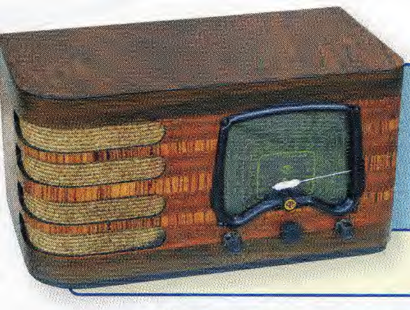
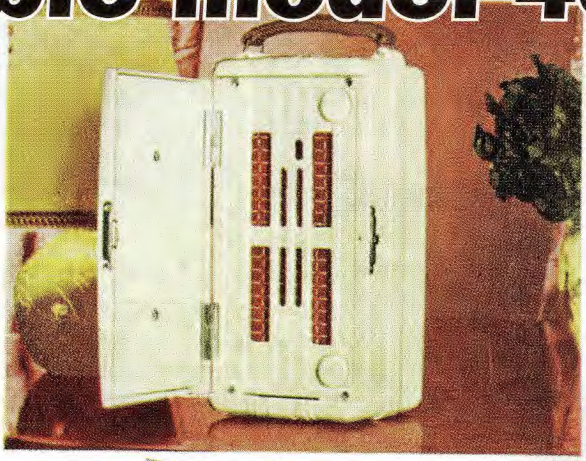


VINTAGE RADIO

By Associate Professor Graham Parslow

AWA 1948 compact portable model 450P



The AWA Radiola 450P is quite unusual for a portable and looks more like a small suitcase than a radio. At just 220 x 110 x 100mm, it is roughly comparable in size to an average mantel radio of the time. Most contemporary portables were much larger and built into a fabric-covered timber case.

From the 1920s onwards, there was a market for portable radios that had a role roughly analogous to contemporary mobile phones, as a form of portable entertainment. You can see its intended uses in the illustrations on the cover of the product booklet reproduced above.

The 450P model has become a collectors' item. Although they are reasonably common, they rarely come up for purchase. My good fortune in acquiring this example was due to the break-up of a remarkable radio collection, necessitated by the collector's poor health. Sadly, many other collections will likewise soon be broken up due the ageing demographic of most radio collectors.

The 450P opens up a bit like a 1940s fridge. However, there is a larger AWA mantel radio model 520MY that lays genuine claim to the fridge title. Iconic radios generally have a descriptor and being known as "the fridge" adds resale value.

But either through ignorance or commercial motivation, the 450P and other related models have been described this way too. So the 450P is often referred to as "the AWA Fridge".

The booklet shows a model 450P in cream. The Bakelite case is made of three moulded pieces: the lid, the top and the bottom. AWA made all of these parts in cream, black and brown. They offered the radio with all pieces the same colour or as a two-toned version with the top being a different colour from the rest.

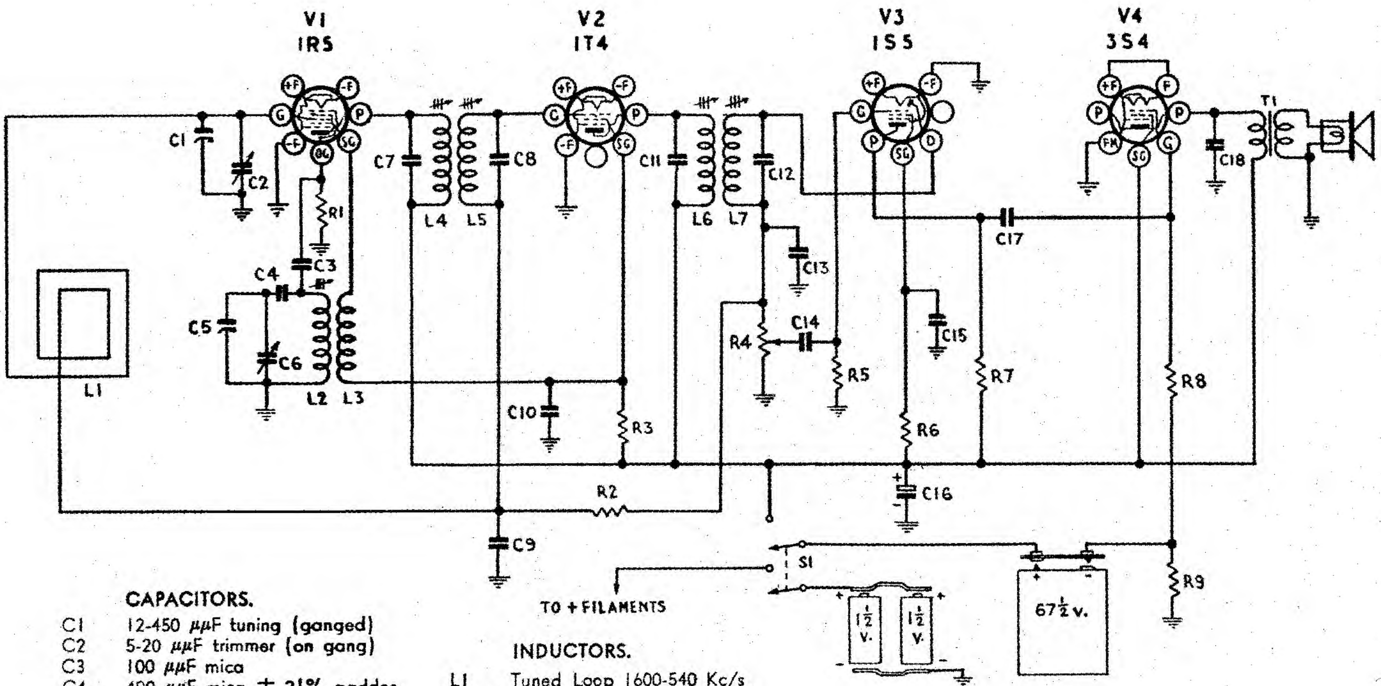
It weighs 1.8kg without batteries, so it is not too heavy to carry, at least not compared with contemporary portables. The lid has a restraint that only allows it to open by 90°, protecting the hinges from damage from overextension. But it looks odd if the radio is carried while switched on; it switches off automatically in the closed position.

Other portables of the time had provision for the lid to slide away, to leave an unobstructed front panel during use.

The unit I restored has a replacement carry strap. The original handle, which is shorter, can be seen on the cover of the product booklet.

Circuit description

The 450P is a minimalistic 4-valve superhet radio with a conventional line-up of battery valves. There is no RF amplification and only one IF amplifier stage. This minimalism, combined with the mass-produced moulded case, kept the price modest.



CAPACITORS.

C1	12-450 μμF tuning (ganged)
C2	5-20 μμF trimmer (on gang)
C3	100 μμF mica
C4	490 μμF mica ± 2½% padder
C5	12-450 μμF tuning (ganged)
C6	5-20 μμF trimmer (on gang)
C7	50 μμF mica
C8	50 μμF mica
C9	0.05 μF 200 v. working
C10	0.025 μF 400 v. working
C11	50 μμF mica
C12	50 μμF mica
C13	100 μμF mica
C14	0.0025 μF 600 v. working
C15	0.025 μF 400 v. working
C16	20 μF 200 P.V. electrolytic
C17	0.0025 μF 600 v. working
C18	0.01 μF 600 v. working

INDUCTORS.

L1	Tuned Loop 1600-540 Kc/s
L2, L3	Oscillator coil 1600-540 Kc/s
L4, L5	1st I.F. Transformer
L6, L7	2nd I.F. Transformer

RESISTORS.

R1	0.1 megohm ¼ watt
R2	6.3 megohms ¼ watt
R3	16,000 ohms ¼ watt
R4	1 megohm volume control
R5	10 megohms ¼ watt
R6	4 megohms ¼ watt
R7	1 megohm ¼ watt
R8	2.5 megohms ¼ watt
R9	800 ohms ½ watt

TRANSFORMER.

T1 Loudspeaker transformer

SWITCHES.

S1 Battery switch

LOUDSPEAKER.

3½ inch Permanent Magnet

Owing to an unavoidable shortage of 3S4 valves, a 1S4 has been used in some receivers.

If it is necessary to replace the 1S4 with a 3S4, the following must be done:

Disconnect the lead connecting pin 7 on the output valve socket to pin 7 on the 1S5 socket and remove the insulating sleeve. Then, re-connect the lead from pin 7 to pin 1 on the output valve socket and thence to pin 7 on the 1S5 socket.

A 3S4 valve may now be plugged in and the receiver operated as before.

Circuit diagram for the AWA Radiola 450P portable. It's a conventional 4-valve superhet set with no RF amplification and one IF amplifier stage (1T4 pentode) with an intermediate frequency of 455kHz.
Source: www.kevinchant.com/model-numbers-401---500.html

It retailed for £20.15s.9d.

The circuit here is reproduced from Volume VII of the Australian Official Radio Service Manual (AORSM). V1 (1R5 pentagrid-converter) is the mixer/oscillator, V2 (1T4 pentode) is the IF amplifier, V3 (1S5 diode-pentode) provides audio demodulation and preamplification and V4 (3S4 pentode) is the audio output stage, which operates in Class-A mode.

The large loop aerial is mounted inside the set's lid, behind the panel holding the station logging card. Interestingly, the electrical connections to the loop are made via the lid hinges. One wonders how reliable that would have been. Tuning is via a full-size dual-gang tuning capacitor (which only just fits in the case) that ranges from 12pF to 450pF.

The oscillator employs a tuned circuit based around transformer L2/L3 (which has a tuned primary), fixed capacitors C4 & C5 and tuning gang variable capacitor C6. The transformer primary is coupled to the second control grid (labelled "OG") of the 1R5, while the secondary winding is connected to the screen grids ("SG") and DC-biased by the HT supply, decoupled by resistor R3 and capacitor C10.

As the tuned signal from the aerial is fed to the main control grid pin ("G"), this is mixed with the oscillator signal and the result appears at the anode/plate ("P"). The gain of this stage is regulated by AGC fed through the aerial coil and resistor R2 (6.3MΩ). The resulting 455kHz signal passes to the IF amplifier, V2, via the first IF transformer, L4/L5.

After further amplification, the signal then passes through the second IF transformer L6/L7 and is fed to the diode within the 1S5 envelope for demodulation. Capacitor C13 removes the IF signal and the audio is then fed to 1MΩ volume control potentiometer R4. The signal at its wiper is AC-coupled by capacitor C14 to the grid of the 1S5 pentode, for further amplification.

The audio signal at its plate is then AC-coupled via another capacitor, C17, to the grid of the 3S4 pentode output valve, operating in Class-A. Unlike the more common 3V4 valve, it is designed to operate reasonably efficiently from the 67.5V B battery.

Power switch S1 is a spring-leaf type which is actuated by a metal pushrod. This protrudes into the opened case by 5mm, immediately behind the lid-locking catch. The switch's construction achieves two beneficial outcomes.

The B battery holder is located at upper left and the two A batteries on the right. This model was designed with a 3S4 pentode valve for the audio output stage, but due to its scarcity at the time, many models used a 1S4 instead.

Firstly, it serves as a double-pole switch to separately switch each battery. This is necessary because the HT battery does not connect directly to ground but instead, to 800Ω resistor R9, which provides grid bias for the 3S4 (around -7V). The switch's second function is to provide a spring release for the lid. When the catch is released, the lid pops up and the radio switches on.

Battery life

Most of the power consumed by this set is in the Class-A output stage based around the 3S4 output valve. That includes 5mA from the HT supply (more than half the 8mA total) and 100mA from the A battery (out of a total of 250mA).

As it's portable, the unit uses relatively small batteries. Fortunately, the low HT current means that the expensive B battery has a reasonable life.

According to the Service Instructions in the manual, the B battery would last four times longer than the A battery. Advertising for the radio claimed that the batteries would last for months of casual use.

Restoration

Despite looking cluttered, most of the components are more accessible than in many larger sets. The only difficult component to access is the 1R5 valve (V1), which is tightly boxed in by the B battery tray.

In their service notes, AWA provided the following procedure for chassis removal:

"Remove the back lid and withdraw

The front of the chassis is adorned by just the 3.5-inch speaker and tuning knob, with a tuning range of 540kHz-1600kHz. The volume control protrudes at lower left of the chassis.

The lid functions as an automatic on/off switch and the loop aerial antenna is taped to a wooden insert which screws onto the inside of the lid. The radio is typically shown standing upright, but here it is horizontal, with the volume knob at left, and the tuning knob on the right.

the batteries from their compartments. Open the front lid and pull the knobs straight off their spindles.

Remove the four mounting screws from the front panel and withdraw the chassis from the cabinet. Care should be taken when removing the chassis that the plunger operating the ON/OFF switch does not fall out and become lost."

I first powered up the radio using bench power supplies and the radio was utterly mute. It intermittently drew between 1-5mA from the HT supply, with the filament current varying between 100-150mA at 1.4V. The AWA manual states that the HT current should be 8mA and by summing the valve data, the total filament current should be 250mA.

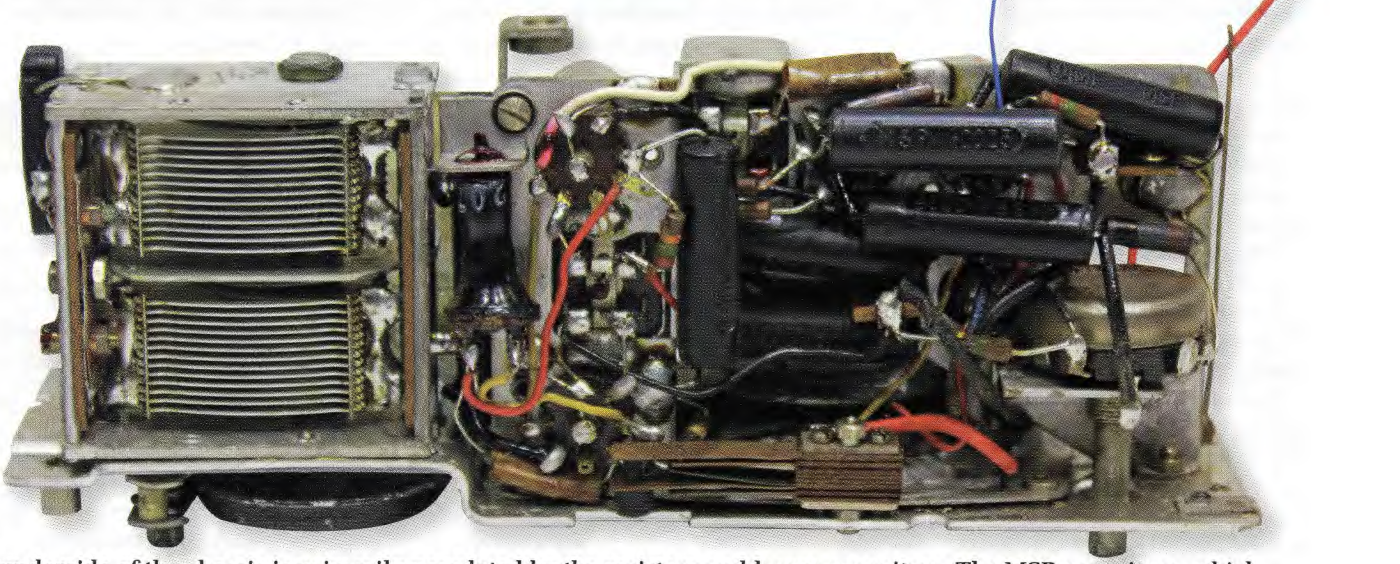
Cleaning the oxidised valve pins restored the filament current to 250mA but the HT drain remained at 5mA and the radio was still completely silent.

The modest HT current at least meant that the HT filter electrolytic capacitor C16 was still serviceable (a Tecnico 20µF 200VW in a white cardboard sleeve, mounted above the chassis).

Jiggling the valves (something that I did almost subconsciously) increased the HT current to 10mA but the radio remained silent.

Most capacitors in this radio are MSP types, colloquially described as "melted chocolate". They are notorious for having cracked cases, resulting in no contact between the axial leads and the capacitor foils.

In this radio, all the capacitors looked to be in excellent condition



The underside of the chassis is primarily populated by the resistors and larger capacitors. The MSP capacitors, which surprisingly still worked in this set, are coated liquorice-black and marked with "MSP" and their capacitance value. The leaf-spring power switch can be seen at the bottom centre.

and indeed none needed replacing. A handy feature of the MSP capacitors is that the capacitance value is clearly visible, as it is moulded into the case.

Editor's note: MSP stood for Manufacturers Special Products, a division of AWA which made a very large range of radio hardware items; tuning gangs, all sorts of switches, loudspeakers and significantly, those "chocolate" capacitors.

While the majority of MSP devices have stood the tests of time, the capacitors are generally cracked and have very low insulation resistance; that is, if they work at all. That this set had MSP capacitors which were OK is surprising indeed.

So why was the radio silent? The most common reason for this is an open-circuit output transformer primary winding because the fine wire is highly prone to corrosion and going open circuit.

I was dreading this because the small transformer was going to be a challenge to replace. Fortunately, I measured almost the full HT voltage at pin 2 of the 3S4 (the anode), indicating an intact output transformer primary.

I used an old-fashioned analog resistance meter to check the continuity of the secondary of the output transformer, which gave a reading of around 1Ω, as expected. Significantly, there was no crackle from the speaker as I made contact with the meter leads. Close inspection showed that one fly lead to the speaker voice-coil was corroded and open-circuit.

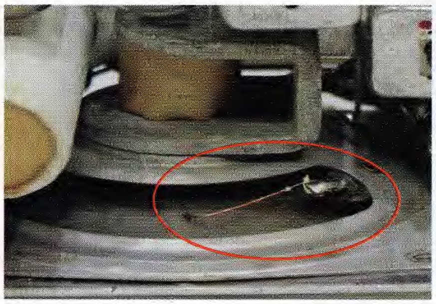
There was battery-leakage corrosion close by on the metalwork, so the speaker was collateral damage.

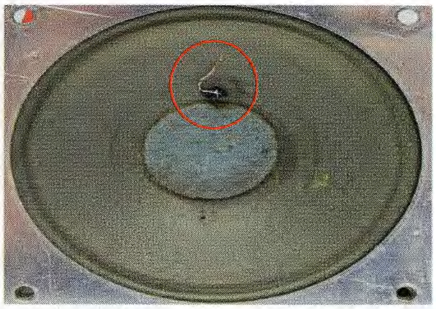
I hoped that I could fix this without replacing the 3½-inch speaker as it was unlikely I would find an exact replacement and would have to make some changes to accommodate a different speaker.

Fortunately, I was able to temporarily solder a new fly lead to the voice coil and the speaker then crackled encouragingly when tested with the analog resistance meter.

The replacement lead was fed through a hole in the speaker cone and soldered to the small tail of the voice coil wire emanating from the felt centre cap (see the two photographs above).

This restored the audio section. Feeding audio input from a CD player to the 3S4 grid produced surprisingly





A lead was fed through a hole in the speaker and soldered to the voice coil lead to restore the audio section.

clear audio, so the speaker was working very well.

This repair will do until I can find a suitable replacement, a very light multi-strand wire which is able to cope with the vibrations of the speaker cone.

The 3S4 grid bias was -7.0V (textbook perfect) but I still couldn't tune in any stations. I then discovered that a lead from the grid of the 1R5 mixer valve to the loop aerial was shorted to ground because the rubber insulation had failed and bare wire was touching the chassis. A replacement lead restored the set's operation but there was a lot of noise and low sensitivity, making for unsatisfactory listening.

My next thought was that there was a dry solder joint, compromising the signal path. I then prodded various solder joints with a multimeter probe, simultaneously checking voltages and also the mechanical integrity, as I was listening to see whether there was any change in the set's behaviour as I did so.

Contact with a couple of joints produced a miraculous transformation to excellent performance but it was not a dry joint problem. Simply providing an extra antenna at the front end (ie, the multimeter leads) was what made the difference. The antenna effect was better at the plate of the 1R5 than at the grid.

I discussed this puzzling situation with Ian Batty (my fellow Vintage Radio contributor). Ian took the radio and confirmed my observations. Serendipitously, Ian resolved the problem by simply aligning the IF stages (see table below). With hindsight, I should have done this myself.

The aligned radio handily produced the 150mW output that the 3S4 is capable of on local stations. The promotional advertising for the radio claims "beautiful tone and exceptional range".

The sound is fine but the "exceptional range" claim is hard to credit, given the limitations of the bare-bones circuit and small antenna.

In summary, it is an interesting set, not so much for its very basic circuit but for its unusual presentation in that polished Bakelite case.

Few people would recognise it as a portable radio, at the time or now, many decades later. **SC**

Operation	Connect high side of generator to:	Tune generator to:	Tune receiver dial to:	Adjust for maximum peak output:
1	Aerial section of gang (front portion)	455kHz	540kHz	L7 (core)
2				L6 (core)
3				L5 (core)
4				L4 (core)
Repeat above adjustments until the maximum output is obtained				
5	Inductively coupled to loop [A coil of 3-turns of 16-gauge D.C.C wire about 75mm in diameter should be connected between the output terminals of the test instrument and placed co-axial with the loop]	600kHz	600kHz	LF oscillator core adjustment (L2) [rock tuning control back and forth through the signal]
6		1500kHz	1500kHz	HF oscillator adjustment (C6)
7				HF aerial adjustment (C2)
Repeat steps 5-7 until the maximum output is obtained				

Alignment steps for the AWA Radiola 450P, from the service manual.