part 2

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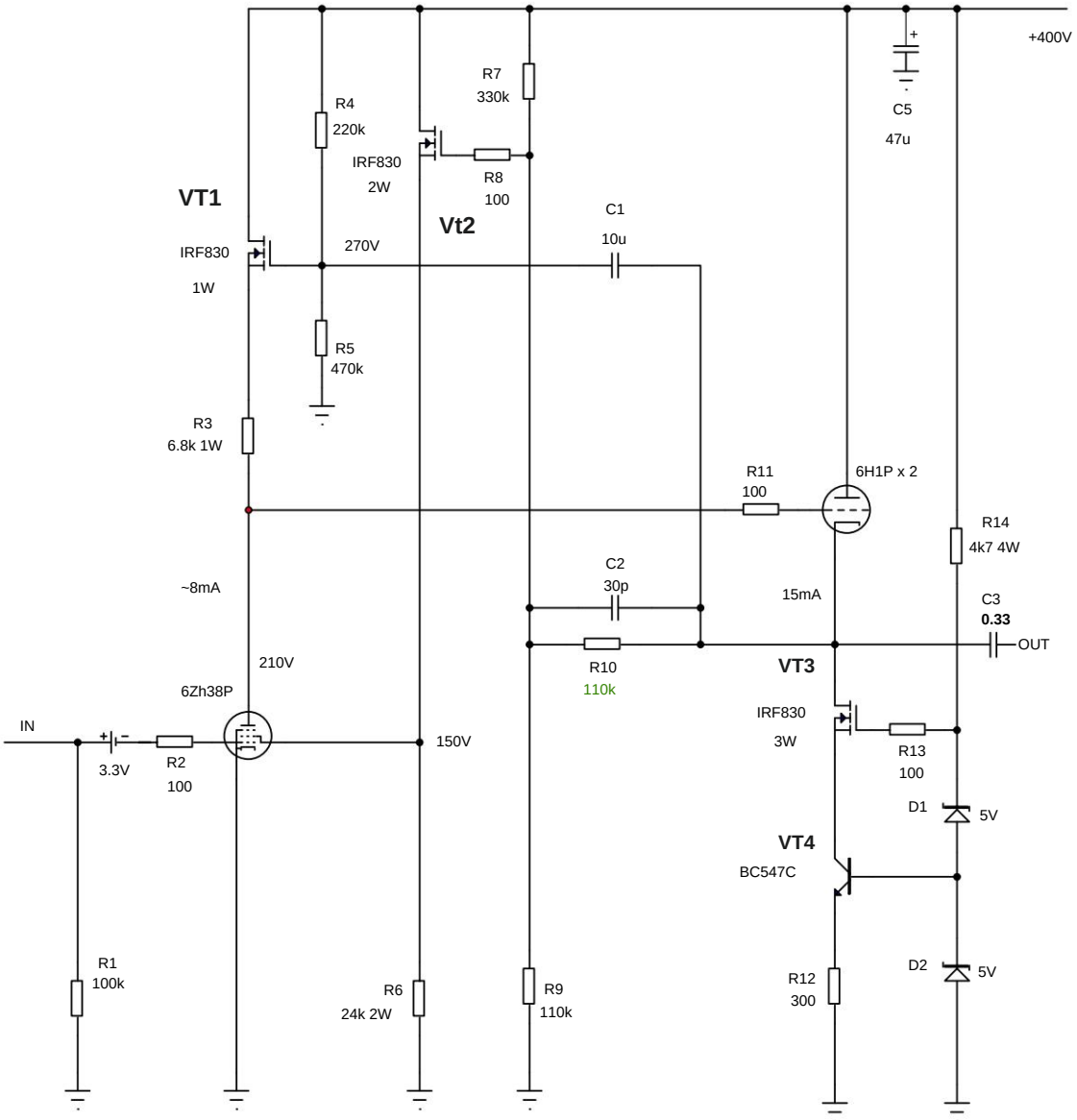
Pentode's ultralinear mode pre-amp stages

Although the circuit discussed in the first part of the article has good objective parameters and subjectively good sound, its application is rather limited. It would be tempting to expand its application and use it as a driver for power amplifiers. This is especially interesting for use in hybrid amplifiers, where the output stage has a gain of about 1. Sufficient gain, low output impedance, only two stages, but one BUT arises in the way of this desire: a relatively small level of permissible output voltage. To be more precise, the output voltage swing can be quite large, but the increase in the swing is accompanied by the appearance and rapid growth of higher harmonic components of non-linear distortions. In general, this phenomenon is typical for almost all types of low-power pentodes in a classical inclusion. Simple mechani

logical increase in the supply voltage of the cascade does not lead to a significant change in the us.

It is possible to significantly increase the output voltage range while maintaining high linearity in a fairly simple way by organizing a tracking power supply for the first stage (Figure 1).



Picture 1

In the original circuit (Ultralinear mode of the pentode in the preliminary amplification stages) was added source follower transistor VT1. Resistors R4 and R5 set the DC follower mode, the repeater input signal comes through capacitance C1 directly from the driver output. The method of organizing the displacement of the first lamp was also changed, it was made fixed using a lithium battery. Exclusion of automatic circuit elements

shifts had a beneficial effect on the sound. No further changes were made to the scheme.

Below are the main parameters of the amplifier, the measurements were carried out at the output voltage 45VRMS, load resistance 100kÿ and load capacitance 100pF.

Gain Power Bandwidth Output	90
Impedance Harmonic Maximum	5Hz÷0.7MHz
Output Voltage (THD = 0.23%)	90ÿ
	0.1%
	90VRMS

Figure 2 shows the change in the level of harmonics from the level of the output signal, and Figure 3 shows the change in the level of non-linear distortion.

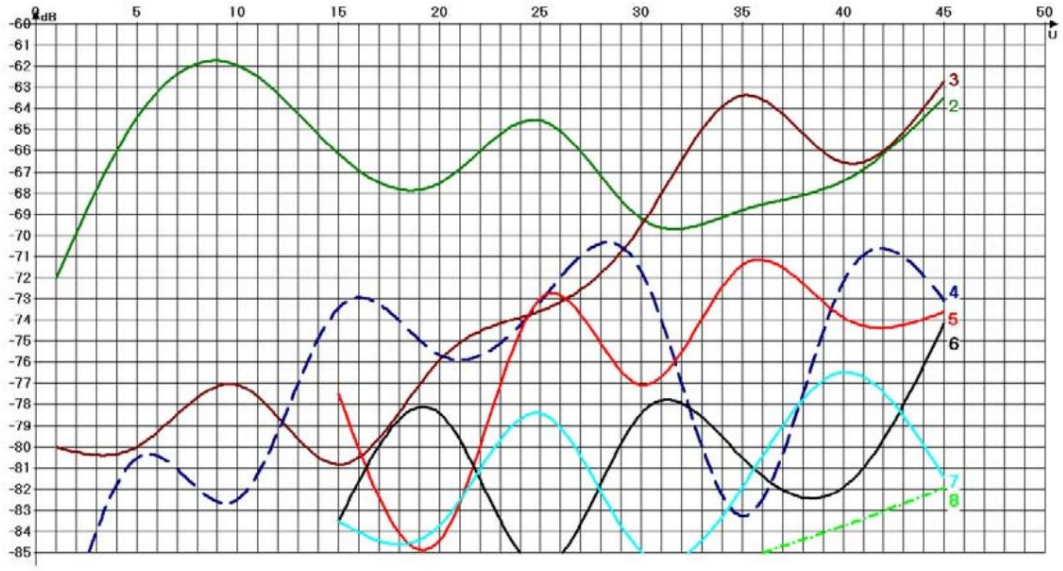


Figure 2

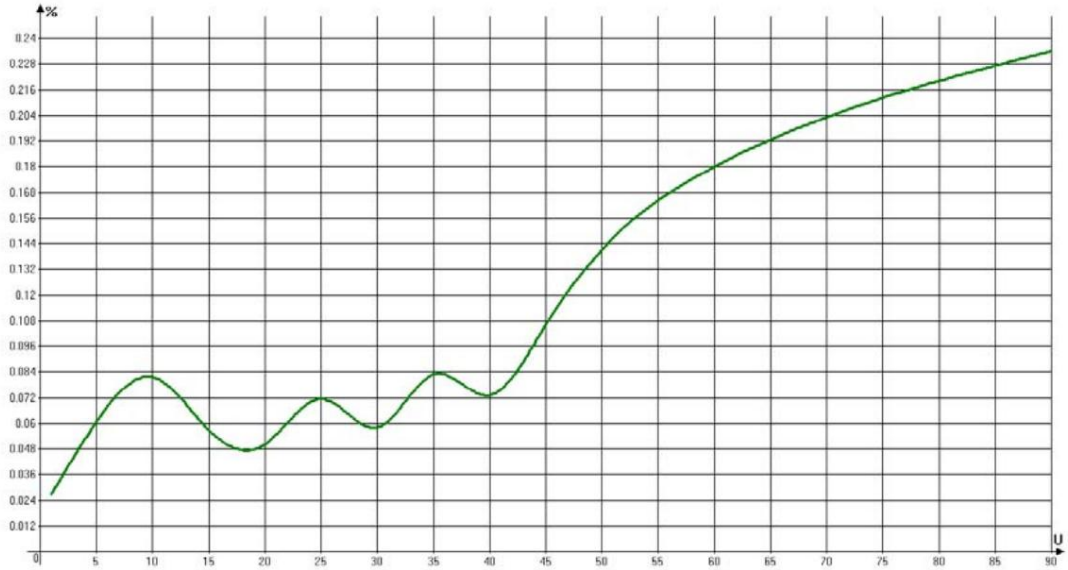


Figure 3

It is not desirable to change the type of the first lamp. More precisely, you can use other types of low-noise pentodes, but this will require re-determining the optimal mode work. As a second lamp, you can use any analogues of the 6N1P lamp or a half lamps 6N6P and its analogues.

Adjustment of the gain, if necessary, is carried out by selecting resistors R9, R10. It is quite acceptable voltage deviation at the electrodes of the first lamp by 10÷15%. Correction of the frequency response in the high frequency region (300÷400 kHz) is carried out selection of capacity C2. The schema configuration process is described in more detail in the first part of the article. It is not worth it to heavily load the driver output, the minimum load resistance is desirable limit 50÷100 kÿ.

Structurally, taking into account the large number of elements and the broad bandwidth of the circuit, it is expedient to implement the amplifier on a printed circuit board. Power transistors are cooled according to their power dissipation (see Figure 1).

I want to draw special attention of readers to the power supply system. The level of pulsations of the anode voltage should not exceed a few millivolts, and it must be stabilized. In the process of testing, a curious fact turned out: a change in the supply voltage with a small change in the THD value, it leads to a significant redistribution of the levels of high frequency harmonics. To avoid any otherworldly effects in the sound from time of day and weather, the anode voltage must be fixed. The incandescence of the lamps can be powered by a variable unstabilized voltage. Significant influence on the parameters when finding heating voltage was not observed within acceptable limits.

