Oriole Model 100 - W-K Electric Co.
Kenosha, Wisconsin.
Circa: Spring of 1927

Introduction

All the Oriole radio designs used one or more stages of tuned radio frequency amplification. Except for their apparently first Oriole branded radio, the Model 5, their uniqueness was in using a cathode follower RF amplifier scheme. This was coupled with clever applications of regeneration to maximize sensitivity. As with many 1920s makers of radios, they employed regeneration in violation of patents controlled by the RCA. In the case of Oriole, this complicated their obtaining publicity about their 'revolutionary' *Trinum* circuitry. If they were to explain the circuit in articles in the popular press, the RCA patent department lawyers would surely quickly appear with a cease and desist order or threaten litigation.

From the collection of Robert Lozier, Monroe, NC
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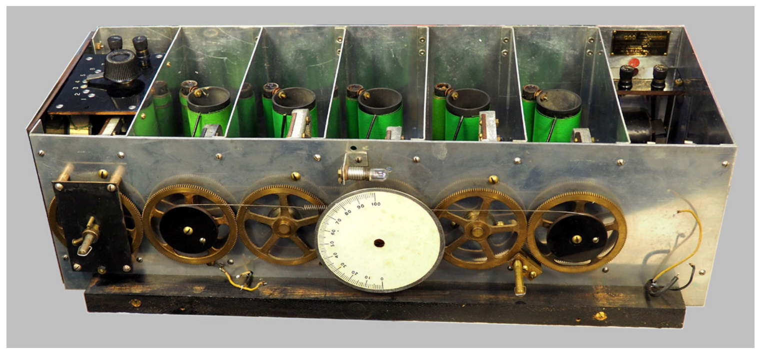
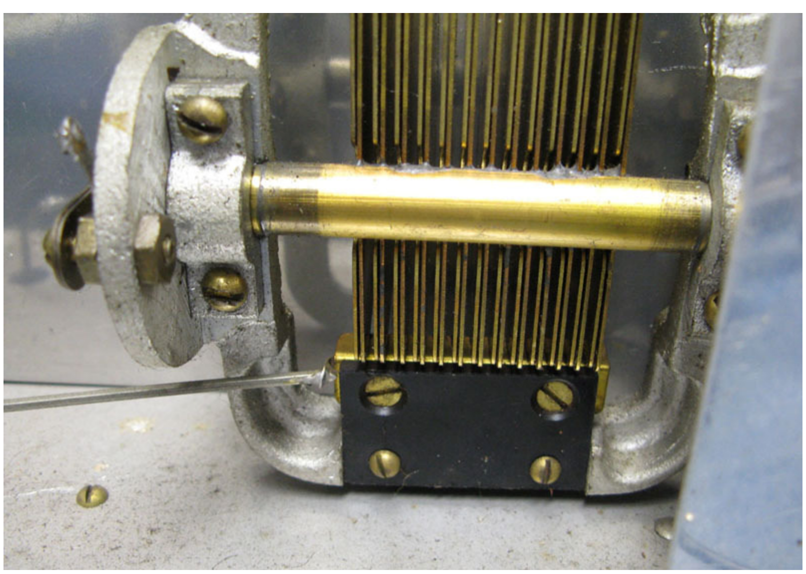
Oriole Model 100 Description

This, apparently, final design recognizes the industry trend to sell the notion of 'single dial tuning'. Sure enough all six tuning capacitors are ganged via large cut brass gears with a clever zero-backlash spring loading feature.

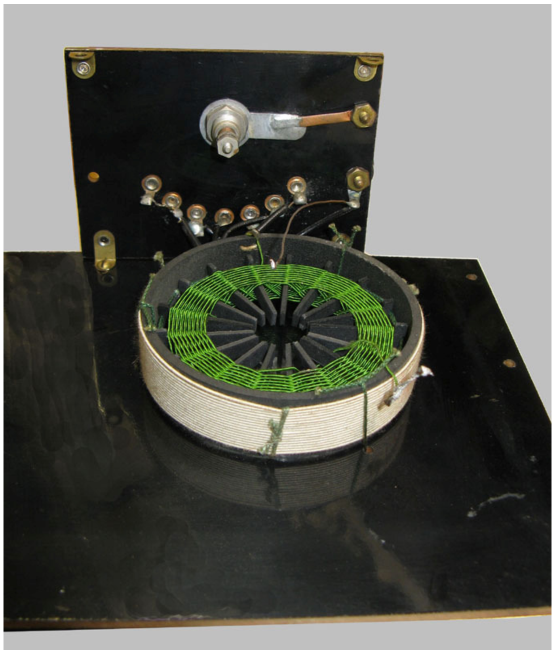


With six tuned circuits in individual shielded compartments, the selectivity becomes quite narrow. So much so that the first tuned stage does not track well across the whole broadcast band. It is here that the designer had to fudge the claim to 'single dial tuning' by adding a mechanical method of vernier adjustment to the capacity of the first stage that appears to be unique. (It is fair to note that many other 'single dial' sets had some sort of control to peak the tuning of one or more stages. They were often labeled verniers, clairifiers or compensators.)



Here the unique mechanical approach to fine adjustment of this first tuned stage is made by a <u>lateral shifting</u> of the shaft that mounts the rotor plates such that they are more or less centered between the fixed stator plates of the capacitor assembly! This method works very well in practice.

With so many high Q stages, I wondered if it is necessary to stagger tune the stages to get acceptable bandwidth but informal listening tests don't flag that as a problem. To accomplish the task would require the removal of the front panel. (No small task.)



There is an antenna matching circuit that works well for long wires of varying length. With the apparent rarity of this particular model it was indeed great luck that the 20 page user manual was still in the receiver cabinet. There is no mention of using this receiver with a loop antenna. I have connected a loop antenna to the radio but there is a great penalty in sensitivity. There were five and six tube non-superhetrodyne radios of the day that could work just as well for a local loop antenna application. Where this radio shines is in long distance work with an outside long wire antenna as described in the manual.

Working with this receiver soon demonstrates that it is much more selective at the high end of the broadcast band than many other TRF radios of the day. I was surprised to be able to tune-in early evening broadcasts from 1690, WPTX Lexington Park, MD; at a distance of 375 miles to a 10 kW station. I have 4 & 5 kW stations less than two miles away. With such high signal levels, they obliterate stations +/- 30 kHz.either side of 1060 and 1190 but otherwise the band is full of DX in the evenings.

The only improvement to high end tuning ease would be to substitute the straight-line capacity condensers with straight-line frequency units, BUT they would not fit in the same size compartments. I think the chassis would have to be 8 to 10 inches wider…..

Restoration Challenges

When found in the flea market at the annual conference of the AWA in Henrietta, NY in August 2017, the cabinet was in the usual state of many attic or dry basement stowaways. Finish flaking beyond simple conservation techniques and loose cabinet joints mandating a complete refinish. Otherwise not really dirty enough or rusty enough to be called 'barn fresh'. Fortunately almost all chassis parts are aluminum or brass.

There are many radios of the 1920s that have 'deal killer' defects that keep many people from attempting to do accurate restorations. Atwater Kent horn speakers, Crosley 'tool box' radios, Kolster and FADA radios are notorious for their fractured 'pot metal' die cast parts. RCA Radiolas such as the Model 20, 25 & 28 have cabinets using laminate glue that lets-go far more easily than seen in other cabinet makers product of the day. The radios and horn speakers with crystalline lacquer finishes cannot be duplicated these days because the chemicals used and processing techniques employed have been banned for proven damaging health reasons. Certain dyes used on cotton, Rayon or silk fabrics of that period were very vulnerable to radical fading and loosing fiber strength by light and atmospheric exposure. Some excellent reproduction cloths have been made in recent decades but do not cover the full spectrum of restoration needs.

The same can be said of battery cables and general wiring within early radio equipment. Many know of the colorful rubber covered hook-up wire used in Atwater Kent radios of the early 1930s. The insulation is now potato chip rigid and just as fragile.

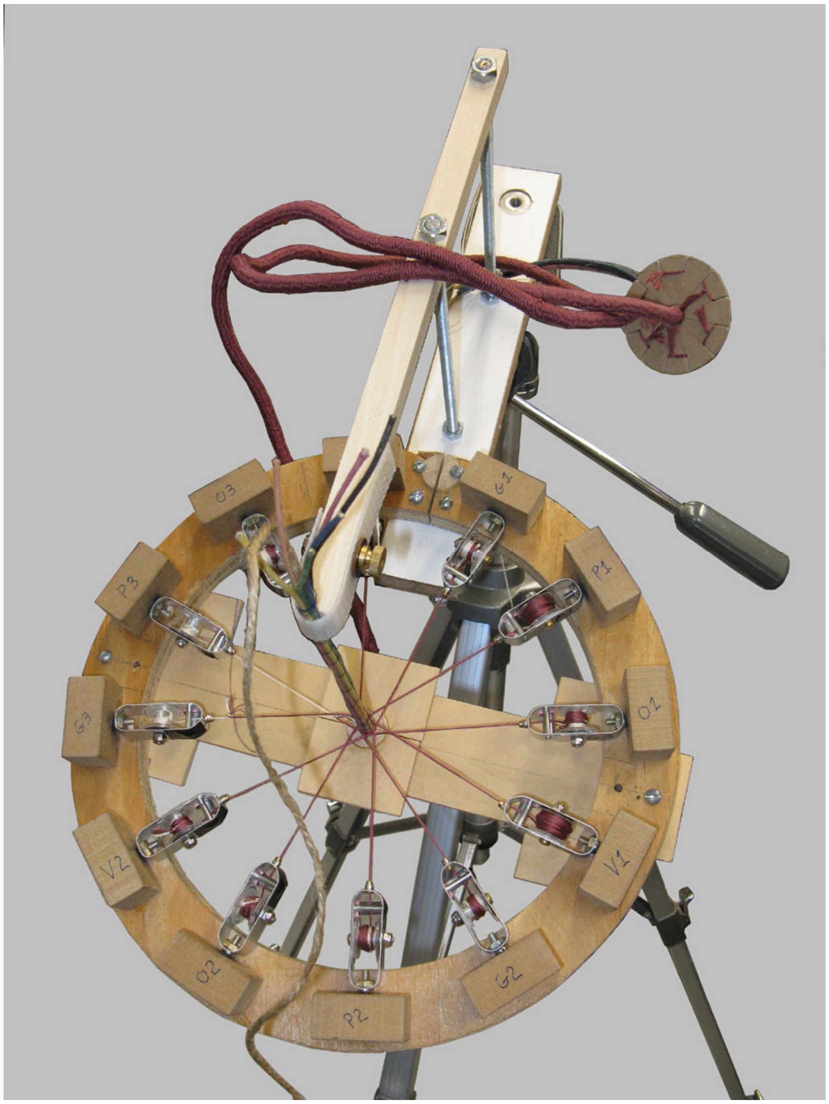
Challenge #1

In this Oriole radio the 'deal killer' is the 9 conductor battery cable hard wired to a tag board under the chassis. The cable is severely deteriorated and cannot be salvaged. I made a replacement cable using techniques developed during the restoration of my second Swedish Radiola M55 of 1927 vintage.

The battery cable is a little shorter than I would have expected. But there is evidence that the cable was never longer because each wire has a metal ID tag attached just about where you would expect it to be. There are 7 – 20 gauge wires and 2 – 16 gauge wires to service the filaments of the 8 type 01-A tubes.

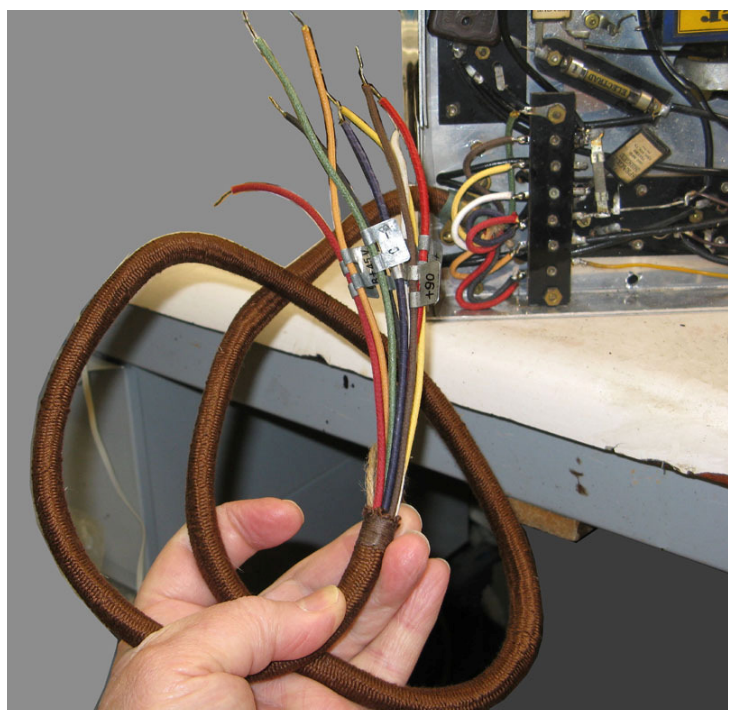
Here I used 20 gauge cloth covered wire obtained from ***Radio Daze***. This is the closest wire I've seen to replicate the original rubber insulated wire with color coded cotton over-braid. Unfortunately this reproduction wire uses common PVC insulation which makes the wire much less flexible. I have found that it is possible to get black silicone rubber covered wire in similar gauges. It is rated for 200 C environments while PVC type wires are rated no more than 105 C. It is no doubt more expensive but I would gladly pay more to get reproduction wire as flexible as was available 90 years ago.

I have an old spool of 16 gauge stranded hookup wire that must date from the 1950s that has a green dyed braided covering. It is still in fine, flexible shape. I found that I could bleach the color from the wire braid and then use RIT brand dye to make Red and Black 'A' supply wires for my new cable.



I engineered a braiding fixture with 16 shuttles, just like this 12 shuttle fixture I made for my Radiola M55 project, to permit braiding a jacket over a bundle of 9 wires (plus a filler strand of jute string); the filler necessary to form a smooth, slightly oval cable.

Once the bundle of wires are gathered into parallel alignment and secured by a spiral wrap of thread, it can be placed into the braiding fixture. In this case, about 36” of the bundle needs to have the braided jacket. To do the braiding takes about 8 hours work but the results are quite good. Good enough such that viewers are not likely to spend time questioning if the cable is not just ‘new old stock’ cable of the correct style.



Challenge #2

The Bakelite front panel was going to have to come off for proper cleaning of the chassis. Unfortunately the knobs were not attached with traditional set screws but with a music wire clip that is anchored in a small hole drilled crosswise in the brass shaft. What happens is that these clips rust and they will no longer slip the few thousandths required to permit the knob to slide off under any reasonable force.

An extraordinary amount of time was spent on devising a way to remove the knobs in a way that would not crack them. It involved making tools to remove screws behind the panel that were never intended to be accessible unless the front panel was off the chassis.

Once these screws were detached, it provided just enough wiggle room to insert additional tools and supports that would permit sufficient force for clip extraction without breaking the knobs. It worked! But that task burned more than a full day of shop time.

With the front removed I could inspect the tuning linkage between the six tuned circuits. There are six brass gears with an anti-backlash feature that was not unexpected and seems to work well. What I did discover, that I cannot recall having ever seen before, is a method of vernier capacitor adjustment on the first tuned stage.

I had expected that this vernier might have been built as a single rotating vane actuated by a coaxial drive shaft. Not so; the change in capacitance is accomplished by causing the rotor vanes to <u>shift laterall</u>y on the shaft bearings so they are more or less centered on the stator vanes! Crazy! Eh? But it works very smoothly.

The aluminum shielding was removed in order to properly clean the chassis.

At present one of the audio transformers is open circuit… No plans to replace it. A substitution will be tacked in place in order that performance checks can be made on the radio.

Challenge #3

As mentioned, the cabinet finish was too damaged to just employ conservation methods. In addition the cabinet joints were loose and needed to be separated for proper clean-out and re-gluing.

Like the Oriole - Warwick 71, there is shading of the base and sides. It is not something that is appealing to modern eyes but never the less it was their deliberate decision. I find this very difficult to replicate and my work is only moderately successful in achieving the original effect. The top lid coloration departs from the Warwick 71 in that there does not appear to be shading of the central panel of the lid. Instead they outline the area with an opaque VanDyke brown.

This cabinet is dimensionally identical to that of the Warwick 71 and the Nunn-Landon *Cascade* radio is made the same way except for being a deeper cabinet. The only differences are the decorative simulated wood carvings attached to the front of the cabinets. They must have been manufactured by the same cabinet maker.

Challenge #4

In preparation for testing the Oriole 100, I found out that my Heathkit Capacitor Tester had a very, very weak eye tube and eye closure was not proper in showing the extent of leakage. I was surprised to find a 220K resistor was measuring 23.4 Meg! Two 100 Ohm resistors were more than double in value; a resistor in the voltage divider was way too high. This unit has been on my work bench for about 45 years and I was surprised that the ½ Watt composition resistors although properly sized for their load can fail… I had presumed that the resistor technology of the day had matured to eliminate such failure modes by that time.

With my capacitor checker back in operation, I could test the six big 0.5 mfd. bypass capacitors mounted on the bottom of the chassis made by Potter Manufacturing Co. Inc., North Chicago, Ill. These were the same capacitors that I had found on my Oriole Warwick Model 71; one of those capacitors was shorted. I did not find any of the Model 100 capacitors to be shorted but leakage resistances were found to be between 2 and 6 meg Ohms. Power factor (at 60 Hz.) was about 15%. For an experiment, I replaced all these capacitors with 0.47 mfd. polypropylene units. I saw no measurable difference in circuit gain or distortion at 850 kHz. (arbitrary test point) Therefore the original units were reconnected for all formal testing.

I have a Heathkit RF Generator, IG-102, that was found to have a very distorted 400 Hz modulation. Rather than go into the debug of that unit, I turned to a URM-25D that I must have acquired 10 or so years ago but had never used. After a checkup of the generator power supply to make sure it was operating OK, I powered the generator and found that there was no 400 / 1k Hz. AM modulation. Geez… Something else to fix. Fortunately there is very good information on the Web on how to refurbish these units…

These units have 0.2, 0.1 & 0.01 mfd. paper dielectric capacitors molded into Bakelite cases that are notorious for high leakage over time… And sure enough they tested bad in this generator. The sealed potentiometer for the setting of RF output was very noisy and switches needed a good cleaning. Unfortunately the chassis is a nightmare for repair access. The majority of repairs were on a sub chassis with the RF Voltmeter.

The output now appears stable and modulation looks good on a scope. I have a digital counter and the generator output calibration over the MW frequencies agree within about 0.2%; completely satisfactory for my needs.

The final instrument necessary for these investigations is an inductance meter that can test at MW frequencies. I was not successful in finding anyone in my area that would loan me such a meter… The standard price on eBay for the Heathkit QM-1 is $200 plus shipping (although they are slow sellers). Of course these are meters that can be 40 to 60 years old at this point so will probably require servicing. That is OK because a basic re-cap job is all that is necessary. There are more expensive meters out there like those made by Boonton but I am told that they use a different and maybe superior circuit BUT there are 'unobtanium' components in that circuit that are known to fail especially if stored in damp locations for a long time. Eventually I was able to obtain a QM-1 complete with reference inductor from one of the Board members of the AWA Museum. An afternoon of re-capping and other checkout had it ready for use. One addition was made to the unit; a BNC connection to the output of the built-in signal generator to go to my digital counter. (The calibration markings of the Heathkit are 3 to 5% off..)

Ready for testing…

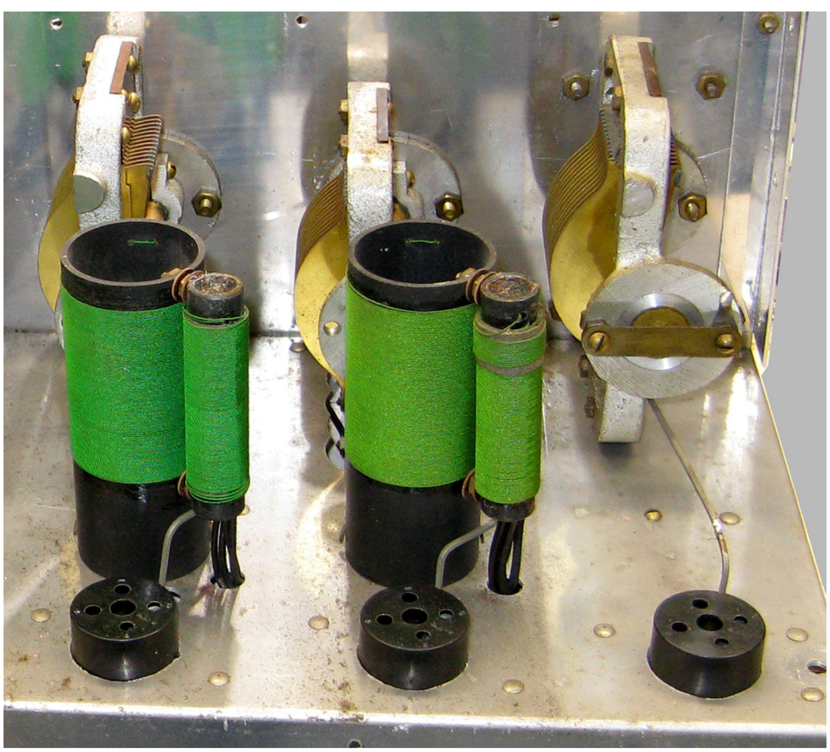
The first measurements of the Oriole 100 were general gain per stage over the broadcast band which goes from 500 kHz to 1700 kHz. (I was surprised to get good early evening reception from 1690 WPTX in Lexington Park, Maryland; a distance of 375 miles to a 10 kW station.) After a series of measurements, the tubes were cycled through the 3rd. stage to see if there was a significant change in per-stage gain because of the tubes used. With the tubes I have, there was something like 20% variability. The tubes matched closely (3%) on my Heathkit emission tube tester. After several rounds of measurements I was totally frustrated by discovering that measurements were not repeatable. Eventually I was able to identify one tube as the primary culprit. (It still tests good.)

While I can use a 10x scope probe on the primary of any stage, RF transformer, touching the probe to any grid circuit kills the signal almost completely. My O-scope has a maximum input sensitivity with a 10x probe of 10 mV. per division.

Signals were coupled to the radio using a 0.02 mfd film cap in series with the antenna input. There is a tap switch to match the antenna to the radio. Setting the tap switch to Position 1 or 2 (they are actually shorted together) provides the best coupling to the first stage.

The RF coils have a turns ratio of 1:1 with approximately 106 turns on each coil. (Each leg of the bifilar wound cathode coils have 106 turns in a close wound - double layer and the grid coil has 106 turns in a close wound - single layer. There is a lamination stack inside of the cathode coil presumed to be silicon iron alloy sheet similar to that employed in MW RF transformers such as are seen in the Federal 61, Erla Superflex and Acme reflex designs circa 1924. The approximately 20 strips that make the core are approximately 1.5" long, 0.25" wide and 0.015" thick thus making a stack about 0.315" high.

The DSC wire for all windings is single strand 28 gauge. The Cathode former is 0.59" o.d. and the Grid former is 1.5" o.d. of Bakelite impregnated paper stock about 1/16" thickness. These coils are spaced ¼" apart.



At left are the first and second RF amplifier transformers. The small coil is in the cathode circuit and the larger coil is the grid circuit.

Note on the right cathode coil there is a small additional winding, this is the global regeneration winding.

The right tuning condenser has a leaf spring to control the lateral shift of the rotor being used as a vernier adjustment.

Photo Gallery