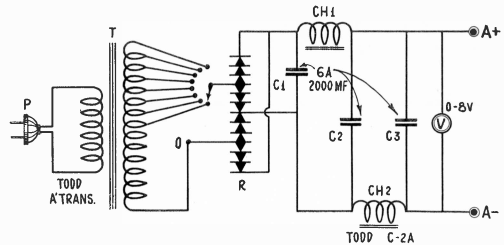
The Todd "A" Battery Eliminator



WHILE there are still many homes not supplied by electricity, by far the majority of those in which radio receivers are operated are wired for 110-volt, 60 cycle A. C. current suitable for operating a receiver with the necessary apparatus to change the A. C. current into the required values of direct current for the operation of a receiver.

Much has been said of late regarding the relative advantages of direct operation of receivers from A. C. lines by using A. C. tubes as against the use of an "A" eliminator with D. C. tubes.

From the standpoint of first cost both systems will size up about the same because while the cost of the "A" eliminator may seem to be high, the fact that it can be used to operate a receiver equipped with D. C. tubes of the CX-301A type serves to reduce the cost of the tubes and tube replacements required in a receiver and also makes possible the use of a D. C. energized dynamic speaker, a type which is less expensive than the A. C. operated type.

The use of an "A" eliminator with an existing set which was designed for D. C. tubes is practical because it eliminates any necessity for changing the wiring of the receiver, scrapping the D. C. tubes which may still be good for many hours of service, and buying harness arrangements and accessory equipment required to effect the change from D. C. to A. C. operation.

List of Parts Required

A+, A—: Eby Engraved binding posts.
C1, C2, C3: Aerovox Type 6A, 2,000 mfd. "A Power" condensers.
CH1, CH2: Todd Type C-2A Choke coils.
P: Standard cord plug.
R: Westinghouse, Benwood-Linze or equivalent dry rectifier unit.
T: Todd "A" transformer.
V: 0-8-volt voltmeter.
One Todd foundation unit consisting of metal case, terminal and instrument panel, hardware and wire.

The Todd "A" eliminator, the wiring diagram of which is shown with this article is one of the most efficient of these units. It consists of a transformer, "T" with a tapped secondary to step down the 110 volt A. C. current to the proper value of approximately 12 to 18 volts required to provide 6 volts at the terminals of the unit. A dry rectifier, connected to give full wave rectification is employed.

Two Todd choke coils "CH1" and "CH2," capable of carrying 2½ amperes safely and three Aerovox Type 6A, 2,000 mfd. "A Power" condensers are employed in the filter system.

The Aerovox "A Power" condensers used in this filter system were developed to meet the demand for an efficient low voltage, high capacity unit capable of smoothing out A. C. ripple to the extent required for the operation of D. C. tubes.

These units are available in three capacities, 1,500, 2,000 and 4,000 mfds. to suit the filtering requirements of all types of "A" eliminators.

Ordinarily a filter using only two condensers, either "C1" and "C2" or "C2" and "C3" is sufficient, but better filtering action is obtained by using three condensers as shown in the diagram.

In the case of some receivers, such as those which use resistance or impedance coupled audio amplifiers, it is sometimes necessary to use 4,000 mfd. condensers in the "A" filter system to prevent hum but in the majority of cases, 2,000 mfd. units will be found sufficient for all ordinary purposes.

It will be noted that in this wiring diagram, one choke is placed in the positive lead and the other is placed in the negative lead. This manner of connection will give best results in most instances but in some cases, better results may be obtained by connecting both chokes in either the positive or the negative lead.

A voltmeter having a scale from 0 to 8 volts, is used across the output terminals of the unit to set the output to the required 6 volts. In operation, the unit is connected to the receiver and the adjustable lead is connected to the tap which gives an output of the required value for operation of the receiver.

Further details regarding the units used in this "A" eliminator may be obtained by writing to:

Department "A"
Todd Electric Co.,
42 Vesey Street,
New York City, N. Y.

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A Simple Guide to Trouble Shooting

By the Engineering Department, Aerovox Wireless Corp.

MOST of our readers will recall that in our November issue, we included a questionnaire, designed to call forth from our readers suggestions as regards subjects which they wished to have treated in future issues of the Research Worker. The number of requests for some tangible information of how to locate troubles in A. C. receivers so far outnumbered all other suggestions that we are devoting this month's issue to a treatment of this subject.

It is unfortunate of course that radio receivers, whether they be factory made or custom built are subject to much the same troubles that afflict automobiles, mechanical devices and even that most perfect of all mechanisms, the human body.

Fortunately, however, most troubles are very easy to locate if one goes about the business of locating trouble in a systematic and professional manner, like a specialist diagnosing a bodily ailment or an expert mechanic checking up the innards of a car to find a hidden trouble.

The first step in looking for trouble is to check the tubes. If the tubes are new or have been used only a short time and the tube filaments light up, the chances are that they are all right. If they have been used for some time and the set operates, but only weakly or gives a great deal of distortion, the tubes should be tested with a standard tube checker. This step takes only a very short time and can be performed by the average service man or dealer. It is best to perform this test before anything else is done with the receiver.

If a superficial examination and a test of the tubes does not bring the trouble to light, the next step is to obtain the wiring diagram of the receiver. Various service organizations and magazines have been featuring such wiring diagrams and these should be a part of every service man's kit of tools. If you are going into servicing work as a regular thing you should make it your business to get this data. Otherwise it will be necessary for you to trace out the circuit from the wiring of the receiver. The job of tracing out the circuit may take you several minutes but it will be time well spent. A service man trying to shoot trouble, without knowing the circuit diagram of the receiver is just working blindfolded because the results of tests on a receiver often hinge on the peculiarities of a circuit.

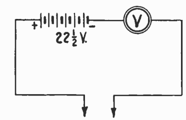


Fig. 1

An expert troubleshooter who has had a great deal of experience with certain types of receivers and knows their weak points and peculiarities can very often locate the trouble quickly by a hurried inspection of the weak points of the receiver, but the average troubleshooter who has not had much experience with the particular receiver at hand will do better to proceed along a definite routine, checking up each section of the circuit, step by step.

While there are many elaborate test sets on the market, by far the majority of troubles can be located by using a test set connected as shown in Fig. 1. This consists simply of a small 22½-volt battery and a good grade high resistance voltmeter of the type which has a resistance of about 1,000 ohms per volt.

Another point for the troubleshooter to remember is that while circuits will vary somewhat from each other, in the last analysis all circuits are very much alike and can be reduced to fundamental filament, grid and plate circuits in which "All Roads Lead to Rome" or, in other words, the "B—" lead. You can take any circuit, no matter how involved it may be and reduce it down to elementals. You can also start at any point of the circuit and trace the circuit back through resistors, condensers, transformers windings and whatnot until you finally wind up at the "B—" lead of the receiver.

If these facts are kept in mind, the testing of a receiver to find trouble, in the form of open resistors and coils or shorted condensers, etc., will resolve itself into a very simple proposition.

To take a concrete example we will follow through the routine tests which should be used in checking up for possible trouble in the Songbird Screen Grid Receiver described in the November issue of the Research Worker. To make the circuit complete, the circuit of the power pack has also been included. It might be worth while mentioning that in making tests on a receiver, the power pack circuit should also be included so as to make sure that no part of the whole installation is overlooked.

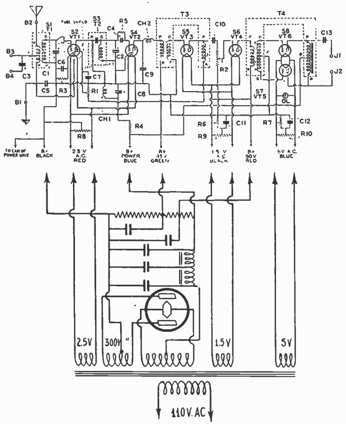
After making the preliminary tests to make sure that the tubes are in good condition, disconnect the receiver from the lighting lines. The next thing to do is to locate the "B—" lead of the receiver and attach one of the test leads to it. This leaves the other test point free to test between the "B—" lead and the other points of the receiver.

Now touch the other test point to the "B—" lead. You should get the full voltage of the test battery on this test. Make a note of the full voltage. Now test the first R. F. or antenna coil, "T1."

It is perfectly obvious that, because of the very low resistance of the secondary winding of the transformer, touching the test point of the circuit to terminals "H" and "G" of the coil should give a full reading on the voltmeter. To avoid the possibility that the coil may be open but the variable condenser "C1" shorted, which would give a full reading on a test to point "G" of the coil, the lead from the variable condenser "C1" to the "G" terminal of the coil should be disconnected temporarily while making the test. While the condenser is disconnected in this way, you can test the secondary of the coil for continuity and then test the variable condenser for a possible short, while moving the rotary plate through the whole range.

It will be noted that in this circuit, the primary coil of transformer "T1" is connected with the "B—" lead through a condenser "C5." It is therefore obvious that a test between the "B—" lead and any terminal of the primary circuit should show no reading.

The primary circuit can be tested by attaching one terminal of the



test set to the "GROUND" binding post "B1" and testing all of the other points in the primary or antenna circuit. Full readings should of course be obtained between this point and all the other points of the antenna circuit with the exception of the "LONG ANT" post "B4" which is isolated from the antenna coil by condenser "C3."

A full reading should be obtained between the ground terminal and the tube shield used over tube "VT1."

A reading when testing across a condenser, with the exception of a slight flicker of the voltmeter needle and a return to zero which indicates a charging current on the condenser when testing fairly high capacity, naturally indicates a short or a high resistance leak in the condenser, unless the condenser is shunted by a resistor, a choke coil or other connecting element, as is the case for instance with condenser "C6" which is shunted by resistor "R3," a shunt which is very obvious, or the case of condenser "C10" in which the shunt is not quite so obvious. In the case of condenser "C10" one end of the condenser is connected directly to the "B—" lead through the choke coil of transformer "T3" and through the resistor of the voltage divider of the power pack between the "B—" and the "B+90" terminals. The other terminal of the condenser is connected to the "B—" through the resistance element of the high resistance potentiometer "R2." A test across the terminals of condenser "C10" would therefore show a slight reading. To properly test this condenser, one terminal should be disconnected from the circuit before testing across its terminals.

A little experience will show the value of the wiring diagram in showing up why readings are obtained when ordinarily none would be expected in merely testing blindly between points without knowing or following through the actual connections of the circuit.

In testing any particular circuit for continuity, the test should be made between the extreme points of the circuit. For instance in testing the grid circuit of the screen grid tube "VT1" the test should first be made between the "B—" terminal and the control grid (cap) terminal of the tube itself. If there is any break in the circuit the test point can be moved from point to point back to the "B—" terminal until the nearest point to the break is reached.

When a resistor or other unit is connected across a condenser, naturally the unit should be disconnected temporarily while testing the condenser, or the condenser should be disconnected from the circuit while testing it.

If the tubes light up, and the proper voltages are obtained across the tube filaments, the filament

windings of the transformers can be given a clean bill of health, but if the tubes do not light up, the filament windings should be tested for continuity. This should be done by disconnecting the filament leads from their associated filament circuits because of the fact that the tube filaments and the shunt resistors would complete the circuit across the filament leads and show a reading even if the filament winding itself were open.

The next step after testing all the points in the grid circuit of "VT1" is to test the plate circuit, testing between the "B—" and every other point on the plate circuit. Here again a little study of the plate circuit will reveal pitfalls in testing unless care is taken to see just how the plate circuit is wired. The complete list of parts which are included in a test between the "B—" terminal and the plate terminal of tube "VT1" when the receiver is not connected to the lighting circuit, include the plate resistor of transformer "T2," the choke coil "CH1," resistor "R4" and the voltage divider resistor of the power pack. This forms a continuous connection of fairly high resistance and it should be expected that although a reading will be obtained, the reading will be comparatively low. As a matter of fact, the plate resistor of the transformer is 50,000 ohms, that of resistor "R4" is another 50,000 ohms and that of the voltage divider is almost 13,000 ohms. The actual reading obtained in this case, using a 22½-volt battery and a 1,000 ohms per volt voltmeter is about five volts. A test between the "P" and "G" terminals of transformer "T2" while the unit is connected into the circuit should show a reading, although at first glance it would seem that the test is being made across a condenser and therefore should show no reading. A careful study of the circuit however, will show that when the coil is connected into the circuit there is a direct connection between the two terminals, through the plate resistor of transformer "T2," choke coil "CH1," resistor "R4," the resistor of the voltage divider between the "B+ Power" and "B—" terminal of the power pack and thence through the "B—" lead and the secondary winding of transformer "T2" to the "G" terminal of the transformer.

A test across the resistance element of potentiometer "R1" for instance would be expected to give a very low reading because of the fact that this unit has a total resistance of 500,000 ohms. However, a close inspection of the circuit will show why a very high reading will be obtained if the test circuit is connected directly across the terminals of this resistance. It will be noted for instance, that this high resistance is shunted across the "B+90" and the "B—" terminals of the power pack. This of course, means that the high resistance is shunted by the comparatively low resistance of the voltage divider

section which is connected between the "B+90" and the "B—" terminals of the power pack so that even if the high resistance element of the potentiometer "R1" were broken a test across its terminals would give a high reading and not the very low reading that would be expected even if there were no break in the resistance element.

In making the tests in the circuit, it is also a wise procedure to take out the tubes to avoid any possibility of shorted elements in the tubes from giving erroneous readings in the tests.

Tubes can be tested for shorted elements, such as grid or plate elements touching each other or the filament, by testing between the grid and the plate prongs, or between each filament prong and the grid and plate prong.

The voltage divider of the power pack can be tested by connecting one lead of the test circuit to the "B—" lead and touching the other lead to each "B+" terminal or lead from the power pack.

A test between the "B—" and "B+45" terminals should show a small drop in voltage. If there is no drop in voltage it indicates that there is a short between these two terminals or leads. A study of the circuit will show the possible causes of such a short. It might be due to a short in condenser "C9" or a short in the bypass condenser that is shunted across the section of the voltage divider between the "B—" and "B+45" terminals. No reading would indicate an open in the resistor section.

A test between the "B—" and "B+90" terminals or leads should show a larger drop in voltage and correspondingly lower reading than the test between the "B—" and "B+45" leads because of the additional resistance between the "B—" and "B+90" leads.

A test between the "B—" and the "B+Power" lead should give the lowest reading of all because of the greater resistance introduced into the test circuit by this connection.

As each circuit or individual unit is tested, the connections to the particular unit or of the circuit tested can be traced over with a colored pencil to indicate that that particular section or unit has been tested and is all right.

This type of routine test is bound to show up any defect so that all that will be left is to determine which unit is causing the trouble and either replace the unit or repair it.

Of course such a routine inspection will not bring to light any slight deviations from the exact values of capacity and resistance required in various units for maximum efficiency, but if a receiver has been operating and then suddenly quits on the job, the chances are that the trouble will be located very easily by such a routine inspection.

This routine inspection is applicable to receivers with properly designed circuits and is not intended to locate the possible causes for hum, distortion, poor sensitivity and selectivity which may be due to poor design of the circuits and apparatus.

If you are interested in a follow-up article dealing with design factors which must be taken into consideration in the design of receivers to give maximum efficiency, please write to the Aerovox Research Worker to that effect. If there is sufficient interest to warrant such an article, we shall be glad to treat the subject in detail in a later issue.