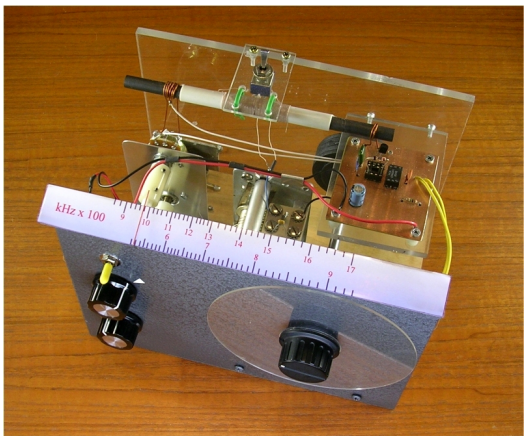
The Macrohenrydyne

The Most Powerful One-Transistor Radio

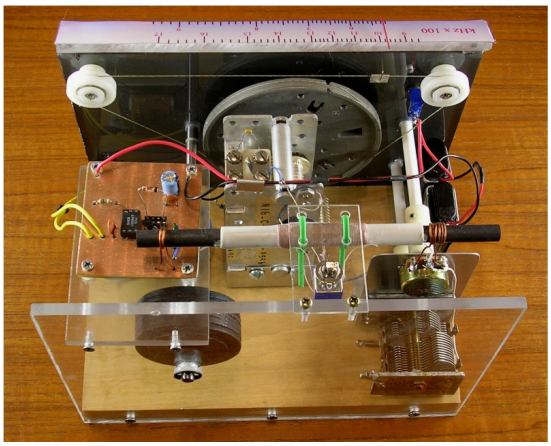
If anyone can successfully disprove this claim, I'll gladly retract it
(Posted August 2007)



Researching simple radio circuits, I found Charles Wenzel's Techlib website. There I was introduced to Robert Bazian's incredible reflex radio. Using a very high gain transistor for both radio and audio frequencies, Bazian's design had the loudest output of any, one-transistor radio I've ever heard. It drives a speaker to room volume on local stations and it's reasonably selective.

Then I learned of an upcoming DX listening contest for radios that use only one active device. I began optimizing the basic Bazian circuit to become my DX entry in the contest. The biggest unknown was the RF transformer. There were no specifications for it until Robert Bazian graciously answered my inquiry. His radio was not intended for DX, so I experimented with many, many configurations and finally decided that a lot of them produced the same sensitivity. However, each came with various side effects such as hysteresis (backlash) and painfully annoying motorboating and screeching. For the contest, I settled on one of the first RF transformers I wound, and my contest radio performed superbly.

Testing my contest radio, I stumbled upon the elegant notion of using the RF transformer to introduce positive feedback, transforming the already powerful reflex circuit into a true regenerative reflex radio. The noisy side effects manifested themselves only when I had the regeneration cranked up too high. Under time pressure, I decided to accept them as necessary consequences of such a simple radio. I found that if I was careful with my fine motor skills, I could avoid most of the ear-splitting blasts.

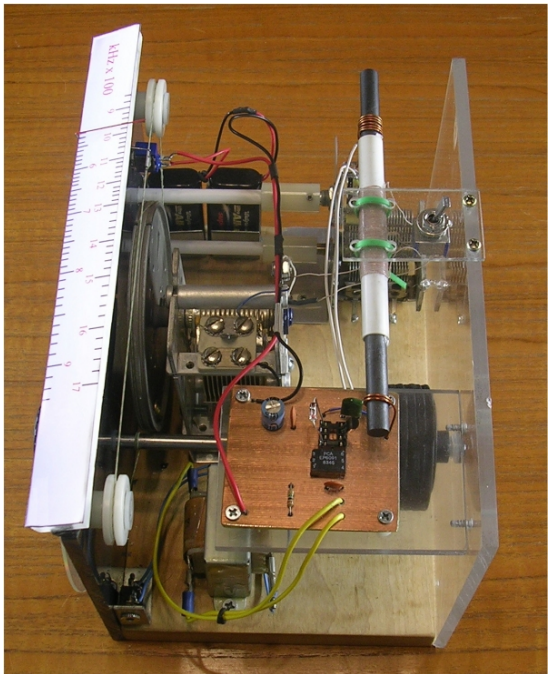


In addition to optimizing the RF transformer and using it to introduce regeneration, I coupled an outdoor antenna to the radio. Using ordinary stereo headphones, at times the radio was so loud I had to disconnect the outdoor antenna .

I was so smitten by this little jewel, that after the contest, I began optimizing it further. I tried more RF transformers and realized that they all interacted inductively with the tank coil, no matter how I

tried to isolate them. It was difficult to make progress because there were too many variables. I concluded that the regeneration source should be separated out from the RF transformer. The resulting schematic below differs from the contest radio in that it employs a tickler coil. It also does away with the external antenna.

With a separate tickler the RF transformer should be shielded. Previously I'd met Charles Wenzel and he'd generously given me a couple of the ISDN tranformers like he uses in his version of Robert's radio. I settled on using one of those. It's the black rectangular object (with white lettering) near the middle of the circuit board in the picture to the left, seen at the left end of the long ferrite rod.



MACROHENRYDYNE MODIFICATIONS

Tapped tickler coil provides both positive and negative feedback for wide range RF control; I've never seen this before and I'm very happy with how well it works

Contrawound tuning coil provides dual range tuning for high Q and very fine control (silver switch next to tuning coil is range switch)

High Q variable capacitor was intended to optimize performance; in fact, the radio can perform as well with an inexpensive poly capacitor

70-volt line transformer provides optimum matching for headphones or speaker

Dial string tuning with 13:1 slow motion ratio aids in razor sharp tuning

Heavy flywheel provides for buttery smooth action, a pleasure to operate

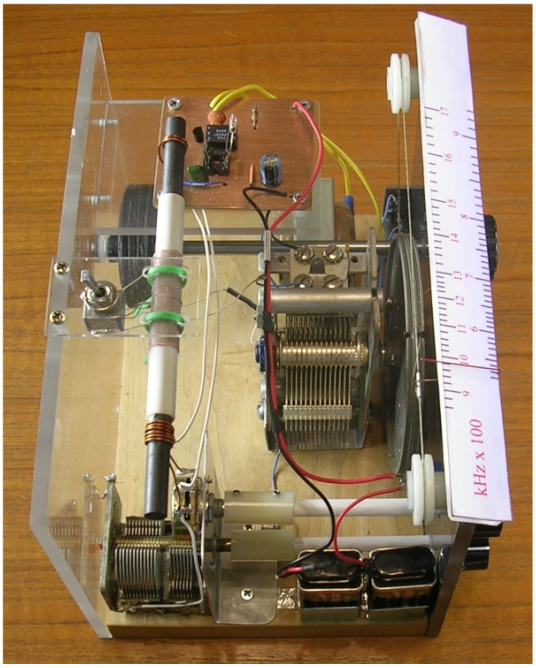
Slide rule dial with 3/32" per 10 kHz at the upper end of the AM dial makes locating stations extra satisfying

Eight pin IC socket permits easy substitution of transistors and diodes

Previous version (not shown) used dual back-to-back diodes to smooth regeneration and control howling; not necessary with tapped tickler version

Inexpensive shaft couplers made from hardware store nylon bushings and set screws

Optional external antenna coupling using contrawound air core coil



PERFORMANCE

No external antenna is necessary; adding one increases performance impressively

Smooth regeneration all the way from negative feedback to raucous oscillation, no hysteresis or backlash

Regeneration control is so fine that synchronous homodyne reception is possible

Local reception drives speaker to room filling volume using no extra amplification-click here to listen (This recording was made with a stereo microphone placed two feet from the radio speaker)

Audio output is strong enough to use ordinary stereo headphones on the weakest signals

Sensitivity sometimes exceeds that of commercial DX radios

10 kHz selectivity with adjacent loud locals

External antenna coupled with contrawound air core coil increases chances of beating commercial radios

Macrohenrydyne Regenerative Reflex