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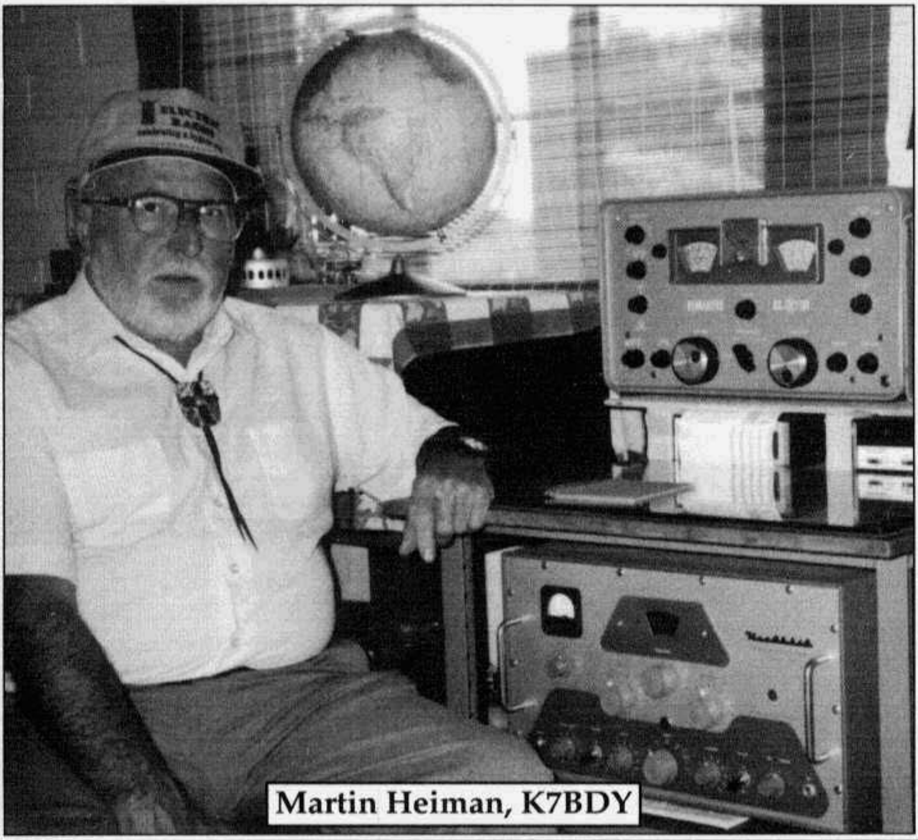
ELECTRIC RADIO

celebrating a bygone era

Number 101 September 1997


Martin Heiman, K7BDY

ELECTRIC RADIO

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Editor - Barry R. Wiseman, N6CSW
Office Manager - Shirley A. Wiseman

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:

Walt Hutchens, KJ4KV; Bill Kleronomos, KDØHG; Ray Osterwald, NØDMS; Dave Ishmael, WA6VVL; Jim Hanlon, W8KGI; Chuck Penson, WA7ZZE; Dennis Petrich, KØEOO; Bob Dennison, W2HBE; Dale Gagnon, KW1I; Rob Brownstein, K6RB; Don Meadows, N6DM; Lew McCoy, W1ICP; Kurt Miska, N8WGW; Warren Bruene, W5OLY; Brian Harris, WA5UEK and others.

EDITOR'S COMMENTS

For some time Shirley's been urging me to write about some of the problems we're having with the classified ad section of ER. The problems create a lot of extra work for both her and me. Hopefully, some of these problems can be eliminated.

The first problem that causes us no end of grief is illegible copy. Please try and print clearly or type your ads. I'm sure everyone understands the problems that a bad phone number or address creates. Then there's the problem of not including your state (we started including this info with every ad a couple of years ago) - this means that Shirley or I have to go to our sub list to find this information. It may take onlya minute or two but when we have to do this many times you can see that it can become an irksome task.

Then there's those people that forget that we advertise VINTAGE EQUIPMENT ONLY and when I cut a non-vintage item call to bellyache to us. Please remember ER's policy in this regard. When I receive an ad with a non-vintage item in it, I just cut that item. I can't phone or write to explain what I've done, I'm sure everyone can understand that, considering there's only the two of us doing everything here.

The last problem concerns payment for extra ads or extra words in an ad. If your ad runs over 20 words please send 20 cents for each extra word. It's a real hardship for us to be sending bills for a few cents or a dollar or two and then have to record that information in a ledger. And if you've faxed, e-mailed or phoned in an ad with extra words please indicate what you owe us and that you're sending it. That way we can just set your letter aside and toss it when you pay us. Most of our subscribers have been very good about doing this.

Actually, we have very, very few problems with our subscribers. This editorial is just an attempt to get you all absolutely perfect. N6CSW

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Cover: Martin Heiman, K7BDY, well-known AM'er and vintage radio enthusiast, at his operating position.

Looking Back

by Lew McCoy, W1ICP
1500 Idaho St.
Silver City, NM 88061
mccoy@zianet.com

The advantage in working at ARRL Headquarters was that one got to meet some very famous and very fine people. Many of the great technical minds would come through for a visit and you can be sure I was always on hand to meet them.

One man in particular always impressed the very dickens out of me - and that was George Hanchett. He was kind of unknown in one way but very well known in another. Let me explain. George Hanchett worked for RCA Corporation back in the days when RCA was number one in radio. What did George do with RCA? Well - he was head of the transmitting tube division of RCA. I am not sure but I believe George was the father of the 807 tube - I could be wrong about that but George really knew his tubes.

One of the jobs that Ed Handy, W1BDI, gave me when I came to work at ARRL was rebuilding some of the amplifiers at W1AW. Most of the amplifiers used Eimac 250TH triodes - two tubes in push-pull. I was just a green young ham in those days but I recall that I was invited to go to lunch with some of the technical department characters - and they were taking George Hanchett. George had come up from New Jersey to visit. Well - not really to visit but to actually see me but greenhorn that I was - I didn't catch on until later. Now, I have never told this story because it might cause some people who are still alive to have some damaged toes! My good buddy who I know is reading this column will - I hope - remember the incident because he was involved - By Goodman, W1DX.

To get to the meat - some of the guys in the technical department, while they were great admirers of EIMAC tubes (as I was!), also really liked George Hanchett and wanted George to score a few points. The upshot was that George knew I was designing this new amplifier and he wanted to see at least one RCA tube running in one of W1AW amplifiers! So I got sold on using a single 8005 - I believe that was the tube designation. The result was a very stable 80 meter amplifier that literally thousands of amateurs learned the code from. So George succeeded! (And so did I!)

I always recall how happy Hanchett was when I invited him one day over to W1AW to see that new amplifier. He really beamed to see an RCA tube so well displayed. As I remember, it was an easy amplifier to build and get working. I have no idea of the status of W1AW in these days but when I came to work there in 1949, the rigs were all rack and panel, with full rigs on 80, 40, 20 and 10 meters. They could be VFO controlled but primarily, because W1AW stayed on specific frequencies, they were mostly crystal controlled. While it has nothing to do with this tale - there was the huge rhombic, aimed at California, and there were dipoles, fed with 6 inch open wire lines for the other bands. As an aside, I recall that Ed Handy, the Communication Manager, more or less forbid any of us to use the rhombic for working DX - strictly keep working those W6's!! But back to Hanchett and the interesting part.

My designing and building the RCA amplifier was only the beginning of a very long and valuable friendship. Hanchett was really a genius - in every sense of the word. He was a quiet individual with a marvelous sense of humor. He would travel up to West Hartford and later Newington every few months to visit George Grammer and

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How Many Crystal Manufacturers Were There?

by Martin Heiman, K7BDY
P.O. Box 744
Show Low, AZ 85901

Several years ago I bought a five gallon pail of radio crystals at a swapmeet. The pail was about three quarters full and contained 994 crystals.

Out of curiosity I sorted them out according to manufacturer. I came up with a total of 72 different company names. I've listed them here in alphabetical order. I tried to copy the information exactly as it appeared on the crystals however I may have added or deleted a comma or period here and there.

Editor Barry says that if ER readers would care to add to my list he will publish an upgraded list in a future issue of ER. I'm sure that the final list will be at least twice as long as mine.

I think that a lot of companies not in the crystal manufacturing business were awarded contracts to produce them for Uncle Sam during WW II. I suspect that the actual list of bonafide crystal manufacturers is a very short list.

[ed. I contacted Leo Meyerson, WØGFQ, a major crystal manufacturer during WW II (Scientific Radio Products) and he agrees with Martin, in fact he told me that his company manufactured crystals for many companies, including Hallicrafters and Collins. He would put any name they wanted on the crystals and in some cases (Hallicrafters for one) these other companies would even provide the holders with their companies' name stamped on the holder.]

A.E. Miller
Aircraft Accessories Corp Kan City
Aireon Mfg Corp, K.C. MO.
A.M.E. Stabilized Freq Control, PHX
AZ & LA CA
Beaumont Electric Chicago IL
B.E. Co
B.E.S. Co
Bliley Elec Comp. Erie PA
Bodnar Labs
B.S.D. 7A
CA Mfg
Cambridge Thermonic Corp
Carlisle Crystal Company
C B Y K
Cecor, KC MO USA
C.K.Z.
Commerical Crys. Co., Lancaster
Crystal Labs Wichita KANS
Crystal Prod KC MO
C.T.&E Div. G.A.I. Inc
Daughette Mfg. Co.
DX Xtal Chicago
Elect. Prod. Oakl'd Calif
E.P. Co
Federal Tel & Radio, CO. Newark NJ
F.M.S. Inc KC MO.
Franklin Trans Mfg CO
G.C. Hunt & Sons, Carlisle Penn
Gentleman Products Omaha USA
Goodall Elec Mfg Co
Harvey Crystal Camb MA
Harvey Wells Comm Inc
Hatch Fisk Mfg Topeka KS
H.I. Inc (Higgins Industries)
Higgins Industries
J&K, Sandwich, IL
John Meck Plth IND.
Keystone Electronics
Majestic Radio Chicago IL
Mid Mfg. K.C. MO
Monitor, Co, Pasadina, CA
Mon. Watt Electric Corp
M.P. Co
Nat. Scien. Prod. Co. (N.S.P.)
Penna
Petersen Radio Co
Polytech Devices
Pre-Cise Chic. USA
Precise Dev. Co. Chicago

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Widow Maker 50C5

by Mike Murphy, WB2UID
38 N. Reading St.
Hooksett, NH 03104

My ninth grade electrical shop textbook was loaded with interesting projects that lived at the tail end of the book. Of course, I wanted to build all of these. How about the phonograph amplifier using a 35Z5 and a 50L6 or a deluxe version with two 50L6's and a 12SL7? This was the early 70's and our music was on vinyl (as I recall most of our clothes were vinyl as well) and the low cost AC/DC throw away radio and TV era was in full swing.

But a boy needs tubes to build such wonderful toys and it was this quest for tubes that brought me to my cousin's TV repair shop. As I soon learned, the price is not cheap for these highly valuable devices as purchased new in the box. Instead of selling me the tubes, Fran had mercy and gave me an old All American 5 that someone had abandoned to the shop. He also (at no charge) took the time to hand draw a complete phono-broadcaster schematic using a 35Z5 and a 12SA7. He said that it transmitted so well that when he hooked it up to a fence to play music around the farm, an FCC snooper truck came around about a month later and he had to race to the house and unplug it.

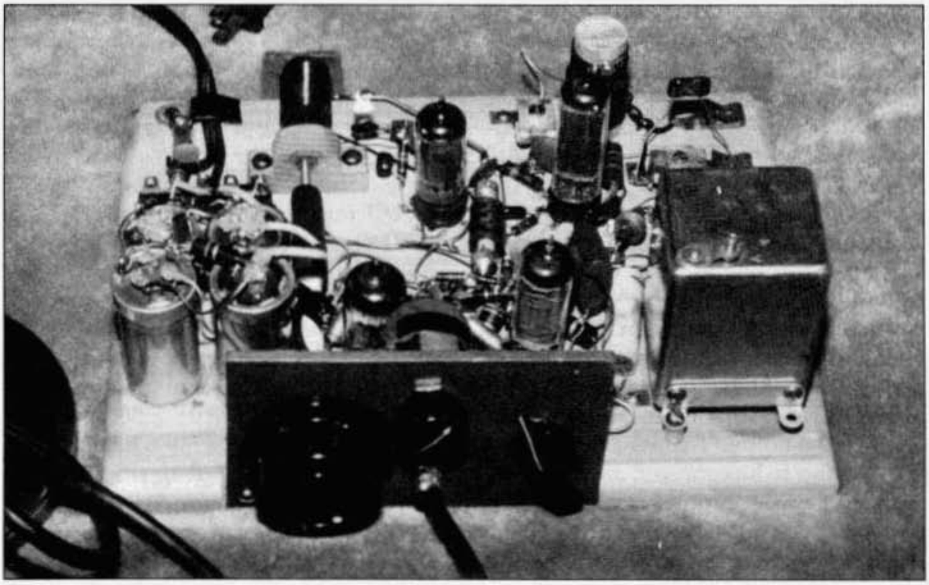
For the benefit of those who may need a refresher, the "All American 5" was the common name for the AC/DC powered, usually bakelite cased, table radios of the late 1940's through 50's. The octal tube lineup was typically a 12SA7 pentagrid converter, 12SK7 IF amplifier, 12SQ7 detector/AGC audio voltage amplifier, 50L6 audio power output and 35Z5 power supply rectifier. In the 60's through the early 70's a functionally identical miniature tube lineup was substituted.

AC Polarity - Or Being Right About Half of the Time

As I read and learned more about electronics, my parents noted that I began using a new kind of language around my friends consisting of terms like: series heater string, AC/DC, selenium rectifier, half-wave tripler, double insulated chassis, polarized plug and cheater cord. They simply looked at this as some kind of weird phase that I would eventually grow out of. You see, my dad was not particularly electrically inclined; in fact, the one time that I saw him adding one of those scary add-on lampcord extension affairs along one wall in a bedroom he asked me to help. Anyway, I ended up getting electrocuted a little.

In spite of that incident, I was hot to build my first real big voltage circuit! Thankfully, I had a mentor from the sophomore class, an electronics expert, Bob, who would assist me in testing my first project - a simple half-wave 160V power supply. By this time I had procured an old Heath VTVM that would serve as my "eyes into the exciting world of electronics". And yes, by this time I had finally discovered the real source of all electronic components - junked TV's.

Naturally the power supply was built on a pine board. The interconnection technology consisted of galvanized wood screws and washers that served to capture the various wires and component leads. Bob gazed at the board reverently. I am sure he was moved by the elegant layout.



The Widow Maker 50C5

"Nothing interesting happened within the first half second or so of plugging the device in."

Not much to look at really, the supply consisted of a crispy rubber lamp cord, a pretty blue selenium rectifier, a 20 Watt sand resistor and a couple of dented capacitors, all stolen from a wayward Dumont. My picnic table turned electronics bench, located in a spare bedroom, was not wired for AC at picnic level, so the power supply would have to be plugged into the floor outlet under the table. Of course, I would be performing this critical function while Bob was holding the VTVM leads on the output screws (and looking for the 160VDC). Nothing interesting happened within the first half second or so of plugging the device in. Bob noted that the meter is somehow moving down past zero just before the explosion. Frankly, I do not think either one of us was prepared for the worst case scenario that followed. The electrolytic capacitor had literally blown its top into Bob's belly (no serious effect in itself) with a shotgun like pop. The entire room (including most of Bob) was instantly covered with strips of hot waxy aluminum foil and paper. Even though kiln dried pine is a good fuel, no actual fire ensued. Certainly much smoke resulted from the electrolytic bomb, with special regard to the selenium rectifier system that had produced a particularly foul fallout. Like always, significant events like these in the shack normally bring home shortcomings in our understanding and help us to grasp the basic concepts more quickly. The primary concept here of course was one of POLARITY, not to mention safety features - (the lack of) fuses, switches and safety gear like a fire extinguisher.

ALL American Five AC/DC Supply

I have included as a representative circuit a simple half wave supply using a 35W4 as commonly employed in the miniature tube version of the All American Five. When loaded by the radio's circuitry, about 135VDC is available for the 50C5 power amplifier and the better filtered 110VDC handles everything else. The heaters, which require 150 milliamperes of current, are series con-

continued next page

nected across the 120V line. Note that these supplies truly are AC/DC, that is, 120 volts either from the AC line or 120VDC from batteries or some other DC source (such as a generator or dynamotor) can be utilized. If an external 120VDC supply is actually used, the radio will be operating on about 20 volts less than the voltage produced by the internal supply running on AC. This voltage reduction seems to be generally tolerable within the design parameters of these radios. Certainly the series string filaments do not care whether AC or DC is heating them. Note that the 35W4 has a tapped filament that allows a #47 lamp to be powered as an on/off indicator under normal operation. For greater than 60 mA current drain, a resistor will normally need to be shunted across the lamp.

In AC/DC series heater strings, it is customary to place the 35W4 and 50C5 at the highest AC potential position in the string. This is because the 35W4 and 50C5 tubes are designed to have much higher heater-cathode DC voltage rating than the 12 volt tubes. The high end of the string is also the best place to install any voltage dropping resistors, if required. The low end of the string (ground position) is normally reserved for low level devices like the 12AV6 detector/audio preamplifier tube since less heater to cathode potential usually yields less heater to cathode impressed hum. Hint: Also keep oscillators (in particular, VFO'S) towards the low end of the string. Solid state (selenium rectifier and later silicon) versions of this basic supply really caught on in the late sixties and proved to be somewhat better in terms of voltage regulation and available current than the older 35Z5 and 35W4 circuits.

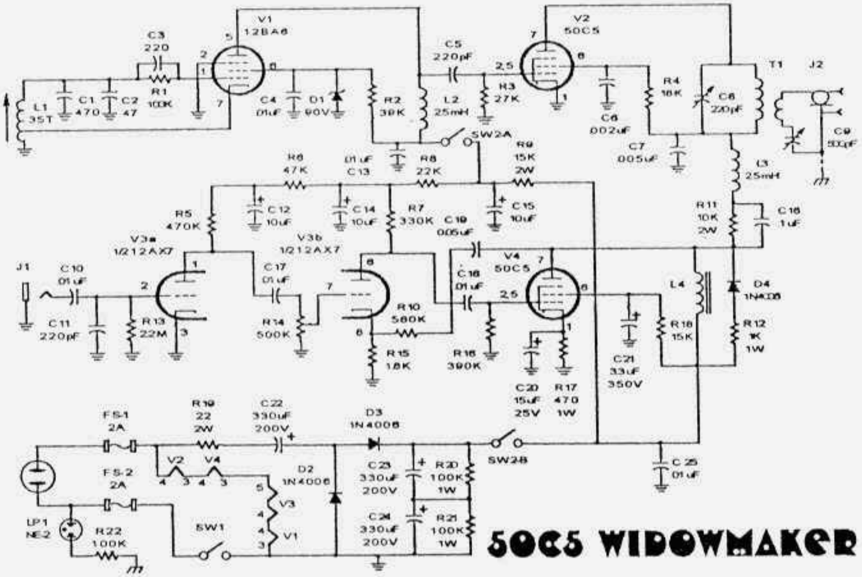
"Remember ... THIS ANIMAL CAN BE DANGEROUS."

The Last Command Set

An old, and somewhat evil, practice is to use a supply of this nature to power an ordinary ARC-5 or SCR-274N series Command receiver in a transformerless fashion. Fortunately, all of the Command set tubes; 12K8, 3/12SK7's, 12SR7 and 12A6 have 150 mA heaters. The filaments are simply rewired from a series-parallel configuration, originally suited for operation from aircraft 24-28VDC, to a conventional series string heater arrangement. The 50 volt deficit can be quite easily handled by including a 330 ohm, 10 watt resistor in the string. This rather warm resistor can be disposed of if the conversion "artist" replaces the 12A6 with a 50L6. Bonus: The high gain of the 50L6 beam power pentode as compared to the 12A6 tetrode is quite pronounced at the low operating voltage of around 120VDC as delivered from our power supply. For "room filling" audio, decrease the 50L6 cathode resistor R21 from 1500 ohms to 150 ohms and replace TI, the 600 ohm headphone output transformer with a small All American Five 8 ohm speaker transformer. Remember... THIS ANIMAL CAN BE DANGEROUS if the line cord has been inadvertently plugged in backwards, since one side of the line is connected essentially to the command receiver's metal chassis. Under these conditions, the case of the command set becomes AC line "hot"; get any part of your anatomy connected across the chassis and any legitimate (or illegitimate) ground return and note the room filling volume as you "call for Watson"! Use a three prong plug and keep it in a "known correct" AC outlet! Or be a sissy, defeat the whole concept, and use an isolation transformer consisting of a couple of filament transformers back to back.

The Widow Maker

The motivation to build this transmitter did not come from amateur radio at all, but rather from the desire to have an AM broadcast band transmitter that would allow me to play nostalgic programming through a couple of antique



50C5 WIDOWMAKER

radios that I owned. My desire was to construct a fairly simple line powered Part 15 transmitter that was similar to the AM broadcaster that I had built (a Graymark Kit) in high school. As a broadcast station running 100 mW input power, the rig performed wonderfully. It bridged the gap between my basement ham shack and the upstairs world. The conversion to 160 meters as described below was a process that occurred some months later when I wanted to see what an AC line powered transmitter could do on a real ham band.

Modulator

Several modulation schemes were considered, but I wanted to keep it simple. The original Graymark kit that inspired me used a kind of series connection of the two 50C5s that was truly "ironless", but the modulation quality of the kit was somewhat distorted. Beyond this series modulation scheme, clamp tube or conventional screen modulation as in ER #77 could be employed successfully. Standard high level plate was however my first choice since it would allow both modulator and final to be operated at the same potential, with the turns ratio setting the correct amount of audio voltage for 100% modulation. An old SCR-522 modulation transformer would be a good choice at this power level. In the end, I did not have a suitable transformer in my junkbox, so I decided to try an old fashioned system, Heising modulation. At this power level, Heising is completely feasible, and it requires only a single choke reactor. This reactor can simply be the primary of an audio output transformer or a high Z power supply choke. The serious downside of Heising is that it is strictly a one to one impedance (and thus voltage) transforming system since the modulator and final are essentially parallel connected. This means that 100% modulation is technically impossible unless the voltage of the final is reduced somehow in respect to the available modulator voltage swing. In the Widow Maker, the required voltage reduction is accomplished with an RC parallel network that is inserted in series with the final amplifier plate lead. I found that in order to get really good

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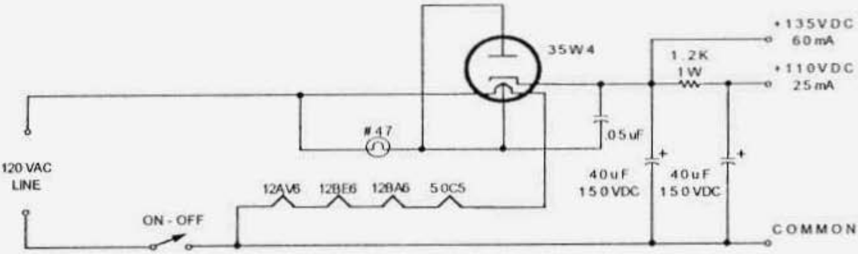
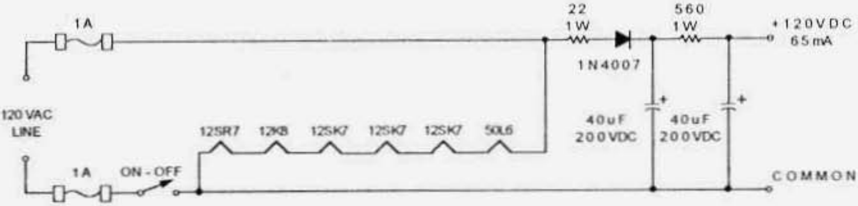


TYPICAL ALL AMERICAN FIVE POWER SUPPLY



COMMAND SET HALF WAVE SUPPLY

upward swing, the network will end up stealing about half of the plate available voltage without modulation.

The very conventional looking 12AX7/50C5 class A modulator has plenty of gain and works with standard dynamic and piezo microphones. A voltage feedback scheme eats some of the excess gain, smooths out the response of the audio choke and lowers the modulator impedance, yielding a surprisingly flat audio quality. Hum can be a problem for any line operated breadboard, so overdo the power supply filtering, shield the low level audio lines and choose coupling capacitors with reasonable values. For more "presence" try inserting a shunt RC network in series with C17 or capacitively shunting some audio around R4, the final screen resistor. Do not forget to check that the audio "polarity" of the microphone is correct and producing an overall upward modulation characteristic with normal speech. Finally, a simple, single diode negative cycle loading circuit (D4, R12) is connected across the modulation reactor that allows some 20% more upward modulation than negative.

"Note the cute neon warning lamp that lights if the line cord is plugged in backwards"

Power Supply

Except for the fact that it can bite its creator, the power supply is even more boring than the modulator circuit. Incidentally, I first tried the transmitter with the more popular two-diode, split-C, full-wave doubler circuit with no apparent consequences but my conscience got the better of me. I felt that such a system, with the AC line neutral not firmly connected to the transmitter ground buss, was probably dangerous. I converted the supply over to a conventional half-wave voltage doubler that resulted in losing some 50 VDC, but otherwise the supply works out fine as long as large enough capacitors are employed. A clean 300 VDC is produced by this supply. Note the cute neon warning lamp that lights if the linecord is plugged in backwards (providing that an AC line ground is connected to the earth connection as shown). With any luck this lamp is noticed before the on/off switch is thrown. This basic half wave supply was stolen from an old Popular Electronics article from the late 60's that featured a 50C5 one tube CW transmitter, likewise built on a board.

To Ground: Or not to Ground?

Is it a good idea to actually seek out a good AC ground and bond it firmly to the common in the transmitter? This in effect makes sure that the fuse or something else will express distaste if the neutral side and hot side are swapped. On the other hand, most tabletop appliances shun ground at all costs, using clever plastic cases, embedded cheater cords and a 100% floating chassis. I personally like the solid grounding approach, but you will notice that on the Widow Maker, the grounds are deliberately separated in order to allow the warning lamp to function. You may choose to bond them together after establishing a non-dangerous phase connection.

RF Lineup - "You won't be QSOing Germany with this rig."

An old fashioned V.F.O. M.O.P.A. approach was taken. The 12BA6 VFO is an electron coupled Hartley with an untuned output. It really is quite good on 160M. The circuit benefits from screen regulation and has a good note. For NBFM, unplug the 12BA6 and plug in a microphonic 12AU6 and speak softly into the tube. My attempt at duplicating the feel of a quality Collins-like PTO definitely fell short. Perhaps it was the rubber fuel hose I used as the pencil shaft to ferrite slug coupler. The pencil I selected, however has a barber pole design on it making zero-beat tuning a visual, if not audible, pleasure. As shown, the rig runs about 5 watts input power for about 2 watts of carrier out. Don't worry about the carrier power level; I was always told that it's the sidebands that count. On any typical winter night, with my 120 ft. inverted L antenna, I have worked (bothered) louder stations from NY to ME.

You Did What?

It's natural to try to improve on circuits like the Widow Maker. Tom, K1JJ built a similar 50C5 rig, but used two in the final, and four in the modulator, with a real modulation transformer. He also used an embarrassingly high plate voltage on the tubes, 300 VDC on the finals and 600 VDC on the modulators! This gets you into the 25-watt class. Just how much voltage will a 50C5 plate take in amateur service? The RCA Receiving Tube Manual lists the 50C5 plate voltage at 150V and screen at 120V and the 50L6 at 200V plate and 125V screen. Most users report that these ratings can be exceeded by a factor of 2 to 3 but you will notice that I was careful with the screens and used dropping resistors anyway. With air, 20-25 watts of CW input power is possible with a 50C5. A 100 watt SSB linear with six 50C5's? - Sure.

With appropriately sized electrolytic capacitors and diode banks, positively frightening "off the line" power supplies can be constructed for RF power amplifier projects and such. Supplies of this type, capable of several hundred volts at the 1 amp level were discussed in Frank Jones classic, CQ VHF Manual.

Finally, consider an experimental grounded cathode, KILOWATT LEVEL linear amplifier built by a local New England ham. The bright idea was to use as many 50C5s as would be required to approximate a direct 50-ohm output impedance with 300 volts on the plates. Lets see; at 300V and 75 mA per tube the plate Z is 4000 ohms. Divide by 50 and it works out to a cool 80 tubes. Of course 600 watts or so will be wasted as filament power. A 120 VAC, 20 amp service seems "just adequate". Gosh ... better use a 220 service. **ER**

5894 Finals in the Globe Champion 300/300A

by Jim Jorgensen, K9RJ
1709 Oxnard
Downers Grove, IL 60516
jandrjor@interaccess.com

The Globe Champion 300/300A is a great AM transmitter. It covers 160 through 10 meters, puts out more power than most other desktop transmitters, and is admired for its robust audio.[1] However, the scarce and expensive AX-9909/6083 finals have posed a problem to many Champion owners. This article describes modification of the Champion to use plentiful and inexpensive 5894 final amplifier tubes instead of the AX-9909.

The 5894 (also called the AX-9903) is a version of the 829B dual tetrode, in an envelope similar to the AX-9909. It has a common cathode, two control grids, a common screen grid, and two plates extending to two plate pins on the top of the glass envelope, as shown in Figure 1. It is a rugged tube that has been used widely in commercial two-way radio and is easy to find at hamfests. I bought several good used 5894's at the 1997 Dayton Hamvention for prices ranging from $1.50 to $7.50 each.

The 5894 uses the same socket as the AX-9909 and has similar ratings when the two halves of the tube are connected in parallel. The plate dissipation is 40 watts CCS (45 watts ICAS) compared to 45 watts for the AX-9909; screen dissipation is identical -- 7 watts In class-C telegraphy, 6 watts in class-C plate-modulated telephony. Typical operating parameters are 250 volts on the screen and about 5 mA grid current for -100 volts grid bias (class C operation), just like the AX-9909. The main difference in the published specs is that the maximum plate voltage for the 5894 is listed as 600-750 volts, compared to 1000 volts for the AX-9909. In spite of this, I find the 5894 to operate reliably in the Champion at a plate voltage of about 1000 volts with no changes in the other operating voltages.

Performing the Modification

Modification of the Champion to use the 5894's is simple and straightforward. I was able to complete the work in about 2-1/2 hours. The sockets must simply be rewired to accommodate the different pin-out and the plate leads must be moved from the socket to the plate pins on the tops of the tubes. The pin assignments for the AX-9909 and 5894 are shown in Figure 2 and given in Table 1.

Table 1. Pin assignments for the AX-9909/6083 and AX-9903/5894 tubes. Pin number 4 is the large diameter pin. The pins are numbered clockwise when viewed from the bottom of the socket.

Pin Number	AX-9909/6083	AX-9903/5894
1	heater	heater
2	control grid	control grid (1)
3	screen grid	screen grid (1 & 2)
4	plate	cathode
5	cathode	heater center tap
6	suppresser grid	control grid (2)
7	heater	heater
plate pins	none	plates (1 & 2)

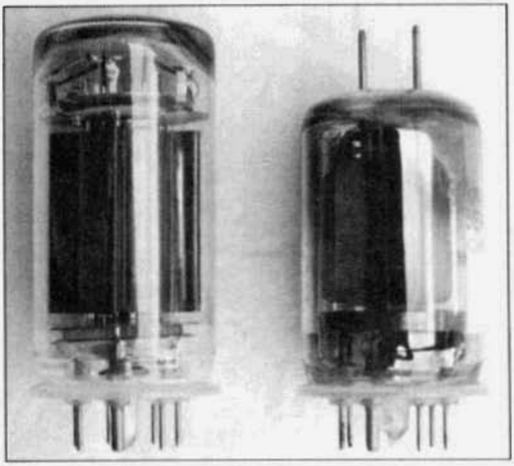


Figure 1. The AX-9909/6083 (left) and AX-9903/5894 (right) tubes.

First, the subchassis on which the finals are mounted must be removed from the main chassis. This is done in the following steps:

1. From the underside of the main chassis, note the color codes of the four insulated wires (heaters, screen, and cathode leads) that extend through a grommet in the chassis. In my Champion 300A, these were (starting at the end of the terminal strip furthest from the panel) black (screen), orange (cathode), and two heavier brown wires (heaters). Unsolder these four insulated wires and the two bare wires (grid leads) that extend through other grommets.

2. From the top of the chassis, unsolder the two parasitic chokes (PS1 & PS2) at the ends connected to the plate choke (RFC6). These chokes will later be mounted extending upward to allow connections to the plate pins of the 5894's.

3. Remove the four sheet metal screws holding the sub chassis and lift it out of the transmitter while gently pulling the wires through the grommets.

Next, rewire the tube sockets using the pin designations given in Figure 2 and Table 1.

4. The heater leads (brown wires to pins 1 and 7), screen grid lead (black wire to pin 3), and control grid leads (bare wires to pin 2 of each socket) stay the same.

5. Disconnect the ground leads on pins 6 and connect pins 6 and 2 (control grids) together on each socket. This puts the control grids of the two sections in parallel.

6. Remove the parasitic chokes connected to pins 4. These chokes will be used later.

7. Remove all wires connected to pins 5 and unsolder the 0.005 mFd ceramic cathode bypass capacitors (C37 & C38) from these pins.

8. Loosen the screws and turn the ground lugs so that the bypass capacitors previously connected to pins 5 (C37 & C38) can be connected to pins 4. Then connect them to pins 4. Don't solder these connections yet.

9. Connect a new cathode wire of the same color (orange) and adequate length to pin 4 of one socket and connect pins 4 of the two sockets together.

Now, reinstall the sub chassis onto the main chassis.

10. Replace the three grommets in the main chassis if they have become brittle with age.

11. Route the four insulated and two bare wires back through the grommets in the main chassis and install the sub chassis using the four sheet metal screws.

12. Resolder the six wires under the chassis in their original locations noted in step No.1.

13. Install two 5894s so that the lengths required for the plate leads can be determined.

14. Shorten the leads of the parasitic chokes (PS1 & PS2) removed in step No. 6 and connect them to the plate choke (RFC6) extending upward towards the plate pins.

15. Connect the parasitic chokes to the plate pins. I used Fahnestock clips

continued on next page

5894 Finals in the Globe Champion 300/300A from previous page

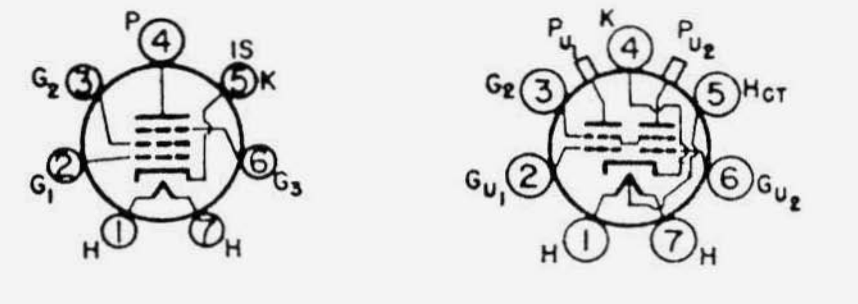


Figure 2. Pin diagrams for the AX-9909/6083 and AX-9903/5894 tubes.

and short lengths of flexible braid to make the connections between the parasitic chokes and the plate pins. A photo of the completed job is shown in Figure 3.

I did not repeat the neutralization of the finals after the modification, but this may be necessary for stable operation at the higher frequencies in some transmitters.

Operation

I find the operation of the transmitter to be unchanged except that the 5894's seem to produce slightly more output power for the same input power. Running 12 mA of grid current and 300 mA of cathode current, at a measured screen voltage of 215 volts (I will comment later on the screen voltage), I obtain 175 watts output into a 50-ohm load measured with a Bird 43 wattmeter. (Note that the "F. PLATE" meter position on the Champion actually reads final cathode current, not plate current.) This is about 10 watts more output than I achieved running a good set of AX-9909's under the same conditions.

Other Common Problems and Improvements

While working with the Champion and talking with friends who own them, I have learned of some common problems and their solutions. In hopes of providing useful ideas to those who like to tinker, I will briefly describe some of these.

Low Output on 160 Meters

Like many other radios of the same era, the Champion was designed for a high impedance load, 300-600 ohms, on 160 meters. This allowed the use of a lower value of plate tuning capacitor and reduced manufacturing costs. However, the efficiency is poor into a 50-ohm load. There are two solutions. One is to use a 4:1 or 9:1 balun between the output of the transmitter and the antenna. The other is to change the tank circuit. The inductance of the 160 meter section of the tank coil (L10, 34 µH) can be reduced until the existing 250-pF plate tuning capacitor (C41) will just resonate on 160 meters at maximum capacitance. I achieved good output using a 160-meter tank coil of 27 turns of #14 enameled wire wound on a T200A-2 toroidal core (15.9 µH), which just resonated at the top of the 160-meter band. Slightly more inductance (about 18 µH) would be required to reach the bottom of the 160 meter band. Alternatively, the 250-pF plate tuning capacitor can be replaced with a 350-pF variable (identical to the loading capacitor, C42) so that the tank Q can be fully optimized. If the transmitter is operated into 50 ohm loads, the loading capacitor does not need a high voltage

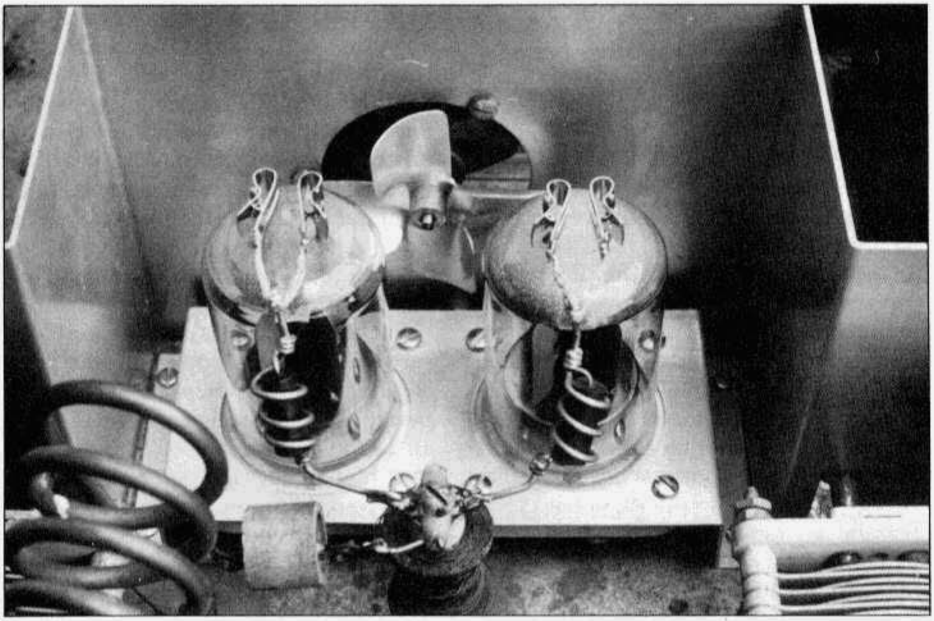


Figure 3. Photo of the completed modification showing the use of short lengths of flexible braid and Fahnestock clips to connect to the plate pins of the 5894's.

rating, as was used in the original design. This suggests the possibility of using the original loading capacitor as a plate tuning capacitor and installing a new loading capacitor with more capacity at a lower voltage rating.

AC Hum in The Audio

A slight AC hum in the audio seems to be more common on the 300A than the 300. I'm not convinced we've found all of the causes, but here are some ideas. Most of the hum pickup seems to be at the input of the 6AU6 mic amplifier. The shielding can be improved by unsoldering one end of R27 which is suspended between the mic connector and the grid (pin 1) of V7, insulating the full length of the resistor and its leads with shrink tubing, and slipping a braided shield, grounded at one end, over the insulation. The grid bias resistor, R28, can also be shielded in a similar way (as was done in the Viking I, which also used a 6AU6 first audio stage). Filtering of the PTT relay power supply can be important. Try increasing the value of the filter capacitor (C65) for the relay power supply from 500 mFd to perhaps 2000 mFd.

The Screen Supply

There are differences in the final screen voltage supply between the 300 and 300A. In both cases, the screen voltage is obtained from the +350-volt supply through a series dropping resistor. In the original 300, the dropping resistor (R49) was 2000 ohms. 0A2 and 0B2 regulator tubes in series to ground established a regulated screen voltage of 258 volts. In the 300A, the series dropping resistor was increased to 5000 ohms and the regulator tubes were replaced with a 20,000 ohm shunt resistor to ground (R50). At a screen current of 32 mA for two tubes (specified in the AX-9909 tube data sheet) the voltage drop across 5000 ohms (R49) is much too high to provide the recommended 250 volts on the screens; the actual screen voltage is closer to 200 volts.

Screen current varies dramatically with operating conditions, such as plate loading. The series screen resistor (R49) should

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Cooling The Drake TR-4

by Gerald C. Lemay, W1ID
238 Milford St.
Manchester, NH 03120-4735

Judging by its frequent appearance at hamfests and in ham ads, the TR-4 must have been one of the most popular transceivers of all time. As a Novice, I spent many enjoyable hours with this rig. When I upgraded my station to the C line of the same parentage, the TR-4 was retired and eventually sold. Last year I had a chance to renew my acquaintance with this fine radio and relive some of my good old Novice days with a TR-4CW/rit. This was the last iteration of the model put out by Drake which had the CW filter, noise blanker, full 10 meter coverage, and last but not least, RIT. For a short period of time it was even offered for sale along with the TR-7.

One of the characteristics of many transmitting equipment designs from that era is that they usually have sweep tube finals, have no provision for forced air-cooling, and consequently get pretty hot. This was not a major concern at the time as sweep tubes were cheap and plentiful. Besides, a fan probably cost more than a set of replacement finals. Times have changed! Drake did provide for a modicum of natural convection cooling, by a perforated area located on the bottom of the case just underneath the final compartment. What supposedly happens is hot air rising on top draws cooler air from the bottom of the case. This system relies on a direct, unimpeded flow of air which the small holes in the case and internal component placements unfortunately prevent. The TR-4 gets so hot that ambient temperature near the case also rises and while the air on the bottom is somewhat cooler than the top, it's still pretty warm. The final tubes generate a lot of heat. Other prime generators of heat are located towards the front of the cabinet near the PTO. In that area, V14 and V17, and power resistors R111 and R112 contribute towards making the TR-4 a real space heater! Efficient cooling is not only important to extend the life of the sweep tubes which as we all know are very hard to find these days, but also for the other components inside the transceiver. Everyone knows frequency stability will also suffer if too much heat is generated and trapped inside the case.

But hold on! That is not necessarily the case with the TR-4. Apparently the Drake engineers did an excellent job of temperature compensation on the PTO. I was all set to replace the RIT components with high quality temperature stable devices and do other various things to the rig until I thought it might be a good idea to collect heat and frequency data on a stock configuration. Having spent a good deal of my career in the measurement and control of temperature, I guess it was only natural that career and hobby would eventually collide and complement each other.

No longer having access to multi-channel chart and data loggers meant I would have to make-do with my meager resources (read: bank account). Consequently, I purchased 3 Platinum 11 Resistance Temperature Detectors (RTD's) from Omega Engineering to supplement the one I already had. Three were anchored at spots previously identified as very hot to the touch and would provide a rudimentary heat profile of the radio. Next, an old breadboard of a design from my temperature measurement days was dug up and checked for operation. Calibration was checked for accuracy and I was in business. RTD #1 was placed inside the PTO enclosure. RTD #2 was located just beneath the inside top cabinet in line with power resistor R111 and R112. RTD #3 was placed inside the final cage between V9 and V10. RTD#4 was left out on the bench, away from the transceiver to measure ambient temperature prior to each measurement. A frequency counter

Table 1, No cooling fan, unmodified TR-4cw/rit

Time hhmm	*Ambient* °F	*PTO* °F	*Final* °F	*Resistors* °F	*V Zener* Volts	*V rit* Volts	*PTO Freq* Hz	ΔF Hz
12:31	76	76	76	76	15.401	6.525	5,251,020	
12:45	76	89	101	118	15.491	6.526	5,251,070	+50
1:30	77	109	109	143	15.560	6.557	5,250,982	-90
2:30	78	112	112	144	15.570	6.559	5,251,049	+70

Table 2, Cooling fan, Dale RH-10's, modified cage

Time hhmm	*Ambient* °F	*PTO* °F	*Final* °F	*Resistors* °F	*V Zener* Volts	*V rit* Volts	*PTO Freq* Hz	*ΔF* Hz
7:36	73	78	83	92	15.401	6.527	5,256,240	
7:50	73	94	92	112	15.521	6.580	5,526,260	+20
8:35	74	110	92	126	15.550	6.590	5,526,150	-90
9:35	74	112	92	133	15.560	6.596	5,526,180	+30

Table 3, Cooling fan, Dale RH-10's, modified cage, 13DE7 removed

Time hhmm	*Ambient* °F	*PTO* °F	*Final* °F	*Resistors* °F	*V Zener* Volts	*V rit* Volts	*PTO Freq* Hz	*ΔF* Hz
7:12	72	78	82	93	15.400	6.527	5,256,252	
7:27	72	92	89	107	15.511	6.572	5,256,258	+6
8:07	72	105	91	116	15.555	6.586	5,256,180	-78
9:07	73	108	91	119	15.560	6.590	5,256,201	+21

was connected to the PTO output in order to verify correlation between temperature rise and frequency drift. A pair of DVM's were also connected to the RIT Zener diode and the arm of the RIT pot. I anticipated the carbon resistors and the Zener itself would drift considerably with the temperature rise and expected these components to adversely affect frequency stability. The attached wiring connections were then routed out of the chassis such that the case could be reassembled to the transceiver. All test equipment, with the exception of the DVM's, was allowed to stabilize for about one hour before proceeding with the experiment.

As can be seen from the data in Table 1, the major heat area while in the idling or receive mode is towards the front of the rig and NOT the final cage. But how much heat buildup would there be in the final cage under simulated transmitting conditions? With the transceiver in the CW mode and keyed at the rate of 5 seconds on and 5 seconds off for a period of one minute the final cage temperature went from 112 to 121 degrees. It probably would have kept on climbing had I persisted for a couple of hours but I like to baby my final tubes! (If anyone out there would like to donate a set of finals, I'd be happy to carry this experiment to its ultimate conclusion!). Frequency drift was well within the claimed specification which is +/- 100 Hz per hour after warm up. My misgivings about the RIT circuit components turned out to be unfounded. Though the circuit itself is unstable, the voltage increase with temperature has the overall effect of canceling PTO frequency drift! Varying the RIT pot to obtain +/- 100 millivolts from center corresponded to -90 Hz and +80 Hz respectively. By the way, the total RIT spread was 6.65 kHz corresponding to a voltage change of 10.2 to 2.878 volts from end-to-end.

Now that I had a baseline, I proceeded with a plan of attack. First, a 3-1/2 inch 12 VDC brushless fan of unknown origin

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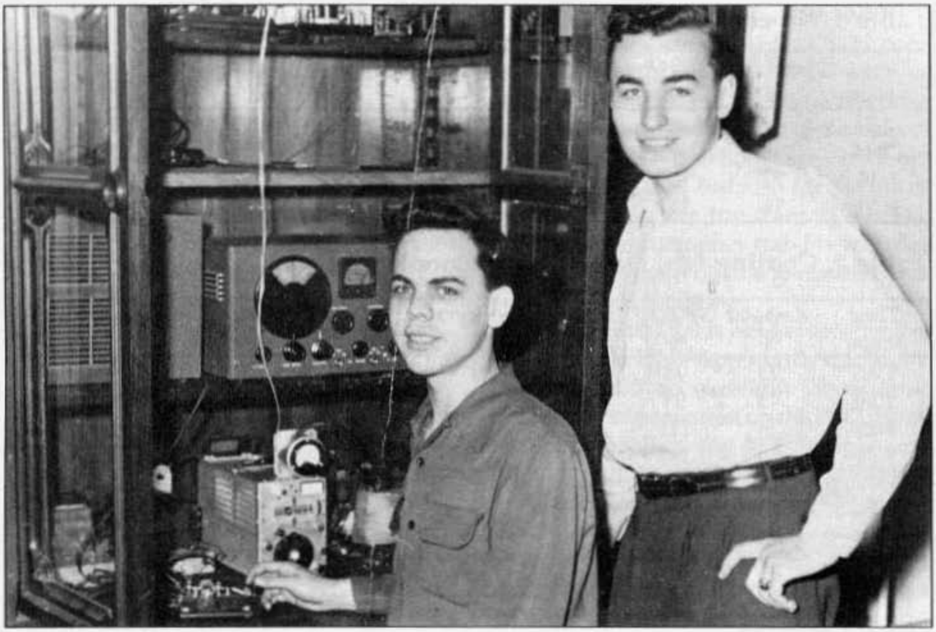
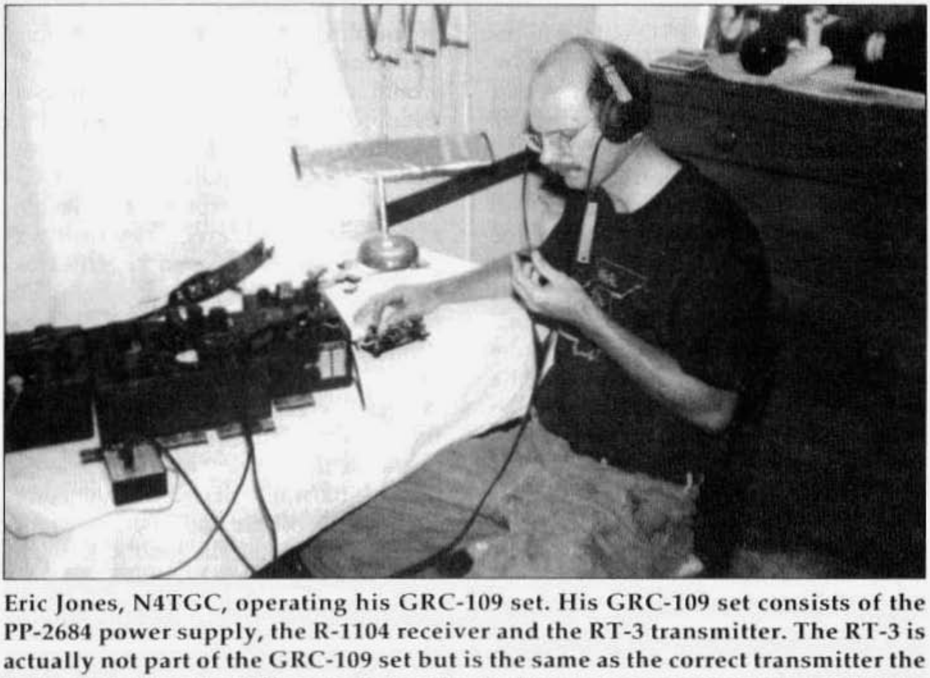
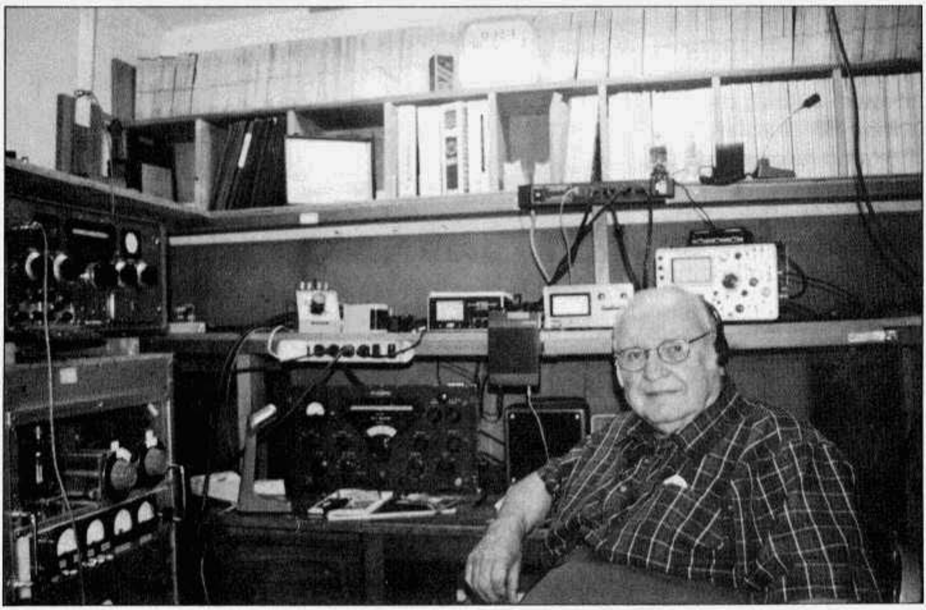


Ron Mayer, W8KYD, on the left with an unidentified highschool pal operating a station located at St. Ignatius Highschool in Cleveland in 1953.



Eric Jones, N4TGC, operating his GRC-109 set. His GRC-109 set consists of the PP-2684 power supply, the R-1104 receiver and the RT-3 transmitter. The RT-3 is actually not part of the GRC-109 set but is the same as the correct transmitter the T-784 with the only difference being that it does not have code burst capability.

Earl Harris, K5FTE, in his vintage-equipped hamshack. His AM station consists of a B&W 5100 and an R-390A. The SSB equipment on the left side is a Drake C with an L4B linear.



Louis W. Erath, W5BM, at his operating position. A CE 100V sits on top of a homebrew linear on the left and his receiver (on the desk) is a Collins 75A-2. He was first licensed in 1938 as W5HTO.

Brian Ryan, NØLES, Silent Key

Brian Ryan, NØLES, died on July 1 in an airplane accident near Munich, Germany. I think most longtime ER readers will remember him for an article "The Russian Connection: military aircraft radios" that he produced for ER #53, September 1993. Although he wrote two or three other good articles for ER, the 'Russian Connection' article was truly outstanding. In this article he managed to combine good technical information, historical perspective and humor. In my opinion this is the most humorous - truly funny - article we have ever printed. I think there's a kind of 'Russian humor' and he captured it perfectly.

I talked with his wife Sally recently and she gave me the following information:

Brian was born in Saint Paul, Minnesota in 1939. He received a Bachelor of Science degree in Electrical Engineering from the University of Minnesota. He served in the U.S. Army in the early '60's where he was stationed in Damstadt, West Germany as an Electronics Specialist. After the military he worked for several defense contractors including - Honeywell, Alliant Tech Systems and, most recently, United Defense.

Brian's first love (after his wife Sally) was flying. He owned a 1948 Navion and attended the annual fly-in at Oshkosh, Wisc. for 27 years straight.

Brian was well known for his extensive collection of radios. His dream was to someday open a military radio museum. It's sad to think that that dream eluded him. N6CSW

VINTAGE NETS

Westcoast AM Net: Meets informally, nightly on 3870 at 9:30 PT. Wednesday at 9:00 PM PT they have their formal AM net which includes a swap session. Net control rotates.

California Early Bird Net: Saturday mornings at 8 AM PST on 3870.

California Vintage SSB Net: Sunday mornings at 8 AM PST on 3835.

Southeast Swap Net: Tuesday nights at 7:30 ET on 3885. Net control is Andy, WA4KCY. 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 3:00 PM PT, 7 days a week and usually goes for about 2 hours. Net control varies with propagation.

Arizona AM Net: Meets Sundays at 3 PM MT on 3855. On 6 meters (50.4) this group meets at 8 PM MT Saturdays.

Colorado Morning Net: An informal group of AM'ers get together on 3876 Monday, Wednesday Friday, Saturday and Sunday mornings at 7AM MT.

DX-60 Net: This net meets on 7290 at 2 PM ET, Sundays. Net control is Jim, N8LUV. 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 Dennis, WA3YXN but sometimes it rotates to other ops. Saturday mornings on 1995 at 0500 ET. Will move to 3885 for summer.

Westcoast Military Radio Collectors Net: Meets Sunday mornings at 0930 local on 3975 + or - QRM, except the 1st Sunday of the month when the net meets at 2130 local. Net control is Tom, WA6OPE.

Grey Hair Net: The oldest (or one of the oldest!- 43+ years) 160-meter AM nets. It meets on Tuesday nights on 1945 at 8:30 PM EST & EDST. Call-up at 8 PM.

Vintage CW Net: For CW ops who enjoy using vintage equipment. This is not a traffic net; speed is not important. The net meets on 14037 Sundays at 7 PM Eastern. Net control is Tracy, WB6TMY.

Vintage SSB Net: Net control is Andy, WB0SNF. 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 at 0100Z Tuesday nights on 3805 and on Thursday nights on 3875.

Collins Swap and Shop Net: Meets every Tuesday at 8PM EST on 3955. Net control is Ed, WA3AMJ.

Drake Users Net: Another relatively new net. This group gets together on 3865 Saturday nights at 8 PM ET. Net controls are Criss, KB8IZX; Don, WZ8O; Rob, KE3EE and Huey, KD3UI.

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.

JA AM Net: 14.190 at 0100 UTC, Saturdays and Sundays. Stan Tajima, JA1DNQ is net control.

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 California Sunday Morning 6 Meter AM Net: 10 AM Sundays on 50.4. Net control is Will, AA6DD.

Westcoast 40-Meter Sunday Net: Net control varies. The group meets on 7160 starting at 4PM PT.

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. For hams who enjoy using AM, restoring and operating.

Midwest Classic Radio Net: Saturday mornings on 3885 at 8AM Central time. Only AM checkins allowed. Swap/sale, hamfest info and technical help are frequent topics.

Boatanchors CW Group: Meets nightly at 0200Z on 3579.5 Mhz (7050 alternate). Listen for stations calling "CQ BA" or signing "BA" after their callsigns.

Nets that are underlined are new or have changed times or frequency since the last issue.

The Knight Kit T-150

by Jim Hanlon, W8KGI
PO Box 581
Sandia Park, NM 87047

Funny things happen at a swap meet sometimes. I can't recall the last time I'd seen a Knight T-150 before - if ever. But at the spring swap meet in Albuquerque this year there were two of them! One was being offered by a guy who had apparently been told that classic ham rigs are highly sought after antiques, and he had his stuff priced accordingly. The other was on the tailgate of a hamfest veteran who was trying to prune his collection, and who had also gotten there before me and found an HRO-60 with three coil sets for all of $60! He definitely needed to make room for his new acquisition. His T-150 was also in arguably better shape, it had a paint blemish but not an extra control and hole in the front panel. So I parted with a very reasonable $20 and became the new owner of a Knight T-150A.

The Knight T-150 is a 150 watt CW and (lower power) controlled-carrier AM transmitter brought out as a kit by Allied Radio in 1961. By 1961, the transition from AM to SSB was already moving rapidly. Good SSB gear had been on the market for half a dozen years, and contemporary transmitter offerings included the Hallicrafters HT-32 and HT-37, Collins 32S3, B&W 6100, Heath HX-10 Marauder, Johnson Invader and Invader 2000, and the Hammarlund HX-50. SSB transceivers were already starting to hit the market, in the form of the Drake TR-3, the Hallicrafters SR-150, and the Collins KWM-2.

But this gear was relatively expensive, starting at $335 for Heath's Marauder kit and going as high as $1229 for the wired and tested Johnson Invader 2000. So there was still a lively market for mostly lower power, less expensive CW/AM rigs. And there were, in 1961, still a good number of them, including the Heath DX-60, the Hallicrafters HT-40, the Lafayette Starflite KT-390, all around $80, and moving up in price through the Viking Challenger, $125, the Ameco TX-86K, $130 with power supply, to the top of the line Viking Ranger II and Valiant II kits at $249 and $375 respectively. Only the Ranger and Valiant featured built-in VFO's and high-level plate modulation, and only the Valiant and the Challenger ran more than 90 watts. The rest of the crowd were crystal controlled, ran 60 to 90 watts, and had some type of screen grid/controlled carrier AM modulation.

I'm only reading tea leaves, but it seems to me that the guys at Allied must have seen a potential market niche in that CW/AM bunch and set out to fill it with their T-150.

As I mentioned above, the lower priced popular rigs in that market were kits that cost about $80, crystal controlled, and used either a single 6146 or a TV sweep tube final amplifier with screen modulation, which put them in the 60 to 90 watt CW power range, less on AM phone. You could add a Heath HG-10 VFO for an additional $37.95 which got you up to about $118.

The Knight T-150 moved into this competition offering a pair of 6146's in the final for about double the power output, a built-in VFO like the Ranger, and inexpensive, screen grid, controlled carrier AM modulation like the DX-60 and its fellows. Yet its price was only $119.95, right in the range of the low-

The Knight Kit T-150A, more than just a pretty face.

priced leaders with an added Heath HG-10 VFO. It should have been an obvious favorite! Allied gave it exposure, including showing it on the front cover of their 1963 catalog. But for some reason that I don't really understand, it just didn't catch on.

But enough with the sales speculations, let's have a look at what's inside the T-150. What I'm going to report now relates specifically to my rig, which is a Knight T-150A, the 1963 version. My rig came with its original assembly manual, a T-150 manual, and it has a number of corrections and additions written in that appear to have been copied from an Addendum list, since discarded. Judging from the manual, I would have to say that there are only very minor differences between the two versions.

Circuit-wise, the T-150 doesn't skimp on its RF lineup. It starts out with a 12BY7 Clapp VFO that runs on 160 meters for 80 meter transmitter output, on 80 meters for output from 40 through 10, and on 8 mc for 6 meter output. It is good design practice to have the VFO run on a different, usually subharmonic frequency from the output so that it is not "pulled" by the higher power signal from later stages. A 6CL6 following the VFO runs as a doubler on 80, 40, 20 and 15, a quadrupler on 10, and a doubler on 6. It also runs as a modified Pierce crystal oscillator when the front panel crystal-VFO switch is in the XTAL position. 160 or 80 meter crystals can be used on 80, 80 or 40 meter crystals can be used from 40 through 10, and 8 mc crystals can be used for 6 meters. The 7189 driver stage runs straight through on 80 and 40, doubles on 20, triples on 15, doubles on 10, and triples on 6. The final, a pair of 6146's in parallel, runs straight through on all bands. The final plate tank is a typical, tapped Pi-Network that is rated to match 40 to 600 ohms on all bands. Incidentally, the information about what bands the intermediate stages run on is not mentioned in the instruction manual! I had to find it out for myself with the aid of a Millen grid dip meter running as an absorption wave meter. The manual also says that the VFO runs on 80 for 80 meter

continued next page

The Knight Kit T-150 from previous page
output and on 40 for 40 through 10 meter output, which is wrong as noted above. Finally, the manual says that only 80 meter crystals may be used for 80 meter output and that only 40 meter crystals may be used for 40 through 10. I confirmed that the other crystals would work by trying them out.

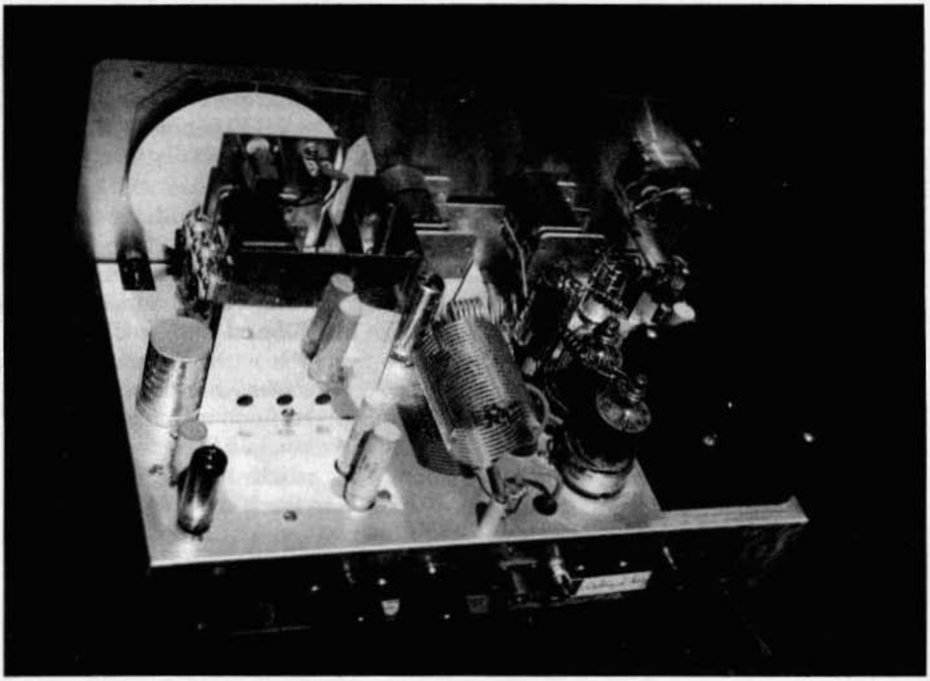
For CW, all of the stages are keyed together in a common cathode line. There is a 2.2K ohm resistor across the key jack and several additional cathode resistors in the VFO, crystal oscillator and buffer multiplier stages. This combination produces 28 volts across the open key in the AM mode and 77 volts in the CW mode, which is enough to cut the oscillator off and to bias the other stages far enough so that they stay within their dissipation ratings. (It's also enough on CW to give its operator a very noticeable bite, so be careful not to put your fingers across the open key of a T-150!) At the same time, there is some load on the power supply at all times, so Knight did not bother to include a power supply bleeder resistor in the T-150.

The modulator in the T-150 is a lot like the modulator in its DX-60 competitor. Crystal mic audio is amplified in both halves of a 12AX7 which in turn drives a 6DR7 controlled carrier screen modulator. The 6DR7 contains a pair of dissimilar triodes. The plate of the lower powered section is directly coupled to the grid of the higher powered section, which runs as a cathode follower. The final screens are driven from the cathode of this second stage. A modulator of this type increases the average output amplitude under modulation, so someone listening to my T-150 will notice his S-meter bouncing upward when I talk.

But "Where's the beef?"

While earlier 150 watters from the 1950's were heavyweights, for example the Viking II at 65 pounds, the DX-100 at 100 pounds, and the 32V3 at 110 pounds, the T-150 weighs only 26.5 pounds! If you open it up, you'll quickly see why. The only hunk of iron inside is the single power transformer; there are no chokes, no modulation transformer, no audio transformers! The final pi-match tuning capacitor, the intermediate stage tuning capacitors and the three section VFO tuning capacitor are all light weight, double bearing jobs derived from broadcast receiver hardware but with double spacing. The pi-match loading capacitor is a two gang "single spacing" broadcast type. The final plate coil in my T-150A is a respectable 2 inch diameter, 20 turn piece of B&W miniductor stock, tapped and progressively shorted by the bandswitch as is typical of just about every rig of this era. There is also a separate, smaller coil for 10 and 6 meters. If I can believe the picture in the manual, the T-150 had a 28 turn main coil and an adjacent smaller coil that was used only on 6 meters. The only shield above the chassis is a light gauge aluminum L-shaped wall surrounding the VFO. It's tied down to the chassis with only two screws and it vibrates freely if I pluck it up near the panel. Even so, there's no sign of microphonics or frequency bounce when I hit the outside of the cabinet with my fist.

Under the chassis, one of the first things I asked myself was, "Where are all those coils for the two intermediate buffer/multiplier stages?" Most rigs and receivers of the era had several banks of coils fastened somehow to the chassis. But in the T-150, the intermediate stage coils are wound around small, moulded forms that look a lot like 1 watt resistors, and they are hanging by their leads from bandswitch terminals and various other tie points. There is one shield under the chassis separating the VFO from the following 6CL6 stage, tied down by one screw into the chassis and tucked under the VFO bandswitch on the front panel. Several wires between the VFO and the following stage



A look inside, "where's the beef?"

just sneak underneath the shield between it and the chassis. This rig is definitely not much for fancy inside! The amazing thing to me is, that with all of this seeming haywire, the intermediate stages are completely stable. There's no hint of parasitic oscillation in the rig no matter how things are tuned. The main reason for this is, I suspect, that the plate coils for the 6CL6 and 7189 intermediate stages are both shunted by oscillation spoiling resistors on 80 and 40 meters where the 7189 runs straight through. On the other bands, both stages are multiplying and as such are much less likely to oscillate on their own. And finally, the 6146's are neutralized and they each have a parasitic suppressing choke in their plate leads making them quite stable.

The power supply components for the T-150 are mostly under the chassis as well. Two silicon diodes are wired in a full-wave voltage doubler circuit which produces both 600 volts for the 6146 plates and 300 volts for the intermediate stages under load. Four 40 microfarad capacitors do an adequate filtering job. Two with one side grounded share a metal can mounted atop the chassis, the other two with both sides hot to ground are paper tubular types mounted below. Even with 34 year old filter capacitors, there is only about a 5% 120 Hz ripple on the CW carrier, and half that on phone where the power supply loading is less. There is an 0A2 150 volt regulator for the VFO plate and 6CL6 screen supply. The power transformer, mounted topside rear beside the 6146's, is relatively simple with only two secondary windings, one for filaments and the other for high voltage, neither of them center tapped. As I think about it, it appears that the designer of the T-150 squeezed an awful lot of function out of the least expensive, off-the-Allied-Radio-shelf, available parts.

Of course, the rear wall of the chassis

continued next page

The Knight Kit T-150 from previous page
is also used. It holds the SO-239 RF output connector, an 8 pin socket arranged to connect to an external, high level, plate modulator, and an 11-pin socket interfacing with other handy power and control circuits inside the rig. There's also a nice big ground screw with a wing nut in case you want to make connection to the chassis.

A Pretty Face

The T-150 is a pretty rig from the front panel. Its color scheme is grey, black and chrome with just a touch of red. Knobs are black with chrome center inserts, a little small but not chintzy looking. The meter and the half moon shaped VFO dial both have white lettering and scales on a black background. The VFO dial is back-lighted. Its somewhat small numbers are not too easy to read with these 59 year old eyes, but I would have loved it in 1961. The crystal socket, formed by two Allied Catalog stock pin jacks appropriately spaced for an FT-243, adds its red circular insulators as a final color accent to the panel.

Across the lower portion of the panel, from right to left, you will find the key jack and crystal socket, the Function switch which includes a VFO spot position, the Xtal/VFO band switch, the Oscillator Tune control, the Band switch (which is quite stiff on my T-150A and was likewise stiff on the other one in the flea market), the Buffer Tune control, the Audio Gain control and the microphone connector. Above these last two is the meter function switch which selects Buffer Grid, Final Grid, Final Plate and Relative Output ranges. The manual directs that the final pi-match be tuned for maximum Relative Output, first on the AM setting where low screen voltage protects the final from heavy dissipation off resonance, and then on the CW setting (if you're operating CW) but without exceeding 250 mA final plate current. Just below the meter is a knurled shaft which sets the Relative Output level. Across the top of the panel, the Final Tune control is beside the meter and the Load Control is between it and the VFO Tuning dial and control. With two intermediate stage tuning controls, the T-150 is not a particularly quick QSY rig, especially when changing bands.

Performance

The proof of any rig is how well it performs on the air. I've had the T-150A tuned up on all bands, and I've made QSO's on CW and phone. CW reports have been T9, with no chirp or click. Even on 10 meters there is no noticeable chirp, a pretty good trick for a rig whose oscillator is keyed. The week before I sent this article to Barry, I snagged UR3IDD in the Ukraine on 40 CW (my rst 569) on the first call! Phone reports from the 75 meter Colorado morning net are that the audio is clear, undistorted, and full. The signal is not up there with the high power boys, but when the band permits it's good quality. My power output measurement capability is not the best in the world, a Radio Shack SWR/Power meter, but my readings show that the T-150 puts out on CW about 80 watts on 80 and 20 meters, 100 watts on 40 meters, and 60 watts on 15 and 10 meters. On phone, the unmodulated carrier is about 13 watts on 80, 40, 20 and 15 meters and 9 watts on 10 meters. The average power output due to the T-150's controlled carrier modulation increases to about 40 watts. On my home NC-303, I see about 6 dB increase in the S-meter under modulation which is roughly consistent with the power measurements. The T-150 also tunes up on 6, but I haven't measured its output there or made any 6 meter QSOs. I'll warn you that it is possible to tune the T-150 up on the 5.25 mHz third harmonic of the VFO in the 80 meter bandswitch position. To avoid that problem, make sure that the final is resonating with its plate tuning capacitor near maximum capacity rather than near 1/3 closed. Also on

80 meters I'm not able to fully load the T-150A into 50 ohms, especially on the lower end of the band. I suspect that Knight pruned a few too many turns from the coil when they changed to the "A" version.

The T-150A, especially warmed up a bit, is acceptably stable, although it is not the "only 200 cycles from 10 to 30 minutes" promised in the manual. I'll caution you that one of the improvements in the T-150A model was to add negative temperature coefficient fixed capacitors in parallel with the VFO fixed padder capacitors on its 160 and 80 meter ranges. So drift on my T-150A may be a bit less than that on the T-150. I made the following measurements starting 1 minute after a cold turn-on by running the transmitter continuously in the AM mode.

On 80 meters, the signal drifted up 80 Hz in the first 1-1/2 minutes and then started drifting downward. The maximum frequency change in the first 5 minutes of operation was 159 Hz. Beyond that, it drifted down between 66 and 50 Hz per minute for the next ten minutes for a net change of 516 Hz. Between 15 and 30 minutes it drifted from 49 to 11 Hz/minute for a net change of 458 Hz. Beyond half an hour, drift did not exceed 20 Hz/minute; from 30 minutes to 1 hour its net change was 278 Hz. From 1 hour to 2 hours, its net change was 95 Hz, all downward.

For 80 meter operation, I'd recommend warming the T-150 up for at least 15 minutes before you put it on the air. It will really settle down after an hour.

On 40 meters, again starting 1 minute after a cold turn-on and running continuously in the AM mode, the signal moved up 73 Hz in first 2 minutes, then started drifting down. The maximum frequency change in the first 5 minutes of operation was 201 Hz. It continued to drift downward between 75 and 40 Hz/minute for the next 8 minutes, for a net change of 454 Hz. Between 13 and 27 minutes, it drifted downward between 31 and 5 Hz/min, moving a total of 315 Hz. After 27 minutes, drift was sometimes up, sometimes down. The net drift from 27 minutes to 1 hour was 65 Hz downward. The drift for the 20, 15 and 10 meter bands would of course be twice, three times, and four times the drift for 40 meters.

So for operation on 40 meters and above, it would be best to warm up the T-150 for 13 minutes before you put it on the air. It will really settle down after 1/2 hour warm up.

After my experience with the decidedly poor calibration of the Knight Kit VFO, I did not have great expectations for good calibration from the T-150. I was very pleasantly surprised to find that VFO frequency was exactly where the dial said it should be at every 100 kHz point in the 80 meter band, except for 3700 kHz where it was 2 kHz low and for 4000 kHz where it was 2 kc high. On 40 meters, it was exact at 7000 and 7400 kHz and 5 kHz high at 7100, 7200 and 7300 kHz. These figures are for the rig as it came to me "right off the tailgate" without any tweaking. The VFO does have three coils, all wound on ceramic, slug-tuned forms and each coil has its own associated padder capacitor. The inductance is adjustable for proper calibration at the lower band edge and the capacitor at the upper edge.

Another very important characteristic for me of any classic transmitter that is to be a keeper is its ability to live with my family television set. You would expect any decent ham transmitter built in the early 60's to have this problem solved, and indeed the T-150 is pretty good. There are a few significant holes in the front panel for the meter and the VFO dial scale, but despite these the T-150 properly installed inside of its cabinet causes no TVI on 80, 40, 20, 15 or 6 meters. On 10 meters, there is a slight crosshatch pattern on channel 2, the

continued next page

The Knight Kit T-150 from previous page
second harmonic. My local VHF channels are 2, 4, 5, 7, 11 and 13. To find a 1963 AM/CW transmitter this clean is pretty decent in my estimation.

Manual Gripes

As I said before when reviewing the Knight Kit VFO, Knight manuals sure aren't up to Heathkit standards! The manual is obviously adequate to get the transmitter successfully put together. But, as I mentioned earlier, it doesn't fully explain the functions of the RF stages, is wrong about the frequency ranges of the VFO, and does not give complete information about crystal frequencies that may be used on the various bands. It also has several bits of erroneous information in the Resistance Chart which lists values to be measured from the various tube pins to ground. In general, the resistance listed for every plate or screen grid pin is much lower than that measured in the actual circuit. My guess is that Knight had originally put bleeder resistors across the high voltage filter capacitors which would lead to resistances to ground on the order of 13K on the low B+ lead and 20K on the high B+ lead. They must have decided when they went into production that the various stages put enough load across the capacitors even with the key up so that no bleeders were necessary, because they sure aren't there either in the transmitter or on the schematic. I do take special care poking around inside this beastie, being careful to short both B+ lines to ground with a clip lead before I inadvertently do it through a more tender portion of my own anatomy! There are also high voltage values scattered around in various places on the schematic diagram. They all seem to be reasonably correct except for the screen grid of the 6CL6 crystal oscillator. There is 39K between that screen and the +150 volt plate of the 0A2 regulator tube, and yet the manual lists the screen voltage as 158 volts! Knight must have written that voltage note before they decided to connect the screen to the +150 supply.

Another gripe I have with the manual is that it has no instructions whatsoever on how to set the audio gain control for proper modulation. The audio stages have plenty of gain for my D-104 and JT-30 crystal mics. I set up the microphone gain control as best I could, looking at the modulation waveform on an oscilloscope. The guys on 75 helped me back off from that point until I sounded "clear, undistorted, and full." For the information of other T-150 owners, my audio gain control is set at 4 for my D-104.

The only other comment, not a gripe, that I have about the manual is on one of the penciled-in notes that says to limit the 6146 final grid current to 2 mA - for two tubes! In my experience that's a bit on the low side, 1.5 to 3 mA per tube being more like what I usually run to 6146's. The note recommends detuning the driver if necessary to reduce the final grid current. On 80 and 40 meters it's just not possible to get the grid current down to 2 mA no matter how far the driver is detuned. But on 20 and above I can get it down that far, and the final plate current and output do not seem to suffer at that level. Now I know why the other T-150 in the flea market had an extra control labeled "drive" added in place of the microphone connector. It was probably a pot to adjust the screen voltage on the 7189 driver tube.

Some Final Thoughts

This T-150, though it works very well, has part of the black paint on the panel damaged by one of those darned sticky labels backed with rubber cement. The acetone in the glue eats most paints used on ham radio gear. Please, guys, be careful not to use those darned labels on our good boatanchors!

As I'm sure you've figured out by now, I am pleasantly surprised by what a nice rig the T-150A turned out to be.

I'm tempted to call it a "poor man's Ranger." It's got more CW output, less phone output but still decent audio quality, a good VFO, and very little TVI. This is definitely one of the under appreciated and under valued rigs on the boatanchor market.

I also owe a thank you to Arthur J. Hinz, the original builder of my T-150A, number 83Y409 308005. Not only did he leave his name on the serial number tag on the rear chassis, but he did a nice job of putting the rig together and making it work. ER

1997 Fall Classic (and Homebrew) Radio Exchange

The Classic Radio Exchange ("CX") is a contest celebrating the older commercial and homebrew equipment that was the pride of our ham shacks and our bands just a few short decades ago. Our object is to encourage restoration, operation and enjoyment of this older equipment. A "Classic Radio" is at least ten years old (age figured from first year of manufacture), but NOT required to participate in the Classic Exchange. YOU MAY USE ANYTHING in the contest, although new gear is a distinct scoring liability. You can still work the "great ones" with your new equipment!

The Classic Exchange will run from 1900 UTC September 28, to 0400 UTC September 29, 1997. Exchange your name, RST, QTH (state/province for US/Canada; country for DX), receiver and transmitter type (homebrew send final amp tube or transistor), and other interesting conversation. The same station may be worked with different equipment combinations on each band and on each mode. CW call "CQ CX," phone call "CQ Classic Exchange." Non-participants may be worked for credit.

Suggested frequencies:
CW: 3.560, 7.060, 14.120, 21.180, 28.240
Novice/Tech Plus: 3.695, 7.120, 21.180, 28.240
Phone: 3.880, 7.290, 14.280, 21.380, 28.320
7.060 and 3.560 tend to be the most popular CX frequencies.

Scoring:

Multiply total QSO's (all bands) by total number of different receivers plus transmitters (transceivers count as both xmtr and rcvr) plus states/provinces/countries worked on each band and mode. Multiply that total by your CX Multiplier, the total years old of all receivers and transmitters used, three QSO's minimum per unit. For transceiver, multiply age by two. If equipment is homebrew, count it as a minimum of 25 years old unless actual construction date or date of its construction article (in the case of a "reproduction") is older:

Total QSO's all bands times RCVRs + XMTRs + states/provinces/countries (total each band and mode separately; add totals together) times CX Multiplier:

SCORE = QSO's x (Rx + Tx + QTH's) x CX Mult

Certificates and appropriate memorabilia are awarded every now and then for the highest score, the longest DX, exotic equipment, best excuses and other unusual achievements. Send logs, comments, anecdotes, pictures to Jim Hanlon, P.O. Box 581, Sandia Park, NM 87047 or to Marty Reynolds, AA4RM, POB 13354, Atlanta, GA 30324. Include TWO-stamp SASE for next CX Newsletter and announcement of next CX.

A 1936 Transmitter

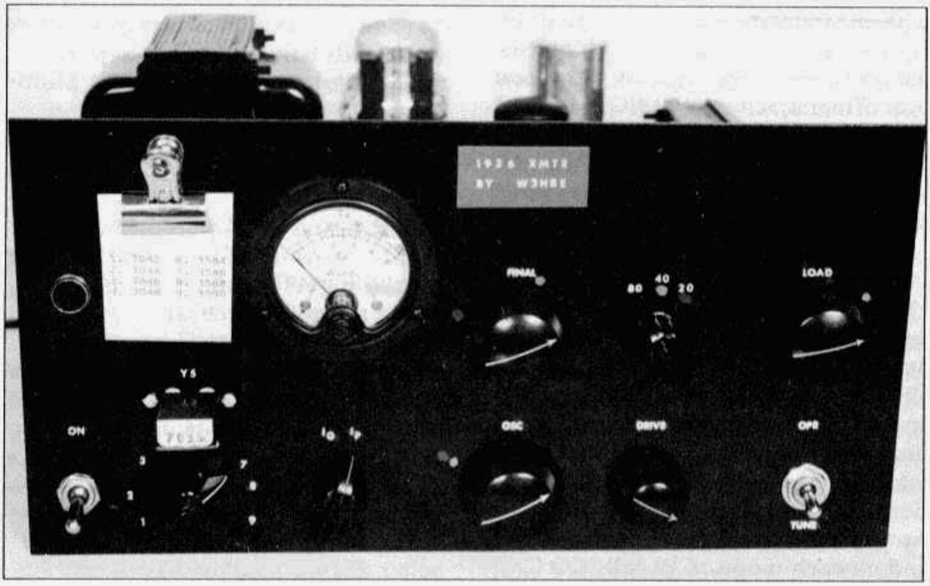
by Bob Dennison, W2HBE
82 Virginia Ave.
Westmont, NJ 08108

Early each year, the Antique Wireless Association, AWA, holds its Old Timer's Contest in which the participants use equipment representative of that in existence before WWII. Typical gear includes SW-3's, HRO'S, homebrew regens and a wide variety of home-made transmitters. In eight of these contests, I employed a 1937 transmitter[1] using a '42 crystal oscillator. Then in 1994, I built a 1939 transmitter[2] using a 6AG7 oscillator and an 807 final. For the 1997 contest, I decided to build a 1936 rig to commemorate the year that I was first licensed.

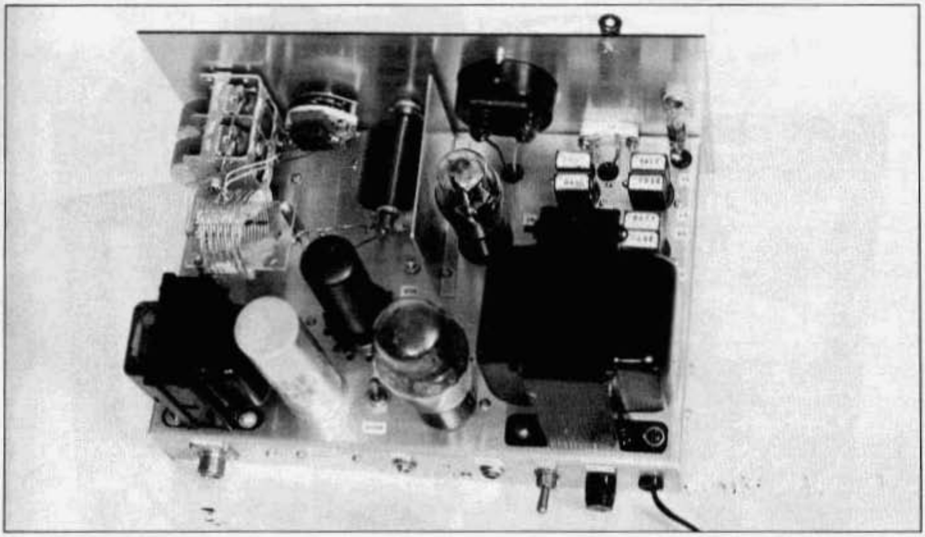
Circuit Details

After studying the 1936 QSTs, I decided that my tube lineup would use a '41 crystal oscillator and a 6L6 amplifier. During breadboard tests, various oscillator circuits were tried. With the Pierce oscillator, crystal current was too high for the small FT-243 crystals already on hand. The pentode connection was much better but it now required a tuned tank circuit. By using a 250 pF oscillator tuning condenser, it was possible to tune both 80 and 40 meters without changing the coil. After the rig was built, the oscillator was changed to the Jones circuit - see Reference 1 for further comments on this circuit.

Goodman[3] stated that the 6L6 should be neutralized if you want a well-behaved amplifier. I chose to use capacitance-bridge neutralization since it is relatively easy to implement when a pi-net output tank is used. Now I know that no one knew about this type of circuit in 1936 but I wasn't about to go back to center-tapped tanks and link coupling! To get near perfect neutralization, it was necessary to add a shield between the grid and plate pins of the 6L6. This shield also isolates the oscillator tank from the amplifier plate circuit. The shield is made from thin tin plate and is supported by soldering it to the ground lug on the terminal strip near



Front View - The '1936' AWA contest rig puts out 15W on three bands.



Top-Rear View - A piece of Lucite is glued inside the tank coil and this is supported by two threaded hex posts.

C5 and to pin 8 of the 6L6 socket - see photo showing bottom view. The shield extends over and to the end of the neutralizing condenser, C6.

The 6L6 tank coil, L2, is made from an old AIR DUX coil, two inches in diameter, wound with No. 16 wire at 12 turns per inch. The coil has 11.75 turns with taps at 4.12 and 6.2 turns from the J2 end.

J3 permits connection to the station SEND-RECEIVE switch. Thus in RECEIVE, the transmitter HV is Off and the '83 mercury vapor rectifier generates no 'hash'. Switch S7 permits local control of the transmitter when it is being tested on the bench.

The power supply uses a power transformer given to me a year ago. I would have preferred one giving 400 volts DC but I used what I had. To secure good regulation, I used an 83 mercury vapor rectifier and a choke-input filter employing a low-resistance swinging choke. The 25K bleeder pulls about 14 mA standby current. At this current, the choke inductance is over 40 Henrys whereas anything over 25H would be sufficient to ensure good regulation.

The filament windings of this power transformer were designed for a heavier load so it was necessary to add R12, R14 and R15. Too high filament voltage shortens tube life and tubes are too scarce and expensive to be wasted. Resistor R12 was made by winding 7' 3" of No. 22E wire on a 1 watt resistor as a former.

The tap on R13 was set to give about 290 volts key down when the final is fully loaded. This occurred with the tap about 0.6 inches from the end of the resistor.

A 0-1 mA meter is used to measure either grid current (5 mA full scale) or plate current (150 mA full scale). The meter resistance plus R10 was made 1000 ohms so that the full scale deflection requires 1 volt. Thus with R7 equal to 250 ohms, full scale grid current represents 5 mA. The plate current shunt resistor, R9, needs to be 6.71 ohms. I used three 22 ohm resistors in parallel and then added another shunt until I got the required resistance.

In order to achieve maximum reliability, there are no paper condensers in the transmitter. All are mica except

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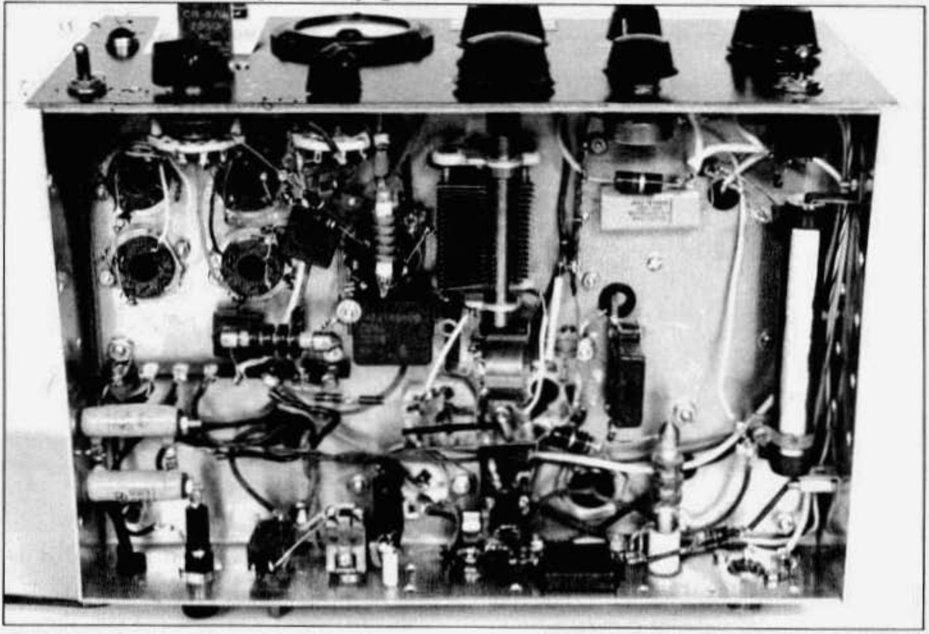


Bottom View - The oscillator coil, L1, is just behind tuning condenser C5. Cathode bypass C8 is below L1.

C16 which is mylar and C17 which is an electrolytic rated at 600 WV. Keying is chirpless and thump-free.

Construction

Inside dimensions of the chassis are 12 X 8 X 2 inches. It is made of .062 inch aluminum. The front panel is made of .08 inch aluminum and measures 12.62 X 6.5 inches. The oscillator tuning condenser, C5, is mounted on the bottom side of the chassis using fiber shoulder washers to insulate it from ground. A bakelite shaft extender (Birnbach 539) extends the shaft out through the panel and eliminates hand-capacity effects.

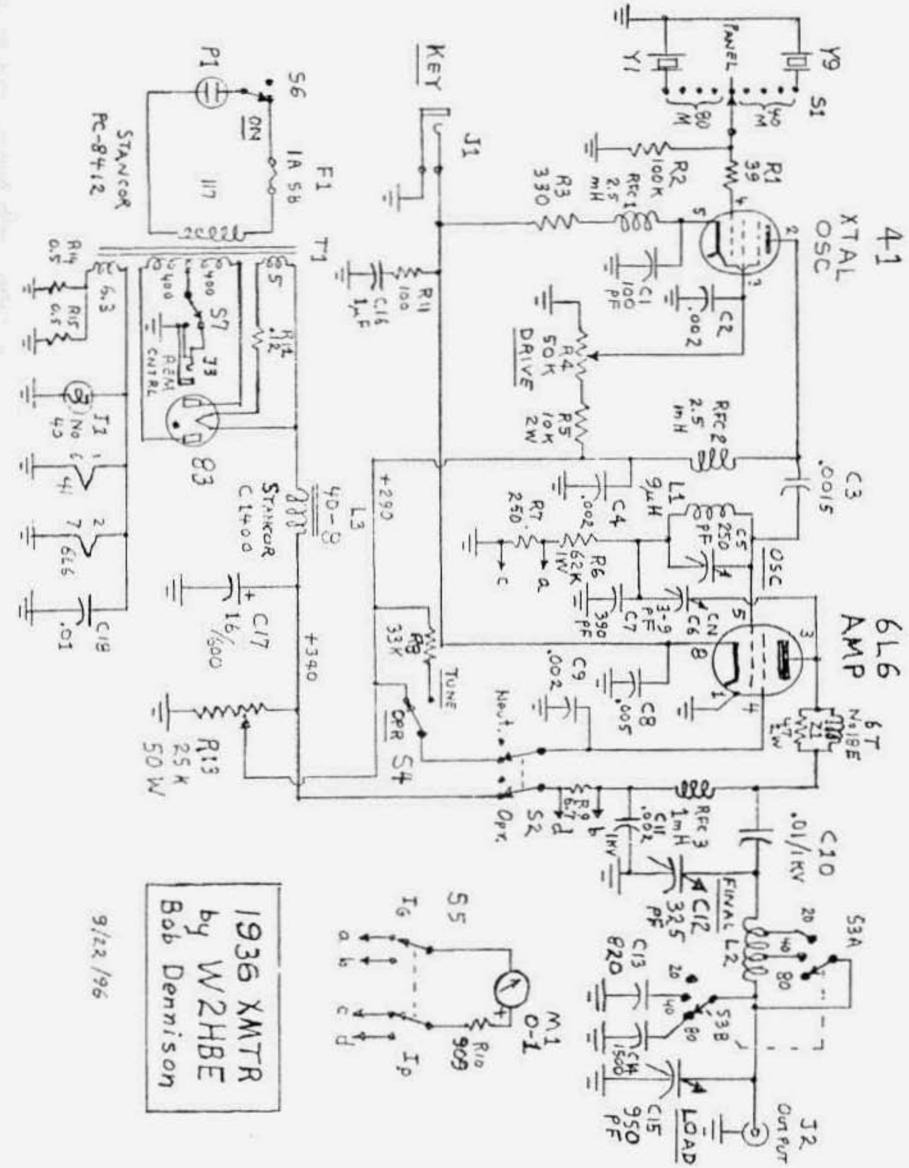
The oscillator tank coil, Ll, consists of 19 turns of No. 24 wire made from B & W stock 3016 (32 TPI, 1" Dia). The 6L6 cathode bypass, C8, is directly below this coil and offered a means of support for Ll. A 1/4" thick piece of Lucite was glued to C8 and Ll was glued to this insulator.

A number of No. 18 holes were drilled around the perimeter of the chassis, above the bleeder, R13, and around the 6L6 tube socket to provide ventilation and assure cool operation.

An aluminum shield 3 inches high and 4 inches long is placed between the oscillator tube and the final tank condenser, C12. It was necessary to rotate the body of C12 about 45° because of this shield.

For safety's sake, I covered the terminals on the back of meter M1. I used Mortite Weatherstrip & Caulking Cord™. This is similar to modelling clay and adheres well and can be shaped to cover the meter terminals and solder lugs. Let this set a day or two, then add red paint.

After all the holes were drilled, the chassis and panel were sanded and then polished with 0000 steel wool. The panel was given three coats of Spray-on 00343 yellow primer sold by Sherman-Williams for use on aluminum and nonferrous metals. Three coats of black semigloss enamel come next. The heads



of the meter mounting screws were painted black. Then both T1 and L3 were cleaned and sprayed with black lacquer. The panel controls were labelled using dry-transfer letters. These were covered with a thin protective layer of Sally Hansen ™ fingernail coating. A one-inch wide paper clamp is mounted between I1 and M1 to hold a piece of file-card stock listing the frequencies of the crystals in current use.

Tune-Up

Check the oscillator and amplifier tank circuits with a grid-dipper to pre-

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20 6AG5s in Parallel

by Bob Friess, N6CM
16141 Matilija Dr.
Los Gatos, CA 95030

Several weeks ago an offer came across the Internet for lots of 200 new in the box 6AG5 vacuum tubes for the unbelievable price of $20.00 including shipping. I'm sure that I was not the only reader of ER that could not resist the bargain and sent off his check for $20.00. A week or so later the box of tubes arrived on my doorstep as promised. By then the thrill of the bargain has somewhat subsided and I began to ask myself what I could do with several lifetime's worth of 6AG5s. As a teenager, surplus tubes made great targets for BB guns and 22 rifles and interesting ammo for slingshots. Those thoughts were quickly rejected as not original enough. I decided that it would be fun to build something unusual. Two criteria were quickly developed. First it had to be fun. Second, it had to use a lot of tubes. It wasn't long before the idea of building a simple transmitter using 20 of the 6AG5s began to develop. The resulting transmitter is described here.

The transmitter is a simple CW design. It uses 2 tubes in parallel as a Colpitts crystal oscillator driving 18 more in parallel as an amplifier. The transmitter operates in the 40 meter band and the power output is about 15 watts.

The filaments are operated directly from the AC line and plate and screen power are derived from a full wave voltage doubler directly operating from the AC line. Both sides of the power supply are isolated from the chassis for safety resulting in the plates operating at about +135 volts and the cathodes at about −135 volts relative to chassis ground. Additional safety precautions were "layered" in by the use of a three-wire cord and a neon lamp to indicate a miswired AC outlet.

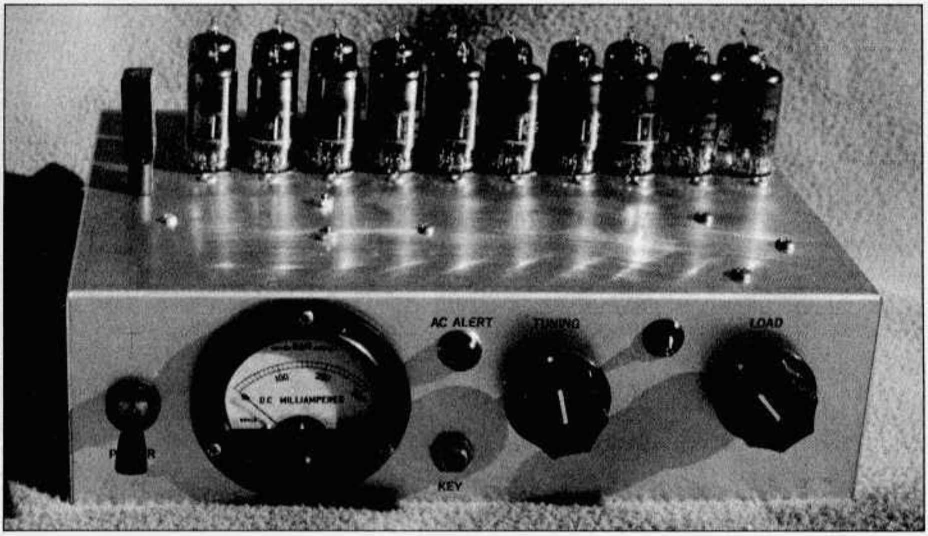
Design of this transmitter was not without its problems. This design is far from the intended use of the tube. Fortunately, the problems were easily identified and modern test equipment and use of devices generally unavailable in the era of vacuum tube transmitters resulted in straightforward solutions to most of them.

Circuit Description

The crystal oscillator is a Colpitts design with the plate tuned to 7 MHz allowing the use of either 3.5 MHz or 7 MHz crystals for 40 meter output. The plate tuned circuit Q is deliberately low allowing the use of fixed components. Plenty of drive is available and it was found that operating the oscillator from the negative supply only was adequate. The oscillator is keyed for CW using a relay from Radio Shack and a 9-volt battery to maintain isolation from the power supply. Other, "more elegant", schemes using high voltage FET transistors with large gate resistances were tried first. In the end, I decided on simplicity and used a relay and battery.

Amplifier

The amplifier is operated class C with a 6.2 volt zener diode in the cathode circuit providing bias to cut off plate current in the absence of drive. Each of the cathodes of the 18 tubes in the amplifier is separately bypassed to chassis ground with a .01 uF disk ceramic and each of the screens is connected to chassis ground at each socket. This results in the screens operating at +135 volts relative to the cathodes. Connecting 18 tubes in parallel resulting in a large amount of control grid to plate capaci-



The 20-tube 6AG5 transmitter.

tance. This is primarily the result of the interconnecting wires rather than the tubes themselves. I measured about 15 pF. This is enough to turn the amplifier into a fine free running oscillator. Fortunately, another relatively modern tool came to the rescue. A broadband ferrite transformer, T1, was used as a phase inverter and neutralizing capacitor Cn allowed the circuit and tube feedback capacitance to be neutralized. Adjustment is easy.

With the transmitter unplugged from the AC line, a signal generator is connected to the output, a scope to the grid line, and Cn is adjusted for a null.

After the amplifier started behaving as an amplifier rather than an oscillator, a new problem was identified. VHF parasitics were present in the output. Ra, Rb and Rc were added along with the series network Cd and Rd. These resistors provide resistive loading at higher frequencies and effectively eliminated the parasitics. A neon lamp was connected to the output circuit as a visual output indicator. One lead of the neon lamp is connected to C1 and the other is insulated and placed near the chassis. Sufficient capacity to ground results to light the neon lamp at normal transmitter output.

Heater Circuit

Initially all 20 heaters were connected in series and operated off the AC line. During early testing several tubes failed with cathode to heater shorts. Examination of the tube specifications indicated a maximum cathode to heater rating of 90 volts. In the way I was using the tubes, the cathode to heater voltage for the tubes near the end of the string reached 135 (the cathode voltage)+ 120x1.414 (the peak AC voltage)=290 volts. Even conservative tube ratings could not deal with that. The heater circuit was modified as shown in the schematic to two series strings in parallel and fed through a diode to eliminate the positive half cycle from the heater supply. Using the diode reduced the RMS heater voltage to the original value by turning the supply off for half of the time. The peak cathode to heater voltage is now 135 volts, still more than 90, but further tube failures were eliminated.

Initial Adjustment

Initial adjustments were made with the transmitter turned off and un-

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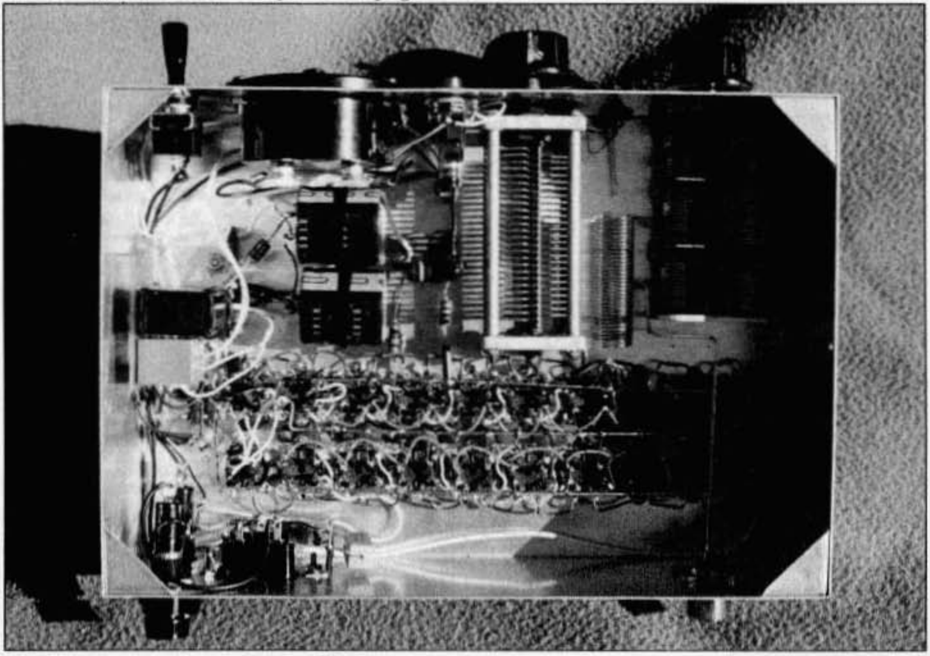

Underchassis view of the 6AG5 transmitter

Parts List

Capacitors in pF except .01 uF 1000V
Inductors in uH
Resistors in ohms

C1 - 220 pF maximum
C2 - 1500 pF maximum
C3, C4 - 220 uF, 200V
Cd - 15 pF, 1000V
Cn - 4-20 pF ceramic trimmer
D1 - 6.2V 1 watt zener diode
Kl - Radio Shack RS275-005
M1 - 0-300 mA
NE1 - Radio Shack 272-712, associated resistor built in
NE2 - Radio Shack 272-1100
Ra, Rd - 47 ohms
Rb - 33 ohms
Rc - 560 ohms
T1 - 32 turns #28 center tapped on Amidon FT50-061 core

plugged from the wall. Only two adjustments are needed, the pi network output circuit and the neutralizing capacitor.

Temporarily connect a 1000 ohm carbon film resistor from the plate circuit to ground. This value represents the desired plate load impedance. Next connect an antenna analyzer, e.g. an MFJ 247, to the output connector and adjust C1 and C2 for minimum VSWR. This adjustment presets the tuning capacitors very close to the optimum settings. Remove the 1000 ohm resistor after making this adjustment. If it is left in place and the power is turned on, it will remove itself in a cloud of smoke. The goal of the neutralizing adjustment is to exactly cancel the effect of the tube and circuit capacitance between the control grid and the plate. This is easily accomplished by injecting a signal into the

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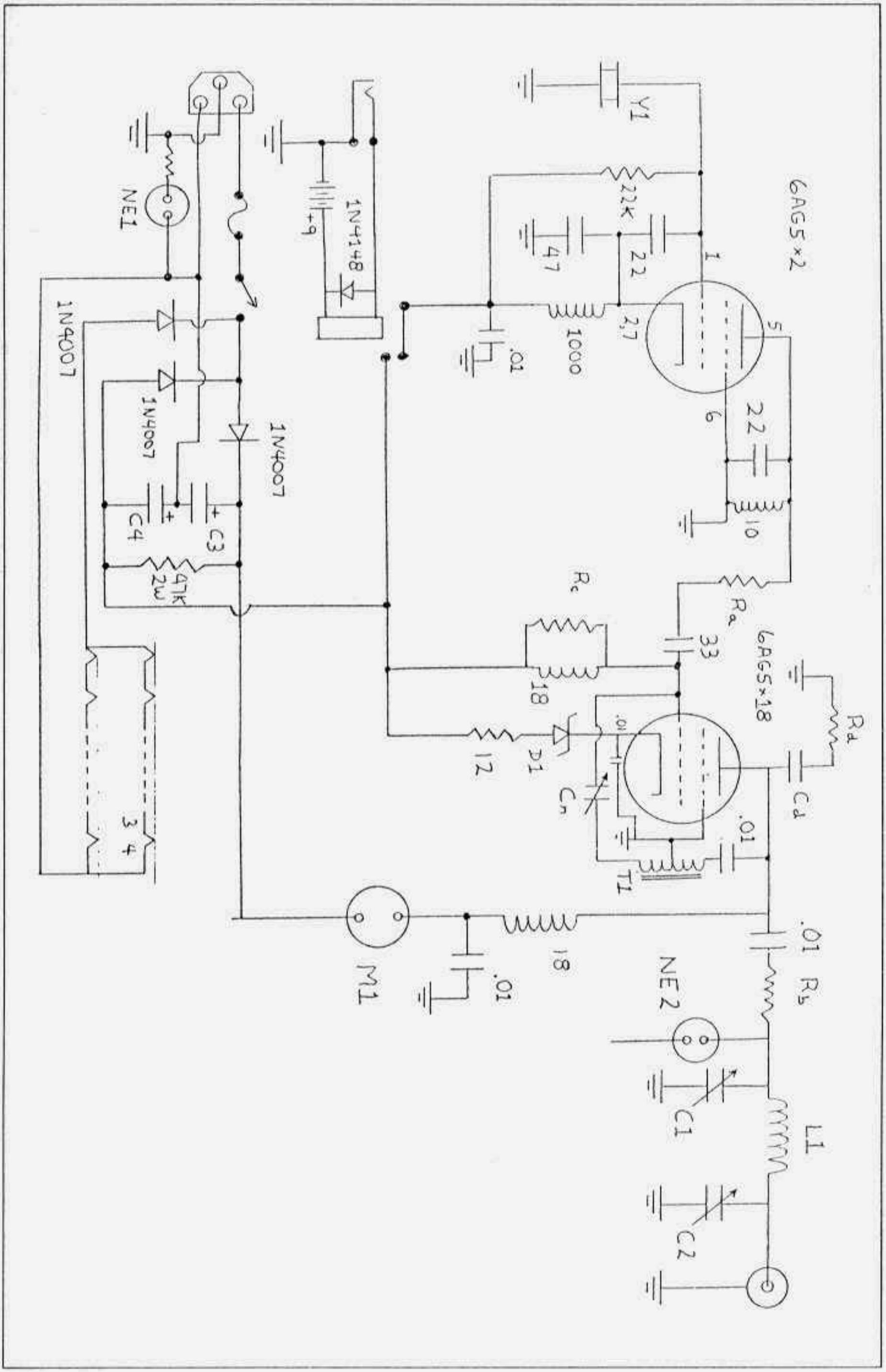
6AG5×2
6AG5×18
Y1
22K
22
47
1
5
6
2.7
1000
.01
10
33
Ra
Rc
Rd
Cd
18
12
D1
Cn
T1
.01
NE2
Rb
C1
L1
C2
M1
1N4148
+9
NE1
1N4007
C3
C4
47K
2W
3
4

be chosen to produce a voltage drop large enough to prevent the maximum screen dissipation (12 watts for two tubes in class-C plate-modulated telephony) from being exceeded under any operating conditions. Operating from a 350-volt supply, this requires a series resistor of at least 2200 ohms (assuming no shunt resistor, R50) with no margin for error such as tube imbalance, changes in the supply voltage, etc. Thus, the choice of a 2000 ohm screen resistor created the risk of exceeding the screen dissipation, leading to tube failure in the original 300. Gas-filled voltage regulator tubes must experience an overvoltage of about 20-30% before they will fire and begin regulating, so they may not provide suitable regulation under all conditions if the value of the screen resistor is too large. Such reasoning probably led to the elimination of the regulator tubes and the larger screen resistor in the 300A.

With the 5894 finals, I experimented with several different screen circuits. Zener diodes, instead of regulator tubes, can be used to set the screen voltage at the recommended value of 250 volts with a series dropping resistor just large enough to prevent the screen dissipation from being exceeded under any conditions. In my 300A I first changed R49 to 2500 ohms, 10 watts, and replaced R50 with a string of ten 25-volt 5-watt zener diodes (1N5360Bs for $0.52 each from Mouser Electronics) in series. By tapping the zener string at 175, 200, 225, and 250 volts, I was able to learn that power output for a given cathode current does not vary much for screen voltages in the 200-250 volt range. In the end, I used a simpler circuit consisting of 2500 ohms for R49 and 20,000 ohms for R50 (with no zener diodes). This gave a screen voltage of about 215 volts with the 5894's loaded to 300 mA cathode current.

Modulator Bias

The modulator bias is set at about 8 volts by using the forward voltage drop of a series stack of selenium rectifiers (SR1 & SR2). I replaced this with an 8.2-volt 5-watt zener diode (1N5344B for $0.52 from Mouser Electronics). At the same time, I replaced the selenium rectifiers in the bias supply and relay supply (SR3 & SR4) with silicon diodes.

Backwards Loading Controls - Error in The Manual

A friend said he couldn't get his Champion 300A to load properly. He was unable to reduce the plate current to acceptable values. The problem was confusion about the operation of the COARSE LOADING switch and FINE LOADING control. Both of these controls operate backwards from most other transmitters; that is, minimum plate current is achieved with both controls in their extreme clockwise positions. These are the correct settings to begin tune up - then, advancing the controls counter-clockwise to increase the plate current. The manual incorrectly states that the COARSE LOADING switch should be in the extreme counter-clockwise position to begin tune up.

Receiver Muting With the Internal Relay

An internal DPDT relay (RLY4) is used to switch the antenna between the receiver and transmitter. The contacts are wired in parallel. With a simple wiring change, one set of contacts can be used to switch the antenna and the other set used to mute the receiver. This eliminates the need for any external relays.

I hope that these ideas are used to put more Globe Champions back on the air. I wish to thank Harry, K7HK, for first suggesting to me the idea of using 5894's; Bill, KD4AF, who has used 5894's in several transmitters including the Champion, for helpful ideas and encouragement; and Bruce, W9QAH, for proofreading this article and adding comments based on his experience with the Champion. **ER**

Reference

1. See the review by Capt. Larry Rau, KF6WV, Electric Radio, No. 83, p. 4.

A 1936 Transmitter from page 31

determine the approximate settings of C5 and C12 for each band. I use 80M crystals for 80M operation and 40M crystals for 40 and 20. While testing the oscillator, you can remove plate and screen voltages from the 6L6 amplifier by throwing switch S2 to the 'Neut' position. With the DRIVE control, R4, at MAX, you should be able to get about 4 mA amplifier grid current. Detune the oscillator, C5, to the high side (less capacitance) till the grid current drops to about 80% of its maximum value. Then turn the DRIVE control down till grid current is about 2.5 mA. Make this test with both 80M and 40M crystals and record or mark the positions of C5. I used a dot of red paint for 80M and yellow for 40M. In passing, I should tell you that in normal use, this transmitter sits on top of a two-drawer metal filing cabinet. Thus when the unit is being tested in my basement lab, I set it on a sheet of aluminum to simulate the effect of the filing cabinet.

The 6L6 amplifier was neutralized on 40M. Leave S2 in the 'Neut' position. Connect a sensitive RF indicator (microammeter and crystal diode - see Handbook for details) to J2 or C15. Depress the key and tune C5 and C12 for maximum indication. Now adjust C6 for minimum RF. Repeat several times. Disconnect the RF indicator and connect a dummy load - a 25 watt unit is sufficient. Now throw S2 to 'OPR' and S4 to 'Tune'. Depress the key and tune the final for minimum plate current. Make sure that the final is tuned to 40M and not a harmonic. Throw S4 to 'OPR' and adjust FINAL (C12) and LOAD (C15) to bring the plate current up to about 75 or 80 mA. Power output should be about 15 watts. Grid current will be about 2.5 mA. Nearly the same power output is obtained on 20M although plate current runs slightly higher - about 84 mA and Ig will be about 2.7 mA. I marked the 20M dial settings with a dot of green paint.

Conclusion

I used this rig in the Feb-Mar '97 AWA Old Timer's Contest and worked 29 AWA members and one fellow who wanted to know more about AWA. All this was on 80M since there didn't seem to be any activity on 40M. I received many 589-599x reports so I am well pleased with this transmitter. No attempt was made to make it TVI proof since I wanted it to look 1936-ish and because it will only be used once a year in the Old Timer's Contest. **ER**

Footnotes

1. A '1937' Transmitter, Bob Dennison, W2HBE, Electric Radio, p. 14, June 1995.
2. The T-807, A Compact 50 Watt Rig, Bob Dennison, W2HBE, Electric Radio, p. 20, April 1994.
3. The 6L6 as Amplifier and Doubler, Byron Goodman, QST, p. 30, Sept. 1936

Crystal Manufacturers from page 3

Premier Crystal Labs Inc NY NY
Quartz Products Co of NY
Radell Corp Indpls Ind.
Radio Specialty Mgf Co
RCA
Ross Mfg
R.S. Mc
S.C. CO
Scientific Radio Prod
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Teli Con
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Turner Company Cedar Rapids Iowa
Union Piezo
Universal Television K.C. MO
Valpey Crystal
Western Electric N.Y.
White Equip Co, Indpls, Ind
Wm.T. Wallace Mfg. Co
Wonder Lite Co W. Orange N.J.

Looking Back from page 2

he would always spend some time with me.

But now we come to the big part of this story. On one occasion, George Hanchett came up to Headquarters and he was closeted for several hours with George Grammer our technical director. I was rather surprised when Grammer called me into his office. As it turned out - he and Hanchett were discussing a replacement for the popular 807 and they asked lowly me what I thought was needed in a tube in the power class of the 807. I was the "Novice" editor so I guess I qualified in some sense. I had been a user of 807s and some of you will remember that I built several Novice rigs using 807s. In fact, at home, my main rig was a 6L6 tri-tet oscillator driving an 807 (with 1000 volts on the plate!) which in turn drove a pair of 810s - I also used primary keying with that rig - think about it - but I was never in a class with Vic Clark who also used a tuned choke and primary keying.

In any case, getting back to Hanchett, I suggested a smaller tube capable of the same power and one that could be used up in VHF and possibly UHF, also easier to drive than the 807, etc., etc. Not that I had much to do with it but the upshot was the 6146. Who in the world would have visualized the popularity of the 6146. There must have been jillions of the things made and still being made!

If one looks back in QST there were literally multitudes of 6146 rigs described - I know I had scores that I designed. I remember quite clearly that one tube 6146 crystal controlled oscillator at 75 watts. It was a nice rig but if the guys did not tune it just so so - pow! Out went the crystal.

I also remember Grammer building a multiband rig using a 6146. The 15 meter band was quite new at the time and when George was tuning up the rig, the 2.5 mH RF choke in the plate circuit of the 6146 blew up. George had me checking choke impedances for weeks after that incident.

Many nice things happened to me after that with George Hanchett. I once got a package at home when I unwrapped it - it had 24 brand new 6146s with a note from Hanchett just telling me to have fun - and I did. I also have a real historical prize in my collection. When the 6146s were in development I got several of the experimental tubes - I still have them, and I am sure they would be real collectable items now.

I like to think that Grammer and Hanchett are sitting up in the great ham shack in the sky - not discussing DX - nor talking about contests - but designing solid state 6146s! **ER**

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20 6AG5s in Parallel from page 34

output connector, the antenna analyzer used in the previous step does a fine job of this, and looking at the signal on the grid line. I used a spectrum analyzer for a detector, but a receiver or a sensitive oscilloscope would work just as well. Adjust Cn for a null at the grid circuit. The null will be quite sharp so a careful adjustment is needed. This completes the initial adjustments, the smoke test is next.

Final Adjustment

Connect a power meter and dummy load to the output connector and insert a key into the key jack and a suitable crystal into the crystal socket. If you haven't already done so, remove the 1000 resistor temporarily installed for initial adjustment of the output circuit. Plug the transmitter into an AC outlet. The neon light NE1 should remain dark. If it lights, the AC wall outlet is not wired correctly and needs to be repaired. Assuming all is well, turn the power switch on and watch for the heaters to light up. After a minute or so, close the key. About 150 milliamps of plate current should be indicated along with about 15 watts of output power.

Minor adjustment of the turning capacitors may improve the output a little. Maximum output as indicated by a wattmeter or the brightness of NE2 and corresponds with a dip in plate current. The dip is not very deep, about 10 mA., when the transmitter loading is adjusted as described.

Conclusions:

What's good about this transmitter?

1. It's a heck of a lot of fun to build and talk about.
2. It uses some of your 6AG5s

What's not so good?

1. It's totally impractical, almost any way of getting 15 watts on 40 meters is easier.
2. Its efficiency is terrible; about 35%.
3. The keyed signal is, at best, no better than T8. The cause for this has not been identified. It is not plate supply ripple, but it may be heater to cathode leakage, those rating are still being exceeded.

What about the other 75 or so tubes?

It might be fun to design a companion receiver to go with this transmitter. I'll have to think about that. **ER**

Cooling the Drake TR-4 from page 15

was installed on the back of the final compartment. It was picked from several junk box items because of its quietness and amount of air it moved. Power was obtained by rectifying some of the filament voltage. Then power resistors R111 and R112 were replaced with Dale RH-10 jobs obtained from Allied Radio. These are high quality power resistors rated at 10W. Encased in aluminum with small heat dissipating fins on the sides and with a flat surface underneath they are ideal for mounting on a chassis or heat sink. I mounted them on the outside of the final cage with number 2 hardware and some oversized washers. Suitable wire jumpers had to be added to the existing wiring to reach the distance. The inside of the final cage was lined with dark colored fish paper except for the side facing the left of the enclosure and top. The idea is to reduce heat reflection and prevent hot air blowing towards the front of the rig. Then the experiment was repeated.

The average results of several trial runs are tabulated in Tables 2 and 3. Notice the significant drop in temperature in the final cage in Table 2. While the data shows idling or receive mode temperatures, typical intermittent transmitting conditions will show similar results. The 5 seconds on/off test conditions previously mentioned showed an average increase of about 8 degrees F for the period of transmitting plus a few seconds thereafter. Certainly adding a fan to cool things down, as is common knowledge is well worth the time. Replacing the stock power resistors didn't have much effect since most of the heat comes from the tubes towards the front of the rig. This is shown in Table 3 where the 13DE7 AM modulator tube was removed in the final experiment. Notice decreased temperature and enhanced frequency stability as a result. If you don't plan on AM operation with your TR-4, removal of this tube is a worthwhile consideration. The biggest surprise of all was the RIT circuit. Incredibly the instability of the Zener diode coupled with carbon resistors helped compensate for some of the PTO frequency drift! And I was ready to replace the Zener with a three terminal regulator and replace the carbon resistors with 1-% metal film types! I was humbled.

So what did I learn from this experiment? I learned to appreciate the integrity of the basic design of the TR-4 and the excellent engineering which was incorporated into it. I kept hoping to find design problems and found none. The TR-4 doesn't have any bugs, it can only be made better, and cooler! **ER**

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FOR SALE: National 183D w/ matching spkr and manual, good to exc condx - $325 + shpg. William Bogart, KA9CWK, 4146 S. Goff Rd. Hillsboro, IN 765-397-3860 bogart@glenmar.com

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FOR SALE: Rare Collins R389/URR rcvr - $975; CV157/URR sideband converter - $250; HQ180C rcvr - $225; HC10 adapter - $50; HRO 50 rcvr - $200; Marconi Canada CSR5A Navy rcvr - $160; RCA RCAF AT12 WW2 xmtr (have 2nd parts set) - $100; NC46 rcvr w/spkr - $130; Meissner signal shifter - $125; Heath HD15 phone patch - $25; Heath HD10 keyer - $25. Larry, VE3RF, Box 509, Ayr, ONT N0B 1E0 Canada (519) 632-7921 eves.

FOR SALE: Repair! Radio repair, tube or solid state, reasonable rates. Jim Rupe, AB7DR, Western Amateur Radio Repair Co., (WARRC), 998 Whipple, Grayland, WA 98547-0697. (360) 267-4011

FOR SALE: Vintage tubes, (833A, VT4C, etc.); assorted radio/wireless telegraph books & magzines, 1880-1935. SASE list. Jan Perkins, 524 Bonita Canyon Way, Brea, CA 92621.

FOR SALE: Collins repair: FCC Licensed Technician, we repair the Collins Gray Line i.e. S-Line, KWM-2/2A etc. & other select models. Merle, W1GZS, FL, (352) 568-1676

FOR SALE/TRADE: Johnson Viking Challenger, US Coast Guard; AN/URC-7, 25W, xtal cont - make offer. **WANTED:** Tuning mechanism for an R-48A/TRC-8 rcvr; manual/schematic for a Allied JR-500S ham rcvr. Bob Kwiatkowski, 103 Wallace Hill Rd., Townsend, MA 01469. (508) 597-6608 kwiar@uicc.com

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FOR SALE: Collector quality Two'er, 9.5 to 10, book, mic, very nice; black S-38B, good condx. Fred Clinger, WA8KJJ, OH, (419) 468-6117 after 6 PM EST.

FOR SALE: New GE boxed 211 tubes - $75; rcvr R23/ARC5, 3 ant. term., 2 shaft drives w/dm - $100. W5WBA, NM, (505) 831-2646 kbaltz@nmol.com

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FOR SALE: Collins 32V3, nice, 70E8A PTO. Jerry, W8EGD, CO, (303) 979-2323.

WANTED: Very early Hallicrafters and Hallicrafters/Silver Marshall equipment including Skyriders with entire front panel dull aluminum color, S-30 radio compass, S-33 Skytrainer, S-35 panadaptor, wood console speakers - R-8 & R-12, HT-2, HT-3, BC-939 antenna tuner, parts, advertising signs, paper memorabilia of Hallicrafters. Also want RCA model AVR-11 airport tower receiver. Chuck Dachis, WD5EOG, "The Hallicrafters Collector", 4500 Russell Dr., Austin, TX 78745. (512) 443-5027

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: WW II Japanese, German, Italian radios & communication equip for display in intelligence museum. LTC William L. Howard, 219 Harborview Ln., Largo, FL 33770. (813) 585-7756

WANTED: JW Miller RF coils, IF trans, chokes. Buying JW Miller & Millen parts, esp. need Miller B-727, B-727C, S-27, 912-C2, 912-C4, 912-C5. WA5THJ, Rt9 Box 163, Alvin, TX 77511. (281) 331-2956.

WANTED: AR-88, CR-88, CR-91 w/manuals, junkers or parts OK. David Boardman, 10 Lemaistre, Sainte-Foy, Quebec G2G 1B4. Canada. (418) 877-1316

WANTED: Collins 310B-3 parts or parts set; need antenna tuner parts & coils; final parts & coils; Browning Labs preselecter; other pre-1950 ham gear. Dean Showatler, WA6PJR, 72 Buckboard Rd., Tijeras, NM 87059. (505) 286-1370

WANTED: Channel alignment indicator ID-292/PRC-6. Lee T. Bird, N7YXW, NV, (702) 575-6705

NOTICE: From Longmont Audio Lab: Due to my pending move to a new QTH, I cannot accept any additional orders for the R-390A Super Audio Chassis until the 1st quarter of 1998, about six months from now. When I can resume my work, my new shipping address will be posted here in ER. Thanks for your patience during this transition period! I'll be looking forward to everyone's continued business at that time. Bill Kleronomos, KDØHG, Longmont Audio Lab, wkleros@longs-peak.org

WANTED: Tubes: Taylor 203Z, Ampex ZB 120, 45, any brand, new or used; National SW-3 first model, 2 volt version, uses 32-32-30 tubes; knobs for SW-3; other pre-1950 ham gear. Dean Showalter, WA6PJR, 72 Buckboard Rd., Tijeras, NM 87059. (505) 286-1370

WANTED: Small size QST binder. RJ Eastwick, N2AWC, 224 Chestnut St., Haddonfield, NJ 08033. (609) 429-2477

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

WANTED: GPR 90, 91, 92; Hallicrafters SX-88; Eddystone rcvr's. James B. Geer, 1013 Overhill, Bedford, TX 76022-7206. (817) 540-4331

WANTED: Old tube amps & xfmr's by Western Electric, UTC, Acro, Peerless, Thordarson, Jensen, JBL, EV, Altec, WE spkr's. Mike Somers, 2432 W. Frago, Chicago, IL 60645. (312) 338-0153

WANTED: CB radio equip. I am looking for all types of old/vintage CB radio, amps, manuals, magazines, mics etc. Walter, CA, (818) 297-7249

WANTED: Valiant II; Swan 600R Custom; Hammarlund SP600-JX21A; TMC GPR-92. Ric, C6ANI, POB N4106, Nassau NP, Bahamas.

WANTED: Mics: Shure 705, CR88, CR80, 520/440, 707A; EV638/641/605; Astatic T-3; parts & elements. Tom Ellis, POB 140093, Dallas, TX 75214. (214) 328-3225, fx 328-4217. 74053.3164@Compuserve.com.

WANTED: Manual/accessories for National FRR-59A rcvr. James Cavan, 6 Timberline, Norfolk, MA 02056. (508) 528-0908

WANTED: Harvey-Wells R-9 rcvr, APS-90 power supply, any accessories for the T-90 Xmiter. Paul, (209) 334-2257, CA, pauls@inreach.com

WANTED: Top dollar paid for Winchester Radios and Winchester related items. Donald, NY, (914) 985-7249, WC2F@webtv.com

WANTED: Set up switch C or S3 part No. 25641A for Sencore tube tester model TC-142 or a parts unit w/a good S3 switch. E.F. Hayes, WØJFN, 3109 N. Douglas Ave, Loveland, CO 80538-2549.

WANTED: Thanks to ER & all who helped find Swan 160X, how about TCU for SW 240, 2 mtr or unusual or parts rig? Eric, KBØXP, 407 Eastern Box 98, Stanton, IA 51573.

WANTED: ASB Antenna switch CJP-14; control box CJP-23; & manual for ASB series radar. Rich, K9RLF, 1140 S. Taylor, Oak Park, IL 60304. (708) 383-4579

WANTED: ARC type 12, C-49, C-56 or similar control units, cables. David Boardman, 10 Lemaistre, Sainte-Foy, Quebec G2G 1B4. (418) 877-1316

WANTED: Broadcast xmtr xfmrs 1 kw plus, mod reactor, plate (4KV); chunky plate sply chokes. John Freeman, W7KBB, 10 S. Wrenn Pl., Jackson Spring, NC 27281. (910) 673-3793

WANTED: Coils for Millen 90651 grid dip meter; meter for URM120; Struthers pwr mtr. Norm, W1CIX, POB 402, W. Bridgewater, MA 02379. (508) 583-8349

FOR SALE: New list -hundreds of manuals, schematics and service information. Send 2-stamp LSASE. David Crowell, KA1EDP, 40 Briarwood Rd., North Scituate, RI 02857-2805. (401) 934-1845

FOR SALE: Join SPAM, the Society for Promotion of AM. Learn about Advanced Modulation Certificate, Circuits - $1 plus large SASE 3 stamps. W4CJL, 202 Baker Dr., Florence, AL 35630.

MESSAGE: Stolen, w/2 duplicate keys out of a private apartment in W Germany, these items of a radio collector. Transistor radios: (1960-1970) 3 Schaub-Lorenz T20, T40, T50; 2 Russian VF 601; 1 Saba; 2 German & English vintage wireless literature. Each item engraved or stamped "W.B.", "W. Brox", "Oberursel". Necessary 10 days to restore each radio! Reward for returning the property & for proofs about the producers of dup keys. Mr. W. Brox, POB 110302, 60038 Frankfurt/M, West Germany.

FOR SALE: Swan ST-1 antenna tuner - $70. **WANTED:** Gonset G-63 rcvr in almost any condx; Drake L-4B amp; Globe/WRL LA-1 amp; black krinkle base Vibroplex bug. Ron, WOOIZ, prefer E-mail, arongv@aol.com or wknights only, KS. (913) 268-5973

FOR SALE: Collins 30L-1 linear & Millen 2KW antenna tuner. SASE for Collins literature list. Bill Mills, 188 Ellis Mill Rd. NE, Milledgeville, GA 31061-9020. (912) 452-2957

FOR SALE: New Collins 500 kHz filters 2.75 kHz wide, plugs into 51J-4 for extra 12 dB gain - $125. Walter M. Chambers, K5OP, POB 241371, Memphis, TN 38124-1371. (901) 761-9381

FOR SALE: Hundreds of books: ARRL; Rad; Lab; RCA, Receiver Design, 2-stamp SASE for list. Charles Brett, 5980 Old Ranch Rd., Colorado Springs, CO 80908. (719) 495-8660

FOR SALE: Galena xtal radios &/or parts to make your own. Len Gardner, 458 Two Mile Creek Rd., Tonawanda, NY 14150. (716) 873-0447

FOR SALE: New Release: Send 2-stamp LSASE for Olde Tyme Radio's latest flyer NO. 197 to: Olde Tyme Radio Co., 2445 Lyttonsville Rd., Ste 317, Silver Spring, MD 20910. Ph/Fax (301) 527-5280

FOR SALE: Ancient (30s - 40s) neons, one watt 110V, size 1-1/4 inch globe - $5 ea, 7.50 for two, etc. Request info. Charles Graham, 4 Fieldwood Dr., Bedford Hills, NY 10507. (914) 666-4523

FOR TRADE: The ultimate Millen collectible: Jims personal QCWA membership pin, W1HRX. Want any Mac Key I don't have. Tom French, "The McElroy Collector", 151 Barton Rd, Stow MA 01775. (508) 562-5573

FOR SALE: Instruments Design A-100 modulation scope (QST 8/65); Hammarlund FS-135-C xtal calibrator (HQ-129X) - $20 each; Yaesu FF-5 LF filter (FRG-7700) - $15. Robert Baumann, 1985 S. Cape Way, Lakewood, CO 80227. (303) 988-2089

WANTED: Anything related to Tecraft & Ameco, cheap stuff only; Tecraft pwr sply & manuals. Bud Fritz, N3SFE, 104 2nd St., Montgomery, PA 17752.

WANTED: Military sets WS #29 Canadian A set; US DAS-2 Loran rcvr-indicator. Leroy Sparks, W6SYC, 924 W. McFadden Ave., Santa Ana, CA 92707-1114. (714) 540-8123

WANTED: Collins R389, 30K-, 310-, 399C-1, KW-1, HF80 i.e. HF8014, 851S-1, Hallicrafters SX-115. Richard, WAØAKG, NE, (402) 464-8682.

WANTED: National HRO or RAS Desktop spkr (black wrinkle); S meter for HRO RX (L40s/E50s), would consider used RX & spkr, etc w/good meter & spkr; Globe Scout 40, 65 or 66; Gonset Monitone; 1931 ARRL Handbook; Philmore Catalog 1958-64; WW2 TCS xtals; BC-456 modulator & shockmount; FT-221 & FT-225 racks; C-30 control; Broadcast Band Crystal Set; Vibroplex bug; & GRC-9 components. Thanks. Greg Greenwood, WB6FZH, POB 1325, Weaverville, CA 96093. (707) 523-9122 message, greg6fzh@aol.com.

WANTED: Info/history on WW2 TCS Radio System for article. Any help appreciated. Thanks. Greg Greenwood, WB6FZH, POB 1325, Weaverville, CA 96093. (707) 523-9122 message, greg6fzh@aol.com.

WANTED: National HRO-60 coils AC, AD; XCU-60-2 calibrator; SOJ-3 select-o-ject; 4H4C current tube; spkrs HRO-60T, 50TS, NC-183TS, NTS-300TS; any parts sets; NC-series. Paul, N3YBO, 2110 E. Lombard St., Baltimore, MD 21231. (410) 327-5895 6-10 EST.

WANTED: Help, any info on pre WW II, National rcvr, RBL-5 (Navy) welcomed. Bill Bowes, N7MOB, 31132 14th Ave. SW, Federal Way, WA 98023. (206) 839-8591

WANTED: NC44, NC45 any version. Paul Dennis, POB 5186, Tucson, AZ 85703. (520) 743-7755. pdennis@rtd.com

WANTED: Huge Navy equipment: shipboard & shore radio, radar, & sonar, mint thru junkers. William Donzelli, 304 S. Chester Ave., Park Ridge, IL 60068. (847) 825-2630, integrat@usr.com

WANTED: Military electronics, RDF, radar, communications, test, manuals, literature, etc. What have you got? William Van Lennep, POB 211, Pepperell, MA 01463. (508) 433-6031

WANTED: Watkins-Johnson or Communications Electronics Inc. info, catalogs, manuals or equipment. Terry O'Laughlin, WB9GVB, P.O. Box 3461, Madison, WI, 53704-0461, 608-244-3135

WANTED: Globe King 500, A, B or C xmtrs, any condx., reasonably priced. Terry Collins, KB9AUP, 18 N. Tomahawk Ave., Tomahawk, WI 54487. (715) 453-3707 d, 453-4633 eves

WANTED: In pristine condx.: Collins 32V3, 75A1, 30S1, 270G-1, 32S3A (RE), 310B3, 30K1, mech filter adapters. Lee, W9VTC, IL, (847) 439-4700 d, 726-1660 eves.

WANTED: Hallicrafters HT-1, HT-9, HT-31, 5-T, SX-11, SX-17, SX-25; Howard rcvrs; Harvey xmtrs. Ken Seymour, KA7OSM, 9115 SW 176th Ave., Beaverton, OR 97007. (503) 306-7439 24 hrs. ken.seymour@attws.com

WANTED: Info/history on WW2 TCS radio system for article. Your help appreciated. Thanks. Greg Greenwood, WB6FZH, Box 1325, Weaverville, CA 96093. greg6fzh@aol.com

WANTED: Cash for Collins: SM-1, 2, 3; 312A-1, 2; 55G-1; 62S-1; 399C-1; 51S-1; 302C-3; KWM-1; KWM-380; also buy estates. Leo, KJ6HI, CA, Ph/Fax (310) 670-6969.

WANTED: Manuals, manuals, manuals for radio-related equipment to buy or swap. Catalog available. Pete Markavage, WA2CWA, 27 Walling St., Sayreville, NJ 08872. (908) 238-8964

WANTED: Broadcast gear, compressors, limiters, old mics, consoles, EQ, tube recorders, thanks! Mike States, Box 81485, Fairbanks, AK 99708. (907) 456-3419 ph/fax.

WANTED: Squires-Sanders SS-1R, SS-1T, SS-1V, SS-1S, see my web page tulsa.oklahoma.net/~wd5jfr. Hank, WD5JFR, OK, (800) 364-4265

WANTED: Manuals for Wilkinson AM 1000B broadcast xmtr & Collins 20V-3 AM xmtr. Dan Mason, RRT1 Box 204F, Santa Fe, NM 87501. (505) 455-3416

WANTED: Instruction book for Gonset 100%R AM modulation monitor. Tom Berry, K9ZVE, 1617 W. Highland, Chicago, IL 60660. (773) 262-0016/262-5360

WANTED: NAVPERS "Radioman 3/2" mid 1950s to early 1960s. Robert Harding, KC5LHR, 1321 Monte Largo Dr. NE, Albuquerque, NM 87112. (505) 291-0950, robert.harding@abq.com

WANTED: Topcover for GF10 xmtr & pwr connector; ID plates for RAL & BC611; manuals Geloso G207DR, G212TR, HW TS90 xmtr. Mel Stoller, K2AOQ, 100 Stockton Ln., Rochester, NY 14625. (716) 671-0776

WANTED: Hallicrafters S-14 Sky Chief, my first radio. Jim, K7BTB, POB 50355, Parks, AZ 86018. (520) 635-2117

WANTED: Small tone knob for Hallicrafters Sky Chief, has 4 finger indentations, black color. Pat Stewart, W7GVC, 1404 Ruth Ave, Walla Walla, WA 99362-3558. (509) 525-1699

WANTED: Narrow based Vibroflex bug, 3 inches or less; McElroy bug; early Collins items. Brian Roberts, K9VKY, 130 Tara Dr., Fombell, PA 16123. (412) 758-2688

WANTED: Globe 755 or 755A VFO. Jim Mackey, KBØWVL, ND, (701) 852-4809

WANTED: Metal case around final tubes in National NCX-5. Marvin Moss, W4UXJ, POB 28601, Atlanta, GA 30358.

WANTED: Copy of spec sheet for Lafayette SWR/PWR meter #99-26411; LS-7 spkr. KA1ZQR, CT, (860) 535-1286.

WANTED: S-meter for Gonset G-76 & 6M Communicator IV. Bob Kerby, POB 991, Waynesboro, VA 22980. (540) 942-4356. w4bld@juno.com

WANTED: Watkins-Johnson freq counter, model DRO309A or 333. Walter Iacobelli, 2147 Harman St., Ridgewood Queens, NY 11385. (718) 456-1988

WANTED: Octal-size plugs 9-pin; octal-size sockets 11-pin; 6 inch Jones connectors 4-pin females; sockets for 813s, 1625s, etc; send SASE for list "U" of tubes, sockets, extenders, air-variable capacitors. Typetronics, Fred Schmidt, N4TT, POB 8873, Ft Lauderdale, FL 33310-8873. (954) 583-1340, fx 583-0777

WANTED: Tube type Clipper for audio input of Viking II commercial or homebrew. John Cohen, 61 Pearl St., Brooklyn, NY 11201. (718) 596-3278 after 7 PM.

WANTED: Triplett model 321T, 3-1/2" dia. round milliammeter, range: 0-15 or 0-25. Willing to pay well for one in good condx. Dan Knipe, W7IGE, 3750 Highgrove Ln., Nampa, ID 83687. (208) 888-9575

WANTED: Teletype 32KSR in running condx; teletype manual 309 vol. 1. Wayne Letourneau, WBØCTE, POB 62, Wannaska, MN 56761.

WANTED: Drake T4XC w/wo AC4 ps, must be clean. Harold Sullivan, KØVR, 15300 Prairie Rd. NW, Andover, MN 55304-2625. (612) 434-3003

WANTED: Noise blanker for KWM-380 (CP/N AC3801). T. Haruyama, JA1OZZ, t_haruyama@atg.mitsumi.co.jp

The Radio Finder©

11803 Priscilla, Plymouth, MI 48170
TEL/FAX 313-454-1890
e-mail: thurtelljh@aol.com

FALL SALE! The Radio Finder will hold a private "as-is" flea market from 9 a.m.-2 p.m. Sunday, October 5 at his warehouse at 975 Arthur, Plymouth. Warehouse is 8/10 mile from the M-14-Sheldon Road exit. Transmitters, receivers, accessories, components. Many items will be marked down for clearance.

SEPTEMBER SPECIALS

AMATEUR TRANSMITTERS: COLLINS KW-1; **GLOBE** King 500-B; **JOHNSON** Invader 2000; Valiant; Thunderbolt; Ranger; Johnson mobile VFO; 32S-1; 30L-1; 516F-2 AC; **HEATH** DX-100; **CENTRAL** 100-V; 200-V; **HALLICRAFTERS** HT-32B; HT-32; HT-37; **MULTI-ELMAC** AF-67; AF-68.

AMATEUR RECEIVERS: COLLINS: Late 75A-4 #,#5,275; 75A-4 # 397; 75A-1; R-388 w/prod det; R-388 stock; 75S-3B; 75S-3; 312B-4 console; S-line speaker; CP-1; 270-G-2/3 speakers; **DRAKE** R-7; **HALLICRAFTERS** SX-88; SX-73; SX-62A; SX-101A; SX-28; SX-17; S-40B; R46/R46B speakers; **HAMMARLUND** SP-200; HQ-170; HQ-129-X; **NATIONAL** HRO-500; HRO-60; NC-300; NC-183; RAO WW II Navy receiver; National speaker; **RME** 69/DB20; **SCOTT** SLR-F "anti-submarine" receiver

MILITARY RECEIVERS: R-390; R-390-A; complete R-391; R-392; **MILTRONIX** R-725, R-390, R-390-A; R-1051E; CEI 354; **WATKINS-JOHNSON** DMS 105A

TRANSCEIVERS: ROCKWELL-COLLINS KWM-380; KWM-1; KWM-2A; 516F-1 AC; 516E-1 DC; **DRAKE** TR-7; **HALLICRAFTERS** SR-150; **HEATH** HW-16; Twoer; **NATIONAL** NCX-1000; **SBE** SB-34; **YAESU** FTDX-560; FT-101-EE accessories: remote VFO, monitor, Landliner, digital readout

FILTERS: CW for 75S-3; 75S-3B/C; 51S-1; 75A-4 -- 6 khz; ; 75A-3 -- 6 khz, 800 hz; Drake R4C -- 250 hz

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NOTICE: Watch Radio Finder web site http://www.radiofinder.com for new listings of old keys and bugs, including a 1920 Vibroplex, an old McElroy and plenty more. Old QSTs, CQs, and Radio magazines now are part of the web catalog plus many old Handbooks and other radio publications.

FOR SALE: Tube list, new & used, wide variety audio, ham. Recently expanded. SASE 52¢. Bill McCombs, WB0WNQ, 10532 Bartlett Ct., Wichita, KS 67212-1212.

FOR SALE: Radiotron Designers Handbook, 3rd ed. - $20; VHF Horizons, 4 issues - $5; CQ 1950 - $8; VHF Amatuer Sept-Dec 1961 - all/$6; RCA RC-14 (1940) Tube Manual - $10; Heath T-3 Signal Tracer - $12. Patrick Marineau, K9HF, 6300 Kingsway Dr., St. Louis, MO 63123.

FOR SALE: WW II communications equip catalog #11 revised, 54 pgs, historical info - $3 US, $5 overseas. Sam Hevener, W8KBF, "The Signal Corps" 3583 Everett Rd., Richfield, OH 44286-9723. (330) 659-3244

FOR SALE: Xtals 7010 kHz, type CR-1, NOS military - $2 ea, quantity pricing available. WA5THJ, Rt 9 Box 163, Alvin, TX 77511. (281) 331-2956

FOR SALE: R-390A's; R-390A parts; RF xtal decks - $75; Audio - $50; IF - $65; pwr splys - $20 & PTOs - $40. Tested & checked. George, K1ANX, MA, (413) 527-4304

FOR SALE: Two NIB 1EP11 oscillocope tubes & one 3BP1-A. Call after 6PM. Gary Peterson, K0CX, 3288 Sandstone Ln., Rapid City, SD 57701. (605) 343-6739

FOR SALE: Collins repair. I specialize in S-line equipment. Reasonable, & work guaranteed. Steve, N6HK, Box 1136, Goleta, CA 93116. (805) 967-7466

FOR SALE: Classic gear - SASE for list. **WANTED:** Vintage rigs. The RadioFinder, Joel Thurtell, 11803 Priscilla, Plymouth, MI 48170. Tel/Fax (313) 454-1890

FOR SALE: Copies: Hard to find schematics for radios, also kit radios 1922-1950; manuals: test equip.,ham gear. Contact me for prices, availability. Duane Ballew, KB7QZK, 6813 152nd St. Ct., NW, Gig Harbor, WA 98332. (206) 851-4505

FOR SALE: Vintage Heath test equip., parts, more! 2-stamp SASE or $1 for list. Jim Miccolis, N2EY, 126 Summit Ave., Upper Darby, PA 19082. (610) 352-5247

FOR SALE: Convert any wattmeter to read PEP! Perfect for AM/SSB - $19.99 ppd for complete kit! HI-RES, 8232 Woodview, Clarkston, MI 48348. (248) 391-6660, hires@rust.net

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/Trade: Tubes, new, used, antique VT-1, VT-2 , 211, 45, 71A, 210, 250, others. Marty, KG7DA, WA, (360) 687-5650.

FOR SALE: Heath HM-102 SWR/pwr meter - $30; Bliley 100KC oscillator - $20; EICO 710 GDO w/ coils, book - $17; 100+ assorted panel meters - $125; 6-30 volt, 30 amp regulated sply - $50; 2" modulation monitor scope foundation - $12; tubes: NOS: 803 - $10; 829B, 1625, 837, 8552/6883 - $4; 4CX-250B - $45; 39/44 - $ .50; used checked good: 829B, 837, 832A, 2E25A, 2E26, 1625, 807 - $2; 872A, 802, 5933, 6159 - $5; 422A(WE), 802, 811A, 803 - $6; 4-65, 4E27 - $10. U-ship. WA7HDL, ID; (208) 756-4147 after 2330Z.

FOR SALE: Hammarlund HX50 exciter - $125; HQ110C rcvr - $125; Heath HW101, HP23 - $125; Yaesu FTDX400 xcvr, needs work - $175. Dave, W1DWZ, MA, (508) 378-3619.

FOR TRADE: (2) new 8122 RCA tubes for (4) 572 tubes in like conds. Smitty, K6ZL, CA, (209) 255-1177.

FOR SALE: New orig. PJ-068 mic plugs for Collins S-line/KWM-2A/HF-380 shp'd in USA - $8 ea. Clint Hancock, KD6H, 6567 Ashfield Ct., San Jose, CA 95120-4502.

FOR SALE: KWM-2 fan bracket - $15 ppd. Dave Ishmael, WA6VVL, 2222 Sycamore Ave., Tustin, CA 92780. (714) 573-0901

FOR SALE: 2152 page MIL-HDBK- 161 of 1959, almost new; over 3700 pg MIL-HDBK, 172 - $200; J-4 filters - $150. Walter Chambers, K5OP, POB 241371, Memphis, TN 38124-1371. (901) 761-9381

FOR SALE: Used 807 tubes, tested OK, guaranteed - $5 ea + $3 priority mail. James T. Schliestett, W4IMQ, POB 93, Cedartown, GA 30125. (770) 748-5968. imq@bellsouth.net

HISTORY: I would like to correspond with anyone who can help provide information on the history of the National NC-100 series & variants. Please write, call or e-mail: Larry Ware, 7436 Fieldcrest Ave., Winter Park, FL 32792. (407) 679-6975, lrware@pipeline.com

FOR SALE: Astatic 513H mic, NIB - $75 shpd; 4-811A's made by GE, NIB - $80 shpd; Collins 637T-1 Adjustable Dipole antenna, box opened but antenna sealed in pouch - $275 shpd; R-390-A, made by EAC, complete w/meters & all filters, copy of manual, works perfect - $400; National HRO-500 rcvr, last lot made (Lot 140), purchased new in 1972, comes w/matching spkr & rack mount, works like new, includes orig manual, bill of sale & factory box - $1750; Collins KWM-2 R/E, 1973 Vintage, (37K serial number), w/Waters rejection tuning, plastic trim ring, PM-2 sply, R/E, CC-2 Suitecase R/E & a 312B-5 VFO/Console W/E , all manuals - $1800. **WANTED:** Hallicrafters TO Keyer in good working conds. Steve, K2WE, NY (914) 693-3669 after 7 PM EDST.

FOR SALE: Rare tubes (unused) all at - $10 ea; (5) type 866A, (4) 814, (1) 705A; EICO high voltage probe for use w/VTVM - $10; Heath spkr, new, HS-24 - $15. Bill Riley, W7EXB, 863 W. 38th Ave., Eugene, OR 97405. (541) 345-2169

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The Collins KWM-2 Video 4 hours
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The Collins KWS-1 Video 2 hours
This video is the perfect companion to the 75A-4 video for owners of the "Gold Dust Twins"! Butch Schartau, KØBS, shows you how to operate, maintain and repair your KWS-1. Watch as Butch goes through the entire alignment and neutralization process, as well as showing you how to properly operate this famous transmitter.
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The Collins 75A-4 Video 4 hours
This video is four hours of information on how to repair, maintain and restore this classic receiver. Butch Schartau, KØBS, guides you through all aspects of keeping your own 75A-4 running like a top.
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R-390A Video 7 hours
Here it is! Long awaited by serious "boatanchor" enthusiasts! The ultimate receiver now has the ultimate video to go along with it. R-390A expert Chuck Rippel, WA4HHG, covers an absolutely incredible array of information in this "heavy duty" video. This video looks at operation, its modules, circuit description, front and rear panel details, complete mechanical and electrical alignment, PTOs, performance evaluation, modifications, troubleshooting and restoration. There is nothing like this video available today, at any price!
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FOR SALE: Drake WH-7 watt meter - $65; Drake TR-4 xcvr, even copper shines, exc - $200; very nice Knight T-150A - $100; Knight Ocean Hopper w/ coils - $125, $100 w/out coils; Collins 4KC filter (75A) - $50; PM-2 pwr sply for parts, works great - $65. Mike, WA6NGF, CA, (209) 568-0345 mornings.

FOR SALE: Collins filter F455FA05 - $200; Rockwell F455FA15 - $200. Ron, K1BW, MA, (413) 538-7861

FOR SALE: Heathkits: AC-1 antenna tuner - $90; AM-1 antenna impedance meter - $35. Shpg extra. Larry Wright, N4QY, 170 Heritage Ln., Salisbury, NC 28147. (704) 633-3881

FOR SALE: Hallicrafters BC-610 xtal in orig box marked the Hallicrafters CO, Chicago, IL, includes order no's etc - $8 shpd US priority; like new Ham Radio Magazine, first issue, March 1968 - $25 shpd US priority. George, K1ANX, MA, (413) 527-4304.

WANTED: National coils, dog house pwr splys & NIB parts. I love National. Sylvia K. Thompson, N1WVJ, 33 Lawton-Foster Rd., Hopkinton, RI 02833. (401) 377-4912

WANTED: Heathkit HW-7, 8, or 9 QRP rig & VF-1 VFO. Jim Clifford, KE4DSP, 108 Bayfield Dr., Brandon, FL 33511. (813) 654-7531. j.c.clifford@juno.com

WANTED: Hallicrafters HT-37 & Central Electronics 100V. Robert Braza, N1PRS, 23 Harvard St., Pawtucket, RI 02860. (401) 723-1603

WANTED: Dial & schemo for RCA model 125 BC/SW cathedral. Frank Coxe, W6LPU, 5112 E. Glen Arran Ln., Orange, CA 92869. (714) 639-9075

WANTED: Knife switches, Leviton, white porcelain base, copper, SPST 1-1/8" X 3-1/8"; SPDT 1-3/8" X 3-7/8". Charles A. Hill, Rt3 Box 400, Buhl, ID 83316. (208) 543-6081

WANTED: Johnson Navigator, to a caring home in Waseca. Doug Knoll, KA9IQA, 1400 4th Circle NE, Waseca, MN 56093. (507) 835-8821

WANTED: Collins 310C-2 VFO. Al, KØAL, IA, (319) 377-4367.

WANTED: Mics: EV638/641/619/719; Astatic JT-30/T-3; Shure 510/520/440/CR80, also connectors. Tom Ellis, Box 140093, Dallas, TX 75214. (214) 328-3225/fax 328-4217. 74053.3164@Compuserve.com

WANTED: Johnson 500 in good or repairable condx. Will pay above average price. Don, K1SDT, TX, (903) 893-5357.

WANTED: Nems Clark radio rcvrs, service & operating manuals, parts, etc, any condx. Chuck Dachis, The Hallicrafter Collector, 4500 Russell Dr., Austin, TX 78745. (512) 443-5027

WANTED: Motorola Mocom 35 VHF xcvrs. Ed, UT, (801) 484-5853.

WANTED: Collins 310B-3 parts or parts set. Need antenna tuner parts & coils, also final parts & coils; Browning labs preselecter; other pre 1950 ham gear. Dean Showalter, WA6PJR, 72 Buckboard Rd., Tijeras, NM 87059. (505) 286-1370

WANTED: Both meters for a Hunter Bandit 2000C amp. **FOR SALE:** Heath sb301, 401, 610, spkr, $275 plus shpg. Mark, AF1Z, FL, af1z@juno.com

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FOR SALE: New EF Johnson CB xcvr tester 250 0718 001 - BO over $85. Walt Bieber, W2UGZ, 563 Hook St., N. Woodmere, NY 11581. (516) 791-2314

FOR SALE: Collins 30L-1, K7RMT mods - $575; SM-3 - BO over $300; F455C-3.1 - $90; Johnson Valiant - $300; 6N2, spare finals - $90; DX-40 - $50; HQ-145X - $200; 811 mod deck, Thoradson 300 watt multi-match 2A3 driver deck - $200; Heath SB-634 console - $125; National spkr - $90. All very good to exc. WANTED: 75A-1/cabinet; Drake TR4-CW. N1MAA, RI, (401) 253-4257. jimru146@aol

FOR SALE: Sprague tel-ohmike cap checker - $60. Al Jenkins, WA1RWB, POB 1162, Nantucket, MA 02554. (508) 325-7122 PM EST

FOR SALE: Heath SB-102, 80-10 xcvr, SP-600, sply, manual, SB630 - $275. Ken Kolthoff, 8967 Scott Dr., DeSoto, KS 66018. (913) 585-1196

FOR SALE: National NC-88, working, very good - $67; NC-88 for parts - $15; Heath IB-2A impedance bridge - $20; Heath QM-1 Q meter - $20. Mervyn Ellsworth, 2309 N. 25th St., Boise, ID 83702. (208) 345-6878

FOR SALE: Racal xmtr type RA371C; all tube, Servo tuned, 1.5 to 30 MHz, 1 KW, beautiful unit in orig cabinet w/telescopic slides & wiring harness, complete w/spares & manuals; also have other Racal equip for sale: RTA191 rcvr; TA83 & TA127 xmtr's, note this equip is very scarce. Call for full details; Millen dip meter 90651, good conds - $65; military automatic antenna tuner CU2351 1.5 to 30 MHz, unused - $600; Tadiran TER100 military RTTY VDU terminal, mint - $200; coaxile dynamics directional wattmeter, very good - $100; Hal ST6000 RTTY demodulator, mint in box - $150; Marconi morse key type 352EZ - $260. Nigel Boyd, K4UGD, 4290 Day Rd., Conyers, GA 30207. (770) 414-0550 w, 922-8546 res.

FOR SALE: HQ-110 - $135; SX-140 - $85; NC109 - $115; NC155 - $165; HRO50 - $295; DX40 - $85; Waters Codax keyer - $95; Millen 92200 KW transmatch - $250; current list - free. Richard Prester, 131 Ridge Rd., W. Milford, NJ 07480. (973) 728-2454

FOR SALE: Hallicrafters HT 32 & SX-101 w/160 meters - $450; Heath HW-16 w/VFO - $150; QST 1932-1994 w/Walter Ash binders - BO; ART-13 w/beautiful 4 foot rack ps w/866 & window - $350; BC-348 w/ps - $175; various broadcaster compressor limiters - $150; (2) Gates STA level compressor limiters, tube type - $150; Symetrix 525 micprocessor - $225; EV RE 20 mic - $175; various parts - call; 4 125A pulled good - $25; 813 - $10. Jeff Garrett, UT, (801) 533-0102, jgarrettabo@949.com

FOR SALE: Turner model 999 high impedance dynamic mic w/stand, good conds - $95 ppd. J. Ekstrom, W1UGX, POB 391, Cabin John, MD 20818. (301) 469-6562

FOR SALE: Collins 500 kHz mechanical filter set, 7 kHz AM, 3.2 kHz USB/LSB, 800 Hz CW, 4/$160; PTI 9 MHz xtal BP filters (#6344), 8 poles, 5 kHz BW, 90 dB ultimate rejection, new - $35. Chase Hern, K4AFW, 104 Glenwood Dr., Williamsburg, VA 23185. (757) 229-7263

FOR SALE: Copy Introduction to SSB - $10. Gary, CA, (714) 552-1068

FOR SALE: Collins mechanical filter plug-in adaptor w/3.1 kHz filter for HRO-60, also same w/1.2 kHz CW filter - $140 ea. Bill Smitherman, KD4AF, 9401 Hwy 67, E. Bend, NC 27018. (910) 699-3699

At Auction: With no reserve, 75S3, 32S3, 30L1, 312B-4, 516F-2, 62S-1, Dentron MT-3000A, all w/manuals; Elmac AF-67; TR-44 rotor, NIB; Heath HO-10 monitor scope, mint; ARRL Handbooks, 1929, 1933, 1938, 1947, 1955; J-38 key; also consigned: NC303 w/all converters & matching spkr; Johnson Ranger; Multi-Elmac AF-68 w/ps & ant relay; 450TH, 450TL, both new. Sept. 20, K.C. Hall, Lexington, NE. 11 AM. For more info: Gary Reiss, WAØJRM, Rt1 Box 141, Wilcox, NE 68982. (308) 995-5541. For consignment updates: http://homepage.usr.com/h/hara

FOR SALE/TRADE: NOS 1625 tubes, JAN Navy - $5, 5/$20. Will trade for spare NOS HV rectifier tubes for Viking II & 807s. John Cohen, NY, (718) 596-3278

HAMFEST NOTICE: Pennsylvania (Newtown) - TRADEFEST '97: Oct. 19; dealer setup 7AM, buyers 8AM. SPR: Penn Wireless Association, Bucks County Community College, Swamp Rd, Newtown, PA. VE'sess, free parking. TI: 145.25/- . ADM: $5. (under 12 free w/adult) Spaces: $10 outdoor, $15 indoor. Tables avail on request - reserve early. Steve, PA, (215) 752-1202. Email to sewall@erols.com or send to PWA TRADEFEST '97, POB L-734, Langhorne, PA 19047.

FOR SALE: Collector quality Navy type number CBY-46108 RAT-1 Command set 13.5-20 mc, only 50 made & 8 known to exist, serial #14, yours for only - $600. Walter M. Chambers, K5OP, POB 241371, Memphis, TN 38124-1371. (901) 761-9381

FOR SALE: Collins 32V2 from orig owner, works exc., pristine conds w/orig manual. No shipping - $600. Ed, UT, (801) 484-5853.

FOR SALE: Jewell Pattern 563 sig gen, battery op, 1930's vintage, rare, very nice conds - $150 + shpg. R. Hummel, 202 Midvale Dr., Marshall, WI 53559. (608) 255-0400

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WANTED

Collins promotional literature, catalogs and manuals for the period 1933-1993. Jim Stitzinger, WA3CEX, 23800 Via Irana, Valencia, CA 91355. (805) 259-2011. FAX (805) 259-3830

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FOR SALE: Collins meatball lapel pin - $5.95 + $.75 S & H. George Pugsley, W6ZZ, 1362 Via Rancho Prky, Escondido, CA 92029.

FOR SALE: Radio & electronics related books, 160 titles, call or write for list. Paul Washa, W0TOK, 4916 Three Points Blvd., Mound, MN 55364-1245. (612) 472-3389

FOR SALE: R-390As complete units, modules, small parts, call & ask, no covers or meters; M/C, Visa,Discover. Howard or Tony, NC, (919) 441-1360. fax 441-7322. 9 AM - 6 PM EST.

FOR SALE: Shack clean-ups, Heath, EICO, Millen, etc., etc. Lge SASE for list. Bob Napoli, K2LGO, Box 158, Riverhead, NY 11901.

WANTED

Vintage AM equipment for personal use. Must be collector quality or mint. Prefer Collins, will consider others. Bob Tapper, K1YJK, 5 Polo Club Dr., Denver, CO 80209-3309. (303) 740-2272, FAX (303) 777-6491

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ASB-5 receiver - $750
J-5A flameproof key - $35
AN/FRR-60 dual diversity receiver, 2 receivers in one large cabinet 47"x30"x72" with 19 inch racks, contain 2 each RF Tuner, Signal Generator, AFC, Multiple SA adaptor, MUX Carrier Generator, Decoder Receiver, Signal Converter; bridging panel with 2 speakers and 2 power supplies for each receiver - $2500

FOR SALE: Command sets - $30; Surplus Schematics Handbook - $25; Surplus Conversion manual, vol. 3 - $35, vol. 1 - $15; Radio Handbook 10, 13 edition - $25 ea; orig Collins manual 62S1 - $35; 51S1 - $40; Fundamentals of SSB, Collins - $65; ARRL Handbook 55, 68 - $25 ea. Gary, MN, (612) 496-3794.

FOR SALE: Heath mobile ps for Two'er or Six'er etc; GP-11 - $20; PM-2 field strengh meter - $20; Swan WM-6200 VHF watt & SWR meter - $75; Collins mobile ps & mount for KWM series - $125; TO keyer Hallicrafter - $70; Heath SB-300 w/AM filter, mint - $125; Heath DX-35 case - $10. Marty, NJ, (609) 466-4519

FOR SALE: BC-611 test set IE-135 - $125; LM-21 w/matching ACPS book - $40; MN-26 radio compass - $30; ARRL Handbooks 55, 68, 95 - $25 ea; MC Jones micromatch coupler - $35. Gary, MN, (612) 496-3794

FOR SALE: 20 or more, NIB, projection bulbs - $5 ea, or all for $50 + $5 shpg; used, tested 807 tubes - $5 ea; a limited number of new RCA & Sylvania 807's - $10 ea + shpg; NIB 4-pin ceramic tube sockets - $3 ea + shpg; white ceramic egg antenna insulators - 50¢ ea + shpg. James Fred, 5355 S. 275 W., Cutler, IN 46920. (765) 268-2214

FOR SALE: Vibroplex keyer - $65; Heath tube checker, mint TC-2 - $50; Drake T-4XB, mint - $175. Marty, NJ, (609) 466-4519.

FOR SALE: Boatanchor paints; Heathkit Tech Journal Subscriptions; phone filters - call or write for free catalog. R&R Designs, 202 Midvale, Marshall, WI 53559. (800) 372-4287

FOR SALE: National SW-5 coils & blueprints, 4 coil sets (total of 8 coils) #10 9-15 meters, #11 14-25 meters, #12 23-41 meters, #14 65-115 meters; 2 original blueprints from Jackson Engineering, Malden, MA covering electrical diagram & pictorial diagram for the SW-5 "Thrill Box". Coils in very good condx, blueprints good but they have been folded. The lot shipped to CONUS address for $120. Al, KØAL, IA, (319) 377-4367.

FOR SALE: New, orig front panels for Hallicrafters SR-150, SR2000, SX-115; various NIB meters for Halli gear. **WANTED:** Parts for NC-173, NC-183, NC-300 & 303, HQ-129X. Bruce, N9KGR, WI, (414) 693-3247

FOR SALE: HT30, may need work, out of service since 1960 - $59 + shpg. Henry Mohr, W3NCX, 1005 W. Wyoming, Allentown, PA 18103.

FOR SALE: Johnson Viking II, VFO 122, KWMB, Hallicrafter SX-71, R-46. **WANTED:** KW twins 599D. Ray, MO, (314) 428-1963.

FOR SALE: National NC109 & NC 190. Noonan, SC, (803) 726-5762.

FOR SALE: Pair new Amperex 6146A - $25; ceramic RF doorknob capacitors type 851 100 pF 15 KV - $3 ea. David McClelland, W3KDD, 5129 Avoca Ave., Ellicott City, MD 21043. (410) 465-3884

FOR SALE: NC-66 - $100; SB-310 - $150; Gonset G-63 - $150. John Keil, 4618 Norwalk St., Union City, CA 94587. (510) 471-4838

FOR SALE: SB101/spkr pwr sply, manual; BC610 mod xfmr; GRC 109 manual. Joe, K2QPR, FL, (407) 220-7362.

FOR SALE: ARRL Handbooks 1970-1976, very good condx., all 7 - $25 + UPS. Howard Hood, 5670 SW 44th St., Port Orchard, WA 98367. (360) 674-2179

FOR SALE: Hallicrafters rcvr SX-111, looks & works great - $200 + shpg. Kevin DiPeri, AA2CB, 324 St. James Ave., Woodbridge, NJ 07095. (908) 855-5453. aa2cb@mindspring.com

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FOR SALE: Bandswitched Globe King 400. This was a special order xmtr from WRL's shop: pwr sply, mod deck, switch panel, 3 RF decks, & antenna tuner at the top, all in a 5-1/2 foot rack. It includes all 6 V70D's & coils for 160, 80 & 40 meters. This Globe King is unique & very rare - $700 PU only. Pictures for those seriously interested. Jim Roseman, W9UD, 2716 W. 3rd St., Coal Valley, IL 61240. (309) 799-7447

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WANTED: Navy xmtrs: TCA, TCE, TCN, TCX, TDE; rcvrs: RAX, RBD, TBM; modulator CAY-50065. Steve Finelli, N3NNG, 37 Stonecroft Dr., Easton, PA 18045 (610) 252-8211

WANTED: Xmtg tube sockets, 813s, etc. Send SASE for list 4 tubes & socket extenders. Typetronics, POB 8873, Ft. Lauderdale, FL 33310-8873. (954) 583-1340, fax 583-0777

WANTED: Condenser, carbon and other early broadcast microphones; cash or trade. James Steele, Box 620, Kingsland, GA 31548. (912) 729-2242

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: Keyer paddles of all kinds. Cap, WØXC, CO, (970) 247-0088. capallen@frontier.net

WANTED: Collins S-line, KWM2A, 30L-1, etc. Mark pays the most for clean gear. WD4AAS, FL, (954) 776-5996 (d), 566-0014 (n).

WANTED: National (early) HROs, any National coils, pwr splys, spkrs or parts. I love National radios. Sylvia Thompson, N1WVJ, 33 Lawton-Foster Rd., Hopkinton, RI 02833. (401) 377-4912

WANTED: Black base Vibroplex bug; Gonset G-63 hamband rcvr; Globe/WRL LA-1 amp. Ron, WØOIZ, arongv@aol.com. KS, (913) 268-5973 wknights only

WANTED: Looking for main tuning knob for Hallicrafters SX-100; orig manuals, amateur & audio. Pete Markavage, 27 Walling St., Sayreville, NJ 08872. (732) 238-8964

WANTED: To buy or trade military surveillance & countermeasures rcvrs & jammer or related gear 1960 - present. Tony Snider, VA, (757) 721-7129.

WANTED: Compressor amplifiers & other pro-audio gear: mics, preamps etc-tube or solidstate. Mark Linett, CA, (818) 244-1909.

WANTED: Main tuning knob KWM-1; 30L-1 meter face; 2X 51-S1 rejection tuning knobs DL-1. Steve Darveniza, 20 Scott Rd., Herston, Brisbane Australia 4006. phone/fx 61-7-38562543

WANTED: Excellent R-389 & Collins amp 204H-1. Mitsugu Shigaki, 2825-2, Jozan Kamidai Machi, Kumamoto, 860 Japan. Fx: Japan (0)96-329-4601. shigaki@mxw.meshnet.or.jp

WANTED: Collins 32V-3, 312A-1; Johnson Desk Kilowatt; National HRO-60 & HRO-500; Hallicrafters SX-88; Globe King 500-C. Dennis, KC7VXD, ID, (800) 891-1990 anytime. leeid@ix.netcom.com

WANTED: WW2 Japanese military radio of any kind; spark xmtr & loose coupler xtal rcvr. Takashi Doi, 1-21-4, Minamidai, Seyaku Yokohama, 246 Japan. Fax: 011-8145-301-8069. taka-doi@kk.iplu.or.jp

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Fixing Up Nice Old Radios by Ed Romney......$24.95

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