

## Restoring an Atwater Kent Model 84

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I recently restored an Atwater Kent model 84 for a non-technical friend. In the process, I ran into a number of problems, all different from those in a paper on the model 84 that was published several years ago (1). Therefore, I thought that some collectors might be interested in a brief description of my experiences. This AK model 84 was in relatively unspoiled condition. It appeared that the only repair ever done on it was to replace filter and coupling capacitors. The little spots of brown wax were still in place on all the adjustment screws indicating that the set had not been aligned since it left the factory. The cabinet was in good shape as may be seen in Fig. 1.

### Dial Drive Tire

The first problem to be noted was with the dial drive. These sets use a rubber tire in the drive mechanism as may be seen in Fig. 2. The tuning knob (not shown in this picture) attaches to the end of the tuning shaft, and the rubber tire is a force fit so it turns with the shaft. Its outside surface engages a sector gear that transfers the motion to the main variable capacitor.

The rubber tire in my set was badly deteriorated and needed to be replaced. Worse than that, the mounting screws were rusted in place and the tuning shaft had rusted into its bushing and would not turn at all.

I anointed the corroded parts with PB Blaster<sup>1</sup> and kept on doing so several times a day for about ten days until they finally came apart. (I know of no other product that actually frees up parts like PB Blaster!) Before reassembling, I polished the tuning shaft a little with crocus cloth and added a drop of sewing machine oil to ensure that it wouldn't seize up again.

To do any work on the dial-drive mechanism it is necessary to first remove the mounting screws, which is difficult because the power transformer is in the way. Instead of a standard screwdriver, an offset type must be used. Reassembly can be made much easier if screws with Allen heads replace the original slotted screws. Then a standard L-shaped Allen wrench can be used conveniently to tighten them up. Alternatively, Phillips-head screws can be used with a Phillips offset



Fig. 1 The Atwater Kent Model 84 on my repair bench.

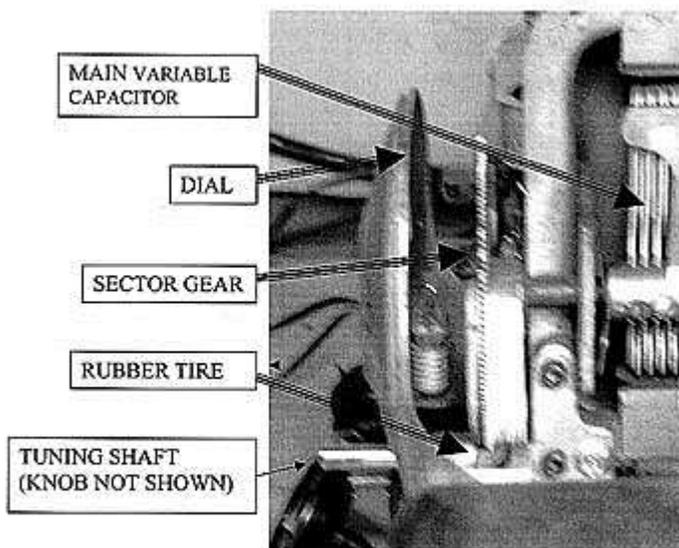


Fig.2 Sorry for the poor picture, but this will give you an idea of the construction of the dial drive mechanism.

screwdriver.

The replacement for the rubber tire in the dial drive must be selected carefully. The rubber must be strong and resilient since the sector gear it mates with has sharp teeth.

Furthermore, it must have the right thickness to engage the sector gear. The amount of engagement can be changed by loosening the mounting screws and moving the whole tuning shaft assembly a little. The amount it can be moved is limited, so the thickness of the rubber has to be within about 0.1" of the correct value.

On the web site of the International Society of Atwater

Kent Collectors (2) automotive hose is recommended as a replacement for this rubber part. I was fortunate to find a piece of hose of the right thickness in my junk box. Slicing it into half-inch long pieces made perfect rubber tires. Those not lucky enough to have hose of the right thickness on hand can purchase it at auto parts stores as automotive "multi-purpose" hose with a nominal inside diameter of 3/16 in. The manufacturer is Trico Products; the catalog number is 93-546.

### Volume Control

As mentioned before, some caps had already been replaced in this set. Unfortunately, whoever worked on the set used caps with too low a voltage rating. So I had to do the job over again. I then cautiously fired the set up. Basically it worked, but the sensitivity was poor and the volume control did not completely kill the sound from any of the strong local stations.

The failure of the pot to provide high attenuation may have been partly due to its basic construction. Instead of using a slider that makes direct contact with the resistance element, this Centralab pot used an intermediate piece of springy metal that is supposed to eliminate wear by avoiding any sliding motion against the element.

In this pot, the contact between the springy metal and the grounded end of the element was not good enough to provide the necessary attenuation of strong signals. Squirting it with the usual control cleaners did not help. Replacing the pot with one of conventional construction cured the feed-through problem.

Incidentally, it should be noted that the set I have is an early model 84. In the late 84, a completely different circuit is used for controlling the volume. The volume control pot is not used as an attenuator directly. Instead it controls the signal level by varying the grid bias on the mixer and I.F. stages.

### Oscillator Grid Leak

At the high end of the dial, the set would play normally until some noise was introduced (by connecting the antenna, for example). Then the set would break into a horrendous screeching sound, which could be killed only by shutting the set off. Paralleling the bypass capacitors with known-good units had no effect on the screech. A routine ohmmeter check of the resistors showed that they all were within tolerance except for the oscillator grid leak which had aged to three times its original value. Replacing it with the correct value got rid of the screech. A possible explanation is that the high resistance created the conditions for the oscillator to modulate itself. As explained by Ghirardi (3), a simple sine-wave collator can become self-modulated if the product of grid-leak resistance and coupling capacitance is too large. As explained by Arguimbau (4), the self-modulation waveform can be highly non-sinusoidal as was the waveform in this case.

### **Filament Balancing Pot**

When the set is tuned off station, there is enough gain so that you hear a small hum. This hum has nothing to do with filter capacitors; it is due to capacitive pick up from the filament/heater circuits. I found it loud enough to be annoying.

There is a way to reduce this hum that has been used in audio amplifiers for many years. A small pot is connected to the two sides of the filament/heater circuit and the arm of the pot is grounded. The pot is adjusted for minimum hum. Adding this pot balances the ac pickup on one side of the circuit against that from the other side, effectively nulling it out.

An incentive to make this addition is that local Radio Shack stores stock 25-ohm 3-watt pots that are ideal for this application (Catalog number 271-265). Purists will have to decide whether it is ok to add something to the radio that was not there originally.

### **Trimmers and Padder**

We are all familiar with the traditional I.F. transformer. It is usually in an aluminum can and has two little holes in the top to allow the coil to be adjusted. The I.F. transformer in this set looked normal, except that there were no holes in the top. Evidently Atwater Kent wanted to discourage the repairmen of the day from doing alignments on AK radios. The first order of business in aligning an AK is therefore to temporarily remove the coil from the can and drill two holes right over the adjusting screws.

In addition to the two trimmers in the I.F. can, there is also an unshielded I.F. coil with a trimmer. After adjusting these three trimmers to the I.F. of 130 kHz, the oscillator and antenna trimmers were next. A quick try at adjusting these by ear did not produce very good results. The set did not seem to track well. The trimmers peaked nicely at 1500 kHz, but at the low end of the dial the set was weak, and the dial calibration was off. To receive a station, the radio had to be set at a dial frequency that was about 40 kHz above the actual frequency of the station. Since the I.F. had just been aligned at exactly 130 kHz, there was no reason for the difference unless the padder was bad.

I put together two new epoxy-dipped mica capacitors that added up to the value of 1450 pF. given on the schematic and replaced the original padder, which was in one of the capacitor cans with several other caps. After this change, the dial

calibration back to normal; after final alignment, the set had the expected good sensitivity as it should.

### The Double Spot Trimmer

To properly align this set, one needs to use the special procedure that AK specifies for the so-called "double-spot" trimmer. AK called this a double-spot circuit because without the input filtering it provides, the same signal can be received at two spots on the dial. These two spots are: 1) the correct dial setting, and 2) a dial setting that is below the actual frequency by an amount equal to twice the I.F. frequency. Double-spot tuning is an example of the kind of image response that can potentially occur with any superhet.

If the AK 84 is receiving a 1500 kHz signal, it of course will come in with the dial pointer set at 1500 kHz. But unless the double-spot trimmer is properly adjusted, it will also receive this 1500 kHz signal when the dial pointer is at 1240 kHz. Preventing this image response is the primary function of the input filter in the model 84.

This input filter is shown in Fig 3. Here chassis grounds are represented by black triangles and sections of the main tuning capacitor by the usual symbol for capacitance with the lower plate curved. The circuit can be regarded as a filter with its input at the antenna ("A" in the figure) and its output to the grid of the '24. The antenna trimmer and choke serve to couple the signal into the first tuned circuit composed of L1 and a section of the tuning capacitor. This part of the circuit behaves like

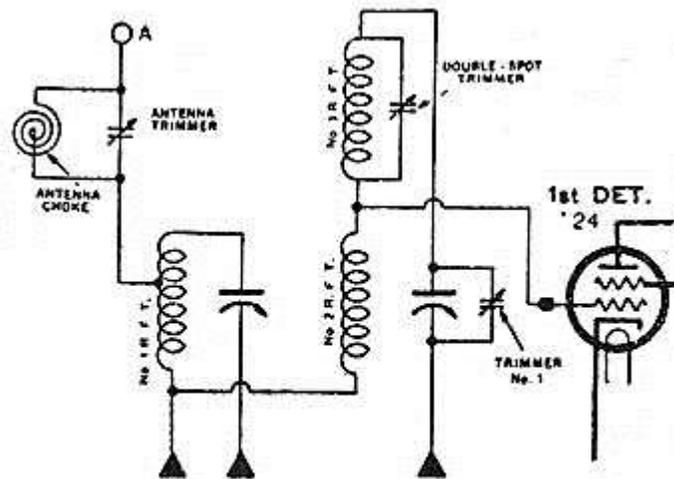


Fig.3 The double-spot filter circuit as presented in the Atwater Kent schematic for the model 84.

the antenna coil used in simpler input circuits: i.e., it passes the frequency it is tuned to and rejects signals with other frequencies. So far, so good.

At this point, however, there is a problem with the schematic. The circuit in Fig. 3, which is copied directly from the AK schematic, shows no pathway for the signal to get from L1 to the '24 grid. But a check of the wiring in the radio shows that it conforms to the schematic.

How does the signal get through with the junction of L1 and L2 grounded? The answer must be that there is enough stray magnetic coupling between the coils to provide the necessary path for signal energy to get from L1 to L2 and thence through the rest of the circuit to the tube grid.

The basic double-spot circuit consists of the double-spot trimmer, trimmer no. 1, sections of the main tuning capacitor, and coils L2 and L3. I searched for some time and finally found a discussion in Ghirardi (5) of how this circuit works.

If the values of these parts have been properly selected, it will pass the desired

frequency (1500 kHz in the previous example) and simultaneously provide an R.F. short for frequencies that are 260 kHz below the frequency that the receiver is set for. This 260 kHz difference is supposed to be maintained over the whole range of the tuning capacitor, thus theoretically eliminating all images.

Ghirardi gives the official AK instructions for adjusting the double-spot trimmer. I followed this procedure and it seems to work well. It is done at the frequencies we used for illustration in the above discussion, i.e. 1240 and 1500 kHz. A strong signal at 1240 kHz is applied and the double-spot trimmer adjusted for minimum output with the set tuned to 1500 kHz.

### **Tuning Wand**

I used a tuning wand to make a final check of the alignment of this receiver. A tuning wand is just a stick with a small piece of ferrite attached to one end and a piece of copper to the other. Putting the ferrite end into a coil raises its inductance while the other end lowers it. If the adjustments are correct, as they were in this case, inserting either end reduces the output.

<sup>1</sup>Blaster Chemical Companies, Inc., 8500 Sweet Valley Drive, Valley View, OH 44125; info@blasterproducts.com

### **References**

1. Richard Arnold, *Antique Radio Classified* 21, 12 (April, 2004). (This article is available on the ARC website at [www.antiqueradio.com/Apr04\\_Arnold\\_Model84.html](http://www.antiqueradio.com/Apr04_Arnold_Model84.html))
2. "Oldfrog Collector" at [www.atwaterkent.com](http://www.atwaterkent.com) website of the International Society of Atwater Kent Collectors.
3. Ghirardi, Alfred A., *Modern Radio Servicing*, First Ed. p.366ff. New York City: Radio & Technical Publishing Co. 1935.
4. Arguimbau, Lawrence B. *Vacuum Tube Circuits*, First Ed. p. 324. New York: John Wiley & Sons, 1948.
5. Ghirardi, Alfred A. *ibid* p.734ff.