VINTAGE RADIO

By JOHN HILL

The different types of radio valves

This month, we shall be looking at valves a little more closely. Instead of discussing them collectively, it's now time to discuss them individually and to sort them into categories depending on their applications.

In the early days of valve radio, everything was wonderfully simple. The 3-element or triode valve reigned supreme and was the only type in use. What's more, the receivers were all battery operated and had from one to five valves (sometimes more), depending on price.

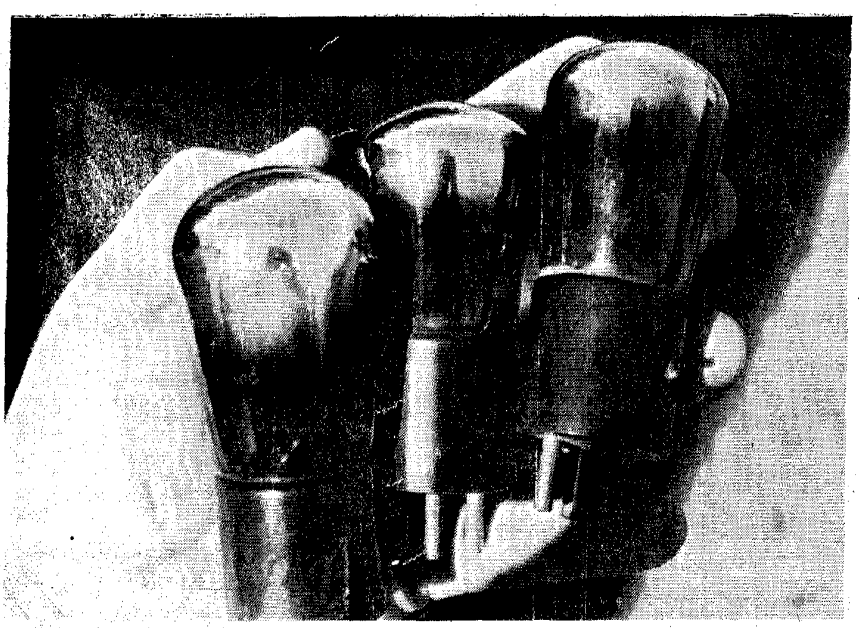
Those old triode valves weren't all the same. Most were made to suit special applications such as radio frequency amplifiers, detectors, audio amplifiers and audio output. Each manufacturer produced their own range of products which tended to complicate things a little, but the decision as to what should be used for a particular job was fairly straightforward in the mid 1920s.

Early radios had a few problems, one such problem being the high cost of batteries. The purchase of dry cell "B" batteries at six to 12-month intervals was a considerable expense, to say the least. There was, therefore, a large market just waiting for mains operated radio receivers and this type of set became increasingly popular from around 1927 onwards.

These first "all electric" radios had two types of valves: the usual complement of triodes, plus a double diode or 2-element valve which was used to rectify the AC mains current to DC.

The late 1920s to mid-1930s saw a period of intense development for both radio valves and the receivers they were used in. Mains-operated superhet receivers were taking over from the old squealing reaction sets and radio improved so much in such a short time that the period can only be described as "remarkable"!

Within this rapid developmental period, numerous new types of valves evolved and most were tailored to suit the AC-powered superhet receiver. These new types included tetrodes, pentodes, pentagrid converters and variable mu valves that worked in conjunction with diodes for automatic gain control. Beam power tetrodes and pentodes were also developed for power output applications.

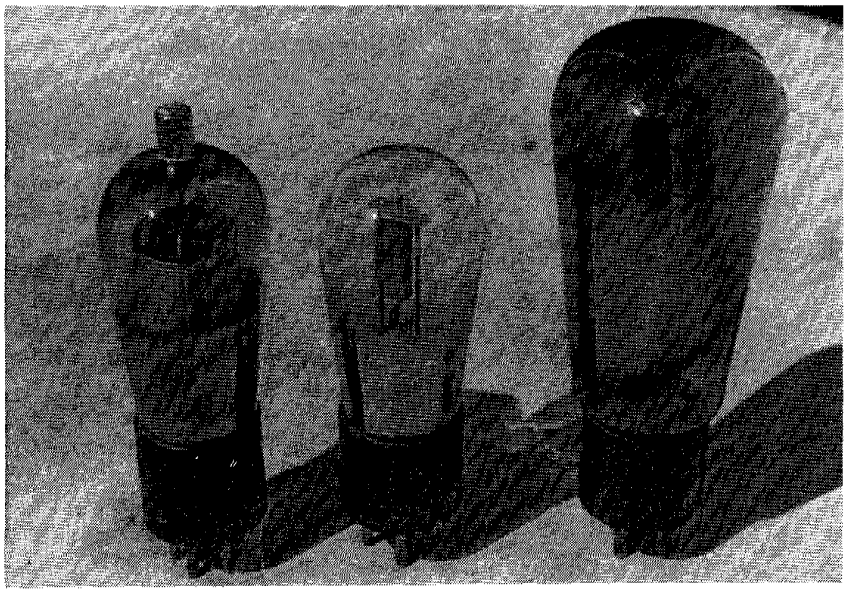


In the mid 1920s, battery operated triode valves were the only radio valves in common use. Things really were simple in those days!

The 5-valve receiver

It wasn't long before a standard pattern emerged that was to be adopted by all manufacturers for many years to come. While commercially made radios ranged from cheap 3-valve sets to monsters with a dozen or so valves, the industry standard was the 5-valve receiver.

The rectifier valve was usually included in the count even though it did nothing more than convert AC current to DC current for the high tension supply. In other words, a 5-valve receiver was really a 4-valve receiver and the majority of



This photo shows some early AC valves. They are (from left) 224, 227 and E406. Note the top cap on the 224 (left).

These three valves — 2A5, 42 and 6F6 — have the same electrical characteristics, the only differences being heater voltages and base pin configurations.

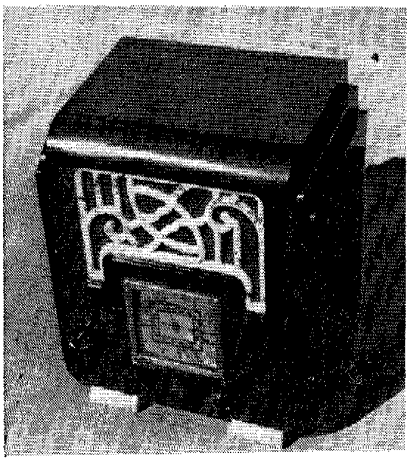
sets made at the time fitted into this four plus one or 5-valve category.

Popular valve types

Let's take a close look at the valve complements of some of those old receivers and, by so doing, establish popular valve types. This information will be a good start to compiling a list of common valves; the types that radio restorers should have on hand.

Domestic superhet radio receivers used only a few types of valves. These can be categorised as: power rectifiers, frequency changers, radio frequency amplifiers, detectors, audio amplifiers and audio output valves. The detector stage consisted of a diode (much smaller than the ones used in power rectifiers) and this was normally (but not always) incorporated into one of the other valves. Some old sets used a 6H6, a double diode which performed the roles of detection and automatic gain control.

I have in my collection of radios several 1936-37 mantle models. The valve complement used in these sets



The valve complement of this old Radiolette was common for many 1936 receivers. The line-up was 80, 6A7, 6D6, 6B7 and 42.

is as follows: 80, 6A7, 6D6, 6B7 and 42.

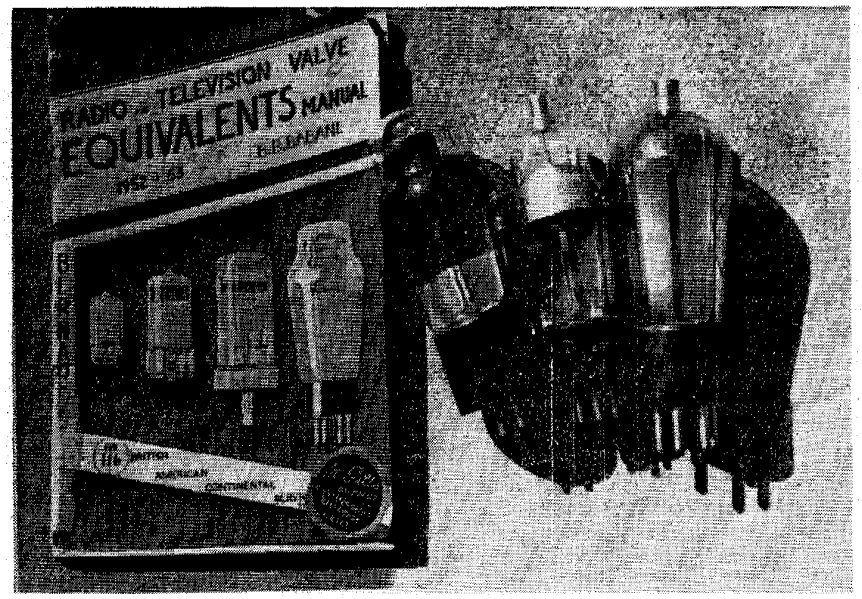
In order, these valves perform the following functions:

- 80: supplies high voltage DC to the other valves;
- 6A7: mixes incoming RF signals with the oscillator frequency to form an intermediate frequency;
- 6D6: amplifies the intermediate frequency;
- 6B7: amplifies the audio signal from the detector (the detector diode is within the same envelope);
- 42: additional audio amplification prior to loudspeaker.

Any radio that is about two or three years older than the previous example would most likely have 2.5-volt valves instead of the 6.3-volt types just listed. One could expect to see the following valves in such a receiver: 80, 2A7, 58, 2B7 and 2A5. In this case, all these valves are electrically the same as the first example except that they have 2.5V heaters instead of 6.3V heaters, with the 5V 80 being the only exception.

However, there could be other variations for there are many types of 2.5V valves. The output valve need not be a 2A5; it could well be a 47 or a 59, so what you expect to see and what might be there are often two different things.

Going back once more to the first example, the valves in these particular radios were becoming obsolete while the sets were built. The "new" octal-based valves were coming into use at the time and if



A valve equivalents manual is a handy book for the vintage radio enthusiast. If you cannot locate the original valve type, it can nominate a suitable substitute.

these radios had used octal valves, then the valve complement could have been: 5Y3, 6A8, 6U7, 6B8 and 6F6. Once again, the valves are electrically the same as those in the first example but the octal valves have different bases.

Therefore, in the 1930s, a good many apparently different valves were basically the same, the only real differences being their bases and heater voltages. Hence, one set of valves can be interchanged with another by the addition of a separate heater transformer or by using different valve sockets.

European valves

Unfortunately, the picture is not quite as clear as it may appear to be at this stage. The valve types mentioned so far have been American types; the European varieties complicate matters somewhat.

European manufacturers made a range of valves that were not generally interchangeable with American types. For a start, the bases were different. British 4 and 5-pin types used a different arrangement to American 4 and 5-pin types and so on. There was also a series of 4V valves and from 1936 many Philips and Mullard valves used the side contact "P" base, making substitution totally impossible.

In addition, English Mazda valves had their own non-standard version of the octal base just to make things even more difficult. There were many differences and variations between American and European

Vintage Radio Service Tips (From Resurrection Radio).

This is the start of a regular series briefly detailing the day-to-day experiences of a vintage radio service technician. Some problems are unique to specific brands and models but many are commonplace faults found in many radios.

Silver Mica Capacitors

- Alignment drift — sometimes the IF gain can drop with a click when final alignment is being performed. This is often caused by a faulty silver mica capacitor across one of the IF windings. Try to repeak each slug until one has a noticeable improvement in gain. Note the slug, disassemble the IF transformer and replace the capacitor across the corresponding winding.
- IF slug won't peak — open circuit silver mica capacitor across the appropriate winding.
- HMV Little Nipper — crackles and popping noises in late model Little Nippers can be caused by a defective silver mica bypass capacitor on the plate of the 6AV6 audio valve (see Fig.1).

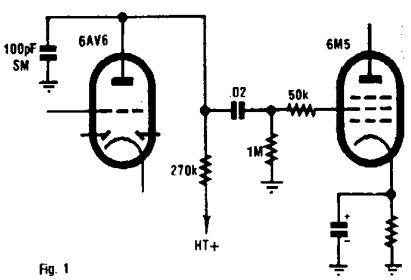


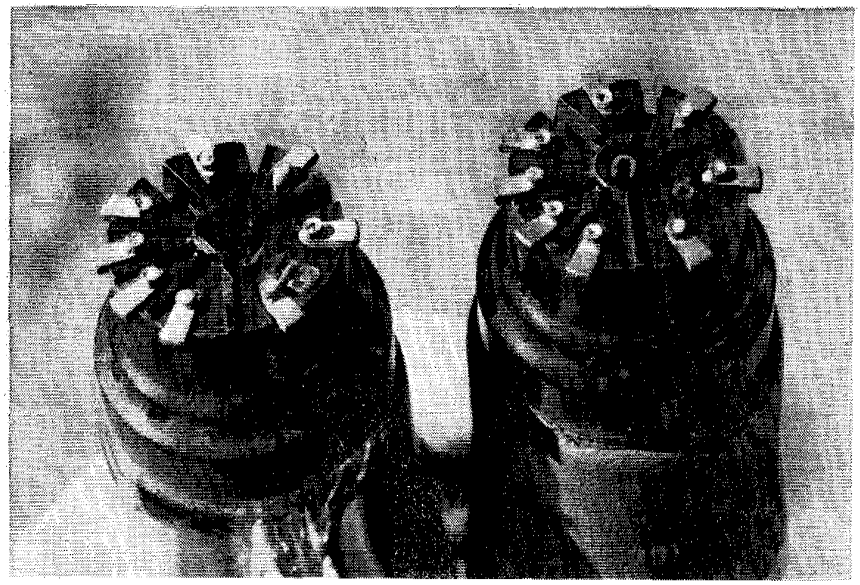
Fig. 1

Hum Problems

- For those that don't already know, most hum in vintage receivers can be traced to old dried-out electrolytic capacitors, both tubular and chassis mounted. Replacement usually cures the problem. If you leave the chassis mounted capacitors in the set (and most people do), check that they are not leaking. Also, don't leave them in circuit as convenient tie points for the new capacitors. They may eventually short and take out the rectifier and power transformer.
- 50Hz hum in early sets is often due to long unshielded leads in the audio section. Replace these with shielded cables where necessary.
- Can't track down an elusive hum? — when all else fails, try connecting a large electrolytic (25-100uF) across the back bias resistor (be sure to observe the correct polarity).

Audio Distortion

- Audio distortion is the most common symptom in vintage radios that are still operating but have not been serviced for many years. It's generally the result of a positive voltage on the control grid of the output valve. A leaky coupling capacitor from the plate of the audio amplifier is the likely culprit and this should be replaced. An output valve with low emission can also exhibit similar symptoms.



European side contact or P-base valves were produced by some manufacturers from the mid-1930s. P-base valves are most commonly encountered in sets made by Philips and Mullard.

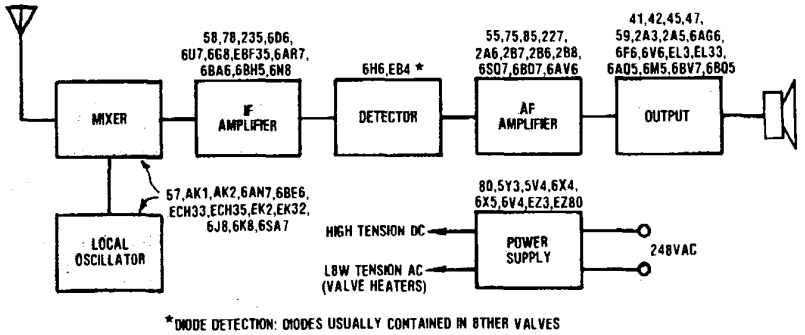


Fig.1: this diagram lists most of the valves likely to be encountered in the average Australian-built receiver and shows where they are used. About 60 different types just about covers everything.

valves and while some may be interchanged, most can not.

Fortunately, the majority of Australian manufacturers went with the American system and most of our locally made sets have American type valves in them. However, P-base valves do appear in some radios, particularly those made by Philips and Mullard.

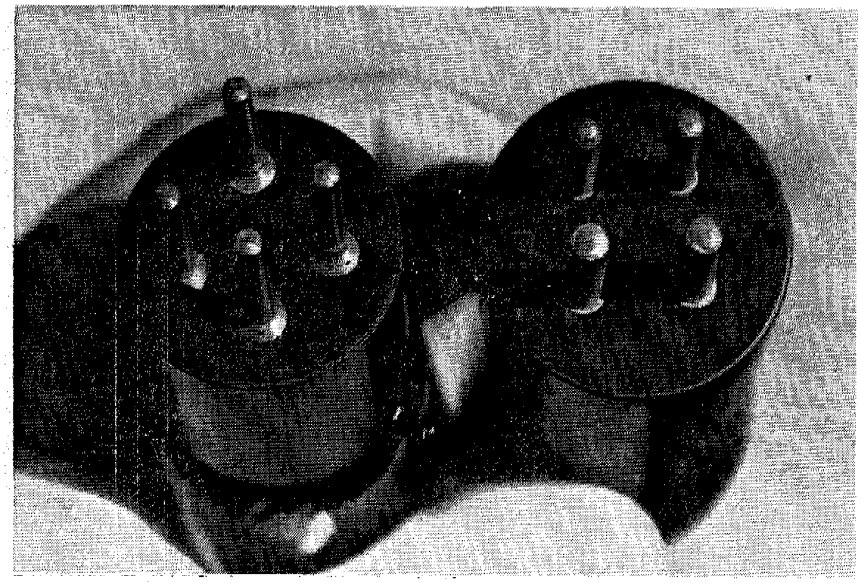
Personally, I make a point of avoiding radios with P-based valves. Unless exceptionally appealing, I prefer to collect receivers that have what I consider to be "standard valve types".

Now I know that last statement will stand on a few toes but as I see it, P-based valves are non-standard varieties and I avoid them where possible. Although I have a few sets with the odd P-based valve in them, I prefer the standard American type valves because of their better availability.

The advent of the miniature baseless valves saw the end of an era where so many manufacturers and countries had their own special standard. Miniature valves valves have either seven or nine pins and no topcap connection to come loose and fail off. It was not until this last generation of valves that some form of international standardisation came about.

Frequency converters

Frequency converters warrant some discussion as they come in many shapes and forms. There are pentagrid converters, octodes, triode heptodes and triode hexodes — whether they be in one envelope



American and European valve bases were of different designs which prevented convenient substitution. At left is the European 4-pin style while at right is the American 4-pin base.

or two. There are a number of ways to produce an intermediate frequency but this particular story is not going into those details at this point.

The mixer and the oscillator stages of a superhet receiver can be designed to work with one valve, two valves or two valves in the one envelope. In the block diagram (Fig.1), all the frequency converter valves, regardless of what type or where or how they are used, are listed under "mixer".

Fig.1 lists most of the valves the vintage radio enthusiast is likely to encounter in the average Australian built receiver. About 60 different valve types just about covers everything.

Note that the last statement says "just about covers everything". There is always some obscure set that has something different in it. Also note that the list covers from the early 1930s on. Mains operated radios from around the 1928-1930 era used entirely different valves but these have been deliberately left out because of the rarity of such sets and suitable replacement valves.

Astor Mickey

I recently picked up an Astor Mickey of mid-1950s vintage only to find that it had a 6AD8 in it, a valve that was not in my collection. However, a study of the valve manual showed that the 6AD8 is a very close relative of the 6N8. Slipping a 6N8 into the socket had no effect on the set's operation which goes to show that a ring-in valve will often do the job just as well.

Astor seems to be the odd one out. I also have some early 1930s Astors which use 41 and 43 output valves instead of the normal 42. The 43 seems most odd for it has a 25V heater, while the remaining valves in the set are of the usual 6.3V variety. No, it's not an AC/DC set and the heaters are not connected in series.

Many valves can be recognised simply by looking at them. Rectifiers are easily identified by their internal construction. Anyone familiar with valves can instantly pick an 80 from a 5Y3 because of the different bases. Likewise with a 6X4 and a 6V4. The 6X5 is different again.

Valves such as the 6B6, 6SQ7, 55, 75 and 85 all look the same inside. However, the size and shape of the glass envelope, the type of base and the heater voltage will soon sort most of them out. Anyone familiar with these valves will be able to distinguish between them.

Getting to know all these old valves takes considerable time and effort but it is very necessary if one takes vintage radio seriously.