H

XXFM Data for Models 220, 222, 325, 333, 440 (Not Modernized)

Tube Type	Fil. Sel.	Load No.	Tube Sel.	Toggles Test 1	Toggles Test 2
XXFM					
Tri	6	1	41	BC	
Dio.	6	3	0	F	H

. . . . . SERVICE HINTS . . . . .

Making Adaptors for Crowded Sets. Often times when making a tube substitution with an adaptor, the tube and adaptor will not fit in some of these cabinets due to the added height of the adaptor.

This can be overcome, by taking a tube base and sawing the top off at an angle. When the socket is fastened to this base, the substitute tube will be at an angle, thereby fitting into the cabinet.

Figure out the angle you want the tube to lean, so it will fit in the cabinet and then saw the top of the tube base accordingly.

This little hint saved me changing sockets which meant saving rewiring in a crowded chassis. —Al. Santmier, Jr., **Dolgeville, N. Y.**

Substitute for Type 25AC5GT. Many sets use a Type 25AC5GT as a final audio with a Type 6AC5 first audio. The cathode of the Type 6AC5 is connected to the Type 25AC5 control grid. A number of Emerson Sets employ this system, the rather acute shortage of the Type 25AC5 has proven a problem. I have successfully circumvented this by substituting a Type 25L6GT, tying screen grid and control grid together and grounding to chassis direct. The bias is sufficient to bring the set to a remarkably well operating point. Realignment is necessary for a complete job.

Number 4 pin of the Octal Socket in the Model C5-320 is used as a connecting lug for voltage distribution to the second I. F. Remove the connections when replacement is made with the Type 25L6. —Edward Nareski, Wilkes-Barre, Pa.

GOOD NEWS

You will all be glad to hear that we can now resume our tube awards for Service Hints accepted. For a while, however, until our tube stocks are more normal, please specify a second choice and allow us to supply other useful types if neither of the ones you specify are yet available.

To those of you who have kept the column going during the war we can only say, "Thanks; we appreciate your cooperation."

Tube Substitution. There have been quite a few radios coming in needing new Type 1LE3 tubes which are hard to get. I experimented and found that by cutting off pin #4 of a type 1LH4 that it made a good substitution. I checked one set after 4 months service and found that the 1LH4 was still in perfect condition.—Petes Radio Shop, Clovis, Calif.

Sylvania News

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December, 1945 EMPORIUM, PENNA. Vol. 12, No. 6

COMMENTS . . . .

By **BOB ALMY**
Manager Sylvania Distributor Sales

We would all be very happy if the radio serviceman's dream of a perfect Christmas could be realized. (See cartoon)

Did you see "your" advertisement in the December 8th issue of THE SATURDAY EVENING POST? Radio Servicemen have done a grand job in keeping the nation's radios in operation, under extreme difficulties. We felt that the public should be told.

Licensing of Radio Servicemen

This subject is continuing to receive more and more attention throughout the trade. We have again discussed it in the adjacent article. Sylvania Surveys show that the public is satisfied that the radio repairman does good work and that his prices are reasonable.

Tube Deliveries

As more tubes are being shipped for replacement use the situation is easing. While it will be many months yet before the regular demand types will be in free supply, progress is definitely being made on an overall basis. Several of the older types which have not been available are now being delivered in modest quantities.

Many servicemen are concerned that when new sets are available the public will buy a new set rather than have their old set repaired. Quite naturally this will be true to a certain degree but in our opinion there will still be plenty of repair business. Don't forget that the new sets represent a potential repair market.

Radio Sets

It is estimated that radio set production has suffered what amounts to a three months delay. This is attributable to several factors including compliance with OPA regulations, inability to obtain component parts and also some labor difficulties. Probably only a few hundred thousand sets will be delivered by Christmas. Some authorities now predict that it will be the middle or late '46 before new sets will be in free supply.

"FM" Sets

Sylvania recently completed a survey among consumers to determine their attitude towards "FM". (See article on **Page 2**.) This shows that the public likes and definitely wants "FM" and is willing to pay for it. "FM" will create a new market for radio service in both installation and maintenance.

LICENSING OF RADIO SERVICEMEN

At various times we read in our newspapers that radio repairmen are haled into court for illegal practices, gypping etc., and the conclusion is drawn by some people that therefore, all radio servicemen are "gyps." However, in these same newspapers we also find articles about the disbarment of members of the legal profession, conviction of medical doctors for malpractice, cashiers absconding with funds from their banks, but do we conclude that all lawyers are dishonest, all doctors malpractitioner and cashiers thieves? Certainly not.

Back in 1941 Reader's Digest magazine had one of their editors investigate the honesty of radio repairmen. The published findings from this somewhat informal investigation were to the effect that radio servicemen cheated the public on 64 out of every 100 radio repair jobs. This same magazine also conducted a similar investigation among jewelry repairmen and auto mechanics, and reported a large number of these repairmen also gypped the public. The result of these investigations has been the subject of much controversy.

Some months ago Sylvania had an impartial survey, based on a broad, national sample, made among radio set owners by a nationally known research organization who asked the question: "Were the last repairs made on your radio set satisfactory?" Were the charges made for such services reasonable?" 93% of the people interviewed stated they were satisfied with the last repairs made on their radio, and 89% said that the charges were reasonable. We thoroughly believe these figures, else how could so many radio servicemen have stayed in business for so long a time? This year we are celebrating the 25th anniversary of radio, and many service establishments date back similarly.

There is one school of thought that says licensing of servicemen will end gypping, overcharging, etc. Others point out that licensing may mean unfair examinations, politically appointed inspectors, graft, collusion and other evils.

The matter of licensing servicemen is, we believe, the servicemen's own problem. If the servicemen in one locality feel they should be licensed, they can take the necessary steps to have such license procedure enacted in their own city, county or state; but before taking any final steps, they should study carefully both the benefits and shortcomings, and remember legislation alone is no guarantee of honesty or integrity.

The Serviceman's dream of a *Perfect* X'mas!

ORGANIZATION'S RAPID EXPANSION TRACED TO AGGRESSIVE MERCHANDISING METHODS

In March 1940, Mr. Alex Gettman, President of the Chemcity Radio and Electric Company started his distributor business in modest quarters in Charleston, W. Va. So rapid was his growth due to the wide awake and aggressive merchandising methods of his organization, that he moved to his present and larger location in 1942. And now Chemcity's continued expansion has forced them to plan on the erection of a larger building.

Mr. Gettman opened a branch in Knoxville, Tennessee in August, 1944 and to date this off-shoot has been enjoying a rapid growth too. He has handled Sylvania tubes ever since he started in business.

Shortly after Mr. Gettman began his operations in Knoxville, he was inducted into the Military service where he is still busily occupied.

While his staff is eagerly hoping for his early return, Chemcity's business is being well cared for by Mr. Byron E. Cracraft, the able Vice President and Manager.

The picture above shows the concern's store front with its display windows in their own building in Charleston. And at the left is a photo of the staff of employees; from left to right: Katherine King, Stenographer; Thelma Shafer, Stenographer; Lucille Dunn, Bookkeeper; Pearl Egnor, Secretary; Byron Cracraft, Vice President and Manager; Melvin Swillinger, Manager of Radio and Appliance Sales; Richard Rankin, Sales; Joe Krantz, Sales; Robert Warner, Stock Clerk; Robert Brown, Sales.

SURVEY INDICATES FM'S POSSIBILITIES FOR INCREASED PROFITS

According to a recently released Sylvania Survey, details of which were revealed and interpreted by Mr. Frank Mansfield, Director of Sylvania Sales Research, out of a total market of 17,400,000 home radio sets, 60% or 10,700,000 FM sets can be sold based on the tremendous acceptance of FM by the public. During the next two or three years, FM set production may add about $600,000,000 to the radio set market.

Not only do people definitely want FM receivers, but they are willing to pay more for them, the survey showed, and it indicated 56 per cent of the prospects are willing to pay $100 to $150 more for an FM set with true high fidelity; 27 per cent said they will pay $30 to $50 extra; and only 13 per cent said they didn't know how much more they would be willing to spend.

These amazing figures show beyond a doubt the tremendous new market there will be, not only in the retailing of FM sets or AM-FM combinations, but in the installation and servicing of them as well. Within the coming year there will be a golden opportunity presented to all servicemen and radio service dealers, who have acquired the technical know-how of FM servicing, to tremendously increase their service profits.

As radio servicemen well know, the modern, standard AM receiver did not involve any special installation or the erection of a special aerial, whereas an FM set does require a special outside dipole type of antenna, so that the proper installation has to be done by an experienced serviceman rather than by the average purchaser. The antenna itself is an additional piece of merchandise to be sold, and the entire erection and installation of FM involves a labor and time profit for which, according to the survey, more than 80 per cent of the people questioned are willing to pay.

GEN. SOMERVELL LAUDS RADIO'S CONTRIBUTION TO HISTORY

Gen. Brehon Somervell, Commanding General of the Army Services Forces, in his annual report cited the "miracle of radio" and other electronic developments for their part in winning the war.

"The Signal Corps," he said, "working on British beginnings, made radar a weapon of war from a scientific curiosity. It performed daily miracles behind the screen of censorship.

"Our planes were equipped with this device in rapidly increasing numbers and its application both on land and sea for offense and defense gave deadliness to our attack and certainty to our defenses. Thanks to the magic eye of radar, able to penetrate night and fog, we had Miracle Number One. But it was a secret; no one dared talk about it."

Sylvania News

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December, 1945 EMPORIUM, PENNA. Vol. 12, No. 6

A NEW HEADACHE FOR SERVICEMEN

Many G. I.'s and their friends now have European built radios brought back from the war-torn countries by returning veterans. In many cases the tubes were worn out or have become broken in transit. As a result servicemen have been handed another headache; finding American tubes for use as replacements for European type tubes for which, in general, they can find no published characteristics.

Some general comments which apply to these sets may be of assistance. Many of the sets which have been called to our attention are series (AC-DC) operated, probably because the portable sets were easier for the "boys" to carry away. Some of them are also connected for battery operation as well, with a switching arrangement at the back which may also be adjusted for the unusual line voltages commonly found in foreign countries, 240 volts for instance. The AC-DC sets seem to use 100 ma. filament current instead of 150 or 300 ma. commonly used in this country. It is unfortunate that no American tubes are made which use this value of heater current, but this can be compensated for by shunting all the remaining 100 ma. tubes with a resistor to carry the additional 50 ma. required by tubes suggested as a substitute. Any ballast resistor will also require a shunt.

Ballast Tubes

Very little data is so far available to us on the latest ballast tubes used in these sets but in general this would be of little use anyway. In some cases the series string can be arranged to add up to 120 volts so that no ballast will be necessary for use on the voltages available in this country. If any substitution is made in the set, the current, and probably also the voltage drop of the ballast tube will also require changing and it is easier and quicker to put in the required single resistor than to try to work out a shunt for the unknown ballast resistor.

Battery Tubes

Battery type tubes seem to use 1.2 volts as well as the 1.4 volts generally used here and the currents vary from 25 to 100 ma. instead of being mostly 50 ma. as is American practice. If series resistors are used here they may require changing, or just shorting out if all American tubes are used.

Sockets

Some of these European tubes use a socket which our correspondents refer to as the lock-in type. We believe that there are some minor differences in the size or spacing of the locking lug but that if the socket is worn or forced a little they can be made to fit. Still other types are reported as having the standard American octal base but there are many types with special arrangements of the pins and also with contacts on the sides instead of prongs. The best procedure in such cases is to install an American style socket by using the base connections given here.

Multielement Tubes

A really tough problem is found in those cases where the foreign tube combines two or more functions which have not been combined in any American type, for example, types CBL6, UBL21 and UCL11. All of these are duo-diode output pentodes and we do not know of any American tube which is made similar to this arrangement. Of course you realize that most European countries base the license fee for owning a radio on the number of tubes and that consequently the development of multiple tubes has progressed further there than in this country. It has also resulted in more sensitive tubes, particularly converters and power output tubes. Their converters usually have much higher conversion conductance than ours and this may cause a loss in sensitivity of as as much as 2 to 1. The greater sensitivity of the power output tubes allows them in many cases to go direct from the diode detector to the output pentode with no audio amplification.

Table 1 gives the base connections of 37 common European types. Rather than list the plate currents, resistances, etc., of all these tubes two or three American tubes have been selected as close to those published characteristics as possible and the set changes required have been listed. This is shown in Table 2 in the same form as in our popular "Aids to Wartime Servicing Chart." Note however that there are no direct substitutes. The least

(Continued on page 5)

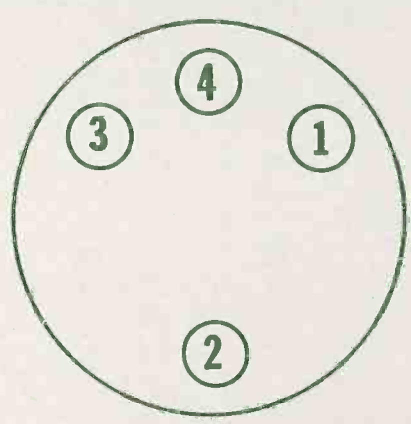


FIGURE 1

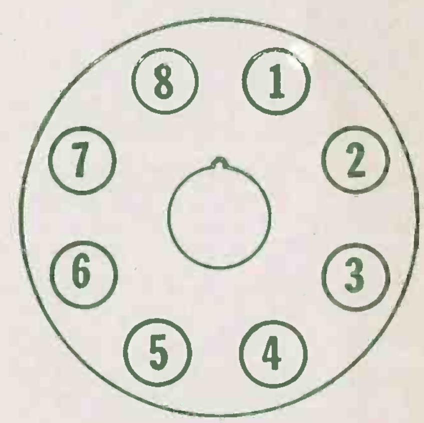


FIGURE 2

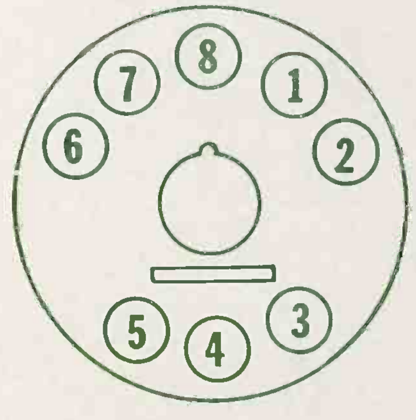


FIGURE 3

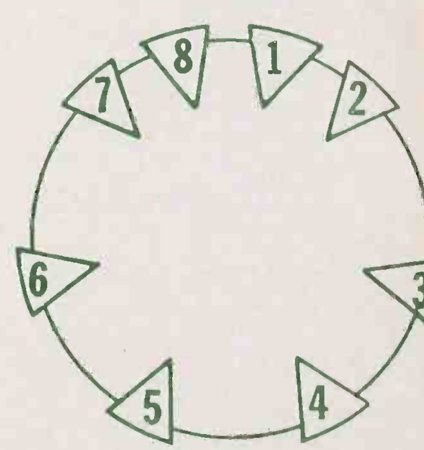


FIGURE 4

TENTATIVE SYLVANIA TUBE CHARACTERISTICS

PROXIMITY FUSE STYLE

Type	Class	Bulb Size	Filament Rating		Use	Plate Volts	Negative Grid Volts	Screen Volts	Plate Current Ma.	Screen Current Ma.	Plate Resistance Ohms	Mutual Conductance Micromhos	Amplification Factor	Ohms Load for Stated P. O.	Undistorted P. O. Milliwatts
			Volts	Amps.											
RECEIVER TYPE TUBES															
1C8	Triode Heptode	Diam. ⅜″ Length 1½″	1.25	.040	Converter	45	0	45	0.4	1.0	1. Meg♦.	100 ▲	Ic_1 = 35ua	Rc_1 = 100,000	Ic_2 = 1. Ma.
1Q6	Diode Pentode	Diam. ⅜″ Length 1⅜″	1.25	.040	Det. Amp.	67.5	0	67.5	1.1	0.3	500,000	425	Gain = 50♦		
1V5	Pentode	Diam. ⅜″ Length 1⅜″	1.25	.040	Power Amp.	67.5 45	4.5 3.0	67.5 45	1.8 0.8	0.35 0.2	185,000 250,000	625 500	....	25,000 40,000	50 15
1W5	Pentode	Diam. ⅜″ Length 1½″	1.25	.040	R. F. Amp.	67.5	0	67.5	1.7	0.4	500,000	675	......	....	....
HEARING AID TUBES															
1245	Pentode	Diam. ⅜″ Length 1⅛″	0.70	.030	Amplifier	30	0	30	0.2	0.05	950,000	105	Gain = 32♦	....	....
1246	Pentode	Diam. ⅜″ Length 1⅜″	1.25	.030	Power Amp.	45	2.0	45	1.2	0.25	150,000	595	......	50,000	10
SPECIAL															
6K4	Triode	Diam. ⅜″ Length 1⅜″	6.3	0.15	H. F. Osc.	100 200	2.0 8.0	....	12.0 12.0	....	3,650 4,600	5.500 3,500	20 16	....	....

Symbols: ▲Conversion Conductance ♦Approximate

PROXIMITY FUSE TUBES

When we prepared the article for last months's "News" on the Sylvania proximity fuse tubes we did not realize that this month we would be able to announce tentative characteristics of the commercial version of those tubes.

It is quite possible that there may be additions as well as changes to this list. For instance, type 6K4 is obviously the first of a series of 6 volt 150 ma. cathode types. Those for use on batteries form a normal set complement and we realize that most experimenters will want a set immediately.

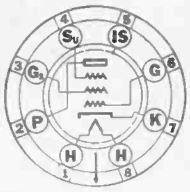
Unfortunately these are in too early a stage of development for samples to be generally available, or even prices determined. A few equipment manufacturers can get samples now, but only after we have settled on the final ratings will the tubes be listed for sale. We will try to let you know what progress is being made on this.

NEW SYLVANIA R. F. AMPLIFIER TUBE TYPE 7AG7

PHYSICAL SPECIFICATIONS

Style . . . . . Lock-In
Base . . . . . Lock-In 8-Pin
Bulb T-9
Diameter . . . . . 1 5/16″ Max.
Overall Length . . . . . 2 25/32″ Max.
Seated Height . . . . . 2¼″ Max.
Mounting Position . . . . . Any

BASE PIN CONNECTIONS



8-V

Pin 1 . . . . . Heater
Pin 2 . . . . . Plate
Pin 3 . . . . . Screen Grid
Pin 4 . . . . . Suppressor Grid
Pin 5 . . . . . Internal Shield
Pin 6 . . . . . Grid
Pin 7 . . . . . Cathode
Pin 8 . . . . . Heater
RMA Basing 8V-L-5

RATINGS AND CHARACTERISTICS

Heater Voltage (Nominal) . . . . . 7.0 Volts
Heater Current (Nominal) . . . . . 0.160 Ampere
Maximum Plate Voltage . . . . . 300 Volts
Maximum Screen Grid Voltage . . . . . 300 Volts
Maximum Plate Dissipation . . . . . 2.0 Watts
Maximum Screen Grid Dissipation . . . . . 0.75 Watts
Minimum External Negative Control Grid Voltage . . . . . 1.0 Volts
Maximum Heater Cathode Voltage . . . . . 90 Volts

DIRECT INTERELECTRODE CAPACITANCES*

Grid to Plate . . . . . .005 μμf. Max.
Input . . . . . 7.0 μμf.
Output . . . . . 6.0 μμf.
*With 1⅝″ diameter shield (RMA Std. M8-308) connected to cathode.

TYPICAL OPERATING CONDITIONS

Class A1 Amplifier

Heater Voltage . . . . . 6.3 Volts
Heater Current . . . . . 0.150 Ampere
Plate Voltage . . . . . 250 Volts
Screen Grid Voltage . . . . . 250 Volts
Suppressor . . . . . Connected to cathode at socket
Cathode-Bias Resistor** . . . . . 250 Ohms
Plate Current . . . . . 6.0 Ma.
Screen Grid Current . . . . . 2.0 Ma.
Mutual Conductance . . . . . 4200 μmhos
Plate Resistance . . . . . 0.75 Megohm
Control Grid Voltage for ib—10μa. . . . . . −10.0 Volts
**Bias voltage is approximately 2.0 volts but fixed bias is not recommended.

CIRCUIT APPLICATION

Sylvania Type 7AG7 is a high efficiency sharp cut-off RF pentode amplifier tube designed for use in 6.3 volt or AC-DC series service.

The use of the full plate supply voltage on the screen makes possible a tube design having high input resistance due to the reduction of transit time losses. For use in the Television and Frequency Modulation bands, higher gains may be obtained than with types having somewhat higher mutual conductance because of this increased input resistance.

The use of the same voltage on the screen as on the plate may permit the omission of the screen filter resistor and by-pass condenser.

CORRECTION: An error slipped into the article last month on Using Your Vacuum Tube Voltmeter. The equation at the bottom of the first column should read:

$$Rx = Rs \times \frac{Ex}{Es}$$

A NEW HEADACHE FOR SERVICEMEN (Continued)

TABLE 1 — BASING CHART

Type	Base Figure	1	2	3	4	5	6	7	8	Notes
AZ11, AZ11N	3	NC	P	P	NC	NC	NC	F	F	
CBL6	4	H	NC	P	Gs	Dp	Dp	K&S	F	(2)
DAC25	2	—F	P	G	—F	—F	Dp	—F	F	
DAF11	3	NC	Dp	Gs	G	—F	P	F	—F	
DCH11	3	Go	Ga	Gs	HexG	—F	HexP	F	—F	(1)
DCH21	2	—F	S	HexP	Gs	Go	NC	Ga	F	(1) (4)
DCH25	2	—F	HexP	Ga	Go	Gs	HexG	—F	F	(1)
DC25	2	—F	P	NC	NC	—F	G	NC	F	
DDD25	2	—F	NC	Pt1	Gt1	Gt2	Pt2	NC	F	
DF11	3	NC	P	Gs	G	—F	NC	F	—F	
DF25	2	F	P	Gs	J	J	G	J	—F	
DF26	2	F	P	Gs	J	J	G	J	—F	
DL11	3	NC	P	Gs	G	—F	NC	F	—F	
DL25	2	Fc	P	Gs	Fc	NC	G	—F	F	(3)
EBC11	3	K	Dp	P	G	K&S	NC	H	H	
EBF11	3	K	P	Gs	G	K&S	P	H	H	
EB11	3	NC	Dp	Dp	K2	K1&S	NC	H	H	
ECH4	4	H	K&S	HexP	Gs	Go	Inj.G	Ga	H	
ECH11	3	Go	Ga	Sg	HexG	K&S	HexP	H	H	(1)
EDD11	3	Gt1	Pt1	Pt2	Gt2	K&S	NC	H	H	
EF11	3	NC	P	Gs	G	K&S	NC	H	H	
EF12	3	NC	P	Gs	G	K&S	NC	H	H	
EF13	3	Su	P	Gs	G	K&S	NC	H	H	
EL11, EL11N	3	NC	P	Gs	G	K&S	NC	H	H	
EM11	3	NC	P1	P2	G	K	T	H	H	
EUXX	4	J	NC	F1	Tied to 3	J	F2	J	J	(5)
EZ11	3	NC	P1	P2	K	S	NC	H	H	
UBF11	3	Dp	Dp	Gs	G	K&S	P	H	H	
UBL1	2	H	NC	P	Gs	Dp	K	Dp	H	(2)
UBL21	2	H	P	G	Gs	Dp	Dp	K	H	
UCH4	2	H	Shell&K	HexP	Gs	Go	InjG	Ga	H	(4)
UCH11	3	Go	Ga	Gs	HexG	K&S	HexP	H	H	(1)
UCH21	2	H	HexP	Ga	Go	Gs	HexG	InjG	H	(6)
UCL11	3	Gs	Gp	Pt	Gt	K&S	Pp	H	H	
UF11	3	NC	P	Gs	G	K&S	NC	H	H	
UY1, UY1N	2	H	J	P	NC	J	J	K	H	
UY11	3	NC	P	NC	K	NC	NC	H	H	
1904	1	F	NC	F	NC					(5)

Notes:

(1) Internal connection between Osc. G and Injector grid of hexode.
(2) Cap connected to grid.
(3) Suppressor grid tied to Fc internally.
(4) Cap connected to hexode grid.
(5) Ballast resistor.
(6) Cathode connected to locking lug.

Abbreviations:

Dp — Diode Plate	F — Filament	Fc — Filament Center
G — Control Grid	Ga — Oscillator Anode	Go — Oscillator Grid
H — Heater	IC — Internal Connection	Gs — Screen Grid
K — Cathode	NC — No Connection	J — Jumper
Su — Suppressor Grid	T — Target	P — Plate
InjG — Injector Grid	S — Shell	t1, 2 — Triode 1 or Triode 2

Pin numbering system used in above table and in figures is arbitrarily taken similar to the RMA system used in this country. It is probably different from any European system which may appear on either the socket or the tube.

This information has been compiled from various sources and while we believe it is correct, we can accept no responsibility for errors.

NOTES FOR TABLE 2

(1) Our information on these foreign types does not always include the physical size. It may be that some of the suggested tubes are too large for the space available. Lock-In tubes are listed whenever possible since they are as small or smaller than any European tubes we have seen used in such sets.
(2) The filament of the suggested type may not be hot enough to work properly unless the primary taps permit adjustment to the correct voltage.
(3) The optimum load resistance for these types is more than 20% off. If tone is noticeably poor, transformer tap adjustment or a new transformer may be required.
(4) Filament type triode-hexode converters are not made here. The suggested converters should work with the same coils.
(5) Change screen voltage or dropping resistor to get rated voltage on screen.
(6) European tuning eyes are double with two separate ray control sections. One section only used on the recommended American tube should prove satisfactory.
(7) Be sure total drain is within rating of American tube as European tube is rated higher.
(8) The European tube has the injector grid of the hexode brought out separately. Connect this to the oscillator grid when replacing with the recommended substitute.

TABLE 2 — SUBSTITUTION CHART

Required Type	Fil. Volts	Filament Current Amperes	Suggested Replacement	Rewire Socket D	Change Socket E	Realign F	Add Top Cap Connection G	Remove Top Cap Conn. H	Change Bias or Plate Volts K	Note No.
AZ11	4.0	1.1	80		E					(1) (2)
AZ11N			5Y3G		E					(1) (2)
			7Y4 Use Fil. winding of other tubes.							
CBL6	14.0	0.2	No single tube unless diode plates tied together							
			25A7G		E			H	K	(3)
			35A5 & 7A6		E			H		
DAC25	1.2	.025	1LH4	D						
			1H5G		E					
DAF11	1.2	.050	1LD5	D						
			1S5		E					
DCH11	1.2	.075	1LA6		E	F				(4)
			1LC6		E	F				(4)
			1A7GT		E	F	G			(4)
DCH21	1.4	.150	1LA6	D		F		H		(4)
			1LC6	D		F		H		(4)
			1A7GT		E	F				(4)
DCH25	1.2	.100	1LA6	D		F				(4)
			1LC6	D		F				(4)
			1A7GT		E	F	G			(4)
DC25	1.2	.025	1LE3	D						
			1E4G		E					
DDD25	1.2	.100	3B7/1291	D					K	
DF11	1.4	.025	1LN5		E	F				
			1N5G		E	F				
DF25	1.2	.025	1LN5	D		F				(5)
			1LC5	D		F				(5)
			1N5G		E	F				(5)
			1P5G		E	F				(5)
DF26	1.2	.050	Same as DF25 except sharper cutoff.							
DL11	1.2	.050	1LA4		E					
			1A5G		E					
DL25	1.2	.100	1LA4	D						
			1A5G		E					
EBC11	6.3	.200	7E6 (parallel)		E					
			14E6 (series)		E					
			6R7GT (parallel)		E		G			
			6SR7 (parallel)		E					
			12SR7 (series)		E					
EBF11	6.3	.200	14E7 (series)		E	F				(5)
			14R7 (series)		E	F				(5)
			7E7 (parallel)		E	F				(5)
			7R7 (parallel)		E	F				(5)
EB11	6.3	.200	7A6		E	F				
			6H6G (parallel)		E	F				
ECH4	6.3	.350	7J7		E	F		H		(5)
			7S7		E	F		H		(5)
			6J8G		E	F				(5)
ECH11	6.3	.200	7J7 (parallel)		E	F				
			14J7 (series)		E	F				
			7S7 (parallel)		E	F				
			14S7 (series)		E	F				
			7A8		E	F				
EDD11	6.3	.400	7N7		E				K	
			6F8G		E		G		K	
EF11	6.3	.200	7B7		E	F				
			6S7G		E	F	G			
			7A7 (parallel)		E	F				
EF12	6.3	.200	7C7		E	F				
			6W7G		E	F	G			
EF13	6.3	.200	7B7		E	F				
			14H7 (series)		E	F				
			7A7 (parallel)		E	F				
			14A7 (series)		E	F				
EL11	6.3	.900	7C5		E				K	(2)
EL11N			6V6G		E				K	(2)
EM11	6.3	.200	6N5 (series)		E					(6)
			6U5/6G5 (parallel)		E					(6)
EUXX	0	.200	Ballast Resistor. See article.							
EZ11	6.3	.290	7Y4		E					
			6ZY5G		E					(7)
UBF11	20	.100	14R7		E	F				(5)
			14E7		E	F				
UBL1	55	.100	14R7	D		F				
UBL21	55	.100	No single tube unless diode plates tied together							
			70A7		E				K	
			70L7		E				K	(2)
UCH4	20	.100	14J7		E	F		H		(8)
UCH4	20	.100	14J7		E	F		H		(8)
			14S7		E	F		H		(8)
UCH21	20	.100	14J7	D		F				(8)
			14S7	D		F				(8)
UCH11	20	.100	14J7		E	F				
			14S7		E	F				
UCL11	50	.100	No single tube							
			7C6 & 50A5		E					(5)
UF11	15	.100	7B7 (series)		E	F				
			14A7		E	F				
UY1	50	.100	35Z5G		E					(7)
UY1N			35Z3	D						(7)
			50Z7G		E					
UY11	50	.100	35Z5G		E					(7)
			35Z3		E					(7)
			50Z7G		E					
1904	50 to 70	.100	Ballast resistor see article.							

you can expect is to rewire the socket and since the heater ratings are nearly always different from the American tube these are given in full to enable you to adjust the series or parallel resistors as required by the circuit.

Don't be surprised at some of the queer tube line-ups you get. We saw one the other day which used two converters! This would seem rather unusual for a portable set but a little inquiry disclosed that this was a fairly common European arrangement which allows one tuning condenser and a fixed frequency oscillator to give the selectivity we generally get with two tuned stages in this country. If this is the case two converters would be the proper replacement but other unusual combinations may be found which are not quite as simple—so just watch your step.

Although only a few substitutes are listed in table 2, others may be found by consideration of substitutes listed in the "Aids to Wartime Servicing."

A CHAT WITH W. R. JONES

The delay in making large numbers of new radio sets available to the public will increase the pressure on the radio serviceman. Most everyone uses radio receivers during the Christmas season more hours per day than is normally the case.

Undoubtedly, many people held off having their defective sets repaired in the hope that new receivers would be ready by Christmas. The latest published figures, however, indicate that the number of sets to become available will probably not exceed 250,000. This fact will bring about a tremendous pressure on radio repairmen a few weeks before the holidays. In order to expedite service and also increase the turnover, all of the service aids which will permit rapid substitution of parts for those originally specified should be utilized to reduce the man-hours required to place the receivers in operation. The SYLVANIA "Aids To War-Time Servicing" should be very helpful as a guide for tube substitutions.

* * *

New test equipment for the serviceman will soon appear on jobber's shelves. It is important to become very familiar with one's equipment for it is surprising what can be done with fairly simple equipment if its possibilities are evaluated correctly.

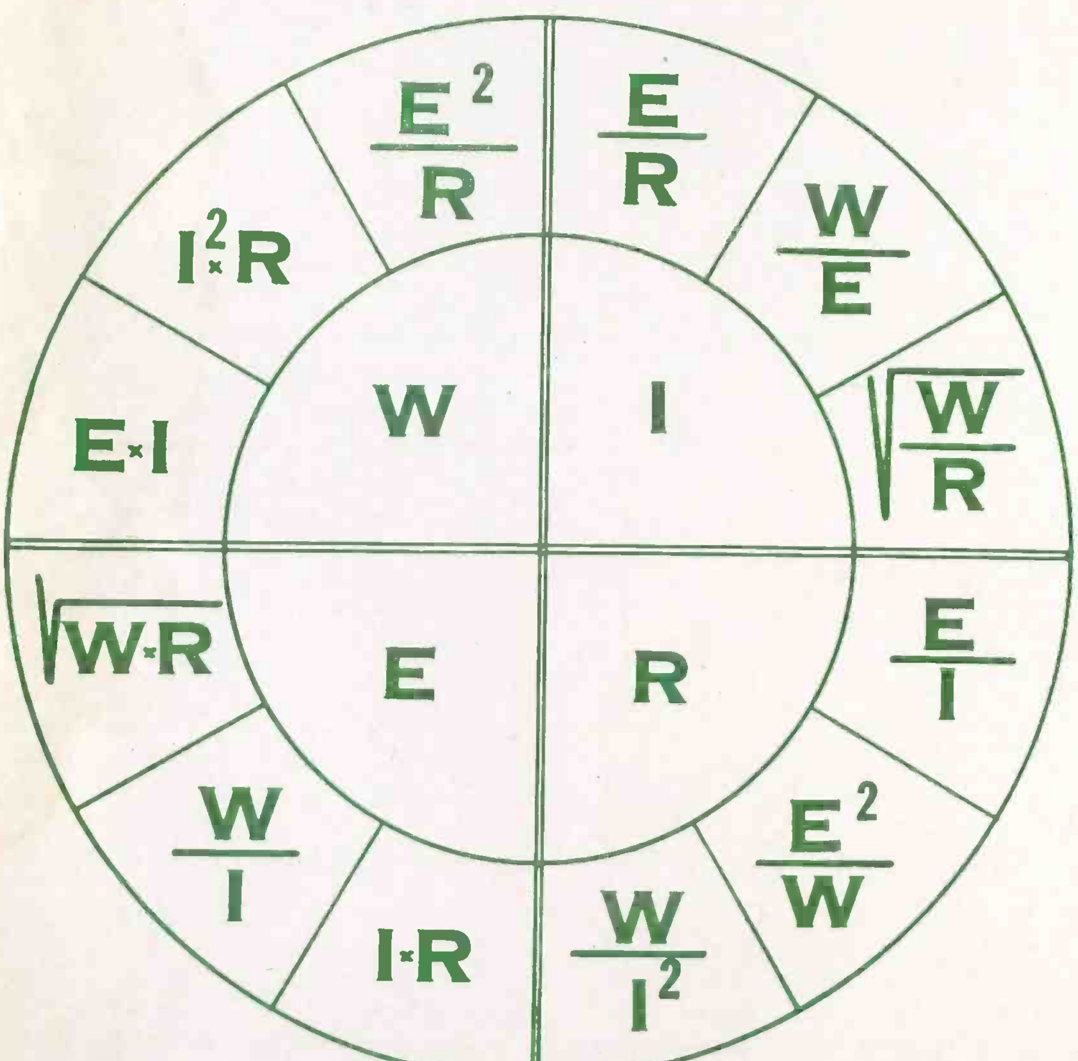
During the war, commercial tube testers were used in many Army and Navy depots for testing radio tubes. One of the most general complaints in testing 1.4 volt tubes arose when the testers indicated that a large percentage of these tubes had grid-to-filament shorts. If your new tube tester indicates this same result, it is a pretty good indication that the voltage exceeds 100 volts instead of being on the order of 50 or 60 volts. The electrostatic field set up by the voltage between grid and filament is sufficient to attract the filament to the grid, thus giving an indicated filament-to-grid short. However, these voltages are required so that the lamps employed can give the proper indication. If the voltage is reduced, the lamps will not light even if the short is present. On the other hand, if the voltage is reduced, the short will not exist in the battery type tubes. Thus, tubes which indicate shorts should be retested and, if otherwise satisfactory, considered passable.

SERVICE HINTS

WALL CHART FOR OHMS LAW

From the fundamental equations, $I = \frac{E}{R}$ (Ohms Law) and W = EI, twelve possible equations may be written giving each of these quantities in terms of the other three. Mr. Searl of Malaga, New Jersey, has made a novel arrangement of these in the circular form shown below.

We believe many of you will find it a convenient reference pinned on the wall or under glass on your desk.



Idea for Servicing AC-DC Sets. It is the usual practice of most servicemen to remove the tube of a particular stage when looking for the source of a certain noise or hum. On many occasions, I have wanted to use this system on AC-DC but could not due to the fact that removing a tube breaks the continuity of the filament string. To get around this I made a set of dummy tubes out of tubes that were defective in some way other than filaments i:e shorts, noisy, gasy or open elements etc. The filament must be good. Clip off all the pins on the tubes with the exception of the filament pins. My set consists of a 12 volt tube with filaments on pins 2 and 7, a 12 volt tube with filaments on 7 and 8, 35 and 50 volt tube with filaments on 7 and 2. This takes care of most anything in the 150 MA types. This is a very convenient way of isolating any particular stage.

Lyle C. Motley, Danville, Va.

* * *

RCA—VHR-307. I was recently called to service an RCA-VHR-307. The complaint: Set dead with a burned out 12K7 tube. The customer had tried replacing the tube only to find the new tube also burned out.

The 12K7 tube is the only 12 volt tube in the set; the remainder being of the 6 volt type with a 5U4G for rectifier. The 12K7 tube is the microphone preamplifier and receives its filament supply not from A.C. but from the rectified voltage of the set. Therefore, I warn my fellow servicemen not to replace this tube until they have checked the set for shorts.

I used a resistor in the filament circuit in place of the tube and checked the set. I found an intermittent short in the voltage divider that would not test short with the current off. I replaced the voltage divider, used a 12SK7 with an adaptor, and the set is now working OK.

I hope this hint proves of some use to my fellow servicemen.

Samuel Greco, Philadelphia, Pa.

SHOP OF THE MONTH

The December selection for "Shop of the Month" goes to Mr. T. J. Pandazes, proprietor of the Park-Presidio Radio Sales and Service of San Francisco, California.

This concern had moved about ten months ago to its present location, and the new shop was designed by Mr. Pandazes "to comply with these modern times," as he expresses it. Mr. Pandazes adds that the shop and store were designed for quick, time saving service and for "arms-length" inspection of merchandise and parts, with an accent on neatness throughout.

The owner of this modern, attractive, and well planned establishment may be justly proud of his store. The pictures show two views that give a good indication of the layout arrangement.

The first view is a good shot of the sales counter and merchandise shelves and indicates how sales and service are kept separated, and yet there is excellent two-way visibility between shop and front-of-store. Mr. Pandazes says there is an archway that connects, yet separates, sales from the display room, and adds that new equipment will be purchased as soon as it's available.

The second picture gives an excellent view of the fine and modern work bench in the rear of the layout, which also shows Mr. Pandazes and his assistant busy at work.

We congratulate Mr. Pandazes on his enterprise, and his outstanding, up-to-date, and well planned layout, and wish him every success for the future.

IF YOU'RE PLANNING ON EXPANDING OR REMODELING YOUR SHOP—READ THIS

Servicemen are waking up to the real importance of "front" to create a better impression and induce more respect from the set-owning public. Just about finished are the comfortable old days when servicemen were satisfied to operate in a dingy back room cluttered with disemboweled sets and dusty piles of salvaged parts; and the practical members of an important profession will shed few tears over the passing of the "junk shop" era. This is not merely a matter of pride in appearance, but of the jingle of dollars in the cash register.

From all over the country come reports of servicemen who have been inspired to shop modernization by a booklet compiled by Sylvania entitled, "The Sylvania Model Service Shop." This informative pamphlet contains architect's plans and specifications for each section of the shop, and a floor layout plan. While it is not to be expected that the majority of servicemen will be able to adopt these plans exactly, the book will prove a mine of practical suggestions for economical improvements in appearance and efficiency.

Especially now that the war is over and everyone is reconversion minded and competition for improved service is getting keener daily, you will want this helpful booklet of proven benefit and inspiration, "The Sylvania Model Service Shop." Copies are still available at ten cents each. Order your copy now from your distributor while they last, or write to the Advertising Department, Sylvania Electric Products Inc., Emporium, Pa.

MATCH THIS FOR GOOD NEWS!

During the war, as dealers and distributors alike well know, matches for advertising purposes were almost impossible to obtain. Sylvania was no exception and we had great difficulty in filling orders, because our supplier undoubtedly had his troubles getting materials.

Now, however, the situation has decidedly improved, and soon, once again, matches will be obtainable, and we hope to be able to fill orders promptly, but probably not until early or mid-February, 1946.

Meanwhile, in order to expedite matters, we think it a good idea to book orders now for shipment early next year. So send your orders to the Advertising Department, Sylvania Electric Products Inc., Emporium, Pa., and do it as promptly as possible, because these orders are filled in the sequence in which they are received by us—so, first come, first served!

Imprinted—1000-$3.25, 2500-$7.50, 5000-$14.90, 7500-$22.35, 10,000-$29.80. Note: Less than 7500 books, F.O.B. shipping point; 7500 books or more, F.O.B. destination. (Plus Federal Tax, 40c per M).

NAVY RELIES ON ELECTRONICS TO PILOT PLANES OF FUTURE

Predicting that "man's mind will be too slow for combat of the future," the Navy Department in a recent release promised to press radio research during peacetime to prepare for the "robot" fighting aircraft of the future.

"The pilotless aircraft of the future, controlled by electronics, will 'home' electronically on its target," the Navy said. "Electronic 'brains' will guide the counter-missile with precision. Out of research and development programs will come airborne radars which can initiate defense."

ENTERPRISING SERVICEMAN PLANS ALL OUT POST-WAR MERCHANDISING PROGRAM WITH EMPHASIS ON SERVICE

Mr. Percy Clough, who is the owner and manager of the Royal Radio, modern radio service shop at 31 South Martha Street in Akron, Ohio, started his flourishing business in 1941. The following year he closed his shop and volunteered his services to the Civilian Air Patrol in which he was given the rank of Cadet Commander. At the same time he was also the Radio Communications Officer of his group. In addition to these duties he taught radio and electricity to Goodyear Aircraft employees and also aeronautic mechanics to the cadets. The students in this course, with help and guidance from Mr. Clough, built a Funk 75 B plane which seats two people.

After having been discharged from service, Mr. Clough re-opened his shop in July of this year. Although doing a big business in home receivers, Royal Radio specializes in auto radio service. Immediately adjoining the shop is a four-car garage which is completely equipped to handle any radio service or installation work.

As soon as he is able to obtain additional servicemen, Mr. Clough plans to return to his pre-war basis during which time he employed three men for technical service work, and three girls for non-technical work such as testing tubes, cleaning chassis, replacing dial belts, and general office work. A fleet of three trucks was busy picking up and delivering radio sets.

Mr. Clough attributes his success to the fact that he has concentrated on his service work in a manner similar to successful merchandising plans in retail stores. Regular advertising has been an important part of his plans. Not only does Royal Radio return a set that plays like new, but its appearance is revitalized so that it also looks like new. Dissatisfied with his present facilities for cleaning of sets and chassis, Mr. Clough is setting up a special work rack for cleaning the sets. Wooden cabinets are polished and the scratches removed. Plastic cabinets are washed, and, if necessary, resprayed to give a new finish, all as part of the regular service charge.

By concentrating on service, Mr. Clough expects to obtain an even greater proportion of the service work in his area during the post-war period, as many present servicemen are planning to devote their efforts to retailing radios and allied lines. As a part of his post-war plans, Mr. Clough, is refurnishing his waiting and display room with stainless steel furniture. He is even planning on carpeting the display room.

Having been very successful with his service methods in the past, Mr. Clough is planning to go all out in his application of successful merchandising principles to a service establishment during the post-war period.

COAST GUARD WAR SECRETS DESCRIBED

The U. S. Coast Guard is pulling the wraps off some of its secret radio-controlled navigation aids used successfully during the war.

It disclosed the use of "ANRAC" (Aids Navigation Radio Control), which was designed to blackout unattended aids to navigation by means of radio signals, but was applied to control other types of aids, such as fog horns, electric ball strikers, etc. The system was installed at Pearl Harbor, Midway, sections of Alaska, and the southwest Pacific, and at major U. S. ports.

Earlier the Coast Guard publicized its use of "Loran" (Long Range Navigation) and "Racon" (Radar-beacon) as important aids to navigation during the war.

Discussing radar in the war, the Coast Guard said: "Manufacturers of radar equipment turned out more than 52,390 sets of 64 different types during the war. This mass production of the revolutionary device would seem to indicate that it will not be long before the entire merchant marine can be provided with radar equipment."

Seasons Greetings

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