

BREADBOARDING

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Extreme Breadboarding

When I started this column ten years ago, the editor's intention was to open up the hobby to beginners and show some simple workbench experiments on pioneering radio circuits. I thought the limits had been stretched pretty far when, in July 2004⁽¹⁾ I made a superhet out of a perfectly innocent Radiola 18. But this February my e-mail lit up with several folks sending me a do-it-yourself blog page⁽²⁾ showing an intrepid craftsman actually making his own tubes (Figure 1). The gentleman in question is Frenchman Claude Paillard. On December 31, 2007 he had

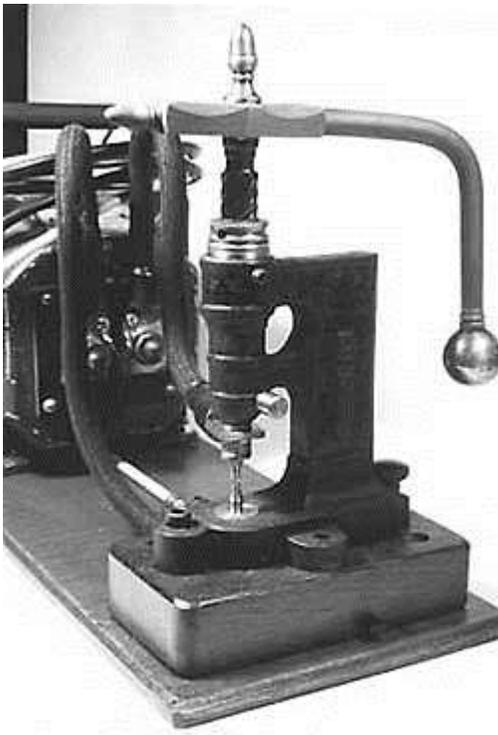


Fig. 2. The Spot Welder

posted a seventeen n-minute video showing how he makes his own triodes. I e-mailed Claude and got permission to describe his work in this column.

The Builder's Background

If you follow the internet link to M. Paillard's personal website, you will encounter a short statement about his background, which I will try to paraphrase here in English:

The author Claude Paillard began, like others in the 'fifties, with radio-controlled models, making it a point of honor to build even the motor to propel a boat. In 1959 he became F2FO, passing his test on a 5-band AM transceiver of his own design. As a ham he

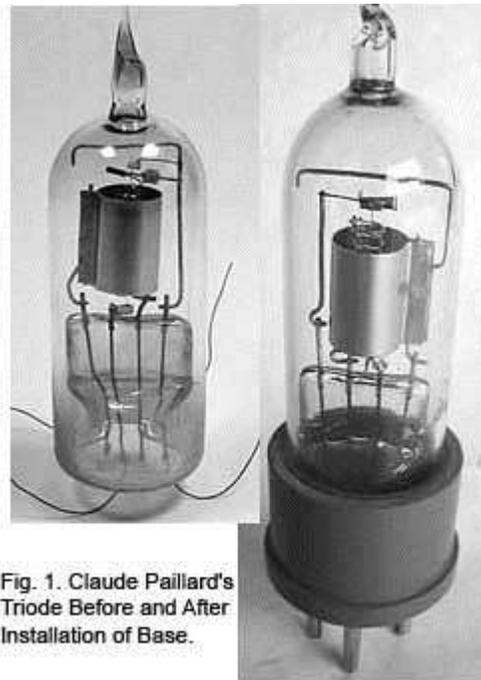


Fig. 1. Claude Paillard's Triode Before and After Installation of Base.

gathered DXCC and SSB certificates, though rag-chewing was not his cup of tea. He worked RTTY on machines that he repaired. His first article for Radio-REF magazine was a BFO for the BC453 command set to improve its selectivity. He became Editor for the "Analysis of Reviews" column, a position he held for many years, and also served on the magazine's editorial board.

Claude published articles on an 811 linear amplifier, an oscilloscope for a modulation/signal quality monitor, a TV camera using ICs, and several SSB units including a widely-used mobile system. Next he worked higher up the spectrum, first at 2300 MHz, then at 10 GHz., making pioneering QSOs between France and England in 1968 and 1969 at these frequencies.

An admirer of old tubes and components, he worked QRP across Europe, using tubes of the '20s, on 80 meter CW. He restored several Collins 618-T transceivers. Then, recognizing the approaching centennial of the DeForest's vacuum tube in 2006, he began trying to duplicate the famous TM triode of General Ferrié (1915) using various vacuum pumps [and furnaces - ed.] to allow the tubes to function. He built a dozen useful tubes in this way, and made his first QSO with them in 2005. F6BWO used the same tubes to work four continents.

Watching M. Paillard's Video

Watching the video, and grooving to Teddy Wilson on the soundtrack, you see this incredible craftsman, skilled in several kinds of lab and bench work, in action. He begins by using a Swiss Army knife to cut thin strips of metal that will become the plate electrodes of his tubes (which look like WD12s). At a later stage of construction, he shows us a sweet little spot welder with quarter-inch copper electrodes (Figure 2). Next you see him wrapping grid wire around a hand-held mandrel and drawing filaments into end clips before doing more spot welding. (Figure 3).

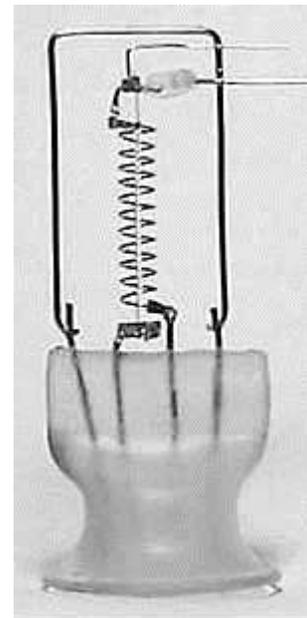


Fig. 3. Early stage in Assembly of Electrodes

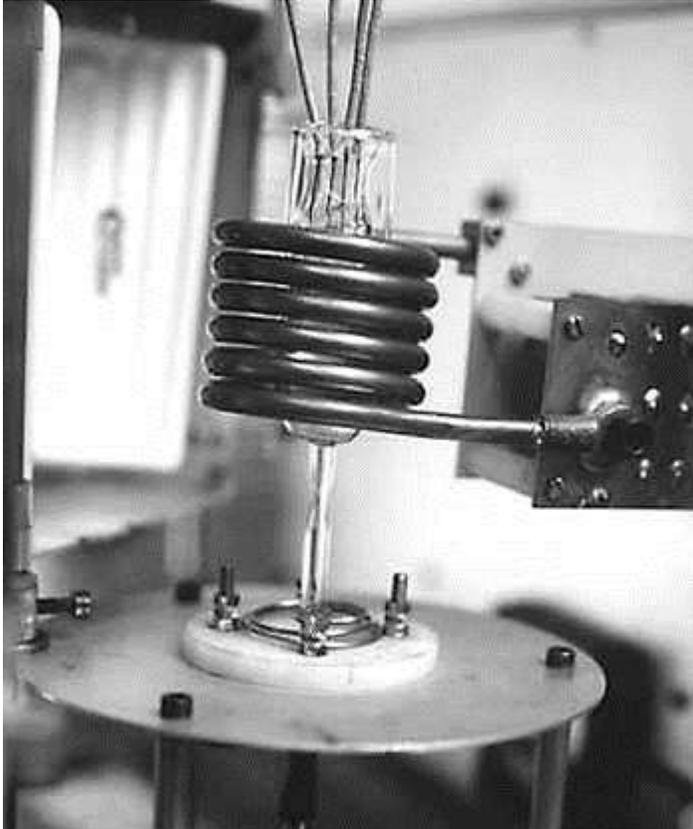


Fig. 4. Out-gassing a Tube in RF Induction Coil

By the time Claude gets to forming the glass envelopes on a lathe, heating the glass with a butane torch the whole time, you begin to wonder if this is really something you might want to try yourself. When he cuts the glass to length with a hot-wire tool he made himself and shows us a 500-watt annealing oven that looks like a very small tanning booth, you give up and just watch amazed. He can weld glass and uses a homemade RF induction rig (Figure 4) for driving out residual gases before drawing the vacuum. The induction circuit uses a TB3/1000 triode with 2700 volts on the plate running 805 watts input at about 450 kHz! To top it all off, Claude built the vacuum pump shown at the end of the video.

Sealing the tip of the tube (Figure 5) is a delicate operation that can easily lead to breakage. Not shown in the photo are two heat shields that can be positioned to allow slower heating of the assembly. The two heat nozzles can be moved around the tip to obtain even heating.

At the end of the video, as a final *tour de force*, Claude shows the characteristic curves of the completed tube being drawn on a curve tracer. Paillard tubes are then shown in an operating Paillard-constructed breadboard regenerative receiver (see "From the Editor") and transmitter.

There's a link on Claude's site (3) that leads you to essays on some of the circuits he has developed. They are all written

in French, but web translators are available. Finally, here's a quote from the best comment I've seen from another viewer of the web video:

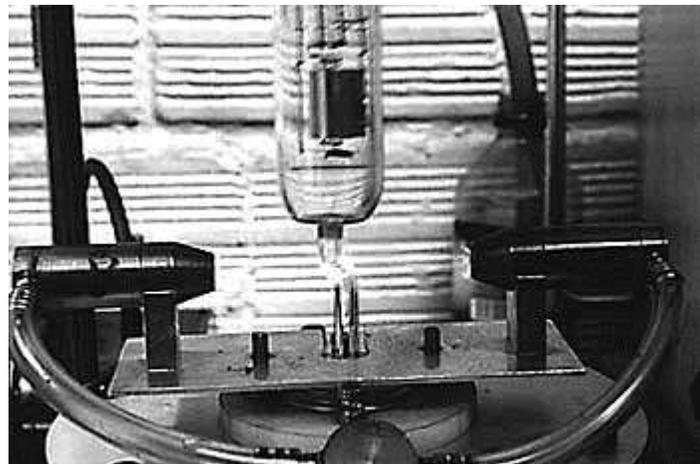


Fig. 5. The Delicate Work of Sealing off the Tip

When you hear people say we do not need apprenticeships any more, you need to remember that this is a display of classic craftsmanship; a truly skilled artisan. In today's world, we place no value on such skills; assuming that they can be bought. But you need to build a society that respects and encourages such skill. France is such a nation. They still have many rural villages that retain the idea of the individual in their local community, providing everything you need from the local skill base, and respect the idea that an individual can make his mark through his individual skills as an artisan.

You cannot buy these skills at the local Walmart. You have to create a society that creates them within its structure as a society of artisans. But to do that, you first have to value such skills and do everything you can to encourage them, from childhood right through to old age.

Note: Further comments on Claude's video will be found in Dave Kraeuter's book review column elsewhere in this issue--mfe

References

1. Winter Madness--Creating a Radiola 18-S OTB, Volume 45, No. 3 July 2004, p. 29
2. MAKE Magazine weblog:
http://blog.makezine.com/archive/2008/01/make_your_own_vaccum_tube.html
3. Claude Paillard's website: <http://paillard.claude.free.fr/>