

Vintage Radio

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The 1951 AWA Radiola 433MCZ 4-valve battery receiver

Battery receivers of various sorts were always around during the era that valve radios were king. One such set was the AWA Radiola 433MCZ which was designed for use in rural areas that lacked mains power.

Early battery-powered valve sets were based on valves such as the ubiquitous 201, which had a filament requirement of 1A at 5V. By contrast, some of later “battery type” valves required just 25mA at 1.4V to heat them.

In addition, the HT (high-tension) voltage required by the early valves

used in battery sets varied from 60V up to about 180V, with valves such as the 1L5G being rated at 180V maximum. In practice though, the 1L5G was usually run with 135V on the plate.

The later “battery-type” valves operated at much lower voltages. They were generally rated at 90V on the plate but were often run at 67.5V.

However, there were valves that operated with even less voltage and current on the filaments, such as hearing-aid valves. In fact, the latter typically ran with about 22.5V on the valve plates. It's also worth noting that the space charge tetrodes developed in the 1920s and 1960s ran with plate voltages from around 2V to about 20V.

We didn't see many very low-current valves in Australia and the most common valve line-up in a battery receiver at the end of the valve era was as follows: 1T4 radio frequency (RF) amplifier, 1R5 frequency converter, 1T4 intermediate frequency (IF) amplifier, 1S5 detector and first audio stage and 3V4 audio output stage.

These valves all drew 50mA of filament current at 1.4V, with the exception of the 3V4 which drew either 100mA at 1.4V or 50mA at 2.8V, depending on how the filament was wired. The high voltage (HT) was usually 90V DC.

Design compromises

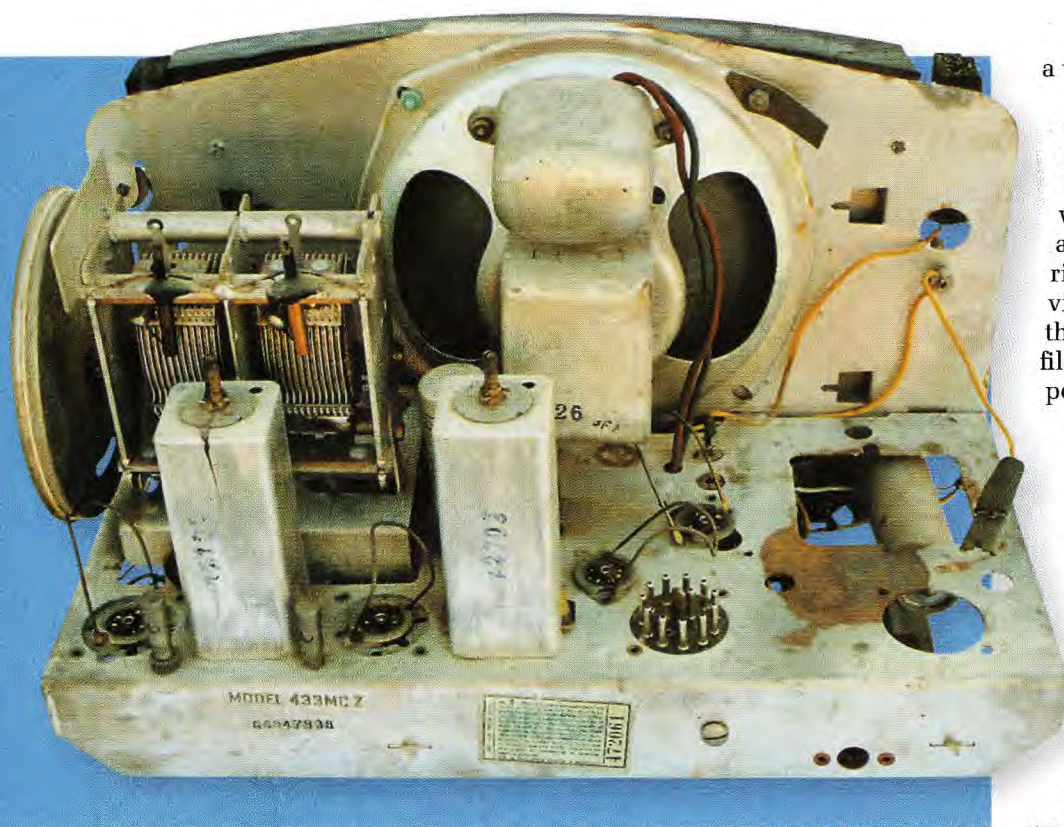
Achieving low power consumption on both the filament and HT lines meant making compromises in the way these valves operated.

First, because of the low filament drain, the filaments were both mechanically and electrically fragile. In fact, tapping the side of an audio valve with a finger would generally produce an audible “ting” in the output – ie, these valves were noticeably microphonic.

It also meant that they could not tolerate an “over-voltage” condition on the filaments. If the HT was mistakenly connected to the filaments, for example, you could be certain that a



This view shows the fully-restored receiver. It turned out to be quite a reasonable performer, especially after it had been aligned correctly.



The old Radiola 433MCZ was in relatively good condition, although there was some corrosion on the chassis due to leakage from the dial-lamp battery.

operated set which used one valve as a rectifier.

However, the deficiencies of battery-type valves were more than made up for by their economy of operation. This meant they could be used in remote areas, well away from 240V mains and 32V home-lighting plants. Many remote high-frequency (HF) monitoring receivers, as used by the Royal

Flying Doctor Service, the fishing fleet and bushfire brigade bases, also used these valves to great effect.

The 433MCZ power supply

The AWA 433MCZ looks a bit like an oversized Astor Football. It is a 4-valve dry battery receiver but like many other AWA battery receivers of the era (1951), it could be powered by

a vibrator power pack as well.

In practice, the receiver was made to operate as a battery-powered set simply by fitting a particular power lead. Conversely, for vibrator use, it was supplied with a vibrator pack and a power lead that fitted on the righthand end of the chassis, as viewed from the rear. The wiring of the power supply plugs altered the filament wiring to suit the particular power source.

It was quite a nifty idea and was used in a number of AWA battery-operated valve receivers.

Circuit details

Fig.1 shows the circuit details of the AWA Radiola 433MC. The input to the receiver is conventional, with a tuned circuit feeding the 1R5 frequency converter stage. In addition, a 455kHz IF trap was also included across the input (L1 & C1)

to reduce breakthrough from marine radio stations operating on frequencies close to the IF (this was a common addition to the front end of many receivers of the era).

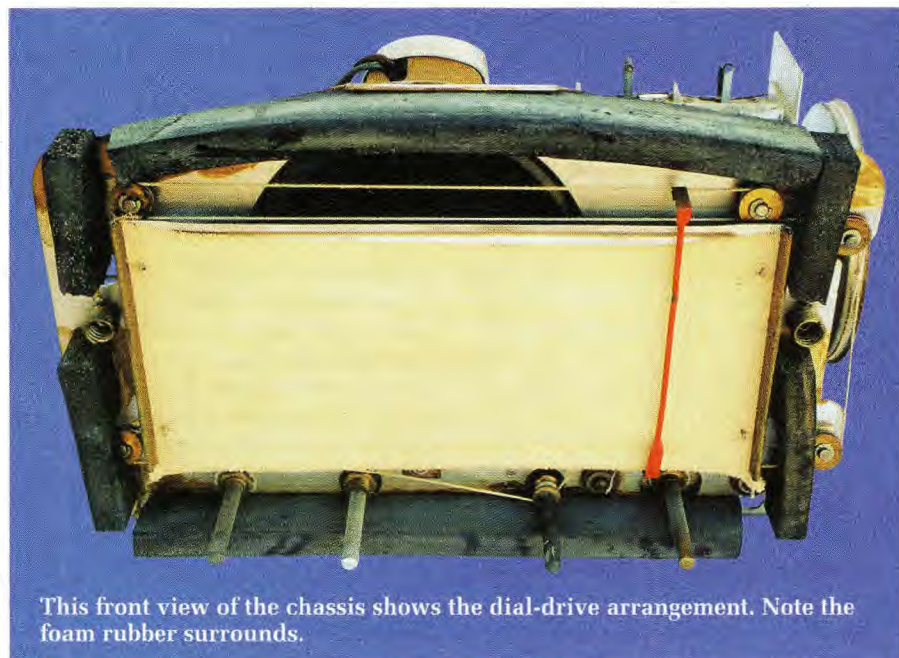
The second stage is based on a 1T4 and this is wired as a neutralised IF amplifier. Note that only one extra component is required for neutralising and this is capacitor C14 (4pF). Neutralising was commonly used on triode RF/IF amplifiers but not as often on tetrode and pentode amplifier stages, due to their inherent greater stability.

The 1S5 has only one diode and this is used both as a detector and for simple automatic gain (volume) control (AGC). This AGC is applied to both the 1R5 and the 1T4. In addition, the 1S5 has a pentode section which is used as the first audio stage. This then feeds a 3V4 audio output stage.

The audio output is a modest 250mW and drives a 150mm (6-inch) loudspeaker. The resulting audio is sufficient in volume for normal listening but it's certainly no match for today's ghetto blasters

Cleaning the set

The set itself was quite dusty, having been stored for many years in a relatively dry environment. There was some evidence that a mouse had been in the set but after a short stay, it must have decided that there were better lodgings elsewhere.



This front view of the chassis shows the dial-drive arrangement. Note the foam rubber surrounds.

The set was generally in quite good condition. However, the 3V battery used for the dial lights had corroded through its case and spilled electrolyte onto the chassis. As might be expected, this caused some rusting and general corrosion of the steel plating in the area affected by the spill (see photo).

After cleaning up this corrosion, the cabinet and the chassis itself were dusted using a brush and then the valves, cabinet and knobs were washed with soapy water. These parts were then rinsed in clean water and left to dry.

By the way, it's always a good idea to be careful when cleaning valves, to ensure that you don't wash the markings off.

The cabinet was in quite reasonable order, with only one or two cracks in the bakelite. It was given a gentle "going over" with some automotive cut and polish and now looks almost as good as new.

Next, the knobs were given the same treatment and came up well. However, there is a circular groove in each knob that had been painted in the past, along with a dimple on the on-off knob (to indicate on/off position). Only remnants of the original paint remained, so I used an old steel nib pen and some black paint to fill in the grooves and the dimple.

The end result looked terrible until I wiped away the paint that was outside the grooves with a cloth. The edges were then clean and sharp but the knobs were left with a dark grey smudge over them. This was easily fixed - I let the paint dry and then carefully polished the knobs and they came up looking like new.

Circuit restoration

It was now time for the circuit restoration. First, the rubber insulation on the battery cable leads was in poor condition and so they were replaced with plastic covered leads of the same colour. These leads were then carefully wrapped in insulation tape as far as the cable socket.

The original cable had a 375mA fuse fitted to the HT line but I can see no reason for this and so left it out. If I can work out a way of getting the brown cotton covering off the old cable, I'll slip it over the new cable to make it look more authentic and refit the fuse.

I also left the battery plugs off, as it's



This is the original battery cable from the old Radiola 433MCZ. The insulation had perished so badly that the entire cable assembly had to be replaced.

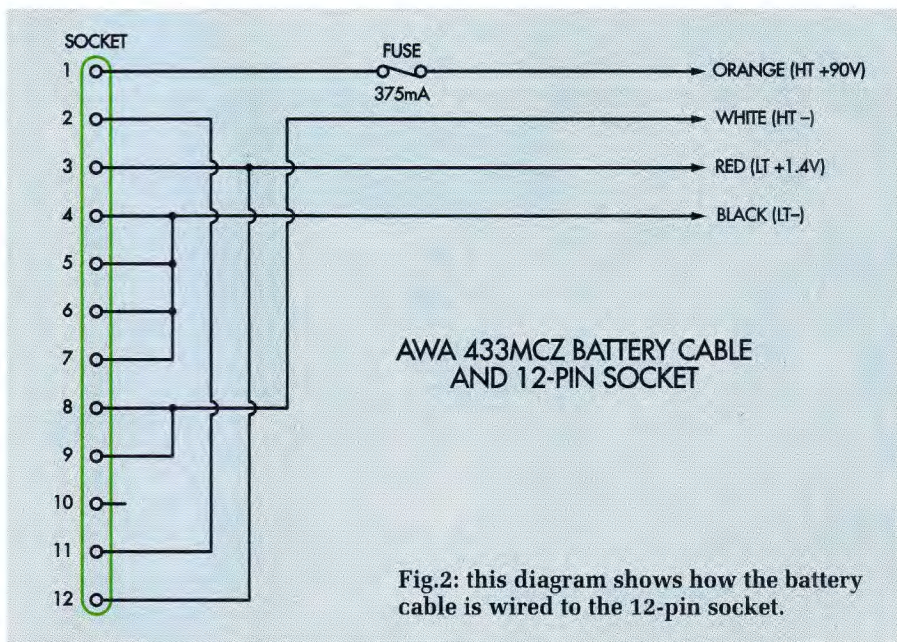


Fig.2: this diagram shows how the battery cable is wired to the 12-pin socket.

more convenient to connect the power leads directly to the power supply. However, you do have to ensure that the filaments are not connected to the 90V line!

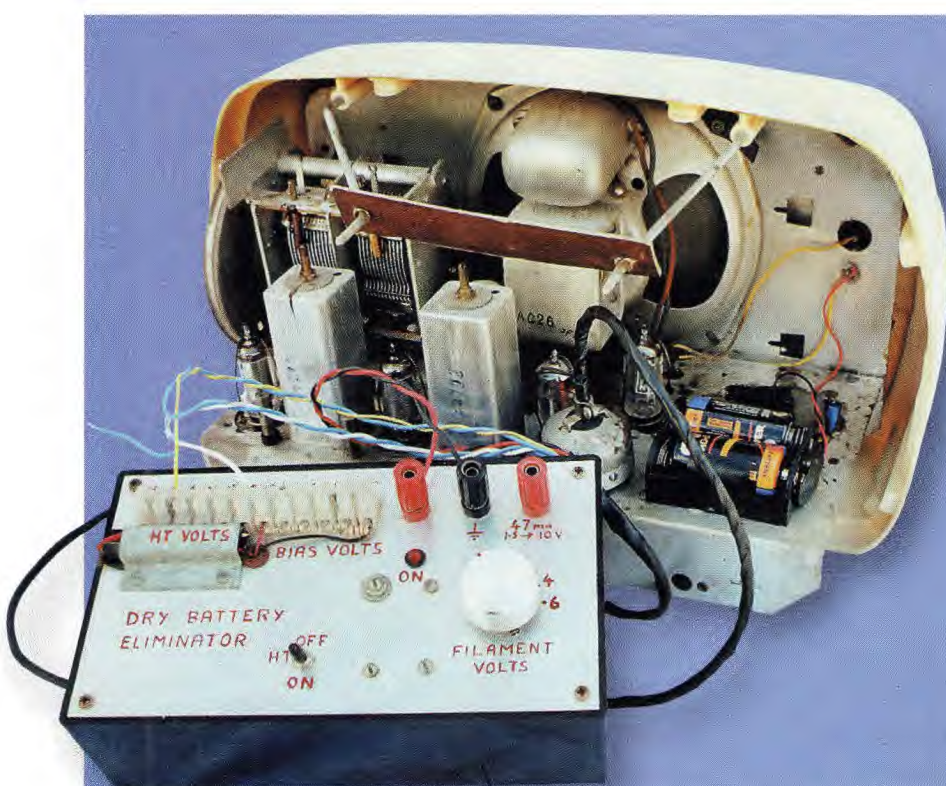
My next step was to test all the capacitors and resistors in the set. As usual, a number of the paper capacitors required replacement - ie, the two automatic gain control (AGC) filter capacitors (C3 and C17) and the audio

couplers (C22 and C23). The remaining paper capacitors were leaky but were OK to leave in the circuit.

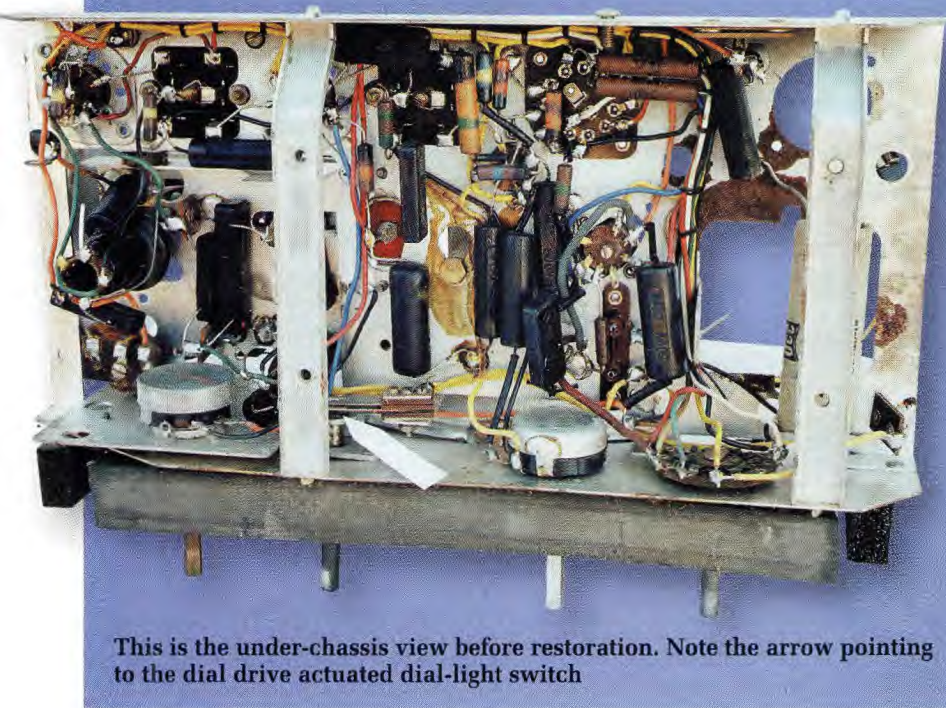
The resistors fared somewhat better and only R14 was well out of tolerance at around 600Ω. It was replaced with a 330Ω 0.25W resistor.

Supply checks

Before installing the valves, I decided to carry out a few simple voltage



Powering battery-operated receivers is no problem if you build a mains-powered dry-battery eliminator.



This is the under-chassis view before restoration. Note the arrow pointing to the dial drive actuated dial-light switch

checks. First, I connected the repaired supply cable to the receiver and did some resistance checks to my "battery eliminator" power supply (which I made about 15 years ago). That done, I switched on and found that the supply voltages (1.4V and 90V) at various

points in the receiver were correct.

I then checked the filaments of all the valves using an ohmmeter and all had continuity. The valve sockets were then sprayed with Inox anti-corrosion spray and the valves re-inserted. One of the valves, an N19, didn't match

any of the type numbers on the circuit. However, a quick rummage through my valve data books soon revealed that it is equivalent to a 3V4.

The smoke test

It was time for the smoke test so I connected an antenna and earth and switched on. The set immediately showed signs of life and I was able to tune in various local stations.

However, the front end alignment was out and I quickly adjusted the tuning range so that the entire broadcast band could be tuned. I then attacked the alignment of the IF amplifier stage. Three out of the four 'screwdriver adjustments were nearly spot on but I couldn't get the fourth (L8) to peak at all. The performance improved as I screwed the slug further into the transformer but there was no peak.

I've had this problem before with and the cure has been to replace the IF transformer. Unfortunately, I didn't have a replacement transformer available this time, so I decided to pull the transformer to pieces and replace the mica tuning capacitor (C15).

When I finally removed the capacitor, I checked its value and it read 125pF. However, its correct value is listed in the parts list as 70pF, so I replaced it with a 68pF styroseal capacitor mounted external to the transformer

That done, I adjusted both L8 and L9 in the IF transformer again and the improvement in performance had to be heard to be believed – the set was now performing really well. But why had mica capacitor C15 increased in value to 125pF? Was it incorrectly marked or had it gone high over the years? I really don't know the answer to that question.

The set was now performing quite well but did produce a few "scratching" during tuning, which suggested that the tuning gangs were partially shorting at times. This problem was cured by applying 40V across the plates (with the other components disconnected) and winding the plates in and out a few times. I then switched my high-voltage tester to its 500V range and checked again. There were now no signs of any shorts and the gangs were wired back into circuit.

The dial lamps

The original 3V cycle batteries that were used to power the dial lamps

Photo Gallery: AWA Radiola 55E

Released in 1932, the Radiola 55E was one of the last TRF (tuned radio frequency) consoles manufactured by AWA. It was fitted with an 8-inch (20cm) electrodynamic speaker and used a 4-gang tuning capacitor to tune its three RF stages and detector stage. The valve line-up was as follows: 3 x 235 RF amplifiers, a 224A detector, a 247 audio output stage and a 280 rectifier stage. Photo: Historical Radio Society of Australia, Inc.



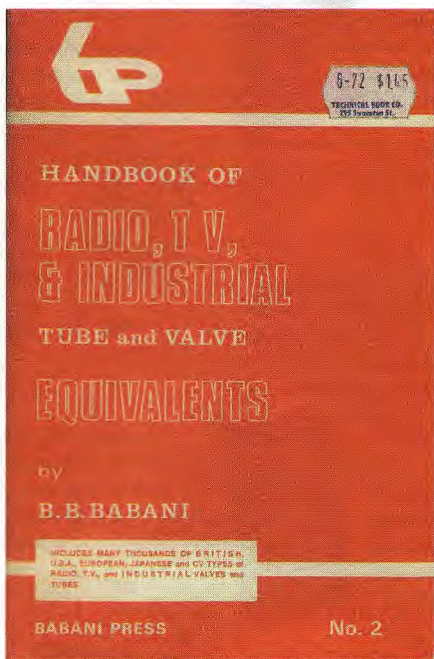
are no longer available, so I fitted a 2 x C-cell battery holder to the chassis and ran the necessary connections to the lamp and to the chassis. At the same time, the old battery lead was kept in place, in case I do happen to come across an old cycle battery down the track.

The original dial lamps had failed and these were replaced with two MES 3.6V torch globes. They are tuned on by pushing the tuning knob and are required at night time because the dial pointer is not particularly easy to see.

Powering battery receivers

Powering a battery receiver is a problem for many collectors, as the batteries are now either unobtainable or very expensive. I first realised this about 15 years ago and decided to do something about it by building the supply shown in one of the photographs. It will handle most battery sets from the mid 1930s onwards, as well as 6V vibrator receivers that draw no more than 1A.

It's important that we collect and restore battery receivers. They are an



A good valve equivalents data book is invaluable when it comes to restoring vintage radio receivers.

important part of our radio heritage and this little receiver is well worth having in any collection. **SC**