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The Collins 30K-5 – Bringing up a rare find!

By Bill Carns, N7OTQ/K0CXX

That is the beautiful 30K-5 on the right!

The 30K-5 has a beautiful face!

Model # / Serial number plate at rear of 30K-5

The 30K-5 is not a commonly seen version of the 30K family. In short, it is the commercial market, 2-30 mc, younger brother of the 30K-1 amateur radio transmitter.

The 30K family uses a 4-125 in the final, driven by an 807, and modulated by two 75THs, to produce 250 watts of beautiful-sounding AM. Audio bandwidth is limited to 3 kc and clipping can be adjusted between 0 and 12 dB, constraining modulation to just under 100 %.

I would be remiss if I did not add a bit of the personal history associated with this transmitter, since it is the people of Collins Radio who made the company, and its equipment, what we love today.

Warren Bruene, W5OLY, (of the Bruene Coupler, Conjugate Match, 30S-1, and RF Power design fame) started it all shortly after WWII ended with the design of the 30K Amateur Radio Transmitter. At that time, Warren was a young design engineer with Collins Radio in Cedar Rapids, having joined the company in November 1939 at the age of 22. His original 30K design was a single-frequency crystal-controlled, or 310C-2 exciter driven, amateur radio transmitter. It was designed to operate between 75 and 10 meters. The original design had a link-coupled balanced output and no antenna tuning capability.

By 1946, Warren was working on the 30K-1, which included antenna tuning and loading capability in the main cabinet.

The first 30K-1s were delivered in 1947 and became the Cadillac AM transmitter of their day. Demand (from the Bureau of Reclamation) appeared in 1946 for a fixed-frequency two-channel (day and night) version for use between dam sites in the U.S.

By October of 1946, Warren had written the specs for the 30K-2 (two-channel) commercial version of the 30K-1, the big difference being the addition of all duplicate RF tuning components between the oscillator and the PA. Frequency change to either of the pre-tuned channels is accomplished with a single switch controlling lots of relays and one big solenoid in the PA deck.

The 30K-2 first shipped in 1947. Over the next several years, the 30K-2 evolved into the K-3, 4, and 5. The differences were minor and mostly associated with the remote-control capability and "tweaking" the models for various market niches.

The 30K-5 was specifically touted as a "Ground Station Transmitter" for ground air-traffic control and police service and has two relay-selectable unbalanced outputs with Pi (optional Pi-L) tuning. Warren was involved after the 30K-2, but by the introduction of the 30K-5 in 1955, he had moved on to focus on that new interloper - SSB. You also can credit him for that beautiful 30S-1 amplifier you love so much.

The 30K-5 that I obtained several years ago has a mysterious history. It was purchased in approximately 1956 and installed in an air-traffic control station in Guadalajara, Mexico. It is apparent now, after the restoration, that not long after it went into service it suffered some kind of "Antenna Event" which blew the RF Ammeter and the Plate Current Meter shunt. For some reason (I guess this was considered not repairable on site), it was then put back in the crate, sealed up, and put in storage . . . and then lost for 45 years. Several years ago, a friend of a friend was looking for MacIntosh tube stereo gear in a Mexican furniture warehouse and discovered the crate screwed to the wall in the warehouse office. It was supporting conduit and a light fixture and being used as a TV stand. Demeaning service for a pristine 30K-5!

The transmitter was promptly rescued and over the next several months made its way to Arizona after some checking and initial repair at the QTH of Sandy Meltzer, KW6KW. He and Gary Halverson, WA9MZU, did a little damage control after the MacIntosh guy tipped the box on its side and trucked it to San Francisco with the plate transformer rattling around in the bottom of the cabinet.

Early this year I decided it was time to get the 30K-5 on the air. As is my usual pattern, cosmetics, cleaning, and restoration came first. This was not trivial due to the mopping of the floor in Mexico with acrylic floor wax. Mucho days were spent removing that wax without removing the paint and then restoring the bottom four inches of the cabinet. In

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The Collins 30K-5 – Bringing up a rare find! *(continued from Page 1)*

By Bill Carns, N7OTQ/K0CXX

addition, I made the decision to run the box on 220 Vac, so I had to add the specified autotransformer, wiring, and brackets needed to generate the 110 Vac required internally. This turned out to be a good, but painful, decision.

After months of cosmetic and electrical work on the 220 Vac issue, the day came to plug 'er in. I didn't even have to turn on the 30K-5 AC switch. Major smoke and blowing circuit breakers at my house! I immediately went into remorse mode, asking, "What have you done wrong now, you idiot?" The event blew almost every fuse in the 30K-5 box and there are a lot of them . . . fortunately.

To make a long story short, after going from "I made a mistake" to diagnostic mode and "It looks like a short in the harness," I found a wiring error that Collins had made at the factory. Two wires coming out of the harness behind the power panel were the same length, same tracer, and they were switched. In 110 Vac service, the problem was jumped. When I put in the autotransformer and removed the jumpers for 220 Vac service, the error put 220 Vac on the internal 110 V line. Boy, did I get lucky! No damage to anything but fuses. I swapped the two wires and up she came. I did call Collins the next day and tell them I had a warranty claim on my 30K-5. Rod Blocksome, K0DAS, was very nice . . . but refused the claim.

The rest was pretty straightforward. I had new bases tooled and made for several broken PA coils that I got. I got lucky and found a whole set of oscillator and multiplier plug-ins along with enough PA plug-ins to assemble a complete set of coils for all bands, including the WARC bands.

Then followed about a month of chasing dirty RF relay contacts. Those old relays didn't like 45 years of storage. The antenna relays were rewired to accommodate a single antenna unbalanced output (a Collins option using a provided relay) and a 310C-2 interface box was built to plug into the two adjacent crystal sockets. This gave the ability to easily switch from crystal to dual-channel PTO control. My 310C-2 exciter was then hooked up, and the transmitter has been getting 5-9 reports all over the west, including down into Texas with a "First Contact" with Pete, K5PZ, and his KW-1. OK, Pete, your 30K-5 is next on the agenda.

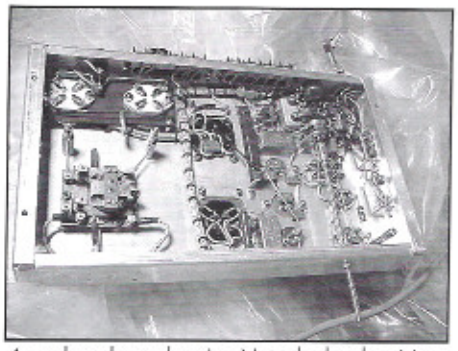
Oh . . . I also had a bit (understatement) of trouble with RF in the audio. This of course was my fault, since I needed to have some Collins audio processing in line. Therefore, a Collins 212Z-1 broadcast mixer was inserted in the mic line. This required a mic transformer to get back to Hi Z. The result was an additional nominal 90 dB of audio gain in the chain to a Hi Z output and voila! – automatic howling audio. Putting a 60 dB 600 ohm pad and another 30 dB of external mic gain pot – all in the mic transformer box along with a low-pass filter – healed that self-inflicted wound.

Come by and see 30K-5 serial number 131. She's a beauty!

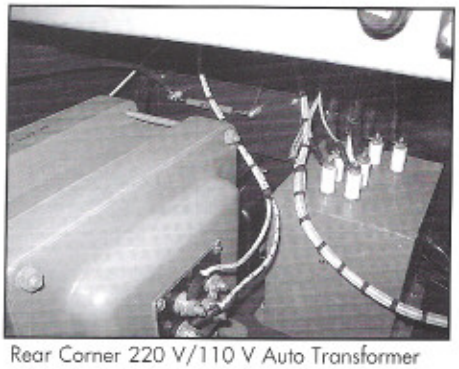
Warren, "Thank You!" for another beautiful design and taking the time to talk with me about your engineering book notes. Warren lives in Dallas, Texas with his wife and is still doing RF design – as a hobby of course. He is 88 years young!

I also would like to thank Pete Zilliox, K5PZ, for his help documenting coil data and configurations, sharing some critical parts with me, and listening to me whine when I blew all those fuses.

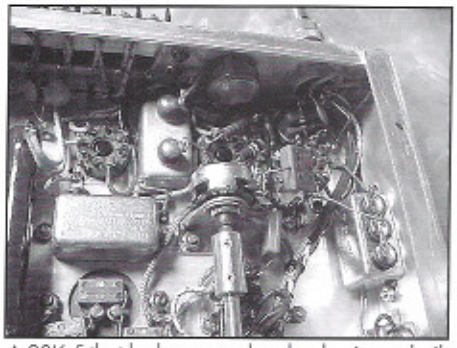
See you all on 75 or 40 meters...AM naturally! 73s for now, de N7OTQ



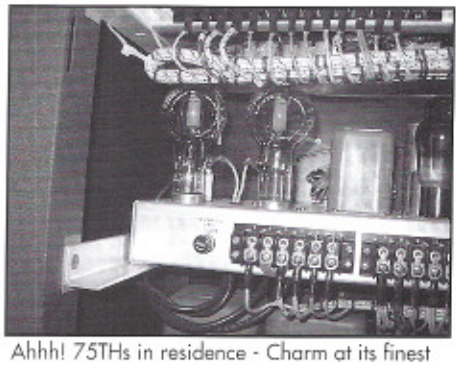
A peek under a chassis - Note the lovely wiring



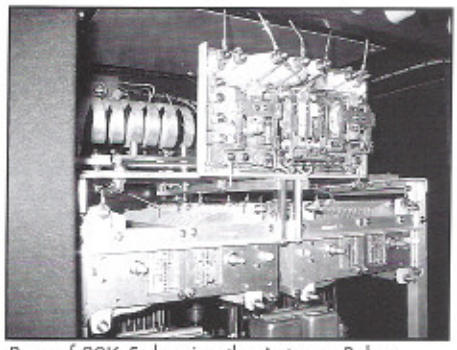
Rear Corner 220 V/110 V Auto Transformer



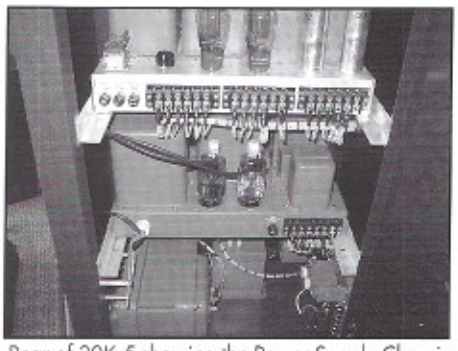
A 30K-5 that looks as good as the day it was built



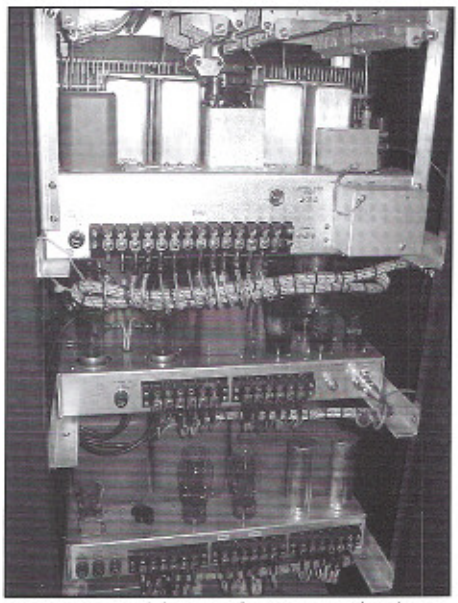
Ahhh! 75THs in residence - Charm at its finest



Rear of 30K-5 showing the Antenna Relays



Rear of 30K-5 showing the Power Supply Chassis



30K-5 RF, Modulator and Power Supply Chassis

At The Mic

by Floyd Soo, W8RO - President CCA
floyd@hi-rescom.com

As the days are getting shorter and the nights longer, we are seeing more and more members checking into the CCA nets again! We certainly understand that nice weather draws everyone outside, but now the shack seems to be more inviting as the temps start to dive with the season's change. With the renewed interest in the CCA nets, we are hoping to find a volunteer to help with Net Manager duties. At the moment we still do not have a Net Manager, and thus no "Net News" column in this newsletter. If we can get several people (a "team") to assist with the different nets that the CCA sponsors, each person's responsibilities will be minimal. We would like to have an Assistant Net Mgr. in charge of the Tuesday Net, another person for the Thursday Net, someone else for the Friday West Coast Net, and one more maybe for the Sunday Net. This way each Assistant Net Mgr. will be responsible for only one (maybe his favorite) net. It would be nice to have a fifth person maybe coordinating these four folks and backing them up, too! Please consider helping with the organization of the NCOs for a particular net. It really isn't very difficult. Everyone just stays in touch with one another and makes sure that there will be a couple of NCOs available for each net. For more information on these all-important positions, contact any CCA Board member.

Recently, several of us on the CCA E-Mail Reflector got into a discussion about Collins radios appearing on TV or in the movies. About 10 years ago or so, I began to keep track of the different movies and TV shows that showed Collins gear in their scenes. I will include this list at the end of this column in the next issue of the Signal (1st QTR 2006). If any of you know of other shows or movies that contain Collins gear within, please contact me so I can add them to this list. Rod Blocksome, K0DAS, at Rockwell/Collins suggested that I find the different scenes in these productions and catalog them. Sounds like a full time job to me! In any case, I have seen many of them, and it sure is fun to see our beloved equipment on the tube or screen, no matter how briefly. Hopefully, in future columns I will be able to share some stories about some of these shows or movies.

Don't forget, Rich Sperling, WB3JLK, has taken over as Dayton Chairman for 2006. Tony Sokol, W9JXN, will still assist Rich where he can, and I hope that many of you will volunteer to help these guys pull off another great Dayton event this spring. We will be changing locations to the Holiday Inn Dayton North for 2006. This Holiday Inn is the one at Wagoner Ford Rd. and I-75. It is closer and more convenient as far as access to Hara Arena is concerned AND they have a couple of free shuttles that run there and back regularly. This will make things very convenient for folks who do not want to deal with the parking at Hara Arena.

Please vote for your CCA officers! The elections are very important, as they are the primary means a member has to take part in the decision-making process.

Catch you all on the air! Keep the shack warm with those Collins rigs (my favorite "shack heater"). Have a great winter!

The KWM-1 transceiver designed by Gene Senti

Gene Senti W0ROW, SK

Gene Senti, W0ROW, passed away suddenly in his home on Thursday, October 20, 2005. He was 88. He is survived by two sons, their wives, and eight grandchildren.

Gene was a retired engineer from the Collins Radio Company and was instrumental in the development of Collins Amateur Radio Products during his 30-year career. Probably his greatest achievement in the field of Collins Amateur Products was the development of the HF transceiver. Gene's idea for a transceiver was proven practical when he modified his personal 75A-4 receiver into a "homebrew" transceiver. (Think about this for a moment, considering the cost of a 75A-4 in 1955). Arthur Collins came over to see it, and after putting it on the air, he decided it was the way to go for the mobile market. Thus was born the Collins KWM-1 transceiver under Gene's design expertise and direction. (Tks to Rod, K0DAS – ed.)

We will have more on the life and accomplishments of W0ROW in the 1st-quarter 2006 issue of "The Signal."

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- Sunday 14.263 mHz at 2000Z
- Tuesday 3805 kHz at 8pm CST
- Thursday 3872 kHz at 8pm CST
- Friday (West Coast) 3895 kHz at 10pm CST
- Sunday 10m AM 29.050 mHz at Noon CST
- 1st Wednesday AM 3885 kHz at 8pm CST

Sunday for Technical, Buy, Sell & Swap
Tues., Thurs., Fri., & Sunday for Ragchew

THE COLLINS VIDEO LIBRARY!

- The R-390A Addendum Video
- The R-390A Video
- The Collins Amateur Radio Equipment Video Spotter's Guide
- The Collins 75A-4 Video
- The Collins KWS-1 Video
- The Collins KWM-2 Video
- The Collins 75S-3 / 32S-3 Video
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Collins Radios, Still the Best in Town - Part 4

by Edison Fong, WB6IQN - edison_fong@hotmail.com

In the old days of Permeability Tuned Oscillators (PTOs), such as in the Collins R390s and S-Lines, there was no memory. The memory usually was the operator tuning the dial. Memory was simply a pencil and paper. Old timers will remember the US government having racks and racks of R390s and 51S1s at our monitoring stations in Guam, Anchorage, and Osaka, Japan. Each was tuned to a predefined frequency during the Cold War to listen in on enemy communications. That certainly is one way to solve the memory problem; each receiver is set to a single frequency. The only problem is that you needed 1000 receivers for 1000 memory channels. With the advent of PLLs and PC computers, all that is needed to scan 1000 channels is a modern-day microprocessor-controlled radio with a PC interface and a PC computer.

This all sounds fine in the ideal world, but in reality the system of PLL does not work as well as one would desire. The problems of jitter, lock time, lock range, capture range, and phase noise cannot be ignored. These problems are nonexistent in the older PTO radios. Unfortunately, older radios such as the S-Line used crystals for the first LO. To obtain general coverage, one needed 114 crystals for the S-Line. This is a pretty expensive way to eliminate jitter. Jitter is the most annoying of problems in VCOs. This is because the VCO is not as stable as a crystal. Jitter primarily is caused by the low-pass filter (LPF) having a time constant that is much less than the VCO's oscillating frequency. Typically, LPFs are set to several kHz on PLLs. The VCO may be operating at 50 MHz in a modern radio, but the frequency correction rate may only be a few kHz. The result is that the VCO drifts at the rate of the low-pass filter. This is extremely annoying, because it causes a hissing, wobbling sound at the speaker which is apparent on almost all synthesized radios, with the exception of perhaps the most expensive ones, such as the Harris 3200 or ICOM 756Pro. It becomes worse in the presence of a strong signal while trying to listen to a weak signal.

Another apparent problem with PLL radios is the "divider noise." As you tune across the band on a synthesized radio, the frequency divider on the PLL is constantly changing. This causes the LPF to inject sudden jumps in voltage to the VCO. Even with a good LPF, chirping is heard at the speaker when one tunes through the band. This is particularly noticeable when one tunes across a carrier on the SSB/CW mode. With an analog PTO, the carrier appears as a smooth tone coming in and out. With a PLL radio, a changing chirping tone is heard.

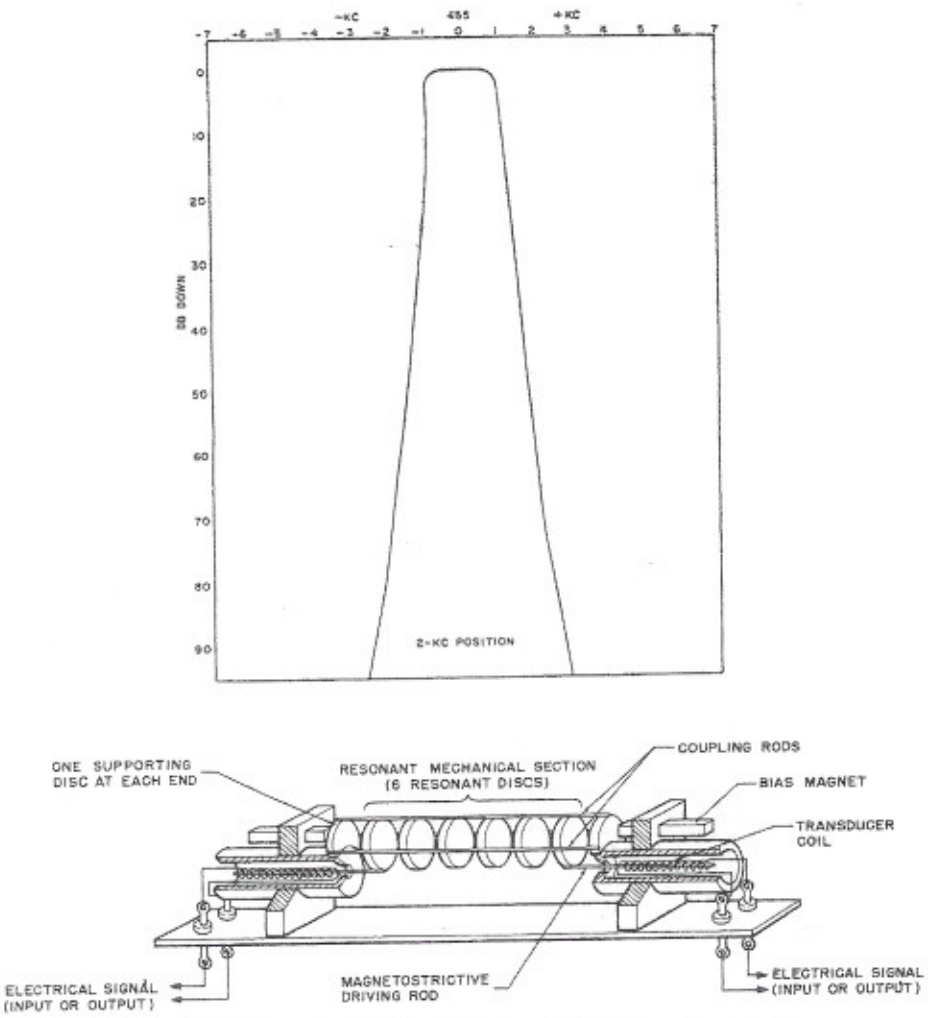

Figure 6. Response of a Collins mechanical filter (taken from the R390A service manual).

The internal CPU and PLL divider clocks also contribute to front-end noise, since clocks take the form of square waves and are rich in harmonics. This again reduces the noise performance of the receiver.

Are there any solutions on the horizon? Manufacturers are now beginning to use higher and higher frequency VCOs. Previously, this was not possible due to the high cost. With the advent of cellular technology, using a VCO in the 1-GHz range is a daily practice. The National LMX2320 is a 2.5-GHz PLL and sells for under $2. The approach with these high-frequency VCOs is to develop the LO signal at a frequency many times higher than desired. The signal then is divided down through a frequency divider chain. The jitter also is divided down, resulting in lower phase noise.

IF Filter Performance

A lot has been said with regard to IF signal processing and filtering, some truth, some myth. In the old days, one really didn't have that many options. If you wanted the best, the Collins mechanical filters did the trick. These were the best on the market. A good Collins filter had skirts of 1.8. Mechanical filters are spec to what is known as a 6-60 ratio. The response is measured at the -6 dB point and then again at the –60 dB point away from center. The ratio of theses two frequencies from center is the skirt selectivity. As an example, a filter with a skirt selectivity of 2.0 will have a –60 dB response at 4 kHz away from center and the –6 dB point would be 2 kHz from center. A mechanical filter and its response are shown in Figure 6. They usually consist of 6-10 sections, depending on the desired response. Some of these filters would roll off by as much as 90 dB. Using a 10-bit DSP processor will only yield 60 dB of dynamic range. The advantage of the DSP filter is that one can change its bandwidth and response in software, but it is at the expense of dynamic range. Consumer receivers today usually use ceramic filters, which although low in cost, have poor performance.

(continued in Part 5 - next issue)