SEM Diaries 5 - It Broke!

Jeremy Poole

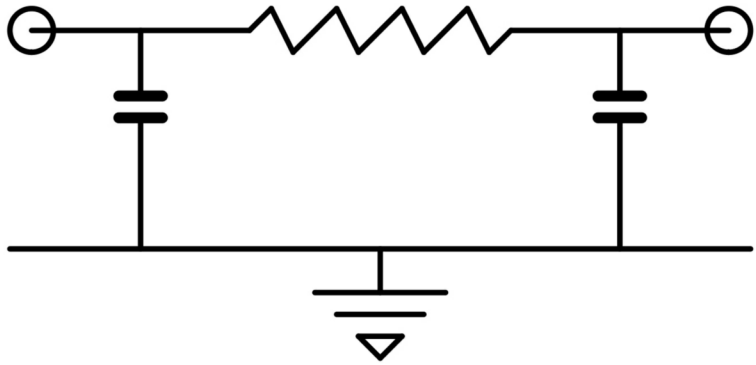

Fig. 1: The circuit diagram of the stage touch alarm “filter”.

One of the items on my large shopping list with my suppliers, Tron-Tech, was a couple of days training on the use of the Beast. The first day took place prior to delivery. The second was provided, in the middle of March, by a facility manager at one of the (relatively) local universities, who was familiar with the FEI range of SEMs. This day was a great success, introducing me to many shortcuts and techniques, and also the Low Vacuum mode (of which, more in a later edition of Diaries). However, during that session the stage of the SEM started producing “Touch Alarm” warnings, suggesting that the stage or a stub was touching the walls of the chamber. This was despite the chamber scope indicating that there was no touching taking place. For the rest of the session we could get round the problem by disabling the touch alarm through the user interface, but when I fired up the system the following day a different error message came up, indicating a fault, and the stage could no longer be moved under computer control. This did not mean that the SEM was totally unusable, as the stage could be moved by twiddling the knobs on the chamber door, but this was far from ideal. Anyone who has had to fully open the jaws of a 25 mm screw micrometer from the fully closed position might understand the frustration, as a similar number of revolutions would be required to navigate the width of a stub across the field of the beam.

Obviously a service call was required. Don duly arrived and I left him fault-finding. The problem was eventually traced to a small module. Imagine a metal cylinder about 15 mm in diameter and 100 mm in length, with a bnc coaxial connector on each end. Inside this is mounted a simple filter circuit consisting of a resistor with a

capacitor connected to earth at each end (Figure 1). Compared with microcircuits containing literally millions of gates or similar logic components, such a simple circuit might be expected to be extremely reliable. However, the construction of this was horrific, at least to someone who has spent almost his entire working life in the electronics industry. The resistor was connected directly to the centre pins of the bnc connectors, which was almost acceptable, but the capacitors, which were of the "chip" variety, were soldered between a solder tag on each end plate and the wire of the resistor. (I wish I had had the presence of mind to take a photograph at the time!) The solder joint between one of the capacitors and the resistor had become dry, or else the solder "blob" on the capacitor had separated from the body of the capacitor. Either way, the filter was not operating correctly, and it proved impossible to re-solder the capacitor without irreparably damaging it.

Don took the offending part away for repair and returned with it in due course, suitably mended, presumably using a more sensible type of capacitor. I must admit that I was sceptical that this could be the only fault in the system, given the simplicity of the circuit, but when the bnc plugs were connected in circuit the touch alarm light was extinguished and the stage resumed operating with full functionality. A great relief all round!

While waiting for the stage functionality to be restored, I turned my thoughts back to the rotating stubs that I described in the last issue of Diaries. The photos of the *Tegenaria* pedipalp reproduced there show a mottled background resulting from the rather poor machining of the surface of the stub. I thought, "Suppose I put a self-adhesive carbon pad between the pedipalp and the surface of the stub. The smooth surface of the carbon pad will provide a better background and serve equally well at conducting away the electron beam."

The result is shown in Figure 2, which is, in my view, a significant improvement on the original, despite the finger mark at the top left of the image.

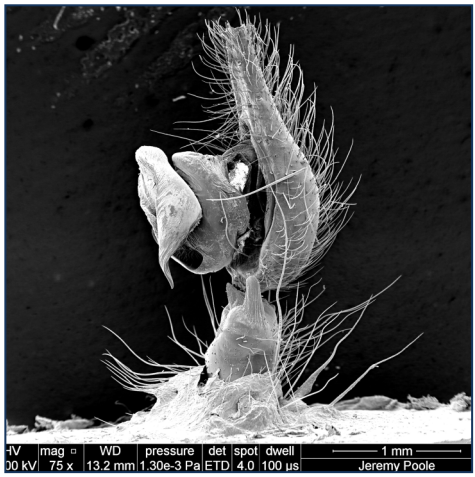

Fig. 2: *Tegenaria saeva* pedipalp imaged with a carbon pad directly below the palp.