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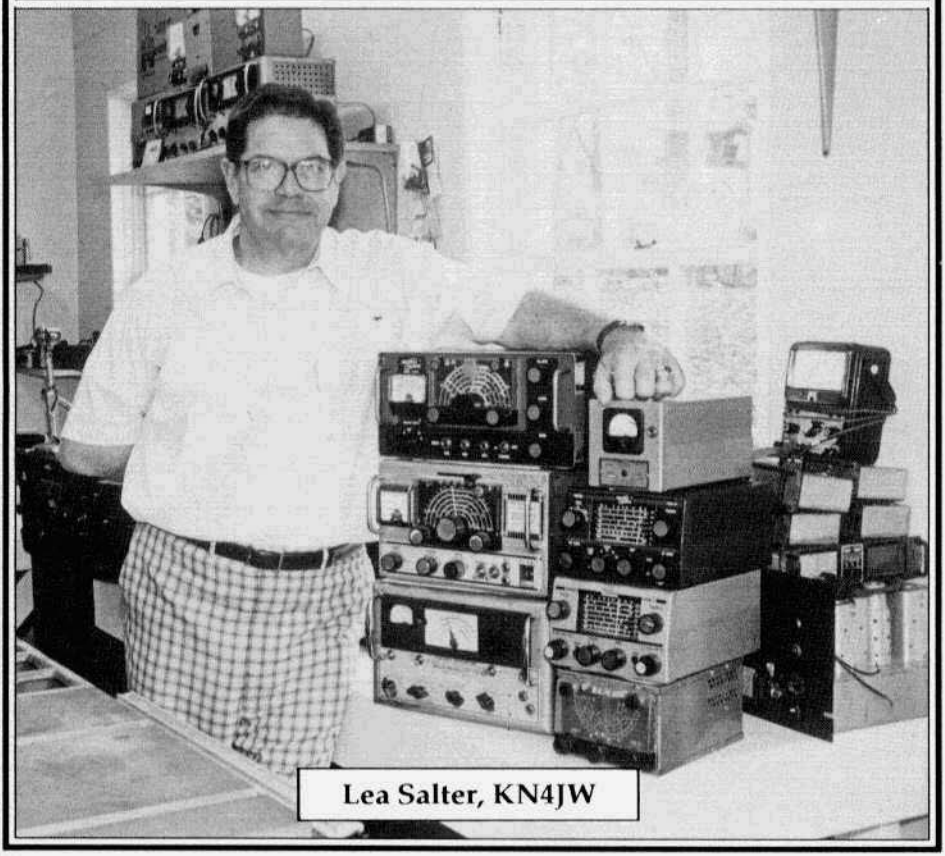
ELECTRIC RADIO

celebrating a bygone era

Number 39 July 1992



Lea Salter, KN4JW

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REGULAR CONTRIBUTORS

WALT HUTCHENS,KJ4KV.....ELECTRIC RADIO IN UNIFORM
FRED HUNTLEY,W6RNC.....REFLECTIONS DOWN THE FEED-LINE
BILL KLERONOMOS, KDØHG.....VINTAGE PRODUCT REVIEWS
DALE GAGNON, KW1I..... AM REGULATION UPDATES

Electric Radio is published for amateur radio operators and others who appreciate the older tube type equipment. It is hoped that the magazine will stimulate the collecting of, and interest in, this type of equipment.The magazine will provide information regarding the modification,repair and building of equipment. We will also work to-wards a greater understanding of amplitude modulation and the problems this mode faces.

Electric Radio Solicits Material

We are constantly searching for good material for the magazine. We want articles on almost anything that pertains to the older amateur equipment or AM operation. From time to time we will also have articles and stories relevant to the CW operator and the SWL. Good photo's of ham shacks, home-brew equipment and AM operators (preferably in front of their equipment) are always needed. We also welcome suggestions for stories or information on unusual equipment. For additional information please write us or give us a call.

EDITOR'S COMMENTS Barry Wiseman, N6CSW/Ø

A while back I indicated my interest in vintage RTTY and that we might do some articles on the subject. This is something of an update.

Recently I acquired a Model 19 Teletype from Doug Bainbridge, NØHP'K, who lives down the road from here in Cortez, about 50 miles west. I then acquired a Hal ST-6 from Skip Green, K7YOO. The Hal is hardly vintage, being only about 20 years old and all solid-state but until something with tubes turns up it will serve adequately as my demodulator.

Getting it all hooked up took only a few minutes. Ten years ago I was very much involved in Vintage RTTY and most of what I knew then came back to me. The next step was to find a RTTY signal and check everything out. It was afternoon so I decided to try 20-meters first. I recalled that most of the RTTY activity was just below 14.100; down about 10 or 15 kcs. I couldn't find anything there so I checked 40 and found nothing there either. It wasn't until evening when I found a lone RTTY signal on 80 meters. Tuning across the signal the old Model 19 started to clatter and pound out the copy. Everything worked just fine. Once again I was back in my glory. I enjoy playing around with RTTY and the old Teletype gear.

But I've come to this conclusion: there is very little RTTY activity anymore and maybe no vintage RTTY activity at all. I'm sure that all the stations I've copied so far (I haven't worked any yet) have been using modern computer setups. I think that AMTOR and computer generated CW have almost replaced RTTY. I wonder if there's anyone out there still using the good old Teletype gear. Skip, K7YOO, has found a Model 28 that he'll be putting into service soon and Bill, KDØHG, has a Model 15 that he says he'll get going this winter. I'd like to hear from anyone else who has vintage RTTY gear that they can get up and running. Maybe, if there's enough of us we can get some kind of a net going this winter.

continued on page 37

TABLE OF CONTENTS

Cover: Lea Salter, KN4JW, in his workshop/hamshack. Shown with Lea is the gear manufactured by the Multi-Elmac Company. See the article on page 14.

Reflections Down the Feedline

by Fred Huntley, W6RNC
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Nevada City, CA 95959

Snagging The Big One

I was listening to the 40 meter SSB swap net while waiting for 4:00 PM and the start of the Sunday SPAM net lower in the band. W6DFC, the master of ceremonies, was reading the offerings of Yaesu and Kenwood. Suddenly, my ears perked up. He was saying there was a FRT-24 in Marysville, Calif., for $600. I was not tuned up for the SSB frequency, but another station called in for the telephone information, so I copied it down also.

The reason that the FRT-24 sparked my interest is that K7YIR, in Washington State, has one. It is pictured in the June 1989 issue of the *AM Press Exchange* – a giant Collins 2-30 Mc military autotune transmitter with an imposing appearance.

After our 40 meter SPAM net got started, I mentioned about the FRT-24 being available, but nobody seemed interested. After the net was over, the thought of the FRT-24 kept bugging me – so I phoned its owner, K6KUS, and got some information.

By Thursday night, I couldn't resist any longer and decided that I wanted the rig, so I called K6KUS again and made arrangements to come and look it over. Marysville is only 40 miles from Nevada City and that close a distance was a big factor when 1,500 lbs of transmitter is involved.

On Friday morning, I arrived at K6KUS QTH and saw the rig standing on his driveway, wrapped in clear plastic sheeting. It was very impressive and high-tech. As it turned out, it was a FRT-24A – not a 24. The FRT-24 has a 4-1000A final and a pair of 4-400A class B modulators.

This FRT-24A had a big 8576 ceramic tube in the final, and was an SSB transmitter with LSB, USB, ISB, PSK and compatible AM modes. (Compatible AM is carrier with one sideband and on this transmitter the carrier is adjustable to 1,000, 100 or 10 watts PEP.)

The transmitter looked to be in good condition and would make an interesting project, so after a very brief deliberation I wrote out a check to K6KUS for it.

The next question was how to move it. This rig is a double cabinet 83 inches high, 47 inches wide and 32 inches deep and weighed about 1,500 lbs. A few furniture moving companies were contacted for price estimates, but their figures were prohibitive. So, I returned to the K6KUS QTH on Sunday morning, with some tools, and we disassembled a lot of the transmitter, to lighten it up. The whole rig is unitized and everything is unpluggable and removeable. All the slide out drawers were removed, as well as 2 low- voltage power supplies and 2 high voltage filter units, and the power control unit.

The next day I was lucky and came across a fellow in Nevada City with a flat bed truck, who did odd jobs and hauling. We negotiated a deal and on Wednesday headed down Highway 20 towards Marysville.

The trucker, his wife, a helper, and myself were aboard. With the strategic assistance of K6KUS we managed to get the transmitter slid up on the truck. Then all the loose units were also placed aboard.

On arrival back at my QTH in Nevada City, the unloading worked out OK, with the use of a block and tackle that I fortunately had on hand. The transmitter is now sitting in the middle of my garage, work/storage area. I reinstalled all the individual units, reconnected the numerous cables and thoroughly cleaned every part of the equipment.

The set is a real beauty. All mil-spec

continued on page 36

Letter From Australia

by Colin MacKinnon, VK2DYM
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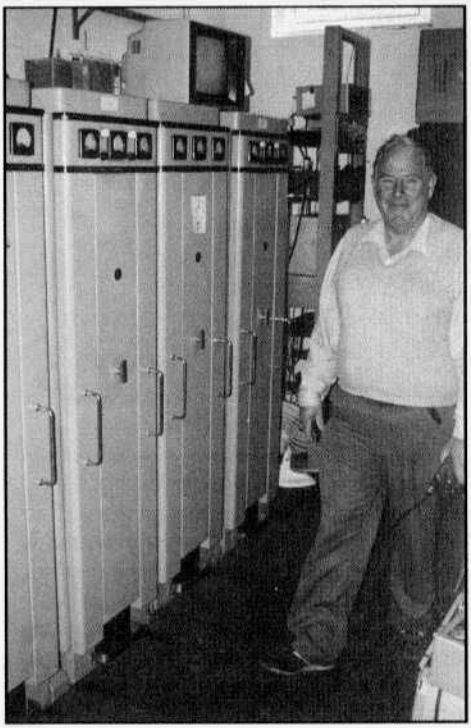
When reading the article on broadcast transmitters in ER No.36, it dawned on me that our radio society has been using several commercial transmitters in the ham bands for about 25 years.

The Wireless institute of Australia, NSW Division, which is equivalent to the ARRL, provides weekly news broadcasts on a number of amateur frequencies and includes AM amongst the modes. The transmitters that we have used for the past 17 years are commercial 500 watt output units made by a local electronics company, "A.W.A." There are three transmitters in use, crystal controlled on frequencies in the 160, 80, and 40 meter ham bands. They are all remote controlled via a computerized studio control panel.

The "AWA" J54800 transmitter was originally designed for low power broadcasting and point to point AM or CW communications in the range of 2 to 20 Mhz. It comprises two similar cabinets, each about 6 ft. tall by 1 ft. 6" wide. One cabinet contains the power supplies and modulator and the other has the RF Unit, electronic keyer and monitor circuits. The unmodulated power output is rated at a very conservative 500 watts. They are not exactly portable as together the two cabinets weigh 3000 pounds. To obtain access, the cabinets roll forward on rails to expose the circuitry.

The RF circuit starts with a 6AU6 Pierce crystal oscillator feeding up to three 807 amplifier/doublers, depending on the frequency. A fourth amplifier stage has two 807's in parallel, driving the final amplifier which consists of two 810 valves (or "TOOBS" to you guys) in parallel. To cover the entire frequency range, different inductors are switched in the input and output tuned circuits.



A view of two of the AWA transmitters. The rack at the end contains receivers and the television set is for monitoring ATV transmissions. The gentleman in the picture is Tim Mills, VK2ZTM, one of our volunteer technicians.

The WIA provides a news service, beacons, packet and voice repeaters and contest facilities on all Australian amateur bands from this 5 acre operating site overlooking Sydney, NSW. There are several antenna towers ranging from 100 ft. to 280 ft. high. Before acquiring the AWA units, our broadcasts were done on war surplus BC-610 transmitters.

The modulation cabinet includes a submodulator with two 6BA6's, with compression and limiting circuits, coupling to two triode connected 807's. These in turn are cathode coupled to two 810's in the main modulator.

The plate voltage is 1750 volts derived from two 872 mercury vapor valves, with minor HT supplied from two 866 rectifi-

continued on page 36

ELECTRIC RADIO IN UNIFORM

by Walt Hutchens, KJ4KV
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"The RT-91/ARC-2 Transceiver"

What makes a military radio truly outstanding? You would expect that:

- The features of the set are a good fit to the requirements of the job for which it was built -- and better than those of other sets of about the same time,
- The design is innovative without unnecessary complication,
- The radio is simple to operate and repair, and
- It uses inexpensive construction methods as far as possible.

This month's 'tour of duty' is my candidate for the top scorer -- but, sadly, we will find a fatal flaw when looking at it as a ham set.

Overview

The AN/ARC-2 is an eight channel liaison (long range) aircraft transceiver covering 2 to 9 Mcs in four bands. The set was developed by Collins Radio for the U.S. Navy about 1944; it weighs 64 pounds and is 8" x 15" x 20" (H x W x D) which is the standard '1-1/2 ATR' package. It is rated at 15 to 30 watts AM or CW and requires 26.5 VDC at 20 amps. It has a self-contained dynamotor and antenna tuner. The set has 25 tubes, all of them octal except for the final amplifier and modulator.

Four Collins Autotune units control the bandswitch, frequency and antenna coupling and tuning. These controls are preset during tune-up for each channel. The dial is calibrated directly in frequency at intervals of 2 kcs.

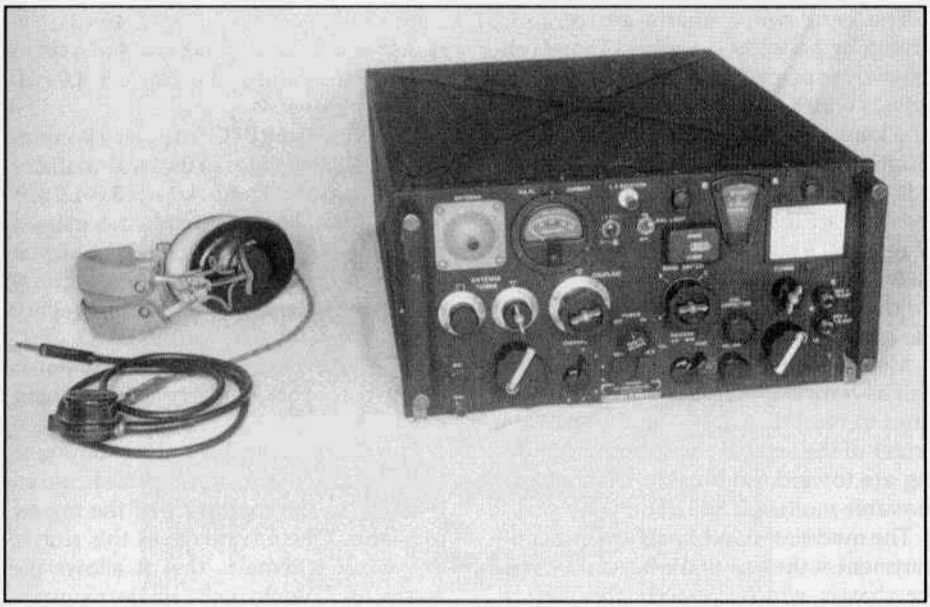
Any number of remote control units can be used; the last box to be turned 'ON' has control of the channel and (with the C-732 control panel) the sensitivity. Audio connections normally were tied to the plane's intercom system but these and all operating controls are also on the front panel of the set.

The ARC-2 brought several important innovations:

- As the first HF transceiver to be used by our armed forces it marked the end of separate receiver-transmitter installations in aircraft and in many ways became the model for aircraft communications sets right down to the present,
- It is the radio for which the famous Collins PTO (Permeability Tuned Oscillator) was developed and set new standards for calibration accuracy, linearity and stability,
- It is the first U.S. developed HF military set to tune both the receiver and transmitter with a single knob,
- It is our first military set to use a tunable IF, and
- It is the first set to have automatic modulation level control.

History

The build-up for WW II found the U.S. Navy scrambling to develop equipment and tactics for a new kind of warfare in which opposing fleets would strike not with big guns having a range of perhaps 20 miles but with aircraft launched at ranges of over 100 miles. The low-powered command transmitters of the pre-war era wouldn't do the job; neither (in a military force made up of quickly trained civilians) could CW-only sets be used. The



The RT-298/ARC-2A transceiver. The RT-91/ARC-2 looks the same but (except for some modified sets) does not have the fuse holders. The RS-38 mic and ANB (Army-Navy-British) H-1 phones were often used with this set.

resulting scramble for higher-power voice gear led to an outstanding new design (the Collins ART-13, then called the ATC), increased production of a successful older transmitter (the Westinghouse GP-7), and the truly peculiar Bendix ATD. These transmitters, paired with at least two different types of receivers, can be said to have won the war; the ART-13 was so successful that it had a long and varied post war career.

Using a separate receiver, however, doubles the chances of a wrong set-up; recent reruns of the film "Midway" showed several examples of how radio communications failures changed the course of this critical battle. And all of the early wartime transmitters really should be tuned up by someone who knows transmitter theory, rather than (for example) a combination radioman-gunner.

Yet another problem was space: by 1944 even single-place aircraft had radar, IFF (Identification Friend or Foe), survival, and electronic navigation sets which did not exist in 1940. A large transmitter with a separate receiver, frequency meter, and cabling between them was no longer practical.

I don't have development details for the ARC-2, other than that it was done by Collins, with the PTO unit being designed by Ted Hunter, who was later to found Hunter Manufacturing, the producer of the 'Hunter Bandit' linear amplifier. The first contract date is 1944 so development must have begun right after the ART-13 got into full production, say 1943 or so.

The set was clearly successful because a second model, RT-298/ARC-2A, with important small improvements was contracted in 1949. All the sets were built by Collins and there were at least eight contracts, totalling perhaps 10,000 radios. The ARC-2 probably phased out gradually after the ARC-38 came into service about 1952.

Design

The first impression you get from this radio is of 'never mind the cost' quality.

continued next page

ER in Uniform from previous page

The bandswitch shafts are ceramic, driven by helically cut gears. There's extensive use of machined castings, even for shields which don't have to be that strong. The knobs are machined black anodized aluminum – the finest I've ever seen on a military set. The two ventilation holes in the back of the set have large screened plugs which screw into a threaded block on the rear of the chassis; a special wrench for these plugs is mounted on the back of the case.

Mechanically, the ARC-2 consists of a pair of vertical aluminum chassis running front to rear; the tubes point toward the center of the set and the sockets and wiring are toward the outside. The only removable module is the PTO.

The modulator and finals are in a compartment at the rear of the horizontal center chassis which connects the vertical ones; also in this compartment is the dynamotor. The dynamotor blower circulates air through the power tube compartment through the screened plugs on the back of the set.

The front center area of the chassis is taken up by the PA tank and loading arrangements.

The sealed PTO unit is at the right, mounted inside a separate cast box. That gives three closed boxes between the oscillator tuned circuit and the outside world; you could hardly have more stiffness, shielding, and protection from sudden temperature changes. As with other Autotune sets the chassis are attached to a front casting which carries the Autotune units and the controls they operate. The PTO is driven by a linearly calibrated frequency dial consisting of two concentric polished aluminum dials, the outer one is marked in 100 kc steps and the inner in steps of 2 kcs.

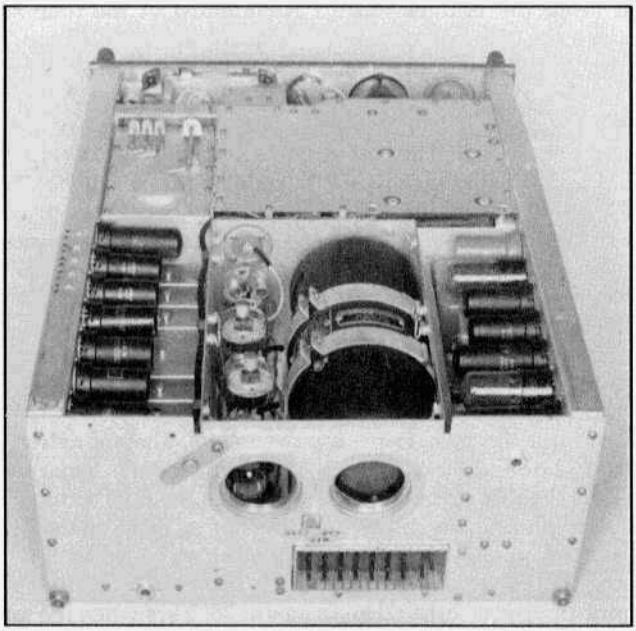
The ARC-2 is the first radio to display what became the Collins Radio standard of using new techniques in every part of every new set. Looking first at how channel frequencies are generated, the PTO is used on both transmit and receive and tunes 1.0 to 1.5 Mcs for all bands. On transmit, it is multiplied 2, 3, 4 or 6 times giving bands of 2.0 - 3.0, 3.0 - 4.5, 4.0 - 6.0 and 6.0 - 9.0 Mcs.

On receive, the PTO frequency is multiplied 3, 4, 3 or 5 times so the local oscillator frequencies are 3.0-4.5, 4.0-6.0, 3.0-4.5 and 5.0-7.5 Mcs. The IF circuits are ganged with the PTO and also tune 1.0 - 1.5 Mcs on all bands. On the two low bands, the local oscillator is above the channel frequency giving bands of 2.0-3.0 and 3.0-4.5 Mcs.; on the high bands the local oscillator is below the channel for bands of 4.0-6.0 and 6.0-9.0 Mcs.

The ARC-2 is the first radio I know of to use a tunable IF and the only one to use an IF equal to the frequency of the master oscillator. One advantage of this simple frequency scheme is that it allows the master oscillator to tune a single frequency range for all bands on both transmit and receive without an extra mixer circuit; it also gives you a 'free' BFO – namely the master oscillator frequency itself. Another advantage is that all circuits tune at the same rate, so a single slug rack can be used for all of them.

But with the master oscillator operating on the IF frequency and a subharmonic of the channel, elaborate measures (lots of shields, finger stock on covers, series chokes to decouple supply leads and five tuned circuits at the output of the receiver multiplier to select the right harmonic) are needed to prevent 'birdies' on AM signals. And because the tuning rate increases with the multiplication factor, the scheme is limited to sets with a modest frequency range.

A second price is having to get selectivity at a relatively high and variable IF frequency. Both the difficulties of precise tracking of nine tuned circuits and the practical limits on the 'Q' of the coils mean that a 6 dB bandwidth of 10 to 15 kcs must be accepted – okay for a 1940's aircraft liaison set but not for more demanding jobs. Clever as it is, the idea of using a tunable IF in this way began and ended



Top view of the ARC-2A; front panel is at top of photo. The cover over the power tubes has been removed. On the left are the RF, IF and transmitter driver stages; the RF and IF slug racks are below the tubes. On the right, the receiver detector and audio and transmitter modulator circuits and transformers.

with the ARC-2. Later Collins sets such as the ARC-38, R-390 and 75A series followed the tunable IF with a conversion to a fixed frequency such as 455 kcs allowing the use of a crystal or mechanical filter to set the bandwidth.

Overall, the receiver consists of a 12SJ7 Hartley electron coupled oscillator (the PTO) feeding a 12SG7 multiplier. There are three 12SG7 RF stages, a 12SA7 mixer and four 12SG7 IF's. The tunable IF system has the additional problem that its gain rises as it is tuned to higher frequencies; this is handled by making the last two stages broadly fix-tuned with gain going down with frequency.

A slight back-bias is applied to the diode detector so that tube noise doesn't come through; unfortunately this also prevents copying very weak signals. Conventional AVC circuits are used; the series diode noise limiter is 'always on' but biased so it causes no noticeable distortion. AVC action is good, allowing less than 5 dB change of audio output with signals varying from 1000 microvolts down to 10 microvolts or from 1000 microvolts up to 100,000 microvolts. There's also a fast acting audio AVC circuit which lowers the gain of the 12SA7 first audio stage when extremely high audio outputs occur; this helps with static crashes and extremely strong signals from nearby transmitters on which normal AVC and noise limiters aren't effective.

On transmit, the PTO feeds a 12A6 multiplier coupled to a 12A6 driver. The final is a pair of 1625's in parallel.

Plate modulation is provided by two 1625's operating class AB2. There is a separate winding on the mod transformer which feeds back to a 12SL7 used as the variable arm in a pair of Wheatstone bridges between the mic transformer and the triode connected 12A6 driver stage. Audio peaks which could cause

continued next page

ER In Uniform from previous page
overmodulation bring the bridges into balance and reduce the mic voltage almost instantly, limiting the modulation level to about 95% for an extremely wide range of mic inputs.

This too was a one-time idea. The best later military AM sets (the T-195/GRC-19, ARC-38 and 39, etc.) used simple diode clippers to achieve comparable results with much less circuitry.

Like the telephone system, military radios always feed the operator's voice back into his headphones so he will know the set is working and to allow him to adjust the loudness of his speech. Usually this 'sidetone' is taken from the mod transformer but the ARC-2 does it by using a 12H6 diode to rectify the RF output to the antenna; not only do you hear any distortion which occurs but you know you are actually producing RF. This is a real improvement but, probably because the 12H6 circuit itself could cause failures, it is another 'never used again' innovation.

On The Air With The ARC-2

I've operated three ARC-2 sets; the ARC-2A now in service at KJ4KV came in near-perfect condition from perhaps the most prolific 'surplus radio' writer of all time, Roy Pafenburg, when he was reducing his storage shed a few years back.

It is a mark of the overall quality of this set that more than 35 years after it left the Collins plant it went on the air without a hitch. Problems which showed up in the first 20 hours of service were a bypass capacitor which shorted, dirty relay contacts which caused a beat note from the BFO even when on AM, and a meter movement which intermittently sticks; all three of these happened with the other sets as well.

The transmitter output ratings are conservative; mine delivers over 40 watts on both 80 and 40 meters.

Because it contains the 70E-1, the very first PTO, I was eager to test the ARC-2's stability. Unfortunately, like many older PTO's, the one in this set was considerably off calibration when I got it and was recalibrated at the time so I could not measure the 'from factory' drift for this article. I did the test anyway; the usual test sequence of four minutes warm-up followed by 30 minutes of one minute transmit/four minutes key up cycling gave a drift of -313 cps. During 10 minutes continuous key down the drift was another -76 cps. The drift is so steady that a small amount of added compensation would probably bring it well under 100 cps/hour.

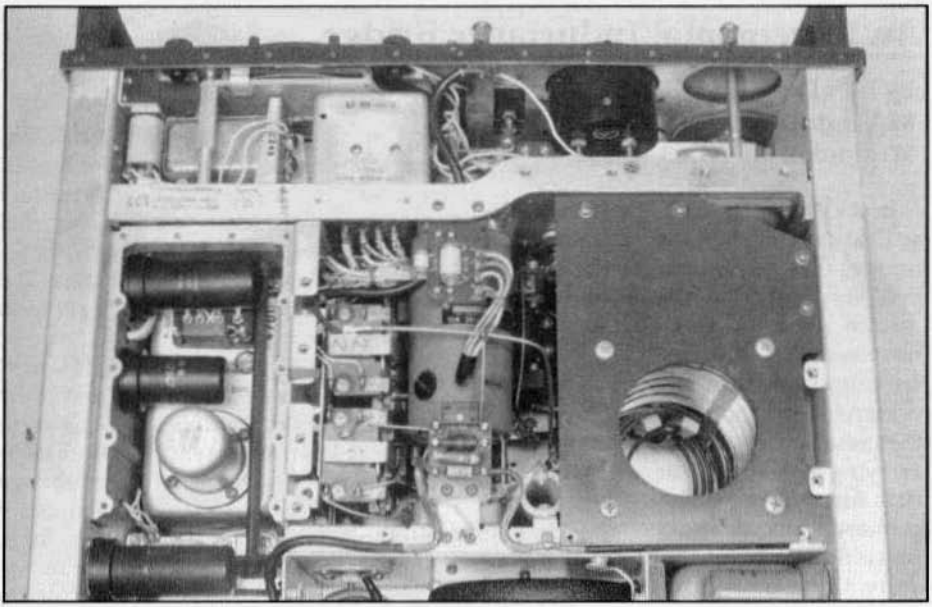
Corresponding numbers for the ART-13 tested here were -112 cps and -130 cps respectively.

The ARC-2 has the redesigned Autotune units which don't require you to always approach the final setting from the same direction as those on the ART-13 do; sure enough they work just as accurately as the early design did, coming back within 32 cps at 3885 kcs when the same channel is selected.

This is the easiest to use of all the medium power HF military radios I have operated. Select the channel, unlock the controls, set the band, dial up the frequency, key the mic, adjust the antenna tuning for maximum plate current then set the antenna coupling for 190 mA plate current. Lock the controls and finish your preflight checks... (Connectors and shock mounts safety wired, Crew mics and headphones on stations...)

The ARC-2 puts full power into my dummy load and loop antenna without the external help (series capacitor, etc.) needed by many aircraft sets. Because of the automatic modulation level control, any microphone which produces enough voltage will modulate it fully with no risk of overmodulation. I use one of the 'carbon mic replacement' circuits shown in this column in the past; some hams using carbon mics, however, report that they can't get full modulation without pulling V-120, the 12H6 limiting rectifier, to disable the limiter circuit.

In order to hear weak signals, I disabled the detector back-bias circuit by wrap-



Front section of ARC-2A with covers removed. The 70E-1 PTO is in the left compartment with the 12SJ7 oscillator tube inside the aluminum can. The two horizontal tubes are the transmitter and receiver multipliers. The center compartment holds relays and the autotune motor. The top of the PA tank coil is at the right.

ping a piece of bare wire between pins 1 and 8 of V-114. I am indebted to Charlie DiCecca, KA1GON, for pointing this circuit out to me.

The big -- really big -- problem with the ARC-2 as a ham set is the poor selectivity. A set with this much gain connected to a ham antenna will hear a strong signal which is many dB off the nose of the selectivity curve; the ARC-2's effective bandwidth is easily 25 kcs. There are many ways to improve this but none of them offer much without extensive changes; probably the best idea is to bring out the IF signal and use an external Q-5'er such as the BC-946 broadcast band command receiver.

Conclusions

The fit between the requirements of the job and the features of the ARC-2 is almost perfect, especially when you consider that so many of its features were new. Overall performance (stability, high modulation percentage, good audio quality on both receive and transmit), ease of use, and reliability are outstanding. It was a major achievement to squeeze a multiband transceiver of this power level into a package this size -- especially with octal tubes!

There are some problems. The design is over complicated, particularly as shown by the automatic modulation level control and back-biased detector. Needlessly expensive design features such as the screw-plug vents and ceramic bandswitch shafts further increased the price; considering both unnecessary or overcomplicated features and high cost methods, the ARC-2 probably cost 30% more than it should have. Some parts (such as the tunable IF coils of the early model) are too hard to service.

Usability isn't perfect -- the frequency dial is hard to read and the use of red lighting (though it may have been required by general design specs for aircraft equipment) makes it worse; this dial light only shows you where to point the flashlight.

continued on page 37

An Incremental Inductance Bridge

by Bob Dennison, W2HBE
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In the April 1987 QST [1], the author described a simple Hay-Maxwell inductance bridge. This general-purpose bridge has been very useful but it lacks one desirable feature - that of being able to measure incremental inductance.

Incremental Inductance

Incremental inductance is defined as the inductance present in a circuit that is carrying both a dc and an alternating current. An audio transformer may have high primary inductance when no plate current is flowing but in the presence of plate current, the actual (incremental) inductance may be much less. This adversely affects the low-frequency response of the transformer. Similarly, filter chokes must be designed to carry the dc current that they are employed to filter. Inductors and transformers that must carry dc current usually employ heavier iron-cores and often the iron core contains an air-gap to limit the magnetic flux density in order to prevent saturation of the magnetic core. Measurement of incremental inductance requires a special bridge circuit arranged so that a dc current may be passed through the inductor while its inductance is being measured.

The Modified Hay Bridge

The Hay bridge can be arranged to permit the passage of a dc current through the unknown inductance so as to permit measurement of incremental inductance. The circuit shown in Fig. 1 (page 13) is adapted from a scheme given by F.E. Terman[2] for use in the laboratories at Stanford University.

If the ac losses in the inductor are low, the inductance is given by the following equation: $L_x = R_a R_c C_b$

If the Q of the inductor is 10, the error is only 1% and if the Q is 5, the error is 4%.

The main inductance dial is a 100K linear rheostat (potentiometer). For limited amateur use, an Allen-Bradley carbon unit will give satisfactory results. The dial scale is calibrated 0-100 indicating the actual resistance in thousands of ohms. The ohmmeter portion of your VTVM can be used to calibrate this dial.

A 2-pole, 3-position switch (S1) is used to select different values of R_c and C_b for different scale multipliers as shown in Table 1. The resistors should have a tolerance of one or two percent. The two bridge capacitors (0.5 and 5.0 mFd) were made by parallel connecting smaller units to get the values required. A tolerance of plus or minus 5% is OK since you seldom need to measure incremental inductance closer than that. Another reason will be presented later.

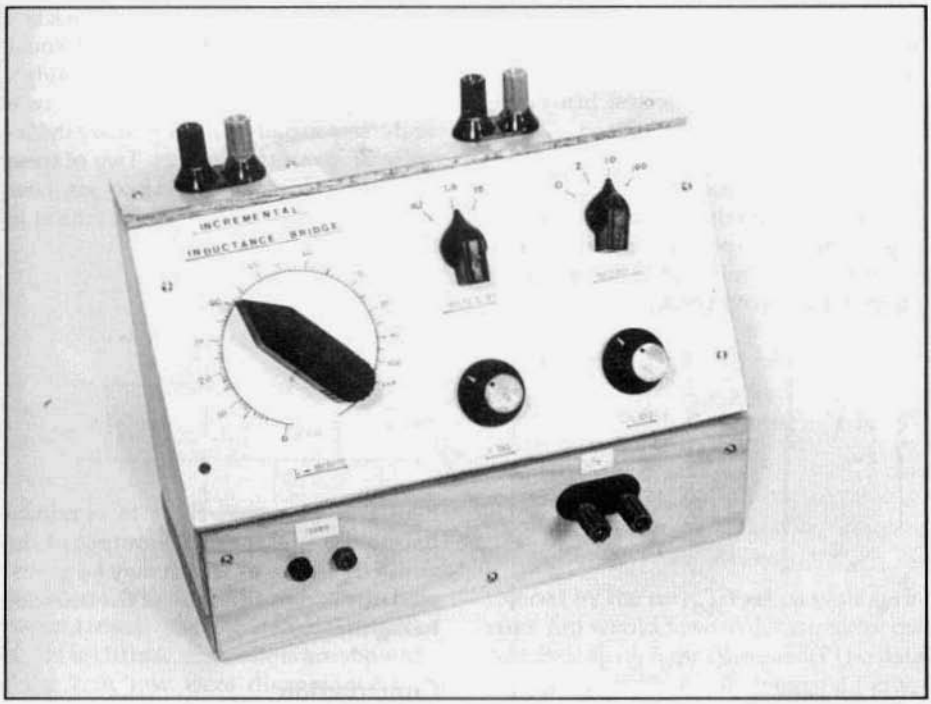
Multi L Scale by	R_c	C_b	Max L Meas. (H)
0.1	200	0.5	10
1.0	200	5.0	100
10	2000	5.0	100

Table 1. Values of R_c and C_b for the various scale factors.

Resistor R_a is used to balance out the resistive part of the unknown. Either a wire-wound or carbon potentiometer may be used. It is not necessary to calibrate this dial.

Transformer T1 is used to couple the audio oscillator, one side of which is grounded, to points a and c of the bridge, neither of which is grounded. I used a small audio transformer from my junk box - a Stancor A-64C connected to give a 2:1 step-down ratio. My oscillator is a RCA WA-44C which I found at the flea-market for $5. It provides about 12 volts, peak-to-peak.

continued on page 12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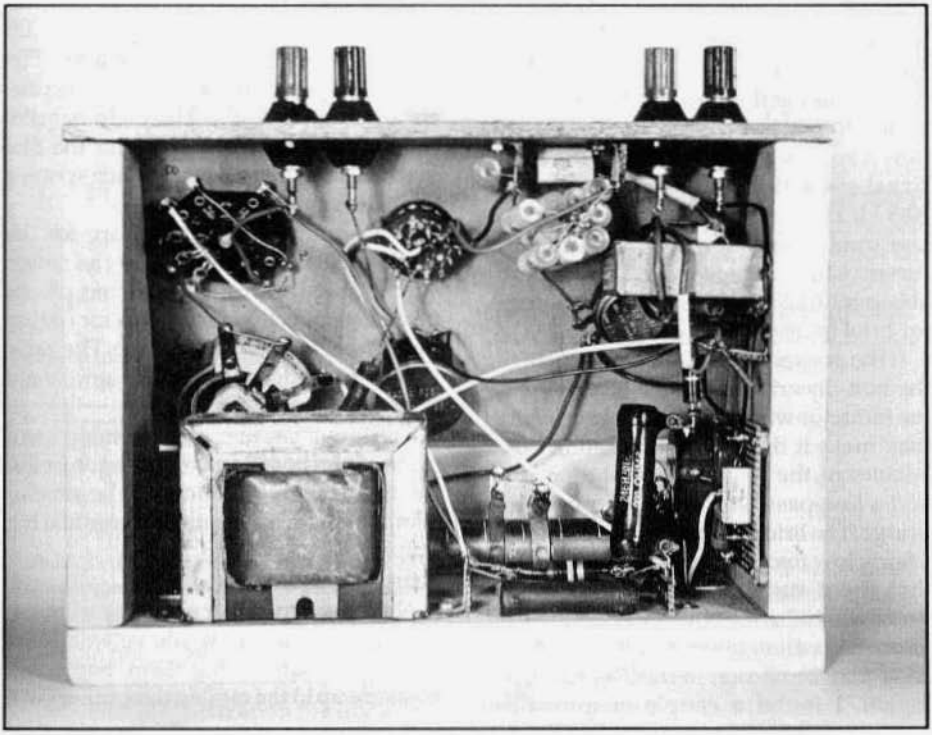
INDUCTANCE BRIDGE



The circuit in Fig.1 shows two terminals for connection to a variable-voltage power supply so that a dc current can be passed through the inductor under test. In my unit, I broke the circuit at X and introduced the auxiliary current control circuit shown in Fig.2. This permits easier adjustment of the dc current level in the unknown inductor. Depending on the power supply available to you, you may omit this feature or modify it to better suit your needs.

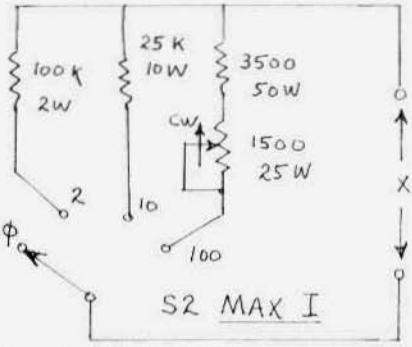


Figure 2. Auxiliary current control circuit.

Choke L1 permits passing dc current into the bridge so that it passes through L_x and R_c while at the same time it presents a high enough impedance to prevent the power supply from shorting out the audio signal at the detector terminals. I used a 10.5 H, 110 mA choke (Stancor C-1001). Use something that will carry the highest current you anticipate using. You can probably overload L1 as much as fifty percent for brief intervals of time.

If the ac excitation of the bridge is high, the non-linearity of the magnetic core of the inductor will generate harmonics that may make it difficult to determine exact balance of the bridge. The solution is to add a low-pass filter at the output of the bridge. The bridge is normally operated at a fairly low frequency (about 250 hertz) so that the distributed capacitance of the unknown inductor will not affect the balance. Thus the cut-off frequency of the filter may be chosen in the 300-400 hertz region. I found a couple of miniature Collins toroidal inductors in my junk box so my filter was small enough so it could be tucked into the box holding the bridge. The output transformers used in 5-tube ac-dc sets usually have a primary inductance of about two henrys. Two of these can be used to make a good low-pass filter as shown in Fig.3. Nothing is critical in this circuit.

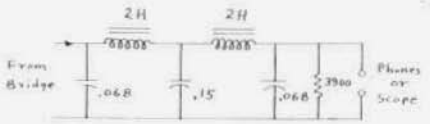


Figure 3. Low-pass filter to eliminate harmonics present in the output of the audio oscillator or which may be generated due to non-linearity of the inductor being measured.

Construction

Since the bridge operates at low frequencies, it doesn't need to be shielded. I put mine in a simple home-made box. The base and sides are 3/4" pine and the panels are thin plywood. The main panel is covered with bristol board and the dial markings are drawn on it and then sprayed with clear plastic.

The terminals at top left, are for the audio oscillator. Terminals for the power supply are on the right. A pair of tip jacks provide connection to the detector - either headphones or an oscilloscope. The latter is recommended for quicker and more accurate results.

The low-pass filter was assembled on a piece of perf board and mounted on one of the ends below T1. Most of the smaller components are mounted on terminal lug strips.

Application

Now you can gather up all those chokes and transformers that you've wondered about and start testing them. Some will measure up to the catalog data, others will

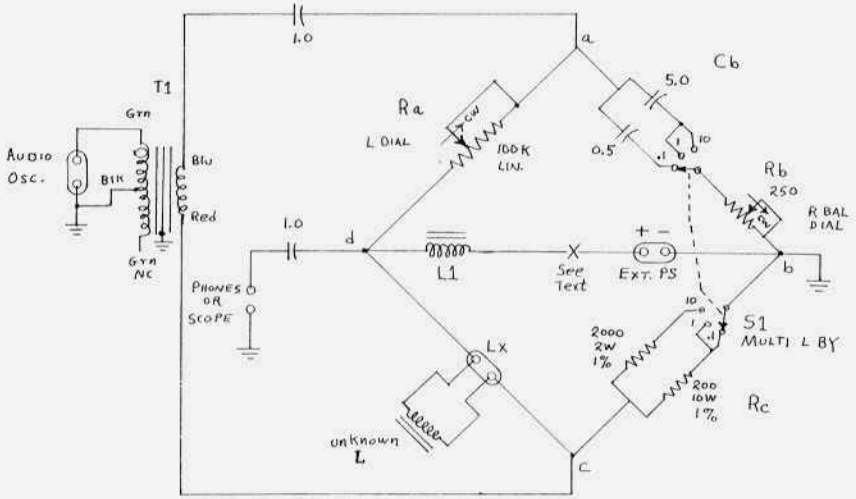


Figure 1. Schematic diagram of the incremental inductance bridge.

differ - usually on the low side. One of the chokes I tested was a Merit C 2993 rated at 10.5 H @ 110 mA. The results are shown in Table 2. A few were disappointing. A Thordarson detector plate choke T-20C50 gave the results shown in Table 3. It's a brand new choke, never used, but it may have a shorted turn.

DC Test Current	Measured Incre. L
0	11
20	10.3
40	9.6
60	9.1
80	8.7
100	8.6

Table 2. Incremental inducatance of Merit choke C 2993 at 10.5 H @ 110 mA

DC Test Current	Rated L	Meas. L
0	475	220
5	350	160
25	75	34

Table 3. Incremental inductance of Thordarson T-20C50 detector plate choke. This unit may have a shorted turn.

Terman points out that the incremental inductance you measure will depend on the previous magnetization history experienced by the core. To get consistent results you would have to demagnetize the core before each measurement. The data in Table 4 shows the incremental inductance measured on the primary of a small interstage audio transformer (Stancor A-63). Notice that the first time the primary inductance was measured, it was 8 H. After running the primary current up to 10 mA and back down to zero, the inductance was 9.2 H. The fact that the incremental inductance depends on the previous magnetic history is one more reason why the bridge does not need to provide great precision. A tolerance of + or - 5% on the capacitors at C_b should be sufficient.

Pri. Current (mA)	Incr. L (H)
0	8
5	6.2
10	4.9
0	9.2
5	6.2

Table 4. Primary inductance of a small interstage audio transformer. Note how plate current affects the primary inductance. When the plate current is dropped to zero, the inductance does not return to its initial value.

continued on page 36

The Multi-Elmac Company

by Lea Salter, KN4JW
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About two years ago I decided to collect at least one of each of the ham rigs that Multi-Elmac produced. There were several reasons for this. First, the equipment is rugged, well built and performs well. Second, I had an AF-67 and a PMR-8 in my car in 1961 and '62 during the Berlin crisis. Our reserve unit was called up for a year and I made many trips between Greenville, S.C., and Columbus, Ga. That rig was quite a comfort during those trips. Third, there were not that many different rigs made by Elmac, making them easy and affordable to collect. Last, and probably most important, it seemed like a fun project that would get me back on AM. The first equipment I obtained was the AF-68 and the PMR-8, but as you can see in the picture I now have an example of each of the six basic items that were produced.

After many ads in the ham publications looking for information about Multi-Elmac, I received a note from John Werner, WB8IPG, telling me about Angelo Diamantoni, W8ERN, a former engineer for the company. I called Angelo and he was very helpful and friendly. During several interviews he gave me much information about Elmac and the names of others who had been associated with the company.

The company was founded in Michigan in 1947 by five people: Gus Undy, W8YNC, Jack Bourassa, Phillip Cummings, Gervase McKeon and Mrs. Mable Collom. The name Elmac is a contraction of Electro Mechanical. At first the company was not involved in ham equipment but made many items including marine radios.

George Wilde was their sales manager and lives in Michigan with his wife Ann. He was first licensed in 1923 as 2CY and when he moved to Michigan his call was changed to W8CYL, which he still has.

George Goldstone, W8AP, was the corporate attorney. Other names and calls are, Bob Leland, W8CBT, and Harvey Steward, W8PSV.

The company remains in business but was bought out in 1976 by the Stanley Door Co. which manufactures garage door openers, marine equipment, depth sounders, Conelrad radios, civil defense radios, CB radios, transverters for car radios and many other items.

Descriptions of the six basic ham rigs are listed below in chronological order.

The first was a transmitter. The title block in the wiring diagram has the date of October 22, 1951. Its designation is A-54 or A-54H. The difference in the two is that the A-54 has an audio section that is built for a carbon mike and A-54H has a high gain speech amplifier for a crystal or a dynamic mike. Note that the next transmitters had a switch installed for one mike or the other, rather than making separate transmitters. The A-54 is a 50 watt, VFO or crystal frequency control transmitter. It covers 75, 20, 11 and 10 meters with a spare band switch position for 160, 40 or 6 meters. The R.F. Amplifier is an 807. It has nine tubes plus a voltage regulator tube. The OA2 was not supplied because it is not needed for phone but the tube socket and wiring were included.

The instruction book gives information on how to add the desired band to the blank band switch position. For instance, if you wanted to put 40 meters in that position, the book describes a couple of jumpers and two coils to add. It tells you how to make the coils and where to install them.

The power supply for the A-54/A-54H is the PSA 500 and is designed to operate from a 115 volt, 60 cycle power source. It

Lea Salter, KN4JW, in his workshop/hamshack. The Multi-Elmac gear is in two stacks on the right of the photo. On the top of the left stack is the AF-68 transmitter, below it is the AF-67 and on the bottom is the A-54 transmitter. The right stack consists of (from the top down) the PSR-612 power supply, the PMR-8 receiver, PMR-7A receiver and PMR6A receiver.

put out 450 volts dc at 250 mA. The rectifier tube is a 5Z3. The instruction book also explains how to use a surplus PE-103 dynamotor as the high voltage power source for mobile operation.

The next radio was the PMR-6A. The date on the wiring diagram is 1-21-53. This radio is a ten-tube double conversion superheterodyne receiver covering the 160, 80, 40, 20, 15 and 10 meter amateur bands plus the standard broadcast band. This one is the smallest of the radios (4 5/8 x 6 1/4 x 10 3/8), weighing only 6 1/2 pounds. There are four different power supplies listed in the accessories paragraph. I have noticed that none of the receivers list a speaker as an accessory. Along with the band switch, on-off-vol and tuning control there is an antenna trimmer and an AVC-BFO-N.L. switch. The frequency indicator is a pointer and works well.

The manual for this receiver is very good. It gives not only parts list, wiring diagram, power supply wiring, voltage charts, alignment procedures etc., but also a resistance chart for each pin of each tube.

The AF-67 transmitter came out next and this is probably the best known Multi-Elmac rig. I'm quite sure there were more AF-67's manufactured than anything else at Elmac. The wiring diagram title block has the date 9-26-53. The transmitter is a 10-tube, VFO or crystal controlled and the instruction manual says seven bands but the band switch has six positions for 160, 80, 40, 20, 15 and 10 meters. The modulator tubes are 5881s and the final amplifier is a 6146. It is capable of about 60 watts input. The transmitter was introduced as a Trans-citer. Many have used it to drive higher powered modulators. It will deliver approximately 40 watts of audio.

continued next page

The Multi-Elmac Company from previous page

The unique feature of this rig is the band switching arrangement. There is a lever on the front panel that has a chain connected to it. The chain goes around three sprockets and each of the three sprockets controls a switch that is a part of the band switching circuitry. In my use of this rig I have not had any problems with this arrangement. On the back of the transmitter there is a switch for the carbon or dynamic mike and a CW-AM-NBFM switch that also has lever linkage.

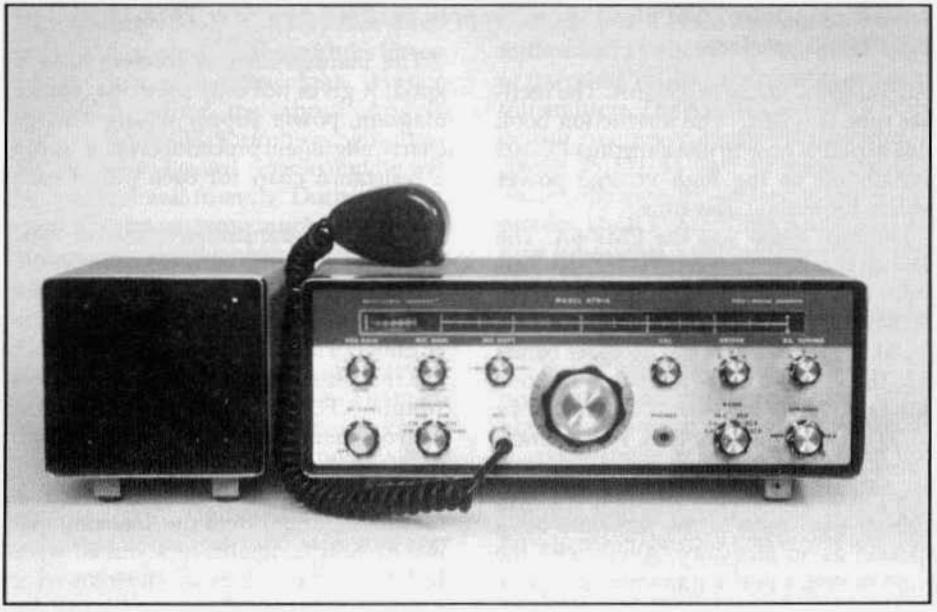
The only accessories listed for AF-67 are the power supply (PS-2V) and the connecting cables. I have not used this power supply but used the M-1070 which I will describe with the AF-68.

There is one other feature of the AF-67 that may be of interest to some of you. It is one of the few rigs manufactured that has narrow band FM capability. It is a feature that I have not used. The instructions say "A reactance tube modulator is incorporated in the VFO circuit for NBFM." I used this rig for several years in the '60's and had no problems.

The next item is the PMR-7 receiver. It is also a ten-tube double conversion superheterodyne rig covering the 160, 80, 40, 20, 15 and 10-meter amateur bands as well as the standard broadcast band. The wiring diagram has a 1-11-56 date. This receiver has some features that are not included on the other radios. The on-off switch and AF gain is a smaller knob centered on the RF gain. There is also a BFO injection control and centered on it is a smaller knob for AVC on-off and a squelch control. The other controls are tuning, BFO, pitch, band switch, antenna trim, BFO on-off and ANL on-off.

Also shown in the picture is the PSR-117 power supply. This power supply is for 117 volts. Note that it has a built in "S" meter. You could also get a PSR-612 power supply for either 6 or 12 volt operation. Available also was as ESS-3 "S" meter that could be used with the accessory plug on the PSR-612.

The AF-68 Tran-Citer. The wiring diagram does not have a date but the operating instruction sheet has 2-26-60 on it. This rig



The ATR-4 transceiver. This was Multi-Elmacs last effort in the ham radio business. They built 11 prototype units but the rig was never marketed.

is a nine-tube VFO or crystal controlled six band transmitter or exciter. The bands covered are 80,40,20,15, 10 and 6. With this unit (an upgraded or modified AF-67 basically) they did away with the lever for bandswitching, added 6 meters and dropped the 160 meter band. The AF-68 has a switch inside the housing for changing from dynamic to carbon mike. They kept the final RF amplifier a 6146 but changed the modulators to 6L6GB.

There are two power supplies listed, PS-2V and M-1070. The M-1071 was a kit form of the M-1070. I used the M-1070 with the AF-67 and the PMR-8 receiver both fixed and mobile. It is a fine unit that is very rugged. I have used three of these through the years and have had no failures. There are separate instructions with this unit, the other supplies had instructions included with the radio instruction manuals.

The manual describes jumpers for both 6 volt and 12 volt use. There are relays for the push to talk circuit and a bridge rectifier. There is a heavy vibrator for mobile use and a voltage regulator tube. One of the M-1071s I obtained recently was in terrible shape because of the bad job someone did in putting it together. I completely disassembled it and put it back together using new diodes, resistors and capacitors. Due to modern advances and the resultant changes in size, there is a lot of room under the chassis now.

The last receiver is the PMR-8. It is a nine-tube double conversion superheterodyne receiver covering the 80, 40, 20, 15, 10 and 6 meter bands plus the standard broadcast band. With this unit the controls were changed to eliminate the squelch and the BFO injection. It is in the same box that was used for the PMR-7 and weighs the same (8 1/2 lbs). This manual also has good instructions on vehicular noise suppression. I followed these instructions for my '58 Ford and they did the job. The AF-68 with an Astatic 10D mike and the PMR-8 are the radios I use on a daily basis now when I am using AM or checking into the Vintage CW net.

I find that the receiver and the transmitter are stable after a reasonable warm up. I've had good signal reports on both AM and CW. It is amazing to me that this small 9-tube receiver is as good as it is.

Gus Undy developed the first two rigs, A-54 and PMR-6A. Angelo Diamantoni and Bob Leland worked on the others. It must have been a fine team effort. One of the general things of interest has to do with the front covers. If you will look you can see that the covers are the same with knobs being in similar positions on the PMR-6A, AF-67 and AF-68. This was a fine economy move.

The final effort that Multi-Elmac made in the ham equipment business was the development of the SSB transceiver, the ATR-4. This 5-band rig (80-10) was also designed by Angelo Diamantoni and Bob Leland. They made 11 as prototypes and the project died. The rig turned out to be just too expensive to compete with the other rigs on the market at that time (early '60's).

I recently acquired one of the 11 prototype rigs and I have been very impressed. I think it is a superb rig. Although mainly designed as a SSB rig, it is also capable of low-level AM and is a super CW rig. There are few features that set it apart from other transceivers of that period - 6146 finals, VOX, plug-in coils etc. - but it is truly a high quality rig. For instance the main dial has a backlash of approximately 10 cps. Others of the same period, that were considered the best, had a backlash of 50 cps or more. When I acquired mine recently, I just plugged it in and went on the air. It worked flawlessly.

Angelo Diamantoni tells of the time that Bob Drake visited the Elmac plant. After examining and testing the ATR-4, he inquired if they might consider manufacturing it under the Drake name!

As you may have gathered, I really appreciate Multi-Elmac gear. I think it deserves a spot in anyone's collection of 'vintage gear'. **ER**

Collecting/Repair/Restoration...Tips

Comments/Additions To June 'In Uniform' Regarding TM's

TM 11-487A, August 1950, is an excellent reference for the military radio collector. It is one volume of a series published from 1944 to 1965. The series started with TM 11-487, October 1944. This one volume reference has ground radios, teletype, headsets, telephones, test equipment, microphones, generators, etc. It was first revised in 1950, being split into thirteen volumes by type of equipment. Further revisions followed through the 50's and early 60's, with most of the original volumes being split into two or three volumes each. The total set (which I don't have quite all of) takes up about three feet of shelf space. Some of the later volumes are (still) classified. TM 11-487A, which also became MIL -HDBK-161A in 1959, was last revised March 1964. The June 1959 revision must hold some sort of record for size, as it has 2152 pages. The later editions, particularly the 1959 one, also cover some Navy equipment.

A related manual is TM 11-227, April 1944, which covers Army tactical radios. It has generally better photos than TM 11-487, and covers a few different sets, such as the glider version of the BC-611, but it has no information on accessories, such as headsets.

As Walt noted, these books cover almost no avionics. The only thing that I have come across that does is 'Airborne Radio Equipment Handbook', 182 pages, published April 1943. It has photos of most of the common WWII aircraft radios, component lists, interchangeability lists, some accessories, and a few navigation sets. Not covered are radar or IFF equipment. There are photos of aircraft, with line drawings showing about where each component was usually mounted. Aircraft covered include most of the fighter, bomber and cargo types in service with the AAF in 1943. According to a note in the front, it was supposed to be revised as new aircraft and equipment came into service. If anyone ever comes across a later edition, I'd like to have it, or at least a copy.

Another 'official' source for military tech manuals is NTIS (The National Technical Information Service). They have access, through the Departments of the Army, Navy, and Air Force, to any document or publication still considered 'current', so long as it is unclassified. This means that most of what they can get for you is on newer equipment, but I've sometimes been surprised at what is still considered current. Some WWII era equipment is still being supported for NATO and other users. Details of how to deal with them, and pitfalls to avoid, are a little too long to include here. Anyone interested may send me a LSASE. If you don't want to write a letter, just write 'NTIS' on the flap.

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2027 Mapleton
Houston, TX 77043

YEAH, IT WAS A BEAUTIFUL RESTORATION-- YOU SHOULD HAVE SEEN IT BEFORE THE XYL FOUND OUT HOW MUCH I PAID FOR IT!

AM FREQUENCIES

2 Meters - 144.4, calling freq., activity in most cities; **6 meters** - 50.4 calling freq. **10 meters** - 29.0-29.2 operating window; **12 meters** - 24.985 calling freq.; **15 meters** - 21.400 - 21.450; **17 meters** - 18.150 calling freq.; **20 meters** - 14.286 for the nightly SPAM net starting at 5:00 CA time; **40 meters** - 7160, 7195, 7290 are the main freqs. Westcoast SPAM net every Sunday afternoon ,4:00 PM on 7160; **80 meters** - 3870, 3880 and 3885 are the main freqs. Westcoast SPAM net Wednesdays nights, 9:00 PM on 3870. AM Swap net Thursday nights, 7:30 PM on 3885; **160 meters** - Gray Hair net every Tuesday at 8:00 PM EST on 1945. Mostly sporadic summer-time activity but during the winter signals can be heard anywhere on this band.

From the Editor:

AM DX-pedition Coming Up From Grand Turk Island

Jim Taylor, W4PNM, and Hank Clark, W2IQ, expect to be operating from Grand Turk Island sometime around mid-August. Jim will be operating with the call VP5PNM; Hank has yet to receive his call but it will probably be VP5IQ. While they're there, Jim will be setting up a broadcast station on the northern tip of Grand Turk on an old Navy base. Jim says that the island is only 6 miles long and about a mile wide and that they'll be operating right on the salt water.

It's interesting that the rig they'll be using is Hank's Ten-Tec Paragon which is one of the few that Ten-Tec has manufactured with AM capability; and according to Jim it's the only one that has been sold to a ham so far. The Paragon transmits AM on one sideband only and Jim advises those with narrow filters to listen on the lower sideband. They'll be using an amplifier with the Paragon.

They plan to operate mostly early morning and at night on the standard AM frequencies: 1885, 3885, 7290 and 14.286. They plan to put up wire beams if they find the site has palm trees situated so they can be used for supports. On 160 they'll be using the 360' broadcast tower until it's put in use with the 50 KW transmitter.

Jim says that they're going to answer AM calls only and that he and Hank would like to talk to as many AM'ers as possible.

Report on Vintage Nets

The two vintage nets we've been promoting - CW and SSB - are surviving but not really flourishing. Tracy Reese, WB6TMY, net control for the vintage CW net, says that over the last few sessions they've been averaging only about 6 check-ins. Chuck Chuck, N5SWO, who has been net control for the SSB net, says they're averaging about 25 check-ins. I can remember that quite recently both nets were doing better. For some reason the interest in vintage net activity is waning.

I think that vintage net activity should be something that should be interesting to all of us that collect, restore and/or operate vintage gear. Maybe the answer is to have the nets more interactive. And maybe both net controls should have more input from those that are participating. I think that both Tracy and Chuck would be very receptive to any input.

The vintage CW net meets Saturday nights on 14.062 at 6:00 PM Pacific time. The vintage SSB net meets Sunday afternoons on 14.295 plus or minus at 12 noon Pacific. Consider checking into these nets and feel free to pass along any ideas you might have to either Tracy or Chuck.

Hallicrafters Test Equipment

by Mike O'Brien, NØNLQ
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Hallicrafters is one of the best-known brands of classic ham receivers and transmitters. Less well-known is the fact that in the company's early heyday and again, as its fortunes fell, Hallicrafters marketed test equipment aimed at amateur radio enthusiasts.

The prefix "HT" in a Hallicrafters model designation almost always signifies a transmitter, linear amplifier or transceiver. Two exceptions appeared in the late 1930s. One was the HT-5, the speech amplifier for the HT-4 transmitter. (When the military adopted the HT-4 for WWII service, it became the BC-610 and the companion HT-5 became the BC-614).

The other "HT" exception was the HT-7 Frequency Standard, a forerunner of the crystal calibrators that eventually became standard features of top-of-the-line receivers. Introduced in 1939, the HT-7 was built around a special Bliley crystal, known as the SMC 100, which was precision-ground to a tolerance that was impressive for the day – .05 percent.

The HT-7's four-tube circuit (6F6, 6N7, 6L7 and 6X5G) provides an oscillator and harmonic amplifier to generate markers every 100 kHz or 1000 kHz up to 30 mHz. A miltivibrator, locked to the crystal frequency, provides additional markers every 10 kHz. Output is sufficient to be detected by a receiver with only a casual connection between the HT-7 and the receiver's antenna.

"When Bliley came out with their crystal dedicated to this kind of service in a lab, we decided to put it to use for our own purposes," recalls Bob Samuelson, then Hallicrafters' chief transmitter design engineer. "We used them at all our test positions for our receivers and transmitters."

When in-house production line needs were met, Hallicrafters made the HT-7 available to the public. "The HT-7 will be of great help in providing an accurate source of signal energy for receiver alignment purposes," company literature promised service technicians. And, in appealing to hams in 1939, Hallicrafters noted: "With recent FCC regulations imposing the necessity for accurate amateur transmitter frequency checking, the HT-7 fills a need." Several hundred HT-7s also were purchased by the U.S. Army Signal Corps.

Housed in a sturdy metal cabinet 7.5 inches high, 5.5 inches wide and 8 inches deep, the HT-7 is finished in black-crackled paint and white panel markings. It sold new for $29.50.

Plugging in the HT-7's power cord automatically lights the tube filaments, a scheme to stabilize the temperature of the unit. A front panel Off/On toggle switch controls tube plate voltage. Temperature-related drift was found by Hallicrafters engineers to be about 10 Hz per mHz per degree centigrade.

Of the four knobs on the front panel, two are connected to rotary switches. One chooses 10-, 100- or 1000-kHz output. The other is a five-position "band switch" that selects among output coil taps to produce the strongest possible signal in the desired range.

The two remaining knobs control variable condensers. One fine-tunes the HT-7's output to allow precise zero-beating against a known signal, such as WWV. The other, working in concert with the "band switch," peaks output signal strength.

The rear chassis panel offers screw ter-

A Hallicrafters HT-7 Frequency Standard, circa 1939, a forerunner of crystal calibrators that became standard equipment in premium ham receivers in later years.

minals for an antenna wire and a ground lead. Also present is an adjustment screw to select the sub-harmonic of 100 kHz on which the miltivibrator operates. Adjustment is simple: turn the screw until only nine marker signals can be heard between any two adjacent 100- kHz points.

Taking into account that the unit might be used in conjunction with receivers with no beat frequency oscillators, the HT-7's output is modulated with enough hum to distinguish the signal, although precision alignment is easier with a BFO.

More than a half-century after it was introduced, the HT-7 still is capable of producing reliable frequency markers. Checking output of the author's HT-7 against WWV yields reassuring results, and markers are found spot-on or within a few Hz of their expected locations throughout the range of a synthesized HF receiver with digital readout.

(Hallicrafters veteran ,Samuelson, recalls another 1930s production line test gizmo that, unlike the HT-7, wasn't marketed to the public: "It was a rather haywire setup we used to test transmitters for output. We had trouble with RF power meters because they can be frequency-sensitive. So we'd take an ordinary lightbulb, with a wattage near what we reasonably expected from the transmitter. Using a Variac and a photo-electric cell with a meter attached, we'd light the bulb with 100-volt AC and calibrate the meter according to how much power it took to achieve various levels of brightness. Then we'd light the bulb with the transmitter and, because the filament of the bulb was small compared to the wavelengths we were dealing with, we'd get pretty accurate readings from the light meter. It was simple, but it was handy and it worked.")

The HT-7 was dropped from Hallicrafters' revamped post-WWII ham gear line. For the next 15 years the company thrived, producing more than 50 different models of shortwave receivers and more than a dozen ham transmitters and amplifiers. However, at the dawn of the 1960s, Hallicrafters was feeling the pinch of competition. Taking a cue from the super-successful Heath Company, Hallicrafters introduced a receiver (SX-140) and transmitter (HT-40) in kit form. Soon thereafter, in the summer of 1963, Hallicrafters launched more products seemingly inspired by Heathkits – seven build-it-yourself test instruments.

The line included:

– HD-1 capacitance decade box. Contains 16 precision capacitors and 16 slide switches to connect in 10,000 possible combinations. Range .001 to 1.0 mFd, variable in steps of 100 pFd. Price $14.95 as kit, $24.95 wired.

– HD-2 resistor decade box. Contains 28 resistors and 28 slide switches, with millions of possible resistance value combinations. Range 1 Ohm to 10 megOhms, variable in one-Ohm steps. Price $14.95 kit, $24.95 wired.

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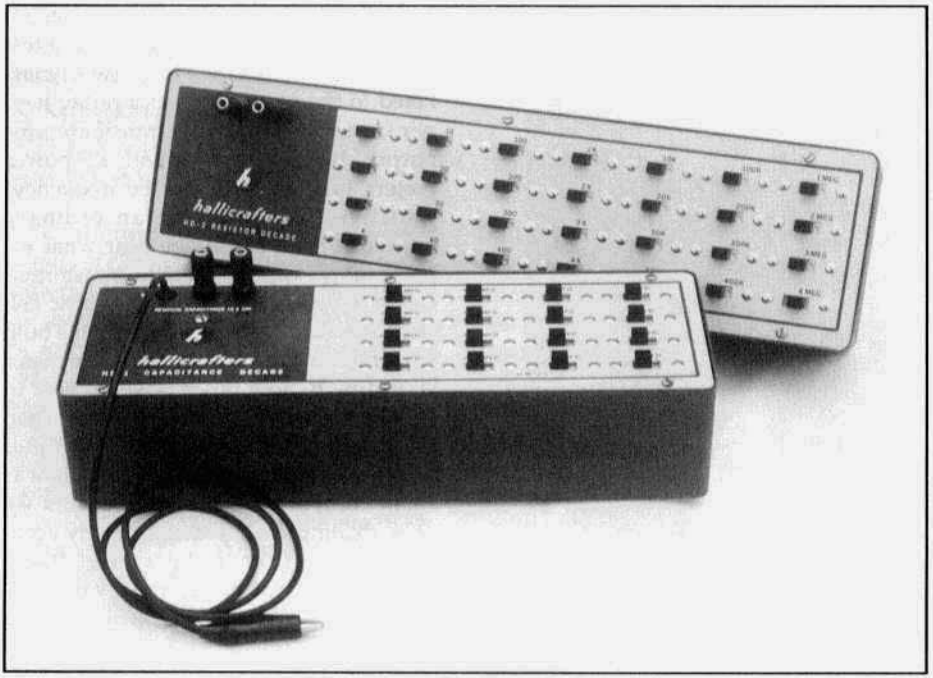


Two examples from a line of test equipment introduced by Hallicrafters in kit form in 1963. In the foreground is a capacitance decade box. At rear is a resistance decade.

– HC-1 condenser tester. Checks for unknown condenser and resistor values under operating conditions. Tuning eye aids adjustment. Price $29.95 kit, $49.95 wired.

– HO-1 five-inch oscilloscope with 5-mHz bandwidth. Price $84.95 kit, $164.95 wired.

– HG-1 RF generator. Range from 50 kHz to 55 mHz in six steps. Harmonics extend range to 220 mHz in additional two steps. Bandswitch is prewired and calibrated. Price $29.95 kit, $59.95 wired.

-- HM-1 vacuum tube volt-milliammeter. Seven AC/DC voltage ranges from 1.5 to 1500. Seven Ohmeter ranges from .1 Ohm to 1000 megOhms. Six milliammeter ranges from 1.5 to 500 milliAmperes. Price $29.95 kit, $59.95 wired.

-- HP-1 battery eliminator. Voltage ranges 0-8 and 0-16. Separate panel meters monitor voltage and current. Price $49.95 kit, $69.95 wired.

Marketed as "Master Kits," the Hallicrafters test gear never gained the popularity of the rival Heathkits, despite the luster of the Hallicrafters nameplate. Within a couple of years, the line was quietly dropped. Before the decade was out, the once-proud Hallicrafters company itself was on the financial ropes, soon to disappear along with most other pioneer American ham gear manufactures as the solid-state revolution gained momentum and imported gear reached U.S. shores.

Today, Hallicrafters gear once again is coveted by collectors, if not "appliance operator" hams. And Hallicrafters test gear makes useful companion pieces to sit alongside restored receivers and transmitters bearing the famous "h" logo. **ER**

LETTERS

Dear ER

In the June issue, Walt Hutchins had some interesting thoughts on the vintage SSB net. Restoring and operating older SSB equipment is both challenging and rewarding. When you think about it, amateur SSB gear has now been in production longer than amateur AM gear was, and the diversity of equipment and technology, is all the greater for it, and certainly deserving of preservation.

Due to antenna problems that were just recently solved, I have not had a chance to personally check in to the net, but I've listened to it, and have heard a few comments similar to Walt's from friends of mine that have checked in. I think that Walt's idea of going to 40 meters is a good one, and I'd like to offer a slight skew on it.

Any one that has spent time on 75-meter SSB with at least a dipole and medium power, knows that the nighttime coverage can be pretty dramatic. From my QTH near Boston, I can easily hear and work people in the Eastern half of the US on a very consistent basis, and often well beyond that. Keying on Walt's idea, I wonder if there would be any interest in getting regional 75-meter nets going on Sunday evenings after dark. Thinking back to my novice days in the late 50's, 75-M was a hotbed of SSB activity, and operating vintage equipment there would, I'm sure, be a real nostalgia trip for many of us. In addition, I think more people would be available in the evening versus mid-afternoon, as is the case with the 20-M net.

By the way, having been spurred on by KØEOO's great 100V article, I was lucky enough to recently acquire a CE 100V, 200V and 600L, all of which are currently going through the KU1R recycling program for aging radios. With any luck, I'll have them ready for action soon, in combination with my 75A-4. This was the kind of rig I could only dream of in the 50's, and yet the stability, selectivity, frequency readout, and "no tune" technology make it competitive with many of todays rigs. See you on vintage SSB !!!

George Maier, KU1R

BIG HAMFEST IN SPRINGFIELD,Mo.

The 1992 ARRL Missouri State Convention, Ozarks Regional Hamfest that will be held August 1-2 in Springfield, Mo., promises to be a very unusual event.

What's unusual is that the organizers have deemed to stress Vintage Amateur Radio. One of the main organizers, Larry Howe, KBØHIB, described what they're going to have there for those interested in vintage amateur radio. First of all they're going to have two excellent seminars conducted by two very knowedgeable and well known hams, Mike O'Brien, NØNLQ (a regular contributor to ER) and Bill Wheeler, KØDEW. Mike will conduct a seminar on vintage radio and Bill will conduct one on Collins. Besides these seminars they're also going to have a special event vintage station operating on AM. Another attraction for those who might want to sell in the flea market (indoor, air conditioned) is that the organizers there will, "load and unload your boatanchors and help you set up your tables." Pretty hard to beat that. Besides all of the above there will be lots of the usual fare found at hamfests.

In their advertising they're also stressing their proximity to Bass Pro Shop and Branson, Missouri, 'Country Music Capitol of the Universe'.

It sounds to me that this will be a first-class hamfest. For more information call Tom, WAØX, at (417) 887-5904 or Larry, KBØHIB, at (417) 882-1682. For written information and brochures of the area, write: SMARC, P.O. Box 1163, Springfield, MO 65808. **N6CSW/Ø**

Lee Faber, W7EH...Radio Pioneer

by Barry Wiseman, N6CSW/Ø
4 Aspen Place
Durango, CO 81301

Last month part two of this series ended with Lee getting married in 1925.

Part Three

To further quote Lee:

"Marriage and family life really agreed with me, my wife freed me up from all the housekeeping drudgery and things like that and kept me feeling good. She was also very encouraging and positive. I think I had more energy and ambition after I got married.

"As I recall, and maybe I'm wrong, ham radio really started to grow during this period. Tubes and parts were more available, information in the form of magazines and text books was more available, and ham radio was starting to get a lot of favorable mention in newspapers and magazines. All this contributed to the growth of ham radio. And people were really fascinated by radio communication. To most people it was almost magic. It seemed that young people, particularly boys, all wanted to get involved in radio.

"Even when the depression came along the interest in ham radio didn't seem to wain. I guess there were a lot of young people around with nothing to do and even though money was tight people improvised and got on the air or stayed on the air somehow. I was very fortunate in having a good job with the power company - I made $120 a month throughout the depression - but with a growing family it was tough getting by. And I also had to support my mother and father, who had lost everything.

"My father had sold the meatmarket in 1921 and went into the cattle feeding business. That didn't prove too successful. Then someone talked him into mortgaging several hundred acres of land in Illinois to buy a section of land out in South Dakota. And in South Dakota the tenants stole the crops and went into bad times. My father's finances started to fall apart. By 1932 or 33 he was totally broke. In ten years his entire fortune, which was $75,000, was diminished. And $75,000 in those days would be like a million today. You could say that he was trying to 'pyramid' his finances and got caught. I think that history is repeating itself and some people are going through the same thing today. During the '30's my father and mother came to live with Ruth and me. They were totally destitute. My father died in 1941.

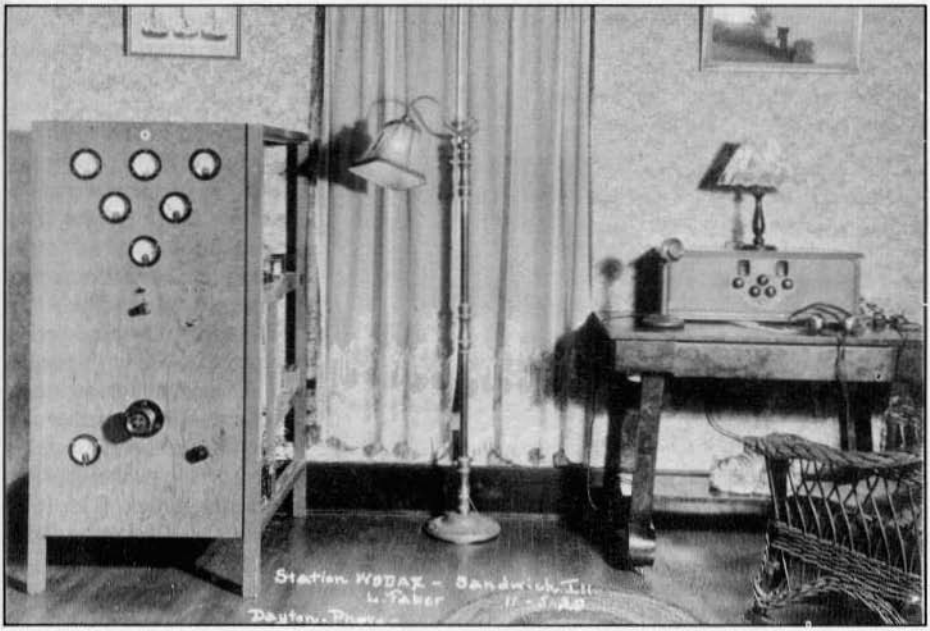
"At this time my main interests in ham radio were in building bigger and better transmitters - always cannibalizing the previous set for the next one - and in getting up on the higher bands; first 80, then 40 and eventually up on 10. Needless to say, higher power and higher frequencies presented some challenges. However, 160-meters remained a favorite band."

In the January 1931 issue of QST there's a story "W9DAX, A Modern Station Specializing in 1750-kc. Phone Operation" W9DAX was the call assigned to Lee when he inadvertently let his previous call lapse.

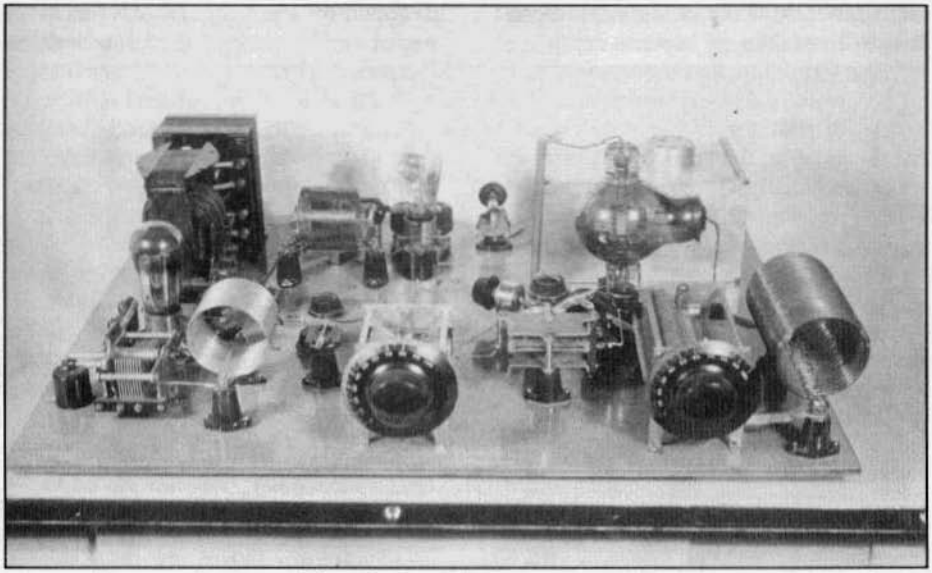
They quoted Lee as saying, "The thrills with 1750-kc. phone are the best of all, because many fine contacts are possible and one can make very close friends."

"The station is located on the main floor of the house, with the permission of Mrs. W9DAX. The permission might not have been so readily forthcoming if the outfit were not characterized by the neatness which is apparent in the photograph. [photo facing page]

continued on page 26



Lee's '150-meter' station that was put together in 1929 and used for several years. The large knob on the lower front panel of the transmitter was to 'rock' the mercury vapor tube. The receiver is a Silver-Marshall superheterodyne set built from a kit. The microphone is a Western Electric 389-W .



The oscillator and RF amplifier deck, which was mounted on the top deck with the control knobs to the side where they could be easily reached. The sides of the cabinet were open. The odd looking tube is the Type 52 final.

Lee, his daughter, Beverly, and wife, Ruth, about 1934.

"W9DAX consists of a crystal-controlled transmitter, using Heising modulation and a linear amplifier; power-supply equipment and other accessories; a superheterodyne receiver, and one or two other gadgets which, though not visible in the photo, are useful about the station. The transmitter is the feature of most interest, and will be taken up in some detail.

" The frame houses five separate units, each of which may be removed readily for repairs or changes. These are: The radio-frequency unit; the speech amplifier and modulator; the mercury-arc rectifier and keep-alive; the filter, and a control unit which contains the various relays for operating the set."

The RF portion of the set consists of a Type 10 oscillator, Type 10 buffer amplifier, Type 10 modulated amplifier and a Type 52 amplifier.

QST continues:

" The modulating portion of the outfit consists of a double-button microphone, three stages of speech amplification and two type '50 tubes in parallel used as modulators.

"The microphone is a Western Electric 389-W public address instrument and is capable of excellent reproduction.

"The receiver at W9DAX is a superheterodyne, using a regenerative first detector, oscillator, three stages of screen-grid intermediate-frequency amplification, second detector arranged for plate detection, and a single stage of audio-frequency amplification. The outfit is built from a factory kit made by Silver-Marshall.

"For monitoring transmissions an old broadcast crystal receiver is used. No trouble is experienced in getting enough pickup on W9DAX's frequency to get a good check on the quality of modulation.

"The station has been heard regularly over a considerable area, and has been picked up in California - an excellent record considering the fact that comparatively few amateurs listen on this band. Since broadcast receivers have been made selective, interference difficulties have dropped off - in fact, W9DAX has never had a single complaint of interference. People even call up to compliment him on his outfit when they happen to pick it up!

"There are 285 perfectly good kilocycles in this band which should be a fertile field for 'phone men, especially. W9DAX says,'come on up and see for yourself!' "

Lee continues:

" In the late '20's, I started working more and more DX, particularly on the higher bands. I remember I was one of the first stations to work Belgium on '40. As time went on it became almost routine to work DX but it was always a thrill.

"My first record of grinding crystals was in 1932. I worked a ham up in Sycamore, Illinois, 20 miles away and he was using a crystal. The tone and stability of his signal was just exceptional so I had to have one. So I order a piece of raw quartz from a company called "Electro Importing Company" in New York City. I paid $3.95

for it when my wife needed a pair of shoes. Believe me, in '32 we had no money. A nickel ice cream cone on Saturday night was a treat. But anyway I ordered that quartz (pret-near getting a divorce in the meantime).

"I cut these crystals with a piece of metal and carborundum just by moving the metal back and forth like a saw until I wore a path thru the raw quartz. Then I ground the crystal flat by using the same carborundum on a piece of plate glass (on many pieces of plate glass because the glass wore out faster than the crystal.) I wound up getting a crystal to oscillate somewhere near the 160-meter band.

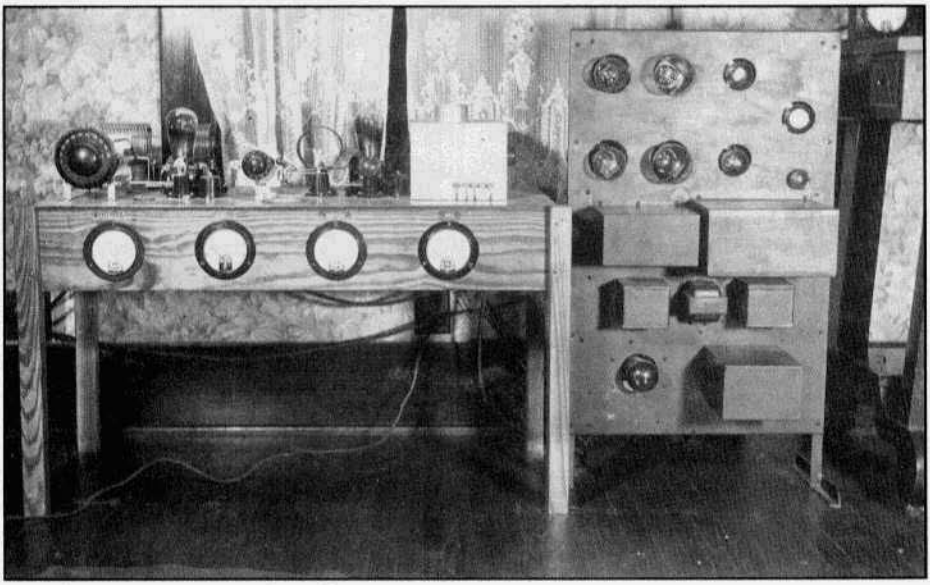
"It's interesting that in the first article on crystals that QST presented they got the information on the X and Y cut reversed. So when I thought I was making an X cut I was actually making a Y cut. Can you imagine that!

"The difference between and X and Y cut crystal is determined by the axis. A crystal has electrical, mechanical and optical axes. Well a Y cut is oriented from the crystal in relation to those three axes and an X cut is oriented at another angle. I think they're 60 degrees apart, I've forgotten. A Y cut has much higher temperature coefficient. In later years I ground many Y cut crystals for temperature measuring equipment at the bottom of oil wells. We'd cut a crystal at a certain frequency and drop the equipment down into an oil well and you could tell the temperature at the bottom of the well by the frequency generated by the crystal.

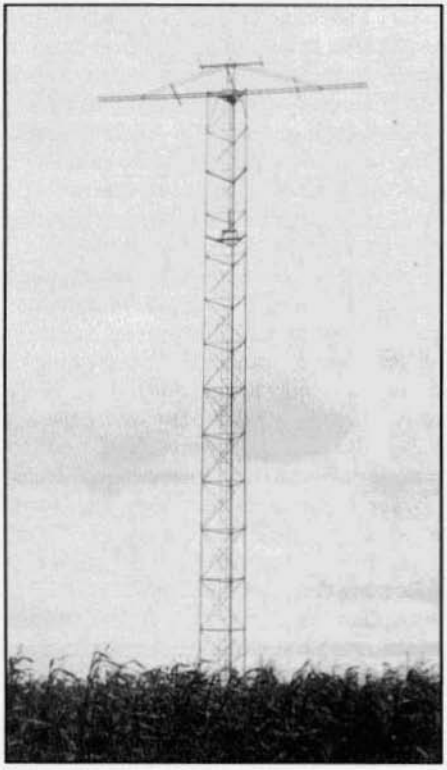
"After I had cut some crystals and used them I was very impressed. I knew that crystals would play a big part in the future of radio and I thought there was going to be a lot of money to be made there. In 1932 or 33 I formed a company and called it Faberadio Electric Company. I have to mention that at that time and later I was always learning from others who were making crystals. I think that much of what I was doing then and even later was really following the work of others.

"At first I sold crystals to hams that I got together with at club meetings at Aurora, a large town about 20 miles from Sandwich. I remember I had a special deal for club members only; 25 cents per crystal, 5 cents down and 5 cents a club meeting. Remember this was the '30's and times

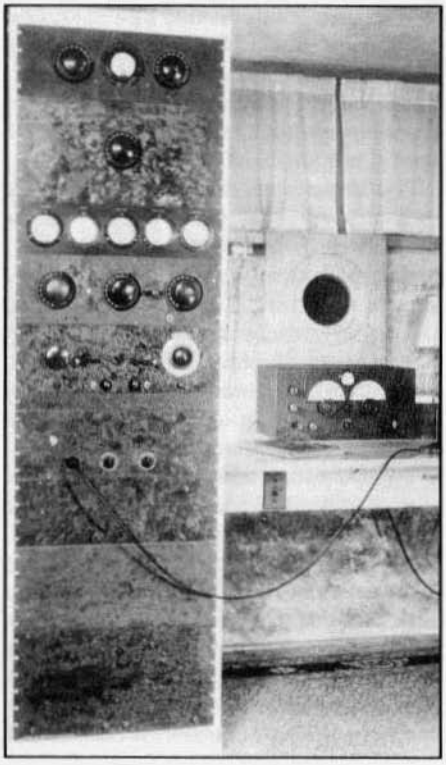
continued on page 29



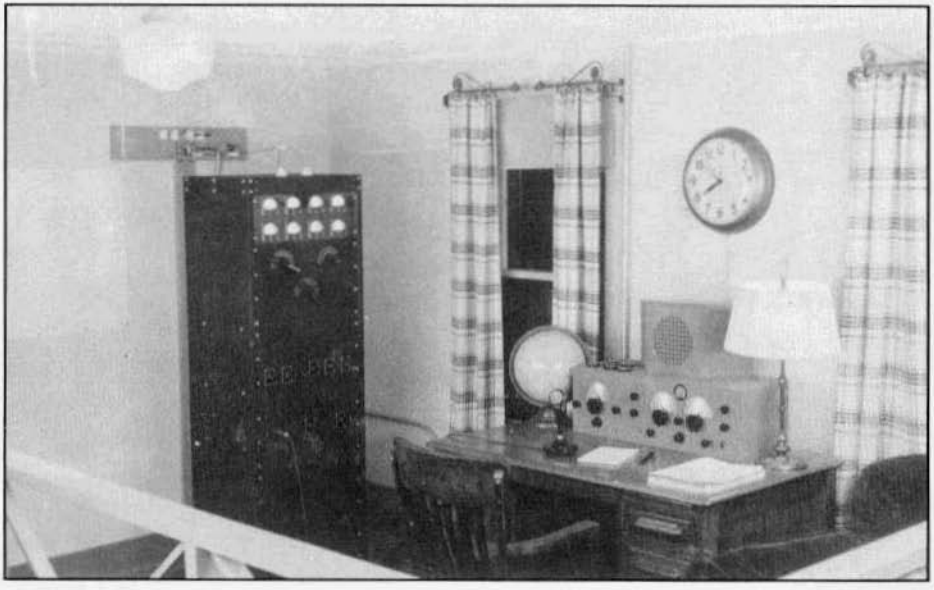
Another '150-meter' station about 1932



Lee's 82' tower in 1940. The boom was a 24' wooden ladder.



A 1938 station.



A 1939 station.

CRYSTAL HOLDER

THE FABERADIO ELECTRIC COMPANY has been in close contact with amateurs for many years. We know their needs. We offer for approval the type 36V variable air gap crystal holder.

When used with an active crystal, such as the "A" or the "V" on frequencies within 1000 KC above or below 4000 KC, the fundamental frequency variation will be approximately 6 KC. The frequency adjustment is made by turning the control knob.

When used with "A" or "V" crystals on frequencies within 300 KC above or below 2000 KC, the fundamental frequency variation will be approximately 2 KC.

Crystals one inch square are easily accommodated in this holder. Commercial stations can use this holder for precise frequency adjustments.

CRYSTAL HOLDER

THE FABERADIO ELECTRIC COMPANY crystal holder is compact (1¾" wide and 3/8" thick), rugged and dust proof. The pressure of the top plate can be varied. The plates are lapped flat. The lower plate is exposed to radiate heat and helps to lower frequency drift when the crystal is worked at maximum output. The body is molded bakelite which is moisture proof, physically strong, and low loss electrically. It will not break if dropped. The color is mottled brown and black with a high lustre finish. The terminal pins are on ¾" centers and by removing the terminal pin springs the holder will plug into a standard UY socket.

The design of this holder is ideal for the modern idea of stacking a number of crystals for frequency or band switching layouts. This holder will accommodate all crystals up to and including those one inch square.

Specify type 36 for frequencies below 5000 KC and type 36H for frequencies higher than 4999 KC.

Two pages from from an early Faberadio catalog describing a couple of Lee's best selling items.

were tough.I then came in contact with a man name Pat Paulson who was an engineer up at radio station WBBM in a Chicago suburb. He helped me make commercial sales to NBC, CBS and other big broadcasting outfits. At this time, in the early '30's, I think there may have been only a few other people grinding crystals. It was a new enterprise."

From the Sandwich Free Press, 1936:

"One day this week Leon Faber received an order to grind three crystals for the MacMillan expedition which leaves soon for the Arctic region. The order was received from Mr. Paulson, engineer in charge of building the radio equipment for the expedition.

"Since establishing this business Mr. Faber has supplied crystals to the National Broadcasting Company and Columbia Broadcasting company. He has also shipped crystals to China, Japan, Alaska, the Netherlands and Australia."

Lee continues:

"I was working as a Superintendent with the power company during the day and making crystals practically all night. I had a couple of part-time employees as well. It occurred to me that I needed a partner to help out so in 1936 I sold a half interest in Faberadio to Carleton Hough who also worked for the power company as a lineman. However, Carleton didn't like the idea of working 24 hours a day like I was doing. By mutual agreement I bought him out in 1938 and carried on alone in the business until 1942 when I formed the James Knight Company with James Knight as a partner. **ER**

Part Four will appear next month

Editor's Note:

In some future issue we'll have more on the mercury arc rectifier that Lee used with some of his earlier transmitters; it's a very intriqing devise.

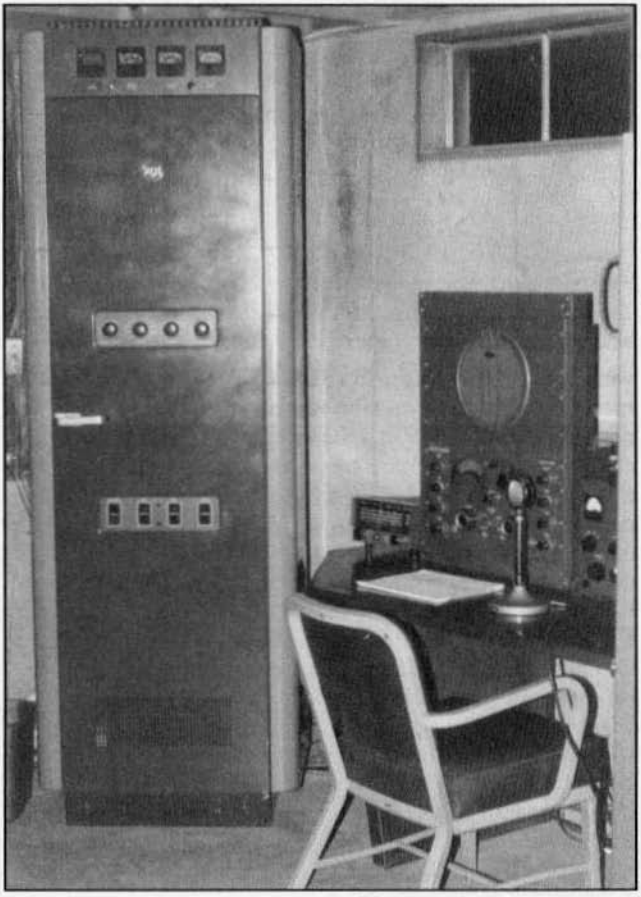
A Tale of Three Transmitters

by Dale Gagnon, KW1I
9 Dean Ave.
Bow, NH 03304

In the early 80's I caught the HF AM bug. After 10 meters closed up I was attracted by 160 meter AM operation and I began to scout around for larger transmitting equipment. I'm not sure I was looking for a broadcast transmitter when one found me!

A nearby amateur who worked at a vocational training school had been contacted by a local radio station that was seeking to donate a radio transmitter to the school. The school was not interested, but my amateur friend thought I might be. A call to the station revealed that the transmitter in question, a RCA BTA 250M, had been the original transmitter in the station, had become the backup transmitter when a higher power transmitter had been installed and now was no longer necessary because a brand new transmitter was on the way. In fact delivery was expected any moment and there was no room for the new unit until the old RCA was moved out. The station manager offered me the transmitter contingent on picking it up at once. I called the local equipment rental company for a large appliance mover, took along a friend and got the transmitter loaded on my trailer the same day.

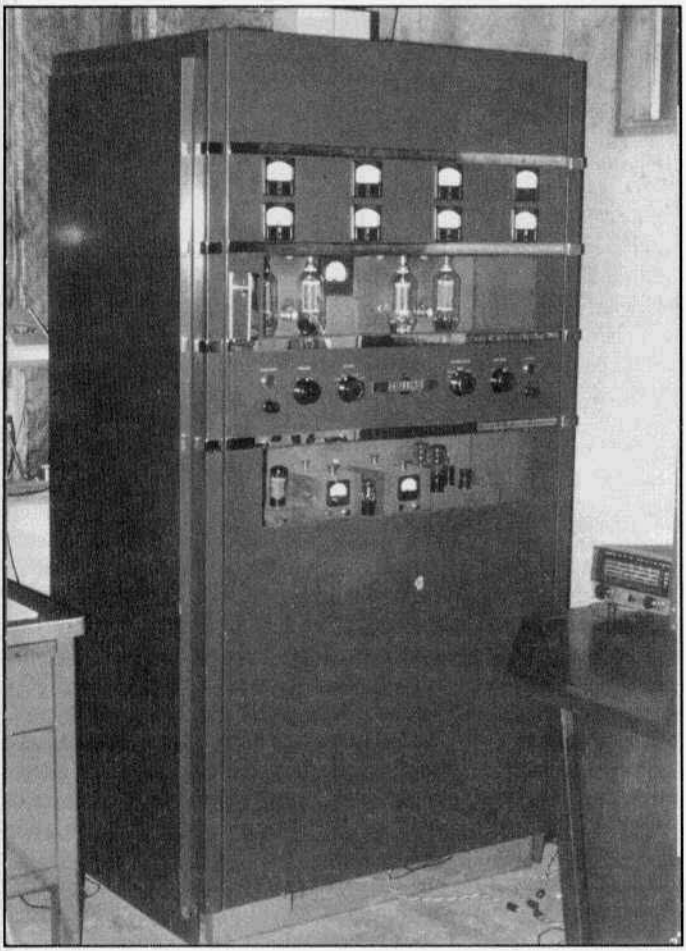
The BTA-250M is 7 feet tall and weighs 600 pounds. It has two 813's modulated by two 813's for a nominal power of 250 watts out. This transmitter was maintained very well and was in good condition inside and out.



RCA BTA-250, conservatively rated at 250 watts output. This transmitter runs 813's modulated by 813's. I need a ladder to check the meters on this one.

Before I could try to get it on the air I had to disconnect a number of external connections associated with remote operation and restore the transmitter to its pre-remote control configuration. I mounted a coaxial relay for transmit/receive switching inside the cabinet and used external relay contacts to close the transmitter plate relay. I removed the crystal and connected a Globe Electronics VFO to the crystal socket. The manual included tune up information and charts for the broadcast band. To obtain appropriate drive I changed the location of a jumper on a terminal strip. I extrapolated curves on the charts in the manual to get an idea for coil taps. I eventually disconnected half of the coil stock and configured the tank circuit as a pi network.

The transmitter tuned up very nicely after a little trial and error tap changing and strapping of a selection of mica caps that are provided for loading rather than a variable. I used a small audio amp's 8 ohm output into an 8 to 600 ohm transformer to match the 600 ohm input to the modulator. It didn't take long to get on the air. I knew I had achieved success when one of my first contacts with the RCA gave me the unsolicited report, "You sound like a broadcast station". One of the only drawbacks using this rig was the necessity of standing on a small ladder to read the meters, they are across the top of the 7 foot cabinet!



I used the RCA for several years. One night I called CQ and was answered by a sideband station operated by a retired broadcast engineer from Connecticut. He said he knew where a 250-watt Collins 300G broadcast transmitter might be available. He had installed the transmitter in 1946 and had been responsible for it while it was in service, the best part of 40 years. He said he would call me with details.

Collins 300G, another '250 watter'; 810's modulated by 810's. Note chipped paint where the transmitter stopped the bullet (see text).

continued next page

A Tale of Three Transmitters from previous page

Sure enough he called me long distance to tell me that I could buy it for $100. He would make all the arrangements and have a team of people ready to load it when I arrived at the transmitter location. I immediately started planning this next ham radio adventure.

When I arrived, the team was there waiting for me. The transmitter building was in a depressed part of town. I was shown a bullet hole in the building door and the mild depression had chipped paint where the 300G's cabinet door had stopped the bullet!

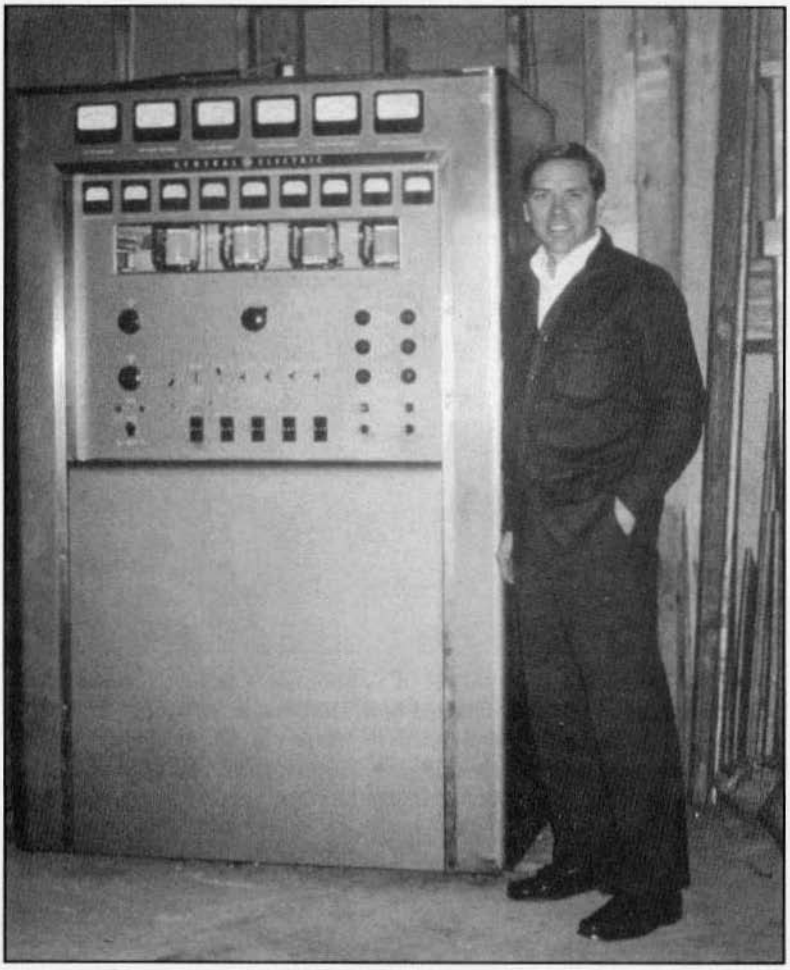
The 300G is 6 feet high and is almost twice as wide and twice as deep as the RCA. It weighs 1485 pounds. It has heavy doors, glass windows, decorative end panels and chrome strips. All this extra size and weight, but still the same power class as the RCA. One amateur with broadcast experience made the observation about these two rigs from the same era. The RCA could be found in more rural stations with lower budgets and the Collins was more likely to be found in cities in stations with better advertising revenue. The 300G uses two 810s modulated by two 810s. Because of the weight I had to significantly disassemble the transmitter to move it and set it up. To make room for it, I eventually moved the RCA out of the shack and then transported it to my brother Dean, KK1K's, station in Vermont.

The 300G manual was very helpful in getting the unit on the air. I used the Globe VFO to drive the crystal oscillator stage on this transmitter as well. The motorized tuning unit on the intermediate stage was frozen, but placing a jumper on a coil and manual placement of a variable cap produced drive across the whole 160 meter band. The tank circuit tuning and loading is accomplished with permeability tuned coils. The slug in the coils is motor positioned. The motors unrolled and rolled up a thin metal strip that moved the slug in and out of the ceramic coil form. The motors worked, but the strips of metal were long gone. Eventually, I used about half the width of a common tape measure replacement to fashion new strips which worked out fine. In the interim I used an insulated rod to position these slugs (not recommended!) About the same time I found this transmitter I acquired a Collins 26U Peak Limiter with 600 ohm output which matched the 300G audio circuit input. The 300G is still in service in my shack.

A few years ago I was mobile listening to a conversation on 2 meter FM when I heard a fellow mention he worked for a company that owned several broadcast stations and he was part of the engineering staff. I got him on to a direct frequency and asked him if he ever ran into any transmitter components or even transmitters that might be available for amateur service. He came back with the reply, "Is this your lucky day." This well placed query led me to my General Electric XT-1A. Apparently the company he worked for had just acquired a station which they were modernizing and changing format in anticipation of reselling.

Some commercial radio station transmitter sites are as clean as a hospital operating room; others are more like the typical ham shack with accumulation of equipment and a good measure of haywire. This station was more like the latter. I was invited to pick over anything I was interested in before they filled up a dumpster. Months later, as we got the building cleared out I was able to move the XT-1A out with a good size crew of amateur volunteers and a healthy flat bed trailer. Our crew also moved a much newer Gates 1 KW transmitter into the old operating position. They were happy they did not have to pay any riggers for the equipment moves and I was happy to be given a beautiful kilowatt transmitter, complete with a few spare 833s.

Unfortunately, the XT-1A cabinet which is 6 feet high, four feet wide and about 3 feet deep does not disassemble and so could not join the rest of my equipment in the basement shack. I have wired



Dale, KW1I, with his General Electric XT-1A. This transmitter runs 833's modulated by 833's and is rated at 1100 watts output.

it up remotely from the garage. I use my FT-757 inside the house with less than a watt of output to drive the oscillator circuit in the XT-1A. Tune up was easy because the transmitter was actually designed to completely cover 160 meters.

This '50's vintage, 6 foot high, 2000 pound transmitter has a pair of the classic 833 triodes modulated by another pair. This transmitter is rated at 1100 watts output from .5 to over 2 mHz. I monitor the power output and a scope trace from inside the house. I have not set it up for remote tuning although this could be accomplished quite easily. The only problem I have experienced is with vacuum high-voltage rectifiers in sub zero temperatures. They may or may not work if the tube temperature is too low. Solid state rectifiers and a step-start circuit have cured my power supply problems.

These large transmitters are a great conversation piece and are definitely worth the trouble of moving and retuning. **ER**

This picture was taken at a flea market in Yokohama. The hams in the photo are all regular check-ins to the "Yokohama AM Net" that meets Saturdays and Sundays on 14.286 at 0100 UTC. From left to right: Isao Mannen, JI1IRC; Hideshi Takahashi, JA1FFX; Yoshio Koyanagi; JA1EIA and Stan Tajima, JA1DNQ/KD2HB.

Marv Toepfer, W5TQO, in his nicely organized vintage shack.

John Brewer, WB5OAU, with a recently acquired Johnson Ranger that came in the original box. He says it was 'grimy as sin' when he got it but it's now 'cleaned up like a jewel'. A Johnson Matchbox is sitting on top of the Ranger.

Annual Christmas 'bash' at KF6EA QTH in 1991. From left to right: Harry Wells, AA6PP; Dave Mills, AJ7O; Bob Sitterley, K7POF; unknown; Ralph Miller, KD6OS; John Barcroft, WA6ZJC; Norm Johnson, W6CC and Rich Smith, KF6EA.

Reflections Down the Feedline from page 2

quality. Most of the units, including the final RF amp., can be slid out on slides for ease of servicing. The RF final band switch is a mind-boggler--big and complex. How does this set work? I'm still trying to get the Navy tech manuals. This is more complicated than a regular AM rig.

The FRT-24 was made by Collins from 1952-54 and was a special Navy version of the Collins 430 series of transmitters. The 430 series came out in 12 different variations.

The FRT-24A that I have is made by Manson Laboratories of Wilton, Conn. This model dates from 1965 and 1966. The book: "Collins-The First 50 Years" shows no production of the FRT-24A, but it is a Collins design and there is a small Collins patent license nameplate on the front panel.

The cabinets of the FRT-24 and the FRT-24A are almost identical in appearance, but the 24A has more drawer units on the left side.

Manson Laboratories was a subsidiary of Hallicrafters in 1965. I even found 2 small filter units inside the set with the Hallicrafters name on them. But also, in 1965, Hallicrafters was owned by Northrop Corp. -- the California aerospace company. So, the FRT-24A is really a Manson - Hallicrafters - Northrop - Collins transmitter.

My FRT-24A still has a front panel nameplate of the Naval Auxiliary Air Station, Kingsville, Texas. K6KUS said he got the transmitter from a fellow in the San Francisco Bay Area, so how it got there from Texas, I'll never know. ER

Inventor of Loudspeaker Dies

Edward Mantick, N3GWE, sent in a newspaper article about John Spence Timmons, who died recently at the age of 99. According to the article, he invented and patented the first radio loudspeaker around 1921. He started J.S. Timmons Inc. and Timmons Radio Products to sell his invention and other radio parts.

Incremental Inductance Bridge from page 13

Many chokes are found at hamfests that bear only a drawing number. These can often be obtained at very low prices because nobody has any idea what they are. Now you can buy them and put them to work. You can usually guess which inductance range to use by looking at or 'hefting' the choke to be measured. Then adjust both the 'L' and 'R BAL' dials for a complete null. With certain low-Q coils these adjustments tend to interlock making it difficult to find the exact null point. In this event, try a slight increase in 'R BAL' and then readjust 'L'. If this improves the null, continue this procedure. If not, try a slight decrease in 'R BAL' and readjust 'L'. With practice, you will soon become adept at balancing the bridge.

You may not need the services of an incremental inductance bridge often, but it is a pleasure to know you have one available when the occasion arises. If you have a well-stocked junk box you can build one in just a few days! ER

Notes

1. A Low-Cost Bridge for Large Inductances, Robert C. Dennison, QST, April 1987, pp 44-50.

2. Measurements in Radio Engineering, Frederick E. Terman, 1st Ed., McGraw-Hill Book Co., Inc., NY, 1935, pp 55-57.

Letter From Australia from page 3

ers. Separate HT, screen and bias supplies provide power to the electronic keyer, sequencing and monitoring devices.

The antennae in use are dipoles and slopers hung off adjacent towers or tall wooden posts. Whilst the news coverage is meant to be within the state, we often receive reception reports from interstate. The broadcasts are done on Sunday mornings and repeated in the evening but to restrict night-time distance the evening news does not go out on 40 meters.

Whilst the transmitters have given very good service over the years, a severe shortage of 810 valves is causing concern and may soon close the equipment down. Hope the above is some interest to you. ER

ER in Uniform from page 9

The 15 to 30 watt rated output is low for a liaison set though probably all that was possible in a package this size with 1943 tubes.

But some mistakes are unavoidable when you build something really new. The worst problems (the bandswitch and hard-to-service coils) were fixed in the ARC-2A. With the ARC-38, Collins brought back the 100 watt power level and eliminated the clever but unnecessary circuits.

Look at the other radios delivered late in the war. Is the SCR-506 a competitor? The GRC-9? The ARC-1, ARC-3 or any of the 1944-46 (early) aircraft UHF sets? Only the Army's GRC-3 through -8 FM sets (RT-66 through 68 and RT-70) even come close. What other radio, 1930 to 1960's, so much advanced the state of the art? Even with its high-cost design and a few unnecessary features, the ARC-2 is my pick as the all time best design among U.S. small and medium size military sets.

Looking at the ARC-2, we see Collins Radio at its best, but also at its worst. Such a radio could never be built without the ability to attract brilliant engineers and get the most from them. Yet a radio with such costly design can only be sold to the government and then most easily during wartime. Collins never solved the problem of combining brilliant innovation with cost-controlled design and efficient production; the result was that many later Collins military sets such as the R-390 were built mostly by other firms. A manufacturing company can't be profitable when most of its 'big winners' are built by others. The brilliant but expensive design of the ARC-2 was an early shadow of both repeated technical triumphs and the end of Collins as an independent company. **ER**

(The following sets mentioned in this column have been covered in previous issues: the ATD, March 1992, the ART-13 or ATC, November 1989, and the ARC-38, October 1990.)

Editor's Comments from page 1

I think that Vintage RTTY is something that should be preserved. According to "The New RTTY Handbook" written by Byron H. Kretzman, W2JTP, in 1962, RTTY was first used in a landline operation in 1849, when a loop was put into operation between New York and Philadelphia. From that time on RTTY, or Teletype, as it became more commonly known as, flourished. It was used by news agencies, governments, all kinds of businesses and was almost indispensible during the World Wars, particularly WW II.

The Teletype Corporation which was formed in 1925 has pretty much dominated the teleprinter business. There were other companies in the business like Morkrum and Kleinschmidt but they didn't do very well compared to Teletype. I believe that the Teletype equipment represents U.S. technology and manufacturing at it's best. They made absolutely first rate equipment.

Even ten years ago when I was very much involved with the old Teletype machines, I was in a small fraternity and nobody wanted the stuff anymore. More modern and, I guess, easier to use computer gear was coming out and most hams wanted to be out there on the 'leading edge of technology'. Another disadvantage of course, was the weight and bulk of the machines and the noise they generated; not to mention that wonderful smell of oil!

I hope that I can promote some interest in vintage RTTY. If I can't, I think that all the machines and gear will wind up in the landfill (most of it's there already) and that aspect of radio will go the way of the steam engine.

I'd enjoy hearing from anyone with an interest in vintage RTTY. Please write or call. **N6CSW/Ø**

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Advertising Information

Subscribers receive 1 free - 25 word- ad per month. **Extra words are .15.** Here's how to count the words in your ad: the heading - For Sale, Wanted, etc count as **1 word.** Your name, call, address and telephone number count as **6 words.** Hyphenated words count as **2 words. Please count the words in your ad and if you're over 25 words send payment for the extra words.**

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DEADLINE FOR THE AUGUST ISSUE: AUGUST 3

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

FOR SALE: Military tech manual listings, largest stock in the world, over 50k - $5 refundable with first order. SASE for inquiries. Lee Frank, POB 10776, Harrisburg, PA 17105-0776.

FOR SALE: Collins 75S-3C RE with spkr, manual, SW xtals. Serviced by former Collins tech. - $650 ppd. Levy, 8 Waterloo, Morris Plains, NJ 07950. (201) 285-0233

WANTED: Original US military radio technical manuals, vintage 1942-1960. Glanzmann, Impasse 22Bis Ave.,Gros-Malhon, 35000, Rennes, France.

WANTED: SX-133 w/spkr. Ed Sauer, KC9SP, 787 N. Peterman Rd., Greenwood, IN 46142. (317) 881-1483

FOR SALE: Thordarson model T44016 multitap xfmr, 230-250 pri, 7,000 CT sec. - $150; 872 filament xfmr (new) - BO; 4-250 (or 4-400) filament xfmr (new) - BO; xfmrs of all sizes (no audio). Joe, W6CAS, (916) 731-8261

FOR SALE: Transmitting tubes: (1) 4-125A - $30; (1) 211/VT4C - $20; (1) 810 - $25; (1) 813 - $25; (4) 814s - $20 ea. Bill Riley, W7EXB, 863 W. 38th Ave., Eugene, OR 97405.

WANTED: Hallicrafters HT-32 or HT-37 and HA-1 keyer, with manuals; National NC-300TS spkr and "RFG" knob for NC-300 rcvr. Please state condition and reasonable price. Bob Smith, KC4WJO, 14779 Kogan Dr., Woodbridge, VA 22193-3314

FOR SALE: National NCX-5/NCX-A - $2351 ship; Hallicrafters HT-32A - $100, pick-up or meet in the NE, both very clean, w/manuals. George Maier, KU1R, 64 Shadow Oak Dr., Sudbury, MA 01776. (617) 622-1857 anytime, leave message or (508) 443-7083 eves 6-10 PM EDT

WANTED: Philco model 37-600 4-tube superhet, 6A8, 6J7, 6K6, 80 tubes; table model. William Shibler, W3QII, 5899 Barnes Ave., Bethel Park, PA 15102.

FOR SALE: 4D32 tubes - $50; Johnson low-pass filter 1- $25. **WANTED:** Collins 312B-3 spkr; 75S-3C rcvr. Ron, KC6WTG, POB 783, Santa Rosa, CA 95402. (707) 539-8319

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FOR SALE: Used technical books - radio, electronics, military, test equipment, catalogs, etc. List- $1 (stamps ok). Softwave, Dept. ER, 1515 Sashabaw, Ortonville, MI 48462

FOR SALE: Simpson model 1000 tube checker - $10; HP 200CDR - $20. **WANTED:** R42 spkr and BFO knob for SX-42. Barry, N6SVR, 21225 Saratoga Hills Rd., Saratoga, CA 95070. (408) 255-9155

WANTED: Manuals and schematics for Tektronix scope model 543B, Tektronix signal generator 190A, Hunter Bandit linear amp 2000C. John Lellelid, Box B, Colman, SD 57017. (605) 534-3744

FOR SALE: Gonset G-66B rcvr, exc. cond. - $90; Allied R-2516 rcvr, exc. cond. - $90; RME LF converter LF-90, 1940, exc. cond. - $25; Drake 2B w/2BQ, exc. cond. - $150. Plus shpg. Richard Lucchesi, WA2RQY, 941 N. Park Ave., N. Massapequa, L.I., NY 11758. (516) 798-1230

WANTED: Hallicrafters SX-73 and SX-88 in near mint or exc. condition. I will pay premium Doe-Ray-Me for these rcvrs and I'll pick up within 250 miles of my QTH. Bob Bell, 89 Ridgehill Dr., Toronto, Ont., M6C 2J7. Canada (416) 783-3288

FOR SALE: R-390A; tubes - 837s, 836s, 816s and 4-125As. **WANTED:** NCX-5 and 51J4. Russ Hunt, W9HZD, 2242-C Via Puerta, Laguna Hills, CA 92653. (714) 859-6428

FOR SALE: Dynamotor DY-17A/ART-13A - $45; Control Box C-87/ART-13 - $27.50. Both NOSB, plus UPS. **WANTED:** 307/VT-225s; Bags BG-56 thru BG-176; GN-45. Robert W. Downs, WA5CAB, 2027 Mapleton, Houston, TX 77043. (713) 467-5614

FOR SALE: Teletypewriter manuals - 3 TM11's (2201, 2214 and 2230), and Kleinschmidt GGC instructions (SCPA) with 2nd addenda - $30 ppd. Tom French, W1BMQ, 120 Great Rd., Maynard, MA 01754. (508) 897-2226

WANTED: HRO-60 coils type G/J/AA/AB and pre-1950 ARRL Handbooks. B. Nadel, Box 29303, San Francisco, CA 94129. (415) 346-3825

FOR SALE: Hallicrafters HT-32A, good visual shape - $100. Jonathan Bouve, 24 South St., Hingham, MA 02043. (617) 749-0445

FOR SALE: Lafayette radio operating and service manuals, schematics etc. If I don't have it,they never printed it. Pete Markavage, WA2CWA, 27 Walling St., Sayreville, NJ 08872. (908) 238-8964

WANTED: Old books; magazines; Handbooks; White's Radio Log; first callbooks; old writings on early radio; issues of "Radio Magazine". Call, write or FAX. I pay shpg. Please do not throw them away. Donald R. Boland, N1FYX, 28 Faulkner St., Malden, MA 02148. (617) 3245362, FAX 322-8412

FOR SALE: Electron tubes, all types, new and used, pre-tested; orig. Sams for vintage radio and TV. Henry Seegitz, 32 Sylvaton Terr., Statten Island, NY 10305. (718) 273-7306

WANTED: Need osc. and final plate coils for Hallicrafters HT-6. If you won't part with yours I would appreciate construction data so I can restore this classic. Also need a junker unit. Thanks. R. Haworth, W2PUA, 112 Tilford Rd., Somerdale, NJ 08083. (609) 783-4175

FOR SALE: Scott SLRM, vg cond. - $200; Central Electronics 100V xmtr and broadband 600L linear amp - $350; Drake TR-4 xcvr (unused since last factory service) - $200; heavy-duty matching set of RF amp (two 4D24s), modulator and power supply, made in '60's for govt at cost of about $10,000, great for HF AM building - $100 for all plus shpg; TCS-12 rcvr, xmtr and AC ps (1.5-12 mHz continuous) - $100 plus shpg; McGraw Edison grid dip meter, mint - $85; Johnson KW Matchbox - $250; Skyrider SP-44 w/manual - $80; two Panoramic Electronics 2-tone generators TTG-2 - $125 for both; modulation scope A-100 - $35. Glen Fritz, 777 - 37th St., A-106, Vero Beach, FL 32960. (407) 567-7888 (7-9 PM EDT)

WANTED: Heath DX-100 or 100B, working or not, with or without cabinet (to use on 160 AM) possibly Viking II/122 instead. Also looking for SX-28 spkr/cabinet and Superpro (600) spkr/cabinet. Al Feder, W1EOX, POB 640 Killingworth, CT 06419. (203) 663-1811

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WANTED: Manual for HP600B; 3TF7 tubes; meters for R390A; TEK 465 or 475 scope, must be in very good cond. Clark Hatch, WØBT, 2546 SE Peck Rd., Topeka, KS 66605. (913) 235-2721

WANTED: Buy and sell all types of electron tubes. Harold Bramstedt, C&N Electronics, 6104 Egg Lake Rd., Hugo, MN 55038. (800) 421-9397, (612) 429-9397, FAX (612)-429-0292

FOR SALE: SAMS for hams. Photofacts of vintage ham gear. We also buy used SAMS. A.G. Tannenbaum, WA2BTB, POB 110, East Rockaway, NY 11518. (516) 887-0057

FOR SALE: Collins mech. filters, set of 4 (2 kc, 4 kc, 8 kc, 16 kc), 455 kHz can be used with 75A-4 etc. - $90 for all four. Larry Asp, VE3DRA, (416) 722-5853

WANTED: Connector receptacle electrical, 22 female contacts # 370 2074 00; 516F1 for KWM-1. Mimi, (310) 379-6052, FAX (310) 379-5543

FOR SALE: Drake C-Line, R4C/T4XC/AC4, w/spkr, MN-4 tuner; RCA AR-88 rcvr; BC-610F w/coils/tuner, 160 thru 10; Collins 32V-3/75A-3; Drake 2B/2BQ; Viking II w/vfo; Heath amp, pr 4-400z, 2200V 1/2 amp pwr supply; misc parts/gear from the past 35 years. Call for more info. Joe Perratto, K2QPR, 1341 SW Evergreen Ln., Palm City, FL 34990. (407) 220-2189 (anytime)

WANTED: Units or modules - PRC-47; PRC-74, esp. P.A; 618T; KWT-6; ARR-41; R-1051B. Byron, WA5THJ, 1920 Maxwell, Alvin, TX 77511. (713) 331-2854

FOR SALE: Un-used Collins 70E-3 PTO; Bud 'Codemaster' - $25; ARC-5 (3.0-6.0) - $35; Zenith R600 Transoceanic w/manual - $95. All super-mint. Large SASE brings mega-list.WB8IPC, (313) 754-3943

WANTED: AC power supply for ART-13 xmtr, homebrew ok. F.W. Nicholas, P.O. Box 37094, Phoenix, AZ 85069.

WANTED: Drake 1A rcvr. Art Charlap-Hyman, W6ZNO, 18151 Rancho St., Tarzana, CA 91356. (818) 342-1170

ELECTRON TUBES FREE 1992 Catalog, over 2,000 types in stock. **Electron Tube Enterprises,** Box 311, Essex, VT 05451. (802) 879-0611, FAX (802) 879-7764

WANTED: WW II military sets, racks, manuals, books, etc. Have Sky Buddy and S-20R for trade. Sam Hevener, "The Signal Corps", W8KBF, 3583 Everett Rd., Richfield, OH 44286. (216) 659-3244

FOR SALE: Radio tubes; repair and restoration of all vintage amateur and commercial radios, 25 years experience. Herbert Stark, 321 N. Thompson St., Hemet, CA 92543. (714) 658-3444

FOR SALE: Collins 51S1 - $800,30L-1-$575, PM 2 - $140, 516E1 - $60, MM 1 - $35, 62S1 - $675, DL 1 - $75, rack panel - $50; Heath DX-60B - $85. Mick Palmer, K5FZ, 16707 Creeksouth, Houston, TX 77068. (713) 893-7004

WANTED: Western Electric AM xmtr, audio equipment, mics, loudspkrs, catalogs, etc. Ron Steinberg, K9IKZ, (800) 279-8324 (w), (708) 773-3583 (h) or FAX (708) 773-0822

WANTED: Ranger I or II, must be in working cond. and w/manual. Al Gross, W8PAL, 12219 N. 112 Lane, Youngtown, AZ 85363. (602) 933-3499 or 814-6387

FOR SALE: Military generator MN GN-58-A; emergency TX/RX MN RR-6, RT-6, RA-6 and RP-6 as a set; TX/RX MN SSR-5-A as a set; TV-6U, brand new; SCR 211-M, brand new; OS-8B/U, brand new. Please write or phone for list. Clyde Sakir, N7IOK, 4243 E. First St., Tucson, AZ 85711. (602) 323-1120

WANTED: Viking I, II, 122 vfo; DX-100; SX-101; Ranger. All VGC + please. Also DX-100 for parts. Tod Zelasko, KA8CEF, 9401 Grand Division, Cleveland, OH 44125. (216) 883-5134

WANTED: S-Meter and documentation for RCA AR-88 rcvr. Marc Melucas, KBØJPQ, 713 E. Ohio St., Rapid City, SD 57701. (605) 342-1071

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FOR SALE: Conset Communicator #3, 6-meter xcvr, like new, never used - $125 plus UPS. Roland Matson, RFD #1, Box 2943, Kennebunk, ME 04043. (207) 985-3751

WANTED: Triplett panel meter, model 327-T, 0-500 ma DC, new or good cond. used. Paul Courson, WA3VJB, Box 73, W. Friendship, MD 21794.

WANTED: Cabinet for a Johnson Invader 200/2000. (Will take a parts unit providing cabinet is clean and straight. Bob Kemp, 304 S. Washington, Lake City, MN 55041. (612) 345-5345

FOR SALE: TMC 18 KW 0-30 mHz dummy load - $200 PU only. Richard A. Smith, 1122 Via La Cuesta, Escondido, CA 92029. (619) 739-1835

WANTED: Complete magneto for Generator Set PU-286/G (Hercules ZXB engine). NK5C, POB 1798, Pasadena, TX 77501-1798. (713) 473-7951

WANTED: Low frequency coil sets for National HRO-5, especially 'H'. Ted Althof, KE3AL, 504 E. 9th Ave., Tarentum, PA 15084. (412) 224-0905

FOR SALE: Hammarlund HC-10SSB converter, exc. - $150. **WANTED:** Drake 2B/2BQ in mint or near mint cond. Mike Draa, RR 1, Box 1615, Brooks, ME 04921.

FOR SALE: Field radar set AN/PPS-4 complete with tripod - $500. **WANTED:** Early radar equipment, units or complete sets. Also pre-war oscilloscopes and CRTs. Allen Weiner, 14 Prospect Dr., Yonkers, NY 10705. (914) 423-6638

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WANTED: Lafayette HA-1200 2-m xcvr; also matching spkr for Squire-Sanders SS-1R. Pete Markavage, WA2CWA, 27 Walling St., Sayreville, NJ 08872-1818. (908) 238-8964

WANTED: Low-freq. coil sets for National HRO-5, espec. "H". Ted Althof, KE3AL, 504 E. 9th Ave., Tarentum, PA 15084. (412) 224-0905

WANTED: 75A-4 reduction knobs; manuals and supplements for Hammarlund SP-600VLF longwave rcvr. Paid by money order or MC. JA1-3477, Hajime Suzuki, Nishikuniyoshi, 1644-24, Ichihara-Shi, Chica-Ken, 290-02 Japan.

FOR SALE: B&W 5100B - $200; L-1000 linear - $450. Gil, N4QAS, (703) 437-1559

FOR SALE: Guaranteed as new - RCA 8122s - $188/pr; matched 572Bs - $118/pr; Eimac 8295As - $380. Ozzie Jaeger, W6AD, POB 460, Nixa, MO 65714. (417) 725-5742

WANTED: Cabinet and spkr for 75A-1 rcvr; "KC" dial for 75A-3. Bob Kemp, POB 470, Lake City, MN 55041. (612) 345-5345 days

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WANTED: Armstrong FM detector diagram (about 1940) (no output from AM input). Please look up for me and call toll free. George Bonadio, W2WLR, 373 East Ave., Watertown, NY 13601-3829. (800) 724-7460

FOR SALE: BC-640 xmtr, 6' tall, weighs a ton; (2) late '30's homemade xmtrs, 6' tall, one with 1943 FCC wartime authorization; several smaller ones with various circuits. Cannot ship these. Tons of ham homebrew; test equip; parts; military surplus gear; ARC-5 stuff; gas generator; PRO-4 w/pwr supplies; Collins clone homemade xmtr w/Collins VFO unit & dial; lots of rare tubes; wire recorders; radios; mini-tape recorders; plastics; woods; mikes; early hi-fi; some books. Send a 52 cent LSASE, no exceptions. Still taking inventory, so phone call may not help. In storage for over 12 years. Stephen Ponek, 462 O'Farrell Dr., Benicia, CA 94510. (707) 747-9180

FOR TRADE: Perhaps the rarest HRO, HRO-7 for clean HRO-5A-A1 w/coils, pwr supply, spkr. Jim, K7BTB, POB 50355, Parks, AZ 86018. (602) 635-2117

FOR SALE: Hallicrafters CR 3000, rare LW/SW/FM stereo receiver w/BFO, etc., exc. condition w/manual - $100. Lance Johnson, K1MET, 32 Myrtle Rd., Portland, CT 06480. (203) 342-2601

WANTED: For RACAL RA. 253B restoration: Escutcheon plate and tuning knobs. also pwr supply and cable for same. Al Roehm, W2OBJ, (908) 276-2997

FOR SALE: NC-183D - $145; HQ-110A - $90; S-40B - $60; Collins PTOs 147A-1 and 70E-3 - $25; ARRL Handbooks, 1949, 1950, 1956 - $15 each; 1942, 1943, 1944 - $18; BC-429 w/mount - $70. Mark Howda, NØJWI, P.O. Box 10091, Cedar Rapids, IA 52410. (319) 364-4048

FOR SALE: Collins 75A-4 filters: 6 pole ceramic for high quality AM. 3 bandwidths available: 4, 6, or 9 Khz - $83.50 ea.; single pole CW crystal filters - $88 ea. 10% discount for two filters. Money back guarantee. Calif. residents please add sales tax. Vector Control Systems, 1655 No. Mountain, Ste. 104-45, Upland, CA 91786. (714) 985-6250

WANTED: "Broadcast News" (RCA), "Pick Ups" (W.E.), other broadcast literature and catalogs of the '30's - '50's. Sam Thompson, W6HDU, 1031 San Antonio Ave., Alameda, CA 94501. (510) 521-1429

FOR SALE: GPR-90 w/matching spkr, ex. cond. - $325; Drake R4A - $160; SB-303 w/CW filter - $160. Cliff Fleury, AI7Y, 64174 Tumalo Rim Dr., Bend, OR 97701. (503) 382-9162

WANTED: Manual for Panoramic Products panadaptor PR1. Will reimburse for photocopy/mail expenses. Al Feder, W1EOX, POB 640, Killingworth, CT 06419. (203) 663-1811

WANTED: B&W L-1000A amp; XCU-300 xtal calibrator. F.W. Nicholas, (602) 864-9987

WANTED: Top $ for excellent to mint DX-20; HR20; WRL Q-Mult.; Kantronics Rockhound; Ameco AC-1; Hammarlund keyer and Mosley CM-1 rcvr. Gary Wagner, K3OMI, 11124 Oak Hollow Rd., Knoxville, TN 37932. (615) 690-4217 M-F days

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

WANTED: Clean Drake equip. - 2B, 2C, R-4B, T4XB and acc. for any of these. Byron, WA5TIIJ, 1920 Maxwell, Alvin, TX 77511. (713) 331-2854

FOR SALE: Hallicrafters SX-100; T.S. 147 freq meter - $45; B&W L 1000A linear w/spare set of 813s - $300 plus shpg. Milt, (512) 366-3290

WANTED: Need photo for Colonial AC-31 radio (floor model). Will pay for picture and postage. S. Kalista, (717) 325-4120

FOR SALE: Mechanical filters - Collins75A-4, 1.5 Kc - $45; Rockwell, 500 Kc, 2 Kc & 7 Kc - $40 ea; Collins R-390, 2 Kc & 16 Kc - $35 ea. Colin Trass, N1KYX, 6 Quail Run, Acton, MA 01720. (508) 635-0261

WANTED: Drake 1A rcvr. Please write or leave message with price and cond. Art Charlap-Hyman, W6ZNO, 18151 Rancho St., Tarzana, CA 91356. (818) 342-1170

FOR SALE: New Collins parts: 30L-1 blower motors - $35; 51S-1 PTO osc., 70K-7, P/N 522-2918-000 - $200; silver plated 30S-1 tank coils - $7. Dennis Brothers, WAØCBK, HC 84, Box 1, Potter, NE 69156. (308) 879-4552

WANTED: Books on radio repair and trouble shooting. Also radio and 2-way receiver/transmitter servicing courses by National Radio Institute and Cleveland Institute of Electronics. Alan Mark, POB 372, Pembroke, MA 02359.

FOR SALE: BC-455B receiver w/all acces. - $75; BC-458A xmtr w/new rack - $75; BC-1031A panadaptor - $50; R-28-T13/ARC-5 manual, new - $30. J. Orgnero, VE6RST, Box 32, Site 7, SS 1, Calgary, AB T2M 4N3. Canada (403) 239-0489

WANTED: Heathkit QF-1 Q-Multiplier. Also looking for an original matching spkr for my RCA AR88LF rcvr. Edward Swynar, VE3CUI, 3773 Concession Road 3, RR #8, Newcastle, Ont. L1B 1L9. Canada (416) 987-3603

FOR SALE: (9) Eimac 304TLs - $35 ea; (2) RCA 7094 tubes for $75 ea. Dick Ridinger, 3487 Bayberry Dr., Chino Hills, CA 91709. (714) 597-3865

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WANTED: HRO type MCS spkr in good cond. for HRO-5T; also want coils JA thru JD and top case in good cond. Dan Brown, KA5ONH, 49A Prairie Ave., Newton, MA 02166. (617) 332-9326

FOR SALE: Lysco 600S w/ tuner $75; HQ-170C w/spkr - $125; Viking 500, fully operational - $600; T368C, fully operational - $750; Lafayette HA-230 (GC) - $50; NC-98 w/spkr - $75; NC-300 (GC) - $125; Viking II w/vfo - $125; HT-37 - $75. Most equipment w/manuals. Pickup only. Tony Wheeler, K9BBA, RR 1, Box 215, Carlock, IL 61725. (309) 376-7721

WANTED: Info on rcvr CND 46156 model RAL-7. Herman Gibbs, KD8PD, 741 W. Liberty St., Wooster, OH 44691. (216) 263-2000 ext. 2212, leave message

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ANNOUNCEMENT: Hammarlund collector? I'm interested in starting a club/newsletter for fans of "Mars Hill iron". Send large SASE for free copy of information sheet with Hammarlund tips and info. Harry Helms, AA6FW, 7445 Andasol, San Diego, CA 92126.

WANTED: Clean Collins 75A-2 w/spkr. Tom Russell, K8LZF, 1320 Cedarhill Dr., East Lansing, MI 48823. (517) 351-4553 or (616) 325-2370

FOR SALE: Working antique Hickok RF-AF generator - $65. **WANTED:** Sylvania 6JB6 tubes and working Ranger; preferably Ranger II. Rick, K8MLV/Ø, 1802 W. 17th St., Pueblo, CO 81003. (719) 543-2459

WANTED: Central Electronics 100V. Must be in good physical condition, minor electrical problems ok. Also consider CE 200V. Lock Pingree, KB7TQ, 20425 N. 17th Terr., Phoenix, AZ 85027. (602) 581-2778 (h), 870-2871 (w)

FOR SALE: Heath SB-401 w/xtals, exc. - $90; SB-634 station console, exc. - $40; HW-2036A syth. 2-meter FM, 10 w, low hours, very good - $100. All with manuals. Wayne Arnett, AI7C, 2699 Mazatlan Dr., Grand Junction, CO 81506. (303) 241-3474 days

ELECTRIC RADIO PARTS UNIT DIRECTORY

At this point the directory has 200 units in it. If you need a part for a vintage restoration send $2 and an SASE (.52 postage) for the list. If you have a parts unit, consider putting it on the list. Your dead unit can help bring others to life!

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WANTED: Machine shop work. Knobs shafts bushings, etc. made to your sample or drawing. Reasonable. Jim Dill, Box 5044, Greeley, CO 80631. (303) 353-8561 evenings.

FOR SALE: Repair & refurbishment of older tube-type amateur equipment. Fully FCC licensed; 35 years experience. Chuck Banta, N6FX, Claremont, Calif. (LA area) (714) 593-1861

WANTED: E.F. Johnson milliammeter; Speed-X bug; Collins spkr; vernier knob; EV 664 mic; Taylor 203Z; RCA 6KD6. Brian Roberts, K9VKY, 3068 Evergreen Rd., Pittsburgh, PA 15237. (412) 931-4646

WANTED: Pre-WW II HRO revrs and Collins xmtrs such as 45A, 32G, etc. Bob, KD9B, 1025 North Vine St., West Lafayette, IN 47906. (317) 743-4053

WANTED: Reference to 1950's-'60's QST or Handbook article on building a low-powered cathode modulator. This unit had two tubes, one of them a 6Y6, I think, with no transformers. I built one over 20 years ago to modulate an ARC-5 - plugged into its key jack! Thanks. Rick Ferranti, WA6NCX, 254 Florence Ave., Arlington, MA 02174. (617) 646-6343

FOR SALE: Morrow FC-20 10-meter AM xcvr - $60; Western Electric 19C audio gen. - $42; military AM 494/GR 2-meter amp - $75; HP 200CDRM audio gen. - $38. Richardson, WI5D, 1040 Cleveland, Stephenville, TX 76401. (817) 968-3365

FOR SALE: Want to share hard to get radio equipment, parts, tubes, etc. Cdr. Glenn W. Richey, USN Ret., W7SAB, 219 Naval Ave., Bremerton, WA 98310. (206) 373-9631

FOR SALE: Single pole double throw vacuum relay, new- $35; 833 pullout - $25; pair of used 304TLs - $40; pair of used 4-400As - $50. Pete, VE7FY, 12347 Davison St., Maple Ridge, BC V2X 5N5 Canada. (604) 463-4904

WANTED: SX-96 manual, xerox ok; NC2 or spkr w/af xfmr for p/p 6V6s; good dial window for NC-240D. Mike, AC5P, POB 33, Bartlesville, OK 74005. (918) 333-2795

WANTED: Ranger II or similar AM xmtr in original condition. Write conditions. Stan Tajima, KD2HB/JA1DNQ, c/o Shinagawa, 21555 Sterling Dr., El Toro, CA 92630.

FOR SALE: Hammarlund HQ-170 - $150; Heath Apache - $100; National NC-303, ugly but working - $80; Heath DX-60B - $50; HG-10B vfo - $30; parting out Ranger. No shpg over 70-lb UPS limit. **WANTED:** HRO-60 coils; low-voltage xfmr for 32V-3. Jim Jorgensen, K9RJ, 1709 Oxnard, Downers Grove, IL 60516. (708) 852-4704

WANTED: WW II military: ATD xmtr w/tuning units, aircraft IFF and beacon sets, British and German military radios. Leroy E. Sparks, W6SYC, 924 W. McFadden Ave., Santa Ana, CA 92707. (714) 540-8123

FOR SALE: National HRO-60T; Conset Comm. III w/50 xtals; McMurdo Silver wavemeter; spkrs - R47, S200; manuals - HQ-129X, SX-71. **WANTED:** 75A-1; Hallicrafters PM-23 spkr (SX-28). Carter Elliott, WD4AYS, 1460 Pinedale Rd., Charlottesville, VA 22901. (804) 979-7383 (n), 980-7698 (d)

WANTED: All types of military electronics, especially RDF and radar items, manuals too. Also need URD2 antenna. William Van Lennep, POB 211 Pepperell, MA 01463. (508) 433-6031

WANTED: Manual for Hickok tube tester KS15750. Will reimburse for photocopy/mail expenses. Al Feder, W1EOX, POB 640, Killingworth, CT 06419. (203) 663-1811

FOR SALE: Conset Super-Six & ANL acc. - $25; Collins 310B-1 - $60; MD-7 - $20; HT-32A - $55 or part out; Viking II - $45 or part out. **WANTED:** Manual or copy for SX-24. Joe Sloss, K7MKS, (206) 747-5349

FOR SALE: (3) Elmac AF-67s suitable for parts - $8, $12 and $20. Tom Berry, K9ZVE, 1617 W. Highland, Chicago, IL 60660. (312) 262-5360

Please remember to count the words in your ad. If you are over 25 words, please send 15 cents for each extra word.

CLASSIFIEDS

FOR SALE: R-390A's, complete units in various stages of tune; partial units; modules; cabinets; repair/restoration service available. LSASE for list. APS, Dept. E, 107 Fayton Ave., Norfolk, VA 23505.

FOR SALE: Special transformers for your vintage equipment. We rebuild transformers for all equipment. Max Kunz, Top Tech Inc., 10811 Fairbanks, North Houston Rd., Houston, TX 77086. (713) 440-9909

WANTED: Hallicrafters SX-100 and SX-101A. Must be clean, original and in good working cond. Also need manual (copy ok) and knob (pointer reset) for SX-62. John B. Keil, 4618 Norwalk St., Union City, CA 94587. (510) 471-4838

FOR SALE: Hallicrafters SX-101 and HT-37, clean - $200; Drake 1A - $200; 2B w/2CS - $150. All with manuals. Randy, NØAEF, (319) 752-1673

WANTED: Viking I, II, 122 vfo; SX-101; DX-100. VGC +. Also need DX-100 for parts. Todd Zelasko, KA8GEF, 9401 Grand Division, Cleveland, OH 44125. (216) 883-5134

FOR SALE: Johnson Thunderbolt - $500; KW Matchbox - $200. W6RNC, POB 478, Nevada City, CA 95959.

FOR SALE: Complete electronics suite from decommisioned U.S. Navy aircraft carrier. 1960's vintage equipment. Collins URC32A (500 W HF xcvr); Westinghouse WRT-1s and 2s (1 KW multimode xmtr); Collins R390A rcvrs; Magnavox WRR3A rcvrs; radar sets; ant. couplers; teletypes etc. Call for details. Bob Mantell, W6VQT, 3135 N. Ellington Dr., Los Angeles, CA 90068. (213) 851-2786

WANTED: Nems-Clark 200-2 panoramic adaptor. Bill Springer, 923 Nelda, Houston, TX 77088.

FOR SALE: 814 - $10. **WANTED:** Any National octal plug calibrators or spkrs; WRL vfo; cabinets for GPR-90 or 51J/75A. Bill, KE7KK, 6712 Lake Dr., Grand Forks, ND 58201. (701) 772-6531

WANTED: Ameco AC-1 novice CW xmtr and Knight Space Spanner rcvr. Bob Mattson, KC2LK, 10 Jane Wood Rd., Highland, NY 12528. (914) 691-6247

CLASSIFIEDS

FOR SALE: Transmitting/Receiving tubes, new and used. LSASE for list. NIB 250TH - $25; 100TH, 211, 813 - $15; 813 tube socket - $5. I also collect old and unique tubes of any type. Looking for Taylor and Heintz-Kaufman types and large tubes and sockets from the old Eimac line; 450T through 2000T for display. Maybe you have something to trade? John H. Walker Jr., 16112 W. 125th St., Olathe, KS 66062. (913) 782-6455

FOR SALE: Gates Mfg. books: FM-5B transmitter instruction book; BC-250CY xmtr instruction book; M-5627/BC250T 250 W xmtr installation and operting manual; Broadcast Communications Equipment Vol. 99 - all for $75 shipped. Steve, N9HGF, (812) 474-0842

WANTED: Hammarlund HX-50 and/or HX-500 xmtrs. Carl, K1EYY, Box 204, Buzzards Bay, MA 02532. (508) 833-0062

WANTED: A few 'missing pieces' of that great old military gear: DM-43 or Dy-96 dynamotor (24 volts, for BC-653 xmtr); CRR-21748 dynamotor for the ATD; MAR xcvr complete or just good case and covers; CRC-7 emergency xcvr; tuning units range 'D' and 'F' for the GP-7; GRC-106 freq. standard module; CAY-20084 rectifier/modululator for Navy model TBW xmtr; set of xtals for the PRT-4 and PRR-9; URC-68, PRC-90 and PRC-63 survival xcvrs; MAY xcvr; junker R-442/VRC rcvr or just a good front panel for one; BC-923 rcvr ; 61851 xcvr; accessories for URC-87(V) (Southcom SC-130 'Patrolfone') xcvr - battery box, whip antenna; dynamotor DM-21 for BC-312 rcvr; manual for CPRC-26(Canadian) xcvr; ARC-33 aircraft xcvr; dynamotor for RAX rcvr (this has 3 pins that stick out on the bottom. Whew. Thanks for taking the trouble to read all this. Walt Hutchens, KJ4KV, 3123 N. Military Rd., Arlington, VA 22207. (703) 524-9794

WANTED: Heathkit Conelrad monitor; Millen vfo; Millen exciter 90801. Thanks to all who purchased 6000 tubes. No more available at this time. Andy, WA4KCY, 105 Sweet Bay Lane, Carrollton, GA 30117.

WANTED: National 200 xcvr and AC 200 ps. James Herkimer, WB2ANO, 338 Village Blvd., S., Baldwinsville, NY 13027. (315) 635-8016

WANTED: 6L6GX or HY6L6GTX tubes. Have cash, manuals and parts to trade. Bob Mattson, KC2LK, 10 Jane Wood Rd., Highland, NY 12528. (914) 691-6247

FOR SALE: Exceptional vintage station. All gear in excellent condition w/manuals. Johnson Valiant - $350; Hammarlund HQ-170 - $145; 275 W Matchbox (orig. manual) - $80; D-104 model G - $25; Heathkit 5-position coax switch - $15; Dow-key coaxial relay (new) - $50. Bob Lemanek, K8HVG, 14565 Garfield, Allen Park, MI 48101-2115.

WANTED: Will pay top $ for HT-4B speech amp, HT-5; HT-4B orig. manual; HT-4/BC-610 tuning unit #TU-61 (1.5-2 mHz); coil unit C-454; good vfo that will work with HT-4/BC-610; quantity of DC-34 xtals; orig. HT-4 air padder. Barrie Smith, KF7VA, 125 Ben Hogan Dr., Missoula, MT 59803. (406) 549-1921 eves & wknds, 728-7637 wkdys

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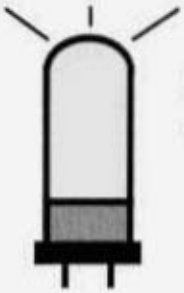
FOR SALE: Heathkit gear - SB-301, mint; CW filter for SB series rigs; Collins T-shirt, large, new; cap sub box; HW-12 mono-bander, 75 M; catalogs, 1980's; manuals, early test gear; SWR meter; IT-28 cap checker; IG-102 sig. gen.; EF-1 VTVM course; glass insulator, pole type; HB-10B vfo; A7 audio amp; cantenna dummy load; spare meter for SB rcvr; SSB filter for SB rigs; spare parts for HX-10; SB-610 monitor scope; #19 handbook; Ameco 6-meter converter, mint; knobs for SB series rigs. **WANTED:** Service bulletins for KWM2A. Marty, WB2FOU/5, (817) 497-6023. Please call after 6:00 PM CST.

WANTED: Espionage equipment. Historian purchases spy radios, code and cipher machines and any equipment, devises or manuals pertaining to the world's intelligence organizations. Keith Melton, Box 5755, Bossier City, LA 71171. (318) 747-9616

WANTED: Johnson 122 vfo. Pat Keogh, WB9CKZ, 3767 Fairview Rd., Green Bay, WI 54313. (414) 434-9016

FOR SALE: Valiant HV xfmr - $25; LV xfmr - $25; HV choke - $10; LV choke - $5; audio xfmr - $5; all - $50. Dan Radcliffe, KP9BP, 8201 Plainview Pkwy, Sussex, WI 53089. (414) 255-9165



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