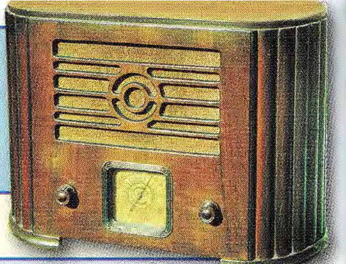
Vintage Radio



By Associate Professor Graham Parslow

HMV 1955 Portable Model 12-11

If you think the HMV set featured this month looks very similar to the model B61D featured in the June 2017 issue, you are quite right. But even though both sets use the same battery valves, the same case and even the same chassis, there are significant differences in their circuits.

How can that be? Partly this is explained by the fact that the later set has a 4-valve superhet instead of five valves but offsetting this is fact that it can be powered from batteries or from its inbuilt 240VAC mains supply.

Externally, there are few differences between them since the same case was used for a number of HMV portable radio models between 1951 and 1956.

One subtle difference between the 12-11 and B61D is in the brass Little Nipper badge on the front. There is a line across the bottom of the 1955 badge, while the 1951 badge had the words "HIS MASTER'S VOICE" instead. The badge on the model 12-11 does contain those words but they are written in a smaller font, below the image of Little Nipper (the dog listening to His Master's Voice from the gramophone) and above the horizontal bar.

When I received this radio, the exterior was quite grubby but internally it was quite clean. Luckily, the exterior cleaned up well and now matches the clean sound that it produces, which is about as good as a portable of this type can get.

The circuit

The speaker and some other components on my set are stamped February 1955, so this one is reliably dated. Its circuit appears in the 1955 compilation of the Australian Official Radio Service Manual (AORSM) and is reproduced in Fig.1.

Both these sets use the same chassis and the same loop antenna with external aerial coupling. However, there was a welcome change in the later 12-11 set with the use of a plug and socket connection of the aerial to the chassis so that the back can be easily removed. The loop antenna is part of the first tuned LC circuit.

And that is where the first major change to the circuit becomes apparent in that there is no tuned RF amplifier stage and the top of the chassis reveals an unused hole for the missing valve.

At the same time, the tuning condenser is 2-ganged rather than 3-gang and with no RF preamplifier, the tuned signal feeds directly into the control grid (pin 6) of the 1R5 pentagrid frequency changer, V1.

From that point on, the arrangement of the four remaining valves in this largely conventional superhet circuit is quite similar to the B61D model. It has an almost identical 1R5 frequency changer circuit and the intermediate frequency is the same at 457.5kHz.

Neutralisation

This radio has a neutralisation capacitor, shown on the circuit diagram connecting the two grids of the 1R5 via the local oscillator; its value is not specified.

Neutralisation in valve circuits refers to cancelling the effect of internal inter-electrode capacitance in order to reduce its tendency to oscillate and this also usually improves the stage's bandwidth.

Typically the neutralisation capacitor is connected between a point which is 180° out of phase with the anode of the mixer stage and its control grid. Often, a tap on the IF transformer, or the IF transformer secondary is the connection point and so the IF transformer provides the necessary phase inversion. This provides positive feedback at lower frequencies, improving bandwidth.

But at higher frequencies, inherent phase shifts, including those due to the reactance of the neutralisation capacitor, cause this feedback to become negative and this is why it reduces the tendency of the amplifier to oscillate at an unwanted frequency.

In this circuit, the connection of the neutralisation capacitor is a little unusual. V1 drives the local oscillator at 457.5kHz above the tuned station's frequency.

Now the input and output sides of the oscillator are normally 180° out of phase at the oscillator's operating frequency. In this case, they are the anode (pin 2) and grid (pin 4).

So the designers have taken advantage of this existing phase inversion from the anode of V1 and are simply connecting the neutralisation capacitor between the local oscillator and main control grid.

The signal path is slightly different for neutralisation (via C2 rather than C3) but the phase shift of both paths will be similar and hence the neutralisation is effective.

There has been some correspondence to the Editor recently about the subject of neutralising, with much disagreement over exactly how it works. To look into the topic a little more deeply you might like to start with the Wikipedia entry at **https://en.wikipedia.org/wiki/Neutrodyne**

HIS MASTER'S VOICE 12

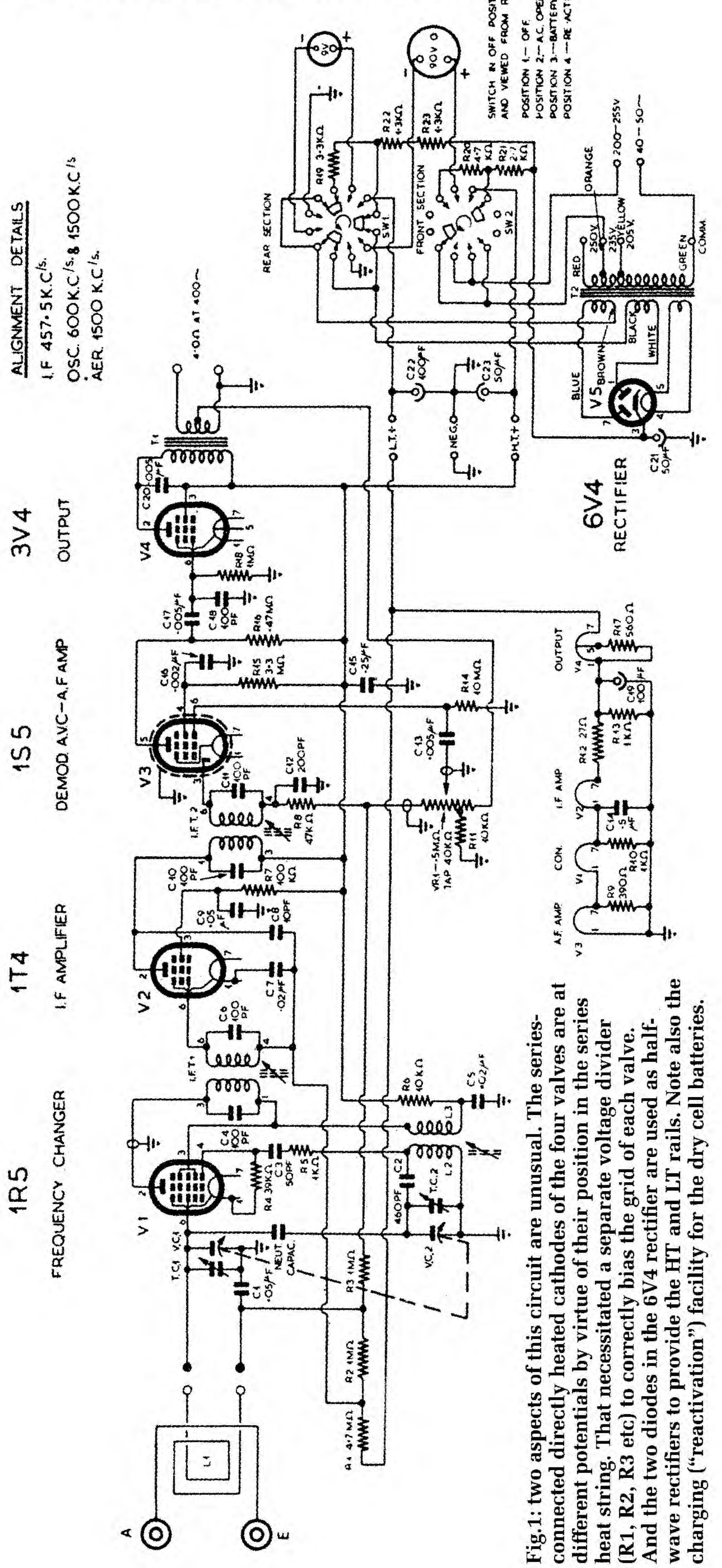
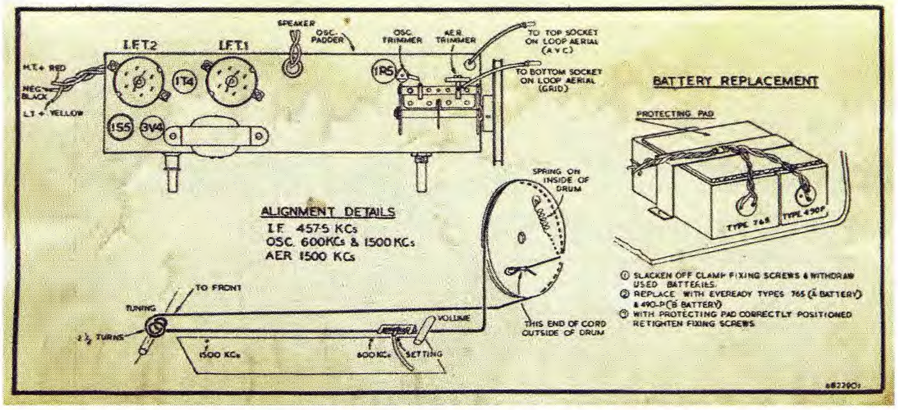


Fig.1: two aspects of this circuit are unusual. The series-connected directly heated cathodes of the four valves are at different potentials by virtue of their position in the series heat string. That necessitated a separate voltage divider (R1, R2, R3 etc) to correctly bias the grid of each valve. And the two diodes in the 6V4 rectifier are used as half-wave rectifiers to provide the HT and LT rails. Note also the charging ("reactivation") facility for the dry cell batteries.



Reproduced from a label stuck to the underside of the chassis, this diagram shows the dial cord stringing arrangement, chassis arrangement, battery replacement instructions and the alignment frequencies.

IF stage and biasing

Moving on now, IF transformer IFT1 feeds the 475.5kHz signal to the 1T4 IF amplifier, V2. This stage is stabilised by shunt capacitor C8.

The amplified signal is demodulated by the diode in the 1S5 valve (V3) and the audio appears across R8 in series with the volume control VR1. The junction of these two resistors becomes more negative under strong signals and this provides feedback for automatic volume control (AVC, otherwise known as AGC).

At this point, it's worth mentioning the somewhat unusual biasing arrangement in this set.

Both mixer/oscillator V1 (1R5) and IF amplifier V2 (1T4) have different negative AVC bias voltages applied to their grids via resistors R1, R2 and R3. V2's screen grid is connected to HT via a decoupling network comprising R7 and C9, while V3's screen is similarly connected to HT via R15, filtered by C16.

Series-connected filaments

All the filaments of the five valves in the earlier B61D model ran from a 1.5V cell but in this set, all the filaments are connected in series to run from a common 9V B supply which can be a battery or the in-built 240VAC mains supply.

Note that these are directly heated cathodes and that means for V1-V4, the cathode connection at pin 1 is shared with one side of the filament (heater). And that means that the cathodes of V1-V4 are all at different potentials. V3's cathode is at ground potential while V1 is higher, V2 higher again and V4 the highest.

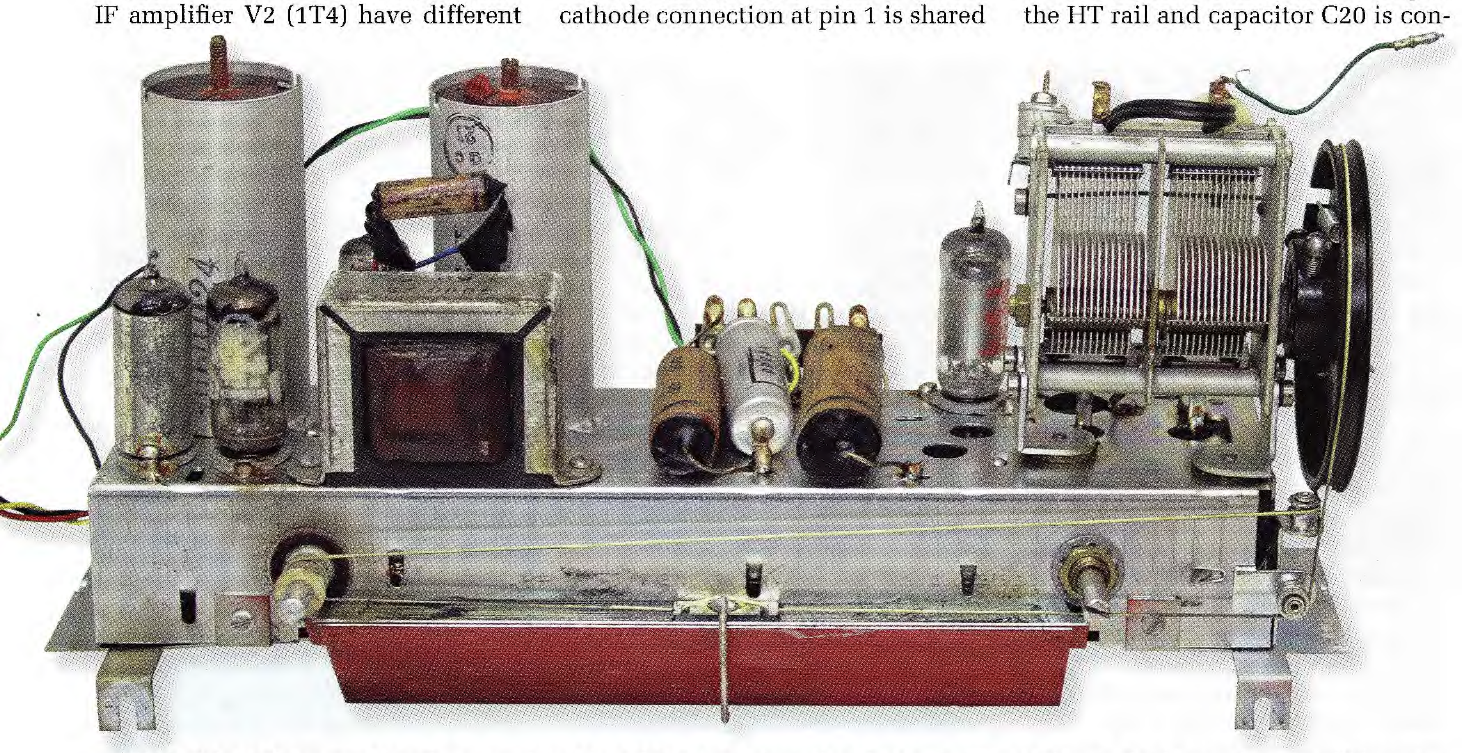
This meant that the designers had to go to special lengths to correctly bias the grid of each valve and this was arranged in two ways. First, while the grid of V4 is connected to chassis via a 1MΩ resistor (R8), the grids of the other three valves connect to a voltage divider comprising three high value resistors (R1, R2 & R3) together with the volume control VR1.

At the same time, three of the four heaters (V1, V3 and half of V4's tapped heater) are shunted with resistors and these have been chosen to fine-tune the grid bias voltages of the various valves. Note the two RC filters in the filament network, to reduce the noise and ripple coupling into the most sensitive stages, V1 and V2.

Audio amplification

Audio from volume control pot VR1 is AC-coupled to the pin 6 control grid of V3 (1S5) which is the first audio amplification stage. The signal is then coupled by C17 to pin 6 of V4, the control grid of the 3V4 output pentode.

V4's screen is connected directly to the HT rail and capacitor C20 is con-



While this is the same chassis as used for the HMV B61D described in the June 2017 issue, the layout is quite different with four valves rather than five, a 2-gang tuning condenser rather than a 3-gang unit and three extra capacitors.

nected across the speaker transformer to limit the audio bandwidth.

Negative feedback from the speaker output is provided by a centre tap on the output transformer secondary, which is fed back to the bottom of the volume control pot. The volume control is earthed via the output transformer so the signal to the 3V4 valve is diminished by subtracting an out-of-phase waveform.

Resistor R11 is connected between a tap on the volume control pot and ground and presumably helps to ensure that there is no output with the volume control wound fully down and may also serve to linearise the operation of VR1.

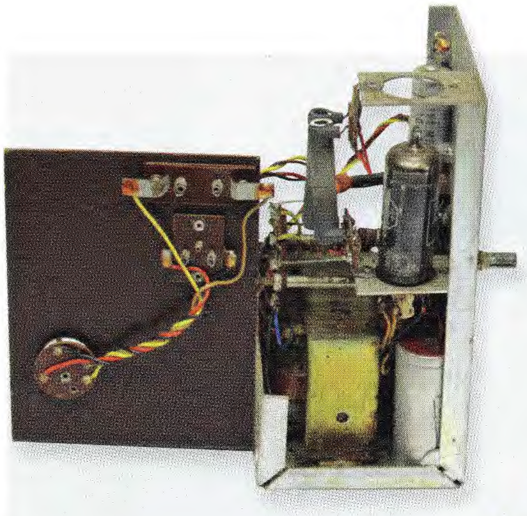
Power supply

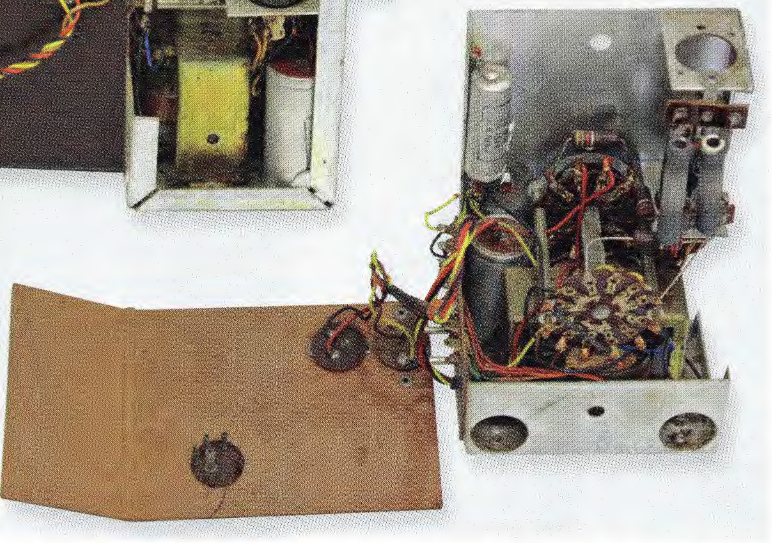
The separate 240VAC power supply might look conventional, being based on a 6V4 rectifier valve (V5). However, the 6V4's two diodes are cleverly used separately, to produce both the HT and LT rails, providing half-wave rectification for each.

A limit on maximum current and the relatively high internal resistance of the 6V4 rectifier (around 160 ohms) makes a 1.5V supply providing 300mA impractical.

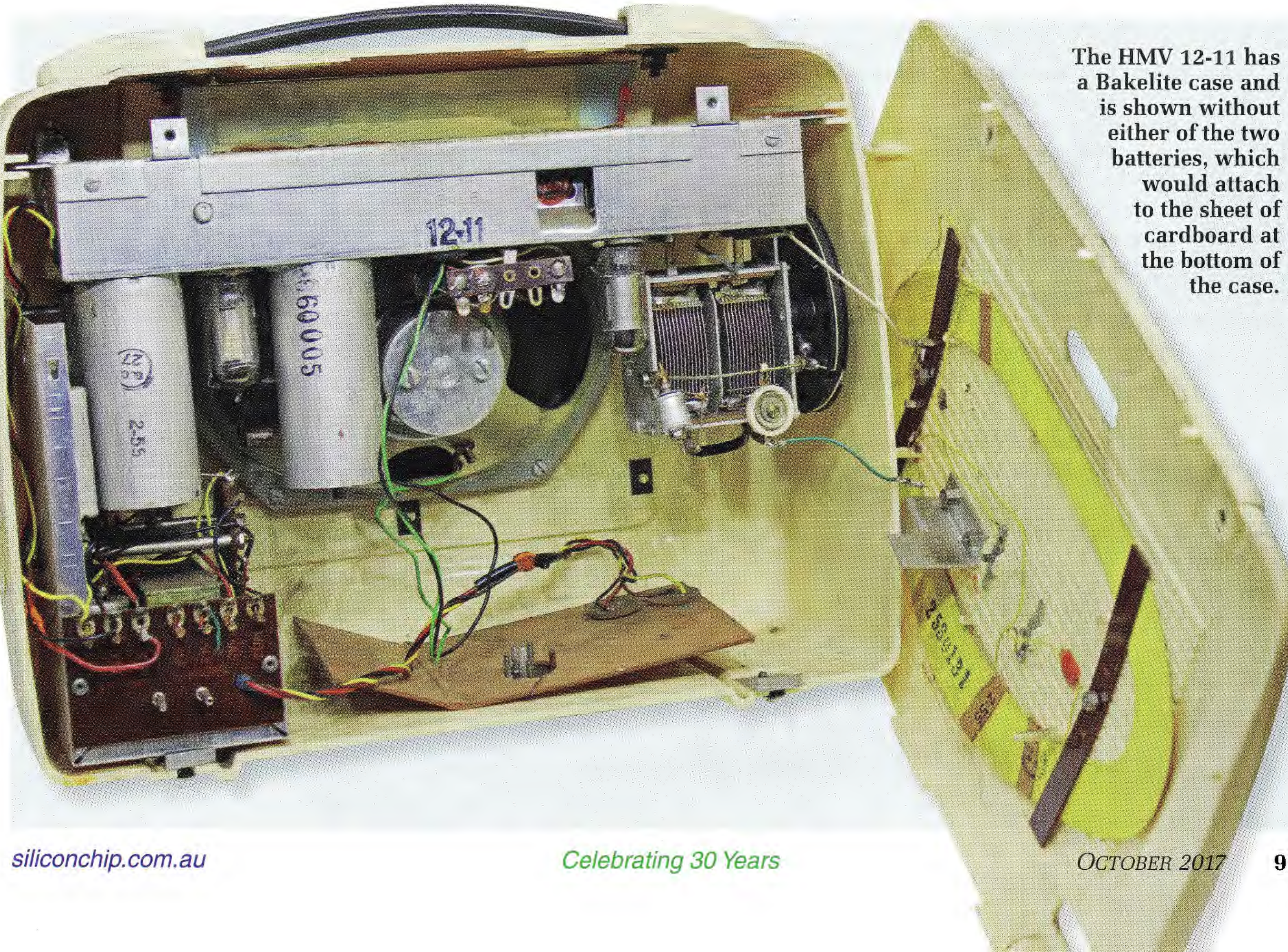
Instead, the LT unit in this radio produces 20V without load which reduces to 10V under load (close enough to the nominal 9V of the battery). Using a bench supply, this radio drew 55mA at 9V which is close to the AORSM specified value of 47mA.

The HT rail was measured as 79V from the on-board supply, a bit lower than the nominal 90V but this made





The power supply module, with the mains transformer and 6V4 rectifier, was designed to be shoe-horned into the case of the radio (see photo below).



The HMV 12-11 has a Bakelite case and is shown without either of the two batteries, which would attach to the sheet of cardboard at the bottom of the case.

little difference to performance as assessed by using a bench supply varied between 80V and 90V.

The power supply simply incorporates series ballast resistors to reduce the voltage to the nominal 9V and 90V rails based on expected current drain. By long-standing convention, the 9V "A" and 90V "B" batteries are physically separate.

The model information glued to the top of the chassis, behind the tuning dial, shows a user how to install Eveready battery types 765 (9V) and 490P (90V).

However, an intriguing extra came with this radio. The two connectors for separately plugging into the "A" and "B" batteries were plugged into an adaptor built on strong cardboard. It served to combine the two plugs into a single plug for a battery pack offering the "A" and "B" batteries in one package.

This seems to have been an innovation for HMV in 1955 because neither the packaged information with the radio nor the AORSM data mention the adapter.

Other manufacturers had used single battery packs from at least 1951. The Eveready type 753 combination battery incorporates a dummy-pin hole, set off-centre to promote correct insertion of the connector.

Battery reactivation

The side of the radio has a knob marked OFF/AC/BAT/RE-ACT. The circuit diagram shows how two Oak wafer switches in the mains power unit control these functions.

In RE-ACT mode, the set is off but the mains power supply is connected across both batteries for trickle-charging, with extra series resistors to limit the charge current to trickle levels. HMV provide the following instructions for battery reactivation:

"After the receiver has been operated on its internal batteries the power switch should be set to the RE-ACT position and the mains supply to the instrument turned on. The period of reactivation should be approximately six hours for each hour of use on dry batteries. As an example a receiver operated for two hours on dry batteries would require twelve hours reactivation and this could conveniently be done overnight."

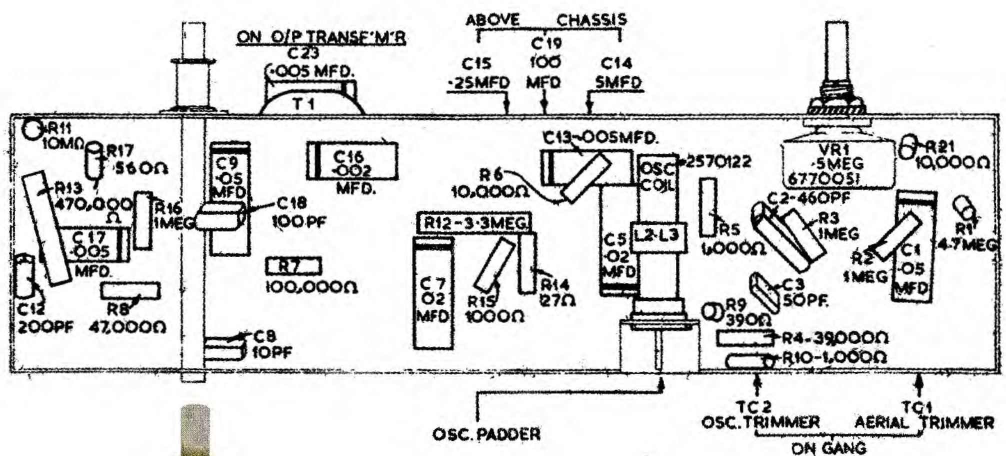
"Although the time of reactivation is not critical within an hour or so, it is important not to exceed the recommended period by any considerable margin. The ratio of reactivation to battery usage time applies only to the last daily period used."

"For example should the receiver be used on batteries for a total of two hours daily for three days without re-activating, then the reactivating period would be twelve hours, based on the last period of two hours usage."

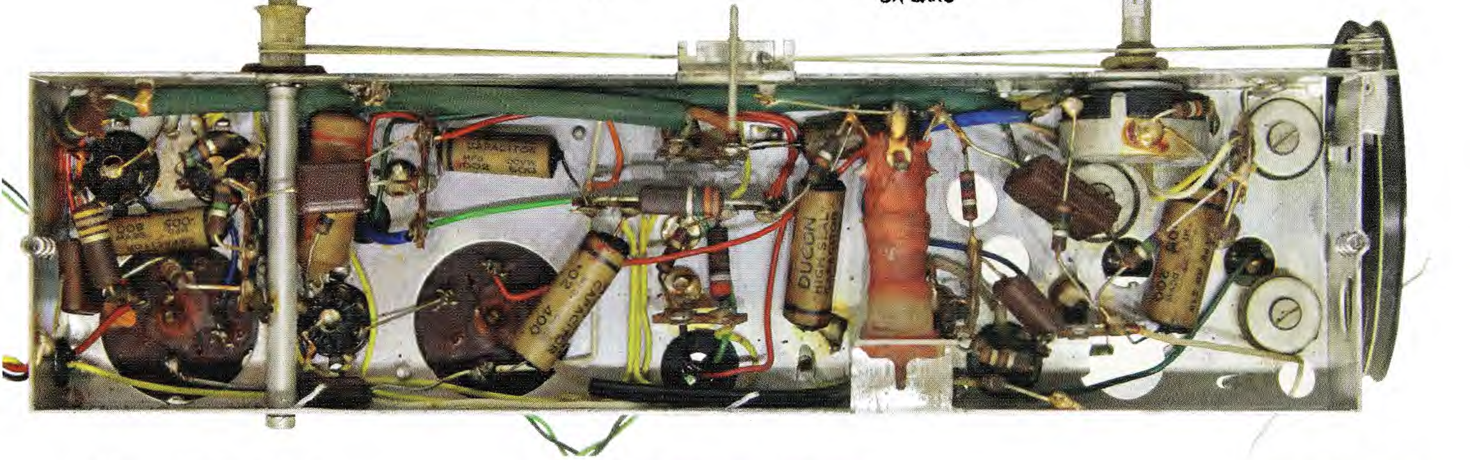
"The cost of power taken from the electric supply mains for reactivation is very low. On the basis of power costing 3d [three pennies] per unit, the cost of a reactivating charge of twelve hours would be approximately one third of a penny."

While HMV referred to it as reactivation, this shows that charging of carbon-zinc batteries has been around for more than 60 years, even though battery manufacturers normally do not recommend charging of any primary batteries.

Reversing the chemical reaction that creates battery current is a simple matter of chemistry, but the advisability of doing so is another matter. During reactivation, there would also be elec-



The under-chassis layout of this set is much less cluttered than the B661D set described earlier, mainly due to the omission of the RF amplifier stage valve.



Just for reference, here is what the set looked like pre-restoration. You can see the dial is slightly cracked along the Queensland section.

trolysis of the aqueous electrolyte releasing hydrogen gas.

Reactivation does not create a magic pudding of inexhaustible power because the chemistry is not completely reversed.

Modern alkaline batteries can likewise be regenerated, through perhaps ten cycles, and there are many commercial products to do this. See the discussion at https://en.wikipedia.org/wiki/Recharging_alkaline_batteries

The speaker

The 1951 model previously described had a round 5-inch speaker that was labelled HMV. This 1955 model has a larger 5x7-inch elliptical speaker branded EMI and this would have been manufactured at the Homebush plant in Sydney.

The HMV brand was first used by the Gramophone Company UK in London in 1921 for gramophones and records. In 1931, The Gramophone Company and The Columbia Company merged to form Electric and Musical Industries (EMI) and began manufacturing radios. HMV radios were made in Australia from 1936 at Homebush.

From the mid-1950s onward, all HMV radios, valve and transistor, carried an EMI logo on the speakers. The HMV radios of the time were also badge-engineered as Kelvinator with some modified case work. Using EMI as the speaker brand disguised its origin at HMV.

AWA did the same thing when it branded speakers MSP (Manufacturers Special Products) so that other manufacturers would not be overtly conflicted when they used MSP speakers.

A view of the case from the back shows the elliptical space for mounting the speaker. A picture of the rear of the case also shows the slots that guide the chassis to precisely register the knobs with their access ports.

A bonus with this radio is the internally pencilled signature ("ER"), presumably of the person who checked this radio for dispatch.

The dial background is red, a change from the dark brown of earlier models.

The previously described 1951 model B61D had a cluttered, tightly-packed arrangement of components under the chassis. This radio is much less cramped, partly because it lacks an RF amplifier section. Also, the bulky power filter capacitors are mounted on the chassis, not below.

This model also incorporates more modern compact components, notably the resistors that have the now-familiar colour bands for indicating values.

Although this radio lacks an RF amplifier section, other HMV models such as the 22-11 of 1956 offered both an RF amplifier and a mains power unit.

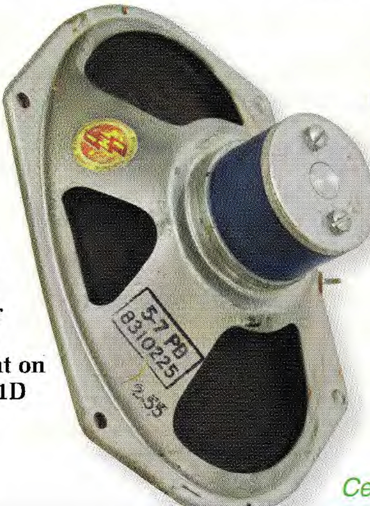
Restoration

This radio was a relatively easy restoration project. However, at first power-up, it remained absolutely silent. The solution was meticulous cleaning of all valve pins and sockets to ensure reliable contact.

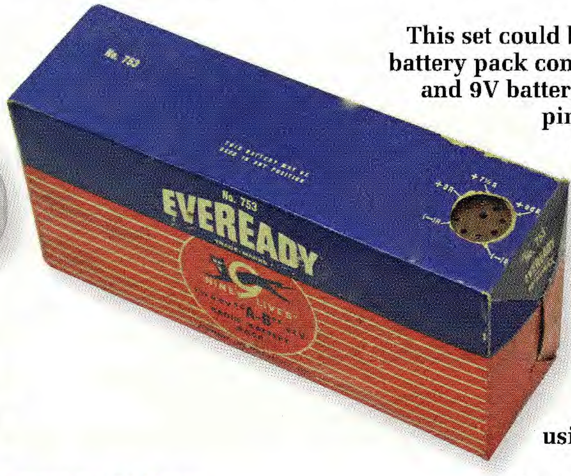
During handling, the celluloid dial sadly cracked and disintegrated into fragments. Happily, a reproduction dial was at hand, printed as described in the article on the B61D, June 2017.

This radio was one of nine HMV portables restored as a batch. Some were more challenging than this radio and their story may be told later.

This radio is a reasonable performer on local stations in my area of good signal strength. The case polished up well so this restoration had a pleasing conclusion. **SC**



The HMV 12-11 uses a 5x7-inch elliptical speaker. This speaker sports the EMI label, which was not present on the speaker in the B61D four years earlier.



This set could be powered by a battery pack containing one 90V and 9V battery, using a multi-pin connector. The disadvantage of this is that the pack would need to be discarded as soon as one of the two batteries became flat. This could be mitigated by using reactivation.