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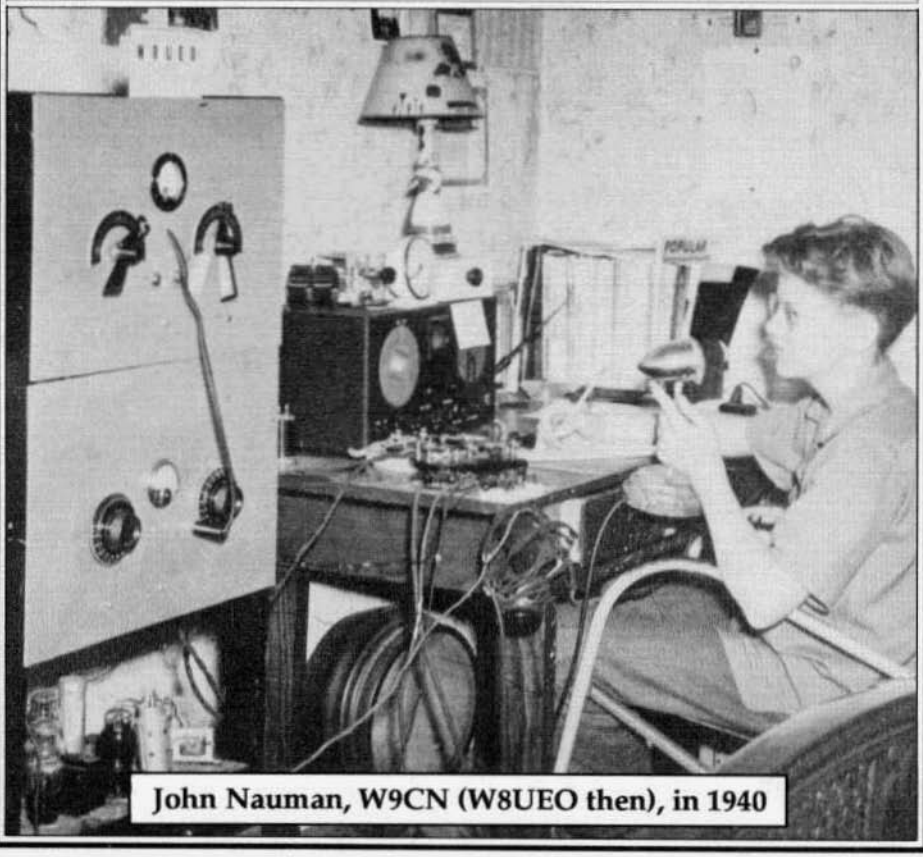
ELECTRIC RADIO

celebrating a bygone era

Number 31 November 1991



John Nauman, W9CN (W8UEO then), in 1940

ELECTRIC RADIO

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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

The 10 meter contest was a truly wonderful experience. It was as if the clock of time had been turned back to the 'good old days' of the '40's and '50's and all was well with amateur radio again. It seemed that everyone turned out and that they were having a great time. I worked about 20 stations over the two days - like most I was more interested in rag-chewing than contesting - and I spent a lot of time tuning across the AM window just reading the mail.

I think that my most profound observation was how the AM'ers on 10 appreciate one another and truly enjoy getting together. The contest seemed to bring them out but it really wasn't 'contesting' that they were interested in. They're interested in being a part of an 'event'; it's like a party where they know everyone will show up. From my perspective the contest weekend demonstrated what amateur radio could and should be like again.

I think that when 10 dies out, either this winter or next, we're all going to experience a great sense of loss. Maybe more so this cycle than any other. We've made more friends this time around and maybe we've been more active. And we know that even if we move to 15 or other bands some of our friends will not. For some reason they'll stay on 10, working the band during those brief openings that occur sporadically, as if they're incapable of moving.

This summer - or when ten goes dead - we must make a concerted effort to get on 15 meters. We're not going to have the same conditions, there's going to be more QRM, but it's the only real viable alternative to 10. To-wards late winter or spring we're going to have another contest on 15. Maybe that will 'kick off' some serious activity on this band. On to 32.....

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Cover: John Nauman, then W8UEO, now W9CN, at the age of 15. From John's letter: "Here's a picture of a my genuine home brew station taken in 1940.It should be quite typical of the era. I was fifteen years old at the time. My vfo used a 6J7 into a 42 doubling from the BC band with output on 160 meters. The exciter was a 6L6G into a 6L6G. **continued on page 29**

Reflections Down the Feedline

by Fred Huntley, W6RNC
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What piece of radio equipment at the local ham swap-meet lurks in your future? Only The Shadow knows!

In early October, at the Hanford, Calif. swap-meet, K6PKO was cruising around the table and sizing up the offerings, while at the opposite end of the area, his friend, AD6V, came upon a pickup truck loaded with a very old ham transmitter. After some discussion with AD6V, the owner (a non-ham) declared that he would like to give the transmitter to someone who would appreciate it and preserve it. AD6V replied that he knew just the right fellow for it, and called over K6PKO to look at the find. Thus, a beautifully constructed 1936, 500 watt AM phone transmitter was acquired by Jerry Chandler, K6PKO. The transmitter had been built by Phil Davis, W6TO, who became a silent key in 1940. How the rig wound up in the town of Kingsbury, where it had been stored in a garage for many years, nobody knows.

The transmitter consists of 2 side by side 6 foot high steel racks; each with a 19 inch wide one-piece masonite panel which is painted black. One rack houses the speech amplifier, modulator and two HV power supplies. The other rack contains the RF driver, final amplifier and antenna coupler. There are 10 old-style, round, surface mounted meters on the front panels. They measure just about everything.

The RF tube lineup is a 47 crystal oscillator, with a 1902 Kc. crystal oscillator, with a 1902 Kc. crystal plugged in on the chassis, two 46 buffers, a 203A driver and push-pull 203A's in the final. The audio lineup is three 56's and push-pull 2A3's in the speech amplifier with a pair of class B 203A's in the modulator. The two HV power supplies use 866A's. There also is an 83 rectifier for screen and bias supplies. On top of the RF section there are two big feed-through insulators for a 600 ohm antenna feed. There is an RF ammeter on the front panel for each side of the feeder.

It is reported that Phil Davis, W6TO, did build a few transmitters for local hams, but he built this one for himself. He labelled it as serial number 100, but Allen Ross, W6JPS, who knew him, says he just grabbed the number out of the air, thinking that it looked good. HI!

When W6TO went to Arizona in 1936, he loaned the transmitter to W6JPS. When he returned, he took it home again but later sold it to someone else. W6JPS has been active in the Fresno Radio Club for many years and provided some of this info.

Phil Davis, W6TO, owned a radio store in Fresno on the corner of Tulare and "O" Streets. He was a very good friend of the local radio club and would always bring prize donations to the club meetings. When he died, the club asked his widow if she would care if the club asked to be assigned his call. She replied that it would be an honor. So, W6JPS and the other club members went through the FCC and asked for it; explained why they wanted it and they got it.

Meanwhile, down at the ranch, K6PKO is overhauling the old rig. W6JPS has provided him with some of the missing tubes. A picture of the set should be forthcoming in ER in the near future, and a lot of us are hoping to hear it in operation on 160 meter AM, one of these days. •

Two Homebrew Transmitters

by Hank Clark, W2IQ
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I started in ham radio in 1937. I built my own rigs until after the war when Collins came out with the 32V-1 and the 75A-1. From then until recently I kept myself pretty well equipped with factory built rigs from Collins, Henry and Ten Tec.

About ten years ago, after retiring, I moved to Tennessee, where I got involved in AM activity again. The first AM rig I got back on the air was my old BC-610. I then spent a lot of time restoring and modifying other old rigs like Johnsons and Heathkits. I think they were all great in their time but the original design engineers had something different in mind when it came to audio. Their purpose in life was to conserve spectrum at any cost. Today, most of us old timers enjoy the nice clear sound of AM so modification takes place to open up the audio bandpass and take the restrictions out. Generally, the RF seems to be workable in the old rigs but the audio needs lots of help!

At some point it occurred to me that instead of spending so much time repairing, restoring and modifying I might build my own rig. The first rig I built was the 211 rig for 40 meters. This rig consists of three 211s driven by a single 211 buffer and a 42

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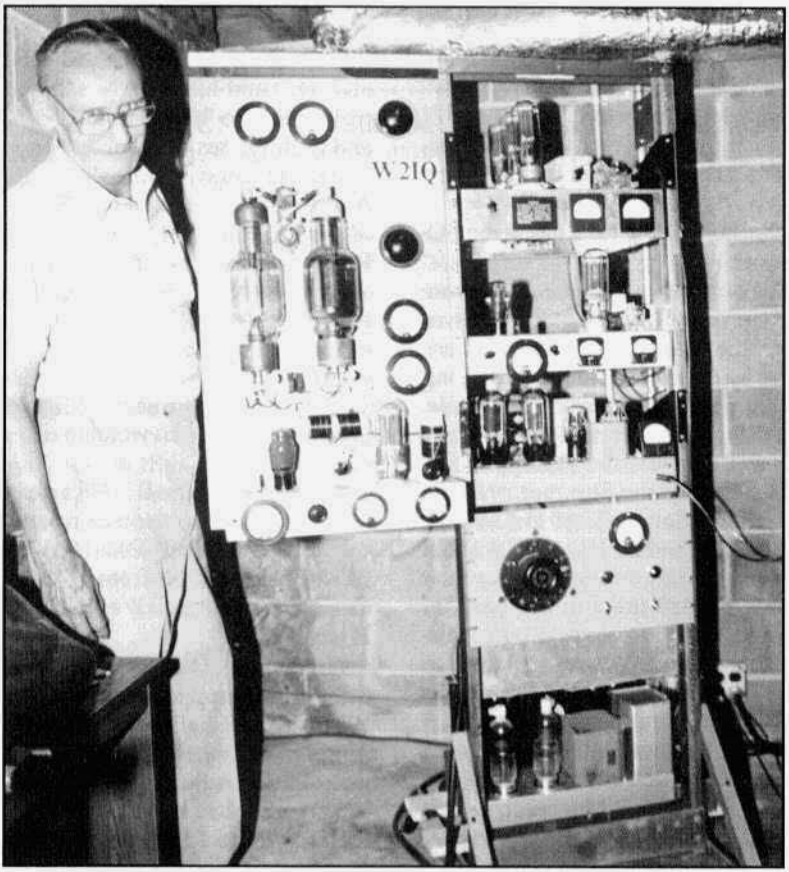

204A rig on the left, 211 rig on the right with common power supply and modulator.

ELECTRIC RADIO IN UNIFORM

by Walt Hutchens, KJ4KV
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"The BC-348 Receiver"

What three military radios had the greatest effect on ham radio? The first, obviously, would be the 'command sets' -- surely there can't be many of us who were hams in the late 1940's to 1960's who didn't convert at least one for use as a transmitter, receiver, VFO, 'sharp' IF (Q5'er), or something else.

Second would have to be the SCR-522 VHF transmitter-receiver, which effectively opened the two meter band to hams after the war.

And third, you'd have to name the BC-348 receiver.

Recall that regenerative receivers were still common among hams before the war and that in the post war years, most Americans were spending their money catching up on five years of deferred family life. Because of legal, bureaucratic and logistic delays, "war surplus" didn't happen immediately. But by the Summer of '47 in addition to the Collins 75A1 at $375, the NC-183 for $270, and the HQ-129X at about $175, your choices for a station receiver included a BC-348 (new in the box) for $55. Designed to be powered by an aircraft electrical system, it wasn't quite as ready-to-go as an HQ-129X. But at less than 1/3 the money, they were popular overnight and as we will see, it wasn't only the price that lead eager hams to snap them up...

Overview

The BC-348 is an eight-tube aircraft communications receiver built before and during WW II. It covers 200-500 kcs and 1.5 to 18.1 Mcs in six bands. The unit measures 8" x 18" x 9" (H x W x D) and weighs about 33 pounds with dynamotor but less connector and mounting.

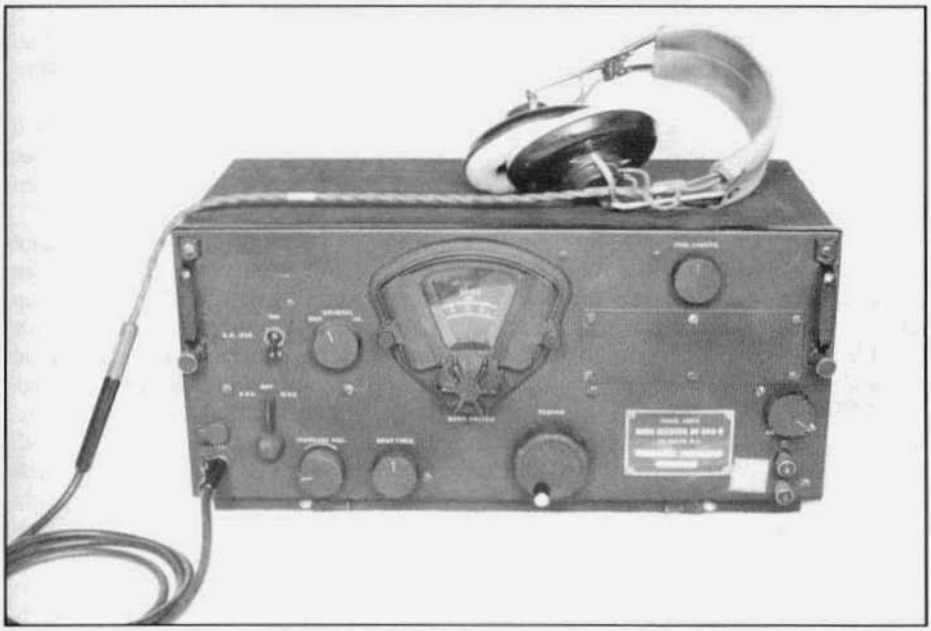
There are many letter-suffix models, corresponding to different contracts and manufacturers, however nearly all of them fall into two groups: the 'early' design, most often represented by the BC-348-K, L, and R, uses double ended tubes (6F7, 6K7, etc.) and has an 'ANT ALIGN.' control while the 'late' design (BC-348-J, N, and Q only) uses single ended ones (6SK7, 6SA7, etc.) and has no 'ANT ALIGN.' Among other early models, BC-348's E, H, M, and P are very similar to the K, L, and R sets, while the others are less so.

The receiver is directly calibrated in frequency. It is designed for local operation only and for output to 600 or 4000 ohm headphones or an aircraft intercom system. A crystal filter and tunable BFO are provided. There were no external accessories.

All models of the BC-348 are designed for 24 volt DC operation using an internal dynamotor. The BC-224 is identical to the BC-348 but operates from 12 volts. It was also made in both early and late versions.

History

Both here and in 'Design', I will draw on information appearing in the American Wireless Association Old Timer's Bulletin, particularly the BC-224 and '348 historical information from H.A. Robinson, W3LW, the electrical design engineer for the set which appeared in Bill Fizette's 'Communications Receiver' column in August, 1986.



The BC-348-R. The ALIGN INPUT knob above the antenna terminals at lower right identifies this as an early design set. The dial/bandswitch bezel can be removed from the front to replace the dial lamps.

The BC-348 had its beginning in a 1934 request from the Army Signal Corps for interested manufacturers to submit prototype aircraft liaison (long range) receivers meeting certain specifications, including sensitivity, frequency stability and accuracy, spurious responses and size and weight. General Electric and RCA submitted prototypes but the GE design did not meet some of the minimum requirements. The RCA version became the BC-224-A, 650 of which were built at RCA's Camden, New Jersey, plant in 1936 and 1937. This set covered 1500 kcs to 18.1 Mcs in six bands.

The specification was revised in 1938 and RCA again won the contract; the BC-224-B included many performance and maintainability improvements. Among these are the plug-in dynamotor, separate removable RF coil assemblies, an invar (zero temperature coefficient alloy) tuning capacitor, and air trimmer capacitors for front end alignment. This version established the basic design of the BC-224/348. Later models added the 200-500 kcs band; the original 1500 kcs to 18.1 Mcs range being covered in the remaining five bands. The invar tuning capacitor didn't last; my BC-348-Q, and R and BC-224-H all have aluminum capacitors.

As the war required increased production, Stromberg Carlson, Belmont Radio, and Wells-Gardner also began to make the set. In 1943-44, Wells-Gardner developed the somewhat simplified and improved 'late' design, produced as BC-348 J, N, and Q.

The BC-348 served in every large Army aircraft. It was paired in the B-17, 24, and 25 and C-47 with the BC-375, this combination being called SCR-187, and in the B-29 with the Collins ART-13, the pair being called AN/ARC-8.

The days of aircraft liaison sets which could be tuned only by a radio operator at the set were, however, over in August 1945; postwar bombers and transports got

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transceivers operating on preset channels and able to be controlled remotely. After the war, the BC-348 hit the surplus market as the planes in which it was used were scrapped; the ones offered 'new' in 1947 were probably late wartime production which were excess to postwar requirements for spare sets.

40,000 BC-375's were built by GE (the only maker) and each had an associated BC-348. Counting BC-348's used with ART-13's and for other purposes, a reasonable guess at total production might be 50,000 sets. 30,000 BC-191's (12 volt BC-375's) were built, but most were used in ground applications with the BC-312 receiver; if 1/3 of them were used in 12 volt aircraft, then there might have been 10,000 BC-224's.

Because so many were installed in non-front line aircraft, some '348s continued in service into the 1950's; my sets were overhauled at SAAMA (San Antonio Air Materiel Area) in 1951 and '52. The manual was reprinted by the Air Force in April 1957, indicating that some were still in service then.

Many aircraft equipped with the '348 were transferred to foreign governments, taking their radios with them. A Russian-made BC-348 'clone' turned up at a recent flea market; the set looked like the original, but the 'fit and finish' was poor. Although it is now past its 55th birthday, the '348 is still usable as a ham or shortwave receiver; because of its simple sturdy design, it is likely that it will still be in use somewhere long after most of today's plastic and silicon sets become part of the solid waste problem.

Design

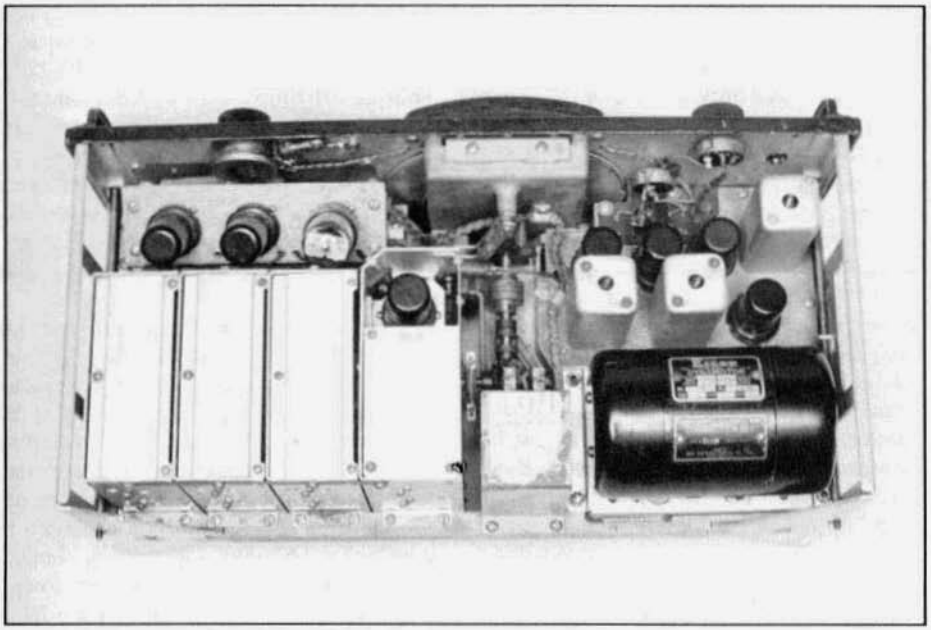
The BC-348 is an eight tube superhetrodyne made up of seven main subassemblies (the dynamotor, an RF amplifier subchassis, a local oscillator box, three RF coil boxes and the IF/audio unit) mounted on a cast chassis. The dynamotor and local oscillator and RF coil units are designed to be removable for service. The chassis support brackets, panel and case are of heavy stamped aluminum. The tuning and band change mechanism is built on another casting; this is not a flimsy receiver!

The set's electronics will be covered in terms of the BC-348-K, L, and R 'early' sets with differences in the 'late' model mentioned where necessary.

The set begins with two 6K7 RF stages feeding a 6J7 mixer. These three tubes are mounted on a small subchassis at the upper right of the set; you can reach the bottom of the subchassis through a rather cramped access hole covered by the plate to the right of the dial on the front panel. The separate local oscillator is a 6C5 mounted inside the oscillator coil box; the tube can be reached from above through a hole with a removable cover plate but to get to the bottom of the socket you must remove the oscillator coil box. The oscillator is above the channel frequency on the lowest four bands; on the top two bands it is below the channel. A tickler feedback circuit is used.

The first IF tube is a 6K7; the second IF is a 6F7 triode-pentode with the triode section serving as a BFO. A 6B8 dual-diode-pentode is the third IF, detector, and AVC tube and a 6K6 is the (only) audio amplifier. There is no noise limiter.

The BC-348's controls are about the simplest possible for the set's functions. The lever switch at the left turns power off in the center position; to the left the set is on in AVC mode and to the right it is on with the AVC disabled. In AVC mode the RF/IF gain control is disabled while in MVC mode it operates and the audio gain control is disabled. The INCREASE VOL. knob controls both potentiometers. The other controls are a crystal filter IN/OUT switch, TUNING and BANDSWITCH, the CW oscillator ON/OFF switch and a BFO FREQ adjustment, a DIAL LIGHT dimmer, and (on early sets only) an ANTENNA ALIGN trimmer. All the knobs are large and well spaced, making them relatively easy to operate with your (bulky) heated flying gloves. The rotary controls



BC-348-Q top view. Left to right next to the front panel: RF subchassis, dial, and IF/ audio plate. At the rear, three RF coil boxes, oscillator box and tube, output transformer, and dynamotor. Three IF cans mark a late design set; the early design has the crystal filter and BFO coils in similar cans.

have springs inside them to prevent aircraft vibration from changing the setting.

The tuning rate at 3885 kcs is about 27 kcs per knob revolution; at 14,286 kcs it is 42 kcs per revolution -- better than most ham sets of the 40's or 50's.

There are a few somewhat unusual design features. In order to maintain constant gain as the set is tuned across each band, a rheostat ganged to the tuning capacitor was connected in the cathode circuit of the second RF stage; this was eliminated in the late models which maintained constant gain by using a combination of capacitive and inductive coupling between the RF stages.

The negative end of the dynamotor returns to ground through a resistor, providing a few volts of bias for the audio amplifier grid and (on late models) the mixer signal grid. This arrangement tends to hold the volume of the set constant against changes in the 24-28 volt DC supply and increasing plate voltage caused by AVC action on strong signals.

Early sets have a 991 neon lamp to regulate local oscillator plate voltage; this was eliminated in late sets which use a 6SA7 as a combination oscillator-mixer but I'd be willing to bet that the bias arrangement tends to stabilize the oscillator frequency.

The IF is 915 kcs, almost exactly the "5% of the highest channel frequency" recommended by the handbooks of the 40's and 50's to provide adequate image rejection. The crystal filter is at the start of the IF chain; the phasing (neutralizing) adjustment is fixed, being composed of a combination of wiring capacitances and a small stub on the filter transformer. The filter width is stated as 800 to 3000 cps; the ones on my sets are about right for copying voice signals under very poor conditions. Like all such filters, it considerably reduces signal strength when in use; there's no automatic increase in gain to compensate for this.

The combination of two RF stages and

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three IF stages with only one audio stage puts more than the usual amount of gain (though not as much as you'd think – the tubes used give only 20-50% of the stage gain of more modern types) ahead of the AVC circuit, giving better action on strong signals. Though this results in less speaker volume, you can't use a loudspeaker in a B-17 anyhow and there's ample audio for headphones.

Another 'looks strange but makes sense when you think about it' is mounting the local oscillator or converter tube inside the oscillator coil assembly. This definitely increases drift when testing at ham shack temperatures, but at 25,000 feet the temperature might be about -35 degrees... then of course when you land in the humidity of an English airfield, a well-below-freezing oscillator compartment would condense moisture.

A few differences between early and late sets which have not already been mentioned: early sets have the audio tube on the IF/audio plate while in late units it occupies the spot on the RF subchassis which was vacated by the mixer. The underchassis of the late units is easier to work on, due to use of point to point wiring instead of a forest of terminal boards. Late units got ceramic trimmers in the front end instead of the bulky and expensive APC air units. The crystal filter on late sets is between the first and second IF stages and the circuit is considerably simplified.

On The Air With The BC-348

It has been several years since I last started with a 'repairable' BC-348, however, Dave Ishmael, WA6VVL, did the job recently and sent along the following comments:

"Your short and sweet mention of the BC-348 in the September 1989 column said 'Many of these sets use flat molded plastic (paper) capacitors; be prepared to replace most of them.' I took that with a grain of salt because I have heard similar stories for years about the caps in the command receivers and have never had a failure. All of the .1 mfd 400V paper caps (in my set) were original. I left the set on one day and unattended and the cap across the 225V shorted to 0 ohms. Only a solder joint that unsoldered itself saved the power supply from some serious damage.

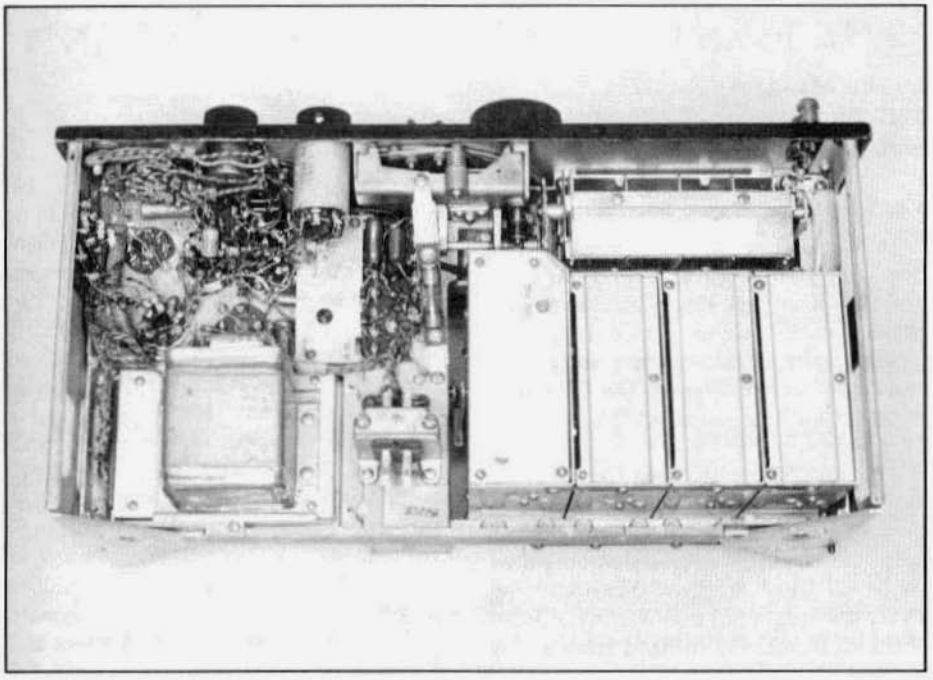
"The other set (a -P) was original and absolutely in mint condition... it had the dynamotor in it and you can barely hear it running! I will continue to use it like this.

"The previous owner had replaced one of the .01 mfd 400V plate bypass caps but had missed the 'crispy critter' 4.7k plate resistor that had turned into a 400 ohm cracked resistor. In aligning the set I discovered another 4.7k plate resistor that had changed value to 6.3k. I suspected the plate bypass cap and removed it – it was leaky. To make a long story short, I replaced all 17 of these capacitors. Every one of them was leaky on a Simpson 260's Rx10k range, measuring from 200k to 10 megs. With 200V across these caps I could slowly heat them up with a heat gun and cause them to catastrophically short... I have never seen a class of capacitors that are so bad...

"Bill Webster/K6EOB performed the alignment on both '348's: Band 2 was dead because the rotor of the detector APC variable was lying in the bottom of the assembly, shorting something out; (I will replace this later). The band 6 osc. APC fell apart while Bill was adjusting it. This one had to be replaced and it turned out to be fairly easy (we used a spare from a '348 'hangar queen')."

Long time readers know that I don't favor wholesale replacement of parts, but regarding those darn flat black paper caps – "be prepared to replace most of them". And – as Dave's experience shows – you can't really trust a '348 with original caps; if you run yours that way, adding a 100 ma fuse in the HV line is a good idea.

A solid basic design plus the space made available by removing the dynamotor made the BC-348 ideal for the technically able ham; surely this radio has been more



Under chassis view of the BC-348-Q. BFO coil in can on panel to left of center and only one vertical terminal board mark this as a late design set. The connector located left of center at the rear supplies power, muting and audio output as well as high voltage to external equipment such as a frequency meter.

often modified than any other military radio except the command sets. But more than almost any other set, it illustrates the fact that most changes popular in 1947 because they gave you a low cost modern receiver, make no sense today when the result will be something between a curiosity and a parts set. Some of the most popular mods were increasing IF selectivity by adding a sharp IF or crystal lattice filter, increasing the gain on 20 meters by replacing the first RF stage with a 6AC7, 6SG7 or 6BA6 and adding an 5-meter – no combination of which would bring the '348 up to 'modern' status today.

Hams often shorted or removed the compensating rheostat on the end of the tuning capacitor shaft. There's no reason to do this, as the set has enough gain except at the highest frequencies and overloading on the low bands is likely to result.

There are, however, a couple of changes which may be worthwhile even today and which can be made without damage. If you plan heavy or long-term use of the set, I suggest a 120 volt power supply because dynamotors have an expected life of only a few thousand hours. You can use either an external unit (added benefit: this keeps the heat outside the radio) or build it in, replacing the dynamotor. Two Radio Shack 273-1512 transformers connected back-to-back will give you both 24 VAC for filaments and (with a voltage doubler) ample high voltage -- in fact, use a choke-input filter to keep the voltage down, as the set was designed for 220 volts. Don't destroy an original dynamotor supply in order to do this; I have seen them advertised recently for up to $65 and a flat plate will work fine when building an internal supply.

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THE FIRST FIFTY YEARS OF SIDEBAND

by Jim Musgrove, K5BZH
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Part One

Most folks probably don't realize just how long that single sideband has been around. The first single sideband suppressed carrier signal was radiated not long after conventional amplitude modulation came into existence. The telephone company has been using sideband for well over 60 years.

Around 1914 it was realized that an amplitude modulated signal contained a carrier and two sidebands. In 1915, a fellow named H. D. Arnold demonstrated single sideband suppressed carrier using a very low frequency that was in the order of 20 kilohertz. He utilized the narrow bandwidth of an antenna to attenuate the carrier and the upper sideband. John R. Carson of American Telephone & Telegraph conducted more testing. He concluded that both sidebands contained the same information. He also determined that the majority of the radio frequency power was contained in the carrier and that the only purpose it served was as a reference for the sidebands. The carrier could be reinserted at the receiving station.

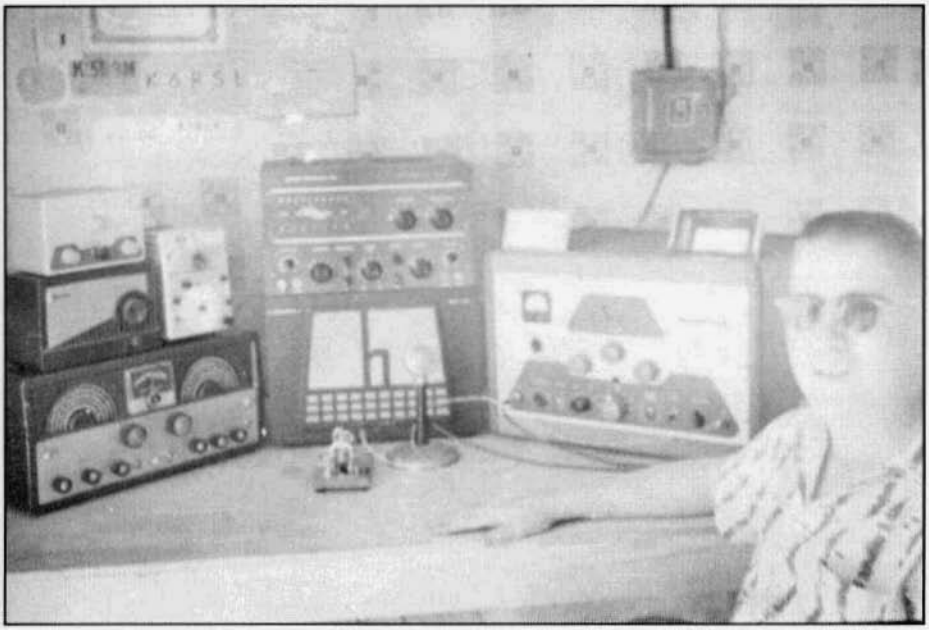
Carson built a balanced modulator and generated a double sideband suppressed carrier signal. He was able to prove to AT&T that the carrier could be eliminated without losing any intelligence. He also worked at suppressing one of the unwanted sidebands with a filter. Carson was able to show that only one sideband was needed to transmit intelligence. He filed for a patent on "A Method And Means Of Signaling With High Frequency Waves" on December 1, 1915. He was issued patent number 1,449,382 on March 27, 1923.

Carson's work made the 1927 trans-Atlantic submarine cable possible. Single sideband greatly improved the telephone company's ability to have multiple channels on a single set of wires. One person referred to this as "wired wireless." Frequencies of around 10 to 100 kilohertz were utilized. Actually, if you think about it, using double sideband at these frequencies could have been a problem due to insufficient bandwidth that would result from the typical circuit Q's. Frequency stability was not a problem as the receivers and transmitters were crystal controlled.

Leroy May, W5HN, recalled seeing an article back in the middle twenties, around 1924, that discussed the AT&T and Bell Laboratories' work with single sideband. He believes that the article may have been in "Radio News" and he says it contained photographs. He also commented that at the time he was a spark gap operator and consequently didn't understand the material that well.

Sometime in 1933, Robert Moore, W6DEI, put a single sideband suppressed carrier signal on the ham bands. He published an article in the December 1933 issue of "R9" magazine. By Goodman, W1DX, revealed that Moore published a series of three articles. By 1934, perhaps a half-dozen hams were on the air with sideband. The mode did not catch on at that time though. One problem was that the state of the art for the receivers was not to the point that frequency stability was good enough to utilize this mode of emission. In fact, a lot of hams were still using regenerative receivers.

In the world of radio, single sideband lay dormant until after the second World War. In September of 1947, Oswald Garrison Villard, Jr., W6QYT, placed the Stanford University club station, W6YX,



The author's 1959 station. The CE 10B is sitting on the Hallicrafters speaker next to the DX-100. Jim was 15 when this picture was taken.

on the air with single sideband. Interestingly enough, one of Villard's concerns was how the Federal Communications Commission would view SSB. Would it be considered as a legal mode or not? Apparently they viewed it as another form of amplitude modulation. He alerted the American Radio Relay League of his activity. It didn't take too long for this to attract the attention of fellow hams. Oswald G. Villard was better know as "Mike" to the ham community. He was an electrical engineering professor at Stanford who was working in the field of communications. Mike may not have been the father of amateur radio single sideband, but he certainly deserves a lot of credit for getting the ball rolling as his activities generated the interest that led to the development of modern day sideband.He used a different technique than had been previously used for the generation of single sideband. He used the phasing method. The modulation took place in the final amplifier which used four 813's. The amplifier was biased for class C operation. The RF drive was inductively coupled to the control grids. Audio was applied to the screen grids. Specific phase relationships were maintained. It was similar to a high level double sideband suppressed carrier system. This transmitter tuned about as easily as a conventional class C plate modulated AM transmitter.

I asked Dr. Villard what developed his interest in single sideband. He replied that during World War II hams couldn't transmit. He thought about things with his spare time during the war. He read "R9" magazines from cover to cover. Other magazines were reviewed. Dome's article in "Electronics" after the war caught his attention. Brother Dome discussed the phasing network. Prior to World War II, the sideband generators used by the phone company were strictly of the filter type of around 10 kilohertz and a little higher.

Pete Hoover, W6ZH, also referenced the Dome article which appeared in the December 1946 issue of "Electronics" en-

continued next page

Oswald G. Vallard (sitting), better know to the ham community as "Mike", at Stanford University during WW II. He and an assistant are shown setting up equipment to record propaganda programs from Japan.

titled "Wideband Phase Shift Networks" as being a little known article that had a substantial influence on single sideband. By Goodman, W1DX, in turn emphasized Dome's article. The mathematicians were discussing the phasing technique in the early thirties. Unfortunately, no one knew how to phase shift several octaves of audio by 90 degrees and maintain good accuracy. Dome solved that problem.

Dr. Villard viewed the phasing type of transmitter as being one that was somewhat easier for a hobbiest to construct and properly align at home due to being able to use readily available materials and less expensive test equipment.The phasing technique could be done using a resistance and capacitance bridge plus a scope to set the phases and magnitudes of the RF and AF drive.

Seven days after hearing W6YX on the air with single sideband, Art Nichols, WØTQK, had a filter exciter lashed together and ready to go. This rig generated the sideband signal at 9 kilohertz. He used some surplus telephone company filters in building this unit. Nichols published an article about it in the January 1948 "QST." Mike Villard also had a sideband article in the same issue.

Several others got interested at this time and people started building sideband transmitters. Both techniques of sideband generation were used.The phasing method was found to be preferred by about a two to one ratio at the start of the fifties. Many discussions were held about the merits of each. Indications are that in a given region of the country, one technique would be more popular than the other. The W2, W6, and W8 call areas leaned heavily towards phasing. On the other hand, the W3, W4, and WØ call areas were found to be using almost all filter rigs.

A lot of the early filter exciters generated the sideband signal at 10 to 20 kilohertz using LC filters. The technology

was still at a state where it was difficult to obtain the necessary Q's at higher frequencies. By the early fifties, rigs started appearing which used crystal filters that were designed around the surplus FT241 crystals with the passband centered near 450 kilohertz. The filter exciters used heterodyning to translate the single sideband signal to the desired frequency. As might be expected, most of the hams that pioneered sideband were technically orientated. A lot of them worked for the telephone company. Several others were employed by the Federal Aviation Agency.

The phasing rigs could generate the sideband signal at the operating frequency as Dr. Villard had done at the Stanford University club station. Another choice was to generate the signal at a fixed frequency and heterodyne it to the operating frequency.

One needs to also recall that at this point in time, the HF phone operation existed only on 75, 20, and 10 meters. Fifteen meters didn't exist and it would be some years before phone operation was allowed on 40 meters.

As previously mentioned, the original filter rigs were using low frequency sideband generators and heterodyning to 75 meters. Heterodyning to 20 meters took a little more effort. The phasing rigs were easier to get to 20 meters. Another issue was receiver stability and of course they were more stable on 75 meters. The natural result was that most operation took place on 75 meters.

In the forties, single sideband was referred to as single sideband suppressed carrier or SSSC. In the early fifties, this terminology was changed to single sideband or SSB as virtually all sideband operation utilized suppressed carrier. At the start of the fifties, there were probably less than 100 people on SSB. Most of these guys would congregate on one part of the band. The original transmitters were crystal controlled. The favorite frequency was 3999 and up. This necessitated the use of lower sideband in order to remain within the legal 75 meter band limits and that established the standard of lower sideband on 75 meters. I understand that this practice was established because AM operators would have been out of the band if they had attempted to operate there.

Sideband suppression on the early transmitters typically ranged from around 20 to 35 decibels. The carrier suppression was in the order of 30 to 45 decibels down. Receivers manufactured in the forties weren't designed to copy sideband; however, they were a lot better than those of the early to mid-thirties. With a little effort one could do a reasonable job in demodulating a single sideband signal.

One of the new requirements was that a reference carrier had to be inserted at the receiver. The beat frequency oscillator could be used to do this. The receivers of that period of time used diode detectors and the BFO injection levels were very low. If a reasonably strong signal were being received, the results could easily be highly distorted audio emitting from the speaker. To avoid this distortion, the operator had to ensure the BFO injection level exceeded the level of the incoming IF signal. This could be achieved by running the audio gain near maximum and using the RF gain control to set the volume to a comfortable listening level.

Stability of the local oscillator and the BFO was another issue. With conventional AM, one did not worry too much about a little receiver drift. Inserting the reference carrier at the receiver meant that stability would become noticeable in a hurry. The pitch of your contact's voice would change and it would take on Donald Duck like characteristics. One would then have to retune the receiver. Drift was even more noticeable with sideband than it was with CW.

Another receiver problem was that the automated gain controls were not designed to handle a rapidly changing RF level. The receivers would gulp, that is change gain suddenly. For this reason, most guys simply did not use AGC or AVC as it was known in those days.

continued next page

It seems that the favored receivers were the National HRO's and Hammarlund Super Pros. The early Hallicrafter products were known to be somewhat more prone to drift in frequency. The pioneering sidebanders worked at improving their receivers. Frequency stability problems were addressed. In many cases voltage regulation was added for the oscillators. Some hams relocated components to avoid thermal effects. A few wound new coils. Some sidebanders even revised the oscillator electrical designs.

Surplus BC221 frequency meters were used by a few sidebanders for the reference carrier. The BC221 was nothing more than a very accurate RF oscillator. They would tune the BC221 to the frequency of the incoming signal. The BFO was not used with this scheme, so its drift was not a concern. If the local oscillator changed frequency, the incoming signal would move in the receiver's passband, but the pitch of the demodulated signal would not change.

The sidebanders worked at improving the passbands of their receivers. Military surplus BC453's were used behind the existing 455 kilohertz IF amplifiers to improve the selectivity. The 453 was a small receiver that tuned from 190 to 550 kilohertz. It had an 85 kilohertz IF amplifier that had a bandwidth of about 2.5 to 3.0 kilohertz. Some hams elected to use parts from the BC453 receivers and build 85 kilohertz IF strips into their existing receivers. Phasing sideband slicers were also built by some of the folks. These changes also improved the receiver for CW operation.

Single sideband stations were rare in the late forties and early fifties. Many hams did not know what this strange sounding signal was. Several of the early sideband operators told me that it was not unusual for a sideband operator to establish a contact with an AM operator. The sidebander would then mention that he had sideband capabilities. Next he would explain to the AM operator that the automatic volume control should be turned off, the BFO turned on, the audio gain should be set to near maximum output, then the RF gain should be used to set the receiver to a comfortable listening level in order to prevent distortion from occurring within the AM operator's receiver. The receiver LO should be slowly tuned to obtain normal sounding speech. At this point the sidebander would suppress the carrier and continue with his newly established contact.

George Devoll, W5EFJ, emphasized that the sideband operators that made the contacts with the conventional AM stations as described above really deserve a lot of credit for helping to draw many others into their ranks. It created a positive interest and helped to develop an understanding of this new mode.

There are many things that the pioneers developed that we never think about today. VOX, or voice operate transmit, is a good example. How did it come about? Duplex was tried on 75 meters. Dick Long, W3ASW, and Grady Fox, W2VVC, initiated this practice. Sideband was a natural for this as there was no steady carrier. W3ASW would transmit on the upper end of 75 meters and W2VVC would transmit on the lower end of the band. Others soon followed suit. The Federal Communications Commission frowned on it. They didn't care that the carrier was suppressed. At least one citation for operating duplex was issued. While these activities continued, Harry Hackerty, W3BOL, came up with an electronic VOX, which used no relays, as a solution. It was quickly adopted by the others.

In those days, the commissioners actively monitored the ham bands. Most amateurs attempted to abide by the established regulations and accepted practices. Those that didn't could expect to be contacted by the Federal Communications Commission. The Commission was determined to resolve issues and keep the bands clean.

One enjoyable story that I was told dealt with a FCC commissioner that vis-

ited a West Texas ham who ran double sideband suppressed carrier. This particular ham found that sometimes the way to a commissioner's heart is through his or her, whichever the case may be, stomach. This fellow had a rig that was built inside an ice box. It had a 304TL in the final and was rather junky to say the least. The West Texan was well known for splattering all over the band. I'm told that the commissioner informed this particular individual that they had more complaints on him than anyone else. The ham's mother lived with him, and while the commissioner was there, Mama fixed a real country meal, complete with the fried chicken. She then insisted that the commissioner eat with them. After an excellent meal, the commissioner apparently developed a liking for the ham in question and the icebox 304TL stayed on the air.

The early culture was such that many of the operators scattered throughout the country managed to get acquainted. They found excuses to get together for "eyeball contacts." One of the well known meeting places was at the New York IRE meetings where the sidebanders would get together of an evening for an informal dinner.

By Goodman, W1DX, mentioned that sometimes the sideband operators, meeting in person for the first time, would say something like, "Heck, I've had you tuned in 100 cycles too high." Joe Galeski, W4IMP, told me that the sideband dinners started with a small number of folks, probably less than 25. The number of people attending steadily grew to over 500. The point was finally reached where sideband was no longer a novelty and the meetings kind of dissipated.

Searching through "QST's" and "CQ's" reveal that the original meeting occurred in 1951. The "On the Air with Single Sideband" column in the May 1951 issue of "QST" stated that W2SNQ arranged a dinner where W2NJR, W2AZW, W2MTJ, W3MBY, W4OLL, WØMNN, and WØRZF were present. W6QYT and W7FFP, were around, but couldn't get to the dinner. It is believed this dinner was started with the hope of luring Mike Villard, W6QYT, to the affair. Apparently everyone had an excellent time and decided to have another informal dinner the next year.

The May '52 "OAWSSB" column stated that approximately 30 active SSB operators attended the 1952 dinner. W2NJR made the arrangements.

The May 53 "OAWSSB" column revealed that about 110 people attended that year's dinner. The next reference I found was in the new "SSB" column that "CQ" started in June of 1956. It stated that the sixth annual SSB dinner was held on March 20th in New York and that it was a huge success.

The May 57 "SSB" column in "CQ" stated that the March 19th SSB dinner had more than 300 attending. The principal speaker was "Butch" Griswold, KØDWC. The June 58 "SSB" column stated that close to 900 people attended the annual SSB dinner on March 25th. •

Part two will appear next month.

Antique Single Sideband

by Mike Palmer, K5FZ
16707 Creeksouth
Houston, TX 77068

"What's a Central Electronics 10B?" or "Yeah, I've heard of Drake but not their 1A... is that a new unit?" these are typical responses I've received while operating these old restored SSB rigs.

A $10 BC458 vfo, $50 10B and $35 1A makes me feel like I'm cheating the system somehow when I slip into a QSO with those who are running $2000 Kenwoods and Icoms etc.

The 10B was available in kit form or assembled and was first seen in the pages of QST in the June, 1954, issue. It operated 160-10 meters,10 watts PEP RF out, selecting either sideband with the phasing method instead of a mechanical or crystal filter, resulting in about 3.5 Khz bandwidth. Unwanted sideband suppression is only about 40 dB down; not quite as good or simple as a filter, but more economical at the time. Crystal control provided the best stability but Central Electronics provided a vfo in the form of a conversion kit and matching cabinet for a BC-458 low power transmitter that was plentiful after the war.

The Drake 1A, first seen in December, 1957, QST works superbly. Some of it's features are crystal controlled front-end, high mechanical and electrical stability, linear dial, large S-meter, real pass-band tuning like on the 75A-4 and a fine AGC/product detector.

There are other 'antique SSB' rigs that are good, and as the interest in this aspect of vintage radio grows I'm sure we'll be hearing more and more of them on the air.

Mike, K5FZ, with Central Electronics 458 VFO, 10B exciter and Drake 1A receiver.

LETTERS

Dear ER

It is a good thing that you are doing. Vacuum tubes, high voltages, wires, capacitors, resistors and the like are an important part of our hobby. Old timers like myself and many, many others appreciate the rewards of designing and constructing, or simply modifying equipment and then using it on the air. Although I am a NASA engineer, and work with the latest technology on a routine basis, I find the greatest pleasure when I work with actual circuits that can be seen and touched and adjusted and soldered and measured... I personally believe that one of the greater threats to our hobby is the erosion of the design and fabrication skills that originally distinguished the amateur radio operator as an important entity of the electronics and communication world. I meet too many so-called hams these days whose faces assume a blank expression as they pretentiously nod understanding when they find themselves trapped in discussions where vacuum tubes are mentioned. Let's face it, circuit board R&R (removal and replacement) is not amateur radio. ER is a breath of fresh air to an old-timer's lungs.

Gary Musgrave, WA4ODY

Dear ER

In July I was contacted by a a movie production company from Los Angeles. They informed me that they were in the Seattle area shooting a made-for-TV movie and they needed to rent some early ham radio gear.

They came out to my shack and took pictures of my gear so their staff and writers could select the 'ham set' that would suit their needs. They finally selected the Collins S-Line because of the size and the camera angle they required, etc.

Since they asked for my suggestions, I said that that every good authentic ham radio set-up should have the basic extras such as QSL's on the wall, Handbook and magazine on the desk (Electric Radio of course!). Some of the QSL's I loaned them include: K6HLO, W6PSS, W6HDU, K7INK, WA7YBS, K8MLV/Ø, KØJM and KO9S.

I didn't get to read the whole script but the film should be fun for the ham community to see. The title of the movie is "Crazy In Love" and stars Holly Hunter, Gina Rowlands - she plays the role of a ham radio operator and incidently will be using my call - and Bill Pullman.

The movie is tentatively scheduled for the first quarter of 1992, on the TNT network, watch for promotions.

Pat Person, K7YIR

Dear ER

G'day from Down Under! It has been a while since we corresponded and I owe you a letter. I was finally prompted off my butt by your request in ER No. 30 for info. on Eddystone. Incidentally I received No. 30 on 14-10-91.

Enclosed is some stuff on Eddystone and a copy of the handbook for the 770R. It's not much of a handbook but apparently that's all there was. I wrote articles on the 770R and 770U for the local amateur magazine AR, and if I can remember which issues, you will find copies enclosed. As poor colonials of the British Empire, we here in Australia had to accept English wireless equipment (from the Marconi era onwards) so there were many Eddystone models available here, used by government monitoring stations and rich amateurs. Some receivers are still in use by hams and turn up on the 2nd hand market occasionally. It is hard to keep up with the list of different versions. I have several such as the 640, 680A, 770R and 770U. Some of them used weird valves with glass spigots which are hard to get and don't have equivalents. My 770's cost $50 each (about $60 US) from a radio laboratory. I am not impressed by the performance of Eddystone sets but I guess they were all pathetic Poms had, other than WW I design TRF sets. Oops, I hope you are not of English ancestry!

Colin MacKinnon, VK2DYM

Collecting/Repair/Restoration...Tips

Cure for the Ranger and Valiant Bandswitch Problem

Underneath the chassis of these transmitters is a block type cam mechanism, coupled to the band switching shaft, which is supposed to turn freely when switching in the 6, 80 and 160 meter positions.

I have several of these transmitters and all of them have had the cam block frozen so tightly to its shaft that forcing it to turn would cause damage to the mechanism.

A very simple solution to this problem would be to lubricate the cam block shaft; but, doing this is not as easy as it may seem because the lubricant runs off or evaporates before it can accomplish its task. I tried various contact cleaners and lubricants, to no avail. Applying even a slight pressure on the band switch would cause slippage between the cam block and the shaft because the set screw does not hold.

Remove the four screws that secure the aluminum shield next to the cam block and lift out the shield, making room to get at the set screws. Loosen the set screws and discard them, replacing them later with Allen type set screws.

Build a dam around the screw threads that hold the shaft by using a rubber grommet or with 'DUCT SEAL'... similar to putty to form a well into which a fluid like penetrating oil (LIQUID WRENCH) may be poured.

After a half hour, apply a slight pressure to the band switch knob, trying to turn it to the right and then to the left... as it loosens, greater pressure can be applied until the shaft turns freely. Remove the dam and apply a light oil to the shaft. I secured a shaft coupling to the band switch with a knob on the end to make turning easier.

Alignment of the cam block to the shaft, in proper position, is easy with trial and error. Replace the aluminum shield and you're back in business.

Roland Matson, K1OKO

Replacement Bulbs for Collins Lighted Speakers

Collins Lumiline lamp replacements are available from Lightbulb Supply Co. 800-292-2852. The 1991 cost is $16.83. This bulb is manufactured by GE and will probably be discontinued in the coming years.

Ray Osterwald, NØDMS

Coating for Cloth Covered Wire

When restoring a very early rig with cloth covered wire it's sometimes easier and better to cover the cloth with a silicon resin rather than re-wire the whole chassis. A product that I've used is called Conformal Coating and is made by GC Electronics. It's available at most electronic parts places. I've found that it's most easily applied with a brush. When it dries its quite hard and leaves the cloth somewhat darker than it was originally.

Ray Osterwald, NØDMS

Antique Electronic Supply...

On a business trip, I visited an ER advertiser, Antique Electronic Supply in Tempe, Arizona. The store has hundreds of items not listed in their catalog, cheap tubes and friendly people. It's a gold mine for boat anchor owners, but you almost have to shop in person.

Wayne Arnett, A17C

AM FREQUENCIES

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

From the Editor:

Vintage CW Net Activity

Tracey Reese, WB6TMY, reports that the vintage CW net is doing well and that each week there are more check-ins. The net is now operating on the 40 meters - 7137- at the same time - 6PM Pacific, 9PM Eastern.

Some of the recent check-ins include: Bob, NV1X - DX-60/SX-115; Lea, KN4JW - AF-68/PMR-8; Brian, K9VKY - Ranger/HQ-140; Greg, WA8JPC - TX4/R4B; Fred, W6RNC - Valiant/GPR-90; Steve, KJ8L - Viking I; Jim, N2EY - HB807s; Bob, K1BUB - Adventurer; Tom, K8JOR - Ranger; Henry, WA7YBS - Viking 500/75A-4. The net controls are Tracey and Ray, NØDMS. Tracey uses a Globe Chief and an SX-42. Ray uses a 32V-2 and a 75A-4.

Tracey and I have talked about some sort of a 'promotional' contest. Maybe we'll have some kind of an awards for 'oldest', 'most exotic' etc. Another idea might be to have a 'jamboree' or something along the lines of "Straight Key Night". If anyone has other ideas for the net please forward them along to Tracey or I. We'd welcome your input.

Please consider checking into the net and remember that 'high speed' is not necessary and it's quite 'acceptable' to just check-in and check-out.

CU Sat. night....N6CSW/Ø

10 Meter Contest... Great!
Announcing 20 M Allnighter, Nov. 30

Maybe the best accessment of the weekend came from Pat Keogh, WB9CKZ, quoting from the beer commercial, "It just doesn't get any better than this". It seemed like the propogation was exceptional - or did it just seem that way because there were so many stations on? Anyway, ten meters,has probably never seen so much AM activity since the cycle in the '50's. It was a wonderful experience.

So far I've received logs from the following stations: Ron, N6OMW; Bill, VE3AUI; Roger, KD4AS; John, WB5OAU; Sam, W1MCP; Dean, KH6B and Vance, K5CF. At this point Ron Cole, N6OMW, has clearly 'blown away' all the others with 100 points (100 stations) logged. Next month we'll list the high scoring stations and announce the winners.

The next contest is going to be the "Second Annual 20 Meter Allnighter" on Saturday November 30. This year we'll get started at 8 PM California time or 11 Eastern and continue until 5 AM California time the following morning. In this contest I'd like to see the following information on the logs: the time of contact; signal reports; gear being used and the antennas.

For those who have never operated 20 all through a night let me say it is a very unusual experience. Everyone should do it at least once..... or twice. **N6CSW/Ø**

The Collins Linear PTO, Part two

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

PTO MAINTENANCE

The oldest ham gear from the Collins Radio Company using their PTO is now around forty years old. A piece of electro-mechanical equipment can't be expected to run forever without maintenance, and Collins is no exception. Luckily, the equipment is super-well built, and the few problems that do occur with PTO performance fall into several common areas.

The most frequently encountered problem area is dried out lubrication, and this shows up usually after about 8 to 10 years of service. A Collins tuning mechanism in good condition should be a joy to use, and smooth as glass, with no backlash. Unless the rig has been abused or in an accident, problems with dried out lube show up as stiff, balky tuning, or in severe cases as a squeak or bind in some portion of the tuning range. Dried out lubricant may also cause an annoying sudden jump in frequency, sometimes as much as 2 to 3 Kc. On some of them, this may occur without touching the tuning knob. At other times the same problem is evident by a sudden jump in frequency when the operator has either just started tuning, or just as the dial comes to rest.

Another common problem is a slow drift in dial calibration. After a period of years, our dial fiduciary usually gets farther and farther to the right, although some never seem to ever drift more than 2 or 3 Kc. This can be cured in most cases by doing an "end point adjustment", pointed out in the instruction books. In some receivers, notably the 51J series, the end point adjustment lead screw is backed out against the PTO frame, and no further adjustment is possible.

A change in dial linearity may show up with time as inaccuracy in one or more of the intermediate 100 Kc. calibration points, even though both ends are zeroed.

An oscillator may fail to start, or may quit after getting warm. Tube problems aside, this is usually caused by faulty bypass capacitors. They are luckily located on the outside of the PTO can.

Once in a very great while, a tuning slug may come loose from the lead screw, or may even break off. Don't give up, as the PTO can be disassembled and the core glued together with Crazy Glue. It will hold forever, but try to figure out what caused the original problem.

CLEAN, LUBE, ADJUST

Here comes the greasy part! The tips to follow are specific to the PTO in the R390A, but since all Collins PTOs are of the same design, the tips apply equally. Fortunately, the ham gear isn't as complicated, and I'm sure that any factory warranty has long since expired!

Begin disassembly by removing the PTO from the receiver. Scribe some lines around the triangular mounting plate at the rear of the outer cover, and remove the plate. Remove the three cover screws and their star washers. Slide the outer cover off enough to clear the rear of the PTO. Pull it to one side, and unsolder the heater wires which pass through a bushing in this cover.

FIGURE 1

This is a view of the PTO from the R390a with its outer cover and fiberglass insulation removed. The long cylinder near the disk ceramic bypass caps, running the length of the PTO, is the oven thermostat. The heaters are under spot-welded covers on either side of the thermostat. Note the thermostat adjusting screw, located just behind the access screw labeled 5-701. This is used to set the thermostat control

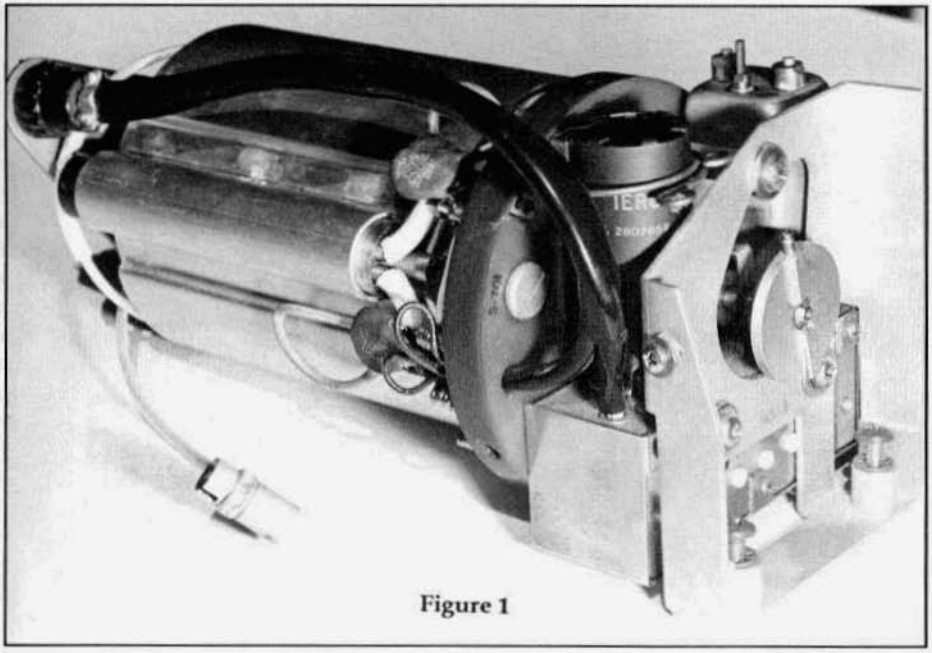


Figure 1

range, and is normally never touched. The large oval disk at the front is the rear portion of the 3-piece "Oldham" shaft coupler. The power plug and triangular mounting plate at the rear are not attached to anything, but just set in place for the photo.

FIGURE 2

Make a quick wiring diagram of the connections at the front where the wires, caps, and choke are located. Carefully unsolder the 2 wires for the thermostat, and the 2 wires running to each side for the heaters. Remove three more screws and star washers from the rim of this inner cover. Carefully slide the heater cover to the rear, and set it aside. Now visible is the third and last cover, which is the only cover you'll find on a PTO in the ham equipment. (Some R390As had a pressure fitting at the rear of this last cover, and were used for injecting nitrogen for moisture prevention.) The three screws just removed also hold this cover, so slide it to the rear just like before. Some resistance may be felt, as the cover slides past rubber O-ring seals.

Once the PTO components are exposed, become familiar with the various parts, and begin cleaning. The points labeled are as follows:

#1 is the sealed ceramic tank capacitor, #2 tubular tank capacitor, #3 Variable-pitch coil, covered with molding material, #4 Tuning slug, #5 Compensation cam stack, #6 Cam follower roller, #7 Cam follower pivot, #8 felt lubrication washer, #9 Lead screw, #10 Rear bearing. Also visible is the oscillator tube socket, #11. Here is where the bypass caps are located, should they need replacement. On an R390A, they are all sealed up in a block of epoxy, #12.

Solvent is used to clean points #5, #6, #7, #8, #9, #10. Be sure to get point #8, the felt wick, well cleaned. It carries enough oil so that the lead screw is always supplied with lube. The lead screw rear ball bearing should be thoroughly cleaned. It is not necessary or advisable to remove it.

DO NOT ALLOW ANY SOLVENT OR LUBE TO RUN DOWN THE LENGTH OF THE TUNING CORE AND GET INTO THE SECOND HALF OF THE FRONT LEAD SCREW BEARING!

continued on page 23

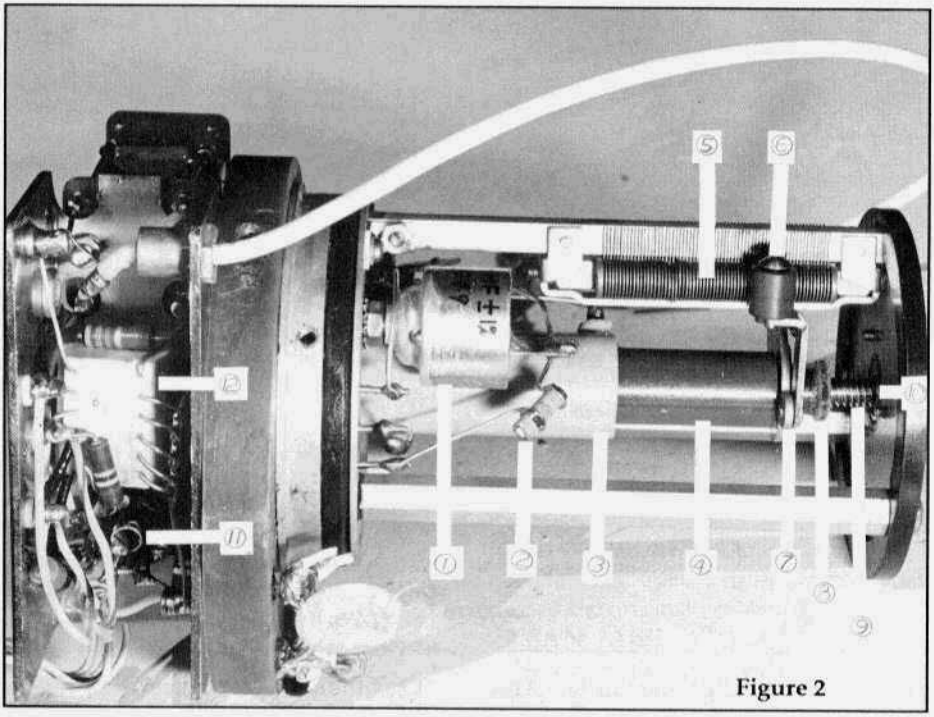


Figure 2

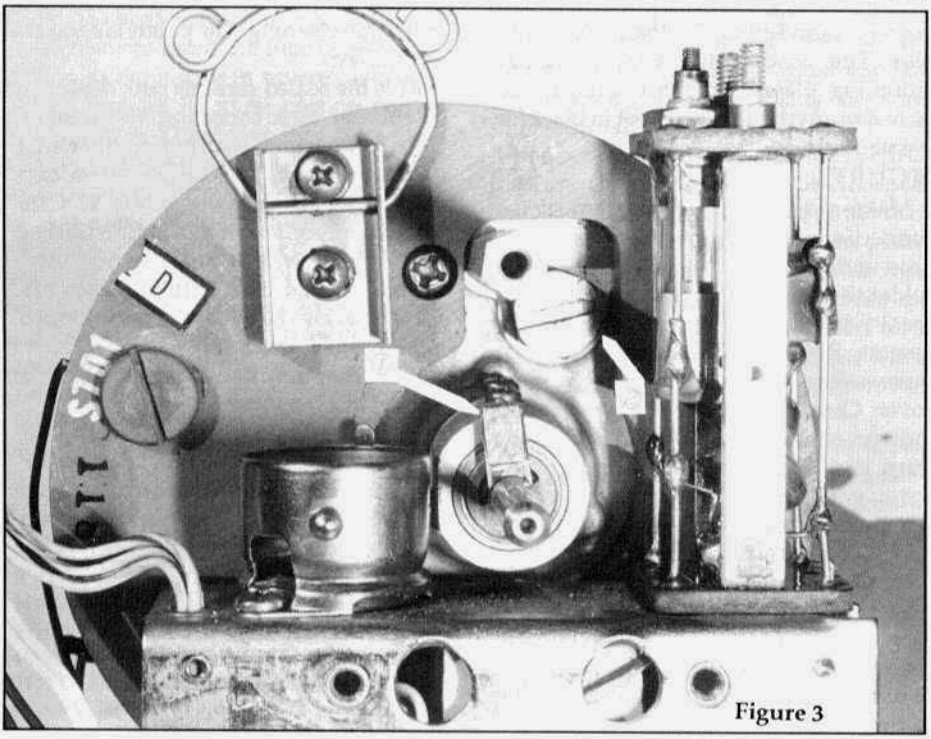


Figure 3

FIGURE 3

This is a front view of a typical R390 PTO with the front mounting plate removed. (Notice the high-quality hi-Q glass piston trimmer in transformer 2702 to the right.)

Find the angled ground strap, #1, which is held on by 2 small screws. Remove this piece and clean it, and also clean the groove on the shaft where the strap rides. Remove any burrs found on either place. It is necessary to get this strap and the shaft journal as clean as possible, as it is designed to carry RF ground return currents.

The end-point adjustment cover screw is to the upper right of the lead screw, #2.

The outer front bearing may be removed for cleaning, but you'll need a C-ring tool to get the retainer off and on. With the ring off, direct a blast of compressed air down the shaft axis, and the bearing should pop right out. If it won't easily come out, leave it in and flush clean as necessary. Don't let any solvent get down inside the PTO. Be careful, as the metal in the ball race is easily bent.

MOISTURE REMOVAL

After cleaning, the next step is to remove any residual moisture which may have built up in the PTO components. Remove the 2 rubber O-rings and carefully put the PTO on an aluminum cookie sheet. Set an oven at 125 to 140 degrees and bake the PTO about two days. This procedure sounds radical, but it was recommended to me by a former Collins engineer. There is nothing inside which can be hurt as long as the oven stays well below the boiling point.

FIGURE 4

This is a close-up of the compensation cam stack and the cam followers. At this point, work the cam followers up and down, get familiar with how they work and see if there is any binding. The top follower is staked on and does not roll. The bottom follower has a roller on it, and should be free to move.

Visible to the right is #1. This is the threaded clamp screw which needs to be loosened up if linearity is to be adjusted. The fixed follower is firmly attached to the tuning slug. As it follows the shape of the cam stack, it rotates the tuning slug somewhat. The follower with the roller is pivoted at the slug and spring-loaded, so that it keeps the other side in firm contact with the shape of the cam stack.

When lube has dried out, these parts cause the PTO to jump in frequency and become unstable. A dirty front ground strap adds to this problem. The followers ride up on hardened grease and suddenly fall back, or the rolling follower hangs up in mid-air, causing the same problem. Binding at the follower pivot will cause the same thing to happen.

Lack of linearity can be caused by moisture in the core, which baking should have taken care of. Examine the surface of the cam stack. If the cam surfaces are scooped out from lots of tuning around, as a ham receiver is likely to be, then linearity should be adjusted. Often, a military rig was left for months, or years on the same frequency. Very few of the military PTOs I've seen show much wear here.

LUBRICATION

Refer to Figure #2. Using a good synthetic oil (from Radio Shack), sparingly lubricate the rear bearing (#10), cam follower pivot at the slug (#7), the cam follower with the roller (#6), and the front ball race mentioned above in figure #3. Saturate the felt washer (#8) with oil.

If available, use Stabilant 22 (restoration tips in ER #29) on the lead screw ground strap at the front, or else use some paste-type tuner lube.

Hold off lubricating the cam stack until any compensation work is completed. When it is done, run a thin bead of DuPont Super Lube along the length of the cam stack, then run the lead screw back and forth a few times to spread it around.

If the Super Lube isn't available, use instead a good grade of automotive wheel bearing lubricant. I used to use it until the synthetics became available, but it won't

continued on page 25

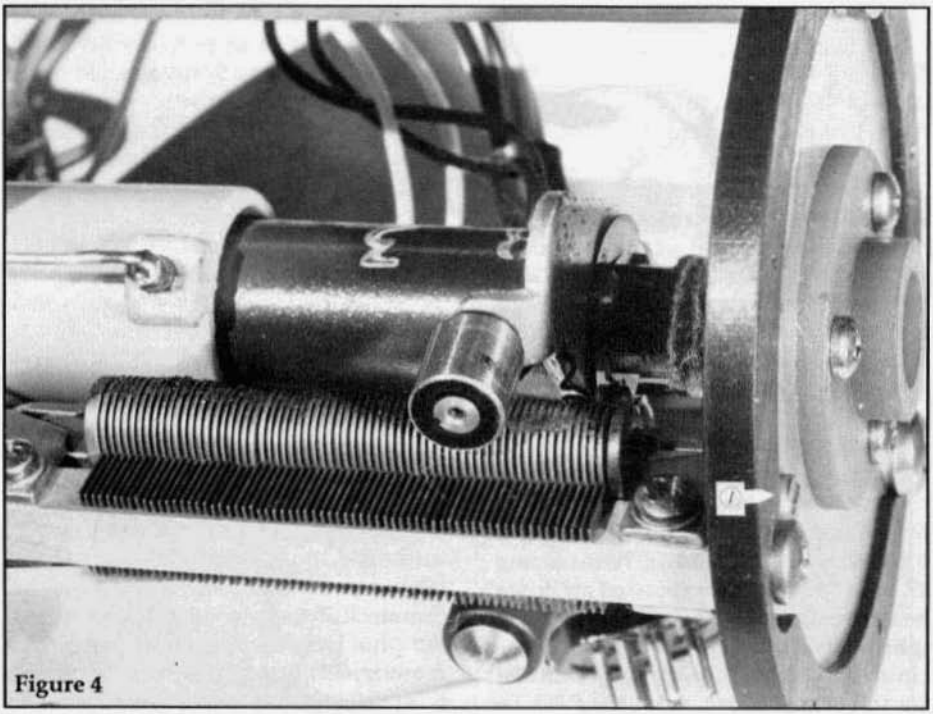


Figure 4

Figure 5

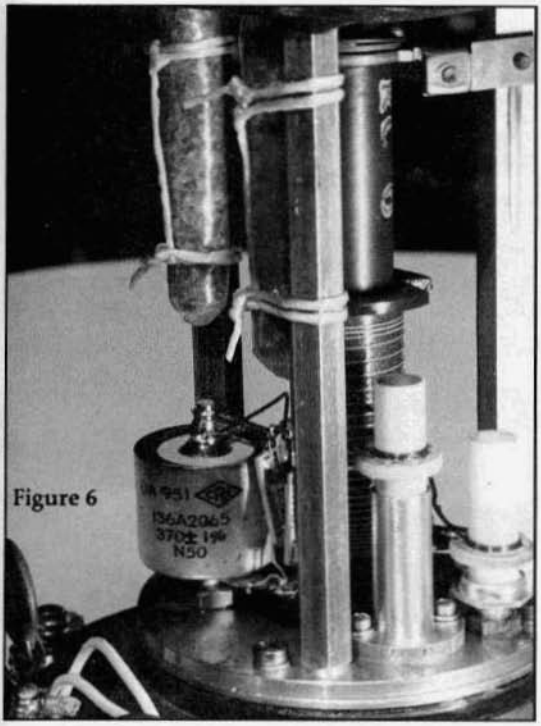


Figure 6

last as long because it is petroleum-based and eventually dries out.

CAM STACK COMPENSATION

The object of the compensation is to make the oscillator produce a linear frequency change throughout its tuning range. Its a tedious procedure, but it only has to be done every thirty years, You'll need a way to power up your PTO, a frequency counter, and a way to terminate the oscillator output voltage. Usually a resistor works fine, about 50K.

Power up the PTO, and allow it to warm up a few hours (the longer, the better). Back the slug out to the starting position. This can be found by noting where the shiny marks on the cam stack begin. Put the cover back on, as it really affects the oscillator frequency. Taking the cover on and off, time after time, is the tedious part; but it is very necessary. Then, set the oscillator to exactly 2.455 Mcs by moving the spring retainer lug on the Oldham coupler a little bit. Put a pencil mark on the mounting frame, lined up with the lug, as your starting point.

This is a ten-turn PTO which changes a total of 1 Mcs. Move the Oldham coupler one turn clockwise. The counter should read 100 Kc higher, or 2.55 Mcs. If it doesn't, remove the cover, loosen the cam stack clamp screw slightly, and move the cam stack washer under the follower one way or the other so that the tuning error is compensated. Replace the cover and check the frequency. With a little practice, you can begin to allow for the capacity of the PTO cover, and include it in the amount corrected for when you adjust the cam positions.

When this is completed for all ten turns, be sure to tighten the clamp screw, and then seal the nut on the other end. Lubricate the cam stack, and put the PTO back together.

After the PTO is re-assembled to the rig, do the end-point adjustment. (It is hard to make this adjustment accurately without a VFO dial and the rest of the tuning mechanism.)

For other model PTOs, refer to the chart in part 1 to get the proper tuning range and number of turns.

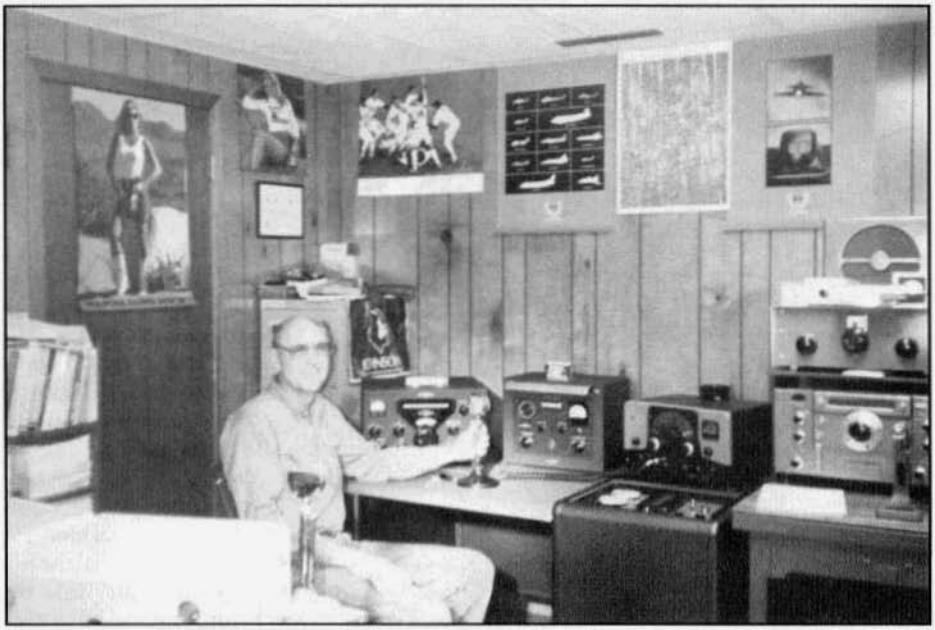
FIGURE 5

This is a view of the series end-point adjusting coil, and the two temperature-compensation caps to the right. In very stubborn cases where the end-point adjusting screw still doesn't have enough compensation range after the baking step is done, a single turn may be carefully removed from this coil to bring the adjustment back into range.

FIGURE 6

Beware of cheap imitations! Here is a Collins-clone PTO from an R390A. How this manufacturer managed to meet contract specifications I'll never know. This thing was removed from an early sixties Stewart-Warner receiver and dropped deeply into my junk box after a frustrating two weeks of work (Not a Stewart-Warner

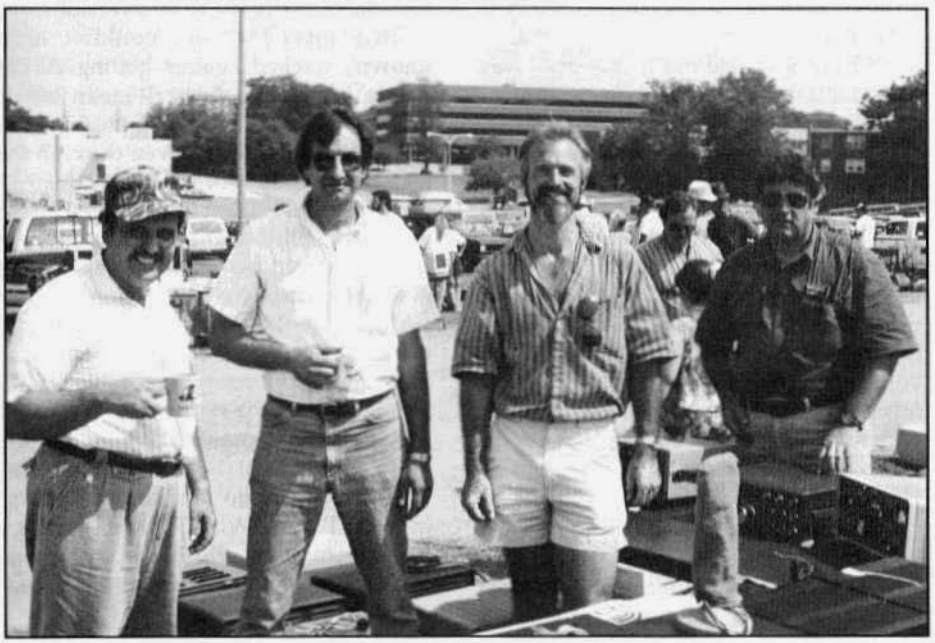
continued on page 29



Butch Schartau, KØBS. Some of the gear shown in the photo includes a Collins 75A-4, Johnson Desk KW, Ranger and National HRO.

Vane Gildersleeve, K5CF, with some of his vintage gear which includes a RME -70, homebrew 6L6 rig, a National SW-3 and a TNT transmitter. He uses the TNT and SW-3 for AWA contests. Also shown is a Ranger II and a Drake R-4B.

AM'ers at the Butler, Penn., Hamfest, September 8. Left to right,standing, back row: Brian, K3USC; Ron, K3NFS; Walt, W3NFY; George, WB3FRY; Ken, N2BAU and Dave, WB3ETN. Next row, standing, left to right: Mike, NO3E; Mark, SWL; Ray,W2XC; Dave, W3BJZ. Seated, 2nd row, left to right: Ed, N3GWE; Earl, N3IYP; 'Ashtabula Bill', W8VYZ; Art, W8RXP and Ed, KO3L.



AM'ers at the Gaithersburg, Maryland, hamfest, left to right: Len Crispino, WB2MJH; Gary Burrows, N2INR; Paul Courson, WA3VJB and Gil Geoffrion, N4QAS.

ER in Uniform from page 9

To increase the audio gain many hams added another stage by adding a socket either in the IF/audio plate or elsewhere. However, a 12AU7 dual triode or a miniature 9-pin triode-pentode on a plug-in unit would replace the 6K6 (or type 41 in some early sets) with no holes or important under-chassis mods and would give all the gain and power necessary. If a noise limiter is essential at your location, one probably could be squeezed in to this assembly.

Calibration accuracy isn't great even with careful alignment because only the 200-500 kcs band has independent adjustments for the high frequency and low frequency ends of the band. However, there is only one ham band per bandswitch position; if you trim the oscillator on the frequencies you use, it will be fine. Dave reports warm up drift of about 7 kcs at a frequency of 7240 kcs for a BC-348-P; this can probably be reduced somewhat by changes to the temperature compensation but with the oscillator so spread around and a tube in the coil box, the best answer is to warm the set up first. It would not surprise me if this drift was considerably less in the late design receivers.

If you have an early set, be sure to stash away a spare 6F7; it's an uncommon tube and there's no easy substitute. Finally, with all the modifications done to these sets, be sure you understand what you have before trying to put one in operation. Check especially for filaments rewired to 6 volts before applying 28 volts... For what it's worth, I put quite a few hours on an unmodified '348 running with the dynamotor; you don't have to do mods to use this set.

Conclusions

One can find a few things to quibble with in the '348. The BEAT FREQ and C.W. OSC. ON/OFF controls should have used the same terminology for the same function (for example, BEAT FREQ and BEAT FREQ OSC ON/OFF) and I'd prefer CRYSTAL ON/OFF, instead of IN/OUT. Too bad a bit more effort wasn't given to making the bandswitch and RF coils easy to service; it takes you an hour or so to unsolder the wires from each coil box and remove all the mounting screws in order to slide the boxes off of the bandswitch shaft. And how many servicemen and hams have cursed those flat black plastic paper caps... but of course, the builders of the set couldn't have known they would turn out to be dogs as the Bakelite plastic shrank away from the leads over the years.

Let's list a few strong points. The controls are easy to understand and use. Castings were used for stiffness, but they are of aluminum alloy, the cross sections are no thicker than necessary and overall lightweight design was achieved through the extensive use of aluminum stampings in other places. Sensitivity (average 1.2 microvolts), selectivity, and calibration accuracy (rated 0.5%) are all adequate for the intended job. The design shows good attention to serviceability and cost control, particularly in the late versions.

Two 'nits' and one 'couldn't have known', stacked against getting all the basics right. See what I mean about 'quibble'? The BC-348 is a true professional which having served through the lean times of the '30s was ready to go on the first Pearl Harbor day. Not only does it show an almost unique grasp of what the job would be like, but the overall design is years ahead of its time -- when we look at the BC-312, designed at exactly the same time at the Signal Corps labs at Ft. Monmouth, that will be painfully obvious.

After several months of 'stopgap set', 'didn't know what the war would be like', 'almost a fine radio', and too many helpings of 'Turkey With Trimmings', it's a pleasure to call the BC-348 what it is – an outstanding job and in every sense a classic of the radio art. •

Two Homebrew Transmitters from page 3

oscillator. I used a pair of 805s in the modulator. I used all these 211s primarily because a good friend, W2VDZ, came up with a dozen of them still wrapped in the original packing.

The power supply utilizes a brand new Peter Dahl transformer - 1500 volts, 1 amp - and 872s as rectifiers. I control the power supply with a variac. The rig is very simple because all the stages except the oscillator use the same B+.

This rig is of the chassis and rack construction with no panels. It's all open like it used to be. While I was building this rig all the things we used to do and talk about in the good old days came out of the old memory. That was a big help. Running it at 1000 volts and 450 Ma I get 300 watts output and it sounds real pretty!

The next rig I built was the 204A rig for 75 meters, again using the proven design of a 42 oscillator and 211 buffer. I use the same power supply and modulator for this rig that I use for the 211 rig. Thanks to Leo Gibbs, a retired broadcast engineer, and Dick, W8GNV, I was able to find a pair of old 204As, about 60 years old, that were still good.

In an old copy of QST, Nov. 1927, I saw a rig with the tubes mounted vertically on the front panel, out in the open, with the tuned circuits behind the panel. I decided that was how my rig had to be. I submounted the panel to provide some degree of protection for the tubes and the operator. I run this rig at 1200 volts, 400 Ma and get 300-400 watts output.

These days I spend most of my time building. Another project I have on the drawing board centers around an old 861, a screen grid tetrode made by Westinghouse around 1945. •

Cover from page 1

It was link coupled to a single 812 final. The modulator was a 6J7 driving a 42 into 2 46 tubes, triode connected in class B. The mike was an F1 from the telephone company, mounted in a bicycle headlight. My receiver was a Sky Buddy, S20R. My call was W8UEO at West Branch, Michigan.

"The antenna I used then was a 250 foot end-fed Zepp. Of interest might be the two knife switches on the operating table. I had no relays, so did all the T/R switching with the switches. I guess I'm lucky I didn't kill myself.

"When I first got on phone, my voice had not changed and all the guys I worked thought my handle was 'Joan' instead of John. So I would scream at them, "I'm a boy"!

"I'm ex W8UEO, W9GVI, G5ACO, VP5JNX, ZD8JGN. I also bootlegged KA1JN from Luzon in 1945/46."

John Nauman

Collins PTO part two from page 25

PTO). Notice there is no compensation cam stack. Instead, they have used a second padding coil for compensation, which is standing up in the center of the photo. Also there is no molding material around the coil, and it is wound on a bakelite form! These are impossible to linearize and don't hold their calibration very long, so do yourself and your R390A a favor and replace it. They may be recognized from the outside by an extra cover screw in the front plate.

CONCLUSION

The final step (for ham equipment) after getting everything back together is centering the dial fiduciary. This is usually well explained in the instruction books as loosening a shaft coupler and zero beating with WWV.

Now that this work is all completed, you'll find that the rig tunes like a new set. If you ever have to part with a piece of equipment, you will probably find that it is worth much more with a well-calibrated dial. •

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WANTED: Old receivers, SX-73, SP600JX, AR-88, BC-342, BC-348, ST Tube Type HRO and etc. Masahiro Nada 6-9-3 Fujiwaradai-Kitamachi Kita Kobe 651-13 Japan. FAX 011-81-78-981-3261

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WANTED: Johnson T-R switch and SW-band xtals for Drake R-4B. Doug Jorgensen, K9PFA, 408 Maple St., Prophetstown, IL 61277.

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FOR SALE: New TV-7D/U tube tester - $90; original Hallicrafters manuals - SX-28A, S-36, SX-115, SX-117 and SX-130 - $10 each. Ward Becht, W6IRK, 625 Tufts Ave., Burbank, CA 91504. (818) 842-3444

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FOR SALE: Perfect HT-33B and HT-37. **WANTED:** IF xfmrs from 75A-2; Ranger II panel; AT-1 meter. David Knepper, Box 34, Sidman, PA 15955. (814) 487-7468

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WANTED: Military Radios and Electronics. Systems, collections and accessories: dynamotors, DF loops, control boxes, etc. Any vintage or nationality. Charles DiCecca, KA1GON, 501 Mystic Valley Pkwy, Medford, MA 02155. (617) 396-9354

WANTED: Vibrokeyer. Marcus Frisch, WA9IXP, Box 28803, Greenfield, WI 53220-0803.

FOR SALE: Clearing 100's of unused/NOS audio, TV and radio tubes. Grab bag sale: 50 assorted NOS rcvg tubes, most in boxes. Each assortment contains a new pair of RCA 6CA7/EL34 (audio special) or a 6146A and 5763 (ham special). Specify which special you want - $55 ppd per assortment. Bill Kleronomos, KDØHG, Box 1456, Lyons, CO 80540. (303) 823-6438

FOR SALE: BC-610F w/coils and tuning units, 160-10 meters; HT-32; Drake 2B w/2BQ; Viking II w/vfo; KW amp in 6' rack; AR-88 without meter & cabinet; Collins 75A-3/32V-3; Heath 2 KW amp w/pr 4-400s & ps; TR4C, complete Drake C-Line w/matching tuner & ps/spkr. Joe Perratto, K2QPR, 1341 SW Evergreen Ln., Palm City, FL 34990. (407) 220-2189

WANTED: Manual for Johnson Viking Ranger II. Photocopy ok. Will pay for copying and shpg. R. Eric Sluder, KB9BCS, 437C Redwood Ct., Greenwood, IN 46143. (317) 885-7112 eves.

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

WANTED: Sourse for generic vacuum tube boxes for subminiature, miniature, octal, large tubes, e.g. 813s, 1625s, etc. Gary Musgrave, WA4ODY, 1428 T St., N.W., Washington, DC 20009. (202) 483-3932

FOR SALE: 813s; new/used ceramic sockets; caps; PL175 and socket - offer; HW8 - $65; Messenger (11 M) - $40; SX-122, xlnt - $145. Bill, KE7KK, 6712 Lake Dr., Grand Forks, ND 58201. (701) 772-6531

WANTED: Multi-Elmac ATR-4; ESS-2 or any mint Multi-Elmac equipment. Lea, KN4JW, 310 So. Park Dr., Spartanburg, SC 29302. (803) 582-8237

FOR SALE: Westinghouse MW2, 2-30Mhz, 3KW AM (output), 5736 modulated by 833s - $750. PU only. Jack H. Osborne, K6LVO, 5636 Del Monte Ct., Santa Rosa, CA 95409. (707) 539-3949

WANTED: RCA 77DX mike and unusual 7" TV. Neil Dorfman, 7028 Clements, West Bloomfield, MI 48322. (313) 661-8770

FOR SALE: Manuals: B&W, Collins, Heath, Hallicrafters, Johnson and others, SASE for list.**WANTED:** Tubes 304TH, 885, 6L7; neon bulb NE-32; manual for Gates MO-2639 mod. monitor and SA-39 limiter. Mike Carroll, NI4N, 108 Wessington Ct., Hendersonville, TN 37075. (615) 822-0082

WANTED: Model 3201 modulator/ps for Gonset G-77A xmtr. John Lewis, WB9NWO, 3526 N. Elmcroft Ter., Peoria, IL 61604. (309) 685-5865

FOR SALE: Restorable rcvrs: SP-210 (1939), S-36A and NC-156; BC-610 parts; 19" racks; very clean Johnson KW, T-Bolt and KW Matchbox; misc gear and parts; vintage mags, Handbooks, etc; military surplus. SASE for list. Rick, K8MLV/Ø, (719) 543-2459

CLASSIFIEDS

FOR SALE: Our triple output Crystal Calibrator runs off rectified filament voltage or 9V battery. Kit or built. Visa/MC accepted. Call or write for our latest six page parts and kits flyer. Large SASE appreciated. Steve, NW2F, Two Fox Electrix, POB 721, Pawling, NY 12564. (914) 855-1829

WANTED: Military electronic items, including Radar, RDF, communications and odd or unusual items; APS-10; APS-13; loop for DAG. William Van Lennep, POB 211, Pepperell, MA 01463. (508) 433-6031

WANTED: HRO-60; NC-400; coils for HRO-50T1; speakers for NC-303 (NTS-2), HRO-50T1, NC-183D (NC-183DTS), 75A4 (270C3); original manuals for HRO-60, HRO-50T1. Carter Elliott, 1460 Pinedale Rd., Charlottesville, VA 22901. (804) 979-7383 H, 980-7698 W

FOR SALE: (2) sealed mod. xfmrs for BC-610/1 - $50 each, U-ship; Tubes: NIB 4D32 - $50; NOS 5894 - $25; 6939 - $10. Collectors phototubes: NOS 1P29, 920, 931 - $5 each. **WANTED:** 801 tubes. Bill Kleronomos, KDØHG, Box 1456, Lyons, CO 80540. (303) 823-6438

WANTED: Tuning units for BC-191 or BC-375 xmtr; Index To Surplus by Roy Pattenberg, W4DKM; Understanding Amateur Radio. Alan Mark, POB 372, Pembroke, MA 02359

FOR SALE/TRADE: 51 years of QST, 1931-1981 - $400 or equipment trade. Free delivery 200 miles Youngstown, OH. K8SJ, (216) 545-9632

FOR SALE: Hallicrafters SX-115 - $395; Hallicrafters WR4000 - $155; HB antenna tuner, 5 KW. Mil/spec, looks commercial, pictures avail. - $275. Steve Harmon, N9HGF, (812) 474-0842

WANTED: Sams CB-1 thru CB-50 service manuals. James A. Weil, 15915 Armada Center Rd., Romeo, MI 48065. (313) 784-9860

WANTED: Hallicrafters SX-16; Super Skyrider SX-28 and SX-25. Bob Bricker, K4CSV, 2801 Atlantic Ave., Fernandina Beach, FL 32034. (904) 261-0193

WANTED: Brown Bros. keys, paddles, semi-automatic, company brochures. Also 'IC Keyer' by Palomar Engineers. Gary Wagner, K3OMI, 11124 Oak Hollow Rd., Knoxville, TN 37932. (615) 690-4217 days at work

CLASSIFIEDS

FOR SALE: Central Electronics 20A, mint - $65; Hallicrafters HT-37 - $150; BC-373 tuning units - $10 each; Gonset 2 mtr linear - $70; 813s - $15; 805s - $20. Milton Levy, 539 McCarty, Apt. 407, San Antonio, TX 78216.

WANTED: Military sets: AN/PPN-1 or PPN-2; BC-966 (SCR-695); AN/APN-2; BC-800; TRC-10; R-105/ARR-15; ID-59/APA-11; R-252/ARN-14. Also any small aircraft I.F.F. or beacon sets, WW II era. Also interested in WW II German and British military radio equipment. Leroy E. Sparks, 924 W. McFadden Ave., Santa Ana, CA 92707. (714) 540-8123.

FOR or TRADE: Collins R-388 w/cabinet and manual - $200; PM-2 - $75; 516E-1 - $100; assorted Collins xtals, 3-30Mhz - $7 each. Bill Jenkins, WA5MWJ, 11916 Donahoe Bend, Fort Smith, AR 72916. (501) 646-3859.

WANTED: Hammarlund variable condensers, type MTCD-100B and 100C; type MTC-100C, neutralizing condensers type "N"... any capacity; Hammarlund Foundation Units, complete PA-300 or PA-500; Hammarlund xmtr choke CH-500; metal skirted dials with bakelite knobs, any manufacturer. Roland Matson, K1OKO, Box 2943, Kennebunk, ME 04043. (207) 985-3751.

FOR SALE: Tubes, test equipment and hardware. LSASE for lists. **WANTED:** Basketcase test equipment. Ray Bintliff, K1YDG, 2 Powder Horn Lane, Acton, MA 01720. (508) 263-7435.

WANTED: SX-32 parts source; lighted HRO-5 meter; Ranger meter; Vibroplex or Speed-X bug; late production, unmodified 75A-4; Viking Navigator; Help: information, manual, schematic for SRR-13 or WRR-3B military rcvrs. Brian Roberts, K9VKY, 3068 Evergreen Rd., Pittsburgh, PA 15237. (412) 931-4646.

WANTED: Eico 751 AC ps; Johnson 10 watt audio amp.; Johnson power reducer or manual (copy ok); 3.2 ohm spkr; keyer paddles; Johnson 6N2 Thunderbolt; Heath Seneca; Heath SB 110A; old QSTs; old CQs; old Handbooks; 1625 tubes. Mack Fairley, AB4ZF, 506 Tallyrand Ave., Monroe, NC 28112. (704) 283-5146.

WANTED: FT-151 mounting rack for BC-191 or 375 xmtr. Pete Hamersma, 87 Philip Ave., Elmwood Park, NJ 07407.

FOR SALE: Hallicrafters SX-122, good cond., w/calibrator and manual - $85. Jim Jorgensen, K9RJ, 1709 Oxnard, Downers Grove, IL 60516. (708) 852-4704.

ELECTRIC RADIO PARTS UNIT DIRECTORY

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

CLASSIFIEDS

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

FOR SALE: National SW-5 - $180; Collins 62S1 VHF converter - $700; Shure 55 super cardioid mic - $50; BC-221F freq. meter - $20; KWM-1 manual - $20; Amateur Radio Transmitter Design, James Millen, 1937 - $15; ARRL Handbooks, 1949, '50, '52, '54 - $15 ea.; Radio Magazine Telephony Handbook, 1938 - $15; First 50 Years of Collins, new - $23; 1953 Heathkit catalog - $8. Mark Hovda, NØJWI, POB 10091, Cedar Rapids, IA 52410. (319) 364-4048 7-9 PM CST

WANTED: Excellent 75A-4; R-389; R-274/SX73; NC-400. Also need tech. maint. manual for ARC-4; CV-591 SSB adapter or similar; HC-10. Mike, KC8CU, RR 1, Box 1615, Brooks, ME 04921. (207) 525-4421

FOR SALE: Eico 720 and 722 - $80; Elmac AF-68 - $65. Plus shpg. Gary Elliott, NO5H, POB 295, Epps, LA 71237. (318) 926-3343

FOR SALE: Transmitting/Receiving tubes, new and used. Some 304TL, 35T, 203A, 811A, 833A. LSASE for list. I also collect old and unique tubes of any type. Looking for Taylor and Heintz-Kaufman types. Maybe you have something to trade? **WANTED:** Large tubes and sockets from the old Eimac line; 450T through 2000T for display. John H. Walker Jr., 16112 W. 125th St., Olathe, KS 66062. (913) 782-6455

FOR SALE: Several Hallicrafters S-38, ABCD's, very good, may need alignment - $50 each. Includes manual and shpg (48 states); Collins mech. filter F455a2 for KWM-2 - $60; 40 ARRL Handbooks, 1943 to date; plus other books - SASE for list. Parting BC-610 and B&W 5100. **WANTED:** Pre-1940 ARRL Handbooks for my collection. Bob Schafer, WA7IHN, POB 442, Aumsville, OR 97235. (503) 749-1149

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

CLASSIFIEDS

ROCKWELL/COLLINS INSTRUCTION BOOKS

Instruction Books and the Collins Service Modification Compendiums, are in stock and available for immediate delivery:

* 75S-3/3A, 32S-3, 30L-1 - $25
* 516F-2 - $15
* KWM-2/2A - $30
* 312B-4/5 - $20
* 75S-3B/3C, 32S-3A, 30S-1 - $30

Collins Service Modification Compendiums:

* S-Line and KWM-1/2/2A Series - $40
* KWS-1, 32V and 75A Series - $25

Please add 10% to cover the shipping and handling costs and 6% for sales tax if you reside in Ohio. Send check or money order to:

VISTA Technology Incorporated
3041 Rising Springs Ct., Bellbrook, OH 45305 (513) 426-6700

WANTED: WW II military RA88 and RA90 rectifiers. These were high voltage supplies used with various radar sets. Jeary Vogt, 3 Brampton Rd., Malvern, PA 19355. (215) 296-2162

WANTED: Case for NC-303 or what paint number would apply to the top half of the NC-303; also need the xtal calibrator XCU-303 and a manual for same. Merle Crowley, W1GZS, P.O. Box 51 Cole Rd., West Kennebunk, ME 04094. (207) 985-3086

FOR SALE: Knight TR106, 6 Mtr AM, w/ TR107 vfo, tilt console, mike, mint - $39; Hallicrafters S38E - $39. Plus shpg. Henry, W3NCX, 1005 Wyoming St., Allentown, PA 18103.

WANTED: Original manuals for 75A-4, 32S3, 75S3-B, 312B-4, 516F-2. Also need Nye Viking transmatch; Millen 90801 exciter; EV model 619 mic; IERC tube shields. Tom Smith, N5AMA, 13034 Elmington Dr., Cypress, TX 77429-2062

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

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WANTED: More of that great military radio gear - R-1051 'parts' set, freq. standard module for GRC-106 xcvr, MAY, MAW, URC-11, URC-68, other interesting stuff. Walt, KJ4KV, 3125 N. Military Rd., Arlington, VA 22207.

FOR SALE: TCS rcvr, xmtr, loading coil - $100; RBB-1, RBC-2, w/ps - $100 each; 4CX-250B in box - $25; TEK plugins 53/54, "D" - $15 each; LM-18, LM-21, LP-5, RCA M-158 scope, Sylvania dual trace adapter, Ballentine 310A, HP-410BR - $30 each; Collins F-455-Z-56609 16 kc - $15; tube list - $1 plus LSASE; Carter Genemotors, output 420V at 280 ma., 6v/33 amp or 12v/17 amp input - $8. George, WA7HDL, (208) 756-4147

FOR SALE: HQ-129X, excellent w/manual. WANTED: Junker S-38, S53-A and Drake 2B for parts. Al Bernard, NI4Q, Box 690098, Orlando, FL 32869-0098. (407) 351-5536

WANTED: Navy RAX CG-46115, 200 - 1500 Kcs rcvr; ATD tuning units; BC-375 shock mount. Steve Davis, KD2NX, 705 13th Ave., Belmar, NJ 07719. (908) 280-9760

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

CLASSIFIEDS

FOR SALE: Signal generators, all working w/ manuals HF/VHF, HP608C - $45; HP608F - $60; HP8601A sweeper - $270; Navy URM-25D - $70; 10-450Mhz sweeper made for FAA - $100; National NC-303 - $150; Heath VF-1 vfo - $10; Central Electronics 20A - $40; Vibroplex with Fulton St. address - $70; Sprague TO-5 cap tester - $35. Parting out 32V-2, CE 10B, SX-42 and SP-600. **WANTED:** S-Line rack panels and dial-light parts for 51S-1. Mike Palmer, K5FZ, 16707 Creeksouth, Houston, TX 77068. (713) 444-7737

FOR SALE: Ranger I, no manual - $75. Will trade NC-2000 for Valiant or Ranger II in good condition. Chuck Graves, KØRFQ, (417) 882-8041

WANTED: Eimac 527 UHF transmitting tube. John H. Walker Jr., 16112 W. 125th St., Olathe, KS 66062. (913) 782-6455

FOR SALE: Electronic books and mags at reduced prices. Send $.29 for list. Make offer on two Heath HW30s. Dave Mantor, W9OCM, 2308 S. Fairlawn Way, Anderson, IN 46011 (317) 642-1103

FOR SALE: Control Box C-87/ART-13, NOS8 - $27.50, two for $47.50, plus $2.50 UPS; ART-13 manual repros: Maintainance - $45, Operation - $22.50. State transmitter model. Antenna mount M-48, used - $97.50; VRC-12 parts. Robert Downs, WA5CAB, 2027 Mapleton, Houston, TX 77043. (713) 467-5614

FOR SALE: Porcelain knife switches, new - SPST - $2, DPST - $4 plus $2 per order shpg; Carter dynamotor, 12 VDC in, 600 VDC out - $25 plus $5 shpg; Eico 723, 60W CW xmtr, needs tubes and top cover - $25 plus $5 shpg; General Radio 783-A output meter - $25 plus $5 shpg; HP 63312F multiple output power supply - $25 plus $5 shpg; SW-3 replacement plug-in coil forms - $7.50 ea. plus $2 per order for shpg; SW-3 data packet, includes coil winding data, 19 pages - $5 plus $1.50 shpg. James Fred, R1, Cutler, IN 46920. (317) 268-2214

FOR SALE or TRADE: For Pre-War BC rcvr - several each, 872, 838, 4-125A, HK-54, VT-127 and 100TH. John Nauman, 420 Patrick Ave., Merritt Island, FL 32953. W9CN, (407) 452-7904

FOR SALE: British MK123 spy set. CW transmitter, built in morse key, receiver tunable 2 to 30 Mcs. A super QRP rig - $450. Nigel, KC4TLV, (404) 991-4693 (w), 949-1093 (h)

FOR SALE: Wilcox T158/FRC RF deck, pair of 450TLs, vac. variable output - $200. Jack H. Osborne, K6LVO, 5636 Del Monte Ct., Santa Rosa, CA 95409. (707) 539-3949

FOR SALE: Globe Champion 300 w/manual; Harvey Wells TBS-50 w/matching vfo; Hallicrafters SX-140 & matching HT-40 xmtr; Atlas 210 w/ps; pr V70Ds; Globe VFO Deluxe 6-160. Gene, W7MXM, (208) 522-5854

CLASSIFIEDS

WANTED: Johnson Ranger I/II. Top dollar for clean, working unit. Also looking for Clegg/Polycom VHF AM gear. Brian Hemmis, K3USC, 7575 Hamot Rd., Erie, PA 16509. (814) 866-2585

WANTED: Receivers: Squires Sanders SS-1R; SIS-1; ARR 15; R-388/388A; G1 33. Mitsugu Shigaki, JA6IBX, Jozan Kamidai Machi 2825-2, Kumamoto, Japan 860.

FOR SALE: 2 B&W 850's - $35 each plus $10 shpg. Cliff Christlieb, 16514 Arabian Way, Montverde, FL 34756. (407) 469-3534

FOR SALE: BC-1306, clean - $125; BC-654, no key, fair cond. - $125; 50 assorted meters, AC, DC, MA, RF - $150; 50 assorted air variable caps - $60; BC-946B, .25-1500Kcs - $75; BC-348, fair cond. - $75; BC-224D, nice - $150. Steve Bartkowski, 4923 W 28th St., Cicero, Il 60650. (708) 863-3090

FOR SALE: HQ-170A, w/spkr - $125; HX-50A - $100; DX-100 - $100; VF-1 - $25; SX-43 - $75. More, SASE for list. Jack C. Shutt, N9GT, 1820 Dawn Ave., Ft. Wayne, IN 46815. (219) 493-3901

WANTED: Restoring #29 Collins 30K1. Need various pieces to complete project. Can you help me? David Knepper, W3BJZ, Box 34, Sidman, PA 15955. (814) 487-7468

WANTED: Transmitting mica cap (or two that total) between .004 and .009 mfd, 15 kv or higher. Evan Haydon, 4308 N. 15, Lincoln, NE 68521. (402) 435-4083

FOR SALE: WW II BA-38 walkie-talkie batteries. Fresh manufacture w/replaceable modern 9 volt cells - $21.95 reg., $32.95 alkaline. $3 shpg. Sam Hevener, W8KBF, 3583 Everett Rd., Richfield, OH 44286-9723

FOR SALE: Several Hallicrafters S-38, ABCD's, very good, may need alignment - $50 each. Includes manual and shpg (48 states); Collins mech. filter F455a2 for KWM-2 - $60; 40 ARRL Handbooks, 1943 to date; plus other books - SASE for list. Parting BC-610 and B&W 5100. **WANTED:** Pre-1940 ARRL Handbooks for my collection. Bob Schafer, WA7IHN, POB 442, Aumsville, OR 97235. (503) 749-1149

FOR SALE: BC-669D xmtr/rcvr w/PE-110C power supply and orig. power cable. Set has been stored for many years and appears to be in good cond. Read about it in the Oct. issue of ER. Prefer PU, it is heavy. Price FOB Roswell, NM - $150; Morrow Falcon mobile rcvr, 75-10 meters, AM/CW, good cond. - $50. Also, 6 ft. home built KW, p-p 813s, mod. by class B 211s, lots of big xfmrs. This dude is heavy, come get it - $150 or so. Zeke Adair, W5LUT, 1106 W 4th, Roswell, NM 88201. (505) 623-0005

FOR SALE: Meissner Signal Shifter Deluxe and EX - $35 each; Nems-Clark 1509A 50-260 Mhz, AM-FM, excellent cond. - $125. Ron, KC6WTG, POB 783, Santa Rosa, CA 95402. (707) 539-8319

FOR SALE: AN-WRR2 - $200; ASB-7B - $125. **WANTED:** W.E. tube Hi-Fi. V.Vogt, 330 SW 43rd St., #247, Renton, WA 98055. (206) 251-5420 ext. 247

WANTED: New or good used V-70-Ds; Speed-X or Nye Viking heavy duty straight key with chrome base. Bill Wilson, KØCDJ, HC 9, Box 272, Detroit Lakes, MN 56501. (218) 847-8387

FOR SALE: TMC 18 KW dummy load, 0-30 Mhz - $495; TMC PAL, 1 KW amp - $595; Motorola 10 mtr 250 W xmtr - $250. Rich Smith, KF6EA, 1122 Via La Cuesta, Escondido, CA 92029. (619) 739-1835

FOR SALE: Ranger I - $175; HRO-50 w/A, B, C, D coils & spkr - $325; SX-101, w/spkr - $125; Collins KWM-2, 312B4, 516F2, 30L1 - $1450. PU only. Jeff Garrett, KEØMT (303) 455-5658

WANTED: Copy of " Worlds Equiv. Tubes" by Bran. Gary Cain, W8MFL, 1775 Grand, #302, St. Paul MN 55105. (612) 698-4851

FOR SALE: QST, 1922-1929; ARRL 2nd Ed. Handbook (1927; assorted early radio magazines. Jan D. Perkins, N6AW, 524 Bonita Canyon Way, Brea, CA 92621.

FOR SALE: Want to run AM, have little room, want stability, adjustable power for amplifier? Consider Kenwood T-599D and R-599D twins. Exlnt cond, manuals, boxes - $300 plus shpg. Richard Lucchesi, WA2RQY, 941 N. Park Ave., N. Massapequa, L.I., NY 11758. (516) 798-1230

ELECTRIC RADIO
145 CR 123
Hesperus, CO 81326

TO: