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ELECTRIC RADIO

celebrating a bygone era

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Bob Rose, K6GKU

ELECTRIC RADIO

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Electric Radio is dedicated to the generations of radio amateurs, experimenters, and engineers who have preceeded us, without whom many features of life, now taken for granted, would not be possible. Founded in May of 1989 by Barry Wiseman (N6CSW), the magazine continues publication for those who appreciate the value of operating vintage equipment and the rich 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 and operating with a primary emphasis on AM, but articles on CW, SSB, and shortwave listening are also needed. Photos of Hams in their radio shacks are always appreciated. We invite those interested in writing for ER to write, email, or call.

Regular contributors include:
Bob Dennison (W2HBE), Dale Gagnon (KW1I), Chuck Teeters (W4MEW), Bruce Vaughan (NR5Q), Bob Grinder (K7AK), Jim Hanlon (W8KGI), Brian Harris (WA5UEK), Tom Marcellino (W3BYM), John Hruza (KBØOKU), Bill Feldman (N6PY), Hal Guretzky (K6DPZ)

Editor's Comments

Electric Radio Heavy Metal Rally Results

Congratulations to John Kaufmann (K9KEU) for taking 1st place in this year's Heavy Metal Rally with a whopping 108 point total! I'll print some of the comments I received and equipment used in the rally in a future issue as space permits.

Historical W.J. Halligan Series

Electric Radio has published in 16 episodes (five of seven Parts or Chapters) of Bill Halligan's vignettes, which he wrote as a newspaper reporter in 1923. Bob Grinder (K7AK) has indicated to me that he believes that the material as a whole represents fairly well the young Halligan's early perspectives on both radio phenomena and on people responsible for its development, and importantly, reveals values important to him as he built Hallicrafters into a great manufacturing company. Consequently, to preserve space in ER for new projects, Bob has suggested that the unpublished Parts 6 and 7, which cover dialogue with Boston-area amateurs, be placed on the ER web site for interested readers. This will be a text file that may be downloaded for free. The material will be available at the end of March 2005, and our web site is listed inside the rear cover of every issue.

The BPL Quagmire

Last month I reported on BPL developments, and I quoted portions of a public newsletter released by the Utilities Power Line Council, a lobby group funded by the industry. UPLC claimed that results of FCC testing showed much less BPL interference than expected. However, ARRL submitted a 25-page Petition For Reconsideration to the FCC on February 7, 2005, and as I read the League's petition it seems to call into question all of the information released to date from government and industrial sources, and that is putting it politely.

The ARRL petetion is a very strongly worded statement that is already proving to be quite controversial. It accuses the FCC and its Chairman of prejudgments, of

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Cover: Bob Rose (K6GKU) of Rockwall, Texas can be found on 10 meter AM when the band is open. Bob is a retired solar physicist and helped develop the popular Minimuf propagation program. Bob enjoys restoring Hammarlund gear.

tenna input through a 2-pf ceramic capacitor. It has higher voltages than in a 75A-2, but it still works fine since the screen and plate dissipation is well below the maximum 6AB7 ratings. The calibrator B+ is wired to the output of SW2 and is turned on when the BFO is on. But, a switch in the calibrator's cathode circuit, located near V8, can disable the calibrator. Its signal is strong on bands 1 through 5 requiring a reduction of the RF gain, but is much weaker on band 6 and requires full RF gain.

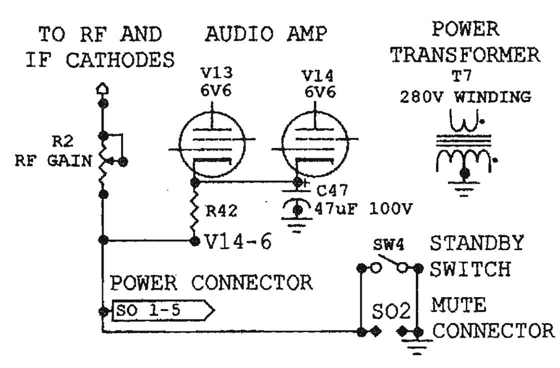
I wanted a calibrator in my early SX-28 since I liked it so well in the later one. But, the later receiver still required V8 as a preamp for the noise limiter. I found I could replace the detector function of V10 with two 1N4248 diodes on a terminal strip mounted on an unused hole for CH3 near V10. This allowed me to use V10's socket for the calibrator, which is a better location because it is close to the A1 antenna connector.

Some Other Useful Modifications

One modification I feel should be done to all SX-28s that are to be used with a transmitter is to change the way the receiver is muted for standby. The stock receiver is muted by opening the contacts of plug SO2, located on the back of the receiver, which turns off the 280 volt B+ by disconnecting the ground at the transformer's high-voltage, secondary-winding center tap. This causes over negative 200 volts to appear on the mute line during standby, which presents a shock hazard with the external TR relay contacts on my BC-610. My circuit in **Figure 3** modifies the SX-28 to disconnect the cathodes of the RF, IF, and audio circuits from ground. This allows the cathodes to float up to around 55 volts, cutting off these stages for standby operation.

I disconnected the HV winding center-tap wire from pin 5 of SO4 and grounded it. Next, I disconnected the ground lug soldered to the grounded end of the RF gain pot, R2, and ran a wire from the ground end of R2 to pin 5 of SO4 on the back of the chassis. I ungrounded R42, the audio output cathode resistor, and connected it to the unused pin 6 of V14. I ran a wire from pin 6 to pin 5 of SO4. I also replaced C47 with a 47-µf, 100-volt capacitor, separated from C49, to withstand 60 volts or more. Now, SO2 and pin 5 of SO4 had no more than 60 volts on them when the receiver was in standby.

My second SX-28's speaker enclosure had a good speaker except for a small tear in its cone, which I repaired with contact cement. I purchased an enclosure for my first SX-28 that had an unrepairable speaker. In its place, I installed a Jensen C10Q high-quality speaker from Antique Electronic Supply. I connected this speaker directly to my SX-28 with the new 8-ohm audio transformer I installed, or I use a Hammond 600-ohm to 8-ohm transformer with my other SX-28. Broadcast music sounds slightly better on the Jensen speaker than on the stock speaker, while voice audio under poor band conditions is better on the stock speaker. This



IMPROVED STANDBY CIRCUIT
FIGURE 3

is because the stock speaker has a little lower high and low-frequency response than does the Jensen speaker. Also, the stock transformer from the bad speaker didn't work well with the 8-ohm Jensen speaker, and its frequency response wasn't as good as with the Hammond transformer. I suspect the Hallicrafters speaker isn't 8 ohms, or its transformer tailors the audio response. For music, I prefer the Jensen, and for voice I prefer the stock speaker.

Noise Limiter Improvements to my Early SX-28

If your SX-28 has the earlier noise limiter, the following information will be of interest. I found the limiter in my higher serial numbered SX-28 was outstanding in eliminating power line noise, while the one in the early S/N SX-28 wasn't as good. A big difference in the two limiters was a low- pass PI network that is used to filter IF voltages from the blanking signal. It was replaced with a tuned 455-kc trap in the later system, as shown in Figures 2A and 2B of Part One. The series coil and capacitive loading of the earlier limiter caused a delay in the blanking pulse arrival, allowing some noise to get through. I obtained a later-version 455-kc trap and replaced CH3, C55, C53, and R47 with the later trap, and increased R49 to 1 Megohm. Now, the noise blanker is more effective. Another change between the two designs is that the earlier system uses the first AVC amplifier as a combined preamp and a full-wave noise detector, requiring a different T5 transformer. I considered converting completely to the later system, but since the limiter was now working well, and I didn't have a later-model T5, I left the preamp in the circuit.

During heavy blanking of strong power line noise I could still hear some noise, but only when I was listening to an AM signal. A problem with the Lamb IF blanker when receiving AM signals had been pointed out to me by Chuck, WAØZHH. If a blanking pulse interrupts a carrier, the pulse actually modulates the carrier, and it generates noise sidebands. My FT1000D turns its noise blanker off when in the AM mode because of this problem. To solve it, Hallicrafters added a shunt noise limiter to the audio circuit when they changed to the later limiter; see Figure 2B of Part One. The audio limiter consists of the second half of V10, a 1-Megohm resistor (R70), and the switches SW5-1; see Figure 2B of Part One. I added this circuit using a 1N4148 diode, a .05 µF capacitor, SW5, and a 1-Meg resistor across R24 on a small terminal strip located near V10. SW5, inside of R53 on the early receiver, has one pole instead of the two-pole later design. I found that by using the single pole of SW5 for the shunt limiter, and leaving the blanker always on wasn't a problem, since the heavy back bias of R51 will bias the blanker off when SW5 is off. Now, the limiter in my earlier receiver works as good as the one in my later one.

Why did Hallicrafters bother with the expense of a Lamb noise blanker, and not just use a less expensive audio peak noise limiter like most AM receivers of that time? The answer is that while the audio peak limiter will eliminate audio noise, additional noise in the IF system will degrade the sensitivity of a receiver by affecting its AVC system and causing spurious noise when the noise mixes with other IF signals. The Lamb blanker eliminates this IF noise by removing noise pulses early in the IF and then the audio limiter further eliminates any noise caused by the blanking action.

Conclusion

George Silva (WB6HCX) supplied me with copies of two interesting Hallicrafters documents. One was a service bulletin issued in 1951 after the SX-28 was out of production. It shows an added crystal calibrator and the replacement of the shunt audio limiter with a series limiter one for better noise limiting. This requires the addition of a 6ST7 tube on a bracket near the audio detector tube. The 6ST7's diode is used for the limiter and the triode for the calibrator. I've never seen this modification in a SX-28 so I don't know how well it works. The shunt limiter in my SX-28's performance is excellent, but it may be interesting to experiment with the series limiter circuit.

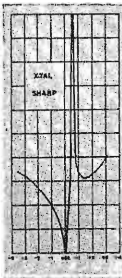
The second document is an addendum to the SX-28A instruction book stating the second RF tube, a 6SK7, has been replaced with a 6AB7 for more sensitivity on band 6. I've never seen this change in a SX-28A so it must have been for very late SX-28A's. I would be skeptical of this change and I don't advise trying it as a modification because the 6AB7 is a sharp cutoff tube and has very poor AVC control. They also had to change the RF circuit to suppress oscillation and instability problems. These were most likely caused by too much RF gain on the lower bands. I think it's better to improve the RF impedance matching and RF coil design for increased sensitivity on band 6.

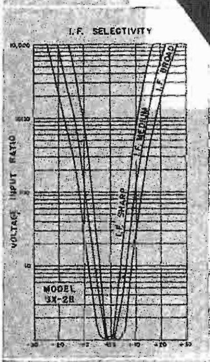
Both of my modified SX-28s have become my favorites for use with my BC-610E and at my Mammoth Lakes, CA, QTH where I often experience power line noise. Also, the variable IF selectivity is an outstanding feature to control selectivity. It is not available on most early receivers. Its noise limiter system is the best I've used for AM reception. Its frequency resolution and stability is not as good as the later Collins A-line receivers, but after the addition of a crystal calibrator it's adequate on 20 meters and below for AM phone reception. The only thing I'm not satisfied with is the lack of sensitivity on band 6, which will be a subject of further work. The receiver's manual states it's designed for a 400-ohm antenna input, but both of my receivers are very sensitive up through band 5 using a 50-ohm input. I suspect a balun for better antenna matching on the input of the band-6 antenna coil would improve sensitivity on that band.

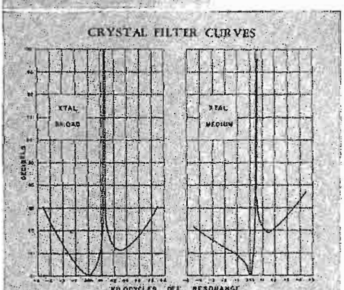
This SX-28 project has been a very satisfying experience and changed my ideas about what makes a good HF AM receiver. It has pointed out some valuable design features to me, such as how noise limiting and a single-conversion design can have less noise, less tendency for RF overload, and doesn't have the birdies typical of multiple-conversion receivers. An experience I had when listening to weak AM signals pointed this out. One night last fall I tuned to 3885 kc using my FT1000D in its AM mode and heard some weak Q3 AM signals. I switched to my modified SX-28 and could copy them perfectly Q5, except for an occasional static burst. My SX-28, even in the 4 kc "sharp" selectivity position, had more highs and less distorted audio than did my FT-1000D. I next tried my 75A-4 with its improved audio and mixers, and it did much better than the FT1000D, but I could still only copy them Q4 at best. My modified SX-28 beat both radios hands down. This may be due to less mixer noise and the SX-28's LC-coupled IF stages that don't ring as much as do crystal or mechanical filters. A good audio system makes a big difference when copying weak AM.

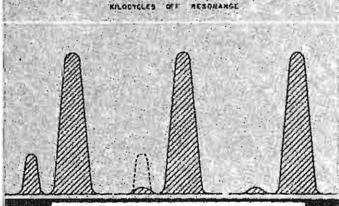
I would like to thank those who contributed ideas and parts for this project: Wayne (W6IRD), John (WB6JUS), Joe (W1GFH), Chuck (WAØZHH), and especially David (KM5TZ) and Mike (K6ZSR) for finding the detector clipping problem and a solution. George (WA6HCX) and Clay (W7CE) supplied documentation on the different SX-28 versions. Additionally, thanks to Brian (NI6Q) for supplying recapping information on his SX-28A along with AVC improvement ideas. I feel every AM enthusiast who has power line noise, who likes to try copying weak AM signals, and who enjoys high-quality audio and working on and improving receivers, would enjoy owning an SX-28.

ER









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Cathode Modulation
History, Theory, and Practical Implementation

Part 1

By David Kuraner, K2DK
2526 Little River Rd.
Haymarket, VA 20169

Ever since I upgraded from Novice to General, I have been fascinated with cathode modulation. It was used in my first AM phone rig. I have had almost 45 years to research the subject. The fruits of that effort will provide fellow AMers a viable option for home brewing an AM transmitter. The techniques described will result in excellent audio characteristics, be simple to adapt and will not employ an expensive and often unobtainable modulation transformer. The modulator to be described has been used for CW rigs in the 100-watt range and can be used with almost any transmitter. The unit even inherently provides excellent negative peak limiting as an added bonus.

Frank Jones was working in his radio laboratory then this photo was taken sometime in the 1930s. (From the 1937 Radio Handbook, in the collection of Gary Halverson, WA9MZU)

We are indebted to Frank C. Jones, a respected radio engineer, for his work published in 1939. It is fascinating from both historical and technical aspects. Many references will be made to his work. Mr. Jones claims many advantages to cathode modulation including greater efficiency over grid modulation. The biggest advantage for today's amateur wishing to build a HB rig is that many of the techniques can easily be used with material still readily available in the 21st Century.

The ARRL handbooks of the 40s and 50s present the classic form of cathode modulation. No practical examples are given. They contain some interesting theory, which at times differs from the Jones text and several pre-war articles.

The first known published reference to cathode modulation was for a simple 5-meter transceiver. It places a carbon microphone in the cathode circuit, see **Figure 1**. Nothing could be simpler. Fidelity was questionable and the circuit could only be used for low power. Over the next five years the method was developed and resulted in Stancor producing a pre-war, 100-watt AM transmitter employing cathode modulation in 1939. Stancor was known for its transformers.

Modulation Methods

Most AMers are familiar with plate and screen modulation. Their requirements, advantages and disadvantages are well documented and widely known by

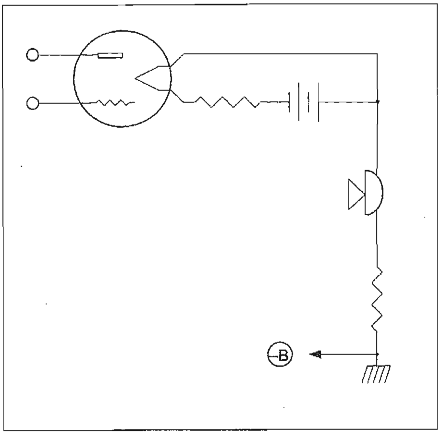


Figure 1: Originally published in 1934, this is the first known reference to cathode modulation.

those of us into "Angel Music". A common subset of screen modulation is, of course, controlled-carrier modulation which increases the average RF output during modulation. Other forms of modulation deserve mention, either because of their uniqueness, or their relationship to the subject of cathode modulation.

Loop Modulation

One of the earliest reported forms of voice modulation is called absorption modulation, and the basic circuit is in **Figure 2**. A variant known as loop modulation is shown in **Figure 3**. The objective of both methods is to vary the RF antenna current at an audio rate. Like the crude cathode modulation circuit, in is simplest form, one or more carbon microphones are placed in the antenna circuit. Again, the transmitter power is severely limited and fidelity is lacking. It was used primarily before World War I and resulted in many destroyed carbon microphones. Thankfully it has been obsolete for about 80 years.

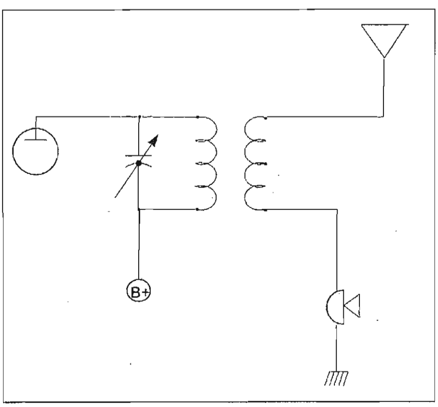


Figure 2: Absorption modulation.

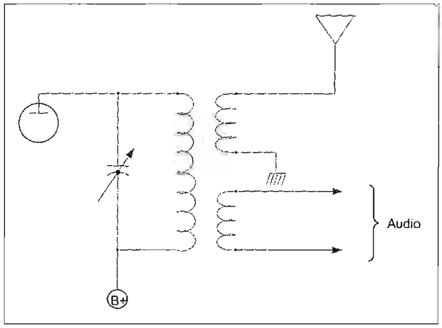


Figure 3: A loop modulation method.

Bob Raide (W2ZM) has a working specimen. Bob is a very talented and knowledgeable broadcast engineer with a passion for "Old Buzzard" rigs. If you are lucky enough to work him, he can be coaxed into demonstrating loop modulation on the air. It's a real kick and does not sound all that bad. In his transmitter, a loop is coupled to the final output coil and fed with audio. This just goes to show that simple unorthodox methods can be made to work. Bob also has a high powered rig built by Frank Jones. The RF deck bears a suspicious resemblance to the high-powered, cathode-modulated transmitter illustrated in his 1939 publication.

Grid Modulation

There are many forms of grid modulation. As mentioned, screen modulation and its various forms are often used on the Ham bands. Where RF pentodes are used, you can even modulate the suppressor grid. It is claimed that close to 100% modulation is possible with ¼ of the CW RF output at about 50% efficiency. Of these, it is rarely used because most RF output tubes are triodes or tetrodes. Those that are pentodes, the suppressor grid often can not be separated from the cathode. So, like loop modulation, it is basically a foot note.

The other grid, not often thought of these days in the context of AM modulation, is the control grid. The grid bias is made to vary at an audio rate by injecting audio between the grid and its bias supply. The method is often referred to as efficiency modulation. The overall efficiency varies over a 2 to 1 ratio for 100% modulation. The resting efficiency is claimed to be about 15% and varies to about 25% with little or no distortion. If some distortion is accepted, the Jones text suggests that up to 40% efficiency can be obtained. Compare these figures to the generally accepted values of 30 to 35% for screen-grid modulation.

As with all grid modulation schemes, the audio power requirement is low. However, the overall RF output suffers. The control grid method tends to be difficult to adjust for distortion free audio. Grid-bias voltage and audio variations must be critically adjusted for proper operation. Also, since the efficiency is low, large reserves of plate power dissipation are required. The same RF output can be obtained with smaller tubes by using plate modulation. As in all of engineering, there are always economic tradeoffs to be made.

The importance of this brief discussion expounding the characteristics of grid bias modulation will become apparent as we delve into the practical aspects of series-cathode modulation. Traditional cathode modulation circuits (those briefly mentioned in the ARRL handbooks) produce a combination of plate and grid modulation. As we shall realize, one of the easiest forms of cathode modulation to implement is really a form of control-grid bias modulation.

Cathode Modulation

While there is no prohibition against tetrodes or pentodes, better results are claimed to be obtained with triodes in the RF stage. Like plate modulation, the modulating impedance has to be matched to the impedance of the cathode circuit. The audio requirements are considerably reduced and depend on the ratio between grid and plate modulation. Typically this runs between 10 and 20% of that required for plate modulation.

The ARRL handbooks give a theoretical example of impedance matching and requirements based on the ratio of plate to grid modulation. Their presentation is that the normal plate impedance is modified by this ratio. More plate modulation gives higher impedance. Thus, 5k plate impedance with an equal amount of grid to plate modulation yields 2.5k as the impedance that should be matched. Both the ARRL and Jones texts agree that the way to vary this ratio is via a tap on the cathode modulation transformer. In all examples of pre-war cathode modulation circuits, a transformer is shown.

Interesting differences between the two texts appear. While the ARRL implies that the theoretical value is to be matched, the Jones text just plainly states that the practical value varies between 300 and 1500 ohms. Other 1939 articles suggest the matching impedance to be 10% of the plate impedance. Jones further states that for all practical purposes, the secondary of this matching transformer can be 500 ohms. If there were a mismatch, slightly more audio would be needed. It simply would not be a show stopper. A small mismatch would not affect audio quality. Jones claimed that a 2-to-1 mismatch can be readily tolerated with some inverse feedback in the audio modulating stage.

It would appear that an audio transformer matching the audio output tubes of a small amplifier to 500 ohms might do the job very nicely. The secondary must be able to handle the cathode current and voltage from cathode to ground. We obtain insight to the voltage across

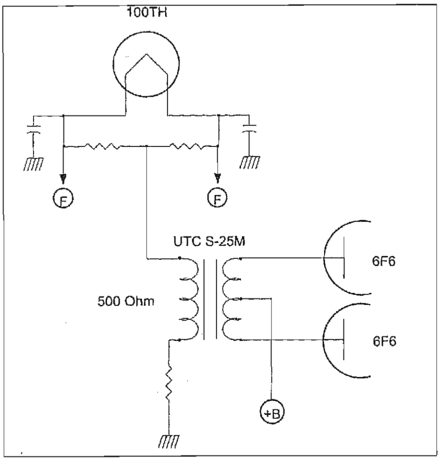


Figure 4: Partial schematic of a 160-meter, cathode-modulated transmitter using a "conventional 20-watt public address amplifier. (Frank Jones, 1939)

the transformer in the cathode circuit from a December 1939 article by Ray L. Dawely, W6DHG. He is giving numbers of between 175 and 450 volts. These figures are for a different circuit configuration. At least we have somewhere to start. In any event, the voltage should be much lower than that on the RF plate to ground and much closer to that of the small audio amplifier.

Do you have an audio amplifier with a 500-ohm output or an audio output transformer with 500-ohm taps? How about a speaker to line-level transformer back-to-back with the speaker output of the amplifier?

The 1939 Jones text shows a cathode-modulated transmitter that uses a pair of 6F6s in the modulator and 100THs in the PA at the 1 kW level. This is shown partially in **Figures 4**. The rule of thumb has been to provide at least 10% of the required plate modulation audio to the cathode circuit. There is one caveat: The transformers Jones used were specifically designed for cathode modulation service. Period advertisements offer the Jones transformers for sale. Now if you think plate mod iron is rare, try finding on of these guys. Even if you had one, you may not recognize it for what it is.

A modern version of this scheme is found in a broadcast transmitter designed by James R. Cunningham. His CM 30-50 Cathode Modulation Transmitter is registered with the FCC. Efficiency is stated to be similar to conventional plate modulation. Circuits and descriptions are provided on his web site, http:groups.msn.com/GospelRadio/cathodemodulationbycunningham.msnw. A visit is well worth it because the techniques appear to be easily adapted to amateur AM.

It Works!

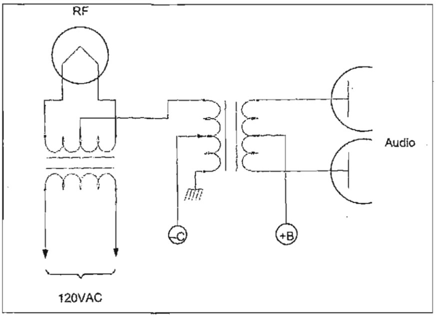
Yes, Frank Jones was a genius! An experiment with a DX-20 worked and proved quite capable of 100% modulation. The only problem encountered was downward modulation, perhaps due to the limits of the power supply. It sounded quite good. Here are the test conditions and results:

A small Bogen audio power amplifier (power rating unknown) was used, with the 500-ohm tap connected in series with a 500-ohm pot from cathode to ground. Optimum resistance (as Jones shows in his schematics) is 200 ohms. The pot can be used to control the carrier level for correct linear amplifier conditions if this exciter is fed into an amplifier. 510 volts at 130 mils (66 watts input) yields 50 watts CW out and 75% efficiency with the modulator out of the circuit. 510 volts at 115 mils (58.65 watts input) with the modulator in the circuit yields 40 watts out and 68% efficiency.

You bet I was surprised! Now we have a super-simple way of producing AM with a CW transmitter. Do remember that the RF stage's grid is self biasing under the test conditions.

Series Cathode Modulation

Paul Goodman's article "A Simple Low-Power Series Modulated Transmitter" (ER #178, March 2004) does not use a transformer. The entire audio output stage is clearly placed in series with the



Simplified schematic of a traditional cathode modulation circuit. Vary the tap to adjust the ratio of plate-to-grid modulation.

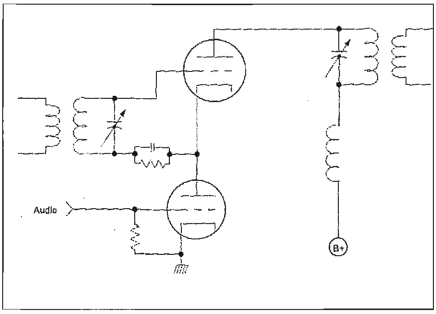


Figure 5: Simplified schematic of series-plate modulation.

RF stage through its cathode circuit. Ray L. Dawely, in his December 1939 article in Radio Magazine, refers to this as series *plate* modulation as shown in **Figure 5**.

Let's change the circuit just a bit. Instead of placing the RF stage's grid-circuit return to relative ground at its cathode's potential, we return it to ground at the audio modulator cathode or circuit ground. We now have a totally different circuit which only looks like the RF stage is being cathode modulated. This configuration is shown in **Figure 6**.

Remember those figures of 175 to 450 volts between the cathode and ground of the modulated RF stage? With the RF stage's grid at ground potential and its cathode above ground, the voltage drop across the modulator tube is actually providing negative bias to the RF stage's grid with respect to its cathode. This bias voltage changes at an audio rate as the

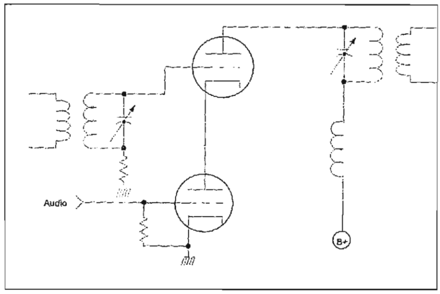


Figure 6: The RF grid return is now at ground, rather than the cathode of the first RF tube. This is series cathode modulation.

resistance to ground varies due to the changing conduction of the modulator tube. We now have mostly grid bias modulation via the cathode circuit. Still, the technique is referred to as series cathode modulation.

The big advantage of this circuit is that no modulation transformer is used and it can be used at any power level. Unlike traditional control-grid modulation where the bias and audio levels are critical, correct operating conditions are almost automatic if the RF stage is self biasing. Fixed bias presents problems which will be elaborated on in Part 2. Additionally, the RF stage can never be completely biased to cutoff. Thus, a very effective negative peak limiter is produced. Practical circuits have been developed and employed with excellent results at all power levels.

Part 2 of this article will describe a simple, yet highly effective modulator which can be applied to almost any CW transmitter at any amateur power level. It features a more modern approach than that of 1939 and subsequent versions and includes PTT control relays and negative feedback with carrier level adjustment. I have used it with a DX-20, Globe Chief, HB 1625 and a SB-400 SSB Heathkit transmitter and worked someone using a similar modulator coupled to a 4-1000. Construction, interfacing, and operating will be presented in the next installment of this article.

RADIO

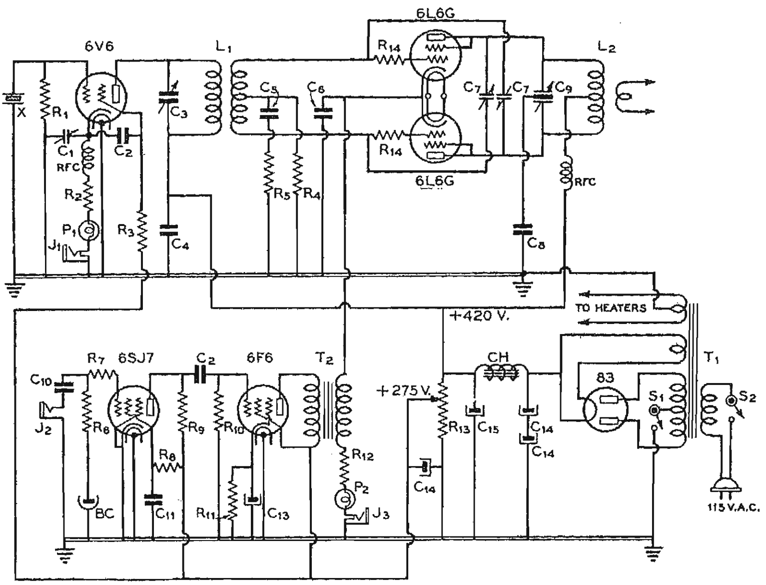


Figure 2. Schematic of the cathode modulated 6L6G phone.

C_1—170-600 µµfd. mica trimmer condenser.
C_2—.01-µfd. 600-volt tubular
C_3—100-µµfd. midget variable.
C_4—.01-µfd. 600-volt tubular
C_5—0.5-µfd. 200-volt paper
C_6—.005-µfd. 600-volt mica
C_7—Homemade neut. condenser, 1" by 2" parallel plates
C_8—.002-µfd. 600-volt mica
C_9—100-µµfd. per section split stator
C_{10}—.01-µfd. 600-volt paper
C_{11}—.05-µfd. 600-volt tubular
C_{12}—.005-µfd. 600-volt mica
C_{13}—10-µfd. 25-volt elect.
C_{14}—8-µfd. 450-volt elect.
C_{15}—16-µfd. 450-volt elect.
R_1—100,000 ohms, 1 watt
R_2—300 ohms, 10 watts
R_3—10,000 ohms, 1 watt
R_4—10,000 ohms, 10 watts
R_5—3000 ohms, 1 watt
R_6—1 megohm, ½ watt
R_7—25,000 ohms, ½ watt
R_8—2 megohms, ½ watt
R_9—500,000 ohms, ½ watt
R_{10}—1 megohm, ½ watt
R_{11}—400 ohms, 2 watts
R_{12}—200 ohms, 10 watts
R_{13}—25,000 ohms, 50 watts
R_{14}—50 ohms, 1 watt
T_1—800 v. c.t., 175 ma.; 6.3 v., 5 a.; 5 v., 3 a.
T_2—2500 ohms to 500 ohms, 10-watt rating
CH—15-hy., 200-ma. choke
BC—Bias cell
Coils—See coil table
S_1—Plate on-off switch
S_2—A.c. on-off switch
P_1—150-ma. 6-volt lamp
P_2—250-ma. 6-volt lamp
J_1—Crystal plate current jack
J_2—6L6G cathode current jack
RFC—2.5mh., 125-ma. choke

Figure 7: Cathode-modulated 6L6 transmitter, October 1939 Radio Magazine.

[The cathode-modulated 6L6 phone transmitter on this page is reproduced from the October 1939 issue of Radio Magazine, by Frank Jones. The coil chart for this design is on page 19, and there are no parts which are especially hard to find.

The large schematic on page 18 is a 250-watt CW transmitter using 6L6s and an 813 final amplifier. Its coil chart is on page 19, along with a parallel cathode modulator for the transmitter. This was originally published in the 7th edition of the Radio Handbook, 1941.

Although originally published at least 64 years ago, it should be relatively easy to built these transmitters even today because no special transformers are required, and the power supplies are of conventional design.]

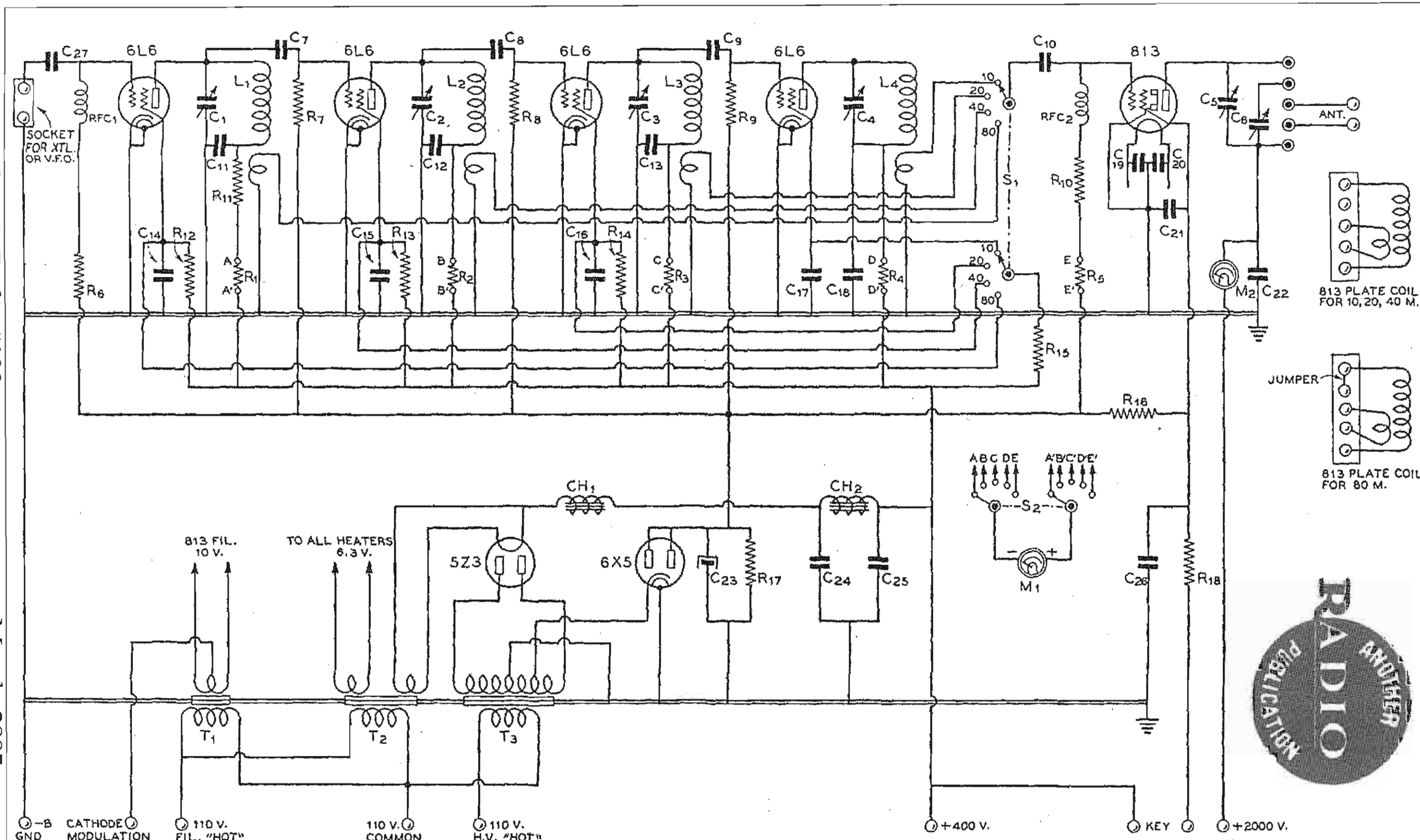


FIGURE 21. WIRING DIAGRAM OF THE 250-WATT C. W. TRANSMITTER.

COIL DATA CATHODE MODULATED 6L6G TRANSMITTER			
BAND	OSCILLATOR (1½" dia. forms)		FINAL PLATE
	Plate	Grid	
10	3½ turns no. 20 d.c.c. 1" long. ⅛" separation btwn plate and grid coils	5 turns no. 20 d.c.c. ½" long, c.t.	6 turns no. 14 E. 1¼" long, 1¼" dia., c.t.
20	7 turns no. 20 d.c.c. 1" long. ⅛" separation btwn plate and grid coils	12 turns no. 20 d.c.c. ½" long, c.t.	8 turns no. 14 E. 1" long, 1¾" dia., c.t.
40	14 turns no. 20 d.c.c. 1" long. ⅛" separation btwn plate and grid coils	32 turns no. 24 d.c.c. 1" long, c.t.	18 turns no. 16 E. 1¾" long, 1⅝" dia., c.t.
80	24 turns no. 24 d.c.c. close-wound. ⅜" separation btwn plate and grid coils	56 turns no. 26 E. close-wound, c.t.	32 turns no. 18 E. 1½" long, 1⅝" dia., c.t.
160	44 turns no. 26 E. close-wound. ⅜" separation btwn plate and grid coils	80 turns no. 28 E. close-wound, c.t. Shunted with 3-30 μμfd. trimmer	56 turns no. 22 d.c.c. 2" long, 2¼" dia., c.t.

Amp. "grid" windings semi-resonant. Space for best operation before cementing turns on form.

VALUES OF COMPONENTS USED IN THE 250-WATT C. W. TRANSMITTER.

C_1, C_2—50-μμfd. midget variable
C_3 — 35-μμfd. midget variable
C_4 — 15-μμfd. midget variable
C_5, C_6—70-μμfd., .070" spacing
C_7, C_8, C_9—.00005-μfd. mica
C_{10}—.005-μfd. mica
C_{11}, C_{12}, C_{13}—.005-μfd. 1000-volt mica
C_{14} to C_{21}—.003-μfd. mica
C_{22} — .001-μfd. 5000-volt mica
C_{23} — 25-μfd. 50-volt electrolytic
C_{24}, C_{25}—4-μfd. 600-volt oil-filled
C_{26}—0.5-μfd. 400-volt tubular
C_{27}—.0001-μfd. mica
R_1, R_2, R_3, R_4, R_5—50 ohms, ½ watt
R_6—25,000 ohms, 1 watt
R_7, R_8, R_9—100,000 ohms, 2 watts
R_{10} — 5000 ohms, 2 watts
R_{11} — 2000 ohms, 2 watts
R_{12}, R_{13}, R_{14}—100,000 ohms, 2 watts
R_{15}—15,000 ohms, 10 watts
R_{16}—150,000 ohms, 2 watts
R_{17} — 2000 ohms, 10 watts
R_{18}—5000 ohms, 10 watts
T_1—10 v., 8 a.
T_2—5 v., 3 a.; 6.3 v., 6 a.
T_3—1030 v., c.t. bias tap at 30 v.
CH_1, CH_2—13 hy., 250 ma.
RFC_1, RFC_2—2½ mhy., 125 ma.
S_1—2-pole, 4-position isolantite selector switch
S_2—2-pole, 5-position selector switch
M_1—0-100 ma.
M_2—0-250 ma.
L_1—30 turns no. 20 d.c.c. closewound on 1½" dia. form
L_2—25 turns no. 18 d.c.c. closewound on 1" dia. form
L_3—11 turns no. 20 d.c.c. spaced to occupy 1½" on a 1" form
L_4—8 turns no. 12 enam. 1" dia. and spaced to a length of 1½". Self-supporting.

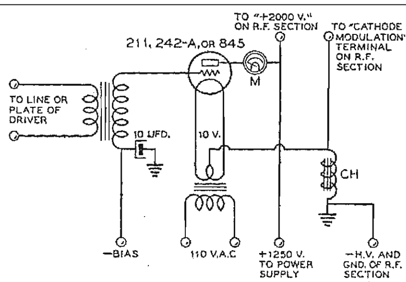


Figure 25.
PARALLEL CATHODE MODULATOR FOR 250-WATT TRANSMITTER.

The 250-watt c.w. transmitter will give a 125-watt phone carrier when modulated by this cathode modulator. The bias voltage should be adjusted so that the modulator tube plate draws 80 milliamperes. Choke CH should have 8 to 20 henrys inductance and be capable of carrying about 250 milliamperes—175 ma. plate current to the 813 and 80 ma. to the modulator. It will be necessary to reduce the power supply voltage to 1250 volts when cathode modulation is used.

[Editor's note: Part 2 will be featured in the April 2005 edition of ER. Also, as K2DK mentions, any of the Radio Handbooks published by Editors and Engineers Ltd. from 1940 to about 1962 have very detailed information about alternative modulation methods such as cathode modulation that ARRL handbooks do not.]

ER

A 1948 GE FM Police Radio Club Project

By Chuck Teeters, W4MEW
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Martinez, GA 30907
Photos by Tony Chang, WW4TC

Due to the number of 10-meter sporadic-E openings in the past few months, the Amateur Radio Club of Augusta was discussing adding 10-meter FM to the club station. As with most clubs, funds were limited, so the talk turned to surplus. Henry (KN4AV) offered to head the project if I would help. Later, at Henry's home, I noticed the original step to his shack had been replaced with two heavy metal cases about 12" by 10" by 10". I asked about them and he said they were a temporary (for the last 26 years) replacement for a missing step. I recognized the units as GE two-way mobile radios like the ones I maintained for the Monmouth County Police in the late forties. Henry said someone had given them to him. He had never opened the units up as they were locked. A look at the undersides confirmed they were low-band GE FM radios.

A 3/8" drill and punch unlocked the top covers. A check of the ID tag confirmed they were 30 to 40 MHz GEs, with a 4ET6F5 60-watt transmitter with a pair of 807s running from a 6-volt dynamotor, and a 4ER6B8 vibrator-powered receiver. Both were single channel, crystal controlled radios. Another the tag indicated the pair had belonged to the Southern Railroad and were on 31.13 kHz. I

After serving in a railroad locomotive for years, and then as a door stop for 26 years, these GE mobile radios were easily returned to service as a club radio project.

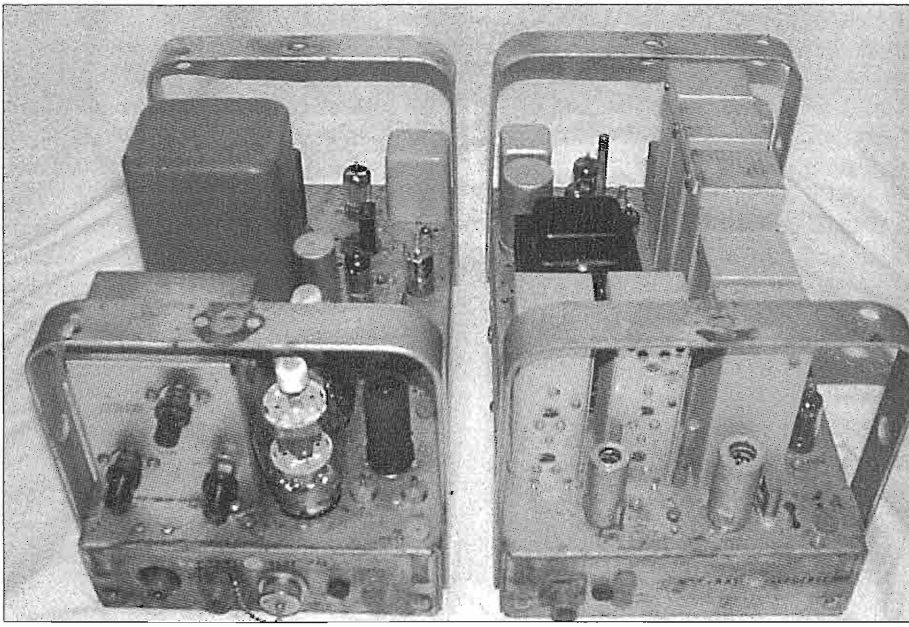
suggested to Henry that this would be a great chance to acquaint the newer club members with tube radios. We agreed it would be a good club project to bring them up on 29.6 MHz, the FM simplex frequency.

Link Radio led the way into police FM in 1940. They had built AM police radios for seven years before the FM sets. Police radio started in the early thirties with modified AM broadcast transmitters and auto radios working just above 1500 kHz, the upper limit of the broadcast band back then. It was a one-way system, base-to-cars only. By the mid thirties, two-way operation was added by using 30-42 MHz AM for mobile-to-base. The higher frequency was selected due to mobile antenna limitations. Link took the lead in sales with their model 199 and 205 AM equipment, with crystal-controlled transmitters and receivers with squelch. Western Electric built a model 133A police set. Stancor entered the field with their model 2840 AM unit. Link, GE, and RCA made 100 to 1000 watt MF AM transmitters, operating between 1.6 to 2.5 MHz, for police base station transmitters.

In 1940, Link developed and tested an FM two-way 30 MHz system with the Connecticut State Police. The test results virtually ended the AM police radio reign. Before the change over from AM to FM could get started, WWII intervened and the Link FM radio production was taken over by the military. Motorola, Western Electric, and others developed FM radios for the military also. After the war, everybody got into the police FM two-way business. Link, Motorola, RCA, Dumont, KAAR, and Federal Radio were prominent in the field. GE got off to a slow start, but in1948 their FM equipment offering was a rugged, dependable set that cost a bit less than the competition. Monmouth County, New Jersey, added the GE 30 MHz equipment to their system. The county continued to use their Link 1-kW MF AM base-to-mobile transmitter on 2366 kHz, and used the GE FM on 37.1 MHz for mobile-to-base. However, the post war growth of the county had over 200 mobiles on that one frequency. Two major disasters in the late forties, a train wreck and a ship explosion, so overloaded the channel that 12 additional police frequencies were put into service around the county. The GEs continued as the radio of choice for 37.1 MHz, but Motorola won the bid for everything else. I serviced the GE sets for many years, until the equipment was taken out of service.

Once a month, I checked the GE receivers at the county base station in Freehold, about 15 miles from my Asbury Park home. I usually drove over in the evening after work. One night the Freehold radio operator, Bob Reynolds, a Ham I knew well, walked outside to glance at my car as I was leaving. I had a Link 205 receiver on 2366 kHz in the car, but no transmitter. About 10 minutes after leaving the radio site, my Link receiver came to life with a stolen car broadcast, authority Freehold. It reported a gray 1950 Chevrolet, 2 door, NJ license MA2412, stolen in Freehold, and was headed towards Asbury Park. That was my car. Every set of headlights coming at me or up behind me looked like a police car. That was a nervous drive home that night. The minute I walked in the door, I called Freehold, and asked what was going on. Bob said he would cancel the stolen car broadcast. He just wanted to see if I made it home OK. I could feel the smirk on his face over the telephone.

It was like old home week when I brought the GE into my workshop for a clean up and inspection. The chassis and cabinets were in remarkably good condition, considering the use they had been put to for the last 26 years. They were under a carport that kept most of the rain



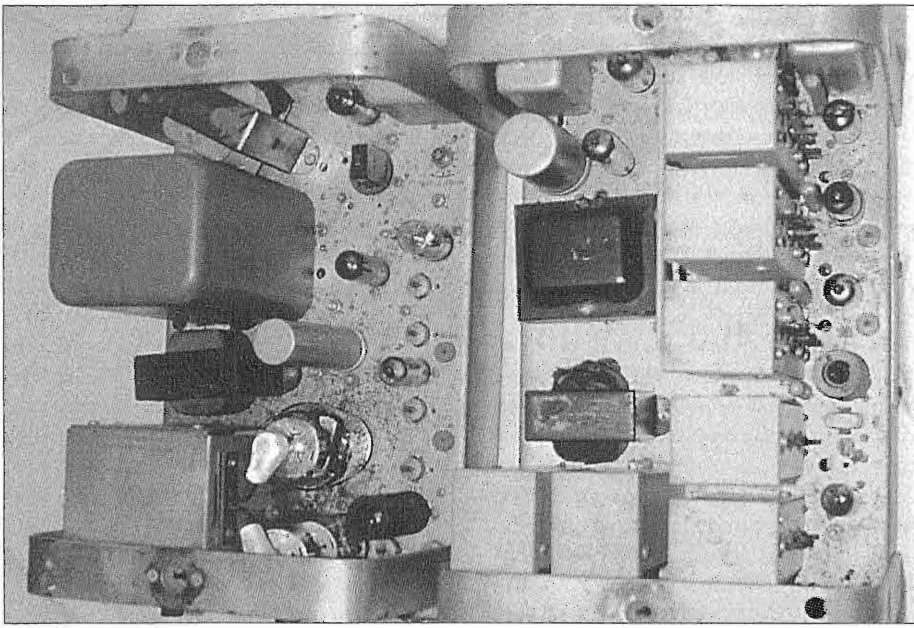
The 4ET6F5 transmitter is on the left, and to the right is the 4ER6B8 receiver.

away from them. The overall condition speaks well of the quality construction employed by GE in the late forties. A trip with the cleaned up radios to the next club meeting for a show and tell generated a lot of interest. Several of the club members work on two-way stuff and could not believe the size, weight, or power connectors of these GEs. The transmitter weighed in at 38 lbs, and the receiver at 21 lbs. These 6-volt units required 45 amps on transmit and 12 amps on receive.

With the interest generated by the old GE, a schedule was set up for the conversion to AC operation. We would start with the receiver, strip out the vibrator power supply, and bring the receiver up on 31.1 MHz (the railroad frequency) with a bench supply and make the necessary repairs to get it working, install the AC power supply, and then tune it up on 29.6 MHz. Then repeat the procedure with the transmitter. A call for help to W3LW and we got the GE schematics, courtesy of K3JPB, for the rig.

The 4ER6 receiver uses a 6BH6 RF amp, a 12AT7 crystal oscillator/mixer, a 6BH6 6-MHz 1st IF, a 12AT7 2nd crystal oscillator/mixer, a 6BH6 455 kHz 2nd IF, followed by two 6BH6 limiters at 455 kHz. A 6AQ7 discriminator is followed by a 12AX7 audio amp and a 6AQ5 power amplifier. The triode section of the 6AQ7 is a squelch noise amp and a 6AL5 is the noise rectifier. The output of the noise rectifier is balanced against the 6BH6 2nd limiter grid current for squelch, and provides cutoff bias to the 1st audio amplifier. The 1st oscillator crystal is a third overtone operating 6 MHz below the RF input, and the 2nd crystal oscillator operates on 6455 kHz.

One 12AT7 tested weak and that was it for tube problems. The tube sockets were cleaned and de-oxed, the vibrator power supply was removed and the bench power was connected. It came to life with over 2 watts of noise, and no squelch to silence it. A signal generator set on



The photo on the right shows where a transformer and a filter choke have replaced the original vibrator power supply that is no longer needed.

31.13 MHz got it quieted down, with full quieting at 1.2 µv. A check of the squelch circuit produced two 1 Meg resistors that had increased to over 1.5 Megs, and a bad 680k resistor also. By replacing the three resistors, the squelch was fine. Now the squelch would trip at .3 µv. Other than the squelch, there was nothing else wrong with the receiver. A touch up alignment didn't do a thing for the receiver. It did prove however that the receiver was as broad as a barn, 30 kHz wide, but that was OK back then as the channels were 30 kHz wide.

An old Philco AM/FM broadcast receiver power transformer and filter choke were mounted on the chassis where the vibrator supply was removed. Two silicon-diode rectifiers and a pair of 8-mfd caps were installed and wired up. The receiver worked great on 120 VAC, except after 4 hours the power transformer was very hot. A 6-volt filament transformer was mounted under the chassis, to lighten the load on the old Philco. A new crystal was installed, the RF was realigned, and the receiver could hear signals on 29.6 MHz under .2 µv and the squelch would release on .3 µv. It was a really good 10 meter FM receiver

The transmitter got much lighter and easier to work on when the dynamotor was removed, along with its 40-amp relay. Two other 6-volt relays, the antenna transfer, and keying relay were left in place. The tubes were pulled, checked, and the sockets cleaned. A 6BA6 grid-plate crystal oscillator operates at 1/16 of the output frequency. A 12AU7 is a phase modulator and doubler. A second 6BA6 is used as a quadrupler, followed by a 5763 doubler/driver. The final is a pair of 807s in parallel with parasitic suppressors in both the grid and plate leads. A 12AU7 is used as a speech amp and modulation limiter. One 807 had a loose plate cap, otherwise all the tubes checked OK. A silicon diode was connected between the AC filaments and the two 6-volt DC relays. The bench power supply was connected and the keying relay closed and we got 19 watts output on the Bird wattmeter with out touching a thing. A low output, but the bench supply was only 350 volts and this transmitter was built for a 660-volt dynamotor. Amazingly, not a thing was wrong with the unit. A carbon mike was plugged in and the audio sounded great in my IFR service monitor. Deviation was 12 kHz and the unit was 300 Hz off the old railroad frequency. If it was 1949, this transmitter was ready to go. Apparently 26 years of doorstep duty is nothing compared to riding around in the trunk of a 1949 Ford? Bolted down in the trunk of a police car, you were lucky to be on frequency with 10 watts out after 6 months.

500-volt plate and 6-volt filament transformers, along with a 300-ma filter choke were mounted in the former dynamotor location. Silicon diodes and filter caps were mounted and wired up. When 120 volts AC was applied and the unit keyed, the output was 41 watts. Plate voltage was 480 volts, so the output seemed reasonable. A 160-meter crystal, 1850 kHz, 1/16 of the output frequency, was plugged in, and the transmitter tuned up on 29.6 MHz. The RF output was 39 watts into the dummy load. The deviation was reset to 5 kHz and the modulation limiter was checked to make sure it was doing its job. With the top and bottom off of the transmitter, the output looked like a broadband jammer on the IFR spectrum display. GE had a low pass filter in the transmitter's output and with the covers on the unit it was cleaned up enough to be almost legal. We installed by bypass capacitors and chokes on the AC and keying leads and it was good to go.

I found a Sonar universal remote head that could be adapted to the GE. As a bonus, the Sonar had a 4" by 6" speaker built in, and the four-pin mike connector matched the GE carbon mike. A cable harness was built up with octal plugs to match the GE transmitter and receiver to the control head. This led to a short class on cable lacing, and the GE was ready to put W4DV on 29.6 FM. A 15' 10" center-fed dipole was hung up in a tree just in time for the fall sporadic E openings.

We worked eleven states and two Canadian districts in three weeks with a radio that had been a door step for 26 years. Everyone thinks it is a joy to operate when 10 is open. On the other hand, the ground-wave range is poor compared to what the younger set expected, but then they were brought up on 2-meter repeaters. A few mobiles have shown up on 29.6 but the activity is sparse compared to 2 meters. But, we now have a renewed interest in old radios, vacuum tubes, surplus, and a let's not be afraid to get inside a radio attitude that was missing in the club for many years. So, thanks to some unknown generous Ham with the Southern Railroad and the General Electric Commercial Equipment Division for helping the Augusta Radio Club get some new interests.

ER

Project National FB-7

Conversion of a FB-7 to a FBXA

By Bruce Howes, W1UJR
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History of the FB-7 Receiver

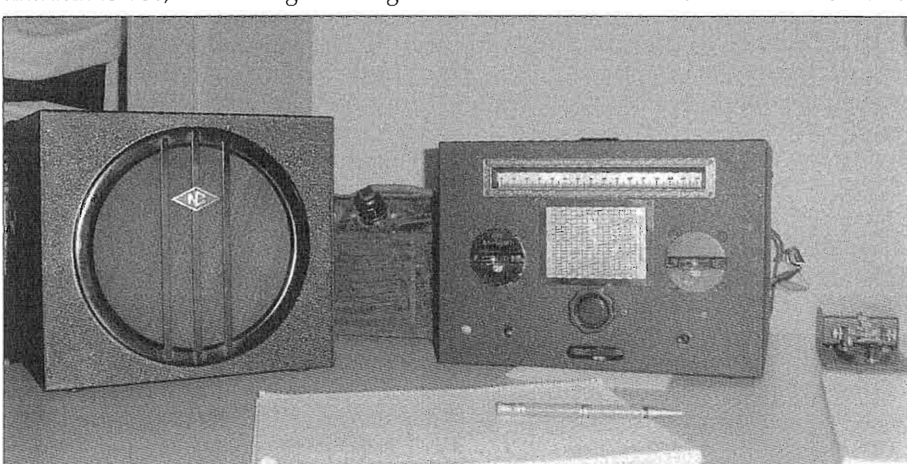
The year was 1933 and the country was still in the grips of the Great Depression. National Radio, based in Malden, MA, had just introduced a new receiver, the National FB-7. The FB-7 was indeed a wonderful receiver for its day. Essentially, it was a low cost version of the famous but expensive National AGS set which National supplied to the commercial aviation industry. In 1933 the radio amateur could buy a new FB-7, complete with one set of coils, for fifty-five dollars. National designed the FB-7 as a single conversion superhetrodyne, with one stage of RF amplification and two stages of IF; the design had only a few minor variations during its production life.

Although somewhat rare, you can still find the FB-7 today at flea markets, or in my case, stored away in someone's basement. The receivers are simple to service and fun to use, but the big challenge is locating coils for additional bands. The receiver is capable of general coverage, coils were available to cover 800 kHz to 34 MHz, and band-spread coils were made for the 20, 40, 80, and 160 meter ham bands. Back in 1933, National sold the coils for $10 per pair, and blank forms could be had for a mere $3.65 each. Today, the XR-39 coil form is nearly impossible to find and many owners resort to rewinding coil forms for other bands.

My Project

This project began after I purchased a rough looking National FBXA receiver from a local radio collector. National seems to have been inconsistent with the use of the designation "FBXA", for FBX, FBX, FB-XA, FBXA all appear in National ad's and publications.

The FBXA is essentially a National FB-7 with the addition of a crystal filter unit. The "front end" of the FB-7 is rather



The freshly restored National FB-7 prior to starting the project.

wide, so the crystal filter certainly helps during crowded band conditions and CW work. The FB-7s came from National prepped for installation of this filter, the owner had only to remove the 1st-IF can, drop the crystal filter unit in its place, and solder two connections.

For reasons which escape me, one of the previous owners of this FBXA had drilled multiple holes in the cabinet, removed parts, even spray painted over the black crackle finish. The unit was a real mess, but thankfully the National crystal filter unit was complete and undamaged. Whenever possible I try to restore and not part out old radios, but given its rough condition and already owning two FB-7s, I felt comfortable designating this FBXA a parts rig to keep my other two going.

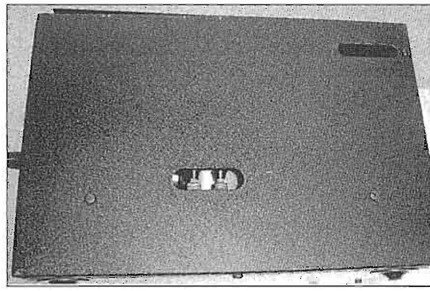
I had a recently restored a nice National FB-7 receiver and entertained the conversion of this receiver into a FBXA, so I was very curious how well the crystal filter unit from the FBXA would work. My plan is to use this receiver for Antique Wireless Association contests this winter, paired with a 1934 era homebrew transmitter which I picked up earlier this year.

After a month of consideration, I put aside any feelings of guilt and the rough FBXA radio became a donor to supply the crystal filter unit to the FB-7 I had recently restored. So, on a rainy Saturday afternoon in September 2003, the FBXA went under the knife - actually the soldering iron.

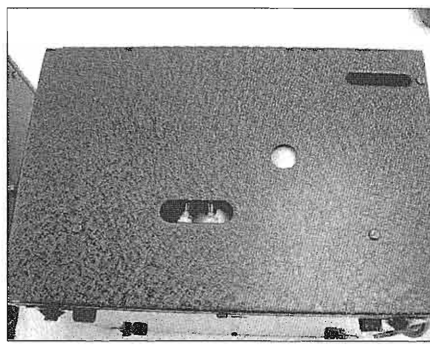
So It Begins

I currently own three FB-7s, but the one which I restored did not have the required opening in the side cabinet for the crystal filter switch. You can see by the photos that the radio on the left has the slot for the thumbwheel used for selectivity adjustment, but it does not have the small opening in the middle of the cabinet for the three-position switch.

Using the second radio, which does have such an opening, I created a template to modify the first radio. Normally the modification of a 70-year old radio is a sacrilege to me, but in this case the modification was an accepted factory upgrade to the FB-7, so I felt I was doing justice to the fine radio. I went about the process in a very methodical way as I wanted to make certain that I did not do a disservice to this old timer and desired to make my workmanship undetectable from a factory job.

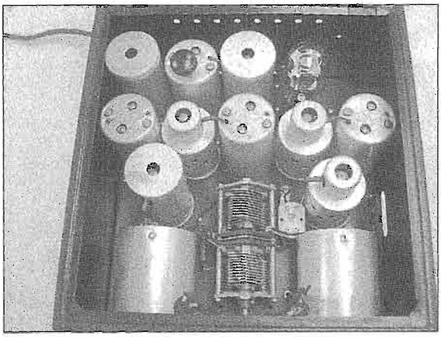


Th FB-7 side panel above has a slot for the thumbwheel selectivity adjustment, but has no round hole for the switch, as the photo just below shows.

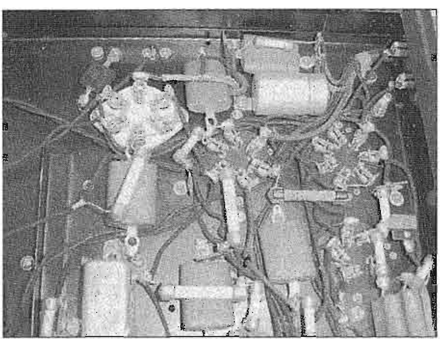


Once cabinet side was center punched, I carefully drilled and then deburred the opening with a hand file. After the filing, with the hole now looking like it was machine punched, I used flat black paint on the bare metal of the opening to match the cabinet. This took some time, but once done, I could not tell my handiwork from a panel stamped out by National.

Installing the FBXA Crystal Filter in the FB-7



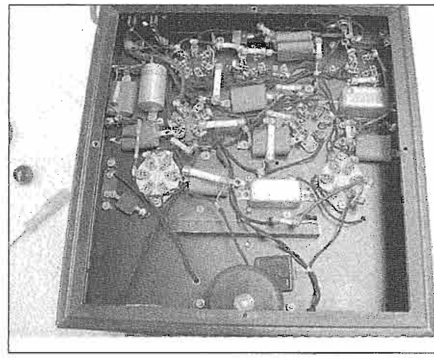
The upgraded FBXA crystal filter unit mounts in place of the 1st IF can on the far right of the FB-7 receiver pictured above.



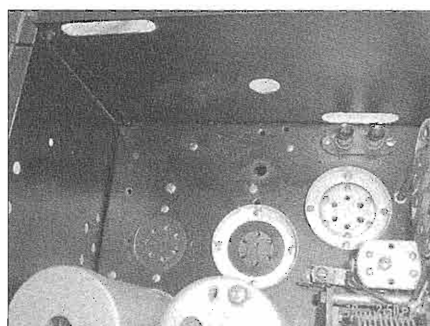
The underside view of the FB-7 before removal of the IF can. For clearance reasons, this IF can needs to be removed prior to drilling the cabinet. It looks rather packed in there, but it does come right out.

To remove the IF can, turn the receiver upside down on a padded surface. Now take off the bottom cover for the receiver and locate the red, black and blue wires that enter the underside via a rubber grommet from the IF can. Unsolder these three wires and straighten them for removal. Now look for two small 1/4" nuts on either side of the IF can. Remove the nuts and small lock washers from below and the IF assembly should fall out into your hands.

The crystal filter was a factory option,



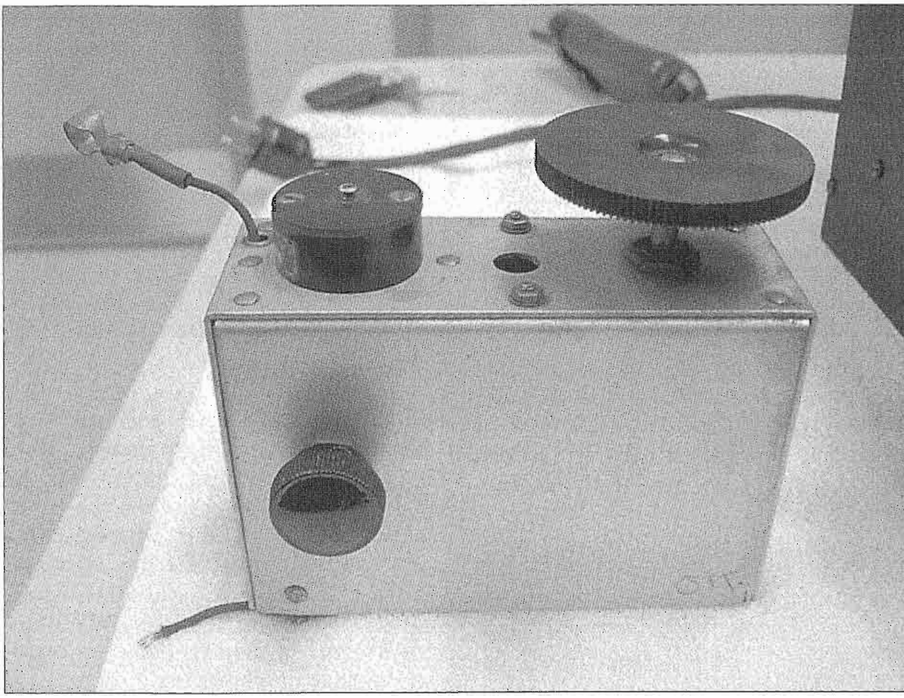
This is the overall view of the FB-7 underside, well worth a closer look, certainly pretty simple compared to today's solid state rigs. When was the last time you saw resistors, the tubular white units, hand numbered with a pen? Overall this unit has survived the last 70 years quite well, it is thankfully free of modifications and sloppy workmanship, which made my restoration that much easier.



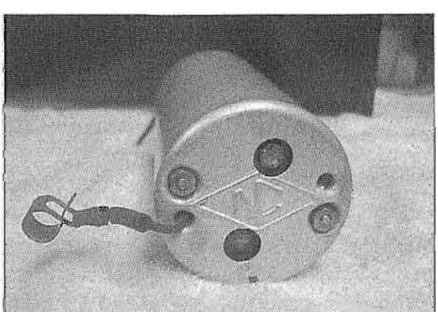
With the IF can removed from the chassis, you can see the mounting holes used for the crystal filter unit. You can see my newly added circular opening in the photo to the right.

With the opening in place, carefully filed and painted to match the cabinet, I next removed the vacuum tubes and shields around the opening to allow plenty of room to install the National stal filter unit.

This particular unit had a problem with the air variable capacitor used in the



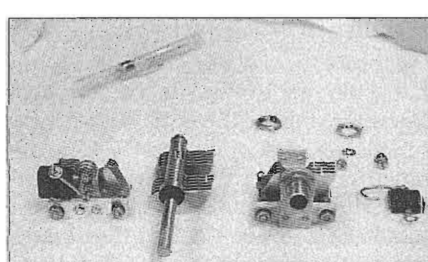
The National FBXA crystal filter unit as removed from the donor radio. I carefully cleaned and inspected this unit prior to installation. The crystal sits on the front of the unit, the selectivity control is on the rear, and the three-position switch on the side extends through the cabinet.



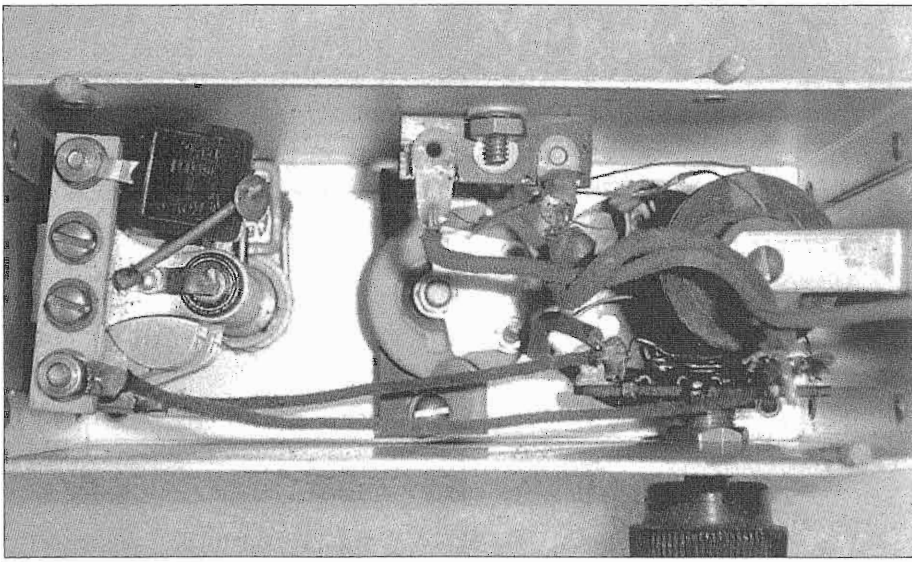
Here is the removed 1st IF can, saved for future use.

selectivity control. The shaft was binding and required a great deal of effort to rotate. I would imagine that this problem occurred due to a lack of use, as I understand the unit had been sitting unused for at least 2 decades!

To rectify the binding, I needed to remove and disassemble the air variable capacitor. Removal from the housing was a snap; there was only one large mounting nut on the top retaining it. With the nut removed, I could now move the air variable out of the housing and desolder the two leads attached to the plates. Now the unit was free to be placed on the bench and inspected.

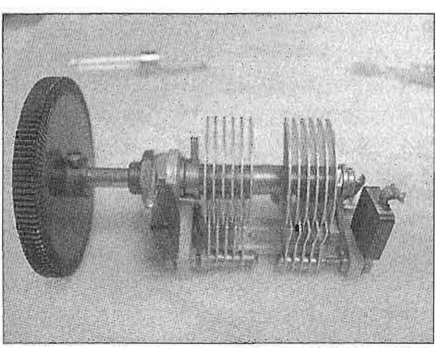


The disassembled tuning capacitor.



The bottom view of the National FBXA crystal filter unit as removed from the receiver. The switch on the side of the unit has three positions. The counter-clockwise position, as viewed from the side of the receiver, places the crystal in parallel. The middle switch position connects the crystal in series for "single signal" reception, ideal for CW work. The fully clockwise or right position removes the crystal from the circuit, and restores operation like the plain FB-7, ideal for AM reception.

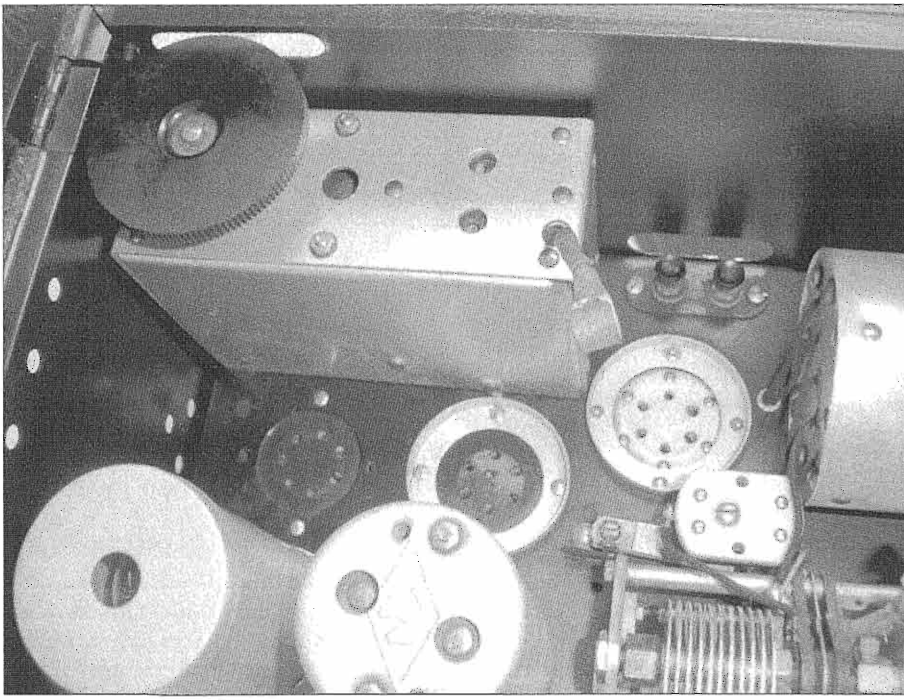
Surprisingly, the air variable capacitor proved somewhat easy to disassemble for cleaning and lubrication. The construction is really first-rate, with individual adjustments for plate spacing on each side; they just don't build them like that anyone.



The cleaned and lubricated air variable is ready for installation back into the filter unit. Note the two fixed mica capacitors on the front and rear of the unit.

One needs to be careful not to bend or distort the plates during the disassembly process. Once I had removed the two flat head screws that retained the rear stator plate, I was able to pull the rotor shaft from the unit. Before removal of the rotor unit I inspected shaft and had to deburr two small gouges at the end where the knob set screw had rested. With the shaft removed, I used a small round file to clean the shaft bushing on the front of the unit. It seems this bushing had shrunk over the years, it appears to be made of some sort of plastic material, and the shrinkage had created the binding issue. After a light clean up with the file, a touch of lubricant on the contact points was applied, and the unit reassembled.

Before reinstallation into the filter unit I checked my work with an ohmmeter while rotating the air variable as I wanted



Here is the National FBXA crystal filter unit installed in the former FB-7 receiver.

to be certain that none of the plates were touching. With a successful test, I soldered the two leads back onto the air variable and installed it back into the crystal filter unit housing.

Installation was quite straightforward; however the unit must be tipped away from the panel to allow the mounting studs to enter the chassis. Once the studs have entered the chassis, you can now tip the crystal filter unit to the outside panel and install the retaining screw on the rear panel.

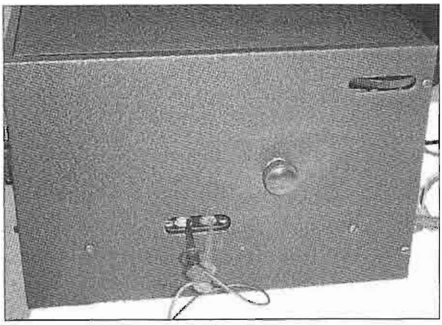
The crystal filter unit mounts with three bolts that are attached to its housing and stick down below the deck. A flat head screw secures the unit on the rear panel. Only two connections, a red and a blue/green wire need to be soldered to install the crystal filter unit. Use one lock washer and one 1/4" nut under each of the crystal filter unit mounting bolts.

With the transplanted crystal filter unit in place, I soldered the two wires from the unit into the receiver, installed the tubes, tube shields and grid connections.

One thing I noted on the crystal filter unit after installation is that the switch does not sit in the absolute center of the opening on the side of the cabinet. I thought perhaps I had made an error in my template and doubled checked my other two FB-7s. I was relived to find that both have the switch sitting to the lower right of the opening. After some consideration, I realized that National had perhaps done this intentionally as the crystal filter unit needs to be tilted for installation and the extra space at the top allows the switch shaft to fit through the side of the cabinet.

I carefully installed the receiver into the receiving position. The National FB series are simple receivers and need only power, antenna and speaker lead connections.

My FB-7 has the 2.5 volt filament tubes and fortunately I had a spare National



The crystal filter has been mounted and the 3-position switch is shown in position on the side panel.

"doghouse" power supply that would do the trick. As this was a Depression-era receiver, many hams homebrewed their own power supplies as a cost saving measure. The power requirements are rather simple, 2.5 volts (6.3 on later units) for the filament and 180 volts for the B plus.

Unlike the later HRO series, National made no provision on the rear panel to interrupt the receiver's B plus supply, instead the operator must throw the left toggle switch on the front panel to break the B plus for transmission. The right toggle switch serves to turn on the BFO for CW reception.

It has taken nearly 3/4 of a century since it was first sold, but this FB-7 has now graduated into National FBXA.

The moment of truth at hand, I flipped on the power switch and the receiver came to life. After some tweaking of the dial, I was soon sipping my coffee and listening to New England AM group on 3885 kHz.

I should mention that the alignment of the receiver, and in particular the crystal filter unit, is not quite as straightforward as the radio itself. Indeed, National devotes at least one full page to just the alignment of the crystal filter unit! With some additional tweaking and alignment later carried out at the QTH of Larry Szendrei (NE1S), the FB-7 has now joined the line up at station W1UJR.

All in all, not a bad project for a rainy Saturday afternoon!

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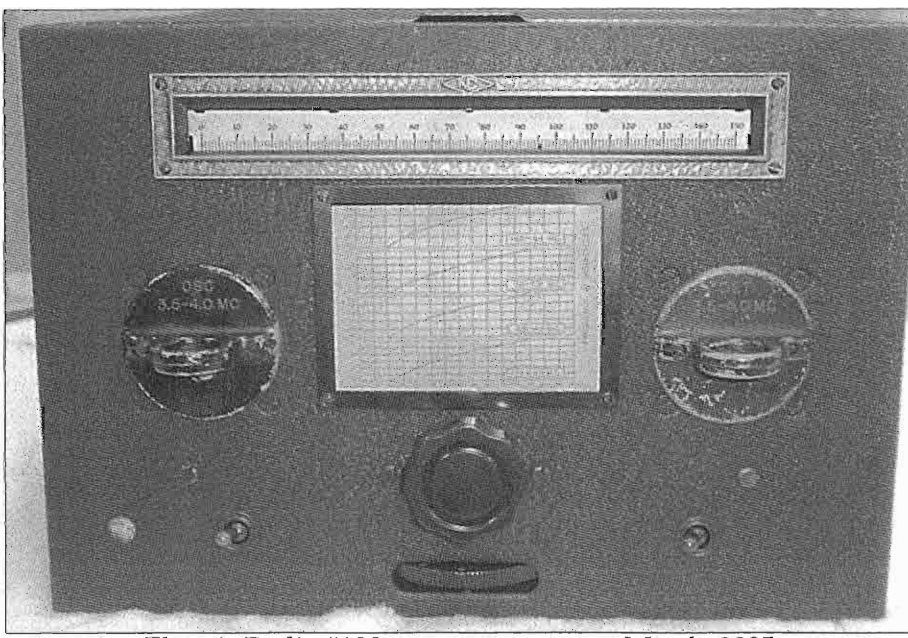

Reconstruction of a Knight DX-er

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This construction project began with the lucky find of a Knight DX-er at a Southern California Antique Radio Society (SCARS) swap meet. Unfortunately, this DX-er had been completely modified with non-original parts in a crude attempt at transistorization. The only original parts left were the front panel, the knobs and the chassis with its antenna/ground and phone terminals on its back panel. The chassis was badly bent and work-hardened in the center, apparently due to the force of repeated insertion and extraction of tubes and/or the plug-in coils. The only way to straighten out the chassis would have been to completely strip it of parts and hammer it flat again. The non-original plug-in coils that came with the deal were somewhat crudely hand-wound on a variety of used coil forms with the wires held in the coil pins by wedging inch-and-a-half long finishing nails into the pins on the insides of the forms and leaving these nails soldered in place (gives a whole new meaning to the term iron-core coil). I decided to strip and refurbish these coil forms for use in future projects

Figure 1: Front view of the reconstructed battery DX-er.

and save only the DX-er's original front panel. I gave the rest of the set to John Hurst (KU6X) who had expressed an interest in it at the same SCARS meet where I bought it.

My newly reconstructed DX-er uses generic components from my junk box that are more-or-less identical to those supplied in the original DX-er kits, and a newly fabricated chassis. After measuring all the pertinent dimensions of the old chassis, I cut, punched, drilled and bent the new chassis out of a piece of painted steel, .031" thick, using my own metal- working machinery. This piece of sheet steel was retrieved from the trash after having been tossed there by my air conditioning contractor. It was a large knockout from the plenum chamber of my recently installed A/C system.

I deviated from the original design to correct what I consider to be two design defects. First, to strengthen the chassis against the severe bending that the original had experienced, while preserving its open-sided appearance, I bent half-inch flanges in its sides. Second, I installed a 4-pin battery connector on the rear of the chassis in lieu of the battery leads that poke out of the open right-side of the original. This makes a much neater installation and prevents strain on the regeneration control and on/off switch lugs where the battery leads terminate. Such strain can occur when the original DX-er is moved around the bench and the battery leads are plugged into a heavy set of batteries (two 45-Volt, B-batteries and a 1.5-Volt, A-battery) or a power supply. I made a 4-wire battery cable with battery plugs identical to the original on one end, and a 4-pin battery socket on the other end to mate with the battery plug that I installed on the back panel of the chassis. These plugs and socket were liberated from an old portable radio and a dead A/B battery pack. Other than these two modifications, the reconstructed DX-er conforms to the original in every way. Under-chassis wiring was done exactly as shown in the pictorial wiring diagrams that are reproduced in the following articles:

The Ocean Hopper, News Letter No. 3, April 1992.
CQ Magazine, March 1994, pg. 110.
Popular Electronics Magazine, March 1952, pg. 25.
Radio-TV Experimenter, Vol. 2, 1952, pg. 139.

The latter article includes complete dimensional data for the chassis and panel and sufficient additional information for you to be able to construct an exact replica of the DX-er from scratch. It even includes instructions for adding a 3V4 audio power amplifier tube to complement the pair of 1S5 tubes used in the set. Additional data may be found in various Allied Radio catalogs and, of course, the original DX-er manual if you can ever find one. The photos in these articles and catalogs (except for the CQ article) show 4-pin plug-in coils which appear to be identical to 1-1/2 inch diameter by 2 inch long, round (not ribbed) ICA/Philmore coils made of black or brown bakelite. The coils shown in the CQ article appear to be 5-pin Ocean Hopper coils. These may work in a DX-er if you change the coil socket from 4-pin to 5-pin. However, I have not tried this as I found a complete set of ICA 4-pin coils at one of the annual Fort Tuttle, AZ, hamfests. These latter coils work perfectly in my reconstructed DX-er. Note that the front panel layout in the CQ article is turned 90 degrees with respect to the markings. The actual battery DX-er panel is taller than it is wide (5-1/2" by 5") with the center of the bandset shaft hole two inches below the top of the panel and the centers of the bandspread and regeneration shaft holes three inches apart and one inch above the bottom of the panel. My original front panel does not have dial scale markings for the bandspread tuning capacitor, as shown

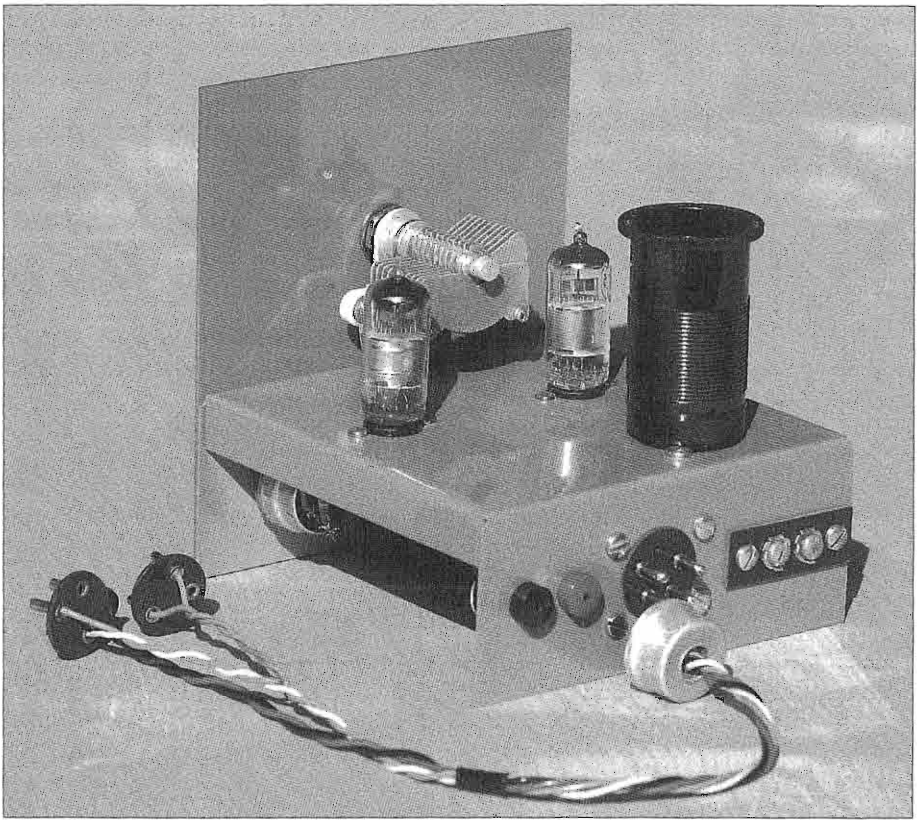

Figure 2: Showing new chassis side-flange (there's one on each side) and new battery cable and mating chassis connector.

in the CQ article, but only the label BANDSPREAD, and the bandset capacitor is labeled MAIN TUNING.

Operation of the battery DX-er is the same as other receivers of this general type including the somewhat irritating requirement for having to constantly readjust the regeneration control as you tune across a band due to the increase in feedback that naturally occurs as you tune higher in frequency. I usually set the regeneration control just past the point of oscillation (you hear whistles in the earphones) and then tune the desired station to zero beat. Then I reduce the regeneration to just below the point of oscillation. As anyone who has built a 2-tube regenerative set will tell you, the performance of these little sets is amazing. My thanks to Steve Barnes (K6PFW) for lending me his set of "Ocean Hopper" news letters including the one with the Knight Battery DX-er article.

[Editor's note: The author's prize-winning "Fontana" regen receiver will be featured as a construction project in upcoming issues of Electric Radio.]

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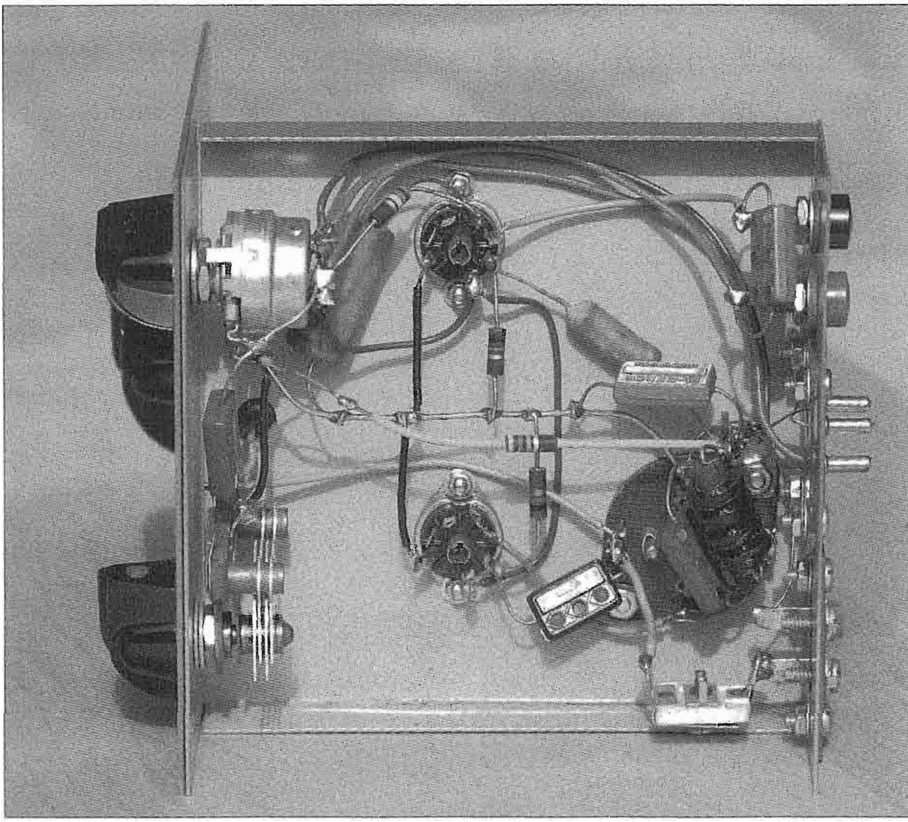

Figure 3: Under-chassis wiring is same as original except for new battery connector.

ALLIED RADIO CORPORATION
CHICAGO

Milestones in the History of Amateur Radio

Why and How Amateurs in the 1920s Supplanted "de" with New Intermediate Designations

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The first International Radiotelegraphic Convention, which was held in London in the summer of 1912, distributed call-letter prefixes to participant nations. The United States was assigned K, N, and W; it was permitted to use all three and four letter combinations beginning, respectively, with the letters N and W, and all combinations from KDA to KZZ, inclusive. The N combinations were reserved for Government stations; the W and K combinations were used for military services, coastal and ship stations, and stations open to public and limited commercial activity. Amateur radio did not figure in the treaty assignments ("Department of Commerce," 1920).

On August 13, 1912, the U. S. Congress ratified the provisions of the international treaty and, simultaneously, passed an act to regulate radio communications in the United States. The Act was administered by the Bureau of Navigation, Department of Commerce, under the auspices of the Secretary of Commerce. It prevailed from 1912 until 1927, when the Federal Radio Commission was created. To facilitate administration of the Act, The Department of Commerce established nine radio districts strategically located throughout the United States. Applicants, including amateurs, for transmitter licenses dealt directly with the Radio Inspector of the District in which the station would be located.

Prior to 1912, amateur telegraphy stations shared the known radio spectrum on a functional basis with commercial, military, and maritime stations. Many amateurs possessed more powerful stations than those used by the Navy and commercial services, and, according to DeSoto (1936, p. 28), many of them generated "murderous interference," all the while showing wanton disregard, even contempt, for the hapless commercial operators attempting to do their jobs. Amateurs, however, were relatively disorganized and possessed limited economic clout. As a consequence, when the time came to prepare legislation to regulate the airwaves, it was payback time, and lobbyists nearly managed to write amateur radio out of existence. It was believed in 1912 that the effectiveness of radio transmissions increased in direct proportion to the length of their wavelengths; military and commercial stations were thus allocated long waves, somewhere in the range of 20,000 (15 kHz) to 700 (428.57 kHz) meters. Amateurs, on the other hand, "were limited to one or two wavelengths [around 200 meters] in a region provenly incapable of giving reliable communication except at great inefficiency and over short distances" (DeSoto, 1936, p. 32).

The bureaucrats assumed that the amateur cohort would soon wither away. Consequently, in the absence of international treaty provisions, an amateur who applied for a license was simply assigned call letters prefaced by a number prefix, from one to nine, which corresponded to the region where the station would be located. Other countries also often divided themselves by regions and assigned amateur call letters accordingly. A decade later, to the surprise of many radio entrepreneurs, the ranks of amateurs worldwide had grown enormously. By 1923-24, as amateurs began to migrate legally to wavelengths near 100 meters for reliable transcontinental, transequatorial, and transoceanic contacts, the preponderance of similar call letters was beginning to create chaos. The locations and origins of amateur signals were becoming indistinguishable from one another. The need for distinction had become acute because DX work was now the prevalent modus operandi. For example, at the beginning of transcontinental DX, 1ZD would have known that 7SC was farther away than 2AL. When the range of DX expanded, each of the stations, respectively, might have been instead in Great Britain, Sweden, or France.

A popular, informal solution adopted briefly by amateurs involved prefixing their assigned call designations with a letter representing the country in which they lived, e.g., 1ZD might sign as u1ZD, 2AL as c2AL, and 8AB as f8AB, signifying that they were located respectively, in the United States, Canada, and France. The scheme was short-lived, however, since many governments, including that of the United States, would not permit amateurs to alter their officially issued call designations. Critics also argued that (a) confusion would arise if amateurs around the world chose to use the same prefix letter, (b) length of three letter calls would increase by 25 percent and two letter calls by 33 percent, and (c) prefix letters might be transposed readily by receiving stations so as to constitute the last letter of a call, to wit, u1ZD might be logged as 1ZDU (Service, 1923, p. 20).

These objections led the ARRL Board of directors to propose a modification in the venerable "intermediate" or "interval" "de" designation, which had long been the traditional method by which radio telegraph operators separated stations being called from those calling. The Board asked: What might "be a perfectly workable scheme that amateurs worldwide could agree upon and put into practice?" It thus determined that the scheme must conform to the following six criteria: ensure identification of both call and nationality of stations in a two-way contact, exclude arbitrary signs, be convenient for amateurs of all nations, not change government assigned calls, not lengthen current operating practices, and must accommodate present and future needs of amateurs until an international radio conference resolved the issue.

The Board proceeded to develop a survey, which was sent to "every representative radio club, amateur organization or prominent amateur of every country of which we knew at the time for an expression of opinion, constructive criticism, or counter proposal" (Service, 1923, p. 19). Eleven countries were "scoured." Fifteen pounds of letters from "hundreds of thinking amateurs" produced a consensual, unified international plan for identifying all amateur signals, no matter what their nationality.

The plan derived from the survey generated a new intermediate to supersede "de" in amateur communications. To create a foundation for the new intermediate, each of the countries worldwide with a population of active amateurs was assigned in English an arbitrary identifying letter. The national identifiers were to be configured in the new intermediate so that the nationality of a station being called would be distinguished from that of a station calling.

Fourteen countries were assigned a national identifying letter initially; the twelve remaining letters of the alphabet were left unassigned for future allocations. Eleven of the fourteen countries obtained a letter that corresponded with the first letter for spelling the name of the country in English, e.g., A—Australia, C—Canada, F—France, G—Great Britain, I—Italy, M—Mexico, N—Netherlands, P—Portugal, S—Spain, U—United States, and L—New Zealand. Two countries were assigned letters phonetically, e.g., Q—Cuba and R—Argentina. One country, South Africa, was assigned "O," a letter having no significance. The ARRL acknowledged that the twelve remaining letters were insufficient to cover all other countries, but since not every one of them "boasted" an amateur, the supply of twelve should last "for five years or so"—at least until another International Radiotelegraphic Convention convenes.

Here is how the national identifying letters constituted the new intermediate: (1) when an amateur called another amateur in the same country, the letter of that country functioned as the intermediate, to wit, 1ZD would call 7SC like this: "7SC, 7SC, 7SC u 1ZD, 1ZD, 1ZD." The two stations in communication with one another would use only "u" as the intermediate. (2) When 1ZD, United States, called 2AL, Canada, he or she would send "2AL, 2AL, 2AL cu 1ZD, 1ZD, 1ZD"; conversely, when Canadian 2AL stood by for 1ZD, he or she would send "1ZD uc 2AL". The two different nationalities in communication with one another would use the national identifier of each country.

Note particularly that the letter of the country called came first; the letter of the calling country came second. By reversing the position of the two letters of the intermediate, the nationality of the station being called was distinguished from that of the station calling. Hence, a few rules made it relatively easy to use the scheme (Service, 1923, p.20-21).

It appears to have worked satisfactorily until late in the decade, when another "International Radiotelegraph Conference was convened in Washington, D.C., November, 1927. Two-hundred delegates, representing 55 countries and 23 dominions and territories, met eight weeks in exhaustive sessions. Kenneth B. Warner, ARRL and International Amateur Radio Union secretary, attended for the entire eight weeks. Afterwards, he proudly proclaimed that "the preservation of amateur radio on the face of the earth to-day is very largely attributable to the efforts of the United States Delegation" (Warner, 1928a, p. 16.)

Conference members acknowledged that amateur radio possessed permanent, institutionalized status within the governments of the world and that it had legitimate claim to frequency allocations in the radio spectrum. One of the more significant regulations, Article 14, stated that "fixed, land, and mobile stations . . . as well as private experimental stations must have a call signal from the international series assigned to each country. . . . The first letter or the first letters of the call signals shall identify the nationality of the stations" (Warner, 1928b, p. 29). The regulations also specified a return to the venerable intermediate "de." Warner (1928b) thus asserted that since call designations would now indicate nationality, use of the amateur intermediates, so carefully worked out in 1923, should be discontinued.

Warner (1928c, p.35) noted in QST that amateur calls in the United States were changing. He said that the League had suggested that the calls of amateurs in the continental United States begin with the letter "W," and that those in distant territories and possessions begin with the letter "K," in order to distinguish Alaskan, Puerto Rican, and Hawaiian stations. Warner reported, too, that renewal licenses were coming back with the letter "W" in front of the call. He also emphasized that "let's not have any foolish business of prefixing "W" or "K" to calls until they are individually changed, or a proclamation is issued by the Government. "We must individually sign just what our licenses read until they are officially changed."

Subsequently, the Radio Division of the Department of Commerce announced that effective October 1, 1928, all amateur station call designations were changed by prefixing existing calls with a letter to indicate nationality, as required by the Washington Convention. The prefix "W" was to be used for stations in the continental United States; "K" was to be used in territories and possessions (Warner, 1928d, p. 43).

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Warner, K. B. (1928b, February). Extracts from the Washington Convention. QST, 15, 28-29.

Warner, K. B. (1928c, August). Amateur Calls Changing. QST, 12, 35.

Warner, K. B. (1928d, September). Washington Developments. QST, 12, 43-45.

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[...Comments, from page 1]

making on-the-record statements that are nonsense, that interference testing done to date proves nothing, and that not one single interference complaint has been resolved. They openly accuse the FCC of "sweeping interference complaints under the rug."

The major body headings of the ARRL document give a good idea of the League's position on the BPL situation:

I. This Proceeding is Tainted by Evidence of Prejudgment

II. Chairman Powell Should Have Recused Himself from This Proceeding And His Failure to Do So Tainted the Proceeding.

III. The Commission's FOIA Responses, Late and Incomplete, Demonstrate the Absence of Any Support for Its Conclusions Regarding Interference to Amateur and Other Licensed Services

IV. The Report and Order Fails to Substantively Evaluate The Interference Potential of BPL

V. The Commission, in Adopting an **Unlawful Balancing Test**, Unreasonably Discriminated among Licensed Services in Terms of Interference Protection

VI. Interference "Mitigation" Rules are Ineffective and Are Applied Inequitably

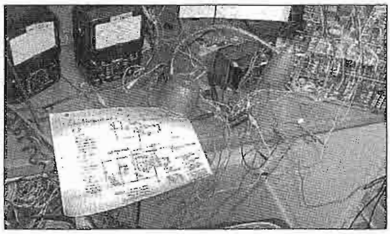
VII. The Commission has Failed to Respond to Harmful Interference Complaints from BPL Test Sites

VII. The Commission's Adopted Measurement Standards Are Incorrect

I have tried to be reasonable about BPL, but as I read the statements and footnotes under each heading, I became increasingly disturbed about what looks like a BPL con job. Allegations about FCC making up its mind about accepting BPL without substantial regulations no matter what the effect would be, and before any hearings occurred are made. It accuses Chairman Powell, in his "self-appointed" role of a BPL "Cheerleader" of using a media blitz before hearings or testing were done to promote BPL for

[Continued on page 47...]

The Restoration Corner



The Invisible Switch

By Joe Sloss, K7MKS
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Bellevue, WA 98006

No doubt many of us who cherish tube type receivers have wondered what frequency we are listening to. Comments such as "Is this 3885?" and "Where is the band edge?" are commonly heard as we tune our favorite SX-71, SX-96, or NC-183D and numerous other treasures from bygone days. Being aware that a crystal calibrator will solve this problem, we are now faced with the task of turning it "On" and "Off," hopefully without adding switches or drilling holes in the panel or the case.

I recalled that my Hallicrafters S-40A had a SPST switch which turned "On" with the RF gain fully clockwise. This was used to turn on the external S-meter accessory on and off. A quick check of the parts bin turned up a spare RF gain pot with the switch; the value matched that of the RF gain pot in my SX-96. A few minutes with a small soldering iron and I had my calibrator "On" and "Off" switch installed--truly an invisible switch!

I've incorporated the same scheme in an SX-71. In this instance a push-pull SPDT switch was used as part of the Tone control. A quick pull of this switch gives calibrator marks throughout the receiver's tuning range.

The Restoration Corner can run only if your restoration topics are sent in to Electric Radio!

Most vintage receivers have several potentiometers that can be replaced with a switched unit. Give it a try and know where you are!

Triplett 630 Battery Replacement

By C. David Miller, K7ALR
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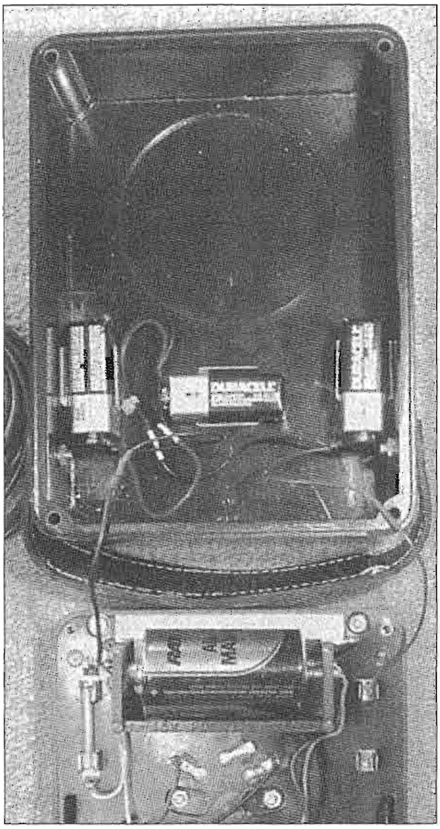
The Triplett 630 series multimeters are among the finest VOMs ever made, in my opinion. So, when I had an opportunity to purchase a model 630 APL at a hamfest for a very reasonable price, I bought it. The 630s use a 30-volt battery for the resistance ranges of x100K and above. This is very useful for checking a high voltage rectifier diode stack as the usual 1.5-volt ohmmeter source will not overcome the normal forward bias voltage drop of the stack. The battery is a carbon-zinc NEDA 210 type, or Eveready® No. 413 currently available at specialized battery shops or special order from Radio Shack® for about $15.00.

I really don't care for this battery because of its limited availability, price, poor storage characteristics and being subject to electrolyte leakage. As there is



The new 9-volt battery clips are shown above, glued to the instrument case. Also shown is the wooden block supporting the "D" cell battery.

ample room inside the case, I installed three series-connected, nine-volt alkaline batteries as shown. I used two-part epoxy glue to secure the battery clips to the case. Use care to position the batteries so that they are clear of all meter circuitry. I also placed a wooden block, made to the size of the original 30-volt battery, in the battery holder to support the 1.5-volt "D" cell installed on top of it.

The 27 volts from the three new batteries is more than sufficient to zero the ohmmeter. These batteries will last a very long time, and if they ever need to be changed, replacements are easily and cheaply available.

Collins Receiver Remote-Standby Function

By Tom Marcellino, W3BYM
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The Collins 51J-4 is a very well known receiver. I've used this fine radio for several years and at one time I was the proud owner of two units. If it had any fault I would have to say it was the remote-standby function. Now, saying this was a fault is really stretching things, but when used with transmitters not having the mute relay voltage required one additional power source. This meant building two external power supplies, one for each 51J-4, and controlling them with the TR relay. This worked fine but required extra boxes and cables.

The 51J-4 uses a DPDT, 12-volt coil relay for muting with the coil wires connected to a rear panel terminal strip. In normal use with the "proper" transmitter, terminal 1 is connected to receiver ground, and terminals 2 & 3 are connected in series with a source of voltage and a set of normally open contacts on the carrier control relay of the transmitter in order to silence the receiver. When this relay is energized, one set of contacts shorts the antenna to ground and the other set ultimately removes plate voltage from the three I.F. stages.

Well, that's the problem. None of my transmitters have been setup with a switchable 12-volt function available on transmit. My solution to this small problem was to "steal" some power from the 6.3-volt filament supply in the 51J-4. To be exact, power was taken from the filament pins of V114, a 6BA6. The circuit shows a voltage doubler that will operate the relay. All the parts for this doubler were mounted to a five-position terminal strip. The coil wire that was connected to terminal 3 on the rear is disconnected and connected to the plus 12-

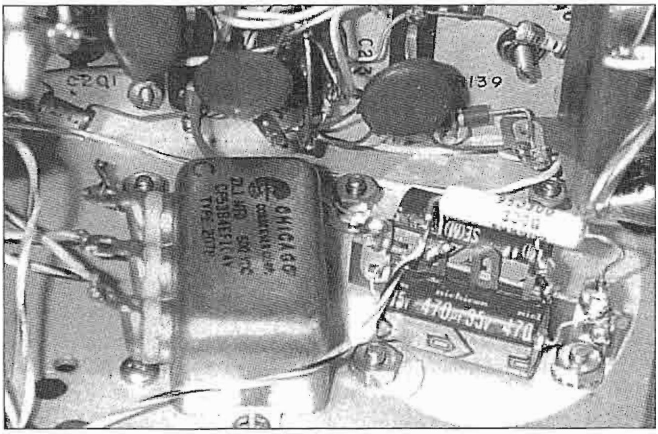


Figure 1: The new parts for the 51J-4 relay are mounted just to the right of the oil-filled capacitorin the highlight area.

volt doubler. Now, the remote-standby relay operates using an external connection from terminal 2 to terminal 1. This external connection is the spare set of contacts on my TR relay.

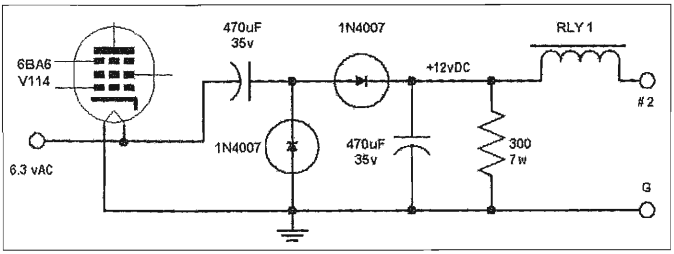


Figure 2: Schematic of the W3BYM relay power supply for the 51J-4 receiver remote-standby function.

Vacuum Rectifier Replacements

By Bill Pancake, WDØX
1139 Ancestra Dr.
Fountain, CO 80817

Before I even start, please know that I have no connection whatsoever with Ted Weber or any interest in his company that makes "Copper Cap" Solid State Plug-In (Octal Base) Rectifiers. I've used his tube rectifier replacements with great success for several years now and am just a satisfied customer, no more, no less.

With that said, using a solid state replacement for a tube rectifier eliminates the need for the filament/ heater voltage on that rectifier tube or tubes Not using the rectifier filament windings from the power transformer helps prevent a filament-winding-to-high-voltage-secondary short, which is all too common as the winding's insulation breaks down with age. Plus, you also now have a power transformer that runs somewhat cooler.

These copper cap units are a "drop-in", octal base replacement for vacuum tube rectifiers (e.g., 5R4, 5U4, 5Y3, etc) and are engineered so that they have the same voltage characteristics as the vacuum tube they replace. The bottom line is that they work exactly as their vacuum tube cousins do!

My current project involves completely restoring my aging (40 year old) Collins 516F-2 power supply. I completely re-capped it, replaced the selenium bias rectifier with a 1N4007 silicon diode (plus a 47 ohm, 1 watt series resistor on the A/ C side as suggested by many folks on this list...thanks!) and installed Weber Copper Cap plug-in rectifiers for the 5R4 and the 5U4 rectifier tubes to help "save" the power transformer from a premature death.

Because of the always great advice I receive from Al Parker (W8UT), I disconnected the filament wires for each tube rectifier at the tube sockets (pins #2 & #8) and insulated the ends with some shrink tubing. Removing the filament wires from the socket pins keeps the HV from appearing on the filament windings. A must if you want to save that power transformer.

There is one thing to remember depending on how your particular power supply is built. The high voltage leads of the power supply will either be connected to pin #2 (like the 5U4) or pin #8 (like the 5R4) of the rectifier tube sockets. The copper cap rectifier is internally wired to have the power supply HV output connected to pin #8 (no connection on pin #2 inside the copper cap). For the 5U4 tube you will have to move the HV lead from pin #2 over to pin #8 to make it all work correctly. This is the only minor "re-wire" needed.

With the idea of preserving your boatanchor's aging parts, it is always recommended that your line voltage be close to the manufacturers recommendation (usually 115-117 VAC) and that a "soft-start" device of some sort be used to gradually bring up the line voltage during the first minute or so of "power on" application.

If you've ever heard your boatanchor's power transformer iron go "thud" when you throw the switch to ON, consider the enormous stress and eventual damage that instantaneous inrush power surge creates while the tubes, etc. are stone cold.

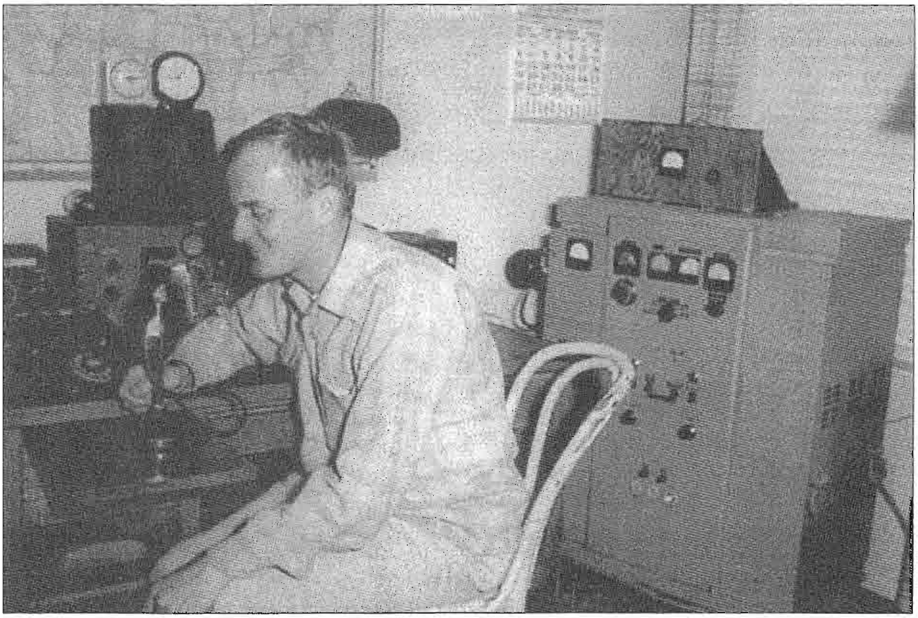
OK, I'm done preaching except to say that this vacuum tube rectifier "substitution" can be used with virtually any make/model of boatanchor power supply. If you're interested in seeing more info on these copper caps just do an Internet search for "weber copper caps".

73, Bill, WDØX

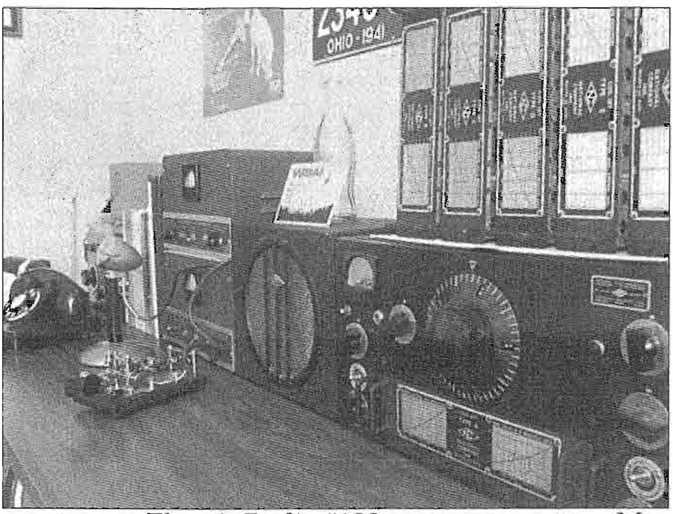
[Editor's note: The Internet URL is:
http://www.webervst.com/ccap.html
Their mailing address is:
WeberVST
329 E Firmin St.
Kokomo, IN 46902
Phone: 765-452-1249] **ER**

Here are the "Copper Cap" rectifiers that have been fitted to my Collins 516F-2 power supply. They come in a nice copper finish that doesn't show in this photograph, but are quite attractive.

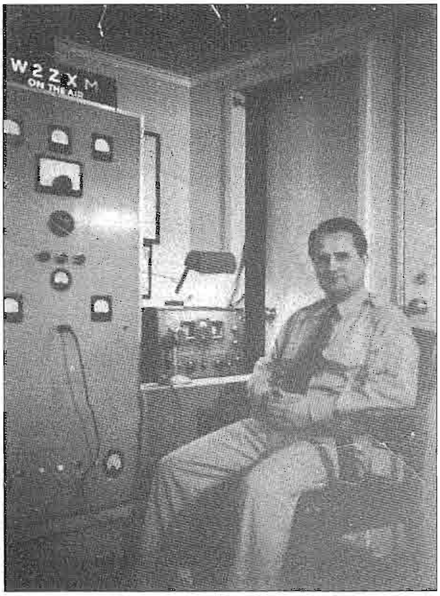
PHOTOS



Above: Long-time ER reader Reid Ross (W7HOP) was at the mic of his BC-610 station at San Mateo California during the winter of 1954. As Reid mentions, "I sure miss those days and great times!"



Left: Tom Nickle (W8AI) has a classic operating position with everything from the same period, from the National HRO 5TA1 and coil sets, to the Stancor 10P transmitter on the left. Notice the Western Electric telephone set and classic mic and key. Tom is on the air from Houston, Texas.



Captain Kurt Carlsen, W2ZXM

Older ER readers may remember Captain Kurt Carlsen, W2ZXM, and his ship, the Flying Enterprise. The History Channel made a feature movie sometime ago about his ordeal on board the ship. Morry Weinschenker (K3DPJ) sent ER the photo above, and a letter written by W2ZXM to his friend Mac (W3OB) in 1952. This material is important to both Ham radio and maritime history, and the letter is reproduced below:

Captain Henrik Kurt Carlsen
Woodbridge N.J.
February, 4th 1952

Mac W3OB
1317 Orangewood Ave
Pittsburg 16, Penna.

Dear Mac.

It was almost with tears in my eyes that I read your kind note 'of January"23rd, knowing it comes from a honest ham friend, and especially from a MM member.

As you no doubt know I am now running on a even more crowded schedule than the Flying Enterprise (if possible) so it is not much of a story I can offer you at this time. One thing I can tell you though. IT WOULD HAVE BEEN A VERY RISKY BUSINESS WITHOUT HAM RADIO.

The KW rig was of course useless as soon as the plant went dead, it was wired so I could run it on the emergency generator but that one went dead too because of the heavy list.

So when I saw that all had been picked up I made QSO with the rescue ships, accounting for all hands by CW on 500 Kc commercial battery operated. However, the acid was running out very fast wherefore I did not dare use the 500 Kc unit more than absolutely needed.

The last half year I had been busy with a all around rig that could be run on everything AC, DC, and 6 volt battery, and that was just my fortune. The receiver was a BC command [set] 2-3 MC job with one audio stage added and the dynamotor rewound to 6 volt input. The xmitter was not wired but fortunately I had a little transceiver (a 6v6 modulated by a 6v6, RCA) and that did the job. My first antenna was long wire stretched over the boatdeck and tuned wit a coil and condenser from the junk box.

However, gale blew down this wire so I simply took my table cord and writing desk lamp cord, tied them together, and after a few prunings we were in business. You should have heard the old man on the rescue ship when he heard my voice booming in with a 5 x 9 signal in his wheelhouse. Anyway, during the 14 days I never lost contact with the world, in fact the gear only went dead when the water filled the shack after I had walked out on the smokestack I could hear the receiver all the time out there.

Although I deeply appreciate your kind thought of replacing the rig, I am not in a position to accept your offer, after all, I emerged from the deal with a perfect health and a clean conscience which is all we ask.

Hoping that you will bring my most sincere regards to the Gang, I remain

Old Man
Kurt

Above: Only a portion of Bob Henriksen's (KFØAM) shack is shown in the photo, but Bob can operate with American-made equipment produced over a 40-year span, or more. Bob's QTH is Rapid City, South Dakota.

Below: Terry Jackson (N4RQ) operated studio "G" (for garage!) during the 2005 Heavy Metal Rally. Terry's signal was heard far and wide that night from Chesapeake, Virginia.

ER

[...Comments, from page 39]
benefit of the industry and hence **prejudge the outcome. He is accused of violating FCC rules in this matter**. The strongest statements are reserved for the FCC's test procedures and results. In fact, they accuse the FCC of effectively covering up information it discovered about the severity of BPL interference by **refusing to release the complete results of testing**. For example, in footnote 17 it says in part: "...The remainder of the Briarcliff Manor presentation redactions reveal the **refusal of the Commission to disclose any information that might be adverse to BPL systems**. In the 'Other Issues' section of that presentation, the references to 'Skywave (<30 MHz); 'New Information Arguing for Caution on HF BPL'; 'HF Issues and Options'; 'Low VHF Options', and 'BPL Spectrum Tradeoffs and Proposal' are all completely redacted...' [Redacted means the information was *edited or revised!--Ed.]*

One of the most disturbing sections has to do with the Commission's testing procedures, and the fact that ***nothing* has been done to mitigate interference** from noisy BPL systems. For example from section VI, quoted in part,: '...At paragraph 93 of the R&O, the Commission cites NTIA comments claiming that BPL operators have a 'market incentive' to prevent interference. The only incentive that BPL operators would have to prevent interference is the threat of FCC enforcement, which is not a real threat based on FCC response to date to interference complaints. Interference to radio amateurs is otherwise of no effect, since there is no jurisdiction other than at FCC for interference resolution. ***No civil action, for example, is possible.*** However, the Commission stresses that it is not the first step in a system operator's response. It is instead a 'last resort' when all other efforts to satisfactorily 'reduce' (not eliminate) interference have failed. The Commission is identified as the sole authority that may direct an Access BPL operator to cease operating. No notification of customers of potential service interruptions is required. Much is made by the Commission of the practicality of 'notching' of Amateur bands as a means of interference 'mitigation'. Notching, however, has proven difficult to implement effectively and has not been successful generally in remedying BPL interference at test sites. In any case, **notching requirements are not imposed on spectrum used for HF operations**...' Further reading of the same section VII says '...The Commission's conclusions regarding interference potential of BPL are both logically inconsistent, and consist entirely of summary, bare, terse conclusions without any specific analysis at all of the extensive engineering studies submitted by ARRL and others in this proceeding. At paragraph 23 of the R&O, the Commission finds that the harmful interference potential from Access BPL systems operating in compliance with the existing Part 15 emission limits for carrier current systems is 'low' in connection with the additional rules it adopts. **This is in direct conflict with the NTIA findings** of substantial interference potential from BPL, absent additional interference avoidance measures recommended by NTIA which were not adopted in the R&O."

I have always held the FCC and FCC engineers in high respect. However, your editor's conclusion from reading the ARRL petition is that there is a lot going on with BPL below the surface, out of sight and out of reach of the average citizen who happens to hold an Amateur Radio License. In comparison with the hundreds of millions of dollars available to the BPL lobby, what the ARRL has at its disposal to represent amateur radio interests is truly minimal. I encourage everyone to read the petition and decide for themselves on what the issues are, but it now sounds to me that the future of amateur radio may be under threat.

Don't be shy, send your thoughts and comments to the ER "Mailbag!" This is important stuff.

73, and Keep Those Filaments Lit!
Ray, NØDMS

VINTAGE NETS

Arizona AM Nets: Sat & Sun: 160M 1885 kc @ sunrise. 75M 3855 kc @ 6 AM MST. 40M 7293 kc 10 AM MST. 6M 50.4 Mc Sat 8PM MST. Tuesday: 2M 144.45 7:30 PM MST.

Boatanchors CW Group: QNI "CQ BA or CQ GB" 3546.5, 7050, 7147, 10120, 14050 kc. Check 80M winter nights, 40 summer nights, 20 and 30 meters day. Informal nightly net about 0200-0400Z.

California Early Bird Net: Sat. mornings @ 8 AM PST on 3870 kc.

California Vintage SSB Net: Sun. mornings @ 8AM PST on 3860 +/-

Colorado Morning Net: Informal AM'ers on 3875 kc Mon, Wed, Fri, Sat, and Sun@ 7 AM MT. QSX KØOJ

Canadian Boatanchor Net: Daily 3725 kc (+/-) @ 8:00 PM ET. Hosts are AL (VE3AJM) and Ken (VE3MAW)

Collins Collectors Association (CCA) Nets: Tech./swap sessions every Sun. on 14.263 Mc @ 2000Z. Informal ragchew nets meet Tue. evening on 3805 kc @ 2100 Eastern time, and Thu. on 3875 kc. West Coast 75M net is on 3895 kc 2000 Pacific time. **10M AM net starts 1800Z on 29.05 Mc Sundays, QSX op 1700Z. CCA Monthly AM Night:** First Wed. of each month, 3880 kc starting @ 2000 CST, or 0200 UTC. All AM stations are welcome.

Collins Radio Association nets: Mon. & Wed. 0100Z on 3805 kc., also Sat 1700Z, 14.250 Mc.

Drake Technical Net: Meets Sun. on 7238 kc, 2000Z. Hosted by John (KB9AT), Jeff (WA8SAJ), and Mark (WBØIQK).

Drake Users Net: Check 3865 kc, Tue. nights @ 8 PM ET. QSX Gary (KG4D), Don (W8NS), and Dan (WA4SDE)

DX-60 Net: Meets on 3880 Kc @ 0800 AM, ET on Sun. QSX op is Mike (N8ECR), with alternates. The net is all about classic entry-level AM rigs like the Heath DX-60.

Eastern AM Swap Net: Thu. evenings on 3885 kc @ 7:30 PM ET. Net is for exchange of AM related equipment only.

Eastcoast Military Net: Sat. mornings, 3885 kc +/- QRM. QSX op W3PWW, Ted. It isn't necessary to check in with military gear, but that is what this net is all about.

Fort Wayne Area 6-Meter AM net: Meets nightly @ 7 PM ET on 50.58 Mc. Another long-time net, meeting since the late '50s. Most members use vintage or homebrew gear.

Gulf Coast Mullet Society: Thu. @ 9PM CT, 3885 kc, QSX control op W4GCN in Pensacola.

Gray Hair Net: One of the oldest nets, @44+ years ,160 meter AM Tue. evening 1945 kc @8:00 PM EST and 8:30 EDT. Also check www.hamelectronics.com/ghn

Hallicrafters Collectors Association Net: *Sun.*, 14.293 Mc, 1:15 PM EST/EDT. *Sat.*, 7280 kc, 1:00 PM EST/EDT. *Wed.*, 14.315 Mc, 6-8:00PM EST/EDT. QSX op W8DBF.

Heathkit Net: Sun. on 14.293 Mc 2030Z right after the Vintage SSB net. QSX op W6LRG, Don.

K1JCL 6-meter AM repeater: Operates 50.4 Mc in, 50.4 Mc out. Repeater QTH is Connecticut.

K6HQI Memorial Twenty Meter Net: This flagship 20-meter net 14.286 Mc running daily for 25+ years. Check 5:00 PM Pacific Time, runs for about 2 hours.

Midwest Classic Radio Net: Sat. morning 3885 kc @ :30 AM, CT. Only AM checkins. Swap/sale, hamfest info, tech. help are frequent topics. QSX op is Rob (WA9ZTY).

Mighty Elmac Net: Wed. nights @8PM ET (not the first Wed., reserved for CCA AM Net), 3880 +5 kc. Closes for a few summer months QSX op is N8ECR

MOKAM AM'ers: 1500Z Mon. thru Fri. on 3885 kc. A ragchew net open to all interested in old equipment.

Northwest AM Net: AM daily 3870 kc 3PM-5PM winter, 5-7 PM summer, local. 6M @50.4 Mc. Sun., Wed. @8:00 PM. 2M Tues. and Thurs. @ 8:00 PM on 144.4 Mc.

Nostalgia/Hi-Fi Net: Started in 1978, this net meets Fri. @7 PM PT, 1930 kc.

Old Buzzards Net: Daily @10 AM ET, 3945 kc in the New England area. QSX op George (W1GAC) and Paul (W1ECO).

Southeast AM Radio Club: Tue. evening swap, 3885 @7:30 ET/6:30 CT. QSX op Andy (WA4KCY), Sam (KF4TXQ), Wayne (WB4WB). SAMRC also for Sun. Morning Coffee Club Net, 3885 @ 7:30 ET, 6:30 CT.

Southern Calif. Sun. Morning 6 Meter AM Net: 10 AM on 50.4 Mc. QSX op is Will (AA6DD).

Swan Nets: User's Group Sun. @4PM CT, 14.250 Mc. QSX op Dean (WA9AZK). Technical Net is Sat, 7235 kc, 1900Z. QSX op is Stu (K4BOV)

Vintage SSB Net: Sun. 1900Z-2000Z 14.293 & 0300Z Wed. QSX op Lynn (K5LYN) and Andy (WBØSNF)

West Coast AMI Net: 3870 kc, Wed. 8PM Pacific Time (winter). Net control rotates between Brian (NI6Q), Skip (K6LGL), Don (W6BCN), Bill (N6PY) & Vic (KF6RIP)

Westcoast Military Radio Collectors Net: Meets Sat. @ 2130 Pacific Time on 3980 kc +/- QRM. QSX op Dennis (W7QHO).

Wireless Set No. 19 Net: Meets second Sun. every month on 7270 kc (+/- 25 Kc) @ 1800Z. Alternate frequency 3760 kc, +/- 25 kc. QSX op is Dave (VA3ORP).

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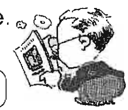

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FOR SALE: Hammarlund Telechron clock plastic face covers, crystal clear, new reproductions, $15 plus shipping. Rick Cutter, WA3MKT, 814-725-9490, richard_cutter@lord.com

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FOR SALE/TRADE: Original manuals: Collins, Swan, Hammarlund, National, Hallicrafters, Johnson, Morrow, Harvey-Wells, Drake, Waters. NI4Q, POB 690098, Orlando, FL 32869. 407-351-5536 ni4q@juno.com

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FOR TRADE: Collins TCS-12 package w/ AC PS, R388 in cabinet, museum quality Western Electric 353-E1 BC xmtr on 1925kHz, Hammarlund RBG, Signal Corp Control Unit C-113A/TRA-2, Globe King 400B, TMC GPR-90RXD. Gary, WA9MZU, 209-286-0931 (CA) or ghal@ix.netcom.com.

FOR SALE: 6 & 12 V dynamotors from 2-way, clean & heavy. Offers. Dave Schmidtke WØBEI 800-500-8055 POB 462 Faribault,Mn 55021

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FOR SALE: Crosley model 51 tube rcvr $100. Swan 250C 6 meter rig w/PS, spkr, ext. VFO, orig. manual $175. 2 Allied FM rcvrs #2589: 30 to 50 Mc and 152 to 175 Mc $25 each. Heath Two'er $25. Astatic mics JT-30, D-104 best offer. Heath sig gen SG8 $25. Heath VTVM V9A $25. All + shipping. Vern Snyder, 5 Parkview Dr., Winder, GA 30680 1-720-307-1459

FOR SALE: GR 1203-A Unit Power Supply, $25. GR1157-A Manual Copy, $15. Ross Wollrab, 229 N. Oakcrest Avenue, Decatur, IL 62522-1810. 217-428-7385.

FOR SALE: Tempo I w/AC ps $100. RF Communications RF-403 VHF FM 12V mobile 2M mod, $60. Drake 2C receiver to restore $75. Al Jenkins, 5 Dailey Ct, POB 1162, Nantucket, MA 02554 508-325-7122

FOR SALE: Military whip antennas. EH Scott military rcvr $250. Bruce Beckeney, 5472 Timberway Dr., Presque Isle, MI 49777 989-595-6483

FOR SALE: Drake 2C rcvr. + 2NT Xmtr. + PM-2 Spkr/Q mult. $375. Jim,KD3S, jreid4@earthlink.net 301 490 3572

FOR SALE: Drake TR-4, RV-4, power supply, speaker & manual $225 in good condition. You won't find one cheaper than that! Bob, W1RMB 508-222-5553

FOR SALE: Tektronix Type 130 L-C meter $75. Norm Roscoe, POB 402, W. Bridgewater, MA 02379 508-583-8349

FOR SALE: Heathkit Apache transmitter model TX1 like new w/manual $300. Hammarlund HQ-170A receiver like new w/manual $300 OBO. Hallicrafters SX71 extra fine condx $300 OBO. Hallicrafters S53A like new $60. Hallicrafters S20R fine shape $225 OBO. Hallicrafters S22R fine shape $200 OBO. National model SW54 like new w/head phones $100. Layayette HE-80 like new w/speaker $180 OBO. Layayette HE30 like new $120. Hammarlund HQ-129X fine shape $200 OBO. Heathkit HW 100 w/ power supply, fine shape, $125. Heathkit HW 101 w/ power supply fine shape $125. Robert, K8VVG, 195 Ruth Ave, Logan OH, 43138

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FOR SALE: Back issues all radio magazines. Frank Bridges, 104 Maple St, Brevard,NC 28712 fbridges@citcom.net

FOR SALE: RME DB-20 $75. BC-348R $75. Hallicrafters World Wide (like Transoceanic) $75. Heath Cheyenne MT1 $60. Heath HW-16, no cabinet $30. IC21 2 meters; Gonset Communicator IV $50. Johnson Viking Invader 2000 & PS $600, pick up only. Richard Cohen, 813-962-2460

FOR SALE: Navy OS-8 B/U Oscilloscope w/ case, manual, in very good condition. $40 plus shipping. k4deejim@aol.com or 864-855-9570

WANTED INFO: RCA/Radiomarine T-408/URT-12/USCG. Sam KF4TXQ PO Box 161 Dadeville, AL 36853, 256-825-7305 stimber@lakemartin.net

FOR SALE: Hallicrafters SX101/101A reproduction main tuning knob. Includes silver inlay and set screws. $35.00 Mike Langston KL7CD, 1933 Diamond Ridge Drive, Carrollton, Texas 75010, 972-392-5336, mlangston@hcpriceco.com

FOR SALE/TRADE: Transmitting/Receiving tubes, new and used. LSASE or e-mail for list. **WANTED:** Taylor 204A, 211, TR40M and Eimac 500T. John H. Walker Jr., 13406 W. 128th Terr., Overland Park, KS. 66213. PH: 913-782-6455, E-Mail: jwalker83@kc.rr.com

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FOR SALE: 1934 Amateur Radio Handbook, make offer. Fred Clinger, 417 Beechwood Dr., Galion, OH 44833 419-468-6117 after 6 PM.

FOR SALE: BIRD 72-R Reversing Coax Switch, $115: National Plate Chokes NOS: R-175, $37; R175A, $37; R152, $25. postpaid. Richard Prester, 131 Ridge Road, West Milford, NJ 07480. 973/728-2454. rprester@warwick.net

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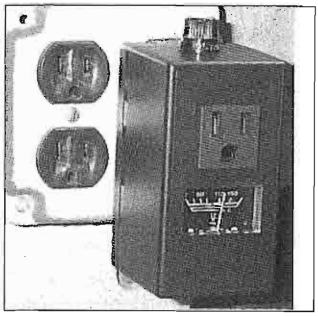

FOR SALE: Free list TT for obsolete Triplett transformers, chokes and manual copies. USA only. Bigelow Electronics, POB 125, Bluffton, OH 45817-0125

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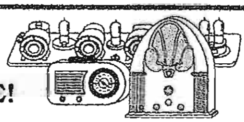
SERVICE FOR SALE: Repair, Restore, Sales of antique, vintage tube radios. John Hartman, NM1H, www.radioattic.com/nm1h

JOHNSON PARTS: New Ranger 1, Valiant 1, & Navigator plastic dials, freq numbers in green, with all the holes just like orig.-$17.50 ppd. Bruce Kryder, W4LWW, 277 Mallory Station Dr., Ste. 109, Franklin, TN 37067. bak@provisiontools.com

FREE SAMPLE!



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NOTICE: Visit Radioing.com, dedicated to traditional ham radio & vintage radio resources. Let's Radio! Charlie, W5AM. http: / /www.radioing.com.

BOOK FOR SALE: Heath Nostalgia, 124 page book contains history, pictures, many stories by longtime Heath employees. (See ER Bookstore.) Terry Perdue, 18617 65th Ct., NE, Kenmore, WA 98028

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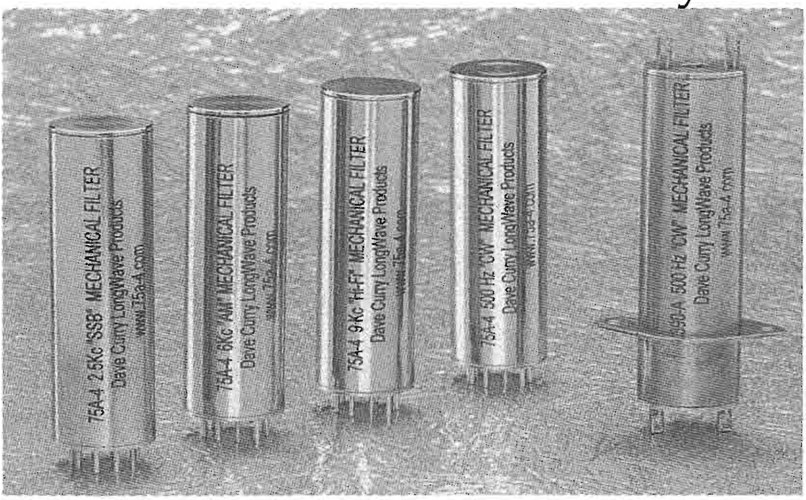

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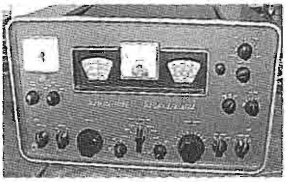

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WANTED: Cabinets for 19" x 8.75, 10" depth and 10" x 10", 10" depth. Harold, W1SKS, 207-877-4283 w1skss@peoplepc.com

WANTED: Schematic and related info on Halowatt TR5 broadcast rcvr made mid-1920s in Portland, OR. Fern Rivard, VE7GZ , PO Box 457, Cranbrook, BC V1C4H9 CANADA crc@cyberlink.bc.ca

WANTED: Heathkit HR-10 receiver. Please call Jerry at 405-373-4727

WANTED: Manual for Hickok VTVM model 209B. Also manual for Knight (Allied Radio) transistor 10-circuit lab kit #83Y299. WJ Klewchuk, POB 927, Wadena Sask. Canada SØA 4JØ 306-338-2264

WANTED: 3 socket sets for the BC-610 plug in modules. I also need a 250TH to complete what I need to rebuild my 610, new or a good pull. Bob, KFØAM 605-923-5309 evenings or kf0am@arrl.net.

WANTED: Stancor audio amplifiers and/or transmitters of the late 30's and early 40's.in any condition. Jim Schliestett, W4imq, 420 Lakeview Dr, Cedartown, Ga 30125, 770-748-5968, imq@bellsiuth.net

WANTED: Collins 312A1 speaker, National SW5, Eldico R104 and T102, QSL cards from 1920's, 9CXX or W9CXX. Scott Freeberg, WA9WFA, 327 Wildwood Avenue, Saint Paul MN 55110. 651-653-2054 Email: wa9wfa@qsl.net

WANTED: Triplett VTVM, model 850 owners/instruction manual. Copy O.K. H.I.Stark, K9UBL, 3215 S. Meridian St. Indianapolis, IN 46217 317-788-1210

WANTED: Plate circuit breaker as used in a Collins 20V-2. Dewey Angerhofer WØZUS, PO Box 540, Edgemont, SD 57735, 605-662-7692, dra@gwtc.net

WANTED: Hallicrafters HT-33 linear amplifier, dead or alive! John, W8JKS, 740-998-4518

WANTED: 1938 Radio Handbook by Frank Jones. Gale Roberts, 920-696-3491 wb9rww@wmconnect.com

WANTED: Sept 1949 QST or photocopied article BC band coverage for BC348Q. John Phillips, 403-652-3649, johnph@cybersurf.net

WANTED: Heathkit HG-10B VFO, HW-16. Jim Theisen, 4692 Theisen Rd., Gaylord, Mi 49735 231-546-3392 WB8REH wb8reh@arrl.net

WANTED: Will buy SP-600 and some other Hammarlund equipment, working, not, or incomplete. Al, W8UT, anchor@ec.rr.com, 252-636-0837

WANTED: Top lid and manual for Hickok 580 tube tester (same as for 752?) **FOR SALE:** AK 20, 42. Carter 434 979 7383. celliott14@earthlink.net

WANTED: Commercial or kit-built 1930s and 40s transmitters.Doc, K7SO, 505-920-5528 or doc@cybermesa.com

WANTED: Hallicrafters SX115, SX88, Collins 75A-1, AM broadcast transmitter in New England area, Heath DX100B. Will pay good price for good equipment. Email w1txjohn@aol.com, 802-775-7632 evenings.

WANTED: Millen 10035 illuminated dial drive, 11x7x2 aluminum chassis w/bottom plate. Louis L. D'Antuono, WA2CBZ, 8802-Ridge Blvd., Bklyn, NY 11209. 718-748-9612 AFTER 6 PM Eastern Time.

WANTED: Meters for following tube testers: Western Electric KS-15750, Weston 774-5 Analyzer. Walter L. Hughes, WB4FPD, 6 Academy Ct., Berryville, VA 22611 540-955-2635

WANTED: Hammarlund SP-600, all models. Need complete unmodified or modified receivers and most all parts. Please call Stan Bryn, AC5TW at 1-800-984-9814 week days between 0800-1100 MST, intor@zianet.com

WANTED: Wanted: Anything by DAVID GRIMES: radios, especially model 3XP, and advertising, ephemera, literature, references, parts; please contact: Mike Grimes, K5MLG; 5306 Creekside Ct.; Plano, Texas, 75094, 972 384-1133. Email: grimesm@flash.net

WANTED: Top dollar paid for WWII radios, PRC-1, PRC-5, AR-11, SSTR-1, SSTR-5, British B2, need pts for PRS-1 mine detector. Steve Bartkowski, 708-863-3090

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WANTED: PYE, Fairchild, Syncron, Langevin. Richard P. Robinson, PO Box 291666, LA CA 90029 323-839-7293 richmix@erols.com

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WANTED: Garrard model 80 or similar Garrard single play turntable. Cartridge and spindle not required must have pickup shell. 914-666-4523 Charles Graham, 4 Fieldwood Dr., Bedford Hills, NY 10507

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WANTED: Collins 310B-3, basket case OK, 70E-8A PTO per 1948. Chicago CMS-2, pair of Taylor T-21. Jerry, W8GED, CO, 303-979-2323.

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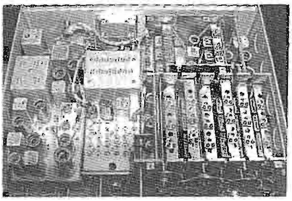

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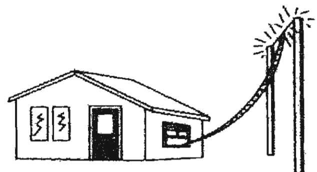

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