

Meucci Telephone Artifact Inspection Mission Report  
Angelo Campanella  
Monday, 10 July, 2011

**Arrival and resistance tests:** Used my GPS to guide cabbie to the Meucci Museum. Arrived on site 11am. 2 Hours until opening. The Acre-sized museum site is tended and trimmed. The Meucci three-story house stands on a weathered concrete pedestal. The neighborhood is mixed commercial-residential. A smaller obelisk commemorates the death of Meucci's wife, Esterre in 1884. The larger obelisk Commemorates Antonio and includes a handsome head bust.

Michaela (director) and Nichole arrived after 1pm, gave me entry, then showed me a video outlining Meucci's life and inventions. I explained my visit, then was given access to the display case where four telephone artifacts are on display. I measured the ohmic resistance of each unit. These were found to be (in sequence as positioned in the display case):

Unit, Approx year	1857	1867	1854	1854
Description	Round Shaped	Terminals	Stranded core	(horseshoe core?)
Resistance, ohms	26	60	31	5

The terminal wires were old but usable to measure internal resistance. All four units showed continuity and a resistance compatible with wire winding of an electrodynamic reversible transducer.

This satisfied the basic quest of this mission; "Were these imitation objects, or working reproductions?", the answer now being that they are in the least working reproductions, or quite possibly original units preserved throughout the years. There are two Meucci era's; the original devices, invented around the stated years and then often lost or sold as junk, or they could be reproductions by Meucci in discussions with Western Union in 1872 or as evidence for the Globe defense during the 1880's trial.

**Microphone Sensitivity:** I did not arrive equipped for the next logical test, which was to evaluate the microphone and speaker sensitivities of these four artifacts. An Internet check for a suitable miniature voice recorder identified the Olympus VN-6000 available in Radio Shack stores; one being locally. I traveled there that evening, bought a VN-6000 voice recorder which also has an external mic input and an earphone output. I also bought a 1/8" plug cord. But Radio shack no longer carries alligator clip leads. The next morning I found a hardware store where I could buy alligator clips and insulated wire. Then I walked to the Museum and awaited staff arrival while assembled a 1/8" mono plug to clip lead input harness. I then discovered that the cable furnished was rally an attenuator patch cord is with 10 ohm resistors across both ends and a 4,600 ohm resistor between. This cable sold to me at radio Shack was really intended to pick up the audio signal from an amplifier output. So I cut open one plug, severed the 10 ohm shunting resistor, then assembled a proper harness with clips on one end, the t1/8" plug jack on the other. Recordings include power line magnetic "hum", varying in level according to the coil sensitivity for ambient ac magnetic field in the museum Garibaldi display room. (The ac E/M field was more intense in the Meucci display room.)

Photographs and Energy-Frequency-Time graphs (EFT, "voice prints") of the recorded audio are included herein. A word document (not shown) will produce sounds. One sound file from the 60 ohm unit is furnished external to the PDF version.

I found the 60 ohm 1859-60 (VR2) unit to be the most responsive to voice, though somewhat narrow band, likely due to a lower frequency resonance of a softer diaphragm. The 26 ohm 1857 (VR3) unit was less responsive, but more clear. The 31 ohm 1854 (VR4) unit exhibited hum pickup and very weak voice sound. The 5 ohm 1854-9 (VR5) produced a weak but clear voice signal. It must be remembered that Meucci often depended on battery driven bias current to energize the magnets, so the voice response signal levels recorded here without bias may not be representative of his practical field performance achieved.

**Loudspeaker Sensitivity:** After these productive observations, I went for a coup de grace; I connected the most sensitive unit, 60 ohms resistance, with the same clip lead harness plugged into the recorder earphone outlet, then played back my recorded sound (VR2). Holding that unit near my ear, my voice emerged with reasonable clarity. I demonstrated this first to Director Michaela, and then to one of her assistants.

**Next steps:**

This work need not stop here. Subsequently, I recommend that middle school teachers adapt a lab experiment where the student is given basic materials to fabricate one of these reversible transducers just as Meucci did.

Here are some recommendations for further technical study by capable ASA parties:

- 1- **Bias Current:** Meucci reported that the sensitivities of all his units were enhanced by passing direct current through them. This should be done, first estimating the voltage which Meucci used. He used some Bunsen cells (about 1.9v each) connected in series.
- 2- **Impedance:** Determine the reactive impedance, the microphone sensitivity and the speaker sensitivity of each of these four artifact units.
- 3- **Public Emulation:** Engage the interest of ASA members in Engineering Acoustics, Physical Acoustics and Archaeological Acoustics in pursuing this quest to evaluate Meucci's products.
- 4- **Archaeological Studies:** Authenticity should be further emulated. Some points are:

A- The external appearances and materials of all four units track closely the many statements that Meucci made during the Globe trial depositions. See pages 214, 215, 228-230 of Schiavo's book that reiterates some Globe trial interrogatory.

B- There is certainly nothing "modern" about any part of these artifact units. The most recent mark I can find is tiny white lettering "1956.1.131" written on the 5.4 ohm 1854-1960 believed to contain a horseshoe magnet. The lettering seems to be a cataloguing aid. Could it have been produced as an exhibit during the Globe trial circa 1882? (The last time I have seen white ink was in libraries that I perused in the 1940's and later.)

C- All diaphragms at first glance appear to be metallic. But Meucci speaks repeatedly of coating them with graphite ("plumbago"). This would give them a dull gray hue, agreeing with what I see. It also speaks to a parchment or animal skin stretched diaphragm that more readily resonates in the audio frequency range, a tab of sheet metal (out of sight) was often affixed by him on the back side to better excite current in the winding around the iron core.

D- Wood turning; Meucci spoke of a lathe in his shop (for fashioning round wood objects?).

E- The wire leads are very old black-oxidized thin copper wire with wrappings of fabric thread, common for "magnet wire" of the 19<sup>th</sup> century and later. Meucci comments in his notebook, page 1 (page 232, Schiavo) that "flax saturated with bichromate of potash is good". Come to think of it, the green color often observed may in reality be wire copper converted into a copper salt of that hue...

Angelo Campanella, 10 July, 2011.

Meucci Telephone Artifact Collection



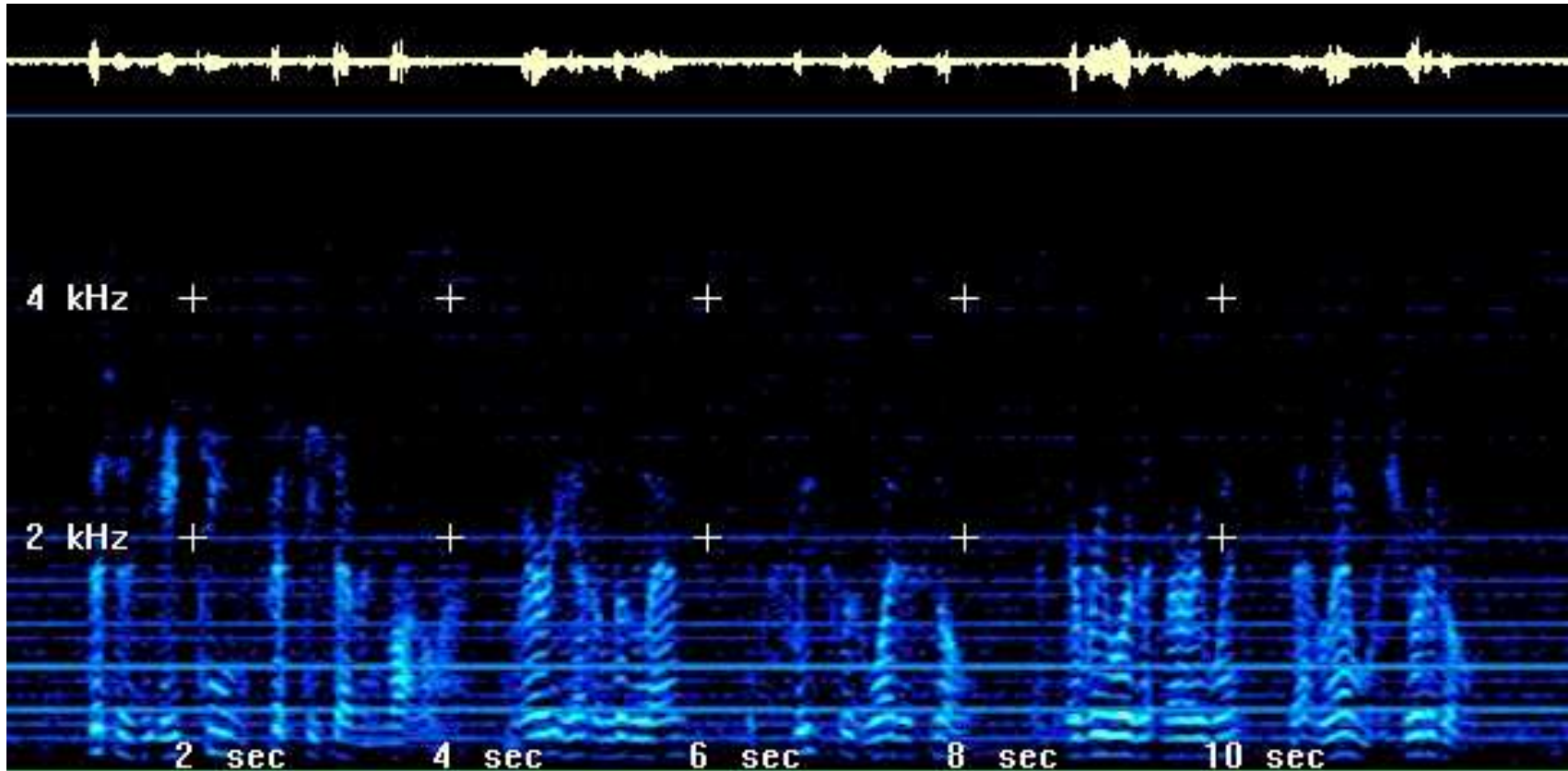


26 ohm 1857 unit (VR3) VR3-L10trimmed.wav






EFT print of 26 ohm 1857 unit (VR3) VR3-L10trimmed.wav

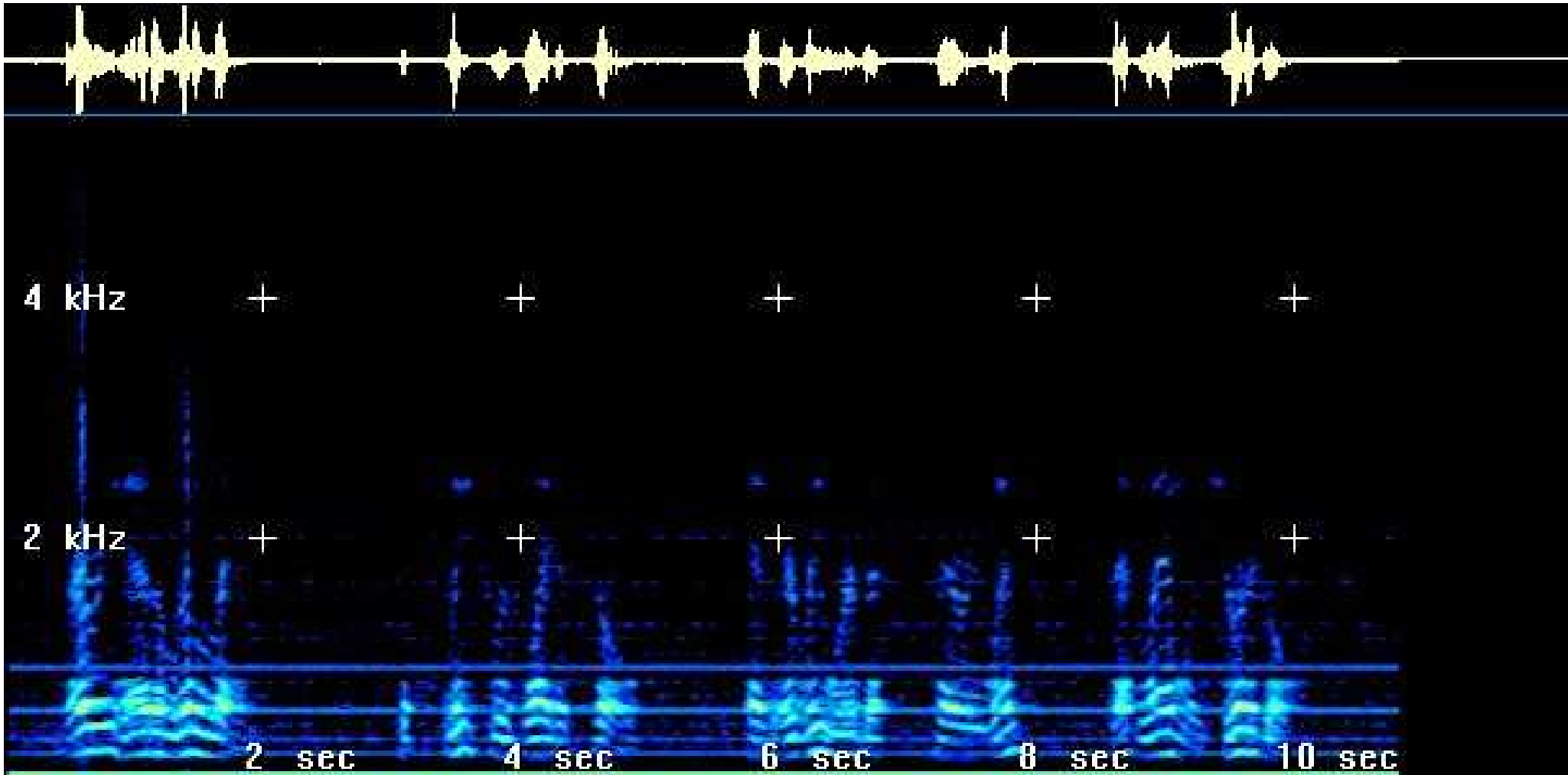




60 ohm 1859-60 unit (VR2) VR2HItrimmed.wav



EFT print of 60 ohm 1859-60 unit (VR2)  VR2HItrimmed.wav



60 ohm 1859-60 unit (VR2) Diaphragm Detail





31 ohm 1854 unit (VR4) Core strands visible on to, near two leads. VR4-L10trimmed.wav

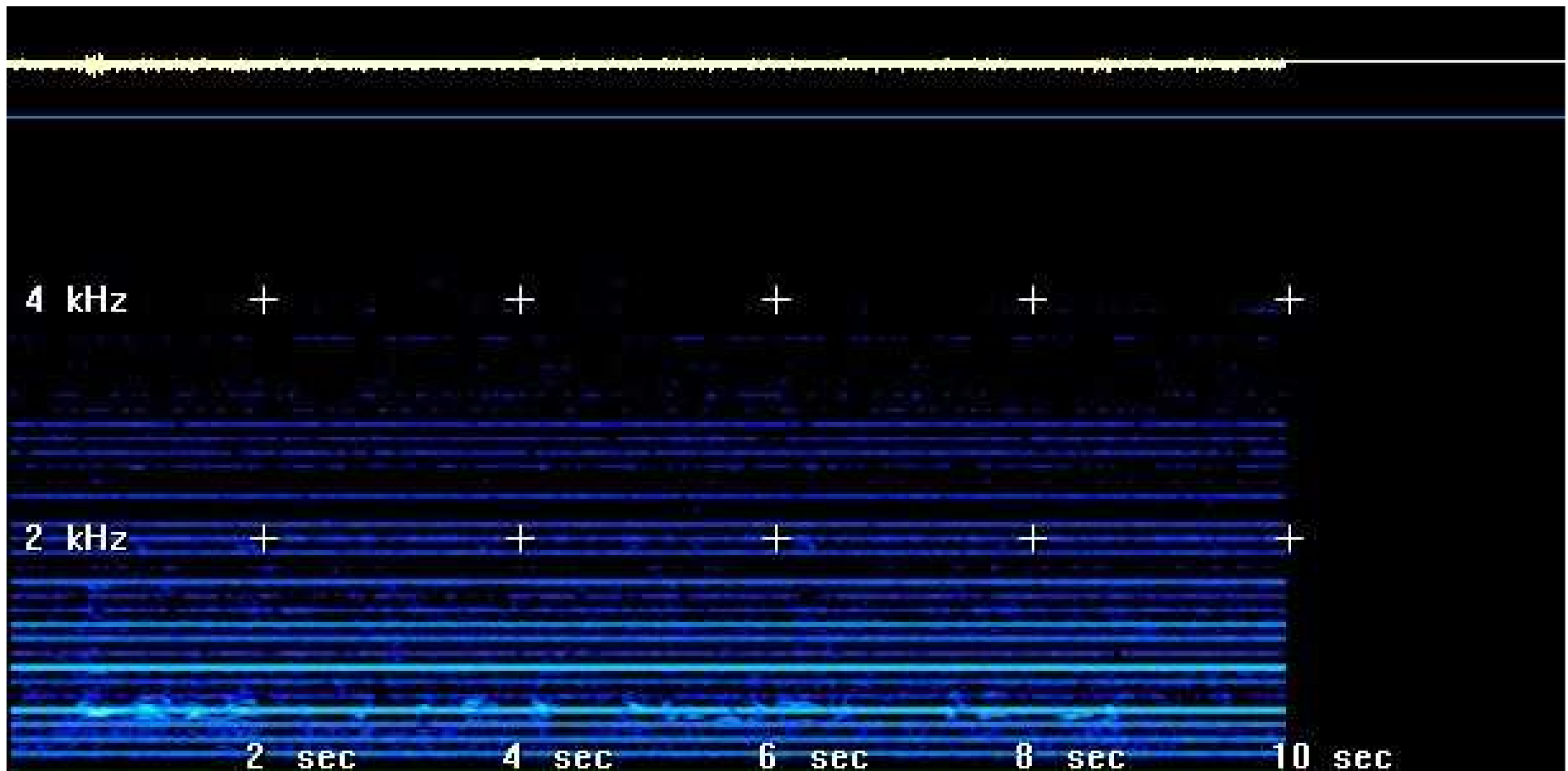
Model of bipolar telephone with horse-shoe magnet, designed by Meucci in 1854 and found in the Memorandum Book enclosed in legal papers pertaining to the case of the Globe Co.





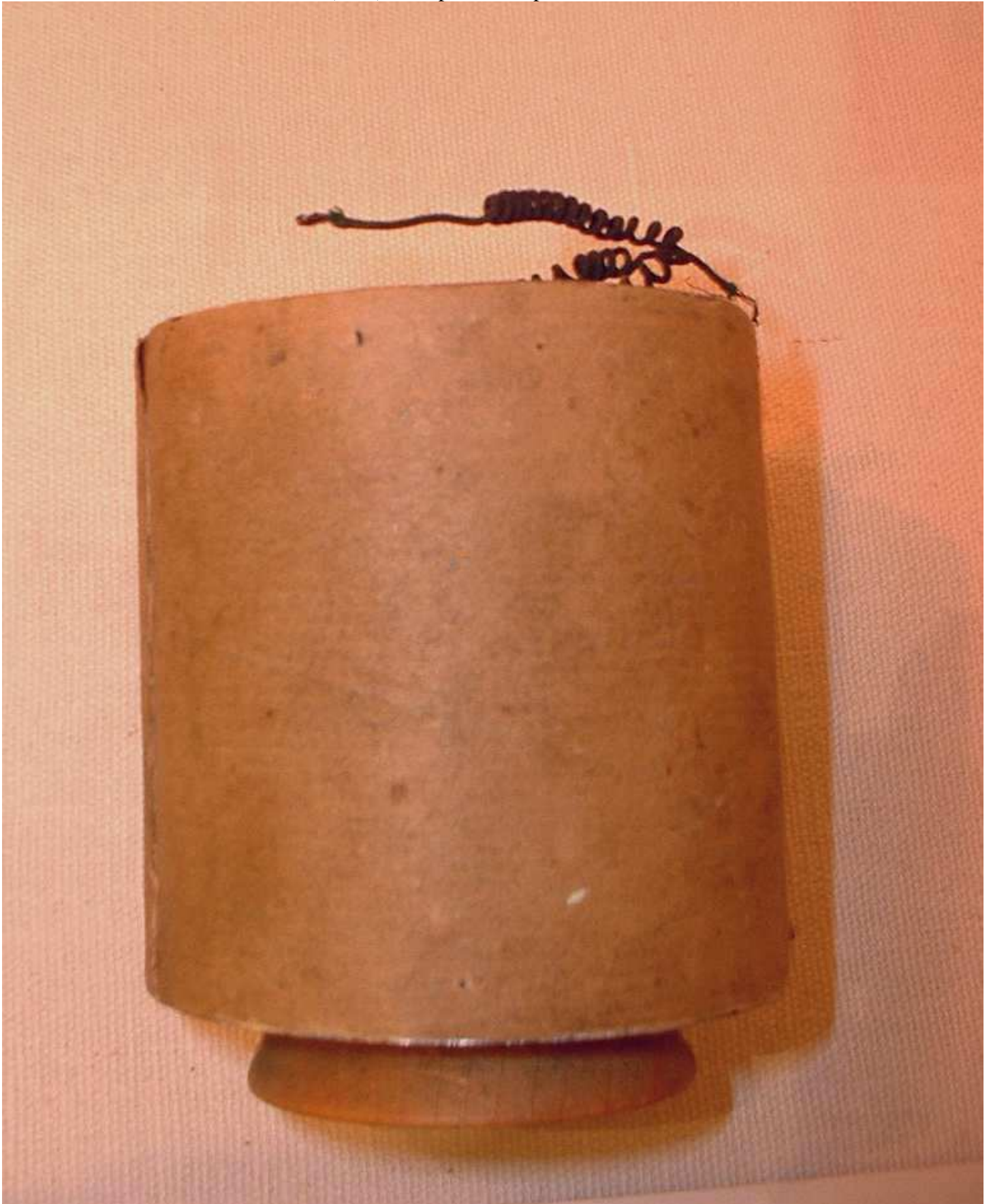
EFT print of 31 ohm 1854 unit (VR4) Core strands visible on to, near two leads.

VR4-L10trimmed.wav





5.42 ohm 1854-9 unit (VR5) Inscription on top "1956...131". VR5-L10trimmed.wav





EFT print of 5.42 ohm 1854-9 unit (VR5) Inscription on top "1956...131". VR5-L10trimmed.wav

