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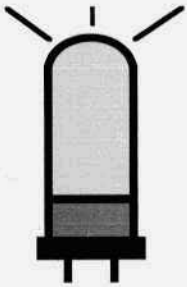
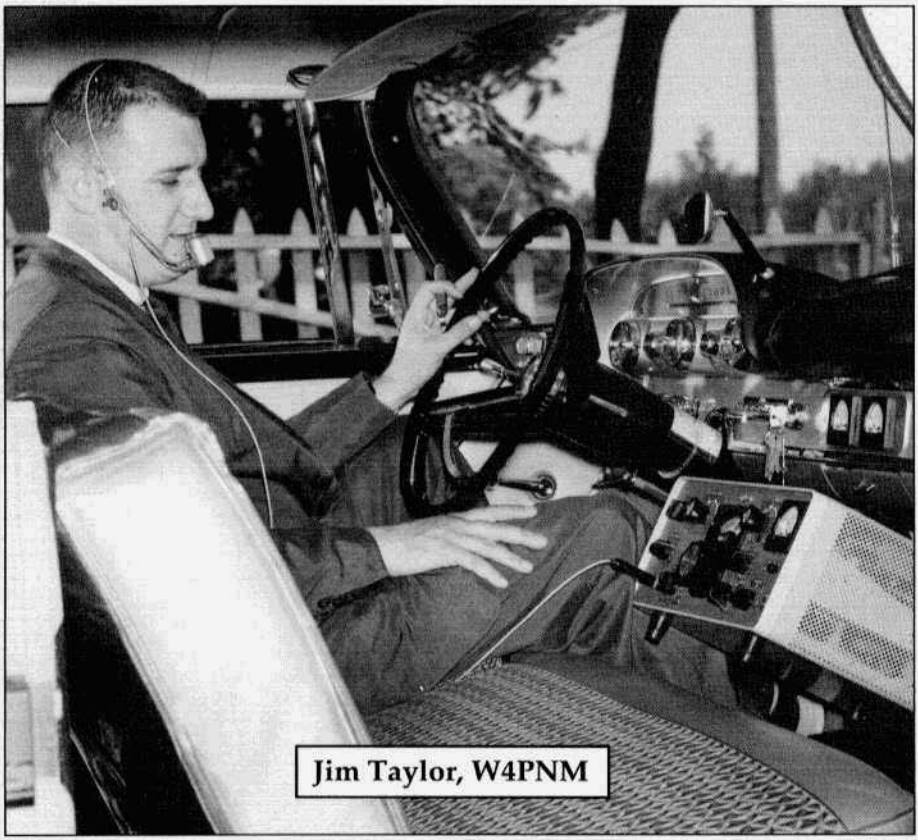


ELECTRIC RADIO

celebrating a bygone era

Number 73 May 1995



Jim Taylor, W4PNM

ELECTRIC RADIO

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

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

Regular contributors include:

Walt Hutchens, KJ4KV; Bill Kleronomos, KDØHG; Ray Osterwald, NØDMS; John Staples, W6BM; Dave Ishmael, WA6VVL; Jim Hanlon, W8KGI; Chuck Penson, WA7ZZE; Jim Musgrove, K5BZH; Dennis Petrich, KØEOO; Bob Dennison, W2HBE; Dale Gagnon, KW1I; Rob Brownstein, NS6V; Dick Houston, WØPK; Andy Howard, WA4KCY; Skip Green, K7YOO; George Maier, KU1R; Albert Roehm, W2OBJ; Mike O'Brien, NØNLQ, Steve Thomason, WB4IJN; Don Meadows, N6DM; Bob Sitterley, K7POF (photos) and others.

EDITOR'S COMMENTS

Shirley and I had a great time at Dayton again this year. Although it's a hassle getting to and from there - this year we flew out and it really wasn't that much easier than driving - it's all worth it and we'll be there again next year. What we enjoy most is meeting our subscribers. It's always a great treat to put a face with a voice we know from the telephone or over the air.

It's like a pilgrimage in many ways. As some religious groups might travel to a shrine for blessings or sanctifications we travel to Dayton to celebrate our hobby with our fellow hams. There's definitely something mystical about it all.

The amount of vintage gear there this year was down from last year and prices were up. It seemed like everybody there was looking for boatanchors. And it seemed to me that there were more foreign hams who were looking for vintage gear this year than last. Attendance at the AM forum this year was up considerably from last year, see KW1I's report on page 3. Interest in vintage/AM operation/collecting is certainly on the rise.

To finish up I'd I'd like to report that I am the new editor of the QCWA Journal, a quarterly published by the Quarter Century Wireless Association. Probably the best part of this job will be working for Lew McCoy, W1ICP, QCWA President, one of the last (and maybe the most notable) of the old QST/CQ writers. Lew started writing for QST in 1949; today at the age of 79 he's still going strong. I'll be talking more about this experience in future issues. **N6CSW**

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LETTERS

Dear ER

The February issue (#70) of *ER* carried a feature on the Navy TBL transmitter. I thought I might share a few ruminations on my experiences with TBL's.

I ran across my first TBL when I was going through the Navy's Electronics Technician course at NTC Great Lakes (IL). During the second week of the course on transmitters we were allowed to examine and learn how to service them. I can remember one of our class set the LR frequency standard to 500 kcs and tuned the MO stage to that frequency and we all learned about "peaking grids and dipping plates". We got a severe reprimand from the school commander because we had set off many ore boat alarms all over the Great Lakes area.

I did not see another TBL until I went aboard the USS McCaffery (DDE-860) in late 1959. I was detailed to repair the "emergency" TBL and the attendant RBA/RBB/RBC receivers. The main radio shack had one of the then new AN/SRT-15's. This rig turned out to be rather unreliable whenever we fired our 5"/38's or the rough weather off Cape Hatteras would cause any severe vibration.

The old TBL gave a good account of itself whenever it was used and except for producing a somewhat wobbly note never failed while I was on board. When sitting in Main Radio the Sparks and I could tell which of the squadron's ships were on TBL's. The longwire antennas used with the TBL would swing around quite a bit in bad weather and change the loading of the final, all the way back to the MO. The note swung several hundred cycles at times. Another cause may have been the large MG set that powered the transmitter. You could hear the MG set pick-up and slow slightly as the ship rolled. As I remember we used a large 2 HP, 3 phase motor and 2 generators for HV, low voltage and bias. Although I cannot remember how we lit the filaments I believe it was a separate filament pig that ran off the 110 VAC lines.

Servicing the TBL was a dream. Just loosen the side panel thumb screws and lift the sides and you could get inside the chassis. Lots of room inside. I am not sure what the final tube was, an 852 or 860 I think. The tube had two large knobs on the side and top of a round envelope with wire leads for the plate and grid. These went to screw-down terminals. The tube could then be twisted out of the bayonet-type base and removed. The only difficult stage to work on was the MO. It was a large die-cast box lined with some sort of cloth or batting for thermal insulation. Tuning was easy enough once you learned the drill. We always set the frequency with an LM and then ran up the various stages peaking and dipping. There was an RF ammeter near the top of the transmitter. In the installation on the old 860 we had a large bronze pipe which covered the antenna lead-in. This ran several feet to another bulkhead on which was mounted the antenna connector and grounding mechanism. There was a large wooden handle attached to a large knife-switch. One position was for ground the other for the antenna.

I can remember on one occasion we had to fuel up from a tanker and standing orders were to ground all HF antennas while alongside. Having finished fueling we continued on our way toward our homeport of Newport (RI). We used a standard pilot frequency in the VLF range and as we neared port I was ordered to tune up the TBL. After setting the MO frequency the intermediate stages were tuned. I noticed it was

continued on page 35

AM International Update

by Dale Gagnon, KW1I, President

Dayton Hamvention

Over one hundred people attended the AM Forum in Dayton on April 29th. Several announcements were made during the AMI Update. AMI news will be transmitted over the Gateway 160 Meter Net. A Canadian AMI Region will be formed and is in need of an AMI Director volunteer. Membership stands at approximately 740 with over $300 in the bank. New AMI brochures will be designed and produced over the next few months.

The pictorial segment of the Forum was titled "Broadcast Transformer Conversion Tips". John, W6BM, sent in a number of slides from his restoration of a Collins 20K. John also had slides of W6THW's station featuring a Collins 20T, Western Electric 12B/71B and 300G. W6HDU was shown moving his massive Western Electric 443A1 KW (Doherty modulation) transmitter into his basement. Slides of WA6KKM, W6JDI and K6HQI were also included. Hank, W2IQ, spoke about his strategy for achieving multiband use with his Collins 20V. He showed slides of his attached add-on cabinet, containing a multiband RF deck which uses power and audio from the broadcast transmitter. Steve, N8JRJ, related his experience acquiring and putting his General Electric BT-20-A on the air. Martin, K7BDY's Gates 250 GY photos illustrated RF and audio parts placement, as well as the elbow room available inside typical old broadcast transmitter cabs. I covered some tune up tips and used photos of transmitters and output circuit components from my Collins 300G and from the RCA BTA-250M transmitters installed at AB9G and KK1K.

The panel was manned by Jim (K9RJ), Harold (N8FRP), John (WB5HRI) and Jim (W4PNM). Each gave a report of AM operations in his area. The need for powerful AM stations to anchor AM QSO activity in AM windows was a common theme. Deliberate interference is becoming a major problem. On the positive side, there are many new AM stations coming on the air.

The Forum lasted one hour. The new meeting room was a great improvement from earlier years. In the evening 20 or more AM'ers gathered for several hours at a neighboring pizza restaurant to swap stories and relax.

Armed Forces Day Operating Event

If you receive *ER* before May 20 be sure to spend some time participating on that day. For more particulars, check out last month's *ER*, page 3.

Marlin's Hamfest Special Event Station

Dale Braun, WD9GWH, writes to announce a special event station will be operating on Saturday, June 3 from 1300 - 1900 UTC (8:00 - 2:00PM CDT) on 72909-7295 kHz, AM under call sign WJ9Y from Glenwood City, WI. This operation is in recognition of the third annual "Marlin's Hamfest", an event held each year as a service to regional amateurs who like to build their own equipment and restore and operate vintage equipment. QSL's received (from SWL's as well) will be answered with a special certificate. **ER**

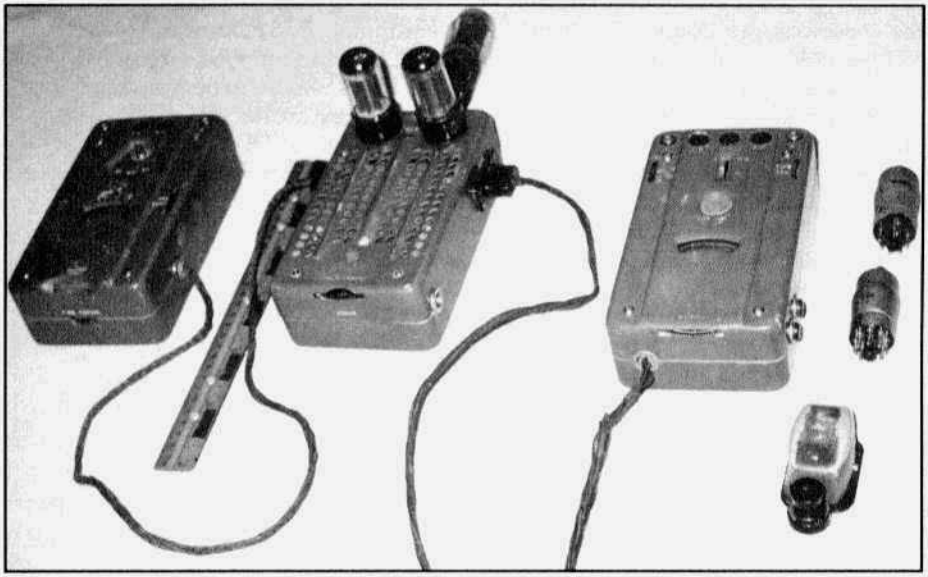
NO, THAT'S NOT A GAG SIGN. IN FACT I USE A SMOKE DETECTOR FOR AN RF WATTMETER

NKVD Spy Radio

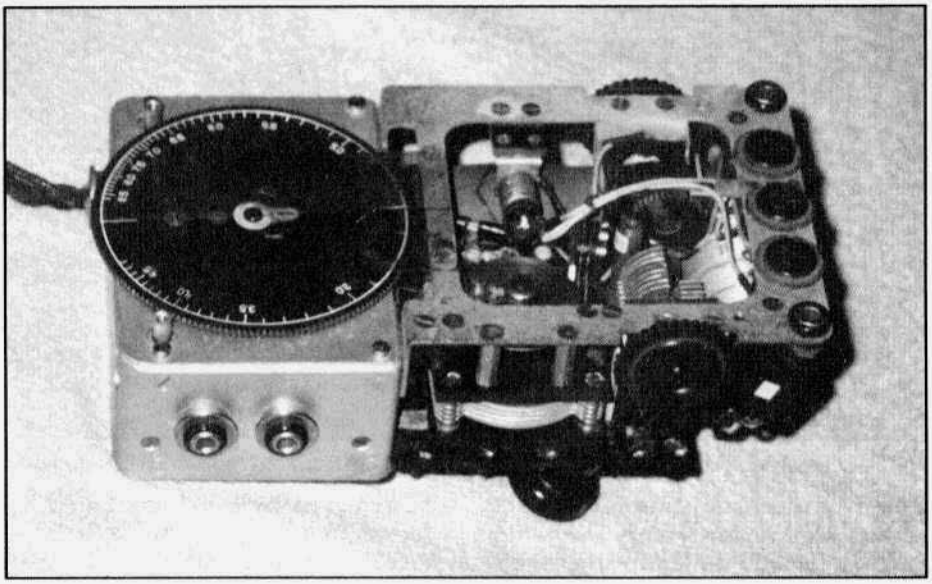
by LTC William L. Howard
219 Harborview Lane
Largo, FL 34640

The NKVD was the predecessor of the Soviet KGB, the main organization responsible for both internal security and external security. External security included secret agents operating in foreign locations or behind enemy lines. Rarely does equipment surface that was designed for use by the NKVD. Clandestine radios were no exception and there were severe penalties for anyone who had one of these sets outside the normal issue channels. One of the rarest items, a clandestine set, was located in the possession of a Ham radio operator in Karelia. I was one of three individuals who acted as "middleman" for a collector in the U.S.A. As such I had the chance to examine this set in some detail.

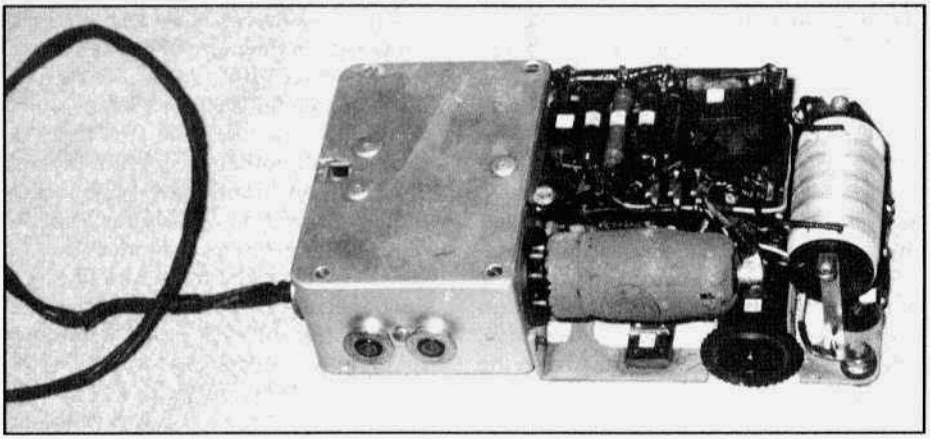
The radio station, as received in the U.S., consisted of three units, a power supply, a receiver and a transmitter. We were fortunate to receive the transmitter key with the set as well as some spare Russian tubes. All three elements were mounted on steel bases and housed in aluminum cases. All three cases appeared to have been stamped from the same set of dies. Each case is 188 x 105 x 55 mm in size. The power supply appeared to be the weakest part of the system, as the two power rectifier tubes were mounted in sockets on the top of the case. The power supply used two 5Z4 tubes. These had to be stored somewhere else when the station was transported which meant they were subject to breakage. On either side of the tubes were four pin sockets where power cords from the receiver and transmitter were plugged in when the set was in operation. The power transformer was mounted in the center and made the unit



NKVD receiver, power supply, transmitter and key.



Transmitter with case removed, topside view.



Transmitter, bottom view.

very heavy but was the best place for balance. The power input section was at the bottom of the case. The power cord did not survive but power went through a multiple tap switch to the transformer. Power supply switch started at OFF and had positions for 235V-220V-205V-150V-110V-100V and 90V, which would allow operation anywhere in the world. Inside were some two-watt resistors as well as paper, mica, and electrolytic condensers.

Without taking the power supply apart and checking the wiring, I am not certain how it worked but I suspect that the secondary had two high voltage windings, one for transmitter and one for receiver plate supplies and a two-volt winding for tube filaments.

The transmitter is a one tube transmitter based on the Soviet SO 257 tube. The cover must be removed and the entire unit taken out of the case to re-

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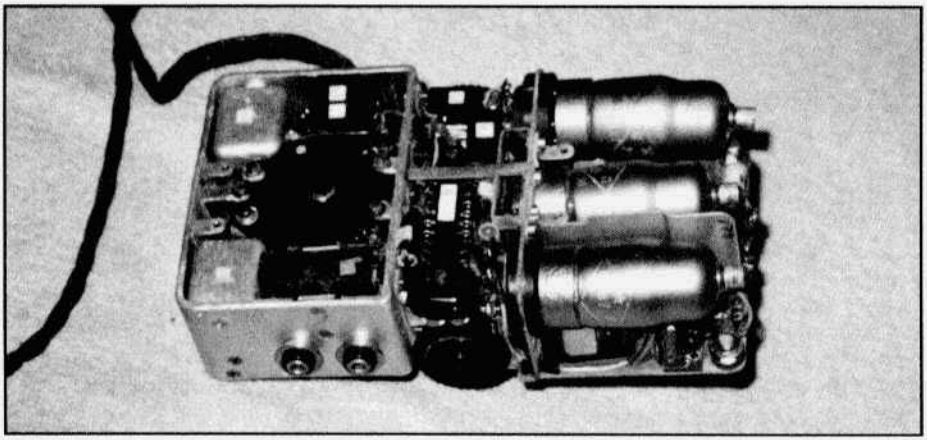


NKVD receiver, cabinet removed.

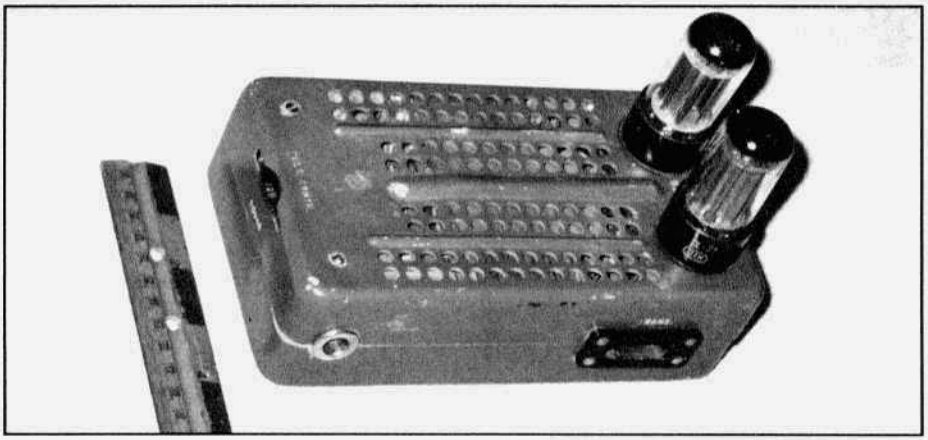
place the tube. The controls for this set consist of a main tuning dial, a fine tuning dial and a filament rheostat to control voltage and a switch to control radiated power marked HIGH and LOW. Also on the front panel at the top are a socket for the antenna, three sockets for a plug-in meter marked F.V., P.V., and P.C. and the socket for the ground connection. On one side is a socket for a crystal and on the other side a socket for the key.

The actual transmitter, once removed from the case, consists of a steel box housing the VFO/XFO. I did not open the box but the main tuning capacitor was in there as well as the tube socket base, crystal and key socket bases. Above the box and on the steel frame were the filament rheostat and the fine tuning control, a small air trimmer. A screw-in light bulb was also mounted there and could be seen through a small glass window. A bakelite board was also mounted which contained resistors and capacitors. At the very top was the coil of silver wire wound on a ceramic base. The main tuning dial had two colors, RED and BLACK. The RED section covered 2.7 MHz, to 4.8 MHz and the BLACK section covered 4.8 MHz to 8.6 MHz.

The key for this set was very small, measuring about 3" x 2". The cover could be removed by loosening two small screws and slipping the cover off to reveal the contacts and adjusting screws. Minor adjustments could be made to the tension and contact travel with a small screwdriver. The key could be concealed in the palm of the hand but it would prove difficult to operate. To operate on a flat surface such as a table would require one hand to hold the base and the other to operate the key. Since the cable for this key was missing, there is no way to determine what distance the designers intended the key was to be from the transmitter.

The receiver was also on a steel base in an aluminum case and also had to be removed from the case to change the tubes. My Ham contact in Russia indicated that the tubes used were the Soviet SO-241(2K2M) and SO-242(2A1M). The SO-241 is an IF, LF amplifier and HF pentode while the SO-242 is a mixer HF pentagrid tube. Both tubes have 2 volt filaments, and require plate voltage of 200 volts.

As with the transmitter, the main tuning capacitor was in a steel box mounted on a steel frame. The box was open to reveal the capacitor as well as several capacitors in metal cans and several other resistors and capacitors. In the center section were two wire-wound rheostats for



Closeup of NKVD power supply.

filament voltage and REG CONTROL which I assumed to be regeneration control. In the center was a three-position switch, missing a control knob, which was marked 2V/OFF/6V whose purpose seemed to be uncertain. Above the central portion were the three tubes, with one tube shielded from the others by a steel plate which I assumed was more for support than for shielding. Under the tubes, and on the front panel, were the socket for the antenna, two three pin sockets for the meter and the ground connection.

The main tuning dial was also color coded, this time in YELLOW and BLUE. The YELLOW covered 2.3MHz to 5.2 MHz and the BLUE covered 4.5 MHz to 10 MHz. As in the transmitter all parts were numbered with paper tags, many of which were still present. Soviet schematics have the parts numbered and with the correct schematic in hand it would be easy to identify which part was what. Unlike comparable U.S. sets, which have a schematic in the cover, these sets had none.

The set was in my possession for such a short time that I did not have time to make a schematic or even a pictorial. Numerous photographs were taken, however. All the controls were marked in English, in an effort to conceal its origin from the casual observer. The set was gone over in some detail by my Russian Ham friend who assured me that the internal parts were all of Russian origin.

The set is very compact, much more so than comparable sets of WW II. The set was reported to have been in use as a Ham station in Karelia before it began its trip to America. I would assume that the set had a range of 100 to 200 miles which would put the set within range of a Soviet base station or an embassy. It was thought that this station may have been a predecessor to the Soviet "TENSOR" station which came along later. To the casual observer, the set resembled the CIA's RS-6 set. (See Keith Melton's book on CIA equipment.)

This set is probably one of the rarest sets to find a home in the U.S. Unfortunately, many of the accessories are missing including a technical manual but I would guess that a partial listing of accessories would include the antenna, the ground wire, a meter to measure current and voltage, a screwdriver and an assortment of spare tubes, crystals and a headset.

If anyone has any further knowledge of this set, they are urged to contact the author, either by phone or by mail. If anyone desires a complete set of the photographs, please contact the author. **ER**

Converting a Three-Phase Power Supply to Single-Phase

by John Staples, W6BM
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Many transmitters that require three-phase power can be easily converted to single-phase without additional components. Collectors are bypassing many interesting pieces of surplus or broadcast gear due to the three-phase power requirement. I will show you how to assess the power supply of such equipment and convert it to operate on single phase power.

Three-phase power supplies provide a number of advantages: less ripple filtering is required and the average rectifier current is reduced. However, in such equipment, the design margins are usually sufficient that conversion to single-phase using the same transformer will result in completely satisfactory operation, especially for ham use.

To determine the feasibility of successful conversion, the power supply configuration must be determined, and some tests must be made on the power transformer. I will walk you through the process.

Determine Your Power Supply Configuration

Figures 1 through 4 illustrate the four most common three-phase power supply configurations. In each case the primary winding is assumed to be a delta-configuration with each leg across one leg of a 240-volt three-phase supply. I will call each leg the "A", "B" or "C" leg. The small dot at the end of each winding in the figures indicates the start of each winding, and is keyed to the start of the secondary winding with the same letter designation. In many cases, each primary winding has a series of voltage taps, not indicated here, and some transformers allow the three primary windings to be disconnected from each other, which will be of use in measuring the transformer characteristics.

Figures 1 and 2 show the most common secondary configurations, the delta-Y bridge and the delta-Y half-wave. Figure 3 shows the delta-Y zig-zag arrangement sometimes found on older transmitters, such as the Collins 20K or 20T series. Figure 4 shows the delta-delta configuration sometimes found in conjunction with a delta-Y and used for additional low-voltage supplies wound on the same transformer. All of these configurations can be converted to single-phase power.

The conversion consists of reconfiguring the primary winding and leaving the rectifier and filter circuits undisturbed. Some care is needed in determining the proper reconfiguration of the primary to make best use of the magnetic circuit (flux linkage) in the transformer and to assure that the DC output voltage is satisfactory.

Flux Linkage

First, a little discussion about flux linkage in the transformer. Most three-phase power transformers contain three sets of primary/secondary windings as shown in Figure 5, wound on three legs of an "E"-shaped core. It is important to identify which winding is wound on the central flux leg, "B" in the diagram, and which are wound on the ends, "A" and "C". It is also important to differentiate the delta-Y configuration from the delta-Y zig-zag configuration. A peek at the equipment schematic may answer this, but a voltage measurement of the transformer should be undertaken. Assume for a moment that all the primary transformer windings can be dis-

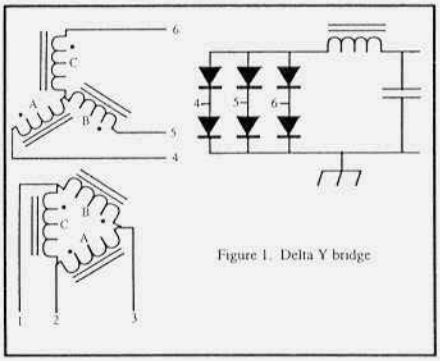

Figure 1. Delta Y bridge

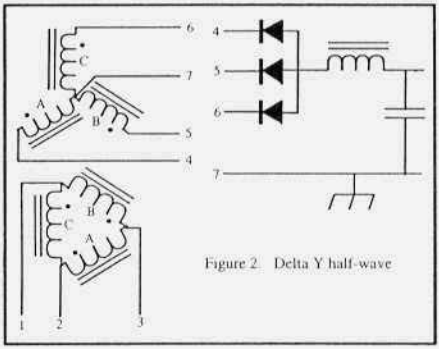

Figure 2. Delta Y half-wave

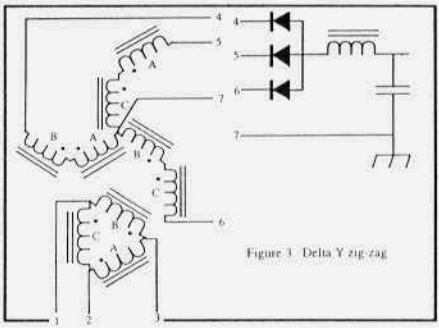

Figure 3. Delta Y zig-zag

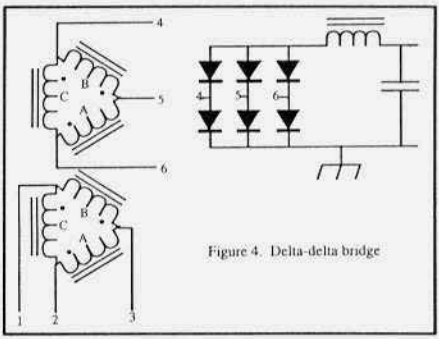

Figure 4. Delta-delta bridge

connected from each other so that each of the three primaries can be separately excited. If winding "A", the end winding, is excited, as shown in Figure 5A, the flux from the "A" leg will return through both the "B" and "C" legs, but will divide unequally, due to the differences in path length from the "A" winding. If a 120 volt AC test potential is connected to the "A" winding and the voltage induced on the primary windings "B" and "C" is measured, you may see 100 volts induced on "B" and 20 volts on "C". This indicates that about 83% of the flux from "A" returns through "B" and the rest through "C".

Now, if both "A" and "C" are simultaneously excited, two things may happen: You can apply voltage to "A" and "C" in phase, as shown in Figure 5B, where twice the flux will return through the center leg. This will excite twice the voltage on the center primary, and secondary, windings. However, if "A" and "C" are exited out of phase, as shown in Figure 5C, no flux cuts the center winding and the induced voltage is zero.

The wiring between the primary windings need not be disconnected to do the following measurement, but you may get more accurate measurements if you do. The "B" winding must be identified and the power will be applied to just the "A" and "C" windings after the conversion for the delta-Y and delta-delta configurations.

Measurements

You will be working with lethal voltages so be careful! You will need to connect each primary winding to 120 volts and measure the induced voltage on each unconnected primary segment and on all secondary segments. Also be aware that AC voltmeters that may be capable of high-voltage AC measurements sometimes will have difficulty. You may want to use a low voltage from a step-down transformer to excite the primary windings.

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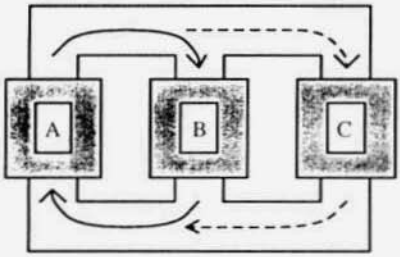


Figure 5A

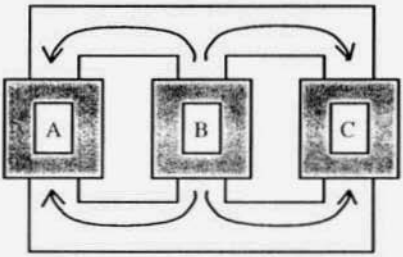


Figure 5B

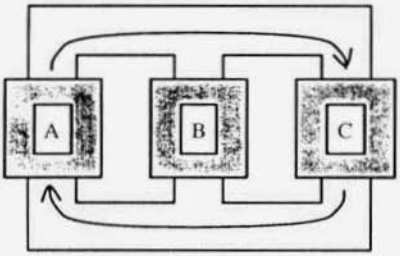


Figure 5C

Figure 5A. End primary excited

Figure 5B. Two end primaries in phase

Figure 5C. Two end primaries out of phase

Apply excitation voltage to each of the three primaries in turn, and measure the voltage on the two remaining primaries and each secondary in turn, from the center-tap to each end, if the center-tap is accessible. In addition, measure the three voltages between the ends of secondaries "A" to "B", "B" to "C", and "C" to "A" again. Again, be very careful, as lethal voltages may be present.

Find the primary winding that, when excited, gives equal voltages across the other two primaries. This will be the "B" winding. Mark it on the transformer for future reference.

Delta-Y Half-Wave and Bridge Configurations

If your transformer is not the delta-Y zig-zag configuration, the voltage on each secondary should be a constant multiple of the voltage on each primary: the multiplier is the turns ratio, and we will call it "k". The ratio of the secondary voltage to the primary voltage for each winding should be the same. If the voltage across the secondary "A" winding is called VA and across the "A" primary is Va, then

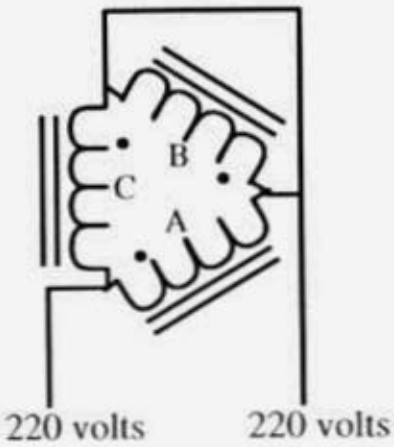
VA = k * Va
VB = k * Vb
VC = k * Vc

If the center-tap is accessible, shown as lead 7 in figure 2, then VA is the voltage on secondary "A" between terminals 4 and 7, and I will refer to it as V (4-7), for example.

Note the winding directions indicated by the small dots: the primaries are wound in a ring, which allows the three primaries to link flux properly without setting up a counter emf when they are connected together. The secondaries are all wound in a star configuration, with all the start ends connected together. This is important to understand if the secondary center-tap is not accessible. The equations for the voltages across each pair of secondaries, that is, from terminal 4 to terminal 5, for example, can be written:

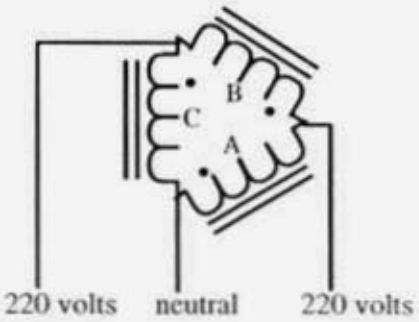
V (4-5) = (VA - VB) = k * (Va - Vb)
V (4-6) = (VA - VC) = k * (Va - Vb)
V (5-6) = (VB - VC) = k * (Vb - Vc)

using the terminology of Figure 1.



delta-Y and delta-delta

Figure 6A



delta-Y zig-zag

Figure 6B

To modify the delta-Y bridge circuit, Figure 1, for single-phase power, the 220 volt primary power will be connected to primaries "A" and "C" in parallel, with primary "B" shorted out, as shown in Figure 6A. The 220 volt neutral lead is not used. If the three primaries can be disconnected from each other, you may want to leave primary "B" open. The flux will thread the three windings as shown in Figure 1C, with no flux in the center "B" windings. As Va = - Vc and Vb = 0, the voltage across secondary terminals will be V (4-6) = k * (Va - Vc) = 2 * k * Va, and since the induced voltage across secondary "B" is zero, V (4-5) = k * Va and V (5-6) = -k * Va. The rectifier configuration can be left unchanged, and the rectifiers connected to secondary "B" will not conduct.

After a choke-input filter, the DC voltage will be around 80% (77% ideally) of the original voltage with the three-phase configuration. However, the actual voltage can be made higher. First, today's line voltage is generally higher than when these transmitters were made. Second, the transformers frequently have line-voltage adjustment taps which allow operation at lower line voltage. Third, these transmitters often permit full power output with slightly reduced plate voltage.

For the delta-Y half-wave, Figure 2, the primary is reconfigured in exactly the same way as above: primary winding "B" is short-circuited and connected to one side of the 220-volt line and the other side is connected to the junction of primaries "A" and "C". The voltage from the center tap 7 across the "B" secondary to terminal 5 will be zero, and the power supply will operate exactly as a full-wave single-phase rectifier. The rectifier connected to terminal 5 will not fire. The DC output voltage will be just as in the full-wave bridge circuit.

Delta-Y Zig-Zag Configuration

The delta-Y zig-zag requires a different primary reconfiguration. Here, each primary has two secondaries wound on it, with the start ends of each pair of secondaries connected together. Note the positions of the dots in Figure 3. This configuration may be identified from the schematic if the measurements above do not give a consistent turns ratio between each primary and the external secondary windings.

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Suffix Numbers on Hammarlund Super-Pro SP-600 Receivers

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Over the years, many articles have been written on the performance and modification of SP-600 receivers. Most state (incorrectly I might add) that production ended with the JX-26.

After a great deal of research and talking with many SP-600 owners, I've come up with the following list.

Most of this information was taken from a Hammarlund "model number designation for type SP-600 ( ) receivers" list.

Sept. 1951, SP-600-JX-1
Std. frequency range, 540 kHz-54 MHz. Also designated R-274A/FRR (Family of Radio Receivers) Signal Corps order no.1689-Phila-51-01.

Sept. 1951, SP-600-JLX-2
Frequency range, 100-400 kHz, 1.35-29.7 MHz.

Sept. 1951, SP-600-J-3
Std. frequency range, 540 kHz-54 MHz. No xtal frequency control.

Sept. 1951, SP-600-J-4
Std. frequency range 540kHz-54MHz. No xtal frequency control. Signal Corps R-320A/FRR. Order no. 19474-Phila-50-06. Also has separate IF gain control.

Nov. 1951, SP-600-J-5
Std. frequency range, 540 kHz-54 MHz. Equipped with 25 cycle (Hertz) power supply. Signal Corps. R-483/FRR, order no. 21478-Phila-50.

Sept. 1951, SP-600-JX-6
Std. frequency range, 540 kHz-54 MHz. BFO range 0-10 kHz. US Navy model R-274B/FRR, order no. NObsr-52039.

Sept. 1951, SP-600-JX-7
Std. frequency range, 540 kHz-54 MHz.

Sept. 1951, SP-600-JX-8
Std. frequency range, 540 kHz-54 MHz. Manufactured for Welch contract no. XG-479.

Sept. 1951, SP-600-JL-9
Frequency range, 100-400 kHz, 1.35-29.7 MHz. No xtal frequency control.

Nov. 1951, SP-600-JX-10
Std. frequency range, 540 kHz-54 MHz. Replaces JX-7.

Nov. 1951, SP-600-J-11
Std. frequency range, 540 kHz-54 MHz. No xtal frequency control. Note: This model made to complete Navy order, without the changes per ECN-1156 as standard J series. Replaces J-3.

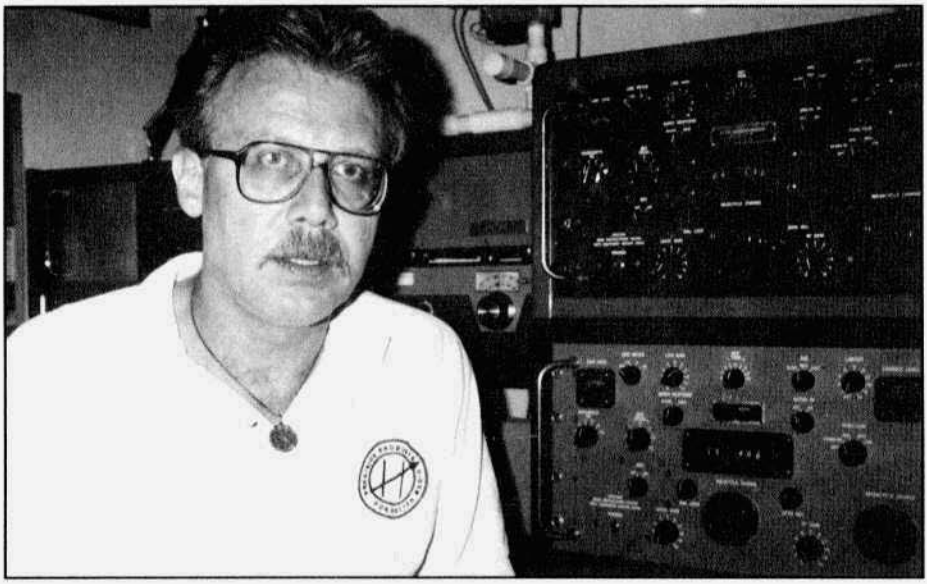
Nov. 9, 1951, SP-600-JX-12
Std. frequency range, 540 kHz-54 MHz. Signal Corps R274A/FRR, order no. 3376-Phila-52. Replaces JX-1.

Nov. 26, 1951, SP-600-J-13
Std. frequency range, 540 kHz-54 MHz. No xtal frequency control. Signal Corps order no. 16838-Phila-51. Serial no's 52 to 67 inclusive. 25 cycle power supply. Replaces J-5.

April 23, 1952 SP-600-JX-14
Std. frequency range, 540 kHz-54 MHz. Signal Corps R274C/FRR, order no. 3376-Phila-52. Replaces JX-10.

June 17, 1952, SP-600-JLX-15
Frequency range, 100-400 kHz, 1.35-29.7 MHz. Replaces JLX-2.

June 17, 1952, SP-600-JL-16
Frequency range, 100-400 kHz, 1.35-29.7 MHz. No xtal frequency control. Replaces JL-9.



Les Locklear, the author, in his radioroom. Note the black-faced R-390A.

June 17, 1952, SP-600-JX-17
Std. frequency range, 540 kHz-54 MHz. Diversity receiver. Manufactured for Air Material Command. Note: Easily identified by "Red knobs."

June 26, 1952, SP-600-JX-18
Std. frequency range, 540 kHz-54 MHz. Made for "GAUVREAU" contract. Replaces JX-10.

Aug. 27, 1952, SP-600-J-19
Std. frequency range, 540 kHz-54 MHz. No xtal frequency control. Equipped with 25 cycle power supply. Replaces J-5, J-13.

Aug. 1952, SP-600-J-20
Std. frequency range, 540 kHz-54 MHz. No xtal frequency control. Same as J-19. Signal Corps R-483A/FRR, order no. 3479-Phila-52. Equipped with 25 cycle power supply. Replaces J-19.

Feb. 13, 1953, SP-600-JX-21
Std. frequency range, 540 kHz-54 MHz. Replaces JX-10.

Feb. 15, 3, SP-600-J-22
Std. frequency range, 540 kHz-54 MHz. No xtal frequency control. Replaces J-11.

Feb. 1953, SP-600-JLX-23
Frequency range, 100-400 kHz, 1.35-29.7 MHz. Replaces JLX-15.

Feb. 1953, SP-600-JL-24
Frequency range, 100-400 kHz, 1.35-29.7 MHz. No xtal frequency control. Replaces JL-16.

Feb. 1953, SP-600-J-25
Std. frequency range, 540 kHz-54 MHz. Equipped with 25 cycle power supply. Replaces J-19.

Feb. 1953, SP-600-JX-26
Std. frequency range, 540 kHz-54 MHz. Signal Corps R274C/FRR, order no. 3376-Phila-52. Effective upon Signal Corps approval of TAR#10 dated 2-12-53. Replaces JX-14.

Mar. 13, 1953 SP-600-JLX-27
Special frequency range, 200-400 kHz, 540 kHz-29.7 MHz.

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A VFO For 160

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It is possible to build an extremely stable VFO unit which spreads the band of 1750 to 2000 kHz over 600 degrees of the dial and costs in the order of $25 to $50 depending on the state of one's junkbox. When I say stable, how does a shift of +/- 2 Hz over a 12 hour period sound? It's fun to build, too. The output is on the order of fifteen volts across 39k ohms.

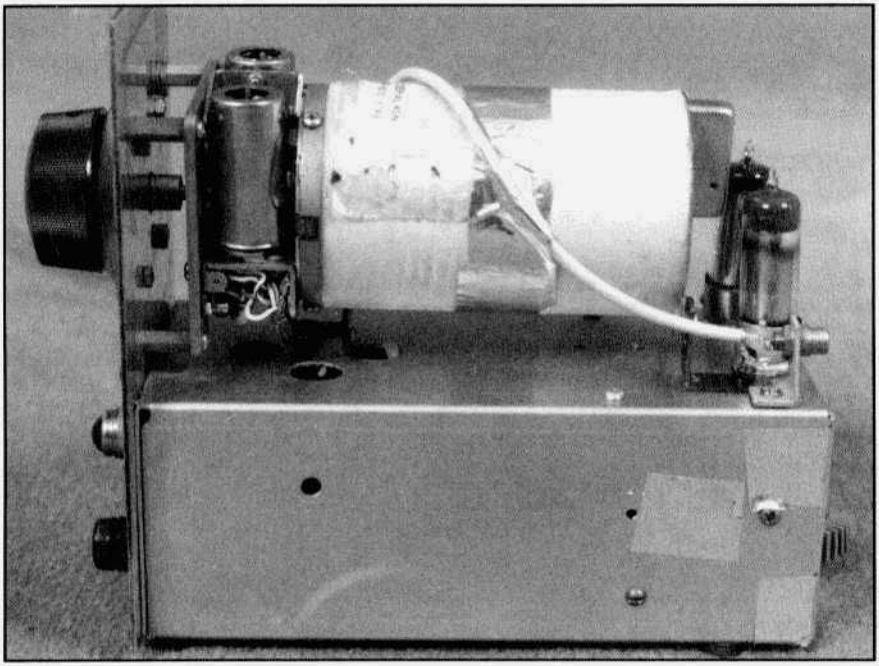
Fair Radio Sales used to list a PTO (permeability tuned oscillator) taken from the T-195 transmitter for $10.95 (the same unit appears to be part of the T-368). It covers from 1500 to 3000 kHz, but we are only interested in 1750 to 2000. While Fair no longer lists the unit, many were sold and a little hunting at hamfests and flea markets should turn one up.

The unit has a 3/16" shaft which extends beyond the mounting plate about 1/2". No information comes with the unit, but it was not too hard to dope the connections out (see wiring diagram). It requires 12.6 VAC at 300 mA to power the series connected filaments of the two 5749 (6BA6) tubes, 216 VDC regulated at about 20 mA on the plates and 6 to 12 VAC at less than 1 amp if you decide to use the built-in heater blanket. Since the heater is thermostatically controlled, it is wise to use a separate transformer winding to power the heater, rather than use the filament winding. Except in very cold areas, I would not use the heater, since it tends to shift the output frequency more when up to temperature than if not used. It does warm the unit up more quickly.

Front panel.

I was unable to find a mating connector for the miniature 7 pin male plug on the power cable, so I cut it off and spliced into the wires directly. On power up, the frequency drifted upward for 30 or 40 minutes. I found that the thermal switch was not working, but after gently digging the sealant out of the small adjustment screw, I was able to get it to work fine. The thermal switch is under the pie slice shaped cover on the back of the unit. Once the heater was working, I found that after about an hour, the frequency would cycle up and down about 5 Hz, roughly tracking the heater operation. Without the heater the unit stabilizes to +/- 1 or 2 Hz. The overall drift from a cold start is about 55 Hz. As a result of these first tests, it was decided to design the VFO to be powered all the time. It only draws about 10 watts without the heater.

Once the unit has been bench tested, the fun begins. The VFO pictured originally had a three-step control switch: heater, standby and operate. Further testing showed a simple on-off switch to be



Side view, cabinet removed.

adequate. The power transformer I had has a 440 volt center tapped winding and a 6 volt winding. A fullwave rectifier and 200 pF filter gave about 300 VDC which is fed to two OB2 regulator tubes in series through a 10 watt resistor. A 12.6 VAC 1 amp transformer, Radio Shack version is fine, powers the two filaments. The power supply in the schematic is a little different but any supply which can deliver the 218 volts regulated and 12.6 VAC at 300 mA will do the job. This completes the power requirements. Use what you have available.

I cut the non-standard coax connector off and connected the coax to a phono jack. Use your favorite RF connectors.

A 5" x 7" panel is fastened to the end of an 8" section of 3" x 4" x 17" chassis I had left over from another project. The PTO has an adapter plate screwed to the shaft end. Remove it and use it as a drilling template, then remount it and support the PTO with screws and spacers from the panel. Support the back end with a small angle bracket. The mechanical design is where you can put your ingenuity to work and make the unit one-of-a-kind. My power supply is built into the unit, but a separate unit is just as good. You may be able to steal the power from the unit the VFO drives.

The dial unit is the most challenging area of the job. I happened to have an old National AD Velvet Vernier drive unit with a blank scale. A small piece of quarter inch diameter split spacer was pried slightly apart, and used as the adapter between the 3/16 shaft and the quarter inch dial hub. When the unit was completed and fully warmed up, it was easy to mark the dial every 10 kHz and then use dry transfer numbers to mark the frequency. Since the dial must turn more than 360 degrees to cover the band, some of the dial divisions will have two frequencies assigned, but unless you have dedicated knob twisters in the house, this is a minor inconvenience. Incidentally, at least on my unit,

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Recent visitors to ARS W7FG, from left to right: Mike McDermott, WØBVA; Gene, Tincher, K5NYT; Larry Watson, W5VHP and Gary Gompf, W7FG.

Woody Binford, W6LHH, with"Muffin" in his hamshack. The transmitter to his left is a DX-100. The receiver on the shelf above the transmitter is an HRO-50T1. Just to the right of the DX-100 is a rare D&R Ltd. receiving adapter, model RA-1.

I read about the B&W 6100 in a recent issue of *ER* with great interest. I purchased my B&W 6100 used from Klaus Radio in Peoria, Illinois in about 1971. It was serial #150. I used it for about five years and had a lot of fun with it. The enclosed picture of my station is as it appeared circa 1976. The receiver is a Hallicrafters SX-101A and the amplifier is a Hunter Bandit 2000-C, which uses a pair of 3-400Zs. The microphone is an Electro-Voice 664. The antenna used for 80/40 was an inverted V at 45 feet. On 20 I used a Hy-Gain 203G at 50 feet.

Russ M. Planck, W9RGH, one of the co-founders of RME, did service and repair work for Klaus Radio. He serviced my B&W 6100 and the Bendix SWR bridge. He installed a matched pair of RCA 6146-A's in the B&W 6100. In the Bendix he installed matched diodes.

I really enjoyed my B&W 6100. The quality of parts and workmanship was very high. The physical appearance was excellent. With the B&W 6100 I only operated SSB. This was my first phone rig. I had only operated CW previously.

Sadly, the call of transceivers won out. I seemed to miss out, because you had to zero beat the transmitter to the receive frequency. I sold everything in order to buy a new Drake TR4-CW/RIT. They had a good close-out price on them at Klaus Radio when the TR-7's were introduced. I sure would like to have my B&W 6100 back. **Van Johnson, WA9DZJ**

Collins 75A-4 Repairs

by Dave Mills, AJ7O
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A few weeks ago I bought another 75A-4 at a good price. It had the typical poor AGC action, bad Q-multiplier performance and a dead band (15 meters) that I had noted on other 75A-4 receivers. It is in great physical condition so I decided to really dig into this classic receiver, find and repair each problem. I thought I would share with you my findings and solutions.

Over the years I've owned two or three Collins 75A-4 receivers and in the past couple of years I've repaired a few that had problems like poor or dead performance on one band or lots of hum caused by bad power supply filter capacitors. I've also gained some experience with how they perform and the details of the circuits.

I never cared much for the 75A-4 and had not kept the ones I owned for long. The reason I sold them in the past is that they seemed to be just plain poor performers. . .especially the AGC action. I couldn't understand why people thought so highly of the 75A-4.

The first thing I did was to install the K7CMS AGC modifications published in the May, 1990 issue of *ER*. This change is very worthwhile. But mine also had another problem that seemed to be a tough one to find.

The receiver gain as indicated by the S-meter dropped by 20 dB over a half hour warm up. The receiver AGC seemed to work OK except that it overloaded badly on very strong local signals. I tried cold spray on the components... no luck. Changing tubes made no difference.

It seems that Collins had a couple of service bulletins on the subject of S-meter pots so I suspected a problem with them among other things. My A-4 is very early (S/N 779) and has the small pots on top of the chassis. I called Dave Ishmael, WA6VVL, and asked him for copies of the service bulletins and mentioned the problems I was having. He sent me the service bulletins and a copy of an article by W4SD that appeared in January, 1971 *Ham Radio Magazine* that described gain change troubles similar to what I had been experiencing.

W4SD had found several leaky mica capacitors in his 75A-4 but did not describe which ones had caused the severe gain change. I started to carefully check the voltage at the control grids of the IF amplifiers and the 12AX7 Q-multiplier in my receiver. I found the wrong AGC voltages at several grids.

An example of the nature of the problem is my experience with mica capacitor C81. It couples the signal from the plate of one IF amplifier to the grid of the next. The grid measured about +2.0 VDC when it should have measured about -1.3 VDC. Some fooling with Ohms Law told me that the leakage current was very small through that 470 pF mica capacitor but enough to really screw up the AGC performance of that stage.

I had several new (old stock) silver mica capacitors in my parts cabinet so I replaced C81. It fixed the gain problem - for two days! My new (old type) capacitor also had a slight leakage.

I went to the local parts store and bought a handful of new dipped mica 500 volt capacitors and replaced the old style micas at C68, C71, C75, C81 and C104. They are all 500 pF except C71 which is 1000 pF. By the way, the values are not critical as they are coupling caps.

The AGC performance is good, and the gain is now stable. The Q-multiplier adjusts and aligns properly and remains stable and very effective with a -50 dB notch. And, the receiver no longer overloads on strong signals.

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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: Wednesday nights at 8 PM PT 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 4 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.
Twenty Meter AM Net: This net on 14.286 has been in continuous operation for at least the last 20 years. It starts at 5:00 PM PT, 7 days a week and usually goes for about 2 hours. Net control is Les, K6HQI.
Arizona AM Net: Meets Sundays at 3 PM MT on 3860. 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 3875 Monday, Wednesday and Friday 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.
Military Net: It isn't necessary to check in with military gear but that is what this net is all about. Net control is usually Walt, KJ4KV, but sometimes it rotates to other ops. It starts at 5 AM ET Saturday mornings on 3885.
Westcoast Military Radio Collectors Net: Meets Sat. at 2300 local on 3885 and Sun. at 1600 local on 3885. Night net control is Andy, KD6TKX, and daytime net control is Tom, WA6OPE. AM is the mode used at present. It is not necessary to check in with military gear.
Grey Hair Net: The oldest (or one of the oldest) 160-meter AM nets. It meets on Tuesday nights on 1945 at 8 PM in the winter and 9 PM ET in the summer.
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 14.050, Saturdays at 1 PM PT. Net control is Tracy, WB6TMY.
Vintage SSB Net: Net control is Chuck, N5SWO. The group meets on 14.293 at 1 PM CT, Sunday afternoons.
Collins Users Net: The oldest of the 'users nets'. It meets on 14.263 Sunday afternoons at 2 PM CT. The net control revolves. This group also gets together for an informal ragchew on 3805 Tuesday evenings at 7 PM CT.
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.
Heath Users Net: A new net started by Marty, WB2FOU/5. Net control is shared by Fred, AA5LW. It meets on 14.275 at 4 PM CT Sundays. Check in on either AM or SSB.
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 has been meeting since 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 Night 6 Meter AM Net: 8 PM Sundays on 50.4. Net controls are Dan, KV6I and Scott, K6PYP. Informal, supports restoring old gear and using it on the air. Loan gear available for those wanting to join in.

The Forgotten Science

by Ray Osterwald, NØDMS
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As previously discussed in *Electric Radio*, theories having to do with vacuum tube design had long predicted performance far in excess of anything yet discovered. Engineers working in the tube departments at the various manufacturers struggled along, making slow progress with materials and manufacturing processes. They knew that the end was at hand, and that solid state devices would eventually be the way electronics would be built, but it was thought that there would always be some room, somewhere, for the vacuum tube. The digital revolution could not even be imagined in the late fifties and early sixties. It was for this reason that research continued, up to about 1965, into vacuum tube materials and construction. This article will describe a little bit about what was going on with vacuum tube research at that time.

The grid structure in an electron tube can be compared to the steering wheel in an automobile, in that the wheel and the associated control mechanism is used to accurately guide the motion of a heavy, powerful piece of machinery. In an electron tube the grid is the control mechanism, because it "steers" the electron beam. In the physicist's ideal tube, only the electrical characteristics of the grid should influence the tube's operation.

The ideal tube was never made, of course. It might have been simulated if the exact physical configuration of the grid was known, and if engineering could maintain this known configuration in every tube which came off the line. If this condition was maintained, the physical characteristics of the grid would have the exact same influence on the electrical performance of each tube produced. Under these conditions, tube electrical characteristics were independent of grid construction and circuit performance could be tailored to customer requirements.

When a method was developed to accurately control grid dimensions, it was relatively easy to optimize the electrical performance of the tube by selecting the proper spacing between the individual grid wires and between the grid structure and the cathode.

By 1962, engineers had developed a flexible vacuum tube. This device was a lab fixture, in which the distances between the cathode, the plate, and the grid elements could actually be changed during operation. This allowed them to determine optimum inter-element configurations for any given tube type by merely dialing up differing spacings on control wheels and noting the effects on their instruments.

Before the invention of this moveable-electrode tube, tube designers were tied to working from crude electromechanical analogies, trial and error, and hindsight. A tube prototype would have to be hand built, tested, and measurements taken. Many painstaking tries were necessary before an acceptable compromise could be reached.

In the flexible tube, the tube elements could move independently from one another without measurable backlash. Each grid could be moved closer or farther away from the electron beam, and the shape of the grid could be changed. This was accomplished by mounting each tube element on a moveable block. The blocks were coupled by control rods

to micrometer dials which were external to the tube. When the dials were turned counterclockwise, they pushed against vacuum-tight diaphragms, much like those used on vacuum-variable capacitors. This counterclockwise motion moved the blocks closer to the center of the electron beam. Alternately, clockwise rotation of the micrometer dial allowed springs to push the blocks away from the beam. In this way all of the tube elements could be moved independently. The dials would allow element changes as fine as one mil to be made, making it easy to find an ideal position. Once this position was found, the elements could be moved to new positions representing manufacturing tolerances and component stress. The effect of the tolerances could then be measured and allowed for in the final design.

Operating voltages were fed through glass insulators on the bottom of the vacuum chamber. The chamber could be opened and different shapes of elements and different materials could be mounted to the blocks, and a new set of operating characteristics measured. Grid and plate currents were monitored on an associated oscilloscope and photos were taken when the optimum design was discovered.

The top of the vacuum chamber was equipped with a quartz glass window. On top of the window was mounted a measuring microscope. It was used to measure the movement of the tube elements during actual fired-up operation. The micrometer dials, although accurate, could not provide fine enough resolution to measure the coefficient of expansion of various materials. The microscope was also used to double-check the accuracy of the dials.

Because the tube elements could be moved during operation, the effects of the space charge could be minimized. It was discovered that small positional changes of the elements could greatly minimize the effects of space charge on the tube's efficiency.

Prior to 1958, conventional grids were made by winding fine wire around two support rods, and then placing the rods into holes in the mica support spacers. This method, although traditional, had enormous drawbacks. First off, the distance between the support rods was determined by the accuracy of the holes in the mica washers, which depended upon the quality of the mica and the method to make the holes. If the support rods were not the proper distance apart, the grid wires would sag when hot, and change the critical grid wire spacing and thus change the tube's electrical characteristics. Also, if during the assembly step one of the support rods were to be pushed up or down when mounting the grid in the tube structure, the grid wires would slant downwards instead of being perpendicular to the support rods. In a multi-grid tube, proper operation occurs only when the grid planes are parallel and the grid wires themselves are directly in line with each other and parallel.

Promoted as a correction to a fundamental tube fault, the "frame grid" was introduced in the first quarter of 1958. These frame grid structures eliminated the problems associated with conventional grid construction. The frame on which the grid was wound was a thick, one-piece welded assembly in the form of an "H". There were small mounting rods on the tops and bottoms of the frame for mounting into the mica spacer holes in the conventional manner. The big difference was that the grid wires had no supporting function to perform, and extremely fine wire could be wound under tension around the frame. Tubes using frame grids have much higher performance, sort of like a sports car with a rack and pinion steering system.

With this rigid grid structure, the grid to cathode spacing could be maintained at .002". All of a sudden a 30% increase

continued next page

in the gain-bandwidth product was achieved! This increase made a much lower noise figure possible, and opened up the VHF bands to lower cost tubes. Microphonics were reduced by 50% at the same time because the grid wire was wrapped around the frame under tension and resisted movement. Also, less screen grid power was required for a given plate power because there were fewer electrons colliding with grid wires during their journey from cathode to plate. The large mass of the frame meant it would get rid of more heat, resulting in lower emission of electrons from the grid (grid emission). This made it possible to get higher plate current before dissipation from the screen and plate became the limiting factor. Also, with reduced grid emission, the tube would be a lot more predictable in terms of circuit behavior. Frame grid pentodes and tetrodes had higher output powers because the plate current would swing very low without running high screen grid current. One thing led to another, and higher screen voltages were then possible at lower dissipation levels. Higher peak output currents were becoming necessary in so many applications, ranging from communications to medical electronics, to radar, and to broadcast equipment.

It's not clear who actually produced the first tube with a frame grid, but it probably was Amperex. By April 1958, Amperex had introduced four types: the 5847, 6688, 6922, and the 6939. Except for the twin-triode 6922 which was based on the 6DJ8, the other types were broadband pentodes with figures of merit as high as 250 Mc. At the same time, Sylvania announced a 6HF6 type, which was designed for television horizontal deflection circuits.

It was through use of the flexible tube fixture that tubes such as the Amperex 7788 were designed. This tube used a double frame grid, for the screen and control grids. It had a transconductance of 50,000 uMohs, and an equivalent noise resistance of 50 ohms, making an ideal low-noise match for a 50 ohm antenna system!

Experiments by materials engineers led to other advancements. In 1960, GE announced a new type of heater made from rhenium/tungsten alloys. They claimed this to be the first significant advance in heater construction in many years. The main advantage of this new material was that it was much stronger and more resistant to breakage and twisting caused by the extreme stresses induced by necessary high filament temperatures. The alloy tended to remain straighter than ordinary tungsten filaments over its working life, which reduced the possibility of internal tube short circuits. The electrical resistivity was higher, which led to design flexibility. A larger diameter heater could be used, which would add to its strength, or a short but tough filament could be employed in miniature tubes where space was at a premium. Some types of rectifiers using filaments made of these alloys actually showed increased emission as the tube aged, rather than lowered emission as in conventional tubes. The cold filament resistance was higher, which made the heater much more resistant to surge current damage when first turned on, sort of like a built-in varistor. All of these factors added up to produce tubes with up to four times the filament life when used in areas where power line voltage ran much higher than normal or was subjected to transients. GE tubes of the "5-Star" variety used these heaters. The RCA "Command" series also had similar special alloys in the heaters and cathodes.

In 1961 Amperex announced a new cathode structure for directly-heated power tetrodes which was based on what was learned from frame grid construction. They extended the theory behind the frame grid to the cathode

and produced a flatter, rectangular structure with the shape of an "H" frame. They called it the "harp cathode". Similar to the musical harp instrument, this frame was strung harp fashion with many fine wires made from special tungsten alloys. This construction gave them a tube that was instantly ready to be used, as only 100 milliseconds were required to heat up from a cold start. This was because the many super-small wires, and the way they were mounted to the frame, provided a high surface-to-volume ratio. This allowed the instantaneous availability of thermal energy at the emissive oxide surface of the cathode. With so many electrically parallel, directly heated wires available, very low cathode inductance was achieved, which permitted some of them to be used into the upper UHF regions. The filament voltages were unusually low, at 1.6 volts, so that the cathode approached the ideal single-potential cathode structure.

There were also experiments with exotic types of glass. In one such experiment, an extra getter was included, being made from "thirsty glass". This was a highly porous silica compound made in a furnace by fluxing with borosilicates. This glass had its empty space as high as 28% of the total volume of the getter. The special glass, being porous, adsorbed moisture and contaminants left over after the degassing and sealing steps were completed. Apparently this glass getter worked well, but was not cost effective for some other reason. I'm not aware that it was ever used in regular tube production.

In addition to advances in materials and techniques, the production and test areas made significant advances in efficiency. At Raytheon, mechanical engineers designed an automatic tube tester that weighed seven tons and kept two employees busy around the clock. This monster was located in Newton, Massachusetts and would perform twenty individual static and dynamic electrical tests at a rate of 1,800 tubes per hour. A tube was at first sent to a pre-heat chamber, where it reached operating temperature. It then was sent to an index assembly which would begin the various test series. Rejects were automatically sent to the scrap bin for crushing. Counters were attached to the machine, and they indicated the total input and output count and the number of rejects. Alarms in the engineering department went off if the reject rate went too high, which allowed material costs to be kept under tighter control. The use of production techniques such as these allowed Raytheon to offer the "Reliability Controlled" series, in which 1000 hours of trouble-free service was given a full credit guarantee. Proportional credit was given for any lot which did not meet an average life of 10,000 hours.

Keep in mind that all of this work was done before the space age, with paper and pencil, typewritters, and of course the trusty wooden slide rule, which needed no battery!

What type of tube do you suppose we could build in 1995? Our imaginary modern-day tube engineer would begin his new designs with the aid of a computer model, as this is how electronic engineering in the 1990's is done. Tube dynamics could be studied in detail on a 3-D basis before ever actually building any prototype tubes. The tube's operating parameters could be mathematically analyzed very rapidly with the computer, reducing to hours what might have taken weeks or months in 1960. He would have access to materials engineers who have produced metals and processes for the aerospace industry which were not even dreamed of in 1962. Near-perfect vacuum chambers are available which have been built for other purposes. Best of all, the tube patents have all expired! Anyone for an output tube the size of a sewing thimble

continued on page 36

Rebuilding The LS-3 Speaker

by Dave Ishmael, WA6VVL
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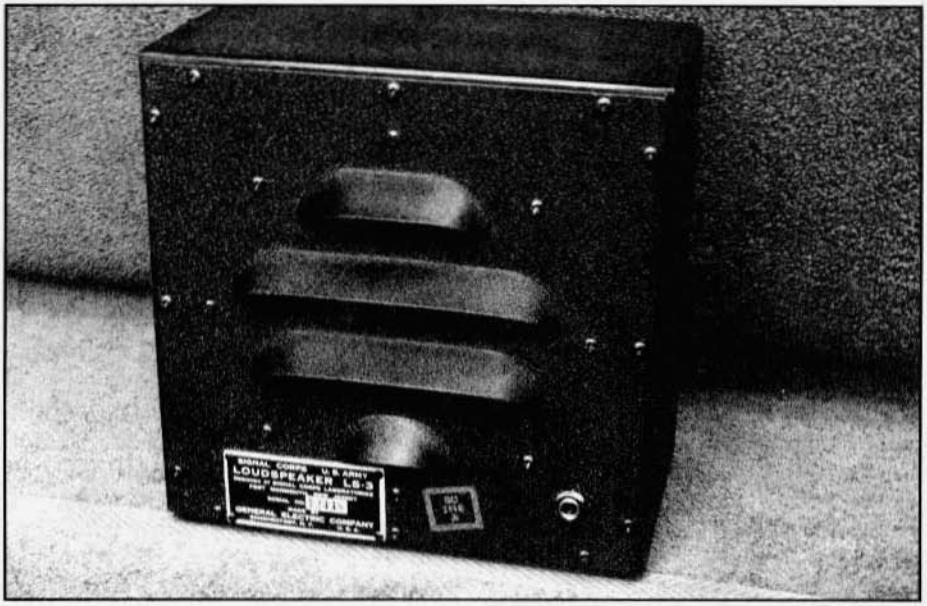
Costa Mesa, CA 92626

After getting my first BC-348 in April '91, I started looking for the matching LS-3 speaker. The LS-3 is a 8-1/4" sqr. x 4-1/2"D, 6" round speaker made for the US Army Signal Corps - a perfect match for the BC-348.

I quickly found an LS-3. It was made by G.E., appeared to be in original condition with no extra holes in the cabinet, and the ID plate was intact and in very good condition. The original 6" speaker was beyond repair and the original black wrinkle finish could not be salvaged. The finish was complete, however, with no flaking paint or scratches. I stripped the cabinet and front speaker plate and thoroughly cleaned them in warm soapy water several times with a bristle-brush, followed by a good rinse. After drying, they were now ready for repainting.

I have been using Plasti-Kote No. 217 black wrinkle paint, carried by the local Pep Boys, to do all of my black wrinkle painting. I have obtained the best results with this paint by placing the ready-to-paint pieces in a "hot summer sun", allowing them an hour to reach temperature, and then painting them. I just haven't had the intestinal fortitude to use my wife's oven, especially as bad as this paint outgasses during drying.

I have been told to paint horizontal surfaces only to avoid paint runs. I follow this advice on relatively large surfaces, like equipment cabinets. For smaller pieces like speaker cabinets, I usually paint both horizontal and vertical surfaces at the same time. Use uniform coats spaced 4-5 minutes apart.



The rebuilt LS-3 speaker. The "final touch" was the addition of a replica Signal Corps inspection stamp to the right of the ID plate.

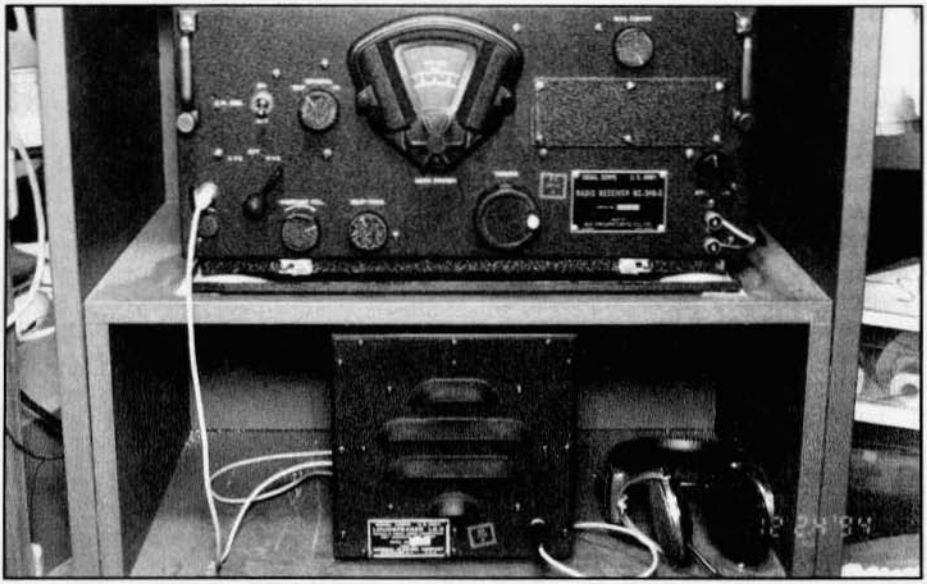
The coats should be relatively thick, just short of running. The more the coats and the thicker the paint layers, the larger and coarser the wrinkles. This paint takes practice, practice, practice... Every time I think I have a handle on using this paint, a cabinet comes out looking like %$#@?>& - usually because I get a little careless. Practice, practice, practice, . . . I would suggest painting a few things before tackling something you really care about and developing your own techniques. The very first thing I painted didn't even wrinkle! This time, however, the LS-3 cabinet and speaker plate came out very good.

I replaced the original speaker with a round 6" from Radio Shack, P/N 40-1285. This is a 20W 8Ω "wide-range" speaker with a range of 55 Hz - 12 kHz, with a 10 oz. magnet. I found quite a few 6" round "replacement" type speakers that would accommodate the LS-3's mounting holes. The speaker was assembled using black phillips-head 6-32 hardware. The original "chicken-wire" grille was retained.

Even though I had wired my BC-348's audio output for 500Ω, I wired the LS-3 for 8Ω without an internally mounted 500Ω to 8Ω matching transformer. I mounted the Stancor A-8101 matching transformer externally in a plastic Radio Shack utility box with a 500Ω/4Ω switch and "hid" it behind the LS-3. My receiver collection is split between 500Ω and 4Ω outputs so I can use this setup for any of them or as a test speaker.

The original ID plate was in very good condition so it was retained. New hardware was used to mount the ID plate. A new 1/4" jack was used without the black jack cover.

As a final touch, I had a replica Signal Corps inspection stamp made, with my street address as the inspection number, and stamped the speaker plate to the right of the ID plate. I use a small section of folded cheesecloth as a stamp pad and have found that Testors gloss enamel #1127 orange is a pretty close match to the original. At first blush, the rebuilt LS-3 looks like NOS (new old stock). I have also used this stamp on rebuilt SCR-274-N BC-45? command receivers with equally good results. **ER**



The finished LS-3 below my BC-348-O. The Stancor matching transformer is "hidden" behind the LS-3.

The Millen Duo

by Jim Hanlon, W8KGI
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Were you lucky enough to work the W2AN Jim Millen Station when it was on the air recently?(1) I copied it late in the day, December 11, on 75 meters way out here in New Mexico, but I wasn't able to crack the east coast and midwestern QRM for a QSO. Shades of 75 in the early 50's! But on March 11 when they showed up on 14286 kc, I got lucky early and worked them twice, once on AM with my Valiant and a second time on CW. The second contact was especially sweet because I was using my serial number L-175 HRO, from the same manufacturing lot as Jim Millen's L-248 receiver and because I was also using a Millen transmitter. Of course, only W2AN has Jim's personal W1HRX kilowatt from the 1930's. My rig came from the James Millen Manufacturing Company which he formed in 1939 when he left National.

In the June 1939 *QST*, the following notice appears on a textured blue paper, full page insert. "James Millen Announces that on May first 1939, he completely withdrew from the National Company, Inc., in order to establish a new company to be devoted primarily to the design and manufacturing of new radio communication products including component parts, receivers, and transmitters. The new company is known as the James Millen Manufacturing Company, Inc., 6 Pleasant Street, Malden, Massachusetts." According to Raymond S. Moore in *Communications Receivers*, National had gone public despite internal disagreement, and this resulted in Jim Millen's decision to leave.

To me, it seems that the innovative spirit that had taken National from the simple SW3 in 1932 to state-of-the-art leadership with the HRO and NC-100 family receivers by 1935 sputtered and died when Millen left the company. National would continue to make improvements to these two fine receiver lines for many years, through the HRO-60 which ran until 1964 and the NC-240D built until 1949. But their subsequent designs of the 40's and 50's, although continuing to be mechanically solid, were largely "me too" in the electrical department.

The new James Millen Manufacturing Company started off making a line of components similar to many made by National. These included variable transmitting, receiving and neutralizing condensers, tube and crystal sockets, terminal strips, plate caps, plug-in coils and coil forms, shaft couplings and right angle drives, RF chokes, IF transformers, knobs, and a high quality slide rule dial. Perhaps it was a combination of start-up and changing market demands due to the oncoming war, but the fledgling company offered little in the way of the promised receivers and transmitters or other assembled equipment typical of the Millen era at National. They offered the model 90700 "Rice-Variarm" VFO which was a one tube plus power supply oscillator for 160 or 80 meters that featured a vernier tuning capacitor adjusted by a lever on the right hand side of the box. And they brought out the model 90505 Secondary Frequency Standard, a crystal calibrator plus multivibrators with outputs from 1 Mc to 10 kc and a detector for beating external signals against its standard markers just before the war started.

The Millen Duo. In front of the VFO from left to right are the coupling circuit that plugs into the crystal socket, a 1930's Bliley LD2 round crystal, a cathode coil, a Millen-made 40 meter coil (the rig uses the same coils in the oscillator and amplifier plates), and a homebrew 40 meter coil for the 807. The extra meter beside the VFO monitors 807 grid current.

After the war, however, things changed. Millen designed two double conversion receivers, both using sliding coil catacombs a la the NC-100 family. The DPF-201 had 11 tubes and weighed 80 pounds, and the DPF-501 with 19 tubes and motor driven bandswitching was a massive 107 pounds. For some reason, they were never brought to market. Even so, the Millen ad in my 1948 ARRL Handbook shows more instruments including a set of adsorption wavemeters, a VHF "Frequency Calibrator" wavemeter, oscilloscopes, and a regulated DC power supply. The famous Millen Grid Dip Meter shows up in my 1953 Handbook as well. Amateur equipment in the 1948 Handbook includes the R9'er matching (receiver) preamplifier, a High Frequency Transmitter (6AG7, 2E26, 829B for 10-11, 6 and 2 meters with 75 watts out), a 500 watt RF Power Amplifier (pp 812's, 80 to 10 meters), the model 90800 50-watt Transmitter discussed in this article, the Rice-Variarm VFO and in the 1953 Handbook a 829B High Frequency RF Amplifier for 11 to 2 meters and the model 90711 Variable Frequency Oscillator.

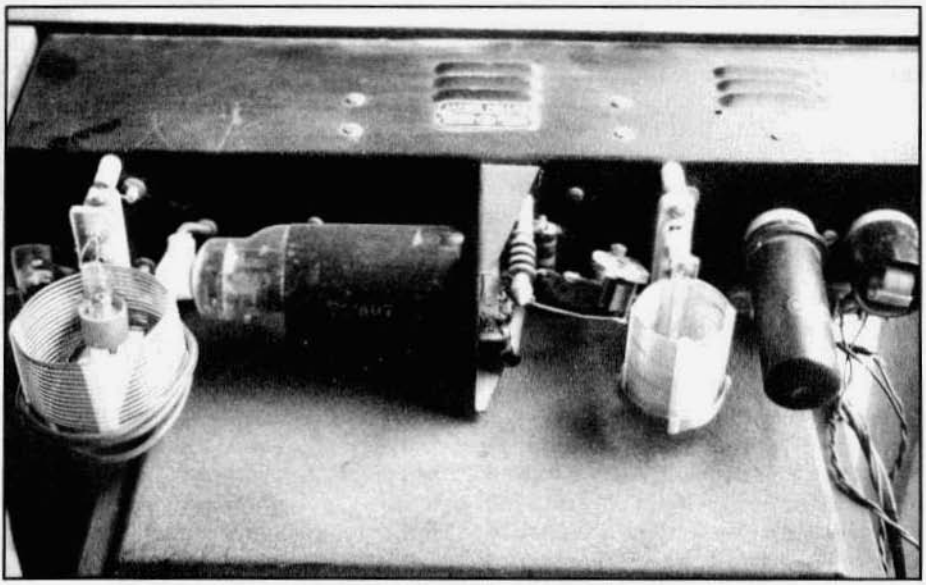
I first became personally acquainted with the Millen 90800 50 watt Transmitter at my Saint Xavier High School Station, W8GYH, in 1953. We replaced the surplus ATD we had been using as an exciter with a used Millen 90800 from Steinbergs (where Ivo(2) worked). You can see it in the picture of the W8GYH Station (3) sitting atop two wooden chalk boxes where we stored the plug-in coils not in use. We drove it with a BC-696 VFO on 80 meters and, as I re-

call, got enough output to drive our push-pull 812A final even on 10 meters.

My current encounter with a 90800 began around 1975 when I acquired it along with a 1941 Meissner Signal Shifter from a friend who had absolutely no idea what either of them was. He bought them at a flea market because he thought the Meissner would make a good antenna tuner for his rig, and the Millen came with it. Fortunately I was able to rescue them both from destruction! This Millen was somewhat the worse for wear as it came to me. It had no knobs, no tubes and only one coil, a 40 meter cathode coil for the tri-tet crystal oscillator. But these were small problems. Like any good Classic Exchanger, I had a few spare 6L6's and 807's put away for just such an occasion. My favorite Columbus, Ohio junk shop, Starr Surplus, had two brand new Millen knobs still wrapped in tissue paper in their original red and black boxes. I made 80 and 40 meter plug-in coils for the oscillator plate and amplifier, using plexiglass for a mounting strip and banana plugs with the leaf springs removed for pins. You can see one of my home-made coils in the picture. A year or so later I found the mother lode, a full set of Millen coils for all bands 160 through 10, again at Starr Surplus. So at this writing I have a once-again whole Millen 90800. By the way, the 40 meter coils also tune to 30 meters so the rig should work there as well. I'll have to wind a cathode coil for my 5 mHz crystals one of these days (it should resonate around 7 to 8 MHz) and try it out.

And what is in the box, you might ask. Well it is the archetypical 1940's low power rig, a 6L6 tri-tet crystal oscillator driving an 807 amplifier. The circuit is quite straightforward and includes a bunch of high wattage wirewound voltage dividing resistors that allow it to run from a single, 500 to 750 volt, 200 mA power supply. The 807 also needs -45 volts of grid bias which I provide with five Radio Shack 9 volt batteries (the cheap carbon zinc ones do better under reverse bias than do alkalines). The 6L6 and 807 are keyed in a common cathode lead. Both my own monitoring and on-the-air reports indicate no chirp or click. On the front panel from left to right are the crystal socket and switch to short out the tri-tet cathode circuit when the oscillator is running straight through, oscillator plate tuning, plate current meter, amplifier plate tuning, and a switch to put the meter in either the 6L6 or 807 plate circuit. At present I'm using about 485 volts of B+ from my Harvey-Wells APS50 power supply and loading the 807 to about 80 mA for 39 watts input. Under these conditions, the rig puts out a respectable 25 watts. I also monitor the 807 grid current with the extra meter you see sitting next to the VFO connected in series with the bias battery. Crystal controlled or driven by its companion VFO, the 90800 is a nice little rig that I use on the Classic Exchange and for regular QSOs.

I have a little trouble putting an exact first manufacturing date on the 90800. The Millen ads proclaim it to be taken from a Handbook design. I do not have a copy of the Handbook it appears in, it's probably in the 1941 through 1947 range. The instruction manual schematic was redrawn on 3/8/47, but an ad for the 90800 appearing in the February, 1946 *QST* says, "Again in production is the No. 90800 transmitter-exciter unit." (It is priced there at $37.50 less tubes but with one set of coils, $42.50 in the '48 Handbook.) It also appears in the cover picture of the June, 1946 *CQ* as part of a larger, rack and panel transmitter. Its prototype was published in the November, 1940 *QST* as, "A Simple Two-Tube Exciter" by Don H. Mix, W1TS, Assistant Technical Editor. That certainly makes it eligible for "pre-war" status in the February AWA Old Time



The 90800 transmitter, rear view, left to right, the 807 plate coil, the 807, the oscillator plate coil, the 6L6 oscillator tube, and a home brew 80 meter oscillator cathode coil.

CW Contest. For Classic Exchange purposes where the score multiplier is the total age of my equipment, I use 1946 as its birthday.

For a long time, I operated the Millen either crystal controlled or driven by the '41 Meissner Signal Shifter that it came with. The Sig Shifter delivers as much as 8 or 9 watts output to a 50-ohm load, so I just capacity coupled its output link to the 6L6 grid across a swamping resistor pot which I adjusted for adequate drive. But then last spring at the Albuquerque flea market, held on Hamvention Saturday no less, fate smiled again and led me to the companion Millen 90711 VFO, serial number 180. This VFO is of the same vintage as the 90800 transmitter, carrying a 3/10/48 date on its drawing. The Millen ads describe it as follows. "The No. 90711 is a complete transmitter control unit with 6SK7 temperature-compensated, electron coupled oscillator of exceptional stability and low drift, a 6SK7 broadband buffer or frequency doubler, a 6AG7 tuned amplifier which tracks with the oscillator tuning, and a regulated power supply. Output sufficient to drive an 807 is available on 160, 80 and 40 meters, and reduced output is available on 20 meters. Close frequency setting is obtained by means of the vernier control arm at the right of the dial (shades of the Variarm). Since the output is isolated from the from the oscillator by two stages, zero frequency shift occurs when the output load is varied from open circuit to short circuit. The entire unit is unusually solidly built so that no frequency shift occurs due to vibration. The keying is clean and free from all annoying chirp, quick drift, jump, and similar difficulties often encountered in keying variable frequency oscillators."

Mechanically the 90711 is indeed solid, built on a heavy copper chassis inside of a 1940's sculptured steel cabinet. The slide rule dial is vintage Millen and is hand calibrated in black India ink on a slightly yellowed heavy paper backing - none of this silk screened or printed stuff that you find on later

Heath, Knight or Johnson kit jobs! The price tag on the 90711 was $124.50 in a 1951 *QST*, more than half the cost of an entire Viking I kit in the same magazine! Considering that I bought a well used BC-457 Command Set for $2.95 about then and used it as a VFO for a good many years thereafter, the Millen was indeed a premium article.

My 90711 is in pristine shape. All I did was plug it in and it played - a tribute no doubt both to its previous owner and to James Millen Manufacturing. Its 50-ohm link output is rated to give at least 0.9 watts on 160, 1.2 watts on 80, 0.6 watts on 40, and 0.11 watts on 20. It originally came with a link coupled tuned circuit covering 160 to 20 meters in two sections designed to couple to the grid of a crystal oscillator like the 6L6 in the 90800 transmitter. That part was missing, so I made up an equivalent unit from vintage parts taken from a BC-610 TU53 tuning unit. In all honesty, the 6L6 is a little "squirrelly" when its grid is tuned, but there is no trouble adjusting things so that it is stable and happy with the drive from the VFO. There are two options for keying, in the oscillator cathode which is good for break-in but which the manual warns will produce clicks or in the amplifier cathode which has no clicks. I key the oscillator with a time differential keyer that delays turning on following amplifiers until the click is over, so I have the best of both worlds. And now with the combination of the 90711 VFO and the 90800 exciter, I have a much more complete, genuine Jim Millen transmitter.

In preparation for this article, I decided to see if it was possible to make any contacts using just the "barefoot" VFO. I've not been much of a QRP person, but it was at least worth a try. In one evening's casual hamming, I worked N6ZFO in San Francisco and W7TCI in Austin (Texas, you all) on 80, the latter contact being an enjoyable half hour rag chew. Then I switched to 40 and had a half hour rag chew with VE7AKU in Victoria, British Columbia! My highly accurate Radio Shack power meter was indicating about 1.2 watts out on 80 and 0.5 watts on 40. Later in the week, I raised KG8GD in Greenfield, Indiana running about 30 milliwatts out on 20! I think I'll tweak the trimmers and maybe spring for a new 6AG7 so I can work some real DX.

You might wonder what a completely open, class C harmonic generator like the Millen 90800 does to television sets. In the late 40's and early 50's, the "Tennessee Valley Indians" put a good many hams with rigs like this off the air. The manual, a faded blue mimeograph set of seven pages (you couldn't get all of the legal disclaimers into seven pages these days!) suggests shielding the transmitter and using a good high-pass filter in cases of TV interference. "The 90800 Exciter-Transmitter causes very little TVI on 20, 40, 80 or 160 meters. For operation on any of these bands, the above treatment usually will eliminate all trace of TVI." It goes on to explain that to avoid TVI on 10 and 11 (yes) meters you have to operate the 807 as a straight through amplifier instead of a doubler.

In these days, TV signals are a good bit stronger than they were back then. I live roughly 10 line-of-sight miles away from a forest of TV transmitter towers on top of the Sandia Mountains. With our modern TV set operating on rabbit ears about 40 feet away from the Millen, I see a light crosshatch on channel 2 when I'm fired up on 20 (fourth harmonic), but nothing on any of the other local channels, 4, 5, 7, 11, 13 and UHF or on the channel 3 feed from my VCR. On 15 there is again a very slight crosshatch on channel 2, though it is not harmonically related. On 10, with the 807 doubling from 20, there is a slight crosshatch on channel 2 (second harmonic) and on channel 7 (sixth harmonic). None of the patterns is at all

serious (no complaints from the family). So an ardent Classicist should be able to get away using the 90800 at least up through 20 meters without trouble.

In summary, both the Millen 90711 VFO and the 90800 transmitter still generate quite acceptable signals on the bands. If you run across either one of them, do not hesitate to add them to your Classic Collection. And then make a sked with W2AN. ER

References:

1. Robert J. Raide, W2ZM and William B. Fizette, K3ZJW, "The James Millen Memorial Station at AWA," *The Old Timer's Bulletin*, November 1994.

2. Hanlon, "Ivo's Mighty Fleapower," *Electric Radio*, September 1993.

3. Hanlon, "The HQ-129-X", *Electric Radio*, October 1994.

Three-Phase to Single-Phase from page 11

The voltages on each of the individual secondaries to the center-tap are:

V (4-7) = k * (Vb - Va)
V (5-7) = k * (Va - Vc)
V (6-7) = k * (Vc - Vb)

The voltages between the pairs of output terminals are:

V (5-4) = k * (2 * Va - Vb - Vc)
V (4-6) = k * (2 * Vb - Va - Vc)
V (6-5) = k * (2 * Vc - Va - Vb)

The correct primary configuration in this case is to place the full 220 volts AC across primary "B" (terminals 1 and 3), and 120 volts across each primary "A" and "C" by connecting the neutral wire to terminal 2, as shown in Figure 6B.

Then,

V (4-7) = 3 * k * Va
V (5-7) = 0
V (6-7) = -3 * k * Va

where Va is 120 volts in this case, and the full voltage across the terminals 4 and 6 is 6 * k * Va. The rectifiers connected to terminals 4 and 6 will fire and the output voltage will be as in the previous cases. It is important to note here that if this primary configuration is applied to either of the delta-Y configurations above, the DC voltage will be dangerously high. Conversely, if the primary configuration for the first two cases is applied to the delta-Y zig-zag, the output voltage will also be dangerously high and the rectifiers will not share the load evenly. Thus it is important to distinguish the delta-Y zig-zag from the delta-Y half- and full-wave and delta-delta circuits. Applying the wrong modification may harm the equipment.

Delta-Delta Configuration

Finally, a word about the delta-delta configuration, Figure 4. This circuit is sometimes included as auxiliary windings on the same transformer as the delta-Y half- or full-wave to provide low voltage. Fortunately, the same modification, shorting the "B" primary and placing the 220 volts directly across the "A" and "C" primaries applies to the delta-delta configuration.

With all of these modifications, the rectifiers will experience a 50% increase in average current (the peak current should not increase significantly), the transformer copper losses and the ripple voltage will increase.

It has been my experience that, due to the overdesign of the military and broadcast equipment, the components will function reliably. Poor rectifiers (too much voltage drop) will behave even more badly. In intermittent amateur service, the power transformer should not heat excessively. And I have found that the original power supply filters give more than adequate ripple filtering, even with increased ripple voltage and decreased ripple frequency after the conversion.

I hope as a result of this article that many of you acquire some of that "big iron" that uses three-phase power and have success converting it to single-phase power. I will be listening for your signals. ER

The Termite Talker

by Horst A. Geipel, WAØNUH
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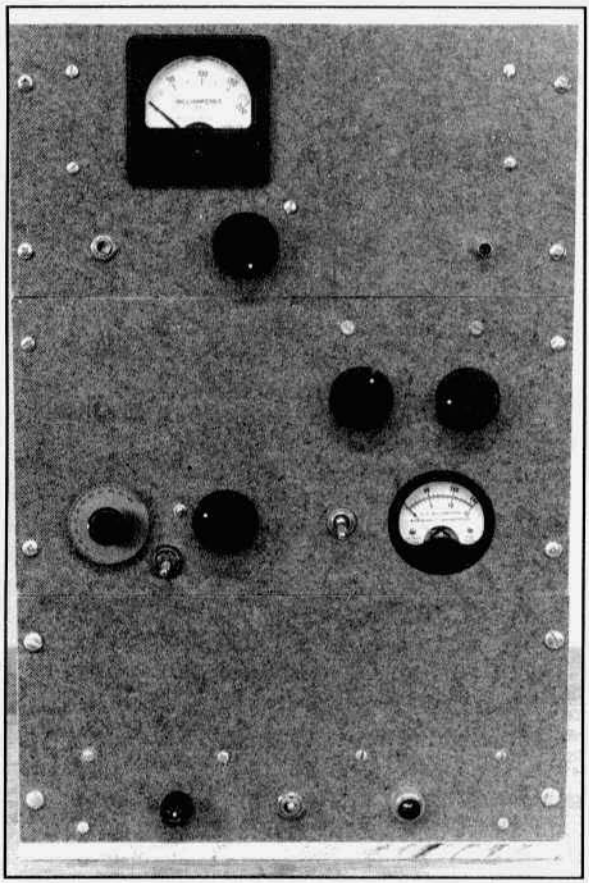
This homebrew AM rig was built specifically for participation in the seventy-five meter Colorado Morning Net. The name "Termite Talker" was coined by KØOJ during my first net check-in with this rig because of its wood and masonite construction.

The decision to build an AM transmitter for seventy-five meters was made when, after listening to the Colorado Morning Net a few times, the desire arose to participate. Up until that time I had been operating only CW and no rig capable of working fone was in my possession. As my hobby budget is somewhat restricted, a new rig would have to be homebrew and would have to be built one hundred percent from junk box parts. The only aluminum chassis available was too small to accept all the parts for the envisioned rig. Then, in a 1937 issue of "*Radio*" I saw a construction article for a low power AM rig utilizing masonite and wood for chassis, panels and rack. This type of construction seemed both functional and affordable. I decided to build my rig in this fashion.

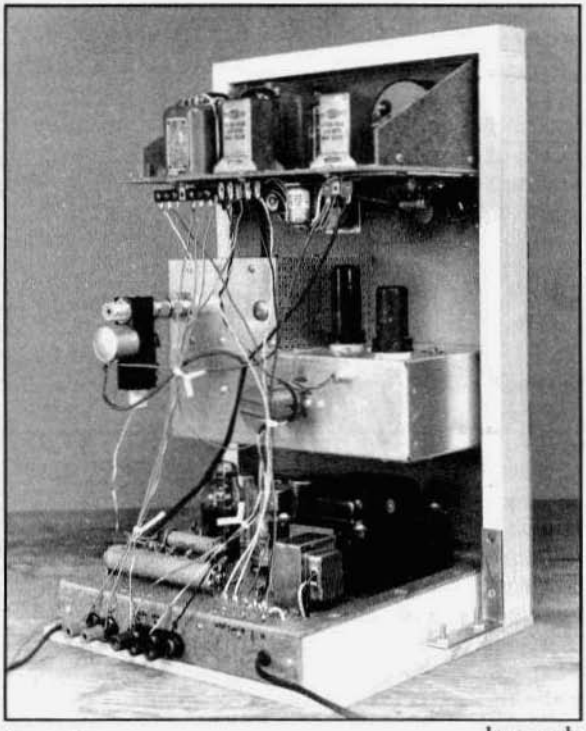


Front panel

The RF Deck

A 5 x 10 x 3 inch aluminum chassis, the only "termite proof" part of the transmitter, contains the RF portion of the rig. The power amplifier section is enclosed in a box made from perforated aluminum for TVI and RFI shielding. Aluminum foil glued to the front panel and a perforated aluminum bottom plate complete the shielding.

A 6AC7 operating as a parallel tuned Colpitts oscillator with the grid tuned to 160 meters serves as the VFO. Silver mica capacitors and an air trimmer minimize drift. Initially both the screen and the plate of the 6AC7 were supplied with regulated 150 volts. However, due to the



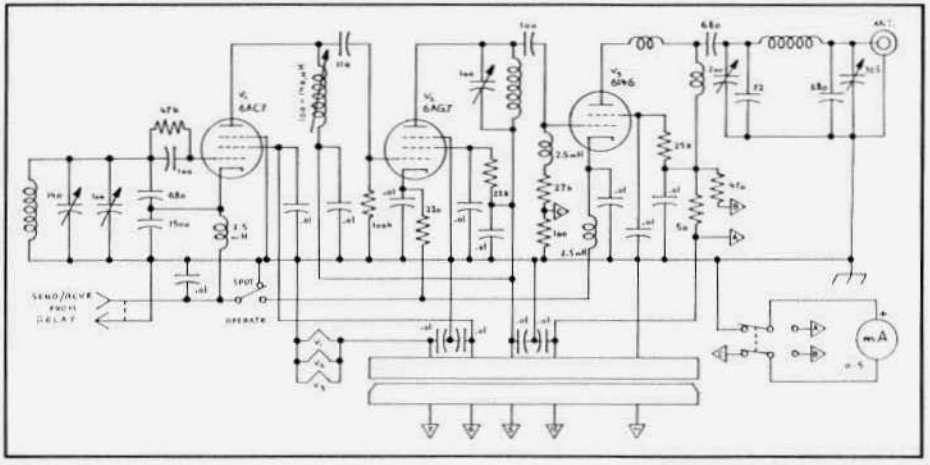
Rear view

extensive shielding, the VFO spotting signal could not be heard in the receiver. After connecting the oscillator plate to the 250 volt supply, the spotting signal is audible but drift is increased.

A 6AG7 functions as buffer, doubler and driver for the 6146 class C power amplifier. A meter salvaged from a cannibalized Globe Scout transmitter measures the amplifier grid and plate current. The 6146 is recessed below the chassis surface to reduce panel height and to prevent coupling between the amplifier grid and plate circuits. The RF deck is connected to the power supply and modulator via a chassis mounted octal socket and plug.

The Modulator

The modulator is built on a masonite chassis and panel. A 6AU6 pentode functions as a voltage amplifier with a high-impedance input for the crystal microphone. A coupling capacitor of relatively low value between the 6AU6 and the triode-connected 6AQ5 driverrestricts the low audio frequencies and a capacitor from the 6AQ5 grid to ground rolls off the high ones. The restricted frequency range thus obtained allows for more talk power within the restrictions for one hundred percent modulation.



RF Deck

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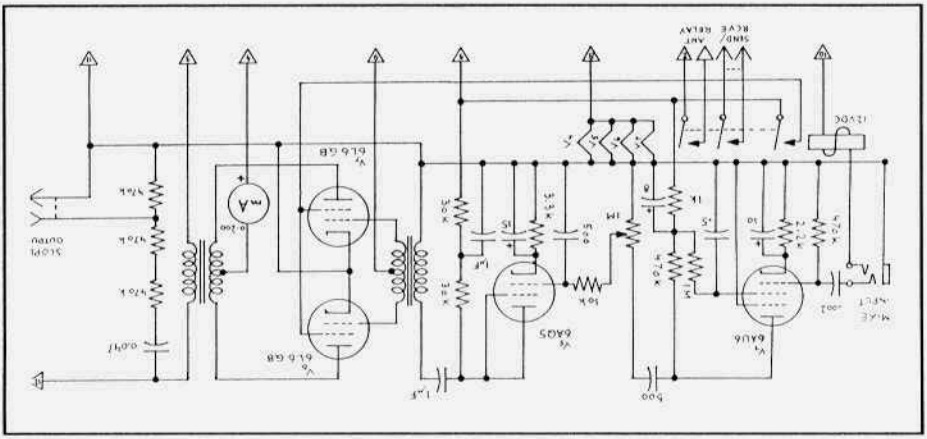


Modulator

As no suitable plate to push pull grids interstage transformer was available from the junk box, the carbon mic to push-pull grids input transformer from a TCS 12 transmitter was substituted. The input winding of this transformer is connected through a coupling capacitor to the driver plate. Despite the resulting impedance mismatch there is enough audio for one hundred percent modulation. The 6L6 GB push-pull amplifier operates with fixed bias of 22 1/2 volts obtained from a separate transformer and rectifier on the power supply chassis. A push-to-talk relay connects the 6L6 GB screens to the 250 volt supply and at the same time actuates a 115 volt AC antenna relay during transmit periods. A 200 mA meter in the plate supply line allows the monitoring of the modulator plate current. A voltage divider connected to the secondary winding of the modulation transformer supplies audio sampling for connection to the horizontal plates of a monitor scope. The modulation transformer was salvaged from a defunct AF-67 transmitter.

The Power Supply

The power transformer from an old TV set supplies all the power to the high-voltage circuits and the tube filaments. A separate 24-volt transformer furnishes bias for the modulator and 12 volts for the push-to-talk relay. The high-voltage supplied by the full wave rectifier with capacitor input is about 500 volts under load. A voltage divider provides 250 volts to the VFO and buffer as well as the speech amplifier and modulator screens. A VR150 regulates the VFO screen voltage.

As the photograph of the transmitter rear view shows, many of the high voltage connections are exposed and a serious shock hazard exists. As there are neither small children nor cats in my house and the rear of the transmitter is not accessible once the rig is on the operating desk, the shock hazard is being tolerated. However, I do strongly discourage use of exposed high voltage circuits, especially where children and/or cats could come in contact with them. During testing and adjustment of this rig I kept my left hand in my pocket.

This safety precaution paid off when I came in contact with a terminal of the modulation meter and the shield of the 6AU6 tube at the same time! **ER**

Letters from page 2
tuning kind of funny but did not pay it too much mind. Test transmissions seemed OK so I told the bridge they were all set. It was only after docking that I realized the switch was grounded and the TBL had been loaded into the hull! I asked the bridge if they had any problems and was told "Negative!". The old TBL had taken a licking and kept on ticking.

Anyway that is more than enough ruminations from an old sailor. I enjoyed the TBL article. Thank you.
Roger W. Kuchera, K1TG

Dear ER

In early 1973, I was the communications officer of the USS McCandless DE 1084. This was a new ship built by Avondale Shipyards and commissioned in 1972. In the radio shack were 8 brand new R-1051B's, the best the Navy could buy. After receiving notice that McCandless would be sent to the Indian Ocean in mid 1973 my radio chief approached me with a "proposition". Basically the conversation went something like this: "Mr. Metz, could we install an R-390A in radio central? My response was something like - Chief, we have 8 of the finest receivers the Navy can buy, why do we need an old outmoded tube model?" RMC Coyle D. Stanley, with 28 years in the Navy at the time, said matter of factly, Mr. Metz in some situations of bad QRM, the 390A is much better than the 1051B. (If anyone knows of his whereabouts today, please let me know). I was fortunately mature enough to trust him and his weird request to ask the CO's permission to install this oddity. With some trepidation, the CO said yes as long as we could pull and hide it in a matter of minutes in case of an INSURV or Squadron inspection. A week later the chief had "procured" one out of the salvage yard that worked very well. Needless to say it would not appear on the approved list of equipment! With the understanding help of the Norfolk Naval Shipyard at the sailor level and a few pounds of coffee in exchange, it was wired into the appropriate "black" distribution box such that it could be used to copy the 16 channel fleet broadcast if necessary.

Afterwards, it became my "private" receiver to listen to short wave broadcasts but most of the time it was dedicated to guard some oddball frequency to free up a 1051B. While I left the ship prior to deployment, I have always wondered how long it lasted and if it was still there last year when the ship was decommissioned. In light of current comments as to the Navy now needing this receiver on all major ships, I guess my radio chief understood the problem 20 years ago. Though I have never gotten around to getting my amateur license, that unique exposure has lasted many years and still continues.
Dave Metz

Dear ER

The design of the Electric Radio Pal receiver (*ER* April 1995) poses electrocution and fire hazards which have been recognized and avoided, even in hobbyist magazine articles, ever since the first transformerless power supply designs appeared in the 1930s. The design flaws are:

1. The direct connection of one side of the AC line to the metallic chassis, instead of an isolated common bus.

2. The direct connection of the shell of the headphone jack to the power supply.

3. The small size of R1, which by itself would allow 1.2 mA of 60 cycle leakage if the power plug were reversed.

4. The lack of fuses in the ungrounded AC power feeds.

Flaws (1) and (2) are potentially lethal, since reversed installation of the power plug, or failure of the neutral connection with the power plug inserted correctly, would place full line voltage

continued next page

Letters from previous page

on exposed parts. Isolation of the common bus from the chassis, or of a grounded chassis from all external metal parts of a surrounding enclosure, are the universal solutions to Flaw (1). A safety-rated audio isolation transformer between the audio stage and the headphone jack is needed even with Flaw (1) eliminated. Since the only function of R1 is to prevent the buildup of static charge on C2, a value higher than 2.7 MΩ would suffice, and would hold the AC leakage current under worst-case conditions to the 0.5 mA allowed by modern US safety standards. Because of their age and questionable safety, line cord resistors should not be used in new equipment. Appropriate fuses should be used in the high-side AC feed or feeds at their point of entry into the enclosure.

I hope that anyone who reads "Electric Radio Pal" will either already know, or will be motivated by this letter, not to follow such dangerous practices. Certainly we all want our hobby to be unmarred by the consequences of designed-in lethality.

Steven E. Fick, N3TE

Dear ER,

The following is my reply to Steven Fick's letter.

Most of Mr. Fick's concerns can be met by a very simple modification of the ER Pal line cord which requires about 15 minutes work. I modified the unpolarized plug on the line cord into a polarized type by widening the ground prong. First I sanded the ground prong to remove all tarnish. Then I filed about .05" off the end. Next I formed a piece of No.16 tinned bus wire into a U shape about 1/4" wide and with legs about 3/8" long. This was soldered on to the ground prong making it about the same width as the ground prong on a standard polarized plug. Finally, the modified prong was filed and sanded to give it a neat appearance. My thanks to Mr. Ludwell Sibley for suggesting the idea. I also wish to thank Mr. Fick for his interest.

Bob Dennison, W2HBE

Collins 75A-4 Repairs from page 18

The 15 meter crystal in the oscillator circuit had been changed by a former owner but the oscillator was still dead. I changed the plate tank tuning capacitor, C43, to a dipped mica (100 pF) and the oscillator now works and 15 meters is very alive on my receiver again.

My experience with a 75A-4 repair job a few months ago also involved a bad mica capacitor in the plate circuit of the 40 meter section of the RF amplifier. The receiver had very poor gain on 40. I couldn't get the circuit to align so I used a grid dip meter to check the resonance of the circuit. It was tuned to 12 MHz indicating an open capacitor at C25. I installed a new dipped mica capacitor and the circuit aligned properly.

I hope this helps you get your A-4 working. **ER**

The Forgotten Science from page 23

running 500 watts input and having constant emission for 15 years?

It has been recently announced that Western Electric, believe it or not, will again start producing vacuum tubes for the audio industry. This is not due to any sort of sentimentality, but is based strictly on business. The market exists! Is it to far out to imagine a future where tube research is once again taken up where it was forgotten 35 years ago? **ER**

Modification For The Collins 516F-2

by Merle R. Crowley, W1GZS
P.O. Box 476
Sumterville, FL 33585

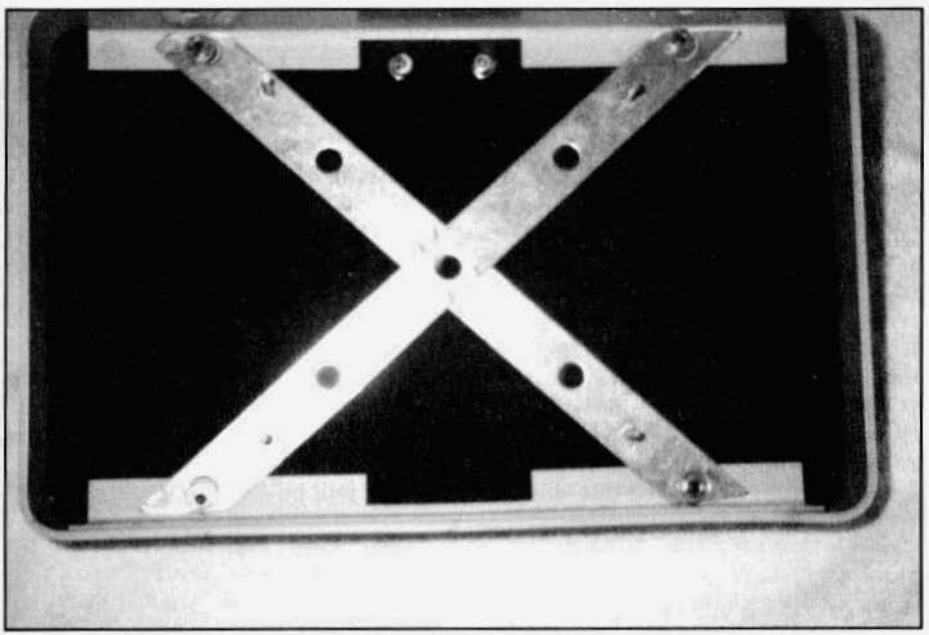
Over the past few years we have repaired several KWM-2/2A transceivers and found that most of the owners have installed a 5x7 speaker in the 516F-2 power supply.

The idea of having a speaker in the enclosure is great, but the way in which they were installed left a lot to be desired. All that I ran into had the speaker mounted directly to the front grill with 6-32 hardware. The weight of the speaker had caused the grill to dent inward and in general look very poor.

The solution we used is quite simple and only takes about an hour to complete, the best part is there is no visible signs that a speaker has been installed. Should you later want to remove it you will find no visible signs that the unit has ever been modified!

Just get a piece of galvanized bracing with holes punched in it. I used a piece that was left over from when I installed our Genie garage door opener. Place it as seen in the photo. Cut out two pieces to form an X brace. Use the existing nuts that hold the front grill in place to fasten these X braces to the unit. Then place the speaker over the X brace, mark the placement of the mounting holes that are in the speaker, remove the braces and drill four holes to accommodate 6-32 screws, add a washer and nut, tighten it all up and that is it. When you reinstall the trim ring the grill fits nice and snug with no signs that a speaker has been installed.

Hope that you find this mod useful. If nothing more you have saved a piece of Collins from becoming defaced! ER



Mike Doliton - K2ZIH, Silent Key

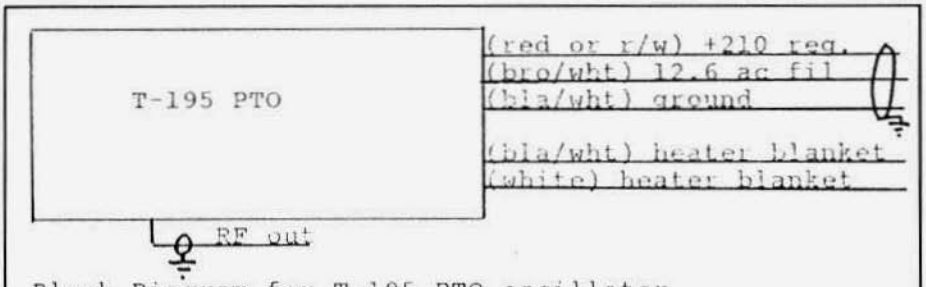
by Pete Malvasi, WB2BYQ
75 Church St.
Ramsey, NJ 07446

It is difficult to write a eulogy for a good friend but if there can be anything easy about it, with Mike, K2ZIH, it is that there are so many good things to say. As many of you know, Mike was a past president of BARA and had been a very active ham for a long time. He was always gentle and generous in nature although a bit on the quiet side. Mike suffered from A.L.S. which is better known as "Lou Gehrig's Disease". For the past two years the most obvious symptoms were his difficulty in speech which progressed to a point where he needed to use a palmtop PC to display his comments.

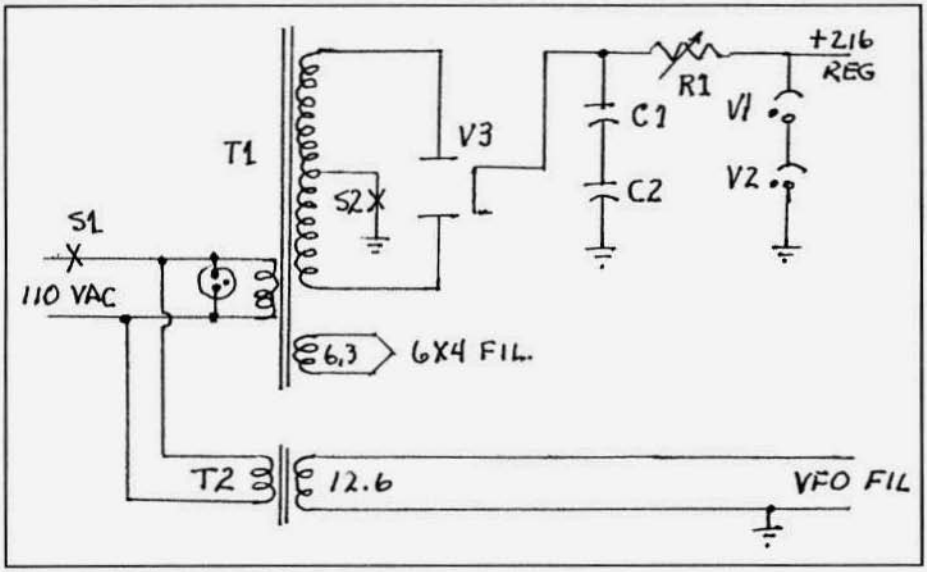
Somewhat before that time he attempted vocal communication which was often too difficult to readily comprehend. Regardless of these factors and his quiet style Mike's inner strength was very obvious since he showed no signs whatsoever of any self-consciousness or embarrassment. And he certainly had no reason for it since Mike was very bright technically, had lots of radio experience and had an all too rare gentle and caring nature. It was always a nice experience to talk with him either on 75 meters AM at 4 in the morning, or at an antique radio fleamarket, or at a barbecue. I once met Mike on a flight out west after his serious voice problems began. He had a PC with him and between his keyboard and voice explained how he restored an old SBE-34 transceiver he picked up for $25 the summer before. We talked this way for at least 3 hours and I was disappointed to leave him on the plane since I was getting out in Denver and he was going on to California for a technical training conference. The old expression that you can't keep a good man down was so true with K2ZIH.

Mike was an avid classic radio enthusiast. He was active on 40 and 75 meter AM and operated lots of the "old green boxes" - Heathkits - which were his favorite. Mike was often heard on 75 AM from his car with his Gonset G76 which frequently blew out the processor chip of his Caddy. Mike was more accurately defined as a resurrector rather then restorer as he would buy the real basket cases and get them back in service in short order. He was not much for esthetics over originality of condition and once proudly presented to me a very beat up Johnson Viking I which he rebuilt but purposely left the pigeon droppings stains on since that's how the old ham who owned it before kept it in his barn. He had to break tradition though to remove the stains from the final cage as the smell was not too pleasant under operating conditions.

Mike leaves his loving wife Heather, his mother and father as well as many relatives, colleagues from Sony Medical - his employer, fellow Maywood Emergency Corps members and of course his many ham friends. He was 53 and will be sorely missed. ER



Block Diagram for T-195 PTO oscillator



Power supply schematic.

Parts List

T1 - 460 VCT, 50 mA (FRS #7514)
T2 - 12.6 VAC 300 mA (R/S 273-1385)
S1, S2 - SPST switches (R/S 275-603)
C1, C2 - 60 mF 250V (FRS page 11)
V1, V2 - OB2 regulator tubes (FRS)
V3 - 6X4 rectifier tube (FRS)
R1 - 10+W wirewound adjustable*
I1 - pilot lite (R/S 272-704)
*** R1 sized to allow VR tubes to pull 25 mA no-load.**

the 10 kHz marks come out exactly aligned in the overlapping areas.

Don't try to duplicate the unit shown. Utilize your junkbox and Radio Shack as well as Fair and other mail order houses. Use what you have at hand. There's nothing wrong with wood for a base and masonite for a panel if that's what you have. A cardboard or aluminum disk fastened to the gear wheel, which comes on the unit, can make a fine dial. No matter what schemes you use, the PTO will work and give you a very stable oscillator and 600 degrees of bandspread for the range of 1750 to 2000 kHz with enough output to drive the normal crystal oscillator to full output.

So be on the lookout for this fine piece of surplus and build yourself a useful addition to your hollow state transmitters. Heck, the hunt for a wanted item is half the fun! **ER**

Suffix Numbers on SP-600 Receivers from page 13

Oct. 5, 1953, SP-600-JX-28
Std. frequency range, 540 kHz-54 MHz. Signal Corps R-620/FRR, order no. 25693-Phila-53-61, contract DA-36-039-SC-49453.

Mar. 12, 1954, SP-600-JX-29
Std. frequency range, 540 kHz-54 MHz. Made for CIA contract no. XG-1178.

Dec. 28, 1954 SP-600-JX-30
Std. frequency range, 540 kHz-54 MHz. Diversity receiver. Replaces JX-17.

Dec. 1954, SP-600-VLF-31
Special frequency range, 10-540 kHz. Very low frequency receiver. No xtal frequency control.

Dec. 1954, SP-600-JX-32
Std. frequency range, 540 kHz-54 MHz. Black wrinkle finish front panel with white engraved lettering. Made for Mackay Radio, their order no. M-41666, Hammarlund production order no. 2467-300. Internally the same as JX-21.

Dec. 1954, SP-600-JLX-33
Frequency range, 100-400 kHz. 1.35-29.7 MHz.

Aug. 7, 1956, SP-600-JL-34
Special frequency range, 100-200 kHz, 540 kHz-14.8 MHz. Made for CIA. Their order no. XG-1765.

Aug. 1956, SP-600-JX-35
Std. frequency range, 540 kHz-54 MHz. BFO range 0-10 kHz. US Navy R274B/FRR, order no. NObsr-71369.

Oct. 3, 1957, SP-600-JX-36
Std. frequency range, 540 kHz-54 MHz. Same as JX-21, except for addition of audio input jack on rear of chassis. Made for FBI, their order no. FBI-16876, their contract no. J-FBI-3873.

Oct. 9, 1957, SP-600-JL-24- (Special)
Frequency range, 100-400 kHz, 1.35-29.7 MHz. No xtal frequency control. Supplied to NAVSHIPS 91661, R274B/FRR per PL-33910-1.

Mar. 28, 1961, SP-600-JX-37
Std. frequency range, 540 kHz-54 MHz. 25 cycle power supply. Otherwise, same as JX-21.

Mar. 1961,SP-600-VLF-38
Special frequency range, 10-540 kHz. Very low frequency receiver. Same as VLF-31 except for 25 cycle power supply.

July 21, 1961,SP-600-JX-39
Std. frequency range, 540 kHz-54 MHz. Made for FAA contract no. FA-2338.

1971-1972, SP-600-JX-21A
This was the last series of SP-600's manufactured. It had the std. frequency range, 540 kHz-54 MHz. Had 22 tubes vs. 20 in other models. Also, a separate product detector, LSB, USB, CW, MOD switch. Appearance was different from other SP-600's in that the knobs had no metal skirts, the front panel was engraved with markings for xtal phasing, selectivity, BFO, audio gain, RF gain. Also is marked JX-21-A on front panel.

Most of the dates came off engineering revision "sign off" sheets, so are only approximate dates.

During the Vietnam War, several "Hybrid" SP-600's were produced with 9 tubes, printed circuit boards and 200 kHz bandpass filters. They were connected to video recorders, usually in banks of 5 receivers to seek signals in the HF spectrum. Tapes were then sent to Fort Meade, Maryland for interpretation. I believe the military designation was R-1151/GR. This is similar to the Manson Labs R-1230 (R-390A's).

The US Navy used SP-600's mainly for signal intelligence work, I don't believe they were installed aboard ships.

Maybe this will help SP-600 owners in identifying the various model types of Hammarlund SP-600 receivers. ER

CLASSIFIEDS

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DEADLINE for the JUNE Issue: JUNE 3

FOR SALE: Repair and restoration on all vintage equipment; 35 years experience. Barney Wooters,W5KSO, 8303 E. Mansfield Ave., Denver, CO 80237. (303) 770-5314

FOR SALE: HS-30 headsets, GI dated 1944, brand new, in sealed, waxed, protective cartons. Extra earpieces, dessicant, instructions, cord, included. Used with virtually all WW II and many later combat and clandestine radios - $20. Gene, KD4YIZ, (800) 619-0900.

FOR SALE: Clegg Interceptor B, VGC - $175; RME 4350A, VGC, manual - $195; Realistic DX-150, exc. - $85; Heath HW-16, VGC, manual - $125; Gonset Comm. IV, 220 MHz, good - $50; many others - request list. Richard Prester, 131 Ridge Rd., West Milford, NJ 07480. (201) 728-2454

FOR SALE: Drake TR-44B (R4-B & T4-B in one cabinet), T4-B has factory 10-position crystal deck, Drake mic, AC-4, manuals, almost mint - $450 shpd; Collins 75A-2, 32V-3, spkr, manuals, rcvr has optional calibrator & FM unit, exc. condx - make offer, PU only; Collins 30L-1, exc. - $500 PU only. **WANTED:** 75M coil for BC-610. Marc, RI, (401) 849-8531

FOR SALE: Drake 2A w/2AQ - $135; Allied AX-190 w/manuals - $85; Hammarlund HQ-110 - $75. **WANTED:** AC voltage probe for HP-410C; data for tubesters as used in Collins S-line rcvrs. John Keil, 4618 Norwalk St., Union City, CA 94587. (510) 471-4838

FOR SALE: Collins S-Line aluminum knob inlays: small (exciter/PA tuning) - $1; 30L-1 - $2; spinner/plain (main tuning) - $3. Charlie, K3ICH, 13192 Pinnacle Lane, Leesburg, VA 22075. (703) 822-5643

FOR SALE: Galaxy Comm-2, 2 ch. xcvr, USB/LSB military version w/antenna base & loading coil (no whips), handset, canvas case. Xcvr VG, case fair - offer or trade. **WANTED:** Globe Scout, Chief or Champions 300 (A). Difference negotiable. Berk, Berkemeyer, MO, (314) 394-0441.

FOR SALE: Gibson Girl xmtrs & accessories; URC-4, 10, 11,14 radios; Bendix PA-20. Gary Sarra, POB 310783, Newington, CT 06131. (203) 665-6056 (d)

FOR SALE: (2) S-38E's, (1) S-38B - $45 each. Jack, KL7GKY, Box 103, Lehr, ND 58460. (701) 378-2736

FOR SALE: Electron tube data for TV7U, TV7BU and TV7DU, 81 pages - $15 ppd. Joseph R. Forth, WA2TRT, 321 Long Vue Acres, Wheeling, WV 26003. (304) 277-3154

FOR SALE: TM11-242 (SCR-300A) manual. A few water spots & slightly frayed but perfectly readable - $4 ppd. R.J. Eastwick, N2AWC, 224 Chestnut St., Haddonfield, NJ 08033. (609) 429-2477

FOR SALE: Xcelite Bristol screwdriver sets #99PS-60, complete 11 piece w/case - $30 shpd. Larry, W5VHP, 4212 Beacon Ct., Bartlesville, OK 74006. (918) 333-2891

WANTED: RME DM36 converter. Matches RME69 rcvr. Trade nice RME VHF152A converter or money. Bill, WC7O, 12405 Ranchette Dr., Tucson, AZ 85743. (602) 682-7285

WANTED: HRO coil sets & radios; all RCA comm. rcvrs, especially ACR 111, 136, 175 and AVR 1; pre-war BC rcvrs w/12 plus tubes by E.H. Scott, Midwest, McMurdo Silver & RCA, any condx. Rick, NM, (505) 983-3623 eves.

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: SC-101; SC-301; KW-1; 30K-1 thru 5; 302C1; 75A thru 75A-4 rcvrs and spkrs, any condx. Purchase entire estates, pick up 48 states and top $ paid. Rick, (800) 462-2972

WANTED: For my collection: Xtals and xtal holders made prior to 1950 by or for amateur radio. Any 160M, 20M, 10M; Bliley VF-1 AX-3 any freq.; Bliley xtal VFO; manual for Bliley 1A CCO. Thanks to the many who have responded to my xtal ads! Xmtr plug in coils by Bud, Millen, B&W and others; Hallicrafters SX-11 parts radio. Dean Showalter, WA6PJR, 7816 Redberry St., NW, Albuquerque, NM 87120. (505) 899-9376

WANTED: Johnson gear, all models, any condition. Please state asking price. Wen Turner, AD7Z, Box 451, Cal-Nev-Ari, NV 89039-0402.

WANTED: Any information on Thordarson T17K21 Tri-Band xmtr, 80, 40, 20 meters, uses Taylor TZ-40 in final; Taylor TZ 20 in modulator, commerically made circa 1940? Do I have the only one left in existance? Chuck, WØIUH, 9917 Irving Ave. S, Bloomington, MN 55431. (612) 888-7104

WANTED: T-368 exciter w or w/o tube, condx very good only. Smitty, AD6V. (209) 255-1177

WANTED: QST '45-'55; HT-40 mode switch. Bob Napoli, K2LGO, Box 158, Riverhead, NY 11901. (516) 722-5737 after 6

Vintage Manuals Available
for amateur, audio, and radio-related equipment. Quality is always our number one customer priority. Catalog, two $.32 stamps. Pete Markavage, **Manual Man**, 27 Walling St., Sayreville, NJ 08872. (908) 238-8964

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

WANTED: KWS-1; HF-380; 6251; R-389 and SP-600JX. Need exc. condx. Mitsugu Shigaki, JA6IBX, 2825 -2. Jozan Kamidai Machi. Kumamoto. 860 Japan. FAX Japan-96-329-4601

WANTED: KWS1 lower sideband crystal 251.65 kHZ; also TR4 sideband filter; will reimburse for phone call. Lorne, VE7BOX. (604) 587-6305

WANTED: Hi-fi AM mods for Heath DX-60; pwr xfmr for Johnson Ranger 1; dial assembly for early Hallicrafter gen. cov. rcvr; outboard mod driver suggestion for Johnson Viking 1. Jay Fink, N1UJT, 8 Blackman Ave., Bethel, CT 06801. (203) 792-4266, lve message

WANTED: Repair & restoration of Ham. SP-600-JX-17, within 25 miles of Danberry, CT. Jay Fink, N1UJT, 8 Blackman Ave., Bethel, CT 06801. (203) 792-4266, lve message

WANTED: Cardwell receivers (e.g. 54), manuals, advertising literature & technical bulletins. Newell, VE7AEC, in callbook. (604) 943-6033

WANTED: Johnson KW matchbox or 275W. Gary, VE3MPQ. (519) 944-2962

WANTED: Collins 516-F2 pwr transformer or junker whole supply, original R-388 manual. Randy, WA7CPA. (602) 266-2256

WANTED: CY 2562/PRC-25 battery box for PRC-77. Pete Hamersma, WB2JWU, 87 Philip Ave., Elmwood Park, NJ 07407

FOR SALE: Drake 2C - $90; Hammarlund HQ-180AC, needs work - $175. WANTED: Coil F, G, H, J for Nat'l HRO-7. Doug DeWeese, 502 East 80th St., Tacoma, WA 98404-1014. (206) 472-3478

FOR SALE: Homemade galena crystal radios, detectors and galena crystals. $1 regular, $2 super. Radio parts. What do you need? L. Gardner, 458 Two Mile Creek Rd., Tanawanda, NY 14150.

FOR SALE: 30L-1, RE - $475; 30L-1, WE - $350; Viking Valiant - offer. **WANTED:** RME 4301 adapter. Fred Honnold, W6YRM, 17890 Sharon Ct., Pine Grove, CA 95665. (209) 296-5990

FOR SALE: Receiving tubes, new and used; multi-section twistlock electrolytic caps to 500-VDC; SAMS photofacts. Send stamp for lists. Turner Electronics, 16701 Main St., Ste. 121, Hesperia, CA 92345.

FOR SALE: Radio tubes; repair and restoration of all vintage amateur and commercial radios, 25 years experience. Herbert Stark, 321 N. Thompson St., Hemet, CA 92543. (909) 658-3444

FOR SALE: R-390A/URR maintenance manual, TM 11-5820-358-35, issued Dec. 1961, 189 pges - $25 includes domestic postage. Abe, POB 4118, Jersey City, NJ 07304.

FOR SALE: HRO coil set, 50 kHZ to 30 MHz, types J, H, G, F, JE, JD, JC, JB, JA, orig. wooden boxes - $250. Lloyd, AA6T, CA, (408) 722-4349 eves

FOR SALE: Robyn Hi-bander 8-channel scanner, model 100B, works OK - $50 + $5 shpg; RCA Voltohmyst model WV-772, unchecked - $25 + $5 shpg; tube tester TV-7B/U, unchecked - $50 + $10 shpg; WD-11 adapters - $5 each + shpg. James Fred, R1, Cutler, IN 46920. (317) 268-2214

FOR SALE: KWM1, mobile mount, pwr sply, DX adapter. **WANTED:** 4 pin coil forms by Short-wave & Television Laboratory/Boston; Drake 1A vernier knob. Brian, WA5UEK, 3521 Teakwood Ln., Plano, TX 75075. (214) 596-2914

FOR SALE: Collins manuals (copies) - R-390, R-390A, R-391. **WANTED:** Tube CB's & accessories. N1FRX, ME, (207) 834-6273, eves & wknds

FOR SALE: 4X150D's; socket for 4CX5000 to 20000; 4-400 chimney. **WANTED:** KWS-1; SC-101 or 312A-1. KO6IJ, CA, (714) 643-7930

FOR SALE: DX-60B w/HG-10 VFO - $150; Hammarlund HQ-129X - $150. PU or pay shpg & packing. Michael H. Wilke, WB4AQL, (706) 861-3070

FOR SALE: Heath distortion analyzer IM-5258, audio generator IG-1272, AC voltmeter IM-5238, all w/manuals. Gene, NG7A, UT, (801) 635-7343

TRADE: Collins 353C-31 75A-1 mech. filter/adapter for 75A-4 4:1 reduction gear drive. Dave Mills, 1503-G Adelaide, Tucson, AZ 85719.

FOR SALE: Nice Drake rcvr model 2B, cosmetically clean, works fine, w/calibrator but no manual - $150 OBO; museum quality SW-3 w/orig. battery cable and plug and BS coils for 20 and 160 meters, works, complete w/tubes - $200 OBO; early Bunnell Model 'W' Side-Swiper key (QST Sept. 1923) - offer? Above plus shpg. Wes Chatellier, W5DPM, 1950 Chevelle Dr., Baton Rouge, LA 70806. (504) 927-2199 eves before 9 PM

FOR SALE: Crystal radio kits and parts. Send SASE for brochure. Carl & Grace Ent., 5636 Romeyn, Detroit, MI 48209.

FOR SALE: KWM-2 fan bracket lowers internal temp 20 deg.C using two 60MM micro-bower fans. Drop-in, no mech. mods - $15; replica Ocean Hopper front panels - $20; 516F-2 mod-kit (ER #62) - $13. All $ ppd. DWI Engineering, POB 3611, Costa Mesa, CA 92628-3611.

FOR SALE: Modified command sets, mostly w/o covers, tubes included unless noted - $9 each: BC-455A, BC-454B, BC-454B, BC-455B; $14 each: CCT-46104 (ARA), CCT-46104 (ARA), BC-454B, BC-453B, BC-457A (no tubes), T-23/ARC-5, BC-458A (no tubes); stripped racks - FT-220 double - $17, single - $8. Don, N3RHT, (412) 234-8819 EST wkdys.

FOR SALE: New Collins PJ-068 mic plugs for S-line/KWM-2 - $8 each. Clint Hancock, KM6UJ, 6567 Ashfield Ct., San Jose, CA 95120-4502.

FOR SALE: Vintage parts. Send stamp and request "Vintage Flyer". USA only. 40 years of mail order electronics. Bigelow Electronics, P.O. Box 125, Bluffton, OH 45817

FOR SALE: Mic plugs: 3/16, 3 conductor - $4, 2 conductor for Heath - $6. $1 each shpg. PA add 6% tax. DSM Diversified, 909 Walnut St., Erie, PA 16502.

FOR SALE: Racal equipment from England - xmtr type TA83, 500W, SSB/CW, 19" rack mounting, unused condx, all tube; type MA79 xmtr drive unit, all tube SSB/DSB/CW/FSK, 1.5 to 30 MHz continuous, good condx; many other Racal items - call for details. **WANTED:** Frederick Electronics RTTY units and Siemens T-100 teleprinters. Nigel, AD4AG, GA, (404) 949-1097 (h), 255-6790 x 252 (w)

FOR SALE: SX-99 - $90 + shpg. Ken Kolthoff, K8AXH, 5753 David Pl., Fairfield, OH 45014-3507. (513) 858-2161

FOR SALE: Must sell. Everyone thank the Internal Revenue Service for these fantastic deals! R-392 w/ps - $175; T-195, clean, no PA - $135; R-390/URR - $195; GPT-750D, whole or by UPSable subassemblies - call; TMC SBE-2 SSB exciter w/ps - $200; BC-348M, w/AC ps - $60; BC-348Q, w/AC ps - $75; ART-13 set - xmtr, clean - $135; orig. manual - $25; orig. pwr plug, new - $25; pilot's control, new - $12; CDA-T xtal control - $20; ART-13 package - $195; Forest Service 1940's SPF HF field radio, w/pack box - $95, w/o box - $75; RBB w/ps - $160; Collins TCS-12 xmtr - $95; TCS-13 set, rcvr, xmtr, cables, control box, vertical mount w/base, Navy AC sply, & manual copy - $365; Perkin MTR-636-30 6 to 30 volt, 30 amp regulated sply - $85; LS-166 - $10; H-233/AIC - $10; HS-30 - $10; H-157/AIC - $15; T-32 carbon desk mic - $30; Electrovoice MSA-3000 mic, new - $30; TM-11-856A, R-390A - $20; TM-11-5820-358, R-390A operator's - $10; TM-11-856, R-390 - $20; ME-352 multimeter - $15; parting out - BC-348R, TS-382, TCS rec/xmtr. Trades? Offers? U-ship. WA7HDL, ID, (208) 756-4147 after 1730 MST.

FOR SALE: Johnson Thunderbolt, exc. w/Peter Dahl xfmr, PU only - $675; Eimac 4CX1500B, tested and guaranteed - $125. Steve Scott, KI3W, 712 Pine Hill Rd., Lititz, PA 17543. (717) 626-0991

FOR SALE: Clegg Thor 6 - $100; DX-40 & VF-1 - $100; NC-183D - $200. Mike, PA, (717) 656-8746

FOR SALE: Repair! Radio repair, tube or solid state, reasonable rates. Jim Rupe, AI7DR, Western Amateur Radio Repair Co., (WARRC), POB 697, North Cove, WA 98547. (360) 267-4011

FOR TRADE: Command sets, all orig. - BC-455-B, BC-457-A, T-18/ARC-5. Also one T-20/ARC-5 w/SO-239 antenna connector, otherwise orig. **WANTED:** Unmodified, black R-xx/ARC-5 rcvrs covering 3-6Mc and 6-9.1 Mc; shockmount for 3-rcvr rack. Don, N3RHT, 47 Hazel Dr., Pittsburgh, PA 15228. (412) 234-8819 EST wkdys.

FOR SALE: Drake R7; Heathkits HW-22A, HP-23, SB-610 scope, SB-650 digital display, SB-104A, SB-644A, SB-614. Richard Lucchesi, WA2RQY, 941 N. Park Ave., N. Massapequa, NY 11758. (516) 798-1230

FOR SALE: SX-62 - $150; S38E - $50; Globe Scout 680A - $75; Collins KWM1, pwr plug, manual - $395; KWM2A, RF - $595; 75S-1, 32S-1, 516F2 - $795; new 18051 antenna tuner - $295; Collins parts - new spinner knobs, S-line or 75A-4 - $60; Drake R4C, T4XC, AC4, MS4, books, filters etc - $495; 2C/2NT - $150; R4A - $135; Heath AT-1 (2) - $45. Ron Follmar, K5GJT, 332 Camino Real, Kerrville, TX 78028. (210) 896-8830

FOR SALE: Many back issues of Pop Com, Antique Radio, Monitoring Times, Electric Radio, Audio Mart, Antique Radio Classifieds, World Radio TV Handbook, Old Dyna Kit manuals, MacIntosh stereo equipment. Joe, IL, (708) 328-3112, FAX 328-3134.

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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 Dachs, 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: All items in WW II B-26 radio compartment, BC-461 antenna control box, clock lamps, oxygen, chair, etc. Greg Greenwood, WB6FZH, Box 1325, Weaverville, CA 96093. Msg. (707) 523-9122

WANTED: National NTX30 exciter; NSM modulator; Hallicrafters HT-6 xmtr. Thanks. John Zitzelberger, WB6JJE, 5257 Lewis Rd., Agoura, CA 91301. (818) 991-8358

WANTED: Coil cover and mechanical filters for 75A-3; Collins collectable paper and promotional items. Brian Roberts, K9VKY, 3068 Evergreen Rd., Pittsburgh, PA 15237. (412) 931-4646

WANTED: Manuals (T.O.s) or info on PRC-72, includes RT-835 through RT-838. Norb Wokasch, WAØKJE, 3312 W. Bijou, Colorado Springs, CO 80904

WANTED: Heathkit, Eico, Fisher, Dynaco or similar tube audio amplifier in any condition or manuals for same. Mike Nowlen, WB4UKB, POB 1941, Herndon, VA 22070. (703) 716-1363

WANTED: Info on Bendix Marine ADF100 auto direction finder. Also to buy RBA, RBB, RBC rcvrs. John Hartman, 11 Woodbenge Cir., Londonderry, NH 03053. (603) 437-2819

WANTED: Dial drum for Heath TX-1; AM filter for Heath SB-301. Joe Filice, KE6EZZ, 11346 Red Cedar Ln., San Diego, CA 92131. (619) 695-9099. e-mail jpf@photon.com

WANTED: Catalogs- WRL 1953, 1954, 1955, 1956, 1963; Walter Ashe 1955, 1956; Radio Shack 1954. Al Bernard, POB 690098, Orlando, FL 32869-0098. (407) 351-5536

WANTED: Copy of instruction manual and/or service manual receiver. Rick, N6NVG. (510) 687-2719

WANTED: Hallicrafters HT-9 oscillator/antenna coils and crystals. Robert Braza, N1PRS, 23 Harvard St., Pawtucket, RI 02860. (401) 723-1603

WANTED: Central electronic 100 V working or not, parts unit? CE 600L linear. Del, K9FCM, 1444 Melrose Ave. Port St., Lucie, FL 34952. (407) 336-1455

WANTED: Main operation switch for Johnson Ranger 1; Also Ranger in any condition. Please leave message. Bill, KO4XF. (404) 887-7567

WANTED: WW-2 Japanese Military radio equipment of any kind; anything PANAM China Clipper and Lindbergh related, even a post card. Takashi Doi, 1-21-4, Minamidai, Seyaku, Yokohama, Japan. FAX: 011-8145-301-8069

WANTED: Manual for AN/USM-281A or HP 180A scope. Geoff Fors, WB6NVH, POB 342, Monterey, CA 93942

WANTED: AF/RF control knob for Collins A/J rcvr; 51S1 orig. manual; SR400 lever knob. Bill, KE7KK, 6712 Lake Dr., Grand Forks, ND 58201. (701) 772-6531

FOR SALE: Hammarlund HQ-170C, exc. condx, very clean, clock works and cover in exc. condx, manual - $215 shpd. Bill, KO4XF, GA, (404) 887-7567

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

FOR SALE: Morrow BC/rcvr (Conelrad CM-1), Globe 6+2 VFO, excellent, bookless - $35 each + shpg. H. Mohr, 1005 W. Wyoming, Allentown, PA 18103.

FOR SALE: Tubes/semiconductors/parts/meters/phono needles/radios - LSASE for 20 page list. W.F. Horn, 13110 Marsh Rd., Bealeton, VA 22712. (703) 439-9781

FOR SALE: Collins 51J4, 388, 30L-1, KWM-2A, 516F2, 312B4, B&W (Waters) rejection tuning, CPI, all RE and brand new manuals; TMC GPR-90 & GSB1, GPR-90RX w/SSB adpt, all rack mounted in cabinet; Eldico 100F, 100M; Gonset 101 amp; (4) 811A's; B&W #651 Matchmaster; Heath HD-20, HD-16; Mosley CM-1, spkr. Don, W6TVW, NV, (702) 475-0211 day or night.

FOR SALE: Collins KWS-1 & 75A-4, good condx, decks have exc. cosmetics, spare finals and manuals - $1900. WA6HAS, CA, (415) 592-5694

FOR SALE: Ranger II; loaded Sherwood R-4C; MS-4; HT-44; SX-117; SB-610; S-20R. Bill Gode, KB9IY, 1540 Kaywood Ln., Glenview, IL 60025. (708) 998-0974

TRADE: General purpose ATR mounts. **WANTED:** Cold war aircraft stuff - communications, radar, countermeasures, manuals. William Donzelli, 304 South Chester, Park Ridge, IL 60068. (708) 825-2630

FOR SALE: NCX-1000 partial chassis, front panel, meter, RF parts, other spare parts available. George, K1ANX, MA, (413) 527-4304

FOR SALE: Bunnell bug, model J-36, very good condx; Boonton RF sig. gen. model 84-TVR. Marty Drift, POB 21, Blawenburg, NJ 08504. phone only 6-10 PM EST (201) 305-2338

FOR SALE: Johnson panel refinishing: Ranger I, Ranger II, 500, Desk KW, Viking I, Viking II. Production runs this summer. Call or SASE for info. Ron, AB5WG, 115 First St., Sugar Land, TX 77478. (713) 491-7823 after 6PM CST

FOR SALE: Hammarlund HQ-180 w/spkr - $300; (2) Knight T-60's (one parts unit) - $50. Bob Braeger, WA6KER, 6634 Navel Ct., Riverside, CA 92506. (909) 682-5084

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: Thordarson mod xfmrs - T- 45916, pri - 8000 ohms - $200, T11M78 multi-match - $200; Gonset G-66B rcvr - $50; VFO-Matic model 8020 - $75; Johnson low pass filter 250-20 - $20; Line Material Industries filter cap 375 mfd @ 4000V - $125; Millen 90651 GDO, total 11 coils in wooden box - $125; BC-610 coil 5.7-8 Mcs - $20; Johnson 275W Matchbox w/SWR - $125; Heath antenna impedance bridge - $20; RME 45 rcvr & spkr - $125; Boonton 260A Q-meter - $200; ARC-5 T-21 brand new in orig. box - $125. George, K1ANX, MA, (413) 527-4304

FOR SALE: 3-conductor #26 shielded cable, Teflon insulation and jacket, exc. for balanced audio applications - $.25 per ft., plus shpg. Dick, 160 Penfield Rd., Macedon, NY 14502. (716) 377-1354

FOR SALE: Hammarlund SP-600, very clean, works perfectly - $295; Viking II w/VFO, clean, no mods, new caps, works perfectly - $250; Meissner signal calibrator, 100kc, 50kc, 10kc, model 9, all orig. - $95; "TAC" chrome plated bug, old, nice - $90; Heath HW12A, absolutely new condx w/mobile bracket, mic, HP13A pwr sply - $150, xtal calibrator - $35. Call for pictures. Dick, W4NFN, WI, (715) 866-8704

FOR SALE: Realistic cardioid mic w/stand, cat. no. 33-1080, like new - $25 OBO. Frank, W8SET, 1 Wildacre Rd., Charleston, WV 25314. (304) 343-0415

FOR SALE: A few left! NIB Monarch 0-50 micro amp panel meters, 1-3/4" face, 1-1/2" hole - four for $10, I ship. Gary Reiss, WA0JRM, Rt 1, Box 141, Wilcox, NE 68982. (308) 263-3231 (h), 995-5541 (w)

FOR SALE: Cleaning house, need room. Drake TR3, AC3, RV3, VG - $185; Yaesu FC 901, VG - $100; Ranger I, nice - $200; CE B SSB slicer - $75; Viking I - $50; 122 VFO - $75; D-104 Silver Eagle, nice - $85; HC-10 - $75; SB-610, VG - $100; HQ-140X, VG - $145; SX-101 - $100; SX-122 w/R48 spkr, VG - $175; R-388, fair - $150; SX-42 w/R42 spkr - $300; DB20, VG - $65; VF-1 - $35. Offers considered. Fred Watson, KB8WRF, POB 58, 581 W. Summit St., McClure, OH 43534. (419) 353-8131

FOR TRADE: HQ-180AC, exc. condx, w/S200 spkr for SX-115, NC-183D, 32S3B in like condx. Trade up or down. Fred Watson, KB8WRF, 581 W. Summit, McClure, OH 43534. (419) 748-8798

FOR SALE: Hallicrafters SX-100, VG - $160; Atlas 350XL, dig., VFO, ps, mic, exc. - $475. John Hurst, KU6X, 2512 Euclid Crescent E., Upland, CA 91784.

FOR SALE: 4:1 reduction tuning knob w/gears, exc - BO; Johnson TR switch - $37; Heath Q-mult - $10; NC-240D - $175; HRO-60 spkr - $65; Galaxie III external VFO - $35. Joe Sloss, K7MKS, WA, (206) 747-5349

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

WANTED: McIntosh and Thordarson amplifiers any condx. Marcus Frisch, WA9IXP, Box 28803, Greenfield, WI 53228-0803. (414) 545-5237

WANTED: Telegraphic apparatus and keys by collector, not a dealer. Will pay top dollar. Pete, WB2BYQ, (201) 818-4311

WANTED: 6 meter AM gear - Clegg, Gonset, etc. FOR SALE/TRADE: Various Swan gear. Scott, K6PYP, 210 Mantua Rd., Pacific Palisades, CA 90272

WANTED: Radar equipment, the bigger the better! Also early TV cameras. Allan H. Weiner, 507 Violet Ave., Hyde Park, NY 12538. (914) 471-9500

WANTED: 1950-60 desk xtal mics; also want working Viking II w/VFO. Bob, K6GKU, 15514 Richwood, Fountain Hills, AZ 85268. (602) 816-0660

WANTED: Hallicrafters HT-20 xmtr, must be clean and complete, prefer working condx & manual. Skip Hardy, KI4YA, Vienna, VA 22182. (703) 255-0759

WANTED: National VX-501; NCL-2000; Harvey-Wells R9A; Gonset G-77. R. Nickels, 1444 S. Rotzler, Freeport, IL 61032. (815) 232-7142.

WANTED: AN/BRR-3 and RAL rcvrs; MP-50 antenna bracket. Tom Brent, Box 1552, Sumas, WA 98295. (604) 826-4051

WANTED: Polycomm 6&2 xcvr; matching spkr for National HRO-500; Lafayette HB-333 xcvr. Pete Markavage, WA2CWA, 27 Walling St., Sayreville, NJ 08872. (908) 238-8964

WANTED: Help Vibroplex build its Company collection of Vibroplex bugs, keys and memorabilia. Call Mitch, WA4OSR, at The Vibroplex Co., (800) 478-8873

WANTED: Manual for CU-1280/FRD 10A(V); nuvistor plugs Raytronics, any info? Manual for TBX-5; canvas carrying case CWP-10027A for TBX-5; BC-442A; TU-6B, TU-8B for BC-375 or BC-191. George, K1ANX, MA, (413) 527-4304

WANTED: Collins - Amateur catalogs, sales literature, manuals, promotional items & Signals. Richard, KD6CPE, POB 992, El Toro, CA 92630-0992. (714) 855-4689

WANTED: Collecting: Pre-1950 commercially built amateur gear; xmtrs, rcvrs & accessories. Dean Showalter, WA6PJR, 7816 Redberry St., NW, Albuquerque, NM 87120. (505) 899-9376

WANTED: Military radios RT-136/GRC-13, Soviet xcvr R-112, rcvr R-323. Leroy Sparks, W6SYC, 924 W. McFadden Ave., Santa Ana, CA 92707-1114. (714) 540-8123

WANTED: WW II Bendix model ATD transmitter and dynamotor; National NC120 rcvr; Temple portable model G410, G415 or G521; Popular Mechanics 1930-1950. Harry L. McCall, KB4CSY, Rt 1, Box 244, Ennice, NC 28623-9641. (910) 657-8248

WANTED: Manuals for receivers: RU type CW-46048-D, RAX-1 type CG-46115 and Harvey-Wells ARA-3. Al Kaiser, W2ZVR, 713 Marlowe Rd., Cherry Hill, NJ 08003-1551. (609) 424-5387

WANTED: S38E manual; Brown Brothers straight key; Yaesu FR50 RX and FL50 xmtr. Gary Wagner, K3OMI, 11124 Oak Hollow Rd., Knoxville, TN 37932. (615) 690-4217

WANTED: Geiger counters and Scintillation counters sales literature manuals and radiation samples. Buddy Herring, 1310 Andover Rd., charlotte, NC 28211. (704) 366-6600

WANTED: National 2.5V ps, 4-prong pwr cord for HRO, spkr; 01A tubes; SX-42. Carter Elliott, WD4AYS, 1460 Pinedale Rd., Charlottesville, VA 22901. (804) 979-7383

WANTED: High-power commercial 4:1 balun (Collins, Harris, TMC, etc). Alan, W3VL, (215) 795-0933

WANTED: Intelligence museum wants German, Japanese, Italian, Russian and Chinese communication equipment and any British or U.S. spy radios. LTC William Howard, 219 Harborview Lane, Largo, FL 34640. (813) 585-7756

WANTED: WRL-70 xmtr; HB xmtrs for display, must be museum quality; thousands of QSL cards to paper walls of Amateur display. Call Leo, (402) 392-1708, Western Heritage Museum, Omaha.

WANTED: Military radios, any URC/PRC, manpack, walkie-talkie, survival, particularly URC-4, 64, 68; PRC-63, 93, 68, 47, RT-10, 20, 60. Pref. working/repairable. Additional contacts appreciated. Daniel Cahn, 3444 Greenwood Ave., Los Angeles, CA 90066. Msg/FAX (310) 398-7159

WANTED: Hammarlund manuals, parts, parts units, from the series Comet, HQ, SP. Also accessories, catalogs, spec sheets, memorabilia. Robert, Amateur Radio Surplus, (517) 789-6721

WANTED: Collins 30J, 30FXB/C, other pre-1940 Collins amateur gear for my collection. John Firey, WB5HRI, 14818 Delbarton, Houston, TX 77083. (713) 5615-KW1

WANTED: Vintage tube CB's; pwr sply/modulator for Johnson 500. Send card or call with model you may have. Steve White, WB5UGT, Box 1086, Clute, TX 77531. 800-374-6477 - 9008 (leave message)

WANTED: Uniden CR-2021; (Hickok, etc.) mutual conductance tube tester; Kenwood T-599 xmtr; Radio Shack DX-400; SB-610 scope. Rick, K8MLV/Ø, 1802 W. 17th St., Pueblo, CO 81003. (719) 543-2459

WANTED: Plug in xtal for National HRO variation two. Stan Tajima, JA1DNQ, c/o Nakagawas, 22942 Cedarspring, Lake Forest, CA 92630. (714) 707-4675

WANTED: WW II Japanese military radio equipment of any kind; anything Panam China Clipper and Lindbergh related, even a postcard. Takashi Doi, 1-21-4, Minamidai, Seyaku, Yokohama, Japan. FAX 011-8145-301-8069

WANTED: Experienced restorer to repaint old radio metal dial face. May involve silk screening. Details furnished upon request. Don, WB5UIA, 903 Madison, Minden, LA 71055. (318) 377-0651

WANTED: R-390A operations manual, must be Fowler Industries issue or copy; Bencher iambic paddle; Alpha-Delta sloper. Victor, CA, (805) 581-5317

WANTED: Paying immediate cash for old Fender and VOX guitar amplifiers. Frank Czaja, AI9T, 8968 W. Forest Home #4, Greenfield, WI 53228

WANTED: Hammarlund matching spkr for HQ-129X, HQ-215, SPC-10 SSB converter. Charles P. Jedlicka, N9SOR, (708) 515-1836

WANTED: SLRM and all other E.H. Scott rcvrs, Splitdorf rcvrs & spkrs, any condx. Bill, NM, (505) 831-7279

WANTED: Squires-Sanders FM Alert tunable VHF monitor. Gene Peroni, KA6NNR, POB 58003, Philadelphia, PA 19102. (215) 665-6182.

WANTED: Hallicrafters R-42 spkr (the one with the "mouth" on the bottom). Rusted junk OK. Marcus Frisch, Box 28803, Greenfield, WI 53228-0803.

WANTED: National company catalogs, manuals & parts sets. LSASE ($ .55) for radio/book list. Wayne Childress, 1903 Jerome Pl. #3, Helena, MT 59601. (406) 443-7255

Dovetron NB-1 Noise Blanker

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The Dovetron NB-1 Noise Blanker is a small solid-state devise that plugs directly into J22, J23 and J24, which are located on the top of a Collins KWM-2/2A HF transceiver. The NB-1 may also be installed in all versions of the Collins 75S(*) receiver.

In addition to noise pulse blanking and random noise suppression, the level of the received signal may be amplified 15 dB or attenuated more than 20 dB. Specs upon request.

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FREE: Looking for antique radios, parts, tubes, schematics and restoration service? For free catalog send 2-stamp LSASE to Howard W. Granoff, 2445 Lyttonsville Rd., Ste. 317, Silver Spring, MD 20910. (301) 585-8776

FOR SALE: Parting 75A-2, Viking II, NC-46, SX-99; used 833A, glass clear - $25; DX-100 pwr xfmr, choke, mod xfmr - $25 all 3. **WANTED:** S-76 and any condx SX-96. Joe Sloss, K7MKS, WA, (206) 747-5349

FOR SALE or TRADE: Navy CCT-46077 (RBM-2), 2-20 Mc rcvr w/AC ps; BC-312M w/builtin AC; Collins Navy CMX-47205 ant. loading coil (TCS-42); Jetroid 704 field strength meter; Viking II; Harvey-Wells TBS-50D. **WANTED:** Viking I; 122 VFO; Ranger; NC-183D; National spkrs; spkr emblem; Select-O-Ject; Heath Sixer. Sam Champie, KD7XX, 105 W. McKenzie, Hermiston, OR 97838. (503) 567-2879 weekends only

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FOR SALE: SX-96 - $100; S40B - $65; S38C, VGC - $65; S20R (modified but works well) - $40; Drake 2A w/Q-Multiplier spkr - $175; tubes - NIB Sylvania 811A - $22 ea., 816 - $16 ea., 6476 - $30 ea., 615/7018 - $40 ea., 710L/7518 - $25. All plus shpg. Dave Metz, (703) 885-7914 eves till 10PM EST please.

FOR SALE: Hallicrafters (SX-73) R-274/FRR manuals, 100+ pages, NOS - $10 + postage; Drake MN-4 antenna tuner w/manual - $60; LM-21 w/factory sply & manual - $25; Hallicrafters S-19R, VG - $80. All plus UPS. **WANTED:** RCA Radiomarine AR-8516; manual for 75A-2. Dan Mason, R.R.T.1, Box 204F, Santa Fe, NM 87501. (505) 455-3416

FOR SALE: 50+ items incl. Collins 30L-1, KWM2, 32V-3, 75A-2, ART xmtrs, Hallicrafters Skyrider rcvrs, HQ-129X, lots more. For complete list send SASE to Jack Young, K4LKD, Estate, 8314 Brynwood Dr., Boise, ID 83704.

FOR SALE: Amplifiers - Boggen 100W tube, uses 8417 quartet - $75; MXM-A mixer for same - $50; Western Electric 300W USN WW II - $100; H.H. Scott preamp/amp - $100; Army AM-20/TIQ-2, works - $50; xfmr set from old Carillion amp, uses PP 807s, pwr, dvr and output - $50. HF - Transworld TW1000 Flyaway 1.6-30 MHz, SSB, 125W in Zero suitcase - $2500; B&W 300 ohm terminators, 2-30 MHz @ 10 KW - $200 each; TMC 6:1 20 KW balun - $500; new LC to 1-5/8 adapters - $50; 400 ohm 250W non-ind. resistors - $5 each; Andrew LDF-5 w/LC connectors - call; Empire Devices R-1040, .15-30 MHz rcvr, so-so - $50; BC-314 - call; Plantronics programable modem - $20; Collins TE-233 HF modem, serious business here - $250; T-195, ugly, works - $100; RT-671/PRC-47 - $50; RT-695/PRC-41 - $50. Misc - 1920's Western Union variable cap, 0-4 mF in 1/4 mF steps - $50; Ampex 350 mono military model in field rack - $300; meter panel from big tube xmtr, six meters for - $30; Weston 6" dia. 8 RF amp, nice - $50; 1927 GR model 457-A mod meter - $75; 40' nylon ropes w/insulator for antennas - $3; Collins TCS-118 audio center/control - call; AS-3438/G, 200-400 MHz satcom array - $250; ready-power 24 VDC to 120 VAC 60 Hz 1600W rotary inverter - $300; PP-1383, 120V 3-phase in 24 VDC 100A out, regulated - $100; many panel meters, var. caps, coils, tubes, sockets, etc, and I'll always listen to a trade offer, thanks. Dennis, AZ, (602) 839-1901

ELECTRON TUBES: All types - transmitting, receiving, obsolete, military--Large inventory. **Daily Electronics Corp.**, 10914 NE 39th St., B-6, Vancouver, WA 98682. (800) 346-6667, (206) 896-8856, FAX (206) 896-5476

WANTED: Heathkit Mohawk RX-1 receiver. Al Hubbard, WB9SAX, 1934 Fallen Leaf Ln., Los Altos, CA 94024. (415) 940-6304

WANTED: National SW3 or FB7/FBX-any model, manual or copy & coils or coil data a big plus! State condition & price in first letter. R. Kuchera, 270 Tawny Thrush Rd., Naugatuck, CT 06770

WANTED: Manual for HP 5328A. Also, info on Lecher wires, construction, use, etc. Kurt Miska, N8WGW. (810) 641-0044, FAX (810) 641-1718

WANTED: Copy of schematic & alignment instructions for 10 meter Gonset G-28 transceiver. Gil, WA8JIW, POB 192, Ross, OH 45061. (513) 867-0820/FAX (513)-867-8380

WANTED: Hammarlund SP-600 meter, tuning knob, audio output xfmr; Collins 51J4 mech. filters; Hallicrafters SX-73/R-274 tuning capacitor drive coupling; General Radio Company apparatus, parts, manuals, literature. John Tiedeck, WA2SDE, 212 Grandview Rd., Media, PA 19063. (610) 566-8049

WANTED: A good clean Hallicrafters SX-62, must be in good working condx. Will pay top dollar for a good one. Billy Burdette, K4NJS, SC, (803) 585-2810.

WANTED: Plate xfmr Thordarson T-19P-61 or Eldico TR1 xfmr, 3500 or 3750 VCT @ 300 mA, 115V primary. Don Hilliard, WØIPW, Rt 5, Box 219, Neosho, MO 64850. (417) 451-5892

WANTED: Tech manual for Empire Devices noise and field intensity meter, model NF-114. Harlan, K6JFW, CA, (408) 257-8811

Repair & refurbishment of older tube-type amateur equipment. Fully FCC licensed; 35 years experience. Chuck Banta, N6FX, Claremont, Calif. (LA area) (909) 593-1861

WANTED: Drake 1A; 75A-4 with filters. Mike, KE6HD, 310 Houston Ct., Danville, CA 94526. (510) 831-1051

WANTED: Nice Hallicrafters S-40; Heathkit DX-40. Jerry Boles, N5KYT, 14857 Redbud Ln., Piedmont, OK 73078. (405) 373-2228

WANTED: TMC GPR-92 HF Rcvr. Hank, W6SKC. (602) 281-1681 FAX: 281-1684

WANTED: Cabinet for GPR-90; SX-42. Only in very good condx. Jose Cangas, EA4JL. Contact in the States Kurt Keller, (203) 431-6850

WANTED: Cosmophone, or related info; Viking 500 ps/mod; B&W coils 2175-2179; Drake 1A vernier knob. Brian, TX, (214) 596-2914

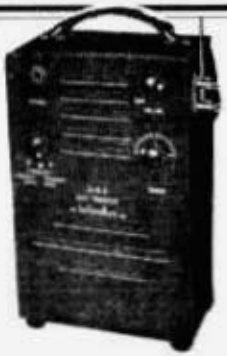
WANTED: Condenser, carbon and other early broadcast microphones; cash or trade. James Steele, Box 620, Kingsland, GA 31548. (912) 729-2242

WANTED: Teletypes and any other teleprinter machines, parts, literature or information from the 1940's to the '70's. Gary Ashbaugh, POB 2008, Corvallis, OR 97339. (503) 758-8006

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: Manual/schematic for Eico model 250 VTVM; Heath SB-310 rcvr. Don Morris, N6IDY. (818) 368-7374

WANTED: Dead Atlas 180, 210X, 215X and 350XL radios for parts. Dennis Hatch, WAØWAB, (316) 225-3736 (d), 225-2961 (n).



WANTED: Any condition, Hallicrafters S-35 panoramic adaptor and S-33 Sky Trainer as shown. Chuck Dachis, 'The Hallicrafter Collector', 4500 Russell Dr., Austin, Texas 78745. (512) 443-5027

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

FOR SALE: R1051 rcvrs, exc. condx, cleaned, completely checked, various models to choose from. Shawn Daniels, (314) 343-5263.

FOR SALE: Level meters for Collins R-392/URR rcvrs, new - $35, UPS prepaid. Dennis, WAØWAB, (316) 225-3737 (d), 225-2961 (n)

FOR SALE: 3' x 5' reprint of factory schematic for Collins KW-1. Please send $25 ppd US to Tom Berry, K9ZVE, 1617 W. Highland, Chicago, IL 60660. (312) 262-5360

FOR SALE: WE 312B-4 - $125. WANTED: Hallicrafters 100 kHz TE-9 xtal or SX-100/101/111 calib w/xtal; original SX-100 and SX-117 manuals; Conar 400 schematic. Dave Ishmael, WA6VVL, 1118 Paularino Ave., Costa Mesa, CA 92626. (714) 979-5858.

FOR SALE or TRADE: Mercury in-circuit cap checker, as new - $25. Fred Clinger, WA8KJJ, 417 Beechwood Dr., Galion, OH 44833.

FOR SALE: Hallicrafters S408, exc. condx - $75 + shpg. Paul, CA, (408) 484-1778, lve msg.

FOR SALE: Up-dated list of Hallicrafters, Drake, RME, Gonset and more. Send LSASE. Don Jeffrey, P.O. Box 1164, Monrovia, CA 91017.

FOR SALE: Homemade galena crystal radios and parts. L. Gardner, 458 Two Mile Creek Rd., Tonawanda, NY 14150. (716) 873-0447.

FOR SALE: Surplus military gear. New BA-386 batteries. SASE for current listing. Tim Banse, P.O. Box 2522, Iowa City, IA 52244-2522.

FOR SALE: Valiant - $300; R4B - $175; **WANTED:** Globe VFO 755 or 755A; 6 kHZ filter F-455-J-60. Rob, NS6V, (408) 464-0505 weekdays.

FOR SALE: ARC-38A set, years in storage but as removed from aircraft, RT-594/ARC-38A w/MT-1415 rack, DY-118 dynamotor w/MT-1414 rack, C-3428/ARC-38A cont. box w/connectors, C-1399 remote box w/connectors, 180L-3 Collins coupler w/rack & connector - $480; ARC-49 set like ARC-3 but 48 channels, T-452 and R-608, C-1400 cont., head all w/mounts, connectors, xtals, J-68/ARC-3 pwr unit w/DY-21, -22, connectors, (no mount) as removed - $145; R-1170/ARR-52A, four sonobuoy rec. in MT-2258 rack w/C-4505 cont. head & SB-1084 indicator box, 162.25-173.5 MHz, as removed - $125; R-648?ARR-41 Collins rec w/rack, connector, several avail. - $225; PRC-47 sets, used, still - $150; RT-671/PRC-47 parts units - $45; RT-77/GRC-9, used, U.S. - $95; CW-212/GRR-5 batt. bag, new - $8; AS-2851 30-76 MHz Hi Gain log periodic, NOS - $135; C-2171/GRC-14 local cont. box (like C-434), NOS - $30; R-761/ARC-58 rec, used-ex - $135; URM-120 wattmeter set - $120; PSM-13 batt. test set for PRC-10, -25, -77, others NOS - $25. Add shpg. Tartan Electronics, Inc., POB 36841, Tucson, AZ 85740-6841. FAX (520) 293-7145, (520) 577-1022.

FOR SALE: Heath GD-1B grid dip meter, Heath 10-14 laboratory scope, both mint condx w/manuals; Westinghouse Model PC 0-150/300 VAC D'Arsonval voltmeter (wooden case), Weston 697 multimeter, Triplett 1632 sig. gen. w/manual, all vintage early 1940's; RCA crystal calibrated marker generator model WR-89A w/manual (early 1950's); misc unused vintage parts - pots, rheostats, switches, terminal strips, semiconductors, meters, etc. Best offer. Harold Benzuly, 1985 Richfield Ave., Highland Park, IL 60035. (708) 831-9107.

FOR SALE: Tubes, capacitors, sockets, NOS and reproduction parts for antique radios and TV's. Large SASE for tube list or $2 for 20 page catalog refundable with 1st order. Vintage TV-Radio, 3498 West 105 St., Cleveland, OH 44111.

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FOR SALE: Swan HF7005 w/ps - $130; Swan VX-2 VOX unit - $20; Heath SB-301/401 xlnt - $260. Rick, KF5NU, (713) 774-5102.

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: PRC47 LSB/USB kit - $40; new machined coax antenna panel - $9. All restorable. Jay Craswell, WB9VNE, 321 West 4th St., Jordan, MN 55352-1313. (612) 492-3913.

FOR SALE: R-390A sales, service and parts. Sase for info. Miltronix, POB 3541, Toledo, OH 43608.

FOR TRADE: Two good RCA 833A's for one Taylor 833A. John H. Walker Jr., 16112 W. 125th St., Olathe, KS 66062. (913) 782-6455.

FOR SALE: HQ-129X - $85; Globe Scout 65A - $75. **WANTED:** National rcvrs - NC-173, NC-183, NC-183D, NC-400, dials, bandswitch knob, dark 183 cabinet, spkr emblem, knobs, spkrs, manuals. Sam Champie, KD7XX, 105 W. McKenzie, Hermiston, OR 97838. (503) 567-2879 weekends only.

FOR SALE or TRADE: Pioneer SX-6 rcvr for WW II infantry radio. NOS, orig. carton. Ed, 916 Lenox, Glen Ellyn, IL 60137. (708) 469-3183.

FOR SALE: World's largest selection of WW II military radios and accessories. 54 page catalog - $2 US, $5 Foreign. Sam Hevener, W8KBF, "The Signal Corps", 3583 Everett Rd., Richfield, OH 44286. (216) 659-3244.

FOR SALE: Drake 2-AQ, VG - $70 shpd CONUS; Hammarlund HQ-140X, VG cond electrically and physically, w/manual copy - $200 plus shpg.; parting out Drake 2B and HQ-140X. **WANTED:** National Select-O-Ject. Al, KØAL, IA, (319) 377-4367.

FOR SALE: RCA rcvg tube manuals - RC-15 (3/48), RC-20 (6/60), RC-23 (8/64), RC-25 (11/66) - $10 each; RCA Radiotron Designers Handbook (1941) - $25; RCA De Forest xmtg tubes (1934) - $25; Bassett Handbook of Rotary Beam Design (1939) - $15. All plus $3 shpg. Ron, KC6WTG, POB 783, Santa Rosa, CA 95402. (707) 539-8319.

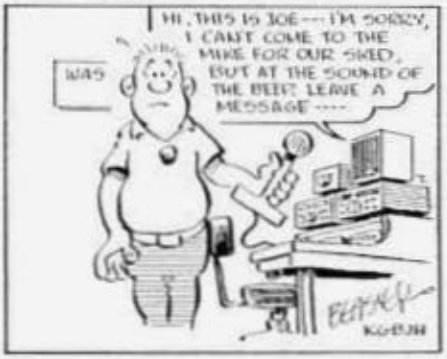
FOR SALE: National 1933 SRR rcvr w/two coils and data - $300; National 1935 TRM (TR56) 5 meter xcvr - $200; Vibroplex older lighting bug, good condx - $40; ARRL Handbooks: 1942, 49, 52, 54, 61, 66, 68, 69, 72, 74 - $20 ea; Editors and Engineers Radio Handbooks: 1939, 1947, 1970, 72, 78 - $25 ea; transmitting tubes, new & used: 211, TZ40, 4D32, 7094, 4E27, 8001, 838, 803, HK24G and rare Lorenz RD12 TF Jelly Jar; R390A top & bottom covers, good condx; Waters Compres/amp model 357. R. Faulstick, KD4AS, 210 Mariah Ct., Merritt Is., FL 32953. (407) 453-3312, FAX 453-2258.

FOR SALE: Collins mech filter new F455F15 - $60; SB-220 plate meter NIB - $40; SB-220 plate xfmr NIB - $110; Vibroplex Blue Racer - $65; Murch ant tuner - $225. Mel, WØMLT, CO, (970) 249-1544.

FOR SALE or TRADE: KWS-1; Viking II CDC; 32V-3; Hallicrafters Super Skyrider SX-9; Triton II w/spkr/ps; Harvey-Wells Bandmaster Senior. **WANTED:** SX-88; KWM-2A; 51S-1; 75S3-C; HT-32B. Joel Thurtell, MI, (313) 453-8303.

FOR SALE: National Co. RF chokes, R-100ST, R-100S, R-100U (2.5, 5, 10 mH), R-154U, R-33, NIB - $5 ea. **WANTED:** Old National spkr, black w/3 vertical bars on front. Greg Gore, 11528 Watermoss Ln., Charlotte, NC 28262. (704) 549-4719.

FOR SALE: Jennings vacuum var. USLA-465, 5KV - $70 each plus shpg. Jack Dubbs, 44 Monk, Security, CO 80911. (719) 392-2043.



FOR SALE: Echophone EC-1, nice - $95; Hallicrafters S-38C, nice - $49; Bendix TA-12B & TA-12A dynamotor, nice - $100; Johnson Challenger, some scratches - $109; Gonset G-66w / AC sply, nice - $100. 2-stamp LSASE for 8 page list. Don, N3RHT, 47 Hazel Dr., Mt. Lebanon, PA 15228. (412) 234-8819 EST weekdays.

FOR SALE: NOS Tubes. List SASE. NOS 6146W - $18; 5894 - $27.50; PRC-47 LSB filter - $20. Joseph Pinner, KC5IJD, 201 Ruthwood Dr., Lafayette, LA 70503. (318) 981-7766

FOR SALE: Heath SB200, excellent - $395; Svetlana & Pride tubes (warranteed 1 year) 3-500Z - $95; 833A - $110; 4CX250B - $105; 811A - $20; 572B - $60. Sound In Mind, (800) 755-2365 Waynesboro, VA

FOR SALE/TRADE: Transmitting / Receiving tubes, new and used. LSASE for list. I collect old and unique tubes of any type. **WANTED:** Taylor and Heintz-Kaufman types and large tubes from the old Eimac line; 152T through 2000T for display. John H. Walker Jr., 16112 W. 125th St., Olathe, KS 66062. (913) 782-6455

FOR SALE: Chassis punches misc. sizes, brands; Heath grid dipper-GD1B & manual (copy) - $15. Harry Blesy, 9S740 Clarendon Hills Rd., Hinsdale, IL 60521. (708) 789-1793

FOR SALE: TCS rcvr / xmtr (matching serial numbers) with TCS AC pwr sply, orig. cables, spkr, and antenna tuner - $300; 618T(3) tested - $350; 618T(3) in land mobile case with control head, amplified spkr, cables, mic, servo 400 Hz inverter and complete manual, part of MRC-95 - $800; HP3400A - $175; HP 403B - $80; SASE with two stamps for list. Bob Miller, KE6F, 9655 Appalachian Dr., Sacramento, CA 95827. (916) 362-5481 eves, FAX (916) 369-6277, internet rmmiller@netcom.com.

FOR SALE: Thousands of Tested Tubes w/Warranty! Send for new list with improved discounts and monthly specials. Both xmit and rec. tubes. I have acquired many common tubes recently. Buy those spare tubes for your tube radio, audio, ham and electronics. Most tubes are used at about 33% of new, many are about $1. I have bunches of octal, older, 7 and 9 pin tubes. All tubes are tested on TV/7D/U tester and then boxed. I give a 30 day warranty. Send wants or SASE with two stamps for list. Daniel Nelson, 1025 E. Desert Ln., Phoenix, AZ 85040. (602) 243-7421 eves

FOR SALE: Drake 2C, 2NT, 2CQ, Hallicrafters HA5. All on roll around cart. Lars, NM, (505) 296-4129

FOR SALE: Collins 32V2, 75A3, 32S1, 75S1, 516F2, Drake TR4CW / RIT, MS4, AC4, 275 watt & Kilowatt Johnson Matchboxes. Joel, WB2BMH, (516) 757-7641

TRADE: Harvey Wells Z-Match, some paint chips, all orig.; Heath DX-100, excellent but some knobs wrong; RCA Radio Service News, V1#1 (1934) and 9 more issues; 1931 USN Int'l Code of Signals book; TM-11-467 (Radar); AWA Review Vol 1, trade for Vol 2 or 5. **WANTED:** BC-342 rcvr, DX-100 knobs, 30 amp 28 volt regulated sply, ARB connectors, ARC-2 shockmount, Jefferson Travis 350A cabinet and manual; TBX-6 antennas, 1926, 1931, 1939 & 1941 ARRL handbooks. Don, N3RHT, 47 Hazel Dr., Mt. Lebanon, PA 15228. (412) 234-8819 EST weekdays.

FOR SALE: "Vibroplex Collector's Guide". Got the bug? Get the book! 87 pages, $16.95 ppd. Artifax Books, Box 88-E, Maynard, MA 01754

FOR SALE: NC-300 - $300; **WANTED:** B&W L-1000-A or L-1001-A amp. F.W. Nicholas, (602) 864-9987 call after 5 PM MST

WANTED: Copy of manual for Triplett modulation monitor 1696A or 3296. Rolynn, K7DFW, 23471 Cedar Grove Rd., Clatskanie, OR 97016-2505.

WANTED: Panel meter for Heath DX-60 xmtr. Frank Dolwick, POB 21, Boyne City, MI 49712. (616) 582-6630

WANTED: RBB SRR-12, SRR-22 or similar rcvr in repairable or better condx, cash or trade. Ray, WA2ZYE, Box 6591, Edison, NJ 08818. (908) 225-0909, bus. hrs EST

WANTED: NC-200 manual, good copy OK. Vance Gildersleeve, K5CF, 206 Michelle Dr., Poteau, OK 74953. (918) 647-9044

WANTED: Atlas 350 XL, need not be working. Bob Kemp, POB 470, Lake City, MN 55041. (612) 345-5345 days

WANTED: 5-25 Hy swinging choke, .5-1.0 A. Woody Binford, CA, (415) 892-2643

WANTED: Globe King 500 B or C. Norm Hegy, KG9D, 9200 Henry St., Dyer, IN 46311. (219) 365-4089

WANTED: Info on Gross Radio CB-55, pre WW II xmtr. Randy Hull, WB3ECC, 1101 Hagy Ln., Dauphin, PA 17018. (717) 921-2966

FOR SALE: NOS KW mod xfmr, turns radio 1:1, 810's modulated by 813's, has screen winding. Tim Walker, N2GIG, CT, (203) 454-4376

FOR SALE: 400 W xmtr, BC-325, made by Federal Telegraph Co., in 1941, mint condx, should be in a museum, covers 1.5 to 18.0 MHz, all manuals and tuning charts included - call for details. Also an ART-13, clean, no pwr sply - $100. Call for list of other ARC rcvrs, xmtrs, racks and misc military gear. Pete, N9GED, Rockford, IL, (815) 965-6677

Please remember to count the words in your ad. If you are over 20 words, please send 20 cents for each extra word.

WANTED: AN/APA-17 radio DF set components in any condx; antenna drive unit PU29, pwr sply PP85, antenna elements AS545/AS186/AS247/AS108, manual to 12P1-2APA17-32; manual to 12R4-2ARR8-1/52/54 and any components in any condx for AN/ARR-8B radio set; IF main amp J68330A and IF preamp J68330N for Western Electric tube type microwave rcvr model TD-2. Robert Bennett, 5675 Shadow Hills Rd., Las Cruces, NM 88012. (505) 382-0148

WANTED: Collecting early Heath gear 1940's - 1950's; early Heath catalogs and literature; Heath mics, spkrs, supplies, access., any parts units. Byron, WA5THJ, 1215 Fresa Rd., Pasadena, TX 77502-5017. (713) 941-3631

WANTED: Kleinschmidt "Teletype" equipment, literature, 7/8" paper tape, Hallicrafters elevating base for SX-42. Tom Kleinschmidt, 506 N. Maple St., Prospect Heights, IL 60070. (708) 255-8128

FOR SALE: New, sealed in-the-can EIMAC JAN-CBXT7035/4X150D - $100/pr; Hallicrafters R-45/ARR-7, airborne version of SX-28A, appears new inside & out, near mint condition - $200. Bob Bakinowski, 1524 St. Tropaz, Tucson, AZ 85713. (520) 624-8029

FOR SALE: Johnson gear 6N2 xmtr - $85; 6N2 Conv. - $50; 6N2 VFO - $60, no manuals. Clem, W8VO (810) 795-4670

FOR SALE: "Vibroplex Collector's Guide". Got the bug? Get the book! 87 pages - $16.95 ppd. Artifax Books, Box 88-E, Maynard MA 01754.

FOR SALE: Ten-Tec Omni or Argosy 500 Hz filter for 9 MHz IF - $40. Dave Mills, AJ7O, 1503-G Adelaide, Tucson, AZ 85719

FOR SALE: TA-182/U Telegraph Converter 110 VAC NOS - $35 includes UPS. Alan Dale, W9ZPP, 2824 Forest Ave., Evansville, IN 47712 (812) 424-5208

FOR SALE: R1051B rcvr with matching MT-3114 shock mount, works well. PU only - $325/BO; Hammarlund SP-600JX - $65, PU only; HRO-60 A, B, C and D coils - $30 ea including shpg. Dennis Gibbs, 13002 Piney Glade Rd., Herndon, VA 22071. (703) 742-9843

FOR SALE: Heath Apache Cabinet - $40 + shipping; Fisher 400 stereo rcvr + manuals - $225 ppd. Charlie, N1FRX, ME, (207) 834-6273 eves

FOR SALE: 304TL, new - $35; HRO50 coils "E/F" - $125; "B" - $40; VG HRO50T, NBFM option, B/C/D coils, spkr - $300. K5YY, AR, (501) 756-5010

FOR SALE: Used tube list, good selection and quality, SASE. Bill McCombs, WBØWNQ, 10532 Bartlett Ct., Wichita, KS 67212-1212.

FOR SALE: Repair of TV-7 tube testers and calibration: I will fix and then verify calibration of your TV-7 tube tester for $40 plus shpg or return it no charge. I now have meters to repair those units with. Daniel Nelson, 1025 E. Desert Lane, Phoenix, AZ 85040. (602) 243-7421 eves

FOR SALE: Johnson front panels refinished and silk screened. Viking I - $75, 122 VFO - $40. Exchange prices. Turner Enterprises, POB 451, Cal-Nev-Ari, NV 89039-0402

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FOR SALE: Magnecorder PT-6 - $95; Heath 10-12 scope - $40; "Electronics" 1944-'45, 14 issues - $45. Ted Stewart, W6NPB, 2157 Braemar Rd., Oakland, CA 94602. (510) 531-7042, FAX 531-7072 anytime

FOR SALE: Collins 212F1 audio console (mid'60's) tube unit, needs some restoration, w/manual - $195; Heath 1 KW Warrior amp panel & cab., some hardware - $45; Johnson Navigator, parts unit, w/meter & knobs - $40. **WANTED:** Eico, Fisher, etc, tube-type audio amps. Offers accepted + shpg. Franklin Albanese, 1610 Prince St., #6, Berkeley, CA 94704. (510) 845-2625

FOR SALE: (5) Heath Q-multipliers. **WANTED:** ARRL "How to Become a Radio Amateur", circa 1953/4, copy OK. Joe Perratto, 1341 SW Evergreen Ln., Palm City, FL 34990. (407) 220-7362

FOR SALE: Heathkit lives on in historical anecdotes by employees. Quality 124-page illustrated book. $9.95 postpaid. Heath Nostalgia, 4320 196th S.W., Suite B-111, Lynnwood, WA 98036-6754

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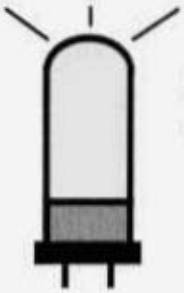

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