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ELECTRIC RADIO

celebrating a bygone era

Number 88 August 1996

Dave Kuraner, K2DK

ELECTRIC RADIO

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

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

Regular contributors include:

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

EDITOR'S COMMENTS

We've finally completed our move with minimal disruption to the production and workings of ER. But Shirley and I are totally worn out and I don't think we'll ever move again. We just don't have the energy to ever go through this again. Moving is absolutely pure hell.

When I regain some energy I'm going to start setting up a station. I hope to be back on the air for the AMI Discovery Weekend on Sept. 6, 7 and 8. For further information on this event see this month's AMI Update on page 2.

We're making some changes that we've been thinking about for some time. The first change is to the rates charged foreign subscribers. We're lowering the rate from $70 to $54. Shirley will be extending the renewal date of all the foreign subscribers to reflect this reduction. But for the Canadian subscribers (I guess they're foreign too) there will a rate increase from $39 to $42. These changes will make the rates more fair for everyone.

We still need more parts units for the Parts Unit Directory. If you have a parts rig please put it on the list. Remember your dead parts rig could bring another rig to life.

We also need photos of hams in their vintage shacks for our photo pages and covers. Up until lately we've always had a surplus of photos, but now our supply is almost depleted. These photos can be color or black & white, any size (3x5 color snapshots are what we're using mostly) and should be sharp, with good contrast. If you would like the photos returned please indicate that on the back of the photo with your name and call.

I'm looking forward to working as many AM'ers as possible over the AMI Discovery Weekend. Mark your calendars and plan to participate. N6CSW

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Amplitude Modulation International - August Update

by President Dale Gagnon, KW1I

Announcing AMI Discovery Weekend

It's time to mark your calendar and plan to participate in the premier AM International operating event, AMI Discovery Weekend on Sept. 6, 7 and 8. This year will have the same three levels of particpation for formal award recognition, but the required activity for each level will be set a bit higher than last year.

Level 1: Make 20 or more AM contacts on 160, 75 and 40 meters during the event period.
Level 2: Make an AM contact on 14.286 mHz. Look for AM activity starting at 4:00 PDT (7:00 EDT) each evening.
Level 3: Make an AM contact on 10 or 15 meters (or one of the VHF bands) during the weekend.

Send your log to AMI Headquarters, Box 1500, Merrimack, NH 03054.

Attractive "Participant" certificates will be awarded to Level 1 achievers. "Participant-Plus" certificates will be awarded to stations reaching Level 1 and either Level 2 or Level 3. "Participant-Primus" certificates will be awarded those stations achieving all three levels.

This event is important because if a good percentage of us get on the air it is a clear indication to most of hamdom that AM is still an active and enjoyable mode.

You don't have to be an AMI member to participate in this event, but I would like AMI members to swap certificate numbers.

To: Future of the Amateur Service Committee (FASC)
From: Dale Gagnon, KW1I, President, AM International
Subject: Comments on the treaty obligation to test certain amateur license holders for Morse code ability.

Summary

The membership of AM International believes that dropping the international requirement for CW testing for licensing on the HF amateur bands would be a mistake. We believe that development of CW proficient operators is essential to the amateur services' role as a backup emergency communications system for this country and for intercountry emergency communication. Attaining CW proficiency insures basic communications capability and also instills a proper level of communications discipline in an individual to successfully carry on emergency communications operations in any mode.

Amplitude Modulation International

We have 900 members most of whom are in the US. The organization's purpose is to foster enjoyment of the use of AM on the amateur bands, to promote the use of AM by those amateurs with AM capability, and to preserve our AM operating privileges. Our membership is characterized by individuals who enjoy operating vintage gear as well as modern. Along with the appreciation for vintage equipment is a strong feeling for the traditions of the US.

Amateur Radio Service. Among these valued traditions is the historical highly disciplined operating skills and the use of those skills in providing emergency communications.

CW and Amateur Radio's Emergency Communication Role

One of Amateur Radio's most important purposes is to provide emergency back up to civil and military communications systems.

Historically, CW has been an important emergency communications mode. In the future, CW, by its very definition, will always be the backup emergency communications mode of last resort because when all else fails any transmitter can be keyed off and on to pass a Morse message. The fact that the civil and military use of CW has been largely discontinued does not change this fact. CW emergency messages will have occasion to be tapped out on makeshift or partially disabled transmitters long after CW is removed from the mode switch of modern radio equipment. CW use has been discontinued in these other services because with more modern communication systems and solid state reliability its use is no longer cost effective. Cost is not a factor for Amateur Radio provided emergency communications. The fact that tens of thousands of amateurs are ready in a moment to back up government communications systems is free to society. The availability of CW, the ultimate backup mode in emergency communications, is also free. Future radio treaties and regulations should be established to include CW testing for select classes of amateur licenses to insure this important emergency backup capability continues to be available to society.

CW and Amateur Radio Operating Standards

Disciplined behavior and high operating standards are important to the Amateur Radio Service, especially when it is called on to perform emergency communications. How can future amateur radio license testing insure that operators have an acceptable minimum level of operating discipline? Probably the best way is the method we have now, to include CW as a testing requirement for select amateur radio license classes. Learning the code, its abbreviations and conventions and formal and informal message protocol, instills disciplined messaging skills in amateur radio operators.

Transmitting CW requires an operator to form letters and words clearly to insure they are understood by receiving stations. Proficiency in receiving CW depends on developing automatic responses to letters, words, phrases and Q signals and to learn to this without distraction under high levels of stress and in QRM and QRN. The amateur operator disciplines and operating standards acquired by developing proficiency in CW are transferable to operations in any mode. High operating standards will also have a positive effect on the general civility of regular amateur radio activity.

Conclusion

Please consider carefully your position on the requirement for CW testing for amateur licensing. The discontinuance of civil and military use of CW in no way offsets the usefulness of CW as an emergency communication mode of last resort. CW skill must continue to be cultivated in the amateur ranks to fulfill our backup emergency communication role. Countries are depending on their amateurs to provide the communications systems and modes of last resort.

CW proficiency is the best way to instill high standards of operating discipline in amateur radio operators in the future. I encourage the FASC committee to recommend continuance of the present international treaty requirements for CW testing for amateur radio licensing.

AM International
Box 1500
Merrimack, NH 03304

Alfred H. Grebe:

First Manufacturer of Amateur Short Wave Receivers

by Robert E. Grinder, K7AK (1)
7735 N. Ironwood Dr.
Paradise Valley, AZ 85253

November 27, 1923, marks a significant milestone in the annals of amateur radio. During the dark hours of the day, three amateurs - Leon Deloy, 8AB, in Nice, France, and Fred Schnell, 1MO, and John Reinartz, 1XAM, in Hartford, Connecticut - held the first successful trans-Atlantic short wave QSO on a wavelength of 100 meters. Each participant used a fifty-watt tube transmitter. Reinartz devised tuner/regenerative receivers for Schnell and himself ("John Reinartz," 1960). Deloy received the American signals in France on a Grebe CR-13 (American Radio Relay League, 1965a).

Alfred H. Grebe & Company sold the CR-13 to Deloy at the ARRL national convention in Chicago during the summer of 1923. Deloy was visiting in the United States in hopes of finding state-of-the-art equipment. Alfred H. Grebe, a young radio engineer, who possessed substantial operating, technical and manufacturing skills, recently had developed the CR-13. It was the first short wave receiver created commercially for amateur operators.

Grebe had adapted the well-known variometric configuration to achieve an effective short wave receiver that transcended expectations of the day. Advertisements of the CR-13 indicate that Grebe also strived to attain goals shared today by manufacturers of amateur equipment. For example, he proclaimed that the CR-13 possessed beat-oscillator stability, sharp selectivity, and unsurpassed sensitivity. Further, in a contention that was unprecedented at the time, he asserted boldly that the CR-13 was also capable of locating instantly the wavelength of a desired station ("Advertisement", 1923).

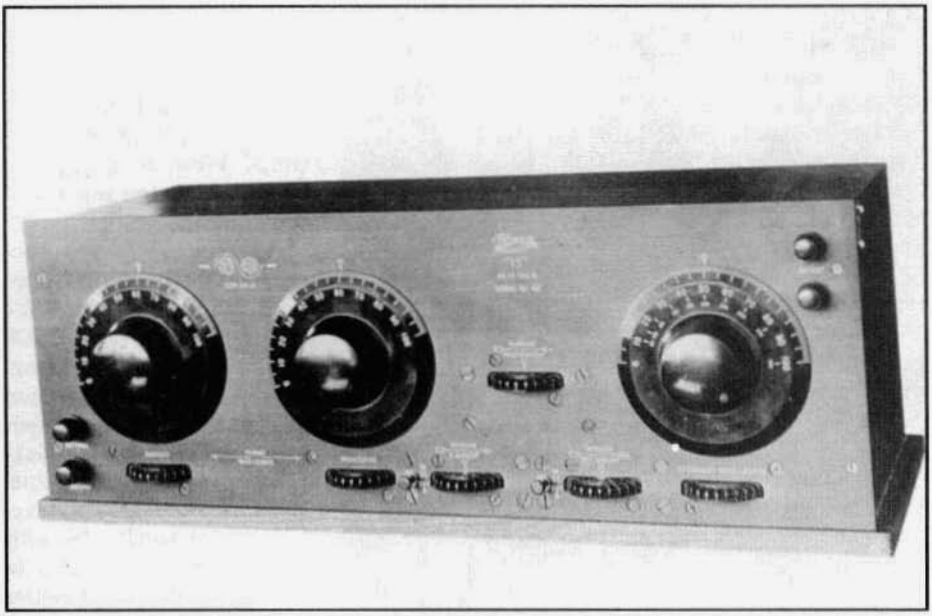
Contemporary amateurs are relatively familiar with early manufacturers of communications receivers such as William J. Halligan (Hallicrafters), Lloyd Hammarlund (Hammarlund), James Millen (National), and E.G. Shalkhauser and R.M. Planck (RME). These pioneers are remembered particularly because advances in understanding propagation and technological issues have progressed relatively linearly since the 1930's; hence, many of the significant features that the pioneers introduced to superheterodyne circuitry are still conventional today.

Alfred H. Grebe is undeservedly an obscure icon. He warrants recognition as predecessor to Halligan et al in developing short wave receivers for amateurs. Unfortunately, he is a victim of circumstances. In his day, beliefs about propagation were shrouded in mystery and vacuum tubes had not evolved beyond primitive triodes, a problem which, along with RCA control of superheterodyne patents, limited manufacturers to refining regenerative receivers.

The purposes of this paper, therefore, are (1) to review briefly the historical context in which Grebe toiled; and (2) to indicate how personal experiences in his youth prepared him to become not only the first manufacturer of amateur short wave receivers, but also one of the more distinguished radio entrepreneurs of the 1920's.

Amateur Radio Early In The Twentieth Century

When amateurs returned to the air in



The CR-13. ***Photo courtesy of Donald O. Patterson.***

1919, following WW I, their mind-set was still in the spark era. Pressing military demands had stimulated the development of vacuum tubes, but amateurs and radio engineers alike still believed that radio efficiency improved at longer wavelengths. They regarded the shorter wavelengths as useless. Indeed, the Radio Act of 1912 limited amateurs to the single transmitting wavelength of 200 meters; however, since accurate frequency-measuring devices had yet to be developed, amateurs operated routinely - with impunity - during the prewar years from 200 to as long as 600 meters, taking care to avoid signals of ships at sea and other commercial services.

Two disquieting circumstances disrupted postwar complacency. On the one hand, amateurs were obliged to abide by the law when the new phenomenon of broadcasting encountered severe interference from their transmissions. On the other, amateurs were forced to consider wavelengths shorter than 200 meters as a means of escaping interference from one another. A spark transmitter, for example, blotted out huge segments of the radio spectrum, as a function of its distance from receiving apparatus.

Efforts to resolve the interference mess led amateurs to the continuous wave transmitter (CW), a product of tube technology. Amateurs found that via CW they could transmit farther with less power, and, significantly, with less than one percent of the bandwidth of a spark transmitter. Most amateurs at the time used motor-generators as power supplies, which put raw AC on the plates of transmitting tubes, and a nice 25-, 50-, or 60-cycle note on signals, which, in turn, enabled them to be copied by non-oscillating detectors.

CW adherents faced problems less of signal quality than of signal stability. Oscillator-amplifiers, which isolated oscillators from antenna vagaries were yet to be invented; consequently, when wind or whatever led to movement in a transmitting antenna, the wavelength of the transmitted signal was affected.

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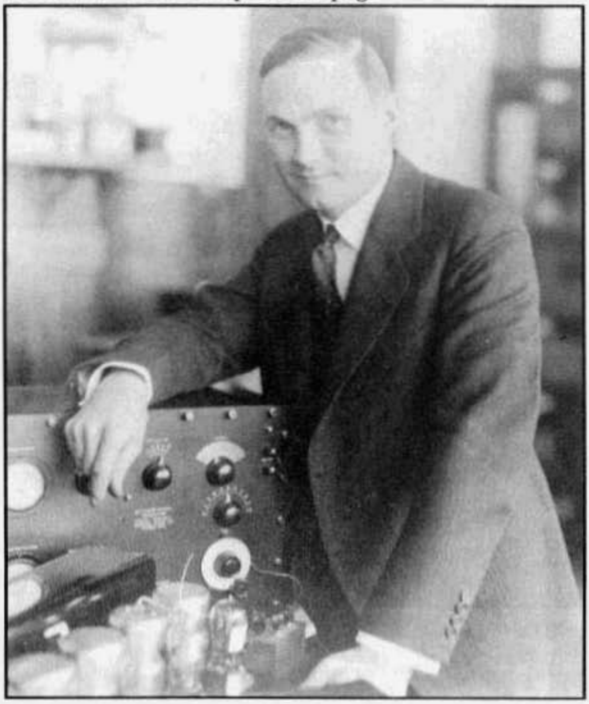

Grebe at about 34 years of age.

greater distance? How do seasons affect short wave transmissions? What is the relationship between fading and reliable communications? Why do conditions change between night and day (Henny, 1925)?

Amateurs thus persevered in attempting to understand short waves. A few amateur stations in 1921-22 were licensed to experiment on 175 and 180 meters, and at a national radio conference in 1923, the US Government permitted all amateurs to operate on wavelengths between 150 and 200 meters, and some stations with special permission, such as 1MO and 1XAM, to work as low as 100 meters.

The amateur community, however, was stymied. Members could construct CW transmitters that would function at 100 meters, but no one knew how to build a receiver that would work satisfactorily at such a short wavelength. The basic difficulty was grid-plate capacity, too much of which sent a triode tube into oscillation and unstabilized the receiving circuit. The only stabilizing method then known to the amateur world was that of increasing the positive bias on the grid, and thereby, desensitizing RF amplification. Whether using a detector tube alone or RF amplifier/detector tubes in cascade, the problem seemed irresolvable.

As one amateur lamented: "Is there not some manufacturer (sic) who will produce a tuner... whose normal range is from 100 to 200 meters . . .? Certain stations to our knowledge have done excellent work on waves as low as 150 meters. . . but . . all these stations have abandoned the short wave. . . because no one else could tune down to them...

Stability was particularly acute in respect to receiver tuning. Amateurs in the immediate postwar years used a one tube, regenerative set having variometers in the grid and plate circuits. The variometers worked well when receiving spark, but were inadequate for CW reception. Antenna motion notwithstanding, hand movement also affected tuned circuits via body capacity. Operators had to become practically immobile and cease breathing to hold a signal in resonance.

The severity of the stability problem led many amateurs to question whether CW transmitters and receivers could be made sufficiently stable to permit two-way contacts at a wavelength as short as even 200 meters. Nevertheless, the long-range advantages of CW over spark were apparent and questions about short wave activity were coming into focus. For example, why do signals jump over near stations to reappear at a

No one within their range had been able to buy a tuner that was made for amateur wavelengths" (American Radio Relay League, 1965b).

Alfred H. Grebe Comes To The Rescue

Grebe knew both theory of development and art of receiver construction better than anyone else of his time. No other manufacturer had acquired as much personal, direct experience as had Grebe. He was born in Richmond Hill, New York, in 1895, and as early as 1907 he had built crystal sets in a backyard workshop and sold them to friends. He was only 12 years old. By 15 years of age, he was licensed as 2PV, and he handled relay traffic at 2LH's elaborate amateur station. For a few years, from 1911 to 1914, Grebe traveled the high seas as a wireless operator.

Upon returning to New York, he found that interest in wireless communication had grown apace. Amateur friends - including Edwin H. Armstrong, for whom Grebe conducted experiments in support of Armstrong's patents for the regenerative receiver - encouraged him to manufacture receivers to meet demands created by new experimenters and amateurs. Thus, in 1916, at age 21, the A.H. Grebe and company was founded to put into production the AGP line of regenerative receivers. (AGP stood for Armstrong-Grebe-Pacent; Edwin Armstrong held the patent, Grebe the manufacturing line, and L.G. Pacent the merchandising rights) (Gray, 1965; "Alfred H. Grebe", 1936).

Grebe's attention was diverted for a time by the demands of WW I. Subsequently, throughout the 1920's, the A.H. Grebe & Company manufactured both broadcast and short wave receivers. Of the myriad broadcast receivers manufactured in the 1920's, Grebe's "synchrophase" models approximated the very finest in design and construction. Grebe designated his basic model, the MU-1, after a mythical Dr. Mu, who appeared in his magazine advertisements as a sagacious Chinese gentleman. The MU-1, a five-tube, battery operated TRF receiver was designed around "binocular" coils for stability and "straight-line" variable condensers for tuning from one end of the dial to the other in equal dial divisions. Tuning condensers were mounted vertically and incorporated a friction vernier shaft for precise adjustment. Both tuning and vernier dials projected horizontally through 24 karat gold covered escutcheon plates (Batcher, 1925a).

The MU-1 was first introduced in 1924, when Grebe was only 29 years of age. Competition was fierce at the time; older, highly sophisticated radio designers employed by rival manufacturers challenged him unmercifully in the marketplace. Nothing that they could produce, however, excelled the synchrophase models in sensitivity, selectivity and distinctiveness. Moreover, Grebe also entered broadcasting in 1924, when he established WAGH in New York City. However, Grebe preferred manufacturing to broadcasting, so in 1927 he sold WAGH to the Atlantic Broadcasting Company, which changed its call letters to WABC (Patterson, 1983a). By 1928, Grebe had ceased manufacturing the MU-1 in favor of single-dial, AC, synchrophase models. His name was now associated in households across America, like that of Atwater Kent and Colin B. Kennedy, respectively, with superlative quality in radio manufacturing.

From 1919 until 1928, between his twenty-fourth and thirty-third birthday, Grebe manufactured the CR line of tuners and receivers primarily for the amateur market. Grebe used his awareness of the problems of wireless reception, which he had acquired as an amateur and commercial operator, and his technical skills, which he had honed in his backyard workshop, to become during the 1920s the only significant manufac-

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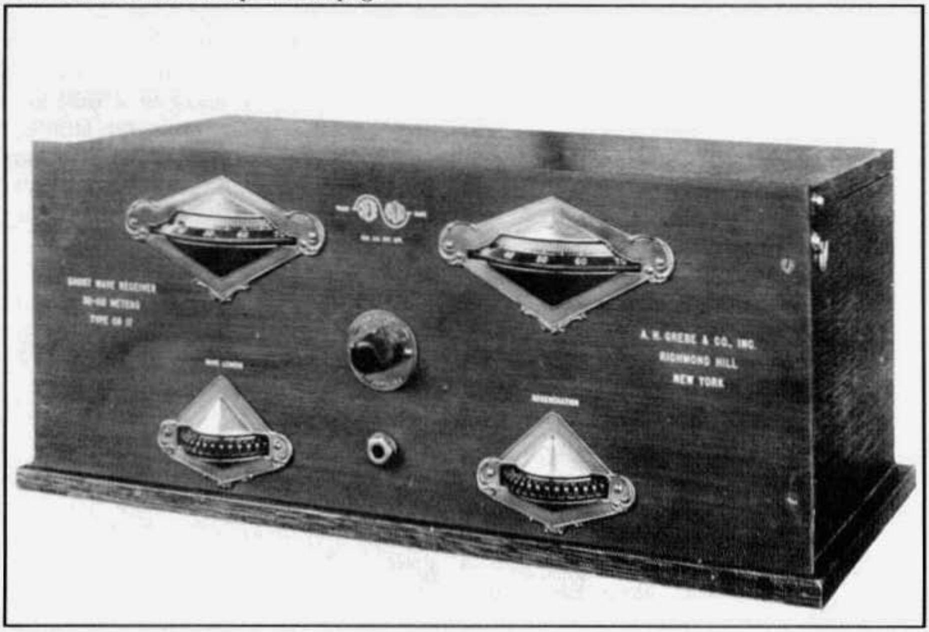
Alfred H. Grebe from previous page



The CR-17 ***Photo courtesy of Donald O. Patterson.***

The CR-18 ***Photo courtesy of Donald O. Patterson.***

The CR-19. ***Photo courtesy of Donald O. Patterson.***

turer of amateur short wave receivers. To keep abreast of amateur happenings, Grebe obtained experimental amateur licenses, 2XE and 2ZV.

He built his postwar factory into a showplace of engineering excellence. Grebe controlled every aspect of production, from the smallest screw and washer to the largest condenser and coil in his self-contained manufacturing plant. He even heated, pressurized, and molded powered bakelite to create variometer frames, sockets, dials, and panels. Grebe believed, in true Horatio Alger fashion, that perfection evolved from doing little things well.

Certain models in the CR line are historically noteworthy to present-day amateurs. In 1919, at age 24, Grebe produced the CR-1, a one tube, regenerative receiver with a wavelength range of 170 to 680 meters. The CR-1 configuration was built around a rotary coupler with tap switches, two variometers, one in the grid circuit and one in the plate circuit, a filament rheostat, and a vacuum tube socket made of seamless brass tubing.

For strictly long-wave reception, Grebe offered in January, 1920, the CR-7, an elaborate, three-tube receiver, with a 12" x 21" panel, which tuned from 500 to 20,000 meters. The long-wave CR-7 was touted as a receiver capable of copying messages sent by high-powered stations operating in Europe and Asia. In March, 1920, Grebe followed the CR-7 with the CR-5, which covered an extended range of 150 to 3000 meters without plug-in coils. The CR-5, was the first short and long wave receiver to be manufactured commercially. It was tuned by an antenna series capacitor and a ten section inductance that was wound in series with the stator winding of a variometer.

In 1923 at age 28, in response to the urgent need of amateurs for a truly short wave receiver, the A.H. Grebe Company proudly introduced in the marketplace the now classic CR-13. The receiver was designed especially for amateur short wave operation. The self-contained CR-13 tuned from 300 meters (1000 kHz) all the way down to 80 meters (3750 kHz). The two tube receiver included a single stage of tuned radio-frequency (TRF) amplification feeding

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The Coherer Detector

Part 3. Some devices that may act as either coherers or semiconductors

by Bob Dennison, W2HBE
82 Virginia Ave.
Westmont, NJ 08108

Introduction

Part 1 mentioned that some of the early coherers involving mercury were self-restoring and may have been precursors of the crystal detectors. My theory is that under certain conditions, the oxide layer on mercury can be punctured by an electric signal (coherer action) while under certain other conditions, the barrier layer may behave as a semiconductor. Furthermore, it seems likely that Lodge's crossed-wires or 'loose-contact' detector may have involved the same basic mechanism. This article will discuss experiments with two of these devices.

A Wheel Coherer

A wheel coherer was built to allow further investigation of this device - see photo 1. I found a small metal disc about one inch in diameter and attached it to a hub that would fit an 1/8 inch shaft. The motor is a Haydon timing motor with internal gearing to produce four RPM. Anything from two to five RPM should be suitable. A switch was provided to turn the motor on or off. The wheel dips slightly into a pool of mercury held in a plastic cup one inch in diameter and one-half inch deep. A wire encircles the bottom inside circumference of the cup to make electrical contact with the mercury. This wire is held in place by several small drops of epoxy.

The mercury cup is epoxied to a brass lever arm. At the left end, this arm is attached to a hexagonal aluminum post by two 4-40 screws. The rear end of this post is tapped for a 6-32 screw which then holds the arm assembly to the face plate of a 4 X 4 X 2 inch mini-box. This screw is left slightly loose in order that the position of the mercury cup can be adjusted so that the wheel just makes contact with the mercury.

A 3/4 inch long spring pulls the lever arm upward against a stop provided by a brass 6-32 screw. This screw permits adjustment of the penetration of the wheel into the mercury. A phosphor-bronze wire is arranged to bear against the hub of the disc to insure that it is constantly grounded.

The surface of the mercury is covered by a thin film of oil. Lodge specified mineral oil. My mineral oil was rather heavy and I got better results using thin watch oil. I suspect that ordinary household oil (3 in 1 or sewing machine oil) would do just as well. If you get too much oil on the mercury, the excess can be removed by touching the surface with a piece of absorbent paper towel.

To test the wheel coherer, I built the simple receiver shown in photo 2 with circuitry as shown in figure 1. Potentiometer R1 permits varying the bias on the detector. Most articles say that the bias should be .1-.3 volts. My detector worked best with about .45 volts.

Initial tests were made by setting the spark transmitter (see part 2) alongside the receiver. After an hour of experimentation, I still had heard no signal in the headphones. Perhaps the sounds of the Ford coil vibrator and the arc at the spark gap conspired to drown out any sound in the headphones. Now I knew how those kids must feel when they

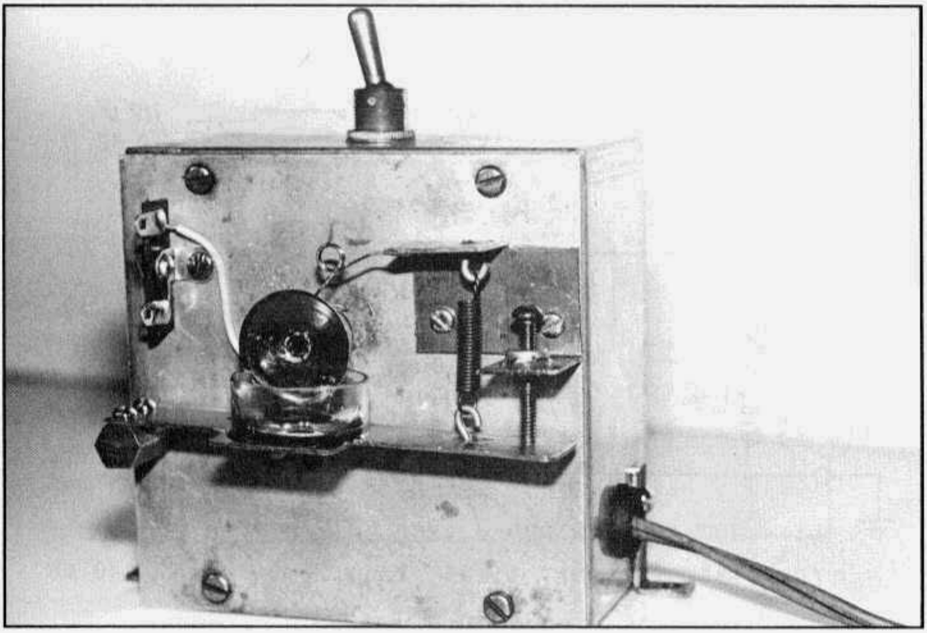

Photo 1. A wheel coherer.

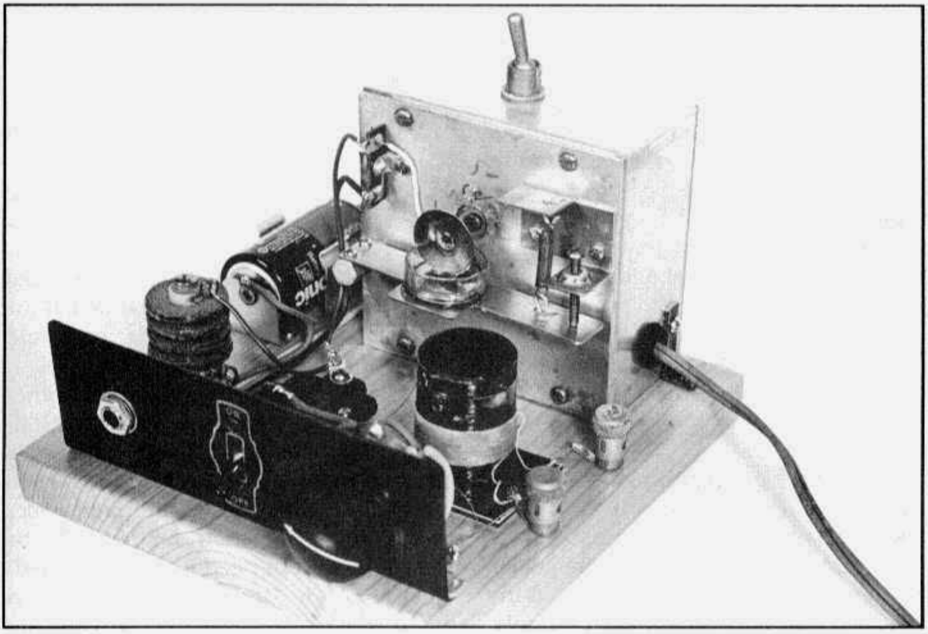

Photo 2. Complete wheel coherer receiver.

build their first receiver and it doesn't work. The next morning I had an idea. I hooked an RF signal generator to the ANT-GND posts and started adjusting the wheel. Suddenly, I heard the 400 Hz tone modulation! It would come and go

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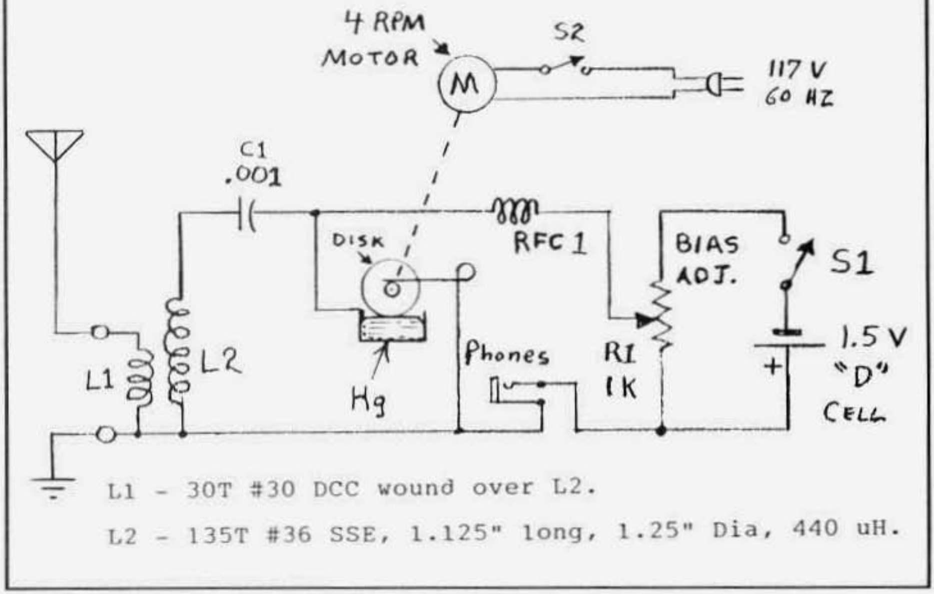

Figure 1. Wiring diagram of the wheel-coherer receiver.

because my wheel had some eccentricity. But, there was no doubt about it - the detector was less a coherer than it was a diode detector! Next, I connected it to an outside antenna and heard radio station WCAU - a 50 KW BC station only five miles away. Back in Lodge's time, there were no AM stations so this discovery had to wait many years. In fact, AM broadcasting began long after the wheel coherer was abandoned so I may be the first person to discover this phenomenon. When I turned off the motor to stop the wheel, reception would usually continue for a few seconds, then cease.

Phillips (2) gives the history of the development of the wheel coherer. It didn't arrive full-blown in one sweep of inspiration but went through the usual trial and error process common to invention. At first, Lodge, et al, simply used a pointed iron wire dipping into the oil-covered mercury pool. Each time a signal was detected, the wire had to be lifted to restore the detector. Next, they attached the pointed wire to a vibrating tuning fork so that there was recurring restoration. Finally, the wheel type device was conceived.

Phillips (2) points out that several early workers mentioned that, for best results, the wheel should have a positive bias. This also attests to the fact that the detector is acting as a semiconductor diode with the wheel acting as the anode, hence conduction is enhanced with a positive bias on the wheel. If the device was a coherer, polarity would not matter.

All of this may explain why the other mercury type detectors work. The Italian navy detector probably relied on a thin film of mercury oxide to make it a semiconductor. These primitive devices were noted for their tendency to be unstable and in need of constant readjustment. The life of the early wireless men must have been one of constant frustration. It is not too surprising then that inventors would seek and soon discover more stable semiconductors using crystal-line solids to replace the finicky mercury devices. Starting in 1902,

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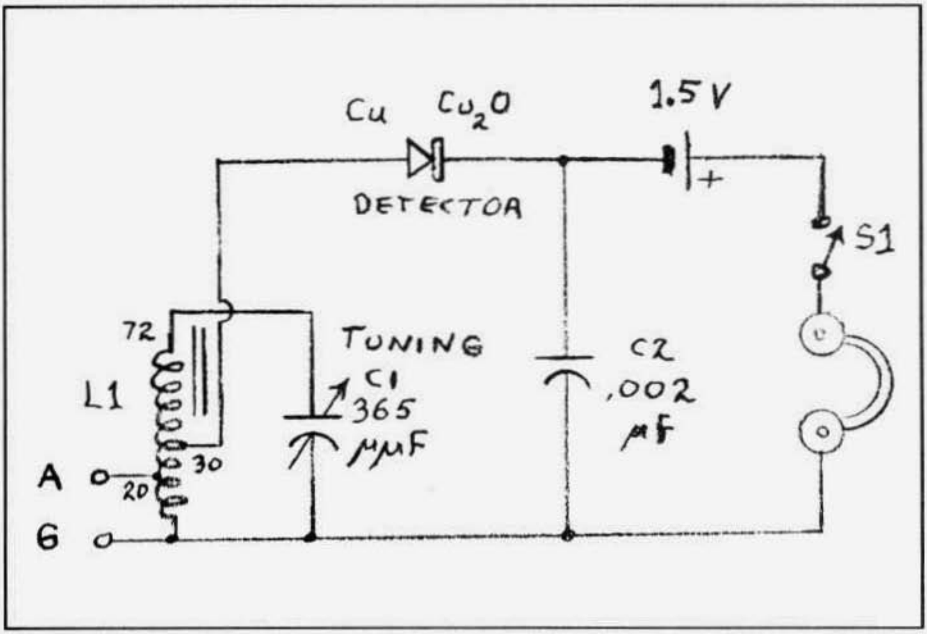

Figure 2. Simple "fox-hole" radio using copper oxide detector.

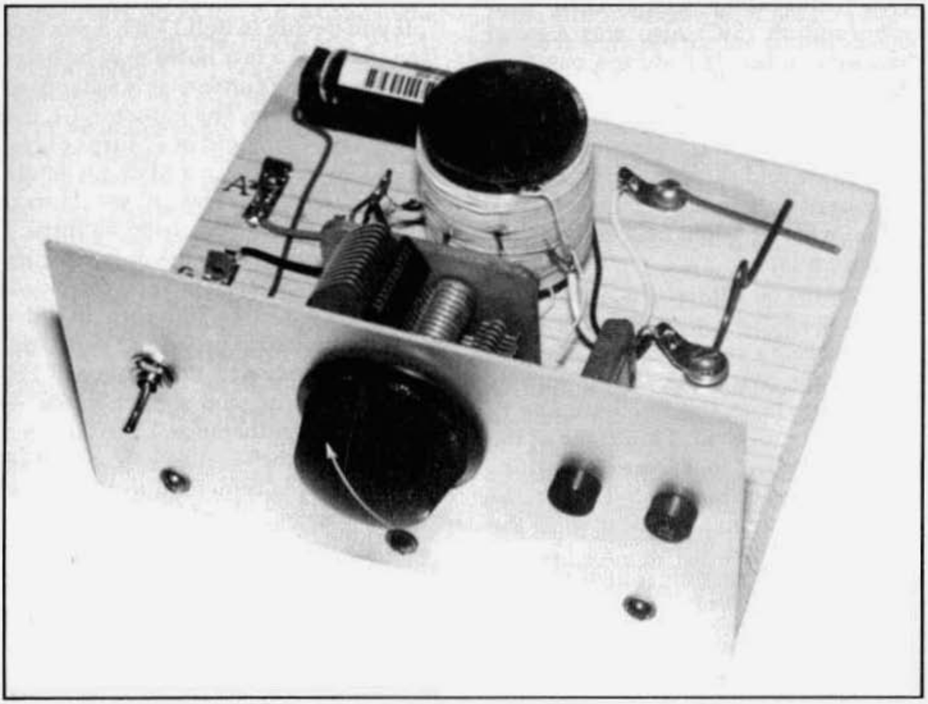

Photo 3. An improved "fox-hole" radio.

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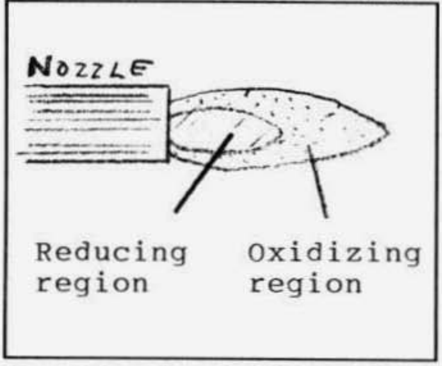

Figure 3. Location of oxidizing region of flame.

G.W. Packard (14) began a systematic study of various minerals and discovered many important semiconductors such as iron pyrites, galena, chalcopyrite, silicon and the perikon detector which consisted of a piece of zincite (iron pyrite) pressing against the surface of a piece of chalcopyrite. Later, H.C. Dunwoody discovered that carborundum (SiC) also was a good detector and he applied for a patent in March 1906.

Many an early wireless operator, on finding a particularly sensitive crystal detector, would carry it with him from one tour of duty to the next, rather than rely on what he might find in the ship's wireless room.

An Improved Fox-Hole Radio

In part 1 I mentioned Branly's work with loose-contact coherers using oxidized wires. His work led to various discoveries from the Oscillaphone to the fox-hole receiver. I built one of the latter as shown in Figure 2. Various combinations of materials for the anode and cathode were tested with the following results:

ANODE	CATHODE	RESULTS
Carbon rod	Razor blade	generally poor
Carbon rod	Oxidized nail	slightly better
Carbon rod	Oxidized copper wire	Good
Copper wire	Oxidized copper wire	Also good

Apparently, the iron oxide layer is not very strong and is easily damaged or cut through when pressed against the anode. But the cuprous oxide (Cu_2O) cathode gave better results. When tuned to the local radio station, WCAU, I got the following headphone currents:

DETECTOR	BIAS	uA
Cu_2O	Zero	35
Cu_2O	1.5V	80
1N34A	Zero	150

The cuprous oxide layer was formed as follows: A six-inch piece of clean No. 14 bare copper wire was clamped in a vise with about 2-1/2 inches extending away from the jaws. This wire was heated in the oxidizing portion of the flame (see Figure 3) for two or three minutes. Let the wire cool and then examine it. It should have a dark, brownish-black color. If you measure the wire diameter before and after heat treatment, one-half the difference is the thickness of the oxide layer. I found this to be about 1/4 mil. Since the oxide layer is very thin, it is easily damaged.

If you decide to build such a receiver (see photo 3) a few notes may be helpful. The tuning condenser is a standard 365 uuF variable. The inductor, L1, is a single-layer solenoid of 72 turns of No. 30 DCC wire. Length and diameter are each 1-1/4 inches. The coil was tapped every five turns from 10 to 45 turns. I got best results with the antenna connected to the 20 turn tap and the detector connected to the 30th turn. In order to tune the entire broadcast band, the coil should have an inductance of 250 uH. My coil needed a ferrite core to achieve this inductance. I used a piece of ferrite 3/8 inch in diameter and 1-5/8 inch long. It is cemented to the inside wall of the coil.

When broadcasting started - about 1921 - crystal sets became very popular. Nearly 400 companies are known to have produced such sets. Today, Radio Shack still sells a crystal set in kit form. Today's germanium crystal diodes are considerably more efficient than the early galena-catswhisker types.

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Observations on the Central Electronics 100V and 200V

by Charlie Talbott, K3ICH
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We don't often think about styling and esthetics when we enjoy our hobby, but they are all part of marketing and play a large part in exactly what an end product looks like. After looking at KØEOO's 100V and 75A-4 pictured in his fine *ER* article [1], I couldn't help but think that there was just a little attempt by Central Electronics to give the 100V the 'Collins' look. The knobs are the same and dial escutcheons are very similiar, but tastes were moving away from the black wrinkle (make that St. James Gray) in favor of lighter grays and chrome. Remember, the 100V was introduced in 1957, where as the King-of-the-Hill Collins line-up started in the late forties with the 75A-1 and 32V-1. Hammarlund, National and Hallicrafters had all dropped the dated black wrinkle-finish. So, when it came time to attend to the physical appearance of the 100V, the designers probably tried to get the best of both worlds. A Collins-like faceplate, but with a more modern paint color. Hence, the almost Collins look of the 100V. CE never made a companion receiver, so I was wondering how a St. James gray 100V would look next to an 'A4? (Put away your voodoo dolls, I was just wondering!) [2]

Since reading Dennis' article, I've had the occasion to restore several 100/200V's. I don't claim to be an expert or even close, but some common problems have surfaced that I thought ER readers would like to know about. (I welcome any comments if I 've stuck my foot in my mouth or said something you consider too bizarre.)

PS-2 Phase Shift Network

The PS-2 uses a curious combination of very stable silver mica and ceramic capacitors along with both precision and common carbon resistors to form the audio phase shift network required for a phasing type SSB generator. Each module has hand-picked values that result in a 0.1% (claimed) value tolerance. The carbon resistors would seem to be a poor choice in such a circuit for long term stability, but every one I've measured has been very close. The biggest problem stems from the fact that two of the input capacitors, C-128 & C-130 are connected directly to the plate of the 12AT7 phase inverter tube, V-7A. This of course, applies the full plate voltage of 120 volts to one side of these caps. This in itself would not be a problem if it were not for the stranqe condition that seems to occur in silver mica capacitors known as silver migration. This erratic DC path through the capacitors results in random pops & crackles in the audio and/or poor unwanted sideband suppression. Sometimes this effect takes several minutes to develop when the transmitter is first turned on, so you'll have to let it cook a while to be sure. Eventually these input caps get so leaky that they conduct a small portion of the positive plate voltage on through the network to the grid(s) of the following stage, V-8 A & B, This shows up as a positive grid voltage which tries to turn on triodes. At this point, unwanted sideband suppression is zero with lots of distortion in the remaining audio. One curious characteristic that I have observed about these afflicted SM capacitors is that even though they're very leaky, they still maintain their capacitance integrity. A cap marked 4700.0 pF still measures 4700.0 pF even though it

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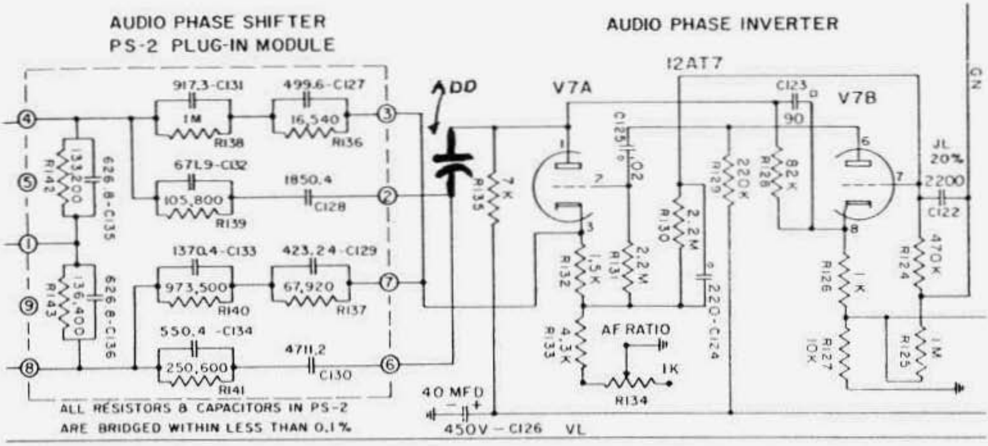

Figure 1.

might have a DC leakage of 50K ohm! The solution in this case is simple, just use another good quality coupling capacitor of relatively high value off the plate of V-7. If you use a value much larger than the PS-2 input caps, the effect on the phase shift is negligible since both legs are driven from the same point. Lift the blue wire off pin 6 of the 9-pin PS-2 socket and add the new capacitor in series. Pins 2 & 6 are jumpered at the socket. [Fig. 1] I used a GE 1.0 uFd, 200V polyester cap here. This fix has been so effective that I recommend it as a precautionary mod even if you are not experiencing the problem now. Apparently this SM cap phenomenon does not occur unless there is a significant voltage applied to the caps. Therefore, I have not found it necessary to add a coupling cap in the cathode output of the phase inverter since the DC voltage at this point is low (7.5V). One final note on the PS-2, if you transmit with the module unplugged (missing), you will put out a loud 60 HZ modulated signal and obviously no voice audio.

Capacitor Network

This is the 6 pin aluminum can marked "MOD CAPS" next to the "MOD DIODES" can near the left front of the chassis. Inside, there are four 6 uFd, 50 volt caps. I echo Dennis's comments, as I have never seen a good set of stock caps here! The designers must have anticipated the capacitor failure by putting them in the easy to remove can. In the ones I have restored, I used hand matched 5 uFd units. The actual value can be anywhere from about 4 to 10 uFd as long as they're within a couple percent of each other. In fact, some previously replaced caps I've seen have been measured to be only +/-5% and seem to perform adequately.

Diode Network

This one looks identical to the MOD CAPS can, but is actually an 8 pin octal plug. In most of the units I've worked on, the diodes were OK. They're easy to check with a digital ohmmeter for forward conduction. I'm not sure just how critical diode matching is to carrier/ sideband suppression, but it's easy to pick out a matched set of four from a bag of 1N100's or 1N4148's if you find they need to be replaced. Use whatever signal type (not power types such as IN40071s) diodes you have around. I've used four germanium or silicon types with equal success. Don't mix germanium with silicon though!

Transmit Relay

In one 200V, the relay coil opened up. Needless to say, I couldn't find an exact replacement. I even tried to find a

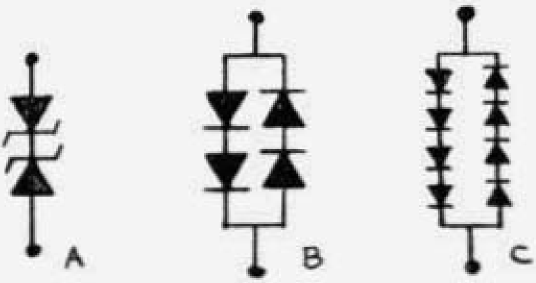

Figure 2.

similiar coil in a different relay to swap. I finally gave up and cheated by mounting another relay under the chassis right below the original one. This way, the physical appearance on top the chassis would be unchanged. The contact configuration of the original 100/200V relay is such that it has two double throw contacts and two single throw contacts. A regular 4PDT relay will work in the 100V. In the 200V however, one set of the double throw contacts is not used, so that a 3PDT (easier to find) relay will work fine. The relay I finally used was a small 3PDT, 220VAC coil unit that was formerly mounted in an 11-pin octal plug-in, probably made by P&B etc. If you pay more than 50 cents for one of these at a hamfest, you got ripped off! Yes, you can use an AC relay on DC. Just make sure the coil measures close to the 12 K ohm of the original. You can experiment with added series resistors to make 110 VAC or lower coil voltage relays work. Set your variac [6] to a low line voltage, say 100 volts, and check to be sure you have enough relay pull-in current.

Audio Limiter Module

Since mercury batteries are very hard to find these days replacing the ones used to bias the clipping diodes in the audio limiter module can be a real problem. You might root around in the small battery section of Radio Shack to find some that fit. The actual voltage is not of much concern, as long as it's only a single cell, (1.2 to 1.5 volt) rather than a stack. An easy mod suggested by Wes Schum [3,4] replaces both diodes and batteries with a pair of 3.6 volt back to back zeners. [Fig. 2] The original combination of a 1.4 volt button cell and germaniun diode result in a clipping level of about 1.6 volts. It would seem that back to back 3.6 volt zeners would yield a clipping level closer to 4 volts, or, over twice the original value. Note that the clipper output is NOT adjustable and appears to fix the audio drive to the balanced modulators. The pot on top of the clipper module only sets the INDICATOR threshold, not the actual audio. Also, the front panel pot called "SPEECH LEVEL" only controls the INPUT to the clipper, not the output. As a start, I tried two series silicon diodes (1N914, 1N4148, etc.) in reverse parallel with two more diodes [Fig. 2B] so as to set the clipping level at about 1 volt. The SSB RF output did in fact suffer from this lower level. In CW, the output was over 100 watts, but the single tone SSB output was only 40 watts. Next, I tried a 4 x 2 [Fig. 2C] that yielded full SSB output. Since zeners are generally only available down to about 3.3 volts, it would seem that the 4 x 2 combination would be the most practical. I have also seen two AAA cells mounted on the outside of the limiter module can and wired in place of the button cells. (no comment!)

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Heathkits That *Weren't*

Part Four, the HD-1781 rotator

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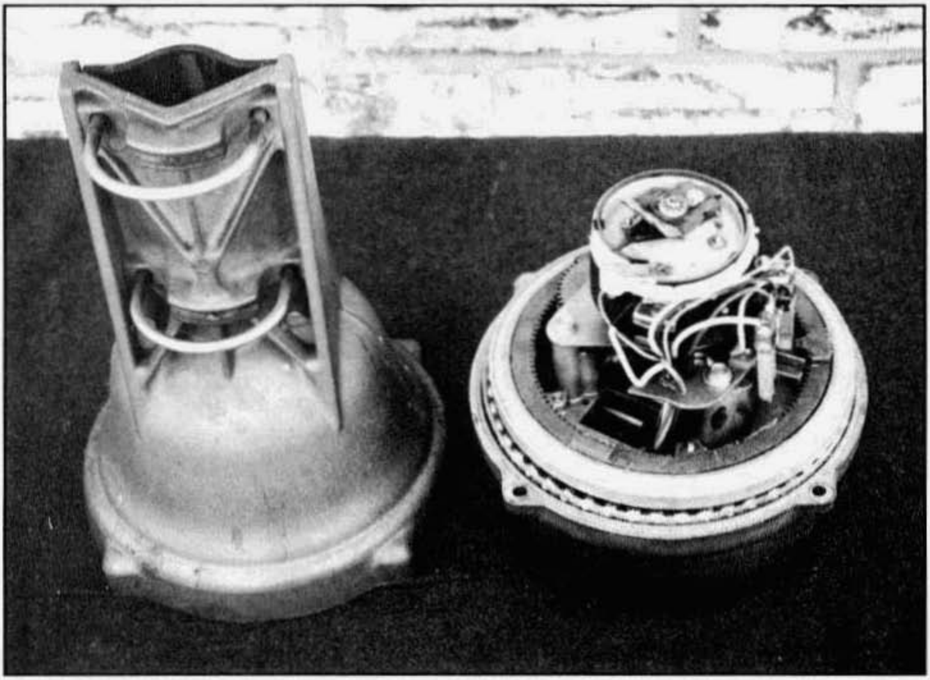

This is the fourth part of a series of articles about Heathkits that never went into production. Unless you were a company employee, you probably never even heard of these products, much less saw them. Any information about these products was generally kept inside the walls of the company, and most existing units were destroyed. But now that several years have passed since their inception, and because the company is no longer in the kit business, I will let you in on some of these "secret" projects. This month, we will take a took at the HD- 178 rotator.

The accompanying photograph is a picture of the author's HD-1781. To many of you, this photograph may look familiar. In 1988, Heath worked with Telex/Hygain to make a kit version of their HAM-IV rotator. It was to be offered as a complement to our HD-1780 IntelliRotor™. The kit consisted of all the parts needed to construct the rotator, including a packet of grease. An accessory mast-mounting plate, model HDA-1781-1, was also to be offered.

Following are the rotator's specifications:

Input Voltage: 120 VAC, 50/60 Hz
240 VAC, 50/60 Hz
Motor: 24 VAC, 2.25-ampere capacitor

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VINTAGE NETS

Westcoast AM Net: Meets informally, nightly on 3870 at 9:30 PT. Wednesday at 9:00 PM PT they have their formal AM net which includes a swap session. Net control rotates.
California Early Bird Net: Saturday mornings at 8 AM PST on 3835.
California Vintage SSB Net: Sunday mornings at 8 AM PST on 3835
Southeast Swap Net: Tuesday nights at 7:30 ET on 3885. Net control is Andy, WA4KCY. This same group also has a Sunday afternoon net on 3885 at 2 PM ET.
Eastern AM Swap Net: Thursday evenings on 3885 at 7:30 ET. This net is for the exchange of AM related equipment only.
Northwest AM Net: AM activity daily 3 PM - 5 PM on 3875. This same group meets on 6 meters (50.4) Sundays and Wednesdays at 8:00 PT and on 2 meters (144.4) Tuesdays and Thursdays at 8:00 PT. The formal AM net and swap session is on 3875, Sundays at 3 PM.
K6HQI Memorial Twenty Meter AM Net: This net on 14.286 has been in continuous operation for at least the last 20 years. It starts at 4:00 PM PT, 7 days a week and usually goes for about 2 hours. Net control varies with propagation.
Arizona AM Net: Meets Sundays at 3 PM MT on 3855. On 6 meters (50.4) this group meets at 8 PM MT Saturdays.
Colorado Morning Net: An informal group of AM'ers get together on 3808 Monday, Wednesday and Friday mornings at 7AM MT.
DX-60 Net: This net meets on 7290 at 2 PM ET, Sundays. Net control is Jim, N8LUV. This net is all about entry-level AM rigs like the Heath DX-60.
Military Net: It isn't necessary to check in with military gear but that is what this net is all about. Net control is usually Walt, KJ4KV, but sometimes it rotates to other ops. It starts at 5 AM ET Saturday mornings on 3885.
Westcoast Military Radio Collectors Net: Meets Fri. at 2200 local on 3990 and Sat. at 0800 local on 3990 + or - QRM. Net control is Tom, WA6OPE or Andy, KD6TKX.
Grey Hair Net: The oldest (or one of the oldest) 160-meter AM nets. It meets on Tuesday nights on 1945 at 8:30 PM EST & EDST
Vintage CW Net: For CW ops who enjoy using vintage equipment.This is not a traffic net; speed is not important. The net meets on 14.037, Sundays at 7 PM Eastern. Net control is Tracy, WB6TMY.
Vintage SSB Net: Net control is Chuck, N5SWO. The group meets on 14.293 at 1 PM CT, Sunday afternoons.
Collins Collectors Association Nets: Technical and swap session each Sunday, 14.263 MHz, 2000Z, is a long-established net run by call areas. Informal ragchew nets meet at 0100Z Tuesday nights on 3805 and on Thursday nights on 3875.
Drake Users Net: Another relatively new net. This group gets together on 3865 Saturday nights at 8 PM ET. Net controls are Criss, KB8IZX; Don, WZ8O; Rob, KE3EE and Huey, KD3UI.
Heath Users Net: A new net started by Marty, WB2FOU/5. Net control is shared by Fred, AA5LW. It meets on 14.275 at 4 PM CT Sundays. Check in on either AM or SSB.
Swan Users Net: This group meets on 14.250 Sunday afternoons at 4 PM CT. The net control is usually Dean, WA9AZK.
Nostalgia/Hi-Fi Net: Meets on Fridays at 7 PM PT on 1930. This net was started in 1978.
K1JCL 6-Meter AM Repeater: Located in Connecticut it operates on 50.4 in and 50.5 out.
JA AM Net: 14.190 at 0100 UTC, Saturdays and Sundays. Stan Tajima, JA1DNQ is net control.
Fort Wayne Area 6-Meter AM Net: Meets nightly at 7 PM ET on 50.58 MHz. This net has been meeting since the late '50's. Most members are using vintage or homebrew gear.
Southern California Sunday Night 6 Meter AM Net: 8 PM Sundays on 50.4. Net controls are Dan, KV6I and Scott, K6PYP. Informal, supports restoring old gear and using it on the air. Loan gear available for those wanting to join in.
Westcoast 40-Meter Sunday Net: Net control varies. The group meets on 7160 starting at 4PM PT.
Collins Swap and Shop Net: Meets every Tuesday at 8PM EST on 3955. Net control is Ed, WA3AMJ.
Old Buzzards Net: Meets daily at 10 PM EST on 1945. This is an informal net in the New England area .

Why AM?

by James B. Jenson, WAØLEU
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After being out of the ham radio loop for several years, I found myself in a SSB QSO somewhere around 3885. According to the conversation these guys had camped out around this frequency for more than a decade. They rehearsed for me the history of their roundtable. In the course of those recollections they began to complain about the interference from the AM stations operating around this part of the band. Then things became more interesting. It seemed that AM should never be used by hams. This thinking was interesting because they were all of the vintage of those who learned radio phone on AM. So I probed a little and was treated to the now familiar litany. "It's outdated, it takes up too much spectrum, it's inefficient, so let's get out of the past and move ahead, etc." There seemed to be a tone of moral indignation to these comments, like we all have a moral obligation of some kind not to sin against progress in radio by using AM. With that all said, the VOX rhythm of the QSO told me the burden of proof was mine. Why AM? What to say? Not the type to be quick on my feet, but with the dead air pressing hard, I blurted out something like this. "Well, AM is basic to understanding the transmission of intelligence by amplitude variation of a signal. After all SSB is AM derived. Secondly AM is current technology. Broadcast television uses AM to transmit video intelligence. We all use AM radio at home or in our cars, there's international shortwave, and then there's WWV our National Bureau of Standards station. And it's just fun." No one argued.

Well then, why AM? AM'ers do it for the love of radio, for the practical benefits of it, and the fun of it.

The Love Of It

First let's remember the thing that really drives amateur radio: love. Our activity has long been called amateur radio. The word amateur comes from the French amator which means lover. That's derived from the Latin amare which means to love. So the dictionary defines amateur as "a person who engages in some art, science, sport, etc. for the pleasure of it. . ."(1) That's we hams. We're lovers of radio. We do it for the love of it.

In any human endeavor where the motivation is love, what naturally follows is a high degree of accomplishment. That's why technical discussions on the ham bands can be so invigorating and humiliating. Invigorating because of the learning that takes place, humiliating in a good sense because no matter how accomplished one becomes the depth and breadth of knowledge and experience found on the ham bands cannot be exhausted. So this "amator", this love of radio, produces a group of radio experts in all the various stages of learning and development. Year after year our beloved handbook states this in its opening pages with these words.

"Amateur radio is a scientific hobby, a means of gaining personal skill in the fascinating art of electronics and an opportunity to communicate with . . . short wave radio.

". . . from whose ranks will come the professional communications specialists and executives of tomorrow." (2)

Love, fascination, and fun motivating people to great expertise - that's the spirit of amateur radio. This inspiration gives true amateur activities a valuable role. The academic and the professional do not always have this love to help him. Besides the love of his vocation, survival, competition for business, meeting schedules, etc. moves him to


The author in his hamshack.

hone the principles of their vocation. The amateur has no such pressure. Love moves him. That is why many great accomplishments have come from the amateur ranks of divers human endeavors. The development of the Collins 30L-1 linear amplifier as related in *Electric Radio,* number 58 demonstrates such an accomplishment coming from amateur tinkering. The story is so good that a few words must be excerpted.

"Well, as it happened one time, two ham engineers under Ernie Pappenfus had come up with a clever RF linear amplifier concept. They had done it more or less on their own time -- in typical ham fashion . . . Gene (WØROW) had mounted the four 811's with their output network on a nondescript chassis. When Arlo (WØLBK) saw it, he thought, 'Holy cow, I could put that in an S-line case and have an amplifier that I really want.'"(3)

Granted, they had a professional edge, but the driving force came from the amateur heart. The same spirit is at the heart of operating AM. The AM operator loves the intricacies of the mode. He loves the ambiance of the AM QSO. He loves the sound of an AM signal. He loves the knowledge that the mode yields. He loves to experiment and tinker with the possibilities of the mode.

The Basics

All that is fine, but wouldn't we be justified in leaving this basic mode to its venerable historic position and focus our passions on some really progressive things? Any really progressive endeavor requires a constant return to the basics. One of the reasons I was inactive in ham radio for several years was my involvement in Little League baseball. Impressed relentlessly on me by the older coaches was a back to the basics approach to teaching. Hitting, running and fielding basics were always preached and drilled. All the really advanced plays were built on these basics. Academic curriculums work the same way; likewise in professional endeavors. All problem solving requires not only knowledge of the basics, but real proficiency in the first principles.

AM operations provide for this re-

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Why AM from previous page
hearsal of the basics. AM is one of the first principles in the communication of intelligence via radio. In terms of basics, we find only two ways of communicating intelligence via radio. One is to vary the frequency of a signal, FM. The other is to vary the amplitude of a signal, AM. Every mode may be explained by one of these principles. For example, CW is often explained in terms of AM. The modulation envelope of a CW signal consists of a carrier, upper sideband, and lower sideband. In CW we call the sidebands clicks. We shape the amplitude varied envelope to provide just the right sidebands at just the right amplitude for effective Morse communication and minimum spectrum use. All modes which use variation of envelope amplitude rely on the principles of AM.

AM is essential to SSB. The spirit of the amateur drives many of us to take things apart. Sooner or later this love will drive such a person to take apart the theory of his SSB "radio." Guess what's at the heart of this "radio?" An AM rig! All the AM'ers know that. Yes, it's called a balanced modulator. Anyone fascinated by this thing and wanting to know how it works will find that AM theory explains the thing. Understanding AM is basic to a thorough understanding of SSB. We developed SSB by way of AM. The ARRL Handbook introduces the theory of SSB with these words:

"Since SSB is a sophisticated (or simplified, depending on one's point of view) form of amplitude modulation, it is worthwhile to take a brief look at some AM fundamentals." (4)

AM operating provides the opportunity for the lovers of radio with hands on experience in these "fundamentals" one of the building blocks of radio communication. Where in all the world but the ham bands can such a radio school be found? A school of "hands on" experience motivated by love, fascination and fun. Not only do AM'ers gain this knowledge and experience for themselves, but anyone tuning the bands and hearing these AM signals will be enriched by the experience. Expertise, practice, learning, and experience in essential building blocks of radio abound in these AM QSOs.

Modern radio not antique radio

Even so, are we still dealing with a dinosaur, an anachronism? Some say that an AM roundtable is like the classic car meet where the antiques are displayed and even driven. Au contraire! Certainly we all can appreciate the historical value of preserving and operating the rigs of the past. That's fun! There is, however, much more to it than nostalgia. AM is a modern mode in daily commercial use. The venerable WWV uses the AM mode, international shortwave broadcasters use the AM mode. Then there is the ever present AM broadcast band which holds a huge market share throughout the world. AM has advantages and disadvantages like every mode. Ease of access gives AM the great advantage for large audiences. Any simple detector will receive AM with excellent fidelity. Because of this accessibility, we can be sure that AM will be current for many years to come. Consequently, there will be a demand for those who understand it.

Now let's spend a little time with a most intricate AM signal that touches all our lives. It is broadcast television. The NTSC system uses AM to transmit video intelligence. Whether the signal comes off the air or via cable, the receiver requires an AM signal for the video portion of the signal. Video intelligence is transmitted by a system called vestigial sideband (VSB). Harold Ennes describes the TV system like this:

"The basic functions of a television transmitter are (1) to provide a video carrier, AMPLITUDE (5) modulated with the composite TV waveform, and (2) to provide an aural carrier, FRE-

QUENCY (6) modulated with the audio program signal."

"In practice; one complete sideband of the visual carrier is transmitted together with only a small part (vestige) of the other sideband." (7)

AM theory and technology are at the heart of modern video transmission. Spending time learning, using and enjoying the details of this mode on the ham bands certainly cannot be compared to the antique museum.

But what about the digital revolution? Won't that obsolete AM? No. If we look to the future we see on the near horizon HDTV, that is High Definition Television. HDTV will rely heavily on digital techniques, but the modulation system will be guess what - AM!! Stan Prentiss writes this concerning proposed HDTV systems:

"Additional issues involve transmission systems, such as vestigial sideband (VSB) or quadrature amplitude modulation (QAM). The 4 VSB, 32 QAM, and 32 SS-QAM featured in initial digital proponent systems are said to have worked well, . . "(8)

Quadrature AM, not the usual AM one would find on the ham bands, but the principles are the same. (9) Any amateur familiar with an AM envelope can understand and work with the HDTV literature. When one experiments with a basic system such as AM that experiment yields knowledge that makes the cutting edge understandable.

AM is fun

We can't forget the fun. Those experienced with AM know the leisurely and warm ambiance that accompanies the average AM QSO. The rapid fire pace of the VOX is not there. Neither is the noise. The carrier silences the receiver with a thump. Sometimes the echo of a closing T-R rely can be heard adding an authoritative accent to that thump. Then the operator's voice fills the room in astounding fidelity. Even the rigs with communications shaped audio sound like Hi-Fi compared to the familiar SSB squawking. Many a pleasant evening can be spent in a huge roundtable. One can listen to monologues filled with every imaginable topic go on and on as the conversation moves from station to station all while working on a project across the room. Topics include wonderful technical discussions about things like power distribution in sidebands, negative cycle loading, compression and clipping, splatter filters and whether to move, remove, or preserve them, modulation methods, audio amplifiers, saturation characteristics of transformer cores and their frequency responses, and on and on. There'll be experts, at least one, on every topic. It's great fun to prepare a favorite beverage, heat up the soldering iron, turn the mode switch to AM, set the receiver selectivity switch to the broad position for full fidelity, and join in live AM radio. AM has its unique brand of fun.

We're hams

AM is a fundamental part of radio communications. AM is part of cutting edge technology. All those who love radio, true amateurs, appreciate this. All aspects of radio, not just a few modes, have their place among amateurs. That's the very thing that makes the amateur valuable. Of course we don't all enjoy or even like all modes and aspects of radio. We usually settle on a few favorites. But being radio amateurs we can certainly appreciate the contributions made by those interested in all the various aspects of radio, AM too. Only ignorance diminishes such appreciation. So, why AM? 'cuz we're hams! **ER**

References

1. Webster's New World Dictionary of the American Language.

2. Headquarters Staff, The Radio Amateur's handbook 41st edition 1964, pg. 7, American Radio Relay League, Newington, Conn.

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The Transcon M-II 10

by Tom Raymond, W5JM
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During a recent visit to the East to visit a daughter, I found a ham and CB store that was unusual in that it obviously had been in business for some years. They had some old gear for sale some of which they had restored and made operational.

The restored equipment could be seen on line at an operating console at one corner of the basement.

After I visited with them and examining what was visible, they invited me to the basement where a beautifully restored Collins 50K was displayed. It was operational as original with the Collins 310A exciter. There was a significant number of other pieces in these catacombs. Because of my extreme interest they gave me a flashlight and the permission to explore.

A piece of gear I had never seen before was a small box, 5" by 5" by 7" that had the words TRANSCON M-II 10 screened on the panel.

It was gray in color with the switch and jack markings being very provocative. A screwdriver was provided and the cover and bottom plate removed.

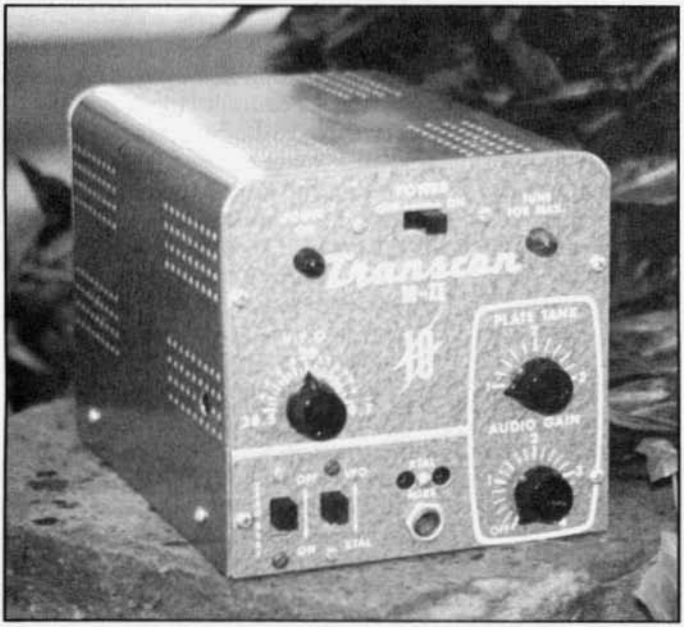
Upon a cursory inspection it appeared to be a plate modulated transmitter with a 5763 tube in the final. There was a front panel VFO/XTAL switch with a built-in VFO controlled by a front panel knob. A DPDT relay handled the antenna switching and XMIT/RCVE voltage switching. A 27.76 Mc. crystal was plugged in the back chassis in line with 6AK5 and 6U8 tubes. This subassembly was obviously a crystal controlled broad band converter which used the car radio broadcast receiver as a tunable IF when operating mobile.

In the late 40's and early 50's an external converter was often used in both crystal controlled and VFO-tuned configurations with the output fed to the automobile radio for AM reception. I don't think I had ever seen a design that had a receiving converter on the same chassis as the transmitter. A number of labeled slide switches were on both the front and back panel; some functions obvious while others were a bit confusing. A labelled octal power socket for applying external power was present on the back, with some of the labeling being a bit confusing as well.

There was no manual or schematic available, but I bought the unit because it was so titillatingly interesting.

Upon arriving back home in Arkansas the first thought was to fire it up. Drawing the control circuitry was puzzling at first, and by the time it was understood enough to be able to operate the unit, completing the RF and AF circuitry was anticlimactic. I did get some information from a copy of "HAM EQUIPMENT BUYER'S GUIDE" where a picture of the unit was found with the legend stating it was manufactured in both 10 and 6 meter models with a further choice of either a 6 or 12 volt DC model. The DPDT relay is a DC relay and without some modification of the TRANSCON of the PTT circuitry would not operate on AC.

Before really getting into the unit, I sent SASE's to a few manual supply houses and an SASE to WA9MBJ, the publisher of "HAM EQUIPMENT BUYER'S GUIDE", hoping he would have a source for the short description



Front view of the Transcon M-II 10.

in his book. No further information was forthcoming from Alton, WA9MBJ, with the letter being returned with a note that Alton is a Silent Key. After modifying a power supply and some servicing to get the TRANSCON to work, I had occasion to speak to Barry who sent further information from Raymond Moore's new transmitter book. A subsequent attempted phone call to the different name and address of the manufacturer was unfruitful.

If anyone is interested in my schematic I would be glad to provide a copy to anyone who sends me an SASE. It is not complete as I was unable to easily read the values of the smaller capacitors used mostly in coupling and bypass circuits. I do not have a CAD program for electronic schematics so my schematic is the result of using a general purpose template with various sizes of triangles, circles and squares.

In discussing the circuits, a good place to begin is the octal power plug on the back of the unit. Since the unit I have is the 10 meter, 12 volt version, assume this discussion refers only to that model. The pins are labelled as such:

1-FILAMENT
2-CW
3-GROUND
4-B+ RETURN
5-LO B+
6-EXT. RELAY CONTROL
7-HIGH B+
8-NO CONNECTION

On the back of the unit a note states "JUMP PINS 2 AND 3 FOR PHONE OPERATION". This line simply grounds the cathode of the oscillator section of the 6U8 through an RFC so that the tube will operate. This circuit could be used to key the transmitter for CW, but this is inadvisable in that the 5763 PA has no grid bias unless it is being driven. The key-up current through the 5763 could be excessive. The question is moot since there is no provision for demodulating the received CW anyway.

Pin 4 label is confusing. Just what does "B+ RETURN" mean? Most of us in the past have felt the meaning of "B+ return" in a circuit would imply a ground return. This pin's voltage is actually the B+ voltage applied to the back contacts of the relay. It is there to apply B+ to the built-in converter during receive conditions. The operator could steal B+ from the automobile receiver without applying the B+ to the transmitter.

Back in those days an external power supply was used to supply the B+ power for the mobile transmitter. This was usually done with either a vibrapack or a dynamotor that was switched on during transmission.

continued next page

The Transcon M-II 10 from previous page

Pin 5 is where B+ can be applied to operate the unit from an external supply. Pin 7 becomes the B+ pin when the EXT. POWER switch is on. So why the two different pins? Previously in this article the use of an external vibrapak for B+ was mentioned. A convenient vibrapak could be found in the automobile broadcast receiver. The problem is that the vibrapack in the receiver would be incapable of supplying the current for both the receiver and the transmitter at the same time. This is simple to remedy by switching this B+ source between the transmitter and the receiver with an external relay controlled by the EXT. RELAY CONTROL, Pin 6. Another vibrapack wasn't needed after all! In reality this scheme would work, but since most of the old automobile radio power supplies would only give voltages under load of something around 250 volts, one may wish use a higher voltage with a different external supply with a result of perhaps almost doubling the power output of the transmitter!

In those days WWII carbon mikes were cheap and plentiful. The war surplus T-17 mike was probably the best known. The audio quality was certainly not of broadcast standards, but just think of this: they were cheap and plentiful; the audio bandpass was already shaped (minimal low and high frequency response, in fact the unit didn't need a speech processor!), and one didn't need a speech amplifier, or at least as many stages. A disadvantage was that one used a mike transformer for impedance matching and a circuit to help apply a small current to excite the carbon mike. In ham use this was usually done with a 1 1/2 volt dry cell in series with the mike through the primary of the mike transformer.

An interesting circuit was seeing some use around that time. It could have been implemented in a number of ways, but a common use was to use a dual triode tube such as a 12AX7. Since a cathode circuit generally is operated at a low impedance, a carbon mike was placed in the cathode circuit in series or in place of a cathode resistor. This first amplifier stage is now also a current excitation and impedance matching circuit for the carbon mike without the use of a transformer or battery. The second half of the 12AX7 then was used as a simple voltage amplifier to drive higher power modulator stages. Other hams wanted the fidelity of a crystal or dynamic mike which required generally at least two stages of voltage amplification in order to drive a modulator tube.

Transcon 10 ingeniously used a DPDT slide switch to give one a choice of using either a carbon mike or a crystal mike with the same 12AX7. I can't remember a published circuit that did both although I have used each alone on different designs.

A DPDT switch labelled MOD/DEMOD with an associated RCA jack marked EXT AUDIO was interesting. It is a switch that switches the output of the 12AX7 from the modulator to the EXT. AUDIO jack. I don't know why the designer did this. I do remember after WWII some folks mounted loudspeaker horns on top of vehicles for mobile announcements. Many of these PA amplifiers used mikes that were carbon. A crystal or dynamic mike could be used with a circuit such as this design in the TRANSCON. Other than that possibility I can't think of an immediate mobile radio amateur use for that feature.

The audio amplifier gain control is a potentiometer with a SPST switch mounted behind it. Small shielded cable was wired to this switch, but since there is already an ON/OFF switch on the front panel, what could it be for? Checking with an ohmmeter revealed the switch turned on in the extreme CCW position and off when the pot was advanced. This proved to be the control to switch the antenna from the

TRANSCON converter to the input of the automobile radio for normal broadcast listening.

A switch on the front panel is the VFO/XTAL selector. The pentode portion of a 6U8 is used as either a VFO or a crystal oscillator.

Another switch on the front panel is the ZERO BEAT switch. It is actually a spotting switch. B+ RETURN VOLTAGE is applied to the 6U8 oscillator without having to key the transmitter. One can then find his own signal on the car receiver dial for spotting.

In tracing the RF exciter stages in the 6U8 circuitry pin 9 was found to have never been soldered. The variable inductors in the plate circuits showed evidence of having the slugs manipulated to a moderate degree; probably the previous owner was having difficulty in obtaining enough drive to the 5763 PA amplifier. It probably would also have been intermittant even if he could entice the transmitter to work.

The TRANSCON was proving to be a delightful toy with features not usually seen in little rigs like this in the '60's.

I feel a major blunder was made in the design of the filament circuitry. The filaments are wired in a series/parallel manner in order to supply the proper voltages to the filaments of the tubes. In a 6.3 volts configuration there would have been no problem by just wiring the filaments in parallel with the 12AX7 pins being wired in its 6.3 volt configuration. The chassis has both 5763 and 6417 marked by the same tube socket and another socket is marked with a 6.3 and 12.6 volt version of the same tube, so some thought had been given for an accurate application of filament voltages for the 12.6 volt version. My unit is a 12.6 volt model wired where some tubes filaments have approx. 5 volts across them while others have over 7 volts applied to them.

The 6U8's are wired in series across the 12.6 volts which is perfect, but all other filament wiring is wrong. A much better job could have been done using the same tubes, placing the filaments of the 5763 and 6BQ5 in series and a small dropping resistor for the 6AK5. By substituting a 12AK5 it would have been almost perfect and still use the other supplied tubes.

This particular unit would operate on a 12 volt AC filament supply with a slight modification of the relay coil circuit. This could easily be done by using a silicon diode rectifier and an electrolytic capacitor.

I really like the TRANSCON and have enjoyed going through it. I did end up making the filament modifications to it which were really very simple. I used a 2 watt resistor as close to 36 ohms as I could get to place in series with the 6AK5. If I had a 12AK5, I would have connected the 12.3 volts directly to pin 3. The measured filament voltages are now proper.

The TRANSCON 10 works great. With a B+ of 250 volts the RF output is 3 watts with the total current drain of less than 70 mils. With 350 volts the power output is 5 watts with the corresponding total B+ current of 105 mils. The modulation report given on the air was "sounds great with full modulatiion", but I didn't put it on the scope. I used a D-104 mike and didn't try a T-17B carbon mike because all mine have PL-68 plugs on them. One of these days I will wire up a small adapter and give old man carbon a try.

In the crystal position the unit was very stable, but there was some drift when using the VFO. Perhaps the wideness of the AM signal heard through the broad IF's of a broadcast car receiver would be OK, but I didn't hook it up that way.

If one were to modify the TRANSCON a bit further, it would be preferable to change the PA output to a pi network instead of the link coupling offered in the unit. This would really be very easy to do using the same parts and adding

continued on page 39

The AM-141 = 2 KW From the BC-610/T-368

by Chuck Teeters, W4MEW
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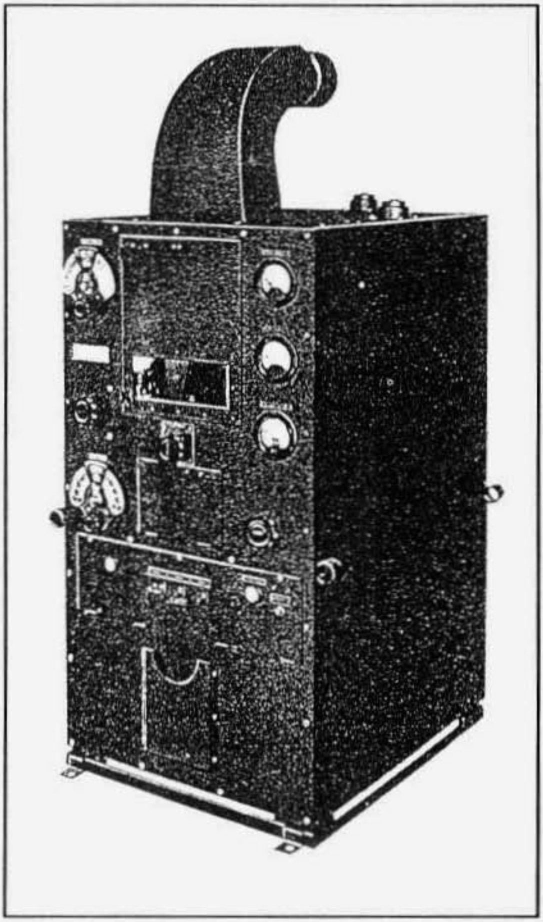
Augusta, GA 30909



Yes, Virginia there was a 2 KW amplifier for the BC-610. In an ER article on the R-388, I gave some Signal Corps history which generated requests for information on where the 2 KW came from with the BC-610. It was from the AM-141/MRC amplifier used with the -610. If any are around I don't know, but like most surplus, things keep showing up, and if anybody can find it, hams can.

The amplifier came from a 1942 request by Dept. of the Army Hdq. for a mobile high speed CW radio to interface ACAN, the Army fixed station radio net, with the field Army. Nomenclature assigned to this hi-powered CW radio was one of the first under the new Army Navy system, AN/MRC-1. Development was done at Fort Monmouth. The BC-610/SCR-399 was the starting point. Federal Radio was building a 1 KW CW transmitter for the Army, the BC-339, with push-pull 833As. W2VQR, the project engineer at Monmouth took the PA and added a single phase 115 volt power supply with 872s. A pair of 866s provided bias. Test results were good, the amplifier could put out the 2 KW required. 26 amplifiers were built by the Coles Lab section of Monmouth along with rest of the AN/MRC-1 stuff and shipped between 1943 and 1944.

A follow-on requirement for more radios resulted in a production contract to Lionel Electric Train. The Lionel production amplifier simplified the sheet metal a bit. Lionel built 135 units. These were nomenclatured as AM-141A. The rectifiers were 3B28s and 4B32s and a time delay relay was eliminated. The 141s looked a lot like the 610, but with a large cooling fan on the back, a viewing window for the 833s on the front, and an exhaust hood on top. The plate used a similar but larger coil than the 610 plate coil. Regular 610 plate coils were used in the grid of the 833s. Both coils were behind doors on the front of the amplifier. A band switch on the front was misleading as there was no band switching. The switch changed the plate capacitor value to keep a decent L/C ratio when you changed coils. No modulator or antenna tuner was ever built.

In 1945, a QMR came in for a RATT version, the AN/MRC-2. The development contract went to Bell Labs. Bell came up with an VFO frequency shift exciter for the BC-610, the O-39/TRA-7, and FS converter, the CV-31 for the receivers. They made very minor changes to the amplifier which became the 141B. The production contract went to B&W. There must have been some hams testing MRC-2s as they would connect a EE-8 telephone to the FS exciter and run 2 KW of NBFM voice. The project engineer for the MRC-2 could have been W2GUM, W2VQR, W2ZK, or W8CI. I would bet on Lloyd, W2VQR as he did almost every thing at Monmouth associated with the BC-610.

If you wanted to turn Lloyd on, all you had to say was that he sure had it easy when he came up with the 610 from the Hallicrafters HT-4. You were in for 3 hours of pictures, schematics, and MFRs about the Signal acquisition of HT-4s. If you thought the 610 was a military HT-4 you found out you were wrong. Only two rectifier tubes, and the outward appearance were the same between the two transmitters. Coils, tubes, and most components were changed. One of Lloyd's favorite pictures was of the HT-4 after a 20 minute truck ride over rough terrain. The final tank capacitor plates are scattered all over the bottom, along with most of the parts from the modular deck of the transmitter. It looked like somebody had taken tin snips and cut the chassis up into sections. Sure was a great advertisement for heavy metal and glyptol, the second world war way of welding nuts and bolts together.

Several follow-on units, the AN/GRC-26 and the AN/GRC-41 mobile radios switched from the BC-610 to the T-368, and the amplifier was tested with them but never employed in the production versions. Some thought was given to a band switching amplifier, but by that time SSB was in and the project was dropped. We never had a requirement to try to run the 141 linear. Both power supplies were very soft, and the tanks were fairly low C. I would guess it would take considerable reworking. The AN/MRC-2 went through 5 production runs with the last, the D model, in 1954. Production called for 280 units of the AN/MRC-2D and specified 94 additional amplifiers to be held in stock for some unknown reason. The manual was TM11-624, and covered all models A through D.

Good luck if you find one, but be careful of the 141's interlocks. Like the early 610s the interlocks were in the plate relay primary, and a sticky relay left HV on when the coil doors were open. The only soldier ever killed in over 55 years of signal training at Fort Monmouth bought the farm because of a stuck relay in a 141. **ER**

THIS IS ALL SHE LEFT ME FROM MY SHACK-- SHE THOUGHT IT WAS AN EMPTY BEER BOTTLE

The National Radio HRO-500

Last of the dinosaurs or technological innovation?

by David Kuraner, K2DK
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Haymarket, VA 22069

The Raymond S. Moore communications receivers book describes The National Radio Company as "a pioneer in the development of the solid-state receiver" but it "didn't save the company". It seems that here is a paradox. National produced the first completely solid-state communications receiver employing frequency synthesizer technology. What happened?

To answer the question, one must not only understand what the 500 was, but also its shortcomings. Fortunately, a friend and co-worker had three of them in various states of operational status. My curiosity got to me after reading Mr. Moore's book and some insight into "what happened" can now be told.

Dave had purchased these units, along with numerous other devices, at a government surplus sale many years ago. He and his children tinkered with them from time to time. They never worked satisfactorily. One was missing parts. He never really knew what frequency he had tuned to or if any would work the next time he turned them on. So into storage they went.

Dave and I share a common interest in classic ham gear and over the years of our friendship numerous pieces were exchanged almost without regard to value or who got the better of the deal. We have fun, provide each other with what we think we simply can not live without and come away happy. So after Dave came in one day announcing that he could not find them and his wife thought she had thrown them out, came disappointment. OK, "C'est la vie".

Six months later: "Guess what? — I found them buried in the garage". By this time enthusiasm was lost and the possibility of exchange remained dormant. Just as suddenly one fine day, Dave came bouncing into my office with one of those ear-to-ear grins. An exchange was agreed to. He simply had to have a box which I had to match another box he had just acquired. Once again happiness and contentment prevailed.

OK — now I've got them — with no manual and not even a paragraph of description from Mr. Moore. These, after all, were not vacuum tubes, although they were produced during that era. I did learn from other sources, the following: they weigh 32 pounds, originally cost $1295, a portable version (with self contained batteries) and later an HRO-600 VLF-HF receiver was also produced.

Dave's right -- they're flaky.

With one unit missing parts and one comatose, only the third showed sparks of life. Some days it would work just fine and the synthesizer locked. Other days, after changing the main frequency band switch, either the synthesizer would not lock or received signals acted as if no antenna or just a few inches were connected. And just to really confuse the issue, the dial tuned backwards!

Now I simply had to have a manual. I became obsessed with curing the beast. Dr. Radioman was going to effect a miracle cure or the patient would beg for another physician — perhaps a famous doctor from Michigan.

Enter Rich Olenak, K3UUT. Rich needed an HRO-500 panel and I needed his documentation. The exchange was

six pack

National offers six of the world's finest receivers to meet *your* particular requirement.

Receiver number one provides greater amateur band performance and features than any amateur receiver ever built.

Receiver number two has the widest frequency range (from 5 kc to 30 Mc) of any general coverage communications receiver ever built for lab or commercial application.

Receiver number three is *completely* solid-state for high reliability, versatility and portability. It operates from 12/24 V.D.C. or 115/230 V.A.C. This receiver draws less current than a couple of dial lamps (when its dial lamps are switched off), and provides instant-on operation.

Receiver number four incorporates specific features for high selectivity and has a six-pole filter to provide built-in steep-skirted 500 cps, 2.5 Kc, 5.0 Kc, and 8 Kc bandwidths with *passband tuning* for CW and SSB. Also *AGC threshold control* to knock out background QRM. Also a 50 db notch filter.

Receiver number five has a phase-locked frequency synthesizer to replace conventional high frequency oscillator crystals for superior stability and over-all calibration.

Receiver number six offers frequency meter performance with 1 Kc dial calibration and accuracy over its entire tuning range, 24 feet of bandspread per megacycle, and 10 Kc per turn tuning rate.

Each of these receivers is called the HRO-500. National's new HRO-500, at $1560, is the finest *total* receiver you can buy . . . at any price.

Interested in trying out National's new sixpack?
See your National dealer for an opener.

NATIONAL RADIO COMPANY, INC. 37 WASHINGTON STREET, MELROSE, MASS. 02176

World Wide Export Sales: Auriema International Group, 85 Broad St., N.Y.C.

A full-page ad from CQ.

continued next page

The National Radio HRO-500 from previous page

Front panel of the HRO-500.

made. Now thanks to K3UUT, and some fill-in from Dennis Petrich, KØEOO, I have the complete story with the benefit of their knowledge on the HRO-500 receivers.

The Full Description

The radio is described as a highly reliable device for laboratory, surveillance, or point-to-point communications. Amateur radio installations are mentioned although it's doubtful that many hams actually purchased them new. It operates off 115/230 volts AC or 12 volts DC. The specs call for drawing only 15 watts at 50 mw of audio output. With the dial lights off, the power drawn is 2.5 watts and 9 watts with full 1.5 watts audio output.

Frequency coverage is 500 kHz to 30 MHz in 500 kHz segments (better than 1.0 uV for 10 dB s/n) and 5 kHz to 500 kHz at reduced sensitivity (25-50 uV). A separate preselector (LF-10) was available to provide the higher sensitivity in the VLF range. With no antenna, the radio is really quiet. The preselector is almost as sharp as the Drake R4 or 2B receivers.

Yes it really is an HRO with the classic HRO mechanical dial providing 1 kHz calibration markings. The gear ratio gives 10 kHz per inner dial revolution and National claims 12 feet effective band segment scale length. (Another source quotes this as 24 feet per MHz.) Dial calibration accuracy of 1 kHz over the 500 kHz dial range is also claimed.

The internal crystal calibrator is at 50 kHz and injects at the tunable IF. The strength doesn't vary with band changes. Also, the phase locked loop reference to one crystal permits calibration on one band or segment to carry through for any other.

To rapidly move from one end of the band segment to the other, use the outer and larger main tuning dial. Total drift is claimed to be under 100 Hz over a ten minute period including some wild temperature and primary voltage excursions.

Selectivity is obtained from a tunable six-pole filter at 230 kHz. Bandwidths are standard at 500 Hz, 2.5 kHz, 5 kHz and 8 kHz. Selectable sideband or CW is available in the two tighter positions. The receiver includes a typical rejection tuning filter which appears to work very well. For a moment I thought it was a DSP filter --- nah, couldn't be!

The AGC is somewhat unconventional. A rotary panel control permits it to be turned on and off and inserts up to 30 dB of attenuation in 10 dB steps. When it becomes necessary to reduce RF gain on a conventional receiver, AGC is impaired. The attenuation loss for the 500 occurs in the RF amplifier stage leaving the AGC alone to do its thing but with less overall input.

The really striking difference is in the method of tuning and frequency display. From a quick look you expect a dial pointer to track with the main tuning in the large elongated rectangular window. This window instead displays the first two significant digits of the frequency on a changing rotary drum. The drum changes to both the 500 kHz segment locked in by the synthesizer and the main band switch. This main band switch changes tuned circuits and conversion schemes at 4, 10 and 20 MHz.

The receiver is double conversion above 4 MHz and triple conversion below 4 MHz. Yes friend, you read it right. Below 4 MHz the signal is upconverted to 26.0 MHz plus the receiver signal frequency. The tunable IF is from 2750-3250 kHz and then on down to 230 kHz. When Mr. HRO-500 gets his act together and everything goes with the program, he is an excellent performer and a pleasure to work with.

The Times, They are a Changing

As Mr. Moore points out in his book, the typical amateur was opting for smaller more compact equipment. Coupled with the rather large price tag, few if any, of these radios were actually purchased initially for amateur use. The consensus of "guestimates" are that about one thousand were produced. Dennis, KØEOO advises that three series were made, a 75, 88 and 102 series identified by serial number.

The common transistor radios of this era were much smaller and lighter than this rack mounted device. There is something wrong with a 32 pound box drawing only 15 watts and operable from batteries. Like the "portable" black and white TV sets of the late '50's, simply bolting a handle to it did not make it any lighter and battery operation did not make it any more portable.

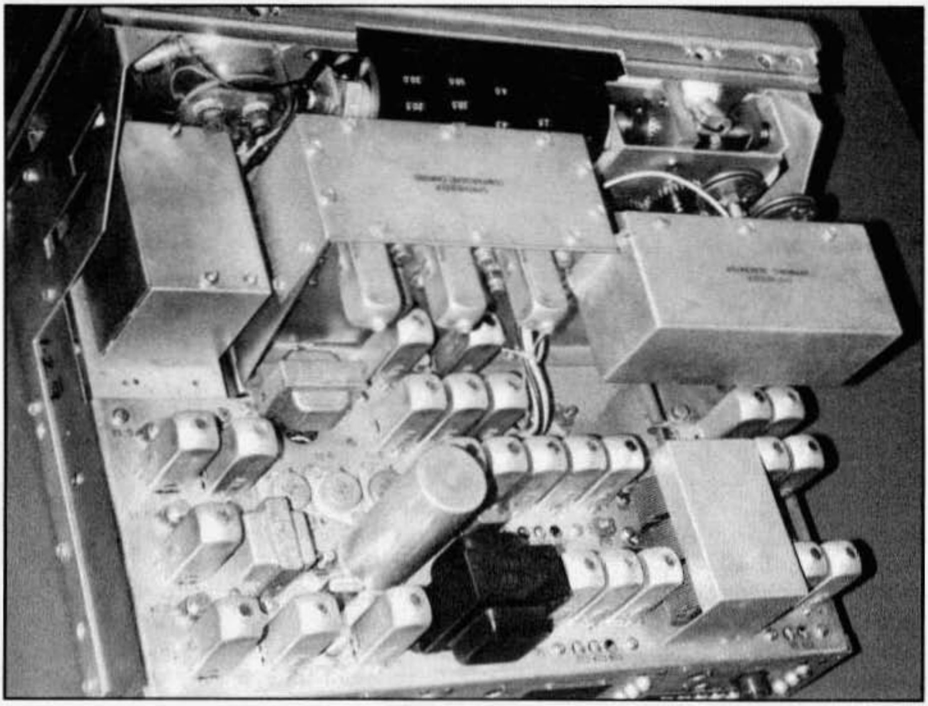
The mechanical layout still reflected the old way of doing business. The components were large and for the most part solidly made. More on this in a moment. The impression one gets is that vacuum tube sockets were removed and transistor sockets substituted. With the new solid state technology, National simply did not make (or make in time) the paradigm shift to a new way of thinking. This was the same fatal thinking of the Swiss watch makers to digital technology --- the public would not accept it --- wrong!

(Although the stated market was actually government, military and commercial use, the affluent amateur was also targeted.)

But just maybe they were right --- "kinda"! The HRO-500 surely did not need to be calibrated with every band or segment change. For laboratory work, OK, but this was not necessary for the amateur. High accuracy laboratory frequency displays were performed by "digital" nixie tubes and not a 1930's mechanical design. So now, frequency display, calibration and bulk create a paradox when viewed with 20-20 hindsight.

At the time, perhaps this was the best way to ease the new technology into common acceptance. When teaching new ideas, it is always best to start with the known and common knowledge and then expand to the unknown. By this point however, National's "class" was limited to professional organizations. They could pay for the lesson at $1295 each.

We are surely in debt to National for their innovations but the market place sometimes is not kind to innovators. The story of Major Armstrong and FM taking thirty years to be established as



Top rear view, cabinet removed.

the dominant aural broadcast service just highlights this truism. Armstrong, like National, did not survive to see his FM technological breakthroughs commonly accepted. Although almost every radio receiver employs his superheterodyne principle.

The Surviving HRO-500's

Today, after over thirty years, we begin to get some hint that National may have been in its financial death spiral while desperately trying to bring this and other innovations to market. Rich, K3UUT, provides the insight that almost every unit he has heard about suffers from intermittent bandswitch and other rotary switch contacts. With the passage of time, no amount of conventional contact cleaner seems to solve the problem. These switches are definitely inferior to the ones in the earlier classic radios.

Dennis, KØEOO reports that he has not experienced problems with the switches because most of the units he has worked with were new in the box. He suggests Deoxit rather than garden variety contact cleaners. He also suggests that vacuum tube circuits employed hundreds of volts while this HRO uses only twelve volts. What makes contact at 200 volts may not do the same at 12 volts.

As a result, "disturbing" the main band switch, function switch and sometimes the mode/on-off switch could result in a non- or semi-functional radio. The only practical cure appears to be to hard-wire the offending switches. One really has to look closely at these contacts to insure all or the right ones are connected. Another solution, suggested by Dennis, would be to resilver the wafer contacts.

Now hard-wired for 1.5 to 4 MHz, it works quite well. Just make believe it's a classic plug-in coil HRO and you relive the 1930's HRO with the 1960's rudimentary implementation of common place 1980's "modern" technology. The incongruity is like visiting an "exact" replica of the Mayflower. If you see an early steam engine for auxiliary propulsion and a spark-gap transmitter for today's emergency communications, something just isn't right for any of the historical or modern eras.

The backwards tuning was simply resolved by rotating the main tuning dial 180 degrees with the tuning capacitors. Puzzling was the fact that the main tuning capacitors meshed as the tuned frequency became higher. With this up conversion and tunable IF scheme, the IF tuning starts at 3.25 MHz going down to 2.75 MHz. Without a complete alignment, the dial for this unit tracks within 10 kHz end-to-end. Adjustment calls for bending capacitor plates for proper tracking.

Dennis also reports that typically, SSB reception is distorted and this appears to be a design flaw. Several 25 uF electrolytics in the AGC circuit and a 15 uF cap in the 2nd IF of his units needed replacement, resulting in improvement to the product detector and AGC action. Also, the germanium transistors of the early solid state era were not as stable as the later silicon devices.

Conclusion

Should you discover an HRO-500 be prepared for some mental adjustments to your beliefs on boat anchors. It "sorta" looks like an HRO but doesn't get hot and can run almost forever on batteries. Like the Mayflower example, something just doesn't fit. George Washington never shook hands with Abraham Lincoln (and neither shook hands with Forrest Gump). Like the Panasonic ad of a few decades ago, it was "slightly ahead of its time".

Perhaps its real problem was that it was way ahead of its time but disguised as something more familiar. Imagine the Pilgrims "sailing" to the New World under nuclear power in a wooden ship of their era and you begin to understand what happened. Trying to explain nuclear power to 17th century human minds would be best done by starting with something familiar or just don't try.

National broke new technological barriers but in order to introduce them, rightly or wrongly, the vehicle chosen was that old familiar boat anchor. By the early 1960's, boat anchors were still very much honored but as obsolete as wooden sailing ships. On land, I'll drive a classic Beetle for fun, but I wouldn't look forward to regularly commuting with it in heavy rush hour traffic.

Imagine in the future Chrysler, Ford or GM want to mass market a beetle-like vehicle and introduce Star Trek type "warp drive" engine technology. The development costs have to be recovered and the public still has to accept the new technology. This situation is true today for electric cars. In either case don't give it the luxurious attributes of a model "T" Ford, use inferior parts and then charge Lexus prices.

Under these circumstances, a manufacturer must be able to absorb losses. Ford recovered from its Edsel. National could not. Both are now collector's items for their uniqueness and place in history. **ER**

I'LL BET YOU LET YOUR NEW 160 M RHOMBIC SPILL OVER ONTO RESERVATION LAND!!

VFO Dial Calibration

This is a fairly obvious and easy procedure given today's accurate frequency counters. The VFO output is 5.0 to 6.0 MHz, reverse reading. That is, it measures 6.0 MHz at the LOW end of the dial, and 5.0 MHz at the HIGH end. If you are measuring the actual output frequency, remember that the heterodyne crystal tolerance comes into play here also. Check each band at the same fixed VFO dial setting. You can tweak the crystals with the screw adjustable caps, CX 1-6. Once you verify the crystals, pick a band and start at the low frequency end of the dial. I find the 20 meter band is best because there is adequate output across the dial scale to drive a counter, loosely coupled to a dummy load.

The VFO tracking adjustment is accessed through the front hole in the top of the VFO can between the two VFO tubes, V 17 & 18. You'll note a zig-zag pattern of small slotted screws through the hole. Start with the dial at 13.5 MHz. Key the transmitter in CW and increase the output power to get a stable counter reading. Adjust the most accessible screw to match the actual output frequency with the dial reading. CCW raises the frequency. Do this in 50 kHz increments all the way up the band. One more pass should do it. If you find that you are consistently running out of adjustment, start over, but with the dial set five kHz hi (or lo, depending on the error) at each calibration point. It's easy to mechanically reset the dial scale back to zero by loosening the two set screws and physically moving the dial scale.

I can understand why Central Electronics went broke building these things. I alluded to the Collins look earlier, but look is where the similiarity ends. These are EXTREMELY complicated radios, using 26 tubes just for a transmitter! The patented broad band coupler networks [5] do in fact work and provide full output across each band with NO tuning other than frequency. But they must have been a nightmare to adjust in production since each one required separate tweaking. They are also somewhat lossier than more conventional tuned circuits. If you find that there are some marginal tubes, you had best replace them. I've seen the RF output jump from 50 watts to well over a hundred just by replacing a couple of weak mixers. All of the tubes involved in the RF section are critical, from the 6EA8 XTAL oscillator, all the way to the 6BQ5 driver and 6550 finals.

The physical appearance of the final stage coils is drastically different from one 100V to another. The spacing and position of the windings are both critical in the performance of the couplers. I've seen all sorts of added capacitors and even small ferrite slugs glued inside the ceramic coil forms [5]. I'm sure they had all sorts of test jigs in production, but I'll bet it was still a pain to do. I'll have to admit though, that unless they've been fiddled with, once set, they seem to be set for good. Tune & Talk operation is something we've come to take for granted, but in 1957 it was something to marvel over. The 100/200V's were indeed unique. They did ALL modes, and sounded good too. Even with today's modern solid state rigs that's not ALWAYS the case. **ER**

References

[1] "Restoration of the Central Electronics 100V" by Dennis Petrich, KØEOO, *Electric Radio* #30, October 1991.

[2] W3HM has 100/200V front panel silk screens available, so we can even do one in matching Heathkit green if you like.

[3] Wesley Schum, W9DYV, 6223 N. McClellan Ave., Chicago, IL 60646.
A curious paragraph is included with W9DYV's zener mod info sheet dated

25 March '82. It reads as follows: "If the transmitter exhibits a fall off in audio gain during highly humid weather, the circuit card will have to be replaced. Acid from the batteries has soaked into the card and defies removal. The acid combines with humidity and effectively shunts the audio to ground." Heavy stuff, eh what? I've never seen this in any of the eight or so 100/200V's I've done. Has anybody observed this happening in theirs? Wes apparently offered new audio limiter boards for $10 each postpaid back in '82.

[4] Do not connect zeners in parallel. A zener diode conducts in both directions. With a negative voltage on its cathode, it acts like a conventional diode, breaking down at about 0.5 volts. Therefore, two zeners connected cathode to cathode act like a zener diode in series with a normal silicon diode in either polarity, forming a bi-directional clipper circuit.

[5] Complete copies of the actual patents and information on how to construct the broadband couplers are available from the author for $5, postpaid.

[6] ALWAYS use a variac when testing older radios! Especially on initial turn-on. Most 40's - 60's sets were designed for 110/115 VAC operation. The 125 volts and up that we get nowdays leaves no safety margin for high line conditions. It's also handy to have an AC ammeter in line. Bring the line voltage up slowly starting at about 30-40 V. At this point, rectifier tubes will just start to conduct, re-forming those electrolytic filter caps. After about a minute, gradually crank it up to 110 V while keeping an eye on the ammeter.

LETTERS

Dear ER

In the debate about retail outlets that deserve our support as they help us pursue our interest in vintage electronics, Radio Shack will probably fade further from view. The company's latest earnings tally for the second quarter of 1996 shows a 37 percent decline in fortunes, due primarily to weak market share selling consumer-grade computers.

In years past, radio hobbyists enjoyed a certain subsidy for their low-volume purchases as the company distributed revenue from its mainstream products. This protected the availability and price of resistors, capacitors, inductors and even vacuum tubes.

But Radio Shack's fortunes have declined from when it was making money selling Citizens Band gear at the height of that craze, and later as it moved on to the emerging retail computer market. Falling revenue made it tougher to justify carrying slow-moving items.

Part of the corporate cost-cutting response has been to restrict its offering of components of interest to our community. For what's left, the prices have risen and the quality has dropped, as anyone who's been to a Radio Shack can testify.

It's becoming all the more important to patronize the smaller, independent retailers in your community and by mail order, to help let them know we support their efforts at manufacturing, acquisition and stocking of the parts needed to support our special facet of "electronics."

Paul Courson, WA3VJB

Alfred H. Grebe from page 9

a non-regenerative detector. The design reduced antenna effects by coupling it loosely to the RF amplifier variometer and by providing an adjustable rheostat to control propensity of the amplifier to oscillate. Further, the plate inductance of the detector tube was also loosely coupled to the detector circuit.

The two-tube CR-17 succeeded the CR-13 in 1925. All of the early CR models used the then common, external, circular dials of molded, polished, black bakelite with 180 degree scales of 100 divisions. The CR-17 was the first short wave receiver of the series in which tuning and vernier dials projected horizontally through 24 karat gold covered escutcheon plates. The CR-17 was scheduled to reach the marketplace about the same time as the MU-1, and Grebe used many of the same components in the two receivers. The self-contained coils in the CR-17 covered from 30 to 110 meters. The TRF stage, which had proven to be so useful in the CR-13 was omitted. Oscillation and tracking problems were insurmountable at such short waves, since triode tubes were all that were available in 1925 for use in RF stages. Grebe engineers thus regarded the CR-17 merely as a prototype of things to come (Batcher, 1925b). As a consequence, few, if any, CR-17s were actually manufactured. None are known today to exist.

The CR-17 evolved within a year into the CR-18, which soon became popular among amateurs (Kelley, 1995). No other shortwave receiver of the mid 1920's had so many advantages. The foundation of the CR-18, like that of the CR-17, was a two-tube receiver - a regenerative detector and one stage of transformer coupled audio amplification. The configuration offered relatively smooth control of regeneration, cushion sockets to eliminate microphonics, variable straight-line frequency condensers with vernier tuning, like the MU-1 and significantly, to avoid the problems of single circuit tuning, plug-in coils that covered five wavelength ranges: 8.5 to 18, 15.8 to 31, 29 to 62, 56 to 112, and 107 to 216 meters (1380 kHz to 35,000 kHz, inclusively). A final version, the CR-18 Special, added a stage of audio frequency amplification for operation of a speaker (Clayton, 1926; Patterson, 1983b).

Grebe manufactured his last receiver for the amateur market in 1928 at age 33. The advent of the screen grid tube, type 222, enabled him to produce the CR-19, a short wave receiver comparable in appearance and function to the CR-18, but with the added advantage of an RF stage. The CR-19 was developed for reception of both short wave CW and shortwave broadcasting ("New Factory Built", 1928). The receiver, however, proved to be an anachronism in the 1928-1929 market place. The addition of an RF stage to the CR-18 design failed to offset the fact that the CR-19 was a battery operated receiver with DC tubes that were in swift descent toward obsolescence. Grebe never advertised the CR-19 in *QST*; apparently he pulled it off the production line almost as soon as he announced its availability. Nonetheless, the CR-19 may be the best short-wave receiver of the 1920's. Unfortunately, as with the CR-17, none is known to have survived.

One can only speculate about what A.H. Grebe might have accomplished in manufacturing shortwave receivers had he concentrated, after introducing the CR-18, on developing the CR-19 as an AC, state-of-the-art version. Perhaps within a few more years Grebe would have created short wave receivers equal, perhaps even superior, to the HROs, Super-Pros, Hallicrafters and RMEs of the mid-1930's. Sadly, Grebe did not have the opportunity. The Great Depression threw his company into disarray. In 1931 - at age 36 - a time when Halligan, Hammarlund, Millen, Planck and Shalkhauser, were beginning to contemplate their enterprises - bankruptcy forced Grebe to yield to creditors his building and manufacturing equipment.

After maintaining for a few years a small research laboratory, Grebe prepared in 1935 to resume manufacturing as the A.H. Grebe Radio & Television Corporation. He was in the process of obtaining bank credit and facilities when, following serious illness, a sudden coronary occlusion resulted in his untimely death at age 40. Not only the amateur community but the entire radio industry had lost precipitously one of its premier leaders. **ER**

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Footnote

(1) Portions of this paper are derived from two earlier papers published in the California Antique Radio Gazette, November, 1990, vol. 15, and February, 1991, vol. 16.

(2) Donald O. Patterson, in a series of articles, Radio Age, vol. 9, 1983, produced a comprehensive review of Grebe broadcast and short wave receivers. He has graciously provided from his extensive collection the pictures in this article of Grebe and of, respectively, the CR-13, 17 and 18; I am indeed very grateful to him. The picture of the CR-19 shown is from the July, 1928, issue of Radio; it is the only original picture of the CR-19 known to exist.

The Transcon M-II 10 from page 27

a coupling capacitor for the pi network. For the output capacitor, it may be possible to use the present series capacitor that is in the link circuit, but it may be necessary to increase this value a little.

Someone spent a lot of time designing his dream and had put a number of interesting innovations together on a small chassis.

This article has been fun since the work in studying it has given me a chance to live vicariously in the 50's and 60's. If anyone has further information or a manual with a schematic on the TRANSCON I would appreciate a note or a call. **ER**

Please remember to use our new address and phone number:
Electric Radio
14643 County Road G
Cortez, CO 81321-9575
Phone/FAX (970) 564-9185

Why AM from page 23

3. Fred Johnson in Electric Radio, number 58, February, 1994, pg. 12 & 13.
4. The American Radio Relay League, The ARRL Handbook For Radio Amateurs, 17th edition 1993, pg. 18-1, The American Radio Relay League, Newington, CT 06011, USA.
5. Emphasis in the original.
6. Emphasis in the original.
7. Harold Ennes, Television Broadcasting. Equipment, Systems, and Operating Fundamentals. First edition, Howard W., Sams & CO., Inc. The Bobbs-Merrill Co., Inc., Indianapolis-Kansas City-New York.
8. Stan Prentiss High Definition Television, 2nd edition, TAB Books Division of McGraw-Hill, Inc., Blue Ridge Summit, PA.
9. Any ham who has aligned an old Viking Pacemaker, or any other phasing type SSB rig can quickly grasp the principles of QAM.

The Coherer Detector, Part 3 from page 14

Professor Branly died in 1940 at the age of 95. He lived to see radio progress from his coherer (1890) to such wondrous things as vacuum tubes, AM and FM broadcasting, television, facsimile, radar, radio altimeters and direction finders and, of course, most precious to us, amateur radio. The next fifty years brought us still greater marvels - loran, color TV, video tape recording, satellite systems, cellular phones, paging, hi-definition TV, cable TV, digital logic, transistors, integrated circuits, and much more. It has been a remarkable century of electronic development and it all started with the coherer about 100 years ago. **ER**

NOTE: References were given at end of part 1.

Heathkits That *Weren't* from page 18

start, capacitor run.

Maximum Cable Resistance: Terminals 1 and 2, 8 ohms. Terminals 3-8, 2 ohms.

Rotation Time : 45-60 seconds with 60 Hz input.

Brake: Positive, electrically-operated wedge. 75 segments spaced 4.8 degrees apart.

Rotator Size: 8" maximum diameter x 13.5" high, (20 cm x 34 cm).

Maximum Antenna Mast Size: 2-1/16" OD (52 mm).

Mounting Hardware: Stainless steel and plated steel clamping plate.

Weight: 23.4 lbs. (10.6 kg)

The manual recommends inside tower mounting and it is desirable to use a thrust bearing on the mast at the top of the tower. Such an arrangement helps protect the rotator from side bending forces and you can use an antenna with up to 15 square feet of wind loading. Other methods described are outside tower mounting and top mast mounting. These latter two methods will handle antennas with up to 7.5 square feet of wind loading.

It is also recommended that you use shims between the mast and rotator mounting surfaces to help reduce bearing and motor wear by keeping the weight balanced.

Closing Comments

The rotator got as far as the proofbuild stage, but was canceled because we could not get a good enough price break on parts from Telex/Hygain.

This completes a look at the HD-1781 Rotator. Next month we will take a look at the GR-1133 aircraft scanner. **ER**

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FOR SALE: New Ranger I, Valiant I & Navigator plastic dials, 160-10, freq. numbers in green, w/all holes, like orig. - $17.50 ppd. Bruce Kyder, 4003 Lauarawood La.., Franklin, TN 37064. (615) 794-9692

FOR SALE: Golden Tube SE-40 stereo amplifier, 40W P.C., as new w/ box & manual - $750 + UPS. Ron, KC6WTG, POB 783, Santa Rosa, CA 95402. (707) 539-8319

FOR SALE: ER back issues #40 thru 87 - $90 includes shpg. John File, KG9AG, POB 566, Tolono, IL 61880. (217) 485-3439

FOR SALE/TRADE: HT32, SX25, HQ120. **WANTED:** Heath Warrior amp, HT18 high tower. W7RBF, AZ, (602) 864-9987.

FOR SALE: (2) T150 - $100 ea; RME 45 - $125; RME 4350 - $200; Drake 1A - $225; HRO7 w/coils, spkr, ps - $250; Ranger 1 - $160. Greg Richardson, WA8JPC, POB 405, Gallipolis Ferry, WV 25515.

FOR SALE: Collins S-Line aluminum knob inlays: small (exciter/PA tuning) - $1; 30L-1 - $2; spinner/plain (main tuning) - $3. Charlie, K3ICH, 13192 Pinnacle Lane, Leesburg, VA 22075. (540) 822-5643

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

FOR SALE: WW II Liberty Ship Radio Set FT-102. (See ER#67). Includes Mackay 167-BY xmtr, custom built speech amplifier & modulator (805's) & all pwr sply's, very nice condx. - $400. George Shute, W4BDG, 2910 Virginia St., NE, Albuquerque, NM 87110. (505) 298-7347.

FOR SALE: Collins 75S3 (modified) & 312B3 - $300; BC-610 xfmrs: input, driver, mod, & 100TH fil. xfmr - $85; TCS-12 xmtr, TCS-13 rcvr, PP-380/U AC pwr sply, control box, loading coil, cables, orig. manual - $325. James Owens, NWØO, 1363 Tipperary St. RR 3, Boulder, CO 80303-1621. (303) 673-9019

FOR SALE/TRADE: 1944 Navy radar scope, model TS-34-AP, mint condx., complete w/orig. carrying case, test leads/manuals/keys for case - Offers. Will trade for GN-44 or GN-45 hand crank generator. Pat Stewart, W7GVC, 1404 Ruth Ave., Walla Walla, WA 99362-3558. (509) 525-1699

WANTED:
Collins KWM1; KWM1 power supply, etc; 55G1;3253A; 310A3; 75A4 late S/N & weighted spinner knob for S-line. Willing to pay top $ for prestine condition only.
Lee, W9VTC, (847) 439-4700 (d), 726-1660 (n)

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

WANTED: Heathkit, Eico, Fisher, Dynaco or similar tube audio amplifier in any condition or manuals for same. Mike Nowlen, WB4UKB, POB 1941, Herndon, VA 22070. (703) 716-1363

WANTED: Still collecting early WW II radar equip. & manuals, what have you. Allan H. Weiner, 97 High St., Kennebunk, ME 04043. (207) 985-7547

WANTED: Meter historian searching for instruments, The Instrument Maker & other 1940s meter magazines. Chris Cross, Box 94, McConnell, IL 61050.

WANTED: Collins 302C-3, DL-1, 62S-1, 51S-1, 55G-1, 312B-5, 399C-1, KWM-1, SM-1/2/3, 32V2, any Collins spkrs. Leo, KJ6HI, CA, (310) 670-6969.

WANTED: QST, CQ, Radio Craft & Radio News magazines, 30s, 40s, 50s. Advise price + shpg. Beni Fernandez, KP4DN, 1674 Atlas St., Summit Hills, PR 00920.

WANTED: Military radios: Canadian WS 29(Cdn) "A" set; British WS 21, WS 42, US AN/ARC-19. Leroy Sparks, W6SYC, 924 W. McFadden Ave., Santa Ana, CA 92707-1114. (714) 540-8123

WANTED: Collins S-line filters, F455FA-05, (part # 546-9494-00) &/or F455FA-08 (part # 546-9446-00); manual or copy for 32S-1. B. Lee Cornwell, KD3KD, HCR1 Box95, Mt Pocono, PA 18344. (717) 839-2710

WANTED: Citizens Radio Amateur Callbook magazines for fall & spring 1925. Bob Arrowsmith, W4JNN, POB 166, Annandale, VA 22003. (703) 560-7161

WANTED: Johnson 6N2 final plate tuning capacitor; DX-100/Apache mod xfmr; Hallicrafters HA-6 transverter. Emil Zelasko, KA8GEF, 9401 Grand Division, Cleveland, OH 44125. (216) 883-5134

WANTED: Manual or any info on Wayne Kerr autobalance capacitance bridge B541. Geoff Fors, WB6NVH, POB 342, Monterey, CA 93942. (408) 373-7636, FAX: 373-2345

WANTED: Dead or dying Swan 500C or 500CX, must be clean; any Collins 75S3, Collins spkr. Bob Kemp, POB 470, Lake City, MN 55041. (612) 345-5345 (d), 345-3600 eves

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

WANTED: Tektronix memorabilia & promotional literature or catalogs from 1946-1980. James True, N5ARW, POB 13280, Maumelle, AR 72113. (501) 851-8783, FAX 851-8784.

WANTED: I buy ham rcvr's not working but worth saving. Ron, 10701 W. 54th St., Shawnee, KS 66203.

WANTED: Old ham desktop microphones, any condx.; separate mic heads & stands. Rick, KF5NU, 9031 Troulon Dr., Houston, TX 77036. (713) 774-5102

WANTED: Heath xtal sets; early ham & shortwave equip., literature, accessories, broken or parts units; any Heath amateur gear. WA5THJ, Rt 9 Box 163, Alvin, TX 77511. (713) 331-2956

WANTED: Pre 1980 microcomputers for historical museum collection; early magazines & sales literature. Dave, KK4WW, POB 341, Floyd, VA 24091. (540) 231-6478/ 763-2321

WANTED: Fair to good condx. E.F. Johnson Valiant I or II . Will pay above average price. J. Costello, WA5HSI, LA (504) 889-2424.

WANTED: Vintage AM equipment for personal use, must be collector quality or mint. Prefer Collins, will consider others. Bob Tapper, N0IMH, Box 61538, Denver, CO 80206. (303) 740-2272, FAX 777-6491

WANTED: BC-611 &/or spare parts. Andy, WA4KCY, 105 Sweet Bay Ln., Carrollton, GA 30116. (770) 832-0202. wa4kcy@usa.net

WANTED: Heath SB-301/401 & SB-200 or SB-220. Robert Braza, N1PRS, 23 Harvard St., Pawtucket, RI 02860. (401) 723-1603

WANTED: Face plate for a Heath Tenner Lunch Box, must be mint, no junk; manual on Heath PM-2 field strength meter. Marty, NJ, (609) 466-4519.

WANTED: Coil winding info &/or instruction manual for Graymark model 511. Harry Blesy, N9CQX, 95740 Clarendon Hills Rd., Hinsdale, IL 60521. (708) 789-1793

WANTED: Good Eimac 3-1000Z or 3CX 1200A7 for my BTI LK-2000 amplifier. Fran, KA1DD, MA, (508) 464-5500.

FOR SALE: T-Shirts w/Johnson Viking logo - $15, state size. Viking Radio Amateur Radio Society, POB 3, Waseca, MN 56093

FOR SALE: Used technical books - radio, electronics, math, military, magazines, etc. List: $1 (stamps OK). Softwave, 2 Dept. ER, 1515 Sashabaw, Ortonville, MI 48462

FOR SALE: Repair/restoration of vintage Drakem EFJ, Collins & others. Please call for info. Dee, W4PNT, (540) 949-8300

FOR TRADE: Two good RCA 833A's for one Taylor 833A. John H. Walker Jr., 16112 W. 125th St., Olathe, KS 66062. (913) 782-6455

FOR SALE: B&W 5100/5100B VFO dial overlays, super quality - $10 postpaid. Marcus Frisch, WA9IXP, Box 28803, Greenfield, WI 53228-0803.

FOR SALE: National NC-46, some paint blemishes, working poorly - $99; National military RBL-6 VLF rcvr, nice but in unorig. cabinet - $160; URM-25F, missing accessories, otherwise good, orig. manual - $69; Astatic 10DA mic (gray) - $35; ARC-2 manual reprint - $34; 1935 ARRL Handbook, cover loose - $45; military & vintage literature, 2-stamp LSASE for list. Don Merz, N3RHT, 47 Hazel Dr., Pittsburgh, PA 15228. (412) 234-8819.

FOR SALE: Consignment auction Sat. Sept. 21st, Lexington, Nebr. Equipment check-in 8:30 AM. Sale start, 11:30 AM. Some units already listed: HQ 170 rcvr; HT 32 xmtr; QSTs, tubes, parts etc. List updated weekly & listed on area BBSs. For more info contact Gary Reiss, WAØJRM, Rt1, Box 141, Wilcox, NE 68982.

FOR SALE: Several Hallicrafters S38, S38ABC's unchecked w/manual - $85, shp'd USA; Johnson Valiant - $325; Ranger - $250; TX1 Apache, mint $275; TX10 Marauder, mint - $200; HT32, HT32A - $145; HT18 - $125; Harvey-Wells TBS5OD - $125; Dow relays - $20-$35. Much more, many ARRL Handbooks. LSASE for list. WA7IHN, POB 442, Aumsville, OR 97325. (503) 749-1149, after 5pm PDT

FOR SALE: WW II Navy panadapter RBU2 - $80; Rycomm VLF rcvr - $80; WW II Navy VHF field strength meter TS-587/U & plug in heads - $100; Knight T-60 - $50; VF1 VFO - $50; R-388 Collins rcvr (fixer) - $100. Ed Hammond, POB 390, Buckfield, ME 04220. (207) 336-2858

FOR SALE: HT-18 xmtr w/manual, exc condx - $100. I ship CONUS. Fred, WØBMT, 205 E. 4th St., Neligh, NE 68756. (402) 887-5201

FOR SALE: Doolittle-Faulkner 250W broadcast xmtr, circa 1935. Send SASE for photo & data. G. Peterson, 3288 Snadstone Ln., Rapid City, SD 57701.

TRADE: OSS SST-1 for SSR-1. **FOR SALE:** 100V 600 L, HT-33. All exc condx. Gary Cain, POB 521, Shakopee, MN 55379. (612) 496-3794

FOR SALE: Homemade galena xtal radios & parts. Write for details. L. Gardner, 458 Two Mile Creek Rd., Tonawanda, NY 14150. (716) 873-0447

FOR SALE: Tube radios and amps. Send LSASE for list. Hoover Noonan, Rt. 1, Box 187, Pineland, SC 29934. (803) 726-5762

FOR SALE: BC-610 I xmtr w/BC-614; 1 speech amp w/patch cord also latest TN-339 antenna tuner; 2 spare 250TH mod tubes also all output coils for 160 to 15 meters & some spare coils. Goes to best offer but as last resort will sell major assembles. RE-pwr sply modulator, RF decks, speech amp, ant. tuner, no requests for smaller items such as xfmr's, caps & meters, please. **WANTED:** Grid dipper; issues of Ham Radio magazine, 1 issue to complete collection. I will pay packing/shpg charges on these items. J. Davis, AB5LL, POB 375, Hardy, AR 72542. (501) 257-2567

FOR SALE: If Jim Hanlon's article on the RME-45 in July ER whetted your appetite, I have a nice one w/matching spkr, manual photocopy. Cabinets & panels were disassembled & resprayed. Slight dial slip as mentioned in article - $180 + UPS. Gus Stellwag, 117 Edgewood Dr., Orangeburg, NY 10962. (914) 359-0769

FOR SALE: Morrow MB580A & MB585 xmtr's, complete, unmodified, rough cases - $50 ea; Johnson 250-39 T/R switch, exc - $60; Heath QF-1 Q-mult - $25; Heath unbuilt keyer HD-1410, no book - $50. Berkemeyer, MO, (314) 394-0441.

FOR SALE: Heath HD15 phone patch, manual, exc - $25. **WANTED:** Hallicrafters SR400 parts, TS413CU signal generator manual. Bill, KE7KK, 6712 Lake Dr., Grand Forks, ND 58201. (701) 772-6531

FOR SALE: Heath digital electronic course w/trainer, all parts, w/meter cost $270 will sell for $120. I pay UPS. Daniel Seidler, 3721 W. 80 St., Chicago, IL 60652. (312) 284-8221

FOR SALE: Drake R-8 rcvr, exc - $650; Conar 400 xmtr (built by Howard S. Pyle), VG - $75; Magnum Six RF speech processor for Drake 4-line - $65; new SX-88 band selector drive belts - $25/or 2 for $40. Jim Jorgensen, K9RJ, 1709 Oxnard, Downers Grove, IL 60516. (630) 852-4704

FOR SALE: McKay/Dymek DR55 rcvr 50 kHz, 29.7 Collins mechanical filters - $300. Geoff Greer, 1530 Hampton, Mt. Clemens, MI 48043. (810) 465-1844

FOR SALE: New Release: Send 2-stamp LSASE for Olde Tyme Radio's latest flyer, No. 196 to: Olde Tyme Radio Company, 2445 Lyttonsville Rd. Ste 317, Silver Spring, MD 20910. Ph/FAX 301-578-5280

FOR SALE: 75A-4 MHz drum decals, 20.5 or 20.8 MHz (you specify), buff color, install instructions - $8.50 ppd. W3HM, Rt 3 Box 712, Harpers ferry, WV 25425

FOR SALE: R-390A orig. Dec. 1961 maintenance manual TM 11-5820-358-35, 189 pgs. - $28 incl. priority mail. Aben, POB 4118, Jersey City, NJ 07304

FOR SALE: New variable cap, 347 pF, 0.075 spacing, similar to Johnson 154-10 - $20 + shpg. Earl, K6GPB, CA, (707) 764-3141.

FOR SALE: Fisher K10 Spacexpander tube reverb - $100; mic's: Turner +2, +3, super sidekick - $60 ea; NIB Turner 350C - $50. N1FRX, ME, (207) 834-6273.

FOR SALE: 833A pulls - $50 ea, 5 for $200. Berk Berkemeyer, MO, (314) 394-0441.

FOR SALE: Paragon DA-2 detector amplifier, nice cosmetic conds. Prefer trade for Paragon 10-R RF amplifier. Pat Stewart, W7GVC, 1404 Ruth Ave., Walla Walla, WA 99362-3558. (509) 525-1699

FOR SALE: Johnson Viking Ranger I, re tubed/caped, PTT, manual, esc. - $350, PU only. Jim Riff, K9JSC, 81 N. Ela Rd., Barrington, IL 60010. (847) 576-7832

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

FOR SALE: Collins 51J series drum overlay - $10 ea, specify which. Ron Hankins, KK4PK, 555 Seminole Woods Blvd., Geneva, FL 32732. (407) 349-9150

FOR SALE: Misc. military equipment & accessories; ham/military manuals. List available. Henry, KD6KWH, POB 5846, Santa Rosa, CA 95402. (707) 544-5179

FOR SALE: 2 PRC-8 backpack radio sets w/ matching VRC-8 or -16 radio set. All government reconditioned w/NOS accessories. Includes: 2 of each RT-174, CY-744 case, AT-271 & AT-272 antennas, AB-129 spring, ST-102 harness, M-1945 suspenders, H-33 handset, CW-216 bag & combat belt; also RT-66, PP-109 pwr sply; MT-299 mounting; CX-1211 dog bone; H-33 handset; CW-329 canvas cover; R-108 rcvr's; PP-281 pwr sply - $600 OBO + shpg. Bob Bakinowski, 1524 Saint Tropaz, Tucson, AZ 85713. (520) 624-8029

FOR SALE: Heath DX60B w/HG10 VFO; 2 Viking II w/122 VFO; RCA AR88 w/spares. Michael H. Wilke, WB4AQL, 215 Dale St., Rossville, GA 30741. (706) 861-3070

FOR SALE: Collins 51J4 - $400; Collins 32V1 - $300. Both in good conds. Cash, PU only. Buffalo, NY area. Richard, NY, (716) 684-0283.

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

WANTED: Info on the old Allied Radio in Chicago. I'm researching the company for an article in ER. Need anectodes, stories, history, etc. Kurt H. Miska, N8WGW, 3488 Wagner Woods Ct., Ann Arbor, MI 48103. (810) 641-0044 wk. FAX (810) 641-1718. 76247,1422@compuserve.com

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

WANTED: Old tube amps & xfmr's by Western Electric, UTC, Acro, Peerless, Thordarson; Jensen, JBL, EV, Altec, WE spkr's. Mike Somers, 2432 W. Frago, Chicago, IL 60645. (312) 338-0153

WANTED: HF-380, 451S1, AC-3814. Koji Mitoshi, Japan. TEL/FAX: 011-81475-24-9115, e-mail: byj01726@niftyserve.or.jp

WANTED: CRT-3RP1A for the Heath SB-614 station monitor. KØRTJ, 1522 B Ave. NW, Cedar Rapids, IA 52405. (319) 362-6462

WANTED: Tnxs to all for help w/S-76/Ranger quest now a few more "toys" are desired. HW-8, HQ-1 hybrid mini Quad & HT-18. Did anyone ever convert an S-53A to ham band only coverage? Bill Bowes, N7MOB, WA, (206) 839-8591.

WANTED: Hallicrafters HT-1, HT-9, HT-4; National SW3 model 1, 6 & 2 volt versions; other pre 1950 ham gear. Dean Showalter, WA6PJR, 72 Buckboard Rd., Tijeras, NM 87059.

WANTED: Manuals for Lafayette VFO model HE-74 & Geloso VFO model 4/102-V. Chuck Maas, WØIUH, 9917 Irving Ave. S., Bloomington, MN 55431. (612) 888-7104

WANTED: 6 kHz mechanical filter for 51J4, Collins model #F500B60; Harvey Wells R-9, R-9A rcvr. Chuck, POB 369, Bolton, MA 01720. (508) 779-5051

WANTED: Mics by Altec, Neumann, AKG, WE, Sony, any vintage; tube compressors/limiters; will trade my rare NOS tubes for mics. Mike States, Box 81485, Fairbanks, AK 99708. (907) 456-3419 ph/fx

WANTED: Manuals, Squires Sanders SS1BS; Allied Knight KE-687 sweep gen. Weber, 4845 W. 107th St., Oak Lawn, IL 60453-5252

WANTED: Kleinschmidt teleprinter models: 311, 321, (AN/FGC-40, AN/GGC-16, AN/UGC-39...) Tom Kleinschmidt, 506 N. Maple St., Prospect Hts., IL 60070-1321. (847) 255-8128

WANTED: SP400, EH Scott rcvrs, only in very good condx. Jose Congas, EA4JL. Contact in the States, Kurt Keller, CT, (203) 431-6850.

WANTED: Military technical manuals w/respect to space diversity reception; R390/391 or SP600 related. Peter, NY, (212) 725-7163

WANTED: Information, techniques & reference materials on solid state VHF & UHF super-regenerative rcvrs. Stuart, KI6QP, 308 Nevada St., Redwood City, CA 94062. (415) 369-0575

WANTED: EF Johnson Hamalogs & amateur radio catalogs, 1950-60s; manual SB-610. Bruce Hering, 41120 State Hwy 13, Waseca, MN 56093. (507) 835-5619

WANTED: XCU-303, XCU-300 or similar xtal calibrator for NC-303 rcvr; Heath DF-2 Navigator rcvr. Al Kaiser, W3LEQ, 713 Marlowe Rd., Cherry Hill, NJ 08003-1551. (609) 424-5387

WANTED: B & K 1801 counter - need diagram to get mine working again, Please. K2LGO, Box 158, River Head, NY, 11901.

WANTED: Drake 1A. Mike, KE6HD, 310 Houston Court, Danville, CA 94526. (510) 831-1051, FX - 1220

WANTED: Working homebrew tube type superhet ham band rcvr's from QST or handbook articles. Louis D'Antuono, 8802 Ridge Blvd., Brooklyn, NY 11209. (718) 748-9612

WANTED: Triplett 630, PLK analog meter, clean, like new condx., all working order. Joe, W6CAS, (916) 731-8261.

WANTED: Help! Need schematics/owners manual/tech manual for laboratory-style tube tester Weston model 686 -type 9C-serial 628. **FOR SALE:** TU coils for BC 610. Send for list - have 40 coils!! Barry Nadel, POB 29303, San Francisco, CA 94129. (415) 346-3825. FX 346-0468

WANTED: 465 kc xtal in Hallicrafters plug-in holder; orig. ins for Hallicrafters S-1. Bill Ross, KY9M, 875 Gordon Terr., Winnetka, IL 60093. (847) 441-6462

WANTED: Schematic, mods, anything for Altec 436C compressor/limiter, replacement caps for Black Cats? Vincent Tese, WA2UXO, Cherokee Station Box 20597, New York, NY 10021-0071.

WANTED: GPR 90, 91, 92; Hallicrafters SX-88; Eddystone rcvr's. James B. Geer, 1013 Overhill, Bedford, TX 76022-7206. (817) 540-4331

WANTED: T-368 exciter; 6LF6 tube(s). Charles, W8KUX, 11203 Waycross Way, Kensington, MD 20895. (301) 942-7043

FOR SALE: Collins 136B-1 noise blanker for KWM-1 xcvr - $135. Peter Brickey, KD6KDR, CA, (408) 353-1925.

FOR SALE: Liquidating equipment from K2KUC: KLM, Drake, Clegg, Kenwood, Icom & Yaesu gear for HF, 144 & 220; Heath & other test equipment plus misc items. Please send SASE for list to B. Novak, 85 Greendale, Clifton, NJ 07013. For tech questions call of fax Ken, WB9OZR, NY, (212) 288-1310, FX 288-3070, will send list via fax if requested.

FOR SALE: Hallicrafters S-27 - $95; Lafayette HA-800B 6 band rcvr - $45; Clegg-Thor 6 meter xcvr - $65. Pete Cullum, KØWRX, 1332 Harlem Blvd., Rockford, IL 61103. (815) 965-6677

FOR SALE: SW-3 plug-in coil forms; WD-11 replacement tubes; 1629 adapters; WD-11 adapters; test equipment & literature. SASE for info. James Fred, RR1, Box 41, Cutler, IN 46920.

FOR SALE: Coming Soon: Aluminum can electrolytics & FB-7 coil forms. SASE for info. James Fred, RR1, Box 41, Cutler, IN 46920.

FOR SALE: New list -hundreds of manuals, schematics and service information. Send 2-stamp LSASE. David Crowell, KA1EDP, 40 Briarwood Rd., North Scituate, RI 02857-2805. (401) 934-1845

FOR SALE: Handbooks, exc condx. '54, '56, '57, '58, '59 - $15 ea ppd. Ken, WB9OZR, 50 E. 79th St., New York, NY 10021.

FOR SALE: "Glass Audio" DuKane theatre amps, one 400 watt & two 250 watt. Bob, KBØBY, KS, (913) 823-8455.

FOR SALE: Johnson Desk KW, exc. condx. - make offer. John Storie, W7KPA, 2445 S. Hillside Dr., Springfield, MO 65804. (417) 889-0233

FOR SALE: Heath Mohican w/manual in exc condx., no scratches - $125 + shpg. Bob Mitchum, N9WEZ, IN, (317) 881-9083

FOR SALE: Money back guarantee on classic xmtrs, rcvrs, xcvrs, accessories. SASE list. Ed Clink, WA9PFB, 1285 New Salem Church Rd., New Berlin, IL 62670.

FOR SALE: Collins 51S-1 (WE) w/case, matching 312B-3 spkr & orig. manual, exc condx - $1500. All + UPS. Ron, KC6WTG, POB 783, Santa Rosa, CA 95402. (707) 539-8319

FOR SALE: NIB Taylor T55 - $20; NIB Eimac 35T - $15; Harvey-Wells Senior GC - $20. + shpg. Thomas N. Berbari, 870 Wales Rd. NE, Massillon, OH 44646.

WANTED

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

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

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

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

WANTED: ARC51, ARC164, ARN83, ARN118, ARN127, SST181X, KY28, Wilcox 807, radios, mounts, cables, manuals. James Treherne, 11909 Chapel Rd., Clifton, VA 20124. (703) 830-6272

WANTED: 1940's, 1950's Radio News & Radio Craft magazines; Hallicrafters SR-46, SR-46A. Al Bernard, NI4Q, PO Box 690098, Orlando, FL 32869-0098. (407) 351-5536

WANTED: Hallicrafters HT-40, good working condx please. Joseph Falcone, AA8HV, 3000 Town Center, Ste 2370, Southfield, MI 48075. (810) 357-6610

WANTED: Heath equip.: AC-1 antenna coupler; CO-1 & DD-16 code practice oscillators; AT-1 xmtr & HD-20 xtal calibrator. Pete Cullum, KØWRX, 1332 Harlem Blvd. Rockford, IL 61103. (815) 965-6677

WANTED: 8R1 calibrator for 75A3; 75A3/2 parts; 51S1 knobs; telegraphy items. Brian Roberts, K9VKY, 3068 Evergreen Rd., Pittsburgh, PA 15237. (412) 931-4646

WANTED: ARC/5 equipment, R25 1.5-3 Mc rcvr; T17, T18 xmtr. Pete Hamersma, WB2JWU, 87 Philip Ave., Elmwood Park, NJ 07407.

WANTED: Huge Navy equipment: shipboard & shore radio, radar, & sonar, mint thru junkers. William Donzelli, 304 S. Chester Ave., Park Ridge, IL 60068. (847) 825-2630, integrat@usr.com

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WANTED: TMC GPR 92; Hallicrafters SX28, SX42 rcvrs, collector quality, complete. John, NE6G, 7495 Gunter Rd., Pensacola, FL 32526. (904) 944-6563

WANTED: Mics: Shure CR80, 707A, 520SL, 705, 545, 54PE; Turner BX/CX, BD/CD; Astatic T-3. All condx's. Also mic parts, elements, etc. Tom Ellis, Box 140093, Dallas, TX 75214. (214) 328-3225/FAX 328-4217

WANTED: SP400, RME & EH Scott radios, only in very good condx. EA4JL, contact in the States, Kurt Keller, CT. (203) 431-6850.

WANTED: Military instruction manual, orig. or copy for resistance bridge, ZM-4 B/U. Ed, W3WDF, 8245 Garden Oaks Dr., San Antonio, TX 78266-1710. (210) 651-9348, call collect.

WANTED: Collins F455C-60 (6 kc) 75A3 filter; main/bandspread tuning knob for 520R. Bill Smith, W5USM, CBA or (214) 530-3116.

WANTED: Heath DX100 knobs. Please help, no reasonable price refused. Lee Bahr, WØVT, 914 Golden Bear Ln., Kingwood, TX 77339. (713) 359-5284

WANTED: Mics: Shure 330, 300, 707A, 545, 705, CR80; Astatic T-3; EV605, 641; Turner BX/BD, CX/CD, VT-73. Good condx., working or not - ready to buy! Tom Ellis, Box 140093, Dallas, TX 75214. (214) 328-3225. FAX 328-4217

WANTED: Manual for R-1051C, D, E, F, G, H version, RT-618B/AM3007, ARC-133/AT-440 1 kw amp, G-133/(not 51S1), & units for Harris RF amp HFL - 1000/WPS, control head/914B3 for 635V1, Collins amp 204 HI & C-733 for ARR-15A; tuning knobs of PA loading, PA tuning for KWS-1; excellent SP600JX, R-389/URR & 51S1. Mitsugu Shigaki, JA6IBX, 2825-2 Jozan Kamidai Machi, Kumamoto, 860 Japan. FAX (0) 96 -329-4601. e-mail inet#fle83163@pcvan.or.jp

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WANTED: BC 614 speech amp & J70 control box for BC610H xmtr. Phil Epstein, AAØTK, 3446 Columbus Ave., Minneapolis, MN 55407. (612) 822-6369

WANTED: Will pay premium prices for unassembled Heath rigs: HW-99, HW-5400, HW-101, SB-104A, etc. Gary, N7EKX, WA. (206) 848-4748.

WANTED: Millen 565 or 595 tuner; Heath CR-1 xtal rcvr. Charles R. Glover, 2700 Ponderosa #137, Camarillo, CA 93010. (805) 389-1520

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

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

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

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

WANTED: Frequency meters & pwr sply's LM10/13/14/21 & BC221. David Boardman, 10 Lemaistre, Sainte-Foy, Quebec G2G 1B4. Canada (418) 872-4552

WANTED: Sylvania receiving tube types 29, 69, and 70. Jim Cross, 3246 Floridale Lane, Cincinnati, OH 45239-6203, (513) 385-3855.

WANTED: ART-13 components, reasonable condition, will pick up in Texas area. E-mail john_stott@mail.utexas.edu

WANTED: Knight R-195 rcvr & Knight Star Roamer II. Dave, WB4KPD, 106 Rowe Ave. Wilson, NC 27893. (919) 291-2595.

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

WANTED: To buy any lunch boxs & related items. Arthur Fritz, N3SFE, 104 2nd St., Montgomery, PA 17752. (717) 547-2674

WANTED: WW II Japanese military radio of any kind; pre-war Japanese QSL cards. Takashi Doi, 1-21-4 Minamidai, Seyaku, Yokohama, Japan. FAX: 011-8145-301-8069

WANTED: WW II Japanese xmtrs & rcvrs (parts, plug-in coils) for restoration & ER articles. Ken Lakin, KD6B, 63140 Britta St., Ste. C106, Bend, OR 97701. (503) 923-1013. klakin@aol.com

WANTED: Heath HX-20, dead or alive. Gene Peroni, KA6NNR, POB 58003, Philadelphia, PA 19102. (215) 665-6182 days

WANTED: Books - How to Build Working Digital Computers, Alcosser; Microcomputer Design, Martin (1976); Digital Computer Electronics, Malvino. Dave Dameron, KG6BP, 819 Boundary Pl., Manhattan Beach, CA 90266-6621. (310) 318-5311

WANTED: Yaesu FRDX-400 "Super Deluxe" rcvr, FR-100B rcvr-spkr's. John, (907) 337-9157, Alaska time (PST)

WANTED: Stick on letters to display your call in a Heath SB-104 or HW-104. Letter needed: WB2FOU. Marty, NJ, (609) 466-4519.

WANTED: R25/ARC5 1.5-3Mc rcvr, MT65/ARC5 3 rcvr rack; TBY manual. Pete Hamersma, WB2JWU, 87 Philip Ave., Elmwood Park, NJ 07407.

WANTED: Rcvr's: Guthman U-17, U-50; cabinet for RME-84. H. Mohr, W3NCX, 1005 W. Wyoming, Allentown, PA 18103.

FOR SALE: Johnson T/R switch - $50. Ed Cuevas, N5BFW, 7902 Creek Trail, San Antonio, TX 78250. (210) 684-9754 eves.

FOR SALE: Prop pitch motor. Francis Waggoner, W2PTI, 268 Barben Ave., Watertown, NY 13601. (315) 788-1621

FOR SALE: RCA limiter model 86A1 - $75 + shpg. Jim, W8HPL, Alaska time, (614) 927-2592.

FOR SALE: Hallicrafter S-38 - $60; Globe DSB-100 - $65; Drake MS-4 - $40; AC-4 - $90; National NCXA - $55; Drake/Collins xtals - $8. WA1APX/8, MI, (810) 781-9717

FOR SALE: HP606A, 50 kHz-65 MHz, sig gen w/ free frequency counter - $125; HP5245L/5254C, 3 gHz counter - $98; HP5300/5303/5308/5310 frequency counters, 600 MHz, nicads, case, exc, all for - $225; HP1710A, 200 MHz, dual trace scope - $250; HP654, 10 Hz-10 MHz, solid state oscillator, calibrated/metered output, multiple output impedances - $148; much more, list-LSASE. Kirk Ellis, KK4YP, 203 Edgebrook Dr., Pikeville, NC 27863. (919) 242-6000 eves

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FOR SALE: 1937 Frank Jones Radio Handbook, exc condx. - $50. Joe Moraine, N5UX, 3700 Cliffwood Dr., Bedford, TX 76021. (817) 281-1128

FOR SALE: Rare Collins R-389/URR low frequency rcvr, S/N 289, exc condx. & performance - $450. Jeff Holmquest, K2EWM, 58 Saddle Shop Rd., Ringoes, NJ 08551. (908) 782-2346

FOR SALE: R-390A/URR orig. 1961 maintenance manual, TM 11-5820-358-35, 189 pgs - $28 incl. priority mail. Aben, POB 4118, Jersey City, NJ 07304.

FOR SALE: HW-16 - $65; HP-10 - $15; HP-606A sig gen, exc. - $100. **WANTED:** Command set rcvr's. Dave, W1DWZ, MA, (508) 378-3619

FOR SALE: Homebrewers, custom chassis & panel fabrication, 15 years prototype tech experience, vacuum tube literate. Brian, KA9FGW, IL, (708) 487-5359/FAX 487-5424.

FOR SALE: Tube list, new & used, wide variety audio, ham. Recently expanded. SASE 52¢. Bill McCombs, WB0WNQ, 10532 Bartlett Ct., Wichita, KS 67212-1212.

FOR SALE: Drake C-line, all filters, noise-blanker manuals, boxes, exc - $625; Drake B-line, manuals, boxes, exc - $350; Drake TR-7, PS-7, filters, noise-blanker, boxes, manuals, exc - $650; Drake TR-4C, RV-4C, noise blanker, boxes, manuals, exc. - $500. All + shpg. Richard Lucchesi, WA2RQY, 941 N. Park Ave., N. Massapequa, NY 11758. (516) 798-1230

FOR SALE: ARC rcvr 46104 1.5-3 MHz - $60. **WANTED:** FRR-520 rcvr, 16-32 MHz plug-in. Ken Kolthoff, 5753 David Pl., Fairfield, OH 45014. (513) 858-2161

FOR SALE: 32S3, 75S3B round, CW filter, orig. manuals, 516F2 - $1300; 75S3B, 32S1, 516F2, CW filter, manuals - $950. Fred, W6YKM, CA, (209) 296-5990 eves.

FOR SALE: Surplus radio conversion manual Vol. 2, Evenson & Beach - $20 ppd. R. J. Eastwick, N2AWC, 224 Chestnut St., Haddonfield, NJ 08033. (609) 429-2477

FOR SALE: Vintage equipment manuals starting at - $5; Hallicrafters, Johnson, WRL, others. SASE for list. DSM Diversified, 909 Walnut St., Erie, PA 16502.

FOR SALE: Repair of TV-7 tube testers w/ calibration: I will fix & then verify calibration of your TV-7 tube tester for $45 + all shpg or return at no charge. Daniel Nelson, 1025 E. Desert Ln., Phoenix, AZ 85040. (602) 243-7421 eves. djn@indirect.com

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FOR SALE: Heath: Sixer - $55; Twoer - $55; VF-1 VFO - $60; HR-1680 & spkr - $165; CW filter - $50; IT-121 transistor tester - $45; HP-23 - $65; HD-1426 - $15; Globe VHF-62 - $115; others, request list. Richard Prester, 131 Ridge Rd., West Milford, NJ 07480. (201) 728-2454

FOR SALE: Johnson Viking Ranger w/manual & D-104 mic - $200 + shpg. Richard, WA2TUM, NJ, (908) 968-1452.

FOR SALE: Military frequency indicating unit, model LM-13 120- to 20,000 kc ,w/home brew AC sply, manual - $25. Don, TX, (806) 352-4776 eves.

FOR SALE: TV-2B/U test set, good condx, clean, spares, manual - $250 + shpg. Don, WA5BBS, 46 Arbor Oaks Dr, N. Little Rock, AR 72120. (501) 835-5614, dr@cei.net

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FOR SALE: Globe Matcher Jr., AT3, orig. & good condx - $35.00 plus UPS. Pete, WB2BYQ (201) 934-0321.

FOR SALE/TRADE: SW-3 w/2 coil sets; FB-7 w/ 1 coil set. **WANTED:** National manuals, catalogs, etc. Hank, 805-498-8907 or QuailHill@aol.com

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FOR SALE: "Teletype" T-shirts. The Teletype Corporation's "T" symbol in black on a yellow (what else?) Hanes shirt - $15 ppd. Sizes L or XL only. Jack, WA2HWJ, NJ (201) 927-7784.

FOR SALE: New orig. PJ-068 mic plugs for Collins S-line/KWM-2A/HF-380 shp'd in USA - $8 ea. Clint Hancock, KM6UJ, 6567 Ashfield Ct., San Jose, CA 95120-4502.

FOR SALE: Legends of Amateur Radio, a 42 minute video featuring W6HX, K6OJ and W6EA. "Tall Tales and Big Antennas", produced by the Southern California DX club "...enjoyed running it" - Hugh Cassidy, WA6AUD - $10 + $3 shpg. Please send check and make payable to: Harvey Laidman, N6HL, 4923 Encino Terrace, Encino, CA 91316.

FOR SALE: Collins WE S-line 75S3/B 500 C CW, 32S3, 312B4, 516F2, 30L-1, all cables/manual - $1800; KWM 2/A, 312B5, 516F2, 30L1 cables/ manual - $1800; KWM 2/PM2, CC-2 - $750 shpd; R390/A tech man TM-11-5820-358-35 1961 w/ 3TF7 ballast NIB - $40 shpd; military CW rig 100AC & 6 VDC pwr, GRC 109 TX & RX 2 to 24 Mc w/manual, NC 183 - $200 shp'd; HW16/HG10 - $150 shpd; Globe Scout 680 w/Lafayette HE10 RX - $100 + shpg; keyers, T/R SW, tubes, etc., call anytime. Joe, K2QPR, FL, (561) 220-7362

FOR SALE: NC-240D w/spkr - $225; Measurements model 59 GDO - $65; Johnson Viking mobile (2), Viking mobile VFO & mobile PS - $300; GRC-109A NIB, accessories & G-43/G handcrank generator - $500; Conair NRI model 400 xmtr & model 500 rcvr - $75; R-392 w/spkr & pwr connector - $175; Boonton model 101-B UHF GDM - $30; HP 803-A VHF bridge - $30; URM 25F, accessories - $100, shpd; URM-25D, accessories - $100 shpd; TCS ant. loading coil - $30; HB AM xmtr, pr 810's mod by 805's - trade, cash or whatever; Hallicrafters S-53A - $75. George Rancourt, K1ANX, MA, (413) 527-4304.

FOR SALE: B & W 5100B, exc - $350; 813 HB xmtr, HV PS & 300W mod xfmr - $250. Bill, N2WXJ, NY, (914) 356-6553.

FOR SALE: Collins AN/ARR-41; Eimac 4CX250 tubes & sockets; BC-375. Tom Brent, Box 1552, Sumas, WA 98295. (604) 826-4051

FOR SALE: Hallicrafters HT46 - $150; Hallicrafters S38 A&E - $50; Lafayette HE 45B 6 meter xcvr - $60. Prices include shpg. Jack, KL7GKY/Ø, ND, (701) 378-2736.

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

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

FOR SALE: M52 carbon mic, replaced T-17s, w/ PL68 plug, 6' cord, PTT, orig. manual, NIB - $15; HS-30 headsets, WW II dates, NIB w/extra earpieces, cordage, dessicant, instructions - $30 ea, 5 for $100. All plus UPS. **WANTED:** Military radio manuals, any date, quantity, etc. Military Marketing, Inc., Box 741, Norcross, GA 30071. (770) 729-9315

FOR SALE: All electronic repairs welcomed. Specializing in ham gear, qualified. Stocking Collins, Heath, etc. Tiki Electronics, 1564-62 Front St., Cuyahoga Falls, OH 44221. (330) 922-8454.

FOR SALE: Thousands of tested tubes w/ warranty, send for new list w/improved discounts & monthly specials. Both xmtr & rcvr tubes. I have acquired many common tubes recently. Buy those spare tubes for your tube radio, audio, ham & electronics, most tubes are used at about 33% of new, many are about $1. I have bunches of octal, older, 7 & 9 pin tubes. All tubes are tested on TV-7D tester & then boxed. I give a 30 day warranty. Send wants or SASE w/two stamps for list. Daniel Nelson, 1025 E. Desert Ln., Phoenix, AZ 85040. (602) 243-7421 eves. djn@indirect.com

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FOR SALE: Hallicrafters S-19R, SX-24, S-29; Hammarland HQ-110 w/clock; RME-45; Lafayette Star Roamer; more - SASE. Don Jeffrey, POB 1164, Monrovia CA 91017.

FOR SALE: RCA BTA-1MX AM KW xmtr, extra tubes - $1100 PU, $1600 crated/shpd 48 states; BC-939 ant. tuner - $200; DX-100 - $125. U-ship. Hank, KN6QI, CA, (818) 886-2382

HE'S BEEN FOOLING WITH HOLLOW-STATE RADIO SO LONG, I THINK IT'S GONE TO HIS HEAD

FOR SALE: Fiberglass rods, 5/8" dia., 13" long, UV resistant, good standoff insulators, twinlead spreaders, ten ppd - $10. Ron, K5YNR, NM, (505) 327-5646.

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

FOR SALE: Radio & electronics related books, 160 titles, call or write for list. Paul Washa, WØTOK, 4916 Three Points Blvd., Mound, MN 55364-1245. (612) 472-3389

FOR SALE/TRADE: SX25 $200, S20R $100 Both restored, working. **WANTED:** Heath VF1. Bob, AZ, (602) 816-0660, 5415414@mcimail.com

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FOR SALE: Exceptional Hallicrafters S38-B - $75; Collins 75A3 w/ Universal product detector, 2 filters & a fresh W3HM overhaul, outstanding - $600; Drake R4C with Sherwood 6/600 1st IF, dual 1st IF SSB, NB, .25, .5, 1.5 and AM filters; T4XC, MS4, AC4 and MN2000, package only - $900; ARRL handbooks 1945, 1946, 1949 hardbound - $50 each, softbound 1946, 1948, 1950, 1952, 1953, 1956, 1957, 1965 - $25 each, 1969, 1976, 1977 - $15 each; Collins KWS-1 ant relay, new - $75; National NC183 w/ spkr - $175. Wen, NV, (702) 297-1156

FOR SALE: Collins embroidered grey baseball caps, winged or meatball - $15 ea or both for $27. Outside US enquire. Mail check to Ridinger's Enterprise, 3487 Bayberry Dr., Chino Hills, CA 91709-2817.

FOR SALE: Compactron adapters - set of 2 adapters, which allow 9 pin & 12 pin compactron sweep tubes to be tested on TV-7 type tube testers. This lets popular tubes such as 6JB6, 6JE6, 6JF6, 6JM6, 6JS6, 6JU6, 6JZ6, 6KD6, 6KM6, 6KN6, 6LB6, 6LF6, 6LQ6, 6LR6, 6LX6, 6ME6, 6MJ6, 12BJ6, 20LF6, 21JS6, 23JS6, 24JE6, 27LF6, 30KD6, 40KD6, 8950, 7868 be tested on TV-7 testers which do not have compactron sockets. Tube test setup & test data are supplied for the TV-7 tester series only. This includes switch settings & bias values as well as minimum & 'as new' test values. 2 adapters as well as tube test info & pin-out conversion data are supplied. Please send - $25. Daniel Nelson, 1025 E. Desert Ln., Phoenix, AZ 85040. (602) 243-7421

FOR SALE: Several Hallicrafters S38, S38ABC's unchecked w/manual - $85, shp'd USA; Johnson Valiant - $325; Ranger - $250; TX1 Apache, mint $275; TX10 Marauder, mint - $200; HT32, HT32A - $145; HT18 - $125; Harvey-Wells TBS50D - $125; Dow relays - $20-$35. Much more, many ARRL Handbooks. LSASE for list. WA7IHN, POB 442, Aumsville, OR 97325. (503) 749-1149, eves

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FOR SALE: Collins repair. I specialize in S-line equipment. Reasonable, & work guaranteed. Steve, N6HK, Box 1136, Goleta, CA 93116. (805) 967-7466

WANTED: Dead or dying Johnson Viking I or II for restoration project. Collin Collier, N4TUA, GA, (912) 988-1276.

WANTED: Heath Lunchbox volume control knob; 1939 & 1955 ARRL handbooks. John Zitzelberger, WB6JJE, 1563 El Cerrito Dr., Thousand Oaks, CA 91362. (805) 379-1894

WANTED: April 1963 CQ magazine. James T. Schliestett, W4IMQ, POB 93, Cedartown, GA 30125. (770) 748-5968

WANTED: Globe Scout 66 or 65, must work perfect. Robert, 1107 Second Ave., Apt. 608, Redwood City, CA 94063. (415) 367-1660

WANTED: Henry, mint 2K-Ultra. Takashi Nakamura, JR7TEQ, 20-2 Midorigaoka Shiroishi, Miyagi 989-02 Japan. FAX: +81-224-26-1424

WANTED: SSB xtal bandpass filter, 915 kc (BC348). Mike, AC5P, POB 33, Bartlesville, OK 74005. (918) 333-2795

WANTED: Motorola/US Army Signal Corp radio set AN/TRC-22 or AN/TRC-28; xmtrs T-417/GR, T-416/GR. Tim, N3PFC, PA, (717) 323-4055

WANTED: TMC xmtg mode selector SBE-2; TMC PMO-5 VFO; TMC GPR-92 rcvr. Bill Marvin, KA2VJV, 2 Venice Rd., Patterson, NY 12563. (914) 279-5035

FOR SALE: "Introduction to Key Collecting", 64 page softcover illustrated guide - $11.95 ppd USA. Start now in this fascinating hobby. Artifax Books, Box 88-E, Maynard, MA 01754

FOR SALE: Classic gear - SASE for list. **WANTED:** Vintage rigs. The Radio Finder, Joel Thurtell, 11803 Priscilla, Plymouth, MI 48170. Tel/Fax (313) 454-1890

FOR SALE: Estate sale: Radio Vision English Commander, nice - $225; Galaxy V Mark III - $275 Swan 750 w/ps-U3 - $225; Johnson Viking/Valiant - $250; Heath monitor scope HO-10 - $45; National NC-155 to 183 type spkrs, large - $50; medium - $40; Eico 315 sig gen - $30; Echophone commercial, EC-1B, nice - $75 ea; EC-3 works terrific, exc - $150; National FB-7 near mint w/FB-7 ps & Red Diamond spkr w/3 sets coils - $650; National ACS/AGL rack for 12 coils - $75; Radio Shack 2020 scanner, nice - $125; Heath SB-102 w/ps spkr, manual exc - $165; SB-101 as above - $115; Precision appartus sig gen, nice - $45; huge lot of xmt'g tubes & ceramic sockets 803-814s, 866s, radar tubes, 6336 NIB, Taylor, HK, etc, many 211's - BO. All + UPS. Ask about rare tubes; many other items. Send 2-stamp SASE. Robert Enemark, W1EC, POB 1607, Duxbury, MA 02331. (617) 934-5043

FOR SALE: Compactron adapters, set of 2 adapters which allow 9 pin & 12 pin compactron sweep tubes to be tested on TV-7 type tube testers. This lets popular tubes such as 6JB6, 6JE6, 6JF6, 6JM6, 6JS6, 6JU6, 6JZ6, 6KD6, 6KM6, 6KN6, 6LB6, 6LF6, 6LQ6, 6LR6, 6LX6, 6MF6, 6MJ6, 12BJ6, 20LF6, 21JS6, 23JS6, 24JE6, 27LF6, 30KD6, 40KD6, 8950, 7868 be tested on TV-7 testers which do not have compactron sockets. Tube test setup & test data are supplied for the TV-7 tester series only. This includes switch settings & bias values as well as minimum & 'as new' test values. (2) adapters as well as tube test information & pin-out conversion data are supplied. Please send $25 to Daniel Nelson, 1025 E. Desert Ln., Phoenix, AZ 85040. (602) 243-7421 eves. djn@indirect.com

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FOR SALE: 500KHz Collins filters for the filter modifications described in the March and June 96 issues of ER. They are 3.5 KHz wide, centered at 501.5 KHz - $50 each plus $3 for priority mail. Ron Hankins KK4PK, 555 Seminole Woods Blvd., Geneva FL 32732. (407) 349-9150 E-mail rh8421@usa.net

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FOR SALE: Eico test gear; National NC-98, spkr, nice - $130; S-53A - $75; Stancor ST-203A, fair - $25. Sandy, W5TVW, (504)836-2134. w5tvw@juno.com.

WANTED: Heathkit, Eico, Fisher, Dynaco or similar tube audio amplifier in any condx. Mike Nowlen, WB4UKB, POB 1941, Herndon, VA 22070. (703) 716-1363

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

WANTED: Orig. tube-type CB radio operating/owners manuals; also tube-type CB radios. Walter Ryan, 7114 Geyser Ave., Reseda, CA 91335. (818) 344-8735

WANTED: Collins KW-1, 30S-1, KWS-1. WAØAKG, NE, (402) 464-8682

WANTED: Johnson Challenger, Adventurer, Navigator, good cosmetic condx. Doug Knoll, KA9IQA, 1400 4th Circle NE, Waseca, MN 56093. (507) 835-8821

WANTED: Matching spkr for NC-183D; manual for Globe Scout Deluxe. Clark Thompson, KD9QI (608) 251-0273, cmthomp1@facstaff.wisc.edu

WANTED: Manual or schematic Realistic, DX160 all band rcvr; dual IF(T1) #K26402-1 HQ170. Norm, W1CIX, POB 402, West Bridgewater, MA 02379. (508) 583-8349

WANTED: Manual for Navy RBH rcvr made by National; TBW &TCE xmtr's. Steve Finelli, N3NNG, 37 Stonecroft Dr., Easton, PA 18045. (610) 252-8211

WANTED: Meters for GRC-106,(RT-834,AM-3349 and MD-522A) WA3BZT Ed. White, 809 Seymour Road, Bear, DE 19701-1121. (302) 322-1313 ewhite@dtelunix.dtcc.edu

WANTED: Hallicrafters HT-32B xmtr, 4-400A tubes. Alan Gray, W3BV, (215) 795-0943, Fax 795-2046

WANTED: HeathGear, unassembled kits, catalogs and manuals. Bill Robbins, 5339 Chickadee Drive, Kalamazoo, MI 49002, (616) 375-7978. billrobb@serv01.net-link.net

WANTED

Vintage AM equipment for personal use. Must be collector quality or mint. Prefer Collins, will consider others. Bob Tapper, NØIMH, Box 61538, Denver, CO 80206. (303) 740-2272, FAX (303) 777-6491

WANTED: Watkins-Johnson or Communications Electronics Inc. info, catalogs, manuals or equipment. Terry O'Laughlin, WB9GVB, P.O. Box 3461, Madison, WI, 53704-0461, 608-244-3135

WANTED: Johnson Ranger; Johnson Desk KW. Willing to pay top $ for pristine condx. Lee, W9VTC, IL, (847) 439-4700 (d), 726-1660 (n).

WANTED: Reward paid for National SW-4, has 4 tubes but only one set of coils. Robert Enemark, W1EC, POB 1607, Duxbury, MA 02331. (617) 934-5043

WANTED: Globe King 500, A, B or C xmtrs, any condx., reasonably priced. Terry Collins, KB9AUP, 18 N. Tomahawk Ave., Tomahawk, WI 54487. (715) 453-3707 d, 453-4633 eves

WANTED: Cabinet for Heath HW-101 or junker. George Rancourt, K1ANX, MA, (413) 527-4304.

WANTED: Early or unusual telegraph keys, sounders, registers, etc; early wavemeters. Larry Nutting, K&KSW, 4025 Slate Ct, Santa Rosa, CA 95405. larryn@sonic.net.

WANTED: Specs or method of finding impedence of windings for modulation trans UTC LS845M. KA5SRB, (505) 824-2155

WANTED: BC-348, mint, prefer NIB but will accept real mint (not hamfest mint). Tom, (318) 989-3430, n5off@aol.com

WANTED: Hammarlund HQ-129X and Heathkit DX-40 w/VF-1. Must be nice, rebuilding my novice station. AC1Y, (860) 675-5566, angerb@connix.com

WANTED: Pwr xfmr for Hallicrafters HT32/37. Frank, WB4AYJ, (954) 472-9474.

FOR SALE: Tubes, new, 1 or 3000, 40% + off. SASE or e-mail for list. Jim Dillon, WL7CMQ, 201 Seward, Juneau, AK 99801. (907) 586-3223, beadgal@ptialaska.net

FOR SALE: Ultra-Mod & Taylor Super-Mod circuits allows up to 1500 watts positive peaks, each circuit instruction - $2 ea. WB8BEM, 410 Robinhood Dr., Florence, AL 35630.

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

FOR SALE: 75A-4 MHz drum decals, both old and new, buff color, install instructions - $8.50 ppd. W3HM, Rt#3, Box 712, Harpers Ferry, WV 25425.

FOR SALE: See July ER ad, most items still available. Two first-class stamps & mailing label for K7FF (ex KI6O) Mailorder Parts/Equipment List (contains recent additions). Derek, K7FF, 5191 Rimwood Dr., Fair Oaks, CA 95628. (916) 965-4904

FOR SALE: Hammarlund SP-600 JX26, 2 available, PU only, no shpg. Victor, KE6VHI, CA, (805) 583-4026

FOR SALE: H/P 410C owners: NIB panel meter - $30; 2-01C diodes - $7.50; Chicago CIS-1 input xfmr's - $6; 4CX250, etx. xhimneys - $4.50; KWM-2 meters - $30; 30L-1 xfmes - $90. Lowell Thomas, AA6ZD, POB 15026, Fresno, CA 93702. (209) 227-1605

FOR SALE: Collins 75A4 - $550; 270G3 - $150; 312B1 console - $495; KWM-2A cabinet - $30; National NC300 - $95; NC-200 - $295; Valiant cabinet - $65; Scott RB02 - $225; Heath IT-28 capacitor checker - $30; RF oscillator, IG-5280 - $45; Vectorscope IO-101 - $45; electronic switch ID101 - $35. Michael Behar, WM1O, 17 Gerlach Pl., Larchmont, NY 10538. (914) 834-7678

FOR SALE: Heath DX-20 - $55; VC-1 voltage calibrator - BO; PM-1 & PM-2 FSM - BO; HM-102 pwr & SWR meter - $35; HD-1426 FSM - $30; HR-10B - $60; unbuilt GD-39 ultrasonic alarm - BO; SBA-300-4 2 meter converter - $35 or BO; HW-100 w/new face plate - $150; Hammarlund HQ-170 - $150; Drake R-4B, T-4X, MS-4, AC-4 - $300, may split. All w/manual or copy. All + shpg. Larry, N4QY, 170 Heritage Ln., Salibury, NC 28147. (704) 633-3881

FOR SALE: Gates broadcast xmtr, set up for 160M - $1000; SX 100 - $200; Viking II & 122 VFO - $200. Steve, KA9QLF, IL, (217) 243-3920.

FOR SALE/TRADE: Xmt'g/rcv'g tubes, new & used. LSASE (52¢) for list. Many thousands added lately. I collect old & unique tubes of any type. WANTED: Taylor & Heintz-Kaufman types & large tubes from the old Eimac line; 152T through 2000T for display. John H. Walker Jr., 16112 W. 125th St., Olathe, KS 66062. (913) 782-6455

FOR SALE/TRADE: Heath HW-100 xcvr, HP 23 pwr sply & orig. manual - $150 or trade for Drake T-4XB xmtr & pwr sply. Dan, KO4RA, GA, (912) 452-1015 eves, EST.

FOR SALE: R390A carrier meter drift problems? Also, protect your mechanical filters. Easy to install parts kit and complete instructions - $29. WANTED: TMC CV-157 SSB adaptor. Chuck Rippel, WA4HHG, 2341 Herring Ditch Rd., Chesapeake, VA 23323. (804) 485-9660, crippel@exis.net

FOR SALE: Collins repair. I specialize in S-line equipment. Reasonable, & work guaranteed. Steve, N6HK, Box 1136, Goleta, CA 93116. (805) 967-7466

FOR SALE: Numerous old ham rcvrs & old components - SASE. Robert Enemark, W1EC, POB 1607, Duxbury, MA 02331.

FOR SALE/TRADE: Meissner signal shifter EX - $125; Millen NOS 90801 TX, Millen 90881 amp. WANTED: HRO-5 rcvr, Millen 90711 variarm VFO, Stancor 10p. Thanks! Tom Smith, N5AMA, 13034 Elmington Dr., Cypress, TX 77429-2062. (713) 376-3436 h, 957-6420 w

FOR SALE: Mod xfmr from BC-610, should be good for 3-400 watts - $45 + shpg. Tom Berry, K9ZVE, 1617 W. Highland, Chicago, IL 60660. (312) 262-5360

TRADE: 7027A, 829A & AX-9903 for AX-9909 & 6MJ6. Clyde, N7IOK, (520) 323-1120, csakir@juno.com

FOR SALE: Heath HW-101 w/pwr supply, great cosmetics, works fine - $100 + UPS. Bernie, WA6HDY, 300 James Way, Arroyo Grande, CA 93420. (805) 481-6558

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All back issues are available at $34 per year or $3.25 for individual copies. Buy the entire first 7 years (#1- 84) for $175, for a limited time. This price includes delivery in the U.S. Foreign orders please inquire.

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