The SIGNAL

Collins Collectors Association

Issue Number Forty One | Official Journal of The Collins Collectors Association | First Quarter 2006

KWM-1: Trendsetter Traced to Basement Workshop

By Mike O'Brien, K0MYW

The Collins KWM-1 tranceiver (Photos © Joe Veras, K9OCO, 2006, All Right Reserved)

The Collins KWM-1 transceiver, which in 1957 pointed a design course that communications equipment manufacturers still follow today, is even more remarkable because it was born not in a fancy company laboratory, but rather in a home basement ham shack.

The basic concept was the brainchild of Gene Senti, an engineer who joined the Collins crew in Cedar Rapids, Iowa in 1941. Senti became a Silent Key on October 20, 2005 at the age of 88.

During his 30 years with Collins, Senti worked on several military projects, including the ART-13 aircraft transmitter and R-392 HF receiver, and he was a principal designer of the classic 30L-1 ham linear amplifier.

In early 1956, Senti, then 38 years old, began tinkering on his home workbench with his personal example of the Collins then-new 75A-4 ham-band receiver. Senti, who liked to point out that his WØROW call "looks the same forward or backward," similarly described his early transceiver experiments as "sort of like taking the receiver's block diagram and running it backward."

"I was trying to figure out a way to use the 75A-4's high-stability PTO, with its good linearity, along with the crystal oscillator for injection purposes in a transmitter," Senti recounted in a telephone interview from his Cedar Rapids home in the early 1990s.

"I took the signals from the oscillators out of the 75A-4 with some pieces of coax and re-combined them in a separate chassis. I also took out the BFO. So I was using all three of the receiver's oscillators. All I had to do was come up with new mixers."

While he toyed with the engineering challenges of the project (for instance, tracking with the 75A-4's variable IF), Senti also began dreaming of the convenience such a setup could bring to his ham shack.

"After I saw where I was heading, I thought to myself, 'Gee, this could be neat! All I'll have to do is tune in a signal and my transmitter will be zero-beat with it.' So I went ahead and hooked it up—and, by golly, it worked!"

Of course, his experiments were too good to keep to himself. Senti shared his excitement with fellow engineers at work. Soon word reached top boss Art Collins himself. One evening shortly thereafter came a knock on the door of the Senti home.

"Mr. Collins came to my basement for a demonstration in my junky workshop," Senti recalled. "I was kind of embarrassed, but he seemed to enjoy it."

Art Collins promptly set a factory team to work on Senti's concept. The KWM-1 was on its way to dealers little more than a year later.

"It was Mr. Collins' idea to make it a mobile rig," Senti said. "Mr. Collins thought the simple frequency control would appeal to the mobile operator because he wouldn't have to take his eyes off the road so much to tune."

The decision to limit the KWM-1's coverage to 10, 11, 15, and 20 meters also came from Art Collins, according to Senti: "Mr. Collins was thinking of it mainly as a mobile rig, and he said to us, 'The lower in frequency you go, the more loading coil and less antenna you have.' He told us to concentrate on 10 through 20 meters, and to worry about the rest later. Also, there were bad spurious emissions in the 80-meter band in our early models that weren't the type of thing you'd want to sell to the public."

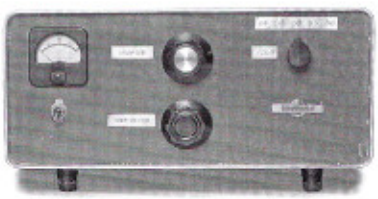
The KWM-1, with a pair of 6146s putting out 175 watts of CW or SSB (no provision for AM), sold new in 1957 for about $1,000 with typical accessories.

The KWM-1 spawned the Collins S-line gear. The Collins 32S-1/75S-1 transmitter-receiver combo, with the capability of common frequency control, was introduced in 1958. Shortly thereafter came the KWM-2 transceiver, which added 40 and 80 meters and other refinements to the original KWM-1 package.

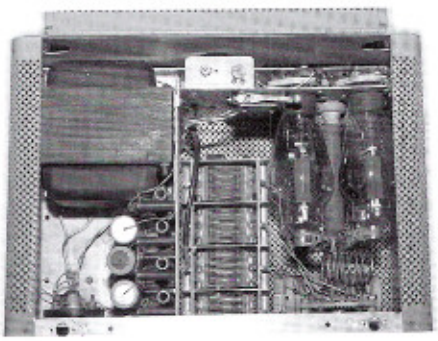
"Mr. Collins used one of the first three KWM-1 prototypes to contact both the North Pole and South Pole," noted Senti with pride. "It turned out to be a pretty good little rig."

(This piece was drawn from an article by K0MYW that appeared in *Electric Radio* magazine in the early 1990s.—ed.)

75A-4 Receiver



30L-1 amp prototype, front & inside views



In this issue...

Do You REALLY Want To Use That Electrolytic?

By Bob Sullivan, W0YVA

At one time or another you are going to be restoring or repairing your Collins equipment. There have been many discussions and opinions about replacing electrolytics on the Collins reflector and other forums. Most agree that 40- to 50-year-old electrolytics should be replaced with new ones, but we are tempted to use anything we have on the shelf. I want to pass along my experiences to assist you in deciding whether or not to use an electrolytic you have on hand.

I agree with those who say that if you're "inside" a 50-year-old piece of equipment you should replace ALL the electrolytics. If you're like me, you have a good supply of NOS electrolytics on hand and maybe some you aren't too sure of. The question is how to determine if a replacement electrolytic is good.

Using a variety of methods, I tested 25 electrolytics (new, used, and NOS) ranging in value from 10 to 220 uF and with voltage ratings ranging from 100 to 450 VDC. Here is what I found:

Test #1. Using a VOM highest resistance scale. The capacitor is charged using the internal batteries of the VOM. This admittedly is a simple method, but one used by many. The ohmmeter test told me that all 25 capacitors were "good." The VOM indicated a fairly high resistance.

Test #2. Capacitance of each was measured using an impedance (LCR) meter. All 25 capacitors read within 20% of their value, so one would conclude all were good.

Test #3. Capacitance of each was measured with a fairly modern (solid state) B&K capacitance meter. All but two tested within acceptance values. Two (old) 40 uF capacitors showed capacitance in the pF range, so I concluded these were not good and set them aside.

Test #4. Remaining capacitors were tested on a Sprague TO-6A capacitor analyzer. This great vintage test instrument measures capacitance, power factor, leakage, and insulation resistance. Leakage current is measured at rated voltage.

All 23 capacitors showed capacitance values within acceptable limits, but 10 (!) of these showed very high values of leakage and of these ten, three showed high power factors. In a couple of cases the capacitors were quite warm to the touch after testing.

Obviously, electrolytic capacitors need to be tested at or near their rated voltage. The LCR meter provides only a very small voltage and the VOM and B&K only a few volts—not good enough!

For a valid test one must test using higher voltages. The Sprague unit has a variable high-voltage supply that can be adjusted to the capacitors' voltage rating.

Power factor for electrolytics should range between 10 and 25%. Leakage current should be less than 1 ma at rated working voltage. Allow less for very small capacitance values and a bit more for very large capacitance values (>500 uF).

With the few electrolytics we use it is not a major job to test every one with a proper test instrument prior to installation. TO-6A's are available, as are other similar instruments. Get yourself one! They are almost always available on eBay and sell for $100 to $200. Installing tested capacitors will make you more confident of the quality and future performance of your boatanchor.

CCA Awards Banquet

The Dayton Hamvention is May 18th, 19th, & 20th. It's time to start making plans. The CCA will be hosting its annual awards banquet on Friday night, May 19th at the Holiday Inn North at 2301 Wagner-Ford Road, Dayton, OH. The hotel is located 5 mi. south of I-70 at the Wagner-Ford Rd exit (#57B) of I-75.

If you would like to stay "where the action is," you can make reservations by calling the Holiday Inn North at 937-278-4871. Be sure to tell them you are a CCA member to get the special $118.00 per night special rate (based on a three night stay). The CCA has 30 rooms reserved and the reservation deadline is April 21st. Please make your reservations soon...space is filling quickly.

The Holiday Inn North will be running a shuttle service from the airport. Call the hotel upon arrival. Buses will pickup you up near the baggage area (near flagpole).

The CCA Annual Awards Banquet will take place at the Holodome at the Holiday Inn North on Friday night, May 19th at 7:30pm. Use the CCA Banquet Reservation Form with pre-addessed mailing envelope included with this issue of the Signal newsletter or download the banquet reservation form on the CCA web site at www.collinsradio.org. Be sure to tell us whether you want chicken or beef for your entrée. Cost per person is $35.00. Of course, there will also be a nice array of goodies offered as door prizes and in a raffle. Get those reservations in now and don't miss out on the fun!

The CCA will also be hosting hospitality rooms on Thursday night, May 18th (6:30pm-10:00pm), Friday night, May 19th (6:00pm-7:30pm...preceeding the CCA Banquet), and again on Saturday night May 21st (6:30pm-10:00pm) at theHoliday Inn North on the Observation Deck, one-floor above the lobby. There will be a cash bar on-site.

Daytime action at the Hara Arena will be at the CCA booth, #459 in the Ballarena room. The booth provides a great gathering place to meet up with members and sit a spell. The CCA "Dance Card" showing the location of various Collins-related booths and fleamarket spots will be available at the CCA booth.

A general CCA membership meeting is planned for Dayton, please check the CCA web site and Collins reflector for more information as it becomes available. You can also check out general Hamvention information at the Hamvention web site at: www.hamvention.com.

The CCA Dayton chair person this year is Rich Sperling, WB3JLK. You can reach Rich at lawrencebcst@hotmail.com if you have any question about the CCA's events at Dayton this year.

Watch the CCA reflector for more details and updates as we get closer to the Hamvention. See you in Dayton!

Call For Articles!

by Gail Schieber, K2RED

We need material to publish in the Signal newsletter! Technical articles, "hints 'n kinks," on-the-air experiences with Collins equipment, articles of historical nature, and items for the new column, "Collins Radios at Work"...which includes experiences of CCA members who used Collins gear in the military, commercial, aviation, and space services.

We don't necessarily need full-length articles. A few paragraphs or even just a photo with an explanatory caption are welcome. You do not have to be an experienced writer either. We are willing to help you. In exchange for any full-length articles accepted for future publication, the CCA will provide you with a FREE 1-year CCA membership!

You can contacted me via e-mail at K2REDCCA@aol.com or via snail-mail at P.O. Box 1396, Port Washington, NY 11050.

We are also looking for shack photos for "In The Shack." Please send us a photo of yourself sitting at your Collins station and include a brief description of your equipment. Email them to Sandy KW6KW at kw6kw@comcast.net.

CCA Election Results

Congratulations to Bill Wheeler and John Bess for being elected to the CCA Board of Directors for a two-year term. Thanks to Walt Barczak KB3CGZ for processing the ballots.

At The Mic

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

Happy New Year to one and all! I hope all of you had a great holiday season with family and friends. I also hope you had a chance to get on the air and make some contacts on HF. Spending quality time with family and friends (on the air and off) is what life is about, so keep those Collins rigs warmed up and exciting electrons!

I want to congratulate Bill Wheeler, K0DEW (one of our founding fathers!), for being re-elected to the CCA Board of Directors. I want to congratulate John Bess, WA5VVT, on his election to the BoD as well. Welcome back to the both of you!

We're still looking for someone to take on the Net Manager's position. It's not a tough job. All he/she needs to do is assist the NCOs with their schedules. The Net Mgr. is NOT required to make all the nets! If you, or someone you know, has the inclination please contact me.

Plans are in full swing for Dayton 2006! 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 them pull of another great Dayton event this spring. As you will recall, 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 to the arena and back on a regular basis. This will make things very convenient for folks who do not want to deal with the parking at Hara Arena.

Please stop by the CCA booth and say hello. As a matter of fact, if you would like to volunteer to spend some time in the booth to chat with others about Collins and the CCA, please contact me. If you can spend an hour or two on Friday, Saturday, or Sunday morning, that would greatly help the booth volunteers. All you do is talk Collins to the folks who stop by! This way, the other volunteers can have a chance to walk around the flea market or the arena. Rich can probably use some help during the Friday evening CCA banquet, too. If you can help out, please contact him.

Hope to catch you on the air and see you at Dayton!

Subscribe to the Collins Reflector...a FREE e-mail mailing list of over 1300 Collins users and collectors! Visit the CCA web site for complete information!

Visit the CCA web site at:
www.collinsradio.org

In the Shack

The radio shack of Jim Smith, VK9NS

I have been a licensed radio amateur for almost 60 years and have continuously worked in the world of radio communications. My path has often been touched by Collins Radio equipment, both in the world of amateur radio and also in a professional sense.

In amateur radio I have always been an avid homebrewer. Recently (at the ripe old age of 74), I completed a multi-band (21 tube) CW/SSB transceiver running low power. I was building it for the second time, and it was based on a 1960's "GE Hams News" article called the "LWM-3." The circuit was based on the Collins KWM-2, and in the early '60s I built it for the first time. It was a major project, and to assist my efforts I purchased a KWM-2 manual. I wanted to see what Collins would have done at this point or in that area of the circuit. It was an interesting comparison.

A couple of years ago I decided to build the LWM-3 again (a glutton for punishment!), and I was to find myself pouring over my 40-year-old KWM-2 handbook one more time. It reminded me that in those far-off days of the early '60s, buying a KWM-2 was really out of the question for me, what with UK/US exchange rates, not to mention family, mortgage, and so on. I guess it was on the "wish list" of most radio amateurs.

In completing the LWM-3 and making a few QSOs with it, I suddenly had a yen to own a KWM-2, and I placed an advertisement on a VK ham site: "Wanted to buy, a KWM-2, clean but not necessarily in working order." I was to buy two KWM-2 units, one in very nice condition and the other? Well, a basket case, or more correctly, a cardboard-box case, as this is where it had ended up.

This rig is in great shape these days, as I was able to rehabilitate it, and it gave me a lot of sheer pleasure in doing so. After being reassembled and repaired, it cleaned up very nicely indeed. Collins radios are, and always have been, quality items, a pleasure to work on.

I am a further three years down the track now. I became a member of the CCA, which introduced me to the members, and I can only say in all honesty that the amount of assistance available from the group is amazing. I enjoy my membership very much, and I have made several good friends in the process. It was nice to be at Dayton last year as well.

The photograph shows my basic Collins station based around the KWM-2. I homebrewed the external PTO on the left (using the Collins 70K PTO, etc.), and it lends greater flexibility to the station. I use an HF 6V multi-band vertical, and the station is virtually a standalone outfit. It is in my workshop area, and I often leave the KWM-2 running, listening to a net or whatever.

Join Us on the Air!

- 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 **Signal** is published quarterly by The Collins Collectors Association

The Collins Collectors Association
P. O. Box 354
Phoenix, MD 21131

www.collinsradio.org

Collins Radios, Still the Best in Town - Part 5

by Edison Fong, WB6IQN - edison_fong@hotmail.com

An ICOM IC-730 has a 2.5 skirt selectivity and a maximum attenuation of about –60 dB.

I certainly have noticed that many modern-day receivers are awfully "hissy." I can't say that it all comes from the noisy IF amplifiers combined with poor mechanical or crystal filtering, but certainly bad IF filtering contributes to noise. In combination with the noisy LO and diode switching, it is not difficult to see why an old boatanchor such as the R390A wins hands down.

In the old Collins receivers, everything was wafer switched. These direct mechanical switches would give virtually near-perfect linearity and lossless switching. With the advent of switching diodes, the nonlinearity of the diodes and "on resistance" became a factor in determining the noise floor. To be fair, the electronic switching does offer an economical means of computer control which is not practical in the mechanical approach. Also, with the electronic approach the need to clean contact switches every two years is eliminated. However, modern radios do not optimize for performance. Again, it probably just comes down to cost. In my 1979 AES catalogs my Collins CW filter went for $406.92. Remember that this was in 1979 dollars, so today that would be well over $1000. Many of these high-priced items were designed for the US Government during the Cold War when it was simply tax payers' money.

Today, there just is not a demand for such items. Rather, value is emphasized, not just brute performance at any cost. Filtering is often done by Digital Signal Processing. Are they what I would call "high performance"? Probably not. They are, however, very versatile and fully programmable for various bandwidths, various skirts, even built-in gain. However, I find them a bit on the noisy side, especially when used in the IF stage, such as with the Watkins Johnson HF1000. I don't know the exact processor they are using, but typical DSP engines that can perform at 455 kHz usually do not exceed 10 bits. This translates to a noise floor of only 60 dB. This is a far cry from the Collins filter with a noise floor of about 90 dB. Because the rest of the radio is so quiet in the R390A, it is usually the audio amplifier which limits the noise floor on many older tube-type receivers. Modern receivers usually are limited by the noisy LO. My Collins 75S-1 has an audio noise floor of about -65 dB. My "modern" Drake TR7A has an audio noise floor of about -55 dB. I really can't say where all the noise is coming from in modern receivers, but it is probably a combination of the LO, IF filtering, the switching diodes, and perhaps some noisy bipolar transistors.

Product Detector

I find little information in the literature with regard to the effects of product detectors on audio quality. Personally, I think the product detector is one of the most important stages of the receiver in terms of audio distortion. Often what is misunderstood for audio cross-over distortion is really poor matching on the product detector mixer. Shown in Figure 7 is a typical product detector which is used in most (if not all) HF SSB receivers.

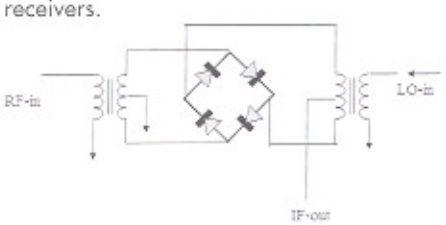


Figure 7. Schematic of a double balance mixer. This configuration is used in the majority of product detectors today.

For minimum distortion, the four diodes must be perfectly matched. This is not always the case. I have been told that by replacing conventional diode detectors with well-matched Schottky diodes, the audio will improve dramatically. At least that's what Dennis, AE6C, tells me. I personally have not performed this modification. However, it is not difficult to see that the Schottky diodes provide far less conversion loss than conventional diodes, since their turn on point is closer to 300 mV as compared to conventional silicon diodes which have a turn on point of about 600 mV. Nevertheless, even with Schottky diodes, the ring diode configuration still experiences a conversion loss of 6-10 dB.

Figure 8 is a schematic of the product detector in the Collins 75S3C. It consists of one half of the 6EA8 triode. These tubes are very linear and thus produce very low distortion. The configuration is single ended, and thus no critical matching components are needed. This is probably the major reason why people say that their Collins sound so rich. The other major reason is that tubes will handle transients far better than solid-state components. Tubes will have soft clipping, so even if the stage is overloaded, it will not sound objectionable. Most people will tell you that they instantly can tell a tube radio from a transistorized radio. There may be truth to that statement, although with some of the newer radios (such as the SGC, Harris, ICOM, and JRC radios) it is getting more and more difficult to differentiate.

Audio Stage

What about audio quality? I have found that most radios have good audio quality. Most modern rigs have 1-5 watts of audio and in general the quality is very good. Today's audio amplifiers are far more efficient than those produced 30 years ago due to IC technology. Without question, I would prefer today's efficient, compact, and low-cost audio amplifiers over a tube. In the old days, we would use 6AQ5s or 6BF5s at the audio running in class A. The class A configuration would only give 25% efficiency and the rest was lost in heat. This was okay for a fixed station at home, but certainly was not very practical for mobile or portable operation. I must concede, however, that the audio did sound very good.

(conclusion in Part 6 - next issue)

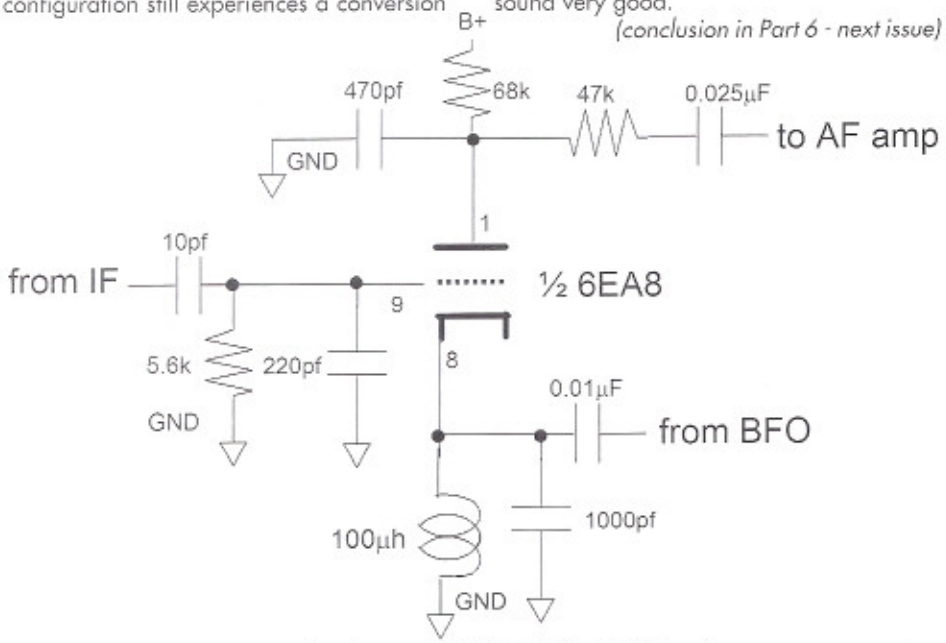


Figure 8. Product detector used in the Collins 75S3C receiver.