10.1.9 Pentode-preamp

Of all amplifier tubes, the pentode is the most widely used. Compared to the triode, the technical advantage of the pentode used in input stages is based on the high internal impedance and the very small capacitance between grid and plate. Large voltage gain is possible without running the danger of self-excitation [Meinke/Gundlach]. However, as we so often see it: what is true for classical circuit design does not necessarily hold as guideline for guitar amplifiers – the latter most often employ a triode in the first stages. There are exceptions, though: the VOX AC-15 or the Fender Champ may serve as examples. In these rather early amps, we find a **pentode** in the preamplifier. We will look into the technical details of this five-electrode-tube a little later; as a simplification, it functions similar to the triode: the plate-current is controlled by the voltage at the control-grid, the extra screen-grid (g_2) is connected to a constant (high) voltage, and the suppressor-grid is joined with the cathode. The **transconductance** of the **6 SJ 7** pentode used in the Champ is rather comparable to that of an ECC83 (1,6 mA/V) but the internal impedances are very different: 1000 kΩ in the 6 SJ 7 but merely 63 kΩ in the ECC83. Purely by way of calculation, this yields – e.g. for R_a = 200 kΩ – an operational gain of 267 (6 SJ 7) and 48 (ECC83). The operational gain-factors therefore differ by 15 dB! The **EF 86** as it is deployed in the AC-15 features even larger values for transconductance (2 mA/V) and internal impedance (2500 kΩ), and we get an additional 3 dB gain.

It was the susceptibility to oscillations that made VOX replace the EF 86 by a triode, after all: *The EF 86, although excellent electronically, was susceptible to mechanical damage through vibration and would soon begin adding it's own ringing, rattling accompaniment [Petersen/Denney]*. Another reason could lie in the seeming advantage of the pentode: its high voltage gain is helpful when dealing with small input signal. However, when confronted with pickups able to deliver in excess of 1 V, this advantage can easily backfire: the preamp will generate considerable distortion that is not generally desired.

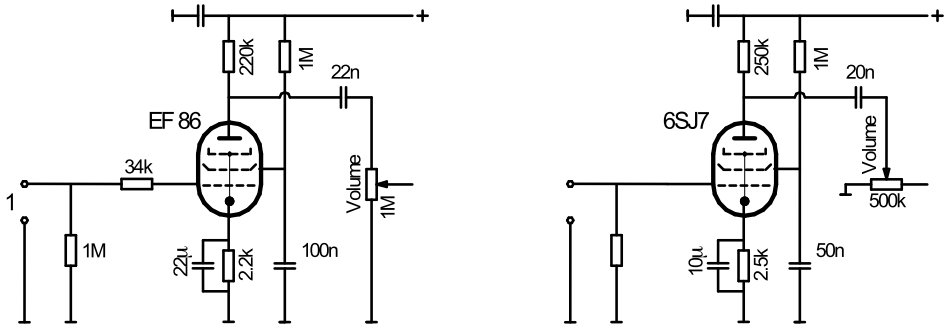

Fig. 10.1.31: Pentode-input-stages in guitar amplifiers: VOX AC-15 (left), Fender Dual Professional (right).

Fig. 10.1.31 shows the input-circuits of two early guitar amps. The AC-15 employs the more modern pentode with the noval-socket while the Dual Professional (developed more than 10 years earlier) still relies on the octal-tube. Only shortly thereafter Fender changes to the dual-triode 6SC7, and in the following generation to the 12AY7.

