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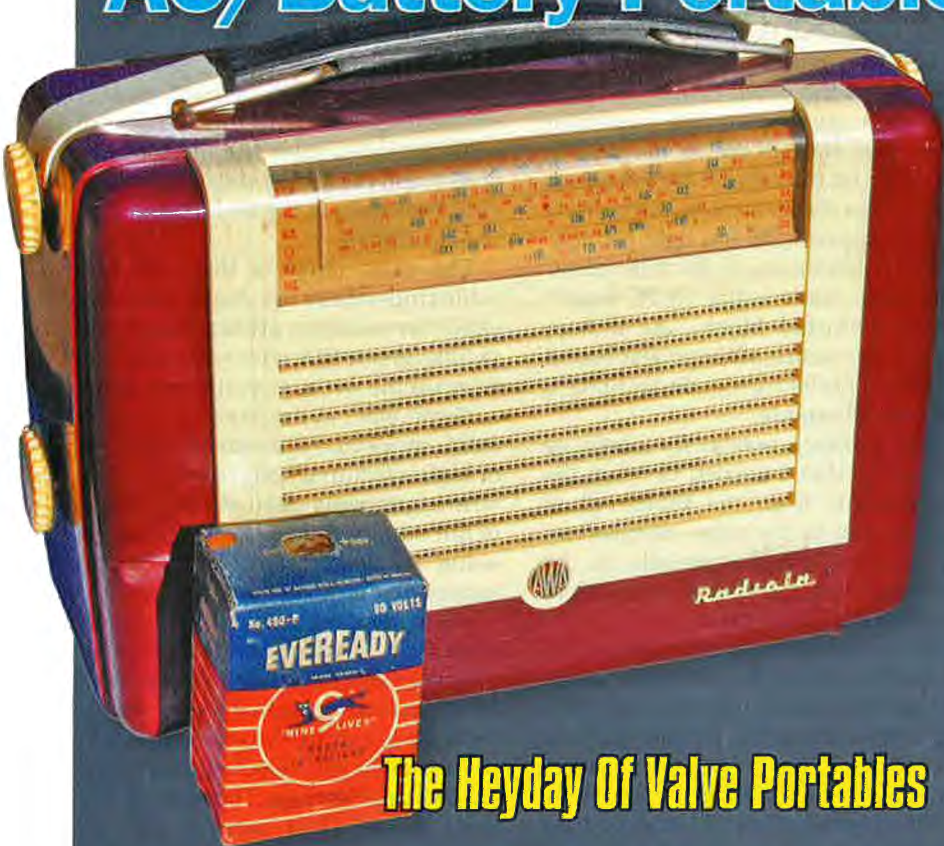
The AWA Radiola 653P AC/Battery Portable



The Heyday Of Valve Portables

First released in 1954, the AWA Radiola 653P was a 6-valve portable receiver that could operate from both batteries and mains power. It's a good performer that's easy to restore and get going.

COMMERCIALLY-manufactured portable valve radios first appeared around 1925 with the introduction of sets like the RCA26 6-valve receiver (see SILICON CHIP, August 2008). However, sets of the RCA26's calibre were well before their time and weren't particularly common.

In fact, early portables varied greatly both in terms of quality and performance. From 1925 onwards, a few manufacturers dabbled in making "portables" using 2V valves and vibrator power supplies but serious production of Australian-made portables didn't occur until 1939. That's because commercially-viable portables had to wait until the introduction of the octal 1.4V battery valves that required only 90V of high-tension (HT) supply.

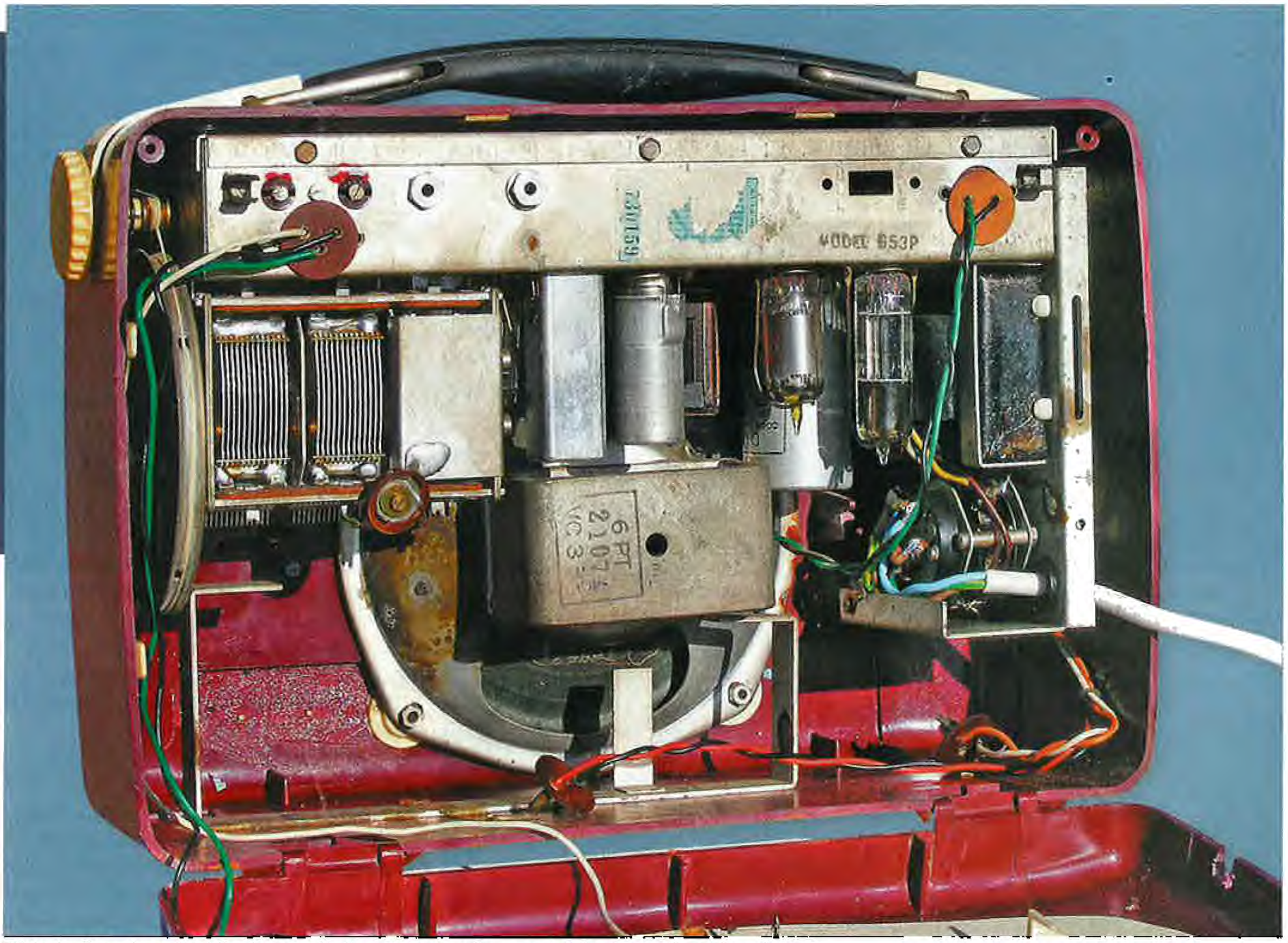
From that time onwards portables became more popular, although World War II slowed their introduction considerably. The octal 1.4V valves were subsequently commonly used up until around 1950, sometimes in combination with the much later 7-pin miniature types. After that, the 1.4V 7-pin miniatures were used almost exclusively.

The 1950s saw the development of good-performing 5-valve and 6-valve battery-portable receivers. These sets usually used a No.745 1.4V battery for the filaments and two No.482 45V batteries in series to give a 90V HT supply. This combination gave a battery life of around 300 hours.

Mains/battery portables

Because they could so easily be taken from room to room, many people also wanted to use portable sets in the home. As a result, the manufacturers developed portables that could be powered both from the mains and from batteries. This meant that the set could be run economically from the mains around the house, with the expensive batteries reserved for truly portable applications when no mains power was available.

In many cases, the batteries used in these sets were smaller than those used in the battery-only portables and



This is the view inside the Radiola 653P 6-valve portable. Note that the chassis is mounted upside down, with the valves secured in place using valve clips. The batteries are normally stored in the space at bottom left.

therefore had a shorter life. The AWA 653P AC/battery receiver described here was one such set.

To get around this problem, some manufacturers at that time experimented with "reactivation". This involved recharging the batteries from the mains (to a certain extent) to prolong their useful life.

Unfortunately, I've been unable to find any literature that indicates just how successful reactivation really was. I suspect that, used correctly, it may have extended battery life by up to four times.

Because reactivation was being used to recharge primary cells, set owners would have needed to watch out for leaking batteries. This could typically occur if the recharging process was not uniform in a cell, thereby causing some locations in a cell to be "eaten through" over a period of use and leak corrosive chemicals. In fact, the remaining HT battery from my set looks as though it has suffered from this problem.

The manufacture of valve portables (with or without reactivation) quickly ceased with the advent of transistor portables. The latter had many advantages: they were more compact, weighed less, consumed considerably less power and were much less expensive to run. The batteries in transistor sets not only lasted longer but also cost a fraction of those used in valve portables.

AWA 653P 5/6-valve portable

The AWA Radiola 653P first went on sale in 1954, a time that was right in the middle of the heyday of good valve portables. It can be powered from either mains AC or dry batteries and also includes provision for recharging the dry batteries.

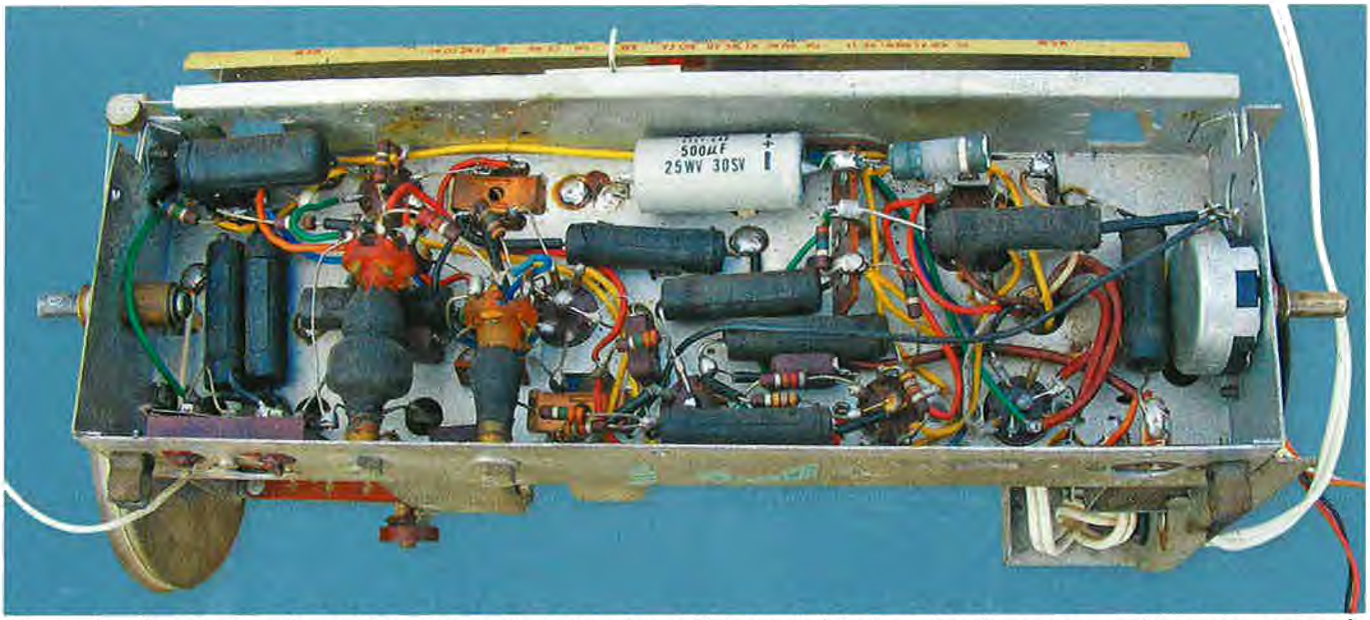
This set was housed the same plastic cabinet used for the battery-only version and measures 330 x 249 x 150mm (W x H x D), including the knobs and handle. As shown in the photos, the cabinet of my set is maroon and cream and features a slide-rule dial-scale at the top of the front panel. It weighs 4.7kg without batteries and just under 6kg with batteries.

At the top of the set is a carrying handle which is made of hard rubber. This handle drops down onto the top of the cabinet when not in use. The control knobs were mounted at the ends of the cabinet.

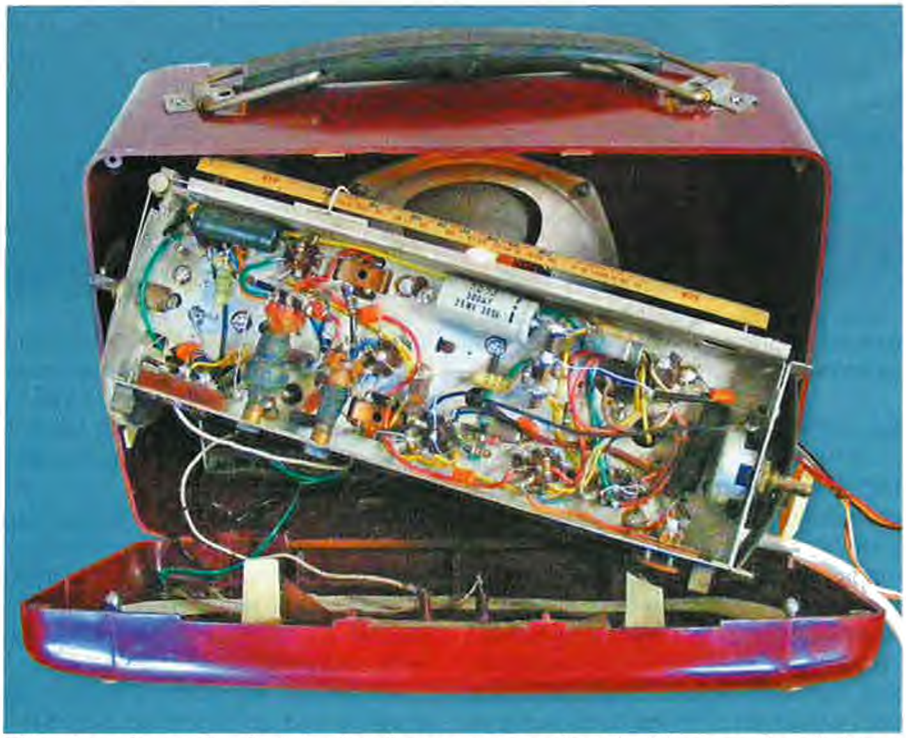
All in all, it's quite attractive in appearance but like other portables, it wasn't cheap. This set sold for 30 pounds and nine shillings in 1955, an amount that represented several weeks' wages for the average person.

Inside the set

Turning two screws at the back through 90° and then laying the back down gives access to the inside of the set and to the batteries and AC power lead. As can be seen in the photos, the chassis is mounted upside down at the top of the cabinet, with the AC power supply at the right. The valves are all



This under-chassis view shows the unit prior to restoration. All but one of the large black paper capacitors were replaced with polyester types. The original power cord was secured using a knot, which is now illegal.



This view shows the chassis after the paper capacitors had been replaced. An electrolytic filter capacitor was also replaced, along with two charred resistors.

held in position by clips, so that they don't fall out.

The six-inch speaker is in the centre of the cabinet against the front, while the two batteries sit on the bottom lefthand side of the case and are held in place by brackets. The AC power cord is stored in the space to their right, beneath the power supply transformer.

As in other valve portables of the era, this set employed a flat loop antenna. This is glued and held in place on the inside back panel of the set using clamps.

Circuit details

Refer now to Fig.1 for the circuit details of the AWA Radiola 653P.

As shown, the tuned loop antenna (L1) is connected to a radio frequency (RF) amplifier stage based on a 1T4 valve (V1). Its output is then applied to tuned RF transformer L2/L3 and fed to a 1R5 converter valve (V2).

Following V2, the signal is fed via 455kHz IF transformer L6 & L7 to IF amplifier stage V3 (1T4). This IF amplifier stage is neutralised via C17 in a bridge circuit. The amplified signal is then applied to a second IF transformer (L8 & L9) and from there to the detector/AGC diode in V4 (1S5). The detected audio is then fed via volume control R10 to a 1S5 pentode, amplified and fed to a 3V4 output stage.

Note that when AGC/AVC is applied to series-connected filament valves, care must be taken to ensure that the AGC not only works but that the bias requirements for each valve are met. As a result, I noted the voltage at the positive filament terminal of each valve so that the bias could be determined (note: the filaments are connected in series).

In this set, 9V is applied to V5, then 6V to V1, 4.5V to V2, 3.0V to V4 and finally 1.5V to V3 (note: V5 is a dual-filament valve). The AGC output from V4 is applied to V1 and V2 only.

A voltage divider network from the +6V rail consisting of resistors R1, R2 & R5 operates with the AGC bias (at the diode output of V4) to provide effective AGC to the two controlled stages (ie, V1 & V2). However, V3 has no bias applied to it all and runs at full output at all times.

By contrast, the 3V4 (V5) derives its bias from the +1.5V at V3's positive filament. This, together with the +6V at the 3V4's negative filament terminal, gives a bias of around -4.5V.

Power supply circuit

The power supply is more complicated than usual. That's because, as previously stated, the set can run from either mains or battery power. In addition, the supply is capable of providing charging current for the battery reactivation process.

The power switch has five positions labelled Full, Save, Off, AC and Reactivate. In the "Full" position, the 9V and 90V batteries are connected to the set.

When switched to "Save", a 1.8kΩ resistor is connected in series with the 90V battery to conserve power while in the "Off" position, both the batteries and the AC mains are disconnected.

In the "AC" position, mains power is switched to the transformer which then feeds a 6X4 rectifier (V6). Approximately 120V DC is produced at the output of the rectifier and this is dropped to 9V by resistors R12 and R13 which are switched in series with the filaments and to 90V by R14 for the HT supply. Capacitors C28, C29a and C29b do the filtering.

Note that because the rectifier is only a half-wave type, the filter capacitor values are considerably higher than for a full-wave system. This is necessary to ensure well-filtered supplies for the filaments and plates of the valves.

Note also that the AC power supply circuit layout is rather unusual in that the plates of the 6X4 valve are wired to chassis while the cathode is connected to the relevant secondary of the power transformer. This is opposite to method used to wire power supplies in normal AC receivers. It's done so that in the "Reactivate" mode, the 9V and 90V batteries are not connected to each other via a resistor string if the power is switched off at the mains instead of at the set.

Finally, when the power switch is in the "Reactivate" position, the two anodes of the 6X4 are separated so that the charging circuit for each battery is entirely separate. In this case, one still goes to chassis but the other is now connected to the negative terminal of the 9V battery.

Dismantling the receiver

Dismantling this set for service is straightforward. First, the three knobs are pulled off their control shafts although this was slightly difficult on this set because there was some paste or grease on the shafts that had partially solidified.

Next, with the back of the set open, I pulled the 90V battery out (it was the only one fitted) and disconnected it. Unfortunately, the battery plug had corroded due to battery leakage and broke but I had some spares on hand.

The antenna plug and the speaker

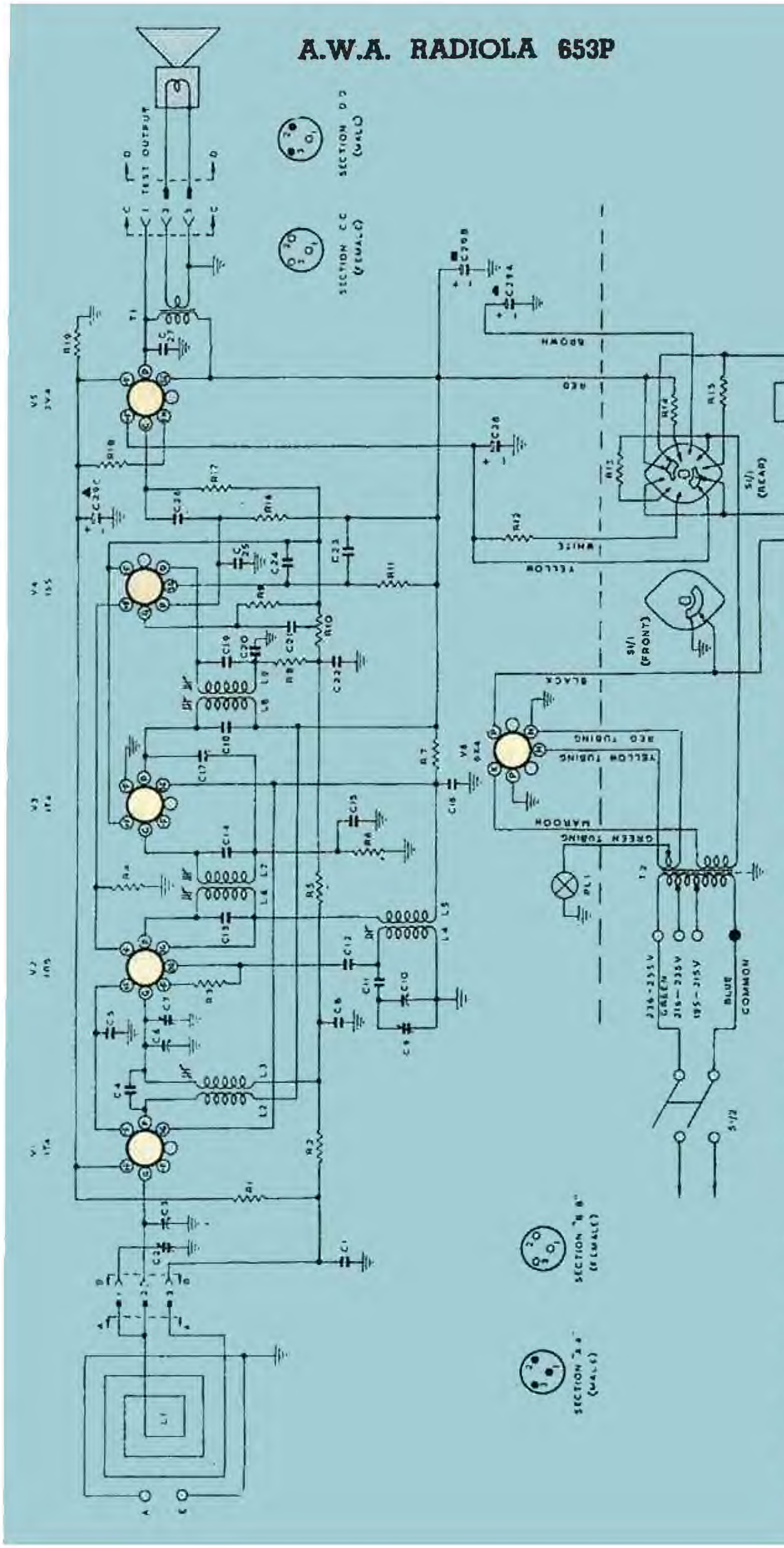
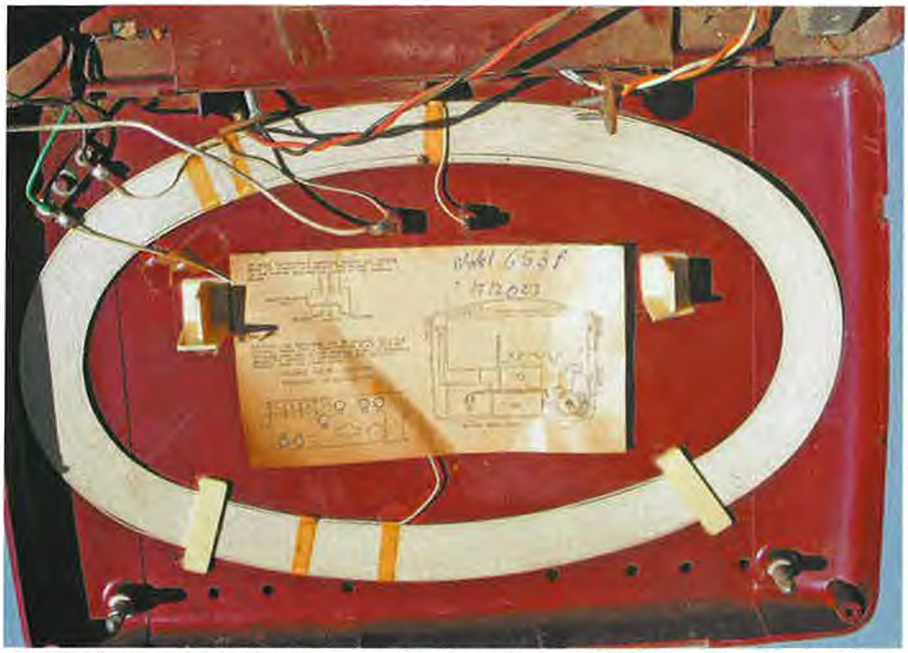


Fig.1: the circuit is a 6-valve superhet with power derived either from the 240V AC mains or from a 90V HT battery and 9V filament battery.



The flat loop antenna has its turns glued together and is clamped to the inside back of the cabinet. The attached note shows the valve locations and details how the batteries and power cord are stored.

plug were also removed and the earth wire from the chassis to the earth terminal was desoldered. The covers over the handle mounting screws were then removed, followed by the two screws hidden under the two higher knobs. This gave me access to the chassis retaining screws which were also removed.

That done, the chassis was lifted out of the cabinet, ready for restoration.

Once the chassis was out, the cabinet was dusted out and washed using soapy water and a sponge. The knobs were then given the same treatment, with any remaining gunk on the knobs and on the control shafts removed using kerosene.

Although the cabinet looked clean after this treatment, its surfaces were quite pitted due to a rather hard life. As a result, I attacked it using some automotive cut and polish cream and most of the marks disappeared. Some, however, were just too deep to be removed and so although the cabinet now looks quite reasonable, it's certainly not in pristine condition.

The chassis was cleaned using a kerosene-soaked kitchen scourer and the small amount of gunk that was on it came off quite easily. In fact, it came up quite well, with just slight discolouration in a few spots.

Restoring the circuit

In order to access the parts under the chassis, it's first necessary to remove a metal shield that's attached to the bottom. This is easily done by removing five self-tapping screws.

With the shield removed, inspection of the under chassis components revealed that virtually nothing had been done to the receiver during its life. At this point, it was time to make a few basic checks before I risked applying power to the receiver.

First, with the set turned off and disconnected from both AC power and the batteries, I checked the filament line for continuity. In practice, this involved checking between pin 7 of the 3V4 and chassis and I measured around 80Ω, which is the cold resistance of the filaments in the series valve string.

This was a good start but I did notice that two 3W resistors, R12 and R13, had been charred and blackened due to overheating. That wasn't so good, although both resistors still measured correctly.

Next, I endeavoured to test all the electrolytic capacitors even though my capacitance tester only covers values up to 40µF. These checks revealed that C28 was down to just 0.18µF, which meant that it was virtually open circuit. It was replaced with a 500µF 25V electrolytic.

The remaining electrolytics were all close to their correct values and so were left in circuit.

The paper capacitors were the next suspects, as most prove to have excessive leakage resistance. In high-impedance circuits, this alters the operating conditions of the valves and causes lots of problems. Replacement polyester or similar capacitors are cheap but for the sake of authenticity, I only replace those capacitors with excessive leakage.

If, for example, a paper capacitor is wired across a cathode resistor, I would not replace the capacitor, as even a capacitor with high leakage would not noticeably alter the operating conditions of the valve.

The resistors were also checked and these were all within their tolerance range of 20%. However, I did subsequently find it necessary to add an 18kΩ resistor in parallel with R12 to obtain the correct voltage on the filament line, even though the resistors in this line were within tolerance.

Sets of this era came fitted with 2-core (figure-8) power lead, so the chassis wasn't earthed. A figure-8 lead was also necessary in this set so that it could be "folded" up and fitted inside the case when the set was used as a portable.

In my case though, I wasn't going to use the set as a portable, so this didn't matter. As a result, I decided to earth the chassis in the interests of safety. This meant that I had to slightly enlarge the cable exit point in order to accommodate a 3-core cable. This cable was securely anchored using a cable clamp.

Testing & troubleshooting

At this stage, everything looked in order. Apart from the component changes, I had checked that there were no shorts on the HT line and had double-checked the filament supply line to ensure that no more than 9V would be applied to the valve filament string.

It was time for the smoke test. I plugged the mains power cord into the wall socket, turned the set on and after about 30 seconds, the receiver burst into life. It didn't exactly blast me out of the workshop but at least it was going.

Next, I checked the voltages applied to the valves. The HT line measured 85V and there was only about 6.8V going to the filament line. I then checked the voltage across filter capacitor C29A and it measured around 105V but should have been 120V.

So both the HT and filament voltages were low, which explained why the output of the set was so low. But what was causing the problem?

I checked the voltage across the transformer's secondary winding and found it to be 130V. This is correct so I tried replacing the 6X4 rectifier and the voltage rose to around 89V on the HT line and to about 7.5V on the filament line.

The HT voltage was now correct but the filament voltage needed increasing slightly. As a result, I tried connecting different value resistors across resistor R12 and finally settled on a value of 18kΩ, which brought the voltage up to 8V. This gave just over 1.3V across each of the 1.4V valve filaments, which is quite acceptable.

Alignment

Now that the voltages were correct, the set was performing quite well and it was time to check the alignment of the IF, RF and oscillator circuits. First, with the shield removed from the bottom of the chassis, I tweaked the four IF transformer adjustments while listening to a relatively weak station. They were all very close to correct alignment.

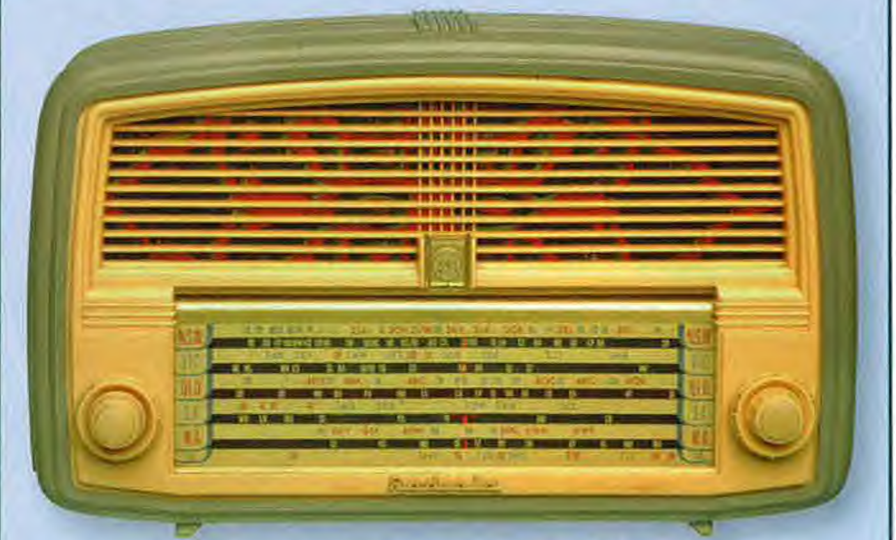
Next, with the shield plate refitted, I checked the oscillator circuits and the only thing I found was that the dial pointer was slightly out of position. Once this had been corrected, no further adjustment of the oscillator circuit was necessary. The set was then reassembled so that the remainder of the alignment could be done.

I began by tuning to the low-frequency end of the dial (around 600kHz) and adjusting L3 for best performance. That done, I then tuned to 2QN Deniliquin (1520kHz) and adjusted trimmer capacitor C7, again for best performance.

The final task was to align the loop antenna. There is no adjustment at the low-frequency end of the tuning range so only trimmer capacitor C2 has to be adjusted. However, this must be done correctly if the set is to perform well at the high-frequency end of the dial.

The antenna alignment is done with the back on the set, using a screwdriver inserted into the top lefthand access hole. It's then simply a matter of peaking the antenna trimmer (C2) for best performance at the high-frequency end of the dial (in my case, station 2QN).

Photo Gallery: AWA Radiola 573MA



MADE BY AWA in the mid-1950s, the Radiola 573MA was a 5-valve mantel set housed in a two-tone Bakelite cabinet. This one is grey and cream but many colour combinations were available. Behind the grille is a red & black floral motif fabric. The valve line-up was as follows: 6BE6 1st IF/mixer; 6BA6 RF amplifier; 6AV6 detector/AGC/audio amplifier; 6AQ5 audio output and 6X4 rectifier. Photo: SILICON CHIP.

Note that this adjustment is normally done with the batteries fitted (and the back closed). That's because the proximity of the batteries and any metalwork affects the capacitance across the loop antenna and hence its tuning.

In my case, however, I didn't have any suitable batteries, so the adjustment was done without them. This didn't really matter, since I don't intend fitting batteries to the set.

Once all the adjustments had been completed, the old Radiola 653P performed very well indeed.

6-90V DC-DC converter

Back in the early 1960s, I serviced many of these sets, along with similar sets from other manufacturers. They were all good performers in the rural area in which I lived.

Because 90V HT batteries are no longer available, running these receivers as portables is now impractical unless you have a 6-90V DC-to-DC converter. Fortunately though, one member of the Historical Radio Society of Australia (HRSA), Tony Maher, has developed such devices so that radios like this can be used as portables.

The 653P can be awkward to service, although access for maintenance while the radio is inoperative is quite reasonable except around the power switch. That said, it's a set that performs well and is a good unit to have in any vintage radio collection. SC