VINTAGE RADIO

Philips 1948 table model 114K

By Associate Professor Graham Parslow

The 114K radio is one set in a series of similar radios made by Philips, and was among the last all-octal radio designs, due to decreasing stock in the post WW2 era. The radio is otherwise a fairly standard six valve superhet, but weighs in at a hefty 12kg.

For 12 years, this radio sat in my storage shed because I considered it an ugly duckling, but events conspired to change my opinion recently. So I got it out of storage to see if I could clean it up.

I purchased this radio in a lot with other radios which I was more interested in. Recently, a friend who worked for Philips some time ago told me that one of his managers used this model of radio at his house, and took great pride in having it.

That started me wondering if I had judged it unreasonably. The COVID-19 lockdown inspired me to look at my back shelf for a project. Hence, a large grubby radio entered my restoration queue, emerging resplendent, and much elevated in my estimation.

1948 was three years after the end of the Second World War, and radio manufacturers were slowly exhausting stocks of large 8-pin octal valves before moving to 7-pin and 9-pin miniature valves. At that time, many radios used a mixed lineup of octal and miniature valves to best utilise their inventory.

The model 114K is among the last of the all-octal radios. It is also among the last of the multiple timber veneer cabinets. Through the 1950s, almost all timber cabinets were simplified to single veneers (usually stained), and cabinets were changed to easily fabricated shapes; mostly rectangular.

The model 114K is a heavyweight table radio at 12.2kg, measuring 560mm wide, 245mm deep and 360mm high. It has an eight-inch Rola permanent magnet speaker (type 8K) that produces excellent sound from the baffle provided by the substantial cabinet. That sound is also optimised by circuitry that is consistent with a premium radio.

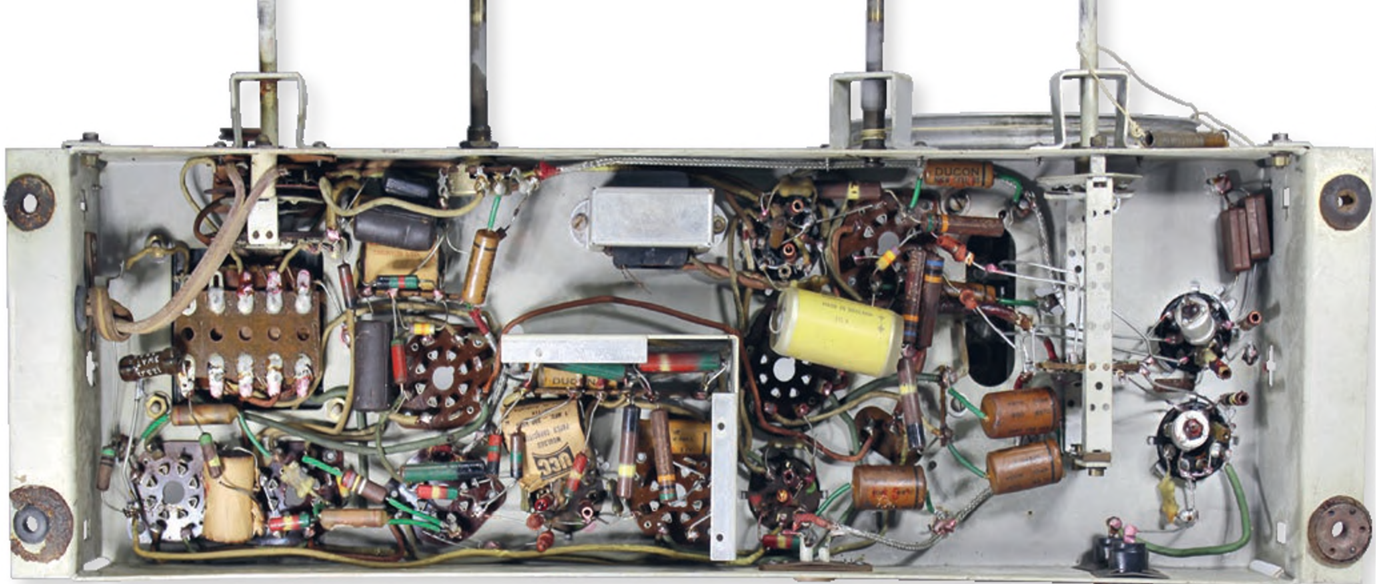
The 114K sold for £46/17s/00d, more than double the price of contemporary Bakelite kitchen radios, which were usually in the range of 15-20 pounds (£).

Unusual design

This radio conforms in style to a series of late-1940s Philips radios with the dial mounted at the top. As the premier model, this dial articulates so it can be laid flat for moving the radio. On lesser models, the glass dial was fixed, although it could be removed and slotted back in.

The advertising angle to promote this set was that while others fill the front with a dial and a small speaker, Philips builds in a large unobstructed speaker and puts the dial on top.

If you are unconvinced, then you have good grounds, because this was not a good idea. One indicator is that other manufacturers did not follow. The yellow screen-printed station information is difficult to read without



Shown here is the underside of the chassis before restoration. The components with green-sleeved leads had already been replaced by a previous owner.

a black background, and the printing is easily damaged or eroded while cleaning.

Exposed at the top of the cabinet, a large number of those dials were broken by misadventure. Philips realised the downsides to this design, and moved their dials to the main face in the 1950s.

A brief history of Philips

Philips began their rise to become electronic industry leaders after founding a light globe business in Holland in 1891. A light globe can be frivolously referred to as a "monode", but it did not take Philips long to add electrodes to the envelope and create a range of thermionic valves.

The edge that Philips initially enjoyed with their Miniwatt range was the high emission efficiency they achieved at lower filament current than their competitors; a crucial advantage for battery operation. By 1933, Philips had manufactured 100 million valves and led the world in quantity and quality.

Valves with an E prefix (eg, ECH and EL) follow European designations. Philips made these valves in Europe and at Hendon in Adelaide for the Australian market.

The mixer valve in this radio is an ECH35, released in Europe in 1939. The red-painted opaque envelope on an ECH35 covers a metallic coating that acts as an RF shield while the primary grid is connected via a top-cap.

The photo of the top of the chassis shows the uncramped layout of this large radio; all the components follow a linear arrangement by function. The speaker and output transformer connects to the octal socket adjacent to the power transformer.

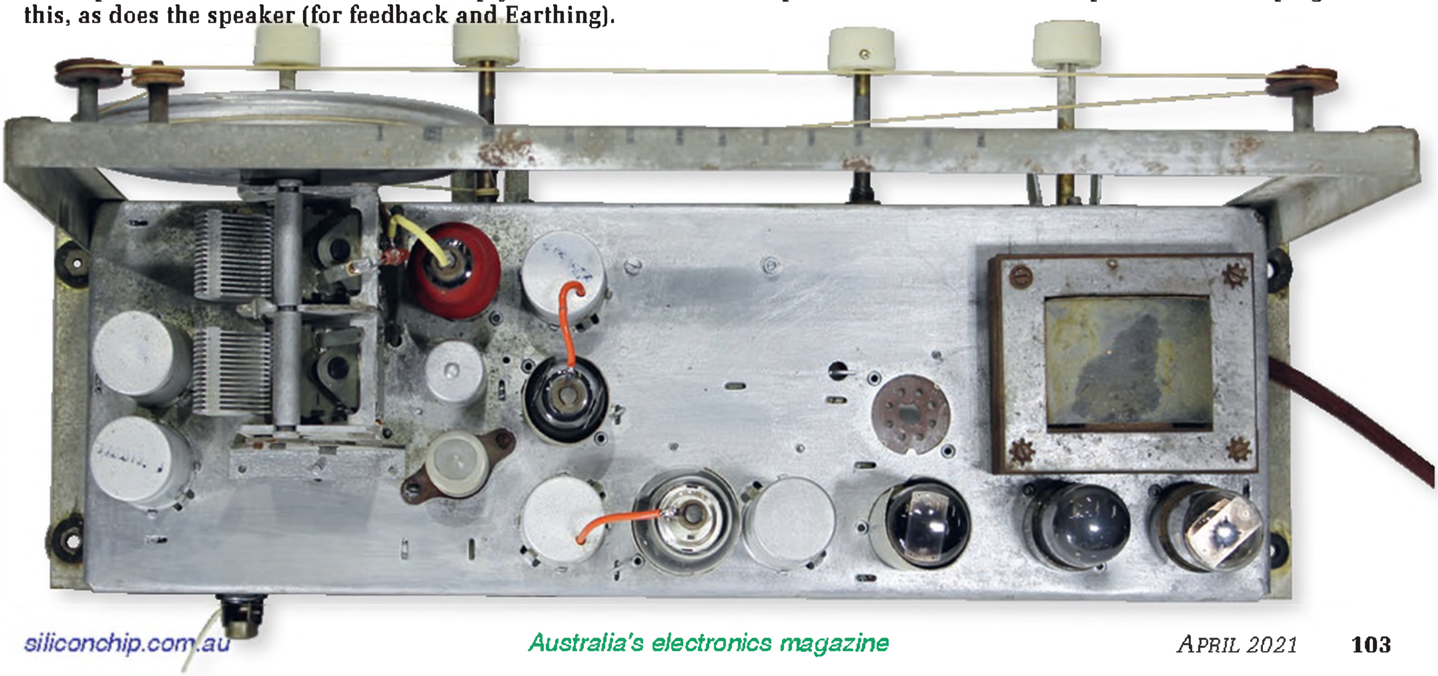
Circuit details

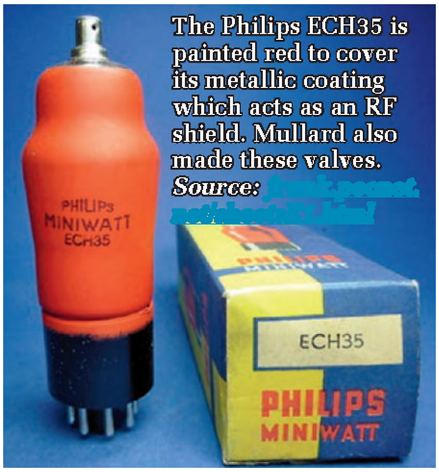
The radio tunes two bands, 530-1620kHz (medium wave [MW], AM broadcast band) and 5.9-18.4MHz (shortwave [SW]). The RF input is from a conventional external aerial with L1-2 tuning MW and L3-4 tuning shortwave.

The aerial coil is in the indented can that is seen at the far left in the rear view of the chassis (page 106). These indented cans are an immediate give away of manufacture by Philips.

C47 (5pF) is included to improve the aerial transformer's primary-secondary coupling towards the top end of the MW

The top view of the chassis shows an empty octal socket next to the power transformer. The output transformer plugs into this, as does the speaker (for feedback and Earthing).





The Philips ECH35 is painted red to cover its metallic coating which acts as an RF shield. Mullard also made these valves. *Source:*

Valve Function	Valve No.	Valve Type	Plate Volts	Screen Volts	Osc. P. Volts	Cathode Volts	Bias Volts	Bias Resistor
Frequency Converter	V1	ECH35	255	44	100	1.0	—	R3
1st I.F. Amplifier	V2	6K7GT	255	69	—	0	—	—
2nd I.F. Amplifier	V3	6K7GT	245	83	—	0	–2.5	R24
Demodulator, A.V.C. and 1st Audio	V4	6SQ7GT	90	—	—	0	—	—
Power Amplifier	V5	6V6GT	230	255	—	0	–13	R24 & 26
Rectifier	V6	6X5GT	Unfiltered B+ to B– 305 volts					
Dial Lamps	6.3V 0.32A tubular screw							

NOTE: These voltages are measured across the resistors, or from the socket points indicated, to chassis, using a "1,000 ohms per volt meter." They may vary ± 10% from the quoted figures. The receiver should be in a "no signal" condition.

Power Supply	220-260 volts, 40/60 c/s.
Tuning Ranges	B/C Band, 530-1,620 Kc/s. S/W Band, 5.9-18.4 Mc/s.
Intermediate Frequency	455 Kc/s.

This table (from the service manual) shows what each valve in the set does.

band, so there is a balanced sensitivity across the MW spectrum.

Band change switch A1 has a third position to select pick-up from a two-hole socket at the rear of the set, while also disconnecting the radio signal from the output.

Overall, the circuitry around the ECH35 mixer valve has no surprises beyond featuring only a two-gang tuning capacitor in a six-valve radio. The tuning capacitor is full-sized in this radio, slightly ahead of the introduction of much smaller brass-plate capacitors used by Philips through the 1950s.

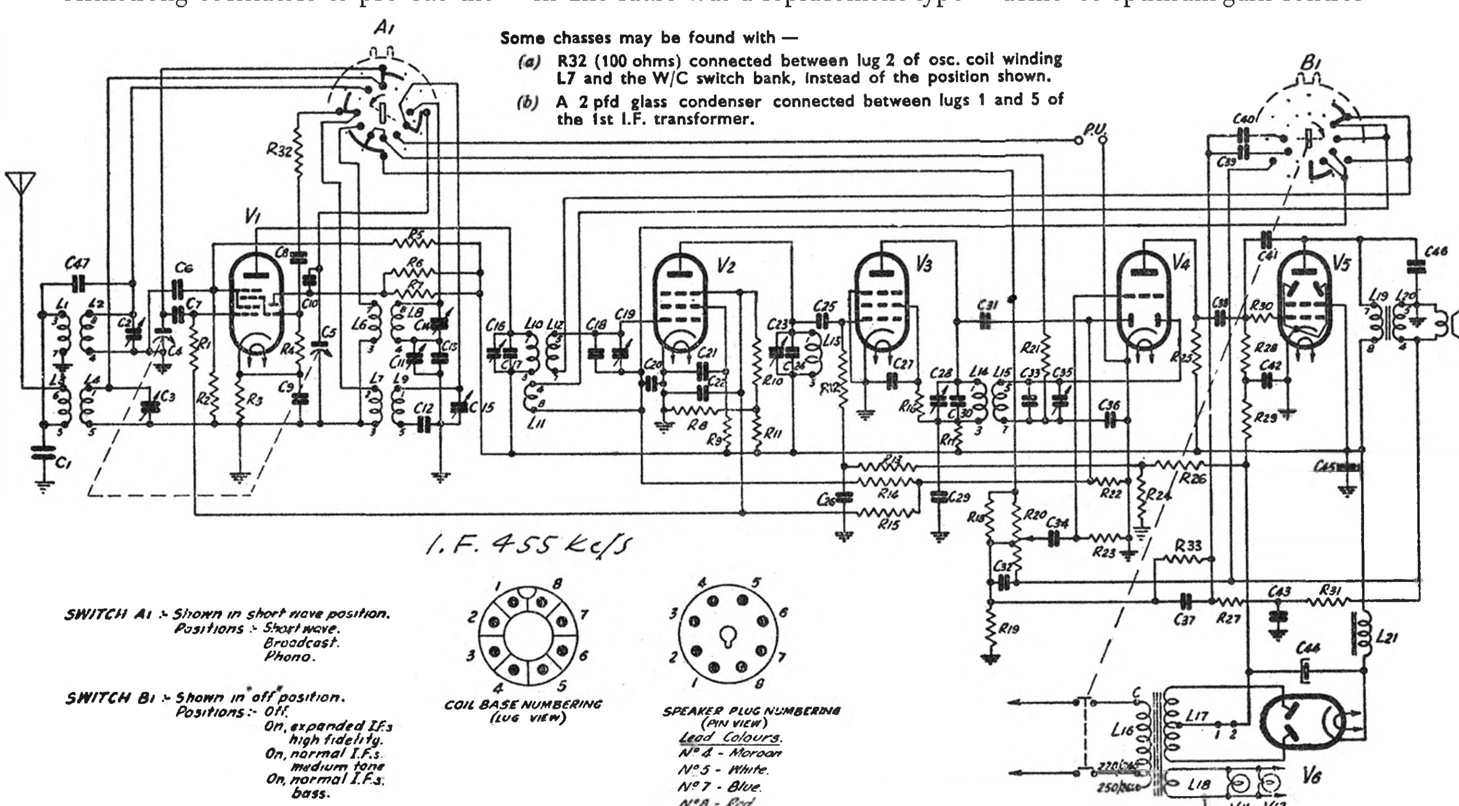
The local oscillator (inductors L6–9) has two sections configured as Armstrong oscillators to provide the heterodyne signal that generates the 455kHz intermediate frequency (IF) difference signal. The local oscillator coils are housed in an indented can, identical to the aerial coils, and mounted adjacent to the tuning capacitor and aerial coils above the chassis.

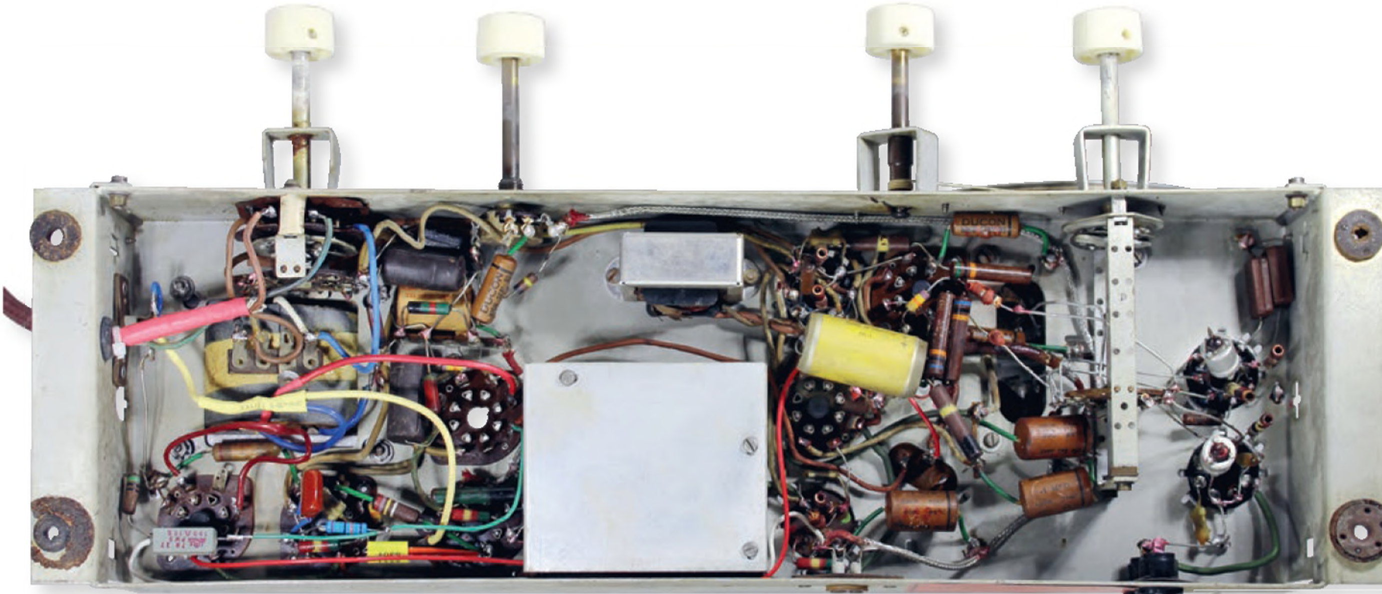
Instead of featuring an RF preamplifier stage, this radio has two IF amplifier stages that also increase its gain and selectivity. The IF amplifier stages cascade two 6K7GT valves; or at least, these were the types installed at manufacture. GT types have glass envelopes in a tubular shape (hence "GT") that can be fitted with a cheap cylindrical metal shield.

However, the second IF amplifier in this radio was a replacement type 6K7G (not GT) that has the classic larger shouldered valve profile. The original GT type shield had been deformed to shroud the larger valve. It looks odd, but it works.

The first IF transformer is not a standard IF transformer, because L11 is connected to the grid of V3 when switch B1 is set to select "expanded IF high fidelity". The effect of L11 is to broaden the bandwidth passed by the IF transformer, so higher audio frequencies are less attenuated.

Valve V4 (6SQ7) has two diodes providing negative AGC voltages which are fed to V1 via R15 (2MΩ) and to V2 via R16 (100kΩ). Splitting the AGC line in this way is unusual, but achieves optimum gain control.





The underside of the chassis after restoration. The rubber insulation on the valve top-cap connectors had to be replaced, along with several damaged wires. A few resistors and capacitors were also changed, as they were out of tolerance.

The audio signal passes from the 6SQ7 triode through resistor R21 to switch A1, which then routes it back to volume control potentiometer R20 (500kΩ) unless the switch is set to select the external pick-up.

R20 features a fixed tap with additional components to strengthen bass frequencies. In addition to "high fidelity", the three-position tone control switch B1 offers two top-cut positions using C39 (6nF) or C40 (50nF).

For a top-shelf radio, it is unusual to see such a simple set of choices for tone, but the circuitry ensures that the three options focus on optimising listening for the broadcast content. This optimisation includes frequency-filtered negative feedback from the speaker (L20, connection #4).

The well-established 6V6 beam-tetrode (V5) completes the circuit for audio amplification. The 6V6 cathode is connected to the chassis so the grid bias, specified as -13V, is generated by R24 (35Ω) and R26 (150Ω).

HT power rectifier V6 is a 6X5 with an indirectly-heated cathode. This radio generates over 300V between the 6X5 cathode and filament. In radios manufactured earlier than 1948, the most common valve in this application was a 5Y3 that had a 5V filament which also served as the cathode. It took some time to find an efficient way to isolate a cathode from arcing to a nearby heating filament.

Radio construction

An odd feature of all the tuned circuits in the IF section is the absence of tuning slugs in the inductors to align the set to 455kHz. Fine-tuning is instead achieved by cheap wire-wrapped stick capacitors that are inconvenient to work on after leaving the factory. Not to mention that some are at lethal high tension. Thankfully, the radio worked well as received, so I didn't need to alter the alignment.

Some Philips models of this era are notorious for being unstable due to stray capacitance. The IF stages in this radio have additional shielding under the chassis, and I have taken two under-chassis photos, one with the shield cover plate removed and one with it installed.

Restoration – the cabinet

Restoring a timber cabinet will always take several days for completion, so it is logical to start on the case and perform electrical troubleshooting in parallel.

Developed through the 1920s, the original finish was nitrocellulose. This starts with glossy clarity, but slowly decomposes to produce brown oxides of nitrogen trapped within the nitrocellulose matrix. The result is mellow golden hues that are

CAPACITORS

No.	Description
C1–17–18–24–30–33	150 pfd mica
C2–3–15	30 pfd glass trimmer
C4–5	2 gang tuning 114 114A
C6–9–27–29	0.01 mfd 600v. paper
C7–8–10–25–36–41	100 pfd ceramic
C11–16–19–23–28–35	125 pfd ceramic trimmer
C12	0.0045 mfd mica
C13	400 pfd mica
C14	30 pfd air trimmer
C20–22–26–34–37–42	0.1 mfd 200v. paper
C21	0.1 mfd 400v. paper
C31	33 pfd ceramic
C32	0.001 mfd 600v. paper
C38	0.004 mfd 600v. paper
C39–46	0.006 mfd 600v. paper
C40–43	0.05 mfd 200v. paper
C44–45	24 mfd 350v. electrolytic
C47	5 pfd glass

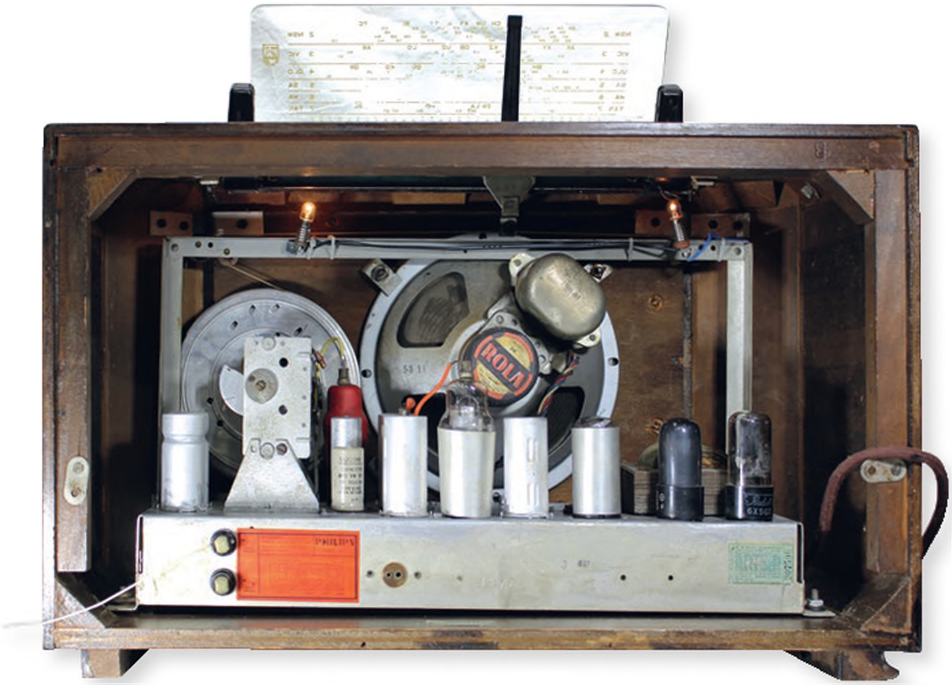
RESISTORS

No.	Description
R1	0.5 megohm 1/2W carbon
R2–8	50,000 ohms 1W carbon
R3	150 ohms 1W W/W
R4–30–33	50,000 ohms 1/2W carbon
R5–9–16	100,000 ohms 1W carbon
R6–7	60,000 ohms 1W carbon
R10–23	5 megohms 1W carbon
R11–25	250,000 ohms 1W carbon
R12–21–22–28	250,000 ohms 1/2W carbon
R13–14	1 megohm 1/2W carbon
R15	2 megohms 1/2W carbon
R17	1,000 ohms 1W carbon
R18	150,000 ohms 1/2W carbon
R19	2,500 ohms 1/2W carbon
R20	0.5 megohm tapped potentiometer
R24	35 ohms 1W W/W
R26	150 ohms 3W W/W
R27	5,000 ohms 1/2W carbon
R29	100,000 ohms 1/2W carbon
R31	1,000 ohms 1/2W carbon
R32	100 ohms 1/2W carbon

COILS

No.	Ohms	Description
L1	22	Aerial Coil
L2	4	
L3	1.5	
L4	<0.5	
L6	2.3	Oscillator Coil
L7	0.5	
L8	5	
L9	<0.5	
L10	5	1st I.F. Transformer
L11	0.7	
L12	5	
L13	7.5	2nd I.F. Choke
L14	6.0	3rd I.F. Transformer
L15	6.0	
L16	30	Power Transformer
L17	300	
L18	<0.5	
L19	650	Speaker and Transformer 5,000 ohms
L20	0.5	
L21	450	Filter Choke

The circuit diagram for the Philips 114K radio. The circuit doesn't have any component value labels, so the parts list scanned from the AORSM is reproduced here.



This rear chassis shot shows the size of the Rola speaker. The dial lamps were initially installed with incorrect orientation, this was fixed in the image below.

often valued in vintage musical instruments.

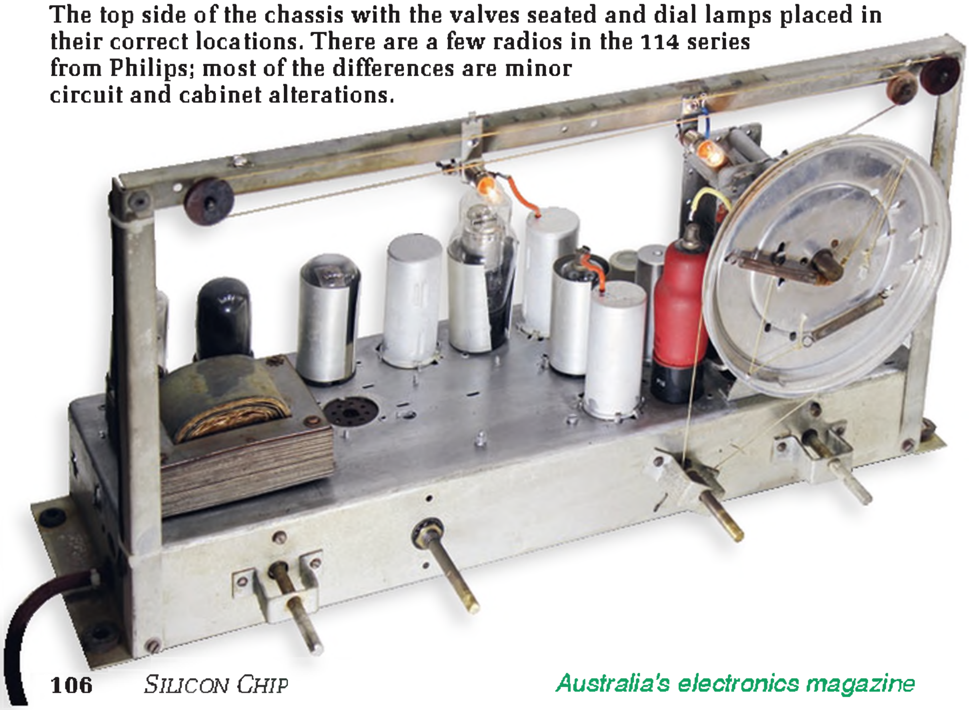
Spraying contemporary polyurethane finishes over nitrocellulose commonly produces an undesirable reaction resembling heat blistering. This is because nitrocellulose and its degradation products are chemically related to the polyols that react with isocyanates to create polyurethane.

The only way to avoid this is to completely remove the nitrocellulose and start with bare timber before applying polyurethane.

This radio was re-finished with satin spray-Cabothane purchased at Bunnings. Paint stripper, metal scrapers, heat guns and abrasives are all possible approaches to removing nitrocellulose. In this case, I used P40 coarse garnet paper.

I have found the coarse grit resists fouling with the abraded material, so it is reasonably economical with the consumables. However, the use of P40 abrasive does require care to stop penetrating the veneer and exposing the base ply below.

The top side of the chassis with the valves seated and dial lamps placed in their correct locations. There are a few radios in the 114 series from Philips; most of the differences are minor circuit and cabinet alterations.



Another requisite is to work only with the timber grain and not cut across it. Although the timber surface is left somewhat rough after P40 abrasives, there is no need to sand with finer grades because that is best done after stabilising the surface with two coats of polyurethane. I use P400 silica abrasive to sand back between finishing coats (three finishing coats in this restoration).

Another part of this restoration was restringing the broken tuning system. It turned out to be less intuitive than it looked, and the photo of the front of the chassis shows the result.

That photo also shows two dial globes that were installed to replace the blown original globes. At first I believed that the original globes were captive in the Bakelite mouldings at the side of the dial, however they are behind clip-on covers that can be prised off by a small blade inserted into the joint.

A reproduction dial was purchased to complete the cabinet. The original dial with partly erased printing is shown in the photograph to the left.

Restoration – electrical

The rubber insulation on the valve top-cap connectors was badly perished, as were several links below the chassis.

After replacing this wiring, it was time to check the transformer without valves installed. At switch-on, the transformer dissipated 20W, rising rapidly to 200W. Fortunately, a replacement transformer was at hand.

Some components sleeved with green tubing had been previously replaced. After replacing some additional out-of-tolerance resistors and some dubious capacitors, switch-on was disappointing – it did nothing.

The radio was only consuming 20W, and the HT from the 6X5 rectifier was a mere 145V. A replacement 6X5 was the answer to bring the HT rail up to the expected value.

A signal injected to the 6V6 output grid produced audio, but nothing when a signal was applied to the grid of the 6SQ7. The 6SQ7 had an open-circuit filament; replacing it led to a functioning radio, drawing 41W.

This proved to be a satisfying project in all aspects of the restoration. A bonus, by analogy to George Orwell's novel 1984, was that I came to love Big Brother. SC