BY D.K. OWENS

RESTORING ATWATER KENT POWER PACKS

A lot of fine metal-cabinet Atwater Kent receivers have been junked because their owners considered power pack restoration to be beyond their capability. As you will see, it's not that formidable a job once you know what's inside and can identify the connections.

The Atwater Kent power pack evolved from the Type R battery eliminator. Starting as a separate unit in the first AC Model 36, it was moved inside the radio cabinet in the Model 37 and reached its final form in the Model 40 and all subsequent metal-cabinet sets.

This final version is a narrow, one-piece box with a lid and looks like a miniature version of the radio cabinet. Dividers form 3 approximately equal compartments to contain the electrical parts.

Viewed with the rectifier socket on your left, the left hand compartment holds the power transformer, the middle holds the two filter chokes, and the right hand compartment contains all the capacitors and the plate choke for the 71A output tube. After the parts were installed and connected, the compartments were sealed with tar—which hides everything and complicates matters.

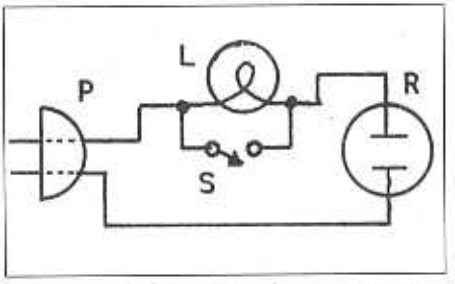

Fig. 1. Simple lamp tester shows power transformer condition at a glance.

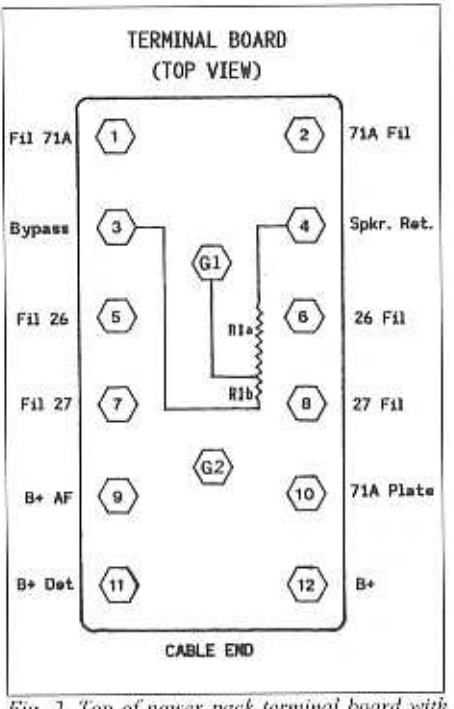

Fig. 2. Top of power pack terminal board with cable removed.

Testing the Power Pack

The first step, as with any AC set, is to test the power transformer. First, check for an open primary by measuring continuity across the line cord. Short the toggle switch with a jumper wire in case it is corroded or bad. The "regulator" Models 42 and 44 use a wirewound ballast resistor in series with the primary to cope with line voltage variations. It is located under a bracket behind the rectifier tube and may be open. The AK manual gives its cold resistance as 28Ω for Model 42 and 21Ω for Model 44. Never having had to replace one, I have no recommendations, however, don't try to operate the radio without this ballast.

Next, check for shorted turns. Although I have lots of instruments to measure the primary current, I still prefer the simple tester shown in Fig.

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TABLE 1. ORIGINAL PARTS VALUES

C1, C3 = 1.0μF
C2 = 1.5μF
C4, C5 = 0.5μF
R1a = 2200Ω
R1b = 625Ω (500Ω in Model 44)
Rf = 20Ω CT
R2 = 12.5kΩ
R3 = 65kΩ
CH1+CH2 = 1350Ω (1400Ω in Model 44)
CH3 = 550Ω (500Ω in Model 44)

1. P is an AC plug, L is a 100W household lamp, and R is an AC receptacle. Switch S allows the lamp to be shorted out of the circuit. The tester will let you know the status of your power transformer at a glance. It also limits primary current and protects the set.

Remove all tubes from the set and make sure they are good. Check the wires in the large power supply cable, they often break at the lugs on the cable connector board. Repair any broken connections. With the test lamp in the circuit, apply AC and turn on the set. A good power transformer draws almost no current with no load, so the lamp should remain dark. Any glow at all indicates shorted turns. If the transformer has a problem, you can stop here. Unless you can find a good transformer, you have a parts set.

Turn off the set and replace all tubes *except the Type 80 rectifier*. Turn the set back on. The lamp may glow faintly with the filament load on the transformer. Locate terminal 12 using Fig. 2. Set your meter for 500V DC and connect it between terminal 12 and chassis. With the set still on, insert the 80 and watch the lamp.

The lamp will brighten. A good set with no shorts will light the lamp half brightness or less. Seven-tube sets like the Model 40 draw about 40 watts and 8-tube sets (Model 44) draw about 60 watts. The voltmeter should indicate 150-220V if all is well. If the lamp glows brightly and the meter shows little voltage, turn the set off quickly and get ready to melt tar.

Your filter capacitors may be good initially, but may very well fail later. Leave the set on and monitor it constantly for several hours. Any sudden increase in lamp brightness or decrease of voltage indicates capacitor failure. Stay by the set during this test.

Although open chokes are rare, you need to know their resistances for use later. Disconnect the set from the AC line. Short terminal 12 to chassis for 1 minute to completely discharge the filter capacitors. Connect your ohmmeter between terminal 12 and pin 1 of the rectifier socket. Your value should be close to that in Table 1 for both filter chokes in series. Measure the 71A plate choke between terminals 10 and 12 and compare with Table 1. Write down your readings.

Power Pack Description

Remove the nuts holding the cable connector board to the power pack. Remove the receiver chassis from the cabinet to make room to work. You will probably need to replace some parts on it anyway.

Fig. 2 shows what you see when the cable connector is out of the way. The function of each terminal is identified. The flat, wirewound resistor on top of the terminal board is the combined bias resistors for the 71A and the Type 26 tubes. Measure the resistance of both sections and compare with the values in the Table 1. If either section is open, note that for later.

On the underside of the board (Fig. 3) are 5 resistors which you will see when we get to that

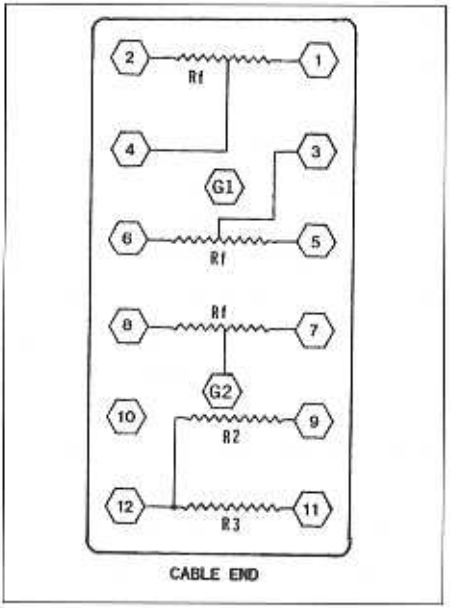

Fig. 3. Underside of terminal board showing resistor hookup.

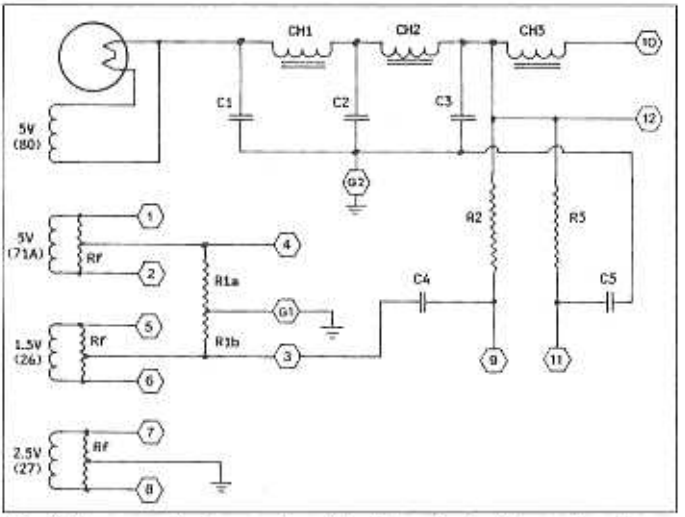

Fig. 4. Power supply is conventional in design. See text for parts values.

part of the restoration. Three of them are flat, wirewound, center-tapped resistors for the filament returns. The others are carbon-in-glass cartridge resistors mounted in clips.

Fig. 4 is the diagram of the power pack showing how the terminals are connected. It is a standard circuit—nothing unusual. Values from the AK service manual. See Table 1 for parts.

Removing the Old Capacitors

In the following instructions, the back of the power pack is the side adjacent to the back of the receiver cabinet. With the rectifier socket on your left, the back is the side farthest away from you and the front is closest.

Unsolder all wires along the back side of the terminal board (even numbered terminals). Mark the wires from terminals 10 and 12, and treat them carefully. They are attached to the plate choke which you must save and reuse. Unsolder the wires from terminals 3, 9 and 11 on the front. Remove the nuts from the two ground terminals in the center of the board, lift the board up and lay it over the front edge of the case. When the back side of the board is exposed, check the filament resistors (Rf). Don't bother with the glass resistors; you will replace them.

There are two types of power pack. The first type embedded the capacitors directly in the right hand compartment. If a capacitor failed, the entire pack had to be replaced. Atwater Kent soon realized that this was wasteful and unnecessarily expensive for the owner. Later versions were modified by potting the capacitors and choke in a separate metal box which was dropped into the compartment. In case of failure, the wires to the bad unit were cut or unsoldered, it was lifted out, and a new unit dropped in. Its leads were spliced to the cut wires from the rest of the power pack. The later type has a metal strap across the capacitor unit to hold it in place. The approach to capacitor replacement depends on which type you have.

If your power pack is the first type, the whole thing must be removed from the radio cabinet. Disconnect the primary AC leads which enter the pack through the same hole as the large cable. Remove the bolts from the ends of the base flange and the three bolts holding the back of the pack to the back of the cabinet. Now you can lift the pack out of the receiver cabinet.

Look carefully at the pack. There is a wire going from the left hand compartment into the center compartment. This is the B+ input from the rectifier tube. Leave this wire alone. There are three wires going from the center compartment into the right hand compartment. They are the input, center and output of the filter choke string. Cut these 3 wires at the surface of the tar *where they enter the right hand compartment*. Leave as much wire extending out of the center compartment as possible. Before you cut anything, read these instructions again. Unsolder the bare wire coming out of the capacitor compartment to the lug under terminal G2.

If you are married, you will need your wife's cooperation. Get permission to use her oven. Obtain a disposable aluminum pan of the kind used to roast turkeys. Set the oven for 275°, put the entire power pack *upright* in the pan and put both in the oven.

This operation is smelly, so use the exhaust fan or open the window. Oven thermostats are not accurate. If the tar begins to smoke, your oven is too hot; turn it down. Check the process periodically by poking the tar in the right hand compartment with a stick. When it has the consistency of molasses, remove the power pack from the oven and take it outdoors to avoid stinking up the house any more than necessary. Use

heavy gloves; it's hot. Work quickly to extract the contents of the compartment before the tar hardens. The parts were tightly packed into the compartment before the tar was poured and don't come out easily. Don't even think of pulling on the wires. The best tool for extracting the old capacitors is a sturdy, old-fashioned corkscrew — the kind with a wooden handle.

Insert the corkscrew into the compartment about ½ inch from the front edge of the case and roughly centered between terminal G2 and the end of the case. Screw it in until it has a good grip and pull straight up slowly and steadily. When the first capacitor is out, the others come out more easily. When you get to the back of the compartment, be very careful. This is where the plate choke is located.

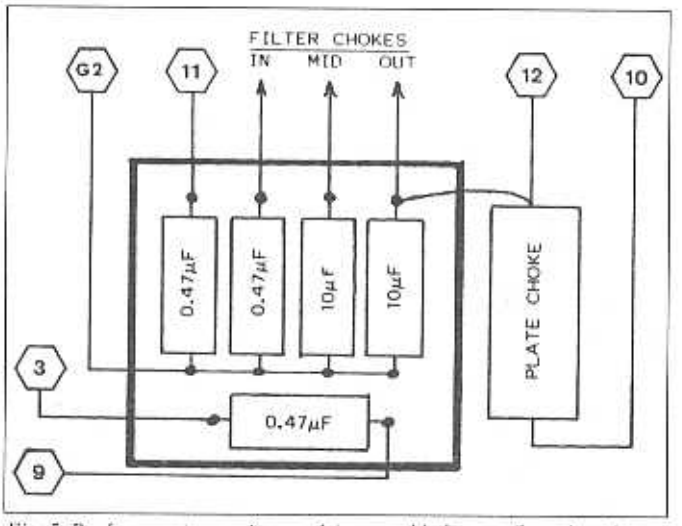

Fig. 5. Replacement capacitor pack is assembled on perfboard as shown.

If the tar isn't too cool, you should be able to lift out the plate choke by its wires. If it doesn't come out easily, heat the pack some more. The choke is a cylindrical object connected to the capacitors by a single wire from the same point where the long wire to terminal 10 is attached. Cut this wire where it joins the capacitors leaving as much wire as possible attached to the choke.

The choke and wires will be covered with tar and quite messy, but you don't need to clean them. Scoop the excess tar out of the empty compartment with a stick or old spoon while it is still soft, but the compartment needn't be absolutely clean. Wipe off any tar on the outside of the case while it is hot. Set everything aside to cool.

If your power pack is the later type, the procedure is the same except you don't need to remove it from the radio cabinet. Just remove the hold-down strap, cut and unsolder the wires as described above, and lift the capacitor pack out of the case. I put these units in the oven upside down on a pair of small wood blocks so the tar can run out as it heats. Be sure that you unsolder, not cut, the wires to terminals 10 and 12.

Making the Replacement Capacitor Pack

The voltage output of a capacitor input filter is dependent on the size of the input capacitor. If the original value of 1μF is used, the B+ voltage runs too high with modern line voltage, so I use a 0.47μF/600V Mylar unit for the first filter. I use 10μF/450V electrolytics for the other two. This combination gives the proper voltages and low hum.

The two bypass capacitors are not critical. You can use the original values or you can use 0.22μF units. They should be rated at 400-600V DC.

Arrange the capacitors as shown in Fig. 5 on a piece of plain perfboard cut to accommodate the capacitors and also to fit the compartment. Stick the capacitor leads through the board and bend them to anchor them. Connect them as shown and attach lead wires. There will be 9 wires, so mark each carefully. Connect the plate choke to the capacitor pack with the original connecting wire which you left attached. It is old, brittle and covered with tar. It isn't easy to strip and clean the end, so work carefully.

When the wiring is completed, cut a piece of thin cardboard slightly larger than the pack and twice as long. Coat it with shellac for moisture proofing. When dry, fold it around the capacitor board and tape it in place. This will insulate the pack and keep it from shorting to the case.

Installing the New Capacitor Pack

Drop the capacitor and choke assembly into the compartment or box. I leave them loose in case they ever have to be removed for servicing.

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pieces that are essentially complete, and with the original finish, should NOT be refinished for the sake of a few dings and scratches.

In the same manner, reworking the electronics of a truly rare radio just to hear it play can also be considered a bit of sacrilege. Aside from the fact that refinished pieces can lose up to 50% of their monetary value, if we rework everything there will be fewer and fewer original pieces left for succeeding generations of collectors to study.

My own early interest was the National Company HRO communication receiver, introduced in 1934. I have a very early production run HRO (I am only the 2nd owner) that still has the original parts as well as the original black crackle finish. I have elected to leave it alone, cleaned up, but otherwise original in every respect. Since there are (or at least were) lots of original-design HROs around, I found later production versions of the same design to restore and play with. There are techniques for rebuilding original parts, and this argument seems to be never ending, so my suggestion is that you do a lot of reading to develop your own thoughts.

Next time we take a look at and perhaps restore to working condition two important pieces of test gear, a VTVM and a capacitor checker. In the meantime, start developing your knowledge base by reading and more reading. The reference I listed last time by Ed Romney is, I repeat, an excellent beginners' book.

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You're not going to operate the radio upside down anyway. Now tighten all the terminal bolts on the board and remove the glass resistors. I use 2W metal film resistors for replacement. Values of 68kΩ and 13kΩ are close enough to the original values. Solder them to the appropriate clips as shown in Fig. 2. Don't leave the glass resistors in place; they may cause noise.

TABLE 2. POWER SUPPLY VOLTAGES

Terminal	Voltage
12	+185-205
10	+180-190
11	+35-40
9	+150-165
4	+35-43
3	+10-15

If either section of the bias resistor on the top side of the board is bad, replace it with a 2W metal film resistor of the nearest value. They are small enough to fit on the underside of the board. Disconnect the bad section of the original resistor.

Connect the ground wire from the capacitor pack to the lug under terminal G2. To connect the filter chokes, you must first identify the cut wires emerging from the choke compartment. Strip and clean the ends of these wires. Connect your ohmmeter to pin 1 of the rectifier socket and locate the wire which reads close to zero Ω. Label it "in."

Next, locate the wire which reads *one-half* the value you recorded for the resistance of CH1+CH2. Label it "mid." The remaining wire is "out." Confirm that the reading on this wire is the total value you previously recorded. Now solder these choke leads to their respective capacitor leads. Insulate these splices. A piece of shrink tubing slipped on before joining the wires can be shrunk over the joint after soldering.

Replace the holddown strap if your pack uses one, replace the terminal board, and bolt it down to the 2 ground terminals. Solder the remaining wires from the pack to their correct terminals and reattach the filament wires to their terminals. If you haven't disturbed these wires, they will line up correctly. Be sure not to interchange the wires from the plate choke. The restoration is now complete and ready for testing.

Final Testing

Check your wiring by measuring the resistance from terminal 10 to pin 1 of the rectifier socket. You should get the sum of CH1+CH2+CH3. You can power up without putting everything back in the cabinet in case you need to do further work. You should have checked the radio chassis and replaced any bad capacitors and resistors. Also check the windings of the audio transformers for continuity.

Bolt the cable connector to the terminal board and install all tubes. With the test lamp *in the circuit*, apply AC to the primary leads and be sure the lamp glows no more than half brightness. Short out the lamp and measure the DC voltages from the terminals in Table 2 to chassis. Your readings should be within 20% of those given.

If the voltage at either terminal 9 or 11 is the same as terminal 12, the associated audio transformer has an open primary. Otherwise, connect a speaker and antenna to the set; you should be hearing stations. Happy listening!