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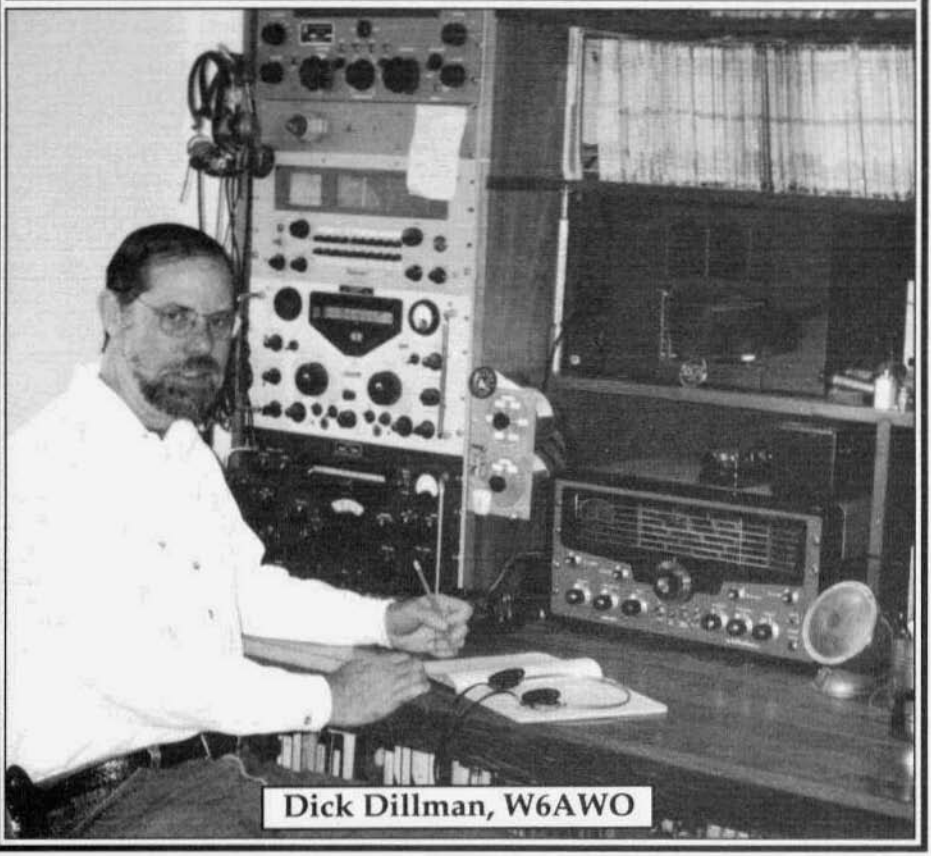
ELECTRIC RADIO

celebrating a bygone era

Number 105 January 1998



Dick Dillman, W6AWO

ELECTRIC RADIO

published monthly by Electric Radio Press, Inc.
14643 County Road G, Cortez, CO 81321-9575
Second Class postage paid at Cortez, CO and additional offices
Authorization no. 004611
ISSN 1048-3020

Postmaster send address changes to: **Electric Radio**
14643 County Road G
Cortez, CO 81321-9575

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Office Manager - Shirley A. Wiseman

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

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

Regular contributors include:

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

Editor's Comments

Last issue I erred in describing our annual 160-meter contest/jamboree as the Eighth Annual ER Sponsored 160M AM Contest/Jamboree. I forgot that last year we changed the name of the event to honor the memory of David Smith, N2KSZ, one of the events most ardent supporters. The correct name of the event is "The Annual Electric Radio/N2KSZ Memorial 160-Meter AM Contest". Readers will remember that David was killed in a farm accident last February. Please forgive me this oversight. Speaking of the contest, I think that it was a huge success again this year, judging from the activity I heard. Next issue the logs will be all in and we'll have a full report and announce the winners.

I'm also thinking about sponsoring a contest/jamboree on 15 meters. The band has been behaving very well lately and a contest/jamboree is certainly feasible. I remember that the last one we had, several years ago, was held over a weekend. That might be what we should try again. I invite readers to let me know what they think of the idea.

We also have our 2nd Annual Vintage Field Day coming up. Let's have some input on that. Last year there was some suggestions for a change of date and some rule changes. I'd like to start advertising this event in other publications well in advance of VFD so please let me have your input ASAP.

I received some complaints that I did not give enough advance notice for the last Field Day and for this last 160M contest. I will try to do better in this regard in the future. Hopefully we'll be able to give a couple of months notice for all future ER sponsored events. N6CSW

TABLE OF CONTENTS

COVER: Dick Dillman, W6AWO, at his HF operating position. He says that he doesn't have a transmitter in his shack because he has access to WB6TMY's remotely operated Collins 30K-5. We'll have more on this transmitter in a future issue.

Looking Back

by Lew McCoy, W1ICP
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In my last article I wrote about the people who worked in the technical department at ARRL. As I mentioned in earlier columns, we had a nice laboratory to work in. Our stock room, attached to the lab, had a very good supply of parts, resistors in 1/4 watt, 1/2 watt, 1 watt and 2 watt with values in the entire range. The same was true for capacitors. Both National and Millen seemed to vie with each other keeping us supplied with everything they produced. Variable capacitors, isolantite and bakelite sockets, knobs - you just name it and we had it. We rarely ordered chassis but the local store did a good business with us for other parts that were not in our own stock room.

Tubes we got by simply for the asking from EIMAC, RCA and others. Excuse me for wandering here but this reminds me of something worth passing on. George told me that a school had called him and told him that they had a bunch of war surplus tubes so he suggested that I go over and see what the deal was. It turned out that this school had inherited about 30 brand new, war surplus, 4-1000s. I came back and told George but he said they would be a waste of space for us. I told him that they were going to throw out the tubes so could I possibly have them. He told me to go ahead and get them-which I did-in a hurry. I had a huge pole pig at home so I finally built up an amplifier using two of the 4-1000s. It so happened that I had a special permit from the engineering section of the FCC to make high power tests for TVI; of course I did that frequently.

Getting back to our lab at ARRL, we would design a receiver or transmitter on paper, and then follow through with layout of components and so on. The next step would be the lab, where we would either make a chassis or buy a ready made unit. We stocked large sheets of aluminum, usually three feet by six feet in size. We would lay out the chassis dimensions and then using a large metal shear, we would cut the sheet to the desired size. The next step involved a unit called a 'brake' that would bend up the sheet aluminum to form the chassis. It got so that we could build any kind of chassis in very short time. But always our aim was that the home constructor could do the same thing with a simple vise and tools that most hams would have.

We had a large supply of punches that could make holes for tubes so usually that was the next step. Plus all the necessary drilling for mounting connection posts, etc. soon followed. It then was a case of starting the mounting of components and wiring them. Working at ARRL, one quickly learned that it was just as easy to make a nice looking wiring job instead of a rat's nest sloppy one. All wires were run parallel to the chassis sides.

Once the wiring was completed, the next step was a "smoke" test plus making sure that all the meter shunts and so forth were correct. We were all far from perfect and we frequently made mistakes, even including George Grammer. I recall one rig that George built for TVI purposes and it included at that time the new 15 meter band. The rig worked fine until George went on 15. Smoke started pouring from the rig and a quick study showed that the common 2.5 mH plate RF choke had a bad reactance on 15. George put me on a project along with Vern Chambers checking reactances of commonly available chokes. Many of you are familiar with the old R175 choke which we finally got cooled off for all the modern bands. National

W1ICP in his hamshack in the mid-fifties. The amplifier on the left uses 4-1000s.

immediately came out with the R175A choke.

Once a unit was completed, wired and tested, it was then used at home in the writer's station as a final test before describing it in QST or in the Handbook.

There were many standards that we in the technical department had to follow.

I remember quite clearly a good example of an antenna which is still popular today. It was the off center fed antenna, using 300-ohm twin lead for feeders. The antenna appeared in one of the magazines (not QST) as an 80 through 10 meter antenna. The overall length was on the order of 130 feet and the antenna was fed 1/3rd from one end. It was and is not a bad performer on most bands but the problem was that on 15, the feed line became part of the antenna and radiated quite badly. At QST we would not answer questions about the antenna and we would not describe it in the Handbook simply because it was technically unsound. It may not make a difference to many hams but radiating feed lines are a no no in our business. The strange thing about this particular antenna was that it became so doggone popular, even with its obvious problem, By Goodman was forced to include it in the Handbook (with a proviso of course.) Many times being right is not the way to be popular!

That makes me think of the time I designed a high power amplifier for By Goodman for the handbook. I know many of the readers built that amplifier. It used a pair of 4-250s (later modified to 4-400s). I got it all completed and applied power and then checked it for stability on all the bands, 80 through 10 meters. I recall what happened like it was yesterday. I went into By's office as

continued on page 39

The Taylor System of Supermodulation

An Introduction

When Curt Reed, N7AH, sent me a diagram of his 'mystery' supermodulation transformer I printed it in the December issue not expecting the response that it received. Curt received many letters - which he forwarded to me - telling him how his transformer was used in the Taylor supermodulation circuit. The letter writers also gave him direction to the various articles that have been published over the years on Supermodulation. Some of the writers even sent copies of some of the articles.

The Taylor System of Supermodulation was invented by R.E. Taylor, W6FNX. He received a patent for it in May, 1942. The first article describing his new modulation method appeared in the Sept. 1948 issue of "Radio News." Part 2 of this article was in the Oct. issue. As yet I have not been able to find these articles. Other articles followed in the various ham/electronics magazines.

In the December 1950 issue of QST Oswald G. Villard Jr., W6QYT, wrote an article, "Supermodulation - An Evaluation and Explanation, A Discussion of Principles and Design Factors". In this article he discounted the benefits of Supermodulation and I think that was the last time QST addressed the subject.

I think it's time to have another look at Supermodulation. The essence of this system is that by using it we can increase our 'talk power' and eliminate the need for hard to find and expensive modulation transformers. This system could be of great benefit to those of us who operate AM.

Ken Kinderman, WB9OZR, sent a copy of the January, 1955, issue of the "CD Capacitor" in which a transmitter is described that was designed and built by R.E. Taylor, W6FNX. There was no indication who actually wrote the article. We're reproducing this article in this issue because I think it might be a good way to introduce Supermodulation to ER readers.

At the present time I know of only one AM operator using Taylor Supermodulation and that is Don "Hoisey" Hoisington, W4CJL. We'll be hearing from him in a future issue. I'd also like to hear from any others that are familiar with the system; particularly if they've built a transmitter using it.

I wanted to print some of the letters that Curt received but space is not available this issue. Thanks to all who responded, especially to those that included copies of articles. N6CSW

An Improved 150-Watt Phone - C.W. Supermodulated Transmitter

Reprinted from the "CD Capacitor" published by the Cornell-Dubilier Electric Corp. Author unknown.

The Taylor system of supermodulation now is fairly well known. It differs from conventional high-level AM modulation systems in that an audio-frequency modulator is not employed. Instead, the final amplifier has two r.f. tubes. One, called the power amplifier, or "PA", continuously supplies the carrier. The other, called the power modulator, or "PM", is triggered into operation by the speech amplifier and supplies to the final tank the amount of r.f. power needed to boost the r.f. peaks to the amplitudes corresponding to 100% amplitude modulation. Large economies without reduced efficiency are obtained by thus dispensing with the conventional modulator and its power supply.

Its characteristic audio potency makes the signal from a supermodulated transmitter sound like one having several times its actual carrier power. This is important when working DX with limited power and when attempting to penetrate interference. More receiving operators are taking notice of supermodulated signals.

The increased "talk power" plus the fact that the Taylor system allows efficient amplitude modulation to be obtained in the most economical manner, is attracting the attention of operators of low-powered transmitters. In the supermodulated low-powered transmitter, exceptional performance can be obtained with economy of space and components. The transmitter described in this article embodies improvements not included in earlier circuits. Both c.w. and phone operation are provided. This present transmitter was designed and built by R. E. Taylor, W6FNX, inventor of the supermodulation system bearing his name. It has features which recommend its use by operators who prefer to remain in the 807 class and still obtain maximum performance and strong signals on phone.

New Features

The present transmitter employs a pair of 807W tubes in the PA and PM positions in the final amplifier. These improved tubes are unusually free from parasitics and are much smaller in size than the standard 807. The complete circuit diagram appears in Figure 3.

Maximum input power on both c.w. and phone is 150 watts. The final amplifier input power may be reduced to 100 watts, when desired, by the flip of a switch (S(4) in Figure 3). This reduces input for both c. w. and phone. On phone, the available sideband power is unaffected when carrier power is reduced. Power reduction results from a decrease of screen voltage of the 807W PA tube when switch S(4) is thrown to its LO position.

Previous supermodulated transmitter circuits have employed shunt feed to the PA plate and series feed to the PM plate. Some confusion has resulted from that arrangement. An examination of Figure 3 will show that series feed is used on both 807Ws in this circuit. When switch S(4) is in its PA position, the screen of tube PM is disconnected from the voltage supply and tube PM is rendered inoperative. Meter M(2) then reads PA plate current only. Conversely, when S(4) is in its PM position, screen voltage is removed from tube PA which accordingly is put out of operation, and

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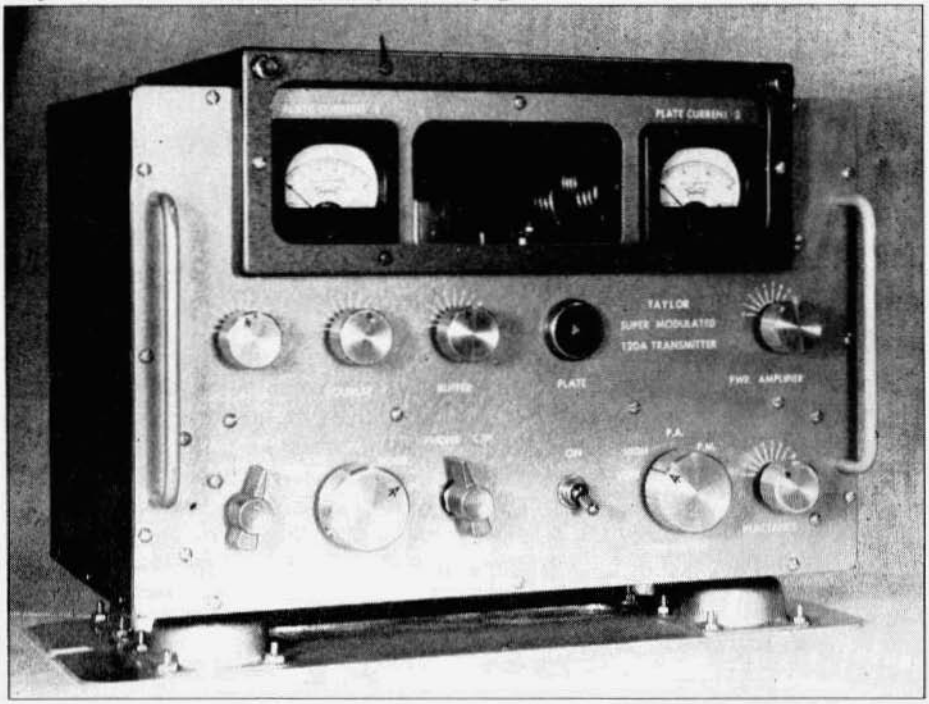

FIG. 1. External view of the supermodulated 807W transmitter. The two milliammeters are mounted behind a Plexiglass window which displays also the tubes and final amplifier tank coils. See Figure 6 for identification of controls.

meter M(2) reads PM plate current only. After reading the separate plate currents, switch S(4) is set to HI or LO, whereupon meter M(2) reads total PA and PM plate currents. The transmitter is operated always with S(4) at HI or LO, depending upon the input power desired, since these are the only settings of the switch which allow both tubes to operate.

The CW-PHONE switch, S(3), reduces the bias of tube PM for c.w., so that this tube is in continuous operation without having to be triggered by the audio channel.

The exciter section uses miniature tubes throughout. Ten meter operation is obtained with a 20-meter crystal or 20-meter-output v.f.o. Twenty meter operation is secured with a 40-meter crystal or 40-meter-output v.f.o. When using an external v.f.o., the 6AK6 oscillator stage operates without difficulty as a straight-through amplifier. Forty and 80-meter coil designs have not been settled at the time of this writing, and will be reported in a later issue of "The Capacitor" as soon as available.

Plate currents of the various exciter and audio stages are read by switching milliammeter M(1) successively across shunt resisters R(5), R(9), R(13), and R(23). The resistance values of these shunts have been calculated for a 0-1 d.c. milliammeter having an internal resistance of 105 ohms. They provide meter ranges of 0-10 ma. for the oscillator, 0-20 ma. for the doubler, 0-30 ma. for the buffer, 0-3 ma. for the total current reading of the two triode sections of the 12AX7 speech amplifier tube, and 0-50 ma. for the audio driver. Typical current readings for the various stages are: oscillator 6 ma., doubler 15 ma.,

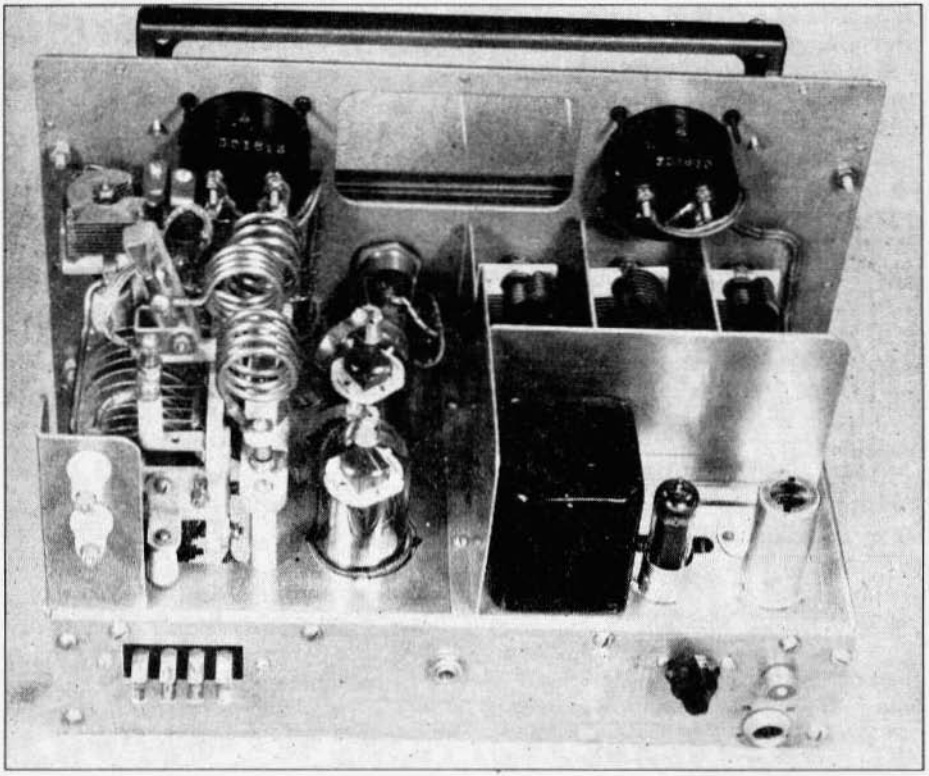

FIG. 2. Inside view of the transmitter showing chassis layout. 10-meter final amplifier coils are in place.

buffer 25 ma., speech amplifier 2 ma. total, and audio driver 38 to 40 ma. If the reader employs a milliammeter having a full-scale current value other than 1 ma. and/or an internal resistance other than 105 ohms, new shunt resistance values must be calculated. Use the formula: R(s) = R(m)/f-1. R(s) is the resistance required for the shunt, in ohms, R(m) the internal resistance of the meter in ohms, and f is the factor by which the full-scale reading of the meter is to be multiplied. The shunts can be made by winding the proper length of Manganin resistance wire on small strips of insulating material. A much easier way is to use a small wirewound rheostat for the shunt, with a slotted shaft for screwdriver adjustment. The latter scheme probably will appeal to most amateurs, since an accurate resistance bridge is needed for best adjustment of the wire shunt.

The speech amplifier employs the two high-gain triode sections of the 12AX7 tube in cascade. With the gain control (R(17)) at its maximum-gain settng, sufficient gain is available for "arm-length" talking into a crystal microphone.

When switch S(4) is in its OFF position, the entire final amplifier is silenced, but the exciter and audio stages remain in operation. This allows the exciter to be tuned-up before applying voltages to the final amplifier. S(5) is the standby switch for muting the transmitter during receiving periods. The lower section of S(5) switches 6.3 volts a.c., derived from the tube heater supply, to a 6-volt a. c. relay which makes and breaks

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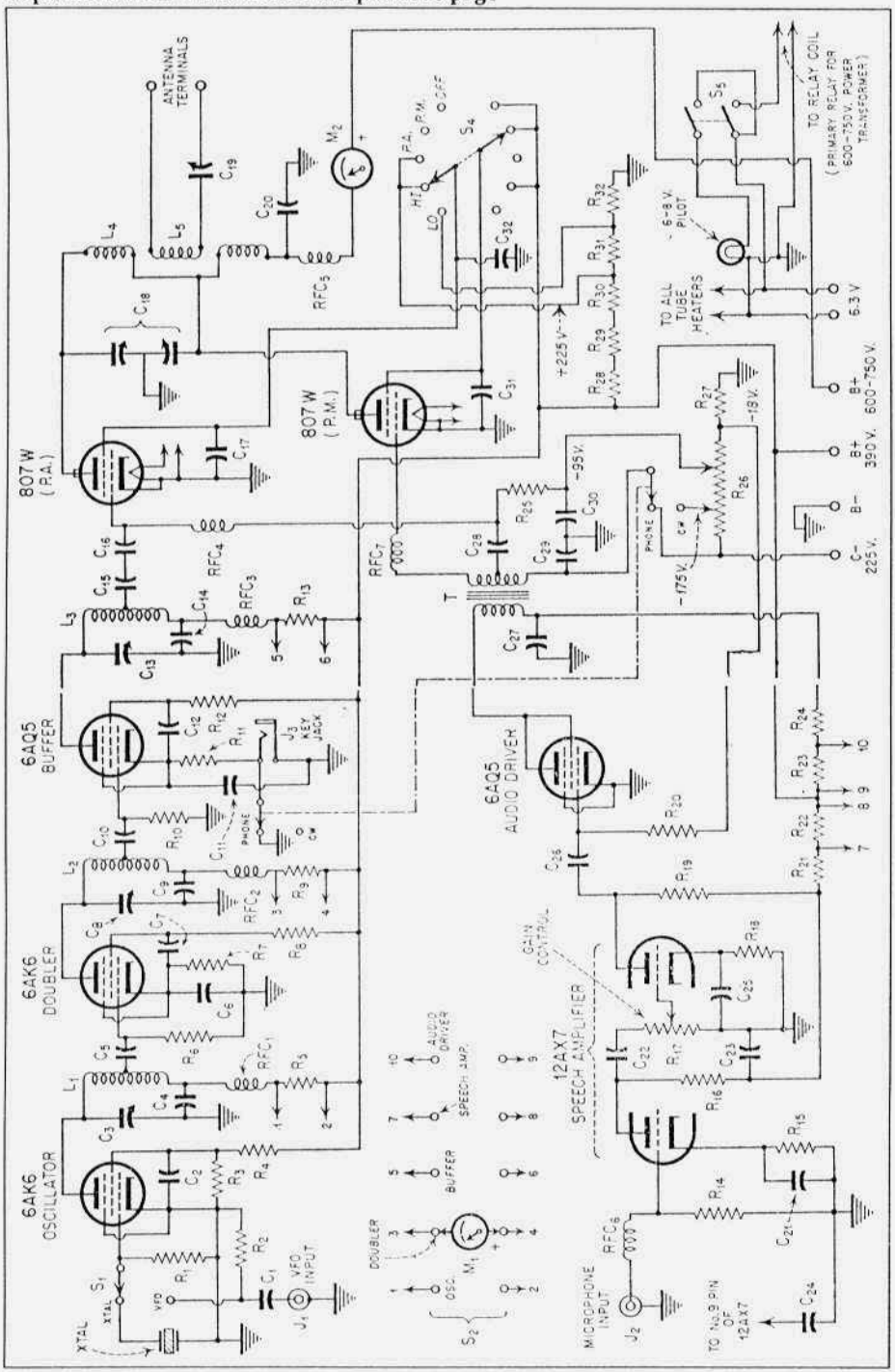

FIG. 3. Complete circuit of the Supermodulated Transmitter.

the primary circuit of the plate power transformer. Thus, the entire transmitter is placed out of operation when this switch is opened, only the tube heaters remaining powered. The upper section of S(5) switches on the front-panel pilot lamp to signal activation of the transmitter.

Power Supply

The power supply for the transmitter must furnish 600 to 750 volts d.c. at 200 to 250 milliamperes; 390 volts d.c. at 125 ma.; negative 225 volts d.c. at 50 ma.; and 6.3 volts d.c. at 4 amperes.

Figure 7 shows an a.c.-operated power supply built for use with the transmitter. The conventional circuit is used. Hence needs no detailed description here. A 5R4GY rectifier furnishes plate and screen voltages. Bias voltages are supplied by a transformer-operated selenium rectifier system. The power supply was made external to the transmitter for easy disconnection when a battery-operated portable power supply is to be used in the field. The latter consists of a 6-volt storage battery and dynamotor. An individual builder may include the a.c. power supply on a larger chassis together with the transmitter, if completely self-contained operation is preferred.

Construction

The transmitter, as shown in the photographs, is built on a 12" x 7" x 3-1/2" chassis and is enclosed in a 14" x 9-1/2" x 7" cabinet. While these dimensions have given the greatest compactness, they do not necessarily have to be followed closely. The lay-out can be spread out more, if desired, provided the usual care is taken to avoid long leads.

It is essential that the exciter, final amplifier, and audio sections be shielded from each other, both above and below the chassis. In addition, top-chassis shields are provided between each exciter stage. Figures 2 and 4 show the simple placement of baffle shields on top of the chassis, and Figure 5 shows shield partitions below chassis. The 12AX7 speech amplifier is the only tube requiring an independent shield (See Figure 2). The 807Ws require no shields, but their sockets are mounted below the chassis so as to bring the bottom of the tube plates even with the top of the chassis. 3/8"-wide flat copper strip is used to connect the 807W plate top-caps to the plug-in base for the final amplifier tank coil.

The audio gain control, R(17), is mounted on the rear lip of the chassis (see Figure 2), since this control has been found not to need frequent re-adjustment. There is no objection, however, to mounting R(17) on the front panel, provided an extension shaft is used to place this potentiometer close to the 12AX7 tube socket. Examination of Figure 2 shows that the key, microphone, and v.f.o. jacks also are mounted on the rear lip of the chassis.

The builder must adhere religiously to the rule of making one solid ground connection to chassis in each stage. Return all grounds in a given stage to this one point, and later connect all of the separate stage-grounds together by means of a length of No. 12 solid wire. The 807W screens must be bypassed separately, each at its own socket, by means of C(17) and C(31). The third screen bypass capacitor, C(32), is connected halfway along the length of the lead between switch S(4) and the screen of the PA 807W. One side of the 807W heater is grounded at each socket, as shown in Figure 3.

The final amplifier coils (L(4)) each are wound in two halves which are spaced sufficiently well apart to allow the pickup coil, L(5), to be swung between them for coupling adjustment. The exciter coils, L(1) to L(3), are wound on small plug-in forms. The number of turns given for L(5) in the COIL TABLE works satisfactorily (in conjunction with output tuning capacitor C(19)) with 50- and 72-ohm transmission lines. The

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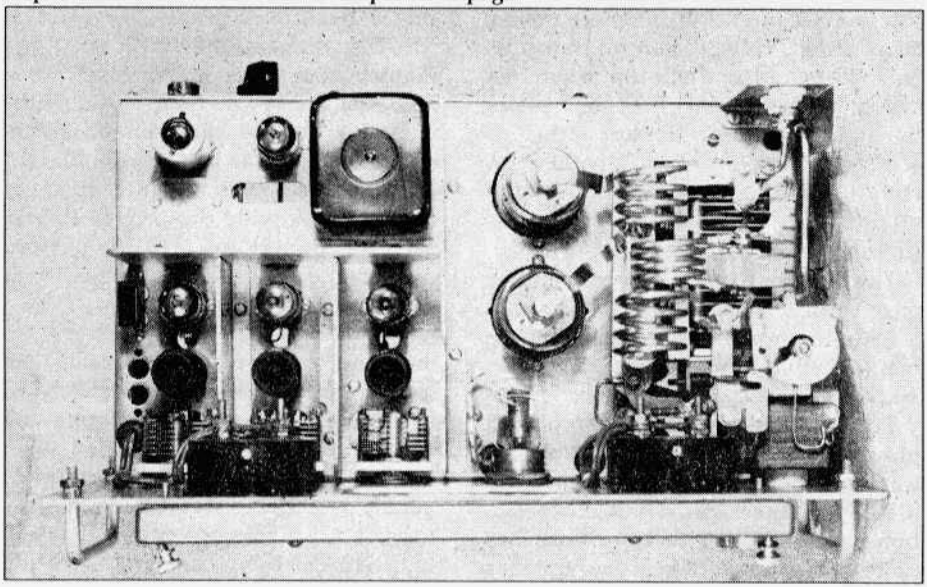

FIG.4. Top view of the chassis. Speech ampliiior and audio driver are in the shielded section in the upper left corner. The 3 exciter stages are in the three shielded sections in the lower left half. The entire right half of the chassis is occupied by the PA and PM stages of the final amplifier.

number of turns must be changed experimentally for best loading when a transmission line of different impedance is used.

Tuning and Adjusting

After wiring has been verified as correct, the final amplifier bias voltages must be adjusted to specified values in the following manner: (1) Set switch S(4) to its OFF position. (2) Plug-in the 40-meter crystal and the complete set of coils for 20-meter operation (See COIL TABLE). (3) Set switch S(3) to its PHONE position. (4) Set gain control R(17) to its minimum gain position. (5) Set switch S(1) to its XTAL position. (6) Set switch S(2) to its OSCILLATOR position. (7) Switch-on power. (8) After the tube heaters have come up to operating temperature as indicated by deflection of meter M(1), tune C(3) for meter M(1) dip. (9) Switch S(2) to its DOUBLER position and tune C(8) for M(1) dip. (10) Switch S(2) to its BUFFER position and tune C(13) for M(1) dip. (11) Using a high-resistance d.c. voltmeter, set the sliders on resistors R(26) to give -175 v. and -95 v., respectively, between slider and ground, as indicated in Figure 3. The preliminary adjustment of the bias voltages now is completed. Final adjustment must be made, as will be explained later, after the final amplifier has been tuned.

Final amplifier tuning now may be undertaken. With the exciter stages still in operation, (1) Connect a 200-watt lamp, as a dummy load, to the ANTENNA terminals. (2) Swing coil L(5) completely out of coil L(4). (3) Set switch S(4) to its HI position. Meter M(2) now reads the total PA and PM plate currents. (4) Tune C(18) for M(2) dip, and touch up the tuning of C(3), C(8), and C(13) to improve this dip. (5) Swing-in coil L(5) in small steps, noting the increase in M(2) reading as the coupling is increased, and tune C(19) for maximum brilliance of the lamp. (6) Work back and forth between C(18) tuning

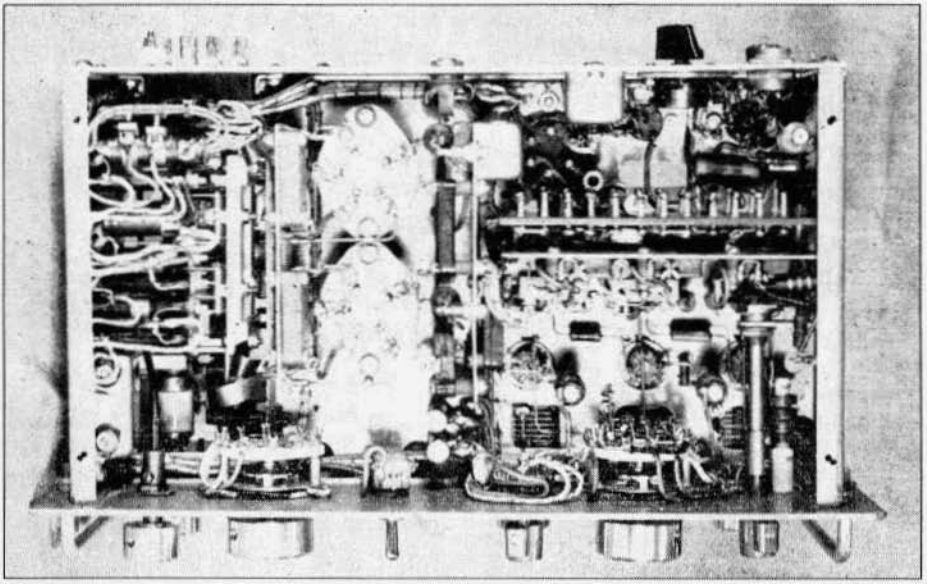

FIG. 5. Under-chasis view

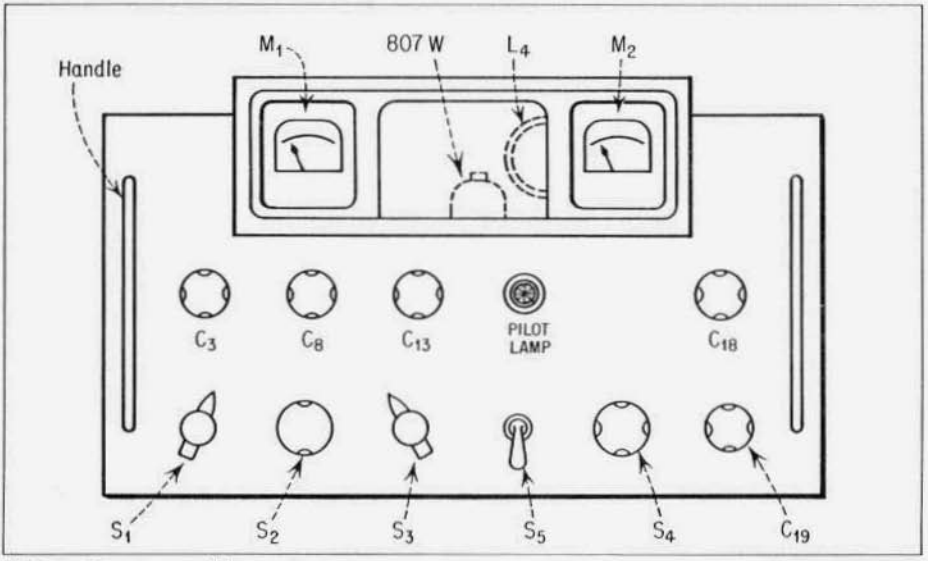

FIG. 6. Front panel layout.

for dip, and C(19) tuning for maximum lamp brilliance. When the tuning is correct, M(2) dip and maximum lamp brilliance will occur at the same setting of C(18), and the M(2) reading will be in the vicinity of 130 milliamperes. (7) Plug the microphone into jack J(2), advance the setting of potentiometer R(17), and whistle a sustained tone into the microphone. The M(2) reading should increase to 200 ma. (with 750 volts input to the final amplifier) and the lamp brilliance should increase. If the lamp dims on modulation, undesired downward

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modulation is taking place and indicates that steps 3 to 6 have not been performed correctly. (8) The final amplifier plate currents may be checked separately with switch S(4) in its PA or PM position as required. At 750 v., unmodulated PM plate current will be approximately 30 ma.; unmodulated PA plate current 100 ma. Under modulation, a slight decrease in PA plate current and a large increase in PM plate current will take place. (9) With switch S(4) in its HI position and the transmitter in operation, make final adjustment of the sliders on resistor R(26) to bring the bias voltage values to the exact -175 v. and -95 v. levels indicated in Figure 3. USE MORE THAN ORDINARY CARE WHEN MAKING THESE ADJUSTMENTS TO PREVENT HARMFUL ELECTRIC SHOCK! (10) With switch S(4) in its HI position and the transmitter operating into the lamp load, check modulation percentage and speech quality by any one of the usual well-known methods. (11) Repeat the entire procedure (except bias voltage a adjustment) with the 20-meter crystal and 10-meter coils. (12) Substitute the antenna for the lamp load and repeat transmitter tuning. A 0-1.5 or 0-2 thermocouple ammeter (or a lamp connected temporarily in series with one of the ANTENNA terminals and the transmission line) will serve as an output indicator when tuning C(18) and swinging L(5) in and out of the tank coil.

COIL TABLE

20-Meter Operation

40-Meter Crystal

L(1)-Oscillator. 37 turns No.18 enamelled wire on 3/4"-diameter form. Winding length 3/4". Tap 9th turn from B-plus end.

L(2)-Doubler. 19 turns No.18 enamelled wire on 3/4"-diameter form. Winding length 1-1/8". Tap 3rd turn from B-plus end.

L(3)-Buffer. 16 turns No.18 enamelled wire on 3/4"-diameter form. Winding length 1-1/8". Tap 9th turn from B-plus end.

L(4)-Final Amplifier. Each section 6 turns (1/16)" o.d. copper tubing air-wound 1-3/4" in diameter. Winding length 1-5/8". Separation between sections of coil 7/8".

L(5)-Antenna Coupling. (50 to 72 ohms). 4 turns (1/16)" o.d. copper tubing air-wound 1-3/4" in diameter. Winding length 5/8".

10-Meter Operation

20-Meter Crystal

L(1)-Oscillator. 16 turns No.18 enamelled wire on 3/4"-diameter form. Winding length 1-1/8 inch. Tap 4th turn from B-plus end.

L(2)-Doubler. 8 turns No.18 enamelled wire on 3/4"-diameter form. Winding length 1-1/8 inch. Tap 1-1/4 turn from B-plus end.

L(3)-Buffer. 5 turns No.18 enamelled wire on 3/4"-diameter form. Winding length 3/4 inch. Tap 3-1/4 turns from B-plus end.

L(4)-Final Amplifier. Each section 4 turns (1/16)" o.d. copper tubing air-wound 1-1/4" in diameter. Winding length 1-1/4 inch. Separation between sections of coil 1 inch.

L(5)-Antenna Coupling. (50 to 72 ohms). 5 turns (1/16)" o.d. copper tubing airwound 1-1/4" in diameter. Winding length of 3/4 inch.

PARTS LIST FOR FIGURE 3

C(1)-0.00025 ufd. mica (C-D 5W5T25)
C(2)-0.01 ufd mica (C-D 1D3S1)
C(3)-35 uufd. midget variable-Cardwell ZR-35-AS
C(4)-0.002 ufd. mica (C-D 1W5D2)
C(5)-0.0001 ufd. mica (C-D 5W5T1)
C(6), C(7)-0.01 ufd. mica (C-D 1D3S1)
C(8)-35 uufd. midget variable-Cardwell ZR-35-AS
C(9)-0.002 ufd. mica (C-D 1W5D2)
C(10)-0.00025 ufd. mica (C-D 5W5T25)
C(11), C(12)-0.01 ufd. mica (C-D 1D3S1)
C(13)-35 uufd. midget variable-

Cardwell ZR-35-AS
C(14)-0.002 ufd. mica (C-D 1W5D2)
C(15)-0.00025 ufd. mica (C-D 5W5T25)
C(16)-0.00005 ufd. mica (C-D 5W5Q5)
C(17)-0.01 ufd. mica (C-D 1D3S1)
C(18)-35 uufd. per section transmitting variable 0.085" spacing. National TMH-35D.
C(19)-100 uufd. midget variable-Cardwell ZR-100-AS
C(20)- 0.002 ufd. 2500-volt mica (C-D 1DP25D2)
C(21)-1.0 ufd. 600 v. oil (C-D DYR6100)
C(22)- 0.001 ufd. mica (C-D 1W5D1)
C(23)-0.1 ufd. 600 v. oil (C-D DYR6010)
C(24)-0.0001 ufd. mica (C-D 5W5T1)
C(25)-1 ufd. 600 v. oil (C-D DYR6100)
C(26)-0.0033 ufd. mica (C-D 1W5D33)
C(27)-0.5 ufd. 600 v. oil (C-D DYR6050)
C(28, C(29), C(30)-0.1 ufd. 600 v. oil (C-D DYR6010)
C(31)-0.01 ufd. mica (C-D 1D3S1)
C(82)-0.5 ufd. 600 v. oil (C-D DYR6050)
J(1)-Concentric female chassis jack-Amphenol 80-C
J(2)-Chasis-type microphone connector - Amphenol 75-PC1M
J(3)-Miniature open-circuit phone-type jack - Carter
L(1), L(2), L(3), L(4), L(5)-See COIL TABLE
M(1)-0-1 d.c. milliameter
M(2)-0-200 d.c.. milliammeter
R(1)-100,000 ohms 1/2 watt carbon
R(2)-27,000 ohms 2 watts carbon
R(3)-22,000 ohms 2 watts carbon
R(4)-27,000 ohms 1 watt carbon
R(5)-11-1/2 ohm wirewound meter shunt (See Text)
R(6)-100,000 ohms 1 watt carbon
R(7)-470 ohms 2 watts carbon
R(8)-27,000 ohms 2 watts carbon
R(9)-5-1/2 ohm wirewound meter shunt (See Text)
R(10)-100,000 ohms 1/2 watt carbon
R(11)-470 ohms 2 watts carbon
R(12)-27,000 ohms 2 watts carbon
R(13)-3.6 ohm wirewound meter shunt (See Text)
R(14)-3 megohms 1/2 watt carbon
R(15)-5200 ohms 1/2 watt carbon
R(16)-0.47 megohm 1/2 watt carbon
R(17)-1 megohm potentiometer
R(18)-4000 ohms 1/2 watt carbon
R(19)-0.47 megohm 1/2 watt carbon
R(20)-0.47 megohm 1/2 watt carbon
R(21)-0.25 megohm 1/2 watt carbon
R(22)-52-1/2 ohm wirewound meter shunt (See Text)
R(23)-2.15 ohm wirewound meter shunt (See Text)
R(24)-1500 ohms 5 watts wirewound
R(25)-3300 ohms 2 watts carbon
R(26)-7500 ohms 25 watts wirewound, with 2 sliders
R(27)-800 ohms 10 watts wirewound
R(28)-1000 ohms 20 watts wirewound
R(29)-5000 ohms 10 watts wirewound
R(30)-5000 ohms 10 watts wirewound
R(31)-10,000 ohms 10 watts wirewound
R(32)-5000 ohms 10 watts wirewound
RFC(1), (2), (3), (4), (6), (7)-2-1/2 millihenry, 125 ma. r.f. chokes
RFC(5)-2-1/2 millihenry, 300 ma. r.f. choke- National R-300U
S(1)-S.p.d.t. non-shorting wafer-type switch
S(2)-2 pole, 5-position, non-shorting rotary selector switch
S(3)-D.p.d.t. non-shorting wafer-type switch
S(4)-2 pole, 5 position, non-shorting rotary selector switch
S(5)-D.p.d.t. toggle switch

T-Special supermodulation audio transformer-Gaertner CS-3262 (The Gaertner Co., 3614 Maple Ave., Los Angeles, California)
XTAL-Quartz Crystal (See Text)

Vintage Radio and the Internet Part 3

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USENET/NETNEWS and THE WEB

The final article of this series will cover the newsgroups and the World Wide Web as it relates to vintage radio communication equipment. First of all, what are Newsgroups? Also called Usenet and Netnews, these collections of posted messages are fed to your Internet service provider via an elaborate network of servers and routers. There are thousands of them, but only a few are of interest. You can subscribe to as many newsgroups as you wish. This tells your news reader program which groups to look for messages and present them to you by author and subject to choose messages you want to read. Netnews differs from a mailing list in that you only have to configure your news reader to accept newsgroups you are interested in. You do not have to send any e-mail messages to initiate the process. Also newsgroups are much more widely distributed than mailing lists. There is no way of knowing who and how many people are reading the newsgroup's traffic.

A newsgroup has often been compared to an electronic bulletin board where anyone can post and read messages addressed to any and all who view it. Postings are presented showing name of sender and the subject. Your screen will show the list of postings available for reading and you simply choose the postings of interest to you and read them one by one. You can search the index for key words, subjects of interest, etc., and you can reply privately to the sender, post a reply to the newsgroup, save or delete postings easily. The way this is done depends on which news reader you are using. Most people use the news reader that is a component of their Web browser, but others who use a dial-up unix shell account will probably use a separate news reader like TIN or TRN that resides on their ISP's server.

The newsgroups that are of interest to us are:

rec.radio.amateur.boatanchors
rec.radio.swap
rec.antiques.radio+phono

I mentioned rec.antiques.radio+phono because there are some overlapping areas of interest but that group is primarily for old broadcast radio and phonograph enthusiasts. When first getting on with a new group the best strategy is to read the traffic for a while to get a feel for what the group is all about before posting anything. Most newsgroups have a document called a FAQ, which stands for Frequently Asked Questions and its always a good idea to get this and read it. The FAQ for the rec.radio.amateur.boatanchors is compiled by Nick England, KD4CPL. It is posted to the newsgroup on a regular basis and may also be read online at Nick's Web Site http://www.cs.unc.edu/~nick/rrab.faq.htm.

Rec.radio.swap is in interesting collection of postings that includes commercial equipment as well as amateur gear for sale or wanted. As with on-air transactions, care and caution should be exercised here when dealing with people who are unknown to you. I do not intend to go into a full dissertation on buying and selling online, but I can summarize this by saying that there are a lot of items being offered at prices that range from the absolute bargain to outrageous rip-offs. Rec.radio.amateur.boatanchors also contains many buy-sell postings but as with the real world, the Boatanchors community is much

smaller and people tend to know each other and deal with each other accordingly.

While on the subject of newsgroups, there is the ugly spectre of numerous frivolous messages posted to many newsgroups that are intended to sell goods, services or "get rich" schemes. Paul Courson, WA3VJB refers to these as "rug merchants". This random, shotgun approach is commonly called Spam, after the Monty Python sketch of the same name. In addition to Spam there are certain individuals out there who like to engage in stirring up discord and dissent resulting in what is known as "flame wars" in the news groups. There folks are known as "trolls" and their postings "flame bait". Generally any mention of, particularly in support for Lambda will do it. If you want an on-air example of trolling and flaming just listen to 14.313 just about any time. Fortunately all news readers have filters and you can easily eliminate postings containing specific key words in their subject line. Once properly configured this filtering will eliminate most of this garbage. As an aside, mail readers also have this feature and you can likewise shield yourself from much of the junk e-mail that you will be sent once the bulk mailers get your address. Many of these utilize extraction programs that search for the @ sign in text which is an integral part of everyone's e-mail address and netnews postings are prime and fertile territory.

Now, onto the World Wide Web. There is a great deal of vintage radio material available on demand and it is an excellent resource. The Web is the second most used Internet component (first is e-mail). It is well named. Like a spider's web, it connects and links different sites and you can follow these links moving from one site to another. Internet site addresses are called URLs (Uniform Resource Locators) and generally are written as such: http://www.thebizlink.com/am/home.htm which is the URL for the AM Page, a most excellent site that is an excellent starting point to access the information available on vintage radio. As with e-mail addresses, syntax and accuracy are paramount. One character you will see often is the tilde ~ and if omitted you will get a "not found" message.

You will need to use a Web browser program to navigate the Web. Netscape Navigator is the most popular one with Microsoft Internet Explorer second in line. There are others but Navigator and Explorer are the ones most people use. You get Explorer free with Windows 95 or by downloading it or if you prefer Navigator it'll cost you about $30.00. Easiest way to get either is at your local book shops that carry computer books that come with the program on CD-ROM. Several publishers offer titles on Netscape or Explorer. Ventana Press is the "official" Netscape book publisher but Sams, Que and Sybex also feature great volumes on the subject ranging in price from $30.00 to $50.00 including the program. For those with a dial-up shell account there is a very interesting Web browser called Lynx that was written at the University of Kansas that is very good. It is strictly text only but is often much faster than Netscape Navigator or Explorer because it does not have to load images.

A quick word on the AM Web Page. The Webmaster is Steve Ickes, WB3HUZ a well-known Baltimore area AMer. It features information, a Web-based bulletin board, photos of AMers, modifications, technical information, resources, lore and legend of AM and even audio feeds so you can actually hear the gang at play. Steve is constantly adding to the AM page and it has a very large collection of links to other sites. As mentioned in the first installment of this series it is an excellent starting point. In my humble opinion, Steve's Web page is the on-line equivalent of ELECTRIC RADIO magazine!

continued on page 39

A RARE FIND ON THE WEB

by Kurt H. Miska, N8WGW
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Like so many of us who travel back in time by reading Electric Radio and play with vacuum tubes, we also pursue this very nostalgic hobby of electric radio via that most modern of communications tools, the Internet, the Web, whatever you want to call it. I am no exception. There are days when my e-mail box contains more messages about boatanchors and electric radio matters than it does business e-mail. As you might imagine, these general e-mail postings are of enormous interest to me.

And so it was that some months ago a gentleman was offering a Hewlett Packard RMS voltmeter for a very modest sum. Well, after some e-mails back and forth a swap resulted.

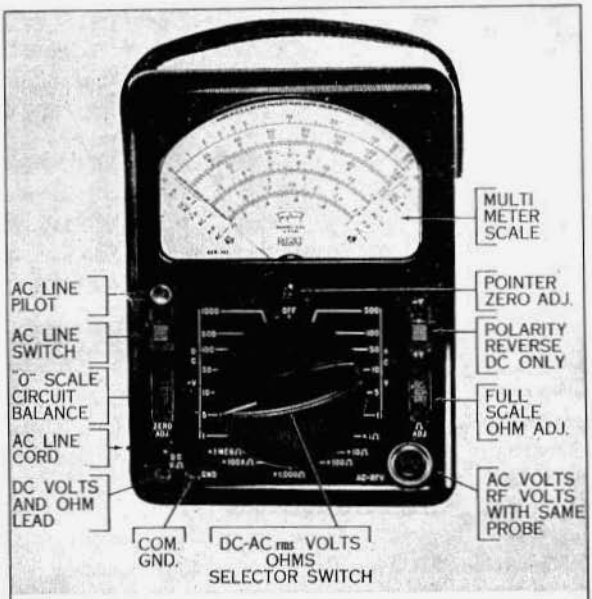
I received my treasure and hopefully he is equally happy with what I sent him. More recently, it has happened again. I missed out on what was advertised as a near new Simpson 260 VOM but only to have a better offer come along from the same source. He had a Triplett 650 VTVM. The "he" is Mike Maloney, AC5P, in Oklahoma.

Until then I had never heard of a Triplett 650 VTVM, but that, of course, doesn't mean a thing. Mike described the instrument and based on that I also contacted Triplett for more information. Jeanette Makley, a very helpful lady in customer service, was kind enough to fax me several pages from the instruction manual and, much to my surprise I learned that the 650 looks just like my old 630. I knew I had to have it. The exception being the additional features that indeed distinguish it as a VTVM.

Again, it was more than a few e-mails back and forth. Mike related how when he came across this particular instrument it still had in it the Eveready C-size battery from 1954. It hadn't even leaked. So, a few more days passed and UPS delivered what was really a new Model 650 (S/N 4848) VTVM. All the test leads were there and Mike had included the original and slightly worn Triplett box, the barely touched instruction manual. A little bonus of historical interest was a general four-page brochure dated March 1953 describing the then current product line. It was truly an incredible experience to unpack an instrument that had, for all practical purposes, arrived over 40 years late. The only thing missing was the warranty card. Talk about time travel.

After I unpacked it, I plugged it in and let it warm up for five minutes. Everything zeroed out just fine and the DC/Ohms probe did its thing just fine. To check calibration on AC, I used my H-P 200CD set to 60 Hz with about 10 volts output, monitored by an H-P 3400A RMS voltmeter and found that the 650's AC ranges needed some attention. The adjustment pot did not bring it in. The DC and ohms ranges were very much on the money. I have changed the 12AU7 to a 5814A, this being an industrial-strength version. Initial tests showed some improvement of the AC calibration but I'll need more time and testing to see if I can fix the problem.

Then one of these incredible coincidences happened. While checking out the daily boatanchor postings on the web, I came across a message describing someone's dealings with Standard Meter Lab in Livermore, Calif. This is a shop that specializes in servicing older analog instruments and they had come to the aid of a fellow boatanchorist with a Simpson 260 that needed some parts. The message also posted the telephone number. I decided, "what the heck; let me call and find out if they can help with the ills of my Triplett 650. Well, the



Model 650

nicest and very informed calibration technician you'd ever want to meet patiently discussed the problem with me.

About the 650

The history of Triplett's VTVM dates back to the 1930s. However, World War Two, for all practical purposes, stopped development of such commercial products. Postwar developments brought about a more or less complete redesigning of these products. As a result, the VTVM came back into the line as the Model 650 in 1951. Clearly using some technology and design aspects of the classic Model 630 VOM, the Model 650 was born and it had a production life of 12 years.

Two other VTVMs were produced by Triplett. The Model 631 was a combination VOM/VTVM that was made from 1955 to 1972. It also shared many of the features of the 630 PLK VOM. The larger Model 850, made from 1960 to 1974, was totally different in appearance from the 600-series meters.

But, back to the Model 650. In 1952 it sold for $69.50 and, according to a then current advertisement, "a little more West of the Rockies." Apparently there were no variations of the instrument and it was discontinued for the simple reason that the number of sales did not warrant further production. From a quality point of view, it is clearly a notch above the sundry kit VTVMs then in vogue and perhaps that's the reason it couldn't compete with the entirely practical, reliable and less expensive Heaths, Eicos, Knights and RCAs. Basically, it is a classic VTVM covering DC and AC voltage and resistance.

Mr. Ropp Triplett was kind enough to write me a short note, from which I quote, "As I remember, the RCA Voltohmyst was the big name in our lines of distribution. Heathkit, of course, was very popular but I don't recall they did much with our type distributors. The Model 650 was made to fill a void in our line at that time and to be compatible with it. However, I'm sure it did not sell in the same quantities as RCA or Heathkit."

The 650 features the 20-position range switch with seven decks so characteristic of the 630-series VOMs. In addition there is a power switch with a pleasantly unobtrusive neon indicator light, a polarity reversing switch, the ohms zeroing (ADJ) control, and the zero adjustment used with the AC and DC ranges. Three front panel jacks are DC V, AC/RF V and ground (GRD). The flush-mounted range switch features an OFF setting. This setting does not control AC power to the VTVM; it takes the meter movement out of the circuit and adds greater damping to the meter and avoids violent swinging of the pointer during transport. There is no

continued on page 38

1998 Winter Classic & Homebrew Radio Exchange

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

The Classic Exchange will run from 2000 UTC February 1, to 0500 UTC February 2, 1998. Exchange your name, RST, QTH (state/province for US/Canada; country for DX), receiver and transmitter type (homebrew send final amp tube or transistor), and other interesting conversation. The same station may be worked with different equipment combinations on each band and on each mode. CW call "CQ CX;" phone call "CQ Classic Exchange." Non-participants may be worked for credit.

Suggested frequencies:

CW: 3.560, 7.060, 14.120, 21.180, 28.240

Novice/Tech Plus: 3.695, 7.120, 21.180, 28.240

Phone: 3.880, 7.290, 14.280, 21.380, 28.320

7.060 and 3.560 tend to be the most popular CX frequencies.

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

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

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

Certificates and appropriate memorabilia are awarded every now and then for the highest score, the longest DX, exotic equipment, best excuses and other unusual achievements. Send logs, comments, anecdotes, pictures to Jim Hanlon, P.O. Box 581, Sandia Park, NM 87047, Marty Reynolds, AA4RM, POB 13354, Atlanta, GA 30324, or Allan Stephens, 106 Bobolink Dr, Richmond, KY 40475. Include TWO-stamp SASE for next CX Newsletter and announcement of next CX. E-mail reports may be sent to modsteph@acs.eku.edu (A1, N5AIT).

Ten-Meter News.....

This month this column is going to be very abbreviated due to other material that took priority. Next month we'll get more information in.

I've received many letters regarding 10M activity and one constant is the excitement that everyone is feeling about the improved conditions. It's great to be hearing AMers that I haven't heard since the last cycle. Some of those are: Jack, KH6CC; Andy, W5QXX (ex-N5JBT); Smitty, KD4AF; George, W1GAC and many others.

Dewey, KØZUS, has suggested that we create a window exclusively for 10M AM DX. We talked about allocating 50 kcs below 29.0. Until I hear some objection to that idea I guess that will be our AM DX window.

I'm monitoring the AM window all day now. I hope to hear you. N6CSW

VINTAGE NETS

Westcoast AM Net: Meets informally, nightly on 3870 at 9:30 PT. Wednesday at 9:00 PM PT they have their formal AM net which includes a swap session. Net control rotates.
California Early Bird Net: Saturday mornings at 8 AM PST on 3870.
California Vintage SSB Net: Sunday mornings at 8 AM PST on 3835
Southeast Swap Net: Tuesday nights at 7:30 ET on 3885. Net control is Andy, WA4KCY. This same group also has a Sunday afternoon net on 3885 at 2 PM ET.
Eastern AM Swap Net: Thursday evenings on 3885 at 7:30 ET. This net is for the exchange of AM related equipment only.
Northwest AM Net: AM activity daily 3 PM - 5 PM on 3875. This same group meets on 6 meters (50.4) Sundays and Wednesdays at 8:00 PT and on 2 meters (144.4) Tuesdays and Thursdays at 8:00 PT. The formal AM net and swap session is on 3875, Sundays at 3 PM.
K6HQI Memorial Twenty Meter AM Net: This net on 14.286 has been in continuous operation for at least the last 20 years. It starts at 3:00 PM PT, 7 days a week and usually goes for about 2 hours. Net control varies with propagation.
Arizona AM Net: Meets Sundays at 3 PM MT on 3855. On 6 meters (50.4) this group meets at 8 PM MT Saturdays.
Colorado Morning Net: An informal group of AM'ers get together on 3876 Monday, Wednesday Friday, Saturday and Sunday mornings at 7AM MT.
DX-60 Net: This net meets on 7290 at 2 PM ET, Sundays. Net control is Jim, N8LUV. This net is all about entry-level AM rigs like the Heath DX-60.
Eastcoast Military Net: It isn't necessary to check in with military gear but that is what this net is all about. Net control is Dennis, WA3YXN but sometimes it rotates to other ops. Saturday mornings on 1995 at 0500 ET. Will move to 3885 for summer.
Westcoast Military Radio Collectors Net: Meets Sunday mornings at 0930 local on 3975 + or - QRM, except the 1st Sunday of the month when the net meets at 2130 local. Net control is Tom, WA6OPE.
Grey Hair Net: The oldest (or one of the oldest!- 43+ years) 160-meter AM nets. It meets on Tuesday nights on 1945 at 8:30 PM EST & EDST. Call-up at 8 PM.
Vintage CW Net: For CW ops who enjoy using vintage equipment.This is not a traffic net; speed is not important. The net meets on 7037 Sundays at 7 PM Mountain. Net control is Tracy, WB6TMY.
Vintage SSB Net: Net control is Andy, WBØSNF. The Net meets on 14.293 at 1900Z Sunday and is followed by the New Heathkit Net at about 2030Z on the same freq. Net control is Don, WB6LRG.
Collins Collectors Association Nets: Technical and swap session each Sunday, 14.263 MHz, 2000Z, is a long-established net run by call areas. Informal ragchew nets meet at 0100Z Tuesday nights on 3805 and on Thursday nights on 3875.
Collins Swap and Shop Net: Meets every Tuesday at 8PM EST on 3955. Net control is Ed, WA3AMJ.
Drake Users Net: Another relatively new net. This group gets together on 3865 Saturday nights at 8 PM ET. Net controls are Criss, KB8IZX; Don, WZ8O; Rob, KE3EE and Huey, KD3UI.
Swan Users Net: This group meets on 14.250 Sunday afternoons at 4 PM CT. The net control is usually Dean, WA9AZK.
Nostalgia/Hi-Fi Net: Meets on Fridays at 7 PM PT on 1930. This net was started in 1978.
K1JCL 6-Meter AM Repeater: Located in Connecticut it operates on 50.4 in and 50.5 out.
JA AM Net: 14.190 at 0100 UTC, Saturdays and Sundays. Stan Tajima, JA1DNQ is net control.
Fort Wayne Area 6-Meter AM Net: Meets nightly at 7 PM ET on 50.58 MHz. This net has been meeting since the late '50's. Most members are using vintage or homebrew gear.
Southern California Sunday Morning 6 Meter AM Net: 10 AM Sundays on 50.4. Net control is Will, AA6DD.
Westcoast 40-Meter Sunday Net: Net control varies. The group meets on 7160 starting at 4PM PT.
Old Buzzards Net: Meets daily at 10 AM Local time on 3945. This is an informal net in the New England area . Net hosts are George, W1GAC and Paul, W1ECO.
Canadian Boatanchor Net: Meets Saturday afternoons, 3:00 PM EST on 3745. For hams who enjoy using AM, restoring and operating
Midwest Classic Radio Net: Saturday mornings on 3885 at 8AM Central time. Only AM checkins allowed. Swap/sale, hamfest info and technical help are frequent topics.
Boatanchors CW Group: Meets nightly at 0200Z on 3579.5 Mhz (7050 alternate). Listen for stations calling "CQ BA" or signing "BA" after their callsigns.

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

New Hope For Your Heathkit Mohawk

Part Three

by Thomas Bonomo, K6AD
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You may remember from Part One of this article (ER - November, 1997) how bad the VFO drift in the Mohawk is: on the 75 m band, it is nearly 3.5 kHz in the first hour in the cabinet and over 2 kHz when open on the bench! The news gets even worse, because it drifts far more than this on the higher bands. I'm amazed there is still chrome left on the main tuning knob, since I needed to give it a tweak every few minutes to keep SSB signals sounding natural. Dare leave the room for an hour, and the Mohawk could drift up to a completely different QSO! I have never seen a receiver drift as badly as this. Heath just didn't seem to pay to any attention whatsoever to temperature compensating the VFO. Perhaps Heath's engineers only listened to this receiver on AM where drift is not as annoying as it is in CW or SSB modes. Who knows....

When I first started this project, I thought attacking the Mohawk's horrendous VFO drift would be the easy part, so I saved it for last. I thought that all I needed to do was just throw in a few carefully selected temperature compensating capacitors to fix the problem. I assured my wife, who hadn't seen me much since I began hibernating in my shack with this project, that it couldn't *possibly* take more than another couple of hours to get my receiver and this article wrapped up. *Wrong*, radio breath! I soon discovered how many evenings and weekends can be wasted trying to get the right results.

As shown in Figure 9, the heart of the Mohawk VFO is a 12AT7 twin triode which combines the functions of a Hartley oscillator and cathode follower. Oscillator "pulling" is eliminated by using half of the tube as a cathode follower to couple the oscillator to the mixer stage. Unlike most receivers, in which the VFO generates the same range of frequencies for each band, the Mohawk VFO *generates* a completely new range of frequencies for each band! With its 1.682 MHz 1st conversion stage, the VFO always operates 1.682 MHz above the desired frequency. This means the VFO must cover a range from 3.4 to well over 30 MHz.

This is why the drift gets worse as you go up to higher bands. If you think of the oscillator drifting a fixed percent with temperature over time, it is apparent that the number of cycles it drifts is directly proportional to the frequency generated. Since SSB reception is sensitive to drift in terms of the absolute number of cycles, not percent, the drift problem in this receiver just gets magnified as you move up to higher bands.

Another problem with Heath's design approach is that the short-term stability of the oscillator also becomes much worse on the higher bands. On 160 m, short-term drift is barely noticeable. But on 10 meters, within just a couple of minutes you will see short-term swings of nearly 150 Hz (which in terms of % isn't too bad for a variable oscillator at this high frequency). This made taking measurement readings on the high bands a real pain in the rear.

"Caught you in the act! Just what do you think you are doing with my hair dryer Mr. Bonomo?"

The Hunt For Drifting Components

I had hoped that it would be easy to determine which components were causing the VFO to drift. I tried heating and cooling various components, but virtually everything associated with this VFO seemed to cause it to drift. It was hard to isolate components and keep heat from spreading to others. Since I wasn't making good progress with the VFO mounted in the radio, I finally decided to disembowel the entire oscillator section out of the radio, where it would be easier to isolate and test components separately.

With the oscillator out on the bench, I warmed it up for 2 hours while keeping it as cool as possible with several fans. To ensure accuracy of the oscillator drift tests, the AC line voltage was regulated ± 1 volt. This steady-state condition allowed more accurate analysis of the problem. Heating and cooling individual components was possible without affecting other parts. As you can see from the following table, which was derived on the 75 meter band, everything drifted in the wrong direction. No benefit from parts drifting in opposite directions here!

Main Tuning Variable-1.610 kHz
Calibrate variable - .100 kHz
12AT7 VFO Osc. - .650 kHz
Band coil -1.250 kHz
Band capacitor -1.820 kHz
Total Drift - 5.42 kHz (yikesl)

You'll notice none of the remaining HF oscillator components are included in the list. Well, I tested them - it was a gruesome task - and the good news is that none of the components in the "nearly-impossible-to-get-to, fully enclosed, soldered-in-place RF front-end" cause much drift (finally, a small bit of luck).

The VFO tube contributed much less drift than I expected. Having a good supply of new 12AT7 tubes on hand, I measured the drift contributed by various cold tubes in the warmed-up steady

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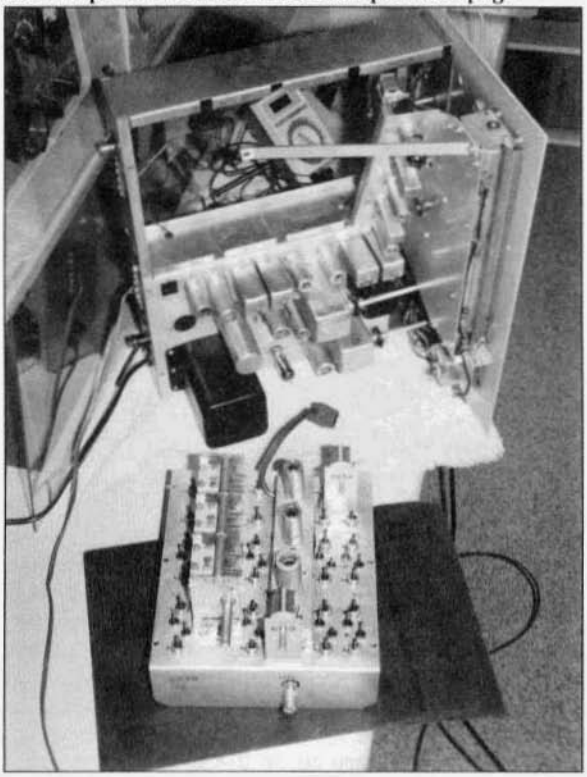

Disembowled RF section. You don't need to do this!

state oscillator. Surprisingly, not all the tubes even drifted in the same direction. While most tubes made the problem worse by drifting down in frequency as they warmed up, I found several that drifted *up* in frequency, at least partially offsetting the drift caused by other components. Out of a batch of 6 tubes, the range was from -650 Hz to +180 Hz. This was certainly an unexpected result worth knowing about. For drift, GE tubes seemed to be the worst, while Sylvania gave me the best results. These tubes are cheap at swapmeets (usually $1) so grab a bunch and begin testing.

Finding Compensating Capacitors

The remaining sections of this article require temperature compensating capacitors. These days, capacitors with a negative temperature coefficient are not as easy to find as they used to be. The type of capacitor to use is a Class 1 temperature compensating disc ceramic. The temperature coefficient is measured in capacity change in parts per million and they carry EIA designations like N80, N330, N470, N750, N1500, etc. These drift in a negative direction with increasing temperature. NPO capacitors are temperature stable and so have no drift.

I found it difficult to find the exact values with the exact temperature coefficient I needed, so it was necessary to be creative by combining various values. Most distributors don't carry a good selection and usually all you will find are the NPO variety. Surplus Sales of Nebraska has some stock of negative coefficient temperature compensating capacitors at (800) 244-4567 for about $4 per capacitor. Another good source is Johnson Shop Products at (408) 257-8614 for between 8 and 10¢ per capacitor (and these are very good quality). Al Johnson's company is a small mail order operation and his free catalog is really worth getting. He also has the best selection of temperature compensating capacitors I've seen in years (but only Surplus Sales had the N2400 capacitors). Since Al's prices are so cheap, I'd suggest ordering numerous different values so you can easily combine them to get the temperature coefficient you want (I now have a great assortment).

To get the best results, the top side and bottom side of the chassis must each be compensated separately, since drifting components are located in both places and heat reaches them at differ-

ent points in time. Trying to do it all in one step results in the receiver first drifting one way, and then later in the opposite direction. Doing the top and bottom separately makes the project a bit more work, but the results are well worth the extra effort.

Top Side Compensation

The problems created on the top side of the chassis were caused by the main tuning and calibrate air variable capacitors having a positive temperature coefficient. The circuit shown in Figure 8 adds negative compensation by adding two temperature compensating capacitors to the calibrate capacitor (at the cathode side of the oscillator). The calibrate and main tuning variables are physically close so this scheme compensates both of them in one stroke.

In addition to providing temperature compensation, this circuit also reduces the range of the calibrate capacitor, which I found excessive and hard to adjust. The original range of the trimmer was 7-29 pF, while the range using the compensating circuit was reduced to 17-24 pF. The reduced range makes it easier to set. This scheme isn't perfect, because Heath switches in two different sections of air variable, and they each contribute different amounts of drift. In addition, the drift will be a bit different depending on whether the air variable is fully open or fully closed; however, the bulk of the drift is still eliminated.

I found that the circuit of Figure 8 needed capacitors with a larger negative temperature coefficient to eliminate all the drift, but I just couldn't find them. The N2400 types shown just don't quite do the job: the top side drift component is still about -300 Hz on 75m and about -1.5 kc on 10m which is a big improvement, but still not perfect. Unfortunately, I could not find units with more compensation than N2400. If you know of a source, I'd really like to hear from you.

Bottom Side Compensation

The bandcoils and capacitors for each band are located on the bottom side of the chassis (only one band assembly is shown in Figure 9). Physically, the capacitor is located right on the coil for each band. Heath used precision mica capacitors for each of the bands, but with the wrong temperature coefficient! The band capacitors and coils each contribute to a drop in VFO frequency. Instead of using capacitors which offset the drift contributed by the band coils, the capacitors used by Heath had a positive temperature coefficient which contributed further to the problem. Replacing the band capacitor located on each coil assembly with one which has a small negative temperature coefficient can eliminate nearly all of the drift caused by this assembly. The values which gave the least drift in my unit are shown in the table below. Because this circuit is very, very sensitive, your mileage may vary.

Band	C Required	Band Coil Capacitor (pF)	PPM Units (C X TC)
160	245pF	128-NPO + 110-N150+ 7-N750	21,750
80	120pF	102-NPO + 7-N750+ 11-N470	10,420
40	270pF	214-NPO + 56-N330	18,480
20	220pF	162-NPO + 47-N330 + 11-N470	20,680
15	245pf	186-NPO + 56-N330 + 3.3-N750	20,955
11	270pf	220-NPO + 47-N330 + 3.3-N750	17,985
10	165pf	80-NPO + 39-N220 + 47-N80	12,340
Conv.	75pF	36-NPO + 39-N220	8,580

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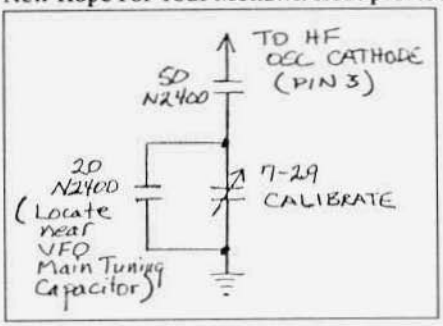

Figure 8. VFO temperature compensation.

On most band coils, I ended up with a combination of three or more capacitors designed to provide the right capacitance at the right temperature coefficient. You will probably get reasonably good results using the values presented in this table, but if you find a particular band still drifts more than you want, you can have some fun fine tuning. It took me about 5 hours to compensate each band through tedious trial and error (each test took about 1 hour, and there were usually 4 - 6 interations for each band). I considered the result acceptable if the band coil assembly contributed less than -0/+300 Hz on the low bands and -0/+800 Hz on the high bands. A small positive drift is definitely better than a negative one as it helps offset the negative drift still remaining on the chassis top side.

Tips And Techniques

If you decide to fine tune the values in the table, a few words of caution are in order (which I learned the hard way by wasting lots of evenings and weekends). When heating the band coil assemblies, it is important to provide only light heat and be very, very patient. Subtlety should be your guiding light. This isn't an exercise using a heat gun and freeze spray. Take a systematic, standardized approach and you'll save yourself lots of time and frustration. Don't try providing heat by hand like I did, because you'll just get poor, inconsistent results. I finally got best results using my wife's hair dryer (don't get caught like I did) laid on a pile of books set to the low heat setting while remaining 11" from the assembly. Provide low heat in this manner for at least 10 minutes. Remember, you don't want to get it too warm - uniformity is more far important. A rise of only 20° F will give you the answer you want. When you first begin heating the band coil assembly, you will notice that the frequency will go way up. Don't be alarmed - this is because the compensating capacitors heat up much more quickly than the heavy ceramic bandcoil form.

To shorten the time required for the oscillator to restabilize when turning off the radio, which can take 20-30 minutes, I soldered the capacitors to the band coils while it was on. There aren't any high voltages in the band coil section of the radio. Just switch to a band you aren't working on when soldering the capacitor in place. Keep the temperature in the your room constant. You'd be surprised how just a few degrees can really throw off your measurements. Allow sufficient time for the band coil to completely cool off after a heating cycle. Even using a small fan, I discovered that these things take 25 minutes or more to completely restabilize after a heating cycle (they behave as though they have memory).

The top side of the chassis should be continuously cooled with a large fan so heat won't reach the air variable mounted to the chassis (the top side compensating circuit won't help you if it does because it will remain cool while the air variable will heat up just a bit, causing drift and messing up your test results). There is also a 1" X 2" square hole right under the air variable which you should fill with tissue paper to keep warm air from reaching the air variable during bottom side heating tests.

It is easiest to select temperature com-

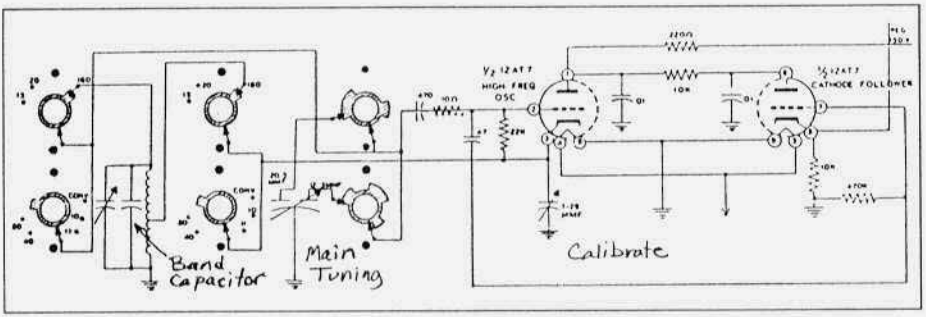

Figure 9. HF oscillator.

pensating capacitors by thinking in terms of "total part per million units": PPM Units = (*temp. coefficient*) X (*capacitance*). When iterating during trial and error, it is much easier to select one when thinking in terms of PPM Units. This eliminates much of the guesswork. You will find that a change of only 1,500 PPM Units of compensation will make a big difference. After selecting the compensating capacitor, use a combination of NPO values to make up the remainder of capacitance needed. It is really helpful to have an LCR meter.

The acid test is trying your Mohawk in the cabinet and measuring the drift as before. You will probably find you need to make some adjustments (<3,500 units) to get it just right. I took measurements every 5 minutes for at least 2 hours to be absolutely sure of the long-term trend. As you proceed, don't forget K6AD's Law: *drift is directly proportional to how much time and patience you have!*

The easiest way to measure the VFO frequency is to put the 12AT7 HF oscillator tube on a 9 pin extender. Hang your frequency counter on the cathode of the follower section, pin 8. The absolute frequency won't be accurate because of the extender and probe capacitances, but the drift will be readily apparent. Use a good 10X scope probe to avoid killing the oscillator.

Temp Compensating Results

To reduce chassis heat, I replaced the 5V4 rectifier with a 5U4 solid state replacement and added a 110 ohm 5W resistor between the rectifier and first filter cap to bring the B+ back down to +225 volts. After making all of the recommended changes and selecting a 12AT7 for minimum drift, my Mohawk now drifts less than -325 Hz on 75 meters from a cold start in the first two hours. This is an incredible improvement from the 3.5 kHz I had to put up with on the 75m band before. While drift on all of the low bands is now excellent, performance 15m and up isn't quite as good - I measured about -1.2 kc on 10m in the first two hours (but it was over 16 kc before!!) Fortunately, almost all of this drift now occurs in the first 15 minutes. I still find the short-term stability on 10 meters to be poor. Bill Noonan, W6WJN, prototyped a solid state plug-in replacement for the 12AT7 and we plan to experiment with it to see if it improves stability.

Receiver Muting Improvement

I discovered that receiver muting in the Mohawk was yet another example of Heath just not thinking this equipment through as a complete system. When the Mohawk is connected to an external transmitter like the Apache or Marauder, I noticed that the receiver would come back "numb" after transmitting. Well, take a look at the receiver muting line in the bottom corner of Figure 6, Part Two of this article (ER - pg 24 -December, 1997). The mute line is grounded in receive and

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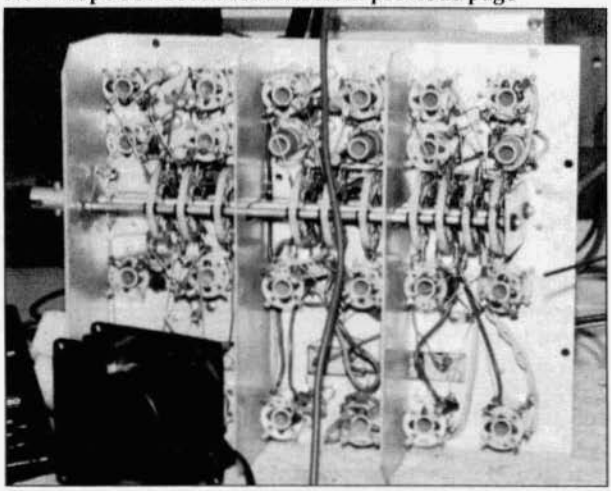

Band coil assembly out for evaluation. These band coils cause a lot of drift.

floats to +44 volts in standby, cutting off the IF and RF tubes through the front panel gain pots. The mute relay contacts in the transmitter similarly ground this line in receive and let it float during transmit.

As you can see, the problem is that Heath connected the transmitter's mute relay contacts and the standby switch on the Mohawk in parallel when they should have been connected in series. The Mohawk's standby switch grounds the line all the time in the receive position, allowing the receiver circuits to remain fully active while you are transmitting. Afterwards, the receiver will remain numb until the AGC voltage decays. The mute line from the transmitter is thus rendered useless.

You have two choices to fix this problem. The easy solution is to just leave the standby switch on the Mohawk in the "standby" position when using an external transmitter. The external relay contacts can then properly mute the receiver. The disadvantage is that the standby switch doesn't work as labeled and you have to remember to keep it in "standby" which is non-intuitive (in a few months I'd probably forget and end up wondering about this problem all over again).

The second option, which I chose for my unit, requires rewiring the standby switch. The benefit of rewiring is that the standby switch will work like it should have worked to begin with. Simply remove the ground from one side of the standby switch, and reconnect the wire from pin 6 of the accessory socket to the switch terminal from which the ground was removed (the switch is now in series with the external relay contacts via pin 6). When you disconnect the transmitter from the Mohawk's accessory socket, you will need to plug in a jumper socket with pin 6 connected to pin 1 (ground). Now everything works like it should.

That's All Folks

The changes outlined in this article turned my Mohawk into a receiver that is really great for everyday use. In fact, now it gets the respect in my shack that a fine vintage rig should. The Mohawk offers surprising sensitivity for its time and the audio quality just makes it a real joy to listen to. While its selectivity won't match mechanical filters, the adjustable selectivity control on the front panel is very convenient. When QRM isn't a problem, I enjoy listening to SSB at the 5 kc selectivity setting for really rich audio. At 5 kc even AM sounds reasonably good, despite the fact that only one sideband is present.

So the next time you see one of these at a swap meet, grab it and get out your soldering iron! It's a collectable receiver that is becoming harder to find. Now it's time to turn my attention to restoring the Marauder transmitter and the matching Chippewa 2 KW linear. I can't wait to get the entire station on the air! ER

A Flea Market Gallon

by R.W. (Berk) Berkemeyer, WØREP
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There comes a time to everyone who has the building bug (buggis hammus nuttis) when he just has to build something, whether he really needs it or not. These projects, however, have to be low cost or there is no justification (excuse) for them. I found myself in this position. It was too cold to go to the gun range or do much work outside. Solution: find a use for the half-dozen 833A tubes I had bought on spec at a hamfest and for which I had no takers. OK, I had the tubes - what else was needed. A thorough check of the junkboxes determined that I had everything I needed except for the 10 volt 10 amp filament transformer. The local electronic surplus store had some 10 volt transformers, but I would have to parallel three or four of them to light that tube. Then I found a 12 volt 10 amp transformer. A quick calculation indicated that with a 20 ohm resistor in series with the primary I should get 10 volts at the tube, which proved to be true.

The rafters of the shop furnished a 12x17x3 inch chassis without too many holes from someone's previous project. (I never pass up a chassis at a flea market). I had a "set" of kw coils and the swinging link/socket assembly, as well as a number of unmatched 50 watt plug in coils for the grid. The link assembly was a Bud unit and the coils were a mixed bag of Johnson and B&W. They could all be modified to work together.

Front View of Flea Market Gallon. Lower left is output tuning, directly above is swinging link control. Right side is grid tuning with power switch just below. Grid and plate meters above.

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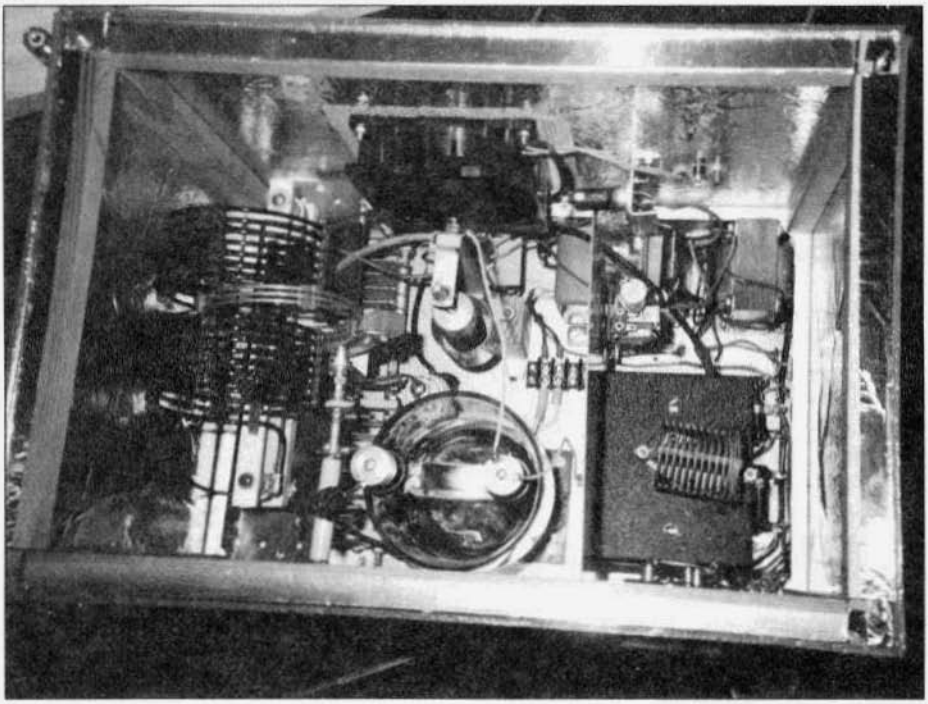


View from above showing general layout and some details of the masonite, wood and aluminum foil construction.

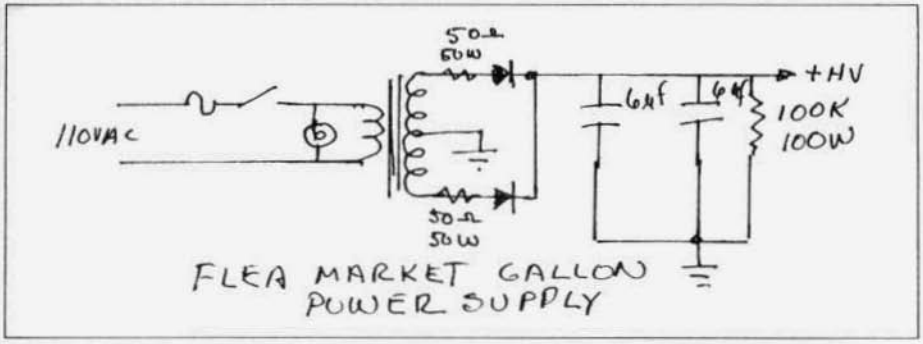
If I had not had the swinging link assembly, they are not hard to build using a shaft bearing and scrap plastic. There was a dual 125 pF variable that someone had put together from two single section caps, and there were several neutralizing caps from unknown sources. I had also found the filament connectors for the tube in a box in the hands and knees portion of a flea market seller's display.

I had the expensive parts, it was time to design the amplifier. To use the triode tube I had to decide whether to use a Class C grid-driven circuit, or to try to run it Class B linear. Since I already have a linear, I decided on Class C.

The 833A is a big tube. To keep the cabinet height at a minimum, I inverted the chassis. The split-stator variable, the coil assembly, the tube and the filament transformer were moved around until I had an acceptable layout, leaving room for the grid circuit, neutralizing condenser, bias transformer and meter.

I'm not going through all the details of drilling holes etc. A study of the photographs will show the results. Besides, no one is ever going to reproduce this amplifier. I'm trying to show that one can build a high power amplifier without the layout of large sums of cash. As you pick up parts on the cheap, you find that the project sorta plans itself. I almost used a 304TL tube when I couldn't find the 10 volt filament transformer. Maybe you'll find a 250TH, some 813s, a 4-400 or whatever. Keep an eye out at the hamfests for parts, and wear old pants so you can spend time on your hands and knees hunting down the real bargains.

Anyway, the parts got mounted and wired. A 4x5x6 box housed and supported the grid circuit as well as acting



as the mount for a piece of circuit board that shields the grid coil from the plate circuit. The fixed bias was calculated (see handbook) and the additional grid resistor was determined. A plug-in 10 amp relay was mounted to switch the amp in and out of the circuit and then the major problem finally had to be tackled. Have you priced heavy aluminum sheet lately, much less relay rack panels? Ouch!!! Less than $3 bought a quarter sheet of 1/8 inch masonite at the local hardware giant, some old onebys were ripped up to make 3/4 square strips, and the xyl's pantry was raided for the aluminum foil. Elmers SAF-T contact cement (good stuff, no flammable fumes) glued the foil to each panel after it was fitted, the whole thing being framed with the strips. (In case you wonder if this makes a good shielded enclosure, I cannot get any reading on my field strength meter that normally indicates full scale next to my linear which is built of aluminum sheet). A 4" trim roller and gray latex enamel does a nice job of finishing the cabinet. Rectangular holes front and back covered from the inside with 1/8" hardware cloth allow for good airflow driven by a muffin fan.

The power supply is also flea market hardware. The transformer was $1. It doesn't look like much, but it delivers 2250 volts at 500 mA without a groan. It appears to be a repackaged pole pig from the 30s or 40s. The rectifiers were in a box of junk on the dollar table and the two caps in parallel cost less than $5 apiece. The bleeder is two 140 watt 50K ferrule mount resistors. They were also $1 each. No choke? A couple of 50 ohm 50 watt resistors in series with the rectifiers protect them adequately. However, don't try this if you are really a diehard hollow state person and use 866s.

The proof of the pudding, they say -- I get over 700 watts output with only 2250 volts on the plate on both 40 and 20. I'm going to have to add a vacuum capacitor across the tank to work 80 (75 will tune) and I have installed the clips for it, but that will have to wait until I find one at a flea market. It also will work on 15 but I haven't tested it thoroughly there.

OK so what's the bottom line? There is a lot of fun and satisfaction to be had by building and using homebrew equipment. Sure, parts are scarce and expensive through normal channels, but cheap if you really search the boxes under the tables at hamfests. If you are flexible, you may end up with something that isn't what you originally had in mind, but it may work just as well or better. I'm already thinking about a 304TL linear for 160 to give me the legal max out using the controlled carrier AM output from my T4X-B. So dig into the junk box, search out parts at the flea markets, design the rig when you have enough parts, be flexible in the design and HAVE FUN! ER

The Versatile Harvey Wells TBS-50 Transmitter

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I became acquainted with the Harvey Wells TBS-50 in 1955 when a friend lent me one for the summer. It was the first commercial rig that I used and I found it quite awesome, with many bands and features. The rig still stands out as a solid winner if you want to experience AM or just to keep a vintage rig around to show off and remind you of that era.

As a point of reference, my hamming days began with the novice class license in July 1951, I took the test just before my 16th birthday. After 2 anxious weeks I received my ticket as WN1TUJ. Eventually I was hamming with the "big boys" on 75 and 20. In 1955 I was on top of the world, college, car, part time work, girls and ham radio (not necessarily in that order!). You can imagine my joy at receiving the TBS-50C. I installed it on the back shelf of my '46 Ford business coupe (no back seat in the business coupe), powered it up with a PE103 dynamotor and received on a home brew converter (plug in coils yet!). I had an antenna for 10 and added a large coil for 75 meters. The Ford had a 6 volt electrical system and DC generator (very noisy). The TBS-50C worked great; when I pressed the button on the T17B carbon microphone the PE103 started whining and the rig came up to power. It was interesting to watch the pedestrians take a step back as they heard the whine of the dynamotor, I think they expected an explosion! I'm sure that they wondered who that tall, skinny kid with glasses was that had such a formidable weapon. Sporadic E was great on 10 and I had many fine contacts; 75 was OK, I had a few good contacts but I don't think that the rig loaded very well.

Hoping to relive some of that nostalgia, I recently obtained a TBS-50D, matching VFO and AC power supply on one of the traders' nets, and plan on using it in the shack on 10 and 6 meters AM. I was lucky - the rig was clean and the only modifications were new caps and an antenna changeover relay. The Bandmaster VFO was a bonus! I didn't expect to find one and hadn't seen one advertised before. Similarly, the power supply was a rare Harvey Wells unit. Many supplies were home built at that time; even Harvey Wells provided information in their manual to build one, expecting that most hams appreciated having an economical alternative.

Background

The TBS-50 was developed just after WWII at the Harvey Wells factory in Southbridge, MA. This article is about the TBS-50B, C and D models, which followed the TBS-50 and TBS-50A and provided improved operation. The rigs were also known as the Harvey Wells Bandmaster transmitters. The B version was called the Bandmaster Junior, the C version was called the Bandmaster Senior and the D version was called the Bandmaster Deluxe. Harvey Wells also produced the T90 transmitter, a R9 receiver and a Z Matcher Antenna Matcher. There were two other companies producing HF radios at that time with part of the Harvey Wells name, Harvey Radio Labs (Cambridge, MA) and Wells Gardiner (produced one version of the RAO-3). I suspect that they might have been related, since the TBS-50 exhibits some military construction. (cable harness and solid mounting of components.). Anyone know about this? The TBS-50D that I have was designed in 1947 by C.E.H. (C.E. Harvey?).

Harvey Wells TBS-50D with VFO

General

The rig is compact and solidly built with a black crackle finish, white lettering and a distinctive red background for the lettering at the top and bottom of the front panel. It also sports the Harvey Wells emblem (removable) in the center of the panel and a small frame under it to hold a crystal frequency reference card. The dimensions are 13 1/4" high, 9 1/4" wide and 8 1/2" deep. It weighs 17 pounds and contains both the RF deck and modulator components integrated onto one chassis. It is essentially a 45 watt input CW/AM transmitter using an 807 in the final (plate voltage up to 450 and current at 100 ma.).

The rig has some nice features; the oscillator and driver stages use slug tuned coils and drive is controlled by varying a front panel pot to adjust the screen voltage on the 6AQ5 driver. No other adjustments of the oscillator or driver stages are required to change bands. Most commercial rigs of that era had front panel tuning for the multiplier and driver stages, making bandchanging more cumbersome. Only the PA tank circuit requires tuning. A front switch selects either plate or grid current for the meter. There are two terminal strips on the back to configure the rig for different modes of operation, different power sources, cathode keying and when used as an RF/AF exciter. The bandswitch shaft is mounted parallel to the front panel and rotated with a 90 degree geared shaft. The final amplifier is tuned with a conventional pi network. The tube line up consists of a 6AQ5 oscillator/multiplier, a 6AQ5 multiplier/driver and the 807 final amplifier. The modulator uses 2 6L6Gs, and 2 6AU6s and a 12AU7 in the speech amplifier.

The TBS-50 has bandswitching to cover all the ham bands from 80 through 2 meters! That is 80, 40, 20, 15, 11, 10, 6 and 2. Some feat for a rig at that time. Harvey Wells appeared to be targeting the Civil Air Patrol market as well as ham radio. The CAP frequencies were up in the 2 meter band. A separate coil, series tuned with the capacitor in the plate circuit of the 807, provides link output for 2 meters. The 807 operated as a direct amplifier on all bands except 2 meters, where it doubled in the final. Use on 2 meters also required re-peaking the 6 meter slugs for maximum output, which was not maximum for 6 meters, so one set the TBS-50 up for either 6 or 2, not both!

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Harvey Wells TBS-50 from previous page

The rigs were designed to be very versatile and to fit the pocketbook and desires of the operator. In addition, they could be operated fixed, mobile or as an exciter. The 3 models were designed as follows:

TBS-50B (Bandmaster Junior): provided CW operation only, did not contain any of the modulator components, but the chassis was pre-punched to allow later addition of the modulator tubes and transformers.

TBS-50C (Bandmaster Senior): provided both CW and AM operation, included 2 6L6 modulator tubes, plate modulation transformer and a high level driver transformer that could be driven directly with a carbon microphone. Harvey Wells recommended this configuration for mobile operation because the carbon microphone was more immune to background noise than the high impedance microphone. I had to speak loudly into the T17B in 1955 to obtain decent modulation, so I imagine that the speech amplifier described by Dennis, A3YXN , would work well for the TBS-50C. I wish I had it back then; people often looked at me kind of funny, wondering who I was screaming at.

TBS-50D (Bandmaster Deluxe): provided both AM and CW operation, it added a 3 tube preamplifier for a high impedance microphone (the driver transformer was removed and a tube was used as a driver/phase splitter).

One could easily upgrade from a B to C or D with complete kits offered by Harvey Wells. The chassis was pre-punched and the wiring harnesses contained the additional wiring.

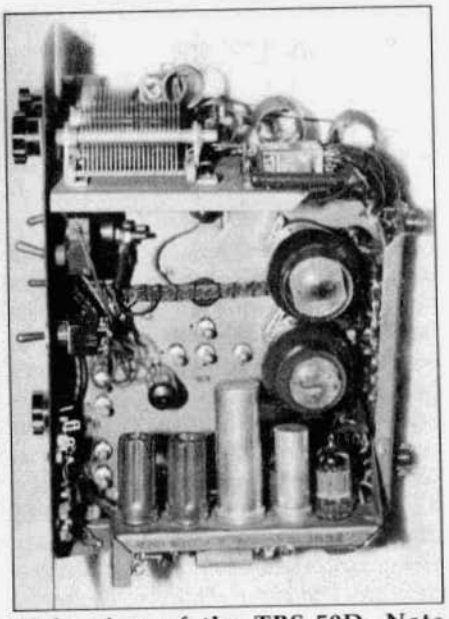
Power Supplies

Harvey Wells offered 3 power supplies, the APS-50 AC supply, the DPS-50 dynamotor and the VPS-50 vibrator supply. The standard AC power supply, the APS-50 provides 425 volts DC at 275 ma. to power the RF, modulator and VFO. A separate transformer supplies 6 volts for the exciter/VFO filaments and 5 volts for the 2 5U4G HV rectifiers. There is a HI/LO switch on the HV transformer primary to reduce the HV to 350 volts during tune up and for low power operation. The standby/transmit switch on the TBS-50 switches the HV primary on/off to operate the rig. Harvey Wells also provides instructions for operating the TBS-50 using their DPS-50 dynamotor and VPS-50 vibrator supply and give instructions for using the surplus PE-103 dynamotor, the one which I used in my coupe.

VFO

Harvey Wells also produced a matching VFO for the TBS-50, it was called the Bandmaster VFO, it had no other designation and I don't remember it having any other name. Mine was designed in 1953 and the only reference I have to the designer is the initials DLR. The VFO is packaged in a steel box with a slanted front panel and mounts under the TBS-50. The top of the box matches the base of the TBS-50 and they are bolted together to make one unit as pictured. Inside is a 6AG7 and OB2 regulator tube. The slanted front panel has a slide rule dial which is calibrated for each of the HF bands. Typically, the higher bands were condensed by a factor of 2, 4, 6 or 8 and offered not much more than dial markers for the bands. The oscillator tunes 3.5 to 4.0 MHZ and has a front panel switch to add a trimmer capacitor to lower the frequency slightly to cover 11 meters (8th harmonic).

Rather than to provide a bandswitch for 80 or 40 meter output (the TBS-50 requires an 80 meter xtal or VFO frequency for operation on 80, 40 or 20 meters, and, 40 for operation on 15, 11 or 10), Harvey Wells added a peaking coil swamped with a 4.7 K resistor to the plate circuit of the 6AG7, tuned to 40 meters. As a result both 80 and 40 meters appear in the output. A simple way of automatic bandswitching! Not my choice, but it works. The VFO does not support 6 or 2 meters.



Right view of the TBS-50D. Note preamp chassis (removable), 6L6Gs and slugs for tuning intermediate stages.

My VFO had been modified with the addition of 2 OA2 voltage tubes to regulate the HV voltage coming into the VFO to 300 volts.

Operation

After an eyeball and some resistance checks I turned the rig on without the 2 5U4 rectifiers in place to check the filaments. Filament voltage measured 5.6 volts with the VFO connected! Even without the VFO, the filament voltage was still low, just under 6 volts. I ended up adding a separate power supply for the filaments and for the VFO B+. I also added a small relay to the Harvey Wells power supply to switch HV and B+ on/off with the standby/transmit switch. The new filament transformer measured 6.28 volts with all tubes connected.

After replacing the 5U4s (no smoke!) I fired the rig up into a dummy load and checked the output. Grid current was quite low so I removed the rig from its case to adjust the oscillator and driver slugs (I love to do this, tweaking is an art form). I was able to obtain at least 2 ma. grid current on each of the HF bands and about 1 ma. on 6 meters. Grid current on 2 meters was just barely detectable (maybe 1/4 ma.). Output was very satisfactory, running between 20 and 25 watts on 80 through 10 and about 10 watts on 6 meters (relative to a 40 watt light bulb dummy load). I plugged in a D104 microphone and listened to the modulation on 40 meters on a Paragon. Quality was good and the modulation level appeared high. Plate current increased slightly and there was no change in grid current. I operated using both crystals and the VFO and found no significant difference in grid current. I did not detect any significant output on 2 meters (and really didn't expect much based on the tube lineup and the fact that the 807 doubles).

All RF stages are cathode keyed, the VFO can be wired on all the time or wired into the key chain. Keying was surprisingly good. No chirp was noted and the note was T9. There was no significant difference in keying with the oscillator running or in the key chain. Nice sounding rig for CW.

The VFO drifted about 2 KHZ during the first 60 minutes and also exhibited some short-term instability thereafter. Probably acceptable on 75 or 40 phone, but not too good for CW or the higher bands, particularly 10 meters where the effective drift would be 8 times greater! I ran some tests and decided to change the fixed caps in the tank circuit and to add an NPO cap. I added a 4.7 pf N750 and adjusted the existing trimmer to compensate for the additional capacitance. The 2 curves are shown in the attached figure, note the shift on the original measurement (before curve). It occurred on several measurements, including one taken with the case removed. When the fixed caps were changed it went away, and the NPO significantly reduced the warm up time

continued on page 37

Vintage Transformer Restoration

by George Cogswell, W1UAX
33 Edgehill Rd
Stow, MA 01775-1407

One of the greatest obstacles in restoring vintage equipment to service is the critical lack of exact replacement transformers. I was very fortunate in my college days to have spent some time working in the transformer winding department of a major electronics manufacturer so I can restore my transformers when they fail. It's really not very hard to do.

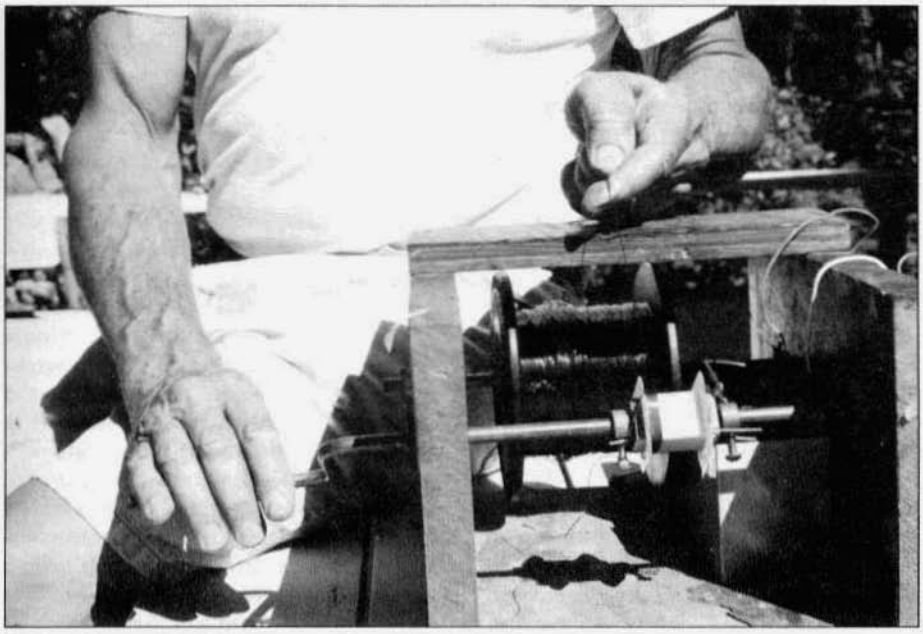
After I built my former 304TL-8000 transmitter in the late '50s and early '60s, I soon experienced high-voltage breakdowns in a basement shack from mold and mildew formation in open case transformers and chokes. It soon became evident that to keep the AM kilowatt on the air I would have to rewind these components.

After much thought I came up with a simple coil winder, which I am still using to this day. Basically, the coil winder is a three-sided box with holes drilled in opposite sides to take a curtain rod bent in the form of a hand crank and a second rod to hold the spool of wire. Inside the bend in the hand crank is soldered a fine-toothed gear (bearing against one side of the box). A pawl engages the teeth of the gear. The pawl is made of square shaft key stock, cross-drilled and secured to the box with one wood screw. The pawl restricts the motion of the hand crank to one direction only. There is a narrow strip of wood across the top of the open box on which to rest the hand that guides the wire. Added to the box is a 12-volt, resetable, Veeder-Root counter, a microswitch and a 12-volt gel cell. (See diagram).

Other materials needed: 2-mil Nomex is best for layer insulation, as it has a rough surface which holds the wire in place. Mylar is too smooth, the wire tends to slip off the ends of each layer, causing possible shorts. Mylar is excellent for all other insulating needs, as it is high temperature, plastic-impregnated fiberglass cloth. I use clear Mylar package tape to secure layer insulation and beef up weak or shorted cores. One should avoid all cellulose-based insulating materials, as they tend to attract mold and mildew. The best high-temperature "poly" wire comes from odd lots in motor-rewinding shops.

Setting up to rehab a transformer is as follows: First, the covers of the transformer are removed, and any possible potting compound is melted out in the backyard over a disposable hot plate or stove (a messy and stinky job). Next the iron lamination stack is disassembled. Removal of the first "E" lamination is the hardest. I tap a jackknife into the seam below the first "E" lamination, freeing all exposed surfaces. Next I bend the back outward, and grab the flange, thus formed, in the center, with visegrips. Holding the visegrips, I tap the visegrips with a mallet carefully until the impregnated varnish/potting compound lets go of the center leg of the "E" lamination. After 3 or 4 laminations are removed, the job gets easier, and no bending is necessary. It's like "shucking oysters" until all the laminations are removed.

With coils and paper core in hand, the next step is to form a mandrel out of a block of hardwood (preferred), to fit the paper core with fish-paper shims for easy removal later. The mandrel



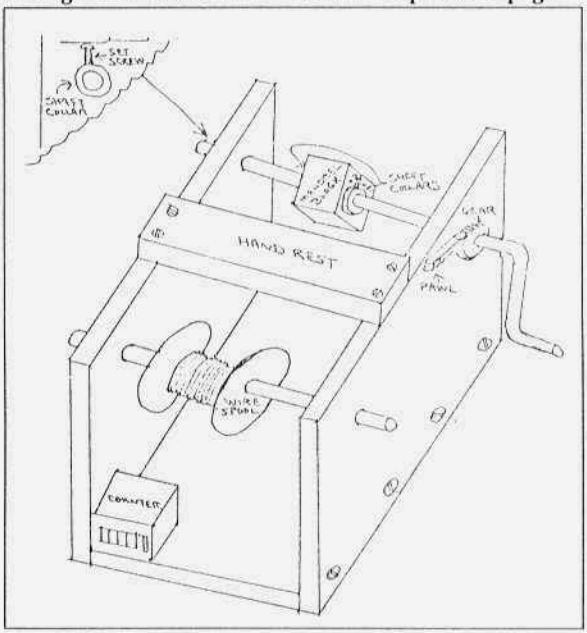
The author with his homemade coil winder.

block is concentrically-drilled with a 3/8" hole from end to end. Near the holes on each end, two nails are hammered in, spaced to hug long set screws in shaft collars, on either side of the mandrel block. The shaft collars, set screws, and nails secure the mandrel block and coil assembly to the hand crank within the box. On the far end of the hand crank, protruding out the opposite side wall of the box, is affixed a third shaft collar with a long set screw. This set screw trips a lever-type microswitch. The Veeder-Root counter is wired in series with the microswitch and battery to count turns on or off the coil assembly.

If you are repairing an existing transformer, and you have unwound it past the point of failure, it's best to remove the whole winding, as the insulation is usually compromised in the unwinding process due to the varnish dip of the original unit. Winding on new wire with thicker coating, and thicker layer insulation means that you will end up with fewer turns than the original product - most likely. A trick in winding a new coil is to use an "E" lamination with the center leg bent as a gauge to see how much "window" you have left as wire is added to the new winding.

If you find yourself slightly overboard on winding thickness when it comes time to remount the laminations, don't despair, take the whole coil assembly with mandrel block in the center, and squeeze the assembly between the rubber-faced jaws of a steel visa. This action will compress the air and wire curvature out of the assembly until, hopefully the laminations will fit when the mandrel is removed. With a hardwood mandrel, the whole assembly can stand quite a bit of compression without breakage. Remember that, to reassemble a power transformer, you cross-laminate the lamination stack, alternating the "I"s and "E"s until all laminations are in place. If you cannot get all the laminations back, try opening a slot with a jackknife and tapping them in

continued next page



Coil winder (left-handed setup)

place, being careful not to gouge the paper core or winding cover material. If 2 or 3 laminations won't fit after the above treatment, discard them.

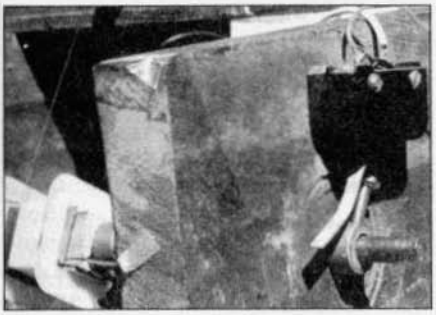
If you are building a transformer from scratch and have the iron and core in hand, I would refer you to the 1950 ARRL Handbook for information. The chapter on Power Supplies has a section on transformer construction. The table on transformer design is based on a wire current-carrying capacity of 1500 circular mils/ampere. Transformers today are based on 600 circular mils/ampere. The primary turns in the table are correct as well as the center-leg "E" lamination cross-sectional wattage. However, the wire size may be reduced to a smaller size for intermittent duty due to the higher-temperature capabilities of poly wire over enamel wire, thus saving "window" space. The wire table in the Miscellaneous chapter of the same publication, lists wire size current-carrying capabilities at 1500 circular mils/ampere also. To find the current-carrying capabilities at 600 circular mils/ampere, multiply the table figures by 2.5.

If you are building a modulation transformer out of power transformer iron, you derate the wattage capabilities of the "power iron" by 40% to figure the maximum modulation wattage that same stack of "power iron" will handle without excessive loss of low-end response in the modulator. In building modulation transformers the "E" laminations are all inserted into the coils on one side and the "I" laminations on the other with a gap spacer in between. The thickness of the gap spacer I leave to the gurus on AM - it increases with wattage. By experiment, I have found the primary wire size of modulation transformers should be rated at 70% (Class A, 100%) of the peak current expected from the modulator tubes. The primary/secondary turns ratio is the square root of the impedance ratio. It is best to add tape above and below the calculated number of secondary turns, especially if the modulator tubes are operated out of given specifications. The secondary wire must be rated to carry the maximum expected RF final current.

If you are rebuilding a choke it's best to use the same size wire as the original product and just fill up the "window". Choke assembly is like modulation transformer assembly, and don't forget to reinsert the gap spacer that came with the original product.

In conclusion

I work this coil winder clamped to my workbench. I can crank with one hand and guide the turns with the other hand. The best thing of all is to be able to stop the job at any point by simply



View of the coil winder showing the turns counting mechanism.

taping the feed wire to the handrest. The gear and pawl combination keeps the turns counter honest.

I also want to make very clear in this article that I do not wind transformers for others. I just want to pass along a few ideas to the vintage equipment restorer who might have the patience and desire to tackle a dead transformer occasionally.

I want to thank Dave, N1RBM, for helping me with my 386 computer to get started on this article. ER

Footnotes

1. Insulated feed-wire anchors are formed out of 8-mil plastic-impregnated fiberglass cloth. Two or three holes per lead are punched with a leather punch. The feed wires are threaded through the holes and the anchor assembly is taped to the finished coil unit in the open area with Mylar tape. The feed leads are soldered to the coil leads and the soldered junctions are bent back flat along the sides of the feed leads. More Mylar tape is added over the anchor assembly before the laminations are mounted in the coil assembly.

2. To reduce "talk back" in all transformers, fashion wedges out of tongue depressors and drive the wedges between the two end "E" laminations and the paper core. In addition, in modulation transformers and chokes, cross-laminate the two end "E" laminations before driving the wedges. ER

Harvey Wells TBS-50 from page 33

(after curve). Providing recompensation, as WB6VMI proposed for older oscillators would reduce the warm up time even more. I monitored the frequency after warm up for about 90 minutes (see the 2nd chart), the instability remains a significant problem.

I am not satisfied with the VFO performance and will do more work on it this winter. My first impression was that it was a bad VFO, poorly designed - a thermal runaway! It has no ventilation, heating elements close to the tank circuit (a dropping resistor as well as the 6AG7), and no thermal compensation. I guess the idea was to heat it up and it would settle down. I was a bit surprised that the VFO did not repeat the same craftsmanship characteristic of the TBS-50. Mounting the VFO under the rig didn't help.

Documentation

The manual provides good documentation for the rig including a technical characteristics and operating instructions and tips. It provides instructions for different antenna configurations, for using the rig as an exciter, and for using the rig on 160 meters and on 2374 Mhz (then CAP frequencies).

In addition to kits to upgrade to a C or D there was also an antenna changeover relay kit that could be installed in the later TBS-50 models which had the chassis pre-punched for this purpose. Harvey Wells also provided a series of amateur service notices on different aspects of operating, including operation on 2 meters, TVI and using an automobile whip antenna. I have #10, #11 and #12, anyone have others?

Hope to work some of you with this rig. I'll be using it on 29.000 Mhz and 21.4 MHZ this winter. ER

1. Electric Radio #100, 8-97 "Electric Radio In Uniform" by WA3XYN
2. Electric Radio #90, 10-96 "Recompensating Old Oscillators to Minimize Drift" by WB6VMI

A RARE FIND ON THE WEB from page 17
mirror scale. Since there are more components in the 650, its bakelite case is somewhat deeper than the Model 630. The DC and resistance function use a common test lead with a switchable test prod to change functions. The AC probe is a bit bulky since it has to contain the 6AL5 diode rectifier. A common or ground test leads completes the set.

DC coverage is in seven ranges to 1,000 volts; there are six AC/RF ranges up to 500 volts at frequencies from 15 cps (Hz) to 150 Mc (MHz) and six resistance ranges go up to X1,000 megohms. Input impedance is 11 megohms on DC and 1.4 megohms and 10 mmf (pF) on AC/RF. There are scales for decibels and peak-to-peak values are read off a series of red scales. Zero center for discriminator alignment is marked with -0 +.

The tube complement consists of a 12AU7 medium-mu twin triode, a 6AL5 twin diode in the VTVM and a 5726 in the AC/RF probe. The 5726, a low current rectifier made by General Electric, was a 5-star version of the standard 6AL5 twin diode. (The 5-star tubes were higher performance versions of standard tubes but the GE tube manual does not reveal what is meant by higher performance.) The optional UHF probe uses a 9005 acorn diode.

The circuit is very simple indeed and bears considerable resemblance to other classic and generic VTVM circuits. The 12AU7 is arranged so that, with no voltage applied to the left grid, equal currents flow through both sections. Under this condition the two cathodes are at the same potential and no current flows through the meter. The currents can be adjusted to balance by a potentiometer, which takes care of variations in the tube sections and in the values of the two cathode resistors. When a positive DC voltage is applied to the left grid the current through that tube section increases, so the current balance is upset and the meter indicates. The voltage dividers for the AC and DC ranges consist largely of "standard" value wirewound and carbon 1% resistors. The 6AL5 rectifier is connected in a half-wave circuit.

Triplett went into considerable detail about the importance of only using a properly aged 12AU7. Instructions called for a 100-hour aging period and what to do if instability is detected during the aging process. The aging process was carried out with the meter itself.

At the back of the VTVM there is a small opening for a screwdriver to make the AC balance adjustment, a control common to a great many VTVMs. This control is adjusted so that there is no pointer movement when switching from AC to DC- and DC+.

Accessories

Accessories included two versions of leather carrying cases. The plain one was $9.50 and for $5 more you could buy the sponge rubber lined one. No imitation leather in those day, I'd be willing to bet. Three DC high voltage probes were available and these covered 5,000, 10,000 and a staggering 50,000 volts. For working at frequencies up to 980 Mc (MHz), a special probe was available. Last but not least there was a stand that positioned the VTVM at a 45 degree angle for easier viewing.

So, there you have yet another insight into my passion for these elegant instruments. Do I really need that many? Heck, no, but who can pass up a new 40 year old VTVM. Let's see, that makes three different Hewlett Packards, two different Heathkits and a Ballantine. My next project will be to breathe new life into a small Triplett Model 666 1,000 ohms/volt VOM. See you later. ER

The writer appreciates the assistance provided by Mr. Ropp Triplett and Ms. Jeanette Makley at Triplett Corporation in the preparation of this article.

Vintage Radio and the Internet from page 15

Space does not permit a comprehensive listing of the URLs dedicated to the subject of vintage radio communications equipment but even if they were listed they would be outdated by the time I finish this article. Fortunately the AM Web page contains most of the links that you may want to follow. Your Web browser allows you to save links of interest in a special bookmark file so you can revisit them at any time without accessing the original site where you first found them. My personal bookmark file contains several hundred sites covering everything from the excellent Collins Virtual Museum of post-war amateur equipment run by Norm WA3KEY to a couple of military radio databases containing specs and even schematics. Just access the AM Web page (www.thebizlink.com/am/home.htm) and look under Resources. Voila - instant bookmarks!

Finally, a very brief discussion of search engines. These are a collection of sites on the Web that perform searches based upon your specifications. There are three that are of note: Yahoo (www.yahoo.com) and Alta Vista (www.altavista.com) that search the Web. The third, Deja News (www.dejanews.com) that searches Netnews groups. They are deceivingly easy to use. Just enter the word or group of key words and see what happens. You'll be absolutely amazed with the results! Try searching on your callsign or R-390A or KWM-2 and see what comes up. I ran a Yahoo search on my friend Tim Smith, WA1HLR and found over 25 entries including several photos and audio clips, modifications Tim has developed for numerous AM transmitters. These search utilities feature extensive on-line context-sensitive help and how-to information so a little effort and trying different ways of searching will most likely lead to pretty interesting results. It is interesting to note that these three search engines link to each other so you can actually perform an Alta Vista search through Yahoo.

This series is of course written to help folks with little or no computer experience and knowledge to mine the wonderful resources of the Internet and World Wide Web. Computers themselves can be frustrating and trying to deal with them are often hair-pulling experiences filled with curses and damnation. However, the rewards are very great and so the effort is well worth while. ER

Looking Back from page 3

proud as punch and I told him the amplifier was all stable and ready to go. He came out to lab and looked at the unit, and promptly took the antenna off (which was a 50-ohm dummy load). He looked at me and said "Turn it on." Naturally, being stupid, I had not tested the amplifier without a load and sure enough, it was stable on 80 and 40 but took off like a wild haired hound on the higher bands. By looked at me and said, "Get it right!." So I spent several days chasing parasitics and lord knows what else but finally it was stable.

So this column and last month's is my response to a letter from Grayson Evans, KJ7UM. Those days at ARRL were really something else. I have said it before and I'll keep repeating it. The men that ran that department in those days were real giants in the amateur radio field. Much of what has happened in ham radio you owe to them. I was just lucky to be there at the right time. W1ICP

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Don Buska, N9OO, has compiled an excellent index of all ER issues, #1 thru #103. This index is available on Don's webpage:

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

FOR SALE: WACO-5NWX telephone filters. Just plug in. 1/$13.95, 2/$25.00,3/$34.00. Money back. Cecil Palmer,4500 Timbercrest Ln.,Waco, Texas 76705. (817) 799-5931. W5NWX@juno.com

FOR SALE: Dial/clock covers. Send bezel, old or drawing, make/model, guaranteed satisfaction - $10 ppd. William P. Turner, WAØABI, 1117 Pike St., St. Charles, MO 63301. (314) 949-2210

FOR SALE: Nice TS-323 UHF military freq meter, w/AC sply; S-94 Civic Patrol rcvr. Fred Clinger, WA8KJJ, OH, (419) 468-6117, after 6 PM EST

FOR SALE: Collection of QST, 250 total, 1920 to 1975. Harry Mills, K4HU, NC, (704) 693-7519. millsjr@bigfoot.com

FOR SALE: Hallicrafters S-38 - $85; S-38 A, B, or C - $75; Includes shpg & schematic info; B&W T-R switch 380B - $45 + shpg; ARRL Handbooks & several AM rcvrs & xmtrs, LSASE for list. WA7IHN, POB 442, Aumsville, OR 97325. (503) 749-1149

FOR SALE: 17 pcs modulation xfmrs - $400. V. Vogt, 330 SW 43rd St. #247, Renton, WA 98055. (206) 382-5571

FOR SALE: Audio amp Heath AA-1506, 50 watts, one channel dead, weighs about 30 pounds - $50 + shpg. Charles Graham, W1HFI, 4 Fieldwood Dr., Bedford Hills, NY 10507. (914) 666-4523.

FOR SALE: Richter model P-75 1.5 KVA xmtr - $200, + shpg (very heavy) Steve Leffel, 1790 Edison St., Green Bay, WI 54302. (920) 465-1855 eves.

FOR SALE: Free info on many topics related to vintage amateur radio equipment & operations at http://www.mnsinc.com/bry/hamlynx.htm Everyone welcome. Brian Carling, G3XLQ/AF4K

FOR SALE: Globe King 400B restored & orig. includes manual & coil set - $450. John, NC, (910) 686-4236. ae4en@aol.com

FOR SALE: Magazines, manuals, surplus books, some surplus xfmrs, & other parts. Call your needs. Vic Edmondson, W4MYF, RT 1 Box 2599, Lee, FL, 32059. (904) 971-5580

FOR SALE: Collins 516F-2 bias mod, parts/instr - $12, ppd/US. Cory,N2AQS, 1000 E 14th/178, Plano, TX 75074-6249. hinec@ccgate.dl.nec.com

FOR SALE: Federal Telephone AN/URT3 xmtr, US Navy, uses 4-250's,includes a trunk full of test equipment made just for this radio, a remote station, a spare IF stage, a 3 phase pwr sply, (set up now for 110 operation),puts out 100-125 watts on 110, 600 watts on 3 phase, cw @ 400 wpm,complete set of manuals and schematics, exc condx, pick-up only (located in Colorado Springs), asking - $1500 kb0mmx@kktv.com

FOR SALE: Vintage odds and ends. I need to do some serious shack cleaning. Everything must go. B&W coils - HDVL, HDL, TVL, JEL, MCL series; also misc. parts such as jacks, coil bases, etc; large split stator capacitor (60pf) for KW class push pull xmtr; Thordarson mod xfmr T42O69 - PT980s to 6300/5000 ohm load approx 500W; UTC S-50 plate xfmr 6000vct @ 300 ma; Heathkit SB610 monitor scope; National MB 150 tank circuit; B&W low pass filter; Johnson KW RF deck carcas with tuning capacitor and roller inductor; tubes - 813, 805, 250TH, 803, 5514, 866, 3B28, 872, many others. Everything priced reasonable. Ron Skipper, W8ACR, Rugby, ND, (701)776-5492. skipperclan@stellarnet.com

FOR SALE: Drake FS4, excellent - $325; Drake MN2000, scratched front panel - $165. I ship, CONUS. Gerry Andrews, DA1/WB3BDM-LRMC, CMR 402, Box 1280, APO AE, 09180; 011-49-6371-17878. gandrews@kaiserslautern.netsurf.de

FOR SALE/TRADE: TMC SBE-2, GPR-90RX, CV-591A, 75A-2, 51J-4, NC-300, NC-183R, Viking-I, Challenger. **WANTED:** Novice crystals. SASE. Sam Timberlake, KF4TXQ, POB 161, Dadeville, AL 36853. (205) 825-7305, stimber@lakemartin.net

FOR TRADE: Attention ham railfans, trade Trains Magazines for any amateur equip, 1950's QSTs, manuals. Louis L. D'Antuono, 8802-Ridge Blvd., Bklyn, NY 11209. (718) 748-9612

FOR SALE: 3'x5' reproduction of schematic for Collins KW-1 - $25 ppd. Tom Berry, K9ZVE, 1617 W. Highland, Chicago, IL 60660. (773) 262-0016, 262-5360

FOR SALE: Used xfmrs: Stancor PC8410, PC8302, triad R83A for 0-12 scope - $8 ea + shpg. Henry Mohr, W3NCX, 1005 Wyoming, Allentown, PA 18103.

FOR SALE: Hundreds of WWII communications items, lge catalog, 52 pgs - $3 US, $5 Foreign. Sam Hevener, W8KBF, 3583 Everett Rd., Richfield, OH 44286-9723. (330) 659-3244

FOR SALE: 75A-4 MHz drum decals, 20.5 or 20.8 MHz (you specify), buff color, install instructions - $8.50 ppd. W3HM, Rt 3 Box 712, Harpers ferry, WV 25425

FOR SALE: Collins 51J series drum overlay - $10 ea, specify which. Ron Hankins, KK4PK, 555 Seminole Woods Blvd., Geneva, FL 32732. (407) 349-9150

FOR SALE: NIB 872As - $40; 829Bs - $13; 815 - $10; 4E27 - $30; &1625s - $4. Frank S. Law, W8SET, 1 Wildacre Rd., Charleston, WV 25314. (304) 343-0415

FOR SALE: Buttermut HF-6V w/radial kit - $125. **WANTED:** Schematic or manual for Konel Marine Radiotelephone model KR-1055B. Ronnie, N1UDI, CT, (203) 371-6691

FOR SALE/TRADE: James Millen xmtr. Jerry, N5KYE, OK, (405) 373-2228

NOTICE: The manuals & military equip list was delayed. Will be ready January 15. Henry Engstrom, KD6KWH, POB 5846, Santa Rosa, CA 95402. Ph/Fx (707) 544-5179

FOR SALE: Book, ITT Reference Data, 5th edition -$22 ppd. R.J. Eastwick, N2AWC, 224 Chestnut St., Haddonfield, NJ 08033. (609) 429-2477

FOR SALE: Dentron MLA-2500-B, Dentrons finest amplifier, very nice condx, split shpg - $675; mint Drake TR4/ AC-4 - $285 + shpg. Mike, CA. (209) 568-0345.

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

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

FOR SALE: R-390A Repro nameplates - $9 shpd. N5OFF, 111 Destiny, Lafayette, LA 70506. trinit698idt.net, (318) 989-3430

FOR SALE: Millen 90881 450W amp w/10M - 80M plug-in coils, 2 812 tubes & manual copy, orig, exc - $260; Lafayette HA-1200 2-meter, 1967-vintage AM scvr made by Trio, looks great, untested, w/ orig manual - $99; Gonset Super 12 converter, case scratched, front panel nice, untested - $45; Ameco 6n2 xmtr TX-62 w/VFO-621, front panels nice, some cabinet scratches, working - $60; Hallicrafters SR-42 2 meter AM scvr, good looking & working - $50; military PRC-6 walkie-talkies (2), nice, untested - $45 ea; SCR-284 BC-654 xmtr/rcvr, case paint & power connector wrong, otherwise exc looking & orig, untested - $170; SCR-284, J-48 key, exc - $90; SCR-284 FM-41-A rack for vehicular mounting, rare, nice - $250; military SEM-52A VHF walkie-talkies (2), German, cover 6M, 2ch xtal, w/all accessories, just add batteries, exc - $85 ea. Don, N3RHT, PA, (412) 234-8819 EST wkdays or 71333.1448@compuserve.com

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

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

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

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

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

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

WANTED: Hallicrafters SX-43 in repairable or better condition at reasonable price. Jim Hanlon, W8KGI, PO Box 581, Sandia Park, NM 87047. jthanlo@sandia.gov

WANTED: Tuning assembly for HRO-500. Adam McLaughlin KD6POC, 323 Asuelo Way, Santa Rosa, CA 95401-6748. kd6poc@jps.net

WANTED: Heathkit monitor scope in good to exc condx. Travis, K5AVH, (903)792-2080, k5avh@slinknet.com

WANTED: CW filter for 75S-3B; F455FA-08,-05. AM filter for same; F455FA-40-60. Thanks! Matt, NØXEU, MO, (314)962-1418, kastigar@swbell.net

WANTED: 304-TL sockets, 866-Globe-RCA or Taylor (not A's), Northern Electric R205D Triode/PR, WE-437A's Stancor-A-4762 Driver Trans, Stancor-A-3829 modulation, Stancor C-2317-Splatter choke. Robert, CA, (562) 928-8820, rrjlife@earthlink.net

WANTED: IF/audio board for Kenwood TS-820-S radio. Al, W6UBM, CA, (818) 762-6842.

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

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

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

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

WANTED: (2) Eimac HR-3 heat dissipating connectors for 35TG tubes. Dan Knipe, W7IGE, 3750 Highgrove Ln., Nampa, ID 83687. (208) 888-9575

WANTED: HQ-100 rcvr; HW-32; HW-22; & HW-12. Pete Cullum, KØWRX, 1332 Harlem Blvd., Rockford, IL 61103. (815) 965-6677

WANTED: Circuit for LM-10/13/14 freq. meter; Precision E-200-C sig. gen. for parts. David Boardman, 10 Lemaistre, Sainte-Foy, Quebec G2G 1B4. (418) 877-1316 eves

WANTED: Johnson Ranger II, in VG to exc condx; ARRL Antenna Handbook 2nd-Edition; manuals, copies, or info on Mackay Marine 3020A rcvr. Brian, IL, (888) 851-4202.

WANTED: Mics: Astatic JT-30/40, WR, 820, UT-48; EV638, 605; Shure C381, 520, 707A/7A; also mic parts & elements. Tom Ellis, POB 140093, Dallas, TX 75214. (214) 328-3225. tomsmics@flexcomp.com

WANTED: Hallicrafters SX101A or SX111 MK I (product detector) working or reasonably repairable. Vernon Fitzpatrick, WA8OIK, 520 Royce Rd., Hancock MI 49930-2226. (906) 482-2128

WANTED: WW 2 German ENIGMA coding machine, complete one w/no missing parts. Takashi Doi, 1-21-4 Minamidai, Seyaku, Yokohama 246 Japan. Fax 011-8145-301-8069. taka-doi@kk.iijtu.or.jp

WANTED: Hammalund SP-600 & RCA AR-88 rcvrs. Bill Mills, 188 Ellis Mill Rd. NE, Milledgeville, GA 31061-9020. (912) 452-2957. wmills@gmc.cc.ga.us

WANTED: Knobs for an SX28(A) - xtal phase, AVC/BFO, noise limiter; also need n.l. control/switch assembly for same. Will pay fair price. Willard Smith, 1802 13th St., Bedford, IN 47421. (812) 275-5760

WANTED: Knight VFO w/manual; emblem & all 4 knobs for Hallicrafters S-38B. Gale Roberts, WB9RWW, POB 152, Clyman, WI 53016. (920) 696-3491

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

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

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

FOR SALE: Hallicrafters SX28, works well, looks good - $300. **WANTED:** Band selector knob for Hallicrafters S40 or S76. John Strachan, NE6C, 7495 Gunter Rd., Pensacola, FL 32526. (904) 944-6563

FOR SALE: Kenwood 5205 w/DG-5 digital display, mint, little used, orig boxes - $450; Ameritron AL-80A linear amp, used once, mint, orig box - $500; Hallicrafters S38C, completely orig, near mint - $60. All + shpg. W1YJ, 240 Skysail Rd., Salisbury, NC 28146-9481. (704) 633-0158

FOR SALE: Hallicrafters S-53A w/orig manuals, exc condx. May trade for older straight key. Jim, ND, (701) 852-4809.

FOR SALE: HQ170, mint - $150; Yaesu FRG-7700, #10 great shape - $260; Astatic 10D, stand, push/talk, Collins jack - $65. Jack, AZ, (520) 634-2028

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

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

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

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

FOR SALE: SG-1144 (50kc - 90Mc) $ 150, R-761/ARC-58 $ 75. Joseph W. Pinner, KC5IJD, 201 Ruthwood Dr., Lafayette, LA 70503. (318) 981-7766, kc5ijd@sprintmail.com

FOR SALE: Collins 75A2 & manual - $250; Drake RR-1 Marine rcvr & manual - $250, + UPS. **WANTED:** McMurdo Silver #802, 801, 800; National S-101 audio coupler, good or bad. Dan Mason, RR1 Box 204F, Santa Fe, NM 87501. (505) 455-3416

FOR SALE/TRADE: Collins S/B manual 2nd edition, A/C cover 32V-3, mech fil adapter 353C-14. Ray, MO, (314) 428-1963.

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

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

WANTED: Collins R389, 30K-, 310-, 399C-1, KW-1, HF80 i.e. HF8014, 851S-1, Hallicrafters SX-115. Richard, WA0AKG, NE, (402) 464-8682.

WANTED: Reward for loan of 1930s QSL showing cartoon of W2DNN in prison uniform behind bars operating rig, QTH Ossing, NY. Samuel Macy, W2DNN, 486 Glenwood Trail, Elgin, IL 60120. (847) 695-0218, sammac@interaccess.com

WANTED: "Introduction To Electronics II", (Bernard Grob?, McGraw-Hill?); Precision Apparatus 88 VTVM manual. Robert Harding, KC5LHR, 1321 Monte Largo Dr NE, Albuquerque, NM 87112. (505) 291-0950.

WANTED: HT-9 coils; Flescher TR-128 converter; National RCE manual; Comm. Equip. RHZ manual; TS-2/TG TTY test set spare parts; rackmount spkr for early National HRO or AGS; military antenna loop control box C-48 (C-1342/ARN) or C-18 (C-1113/ARC) or C-25; BC-342x rcvr vernier tuning lock mechanism w/bracket; cabinets for Heath MR-1 Comanche & MT-1 Cheyenne. Don, N3RHT, 47 Hazel Dr., Mt. Lebanon, PA 15228. 71333.1446@compuserve.com (412) 234-8819 EST wkdys.

WANTED: 1963 WRL catalog; will trade pre-1960 WRL, Walter Ashe, Allied, Lafayette, BA, etc. A.J. Bernard, NI4Q, POB 690098, Orlando, FL 32869-0098. (407) 351-5536.

WANTED: Narrow based Vibroplex; someone to align Collins 51S1; unbuilt novice xmtr kits. Brian Roberts, K9VKY, 130 Tara Dr., Fombell, PA 16123. (412) 758-2688.

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

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

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

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

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

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

WANTED: Cash for Collins: SM-1, 2, 3; 312A-1, 2; 55G-1; 625-1; 399C-1; 51S-1; 302C-3; KWM-1; KWM-380; also buy estates. Leo, KJ6HL, CA, Ph/Fax (310) 670-6969.

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

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

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

WANTED: A source of bead chain for NC-300 dial cord. Alex, WA2BMB, NJ, (908) 236-0734.

WANTED: Schematic National HRO R-459/UR rcvr, has slide rule dial. Charles R. Lackey, W4QBE, HC10 Box 567, Lakemont, GA 30552-9718. (706) 782-3670.

WANTED: B&W 852 final tank coil; Jennings R4B, R3A, R3B, RF10. Al, W1BY, 26 Foster Rd., Essex Jct., VT 05452.

WANTED: National NCX5 MKII in exc condx. Bob, KL7HDY, 9501 Brien St., Anchorage, AK 99516. (907) 346-1044.

WANTED: Heath SB-620 Scanalyzer; Cook's Electronics Engineering course. W. Cheatwood, WA4LXK, POB 121, Hope Hull, AL 36043-0121. (334) 281-0970.

FOR SALE: 1936 ARRL Handbook, cover worn w/writing, otherwise good - $40 ppd; RCA Review 3/1960 - 9/1967, 31 issues, near-mint - $62/all; military BC-779, BC-1004, BC-794 orig manual - $24; TM 11-5820-453-10 AN/GRC-87/AN/VRC-34 operator's manual - $13; TM 9-867 Maintenance and Care Of Hand Tools, 1945 - $8; TM 11-242 Radio Set SCR-300-A, 1943 - $14; Heath HW-101 SSB Transceiver Assembly Manual, cover worn - $15; many more manuals & magazine singles of QST, CQ & 73, send 2-stamp LSASE or e-mail for list. Don, N3RHT, 47 Hazel Dr., Mt. Lebanon, PA 15228. 71333.1446@compuserve.com. No calls on literature please.

FOR SALE: Tecraft Cascode VHF converter Model C3/21 - $35; Ameco Model CN VHF converter - $22; Gonset 6m, 10m, 15m converter - $18; new 3-400Z - $60. Larry Wright, N4QY, 170 Heritage Ln., Salisbury, NC 28147. (704) 633-3881.

FOR SALE/TRADE: Xmtg/rcvg tubes, new & used. 55¢ LSASE for list. I collect old & unique tubes of any type. **WANTED:** Taylor & Heintz-Kaufman types & large tubes from the old Eimac line; 152T thru 2000T for display. John H. Walker Jr., 16112 W. 125th St., Olathe, KS 66062. (913) 782-6455, johnh.walker@alliedsignal.com

FOR TRADE: Two good RCA 833A's for one Taylor 833A; also looking for Taylor 803, 813, 875A. John H. Walker Jr., 16112 W. 125th St., Olathe, KS 66062. (913) 782-6455, johnh.walker@alliedsignal.com

FOR SALE: EICO 722 VFO - $75; WRL V-10 VFO - $75; WRL SS-3 Signal Slicer - $25. Jim Hallowell, KA9EXM, 404 Bruer Ln., Maryville, IL 62062. (618) 288-6471

FOR SALE: BC-191/130-375 tuning units, brand new in orig boxes, TU-26B, TU-6B, TU-7B, TU-8B, all for - $150; WWII 42" relay rack cabinet MT-452A/F - $105; TCS-14 remote control - $20; TCS-14 antenna loading coil - $8; Collins PM-2 - $105; Heath CM-1 capacity meter - $22; Allied Radio Catalogs, '69, '70, '71 - $12 ea; (3) NIB Eimac 4X150A tubes - $20 ea; CV89A/URA-8A FS converter - $50; all + shpg. George Shute, W4BDC, 2910 Virginia St. NE, Albuquerque, NM 87110. (505) 298-7347

FOR SALE: HAL RS-2100 RTTY scope - $130; Mirage 2 meter B23A 30 watt. Robert, CA, (562) 928-8820, rrllife@earthlink.net

FOR SALE: (2) National NCX-1000, 1 needs work, 1 partial assy, for parts - both $200 + shpg. Mike, KE3OQ, PA, (610) 759-9257.

FOR SALE: Collins ashtray - $50; Millen GDO w/ coils & spare - $90; TEK-453A manual - $25. Ppd on all. Rudy, W2ZIA, NY, (716) 937-9279

FOR SALE: Repair & restoration, tube & transistor vintage radio. FCC licensed. Mike Zuccaro, 8795 Corvus Pl., San Diego, CA 92126. (619) 271-8294

FOR SALE: SX28A spkr, manual, very exc - $400; Drake TR4C, AC4 pwr sply, MS4 spkr, manual, very exc - $385; RME45 & spkr, very nice - $150; SX140 & HT40 pkg, manuals, very exc - $225; WRL Globe Sidebander, works, fair to good condx - offer; NC300, spkr, manual copy - $225; Johnson Viking Challenger, manuel copy, very good - $110; SX24 Skyrider Defiant, very good - $100; S19R Sky Buddy, manual, exc - $100; HW101 w/pwr sply, clean but non-working - $100; Viking II w/122 VFO & manual copy, near prestine - $375. All + UPS. **WANTED:** WRL Globe Champ 300. Dick Dixon, W7QZO, 16032 Lost Coyote Ln., Mitchell, OR 97750. (541) 462-3078

FOR SALE: Hetrodyne freq meters: BC 221-N w/ RA-133A pwr sply - $45; BC 211T - $28; CRR-7408, Navy LM-10 - $25; TS-323/UR w/homebrew sply - $25. Mervyn Ellsworth, 2309 N. 25th St., Boise, ID 83702. (208) 345-6878

FOR SALE: EICO 720 - $125; EICO 730 - $125; Globe Chief 680 - $100; Johnson Mobile xmtr - $100; Howard 490 rcvr - $200; all in good condx w/ manuals, shpg extra. Greg Richardson, WA8JPC, POB 405, Gallipolis Ferry, WV 25515.

FOR SALE: Drake TR-4C w/AC-4, MS-4, D-104 mic, cables, manuals, spare tubes, exc + condx - $400; Hallicrafters SX-43 w/R-42 spkr, manual, mint condx - $350; (2) British Wireless sets No 19 MKII w/ps, connectors, manual, exc condx - $250 & $300. All + pkg/shpg. Ed Feild, K4GPK, RR2 Box 825, Palmyra, VA 22963. (804) 589-1293

FOR SALE: NIB tubes: 5670/2C51W, 5749/6BA6W, 5750/6BE6W - $1 ea; case/100 - $75, mix OK; 6AZ8 - $3.50; 5V4GA - $4; 6082WB - $4.50; 5U4GB - $5.50; 4D32 - $29; NOS "HN" female in-line coax connectors - $5. Lowell, K6KC, CA, (209) 227-1605, k6kc@lightspeed.net

FOR SALE: Yaesu Landliner phonepatch less cabinet - $15; long sale list printout or diskette - $2, refundable. Joe Orgnero, VE6RST, Box 32 Site 7 SS 1, Calgary AB T2M 4N3, Canada. (403) 239-0489

FOR SALE: Clean Heath Mohican, schematic, needs some work - $75 + shpg. L. Schimmel, POB 1234, Spanaway, WA 98387.

FOR SALE: Poly Comm Sr. 23, tube CB - $125; Heath VF-1 VFO - $35; Heath Twoer - $35; Clegg 99er, 6 meters - $50. Norbert C. Wokasch, WA0KJE, 3312 W. Bijou, Colorado Springs, CO 80904. (719) 633-5661

FOR SALE: Viking Valiant, presently using, w/ book - $295; Heath HM-102 SWR/pwr meter - $30; 100+ assorted panel meters - $100, 28 volt/50+ amp xfmr w/rectifiers - $50. U-ship. WA7HDL, ID, (208) 756-4147 after 2330Z.

FOR SALE: National HFS w/ps - $150; Heath SB102 w/ps/spkr - $175. **WANTED:** SB110A, SB650, HM2103. Don, CA, (818) 368-7374 ph/fx.

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

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

FOR SALE: QST Mags 1981 thru 1990, complete - $5/yr. Francis Waggoner, W2PTI, 268 Barben Ave., Watertown, NY 13601. (315) 788-1621

FOR SALE: Hallicrafters SX-43 rcvr w/matching R-42 spkr & manual, mint condx. Ed Feild, RR2 Box 825, Palmyra, VA 22963. (804) 589-1293

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

FOR SALE: (2) Signal Corps wireless sets No.19 MKII w/pwr sply & connectors, exc condx. Ed Feild, RR2 Box 825, Palmyra, VA 22963. (804) 589-1293

FOR SALE: Homebrew amplifier, ex-K4ENQ(SK) in Premier 36" cabinet, appears complete & like new w/paperwork, utilizes 2 8802/3-500Z, 10-75 meters, (+MARS), SSB output 2400 watts, 4500 watts (PEP), 100 watt exciter required. PU or truck freight - $300. May take military TMs on trade on radios preferred, other subjects too. Military Marketing, Inc., POB 741, Norcross, GA 30091-0741. (770) 729-9315

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

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

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

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

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

FOR SALE: R-648/ARR-41 HF rcvrs: 1 ea 28 VDC, 2 ea 110 VAC - $150 ea; R-109 GRC FM rcvr 27-54 MHz - $50; ME-165 wattmeter, SWR - $50. Al Jenkins, WA1RWB, 5 Daley Ct. Box 1162, Nantucket, MA 02554. (508) 325-7122

FOR SALE: 1959 Hallicrafters promotion "The Amazing World of Short Wave Radio", on cassett, great gift - $7 ea ppd. Neil E. Borg, WØMXX, 2219 Ridgewood Dr. NW, Alexandria, MN 56308.

FOR SALE: Surplus Conversion Manual III; The Surplus Handbook; & 1938 Jones Radio Handbook - $35 ea; KY-65 keyer w/conversion data - $10; LM-21 w/matching ACPS, shock mounts, book - $25; USM-32 freq meter w/ACPS, book, manual - $60; accessory box for GRC-19 - $10. Gary, W8MFL, MN, (612) 496-3794

FOR SALE: Yaesu FT101EE, many options, exc condx - $350; parting R388, 75A-3, HW-101, HRO-50T, no cabinets or knobs. Abe, W3DA, DE, (302) 349-5389, 6 to 10 PM EST please.

FOR SALE/TRADE: TMC GPT-750 RTTY unit. **WANTED:** TMC high level (pair 810s) modulator. C.A. Simsen, W7WXW 1751 Old Prosser Hwy, Grandview, WA 98930

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

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

FOR SALE: Collins manual (copies) R-388, R-390, R-390A & R-391. **WANTED:** Tube CBs. Charles Zafonte, N1FRX, RR3 Box 2075, Fort Kent, ME 04743. (207) 834-6273

FOR SALE: Knight T-150 - $100 + S/H. Ed Sauer, KC9SP, 787 N. Peterman Rd., Greenwood, IN 46142. (317) 881-1483

FOR SALE: Hammarlund HQ110 - $90; ME165/G SWR/pwr meter - $65; Hallicrafters SR42A 2M xcvr - $75; Knight P2 pwr meter - $12. Dave, W1DWZ, MA. (508) 378-3619.

FOR SALE: Heath, unbuilt, never opened, EK-2A & EK-2B, also EK2A/B built w/cabinet (AK8) - to highest offer by 2/1/98. Harry Blesy, N9CQX, 95740 Clarendon Hills Rd., Hinsdale, IL 60521. (630) 789-1793

FOR SALE: AM & antique radios by various amateurs & collectors at the Pendleton Oregon hamfest April 11, 1998. Pat Stewart, W7GVC, 1404 Ruth Ave., Walla Walla, WA 99362-3558. (509) 525-1699

FOR SALE: Collins 51J-4 rcvr, w/spkr & manual, good condx - BO + shpg. Larry Simouetti, 29 Anchorage Ln., W. Yarmuth, MA 02673. (508) 771-3663

FOR SALE: Collins Amateur Radio Equip Video Spotter's Guide, used four times, half price - $12.50 + $2 shpg. Allan Lurie, W9KCB, 605 E Armstrong Ave, Peoria, IL 61603. (309) 682-1674

FOR SALE: Tubes, lge stock, NIB - sell highest bidder. SASE for list. Bill Riley, W7EXB, 863 W. 38th Ave., Eugene, OR 97405-2375. (541) 345-2169

FOR SALE: RME: 6900 - $275; 45 spkr - $85; 4350A & spkr - $250; VHF-152A - $50; HF-10 rcvr - $150; Johnson: CB matchbox - $20; Adventurer - $125; antenna meter - $17; SWR coupler - $40; phone patch - $30; Viking II - $165; Millen: xmatch - $250; rcvr preamp - $65; National HFS - $295. Free List. Richard Prester, 131 Ridge Rd., W. Milford, NJ 07480. (973) 728-2454

FOR SALE: Drake TR-4C xcvr w/AC-4 pwr sply, MS-4 spkr, D-104 mic on T-VG9 stand, manuals & set of spare tubes, exc condx. Ed Feild, RR2 Box 825, Palmyra, VA 22963. (804) 589-1293

FOR SALE: 5894 tubes NIB - $15 ea, 3B28 solid state replacments new - $25. **WANTED:** KWM-380 parts rigs. Fred Honnold, W6YM, 17890 Sharon Ct., Pine Grove, CA 95665. (209) 296-5990, fhonnold@juno.com

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Trade: Only! Hammarlund S-200 speaker for Hallicrafters speaker. Prefer: PM-12-M; R-12-T; R-42; (R-8-T, R-46/A/B?+). Robert Baumann, 1985 S. Cape Way, Lakewood, CO 80227-2415.

FOR SALE: Viking II w/122 VFO, very good - $250. **WANTED:** Johnson Invader 200. Robert Braza, N1PRS, 23 Harvard St., Pawtucket, RI 02860. (401) 723-1603.

FOR SALE: Large number of military radio TO's, $11.50 each, U.S. postage included. For list, e-mail: <karenski@inreach.com, or $2./mailing label to Ski, WA6AME, 7966 Vintage Way, Fair Oaks, CA 95628 (916)966-4749.

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

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

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

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

WANTED: Coil AA for HRO-60. Harold Deppe, NY7Y, POB 31656, Tucson, AZ 85751. (520) 290-1190, trandoc@aol.com

WANTED: McElroy Deluxe marbleite finish key & Bunnell sideswiper. Tom O'Brien, WU8E, OH, (419) 693-5203.

WANTED: Harvey Wells VFO's & spkrs; National MCS spkr; military LS-2 spkr. Kelley, W8GFG, IN, (219) 365-4730.

WANTED: 1 set of xtals for Collins KWM-2A. Will trade Collins 312B-4 spkr console or pay cash. WA9QNN, PSC 1203 Box 1181, APO AE 09803-1181.

WANTED: Collector/builder seeks lge & small vacuum tubes & vacuum tube collections, sockets, etc. Will pay good prices. Please call Marc, OR, (800) 330-2004.

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

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

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

WANTED: Keyer paddles of all kinds. Cap, WØXC, CO, (970) 247-0888. capallen@frontier.net

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

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WANTED: Squires-Sanders equip. H. Weber, 4845 W. 107th, Oak Lawn, IL 60453-5252.

FOR SALE: Heath: VF1, QF1, HR10B, HS1661, SB600, DX20, DX35, DX40, HO-5404 station monitor; Millen: 90651 w/case & coil set, 90501 secondary frequency standard, 90700 variarm VFO; Gonset: 2 meter Communicator, 6 meter xcvr; Harvey Welles Bandmaster Deluxe, Bandmaster Senior, Factory P/S; Mosley CM1 amateur rcvr; Hallicrafters: CB3A, Sky Buddy, HA4 keyer; Sonar VFO120; Conair 400 CW xmtr; Johnson: VFO122, mint Valient, Desk kilowatt (modified); Collins 75A4; Eico 722 VFO; Ten Tec 160 meter converter, (looks new); Lysco model 50 antenna tuner; Drake: 2B rcvr w/2BQ multiplier, nice; UV-3 144/220/440 xcvr w/PS3; Stancor: ST202A 80-10 xmtr; ST203A 10 meter AM xmtr; Wilcox CW3 communications rcvr w/2-4&16-32 MHz modules (or will buy your modules); Lafayette HE40 55-30 MHz rcvr, 6 meter VFO; Spectronics DDI Digital frequency display for Yaesu; Bretting "9" rcvr; Zenith ZE1 B Eliminator (like new). Please send SASE w/specific questions to: Parker, W1YG, 87 Cove Rd., Lyme CT 06371.

FOR SALE: Harris RF-550 rcvrs, AM, LSB, USB, ISB, RF-583 tuning option, mint condx, checked - $795. Shawn Daniels, MO, (314) 343-5263.

FOR SALE: Good, used 4CX1000A & SK800B socket - $85; Tektronic LC130 inductance capacitance meter - $100. Norm, W1CIX, POB 402, W. Bridgewater, MA 02379. (508) 583-8349

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The C75S Digital Frequency Display, displays the receive **Frequency** and **Mode**, by first counting the crystal HFO, the VFO, and the BFO, it then calculates the receive frequency. The correct frequency is always displayed since all of the oscillators which determine the receive frequency are actually counted. Aged crystals or misaligned VFOs simply don't matter. Installation is simple. Plug in three cables into existing RCA jacks in the receiver and you're done. The unit uses a backlighted LCD display and is 2"H X 4"W X 4"D. Power is from a wall adaptor. The cost is $145.00 plus $5.00 shipping.

Models will be available for 51J, 51S-1, R390 and more.

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WANTED: Johnson KW Matchbox; National NC303; National knobs; B&W 500W coils; Turner mics 33X & 25X; National Select-O-Ject; Sprague Black Beauty caps. Sam Champie, 105 W. McKenzie, Hermiston, OR 97838. Please write.

WANTED: Help!! Will pay $25 for copy of schematic for Gonset GSB201 amp. Don, KI5DT, TX, (903) 893-5357.

WANTED: BC-610, BC-614, BC-939, TU49, TU52, & BC-614 manual. Pete Hamersma, WB2JWU, 87 Philip Ave., Elmwood Park, NJ 07407.

WANTED: SCR-838 radar. Fred, fchesson@snet.net

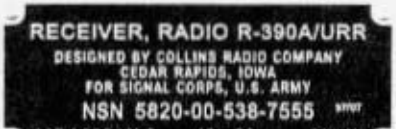
WANTED: UTC A-12, H.L.T., Collins 26U/W; other B'cast gear. R. Robinson, 868 S. Main St., Plantsville, CT 06479. (860) 276-8763, richmix@erols.com

WANTED: NC-300 cabinet, pwr xfmr, meter for DX-60B, VFO dial face for HT-32B. Rick, WB3RT, POB 875, Parsons, KS 67357. (316) 421-4913

WANTED: Drake C line filters & any Drake accessories. Lots here to swap. Fred Watson, K8BP, 581 W. Summit St. Box 58, McClure, OH 43534.

WANTED: Knob for BC 342/312 rcvr marked ant align or part set w/this knob. Ken Kolthoff, K8AXH, 8976 scott Dr., Desoto, KS 66018. (913) 585-1196

WANTED: Manual Schematic VLF rcvr BC-969, SCR-614, tuning range 15 to 150 kHz. Harry Weber, 4845 W. 107th St., Oak Lawn, IL 60453-5252



Repro 390A Nameplates $9 ea, two for $16, five for $35, w/screws, shipped. Tom Marcotte N5OFF, 111 Destiny, Lafayette, LA 70506

WANTED: Requesting to locate Mr. Harold A. Layer, Vintage VLF-ELF, vacuum tube rcvr collector. Please contact Harry Weber, 4845 W. 107th St., Oak Lawn, IL 60453-5252.

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

FOR SALE: Genuine new surplus: Unused R-390A cabinets #CY-979A/URR w/shock supports and misc hardware package - $305; top and bottom cover sets - $75. Mac McCullough, TX (214) 324-4849, Fax - 324-4844

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ELECTRIC RADIO STORE

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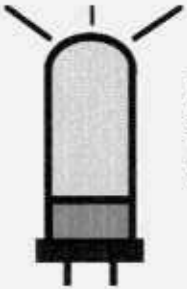

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