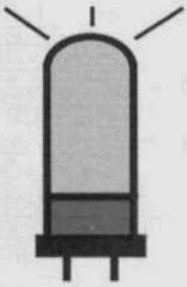
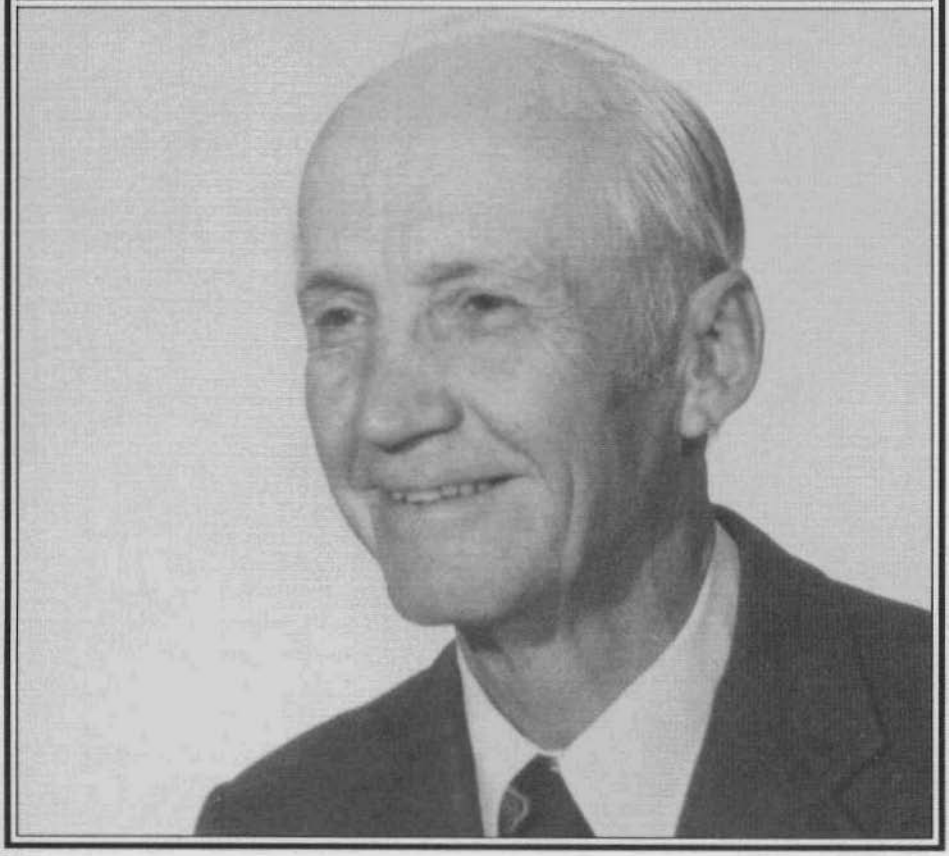
$2.50



ELECTRIC RADIO

celebrating a bygone era

Number 13 May 1990



ELECTRIC RADIO

published monthly by Barry R. Wiseman, N6CSW/Ø
at 4 Aspen Place, Durango, CO 81301

Second Class postage paid at Durango, CO. and additional offices
Authorization no. 004611

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

REGULAR CONTRIBUTORS

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

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

Electric Radio Solicits Material

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

EDITOR'S COMMENTS

Barry Wiseman N6CSW/Ø

After lunch on Sunday - the day after the contest - I came out to my work area in the back porch planning to spend the afternoon working on the magazine. I switched on the computer but rather than the normal display I got a picture of a disk with a question mark in the middle of it. All you guys that work with computers know that what I've described means trouble. Maybe expensive trouble. On Monday I took the computer in to Durango and got the bad news from the Mac dealer there. My hard drive had 'crashed'. And I would loose all the data on it. And it would cost me what I consider to be a 'bundle'. The good news is that the dealer had another hard drive and I was back on line that same day. But minus a lot of work that I had done that I had not backed up. The experience just re-enforces my disdain for all things 'solid state' particularly computers. If I could put the magazine together on an old Remington 'mill' that's what I would do. But I learned a good lesson... never trust your hard drive always make backups.

In the last day or two the contest logs have started coming in. One thing I've noticed, from looking over the logs, is that there may have been more stations involved than the 100 I estimated in my report on page 19. The logs I've received so far (May 9) are from W7FG, KEØMT, K6HQI, N8IYV, VE3CUI, and N7BEG.

continued on page 31

TABLE OF CONTENTS

Cover: E.F. Johnson one of the most notable of all the early manufacturers of amateur radio equipment. Edgar will be 91 next month. If any of you would like to send him a card or letter - I'm sure he would appreciate it - the address is 111 W. Elm Ave., Waseca, MN 56093.

Reflections Down the Feedline

by Fred Huntley, W6RNC
POB 478
Nevada City, CA 95959

At long last, it appears that the ARRL is admitting that AM is here to stay. At least, in their FCC petition on the AM power limitation, they have gone so far as to state that AM operation "has not declined" during the past five years. But they are incorrect when they also stated, "interest in AM operation has not changed dramatically in recent years".

On the contrary, interest and activity in this mode has made a significant comeback - and without any outside help. All that needs to be done now, is for Kenwood, Yaesu or Icom to come out with a tube-type, high level modulated AM transmitter and activity would soar. These companies ought to take a market survey to determine whether there is the sales potential for such an item. I'll bet there is.

But the FCC is still hung-up with a fixation about "spectrum efficiency". Let's hope that someday they too will become enlightened enough to recognize that there are other characteristics that are as worthwhile in radio, as the concept of narrow bandwidth. AM is the easy listening mode - 'user friendly on the ears'.

While the ARRL has almost missed the boat on AM, they have been completely left on the dock as regards SWL's and BCL's. Instead of thinking only in terms of novices as potential hams, the ARRL should have been cultivating and encouraging shortwave and broadcast band listeners. In earlier days, listener hobbyists were a prime source of recruitment into amateur radio.

SPAM under our late president, WA5TWF (SK), had an active SWL division and the 'Prez' himself, Floyd Dunlop, was an active SWL'er. Under the name of Duke Alexander, his SWL news and activities programs were broadcast on shortwave via Radio South Africa, HCJB, Quito, Equador and Radio Earth from Illinois and the West Indies.

In the late 1920's and 1930's many hams got their start with first being introduced to the crystal set and it's catwhisker. Then, they progressed to a tube set and became a BCL. After they found out about short waves, they became an SWL'er. And when they heard hams coming through the headphones, they became motivated to get their own ham ticket.

I remember in the early 1930's, before I was a ham, I used to BCL with a Philco table-top cathedral type radio set. I lived in New York at the time, and one evening while listening around 860 kcs, I heard WRUF, Gainesville, Florida offer a free box of cigars to the furthest listener of their station. The next morning I dropped them a postal card, confident that I was their best DX. But a week later, the station announced that the winner was a listener in the Panama Canal Zone. So I didn't get the free box of cigars, but they did send me a big packet of Chamber of Commerce literature about Florida - The Sunshine State.

Shortwave listening, like AM, is also making a comeback. This phenomenon has been written up in at least one of the major news magazines. So it would behoove all AM ham operators to be aware of the possibility that they have a listening audience of SWL's out there. Words of recognition and encouragement should occasionally be addressed to them over the air. Other hams listen in too, and many have been attracted to AM operation this way.

Dayton Hamfest

A report on the vintage equipment for sale there.

by Steve Sauer, WA9ASZ
1274 Londonerry Lane
Greenwood, IN 46142

This year the Dayton hamfest was held from April 27th thru the 29th. I was present at the gate when it first opened on Friday at 8:00, and fortunately this year there was no rain on opening day. Instead it got quite warm, 86 degrees, and I got quite sunburned.

I cannot begin to tell you how large the flea market is. It takes me an entire day to get thru it twice to where I feel like I have seen all there is to see (and try to relocate all of those places where I said I'd have to come back to!) As a result, I did not have an opportunity to see any of the commercial displays.

It seemed to me that there was more vintage gear this year than last. Maybe that's because my eyes have been opened to the beauty of the 'old stuff'. This is a complete report on the equipment that was noted on Friday in the flea market.

There were several Collins pieces, including a 75A2 with speaker ($275) and 2 75A4's ($500 & $495). About a dozen S-lines were available from $400 to $600. Also noted was a 32V3 ($200), 3 30LI's for $550, $600 & $700 and 2 30S1's for $1395 each. KWM-2's were fairly common selling around $475, although one was marked at $800. Also, there was a KWM-1 ($600) and a KWM-2A at ($850).

Hammarlund was represented by several pieces including a HQ-140XA ($175), HQ-129X, 2 HQ-170's ($80 & $50 as is), HQ-100 ($100) and more SP600's than I have ever seen before including one mint one for $225. Prices for the SP600's started at $100. There was also a HC-10 for $95.

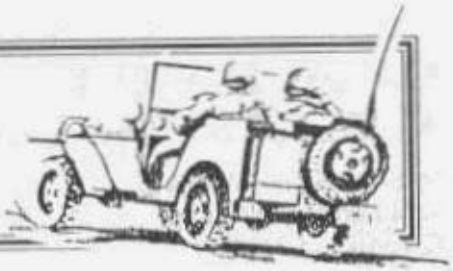
There was a Hallicrafters SP44 monitor for $25 (I should have bought it!), SX-101 ($100), HT-41 modified with one 3-500Z ($250), HT-37 ($50), 2 S-20R's ($50 ea), 2 S-94's ($10 & $20), 2 HT-32A's ($100 for both), SX-117 with speaker ($150), one without speaker ($100), SX-101A with speaker ($75), SX-43 with R44 speaker ($100), SX-100 with speaker ($165), SX-71 with speaker ($50). Some additional Hallicrafters pieces without marked prices included: S-22R, HT-40, S-27, SX-130, S-118, and HT-37. I should point out that there were more vintage radios than I have seen in the past including a very nice Hallicrafter's SR40 for $70 (I severely had to talk myself out of that one).

Having gotten personally 'involved' with old National equipment this year, I was amazed to see a NC-46 and NC-81X. These units were in very poor condition but the price tags were $70 and $65 respectively (a great amount of respect apparently!). Also for sale were 3 NCX-3's ($100 to $150),HRO-7 with 1 coil ($75), HRO Senior with 1 coil ($125) - extra coils $15 each), 686 power supply ($50), HRO5OT ($125), NC-300 with speaker ($90), NC-98 ($75). Also noted without prices were the NC-109, NC-270, HFS, and an early HRO.

No respectable hamfest could be held without some Johnson equipment displayed. Most popular were the matchboxes which were selling in the $85 to $125 range. These were the smaller units and some were metered. Unfortunately, most of the Johnson equipment was not priced (attesting to the fact of its renewed popularity?) The only marked equipment other than the matchboxes was an Adventurer with a Model 122 VFO ($125), Viking II ($15O), 6N2 ($30) and a Thunderbolt ($350). The unpriced equipment included 2 Rangers, a Pacemaker, Invader, Invader 2000, another Viking II, 6N2 Thunderbolt, 2 model 122 VFO's, another Adventurer, Challenger, and two 6N2 transmitters.

continued on page 32

ELECTRIC RADIO IN UNIFORM



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

'The BC-375'

It sometimes seems that modern defence budgets are set on the assumption that only up to the minute (and thus very expensive) military equipment is effective. The BC-375 was outdated when Hitler came to power (mid-1930's) and nearly a museum piece by 1941 – yet it served with distinction throughout the war. How did this happen?

After the war, many thousands of BC-375's were released to surplus where the set gained a reputation as 'unstable' - a good source of parts and not much else. Is this reputation deserved? How did it come about?

This month we will be asking these and other questions as we study the best 'obsolete' radio to serve in the Second World War.

Overview

The BC-375 is a 40 to 100 watt 'liason' transmitter, used in the B-17, B-24, B-25, B-26 and other bombers with 24 volt electrical systems. It can transmit CW, MCW and AM and covers 200 to 500 kcs and 1.5 to 12.5 Mcs using seven plug-in tuning units. The transmitter is 20"x 22"x 8" (HxWxD) and weighs about 40 pounds. A separate dynamotor (the PE-73) furnishes high voltage.

There's a built-in antenna tuning unit for MF and HF; an external loading coil (BC-306) must be used on LF. Only one frequency can be set up and there is no provision for crystal control. The MO (master oscillator) dial is calibrated in revolutions and 100ths; an individually calibrated chart showing frequency in 100 kc steps is mounted on the front of each tuning unit. Aircraft having the BC-375 also had a BC-221 frequency meter which was used to set up a new frequency.

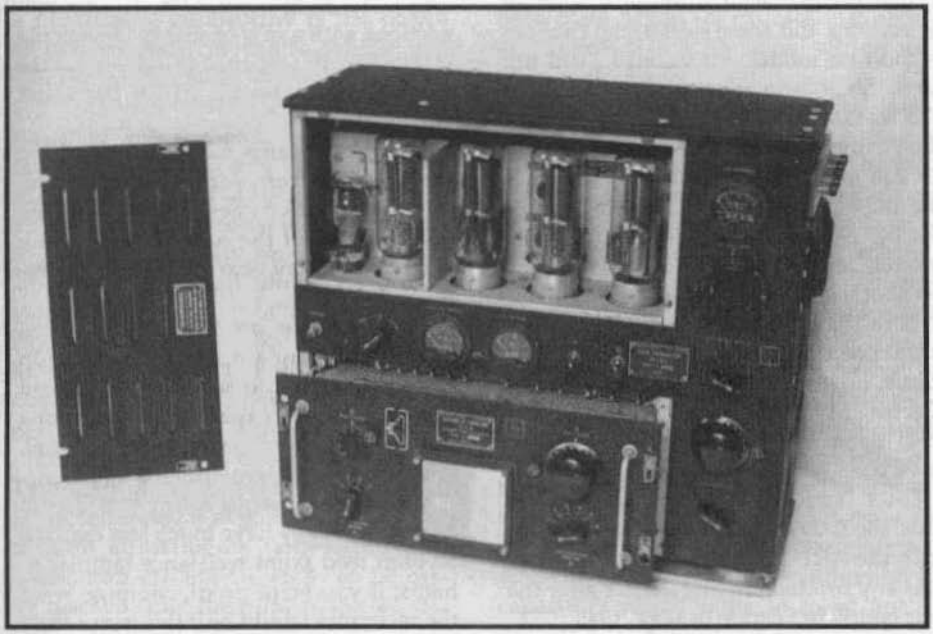
Tune up must be done at the transmitter but transmissions can be made from control boxes at other points in the aircraft. A 12 volt twin, the BC-191, was used in earlier aircraft with 12 volt systems and in ground transportable systems like the SCR-177 and SCR-188 and the vehicular (jeeps, scout cars, tanks) SCR-193.

History

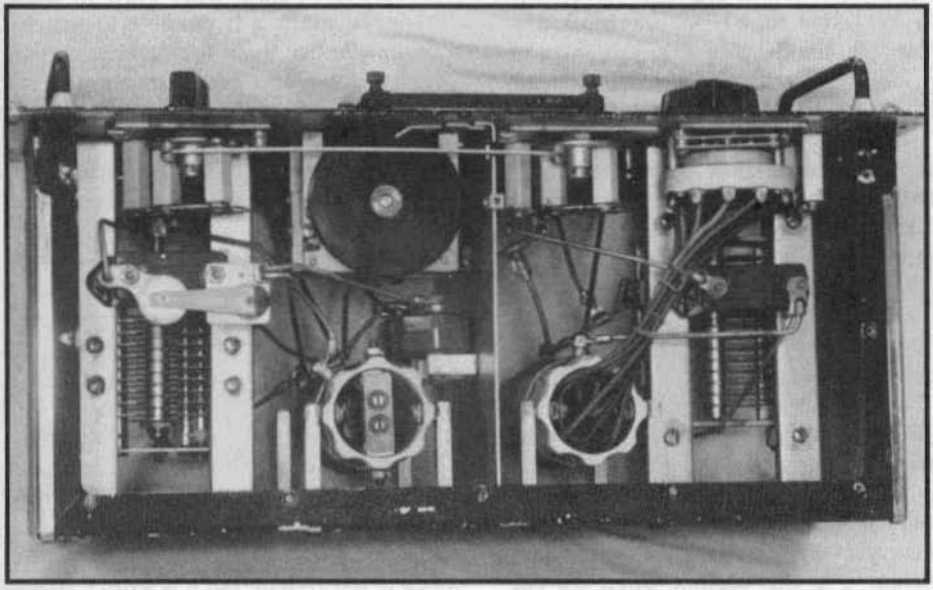
I do not have a good source for the history of this set, so I will be writing as an archaeologist, inferring history from the physical evidence and a few scraps of other information.

The BC-191 was probably conceived about 1930. While both hams and the Army were using sets of this basic configuration (MO-PA sets using 211's and other large triodes) in the late 20's, the BC-191 is a polished gem of the form. There is a statement (in the Surplus Schematics Handbook) that the design of the set was 'finalized in 1935'. Given the leisurely pace of peacetime procurement, five years isn't implausible.

Text continued on page 6



The BC-375. The tuning unit has been pulled part way out. Operating with the tube compartment cover removed as shown will definitely help you keep warm on a chilly 'midwatch' in the shack!



Bottom view of TU-6 tuning unit with covers removed. The MO compartment is on the left; the disk near the top center adjusts the PA neutralizing capacitor. The arm ending in a disk at the upper end of the MO tuning cap is the temperature compensating capacitor.

ER in Uniform from page 4

The BC-191 went through a number of versions and some substantial changes – the first model, for example, did not have the built-in antenna tuner. The BC-375 was developed in the late 30's when the Army began procuring aircraft with 24 volt electrical systems. All models of the BC-375 are like the later models of the BC-191. Only the BC-375-E (the final model, and the one used in wartime bombers) is likely to be seen today.

Both the BC-191 and the BC-375 were produced throughout the war; as far as I know all production was by General Electric. My set is s/n 92,808 and bears 1943 dates, so total procurement must have been well above 100,000.

Later bombers got more modern radios; the B-29 for example was equipped with the ART-13. It is unlikely that there was any production of BC-375's after the war ended in Europe in May, 1945.

Design

The BC-375 is a five tube MO-PA set, using four 211C tubes (Army designation VT-4C) and a type 10 (Army VT-25). While the tube types and block diagram are, for the late 30's, just short of ancient, the circuit and construction details are excellent.

The layout of the set is simple and logical. All operating controls are on the front panel which also holds meters for total plate current (MO + PA + modulator), filament voltage, and antenna current. Tapped resistors and a complex system of movable links let you set the filament voltage when the set is installed or the power source changed.

The tubes are in a compartment occupying the upper left 2/3 of the front panel. A gap around the edges of the top plate of the set and louvers in the front cover plate give enough ventilation to carry away the more than 300 watts dissipated in this section. There's a cut out around each tube socket so air is also drawn from below the tubes.

Most of the space below the tubes is taken up by a plug-in tuning unit. This slides in like a drawer, making connections with a row of sturdy banana pin jacks along its upper edge. Except for the antenna tuner, nearly all RF parts and wiring are in these plug-in units.

The tuning units have perforated top and bottom covers. Air pulled up around the tube sockets comes through from the open bottom of the set so the MO tank circuit parts stay near ambient temperature.

The rightmost few inches of the panel holds the antenna tuner: bottom to top there is a switch to select a loading coil tap, a variable capacitor, an antenna tuner circuit switch, a roller (series) coil, and an RF ammeter with an 8 amp scale.

We have mentioned before that aircraft antennas usually have much less than the 50 ohm feed point resistance familiar to hams; if you want proof, compute what the resistance would be if this meter were pegged when the set is delivering its maximum power of 100 watts!

The antenna circuit switch allows connecting the antenna tuner parts in several ways, making it possible to match anything larger than a straightened paper clip. An open frame antenna relay is located behind the meter next to the antenna terminals.

The set has no chassis as such. It is built up on a brazed frame made of square section alloy steel tubing. Heavy parts are mounted with machine screws and stop nuts; cover sheet metal is attached with thread cutting machine screws. This is the only use of thread cutting screws I can recall in a military radio.

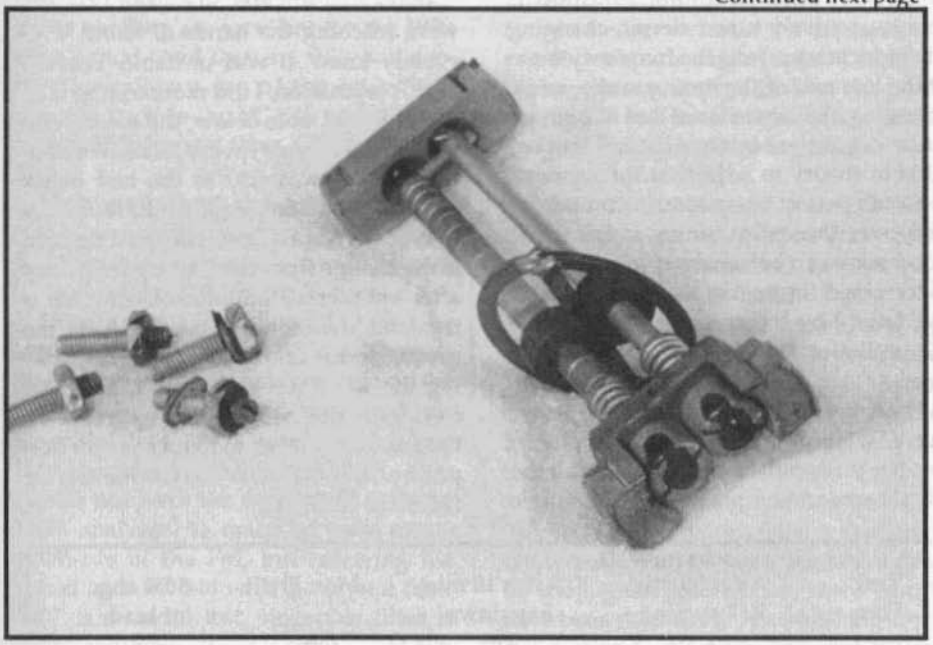
After working with an ART-13 or even a 'command' transmitter, you may want to go for a walk in the woods before unwrapping a BC-375. Such low-tech thinking and construction could be a shock to the system! But it is sturdy, light in weight, reasonably inexpensive, and well adapted to mass production as it was done in the 1930's and 40's.

Particularly noteworthy is the choice of construction methods which use quickly learned skills -- brazing parts in a jig, driving thread cutting screws, stamping and finishing metal plates -- rather than the machine tool operations so extensively used in the ART-13. If you built 1000of these radios in one year and then you suddenly got an order for 25,000 the next, you could do it -- in fact, that is very close to what happened! Don't you wish the folks procuring and building the B-2 and other modern military gear could think like the designers of this set?

The maintainance design is excellent. Two snap slides hold the front covers in place; removing it exposes the tubes. All routine adjustments (sidetone level, transmitter calibration, etc.) can be easily reached from the front of the set. If a problem in a tuning unit is suspected, you can exchange the unit. Removing the back plate of the set exposes just about all the power and AF signal wiring and most components.

Inside the tuning units we find more well engineered basics. The RF wiring is #10 so it isn't going anywhere! The MO tuning capacitor is a sturdy job, built up on a 3/16" front plate. The stator is supported on large flanged ceramic spheres held in cup screws. These are semi-rigidly mounted so the stator can't jump out of its mountings as do those of the 'command' sets. The rotor is mounted in ball bearings and there's a flexible coupling to prevent it from being pushed around the shaft running to the dial on the front panel. According to the manual, this capacitor is made of Invar -- an alloy with nearly a zero temperature coefficient of expansion. The other Invar capacitors which come to mind are in frequency meters; the BC-375 designers were serious about temperture stability.

Continued next page



The temperature compensating mechanism from a BC-375 MO tank coil. One rod is aluminum, the other steel. The nuts which adjust the length of the rods are at the right front of the assembly. The unit mounts in the MO tank coil with the setscrews and nuts.

ER in Uniform from previous page

Both inductive and capacitive temperature compensation are provided. Inside the coil is a copper loop (in effect a shorted turn) mounted at 45 degrees to the axis of the coil. It is mounted on knife edges between two rods having different coefficients of expansion; as the temperature increases the rods expand by different amounts causing the loop to rotate and counter the increase of inductance of the coil caused by the expansion of the coil form and winding. The length of the rods can be adjusted independently so you can set both the nominal inductance of the coil and the amount of compensation.

Temperature compensating capacitors (the number depends on the tuning unit) are mounted below the MO tuning capacitor. One plate of each capacitor is supported on a bimetallic arm which bends to reduce the capacitance as the temperature increases.

As with other trimming adjustments in a capacitively tuned circuit, changing the inductance affects the frequency more at the low end of the tuning range, while changing the capacitance has the greatest effect at the high end. It is thus possible in theory to adjust (at the factory!) for near-perfect temperature compensation over the entire tuning range. How good a job can be achieved in practice is determined (in a set of this size and configuration) by the nasty fact of that VT-4C oscillator tube; more on that topic later.

High level plate modulation is used; the VT-25 serves as a speech amplifier, driving push-pull class B VT-4s. With the usual carbon microphone (T-17 hand mic or T-30 throat mic), modulation probably averaged 50-70%. By using a higher output microphone, 100% modulation can be achieved in the downward direction but this corresponds to only about 40% positive modulation. This is mainly because the final isn't driven hard enough for plate modulation: according to the RCA tube manual a 211 under these conditions should have about 14 watts of drive but the specified amount of grid drive (about 20 ma) corresponds to only 4 watts. No wonder the linearity is poor!

This looks at first like a mistake, but it is in fact a design compromise. Though the VT-4 MO could supply more drive, it would have to be more tightly coupled which would be bad for stability. We'll look at some numbers in the next section; my sense is they got the trade-off about right.

Stability

In the late 40's and 50's when BC-375's were reaching the hands of hams, 'everybody knew' it was unstable. Because of this reputation, I did more testing than usual. In the table below, the second column is the change (in cps, after five minutes initial warmup) at the end of six cycles of one minute transmit/four minutes receive operation. The third column is the change from the starting frequency after another 10 minutes of continuous transmit operation. 'Max. Drift' is the greatest error observed at any time during the 40 minute test period. The final column is the error caused by detuning the antenna enough to reduce power output by 50%. All tests were done from a (24 hour) cold start.

Test Freq.	After 30 min. R/T cycling	After 10 min. key down	Max. Drift	50% chg. of load
1885 kcs	-54	-187	-187	+100
3885 kcs	-135	+163	-202	+250
7285 kcs	-910	-1145	-1436	+1200

In all cases, drift was most rapid in the 30 seconds right after the transmitter was keyed; this time constant seems about right for the effect of heating of the very large plate of the VT-4 oscillator. Further evidence for the tube as the main source of drift may be found in the fact that if you warm up the set and then change to a cold tuning unit, there is much less drift.

It is not surprising that changes in the tube should have a large effect for the plate to grid capacitance is about 7 mmf and it is connected directly across the MO tank circuit! Contrast this with the .1 or .2 mmf typical of a tetrode or pentode and you see the disadvantage of using a large power triode as an oscillator. The problem is aggravated by the fact that (considering losses) the oscillator must deliver about ten watts of output.

These results are of course not what you get from later designs using better tubes but they are excellent for the 1930 time period. And they are fully satisfactory for military use of the set with a receiver such as the BC-348 which has a bandwidth (crystal filter 'OFF') of about 10 kcs.

Ham use is more demanding; the 160 and 80 meter drift numbers are tolerable but the 40 meter performance is not. There is a slight 'chirp' on 40 meters.

Other types of stability must also be considered. In an MO-PA set, there is always some FM because modulating the final varies the load on the oscillator. Since the final gets 4 watts of drive, this load is considerable in the BC-375!

I do not have the equipment (a spectrum analyzer) to make accurate measurements of the FM, but receiving the signal on a BC-348 with the crystal filter 'ON' is a useful test, since this filter is sharp enough to make a normal AM signal sound distinctly 'bassy'. At 1885 kcs my BC-375 sounds normal ("clean but bassy") on this test, indicating insignificant FM. At 3885 and 7285 kcs, the transmitter is badly distorted (difficult to copy) with the filter 'ON' but sounds fine with it 'OFF'. Since the filter is about 2 kcs wide, the FM might be two kcs or so. On the air tests on 1885 and 3885 confirm these results; I will not use the set on 40 meters.

Conclusions

The BC-375 is a much better radio than it got credit for. It is outstandingly simple and sturdy, for one thing. It's easy to build, and, though it requires a trained radio operator, it is absolutely free of 'tricks' – you set the frequency, dip the final, load the antenna, check the final, and talk. Overall it is certainly no harder to use than most ham transmitters of the 30's.

For the time, this is as near a maintenance-free radio as I can imagine. There are few tubes and relays, no motors, and no 'delicate' parts of any kind. As evidence for 'maintenance-free', I offer the fact that mine went on the air (after 47 years!) without a single repair. The loading switch was intermittent on one position until it had been worked a few times; the pilot light filament was partly shorted causing it to be dim.

Service is simple and (remembering that it was built when labor was cheap and machines expensive) the set was surely inexpensive to build.

It could have been smaller, but – why? Its main duty station was in bombers, where weight (not volume) was the constraint. And while it's not a lightweight, it isn't heavy for the power level and the time.

As to stability, it sounds fine on a BC-348, the receiver with which it was most often used. With two or three kcs of drift on the highest frequencies, there would have been no difficulty establishing communication on an assigned channel after climbing from an English airfield to 20,000 feet and flying for a few hours.

continued on page 28

VINTAGE PRODUCT REVIEW

by Bill Kleronomos, KDØHG
POB 1456
Lyons, CO 80540

Hammarlund Super-Pro: SP-600JX-17

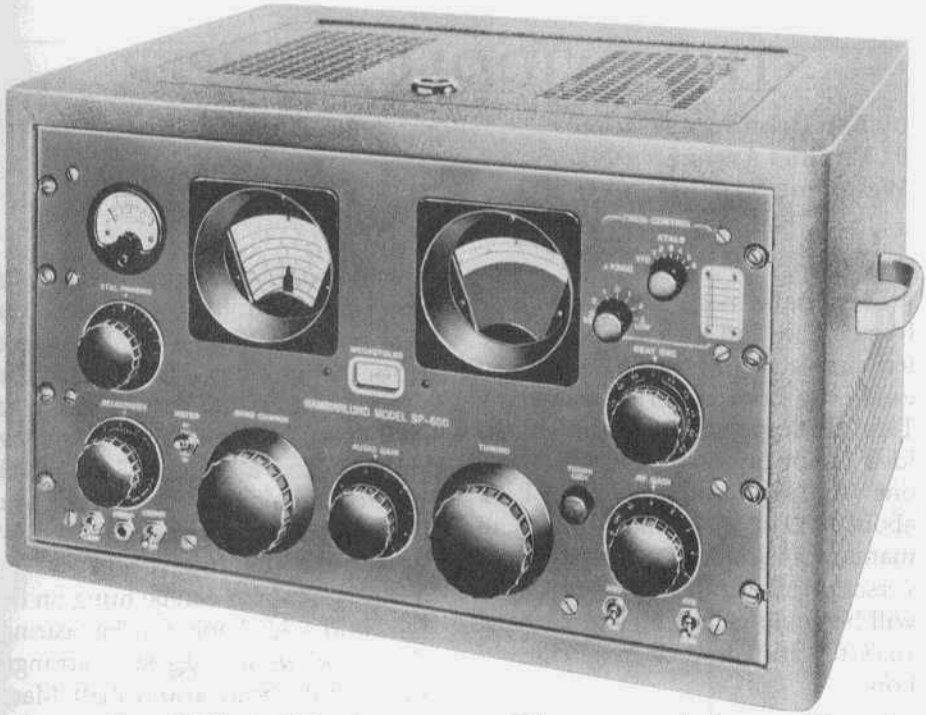
This is the first installment of what will be a fairly regular feature in ER, the purpose of which will be to provide an overview of the more popular vintage radio equipment. And, as with the new product reviews featured in the other electronics magazines our goal will be to provide you, the reader, sufficient technical information to decide if that "pre-owned" boat anchor will serve the intended use before making the purchase.

Every attempt will be made to insure a fair and accurate review of the equipment. Equipment that is reviewed will be given a fresh alignment and overhaul, where required. I am fortunate enough to have access to the latest in test equipment through my employment with accompanying accuracies at least on the order of magnitude of two or better than that required to make a given measurement. So, whether you are a collector or operator, I hope this new ER series is of interest to you.

The Hammarlund SP-600JX is a 'professional' grade of communications receiver that was manufactured into the 1960's. An expensive unit, most were originally sold to the military, government agencies and research laboratories. The number after the hyphen indicates the model number within the series which ends with the -26 model. The X indicates the capability for built in crystal control for spot frequencies and/or where extremely high stability is required. The unit reviewed had the capability to accept outboard oscillator and BFO signals from external sources and had outputs for audio, a buffered IF output for scopes, spectrum analyzers, RTTY, and the like, and an AVC voltage ouput designed to allow the receiver to be used in diversity reception applications. These, and other features such as a product detector are dependent on the exact model number. Ask before buying, if some feature is essential to what you need.

The SP-600JX is a twenty tube unit with self-contained power supply. There are no solid state devices of any kind, even in the power supply. The "J" in the model number indicates that mil-spec components were used by Hammarlund in the production. And, indeed, this unit is built extremely well! All solder connections, for example, are coated with conformal coating for corrosion protection. The main tuning capacitor is gold plated. The RF coils for the different bands are contained within a silver turret assembly which rotates the proper coils into position. The chassis is made from anodized aluminum.

The standard Super-Pro provides continuous coverage from .54 to 54 Mhz in six bands. Frequency readout is made by a combination of direct reading dial and a large logging dial, a la HRO. Through the use of the logging scale, one can measure frequencies to within the nearest kilohertz. The VFO drivetrain is a well made brass gear assembly with 50:1 reduction and several anti-backlash gear tensioners. In fact, no noticeable backlash is observed, even when tuning CW or SSB signals.



Two stages of RF amplification are used on all bands. Single conversion with an IF of 455 khz is used up to 7.4 Mhz and double conversion is used from 7.4 to 54 Mhz, with IF frequencies of 3955 and 455 khz. There are 4 IF amplifier stages, a very effective noise limiter, a BFO, and crystal filter. The audio output is a single 6V6 in class A. Six steps of selectivity are provided for: .2, .5, 1.3, 3, 8 and 13 khz. The crystal filter is in operation when the three tightest selectivity positions are selected. The S meter is calibrated directly in kc with respect to 455 kc.

Stability

A series of stability tests were conducted after a 1 hour warm-up. Due to the thermal inertia exhibited by the massive silver-plated cast front end assembly, I observed that stability continued to improve until thermal equilibrium was reached. This took about six hours! For the most critical applications, I recommend leaving this receiver on all the time in standby mode. I also noted that stability was greatly improved by using the 130 volt power transformer tap instead of the 117 volt tap in my area where the nominal line voltage is 123 volts.

After the warm up period, I measured the stability over a 10 minute period. This receiver held to within 30 hz at 14 Mhz and 10 hz at 7 Mhz. The BFO itself drifted less than 1 hz over the same period. In crystal control at 10 Mhz, drift was less than 2 hz over 12 hours. Mechanical stability was checked at 14 Mhz. Shaking the operating desk produced no change. Frequency only jumped a few hz when a sharp blow was applied to the cabinet.

Sensitivity

Sensitivity was measured using a 30% modulated carrier to check the 10db S+N/N rating of this receiver. For those of you not familiar with this test, it takes into account the thermal and other noise produced within the receiver and provides a figure of merit used by the electronics industry. Merely hearing a signal is not good enough if it is masked by a high internal noise level!

continued on page 31

THE TWIDDLE STOPPER

by Bob Dennison, W2HBE
82 Virginia Avenue
Westmont, NJ 08108

Dear Barry:

Every radio magazine needs a little humor now and then so I have written such a piece for you. Hope you enjoy it. I had fun making my Twiddle Stopper. I must confess the idea is not original with me. I saw one in a shack in Salina, KS, back about 1935 or so. It lends itself to all manner of variation. It is a good conversation starter. Just plain fun. QST will be envious that they don't have such 'fun stuff' in their magazine.
Bob

Did you ever rush into the shack, one minute before a sked with your buddy, flip several switches, press the mike button, only to be rewarded with sky-high plate current and no antenna current? Someone has twiddled your dials when you weren't looking! Let's face it. All those dials, knobs, levers and switches constitute an irresistable invitation to twiddle. That's why the twiddle stopper should find a home in every shack. It doesn't cost much and doesn't take long to make. Even if you just have a 71-A in the final, it will pay for itself if just one twiddler invades your shack. See Fig. 1

The Twiddle Stopper consists of a large dial mounted on a board. The dial can be a 3" or 4" dial salvaged from the junk box - the kind of dial used on three dial battery operated TRF sets of the mid-twenties is just right. I used a piece of 3/16" thick plywood removed from a cigar box. Two holes were required - a 1/4" hole near the top center so the Twiddle Stopper can be hung on the wall and a 3/8" hole for the bearing. Fig. 2 shows a suggested arrangement for the bearing and shaft. Many variations will suggest themselves depending on the contents of your junk box.

The front surface of the Twiddle Stopper is covered with a piece of white bristol board bearing the following message: IF YOU MUST TWIDDLE 'DE DIALS TWIDDLE 'DIS ONE.

Hang the Twiddle Stopper in a prominent place near your rig and watch the fun. The youngsters will fight over whose turn it is to tune. Older visitors will wait until they think no one is observing them. Nevertheless you can tell by the faraway look on their face that they enjoy it very much. So, protect your rig and at the same time bring joy to all those 'would be' hams. You need a Twiddle Stopper.

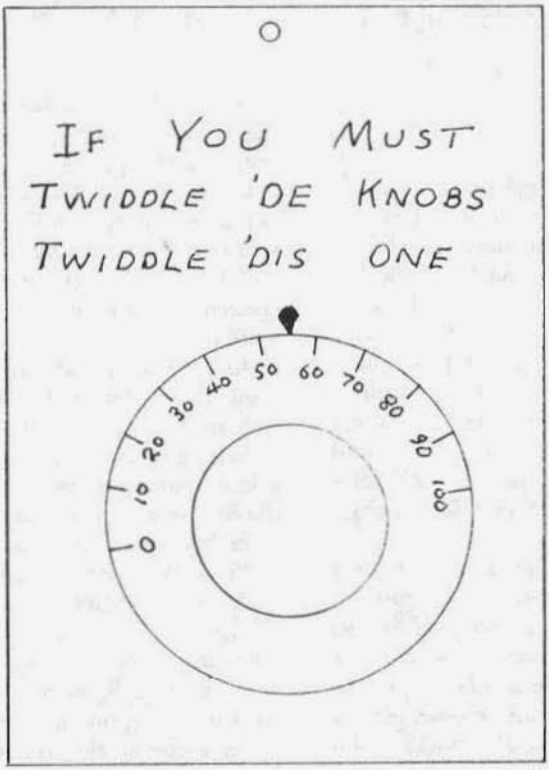


Fig. 1. General Appearance of the Twiddle Stopper.

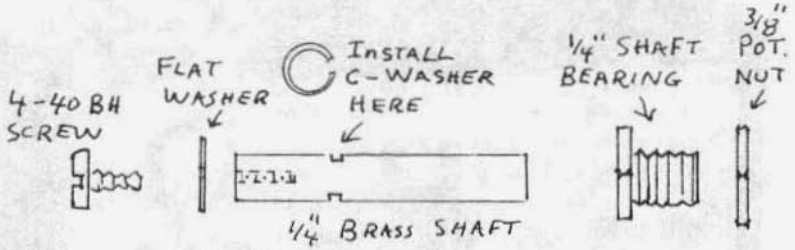


Fig. 2. Suggested arrangement of bearing and shaft.

Manley Youngberg, Design Engineer, E.F. Johnson Co.

by John Magnusson, WØAGD
5329 Gladstone St.
Lincoln, NE 68504

The historical record of Ham Radio would not be complete if it did not include the contributions made by Manley Youngberg. For more than 7 years he was a design engineer for the E.F. Johnson Co. He designed the Viking I, Viking II, Model 122 VFO, Ranger, Johnson Mobile, Mobile VFO and was the engineer on a host of other projects. It was my enviable pleasure to learn from, and work with, Manley while I was employed by the E.F. Johnson Co. in engineering.

Manley is an avid shortwave listener who builds his own receivers; some very sophisticated. Unfortunately he, like so many other well learned individuals, has never made the time available to take the ham exam although he does have a First Class Commercial license. Who knows, one of these days he may get his ham ticket. I sure would treasure being his first contact.

He and I shared the development of the Ranger. He designed the audio section, power supplies and a new approach to an effective shielded enclosure or cabinet. This new cabinet design became the standard used in many subsequent models of E.F. Johnson equipment. My responsibilities in the design of the Ranger were to reduce the size and stabilize the existing Model 122 vfo. The same vfo was used later in the Valiant and the Johnson 500. In addition I solved some band-switching problems inherent when a vfo is built into the transmitter and designed the RF exciter section and final tank coil assembly. In those days responsibilities and credits were rather poorly defined.

Unfortunately a tornado in 1967 totally destroyed Manley's home and he lost all the notes he had accumulated during his years at the E.F. Johnson Co. Therefore we are relying on our combined memories to recall most of the series of events that took place when he first began at Johnson and the years we worked together.

Johnson Viking I

Manley graduated from the University of Minnesota in 1940 with a BEEE, with majors in both power and radio engineering. After graduation he was employed by Chicago's Commonwealth Edison Power Co. He worked in trouble shooting, VLF carrier current and on their fleet of 100 two way radios. In 1943 he took advanced electronic courses at the University of Chicago for nine months under the auspices of the U.S. Signal Corps and the U. S. Air Force. A government convenience transfer to the U.S. Navy was made in the fall of 1943, which led to seven months of study of UHF techniques, IFF, Radar and countermeasures at M.I.T. in Cambridge, Mass. This was followed by a teaching position at Princeton University Department of Electrical Engineering, until all of Princeton was taken over by the Military Government School in early 1945. His last Navy assignment was as a full time instructor and welfare officer (lay padre) at the Radar Maintenance School in Pearl Harbor. He left active duty and went into the Naval Reserve in March of 1946, returning to the Electronics and Radio Division of Chicago's Commonwealth Edison Power Company.

He was hired by the E.F. Johnson Co. in 1947. The first year wasn't very exciting. He was assigned to RF testing projects and the design of final tank coils for ham rigs. At that time the Johnson Co. was primarily known for parts like tube sockets, jack bars, swinging links, air variable capacitors, plug in coils, telegraph keys and additional ham related items. They also had an extensive commercial component product line which included phasing networks and sampling loops for AM broadcast antenna installations. They also custom designed and manufactured components for other electronic companies.

In 1948 the sales department issued the following specs for an amateur transmitter they hoped would sell:

1) to be sold in kit form only, not factory wired and tested

2) the selling price to be about $150

3) 150 watts to the final stage

4) single tank loading final (rotary inductor)

5) provisions for 10 crystals (crystal controlled) note,NO VFO

6) coverage of the 80, 40, 20, and 10 meter bands

7) CW and good quality 100% modulated AM.

A poor man's version of the Collins 32V-1 that sold for about $600. Quite a challenge! And one that would make the Johnson Co. a real contender for their share of the amateur equipment market. Fortunately there wasn't a large percentage of hams that could afford the Collins rigs.

Manley says that the design/development of the Viking I was a very lonely experience. It was more than a one-man job but he had been assigned to do it alone. A great deal of his time was spent locating sources for parts. Then they had to be tested. Once the actual building of the lab prototype began, working out the function and performance of each stage was followed by establishing the neutralization and stability of each stage. There was little if any encouragement from the sales department. They had virtually no knowledge or comprehension of the overall design.

continued next page

Progress was slow due to additional time required for inductor designs and due to other projects he was assigned from time to time.

The one and only chance he had to see the Collins 32V, the transmitter he was trying to emulate, was at an electronics broker in Minneapolis. There was no taking one home or to the lab. Therefore, he had to haul the General Radio Signal Generator from the lab home in the evenings and on weekends to compare the calibration and stability of the Collins equipment on the air to the lab standard. This ritual also served in the design considerations for the development of the companion, Model 122 VFO, he planned to design. Provisions to add the vfo to the Viking I had already been provided. A vfo position had been added to the crystal selector switch and an octal socket had been installed on the rear of the chassis to supply power to the vfo. A SO-239 coax input jack was also installed on chassis rear panel.

The power and audio transformers were custom designed for the Viking I by the SNC Co. in Oshkosh, Wisconsin.

The first sample of the power transformer arrived in early 1948. It was quite a surprise; almost twice the size and weight Manley had expected. To solve the problem, the heat specs were increased and the ON-to-OFF time specs were lowered. This not only reduced the size and weight but it's cost as well. The sample modulation transformer was another surprise. It sounded like a loud speaker, not the quiet presence of a transformer. Changing the magnetic gap size and the core material corrected the problem. Working out these two problems took four to five weeks, considering bench time involved for testing, consulting the suppliers and shipping the samples back and forth.

Edgar, (E.F. Johnson), came to Manley's aid. He designed the cabinet, front panel and the control knobs. The finished lab prototype of the Viking I began to evolve in early 1949. At Manley's urging the 160 meter band had been added. This was a relatively simple consideration. It only required adding one more position to the rotary bandswitch wafers, one more winding on each coil in the exciter stages and adding a series 160 coil to the final tank circuit.

Johnson Viking II

In early March of 1949 the lab prototype was connected to an antenna. The operator was Art Brown, a ham who had recently joined the firm as the Advertising Manager. His first contact was with a ham in Indiana who gave him a very poor signal report. A quick glance around revealed they were loading a 6 foot ground loop, not the antenna on the roof. Switching to the antenna made a big impression on the Indiana contact. Instantly, the NO COST advertising of the ham bands was under way. It also confirmed the adequate range of the PI-network.

Fred Hager, WØDRG, one of the hams in engineering, took the prototype home for his evaluation. His comment when he returned it was to leave everything just as it was, because it was good. Fred later designed the Johnson Viking Desk KW. Unfortunately, Fred is no longer with us.

The low point of the entire project was a meeting in Edgar's office with the Sales Department, Art Brown, Fred, Manley and Edgar. With the exception of Art Brown and Fred Hager there was a complete air of pessimism regarding this new Viking I transmitter. Some of the negative comments were:

1) it's priced too high (initial selling price was $179.95

2) it has too many controls (costs money to eliminate controls)

3) it's too complicated to build

4) no vfo (forgot their original spec.)

A rather conservative forecast that only about 200 units would be built was the end result of this meeting. There was also the comment that with a realistic amount of side sales of the rotary inductor, designed for the project, part of the development cost of the Viking I could be recovered. This could not have been the most motivating and inspiring event of the day for Manley.

Parts procurement and production began immediately. Marvin Johnson, the Purchasing Agent, (Edgar's brother), was put in charge of procuring all the parts needed.

The first public exposure of the new transmitter took place at the 1949 May Parts Show in the Stevens Hotel in Chicago. The Viking I was set up and operated by a couple of Chicago area hams at a trailer in the parking lot. Hams and dealers were escorted to the trailer to see what was NEW in ham radio. The new rig was very enthusiastically reviewed by all. Interest was so great that the original forecast of 200 units was increased to 2000. Over the next few years combined sales of Viking I and Viking II would approach 15,000 units.

Fears by the sales department that the kits would be too complicated to build could be discounted by the following story. A MD gave his wife a Viking I kit to assemble. She had no knowledge of electronics and had never soldered before but she completed the job without a hitch. The MD said that all he did was plug it in and he was on the air. It worked perfectly.

The Model 122 VFO evolved rapidly. The Viking I owners were anxious for this much needed accessory. It was made in a simple square box, nothing fancy or stylish, just functional. The component parts were rigidly mounted to prevent any mechanical movement and to assure stability. The Centralab Co. manufactured the ceramic temperature compensating capacitor. It played a very critical role in the stability and calibration accuracy of the vfo.

Calibrating the vfo dial was a major accomplishment. The calibration marks were made on a blank paper on the dial. A master copy was made for photoetching the production panels. The General Radio Frequency Generator was re-calibrated every 30 minutes during the vfo calibration. When the vfo was brought into Edgar's office for his comments all Edgar asked was Manley's evaluation of it.

continued on page 26

Collecting/Repair/Restoration...TIPS

This month contributed by

Eddy Swynar, VE3CUI
48 Evergreen Drive
Whitby, Ontario L1N 6N6
Canada

Ranger I Touch-up Paint

A reasonably close match to the Johnson's Ranger I's original"... lacquer maroon" paint finish is "Testors" - brand #1531 Metallic Purple enamel. It comes in small 7 ml. bottles, and is available in most any hobby/toy shop. It is used primarily for touch-up work in the restoration of the original finish; narrow scratches in the paint can be "filled" with an application of this paint using the end of a toothpick as an applicator. Chips in the finish are best spot repaired using the end of a paper match stick as the transferring medium.

Repairs To Handbook Covers

If you've ever tried to restore an old ARRL Handbook where the complete cover - front, rear and spine - has become seperated in one piece from the binding of the pages themselves, a very effective repair can be effected with silicone sealer.

Simply treat the sealer as it comes from the tube as glue: apply a liberal bead across the entire inner surface of the spine, but be careful not to coat any part of the inside of the front/rear cover (if you do, the lead/closing page of the book will bond itself to the cover as well). Press the cover back onto the book, close it, and let it stand for 24 hours, propped up at its sides and laying flat on its spine. The weight of the pages will press down on the sealant in this way, ensuring a good bond.

I recently restored an otherwise excellent copy of the 1948 Handbook in this way. Advantages of the silicone are its pliancy, even after curing, and its stickiness when first applied. It sure beats the ugly old 'masking/scotch tape' type of repair and perhaps best of all, it leaves the book looking original.

Coil Dope

Effective coil 'dope' simply is no longer on the market in this area. However, for those who still like to 'roll their own' coils as I do, for grounded grid amplifier filament chokes, slug tuned amplifier input coils, etc. and who are seeking an effective dope for the turns of wire in a coil, a viable and effective alternative exists in the form of women's clear nail polish.

In my instance, a bottle of 'Maybelline' brand transparent nail polish has been very successfully pressed into active service. It dries quickly (a half hour or less), is tough, permanent and it has just the right viscosity to seal the turns, but to not drip off of the coil assembly when drying.

A single coat would probably suffice, but I prefer to use two. A small bottle costs just over $2 (Canadian) and goes a long way. Funny, it even smells like the coil dope of old.

Go North For Vintage Gear

Contrary to the situation in the U.S.A. - wherein availability of classic gear is rapidly becoming a thing of the past - the situation in Canada seems to be quite the reverse. Indeed, two weekends ago I attended what is considered by many to be the biggest ham flea market north of the 49th parallel, and I was, quite frankly, surprised by the width and breadth of the 'oldies' for sale (generally placed beneath the vendor's tables, thus giving you an idea of how little appreciation these 'gems' merit in the eyes of some of the 2 meter 'cowboys' in this area).

continued on page 29

AM FREQUENCIES

2 Meters - - - 144.4 - calling frequency Activity in most cities.
6 Meters - - -50.4 - calling frequency
10 Meters - - - 29.0 - 29.2 operating window. Most activity occurs here, although there is some activity around 28.325
12 Meters - - - 24. 985 - calling frequency
15 Meters - - - 21. 385 calling frequency
17 Meters - - - 18.150 calling frequency
20 Meters - - - 14.286 nightly SPAM net starts around 5:00 PM CA time.
40 Meters - - - 7160, 7195, 7290 - main operating frequencies. Westcoast SPAM every Sunday afternoon on 7160. Starts at 4:00 PM CA time.
80 Meters - - - 3825 - 3850, 3870 - 3890 main areas of operation. Westcoast SPAM net , Wednesday evenings, starting at 9:00 PM CA time. The frequency is 3870. The Northeast SPAM group meets Thursday evenings , starting at 7:30 EST. The frequency is 3885.

THIS IS MY OLD AM RIG -- I GOT KINDA MAD AT IT ONCE, BUT I'D LIKE TO GET IT BACK ON THE AIR FOR OLD TIME'S SAKE!

First Annual Allnighter... BIG SUCCESS!

by Barry Wiseman, N6CSW/Ø

The first annual Electric Radio 20 Meter'Allnighter' contest was a tremendous success. I counted over a hundred stations that I worked or heard or heard others working. Not bad. And the conditions were ideal. The band was very quiet and remained open all night. Others, more familiar with 20 meters late at night, have told me that it is rather unusual for the band to stay open like it did.

When the gun went off to start the contest - 11:00 PM local - the first station I heard calling CQ was Al, WØPUF, up in Rapid City, SD. After Al and I had exchanged information and had a 15 minute ragchew, I tuned down the band and could not believe the level of AM activity; from 14.325 down to about 14.225 there was almost solid AM signals.

I worked 24 stations. That equates to about 3 per hour, hardly passable by most contest standards, but not bad for AM'ers. We seem to enjoy the social aspect of a contest more than the competition.

I found it hard to stay awake but was somewhat encouraged by the fact that Les, K6HQI, (a much older man, Hi!) seemed to be handling it OK. I think Les had a further handicap in that his shack temperature was in the high 80's throughout the contest. 833A's modulated by 833A's generate a lot of heat.

Another 'contester', WA8LXJ, had to shut down his big rig toward morning. The heat in his shack was over a 100 and he just couldn't handle it anymore. Bill shut down the Collins 231D (750TL in the final) and fired up his Viking II for the last couple of hours. Incidentally, I think Bill may be one of the high scorers in the contest with around 50 contacts.

continued on page 32

LETTERS

Dear ER

A beloved East Coast AM'er has become a silent key. Stan Jasut, K1SJ, East Hartford, CT passed away April 15 at the Veteran's hospital in West Haven, Ct.

He was a World War II flyer and a lifelong ham. He homebrewed most of his own equipment and was known for his honest opinions and advice on any given subject. He was most active on 75 and 6 meter AM. Stan will certainly be missed on 'glorious AM'.

Michael Koscak,WA1MTZ

Dear ER

I ran across a blurb for your "Unusual Magazine" in a recent catalog of Linday's publications. Lindsay's of course is in a class by itself and occasionally they run ads for other clubs such as the Stationary Engine society of which I am a member.

Have you anything in your magazines, "old files ok" on the devise known as the "Bug". The bug was a slang - later a standard term - for the Vibroplex semi-automatic telegraph key which utilized a horizontal 'wig-wag' motion and a vibrating reed. I vaguely recall from time to time controversy would pop up about the legality of the bug and at times I believe the FCC would attempt to ban it or at least try to keep it off some of the amateur bands. Bugs were used by the Armed Forces and also by Western Union up to the late 50's. It is conjectural that they were also used by a number of instrumental recording artists in the late 50's; most notably the 'Ventures'. They were plugged into bass guitar amplifiers.

One suspects 'bug' use on the following songs by the Ventures: Hot Line, Vamp Camp, Man from U.N.C.L.E., and also on the record album 'Ventures in Space'. A major drawback of 'electronic music' is that it does not lend itself to live productions and as far as I know the Ventures never did perform at concerts. Among their better known productions was their recording of the 'Batman Theme' and also 'Hawaii Five-O'. These did not, however, use the 'far out' techniques of the earlier disks.

I would appreciate a reply.

K. Chris Hamel

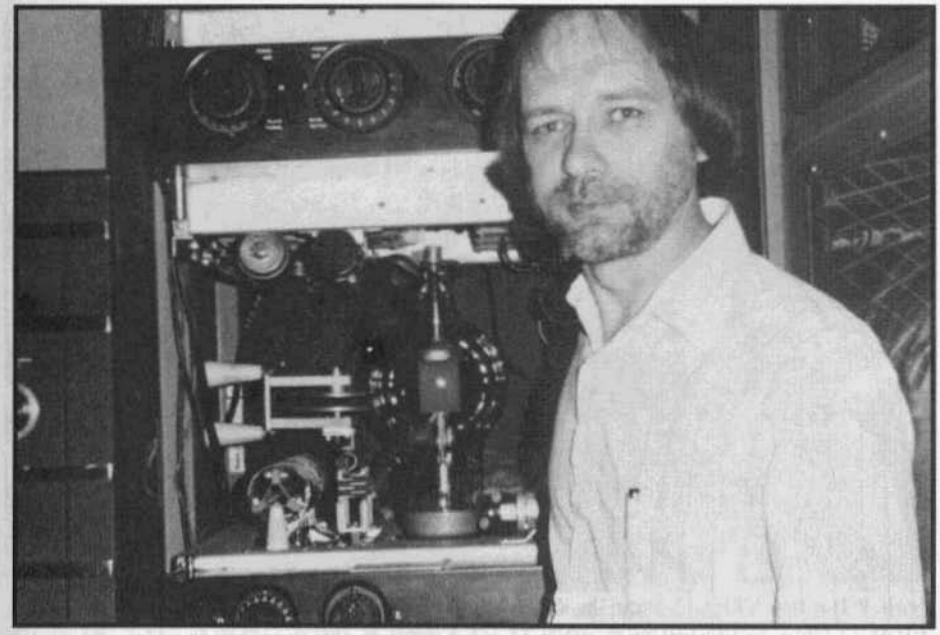
Editor's note: Does anyone have any information for Chris? If you do, please drop me a line and I will forward it on to him.

Dear ER

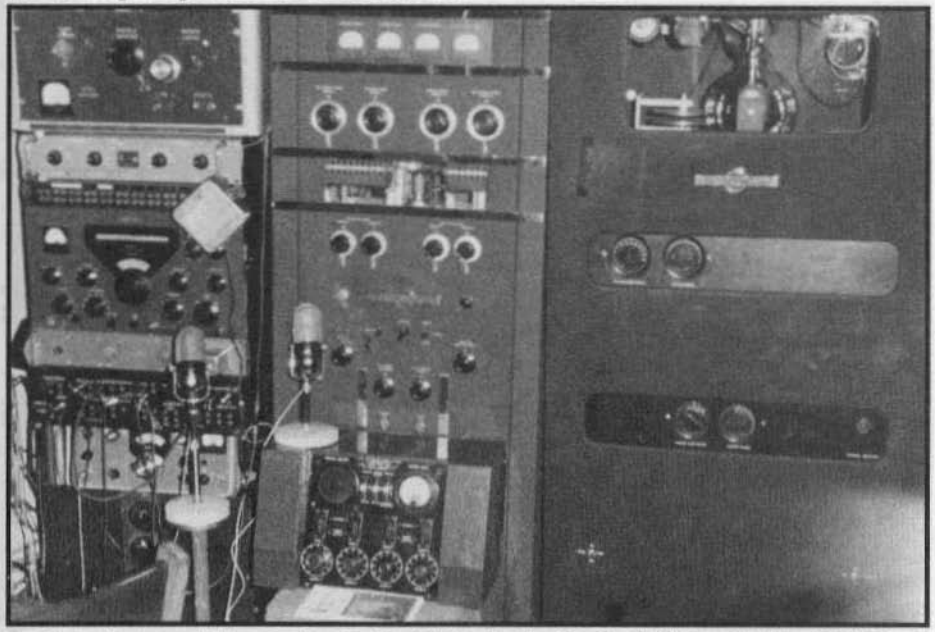
Congratulations on your first year anniversary. Electric Radio sure has brought renewed interest in AM radio to the old timers and sparked the imagination of the newcomers.

Fred Huntley (W6RNC) does an outstanding job on his monthly column. We do not always appreciate the silent wisdom and experiences of those we casually speak with over the air.

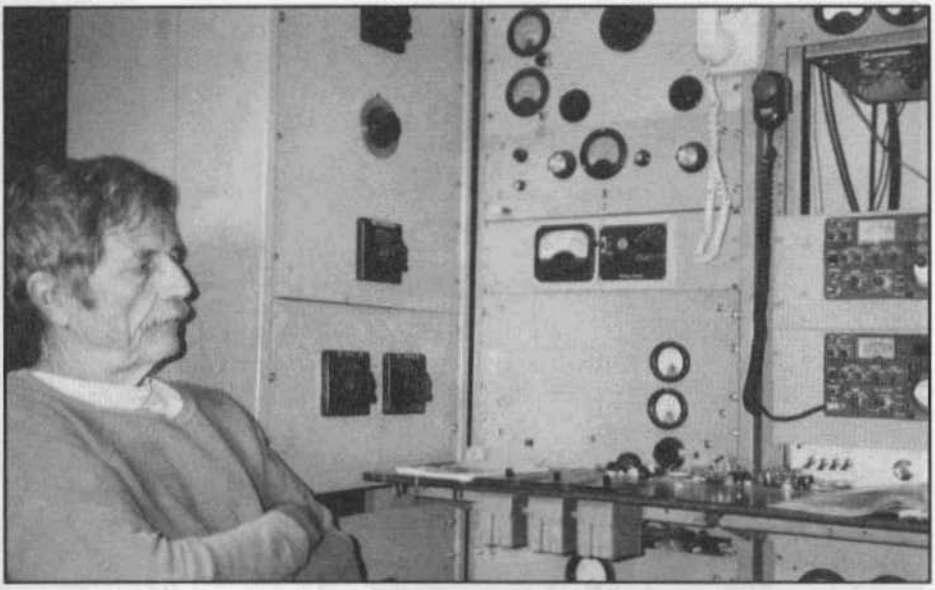
Art Rideout, WA6IPD



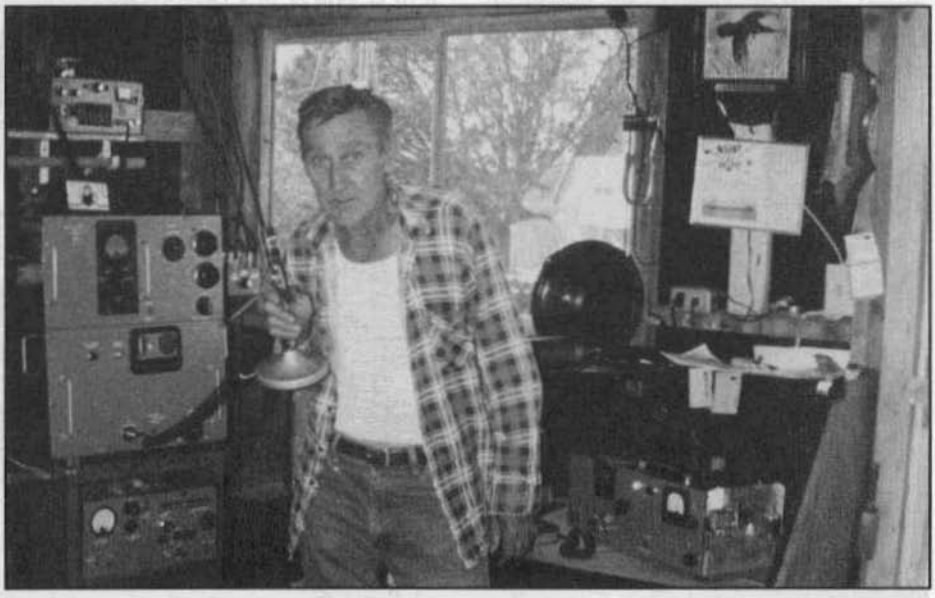
Bill Diggins, WA8LXJ, Morrow, OH standing in front of his Collins 231D transmitter. Note the 750TL final. Bill is presently working on an article on this transmitter and we hope to print it in the near future.



A view of some of the equipment in Bill's shack. On the left is a Collins 75A-2 and a KWM-2. In the center is a Collins 30K-4. In front of the 30K is a TWT broadcast mixer board. And of course on the right is the Collins 231D. The story on the 231D is very interesting. Stay tuned.



Jack Wheeler, KH6CC, Paauilo, HI in his shack. The homebrew gear consists of a PP 450 TL rig on the left with a 250 TL rig next to it. On the right is a rig with a pair of 3-500Z's. Jack is ex W7FNK, W7LAX, KH6CHC, KH6GLV, KC6BD, KP6AL, FO8AI and VR3AL.



David (Andy) Anderson, N5JBT, Ingram , TX in his shack. I think the rig Andy is seen operating is his 813 rig. The rig on the right is a homebrew 6 meter transceiver. Andy and Jack, KH6CC can be found most aftenoons in the winter around 29.0, discussing some aspect of construction. Andy is one of the most active AM'ers in the country.

Ed (Mac) McKnight, WK7U, Helena, MT in his shack. Some of the equipment shown includes a Johnson Desk KW, Johnson 500, Collins 32V-3, a 75A receiver and a National NC-303. Mac has a couple of articles in the works for ER. One of the articles describes how he acquired his Johnson 500. It's an interesting story.

Woody Linwood, WRØS, Denver, CO . Vintage gear shown includes a KWS-1, 75A-4 and a Ranger. Woody was first licensed in 1966 at the age of 11. He says he will qualify for QCWA in 1991 just prior to his 36th birthday.

Edwin Howard Armstrong: Inventions in Wireless

by William A. Diggins, WA8LXJ
2699 Shamrock Road
Morrow, OH 45152

"It ain't ignorance that causes all the trouble in this world; it's the things folks know that ain't so."

Josh Billings said it; but it was Edwin Howard Armstrong who took the statement to heart and proved it true, again and again, with his series of groundbreaking inventions that went against the grain of what passed for the scientific truth of his day. Armstrong's refusal to accept "the things that folks know" as the truth gave the world the regenerative circuit, the superheterodyne circuit and frequency modulation. It is safe to say that without these inventions, radio would not exist today in its present form. What the world gave back to Armstrong in return was far less. In the end he died by his own hand, a broken and disappointed man. Armstrong's inventions will live forever, but the inventor himself now dwells in relative obscurity. Those of us who enjoy experimenting in radio, however, should be in a far better position to appreciate both Armstrong the man and his achievements. This article will attempt a brief sketch of both.

Edwin Howard Armstrong was born on December 18, 1890, in New York City. His father, John, worked for Oxford University Press. His mother, Emily, a graduate of Hunter College, was a public school teacher prior to her marriage. When Edwin was twelve, his family moved to Yonkers, New York, and it was an attic room in that house on 1032 Warburton Avenue that became the setting for Armstrong's earliest experimentations in radio.

According to Armstrong's biographer, Lawrence Lessing, the inspiration which launched Edwin Armstrong into the world of invention came into his hands at 14, when his father presented him with two volumes, The Boy's Book of Inventions and Stories of Inventors. As he pored over the stories of Michael Faraday and Guglielmo Marconi in his books, Armstrong was galvanized to follow their forays into wireless. A 125 foot antenna mast went up in his backyard, and the attic room became filled with the paraphernalia of early radio telegraphy.

What separated Armstrong from so many other experimenters and radio enthusiasts who were bitten by the wireless bug? Many would listen until dawn for far away signals. All dreamed of finding a way to transcend the limitations of the spark-gap transmitter in order to transmit and receive strong wireless signals over long distances. But there was some mixture of stubborn and indomitable will and rare intellectual grasp in Armstrong's makeup that would eventually yield the answer so many sought.

In 1909, Edwin Armstrong entered the Department of Electrical Engineering at Columbia University. It was the beginning of a lifetime association with the school. Armstrong lost no time in ruffling the feathers of some of his professors. Some resented Armstrong's freewheeling and independent turn of mind and his inability to accept "the things that folks know" at face value, whether they appeared in books or in lectures. Other of his professors were better able to recognize Armstrong's gifts. The most eminent among them and the greatest

influence on Armstrong, was Professor Michael Idvorsky Pupin, a founder of the electrical engineering department at Columbia and a renowned inventor in his own right.

Over the next three years, Armstrong continued his experimentations at the school laboratory and in his attic room station. Finally, in the fall of 1912, Armstrong had a major breakthrough, but for a time he kept his discovery for amplifying wireless signals a secret, hiding the circuitry in a mysterious box he lugged back and forth between home and school. Armstrong's fears would prove prescient, for his discovery of regenerative amplification would be challenged by Lee de Forest in an over twenty year legal battle over patent rights.

Lee de Forest was the indisputable inventor of the triode, but his audion tube represented little improvement over the conventional receiving devices of the day. It was Armstrong who figured out how to put the triode to use, by devising the regenerative circuit which, in taking part of the output of the tube and feeding it back to the input, produced a signal of unprecedented amplitude. This created a detector hundreds of times more sensitive than anything prior to its discovery. It was also this same principle of oscillation that took us from spark-gap to the modern transmitter.

Armstrong could not keep his invention under wraps indefinitely. After filing a patent for his regenerative receiver circuit, he announced his discovery via a series of papers delivered before the Institute of Radio Engineers. Six months after Armstrong's first presentation at Columbia, Lee de Forest filed his own rival patent applications, ensuring that Armstrong's claim to the regenerative circuit would be entangled in litigation for years to come. Eventually, in 1934, Armstrong would emerge the loser, in what seems a grave miscarriage of justice.

The setting for Armstrong's second major invention was World War I, where he was stationed in France as a captain in the U.S. Army Signal Corps. At that time, military communications were primitive at best, and there was a need to be able to detect and amplify frequency signals in the 500 Khz to 3 Mhz range the Germans were believed to be using. Armstrong's solution was a four stage receiver able to bring down weak high frequency signals to a preselected intermediate level which then could be amplified to a previously unheard of level. Ironically, this receiver, which became known as the superheterodyne, was never used in the military applications for which Armstrong designed it, but it was to become an integral part of all radio receivers up to the present day. Fortunately, too, Armstrong was able to enjoy full credit for it's invention without serious challenge. In fact, in 1920,patent rights for both Armstrong's superheterodyne receiver and feedback circuit were sold to Westinghouse for around a third of a million dollars.

Around this same time, Armstrong stumbled upon the principle of superregeneration by chance,after hearing signals coming in at an unprecedented volume. From this, Armstrong discovered that by incorporating a "quenching" tube into a regenerative circuit, further amplification could be achieved. He lost no time in filing for a patent.

Ironically, what might be considered Armstrong's greatest inventive feat occurred on the heels of his greatest defeat. As mentioned earlier, in 1934, Armstrong's ten year struggle to establish himself as the rightful inventor of the regenerative circuit was lost in favor of de Forest. The litigation, which eventually went as far as the Supreme Court, had cost Armstrong over a million dollars and took an uncalculable toll on his time, energy, and spirit.

continued on page 30

Manley Youngberg from page 17

When Manley assured him that it was stable and accurate, Edgar ok'ed it for production. Sales were brisk. Manley says it was very rewarding for him to listen to owners of the Model 122 on the air comparing their new vfo to the competition's and claiming better stability and calibration.

The demand from the marketplace was for equipment that had all harmonics or interference reduced to near zero levels. The result was a kit for the Viking I that consisted of a coil and condensor L section to be installed in each lead of the line cord, a large cylindrical low-pass filter in the output, and the resistor treatment of the screen grid to the RF driver stage to eliminate harmonics when operating CW. This TVI project for the Viking I evolved into the almost immediate development of the Viking II transmitter.

Al Pichitino, WØEDX, came to the E.F. Johnson Co. as Chief Engineer at about the same time the Viking II was ready to leave the launch pad. Al suggested trying two of the new RCA 6146's in parallel instead of the 4D32 used in the Viking I. This reduced the cost of the finals 60%.

Al had a homebrew KW. One evening he went on the air using the Viking II as a driver. He made no mention of the pair of 4-250A's modulated by a pair of 810's between the Viking II and the antenna. A natural oversight! It did wonders for the reputation of the Viking II! Al was as sharp an engineer as you'll ever meet. Unfortunately he is no longer with us.

The RCA 6146 was a hot tube but resistors in the screen grid leads tamed it adequately. The rest of the transition from a Viking I to a Viking II using the same RF section and audio was painless. However Manley spent many evenings running the new Viking II with one eye on a TV set. TVI had become a very important consideration. Sales of the Viking II were very brisk.

A single 6146 was used in the final of the Ranger. Fully aware of its characteristics, Manley was doodling on a scrap of paper one day while considering bridge neutralization. The 15 meter band had been added while the Ranger was being designed and that put a kink in our usual scheme of getting all the bands to behave. While he was considering this approach, it suddenly dawned on him that the treatment of the cathode lead of a 6146 is very critical. Experimenting with lead length and lead dress resulted in the Ranger being one of the most stable multi-band transmitters on the market.

I have no idea of the volume of Rangers that were sold in both the kit form and the factory wired and tested models. I have heard some numbers from time to time but I don't know how accurate they are. [Ed. a figure that is believed to come from the Johnson Co. is 11, 481 units].

Every Viking I, II, VFO, Mobile and Ranger is a tribute to Manley Youngberg. It has been my pleasure to share this information with everyone and give Manley the long overdue recognition that he so justly deserves.

Manley would like to give credit to everyone who made their contributions to the development of Johnson equipment during those early days. He says it was the combined ingenuity and devotion of many that made the E.F. Johnson amateur equipment so successful.

Collins 75A-4 Modifications

by William H. Beatty, K7CMS
4721 N. Bamboo Circle
Tucson, AZ 85749

Improved Audio

This modification removes inverse feedback between the plates of the 1st and 2nd audio stages and changes inverse feedback originating at the output transformer secondary from the 1st audio to the 2nd audio cathode. Note: a further improvement can be made by changing to a larger audio output transformer and by trying different amounts of feedback by varying the value of R71.

Remove R71 (33k) from pin 3 of V13 (12AT7) and move to pin 8.
Reverse primary leads of audio output transformer (T5).
Remove R109 (390k) and discard.
Add 470k between C100 (.01) and pin 7 of V13 (12AT7)

Reduced SSB Distortion

This reduces the level of IF signal injection to the product detector

Replace C87 (10 pf) with 5 pf.
Add 50 pf in parallel with C99 (100 pf)

Improved Slow AVC

This increases the slow AVC time constant. It also reduces the AVC attack time and allows the AVC voltage to drop instantaneously when switching to standby.

Remove R90 (2200 ohm) and C112 (.1 mfd) and replace with 22k and .47 respectively, but with the bottom of the .47 mfd connected to junction of R98 (22k) and R104 (270 ohms) instead of to ground.

Connect .001 mfd from the junction of R89 (10k) and former R90 (22k) to ground.

Change C20 (.1 mfd) to .01 mfd.

ER in Uniform from page 9

CW in jamming or heavy interference might be a problem on the higher bands, since the set could not be kept on the nose of your crystal filter, but both CW and those frequencies were little used.

One might wish for features found in later sets -- multichannel capability, remote tuning, fewer operator controls -- but the B-17 and other bombers in which most BC-375's served carried a radio operator and would have done so no matter what features the set had.

Over 35% of the B-17s built were lost in combat. It was more important that the set be reliable and low in cost than that it have the latest features.

One could wish, too, that the BC-375 had been given a minor redesign to use the vastly better tubes available by the late 1930's. I suspect it would have been not just a good radio overall, but a very stable one with excellent modulation quality as well. But it was stable and readable enough to do the job and that is what really matters.

The mission of most planes carrying this equipment was daylight high altitude bombing of Europe. Nothing in the design of the BC-375 suggests that newer technology would have made it more effective for this mission; two users I have talked to told me that the set did it's job. Considering the match between the mission and the set, these must have rated among the most successful military radios ever built.

The BC-375's quality was the result of skill but luck also played a part in its success: the job for which the radio was designed did not change much between 1930 and 1945. History is not always so kind. In recent months we have studied two radios which became obsolete overnight -- the TBY because the conditions in which it would be used changed from 'peacetime U.S.' to tropical jungle warfare, and the MF/HF 'command' sets because VHF was found to be better for the job.

The Legend of The BC-375

Ask any older ham about the BC-375 and the first adjective you hear will be 'unstable'. While this is true if 'unstable' means 'does not meet ham requirements on all bands', the set is fine on 160 and usable on 80. Moreover, the problems can be solved. Driving the oscillator with an external VFO will do it; I think a 6L6 - 814 (or 813) tube lineup would also work. Many other 'surplus' sets required such measures -- the BC-610, for one. Why was the BC-375 singled out as fatally 'unstable'?

The first article I have found which mentions the set is "What About the BC-375-E?", published in the December, 1946 issue of QST. The article says that in order to answer questions coming to ARRL headquarters they got one and converted it for AC operation. After conversion (says the article) it chirped badly on CW, retuning the antenna pulled the frequency (on 80 meters) "a good many kilocycles", and overall, the transmitter's signal wasn't "the kind that a self respecting ham would care to have on the air". These problems are attributed to the difference between the requirements of Army and ham use. The stability "does not appear to be capable of improvement without extensive modification."

The QST results are much worse than my tests showed. As usual I used the original dynamotor with a regulated 26 volt DC supply; like an aircraft electrical system this setup gives voltages which don't vary much with changes in the load. The BC-375 has no internal voltage regulation and both MO and PA run directly from the 1000 volt line. The AC supply used in the QST tests is not described; if it was not well regulated (the dynamotor regulation is 10%, no load to full load!), changing the antenna loading could change the oscillator frequency considerably. The QST tests were done with a 150 watt lamp as a dummy load; when I tried a lamp load a significant

chirp appeared. Doubtless this is because the load on the PA changes greatly as the lamp filament heats up.

The author ("R.M.S.") goes on to discuss changing the set to allow use of an external oscillator. He then grapples with the need for additional changes if full modulation and good linearity are to be obtained. The only positive comments are a couple of remarks on the high quality parts.

I think that the combination of truth (1930 design) and 'bad science' (severe instability and chirp caused by the test setup) in this article is the source of the BC-375 legend. Most hams came to think of the radio as a half-empty glass -- that is, as 'unstable', rather than as a good set needing changes for ham use. It was a bum rap, but with a silver lining: the number of BC-375's built was only one tenth of the number of 'command' sets and if many had been converted, none of us today would ever see one.

The QST tests show how difficult it can be to do a good conversion. Often there are important design features which are not obvious and not described in the manual. This is a major reason that I do very little conversion -- and none without testing the set 'as built'.

More On ...

Several readers have passed along interesting comments on various military sets featured in recent months. From "Cactus Jack" Curtis, KI6XK, comes this:

"The TBY article took me right back to 1942/43 when I was a radio instructor at the Marine Base, Signal Bn., San Diego, CA... All things considered the TBY worked pretty well. However, they were hazardous to the health. Not because they had luminous paint on the dials, but because a radio man was assumed to be directing offshore shipboard gunfire to targets. He therefore became a sought after target... Horizontal radios that could be carried like a suitcase or placed on the ground and dragged a short distance behind the operator (were) more practical..."

Smaller (and 'flat') field radios were better (we'll be looking at some of them in future issues) but in Korea and Vietnam, radiomen were still prime targets. In Vietnam (at one point) only about half of those personnel acting as radiomen had been so trained; the high rate of casualties was a major reason.

Regarding the TRC-75/ARC-58, I had a call from Mark Meltzer of San Francisco who told me of a friend working at a well known military electronics firm which (in the 60's) had a contract to develop an FSK adapter for the ARC-58 and the ARC-65 which is a functionally similar set designed by RCA. Their ARC-58 was down so much of the time they had difficulty finishing the job; the ARC-65 was quite reliable.

That's it for this 'mission'. Next month we'll make our first visit to a VHF aircraft radio. If you worked on, designed, or used any of the military VHF or UHF radios, I'd like to hear your comments as we will be 'getting orders' to quite a few of them in future months!

Tips from page 18

Prices were good on all of the classic stuff that I saw for sale, with the singular exception of the Collins S-line which still seems to have almost an 'air of mysticism' about it in Canada. All in all I think it would be prudent on the part of 'bordertown 'U.S. vintage gear fans to check the hamfest section in QST with the intent of driving northward once in a while to pick-up a few bargains.

Editor's note: To keep this column going we need a lot more input from a lot more people. If you have a good tip, please take a minute and send it in.

Armstrong from page 25

Yet around this same time, Armstrong had a firm hold on a great technical breakthrough, a way to eliminate static and produce superior sound reproduction through FM.

FM was not a new concept, but it had long been regarded as unsuitable for transmitting any sort of information. It took Armstrong to challenge that belief and discover that FM, in contrast with AM, could actually produce the full frequency spectrum of sound almost without static, but only if it was employed over a wide bandwidth. In addition, FM cost less than AM to transmit, requiring less power to cover the same distance and less monitoring of the signal.

It might be surprising then, to realize how resistant the broadcasting industry as a whole was to Armstrong's new development. It was the middle of the Great Depression, and the industry was more reluctant than ever to institute any sort of sweeping change upon an already established technical pattern. Faced with indifference from David Sarnoff of RCA among others, Armstrong decided to attempt to develop FM into a commercial form on his own. By the summer of 1939, Armstrong had an experimental 50 KW FM station, W2XMN, in Alpine, New Jersey on the air with a regular schedule of broadcasts. By 1942, there were over forty FM stations in existence. FM's gains were made amid RCA's concerted efforts to block its growth, in order that the frequencies FM occupied be allocated to RCA's experimental TV efforts.

World War II put an end to civilian production of electronic equipment and interrupted the growth of FM. Once again, Armstrong made invaluable contributions to the war effort, adapting FM for use in mobile military communications and conducting secret experiments on microwave and continuous wave FM radar. For his work, Armstrong received the U.S. Medal for Merit. This could be added to a number of honors awarded to Armstrong during his lifetime including a Medal of Honor from the Institute of Radio Engineers (1918, for his discovery of regeneration); the Franklin Medal (1941) and the Edison Medal (1942) for his many contributions to the field of electronic research.

The last years of Armstrong's life were unfortunately unhappy ones for him. He continued to wage a largely unsuccessful battle with the big radio interests to promote FM, and he saw FM's growth steadily dwindle due to a series of FCC rulings adverse to it. Armstrong also sought to engage RCA and NBC in a lawsuit for infringing on his patents. That, too, dragged on in seemingly interminable pre-trial delays. With his personal life in shambles and his financial resources whittled down by the tremendous costs of doing his own research and development and paying for legal counsel, Armstrong lapsed into a deep despondency. Most devastating of all to him was the belief that he was finished as an inventor. On January 31, 1954, Edwin Howard Armstrong took his own life, jumping out of his 13th story apartment window.

It might be tempting to dwell on the irony that such an illustrious life as Armstrong's could come to such an ignoble end, and worse still, now be nearly forgotten by the vast majority of Americans. Unfortunately, the world has seldom been hospitable to highly individualistic inventive geniuses, and Armstrong's story is not so unique. Rather than lament, it would be far better to celebrate Edwin Howard Armstrong's inventive gifts to wireless and to our society. Beyond this, let us celebrate the questing spirit that lies behind all inventions and one individual's stubborn refusal to accept "the things we know that just aren't so."

Vintage Review from page 11

The sensitivity was checked at 1, 4, 14 and 50 Mhz and measured .6, .6, .7, and 1.5 uV, respectively. This is not bad for AM sensitivity. CW signals were readable at .1 microvolt or less throughout the range. Overall, this receiver has very good sensitivity with somewhat high thermal background noise.

Image and Spurious Responses

These were checked at 40 Mhz and were unmeasurable due to test equipment limitations. My rating, therefore, is 90 db or better - an outstanding figure.

Audio Distortion and Response

Measured distortion, at 1 khz ranged from 3% at 100 mw, 6% at 500 mw and 10% at 1 watt. Audio response was basically flat from 100 hz up to the selectivity limit.

Overview

The SP600JX-17 is an excellent general coverage receiver for general purpose shortwave listening, monitoring and AM amateur use. One needs to bear in mind that the price paid for 54 Mhz of frequency coverage in only six bands is less than modern day stability for SSB and CW work. At least an hour warmup is needed for comfortable reception of these modes. One does not need to continuously change bands as with the R-390 and 51-J to quickly sweet a wide chunk of spectrum. The ability to cover up to 54 Mhz is a plus for 6 meter use. I found the design of the IF provided entirely adequate selectivity for use with strong adjacent signals in the amateur and shortwave bands. The audio is pleasant sounding but has slight distortion audible to a critical ear at higher levels. The weighted flywheel tuning is smooth and backlash free. When properly adjusted the single pole crystal filter provides very, very, good single signal CW reception. Overall, this vintage Super-Pro leaves one with a positive impression. It's an honest, extremely well built, 70 pounds of receiver.

Editor's Comments from page 1

Here's some of their comments:

Les, K6HQI said,"Had a ball Saturday night! Enclosed is my log worth 105 points. I would like ER to thank Mel, NC4L, Hollywood, FL, who is a member of a net that operates on 14.280, for relinquishing his QSO with a station in Hawaii in such a gentlemanly manner to let me continue on that frequency with no QRM."

John, N7BEG, "I had a blast! Lets do this again!"

Tom, N8IYV, "I started at 1:00 AM local time (EST) and finished at 3:38. I just couldn't keep my eyes open any longer; (damned swing shift at work). Wish I could have lasted for the whole contest."

Jeff, KEØMT,"If I had to sum up last Saturday night, it would be with one word...Ragin! Thanks for putting on a great party OM."

Gary, W7FG, "The contest was enjoyable and I was very surprised to see the activity level". Gary also had some suggestions for changes in the rules. I think that next year there will be some changes. I have to admit that I really didn't give the rules much consideration. Like Gary, I too, was somewhat surprised at the level of activity. Next issue we'll talk about those rule changes.

Eddy, VE3CUI, "Band conditions were superb; I don't think I worked a single station that didn't peak over S-9 at some point during the contact. The AM crowd really shone in this contest: all the operators were very friendly and courteous.

Next issue I'll announce the details on a couple more 'contests'. One will be a 'weekender' on 15 meters with a 'multi-op' category. I haven't decided yet which weekend might be best. The other 'event', not really a contest, would be on Field day. Several people have expressed an interest in this. I would appreciate input on these ideas; particularly how we might organize something for Field day.

On to #14

Allnighter from page 19

There was also some DX stations worked. I think there were 3 VK's running AM and at least 1 ZL. As far as Canada is concerned the only stations I heard were VE4BX and VE3CUI. I heard Doug ,VE4BX, at the beginning of the contest working Les, K6HQI, and then he disappeared. I think that Doug must have had rig trouble or else his wife dragged him off to bed. Eddy, VE3CUI, answered a CQ about 6:30 AM local. He had a nice signal down this way.

A little earlier I heard Howard, W3HM, come on the band. I managed to contact him after he finished working a VK. I also 'sort of' worked the VK. Howard said that he went to sleep that night listening to Les, K6HQI. When the alarm went off - he wanted to operate the last few hours of the contest - and he turned on his radio, there was Les, still at it.

It was very gratifying that the SSB operators accepted our activity the way they did. I had anticipated some grumbling but I didn't hear any at all. In fact I there were several stations that switched to AM and got involved with us. One SSB station I heard mentioned that he had a homebrew kw that he had not 'fired up' in years. He said he was going to put it on the air. And he did about a half hour later and it sounded great.

There was something 'magic' and wonderful about the contest. I don't suppose there was as much AM activity on 20 since the 50's. Great hearing the hetrodynes and the great big AM signals. And great being with all the AM'ers I know so well and appreciate so much. Till next year.

Next year there may be some changes in the contest rules. I have received some comments that the 50 points for operating the entire contest unfairly penalizes those that cannot operate the whole time. Also some feel that 10 points for DX stations is too much.

Next month I'll have the 'winners' and a list of all stations that participated. Please send in your log.

Dayton from page 3

As far as Heath equipment is concerned, I saw a HO-10 ($50) AT-1 ($25), 2 HR-10B's ($30 & $65), DX-20 ($20), 2 DX-40's ($20 & $45), DX-60B ($45), Mohican ($25), Warrior ($275), SB300 ($100), 2 SB220's ($450 ea), EK-2 ($15) and an unpriced Warrior and Maurader.

As usual there was a great amount of Drake equipment, mainly sold in sets with a B line going for $300 while 2 C lines were marked $450. Individual pieces had varying asking prices, R4C ($225), R4B ($175), T4XC ($225), 2 T4XB's ($175 & $205), 2 TR4C's ($300 & $375), TR4CW ($450), 2C with 2CQ ($140). Some pairs were: T4X & R4A ($350), T4XB & R4C ($450), R4B & T4XB ($325).

While I am very weak where military equipment is concerned, I am paying much more attention since ER. I noticed the following: R-392 ($125), R392 with power supply ($150), 2 R-390A's ($175 & $250), 2 URM25F's ($75 & $85), AR5 without power supply ($25).

Miscellaneous gear included a Clegg Thor with power supply ($20), Mosley CM-1 ($65), 2 RME 6900's ($50 & $75), 2 RME VHF 152A's ($15 & $25), Eico 720 with 722 VFO ($35), Echophone EC-2, Globe Matcher Senior ($50), Central Electronics CE20A ($75) and 100V (no price), Lysco Transmaster, Bandmaster Z-Match ($60), Scout 65A ($75), 2 Knight T-60's ($20 & $25), Knight Ocean Hopper ($35), Ameco AC-1 ($15), and Ameco AC-1 (no price).

Well, that's about it for this year. Sorry about the missing prices, but the gear sells fast and I wanted to cover the area in its entirety before the goodies got away (from me!). But I would be remiss if I didn't mention all of the old books (Handbooks, QST's, etc) and parts (high voltage caps, 2 watt resistors etc) that can be found at Dayton. That's reason enough to participate in this "greatest spectacle in hamming."

Editor's Note: Steve will be reporting on other hamfests he attends this summer.

CLASSIFIEDS

Advertising Information

Subscribers receive 1 free - 30 word- ad per month. **Extra words are .10.** Here's how to count the words in your ad: the heading - For Sale, Wanted, etc. count as **1 word.** Your name, call, address and telephone number count as **6 words.** Hyphenated words count as **2 words.** **Please count the words in your ad and if you're over 30 words send payment for the extra words.**

Non-subscribers: $3 minimium for each ad (up to 30 words). Each additional word is .20. **Please call or write for display rates.**

VINTAGE EQUIPMENT ONLY

E.R.
Box 139
Durango, CO. 81302 303-247-4935

DEADLINE FOR THE JUNE ISSUE: JUNE 7

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: Audio power amplifiers, 5 to choose from, up to 100 watts output, as is - $25 to $50 plus shpg; automobile radios, 1936 to 1955, most tube type, as is - $25 to $50, restored to $100. James Fred, R1, Box 41, Cutler, IN 46920.

WANTED: B&W Matchmaster model 650 or 651. Don Soule, KA1KDS, (207) 924-3220 call collect.

FOR SALE: Collins 20K broadcast transmitter. 1 KW AM, complete in good condition. 833A's modulated by 833A's, 1360 lbs, with Collins exciter and original manual. For info call. John, KCØFM, (402) 781-2965

WANTED: E.F. Johnson straight or speed key; 122 vfo/manual; Viking Navigator or Ranger II; Hammarlund Four Twenty transmitter; Comet Pro receiver. Brian Roberts, 3068 Evergreen, Pittsburgh, PA 15237.

FOR SALE: Parting out Johnson Ranger. What part do you want? Drake C-4 - $395; Drake MN-2000 - $225. Don Bishop, NØEA, Box 4075, Overland Park, KS 66204-0075.

WANTED: Hallicrafters S-40, S-40A, S-40B, S-85, SX-99, S-108 or SX-110; National NC-88 or NC-98. Advise price and shipping cost. Benigno Fernandez, 1674 AT/AS St., Summit Hills, PR 00920.

FOR SALE: Collins 32V-3 and 75A-3, very good cond., many extras, accessories, finals, speaker etc. - asking $600. Howard, W3QBA, (717) 458-6243

WANTED: National NC-400; plate meter and key switch for Johnson KW; Johnson 6N2 Thunderbolt, Collins KW-1 or 30K with 310 exciter. Joe, WA2PJP, (516) 736-0261

WANTED: RCA AR-88/CR-88 receiver. Will drive 500 miles or call regarding shipment. Bill Armstrong, N6TKG, 26670 Latigo Shore, Malibu, CA 90265. (213) 457-2441

CLASSIFIEDS

WANTED: Collins 6kc mechanical filters: F 455J-60 for 75A-4 and F 455B-60 for 75A-3. Bill Beatty, K7CMS, 4721 N. Bamboo Circle, Tucson, AZ 85749. (602) 749-5773

FOR SALE: Connectors for ART-13, ATD, TA-12, ARB, TCS, GP-7, SCR-543, others using K, MS, large banana type; M-38/A1 radio power connector. Robert Downs, WA5CAB, 2027 Mapleton,Houston, TX 77043. (713) 467-5614

FOR SALE: HP-200 A/B audio signal generator w/manual - $37; xlnt Heathkit capacitor checker model IT-28 w/manual - $40; Navy TS-671/2U substituition decade boxes: capacitors - $15, resistors - $15. Ward Becht, 625 Tufts Ave., Burbank, CA 91504. (818) 842-3444

FOR SALE: Drake R-4A, T-4X, AC-4, MS-4 - $350; Drake MN-2000 tuner - $225; Drake TR-22 two meter transceiver, several crystals - $85; Yaesu headphones - $25; Hammarlund HQ-129X receiver - $100; Hallicrafters SX-101A, HT-32A - $450 for both. **WANTED:** Drake 2-CQ Q-multiplier and spkr for 2-C receiver, also 2-AC crystal calibrator and 2-NB noise blanker. Steve, WB4IJN, (803) 873-7847

WANTED: Have a Hallicrafter FPM-300 III. Any hints, kinks or mods from you guys to tame this little beast. Gene Keenan, 8359 So. Keeler Ave., Chicago, IL 60652.

WANTED: Replacement transformer for National HRO-60, size should be 4"x 4.5"x 4.5", voltages should be 270 - 0 - 270v. @ 200 ma., 5v @ 2a and 6.3v @ 6a. Sam, N4VIB, Rt 3, Box 3469, Chatsworth, GA 30705. (404) 695-5658

FOR SALE: BC-939 tuner - $75; TS-173 freq. meter - $40; GE FM mobile xcvrs on 10, 6 and 2 - offer; UTC S-22 (250w) mod xfmr - $50. **WANTED:** RAX LF receiver. Steve Davis, KD2NX, 2372 84th St., Brooklyn, NY 11214. (718) 265-2390

WANTED: Heath HG10B vfo in clean and operating condition. James T. Schliestett, W4IMQ, POB 93, Cedartown, GA 30125. (404) 748-5968

WANTED: Manual for Johnson Viking II and vfo. Larry E. Meyers, W3MNE, 1598 Brimfield Cir., Eldersburg, MD 21784.

WANTED: SP-600 JX Hammarlund receiver; 211 and 803 tubes. Don Spreeman, WA9ZOR, 542 E. 20th St., Kaukauna, WI 54130. (414) 766-1175

FOR SALE: Clean Heath VTVM, model IM-11 plus AC/DC chassis EF-1, manual, no probes - $30; Heath SWR bridge, model HM-15 - $20. Bob Lemanek, K8HVG, 14565 Garfield, Allen Park, MI 48101.

WANTED: KW-1, 32V-3, NC-303 AND HRO-60. Also histories, catalogs, brochures and info on Collins, National, Johnson and other vintage companies. Tye, KB8FJ, 777 Brightridge, Bridgeport, WV 26330.

WANTED: Calibrator 8R-1 for Collins 75A-3; manual or schematic for Breting 12, copies ok; Riders radio manuals, full set or start #1 thru ? **FOR SALE:** Parting B&W 5100B -5158B. WA7IHN, POB 442, Aumsville, OR 97325. (503) 749-1149

WANTED: Utah Junior transmitter schematic. Bob Mattson, 10 Janewood, Highland, NY 12528. (914) 691-6247

FOR SALE: Zenith BCB receiver model 72, circa 1930 cabinet, fair,PB - $110; Philco BCB model 511, metal cabinet - $100; Stanley Stenuson, 11464 Palm, Coon Rapids, MN 55433. (612) 755-4485

FOR SALE: Complete Hammarlund station, HX-1 transmitter, HQ-170AC receiver and HXL-1 amplifier. All in good condition with manuals. Pickup only. Package only - $490. Charlie, KD4AJ, (404) 396-0276

CLASSIFIEDS

FOR SALE: Hallicrafters service manuals, copies - $4.50 postpaid. Some Hammarlund, Johnson, Heath, Gonset. **WANTED:** Schematic or service manual for Multi-Elmac A-54 xmtr. Miller Radio, POB 6604, Erie, PA 16512.

FOR SALE: Collect keys? You'll enjoy W1IMQ's illustrated references. "Introduction to key collecting", 64 pages - $9.95, "Vibroplex Collectors Guide", 87 pages - $14.95. Add $2 s/h to total. See your dealer or order direct from: Artifax Books, Box 88-E, Maynard, MA 01754.

WANTED: Pre-1953 TM11-487, TM11-227; TO16-30ARC3-?, TO16-40SCR274N-?, TO16-45-?, TO16-1-8; FM20-100, FM31-35, FM100-20. Letter prefixes may vary. Ken Gillis, 27217 Garden Way, Franklin, MI 48025. (313) 851-3240

TRADE: My FB-7 or early SW-3 for pre-WW-II transmitter. **FOR SALE:** modified SX-17 as is - $40. **WANTED:** Conar 400/500 novice twins; Johnson Navigator. Niel Wiegand, WA5VLZ, 911 North Bend Dr., Austin, TX 78758. (512) 837-2492

WANTED: Speedx bugs and keys; 80 and 40 meter band xtals; FT-243 and early round holders; 800 hz cw filter for 75A-4. Herb Spivey, NF5Y, Box 27, Baldwyn, MS 38824. (601) 365-5594

FOR SALE: Transmitting/receiving tubes, new and used. Exa: OA2, OC3, 2E26, 3B28, 4X150, 4-65A, 12A6, 803, 809, 811, 813, 815, 829, 832, 836, 872, 1619, 1625, 1626, 5894, 6130, 6146, 9003 plus others. SASE for list. I also collect old and unique tubes of any type. Maybe you have something to trade? John H. Walker Jr., 16112 W. 125th St., Olathe, KS 66062. (913) 782-6455

FOR SALE: Grundig Majestic 1060, 2066, very fine; HQ-215, filters, manual - offer. Levy, 8 Waterloo, Morris Plains, NJ 07950. (201) 285-0233

FOR SALE: Cleaning out shack. Globe King 400, not operational - $100; Collins 75A-3 with speaker, 3.1 and 8 kc filters - $175; Hammarlund SP600JX - $100; Hammarlund HQ-180AC with speaker - $150; Hammarlund HQ-170 with speaker - $125; Hallicrafters SX-43 with speaker - $50; Hallicrafter S-85 - $50; Viking Ranger I - $100; Viking Adventurer - $50; Eico 720 - $25; National NC-98 with speaker - $85; BC-348 with ACPS - $50; Globe Chief Deluxe - $25; (2) Elmac AF-67 with ACPS - $35 each; Globe King 500 RF deck (no tubes) - $50; Heath vfo's, VF-1 - $25, HG-10 - $35; Hy Gain Hy Tower vertical, 160-10 meters - $150. Pickup only all items. Tony Wheeler, K9BBA, RR1, Box 215, Carlock, IL 61725. (309) 376-7721

FREE TO GOOD HOME: My 220+ duplicate QST/CQ magazines (1945 - 75). Some yeas complete, condition varies. Good starter collection. You pick up. Eddy Swynar, VE3CUI, 48 Evergreen, Whitby, Ontario, L1N 6N6, Canada (416) 723-4326

FOR SALE: Hammarlund HQ-129X, good cond. - $80; Hallicrafters HT-18, HT-40, SX-99 - $40 each; TMC vfo PMO1, rackmount with spare - $100. **WANTED:** Stancor Thordarson kit transmitters; Howard 430; Hallicrafters HT-6; 450th, 812 tubes. Russ Olmsted, K4UJZ, 608 W. Thompson Ln., Murfreesboro, TN 37129.

WANTED: National SW-54 receiver. Robert Becker, 17020 16th SW, Seattle, WA 98166.

FOR SALE: Heathkit DX-60B w/vfo - $75. **WANTED:** National NC-303; Hallicrafters S-76. Terry Knapp, KA7TVP, 1937 Valley Drive, Los Vegas, NV 89108.

WANTED: HRO-60T table model receiver in excellent, unmodified condition with ABCD coil sets, manual and HRO-60TS table model speaker. Al Coil, KO9S, 607 Countryside Lane, Hudson, WI 54016. (715) 386-5284

CLASSIFIEDS

FOR SALE: Hallicrafters R-42/R-46 metalcase speakers (some scratches) - $30 each; Gonset Comm. IV - $30 plus UPS; RT/ARC-2 - $50 (pickup); RAK-8, 15 to 600 kc receiver - $75 pickup. Krantz, 100 Osage Ave., Somerdale, NJ 08083.

FOR SALE: HQ-170AC with speaker - $150; HRO-50 with ABCD coil sets and manual - $150; HW-16 (cw rig) with 500 hz filter - $70; 833 tube - $20. Jeff Garrett, KEØMT, 2822 W. 55th St., Denver, CO 80221. (303) 455-5658

FOR SALE: WW-I aircraft antenna reel dated 1918 - $115 postpaid; BC-348R,BC312-D, BC-645 - $75 each; AK-20 large open audio - $100; VT166/WE371A NIB - $15; RME VHF- 152A RF converter w/manual - $60; Hallicrafter SX-99 - best offer. All plus UPS. **WANTED:** wire recorders and Grebe CR18. Peter Dieguez, 36-48-34th St., L.I.C., NY 11106. (516) 625-0429

FOR SALE: Hallicrafters HT-40 - $40; Hammarlund HQ-150 - $125; Knight VOM - $25; RCA signal gen. (from kit) - $20; Eico signal tracer model 147A - $30; RCA RF signal gen. model WR-50B - $25; Devry scope, 5" screen - offer; Globe Star CB - offer; (6) 120 volt AC relays, 20 amps - offer; Philco TV pattern gen. - offer; RF/IF/VF maker adder - offer; Knight T-50 xmtr - $40; Trancon 10 mtr xmtr - $15 as is; Peirce Simpson CB - $15; model xcv-300 freq. standard for NC-300 - $20; Hallicrafters S-94, needs work - $10; DX-60B with HG10 vfo, w/manual, mint - $100; (2) dynamotors for T-195 xmtr - best offer; RME-4300 with 4301 SSB adaptor - $40; Knight CB, C-540, - $15; DX-60 - $40; GE prog line, as is, works - $50; RT-594 xcvr with manual - $185. Gary Firari, KE9FK (414) 563-2825

WANTED: Collins 75A-1 rcvr; plug in FM unit for Collins 32V1 or 2; matching spkr for 75A-1. Carlton Ellis, KA2Y, 32 Upland Dr., Rochester, NY 14617.

CLASSIFIEDS

"REAL RADIOS GLOW IN THE DARK"®

Bumper sticker -$1 each with a #10 SASE. We service American made amateur radio products circa 1940's, 50's and 60's. Manuals and/or schematics available for most rigs and radio sets back to mid 1920's.Call or write for a quote on your service or tech data requirements. **Classic Radio,** PO Box 3486 Eureka, CA 95502. 24 hour phone (707) 444-3911. K6VHP

WANTED: Anyone owning a National NC-44. Need info regarding physical location of pilot lamps; National NC-80/81, NC-100XA; all National speakers and National 7" speaker. Steve Sauer, WA9ASZ, 1274 Londonerry Ln., Greenwood, IN 46142. (317) 882-4598

FOR SALE: Heath DX-40 with vfo - B.O. **WANTED:** Transmitter to mate with G-66B receiver. Merle, W1GZS, POB 51, West Kennebunk, ME 04094. (207) 985-3986 eves. EST

WANTED: Triad HSM-79; Kenyon T-109; Western Electric transmitters; VT-52/2C45; manual for 32V1, copy ok. Joe Roberts, N4WQC, Box 19302, Alex, VA 22320. (703) 683-2955

FOR SALE: Hammarlund SP-600JX receiver in good condition - $175 or trade for CW transmitter. B.G. Martin, WB9BEH, 127 South Oliver St., Elberton, GA 30635.

WANTED: E.F. Johnson 122 vfo and BC-610 within 200 miles or meet me halfway if further. Butch Schartau, KØBS, 5361 St. Mary Dr., Rochester, MN 55901. (507) 288-0044

FOR SALE: Rider Chanalyst model #11, test instrument, RF, audio, meter, etc. combined - $50 +shipping. Jim Dill, Box 5044, Greeley, CO 80631. (303) 353-8561, 8 - 11 PM and Sat. and Sun.

WANTED: Hallicrafters SX-100 receiver; Johnson Valiant II; Viking 500. G. Hawrysko, K2AWA, POB 568, Boro Hall, Jamaica, NY 11424.

FOR SALE: Central Electronics model B sideband slicer/Q-multiplier - $29; Drake 2-CQ/speaker - $29; Drake 2-AC calibrator - $12; TCI triode demonstrator - $21; Collins 75A-2, cal, FM, book - $175. Send SASE for 3 page list of manuals, tubes, meters, parts etc. Jerry Tastad, KB7M, POB 127, Laramie, WY 82070. (307) 742-4033

WANTED: 1916 and 1917 QST's. Bob Arrowsmith, POB 166, Annandale, VA 22003. (703) 560-7161

FOR SALE: National HFS receiver with 5886 ps - $125; Meissner EX Signal Shifter - $40; Drake 2B, 2BQ - $150; Drake R4B - $165. All excellent with manuals. ARC -5 receivers 190-500kc, NIB - $30 each; new bandswitches and main tuning gear mechanisms for AR-88 rcvrs - $15 each. E.G. Johansmeier, KØOCC, 8240 Grogan Ferry Rd., Atlanta, GA 30350. (404) 396-1312

FOR SALE: BC-610E with BC-614; GRC-127 (two synthesizers for TX/RX, 1.8 - 30 mhz, 100 watts, USB, LSB, AM and CW, seperate RX filters for CW (400hz), AM (6 Khz), SSB (2.7 khz), 120 VAC 60 hz, 36 inches high in 19"rack; Collins KWT6, R19E/TRC1, BC652A; DX-100; T217; MIMS Signal Squirter Deluxe beam rotor and indicator (circa 1939); RBB w/ps and cable; RBC w/ps and cable; PP112. Ken Lakin, KD6B, 2601 Oakwood Rd., Ames, IA 50010. (515) 292-5068

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

CLASSIFIEDS

WANTED: Collins radio book entitled, "The First 50 Years, History of Collins Radio" and "The Radio Designers Handbook" 3rd or 4th edition, 1952, F. Langford-Smith, editor. Bill Mills, KC5PF, 1740 Tonys Court, Amissville, VA 22002. Office: (703) 818-3955. Home: (703) 937-4090

FOR SALE: NC-190 wkg, abt excellent - $80; Comm. III, wkg - $30. **WANTED:** Hallicrafters spkrs: R-46, R-46B, R-48, R-48A and R-50; National spkrs for NC-98, NC-183D and NC-125. Ed Sauer, KC9SP (317) 881-1483

FOR SALE: Globe King 500B - $300; Globe Champion 300A - $175; HQ-170 w/clock, spkr, manual - $100. All plus packing and shipping. Dave Taylor, WA6PBJ, 11428 N. 64th PL, Scottsdale, AZ 85254. (602) 998-3684

FOR SALE: Drake TR-3 - $75; RV4 vfo - $35; Heath SB-10 - $25; RME 4350,nice - $95; rare RME 4301 ext. sideband selector - $35; Instructograph code machine w/tapes - $20; Eldico TR75V cw xmtr - $20. **WANTED:** 1958 - 62 Walter Ashe, Allied, Radio Shack, WRL, Olson, Lafayette, Bursten - Applebee catalogs; a 1961 - 62 U.S. callbook with KN32MI and 1969 - 71 DX callbook with KR6MI. Gary, K3OMI, 11124 Oak Hollow Rd., Knoxville, TN 37932. (615) 690-4217

WANTED

TRANSMITTING TUBES
FOR MUSEUM

Do you have any old amateur or commercial transmitting tubes worthy of saving for posterity? If yes, help us do same. Contact:

Al Jones K6DIA

Ye Olde Transmitting Tube Museum

P.O. Box 97, Crescent City, CA 95531

FOR SALE: Newly published instruction books, authorized by Rockwell International, are now available for the Rockwell/Collins S-Line. These instruction books are brand new and have been printed from the latest editions – complete in every detail, including the front and rear color covers. A money-back guarantee of the purchase price ensures your complete satisfaction. Instruction books for the following models are currently available. KWM-2/2A ($35); 75S-3B/C ($30); 32S-3A ($30); 75S-3/3A ($25); 32S-3 ($25); 312B-4/5 ($20); 516F-2 ($15). For U.S. orders, include 7% of the purchase price for shipping and handling. (Canada and Mexico add 12%; all other international countries add 25%.) Ohio residents add 6% sales tax. VISTA Technology Incorporated, 3041 Rising Springs, Bellbrook, OH 45305. (513) 426-6700

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", WD5EOG, 4500 Russell Dr., Austin, TX 78745.

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

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

WANTED: General Radio Company instruments in wooden cases. Especially want laboratory type equipment. Also need GR experimenter magazines, manuals, and catalogs. Frank R. White, KBØTG, POB 2012, Olathe, KS 66061.

CLASSIFIEDS

SPAM

THE SOCIETY FOR THE PRESERVATION OF AMPLITUDE MODULATION

TO JOIN SEND $1 TO:
SPAM
BOX 27
POTRERO, CA 92063

PLUS: The calls and names of 3 SPAM members you have worked on AM. The names and calls will be checked against the SPAM roster and then the membership certificate will be issued.

FOR SALE: Ham building parts of 1940's - coils, switches, condensors, transformers, tubes, sockets, chassis and cabinets. Everything! F. Yonker, 7 Old Farms Rd., Saddle River, NJ 07458

WANTED: Wireless set #19, Mark II dynamotor unit, need not be working; any other model 19 related accessories; power supply/dynamotor for TCS-12 series. Chris Bowne, AJ1G, 3 Carnot Ct., Pawcatuck, CT 06379. (203) 599-5262

FOR SALE: Bigelow Electronics has been in the electronic mail order business since 1954. Vintage parts and equipment available. Request free "Vintage Flyer". Bigelow Electronics, Box 125, Bluffton, OH 45817.

Electric Radio - the first year - all twelve issues delivered First Class in a padded envelope - $25. Individual copies $2.50 delivered. #1 is a reproduction.

WANTED: PC boards from Harris Corp. RF-716 xmtr. Also Collins TD-1, CP-1 and Hallicrafters S-36. Gary Cain, 1775 Grand,#302, St. Paul, MN 55105.

WANTED: Old National and Hammarlund receivers and accessories. Cash or trade for above my old SW, BC or telegraph sets. Robert B. Enemark, W1EC, Box 1607 Duxbury, MA 02331. (617) 934-5043

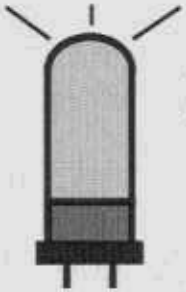
WANTED: Johnson Viking 500 or a well made homebrew500 watt AM transmitter. Must be shippable by UPS. Must be in good to excellent condition. Bob, K7NWB, (602) 833-7786

FOR SALE: Radio Broadcast Books catalog and Antenna/Radio Propogation Books list now available. Send .25 stamp for each one wanted. Rainy Day Books, POB 775, Fitzwilliam, NH 03447.

FOR SALE: UTC transformers, brand new in factory cartons, 100 different types: transmitting, filament, chokes and modulation transformers. Also audio interstage and outputs etc. Commercial, military and amateur grades. Send #10 SASE for catalog and inventory to: Len Crispino, POB 702, Hudson Falls, NY 12839. (518) 638-8199

FOR SALE: 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

FOR SALE: Collins KW-1, #120 - $2,000; Johnson Valiant - $175; Ranger - $125; Viking II - $75. All equipment is in operating condition. Prefer pickup. Bill McCaa, KØRZ, Box 3214, Boulder, CO 80307. (303) 499-1936



SECOND
CLASS

ELECTRIC RADIO
145 CR 123
Hesperus, CO 81326

TO: