

A 1920s Style Colpitts Broadcast Receiver

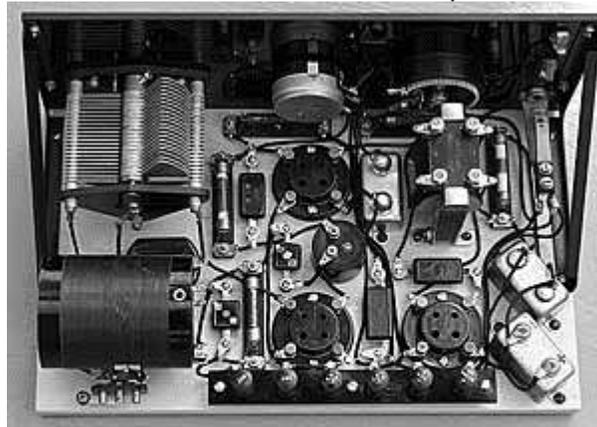
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The traditional methods for obtaining feedback in a regenerative receiver include the use of a tickler coil, the tapped-coil Hartley circuit, the ultra-audion circuit, and the original tuned-plate-tuned-grid system. But, what about the Colpitts circuit? I had never seen it used in any regenerative receiver until, as a teenager in the late 1940s, I obtained a broadcast-band kit radio called the Electrokit No.1. It employed a 1D8GT tube with its triode section serving as a regenerative detector and its pentode section as an audio amplifier. The complete story of this particular receiver may be found in my article in the August 2005 issue of the Southern California Antique Radio Society (SCARS) Gazette. Suffice it to say here that it used the Colpitts circuit and worked extremely well for BCB DX. However it did have certain limitations, including limited frequency coverage, lack of a regeneration control and severe hand capacity effects. Just for the fun of it, I decided to try this circuit, with certain improvements, in a homebrew receiver using 1920s components.

As shown in the schematic diagram, we have a fairly traditional early 1920s receiver circuit with an 01A detector resistance coupled to an 01A audio amplifier, which is in turn transformer coupled to a 71A audio power amplifier. One modern



Tubes have been removed for clarity in this top view. Signal flows from L1 lower left, over to V1 lower center, up to V2 upper center, over to T1 upper right, and then down to V3 lower right. Small knife switch at lower left is S1.



Front panel of my homebrew Colpitts receiver has meter jacks (J3 & J4) at top left, phones/speaker jack (J5) below them. Controls left to right are; filament on/off-rheostat (R7), regeneration (R3), and tuning (C2A).

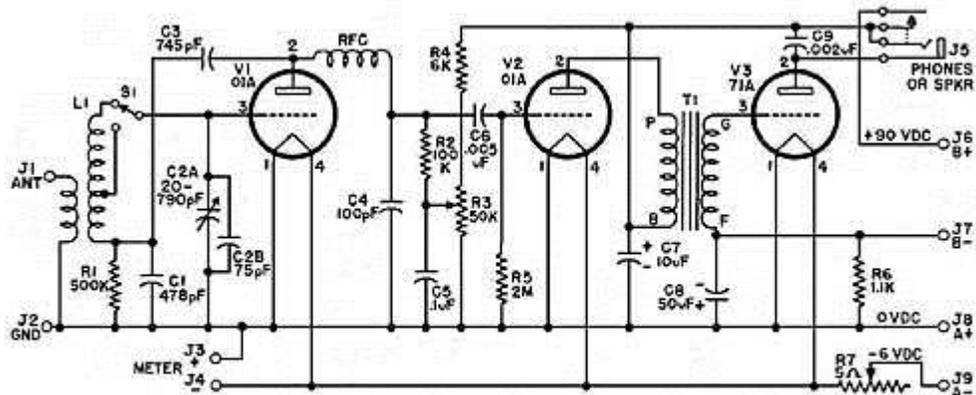
twist is the use of a bias resistor and its bypass capacitor (R6 and C8) in the B- line to eliminate the nuisance of a C-battery. Since I planned on running the set from a regulated power supply, I wasn't worried about running down B batteries due to the power loss in this resistor, as folks back in the 20s might have been.

The unique thing about this receiver is the use of the series connected capacitors C1 and C2 across the tuning coil. These capacitors form a capacitive voltage divider that is the hallmark of the classic Colpitts

oscillator. Feedback voltage is coupled to the detector plate via capacitor C3. Also note that in this particular circuit, C2 is the tuning capacitor. Since the total external capacitance across the tank coil must always be less than the smaller of either C1 or C2, the tuning range over which regeneration can be maintained with this circuit is limited.

Most references indicate that a tuning ratio as high as 3:1 is difficult to achieve with the Colpitts circuit. My experience indicates that this is especially true when only one of these two capacitors is tunable. The tap on L1, switch S1 and capacitor C2B were added after the radio was initially completed to extend its frequency range and maintain regeneration when C2A is at minimum capacity. The tap is at 39% of the total turns on L1 from its ground end.

I constructed the receiver out of 1920s vintage components from my junk box or as gathered at antique and amateur radio swap



Schematic of the BCB Colpitts. The values shown for capacitors and resistors are not optimized, but are the actual measured values of the parts I had available.

meets. Most parts required general cleanup or complete refurbishment. The 12-1/4" x 7-1/2" baseboard was cut from a larger piece of 1/2" thick plywood that I assembled by edge-jointing and gluing together three sides of a discarded kitchen drawer. The 12-5/8" x 5-1/4" panel was cut from a larger piece of Bakelite purchased at a radio meet.

The tuning coil (L1) is of unknown origin and actually has three windings with DC resistances of 1.6, 5.8 and 6.9 Ohms respectively. The 1.6-Ohm winding is the visible outside winding and is obviously the secondary, but either of the two internal windings might have been the primary, a tickler coil in a regenerative set, or a neutralizing coil in a Neutrodyne. I chose the 5.8-Ohm winding as the primary and left the 6.9-Ohm winding floating open-circuited.



With antenna and B+ supply connected, a 6-Volt lantern battery for filament power, and horn speaker and filament voltmeter plugged in, the set is ready for operation.

One nice thing about this circuit, from the home brewer's point of view, is that there are no finicky tickler coils to worry about. Most any old broadcast-band coil will work, but the higher the Q, the better will be the performance. It might be fun to try a basket weave coil. The RF choke (RFC) is an unmarked Bremer-Tully unit. I assume its inductance is between 10 and 30 mH. The audio transformer (T1) is a Jefferson unit, also unmarked, but probably has the traditional 3:1 turns ratio.

With my 90-foot outdoor antenna connected to the set through an

external 10 pF coupling capacitor, and no ground connection, the tuning range is 530–1010 kHz with the full inductance of L1 switched in, and 1007–1743 kHz with the tap on L1 switched in. Actual frequency coverage varies depending on antenna length and coupling capacitance. Volume is more than adequate to drive a speaker on local stations, where with phones, it is necessary to crank down the filament voltage for comfortable listening. Phones are necessary for distant stations, and the sensitivity is there to receive them.

The set comes to life at 3 Volts on the filaments, and seems to like 4 Volts; there is no improvement in performance over 4 Volts up to the full 5-Volt rating of the tubes. There are no hand capacity effects at all unless you place your hands behind the front panel. On either position of S1, regeneration control is smooth for the first 2/3 of the tuning dial, but for the last 1/3 at the high frequency end of the dial, the regeneration suddenly plops in when the critical point for oscillation is reached (I must admit that during the development of this set I had some difficulty in getting Mr. Barkhausen and Mr. Colpitts to agree with each other over the whole tuning range).

The circuit invites further experimentation with different tuning coils and capacitors, operation on short wave, and especially the use of a two-gang tuning capacitor making both C1 and C2 variable under one control. This should not be difficult as the rotors of both capacitors can be grounded.