

# THE 6J7 'FRATERNITY'

For more than twenty years, the 6J7 was a premier audio voltage amplifier valve, and the best known member of a large family whose origins go back to the very first 'sharp cut-off' RF pentode of 1932.

The story more or less starts in 1929 when, after a lot of research and effort, a successful indirectly-heated screen grid RF tetrode was developed. This was the 2.5 volt heater type 224, later to become the 24A, and – together with the superheterodyne – it revolutionised receiver design. A year or so later the 236, a 6.3 volt version for car and DC mains radios was released.

At the beginning of 1932, the 6.3 volt heater 'variable-mu' RF pentodes types 239 and 244 were announced, and it was obviously only a matter of time before 'sharp cutoff' pentodes would appear.

## Sharp cutoff pentodes

By June 1932, the 2.5 volt type 57 was in production as the sharp-cutoff pentode successor to the 224/24A. Along with its variable-mu type 58 partner, the 57 was physically innovative. Instead of using the traditional pear-shaped S bulb, it introduced the new ST envelope with the domed top which was soon to become standard for all types of valves.

Internally, the cylindrical perforated shield which had been standard in previous RF valves had been replaced by a shallow shield, positioned in the domed section above the elements. This type of construction and the particularly tall ST12 bulb was confined to relatives of the 57 and 58 and, interestingly, the Australian 2.0 volt directly heated RF pentodes – including types 1K5G, 1K7G and 1M5G.

Another Australian connection was that, along with the 2A5 and 80, the 57 and 58 were the first valves produced by Amalgamated Wireless Valve Co.

Very shortly afterwards, an equivalent pair of 6.3 volt pentodes designated 77 and 78 appeared. These retained the traditional perforated shield and intro-

duced the shorter form of bulb, which became the future standard ST12 pattern.

## A large family

Although physically different, apart from their heater ratings the characteristics the 57 and 77 were practically identical, a fact not mentioned in the valve manuals for some years. With a 25% greater mutual conductance, and more stable performance than the tetrodes, they soon became popular for mixers, detectors, AGC and to a limited extent, audio amplifiers.

At this time, no reference was made to their performance when triode connected. This is understandable, as ade-

quate and cheaper triodes already existed; but it was to be revived later.

Commercial and marketing influences soon created complications. A 57A appeared, with a 6.3 volt/0.4 amp heater for car radios. Majestic, alone among US manufacturers, had adopted the European practice of spray coating their valves with metal shielding. They gave the 57 a metallised coating, connected to the cathode pin, and called the new creation the 57S. For car radios, they produced another 6.3 volt/0.4 amp heater version called the 57AS.

Majestic later brought out a 0.3 amp version, the 6D7, but gave it a separate shield pin on a seven-pin base! Spray shielding was a problem to other manufacturers who wished to market a complete range of spares, so they made Majestic-type replacements with close fitting tinfoil shields.

The Canadian firm of Rogers, who had ties with Majestic, and were also fond of spray shielding, had a 57s in

| RECEIVING TYPES   |  |                                   |
|-------------------|--|-----------------------------------|
| BASE              | 6.3 VOLT HEATER  | OTHER VOLTAGES                    |
| 6 PIN             | 77 77E 77s<br>87s 57A 57AS<br>6C6                                  | (2.5v)<br>57 57s 57S              |
| 7 PIN             | (Small 7 pin US)<br>6D7  | (13.0v)<br>(7 pin British)<br>8D2 |
| OCTAL             | 6J7 6J7MG<br>6J7G 6J7GT<br>263 KT263<br>6 *6 (Russian)<br>77M 6J7M | (12.6v)<br>12J7GT                 |
| OCTAL<br>(Triode) | 6C5 6C5MG<br>6C5G 6C5GT  |                                   |
| NOVAL             | 6BR7/8D5   |                                   |

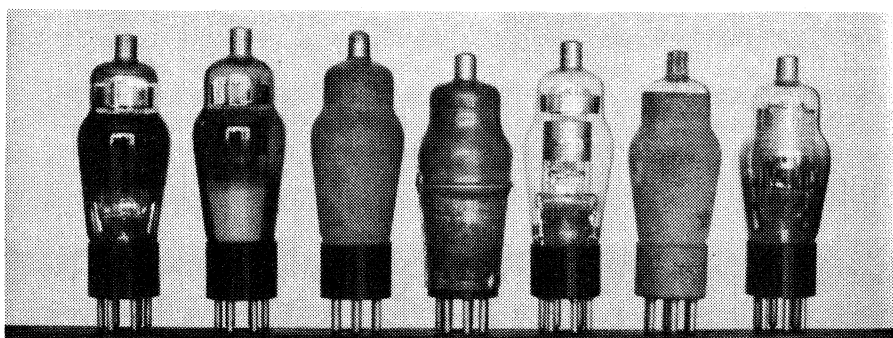
**Table 1: The main receiving tube members of the 6J7 family, grouped in terms of base and heater voltage.**

production by mid 1932. However, in this case, the shielding was not connected to the cathode, but relied on chassis mounted contact fingers for earthing. Soon they were also making 6.3 volt versions of the 57; the 87s with a 0.4 ampere heater and the 77s with a 0.3 ampere heater. Note that Majestic used an upper case S suffix and Rogers generally a lower case s.

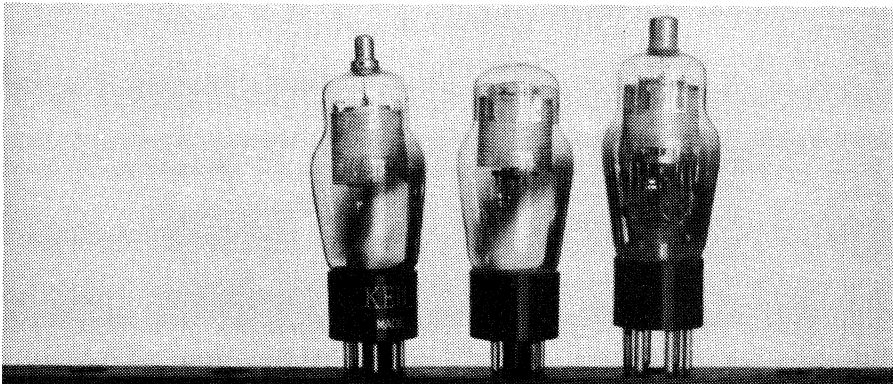
Following the introduction of the RF pentodes, all new R.M.A. valve types were produced with both 2.5 volt and 6.3 volt heaters, as for example, the 2A7 and 6A7. The 2.5 volt series was intended for AC operated domestic receivers, with the 6.3 volt types for DC mains and car radios.

By 1934, marketing people were demanding something to make last year's models obsolete. Some manufacturers, including the giant Philco, had realised two years earlier that the 2.5 volt series was becoming an anachronism, and had standardised the 6.3 volt types for all classes of receiver, using for some of their export receivers the 77E, which seems to be identical with the 77. Now 6.3 volt valves were 'in'. The only major change necessary in many models was a different heater winding on the power transformer.

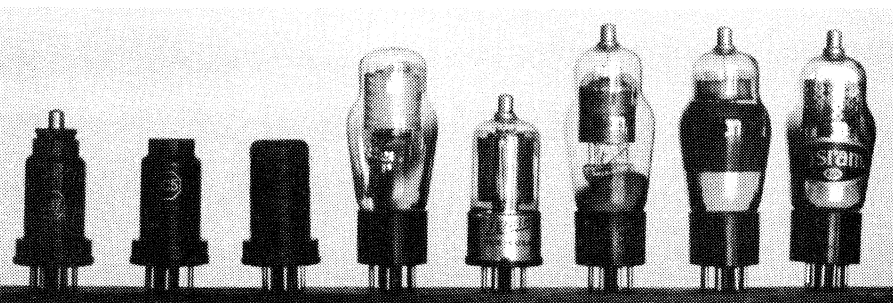
Although the 77 and 78 would have been quite satisfactory for the new sets, there had to be something new. Consequently, the 57 and 58 were given 6.3 volt heaters to become the 6C6 and 6D6.



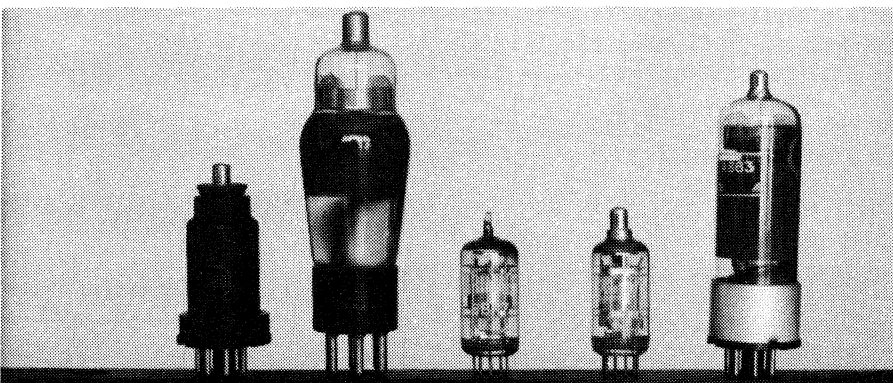
**Fig.1:** Some of the first generation in the 6J7 family. From the left, a Kenrad 57; a blue glass Arcturus 57; a Majestic 57S; a Raytheon 6D7 replacement with metal shield; an RCA 6C6; a Rogers 77s and a Sylvania 77 with Philco label.



**Fig.2:** Brothers under the glass – from left to right, a 6J7G, a 6C5G and a 77. The 6C5 triode was actually a 6J7 without the suppressor grid, and with the screen grid tied internally to the plate.



**Fig.3:** A selection of octal members of the family. From the left, an RCA 6J7; an RCA original-shape 6C5; an RCA 6C5 in the later shape; a Kenrad 6C5G; a Sylvania 6J7GT with Zenith label; an Australian (AWV) 6J7G; a Sylvania 6W7G; and a Marconi Osram KT263.



**Fig.4:** Less common types. From the left, an RCA 1620; an RCA 1603; a Brimar 6BR7/8D5; a Brimar 6BS7/6059; and a Marconi Osram A863.

### INDUSTRIAL TYPES

| BASE          | TYPE      | MANUFACTURER  |
|---------------|-----------|---------------|
| 6 PIN         | 1603      | RCA           |
|               | 1603      | BRIMAR        |
|               | 1603      | AWV           |
|               | 7700      | KENRAD        |
|               | 1221      | SYLVANIA      |
| OCTAL (Metal) | 1620      | RCA           |
| OCTAL (Glass) | 1603/1620 | AWV           |
|               | 7000      | KENRAD        |
|               | 1223      | SYLVANIA      |
|               | A863      | MARCONI OSRAM |
| NOVAL         | 6059/6BS7 | BRIMAR        |

**Table 2:** The less common 'industrial' or premium grade members of the 6J7 family.

The sharp-cutoff pentodes had by now been largely superseded by pentagrid converters and diode-triodes, and their chief use in the future was to be as resistance-coupled audio amplifiers – which had been a minor feature in the original specifications.

## The metal valves

One of the landmarks of valve production was the introduction in mid-1935 of the ‘octal’ based metal valves made by RCA.

Had the original intentions for the metal valves to be a complete range of new designs been realised, the 6J7, as the designated sharp-cutoff pentode, is likely to have been more like the later 6SJ7 – leaving the 57/77/6C6 group to languish. Instead, the project was a bit of a fiasco in that existing valve types were used for many of the series, with the result that the 77 was repackaged as the 6J7. Valve manuals now recognised the similarity of the 77 and 6C6, for although the 6J7 had the internals of the 77, it was stated to be identical to the 6C6.

Previously the use of sharp-cutoff pentodes had been declining, but as the metal series had no combined valve with diodes, a separate audio amplifier stage was required, frequently using the 6J7. The expanding broadcasting and public address industries used the 6J7 in increasing numbers, whilst another use was as a local oscillator for the new 6L7 mixer.

## The unusual 6C5

A further twist in an odd saga was the metal general-purpose triode. To

save time, advantage was taken of the previously mentioned excellent triode characteristics of the 6J7 to produce the 6C5. Apart from the suppressor grid, the 6J7 electrode assembly was used intact – but with the screen grid internally connected to the anode. This construction was never changed, and when glass versions emerged, even the anode shield was retained, a very unusual feature for a triode.

## Still more varieties

Already the family had grown to a dozen, but many valve manufacturers, including AWV, were not equipped to make the metal range. Some put an octal base and small grid cap on the 77, to create the 6J7G. Others made ‘metal’ valves by covering equivalent glass types with cylindrical iron shields. These were given the MG suffix, but soon disappeared from the market.

Three more versions were to be produced in the USA. The compact ‘GT’ series appeared in 1939, and included the 6J7GT and for AC/DC receivers, the 0.15 amp/12.6 volt heater type 12J7GT. Finally, to complete the US family, there was for battery operation a 6.3 volt/0.15 amp heater, octal based version of the 6C6 called the 6W7G.

## Foreign varieties

Rogers once again came up with non standard valves. Their response to the 6J7 was the black painted metallised 77M and 6J7M. These had octal bases, but retained the large grid cap.

Two British companies who had close ties with the US also produced their own versions of the 6J7 family.

Marconi/Osram made two, the KTZ63, similar to to the 6J7G and the Z63, a tall tubular octal based 6C6.

STC, as well as marketing the standard range under the ‘Brimar’ label, made three unusual versions of the 6J7. The 8D2 had a British 7 pin (B7) base and 13.0 volt/0.2 amp heater. They also made two miniature 9-pin Noval types with scaled down and non-microphonic elements for critical applications: the single ended 6BR7/8D5, and the industrial 6BS7/6059 with a top grid cap.

## Industrial types

Professional users in areas such as broadcasting and the film industry found several of the family very useful.

In this type of service, first cost is not as important as reliability and consistency. Production runs were put through extra stringent microphony, noise, leakage and characteristics tests. Suitable specimens were selected as premium valves and given identification numbers chosen by individual makers. RCA for example produced the 6C6 as the 1603, and the metal 6J7 as the 1620.

AWV did not make metal valves, but called their premium version of the 6J7G the 1603/1620! Industrial types that I have been able to locate are listed in Table 2.

I wonder if, back in 1932, the designers of the 57 would have believed that in 1960, the 6J7, which was essentially the same valve, would still be given a major listing in the RCA catalogue. That it was can be attributed in part to the panic production of the metal valves, but also to its excellence as an audio amplifier.