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IN THIS ISSUE

What's New in 1940 Radio Receivers

Checking the Continuity of Radio Circuits

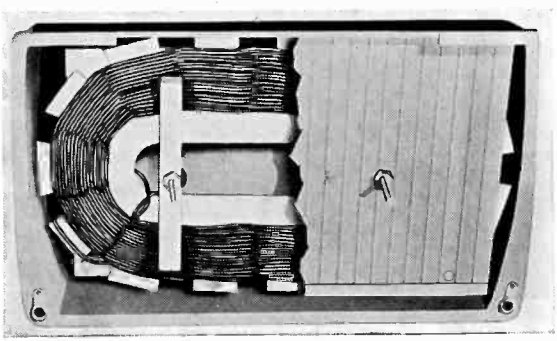
Alumni Association News

VOL. 8
No. 12

tury, Georgian, Heppelwhite, Tudor and Salem Chest designs.

As technical radio men, we are, of course, most concerned with the electrical improvements and changes. The study I have made of the new circuits, shows that the Radio Industry has settled down to real business. The 1940 receivers are outstanding because they represent refinement and improvement of known and tested circuits.

The Stromberg Carlson 420-PL is a dual-range 7-tube Phonograph-Radio combination. The automatic phonograph equipment shifts and plays twelve 10-inch records or ten 12-inch records.



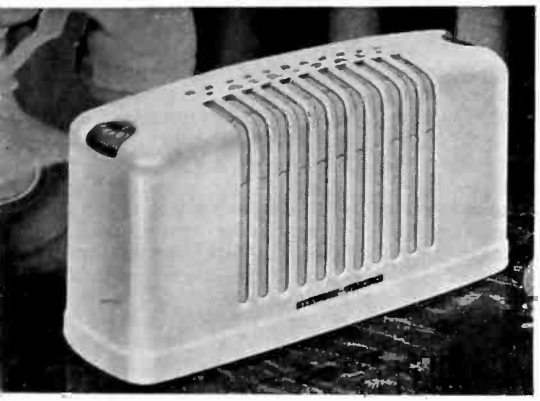
Cut-away view showing the "Aero-Vane" static shielded loop aerial used in Motorola model 53C, an A.C.-D.C. five tube superheterodyne, and in other Motorola models.

The shoulder strap containing the loop for the Motorola "Sporter" model 41S supports the set while you fish, golf, row a boat or, if you are so minded, indulge in a little mountain climbing.

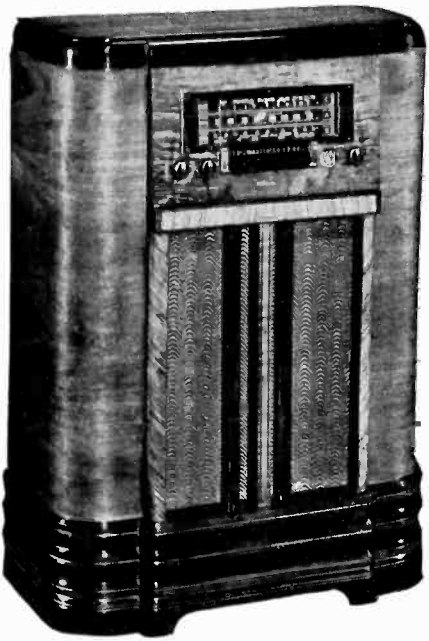
There are no freak circuits this year to give headaches to the serviceman. The 1940 models have seen metal tubes become subordinate to glass. AFC is used in only a few models, and motors for tuning are fast becoming a rarity. This has taken place not because the previous systems were failures but because improvements in other receiver parts and circuits made AFC (automatic frequency control) unnecessary.

The primary purpose of AFC was to correct the drifting in automatic motor and trimmer tuning. Of the two types of automatic tuning, the trimmer types have won out because they were faster to use than the motor type and cheaper to produce. Temperature-compensated resonant circuits eliminated drifting, and hence AFC is no longer needed.

In some cases trimmers are used with the more stable and more expensive variable inductances in push-button tuner units. When used together, the trimmers are placed in the preselector circuit while the variable inductances are placed in the oscillator circuit. This is done because shifts in oscillator frequency will prevent the system from working, whereas a preselector frequency shift only reduces the volume a slight amount. Practically all auto receivers are equipped with push-button tuning, and one manufacturer has a model using a single push-button



he Stewart-Warner model A-6 A.C.-D.C. superheterodyne comes in a choice of either ivory or walnut oulded plastic cabinets. Tuning and volume are ontrolled by the drum dials at each end of the cabinet.



RCA K-80 is an eight-tube superheterodyne with gic Eye, push-button tuning on eight stations, all-e receptions and plug-in connections for Phonograph and Television sound reproduction

to tune in five different stations successively. The push-button rotates a ratchet, throwing the different preset trimmers into the tuning circuits.

Mechanical automatic tuning is holding its own in the small inexpensive models. As these receivers naturally tune broadly, small inaccuracies in the dial setting are relatively unimportant.

Zenith's all-wave model 10S464 is housed in a striking cabinet and features the Rotor Wave-magnet (loop which may be rotated), automatic tuning, Television sound connection and the Radiorgan. The Radiorgan is a multi-step tone control which may be adjusted by the operator to give any desired tone effect.

The octal base tube is still being given a run for its money by, of all things, our old friends the types 78, 77, 37 and 42, which were almost the first 6.3-volt filament type tubes to make their appearance on the market five or six years ago.

When the 25Z5 rectifier tube was first announced many years ago, it was claimed that power transformers were on their way out, and that the new tube was to be used as a voltage doubler. There were a few faltering attempts to make use of the voltage doubler principle, but the 25Z5 was finally to be universally misused by becoming the parallel half-wave rectifier of A.C.-D.C. fame. This year, as I casually scanned the new Zenith factory manual which covers their 4- to 7-tube

models, I sensed something strange and different. Hurriedly examining each schematic, I found not a trace of a power transformer. Instead, in the straight A.C. models I found the circuit shown in Fig. *1*. At first glance the circuit is rather hard to understand, appearing to be two half-wave rectifiers in series. When broken down as shown in Fig. *2*, however, it becomes evident that it is an extremely efficient and ingenious voltage doubler.

For those who have forgotten, we repeat that the voltage doubler circuit is a means of simultaneously rectifying and doubling the voltage of an alternating current supply without the use of a transformer. Referring to Fig. *2*, on one alternation of the A.C. input voltage, tube *A* will pass current, charging condenser C_1 to 110 volts. On the next alternation the polarity is reversed, and tube *A* is inoperative due to the negative voltage on its plate. The input voltage (110 V.), being in series with the voltage across condenser C_1, places a 220-volt positive charge on the plate of tube *B*, which then passes current to the filter system comprising a choke or loudspeaker field and condensers C_2 and C_3.

The current-handling ability of this circuit is limited only by the size of the rectifier tubes and condenser C_1. In a small chassis requiring but a few milliamperes of plate current, a single tube is satisfactory, but in a large chassis, two tubes are used with the plates and cathodes of each tube in parallel. This circuit obviously will not operate on direct current (D.C.) inasmuch as the plate of tube *B* never becomes positive when so connected, and therefore, does not pass current.

The advent of television does not seem to have hurt the sale of sound receivers, as was at first feared, but to overcome any hesitancy on the part of buyers, many receiver manufacturers have equipped their models with a television jack. The idea is that at some future date the customer may purchase a television receiver which is not equipped to reproduce the sound part of the television programs. The audio signals developed by the television receiver may then be fed into the television jack of the home receiver and be reproduced through its loudspeaker. The television jack simply feeds into the first A.F. stage of the receiver, and may also be used for the point of entrance of signals from a phonograph pick-up.

Another innovation appearing in a number of receivers is shown in Fig. *3*, which is a partial diagram of the Zenith model 5539. This is an all-year-around portable receiver because it is

Florida in winter, Maine in summer, everywhere, this little offering by General Electric really hits the spot. The spring-wound motor plays two 10-inch selections with one winding. The model number is HB-408, and the weight of this 4-tube phono-Radio with batteries in place amounts to only 19½ pounds.

designed for either battery or A.C.-D.C. operation. The A.C.-D.C. system holds our interest, as it is a successful revival from the dark ages of radio—the time when the B supply rectifier was also used to furnish filament current to all the tubes. Today this is done with far greater efficiency due to the fact that the new tubes have such low filament voltage and current requirements. Note that the rectifier filament is placed directly across the line without the necessity of a ballast resistor to lower the voltage.

Quite in line with the A.C.-D.C.-battery portables are the new 6-volt and 32-volt farm receivers. Such sets, in many instances, are protected against obsolescence due to electrification of rural districts by designs which enable the sets to operate from an A.C. source. Some receivers have the extra power pack built into them, while in others a special power pack for A.C. opera-

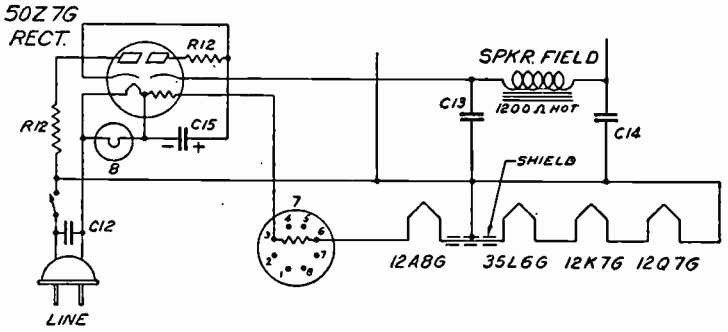


Fig. 1. Power supply of the Zenith chassis 5661. The resistors marked R_{12} have a value of 22 ohms each, and protect the rectifier cathodes against excessive current drain when the filter condensers first charge up. Pilot lamp 8 is shunted by the rectifier tube filament.

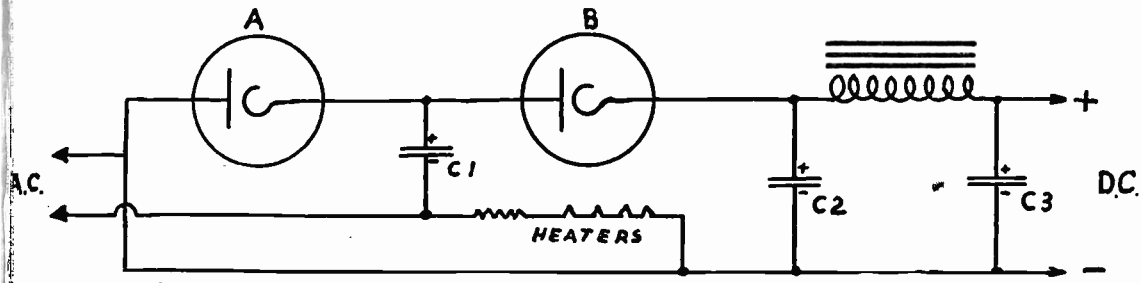


Fig. 2. Tubes A and B may be in a single envelope or may be separate tubes. The filter choke could be a low-resistance loudspeaker field.

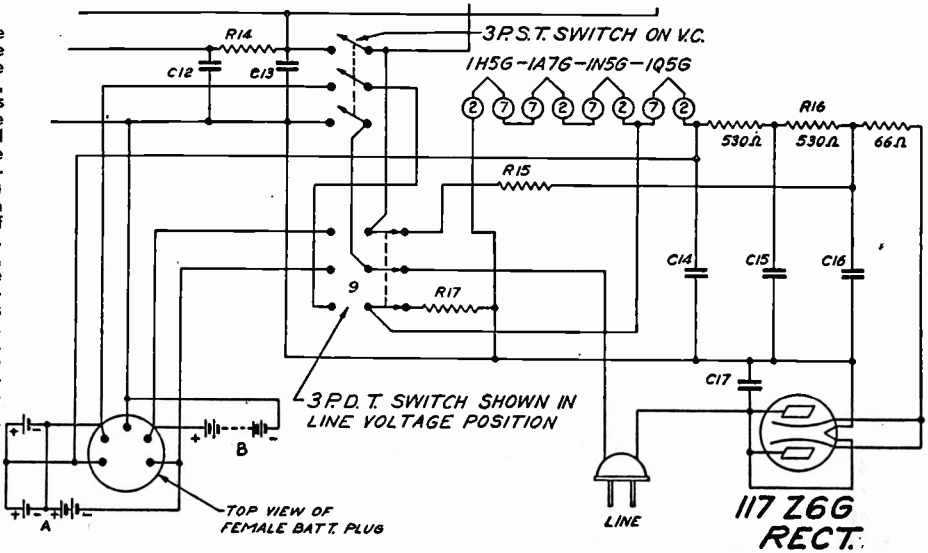


Fig. 3. When the switch is thrown to the battery position, the 117Z6G is not used, the 1Q5G filament is connected across the two parallel-connected A batteries, and the remaining tube filaments (still in series) are connected across a series arrangement of two 1.5 volt batteries. In the A.C. position, the tube filaments are in series with the voltage divider resistors marked R_{16} and B—. As in all A.C.-D.C. receivers, B— is the hot side of the three-cable single-throw on-off switch. The switch is shown in the off position; when closed, the B supply bleeder current flows through voltage divider R_{16} and the tube filaments.

tion may be purchased from the factory. This is welcome news for both set owners and servicemen, as previous battery models did not lend themselves very well to redesign for A. C. operation. When farm receivers were converted to A.C. operation by servicemen, customer dissatisfaction usually occurred because the results were inferior to those obtained with the original design.

Figure *4* shows one method used by Philco to obtain phase inversion for push-pull operation. Note that signal loads are placed in both the plate and cathode circuits. Another method which, due to its simplicity, should become increasingly popular is shown in Fig. *5*. Here the signal developed across a resistor in the screen of one tube, being 180° out of phase with its input signal, is fed through a blocking condenser to the input of the second push-pull tube. The amount of signal fed the second push-pull tube may be adjusted by changing the value of the screen resistor or the control grid resistor.

As seen in Fig. *6*, the Philco model 40-150 uses two separate loops, thus giving all-wave reception without an outside antenna. In the broadcast band position of the wave-band switch here shown, all of loop *1* is used, while in the police

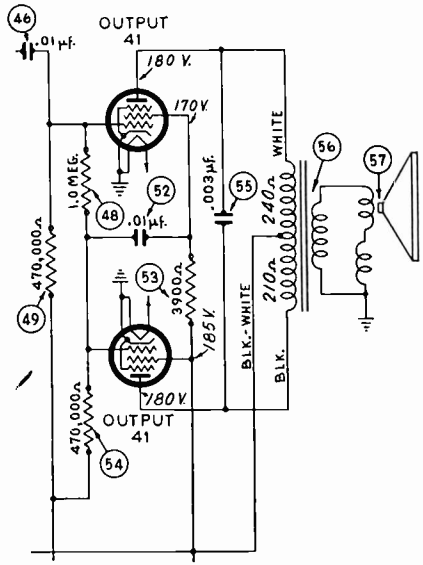


Fig. 5. The signal voltage developed across screen resistor 53 is fed to the control grid of the other push-pull tube through coupling condenser 52.

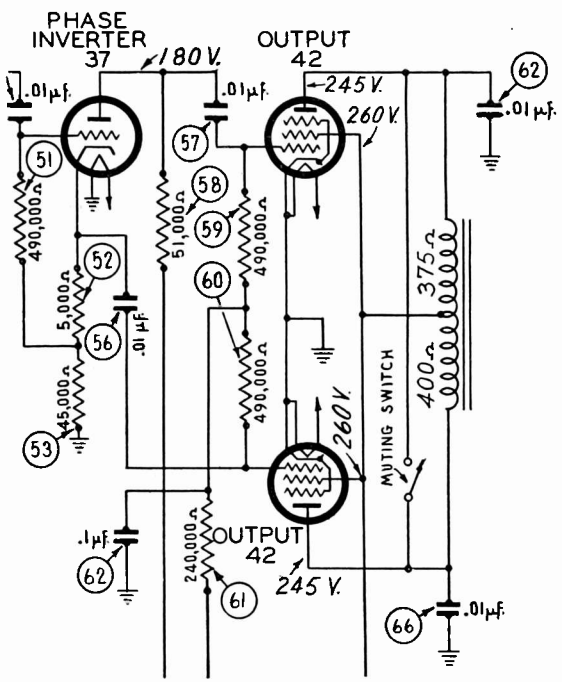


Fig. 4. The two signal loads of the 37 tube are marked 53 and 58. The bias resistor for this stage is marked 52; as the grid return is made to this resistor, the voltage across 53 has no effect on the grid bias.

band (the next switch setting), loading coil *5A* is shorted out and the section of the loop connecting to terminals *1* and *2* is used. In the short-wave band, loop *2* is employed. The broadcast-police loop is statically shielded and may be turned to the position in which it picks up a minimum amount of interference; if interference is not present, the loop may be turned to the position where best reception is obtained.

These new loops, known to the trade as "wave magnets," "beam-o-scopes," "super aerials," "magic loops," "built-in aerials," etc., are increasing in use. Since they fill a real and long-felt need, we venture to predict they are here to stay.

Figure *6* also shows another innovation in that the first detector input is untuned. Compensated resistance-capacitance coupling is used between the R.F. and first detector stages, the design allowing the signal transfer to be fairly constant and independent of frequency.

Figure *7* shows General Electric's method of reducing distortion through degeneration. The signal across the voice coil is placed in series with the cathode of the first A.F. tube. Complete cancellation never occurs as the voltage across the voice coil is always considerably less than the signal input to the first A. F. If you ever replace an output transformer in such a circuit, reverse the secondary terminals if howling oc-

The General Electric model H-116 is an 11-tube three-band receiver. Some of its features are: the beam-o-scope; Television sound or phonograph connections; automatic tuning for eight stations, automatic tone compensation and a cathode-ray tuning indicator. Iron-core coils are used in the I.F. transformers and automatic tuning circuits to eliminate frequency drift.

urs, for howling would indicate the presence of regeneration instead of degeneration.

These circuit samples are typical of 1940 receivers; while there are many others just as interesting, I know that they will not present problems to the man who faithfully studies his N. R. I. textbooks. A thorough understanding of radio fundamentals should enable you to understand the manner in which any new radio receiver circuit works, simply by studying its schematic diagram.

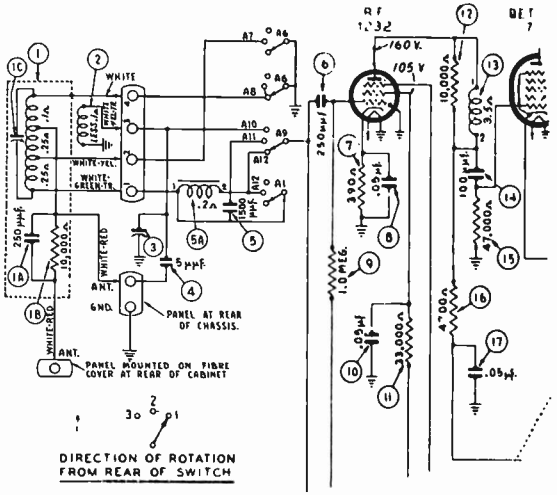


Fig. 6. The two-gang tuning condenser, being in the push-button section of the schematic, is not shown here. Note that the AVC voltage for the type 1232 R.F. tube is applied through resistor 9 and is kept out of the loops by blocking condenser 6. AVC is not applied to the first detector.

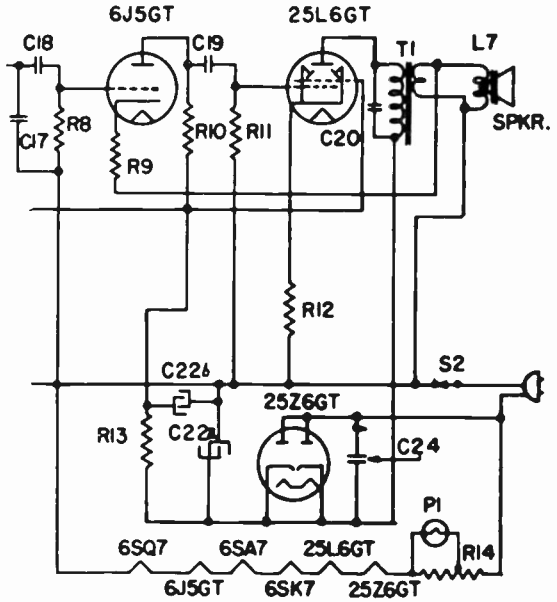


Fig. 7. The A.F. signal is applied through condenser C_{18}, C_{17} simply being used for R.F. by-pass work. Note the lack of a cathode by-pass condenser for the 25L6GT tube. This results in still further degeneration.

YOUNG WESTERNER "STUCK TO IDEA"

HIS INVENTION OBTAINS COMMERCIAL BACKING

This story relating to N. R. I. student F. E. Bole, appeared in the Star Weekly, a leading newspaper in Toronto, Ont., Canada, and is reprinted through the kind permission of the Star Weekly and the author, Corolyn Cox.

By Corolyn Cox

Ottawa, Ont., Canada

GADGETS win wealth. "Stick with your idea," is advice F. E. Bole would give to young inventors, and he ought to know. He has stuck to one of his and come out on top with something that has preoccupied every boy or man that fiddles with radios the world over. Bole's Static Eliminator is not only a finished patent, but has already attracted commercial backing. He's a lad from Saskatchewan, whose education only got him through high school, after which he started life as a brakeman on the C. P. R. But he "monkeyed" with radios early on, and, yes, believe it or not, gleaned his wide technical knowledge on the subject from a correspondence school course. There's a chance for any lad to do it that way, he thinks, and the surface of radio possibilities in the way of inventions has only been touched. But, no correspondence course will do the trick for the lad. The stuff is there only if he digs it out, and that takes some doing.

Bole had a job with an electrical company in Toronto, and went to technical school at night before he arrived in Ottawa three years ago and eventually set up a radio repair shop there. Three and a half years he has been slugging away at his static eliminator. Asked what made him set about solving a problem that even radio engineers seem to have been unable to deal with, he says he just acted on an idea that seemed as though it ought to work. His first product didn't work, and he put it on a shelf. But he kept thinking about it, and eventually dusted it off and started at it again. "Even your friends may laugh after you have failed the first 50 or 60 times, but it appears that the first 20 or 30 tries we make do not bring any results whatsoever. I reasoned that my invention should work, and if it did not, I was determined to find out why. So I got it down off the shelf, dusted it off, and checked it over to see if it was wired right. Then I worked out all the ways I could see to correct the reasons why it did not work, and that kept me busy for nearly three years."

At end of that time Mr. Bole gathered together some interested backers and harried a poor receiving set with a commutator motor, a sunray lamp, and electric razor and a loose socket, four static producers any one of which can be counted upon in the ordinary way to disrupt the clearest and nearest program. He then wiped out all the noises with his eliminator, by a process that he describes as "filtering the wave." It's a small affair, involving four wires, adjustable to various makes of radio and should be a minor item of expenditure—certainly under $10. Young Bole walks in out of the blue, as it were to figure as one of the year's topflight inventors.

LAFAYETTE 1940 MASTER CATALOG IS READY

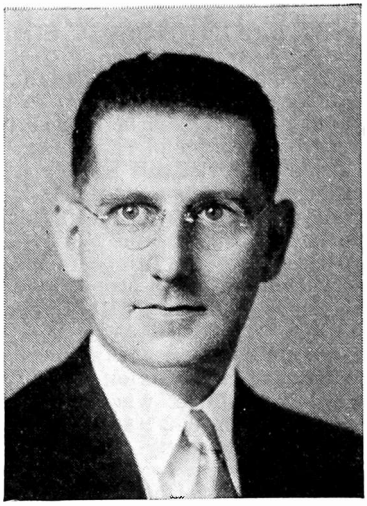
Radio Wire Television, Inc. (formerly Wholesale Radio Service Co., Inc.), announces that its "Master" Catalog for 1940 is now ready for distribution, with 188 pages crammed full of items to meet every Radio requirement. This is said to be one of the most comprehensive Radio buying guides ever published, with 40 pages of home, portable and auto Radios and accessories; 35 pages of public address equipment; 50 pages of equipment, parts and tools for the serviceman; and 30-odd pages for the "Ham" and television experimenter, as some of its major sections.

A post-card addressed to the company's offices at 100 Sixth Avenue, New York City, will bring this catalog to any of our readers, without charge, or a copy may be obtained by a personal call at any of the following branch stores: 265 Peachtree Street, Atlanta, Ga.; 110 Federal Street, Boston, Mass.; 901 W. Jackson Blvd., Chicago, Ill.; 542 E. Fordham Road, Bronx, N. Y.; 90-08 166th Street, Jamaica, L. I.; and 24 Central Avenue, Newark, N. J. When writing for this catalog we suggest you mention that you are a student or graduate of N. R. I.

The Laboratory Page

By GEORGE J. ROHRICH

The purpose of this department is to furnish supplemental experiments to students who have completed their Home Laboratory Course, but who wish additional laboratory experience. You are not required to perform these experiments, but you will gain increased knowledge by doing so. Most of the material required will be that received as part of the Laboratory Course. Any other material necessary can be purchased very reasonably and will constitute an investment rather than an expense, as it will serve as replacements in service work or be useful in your shop later.



George J. Rohrich, Engineer in Charge N. R. I. Laboratory

THE PROPERTIES OF A VACUUM TUBE

The vacuum tubes, as we know them today, are combinations of relatively simple materials which are outgrowths of countless observations made by laboratory workers who observed the properties of materials used in early types of electric lamps.

Thomas Edison knew that a wire had the "property" *or peculiarity* of becoming heated when an electric current flowed through the wire. By making a portion of the wire very small in diameter, he knew this thin wire would become easily heated red hot and finally white hot, thus having the property of producing light with a relatively small amount of current. However, such heated wires as he used, soon changed from pure metal into oxides of that metal. He knew that the heated metal combined with the oxygen in the air and thereby burned the metal. Therefore, he reasoned correctly that if he would keep the oxygen away from this small wire, this wire would have the property of giving off light without becoming burned.

It was only natural for Edison to solve his problem of producing glowing light from electricity by placing his wire of small diameter in a glass bottle and then pumping out the air. The modern incandescent (glowing) electric lamp as we know it today still is made in this manner.

Edison invented his incandescent lamp in 1883 for the purpose of producing light. He was not content in his simple device but set out to learn what went on inside his glass bulb. In one of his experiments he inserted a small metal *plate* inside his bulb near one side of his filament. A *plate* is a *flat* piece of metal. We get the clearest picture of it from *armor plate* as used to cover the sides of a ship. Early vacuum tubes used a single flat plate. Later tubes used two plates, one on either side of the filament, joined together electrically to improve the actions observed with a single plate. Still later type tubes and many modern tubes use a *plate* of metal, bent into the shape of a cylinder or hollow box, surrounding the filament or cathode. Thus we see the origin of the name of *the plate* regardless of the present shape or the kind of material used in it.

Thus, a piece of metal shaped and used as a *grid* can be used as a *plate* in a vacuum tube. You check this property in Experiment No. 13 of Outfit 2 BA-2. Furthermore, one or more grids and several plates also can be joined electrically to serve as a *single plate.* You check this property in Report Statement No. 31 of Outfit 4 BA 1. Many modern tube testers permit you to check the property of producing emission from any tube's cathode by electrically joining all of the grids and plates together to serve as a single plate.

Having inserted the plate in his incandescent lamp, Edison made additional observations of several properties. He found that the direct current batteries which he was using in all of his experiments permitted current to flow between these two metals (the plate and the filament) although separated from each other inside the bulb, provided he fulfilled two certain conditions. One of these conditions was that the filament *had*

(Page 12, please)

The Laboratory Page (Continued from page 11)

to be heated sufficiently; the other was that the polarity of the battery *had to be connected in a definite manner,* with the positive terminal leading to the colder piece of metal plate. Although Edison observed this peculiarity it remained for others to clearly explain and later make practical use of it. You check this property in Experiments No. 13 and No. 14. You also depend on these two conditions to make additional observations of other properties in every other experiment beginning with Experiment No. 15.

Students working with Experiment No. 15 often fail to get a deflection on the milliammeter, or get low readings when connected as shown in Fig. 19 of Outfit 2 BA-2. Numerous letters prove this is so. Directly or indirectly the reason for failure is generally due to lack of meeting these two conditions of heating the filament sufficiently and also applying the correct polarity.

In some instances the lack of final *insufficient heating* is caused by an accidental *temporary overheating* of the filament. These filaments in the type 30 and 31 tubes used in your experiments were specially processed to produce a plate current with very little heating of the filament. The full voltage from a single 1½ volt dry cell, or a controlled higher voltage which does not exceed *2 volts across the filament terminals* generally heats the filament sufficiently, doing so *without the filament showing* a *visible glow.*

Using a controlled higher voltage source for testing the filament as in Experiment No. 12 or heating the filament in Experiment No. 14 also will not overheat the filament *if instructions are followed.*

In Experiment No. 12 the 45 volts are controlled with the aid of the 3300 Ohm fixed resistance in the testing meter so the voltage across the filament itself is less than one-half of a volt. Then there is no danger of overheating unless the ends of the wires connected to the meter accidentally touch the case of the meter.

In Experiment No. 14 you control a three-volt source from two dry cells with the aid of the variable 30-ohm resistor. This control of the filament voltage with the aid of the 30-ohm resistor can be obtained only while the tube is in the socket. This property or peculiarity of the resistor depends upon the flow of additional and much larger amount of filament current flowing through the resistor. Therefore, do not expect to change and control the filament voltage until you insert the tube. Also be aware of this property in each and every other experiment when you check for correct filament voltage.

Normal properties of the tubes are obtained when the special processed filament is not overheated *beyond a very dull cherry red glow* as seen in an unlighted room. In daylight the filament even then often appears not to glow. This glow usually is not observed in a darkened room until the filament voltage ranges between 2 and 2½ volts.

Heating the filament with more than 2½ volts usually impairs the original properties obtained with lower voltages. However, *once impaired* for use with low voltage, the *properties can be restored* while using a *higher than normal* filament voltage.

During tests in the laboratory I have purposely overloaded the filament of countless type 30 and 31 tubes with as much as 4½ volts and more. This did not burn out the tubes although the filaments glowed with a bright yellow light. Attempting then to duplicate the experiments outlined in the N. R. I. course resulted in failure until the filament voltage was again increased near the value used in the overload.

Numerous inactive tubes returned by students have been tested since I observed this property. Practically all of these tubes gave normal action when I used 3 volts for heating each filament. This property of needing 3 volts shows that somehow these tubes were accidentally overloaded previously with this value of filament voltage. The most logical reason appears to be due to an oversight of *frequently* checking the value of filament voltage and *maintaining* this value as directed in the special instruction sheet entitled "About Tubes" which accompanies each of three different experimental outfits.

Information is given here for those students who fail to understand clearly how a "zero bias" is obtained in Experiment No. 16.

A "bias" refers to *a voltage* connected between the grid and cathode of a vacuum tube.

In a filament type vacuum tube, like the type 30 tube, the filament is the cathode. Here you should use *that* filament terminal which produces the *lowest* reading during the time that the grid is *connected* to the filament. In other words, the *negative* filament terminal is considered the cathode terminal of this type tube.

"Zero bias" refers to having *no voltage* between this negative terminal of the filament and the grid. This condition of "zero bias" *will be insured* if you connect the grid directly to the negative terminal of the filament. For example, in Experiment No. 16 you connect the grid to the filament and apply zero bias when you hold the test prods together. An amount of "plate current" should exist with zero bias. This value of *plate current* is usually about 1.8 ma.

RADIO-TRICIAN
REG. U.S. PAT. OFF.
Service Sheet
Compiled Solely for Students and Graduates
NATIONAL RADIO INSTITUTE, WASHINGTON, D.C.

Arvin Model 44C, Chassis RE46

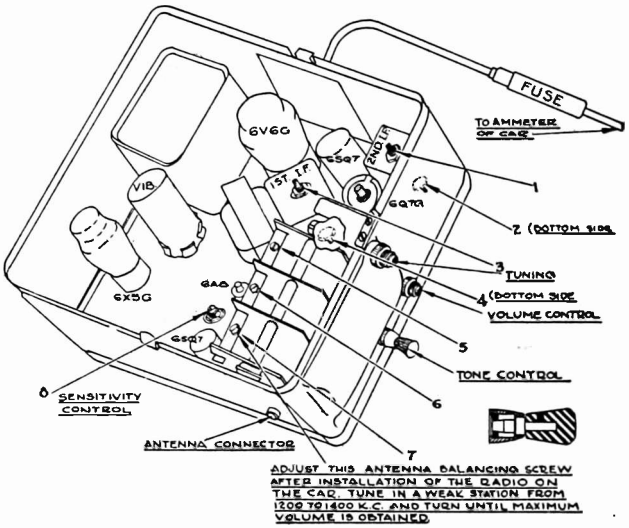
BALANCING INSTRUCTIONS

All sensitivities are given for 1 watt output=1.73 V across speaker voice coil.

SPECIAL NOTE: The intermediate frequency transformers in this receiver are coupled so as to secure flat top characteristics and provide semi-high fidelity reception of radio stations. These transformers may be balanced with a standard signal generator and output meter as follows:

Feed a signal of 170 kc into the grid of the 6A8 tube through .002 mfd. capacity, connect a 30,000 ohm resistor across the primary of the second I.F. transformer (P to B+) and adjust screw No. 1 for maximum output. Disconnect the resistor and place it across the secondary of the same transformer and adjust screw No. 2.

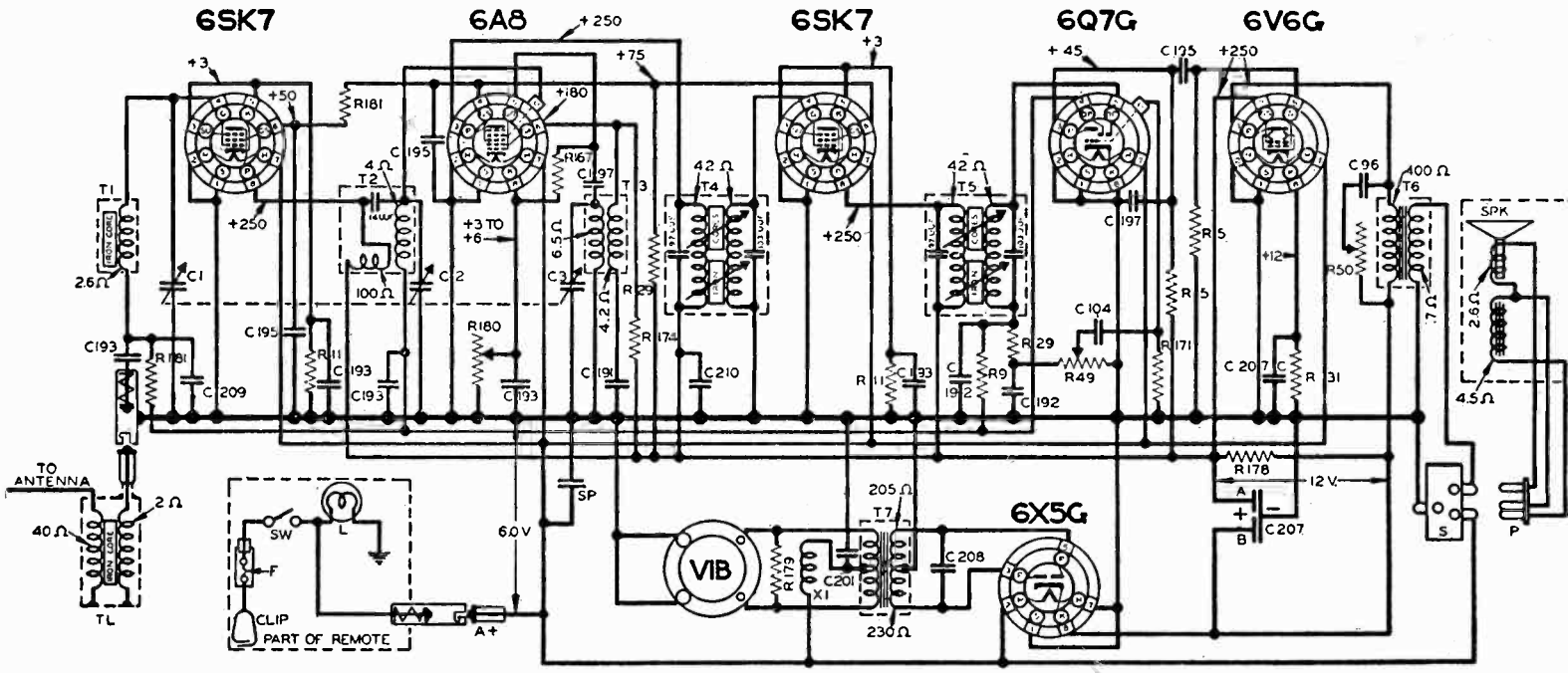
Then connect the resistor across the primary of the 1st I.F. transformer and adjust screw No. 3 and then after placing the resistor across the secondary, adjust screw No. 4.



Operation No.	Connect Bal. Oscillator To	Bal. Oscillator Frenquency	Adjust Padder No.	Dial Setting	Sensitivity
1 (See note above)	6A8 Grid	170 kc	1, 2, 3 & 4	Condenser Closed	700 uv
2	Ant. Coupler Through 20 uuf	1570 kc	5	Condenser Open	—
3	Through 20 uuf	1400 kc	6 & 7	1400 kc	5 uv
*4	Through 20 uuf	600 kc	8	600 kc	3.5 uv

*Operation No. 4 adjust bias on 6A8 to obtain 5 uv. sensitivity; for metropolitan areas this sensitivity may be set as low as 10 uv. and in mountainous areas as high as 1 uv. to secure the most satisfactory reception.

Readers who file Service Data in separate binders remove page carefully, trim on dotted line for same size as data published heretofore.



RESISTORS

R5	500,000 ohm, ¼ watt
R9	1,000 ohm, ¼ watt
R11	2,000 ohm, ¼ watt
R29	50,000 ohm, ¼ watt
R31	260 ohm, 1/2 watt
R49	500,000 ohm
R50	100,000 ohm
R167	60,000 ohm, ¼ watt
R171	15,000 ohm, ¼ watt
R174	30,000 ohm, ¼ watt
R178	1200 ohm, 1 watt
R179	100 ohm, ¼ watt
R180	2000 ohm
R181	100,000 ohm, ¼ watt

CONDENSERS

C96	.05 mfd. 600 v
C104	.01 mfd. 200 v
C191	.01 mfd. 400 v
C192	.00025 mfd. 600 v
C193	.05 mfd. 200 v
C195	.05 mfd. 400 v
C197	.0001 mfd. 600 v
C201	.5 mfd. 150 v
C207A	10 mfd. 400 v
C207B	10 mfd. 400 v
C207C	20 mfd. 25 v
C208	.005 mfd. 1,600 v
C209	.001725 mfd. 600 v
C210	.1 mfd. 400 v

Novel Radio Items

—BY L.J. MARKUS—

One Radio Engineer Hates Cows!

During the installation of a new Western Electric 50-kw. transmitter at station LS1 in Buenos Aires, a minor flood filled the transmission line trench with water. A cow, wandering in the mud one night, fell into the trench and cracked a joint in the coaxial transmission line, ruining all insulators. Air mail brought new insulators from the United States, and engineer Jack Herber worked day and night under political pressure, with all the men and all the pesos he could use, to get the station on the air in time for the opening of the opera season, despite the cow.

n r i

Television Studio Cures Colds!

Performers with sinus trouble or colds are often relieved considerably after working only a few hours under the heat from the batteries of lights used in the television studios of the Crosley Radio Corporation.

n r i

Two-Hour Telecine Program Costs 4c!

Even though some of the larger RCA television sets draw over 400 watts, the owner of one of these sets can see a two-hour televised movie program in the comfort of his own home for a power cost of only four cents (assuming an average price of 5c per kw. for electric power).

Tube Has 117-Volt Filament!

The filament of the new Hygrade Sylvania type 117Z6G full-wave rectifier tube can be connected directly across an a.c. power line, eliminating the need for a filament winding on the power transformer. A hair-thin filament wire with eight layers of baked-on insulation is folded back and forth fifteen times inside its emitter-coated metal cathode.

n r i

Cathode Ray Tube Screen is Flat!

Philco announces a unique new cathode ray tube for television receivers, having a perfectly flat screen in place of the usual curved screen, and having its electron gun aimed off-center so that uncontrollable ions will not produce a brown spot at the center of the screen. An extra deflecting yoke brings the picture back to the center.

n r i

Stations Don't Like Push-Buttons!

With eighteen radio stations serving the Los Angeles area, some of the independent stations are complaining that receivers with only four push-buttons are set to the network stations and discriminate against the other stations. Favored stations retort that all sets have manual tuning, so the listener can choose any desired station.

RADIO OPERATES FROM GAS MAIN! Radio receivers which operate from gas mains were demonstrated in Great Britain and at the New York World's Fair. Thermoelectric generators employing thermocouples are used to convert the heat into electricity. The British version gives an output of 8 watts at 2 volts; this is fed directly to tube filaments, and is stepped up to 150 volts by a converter for plate requirements.

FISHERMEN USE SHIP-TO-SHIP RADIO! Down in Chesapeake Bay, one well-known fishing captain has radio-telephone units installed in several of his boats. When one boat locates the fish, the good news is immediately radioed to the other boats. Low-power short-wave transmitter-receiver units operating from storage batteries are now available at surprisingly low cost for small ship installations like these.

ELECTRIC FENCE SAVES BULL! Down in Louisiana, a 1,000-pound Jersey bull named Ferdinand pushed himself halfway through a fence hole, devoured a 100-pound sack of cornmeal, then couldn't get out again. The owner applied the terminals of an electric fence unit to Ferdinand's rump, and shocked Ferdinand free of the fence in ten seconds. These units operate from batteries and generate harmless high-voltage pulses.

Checking the Continuity of Radio Circuits

By J. B. STRAUGHN
N. R. I. Servicing Consultant

THE word continuity, as used in radio, refers to a continuous electrical path between the points under consideration. A study of any schematic diagram will show the existence of many continuous circuits.

You cannot readily trace the continuity of a circuit in a receiver chassis by examining the wiring and parts. Sometimes the wiring is hidden by other parts or shielding, and a burned out transformer or broken down condenser frequently looks like one in perfect condition. To determine if continuity between two suspected points really exists, a serviceman tries to send a direct current through the circuit between the two points. If current goes through the circuit, it is not open, and we say it is continuous, or has *continuity*.

Test Equipment is Necessary. A check for continuity requires some means for showing the presence of current. One of the earliest and most simple devices was a lamp in series with a voltage source. This was quite satisfactory for low-resistance circuits which could safely stand considerable current. If the circuit resistance was high, however, as it normally is in many receiver circuits, the lamp would not light, even though the circuit was continuous. Then, too, if the circuit or parts were not designed to carry a high current, there would be the danger that the continuity tester would burn the circuit out.

Servicemen got around these difficulties by using headphones in series with a battery. Only a slight amount of current was necessary to cause a click in the phones. However, as phones do not respond to d.c., a click would be heard only when the current started and stopped as it did when the test probes were touched and removed from the circuit.

While a headphone type of continuity tester enabled the serviceman to check the continuity in high-resistance circuits, it introduced other troubles. In many instances, an audio transformer or choke might be open and clicks might still be heard when the circuit was made and broken. This is due to the inherent capacity existing between the turns in the winding. The slight amount of current used to charge up this capacity would result in a click in the phones.

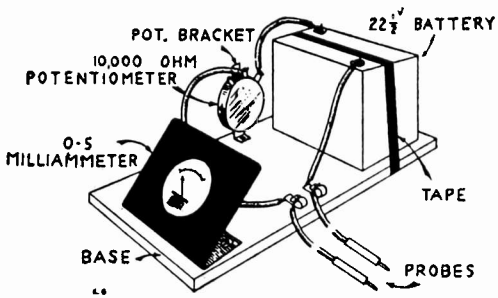


FIG. 1A. Here is an ohmmeter which you can assemble from the parts in your experimental outfits. In addition to the potentiometer, meter and probes, you will need a 22½-volt C battery and two Fahnestock clips. This simple ohmmeter has only one range.

The Modern Continuity Tester. Servicemen finally came to the use of the ohmmeter for checking continuity. This practical and successful device consists of a meter in series with the usual battery. A simple ohmmeter is shown in Fig. 1A. If the ohmmeter is connected across a closed electrical circuit, the battery will cause current to flow through the circuit, and this will make the meter needle deflect. The amount of deflection depends upon the resistance of the parts in the circuit; the meter is calibrated to give the resistance value of the circuit directly in ohms. If the circuit is open, the battery will not send cur-

rent through it, and consequently no reading will be obtained on the meter.

When testing parts with an ohmmeter, try to choose an ohmmeter range which will cause the reading to be somewhere near the center of the scale. At the high-resistance end of the scale, the calibration markings are crowded together and hard to read. For example, if you are using the low range of your ohmmeter and find that the reading is at the highest-resistance end of the dial scale, you should switch to the next highest ohmmeter range; this will give a reading nearer to the center of the scale, where it can be read more accurately.

Some servicemen do 90% of their work with an ohmmeter. I mention this to show the versatility

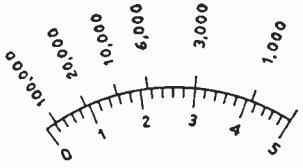


FIG. 1B. This is a rough calibration of the ohmmeter. If you desire, you can mark the scale of your own meter in this same manner.

of the ohmmeter, not to inspire you to similar deeds. A first-class serviceman knows how and when to use all standard equipment; whereas, the man who sticks to one instrument is going to run into difficulties which he cannot solve. For example, there is little sense in making continuity tests when the trouble is due to improper alignment.

The Secret of Success. The whole secret of making successful continuity tests lies in making measurements which will yield useful information, which will enable you to diagnose and correct the trouble in the receiver.

Suppose a receiver is sensitive but has low volume. Continuity measurements in the r.f. section of this set would obviously be a waste of time; the fact that the receiver will bring in many distant stations weakly indicates that the radio frequency section is in good condition and that the trouble is in the audio system. Proper training, experience, and the ability to reason from effect to cause enables a Radiotrician to determine what tests should be made. Aimless testing with an ohmmeter or with any other piece of equipment is simply guessing and is a waste of time.

When you have obtained your practical training by following the instructions in your Course, you will be able to apply effect-to-cause reasoning and will know what instrument to use and when to use it.

A Wiring Diagram Helps. When a wiring diagram is available it is quite easy to make continuity tests. You simply locate the points on the diagram between which you wish to see if continuity exists, then locate these points on the chassis. Without a circuit diagram, however, it is another story, and you must then depend upon your theoretical knowledge of receiver circuits to find the points between which continuity should be present.

Since most of the troubles which can be located by means of a continuity test are in voltage supply circuits, it is very important to know how re-

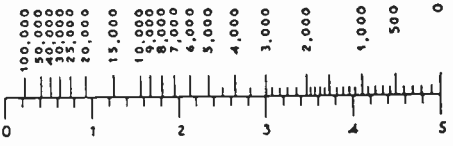


FIG. 1C. A more accurate calibration of the ohmmeter for reference use. Locate the meter reading on the 0-5 scale, then read the upper scale here to determine the resistance value.

ceivers are supplied with power. The positive and negative supply points must be identified. Continuity tests between these points and the various tube electrodes should then be made, in an effort to locate a possible open.

In an A.C. receiver equipped with a power transformer, the highest positive supply point is the electron emitter (filament or cathode, as the case may be) of the rectifier tube.

The most negative point is the center tap on the high voltage winding of the power transformer. This center tap often connects directly to the chassis and, as shown in Fig. 2A, the chassis can be used as the negative reference point. Sometimes, however, the connection is through the loudspeaker field and perhaps a resistor; if we were to use the chassis as the reference point, we would not know if the loudspeaker field coil was open. The center tap itself is not easy to locate, but in every case the rectifier tube plate socket terminals should show continuity to the center tap. It is easy to get at these terminals, hence, as shown in Fig. 2B, they are convenient negative reference points for the ohmmeter.

In the typical A.C.-D.C. receiver power supply in Fig. 3, the most positive point is the cathode of the rectifier, while the most negative point is the set side of the off-on switch. If an ohmmeter

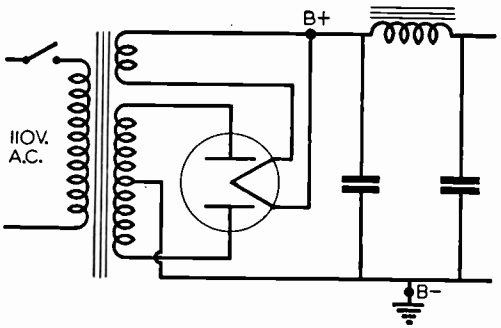


FIG. 2A. Here the center-tap of the high-voltage winding connects directly to the chassis; all measurements to B— are therefore made by placing one ohmmeter probe in contact with any point on the chassis.

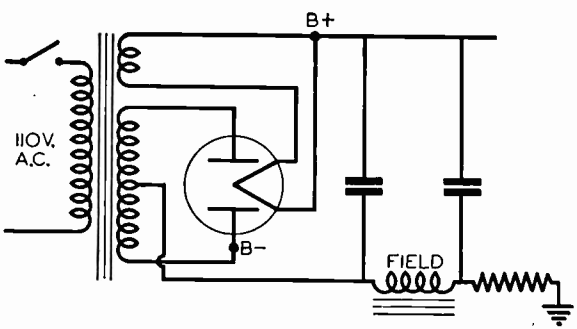


FIG. 2B. The high-voltage center-tap in this arrangement does not connect to the chassis. The tube plate socket terminal must therefore be used as the B— reference point, because a continuity check between it and the negative electrodes of tubes takes into account the loudspeaker field and the resistance in series with it.

check shows zero resistance between the switch and the frame of the tuning condenser gang, use the condenser frame as your negative reference point. It is easier to hold an ohmmeter test probe in contact with the condenser frame than the switch terminals. The chassis is not used as a reference point as it is generally not an electrical part of the circuit.

The Rules of Continuity Testing. Now that the main reference points have been identified, you are ready to check continuity between these points and the tube electrodes. The first general rule is that *all tube electrodes normally at a positive potential should show continuity to B+*. Thus, there should be continuity between the positive reference point and the plate and screen grid electrodes; in the case of pentagrid converter tubes such as the 6A7, the oscillator anode grid is also at a positive potential and comes under this rule.

The second general rule is that *all tube electrodes normally at a negative potential should show continuity to B—*. Thus continuity should exist between B— and the control grids, suppressor grids and cathodes.

When making a continuity test, one probe of the ohmmeter is held in contact with the reference point, while the other test probe is touched to the electrode in question. The resistance between the two points is then indicated on the ohmmeter, and it is up to you to decide whether this resistance is reasonable. Of course, if a diagram is at hand, you may determine the correct resistance values between various points from the information given on it.

Suppose our ohmmeter indicates that a plate supply circuit is open. We must locate the open part. Our knowledge of receiver circuits tells us that there will be a plate load, which might be a resistance or a transformer. Furthermore, the circuit may trace back to B+ through one or more resistors and possibly a choke. Each of these parts may be checked with an ohmmeter; in this way the open one may be quickly located.

If the chassis of a receiver is B—, and we are unable to obtain any continuity between the cathode socket terminal of a tube and the chassis, we at once know that the cathode bias resistor of that tube is open. The circuit is then examined and the resistor located. Check the resistor with the ohmmeter to verify your findings, then insert a new resistor.

So far we have considered circuits in which continuity is supposed to exist. We must not forget that many troubles are due to undesirable continuity, more often spoken of as a short-circuit. Again an ohmmeter will, when properly used, give us the whole story. First, you should know the circuits in which shorts are likely to occur, and the receiver symptoms caused by such shorts.

Filter condensers frequently short; in doing so they may overload the rectifier, causing its plates to become red hot. When such a symptom is observed, the set is turned off, the rectifier tube removed and the resistance measured between B+ and B—, through the rectifier tube filament and plate socket terminals, or if you prefer from the bottom of the tube socket. If a short is indicated, those parts which could cause the short are disconnected and checked individually with the ohmmeter.

Ohmmeters Have Polarity. When checking electrolytic condensers with an ohmmeter, the po-

larity of the condenser must correspond to that of the ohmmeter. This precaution is important because an ohmmeter is a voltage source, and the positive terminal of any voltage source must always go to the positive terminal of an electrolytic condenser. When an ohmmeter is properly connected to an electrolytic condenser the meter needle will swing to a low resistance value. As the condenser charges up it will draw less current and the resistance reading will increase until a final value is reached, at which time it is possible to determine the leakage resistance of the condenser. A good electrolytic condenser should have a leakage resistance greater than 100,000 ohms. The permissible leakage resistance will vary inversely with the capacity of the condenser and will be less on a large capacity condenser than on one with lower capacity.

If incorrect polarity is used when connecting an ohmmeter to an electrolytic condenser, the process of charging will again cause a sudden current surge and a low resistance reading on the meter. The resistance will gradually start to increase as before, but when the condenser has taken a certain amount of charge, the incorrect polarity will cause its dielectric film to break down and the current will again increase. This causes the resistance to stop increasing and the meter reads a steadily smaller value. Such action definitely shows incorrect ohmmeter polarity, and the test probes should be reversed. The incorrect connection will not harm the condenser and the film will reform when a voltage of the proper polarity is applied.

Ohmmeter polarity will result in another peculiar effect which may fool you. If you have been testing out a receiver, and the symptoms lead you to believe that an open exists in a high resistance control grid return, you would turn the set off and check the resistance between the control grid and the chassis. If the ohmmeter is so connected that its positive probe is on the grid and the negative probe on the chassis, you will obtain a continuity reading even if the grid return is open. If you leave the ohmmeter connected in the circuit, you will note that the resistance reading gradually increases. The increase will stop at the true value of the circuit, but if the grid return is open the ohmmeter will finally show this to be true.

When checking circuits not containing electrolytic condensers, servicemen do not wait for the ohmmeter to settle down. They simply note that continuity exists and go on to some other test. In this way it is possible to overlook the real cause of trouble; in this case an open grid circuit.

The peculiar action of the ohmmeter is due to the positive voltage impressed upon the grid by the ohmmeter. The cathode of the tube does not cool off immediately and this positive potential attracts electrons from the cathode, thus enabling the ohmmeter to give a low resistance reading. As the cathode cools off, the electron emission decreases and the ohmmeter reading goes up. To offset this effect whenever noted, reverse the ohmmeter test probes.

Know Your Ohmmeter Polarity. From this discussion, you can see the importance of knowing the polarity of your ohmmeter. Many of the ohmmeters found in combination multimeters use the same two jacks as the voltmeter. The voltmeter jacks are always marked + and — but it does not necessarily follow that they also indicate the ohmmeter polarity. In most cases of this sort, the negative voltmeter jack is the positive ohmmeter jack. It is easy to determine the true polarity of your ohmmeter. Simply connect it across an electrolytic condenser. When the positive ohmmeter probe is connected to the positive condenser terminal, the meter needle will swing to a low resistance value, and then gradually move toward a progressively higher value until it finally comes to rest. After this test you have simply to remember which ohmmeter probe goes to the positive condenser terminal. This knowledge is very valuable when determining the proper polarity of unmarked electrolytic condensers.

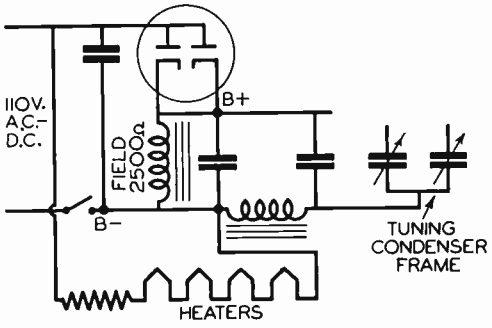


FIG. 3. Here are shown the power supply system and tuning condensers for an A.C.-D.C. receiver. The gang tuning condenser frame corresponds to the chassis of an A.C. receiver. The choke in the negative side of the circuit makes this diagram correspond to Fig. 2B, but here B— is the set side of the on-off switch. Note the 2,500-ohm loudspeaker field, connected between B+ and B—.

Exceptions to the Rules. A test on almost any receiver will show the existence of continuity between the plate of a tube and its cathode. The fact that such continuity exists is of no particular value until we consider the magnitude of the ohmmeter reading. A zero resistance reading or

a value of less than 10,000 ohms would not be normal, and a short of some kind would be indicated.

There are exceptions to every rule, of course; we must remember that triodes such as the 56 or 37 are sometimes used as diodes in the a.v.c. or second detector stage of a receiver. In such a circuit as Fig. 4, the plate is connected directly to the cathode and chassis. For unusual circuits of this type a beginner must rely on a circuit diagram. An experienced man, on the other hand, can often look at the top of a receiver chassis, and after noting the tube numbers and

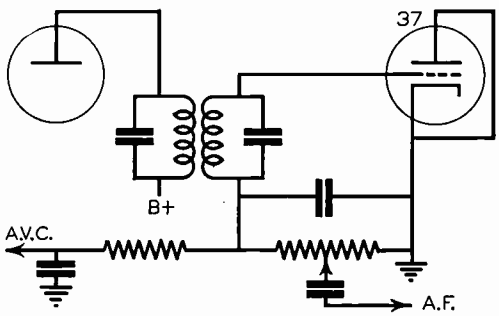


FIG. 4. In this circuit, you would expect to measure zero resistance between the plate and cathode, for they are tied together to give diode operation.

identifying the various transformer cases, tell you just how each tube is used and what should be expected when making continuity tests. This ability is gained by examining many circuit diagrams and receiver chassis. It is an ability which will come to you in time and with study.

Another exception is in A.C.-D.C. midgets, where the loudspeaker field coil has a resistance of 3,000 ohms or so and is connected directly across the output of the rectifier. In this case an ohmmeter check from B+ to B— would (due to the low reading) lead us to believe that a filter condenser was leaky or some other part shorted.

When testing the continuity of circuits, remember that resistance readings are governed by the tolerances of parts and the accuracy of the ohmmeter. An ohmmeter in good condition and with good batteries will have an accuracy of ±2%. As the batteries deteriorate, the accuracy may fall as low as 10%. However, the resistors used in receivers have a much greater tolerance; in fact, resistors in most circuits need not have an accuracy of more than ±20%. This means that a 100,000 ohm resistor might have any value between 80,000 ohms and 120,000 ohms and still be satisfactory.

Series and Parallel Measurements. Suppose we check the control grid return circuit shown in Fig. 5 by touching one ohmmeter probe to the chassis and the other to the control grid cap. The meter should read 100,000 + 10 + 100, or 100,110 ohms. Now, since the 100,000 ohm resistor might be anywhere between 80,000 and 120,000 ohms the 10 ohm and 100 ohm resistors might be completely shorted or increased many times in value without giving a suspicious ohmmeter reading. This leads to the important conclusion that an ohmmeter test on a series circuit containing both large and small values of resistance will only tell whether the circuit is open and tell the

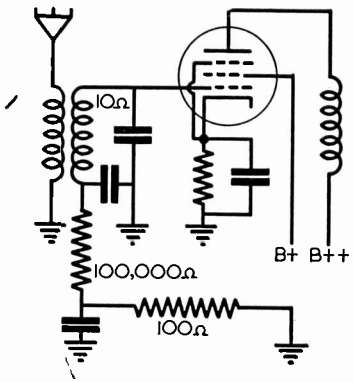


FIG. 5. The condition of the 10-ohm coil and 100-ohm resistor cannot be determined by measuring the resistance from the control grid to the chassis in this circuit; each resistor must be checked separately.

approximate condition of the high-value units. When the symptoms point to the low-resistance parts as possible trouble sources, these must be individually checked.

With parallel circuits, however, the total resistance is governed by the lowest-resistance part, and an open in a high-resistance branch of the circuit will have little effect on the total resistance as measured with the ohmmeter. Here is an example. Fig. 6 shows a loudspeaker field inserted in the negative side of the filter circuit. Resistors R_1 and R_2 act as voltage dividers, and the drop across R_2 serves to bias the power tube. Such resistors sometimes open up or change in value, thus causing distortion through incorrect bias for the power tube. You can see that a change in these resistor values could not affect the total circuit resistance measured between X and Y. The resistance would remain, for all practical measurement purposes, at 2500 ohms. To determine the condition of R_1 and R_2 they must be separately checked.

You have often heard it said that you must disconnect a part to check it. There is a very good reason for this statement, as you will now see.

(Page 24, please)

RADIO-TRICIAN
REG. U. S. PAT. OFF.
Service Sheet
Compiled Solely for Students and Graduates
NATIONAL RADIO INSTITUTE, WASHINGTON, D.C.

Arvin Model 89 and 91, Chassis RE27

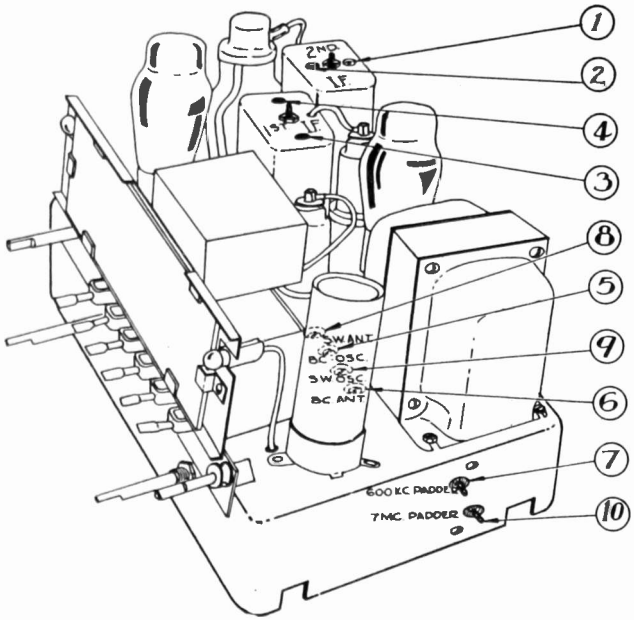
Balancing Instructions

All sensitivities given for 200 milliwatts output—.78 V across voice coil

Operation No.	Connect Sig. Generator To	Input Frequency	Adjust Padder No.	Dial Setting	Band Switch Position	Sensitivity
1	6A8 Grid	455 KC	1, 2, 3, & 4	600 KC	Broadcast	70 uv
*2	Antenna Wire	1400 KC	5	1400 KC	Broadcast	.....
3	Antenna Wire	1400 KC	6	1400 KC	Broadcast	25 uv
**4	Antenna Wire	600 KC	7	600 KC	Broadcast	40 uv
5	Antenna Wire	15 MC	8	15 MC	Short Wave	.....
6	Antenna Wire	15 MC	9	15 MC	Short Wave	120 uv
7	Antenna Wire	7 MC	10	7 MC	Short Wave	150 uv

* Dial pointer should be parallel with horizontal line across center of dial with tuning condenser in closed position (maximum capacity) before proceeding with adjustments.

** After balancing 600 KC padder, return and recheck the adjustments of padders 5 & 6.



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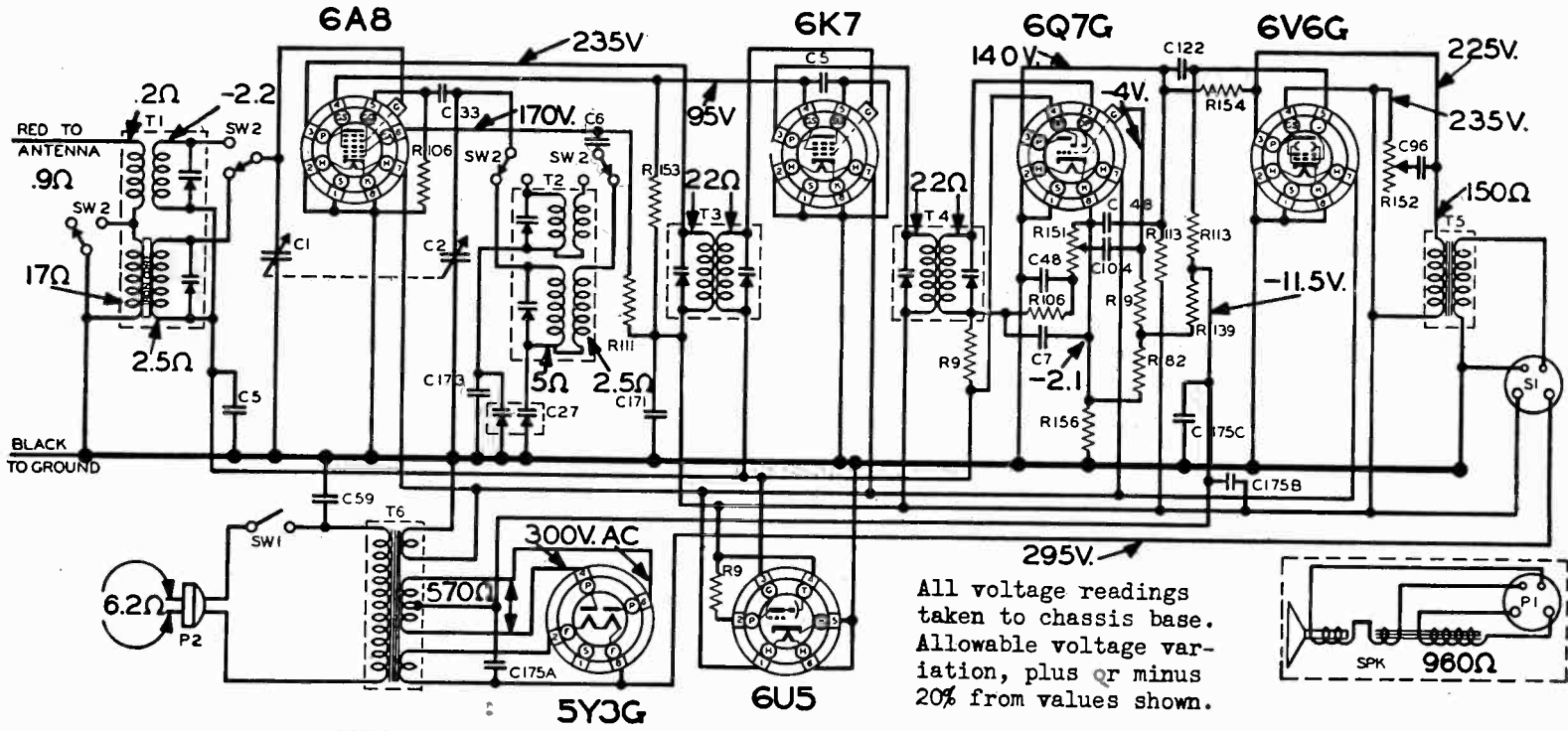


RESISTORS

R9	1,000,000 ohm, 1/4 watt
R82	30 ohm, 1/4 watt
R106	50,000 ohm, 1/4 watt
R111	20,000 ohm, 1/4 watt
R113	250,000 ohm, 1/4 watt
R139	100 ohm, 1 watt
R153	30,000 ohm, 1/2 watt
R154	1,500,000 ohm, 1/4 watt
R156	35 ohm, 1/4 watt

CONDENSERS

C6	.002 mfd. 600 v
C7	.0001 mfd. 600 v
C122	.01 mfd. 400 v
C104	.01 mfd. 200 v
C48	.00025 mfd. 600 v
C27	Series Padder
C5	.05 mfd. 200 v
C33	.00005 mfd. 600 v.
C96	.05 mfd. 600 v
C171	.1 mfd. 400 v
C173	.003 mfd. 600 v
C175 A, B & C	10-10 mfd. 450 v
C59	20 mfd. 25 v .01 mfd. 400 v

The Service Forum

Conducted by

J. B. Straughn, N. R. I. Service Consultant

Send in your service notes. We will re-word them for publication. To qualify your note for the NEWS *you must have observed the same trouble on two or more identical receivers.*

GENERAL ELECTRIC MODEL K66 — **MOTORBOATING**

Replace the 8 mfd. output filter condenser with a 16 mfd. 475 volt unit. The negative terminal of the replacement condenser connects to the chassis while the positive terminal may be connected to the screen of the power tube.

C. R. EMMONS, New Jersey.

n r i

SENTINEL 1939 MODEL — **DEAD**

Check the primary winding of the output transformer using an ohmmeter. If the test indicates the winding to be open, install a new universal output transformer.

GILBERT THOMAS, Texas.

n r i

SENTINEL MODEL 12A — **INTERMITTENT AND NOISY**

Check the primary of the first I.F. transformer with an ohmmeter. If any variation in the resistance reading is noted the winding is partially open and a new transformer must be installed.

A. BALZUM, Minnesota.

n r i

DEWALD MODEL 506 — **LACK OF LOW NOTES**

This condition accompanied by oscillation is due to open filter condensers. Install new 8 mfd. 475 volt electrolytic condensers.

EDWARD FUTRELL, Michigan.

n r i

MOTOROLA MODEL 5T — **BROKEN DIAL CABLE**

To restring the dial cable remove the entire dial assembly by unscrewing the self-tapping screw at the top of the assembly and the two bolts holding the dial to the condenser shaft. Pull off the dial lamp fittings. The position of the dial pointer is immaterial as it is held in place by friction and may be moved to any desired point by holding the condenser gang in place and turning the pointer by hand.

n r i

STROMBERG CARLSON MODEL 235 — **DISTORTION**

This is often due to leakage in the 4 mfd. screen by-pass condenser of the 6B8 tube. This lowers the screen voltage causing the tube to operate on the bend instead of the straight portion of the Eg-Ip characteristic curve. If shorting the cathode of the tube to the chassis clears up the trouble, replace the 4 mfd. screen by-pass condenser. When the cathode is shorted to the chassis the bias is reduced to the point where it is satisfactory for the new screen voltage.

n r i

AIRLINE MODEL 62-305 — **DEAD**

Check for an open in the bias resistor assembly used to bias the power tube and second I.F. tube. Two resistors are employed in a single section having a value of 300 ohms and 150 ohms.

H. O. TYNER, Arkansas.

n r i

AIRLINE MODEL 62-004 — **DEAD**

Check the oscillator coil and if open secure a new replacement from the manufacturer.

H. O. TYNER, Arkansas.

n r i

GENERAL ELECTRIC MODELS F109 AND F107 — **MOTOR DOES NOT RUN**

If the motor armature hums but will not turn replace the 1,000 mfd. condenser.

n r i

GENERAL ELECTRIC MODELS F107 AND F109 — **MOTOR CONTINUES TO RUN**

If the motor keeps on running after the chassis has been removed to be serviced and reinstalled, make certain that the push-button assembly escutcheon plate is not grounded to the chassis through the dial scale escutcheon to the set shafts.

n r i

GENERAL ELECTRIC MODELS F107 AND F109 — **BELT SLIPPAGE**

The tension of the belt may be increased by raising the motor on the relay bracket. If the belt continues to slip, try reversing it to use the other surface, try belt dressing or install a new belt.

n r i

GENERAL ELECTRIC MODELS G105, G106 — **DIAL POINTER VIBRATES**

If this condition occurs after a button is pressed and the dial pointer has come to rest raise the insulator in the drum.

(Page 27, please)

Checking the Continuity of Radio Circuits

(Concluded from page 20)

First of all, you should examine the schematic diagram of the set on which you are working. Are there any parallel parts which should affect the ohmmeter reading? If not, check the part without disconnecting its leads. If it tests all right, it is probably o.k. However, if it tests off value, the part may be bad or some part in parallel with it which normally gives an open reading on an ohmmeter may be leaky or broken down. To find out the facts, you must disconnect the part and check it. Should it then check o.k., some parallel-connected part is at fault, and a study of the schematic will reveal the likely offender.

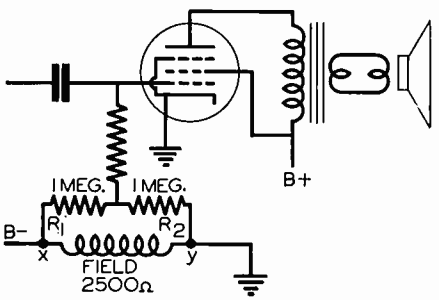


FIG. 6. To check R_1, disconnect it from point x and place the ohmmeter test probes across R_1. The value of R_2 is measured in the same way after it has been disconnected from point y. If more convenient, the resistors could be disconnected at their junction for individual tests. A continuity check across the field coil would not indicate the condition of the resistors.

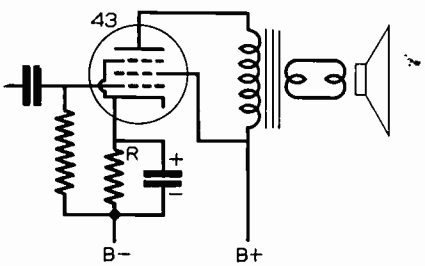


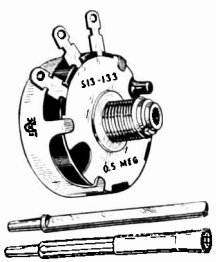
FIG. 7. To test the electrolytic by-pass condenser in this circuit, disconnect one of its leads, then place the positive probe of your ohmmeter in contact with the positive condenser lead, and place the negative probe in contact with the negative lead of the condenser.

One case which I recall brings out this point quite clearly. The receiver was an ordinary A.C.-D.C. TRF, with the output tube being self-biased through a 1500 ohm resistor marked R in Fig. 7. The symptoms pointed to excess bias on the power tube. The coupling condenser was not leaky and the grid return to the chassis was continuous. On measuring the cathode-to-chassis resistance, I found it to be about 2000 ohms, which, while out of the tolerance limits of the resistor, was not great enough to cause the kind of trouble encountered.

The measurement intrigued me, however. You often hear about resistances which increase in value, but seldom find one. I disconnected the resistor and checked it again. The ohmmeter indicated it to be open! Further investigation showed that the electrolytic bypass condenser had broken down due to the excess voltage developed across it when the resistor burned out. With no voltage across the condenser, its leakage resistance was just about that of the bias resistor, and this unit evidently acted more like a resistor than a condenser when the set was turned on. If only the resistor had been replaced, distortion would still have existed due to the absence of a by-pass capacity. That's the way servicemen get "stuck," and the moral is: Don't be too lazy to disconnect a part when testing it if you suspect it enough to check it at all.

New IRC Control Plug-in Shafts

The International Resistance Company of Philadelphia, Penna., has announced a line of "Special Standard" Type CS Metallized Controls. These are similar to the Type CS Standard Controls, with the exception that they accommodate the new IRC Plug-in Shafts which make it possible to position the flat side at any degree of rotation. By inserting the replacement control behind the panel and attaching it before the plug-in shaft is driven in place, the removal of other parts as is sometimes necessary under crowded conditions, is eliminated.



These new controls are made in 14 popular ranges and tapped types from 10,000 ohms to 2.0 megohms.

IRC Plug-in Shaft "A" is packed with each "Special Standard" control and is designed for ordinary usage where a definite flat location is indicated. Shaft "B" which must be ordered separately is for use where either a slotted or tongued shaft is required.

Full details of these units are included in the IRC Volume Control Replacement Guide which is free on request to servicemen.

N.R.I. ALUMNI NEWS

Earl R. Bennett ..... President
Clarence Stokes, C. B. Morehead ..... Vice-Pres.
Allen McCluskey, F. E. Oliver ..... Vice-Pres.
Earl Merryman ..... Secretary
Louis L. Menne ..... Executive-Secretary

STOKES and MOREHEAD NOMINATED

AMENDMENT TO CONSTITUTION IS APPROVED

IN a spirited campaign which saw one hundred and two different candidates receive votes for one office or another the final tally shows Clarence Stokes of Philadelphia and Cecil B. Morehead of Chicago on top. These two men have been nominated for the Presidency of the N. R. I. Alumni Association.

The contest was no walk-away, by any means. It was close with some new men showing up prominently. Thirty-one men, in all, received votes for President. When the final count was in, Stokes and Morehead were the two with the greatest total of votes and they, therefore, are hereby declared nominated.

In the contest for Vice-Presidents we have some new names. Our good friend, Dr. G. B. Thompson of Los Angeles, was again nominated. Allen McCluskey of Birmingham and F. Earl Oliver of Detroit are renominated. Alfred E. Stock, Chairman of New York Chapter, Ed. Sorg, Chairman of Chicago Chapter, J. Stanish, Chairman of Detroit Chapter and Charles J. Fehn, Chairman of Philadelphia-Camden Chapter, are new candidates. T. J. Telaak, President in 1934, again comes into prominence as a candidate for Vice-President. This gives us our eight nominees. Four are to be elected.

J. W. Nally of Washington, D. C., was nominated for Secretary to oppose Earl Merryman and D. L. Hash was nominated to run against L. L. Menne for Executive Secretary. Nally and Hash are new candidates who showed surprising strength. Merryman and Menne received a strong vote and were easily re-nominated.

The amendment to our Constitution to limit the office of President of the N. R. I. Alumni Association to one year, proved very popular and carried with 92% of the votes cast in favor of the amendment. A favorable vote of 75% is necessary for adoption. The amendment, therefore, is hereby declared carried and henceforth the N. R. I. Alumni Association will have a new President with each succeeding year—a proposal which has been overwhelmingly approved by the membership at large.

Earl Bennett, who has been a hard working President will, therefore, retire to the sidelines on December 31, 1939 to make way for the new President we are now about to elect. Bennett has earned the warm affection of the members, who know he will be heard from again in future years.

Now, will you please turn to page 30 of this issue where you will find a convenient ballot for you to mark. Kindly fill in the ballot and mail it promptly. All elected officers shall serve a term of one year. We urge every member of the N. R. I. Alumni Association to participate in this election. Your cooperation will be greatly appreciated. Mark your ballot and mail it now.

New York Chapter

The Chapter wishes to extend a vote of thanks to J. E. Smith, President of N. R. I., Joseph Kaufman, Educational Director, N. R. I., and L. L. Menne, our Executive Secretary, for their recent visit and for their part in helping us put on the biggest meeting in the history of our Chapter. One hundred and fifty-two were present. That's quite a gathering.

As a result of the inspiration which was received at this meeting a total of forty new members has been secured to date with a few new members still coming in with each succeeding meeting.

Left to right (standing) J. H. Struble, Treasurer, K. Barlow, Vice-Chairman, J. Barrette, Past Chairman, Alfred E. Stock, Chairman, E. Sadolsky, Librarian.

(Seated) J. Kaufman, Director of Education, J. E. Smith, President of N. R. I., L. L. Menne, Executive Secretary, L. Kunert, Chapter Secretary, at a recent meeting of New York Chapter, N. R. I. Alumni Association.

Our Chairman, Alfred E. Stock, opened the meeting, quickly disposed of a few items of business and then turned the meeting over to L. L. Menne to act as temporary chairman. Mr. Menne opened with an inspirational talk which was very well received and put the fellows in just the right frame of mind for what was to follow.

The temporary chairman then presented Mr. J. E. Smith, who received a most enthusiastic ovation. Mr. Smith responded with a talk which will long be remembered by those who heard it. It was the first opportunity for most of our members to meet Mr. Smith in person. His pleasing personality, his genuine interest in the welfare of students and graduates of N. R. I. made a deep impression on us all.

Mr. Kaufman then was presented to deliver a talk on "How to Develop a Sound Servicing Technique." After speaking for about forty-five minutes the Chairman asked for a brief recess, after which Mr. Kaufman volunteered to answer questions. This proved so interesting not a man left the hall in spite of the fact we had gone long past our usual closing time. It was finally necessary for our permanent Chairman, Alfred Stock to intercede to bring the meeting to a close amid vigorous applause in appreciation for the information and messages brought to us by Mr.

One hundred and fifty-two were present at this meeting to hear J. E. Smith, Joseph Kaufman and L. L. Menne, from Headquarters. Only a few are visible in this picture, made by our member, Frank Zimmer, but you can get some idea of the large gathering.

Kaufman, Mr. Smith and Mr. Menne. Even then many stayed for a long time fraternizing with our visitors from Headquarters.

The meeting was preceded by a dinner attended by our Chairman, Alfred Stock, Vice-Chairman, K. Barlow, Secretary, Louis J. Kunert, Treasurer, J. H. Struble, Mr. Smith, Mr. Menne and Mr. Kaufman, at which business matters pertaining to the Chapter were discussed in an informal way.

In a subsequent meeting we conducted our usual service forum, assisted by our Mr. Gordy. In another meeting we were addressed by a speaker from Precision Instruments. We have other good speakers lined up for this winter.

Every meeting is a productive one at 12 St. Marks Place, New York City on the first and third Thursday of each month. You will receive a hearty welcome here.

LOUIS J. KUNERT, *Secretary.*

The Service Forum (Continued from page 23)

GENERAL ELECTRIC MODEL F107 — **SCRATCHING**

A scratching noise is generally due to friction of the flywheel which is coupled to the electric tuning motor by a belt. As the pointer moves toward the high frequency end of the dial there is generally no noise but the scratching sound becomes evident when approaching the low frequency end of the scale. This is due to the fact that the flywheel in moving on its shaft comes in contact with the chassis. Move the bracket next to it which is the terminus of the shaft in order that sufficient spacing is given the flywheel for frictionless movement.

n r i

RCA MODEL T6-2 AND T6-1 — **LOW SENSITIVITY**

This condition together with hiss at resonance is generally due to an open circuit in the wire-wound resistor in the control grid circuit of the detector oscillator tube. This resistor is used as the control grid lead and in most cases opens at the lug.

n r i

PHILCO MODEL 39-30T — **OSCILLATIONS**

If oscillation occurs when the volume control is advanced, this is generally due to an open in the R.F. plate by-pass condenser for the 75 type tube. The condenser originally had a value of .00025 mfd. but it may be necessary to increase this value to as much as .005 mfd. to correct the condition.

n r i

PHILCO MODEL 39-11 — **WEAK ON BROADCAST BAND**

This condition accompanied by improper calibration does not always mean that the receiver is out of alignment. Check the band switch stop to see if this allows full movement of the switch arc.

n r i

PHILCO MODEL 39-71T — **AUDIO SQUEAL**

This is caused by feed-back from the grid wire of the 1H5G tube. This wire which comes from the control grid at the top of the tube should go down on the chassis side of the tube shield rather than on the dry battery side. If the wire is adjacent to the dry battery leads, oscillation will occur.

n r i

PHILCO MODEL 39-71T — **MICROPHONICS**

A microphonic condition in this model is often due to the 1H5G tube. Changing this tube will ordinarily clear up the trouble.

n r i

PHILCO MODEL 39-25 — **DEAD ON MANUAL TUNING**

If the receiver plays when using instant tuning, check for an open lead between the tuning condenser rotor section and the chassis and for a possible open between the stator section of the tuning condenser and the push-button switch.

n r i

ACRATONE MODEL 9A — **DEAD AND BLOWS LINE FUSE**

This is due to a shorted by-pass condenser connected across the input of the 25Z5 rectifier tube. For replacement purposes use a .1 mfd. 600 volt paper condenser.

n r i

ARVIN MODEL 10-A — **NOISY**

This is often due to loose I.F. transformer shields. Be sure and install lock washers to prevent the shields from again working loose.

n r i

ATWATER KENT MODEL 534 — **OSCILLATION**

This may be due to either misalignment of the receiver or the twisted lead around the control grid of the 75 type tube. A certain amount of regeneration is obtained through this twisted lead and by experimenting with the position of the lead the trouble may be usually eliminated. If it continues, realign the receiver.

n r i

CROSLEY MODEL 635 — **OSCILLATION**

Check the .02 mfd. condenser between the screen and cathode of the 6A7 type tube for an open by shunting it with another of the same capacity known to be in good condition. Leakage also occurs in this condenser and it may be checked with an ohmmeter or by disconnecting one lead or by putting another condenser in its place.

n r i

CROSLEY MODEL 103 — **OSCILLATION**

This trouble can often be remedied by soldering the ground strap from the condenser gang to the case.

n r i

CROSLEY MODEL B-425 — **DEAD**

If the receiver is dead and reception can be obtained by disconnecting the 22.5 volt C battery, the trouble is due to an open in the 2,000 ohm flexible wire wound resistor on the volume control. For replacement purposes a 5 watt resistor may be used.

n r i

DETROLA MODELS T-1, C-1, C-2, C-3 and C-5 — **ELECTRIC TUNING**

If the tuning does not stop on stations, look for a burned spot on the ribbons fastened to the drums. The burned spot may be removed with emery cloth and carbon tetrachloride. If the dial pointer jumps back and forth when using electric tuning, check the small spring on the end of the motor armature shaft. This spring may lose its tension and permit the motor to run too fast. Tighten the spring to eliminate the trouble.

Here and There Among Alumni Members

We had a chance to hear the much talked about Chicago Chapter orchestra. If you ever heard an orchestra with each man playing a different piece you can get some idea of how it sounded. You never heard such a racket in all your life. Man, do they need practice!

n r i

George C. Hoyt of Cheneyville, La., sold more than 150 *radio sets for the first nine months of the year. He expects to close* 1939 *with a total of* 250 *sales—mostly Philcos and Zeniths. Besides he services about* 15 *sets a week and knocks out* $40 *to* $50 *a week regularly.*

n r i

Harry C. MacCubbin, member of Baltimore Chapter, has been confined to a sanitorium at Mt. Wilson, Md., where he is recovering from a long illness. And what does he do to idle away his time? He picks up a fairly good income by repairing sets for the folks at the sanitorium. In fact he has averaged about $15 a week during the last 12 months. MacCubbin says radio sure has been good to him.

n r i

Roman W. Feltes of Arcadia, Wis., enrolled when he was seventeen. He had to give up picture shows and other things because he was still in high school. He emerged as Valedictorian. He was also presented with a literary medal, citizenship medal, scholarship medal, and a special medal donated by the local American Legion Post. And listen—today he has his own fully equipped shop and is "going to town."

Arthur Foehr of Pawtucket, R. I., is his own boss now in his radio business, but he has a new boss at home having recently married. Art carried his bride over the threshold in a brand new bungalow. Congratulations, Mr. and Mrs. Foehr.

n r i

Howard Spangler and his wife again spent their vacation in Miami and Key West, Fla. This is getting to be an annual event for these folks who have a prosperous radio servicing business in Knoxville, Tenn.

n r i

What really busted up the party at Bennett's house was, when the boys lined up in football formation, using a pumpkin for a ball. Juricek tossed a forward pass high into the end zone, which happened to be an old portrait of somebody's grandpa. Mrs. Bennett took charge at this point.

n r i

J. F. Huff, Austin, Texas, has been elected President of the Texas Radio Service Association for the current year. Congratulations, Huff. Texas Radio Servicemen have a real leader.

n r i

Willard Doan of Fort Worth, Texas, designed, built and put in operation police transmitter KNHE at Fort Smith, Ark., while employed at KFPW.

n r i

Raymond C. King of Creston, Iowa, is back on the air with Amateur Station W9NUS which was just about silenced when little Margaret Kay King arrived to get most of Ray's attention.

n r i

Clarence G. Conrad of Ashland, Ky., informs us that WCMI, with which he is connected, recently joined the Mutual Network and the newly organized Southern Network.

n r i

Alvin L. Campbell of Burdett, Alta., Canada, the author of the article "32-U Power Supply for the Rural Man" in the October, 1939 *issue of* RADIO NEWS *is one of our go-getting members.*

n r i

A. E. Willett of Belmont, Mass., while on a visit to Nova Scotia, met a friend he had not seen for about twenty years. Imagine how pleasantly surprised Willett was to learn that his friend, Miller Spinney, is also a member of the N. R. I. Alumni Association.

n r i

A. Albert Herr is Transmission Operator at WKBO, Harrisburg, Penna.

n r i

Harry W. Panchot, of Dixon, Mont., is sub-foreman at the Flathead Indian Agency, Department of Interior, in charge of installation and maintenance of transmitter and semi-portable short wave field sets, primarily used for forest fire control and isolated stations in the Indian reservation.

n r i

Joseph Strano of Philadelphia-Camden Chapter is the proud daddy of a baby girl. Charles Haraburda of the same chapter also is buying the cigars—it's a boy.

n r i

Herman Doberstein and Alfred J. Wysaczanski operate the Longshore Radio Co. in Philadelphia. For some time the Philadelphia-Camden Chapter has been meeting at their place of business.

n r i

Help! Help! The editor will be glad to have your personal comments for this page.

n r i

Gayle's Radio Electric Service is the name above the snappy full time shop owned and operated by Gayle Robinson of Thermopolis, Wyo.

n r i

P. A. Abelt of Denver, Colo., a disabled and retired government employee is finding radio just the thing to keep him occupied. Good luck to you Abelt.

Philadelphia-Camden Chapter

Our Chapter held a social meeting at the home of our Vice-Chairman, David Blackwell, in Skillman, N. J. Mrs. Blackwell entertained us royally. She was ably assisted by our Bert Champ and John Biaselli, who are something of culinary experts, according to their own claims. In spite of this volunteered assistance by these two kitchen mechanics, the food was very good.

There were plenty of refreshments for all. Mrs. Blackwell is voted a hearty thanks for her hospitality.

The weather was ideal. It was a beautiful late fall day, warm enough to allow for full outdoor activities. There was a full schedule of contests of one kind or another, but the winners are still a matter of dispute and probably will never be determined. The day's program included dancing, card games, quoits and gun shooting. Norman Kraft proved to be the best shot. The boys wanted to put on a William Tell act with the apple reposing on the head of Clarence Stokes, but cooler heads prevailed.

Dave Blackwell has a fine shop and some of the fellows spent most of the day in it, admiring the workbench. Dave explained everything in detail and some valuable ideas were carried away by all.

Our regular business meetings are well attended. Recent meetings have been conducted by Dave

Women and children joined in the fun at Philadelphia-Camden Chapter outing at Skillman, N. J.

Blackwell who spoke on V. T. V. M., John Biaselli, Jr. who spoke on Television, Clarence Stokes and Herman Doberstein who lectured on How to Sell Radio Service. All of our meetings are presided over by our able Chairman, Charles Fehn, who is a tireless worker for the Chapter.

On October 19, Mr. Joseph Kaufman, N. R. I. Director of Education, delivered a lecture which was much appreciated. Mr. Kaufman gave us some real practical suggestions. As usual, when Mr. Kaufman speaks to us, our attendance was good. More than seventy-five students and graduates of N. R. I. attended this meeting.

JOHN BIASELLI, JR., *Secretary.*

The fellows who put on the Philadelphia-Camden Chapter picnic. Charles Fehn, Chairman, is at the extreme right, seated.

Baltimore Chapter

We are going along in great shape. Our membership is steadily increasing. We seem to get a number of new members with each succeeding meeting. Chairman Dunn is doing a fine job.

W. B. Giese, who has always been a hard worker for Baltimore Chapter, and who knows Radio from stem to stern, has started a series of lectures based on N. R. I. textbooks. He gives us the simple fundamentals of circuits and then leads up to the more difficult phases of his subject. Each talk is illustrated with blackboard charts. Giese has been giving us some interesting talks on Television and the boys have gone in strong for them.

A committee has been appointed to arrange a dance and an announcement regarding this will be made very soon. Those who attended our previous dances know that they are always a big success. Jensen and Gralley can be counted on to help put this affair over in a big way. We expect a liberal attendance from Headquarters in Washington.

The welcome sign is always out at Fishpaw's Hall, Baltimore and Gilmor Streets, at 8:30 P. M. every first and third Tuesday of the month. All students and graduates in this vicinity are cordially invited to attend our meetings.

E. O. E. GRALLEY, *Acting Secretary.*

Election Ballot

Fill in this ballot carefully, following instructions given on page 25. Mail your ballot to National Headquarters immediately.

FOR PRESIDENT (Vote for one man)

☐ Clarence Stokes, Philadelphia, Pa.

☐ Cecil B. Morehead, Chicago, Ill.

FOR VICE PRESIDENT
(Vote for four men)

☐ F. E. Oliver, Detroit, Mich.

☐ Allen McCluskey, Birmingham, Ala.

☐ Edward Sorg, Chicago, Ill.

☐ Dr. George B. Thompson, Los Angeles, Calif.

☐ Alfred E. Stock, New York, N. Y.

☐ Chas. J. Fehn, Philadelphia, Pa.

☐ John Stanish, Detroit, Mich.

☐ Ted J. Telaak, Buffalo, N. Y.

FOR SECRETARY (Vote for one man)

☐ Earl Merryman, Washington, D. C.

☐ John W. Nally, Washington, D. C.

FOR EXECUTIVE SECRETARY
(Vote for one man)

☐ L. L. Menne, Washington, D. C.

☐ D. L. Hash, Washington, D. C.

SIGN HERE:

Your Name .....

Your Address .....

City ..... *State* .....

Polls close December 30, 1939.

Mail Your Completed Ballot to:

C. ALEXANDER, BOOKKEEPER
NATIONAL RADIO INSTITUTE
16th and U STREETS, N. W.
WASHINGTON, D. C.

CUT CAREFULLY ALONG THIS LINE

Chicago Chapter

Our attendance at our fall meetings has been a source of gratification to our Chairman, Ed. Sorg, who, as a result, is arranging some fine meetings for us. Sorg has many interesting programs lined up for our winter meetings, and all that he asks is regular attendance on the part of our members to continue to give us these very beneficial talks and demonstrations.

Present at one of our recent meetings was L. L. Menne from Headquarters. A good crowd turned out to renew acquaintances with him. Menne delivered an interesting message. Earl Bennett followed with a blackboard talk which was a humdinger. Our Chapter is fortunate in having a number of fellows, such as Earl, who can take the floor and give us something really worthwhile.

To show Menne what real fraternal spirit means a party was arranged for Saturday night, held at the spacious home of Earl Bennett. This house party was well attended by our members, with their wives and sweethearts. We have had so many of these successful gatherings we are all well enough acquainted to get things under way quickly. Dancing started at nine o'clock and continued until one. Then the party really just got warmed up. Ed Sorg, as usual, took the lead in keeping things moving. He has plenty of pep and seems never to run down.

Sorg presented prizes to the winners of the various contests. Your secretary made a careful note of these winners, but when Menne was given a prize for expert dancing it was declared that the judges were incompetent so perhaps it is just as well not to bring the matter up again.

Between dances the ladies served refreshments. All entered into the spirit of the party so magnificently it would be difficult to mention names for fear we might overlook someone. It was a real party.

Our Chapter makes it a point to have frequent social events. We always look forward to them.

Our regular meetings, on the first and third Thursday of each month are held in our comfortable quarters in Eckert Park Field House, 1400 W. Chicago Avenue. Come out, make new friends and profit through our programs.

RICHARD CORDERO, Secretary.

Birthday Congratulations to Mr. Haas

I would like to express my congratulations to Mr. Haas on his Fiftieth Birthday and extend thanks for the wise and helpful services he and Mr. Smith have given in helping to train thousands of men in radio. I like NATIONAL RADIO NEWS. I am always interested in the laboratory page.

R. A. HERDER,
Irma, Alta., Canada.

n r i

Wants More of Jay and Ozzie

I sure enjoy reading your articles and have gained some valuable information from them. I really get a "kick" out of Electronics, Inc. How about some more of Jay and Ozzie?

GEORGE E. BEAN,
Stilwell, Okla.

n r i

Thanks for Your Frankness, Kershaw. How Many More Feel This Way?

NATIONAL RADIO NEWS is an enjoyable publication with the exception of "Electronics, Inc." and "Novel Radio Items." These are interesting, it's true, but such stories and items are plentiful elsewhere and I feel the space allotted could be devoted to more important material, more suited to the practical needs of graduates and students.

LESTER KERSHAW,
Little Neck, L. I., N. Y.

n r i

Attended Meeting of New York Chapter

After hearing Mr. Smith, Mr. Kaufman and the other speakers at a meeting of New York Chapter, I was more than convinced that the National Radio Institute is a great organization and it is my hope and desire to be a lasting member of so fine and progressive an institution.

HARRY ACOSTA,
Springfield Gardens, L. I., N. Y.

Likes Condensed Form of News

NATIONAL RADIO NEWS is welcomed every issue. It condenses the latest radio developments into a few minutes of very pleasant reading. We of N. R. I., students or Alumni Association members, had our own "little magazine" long before this type of publication became so popular on the newsstands.

PAUL M. ANDERSON,
Northfield, Minn.

n r i

Calling Barnes, Cordell and Haig. Your Buddy Wants to Hear from You.

Your little magazine is always welcome. I was a radio operator on the U. S. S. Montana (armored cruiser in convoy duty) from July, 1917 to November, 1918, and have always been keen about the marvels of radio. Will you do me the favor of printing in your magazine a note requesting Barnes of Illinois, Cordell of Oklahoma, and Haig of New York (I believe) to get in touch with me? They were fellow radio hams on the old Montana in '17, and it is not unlikely that they see your publications.

ROGER W. HIGGINS, Philips Academy,
Andover, Mass.

n r i

Good and Very Good

I received NATIONAL RADIO NEWS, October-November issue. "Frequency Modulation System" was good. Mr. Kaufman's "Working Your Way Up in Radio" was very good.

J. P. WILSON,
Stilwell, Okla.

n r i

Thank You, Too

Congratulations and many thanks for the stories, news, service tips, and information contained in the NATIONAL RADIO NEWS.

ALBERT E. VINCENT,
South Bend, Ind.

Detroit Chapter

We want to call attention to an important change in our schedule. It was voted to change our meeting night from Friday to Thursday. Therefore, the Detroit Chapter, in the future, will meet on the second and fourth Thursday of each month.

Another important change was voted by the members. We have moved our place of meeting to 11800 Woodward Avenue. All members, students and graduates in the Detroit area are requested to make a note of these important changes.

Our new quarters permit us to install our workbench and give us other conveniences which we are sure will be appreciated by our members.

At a recent meeting we were visited by our Executive Secretary, L. L. Menne, who spoke on the benefits of organizations such as ours. Menne gave us a pep talk which was followed by a fine lecture by our Chairman John Stanish, on servicing auto radios. Stanish specializes in this type of radio servicing and few men are better qualified to speak on the subject.

Following the lecture there was a lively discussion with plenty of questions from the floor all of which were ably handled by Stanish.

Refreshments were served. There was plenty of informal entertainment to hold the fellows until almost midnight.

We are very anxious to increase our attendance and we feel sure our new meeting night will prove convenient to many of our regular members who found it difficult to come out on Friday. Remember, we meet on the second and fourth Thursday of each month at 11800 Woodward Avenue.

F. Earl Oliver, Secretary.

n r i

Midget Output-Half-Wave Rectifier Has Pilot Light Connection

Designed primarily for the dual function of output-half-wave rectifier service in AC-DC receivers, the new Arcturus 70A7GT Midget Tube also has the rectifier heater tapped so that a .150 ampere pilot lamp may be connected between pins No. 6 and No. 7, thus making it suitable for triple duty use in combination portable, battery-operated AC-DC receivers as well as straight AC-DC sets.

The heater voltage of this new Arcturus tube is 70.0 volts. Heater current is 0.15 ampere.

Technical data sheet showing typical connections for the 70A7GT Midget will gladly be supplied on request to the Arcturus Radio Tube Company, Newark, New Jersey.

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