



Filter throttle

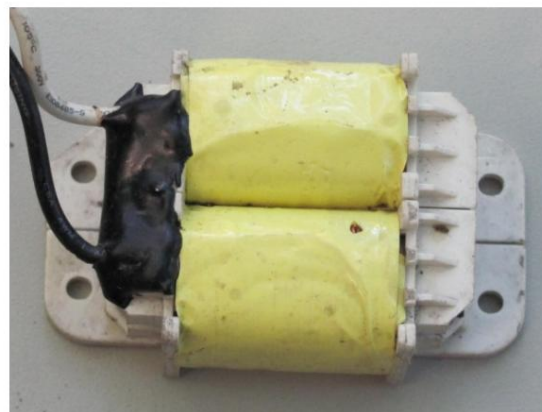
Evgeny Karpov

The manufacture of a filter choke of a high-voltage rectifier from improvised materials is described.

I, like any person who does something with his own hands, is lying in different corners a bunch of junk. No matter how necessary, but it's a pity to throw it away. And just like that, I needed choke for the filter, and a bunch of chokes from computer sources with a passive form factor corrector. On the one hand, in its original form, the thing is for nothing special. unsuitable, but on the other hand, not in short supply, and now you already have a core, and frames, and a gap hidden under winding.

Most often there are chokes of this type (Figure 1).

Core cross section - about 1.6cm² , average the length of the field line is 13 cm. I'll run ahead a bit and I will say a few words about the magnetic properties (I could not figure out the type of material). This is not ordinary silicon steel, but some kind of alloy designed to work in strong fields. It has a relatively small value of the initial μ - about 250, and a long shallow magnetization loop with a large value technical saturation induction. For low frequency chokes - just what the doctor ordered. So, I decided to try using



Picture 1

them for their purposes, according to the dimensions of the core, at first glance, they should have been suitable.

Let's go back a little.

In the article ["Power supplies for high-end tube audio equipment"](#) enough detail different types of filters are described. From the point of view of minimizing the noise of the rectifier itself and the penetration of interference from the network, the L-shaped filter, starting from the inductor, will be the most suitable. For illustrations of this statement below are the oscillograms of the currents flowing in the rectifier circuits and their spectra. Figure 2 and 3 - capacitive filter, 4 and 5 - inductive. The oscillograms were obtained in a real device under the same load. The difference in the level of self-noise generation is quite obvious.

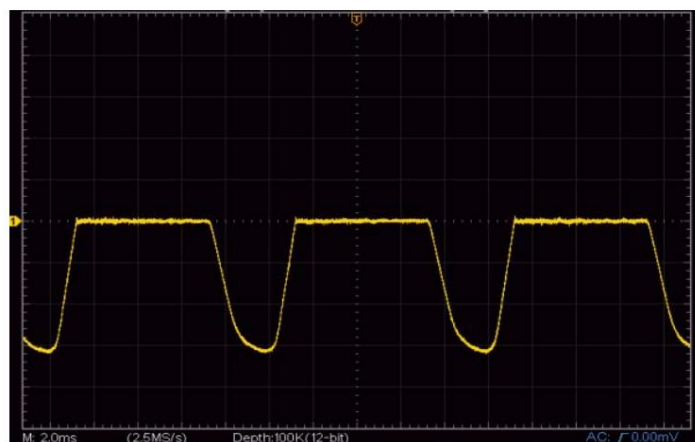


Figure 2

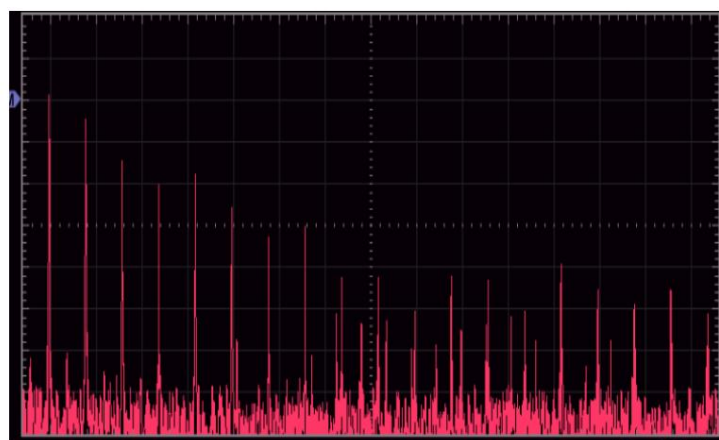


Figure 2

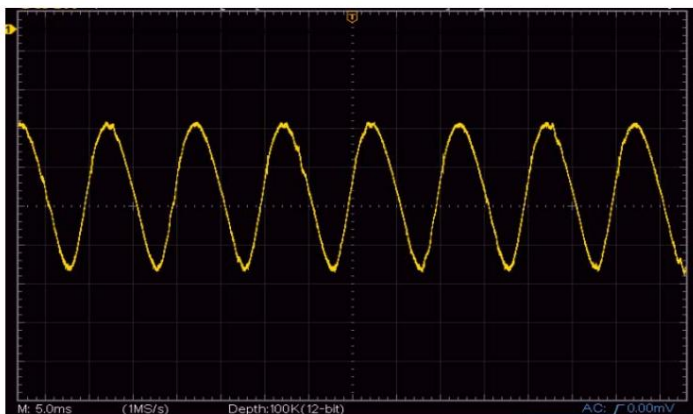


Figure 4

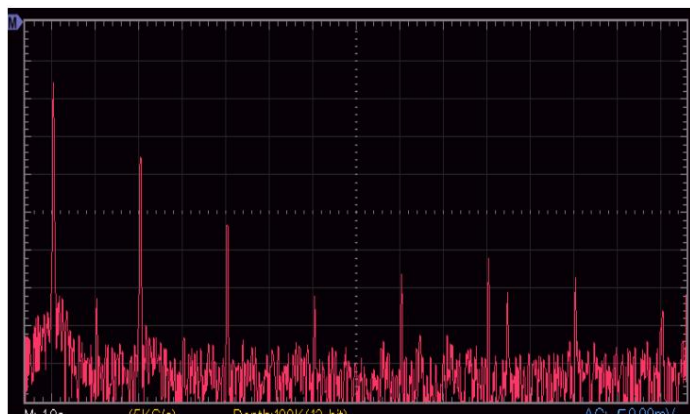


Figure 5

I want to draw the attention of readers that the operation of the inductor in an inductive filter and in a classic U-shaped filter differs in the level of the applied alternating voltage to the winding throttle (many times more for an L-shaped filter). This must be taken into account both in calculations and when choosing a factory product (the maximum value of the variable component on the winding is a normalized value).

Practical implementation.

The main problem during the alteration was the question: how to disassemble the throttle. It turned out that the compound with which the core is fixed has a heat resistance much higher than the frame material. So heating with subsequent kolepaniye - disappears. Yakscho ÿ hour that nathnennya, then you can try chopping the throttle even without heating, but the ability to "get" the core and frames without damage is under big question. It all depends on the generosity of watering with the compound by Chinese colleagues. A more reliable and faster way is to "mine" the core separately, and separately the frames. The downside of this solution is the need to have two chokes.

"Production" of frames.

In the core from the end (Figure 6), approximately in the center of the cores, two blind holes are drilled with a diameter of 3-4 mm and a depth of more than half the height of the core. Through these holes, the middle plates are knocked out with a tray or a suitable nail. When some of the plates are removed, the removal of the rest of the plates is not difficult. As a result, we get whole frames, the wire is unwound from them, and the remains of the compound are removed mechanically (Figure 7).

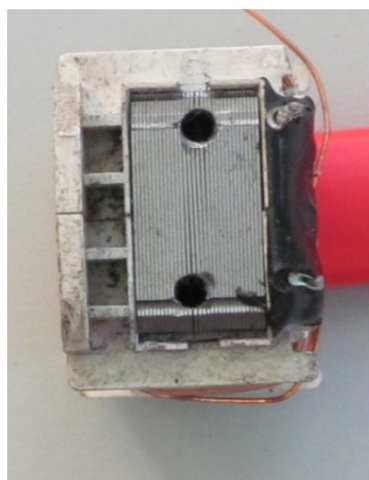


Figure 6

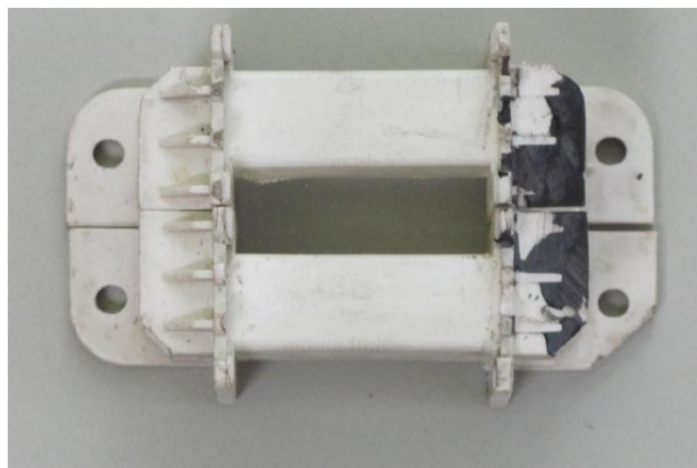


Figure 7

"Production" of the core.

The wire is wound or cut off from the frames, and after heated with a hair dryer, the frames simply break. Remains compound from the plates are removed mechanically (without fanaticism). There are two variants of plates (Figure 8) - the width of the plate rods is the same everywhere, and the jumper has smaller width. The first option is preferable, but the second one can also be used, taking into account that the equivalent cross section of the the nursery will be smaller. Another positive point: most manufacturers have plates of the same size, and cores with coils are interchangeable. The plate type can be determined without disassembly by appearance of the end face of the core.



Figure 8

Technological problems do not arise further, the windings are wound, the inductor is assembled with by fixing the core with a suitable compound, and if possible, it is impregnated with varnish. It is desirable to wind the coils with an ordinary laying, but it is also possible in bulk. Approximately in the middle windings, an insulating gasket is laid to prevent the coils from falling.

The question of calculating the number of turns and the thickness of the spacer between the cores is vague. A very approximate estimate can be made according to the standard method for calculating the filter inductor. The error turns out to be large, it turned out that the actual thickness of the gasket is less than the calculated one by half, and the turns - 20% less. A more accurate option, but also time consuming, is to obtain the dependence of permeability on the thickness of the gasket. Since the number of turns on the coils are the same, having one coil, the second can be used as a test coil.

What I ended up with (Figure 8).

A small inductor with a small stray field, 12 G inductance and 250 ohm winding resistance. Completely silent. Core Gap 0.2mm

(0.1+0.1mm), wire $\varnothing 0.17\text{mm}$, number of turns 5600 (2800+2800). Operating current - 40÷70 milliamps, permissible variable voltage component on the throttle - 140 volts (effective meaning).



Figure 8

And a little advice to those who decide to repeat this adventure. Must see inductor current shape before final assembly with fixing the core with a compound (compress the core clamp, for example). The current should be close in shape to a sinusoid, not decrease to zero (not enough inductance of the inductor), and there should not be characteristic peaks (saturation core).

By the way, the presence of two symmetrical coils allows you to turn on the throttle differentially, which improves the filtering of mains interference.