The ‘Mysterious’ Batchelor Broadband Coupler

The Matching Network that Left Others Behind!

Nick Tusa – K5EF

Traditional Impedance Matching

Impedance matching is a fundamental principal we hams use in all aspects of antennas, transmitters and receivers. In fact, maximum power transfer for amplifiers (tube or transistor) occurs when source and load impedances are made electrically-equal or *matched*.

Tube amplifiers have a high plate impedance, often in the order of 1,000 to 3,000 ohms. Transistor amplifiers have lower collector impedance levels, but are still many times higher than the typical coaxial cable/antenna system (50 ohms).

The device that converts high to low impedance is termed a matching network.

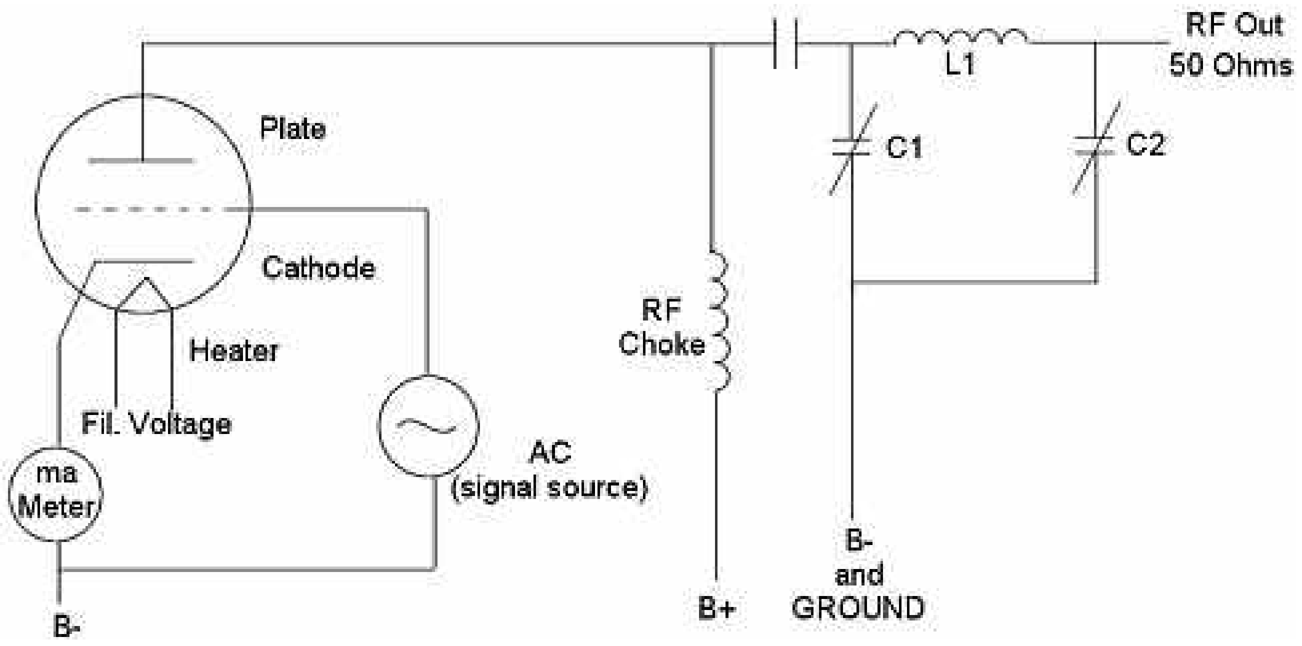
When coils and capacitors are configured into arrangements that are L-type (one L and C); Pi-type (2 Cs and an L) and others such configurations, frequency-dependent matching networks are then possible.

Typical Amplifier Matching Network

This Network has both C1 and C2 as variable elements; but in fact all three (add L1) can be made variable.

At some combination of C1, C2 and L1, it is possible to match tube plate load to antenna load – over a very small range of frequencies.

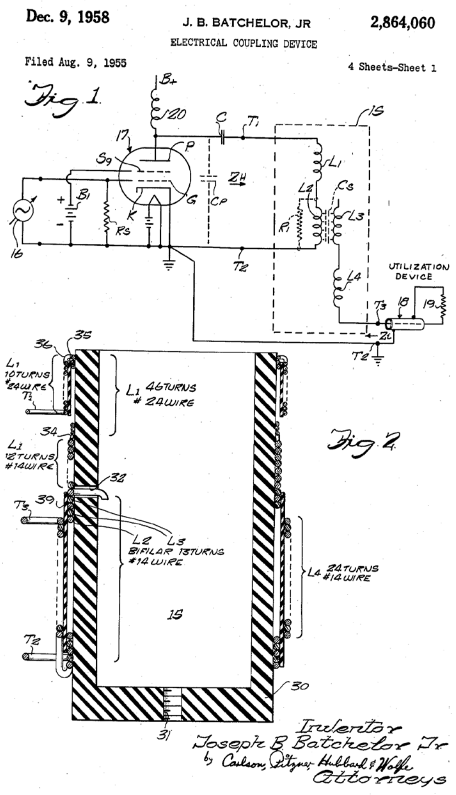
This is network is typical. They work well, but must be retuned as one QSYs….**yuck!**



US Patent # 2,864,060

Filed: August 1955 – Granted: December 1958

Then Things Changed

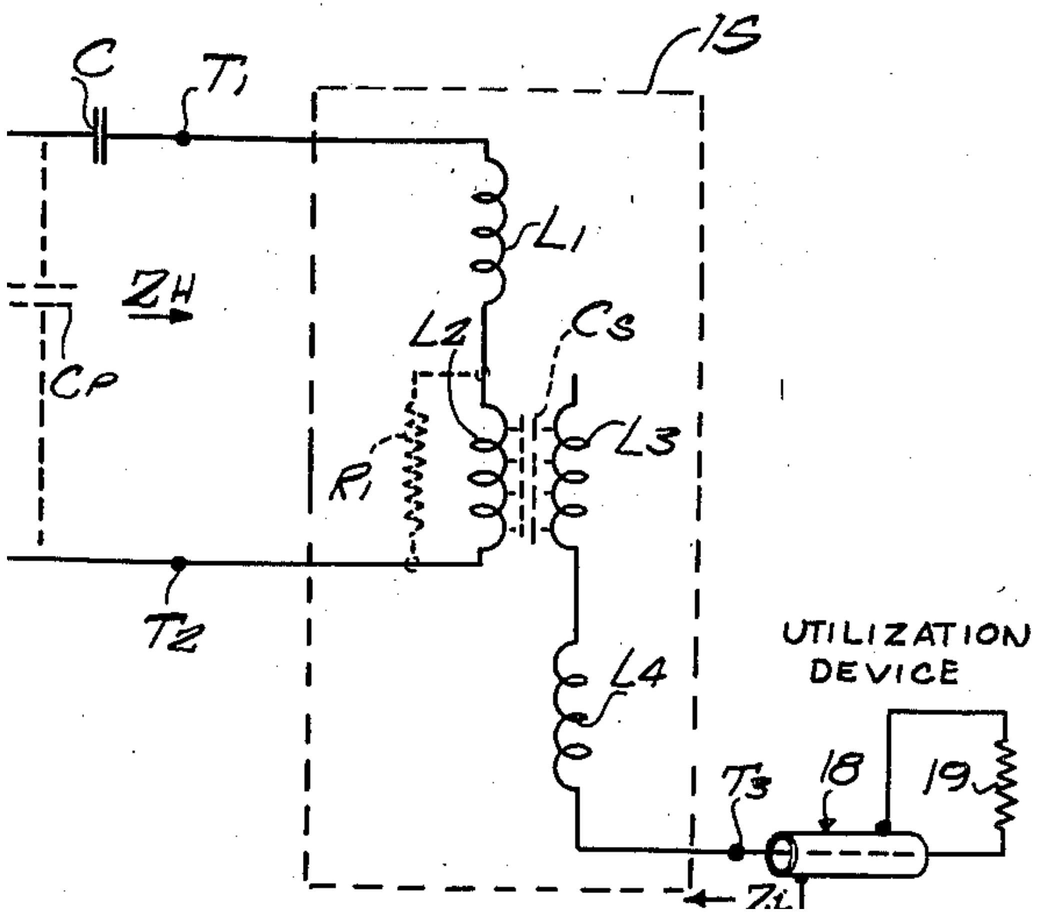


The Central Electronics 600L

Prior to this new design, the only way to transition a radio transmitter to different band segments involved a lengthy retuning process – “Dip the plate/peak the Load.”

Joe Batchelor and Wes Schum changed it all in 1955!

The Batchelor Coupler – No Moving Parts!

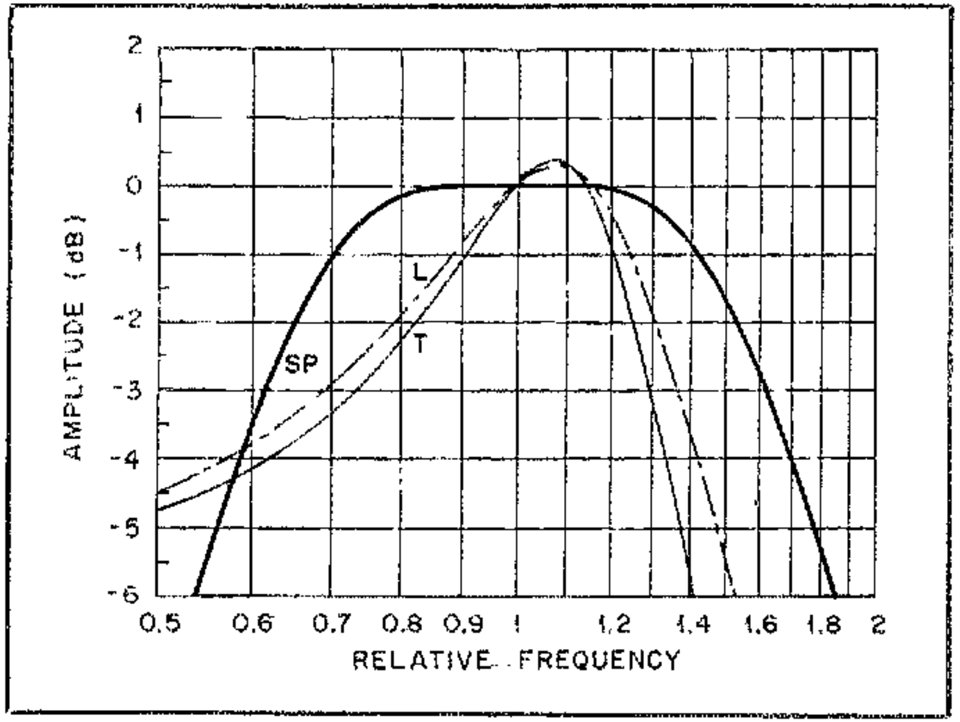


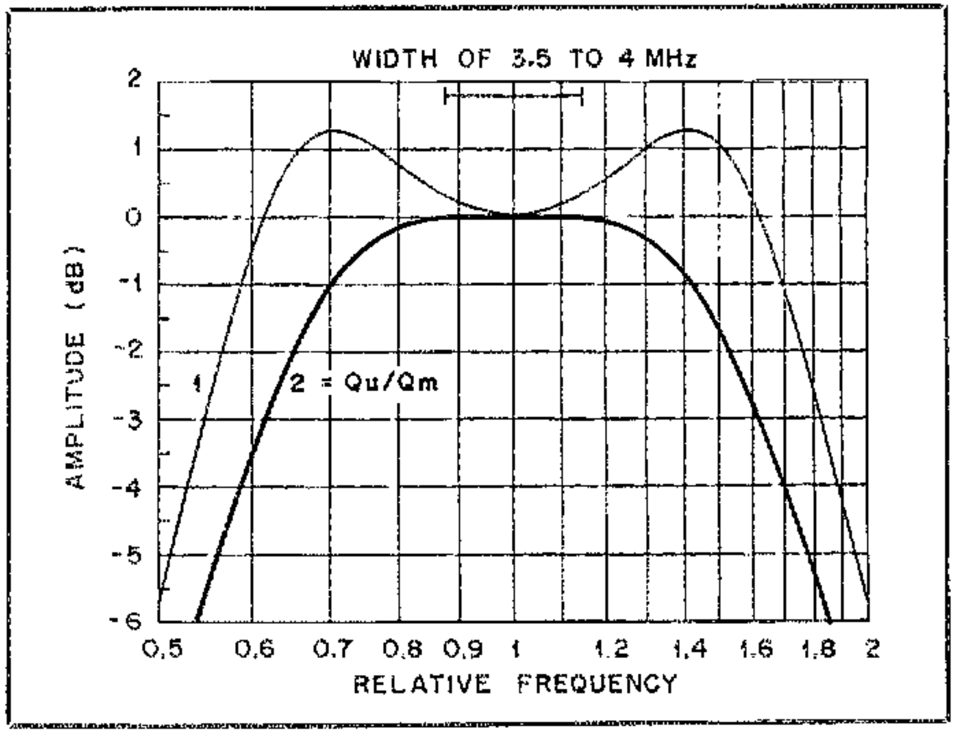
L1, L2 and Cp comprise a parallel resonant circuit…high impedance.

Cs, L3 and L4 comprise a series resonant circuit.

The two halves are coupled via magnetic and capacitive effects.

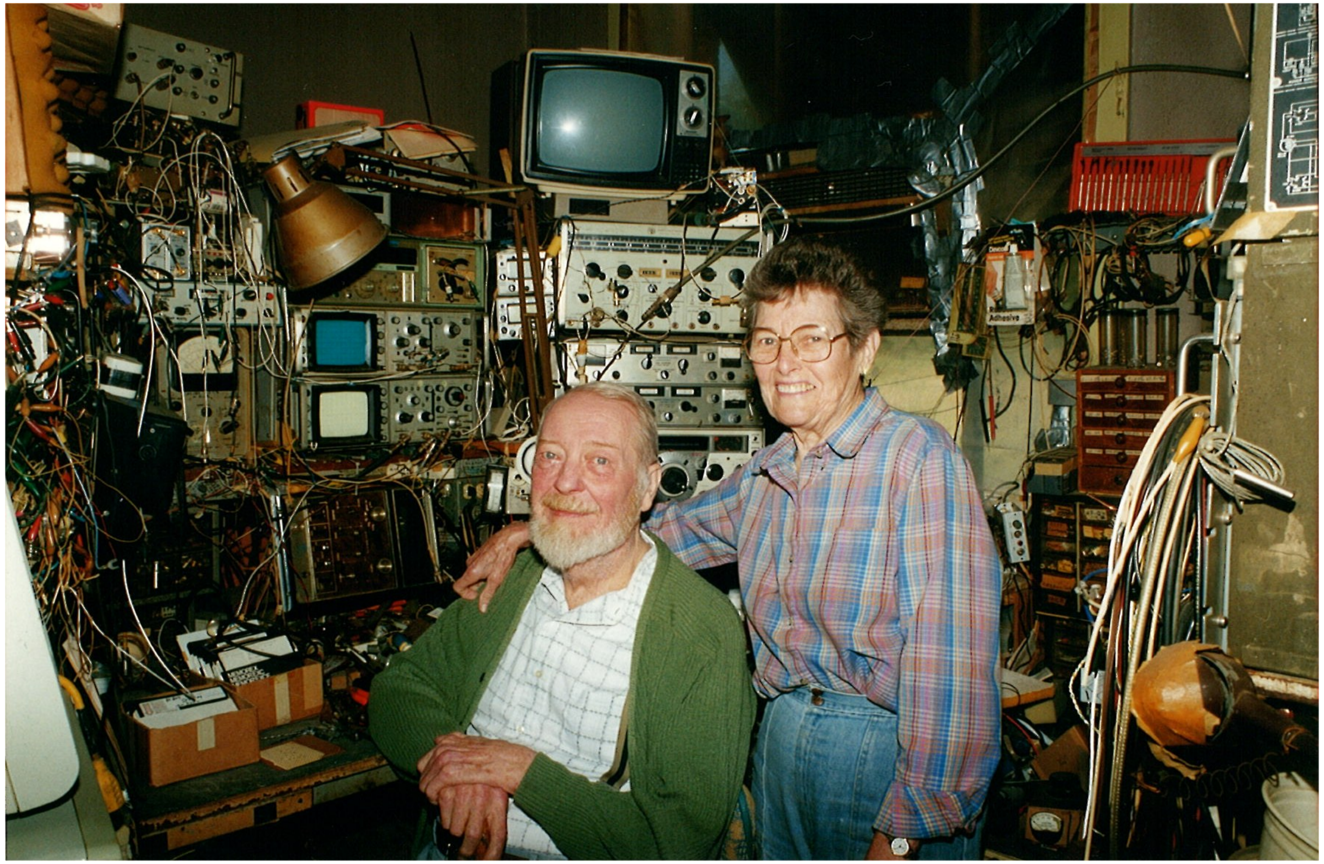
The bandpass width is a function of Cs and L3.





Comparison of Matching Range Batchelor Coupler vs Others

Joe W4EKL and his XYL, Jackie



Jackie painstakingly tested each of Joe’s hundreds of BB couplers before the “Baby Bottle” version was born.

Here is the Patent in Action

CE Presents 'No-Tune' to Amateur Radio in the 1950s-60s

Recap: Batchelor Broadband Coupler vs Others

Pi or L Networks

- Requires costly variable parts.
- Narrow banded – must be frequently retuned, either manually or via complex motor drives and phase detectors.
- 2nd Harmonic Rejection dependent on operating Q but is usually in the order of 35db.

Central Electronics – Batchelor

- Just Teflon wire and coil forms.
- Can be designed to cover large band segments. (Typ. 1MHz, but as large as an Octave).
- Can be band-switched or selected via relays – *fast!*
- *2nd Harmonic down in excess of 40db with 45db possible.*

So, if it is so good why did it fade away with Central Electronics?

Simple: Zenith then owned the patents in 1962 and would not sell to Wes or anyone!

Wes lost the Broadband Coupler – and so did the commercial world as well. Over time and since so few Central Electronics 100 and 200Vs or 600Ls were produced (less than 2,500 in total) the concept fell into obscurity.

Not so Fast, Folks

It Ain’t Over Yet!

While in College, in 1975, I got re-acquainted with the broadband coupler as I FINALLY acquired my first 100V exciter…and eagerly eyed its Broadband Couplers.

I tried to find literature about their design and the result was a big fat ZERO. There was nothing published about them, period, anywhere. CE production had by then been discontinued for many years. Nobody at Zenith remembered CE much less the broadband coupler. The only option was to seek wisdom from the Master Himself: Wes Schum!

We talked a lot, but Wes was elusive. I had to ***prove*** myself and that took many years. By late 1984, success was had. The Crescent Radio Electronic 2500L prototype was the result. When I then called Wes, it was delivering an easy 1,750 watts on 20-Meters. He was ecstatic, which made me feel like I had made it to Mars and back!

Next, I figured that the broadband coupler's main attributes - distributed stray capacitance and mutual coupling – could be adapted to antenna traps. Using the CE-Batchelor principal, I've designed antenna traps for the 80/40M bands and also the Maritime band segments.

What makes these traps so special? The only parts needed are a PVC coil form/housing and about 10 feet of Teflon insulated wire.

Wait – **T**here's More!

Next-Generation 2500L Broadband Amplifier

- Follows original floor-model concept.
- Viewing window for PA tube.
- Built-in Monitor Oscilloscope with trace blanking.
- Electronic bandswitching via vacuum relays.
- QSY time is less than 20 milliseconds.
- Electronic (syllabic) bias to reduce tube dissipation.
- 160-10M operation plus one spare position.

Magnetic CE-style doors for seldom used controls!

Key Ingredient to Coupler Operation – RF Choke

- Couplers are designed to a target Cp value (I use 40pf).
- Cp then equals the tube's output capacity, stay and a small variable device…make it a piston capacitor. This is set once when installing couplers into a PA stage.
- RFC must exhibit a constant and low effective capacitance, band to band, that is within 2pf.
- This RFC design was a difficult as the BB coupler!!

My goal was to produce the Crescent 2500L and even exhibited it at Dayton 1986. A series of major oil industry crashes in the mid 1980s killed that idea and pushed Crescent toward other activities including private carrier paging transmitters.

Today, building power amplifiers and restoring vintage equipment is just a hobby, but my work with the Batchelor Broadband Coupler has been the most technically challenging of my amateur and professional career.

I encourage you to give this unique coupling device a shot in your future projects…*but be ready for a wild ride!*

Questions Anyone??