

Ham Radio 101
Home Brewing a 2 Tube 40/80M QRP Transmitter
By Hal Silverman WB6WXO
Dave Ishmael WA6VVL
SOARA Education Director

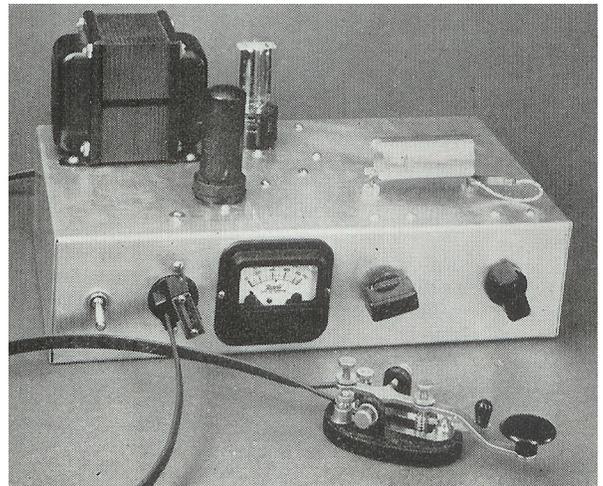
Directors Note: This article space has been turned over to another **SOARA** member, Dave Ishmael WA6VVL. Dave's interest in ham radio centers on restoring antique radios. He recently built the Lew McCoy two tube QRP Transmitter for 40 and 80M. The article here this month will be published shortly in **Electric Radio** and details his home brew project.

The Lew McCoy Memorial 80/40M Novice Transmitter

By David W. Ishmael - WA6VVL
2222 Sycamore Avenue
Tustin CA 92780
(714) 573-0901
daveishmael@cox.net

Like many, my introduction to "radio" was through the pages of Alfred Morgan's **The Boys' First Book of Radio and Electronics** that I found in the Horace Ensign Junior High School library in Newport Beach, CA, when I was in 6th grade in 1956. My progression in my new hobby was painfully slow. By 7th grade I had discovered amateur radio, was given a copy of the 1957 Allied Radio Catalog No.160 (the cover with the satellite on it), and started to learn the code. Sometime later, a neighbor loaned me his **1957 ARRL The Radio Amateur's Handbook** and I discovered *A One-Tube Two-Band Transmitter for the Novice*. I copied that entire construction article by hand before returning his book. I carried that dog-eared copy with me for two years as I dreamed about building that xmtr.

By 9th grade, my family had moved to Santa Barbara, CA, where the high school had an electronics program, and even better, "hams". I was not yet licensed, but my plans in building that xmtr went into high-gear. There was a wholesale electronics store in Santa Barbara, but they wouldn't sell me



electronic parts without a ham license!! I eventually wound up at a TV-Repair shop a few blocks from where I was living, at the corner of Bath and W. Montecito Streets, and met Jim Clearwater, W6WQJ (SK), a radio-TV tech working in the store.

Jim ordered the Shurite Model 950 meter and the 12" x 7" x 3" aluminum chassis for me, and I must have pestered him almost daily on my way home from school until they arrived. I then spent many an evening in Jim's shack as he showed me how to cut the holes in the aluminum chassis for the 5Y3GT, 6AG7, and front panel octal sockets, pwr xfmr, and Shurite meter. Many of the parts for that xmtr came out of his junk box including the pwr xfmr. I remember that one of my concerns was that the pwr xfmr had more current than the one specified!! Boy did I have a lot to learn!!!!

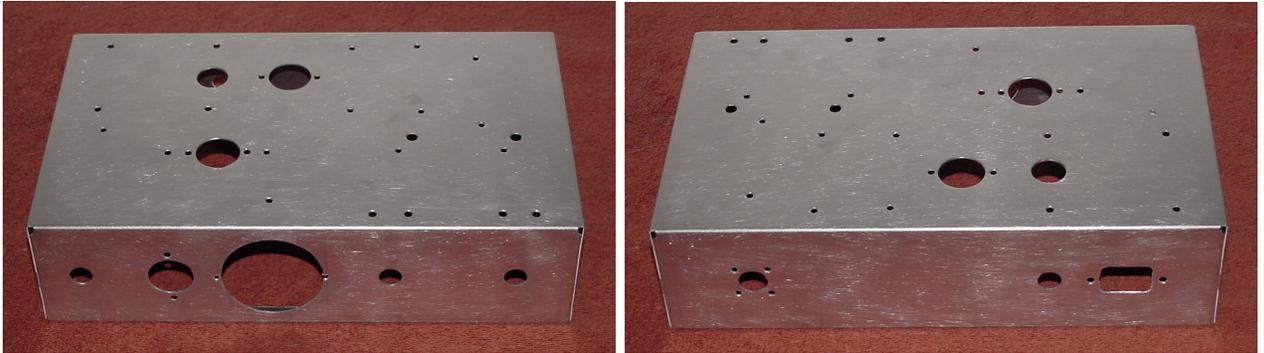
My family eventually moved to Albuquerque, New Mexico, and that xmtr went with me. I remember that the xmtr was (say) 90% complete, but my memories of that xmtr **end** in New Mexico with it sitting on a top shelf in the entry-way closet. I never put that one-tube 6AG7 xmtr on the air, but the time that Jim spent with me during late '58 and early '59 was just an incredible learning experience. Although this was just the beginning of my radio and electronics education, I have never forgotten my first Elmer, Jim Clearwater, W6WQJ, and the 1-tube 6AG7 xmtr that he helped me build.

Fast-forward to Feb.'93 when I built a "modern" version of that *A One-Tube Two-Band Transmitter for the Novice*. That attempt was covered in the Dec.'93 Electric Radio, Issue#56, **Building a Two-Tube 6AG7 80/40M CW Transmitter**, pgs. 24-27. During my research for that article, I discovered that Lew McCoy, W1ICP, had originally written that construction article and that it had appeared in the Nov.'53 QST. Later that year, I had the good fortune of meeting Lew McCoy at the Fort Tuthill Hamfest outside Flagstaff, AZ, where I had an opportunity to thank him for that article in particular, and all the rest that he had written that served as inspiration for so many of my projects. In '95 at Tuthill, the last year I saw Lew, he signed my copy of **Lew McCoy on Antennas**, and I had my photo taken w/him at Barry's/N6CSW/0's Electric Radio "booth". Lew McCoy, W1ICP, passed away 7/31/2000 after a short illness. He was 84.

So, here I am in 2008, 50 years after copying *A One-Tube Two-Band Transmitter for the Novice* by hand, that I am once again going to build Lew McCoy's Novice 1-tube 6AG7 xmtr. My goal was to build as near a copy of his original as I could, using as many of the original components as I could find. I scanned the photo of Lew's xmtr from the 1957 **ARRL The Radio Amateur's Handbook** and blew it up to 8-1/2" x 11". I then scaled the front panel dimensions to obtain a drill template for mine. The front panel layout of mine is near-identical to Lew's original. The location of the 6AG7 socket was determined the same way.

The following are some brief comments regarding the component selection and construction of the xmtr:

- Like Lew's original, mine is built on a Bud P/N AC-408 12" x 7" x 3" aluminum chassis and includes a bottom plate P/N BPA-1595.



The finished chassis. All holes were located using a drill template. The chassis was finished using 3M synthetic steel wool using a circular motion.

- I located the **specified** Thordarson P/N TS-24R02 pwr xfmr via eBay. It turns out that the specified TS-24R02 pwr xfmr is a horizontal mount configuration while the pwr xfmr on Lew's original is clearly an upright mount. The correct P/N should have been TS-24R02-**U**. Modifying the TS-24R02 for upright-mounting by adding angle brackets just didn't look the same with the different xfmr end-bells, so, in the end, I abandoned the NOS TS-24R02 for a NOS TS-24R05-U I located via eBay. Both P/N's have 700-VCT windings. Incidentally, for the record, dimensions from the scanned photo indicate that Lew didn't use the specified TS-24R02-U in his original either – the one he used is much larger – and his had a larger footprint than the TS-24R05-U that I ended up using?
- Even though the TS-24R05-U was NOS, its core was slightly rust-colored. I wire-brushed the core followed by a coat of Krylon glossy black.
- Before laying out the drill template for the power supply components, I bench-tested the TS-24R05-U pwr xfmr with the 5Y3GT and 6AG7 to determine what the max voltage the input filter capacitor would see. At key-up, the only load on the B+ is the 100-k 2-watt bleeder resistor. At 115-VAC, the key-up voltage was 484-VDC, a bit too high for a 500-VDC filter capacitor at higher line voltages. I ended up using two 47 ufd 350-VDC filter caps in series with 100-k 2-watt equalizing resistors across them on both sides of the filter choke. The four capacitors were tested for leakage at full-voltage before assembly. The temperature-rise of the xfmr's core during key-up is minimal as the core stays cold to the touch.
- The Hammond 9 Hy 40mA filter choke was purchased at Antique Electronic Supply (AES, P/N P-T156G) along with the balance of the components.

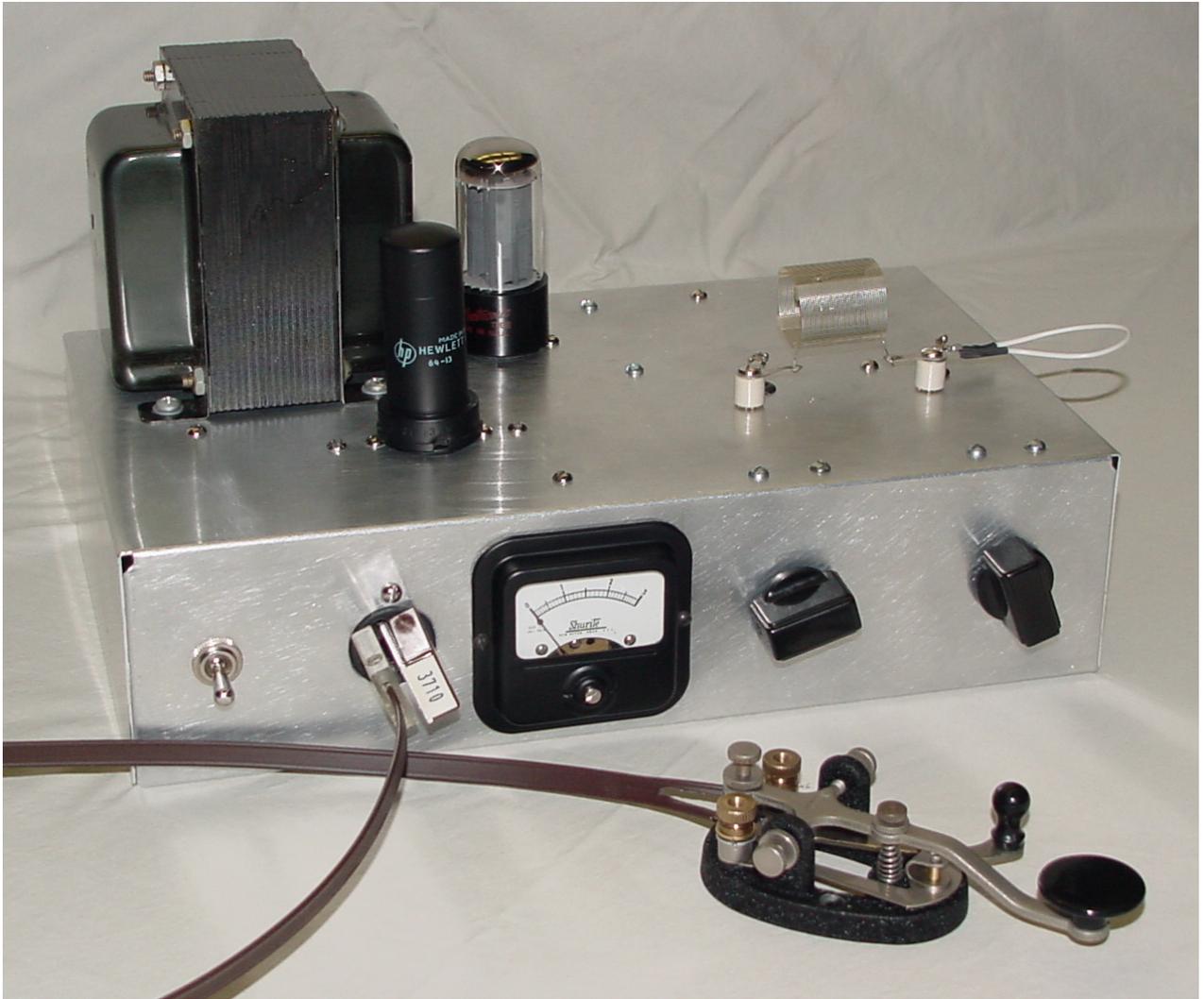
- Although Lew's original used a 0-50 or 0-100 mA DC Shurite Model 950 meter, I located a Shurite Model 950 0-3 mA DC meter via eBay. It requires a 27 ohm current shunt for a 0-60 mA full-scale indication.
- I will typically mount the 365uuf variables (AES P/N C-V365) using the tapped 6-32 holes on the front-face of the variable (if they aren't tapped, I tap them). However, Lew used standoffs on the bottom of the variables and mounted them from two holes on the top of the chassis. I followed suit and used four 9/16" 6-32 hex standoffs (2 per cap) to position the capacitor's shafts at the center-line of the front panel.
- I didn't use ceramic feed-throughs for mounting the 42-turn B&W 3016 coil but chose 3/8" ceramic standoffs (HH Smith P/N 2642) with the wiring going through 1/4" rubber grommets in the chassis. Experience from previous projects using Lew's basic design has shown that 70-turns of B&W 3016 was just too much inductance and I reduced it to the 42-turns used in this project. I soldered a short stub of 0.036" dia. wire to the coil's center-tap and output side and terminated the connecting jumper with the pin removed from a 7-pin miniature tube socket. Even though this combo provides just enough contact pressure for a good connection, you still need to be careful of connecting the center tap because of the coil's relatively small 24 AWG wire (I would have preferred a switch).
- Since I didn't follow Lew's wiring, the location of most of the 6-32 hardware on the top of the chassis is different, and, as a nod to the original, I used round-head 6-32 hardware in the assembly.



- External-tooth lock washers were used throughout the assembly.

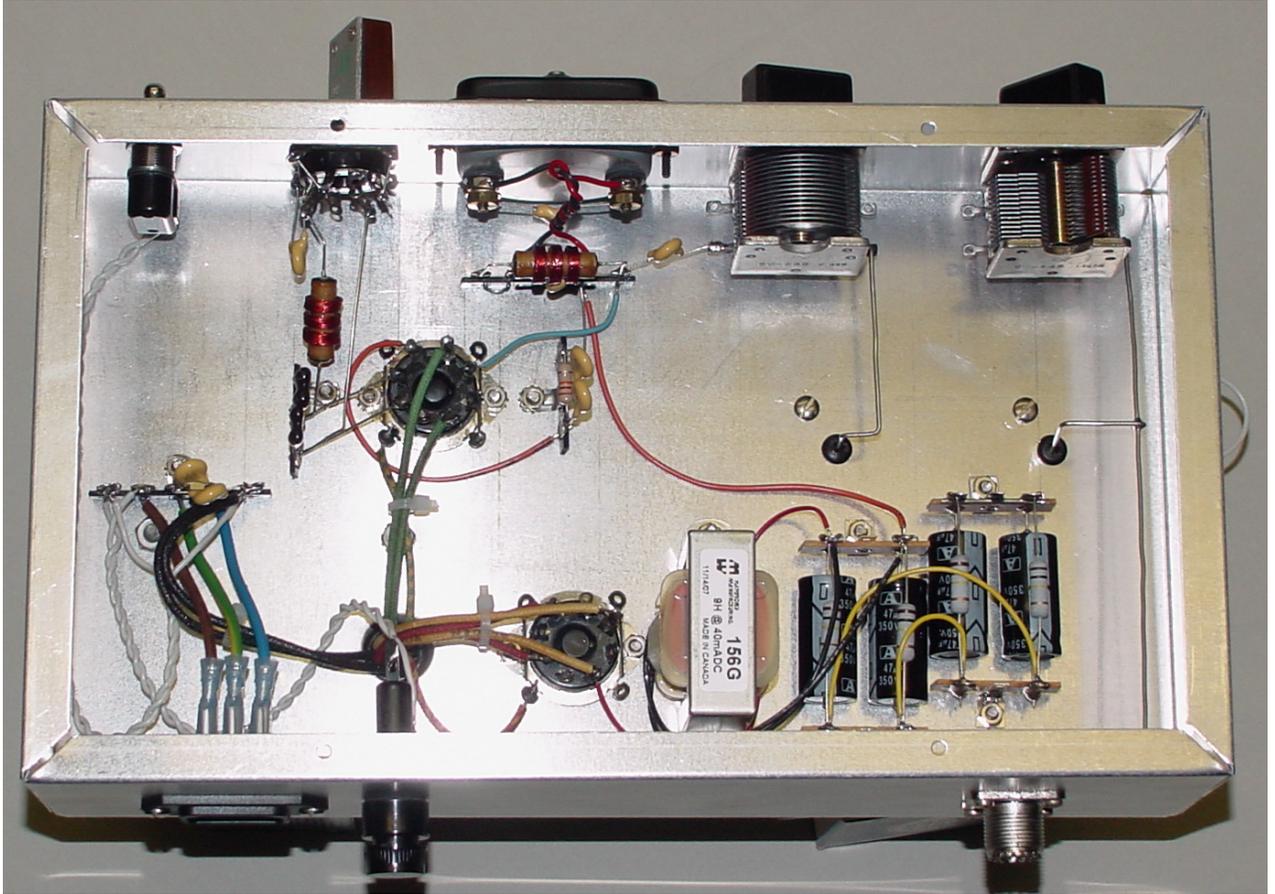
- “Hidden” on the rear panel and much different than Lew’s xmtr (but “transparent” from the front panel) is an IEC AC-inlet connector so that I could use a detachable 3-conductor power cord, a 3AG fuse holder (Radio Shack P/N 270-364), and an SO-239 ant connector.
- A NOS GE 5Y3GT and NOS HP 6AG7 came from my tube supply. The 6AG7 was given to me by Barry Wiseman/N6CSW/0 when I visited ER in Durango, CO, in Jul.'93 (see ER#53 Sep.'93).
- Other than the time locating and purchasing the components, dimensioning Lew’s original xmtr, preparing the wiring diagram and drill templates, and drilling the chassis, took the most time. Fortunately, I have all the Greenlee chassis punches I needed: 1/2”, 5/8”, 3/4”, 1”, and 2-1/4”.
- Most of the discrete components were pre-mounted on four terminal strips, so the actual construction of the xmtr was only 5-1/2 hrs start-to-finish. I used AES P/N P-0501H (pkg of 5) and Radio Shack P/N 274-688 (pkg of 4) 5-lug terminal strips cut down as required to mount the various components.

The completed 80/40M xmtr has a maximum measured output power of 6.0 watts using a 3746 KHz FT-243 xtal into a 50-ohm dummy load. The output power was measured using a Daiwa Model CN-801 SWR & Power Meter. The output power ranged from 3.2- to 6.0-watts on 80M depending on the 6AG7 used and the FT-243's activity. At 115-VAC line, the key-up voltage to the 6AG7 is 480-VDC falling to 417-VDC when keyed with an indicated plate current of 32 mA. 40M output powers averaged 15% less than 80M and 40M xtals tend to be a bit more "chirpy". In my "modern" version, I used a 25uuf variable for the specified 22uuf cap and adjusted it for minimal "chirp" with a handful of 40M FT-243 xtals. When "properly tuned", the keyed waveform is clean and it sounds OK in the monitor receiver. The output loading capacitor is pretty much ineffective when using a 50-ohm load – not surprising since Lew designed his xmtr for a 30-foot indoor antenna for both 80/40M. All-in-all, no surprises after building so many versions of Lew's original design. Performance- and design-wise, Lew's xmtr reminds me of an Ameco AC-1 "on steroids" although the 6AG7 is better behaved than the AC-1's 6V6GT and the AC-1 lacks a plate meter.



Compare this photo to the original above that appeared in the Nov.'53 QST pg. 28

Lew, in his Nov.'53 QST article estimated \$14 to build his xmtr. Pricing his xmtr out in a 1954 Allied Radio Catalog No.135 put that price closer to \$22 including parcel post shipping. My cost, using eBay, Mouser Electronics, AES, Marvac Electronics in Costa Mesa, Radio Shack, Action Electronics in Santa Ana, and my junkbox, approached \$235 of which \$60 was shipping and handling charges!!! The original Millen knobs were supplied by Gary Giles, KF9CM (www.kf9cm.com). A **significant** portion of the cost was driven by my desire to use as many original parts as I could lay my hands on. Again, **my goal was to build as near a copy of his original as I could using as many of the original components as I could find.** In a side-by-side comparison of Lew's and my xmtrs, I think I came pretty close!!!!



Bottom-view showing most of the major components

A version of this article will appear in a future issue of Electric Radio (ER) magazine. ER is published monthly by Ray Osterwald, N0DMS, in Bailey, CO. Subscription information can be found at: <http://www.ermag.com/>

Send me an email and I will send you a copy of the original article from QST, parts list, or higher-resolution photos of the construction. I will also be happy to answer questions via email at daveishmael@cox.net

73,
Dave – WA6VVL

