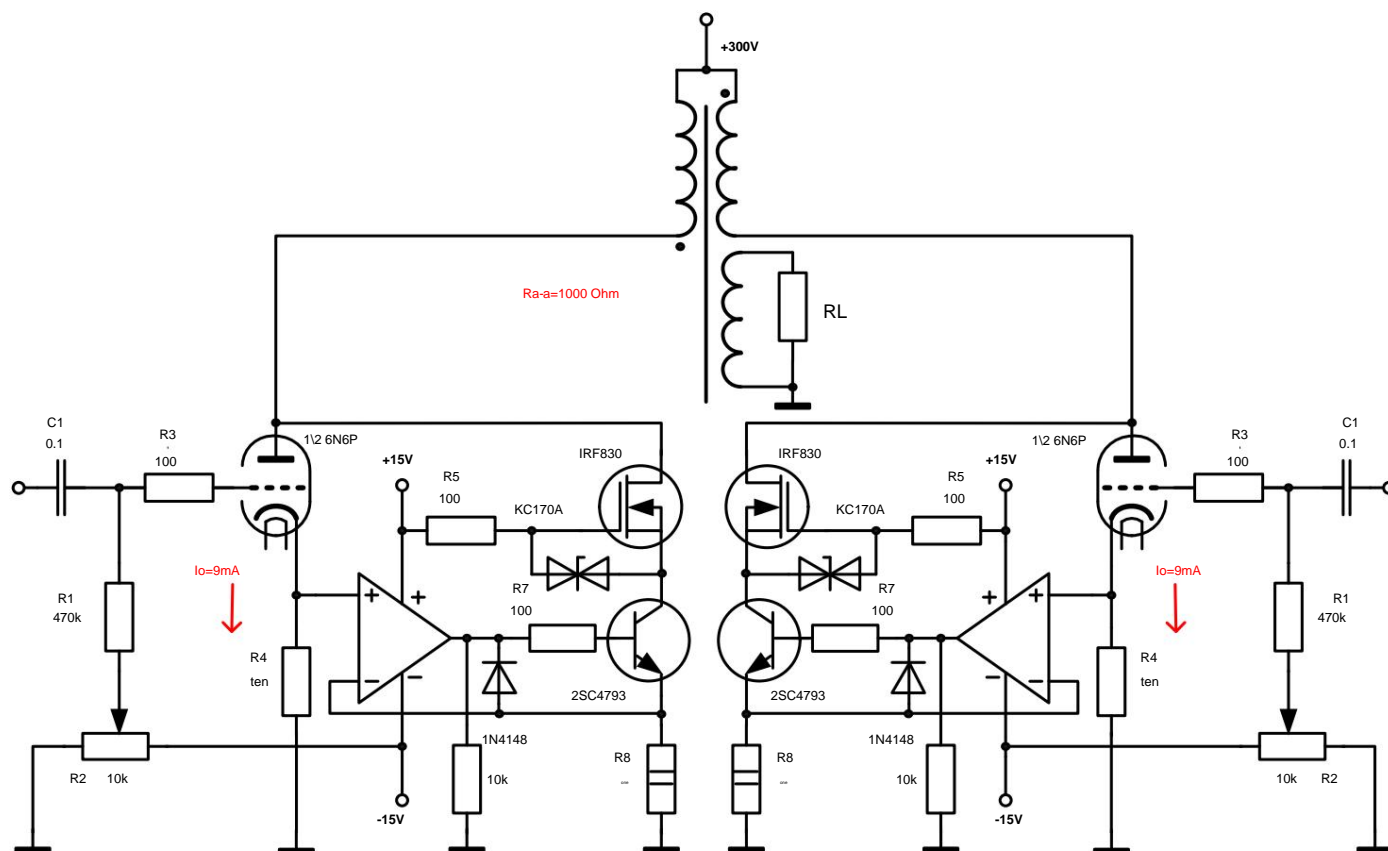


HYBRID LAMP

Part 2

Evgeny Karpov

In general, I decided not to postpone the study of the push-pull cascade with a hybrid lamp for future. And I wanted to check the conclusions made earlier on a live device, and already half of the circuit was assembled on a breadboard. The circuit under study is shown in Figure 1. In fact, the shoulders of the circuit are a copy of a single-ended cascade with a slightly corrected quiescent current.



Picture 1

The cascade was excited directly from the generator through a phase-inverted transformer. Unfortunately, the output transformer was, to put it mildly, not very suitable for this circuit, as it was designed to be used with completely different lamps at much higher anode voltages. So the maximum output power is somewhat underestimated, and using the "correct" output transformer, you can expect an increase in output power up to 25-27 watts. The reduced resistance between the anodes is chosen, rather, to achieve maximum output power. If someone decides to repeat such a scheme, then I would recommend increasing it by 20-30%. This will reduce the output power, but significantly increase the linearity, which will make it possible to implement an amplifier without a common feedback circuit at all or with a minimum depth of feedback.

The behavior and characteristics of the cascade are straight forward textbook. Adjusting the mode of one of the lamps allows you to minimize even harmonics, further suppression of even harmonics (if necessary) can be achieved by balancing the op-amp itself. Approximately up to 5 watts, the cascade operates in a pure class "A" and then safely passes into an analogue of class "AB". A feature of the cascade is the inadmissibility of the transition of lamps to the mode with grid currents. The appearance of grid kov leads to distortion of current-voltage characteristics, loss of symmetry, and a sharp increase in distortion.

The dependence of harmonic levels on output power is shown in Figure 2, and the level of total distortion is shown in Figure 3.

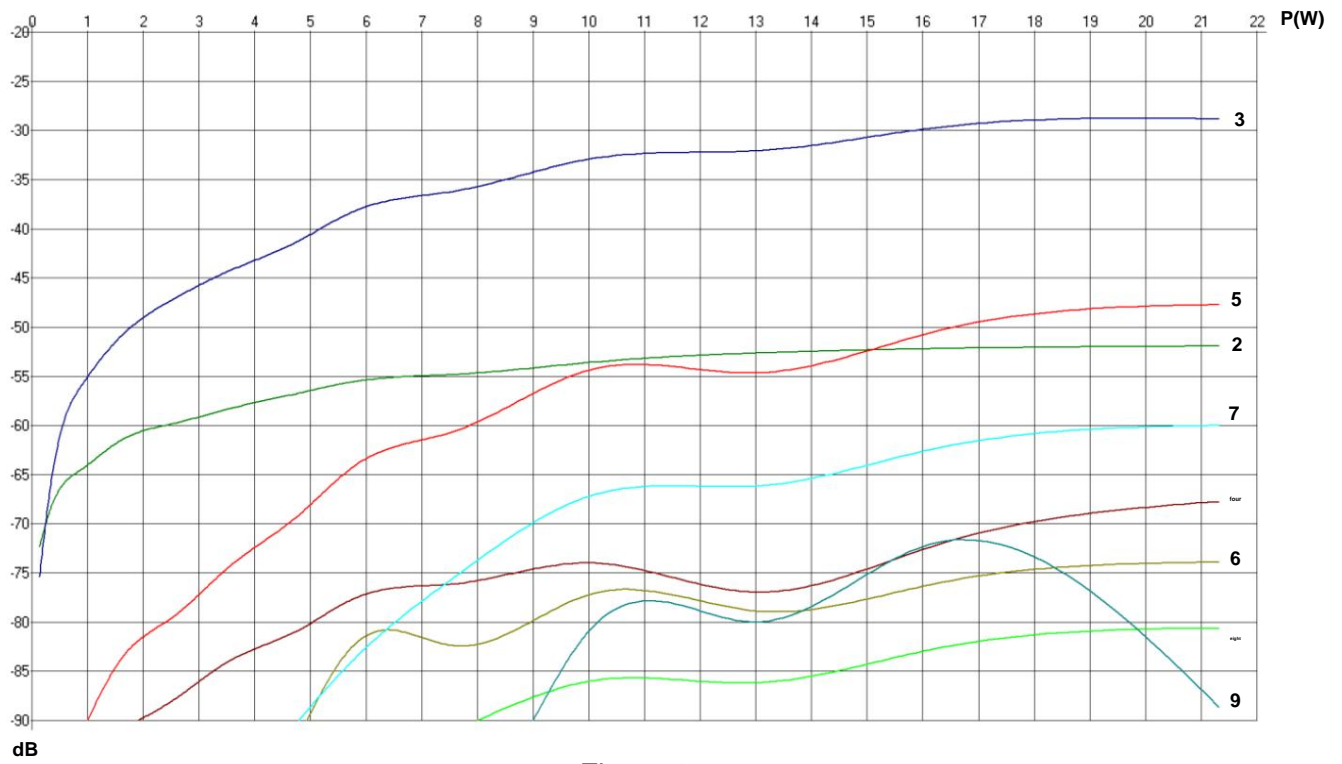


Figure 2

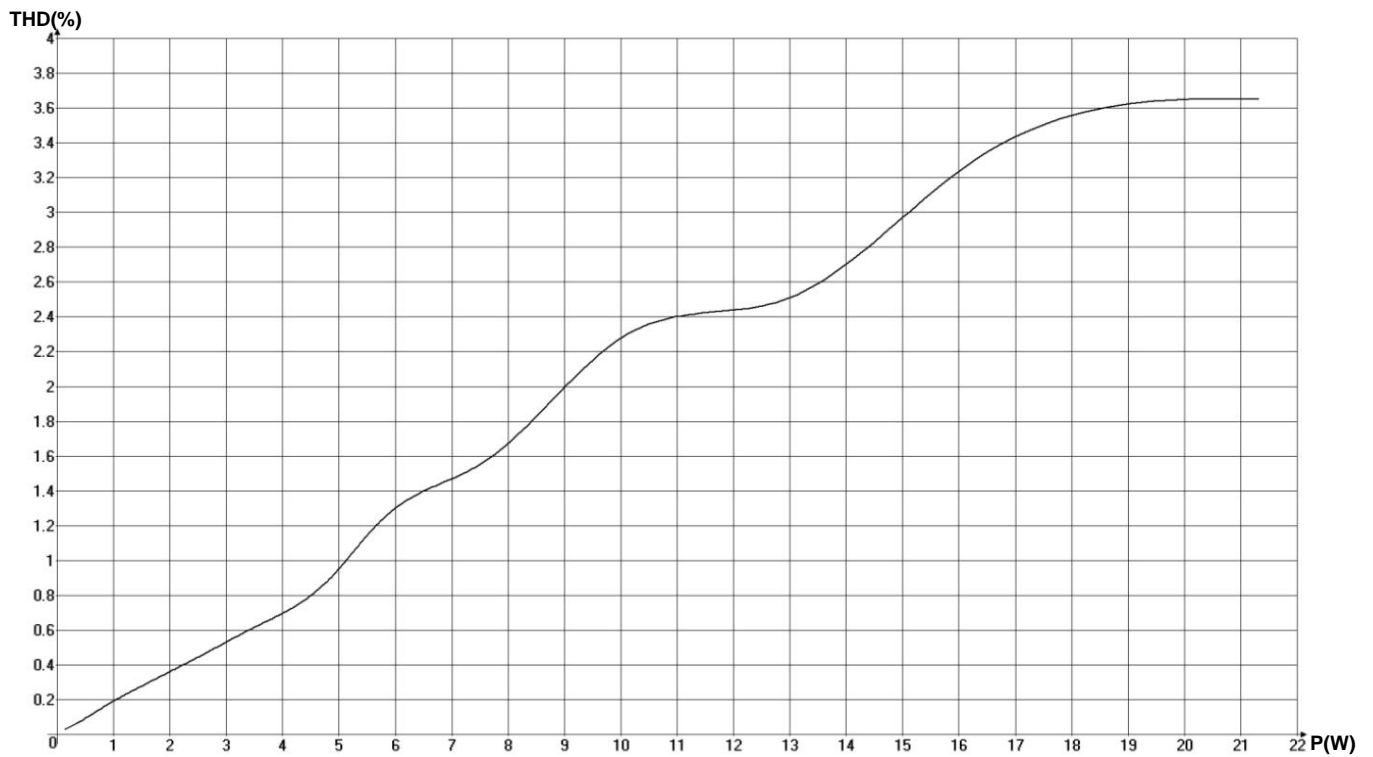


Figure 3

The following conclusions can be drawn from the test results.

The circuit is fully functional and, according to objective characteristics (I think, according to subjective assessment), it is not inferior to the classic push-pull cascade on powerful lamps, but it has the advantage a society in the lowered output impedance.

The scheme shown in Figure 1 can be used as a base and recommended for repetition.