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ELECTRIC RADIO

celebrating a bygone era

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Jose Manuel Cervera, CO2XM

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Electric Radio is published primarily for those who appreciate vintage gear and those who are interested in the history of radio. It is hoped that the magazine will provide inspiration and encouragement to collectors, restorers and builders.

We depend on our readers to supply material for ER. Our primary interest is in articles that pertain to vintage equipment/operating with an emphasis on AM, but articles on CW and SSB are also needed. Photos of hams in their hamshacks are always appreciated. We invite those interested in writing for ER to write or call.

Regular contributors include:
Bill Breshears, WC3K; Bob Dennison, W2HBE; Dale Gagnon, KWll; Bob Grinder, K7AK; Jim Hanlon, W8KGI; Brian Harris, WA5UEK; Tom Marcellino, W3BYM; Ray Osterwald, NØDMS; Chuck Teeters, W4MEW; Bruce Vaughan, NR5Q.

Editor's Comments

And the winner is...

Mike McElhinny, WN3B for the 2nd year in a row has been voted by participants and listeners to have had the best audio among the AM operators in the Heavy Metal Night Jamboree December 23. Jamboree organizer Bill Kleronomos, KDØHG will be providing an award for WN3B. ER sends our congratulations to Mike. We're looking forward to working him sometime. His audio must be absolutely super.

***Arthur Collins, Radio Wizard* by Ben W. Stearns**

Just as I was winding up the this issue I received a review copy of Ben Stearns' new book, *Arthur Collins, Radio Wizard*. I haven't had time to read the book completely but I will say that from what I've read I'm mightily impressed. This is a big, fat book (394 pages) loaded with information that I was not aware of. I'm sure, just on the basis of flipping through this book, that Stearns has produced the definitive biography of Arthur Collins. Stearns, who was a Collins employee, has spent over ten years gathering the material for this book. Most of it came from interviews with other Collins employees who could speak from their own experiences with Arthur Collins. I could tell immediately that Stearns' book contained accurate information. Along with the text there are some great photos of Arthur Collins and some of the people that worked for him. I've already ordered a shipment of the books and will have them available by the time ER subscribers will be reading this. The price is $17.05 plus $3 shpg. And remember we now take credit card payment—Visa, Mastercard and American Express.

About my trip to Cuba

This has been a cold miserable winter in southwest Colorado but I had some respite during my week-long trip to Cuba. I had a great experience which I describe in an article beginning on page 3. Somthing I omitted to say in the article is just how great our hobby is in bringing people together. On first meeting the Cuban hams I felt a sense of kinship immediately. I think they felt the same way. Isn't this a great hobby that we're all involved in. N6CSW

TABLE OF CONTENTS

Cover: Jose Manuel Cervera, CO2XM, in his Havana, Cuba hamshack. We were very fortunate to get to visit Jose's home while we were in Cuba recently. See the story on page 3.

Electric Radio Goes to Cuba

by N6CSW, ER Editor

Just after we got the January issue into the mail, I gave myself an assignment for the February issue: Go to Cuba and find out about Amateur Radio there. I've always been intrigued the way the Cuban's have kept the old pre-revolution (pre-1960) cars running. They must be applying some clever finesse to do this. I've also wondered if they might be keeping their old radios going too.

I brought my older, retired brother Lyle into the project and had him make the travel arrangements from Canada where he lives. It's difficult for U.S. citizens to travel to Cuba because of the embargo but being Canadian citizens he and I had no problems. A seven-day all-inclusive package to Veradera from Vancouver British Columbia was soon found. Veradera is a resort area on the beach about 80 miles south of Havana. I thought that a few days relaxing on the beach would be a good reward for all my hard work on this trip.

About this time I received an e-mail from a subscriber, John Fitzsimmons, W3JN advising me of a change of address. Guess where he had moved? Cuba!! He was transferred by the State Department from Washington to Havana where he was in charge of security for the embassy. I immediately replied telling him that I was coming to Cuba and asked him for his help in locating some Cuban hams who operated HB and/or vintage gear. John told me that he had not been in Cuba long enough to become connected with the ham community (he can't operate from there as Cuba does not have recip-

FRC Executive with W3JN. Left to right standing: Evaristo Rodriguez, CO2EQ; Narciso Viera, CO2NV; Francisco Hernandez, CO2HA, Vice Pres.; Jorge Novoa, CO2II, Sec'y; Carlos Martinez, CO2CW, Sec'y; Pedro Rodriguez, CO2RP, Pres. Sitting, left to right: Oscar Morales, CO2OJ, Sec't; Lazro Alvarez, CO2WL, John Fitzsimmons, W3JM.

In the FRC hamshack. CO2RP on the left with CO2OJ.

rocal agreements) but that he would make inquiries. He also invited Lyle us to stay at his home when we came to Havana. A couple of days later John e-mailed that one of the Cuban employees at the embassy did have connections with the ham community. Fidel would visit the FRC (Cuban Amateur Radio Federation), the equivalent of our ARRL, and make arrangements for us to visit there. John gave him some ER back issues to take along to give them an idea of what I was all about.

January 13th I flew from Colorado to Vancouver, BC and on the following day Lyle and I flew to Veradera. It was around 30 degrees in Vancouver that day and in the high 80's when we landed in Veradera. A nice contrast. We found the resort to be almost perfect in every way and the Cubans to be very friendly. We enjoyed our stay there very much.

While we were soaking up the rays in Veradera John and Fidel had made arrangements for us to visit the FRC on the following Saturday morning. We would have the opportunity to meet the FRC executive and other Cuban hams who gathered there on Saturday mornings for coffee and eyeball QSOs. I would have my opportunity to find out all about Amateur Radio in Cuba and more importantly for me to find out about vintage radio over there. Friday we bussed into Havana where we were met by John. After a walking tour of Havana Vieja (old Havana) and a great lunch there we went to John's home in Miramar (an upscale area of Havana) where we spent the rest of the afternoon smoking Cuban stogies and drinking beer. John gave Lyle and I a great time; I hope that at some time in the future I have the opportunity to reciprocate. I should insert here my impressions of Havana. Although it is a city of 3 million people it has a small-town feeling. Maybe that's because the congestion from traffic that we're familiar with is missing here. There are just not that many cars for a city this size. The buildings are certainly in need of repair but the city is still very beautiful. Restoration is going on and when it is completed Havana will be a unique and truly magnificent city as it once was.

In the evening we went out to dinner with John's friend and coworker at the embassy, Fidel. We had a good dinner and good time talking vintage radio.

continued on page 40

Marconi's Dramatic Moment on Signal Hill: A Retrospective Review

Part Three

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Part III. Marconi's dramatic moment at Signal Hill

Marconi had been somewhat disingenuous with his Board, for his intended coup was not to build simply a powerful spark-gap transmitter in England and America, respectively, each of which would have the capability of sending a signal halfway across the ocean. Hardly! He aimed to build a very powerful transmitter and aerial system on each continent, and each of them would possess the means of spanning the entire Atlantic ocean with its signals. Marconi employed John Ambrose Fleming, University College, London, on December 1, 1900 to design the transmitter. Fleming was the foremost electrical engineer in England, and four years later, while still a Marconi consultant, invented the thermionic valve [British nomenclature for vacuum tube]. R. N. Vyvyan, a construction engineer, was assigned responsibility for building identical transmitters and installing identical aerial systems at Poldu point and in the United States.

Figure 6 presents a diagram of the transmitter that Fleming installed at Poldu point (Vyvyan, 1933, p. 246). Fleming devised a method of "double transformation" to create a spark-gap transmitter that was approximately one-hundred times more powerful than the battery-powered transmitters that Marconi had used heretofore, and at the time it was the most powerful wireless transmitter in existence. According to Bussey (2000), it incorporated a "32-brake-horsepower" oil engine (not shown in Fig. 6) driving a 25-kilowatt 2000 volt 50-cycle alternator ("A" in Fig. 6), which produced a 100 cycle buzz note in the transmitted signal. The output of the alternator was fed to a pair of 20-kilowatt transformers which stepped up the voltage from 2,000 to 20,000 volts ("T" in Figure 6). The oscillation transformers or "jiggers" are marked "J1" and "J2" in Figure 6. The current from transformer "T" charged condenser "C1", a bank of Leyden jars, and discharged through the primary of

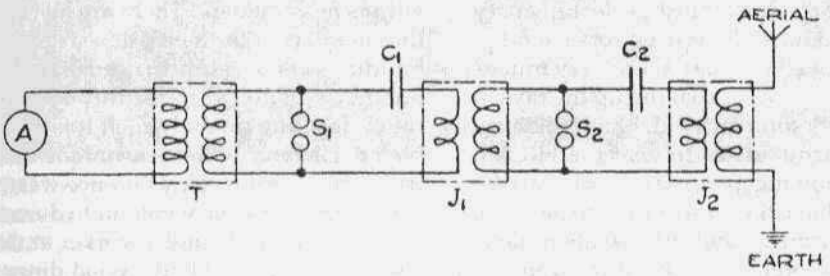

Figure 6.

Figure 7

"J1" across spark gap "S1". The secondary of "J1" is connected to a second spark gap "S2", a second condenser "C2", which is another bank of Leyden jars, and the primary winding of a second oscillation transformer "J2", also across "S2". The secondary of "J2" is in series with the aerial and ground. (Vyvyan, 1933; see also Bussey, 2000, for discussion and pictures of Fleming's huge transformers).

Fleming did not have the transmitter ready until early summer, 1901, because he encountered difficulty developing high-efficiency output coils. Although Fleming had no way of knowing his exact wavelength, he could, at least, influence it by changing the windings on his output coils and adjusting the Leyden jars. Once the transmitter parameters were syntonized to a given wavelength, aerials and a coherer could be tuned roughly to that particular wavelength, which would maximize signal strength at the coherer. [Contemporary scientists estimate that Fleming operated approximately on a wavelength of 366 meters or 820-850 kHz (Bussey, 2000, p. 23; Tarrant, 2001, pp. 62-63).]

Fleming also had to confront the problem of inserting a key in the circuit for sending dots and dashes. A small telegraph key would have been a lethal instrument in the primary of the 2,000 volt alternator, where power in excess of several kilowatts would have to be interrupted. Fleming thus came up with a "ponderous electrical switch to make and break the circuit" (Kreuzer & Kreuzer, 1995; Vyvyan, 1933), which very likely was similar to the one shown in Figure 7 (Thom-Collins, 1908, Part II, p. 17). As of 1901, therefore, the transmitter that Fleming had developed for Marconi could not actually send intelligible messages for two reasons: first, the "switch" a k a "key" was too bulky and dangerous to use speedily, as when sending the letters of Morse code, and second, Fleming was fearful that rapid interruption of power would so strain the alternator, transformers, and condensers that they would burn out.

Marconi met with Vyvyan in early February to discuss his idea for a new long-distance aerial, which like the transmitter, would be the largest and most elaborate ever built, and he was probably too engrossed in design issues to evaluate the concerns that Fleming was raising. Vyvyan questioned whether a physically stable aerial could be built to Marconi's specifications, but incautiously, Marconi ordered on February 12, 1901, that construction begin. The aerial system constituted a ring of 20 wooden masts, 200 feet in height, and 200 feet in diameter. The array was intended to support a conical

continued on next page

aerial of 400 wires, each wire was insulated at the top and all were connected at the bottom, thus forming an inverted cone. A hut was built in the center of the array to house the transmitter, and the lead wire of the cone entered from the middle of its roof. Each mast was guyed to the next one and to the ground in a radial direction both away from and toward the center of the mast system (Vyvyan, 1933). The mast guys, which were anchored to cement blocks, were divided into short lengths by insulators so that they would not pass electromagnetic waves to ground. Vyvyan believed that stress associated with any one of the masts, which might occur during a storm, would jeopardize the entire assembly (Bussey, 2000; Hall, 1996; Orr, 1985; Vyvyan, 1933).

A few weeks later, once construction of the Poldu projects was progressing satisfactorily, Marconi and Vyvyan sailed for South Wellfleet, Cape Cod, Massachusetts, to make arrangements for a comparable station (Hall, 1996). A finished version of the inverted-cone aerial system is shown in Part 1 (ER, December, 2001, #151, p. 11; see also Vyvyan, 1933, p. 23).

Marconi returned to England in April; Vyvyan remained at Cape Cod to supervise building the second station. He delivered in May a paper on "syntonic wireless telegraphy," at the Society of Arts, London, and experimented with the new apparatus at Poldu through the summer of 1901 (Bussey, 2000). On September 17, a furious storm uprooted the masts at Poldu. The cone aerial was destroyed, and a gaping hole was ripped in the roof of the hut. Marconi abandoned immediately the ill-fated circular array in favor of a modest experimental aerial, thus cutting losses, and allaying growing anxiety among his Board members, who worried that expenditures, for which they may never have anything to show, were mounting astronomically. Marconi's action was fortuitous, too, because, only a few weeks later, a nor'easter demolished the circular array at Cape Cod.

Marconi had an experimental aerial in service by September 26 1901, thanks to the enterprising Kemp. The aerial Marconi and his advisors chose to erect was a vertical fan-shaped array, a design that attained later widespread use in the early twentieth-century. In this instance, a horizontal wire of about 200 feet was stretched between two masts, 150 feet in height. Fifty-four wires, spaced one meter (roughly one yard) apart were insulated and suspended from the horizontal wire. The aerial wires were arranged in a fan shape, and connected together at the lower end, where a single wire entered the repaired roof of the transmitter hut. The entire array looked analogously like a fan, a harp, or an inverted triangle standing on it apex (Thom-Collins, 1908; Vyvyan, 1933; see a picture of the array in QST, December, 2001, p. 45).

Marconi was encouraged by the distances that he could cover with the transmitter and vertical-fan aerial at Poldu. But given the catastrophe at Cape Cod, and the likelihood that the substitute was not as efficient as the cone-shaped aerial would have been, he made two major compromises in his ongoing struggle to conduct a transatlantic test. First he chose to try it from Newfoundland instead of Cap Cod, which would enable him to shorten the distance of the transmission by several hundred miles; second, not having an alternative to the station at Cape Cod, he decided that signals would be sent only one-way-from the powerful Poldu transmitter to his coherer in Newfoundland.

Marconi was eager to bolster the morale of his Board members with good news, and he knew that a successful transatlantic transmission would invigorate them, especially since they

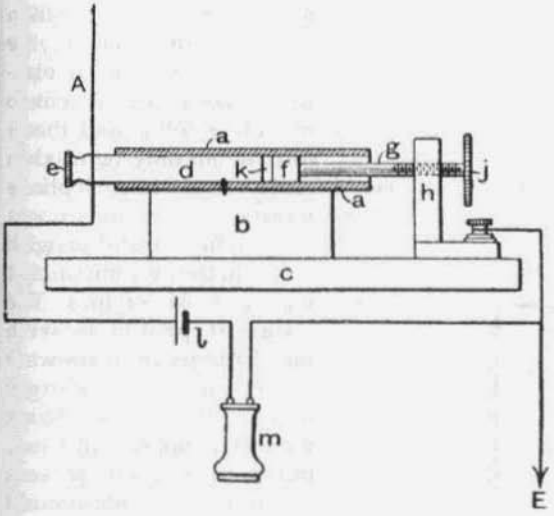

Figure 8

had no idea that was what he hoped to achieve. He kept his goal to himself, however, for three reasons: he did not want to raise the expectations of his Board after so much disappointment had arisen already, he knew a failure would level a crushing blow to his growing stature, and he was uncertain about how authorities in Newfoundland would respond to his overtures.

But Marconi was pressed for time. The onset of the harsh Newfoundland winter was fast approaching, and he was aware that he had to act promptly if he was to have anything to show in 1901 for his investment in time and resources (Jolly, 1972; Masini, 1995; Tarrant, 2001). Consequently, Marconi, Kemp, and Percy W. Paget, a trusted technician who had joined him two years earlier, sailed from Liverpool on the S.S. Sardinian, November 25 1901, bound not for Cape Cod but St. John's. They brought with them several tanks of hydrogen gas cylinders for inflating cotton-silk balloons, 14 feet in diameter with a capacity of 1,400 cubic feet, and six hexagonal kites, which were made of bamboo and silk and measured 9 feet by 7 feet (Bussey, 2000; Hawks, 1927; Tarrant, 2001). Their baggage also included aerial wire, Billy coil, telephone receiver, and batteries; an improved Branly/Lodge coherer including a relay, tapper, and inker as accessories; and at the last moment, almost as an after thought, a self-restoring, mercury coherer.

Paolo Castelli, a semaphorist in the Italian Navy is recognized as having invented in 1899-1900 a new mercury coherer (Masini, 1995, p. 176). Marconi was aware of it. The Italian Navy was using the coherer along with Marconi's syntonic system, which offended him because his patent was being infringed. Eventually, the Italian Navy sent to London his old friend, Solari, to make amends. Solari was then an electrical engineer and Lieutenant in the Italian Navy; he had been Marconi's boyhood compatriot when they studied physics together, and during the early 1900s rose to become one of Marconi's trusted colleagues. He arrived about the time that Marconi was preparing to leave for Newfoundland, and as a gift from the Italian Navy, he gave him a mercury coherer.

A diagram of Castelli's self-restoring, Italian Navy coherer—a precursor of the galena crystal detector—is shown in Figure 8 (Fleming, 1919, p. 378). It is also known as the "Solari coherer," since in a letter to the London Times, July 3 1902, Solari claimed that he had invented it (Fleming, 1919, p. 377). In the diagram, the aerial "A" is connected to one terminal of the coherer [not shown explicitly in Figure 8], and in turn, to battery "L" in series with one terminal of the telephone receiver "m". The other terminal of the receiver is connected to the other terminal of the

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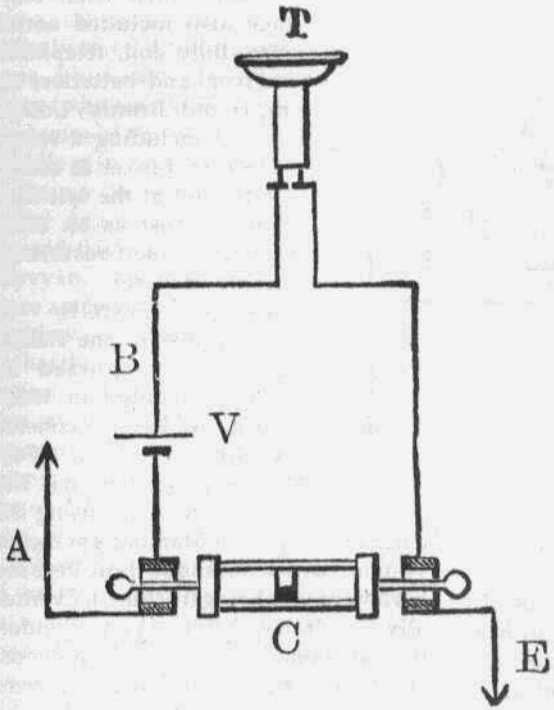

Figure 9

coherer and to ground "E". The mercury coherer is comprised of a thin glass shell "a", carbon plug "d" and head "e", mercury globule "k", iron plug "f", adjusting screw "g" and thumbscrew "j", base "C", and vertical holder "h".

As shown in Figure 9, the mercury coherer is placed in series with a battery and a telephone receiver. Reception of an electric wave causes a sudden decrease in the resistance between the carbon and iron electrodes, and a sharp click is heard in the telephone. When the coherer is properly adjusted, it returns immediately to its original state of high resistance. When the key of a spark gap transmitter is pressed, a buzz sound in the receiver coincides with activation of the arcking sparks, which allows for ready distinction of dots and dashes. Whereas the mercury coherer is much easier to operate than the metal filings coherer, the reaction of mercury to electric waves is insufficient to operate a relay, and therefore, it can only be used in conjunction with a telephone receiver.

Marconi's reunion with Solari in the autumn of 1901 was a stroke of luck. The inherent problems with metal-filings coherers were becoming increasingly distressing to him. Ships were his major constituency, but heaving in bumpy seas magnified a ship's natural vibrations, which subjected the metal filings to mechanical shocks that disrupted reception. This problem, augmented by the inconstancy of the tapper, convinced him that another type of coherer must be devised. Marconi hunted through the scientific literature until he came across the work of Ernest Rutherford, a distinguished, New Zealand physicist, who had recently migrated to England, who received the Nobel Prize in chemistry in 1908, and who later was to become the founder of nuclear physics. In 1894-1895, Rutherford, investigating a rudimentary idea for a detector using a moving bobbin of fine wire and a magnetized steel needle, discovered interaction between electric waves and needle magnetization. Marconi found Rutherford's idea of a magnetic detector enormously attractive, and he constructed prototypical models even while the transatlantic project was foremost in his mind. After he returned triumphantly from Signal Hill, he shielded himself for a few months from all but essential social interaction, while working tirelessly to perfect it.

Marconi's version of a magnetic detector was soon operational, and he applied for a patent on June 2, 1902. Rutherford, as one might expect, was furious that Marconi had preempted the priority of his discovery, harbored enduring, deep-seated bitterness toward him, and tangled with him in litigation for several years.

Jolly (1972, p. 104) observes that when Marconi and his two staff members arrived in Newfoundland "with balloons and kites to raise the aerial wire as high as possible . . . it was a long way from the grandiose scale on which the '"great thing"' had been planned. . . . The little party which sailed from Liverpool, with hastily gathered bits and pieces for an aerial, was a lot closer to the style of the old Villa Grifone days than Marconi and his directors would have wished after all the secret planning and the vast expense."

Marconi certainly maintained his subterfuge in St. John's. He informed media and government authorities that his intention was to try to establish contact with passing wireless-equipped ships. The Canadians were thrilled to have Marconi on site, and they encouraged him to set up his apparatus on Signal Hill, a flattened, rocky peak of high land, beside the harbor, that juts into the water a few hundred feet above the Atlantic. Cabot Tower, erected in honor of John Cabot who arrived in Newfoundland in 1497, shared the site with an abandoned hospital for communicable diseases, and an old army barracks.

The cold in December on Signal Hill is relentless; frequent rain turns to ice as it falls, and incessant wind whips everything about, but the terrain provided a requisite plateau for flying balloons and kites. Marconi, for his receiving station, occupied a couple of drafty rooms, with a stovepipe heater, at the back of the old hospital. On Monday, December 9 1901, a local company was hired to bury zinc plates in the frozen rocks for a ground connection, and accompanied by a photographer, Marconi and his crew, which now included a couple of assistants from St. John's, began to set up their apparatus. The aerial wire passed over a window sill to a nearby telephone pole, where it would be attached to an aerial wire to be elevated by a balloon or kite.

On Tuesday, December 10, the team flew a kite with 600 feet of aerial wire as a preliminary test. Three men barely held the huge contraption steady enough to get it aloft; it twisted and bucked in a heavy wind, but they managed to reel it in safely.

On Wednesday, December 11, Poldu operators were scheduled to begin transmitting daily the Morse code letter "S" (dot, dot, dot) from 3:00 pm to 6:00 pm London time (11:30 am to 2:30 pm St. John's time). The simple letter "S" was chosen on the basis of Fleming's concern that rapid keying of the transmitter would endanger its transformers (see discussion, Part III, above). Bussey (2000, p. 48) also observes, "it assured that the signal could be read on a Morse inker recorder through atmospherics which tended to run all the dots and dashes into each other." Marconi preferred the balloon to a kite, since he hoped that it would hold the aerial height relatively constant, thus stabilizing resonant circuits, so that he could both employ his syntonic system and record the Poldu signals on his Morse inker. Therefore, early in the afternoon, for the first transatlantic test, a 14-foot balloon was inflated with about 1,000 cubic feet of hydrogen; however, scarcely after the beast was in the air, a swift gale ripped it loose from its mooring, allowing it to float off in the clouds. With his aerial gone Marconi was forced to give up for the day. ER

Part 4, the conclusion, next month

The Ultimate Regenerative Receiver

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Part 3, Conclusion

Warning-This article contains material that may be irritating to experienced builders. Reader caution is advised.

Last month we covered the Power Supply-Audio output unit for the 'Ultimate' receiver. Before someone reminds me that the old National Radio Company built some great regenerative receivers, I would like to stress again that this receiver is called the 'Ultimate' because it is the best one I've built. I am in competition with no one but myself.

Assuming you completed the power supply-amplifier chassis, I'm sure you gave it a long cook-in period on the bench to make sure it delivered a rock steady 150 VDC to the B+ terminal on the barrier strip mounted on the chassis rear apron. And I further assume that if you are an old timer you applied a wet finger to the grid of the 6V6 to see if the audio was working OK. If you applied a wet finger to pin three or four, I may be wasting my time giving further instructions. You could very well be operating from that great 'Ham Shack in the Sky.' Seriously, the safe and easy way to check the audio output stage is to clip a test lead to the grid of your output tube. A test lead will pick up AC hum found around any workbench. I leave my test lead connected while I am doing my preliminary 'meltdown' run-this allows me to proceed with other work. A sudden absence of humming from the speaker alerts me to yank the amplifier cord from the outlet. I am sure you had little trouble with this chassis so lets proceed to the final project.

My concern after first listening to the little receiver for a few days was that it seemed to be working better than it should. Did I just happen upon a configuration of NOS and junk box parts that worked perfectly together, or is there a reasonable explanation why it works so well? There's one sure way to find out-build a 'clone' and see if it also work's well.

Now, let's be realistic, today it is practically impossible to 'clone' a homebrew piece of radio gear. We can use the same circuit, try to adjust voltages close to the same, and even attempt to copy the parts layout-but because we use whatever parts we can find there is very little chance of the sets being identical.

Furthermore, as long as I was spending time (over 70 hours as it turned out) I wanted the same level of reception, but wanted to add a few 'improvements.' Because the set was a keeper, I decided to use my best PW dial and gearbox on it instead of the type 'N' dial used on the original. I also wanted to add a few more goodies-like a headphone jack, a standby switch, and a two- step attenuator. I do not believe any of these additions or changes should degrade or improve reception on the radio.

Well, I went ahead and built the receiver with the wanted changes. I used a different dial drive, a slightly modified parts layout, the variable antenna winding, 6C4 detector with 14 volts on the plate, and a shock mounted detector tube. It works every bit as well as the original. So, the results are apparently repeatable.

Bruce Vaughan with the latest version of the 'Ultimate' regenerative radio receiver. Little set under Bruce's elbow is Regenerative Receiver #1. The two-piece 'Ultimate' (receiver and power supply is regenerative #62.

My mail has been exceptionally heavy concerning this radio indicating high reader interest. It appears quite a number of readers actually intend to build the receiver. A number of readers have asked questions that are relevant, and should be addressed here before proceeding. If one reader has an intelligent question, then it follows that other readers probably have the same concern. I shall try to answer the questions as best I can.

1.... You use PVC coil forms. PVC has been proven to have more RF loss than other insulators. Why do you not use a lower loss material?

A... A few years ago I was lucky enough to buy three-dozen B&W air wound inductors. I have tried air wound coils on every frequency from 10 meters down to 40 meters. I can detect no difference in receiver gain. I am sure that with laboratory test equipment I could measure a difference but in actual listening tests I cannot. I might mention that I have experimented with lo-loss ceramic tube and coil sockets. Again I cannot hear any improvement when using them. One other consideration-in the receiver under discussion, the antenna coil is air wound with number 12 wire. There is only one winding on the coil form. That is one reason I love this receiver-the coils are so easy to wind.

2.... Why use, or recommend plywood panels?

A... If I could order the good, old fashioned, crackle finish aluminum, steel, or composition Bud panels for a reasonable price, I'd never cut a piece of plywood again. I am not in love with plywood. Frankly, I prefer the imitation 'Bakelite' panels available from Antique Radio-but they are only 8" high. This is shy about one inch for my use. Also there is the matter of cost. I do not 'penny pinch' when building, but neither can I afford a 'Damn the costs, full speed ahead' attitude. If you have aluminum panels custom cut you have two big problems-where can you get 1/8' stock cut to size, and how can you put a durable finish on the aluminum.

3... I want to use the receiver for High Fidelity radio reception. How well does it work on the BC band? Or a closely related question-I want to use the receiver on 160 meters. How will it work there?

continued next page

A... Regenerative receivers are great for CW. They work on SSB if you have a world of patience, and have great fidelity on foreign BC stations. However, you have a BIG problem when you try to make a regen that covers everything from the BC band up through ten meters. In the old days they even tried plug-in capacitors, as well as plug-in coils. The problems involved were too much for the idea to be practical. My regens work on 80 meters by forgetting about your main tuning dial and tuning in stations with the band-set capacitor. I consider this a real pain in the rear. If I wanted to work 80 meters I'd consider a receiver built for that frequency. I'd do the same with 160 meters or the BC band. Also, when listening to AM your throttle capacitor must be backed off to just below the point of regeneration. This means less gain. In reality, I would recommend a receiver employing one RF stage if AM was my primary interest. The 'Ultimate' works fine of 40 meter CW, though it tunes somewhat 'broad,' it really begins to 'shine' on 30 meters, is great on 20 meters, very good on 17 meters, passable on 15 meters, and practically useless on anything above.

4... Do you really need to build receivers this large and heavy?

A...Yes. If I want them to work, feel, and look the way I like receivers to do.

This is not to say that small, lightweight receivers will not work as well. I do admit that I have never built a small receiver that I considered a 'keeper.'

5... Why don't you build everything on one chassis? It seems you are doing a lot of work for a simple little regenerative receiver.

A... You are absolutely correct about the extra work, and it does cost more to do it this way. However, let's look at the advantages of my construction. One power supply and audio output tube can be used with any number of receivers you might wish to build, thus saving a hunk of money. Prominent handbook writers used to warn builders that it was almost impossible to construct a receiver using a Hartley detector circuit without picking up induced hum-especially on 20 meters. Hum has not reared its ugly head on either of my 'Ultimate' receivers. I have covered other advantages in previous articles.

6... I have read all your stuff and I still am not sure what kind of variable capacitors to use, or where to find them.

A... I understand the problem. I'll try and offer a simple explanation in less than 500 words-if I can. As to the desired capacity: For operation on 15, 17, 20, 30 and 40 meters I recommend the following. The Band-spread capacitor, which is in reality your main tuning capacitor, should be a two- plate capacitor with a spacing equal to about 30 pages of Electric Radio magazine. I have no precision calipers or measuring devices-sorry. As far as minimum capacity-the less the better but in reality if you can end up with a minimum of 10 to 12 pF you are in great shape. The maximum capacity should be about 20 pF.

For the 'throttle' or regeneration capacitor, a 100 to 140-pF midget is great. For the band-set or so-called main tuning capacitor, I prefer the old reliable 140-pF midget. Remember, this capacitor is where you set the band edge. The two-plate capacitor is the one that actually tunes in the stations so it is connected to your good vernier dial.

When building, set your two-plate capacitor slightly open-say about 10°, and connect it to the vernier drive with the scale reading zero. Why? Because strange things start to happen when a capacitor is fully closed. You might never have this problem but I darn sure have. In use, set your bandspread (main tuning) dial on zero, and adjust the band-set capacitor to the lower edge of

the band, 14,000 MHz for example. Then zero on the dial will = 14,000. Now, zero beat your regen with your transceiver set at 14,100. Note the dial reading of your regen. If it is on or near 50 for example, you will know that each division on your vernier is equal to 2Khz.

Let me inject a word about 'band spread' tuning. If you are following my advice in building you will find that the CW portion of 20 meters, covers about 1/2 of your tuning range. If you are using a 7:1 vernier this should be fine-but what about readout? As many of my readers know I am really fond of the National PW dial and gearbox as a means of tuning regens. I love the feel, the ease, and the accuracy of tuning in a station.

On a slide rule type dial of average size-say 8" overall width-the dial scale would be approximately 6 inches wide. On such a dial the band from 14,000 MHz to 14100 MHz would cover about 3 inches of dial scale. Buy a really BIG slide rule dial and you may cover 4 inches on the scale. How long would a slide rule dial have to be to equal the national PW dial? On my latest 'Ultimate' I measured the distance yesterday. It takes five complete revolutions of the dial to cover 100 Mhz on the PW dial. The circumference of the PW dial is approximately 14 1/2". So 5 X 14.5 + 72.5" or about 6 feet. You would need a slide rule dial about 12 feet wide to equal the readout accuracy of the PW.

As I reread mail I have received on this project it becomes quite clear that while most writers have a good understanding of radio, some come up trifle short in actual construction knowledge. There is a small book available I highly recommend to anyone interested in building regenerative radios. I refer to the book by C.F. Rocky, "Secrets of Homebuilt Regenerative Receivers," printed by Lindsay Publications, Inc. I urge you to read, and believe the ideas put forth in this small book.

I think we have more than covered questions people have asked me via e-mail. Let's get back to work.

I began construction by cutting two panels, 9 X 16 from 3/16" oak veneer. I found out, much to my regret, that 3/16 plywood is rather fragile-it's easy to break if you accidentally strike a corner against a hard surface. A piece of screen molding glued to the backside-along the top and both sides should do much to strengthen the thin plywood. I marked the 45° corners of the trim using my combination square, and sawed them with a hacksaw. Surprisingly, the corners looked very good.

Next, I attached a piece of aluminum to the back of the detector panel with JB weld cement. This shield need not reach the bottom of the chassis. Make sure it reaches down to the chassis top and then ground it to the chassis in at least two places.

After sanding, the backs of the panels were painted satin black, and the front finished with stain, followed by three coats of Minwax(r) polyurethane wood finish, then a coat of paste wax. My favorite wax for wood is Kiwi shoe polish-neutral color.

Actually, the power supply, detector chassis, panels, and braces were all completed before I began wiring the power supply.

Speaking of panel braces brings up another thought. For years after WW II, surplus equipment handles were available for practically the taking. Recently the supply seems to have disappeared. I find that drawer pulls from Home Depot, or Lowe's home supply stores work just as well. Drawer pulls, which cannot be told from equipment handles, are available in brushed aluminum, glossy black, brass, and chrome. Black drawer pulls are also available in plastic as well as metal. I

continued next page

buy the black pulls for about $1.00 each. Brass and chrome will cost more. The most secure and comfortable carrying handle for a radio is the chassis to panel brace. Never trust one of the plastic drawer pulls. While they are tough and have never broken on one of my sets, I do not wish to take the chance.

I recommend you install the pulls at the same time you install your chassis to panel braces. The top screw for your equipment handle can also secure your panel brace. Such handles on your receiver offers convenience when moving the equipment, but more importantly, they protect your panel, knobs, and controls when you need to turn the receiver face down on the workbench. This is their real value to me.

I tried to keep a loose record of time spent on my project. I can tell you without question that by far the most time consuming part of building is mounting the parts. In a previous article I underestimated my time to mount parts. It actually took me less than six hours to wire up the detector/preamp stage.

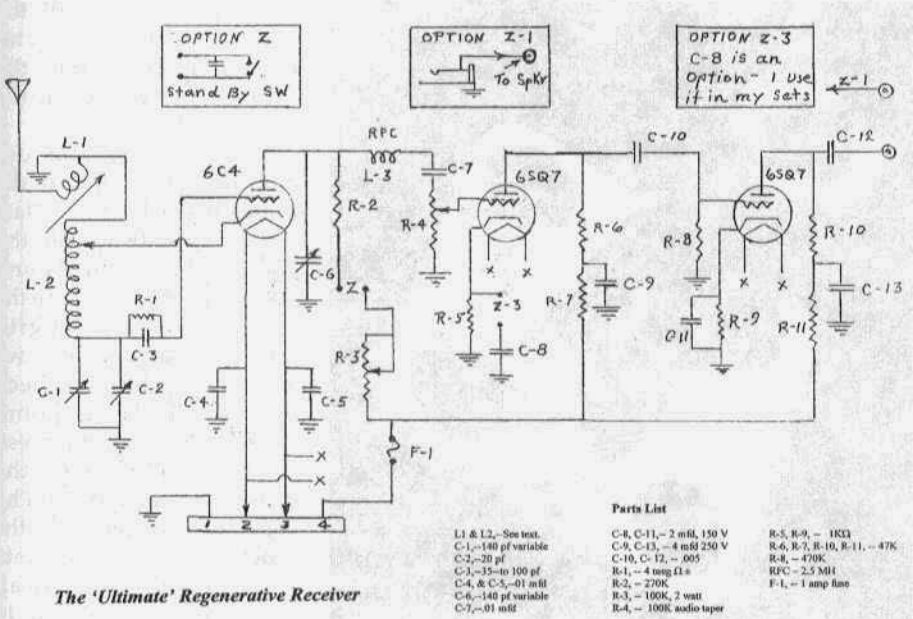
Notice that the power supply chassis, and the detector chassis, have 4-terminal barrier strips centrally located on the rear chassis apron. One terminal is ground, one is B+, and two are for the 6.3 VAC filament supply. Make up a 3-foot long; four wire cable with spade lugs on each end for connecting the two chassis together. Use one red, two green, and one black wire for your cable. As an added safety precaution, use a black and red felt tip marking pencil and mark the ground side of the barrier strip with black and the B+ side with red. I connect my filament leads to terminals 2 and 3. Simple, idiotic instructions, but we can all make mistakes. If we eliminate chances for errors while building we will have a more hassle free life later on.

Use a single wire, shielded audio cable to connect the audio out on the receiver chassis to the audio-in on the Power supply chassis. Standard female RCA jacks are used for audio in and audio out. If you choose to install a headphone jack, and choose to install it on the detector panel, you will need a dual wire audio cable to connect the jack to the speaker. I mounted my phone in, and phone out, RCA jacks about 1" from the audio in and audio out jacks.

Now is a good time to drink a cup of coffee and reflect upon the circuits involved. It will make your job much easier if you 'divide' your construction into stages. The receiver chassis consists of a simple Hartley detector circuit, and two triode tubes in a resistance coupled amplifier circuit. The marker generator is a convenience, but has absolutely nothing to do with operation of the receiver. It is a simple crystal oscillator using a 100 KHz or a 1000 KHz crystal. The lower end of most HF amateur bands can be determined by a harmonic of the crystal oscillator. Notable exceptions are 30-meters and 17-meters.

The marker being an option, perhaps we should discuss it first. The diagram for the marker is from an old ARRL handbook. Sorry, it is no longer in my possession. It seems to work well with my lower supply voltage of 150 VDC. I leave the filament hot along with all the other tubes and break the HV lead to turn it on and off. A 12" lead from the output coupling capacitor, run around the chassis near the detector-within an inch or so, seems to offer enough pickup. I avoid direct connections to the antenna or detector. If the signal from the marker is weak, wrap three or four turns of your lead around the antenna input.

Before mounting parts you have some decisions to make. Do you intend to do a marker generator at this time, later, or do you prefer to omit it altogether? If you intend to install it now, do you want a pilot light to tell you it is turned on? Do you want a standby switch? What about a headphone jack? Do you want some method of attenuating strong



The 'Ultimate' Regenerative Receiver

signals? All of these things must be determined before you begin mounting parts. All of these things mentioned require holes or other metal work, and should be considered so that the panel will present a balanced look. Not absolutely necessary, but it will certainly contribute much to the overall appearance-and performance.

It is better to mount such things as a headphone jack, standby switch, etc., and leave then disconnected if there is a chance you will want them later on. Switches, jacks, pilot light assemblies, are all available from Radio Shack at reasonable prices. You will invest less than ten bucks if you install three or four items that you never use. It is a real mess to try and add them after your construction is complete. Even if I were relatively sure I would never complete the marker oscillator, I think it wise to install octal sockets for the tube and crystal now.

If you are a novice at 'point to point' wiring a few tips might make your job easier. If possible, use tube sockets with ground lugs built into the base. If not, buy a handful of ground lugs and install one on each side of the tube socket. Some you may not use but it is far better to have one and not need it than to need one and not have it. Install terminal strips near the detector, the audio tubes, and the crystal marker. You may need more but you are sure to need them. Install a ground lug near the volume control, and near the coil base. It is surprising how many ground points you need.

BTW, for whatever it's worth, I checked my 'Ultimate' and find that while the C coil covers the 15, 17, and 20 meter ham bands, I recommend winding three coils to cover everything from 21 MHz down through 6 MHz. See coil table attached.

The A coil covers from 6 Mhz up through 10 Mhz, the B coil to cover 12 Mhz up through 21 Mhz, and the C coil will tune from 12 MHz up through 22 MHz. As expected, and desired, there is some overlap. I prefer coils that do not place my band of operation on either

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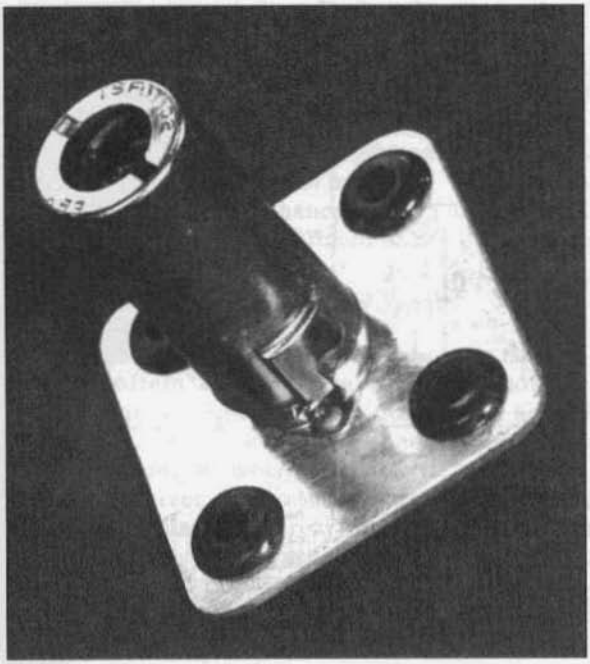


A closeup photo of shock mount for the 6C4 tube. Though the set will operate without the shock mount, it is good insurance against microphonics.

the upper, or lower, limit of my tuning capacitor. I would not expect my 80-meter coil to cover any additional bands.

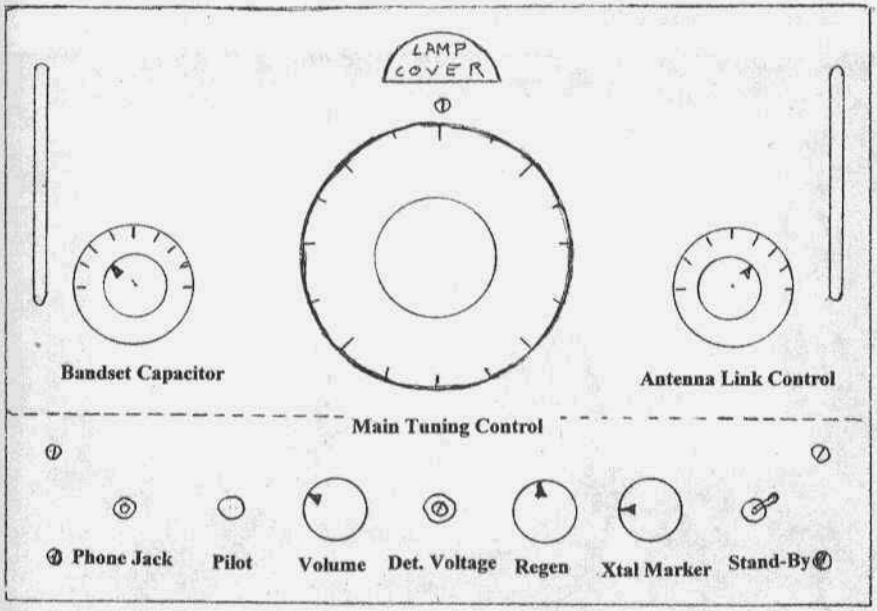
Back to the project, I like to wire up the two audio stages first. Go ahead, connect the power supply and check out the audio. If it works you are over 90% home free. The Hartley detector has only 8 or 9 components in it. When finished, if the set does not operate the way it should you have already eliminated the power supply and all audio components as a problem. All that remains is a very simple trouble-shooting job of the detector.

It is difficult to make an error in wiring of the two 6SQ7's. Do all filament leads first. Remember this is an old fashioned regenerative, twist your filament leads. Then solder all internal tube shields to ground. In the two 6SQ7s, the 6V6, and the 6SK7, this means solder pin one to ground. Now, install the proper resistances and capacitances from the cathode to ground on the preamp tubes.

Next, install the de-coupling resistors to the plates of each 6SQ7. Plate voltage readings on the 6SQ7's should be around 100 volts. Now install the coupling caps and grid resistor. That was easy...we can either double check everything at this point, give the audio another test, or can move on to the detector circuit. The capacitor, connected to the junction of the two plate resistors is not critical. Anything from 4 mFd to 16 mfd seems to work fine.

I am sure many of you recognize this as being the same audio circuit I've used in other receivers. I have used this same circuit, with very few changes, for many years. I believe in the axiom, "If it ain't broke, don't fix it." This audio circuit with its two 6SQ7's into a single 6V6 is very nearly fool proof. It has excellent audio-as most good resistance coupled circuits do-it exhibits no bad habits. The audio is more than adequate for a receiver-approximately twice the amount that most transceivers have. The circuit is very forgiving. Though I do not recommend it, values of components can be changed a lot and you will still have a good audio system. What more could you want? Low cost, that's what, and this circuit is right up there with the best when it comes to economy. I'll probably still be using this audio circuit when I become a silent key.

Confession time! When I completed my 'clone' of the 'Ultimate' I plugged it in and it worked-very poorly. I could not get the regeneration control, (throttle capacitor) to take the set out of regeneration. The detector was oscillat-



Front panel layout.

ing all the time. As a matter of fact, the throttle capacitor had very little effect on the thing. In a case like this my advice is to pull the big switch, pour yourself a cup of coffee, or a stronger beverage if that is your choice, and relax in your easy chair. Be in no hurry to return to the workbench. Stop and reflect. I did not realize I was even thinking of the receiver when suddenly it occurred to me that the trouble could only be one place-the coil. I had made some sort of stupid error while winding the coil. And I had. I simply soldered a lead from my grid coil to the wrong pin. When I corrected my error, the set really came alive-but the regeneration was still a little 'sudden.' By guessimate I had tapped my coil at 1 7/8 turns. The 6C4 goes into regeneration so easily that I reduced the tap to 1 1/2 turns and it is near perfect now. Not much of a change-but enough to make a big difference.

All variable capacitors in the set have grounded stators. Another great move toward simplicity. I use insulated, flexible shaft couplers when I have them. However, as the stators are at ground potential insulated couplers are not a necessity.

Mount the main tuning capacitor first. Mount your detector tube about 1 1/2" behind the tuning capacitor. Now mount your coil. With the loop of the antenna link lowered around the coil, mark the holes for the link assembly. It is necessary that the loop pass over the coil top without dragging on the coil winding. If you are fortunate you may find a throttle capacitor and band set capacitor that can be mounted directly to the chassis. However, this is the exception. You will probably need to bend some brackets from strap aluminum to mount these two caps. Be sure to use the combination square to mark your strap aluminum before making a 90° bend.

One bit of good news: you will probably not have to bend aluminum for shielding. By moving the power supply-audio output circuit to a sepa-

continued on page 32

Product Reviews

This is the Type NPD-3 analog display dial manufactured by National RF, Inc. It very closely resembles the original National dial that was manufactured for so many years. The price of the NPD-3 is $49.95 plus $5 shipping. The ordering address is National RF Inc., 7969 Engineer Rd., Ste. 102, San Diego, CA 92111.

Up until I got this EZ Hang slingshot, getting an antenna hung up in trees was a big chore. This devise makes the whole process a piece of cake. The key to the unit is the quality Zebco reel attached to the slingshot. When the slingshot is fired the lead fishing weight pulls the line out of the reel smoothly with no snags. The unit sells for $99.95 + $8.05 (US) S&H and is available from EZ HANG,Code E, 8645 Tower Dr., Laurel, MD 20723. (540) 286-0176, www.ezhang.com

VINTAGE NETS

Arizona AM Nets: Sat & Sun, 160M 1885 kHz at sunrise,75M 3855 kHz at 6 AM MST, 40M 7293 kHz 10 AM MST; 6M 50.4 MHz on Sat. at 8 PM MST; 2M 144.45 MHz, on Tue. at 7:30 PM MST.
West Coast AM Net meets Wednesdays 9PM Pacific on or about 3870kc. Net control alternates between John, W6MIT and Ken, K6CJA.
California Early Bird Net: Saturday mornings at 8 AM PST on 3870.
California Vintage SSB Net: Sunday mornings at 8 AM PST on 3860 +/-
Southeast Swap Net: Tuesday nights at 7:30 ET on 3885. Net controls are Andy, WA4KCY and Sam, KF4TXQ. This same group also has a Sunday afternoon net on 3885 at 2 PM ET.
Eastern AM Swap Net: Thursday evenings on 3885 at 7:30 ET. This net is for the exchange of AM related equipment only.
Northwest AM Net: AM activity daily 3 PM - 5 PM on 3875. This same group meets on 6 meters (50.4) Sundays and Wednesdays at 8:00 PT and on 2 meters (144.4) Tuesdays and Thursdays at 8:00 PT. The formal AM net and swap session is on 3875, Sundays at 3 PM.
K6HQI Memorial Twenty Meter AM Net: This net on 14.286 has been in continuous operation for at least the last 20 years. It starts at 5:00 PM PT, 7 days a week and usually goes for about 2 hours.
Colorado Morning Net: An informal group of AM'ers get together on 3875 Monday, Wednesday Friday, Saturday and Sunday mornings at 7AM MT.
DX-60 Net: This net meets on 3880 at 0800 AM, ET, Sundays. Net control is Jim, N8LUV, with alternates. This net is all about entry-level AM rigs like the Heath DX-60.
Eastcoast Military Net: It isn't necessary to check in with military gear but that is what this net is all about. Net control is Ted, W3PWW. Saturday mornings at 0500 ET on 3885 + or - QRM.
Westcoast Military Radio Collectors Net: Meets Saturday evenings at 2130 (PT) on 3980 + or - QRM. Net control is Dennis, W7QHO.
Gray Hair Net: The oldest (or one of the oldest - 44+ years) 160-meter AM nets. It meets on Tuesday nights on 1945 at 8:00 PM EST & 8:30 EDT. www.hamelectronics.com/ghn
Vintage SSB Net: Net control is Andy, WBØSNF. The Net meets on 14.293 at 1900Z Sunday and is followed by the New Heathkit Net at about 2030Z on the same freq. Net control is Don, WB6LRG.
Collins Collectors Association Nets: Technical and swap session each Sunday, 14.263 MHz, 2000Z, is a long-established net run by call areas. Informal ragchew nets meet on Tues nights on 3805 at 2100 Eastern and on Thur nights on 3875. West Coast 75M net that takes place on 3895 at 2000 Pacific
Collins Collector Association Monthly AM Night: The first Wed. of each month on 3880 kHz starting at 2000 CST (0200 UTC). All AM stations are welcome.
Drake Users Net: This group gets together on 3865 Tuesday nights at 8 PM ET. Net controls are Criss, KB8IZX; Don, W8NS; Rob, KE3EE and Huey, KD3UI.
Drake Technical Net: Sunday's on 7238 at 4I'M Eastern time hosted by John, KB9AT; Gary, KG4D; Jeff, WA8SAJ and Evan, K8SQG.
Swan Users Net: This group meets on 14.250 Sunday afternoons at 4 PM CT. The net control is usually Dean, WA9AZK.
Nostalgia/Hi-Fi Net: Meets on Fridays at 7 PM PT on 1930. This net was started in 1978.
K1JCL 6-Meter AM Repeater: Located in Connecticut it operates on 50.4 in and 50.5 out.
Fort Wayne Area 6-Meter AM Net: Meets nightly at 7 PM ET on 50.58 MHz. This net has been meeting since the late '50's. Most members are using vintage or homebrew gear.
Southern Calif. Sunday Morning 6 Meter AM Net: 10 AM Sundays on 50.4. NC is Will, AA6DD.
Old Buzzards Net: Meets daily at 10 AM Local time on 3945. This is an informal net in the New England area . Net hosts are George, W1GAC and Paul, W1ECO.
Canadian Boatanchor Net: Meets Saturday afternoons, 3:00 PM EST on 3745.
Midwest Classic Radio Net: Sat. mornings on 3885 at 7:30AM Central time. Only AM checkins allowed. Swap/sale, hamfest info and technical help are frequent topics. NC is Rob, WA9ZTY.
Boatanchors CW Group: 3546.5, 7050, 7147, 10120, 14050. 80 on winter nights, 40 on summer nights, 30 and 20 meters daytime. Nightly "net" usually around 0200-0400 GMT. Listen for stations calling CQ BA, CQ GB.
Wireless Set No. 19 Net: Meets the second Sunday of every month on 7.175 +/- 25 kHz at 1800Z (3760 +/- 25 kHz alternate). Net control is Dave, VA3ORP.
Hallicrafters Collectors Assoc. Net: Sundays, 1730-1845 UTC on 14.293. Net control varies. Midwest net on Sat. on 7280 at 1700 UTC. Net control Jim, WB8DML. Pacific Northwest net on Sundays at 22.00 UTC on 7220. Net control is Dennis, VE7DH
Mighty Multi-Elmac 75 meter AM net: Every Tues eve at 8 PM EST. NCS is Mike, N8ECR
Nets that are underlined are new or have changed times or frequency since the last issue.

The Big Rig Project, an 813 Transmitter

(getting started with some basics and collecting all the parts)

by Tom Marcellino, W3BYM
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Rockville, MD 20853
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Part One

Some Basics

I've been in this great hobby for 47 years, always wanting a rig that would produce maximum legal power. Obtaining parts way back in the 50s and 60s wasn't a problem. I just had to get my dad to drive me to the local parts store and purchased whatever was needed. I still depended heavily on items such as relays from pin ball machines, tube sockets from table radios and cigar boxes for chassis. Finding parts has changed especially for the home brewer of AM tube gear and you will see in this article how I located most of the hard to find items.

But now the time has come to do the Big One! About three years ago I was in QSO with Mike, WN3B; Bill, WC3K; and Frank, WC3E. They all tried their best to get me motivated in this direction. My answer was always, "there's just not enough space in this ham shack for another rig" - especially a full blown 1500 watts PEP plate modulated AM transmitter. See the cover of ER, January 2001 and you will get my point. But with a little rearranging and removing a table and a few pieces of Johnson gear, this project would fit in shack.

The cost will be included for the major parts throughout the article. Some of them will astound you. With a little patience and some negotiating power, a Big Rig can be built for a surprisingly low cost. Two things this project requires for success are an enormous amount of planning and decision making. In my case it was planned at least 10 times in my mind and changes made along the way. Then comes the planning on paper. Yes map it all out on paper in general terms: the whole rig layout, major wiring, chassis layout for each deck to name a few. During the chassis layout planning, I picked up a very appropriate phrase called "chassis chess". Planning the RF deck took two weeks of chassis chess because the components were very large.

It's desirable to have a vision of what is needed throughout the entire project. How you "control" the decks has an influence on the early design of the HV power supply and Control deck. In my case I didn't design the entire rig before starting the fabrication but had a good idea as to what was needed in the major areas. For instance, the speech amp-driver circuit wasn't even considered until the HV supply, Modulator, and Control decks were completed.

During the early part of November 2001 an E-mail was sent to the Editor of ER. By this time the project was well into the fabrication stage. It had been a few months since we last chatted and I wanted to update Barry on the current Big Rig project. When the project was announced to Barry he showed more verbal excitement about this project than me. At the Editor's request many of the small details often omitted from articles will be included. This will be done to make the text clearer for the reader who may want to duplicate part(s) or all of this project. One of the first things to do is get a pad of paper and a stack of pencils will good erasers. Don't try to keep it all in your head put everything down on paper and date it. I have a

The author in his hamshack with the 'Big Rig'.

large folder chocked full of notes about this project. I found myself falling back into the old habit of wiring from my head. After this realization, and a few mistakes, wiring from the schematic was resumed.

There also is an electronic folder in my Outlook Express for the Outgoing and Incoming E-mails on this project. I got into the habit of sending Mike, WN3B daily E-mail and photos of the status. Mike rather enjoyed the daily news from Rockville and knew he had only one chance to inject suggestions and possible change because the project was moving at a rapid pace.

Some of the text will read like Electronics 101 for some. Don't misunderstand I'm not an expert in the field of electronics but just sharing with the readers from my experiences with this project. It's one thing to use good electronic design practices in the electronics and equally important to me is how good does it look both on the front panels and the top and bottom of the chassis. Is it set up for ease of operation? Easy to service? Are all the circuits protected? Is there a single main power shutoff? Does it conform to local electrical codes? Will your shack antenna switching system and associated components tolerate the additional power? These are very important issues that must be considered.

Also decided was to use the best (major) parts that could located without purchasing any new ones while keeping the cost to a minimum. No cost limit was imposed. I just knew the parts were out there somewhere. All that was left to do was be patient and wait till the right ones came along.

The next decisions are what tubes will be used in the PA and Modulator?

continued next page

What Class will these be operating? What style of rack or cabinets will be used? Remember space in this shack is a rare item. Is there enough AC power in the shack? What will be the plate voltage? How will the high voltage supply be configured? Will two high voltage supplies be needed - one for the PA and one for the modulator? What about all the heat that will be generated. Will this be a problem in the small ham shack? Will forced air cooling be needed for the big tubes? You can begin to get a feel of my approach and I have to admit that in the beginning all these thoughts were very overwhelming. Yes I'm a nit picker and by using this method it was hoped to avoid any major surprises deep into the project.

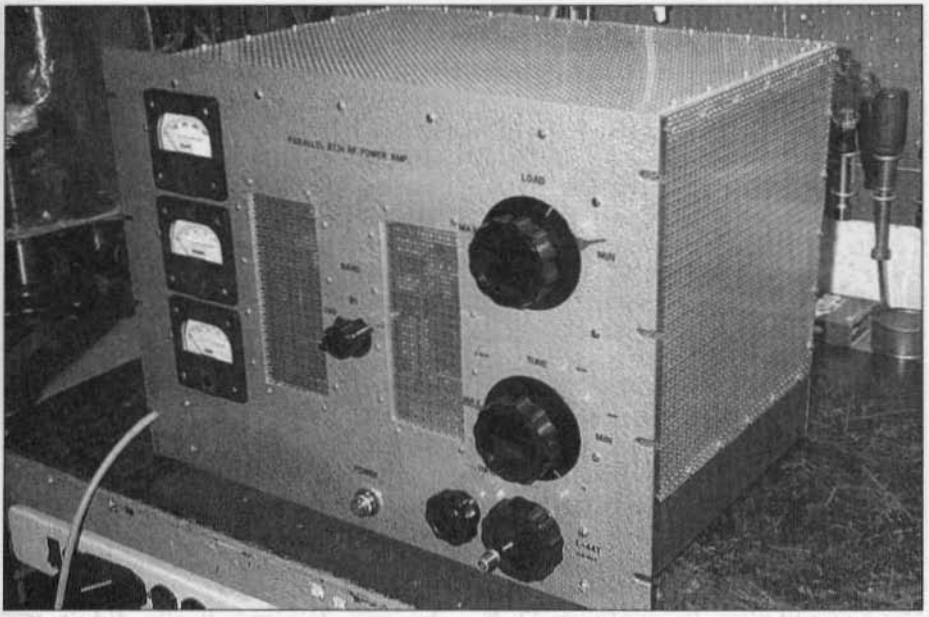
After doing the research in many Bill Orr, Editors and Engineers, and ARRL Handbooks and reading the mail, the tubes were reduced to a few such as 813s, 572Bs, 3-500Zs, and 4-400As. Important point here is a huge amount of information can be gathered just by listening to on the air QSOs. There are numerous hams out there that have been down this road so why not tap into their knowledge. Knowing all the mentioned tubes were used in high power rigs and I wanted to use about 2000 volts from the HV supply, the collecting started in the summer of 1999. The 813s four in all were obtained by swapping four 810s. The 810s are a story in themselves that will be talked about later. The 572Bs, all four, were tailgate purchases for $25 each. They were alleged to have only three to four hours of use. Two 3-500Zs were a hamfest purchase for $80 for the pair and they were pulls but guaranteed. Now the 4-400s were a real find.

On a trip to North Carolina an antique store was visited. In the back of the store were shelves just filled with parts and tubes for sale. One shelf had at least eight 4-400s. They were all marked for five dollars each. Yes they were pulls and most of them were Eimacs. Each was held up to the light looking for stuff floating around inside. Six of them looked OK to me so for the grand total of $30, I was six tubes richer. When shopping for used high power tubes, it would be handy to carry along a low current continuity checker. This way the filaments can be tested before you make the purchase. If you see them on the tailgaters table, the first thing to do is put your hand on them even before reaching for your wallet or start talking to the vendor. You can always walk away but once your hand is on the item, it's as good as in your bag.

Tube operating Class was an easy choice. Again using the above mentioned resources, Class C for the PA and Class B for the modulators were selected. These will be the most efficient modes of operation. Now what tubes to use where. This is where I tell you about the 810s mentioned previously. The first hamfest we attend is the Richmond VA Frostfest. A complete mod deck with a humongous hunk of mod iron and a pair of 810s was found. Turns out it was a Kenyon 442, 600 watt multi-match transformer. The deck was complete with filament and input driver transformers. Well like as said earlier, put your hand on the item.

It came time to ask "what do you want for this mod deck?" He said "well I'd like to get at least $100 for it." I could tell from his voice that he was willing to move on the price somewhat. I was the "owner" of the deck during the negotiating process with my hand firmly attached. So in the spirit of hamfesting an offer of $85 was made. Without hesitation he said yes. Later while in QSO with my friend John, WA4DWW, John said if I didn't buy it that he was standing right next to me and had the $100 in hand and ready to act. This is an interesting part of the story because we have never to this day met in person!

The selection of the PA tubes was just



The PA deck.

about locked with the use of a pair of those five dollar 4-400s. But others convinced me that running the power that was planned would mean the use of forced air cooling for the glass to metal seals on these tubes. While this could be included, I really didn't want to get into a pressurized chassis, glass chimneys and noisy blowers. So another decision was made to use a pair of parallel connected 813s. These tubes with there thick plates didn't require forced air cooling and the design would be minimal since it appears in many of the handbooks.

The next major find was in August of 2001 at the Berryville VA hamfest. At this stage of the design it was still uncertain whether to use two HV supplies because of the 813s in the PA and the "maybe" 810s in the modulator. Through previous transactions three other power transformers were obtained but none had quite the voltage or current ratings needed.

A large black piece was spotted in a tailgaters spot that looked like a choke so I went in for a closer look. It was a 7 Hy at 550 mA choke with a price tag of $25. Sitting next to it was this hugh hunk of iron. Now what was this? Well it looked like a plate transformer with large cast iron end bells. It had three large brown insulators on one side and three smaller connections on the other that were labeled 0 - 2000- 2500. Seems it was a tapped 120 VAC primary HV plate transformer. The current rating was unknown at this time but by the size and weight it had to be at least 500 Ma. Since the choke was priced at $25, I offered $50 for the pair. Again without hesitation the vendor responded with OK After unloading at home, the transformer was weighed and measured 100 lbs! Later investigation revealed the transformer was from a BC-610 transmitter. This really made my day because I knew the 610 used a 250TH in the PA and a pair of 100THs as modulators. Hence the current rating was easily 500 Ma plus.

Around September 2001 the rack cabinets were obtained. Remember I

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said earlier that shack space was a rare item. The cabinets found were only 15" deep but would take the standard 19" rack panel. Several cabinets were obtained by various means. One 36" unit was donated by Bill, WC3K. Another 36" unit was swapped for a plate transformer to Bryant, N3FJN. Two smaller units were purchased for $20 each from Jeff, K3DUA of G&G Electronics. Jeff's establishment also furnished a Variac for $45 rated for 15A at 120V and some NOS 19" rack panels at $2 a pound and a 13"x17"x3" chassis for $15. Two important parts for the RF deck, a B&W 850A tank circuit and National 250 pF at 7 KV capacitor were obtained from Scott, WA3FFC for some boat anchor hauling services.

With this large collection of cabinets it was time to make another decision. How would they be configured? A single structure could be made ending up with a height of 6'5" which included a dolly on the bottom. With only 15" of cabinet depth, this configuration looked to be unstable but probably would have been OK with all that heavy iron in the bottom. Another decision was made instead to place the cabinets side by side knowing this would require a connecting cable and another dolly. So that being the choice, the exciter could sit on top of one cabinet and the receiver on the other top.

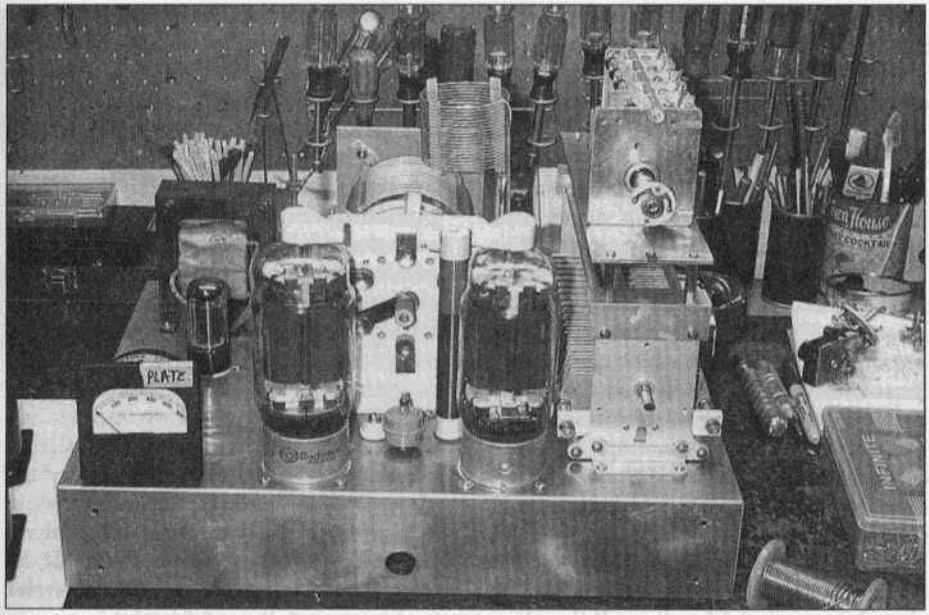
It's now mid September 2001 and all the backlog workbench jobs were finished. Layout of the cabinets and fabrication of the dollies can now begin. The two smaller cabinets worked out nice as a stacked unit. The HV supply could be built into the bottom and the heavy modulator placed into the top. It was about this time when the modulator tubes became another pair of triode connected 813s. This decision was made because no data was available for the driver transformer that was on the big mod deck. Seemed a lot of the guys were trying the 813 in a triode connection and using this eliminated the need for the driver iron.

So another decision was made and this one included one less piece of audio iron which is always desirable. Now the plate transformer was known, 2 KV was available and that would work fine for the PA and mod decks and all the power tubes would be the same. Each cabinet having a steel bottom would work well for support of the heavy iron. One of the larger 36" cabinets placed on another dolly would house the speech amp-driver, some audio equipment, and the PA.

Let me talk about some of the other major parts that were gathered during the summer of 2001. The PA meters were swapped for some parts and came from a broadcast transmitter. Three inch square meters for the entire project became standard. Really didn't care what their scales were because they could be tailored to my needs. I probably ended up with a dozen meters none of which cost more then $2 each.

Switches were another needed item. At the September 2001 Butler PA hamfest another 40 meter AMer Ed, N3GWE, a real home brewer, had several items such as relays and switches at great prices. The switches were nice DPDT units and at fifty cent each my bag got filled with a dozen and several relays at $2 each. Ed also had 19" rack panels in various sizes at $2 each and some recycled large chassis for $1 each.

Along the way several other components were secured such as; a fresh supply of filter capacitors, 1N4007 diodes, ceramic standoffs, fuse holders, six foot extension cords the type with molded plugs, tube sockets, high voltage feedthrus, high voltage ceramic capacitors, pilot light assemblies, circuit breaker switches, large relay contactors, high voltage diode stacks, and a 30 uF at 4.5 KV filter capacitor. This last item, the HV filter, isn't a cheap item in case you



Early PA fabrication.

are interested. I traded to Frank, WC3E a working SX-71 receiver that needed more restoration for this one item. Did you notice the phrase "a fresh supply of filter caps"? This is the one exception to my statement of not buying any new parts. Simply put don't use old filter capacitors. It just doesn't pay. Buy new, fresh units and forget about them giving any problems. Needless to say a well stock junk box is a necessity for this type of project. Much 4-40 and 6-32 hardware is needed and don't forget the solder lugs and solder terminal strips.

Meters

Since meters are used throughout, it is prudent to handle that subject at this time. In a nutshell, meter everything that makes sense and will keep you posted about conditions in the circuits. Besides the three on the PA deck for cathode, screen and grid current, there are meters for the AC line voltage, the high voltage, modulator cathode current, modulator filament voltage, speech amp - driver plate voltage, and the driver plate current.

Most of the meter faces didn't display what was needed and their electrical sensitivity was also incorrect. This meant two things: the meter face had to be relabeled and the meter circuit had to be modified. Modifying meter faces is old hat around here. Use a pencil eraser to remove the old numbers staying away from the graduated scale markings. Much rubbing is required using strong fingers but the white face paint will remain untouched. Don't use one of those Draftsman's electric erasers. It will remove the paint. Now using dry transfer letters the new numbers can be carefully placed. A recent purchase is one of those nice little film label makers because dry transfer letters are getting hard to locate. Mine happens to be a Casio but others are available. This tool is very useful for making word labels for the meter faces and invaluable for making various size panel and chassis labels.

As for the meter sensitivity, it would be great if all of them had 1 Ma movements but that sometimes isn't the

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case. When using the meter to measure current, an external shunt resistor with typical values of 0.1 to 5.0 ohms can be used. Now the meter will actually become a voltmeter because a series resistor must be placed in series with the 1 Ma movement. The meter will be reading the voltage drop across the shunt while calibrated in current. I like to place the shunts in the low voltage circuits like the tube cathode if at all possible. This keeps potentials low in the meter circuit. Sometimes this isn't possible or not desired and the shunt must be placed in the high voltage line such as the B+ feed to an amplifier. This is find just keep in mind the potentials involved and the need for the proper insulation in the metering components. One thing to remember when a meter is placed in the tube cathode it will read the plate current as well as all the other tube element currents.

When meters are used as voltmeters, the higher the movement sensitivity the better. To clarify, higher sensitivity means, for example, that 100 micro amperes is better than 1 milliamperes for this application. What I'm talking about is the minimum loading on the circuit being measured. You may have seen the words "ohms per volt" on some meter faces. Most panel voltmeters will say 1000 ohms per volts. This means, for example, that if the meter was originally intended to measure 150 VDC full scale, the meter will load the circuit being measured with 150 K ohms at full scale. Now to put this into practice, if you are measuring a voltage across a 500 K ohm resistor the meter with its 150 K ohms internal resistance will load the circuit and you will read a less then true voltage.

In my view panel meters are a critical element in any homebrew project. The fact that they are used (previously owned) places more emphasis on their reliability and accuracy. Meters need to work properly and give true readings. Each meter used is first disassembled. This job is delicate and should be left to the experienced. The case that contains the front glass is cleaned with soap and water and thoroughly dried. Usually the glass is loose within the case and requires a few drops of 5 minute epoxy to reset. Final work on the case includes polishing with automotive paste wax.

As for the business end of the meter, remove the meter face and inspect the area of the movement. Many times this will locate fragments of metal that have been attracted by the permanent magnet. These must be removed to insure a smooth working movement. The needle must be straight and ride close but not touch the meter face or the glass after assembly. The stops should be in correct position to limit the travel of the pointer in both directions. If the meter has internal shunts or series resistors and it is desired to remove them, this can be done and then solder in jumper wires where required.

Finally the adjustable set screw on the meter case must operate freely and the attached nub must be intact. Rotate the adjustable screw to position the nub at the bottom and position the meter adjuster straight down. This is the time to remove any unwanted numbers on the meter face using a pencil eraser and applying the new numbers. Reattach the meter face using the two small screws. Now the case and the meter movement is reassembled and fastened with the three small set screws.

Meters are calibrated by adding resistors or shunts depending on the meter's application. It very well may be that you want to use the meter as is. In this case just calibrate (verify only) the current or voltage as shown on the meter face. This is a separate operation done prior to the installation in the project panel. Using various DMMs and a small power supply, the final external values are determined. It doesn't matter whether the 0-500 Ma meter will be in a 2000 VDC line, current is current and

the meter can be calibrated using a 1.5 volt D cell with suitable limiting resistance and insuring the current remains at 500 Ma. The same is true with a 0-3 KV panel voltmeter. You don't have to use 3 KV to test the meter. In this case 500 volts from a capacitor tester, as long as the value of the voltage is known, will work fine. Because the meter will be linear across the dial, the meter will read fine at 2 KV when only calibrated at 500 volts.

Meter mounting also may require some thinking. Remember the meter is not new from a box with a mounting template. If the meter is a round type with through mounting holes your job is simple but suppose it is the square type how do you mount it? There are two kinds: ones with studs protruding from the rear of the meter and ones with threaded mounting holes requiring a screw from the rear of the panel. Well you guessed it I had both of the square types to deal with. For the stud types first drill and punch the large meter body hole and drop in the meter. The meter will bottom out against the panel front resting on the four studs. Now with a marker make two marks along the sides of each stud 90 degrees apart. Remove the meter and extend the marks till they intersect and this will be the center of the hole. A little insurance will be gained if the holes are drilled somewhat larger then each stud.

Meter types with the threaded holes or recessed nuts are a completely different story. It is nearly impossible to make a drill template so I came up with the simple idea of why not just drill through the threaded nut and through the front of the meter. Fearing this would crack the front plastic, this method was tried on a test meter and it worked great. After drilling all the meters that had this type of mounting, use these new meter holes as a template for the panel drilling. The meters were then mounted using 4-40 hardware.

Wire and crimps

I would like to say a few words about wire. This is the assumed commodity that nobody ever talks about. In this project there are many different types. Generally for all wire runs under the chassis use stranded #20 insulated wire. The cloth (lacquered cotton braid) covered type available from Antique Electric Supply is recommended. It is durable and rated for several hundred volts. Whatever you do stay away from solid insulated wire. Although it stays put it is very difficult to bend around and through terminals.

Very heavy #8 solid copper wire was used in the RF deck. It can carry much current and is stable enough to remain in position during temperature extremes. Solid #22 & #24 magnet wire which is copper insulated with two coats of enamel was used for the input coils. In the HV power supply special wire is needed. The primary wiring used #12 stranded with a rubber covering rated for 600 volts. The HV secondary used #18 stranded with insulation rated for 25 KV. Many sources were explored for HV insulated wire including automotive spark plug wire. While the automotive wire is rated for the high voltage, its center core is usually graphite filled and the wire isn't available in bulk. Suitable wire for this purpose is available from RF Parts.

Through out the project a generous supply of wire crimps were used. These were screwed to barrier strips on the chassis decks and to the HV transformer. Yes this is an added expense and does require a little more labor but again good secure connections are absolutely necessary. Also to increase the reliability of the crimps, soldered them after making the crimp.

Grounding

Another subject of equal importance and not addressed much is grounding. Good substantial grounding throughout the entire system is essential. Starting

continued on page 35

Radio Service in the Golden Age
1930's through the 50's

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Episode 9

The Aviator

Those of us who are now past our allotted 'three score and ten' remember a time when the sound of an airplane engine overhead brought everyone running from the house. The entire family would stand in the front yard gazing skyward until the airplane was just a speck on the horizon. The early days of radio coincided with those of aviation and the automobile—all made their appearance near the beginning of the 20th Century and all were still an oddity up until the time of the great depression.

One Saturday night my Dad and Mother were listening to the 'Grand Ol' Opry' from WSM in Nashville Tennessee. Listening to WSM on Saturday night was a ritual with almost all rural families, and many city dwellers across the south. I was playing on the floor with a crude model biplane I'd made from a coffee can and a few scraps of pine. "Why don't we pack a picnic lunch in the morning and head to Springdale," Dad said. "I hear that they are dedicating their new airport tomorrow, and there are supposed to be a dozen or more airplanes there. Flyers are coming in from all over starting early in the morning. A fellow told me that there was going to be parachute jumping, wing walking, and all sorts of 'trick' flying. We could make a day of it. Best of all it's free, all it will cost us to go is the gas to get there, and maybe a bottle of pop when we get thirsty."

Needless to say, this was better than Christmas to a 9-year-old boy. My mother was almost as excited as I was and started preparing food for the upcoming event within minutes.

The Springdale Airport was a small meadow near the east side of town with a north-south grass runway about 1200 feet long. A row of trees along the south end, and power lines along the north discouraged use by all but experienced pilots. Airport facilities consisted of a sheet metal "T" hanger, and a windsock mounted on a black iron pipe about 10 feet above the ground.

My first impression when we arrived at the airport was the spectacle of at least 40 Model 'T' Ford 'Touring' cars* with their tops opened to a near vertical position. They were parked along the west side of the runway. The vertical open tops allowed the passengers to see the planes taking off and landing, and offered a slight amount of shade from the hot summer sun.

The day was a roaring success. The city had to call out its volunteer police workers to aid the Springdale police force with traffic control. The police force consisted of one middle aged, overweight, ill-tempered constable, and a part time deputy. The parachute jump never materialized because of wind conditions, but there were enough loops, spins, and wing-walking daredevils to satisfy everyone.

And who was responsible for this new airport being built, none other than our local tombstone merchant-'Uncle Bryan' (WJB) Work. Bryan and his brother-in-law owned the local monument factory. Bryan was the outside man. While his

brother-in-law took care of management, Bryan searched the obituary columns of papers from all nearby towns. He called on those who had recently suffered a death in the family, and discussed the purchase of a proper memorial for their dearly departed. He would then return to the office where his artist, 'Baldy' Allen, would prepare a nice large drawing of the proposed memorial. With picture and sales agreement in hand, 'Uncle Bryan' rushed back to show the drawing to the bereaved family. The odds were very good for Bryan returning with a nice order. He once told me that the more time that elapsed between a death and a memorial order, the smaller the stone became. A confirmed bachelor, and a hard worker, Bryan earned a good income-enough to indulge in whatever caught his fancy at the time.

Early on, Bryan developed a love of aviation. His first plane was an American Eaglet, with a small three-cylinder engine. By the time he leased the cow pasture, and built his little sheet iron hanger he had traded the Eaglet for a nice 1928 Travelaire Biplane.

Bryan wanted to be on the leading edge of everything. I was not surprised when he came into my store the day after the first write-up appeared in the Springdale News about me receiving a TV broadcast in Northwest Arkansas.

"Bruce," said Bryan, "Did you actually see a picture on that damn television or was that just so much Bull you fed Bob?" Bob Sanders was a reporter, and part owner of our local newspaper. He, his wife and baby daughter lived in the other side of Bryan's duplex.

"No Bull Bryan, I picked up a darn good picture. Of course it is not something you can count on with any regularity. Most nights you are looking at a snowstorm, then you will luck out and hit a night when a picture comes in OK."

"How many of the damn fool things have you sold," asked Bryan?

"I have not sold any...heck, my TV is the third one in the State. They are still more of a toy than for any practical use," I replied.

"I want to buy one-right now. I want to buy the first TV sold at retail in the State of Arkansas. If you sell me one today do you honestly believe I am the first retail customer in Arkansas," he asked?

"Bryan, to the very best of my knowledge there are only three TV's in the state of Arkansas. I have one, Mr. Carter, a radio repairman down in Altus owns one, and recently the radioman in Hartman bought one. I've visited with both of them, and we believe we own the only three TV's in Arkansas. None of us have sold a TV. As a matter of fact, there are probably none in wholesale suppliers warehouses. I just lucked out getting mine." I continued, "Anyway, you would be wasting your money if you bought one today. Give the industry a few months to get this thing off the ground."

"Figure out how much one of the damn things come to and bring me a bill," replied Bryan. "I'm gonna' buy the first one; if I don't get a picture you'll never hear a complaint from me. Here's my check with a deposit—just get it done." With that parting remark the sprightly middle-aged bachelor started for the door.

"Well, we'll need to find enough stuff to install an antenna, and then see if some supplier has a TV available," I said. "I'll get in my car and head to Ft. Smith tomorrow and see what I can find. If nothing is in stock there, I'll drive on to Little Rock."

"Just do it," snapped Bryan. "When I want something done, I want it now."

Two days later I installed two, four element yagi antennas on his roof. One antenna was aimed due west for the anticipated channel 6 station in Tulsa; the other, cut for channel 4, was directed toward Oklahoma City-slightly

continued next page

south of west. After fishing the leads under a double hung window, a 2-position antenna switch was anchored to the wood windowsill. To change stations it would be necessary to go to the window and throw the antenna switch. To a ham this did not seem like an unreasonable solution to the problem.

This was some months before telescoping masts became the accepted method of supporting antennas. I went with what was available. Lightweight triangular aluminum towers were available then in six-foot lengths. They came completely disassembled and were put together on the job. Unfortunately, it was also before electric screwdrivers. By the time I installed the hundred or more machine screws with plastic stop nuts I would have paid a good price for a cordless drill with attachments.

The only TV set I was able to find for 'Uncle Bryan' was a 10-inch Admiral in a mahogany colored plastic cabinet. I don't think it really mattered to Bryan. The important thing to him was being first. To the best of my knowledge he accomplished that goal.

Soon, 'giant' 12-inch screens appeared on the market. Remember, at this point of development, all picture tubes were round. In the struggle to sell television sets manufacturers tried many different approaches to make their screens appear larger. Masking the round picture tube with a mask painted approximately the color of a blank screen was one obvious way. Another way was to mask off only a small portion of the top and bottom and let the sides of the picture remain rounded.

Zenith carried this to extreme when they introduced their 1948 line of TV sets with round pictures. A switch on the front panel gave the viewer a choice-watch a smaller picture in a rectangular format, or enlarge the picture, thus creating a round full screen image. Of course you lost whatever action was occurring on each side of the picture, but usually this was no great loss. In retrospect, the idea was not so bad after all.

I am endeavoring to keep these little episodes in chronological order. However, I feel I must jump ahead three years to mention one other attempt to make TV's appear to have a larger screen. Around 1953, I believe it was, Sylvania introduced their 'Halolight' TV series. Strangely enough, some owners thought it was a great idea. Sylvania surrounded the picture tube with a generous sized mask made from a cream colored translucent plastic. Behind this plastic mask was a circular tube light. When the TV was turned on you were looking at a lighted rectangle with the picture tube in the center. For some, the effect might have been pleasing, to others it might even appear to offer a larger screen—for me it was a joke. Sylvania advertised the 'Halolight' as a set that was easy on the eyes. The concept of the manufacturer was that a bright picture surrounded by darkness was hard on the eyes, whereas a soft light surrounding the TV picture somehow was easier to look at without eyestrain.

I would be amiss if I did not cover some of the other strange gadgets and attachments of early TV. How about converting your Black and White TV to color. For about four bucks you could buy a colored sheet of plastic. The upper part of the plastic was a light blue, the center a flesh tone, and the bottom a light green. Each band of color blended into the adjoining color gradually. When taped on a TV screen if you happened to tune in a western the effect could sometimes be pleasing-for a second or so. For example, Dale Evans and Roy Rogers, riding across a grassy meadow under a brilliant blue sky might appear pleasing-but only for a brief moment. Most pictures looked pretty sick. A close up of either Dale or Roy would show a pink face with a blue forehead and a green neck and chin.

In TV's formative years there were many magnifying devices. One, a massive convex plastic bubble filled with a clear mineral oil, and supported by a heavy metal stand was placed in front of small TV screens in an attempt to get a larger picture. This gadget was not inexpensive and worked to a limited extent. Less successful were inexpensive lenticular devices taped in front of the picture tube.

I suppose all this sounds like fun-and it was to some extent. However, many items thought of as indispensable two years later were not available in the beginning. Antennas are a good example. A number of small manufacturers in the late 40's were turning out TV antennas, most of which were either difficult to install, or terribly inefficient. Occasionally a company came along with a good-even excellent antenna. Unfortunately most of the new aftermarket and accessory manufacturers had a short lifespan.

On day a man came in my store with a rectangular cardboard box about 8-inches square by five-feet long. He introduced himself, and explained he was with the A.H. Dodge Company from Kansas. (I hope my memory is good) He wanted to show me a TV antenna they were making. He unpacked the antenna, and using nothing but a screwdriver assembled a pair of 3 element yagi's stacked on a hefty 1 1/4" mast. The driven elements were folded dipoles. The entire antenna was beautiful. It used heavy, beautifully machined aluminum castings to support the elements and to attach to the mast. Furthermore the antenna was priced competitively. Total assembly time about ten minutes. Of course I ordered six of them. When they were gone I placed another order. My third order was never filled-the company was out of business. Never again, while I was in business, would I see an antenna to equal the Dodge in workmanship, and ease of assembly. The gain was nothing to brag about, but I'm sure the stacked, three-element antenna was designed for use nearer a TV station. We were deep fringe.

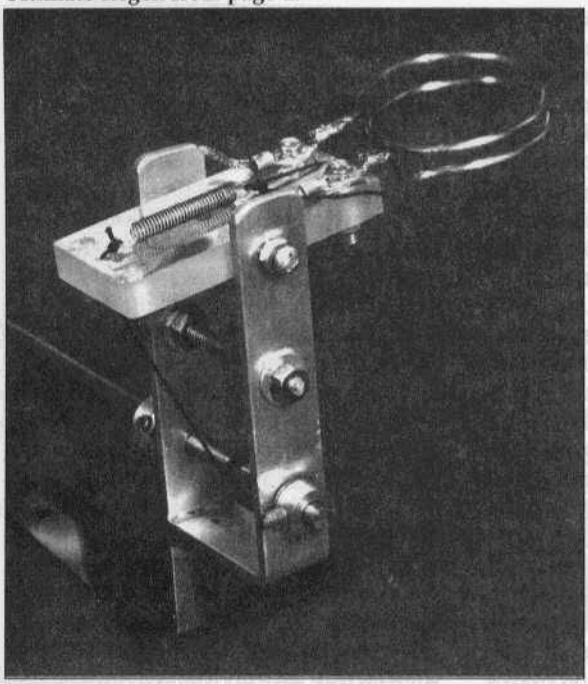
For some time before the push-up mast appeared on the market, I used 20-foot lengths of 3-inch aluminum irrigation pipe to support antennas. All bases were built in the shop to fit whatever type of installation I was doing. Every installation required a lot of shop work. This is where ham experience paid off.

Yes, TV was off and running but consumers would spend millions of dollars on worthless gadgets, temperamental TV receivers, inefficient antennas, and often-haywire installations before the new medium would reach maturity.

I remember one large supermarket here in town that decided I was getting rich selling TV sets, so they jumped on the bandwagon. It was hilarious to see men from the market, often wearing their white aprons tucked up around their waist, running around on a roof trying to install an antenna. Their antennas normally fell within weeks. I inspected one job they did and their anchors in the roof were simply large nails driven into the decking and bent over. When guy wires for a 30 foot high antenna, roof mounted, were tied to the bent nails you could be sure that the antenna would fall within days.

But all of this only proves my long held belief. Place an orange crate on any street corner, hand letter a crude sign that says "Watch Repair," then stand a big bruiser behind the crate with a sledgehammer in his hand. Sooner or later someone will leave a Rolex with him for repair. ER

*Touring Car-A two seat open car with rag top.



A closeup of the antenna link assembly.

rate chassis we eliminate the need for shielding of components in the detector circuit-in most cases.

What about panel bushings? They are very hard to find so if you choose to use them you will probably have to improvise. Old volume controls offer one source. The big problem is finding one with enough threads. Only older controls will have sufficient thread length to pass thru a thick panel. An easy, although less desirable source is your 'Home Supply' stores. They sell lamp repair kits with nuts, washers, and several inches of threaded brass (all-thread) sleeve. We have a minor problem with the all-thread in the lamp repair kit. The brass sleeve inside diameter is a little more than the 1/4" needed. If the shaft fits a little too loosely slip a short piece of shrink-wrap over the shaft where it passes thru the sleeve. Heat the shaft with your soldering iron and when the sleeve shrinks it should make a smooth fit. One other fix: clean the shaft well, coat with paste, then using a torch or large iron flow a coat of solder over the shaft section that passes through the bearing. When cool, chuck the shaft into your drill press and with fine emery paper, dress down to fit. Of course this is not a very good idea on shafts that will get a lot of use-tuning shafts for example. However, on such shafts as the band-set, throttle capacitor, or volume control, the soft solder will last for a long time.

What about pointers for the front panel? I use 6/32" X 1/2" pan head machine screws. Spray the heads of the screws with black paint. When dry, rub (fill) the slot with white lacquer stick. Wipe off excess with a dry rag. If you do not have a lacquer stick, white toothpaste will makes a passable substitute.

Once your preamp stages are complete and checked for operation you are ready to proceed to the detector. If you are of an optimistic nature, forget the check out and assume you wired it perfectly and everything is going to work as planned. My advice? Check the darn thing out. We all make mistakes.

If you have not previously done so, now is the time to push the chassis aside and do a little metal fabricating. Refer to Electric Radio Magazine, November 2000, Page 20. You can build this gadget almost as quickly as I can explain it. If you simply do not wish to put out the effort, leave the dial cord bit off. Use a direct shaft to insulating block that supports the antenna coil. It will work almost as well, though be much more difficult to adjust. To cover bands from 15 down through 40 I would recommend two turns of #12 or #14 wire

for the antenna coil. One turn may sometimes work better with certain antennas. However, after using both one turn and two turn coils on more than a dozen different receivers, I have found that two turns work better in most cases.

While we are discussing this coil, here is a good time to impress upon you that loose coupling is a very good thing with regens. Do not be surprised when you find that for best reception your antenna coil is often 1" or more above the grid coil.

After completing the link coupler, assemble a shock mount for the 6C4. I prefer heavy, copper clad epoxy board for the mount. Unfortunately, not many of you will have it available. I used my last scrap recently, and have no idea where to find more. So lets use a scrap of .062 or thicker aluminum. Cut it into a square approximately 2 3/4" per side. In each of the four corners drill a hole large enough to accommodate a medium sized rubber grommet. In the exact center drill a hole for a seven-pin tube socket. Use a socket with a spring loaded shield. I have included a drawing as well as a photograph of the mount.

Now you are ready to mount all parts. Follow the old carpenters rule, "measure twice-saw once." Care in layout is very important. I try to arrange my detectors in such a manner that lead length can be kept to a minimum.

Before you begin wiring, I would suggest that you solder up your connecting cable and wind your 20-meter coil. Why? Because it is human nature when you complete a radio to want to see if it works, and how well it works. If you wait until the chassis is completely wired before winding a coil, you are more apt to be in a hurry and goof-up in your coil winding.

Here is the coil winding data in a nutshell. Look at your antenna coil on the variable link gadget you built earlier. The top of this coil goes to ground, the bottom to the antenna. Now, note which way the coil is wound as it goes downward. Is it clockwise or counter-clockwise? It is imperative that the grid coil be wound in the same direction. If you can't remember, mark the coil form with an arrow pointing in the proper direction. You will probably want three coils total. The so-called 20-meter coil covers other bands as well but 20-meters will tune when the band-set capacitor is about half open. Think of the coil as being upside down. Normally when using a standard plug-in coil the antenna winding is on the bottom.

I wind all my coils with #20 or #22 solid, tinned, copper wire. It is available from Radio Shack, or almost any mail order supplier. I space my turns. Why? They look good, they are easy to 'dope,' and there is less chance for a shorted turn. The big advantage comes when changes, or 'tweaking' is required. 'Tweaking,' (adding or removing turns, or moving the tap) is also much easier. Do they work better when wide spaced? I never noticed much difference. Some writers like to use insulated wire and close space the windings. Fine, if you want to do it that way. However, you will find it is a lot more work, and there is more chance for error. Also remember that this coil is upside down and the bottom of the grid winding must be very near the TOP of your coil form.

I can hear readers saying, "You mention 'tweaking,' what are the chances that no tweaking will be required on my coils if I follow your directions?"

Hummmm. I would estimate that your chances are almost zero that some 'tweaking' will not be required. It is no big deal. You may want to move the frequency up or down a little or perhaps increase or decrease the feedback.

I promised coil data...here it is: 20-meters... 8-turns, tapped down from the top 1 1/2 to 2 turns, 40-meters... 16-turns, tapped at 2 to 3-turns, 80-meters... 34-turns tapped at approximately 4-

continued on next page

turns. I prefer common Radio Service Cement to hold the turns in place on the coil. I've also used a coat or two of varnish to coils with no apparent decrease in efficiency. It is difficult to give the exact number of turns for your tap. Every set is slightly different. If the set is reluctant to go into regeneration, add turns. If it goes into regeneration with a loud 'plop' or 'thump' move the tap down slightly. The 6C4 is such an easy tube to get into regeneration that it takes fewer turns on the tap than most other sets I've built. I would say this- the set will probably take less turns on the tap than you expect.

In radio's early years there was a lot of discussion-most of it bordering on superstition-about grid leaks. My advice is to use a resistor of 3.5 to 5 Megohms, and capacitor about 50 pf. Will a 100-pF work? Sure. Same for a 25 pf. There is really nothing to be overly concerned about. The grid leak is not all that critical.

You mentioned attenuating the signal for contest weekends. Yes, regens are very sensitive and do overload when the big guns turn loose. On some receivers I use a .01 from the antenna to ground to knock out about half the signal. Other sets I omit this feature and just rotate the antenna coil farther above the grid coil. My circuit for attenuation of signals is still under change from week to week.

OK, you have wired the set and it works. How do you know it is operating as it should? This is an excellent question. How do you measure a length of material without a yardstick or ruler?

Well, actually you cannot. However, here are some tips you may find useful. Assuming you have calibrated your receiver-and this should be your first step after completion-compare the number of signals received on a section of any band. I use the lower 50 KHz of twenty meters. The number should be near the same.

Listen to the audio. It should be clean, and with fidelity as good or better than any transceiver on the market. Try the regeneration (throttle capacitor) control. The set should slide into and out of regeneration very smoothly. You should be able to tune the entire band in question without resetting the regeneration control. You will find that the best operation is when the antenna coil is well away from the grid winding. If the antenna coil is down around the grid coil for proper operation, something is not right. Of course the set should show no excessive heat if left on indefinitely.

Measure drift. Zero beat the signal from the regenerative into your transceiver. Note the transceiver frequency. Now, go take a break and return one hour later. Chances are, you will not hear your zero beat signal. Slowly adjust the transceiver up or down until you pickup your regen. Zero beat the signals and note the frequency. The drift for your regen should not exceed 2 KHz for one hour. My bet is that it will be much less.

I can't think of many more 'pearls of wisdom' to bestow upon your tired ears. If you do indeed build the receiver and have a problem, I am as near as your computer. I will be glad to help you through any difficult times you might have. ER

Addendum: There is a lot of latitude in parts used in this radio. For example, the capacitors used in the cathode circuit of the 6SQ7's. Any capacity from 2 to 20 mfd will work OK. The voltage rating of C- can be anything as long as it is above 25 volts. I urge you to keep your detector voltage around 12 to 16 volts. Other voltages are not so critical. All e-mail questions about parts substitution, or other construction details will be answered promptly.

One more item: Take a look at the front panel of the receiver. Note the 'silver' skirted knobs on the bandset capacitor and link adjustment. I came into possession of some nice metal-skirted knobs for 3/8" shafts. I realize that there is an insert that will reduce these to a

standard 1/4" shaft-but I do not have any and have no idea where to find them. I removed the knobs from the metal skirt and attached the skirt to the panel with Radio Service Cement. Then, I fished around in my junk box and came up with two nice big pointer knobs. I do like the effect better than the original.

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813 Transmitter from page 27

with the input AC commercial power. In this system 120 AC was used based on the primary requirement for plate transformer. The input cable, #12 stranded, contains three wires; white, black, and green. The green always is bonded solidly to the chassis. The white is the neutral and the black is the "hot" side. All switching and fusing must be done in the black line. Two very large terminal strips were mounted inside each cabinet. To insure a low ohmic path scrape away all the paint under the metal end mounts. Using #14 bus wire, bond these terminals to the cabinet. All decks were provided with a rear chassis barrier strip bonded to the chassis and a wire installed between each deck and the cabinet terminal strip. Even the few pieces of commercial audio gear were grounded after removing the surface paint under the grounding lug. Special audio single point grounding in the speech amp will be addressed later.

My methods of obtaining parts has been discussed but don't forget the local stores in your area. You will be amazed what you will find in the plumbing and electrical department of your Home Depot or similar store. Items such as copper plated soft steel strapping and heavy copper wire for use in the PA, sheet and angle aluminum for shielding, and the nut and bolt hardware. Also Arts and Craft stores for dial pointers. Actually these were clock hands modified to fit the 6:1 Jackson drives. Electronic Parts stores for solder terminal strips, barrier strips, XLR mic connectors, lamps, fuse holders and fuses.

In the follow up article the construction of the various decks will be discussed including: the main Control unit, the 2000 volt HV supply, the triode connected push pull 813 Class B modulator, the speech amp with phase inverter and driver using a pair of triode connected push pull 807s in a cathode follower configuration, and the parallel connected 813 power amplifier.

Many thanks to all my 40 meter AM ham friends who contributed in many ways in support of this effort. Some had only encouragement to offer and that was surely appreciated for there were times when I was ready to dropped the entire project. A very special thanks is extended to Mike, WN3B for his continuous technical support, the many hour long twisted pair QSOs, and reading all the daily status reports and keeping me from straying too far off course. Mike is one of those many hams who has been down this road and has valuable experience and incite to offer.

Maybe your interest in home brewing has been sparked and you will enjoy reading the follow up article. As for total cost it would be less than $400. As for design-build elapsed time it was just about three months - retirement does have its benefits! Remember the freedom of home brewing is very rewarding and satisfying. It is a real part of the hobby. Especially if the project includes vacuum tubes with their warm glowing filaments and the clack of big contractors letting current flow into those wonderful humming pieces of iron. Try it. I guarantee you will like it. ER

Part 2 next month.

The 6146 Family of Tubes

by Glen E. Zook, K9STH
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Richardson, TX 75080
gzook@attbi.com

Probably the most used tube of all times in the final amplifier of "boat anchor" transmitters is the 6146. From the early 1950s until at least the 1980s, the 6146 found its way into virtually every manufacturer's line of transmitters. In fact, during the early 1960s RCA had a series of advertisements on the back cover of QST that listed a different manufacturer's equipment that used the 6146 each month. A copy of the January 1960 QST advertisement featuring the Hallicrafters HT-37 is included with this article.

There are actually three distinctive variants of the basic 6146: The 6146, 6146A, and 6146B. It is unfortunate that the 6146B was called the 6146B for it is really a different tube from the first two. Primarily the difference between the "plain" 6146 and the 6146A is the makeup of the heater ("filament"). The 6146A has what RCA calls the "dark heater". This "dark heater" is supposed to be more resilient to vibration, work well at a larger "range" of voltage, etc. Otherwise, the 6146 and the 6146A are the same tube.

In mid-1964 RCA introduced the 6146B with the "claim" of 33.33 percent higher power input than the 6146 / 6146A. Also, it was "claimed" that the 6146B could be directly substituted for the earlier tubes. The 6146 / 6146A had a maximum rated power input of 90 watts for CW and SSB operation and the 6146B had a rating of 120 watts for the same emissions. You can see this in the attached copy of their ad from the September 1964 issue of QST.

Many amateurs are aware that the military "ruggedized" version was designated the 6146W (I will get to these tubes a bit later). However, RCA also introduced in the early 1960s the 8298 tube for use in commercial mobile equipment. The 8298 is just a "heftier" 6146A. Motorola, General Electric, and quite a number of other commercial FM equipment manufacturers used these tubes in all sorts of FM communications equipment for both low band (30-50 MHz) and high band (150.8 - 172 MHz). When the 6146B was introduced, RCA "announced" the 8298A commercial equivalent of the 6146B. In fact, most of the RCA 6146B tubes were "cross branded" with the 8298A number in addition to the 6146B.

Those companies who were manufacturing 6146 series tubes for the military changed from the "plain" 6146 to the 6146A to the 6146B as the military decreed. However, all of the tubes manufactured under military contracts were known as 6146W and, to my knowledge, nothing was done towards marking the tubes as being equivalents of the 6146, 6146A, or 6146B. The only way of telling is from the "date code" which is printed on each tube. Different manufacturers changed tube types at different times. Also, I know of no "master list" telling on what date a particular manufacturer changed from the 6146 to the 6146A to the 6146B. The only "sure" way to know if a particular 6146W is of either the 6146 or 6146A type is to look for a "code date" of before 1964 since RCA introduced the 6146B in the middle of that year. However, some manufacturers did not start manufacturing 6146B equivalent 6146W tubes for at least a year after RCA introduced the 6146B.

RCA "claimed" that the 6146B was directly interchangeable with the earlier members of the 6146 family. Unfortunately, this did not hold true in most cases. Collins, Heath, and probably other companies, at first issued various documents saying that the use of the 6146B in their equipment was "fine". But, this soon proved otherwise!

For example, when the 6146B was used in the Collins 32S-1, 32S-2, 32S-3, 32S-3A, KWM-2, and KWM-2A it was discovered that the components in the neutralization circuitry "burned up" in a very short amount of time. Thus, Collins had to retract the statement that it was "OK" to use the 6146B. Then, due to the fact that the United States military establishment wanted to "standardize" on the 6146W equivalent of the 6146B, the neutralization components had to be redesigned to allow the 6146B to be used. Fortunately, these changes did not affect the use of the earlier 6146 and 6146A in those transmitters manufactured to use the 6146B. All three types of tubes may be used without any problem in these transmitters.

Replacing the 6146 / 6146A tubes with 6146B types often results in spurious emissions, parasitic oscillations, etc. This is due to the fact that there are different bias requirements, different inter-electrode capacitances, etc. of the 6146B versus the other two. It is often difficult to neutralize 6146B tubes when used in place of the 6146 / 6146A. If neutralization can be achieved, often it lasts for just a few minutes before the tube(s) goes into oscillation.

If one insists on trying the 6146B tubes in place of the 6146 / 6146A types, the very first thing to do is to neutralize the final amplifier. If it will not neutralize, then the 6146B tubes should immediately be replaced with the older type tubes. If it does neutralize, then the neutralization should be "watched" for several hours (even days) of operation. If the neutralization changes, then the 6146B tubes again should be replaced with the 6146 / 6146A series. If the neutralization remains constant after several days, then use of the 6146B is fine in that particular transmitter.

I have, in my shack, a number of transmitters that use the 6146 / 6146A type of tubes. These include Collins

continued on next page

32S-1, 32S-3 (earlier model before the neutralization was changed); Heath Apache, DX-100, DX-35, SB-401, SB-110, Seneca; Johnson Pacemaker; and other transmitters as well. Every one of these is much "happier" with the 6146 / 6146A family of tubes. In addition, I have owned transmitters like the Knight T-150 and T-150A that use the 6146 tubes. Frankly, these transmitters were much happier with the 6146 / 6146A tubes.

There is another 6146 family tube that is "superior" for operation at least through 10 meters. That is the 6293. This tube was designed for "pulse" service and is rated at 1-Kilowatt plate dissipation. The primary difference between these and the "normal" 6146 is that the plate is much "heavier" in its construction. Back in the late 1950s and early 1960s we would almost "kill" to get our hands on a pair of these for our DX-100s, etc. The 6293 outlasts the 6146 in "normal" service by at least 5 times and often more than 10 times the life of the tube. These tubes "show up" at hamfests, swap meets, etc., from time-to-time. If you see some of these, definitely "glomp" onto them!

The 12-volt equivalent of the 6146 is the 6883, the equivalent of the 6146A is the 6883A, and the 6146B is the 6883B. Now, there are the tubes that were manufactured for FM commercial service. These series go as follows: 6883, 6883A / 8032, 6883B / 8032A / 8552. Again most of these are "cross branded" with all of the tube numbers that are equivalent.

From 1970 until late 1979 when Motorola went out of the reconditioned equipment business, I owned the Motorola reconditioned equipment center for the south-central United States. We reconditioned Motorola FM equipment for 14 states, everything that Motorola sold reconditioned that was exported, and everything that was sold to the United States Government (this was the height of Viet Nam and the Government did buy reconditioned equipment!).

At that time, the Motrac series of mobile equipment was very popular. Depending on the model, these normally used one, or two, of the 6883A / 8032 tubes. It was only in the very "latest" models (HHT "E" series, LHT series, and MHT series) that Motorola had redesigned the equipment to use the 6883B / 8032A / 8552 tubes. Around late 1976 or early 1977, Motorola decided to eliminate some of the tube types that they were "stocking" at the Schamburg, Illinois, parts depot. Thus, they started shipping 8552 tubes in boxes that were marked as 8032. The Motrac is unique in the fact that you cannot see the tubes when they are in operation (they are enclosed in a metal "heat sink"). In fact, it is difficult to even "tune" a Motrac when the heat sink is not in place.

We went through from 50 to over 100 of the 8032 type tubes per week and within days were "down" to using the 8552 tubes in the 8032 boxes. Within a very few days of starting to use the 8552 tubes we started receiving complaints that virtually every Motrac unit that was received by customers arrived with one, or both, tubes broken. Prior to this we had never had a single complaint. Upon investigation we found that the 8552 tubes had so many parasitic oscillations that they were getting so hot that the glass envelope was being annealed! This was happening within a minute, or two, of tune-up and final quality control. When the radio was subjected to normal vibrations of shipping, the glass envelope of the tubes was being shattered.

This was reported to Motorola. At first they refused to believe us saying that we must have gotten a "bad" shipment of tubes. But, within a couple of weeks they received over 1000 complaints from their service stations about exactly the same problem. It cost Motorola one "heck of a lot" of money

to pay the warranty claims because they had tried to "cut costs" by eliminating the earlier type of tube. They had to re-box all of the 8552 tubes that had been put into 8032 boxes and get in a "rush" shipment of 8032 tubes.

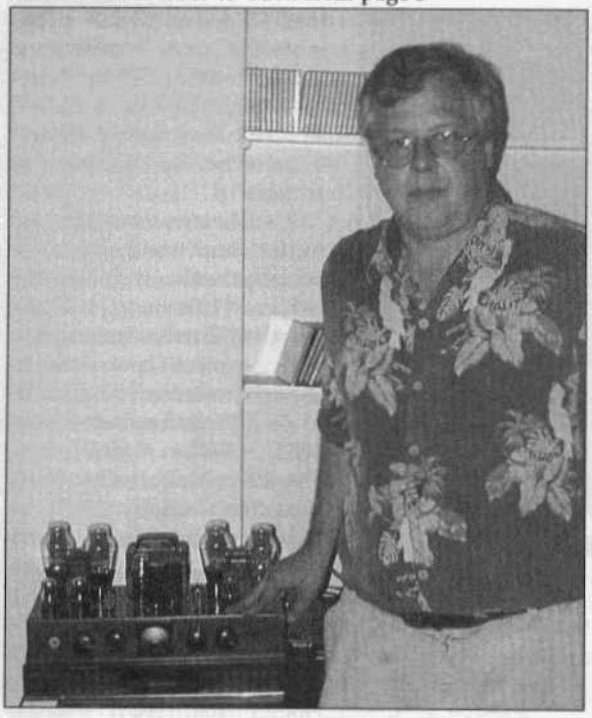
The whole problem stemmed from the fact that the "B" series of tubes is not the same as the "plain" and "A" series. The parasitic oscillations were caused by the different bias requirements and by the "fixed" neutralization of the driver and/or amplifier tube in the Motrac. There was no practical way to change the circuitry to handle the "B" series tubes. Also, making such a change would void the "type acceptance" of the units.

In a "practical" sense, it is "OK" to mix 6146 and 6146A tubes since the primary difference is in the design of the heaters. But, NEVER mix 6146 / 6146A tubes with a 6146B! This is really "asking for trouble".

Also, in a number of transmitters and transceivers (especially the Heath SB-Line) the heaters ("filaments") of the pair of 6146 tubes are in series. In these units it is very easy to change the heaters from series to parallel and substitute the 6883 / 6883A / 8032 tubes. The 12-volt equivalent tubes are often available for "pennies" because of the vast number that were used in the commercial FM market. I have done this with my Heath SB-110A and it works "like a champ". If you every want to change back, it is a very simple operation to do so.

I know that there are amateurs who say that they have used the 6146B tubes in place of the 6146 / 6146A without any problems. I can definitely believe that. But, I have seen way too many examples of the 6146B causing problems in relation to the cases in which the substitution has no effect. As I said before, neutralize and keep checking the neutralization for several days if you do replace your 6146 / 6146A tubes with 6146B types. Otherwise, you can find yourself with TVI, "burned out tubes", and other damage to your transmitter.

You must be VERY careful when dealing with the various tubes of the 6146 family, otherwise you just might be in for some very interesting problems. Substitute if you must, but, be aware that you are "treading on thin ice". ER



John, W3JN with his homebrew 300B amplifier.

I'm sure brother Lyle was bored to tears with the conversation but he was forewarned that this would happen whenever we were in the company of hams.

I found it very interesting that John has lugged a ton of parts, tools and test equipment to Cuba. Because he can't operate from there he spends the time he would otherwise spend on the air, with his HB projects. He has completed a beautiful 300B amplifier and is working on some other things. The amplifier sounded as good as anything I've heard and his craftmanship was very impressive. He can devote most of his spare time to his vintage radio hobby as his wife is presently in Tennessee doing her residency towards becoming a Physician. The house he's rented was very comfortable and stylish in a kind of 1920's way.

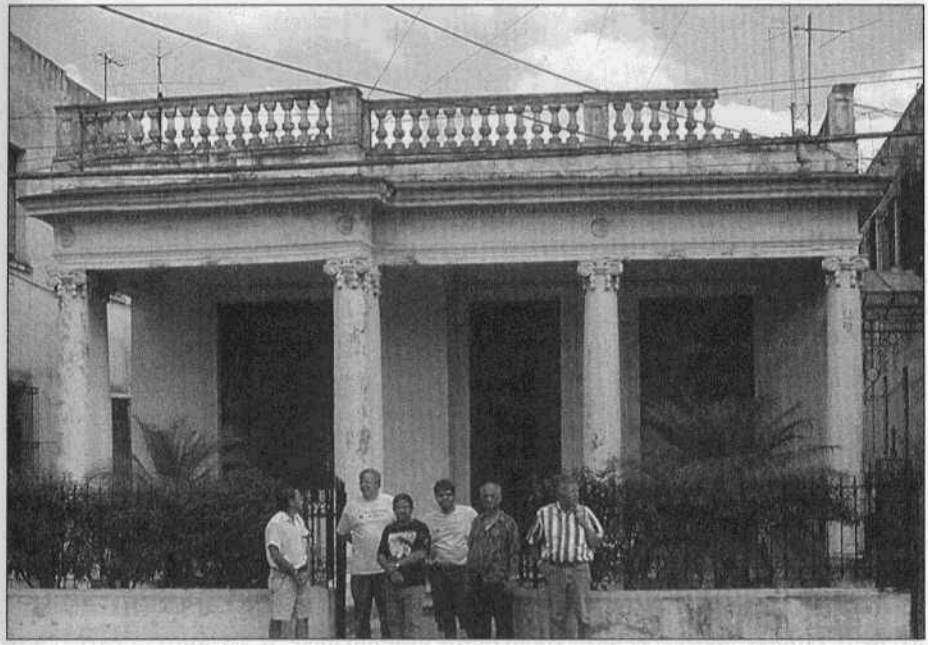
Saturday morning we got up early and headed off to visit the FRC. On the way we picked up Fidel who would provide directions and introductions.

At the FRC we were welcomed like visiting dignitaries. The entire executive gathered to meet us and when we arrived they ushered us into the President's office where through an interpreter (the Secretary I think) the President, Pedro, CO2RP delivered a short welcoming speech. After his speech I responded telling him about the magazine and the growing interest in vintage radio in the U.S. I then conducted an interview through the interpreter asking questions to the group in general.

Here's what I learned from that interview:

The ham radio population there is growing. In 1986 there were 464 hams; now there are 3400. There are 3 classes of licenses—1st, 2nd and 3rd. The 3rd class is the equivalent of our Novice license, the 2nd our General and the 1st our Extra. I was told that 3rd class ops can run 50 watts out; 2nd class 500 watts and 1st class 2000. CW is required: 5 wpm for 3rd class; 10 wpm for 2nd and 13 wpm for 1st class.

I was also told that 50% of the gear that is used in Cuba is homebrew although I think most of the hams on the executive were using Japanese gear and I did not notice any HB gear in the headquarters station. On a future trip (and I definitely want to return) I hope to be able to track down more vintage and HB type hams there. When I asked each of the executives what gear they operated, most responded that their



When we returned from a visit to CO2XM's shack I had the group pose in front of FRC headquarters. Left to right: Oscar, CO2OJ; John, W3JM; Lazaro, CO2WL; Fidel; Jose, CO2XM and my brother Lyle Wiseman.

gear was Yaesu or Kenwood and of recent vintage.

There is considerable interest in VHF amongst Cuban hams. They have 31 repeaters in the country which seems like a large number relative to the ham population. One of U.S. hams they asked me about was Joe Lynch , N6CL, VHF Contributing Editor at CQ. He has been there operating with the Cubans on VHF contests and is very well-known there.

About the time we were going to leave we were introduced to a ham who had just arrived. Through an interpreter he told us he had some vintage gear. He said he lived 3 or 4 blocks away and would be glad to show it to us. Off we went. Jose took us into his home, up the stairs to his hamshack and indeed there sat some familiar faces—a B&W 5100 with the sideband adapter; a much used R-390A (Jose said it was his favorite receiver); a KWM-2; a AR-88 and other gear and a large quantity of parts and accessories. See the cover photo.

It was an interesting trip and like I said, I hope to return someday soon for a longer visit. I found the Cuban hams to be very friendly, hospitable and like hams everywhere enthusiastic about their hobby.

And thanks again to John Fitzsimmons,W3JM, who was truly a gracious and very generous host. ER

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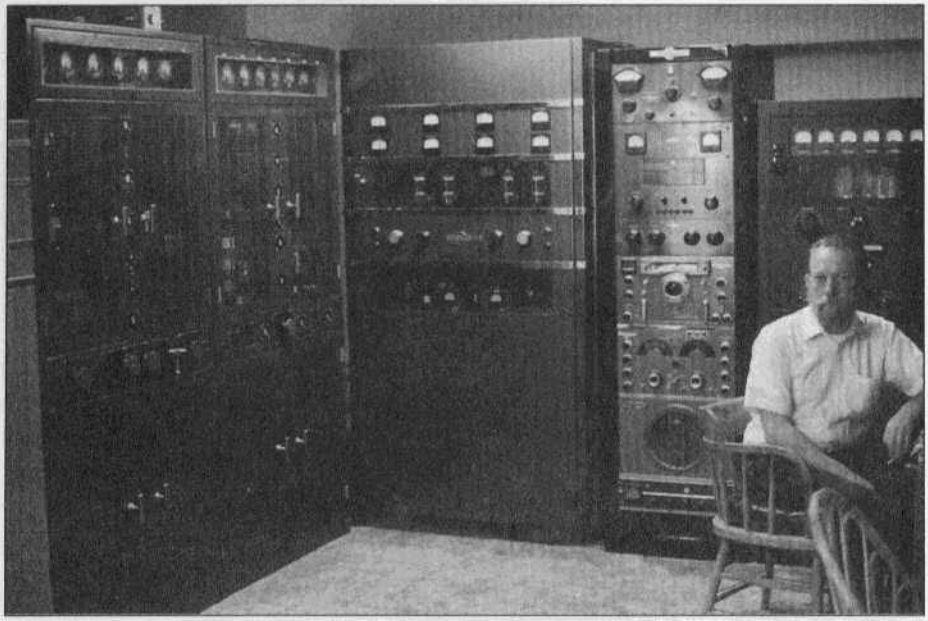
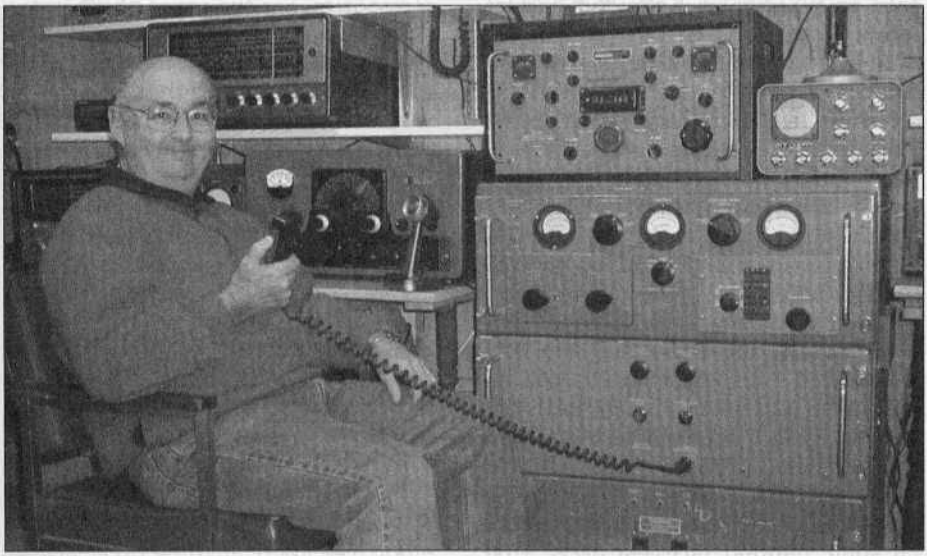
A complete index of the entire 12 years of ER is available for viewing or downloading at the following website: http://www.qsl.net/n9oo



Mike McGuigan, W6THW with some of his vintage gear. A Western Electric 1 KW broadcat xmtr is on the left, then the 250W Collins 300G, next a Collins rack with a bunch of stuff in it, mostly HRO receivers and audio equipment and finally the Collins KW-1.



Mike Warren, KØMAZ, with some of his BA's—T-368, Valiant, SX-101, SX-62, Gonset 6M Communicator, etc. Mike is a long time BA enthusiast, and is very active on the bands. He is also net control of the NorthStar Trader's Net held on Sunday mornings, which is frequented by many of the area's AM operators. ***Photo by Tom Moll, NØBS.***

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FOR SALE: Collins S-Line aluminum knob inlays: small (exciter/PA tuning) - $1; 30L-1 - $2; spinner/plain (main tuning) - $3. Charlie, K3ICH, 13192 Pinnacle Lane, Leesburg, VA 20176. (540) 822-5643

FOR SALE: Hallicrafters, RME, Gonset, others. Also some military, test equipment, VHF/RF amps, more. LASE, Don Jeffrey, POB 1164, Monrovia, CA 91017.

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WANTED: I am rebuilding several old pieces of military equip & need the following parts: For BC610E I need 250th, 100th, TU61 1.5-2.0 MHz, PA tank coil C-455 (1.0-1.5 Mhz) & C-454 (1.5-2.0 MHz) both w/variable links; for Hammarlund SP600JX I need all front knobs including red ones, & signal strength meter; for Heath DX 100 I need 1625 tubes & manual; for NMA-5 field strength meter I need antenna AS-385/U, loop probe MX-822/U, tripod CADV-10545 & measurement scales 15-125 Mhz dipole; main signal strength meter; misc components I need 304TL tube sockets, BC-375/191 tuning units, VT201 tubes for same, ART-13, vacuum relay & some misc RF parts, T-13 carbon microphones & connectors for same; a wide range of 274-N/ARC-5 components unmodified as I am trying to put together the installation for the P-38 Lightning fighter of WW II fame. ACSTW, NM, (800) 984-9814 during MST business hours.

WANTED: Military TM's for: T-51A xmtr P/O ARQ-8; Test Set I-148A; TPN-7 Beacon; TS-35A X band tester; TS-3AP S band tester; TS-656/U volt/amp calibrator, (TM 11-6625-226-R); conv. of TPS-3 to TPQ-3, (TB 11-1540-6); BC-655-4 Target xmtr; APN-9 Loran; CRR-50061 loop ant., P/O DU-1; Boonton Radio Corp type 185 LF Beacon rcvr. Ray Chase, 1350 Marlborough Ave., Plainfield, NJ 07060. (908) 757-9741, enrpnr@erols.com

WANTED: Info on Bendix 3801 Aircraft xmtr/rcvr. Have part of set. Joseph W. Long, WA2EJT, 33 N Harrison St., Johnson City, NY, 13790. (607) 798-7586, wa2ejt@hotmail.com

WANTED: For conversion to 10M AM Olson Audio Visual Spotter 2 CB set made in 1963. Bill Smitherman, KD4AF, 9401 Hwy 67, E Bend, NC 27018. (336) 699-8699

WANTED: Any info relating to ASB-8 Airborn Radar set. Pete Deierlein, KD2LN, 6257 Perryville Rd., Chittenango, NY 13037. (315) 687-5456, p.deierlein@worldnet.att.net

WANTED: For Ferris model 32 field strength meter, 1941 schematic, instructions & figures, copies OK. Robert Enemark, W1EC, POB 1607, Duxbury, MA 02331. (941) 437-4490

WANTED: Stancor 10p, parts, pieces, cabinets, anything. Chuck, W4MEW, GA, (706) 481-0238.

WANTED: Westinghouse MV-2 xmtr (pwr sply, RF unit and modulator) fair price paid. Gary, WA4ODY, Seabrook, TX, (281) 291-7701, myctpab@earthlink.net

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Complete Hallicrafters DD1. Email wb2bmh@optonline.net or call 516-381-5618. Additional pictures at http://www.geocities.com/wb2bmh/DD1.html

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FOR SALE/TRADE: Misc. parts, tubes, for tube gear. Sandy Blaize W5TVW, 40460 Edgar Traylor Rd., Hammond, LA 70403. ebjr@i-55.com

FOR SALE: Vintage equipment at the K8CX Ham Gallery Classified Ads section. Visit the largest Antique QSL Card Gallery http://hamgallery.com

NOTICE: T-368 Registry. For info w2zr@aol.com. Subscribe to the T-368 & BC-610 reflector at: http://groups.yahoo.com/group/T-368_BC-610

FOR SALE! Lots of old radio & related books. Eugene Rippen, WB6SZS, www.muchstuff.com

FOR SALE: Strong steatite antenna insulators. Lengths from two to fifteen inches. SASE for list. John Etter, W2ER, 16 Fairline Dr., East Quogue, NY 11942. (516) 653-5350

FOR SALE: Signal Corps keyer KY-127/GG4 - $35; Wurlitzer Signal Corps converter CV-2C/TX - $65. Shpg extra. Mike Taylor, KA6OIO, 225 Adlena Dr., Fullerton, CA, 92833. (714)871-6665 before 8 PM PST please.

FOR SALE: Seeking good home for my Novice xmtr, Johnson Ranger I. Prefer deliver at Dayton Hamvention. - n8zr@arrl.net

FOR SALE: FT-101E great condx - $250; Hallicrafters HT-32A, exc - $300. **WANTED:** Collins 75A4. Bob Braza, W1RMB, MA, (508) 222-5553.

FOR SALE: Older type electronic parts & hardware; free vintage flyer. Mail order since 1954. Bigelow Electronics, POB 125, Bluffton, OH 45817

FOR SALE: VM parts, new boxed electron tubes, new Heathkit parts, new panel meters. Norm, 1440 Milton St., Benton Harbor, MI 49022

FOR SALE: Build your own "Midget" bug replication by KØYQX, ca 1918, featured by K4TWJ in CQ Magazine, May, '98. 10 detailed blueprints. FAX (507) 345-8626 or e-mail<bugs@mnic.net>

FOR SALE: Parts, tubes, books, ect. Send two stamp SASE or email for list. Wayne LeTourneau, POB 62, Wannaska, MN 56761. wb0cte@arrl.net

FOR SALE: Tubes. We specialize in early receiving & collector tubes & tube related books. Send for free catalog or see www. fathauer.com. George H. Fathauer & Assoc., 688 W. First St. Ste 4, Tempe, AZ 85281. (480) 968-7686, tubes@qwest.net

FOR SALE: Collins restoration. Everything inside & out to make it as Art Collins built it. 50 yrs experience. W90JI / N4PZ, IL, (815) 734-4255 or N4PZ@aol.com

FOR SALE: Radio Shack Transistor Tester 22-024 w/copy manual - $19.95 + $3 UPS. R.J.Eastwick, W2RJE, 400 N.Haddon Ave., Unit 109, Haddonfield, NJ 08033. (856)429-2477

FOR SALE/TRADE: S-40A rcvr - $120; Collins: 51N-2 rcvr - $200; KY-45/FRT5 Exciter - $150; 75S-1/32S-1/516F-2 - $1200 All + shpg. Sam Timberlake, KF4TXQ, (256)825-7305, Dadeville, AL 36853

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FOR SALE: New Release. For details send 2-stamp LSASE to: Olde Tyme Radio Co, 2445 Lyttonsville Rd. Ste 317, Silver Spring, MD 20910

FOR SALE: Military and commercial communications items: http://www.maxpages.com/murphyjunk. Murphy's Surplus, 401 N. Johnson Ave., El Cajon, CA 92020. (619) 444-7717

FOR SALE: Tube list, new & used, wide variety audio, ham. Recently expanded. SASE 52c. Bill McCombs, WBØWNQ, 10532 Bartlett Ct., Wichita, KS 67212-1212

FOR SALE: Panel refinishing: Johnson Ranger sets - $250; Valiant sets - $300; Johnson 500 sets - $300; Collins R390(A), front side - $125, both sides - $225; Hammarlund HQ-180 series panel & bezel - $200, cab add $100. http://w4pnt.8k.com. Dee Almquist, 534 W. Main St., Waynesboro, VA 22980. (540) 249-3161 Cell: (540)480-7179

FOR SALE: QST Library Bound Books: 1950 to 1960 in 12 volumes, very nice - $120. Mike Grimes, K5MLG, 3805 Appomattox Cir., Plano, TX 75023. (972) 867-6373, grimesm@flash.net

FOR SALE: RME DB-23 Preselector - $50; B&W 380-B T-R Switch - $65; Heath HD-20 calibrator - $35. Richard Prester, 131 Ridge Rd., West Milford, NJ 07480. (973) 728-2454. rprester@warwick.net

FOR SALE: 1946 Weston Electrical Instrument Corp vacuum tube tester model OQ1. Mickey, WA6FIZ, POB 4342, Big Bear Lake, CA 92315. (909)584-7183, mandbsiegel@pineknot.com

FOR SALE: Collins 30K-4, unmod, partially restored. Taking serious offers, pix available. Walter Treftz, N4GL, (352) 637-1755 penguino@atlantic.net

FOR SALE: Rare National I-10 UHF rcvr w/pwr sply - $300. Herb, K9GTB, IL, (618) 362-6539

FOR SALE: S-38; ARRL Handbooks, 1969, 1978, 1985, & 1990. Les Mathews, NJ, (856) 218-8838.

FOR SALE: Military whip antennas, pilot emergency radio beacon - $40. Bruce Beckeney, 5472 Timberway Dr., Presque Isle, MI 49777. (989) 595-6483

FOR SALE: MD7/ARC-5 modulator unmodified, w/tubes - $35; free shpg in contiguous USA. John, W2PRR, NY, jandjml30@juno.com

FOR TRADE: FT-243 xtals 7000, 7025, 7040, 7050, 7073, 7100, 7107, 7125, 7200, 7207, 7250, 7300 kc. Bernard, POB 690098, Orlando, FL 32869. n4kq@juno.com

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FOR SALE: Repair, upgrade, performance modification of tube communications & test equip. Accepting most military, all Collins & Drake designs, & the better efforts from others. Laboratory performance documentation on request. Work guaranteed. Chuck Felton, KDØZS, Felton Electronic Design, Box 187, Wheatland, WY 82201. (307) 322-5858, feltoned@coffey.com, www.feltondesign.com

FOR SALE: I am making aluminum plate and grid connectors for T series tubes. If interested contact Alan Price at fixr75268@cs.com

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FOR SALE: Ur old QSL card? Search by call free, buy find at $3.50 ppd. Chuck, NZ5M, CRBCS1@prodigy.net

FOR SALE: BC-779 Super Pro rcvr w/pwr sply & manual, working well, VGC - $225. Dave, WD4PLI, CA (818) 846-0617

FOR SALE: 1944 Jennings type Y 'Peanut' 3 mmfd 15KV fixed capacitor in colorful uranium glass envelope. Come visit me in Hillside Park Senior Apt's to see & buy. Cash and carry, (cheap), no shpg. Bob Ryan, 1000 S. Gilbert St., Apt. 132, Hemet, CA 92543

SELL-TRADE: Swan 350 w/manual, needs 3 tubes, complete w/pwr sply, nice condx - $75 U shp. John Snow, W9MHS, 1910 N. Remington Ct., Andover, KS 67002. (316) 733-5062

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FOR SALE/TRADE: TV-2/U, A/U, B/U military tube tester w/manual exc operating condx. John Snow, W9MHS, 1910 N. Remington Ct., Andover, KS 67002. (316) 733-5062

FOR SALE: UTC CVM-1 modulation xfmr, mutli tap 30 watt audio, new - $25. Tom Berry, W5LTR, 1617 W. Highland, Chicago, IL 60660. (773) 262-5360, 262-0016

FOR SALE: Johnson Invader 2000 + PS - $600; SX101 - $150; Ranger - $200; HT37 - $150; untested, PU only. Richard Cohen, FL, (813) 962-2460

FOR SALE: National NCX3 w/ps, very good - $115; Heath EU40A HV sply - $70; Hallicrafters S38 - $70. Ron, MI, (517) 374-1107.

WANTED: ARC-5 rcvrs, racks, dynamotors. Jim Hebert, 1572 Newman Ave., Lakewood, OH 44107.

WANTED: Orig Heath manuals for ham & test equip. Please state condx & price. Warren, K1BOX, POB 1051, Spruce Pine, NC 28777. (828) 688-1922

WANTED: TMC Model TAC Antenna Tuner in good condx. Al Santangelo, VE3AJM ve3ajm@sympatico.ca or (705) 277-9986

WANTED: National NC-183D, prefer working unit, no basket case. Harold, GA, (706) 754-7388, k4hca@alltel.net

WANTED: Bendix radio rcvr RA-1B; Belguim set RST-101. George Rancourt, K1ANX, MA, (413) 527-4304 or k1anx@mindspring.com

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WANTED: RBB/RBC rcvrs, pwr splys, cables & RAK/RAL equip. Andy Miller, KD6TKX, CA, (831) 484-2389, amillertkx@aol.com

WANTED: Mics: Astatic JT 30/40; UT-48; Shure CR80/81/41; 707A; Turner VT-73; CD/BD; parts for same. Tom Ellis, Box 140093, Dallas, TX 75214. (214) 328-3225. tomsmics@flexcomp.com

WANTED: Desperate for museum display: lge AC cooled or water cooled xmtg tubes. Certain types including RCA, 898, 862, 893A or R & 5831s; other manufacturers such as Federal Telephone & Radio F 124R. Name your price. Tommy Bolack, 3901 Bloomfield Hwy, Farmington, NM 87401. (505) 325-4275

WANTED: R-390A rcvrs, parts rigs or restorable, will restore yours at reasonable prices. Walter Wilson, KK4DF, (706) 733-8323, wewilson@knology.net, www.knology.net/~wewilson

WANTED: WWII BC-610-E series or earlier xmtr; BC-739 interphone control box. BC-652 rcvr. Steve Finelli, N3NNG, 37 Stonecroft Dr., Easton, PA 18045. (610) 252-8211, navrad@enter.net

WANTED: Electric Radio; Antique Radio Classifieds, Old Timers Bulletin. Alan Mark, POB 372, Pembroke, MA 02359

WANTED: National Company emblems, escutcheons, logos from equipment. Also WW II rcvr's manufactured by National. Don Barsema, 1458 Byron SE, Grand Rapids, MI 49506. (616) 451-9874, dbarsema@prodigy.net

WANTED: 1950's Popular Electronics; 1961-65 Heathkit catalogs & Radio-TV Experimenter. John Curtis, WØCAR, 3146 S. Franklin St., Englewood, CO 80110. (303) 781-8027, wøcar@arrl.net

WANTED: SCR602 components, BC-1083, BC-1084 displays, any APS-4 components. Carl Bloom, CA, (714) 639-1679 or 3778111@mcimail.com

WANTED: Antique tubes. Paying $40 ea for good used type 201 tubes (not A). Buy list & new 2000-2001 catalog of collector tubes available. See www.fathauer.com. George H. Fathauer & Assoc., 688 W. First St. Ste 4, Tempe, AZ 85281. (480) 968-7686, tubes@qwest.net

WANTED: Heath VF-1 VFO to complete my first General Class station. Bill, K8DBN, OH, (440) 333-6644 or billyrieke@aol.com

WANTED: Audio interstage xfmr, 600 to 3300 ohms center tapped such as the Stancor A-3802, Thordarson 22S78 or SNC 6P726. Jeff Bishop, , ID, (208) 459-7502, w7id@arrl.net

WANTED: Kleinschmidt teleprinter models: 311, 321, (AN/FGC-40, AN/GGC-16, AN/UGC-39...) Tom Kleinschmidt, 506 N. Maple St., Prospect Hts., IL 60070-1321. (847) 255-8128

WANTED: Military survival communications equip: radios, beacons, manuals, books, historical info/photos. Daniel Cahn, 3444 Greenwood Ave., Los Angeles, CA 90066. (310) 398-7159. danielc411@aol.com

WANTED: Visitors and tubes by museum. Old and odd amateur or commercial tubes, foreign and domestic purchased, traded or donations welcome. All correspondence answered. K6DIA, Ye Olde Transmitting Tube Museum, POB 97, Crescent City, CA 95531. (707) 464-6470

WANTED: RCA 140, 141, AVR5A. GE K80, K80X, K85. Any condx. James Treherne, 11909 Chapel Rd., Clifton, VA 20124. treherne@erols.com

WANTED: Seeking unbuilt Heathkits, Knightkits. Gene Peroni, POB 7164, St. Davids, PA 19087. (610) 293-2421

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WANTED: Collins 310B3, basket case OK - welcomed; & Chicago 500W CMS-2, high-level modulation xfmr; Taylor T21. Jerry, W8EGD, CO, (303) 979-2323.

WANTED: Collins 70K-2 PTOs working or not; IN82A diodes; Bretting 14/14AX manual. Clark, WØBT, KS, (785) 286-2132

WANTED: National NTE. I love National. Sylvia, N1VJ, 33 Lawton Foster Rd., Hopkinton, RI 02833. (401) 377-4912

WANTED: Collins 30K1 xmtr; also need orig manuals & literature for 75A1, 32V1, 30K1. Paul Kluwe, W8ZO, POB 84, Manchester, MI 48158. (734) 428-2000

WANTED: Collins - Amateur catalogs, sales literature, manuals, promotional items & Signals. Richard Coyne, POB 2000-200, Mission Viejo, CA 92690

WANTED: Info on xmtrs made by Clough-Brengle Co. Used by the CCC, in the mid to late 30's. Any help would be greatly appreciated. Ron Lawrence, KC4YOY, POB 3015, Matthews, NC 28106. (704) 289-1166 hm, kc4yoy@trellis.net

WANTED: Heath SB-300 in almost any condx. Bob, WBØDMC, (507) 331-5103, e-mail bobspeck@clear.lakws.com

WANTED: Ranger II, Navigator, Lafayette Precon, Crown TR680 in orig , mint condx. John Curtis, WØCAR, 3146 S. Franklin St., Englewood, CO 80110. (303) 781-8027, w0car@arrl.net

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WANTED: Old Callbooks, especially those covering the years before 1930. Alan, W3BV, PA. (215) 795-0943 or W3BV@arrl.net

WANTED: National HRO black wrinkle spkrs, oak coil boxes, coils; Western Electric horns, spkrs, amps, mics. Barry Nadel, POB 29303, San Francisco, CA 94129. bnadel@ccnet.com

WANTED: Searching for RME CT-100 or 3R9 xmtrs and info about them. David Edsall, W1TDD, 156 Sunset Ave., Amherst, MA 01002. (413) 549-0349, dedsall@crocker.com

WANTED: New or used unmodified BC459A, BC696, T18/ARC/5, T19/ARC/5, CBY52232. Louis Lytch, K2DET, 117-33 230th St., Cambria Heights, Jamaica, NY 11411-1806. (718) 528-5065

WANTED: Manuals, manuals, manuals for radio-related equipment to buy or swap. Catalog available. Pete Markavage, WA2CWA, 27 Walling St., Sayreville, NJ 08872. (732) 238-8964

WANTED: Collecting military electronics including radio, radar, RDF and test, manuals & literature. William Van Lennep, POB 211, Pepperell, MA 01463. (978) 433-6031

WANTED: Postcards of old wireless stations; QSL cards showing pre-WWII ham shacks/equip. George, W2KRM, NY, (631) 360-9011, w2krm@optonline.net

WANTED: RXR-77/ARC3+connectors & control box; C-118/ARC-3. G. Orecchia, Corso Galliera, 14/26, 16142 Genova Italy. sp0208on@tin.it

WANTED: WW-2 Japanese military radio and radar of any kind. Yokohama WW-2 Japanese Military Radio Museum, Takashi Doi, 1-21-4, Minamidai, Seyaku, Yokohama 246 Japan. Fax 011-8145-301-8069, takadoi@carrot.ocn.ne.jp

WANTED: Homebrew AM xmtr 300 to 500 watts, reasonable distance for Atlanta PU. Dave, K4JRB, GA, (770) 448-0588 or thompson@mindspring.com

WANTED: Tektronix memorabilia & promotional literature or catalogs from 1946-1980. James True, N5ARW, POB 820, Hot Springs, AR 71902. (501) 318-1844, Fx 623-8783, james.true@ibm.net

WANTED: Collins promotional literature, catalogs and manuals for the period 1933-1993. Jim Stitzinger, WA3CEX, 23800 Via Irana, Valencia, CA 91355. (661) 259-2011. FAX (661) 259-3830

WANTED: WW II military remote control rcvrs #ARW/CRW, xmtrs, dynamotors PE186 PE126, joy sticks, Gyroscopes for the GB, Azon glide bombs. Maurice Schechter, NY. (516) 294-4416 or mauricsch@cs.com

WANTED: QSL cards from old/pre WW II Ham DX countries; old regen kits. Hajime Suzuki, Nishikuniyoshi 1644-24, Ichihara-Shi, Chiba-Ken, 290-0231 Japan

WANTED: SX88; S-76; MR-2000 morse recieve option for the HAL DS 2000; KSR video Communiate Terminal. Roger Higley, W8CRK, 3507 Clenmore Ave., Cincinnati, OH 45211. (513) 451-1096

WANTED: WW II Japanese xmtrs & rcvrs (parts, plug-in coils) for restoration & ER articles. Ken Lakin, KD6B, 63140 Britta St., Ste. C106, Bend, OR 97701. (541) 923-1013. klakin@aol.com

WANTED: Stancor 10P, parts, pieces, cabinets, anything. Chuck, W4MEW, GA. (706) 481-0328

WANTED: Band selector knob for Hallicrafters SX-96 or SX-100. Also Hallicrafters PM-23 spkr. C. David Miller, 465 Road 8, Powell, WY, (307) 754-4351, cdavid@wir.net

WANTED: 1930-40s vintage bug; Heath SB series friction drive/knob for adjusting hairline calibration. Brian Roberts, K9VKY, 130 Tara Dr., Fombell, PA 16123. k9vky@arrl.net

WANTED: Unmodified, relatively clean panel & unmodified chassis for Globe Scout 680. Wayne, WI, wking@rconnect.net

WANTED: Service manuals, originals, copies for copy of HP 3330B, HP 3582A, HP 11710A. Will pay ALL exp. and more! Reinhard Wieschhoff, 7 rue du Debuche, F-78120 RambouilLet, France. Tel/Fax: 0033 1 304 111 02

WANTED: Scott Special Communications rcvr. EA4JL, please call, Kurt Keller, CT, (203) 431-9740, k2112@earthlink.net

WANTED: Russian 1.5-8 MHz military transceiver, type P(R)-131. Will pay well for a good one. Leroy Sparks, W6SYC, 924 W. Mc Fadden Ave., Santa Ana, CA 92707. (714) 540-8123, leroysparks@earthlink.net

WANTED: SW3 #33A and #35 coils. I will trade my extra coils SW3 coils. Hank Bredehorst, 2440 Adrian St., Newbury Park, CA 91320. (805) 498-8907

WANTED: Long wire ants AT101, AT102, GRC-9; DY88/105; PP327GRC9; counterpoise CP12 & 13 GRC9; BC348 pwr conn PLQ102/103. KA1ZQR, 348 N. Main St., Stonington, CT 06378.

WANTED: Globe King 500 B/C; Viking Valiant I/II; Viking 500; Heathkit Mohawk. Frank, (916) 635-4994, frankdellechaie@sprintmail.com

WANTED: National SW-3 model1, version 3. Uses 32-32 30 tubes. Dean Showalter, W5PJR, 72 Buckboard Rd., Tijeras, NM 87059. (505) 286-1370

WANTED: Collins 32V & Collins 75A series; Globe Scout; National SW54. KB6W, CA, (916) 635-4994. frankdellechaie@sprintmail.com

WANTED: Hallicrafters SX88 or SX115. Larry Redmond, 413 Bedfort Dr., Duluth, GA 30096. (770) 495-7196

WANTED: Clean fully functional w/manuals Swans FC76, PS1 and WM2000A. Contact C6ANI @ c6anirumcay@hotmail.com

WANTED: Instruction Service manual w/schematics for Nems-Clarke type 2801A UHF rcvr. Paolo Viappiani, Via G B Valle 7-19124 La Spezia, Italy. Fax: ++39-0187-21647, pviappiani@tin.it

WANTED: National Co., Inc nameplates, equip logos or other items w/the diamond NC on them; also WW II era tube model military rcvr covering 225-400 MHz. Don Barsema, 1458 Byron SE, Grand Rapids, MI 49506. (616) 451-9874, dbarsema@prodigy.net

WANTED: WW II German, Japanese, Italian, French equipment, tubes, manuals and parts. Bob Graham, 2105 NW 30th, Oklahoma City, OK 73112. (405) 525-3376, bglcc@aol.com

WANTED: Heath Gear, unassembled kits, catalogs and manuals. Bill Robbins, 5339 Chickadee Dr., Kalamazoo, MI 49009. (616) 375-7978, billrobb@net-link.net

WANTED: I wish to correspond with owners of National FB7/FBXA/ACS coil sets. Jim, KE4DSP, 108 Bayfield Dr., Brandon, FL 33511. j.c.clifford@juno.com

WANTED: Parts for a TMC GPT-750 xmtr. I need the AM modulator deck and other parts to restore this unit. John, KF2JQ (716) 873-0524 jprusso@acsu.buffalo.edu

WANTED: Old military radar displays, scopes, antennae, receivers, manuals, etc. Even half ton items! William Donzelli, 15 MacArthur Dr., Carmel, NY 10512. (847)225-2547, aw288@osfn.org

WANTED: RCA Models: 1X52, Ivory; 1X53, Green; 1X57, White. Cosmetically perfect for serious collection. Mike Grimes, K5MLG, 3805 Appomattox Cir., Plano, TX 75023. (972) 867-6373, grimesm@flash.net

WANTED: Hammarlund HX50A. **FOR SALE:** Johnson Viking Ranger - $275. Dick Dixon, W7QZO, 16032 Lost Coyote Ln., Mitchell, OR 97750, (541) 462-3078, richdix@bendnet.com

WANTED: Knight Star Roamer; Hallicrafters S-38E; tube tester; EICO VTVM VOM. George Elliott, #AP-5528, 10745 Rte 18, Albion, PA 16475.

WANTED: Heath SB300 in almost any condtx. Bob, WBØDMC, MN, (507) 331-5103, bobspeck@clearlakes.com

The Collins Video Library

The Collins KWM-2 Video 4 hours - $89.95. Highly detailed video on operation, rebuilding, alignment, troubleshooting and neutralizing of this classic! A must for anyone who owns and operates a KWM-2/2A. Printed documentation included.

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Produced by Floyd Soo, W8RO (ex-KF8AT)

ER Bookstore, 14643 County Road G, Cortez, CO 81321

FOR SALE: RCA tube manuals, RC-15, RC-20, RC-25; ARRL Handbooks, 1965, 1968, 1972 & 1978. LSASE for list. Charles Brett, 5980 Old Ranch Rd., Colorado Springs, CO 80908. (719) 495-8660, brett3729@aol.com

FOR SALE: Collins drum overlays. 75A-2, 3, 51J#. For 75A-4 & KWS-1, specify new/old - $8.50 ea. 2/$15 ppd. Correct colors. Charlie Talbott, K3ICH, 13192 Pinnacle Ln., Leesburg, VA 20176-6146. (540) 822-5643.

FOR SALE: Repro Nameplates, R-390A generic - $9; 51J-3 and 51J-4 exact replicas - $12. Tom Marcotte, N5OFF, 242 Chestnut Oak Dr., Mandeville, LA 70448. marcotte@iamerica.net

FOR SALE: Used technical books - radio, electronics, math, military, magazines, etc. List: $1 (stamps OK). Softwave, 2 Dept. ER, 1515 Sashabaw, Ortonville, MI 48462

FOR SALE: R.L. Drake repair and reconditioning, most models including TR-7's, 35 years experience. Jeff Covelli, WA8SAJ, (440) 951-6406 after 4 PM, wa8saj@ncweb.com

FOR SALE: Heath Nostalgia, 124 pg book contains history, pictures, many stories by longtime Heath employees. (See BOOKS inside back cover.) Terry Perdue, 18617 65th Ct., NE, Kenmore, WA 98028

NOTICE: Visit HamRadioUSA.com a website dedicated to traditional ham radio & vintage radio resources. http://www.radioing.com. let's radio. W5AM

FOR SALE/TRADE: Transmitting/rcv'g tubes, new & used - 55¢ LSASE for list. I collect old & unique tubes of any type. **WANTED:** Taylor & Heintz-Kaufman types & large tubes from the old Eimac line, 152T thru 2000T for display. John H. Walker Jr., 13406 W. 128th Terr., Overland Park, KS 66213. (913) 782-6455 or johnh.walker@prodigy.net

FOR TRADE: Two good RCA 833A's for one Taylor 833A; also looking for Taylor 204A, 813, 866B. John H. Walker Jr., 13406 W. 128th Terr., Overland Park, KS 66213. (913) 782-6455 or johnh.walker@prodigy.net

FOR SALE: NOS British tubes 1930's to 1960's - send wants. David Boardman, VA2DVD, 10 Lemaistre, Sainte-Foy, Quebec G2G 1B4. (418) 877-1316, dbtubes.com

FOR SALE: WACO-5NWX telephone filters. Just plug in. 1/$13.95, 2/$25, 3/$34. Money back. Cecil Palmer, 4500 Timbercrest Ln., Waco, TX 76705. (254) 799-5931, w5nwx@hotmail.com

FOR SALE: 7 or 9-pin tubes, used, test OK - 50¢ ea; others, ask; Galena xtal radios or parts. L. Gardner, 458 Two Mile Creek Rd., Tanawanda, NY 14150. radiolen@aol.com

FOR SALE: Repair! Radio repair, tube or solid state. Reasonable charges. J. Dan Rupe, W7DDF, 998 Whipple, POB 697, Grayland, WA 98547. (360) 267-4011, w7ddf@yahoo.com

FOR SALE: Books, 200+ radio titles. Great prices. SASE or email for New Revised List. Paul Washa, 4916 Three Points Blvd., Mound, MN 55364. w0tok@msn.com

FOR SALE: DX-35, DX-40 reproduction crystal doors. $11.50 shipped. Texans add 8.25% sales tax. Glen Zook, 410 Lawndale Dr., Richardson, TX 75080

FOR SALE: RIT for KWM-2 and S-Line. No modifications for KWM-2. $59.95 tested/42.95 for kit. SASE for details and order info. John Webb, W1ETC, Box 747, Amherst, NH 03031

FOR SALE: Military Radios, etc. E-mail N1UDI@ATT.NET for a List or SASE. Ronnie Parker, 1357 Bridgeport, CT 06601

FOR SALE: RCAF AR6 w/pwr sply - $450. See ER Dec. '01 pg 38. WA9IYF, VA, (703) 876-8419.

FOR SALE: Nice Scott 800B Regency cabinet, manual, extra paper work, advertizing. Bill Coolahan, 1450 Miami Dr. NE, Cedar Rapids, IA 52402. (319) 393-8075

FOR SALE: Johnson Viking II, needs work, w/ Viking II VFO - $225. PU only. W7RBF, AZ, (602) 864-9987

FOR SALE: Radio City products tube tester model 323 - $75. Robert Martin, 111 Bancroft, Rochester, NY 14616. (716) 663-4182

FOR SALE: Collins 30L1 replacement fan motor - $28; Heath precision RF generator IG-42, super mint condx as new - $99. Ed, W3WDF, 8245 Garden Oaks Dr., San Antonio, TX 78266. (210) 651-9348

FOR SALE: NC300 - $275; HT37, needs restoring - $150; rcvr 1051, not working - $200 + shpg. George Portell, W8QBC, AZ, (480) 986-5797.

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The front displays the logo from the cover of ER (the tube outline, Electric Radio, and 'celebrating a bygone era'). The back has "Real Radios Glow in the Dark" (used with the permission of Classic Radio).The T-shirts are U.S. made by Hanes and come in S-M-L-XL-XXL . The color is just a little lighter than the cover of ER - $15 del. ($16 for XXL)

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