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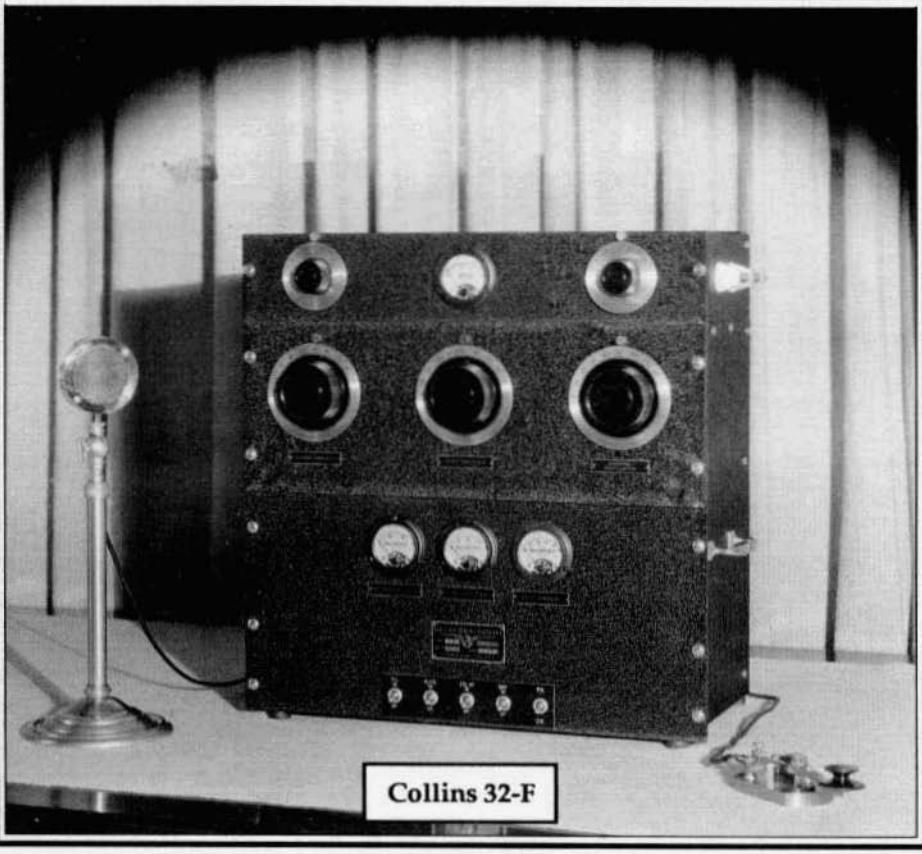
ELECTRIC RADIO

celebrating a bygone era

Number 25 May 1991



Collins 32-F

ELECTRIC RADIO

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The Purpose of Electric Radio

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

Electric Radio Solicits Material

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

EDITOR'S COMMENTS Barry Wiseman, N6CSW/Ø

Regarding last month's story "Collins Mystery Prototype"; we have located Bill McKay thanks to Rick Lutzinger, KD6ZR. I had two long, very interesting, telephone conversations with Bill and here's what he had to say about the 'prototype' transceiver that Harry Snyder, WØRN, owns.

In our first conversation - before he had seen Harry's photo of the rig - he thought that it sounded like one of the 'many' prototypes that had been put together at Collins while he was there. But when he saw the photo he recognized the rig immediately and it was not a Collins prototype. It was one of two rigs that were put together by Ed Andrade, WØDAN, another Collins employee, and himself. Although they may have used Collins parts and done some of the work at Collins, these rigs were never official Collins projects. "They were just something Eddy and I were doing on our own", Bill said. "We each built one. I don't know if Eddy still has his or if he got rid of it like I did". So that's the rest of the story... In a future issue I'll talk about Bill and what he told me of his career at Collins (he worked there for 5 years in the sixties) or as he suggested, he may write something for ER himself.

By next issue we should be 'off the farm' and living in Durango. I think it's going to be good for the magazine. I plan to rent a small office and hire a girl part-time to help me with typing, filing and that sort of thing. At the moment, I feel over-whelmed. The amount of mail I receive has grown from a trickle to a stream and each letter has to be processed in some way. This takes most of my time these days. I need more time to spend on the magazine. Next issue I'll publish our new address.

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Cover: Collins 32-F circa 1935. Only about 25 of these transmitters were manufactured. The story, from information supplied by Bill Stewart, K6HV, will appear in next month's issue.

Beasley by Beasley

Barry asked me to write a little something about myself, so what follows is as little as possible: I'm the guy who draws the little cartoons that Barry uses to fill the empty space that results when he runs out of copy before he runs out of page.

I was born in southern California before I can remember it, and got interested in Amateur Radio circa 1952. The following year I got my license and was off and running. I was in the army in WW II and operated some of the radios Walt Hutchens writes about in his "Electric Radio in Uniform" feature. I was in the Field Artillery as a radio operator assigned to a forward observer. Our average life expectancy in combat was rated not in weeks or days, but in minutes, because we were considered an A-1 priority target. That's why we only used the radio when we lost the 'twisted pair'. Those guys on the other side were really good at T-hunting! I love 2-way radio and figured Amateur Radio was much safer.

I have extensive art training, consisting of a year of art in high school. Gradewise, I remember a lot of D's. Specifically, because my teacher had vastly different ideas on what constituted fine art than did I. She was an advocate of drawing vases and fruit and the study of Renaissance Art. I, on the other hand, preferred such great masters as E.C. Segar, Billy DeBeck, Frank Willard and George Herriman, who drew Popeye, Barney Google, Moon Mullins and Krazy Kat. To me, these guys were the true geniuses. They could take a blank piece of paper and a bottle of India ink and create an entire world!

Most of my cartooning career has been involved with just drawing cartoons for myself, family and friends. I didn't really get involved in magazine cartooning until my retirement from the workaday world six years ago. (See what idle fingers get into?) I guess I have the greatest success with drawing cartoons about Amateur Radio because there are so many potentially humorous situations. It's a little more difficult for ER because I try to orient my gags around vintage radio and that makes it quite a bit more specialized. Periodically, Barry will look up into the slot marked "Beasley Cartoons" and it is empty. He then gets on the horn and says, "Help". I then try to think of another gag relating to old time radio before press time. Many times I have found myself propped up before a blank piece of paper, trying to think of something that might be a little funny. Each time I feel like giving it up, another idea materializes. I guess there is always "one more last idea".

I hope that the readers of ER get a chuckle or two out of my cartoons, and that my old art teacher was not really justified in giving me all those D's.

Editor's Note: Last month, when I was handing out accolades to those people that had helped get ER through the first two years, I missed Bob. I'm sure everyone would agree that Beasley cartoons are a very enjoyable feature. Thanks Bob.

Reflections Down the Feedline

by Fred Huntley, W6RNC
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Nevada City, CA 95959

I got to thinking about ER magazine having all those articles about Collins, National, Johnson, Hallicrafters etc. and nary a word about my favorite company: Technical Materiel Corp. So, I wrote to the president of TMC in Mamaroneck, New York, and asked him if he could supply me with some history of his company and its products.

Within a week, I received a reply. The president stated that regretfully there is no history available; all the old records are gone; and all the old employees are retired. So, our only hope for getting some information about TMC is to put out a call for help. Somewhere out there, there must be retired employees who can tell us something about the company's past.

Suffice it to say, TMC makes military and government communication equipment. Around 1956, they came out with the GPR-90 receiver and the GPT-750 transmitter which they advertised prominently for the radio amateur market in QST.

In 1958, I purchased a brand new GPR-90 receiver from Allied Radio in Chicago and it has been in almost continuous use and is still going strong. The receiver has been very reliable and there have been no failures. Half of the 16 tubes in it are still originals.

The GPR-90 is an all-wave general coverage receiver with a range of .54 through 31 Mcs. It is very convenient for tuning around and seeing what's going on from AM broadcast to ten meters. Bandswitching and dial rotation ratios are not cumbersome. Bandspread coverage provides for fine tuning when it is needed.

Performancewise, the receiver is very good. I did separate the IF and RF gain controls with individual pots instead of both on one, on the front panel. The audio output is nearly hi-fi.

When I bought the set it cost $495. Later, it went up in price to $750. So it is a well made and well designed set with good parts accessibility and convenient operation.

The military version is called the GPR-90RXD. It has one more tube - a ten channel crystal oscillator for fixed frequency operation. Unlike the GPR-90, the RXD is made for rack mounting. The GPR-90 has a maximum selectivity bandwidth of 5 kcs, the GPR-90RXD has 7 kcs and the GPR-91RXD has 15 kcs for multi-channel RTTY operation.

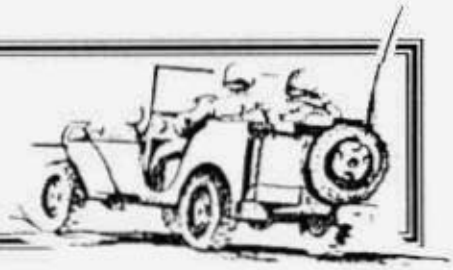
Over the past years, I acquired two GPR-90RXD sets. One is the main receiver in my basement station and the GPR-90 original is used in my upstairs shack.

In the mid-1960's Technical Materiel Corp. came out with an improved model: the GPR-92 receiver. I have the company's sales brochure on this model and it looks to be a very impressive piece of equipment. But, to this day, I have never seen one or heard of anybody who actually owns one. Perhaps only a few were made. From time to time, over the years, I notice ham ads seeking to buy a GPR-92, but has anyone ever seen one of the receivers in person?

The closest I ever came to getting a GPR-92 was five years ago. There was a big hamad in QST -"Estate Sale". I sent the fellow in New York $300 for a GPR-92 and a Hal ST-6 RTTY converter. Unfortunately, the ad was a phoney. The guy didn't have any GPR-92 or ST-6 and I had a lot of trouble retrieving my money.

Anyway, TMC makes good equipment. The GPT-750 transmitter has never come within my grasp but it is an impressive piece of gear that would be interesting to read about in this magazine. Are there any author volunteers?

ELECTRIC RADIO IN UNIFORM



by Walt Hutchens, KJ4KV
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Arlington, VA 22207

"The R-105/ARR-15 Receiver"

"Oops – I'm late for that 20 meter 'military' sked!" 'Course the other guy might be late too – is there a 1940's vintage military receiver in the shack which I can set quickly within a kc or so of the scheduled frequency and which will then stay on channel while I wait for his call?

Most well-known military receivers of the period won't even come close. For example, 20 meter frequencies can't even be estimated to less than 10 kcs on the BC-348 and '342; calibration errors are often much greater than this. The late-40's R-390 and its relatives (R-388, R-392, etc.) can be set accurately enough – but only if they are calibrated on the band in use, which is an extra step.

If, however, I have the Navy's ARR-15 (and, I believe, only with this receiver), I can turn it on, put on the coffee, set the schedule frequency, and walk away, to wait for a call. Because of its unique design, the ARR-15 can be set within a kc of a specified frequency all the way up to the 18.1 Mcs limit of its coverage; after a four-minute warm-up, my set drifts less than 2 kcs even at 18 Mcs! It also has outstanding AVC, a stable BFO, and a great noise limiter, but – didn't I see this circuit in a ham magazine back in the 50's?

Overview

The R-105/ARR-15 is Collins' answer to the problem of what receiver should be used with the ART-13 transmitter. In a 7-1/4" x 10-1/4" x 22" (H x W x D, the standard 'ATR' package) case it packs a 14-tube superhet receiver covering 1.5 to 18.1 Mcs in six bands. Front panel controls for CW or MCW (voice), BFO frequency, volume, tuning and bandswitching and selection of any of ten preset channels allow use without a separate control box. If one or more control boxes are connected, the last one turned on (or the front panel, if the set was last turned on locally) has control of the channel, volume, and other basic functions.

The bandswitch and tuning controls are operated by a Collins Autotune system. To use this, you select the desired channel number at the switch on the front panel, loosen a lock in the center of each knob, set it according to the frequency, and then tighten the lock. Whenever the channel switch is set to that number again, the knobs spin counterclockwise to their stops and then clockwise to the preset frequency. The Autotune system first appeared on the ART-13 and was described in detail in the column on that set, E.R., November 1989.

Including the dynamotor and mounting rack, the set weighs 44 pounds. It requires 28 volts at 3.1 amps except during channel selection when it draws 8.5 amps. The R-105 is the first model; the later R-105A differs mainly in having a minor circuit rearrangement which replaced a solid-state diode with a vacuum tube! Octal tubes are used throughout.

R-105A/ARR-15. Knob marked "Push To Release" is turned right until it latches to switch the set on. If a remote control box is subsequently turned on, an electromagnet pulls this knob in, releasing it and giving control to the box just activated. Manually pushing in the knob which is 'on' turns the set off.

History

The ART-13 transmitter was adapted from a set built by Collins Radio for commercial airline use in the late 30's. The airlines had radio operators in flight crews but needed a transmitter which could be switched to a new channel without the delay and complexity of tuning up a multi-stage set. Since retuning a receiver generally required only turning one or two knobs, an autotuned receiver was not essential.

In military use, however it was desirable for the pilot or other crew members to be able to select a new channel without the help of a radio operator because even in aircraft which had a radio op, he might be busy with other duties. Since no civilian prototype existed, this problem could not be solved immediately and early wartime installations of the ART-13 used ARB or BC-348 manually tuned receivers. However, around 1943 (my guess, based on the delivery date), Collins began work on a team mate for the ART-13; this set became the R-105/ARR-15.

The Collins history book, "The First Fifty Years", doesn't mention the R-105, even in its long list of Collins Radio products. I have a copy of the Collins engineering drawing of the 70E-2 Permeability Tuned Oscillator (PTO) schematic; since this unit was used only in the ARR-15, the design of the set was complete at about the earliest date on this drawing – March 28, 1944. Fellow military radio fanatic Charlie DiCecca, KA1GON, has a Collins-built R-105A with a 1953 contract date; both he and I have sets built by Bendix on a 1952 contact. My set was modified in 1954 and contains a dynamotor which was overhauled in 1969 by 'O&R JAX'-- the aircraft Overhaul and

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Repair Facility at the Naval Air Station, Jacksonville, Florida.

When I was aboard the aircraft carrier Lake Champlain, in the summer of 1958, ARR-15's were in service in the S2F 'Tracker' planes we used to hunt submarines. The ARR-15 is not a satisfactory SSB receiver so it probably left service during the late 1960's as U.S. military HF converted to single sideband.

Total production may have been around 10,000; one reference gives a price of $1500 per set for the ARR-15 but gives no date. In 1953 you could buy a 75A-3 for $530...

Design

The chassis of the R-105 is a deep 'H' facing the panel. The tube sockets and most circuitry are on the vertical sides with wiring on the 'outside' and the tubes pointing toward the center. Items such as the dynamotor and coils are mounted on the center horizontal area. About 3" behind the front panel, an aluminum casting holds the Autotune mechanism and two PTO's -- one is the local oscillator and the other is used as the BFO and for calibration. A small subplate mounted on the casting holds other panel controls; the front panel is essentially a cover plate and is easily removed. There's a five-piece seal on each shaft where it comes through the panel and the case is unventilated.

Electrically the ARR-15 is a single conversion superhet with a 500 kc IF. There is one RF stage, a mixer, and two IF stages -- all 12SG7's. A 12SL7 and 12H6 are used in a complex noise limiter circuit, another 12SL7 is used in the AVC circuit, and a 12SJ7 and 12A6 handle the audio. (The R-105A uses half of a 12SL7 as a first audio tube.) Both PTO's use 12SJ7's and a 12SG7 is used as a buffer/multiplier following the local oscillator.

Two 12SJ7's are used in a 'CFI' or Crystal Frequency Indicator unit-- the 30's and 40's Navy term for a crystal calibrator.

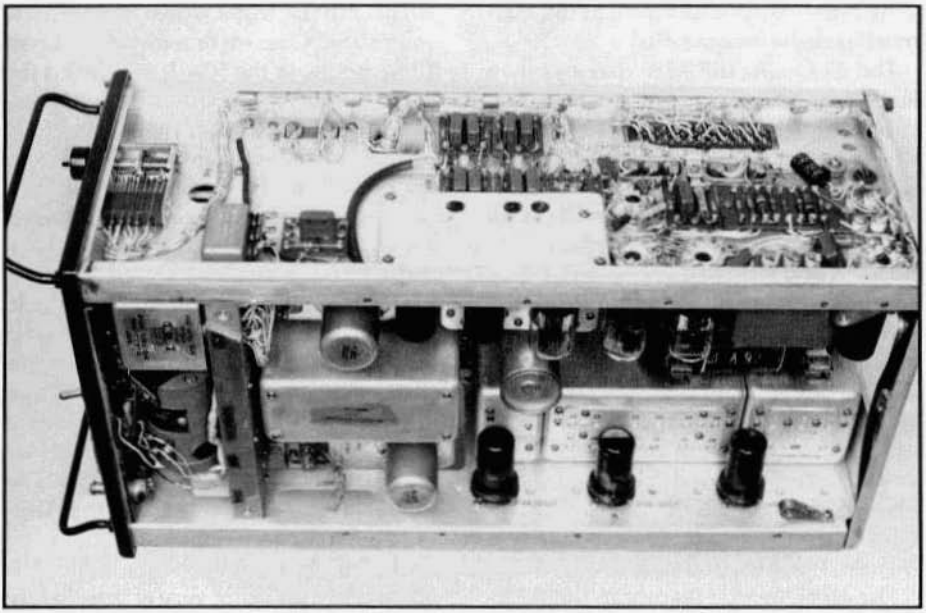
The ART-13 used a bandswitching master oscillator but this feature was eliminated in the sealed unit PTO's for the ARC-2 and ARR-15. This made it easier to build a stable oscillator but led to a new problem: how to control the frequency of a radio tuning a range of 10:1 or more with an oscillator tuning only 1.5:1 or 2:1.

On the ARR-15, the solution is to successively multiply the 2.0 to 3.0 Mcs oscillator output frequency on higher bands while flipping back and forth between 'oscillator above the channel frequency' and 'oscillator below the channel'. On band 'A' it is above the channel frequency, giving coverage of 1.5 to 2.5 Mcs. On band 'B' it is below, for 2.5 to 3.5 Mcs. On band 'C', the PTO frequency is doubled and is again higher than the channel to give 3.5 to 5.5 Mcs, and so on, to band 'F' when the PTO is multiplied by six and used below the channel to give 12.5 to 18.5 Mcs.

But the biggest innovation in the ARR-15 was in the way the operator tuned the set. Think of the problem we were trying to solve -- a receiver to be used with the ART-13. We need to be able to set the receiver within one or two kcs (a fraction of the width of a voice channel) of any specified frequency -- say 18,042 kcs -- hours or days before the signal is there.

On the ART-13 you pick out the nearest calibration point from the calibration book, put the radio in 'calibrate' mode, adjust the oscillator for a zero beat near the expected dial setting, and reset the dial index. This procedure is complicated, needs some judgment, and takes time.

On the ARR-15, the use of the calibrator is hidden. To set 18,042 kcs, for example, you select band 'F' covering 12.5 to 18.5 Mcs. Then set the dial at the left (marked 'BFO-CALIBRATE') to '42'. Now turn the 'TUNING' knob to a zero beat between '18.0' and '18.1'. Finally, turn the 'BFO-CALIBRATE' knob back to '0' where it will drop into a click stop. You



R-105A/ARR-15 with the case removed. The local oscillator, multiplier, RF, and mixer stages are along the right (far) side; BFO, IF, audio and other circuits are on the left. Note the extensive use of terminal boards to mount small parts and the shield over IF circuitry.

are now within a few hundred cps of 18,042 kcs. Lock the Autotune knobs and you have the channel set.

Do you remember the interpolation frequency meter? In this scheme a crystal oscillator generates a chain of harmonics and a tunable is used to measure where you are between harmonics. Until the days of synthesized oscillators and frequency counters (1950's), this was the most accurate way to measure a frequency-- far more accurate than harmonics of a tunable oscillator as used in the LM or BC-221 military frequency meters. The ARR-15's secret is that (under the covers) it has a built in interpolation frequency meter!

The heart of the system is the CFI unit. This consists of a 100 kc crystal oscillator and a harmonic generator covering the frequency range of the receiver. Also part of the calibration system is an accurately calibrated BFO.

Since the local oscillator is below the channel on band 'F', a channel frequency of 18,042 kcs requires setting the oscillator to 17,542 kcs. The crystal harmonic nearest the channel frequency is 18,000 kcs; if we set the BFO to 458 (18,000 - 17,542) kcs we will hear a zero beat when the local oscillator is correctly tuned.

A small problem is that the 458 kcs signal has to go through the 500 kc receiver IF. However, the solution is easy -- the IF is retuned to 458 kcs!

When the 'BFO-CALIBRATE' knob is at the click stop, the BFO and the crystal oscillator are turned off and the IF is tuned to 500 kcs; this is the normal operating condition. Turning the knob out of the stop in either direction turns the BFO and CFI oscillators on, switches the receiver input from the antenna to the CFI harmonic output, and (as you continue turning the knob) tunes the BFO and IF transformers down toward 450 kcs going in one direction and up toward 550 kcs going the other way. If you play with

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some numbers, you can see that this covers all possible frequencies.

The BFO-CALIBRATE dial has two 'last digits' scales: 50 55... 90 95 0 5 10... 45 50 for the bands on which the oscillator is above the channel frequency, and 50 45... 10 5 0 95 90... 55 50 for those on which it is below. A mask operated by the bandswitch shows the right scale for the band you are on.

The first time I turned on my ARR-15, it was about 2100 EST. I connected the antenna, dialed up '86' on the 'BFO-CALIBRATE' knob, found a zero beat near 14,300, turned the knob back to the clic and Les, K6HQI, jumped out of the speaker. You could do this with any modern receiver or with an R-390 or 392 if you calibrated it first -- but this is a 1945 set. Pretty impressive.

The other unique feature in the ARR-15 is the noise limiter circuit. For AM voice and CW signals, the only way to recognize 'noise' is that it is stronger than expected, so what we call noise limiters are usually amplitude limiters. Many types have been used, from manually adjusted clippers on the audio output to more or less complicated automatic circuits in which the clipping level is set in proportion to the average IF or detector voltage or the average audio signal. Nearly all limiters use diodes as switches to chop off what the circuit decides is a too-large signal.

The ARR-15 circuit is an elaborate automatic limiter working on the detector output. It is essentially a series diode limiter with a dual triode added to boost the detector output. Vacuum tube diodes like the 12H6 aren't very good switches because they need several volts (about the output of the usual detector!) to go from 'off' to 'on'. With a larger signal, clipping is much sharper and the threshold can be set above normal modulation peaks; this makes the distortion low enough that the clipper can be left in the circuit at all times.

This circuit (right down to the parts values!) was known to many hams operating mobile in the 50's. It was called the 'TNS' (Twin Noise Squelch); CQ Magazine described it in May, 1952 and in at least a couple of articles after that. It also appears in the 17th edition of Bill Orr's 'Radio Handbook'. There's no mention of the source in any of the articles I have seen; it would be interesting to know how this circuit got from the ARR-15 to ham use.

One reason for the popularity of this circuit with mobile hams is that it can act as a carrier operated squelch circuit if one of the resistors in the triode part of the circuit is made variable. The squelch feature is not used in the ARR-15.

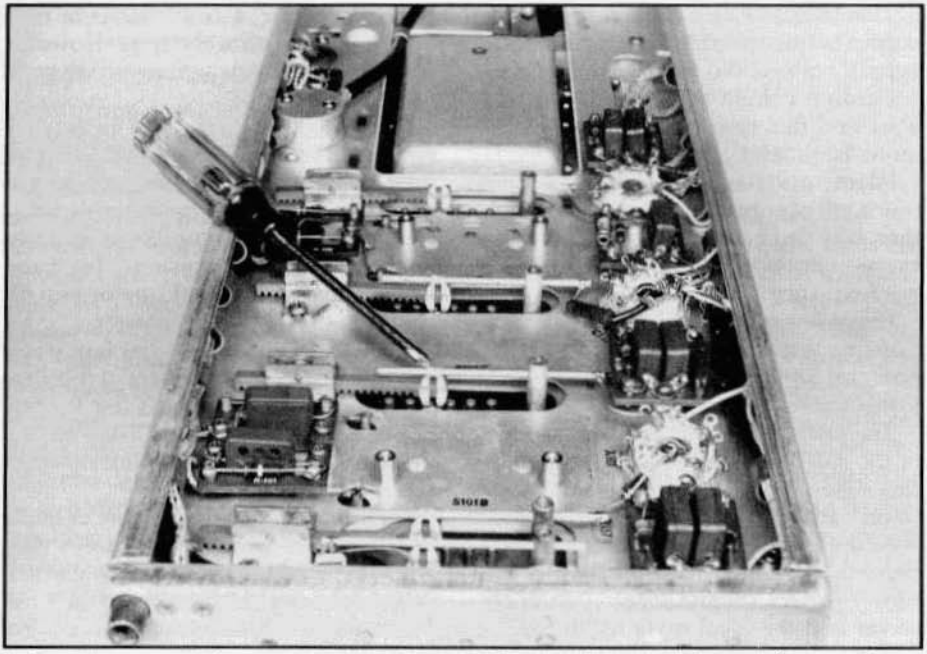
The amplified AVC of the ARR-15 is noteworthy for being very effective without needing either an extra IF transformer (as in the R-390) nor a negative supply voltage.

The ARR-15 has many other features which were new or uncommon when it was built. An L-C filter is switched in on CW to restrict the audio bandpass. All leads in and out of the set are extensively filtered. In the RF stages, .01 uf and 100 uuf bypass capacitors are used in parallel to handle the case of a parallel resonance in the .01 causing it to look like a high impedance at some frequency. To minimize images, the number of RF tuned circuits increases with frequency -- two on bands 'A' and 'B', four on bands 'C' and 'D', and six on bands 'E' and 'F'. Overall, this is a truly advanced design.

On The Air With The ARR-15

I had a 'solid' ARR-15 to start with; the problems which turned up are typical for a set of this complexity and time period.

When first 'fired up' the set sometimes lost audio; the problem eventually disappeared and was probably a dirty contact in the MCW/CW switching circuit.



Is this the most delicate bandswitch in the world? The contacts (tip of screwdriver points to one) slide left to right for bands 'A' through 'F' along silver plated rails to connect them to one of six posts located below. The contacts are operated by plastic racks extending to the left which engage pinions on a shaft below the chassis.

The main tuning dial was off by as much as 50 kcs on band 'F', indicating PTO errors of over 8 kcs. Since calibration is done whenever you set a frequency, dial errors don't cause channel-frequency errors, but they make it harder to figure out where you are. I took out the PTO and retracked it; after a couple of hours of work the error was reduced to about 500 cps at the PTO frequency.

During alignment, one tuning slug in the RF section had no effect. The wire which supported the slug had broken loose where it was soldered to the screw.

One of the RF trimmer caps felt 'loose'. These capacitors are soldered on top of the RF coils; this coil had snapped off at its base. It took an hour of delicate work to remove the antenna coil assembly, repair the coil form with epoxy glue, and reassemble.

The design bandwidth of the set is 15 to 20 kcs at the 6 db points -- rather high for ham use. The first two IF transformers are deliberately overcoupled to broaden the response; since they are capacitively coupled, I reduced the coupling caps to smaller values which cut the bandwidth to about 8.5 kcs.

The unregulated supply voltages for the oscillators in the ARR-15 (and many other military radios) might raise some eyebrows -- but only until you do the measurements. At 2.5 Mcs I measured the following changes at the indicated HV supply voltages for the 70E-2 local oscillator PTO.

Voltage	CPS Change	
120	-50	
150	-22	
195	0	Normal voltage
220	+14	Max frequency
300	-5	

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This oscillator is designed so that its output frequency is almost unaffected by supply voltage. No wonder the designers didn't include a VR tube! You will also find this type of design in the famous 'command' sets.

Filament voltage changes don't have much effect either: a one-volt change either way from the nominal 12.6 volts causes only about a 50 cps change in output frequency.

I have several pages of additional notes from my work on the R-105; send a business size SASE for a copy.

Conclusions

The calibration accuracy and stability of the R-105 are unique for a receiver of this time period; they represent a substantial advance in the radio art. Together with the excellent noise limiter and outstanding AVC they made the ARR-15 the nearly perfect 'set and forget' liaison receiver and the ideal mate for the ART-13.

As the second small but complex Collins radio (the ARC-2 transceiver was first) the R-105 shows more understanding of the problems of such radios. For example, relays (always a high-maintenance item) are grouped in a single replaceable assembly rather than being soldered in and tucked away in various corners as in the ARC-2. Four plug-in assemblies are used and all major sections of the radio can be removed by disconnecting plugs rather than by unsoldering wires.

Like most wartime developments, there are a few problems. The manual is poor -- especially compared to other Collins manuals. The theory sections range from non-existent (the CFI unit) to incomprehensible (the limiter and AVC circuits). Remove and replace instructions are minimal and some important assemblies and steps are not covered at all. Sometimes you get only a frustrating gesture -- at one point they tell you to use a jumper wire to apply power to the CFI unit, but they don't say where to connect either end of it!

The bandswitch in this radio is extremely delicate; a bent contact or misalignment is probably fatal. However some procedures require removing parts of the bandswitch.

Efforts to keep dust out of the set -- by sealing the panel fittings and using an unventilated case -- are commendable but the complexity-- two rubber seals, a nylon seal seat, a spring, and a brass bushing for each knob -- is astounding. Later Collins shaft seals used one or two 'O' rings.

The ARR-15 is one of the few single conversion Collins receivers of this time period. As such it may have less internal noise and is certainly less likely to pick up spurious signals than more elaborate sets like the R-390.

Overall, the ARR-15 is a fine example of using new technology to solve real-world problems. There are a few glitches, a couple of design dead ends (the complicated limiter and interpolation frequency meter tune-up were never seen again) but considering that this was a wartime design, it is an 'A+' job.

The Great ARC-65 Caper

The rule that 'In Uniform' only does radios I can lift has recently been bent more than usual. Case in point: a shipment of half a ton of ARC-65 stuff from fellow bomber radio nut Mark Meltzer. The radio itself weighs 132 pounds and has the figure and good looks of your average beer keg so if I had any rules about radio beauty, they would be on the floor in splinters now. The ARC-65 was (roughly) RCA's competitor for the Collins ARC-38A and ARC-58 and was used in the B-52 bomber in the 1960's.

I'm much in debt to Mark for making the main parts of the set 'happen'. It will be months before this project gets far enough to be reported, meanwhile -- can you help? I'm looking for anyone who had experience with this set as a user, engineer, or technician and who can offer stories, curses, or whatever on its success when it was wearing Air Force blue. We are also looking for a few more parts of the setup -- check the classified section for details.

SAVE YOUR MODULATION TRANSFORMER

by Bob Dennison, W2HBE
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Westmont, NJ 08108

I'm still designing my new AM rig. The relay system is finished and have also built the bias supply for the 813 and 2A3 drivers. Then I started to think about means to protect my modulation transformer.

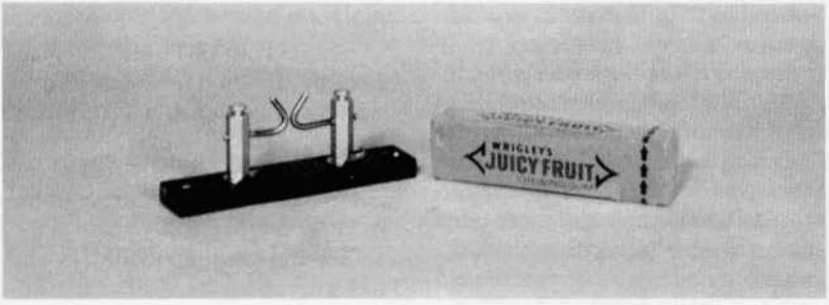
I first thought of using the zener breakdown of ordinary silicon diodes. But so little info is available and the voltages involved are high, so testing is difficult and dangerous. So I decided to use the standard old time idea of a spark gap. I couldn't find any data on this in any of the standard radio books so had to derive my own formula based on a graph given in the "International Telephone and Telegraph Handbook, 3rd Edition".

Most broadcast transmitters and some ham rigs (e.g. the Viking 500) running 500 watts or more, employ a spark gap to protect the modulation transformer. This spark gap is connected across the secondary winding of the modulation transformer and is set to flashover at a voltage of about 1.5 to 2 times the peak voltage occurring at 100% modulation. These days, replacement transformers are either non-existent or prohibitively expensive so it is a good idea to incorporate such protection where applicable.

The photograph shows a spark gap built for use in a homebrew rig employing a pair of 811A tubes in the modulator. The electrodes are formed from no. 12 copper wire. The hexagonal posts are 3/4" high and are threaded at each end of 4-40 screws. The upper screw locks the no. 12 wire firmly in place. The posts are held to the bakelite base by 4-40 FH screws. The holes in the bottom of the base are countersunk but additional clearance between the FH screws and the chassis is secured by means of a layer of insulation (not shown). This can be several layers of insulating fiber or a wafer of bakelite or plexiglass. A solder lug under each post provides terminal connections.

The gap spacing "S", may be calculated from the formula S = (V-350) where V is the desired flashover voltage in volts. The spacing "S" is given in mils and may be set by means of a 'feeler' gauge such as is used to set automotive spark plugs. For example, if the final plate voltage is 1500 volts, we might choose a flashover voltage of 2500 volts. Then S = .01 (2500 - 350) = 21.5 mils. A gap of .021 inches would be OK. Use the .013 and the .008 inch feeler gauges.

This is a simple "weekend" project and it could save your precious modulation transformer.



Getting Back On AM Phone

by John Seginski, N7NV
625 Akard Circle
Reno, NV 89503

"It's hard to go back."

That's what they say anyway. I think whoever first wrote that was referring to someone who had left their hometown to go on to great adventures, and returned home later.

Well, to me, after I decided to go back on AM (amplitude modulation or as some call it "Ancient Modulation"), like the person trying to return to his hometown, I had a tough time getting back. I hadn't been on AM phone since 1953 when I joined the Navy. After my discharge I got back on CW and later had a very enjoyable stint on 75 meter mobile SSB. Then, several years later, after my initial enthusiasm to return to an old friend (AM), I had a hard time finding other hams who were using AM on the phone bands. I work in a hospital - and on the weekends - so it was tough finding those guys on, when I was off work.

Even though AM sounds much more pleasant to the ear and gives a true representation of what a person really sounds like, AM has some serious drawbacks. AM is more susceptible to noise and static and it's efficiency is way less than SSB. In other words, AM isn't as efficient in actual communication as is SSB. Also, AM is wide. It takes twice the room on the band as SSB. These are it's disadvantages.

But despite it's faults and shortcomings, AM has a certain character about it. Sort of like an old classic car, maybe an old Packard, compared to a modern 'econobox wonder car' which is more efficient, more comfortable and more practical than the old Packard, but doesn't have that something special that the old Packard has.

Though the old car is not as comfortable, efficient or practical as the new one, something about the old car is different.... and more desirable. I call this something 'class'. Old classic cars have class. Old homes have class. And old amplitude modulation has class!

Once I started hearing AM operated stations on the various phone bands, I decided I wanted to talk to these guys on AM.

I listened and noted what type of equipment they were using. It was mostly stuff from the late '40's or '50's that was made by U.S. companies like Collins, Johnson, Hallicrafters, Hammarlund and so on.

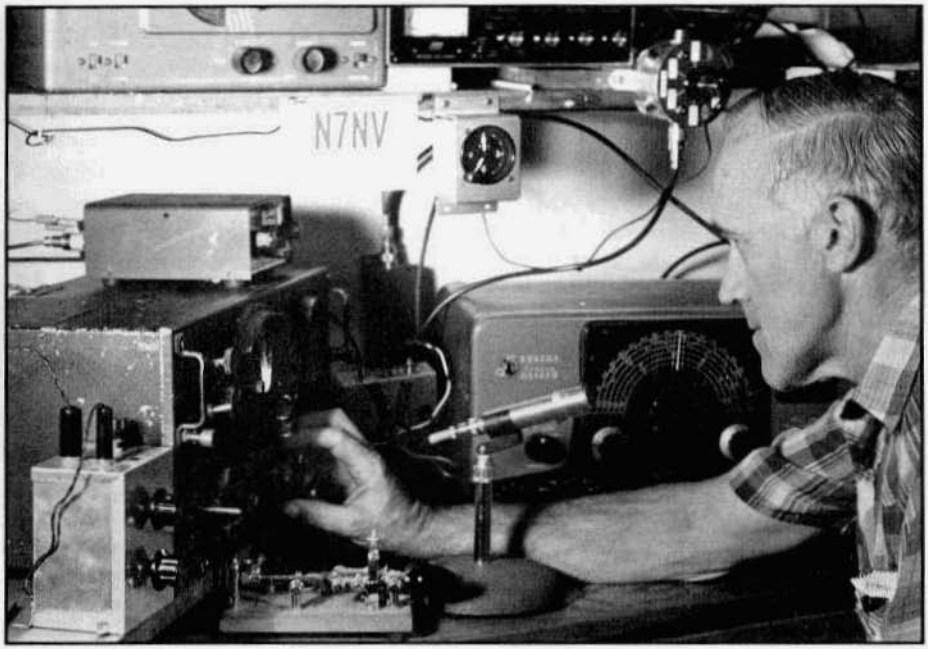
For some reason, none of these AM aficionados were using modern solid state transceivers despite the fact that many of the transceivers have an AM position on the switch. Using AM on these modern rigs just wasn't right. During one of the conversations, one of the hams told another one, "There's something wrong with your rig. You sound like you're using one of those solid state transceivers." Case closed!

I needed a tube type transmitter that transmitted on AM. I already had a nice old tube type receiver. It was a BC348R, a WW II aircraft receiver. It's audio sounded great, especially coming out of that big black speaker which I had picked up at an electronic surplus store for five dollars.

I studied old QST's and CQ magazines from the 1950's. The transmitter I finally decided on was the Johnson Viking Ranger, about 50 watts input. They were made in the 1950's. All tubes of course.

I placed ads for a Ranger in the local radio stores. No luck.

"Try the swap net Saturday and Sunday afternoons on 7240 or thereabouts", one of my ham friends suggested to me.



John ,N7NV, operating his new AM station

"Someone might have one for sale".

I did, and the second weekend of listening I found a Ranger, one hundred miles away. It was a little expensive, but it had all new tubes and looked as good as the day it came off the factory assembly line. I bought it and anxiously drove home so I could get on AM.

When the AM gang got on 75 meters that night, I connected my D-104 dynamic mike and tried to give them a call. "I hear a carrier", one of the AM'ers said."But it has no modulation".

I turned up the modulation control all the way. I couldn't get a flicker on the meter. My modulation wasn't working. So out to the workshop I went, puffing and grunting, carrying that heavy little transmitter.

The scope showed no audio in the audio amplifier section of the transmitter. Observing the RF envelope on the scope, all I could see was a steady carrier... no modulation at all! I fed an audio oscillator signal into the mike connector with one volt (peak-to-peak) audio in, then I could get a 100% modulated RF envelope. The transmitter was doing its job. It must be a bad microphone I thought.

My D-104 worked but only put out millivolts of audio. I needed one volt of audio for my Ranger to work. Four of my other microphones that I had been using on SSB also put out just millivolts. It looked like the Ranger transmitter was designed to be used with a crystal mike which can put out close to a volt of audio. (Later I found that the modulation control potentiometer was 100 K ohms instead of the 1 M ohm which it should have been, this kept the audio gain of the rig too low for dynamic microphones.)

Of course I could find a crystal mike anywhere. So I tried using a small transistorized audio amplifier (as a temporary measure of course). The AM'ers on 75 meters now said someone with weak garbled audio was on the frequency but

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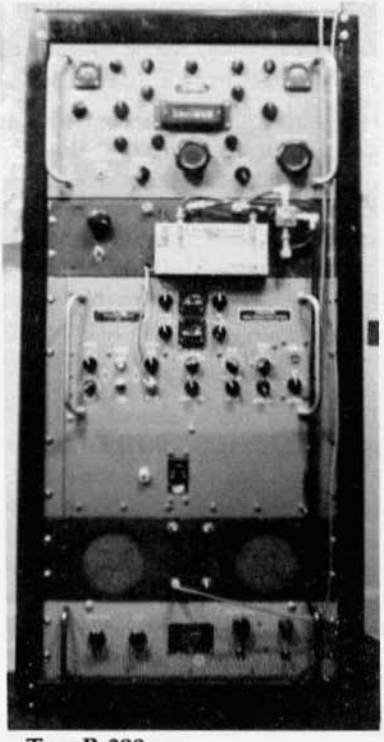
The CV-157 SSB Demodulator

by Michael D. Runyan, KK7F
S. 331 Cd'A #5
Spokane, WA 99204

For most of us who operate AM, the idea of a transmitted carrier signal is central to correct demodulation at the receiving end. SSB of course, adds the carrier at the receiving end with no interest or consideration to where the added carrier is in relation to where the transmitter carrier would be. The result is an artificial sound - like that of cans tied together with string that some of us used as kids. However, in the annals of the transition from AM to SSB there were some attempts at a marriage. This is about a device designed to provide that marriage, the CV-157 demodulator.

First a short description. The CV-157 is a 100 pound rack mounted monster that is really 3 parallel IF channels (a USB channel, a LSB channel and a carrier channel) all in one box. It measures 15 3/4" high by 19" wide by 16 1/2" from the rear chassis support rails and pins to the front of it's panel protection handles. It contains 44 tubes and has an extendible deck which contains most controls and tubes. It is designed to be driven by a 50 ohm 455 to 500 khz IF signal from receivers like the R-388/51J or R-390/A. And finally the CV-157 was originally intended (its military use) to allow multi-channel communications via one transmitted signal complex. I wonder just how well it worked?

So far it doesn't sound too special does it? After all each SSB channel operates like a standard demodulator, and what is the point of a carrier channel anyway? Well the tie-in is that the carrier signal, as taken from the carrier channel, is used to control an electromechanical AFC and/or it is amplified, limited and used as the BFO injection for the SSB demodulators. Therefore the CV-157 can "lock" to a carrier and either introduce an artificial carrier of exactly the same frequency to the demodulators, or it can reintroduce the processed carrier to the same demodulators. This results in what is called "exalted carrier" reception which is nothing new in the history of radio. What is new, however, is the ability of the CV-157 to deal with different signal levels. For example the unit is designed to work with a pilot carrier which is 20 dB on average below the SSB, DSB or ISB level. This means that 100 watts of SB power can be synchronized to, and demodulated by, 1 watt of pilot carrier. Pretty impressive eh? I have found that a 30 dB reduction in carrier is still usable.



Top: R-390a
Center: CV-157
Bottom: Navy AM 413 D/G compressor/limiter amplifier

continued on page 31

Dayton HamVention, 1991

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

The Fortieth Annual Dayton HamVention is now history. This makes it fifteen years now that my brother Dean, KK1K, and I have made the trip. We met in Schenectady, New York, on the Wednesday before the HamVention. We left for Dayton at about 8:00 p.m. and drove through the night to arrive at Lima, Ohio, early the next morning. Contacts with amateurs in New England, a check-in to the 20 Meter Spam Net and notably a long early morning QSO on 40 meters with Gene, N8FSD, kept us moving. We were there when the doors opened at Fair Radio on Thursday morning. We collected some Command set parts for one friend,a schematic for another, connectors for a third , T-195 transmitter parts, a rare cable for a BC-654 and a few manuals for our own projects.

We arrived in Dayton in the afternoon, checked into our motel and went to the HamVention site to check out the whereabouts of our flea market spot. The weather was excellent and excitement was running high. One notable development this year in the flea market was the extensive tent-covered spaces. These more expensive spaces were preferred by the commercial vendors. Quite a bit of flea marketing activity actually takes place on Thursday between flea market sellers as they set-up, even before the opening at 8:00 a.m. on Friday.

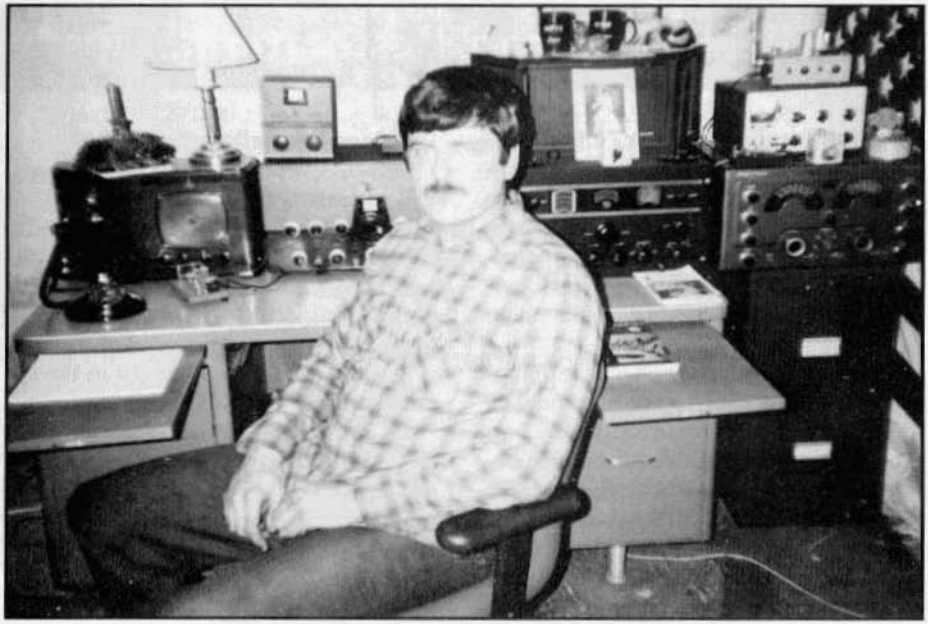
After a good nights rest, interrupted only once by the arrival of Don, K4KYV, we arrived at about dawn at the flea market to set up. The weather threatened as the morning wore on and eventually a terrific down-pore drove much of the crowd to the shelter of the tented-in spaces. The buildings were not available for shelter until the formal opening of exhibits at 12 O'clock. Friday afternoon the weather improved greatly,the crowd grew and Dayton '91 was well underway. Mid-afternoon I attended the Collins Users Forum. The room was packed and the temperature oppressive but the presentations were good and the interest level high.

Saturday was a great weather day and the flea market was packed. Probably the best selection of AM gear was brought by Parker, W1YG. A T-368 that he brought went the first day. There were quite a few 75A-4's and many 390a's, a few Rangers and Valiants and several DX-100's. The FCC forum late Saturday morning ran long, leaving little time for questions and answers. Unfortunately the FCC staffers could take no questions on the AM power issue because it was one of the topics listed that the commission is currently preparing a response for. The SPAM forum followed at 1:15. For the third year running there was standing room only with 60 to 70 in attendance. There were many familiar faces and even more familiar calls. The SPAM forum started with a discussion and survey on development areas for SPAM. [Results will be published later.] An updated "Meet the AM'ers" slideshow was shown, a brief video message from Barry, N6CSW/Ø, was played and Don, K4KYV, finished the program with a historical perspective and current status on the AM power issue. Saturday evening over a dozen AM'ers met for pizza in Dayton.

Sunday had a hazy beginning with activities starting late. Dean and I got on the road about 1:30 p.m. and drove straight through to Schenectady arriving about 12 hours later. The Dayton HamVention is a big push but it's a very rewarding experience. We are thinking of next year's trip already.

Stan Tajima, JA1DNQ/KD2HB, Yokohama, Japan, with some of his vintage gear. He is trying to start an AM net in Japan. (JA's take note). Stan also says that he calls CQ on 20 meters every Saturday and Sunday morning using his Ranger but so far the response has mostly been from stations operating SSB.

Bill Wysock, N6UXW, with his impressive collection of Collins gear.



Donald Boland, N1FYX, at one of his operating positions. He 's been a ham for five years and says that he has operated AM from "day one".

A gathering of AM'ers. From left to right: Bob , K7POF; Norm, W6CC; David, W6PSS; John, WA6ZJC; Jim, WD6EWE; Jim's XYL,Rosita and Rich, KF6EA. Ralph, KD6OS, was at the camera.

Collecting/Repair/Restoration...Tips

Cleaning Bandswitch on AF67's VFO

I kept putting off repairs on my AF-67's vfo for a long time because it appeared a can-opener was needed to gain access to the inside of the vfo compartment. Since access here isn't that obvious, the following might be of some help to other owners of the AF-67.

There are 5 Phillips head (self tapping) screws holding the vfo compartment to the chassis. When removed (from bottom of chassis) the bottom flat plate portion of the vfo compartment can be slid to the right and out of the chassis, thus exposing all of the vfo's innards.

The 2 shielded leads from the 'mic gain' control have their shield braids soldered to the side of the vfo cage and may have to be moved to make room for the vfo's bottom plate removal.

In addition to the vfo band switch, don't forget to clean the XTAL/VFO switch. The tuning and trimming condensors' rotor grounding straps should also be cleaned and lubed.

Chester E. Ksen, W8VQL

Moisture Absorption In Old Xfmers

Unless a vintage (as in 40 years old, or more) transformer was hermetically sealed by design, it should never - according to a design engineer I've communicated with - be trusted in anything approaching a high-voltage application.

To at least minimize (but no guarantee!) the potential for disaster due to long-term moisture absorption in any unit other than the hermetically-sealed type, the transformer should be "dried" in a conventional oven at 225 degrees F. for three to four hours.

Eddy Swynar, VE3CUI

PTT Mod For Hallicrafters HT-37

This mod allows for both VOX and PTT operation.

1) Replace the standard mic jack with a 2 conductor type.

2) Run a wire from the new mic jack to the terminal strip side of the 200 ohm resistor R 51 located off pin 3 of V15B.

3) Place a .01 bypass cap from the terminal strip side of R51 and ground.

4) Connect the center conductor of the mic cable to the other pin of the mic connector.

5) Connect the ground braid of the mic cable to the ground terminal of the CW jack, located next to the mic jack.

Steve Carson, KE4MN

Replacement Driver Transformer For Johnson Viking II

A new replacement transformer for T3, the audio driver of the Viking II, can be obtained from Antique Electronics Supply of Tempe, Arizona. It works well, is almost an identical size as the stock transformer and is rated at 40 ma which should make it suitable for the KT2L modification (see ER issue #9). The part no. is PT-20D89 and the price is $12.95.

Ron Skipper, AD8AD

I THOUGHT YOU SAID THESE OLD VACUUM TUBE RIGS WERE MORE FORGIVING OUT OF RESONANCE!

AM FREQUENCIES

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

Source of Strange Digital Signal in 10 Meter Window Found

In last months ER, Rick Miczak, K8MLV/Ø, reported that he had tracked the spurious output that occurs at 29.015 to a "strange digital" operating on 17.410. Recently I received word from the Grand Island, Nebraska, monitoring station that the station operating there - and creating the interference - is a U.S. Airforce over-the-horizon radar facility that is located in Moscow, Maine. They are actually transmitting on 17.409. Apparently, this facility is also interfering with other government services. Case closed. **N6CSW/Ø**

17 Meters Anyone?

I received the following from Warren, K2LXW:

Barry, I have been trying to stir up some AM activity on 17 meters. Since the first week of April I have called CQ on 18150/18156 at 2000 UTC each day. To date I have been heard by K7LEH, Bob, in Tucson, Ariz. but I could not hear him. The only contact so far has been with Ira, WA2OAX. He is only about 25 miles from me. I will be on these frequencies at 2000 UTC each day (Viking II, NC-183, G5RV); hope someone will join me.

Thanks for the reminder Warren, I'll try to meet you on 17 in the near future. N6CSW/Ø

15 Meter Contest, Weekend of June 15 and 16

The contest will start at sunrise (at your QTH) on June 15 and end at sunrise (at your QTH) on June 17. The rules are simple - the same as other ER contests - but the logging requirements may be somewhat more detailed.
Here are the rules:

1) The contact must be with another station operating AM - at least for the time required to exchange information.

2) There will not be extra points for DX stations. All contacts count for 1 point only.

3) The contest log you submit must contain the following information: time of contact, call sign, name (first name ok), QTH, transmitter used (HB or name and model) power output, antenna, signal report - rec'd and sent.

4) The logs must be submitted to ER no later than June 30.

I hope this contest will lead to more activity on this band. For some reason we always 'talk' about operating more on 15 meters but we never do. Now that 10 is dead (or almost dead) for the summer let's all move to 15.

As I suggested last month it might be best for us to operate above 21.400. That way we will at least know where to look for each other. **N6CSW/Ø**

LETTERS

Dear ER

I recently attended what has been called the biggest Hamfest in Canada, namely, "The Durham Regional Amateur Radio/Computer Flea Market". The past 11 years have seen attendance rise to some 1500+; unfortunately, this was the first year that vintage AM equipment was absolutely conspicuous in its absence! It would appear - sadly - that the availability of classic gear is finally beginning to run dry here in Canada, as well as in the U.S.A.

I saw absolutely no Rangers, no Johnson Matchbox's (now that's a first!) and no Vikings. Oddly enough, there were two Johnson 122 vfo's, one of which was snapped up rather quickly because of its $5 asking price. A mint-looking Collins R-390 had a tag of $300 on it. There were also two Hammarlund HQ-110 receivers, on sale as a pair only (one strictly for parts) for $80.

Nothing at all like in days gone by! I feel rather bad about it, because AM fan W2PFF, was convinced by me to make the 2-3 hour trek from Lancaster, New York, only to be (I'm sure) disappointed upon his arrival.

The smaller Canadian Hamfests - for whatever reason- still seem to bring out the older units, hower. It was at the St. Catherines, Ontario, event three months ago that I saw good-looking, clean HRO-50 and NC-300 receivers side by side - $150 each- and a mint Harvey-Wells transmitter/vfo/ps combo begging for $70 (no takers). The Brampton, Ontario, swap had a clean Viking II ($25) and an AR-88 ($100). This past weekend, I visited the Harwood, Ontario, Ham Auction, and saw a Ranger I going for $75 (no sale).

Eddy Swynar, VE3CUI

Dear ER

Well it was far from Dayton in many respects, but the impromptu Swap Meet in Albuquerque on April 27 was certainly noteworthy.

The statistics are not particularly impressive, perhaps two dozen sellers circled their wagons, trucks and cars in the Foothills Shopping Center parking lot and maybe a hundred or so people showed up. But the fellowship and goodies were well worthy of any hamfest.

First the goodies. I personally acquired QST for the years from 1938 to 1942 for $2; eight 6146's, two 807's and five 6L6's for 50 cents each; two 150 ma power supply chokes, a universal audio output transformer and a 500 vct 200 ma power transformer, all for a dollar; four microphone cords with screw-on Amphenol mike connectors for a dollar; an old TRF tuning capacitor suitable for that '10 Hartley I'm collecting parts for, for fifty cents; the tuning capacitor, PWO drive and the clips that make connection to the sliding coil rack from an NC100A (my NC-200 has several repaired clips that these will back up) for a dollar; a pair of E coils and several extra coil sleeves from an FB7 for a dollar (for Marty, AA4RM); about 50 feet of four conductor cable for free; a BC-375 tuning capacitor with nice wide spacing and at least 150 pF for four dollars; and best of all a Heath SB200 linear in good shape for two hundred bucks.

Also seen, but not acquired, were a Swan 350 for a hundred dollars; a Drake L4B for six hundred; several other small sweep tube linears - price unknown; a Central Electronics 100V for forty dollars; a Hallicrafters S40 and S38D that went as a pair for thirty-five dollars and lots more stuff like two and six meter beams and verticals, wire antennas, a whole bunch of HT's, test equipment, scopes, multimeters, FM alignment equipment, other components, Robot Slow Scan gear, satellite receivers, a prop

pitch motor, a Hallicrafters S41W, a 75S1, a Drake TR4 and on and on.

And then there were the folks. Even though I've only been out here about a year and a half, I've met a lot of the locals and they are very friendly. Obviously, I had a good time. And I got to park in the lot about 80 meters away from the action. I'll miss Dayton, but I sure am enjoying what's out here.

The next bash in Albuquerque is the Hamfest on August 17 and 18. It will be much larger, better organized and indoors. Maybe you'd like to come.
Jim Hanlon, W8KGI/5

Dear ER

I really resonated with the letter by Gerald Parker, KØGPX (ER, April 1991, p. 21). It is a fine letter, which captures the spirit of what ham radio used to be about. I sure wish I had enough space in my shack to set up multiple vacuum-tube stations like he does. In my storage shed I have lots of stuff, gathering dust, left over from the vacuum-tube era.

I decided to bring some of this material back to life. Although I confess I'm a "state-of-the-art" appliance operator with my Kenwood TS-940s, I've discovered that one can still put out an equally good signal on CW by homebrewing out of the junk box. I get a kick out of building breadboard replicas of CW stations of the thirties and forties.

For signal quality, crystal control is a must. A key-click filter will probably be needed. If you restrict operation to 160 or 80 meters and feed the transmitter into a 50-ohm load through the usual low-pass filter and/or transmatch, TVI should not be a problem. I never run more than 100 watts input, usually much less. I live in a TV fringe area. A TV set one foot away from the transmitter shows no interference from 80-meter operation. Forty meters and higher? Proceed at your own risk!

My homebrew nostalgia receiver is a two-tube regenerative job, also on a breadboard. I use a 6K7G detector driving a 6V6 audio stage. However, many other tube combination will work. Go back and review the literature of the thirties and forties - a nostalgia trip in itself!

Here are some tips for making a good regenerative receiver. Use a metal panel. It and all other circuit grounds should be at earth potential. This will reduce body-capacity effects and possible AC hum. Choose a variable-mu pentode for the detector--regeneration control is smoother. Use regulated voltage on the detector plate and screen. Many old-timers solved this problem by using batteries for power. My receiver is powered by an AC supply, using a VR-75 to regulate the detector voltage.

For the receiving antenna I use a separate random wire. This avoids signal suck-out resulting from antenna resonance close to the received frequency. This approach also avoids the need for antenna switching and lets you use full break-in on CW, assuming you key your crystal oscillator, as I do.

Don't expect the regenerative receiver with its one tuned circuit to approach the stability and selectivity of a superhet. However, its sensitivity is truly amazing. Also, don't get rid of your state-of-the-art transceiver, which can serve as an excellent frequency meter for your nostalgia equipment.
Donald F. Meadows, N6DM

I received the following letter from Marc Guitard, WA4IRE, who has just embarked on his first voyage as a radio operator. Marc is a well-known AM'er who is most active on the 14.286 SPAM net.

Dear Barry:

I am presently aboard a military Sea lift vessel heading for Singapore and the Mideast. We are transporting ammo and I am unable to use my ham radio gear

continued on page 31

The R390a Receiver: A Milestone in HF Communications

by Ray W. Osterwald, NØDMS
10679 West Dartmouth Ave.
Lakewood, CO 80227

PART TWO

Since last month's issue of ER, a few more facts have come to light regarding R390a production history. Sam, W8KBF, wrote and mentioned that he has an R391 receiver from the first order, which I listed as being produced in 1951. The R391 is an autotune version of the R390, which was produced for only a few years. I got my original information from an Army book listing modification work orders to the R390a, and I was in error assuming that the 1951 contract number referred to the R390a. Production began in 1954. Also, I ran across yet another production contract. The following data, which came from an I.F. sub-chassis, may be added to the previous list:

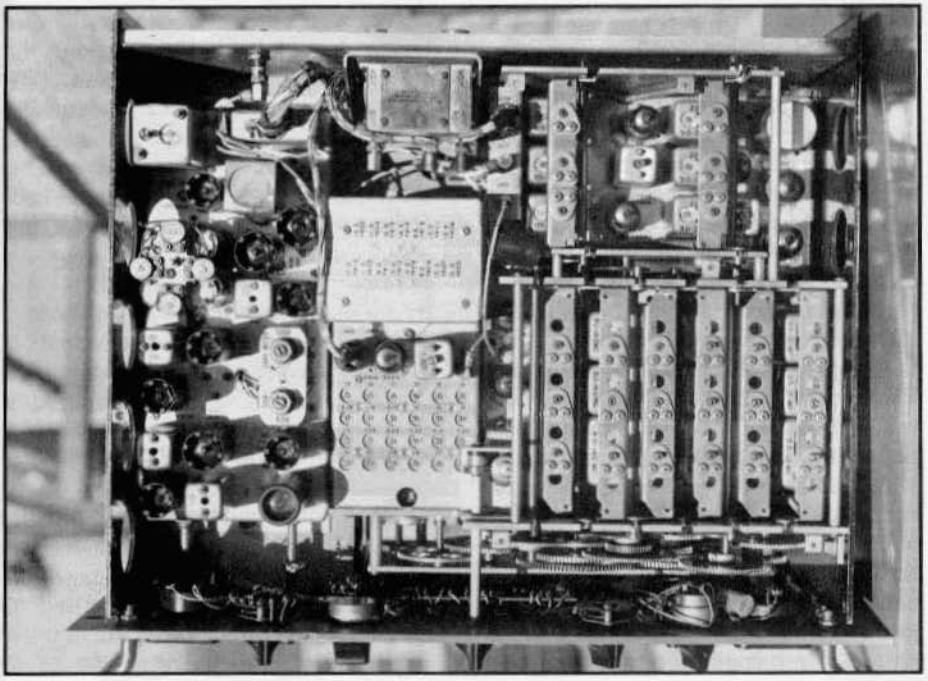
1959, Stewart-Warner, 42428-PC-59-Al-51

Michael, KK7F, wrote to mention his 1967 R390a. It has a very high serial number, 6278. Probably I have under-estimated the total R390a production figures, as I have recently received an I.F. subchassis from this same 1967 order with a serial number over 10,000. He also mentioned that he uses a CV-157 SSB converter which weighs over 100 pounds and has 44 tubes. This unit uses an accurate electromechanical phase-locked loop that does very well eliminating drift and distortion.

I've had a very pleasant conversation with Mr. Ed Andrade, WØDAN, who was a Collins design engineer in those exciting years of the early 1950's. He went on to design the 5-Line receiver, and is personally responsible for the up-conversion schemes used today in imported transceivers and commercial gear. Mr. Andrade's contribution to the R390 and '390a was in the engineering of the diversity combiners. This turned out to be a system of two six-foot racks with two R390a's, power supplies and the combiner, which received AVC levels and "voted" on the receiver with the strongest audio, which was then routed to the operator.

He had some interesting comments about the development of the R390. Lou Couillard - who passed away recently - was the project leader. He was aided by mechanical engineers Bob Griswold and Winston Williams. Ed Houge was the engineer in charge of the R390 electrical design. Mr. Houge designed the 513 receiver, and the R390 evolved directly from the work done on that series. I asked Mr. Andrade if Art Collins had any specific direction in the development of the R390, and he replied:

"I don't think he was all that interested in it, really. He was off thinking about ham gear at that time. I think, well it was a little later, he got very involved with getting single sideband going, in fact he had the signal corps just mad as hell at him because they'd come out with a contract, and we were already working on it, for a mobile HF system. He stopped it right in the middle of it, and decided it was going to go single sideband. They were about ready to sue him, but he got the idea across. He started working with General LeMay and Butch Griswold. That was the time that he really got the kWS-1 and the 75A-4 going, which were the radios on those flights



Collins R390a, top view

they took around the world in the early days of sideband and made a believer out of all of them. So sideband really got going. Of course he didn't invent it, it had been around for a long time, and again a lot of things came together at the right time. Mechanical filters and some very stable VFOs for the time and that made it possible to make a useable system that didn't take sixteen relay racks of equipment."

I mentioned I had heard that the Amateur Products Division didn't really make much money for Art Collins, and Mr. Andrade replied:

"No, but there were plenty of spinoffs that came from it. That was the real benefit of it and he knew that. Ham stuff always got a lot of attention, personal attention. He couldn't stand a three-day weekend. There were always some of us on call, somewhere. He'd get bored and start inventing."

Mechanical Description

The mechanic's portion of the R390a is in a word, complex. Please do yourself a favor by not attempting any major work on the tuning system without the technical manual. This is not meant to imply that service in this area is beyond the abilities of the average person, because it is not. You will just not be able to get it back together in operating condition!

The RF gear train assembly is made up of about 32 gears, 16 cams, two 10-turn stops, a differential, an overtravel coupler, and an intermittent gear, plus couplings, clamps, spacers, etc. Watching all of this in motion is similar to watching a steam locomotive, but I haven't yet found a boiler in the R390a!

The tuning system is typical quality Collins mechanical engineering, and is decended from Ted Hunter's (WØNTI) wartime PTO design work in the AN/ART-13, TDO and TDH Navy transmitters. It provides for continuous, linear

continued next page

Collins R390a from previous page
tuning from 500 Kcs to 32 Mcs in 32 1 Mc. bands, except for the first band which is 500 Kc. to 1 Mc. It is resettable from a cold start to within 200 cycles! To accomplish this feat, not only must the proper coils and transformers be selected at the right time, but the coil slugs must move up and down at the proper rate. As an example of the precision required to tune just the 500 Kc. to 1 Mc. range, the slugs in T201 (R.F. grid circuit) and Z201 (R.F. plate circuit) move .8 inch, their entire motion. At the same time, the slugs in Z213 (1st mixer plate circuit) move .05 inch to cover this range. This is accurate, repeatable, and controllable with a single knob, yet the coil slugs were not hand-selected during production!

The gears which drive the camshafts, the ten-turn stops, and the pinion gears on the differential are split, spring-loaded gears to eliminate backlash in the tuning system. The cams which furnish motion to the slug racks have rollers at each end, and identical cams at each end of the cam shaft. Both the kilocycle change and megacycle change knobs are connected to a common differential.

The digital readout can be set between 0 and 500 Kcs., and the VFO tunes over this range, but there are no front end coils for the L.F. spectrum. The stock R390a won't receive in this range.

Rotation of the megacycle change knob is limited by a 10-turn mechanical stop and a detent. Each stop position selects the first two digital counter positions, corresponding to thousands of kilocycles. Each rotation picks one of 32 2nd crystal oscillator switch positions, and one of 7 RF bandswitch positions. The RF bandswitches and the first mixer bypass switches are operated through an intermittent gear (it only moves its mating gear sometimes) and an overtravel coupler. Through the differential, all the slug racks are brought into proper position, except for .5 to 1 Mc, 1 to 2 Mc, and 2nd V.I.F. racks. Rotation of the kilocycle change knob is continuous, but limited by another 10-turn stop. Through this stop, the knob is coupled to the PTO, to the 2nd variable I.F. slug racks, and also to the 500 Kc. to 32 Mcs. antenna and RF circuit slug racks. As it is connected to the differential, the kilocycle change knob controls movement of all of the 1st variable I.F. slugs. The 1st V.I.F. slugs are pre-positioned at a starting point selected by the megacycle change knob. The kilocycle change knob is directly coupled to the last three digits of the counter, and it reads out in kilocycles and hundredths of kilocycles, with some overlap at each end. At this point, I hope I don't have to mention that this is a mechanical digital display!

Via a clutch, the zero adjustment control on the front panel disengages the gear train from the PTO, and the PTO may be set over about a 15 Kc. range to accurately calibrate the receiver.

SERVICE HINTS

When removing and replacing the VFO or the R.F. sub-chassis, the Oldham coupler which connects the PTO to the turns counter must be removed. On replacement, loosen the triangular mounting plate at the rear of the PTO for a little extra working clearance. It also helps to get a few extra anti-backlash springs from Fair Radio Sales. A GC Electronics spring hook tool saves deforming them.

The front panel must be removed for restoration work, or for removal of the crystal oscillator or R.F. sub-chassis. This procedure only takes a few minutes once learned, but there are a few tricks to make it easier. Most all of the shaft clamps and setscrews on the front panel controls are sealed with lacquer. A little acetone usually loosens it up, and a #8 Bristo wrench fits all of the clamp screws in the receiver. (Bristo wrenches are available from GC Electronics, or from the Bristo Division of American Chain and Cable, Bristol Road, Waterbury CT.

06720) Once the Mc., Kc., and antenna trimmer knobs are off, use some #600 grit wet sandpaper to smooth the shafts out. This is done to avoid scoring the panel bearings, and it makes panel removal easier. The location of the clamps which hold the front panel wiring harness varies. Having them free makes front panel removal much easier. On replacement, be sure not to pinch the wiring harness between the front panel and the mainframe. Set the mainframe on a short piece of 1X2 lumber to allow clearance for the front panel to drop down. When re-installing the front panel, be sure the 3 panel bearings are clean. Loosen them with a spanner wrench, reinstall the panel, tighten up the 8 screws on each side and then lubricate and tighten the panel bearings. This makes the tuning shafts 'ride' free, and avoids some of the binding common in un-restored receivers.

When removing the R.F. sub-chassis, first loosen the right side mainframe panel for additional clearance. A Phillips head screwdriver with a 6 inch shank will be needed to reach the captive head screws at the rear of the R.F. and crystal oscillator sub-chassis. Also be very careful and lift the chassis straight up, as the shielding fingerstock underneath it is easily damaged. Replacement fingerstock may be ordered from Fair Radio Sales, or in lengths from Instrument Specialties Co., Inc. in Delaware Water Gap, PA, 717-424-6213. Remove the crystal oscillator and the R.F. subchassis as a single unit.

Proper cleaning and lubrication is vital to smooth operation and avoidance of the dread 'R390 wrist'. I was fortunate to have access to an ultrasonic cleaning machine where I once worked, and I disassembled the gear train and cleaned each part. It may not be necessary to go to this detail, but bearings, journals, and sliding surfaces need to be clean to work properly. Flush cleaning is OK if compressed air is available to blow out all the old gunk, but do not use a cleaner which gets into the bearing metal, such as trichlor. I use a watch rinse solution made by the L&R Manufacturing Company in Kearney, N.J. 07032. Your local watchmaker may also be able to get you some. Using a GC Electronics syringe, put a little rinse on at a time, work the bearing and journal, and then blow it out. As for an air supply, I found an old but operable Sears compressor at a garage sale for $25. The rinse solution is also good for cleaning chassis parts if used sparingly, but do not use it on, or allow it to come into contact with electrical parts.

I lubricate all the R390a bearings and camshaft rollers with a special synthetic oil which is impregnated with Teflon called "Trick Super Oil", and is available from PBL, Box 749, Chama, New Mexico, 87520. Some hobby shops may also have it. This stuff is specially made for bearing-journal surfaces, has superior lubrication properties, and stays where you put it. For the sliding surfaces, I use DuPont "Super Lube", which is Teflon in another synthetic compound. I do not lubricate any gear teeth except for the intermittent gear, which gets Super Lube. Also put some Super Lube on the megacycle change detent. When lubricating, check the cam rollers for damage. If they are deformed they will do more sliding than rolling. Also, if performing lubrication with the R.F. sub-chassis installed, be careful when cleaning around Z213, as the rear section of the bandswitch is directly below the chassis cutout. I don't use Lubriplate, as it works good for a short while, then dries out.

At the limiter, V507, use only a 5814W and not a 12AU7, as it produces much less distortion and harder limiting action.

Get a supply of IREC black tube shields from Fair Radio Sales. These are modern shields, designed for maximum thermal transfer, and really work fine.

continued next page

They increase tube life 20-30%, and save on scorched fingers, too!

The VFO end point adjustment procedure in the technical manual is very hard to follow. I use an alternate method which is given below:

1. Remove the VFO sub-chassis and then remove the cover plug over the end-point adjustment at the front. Replace the VFO.

2. Set the mainframe on its wooden block, set to 5 000 Mc., and remove the front panel. Replace the Kc. change knob. Check that one of the 3 holes in the riveted locking plate lines up with the end point adjustment screw when the dial is set to 5 +000. If it does not line up, loosen its clamp and align it. (A flashlight with a bright, thin beam will help here.) Be sure to re-load the gear by one tooth, and then tighten the clamp screw. Set the receiver on its right side panel, being careful not to damage wiring or the front panel, as they will still be loose. Get a cup of coffee and allow the receiver to warm up at least 3 hours.

3. Re-tune to 5 000, loosen the clamp holding the VFO shaft coupler, and zero beat with WWV at 100 cycle I.F. bandwidth, using the free end of the VFO shaft. Tighten the VFO shaft coupler. Zero beat the BFO against WWV. Perform the calibrator zero adjustment.

4. Tune back to 5 +000. Loosen the VFO shaft coupler. Turn on the calibrator and zero beat the VFO against the calibrator. Tighten the VFO shaft coupler.

5. Re-tune to 5 000, and again zero beat with WWV, but use the end point adjustment this time. You will need a thin, straight blade screwdriver with a 6 inch shank to reach the adjusting screw.

6. Repeat steps 4-5 until the desired dial accuracy is obtained, or until you can't stand it any more.

7. Reassemble the receiver and enjoy.

PERFORMANCE DATA

The following tests were performed with military test equipment (calibration was checked against recently calibrated labquality equipment) on a stock 1956 Motorola '390a. All the tubes were checked, and a complete mechanical and electrical alignment was performed. The test frequency was 14.100 Mcs, and each test was performed three times to verify the results. These numbers are nothing less than amazing for a receiver designed forty years ago.

1. Total harmonic distortion: 6.2% (4 Kc bandwidth, 1000 uV RF input, modulated 30% at 400 cps. Each audio channel was terminated in 600 ohms.)

2. BFO distortion: 9.6% (same conditions as above except 100uV RF input)

3. Noise Floor: .14uV (-127 dBm) at 2 Kc bandwidth, and .013uV (-147 dBm) at 100 cps. bandwidth. (Noise floor is defined by the signal level required to produce 3 dB gain over the no-signal noise level.)

4. 10 dB S/N ratio: .44 uV (-117 dbm) at 2 Kc bandwidth.

5. AM sensitivity: 1uV.

6. Blocking dynamic range: 72.1 dB (With 2 Kc. bandwidth and 20 Kc. signal separation, a test frequency signal level of 2.5uV., 1 dB gain reduction was reached at -54.9 dBm, or 400uV.)

7. 2-tone, 3rd-order dynamic range (spurious-free dynamic range): 52.7 dB (at 10 Kc. signal separation, 2 Kc I.F. bandwidth. IMD level was -49 dBm. This is worst-case and would be higher if measured at the ARRL lab standard of 20 Kc. signal spacing)

8. Power supply ripple: .012%

Stability

(All stability measurements were made with the ovens switch "off", and the receiver out of its case)

Short-term stability: From a cold start (measured with the BFO zero-beat with WWV at 10 Mc) to +1 hour, beat-note drift was +210 cps after 20 minutes, then

continued on page 31

Audio Modifications For The Eico 730 Modulator/Driver

by Stephen Ickes, WB3HUZ
7555 Rainflower Way
Columbia, MD 21046

The Eico Model 730 Universal Modulator/Driver is a versatile unit that can be easily modified to produce high quality audio. The unit is small (6" x 14" x 8") and weighs 21 pounds. The 730 is capable of producing up to 50 watts of audio making it an excellent modulator for any of the 50 to 100 watt CW only rigs produced in the 1950's-60's, like the Viking Adventurer, Viking Navigator, Drake 2-NT or the controlled carrier transmitters like the Heathkit DX-35/40/60 series. The 730 has a multi-impedance secondary allowing proper matching to different final amplifier plate impedances. The unit would also make an excellent driver for a high power Class B modulator.

My interest in the model 730 started many years ago. After receiving my novice ticket, I obtained my first transmitter, an Eico 720. The 720 is a crystal-controlled, CW transmitter with a single 6146 final amplifier. Not long after, I learned that Eico made a modulator that could be used with the 720. After consulting with the "Ham Equipment Buyers Guide Volume I" (an excellent source of information on vintage equipment published by the Ham Trader Yellow Sheets), I learned the specifics of the model 730. Since I wanted to get on AM when I upgraded, I began looking for one. In my

continued next page

The author and his vintage equpment. The Eico 720/730 are on the right hand side of the desk next to the R4C receiver.

Audio Mods for Eico 730 from previous page

SWLing I heard very few of these units on the air. I thought the 720/730 combination would be unique. I eventually found one (although it required some restoration), and I also found an Eico model 722 vfo to complete the line-up.

The Eico line-up is good for 60 to 70 watts input on 80 - 10 meters, is small and compact and offers the flexibility of separate units, Since the units are kits, the construction and wiring is simple and the chassis are roomy, allowing easy access for modifications and repairs. After studying the model 730 schematic, several modifications were apparent. Several less apparent modifications were given to me by KS3K, Ed. I've included all the modifications.

Figure 1 is the original schematic of the model 730. The stages or components modified are highlighted. The modifications are listed in order of most noticeable affect on audio to the least noticeable. I recommend performing 1 and 2 as a minimum. The exception is modification number 7. This modification does not effect the audio but should be performed at the preference of the owner.

1. Clipper/Filter Stage

Break the circuit at points X and Y and then connect these two points with a jumper. Also disconnect all leads to R9 the clipper adjustment pot. This pot can be used in place of R 27 to control the amount of negative feedback - more on this later. The 6AL5 clipper and lowpass filter stages are completely bypassed. This modification removes a useless source of distortion -the clipper- and improves the high frequency response by removing the lowpass filter from the audio chain.

2. Coupling Capacitors

Change C2 and C3 to 0.05 - .1 uF. This modification improves the low frequency response.

3. Coupling Capacitors -2

Change C8 and C9 to 0.1 uF. This modification further improves the low frequency response.

4. Grid Bypass Capacitor

Change C16 (0.001 uF) to 330 pF. This modification improves the high frequency response.

5.Negative Feedback Loop

Change C7 to 0.2 or 0.25 uF. This change increases the amount of negative feedback at low frequencies. The negative feedback decreases the amount of distortion at these frequencies and further flattens the frequency response. Although it may not always be necessary, R27 (10 K) should be replaced with a potentiometer. A pot will allow the amount of negative feedback to be controlled. This setting may need adjustment when new output tubes (EL34's) are installed. The now unused R9 (50 K pot) in the clipper stage can be wired in place of R27. This modification allows front panel control of the amount of negative feedback.

6. Microphone Input Grid Resistor

Change R2 to 4.7 - 10M ohms. This change will provide a better impedance match for a crystal microphone. A better match improves the low frequency response of the microphone. If you plan to use a dynamic or electret microphone this modification is not necessary.

7. Microphone Input Coupling Capacitor

There is no coupling/blocking capacitor on the microphone input (grid of V1, pin 2). About minus 0.5 -0.6 volts is across the microphone jack. This voltage is not harmful to most crystal microphones but may be to other types. If this condition is objectionable, install a 0.2 or 0.1 uF capacitor at the microphone input as shown in Figure 1. (See Cmc)

I've performed modications 1 - 5 on my 730. I have received many compliments on the quality of my audio. The modications are simple and easily implemented.

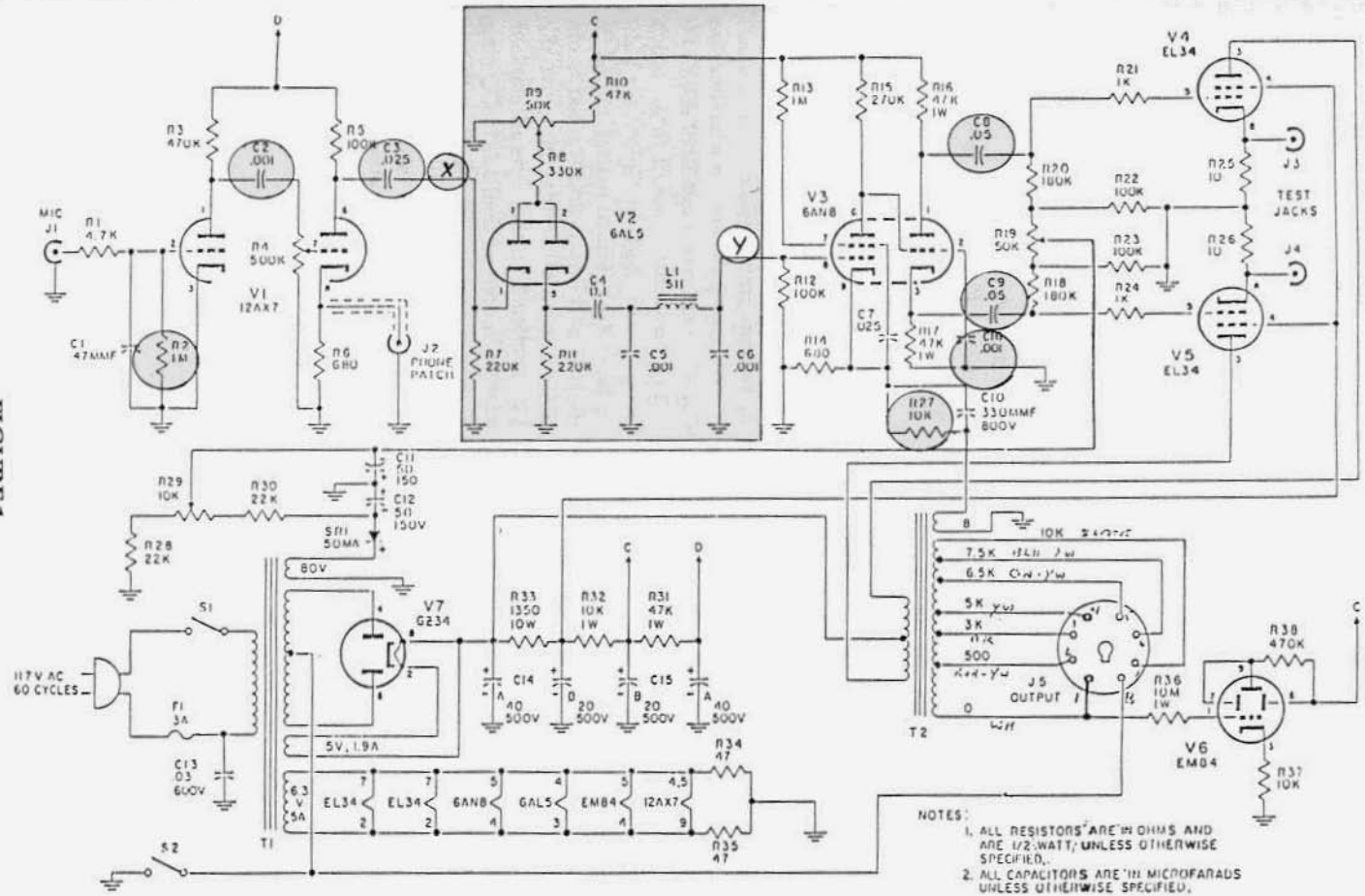

MIC J1
R1 4.7K
R2 1M
R3 47UK
R4 500K
R5 100K
C1 47MMF
C2 .001
C3 .025
V1 12AX7
R6 680
J2 PHONE PATCH
R7 220K
R8 330K
R9 500K
R10 47K
V2 6AL5
C4 .1
L1 5H
C5 .001
C6 .001
R11 220K
R12 100K
R13 1M
R14 680
R15 270K
R16 47K 1W
C7 .025
R17 47K 1W
C8 .05
C9 .05
C10 .001
C10 330MMF 800V
R18 180K
R19 50K
R20 100K
R21 1K
R22 100K
R23 100K
R24 1K
R25 10
R26 10
V3 6AN8
V4 EL34
V5 EL34
J3 TEST JACKS
J4
R27 10K
R28 22K
R29 10K
R30 22K
C11 50 150
C12 50 150V
SR1 50MA
80V
S1
117V AC 60 CYCLES
F1 3A
C13 .03 600V
V7 GZ34
R33 1350 10W
R32 10K 1W
R31 47K 1W
C14 A 40 500V
C14 B 20 500V
C15 B 20 500V
C15 A 40 500V
5V, 1.9A
6.3 V 5A
EL34
EL34
6AN8
6AL5
EM84
12AX7
R34 47
R35 47
S2
T1
T2
7.5K
6.5K
5K
3K
500
J5 OUTPUT
R36 10M 1W
R38 470K
R37 10K
V6 EM84
NOTES:
1. ALL RESISTORS ARE IN OHMS AND ARE 1/2 WATT, UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITORS ARE IN MICROFARADS UNLESS OTHERWISE SPECIFIED.

FIGURE 1

Getting Back on AM Phone from page 13

they couldn't understand a word I said. I had a hunch that the Ranger transmitter didn't like anything to do with transistors or anything solid-state.

So back to my old QST's and CQ's. In one issue I found a schematic for a tube type modulator using a 12AX7 dual triode for the input amplifier, which I promptly built. (Not really 'promptly', it took me over eight hours, using parts from my junk box). For the power supply, I built a full wave rectifier using a 6X4 dual diode. No modern rectifiers for me. I didn't think the Ranger would go for them. My microphone per-amp put out anywhere from zero to ten volts audio, fully adjustable, when using my D-104. I set it for one volt out.

I tuned the rig to 3870 kcs and anxiously awaited for 9 p.m. to arrive, when I know a group of AM'ers get on the band every night. After a final tune up, I quickly double checked the scope - 100% modulation on a whistle. Right on!

I let the guys talk for ten or fifteen minutes before I broke in.

"N7NV"

"Go ahead NV"

"Yeah. I've been listening to you guys and I decided to get back on AM after being off it since 1953." I signed over.

He came back. "Well I'll be. I hear it's pretty hard for some people to come back onto AM. How was it with you? Over."

"Not too bad", I answered. "A few technical problems, but I made it back ok. Over"

" Well. I'll be darned. Gone since fifty-three huh?"

He paused a few seconds, his carrier still on because he didn't use VOX. "Welcome back, John."

My very next project is to get another receiver so I can get on ten meters. Then I can start operating ten meter AM where I left off in 53'.

Editor's comments from page 1

Regarding the AM Power Issue: We still have time to call or write our representatives or in fact the President. This is probably our last opportunity to do something to restore our historic power levels. As I've said before, one of the points we should pass along to our respresentatives and others is that the FCC decision to reduce our power causes hardship to us vintage operators/collectors with absolutely no benefit to anyone else. You might add that Canada has not seen fit to change their regulations nor has any other country to my knowedge. Please take a minute to write a letter or make a call.

I've received a lot of information regarding the 75A-4 survey I proposed a couple of issues back. People have been sending in information and questions that they would like to see on the survey. One letter I received contained the following comments:

"concerning the grey (not hammertone) 75A-4 pictured on page 12 [ER #22, Feb. 1991]. I also have one of these which I believe were made by Collins for Eldico of New York. Eldico manufactured SSB exciters and linears and wanted to offer a Collins receiver that matched their paint scheme. In fact, I recall one being pictured in one of their ads in CQ magazine? Someone told me that Eldico's president had some pull with Collins Company officials and had these made. My unit has no serial number although it seems to be a late model with full filter compliment. I have never heard anything about these grey units being made in Canada, but am certainly interested in knowing the story on these "Grey Ghosts"! Shel Rubin, KT2L

I've heard from a couple of other people who also have grey 75A-4s. I guess there were a few painted this color. And of course there are quite a number that are painted military colors as well. We'll get all this info into a future issue....on to #26

R390a from page 26

back down to +140 cps after an hour.

From cold start to +20 minutes, the calibration oscillator, 1st crystal oscillator, and 2nd crystal oscillator drifted no more than +2 cycles! The cold-start drift in the BFO was no more than -50 cycles, therefore most of the short-term drift is due to thermal instability in the VFO.

Long-term stability: After a one-hour warm-up, a frequency counter attached to the VFO revealed no more than +260 cycles of drift. After a three hour period, drift was no more than +75 cycles. After warming up for 2 days, the counter showed no more than +1 cycle drift in the VFO in three hours and the BFO stayed zero beat with WWV at 10 Mc. within +-5 cycles for three hours.

At this level of stability, its hard to tell what is drifting, my 35 year-old receiver or my solid-state counter!

Next month Part Three

CV-157 from page 14

Now what is the use of such a device for AM phone as we exercise it today? I don't know exactly. I believe the FCC frowns on pilot carriers for T-R synchronization, but there is a VOA station around 19,260 khz doing just that. They transmit a 20 dB reduced pilot carrier with English on USB and a foreign language on LSB. I have occasionally found a leaky sidebander down on 20 meters (maybe running an old HT-37 with the phasing out of adjustment) and have locked on to him. He sounds perfectly natural - a pleasure to listen to.

Historically, (and I am not sure of this) the CV-157 was designed and prototyped by Hoffman Labs. I have an 8 1/2 by 11 glossy of their prototype with a serial # of 1 on the front ID plate. Back in those days, Hoffman was in competition with Collins and others for military contracts. I believe they got some, but in the area of high powered Navy HF transmitters, HF vertical antennas and VLF receivers. They did design and prototype a receiver similar to the R-390 and SP-600 with 2 Mhz bands, an extravagant noise limiter, and a slide-rule dial similar to the 51J, but I have never heard nor seen one in real life.

I think that about wraps it up concerning the CV-157. The rest, I'll leave to the imagination of those who already possess such a unit, or to those who may in the future possess one after reading this introductory article. I wish you all luck.

Letters from page 21

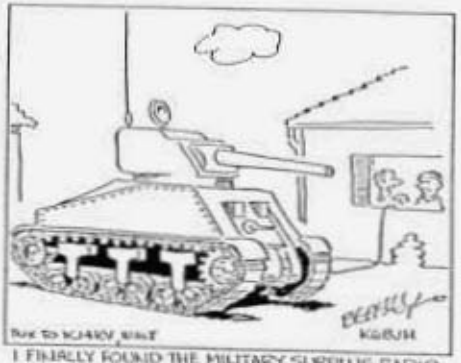
while we are at dock here in Pearl Harbor as RF emmissions may trigger an explosion. I hope to have my ham station operational upon departure 5/18/91. Give my regards to K6HQI and the rest of the gang on 20 meters.

I will send you pictures of the vessel I am on and it's radio room. By the way the station is equiped for AM operation and has a linear amplifier.

Marc Guitard, WA4IRE

Editor's Comment:

I think there's a good many of us that would like to be in Marc's shoes. Didn't we all want to be radio operators at one time or another? Good luck Marc.



I FINALLY FOUND THE MILITARY SURPLUS RADIO I ALWAYS WANTED, BUT I HAD TO BUY THE ENTIRE MOUNT TO GET IT

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FOR SALE: New catalog of old books on wireless/radio is now available. Send $.50 (stamps) to: Rainy Day Books, POB 775, Fitzwilliam, NH 03447.

FOR SALE: Collins 32V-3 transmitter, excellent condition w/spare 4D32 tube, local pickup - $300. Bob Anderson, 428 Central Ave., Milton, MA 02186. (617) 698-9337 nites.

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: Tubes, new in box. Please send $1 for list of 300+ tubes. Refundable. Wilson Hauck. BTB. Inc. E.R., 6820 Stout Rd., Memphis, TN 38119

FOR SALE: RCA tube, Supreme Radio-TV manuals. ARRL and "Radio" Handbooks. Allied, Neward catalogs. Send #10 SASE for list and prices. Charles Simmons, W6PDH, POB 6238, Buena Park, CA 90622. (714) 994-6843

FOR SALE: Parts by mail since 1954. Vintage parts available. Send stamp and request "Vintage Flyer". USA only. Bigelow Electronics, Box 125, Bluffton, OH 45817.

WANTED: U.S. Amateur Callbooks 1912 thru 1940. Bob, W4JNN, POB 166, Annandale, VA 22003. (703) 560-7161

FOR SALE: Hallicrafters receivers: SX-16 - $150; S-20R - $60; SX-99 - $85. Johnson Viking Messenger - $50. All with manuals. Ward Becht, 625 Tufts Ave., Burbank, CA 91504

FOR SALE: Miscellaneous odds and ends, antique radios and parts. LSASE for list. Hidyne Research, POB 3342, Williamsport, PA 17701. (717) 326-2148

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

WANTED: SCR-399A;HO-17 shelter;BC-610E; BC-312; BC-939; BC-614; JB-70A;tuning units; coils; chests; reels; whips; cables etc. Bill Harris, W7KXB, 852 W. Jerome Cir., Mesa, AZ, 85210. (602) 838-0215

FOR SALE: B & W 5100 xmtr w/manual - $100 pu only; National NC-57 rcvr w/Sams - $50 plus UPS. Fred Huntley, W6RNC, Box 478, Nevada City, CA 95959.

CLASSIFIEDS

FOR SALE: Manuals: 51S-1; 51J4; 75S-3C; Drake R4C; SPR-4 and R-7A. Levy, 8 Waterloo, Morris Plains, NJ 07950. (201) 285-0233

WANTED: ARC-65 stuff -- 'In Uniform' still needs some accessories for this beauty: TS-981/ARC-21 test set or the control box for same, MT-971/U, MT-1917/U mounts, DY-153/ARC-65 dynamotor, ME-75/ARC-21 test meter and MK-136/ARC-21 test kit (cables, etc.) Walt Hutchens, KJ4KV, 3123 N. Military Rd., Arlington, VA 22207. (703) 524-9794

FOR SALE: Old ARRL and "Radio" Handbooks; RCA tube manuals; Supreme (Beitman) Radio -TV manuals. Send #10 SASE for list. Charles Simmons, W6PDH, POB 6238, Buena Park, CA 90622. (714) 994-6843

FOR SALE: Collins mech. filters, F 250 Z-5 and F-250 Z-4, matched pair for USB -LSB, new in box. Marty Drift, WB2FOU/5, 108 Hickory Lane, Hickory Creek, TX 76205. (817) 497-6023

WANTED: WW-II military radio sets, operating spares and mounting racks. Sam Hevener, W8KBF, 3583 Everett Rd., Richfield, OH 44286. (216) 659-3244

FOR SALE: Transmitting/Receiving tubes, new and used. LSASE for list. I also collect old and unique tubes of any type. Maybe you have something to trade? **WANTED:** Large tubes and sockets from the old Eimac line; 450T through 2000T for display. John H. Walker Jr., 16112 W. 125th St., Olathe, KS 66062. (913) 782-6455

WANTED: Sylvania transmitting tubes- types 210, 801, 830, 830B, 825, 865; Taylor types T20, TZ20, T40, T55. AA6PP, 8538 Serapis, Pico Rivera, CA 90660. (213) 942-2617

WANTED: WW II military radio equipment: BC-966/SCR-695; ABF; ABK. Also want British and German WW II radios. Leroy E. Sparks, W6SYC, 924 W. McFadden Ave., Santa Ana, CA 92707. (714) 540-8123

WANTED: Hallicrafters R-46B or R-47 speaker. Phil Leonelli, WF6L, 3564 Strawberry Pl., Oceanside, CA 92056. (619) 757-7008

WANTED: 100 K - 200 W bleeder resistors; any model 850 series band-switching pi-network inductor and #3829 switch plate. Roland Matson, K1OKO, RFD #1, Box 2943, Kennebunk, ME 04043. (207) 985-3751

FOR SALE: BC-610E (fair) - $100; BC-610E (better) - $150; BC-610E (good) - $200; BC-939 - $100; BC-614E - $50; CE-20A w/458 vfo - $100; SX-28 - $100; Super-Pro w/ps - $50. Jack Osborne, K6LVD, 5636 Del Monte Ct., Santa Rosa, CA 95409. (707) 539-3940

FOR TRADE: Gonset G-76 with AC/PS; Morrow Twins; RS-6 'Clandestine' CW station. **WANTED:** I am always interested in WW II German, Japanese and Italian radio gear, parts or paper -- anything in any condition. Other interests: U.S. 1930's - '40's non-ham mobile radio - aircraft, boat, lifeboat, etc.; U.S. military and Forest Service mobile radio 1930-1945, expecially models ARC-2, ARQ-1, ARR-16, BC-1209, BC-1306,MBM, RAX, RBD, SP, TCH, mobile radio manuals most any year; magazines - "Electronic Industries", "USN Electron", "USAAF Impact". Thank you! Hugh Miller, KA7LXY, 6400 Maltby Rd., Woodinville, WA 98072-8375. recorder (206) 487-3047

WANTED: RME 4350 rcvr and spkr, sharp and working good; Johnson KW Matchbox, sharp and working good; Dow co-ax relays, 115 V. Eugene L. Clayton, W7MXM, 508 S. Ammon Rd., Idaho Falls, ID 83406.

FOR SALE: T195 xmtr, R392 rcvr, MD203GR modulator, CV 278GR PSC, spares, teletypes. All mint plus - $500. Steve Harmon, N9HGF, (812) 474-0842

FOR SALE: High quality homebrew 1 KW, AM xmtr. PP 250TH's modulated by PP 304TL's. Also included is spare set of tubes and coils for 160-20 meters - $500 cash. Ronald Reu, WB0LXV, RR #1, Box 334, Winfield, MO 63389. (314) 668-6518

FOR SALE: Viking Adventurer modulator - $30. **WANTED:** Manuals, schematics for Clegg - Venus, Appollo, 66'er and Viking 6N2; power supply and vfo for 6N2; coils for HRO-60 and HRO-50. Please call on this. B. Howard, Rt 6, Box 4440, Nacogdoches, TX 75961. (409) 560-5121

CLASSIFIEDS

FOR SALE: Westinghouse MW2 xmtr w/ modulator and power supply (less transformer), 3 KW output, 2-30 Mhz - $750 pu. Jack Osborne, K6LVD, 5636 Del Monte Ct., Santa Rosa, CA 95409. (707) 539-3940

WANTED: Nye Viking MB II (manufactured 1978) antenna matchbox manual and schematic diagram. Bill Mills, KC5PF, 1740 Tonys Court, Amissville, VA 22002. Office: (703) 818-3955, Home: (703) 937-4090

WANTED: F500B14 mechanical filter for 51J-4. Dallas Lankford, 903 Sherwood Dr., Ruston, LA 71270. (318) 251-2716

WANTED: Copy or original of manual/schematic for Gonset G66 receiver. Thank you. R.F. Haworth, W2PUA, 112 Tilford Rd., Somerdale, NJ 08083.

WANTED: HBR receivers, parts and documentation. Any condition or completeness. State condition and price. Frank R. White, KBØTG, POB 2012, Olathe, KS 66061

WANTED: Collins 351R rack mount adapter for S/line; empty box for 302C-3 wattmeter; vernier for 75A-4. Earl Harris, K5FTE, (915) 592-9185

FOR SALE: Complete station: ART-13; Sp-600 w/accessories; test equipment; tubes; meters; parts; manuals; etc. - $500 plus shipping. Frank D'Arrigo, N4MNU, 2820 E. Robinson St., Orlando, FL 32803. (407) 898-0489

WANTED: Wireless Set No. 19 equipment circa WW II. Also looking for information and anecdotes. Chris Basaillion, VE3CBK, 1324 Old Carp Rd., RR #1, Kanata, Ontario, Canada, K2K 1X7

TRADE: Viking Pacemaker or Globe LA1 linear w/manuals for Ranger I or II. John Brewer, WB5OAU, 7605 Roberts, NE, Albuquerque, NM 87109. (505) 821-4239

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

FOR SALE: TEK 190B RF generator, 350 khz to 50 Mhz - $50; Variacs: 208 V 60 Hz 7.5 A, have 3 @ $20 each. All plus UPS. **WANTED:** 500 W modulation xfmr with approx. 2:1 impedance ratio, both primary and secondary rated for 350 ma or more; schematics and specs on Thordarson T-21M-62 matching xfmr; 6C21 data sheet; 1625 ceramic sockets. James Owens, NWØO, 1363 Tipperary, Boulder, CO 80303. (303) 673-9019 eves/wknds, (303) 497-8804 days

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FOR SALE: HQ-140X as found, untested, w/ speaker - $75 plus shpg. WØCFL, Box 180, Dolores, CO 81323.

WANTED: Modulation xfmr for Viking II. Cliff Fleury, AI7Y, 64174 Tumalo Rim Dr., Bend, OR 97701. (503) 382-9162

WANTED: Circuit or manual for Geloso G.222 transmitter. Will reimburse. Nick Shepherd, VE3OWV, RR 2, Kinburn, Ont., Canada K0A 2H0

FOR SALE: P E 103 in carton, never removed, new - best offer. **WANTED:** Viking I manual or copy. Herm Renner, WØSCU, Box 227A, Bruno, MN 55712. (612) 838-3177

FOR SALE: AP R4 rcvr w/CV253 tuner - $125; MSR-4/CV-591 SSB converter - $50; BC-1031 panadaptor - $50; more on list - $.50 in coins. J. Orgnero, Box 32, Site 7 SS1, Calgary, AB T2M 4N3, Canada.

WANTED: SCR-300; TBY-8 accessories. Brown, 4141 West L-2, Lancaster, CA 93536

WANTED: Crystal for Collins 75S-3 that covers 3.8 - 4 Mc band. Ted Bracco, Quincy College, 1800 College Ave., Quincy, IL 62301. (217) 228-5213

WANTED: 24 hour clock for HQ-100A, part # K38874-1, excellent to mint condition. John Lowe, 3025 Harpers Ferry Rd., Sharpsburg, MD 21782.

WANTED: 6L6GC, 6CA7/EL34, 6550A, 7027A and transmitting tubes of all types. Send list to Bob Booker, KØNT, 2120 S. Brownell, Joplin, MO 64804.

CLASSIFIEDS

FOR SALE: WW II tank xmtr, BC-429, mint - $50 each; tank rcvr, BC-603 - $30 each; SC-522 xcvr, mint - $50 each; Heath DX-60B,novice xmtr - $55. Levy, W5QJT, 529 McCarty, Suite 507, San Antonio, TX 78216. (512) 366-4290

FOR SALE: Antique radios, parts, tubes, books, 150 panel meters, knobs, amateur, test equipment, transmitter crystals, etc. 13 lists. SASE + $2 cash (no checks). Richard & Rose's Radio Mart, POB 691443, Tulsa, OK 74169.

Electric Radio Back Issues "The First Year" (#1-#12) - $30, "The Second Year" (#13 - #24) - $30. Individual copies - $3. All prices include First Class delivery in the U.S. and Canada. Foreign orders please enquire. At Present #10, #11, #12 and #13 are only available as good Xerox copies.

FOR SALE: Wilcox RF deck, pair of 450TH's in final, T158D/FRC, good condition - $300 Jack Osborne, K6LVD, 5636 Del Monte Ct., Santa Rosa, CA 95409. (707) 539-3949

WANTED: Coil sets for Model GF-12 aircraft radio transmitter type CW-52063A, Navy Dept. Bureau of Ships. I have coil set RANGE 3000-3675 so I don't need that one. Will buy all others or trade. Roland Matson, K1OKO, RFD #1, Box 2943, Kennebunk, ME 04043. (207) 985-3751

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

WANTED: Any radios used by OSS. Examples are SSR-5, SST-1 or other sets with "SS" designations. Gary Cain, 1775 Grand, #302, St. Paul, MN 55105.

WANTED: McIntosh and Electro-Voice amplifiers and accesories for my collection! Marcus Frisch, WA9IXP, Box 28803, Greenfield, WI 53220-0803. (414) 545-5237

CLASSIFIEDS

FOR SALE: Check your receiver dial with the Tri-Mark Crystal Calibrator. Three WWV referenced outputs provide marker signals from broadcast to UHF. Complete kit, only $19.25. Assembled $26.25. Add $2.75 S&H. NY add sales tax. FREE catalog. Two Fox Electrix Co., POB 721, Pawling, NY 12564. (914) 855-1829 12 noon to 8:30 p.m EST

FOR SALE: Over 150 military manuals of the 1940's and early 1950's. Large SASE w/$.52 postage for list. August J. Link, 2215 Faraday Ave., Suite A, Carlsbad, CA 92008. (619) 438-4420 days.

WANTED: 1937 Gross Radio CB55 amateur transmitter schematic/manual needed for restoration. Will pay/trade for replication costs. Bob Mattson, KC2LK, 10 Janewood, Highland, NY 12528. (914) 691-6247

FOR SALE: FT-241 xtals 0-79 - $40; Rider's #6 - $14; ARRL books, over 80 classic rig manuals - SASE. **WANTED:** Military radios and manuals; BC-252; pre-1942 ARRL Handbooks; HQ-120X; National 1-10. Sheldon Wheaton, KCØCW, 14708 Murray Ln., Olathe, KS 66062. (913) 764-5436

WANTED: HRO coils E and AA, speaker, accessories, SOJ-3, 605C-2, manuals etc. Offer trade or cash. Barry Nadel, Box 29303, San Francisco, CA 94129. (415) 346-3825

WANTED: BC-614 speech amp; 75 and 160 meter coils for BC-610-I; BC-939 tuner. Mike McCoy, AA4TW, 1102 Virginia St., SW, Lenoir, NC 28645. (704) 758-4170

WANTED: Measurements Corp. megacycle meter, model 59LF (0.1 - 4.5 Mhz) grid dipper head and/or coils. L. Burkhardt, POB 465, Los Alamos, NM 87544.

FOR SALE: Harvey Wells TBS-50D Bandmaster with vfo and original power supply, excellent condition - $140; TBS-50C Bandmaster with vfo but no power supply, excellent condition - $100. Both units with manuals. Viking SSB adapter, like new, w/manual - $100; Viking Ranger, excellent, no manual - $100. All units plus UPS. Roland Matson, K1OKO, RFD #1, Box 2943, Kennebunk, ME 04043. (207) 985-3751

WANTED: Knight Ocean Hopper receiver, with plug-in coils, sold by Allied Radio in the '50's. Ronald Thomas, 2479 Peachtree Rd., NE, Apt. #303, Atlanta, GA 30305.

WANTED: Schematic diagram for a Readrite model 423A tube tester and a black snap ring mounted loctal tube socket. Ken Greenberg, 4858 Lee, Skokie, IL 60077. (708) 679-8641

FOR SALE: Tube hi-fi amps - $10 and up; GE 1973 tube manual - $10; books; Johnson ceramic mikes - $1 and up; test equipment; Western Electric BC-1152A indicator (Mil. 1942) - $18; RV-138 Aircraft Monitor - $75. List SASE. W15D, 1040 Cleveland, Stephenville, TX 76401.

WANTED: Help! A couple of us need 9 pin connectors to get our Johnson Viking 500's going. Just like octal only 9 pin. Both male and female needed. Also want 6 khz, AM filter for 75A-4. Thanks! Lloyd, AA6T, (408) 722-4349 eves.

FOR SALE: Viking II with vfo - $100; Eldico SSB 100 - $100; Eldico 100A - $50; National NC-173 - $50; SX-27 and SX-36 - $50. Jack Osborne, K6LVD, 5636 Del Monte Ct., Santa Rosa, CA 95409. (707) 539-3949

WANTED: Collins 30k; KW-1,T368; R389; SP600JX;original copies of ER #1,#5,#10,#11 and #12. Tom Smith, N5AMA, 13034 Elmington Dr., Cypress, TX 77429.

WANTED: Radar equipment units or whole systems. Also need manual and parts for TBL-12 transmitter. Allan H. Weiner, 14 Prospect Dr., Yonkers, NY 10705. (914) 423-6638

FOR SALE: 4-400A tubes - $25; (2) 4-1000A tubes - $75 each; Heathkit SB-401 xmtr and SB-303 rcvr, w/AM, SSB and CW filters - $300 for both. **WANTED:** HW-16. Jeff Garrett, KEØMT, 2822 W. 55th Ave., Denver, CO 80221-1616. (303) 455-5658

WANTED: Very old or unusual Hallicrafters equipment, entire 1934 "H" and "Z" line of Silver Marshal, parts, memorabilia and manuals. Chuck Dachis, "The Hallicrafter Collector", WD5EOC, 4500 Russell Drive, Austin, TX 78745.

CLASSIFIEDS

WANTED: Late, mint, Rockwell/Collins 312B4; 455FA05 or X455Q200; SM-3; 4 N.O.S. 811A's (U.S.). Clint Koester, K7LCT, 1642 Cody Dr., Billings, MT 59105.

FOR SALE: Carter Genemotors, filtered output, 420V at 280 ma., 6V/33 amp input - $5; 12V/17 amp input - $8. George, WA7HDL, (208) 756-4147

WANTED: Boonton model 260A "Q" meter. Also coils for same (type 103A and 513-A) and a 2A6 tube. Bill, K1KV, 5 Oak Knoll Rd., Burlington, MA 01803. (617) 272-3522

FOR SALE: Western Electric instrument #540, DC volt and ammeter, perfect, all fuses included. John Strang, 2355-3G Via Mariposa West, Laguna Hills, CA 92653.

WANTED: Single plate to PI' grids interstage transformer. Andy, WA4KCY, (404) 832-0202

WANTED: CQ Anthology #1 and #2; CQ and QST mags 1942 - 1945; CQ Surplus Schematics. Alan Mark, POB 372, Pembroke, MA 02359

WANTED: Military SCR720 radar; BC-1151A diaplay; BC1150A control; BC1091AM RF; BC1142A modulator; PE218A dynamotor; RA88A; RA90A rectifiers; JB98A; JB102A junction boxes; related manuals. Jeary Vogt, 3 Brampton Rd., Malvern, PA 19355. (215) 296-2162

FOR SALE: Heath Apache - $70; Johnson Invader 2000 - $400. Plus shipping. Mike Nichols, KE9FK, 105 N. 4th St., Fort Atkinson, WI 53538. (414) 563-2825

FOR SALE: Hundreds of panel electrical meters - SASE for list or write needs; adapters, any triode to WD-11 tube socket - $5 each ppd; 10 and 12 inch home recording discs - $3 and $5 each plus shipping. James Fred, Cutler, IN 46921.

WANTED: RCA model ACR-111. Chuck Dachis, "The Hallicrafter Collector", WD5EOG, 4500 Russell Drive, Austin, TX 78745.

WANTED: Navy RAX CG-46115 LF rcvr. **FOR SALE:** Navy RAK -7; Gonset Comm. IV. Steve Davis, KD2NX, (718) 265-2390

CLASSIFIEDS

FOR SALE: Hallicrafters SX-42 w/speaker, w/ manual and Sams Photofacts - $150. Thomas Hatcher, Box 658, Durango, CO 81302. (303) 247-2955

WANTED: A Navy TBX xmtr - rcvr. Cash deal or will trade complete Wireless Set 19, Mark II. Rick Ferranti, WA6NCX, 254 Florence Ave., Arlington, MA 02174-7248

FOR SALE: Lifetime collection! Equipment from Atlas to WRL and all in between! Will listen to offers. SASE. W5JM, 2320 S. "O" St., Fort Smith, AR 72901. (501) 783-8848

FOR SALE: RME HF 10-20 converter; 3 lug terminal strips, package of 25 - $2 ppd; keys for code practice. Art Collatz, 2127 Market St., Blue Island, IL 60406. (708) 385-4876

WANTED: Spy radios. Buying military radios beginning with "SS"; (example SST-1,)! Also M-209 cipher machines! Trade items available! Keith Melton, POB 5755, Bossier City, LA 71171. (318) 747-9616

FOR SALE: BC-375 w/TU6B thru TU10B tuning units - $90; Hammarlund HQ-140-XA - $140; HQ-100A - $55; BC-348 - $35; Heathkit VF-1 - $15; 813's - $12, unused 4CX250F's - $20; R/T 122B - $10; All plus shipping. Mark Hovda, NØJWI, POB 10091, Cedar Rapids, IA 52410. (319) 364-4048 7:00 - 9:00 PM CDT

FOR SALE: Collins 75A-2 rcvr - $300; NCL-2000 KW amp - $400. Chuck, KØRFQ, Springfield, MO (417) 882-8041

WANTED: Help to identify my Globe King-275A, 400 or 400B??? No markings. Please-need manual copies for each. Reimbursement Ubet. Also need pre-1941 Handbooks. WA7IHN, POB 442, Aumsville, OR 97325. (503) 449-1149

FOR SALE: HRO -60 AC coil - $50; HRO-60 dial scales - $4 each. WANTED: NC-183D. Dave, AJ7O, 6782 Marilyn Dr., Huntington Beach, CA 92647. (714) 843-6879

FOR SALE: (2) good T-200 tubes - $15 each; Heathkit DX-35, original box - $35. **WANTED:** R-47 Hallicrafters speaker. Evan Haydon, NØGMR, (402) 435-4083

FOR SALE: Sonar xmtr SRT-120 with vfo 120. Power input is 100 W - AM, 120 W -CW, 5894 final, PP 6L6's in modulator - $125. Don, W7KCK, (503) 289-2326

WANTED: Direction finding equipment and information. Brian Harrison, KN4R, 420 Proctor St., Denver, NC 28037. (704) 483-5679

ER Parts Unit Directory

At this point the directory has **160** units in it and it's growing daily. If you need a part for a vintage restoration send $1 and an SASE for the list. If you have a parts unit consider putting it on the list. Your dead unit can help bring others to life.

CLASSIFIEDS

WANTED: Hallicrafters HT-4 xmtr; RME-9 rcvr; any documentation or schematics for Garod model RAF rcvr. Richard Oliver, KC9GQ, POB 1872, Flagstaff, AZ 86002.

FOR SALE: Push/pull 304TL's modulated by Push/pull 810's, homebrew - $300; pick-up only. Call for details. Bruce, W9OTN, (708) 474-8910

WANTED: Collins 32V-1; Tubes - UT-25, 50, 242C, Kenyon T-109, T110; UTC LS-19 and LS-40. Joe, N4WQC, Box 19302, Alexandria, VA 22320. (703) 683-2955

WANTED: Vibroplex Lightning or Champion bugs in good condition. Call days leave message if unavailable. Ron Bramhall, KQ5A, 7877 S. Magnolia Way, Englewood, CO 80112.

FOR SALE: Hallicrafters speaker from late '40's, works - $45. **WANTED:** Atwater Kent 'Breadboard' radio from early '20's. Will pay top dollar. Kevin Eftink, 16 Edgewood Dr., Quincy, IL 62301. (217) 228-2221

WANTED: For HRO-60 - coils, AC and E, slide rule scales, XCU-50-2 calibrator, 4N-4 tube; vernier tuning knob for 75A-4; KW-1. Butch, KØBS, (507) 288-0044

FREE: 1991 Catalog Available. Dealers in surplus electron tubes. Electron Tube Enterprises, Box 311, Essex VT 05451. (802) 879-0611. FAX (802) 879-7764

WANTED: Radar equipment, units or whole systems. Early TV cameras also sought. Allan. H. Weiner, 14 Prospect Dr., Yonkers, NY 10705. (914) 423-6638

WANTED: Any model of Brown Brothers Machine Company key, paddles or bugs. Jim Zimmerman, KG6VI, 2316 W. Dallin St., Lancaster, CA 93536-5702. (805) 945-6539

FOR SALE: RME 4350 w/manual. **WANTED:** Drake 2B for parts; Electronics Illustrated, June 1961 and Nov. 1972. Al Bernard, NI4Q, POB 690098, Orlando, FL 32869-0098. (407) 351-5536

WANTED: T-368 xmtr. Will pick up within 500 miles of Dayton, OH. Harold Parshall, N8FRP, 3770 Frytown Rd., Dayton, OH 45418. (513) 268-2909

FOR SALE: 2' motorized radar dish ANT-1C EP model 40025-1A - $175; Collins auto ant. tuner CU991/AR - $50; BC645 in orig. carton - $60. Joe, K3ES, POB 8102, Pittsburgh, PA 15217. (412) 621-3977

WANTED: 75A4 4:1 reduction knob or small spin knob for same; 51S1 RF bottom cover and tuning tool; black Collins tube shields; KWS-1 dial drum. Bill Carns, N7OTQ, 9708 E. Desert Cove, Scottsdale, AZ 85260.

WANTED: Manual/copy for Johnson Courier and SX-111 rcvr. Bernie, WA6HDY, 452 Oxford Dr., Arcadia, CA 91007. (818) 445-2891

CLASSIFIEDS

WANTED: Schematic diagram and any other infomation for a model 432A Readrite tube tester. Ken Greenberg, 4858 Lee, Skokie, IL 60077. (708) 679-8641

WANTED: McElroy bugs, expecially with MAC-KEY nameplate. Tom French, W1IMQ, 120 Great Road, Maynard, MA 01754. (508) 897-2226

WANTED: Complete SW-3, FB-7 or Pilot Wasp; Collins 51J4; WRL 755 vfo; Ranger meter; Speed-X bug; Collins 51J4. Brian Roberts, K9VKY, 3068 Evergreen Rd., Pittsburgh, PA 15237. (412) 931-4646

FOR SALE: Miscellaneous odds and ends, antique radios and parts. SASE for list. Hidyne Research, POB 3342, Williamsport PA 17701. (717) 362-2148

FOR SALE: Collins 351D-2 mobile mount, less the two large connectors - $25; 351E mounting plate - $15; Richard Parker, KB2DMD, 21 Blue Grass Dr., Trenton, NJ 08638. (609) 883-3255

BOOKS, MAGAZINES WANTED: Modern Electrics, Experimenter, Science Invention, Radio News, Radio Retailing, Radiocraft, M.I.T. Radiation Laboratory Books, OTHER TECHNICAL BOOKS, MAGAZINES, also CRYSTAL SETS, MICROPHONES. State lot price for resale. Delton Lee Johnson, WB6MNY, 14 McKevett Heights, Santa Paula, CA 93060. (805) 525-8955, evenings

WANTED: National RF chokes R-300 and R-175A and B&W chokes FC-15. Also issues of General Electric Ham News Publication. Roland Matson, RFD #1, Box 2943, Kennebunk, ME 04043. (207) 985-3751

WANTED: Schematic or unit: Western Electric radio BA80-40, two band novice CW transmitter around 1958. Joe Torres, 3628 Kimble Rd., Baltimore, MD 21218.

FOR SALE: Please send SASE for 5 page list of vintage gear for sale; xerox's available for over 200 vintage manuals - 10 cents per page. Mike Horvat, 112 E. Burnett, Stayton, OR 97383.

FOR SALE: TR4C w/AC-4, MS-4 - $325; TR4CW w/AC-4, MS-4, RV4C - $550. **WANTED:** KW-1. Joe Thurtell, K8PSV, 382 N. Harvey, Plymouth, MI 48170. (313) 453-8303

FOR SALE: Hammarlund HQ-170 - $140; Eico 720/730 - $85; Globe Scout 40A - $50; Johnson Pacemaker - $165. Steve Harmon, N9HGF, 4340 North Congress Ave., Evansville, IN 47711. (812) 474-0842

ELECTRON TUBES: All types - microwave, transmitting, receiving, obsolete, military--Large inventory. **Daily Electronics Corp.**, POB 5029, Compton, CA 90224. (213) 774-1255; (800) 346-6667

A directory of vintage parts unit rigs available to subscribers for $1 and a LSASE. Presently there are 150 units in the directory and it's growing daily. The list of units is by manufacturer in alphabetical order followed by the owners address and telephone number. If you have a parts unit please let us put it on the list.

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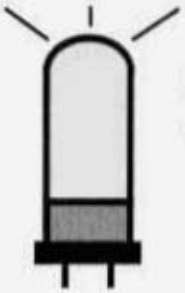

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