

# Vintage Radio

By RODNEY CHAMPNESS, VK3UG



## The Admiral 5BW mantel receiver

**Domestic valve radios with PC boards were relatively uncommon, with most manufacturers sticking to point-to-point wiring until the end of the valve era. One exception to this rule was the Admiral 5BW mantel receiver.**

**I**NSTEAD OF using PC boards, domestic transistor radios were initially built the same way as valve receivers were – ie, with point-to-point wiring. The transistors were also sometimes mounted in sockets, just like valves.

Of course, today we look on such techniques as archaic and totally unsuited to modern technology. Everything is now on PC boards and point-to-point wiring is minimised if

not eliminated altogether.

Valve radio receivers were traditionally built using a metal chassis to which all the major components (eg, transformers, valve sockets, tuning gang, etc) were attached. The wiring was all point-to-point which made the assembly slow and expensive.

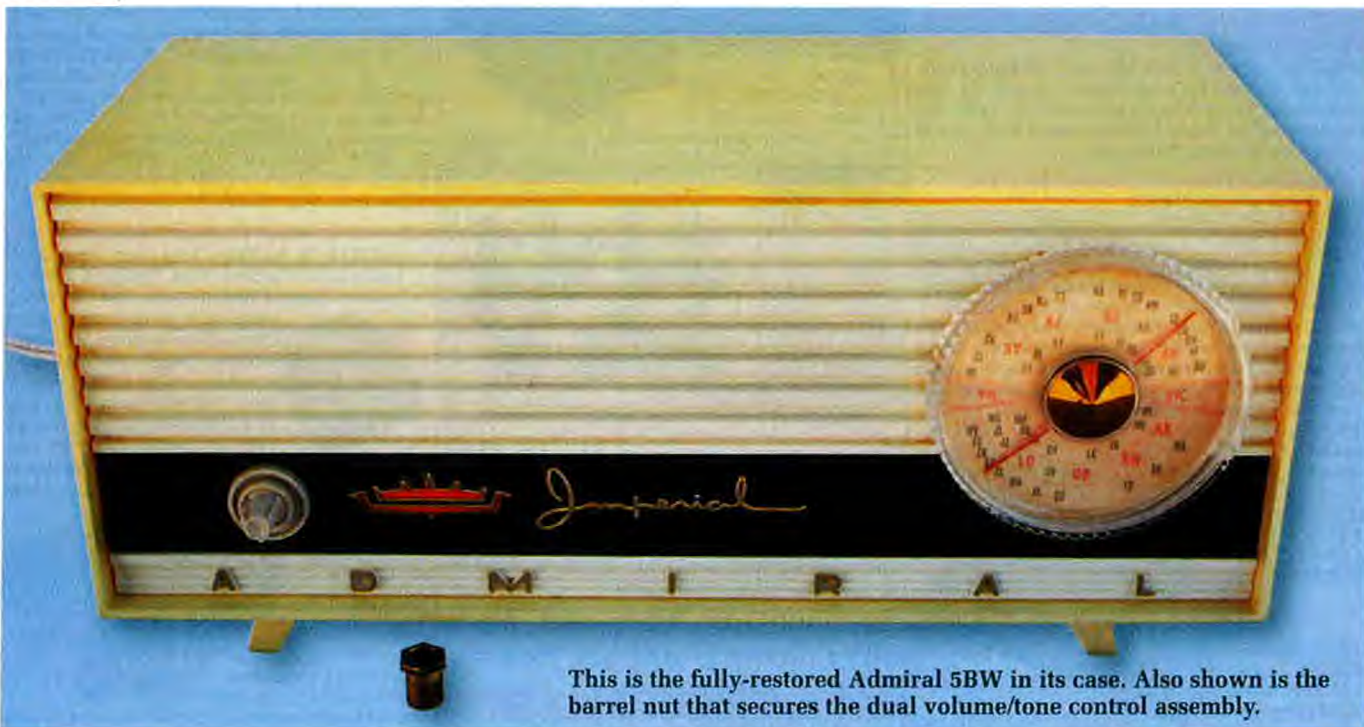
However, some manufacturers did start using PC boards in valve radios in the late 1950s. We looked at one of

these, the Healing 412E, back in February 2001. Admiral, an American firm, also built valve radios with PC boards in Australia but their technique was somewhat different to Healing's.

### Admiral 5BW mantel receiver

Admiral Australia Pty Ltd was located in Gow St, Bankstown, NSW and began manufacturing domestic radios and TV receivers in the mid 1950s. However, they apparently only remained in this field for a few years.

The Admiral 5BW receiver looks much like any other "plastic" mantel receiver of the era. Internally, however, it was different from other receivers in that it used a PC board to mount most of the parts. The only items not mounted on the 100 x 100mm PC board were the ferrite-rod antenna, the combined volume/on-off/tone control,



This is the fully-restored Admiral 5BW in its case. Also shown is the barrel nut that secures the dual volume/tone control assembly.

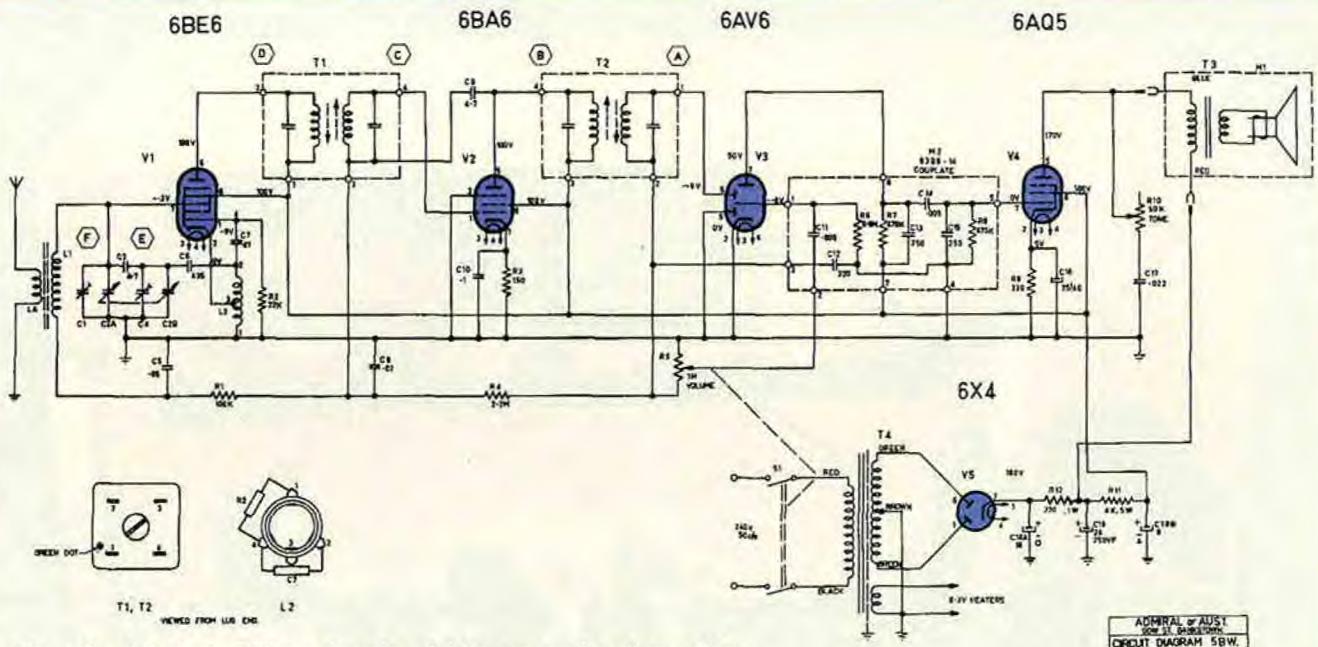


Fig.1: the Admiral 5BW receiver is a fairly conventional superhet receiver with five valves and a loopstick antenna.

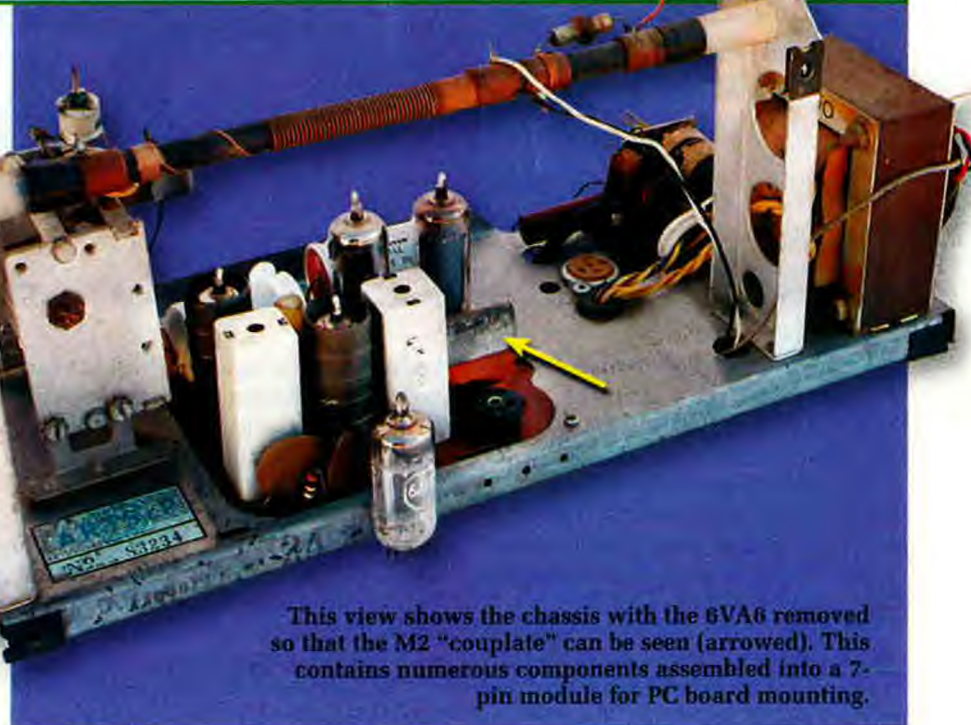
the loudspeaker and its transformer, the tuning gang and the power transformer.

As shown in the photos, the chassis is very sparsely populated except on the PC board. Certainly, if the manufacturer had wanted to, the set could have been made much smaller.

### Circuit details

Although the circuit is conventional, it has a few features that were not commonly used in Australian-designed receivers. For example, the input tuned circuit consists of a 200mm-long x 9mm-diameter ferrite rod with a coupling coil and lead so that an external antenna can be connected to the set. There is no earth lead as such – instead, the set relies on the capacitance between the primary winding of the power transformer and the other windings and the chassis to provide a defacto earth via the mains.

Unfortunately, this isn't the best way to achieve optimum reception, as the mains has electrical noise on it. This noise is coupled into the antenna circuit, giving less than perfect reception in many cases. Additionally, a purpose-made earth ensures that a stronger signal is achieved at the input



This view shows the chassis with the 6VA6 removed so that the M2 "couplate" can be seen (arrowed). This contains numerous components assembled into a 7-pin module for PC board mounting.

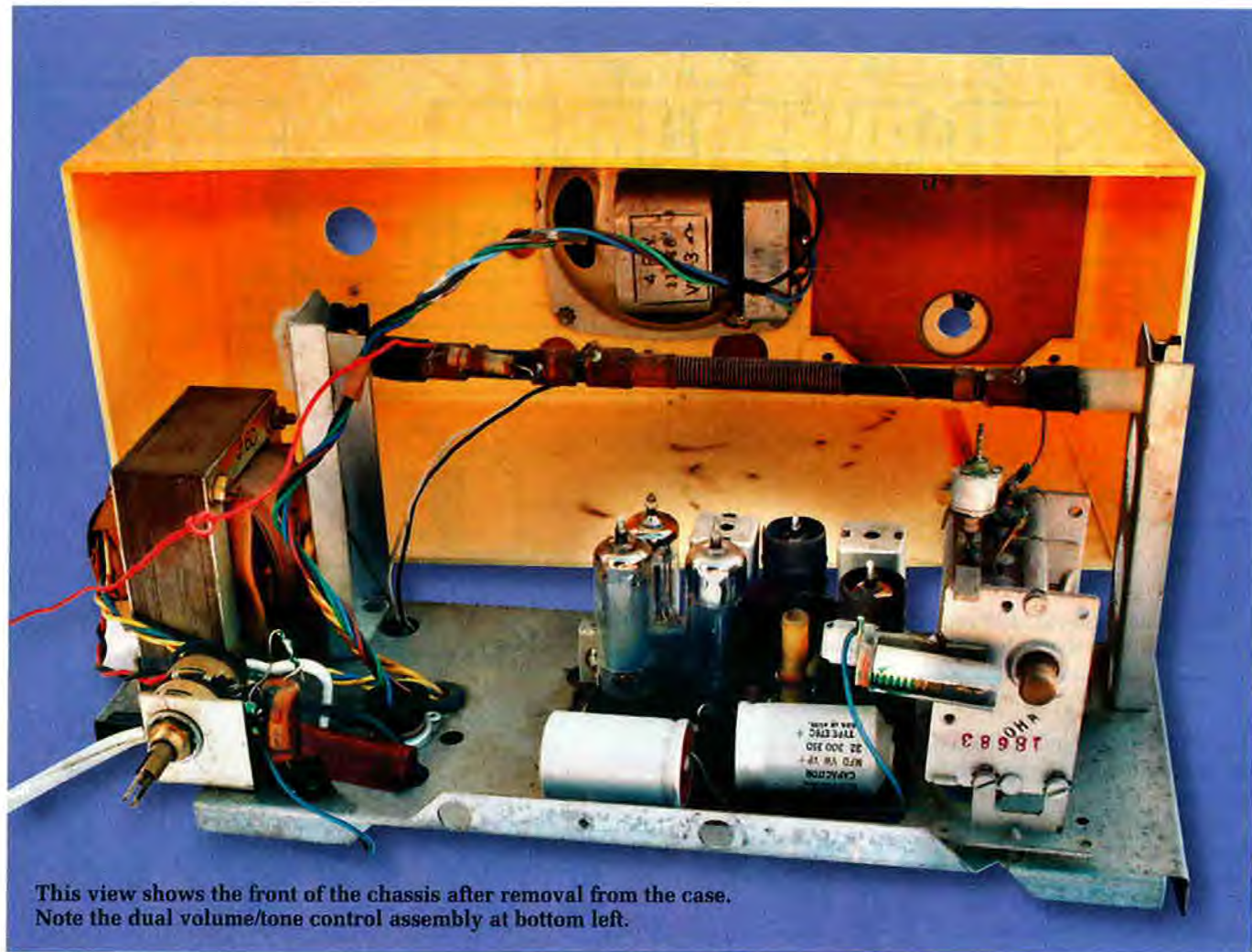
circuit, as the mains "earth" is not all that efficient.

The converter stage uses a 6BE6 and is quite conventional, although it has little standing bias and relies on the fact that the high tension (HT) voltage is relatively low. In addition, the set will normally be tuned to a station and hence AGC voltage will be applied.

The tuning range of the receiver is 535-1670kHz which means that it requires some tweaking to reach the

lowest frequency on the broadcast band (531kHz). By contrast, at the high-frequency end, it can tune to a number of the special broadcasting services in the 1600-1700kHz sub-band. The output of the converter is at 455kHz and this is fed to the IF (intermediate frequency) stages.

The 455kHz IF is amplified by a neutralised 6BA6 amplifier and this has cathode bias applied to it in addition to AGC voltage. The neutralising



capacitor is C9 (4.7pF ceramic) which is in a bridge circuit. Another arm of the neutralising circuit is C8 which is the AGC bypass capacitor.

With this neutralising scheme, neither of these components should be altered to the nearest available value if replacement is required, otherwise the stage could oscillate at 455kHz.

The next valve in the line-up is a 6AV6 which serves a multiple role as the diode detector, AGC amplifier and first audio amplifier. The grid has contact potential bias applied to it and the coupling between the plate of the 6AV6 and the following 6AQ5 output valve is conventional.

However, although the 6AV6 circuit is conventional, the way in which it is made is not. Instead of point-to-point wiring, all the parts (including three resistors and five capacitors) are assembled into a 7-pin module that's suitable for PC-board mounting.

The downside to this is that some faults require that the entire module

be removed for repairs. This isn't easy because of the limited room adjacent to it on the chassis. This is highlighted by the arrow pointing to the M2 "Couplate" in one of the photographs.

On the other hand, the "Couplates" are fairly reliable. Quite a few of the capacitors in the set are ceramic (which are more reliable than paper capacitors) and the "Couplate" also uses ceramic capacitors.

The audio output stage uses a 6AQ5 with cathode bias. The speaker transformer is mounted on the loudspeaker frame, which in turn is mounted on the front of the cabinet. This assembly is connected via a flying lead and a 4-pin plug into a socket on the chassis.

Note that although the circuit shows only two leads from the transformer, there are in fact four wires in total because of negative feedback from the voice coil. As shown in Fig.1, the cathode of the 6AQ5 is connected via the voice coil to earth and the valve is supplied with back bias.

In fact, the circuit diagram and the actual circuit are different in several areas. However, these differences are minor and should not present a problem to restorers.

The tone control circuit in the plate circuit of the 6AQ5 is poorly thought out in my opinion. The potentiometer is "live" at 200V DC (not the 170V shown on the circuit diagram) which places some strain on its insulation and is also a trap for unwary fingers. If the position of the capacitor and the potentiometer had been transposed in the circuit, there would be no DC voltage on the potentiometer and the whole set-up would have been safer.

### Cleaning the cabinet

The instructions in the service manual for dismantling the set are quite clear although they don't completely cover the set I have. However, the chassis isn't hard to remove. First, the centre piece of the "handspan" dial was unscrewed. The dial then

# Admiral

## SERVICE MANUAL for MANTEL RADIO MODEL 5 BW



FIG. 1

### COLOUR RANGE

Red, Cream, Turquoise, Green

### SPECIFICATIONS

**Circuit.** Superheterodyne receiver with five miniature tubes.

**Frequency Range.** Standard broadcast band, 535 to 1670 Kc/Sec.

**Intermediate Frequency.** 455 Kc/Sec.

**Power Supply.** This receiver operates from the mains supply of 240 volts, 50 cycle alternating current.

**Power Consumption.** Approximately 30 Watts.

**Antenna.** Built in Ferro. Scope Antenna.

**Speaker.** 4in. Permanent Magnet Voice Coil impedance 3 ohms at 400 cps.

### SERVICING THE SET.

#### To Remove Chassis from Cabinet

1. Gently pull tuning, volume and tone knobs off.
2. Remove dial scale and remove screw located under same.
3. Unscrew nut from volume/tone control bush.
4. Remove plastic cabinet trim and fibre board packing.

### SERVICE MANUAL S13 P/No. A39-21

This page from the service manual shows the specifications of Admiral's 5BW. Also shown is some basic servicing information, including the PC board layout.

5. Remove screw from bottom centre of cabinet front.
6. Chassis with cabinet back attached may now be withdrawn.

To simplify circuit tracing as well as locating and identifying individual circuit components, refer to figure 2.

Figure 2 refers to the foil side of the board and its schematic symbols illustrate what appears in approximately the same position on the reverse side of the board. Use figure 2 together with the schematic for circuit tracing as well as voltage and/or resistance measurements.

Refer to Service Manual No. AS559, available from your Admiral distributor for further general service and repair information of printed circuit wiring.

### PRINTED WIRING BOARD

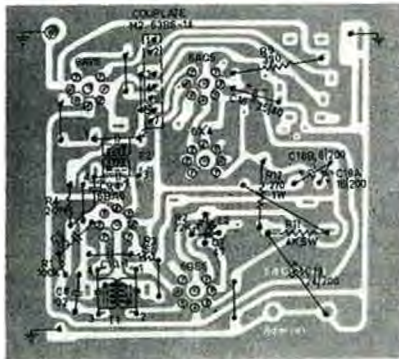


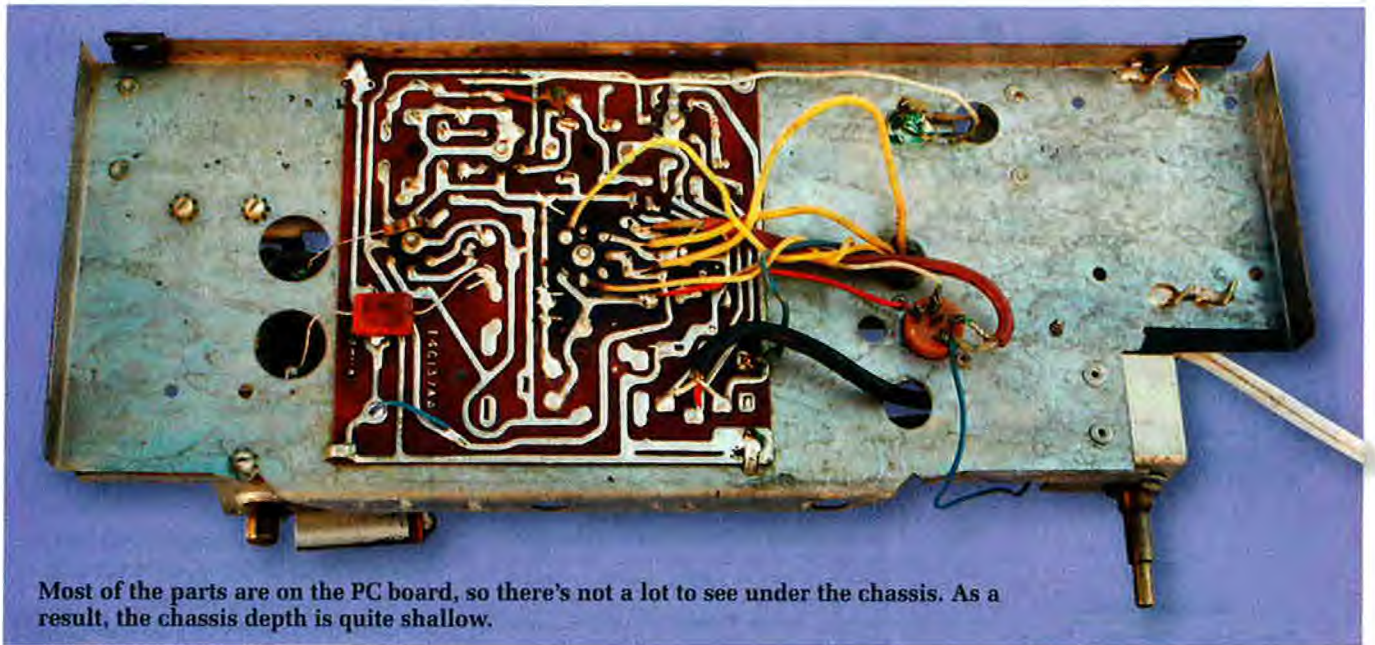
Fig. 2. View of WIRING SIDE of Printed Wiring Board APC27. White area represents printed wiring. Black symbols and lines represent components and connections on opposite side.

came away easily as did the concentric volume and tone control knobs.

That done, the four screws used to secure the back of the cabinet were removed. There were no other screws holding the set in the cabinet but it was still fastened by the volume and tone controls. Closer inspection revealed that these controls are attached to the front panel by a barrel nut over the control shafts. Removing this then allowed the chassis to slide out of the cabinet as far as the speaker leads would allow.

Why do manufacturers leave leads just too short for effective access or maintenance to be carried out? In this case, I wanted to be able to check the set with the chassis out of the cabinet, so I extended the speaker leads.

I had worked on this receiver several years ago, so the cabinet was in reasonable condition and only required a small amount of effort to get rid of any minor blemishes. However, inside the cabinet there are a number of burn marks which are too deep to remove. Just how these burn marks occurred is



Most of the parts are on the PC board, so there's not a lot to see under the chassis. As a result, the chassis depth is quite shallow.

something of a mystery, as there are no hot components in their vicinity.

### Fixing the faults

As normal, I began by checking the insulation between the chassis and the mains wiring using my 1000V insulation tester. This measured OK, however I also used an earth leakage circuit breaker on the mains as an extra precaution, as this set only had a 2-core power lead fitted during these initial tests. It was later fitted with a 3-core lead, so that the chassis could be earthed (which is much safer).

As stated previously, this set used quite a few ceramic capacitors, particularly in locations where leakage could pose problems. However, I wasn't happy with the leakage of the only paper capacitor on the PC board – a 100nF unit across the 100V line. This was replaced with a polyester type and the set then switched on. As it came on, I made sure that the HT rose to the correct level and that the rectifier wasn't showing any red plates, which would indicate a short or near short on the HT line.

During my previous work on this

set, I had cleaned away the muck that had accumulated on the horizontally-mounted PC board. This had been quite difficult to remove due to the crowded nature of the circuit board. It had even effected the components so that they all now looked much the same colour and making it difficult to decipher resistor and capacitor values.

As a result, the new resistors I fitted really do stand out from the dull-looking original components. Of course, the board would not have required anywhere near as much cleaning if it had been mounted vertically.

Anyway, the set had worked quite well when checked over several years ago but its performance had now deteriorated quite markedly. So what had gone wrong with the set? The IF amplifier was now quite regenerative and this had sharpened up the response such that the audio output was quite "bassy".

I began by checking the metal shields fitted to the 6BE6 and the 6BA6 valves as these now appeared quite rusty. As a result, I cleaned the insides of the shields with sandpaper and bent

the earthing fingers to ensure a positive connection to each shield. This made little difference, so I then tried another 6BA6 with the result that there was now no output from the set.

The reason wasn't hard to find – its heater wasn't alight. Initially, I thought it must be a dud valve so I substituted another one but the same thing happened. I then refitted the original valve and its and the heater lit up! So what was going on?

The filaments of the two new valves I have substituted were quite OK so I tried closing up the valve socket pins using a small pointed scriber. That fixed the heater problem and the set was also now quite stable when using one of the replacement valves.

Evidently, there is a problem with the original valve that causes the instability but I'm not throwing it out, as it may be quite OK in a different circuit. However, I have marked it as suspect so that I don't get caught out further down the track.

Although the set was now stable, the sensitivity was down and the IF was off tune, with its centre frequency down around 430kHz. As a result, I

## Photo Gallery: Peter Pan BKM 4-Valve Radio



**MANUFACTURED IN 1948** by Eclipse Radio, South Melbourne, the Peter Pan BKM was a 4-valve reflex superheterodyne housed in a rounded bakelite cabinet that was very modern for the era. This example is housed in the less common green cabinet.

The valve line-up was as follows: 6A8-G frequency changer; 6B8-G reflexed IF amplifier/1st audio amplifier/detector/AVC rectifier; 6V6-GT audio output; and 5Y3-GT rectifier. Photo: Historical Radio Society of Australia, Inc.

tried adjusting the cores to bring it up to 455kHz, which is the correct frequency, and found that I could adjust all but one core which was stuck.

I then tried running some machine oil down the stuck core, after which I was able to adjust it. However, I was still unable to get this core to adjust the tuned circuit to 455kHz and I was beginning to suspect the mica capacitor inside this unit.

Unfortunately, this particular IF transformer is a sealed unit, so I was unable to dismantle it to fix the problem. In the end, I simply replaced it with an IF transformer salvaged from another Admiral chassis. This replacement IF transformer was then adjusted to 455kHz but although the performance was better, it was still not up to scratch.

A quick check of all the RF valves did not reveal any problems, so I decided to take a closer look at the antenna circuit. In particular, I noticed that the antenna coupling coil on the loopstick was quite some distance from the earthy end of the tuned winding. So

did it have enough coupling?

To find out, I wound about half a dozen turns of insulated enamelled wire onto the earthy end of the tuned winding and found that this noticeably improved the performance. I am now satisfied that I've got as good a performance from this set as I can reasonably expect.

### Summary

Admiral was one of the first manufacturers to use PC boards and they nearly got everything right with this set. However, with the benefit of hindsight, the PC board could have been mounted vertically and all the fixed capacitors other than electrolytics should have been ceramic types for greater reliability (polyester capacitors weren't readily available at that time).

The set itself is neat and functional and makes a good kitchen mantel receiver. Finally, although my set is cream in colour, it was also available in red, turquoise and green. It is a set worth having in any collection. **SC**