

Vintage Radio

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The Airzone 612 6-valve battery-powered console



Designed in 1938, the Airzone 612 was a 6-valve battery-operated receiver specifically designed for use in remote areas. It's an excellent performer and even after 70 years, the alignment of the set featured here was almost spot on.

HISTORICALLY, most urban dwellers have not been interested in listening to radio stations outside the city they live in. As a result, radio manufacturers made a point of producing small 4-valve mantel receivers for the mass market. They were typically used in kitchens and bedrooms and were marketed alongside the more expensive 5-valve (or more) mantel and console receivers that were popular from the 1930s to the 1950s.

These little 4-valve sets and their larger siblings were mostly mains-operated and were usually quite simple in design. However, their performance was quite adequate for most city users, who tended to use them for background entertainment rather than for serious listening. It's fair to say that the production of 4-valve sets, along with more ambitious receivers in classy cabinets, was the mainstay of radio manufacturing during the valve era.

Rural listeners

Although such sets performed well in city areas, where there were lots of local stations, they were often unsuitable for use in remote rural locations. Many people at that time had no access to mains power, which meant that the sets had to be battery-powered or designed to run from 32V DC lighting plants. This in turn meant that power consumption had to be minimised.

Sets designed for use in rural areas also had to be more sensitive. AM radio stations back in the 1930s were not particularly powerful and were often even less so in country areas. That's because commercial broadcast stations were allowed to operate with transmitter output powers of 5kW in capital cities but only 2kW in country areas.

As expected, country stations were located only in those areas where there was enough advertising revenue to make them viable. This meant that many areas had no stations within hundreds of kilometres. Where I lived as a youngster, the nearest station was 3WV which was 145km away, while the next nearest station was about 180km distant. And we didn't live in the outback by any means!

As a result, for many people in rural areas, large outdoor antennas and sensitive receivers were needed to pick up a reasonable selection of radio stations. Fortunately, ABC national stations were allowed to broadcast at higher powers than the commercial stations and so many ABC country stations used 10kW transmitters.

Against this background, some manufacturers marketed sets that were specifically designed for rural listeners. One such set was the Airzone 612, a 6-valve battery-powered console receiver.

The Airzone 612 6-valve set

The Airzone 612 console from 1938 was an impressive receiver, both as an attractive-looking console and as a sensitive battery-operated set for remote country areas. Airzone had been making good receivers right from the beginning of the 1930s and this model really performs well.

As mentioned earlier, receivers designed for the more remote regions of Australia needed to be quite sensitive. They also needed to have good selectivity and to use as little power as possible.

Most receivers of that era used large 45V batteries plus a 2V lead-acid cell to power them. Usually, three 45V batteries were used, to give a high-tension (HT) voltage of 135V. These 45V dry batteries were expensive but with frugal use, would last about one year.

Battery-powered sets were not just turned on and let run all day, as became the habit of those with mains-operated receivers. Instead, they were turned on for particular programs and then turned off again to conserve the batteries. The lead-acid 2V cell would require recharging every month or so and this was usually done at a local garage or radio service shop. However, some owners did work out other ways to recharge this cell, sometimes with disastrous results!

In the Airzone 612, the current



This is the view inside the old Airzone 612 console. A large loudspeaker and a decent baffle ensured good sound levels despite the output stage delivering a maximum output power of just 350mW.

draw from the 2V cell is just 0.54A because the valves used mostly have low filament currents. These low-drain valves did not cause any noticeable reduction in performance. By contrast, most battery-operated sets of the era drew around 0.72A of filament current, despite the fact that they only used five valves.

The battery drain on the HT line is 18mA on shortwave and 17mA on the broadcast band. This is a little higher than for many other sets of the era but the Airzone 612 does have six valves compared to five in most other battery-operated sets.

Circuit details

Refer now to Fig.1 for the circuit details of the Airzone 612. The receiver is quite conventional with a 1D5G (V1) as a tuned RF (radio frequency) amplifier. The output from this stage is coupled via another tuned circuit to the signal grid of a 1C7G (V2) which

functions as the frequency converter. This stage generates an IF signal that's 456kHz higher than the tuned RF signal.

This IF signal is coupled via a double-tuned IF transformer to a 1D5G (V3) which functions as the first IF amplifier. The resulting signal is then fed via another double-tuned IF transformer to the second IF amplifier (V4). It then goes through another double-tuned IF transformer to the detection and AGC diodes in a 1K7G valve (V5).

Finally, the detected audio signal is fed to the pentode section of a 1F5G (V6) which in turn drives a large (and efficient) loudspeaker via an output transformer.

The Airzone 612 is not just limited to the broadcast band, however. This is a dual-wave receiver and it also has provision for amplifying the output from a turntable pick-up. It features three tuned circuits for the broadcast band and another three for the short-

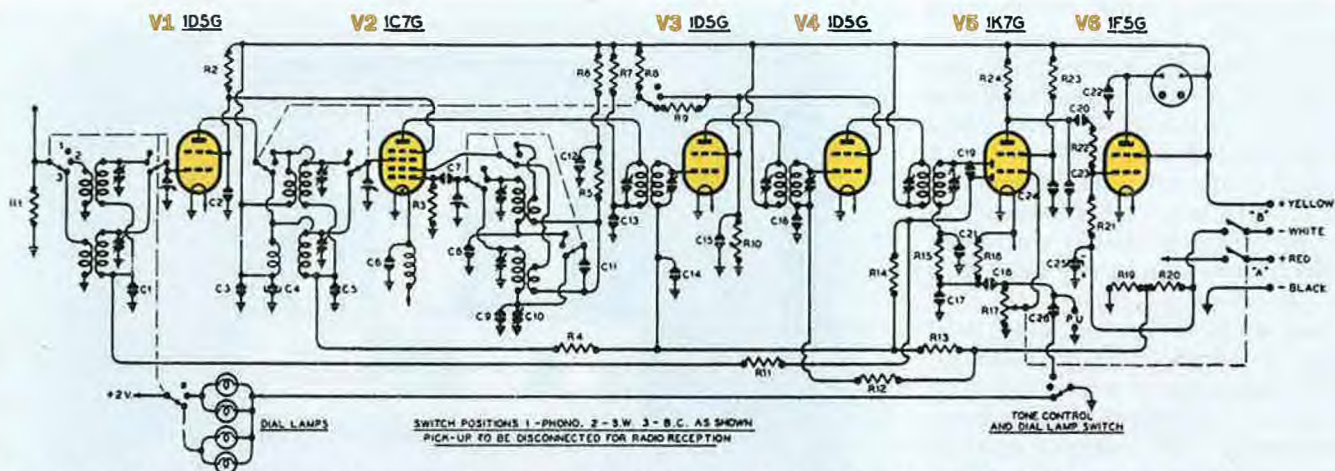


Fig.1: the Airzone 612 is a fairly conventional superhet design employing six valves. It's a dual-band set and was powered from a 2V lead-acid cell (for the valve filaments) and three 45V batteries (to derive a 135V HT supply).

wave band, these being an antenna tuned circuit, an RF tuned circuit and an oscillator tuned circuit (for the converter stage).

The wave-change switch has three positions: phono (record player), shortwave band and broadcast band. This is a 9-section switch, with seven sections involved in switching from broadcast to shortwave. Another section switches the dial lamps so that either the shortwave or the broadcast dial markings are illuminated, while the remaining section alters the screen voltage to IF amplifiers V3 and V4 so that the gain on the broadcast band is less than on shortwave.

When the switch is in the phono position, it removes the screen voltage from the IF valves (V3 & V4) to disable them in this mode.

Another 3-position switch provides

a 1-step tone control and controls the dial lamps. In sets such as this, the dial lamps were only switched on to aid tuning and were then switched off to reduce the load on the 2V cell.

Bias & AGC

The detector diode in V5 has no bias applied to it and commences working as soon as a signal is received. By contrast, the AGC diode is biased to -2V which means that it doesn't start conducting until the IF signal exceeds 2V. This means the set has delayed AGC which is very useful when operating in weak signal areas.

Standing bias is applied to the four RF and IF valves and this is derived from the voltage developed across R19 in the HT-line. In addition, the AGC line applies various amounts of bias to valves V1-V3, depending on the signal strength. The RF valve (V1) receives the full AGC voltage (via R11), while V2 & V3 receive just half the AGC voltage (derived from the junction of resistors R13 and R14). V4 (the 2nd IF amplifier) has no AGC applied to it.

Here's looking at you

Some console receivers of the era looked like they had cabinets made out of wooden packing-cases. Not so the Airzone 612 – its stylish cabinet is well-built by any standard. It features a round escutcheon with the dial-scale in the centre, while the four control knobs are placed along the lower, outer rim of the escutcheon.

This differs from most other receivers which had their controls arranged in a straight line along the chassis.

The clear dial cover in the escutcheon

is now showing its age, having yellowed somewhat. However, because it's curved, a replacement is difficult to source.

The chassis and cabinet interior required very little cleaning and as can be seen, the labelling on the chassis is almost as good as the day it was made. By contrast, the cabinet has suffered a number of knocks over the years and requires a lot of work to make it look new again.

Restoring the circuit

Considering its age, the chassis was really in quite good condition although there were inevitably a few problems. First, when it was removed from the cabinet, it was found that the volume control had been replaced at some time in the past and its shaft had been cut quite short. As a result, it was missing its control knob.

An under-chassis inspection also revealed a degree of tampering by someone who clearly didn't know what they were doing. This is a common problem with many vintage radios – the "hero" who is going to restore it attacks it with great gusto, in the process removing many parts which are earmarked for later replacement. Unfortunately, he subsequently cannot remember where everything goes and so parts finish up where they don't belong and the set doesn't work properly.

Finally, after lots of mucking about, our "hero" gives up and sells the set as "a going concern" (which it isn't) to another collector. It's a scenario I've encountered all too often.

Fortunately, this receiver had since come into the hands of a friend of mine



A close-up view of the dial scale. The dial lamps are switched so that only the broadcast or shortwave markings are illuminated.

(Marcus) who is capable of restoring old radios. His practice is to replace all the paper and electrolytic capacitors when restoring a receiver and so this was one of his first jobs. Marcus also tested all the valves and found that the 1K7G was faulty. This was replaced, after which further checks were made on component values.

During this process, Marcus discovered that the 1K7G's plate resistor (R24) had been changed from 250kΩ to 20kΩ. The original 250kΩ resistor had been wired to the grid instead of the plate, so it was no wonder the valve was faulty. Valves do not take kindly to significant positive voltages on their control grids.

Another problem concerned back-bias resistors R19 & R20. These are actually part of a single tapped wire-wound resistor which is bolted to the chassis. This was faulty, again due to the previous restorer, and was replaced with two separate resistors.

Next, the various moving controls and sliding surfaces were oiled and the dial system checked over. The dial mechanism has a flywheel drive which is good for rapidly tuning from one end of the band to the other. Many sets had this function in the 1930s and 1940s and I've usually found them easy to use.

Marcus' next task was to obtain a 230V AC to 2V DC and 135V DC power supply. Fortunately, suitable kits are available commercially and so one of these was assembled and tested. (Note: a design using readily-available parts and with various output voltages will be described in a future Vintage Radio column).

Having completed the power supply, Marcus connected an antenna and an earth (via a 10nF capacitor to chassis) and switched the set on. The result was complete silence, despite the fact that most of the critical parts had been checked and the obvious faults fixed.

It didn't take long to track down the problem. A close inspection soon revealed that the speaker transformer had been replaced at some stage and the speaker cone had also been damaged. Unfortunately though, the flexible wires that connect the voice coil to the speaker transformer had been broken.

This fault was quickly repaired using some flexible wire from a defunct loudspeaker, while the hole in the



The old Airzone's chassis was in remarkably good condition for its age, with all the labelling still intact. Unfortunately, someone had tampered with the circuitry, although the problems were soon sorted out.

speaker cone was repaired by gluing a thick paper covering in place. This was the original speaker, so it was worth spending the time to repair it.

Marcus was not happy about the speaker transformer being mounted directly on the speaker, however. The reason for this was simple – if anyone was to remove the speaker plug on the back of the chassis while the receiver was operating, the 1F5G output valve would have no voltage on its plate but full voltage on its screen.

It would not survive this sort of treatment for long and so, despite detracting from originality, Marcus decided to mount the transformer on the chassis, with only the voice-coil

leads going to the speaker via the plug.

In fact, it would not have been difficult for Airzone to have corrected this problem. They could have easily wired the receiver so that the HT to the entire circuit was removed if the speaker was unplugged, thus saving the 1F5G from destruction. As shown in Fig.2, the modification is so simple that it makes one wonder why Airzone didn't do this.

It still didn't work

The set was tested again following the loudspeaker repairs but it still refused to work. As a result, the voltages around each stage were checked and this revealed that V1's plate had no

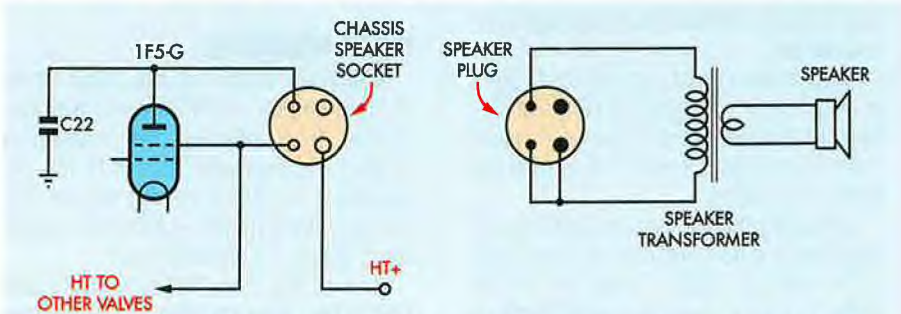


Fig.2: this circuit shows how the unit could have been wired so that the HT to the valves was removed if the speaker assembly was unplugged.



The original loudspeaker required some work to get it going again, including a patch on the paper cone. The flexible wires that connect the voice coil to the speaker transformer had also been damaged and required replacement.

voltage on it. Once again, the cause was simple – an RF (radio frequency) choke in the plate circuit had gone open circuit.

Just why there's an RF choke in this location is a mystery and the circuit certainly doesn't show one. My theory is that it may have been added to overcome some instability. It was replaced with a small resistor-style RF choke but the receiver still refused to work.

It was then found that the earlier

“restorer” had wired gangs two and three together at the switch. Once that had been corrected, the receiver came to life and it was possible to tune stations at good volume.

A quick check revealed that the IF alignment was close to optimum, as was the alignment of the front-end stages around valves V1 and V2. This is a tribute to the quality of the components used by Airzone in this receiver. All that was left to do was to replace

some defunct dial lamps and fix the volume control.

A switch-potentiometer was used for the original volume control and as the on/off switch. However, because the new power supply had its own on/off switch, Marcus decided to fit an ordinary potentiometer instead.

The shaft on this replacement unit was still too short and so an extension had to be fitted. A brass extension shaft was scrounged from his spare parts bin while a sleeve to join the two was made from some 16mm-diameter round aluminium bar. This was turned down in a lathe and drilled through with a 0.25-inch hole. Finally, two holes were drilled and tapped along one side to accept the grub screws.

At this stage, the technical restoration was complete and the set has now been returned to its owner so that the cabinet can be restored to its former glory.

Summary

This set's performance is superb, with distant stations like 5CK (about 750km away from my location in country Victoria) being heard in daylight at a reasonable level. It only has around 350mW of audio output but this is more than adequate due to the efficiency of its loudspeaker and the use of a decent baffle in the large cabinet.

In summary, it's a set that's well-worth having in any collection. **SC**