$2.50

ELECTRIC RADIO

celebrating a bygone era

Number 71 March 1995

Jim Musgrove, K5BZH

ELECTRIC RADIO

published monthly by Barry R. Wiseman and Shirley A. Wiseman
1590 Baby Bear Rd., Durango, CO 81301

Second Class postage paid at Durango, CO. and additional offices
Authorization no. 004611
ISSN 1048-3020

Postmaster send address changes to: Electric Radio
Box 57
Hesperus, CO 81326

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

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

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

Regular contributors include:

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

EDITOR'S COMMENTS

Last month when I announced the winners of the December 160 meter contest I made an error. When I compiled the results I did so having misplaced the log I received from Dennis, WA3YXN. He had sorted his log results as to transmitter, receiver, antenna, etc. and I had put his letter aside thinking I might use that information in an article sometime in the future. Dennis scored 98 points coming in Second which means that Dave, N2KSZ moves on to Third and Norm, KG9D, moves on to Fourth. My apologies to everyone.

Because all of us enjoy the contests/jamborees so much we've decided to sponsor more of these events in the future than we have in the past. The next contest/jamboree will be "A Weekend on 15" April 1 and 2. Rules will be the same as for the 160 Meter contest; one point for each contact and an extra point for contacts with AMI members. Prizes will be T-shirts and award certificates for the winners; first , second and third. I suggest that we try to keep our activity above 21.400 so that we disrupt normal 15 meter operations as little as possible.
The next contest/jamboree that we're planning will be on 20 meters and will probably be another weekend affair.

Last year while we were travelling to Dayton I thought that it would have been nice if we would have had a couple of frequencies - maybe one on 40 and one on 20 - to communicate with other AM'ers and vintage enthusiasts that were also travelling to Dayton. I'd like to get some input from *ER* readers who will be going to Dayton. Maybe we can announce a couple of frequencies for next issue. By the way Shirley and I have made all our reservations for this year's HamVention. Look for us in the same place, Booth 316. **N6CSW/Ø**

TABLE OF CONTENTS

Cover: Jim Musgrove, K5BZH, vintage enthusiast and frequent contributor to ER. He is presently involved in writing two books; one will be a history of SSB and the other will be a biography of well-known radio pioneer Leo Meyerson, WØGFQ.

A Rare 'Valve' Saga

by John Bipes, WØYQX
906 Adams St.
Mankato, MN 56001

Readers will know that a good RF signal generator is a treasure. Accurate attenuators at uV levels and stable oscillators distinguish the good ones and they were (maybe still are?) hard to find and expensive. My 'Rule of Thumb' - if you can gain nondestructive access to the oscillator within 1/2 hour it's just a toy. Therefore, when I bought a used Marconi TF-1066B/IRM for $125 it was a welcome addition to my shack's 'lab'. This generator covers 10-470 MHz displayed by a 9" diagram dial, with metered 0-20/0-100% AM, and 0-20/0-100 kHz,FM modification, and a precision 'waveguide-beyond-cutoff' piston attenuator accurately calibrated from 0.2 uV-200 mV on a 5" diagram dial.

It wasn't long however, before the oscillator output fell off. Trepidly entering the inner sanctum in search of the failing heart of the instrument, I found the rarest of vacuum tubes I'd ever seen. . .what the manual calls a 'ring-seal triode' designated "TD03-10E". It was gently withdrawn from its circular breech like a spent cartridge, after loosening the circumferential brass rings. The era when corner stores had tube testers probably wouldn't make this one more popular! "A what???"

A phone call to Marconi in New Jersey made official my worst fears. Words like "discontinued model" were heard, and "oh yes, that tube is VERY RARE". The respondent did utter something about having heard of someone who at one time had obtained "some replacement tubes for $150 or so. . years ago. .". Great news, just great !@#$%^&*()!

After much labor, and discarded attempts at perhaps 'acorn' subbing, I was successful at separating the brass rings which encircled the tube from the glass envelope. With considerably more effort I constructed a J-FET substitute - built ever so carefully within the original geometry of the triode. And it worked! But, distributed L and C in the makeshift "transistorized VT" disallowed oscillation over portions of the original frequency range. Further, both AM and FM modulation were adversely affected. However, the generator remained useful for measuring 2m. quieting sensitivity. Meanwhile, the ostentatious presence of the handicapped instrument was an annoyance.

One sunny morning, years later, I was with a friend visiting the British Standards Institute lab in Hemel Hempsted, NW of London, England. Setting up the equipment, we made small talk with the BSI engineer who off-handedly commented he'd come from a company whose name I'd heard in some previous context. . .Marconi. A few dozen milliseconds later my grey cells awakened a repressed memory of a relic way back in my home in America with which I'd wrestled. Time requiring one additional anecdote before our serious work, I told my story. Why is it that I can't remember my son's phone number but "TD03-10E" accurately rolled off my tongue that cheery English morning?

Next day, in downtown London, was a message from my British friend. Apparently out of hospitality to his Yankee visitor, he'd driven to Marconi and inquired! The repair parts clerk checked the computer but came up 'dry'. "I'm so sorry, that valve is no longer listed." But, within earshot was a Marconi old-timer who interrupted ". . .Sir, we do yet have 4 dusty items from a special Mullard build before discontinuing our

continued on page 40

AM International Update

by Dale Gagnon, KW1I, President

AM Report from Japan

Greg Harris, WB9MII/7J1ALX, sends in this report from where he is stationed. "I worked JA1DNQ on 10 AM. Stan was running a Viking II and HQ-110 to a beam. Since I was ordered to leave my faithful Drake twins in storage in San Diego when I was sent here, I am using an ICOM IC-729.

"My antenna was 10 meters of wire hung off my balcony. It's funny when I rig this, I tie one end to my veranda rail, drop the wire straight down, run three floors down and tie the other end to a stunted tree. Kind of an end fed wire sloper. Looks bad, but works very well.

"Yesterday, I got on HF and my thinking was, if I called "CQ AM" long enough, somebody would answer up. Took some patience, but I kept calling and worked HL1AZC, who was tickled pink to have an AM to AM QSO. So, I will keep calling because it seems to work.

"Six meter AM is very popular here between 50.5 and 50.8 MHz, with 50.620 and 50.625 as calling frequencies. I use a Trio TS-600 and a two element beam and have worked JA6 and JA7 on AM plus many Tokyo, Yokohama and Yokosuka area hams. I would love to get a 'Goonie Box' and fire it up, but I don't think it would survive being mailed here.

"I will retire from the U.S. Navy in 11 months. My great hope once I get back to W9 land is to hit a hamfest and lay hands on a DX-100 and a vintage receiver. JA1DNQ and I are trying to get some HF AM action going on a regular basis."

AM Forum at Dayton HamVention

The AM Forum is scheduled for Saturday, April 29 at 1:15 PM in meeting room Number 2 in the Hara Arena. This room is over twice as large as the old meeting room. If you have turned away from our standing room only meeting in the past, this is the year to rejoin us. The preliminary agenda includes a short AMI update, a pictorial presentation segment and a panel discussion with AM ops representing most of country. The forum is designed to be brief so you can get back to the flea market in short order. In the early evening the AM'ers will continue the tradition of gathering at a local pizza restaurant. This is the last year for an April Dayton HamVention. In 1996 the HamVention occurs on May 18-20.

Armed Forces Day Operating Event

Saturday, May 20, 1995 is Armed Forces Day. This operating event is dual purpose. It provides a special event for the military radio enthusiast to use his equipment from home, from a field location or from a location of military significance. It also allows the greater population of classic radio users to see how many of these military radios and historic locations can be logged in during the event. There will be award certificates recognizing both the military radio operations and also general participation in the event. More information on recommended activity frequencies in next months *ER*.

20 Meter AM Operating Alive and Well

Propagation is again starting to favor the nightly 14.286 kHz AM net. Les, K6HQI in Reseda, CA and other regulars can be counted on to be on frequency at 4:00 PST (7:00 EST) Monday through Saturday.

AMI Membership Data

Please send me changes in callsigns, addresses and phone numbers so that our mailing list remains accurate. If you would like a change in your certificate for any reason, send me the new information and I will make up a new certificate. Your AMI number will remain the same. **ER**

The AN/URC-35A

Skipp Tullen, K2PXQ
26 Altamont Court
Morristown, NJ 07960

The AN/URC-35A discussed here is a sophisticated and effective transceiver and linear amplifier combination intended primarily for shipboard military applications. A close relative of this equipment is the R-1051 receiver, about which Walt Hutchens wrote a superb article for *ER* in November 1993. Please refer to this article for additional information about the theory of the frequency synthesis technology used in both the R-1051 and the transceiver component of the URC-35.

Overview

Built by RF Communications, Inc. for the Bendix Corporation around 1970, the URC-35 consists of several parts. The RT-618A is a receiver-transmitter combination in which the major circuit element is the R-1051 receiver with additional modules to give it RF generating abilities. As a transmitter, the RT-618 is capable of producing AM, CW, and upper and lower SSB signals with an output of approximately 150 milliwatts from 2.0 to 29.9999 MHz. The RT-618 transceiver is paired with an AM-3007A vacuum tube linear amplifier producing outputs of 100 watts PEP for single-sideband, 50 watts for CW, and 25 watts for AM. The transceiver weighs 58 lb. and the linear amplifier weighs 73 lb.

A CU-937A antenna coupler was used aboard ship to match a 15, 25, or 35 ft. whip antenna to the 50 ohm output of the AM-3007 amplifier. The Shure Brothers handset, an H-169/U, provides convenient press-to-talk communications.

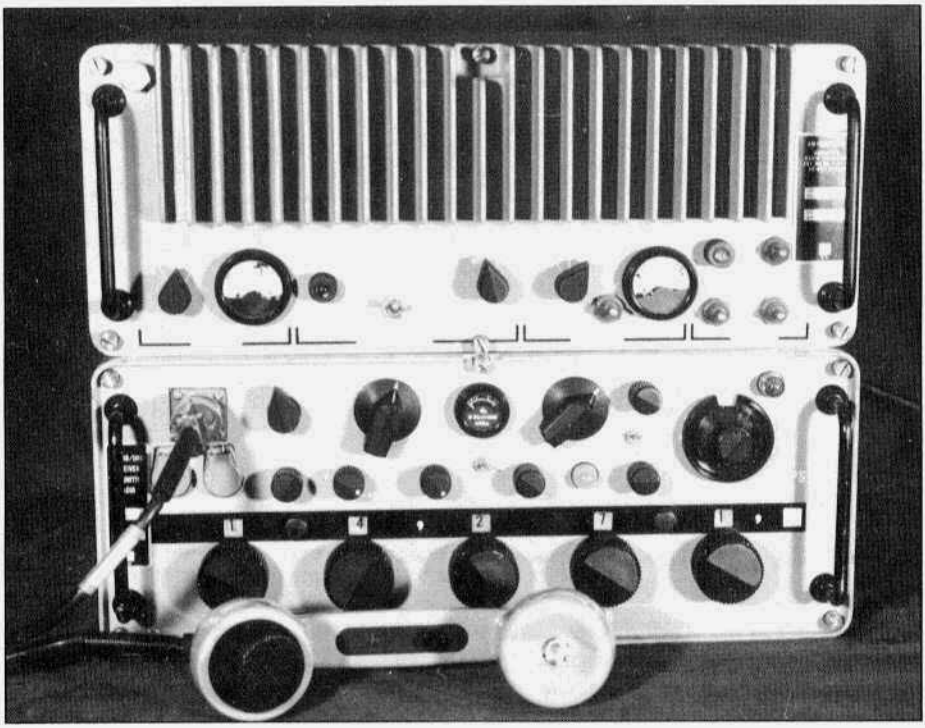
Because of its modular construction, it is difficult to determine exactly the year my particular URC-35 was manufactured. For example, the power transformer has a 9-72 date code stamped on its top, while the RF Amplifier module has a repair sticker with a 4-21-71 date. I am certain there has been much "mixing and matching."

A Closer Look

The RT-618 transceiver is incapable of operating as an exciter for any generic linear amplifer, since it has no power supply of its own. Its power is supplied through an interconnecting cable from the AM-3007 amplifier. The primary power source for the URC-35 system can be either 120 volts AC (48-420 Hz) or 24-28 volts DC from batteries.

Please bear in mind the fact that this equipment has some vacuum tube circuitry, and therefore requires high voltages in addition to low voltage DC rails for the solid-state circuits.

Here's how power is derived. The nucleus of the power supply is a DC to DC converter supplying various high voltages for the tube circuits, including 1,000 volts for the final amplifier tube! Ahead of the DC to DC converter is a 28 volt DC supply driven from the 120 volt AC source available at the installation site. When the URC-35 is to run from batteries, a connector at the rear of the AM-3007 provides direct access to the 28 volt input of the DC to DC converter. In addition to this circuit, there is a 20 volt regulator supplying most of the low voltage needs of the sytem's transistors and integrated circuits. When the equipment is running, the 3.2 KHz switching frequency of the DC to DC converter is *barely* audible in the room.



The Bendix AN/URC-35A, AM, CW and SSB HF transceiver. The transceiver is the lower unit; the 100 PEP linear is the finned unit on top.

Given the "universal" nature of the power supply, every internal circuit element in the equipment is run from DC, including the heaters in the vacuum tubes.

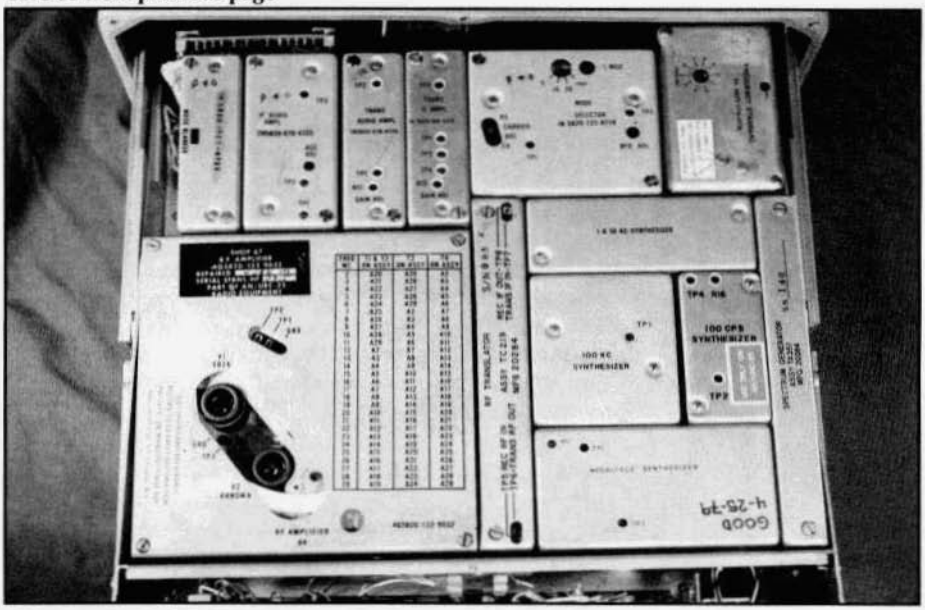
As can be seen in the first photograph, the RT-618 looks strikingly similar to an R-1051 receiver. This is no coincidence, of course, since the basic R-1051 configuration represents the receiver section of this component. The 5 MHz crystal oven frequency standard is the same in the RT-618 as the unit in the R-1051. As long as the primary power switch (acutally a true circuit breaker) on the AM-3007 is in the "on" position, the 28 volt DC power supply is energized and the crystal oven is kept hot and the crystal oscillator is kept running. This condition is maintained whether or not the transceiver is turned on.

The frequency stability of the transceiver is superlative. For example, if tuned to 7 MHz, the transmitted (or received) signal would not drift by more than one cycle per second in 15 days! Which is to say that if you're in contact with some ham who says that he's having trouble keeping you tuned in because you're sliding up the band, **he's** wrong!!

As in the case of the R-1051, tuning the RT-618 requires dialing in the exact frequency with six controls, two for megahertz selection, three for kilohertz selection, and either a step switch for 100 hertz increments or a one-turn potentiometer for vernier, or fine, tuning. The vernier range is 1000 hertz, equaling the range of the 100 hertz selector, but offering the ability to tune in a signal exactly. The vernier knob is calibrated every 100 hertz, and it is pos-

continued next page

URC-35 from previous page



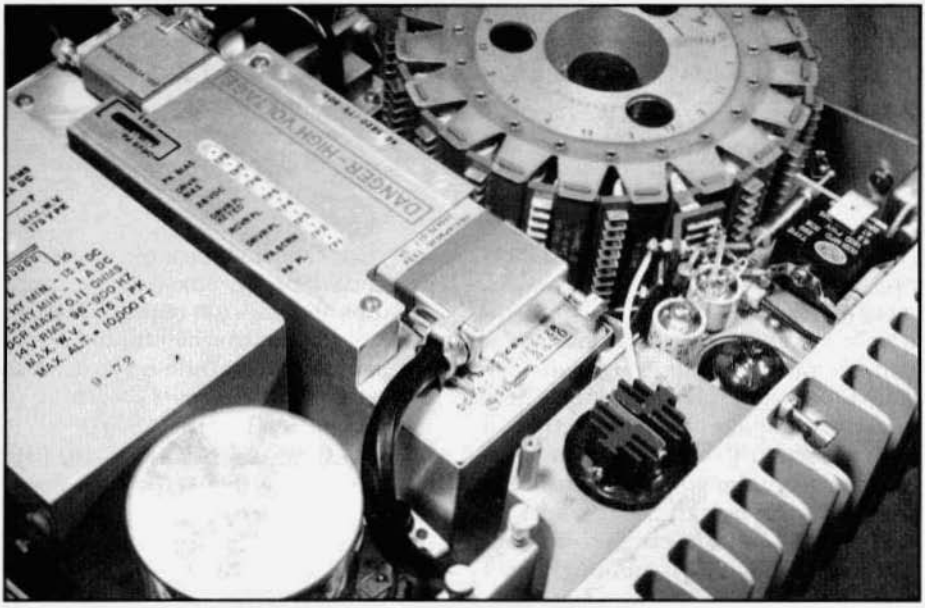
The top view of the RT-618 transceiver.

sible to interpolate the next digit and read a signal to the nearest 10 hertz. For example, the photograph shows the RT-618 tuned to 14.271680 MHz. (Aren't you glad you learned to use a slide rule?!!)

The front panel of the transceiver is relatively uncluttered and displays several controls not found on the R-1051. One of these is the "noise blanker" control. Absent from the R-1051 circuitry, this noise blanker senses broad-band signals passed by the first RF amplifier stage. The bandwidth of the signal at this point is about 1 MHz, and the noise blanker circuitry is configured to trigger an associated single-shot multivibrator only when noise spikes in this broad-band signal exceed five times the amplitude of the average signals present. The rectangular pulse from the multivibrator is used to block the output of the 1 and 10 KHz synthesizers, effectively reducing the receiver's output to zero during the noise spike. Since the "blanking" interval is measured in tens of microseconds, the ear does not perceive the operation of the noise blanker. The RT-618's noise blanker is rather effective in dealing with the kind of noise that local 13KV power lines generate in rainy weather.

The RT-618 has no provisions for such luxuries as receiver incremental tuning or variable notch filtering. However, the mode selection module of the transceiver does contain four ever-luscious Collins mechanical filters. The filter bandwidths are as follows: The upper and lower sideband filters have a bandpass of 3.2 KHz, the AM filter has a bandpass of 7.0 KHz (wide enough to satisfy even the most ardent AM'er), and the CW filter's bandwidth is 700 Hz.

The receiver's sensitivity specifications are quite respectable. For 10dB(S+N)/N, the following values hold: SSB, 1.5 uV; CW, 0.75 uV; AM, 7.5 uV. These specifications are the manufacturer's. In actual bench tests, it is easy to hear a 0.3 uV AM signal in the absence of noise. As in the case of the RT-1051, the inductive elements of the tuned circuits in the RF amplifier stage (the module with two tubes visible



Inside the AM-3007A linear amplfier. The 8116A final tube is in the lower right, adjacent to the massive heat sink. The smaller 8233 driver tube is visible nearby. The circular structure at the top of the photograph is the motor-driven turret that contains the driver and final tuned circuits.

through an oblong cut-out) are selected by a motor-driven turret containing 28 "facets," each of which covers a 1 MHz band segment. The position of the turret is determined by a five-level code transmitted electromechanically. Since the HF spectrum this rig covers starts at 2.000 MHz, it is tempting to entertain the possibility of converting the circuitry to cover 160 meters. Given the frequency synthesis scheme used in the transceiver, you will be more likely to succeed in raising yourself by your own bootstraps than getting this rig on 1.925 MHz!! The two tubes in the RF amplifier stage are a 6BZ6 and a 6AN5WA. These are the last two stages in the transmit mode, and the first two stages in the receive mode.

The addition of a Transmit Audio Amplifier module and Transmit IF Amplifier module is primarily responsible for enabling the R-1051 to become an RT-618. These two modules and the Noise Blanker module occupy the chassis volume left by the removal of the power supply components in the R-1051. The first stage of gain in the Transmit Audio Amplifier circuit is a uA741 integrated circuit which has sufficient output to drive the balanced modulator directly. The gain of the 741 is controlled by a 2N2609 FET in a small compression circuit. About 12dB of compression adds decent punch to the transmit audio of the RT-618.

Let's take a look at the AM-3007A linear amplifier. Housed in its own seamless aluminum housing with NO AIR VENTS, the vacuum tube components are an 8233 driver and an 8116A dual tetrode final amplifier in which the combined plate dissipation of the two sections is 60 watts. Neither of these tubes is common and, to my knowledge, the 8116A was manufactured only by Amperex. The 8233 also comes from the Amperex factory. The 8116A

continued on page 36

A Handy Gate Dip Oscillator

by Walt Hutchens, KJ4KV
3123 N. Military Rd.
Arlington, VA 22207

No, this isn't really a *vintage* vintage project, but the result is a very useful piece of test equipment for the ham who builds and repairs equipment containing tuned circuits - and who besides those who work with vintage gear does that, anymore? However, if you are a particularly sensitive hollow state enthusiast, you might want to turn the next few pages quickly as there are several non-hollow state terms on each and the circuit diagram is nothing if not graphic!

Introduction

I have used GDOs since I was a teenager and they all had the same failings. First, they were large and they wouldn't fit in some of the spaces where I needed them. The vacuum tube designs were tied to a power supply that ended at a wall socket -- heavy, inconvenient, and somewhat unsafe, since it meant holding a piece of grounded metal in your hand while poking around in the rig. Many GDOs were plagued with spurious dips on the VHF frequencies and/or required resetting the meter while tuning across some bands. Finally, none of them worked below the upper end of the broadcast band, making them useless for many projects. When I began doing a lot of portable operation a couple of years back and wanted a wide range test oscillator I decided it was time to build my 'dream GDO'.

Overview

The unit that resulted covers 0.5 to 150 Mcs with 8 coils and the range can probably be extended in both directions if you want to. It is powered by a 9-volt battery and can be built in a 1-5/8" x 2-1/8" x 3-1/4" mini-box if you are careful about choosing the larger parts and can find the proper box. It has no spurious dips and does not require readjustment of the meter when tuning across any band. Current drain is 3 to 6 mA so the battery will last quite a while.

Circuit

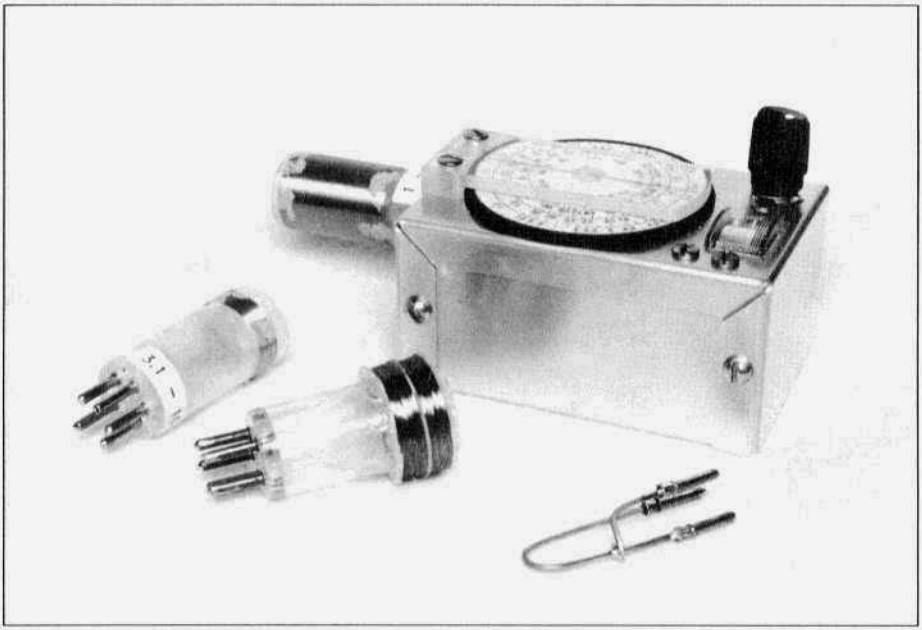
The unit consists of an MPF-102 field effect transistor in a Hartley oscillator with the gate current operating a bridge meter circuit having a transistor amplifier in one arm. The only controls are the tuning dial and combined meter centering pot and on-off switch. Modulation and 'diode' (absorption wavemeter) operation weren't needed for my intended purpose but shouldn't be hard to add.

There are only small innovations. The use of a two-gang tuning capacitor from a superhetrodyne receiver with the gangs in parallel on the bands below 10 Mcs gave a somewhat more constant L/C ratio and made the lower band coils a more convenient size. The capacitor I used had a flat external dial with a scale that was easily replaced with a computer-drawn one to give neat and easy to read calibration, although at this (just over 2") size you need good eyes or good glasses to read it!

The diagram tells you most of what you need to know to build the unit; the few less obvious points (that is, the ones I learned the hard way!) are discussed below.

Coils

Except for the 'hairpin' used on the highest band I wound the coils on Amphenol 24-5H forms. These are 1-5/8" long by 3/4" diameter but anything even close would work as well. If you



The homebrew GDO with some of the coils. The one with the washers on the form tunes down to about 50 kcs!

use polystyrene coil forms like these, clean the pins carefully before trying to solder as you must work very quickly to avoid melting them. (It helps to grab the pins with needlenose pliers right next to the base).

The coils are tapped at the center except for the hairpin used on the highest band; this one required a slight step-up ratio from the source to gate connections to work properly in my oscillator.

Because you may use different forms and almost certainly will have a different tuning cap, I have not given coil winding information. I suggest starting with the lowest frequency single layer coil, winding the from you choose from about 1/4" above the socket end to 1/8" below the open end with #36 wire - or smaller, if you can handle it. This coil covers 520 kcs to 1.52 Mcs in my unit. Then switch to #30 and wind a coil covering the next range up. Mine covers 1 to 3.2 Mcs. the third coil covers 3.0 to 10 Mcs, and so on. For the coils above about 10 Mcs, leave out one jumper connecting to the larger section on the tuning cap so you use only the smaller one.

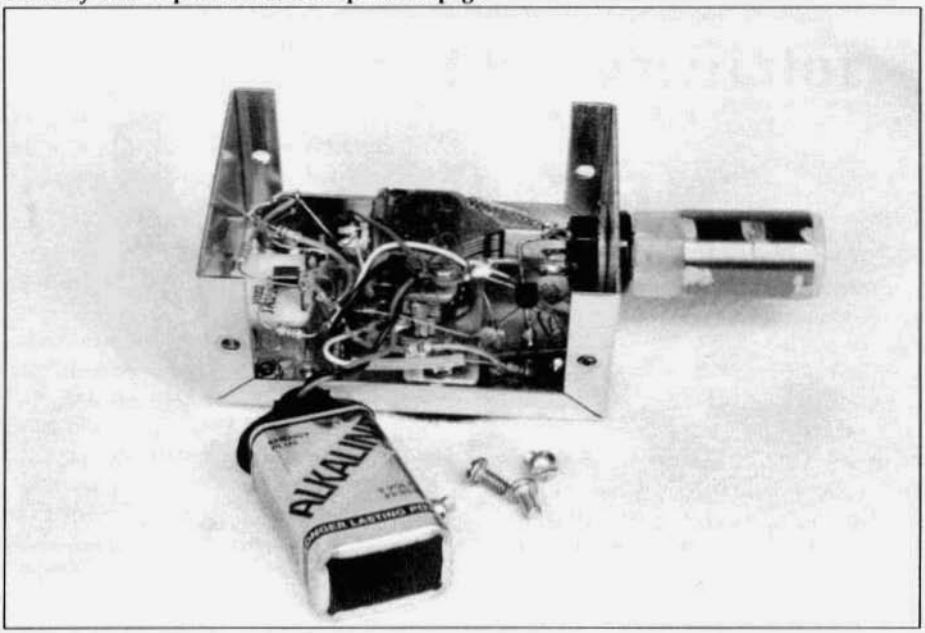
If you want to cover even lower frequencies, make three plastic washers which fit tightly on your coil form. Glue them in place about 1/4" apart and wind each section with #36 wire. You'll have to experiment to get the right number of turns.

You can get the #30 wire at Radio Shack, but you're on your own for the small stuff. Don't overlook dead transformers and the like; my #36 came from a TV horizontal oscillator coil.

Mechanical

There are just a few important mechanical details. Because the battery will shift around slightly no matter how you mount it, it should be installed in the end of the unit which is away from the RF section. A 2-1/8" wide box (the one I used or the slightly larger Radio Shack alternative) is exactly the right size for the battery and snap connector to wedge across the inside so no clip is required.

continued next page



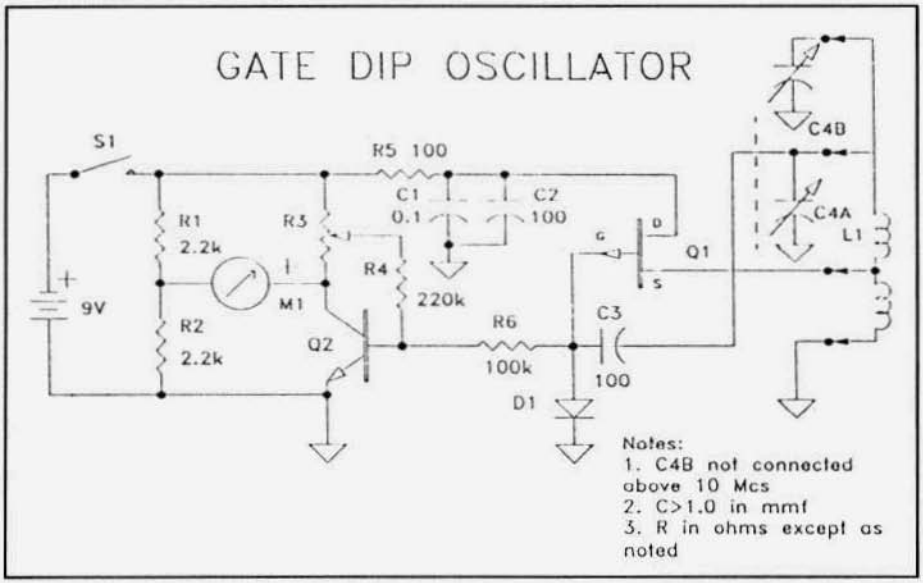
Inside the homebrew GDO. There's little extra space, so get the smallest parts you can and check everything twice before starting to drill.

Make sure you have enough clearance above the battery for any parts (probably the meter, pot/switch, and amplifier) which will be mounted there and also that the metal battery case can't cause a short. Also check where the case screws will go and be sure you don't mount parts where they'll interfere with the lower half of the case sliding inside the flange of the upper half.

I used a small air-dielectric tuning cap (5/8" x 3/4" x 1-1/8" frame) rather than one of those having sheets of polyethylene film between the plates. The film ones, however, are tiny, much more common and should work okay. Whatever you use, check with an ohmmeter and visually before starting construction. My cap had a misaligned stator which caused intermittent shorts; this was fixed by inserting sheets of heavy paper in all the air gaps and heating the stator mounting solder joints alternately until things straightened themselves out. The insulators in the other stator were just slightly loose in the frame (calibration was a sometimes thing. . .) until I filled the staked mounting joints with Krazy Glue.

Keep lead lengths in the oscillator to a minimum by mounting the FET at or on the coil socket and keeping the tuning cap as close as possible. Don't forget to allow for the swing of the gangs! Return the oscillator stage grounds directly to the rotor contact spring of the tuning cap. The 100-ohm decoupling resistor in the FET drain lead and the double bypass caps (0.1 mFd and 100 mmF) are necessary to prevent spurious dips and peculiar behavior.

Make connections between the coil socket and the tuning cap sections using lightweight braid - such as the shield from a piece of RG-174/U coax - so that plugging and unplugging the coils won't put any stress on the capacitor. For best calibration stability put the coil socket close to the top (folded) corner of the mini-box, fit the socket tightly in its hole and glue it with epoxy or Krazy



Parts List

	Radio Shack#
Battery Snap	270-325 is pkg of 5
Metal Case	270-139 is 4"x2-1/8"x1-5/8"
C1---------- .1 mFd/50 WV	272-135 is pkg of two
C2, C3----------100 mmF/50 WV	272-123 is pkg of two
C4A, C4B-------double gang BC variable	See text
M1----------250 uA meter	See text
Q1----------MPF-102 VHF FET	276-2062
Q2----------MPS-3904 NPN high gain	276-2016
R1, R2---------- 2200 ohms	271-1325 is pkg of 5
R3----------0-10k linear taper	271-1715
R4----------220k ohms	271-1350 is pkg of 5
R5----------100 ohms	271-1311 is pkg of 5
R6----------100K ohms	271-1347 is pkg of 5
S1----------SPST On/Off sw	271-1740
Mount on R3	
All fixed resistors are 1/4 watt.	

glue in addition to whatever other mounting it uses.

Two three-lug terminal strips should be plenty for mounting the small parts but they must be small ones.

Dial and Calibration

The tuning cap I used is a common older transistor portable unit with a stub shaft flatted on the sides and tapped in the center for a screw. The dial is about 2-3/16" diameter so it sticks just barely over the sides of the box, allowing for easy thumb tuning. Try to get the dial and capacitor as a unit.

To make reading the dial more accurate I made a cursor from 1/8" Plexiglass

continued on page 39

Taylor Tube Transmitter

R.W. (Berk) Berkemeyer, WØREP
402 Kingridge Dr.
Ballwin, MO 63011

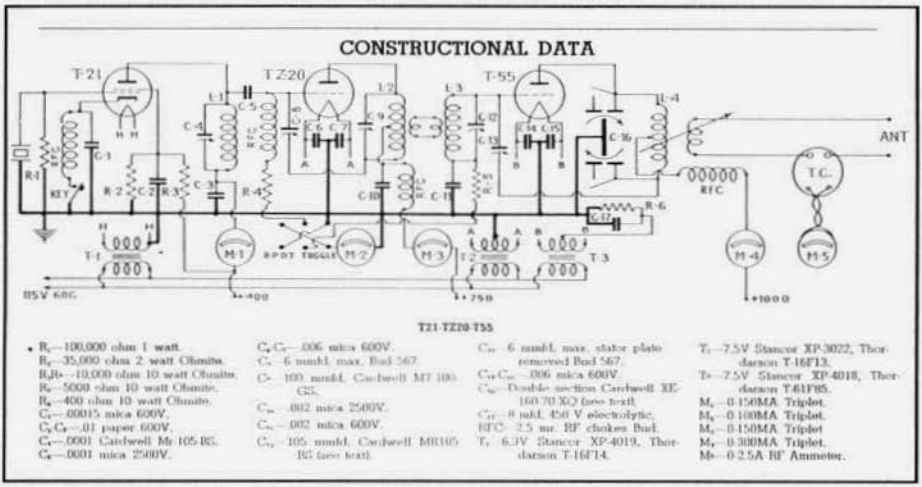
When I was first getting into ham radio in the early '40's, my ultimate dream was the Taylor T-55 amplifier described in a dogeared, coverless 1938 *Radio Amateurs Handbook*. When I got THE TICKET and saved enough money, that was going to be MY RIG!

That was more than fifty years ago, and many rigs have come and gone. However, a number of years ago, I started collecting Taylor tubes and among the group I obtained were several T-55s. After retirement, I started building equipment again, and kept looking at the old tubes on the shelf wondering if they were still good. Finally, I decided to try some of them.

A search of old Taylor catalogs resulted in finding exactly the tube lineup I was after (see schematic). I made a decision to breadboard the rig in stages, the first being a Taylor T-21 crystal oscillator. It roughly followed the schematic, although I did add a key click filter and crystal switch, shown in the front-left of the pictures. It worked well. That was followed by the TZ-20 amplifier-driver: again, similar to the schematic.

I do not like to have meters at high voltage nor did I have a 7.5 VAC centertapped transformer. I used a 250 ohm 10 watt adjustable resistor, setting the slider as close to the center as possible,

WØREP's vintage station. The top shelf holds the Taylor transmitter. On the table at the left is a Hammarlund SP-200 receiver. The platform on the right holds the VFO, keyer and receiver speaker.



and put a 100 ohm resistor from the center tap to ground allowing the use of a non-center tapped filament transformer. The meter went across this resistor. This stage puts out about 30 watts with 700 volts on the plate.

Then came the real heart of the rig, the T-55 final, and like the other two stages, it worked, 50 year old tube and all. With 1500 volts at 150 mils on the plate, and 25 mils grid current, the output is about 175 watts. Here again, I used a center tapped resistor in the filament circuit and modified the metering circuits to permit meter switching at low voltage.

I think the biggest surprise was that almost every tube in my collection performed as new. No gas, no arcing, and only a few with low filament emission, probably as a result of previous owners believing the Taylor advertisements that the tubes could take 500% overload. They can, but not for months or years on end.

Several precautions are mandatory: both triode stages must be carefully neutralized, which means removing the plate voltage at the input terminal and using a sensitive RF indicator in the plate circuit (My old Triplett wavemeter works well), and remember that there are LETHAL VOLTAGES on exposed parts of the transmitter. You must keep kids and cats away when operating!

I've been using the rig on the air for the last several months, and a number of the old timers I've worked have recounted their early homebrew projects using tubes by long gone companies - Hytron, Taylor, H-K, Amperex or from some still with us (but not all making vacuum tubes any more) RCA, Eimac, Raytheon and Western Electric. It's been a lot of fun building, using and discussing the real radios that glow in the dark.

The next project is to renovate an old amplifier using a Taylor 810, and building a series cathode modulator to join in on the AM fun. I should be able to get about 225 watts of AM with only receiving tubes and no additional power supply.

I've also had fun (and frustration at times) with the Hammarlund SP-200 Super-Pro picked up at a hamfest last fall. It's a dream to use, now that I've replaced all the 50+ year old leaky bathtub and paper condensers and heat split resistors, and realigned the mechanical dial assembly, but again, all the tubes (17) were good!

So, dig into the junkbox and keep your eyes open at hamfests for the old tubes. More of them are good than you might think, and it's a real thrill to get on the air with the old bottles. Keep on the lookout for old parts too, and don't be afraid to substitute parts and change circuits, that's all part of the fun. **ER**

End Point Adjustment For Collins 51J4 Receiver VFO

by Mike Maloney, AC5P
POB 33
Bartlesville, OK 74005-0033

I recently acquired a Collins 51J4 in excellent condition but was very disappointed to discovered that the PTO range had shrunk over time in its coverage. What once required 10.00 turns to cover the 1 Megacycle band range now required 10.12 turns. This I have discovered is not unusual for this series VFO.

After examining the green loctite around the adjustment hole plug at the right hand front end of the VFO (after pulling tube), it was obvious the VFO had never been adjusted nor removed from the radio. I dreaded the chore of cutting the factory lacing and removing the VFO from the receiver to get it restored to specs as suggested by the factory manual. This method would also require removing the Kilocycle dial and fabricating some method of accurately checking turns after adjustment.

While consulting with Dallas Lankford on the telephone, he suggested a method of end point adjustment without removing the VFO or KC dial while still using the latter for checking adjustment efforts. His method involved fabricating two offset screwdrivers from bent nails and using them with an inspection mirror.

After some thought and brainstorming, I came up with the following adaptation to further simplify the whole procedure. This I believe is the simplest and so far the best method to accomplish the task. Two short lengths of 1/4 inch hex steel spacers are modified with minor machine work and fine filing as per figures 1 and 2.

The first step is to determine the amount of end point error using the 100 kc marker and sharp filter or BFO. Remove the top dust cover and the VFO tube that parks in the front of the end point adjustment plug. Unscrew the plug using a small double open ended 3/8 inch flat wrench. Be patient and keep the wrench clear of the Megacycle drum. Observe the slotted adjustment slug and notched lock ring collar nut using a small inspection mirror and flashlight just to see what you are dealing with. Maneuver the notched adapter sleeve gently into the hole over the slug using forceps, tweezers or small needle nose pliers. Be patient and keep smiling. Gently hold the hex end of adapter with a small long bladed screwdriver using the left hand. With your right hand and a small 1/4 inch double open ended flat wrench, gently rotate the adapter counter-clockwise (to the left) until the tips engage the lock ring slots. Loosen the lock ring and continue two to three turns. Be patient and keep smiling.

Now remove the adapter sleeve and maneuver the screwdriver head with plastic sleeve adapter into the center of hole over the adjustment slug. Hold hex end with screwdriver in left hand as before if necessary. If you have small fingers, or you can get your wife or daughter to do it, gently rotate adapter clockwise until blade engages slot. If you don't have small fingers or an assistant who does, you will have to use the 1/4 inch end wrench as above.

Once the blade is in the slot the plastic sleeve should hold it on. Turn the slug approximately one turn clockwise and remove adapter, replace tube and warm up set. Check for end point error improvement using the 100 kc marker oscillator, sharp filter and kc dial hair line wiper. Repeat the adjustment procedure as necessary to bring the end point to 1000 kc with exactly 10.00 turns.

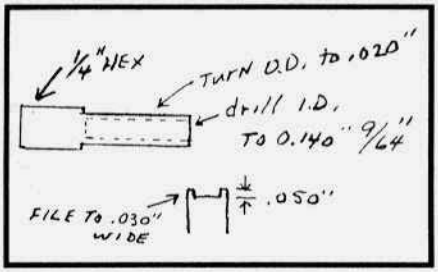


Figure 1. Lock ring adapter wrench.

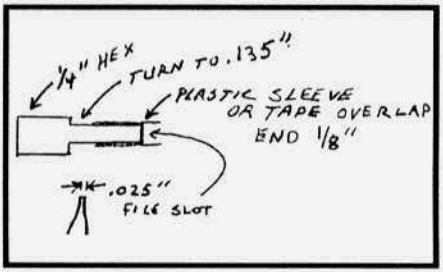


Figure 2. Screwdriver slug adapter

Remember, going clockwise reduces the end point overreach error. I estimate I went 2 to 3 turns (max) to obtain 12 kc of correction.

The secret to the whole procedure is to be patient and keep smiling. When complete, carefully (very gently) tighten the lock ring nut using the adapter sleeve and replace the plug. This is a good dexterity test so be forewarned. Get the XYL to help before you get flustered and loose your smile.

It is difficult to imagine the slug screw turning by itself even without the lock nut being turned down. This may have been overkill by some mechanical engineer at Collins. I bet also he never intended on doing the end point adjustment without the VFO being cleared from the receiver. It was probably by sheer accident that you have as much clearance as there is and I am glad no one told him this before it could be changed.

When you get 1 megacycle band coverage with exactly 10.00 turns, you will find the kc dial to be offset by the same amount all across the band. In my case the end point error was a plus 12 kc. After end point adjustment was complete the dial was offset 7 kc to the right of top center. Also it will be noticed that the MC pointer will be offset at the 0.1 marks across the band. This is normal because the adjustment affects the frequency at both ends of the VFO range. To correct this, the front panel will have to be removed from the subpanel. The small 1/16 inch Bristol spline set screws on the Kilocycle dial hub (back side) will have to be loosened to slip the dial so the correct displayed frequency is at the 12 o'clock or top center position.

To remove the front panel, turn the receiver up on its left side with a board or stack of magazines supporting it such that there is no weight bearing on the front panel. I would recommend removing the screws (a bunch) on the bottom panel and sliding it back a couple of inches. With a good light look up on the back side of the Kilocycle dial hub for the two small spline set screws offset 90 degrees from each other. If they have not been loose before, this could be the hardest part of the job. Warning: Do not use any other tool but the 1/16 inch Bristol spline wrench like the one inside the top cover to loosen the set screws.

With the larger spline wrenches, remove the following knobs; Kilocycle tuning, Band change, Ant. trim, Crystal Filter Selectivity, Phasing and BFO. Put the Mechanical Filter select lever at the 3 kc position.

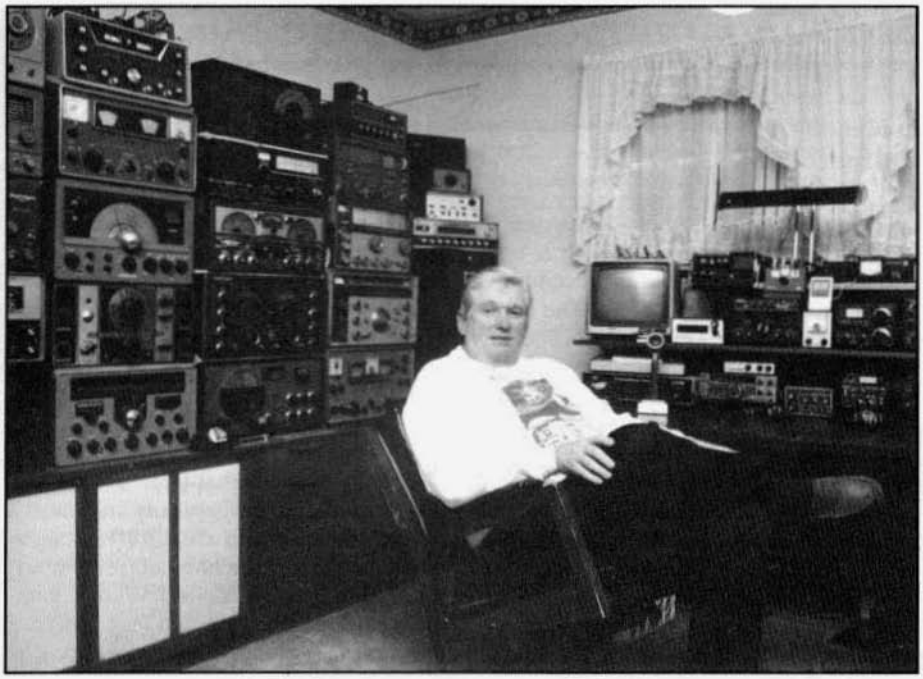
There are 11 total flat-head screws to remove from the front panel; 3 on each side, 4 across the top, 2 of which have lock washers and nuts, and one on the bottom just left of the Ant. Trim shaft.

Now loosen the set screws at the flex coupling in front of the BFO can where the smaller long shaft enters. Loosen

continued on page 40

Bob Hosea, KB8GU, in his workshop. The 813 rig on his bench is a recently completed homebrew project.

Dana Evans, K7OBB, with some of his vintage equipment. Some of the vintage equipment on the shelves behind him include , from top to bottom: Viking Ranger; Hammarlund HQ-129X; Viking Valiant; Johnson 500; power supply/modulator for the '500.



Harry Blesy, N9CQX, in his hamshack with some of his vintage and modern gear.

David Bertman, AB7B, in his shack. Most of the gear is homebrew, which will be described in a future issue of ER.

R-390A Contract/Order Number Update

by Les Locklear
1122 36th St.
Gulfport, MS 39501-7116

Can you stand another R-390A contract/order number update?

Last fall, an R-390A was purchased by a friend on the west coast. The contract number reads as follows: N 00024-84-C-2027, serial #2, manufactured by Fowler Industries for Avondale Shipyards. (Which is located just west of New Orleans, LA). This R-390A was manufactured in 1984! ! !

After many long distance calls by the owner and myself to Avondale Shipyards, San Diego Shipyards, Veedor Root Co., Walter Chambers and many others, the following information was revealed.

Fowler Industries was previously Clavier Corp., located in Port Jervis, NY. They are no longer in business.

They built the R-390A's for Avondale Shipyards who had a cost plus contract with the U.S. Navy.

Veedor Root Co.'s records indicate they shipped the mechanical/digital frequency counters to Fowler in 1983 and 1984. The records do not show how many counters were shipped. The counter assembly is a discontinued item.

The U.S. Navy still has R-390A's installed on warships larger than a frigate. Ingalls Shipbuilding in Pascagoula, MS (about 30 miles east of here) recently christened an LHD, the U.S.S. Boxer. After a quick call to the LBTF (Land Based Test Facility) there, it was confirmed that 2 R-390A's were installed!

The 1984 R-390A is identical to other '390-A's. The mechanical filters were manufactured by a company called Dittmore-Freimuth Corp. They began manufacturing mechanical filters when the Collins patent expired. Wally Chambers said they have much less loss than other mechanical filters, probably due to improved manufacturing procedures. Incidentally, there have been reliable reports that Dittmore-Freimuth built R-390A's on a 1968 contract.

After this information was compiled and verified, I believe the revised contract/order number genesis to be as listed below. **continued on page 25**

1954 Collins 14214-PH-51
1954 Motorola 363-PH-54
1954 Collins 375-PH-54
1955 Collins 08719-PH-55
1956 Motorola 14-PH-56
1958 Motorola 14385-PH-58
1959 Stewart-Warner 42428-PC-59
1960 Stewart-Warner 20139-PC-60-A1-51
1960 EAC 23137-PC-60
1961 Capehart Corp. 21582-PC-61
1962 Amelco, Inc. 35064-PC-62
1963 Teledyne/Imperial 37856-PC-63
1963 Stewart-Warner DA-36-039-SC-81547
1966 Communications System FR-11-022-C-4-26418 (E)
1967 Clavier Corp. DAAG05-67-C-0016
1967 EAC FR-36-039-N-6-00189 (E)
1968 Dittmore-Freimuth Corp. "UNKNOWN"
1984 Fowler Industries N 00024-84-C-2027

VINTAGE NETS

Westcoast AM Net: Meets informally, nightly on 3870 at 9:30 PT. Wednesday at 9:00 PM PT they have their formal AM net which includes a swap session. Net control rotates.
California Early Bird Net: Wednesday nights at 8 PM PT on 3835.
Southeast Swap Net: Tuesday nights at 7:30 ET on 3885. Net control is Andy, WA4KCY. This same group also has a Sunday afternoon net on 3885 at 2 PM ET.
Eastern AM Swap Net: Thursday evenings on 3885 at 7:30 ET. This net is for the exchange of AM related equipment only.
Northwest AM Net: AM activity daily 4 PM - 5 PM on 3875. This same group meets on 6 meters (50.4) Sundays and Wednesdays at 8:00 PT and on 2 meters (144.4) Tuesdays and Thursdays at 8:00 PT.
Twenty Meter AM Net: This net on 14.286 has been in continuous operation for at least the last 20 years. It starts at 5:00 PM PT, 7 days a week and usually goes for about 2 hours. Net control is Les, K6HQI.
Arizona AM Net: Meets Sundays at 3 PM MT on 3860. On 6 meters (50.4) this group meets at 8 PM MT Saturdays.
Colorado Morning Net: An informal group of AM'ers get together on 3875 Monday, Wednesday and Friday mornings at 7AM MT.
DX-60 Net: This net meets on 7290 at 2 PM ET, Sundays. Net control is Jim, N8LUV. This net is all about entry-level AM rigs like the Heath DX-60.
Military Net: It isn't necessary to check in with military gear but that is what this net is all about. Net control is usually Walt, KJ4KV, but sometimes it rotates to other ops. It starts at 5 AM ET Saturday mornings on 3885.
Westcoast Military Radio Collectors Net: Meets Sat. at 2300 local on 3885 and Sun. at 1600 local on 3885. Night net control is Andy, KD6TKX, and daytime net control is Tom, WA6OPE. AM is the mode used at present. It is not necessary to check in with military gear.
Grey Hair Net: The oldest (or one of the oldest) 160-meter AM nets. It meets on Tuesday nights on 1945 at 8 PM in the winter and 9 PM ET in the summer.
Vintage CW Net: For CW ops who enjoy using vintage equipment.This is not a traffic net; speed is not important. The net meets on 14.050, Saturdays at 1 PM PT. Net control is Tracy, WB6TMY.
Vintage SSB Net: Net control is Chuck, N5SWO. The group meets on 14.293 at 1 PM CT, Sunday afternoons.
Collins Users Net: The oldest of the 'users nets'. It meets on 14.263 Sunday afternoons at 2 PM CT. The net control revolves. This group also gets together for an informal ragchew on 3805 Tuesday evenings at 7 PM CT.
Drake Users Net: Another relatively new net. This group gets together on 3865 Saturday nights at 8 PM ET. Net controls are Criss, KB8IZX; Don, WZ8O; Rob, KE3EE and Huey, KD3UI.
Heath Users Net: A new net started by Marty, WB2FOU/5. Net control is shared by Fred, AA5LW. It meets on 14.275 at 4 PM CT Sundays. Check in on either AM or SSB.
Swan Users Net: This group meets on 14.250 Sunday afternoons at 4 PM CT. The net control is usually Dean, WA9AZK.
Nostalgia/Hi-Fi Net: Meets on Fridays at 7 PM PT on 1930. This net has been meeting since 1978.
K1JCL 6-Meter AM Repeater: Located in Connecticut it operates on 50.4 in and 50.5 out.
JA AM Net: 14.190 at 0100 UTC, Saturdays and Sundays. Stan Tajima, JA1DNQ is net control.
Fort Wayne Area 6-Meter AM Net: Meets nightly at 7 PM ET on 50.58 MHz. This net has been meeting since the late '50's. Most members are using vintage or homebrew gear.
Westcoast Broadcast Equipment Net: Tuesdays on 1959 at 9 PM PT. Anybody is invited to join the group, but the emphasis will be on broadcast equipment. Moderator is Mike, W6THW.

The Barker & Williamson 6100

by John A. King, WA1ABI
23 Hope Ave.
Portsmouth, RI 02871

The B&W 6100 is an 80 through 10 meter SSB/CW exciter of the 100W output class introduced by Barker and Williamson, Inc. in 1962. The 6100 was a Cadillac in its class, boasting performance specifications that are impressive even today.

It is historically significant, being the first amateur rig to use frequency synthesis. Frequency synthesizers were found in military gear in the early sixties, but were virtually unknown in amateur circles. The 6100 owner's manual introduces ". . .a radically new type of variable frequency control." There are no free-running oscillators in the 6100, and within the 75 watt power limit of the day, it could legally be operated by a novice class licensee as a crystal controlled rig. At the 1963 price of $875, it is doubtful that many were purchased as novice rigs. The Collins 32S-3, by comparison, sold for $750 in that year and the Johnson Invader was $620.

History

B&W had established its reputation in the amateur community in the 1950's with the 5100 and 5100B transmitters. The 5100 was highly regarded for its modular construction and excellent sounding AM signal. The 5100B was capable of SSB operation with the outboard 51SB SSB adaptor, but in 1960 Jack Williamson, W3GC, decided that the time had come to design a new SSB transmitter from a clean sheet of paper.

For the electrical design, Williamson called upon Jack Brown, W3SHY, who had been the project leader for B&W's most ambitious undertaking - the behemoth C-4 ionosphere sounder, a 25 KW pulse transceiver that swept from 1 to 25 MHz in 15 seconds. Another veteran designer, Harold Carr, W3JFI, was tapped for the mechanical design. Carr had been the project engineer for the T-368 military transmitter. In December, 1960 this team set out to design the new transmitter that would become model 6100.

Frequency stability was a paramount design requirement for SSB. The new rig would use heterodyne frequency generation with a fixed range VFO, but the VFO would be pushing the limits of vacuum state technology to meet the design goals. Fortuitously, Herman Shall, W3BWK of Piezo Crystal in Carlisle, PA, approached B&W with a design for a variable crystal oscillator he called the Crystalplexer. Shall had described the design in a 1958 *QST* article. He wondered if B&W might be interested in using his Crystalplexer in the new transmitter. Shall's design became the synthesizer in the 6100. Piezo Crystal supplied the crystals to B&W, and a lifelong friendship developed between Jack Brown and Herman Shall.

Another design goal for the 6100 was good sounding audio, carrying on in the tradition of the 5100 before it. The audio characteristics of the rig would be shaped in large part by the crystal lattice filter used for SSB generation. Brown was disappointed with the SSB audio quality produced by existing commercial filters, and he asked Shall if he could build a better filter. Shall dissected a commercial filter, then went to work on one of his own. The result was a 4-crystal design with a wide, smooth passband with razor-sharp skirts. Jack Brown was pleased - they had achieved what he called hi-fi SSB.

Production of the first run of one hundred 6100's began in 1962 at the B&W factory in Bristol, PA. Alignment of the rigs proved to be so demanding that B&W had to recruit help from outside the factory. When Jack Brown went to nearby Drexel University to hire engineering students, he had only one hiring criterion: the students had to be hams. One of the student hams he hired was K3ZZA, his son Marty. The alignment process came under control and 6100's began rolling out the door.

Barry Barker, W3BZ, laid claim to 6100 S/N 1, and at his request the front panel was specially painted a powder blue color that came to be called "Barry's Bedroom Blue." Other early serial numbered rigs went to Jack Williamson and sales manager Tom Consalvi, W3EOZ. Sales were moderately successful, given the price tag of the rig. The September, 1963 issue of *QST* magazine favorably reviewed the new transmitter with what it called the "tongue-twisting" frequency synthesizer.

A second production run of 100 units began in 1963. This production lot was farmed out to Sentinel Electronics of Hazelton, PA, in an effort to hold down the cost of what had become a very expensive rig to manufacture. Jack Brown had left the company (though he would return in 1969 to become President and General Manager.) Project engineer Elmer Bush, W3FVT, supervised production at Sentinel, spending several months shuttling between Bristol and Hazelton. Bush was solely responsible for inspection, alignment, and final test of all the Hazelton rigs.

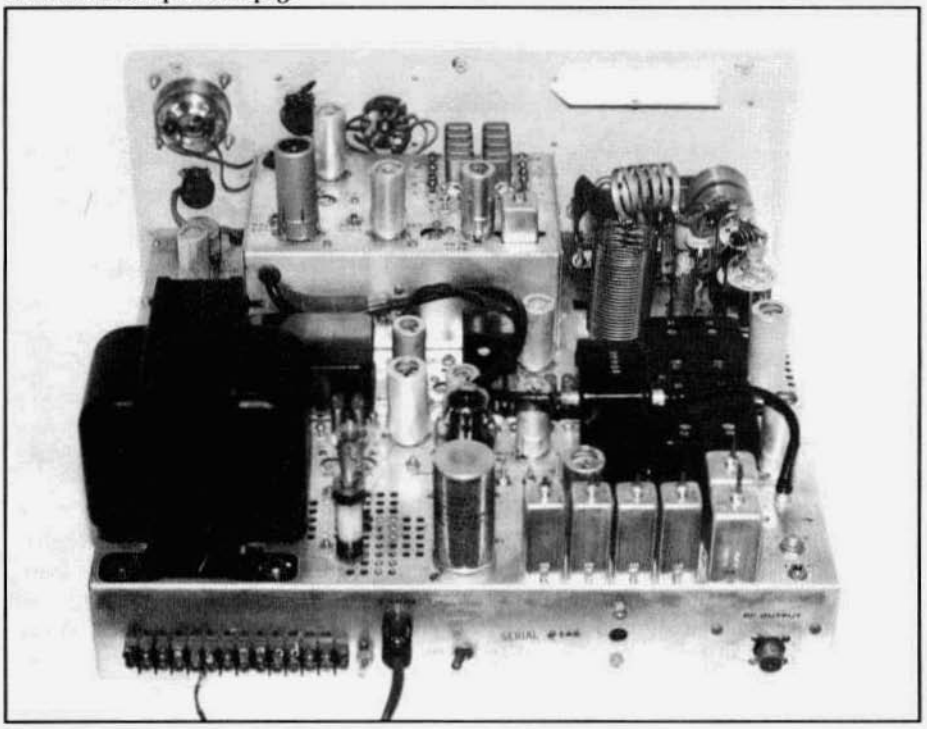
A 'sea change' had been occurring during the production years of the 6100. Amateurs were switching from AM to SSB, but their preference was shifting from separate transmitters and receivers to the increasingly popular all-in-one-box transceiver. The manufacturers who recognized this trend capitalized on the economies of transceiver manufacturing, cranking out thousands, driving down prices and further fueling demand. The market for high-end stand-alone exciters like the 6100 evaporated, and sadly, serial number 200 was the last B&W 6100 to be made.

Mechanical Description

The 6100 is contained in an 18-3/8" W x 9-1/2" H x 16" D perforated grey steel cabinet with a flip top cover. Overall weight is 60 pounds. The front panel is an eclectic design reflecting B&W's diverse background. The panel itself is light tan with white lettering. The syn-

continued next page

B&W 6100 from previous page



Inside the '6100. The large box behind the front panel is the synthesizer assembly. The black box partially hidden by the power transformer is the sideband filter; the other black boxes contain various tuned circuits.

thesizer control group, set in black bakelite, looks distinctly military.

The flowing red "Sixty One Hundred" script screened on a textured silver inlay provides interesting contrast. Surrounding the inlay is a bezel finished in black wrinkle. The knobs are machined aluminum; all are black anodized except for the synthesizer controls which are brushed.

This rig must have kept the machine shop busy - the bandswitch knob looks like the final exam from a mechanical drawing course. A small swing-down door conceals a group of infrequently adjusted controls which are usually found on the back panel or buried inside of most rigs. A 2.5 inch panel meter monitors plate current, RF output, and ALC compression level. Mic and key jacks are also on the front panel.

All internal components are mounted on and under the main chassis, except for the frequency synthesizer which is a separate subassembly connected to the main chassis by a Jones plug, reminiscent of the construction of the B&W 5100. On the rear panel are the RF output jack, a line voltage selector switch, and a barrier block with inputs for a phone patch, anti-vox, and PTT, along with a -100 volt source and 3 sets of relay contacts. Serviceability of the rig is excellent. The tubes and above-chassis components can be reached through the flip top, and a removable bottom panel allows access to the under-chassis components without removing the chassis from the cabinet. Test points are brought out to the top of the chassis by feedthrough capacitors. Clearly, this radio was designed by hams who had worked on their own gear.

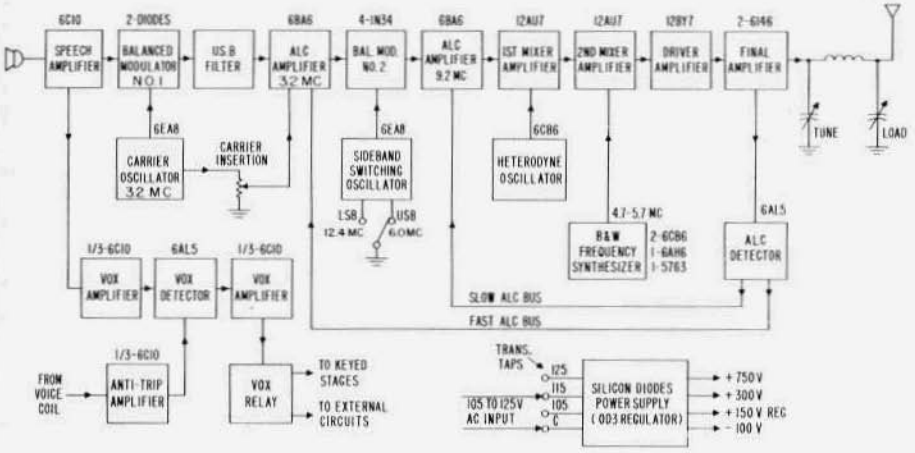


Figure 1. Block diagram.

Electrical Description

Figure 1 shows the block diagram of the 6100. Compactrons are used in the speech amp and VOX circuits. The first balanced modulator combines the outputs of the speech amp and the carrier oscillator to produce a double sideband suppressed carrier signal.

The carrier oscillator is fixed at 3.2 MHz; the SSB output from the crystal lattice filter is always a 3.2 MHz USB signal. This eliminates the problem of asymmetrical filter response introduced by switching between two carrier oscillators ahead of the sideband filter. The 3.2 MHz signal passes through the first of two ALC amplifiers and into a second balanced modulator. Carrier can be inserted into this amplifier by the front panel "Carrier" control for CW and linear AM operation. A red "Carrier" indicator light illuminates whenever the control is moved out of the zero detent.

Sideband selection is done in the second balanced modulator, mixing the 3.2 MHz USB signal with either 12.4 MHz or 6.0 MHz to produce 9.2 MHz LSB or USB. This 9.2 MHz IF runs through another ALC amplifier, then to the 1st mixer. The 1st mixer produces an output offset from the transmit frequency by the synthesizer frequency. On 80 meters the 1st mixer runs straight through and the heterodyne oscillator is disabled. The 2nd mixer combines the outputs from the 1st mixer and the frequency synthesizer to produce the transmit frequency. Both 1st and 2nd mixers are 12AU7 twin triodes configured as cascode amplifiers, which offer better performance than multigrid mixers and yield some conversion gain.

The RF power chain consists of a 12BY7 driving parallel 6146's with a pi-network output tank. RF voltage at the grids of the 6146 final amplifiers is rectified by two halves of a 6AL5 dual diode to produce two separate ALC control voltages with different time constants. The fast ALC, 30 milliseconds, is applied to the 3.2 MHz amplifier and the slow ALC, 1.5 seconds, is applied downstream to the 9.2 MHz amplifier. The ALC threshold is adjustable from the front panel. This dual action ALC not only prevents clipping in the final amplifier, but provides a degree of speech compression as well.

The power supply is solid state except for an OD3 gas regulator tube. Filter chokes are used in the HV and LV supplies, and both sections are heavily

continued next page

B&W 6100 from previous page
loaded by bleeder resistors to enhance regulation.

The frequency synthesizer is an elegant design employing 2 6CB6 oscillators, each with 10 switch-selected crystals. The first operates between 24.80 and 25.70 MHz in 100 kHz steps. The second runs from 20.01 to 20.10 in 10 kHz steps. The crystals in the 20 MHz oscillators can be pulled 10 kHz lower by a variable capacitor, giving continuous tuning between the 10 kHz steps. The oscillators are subtractively mixed in a 6AH6 stage, yielding continuous coverage from 4.7 to 5.7 MHz. The mixer output is bandpass filtered, then amplified by a 5763 and run through another bandpass filter. The crystals are carefully temperature matched so that changes in temperature affect all the crystals equally and in the same direction. The frequency output of the synthesizer remains virtually constant over temperature since subtractive mixing is used. The front panel "X100" and "X10" Kilocycle controls select the crystals; the "X1" control adjusts the variable capacitor. The "X1" control covers 10 kHz in 180 degrees of rotation and is graduated in 500 Hz divisions.

On The Air With The 6100

I became the proud owner of 6100 S/N 146 early in 1995, after a long search. It is not known when the rig was last on the air, but it needed the sort of TLC that any 30 year old radio needs. I replaced all the electrolytic capacitors, a couple of open wirewound power resistors and some marginal tubes.

After removing the 6146 final amplifiers and disconnecting the HV power supply, the rig was brought up slowly on a Variac with a clamp-on ammeter on the AC line. The ammeter revealed no surprises as the line voltage came up and the panel lamps reached full brilliance. The delightful smell of vintage radio wafted through the shop as I threw the function switch to "CAL".

The spotting signal was heard on the station receiver, smooth, stable, and right on frequency. A quick check of the synthesizer output showed that all the crystals were oscillating, although one of the 25 MHz rocks was a bit off. Next the finals were installed, the HV connected, and the Bird and dummy load hooked up. The rig tuned up easily to 100W output, but the plate (actually cathode) current was reading very high on the panel meter. Replacement of the cathode resistors cured this problem, and the rig was ready for some performance measurements.

The output power is rated at 100 watts nominal. Measured CW output by band was: 80M -122W, 40M -130W, 20M -125W, 15M -118W, 10M -93W. Stated frequency stability is +/- 100 Hz for the first 15 minutes, and +/- 25 Hz in any hour thereafter at normal room temperature.

My measurements were taken in a chilly New England basement workshop where the rig had spent a week at 50 degrees F. From a cold start on 3800 kHz the rig drifted slowly downward for the first 90 minutes, settling in 385 Hz lower than the initial frequency. Over the next six hours the frequency never varied more than +/- 2 Hz. Warmup drift was even better on the other bands, probably because the heterodyne oscillators buck the synthesizer drift. Worst case second harmonic output was on 80 meters, measured at -42 dB (ref 100W). The book claims -43 dB, but the rig still meets the 1995 FCC requirement of -40 dB. All harmonics and spurs were better than 55 dB down on the other bands. SSB frequency response was 275-3400 Hz at the 3 dB down points. All well and good, but how does it sound on the air?

In a word: Great! Once the ALC has been correctly adjusted it is impossible to clip the final. Advancing the audio gain to full open simply adds well behaved compression. 6 dB of compression seems to be about optimum for my voice. The SSB audio reports received on the air have been very gratifying.

Most came unsolicited, and one of the best was from a Canadian ham who said that he had never heard anything like it. Nice report, but rather sad commentary on today's SSB operating habits and signal processing gadgets.

I couldn't resist the urge to try the rig on AM, so one Sunday afternoon I took it for a test drive on 3885 kHz. Output on AM is 22 watts, and a scope is definitely required for proper adjustment. I didn't expect glowing reports running such low power, but the stations I did work found it hard to believe that they were listening to carrier insertion AM from a B&W 'what?'.

CW operation is flawless. The PTT relay actuates when the key is closed to provide semi-break-in control for T/R switching and muting. The relay is extremely quiet and the hang time is adjustable from the front panel. The CW note is very clean, and the envelope looks like the classic textbook example of good keying. The leading and trailing edges are shaped, but not to the point of sounding soft.

Conclusions:

At the beginning of this article I alluded to novice operation of the 6100. Long ago in a small town high school club station in western Pennsylvania, I was that novice. The year was 1967, and my home station consisted of a homebrew 12BY7/1625 rig with a Knight-Kit R-100 receiver. School faculty members Hal Faulkner, W3BVP, and Richard Seaman, WA3HUR, somehow convinced the school board to set up a club station with a Hammarlund HQ-180A receiver and a B&W 6100. The reader can imagine the pleasure this young novice had operating that station.

Ever since then, the 6100 has loomed in my memory almost larger than life. Was it really as good as I remembered? Almost 30 years later, I can honestly say yes. . .and maybe better. Subjectively, one gets the sense that everything is right about this radio. The styling is attractive, the feel is solid, the ergonomics are sensible, and the performance is top notch. ER

Acknowledgements

I wish to thank Jack Brown and Elmer Bush for their contributions to this article. They provided historical information, offered technical support, proofread text, and cheerfully endured long telephone interviews. This is really their story; it has been my pleasure to tell it.

References

Shall, "VXO, A Variable Crystal Oscillator", *QST*, Jan. 1958

"Recent Equipment - B&W 6100 Transmitter", *QST*, Sept. 1963

R-390A Update from page 18

Some of the above have different order numbers for the same year, depending on whether they were built for the Signal Corps., or the Navy. There were so many spare parts contracts awarded that I couldn't begin to list them.

The story has circulated for years that 13 manufacturers built R390-A's. Even after adding Fowler and Dittmore-Freimuth to the list, that only brings the count to 11 DIFFERENT manufacturers.

This information should lend credence to the rumors that have circulated for years about R-390A's being built in the '80's.

Wally Chambers is presently researching information that the ladies' cosmetic manufacturer, Helena-Rubenstein subcontracted an R-390A order. Maybe there is another R-390A story out there.

This article would not have been possible without the invaluable assistance rendered by Wally Chambers, who was most helpful, and last, but certainly not least, Victor Hatharasinghe, the owner of a "like new, shiny" R-390A.

If anyone has any additional information, especially on the 1968 contract, feel free to contact me. ER

The Hewlett-Packard 400D AC VTVM

A Basic Bench Instrument

by Kurt H. Miska, N8WGW
3488 Wagner Woods Ct.
Ann Arbor, MI 48103

In my previous article on the Heathkit VTVMs, I mentioned briefly that there is another whole world of much more sophisticated vacuum tube voltmeters out there. Perhaps, the most basic, but still extremely useful and rugged, are what I prefer to call laboratory grade or industrial strength AC VTVMs. One of the most easily acquired of these is the Hewlett-Packard 400D, or its companions, the 400H and 400L. Similar instruments were also made by Ballantine, Boonton, and Fluke. There were probably others.

The Hewlett-Packard 400D evolved from H-P's first AC VTVM, the model 400A, which was built from the early days of World War II to the mid-1950's. Essentially, the 400A differed little from those that followed perhaps only in that it did not have the extremely low voltage ranges of subsequent models.

An interesting aside to my very brief comments about the 400A is contained in an advertisement for this meter. The ad, with David Packard's signature, quotes him, "Please give Hewlett-Packard Laboratory instruments serious consideration. They are sensibly priced, yet in quality and performance they are unsurpassed."

Anyway, my workbench features two H-P 400Ds which were acquired for the princely sum of $31, one at a Dayton HamVention and one from Bauer Industrial Supply Co. (Detroit), a delightful electronic surplus business. Yes, indeed, very sensibly priced.

The 400D and H models measure form 0.001 to 300 volts RMS full scale and from -72 to +52 dB over a frequency range of 10 Hz to 4 MHz. The 400D's 4-1/4" meter has two linear voltage scales - 0 to 1 and 0 to 3, and a logarithmic dB scale from -12 to +2 dB. Front panel controls are minimal and consist of a classic toggle on-off switch, and the hefty and clearly marked 12-position range switch. Each voltage step also has the corresponding dB range. For example, the 0-1 volt range is marked 0 dB, meaning the dB scale is read directly. Or, the 0.1 volt range is also marked - 20 dB, meaning that you subtract 20 dB from the scale indication. Input terminals are a red and black binding post for use with individual or standard 3/4" spacing dual banana plugs. The output terminals, about which more later, are identical to the input connections. Input impedance is 10 MΩ shunted by 20 pF on the 1 to 300V range and 35 pF on the 0.001 to 0.3V ranges.

Construction

The first thing I did when I bought my 400Ds was to open them up. What greeted me was a delight. The solidity of the construction, and rugged wiring, using rigid, large gauge wire, are very much a tribute to a bygone era. The input attenuator is well shielded as is its cathode follower circuit. All the tubes feature hold-down clips. In short, everything about the construction points to high performance coupled with exceptional reliability.

As might be imagined, there are a number of special H-P parts that will be impossible to obtain as replacements and these include the power transformer, the ceramic range switch, and the meter itself. Of course, unless the instrument has been run over by a truck, it seems unlikely that these parts will ever fail. The stuff is just plain rugged.

The classic Hewlett Packard 400D AC VTVM. This one was salvaged at the '94 Dayton Hamvention while sitting forlornly in a puddle. Price, $5. Condition, flawless.

The Circuit

Unlike the more modest Heath VTVMs, the 400D is quite complex but becomes a little simpler when its main elements are considered. Its circuits, consist of the input voltage divider controlled by the range switch, a cathode follower input tube (a 6CB6 sharp cutoff pentode), a precision step attenuator also controlled by the range switch, a broadband amplifier (four 6CB6s), indicating meter, and regulated power supply (6AX5 rectifier; 12B4A low-mu triode; 6U8 triode-pentode, and 5651 voltage reference tube).

The voltage applied to the input terminals for measurement is divided by 1000 before application to the input cathode follower when the range switch is set to the 1-volt range and higher. The input voltage is applied directly to the cathode follower on the lower ranges. The voltage from the cathode follower is divided in the precision attenuator to be less than 1 mV for application to the broadband amplifier. The output of the amplifier is rectified in a full-wave bridge rectifier with a DC milliammeter across its midpoints. The resultant DC through the meter is directly proportional to the input voltage.

Operation and Use

Operation and application of the 400D are simple and obvious. Warm it up for about five minutes and it's ready to perform yeoman's service. When the range switch is set to anything below 1 volt, the pointer deflects increasingly, even when there is no input, as you switch down to the lower ranges. The instrument is extremely sensitive and if you touch the input terminal on those low voltage ranges, the pointer deflects violently. I wouldn't recommended it even if it doesn't damage anything. This strong pointer deflection when there is no input is due a great deal to noise pickup. Common sense tells you to always connect the ground lead first before connecting the input lead. I made up test leads from RG-58U coax with a dual banana plug at one end and small, bronze mini-alligator clips at the other end.

continued next page

Another view of Kurt Miska's not-too-tidy workbench. He's adjusting one of his H-P 400D AC VTVMs, two of which flank an H-P 200CD extended range oscillator. Under this threesome is an H-P 3300A function generator.

The meter can also be used as an amplifier. The last stage of the amplifier also features a 50-ohm output termination that supplies a constant 0.15 volt to the front-panel output binding posts. Maximum gain is obtainable only on the lowest (0.001V) range, since output level is the same for all bands. This is due to the 10 dB amplification loss per step inserted by the RANGE switch as it is turned clockwise. Amplification may also be obtained on the 0.003, 0.01, 0.03, and 1 volt ranges. Maximum gain is 150 on the 0.001V range.

The Hewlett-Packard technical writers thought of everything when they compiled the manual for the 400D. One of the most useful charts is the impedance correction graph. Since the meter's decibel scale is calibrated to indicate dbm for measurements made across 600-ohm circuits, a correction factor must be used when measurements are made across circuit impedances other than 600 ohms if absolute dbm levels are desired.

On my bench, one 400D invariably monitors input voltages to whatever circuit I may be testing, and the other one monitors output. Both are connected in parallel with a dual-channel scope. Since the chassis is at power line ground, it's a bit risky to try measurements not referenced to ground. I haven't tried and don't find a need for that sort of risk.

Variations and Accessories

As I noted earlier, the 400D is the basis of the 400H, the 400L, their rackmount configurations and as the ME-30A/U military version. The H and L models feature the larger meters with mirror scales and the 400L covers from 0.003 to 300 volts RMS full scale. Its voltage scales are logarithmic and the dB scale is linear. This model also does

continued on page 40

Cooling the Collins KWM-2

by Dave Ishmael, WA6VVL
1118 Paularino Ave.
Costa Mesa, CA 92626

During a recent 80M SSB QSO with my KWM-2, I found myself constantly changing frequency, albeit in small steps, since I didn't have an RIT to compensate for the KWM-2's initial warm-up drift. My KWM-2's frequency stability met the "100 Hz during any 1-hour period following a 20-minute warm-up" specification, but the initial warm-up drift during that 20-minute period was annoying. Using a digital thermocouple meter with a type T thermocouple, I measured the KWM-2's internal temperature rise. At 115 VAC line voltage (+288 VDC from the 516F-2), the measured internal temperature rise was 35 - 40° C. At normal room ambient, internal temperatures of >60° C were common. After an hour or so of operation, the top cover was hot to the touch. I started to consider adding a cooling fan to the KWM-2 to reduce its initial warm-up drift. In addition, Walt Hutchens, KJ4KV's letter in ER #64 had planted a "seed" in terms of reducing the heat generated inside the KWM-2. After reading Bill Kleronomos, KDØHG's great article "Electron Tube Survival Primer" in ER #66, I made a few measurements and ordered the fans.

My measurements indicated that there was sufficient clearance in front of the amplifier compartment to mount two "micro-boxer" fans side-by-side. The fan(s) I selected was an NMB model AC 2412PS-12W-B30, 115 VAC, with a specified unrestricted airflow of 10 CFM @ 3000 RPM. Each fan draws 4W (44 mA). I purchased the NMB fans from Newark Electronics @ $11.26 ea. plus shipping/handling. I chose the NMB AC fan primarily because I didn't want to build a separate DC supply to power the fans - it was just more convenient to "plug them in".

A few comments about fan selection:

* These "micro-boxer" fans are readily available in both AC and DC versions. They are 2.36" (60 mm) square and 0.59" to 1.25" thick.

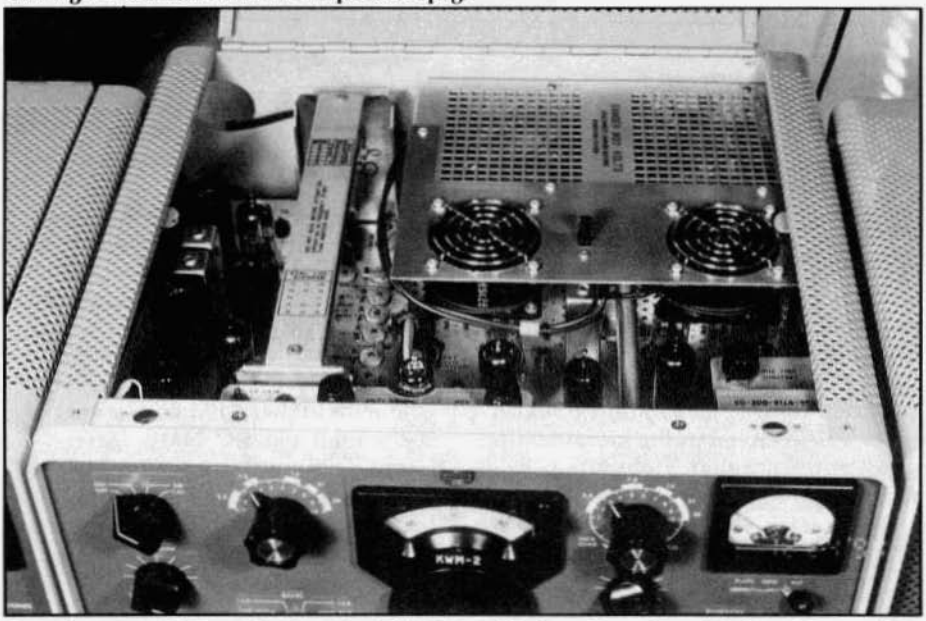
* DC fans offer a larger selection, are more plentiful, and there are fans available with higher CFM and lower noise specs than the AC NMB fan(s) I selected. They range from 2350-5700 RPM with unrestricted airflows from 8-25 CFM. 12,24 and 48 VDC models are available with power requirements ranging from 0.6-3.6W.

* AC fans range from 2350-3000 RPM with unrestricted airflows from 8-13 CFM and range from 3.8-4W.

* Generally speaking, the higher the RPM, the higher the noise. Some of the higher performance/speed DC fans are "real screamers" and although they cool significantly better, they're just not appropriate for use in the KWM-2 - they're just too "noisy". We tend to use what we can lay our hands on, but try to keep the fan's RPM below 3300 to minimize the fan's noise level. When comparing the fan's noise specs, a 3 dB change is "just noticeable", 5 dB is "clearly noticeable", and 10 dB is "twice (or half) as loud". The NMB's noise is spec'd at 29 dBA.

* The RPM of DC fans and their corresponding CFM and noise level can be decreased by reducing the fan's DC voltage. Reducing the fan's RPM 20% will reduce the fan's noise level by 5 dB. A large number of 12V fans have a specified range of 6-13.8 VDC, others 10.2-13.8, and others somewhere between. 24V and 48V versions have slightly different ranges. If you are planning to minimize the fan's noise by controlling the DC voltage, make sure the fan's DC voltage range is large enough. The con-

continued next page



New fan assembly added to the KWM-2. This is a drop-in addition. No modifications are made to the KWM-2 and the fan assembly can be added without taking the KWM-2 out of its cabinet. The fan guards are optional.

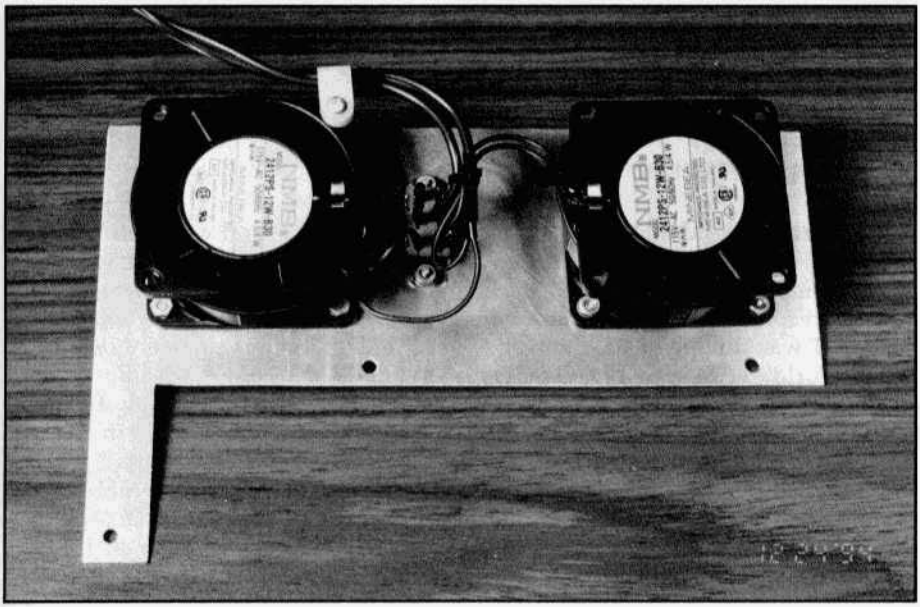
tacts of the KWM-2's ANT RELAY can be used for dual-speed fan control if they're not already being used (hi-speed during receive when you can tolerate the higher noise, lo-speed during transmit).

* Generally speaking, sleeved bearings are quieter than ball bearings. However, since blade noise predominates, don't worry about the fan's bearing system.

The fan bracket was made from a scrap piece of 5-1/4" x 8-1/4" 0.062" aluminum. The holes for the two fans were punched with a 2-1/4" Greenlee chassis punch. The bracket was cut down into an L-shaped piece using an Adel nibbling tool to fit the existing 4-40 mounting holes on the top cover of the KWM-2's final amplifier compartment while clearing the cover's existing ventilation holes. Longer 4-40 x 9/32" screws were used to install the fan assembly to the top cover.

Wire-type fan guards are used on both fans and the guard on the right-hand fan just clears the support bracket for the top cover. Square plastic fan guards won't clear the support bracket with the existing bracket dimensions.

The power for the two fans is provided by a separate power cord to the 115 VAC. A slide-switch mounted on the fan assembly controls the fans' power. The connections to the slide-switch and AC cord were insulated with heat-shrink tubing to prevent accidental contact with the 115 VAC line. I considered modifying the 516F-2 power supply to supply the switched 115 VAC to the fan assembly and eliminating the slide switch. I finally decided to keep the fan assembly separately powered. Right now, the extra line cord and switch is OK. If a toggleswitch is used instead of the slideswitch, the maximum clearance above the bracket is about 9/16" before it hits the bottom of the top cover.



Bottom view of the KWM-2 fan assembly

I chose to mount the fans with the air flow down. I tried both directions and got similar results, so I left the air flow down. With the fans installed and running, there is still a small temperature gradient across the top of the KWM-2 after an hour or more of operation, but overall, the improvement is surprisingly good. The top cover above the fans and amplifier compartment is almost cool to the touch, warming as you reach the left-hand side of the rig. More importantly, frequency drift is negligible during long periods of receive. The initial 20-minute warm-up drift has been reduced to a tolerable level.

The NMB fans cannot be heard during receive at normal audio levels. During transmit or station mute, however, the fans can be heard, but I don't think that it is objectionable.

This was a worthwhile mod that took about four hours and $35 to install. This was an absolutely drop-in modification - no mods were made to the KWM-2 nor did it have to be removed from its cabinet to install the fan assembly. The KWM-2 runs about 20° C cooler with a corresponding improvement in warm-up drift and long-term frequency stability. Tube life and reliability should also improve.

Send me a #10 envelope with an SASE and I will send you a full size drawing of the fan bracket, an NMB AC 2412 data sheet, and a comparison chart of about 30 different micro-boxer fans. The fan bracket is available for $15 ppd. from DWI Engineering, P.O. Box 3611, Costa Mesa, CA 92628-3611. A complete kit of parts for the AC (NMB) version is available for $50 ppd.

Selected References:

1. "Application Engineering Information", Comair/Rotron catalog COM80 19, 8/92, pgs. 2-10.

Are you a member of AMI? If not send $2 to AMI, Box 1500, Merrimack, NH 03054-1500. AMI promotes and protects AM; we should all be members.

The Old Federal 167B

by Jack Shutt, N9GT
1820 Dawn Ave.
Fort Wayne, IN 46815

My interest in AM and old gear was rekindled about four years ago when I fired up my old Globe Scout 40A and NC-183 receiver on the high end of 40 meters. I was delighted to discover a whole world of AM activity and fellow nostalgia buffs that I previously did not know existed. I had sort-of stumbled back into AM after nearly 30 years of absence. My interest in collecting and restoring antique BC radios that later progressed into some old communications receivers and vintage ham gear had also led me to rediscover AM.

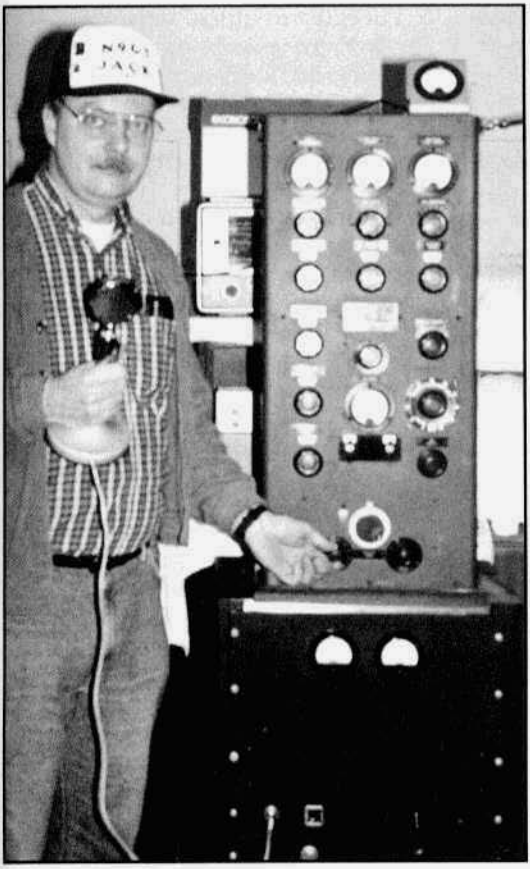
Wow! This was really great. I began to recall what fun ham radio used to be. Having been originally licensed in 1959, I remembered when AM was the prevalent mode and all of that "old tube-type junk" was right in style. Now, as my rediscovered interest in vintage equipment and AM activity increased, I became more and more eager to acquire a "BIG" AM transmitter to put out a decent signal and gain a modicum of respect in the AM window.

The Federal 167B marine transmitter was discovered at the Wabash, IN Hamfest in May of 1991. I managed to acquire the beast in a swap for a couple of antique radios and lugged it home along with a bunch of parts of the boat anchor variety. Transformers, chassis, and other goodies for the necessary power supplies and speech amp/modulator were carefully hauled home and clandestinely slipped into the garage with the hope that the XYL wouldn't notice all of that junk, "high quality vintage electronic apparatus". It was also a stroke of pure luck and good fortune that I acquired the original instruction manual along with the vintage transmitter.

The old Federal came off of a ship where it was originally used as a CW-MCW rig in commercial marine service. According to the nameplate it was manufactured in October of 1943 by the Federal Telephone and Radio Corporation in Newark, New Jersey. The transmitter runs a pair of 813s in the final and was rated at 200 watts "or more" output from 2 MHz to 16 MHz and "in excess of" 150 watts from 16 MHz to 24 MHz. I knew by looking at the very husky Pi-L tank circuit components and "battleship" construction that it was obviously capable of much more. The power supply would probably be more of a limiting factor than the transmitter itself and I had to build that anyway!

Apparently, from the notes I found in the manual, a W8 in the Cincinnati area had this particular transmitter on the air (or tried to get it on the air) in the early 50's, however, no details of this operation or necessary circuitry and conversions were available. This was going to be a challenge but also promised to be a lot of fun!

The Federal 167B is a complete HF transmitter including an exciter consisting of a VFO/XTAL oscillator using a type 76 triode followed by a 6L6 buffer-amplifier and three more 6L6s in multiplier stages. These multiplier stages are switched in as required for each frequency band. The final amplifier uses a pair of 813s in parallel and is fully metered. A nice Pi net tank circuit includes big variable capacitors and silver plated coils on massive ceramic forms. Also included is a series LC tuner designed to load the transmitter into an end-fed single wire antenna aboard the ship. This tuner may be switched in or out as needed.



N9GT at the controls of the "Old Federal" in studio G (the garage workshop).

There are provisions for ten cyrstals in those huge old holders that use banana plugs for pins. (The same type of crystals are used in the BC-610.) The crystal switch selects either the VFO or one of the ten crystals. Crystals in the 160 meter range are required for 40 or 75 meter operation. You can still get crystals in the large holders or just make up adapters like I did and use standard FT-243 crytals.

The transmitter was originally designed to operate from a motor generator set supplying 1750 VDC B+ as well as the ship's 115 VAC line voltage. The filaments are supplied by a transformer which has a 60-75 VAC 60/120 cycle primary originally fed through a large rheostat. Front panel control of the B+ generator field was also provided via a large rheostat. Alternate operation called for piggy-back operation from the power supplies of other ship-board transmitters.

The transmitter is housed in a narrow rack-type cabinet which is approximately 16" W x 17" D x 34" H. This cabinet is shock-mounted on a wooden platform which was originally designed to mount atop the operating table in the ship's radio shack. It has large removable side panels which allow easy access to the inner workings.

I decided to mount the transmitter atop a standard 19" short rack cabinet equipped with large casters. This provides sufficient space to house the associated power supplies, speech amplifier/modulator, and control circuitry and also provides for somewhat easy (?) mobility of the unit. The whole combined unit is about 6 feet high and probably weighs 400 pounds but it sure looks impressive!

After a significant amount of research into possible circuits for the speech amplifier/modulator, power supplies, and control, I embarked on what was to become an almost year-long project to get the old Federal on the air.

The original circuitry was quite interesting and maybe unique in that the multiplier and power amplifier stages were operated from the same B+ supply. The circuitry is described in the manual as follows:

"The DC plate current flows through the power amplifier and multiplier tubes in cascade; that is, the current first flows through the power amplifier tubes and then through the multiplier

continued next page

The Old Federal 167B from previous page

tubes and a regulating resistor. The voltage applied to the plates and screens of the multiplier tubes is thereby controlled by the current flowing in the power amplifier stage. The grid circuit of the power amplifier is returned to a point on the regulating resistor which is negative with respect to the cathodes of the power amplifier tubes. This voltage is also controlled by the plate current of the power amplifier tubes and protects them by biasing the amplifier tubes and maintaining the amplifier cathode current at a safe value should the grid drive be removed. The plate and screen currents of the power amplifier tubes are held at a low value until the multiplier stages are adjusted. As soon as voltage is applied to the grids of the power amplifier tubes the current flowing in the power amplifier and multiplier stages is simultaneously increased. This circuit also protects against high radio frequency voltages in the power amplifier plate circuit which would otherwise occur should the antenna circuit be de-tuned or opened, as the decreasing plate current in the power amplifier plate circuit when loading is removed results in an immediate decrease in grid drive, and the currents flowing in the driver stages as well as the power amplifier stages are reduced to a low value".

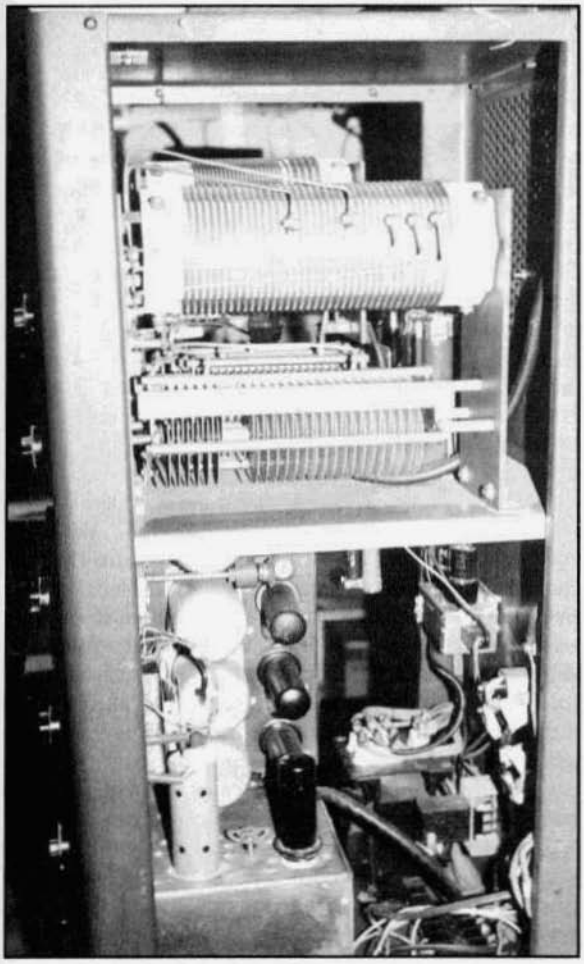
Even though this was a very novel way of protecting the finals from loss of grid drive, I decided that for AM operation and plate modulation I would resort to more conventional circuitry. I added a pair of 6Y6 tubes in a simple clamper circuit and powered the exciter/multiplier stages from a separate 400 V B+ supply. I also added a regulated 105 V supply for the VFO. Initial trials also revealed that the transmitter operated much better with separate power supplies for the finals and for the modulator. More bulk and weight, but fortunately there was enough room for it all in the short rack base cabinet.

I decided to utilize some classic old Radio Handbook (Reference 1) circuitry utilizing all triodes in the speech amplifier, 12AX7-6C4-pp 6B4s and pp class B 811As in the modulator. Of course, larger coupling capacitors were utilized and more attention was given to "broadcast quality audio" measures. The speech amplifier, modulator, and a low voltage B+ supply for the speech amp were all built on one chassis which was installed in the top of the short rack. I had obtained a nice Thordarson "CHT" 300 watt modulation transformer along with the transmitter, however, I later discovered that this turned out to be a "built-in" problem as it had an intermittent shorted winding. To make a long story short, albeit some time later and after some consternation, a replacement transformer was found and installed and the modulator worked beautifully.

The high voltage power supplies were mounted in the bottom of the short rack. I am using about 1200 V on the 811As and only about 1600 V on the 813s. This provides a solid 300 watts or more carrier output and 100% modulation peaks with no problem. I also added a muffin fan to blow across the 813s, so they are really cool and coasting at this power level.

The only problem that I have observed is the Federal is a little anemic in the grid drive department. Symtoms include downward modulation if I try to load the rig for higher power output. According to the manual, I could use about 25 - 30 mA of grid current and I'm only getting about 12-15. Future plans include the possible addition of an 807 in a straight-through driver stage or at least some modifications to the existing exciter to soup up the grid drive. I am also contemplating the use of a regulated bias supply.

Minor mods could also be made to the final to cover all of 160 and also 10 meters, however, the exciter would require more involved changes. I have



Side view (right) with side plate removed. Shows exciter in bottom and final (antenna tuner) on top. Small sub chassis just under rear of final deck is 6Y6 (2) clamper that was added.

also considered driving the 813s with an external exciter such as a Johnson Ranger. I elected, however, to use the Federal transmitter in its entirety as a nostalgia rig with full recognition of the fact that it was far from "state-of-the-art" and could be greatly improved. I also tried to preserve the true character of this '40's vintage rig by making very few exterior changes.

I have operated the old Federal primarily on 40 meters but I have also had good results on the high end of 160 meters (down to about 1970 kHz) and on 75 meters. I recently also discovered that the rig works OK on 160 down to about 1850 Khz by running the first multiplier stage straight through. I have received excellent reports on all three bands. The most common question received is "What the heck is a Federal 167B?" This then leads to a well practiced but proud description of the rig.

I do not know how many of these transmitters were made or how many may have been made available to amateurs. I suspect that more stringent FCC requirements in the late '40's and early '50;s probably made this gear obsolete and it was sold for surplus or scrapped. I can only recall having seen one other Federal at Fair Radio about 20 or 25 years ago and at that time I had thought, gosh, what a boat anchor!

I have talked to a few amateurs who were at least familiar with the existence of these transmitters and of their use in marine service. I was very pleased and interested to read Dale, KW1I's account in ER #67 about the 167BY used aboard the Liberty ships during WW II. The 167BY is a similar rig that was part of the radio set FT-102. That transmitter appears to be almost the same as the 167B electrically, however, it is physically much larger. The 167BY was mounted in a very large rack cabinet which included space for a companion Scott SLR-F receiver and even was

continued on page 38

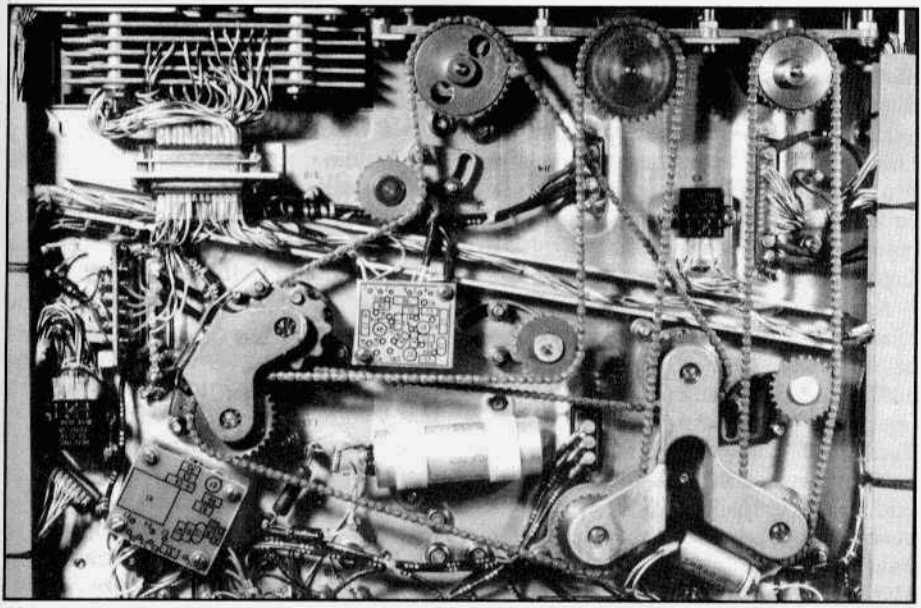
URC-35 from page 7
tetrode's sections are connected in parallel. The plate pins at the top of the tube are coupled by the use of two strapped heat sinks tying both pins to the output circuitry by an insulated wire. Please reconsider the fact that the AM-3007A is in a sealed cabinet. Heat generated by the 8233 driver and the 8116A final is conducted to a massive heat sink which is part of the front panel of the amplifier unit. Note in the photograph that the tubes are themselves mounted in a large aluminum block and that the glass envelopes of the tubes are thermally connected to the block by corrugated anodized aluminum sleeves. Given the fact that power tube failure frequently occurs because of the overheating and consequent outgassing of the glass envelope, the cooling scheme used in this amplifier may be more effective and reliable than the convection and forced-air cooling methods usually employed in more conventional amateur radio transmitters and amplifiers. In operation, the cooling fins of the external heat sink never become too hot to touch.

The tuned circuits of the driver and final amplifier stages are located on a turret similar in construction and size to the unit in the RF Amplifier module of the RT-618. The driver operates in Class A, while the final operates in Class AB1.

The AM-3007A linear amplifier contains several protection and overload circuits. A built-in VSWR bridge has a front panel meter and selector switch. Reading forward power of 100 watts full-scale, and 100 and 30 watts f.s. of reflected power, the protection circuitry is capable of preventing amplifier damage in the event of unusually high SWR values. In addition, the average power control (APC) circuits can be calibrated to avoid operating the final amplifier tube outside its recommended limits. An adjunct of the APC circuit is a front panel control on the RT-618. The "power control" allows the operator to manually adjust the output power of the URC-35 from its maximum rated values to zero.

It may seem a bit odd that the VSWR meter has two reflected power ranges. The reason has to do with the use of an external antenna tuning network in the standard installation. The CU-937A remotely controlled tuning unit normally is positioned near the base of the whip antenna (either 15, 25, or 35 ft. in length). Logic codes from the AM-3007A automatically select any of 12 coarse LC combinations in the antenna tuner's LC network. However additional tuning and loading inductors in the antenna coupler are fine-tuned manually by the radio operator with "hi-lo" switches on the front panel of the amplifier. Controlling bi-directional motors with the switches, the operator simply tunes for maximum forward and minimum reflected power. Initially, it is possible to have the tuning inductor rather far out of adjustment, producing some prodigious reflected power values. Hence the need for two reflected power scales. As the antenna coupler approaches optimum settings, the reflected power falls to small values, and it becomes necessary to use the 30 watt reflected power range.

A second meter on the front panel of the amplifier provides information about three operating parameters. As long as the primary power switch is on, the meter reads line voltage. A spring-loaded switch to the left of the meter selects static readings of driver and final amplifier plate current values, giving the operator some idea of control grid bias adjustments in each circuit. A time delay relay prevents the operator from keying the transmitter before the driver and final cathodes are up to normal operating temperatures. The delay is about 40 seconds after a switch on the RT-618 is turned from "off" to either "standby" or "transceive." In "receive" mode, the linear amplifier's tube heaters are cold.



This is the bottom view of the RT-618. Three bicycle-chain style drives couple frequency selecting circuits to the kilocycle controls on the front panel. In the upper left you can see the wafers of the 5-level code megahertz selection switches.

On the Air With the URC-35

This rig has had its fair share of technical problems. Before dreaming of pushing the press-to-talk button on the handset, I wanted to evaluate the operation of the receive functions. While the AM mode worked consistently, upper and lower sideband operation was intermittent. The receiver would just go dead, although some "white" noise was always produced. I found that the receiver would quit most frequently when I changed the position of the middle kilohertz selector knob. Further investigations led to the conclusion that the intermittent operation was vibration sensitive. More banging and tapping!! Aha! There's a problem in the Frequency Standard module where, of course, I'd least expected it. Cold solder joints in the leads of a coupling capacitor in the 500 KHz output of the module were the culprit. This signal normally feeds the mode selector module where it is used in the detection of sideband signals.

Then there was the issue of the transmitted AM signal that had a significant single-sideband quality. As you can guess, this problem was solved by increasing the carrier injection levels to the balanced modulator. The critical multi-turn pot here is the "% MOD" adjustment visible on the top of the mode selector module. Lastly, a non-trivial problem appeared when going into transmit mode: Sometimes there would be no RF output! I puzzled over this symptom for quite some time. Putting a 'scope on a tee connector at the RF ouput of the RT-618 showed that there was, indeed, occasional absence of drive to the AM-3007. Probing inside the RT-618 with the 'scope showed that there *was* RF output from the 6AN5WA stage, but it was not appearing at the BNC connector at the rear of the cabinet. Sure enough, there is an intermittent contact in a small transmit/receive relay in the RT-618. I am obtaining a replacement from Tony Snider in Virginia Beach (he advertises RT-1051's in ER's classified section).

continued next page

URC-35 from previous page

In spite of the problem with "K4," I have had the URC-35 on 75 and 20 meters and have received complimentary reports on the audio. This rig is exciting to use, and basically nobody knows what it is (until now!). For the foreseeable future, it is going to be my "main" HF rig, occupying a significant corner of my office desk.

Last Words

As with any transceiver with a fixed 50 ohm output, I strongly urge the use of an antenna tuner to satisfy the AM-3007's load requirements. I do not have the CU-937A antenna coupler. Evidentally, they are quite rare.

If you have a URC-35 or eventually get one and want to put it on the air, be aware that if you ever need to replace the final amplifier tube, try to replace the 8116A with another "A" type, rather than with the type 8116. The reason is that the 8116 has a maximum screen voltage rating of 300 volts, whereas the 8116A has a maximum screen rating of 360 volts. The regulated power supply in the AM-3007A applies 340 volts to the screen grid of the final stage, and I'm not sure how well an 8116 would survive.

Here's a piece of related goofiness: The schematic for the linear amplifier circuitry designates an 8116, whereas the heat sink assembly has "8116A" stamped on it adjacent to the well containing the final tube! ER

The Old Federal 167B from page 35

equipped with an operating shelf-table. I suspect the 167BY version was utilized on larger vessels and perhaps also in shore station applications. Apparently there was also a close relationship between Mackay and Federal. I believe that Mackay may have been a division of Federal at one time.

After many months of operating the Federal, I can say that I am delighted with the way it operates, even though changing bands is a major tuning exercise. I have, however, made up a chart recording all of the control settings for each band so it becomes a little easier. Good old reliable 813s modulated by 811As can't be beat for cost vs power and resulting fun quotient! On the air reports seem to indicate that this rig is an excellent performer and probably has a lot of life left in it.

I would like to hear from others who may have operated or owned one of these transmitters as well as anyone who might have more information on how many were made, etc. It would really be interesting if anyone has pictures or manual illustrations, etc which show the Federal 167B in a typical ship installation. Who knows? There may be a few of these rigs left in someone's basement or garage that are just waiting to be discovered and put back on the air! Dale, KW1I, has his 167BY on CW and I have heard of one or two others that may be at least close to being on the air, however, I have never heard another Federal on AM.

These old marine rigs offer another interesting and attractive alternative to the standard fare of vintage Heathkits, Johnson, and Collins AM ham rigs that seem to be becoming more expensive and less available. This transmitter will probably be a mainstay in the N9GT shack for years to come. It has certainly already provided quite a challenge and an enjoyable experience in getting it operational. See you on AM with the OLD FEDERAL! ER

Reference 1 - Radio Handbook, by William I. Orr, W6SAI published by Editors and Engineers Ltd.

Help!

The shipper here at *ER* (who will remain nameless) inadvertently packed and mailed the master copy of our S-Line Compendium. Whoever received it is advised that there is a reward for its return. It has a cover that says VISTA on it and there were spare pages tucked into the cover pockets.

Please call us collect if you think you might have it.

A Handy Gate Dip Oscillator from page 11

and supported it on a small piece of the same mounted above the dial on the panel. It took careful adjustment with washers to get the 1/16" thick dial in the center of the 1/8" space but it isn't complicated - just *hard*. I countersunk the cursor slightly over the center of the dial to clear the dial mounting screw and scribed a line down the center on the side next to the dial.

The dial I got had the calibration printed on a piece of cardboard stuck to the plastic dial. It was easy to replace with a paper dial under a thin piece of hobby shop plastic sheet

Don't even think about accurate calibration until you've really finished the wiring, including making a couple of temporary coils and a rough calibration. Anything you change in the oscillator area will affect the calibration significantly and you don't want to do it twice. As an example of what I mean, I discovered the loose stator and need for 'soft' wiring between coil socket and tuning cap after the first full (8-bands) calibration.

This is the one project I can recall for which an inexpensive frequency counter wasn't really good enough. I had to couple tightly enough to my Heath IM-2410 to cause some pulling of the GDO frequency, which made accurate calibration a pain. If you have trouble with this, a continuous-coverage communications receiver might be a better (though slower) tool.

I made a degree wheel using the AutoSketch computer drawing package and took readings for each calibration point. Then I made a scale using those, and iterated several times to get accurate markings. The result looks great and works well but took longer than the construction itself! The old-fashion method of making a blank scale, calibrating with a pencil and then Xeroxing the result would give good results in a lot less time.

Meter

I used a 250 uA battery test unit intended for a transistor portable. If you use something less sensitive you'll need to experiment with the amplifier and bridge circuit to get good performance but even 1 mA unit should work.

The advantage of the battery test meters is they're a lot smaller than the usual panel meter and you don't need a calibrated scale anyway.

Parts

You don't find all the parts for any project in a single place these days. However, the transistors, resistors and capacitors are available 'off the pegboard' at Radio Shack as are the battery, the pot and knob, and a usable metal case. I found the coils and coil socket in an estate sale homebrew GDO based on a design that appeared in the GE Ham News in (I believe) the 1960's and the meter and tuning capacitor can be salvaged from a dead transistor radio.

I built my unit with a tiny fleamarket meter, tuning cap and centering pot; though the recommended Radio Shack box is larger you should check carefully to be sure that the meter, cap and pot you use will fit the space available.

You will probably have to adjust the value of R4 to get the proper range on the centering control. ER

I NEVER DISCONNECT THE ANTENNA — WITH MY LUCK, IT DOESN'T SEEM TO MAKE MUCH DIFFERENCE

End Point Adjustment for 51J4 from page 15

the two "no-mar" clamps on the 1/4 inch sleeve near the mech filter select lever. The BFO and filter select sleeve should now slide out the front panel hole. Gently pull the front panel forward. Unclip the two upper panel lamps over the MC dial and carefully pull the wire out of the way to allow the top of the panel to come forward and down. You can see how much the bottom of the panel will pull out by the slack in the cable harness entering the sub panel.

You should now have more clearance to access the Kilocycle dial and its hub set screws on the rear side. If the set screws are too tight to loosen with moderate hand (finger) twisting, back off before you break the wrench. I used my trusty Weller 100/140 watt soldering gun with a tongue depressor to protect the plastic dial to heat the screw at the hub for about 30 seconds or so. If the screw does not break loose, try the heat for another shot. Do not let the gun tip touch the plastic dial. Repeat the procedure for the other set screw. It is only necessary to just barely loosen the screws.

Using your fingers on the outside circumference of the dial, slip it such that the correct frequency is at the top dead center. Lightly snug the set screws, warm up the set and check the dial lineup with the marker oscillator. The line of course should be set at the 12 o'clock position.

Before replacing the front panel, now is the best time to clean the back side of the dial windows and polish them with lens tissue. Also you can slip the MC dial pointer as necessary to line up with the marks at the 0.1 divisions when the kc dial is at zero. When all is well, reverse the above procedure with the panels to button things up.

In conclusion, it is quite satisfying to correct end point error without removing the VFO, the kc dial and cutting the cable lacing. I feel the reward was well worth the effort of fabricating the adjustment adapters. I hope the above will be of help to other owners of this fine receiver. ER

The H-P 400D AC VTVM from page 28

not have the mechanical zero adjustment for the meter.

Hewlett-Packard offered a number of accessories for the 400-Series. Some of the more interesting ones were two Capacitive Voltage Dividers that would enable measurement up to 1500 volts and 25 kV. There was a current probe that permitted current measurements without breaking the circuit. Thereis also a set of shunt resistors for measuring currents as small as 1 microamp full scale. I wouldn't mind having the latter two but I've never yet seen things like that at a hamfest.

However, I'm bound to see yet another Series-400 H-P at the next hamfest. Will I go for yet another one? You bet. As I always say to my son, "You can never have too many VTVMs. ER

A Rare 'Valve' Sage from page 2

support of the instrument. . .yes, they are TD03-10E's." When asked, "how many", it's true I only needed 1, but just suppose that one is bad. . .or horrors, suppose it slips from my fingers far away in America just as I insert it! That evening, over a glass of bitter at the Mayfair Hotel on Half Moon St., London, I unfurled the wrappers on two new possessions. Their silhouette. . .'ahhh yes!'

Of course, there was some cost involved. Stopping at American Express enroute to Victoria Station next morning provided me with, if memory serves, £115, about $200, for posting to my friend before flying from Gatwick. Back home the following Saturday and . . .works great! And even a spare on the shelf! ER

CLASSIFIEDS

Advertising Information

Subscribers receive 1 free - 20 word- ad per month. **Extra words are .20.** 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 20 words send payment for the extra words.**

Non-subscribers: $3 minimum for each ad (up to 20 words). Each additional word is .25. **Please call or write for display rates.**

VINTAGE EQUIPMENT ONLY

ER
P.O. Box 57
Hesperus, CO 81326 **Phone/FAX 303-247-4935**

DEADLINE FOR THE APRIL ISSUE: APRIL 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 or TRADE: BC-610 RF deck complete w/all tubes - $100; mod xfmr set for BC-610 (3 xfmrs) - $50; pair of 100TH's w/sockets - $40; BC-1000A, pair - $50 each. **WANTED:** 'C' coil freq. plate for HRO-5TA-1. Mike, WA7MPA, POB 206, Washougal, WA 98671. (360) 837-3560

FOR SALE: Paperback, "South African Radar in World War II", 1993, 229 pages - $12 ppd. Ken Greenberg, 4858 Lee, Skokie, IL 60077. (708) 679-8641

FOR SALE: Hammarlund HQ-110AC VHF, matching spkr & orig. manual, exc. - $199 plus UPS. Mike Sanders, KS0F, 3409 Henry Dr., Imperial, MO 63052. (314) 282-0787

FOR Sale or TRADE: First 15 volumes of Rider's Radio Manuals. **WANTED:** SSB xcvr. Joe Westbrook, NY5Z, UT, (801) 393-6840

FOR SALE: Viking package - 500, Viking II, Ranger, Challenger, Adventurer, 6N2, 275W Matchbox, KW Matchbox w/SWR, 122 VFO, (2) electronic T/R switch, separate coupler & SWR meter - $1500. Gary, K7MHE, OR, (503) 257-6525

FOR SALE: DF set, WW II, w/'loops'; DM-65A; DM-64; RAX; TED-9; BC-191; BC-611. Steve Bartkowski, 4923 W. 28 St., Cicero, IL 60650. (708) 863-3090

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

FOR SALE: Johnson Courier amp, works good - $250. Charlie Svododa, WB0UTC, NE, (402) 474-4272

FOR SALE: TMC GPT-750 w/PSK exciter - $650 PU only. Don Gies, K4GIT, Melrose, FL (904) 475-3306

FOR SALE: Drake 1-A (early run), looks great and works well except for sticking S-meter - $295. Gary, WA5NCX, TX, (713) 787-0040

FOR SALE: Amperex 5868, never used, w/data sheets. Doug McArtin, N2QPX, 4 Portland Pl., Yonkers, NY 10703.

FOR SALE: Military sig. gen. type AN/URM-25D, good condx - $45 each. Mike, CA, (619) 444-7717

FOR SALE: AN/GRC-9 w/PP327 LN, manuals & accessories. PU only (ps heavy!) - $225 firm. Dave Metz, VA, (703) 885-7914 eves.

FOR SALE: Switchcraft audio patch panel w/ patch cords - $45; Hammarlund HQ-170 - $150; HW-16, HG-10B - $135. Will, NV5E, LA, (504) 387-4382

FOR SALE: T-368 xmtr. Gene Schraut, UT, (801) 635-7343

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

WANTED: WW II Japanese xmtrs and rcvrs (and parts) for restoration to operating condx and ER articles; manual or info on TS557; manual for GF-11/12 and TBX-8. FOR SALE: Collins KWT-6 (similar to URC-32) - $650 PU only; E.H. Scott RCH rcvr - $350 plus shpg. Ken Lakin, KD6B, 701 SE Salmon Ave., Redmond, OR 97756. (503) 923-1013, e-mail, Klakin6@aol.com

WANTED: Manual for 51J4; GRC-86 w/antenna coupler; R-1051C, D, E, F, G, H version; RT-618B/AM3007; ARC-133/AT-440 1 KW amp; also looking for the following units, must be in good or exc. condx - ant. coupler for GSL-1900A/1 KW; Harris RF amp HFL-1000 /W.P.S.; KWM-380 w/manual; URG-1; KWS-1; RF-131, any condx; SP-600JX; RT-834 and any HF SSB exciter with 100 mW output. Mitsugu Shigaki, JA6IBX, 2825-2 Jozan Kamidai Machi. Kumamoto. 860 Japan. FAX Japan-096-329-4601.

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

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

WANTED: USN RBS-2 rcvr. **FOR TRADE:** USN TCS-12, rcvr & xmtr. Ed Allison, 5525 - 20th Ave., Sacramento, CA 95820. (916) 454-1788

WANTED: Manual or copy for a General Radio RF bridge MN 916-AL. This is the low freq. RF impedance bridge. I will, of course, cover all expenses and gladly. Clyde M. Sakir, N7IOK, 4243 E. First St., Tucson, AZ 85711.

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

WANTED: ARRL Handbooks, 4th & 5th Editions. **TRADE:** 'Radio' Handbook, any edition (s). Al Bernard, POB 690098, Orlando, FL 32869-0098. (407) 351-5536

WANTED: 80M coils for National SW3 rcvr. Also late 75A-4 in exc. condx. Bob Friess, N6CM, CA. (408) 395-9025

WANTED: Front panel overlay for Collins 30L1. Must be excellent. Larry, W5VHP, 4212 Beacon Ct., Bartlesville, OK 74006. (918) 333-2891

WANTED: Tektronix model 570 curve tracer. Ronald Dement, 755 Quincy Ave., Bronx, NY 10465.

Manuals for Amateur, Audio and Radio Related Equipment. Lafayette, Heath, etc. included. Over 3800 Available. Highest Quality Guaranteed. Catalog, two $.32 stamps. Pete Markavage, **Manual Man**, 27 Walling St., Sayreville, NJ 08872. (908) 238-8964

WANTED: HQ-100 in working condx; HT-17 hand mic. Ron, K6LLQ, Box 21608, Concord, CA 94521. (510) 682-2838

WANTED: BC-348 in good cosmetic condx. W7WXW, WA, (509) 882-1973

WANTED: Drake 2B. Bob Braeger, WA6KER, 6634 Navel Ct., Riverside, CA 92506. (909) 682-5084

WANTED: Control knob (AF-RF size) for Collins A/J rcvrs; Olson audio-visual spotter xcvr. Bill, 6712 Lake Dr., Grand Forks, ND 58201. (701) 772-6531

WANTED: Schematic of Alda 103-A rig; Datong RF clipper; BC-375 plug-in tuning unit. John, Box 687, Ashland, OR 97520. (503) 488-1506

WANTED: One or more 4-125A's. Need not be new, but should have full output. Lock, KB7TQ, AZ, (602) 581-2778 after 4 PM MST.

WANTED: Gonset II 2M matching VFO to complete set. Chris, K2PGB, 15 Runyon Mill Rd., Ringoes, NJ 08551.

WANTED: National CRR and CRU scopes; NC-46TS spkr; HRO-5A1 E, G, H, J coils. Wayne Childress, 1903 Jerome PL, #3, Helena, MT 59601. (406) 443-7255

WANTED: Globe King 500 modulator deck & Globe King 400 RF deck. Jim Roseman, W9UD, 2216-W.3rd St., Coal Valley, IL 61240. (309) 799-7447

WANTED: Range selector box or schematic for pre-war 7 inch Hoyt VOM. Kenneth E. Hodge, KB4CM, 42846 Cinema Ave., Lancaster, CA 93534. (805) 945-4702

WANTED: BC-610 mod xfmr. Chip Owens, NWØO, 1363 Tipperary St., Boulder, CO 80303. (303) 673-9019

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

WANTED: Johnson gear, all models, any condition. Also parts and literature. Please state condition and shipped price. Wen Turner, AD7Z, Box 451ER, Cal-Nev-Ari, NV 89039.

WANTED: National spkr to match NC-300 rcvr; will buy or have other spkrs for trade. Mike Sanders, KSØF, 3409 Henry Dr., Imperial, MO 63052. (314) 282-0787

FOR SALE: Voltage converter, 6.3VAC to 12.6VAC, use to substitute a 1629 for a 6E5 magic eye tube - $7.50 each plus $2 shpg. James Fred, R1, Box 41, Cutler, IN 46920. (317) 268-2214

FOR SALE: Drake AC-4 - $95; Yaesu FL-2100B w/10M - $425; Hallicrafters S-38s w/manuals & shpd USA - $85. Many older rcvrs, xmtrs, ARRL Handbooks, parts - LSASE for list. WA7IHN, POB 442, Aumsville, OR 97325. (503) 749-1149

FOR SALE: R-390A/URR Maintenance manual, TM 11-5820-358-35 issued Dec. 1961 - $25 del. UPS. Abe, POB 4118, Jersey City, NJ 07304.

FOR SALE: SW3 model 1, good condx, HB ps, 4 coil sets - $300. Dave Mills, 1503-G Adelaide, Tucson, AZ 85719.

FOR SALE: NIB Monarch panel meters, 0-50 microamp F.S., 1-3/4" x 1-3/4" face, 1-1/2" hole - $3 each, 4 for $10. Gary Reiss, WAØJRM, Rt 1, Box 141, Wilcox, NE 68982. (308) 263-3231

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

FOR SALE: BC-610E w/speech amp - $300; Invader 2000 - $300; DX-100, poor shape - $50. PU only, possible ship? SX-100, OK - $85; Sonar 10M FM-40 - $15; 60V, 20A xfmr - $5 each; rheostat 2.45 amp, 50R - $10 each; Eico 753, no pwr sply - $35. U-ship. Mike, 10010 W. 59th Pl., #4, Arvada, CO 80004. (303) 431-7298

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

FOR SALE: 75A-4 w/3.1 filter, exc. condx - $495; Drake R4 rcvr in very nice condx - $140; 3253 in good condx, might need some work - $390; Collins 200 cycle CW filter for 7553 - $125. All above you ship. George, W6ZZ, CA, (619) 747-8710

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

FOR SALE or TRADE: Heath TX1 Apache & RX1 Mohawk w/manuals in exc. cosmetic & working condx; also real nice TCS-14 xmtr, rcvr, dynamotor, control head, cables, tuner, mic, headphones w/manual. Will trade for Drake stuff, OBO. C-line wanted. May separate, delivery possible. Fred Watson, KB8NRF, 581 W. Summit, McClure, OH 43534. (419) 748-8798

FOR SALE or TRADE: Multi-Elmac AF-67, AF-68, PMR-7, 1070 pwr sply - $200. **WANTED:** 6M SSB/CW xcvr. Clem, W8VO, (810) 795-4670

FOR SALE: R-390A manuals, new, never opened OP manual TM 11-5820-358-10 - $18; orig. Maint. manual TM 11-5820-358-20 - $20. **WANTED:** 5U4 non-working for parts. John Miller, AK time, (907) 337-9157

FOR SALE: ART-13 parts & other interesting stuff. SASE for "The Bone Yard List." el.Kay electronics, 231 Shenandoah Trail, Warner Robins, GA 31088-6289.

FOR SALE: R-390A IF deck w/tubes, filters, 3TF7 - $100; TU-51 - $20; BC-1306 rcvr - $30; C1306 control box - $35; ID226/APR9, NIB - $50; TS497 sig. gen., working - $50; TS183A/U battery tester - $50; Drake MN7 tuner, w/B1000 balun - $200; Hallicrafters SX-71 - $100. Mel, K2AOQ, (716) 671-0776

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

FOR SALE: BTI LK-2000 HD, w/3 new 3-1000Z's - $1300. Glenn, AA7FC, WY, (307) 684-5496

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

FOR SALE: Pwr xfmr from Gates 1000W xmtr, 220 and 110 primary, sec - 4600/4050/3400 both sides of center, heavy, exc. condx - $150. Evan Haydon, NØGMR, 4308 N. 15, Lincoln, NE 68521. (402) 435-4083

FOR SALE: Two books for Knight-Kit TR-108 2M xcvr, operator's manual and construction - $10, $3 shpg. Roy Cameron, 114 E. 2nd St., Pana, IL 62557.

FOR SALE: Tempo 2020 xcvr - $190; Johnson Ranger I - $150. Both good condx w/manuals. Shpg xtra. Burt Ostby, 2424 F-30, Mikado, MI 48745. (517) 736-8020

FOR SALE: Echophone Commercial, fair - $50; Heath HW-10, needs work - $50; Gonset G-50 - $60; (2) 833A's, 1 new, no box, w/socket assy - $100. Offers? Berk Berkemeyer, WØREP, 402 Kingridge, Ballwin, MO 63011. (314) 394-0441

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

FOR SALE: Valiant - $300. Ken Sands, K8TFD, 11152 Edington Rd., Livonia, MI 48150. (313) 522-8645

FOR SALE: Collins KWM2-A, 312B5, 516F2, W/E, exc. condx; Ameco AC1/R5 combo; rare 6AG7/6L6 Mica Mold xmtr; also Hallicrafters spkr R-46B. Joe, K2QPR, 1341 SW Evergreen Ln., Palm City, FL 34990. (407) 220-7362

FOR SALE: Plug-in replacement coil forms, for SW-3 and 4, 5, and 6 generic coil forms. SW3 info packet $5 each plus $2 shpg. James Fred, R1, Box 41, Cutler, IN 46920. (317) 268-2214

FOR SALE: Heath SB102, pwr sply, collector condx - $240; HW-32, HP13 DC sply, collector condx - $125; Hammarlund HQ-110C, collector condx - $195; Drake 2NT, collector condx - $100; chrome bug, good - $60; SX-43, looks good, fair performer - offer? Call for pictures. Dick, W4NFN, (715) 866-8704

FOR SALE: "The Vail Correspondent", key collector's quarterly journal. Free ads. $10/yr. USA; sample $2. TVC, Box 88-E, Maynard, MA 01754.

FOR SALE: SP-600; HX-50. **FOR TRADE:** HRO-5TA1 for older HRO. **WANTED:** HRO spkr; Drake 2AQ. Carter Elliott, WD4AYS, 1460 Pinedale Rd., Charlottesville, VA 22901. (804) 979-7383

FOR SALE: C.E. 200V, fair/good condx - $250 shpd/del. Abe Levy, WW3V, DE, (302) 349-5389

MESSAGE: Talk to me at Dayton, look for the Tech Corporal stripes. **FOR SALE:** WW II T-85/APT-5 Aircraft Radar Xmtr 1945, NIB - $195; Radio News Special Signal Corps issue, Nov. 1942 - $55; Popular Electronics, Volume One, Number One, Oct. 1954 - $23; 54 page catalog of WW II radio sets - $2 US, $5 foreign. Sam Hevener, W8KBF, "The Signal Corps", 3583 Everett Rd., Richfield, OH 44286-9723. (216) 659-3244

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

FOR SALE: Repair! Radio repair, tube or solid state, reasonable rates. Jim Rupe, AB7DR, Western Amateur Radio Repair Co., (WARRC), POB 697, North Cove, WA 98547. (360) 267-4011

FOR SALE: Hallicrafter (SX-73) R-274/FRR manuals, 100+ pages, NOS - $10 + postage. **WANTED:** RCA Radiomarine AR-8516 rcvr; manual for Collins 75A-2. Dan Mason, R. RT. 1, Box 204F, Santa Fe, NM 87501. (505) 455-3416

FOR SALE: Plate xfmr 220V primary, 2400V CT secondary, 1.7A - $60. Joel, KQ4HZ, 195 Livingston Ave., Babylon, NY 11702. (516) 587-7945

FOR SALE: NOS tubes, list - SASE; used/tested 6B4G - $9; PRC-47 LSB mech. filter - $20. Joseph Pinner, KC5HJD, 201 Ruthwood Dr., Lafayette, LA 70503. (318) 981-7766

"a fine home for your collection"

Western Heritage Museum Omaha, Nebraska

Bring the whole family; something of interest for everyone.

Now there are TWO amateur radio exhibits at Western Heritage. One is the WRL Globe and Galaxy exhibit and the other is a SEPERATE general amateur exhibit that preserves the equipment and history of all manufacturers. It is now one of the largest of its kind in the country.

This permanent display is TRULY UNIQUE and is something that all hams can be proud of. We expect many thousands of visitors annually.

Your TAX DEDUCTIBLE donation will be permanently noted on a plaque that will be prominently displayed.

For more information contact Leo Meyerson, WØGFQ at (402) 392-1708, May-Nov.; 619) 321-1138, Nov.-May.

WANTED: QST's. All issues before 1930. Feb., July 1951; July 1952; Sept. 1956; Feb. 1958; Jan. thru May 1960; Aug., Dec., 1961. Howard Weinstein, 15 Lakeside Dr., Malton, NJ 08053. (609) 596-3304

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

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

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

WANTED: Collins, Signal One, Squires-Sanders. Collins 651S or 1B (should be w/LED display); Signal One CX-7; Squires-Sanders SS1B. Taka, (415) 697-6719

WANTED: DS-1A DC converter for TS-520S. Dick Bean, WV1U, 422 Everett St., Westwood, MA 02090. (617) 461-0101

WANTED: T-17 & T-22 ARC-5 xmtrs; P.A. coil for ARC-5 T-19; 1961 ARRL Handbook; manuals for Jackson 106 & Philco 077 sig. gens. Wayne Letourneau, WB0CTE, Box 62, Wannaska, MN 56761. (218) 425-7826

WANTED: National spkr light gray 173 or 183; NC-183D; Viking Valiant. Sam Champie, KD7XX, 105 W. McKenzie, Hermiston, OR 97838. (503) 567-2879 weekends only.

WANTED: Manual for EICO 222 VTVM; Heath coax switch. Bill Graham, N5LMX/DA1WG, 417 BSB Unit 26124 , Box 1360, APO AE 09031.

WANTED: Standby switch for VF1 VFO; xtal cover/plate/load knobs DX-20. Larry Myers, W3MNE, 1598 Brimfield Cir., Eldersburg, MD 21784

WANTED: Manual for BC-348-R (R only). Prefer orig., exc. copy will do. John Snow, W9MHS, 4539 N. Bartlett Ave., Shorewood, WI 53211. (414) 964-0194

WANTED: Rheostat 20 K ohms, 150W. John Birck, 458 E. 600 N, Orem, UT 84057. (801) 224-4809

WANTED: German WW II equipment, clandestine sets. **FOR TRADE:** Sovjet Special Forces set; Red Army sets; Siemens teleprinter T68; British WW II Bomber Command set; German HRO-copy. Rag Otterstad, OZ8RO, Husterkobvej 10, DK-3460 Birkerod. FAX: 011-44- 4468 1514.

WANTED: Transceiver/transmitter flyers, brochures, spec sheets for compilation of guide. Gene Rippen, WB6SZS, POB 9, Auburn, CA 95604. (916) 885-6147

WANTED: KWS-1 T/R relay; 312A-1 spkr; 51J4 dust cover; RCA AR-88 S-meter; Hammarlund S-100 spkr. Thanks! Joe Eide, KB9R, 2623 Clare St., Eau Claire, WI 54703-1002. (715) 834-4582

WANTED: Crystal IF filters for RACAL 6790 receiver. All bandwidths. Also junker 6790. Bill Crawford, NY, (914) 878-4653

WANTED: Collin 312B2 spkr console w/RF wattmeter; Viking Mobile VFO; Viking Navigator xmtr. R'Leo, N6JZJ, (505) 832-4018

FOR SALE: Collins 32V-3 & 75A-1 - BO; BC-610E w/BC-614, BC-939, BC-221, etc - BO; Invader 2000 - $875; Invader 200, as-is - $250; Viking II - $225; NC-300 - $175; HQ-140-X - $175; SX-101 Mark IIIA - $175; SX-62A w/R-46B spkr - $200. Joel Thurtell, 11803 Priscilla, Plymouth, MI 48170. Tel/Fax (313) 453-8303

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

FOR SALE: Service manual copies. Most $5, shpg $1 each. Hallicrafters, Hammarlund, Heath, Johnson, National, WRL, others. SASE for list. DSM Diversified, 909 Walnut St., Erie, PA 16502.

FOR SALE: Heath 'Twoer', mic, manual, exc. - $50; Drake 2NT - $75; Drake RV-4 - $75; Heath SB-104A, unbuilt, new - $500; Hallicrafters SX-96, Johnson Signal Sentry - $100; Swan 350, 117XC - $175; Swan Cygnet 270 - $100; Drake T-4X only - $75. U-ship. Richard Lucchesi, WA2RQY, 941 N. Park Ave., N. Massapequa, NY 11758. (516) 798-1230

FOR SALE: KWM-380, VG - accepting offers; CP-1 - $130. **WANTED:** 75A-4 spkr. KO6IJ,CA, (714) 643-7930

FOR SALE: 51S1 cabinet - $150; 312B4 - $150; CP-1 - $125; DL-1 - $95; 75A-4 spinner knob - $60. Ron Follmar, K5GIT, 332 Camino Real, Kerrville, TX 78028. (210) 896-8830

FOR SALE: Henry 2K Classic-X; TMC GPR-90; rhombic termination; National NC-88, NC-125, NC-140; Hallicrafters Worldwide portable, S-38, S-38D; Collins 30L-1, PP3390, KWM-2 sply; Rockwell-Collins 5KW HF 4:1 balun; Heath AM2 SWR bridge, QF2Q-multiplier; Vibroplex Original SN 140440; Bird 82A coaxial resistor; Millen dip meter 90651A; Simpson 269 VOM; Triplett model 100-C kit; DowKey/Advance relays; large stock Jennings caps. Pete, KN6BI, POB 77011, San Francisco, CA 94107. (415) 864-8497 eves PST

FOR SALE: Collins: Acquired additional number of PM-2 pwr splies for KWM-2/2A, exc. condx - $75/each, like new, - $100/each; one only 312B-5 - $375; new, KWM-2/S-line freq. dials - $50/each; used, Collins MP-1 mobile splies - $50/each; used, Collins DL-1 dummy loads, without cabinets - $40/each; used, 4D32 tubes for older Collins (and Johnson) rigs - $25/each. Derek, KI6O, callbook address, (916) 965-4904

FOR SALE: Heath SB-301/SB-400 twins, cables, manuals, fair - $250; SG5 sig. gen. - $10. Dave Roscoe, W1DWZ, 49 Cedar St., East Bridgewater, MA 02333. (508) 378-3619

FOR SALE: Swan HF700S, w/ps, fair - $160. **WANTED:** Hallicrafters SX-99 tuning knobs. Rick, 9031 Troulon, Houston, TX 77036. (713) 774-5102

FOR SALE: Repair & restoration of all classic & vintage radio equipment, reasonable rates, prompt turn around, 25 yrs experience. Mike McKean, N3HJQ, 726 McClellan St., Philadelphia, PA 19148. (215) 336-6111

WANTED

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

WANTED: McIntosh and Thordarson amplifiers any condx. Marcus Frisch, WA9DXP, Box 28803, Greenfield, WI 53228-0803. (414) 545-5237

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

WANTED: KWS-1; HF-380; 62S1; R-389 and SP-600JX. Need exc. condx. Mitsugu Shigaki, JA6IBX, 2825 -2. Jozan Kamidai Machi. Kumamoto. 860 Japan. FAX Japan-96-329-4601

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

WANTED: Swan 350-C band switch or junker. Gene Rippen, WB6SZS, POB 9, Auburn, CA 95604. (916) 885-6147

WANTED: Tubes 8005, 6550, 5691, 5692, KT 66, KT 77, KT 88, new or used. George Schwarz, 18504 Arrowhead, Clev., OH 44119. (216) 486-6489

WANTED: Collins 310B3, 70E8A with dial as stand-alone unit with dial; Interest in KW-1 group? Jerry, W8EGD, (303) 979-2323

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

WANTED: Well cared-for Johnson Matchbox 275W w/SWR for my vintage shack. Gene Williamson, K7DBV, 2160 Fairway Lp. Eugene, OR 97401. (503) 683-4164

WANTED: 75S3 B or C. B. Lee Cornwell, KD3KD, HCR#1 Box 95, Mt. Pocono, PA 18344. (717) 839-2710

WANTED: P.S. for SP-210 blk crinkle finish; SRR-II parts. Brian, (315) 788-2866

WANTED: Heathkit SSB adaptor model SB-10 or similiar; ARC-5 receiver, any freq. WILL TRADE: RT-70 xcvr 47-58 MHz FM and AM 65 pwr sply/AFamplifier for RT-70, includes technical manuals, ancillery equipment (used-repairable). David Childers, NL7YU, Loran Station Port Clarence, POB KPC, Nome, AK 99762. (907) 642-3844

WANTED: W.S. (Canadian) no. 29, A&B sets; Soviet R (I?) 112 xcvr; U.S. RT-136/GRC-13. Leroy E. Sparks, W6SYC, 924 W. McFadden Ave., Santa Ana, CA 92707-1114. (714) 540-8123

WANTED: Allied catalog - 1931, top dollar paid. Jim Riff, K9JSC, 81 N. Ela Rd., Barrington, IL 60010. (708) 576-7832

WANTED: HQ 170 junker chassis for parts-or slot freq. coil only. G. Liccione, 118 Hiawatha Trail, Liverpool, NY 13088

WANTED: DX-100 dead, dying, I need parts. Please help. Brian, AI7Z, P.O. Box 31061, Flagstaff, AZ 86003. (602) 527-0143

WANTED: Oscillator coil plug in set for Hallicrafters HT-9. Robert Braza, N1PRS, 23 Harvard St., Pawtucket, RI 02860. (401) 723-1603

WANTED: Any AN/GRC-14 components to complete a museum showpiece. AN/PRC-74 antenna and mounts, W.H.U? Nice 1.3 to 2.1 MHz ARC-5 Tx. S.C. Signal Corps Museum, 5 Rollingwood Dr., Taylors, SC 29687. (803) 244-0324

ELECTRIC RADIO PARTS UNIT DIRECTORY

If you need a part for a vintage restoration send $2 and an SASE (.55 postage) for a 7 page list of parts units. If you have a parts unit, consider putting it on the list. Your dead unit can help bring others to life!

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

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

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

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

WANTED: Test equipment (IE-17E) for WW II walkie-talkies (BC-611); test unit I-135E and artificial antenna A-82A. Richard Mollberg, K6PWF, 2340 Almond Ave., Concord, CA 94520.(510) 283-6786 (n), 827-4056 (d)

WANTED: Drake R4C rcvr; (Hickok, etc.) mutual conductance tube tester; Kenwood T-599 xmtr; Radio Shack DX-400. Rick, K8MLV/Ø, 1802 W. 17th St., Pueblo, CO 81003. (719) 543-2459

WANTED: Manual/schematic S38E rcvr; WRL Comet SS3 Q-multiplier; Brown Brothers straight key. Gary Wagner, K3OMI, 11124 Oak Hollow Rd., Knoxville, TN 37932. (615) 690-4217 days.

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

WANTED: 80M coils for National SW3; also late 75A-4 in exc. condx. Bob Friess, N6CM, CA, (408) 395-9025

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

WANTED: Stancor 20P or 10P xmtr; Meissner SW rcvr. Mack Lester, POB 149, Lewisville, AR 71845. (501) 921-5874

WANTED: Home-brew superhet tube rcvrs; knobs for Heath Apache/Mohawk; optional coils for HRO-60; manual Heath Mohawk. W2YJ, 12072 Valley La. E. Aurora, NY 14052. (716) 655-3562

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

WANTED: Amateur frequency quartz crystals and holders of the 1930's and 40's; anything amateur related made by Bliley. Dean Showalter, WA6PJR, 7816 Redberry St. NW, Albuquerque, NM 87120. (505) 899-9376

NOTICE: If your MF/HF/VHF activity has been curtailed or terminated by CC&Rs (Covenants, Conditions and Restrictions) that prevent the installation of visible outdoor antennas, you may be interested in the Dovetron Stealth Antenna System as described in US Patent Office Disclosure Documents 350704 and 364673. The Dovetron Stealth is invisible and cannot be detected by the most vigilant skulking neighbor. It requires no assembly and no on-going maintenance. Unlike short loaded verticals and small high voltage tuneable loops, there is no shock hazard. It is absolutely child-safe. Its small size (8"x9"x4", same as an Icom 729) and light weight (8 pounds) permits rapid portability for use away from home (office, motels, resorts and RV parks). It is also an excellent standby emergency backup for conventional antenna systems that are susceptible to storm or earthquake damage. A Noise Reduction Circuit (NRC) operates at the incoming signal frequency and removes or reduces QRM and QRN before it can enter the receiver's front end. The typical (2:1) bandwidth on 160 meters is 80 kHz and 350 kHz on 75 and 80 meters, permitting wide frequency excursions without retuning. At higher frequencies, the bandwidth exceeds the width of the ham band. A solid state LED display permits use in any light level including total darkness. One patent has already been issued, a second is due soon, and deliveries will follow quickly. If you are interested in an invisible antenna system that covers all ham bands from 160 meters to 6 meters, your QSL will put your name on our mailing list. No SASE or Green Stamps required. Hank Scharfe, W6SKC, Dovetron, P.O. Box 6160, Nogales, AZ 85628-6160.

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

WANTED: Cosmophone, any shape/model/info; Central Electronics 600L; Viking 500 ps/mod; B&W coils 2175-2179; Drake 1A vernier knob. Brian, TX, (214) 596-2914

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

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

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

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

FOR SALE: See previous ER ads since Oct. '94. Legal 3-stamp SASE for 14-page list. Heath HA-14 mobile HF amp, two 572B's, HP-24 AC pwr sply (no DC sply), cables - $375; new, Heath SB-1000 linear, kit in unopened box - $800; new, J-45 knee keys - $25; used, 10 GHz Gunn diode xcvr units from intrusion devices, adjustable for 10 GHz wide-band FM ham use, includes small horn antennas, (see ARRL Handbook for easy use) - $10 each; new, black plastic Fluke cases, for handheld multimeters/radios and accessories, 4" H x 13"W x 10"D, handle - $10; Lafayette crystal converters, 2M HE-71, 6M HE-56, 7MC-11MC output - $150/pr., NIB, JAN 5814 (12AU7A) tubes - $3/each; new, two 7.5 uFD @ 5KV oil filled caps, about 6" on each side - $25/each; 11 uFD @ 5KV - $30; used, Jennings vacuum variable, 25-1000 pF @ 10 KV - $100. Derek, KI6O, callbook address, (916) 965-4904

BUY/SELL/TRADE: Misc issues of U.S. Amateur Callbooks, 1914 thru 1980. SASE for list. Bob Arrowsmith, W4JNN, POB 166, Annandale, VA 22003. (703) 560-7161

FOR TRADE: Silver Marshal and 4-pin Hammarlund plugin coils. Will trade for National SW-3 and FB-7 coils. Hank Bredehorst, 2440 Adrian St., Newbury Park, CA 91320. (805) 498-8907

FOR SALE: General Radio 1611 cap analyzer - $95; Magnecorder model PT-6, deck and amp - $95; several years of Hewlett Packard Journal - $10/yr. Plus UPS. Ted Stewart, W6NPB, (510) 531-7042, FAX 531-7072

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

FOR SALE: R1051B rcvr, w/matching MT-3114 shock mount, PU only - $325 OBO. Dennis Gibbs, 13002 Piney Glade Rd., Herndon, VA 22071. (703) 742-9843

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

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

FOR TRADE: Old 1943 Vibroplex bug, trade for Johnson Ranger in good-exc. condx. Jim, AZ. (602) 635-2117

FOR SALE: National NC-88, $55; **WANTED:** NC-190; HQ-200. George, 27 La Flecha Ln., Santa Barbara, CA 93105. (805) 682-3094

FOR SALE: HP-608E w/manual - $350; SX-101A - $185. **WANTED:** Bandswitch knob for SX-101; 51J4 rcvr; spkr for National HRO-5TA1. Ben Deovlet, W6FDU, 933 Robin Ln., Campbell, CA 95008. (408) 374-0372

FOR SALE: Collins manuals (copies) - R-390 Maintenance - $20; R-390A Operators - $20; R-390A Maintenance (196 pges!) - $69; R-391 Maintenance (partial) - $45. N1FRX, ME, (207) 834-6273 eves & wknds

WANTED: Crystals in FT-234 cases for the CW portion of the bands. Tim, WB1EXG, MA, (617) 491-2283 (d).

WANTED: Instruction manual (or copy) for Heath SA 2550 antenna matcher. Mills, K4HU, 631 4th Ave., Hendersonville, NC 28739.

WANTED: WW II Japanese military radio equipment of any kind; Japanese made shirt pocket transistor and tube portable radios. Takashi Doi, 1-21-4, Minamidai, Seyaku, Yokohama, Japan. FAX 011-8145-301-8069

WANTED: Hallicrafter HA-5 VFO; Johnson Matchbox tuner 250 w./SWR meter; Eico 722 VFO. Leonard, FL, (407) 546-3847

WANTED: Hallicrafters HT-32 and SX-101A to put on the air; also Knight R100. John, WAØJYJ, 62639 Ohlm Rd., Montrose, CO 81401. (303) 249-2751 (eves)

WANTED: Hallicrafters B42 elevating base for SX-42 rcvr; 7/8" papertape & Kleinschmidt "Teletype" gear and literature. Tom Kleinschmidt, 506N. Maple St., Prospect Hts., IL 60070. (708) 255-8128

WANTED: Manual and parts for Collins 310B-1 exciter; R-391 nomenclature plate. Terry O'Laughlin, WB9GVB, 306 Van Deusen St., Madison, WI 53715. (608) 258-1810

WANTED: Electrovoice 664; Brown Brothers bug. Pete, AA6ZF, 5140 Gates Rd., Santa Rosa, CA 95404.

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

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

WANTED: Heath SB-10 SSB adapter unit for TX-1 xmtr; Heath Mohawk RX-1 rcvr. Al Hubbard, WB9SAX, 1934 Fallen Leaf Ln., Los Altos, CA 94024. (415) 940-6304

WANTED: 2nd IF module for RCA SRR 11, 12, or 13. **FOR SALE:** S40B - $80; BC-683 - $80. Ken Kolthoff, K8AXH, 5753 David Pl., Fairfield, OH 45014. (513) 858-2161

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

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

WANTED: Any condition, Hallicrafters S-30 radio compass and S-35 panoramic adaptor as shown. Chuck Dachis, 'The Hallicrafter Collector', 4500 Russell Dr., Austin, Texas 78745. (512) 443-5027

TRADE: Meissner 150B AM/CW military xmtr w/exciter & all coils, 1.8-12 MHz. Includes new spare tube 811/813, mint, works great, looks good. **WANTED:** Collins (either) 75A-1, A2, A3 or A4 w/AM filter. Will take URR-388 if in cabinet and in good shape. Call Bill, WA4DHH, MA, (603) 425-7023.

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

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

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

FOR SALE or TRADE: 345 WW II xtals, in CR-1A/AR holders, 6700-8200 kcs - $5 each. SASE for list. Fred Clinger, WA8KJJ, 417 Beechwood Dr., Galion, OH 44833.

FOR SALE: Globe Scout 65A, works great - $65; Globe HG-303 xmtr, mint - $75; Hallicrafters S-120 rcvr, mint - $75; Eico 730 modulator - $65. Bill, NY, (914) 356-6553.

FOR SALE: R-392 rcvr orig. service manual - $50; URM-25 ( ) type sig. gens, gov't reconditioned w/acc. - $120; same, exc., not reconditioned - $95. U-ship. Joe Bunyard, 1601 Lexington St., Waco, TX 76711-1701. (817) 753-1605.

FOR SALE: Drake 2AQ - $75. **WANTED:** Drake SW4A; 51J2 manual (copy OK); mint dials, NC-183. Doug DeWeese, 502 East 80th St., Tacoma, WA 98404. (206) 472-3478.

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

FOR SALE: Send SASE for list of vintage & military ham gear and literature. Dave Mantor, W9OCM, POB 1, Fairmount, IN 46928-0001.

FOR SALE: Heath AT-1, nice condx - $100; Apelco AE31MA AM mobile xcvr, single 6146 RF final, w/mic - $20. Franklin Albanese, 1610 Prince St., #6, Berkeley, CA 94703. (510) 845-2625.

FOR SALE: (3) Rangers - $375; Viking II CDC/122 VFO - BO; 1942-1991 QST's - $100. George, WAØZYX, 515 17th St., SW, Rochester, MN 55902.

FOR SALE: Rare Johnson Dual Desk KW, orig. sales slip, w/Johnson promotional literature, in very nice condx. Offers considered. Merle Crowley, W1GZS, POB 476, Sumterville, FL 33585. (904) 568-1676.

FOR SALE: Heath SB-300/SB-401 - $175; QRP amp, runs pr. of 6LF6's, 1-10 W in, 5 W in = 150 W out, mint, 40-10 meters - $225; single 3-500Z plate xfmr, 120V prim., 1800V/2500V sec. - $70; pair 4-400's - $45; Yaesu FV-101B VFO - $100; thrust bearing - $45; (3) 4CX300's - $75; Johnson Viking parts radio - $60. Lane, CA, (619) 462-3857.

FOR TRADE: SX-42, very good for very good SX-28; Valiant I; Ranger I; (2) Matchboxes 275W w/meters; Adventurer; 122 VFO; CE model A Slicer DB 20; VHF 152; HX-11, no cabinet; big box of Ameco stuff. **WANTED:** HT-44 w/ps; nice front panel for R-388; response knob for SX-101; Collins radios and accs, non-working OK. Cash offer considered. Fred Watson, KB8WRF, 581 W. Summit St., McClure, OH 43534.

FOR SALE: Hallicrafters 553A, VGC - $75; Drake 2AQ Q-multiplier, VGC - $85; Heath HW-16, exc. - $125. Richard Prester, 131 Ridge Rd., West Milford, NJ 07480. (201) 728-2454.

FOR SALE: First user friendly circuit for early BC-348's. Send $2 + (3) $.29 stamps. Ray Larson, 1224-1/2 Gotham Ave., W. Los Angeles, CA 90049-5214.

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

FOR SALE: PRC47 LSB/USB kit - $40; new machined coax antenna panel - $9. All restorable. Jay Craswell, WB0VNE, 321 West 4th St., Jordan, MN 55352-1313. (612) 492-3913.

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

FOR SALE: Sectional whip ant. by Bristol, w/ insulator base, surplus, new - $40; copper clad wire, twisted, bare 3#12 - .23/ft; aluminum #10, single, bare - $.08 per ft. Joe, W6CAS, (916) 731-8261.

FOR SALE: Manuals, 300 plus, lab test equipment, military, amateur radio. No list. Best offer. S.T. Carter, II, W4NHC, POB 033177, Indialantic, FL 32903-0177. (407) 727-3015.

FOR SALE: 4D32 - $35; DX-40 - $40; VF-1 - $25; Galaxie III, ext. VFO - $40; Allied T-50 - $45; Viking 500 - $555; BC-442A - $15; CE BC-458 VFO - $50; Shure 701D - BO; CD miniature cap checker - $10; Heath I-28 cap checker - $45; HQ-110A w/clock - $125; S-53 - $50; parting; S-40 (no pwr xfmr). Joe Sloss, K7MKS, (206) 747-5349.

FOR SALE: Lysco model 600 xmtr, VG - $65 + shpg; Radio Shack Globe Patrol SW rcvr, VG - $30 + postage. Al Kaiser, W2ZVR, 713 Marlowe Rd., Cherry Hill, NJ 08003-1551. (609) 424-5387.

FOR SALE: Heath GR-91, paint chipped, spkr buzz, VG tubes - $35; S-40B, looks good but dead, good tubes, w/manual - $75; Eico 460 scope, bad HV, minor rust, one bar knob gone - $45; Hewlett-Packard 500B freq. meter, 10 cps - 100 kc, works, needs cal. - $50; Heath V-5 VTVM, no leads, needs cleaning - $15; ME-9A/U VOM, works FB, no cover, cracked front, w/leads & manual copy - $20; Weston 779 wood-case VOM, VG condx w/ leads - $35; Heath XR-1L leather case AM S-S portable, dead, needs TLC, w/orig. manual - $15; Bendix NVA-2A nav. & RA-21A rcvr, tagged 10/10/79 "servicable part" by ASi (FAA repair sta. 710-9) Memphis, TN - $25 each; Bogen MX30 Series C-10 PA amp, needs tubes, minor rust - $50; Panaonic T-100MD chrome-front portable, VG condx, works FB - $65; Harmon-Kardon "Festival" AM/FM D-1100 chassis only, no tubes, knobs, cover - $25; Bakelite table sets - Motorola 79XM; Silvertone 8070 AM/Phono; Crosley 628-B AM/SW "Tombstone" 5-button; RCA 8X541, works but hums, faded exterior - $15 each; Zenith 5L41 black plastic portable, works FB but scratchy spkr, has 'wavemagnet' antenna - $40; S-S stuff - Silvertone child's 4-speed phono mdl 3234, looks good, needs needle; (label missing) AM/FM/TV portable; Magnasonic AM/FM leatherette; Arvin AM/PB/1W/VHF/MB/SW/FM (whew!) black leatherette 80R75-19; all $15 each (last 3 verified ops). T-150 instruction manual copy, TO-30-100B-1 (1 Oct 43) Advanced Instrument Flying, RCA Super Fleetfone, DX-100 (fair cover), Heath GR-12V clock radio, Allied Radio Circuit Handbook, Allied Radio Builders Handbook - $5 each manual. All items postpaid, OBO. Non-ops, no manuals unless noted. **WANTED:** Buy or trade for good/repairable GRC-109. Eric Jones, N4TGC, Rt 11, Box 492J, Florence, AL 35630. (205) 764-0675. Collect calls will be refused.

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

FOR SALE: Hallicrafters S-120, unchecked - $25 + $7.50 shpg; Morrow 5BR, unchecked - $25 + $5 shpg; SW-3 replacement plug-in coil forms - $7.50 each; SW-3 data packet - $5 + $1.50 shpg; 864/WD-11 plug-in replacements - 2 for $35 + $3 shpg; audio xfmr rebuilt w/A53C new windings - $15 to $20 each + $3 shpg. James Fred, R1, Cutler, IN 46920. (317) 268-2214

FOR SALE: SASE for list of vintage ham parts, equipment and related publications. KC4SJ, 104 Glenwood Dr., Williamsburg, VA 23185.

FOR SALE: Nine pin Male & Female (octal size) connectors (fits Johnson xmtrs) new - $15 for 10 connectors plus $3 UPS. Ron, KC6WTG, POB 783, Santa Rosa, CA 95402. (707) 539-8319

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

FOR SALE: H-P A-B audio osc., late mfg., narrow front, OK condx - $47; Magnecorder PT6 tape playback/line amp, w/pp 6V6's and level meter, age showing but intact - $87. **WANTED:** An Electrovoice A30C audio amp from the '50's. Marty Reynolds, AA4RM, (404) 365-9280

FOR SALE: Collins 208U-3A 3KW xmtr - $4500; Collins 208U-10 10KW xmtr, new condx - $10,500; URG-II remote control unit - $475; Western Electric 22C portable audio mixer - $750; early RCA 77 desk stand - $125; Rockwell Collins HF 8032 solid state pwr sply - $850; HP 182T with 8558 spec. analyzer - $1850; SunAir DCU-100 digital antenna coupler - $450; Frequency Electronics FE1100A-A crystal freq. standard - $375; Andrew 1-5/8 flanged rigid coaxial transmission line elbows, adapters, lot - $250, also, 1-5/8th antenna switch - $75; Collins 51J - $200; Collins S-line 800 Hz filter; KWM 380 main filter board - $100, oven board - $175, DC cable - $35, blower kit - $150; S-line rackmount - $75; 637T-1 adj. dipole - $225; orig. Collins 50th year medalion - $20; orig. Collins 50th year paper weight - $50; Gates, Collins, RCA broadcast catalogs - inquire. Jim Stitzinger, WA3CEX, CA, (805) 259-2011, FAX 259-3830.

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

FOR SALE: R-390A carrier level meters - $30 each; overhauled R-390A Cosmos PTOs - $30 each. Plus shpg. Clark Hatch, WØBT, 2546 SE Peck Rd., Topeka, KS 66605. (913) 235-2721

FOR SALE: Johnson 500 - $1000 FU only. Chuck Graves, KØRFQ, 641 N. Oak Grove, Springfield, MO 65802. (417) 863-7415

WANTED: BC-946 and ARC-5 rcvrs, 550-1500 kHz and 1.5-3 MHz. Don Hilliard, WØPW, Rt 5, Box 219, Neosho, MO 64850. (417) 451-5892

WANTED: Junker/parts for IFF/radar sets: Navy BN, AN/APX-2A, Army BC-647, BC-689, BC-929. William Donzelli, 304 South Chester, Park Ridge, IL 60068. (708) 825-2630

WANTED: Stancor 10-P, 30-P xmtrs, 415 mic amp; National HRO-5A1 rcvr; B&W BVL coils, especially BVL-15. FOR SALE: Parts unit for Heath Seneca xmtr. Thanks! Tom Smith, N5AMA, 13034 Elmington Dr., Cypress, TX 77429-2062. (713) 376-3436 (h), 957-6420 (w)

WANTED: Schematics/manuals for RCA WV-77C VTVM, WR-49B sig. gen.; Hickock 188X sig. gen; Precision E200C (6U8, 6AU6, 5Y3) sig. gen. Jack Bertholf, WA4CSM, 8109 N.W. 58 Ct., Tamarac, FL 33321.

WANTED: Plate relay coil for B&W 5100B; also Gonset pwr sply, 3069 or 3098 for G-66B. Sam, N4VIB, (706) 695-5658

WANTED: Tube amps by Fairchild, Heath, Fisher, Altec, McIntosh, Western Electric, RCA, etc. Any other related Hi-Fi components and literature. Also, early battery radios and related parts, tubes and literature. TRADE: All NIB (2) 715B, (3) 5R4GY, (1) 807, (4) 3B-24, (3) 6B4G. Thanks. Tim Phelan, 845 Lilybud, Ballwin, MO 63011. (314) 227-9264

WANTED: McMurdo Silver communications rcvrs models 3A, 5A, 5B, 5C, 5D, 14-15, and Masterpiece III-X. Working or non-working. Mint or parts sets. Michael Feldt, 12035 Somerset Way, E, Carmel, IN 46033. (317) 844-0635

WANTED: Original manuals AN/ARC1, AN/ARN6, AN/APS13, AVT112A, GO9, TA12B, TBY, SCR269, SCR268, BC322, TBL. Glanzmann, 22bis ave Gros-Malhon, 35000 Rennes, France

WANTED: WW II Bendix ATD xmtr and dynamotor; National NC-120 rcvr; 1930-1950 Popular Mechanics magazines; Model G410 or G415 or G521 Temple portable radio. Harry L. McCall, KB4CSY, Rt 1, Box 244, Ennice, NC 28623-9641. (910) 657-8248

WANTED: Knightkit VFO for T-60 xmtr, or VFO that will work with the T-60. Dave, WA4YRK, (615) 966-9811

Collins 75A-4 Modification Compendium- all the factory modification bulletins from Collins Radio Company, all the articles printed in CQ, Ham Radio, QST and ER, 85 pages - $18
Service Modification Compendium for the S-Line, KWM-1/2/2A series - 260 pages - $40
Service Modification Compendium for the KWS-1, 32V and 75A series - 42 pages - $12
Prices include shipping. Money Back Guarantee.

ER, Box 57, Hesperus, CO 81326

FOR SALE: Heath SB-610 monitor scope, orig. assembly manual, honest mint condx, 1 owner - $195. Victor, CA, (805) 581-5317

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

FOR SALE: Technical Materiel Corp. TAC-1 tuner -$250. Randy, WA7CPA, (602) 266-2256. FAX 263-0095

FOR SALE: 618T (3) w/manual - $350; TCS RX/TX, cables, hbps, spkr and ant. tuner - $300; TM-300, BC-221, first generation copy, bound - $25; R-390A Maintenance TM, bound copy - $35; ARC-12 rcvr w/dynamotor and schematic - $25; monitorscope module, 2" with docs - $35; HP3400A True RMS meter - $250; ART-13 - call; 28VDC/50 amp pwr sply, pu only - call; USM-207 550 MHz counter, UPS paid lower 48 - $150; R-390A engraved front panel, with handles - $65; BC-614 speech amp w/docs - $75; Heath TX-1 - $175 or trade for RX-1 - call; KWM-2, 516F2, WE - $475; dual 5 uF/3KV oil - $15; xmfr 304V @ 600 mA ccs - $40; 28VDC to 115VAC solid-state 400 Hz inverter, approx. 250 watts, w/docs - $75; 4X150 sockets-chimneys - $15/set; LSASE w/2 stamps for list. Bob Miller, KE6F, 9655 Appalachian Dr., Sacramento, CA 95827. (916) 362-5481, 369-6277, e-mail, rmmiller@netcom.com

FOR SALE: Used tube list, good selection and quality, SASE. Bill McCombs, WB0WNQ, 10532 Bartlett Ct., Wichita, KS 67212-1212.

VINTAGE ANTHOLOGY - BOOK 1
A collection of 29 articles written for ER by Dave Ishmael, WA6VVL:

* 8-1/2" x 11" spiral-bound, 139 pgs.
* 10 new unpublished articles.
* Many published articles have been revised and expanded.
* 11 homebrew and 4 rebuild/restoration projects.
* 18 schematics, 8 tables and 5 graphs.
* 80 4" x 6" B&W photos.

$14.95 plus $2 4th-class postage or $4 1st-class postage. CA residents please add 7.75%

DWI Engineering, P.O. Box 3611, Costa Mesa, CA 92628-3611

FOR SALE: The cleanest Hallicrafters SX-71 (W/15M) you ever saw - spotless! Absolutely beautiful - $200 plus shpg. Michael Crestohl, 263 Nahant Rd., Nahant, MA 01908-1342. (617) 581-5479

FOR SALE: Triplett 3423 tube tester, complete, good meter, tester restorable, but case poor - $35; HP-3440A/3444A DVM working, manual, probes - $25; Heath AV2 ACVM, exc. condx, manual - $10. Bill McCombs, WB0WNQ, 10532 Bartlett Ct., Wichita, KS 67212-1212. (316) 722-7669

FOR SALE: Hallicrafters SR-160 w/ps. Extremely low hours, mint - $200 shpd. Joseph Falcone, AA8HV, 3000 Town Center, Ste. 2370, Southfield, MI 48075. (800) 436-7026 leave message.

Collins S-Line Rubber Feet

Current production replacement feet, manufactured by Collins.

Minimum order - 12 for $9

13-49 - $.70/each

50-99 - $.63/each **Shipping included.**

100 plus - call

Tom Nicholson, KA1BAZ
33 Hull St.
Shelton, CT 06484
(203) 924-5635 10AM - 6PM EST
(203) 366-0438 eves EST

WANTED: Hallicrafters SR-2000A, FPM-200, SX-88, SX-73, Collins 75A-4, KWS-1, 32V-3, 51S-1. Hank, WD5JFR, (800) 364-4265

WANTED: National HRO-500TS spkr in mint condx & National NCL-2000. Sam Macy, N9WAF, 486 Glenwood Trail, Elgin, IL 60120. (708) 695-0218

WANTED: Junker RME 4350 rcvr for main tuning assembly parts. Ken Sands, K8TFD, 11152 Edington Rd., Livonia, MI 48150. (313) 522-8645

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

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

WANTED: Highest quality, early-mid 1930's commercial (Collins/National) or home made exciter or xmtr, 10W - 100W, CW, 160-80-40-20 capable, as companion to HRO. Write or call. John Petrich, W7HQJ, 8301-161 Ave., NE, Ste. 300, Redmond, WA 98052-3858. (206) 868-1256

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

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

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

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

Uncle Dave's Wireless World

Just as we were going to the printer we learned that David Kamlin, AB6XK, owner of "Uncle Dave's Wireless World", had died on March 6, after a lengthy illness.
At this time we have no information regarding the status of his business.
We send our condolences to his wife and family.

Subscription Information

Rates within the U.S.
$28 per year 2nd class
$38 per year 1st class

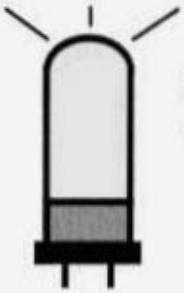
Canada by Air (only).....U.S. $39

Other Foreign Countries by Air (only).... U.S. $70

Guaranteed Refund at any time for issues remaining on subscription

subscribe by mail or phone

ER
P.O. Box 57
Hesperus, CO 81326 **Phone/FAX (303) 247-4935**



SECOND
CLASS

ELECTRIC RADIO
145 CR 123
Hesperus, CO 81326

TO: