

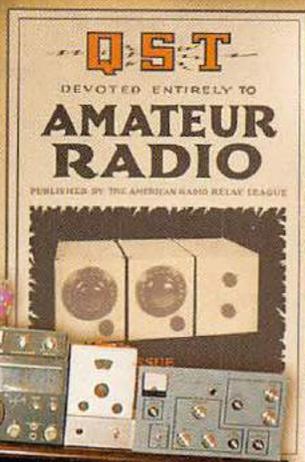
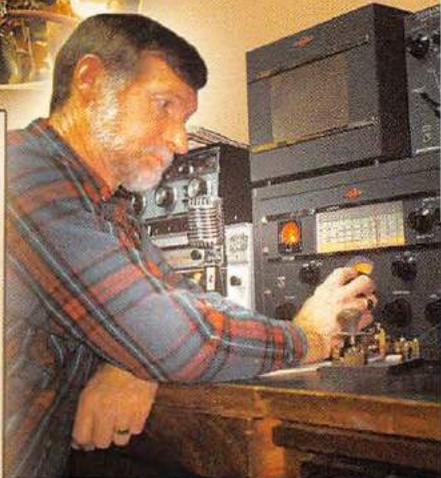
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ARRL'S



Vintage Radio

QST articles
about the lure of vintage
Amateur Radio gear



- Equipment
- Techniques
- Personal Experiences
- Restoration
- Classic Ads
- ...and more!

Published by:

ARRL The national association for
AMATEUR RADIO

ARRL's

Vintage Radio

Decades of Amateur Radio
history from the pages of *QST*

Compiled by Steve Ford, WB8IMY

Production: Michelle Bloom, WB1ENT
Paul Lappen

Cover Design: Sue Fagan

Proofreader: Kathy Ford



Published by:

ARRL *The national association for*
AMATEUR RADIO

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Classic QST Advertising

Foreword

Amateur Radio primarily concerns itself with present and future technology. However, to understand where we're headed, we need to understand where we've been. Looking backward is more than an act of nostalgia; it informs our future. Amateur Radio has a rich tradition that spans nearly a century, and it is one we should cherish.

In *ARRL's Vintage Radio Classics*, we've gathered a collection of vintage radio articles published in *QST* magazine between 1977 and 2003. In this group, we're proud to include the "Old Radio" columns by vintage radio expert John Dilks, K2TQN. John's columns debuted in the January 2000 *QST* and have been favorites ever since. Finally, we've added a selection of classic advertisements that have graced the pages of *QST* since its earliest days. These are particularly fascinating because they offer snapshots of Amateur Radio technology at various points in time.

Of course, what is "vintage" to one person is "just yesterday" to another. That's why the articles in this book cover such a diverse range of products and topics. Please take a few minutes to give us your comments and suggestions. There's a handy Feedback Form for this purpose at the back, or you can send e-mail to: pubsfdbk@arrl.org.

Our thanks to the many authors whose work appears in this book. Without their willingness to share their knowledge with the amateur community, *ARRL's Vintage Radio Classics* would not exist.

Dave Sumner, K1ZZ
Executive Vice President
Newington, Connecticut
March 2004

Amateur Radio and the Rise of SSB

The hams who were first to get on the air with single sideband created a revolution in Amateur Radio. Along the way, sideband would even affect the course of the Cold War.

The cover of the January 1948 issue of *QST* was, well, different. An oscilloscope was pictured, and though it was a piece of equipment few hams owned or were familiar with at the time, that wasn't what made the cover so unusual. Rather, it was the strange-looking modulated wave envelope displayed on its CRT screen. Or actually, only one side of the modulated wave envelope. Normally symmetrical about one axis, the envelope was missing one entire half. What was this all about?

Inside the issue, there was no "On The Cover" to explain the picture. Rather, there were an editorial and three articles all devoted to introducing hams to the arcane subject of "s.s.s.c."—single-sideband, suppressed carrier. The articles also discussed the messy state of the ham bands, clogged as they were with frequency-hogging AM signals often interfering with one another. "In the usual present-day snarl of 'phone interference," *QST* editorialized, "we have the piercing shrieks of heterodynes." It went so far as to predict boldly that "everything points to s.s.s.c. becoming the accepted amateur method in the near future." The three articles that appeared in the issue laid the groundwork for the transformation of Amateur Radio that was to come over the next quarter-century. For most hams, the strange-looking oscilloscope pattern on the cover was to be their first introduction to what would eventually come to be simply called "sideband" or "SSB."

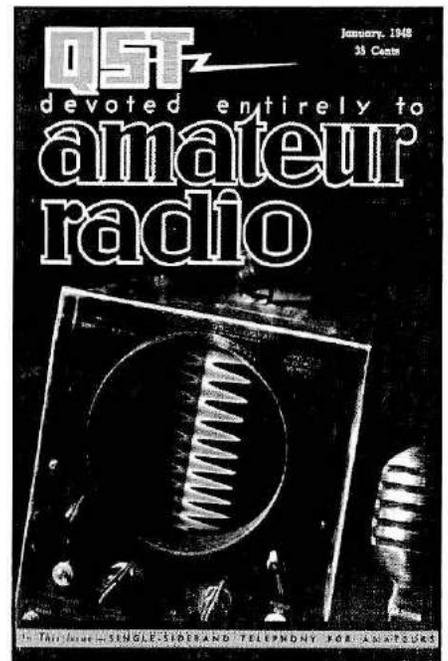
Enormous Impact

If there has been a technical advancement that distinguished ham radio over the past half-century, it would have to be single sideband. The move from AM to SSB would be as controversial in its time as the move from spark to CW had been in the 1920s. Sideband's impact has been enormous

and the changes it has created in Amateur Radio far-reaching. It is ubiquitous today, a standard feature on virtually every commercially produced piece of amateur equipment. And it isn't simply useful for voice communication; sideband technology is employed in computer modems, and vestigial sideband (VSB) has been developed for use in digital television.

The existence of sidebands as distinct from a carrier was first determined mathematically in 1914. A year later, John R. Carson, an engineer working for AT&T, invented sideband technology for use in long distance telephone carrier circuits as a means of increasing the number of calls that could be transmitted simultaneously. Carson's invention, which involved the use of filters to remove a carrier and one sideband while passing the other through, was patented in England that same year, but court litigation held up his US patent until 1923. In January of that year, the first experimental one-way transatlantic single sideband transmissions were made from Long Island, New York, to London, England. In 1927 a regular two-way transatlantic low-frequency radiotelephone circuit using sideband technology opened for commercial use at a cost of \$75 for a three-minute call (that's about \$760 in today's money!).

It wouldn't take hams long to take note of this new technology. A series of three articles on sideband by Robert Moore, W6DEI, appeared in the Amateur Radio magazine *R/9* in 1933 and 1934, and *QST* Technical Editor James Lamb, W1CEI, published the magazine's first article on the subject, "Background for Single-Side-Band 'Phone" in October 1935. An editorial introduction to his article noted that by "action of the 1933 A.R.R.L. Board Meeting, the technical staff of *QST* was in-



structed to investigate the feasibility of single-side-band carrierless 'phone transmission on amateur frequencies." Some sideband experimentation was carried out in the mid-1930s by a small group of hams,¹ but it was hampered by technological limitations of equipment at the time. World War II changed all of that, making enormous advances in radio technology. After hostilities ended and Amateur Radio resumed, there was no longer any technological reason for sideband to stay on the sidelines and a very pressing need for a communications mode that would occupy less bandwidth than did AM and so free up space on ham frequencies. Sideband was exactly what the doctor ordered, and a concerted push by the ARRL would effectively

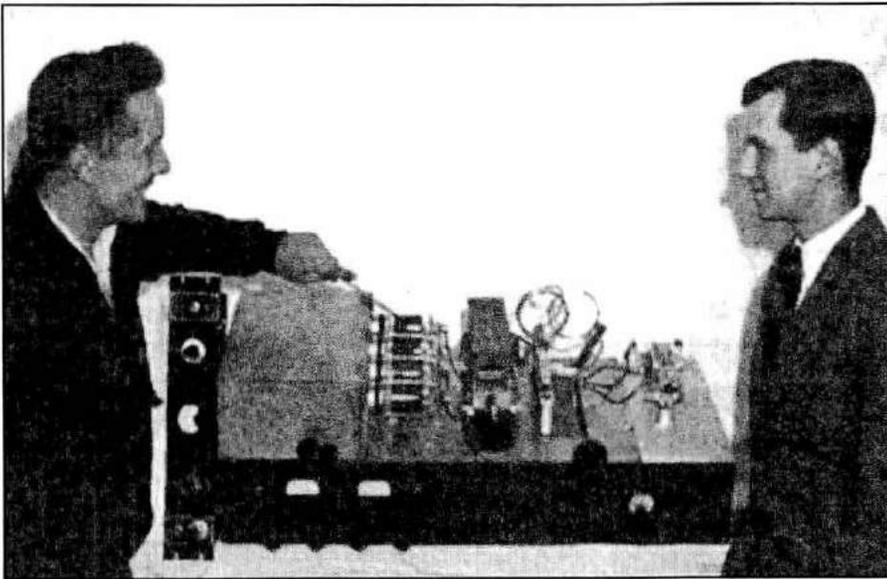


Figure 1—This photo, from the February 1948 issue of *QST*, was captioned: "Although full technical information on the single-sideband suppressed-carrier transmitter at W6YX is not available at this time, this photograph shows Dave Thomson, W6VQB, pointing out the final amplifier to Robert D. Smith, W6QUW, president of the Stanford Radio Club... The transmitter was designed by Oswald G. Villard, Jr, W6QYT, of the electrical engineering faculty at Stanford University."

spread the word, altering the course of ham radio.

W6QYT at Stanford

It was experimental sideband work begun in 1947 on the 75 and 20 meter bands at W6YX, the Stanford Radio Club at Stanford University in California² that inspired the series of January 1948 articles in *QST*. In the issue, Assistant Technical Editor Byron Goodman, W1DX, described this new mode of communicating in "What Is Single-Sideband Telephony?" In addition, Oswald Villard, W6QYT, of Stanford, explained the results of his club's test transmissions and informed hams how to go about tuning in these new signals ("it is very desirable to use the minimum r.f. gain setting when the b.f.o. is used for demodulation," he would write, advice repeated through many issues of *QST* for hams unaccustomed to tuning in these strange-sounding signals). Finally, Art Nichols, W0TQK, detailed the sideband rig he built to communicate with W6YX in "A Single-Sideband Transmitter for Amateur Operation." A follow-up Stray the following month showed a photo of the Stanford station. See Figure 1.

The following month, a full-page advertisement by the National Company in *QST* extolled the possibilities of duplex sideband. By April, *QST* Technical Editor George Grammer, W1DF, was able to prognosticate:

It may not be too much of an exaggeration to say that our present-day 'phone methods will be just as obsolete, a few years from now, as spark was a few years after c.w. got its start. "Old-fashioned 'phone" will eventually be something that

can be tolerated only where there is plenty of room for it.³

In July of the same year, Byron Goodman's column "On the Air with Single Sideband" debuted in *QST*, keeping hams informed of the increased sideband activity in the United States and around the world. The same issue also featured a full-page ad for tetrodes from Eitel-McCullough specifically aimed at sideband enthusiasts. See Figure 2. It was a sign that the radio industry was beginning to see the potential of a market in equipment for amateur sideband use.

Another sure sign of sideband's potential could be gauged by letters to the editor in *QST*. In October 1948, a writer decried "single-sideband gibberish," and accused the magazine of "trying to shove it down the throats of the ham fraternity." But more hams than not were open to the possibilities that sideband offered, realizing that it offered a solution to the very real problems that plagued the ham bands. "I personally have had no experience as yet with single sideband," wrote a Canadian ham in the December issue, "but anything that may relieve the overcrowded conditions of our bands today and make for QRM-free QSOs, I'm all for it."

Filter vs Phasing

The next year, "On the Air With Single Sideband" was discussing the merits of generating sideband signals with filter versus phasing systems. The former involved sharp filters and multiple frequency conversions, sophisticated technical requirements that many hams felt they couldn't achieve. But phasing systems, which used a 90° phase difference in two signals to balance one out while augmenting and

passing the other through, offered a simpler solution to getting a sideband rig on the air. Ralph V. L. Hartley of Western Electric, best known to hams for his invention of the Hartley oscillator circuit back in 1915, had patented a phasing SSB system in 1928, but Don Norgaard, W2KUJ, would pioneer its use in "A New Approach to Single Sideband" in the June 1948 *QST*. By April of 1950, the magazine would report that hams using phasing methods outnumbered those using filter 2 to 1.

Manufacturers began taking more notice. In the June 1950 *QST*, a full page ad from the Collins Radio Company claimed its 75A-1 receiver to be the "SSSC Receiver of the Year," and in January 1951, the magazine announced a commercially produced amateur sideband transmitter, the "SSB Jr.," new from Eldico. See Figure 3.

By April 1953 *QST* had reported a tally of over 300 US sideband stations active, and the first two-way 75 meter sideband transatlantic QSO. In November 1956, *QST* reported the first sideband awards for WAC and WAS (there were 48 states then). The first sideband DXCC had been accomplished a year earlier.

The Military Takes Note

In the mid-1950s, hams and amateur sideband actually had a hand in altering the course of the Cold War. General Curtis LeMay, W6EZV, was Commander of the Strategic Air Command (SAC), charged with deterrence of the Soviet nuclear threat. See Figure 4. New jet aircraft then being introduced were resulting in the elimination of in-flight radio operators and SAC was planning on the use of AM voice equipment in the cockpit. LeMay became aware of the successes of amateur SSB work, and in 1956 undertook two flights, one to Okinawa and the other to Greenland, during which SSB was put to the test using Amateur Radio gear and hams themselves. Two of the hams invited to operate on those flights were Art Collins, W0CXX, of Collins Radio, and Leo Meyerson, W0GFQ, of World Radio Labs. SSB far outperformed the conventional AM communications systems then in use by the military. In 1957, it was formally adopted by SAC for use in its (then) new B-52 bombers,⁴ the same year that General Francis "Butch" Griswold, K0DWC, of SAC would give the keynote address on the subject at the ARRL National Convention in Chicago.

Writing in the January 1953 *QST*, Byron Goodman would report that "Art Collins, W0CXX at Cedar Rapids, Iowa, is making a lot of the a.m. diehards think 'maybe there's something to this single-sideband stuff after all.'" Indeed he was. In addition to his personal involvement in helping SAC decide on SSB for its communications systems, his company, Collins Radio, would end up making arguably the largest single contribution to amateur use of SSB when, in 1955, it all but abandoned production of AM gear and threw its considerable re-

FOR S.S.S.C.*
HERE'S TOP PERFORMANCE



***SINGLE SIDEBAND SUPPRESSED CARRIER**

THE TREND . . . is definitely toward single-sideband operation. Advantages are obvious. Elimination of a continuously running carrier saves power and reduces interference. In fact, a signal is put on the air only when something is said.

HOWEVER . . . it does present some problems. To reproduce voice and music the equipment must handle high peaks of power even though the average power is very low. Unlike conventional AM service, where the modulation level must be held down so that the high peaks will not exceed available carrier, single-sideband modulation levels because of the absence of carrier are unrestricted by peaks and in general are limited only by the average power an r-f amplifier can produce.

TUBES . . . which can handle high peak powers in excess of normal ratings are a natural for single-sideband work.

EIMAC TETRODES ARE THE ANSWER

REMEMBER . . . the universal use of Eimac tubes in radar? They were specified because of their ability to handle high peak power. Now, this ability enables them to take the lesser requirements of single-sideband service in stride. Eimac tet-

rodes handle high peaks because of their inherent ability to take momentary overloads, their reserve supply of emission, and freedom from internal insulators.

IT IS FAR EASIER . . . to produce a single-sideband signal at a low power level. Here again Eimac tetrodes fill the bill. Because of their high power-gain, this valuable low-power signal can be built up from the modulator to high power in a single amplifier stage.

IN ADDITION . . . the single-sideband driver must "see" a constant load resistance, and Eimac tetrodes with their low driving-power requirement mean a minimum of tuning action. It is even possible to run up the screen voltage until no grid current is drawn and no changing load is presented to the driver.

DATA AVAILABLE

PICTURED . . . above is the popular 4-65A tetrode. A new complete data sheet on it has been prepared. You will find SSSC ratings and suggestions in it . . . write today. Other Eimac tetrodes suited to SSSC application include 4X150A, 4-125A, 4-250A, 4-400A and the 4-1000A.

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San Bruno, California

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The Power for RF

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CONCORD, N. H.

Figure 2—This full-page ad for Eimac tubes, published in the July 1948 issue of *QST*, touts the advantages of SSSC.



Figure 4—This photo of General Curtis LeMay, then K3JUY/K4RFA, from the July 1961 issue of *QST*, announced his nomination as chief of staff of the US Air Force. During the mid '50s, Gen LeMay had converted Strategic Air Command communications from AM to SSB, based on his ham experience with the newer mode.

sources behind development of sideband gear, having prepared the way with a series of full-page "Engineering Notes" that appeared in *QST* in late 1954. In May of 1957 Collins would make history with the launch of the KWM-1 transceiver, "the first mobile transceiver," the advertisement in *QST* read, "and the first to offer SSB." A review of the rig in the April 1958 issue would be positively glowing:

It is the writer's opinion that the KWM-1 may well mark the end of one era and the beginning of another. This unit is more than another piece of ham gear; it could be a way of life (in Amateur Radio).⁵

Byron Goodman's column "On the Air With Single Sideband" was discontinued after March 1954 and the ARRL's handbook, "Single Sideband for the Radio Amateur," made its first appearance in December of the same year. SSB had made a secure place for itself within Amateur Radio. Change, however, didn't come easily or quickly for a few hams. The disagreement between AM diehards who disparaged the "Donald Duck" sounds of SSB,

and those who disdained the frequency-hogging of "ancient modulation" would continue well past mid-century. As late as 1963, a letter to *QST* urging the ARRL to "get on the ball and ask FCC to give the a.m. boys six months to go s.s.b.,"⁶ resulted in an outpouring of mail in support of the "a.m. boys." In the end, the issue would finally only be overshadowed by another controversy: the regulatory changes of incentive licensing.

Sideband had won the day.

Notes

- ¹"Correspondence from Members," *QST*, Feb 1948, p 64.
- ²As if its role in the sideband revolution wasn't enough, Stanford University would later be at the forefront of another technological revolution—the computer—and instrumental in the development of nearby "Silicon Valley." Oswald Villard himself was a pioneer in early meteor scatter investigations.
- ³"Technical Topics," *QST*, Apr 1948, p 29.
- ⁴Charles A. Keene, "Once Again, a Ham Operator in Command," *QST*, May 1997, p 43.
- ⁵"Recent Equipment," *QST*, Apr 1958, p 23.
- ⁶"Correspondence from Members," *QST*, Jan 1963, p 87.

Simple · Complete · Amazingly Effective!



ELDICO'S SINGLE SIDEBAND XMTR-XCTR

The Eldico SSB Jr. is patterned after the amazingly effective unit developed by Don Nurgard, W2KLL, and described in the November-December 1958 *QST* Ham News. It is available in either kit form or completely wired and tested.

Everyone can now enjoy all the benefits of single sideband transmission. Tremendous effectiveness of low power; QRM minimized or eliminated entirely; QSB has less effect . . . complete phone contacts with "a.w." reliability.

Eldico's SSB Jr. is a complete 7-tube 5-watt single-side-

band transmitter. Tube complement consists of 12AU7 combination speech amplifier-oscillator; 12AT7 two-channel amplifier; 6AG7 6mhz 12AT7 twin-speech pre-amplifier; 6146 bias 5Y3G rectifier.

Each kit comes complete with all parts, punched chassis, cabinet, tubes, power supply components and full instructions for assembly and operation. Audio phase-shift network comes fully assembled and pre-adjusted, eliminating necessity for elaborate test equipment. Less difficult to construct and adjust than many conventional transmitters . . . practical SSB at amazingly low cost is now a reality. The Eldico SSB Jr. may be used as a transmitter, as a driver for high-power linear amplifier, or in conjunction with a v.f.o. The transmitter provides 30-db. sideband suppression by using a simplified phasing method which because of Eldico's laboratory-optimized phase-shift network, requires only standard components and no special technical skills. A pre-amplifier is included as an integral part of the Eldico SSB Jr. kit to enable the use of any low-level microphone such as crystal or dynamic.

Signals of Distinction

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OF NEW YORK
INCORPORATED

WRITE
W2UOL
FOR FREE--
TVI CAN BE
CURED.

SSB Jr. complete kit with instructions . . . \$59.95
SSB Jr. Wired and Tested . . . \$59.95

1631 DOUGLASS PARKWAY • DOUGLASS, C.T. NEW YORK • 845-6619

Figure 3—This ad, for Eldico, features the company's new 7-tube, 5-W sideband rig. "Everyone can now enjoy all the benefits of single sideband transmission," the ad proclaims.

Vibroplex—The Company and its Classic Key

On one level, the Vibroplex is just a bug—a type of Morse code key. But on another, it's a piece of ham radio history that resonates through the fists of generations of brasspounders.

Mechanically intricate yet functionally obvious, the Vibroplex is instantly recognizable as a quintessential telegraphic instrument. Second only to perhaps the steam locomotive, it is a classic example of form following function. People instinctively wiggle the lever, pushing it left then right. To the right is where it springs to life.

As a telegraphic instrument, the Vibroplex key eliminated a debilitating ailment and doubled code transmission speed. Regardless of its merits in telegraphy, it can draw you into a mesmerizing stare for hours on end. Later models have a liquid chrome finish that you expect to splash when touched. The knurling on the myriad of screws and lock nuts sends showers of glinting light. The adjustments beg the mind to determine their purpose.

The Vibroplex is a semi-automatic telegraph key. The operator makes dashes manually by pushing the lever to the left, but the action is to the right. The dots are automatic. When the lever is pushed to the right, the Vibroplex, as its name implies, vibrates. Weights suspended on a steel spring oscillate rapidly, opening and closing an electrical contact with seemingly endless repetition.

Of Straight Keys and Bugs

The original telegraph key was invented in the late 1830s and was in commercial use by the 1840s. Until 1900, it remained stunningly unchanged. That original key, Alfred Vail's "lever correspondent," a simple switch, was the archetype of the telegraphic transmitter for over 60 years. But the straight key, as it's called today, has a couple of fatal flaws. The first is its speed, which tops out at about 20 words per minute. The second is that it tended to cripple those who used it for any length of time. The more skilled an operator was, the



VIBROPLEX®

more likely he was to be injured. In a business where words equaled dollars, the best operators saw the most action for longer periods of time, placing themselves at greater risk.

Many operators fell victim to what was called "glass arm" or "telegrapher's paralysis." Characterized by excruciating pain and loss of fine motor ability, glass arm was a career-ending affliction. Today, it's known as repetitive motion disorder or, more commonly, carpal tunnel syndrome. If ever there was a perfect device to induce carpal tunnel syndrome, the straight key was it. The telegraph companies responded by replacing the stricken operator with a fresh body. It was a time when labor was both cheap and abundant.

Around the turn of the last century, a young telegrapher and experimenter was working on the problem. Horace G. Martin had developed an electromechanical widget that produced automatic dots and manual dashes. The human interface incorporated a side-to-side motion instead of up and down. This new contraption, the Autoplex, was somewhat bulky and required expensive batteries to power its electromagnets, but it was relatively easy to master and virtually effortless.

Martin developed a totally mechanical and compact version in 1904, which he named "Vibroplex." It brought simplicity, small size, modest cost (about a week's wages) and total relief of glass arm. Martin's Vibroplex was an instant success. The Vibroplex started to appear on telegraph circuits en masse. For reasons not entirely clear, it acquired the nickname

"bug." Perhaps it was the rapid fire dots or the annoying racket that resulted in the hand of a poor operator, but the name stuck.

The Company Evolves

The Vibroplex was originally manufactured by United Electrical Manufacturing Company of Norcross, Georgia. One of the principal investors in the company, A. O. Brown, suffered a huge \$3,000,000 loss on Wall Street in 1908 and UEM collapsed with him. At the time, it was the largest financial failure in history.

Martin subsequently hooked up with J. E. Albright, who had a successful typewriter sales and service business in New York City. Albright sold many typewriters to telegraphers so the Vibroplex was a natural extension of his business. Somewhere along the line, Albright had a bright idea—he was going to corner the bug market.

The partnership with Horace Martin gave Albright control of most, but not all, patents regarding semiautomatic keys. Albright purchased the remaining patents. With all bug patents in hand, Albright seems to have gone on an infringement holy war. It was not enough to go after the counterfeit manufacturers and wire line companies; Albright threatened even the individual telegraphers using infringing keys. Within a few short years, Albright had exterminated all offensive bugs.

The Vibroplex enjoyed high demand and no competition until the patents started to expire around 1920. With time running out on his monopoly, Albright did what any good businessman would: he dressed up his product. In 1920 the Vibroplex label, that brass tag all Vibroplex bugs wore, got flamboyant. Its size exploded and it included a red lightning bug that was to become the company's trademark. See Figure 2. It is simply impossible not to notice it. No longer did the tag merely identify the prod-

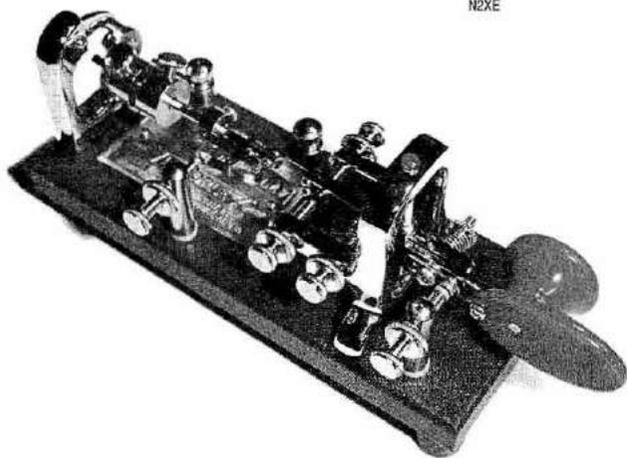


Figure 1—The author's prized 1946 Blue Racer.



Figure 2—The label is perhaps the most distinctive feature of a Vibroplex key.

uct and serial number, the new label made a statement! When the patents did run out, dozens of manufacturers entered the semi-automatic key market. Some were more successful than others, but only one remains to this day—Vibroplex. Did the label make the difference? It didn't hurt.

Vibroplex remained in the Albright family for its first 65 years or so. From the mid-1960s to the mid-1990s, Vibroplex plugged along through several owners and declining sales. Over the years, Vibroplex produced 15 different models. By 1990 they offered only the "original." It seemed the Vibroplex destiny was to follow that of the industry it had originally serviced.

New Owner

The Vibroplex had been around to witness the development of radio, the sinking of the *Titanic*, two world wars, man landing on the moon and the Internet revolution; and you can still buy a brand new one. The need for landline telegraphers has long since vanished. Railroads no longer dispatch trains by wire. Yet the Vibroplex is still in demand and the demand is growing.

In 1995, Vibroplex found a new owner, S. Felton "Mitch" Mitchell, W4OA. Mitchell faced a set of challenges that only a 19th century product could present at the end of the 20th. To understand Mitchell's problems, one needs to understand manufacturing standards of 1900. While the Vibroplex is a fine instrument, it is not machined to super close tolerances. The Vibroplex was state of the art in 1904. In 2002, it's an arcane niche accessory in a market that demands high quality. A telegrapher in the mid-1900s cared little if there was a blemish in the chrome or a tooling mark here or there. A ham in 2002 will not tolerate imperfections. The chrome must be perfect, paint must be flawless. Mitchell has had to become expert in machining,

metallurgy, plastics and plating, and in the process puts out the finest bug that this 19th century design will allow.

New users find bugs to be a bit loose and sloppy feeling. You cannot adjust a bug to 1 micron contact spacing. A bug likes motion and lots of it. Your wrist, after all, is the power source. The Vibroplex is also noisy. In particular, you'll notice the constant clank of the damper. This is not a stealthy key; anyone within earshot will know you're on the air. The Vibroplex still has 10 or 11 possible adjustments to fiddle with. It can take a week to fine-tune a newly acquired bug. It is, with all its quirks, wonderful. It's more emotional than practical but many agree that to tame and master a bug is to become a more complete ham.

Work of Art

Today's Vibroplex is made with some of the same tooling used 100 years ago. The same outfit that first stamped that flamboyant label in 1920 is still stamping them out in 2002. A bug made in 1920 was a necessary tool of the trade and remaining bugs from that era show it. The nickel plating is worn and dull; the base paint is peeling.

Semi-automatic for a Reason

While the Vibroplex is employed today to send International or radio Morse, it was the perfect instrument for American or landline Morse. Landline Morse is a different code than the radio Morse in common use today. Not only was it made up of dots (dits) and dashes (dahs), the length of dashes and spaces (letters C, Y and O) was critically important. The character L was long duration dash. The number 0 was a really long dash—actually the character elements were time intervals between the *click* and *ka-lunk* sounds made by a mechanical sounder. The difference between landline and radio Morse is distinguishable

even by those who know neither. American Morse is "ditty" and comes in bursts; International Morse is smoother but less interesting. The Vibroplex was ideally suited for American landline telegraphy with its high proportion of dits and variable length dahs. Martin went halfway, making only the dits automatic out of necessity.

Morse Nirvana

On Amateur Radio bands, old landline telegraphers are not hard to discover. Even though they are sending radio Morse, old habits expose their history—and they have a lot of history. Virtually nobody was learning landline Morse after 1950 so a practitioner is at least 70 years old. The long tone zero can be a giveaway but many radio Morse telegraphers have picked that up also. More subtle is the letter L. In radio Morse it's *di da di dit*. If you learned landline Morse first then it's *di daaah di dit*. They linger a little on the dah. They also favor bugs instead of the more popular electronic keyers. To strike up an in-depth conversation with a retired railroad telegrapher is a special treat. Their sending is musical and structured but unique to that individual's fist. With a little prodding, you can usually get their life story and it's well worth the effort. Their jobs, kids, loves, the war, retirement, loss of their spouse, the solitude of twilight years. The conversation sometimes ends with a tear shorting out the bug.

A few years ago, I was fortunate to acquire a 1946 vintage Blue Racer Deluxe. Deluxe it is. All chrome, jeweled bearings, bright red finger pieces and quick on the dots. While not particularly rare, the Blue Racer is highly sought. All you need do is use one to know why. Many consider the postwar Blue Racer Deluxe to be the most attractive bug ever produced. It is a very fluid machine both visually and functionally. On the air, you forget the physical interface; dits and dahs disappear. The bug takes you into a telegraphic zone where you directly enter the other operator's mind. If you are lucky enough to find a retired railroad telegrapher on the other end, it is Morse nirvana.

Need More Information?

The Vibroplex Company Web Site: www.vibroplex.com.

A great Vibroplex collectors page: www.la.ca.us/frandy/index.html#bug.

Need to adjust your bug? www.vibroplex.com/New_Folder/BUGAdj.htm.

Harold Collins and his Wonderful 75A-1

How the author came to own a memory-laden radio.

A crisp Saturday afternoon, October 2001. I'm in a big rush. We're getting ready for a trip to the Detroit art museum. I pace briskly through the house, looking for something. The red light is blinking on my phone answering machine.

I slow, stop and from habit push the play button.

A man's tinny voice: Want to buy a Collins 75A-1? Receiver's complete with mechanical filter adapter, Central Electronics Sideband Slicer, speaker.

I remember a setup just like that. A long time ago.

Area code 616. Now he has my attention. Western Michigan, where I grew up. The exchange: 897. Wow—my hometown, Lowell!

After all these years, could this be the radio I've most wanted to find?

I jump in the car, steering for Detroit. But my mind is not on Degas or Renoir.

I First Meet Harold Collins

Another crisp fall. 1958. I'm an eighth-grader and I want to build a radar set as a science fair project. I learn there's something out there called Amateur Radio. Sounds more intriguing than radar.

Hmmm. There's a house on my paper route with a weird sort of antenna on the roof. A guy named Harold Collins lives there.

I'm collecting for the paper. Mr Collins' wife, Alma Collins, pays me. Before she can shut the door, I blurt it out: I am interested in ham radio.

Wait, she says. Mr Collins comes to the door. A guy in his 50s. Gray hair. I am 13. Boy, is he old. But he has a great idea. Come back before nine tomorrow night. He'll show me ham radio.

I'm half an hour early. It's okay. The rig has to warm up anyway.

He calls the spare bedroom a "shack." It once belonged to his older son—"Joe," he calls him, or "Gardner." Joe or Gardner had been in the Navy. By 1958 he was an electrical engineering student at the University



of Michigan.

On the desk, there's a dark gray metal box. Electrical meter on the left beside a big glass window. A smaller, curved glass window under the big one. This, Harold said, was his receiver. It was a Collins 75A-1. No relation to him, he laughed.

A metal rack on the floor holds Harold's transmitter. Homemade. I didn't ask who built it. AM, the premier mode then. He switched it to transmit and said his call sign: W-Eight-L-E-Zed.

His 75A-1 receiver was tuned to 28.620 megacycles. Soon, he was chatting away. Then, suddenly, he said he had a visitor: Joel. He handed me the mike. I wanted to run.

The following Sunday, I went back. Harold explained the calibration on that big billboard of a dial glass. Frequency. He drew a picture of a sine wave: One cycle. "Kilo," Greek for thousand. "Mega," Greek for mil-

lion. So it's twenty-eight-point-six-twenty megacycles or twenty-eight-thousand-six-hundred-twenty kilocycles. Or twenty-eight-million-six-hundred-twenty thousand cycles.

A wonderful teaching tool, that 75A-1.

Ten meters could be very busy in the late 1950s. Sometimes California stations would drown out our pals in Grand Rapids. No problem. Harold pulled a tube out of the A-1 and plugged a gadget into its socket.

He called it a mechanical filter. He drew another picture. A "transducer," Harold said, changes electrical energy to mechanical energy. A microphone or loudspeaker is a transducer. In Latin, it means to "lead across." The transducer leads the energy from the state of electrical to mechanical energy. As mechanical vibrations, the signal passes through a series of metal discs. The discs resonate at a certain frequency but reject energy above and below that resonant frequency. You might say they select that frequency, rejecting signals at other frequencies. Having passed through the discs, a second transducer returns the vibrations to electrical energy for use once again in the receiver. This process is called "magnetostriction." If you insert such a device, resonant at 455 kilocycles, into a receiver's 455 kilocycle intermediate frequency stage, it will easily pass signals that resonate with it but lop off those that don't.

Magnetostriction.

Transducer.

Wow!

I was hooked.

I Become KN8PSV

April 29, 1959. I stopped at Harold's house with a sealed envelope. I tapped something in Morse code. He sent some Morse back to me. I answered 20 questions and in June 1959, a little, white FCC envelope came. Now I had a call sign: KN8PSV. I was a Novice ham.

By then I'd built my first receiver—a

three-tube regenerative set, the Knight-Kit "Ocean Hopper." Sensitive, yes. Selective? Not at all. My hand moving near the panel would change the frequency. It cost eleven bucks. My next receiver was \$100, a National NC-173. It was the real thing.

But Harold Collins warned me that it was a "single-conversion" receiver. More new words. The NC-173 would convert the signal at, say, 14.2 megacycles down to the one and only intermediate frequency of 455 kilocycles. But the conversion process produces two signals—the wanted signal, and another, weaker "image" signal 455 kilocycles away. I would hear duplicate signals 455 kilocycles away from the real signal. That did not happen with the 75A-1, which had "dual conversion." By converting the signal twice, the receiver eludes the unwanted image.

It was true. I heard images on the NC-173. I sure admired Harold's 75A-1. Another big word: "Permeability tuning." You could vary frequency either by changing capacitance or inductance. Other manufacturers used variable capacitors to change frequency. Not Collins. Variable capacitors' values were hostage to heat changes. Collins varied inductance in its variable intermediate frequency oscillator. The knob of Harold's receiver turned a lead slug through a coil in this "permeability tuned oscillator." Less prone to heat-induced drift. Stability, that was Collins, per Harold Collins.

I went to college, but when I came home I would visit Harold. It was Harold who had explained the beauty of single-sideband to me, using that 75A-1 dial as his blackboard: Imagine the carrier on this calibration mark and consider that when AM is applied, two sidebands appear. One is 3 kilocycles above the carrier, the other 3 kilocycles below. Six kilocycles of band space for the AM transmitter. What if you removed a sideband? You'd liberate three kilocycles of band space. If everybody did

it, the effective spectrum would be doubled. Now, what if you removed the carrier? No more squealing heterodynes!

Even better, he said, now making marks with pencil on paper, consider a carrier with 100 watts of power. Modulated at 100 percent, it should have 50 watts of audio—25 watts in each sideband. What if you removed a sideband—25 watts—and the carrier—100 watts—and poured their 125 watts into the remaining sideband? You'd have 150 watts of power in the speech part of your signal, instead of a mere 25 watts. Quite a bargain.

I was hooked on sideband as well.

Sideband Takes Over

What the 75A-1 lacked was a detector for sideband. Harold had to back off the RF gain and run the audio wide open to compensate for strong signal overload. In the 1950s and early 1960s when many hams still were on AM, this was not such a problem. But by 1963, when I went off to college, it was clear that sideband was taking over. Harold was all for it.

But Harold loved his 75A-1. And he had a solution: A Central Electronics Model B Sideband Slicer. It was a standalone unit meant to take sideband signals from the IF output of a conventional AM receiver and process them with a product detector.

Harold's son Joe was by this time an electrical engineer designing avionics equipment and living in California. On a visit to Lowell, he modified the 75A-1 so it would work with the Slicer.

I came back from college and visited Harold. He'd tune the A-1 to a sideband signal and then finely adjust the Slicer's vernier until the voice sounded rich and warm.

By the early 1980s, I was living in southwestern Michigan in a farmhouse where I had a little ham station. I had not seen Harold for some time. Christmas,

1981, my parents visited us. My mother told me the ghastly news. On December 23, 1981, Harold and Alma Collins were going to look at a Nativity scene near their church in Lowell. It was dark and snowing hard. As they crossed the street a driver, blinded by snow, struck and killed Harold and Alma.

Since then, I've often thought of Harold Collins and how he taught me basic radio using that 75A-1. Every time I saw a 75A-1 at a hamfest, I'd think of those Sunday sessions and the warm glow of the dial lights.

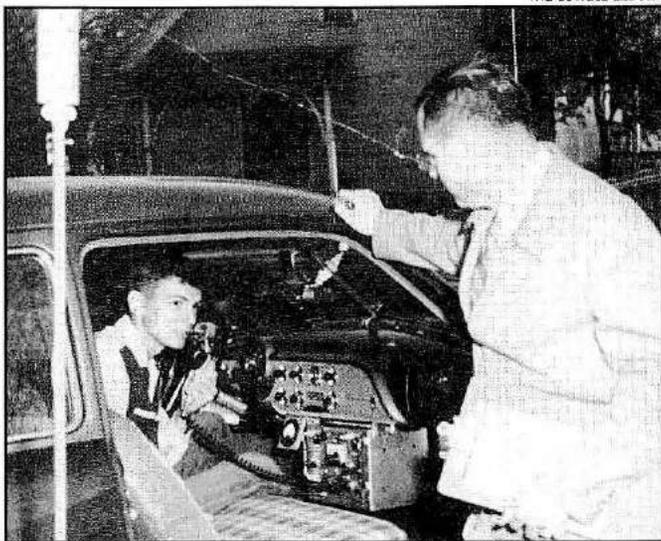
Words like "magnetostriction" and "transducer" would pop into my head.

Over the years after Harold's death, I tried to contact Harold's son. I knew he'd dropped his first call sign, W8FNH, and had a California call sign. I didn't know what it was. I'd heard him referred to as "Joe" and "Gardner." With the Internet, I'd plug "Joe Collins" and "Gardner Collins" into search engines and get nothing. Then in February 2000, *QST* published my cover story about a Collins 75A-4 homebrewed by a onetime Collins technician. "A 75A-4, One Piece at a Time" caught the eye of an engineer in southern California. His name was not Joe, it turns out—that was just an on-air nickname he used back in Lowell. And Gardner was only a piece of it—his middle name. No, he was like his dad, Harold Collins, now W8JES and going by Hal.

Hal, the son of my mentor Harold Collins, is an antenna design engineer who worked on Apollo, GPS and space shuttle projects. We corresponded several times by e-mail, but I never asked him what happened to his dad's 75A-1.

The Radio Finds Me

The phone rang that crisp October afternoon and I heard Merritt Wissman, KA8DMP, aka Curly, describe a virtually mint 75A-1 with mechanical filter adapter, Central Electronics Slicer and speaker.



In November 1953, Hal Collins, W8FNH, shows dad Harold E. Collins, W8LEZ, the mobile transmitter he had built.



Also in November 1953, W8FNH (with mike) and W8LEZ put Hal's homebrew 829B transmitter through its paces.

Yes, he was just outside Lowell.

I asked him if he'd known Harold Collins.

No, he said. He never knew Harold.

Well, I thought, close but no cigar.

But, Curly added, "I bought his 75A-1 from his son."

Harold's radio had found me.

As we ambled through the art museum that afternoon, my mind was only partly on those wonderful suits of medieval armor, the great Picassos and the amazing Diego Rivera mural.

I've gone on some pretty exciting radio quests. When I first got the homebrew 75A-4, it was something of a curiosity that, as I considered and reconsidered it over time, revealed itself as an amazing find. When I was offered the Central Electronics 100-R (November 1998 *QST*, "Zenith's One-And-Only Ham Receiver") I put the phone down and drove straight to Chicago.

As we got ready to go to the museum, my wife, Karen Fonde, listened as I described the call from Curly.

"It's a big deal," she said. "It's part of your history."

This was a radio that could mean much to only one person. Well, maybe to Hal, too, but as I would find, it was my experience of sitting for hours in Harold's shack before that lit billboard dial that made this my one-and-only receiver.

"Outstanding!"

The day before I went for the 75A-1, I sent an e-mail to Hal Collins.

"Hal—I found your dad's 75A-1. The radio never left Lowell."

"Joel," Hal replied, "your note is something special about Dad's receiver. It must be Dad's A-1. This event is outstanding. Or maybe it's best described as 'awesome.'"

Lowell is a two-hour drive from my home in Plymouth. Less on this trip.

It was sitting on a shelf on Curly's radio desk. Ten minutes from Harold's old house.

From Hal, I learned the story of how Harold and Hal each happened to buy a 75A-1, unbeknownst to the other.

It was in 1955, and Hal was in the Navy,

stationed in Kodiak, Alaska. He and his dad had both dreamed of finding a 75A-1. The station in Lowell used a Hallicrafters SX-43—decent radio, but no match for the Collins. In Kodiak at the Navy base, Hal was using a National NC-183-D—"a great performer," recalls Hal. "Personally, I wanted a Collins receiver. Model? Hadn't decided."

"Henry Radio in West LA was reselling the A-1 for something like \$180 for a good, clean unit. So I told Dad that I was going to get an A-1 when I got out of the Navy."

"As it turned out, I had the chance to obtain an A-1 while still in Alaska, unbeknownst to Dad. And unbeknownst to me, dad bought an A-1 for me. So when I returned to Lowell in April 1955, Surprise! Surprise! So Dad kept his A-1, which he substituted for the SX-43. And I kept my A-1."

Hal said his wife, Dottie, was not excited about this purchase. Harold and Hal were paying about \$200 for the 75A-1 in 1955. Adjusted for inflation, that would amount to \$1318 today. But it's better than the 1946 price of \$375 when it was new. That would be \$3394 now.

From Hal, I learned that my radio mentor was Lowell's radio pioneer as well. In the 1920s, Harold Collins and a friend built the first radio in town. A collection of his dad's home-built broadcast radios inspired young Hal to build two-tube regenerative receivers during World War II. Via short-wave radio, Hal, a junior high kid, heard news of the Japanese surrender in 1945.

"I woke my parents up and said, 'Hey, the war is over!' They said, 'Go to bed—you're dreaming.'"

Like his dad, Hal found a Central Sideband Slicer for his 75A-1. The father-son duo had duplicate receiving systems. Hal's transmitter was a phasing rig he built. It was similar to a Central Electronics 20-A, except that it drove a pair of 4CX300As to better than a kilowatt.

That AM transmitter Harold was using on my first visit to his shack? Hal knew all about it. He built it. It was a 100-watter with 829B final amplifier.

Harold replaced the 829B rig in the 1960s. The new transmitter was a Heath Marauder sideband transmitter. By the 1970s, Harold was tired of the Marauder's regular breakdowns. He bought a Yaesu FT-101-E transceiver, but was so attached to the 75A-1 that he devised a way to use the Yaesu as a transmitter while receiving on the 75A-1/Slicer.

After his dad's death, Hal recalls selling the 829B rig and his homebrew sideband transmitter to a Lowell police officer. He couldn't recall the guy's name.

On a Christmas 2001 visit to Lowell, my mother showed me an article in the *Grand Rapids Press* about a student ham radio club at Lowell High School. It was organized by the high school security director, Al Eckman, WW8WW. I remembered Al—he was Lowell High School class of '60, three years ahead of me. Hal said he sold his equipment to a cop. Well, I knew Al had been a cop in Lowell.

I called Al.

"I bought that equipment," said Al.

Fantastic, I thought.

"But I sold it."

Now for a Transmitter

Many of us collectors try to recreate our early stations or stations of mentors like Harold Collins. Seldom do we find the actual artifact—we simply find similar rigs. They're stand-ins, but we make do.

Now I can recreate part of the first ham station I ever saw. I have Harold's receiver—the same receiver he used, not just a duplicate.

What about a transmitter?

I suppose I could use something I have on hand. Maybe a Central Electronics 100-V or Hallicrafters HT-32-B.

All surrogates, I'm afraid.

But wait! It once seemed implausible, but today Harold's 75A-1, the radio I most wanted to find, is now in my shack. What if ...

Has anybody seen a 100-watt AM transmitter?

It would be a homebrew rig.

Rack-mounted.

With an 829B final.

Restoring a Heathkit

Bringing a classic radio back to life can be a challenge, but as the author found, it's likely to be a rewarding one.

The letter was ominous. It was unusual for a technician in the Field Office to receive something directly from Corporate; correspondence had always come through the Field Office Manager. What could it mean? With trepidation, the envelope was opened. The words stood out with shocking clarity: "...due to a reorganization, the position you now hold has been eliminated. A similar position in the Dayton, Ohio area is available. If you accept this position please report to the Dayton office within three weeks." Its recipient had no idea that this letter would lead to a serendipitous gift, a desperate search and an exhilarating adventure for me, 35 years later.

Serendipitous Gift

The receiver, tuned to the local radio club's repeater, crackled to life—I was being called. I answered to find an offer from an old friend. Knowing that I liked to experiment and build equipment, he asked if I would like to have an old, non-working, SSB, tube-type transceiver to salvage, for parts. I hesitated before answering. My junk box was overflowing; my shack was stuffed...did I really need more of this stuff? However, I hated to disappoint him...so, in a moment of weakness, I answered yes.

swered yes.

That's how it all started, on a rainy November day. Showing up at my door with a tattered, water-stained and faded cardboard box in his hands, he explained how, more than 30 years prior, he had been transferred to the Dayton area. He had just received a license upgrade, permitting voice operation on the HF bands. In anticipation, he purchased a Heathkit¹ SSB transceiver. Although it was just about done, there was no time to complete it before the transfer took place. He placed it in a box and set it aside. After the transfer, he had temporarily abandoned Amateur Radio and stored the boxed kit in the attic. Later, coming back into the hobby, he purchased a new, all mode, solid-state transceiver, forgetting the kit. Now, 35 years later, he found it during an attic cleaning and thought of me. I thanked him and put the box in the shack for safe-keeping.

Surprise

I had become quite curious, so...after a week had passed, I opened the box. Removing some newspapers that were used as padding, I noticed the date on a page, a day in April of 1967... 35 years prior. This transceiver was older than half of the local radio club's members! As I removed it, a few

items, including the instruction book, fell out of the box. There, sitting before me, was a Heathkit Model HW-12, 80 meter Single Band SSB Transceiver, in good condition and far from the "junk box" candidate I had expected to see (see Figure 1).

I wondered whether the transceiver would work. Had the parts deteriorated so much in 35 years that they would fail when power was applied? If parts did fail, were replacements available? Where could I find them? And, lastly... how would its operation compare with today's sophisticated equipment? The challenge to place the transceiver into operation seemed daunting, but I felt confident that it could be done.

Expecting the worst, I gently removed the outer case. I was amazed...there was not even a cobweb; just a coating of dust with some minor corrosion on a few metal parts (see Figure 2). Turning the chassis over, I found that the underside was in even better condition than the top. Impatient, I wanted to plug it in immediately but I knew better. From prior experience, I knew that could lead to disaster. I searched for information on restoring older equipment. I found some ideas in *QST*, *Popular Communications* and *Monitoring Times*. It soon became apparent, however, that they dealt

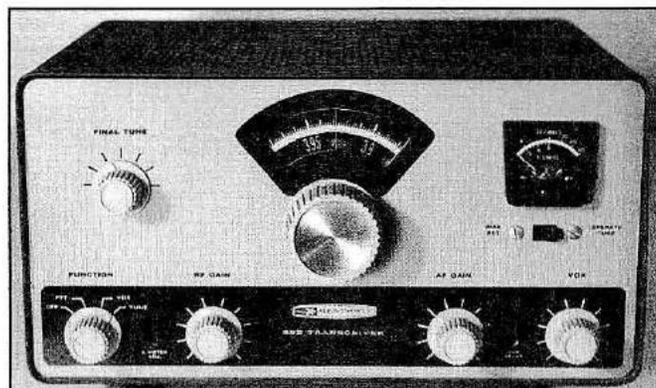
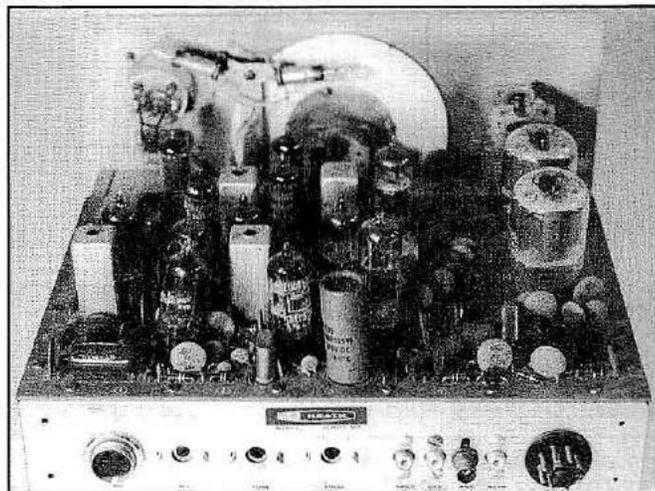


Figure 1—Heathkit HW-12 SSB transceiver, introduced and first sold in 1963.

Figure 2—Interior of the HW-12 showing tubes and components.



primarily with commercially built equipment. Restoration of a kit-built transceiver would require a different approach.

After pondering a course of action, I devised the following basic approach to restoration and used those steps that were applicable:

- Get all the available instruction books, schematics and construction procedures.

- Clean the unit using a vacuum and a soft paintbrush, being careful around delicate components.

- If the unit was stored in a damp area, there was probably moisture penetration into transformers, coils or inductors. Place the unit in an oven set to its lowest temperature to dry it thoroughly.

- If the equipment is extremely dirty, gently wash it with soap and water, then rinse well with distilled water and again dry in an oven set to its lowest temperature.

- Check to see whether the kit has been completed. If not, are parts available to finish it? If not, can those parts be fabricated from other components?

- Check to see that parts have been installed correctly. Look at stenciled locations on PC boards and assembly manual details for parts locations.

- In point to point wiring, check for signs of modification, different types of hookup wire, substitution of similar parts and newly soldered joints.

- By visual inspection, look for any obviously faulty parts—burned resistors, leaking capacitors or broken wires.

- Visually inspect all soldered joints for cold solder joints or faulty soldering technique.

- Check switches or relays for oxidation of contacts; clean all dirty or oxidized contacts with contact cleaner.

- Check all wiring for insulation that has deteriorated and replace damaged wiring.

- Check installed tubes and transistors for proper types.

- Identify any electrolytic capacitors.

In older units they surely will be dried out and useless. Replace all electrolytics with new units.

- Be careful not to disturb settings of adjustable coils, trimmer or padder capacitors and IF transformers. Alignment can be done later using proper test equipment and procedures.

Many of these steps can be combined to simplify the process. The wholesale replacement of parts, without proper testing, is not recommended. Aside from electrolytics, more problems can be introduced by indiscriminate part replacement than may already exist.

When a physical inspection is completed and any obviously damaged parts replaced, the equipment is ready for further testing. If possible, use a variable voltage ac transformer to *slowly* raise the line voltage to the unit over a period of an hour or more.² This will allow the parts, especially capacitors, to adjust to operating voltages that have been dormant, preventing some failures. Apply the usual troubleshooting procedures: check voltages at key spots against those known from the schematic and replace any parts found faulty with exact component types, if possible.

Restoration

With these steps in mind, I removed the chassis from the case and carefully inspected it. Despite the statement by my benefactor that he did not have time to finish assembling the unit, the transceiver appeared to be complete. The underside of the printed circuit board was impressive; the soldering was impeccable. It was not surprising that the exposed silver contacts of a relay and a wafer switch were dark from oxidation. [Silver oxide is black in color and it is common on older, silver plated conductors. Although it appears ominous, it's as good a conductor as the native silver.—Ed.] I cleaned all contacts with contact cleaner. Considering its age, the transceiver was in remarkable condition. There was one modification—a BNC

type RF connector had been substituted for the phono connector originally used by Heathkit as the antenna output jack (see Figure 3). I left it alone.

Next, I checked the separate power supply, a Heath model HP-23A. No schematic was available, although its point-to-point wiring made it easy to draw a schematic. The first portion traced was the -130 V bias power supply. Next came the "low voltage" +250 V dc supply and, finally, the transmitter's truly high voltage 800 V dc supply. These voltages can kill you. Use extreme caution when working on energized tube equipment and its power supplies. Discharge all medium voltage and high voltage filter capacitors, even after you remove power. Never trust bleeder resistors—they may be defective. The advice of an old timer came to mind: "Keep one hand in your pocket when troubleshooting live circuits with high voltage."

Dilemma

There were three electrolytic capacitors in the transceiver and seven in the power supply. These capacitors use a wet paste-type electrolyte to form an insulating barrier on an aluminum foil electrode that acts like a dielectric. Over many years, the electrolyte dries out and the barrier is lost. It is therefore routine practice to replace all older electrolytic capacitors. All were faulty, with low capacitance and high leakage. Finding exact replacements was next to impossible; the values listed in numerous catalogs did not match those that needed replacement. I had to choose the closest value to that needed. Because of technological advancements, the physical size of the replacement units was vastly different from the original (see Figure 4).

This posed a dilemma. Should the transceiver be restored to working condition only or should it be restored to working and original physical condition? I decided to compromise. The original capacitors were hollowed out, leaving only the outer shells. I then inserted replacement units into the

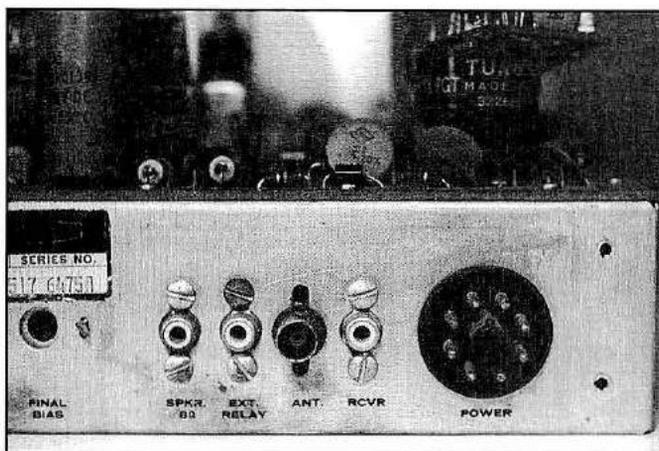


Figure 3—The only modification—a BNC antenna jack substitution by the original builder.

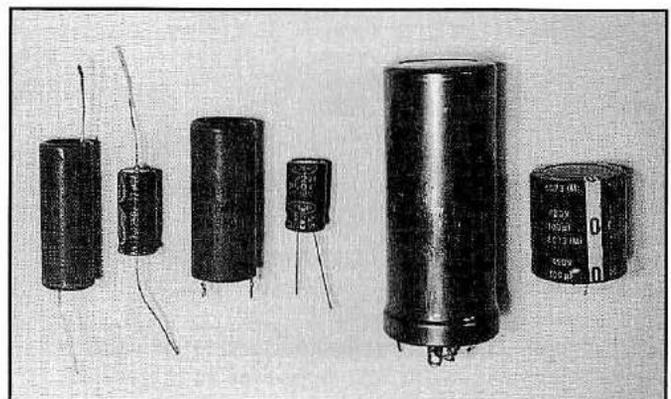


Figure 4—I hollowed out the old capacitors and inserted new, smaller units to preserve the original appearance.



Figure 5—The Heathkit HP-23A power supply. Note the 11-pin socket that needed a plug and the 2 conductor ac cable that was replaced with a 3 conductor grounded type.

shells and reinstalled the new package. The original physical appearance was thus retained, but with new, modern components. A second appearance item took more thought. The power supply ac line cord was the old non-grounding, non-polarized type, having only two conductors. Should I replace the cord with a grounded line cord with the ground conductor connected to the metal case? Safety won out and I installed a 3-wire grounding cord.

With inspection and replacements completed it was time for the proverbial “smoke test.” I plugged the power supply into a variable voltage ac transformer and slowly raised the ac line voltage. Nothing came out of the supply, even with full line voltage applied. My heart sank. If the power transformer had failed there was no way a replacement could be found, since it was custom designed. Wait...there was an output connector on the power supply, 2 pins of which went to the transceiver, so that primary power could be switched from the transceiver. Quickly, a jumper was made to temporarily connect the two pins. Power once again was applied and, once again, nothing happened. This time, the problem was traced to a circuit breaker in the supply. It was temporarily bypassed with a fuse, and presto, the supply became operational! All voltages were present and within expected limits.

Desperate Search

With the power supply operating properly, it was time to energize the transceiver. There was, however, one last item. Where was the power cable that connected the power supply to the transceiver? In my excitement while restoring the units, I had overlooked this cable. A search revealed that no cable came with the units, nor could my benefactor find one. I would have to

fabricate one. The transceiver end of the cable used a standard 8-pin octal tube socket. The power supply end was different; it used an 11-pin plug and socket (see Figure 5).

I made a casual search of several catalogs and then to a local surplus electronics store. Nothing. Then to fellow ham junk boxes and, again...nothing. With no plug available, there were two alternatives, neither entirely satisfactory. A plug would either have to be fabricated using pins from an old octal tube or the connector would have to be changed. A bit discouraged, I waited and procrastinated, which eventually resulted in a pleasant surprise. WD8BMA showed up at the shack with some Motorola, GE and Air Force equipment, circa 1960. As we unloaded an old Motorola commercial FM transceiver chassis, I noticed a cable. One end was cut off. Unplugging the cable to dispose of it, I quickly glanced at the end...hooray! Here was the exact plug I had so desperately searched for. I removed the plug and assembled the power cord, being cautious to use wire with the proper voltage rating, as at least one of the conductors had to handle 800 V dc safely.

Testing...

With the two units connected by the new power cable, it was time for the final “smoke test.” I connected a dummy load to the transceiver RF output jack and turned on the ac power. A faint hissing sound came from the speaker. The transceiver was working! To compare the operation of the HW-12 to today’s more sophisticated equipment, I decided to align the unit using the instructions contained in the manual rather than use more advanced test equipment, as I wanted it to be representative of the way hams of the day would have built it.

With alignment completed, I connected the transceiver to an 80 meter antenna and compared its performance against a modern transceiver. I found receiver sensitivity to be excellent. Contacts on the less crowded frequencies were satisfactory, although on the more active frequencies the simple two-stage crystal filter was too wide to separate closely spaced signals. Without a narrow IF, sharp filters, passband tuning, a receiver notch filter and RIT, reception was difficult. The transmitter, rated at 200 W PEP input, performed better than expected, reaching every station the modern transceiver did.

Conclusion

Restoring older equipment built from a kit is gratifying, but it requires a different approach than that used to restore commercially built equipment. The original builder may not have used proper soldering techniques or possessed good assembly skills; components might have been custom-designed and modification in later years would have been more likely. In many cases, the original assembly manual might not be available. Restoration is an educational and satisfying experience, however, and it will reward the restorer with a significant sense of accomplishment in resurrecting some of Amateur Radio’s past.

Operating with “yesterday’s” technology can be challenging, as the performance of older equipment, particularly kits, will probably not equal that of modern equipment. Despite the challenges, the next time you’re offered an old kit, take the plunge and restore it...you’ll be exploring a bit of the history of Amateur Radio.

Notes

¹Formerly known as the world’s primary producer of electronics kits, the Heath Company of Benton Harbor, Michigan started producing kits for the Amateur Radio market around 1953. During the mid 1980s, a declining electronic kit market caused the company to close its doors. Many an Amateur got his or her start by building a Heathkit.

²A word of caution. Too low a line voltage may actually inflict additional damage, as the instability caused by voltage differentials, regulator “starving” and improper bias voltages can upset intended circuit design. Also, fans or other electromechanical components often overheat at reduced voltages. The object is to effect a “soft-start,” so capacitors have a chance to “re-form” and not be subject to the shock of rated voltage levels. If this technique is used, it is suggested that the equipment be started at its specified minimum line voltage input, usually 85-90 V ac, rather than at 0.—Ed.

The Dangers of Cathode Keying

Keying an older transmitter? Be careful!

Mention cathode keying to older hams and you will probably hear a chuckle as they remember how surprised they were to get shocked the first time they touched the hot side of a key. But the problem is much too serious to laugh off as nothing more than a simple rite of passage—cathode keying combines dangerously high voltages with substantial currents.

Touching voltages as seemingly benign as 40 V dc or 32 V ac can be potentially (so to speak) fatal, and many solid-state circuits in television sets, computer monitors and power supplies operate above these voltages. Because most other solid-state circuitry uses lower voltages, we have been lulled into a false sense of security working with electronic circuitry. Many younger hams have grown up with transistor circuits, which they mistakenly assume are always safe, and far too many experienced hams have become complacent working on solid-state equipment.

Cathode Keying Explained

Most transmitters built before the 1960s were cathode keyed. The external key was placed in series with the cathode and its ground return in one or more key control lines (Figure 1). Cathode keying is simple and effective, but it has one very serious drawback: Because the plate voltage of the keyed stage appears on the key of a cathode keyed transmitter, anyone who happens to touch the hot side of that key and ground places himself in series with the keying circuit and the keyed stage.

Many hams learned to avoid these dangers by trial and error and most survived serious injury. A narrow escape from electrocution, however, should not be part of a learning experience. These dangers have existed since the early days of radio and they have not gone away, even with the transition to solid-state equipment in the 1970s. Dangerous voltages appear in both modern linear amplifiers and most tube equipment. Although we expect dangerously high voltages within the interior of

tube-type equipment, it is also possible to get badly shocked by touching the external key line of many of these transmitters. Vintage novice rigs, including transmitters such as the popular Heathkit DX-40, commonly used cathode keying. The dangers continue to surface as older transmitters and classic boat-anchor rigs are rediscovered and restored by newer hams.

Potentially Fatal—How Many Volts?

When current flows across a person's chest, which would occur between the hands or from hand to foot, a reliable medical source states that the current required to produce ventricular fibrillation is (approximately) 80 mA and that the resistance of wet skin is about 500-1000 Ω .¹ Assuming a worst-case wet skin resistance of 500 Ω , a possibly fatal voltage, at that current level, could be $E = IR = 0.08 \text{ A} \times 500 \Omega = 40 \text{ V dc}$.

Calculating a potentially fatal voltage is somewhat more complicated for alternating current because ac voltages are nor-

mally stated in root mean square (rms) values. For example, the standard 120 V ac line voltage is an rms value, which corresponds to a peak value of $120 \text{ V}_{\text{rms}} \times 1.414 \approx 170 \text{ V peak}$. The 40 V dc value calculated in the previous example, when equated to an ac rms value, corresponds to 32 V ac rms, if the waveform is a sine wave.

The ac calculation is confusing because dc levels are usually interpreted as being the same as ac rms values. That holds true for heating and power calculations only, however. For determining electrocution potentials, the dc level and the same peak ac value are equally dangerous. This is true even though the rms value of an ac voltage is less than its peak value and it means that the 32 V ac rms potential is as dangerous as a 40 V dc potential (because they both have the same peak value of 40 V).

Alternative to Cathode Keying

To counteract the danger of cathode keying, most ham transmitters (both pre-built and kits) began using grid-block keying in

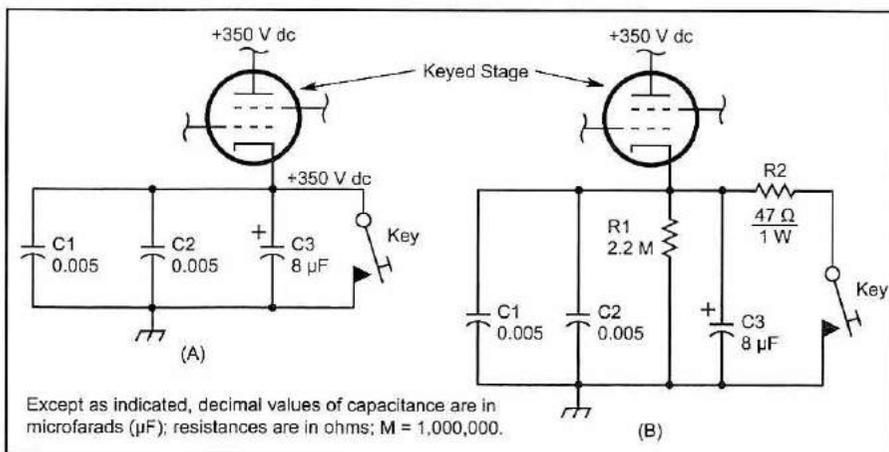


Figure 1—The keying circuit of a typical cathode-keyed tube transmitter is shown in A. Note the transmit key click suppression capacitor, C3. C1 and C2 handle local keying noise caused by key sparking. In B, C3 and R2 furnish wave shaping of the keying pulse and suppress transmitted key clicks. Resistor R1 is added to bleed charge from C3. High voltage is still present at the key.

the 1960s. [Actually, grid-block or blocked-grid keying goes back to the late 1920s. Its primary purpose was to eliminate *key-thump* (hard clicks at turn-on) and *backwave* (RF output when the key is up). It also afforded an easy way to *differentially* key a transmitter (turn on the oscillator slightly before the amplifier... so-called *timed-sequence keying*). The lowered keying voltage and current were byproducts of this technique.—Ed.]

Grid-block keying is safer than cathode keying because grid-block keying uses much lower voltages and currents. Grid-block keying applies a negative voltage to the control grid of the keyed tube to bias it off; it is this negative voltage that the code key switches. The bias voltage is usually around -50 V dc, but it can go to -150 V dc. Although this can still produce a shock, grid-block keying is relatively safe because it uses a very low current that is well below the 80 mA danger level. Because it is more complex (since an additional power supply is required to generate the negative bias voltage), grid-block keying is rarely shown in construction articles, even those that appear in today's ham magazines.

Tubes and Nostalgia

Most solid-state QRP rigs are inherently safe because of their low voltages and currents. However, those old tube-type boatanchor rigs typically use plate supplies that are ten times higher than the 40 V dc fatal value. Some hams still build tube-type rigs from scratch, similar to the one shown in an ARRL publication from the 1950s.² That transmitter uses cathode keying with the key connected between the tube's cathode and ground, as do most homemade transmitters of the period. It takes just the slip of a hand to come in contact with the metal part of the key that is connected to the cathode.

Although the circuit described³ (whose keying circuit is shown in Figure 1A) shows no obvious connection between the cathode and plate, the tube's ungrounded cathode floats up to the same potential as its plate, which is at the B+ voltage level. At the same time, the available current is almost always far above 80 mA. All that is required to complete the circuit is a ground. Simply touching the transmitter's case grounds the operator, with possibly dire consequences if the hot side of the key is touched at the same time.

The circuit reproduced in Figure 1A shows one additional design/safety error. The 8 μ F electrolytic key-click capacitor across the key is dangerous because it remains charged long after the power supply is turned off. As a result, it is possible to receive a shock from the electrolytic discharge by touching the key, even hours after everything has been turned off and disconnected. Because there already are two 0.005 μ F capacitors across the key, which are sufficient for key-click suppression, that electrolytic can be removed to

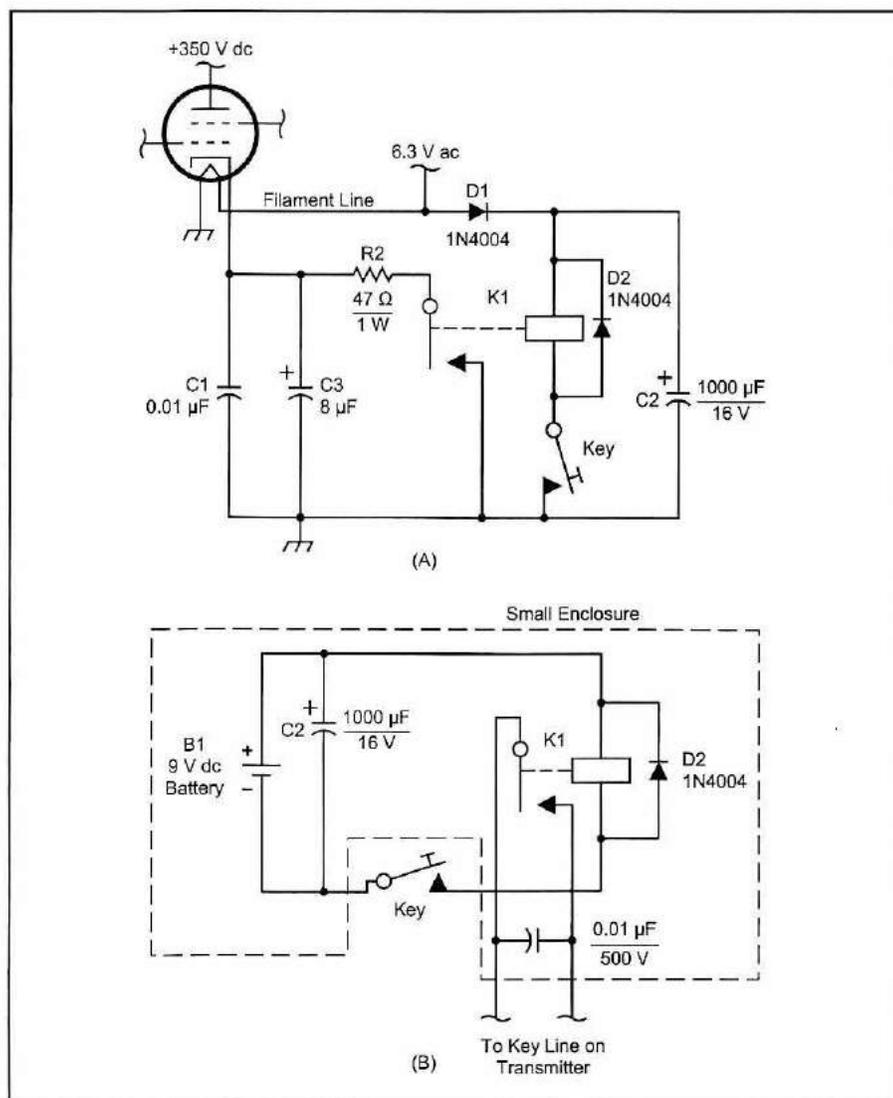


Figure 2—An inexpensive low-voltage keying relay can be used to key a cathode-keyed stage as shown in A. The dc coil voltage is obtained from a rectifier/filter fed by the existing ac filament line. D1 and C2 provide the relay voltage and D2 suppresses the coil back voltage. The reed relay will follow substantial keying speeds and its contacts will handle up to 0.5 A. The key voltage is now a harmless 9 V dc; current limited by the coil resistance to about 10 mA. If desired, the circuit can be built external to the transmitter, as described in the sidebar and shown in B.

improve safety and eliminate arcing across the key contacts. [The twin 0.005 μ F (C1, C2) capacitors don't take care of key clicks in the *transmitted* signal. They mainly affect local clicks heard in the receiver due to sparking at the key contacts. The 8 μ F capacitor (C3), together with a resistor (R2, 47 Ω), effectively suppress transmitted key clicks by wave-shaping the keying pulse. For safety's sake, R1, a 2.2 M Ω , 1/2 W resistor placed across the 8 μ F capacitor, will take care of any lingering charge. The modified circuit is shown in Figure 1B. Cathode voltage is still at the key and the operator is not protected while keying, however.—Ed.]

A similar potential danger exists in electrolytic filter capacitors in power supplies because those electrolytics can remain charged for hours after the equipment has been turned off (if the bleeders have failed). Most power supply designs incor-

porate bleeder resistors (high resistance power resistors) connected across the B+ output to discharge the filters after the power supply has been turned off. However, because they dissipate so much power, bleeder resistors sometimes fail open, leaving the electro-lytics still charged. Although many magazine articles contain prominent safety warnings about the dangers of working around these high voltages,⁴ few discuss the specific dangers of a cathode keying circuit.

More Nostalgia

Unfortunately, because of the nostalgia for tubes, the danger of having high voltage across a key is not going away any time soon. In fact, this danger appears to be increasing: A recent magazine article includes plans for building a quarter-watt tube transmitter that requires a B+ supply of 150 V dc.⁵ Instead of using cathode key-

ing (so that only one side of the key is hot to ground), the design places the key directly in the B+ line so that both sides of the key are hot! The article states that some amateurs might be uncomfortable with 150 V dc across their key and that there are "other ways" to key this transmitter, but it leaves it up to the reader to find those other ways, any of which would be safer than having high voltage on both sides of the key.

Conclusions

That most tube circuits are dangerous because of the high voltages they require

does not imply that all transistor circuits are safe, since many transistor circuits do operate above 40 V dc. Many experienced hams might consider these precautions to be just plain old common sense, until they think about how often they could have been electrocuted while learning them. It is far better to discover these dangers by reading about them, rather than by experiencing them firsthand.

As a suggestion, future articles that describe how to build tube-type transmitters should contain circuitry for the use of safe keying. At the very least, these articles should include prominent warnings about

the dangers of cathode keying.

Notes

¹S. L. Shafer, MD, "Electrical Safety in the O.R." www.stanford.edu/~sshaffer/LECTURES.DIR/Notes/Electrical%20Safety.Doc.

²"A Simple 30-Watt Oscillator-Amplifier Transmitter," *How to Become a Radio Amateur* (Newington: ARRL, 1955) pp 32-39.

³See note 2, p 33.

⁴See note 2, p 57.

⁵R. Fisher, KI6SN, "QRP," *Worldradio*, Aug 2002, pp 40-42.

⁶www.radioshack.com.

⁷Ocean State Electronics, PO Box 1458, 6 Industrial Dr, Westerly, RI 02891; tel 800-866-6626; www.oselectronics.com.

My Big Homebrew Rig Project

Let's jump back to the 1950s when many an amateur—including this one—dreamed of a big rack-mounted kilowatt transmitter.

I felt like I was starring in the movie *Ground Hog Day*—you know...the one where Bill Murray wakes up to repeat the same day over and over? I was bored! I had been retired for a year and needed a big project to keep me busy. Building an SSB rig looked out of my league. How could I build one even remotely similar to the first class equipment now commercially available?

Most of the new rigs are marvels of technology with parts that are unique and difficult to obtain. My hamming interests, however, harken back to the '50s, and I am now active in the new AM activity. I had never, in 46 years as a ham, built a big rig and, since I was into retro radio, I could relive that era in style. I now even had the time to build a vacuum tube era Class C plate-modulated rock crusher.

I remember looking through *QST* during the '50s, marveling at the big kW relay-rack transmitters. Usually, the builder was dressed in a suit and tie, seated in his operating position, looking like someone of importance...an electrical engineer, a scientist or perhaps even a general. As a boy, such hams held tremendous status. All these years later, I was determined to savor the big rig "machismo" of the '50s myself. Actually, during those years, I never got past CW and poverty. Working and going to college at night brought an end to my first foray into ham radio.

I started my project by searching each new hamfest for parts that might be of value and using my collection of old *ARRL Handbooks*, *Electric Radio*, *QST* and *CQ* as a guide to potential circuits. By studying other hams' ideas, I was able to spot a worthwhile part instantly from a distance of at least two tables and pounce on good buys. When you homebrew vintage rigs you are at the mercy of those parts and tubes that come into your possession. If it was a bargain and it looked like those parts illustrated in the old Handbooks, I bought it.

This aspect of vintage homebrewing is real fun. You need a quest to really enjoy a hamfest. And don't forget, you need a place

to store all this "junk." I was very fortunate to have recently moved to a place in rural South Carolina that came with a second two-car garage. I converted it into a shack/workshop.

No matter how early I arrived at a hamfest, I could not find hide or hair of a suitable modulation transformer! I was becoming frustrated, even though plate voltage iron seemed plentiful, by comparison. All of a sudden, I got lucky. Lea, K4VWD, a fellow member of the Old Friends Club, asked if I might be interested in some of the equipment from an estate. He was helping the wife dispose of her husband's lifetime accumulation of rigs and parts. I bought all of the parts that might be of value for the project. This included a Thordarson 500 W multimatch transformer and three Thordarson plate transformers, all of late 1930s vintage. I also obtained a variety of power tubes (including 100THs), tube sockets, a 6 foot relay rack with a very well done meter panel (like a Collins kilowatt rig), a variety of chassis and several



Do It Safely

I want to warn anyone working around high voltage that some very smart and clever hams have made fatal mistakes. Be *very careful*—when using my jury-rigged test set-up, I didn't move anything except the Variac and tuning controls with power on. Pull the ac plugs every time you go into the chassis and discharge the power supply before touching any circuit. Don't count on bleeders. Ground the B+ to be sure. Most importantly, have a friend observe your setup. I'm lucky to have an experienced ham friend, Jim, K4DEE, who looked over my test setup and helped me troubleshoot the entire project.—Robert B. Login, AA8A

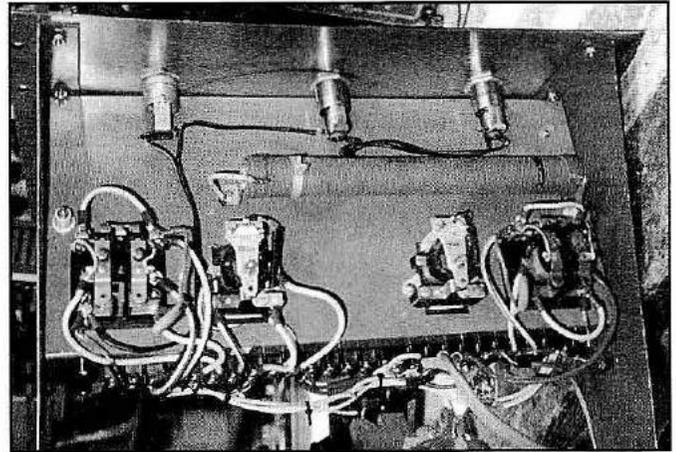
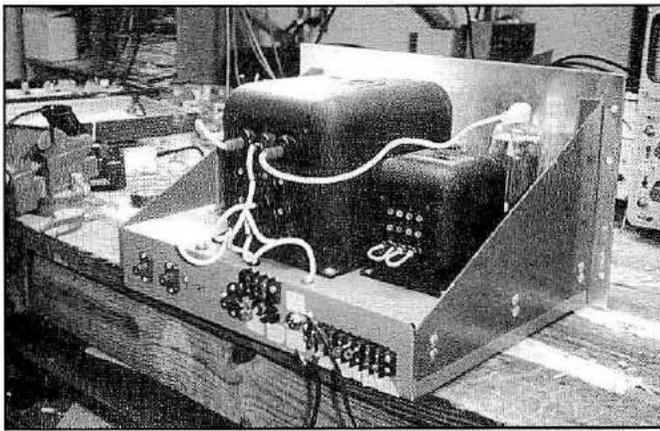


Figure 1—The modulator deck above and below chassis. The transformers were mounted facing toward the rear so the taps could easily be changed.

aluminum panels. I now had almost everything I might need for the project.

Although the former owner had barely started to build a rig in the relay rack, I found that the only thing I could use was the panel fixture with four meters. At this point, I worried that the old transformer iron wasn't any good. After all, the stuff was at least 60 years old! One of the big plate transformers proved to be shorted out. It was rated at 6000 VCT at 0.5 A! I was very upset, but the other iron appeared okay. Even the 500 W modulation transformer looked okay. With 120 V ac on the primary, it had the expected voltage on the output.

Tube Selection

I wanted a band-switching amp and decided to homebrew my own pi-network. The big decision was which tubes to use. After much thought, I decided on 4-400As for the final and triode connected 813s in the Class B modulator. These were available at reasonable prices and would easily produce a kW of plate modulated RF. I also decided that it would be easy to control the screen voltage of the 4-400As as a way toward keeping the output at the legal limit. These tubes would be hardly breaking a sweat at that power, and used, cheap tubes, even at the end of their careers, could "soldier-on" in my service. I've purchased several of them at hamfests for very little. As long as the filaments are okay, you can place your bet that the old tube will put out at least 200 W. Both *The ARRL Handbook* and the *Radio Handbook* published during the late '50s have construction articles dealing with Class C 4-400A amplifiers and suitable Class B modulators.

Collins 32V-2 Exciter

My overall plan was to use my Collins 32V-2 as an exciter for both RF and audio. The setup for this is shown in the 1959 edition of *The ARRL Handbook*. I knew the 32V-2 would produce excellent audio. Furthermore, it has a 500 Ω tap on the modulation transformer secondary. This was ideal, because I had a 600 Ω input transformer

(Thordarson T15D82), designed with a multimatch output, that would easily drive the triode connected 813s. I carefully measured each unit's panel space in the rack and found that the 32V-2 would fit nicely at tabletop height.

The big problem was how to get it in the rack without breaking my back (it weighs over 100 pounds). I wanted to be able to work on the transmitter without having to trouble a friend for help! The problem with the typical relay rack is that it usually lacks support for each deck until they are affixed to the front. I solved this problem by bolting a heavy-duty shelf wall fixture to each side inside near the middle of the rack. The shelf support arms that lock on to the fixture were then cut so that they were a few inches long. With the 32V-2 on a table, and the cut-down support arms positioned approximately and slightly below where I wanted it to be positioned, I was able to push the relay rack next to the table, reach through the back of the rack and pull and pivot the 32V-2 onto the support arms. Once it was on the arms, it was easy to pivot the 32V-2 into position. As a safety precaution, before I started to move the 32V-2, I placed two of the front rack screws slightly below where the 32V-2 was to match up with the front panel so that it could not slip down. I never had to lift the hundred pound exciter and, once in the rack, I was able to adjust its position by placing shims between it and the support arms.

Modulator and RF Deck Circuits

The 1959 edition of *The ARRL Handbook* article, "4-250As in a 1-kW Final" (originally described in *QST*, June 1956, by L. McCoy) and the *Radio Handbook* (W. Orr) "General Purpose Amplifier" formed the models for my project. Of course, I had to "mix and match" according to the parts I already had. Should the rig not work properly, I could always fix the problem once it became obvious. After all, I could then renew the fun search for a more appropriate part.

I decided to hinge together two large

chassis to make a box whose bottom would house the filament transformer, the bias and the screen supplies. Also, I cut a hole in the bottom chassis and mounted a muffin fan under the 4-400A air sockets to force cooling air through the sockets and the chimneys above. The input grid circuit was built around a Bud 80-10 meter turret assembly that looked like it would work. The pi-network consisted of a big ceramic two-pole switch and an E. F. Johnson silver-plated coil. I used copper tubing for the 15/10 meter section. This was mounted at right angles to the main coil and a 100 pF, 9000 V tuning capacitor. This capacitor required several small 20 pF doorknobs to resonate on 80 meters but it worked well, according to my grid dip meter, on the other bands.

The loading cap was a multisection receiver type that I guessed would be about 2000 pF total. I used a National type R-175A choke as the plate choke and the largest neutralizing capacitor I could find. It looked like the one pictured in the *Handbook*. Otherwise, I tried to match the circuit as closely as possible. You can see the results of my efforts in Figures 1 and 2. Figure 1 is a composite of the modulation deck and Figure 2 shows some views of the RF deck.

I used more shielded wire than suggested, especially where the filaments had to be long enough for the two chassis to swing open. Additionally, coax shielding, salvaged from bits of coax was slipped over a suitable twisted pair of filament leads. I used extra 1 kV/0.001 μ F bypass disc ceramics, as I was concerned, because I had the bias and screen supplies in close proximity to the RF section, that I might couple RF into them, causing the final to be unstable. So, I bypassed everywhere the bias and screen supplies were exposed. A 100 mA fuse was placed in the output of the screen supply to protect the tubes should B+ be removed while the screen voltage was applied. I also had to use a 10 H choke in the screen so it could be modulated. When you build something with parts on hand, and you take liberties with the design, you have no idea anything

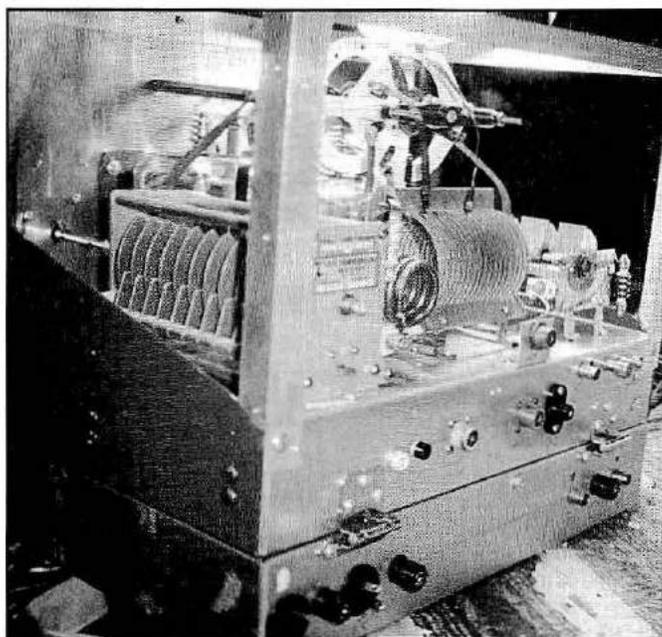
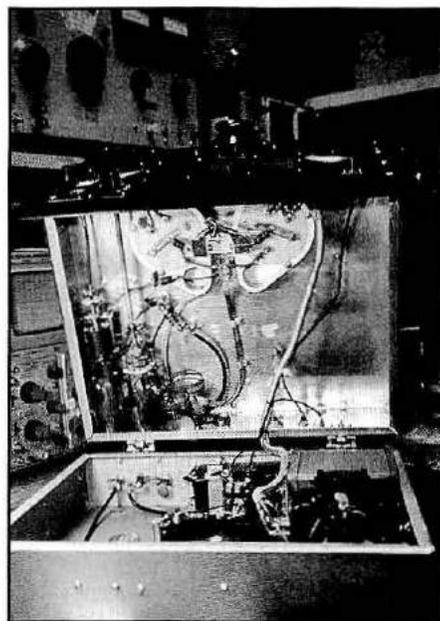
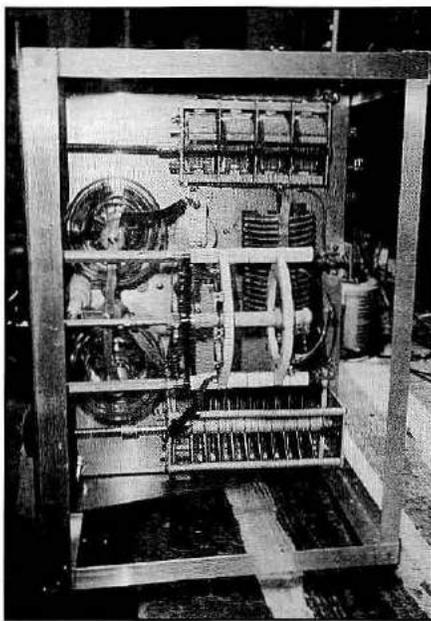
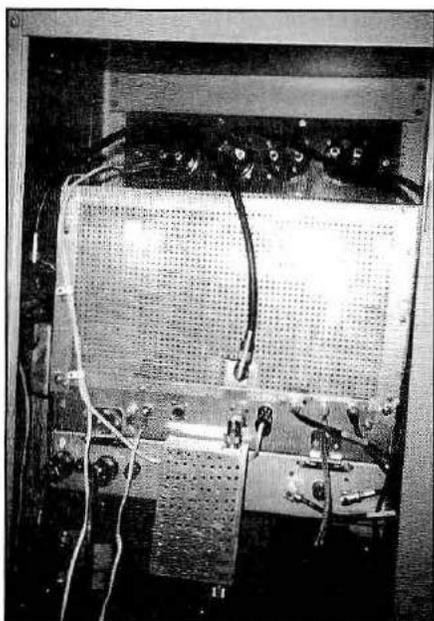


Figure 2—A composite view of the RF deck. Note the two chassis that are hinged together. The cooling system is located on the lower chassis, along with control circuitry.

will work or work properly! This was always on my mind as I labored to cut the holes and do all the metal and mechanical work to put the final amplifier together.

I want to recommend a Dremel tool along with a variable speed hand drill as the two most necessary tools to have to do this type of work. While it's possible to make all the holes with the two, I wouldn't recommend being without a set of socket punches. They make the job much easier and cleaner. The Dremel tool with cutting discs can be used to cut out large holes for windows, transformers, etc. It may require several discs to do the job but you can cut pretty accurate holes that look very good. Circular holes are a problem for the Dremel. I'm sure there are hams that have much better tools for this type of metal work but for utility and low cost you can't beat the Dremel. I used circular cutout saws designed for 1/4 inch hand-drills for larger

holes. With a little practice and the appropriate cutting fluid, you can cut pretty neat meter-sized holes.

Preliminary Testing

When I finished the final, I decided to test it on the bench. I had a power supply that would deliver 3000 V at 250 mA. I used a Drake T4X as a preliminary driver and before powering up I tried to neutralize the amplifier according to the *Handbook*. The final did not behave as suggested and the neutralizing cap seemed to have little effect, but I adjusted it to what I believed to be a minimum. The filaments have their own ac source and I put a 5 A inrush current limiter in the primary of that supply to afford a softer start for the 4-400As. The tubes lit up and looked really nice. The bias supply is also connected to the filament ac source so that the bias is on all the time. It delivers -150 V dc (regulated) to completely turn off the

tubes during receive. On transmit, a 5 k Ω resistor causes the bias to rise for Class C operation.

I hooked meters up to all the circuits and plugged the screen supply into a Variac (a variable ac power supply). With the filaments on, I started to feed 80 meter RF into the rig. It took nearly full power from the exciter to kick the grid up to 25 mA. Something was wrong! Could the input turret be wrong for this circuit? It resonated quite nicely affording a sharp peak indication. It crossed my mind that the output of the T4X exciter was 50 Ω but I had no idea what the input turret impedance was.

I installed a Drake MN4 antenna tuner between the exciter and the final. Sure enough, they were significantly mismatched. When they were properly matched, it took less than 10 W to kick the grid meter up to 25 mA. I also had the B+ supply on a Variac and increased the voltage to 1000 V and the screen voltage to 200 V. When I keyed the exciter the final showed an output that I was able to tune and load to a maximum of a few hundred watts. I increased the B+ to 2000 V and now was obtaining much more output. I went for the maximum B+ and, as I keyed the exciter, I also increased the screen voltage to 500 V. This gave me 600 W out according to my wattmeter. At a plate voltage of 3000 V and 270 mA, that worked out to be 74% efficiency. Not too bad! In fact, I had to reduce the drive to about 4 W to keep the grids at 25 mA.

Attenuator

Since it took only a few watts to drive the amp, how was I to reduce the output of the 32V-2? That's when I discovered attenuators. I noticed that the Viking Thunderbolt amp also used 4-400As and that its manual showed several attenuator circuits that Johnson recommended. I built a version of the one recommended for 100 W rigs. This proved to be too little attenuator

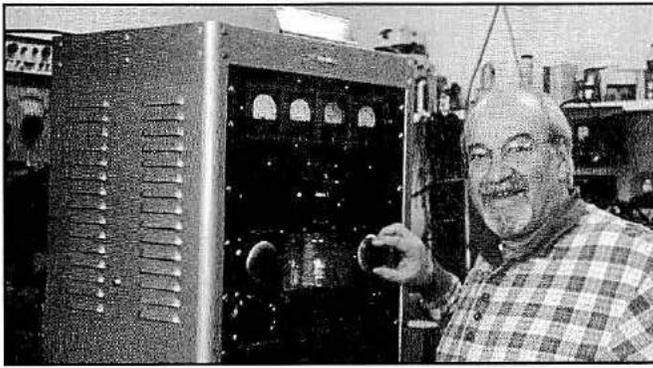


Figure 3—It's gratifying when everything operates as designed. The final amplifier tubes can be observed through the clear window—no red plates here!

Troubleshooting

After months of work, I was finally going to test it out. I plugged her in and hit the ON switch. The filaments came on. I had the power supplies connected to the ac but not connected to the RF and modulation decks in order to test them out. Using a Variac on each in turn, I was able to convince myself that they would give the expected voltages.

Reconnecting them and testing with just the 32V-2, I was able to get the required 25 mA of drive. I then keyed the rig and *bam!*—the fuse blew in the RF supply. I won't bore you with stupid mistakes like using audio plugs for some 120 V ac connectors or the nut shorting out the power supply that had, unbeknownst to me, fallen into it! Once these mistakes were rectified, I was able to key the rig on. Turning up the panel-mounted small Variac in the screen supply resulted in the output coming up. The amp could easily put out the legal limit. I switched to AM, pressed the PTT switch and watched my SB610 'scope as I talked and increased the audio drive. It worked! The 'scope waveform looked pretty good. No doubt about it... I was getting 100% modulation. I cycled through several test transmissions into the dummy load and found no problems. I worked my friend Jim, K4DEE, on 7290 and he really liked how it sounded, loud with good audio.

I had several contacts and received good reports, but then started blowing fuses again. This time I found that the fuse socket assembly was too close to one of the transformers. I changed that and no more fuse blowing. I run the rig at 375 W, the legal limit for AM, but it can do much more, the limitation being the quality of the 4-400As and their plate and screen voltage. I've teamed the big rig up with my 75A-3, resulting in my '50s dream AM station. I'm sure the boy who drooled over *QST* in the '50s would be impressed! I'm very happy with the performance—just look at that smile in Figure 3. As for operation, you can catch me on the 75 and 40 meter AM hangouts.

"Rig Here is Homebrew"

I have a tremendous feeling of accomplishment whenever I say that the rig here is a homebrew pair of 4-400As modulated by triode connected 813s. When that big rig keys on and the meters read what they should and flicker with my voice, I feel the effort was well worth it.

tion, so I added a 50 Ω dummy load to the attenuator output made from paralleling a dozen or so 2 W carbon resistors.

I placed the whole collection of 2 W resistors in a mini box with numerous holes to allow for cooling. The attenuator with the 50 Ω dummy load also solved the matching problem. The 32V-2 switched to the 600 V setting was resonated to 3885 kHz but the loading was set to a light level. Experimenting, I found that I could lightly load to about 40 W and through the attenuator/dummy load connected to the amp, with the filaments on, I was able to obtain the magic 25 mA of grid drive. Similarly, I found the settings for 7290 kHz. Neither 20 nor 15 meters required the attenuator/dummy load because the 32V-2 could be very lightly loaded and I was able to get 25 mA of grid drive reliably. All of this took place with the 32V-2 mounted in the rack, which could be rolled to a position convenient to my workbench where the amp was being tested.

I was able to place the amp deck in the rack above the 32V-2 and the meter panel across the top and it all fit perfectly. As mentioned, the modulator deck was as described in the *Radio Handbook*. The book has a section on triode-connected Class B modulators and I also made use of the amplifier input circuit meant for the 32V-2 as an exciter. Thordarson manufactured both the 500 W multimatch modulation and input transformers. I positioned each to face the rear of the deck so that transformer connections could be changed if my impedance calculations were incorrect. A ceramic wafer switch was used to close the ac interlock to the modulator plate supply so that ac is available to the modulator power supply. It also lights an indicator bulb

showing that the modulation deck is activated. Another ceramic wafer switches the 32V-2 audio into the modulator or returns the circuit to the original 32V-2 configuration should I ever want to run the exciter by itself.

Power Supplies and Control Relays

Because I had two transformers, each individually unsuitable to powering the rig, I was forced to construct two power supplies. Both are choke input with the choke in the transformer center tap. I used banks of 450 V dc electrolytics and 6 A/1000 PIV diode rectifiers in a full-wave or bridge configuration, depending on the transformer. They are standard solid-state power supplies whose circuits are well covered in the literature.

The control deck consists of a SPST contactor whose 120 V ac input comes from the ac activated by the 32V-2 exciter PTT circuitry. This relay is used to feed 120 V ac to the other relays. I did this because I was concerned that the relay in the 32V-2 couldn't handle the current required to activate all of the other relays.

The RF deck's power supply is activated by a DPST heavy-duty contactor, which also completes the circuit to the modulation power supply ac contactor relay. I did this so that the RF deck would require turn-on before the modulation deck. I also used interlocks that are activated by the antenna changeover relay and the relays used to connect the 32V-2 to the RF deck. Therefore, the antenna and the 32V-2 have to be activated for the power supplies to come on. The RF deck power supply must come on before the modulation deck power supply comes on. This guarantees that the modulation deck has a load before it is up and running.

Hams Redeem Old Transmitter at Fountain of Youth

Historic radio station relocates and leaves behind a vintage Collins rig.

WFOY-AM, St. Augustine, Florida, bills itself as "the oldest radio station in the nation's oldest city." Its call sign relates to the station's being built at the Fountain of Youth National Archaeological Park, where artifacts traced to Spanish explorer Ponce de Leon helped date the discovery of the New World.

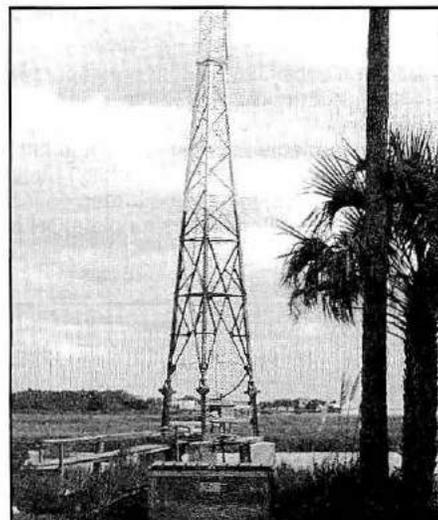
A group of Amateur Radio operators discovered that the station would soon discontinue operations at this location, 490 years after the explorer made landfall there, and that the station's owner would leave behind an artifact now housed at a radio museum where town curators plan to showcase it as part of a fascinating claim to some technical history in the earliest days of wireless.

The "artifact" happens to be a beautiful, art-deco style Collins AM transmitter, the model 300-G, which features a picture window to admire a quad of tall, glowing, type 810 triode vacuum tubes. The rig will take a new spot on the dial on 160 meters where it will be operated as a demonstration of vintage radio for museum visitors and the amateur community. Its first formal appearance on the bands is expected to be during the "Heavy Metal Rally" when retired broadcast transmitters like this one are fired up for the prime winter no-static season.

WFOY, 1240 kHz, is thought to be the first station in America where planners deliberately located a transmitting tower in marshland to test whether such an installation would boost the range of a signal. The concept of *ground conductivity* as it relates to signal patterns has long been proven, but in the early days of broadcasting "we got on the air and then all of a sudden we started getting DX reports from as far away as New Zealand and England," said John R. Fraser,

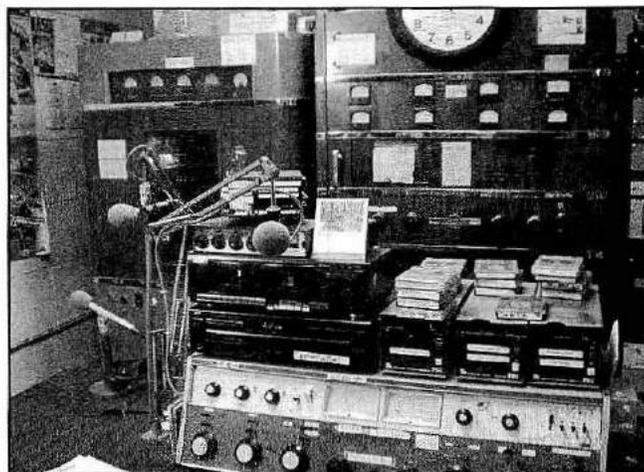


WFOY transmitted from this building for 63 years; those are oyster shells in poured concrete!



This tower, erected in 1936, was among the first in broadcasting to prove the link between ground conductivity and enhanced signal.

One of the last known pictures of WFOY on the air at its original 1936 location. The Collins 20V-2 is on the left, while the 300-G is to the right.



New Life for an Old Transmitter—Converting the Collins 300-G to HF

Jim Young, W8MAQ, sums up best why it is sometimes justified to permanently modify a classic transmitter like this. At more than half a ton but only a quarter kilowatt, "the 300-G had little inherent value as it sat. It could serve an entire second life as a tribanded ham AM transmitter." And so the broadcast engineer took on a design challenge increasing functionality to cover 160, 75 and 40 meters, while somehow preserving many original components.

The original inductively tuned RF tank was a "T" section followed by a "Pi," and used tuning motors that pushed slugs within differential coils. Collins, in a service memo accompanying late serial number transmitters like WFOY's No. 147, realized friction would cause chronic failure of these motors, "which led to the Pi-L solution with dc motors replicating the original tuning method," Young explained. "After that process I never felt guilt about reworking the network," especially when measured RF efficiency jumped from 70% to around 76%.

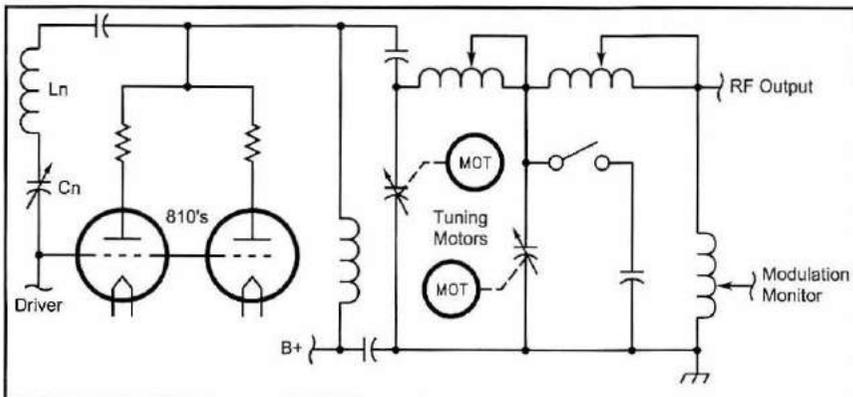
With an eye on how W0CXX, Art Collins himself might have envisioned it, Jim said "I re-used the glazed ceramic coil forms, rewound them to suit and used motor-driven variable capacitors for Tune and Load. This works great. I employed dynamic braking of the dc motors so there's no over travel when power is removed."

Jim continued, "I switch in a fixed capacitance for loading on 160 meters and move adjustable taps on the coils for band changing, and the original motor control circuits in the rig still function as intended." They are tuned from the original momentary contact, spring-loaded switches capped by the pre-war style, anodized aluminum knobs on front door.

The RF drive comes from a pair of parallel-connected 807s and is tuned by a conventional tank. Jim said, "I only had to rewind the coil and determine appropriate taps. The variable capacitor is also motor driven from the front panel, as original, and a fixed cap is added for 160."

Collins used a 6L6 as an untuned Class-A buffer before the 807s. "I added a band switched plate tank here and made the 6L6 screen voltage adjustable to set the 807 drive at 3 or 4 mA," he explained. "For an exciter I am currently using a Boonton Labs signal generator; input requirements are about 4 volts across 10K. I also built a couple of protective bias supplies, one for the finals and another for the 807s."

This protects the impressive and hard-to-replace Weston meters, which originally would pin and (hopefully) trip breakers. Jim notes the RF input is muted while receiving, but can be turned on locally for driver tuning and frequency spotting. Remote controls for plate ON and OFF, and receiver muting complete the conveniences.



The Pi-L output network for 160, 75 and 40 meters.

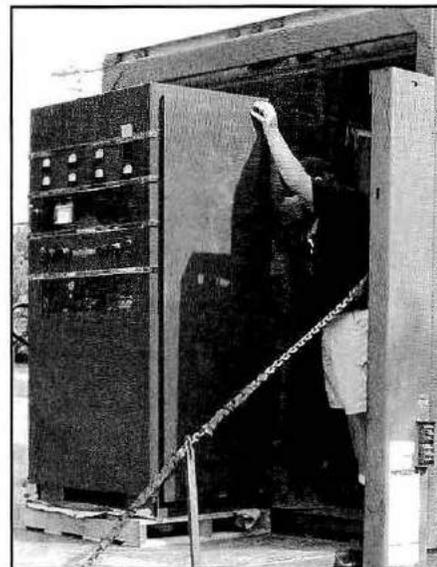
ex-WD4KQX, son of the station's founder, Walter Fraser, who put WFOY on the air in the 1930s.

Fraser said his father quickly faced many questions from others in the broadcast industry, curious as to whether WFOY was within its licensed power limit to be received at locations so far away. Fraser recalled stories of engineering crews coming to Florida from CBS, the station's network, as well as from WLW, the legendary Ohio powerhouse. The technicians had the

same question, Fraser said, "It was just, with 135 watts, 'how do you do that?'"

"The only thing they could reckon was that it was in the marsh," Fraser continued. "What we didn't know was that by putting the ground rods out in the marsh it drew the top of the lobe down closer to the water, so therefore we could get some transmission to stay closer to the surface" and follow the curvature of the earth.

But until WFOY came on the air, the effect "was sort of a blackboard theory—it



Professional movers gently bring No. 147 to its new home.

had never been tried, and this was the first place they tried it," according to stories surrounding the station passed along by Parky Boone, W4YVX, a retired aircraft communications technician who first met the Fraser family as a teenager growing up in St Augustine.

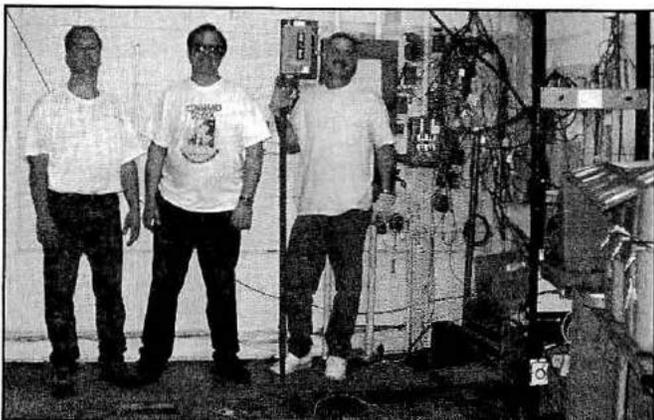
Boone, the station's engineer the past 15 years, affirmed that the station's strong signal has been attributed to its location. "It's ground conductivity. The salt water is far superior to any conductivity you could get on ground." He noted the tower is about a hundred feet out in the marsh of the Matanzas River, just south of St Augustine Inlet to the Atlantic Ocean. Boone said, "The tide comes in and out. It's mud flats at low tide and about three feet deep at high tide."

The station's claim to history seems to be solid. Broadcast engineers and historians contacted for this article knew of no research suggesting any station had gone on the air earlier than WFOY at such a site specifically with a possible signal advantage in mind. Many stations have, however, located their transmitting towers in wetlands over the years as a function of cheap land value, and as validation later came in that such locations can indeed enhance a signal.

Retired Transmitter Rescued

The station's current owner, Doug Shull, had no future plans for the Collins 300-G, but wanted to keep as a backup a newer Collins 20V2, which was now on the air as the primary transmitter at the old site. He told the author that he would give away the 1951 300-G in exchange for moving the 1961 20V2 to the new location. Calls went out to other hams who own examples of the 300-G, Jim Young W8MAQ, and Tom Mackie, W2ILA, and the three of us enthusiastically decided to stage a rescue.

Tom first saw a 300-G at the author's



Success! Tom, W2ILA, engineer Alan Alsobrook, and Paul, WA3VJB, view the now-spacious studio.

Sixty-seven years worth of weathering at the base of the WFOY tower.



house and has been hooked ever since. "The size and look caught me. This was the essence of the art of radio. I believe I mumbled something like 'if you find another one of these, let me know.' That was probably 12 years ago," said Mackie, an engineer with Trimble Navigation who has brought several 300-Gs to safe haven after stations abandoned them or otherwise decided to get rid of the well-built old machines. He operates on 160 meters with a totally restored 300-G that he retrieved in Oklahoma. A second 300-G from Texas awaits his curative powers.

"These little transmitters kinda grow on you, they're pretty, very stylish, even endearing," said Young, also a longtime fan of the 300-G who works as Chief Engineer at a radio station in Ohio. Jim has done the research and design work to allow the Collins to operate at full power on 160, 75 and 40 meters, the most popular bands where AMers gather to share vintage radio stories and technical tips at building, repairing, restoring and enjoying this nostalgic specialty in ham radio (see the sidebar "New Life for an Old Transmitter").

WFOY's old site presented some challenging logistics for the removal of not one but two huge transmitters. When word first came, the station was still in operation at the property next to the Fountain of Youth. The units were located in the same room as the on-air personalities. The Collins operating console in the small studio was directly in front of the transmitters, and nothing could happen until that mixing board was disconnected and removed from the path out the door.

Meantime, Parky and his assistant, Alan Alsobrook, were busy solving some antenna problems at the new site a few miles

across town that delayed the switchover and the move. This temporarily sidetracked plans by the hams to gather at St Augustine from their homes in Annapolis, Rhode Island and Cleveland, respectively.

This provided some additional time to establish what the trio would do with the transmitter. All three men already have working examples of the 300-G on the air. All three men also already have spare, dismantled examples for parts support. And all three men had some trouble seeing where at their homes they could fit another big rig like this. Alert readers will notice this sort of discussion happened after the decision had already been made to retrieve Serial No. 147 at St Augustine.

Radio History Society Becomes Safe Port

Near Washington, DC, is an old farmhouse renovated as a municipal museum sponsored by the town of Bowie, Maryland. The Radio History Society is dedicated to nurturing the appreciation of radio's heritage through displays of broadcast and communications receivers and memorabilia from the "golden age" of radio, including a set of NBC network chimes.

Everyone has heard of or experienced the days when a family's home entertainment center was a big wooden floor console playing the rich, mellow sounds of shows picked up on what was known as the Standard Broadcast Band. The author, who lives near the museum, contacted officials at the Radio History Society with an idea to give people a vintage look at a source of those old signals. They reacted well and responded quickly with an invitation for the men to place the vacuum-tube transmitter on long-term loan for display at the museum.

"I suspect very few of our visitors (other than those who actually worked in radio) have ever been inside a station," said Brian Belanger, the museum's curator who also is an executive with the national Antique Wireless Association. "Being able to showcase even some of that atmosphere is something to strive for." The Maryland museum includes many local radio station artifacts, and by chance, the 300-G was the same model originally installed at local WYRE-Annapolis, and WUST-Washington, DC, when these stations first went on the air just after World War II.

Jim, one of the hams on this mission, owns the WYRE transmitter, Serial No. 22, and the author owns the WUST rig, Serial No. 33. (We've taken to referring to these rigs by serial number since we've now tracked down more than a dozen examples, each with its own history, that are now owned by hams.)

The museum has eventual plans to put together a replica radio station featuring vacuum-tube studio equipment, open-reel tape machines and other gear of the 1940s and 1950s, but for now it is constrained by space. Meantime, hopes are high for a functional ham radio station, combining the Collins 300-G with some classic Hallicrafters and other receivers that have been donated to the facility. Officials say the Radio History Society will be the first museum in the country to have an antique broadcast transmitter on the air and in direct contact with other nostalgic stations, thanks to AM activity on the ham bands.

Related Web sites:

- www.amfone.net
- www.amwindow.org
- www.radiohistory.org

Somewhere There's a Good Home for a Boat Anchor

Do you claim it's your allergies when a dusty rig makes your eyes water and your nose run? Do the pupils of your eyes form little pie-shaped wedges when you're excited? You may just be a Glowbug Geezer!

If, as they say, confession is good for the soul, then I should be downright sanctified by the time I'm through 'fessin' up. That's what I'm about to do, right here and now. Own up to it. Unload. Tell it like it is. You see, I'm an addict—have had the habit for nearly 50 years. It's a wonder I ain't dead from the sheer weight of it all.

Until recently I've been afraid to say anything—mostly because of what I imagined would happen once the word got out.

"There goes the old Glowbug Geezer!" they would shout as I passed by.

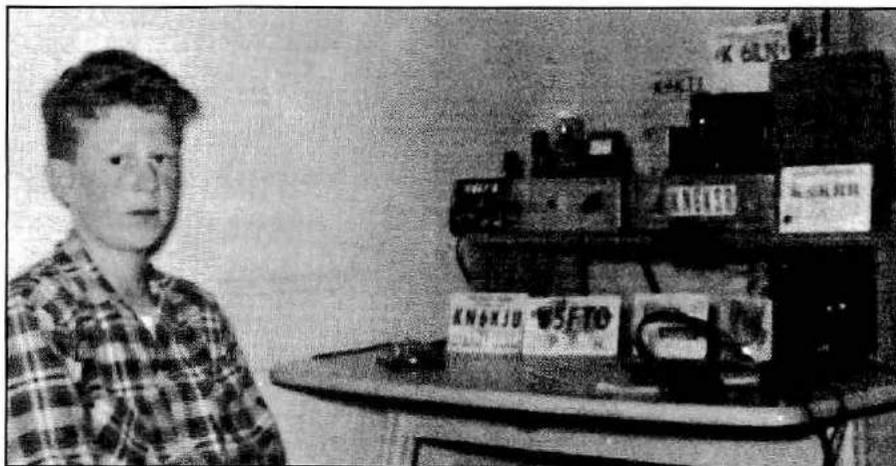
"Hey Geezie," another would holler, "you been sniffin' dust off them old finals again?"

Still another would taunt with, "Yo, Geezo—better not try to move that big ol' radio by yourself 'less you get a real bad hernia!"

The Beginning

As part of my catharsis, I'm going to tell you the exact day I got hooked some 46 years ago. It was summer, 1955, and I'd gotten my ham ticket a few weeks before school let out for summer vacation. I'd spent most of the school year scrounging parts and then assembling a 40-pound, 3-tube transmitter that ran 35 watts input. At full power the plate in the 807 final glowed like a miniature beacon every time the hand key made contact.

Anyway, what with school being out, we could stay up late any night of the week. It seemed like a perfect time for a go at some wee-hours DX with Walter, my old pal. Walter got his ticket a week after me and had



The author operated KN6KSR in 1955, the same year he was stricken with "Glowbug Fever." The 35-watt homebrew transmitter and BC-454 war surplus receiver kept the bedroom corner shack warm during all-night DX-chasing sessions—on non-school nights, of course.

only been on the air once at the school's club station. He'd just finished converting an ARC-5 Navy T-19 surplus transmitter to 80-meter CW. It would be the trial run for his rig that night. We set up our station where my long wire antenna terminated in the dimly lit corner of the bedroom I shared with my kid brother.

I was sitting right beside him when it happened. Here he was, sweat forming rivulets above his upper lip and eyebrows, the headphones clamped tightly over his ears, his right hand hammering away on the old J-38 key, while white spittle foamed at the corners of his mouth. It was sudden... and loud. Walter

was taking that first euphoric step into boat anchor nirvana.

"I got Arizona!" he shouted, causing my kid brother to bolt upright in his bed across the room and holler, "I didn't do it!"

"I got Arizona!" Walter yelled again, looking at me with eyes that had little pie-shaped wedges that kept opening and closing.

"What'd he give you?" I asked, watching Walter begin chewing on the headphone cord.

"Fow sess nam," said Walter, without removing the cord from between his teeth.

"Bitchin' report for DX!" I said. Never



ARS K6KSR today. Except for the Kenwood 2-meter rig and Astron power supply, all gear is at least 20 years old, including the "like-new" Collins 75-S1 receiver (bottom shelf), which the author found at a neighborhood garage sale for \$20.

mind that we were in a town just south of Los Angeles. "Hey, you wanna hang out and try for maybe Nevada or Oregon?" The little pie shaped wedges slammed open 180 degrees. "Afsholutley!" he hollered.

That exclamation sent my kid brother running off to my parent's room. "I'm tellin' on you!" he said, almost sobbing. He came back a couple minutes later and

was about to say something bratty when a booming baritone floated in from my Dad's room down the hall. "Boys, this is the Lord speaking. It's time to hit the sack. Unplug that stuff. Radio Free California is now off the air." To rub it in he began humming the national anthem. "Wibish afshi," garbled Walter, unrolling his sleeping bag.

It was along about first light that same morning that I realized I'd been hooked, too. I can remember vaguely dreaming about my 6AG7/807 rig. Walter tells me I was just sitting up in my sleeping bag, mumbling. "You were saying 'I'll never leave you,'" he said, in between enthusing over the potential QSL card from Arizona and adjusting the headphones he still wore in his sleeping bag. "You just kept saying it over and over like you was chanting or something." He shrugged and began chewing on his headphone cord again. "Aairulzona," he muttered through his cord-chew. "Kenyo beereefit!"

But Why, John?

By now your big question has to be, "Why would this dweeb wanna fool around with 400-pound radios that smell of burning dust, make the room too hot, and take a plumbing contractor to tune 'em up proper when he could do everything faster and easier with one of the solid state rigs?"

I don't think I can give a definitive answer to that one. Maybe the answer is that faster and easier doesn't always mean better. Maybe it's 'cause we cut our teeth on *Drive, Tune and Load* controls. Just maybe it's 'cause we can maintain near-total control over our signal's development — from the time it's introduced into the circuit, as it proceeds along its merry way through amp and oscillators and buffers and drivers to the 6146B finals, out the back door

and up the feedline to Mother Ionosphere. Geezers will tell you it's because real ham radios should be more than a single-finger exercise.

The last thing a Geezer wants to do is to get rid of equipment. That's a no-no—whether you sell it, trade it or donate it. The whole objective is to get more old gear. It's the key to a great set of abs and enhanced mental health. Just ask Herbie over in Texarkana. Uhhh, come to think of it, better ask his XYL, since Herbie got all glassy-eyed a couple weeks after he traded his old Swan 500C for a mountain bike. Not completely centered in his own mind, he took to riding around the big campground just south of town, asking perfect strangers if they'd seen his Swan. "He's just like a little boy who trades his favorite Buck knife for a glass eye," said Mary Ellen, Herbie's XYL. "He's got a heap of 'trader's remorse' that's all," she explained to the Park Rangers.

I phoned Walter. "Hey, Walt—you think maybe we're just a little crazy for hangin' on to all these old boat anchors for nearly half a century? I mean are we dinosaurs or what?"

"You know, I have no feeling in my left leg now." Walter complained. "And yesterday I just know I went blind in one eye for at least five minutes."

"Boat Anchors, Walter." His voice went up an octave. "Hey, is it swap meet this Saturday already?"

"Yeah," I said, "I think it is. You want me to pick you up?"

"For sure, ol' buddy. There's an old junker out there with my name on it!"

"Uh-huh. You know, Walt," I said, quickly scanning my shack to see if there was room for just one more radio that needed a home, "I think I better bring the refrigerator dolly... just in case."

The Age of the Autodyne

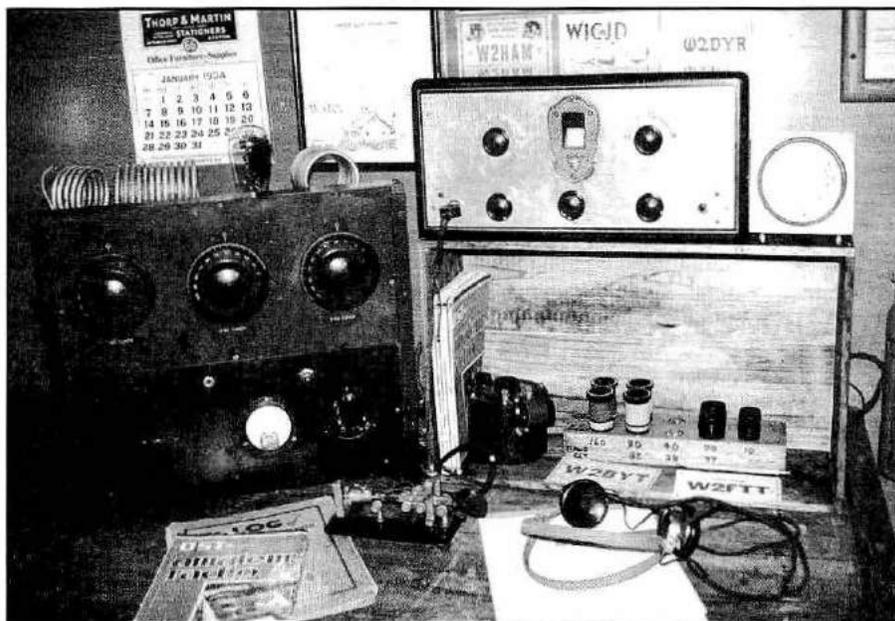
In the early days of Amateur Radio, the regenerative receiver was king of the world.

Most of us grew up equating short-wave communications receivers with the superheterodyne circuit. Yes, we knew there were regenerative receivers, but most of the ones we encountered were clearly toys, and were effective only on strong short-wave broadcast stations. However, an examination of history reveals that there was a 20-year period when the vast majority of short-wave receivers were regens. During this period, amateurs went from transmitting tens of miles to regularly contacting the far ends of the Earth, and they did it with radios that were the second cousin of the lowly Knight-Kit "Ocean Hopper."

Edwin Howard Armstrong, an electrical engineering student at New York City's Columbia University and long-time radio experimenter, invented the regenerative circuit in 1912. The triode vacuum tube, in the form of the De Forest Audion, had been in use as a radio detector since 1906, but its operation was poorly understood. Its performance was better than that of crystal detectors, but its cost and unreliability kept it from displacing them from general use.

The original Audion circuit was what we would recognize today as a grid-leak detector. The grid-leak resistor was usually omitted, as the internal leakage of these primitive electron devices made it superfluous. Armstrong observed that adding a small bypass capacitor across the headset affected the output signal level. This led him to believe, contrary to Lee DeForest's assertions, that RF signals were present in the plate circuit. Being an experienced RF hand, he sought to peak these signals by adding a tuned circuit to the plate lead.

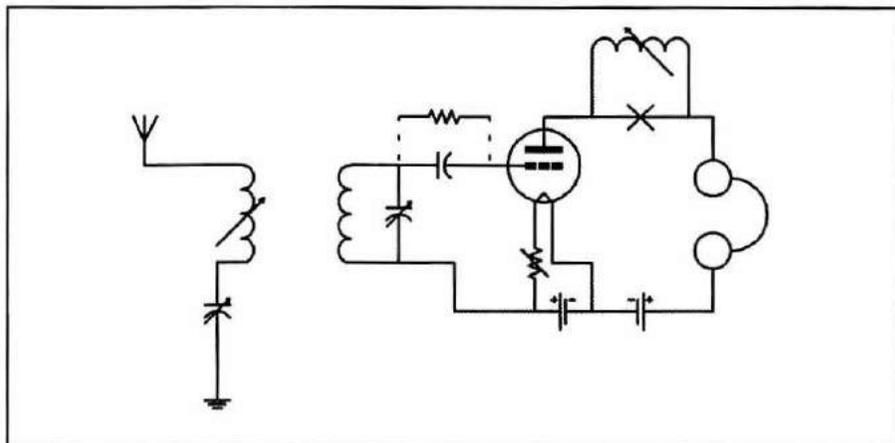
The effect was immediate and astounding. As Armstrong wrote, "Great amplification obtained at once!" By adding the tuned circuit to the plate, Armstrong had introduced positive feedback between the plate and grid circuits. At low levels, this feedback caused the signals to be amplified over and over achieving much greater gain than the original circuit. At higher levels of feedback, the circuit would break into oscillation and generate a radio-frequency signal of its own. This second mode of operation is important for two reasons: It marks the invention of the vacuum tube RF



oscillator, the basis for a new generation of radio transmitters. Equally important, this oscillating grid-leak circuit is the autodyne detector that made continuous-wave (CW) telegraphy a practical reality.^{1,2}

Prior to this time, "radio" almost universally meant spark-gap transmitters and receivers of limited sensitivity. Spark was

inherently wasteful of spectrum space, emitting what was essentially broadband noise, and attaining sufficient transmitter power to overcome the shortcomings of the receivers was a considerable challenge. Experiments had already been conducted with CW transmitters using high-frequency alternators (rotating machinery) and arc



Armstrong's modification to the basic Audion receiver adds an additional tuned circuit to the plate lead.

(dc spark) transmitters, but the necessary heterodyne receivers needed a second alternator or arc to serve as a beat-frequency oscillator (BFO). In one fell swoop, Armstrong solved the basic problems at both ends of the transmission path.

Armstrong's regenerative circuit was protected by a patent, which constrained commercial applications and resulted in a long period of unpleasant litigation. However, this had no impact on the average amateur. All he had to do was add one more

variable inductor, known as a variometer, to his Audion setup.

The Pace of Change Accelerates

Amateur Radio was banned in April 1917 for the duration of World War I. When operations resumed in September 1919, changes came rapidly. Much improved vacuum tubes for both transmitters and receivers were now available. Hams soon recognized that a few watts of CW "got out" better than a kilowatt of spark. Wide-

spread CW operation uncovered serious weaknesses in the Armstrong-inspired receivers then in use. When one wanted to change frequency when operating in the autodyne mode, all the adjustments—primary tuning, secondary tuning, plate tuning and filament current—had to be readjusted to obtain peak performance.

In a series of *QST* articles in 1921 and 1922, John L. Reinartz, 1QP, introduced a simplified regenerative circuit that proved to be a much better solution for amateur

A 1930s TRF-Autodyne Receiver

I purchased the homebrew radio shown in Figure A at an Antique Wireless Association auction some years ago. I was attracted by its excellent construction, and by the fact that it came with five sets of plug-in coils. The small size of the band-spread capacitor strongly suggested it was meant for ham use.

Not knowing exactly what it was, I took it to Gerry Mathis, W3GM, who was the local Grand Old Man of ham radio. Gerry lifted the lid and said two words, "rationalized autodyne." Beyond that, he didn't add much that I hadn't already figured out, but it was an important clue. Later, I discovered George Grammer's "Rationalizing the Autodyne" article in *QST*. In this landmark article, he summed up the current state of the art in regenerative receivers, and detailed the construction of a highly developed receiver that was widely built and elaborated upon by others.

My radio was constructed on a salvaged broadcast-receiver chassis (see Figure B), and was carefully mounted in a handsome mahogany case that formerly held an RCA Radiola 16. While the physical layout is somewhat different from the set in Grammer's article, the circuit is almost identical. Fit and finish are excellent for a home-brew rig.

The RF-amp and regenerative detector stages both utilize type 58 RF pentodes. Band selection is by way of plug-in coils. The coils for the 20 and 10-meter bands are wound on salvaged tube bases. Each tube, and its associated tuned circuit, is surrounded by a separate metal shield to prevent oscillation in the RF stage and to limit interaction between the controls. Audio-frequency amplification, sufficient to drive a headset, is provided by a type 56 triode. The tubes all have 2.5-V ac heaters.

Tuning is accomplished by the parallel capacitor method. The center tuning knob, below the lighted dial, is the "band-spread" control. It actuates two small capacitors that tune the RF amp and detector simultaneously. The knobs at the upper right and upper left are the "band-set" controls. The

detector band-set is used to select the desired portion of a coil set's tuning range, and then the RF band set is tweaked for maximum signal. If you've logged band-set positions, this need be done just once when one changes coils.

The coils are designed so that a fair amount of band-set capacitance is always in the circuit when tuned to a ham band. This "high-C" arrangement greatly improves stability by making the unavoidable variations in tube capacitance, which occur as supply voltages and circuit settings change, small compared to the total circuit capacity.

Grammer pointed out that many operators used battery power supplies to avoid problems of voltage variations on the ac line. However, this particular receiver, while it did not have a built-in power supply, was clearly intended for ac operation. It even has a switch brought out on the power connector to control the power transformer primary. The 1934 *Radio Amateur's Handbook* shows plans for a sophisticated voltage-regulated power supply for just such applications. I constructed one, using vintage parts, that I use with this radio.

On the air, the "rationalized autodyne" gives a good account of itself. Tuning is precise and repeatable. The detector slides smoothly in and out of oscillation making it easy to set the best operating points for both AM and CW/SSB. Selectivity, at least on 160 through 40 meters, is adequate for reasonable CW work. Sensitivity is very good, and the RF gain control keeps things nicely under control when the signals are strong. The set's stability is impressive, and interaction between the controls is minimal. It's easy to copy SSB on 20 meters.

The overall performance of this radio, at least for CW use, is superior to most of the inexpensive non-crystal-filter superheterodynes of the era. After using one of these radios for a while, it's easy to understand how the simple homebrew TRF-autodynes held off the superhets for as long as they did.



Figure A—Rationalized Autodyne, power supply and spare coils.

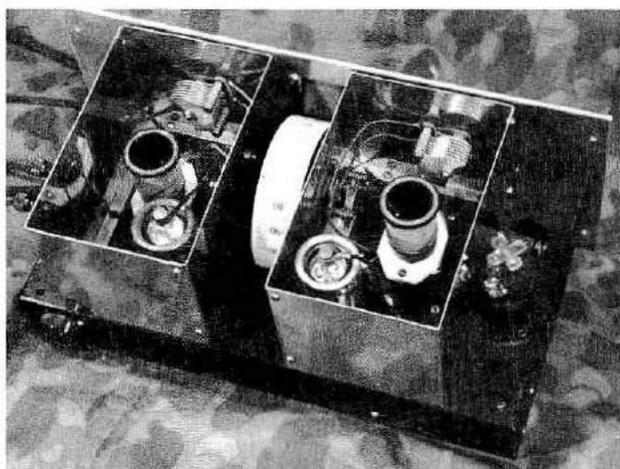
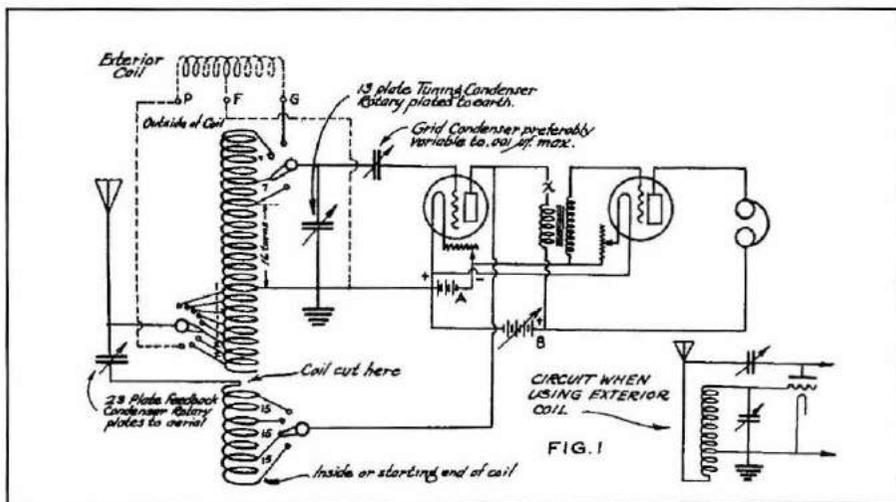
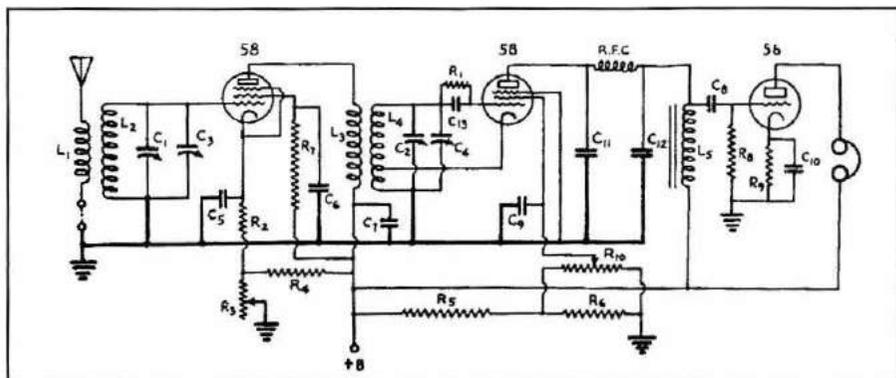


Figure B—Inside the Rationalized Autodyne.



"Improved Reinartz Tuner" from March 1922 *QST*.



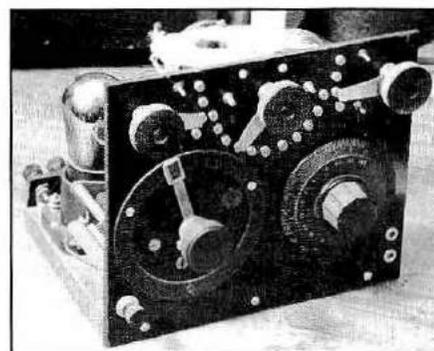
"Rationalized Autodyne" schematic from January 1933 *QST*.

operation. The Reinartz "tuner" uses a single parallel LC tank in the grid circuit. A tapped nonresonant tickler coil provides feedback from the plate circuit that is throttled by a variable capacitor. A third tapped winding allows variable antenna coupling. The three-winding coil was an easily reproducible "spider-web" affair. Hams around the world built thousands of these receivers, and, fortunately, a few have survived.^{3,4}

Receiver development continued to advance as new and more effective vacuum tubes were introduced throughout the broadcast boom of the '20s and '30s. For instance, late 1927 saw the introduction of the "shield-grid" tube or tetrode. A second grid was added between the control grid and plate of the triode. This added element acts as a Faraday (electrostatic) shield between the grid and plate. This reduces unwanted feedback between the output and input of an amplifier, and allows significant RF gain to be achieved.

Shield-grid RF amps were quickly added in front of the traditional triode detector to improve performance on the emerging 20 and 10-meter bands where receiver sensitivity was at a premium. RF amps have some additional advantages. They provide isolation between the antenna and detector. This greatly reduces radiation from an oscillating detector, and prevents its frequency from being "pulled" by the antenna swaying in the wind. A tuned circuit on the grid of the RF amp can improve selectivity, but great care must be taken to prevent the tuned-RF stage from oscillating due to stray coupling between the input and output tuned circuits. An RF stage can also exacerbate detector overload on strong signals by providing too much gain.

Other vacuum-tube innovations included "heater" type amplifier tubes and high-voltage rectifier tubes to allow the radio to be powered from the ac line rather than batteries, low-filament-current types



A vintage Reinartz receiver from the John Dilks, K2TQN, collection.

to allow portable operation from dry batteries, and the introduction of the "remote-cutoff" pentode to allow effective RF gain control.

The End of the Autodyne Era

In January 1933, *QST* assistant technical editor George Grammer published an article called "Rationalizing the Autodyne, A Three-Tube Regenerative Receiver of Unusual Performance" in which he enumerated the common problems in most amateur receivers, and detailed the construction of a highly effective radio, based on the latest tube types and circuit innovations, that carefully avoids these problems.⁵

The year 1932, however, had seen the introduction of the quartz-crystal IF filter. This circuit allowed superheterodyne receivers to deliver "single-signal" selectivity for CW signals. This development made superhets, another Edwin Armstrong invention dating back to 1918, sufficiently better than the autodynes to break into mainstream amateur usage. By the mid 1930s, many of the leading ham operators had abandoned their homemade TRF-Autodynes in favor of commercially made receivers from the likes of National, RME, Hammarlund, and, of course, Hallicrafters.

Notes

- ¹Edwin H. Armstrong, "Some Recent Developments in the Audion Receiver," *Proceedings of the IRE*, Vol 3, no. 3, September 1915, pp 215-248.
- ²Edwin H. Armstrong, "The Regenerative Circuit," *The Electric Journal*, Vol. XVIII, no. 4, April 1921.
- ³"A Receiving Tuner for C.W.," *QST*, June 1921, pp 5-7.
- ⁴"The Improved Reinartz Tuner," *QST*, March 1922, pp 8-10, 26.
- ⁵George Grammer, "Rationalizing the Autodyne," *QST*, January 1933, pp 11-16, 23.

The Drake TR-22: An FM Classic

An affectionate tribute to one of the first amateur FM transceivers.

It was 1972 and the ham community had been overwhelmed by a serious case of FM fever. Repeaters were springing up across the landscape, even in my hometown of Dayton, Ohio. I was a high school senior and a freshly minted ham with only a year's worth of experience under my belt, but I desperately wanted to contract this disease as soon as possible.

In those ancient FM days there was cool, and there was *cool*. The *cool* FM operators had modified Motorola hand-held transceivers, better known as HTs, dangling from their waists. You could spot them a mile away at the Marion's Pizza after-meeting club meeting. They didn't walk through the restaurant; they *strolled* with a haughty gait that put lesser mortals instantly in their places.

The non-italicized cool operators stuffed their automobiles with commercial FM rigs scavenged from 2-way mobile shops. These were hernia-inducing boxes with names like Motran and Progress. The guts of the transceiver remained in the trunk while the *control head*, a kind of semi-empty appendage attached to a cable as thick as your thumb, occupied the dashboard. These radios sucked down enormous amounts of current with every transmission, often dimming headlights dramatically. They were cool in their own way, but they weren't quite *cool*.

As for me, well, I owned a fire engine red Gonset Communicator 2 that could only transmit on 2-meter AM; I had to rely on careful *slope tuning* to listen to the FM action. That placed me somewhere in the FM outer darkness, but I had ambitions.

Enter the TR-22

After months of begging and repeated applications of pretzel logic on my part, my parents purchased a Drake TR-22 FM transceiver—primarily as a means to shut me up. I'll never forget the moment I gently lifted the TR-22 from its packaging. The perfume of fresh electronics filled the air. (To this day I relish that fragrance.) It was

a black-and-chrome brick of a radio, all gleaming knobs and switches. The TR-22 ran on rechargeable batteries or an external dc source; no more buzzing vibrator power supplies and leaking car batteries in the basement. It was blessed with six crystal channels; no more digging in boxes and juggling hot crystal ovens when you wanted to change repeaters. The zipper pocket of the leather carrying case held a slender, lightweight microphone, not a fist-sized hunk of metal you could use to bludgeon someone senseless.

Perhaps best of all, the TR-22 was *new*. It was among the first 2-meter FM transceivers manufactured specifically for the amateur market. Finally, I could join the other deities on the summit of the local FM Olympus. The modified commercial HTs were still *cool* (ham HTs were still a few years away), but at least I could take my place among the semi-elite.

What's Under that Label?

I never intended to deface my TR-22, but I also never intended to shift my father's Oldsmobile into reverse at 40 MPH just



Bill Frost Recalls the TR-22

Bill Frost, WD8DFP, is well-known to hams as the veteran service manager of the Drake Company. In addition to his assistance in the creation of this article, Bill contributed these memories of the TR-22...

I remember going to the Findlay Hamfest in September of 1978. When we returned to Miamisburg (Ohio) that Sunday evening, we learned that a train had just derailed downtown. Jeem Newland, WB8RXI, of the Mound Amateur Radio Association quickly set the emergency plan into operation and we used TR-22s almost exclusively to assist the city officials during the emergency and cleanup

that followed. The MARA club continued to use TR-22s for communication during band festivals, football games, the Miamisburg Turkey Trot, parades, city emergency drills and other public service events.

The Drake Company provided several TR-22s, modified for use on the business band, to emergency personnel in the aftermath of the Xenia tornado of 1974. Holding a TR-22 today or strapping one over your shoulder makes one realize how large and heavy they actually were, but compared to other FM rigs of that time, they were compact and versatile. A great little transceiver.

Versatility plus!... in a 2 Meter FM Transceiver

... IN THE FIELD
IN THE CAR
IN THE HOME ...



DRAKE MODEL TR-22

The TR-22 is a 2-meter VHF-FM completely transistorized, compact, portable transceiver with capacity for six channels. It can be used over the shoulder, mobile, or in your home. Has a built-in telescoping antenna, and SO-239 connector provided for external antenna. May be used barefoot or with accessory two-way amplifier. Operates on external 12 VDC or on internal rechargeable nickel-cadmium batteries. Has built-in 120 VAC 50-60 Hz battery charger.

SPECIFICATIONS

GENERAL • Frequency Coverage: 144-148 MHz • 6 channels, 3 supplied: (1) Rcv: 146.94 MHz, Xmit: 148.34 MHz; (2) Simplex: 146.94 MHz; (3) Rcv: 146.76 MHz, Xmit: 146.34 MHz • Frequency modulation • Push-to-talk Xmit Control • DC Power Drain: Rcv: 45 mA, Xmit: 450 mA • Power Source: 12 VDC ± 20%; 120 VAC 50-60 Hz (for recharging nickel cadmium batteries only.) • Size: 5-3/8" x 2-5/16" x 7-1/8" (13.7 cm x 5.9 cm x 18.1 cm), Wt: 3-3/4 lbs. (1.7 kg) Shipping: Wt.: 7 lbs. (3.2 kg); Dim., 10-1/2" x 4-1/2" x 12-1/2" (26.7 cm x 11.4 cm x 31.8 cm)

RECEIVER • Completely transistorized crystal controlled double conversion superheterodyne circuit. • 1st IF 10.7 MHz • 2nd IF 455 KHz • Antenna Input Impedance: 50 ohms • Sensitivity: 5 microvolt or less for 20 dB S+N/N ratio • Audio Output: 0.7 watt at 10% or less distortion • Built-in speaker.

TRANSMITTER • RF Output Power nominal 1 watt • Frequency Deviation adjustable to 15 kHz maximum; factory set to 5 kHz.

Model BBL-144 Accessory Antenna
Hustler 3.4 dB gain quick-mount with coax \$34.70
Model MMK-22 Mobile Mount for TR-22 \$9.95
Model AA-22 Accessory Amplifier (see reverse side) \$149.95

Accessory Antenna, Model BBL-144 — Hustler 3.4 dB gain quick-mount with coax — \$34.70

AT YOUR DEALER'S!

R. L. DRAKE COMPANY



DRAKE

540 Richard St., Miamisburg, Ohio 45342
Phone: (513) 866-2421 • Telex: 288-017



*PRICE OF TR-22 INCLUDES: Dynamic Microphone, Over-the-Shoulder Carrying Case, 120 VAC and 12 VDC Power Cords, Speaker/Headphone Plug, and 10 Nickel-Cadmium Batteries.

A TR-22 advertising flyer from 1971.

weeks before. The result of my carelessness with the TR-22 wasn't nearly as spectacular, but it was equally educational.

While deftly using a dental pick to scratch at the foil of a PC board, the implement slipped from my fingers and plunged toward my precious TR-22 like a stainless-steel javelin. It brushed the "Drake TR-22 FM" label on the front panel, neatly catching it at the edge and dislodging it with an audible *pop*. Imagine my surprise when I discovered that a little leaf-like symbol (it was actually a tree) and the word "Trio" lay

beneath. What was the meaning of this? Was my TR-22 a Drake radio, or something else?

I would soon learn that the Drake TR-22 was actually an import from a Japanese company known as Trio-Kenwood. (They would later drop the "Trio" and become simply "Kenwood.") In Japan the Drake TR-22 was more familiar as the Trio TR-2200. The TR-22 was the first in a line of other Trio-Kenwood radios that Drake imported at that time, including the TR-22C and the TR-72.

The TR-22 may have been an import, but it wasn't cheap. The rig debuted in the American amateur market in March 1971 with a list price of \$199.95. How much would that be today? Try \$867! If you find this unbelievable, take a look at the inflation factor calculator on the Web at www.cjr.org/resources/inflater.asp.

Profile of the TR-22

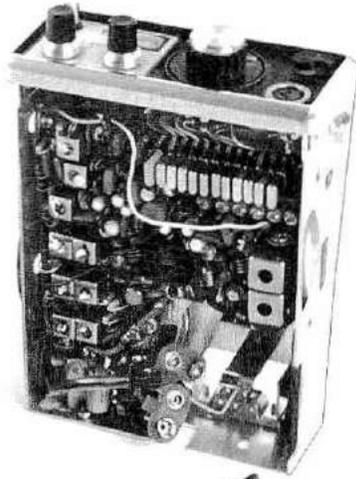
The TR-22 was an FM transceiver with frequency coverage from 144-148 MHz. The large knob on the front panel selected six transmit/receive crystal pairs. Three channels were supplied with crystals for 146.34/94 MHz, 146.16/76 and 146.94 MHz simplex. (No, that last frequency isn't a typo. This was before 146.52 MHz became the "National 2-meter FM Simplex Calling Frequency.") Receive sensitivity was specified at 0.5 μ V for 20 dB S+N/N—not super, but adequate. On the transmit side the TR-22 generated a solid 1-W output, pulling down about half an amp to do so. There was a 25-W companion amplifier, the AA-22, but it is as rare as proverbial hen's teeth today.

The rig weighed seven pounds with its 10 NiCd batteries. You could run it from an external 12-V dc source, as I've already mentioned, but you could also operate with the ac charger cord plugged in if you didn't mind the obnoxious hum on your audio. You could slip the TR-22 into a mobile bracket, or use the over-the-shoulder carrying case when you were operating on foot. The carrying case was a bit problematic for two reasons: (1) it fit as tight as skin and was difficult to remove, and (2) it lacked the macho look of an HT. When you're a self-conscious male adolescent you cringe at anything less than a "manly radio." I decided to awkwardly hold my TR-22 rather than wear it like a fashion accessory.

Thank goodness Drake/Trio-Kenwood added an SO-239 coax connector at the rear of the TR-22. The telescoping quarter-wavelength whip antenna was an accident waiting to happen. I snapped mine off within the first year. When I spoke with other TR-22 owners I learned that breaking the whip was almost a rite of passage. "Have you broken in your TR-22?" I'd ask. "Oh yeah, I broke the whip a few weeks ago." My solution was to adapt a rubber-duck antenna to a PL-259 connector that I could screw into the SO-239 jack. Others went as far as removing the whip completely and installing front-panel jacks to accommodate more durable antennas.

Despite the fragile whip, the TR-22 was a rugged, dependable little radio. It proved its worth during my first public service event (a canoe race down the Great Miami River). It was my constant companion on the road. Even in my inner sanctum (every teenager's bedroom is an "inner sanctum") the TR-22 was my link to the outside world. My school buddies and I would meet almost nightly on simplex to debate critical questions of the day, such as who was the

An interior view of the TR-22. You can clearly see the crystal bank, as well as the terminal clips for the NiCd batteries.



better guitarist—Jimmy Page or Robin Trower. The TR-22's single watt of power covered my area of town nicely.

When I fled to college at the University of Montana in 1973, my TR-22 came along for the ride. From my room in Duniway Hall I could cover most of the city of Missoula. Unfortunately, there weren't many people on the air; FM fever had yet to strike Montana in full force. I recall going to a local club meeting and encountering the curious stares of the Old Timers. I'm not sure if their curiosity was directed at my shoulder-length hair or the TR-22. Later, in the club newsletter, I was described as a "repeaterist from the Midwest." A repeaterist? It sounded like the sort of person you'd feel compelled to chase with a stick.

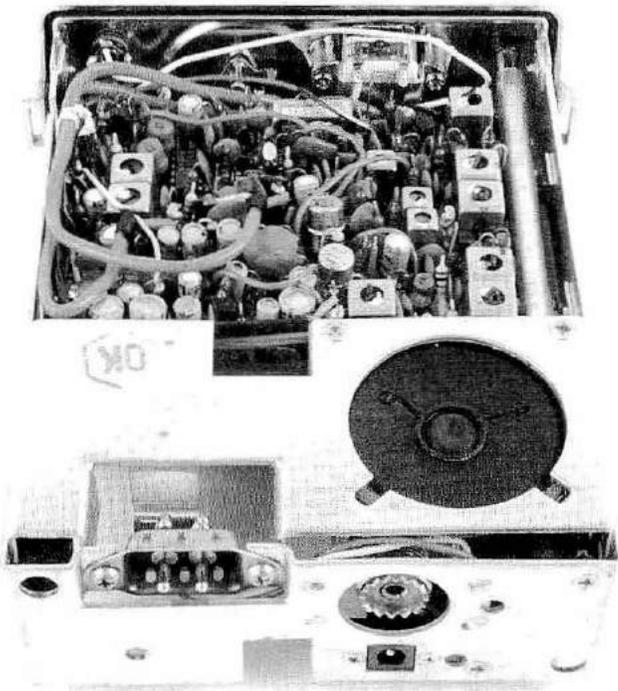
Lost and Found

My TR-22 departed in 1976 at the hands of a thief. I had stupidly left my rusting deathtrap of a car unlocked one night and consequently incurred the penalty I so richly deserved. By that time amateur HTs and even frequency-synthesized transceivers were commonplace, so I quickly bought a replacement. Even so, I still held a soft place in my heart for the little TR-22.

Last summer, while browsing through the eBay auction site (www.ebay.com), the memory of my TR-22 suddenly returned. In the SEARCH window I typed "TR-22." To my astonishment I found a TR-22 at auction. It looked awfully good and awfully complete in the accompanying photo. Even the telescoping whip antenna was intact!

I spent the last 10 minutes of the auction perched on my keyboard, clicking the REFRESH button on my Web browser to see if anyone had attempted to top my bid of \$35. In the last two minutes someone entered a bid of \$38. "Oh, no you don't!" I muttered as I banged out a counter bid of \$40. Apparently \$40 was too rich for my adversary's blood and he decided not to retaliate. The TR-22 was mine.

A week later I gingerly lifted the TR-22 from a battered cardboard box. Brushing away the foam packing, I caught just a whiff of that old familiar fragrance. The radio was in mint condition. Memories flooded back as I opened the case, worked the knobs and extended the antenna. It was as though I was cradling a treasured piece of my past...and perhaps I was.



The top interior of the TR-22.

Classic Kits—Unbuilt or Rebuilt

Assembling unbuilt Heathkits or EICOs can only be enjoyed by time travelers or the fortunate few...but rebuilding classic radio kits can be enjoyed by everyone. Here's how to get started!

"Ah, the good ol' days," is a lament that's heard frequently nowadays. And nowhere is this phrase more pointed than when a group of collectors gets together. Depending on the age of the participants, "the good ol' days" can mean anything from the 1920s to the 1980s. If the group collects cars, the collectors are probably talking about pre-catalytic converter exhausts, easy-to-repair eight-cylinder engines and car doors that could stop a bullet. If the collectors are hams who had their licenses before 1980, however, the conversation is invariably about the large American radio manufacturers and the days of the "classic kits." The "classic kit" was usually a tube-based transmitter, receiver or other radio accessory. Names such as Heathkit, EICO, Knight, Conar and others may even bring tears to the eyes of hams over the age of 40.

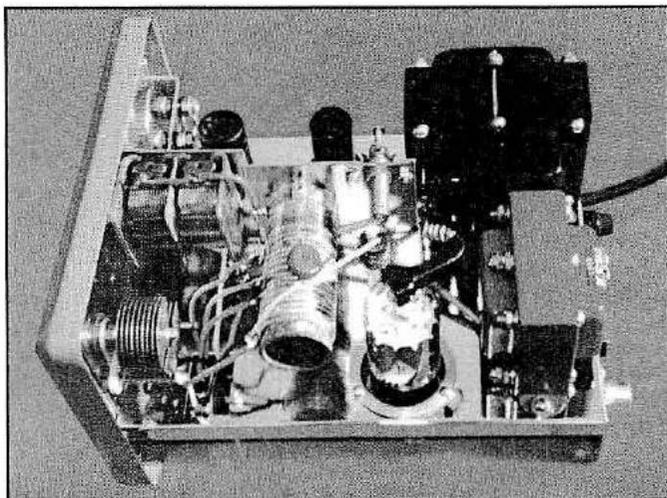
Thankfully, the advertising pages of *QST* are again listing kits, many of them offering exceptional performance. I intend no disrespect to modern manufacturers (they are filling an intense need in the amateur community)—but there is a special fondness for those old vacuum tube kits that can never be replaced.

As evidence of this, the prices people are willing to pay for rare unbuilt kits is truly phenomenal. It's not uncommon to see unbuilt Heathkits selling for thousands of dollars. Even simple unbuilt transmitters such as the EICO 723 sell for hundreds. The EICO 723 was a 60-W (input) CW transmitter that sold in kit form for \$69.95 in 1965.

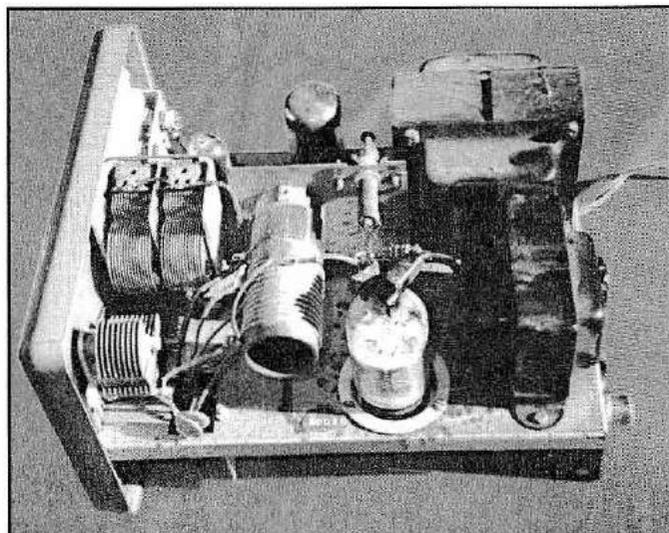
Should you come upon an unassembled kit at a yard sale or flea market, consider yourself truly fortunate. If you find a cache

of unbuilt kits, call your accountant and plan on an early retirement—your ship has just come in! For most of us though, building one of those old kits is something we can only recall in our minds.

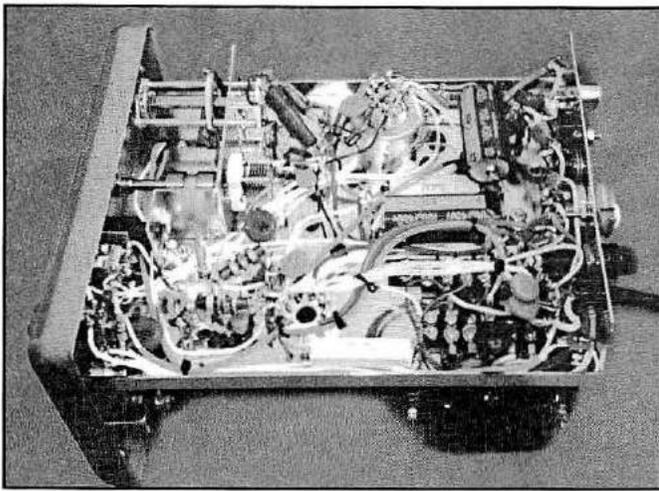
There is, however, a new approach for those who wish to partake in the construction of a classic kit, one I've now used and enjoyed many times. My method stems from the frustration I felt in the early 1990s. I would occasionally walk into my ham shack and long for the EICO 723 I built in '65. After a minor problem, I sold it at a Florida flea market in 1980. My nostalgia was so intense I even tried to track down the ham I sold it to. Unfortunately, there were just too many hams with the last name of Noble, so I resigned myself to accepting that the kit I built was gone forever. A replacement would have to do.



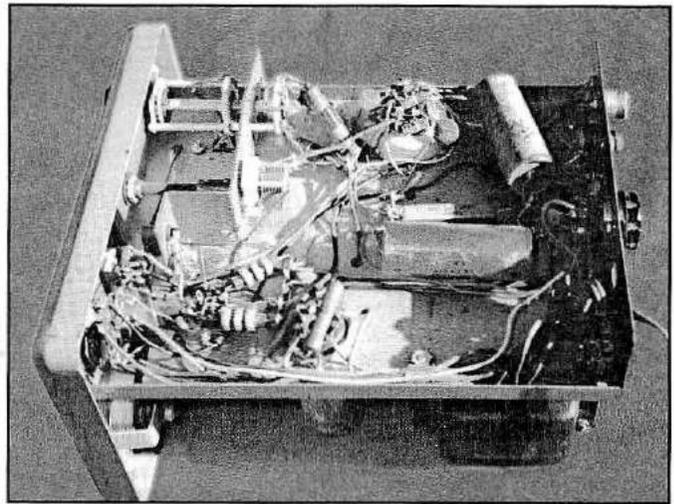
Top view of the rebuilt EICO 723 transmitter. Although these photos are not true before and after photos (they are of two separate kits), they demonstrate the difference attainable through a careful rebuild.



Top view of the original EICO 723 transmitter.



Bottom view of the rebuilt EICO 723 transmitter.



Bottom view of the original EICO 723 transmitter.

I remembered seeing a number of EICO 723s at flea markets and knew they were available for between \$20 and \$70 depending on condition. For reasons I couldn't really justify, I purchased three 723s in poor to fair shape from several different sellers. As I sat in my basement looking at the oxidized chassis and cobwebs, I realized that none of them would quench my desire. This was someone else's work, much of it low quality. None of these transmitters could become part of my station.

Out of frustration sometimes comes inspiration. Why not use the concept of sweat equity, I asked myself? This approach is often used by people buying real estate or classic cars. I had always admired meticulously rebuilt cars at automobile shows. The owners of those old, mint-condition beauties often went to extraordinary lengths to get them looking so new. The one common starting place, regardless of make or model, was complete disassembly. This is also the approach used by the US military when overhauling equipment from submarines to B-52s.

I'm not going to tell you that it's an easy task, but if you're short on money and long on desire, doing a complete rebuild of one of these Classic Kits is a great way to satisfy the yearning. I have now finished a dozen kit rebuilds. My cash outlay has been minimal compared to unbuilt kits and, in many cases, because I used modern components, the kits perform better than their original counterparts. Most importantly, it's my work, not someone else's.

The following paragraphs will cover the procurement and rebuilding approach I've used over the past several years and will focus on kits I've actually worked on. Regardless of what you're building, the advice offered here can be applied to just about any ham kit. If you follow my approach you'll end up with a beautiful piece of functioning equipment and save big bucks in the process.

One word of caution before we begin: Most of these kits use high voltages. In this era when many hams have become accus-

tomized to working on equipment with operating voltages under 50—and often under 14—even simple tube-type equipment can contain lethal voltages. If you're not familiar with vacuum tube construction, pick up a copy of any *ARRL Handbook* from the 1960s and study it before attempting high-voltage work.

Your first step is deciding on the kit you want to rework. Looking through ads in *QST* or on eBay is a good place to start. Nothing, however, beats a trip through a nearby flea market where you can handle the equipment and ask questions of the owner. Don't bother looking for a perfect specimen. That defeats the purpose of this approach. Ideally, look for a non-working but intact unit that isn't heavily damaged. But don't overlook those banged up units if the price is right. They can make good parts sources.

Make sure you find assembly and operating manuals—they're a necessity. You'll want to follow the assembly instructions, have a schematic available and use the troubleshooting and parts lists, which most kit manuals have. Fortunately, reasonably priced copies are readily available from many sources, including magazines and the Internet.

Getting Down to Bare Metal

Don't skimp on the disassembly. Make sure you have a good-quality soldering iron, a desoldering tool (a solder sucker), pliers, wire snips and screwdrivers. A well-lit, clean area and a magnifier will be helpful. Take your time when removing parts. Place them in boxes or containers in an organized way. You may want to lightly clean the cabinet and chassis before disassembly, especially if the equipment has been stored in a garage, barn or basement. A bag of cleaning cloths and a little soapy water are all that's necessary at this point. The real cleaning will come later.

Begin by removing and storing the knobs. Some pull off and some have set screw(s). Be sure you know which you have. Set screws have small slotted,

Phillips or allen-type heads. Some radios may have been modified or may have replacement parts. Don't assume everything is original.

Removing the case is next. Here's where a manual really helps. Remove and keep the old hardware. I usually replace the hardware with new stainless steel nuts, bolts and screws, but once in awhile an unusual piece has to be reused. Once the chassis is separated from the case, carefully remove the tubes with a cloth or soft glove by grasping the base of the tubes and lifting straight up. If a tube doesn't release easily, a slight rocking motion will usually help. In extra stubborn situations try a spritz of WD-40 from the underside of the chassis. Once the tubes are out, clean and catalog them. Don't rub off any markings if at all possible. I use new tubes during a rebuild, but some rare and expensive bulbs are worth keeping. It's also a good idea to have access to a tube tester, as there's no sense in keeping a bad tube or throwing away a good one. If the tube markings are difficult to read, refer to the manual and mark the base of the tube with a label made from a piece of tape. An old trick to read tube markings is to breathe heavily on the tube envelope. The resulting condensation often enables you to read the "invisible" markings.

After the tubes are stored safely, remove the front and rear panels, controls, switches and sockets. Take care not to mark the panel when removing controls. Unless the cables leading to these controls are unique, just clip the wires an inch or so from the connections. Remove any brackets or support structures on the chassis or panels. At this point your hands should be getting dirty and you should have an idea of whether the original builder did a good job during the initial assembly. Many kits were built by first-timers, a fair number never worked and many performed poorly.

I've found the number one cause of all non-working kits to be poor solder connections. For this reason alone it's a good idea to buy non-working units. If you don't

want to bother with a complete rebuild, reheating all the solder joints will often yield a working piece of equipment.

Once the structural components have been removed, look for delicate items on top of the chassis. Certain types of fragile capacitors and coils may be difficult to replace and should be removed prior to snipping out standard components. After all of the fragile items have been removed and cataloged, flip the chassis over and begin removing wires, resistors and capacitors. Be careful to clip transformer wires as far from the transformer as possible or the leads may not be long enough for easy re-assembly. If necessary, unsolder wires rather than clipping them. Although it's difficult to generalize, the typical transmitter or receiver kit takes about an hour to disassemble. It's important not to rush at any stage, but be particularly careful while removing components. Damaging rare items can make you pull your hair out!

After the small components, binding posts and solder terminals have been removed and organized (I use small cardboard boxes), separate heavy transformers, tube sockets and brackets from the chassis. You should now have a completely disassembled kit.

The next stage is the most time consuming and labor intensive—cleaning the chassis and components and removing old solder connections. I like to begin with the chassis. If it's in good condition, a light cleaning with soap and water followed by a metal brightening product will suffice. I sometimes polish the chassis with a natural car wax, paying strict attention to areas that require good conductivity. You must carefully remove residue left by waxes and cleaners around grounding holes, solder terminal connections and tube sockets. A small piece of sandpaper or a Dremel-type tool will do this job easily.

If the chassis is heavily pitted or has worn and oxidized copper or silver plating, you'll need to go beyond a simple cleaning. My EICO 723s all had copper-plated chassis that were so pitted I had to use progressively finer grades of steel wool to get down to bright metal. Even if your chassis is aluminum and in great shape, spending some time with steel wool and a cloth buffer on a hand drill will really make the chassis sparkle.

This may sound fanatical, but when I had my EICO chassis clean there was very little copper left, so I decided to have it *gold plated*. My rationale was simply that copper would again oxidize over time and for \$100 I would have a permanently bright and conductive chassis. So, I packed it up and sent it off to Santa Ana Plating in California. When I received the plated chassis I was truly awed by the beauty of the mirror-like finish. You may not want to go to these lengths, but if you really want the chassis to look new, you may have to spring for a replating job. One of the nice things about doing a rebuild is that you alone will determine the extent and budget



Several of the rebuilt kits completed by the author.

of the project. I try to keep my rebuilds *reasonably* original, but unlike many collectors, I see nothing wrong with making modifications and improvements to the design and appearance.

The next step is to look at the switches and controls. Many switches and potentiometers can and *should* be replaced with modern devices. Make certain the value and power rating are the same or better than the original. Many older rotary switches can be completely disassembled, cleaned and lubricated. The key to getting the switches right is to remove and store the parts in order of their assembled positions. For this reason, make sure you work in an area where children, pets and spouses are unlikely to "rearrange" things for you. A light coating of WD-40 is a good idea, as is a touch of grease on the ball bearings. If you're not sure how a component works, it's best just to clean it with De-Oxit (or a similar product) and leave it as it is. This will prevent any potential problems. Handle switches with care. Phenolic and ceramic parts can crumble if only a little torque is applied in the wrong place. Taking switches apart is a lot of extra work, but really helps performance and eliminates intermittent problems. A clean, oxidation-free switch also adds to a mint-condition appearance. Follow this approach with variable capacitors while being careful not to damage the plates or their alignment.

Improvements, Anyone?

Between work sessions you should compile a list of needed parts. I always upgrade whenever possible. Instead of 10% resistors I opt for 2%. Rather than 1/2-W carbon composition resistors I use 1-W metal film. Be careful when replacing critical parts. Some resistors, for example,

aren't suitable for RF circuits because of their added inductance. Be sure you know the characteristics of the devices you're substituting.

I also like to upgrade capacitors (in voltage and tolerance). I know these replacement suggestions are probably making purists cringe, but I like to actually *use* the kits I rebuild and I see no reason to be limited by the component technology of the 1950s or '60s.

If you're going to reuse components or terminals, be sure to remove all of the old solder from the connections, file or sand the lead and clean the device with a cloth or paper towel. Many old capacitors and resistors will look okay, but be sure to test them before reusing them. Carbon composition resistors can gain 20% or more in value from heating effects and age. Plastic-cased capacitors will often have fine cracks and electrolytic caps will sometimes be dried out or completely disintegrated.

Nearly all kits will have power supplies of some sort. Many have transformers with multiple outlets. I like to disassemble transformers and paint them using high-temperature, ceramic-based engine paint. This is more for appearance than function, but it enables you to see if the transformer has overheated and damaged the wiring or insulation. Be careful when opening old transformers and capacitors—many contain hazardous chemicals such as PCBs. Use gloves and avoid breathing the fumes. Dispose of any suspected toxic material in accordance with local and Federal regulations. Most municipalities have programs to accept these materials.

Upgrade the power cord, preferably to a three-prong grounded plug rated for the necessary current. Make sure you observe the proper polarity, as some older radios have "hot chassis." If you're unsure about

the exact connections, ask for advice from someone with experience or do some research. Another important upgrade for nearly every tube-type power supply is the addition of a current in-rush limiter (ICL). Years ago the voltage supplied by power companies ran about 110 to 115 Vac. It's now closer to 120 V. This extra voltage—along with the possible conversion of rectifier tubes to solid-state diodes—can dramatically shorten tube life. The limiter acts like a thermistor in that its resistance changes with temperature. The devices are rated in cold temperature ohms and current-handling capacity. The ICL will prevent tubes and components from getting hit with full voltage and current when the power is initially turned on. Although I run most of my older equipment through a variable voltage transformer (a Variac), current limiters provide extra insurance. They're easily installed in series with the hot ac power lead. To choose the appropriate one for your project you must first determine the current draw. Choose the limiter with the highest resistance for the required current.

You'll also want to add a fuse if there was none originally. Here again, I have no problem with carefully drilling a hole in the rear of the chassis and installing one. If you don't want to drill, wire a fuse in series with the hot lead of the power cord and tuck it under the chassis.

Although it's not the most glamorous part of the kit, the power supply is extremely important overall. Without attention to the power supply the rest of the project may not perform satisfactorily. One area of hot debate among collectors is replacing vacuum tube rectifiers and supporting circuitry with solid-state components. You can use plug-in devices that

look like metal tubes or you can simply install diodes with a sufficient rating. I do this in all transmitters and other equipment with a high current draw. By eliminating the filament current drawn by the rectifier tubes the whole unit will run cooler. I also like the way CW notes sound when supplied by solid-state rectifiers. If you swap hollow-state for solid-state, the rectified dc voltages will likely increase, potentially causing aging tubes or components to fail.

Power supply filter capacitors almost always need upgrading. In the EICO 723, the original plans called for two 40-mfd, 450-V electrolytics. I upgraded the rating to 100 mfd. This produces cleaner dc and, therefore, a better CW note. But the sky is not the limit with respect to filtering. If you keep the rectifier tubes you'll want to know the maximum filter capacitance the tubes can safely handle. If you put in too much filtering, by the time the capacitors have charged the rectifier tube could be destroyed. For this reason alone it's a good idea to have an old tube data book on hand.

During reassembly—the really fun part—follow the directions in the kit's instruction manual and take your time. I like to limit myself to 90 minutes per session. If you work much longer than that you're more likely to make dumb mistakes. As I've mentioned, I like to use new stainless steel hardware and new ceramic tube sockets. Instead of regular hook-up wire I use Teflon-insulated wire that I can color code with heat-shrink tubing. In critical areas I opt for silver-bearing solder instead of tin-lead. In oscillator circuits I use NP0 capacitors and in RF sections, silver mica. The performance increase provided by modern components is truly amazing.

What if something goes wrong? Rest

assured that almost every bad thing that *can* happen *can* be fixed. If you have a bad transformer, for example, you can buy a replacement or contact a company such as Antique Electronic Supply, which carries the Hammond transformer line. If you break a coil, consider rewinding it on the original form. If you look around you'll see that there are still plenty of old parts available for these kits—and nothing beats a parts rig. That's why, in retrospect, I'm glad I bought those three EICOs. As it turned out, I didn't need any additional parts, but if I ever do they'll be there. If you break a one-of-a-kind part, use the Internet to search for a replacement. Chances are good that if you're looking for a part, someone else has one for sale.

Prior to rebuilding, check to see if any modifications have been made to the original kit. Add grommets to all holes where wires pass through the chassis, and when repainting cabinets, search for paint that is as close to the original color and texture as possible. Don't be afraid to take weeks or months to complete your project.

My original 1965 EICO put out 40 W on 80 meters and 12 W on 10. The rebuilt transmitter puts out 48 W on 80 and 25 W on 10. There is no chirp and the oscillator is very stable. Most of the other rebuilds I've completed also perform better than they did originally. Remember, we are only caretakers of these devices for future generations. By rebuilding your kit with uncompromising detail, you will insure that your construction legacy will be around for decades or even centuries to come. Above all else you will have the satisfaction of knowing you have saved a piece of American electronic history from the dump—and you'll have a ton of fun using and looking at it, too!

The Great Paper Chase

Collecting catalogs, ads, brochures, spec sheets, company memos—any kind of Amateur Radio product literature—is an exciting and accessible way to experience our hobby's rich history. Here's how to get started.

Amateur Radio is a multifaceted hobby. If collecting interests you, there are many ways to satisfy your desires. I've been collecting, restoring and operating antique and classic radios for several years and, until recently, I've limited my collection mostly to Hammarlund receivers.

I recently became interested in old sales brochures, technical specification sheets, catalogs, manuals and related literature about Hammarlund receivers. I hadn't given much thought to collecting these items until I joined the Southeast Antique Radio Society of Atlanta. Several of the members have extensive literature collections covering various early radio manufacturers.

Those collections started me wondering about the Hammarlund literature that might be available. The search has taken me to dozens of hamfests, old bookstores, garage sales, antique shops, used book stores, thrift stores and on-line auction site eBay.

Buying collectible items via eBay has pluses and minuses. Rare items that are unavailable anywhere else are often offered for sale. The bidding process is convenient and doesn't involve any travel, search time or sleuthing. Unfortunately, prices are usually higher than "similar type and quality" items found at more traditional outlets. Also, buyers don't have an opportunity to physically examine items and must rely on pictures and the seller's description. Because it offers a large global audience, buying and selling collectibles (radio and otherwise) on the Internet will likely become more popular in the future.

After unsuccessfully bidding for several eBay items, I finally made my first literature purchase—a 1935 Hammarlund capacitor catalog. The catalog contained information on condensers, coil forms, sockets, transformers, chokes, shields and other Hammarlund components. The back page was devoted entirely to the Hammarlund "Comet Pro," a shortwave receiver sold in the 1930s. It also listed the addresses of 10 former sales offices in the US and Canada.

I was pleasantly surprised at the catalog's excellent condition. Printed 65 years ago, the catalog is older than any of my radios. This purchase hooked me, and my search for Hammarlund literature began in earnest. Since my first purchase I have picked up several additional quality documents and a few that are interesting but not pristine.

As a practical collector, I have to face the fact that there are some radios that I will probably never own. For example, very few Hammarlund Pro-310s were ever manufactured. I've never seen one for sale. Fortunately, I've been able to add an original Pro-310 sales brochure and spec sheet to my paper collection. This document may be as rare as the radio. Although I don't own the radio, I can still enjoy these items.

I'm not too proud to accept a copy of a document if the original isn't available. Copies have no value, but I think they're

better than nothing at all. Besides, a good copy will reveal all the information available from the original. If the original document becomes available in the future, the copy can always be discarded.

Paper collecting offers an opportunity to connect with specific pieces of history. Collectors can also learn more about products offered by the manufacturer, the specifications of various parts and radios, and even gain some insight about how the various products were marketed.

Secrets Revealed

Companies generate a tremendous amount of paper, most of which is never preserved. When a company such as Hammarlund ceases to exist, most of its records are destroyed. Through the study of sales brochures, catalogs and other documents, collectors can gain a considerable



Hammarlund catalog No. 37. Note the Sun Radio Company stamp.

For Radio Radio
Hammarlund
MANUFACTURING
PRODUCTS
(Season of 1927-1928)

Avoids Cracking at Any Part of the Sole

The Improved Hammarlund "MIDLINE" Condenser

The Hammarlund "Midline" Condenser has proved its worth as a precision product since its first introduction. It is now being offered throughout the radio world as a precision product without a peer.

The special design of its plates results in a condenser which is more efficient and more durable than any other condenser of its size.

In the improved model, illustrated above, all of the Hammarlund "Midline" Condensers are now included with the Hammarlund "Midline" Condenser. This new design, with its improved plates, offers a condenser which is more efficient and more durable than any other condenser of its size.

The Hammarlund "Midline" Condenser is now being offered throughout the radio world as a precision product without a peer.

Model	Capacity	Price
10	10	\$1.50
15	15	1.75
20	20	2.00
25	25	2.25
30	30	2.50
35	35	2.75
40	40	3.00
45	45	3.25
50	50	3.50

Hammarlund Manufacturing Company, Inc.
Factory & Main Offices: 424-426 West 33rd Street, New York

A 1927 advertising flyer for the Hammarlund "Midline" condenser.

JULY 1957

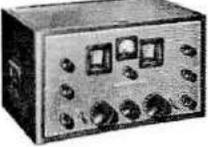
Now... Better than Ever!

HAMMARLUND
COMMUNICATIONS RECEIVER

The
HQ-140-XA
540 KCS to 3-MCS

FEATURES

1. Permanent receiver for 540 to 3-MCS.
2. Over 1000 components used. Most conventional and well known in the amateur radio field.
3. Automatic gain controlled on antenna.
4. 100% efficiency in use of power.
5. Neutral interference-free operation.
6. Automatic gain control for 100% efficiency in use of power.
7. 100% efficiency in use of power.
8. Automatic gain control for 100% efficiency in use of power.
9. Automatic gain control for 100% efficiency in use of power.
10. Automatic gain control for 100% efficiency in use of power.



HERE is another HQ series communications receiver for hamstering centers all of the outstanding performance, dependability and operating features that have made these receivers the "Champion" of their class.

The HQ-140-XA is an improved version of the famous HQ-140-A and incorporates many new features requested by HQ users, as well as many new features formerly found only in amateur class receivers which are a definite improvement of the HQ-140-A. It is a receiver of the highest quality and performance in its class.

The HQ-140-XA is a super-receiver of the latest design. Improved response has been achieved with an improved background noise margin in better signal-to-noise ratio. This has been accomplished through improved component performance and new circuit design. Radio noise level has been lowered considerably over past receiver designs.

Reliability: The HQ-140-XA has been designed to provide years of safety service in the operation of the receiver and its associated items.

It has used a modern communications receiver of the right size — one you can't resist the advanced superiority of the Hammarlund HQ-140-XA.

This flyer from 1957 touts the venerable HQ-140-XA receiver.

amount of company knowledge.

Sales literature often provides insight into how and where equipment was manufactured. One catalog in my collection contains a picture of Hammarlund's Mars Hill, North Carolina, manufacturing facility. From the age of the cars shown in the picture, the photograph was made in about 1960.

Documents sometimes reveal the names of individuals who worked on a particular radio. For example, the spec sheet for an HQ-180A receiver has a statement on the bottom of the last page that says, "These facts brought to you straight from the shoulder by the hams at Hammarlund." The names, call signs and signatures of 11 hams are listed across the page.

Sales literature often reveals a product's original selling price. A technical data sheet published by Hammarlund on the R-390A/URR, dated May of 1970, has the following note written across the bottom of the page, "Terms \$1,000.00 COD or CIA while the supply lasts." When Hammarlund was owned by Electronic Assistance Corporation it manufactured hundreds of R390A receivers for the government.

In a copy of an internal memo dated June 4, 1968, written during the negotiations to sell Hammarlund to Electronic Assistance Corporation, Boris Pundick, Hammarlund's Division General Manager, encourages the employees to bring in new business, work efficiently, minimize errors and maintain quality standards during the critical period. Copies of this letter were sent to Edward J. Eggart, President of Geotel, Inc. and Robert Edwards, President of Electronic Assistance Corporation.

In July of 1971 the Cardwell Condenser Corporation acquired Hammarlund's Capacitor Division. I obtained a copy of a letter on Hammarlund letterhead that is signed by George E. Cardwell, Manager of Commercial Products for Cardwell, making this announcement.

In addition to catalogs and sales literature, I also collect old magazine and newspaper articles about Hammarlund. These are often more difficult to find, but just as interesting. Newspaper articles contain new product announcements and information about plant expansions, employee promotions, etc.

One newspaper article was written on the first anniversary of the opening of Hammarlund's plant in Mars Hill, North Carolina. To illustrate the plant's economic impact on Mars Hill and Marshall County, the payroll for that week was paid in silver dollars! More than 7000 silver dollars were passed out to some 155 employees. In the community those coins quickly become known as "Hammarlund Dollars."

Like most hams, I can't afford to display all of the radios I'd like to own. One solution is to collect pictures of old receivers. At hamfests I usually carry a camera. If something interesting shows up, I talk to the owner and ask for permission to photograph the radio. I've never been turned down.

Digital cameras, scanners and the Internet have made pictures of rare radios readily available. It's easy to print an image of an old radio from someone's Web page. Surprisingly, some of my better radio pictures have been copied from eBay auction photos!

HAMMARLUND

HQ-100

Your Best Buy!



VERSATILE — Continuously tunable from 540 KCS to 30 MCs with automatic gain control, automatic tuning in 50 KCS steps.

BANDSPREAD — Excellent bandspread using air regulated drift and full Automatic Gain Control, giving 30 KCS to 30 MC, and 20 more bands, more than 20 KCS to 20 more bands and more than 20 KCS to 20 more bands.

QUALITY — Parts, carefully selected, available in most of your favorite stores.

STABILITY — Temperature and frequency compensated components, rock-solid stability.

AUTO-RESPONSE — Automatically adjusts itself to any signal strength.

AUTOMATIC HOLDING — Automatic gain control and automatic tuning.

DRIFT — Stable temperature-stable components.

CABINET — Attractive design and construction.

CONSTRUCTION — Rugged aluminum case and heavy-duty chassis and wiring.

WARRANTY — Automatically included in every purchase.

For the amateur who wants the most versatile communications receiver ever produced, it's made the HQ-100. Hammarlund controls these results with a hard-to-match engineering design. The world has benefited (as expected).

Use of the most advanced features of this new receiver in the ham-radio world which makes possible a complete range of audio output from the cleanest tone to a full-scale broadcast reception. The feature is useful in many ways. In its normal use it will work with any speaker of reasonable impedance match to the receiver. In the local market range for HQ-100, it will operate with 8-ohm, 16-ohm and 32-ohm speakers provided by the operator. This provides better audio than any speaker.

Stability and reliability of the HQ-100 give it the edge over other receivers. Its components, tested in a special laboratory, are selected with the strictest standards. Every component is tested in the most exacting manner. The HQ-100 is a Hammarlund receiver and it's built to last.

For the amateur who wants the most versatile communications receiver ever produced, it's made the HQ-100. Hammarlund controls these results with a hard-to-match engineering design. The world has benefited (as expected).

Established 1910

A Hammarlund promotional flyer for a legendary receiver: the HQ-100.

Back issues of *QST*, *CQ* and *73* are also good photo and information sources. They contain product reviews, articles, advertisements and pictures of most amateur gear offered for sale.

After World War II, *QST* did an excellent series of articles titled, "Looking Over the Post-War Receivers." These articles offer a valuable resource for those interested in a particular radio.

The ads in back issues also provide interesting reading and often reflect the price of the radios at the time of publication. It's fun to look over the old ads and attempt to evaluate the various radios that were competing for Amateur Radio dollars.

I keep my collectible literature in plastic jackets bound in a large three-ring notebook. This allows documents to be handled without tearing or soiling the pages. What started as a casual interest has turned into an interesting and informative part of collecting vintage radios. It's amazing what's still out there in the way of literature for those who have the patience to join the paper chase.

Hallicrafters' Chevy, Buick and Cadillac

As the Great Depression gave way to the pre-war era, Hallicrafters had radios to fit every budget. Here's an intimate conversation with the engineer who designed Hallicrafters' first several transmitters—Bob Samuelson, briefly licensed as W9RAD.

Some of the earliest successful factory-built Amateur Radio transmitters grew out of a business philosophy that might've been expressed as: "What's good for General Motors is good for Hallicrafters." Just like the giant automaker, Hallicrafters set out to provide models for wallets both thick and thin.

In the late 1930s, Hallicrafters was leading all American manufacturers in sales of high-quality shortwave receivers. Founder Bill Halligan wanted to convince hams that store-bought transmitters were a good idea as well.

In the spring of 1938, Halligan lured young engineering whiz Bob Samuelson away from the Collins Radio Company in Cedar Rapids, Iowa, to head up Hallicrafters' transmitter development in Chicago.

Samuelson promptly produced the HT-1, a 100-W CW, 50-W AM phone rig that could be configured for three bands between 160 and 10 meters. He followed up with the 400-W HT-4, later to become legendary as the BC-610, the US military's HF workhorse during World War II.

A shrewd businessman and an enthusiastic ham, Halligan wasn't satisfied. He wanted another transmitter.

"Bill's marketing approach took its cue from the automobile industry," Samuelson recalled in an interview at his Phoenix, Arizona, home in 1992. "Bill wanted a lineup of models that fit the pocketbook and needs of every ham. And he wanted to bring out new models to make use of the latest components and techniques."

The HT-1 was priced at \$195. A CW-only version, the HT-2, went for \$175.

An HT-4 equipped with the HT-5 speech amplifier and AT-2 antenna tuner



The Hallicrafters HT-6.

rang up at \$800. Even with the Depression easing in the late '30s, those prices were beyond the reach of most hams. (By the way, if you're keeping count, the HT-3 wasn't a ham rig but rather a marine-band "radio-telephone" aimed at well-heeled yachtsmen who could shell out \$400.)

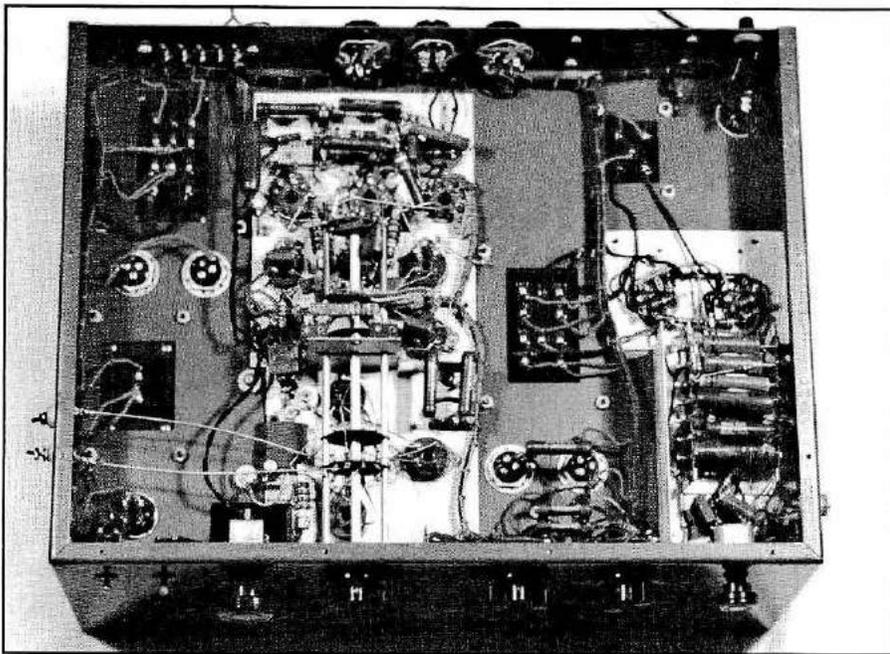
A Low-Price Leader

The Hallicrafters marketing department had a good idea of what amateurs could afford in 1939, measured by sales of their popular receivers. The S-20R Sky Champion (\$49) and the SX-24 Skyrider

Defiant (\$69) were far outselling the more sophisticated SX-17 Super Skyrider (\$140) and the innovative and stylish SX-23 (\$120).

"An obvious conclusion was that the transmitter line needed a low-price leader to go with those lower-priced receivers," remembered Samuelson. "I said: 'Let's shoot for \$100.' Bill came back with: '\$99 sounds better.'"

Thus was born the HT-6. If the washing-machine-size HT-4 was Hallicrafters' "Cadillac" transmitter in 1939, the suitcase-size HT-6 would be its "Chevy."



An under-chassis view of the Hallicrafters HT-6.

Samuelson was given virtual free reign in his design work at Hallicrafters, in some contrast to his three years in Cedar Rapids where he'd labored in the formidable shadow of the legendary Art Collins.

"Art was a genius," said Samuelson. "He'd accept orders to do all sorts of crazy things, and somehow we'd manage to get most of them done. Art gave us quite a bit of freedom—but he didn't hesitate to get his nose right into the middle of what we were doing. If we were having a problem, he'd look it over and then say something like: 'Let's try a condenser at this point here.' And quite often he was right."

Bill Halligan, on the other hand, "was more interested in the appearance of his products," according to Samuelson. "Of course, he demanded good performance. He was a ham (then W9WZE, formerly 1AEH and 1UL and later W4AK) and he knew what the radios ought to do. But he pretty much left it up to the engineers to figure out how to make the radios do it."

Halligan concentrated his efforts on business matters outside the plant, Samuelson said. "There were many days when Bill didn't come in 'til noon because he'd been out in the bars on Rush Street with customers the night before. And he treated suppliers really well, too, so we usually got first crack at new components as they were developed."

Up-to-date components were Samuelson's first priority when he began to sketch circuitry for the HT-6: "I had been intrigued with the new 807 beam power tetrode, along with its cousin the 6L6. Calculations showed that I could count on the 807 to deliver a clean carrier output of 25 watts, with clean 100-percent modulation from a pair of 6L6s in class AB. For grid excitation, a single 6L6 tuned crystal oscillator was adequate, at least down to the

20-meter band."

Unfortunately, a transmitter covering 160 through 20 meters fulfilled neither the design aims nor the sales goals. Despite the agreed-upon price constraints, Samuelson and Halligan wanted a true "all-band" rig, one that would tune up to the then-burgeoning 5-meter band (56-60 MHz).

"To be on solid ground in designing for the higher frequencies, I set up a breadboard test circuit with a 6L6 driving the grid of an 807," Samuelson said. "Tests confirmed that the 6L6 wired as a conventional crystal oscillator was a bit tricky with a 10-meter crystal. With a simple addition to the input crystal coil set, however, the 6L6 was wired as a 'tri-tet' oscillator, with a 20-meter crystal doubling in the plate. This worked fine for 10 meters, but a similar test with a 10-meter crystal doubling to 5 meters again was too tricky. So I made provision in the coil set for extra contacts to add a 6J5 as a 10-meter crystal oscillator doubling in the 6L6 for 5-meter operations only."

A 6F5 microphone amplifier, a 6J5 audio amplifier and two 5Z3 rectifiers completed the tube lineup.

Convenient band-switching was a Hallicrafters hallmark, but the HT-6's modest price tag imposed limits. Samuelson settled upon a scheme whereby coils for three bands could be plugged into chassis sockets and then selected by a rotary switch on the front panel. Each ceramic coil form sprouted braided leads used to tap an integral pickup coil for antenna matching.

The output circuit was designed to match resistive loads from 10 to 600 ohms. A pair of insulated feed-through terminals on the side of the chassis served as antenna feed-line connections.

A cabinet 20 inches wide, 9 inches high and 15 inches deep would be required to



Bob Samuelson in his chief engineer's office at Hallicrafters' Chicago headquarters in the early 1940s.

house the assembly. The exterior was painted in gray enamel. Three hefty Stancor transformers helped boost the weight to 65 pounds.

An ammeter (0-200 mA) was switched to monitor plate current on the oscillator, modulator and final amplifier tubes or grid current on the final. Other front-panel features included an audio gain control; a phone/CW switch; a knob and logging dial to adjust the variable capacitor used to resonate the final tank circuit; and power on/off and transmit/receive toggle switches.

"The first ad for the HT-6 appeared in the May 1939 *QST*," Samuelson noted. "We must have done something right, because the ad in the August issue four months later boasted that production of the HT-6 was in its fourth release (production run)."

True to Halligan's target, the price was listed as \$99 (although soon thereafter it rose to \$110). Again as in automobile marketing, there were extra-cost options.

For example, coils weren't included in the base price. Coils for 160, 80, 40 and 20 meters were available at \$4.95 each. The special coil sets for 10 and 5 meters cost \$6.95 each.

Although the HT-6 was designed for crystal control, Hallicrafters ads also spoke of "electron coupled oscillator units" that allowed the transmit frequency to be shifted with the twist of a knob. ECOs were listed for 160, 80, 40 and 20 meters at \$3.85 each. Perhaps ahead of their time, Samuelson doesn't believe Hallicrafters actually sold many ECOs.

"I let a young engineer named Norm Foot play around with an HT-6 and he came up with the ECO," Samuelson said. "All it really was, basically, was a trimmer in a can. I know we made some, but I think most hams used crystals. Just because the ECOs were mentioned in the ads didn't mean they were being produced in great quantity. We wouldn't allow something to be put into an ad unless we knew it was possible to do—but we may not have actually done it yet."

HT-6s still were being manufactured as

late as 1945. No official production totals are available, but Samuelson was certain that "at least several hundred" of the sturdy little transmitters were built.

Not long after completing the HT-6, Samuelson turned his attention back to his first creation for Hallicrafters, the HT-1.

"Somewhere along the way—probably back at Collins—the idea had been drummed into me that good engineering was a matter of taking something that works and making it better. The HT-1 developed a good following with hams. It was a great value and had an attractive cabinet design that was acceptable in many households. As soon as it was in production, however, I began to see changes that could offer improvements."

Although Samuelson was licensed for a while as W9RAD, he was not active on the ham bands. He worked long hours, and when he did manage to get time away from the plant, he preferred to devote his attention to his wife, Marcy, and their daughters. Nonetheless, Samuelson frequently heard from operators who were using his creations. "I took their input seriously," he said, "and their comments often proved useful."

But when suggestions from hams and Samuelson's own observations began to jell into proposed improvements for the HT-1, Samuelson initially was told by Halligan "in no uncertain terms that I was not to interfere with production" of the company's popular first transmitter.

So, Samuelson said, "I retreated to my notebook with ideas for simpler circuits, newer tubes, better plug-in tuned circuits, and so on, and waited for a proper time for a new, modernized model."

The "proper time" came on the eve of the new decade.

"The war began in Europe and it was obvious that the best radios possible would be needed in an emergency," Samuelson said. "Bill finally agreed with me that a modernized HT-1, to be named the HT-9, would be our new 100-watt leader."

The HT-9

Positioned between the HT-4 "Cadillac" and HT-6 "Chevy," the HT-9 became Hallicrafters' "Buick." (Again, if you're counting, the HT-7 was a frequency standard, and the HT-8 was another marine transmitter-receiver combo.)

In the HT-9, Samuelson discarded the HT-1's RK47 final amplifier tube in favor of the newer, more efficient 814 beam power tube. A pair of 6L6s replaced the 6A6 driver tubes.

Most of the HT-1's power supply and audio circuitry was retained, including the four 6L6 modulators connected in push-pull parallel. Fourteen tubes were employed altogether in the HT-9, including a 6SJ5 first speech amplifier, a 6J5 second speech amplifier and five rectifier tubes—two 5Z3s, two 866s and one 80.

At Halligan's insistence, the HT-1's band switch included all tuned circuits, including the high-voltage final tank

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\$81.50	\$8.15	\$6.47

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CASH PRICE WITH TUBES
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160-80-40 meter coils (crystal frequency operation)	\$6.65 each
20-10 meter coils (twice crystal frequency operation)	\$8.95 each
160-80-40 meter crystals	\$4.80 each
90 meter crystals	\$5.75 each

These accessories may be purchased with transmitter on easy terms, by adding the cost of each item plus 5% and divide by 12 months.

The RADIO SHACK

167 WASHINGTON ST. BOSTON, MASS., U.S.A.

The HT-9 appears in this Hallicrafters advertisement in the April 1940 QST.

circuit. Careless switching while RF was flowing meant burned contacts and a costly repair job. Samuelson successfully lobbied for a simplified band-switching scheme. Thus the HT-9's five-position band switch selected low-voltage oscillator and exciter circuits, but the final tank circuit employed plug-in coils.

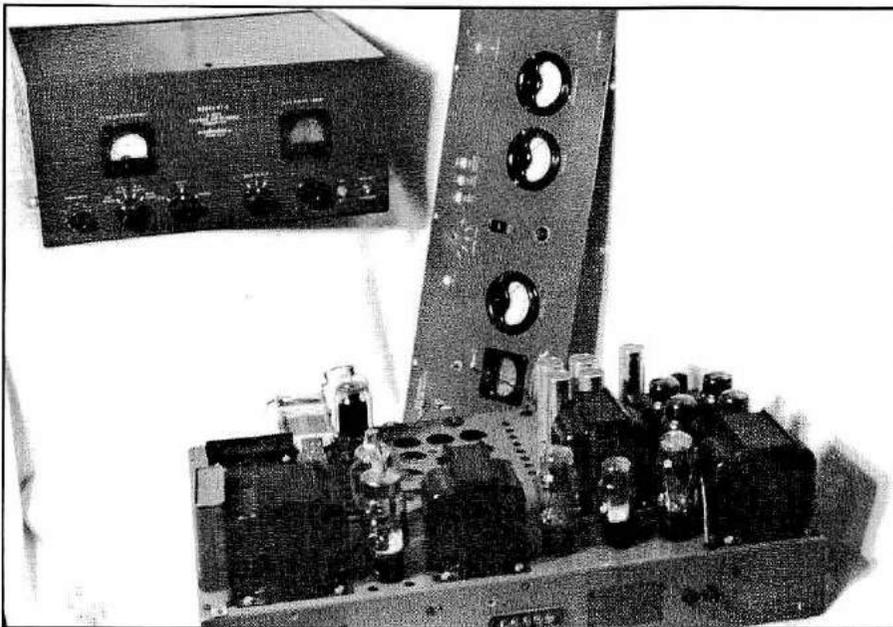
As in the smaller HT-6, antenna matching in the HT-9 was accomplished by tapping a coupling coil that was wound around the final tank coil. Coils were available for any frequency between 1.5 and 18 MHz, plus the 10-meter band.

The HT-9 abandoned the HT-1's rounded art deco styling and chrome trim in favor of a no-nonsense rectangular

cabinet. The transmitter's dimensions remained substantial for a tabletop rig, however. The radio was 30 inches wide, a foot tall and 20 inches deep—about the size of a footlocker—and weighed a hefty 120 pounds.

A good share of that weight was concentrated in the half-dozen transformers mounted on the HT-9 chassis. But even they weren't sufficient to supply all of the necessary power. A 45-V dry-cell battery also was required.

"That was the easiest way to get good grid bias on the 814 and really clean keying," Samuelson explained. "We keyed the oscillator and had to keep constant bias on the final, and a battery was the simple



A Hallicrafters HT-9 (foreground) in the process of being restored, with its little brother, the HT-6, in the background.

way to go." A two-year life was predicted for the battery.

The HT-9's front panel featured an impressive lineup of three milliammeters. Two constantly monitored the 814's grid and plate current while the third measured cathode current in the exciter and modulator stages.

The HT-9 was announced in early 1940 at an introductory price of \$199.50. Coils were extra, at \$6.65 to \$8.95 each.

When America entered World War II the next year, the military put many HT-9s to use. The Army Signal Corps called the rig the T-173/FR.

Production continued throughout the

war years. In the 1942 edition of the *ARRL Handbook for Radio Amateurs*, Hallicrafters advertised the price of the HT-9 as \$225.

Hallicrafters stopped manufacturing the HT-9 in 1945, but surplus units continued to be marketed by Hallicrafters for another three years as "a real ham rig with medium power and maximum flexibility." The advertised price in 1947 was \$250, and by 1948 it had climbed to \$350.

Into the early 1950s, Leo Meyerson's World Radio Labs catalog and other ham gear dealers still listed new-in-the-crate HT-9s. By then, however, Hallicrafters was promoting its new

HT-20 for the 100-W market, touting the HT-20's more modern tube lineup and the suddenly-necessary extensive TVI shielding.

By this time, Samuelson was long-gone from Hallicrafters. He resigned his post as engineering vice president in 1946. His impressive list of credits had grown to include the HT-11 and HT-12 marine radio-telephone units. He also had a hand in Hallicrafters receiver development, including design of the gear drivetrain for the venerable SX-28.

"I left Hallicrafters to fulfill a promise I'd made to myself years earlier that I'd continue my education to get at least a master's degree," Samuelson explained. By 1950, he'd earned a master's degree and a Ph.D. in electrical engineering from Northwestern University.

He then signed on with Motorola's government electronics division, quickly rising to the post of chief engineer and, by the time he retired in 1976, division director for research and development.

Samuelson described his time with Hallicrafters as "the best experience a young radio engineer could've had in that era...I cherish the memories of those years."

Samuelson also fondly remembered the HT-6 and HT-9 as "two of my favorite brain-children." He was surprised and pleased to know examples still are around in ham shacks and occasionally on the air more than a half-century after he penned the circuits.

"I never dreamed they'd last this long," he admitted. "I guess we *really* must've done something right."

Note: This article was originally published in the June 1992 issue of *Electric Radio*. For more information contact: *Electric Radio*, 14643 County Road G, Cortez, CO 81321-9575; tel 970-564-9185; er@frontier.net.

A 75A-4, One Piece at a Time



The thought of building a modern ham transceiver from factory parts is pretty far-fetched, even for experienced builders. But in the late '50s, as an employee of Collins Radio, if you had patience, dedication and a little luck, you could assemble your dream radio one piece at a time...

His longing for the finest ham receiver came at the worst of times. It was 1956. "K" (he asked that I avoid using his name in this article) was low on cash. Married, with a baby, the 23-year-old ham radio operator and University of Iowa student dropped out of school and started looking for a job. But K did not go out and buy his dream radio. He couldn't afford to.

No, he put it together, piece by piece.

In the mid-1950s, the mainline amateur receiver makers all vied for top place in the hearts of hams. There was National, the venerable pioneer of receiver design, still flaunting its line of HROs. Hammarlund had its HQs and Super Pros and Hallicrafters seemed to have topped everyone with its humongous SX-88. But for K, there was no doubt which radio was tops. A year earlier, in 1955, Collins Radio Company whetted the imaginations of thousands of hams by announcing the latest version of its famous 75A series of ham receivers.

QST ads and the owner's manual boasted that Collins' 75A-4 was *the* radio. The instruction book shrewdly hyped the A-4 in good old American car buying terms.

"What does it have that last year's model didn't have?"

"Passband tuning ... is so new that it was necessary to coin a new name to describe its function," the book bragged.

"Separate detectors for SSB and AM reception, a Q-multiplier Bridge-Tee filter, a new AVC system that works on SSB, a new low-cross modulation RF tube, a noise limiter that works on SSB, a built-in crystal calibrator ... all built into a cabinet nearly four inches narrower than the 75A-3."

All the pioneering features of the earlier

75A receivers were still in that smaller, lighter package: dual conversion for better image rejection, crystal-controlled conversion and a permeability-tuned oscillator for increased stability. Now, instead of two choices of mechanical filter, as in the 75A-3, the A-4 offered as many as three of the steep-skirted Collins mechanical filters for unbeatable selectivity.

But K had another reason for wanting a 75A-4: "I had an SX-71."

His supposedly deluxe Hallicrafters receiver "didn't have 15 meters," said K. Calibration was far from exact. "You didn't know where the band edges were."

"Compared to a 75A-4, it was an S-38," Hallicrafters' cheapest, least desirable re-

ceiver. "It was the pits."

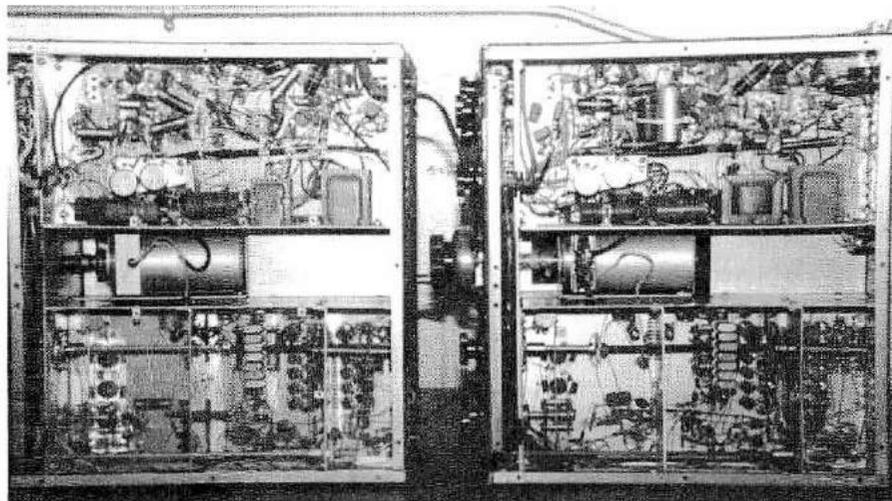
The 75A-4 had everything—including a price tag in its early days of more than \$500.

K could daydream, but his ever-present cash flow problem was forcing him out of school. He needed a paycheck.

Suddenly, Collins Radio was there, but not in fantasy.

"I had to go to work somewhere," recalled K. "There was an ad in the newspaper for a drafting school being run by Collins, and I applied. They tested me and found out I would be a better lab technician than a draftsman."

K went to work making prototype radios at Collins. "I worked for them for one year as an engineering technician—till I got



Which is real, which is the phony? Above is a factory-made 75A-4. On the right is K's version. The most obvious difference is the lack of a bottom cover on the PTO front.

enough money to go back to school.”

You don't get closer to your dreams than this. Imagine a Cadillac or Ford or Studebaker buff working in the very factory where his dream machines were made.

There it was, on the assembly line, the wonderful 75A-4. By now, there was no other receiver for him. “I was exposed to it by working there. There was a ham station set up in the engineering building and hooked up to a God knows how big antenna with a KWS-1 as a transmitter and a 75A-4 as a receiver. During my noon hours I'd go over and work CW. The 75A-4 was the best receiver in the world at that time.

“I just wanted the best, and I knew this would be my only chance.”

K began to plan.

“At that time, you were allowed as an employee to purchase one per year of anything they made at whatever the inventory cost was.”

K guessed a new 75A-4 would cost him, as an employee, about \$350.

“Even that was too much.”

K had a fallback plan, otherwise known as the old ham approach.

Home-brewing.

“The only way was to use my labor and their parts. We were allowed to purchase the parts for products the company made during our noon hour. We could go to the parts supply room and offer a list of part numbers and we had to pay cash for them as our paycheck permitted.”

First, K bought a set of 75A-4 blueprints.

An Intriguing History Discovered

I learned of K's quest and of his unusual solution in the mid-1980s when he responded to my *QST* want ad for a 75A-4. He was apologetic. He had a 75A-4, he said, but he doubted it was worth much. It was not made in the factory. It had no serial number, so he figured it had little value to a collector. But he explained that in every other way—almost—his radio was a ringer for a factory-built 75A-4. The panel and cabinet were standard issue. The components were, well, not exactly the

same—some of his components were of better quality than the production units. And there were three small holes in the rear panel where he once fed the receiver's high-frequency output to a home-brew SSB exciter.

Only the knob was different. Yes, K home-brewed that, too.

As you can imagine, I think the 75A-4 is a marvelous radio. The first ham station I ever saw, about 1958, used the 75A-1, a precursor to the A-4. Ever since, I was focused on the 75A receivers. In my mind, when I'm tuning an imaginary receiver, it is a 75A. By 1959, when I was licensed, I could dream about owning a 75A-4, but even though they were a couple years out of production, I was a teenage boy with a paper route and, like K, I could not afford an A-4. My own solution was to buy a second-hand 75A-2—a darn fine radio, but still a long way from a 75A-4.

By the mid-1980s, when K phoned me about his ersatz A-4, my own admiration for the receiver had seasoned more than a quarter century. The idea that somebody had homebrewed a 75A-4—literally built it in his basement—fascinated me. To K, though, his accomplishment was no big deal. He made it sound routine.

“In the year I worked for Collins Radio, there were at least half a dozen engineering lab technicians who were building their own as well. There's nothing distinguishing about this. I don't know why you think this is so noteworthy—at Drake you would find the same thing. It's not a novelty—there are other ones out there, you bet. It was just economy.”

I believe it. In fact, another collector once told me he bought a 75A-4 with wiring that appears home-brew and without a serial number. That makes two, maybe.

In spite of his modesty, K's roll-your-own approach goes to the very core of what makes ham radio a unique hobby. The proof is sitting in my shack, plugged into AC, a 75-meter sloper and connected to my factory-built KW-1. Over the years, I've referred to it as my “counterfeit” or

“bootleg” 75A-4. Forty-four years after it was basement-built, it works great.

I could not convince K to take credit in print for making the receiver. The last thing he wanted, he said, was calls from readers. “There's a quip that applies to my feelings about class reunions—I don't want to be with all those old people. It's like being an habitu  of the local pub—you hear the same people telling you the same lies all over again.”

This story first appeared in the May 1992 issue of *Electric Radio*. While polishing the text for *QST* last fall, seven years after it first appeared, I decided to call K and see if he would relent about using his name. A woman answered the phone. There was silence on the line as I asked for K. Then she gave me the sad news: Her husband died five years ago.

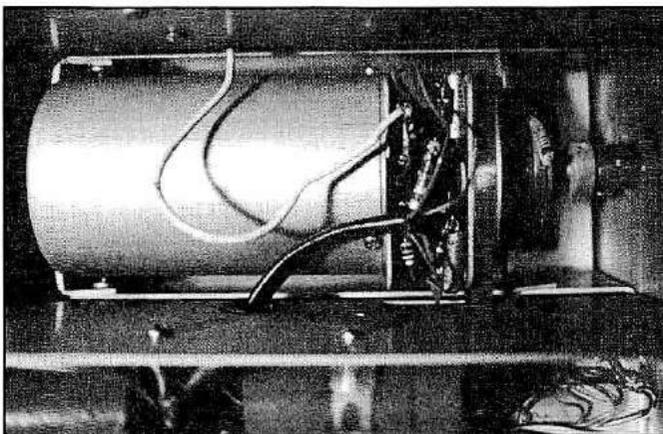
Lovingly Handcrafted, With a Personalized Touch

Remember the Johnnie Cash song about the mythical autoworker who smuggles parts out of a plant one piece at a time to build a car? At Collins, said K, “You couldn't smuggle anything out. They searched you every time you went in or out. If you carried anything, you had to have a receipt or you didn't get out with it. If you wanted to take your tools out, you had to get a pass from the supervisor and the guard inspected you on your way out. They would occasionally just pick people at random and pat them down.”

Building the bogus A-4 “took most of the year,” K said. “Nine months or better, because you weren't always able to get parts when you went to the counter. Sometimes you had to wait because they were being used in production.”

One part never was for sale—the famous Collins permeability-tuned oscillator, or PTO.

“It was never available as an assembly. I had to build that, too. The slug in that thing moves up and down on a lead screw through the coil, which is powdered iron with a brass core. I can remember borrowing a double



A close-up of the homebrew PTO. Note the opening on the bottom where K could not make the plate fit over wiring.



Detail of the homemade gear reduction assembly and hand-milled knob skirt for K's homebrew 75A-4.



The author and his "counterfeit" 75A-4.

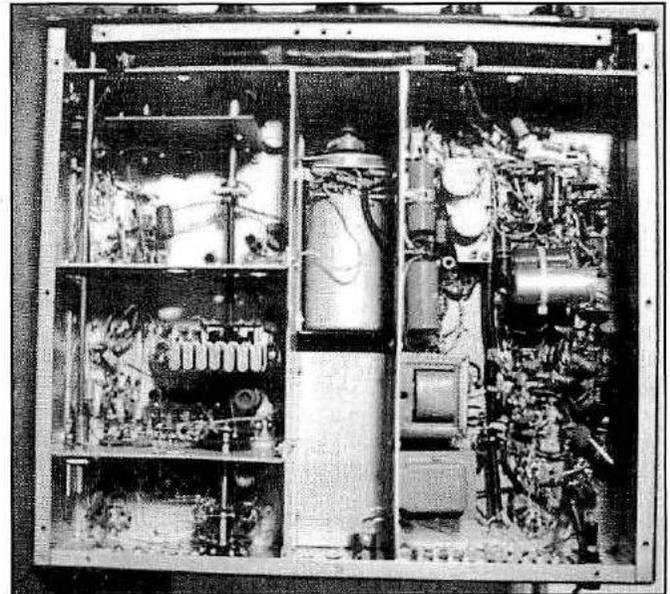
star tap from somebody and threading the slug because the main shaft for the PTO is double star-threaded. Then I had to assemble it all and calibrate it. I did it in the ovens in the engineering lab on my noon hour. There's a corrector stack in there for correcting non-linearity ... It was never perfect, and Collins' engineers designed it so as the slug moved in and out, a little arm with a roller on it bore against a series of discs that were mounted on a long screw with two rather heavy plates on either end. Rotating corrected for displacement versus frequency error. I remember sitting there for hours with that thing held in a vise and a big two-foot wheel with 0-360 marked on it and I was turning that wheel while I watched a frequency counter. Once you got it right, you baked it in an oven and that's the way it was. If you ever lose the seal, put it in an oven for an hour at 150° and put the cover on.

"My wiring wasn't as neat as it should have been. There's a PTO cover to go over all the wiring, but I couldn't get the cover under the tube sockets for the tubes in front of the PTO."

"I used different capacitors than Collins did. Collins used a lot of paper and disc ceramics. There's a mixture in mine. I changed some of them to hermetically sealed, oil impregnated Sprague capacitors."

K made the under-chassis wiring harness from Collins drawings. "You drive little inch finishing nails into the drawing with rubber bands at the top and lay wires in with branches as specified. When you're all done, you tie it. Collins does not lace, they tie. Lacing fails. If one lace fails, the whole thing unravels. You must spot tie, also. This one is that way.

Another view of K's craftsmanship (the underside of the 75A-4).



"There's a tale, true or not, I don't know, about a test Art Collins used to administer while walking through the engineering lab. If he found a piece of equipment he wanted to test, he would pick up the unit by its harness and shake it. If anything broke loose, you would do it over again."

One thing K didn't like about his new 75A-4: The main tuning knob turned the PTO too fast for comfortable SSB tuning. "Collins built a good radio when they built the A-4, but they screwed up. When they realized they'd made an error (in the tuning rate), they had to come out with this accessory knob."

Collins offered 75A-4 owners an optional add-on black plastic knob and a 4-to-1 gear reduction mechanism that could be mounted on the front panel in place of the original knob.

"It was an afterthought," said K. "It should have been done inside, with a gear train."

But K built his 75A-4 early in the production run of 75A-4s, and the knob and gear mechanism weren't yet offered. He had his own solution.

"I had left Collins and returned to school, but I had a junkbox full of stuff from the vernier mechanics of old (military surplus) BC-375 units."

K built his own gear-reduction mechanism. Here, again, he did Collins one bet-

ter. His gear system has a 7-to-1 turns ratio—verrrrry slow.

He turned his drive with a big black plastic knob similar to the big knobs on the KW-1. "For years I ran it with just that knob on the vernier drive."

But the knob didn't hide the gear assembly.

"I got tired of looking at it and decided, 'I've got to have something prettier than that.'" K found a bar of aluminum. He spun it on a lathe, creating a shiny metal skirt to back the knob and hide the gears.

"What you see is what you get."

What I got is a standard-looking 75A-4 with a distinctive black and silver knob that tunes nice and slow.

Through the years, K modified his radio. "The 15-meter band was moved slightly in later models, and later models have different dial decals and different crystals. I changed mine from old to new. It has a circa 1961 dial."

K also replaced the mixers with quieter tubes. "Those 6BA7 mixers are bad news—they hissed and roared at you all the time."

K doesn't know how much money he saved. But he notes that 75A-4s were selling for \$695 towards the end of production in 1957.

"I like to think the changes I made to it improved its longevity."

Collins built a great radio in the 75A-4. So did K.

Regeneration and Crystal Control

This tale of retro-reminiscing is filled with stories of friendship and dreams fulfilled. Take it from a young Old-Timer—the love of radio can lie dormant for years before blooming...

I'd been interested in radio since childhood, but I took more than 30 years to get my ticket. I've always loved building things because of my dad, but a special uncle showed me the "radio ropes." Along the way I became a doctor. Becoming a ham finally became a reality when I met a patient named Fred, who I'll introduce later in the article. If you follow along with me, I'll show you how a few pivotal friendships have made me into an unusual radio specimen—a middle-aged Old-Timer!

Born in Cleveland, Ohio, in 1951, I began making crystal sets with 1N34 diodes and loopstick antennas at age 7, no doubt influenced by my then-teenage uncle, Dick Texler, K8VKW. He and my dad taught me to solder, and before Dick was licensed he lent me a CB rig he'd built from scratch.

I learned the code early on, and I took Alfred Morgan's *The Boys' First (and Second) Book of Radio and Electronics*^{1,2} out of the library so many times that I practically wore them out. My mom finally got me my own copies as a birthday present when I was 10 or 11. From these wonderful books I built a one-transistor radio, a code oscillator, a darkroom timer and, later on, a record player and a three-tube phonograph amplifier.

I dreamed of building Morgan's one-tube regenerative receiver and his Geiger counter, but I couldn't find the right tubes. I pored over catalogs from Allied,³ Lafayette, and Burstein-Appleby. Ham radio looked interesting and I was intrigued by Uncle Dick's ham shack. I fantasized about having my own shack someday and covering the walls with QSL cards. I knew I could probably get my Novice ticket—but I also knew that after one year I would have to upgrade or get off the air (at that

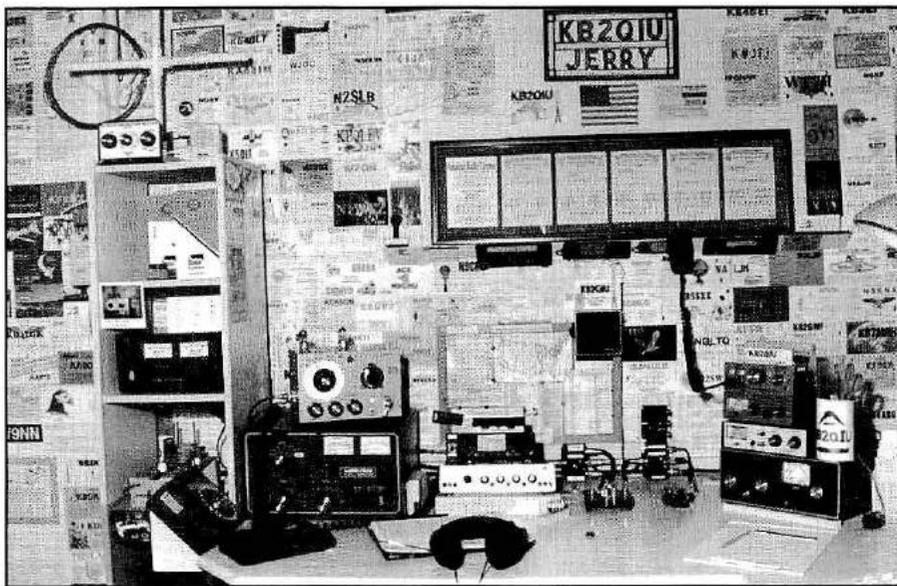
time, Novice licenses were nonrenewable). The General exam seemed way over my head, so I never got my ticket—not then, anyway.

Radios Crated and Set Aside

During my college days in St Louis, I visited a Heathkit store. I still imagined getting my ticket someday, and I even built a Heathkit ham-band receiver and an Ameco CW transmitter. I didn't use them on the air, though. I didn't have an antenna, a license or a crystal!

Through years of medical training and moves to Philadelphia, Denver and New Jersey, my radio time (and interest) waned. Each time I moved my junkbox got smaller—my collection of parts and radios was successively packed into fewer and fewer boxes.

By 1983, I was married and beginning practice as a vascular surgeon. My wife Adelaide and I were leaving our small apartment in New Jersey with toddler Elizabeth in tow. We were moving back to Denver to start in practice. On that day, my



QSL cards paper the walls of the author's shack. His homebrew regenerative receiver sits atop the amplifier, and the 6V6 wooden chassis transmitter is on the left. 1415 The IC-706 MK II transceiver is mounted on the MFJ DSP unit. The 6V6 rig is used with a MFJ-971 tuner and a Cushcraft R7 vertical antenna. A switch to left of the '706 allows either receiver's audio to be fed through the DSP box. The stained glass call letters on the wall were a gift from WA2BLF (SK).

radio hobby fit in a large wooden crate that hadn't been opened in a year. With the moving van out front—and our cargo priced by the pound—Adelaide convinced me to leave the heavy crate behind. After all, I wasn't really interested in radio anymore. But I couldn't just put it in the dumpster.

I loaded the crate into our hatchback and scoured the Englewood, New Jersey, neighborhood, looking for ham antennas. I finally found a house with a beam and tower—but there was no one home! I've often pictured that ham pulling into his (or her) driveway to find my crate and my note, left as a gift to an unknown friend.

Patient, Friend and Inspiration

Years passed. Adelaide got her PhD in Colorado. Mark was born as we moved to Rochester, New York, in 1984. After practicing there for several years, I met a patient whose kindness I will never forget. He was an older gentleman, and when I met Fred Retallick, he was irritated. "Doctor, I'm sure you have a good reason for running late, but today is the first day of the Rochester Hamfest and I need to be there. I've waited all year for this!"

Fred, WA2BLF, told me of his long interest in ham radio and we became friends, not simply doctor and patient. My

son and I visited his home, saw his shack and met his wife, Dot. Fred awakened something that had been simmering inside me for all these years. I went to a hamfest for the first time, looked around and had lots of fun.

A walk through the flea market reintroduced many old friends: Heathkits, tube checkers, soldering guns and needle-nosed pliers, to name just a few. The new radios looked terrific, too.

I left the hamfest, stopping at Radio Shack on the way home. There I bought a Novice study package and discovered how easy it was to relearn the code from the 5-WPM tapes. The theory questions were easy, too. The mandatory upgrade was ancient history. How proud I was to call Fred in June of 1993 to tell him that my Novice ticket had arrived. We were both very happy that he had been in my waiting room that day.

Finally on the Air

I got on the air with a Kenwood TS140S and a Cushcraft R7 vertical. I loved sticking the QSL cards to the wall with little balls of rubber adhesive. I was ecstatic with my first European contact on 10 meters after I passed the Technician test that fall.

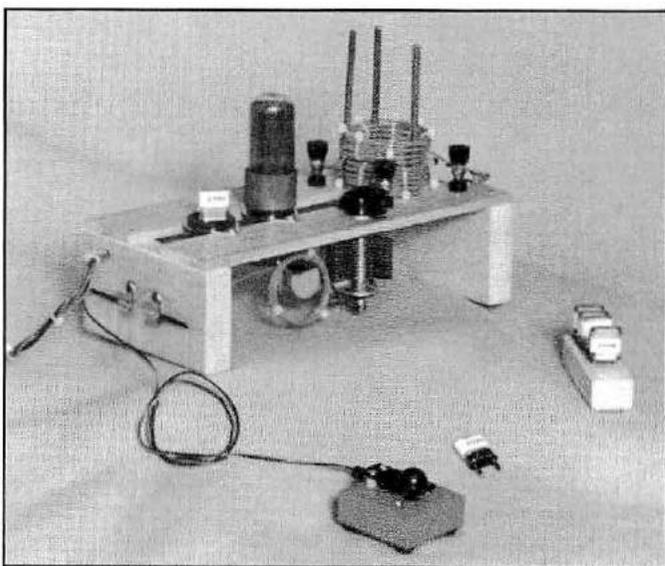
Getting a General ticket—the imaginary goal of my youth—still seemed impossible.

But Fred's encouragement and the lure of all those HF bands kept me working, especially on the code. Jim Collinsworth, N2JC, a member of my church, also kept me on task.

Persistence paid off. I celebrated the unbelievable feeling of passing my General-class exam in the fall of 1994 by (1) calling Fred (a General licensee himself) on the phone, (2) tuning across all those new frequencies and (3) stopping by RadioShack for an Advanced study guide.

I started chasing the League's DXCC award and finished my WAS. With hard work and a week's worth of free time, I upgraded to Advanced by Christmas of 1994. Right away I started thinking about the final step to Amateur Extra and made myself a deal: I would pass the theory first, and have a year to get to 20 WPM with the code. Fred was so impressed by my last upgrade that he decided to give it a go, too. Fred was now 83 years old, but I still have his letter from January 1995 posted in my shack.

"The bread that you cast upon the waters has returned and now it is my turn to say thank you. The loan of your text and encouragement has paid off. Last night I passed the Advanced examination and now have the "AA" suffix added to my call sign. I have used your progress as a shining example of how friends are made in ham radio."



The 6V6 transmitter^{10,11,16,26} pictured with six crystals²⁷ and a Whiterook Products key.²⁸ The original design was by R. O. Deck, W9JVI. In actual use, the author uses a Nye Speed-X straight Key.²⁹ As suggested in the original published design, an octal tube socket is used for the crystal and the coils¹⁹ are hand wound with bell wire. Three wooden dowels support the coils on the chassis. (Photos by author except as noted.)



(Right) Several homebrew projects dress up the station. Top shelf from the left: 40-meter regenerative receiver²⁰ using two 3S4 tubes; 40-meter shielded-loop receiver (N1YBT design);¹⁷ and a broadcast-band regenerative using a 1H4G tube.²¹ Middle shelf from the left: 40/80 meter-regenerative receiver using a 3S4 tube;²² and a 40/80 meter breadboard CW transmitter (N1TEV design).¹⁸ Bottom shelf from the left: Spider web coil crystal set;²³ and a sliding-inductor crystal set.²⁴



Old and new friends at KB2QIU (clockwise from upper right): *Radio Receiver Projects You Can Build*,⁷ *The Boys' Second Book of Radio and Electronics*,² *The Boys' First Book of Radio and Electronics*,¹ *Secrets of Homebuilt Regenerative Receivers*,⁶ *QRP Power*,²⁵ *Understanding Amateur Radio*.⁸



Dick Texler, K8VKW (left), and the author at the Dayton Hamvention, 1998. Dick, who initially interested his young nephew in electronics, is the retired Photographics Division Chief of NASA's Lewis Research Center, Cleveland, Ohio. He presently heads Texier Electronics in Cleveland, which provides circuit design and servicing of commercial strobes and densitometers.

The Push for Amateur Extra

The one-year clock began ticking after I passed the Amateur Extra theory in late 1995. Fred became ill and was in and out of the hospital. Spring arrived and I had made no progress toward 20 WPM. The months were slipping by. If I didn't make Extra this year I would lose the credit I had already gained by passing the theory.

Because I hadn't made many CW QSOs, I doubted I could even pass the 13-WPM code test again! I had little time as a busy surgeon. Practice was hectic, and I had recently accepted the post of president of the medical staff at the hospital. "What a mistake," I thought. "Now I'll never get the Extra."

It was now or never. I ordered Code

Quick⁴ by Jerry Wheeler, W6TJP, and got up "extra" early every morning. I spent 20 minutes twice a day working on the code. On test day, my examiner, Alex Piccirilli, NV2Y, could tell I was really wound up. I was the only one taking a code test and I couldn't seem to get my hands dry.

When he graded my paper and told me I had passed I let out a huge war whoop that neither of us will ever forget. After I settled down, Alex told me to make sure I took my wife out for dinner—good advice! I had made my goal with two months to spare.

Unfortunately, Fred wasn't getting any better. As he spent more time in the hospital, he gradually lost the energy for ham radio. His doctor started him on dialysis, but after the fourth treatment, Fred decided

he'd had enough. He was going home for good.

Fred wrote me a beautiful Christmas card. "To one of a kind," it says. "Your friendship is special." I will never forget Fred. He went back to the Creator on January 13, 1997. His cards and notes to me will stay on my wall as long as I own a radio.

Second Childhood

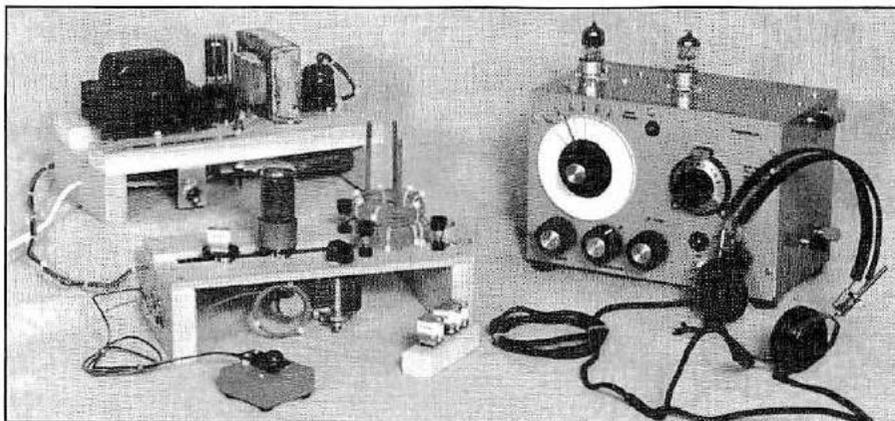
About a year after Fred died, I qualified for DXCC which, oddly enough, took some of the wind out of my DX sails. I became interested in Morse QSOs and QRP, and my old homebrewing fires started burning again. Hamfests became an opportunity for parts. Now in my mid-40s, I got out my well-worn copy of *The Boys' First Book of Radio and Electronics* and thought that now was the time to build that one-tube regenerative receiver.

I managed to find a working 1H4 tube and built a power supply kit for the radio from Antique Electronics.⁵ The radio worked and the hours spent planning, building and scrounging for parts were fun, too.

The radio wasn't good enough for QSOs, though, and I was only able to make it receive AM broadcast stations. I then built a series of regenerative receivers, each one better than the last. Inspiring me were books such as *Secrets of Homebuilt Regenerative Receivers*⁶ and *Radio Receiver Projects You Can Build*.⁷

The Thrill of a Homebrew QSO

Today, I have two stations rolled into one—and I love it. The modern station, an Icom IC-706 MK II transceiver and an Ameritron AL-8 11 amplifier, is alongside my homebrew retro station, a one-tube 5-W CW transmitter (6V6) with crystal control, straight key²⁹, wooden chassis and hand-wound coils.¹⁰



The author's complete homebrew station on display. On the left is the 6V6 transmitter with its power supply.¹² The two-tube regenerative receiver is on the right.

The "Up Front" piece by Bob Reif, WIXP," was my inspiration for this project, and he was helpful in providing the design reference and tips.^{26,9} The receiver is a two-tube (6U8s) regenerative featured in QRP Power.^{12,13,29} Contacts involve careful listening, throwing a T/R switch and the glow of warm filaments. Signal reports don't always end in 9, and they may also have an X, C or K!

Every QSO with the homemade station is a thrill. Using it also gives many Old-Timers an opportunity to share memories of their homebrew days. QRP enthusiasts sometimes respond to my QSL card with schematic diagrams or photos of their own homebrew outfits.

My first contact with the one-tube transmitter was with Hal Fuelling, W8OHM, who wrote, "Ur 6V6 Xmitter sure sounded great. I remember the 6V6. I built many one-tube rigs and receivers. The good old days! Age hr 82 yrs, ham for 63 yrs."

Several hams asked for schematics. More recently, Sterling Copeland, K4JTD, wrote, "Sometimes one really enjoys getting a card as a result of something special. You brought back many memories of the '30s and '40s."

Conclusion

Maybe someday I'll try for the Honor Roll, bounce a signal off the moon or have my first satellite contact. Right now, I'm happy with homemade CW and I'm searching for my first regen/xtal to regen/xtal QSO.

I'm grateful for Uncle Dick, Fred,

Adelaide's patience, my parents and my many other life guides. I've had many great times, but nothing has been more thrilling than getting my General ticket, passing the 20-WPM code test or listening to W8OHM's memories of the golden age of radio.

Have you noticed that you can always find the time for something you really want to do? We all have that potential. When you feel it rise inside of you, get up and go for it!

Notes

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⁴Wheeler Applied Research, 38221 Desert Greens Dr West, Palm Desert, CA, 92260; <http://www.cqinternet.com/codequick.htm>.

⁵Antique Electronic Supply, PO Box 27468, Tempe, AZ 85285-7468.

⁶Rockey, C. F. 'Rock'; *Secrets of Homebuilt Regenerative Receivers*, Lindsay Publications Inc, Bradley, IL, 1996.

⁷Davidson, Homer L.; *Radio Receiver Projects You Can Build*, TAB Books, New York, 1993.

⁸Grammer, George; *Understanding Amateur Radio*, ARRL, West Hartford, Connecticut, 1963.

⁹*QST View, 1950-1959* (and other years), ARRL, Newington, Connecticut, 1996.

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¹¹Reif, Bob; *QST*, "Up Front," Sep 1997.

¹²"A Simple Transmitter Power Supply" in *How to Become a Radio Amateur*, 1953, ARRL,

West Hartford, Connecticut, pp 22-23.

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¹⁴Goodman, Byron; "How to Lay Out a Transmitter; The Elements of Radio Design," *QST*, Jul 1951, pp 38-40ff.

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¹⁶Goodman, Byron; "How to Wire a Transmitter; The Basic Techniques of Radio Wiring," *QST*, Feb 1952, pp 30-32ff.

¹⁷Wissell, Daniel; "The 40M SLR—a Shielded Loop Receiver," *QST*, Oct 1997, pp 33.

¹⁸Kitchin, Charles; "A Simple CW Transmitter for 80 and 40 Meters," *QST*, Feb 1998, pp 40.

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²⁰"Antique Shortwave Set" in Davidson, Homer L.; *Radio Receiver Projects You Can Build*, TAB Books, New York, 1993, pp 245-253.

²¹Morgan, Alfred; "How to Build a One-Tube Regenerative Receiver" in *The Boys' First Book of Radio and Electronics*, Charles Scribner's Sons, New York, 1954, pp 160-183.

²²"A Simple Receiver" in *How to Become a Radio Amateur*, ARRL, West Hartford, Connecticut, pp 13-18.

²³"The Spider-Web Special" in Davidson, Homer L.; *Radio Receiver Projects You Can Build*, TAB Books, New York, 1993, pp 41-48.

²⁴"The Simple Crystal Radio" in Davidson, Homer L.; *Radio Receiver Projects You Can Build*, TAB Books, New York, 1993, pp 31-41.

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²⁸Whiterook Products Co, 309 S Brookshire Ave, Ventura, CA 93003.

²⁹William M. Nye Co, Bellvue, WA 98005.

³⁰Newkirk, David; *QST*, Sep 1992, p 35ff.

Zenith's "One-and-Only" Ham Receiver

In the art world, when a "one of a kind" masterpiece surfaces, collectors battle for the right to possess a unique treasure. Ham radio collectors are no less frenzied. And as the author discovered, mythical, legendary and lost treasures are occasionally recovered—even by mere mortals!

It's 1958. You're a crackerjack engineer at Zenith. Your boss gives you a long-term assignment: Design the best Amateur Radio receiver money can buy. What kind of radio would you build?

Wait! Zenith in the ham radio business? Sure, they made television sets and delved into military electronics. But whoever heard of them manufacturing ham radios back in the '50s?

Well, they did it, but under a different name. Zenith's ham radio products were marketed under the Central Electronics logo. In truth, everything they sold sprung from the fertile brains of ham radio entrepreneur Wesley Schum, W9DYV, or his chief engineer, Joe Batchelor, W4EGK—even the fantastic receiver that would be designed by that hotshot engineer at Zenith.

Central Electronics leaped into ham radio history in September 1952, when *QST* ran Schum's ad promoting a little gray box that transmitted a then-little-used mode called SSSC—single sideband suppressed carrier. We now simply call it single sideband, or SSB, and everybody knows it's the dominant mode on the HF ham bands.

But in the early 1950s, SSB was an exotic form of communication. Standard ham receivers couldn't even demodulate the newfangled signals. And for years, many ardent AM operators rejected the new mode.

Sideband transmitters in those early days were homebuilt. It was Schum who conceived of manufacturing a low-cost kit that would give builders a usable, low-power SSB transmitter. Schum called it the "10-A," and began shipping kits from his garage in Chicago. Schum became a mis-

sionary for sideband, traveling around the country and speaking to every ham radio club willing to give him a time on their programs.

He recalls receiving a standing ovation from Chicago's Hamfester's Radio Club after he demonstrated the 10-A. But the going was often rough. Doc Holt, W9VVN, remembers the Hamfester's Club meeting differently.

"The initial response of the audience was one of skepticism and even derision," recalls Holt. "Many of my ham buddies who were steeped in the AM phone tradition

called it 'silly sideband' or worse yet, 'duck talk.' "

A few curious hams bought 10-As. They discovered that sideband signals, even barefoot 10-W signals, could get through when AM was fading or lambasted by interference. Soon, more hams bought 10-As. Schum found more garages for assembling the rigs.

Meanwhile, in Cedar Rapids, Iowa, the head of Collins Radio Company was listening. Art Collins was used to being king of the pileups with his 1000-W, plate-modulated Collins KW-1.



As pristine today as when it was originally manufactured, the Central Electronics 100-R receiver.



A rare Zenith publicity photo of the 100-R. (Courtesy of Wes Schum, W9DYV)

"A guy in Indiana was pinning Art's ears back with reports much better than Art was getting with his KW-1 and rhombic farm," recalls Schum. The Indiana ham was driving a pair of 811As with a Central 10-A. His power output was less than the KW-1, but single sideband was more effective.

Collins called Schum. He wanted Schum to sell him a 10-A.

Problem was, there were no factory-wired units on hand.

Schum told Collins, "If you think you have anybody out there who could put a kit together, we could sell you a kit."

Collins' response: "I think we could manage, Wes."

"I found out later they didn't read the assembly instructions and went at it in typical ham fashion. It took them a month to get it running," recalls Schum.

A few months later, Collins called to place another order. "We'd like to buy three of them, Wes, but no more kits."

Business was good. The 10-A was followed by the improved 10-B, then the 20-A, which was a band-switching rig that covered 160 through 10 meters with 20 W of RF output. Central also offered accessories such as the MM-1 and MM-2 station monitoring scopes, and the Model A and Model B *sideband slicers* to convert older receivers to sideband reception.

Meanwhile, Schum noticed a potential competitor. In Georgia, Joe Batchelor was converting military surplus BC-696 transmitters into sideband excitors. He sold dozens of the little rigs, even though they had no name. Batchelor said Schum was worried that the little '696s would compete with his 10-A. So Schum invited Batchelor to join him at Central.

Batchelor brought a novel idea to Chicago. How about a "look, ma, no hands" transmitter? A deluxe 100-W output, all-mode transmitter that required no final

amplifier tuning. Batchelor eventually patented his broadband coils, which were the major innovation in the Central Electronics 100-V transmitter and 600-L linear amplifier.

The 100-V had a stable, permeability tuned oscillator and a small oscilloscope for monitoring the transmitter's signal quality. It could transmit CW, phase modulation, double sideband (with or without carrier) and single sideband (with or without carrier). It would also do radio teletype. The 100-V used the phasing method of generating a single sideband signal, with circuitry that ensured long-term carrier and unwanted sideband suppression rivaling or surpassing that achieved by typical filter generators. But the big advantage of the phasing system was audio quality. The final tubes were two 6550s—highly linear audio tubes. If you liked hi-fi, you'd love the 100-V.

A Matching Receiver?

Batchelor and Schum always wanted to produce a receiver that would match the marvelous 100-V. Such a receiver would have to be like its deskmate—revolutionary.

But first they had to deal with production problems. The complex 100-V turned out to be a handful—like a talented, temperamental child.

The first Batchelor broadband couplers were inefficient.

"The first 100-Vs didn't ship until late 1958," said Schum's good friend Nick Tusa, K5EF. "During that time they endured VFO problems, bad HF oscillator crystals and the continual problem of getting the Batchelor couplers to a state where they were consistently reproducible."

By 1958, said Schum, "We didn't have the working capital to produce more than a million dollars of backlogged orders for the 100-V. We had run ourselves out of money.

The (100-V) buyers didn't pay cash. Instead of getting money in hand, we got a purchase order—the dealers had my working capital!"

Schum eventually worked out a takeover that left Zenith in control. New capital flowed in, the 100-Vs—by then performing beautifully—were almost selling themselves. An updated model, the 200-V, went on the market.

With Zenith came new talent. Now Schum and Batchelor outlined what they wanted in a receiver that would properly complement the 100-V: It must have high sensitivity, selectivity and stability. It must transceive with the 100-V and it must resemble the 100-V.

Bill Van Slyck, W9EMB, was head of special products at Zenith. He assigned two top engineers—including Jim Clark, a former Hallicrafters receiver designer—and two technicians to the receiver project.

"They worked several years on this thing," recalls Van Slyck. "We spent a quarter of a million dollars when you think of all the company overhead."

He told Clark's team, "Build the best receiver ever built, with an emphasis on single sideband."

It would be called the 100-R.

Clark's engineering notes show that a prototype was in use by 1960. Follow-up tests were conducted through 1961.

Schum took it home and played with it. "It worked well—I transceived with it one Sunday afternoon with a 200-V."

It covered the ham bands, 160 through 10 meters. The second intermediate frequency was at 50 kHz, with six tuned circuits for excellent selectivity without crystal or mechanical filters. The PTO could be owner-adjusted quite easily. It had three degrees of selectivity for AM, two each for upper and lower sideband and one position for CW.

Once again, the receiver featured a Batchelor creation: The bifilar compressor was an RF-derived AGC system that made the front end virtually immune to strong signal overload. Together with low-noise RF, mixer and IF tubes, the receiver had impressive sensitivity—better than 0.6 microvolts through 40 meters and less than 0.9 microvolts on 10 meters.

Ray Osterwald reviews receivers for *Electric Radio* magazine. He calls the bifilar compressor "true genius."

"It would probably be tough to overload, even with a gain antenna on 40 meters at night," said Osterwald.

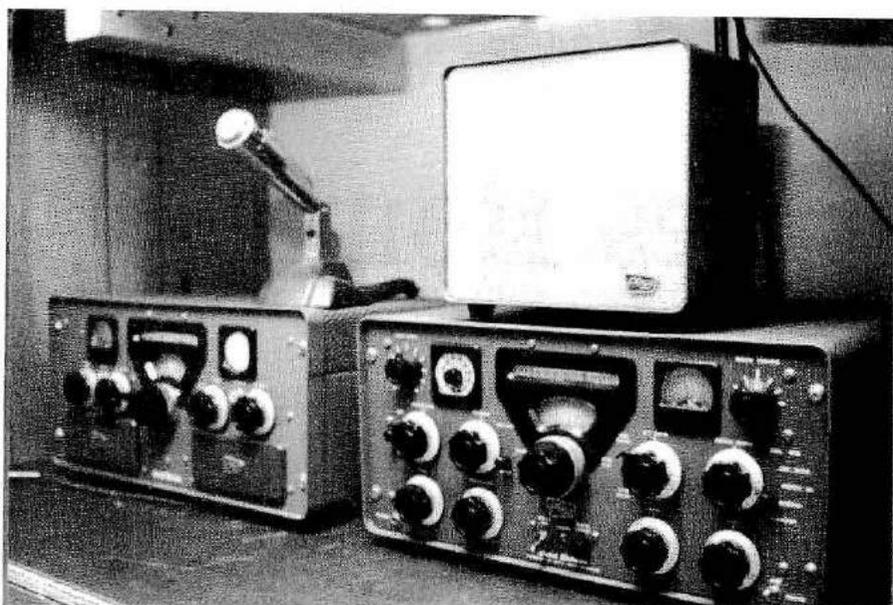
Schum recalls planning to have five more prototypes built with production and sales to begin in 1962.

Central's transmitter sales were brisk, but a new president at Zenith decided Amateur Radio was not good for the corporation.

"I think they experimented with the (ham radio) market and found it wasn't deep enough for them," said Schum.

Late in 1961 came orders from Zenith: Close Central Electronics.

Wes Schum remembers the trash bins. Central's records—everything from de-



The Central Electronics 100-V transmitter, left, and the companion 100-R receiver in the author's shack.

sign plans to sales receipts—went to the landfill.

Including parts for the next five 100-R prototypes.

The lone 100-R prototype vanished.

Years passed. Schum longed to reestablish what he calls "Central Headquarters." He had a couple of 200-Vs and some other Central equipment. And a friend donated a 75A-4.

Whatever happened to that lone 100-R?

I run a small used ham radio equipment business. Over the course of my buying and selling old ham equipment, I had heard a yarn about a receiver companion to the 100-V. I also longed to own it. I had owned 100-Vs and 200-Vs at different times, and always loved the transmitters. I would usu-

ally run a Collins 75A-4 as a receiver, but it was not a perfect match.

Rumor had it that some ham had managed to acquire the 100-R. How many times had I sat in front of my 100-V and wished for a matching receiver? It would be wonderful, but...it was a dream, that's all.

Then one day in September 1997, my phone rang.

I sipped coffee and waited for the answering machine to take the message.

"Joel, this is Bill Van Slyck in Chicago. I have a receiver you may be interested in...."

Turns out Van Slyck bought the 100-R along with a matching speaker and 100-V transmitter from Zenith as the electronics giant pulled the plug on Central. All three

units had sat in his basement unused.

One hitch. Van Slyck had a little auction going. A collector from New Orleans was on his way to make an offer for the 100-R.

I drove to Chicago, and there it was—the mythical 100-R was real after all!

The New Orleans collector paid Van Slyck a visit, too. I figured they'd top my offer. End of story. But the next day I had a phone call. It was Bill Van Slyck, accepting my offer.

After another rushed trip to Chicago, I was in my shack cabling the 100-R to my 100-V transmitter. Transceive with the 100-V!

And thinking. Van Slyck assured me that "there is only one," but still, I wondered. Was there another stray 100-R out there?

Who would know for sure?

I called Wes Schum.

"You got a one and only," said Schum.

Then it hit me. My rival on the 100-R deal, the "New Orleans collector" Van Slyck had mentioned, was Schum's friend Nick Tusa. And Schum was with him.

"I am preparing my second ham shack with a 200-V, and I was looking forward to buying that receiver," Schum said. "I wanted to get the 100-R and 200-V on the air at headquarters."

He offered me a deal: Send him the 100-R on loan. He would tune it up and make detailed notes on its design and performance. So, after playing with it, photographing it and talking about it to anyone who'd listen, I packed it up and shipped it to Wes Schum.

The 100-R is on line at Central Electronics headquarters and Wes has overhauled it. He even sent the PTO to Nick Tusa for repair. Now he's comparing its performance to his Collins 75A-4, the main competition when the 100-R was conceived.

Does the venerable 75A-4 stand a chance?

Stay tuned—that's another story!

A Zenith Goes Home

This is a tale about a radio known in its time as “the Royalty of Radios”—the Zenith Trans-Oceanic. It tells how one radio affected different people in different ways at different times. But beneath it all is a story about Amateur Radio.

My Introduction to Boat Anchors

The story begins during the summer of 1994. I was perusing the aisles of the Gainesville, Texas, hamfest along with my Elmer, Gary Youney, K5QT.

Gary and I worked together. A year earlier, Gary had dropped a *QST* and the *ARRL Operating Manual* on my desk, hoping I might find them interesting. Indeed! In short order, I passed my Technician Plus exam. A few days before the hamfest, I got my Extra. I was on top of the world! In the midst of the hamfest crowd, I reasoned that I deserved to reward myself for passing my Extra. A flash out of the corner of my eye caught my attention.

Several aisles over, sunlight glinted off a radio I didn't recognize. Its big, round, pale sea-green tuning dial drew me closer. A Hallicrafters SX-42 followed me home that day. Such was my introduction to the world of old tube radios.

I couldn't know it at the time, but the boat anchor bug had bitten. I still had a lot to learn, however.

The Offer

By the winter of 1997, I had transferred to another part of the company and no longer worked with Gary. Late one afternoon at the office, after most people had already gone for the day, I was studying a world map on the wall of the coffee room. Another co-worker, Don Boley, walked in and wondered aloud why I was staring at the map. I explained that I was an Amateur Radio operator and was looking at the countries that I had not yet contacted. It turned out that Don's brother, Dick, is an active ham, N3HKN. This led to a conversation about the various aspects of the hobby.

After discussing DXing and contesting, our talk turned to boat anchors. Don said he had an old Zenith Trans-Oceanic at home.

I learned the radio had not been turned on in 35 years! He wondered if he should

plug it in to see if it worked, but I suggested that might not be a good idea. Instead, I offered to check out the radio and see if I could restore it. Now mind you, I had never seen a Zenith Trans-Oceanic nor did I know anything about them. But, mentally I was surmising, “new tubes, new caps, possibly a professional repainting of the cabinet. How difficult could it be?” The conversation soon was forgotten, at least by me.

The Offer Holds

A couple of months later, Don called me into his office. There, I caught sight of what looked like a dirty, scuffed black briefcase on a table. I didn't give it a second thought as I sat down. But, he walked over to the “briefcase” and flipped up the front cover, introducing me to a rather forlorn Zenith Trans-Oceanic H500. The case was separated, and, of all things, covered with ragged and dirty fabric. So much for the professional repainting theory. The dial was barely visible behind a plastic window

clouded with age. There were cracks in the plastic. The back would not open as it was supposed to. This was beginning to look a lot like a “parts” set. Taking an even closer look, my heart sank. This was an impossible task! Even if I could get the radio working electrically, how could I ever restore it cosmetically? Already I was regretting my offer. But, I *had* offered...

Don told me the radio's history. It had belonged to his older brother when they were kids. Over time, it ended up in his mother's attic, and later, it almost wound up in the trash. As far as he knew, his brother had not seen the radio in decades and had forgotten about it.

Then, Don dropped the bombshell.

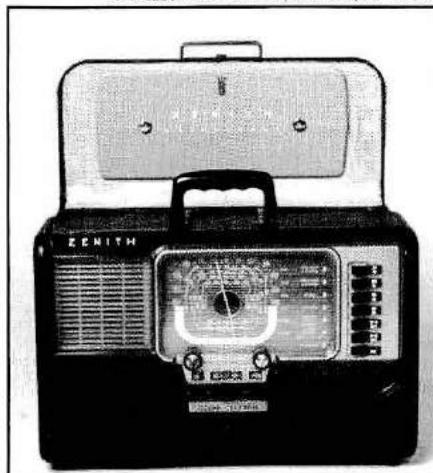
He wanted to know if I could restore the radio so that he could give it to his brother as a 60th birthday present the following year. He was sure his brother would appreciate it. After all, this same dirty, scruffy Zenith Trans-Oceanic sitting there on the table had introduced his brother to Amateur Radio some 45 years earlier and laid a path for his life and career. Through his interest in electronics and Amateur Radio, Dick Boley had gone on to a long and successful career in telecommunications and management at a large, well-known company.

Don recounted stories of his brother's shack in the basement. He remembered his brother working on radios that never had cabinets on them because they were always “works in progress.” He recalled how his father would bring visitors down to the basement and have his brother turn on the tubes, tubes that would light up the whole room. I listened in amazement, looking at the radio that had shaped his brother's life. This radio had a history and a personality. I didn't know how I was going to do it, but I had a mission.

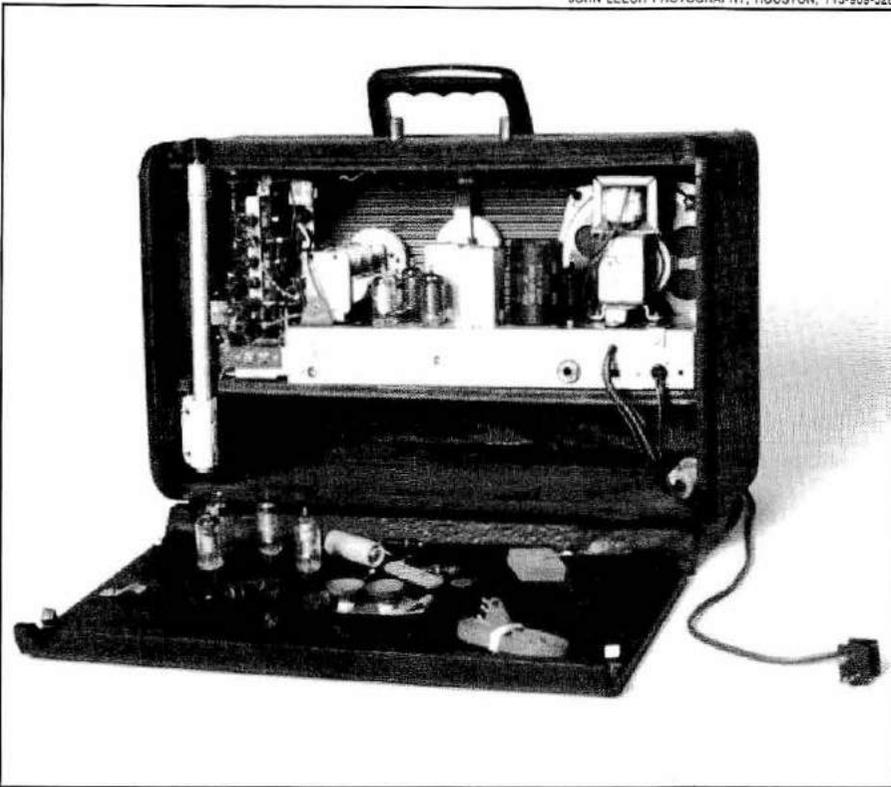
A Plea for Help

That evening, I was finally able to get the back open, only to be greeted by a huge

JOHN LEECH PHOTOGRAPHY, HOUSTON, 713-909-5288



The refurbished Zenith H500 Trans-Oceanic.



A look inside the H500 showing some of the replaced parts and tubes.

mud dauber's nest inside. The finest collection of cobweb specimens one could hope to find had become intertwined among the tubes and the tuning capacitor. Not an auspicious beginning by any stretch of the imagination. After completely disassembling and checking the unit, I elected to bring it up slowly using a Variac.

Meanwhile, I also sought some advice. I had no idea what to do with the case, and I needed a schematic. A Mayday went out over the Boat Anchors Reflector¹ on the Internet.

The Variac was up to maximum and no smoke...a good sign. As I tuned the radio with the volume cranked wide open, I was blasted by silence. Not a sound. Not a single static crackle. Not even a hum. Very likely the 3V4 audio tube was bad—probably along with the rest of the tubes. But this is what Elmers are for. A quick call to Gary—during which he mentioned that he also happened to have a Zenith Trans-Oceanic—turned up a spare 3V4.

I got maybe a half dozen e-mail responses, all with the same advice: use black shoe dye and paste wax polish to restore the case. I tried to imagine what that would look like. To say the least, I was skeptical. Another message advised where I could get a set of schematics.

Let's see. What tubes does this little fella have? Assuming the tubes in the radio were the right ones, I counted one 1U4, two 1U5s, one 1R5, and a 3V4 (plus a spare set). The next day, I placed an order for the tubes and schematics. Replacing the 3V4 with the one I'd gotten from Gary, I was now greeted by static. Progress!

When the tubes and schematics arrived, a folded piece of paper greeted me as I opened the box. It contained instructions on how to modify a 1R5 to replace the 1L6 in the Zenith Trans-Oceanic. Huh? *What 1L6?* Digging through the box, I found the schematic. Sure enough. It showed the tube lineup for my set as one 3V4, one IU5 or 1S5, two IU4s, and a 1L6.

Now I had two problems. First, I needed a 1L6. Second, the count of IU4s and IU5s originally in the radio appeared to be wrong. With the spares I'd ordered, I had enough tubes—just no 1L6. Using a Dremel tool, I performed the recommended pin removal surgery on the 1R5 to make it compatible with the 1L6 wiring. After installing the tubes, it was time to try the radio again. A definite station! Only one to be heard on the Standard Broadcast band, but real music nonetheless. When was the last time real music had come through that speaker?

I continued to be curious about the 1R5. Was it *really* a suitable replacement for the 1L6? Responses from the Boat Anchors Reflector, such as "adequate on the broadcast band, not good on higher frequencies, and really requires realignment", were less than encouraging. Another question went out to the list. "Anybody know where can I find a 1L6?"

I got one ominous reply. "Good Luck. Those tubes are difficult to find." Not satisfied with having to settle for a 1R5 and discouraged at not having a lead on the correct tube, I put the radio aside for a while. Only "a while" turned into a couple of months.

A Second Attempt

It was now mid-summer. Rummaging through the shack one day, I stopped and looked at the Zenith—resting in its new home on the end of the workbench. Enough procrastination. It was time for another call to the Boat Anchors Reflector. Information came back telling where to find the 1L6. Sure enough, a phone call the next day and two were on their way. Another phone call to my favorite electronics supply house and the capacitors were en route.

Capacitors and tubes arrived several days later. Plugging the 1L6 in with a quiet comment to the radio of "C'mon fella, you can do it," I turned the radio on and started tuning the BC band. Music, a local talk show, more music. Punching the 2-4MC button, I kept tuning. A South American station, a religious station, more music. The radio was alive! After 35 years, it was *really* alive!

As you might expect given the age of the filter capacitors, there was a definite hum in the audio. It was then that I made a mistake that cost me several weeks plus a certain amount of frustration. Using clip leads, I bridged the replacement electrolytics across each section of the existing filter cap, then turned the set on. The hum was still there but almost gone. Wonderful! Several evenings of replacing capacitors and it was time for the acid test. Turning the radio on, I started to tune. The stations were much clearer, sensitivity seemed better, an alignment was definitely needed, but that distracting hum in the audio was still there! I was baffled.

I spent evenings over the next several weeks trying to track down the source of the hum. Lifting the leads one by one on the electrolytics did not help. Another call to Gary. "Yep, sounds like power supply hum. Something is wrong with the filter capacitors or your wiring." More evenings of searching. Checking with a 'scope, I could *see* the ripple. Obviously, I was missing something.

Then, it hit me! How could I have been so blind? I had only *bridged* the new electrolytics in parallel with the old filter capacitor sections, so my initial test with the clip leads was misleading. The old filter capacitor was leaky beyond belief! It needed to come out of there altogether. I made the necessary changes, reconnecting everything with clip leads to test.

By this time, the Zenith and I had developed a close personal relationship. We had nightly conversations. Once again, I whispered words of encouragement to the Zenith as I switched it on. There was that instantaneous pause as the 1-V tubes caught up with the current. The shack filled with deep, rich notes of music as the local AM station KQUE played *The Impossible Dream*. There was no trace of hum. I spent the remainder of the evening sitting in the shack, listening to the Zenith. The audio was simply beautiful!

The Final Stage

I completed the rest of the electrical

work with only minor obstacles. During alignment, the dial cord broke. Inspection showed that the dial cord had actually been replaced at one time—incorrectly. Instead of being run through the slots in the chassis, it was wrapped around the tuning knob outside the chassis. Immediately I understood why. I wouldn't have wanted to take this thing apart either. It was also during alignment that I discovered the slug in the 19-meter antenna coil was wedged in with a small jagged square of rubber. I just laughed, "Dick OM, I can see exactly where you've been in this radio."

I approached the cosmetic restoration process with some trepidation. After gluing and clamping the separated case and gluing the loose fabric back on, it was time to try the recommended dye-and-polish trick. Applying the dye, it began drying before I could finish the side I was working on. A sinking feeling grew in my stomach as I worked my way around the set. When I finished, I was horrified. The dye appeared uneven and streaked. I was convinced the radio was ruined, but there wasn't much I could do but let it dry.

Several hours later, I applied the wax shoe polish. I surveyed the results with cautious optimism. It certainly looked a lot better than with the dye alone. After attacking the case with a shoe brush and giving it a final rubbing with a rag, I carried the case outside into the sunlight. Wow!!! This looked good! In fact, this looked *great!* Encouraged and relieved, I turned to the final step.

I was concerned about the plastic front. Not only was it fragile and cracked, the dial window was clouded. My remedy of choice was Novus plastic polish, but I worried that the labels screened onto the inside of the plastic window might come off. Twenty minutes later, I held it up to the light. The window was perfectly clear. The labeling was intact. I had managed to clean and polish the whole front without breaking it or worsening the cracks.

Reassembling the radio, I sat there, admiring the final results. What had started as an impossible dream six months earlier was complete. "Little fella, you are one beautiful radio," I declared.

The Zenith Goes Home

It was time to give the Zenith back to Don, but I put it off for several days. I enjoyed having the set in my shack, and I really didn't want to let go of it. But, with some regret, I packed up the radio and a spare set of tubes with my schematics and notes.

I walked into Don's office and set the refurbished radio on the table where I'd first met it six months earlier. Don's eyes got big, and he smiled. Plugging it in, I flipped up the lid and turned it on. Once again, the deep, rich sound of a local AM



The restored Zenith B600 Trans-Oceanic.

station filled the air. Don didn't say a word as he tuned through the bands, stopping to listen to different stations. Finally, he spoke, "This is amazing. I'm not going to give it to my brother as a birthday present. I'm going to give it to him for Christmas. I want to be there so I can see the look on his face when he opens it."

Before I left, Don said he wanted a bill for the work. Laughing, I replied, "You can't afford the labor." But he insisted.

"Okay" I responded. "The 1L6s were a little pricey,² so I'll give you a bill for the tubes and capacitors." But I did ask for the right of first refusal if he or his brother ever decided to part with the set. "That radio and I have become good friends," I told him.

Later, I wandered back down to Don's office to say goodbye to the radio. I stood there looking at the Zenith, still sitting on the table, still singing its song. Reaching out for one last touch, I bid it farewell, thinking, "Good-bye, my friend. Maybe one day our paths will cross again."

Several days later, I left him an itemized bill for the tubes and capacitors. It came to \$105.31.

A Zenith Comes Home

A couple of weeks had passed when Don asked me to come down to his office. When I walked in, it was *déjà vu* as a vision of the dirty, ragged Zenith crossed my mind. With a mischievous glint in his eye, Don said, "I have a check for \$105 in my pocket, but I have something else that you may want even more. You have to make a choice."

I felt a little awkward and, at first, didn't quite know what to say. "Don, you don't have to do anything special," I said finally. "I simply enjoyed working on the radio, and I'm glad it turned out as well as it did." With that, Don reached down behind his desk, picked up a very familiar black "briefcase," and placed it on the desk.

I was dumbfounded. "He can't do this,"

I thought. "That's his brother's radio." But then I took a closer look and realized it wasn't the same set.

In that same instant, Don flipped up the front to reveal a beautiful Zenith Trans-Oceanic B600. As I sat there speechless, he flipped down the map case inside the lid to reveal the original station maps. Then he showed me the original owner's manual, stowed in the back compartment. Unfolding the original schematic, he held it up and said with a grin, "You can't do anything without this." There was no doubt in my mind that Don had carefully planned this moment, and was obviously enjoying every bit of it.

As he carried the Zenith over to the table to plug it in, I was finally able to get my voice back enough to ask, "Where and how did you get that?"

He explained. He had remembered when I'd mentioned that Gary also had a Zenith Trans-Oceanic. Gary had acquired his Zenith a couple of years earlier from Tucker Electronics when they closed down their museum. He had not done any work on it, but it was museum quality. When Don told him why he wanted to buy it, Gary didn't hesitate to say yes. "It couldn't go to a better home," he told Don.

After Don finished his story, I told him I could not just accept this radio and offered to pay him the difference. Don's response was firm, "No. I know how you liked that radio. I can never repay you for what you did for me. This is the best way I know how."

At this point it dawned on me that Don never intended there to be a choice. I looked at the Zenith Trans-Oceanic sitting on the table. A good friend had come home.

Epilog—*Déjà Vu* All Over Again

This story has an unusual twist. While museum quality, the B600 had sat for a number of years, so minor restorative work was in order, including refurbishing the case and brass as well as an alignment. I completed the work in a couple of evenings and a weekend. The result was a beautiful, mint Zenith Trans-Oceanic, which was playing in my shack as I wrote this article. Just as I finished—literally on the last line—the song *The Impossible Dream* came on the radio again.

The next day at work, I showed Don a copy of this story. "This is amazing," he said. There's more here than you know. It has to do with *The Impossible Dream*."

I told Don about how I'd had the Zenith on while I was working on the story, and that just as I'd finished it, *The Impossible Dream* began to play again.

He just laughed. "Let me tell you something else," he said. "When my wife and I got married, we had a big wedding, 700 people. We each picked a song to be played for the wedding. One of my friends suggested *The Impossible Dream*. That was the song that was played at my wedding."

Refurbishing "Boat-Anchors"

That old rig you've been hunting is finally yours, but it needs a facelift. Now what?

I think my fascination with old rigs stems from a subconscious desire to relive my youth. I find myself drawn to equipment I remember from magazines of my youth, but couldn't possibly afford then: Collins, Hallicrafters, National, etc. If I find one of these rigs at a hamfest, chances are I'll buy it.

I don't really believe any of this older gear is superior in performance to today's equipment, but it does have style. I regard my old treasures more as props than viable operating equipment. As props though, the stuff must *look* good, and, preferably, it should work. A table loaded with clean, restored vintage gear—your old novice station perhaps—can be an impressive sight (see Figure 1).

Since most of the equipment I like is at least 40 years old, it is seldom in mint condition. Scratches, chips, rust and grime have marked the passage of time on the equipment. Too often, modifications detract from its overall appearance. Figure 2 shows a hamfest prize that you probably wouldn't want in your garage, but it's not beyond redemption.

Chances are good that a clean piece of older equipment has already been restored. Most of the equipment I find requires a good cleaning and a few repairs to make it look and work right.

Panel and Cabinet Cleaning Techniques

Before buying an older rig, I generally look it over carefully, paying particular attention to the condition of the front panel. Often, you can restore a particularly unattractive piece of equipment by simply cleaning it.

In many cases, tobacco film and other grime mask the true condition of a piece of gear. Unfortunately, it's hard to be certain of a rig's condition until it's clean. Nonetheless, paint worn through to metal, obliterated decals, rusted panels, etc are sure signs of trouble. Certain finishes, like the

hammertone finish used on the National NC-98 and others (see Figure 3), can be especially difficult to repair. Fortunately, I was able to restore my NC-98 by giving it a thorough cleaning.

I generally find it necessary to completely disassemble a piece of equipment to properly clean it. Start by removing all knobs, bezels, meters and the entire front panel. Once the panel is free of components, I wash it with progressively more aggressive cleaning agents. First is a mixture of dishwashing detergent and water.¹

If my spouse is not around (she dislikes this practice), I stick the panel in our dishwasher and run it through a short cycle with the knobs in the silverware bin. This treatment often restores a panel to near-new condition. Figure 4 shows a vintage Hammarlund HQ-120 panel that I cleaned using this technique.

Frequently, I get a panel that is spattered with paint. For some reason, latex paint is particularly difficult to remove, especially from a wrinkle-textured finish. I often pick the spots off by hand, using a pin

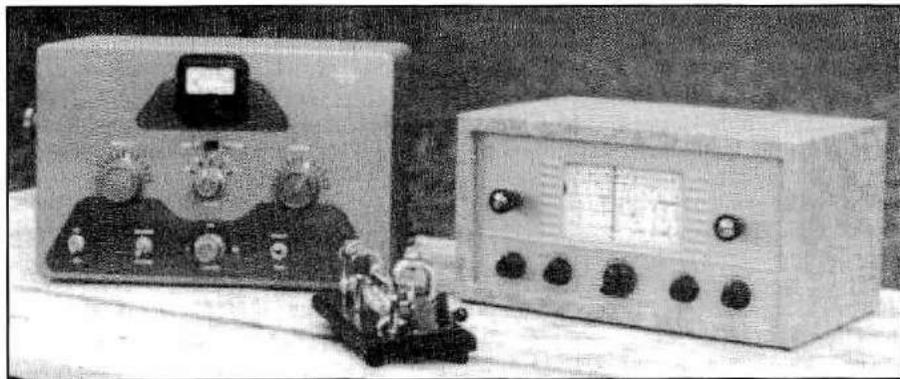


Figure 1—The Heath DX-20 transmitter and AR-3 receiver. This equipment dates from the late 1950s.

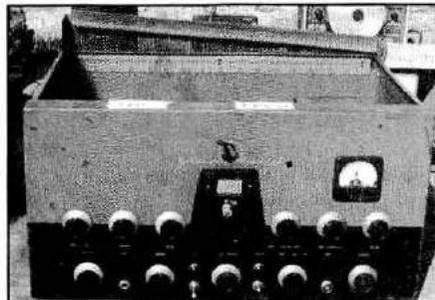


Figure 2—A Johnson Viking II transmitter as typically found at hamfests. While it looks rough on the surface, it is a good candidate for refurbishing.



Figure 3—The National NC-98. Equipment with hammer-tone finishes such as this can be difficult to restore. Fortunately, this one's finish was in relatively good shape, requiring mostly clean-up to get it into the shape shown here.

or needle under a magnifying lamp. With patience and care, it's possible to clean a panel this way without marring the underlying finish to any great extent.

I've had fairly good results by soaking smooth panels for a few hours in a luke-warm solution of dishwashing detergent, then wiping off the paint specks with a wet dishrag. On particularly tough spots, I've judiciously used automotive rubbing compound. Be careful not to remove any decals in the process.

Tobacco stains are troublesome to remove. I've been able to get most of them by using Tilex Mildew Remover, which is a 1.65% solution of Sodium Hypochlorite.² Be careful with this stuff though. I used it on a Hallicrafters S-20R and noticed it attacking the white panel lettering. Fortunately, I was able to wash the Tilex off before it ruined any of the decals.

Tilex's Soap Scum Remover works well on wrinkle-textured finishes. It does a good job of restoring lackluster finishes when brushed into the wrinkles. Beware: It contains diethylene glycol butyl ether and surfactants, which can irritate eyes or skin.

If the equipment is still not clean, use more aggressive stuff. Denatured (rubbing) alcohol is a good next choice. Use lacquer thinner as a last resort. Both denatured alcohol and lacquer thinner can ruin some paints and plastics. Test these cleaners on an inconspicuous spot before using them on visible parts. Older finishes are somewhat immune to these solvents, but you are not. Use them only in well-ventilated areas—preferably outside—and with proper protective garb.

I acquired a Collins R-390 with a messy panel repaint job some time ago. After using everything else (including rubbing compound), I tried lacquer thinner. It completely removed the newer finish and left the original paint, which was in good shape. The original paint and lettering seemed to be completely immune to lacquer thinner. This receiver was a depot-reconditioned unit, and they apparently repainted panels as part of refurbishing (whether it was necessary or not). Figure 5 shows my results.

Give dials particular care. Don't touch them at all, unless absolutely necessary. Just blow away any dust that has accumulated. Dial markings on older equipment seem to be particularly fragile. They often wash away completely during cleaning, and it's nearly impossible for the average person to restore them.

I've always been fussy about knobs. Apparently, a lot of the previous owners ate lots of fried chicken while operating. I use the dishwasher for cleaning knobs whenever possible because it seems to do the best job. Dishwasher heat may damage plastic knobs; soak them in a warm solution of detergent for an hour or so. Then use an old toothbrush to scrub them. Knobs with many grooves or raised markings can require several iterations of this process to get all the crud out of the grooves.

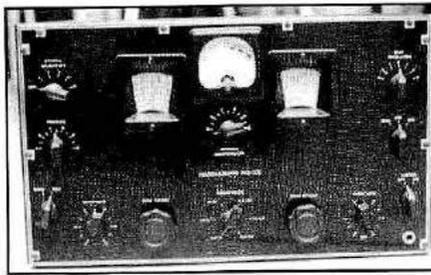


Figure 4—The Hammarlund HQ-120. This receiver was made before World War II. Its panel was cleaned in a dishwasher.

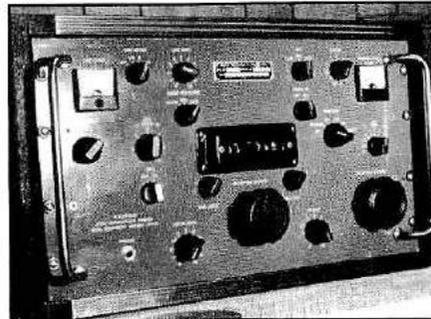


Figure 5—The Collins R-390. Its panel was restored using a solvent to remove a repaint job, which revealed this relatively good panel.

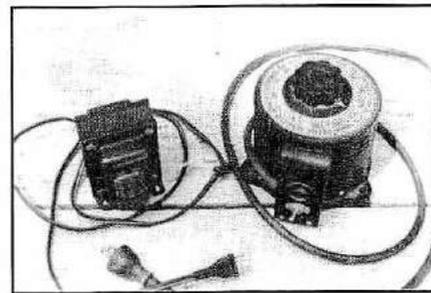


Figure 6—A variable-voltage supply and isolation transformer used in older equipment checkout.

After completely cleaning a smooth panel and cabinet, I usually apply a coat of auto wax. If the panel is scuffed, use a cleansing wax. Such products contain a fine abrasive to rub out minor surface imperfections. After the wax dries, buff it with a polishing cloth for a beautiful finish. Even panels and cabinets with minor scratches look nearly new after a thorough cleaning and polishing.

Occasionally, cleaning does not help much. For such cases, refinishing may be the only fix. Don't make the decision lightly—only after all else has failed. It's a lot of work, and you're likely to experience a few failures before getting it right. See the sidebar "Repainting a Front Panel."

Paint Repairs

You can repair most panel or cabinet mars and scratches, provided you use the correct color and *sheen* of paint. Unless you're skilled at color matching and paint mixing, visit a local specialty paint shop

and have them mix the paint for you.

Most towns have a paint store equipped with a computer color-matching system that can duplicate the color and sheen of most finishes. Such systems generally require a paint sample, which means you must lug the cabinet to the store, but the cost is usually reasonable and the results are well worth the trouble.

I've used an artist's brush to touch up minor blemishes with good success. It's best to orient the repair area horizontally. On a horizontal surface, paint can flow to fill the scratched or chipped area without bleeding into the surrounding area. For best results, load the brush lightly. Use a dip-and-touch technique.

Generally, a few small touch-ups won't show. You can even the appearance of larger touch-ups by spraying the entire surface with a satin or semigloss clear coat, after your touch-ups have dried thoroughly. The clear coat helps to merge the new and original finishes.

Compared to panels, cabinets are relatively easy to refinish. Access to spraying equipment is almost essential for doing a satisfactory repaint job; but spray cans can yield relatively good results, provided the right colors are available. Some specialty paint companies will package custom paint in spray cans, but the cost is generally high. Also, I've spotted ads in *QST* and other magazines offering Collins colors in spray cans.³

Whenever possible, I use acrylic enamel because it dries fast and has good surface-finish qualities, but I've had good results with many indoor/outdoor enamels.

For best results, I generally spray using low to medium pressures and fog the cabinet from a distance of three feet or so. I apply several light coats with around 30 minutes between coats for drying. The result is a slightly grainy finish.

Although restoration of wrinkle-textured finishes is a bit tricky, it can yield surprisingly good results. Because my local supplier stocks wrinkle paint in black only, I use two steps to recreate a wrinkle-textured finish. The wrinkle paint is No. 817 Black Wrinkle Enamel, and I usually get it at a local auto-parts store.⁴

A good textured wrinkle finish dries best at about 150°F, so I usually dry it in the oven when my spouse is out of town. [Warning: This is hazardous! See Note 4.—*Ed.*] Even when the cabinet is black, I cover the wrinkle paint with a color coat because I've seldom gotten the wrinkle coat to dry with a uniform sheen.

After the wrinkle enamel has dried thoroughly, I spray the final color in several thin, light coats using the same fogging technique described earlier. It is especially important that the color coats be thin, so that they do not fill the underlying wrinkle texturing.

Chassis Cleaning

I know a couple of hams who also share my affliction for restoring older equipment, and one of them always takes radio chassis

Repainting a Front Panel

I think repainting a panel is the biggest challenge in equipment restoration. Fortunately, I've only needed to do a few. The Heath DX-20 in Figures 1 and A, is one that I've done recently. It came out better than I expected, considering what I started with.

I'd been after a DX-20 for some time and was not choosy. It was my Novice transmitter nearly 40 years ago, so I was motivated. Nonetheless, expense was a concern. I talked to a fellow recently who restored a similar panel—he spent nearly \$300 for silk-screens. That's the best approach if you have the bucks and/or access to the equipment. For my purposes, a more economical approach is better.

To recreate my panel's background, I traced and cut stencils of the darker shaded areas. One of this rig's former owners added some custom holes to the panel, so I glued a backing behind each hole, filled the holes with automotive body putty and sanded the entire panel smooth.

I have never been a fan of Heath's colors, so I decided to

do this panel in colors that I like (light and dark gray). I used colors readily available in spray cans for this project.

First, I painted the dark panel areas and let them dry thoroughly. Then I glued the stencils down over them with rubber cement. Next, I sprayed the light panel color and allowed the entire thing to dry for several days.

After the panel was dry, I carefully removed the stencils and rubbed the paint out with fine steel wool. To recreate the original panel markings as best I could, I used dry-transfer decals.

After applying the letters, I sprayed the entire panel with several coats of satin clear to make the decals permanent. Figure B shows the results I had before reassembly. The result is not 100% identical to the original panel, but most hams will identify this as a DX-20, and it's good looking.

I must confess that my first attempt at repainting this panel ended in total disaster when the light color paint ran under the stencils and made a total mess!—K8KWD

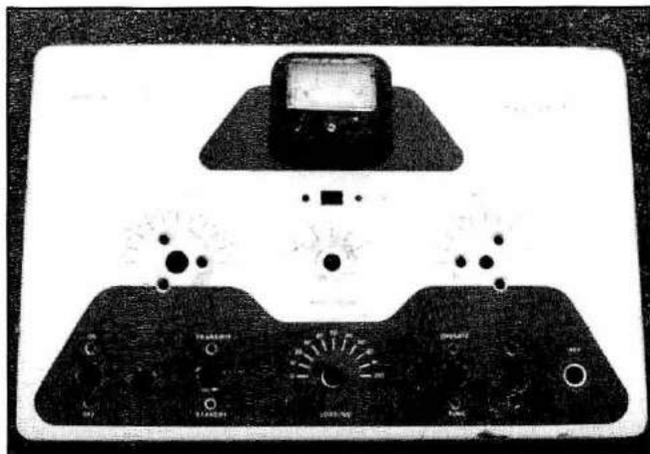


Figure A—A Heath DX-20 panel that required repair.

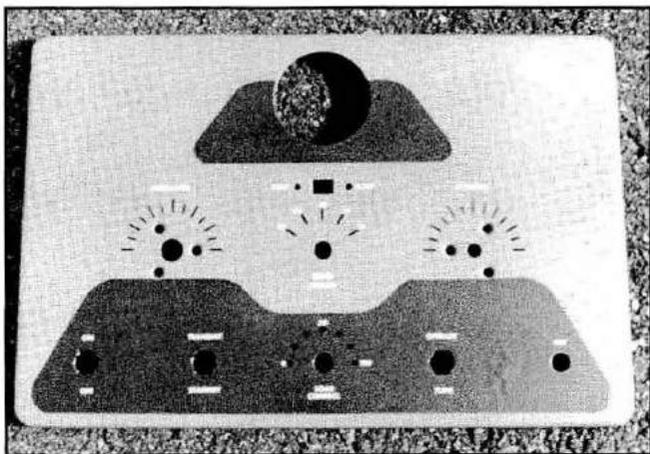


Figure B—The DX-20 panel after refinishing and applying new decals.

to a self-service car wash for cleaning. (He's occasionally lost a transformer, however.) I suggest plugging or taping alignment holes and other vulnerable openings prior to any such cleaning. Generally, water and soap do not significantly damage most electrical components—provided they are promptly rinsed and dried. Be sure to allow sufficient time for transformers, etc. to dry thoroughly before applying power. I strongly recommend using a variable-voltage supply (Figure 6) and optional isolation transformer to slow-start equipment after wet-cleaning the chassis. [This is risky business. ARRL Lab Technician Mike Gruber, WA1SVF, once washed an Atwater Kent TRF chassis in water with some ammonia. The technique permanently damaged one of the transformers.—Ed.]

I generally clean a chassis using a soft-bristled paint brush to loosen up any dirt, then air-blast it clean.⁵ If the chassis is particularly grimy, I soak it with WD-40 and blast the residue away with compressed air. Several applications may be necessary to get satisfactory results. This technique is somewhat effective with minor rust spots, too.

A badly rusted chassis must be stripped of parts and sand blasted clean. That's a lot

of work, however, and the result may be unusable!

You can often clean hard-to-reach spots with a cotton swab soaked in alcohol or WD-40. Don't use sharp tools to clean crevices, they'll produce scratches, which can be more unsightly than a clean—but somewhat tarnished—chassis.

Electrical Considerations

After cleaning and reassembling old gear, electronic repair is in order. As I said earlier, performance is not as important to me as appearance, but I do like my equipment to work. Although older equipment is known as a tinkerer's delight, most electrical defects are easily repairable.

Before applying any power, make a few ohmmeter checks:

- The resistance across the line cord should be very high.
- The resistance from the line cord to the chassis should be very high.
- The resistance from the B+ output to chassis should be 20 k Ω , or more.

If the resistance checks are okay, apply 40 V (ac) to the power plug and let the set run for a couple of hours. Switch off the power and check for unusually warm com-

ponents (eg, the power transformer). If there are none, increase the voltage to around 70 V.

At this voltage level, filaments should light partially if everything is okay. If so, run the radio at this voltage for several hours. Again, if you spot nothing unusual, kick the voltage up to around 100 V and attempt to operate the rig.

Some technicians replace all of the paper-dielectric capacitors in older equipment. Generally, I don't. I make a few voltage measurements at grids and screens, and replace each capacitor as needed.⁶

Older receivers often have a leaky coupling capacitor at the audio-amplifier grid. This problem alters the tube (grid-cathode) bias voltage, usually distorts the audio and causes the tube to run very hot (they normally run very hot). The plate sometimes glows red.

Finally, check the tubes, replacing those that are really bad, and touch up the rig's alignment. A complete alignment is usually not necessary, unless a previous owner has totally misaligned the set.^{7,8,9}

After all this, you'll have a piece of equipment you're proud to own. Shining up old gear takes a little effort, but it's not a

difficult process. Why not get out the elbow grease and add some *style* to your shack?

Notes

¹Safety first! Some of the materials mentioned in this article maybe hazardous. Always read the manufacturer's safety guidelines before using chemicals, solvents and cleaning agents. Follow those guidelines and check with the manufacturers before combining any such chemicals in use.

Also, high voltages are a hazard! Even when powered with only 40 V, vacuum-tube circuits carry lethal voltages. For safety guidelines, look in the Troubleshooting chapter of *The ARRL Handbook*. (See Note 7.)

²Tilex is available at many supermarkets and ceramic-tile stores.

³*Electric Radio* (monthly) magazine serves lovers and restorers of old gear. For subscription information, contact Electronic Radio, 14643, County Rd G, Cortez, CO 81321-9575; tel: 970-564-9185; e-mail er@frontier.net

⁴Made by PLASTI-KOTE Company, PO Box 708, Medina, OH 44258; tel 216-725-4511,

fax 216-723-3674; WWW <http://www.plastikote.com>. Heat helps PLASTI-KOTE's wrinkle paint dry and wrinkle, but the paint can withstand no more than 150°F and may give off an odor while drying. (Propane is used as a propellant.) Because of poor temperature control in ovens and the odor, the manufacturer recommends that users aid drying *only* with a hand-held hair dryer in a well-ventilated area. Wrinkle paint product-information sheets are available from the manufacturer.

⁵Compressed air is available in cans at photography and hobby shops. You'll sometimes see special vacuum-cleaner attachments at flea markets. Wear eye protection whenever you work with compressed gases.

⁶Coupling capacitors pass ac and block dc. When they fail shorted, dc voltages aren't blocked—ie, there will be no dc voltage across the capacitor. When they fail open, the desired signal stops at the capacitor. This is easily tested by bridging a good capacitor across the one in the circuit. This restores the signal to the next stage if the circuit capacitor is bad—*Ed*.

⁷The Troubleshooting Chapter of recent *ARRL Handbooks* gives a lot of guidance for repairing both old and new gear, including advice about alignment. *The ARRL Handbook* (Newington: ARRL, 1996; Order no. 1735). ARRL Publications are available from your local ARRL dealer or directly from ARRL. Mail orders to Pub Sales Dept, ARRL, 225 Main St, Newington, CT 06111-1494. You can call us toll-free at tel 888-277-5289; fax your order to 860-596-0303; or send e-mail to pubsales@arrl.org. Check out the full ARRL publications line on the World Wide Web at <http://www.arrl.org/catalog>.

⁸Howard W. Sams publishes PHOTOFACTS that contain valuable service information for most old radios and electronic gear. You can find Sams on the Web at http://www.badg.com/sams_model_new.html or call them at 800-428-7267 from 8 AM to 5 PM (Eastern Standard Time, year around).

⁹Larry Keith, KQBY, "Bring 'Em Back Alive!" *QST*, Aug 1995, pp 49-52; *Feedback*, Oct 1995, pp 78-79. Larry's article is similar to this one, but places more emphasis on electronic repair.

How to Buy Military Surplus

Have you checked out the goodies at your nearest military base? Why not? You paid for them!

There probably isn't a ham alive who hasn't noticed the advertisements in the classified sections of some science and electronics magazines. Those that begin with an attention-getter such as: "Fifty-Dollar Jeeps!" or "Airplanes—\$300!" The ads then go on to describe how anyone can get bargains like these by attending military surplus sales throughout the country.

As a 12-year-old in 1961, I remember fantasizing about buying an Army helicopter to get to and from high school. My plan was to land in one of the many fields surrounding the school, and I would pity my poor friends who would be stuck driving their old '56 Chevys and Buicks.

Perhaps you've attended a large hamfest and seen table after table of oscilloscopes or signal generators and wondered where they all came from. Maybe you hoped to get just one of those items without depleting your bank account, or envied the merchant with thousands of dollars worth of equipment on his table. Much of that equipment came from the US military and you, my fellow taxpayer, paid for it.

I never bought the aforementioned helicopter, but I've owned and sold enough military equipment to start my own space program. To be candid, it hasn't made me wealthy, but I have acquired electronic equipment that I could never have purchased new without mortgaging everything I own. We've all heard people say "If it sounds too good to be true, it probably is." Armed with sufficient knowledge, however, military sales can prove that adage wrong much of the time!

My initial attempt to purchase surplus can best be described as a learning experience. I was overwhelmed by the procedures and left the sale with no equipment—but plenty of knowledge. My second attempt, though, was extremely successful. For \$65, I carried away dozens of pieces of electronic equipment that had originally cost the taxpayers more than \$30,000! Among

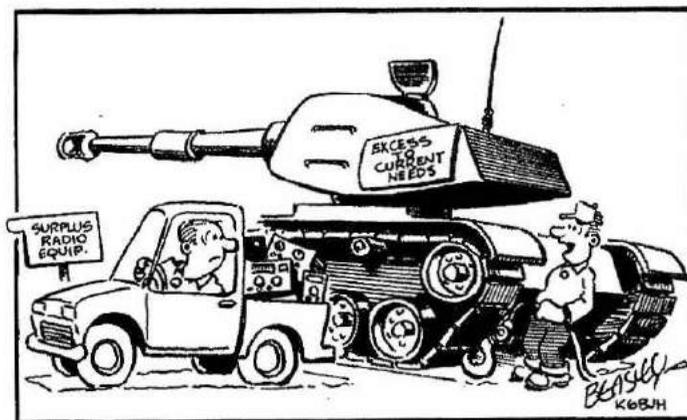
the many items were Hewlett-Packard VTVMs (vacuum-tube voltmeters), Tektronix oscilloscopes, several Variacs, frequency counters, unused components—and some items whose functions are, to this day, still unknown to me.

Get in on the Action

If you've read this far you're probably wondering how you can get in on the surplus bonanza. Don't worry. I'm not going to tell you to send \$5 to a post office box in order to receive directions, like the ads in the classified sections do. Because you read *QST*, you'll get the whole scoop for the price of this magazine, whose cover price is *only* \$4.95!

This is the best time since the end of World War II to buy military surplus. US bases all over the world are closing and consolidating. As a result, much of the equipment that was used at those bases is being sold. The first thing you'll need to do is compile a list of military bases that are within easy driving range. A look through the blue pages of the phone book is a good way to start your list. Next you'll need to contact the switchboard at the base of your choice and ask for the *DRMO*.

DRMO stands for Defense Reutilization and Marketing Office. Some small installations may still go by the old name, *DPDO* or Defense Property Disposal Office. Also, there are installations that are too small to have a DRMO and instead send their surplus to larger bases nearby to be processed. Don't be shy about asking ques-



HEY MAC, CAN YOU GIVE ME A TOW? I SUBMITTED THE WINNING BID, AND I GOTTA GET THIS THING OUTTA HERE TODAY

tions. Remain polite, but persistent, as you navigate the base bureaucracy. Remember, it's your right as a citizen and taxpayer to have access to this information, and to bid on any surplus.

Once you reach the DRMO, ask when the next surplus sale or auction will be held. Tell the person on the phone that you'd like to receive written notification of the sale and, if possible, a list of items being sold. Several weeks before the sale you'll receive a notice stating the date and time of the sale, the location, the type of sale, and the dates and times for inspection. You'll also receive at least a general description of the items being offered and, possibly, a detailed list.

It's imperative that you thoroughly inspect the items before bidding on them, and understand how long you have to pay for and remove property that has been awarded to you. Failure to remove your purchases by a specified date can result in some hefty storage fees, or even cause a forfeiture of the property and subsequent banishment from any future sales! Generally, there will be a three- to seven-day period during which you will be able to inspect the items prior to bidding.

Going to the Base

Most military bases have armed guards stopping all vehicles. So, it pays to look for signs giving instructions for visitors. Many military installations have small buildings outside the main gate where you can park your car and receive a visitor's pass. To get a pass, you'll need to state your purpose for entering the base and produce the following items: a valid driver's license, car registration and insurance card. You must have all three, or admittance will be denied.

If there are no instructions posted for visitors, simply drive up to the gate. Unless you have a military sticker on your bumper or window, the guard will signal you to stop. Most military guards are polite and respectful, but they take their job *very* seriously. They are not known for their sense of humor or willingness to ragchew. (This is not the time to joke about having a bomb in your trunk!) Just ask them how to get a visitor's pass, and if none is required, ask for directions to the DRMO.

The typical DRMO consists of a small office building located next to a well-guarded area of several large warehouses and outdoor storage facilities. The entrance to the office is usually well marked and you will be required to sign a log before passing to the inspection areas. Be certain to carry your identification (preferably a driver's license) with you.

If you don't already have one, you'll be given an item list and allowed to pass into the property storage facility. Most of the property offered for sale will be located nearby, but some property will be located elsewhere. For instance, boats may be in a dock—dry or otherwise. Cars and trucks may be located in a guarded parking lot several miles from the DRMO. The item list will give you details about the locations, although it may be necessary to ask for directions from someone at the office.

Sizing up the Territory

When entering a DRMO warehouse for the first time, it's difficult not to be mesmerized by the sheer volume of equipment. There may be acres of high-tech goodies, both indoors and out. Much, if not most, of what you see, however, will not be included in the current sale. Only the items listed on your invitation to bid will be offered.

Property to be sold is usually placed on a wooden pallet and numbered in black ink on a white card. All of the other "stuff" that you see is being processed. If the military can't use it at some other base, chances are it will be available at a future sale or auction. Make note of anything you see that is not currently being sold, but *don't touch any item that is not specifically numbered and listed for sale*. Doing so will bring a great deal of unwanted attention, and may result in your being searched prior to leaving the area! (You're on a military base, remember?)

As I mentioned, inspecting the sale items is essential. The description in the item list will typically read like this:

ITEM 22—COMMUNICATIONS EQUIPMENT. Lot consists of receivers, transmitters, voltmeters, pan adapters, assorted components. 32 items, gross weight 305 lb.

If item 22 interests you, then go to the pallet marked No. 22 and look carefully at the equipment. You'll be permitted to examine any of the equipment, but be careful to return the items as close to their original positions as possible. There are no guarantees that the equipment works. Much of it does, but some is pure junk, so you'll have to know exactly what you're looking at. If you have questions of a general nature, there are workers, usually civilian employees, who can help you. Don't expect them to know much about a specific item. That's your responsibility.

You can get some idea of the condition of the item by looking at its identification tag. The words **EXCESS TO CURRENT NEEDS** are the ones to look for. It means simply that the government doesn't need it anymore and it likely functions as intended. Other items may have numeric codes for indicating condition, or may just say **FAULTY**. Look for inspection stickers, too. Anything the military owns (including people!) must be inspected and calibrated periodically. The most desirable items will have a recent inspection and calibration date. Some tags will give repair dates or indicate what, if anything, is wrong.

When you buy a pallet of goods, *be-ware*—you might get a mixed bag. There might be three or four 0 to 30-MHz all-mode receivers that you've just *got* to have. But on the same pallet might be 200 pounds of rusted boat-anchor electronics that you'll end up hauling to the dump. That's just part of the game and gamble and, from the DRMO's standpoint, it's a smart move. The bottom line is, *caveat emptor*—let the buyer beware.

While most pallets weigh less than 200 pounds, some can weigh *tons*. Before you decide to bid, make sure you can transport your treasure within the allowable time! You did remember to check about that beforehand, didn't you?

Bidding Time

Let's say you've just spent 90 minutes inspecting 127 pallets and you've found 12 worth bidding on. The next step is to determine the *type* of sale. Usually there are just two: *Spot bids* and *auctions*. Occasionally there is a "store" sale, with merchandise offered at a fixed price and on a take-it-or-leave-it basis. This is not very common, and is usually restricted to items such as clothing or furniture. It might be worth checking out, though, especially if you live close to a base.

During a spot bid, anyone interested in bidding on an item will be given a bidding ticket. On this ticket you must write the item number, the amount you're willing to

pay and your bidder's number. During some spot bids, bids will be accepted during the inspection days and the bids will be opened on the sale date by DRMO personnel without any bidders being present. The high bidders are then notified by phone or mail. My favorite type of spot bid is when all the bidders are present. Not only can you see how much interest there is in a particular item, you can take advantage of the circumstances, so to speak. I've attended these bids during snowstorms, when the turnout is low, and come away with my best bargains.

During "live" spot bidding, I'll usually prepare two bidding tickets—one with the maximum price I'm willing to pay and the other with my "bargain" price. When the bidding tickets for a particular item are collected by the DRMO employees, I watch closely to see how many bids are going in. If the numbers are few, I'll submit my lower of the bids. It's all a gamble, and can be an exciting game of wits.

After the bids are collected and reviewed, the winning bidder's number and the amount paid is announced. It is wise to record winning bids next to the item list for future reference. It's an easy way to educate yourself as to what the market will bear for certain goods.

On rare occasions, the DRMO rejects a rock-bottom offering, calling it a "token bid." In other words, it was too low for the value of the goods in question. I've only seen a couple of bids rejected in several years, so don't be too concerned about this. A token bid might be five cents for an electron microscope, but I've seen working electron microscopes sold for as little as \$12!

The other type of sale is the auction. Nearly everyone is familiar with this format, and it's my personal favorite. One word of caution to those of you who frequent the many ham auctions: Military surplus auctions are deadly serious! If you bid on something you don't get to change your mind later. Don't wave at a friend who just entered the building unless you want to cart home an old dummy torpedo in the back of your car!

If you're the winner, congratulations! Just pay for your goodies in cash or certified check prior to removing them. No items can be removed before the completion of the spot bid or auction. DRMO employees will load the merchandise into your vehicle if you have a truck. Otherwise, pallets will be brought to your car by forklift and you must load the individual items.

Start Saving

Military surplus auctions are fantastic sources for great equipment at the lowest possible prices. I've seen pallets of 40 oscilloscopes sell for \$35, and boats for under \$100. Just call the nearest military base, save up a few dollars and maybe I'll see you at the next auction. And by the way, if you happen to see a helicopter with an **EXCESS TO CURRENT NEEDS** sticker on it, give me a call.

Bring 'Em Back Alive!

Restoring vintage ham gear is challenging and fun, but be sure you take proper safety precautions.

Bringing an old "boat anchor" back to life can cause several shocking experiences. First, you can suffer electrical shock if you aren't familiar with tube-based, high-voltage electronic gear. Then there's the mental shock that hits when you flip the power switch and are rewarded with the sizzle of frying components and a cloud of black smoke! Finally, there's the sticker shock that comes when you discover the cost of the components that must be replaced because you were too eager to see those firebottles glow!

You can avoid the electrical shock by learning more about tube-based equipment and by following the safe workshop practices described in *The ARRL Handbook*. And if you use the techniques described in this article, you can avoid the mental shock (and the black smoke!), and reduce the sticker shock because you only have to purchase items that failed *before* you bought the rig. If you've been bitten by the boat anchor bug, but can't tell a vacuum tube from an inner tube, here's your guide through the process of safely restoring a

piece of Amateur Radio history.

The First Step: Pick a Good Candidate

I always think I've won half the restoration battle when I pick a good candidate. I keep walking when I see badly scratched or rusted front panels and cabinets, corrosion and rust on the chassis, and missing custom parts. Tubes can be found. Even the least-common-value resistor, capacitor or inductor can be replaced by substitution. But I don't waste my time when I see something that's missing its dial-drive mechanisms, band-switches, knobs, dials, transformers and connectors.

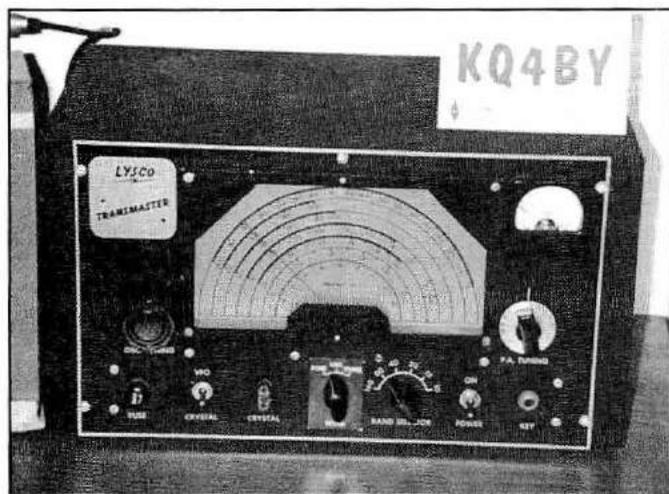
Extra switches, controls or wires poking out of the ventilation holes in the cabinet tend to dampen my enthusiasm. A neat, minor modification, however, is no reason to reject a potential candidate, especially when the seller shows me the modifications documented in the equipment manual. And although a missing manual won't prevent me from buying a desirable item, the presence of the manual for that particular unit increases the chances that I'll buy it.

The Second Step: Discovering What I Bought

When I get home from a hamfest with a new boat anchor, or when UPS drops a purchase at my door, I want to plug it in and listen to it play. But after popping a few circuit breakers and setting off the smoke detector a couple of times, I've learned to take a more dignified approach to reviving an old rig. Now I treat each new acquisition as if it had just come out of long-term storage. I don't "smoke test" my new toy until I've tested and/or replaced the most obvious smoke generators! My restoration approach can be summarized as make it safe, make it work, and make it pretty.

Read The Manual First!

I put the rig on the bench, get a cup of coffee and grab my notebook. Then I settle down to read the manual. In addition to familiarizing myself with the characteristics of the equipment and the operating controls, I look for specific information I'll need to proceed with the restoration. I also look for the alignment procedure and the



A good transmitter candidate for restoration was this Lysco Transmaster 160 to 10-meter CW transmitter. It was complete, except for a dial cord, and in good cosmetic condition. This unit was produced in the 1950s and uses a classic 6AG7 oscillator tube and a 6AG7 buffer/multiplier feeding an 807 final. Somewhere out there is an AM modulator that matches this rig.



This Hammarlund HQ-110A is a ham bands-only receiver manufactured in the 1960s. When I purchased it, this receiver was working and an outstanding candidate for restoration. (I would have been happier if it had included the Telechron Automatic Clock/Timer option.) Although there's noticeable wear around the knobs, I decided not to refinish this panel. This unit will be used with a Globe 6 and 2-meter AM/CW transmitter that's in the restoration queue.

specifications of the test equipment needed to repair and align the unit. When I get to the schematic, I identify and record the safety improvements needed to update the power supply to current standards. I've found that reading the manual spares me hours of head scratching because I missed something obvious, like a jumper that has to be present in an accessory plug to make the thing work.

External Inspection and Cleaning

It's time to inspect the rig. Before I start any disassembly, I scrutinize the exterior of the unit. Does the cabinet need cleaning or refinishing? Are the knobs original? While I'm looking, I do some casual cleaning. A soft one- or two-inch paintbrush usually removes dust from the knobs, meter faces and the little ledges around the dials. A damp cloth and gentle rubbing is often all it takes to get the surface grime off the panel and cabinet. If those methods won't improve the appearance, I record the needed cleaning and refinishing steps in my notebook.

After checking the appearance, I test each control knob and switch, and tighten loose knobs and control-retaining nuts. I check each rotary switch by turning it to each position, to make sure the pointer points to the correct place. A bandswitch that reads "40 meters" when the switch is actually in the 80-meter position can cause troubles later! Stripped or missing setscrews and mutilated control shafts get recorded on the "to-do" list for later replacement.

The safety inspection is next. First I check the condition of the line cord; if it's a two-wire cord, I note that it needs to be replaced. Three-wire cords get checked for cracks, bad connections and wiring errors at the plug. If the unit has a molded plug, I wiggle each of the pins to see if the plug is mechanically sound. If I'm going to retain the power cord, I spray some WD-40 on a paper towel and wipe down the cord to remove the dirt and grime.

I pull the fuse and verify the value against the manual. When I find a missing or oversized fuse, I make a note to double check the power supply during the internal inspection.

Next I look for exposed high-voltage points, especially on the rear of the unit. Some rigs have terminal strips on the rear panel to hook up auxiliary devices. I usually put a strip of electrical tape over such terminal strips to avoid a jolt if I happen to brush against it during my repair work.

Internal Inspection and Cleaning

Now to remove the cabinet and see what's inside. Missing cabinet or panel screws get added to the list. I wipe down the inside of the cabinet with a damp cloth and set it aside. I get my brush and the vacuum cleaner and gently remove accumulated dust and grime. If I can't vacuum the dust, I blow it out with the hose hooked to the output of the vacuum cleaner.

I remove each tube, test it, record the

test results, and put it back in the same socket. Before I reinsert the tube, I spray the pins and the socket with contact cleaner. When I reinstall the tube, I work it up and down a few times to remove the grime and oxidation from the tube pins and the tube socket contacts. While the tube is warming up in the tube tester, I do my cleaning around the socket area. Before I put the tube back in the socket, I wipe it down with a soft cloth. I've found that more vigorous cleaning methods tend to remove the tube markings. If the tube has a plate cap, I spray a little contact cleaner on a paper towel and wipe the plate cap with it. Another squirt of contact cleaner goes into the plate cap connector before I reinstall it, and work it gently up and down a few times. I remove all other plug-in components, like pilot lamps or crystals, inspect and clean them, give the conducting surfaces a shot of contact cleaner, put them back in the sockets and work them up and down. As with the tubes, I clean the area around the removed component before I reinstall it. I log the condition of each component in my notebook.

I take a close look at variable capacitors as I clean them with a soft brush and the vacuum cleaner. Under a bright light I can see if any of the plates are bent. I check the contacts between the rotor shaft and the connecting point to see if there's any oxidation. A quick squirt of contact cleaner and a few rotations of the capacitor knob usually cleans that up. Rotary switches get a good dose of contact cleaner on all wafers, followed by 10 or more rotations through the entire range. Then I get my magnifying light in position and visually inspect the contacts as the switch is rotated. Worn or warped contact points are logged in the book.

I inspect any other above-chassis components and clean them, if necessary. Anything suspicious, like corroded filter capacitors, is logged in my notebook. As I inspect and clean the top of the chassis, I look for signs of modification or repair and failed components.

Now it's time to turn the rig over and look underneath the chassis. Using the brush and the vacuum cleaner, I clean each section of the wiring, being careful not to move things around too much. I look for evidence of undocumented modifications, bad components and scorched areas on the underside of the chassis. Any rotary switches here are cleaned and inspected.

Testing Components

With the initial cleaning and inspection completed, it's time to do some testing. I copy the table of resistance measurements in the manual so that I can record the measured resistance values next to the specified ones. While the vacuum-tube voltmeter (VTVM) is warming up, I make sure all controls and switches are set as specified in the resistance-table instructions. Then I systematically measure the resistance at each test point and record the measure-

ments. I usually find that my measurements are within $\pm 15\%$ of the given values. I always complete each measurement, check off those that are consistent, and recheck the inconsistent ones after verifying my switch and control settings. While the VTVM is still warm I check each filter capacitor. After disconnecting the ground terminal, I connect the ohmmeter leads (observe polarity!) and watch the meter. After the initial kick, indicating that the capacitor is charging, I want to see a steady leakage resistance of at least 100,000 Ω . Any filter capacitors that fail this test are candidates for replacement.

Then I check each plate-bypass capacitor using the same method. Any capacitor with a leakage resistance of less than 50M Ω is suspect and is listed for replacement.

Plan the Restoration

After another trip to the coffee pot, I settle down to review the list of repair, replacement and restoration requirements I compiled during the inspection and cleaning phase. First I check my parts collection to see if I have the replacements I need. I usually don't, so I begin the buying, scrounging and trading process that makes boat anchor restoration interesting. With the parts situation in mind, I decide how I'm going to tackle the repairs and restoration.

Repair and Restore

I tackle the repair and restoration in four phases. As I complete each repair or replacement, I check off the corresponding entry in my notebook. If a parts shortage prevents me from completing a specific phase, I move on to the next one. When I acquire the part, I install it and keep going. By keeping my notebook up to date, I make sure that I complete each item. If I have to stop work on the restoration temporarily because of higher-priority matters, the notebook entries allow me to resume restoration with minimal time to get reacquainted with the project.

In Phase 1, I clean or refinish items that require a lot of disassembly, especially anything that requires disassembly of the panel from the chassis. I can usually complete this phase while acquiring needed parts for the following phases. During this phase, I remove corrosion and rust from the chassis, clean or refinish the cabinet, front panel and any bezels, and clean the dial plates and knobs. In Phase 2, I remove unwanted or undocumented modifications, and replace or refurbish major components found to be defective during the inspection. If this phase is necessary, here's where I replace things like power transformers and filter chokes, bandswitches, major subassemblies, meters and tubes.

In Phase 3, I replace the defective bypass capacitors or other small components discovered during the inspection. Then I recheck all the static-resistance discrepancies, hoping they've all gone away! If not, I continue testing and replacing compo-

nents until I've resolved all the discrepancies.

In Phase 4, I update the ac supply circuit and replace any defective or suspicious components in the power supply. Figure 1 is the schematic of the ac supply circuit for a Hammarlund HQ-110A receiver I recently restored. The rig had a two-wire nonpolarized line cord and a 0.01- μF capacitor was connected from each side of the power line to chassis ground. Sharp-eyed readers will notice that there's no fuse in the ac line. This configuration is typical for vintage rigs, but it isn't safe! When a line-bypass capacitor starts leaking, you can usually tell by the ac tingle you feel when you touch the cabinet. I replaced the line cord with a modern three-wire cord and rewired the circuit as shown in Figure 2. Now if a component shorts, the chassis is at ground potential and can't create an electrical shock hazard.

Because this is the last phase before I apply power to the rig, I pay particular attention to the filter capacitors in the power supply. The aluminum electrolytic capacitors in older equipment consist of two electrodes immersed in a paste electrolyte. When voltage is applied, a thin dielectric film is formed between the conductive electrolyte and the anode (positive electrode). This construction allows large values of capacitance in a small physical package. However, these old electrolytics have two bad traits: When such capacitors are unused for a long period, the dielectric film deteriorates, so if you apply power to a boat anchor that hasn't been used for a few years, you're usually rewarded with a quick flash as the capacitor self destructs, and the smell of overheated transformer insulation as the transformer tries to deliver all that power into a short circuit. If you're lucky, the fuse blows before the transformer does.

The other bad trait of electrolytic capacitors is "acquiring" a voltage rating equal to the applied voltage. Designers used to derate electrolytics by specifying a voltage rating in excess of the actual working voltage. For example, if the actual working voltage was 300 V, the designer would require a 450-WVDC rated capacitor. But after being operated at 300 WVDC for years, dielectric film instability caused the capacitor to become a 300-V capacitor. So although the capacitor checks good and the indicated voltage rating is sufficient, applying power to that old boat anchor may create a voltage surge that exceeds the "acquired" voltage rating. Again, if you're lucky, the capacitor simply self destructs. If the capacitor shorts, it usually destroys other power supply components in the process.

The obvious cure for these bad traits is to replace all old filter capacitors with fresh new ones, but these are in the scarce-and-expensive category, and "new" electrolytics you find at a hamfest may have been manufactured 20 years ago and have deteriorated just like the ones in the rig. So the next best (and most used) solution is to reform the electrolytic film by applying a

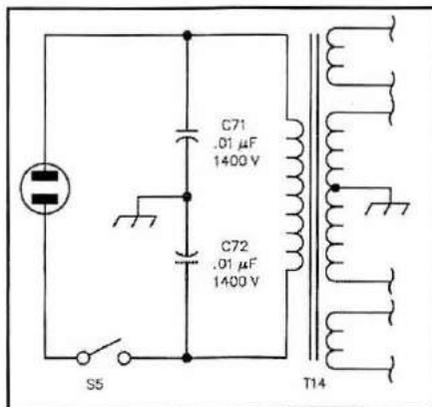


Figure 1—Hammarlund HQ-110A ac-supply circuit. The two-wire power cord with an unpolarized plug and the two line-bypass capacitors create a potential shock hazard. Lack of a fuse in the ac line is a deficiency that should be corrected during restoration.

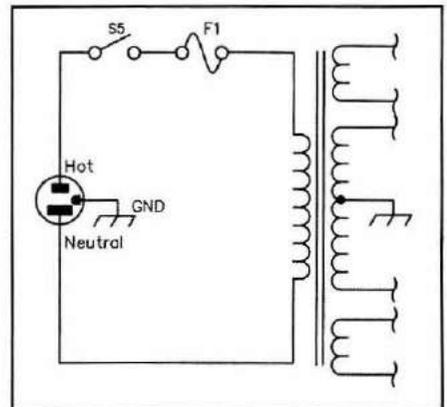


Figure 2—Updated HQ-110A ac supply circuit. The shock hazard has been eliminated by removing the line-bypass capacitors and installing a three-wire power cord. The third conductor is grounded to the equipment chassis to eliminate any chance that the chassis can be "hot." A fuse has been added (under the chassis) to protect those hard-to-find components.

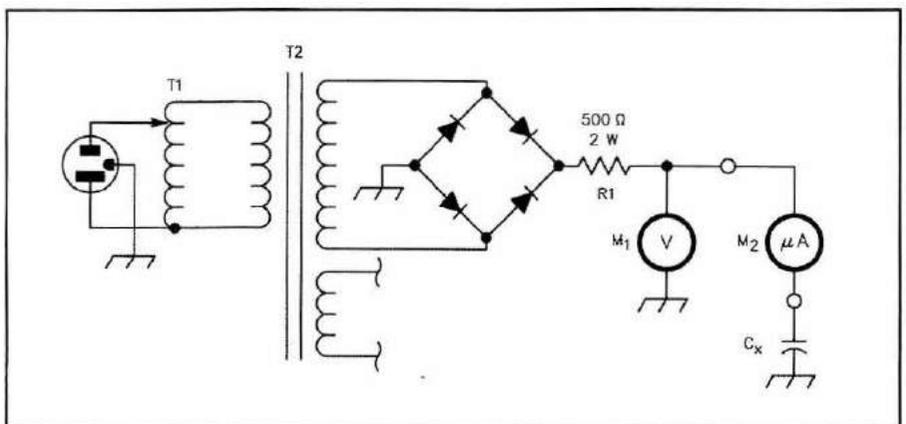


Figure 3—The electrolytic capacitor reforming setup at KQ4BY. See text for details.

low voltage (about 10% of the rated working voltage) and increasing the voltage in 10% increments until the rated working voltage is applied to the capacitor. Current is limited to about 50 mA during the reforming period. If the leakage current is more than 5 mA after the reforming process is complete, I try to find a replacement.

The best gadget to reform old electrolytics is a 0 to 500-V dc variable supply with current limiting and meters to monitor the output voltage and current. Because I haven't run across one of those yet, I use the reforming setup depicted in Figure 3. The variable transformer allows me to control the ac input voltage to the power supply and thus vary the output voltage. The 500 V dc power supply is an old TV power transformer feeding a bridge rectifier. The output current is limited to 50 mA by the 500 W, 2-W resistor. The 0 to 500-V dc voltmeter allows me to monitor the voltage across the capacitor. The milliammeter (Mz) is the digital VOM from my workbench. If I had to build one from new parts, I'd shop around for a power transformer

with a 125-V secondary at about 200 mA and use the voltage quadrupler power supply circuit from *The ARRL Handbook*.

Before I built the reforming power supply, I used a less elegant, but acceptable method to reform filter capacitors: I removed all the tubes from the boat anchor, except the rectifiers and the voltage regulators, plugged the rig into the variable transformer and used the rig power supply to reform the capacitors. The bench VOM was used to monitor the input ac voltage and I computed the voltage applied to the capacitors. For instance, if the rig power supply provides 450 V when 117 V ac is applied, I knew the applied dc voltage was approximately 3.8 times the voltage indicated on the VOM. You can't limit the current through the capacitors using this method, so when I do it this way, I hang around the shack and keep my eyes and ears tuned for sizzles and smoke!

Bring it Back to Life, Slowly

In every restoration project there comes the time when there's nothing left to do but

turn it on and try it out. Some restorers refer to this phase as the "smoke test." I prefer to think that my projects won't smoke when power is applied, but just in case, I drag out the variable transformer again and plug the rig's ac cord into it. With the transformer control set at the minimum, I switch on the rig. I bring the power up to about 25 V, wait a few minutes, and then increase the power to 50 V. At each power setting, I check for smoke or the ugly sound of sizzling components. I follow this procedure until I have full input power applied to the rig. If all goes well, I can begin check out and alignment. If not, I shut the rig down and replace the necessary components. Then I repeat the "bring it up slow" process.

Checkout and Alignment

At this point, the rig should function. Before I do a full-blown functional test, I verify that all the voltages match the voltage table usually found in the equipment manual. As I did with the resistance checks, I use a copy of the voltage table to record the actual measured voltages. If I encounter serious deviation from the specified voltages, I troubleshoot the affected stage until I find the cause of the abnormal voltage reading.

Now it's time to find out if the rig will function on all bands and using all modes. A good checkout takes time. If the project is a receiver, I listen on each band and try to copy CW, AM and SSB transmissions. I like to have the restored receiver operating next to another receiver so I can switch back and forth between the two. If I can hear the same signals on both receivers, I know that my restored unit is operating satisfactorily. Some judgment is required—I don't expect my HQ-110A to equal a Drake R8's performance.

Transmitters are easier to check out. I transmit into a dummy load and monitor the signal with the station receiver. Any operational deficiencies are immediately obvious. If the rig fails to operate on all bands and in all modes, I try substituting new tubes for the ones in the affected

stages. If the replacement tube improves performance or restores the missing function, I leave it in. If tube replacement won't solve the problem, it's time for more troubleshooting until the offending component is found and replaced. Once the rig is functioning on all bands and in all modes, I warm up the test gear and align the rig according to the instructions in the manual. Because alignment is peculiar to each rig, I won't dwell on it here. The best advice I can give you is to take it slow and remember that minute adjustments are usually all that are required to peak a circuit. When I can't complete an alignment step with a small adjustment, I begin to suspect something in that circuit and go back to troubleshooting. Once all alignment steps have been completed, I button the rig up and transfer it to the operating position.

Put it On the Air

The most satisfying moment is when I make the first contact with a vintage rig I've brought back to life. I get a lot of satisfaction when I hear the other station come back to me on my vintage receiver. And when the other operator starts reminiscing about "the rig I never should have sold," I settle back and enjoy the QSO. But I'm alert for signal reports, especially those that alert me to any problems or deficiencies in the rig. It usually takes several contacts with the revived gear before I close the restoration folder and file it away.

Final Advice

Although this article describes all the steps I think are required to restore an old boat anchor, it's not meant to be the final source for neophyte equipment restorers. If you've never tried any of this, find another ham who can provide you with a "sanity check" as you go through the process. Besides, boat anchor restoration, like most ham radio activities, is more fun when it's shared with other people.

I could have kept writing this article for another year; there are hundreds of things I didn't have space to address. A discussion

of cleaning methods, for instance, could easily consume more pages than this general-restoration discussion. If you want to learn more about vintage radios and restoration methods, I recommend that you subscribe to *Electric Radio*, a monthly magazine devoted to preserving our ham radio heritage. Contact *Electric Radio*, PO Box 57, Hesperus, CO 81326; 970-247-4935.

Making the transition from solid-state to "hollow-state" ham gear can be difficult without good information. Because of my interest in vintage gear, my bookshelves contain editions of *The ARRL Handbook* from the 1960s, '70s and '80s. Vintage issues of *Hints and Kinks*, an *ARRL Mobile Manual* and several editions of *How to Become a Radio Amateur* also get used. I wouldn't part with my *RCA Transmitting Tube Manual* and the *RCA and Sylvania Receiving Tube Manuals*. Bill Orr's *Radio Handbook*, 19th Edition, is another prize. The cornerstone of my technical literature collection, however, is my library of back issues of *QST*, *CQ*, *Ham Radio* and *73* magazines. If you're going to become one of the "boat people," I recommend you begin your literature collection now.

Acknowledgments

Thanks to Jim Kearman, KR1S, who encouraged me to write this article, and to all the people on the "Boat Anchors" Internet e-mail reflector who daily rejuvenate my enthusiasm for vintage ham gear. Special thanks to W. S. Lynch Jr, WA6BXH; Greg Weinfurter, NS8O; Terry Zivney, N4TZ; John Brewer, WB5OAU, and others who responded to my e-mail request to verify my capacitor-reforming methodology. Last and best, thanks to my wife of 18 years, Meg, who is resigned to the fact that "her" garage is always going to be full of radio gear and that her husband is going to be hamfesting at least 26 Saturdays every year.

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The Transmitter That Sold Itself

Under the Southern Cross, a ham finds a bit of magic in a secondhand shop.

When on holiday, I rather enjoy window-shopping in second-hand shops (or antique shops, as they are now called), not with any particular aim in mind, but just in case something of interest should present itself.

My wife and I were casually involved in this gentle pursuit one day while we were on holiday in Nelson, when we came across a shop we had visited previously, Britannia Antiques. It had the appropriate ambience—clutter, dim light and collectibles of all sorts, to include even a diving suit with its bronze helmet.

But this time there was some radio equipment on show. Near an old bass-reflex speaker cabinet was an ancient, black, rack-and-panel transmitter about five feet high. A split-stator capacitor with a bent National type O dial peered drunkenly through a large hole in the topmost panel. The filament voltmeter hung out of the meter panel by its leads, its needle stuck forever on 6 V. The nameplate had a globe with wings on it—the old logo of Collins Radio, of Cedar Rapids, Iowa. I had never heard of the 30FXB that it declared itself to be, but it was a *Collins!* I stared at it reverently.

As we left the shop, I told my wife of the preeminent position Collins had held in amateur, broadcasting and avionics equipment, and explained how unusual it would have been for a New Zealand amateur to have had a commercially built transmitter of any kind in the pre-World War II era, let alone a Collins! This one, when it was new, might have been the only Collins in the entire country.

We carried on with our holiday. One evening after dining out, we walked back past the secondhand shop with the old Collins and saw that it was still there. A pity it was so large and heavy—it would be difficult to move and ship, perhaps impossible. It would have to be trucked 200 miles to the South Island ferry port of Picton, then travel by sea for 3½ hours to the ferry port in my hometown.



The ZL2BCW operating position. Various modern equipment of American and British manufacture are seen on the desk, and the recycled Collins 30FXB on the right, softly humming as it warms up the shack.

Even if I got it home, it would not really fit into my shack. Anyway, what in Heaven's name would I do with a 1930s CW/AM transmitter that was in ruins?

No, I did not need this rig. It would be foolish to even consider buying it.

The following day was the end of our holiday. We left our accommodations and, having a couple of hours to spare, I went to say goodbye to the old Collins, with my wife indulgently trailing along with me.

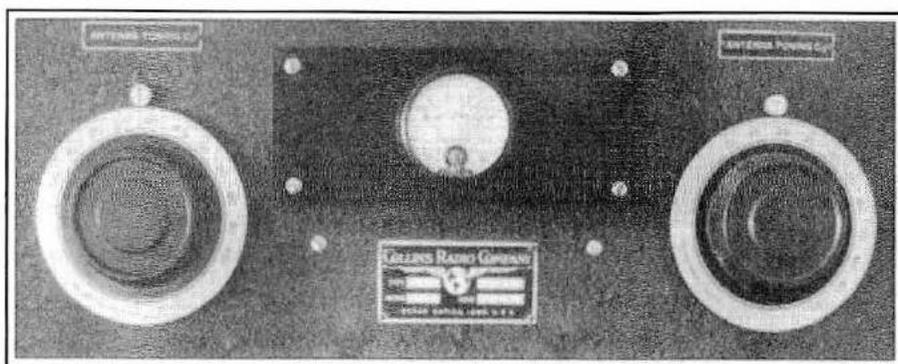
When the man in the shop told me that it would be no trouble at all to ship the Collins to my home, I bought it. My wife stared disbelievingly as the full impact of the purchase hit her. "Where on earth are you going to put it?" she demanded, "the garage and the shack are already full."

"In the parlor," said I, wittily. She didn't laugh.

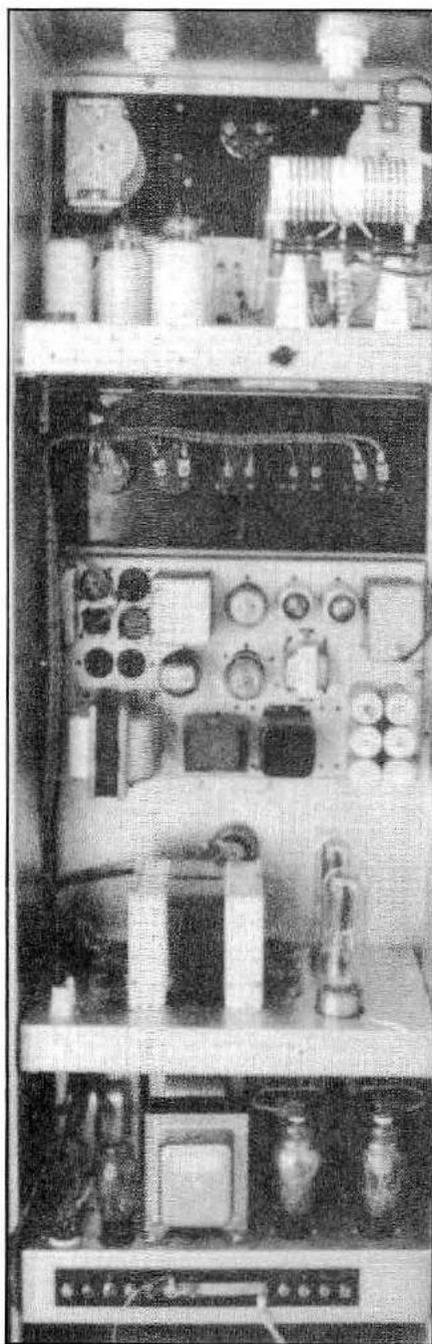
On the flight back home, I spoke of the mental torment that the sight of the Collins had wrought in me and how surprised I was to find myself actually buying it. My wife recognizes an obsession when she sees one, and let the matter drop. After all, everyone is passionate about something.

After we got home I waited anxiously for the rig to arrive, wondering if it had been packed properly and if it had a good journey, and tortured by thoughts that something major would be missing that I hadn't noticed. There was no need to worry, it arrived in exactly the same condition as I left it, broken glass and all, with some crumpled-up newspaper stuffed in the back of the rack cabinet to keep the loose parts in place.

I stared at this heavy, dirty, black box with wires and other parts hanging out of it, including the power supply, as though I was



The antenna tuner, with its wonderful old Collins "winged globe" nomenclature tag.



The rear of the Collins 30FXB. Top to bottom: the antenna tuner, the RF deck, the meter panel, the vertical speech amplifier, and the modulator and power supply.

seeing it for the first time. What had I done? In the full light of day, everything was covered in dust and grime, with rust, corrosion, and peeling chrome plating.

I retired to the shack to search through a few of my old *QST*s from the 1930s in the hope of finding some information or even a picture, which might give me a line on my "find." I found some radios shown in Collins ads, but not my radio. There was a 30FX, smaller than my radio, but with a family resemblance. I carried on my search and suddenly struck gold—a photograph of my transmitter, front and back, on the inside cover of the January 1935 issue!

Further research showed that the 30FXB was introduced around June 1934 and produced until the end of 1935. It was designed for 100 W output from a 203A, over the frequency range of 1.5 to 15 MHz, with high-level modulation by a pair of 203As in Class B. The high-voltage power supply used a pair of 866s.

But then the sobering question invaded my pleasure at learning more about my treasure: What do you actually do with a radio in this condition? I pondered the options of (1) restoration to "original" condition, (2) repairing it, and (3) taking it to pieces and using the parts for something else. Finally, I decided that the best way to celebrate its history would be to preserve as much of the original transmitter as I could. During the restoration, I would need to modify as necessary, renew items beyond repair, and invent whatever else was needed. The ultimate aim would be to have a complete working transmitter that I could use on the air safely, without violating any of today's rules for spurious emissions.

The only reliable technical information I had available was the old *QST*s plus a couple of prewar RCA tube manuals. Talking to fellow hams and old-timers did not produce any further information, neither did writing to the suppliers of old equipment handbooks.

The transmitter consists of five decks. The top one was the antenna tuner, with the single-chassis RF deck below that, then the meter panel, the vertically oriented speech amplifier chassis, and the Class B modulator and main power supply at the bottom. Band switching is carried out by manually

changing plug-in coils.

I started my work on the antenna tuner, mainly because it was the simplest unit. I removed and completely dismantled it, washed the components carefully with soap and warm water and dried them thoroughly. Then I continued my work at refurbishing the other units.

The meter panel was a concern. I have attempted the occasional meter repair—sometimes successfully, sometimes not. This time, with five meters, I decided to go to an expert. The meter man cleaned them up inside and out, sealed the glasses back in place and adjusted their zero-setting—all at a very reasonable price.

I did not have the original tube types that were in the RF chassis; even if I had, it would take a long time to piece together the circuit and then get it working properly. So I decided to use tubes that were available in the 1935-37 era and which were still available. I chose an 802 as a Colpitts crystal oscillator, an 807 as a driver and an 805 as the final amplifier. The 805 had a 10-V filament and a 4-pin jumbo socket, as did the original 203A.

I left the output tank circuit much the same as the original, except to redesign the output link for 50 μ . This change would simplify the measurement of RF output power and allow the addition of low-pass filters and a T-R switching system.

The Collins 7C high-fidelity speech amplifier with its push-pull 2A3 output stage was next. The circuit is a classic one that appeared in old RCA tube manuals and, in slightly modified form, in *The ARRL Handbook* for many years, so it was an easy task to refurbish this unit. Similarly, the Class B modulator was easy to rework, since they are all pretty much the same.

The next challenge was the main power supply. What was the chance that 60-year-old transformers would still be okay—especially after 30 years or more of disuse? I did some checks with an ohmmeter, and found nothing obviously wrong. I disconnected the primary windings and very carefully and very slowly reconnected them, one transformer at a time, using a variable-voltage transformer to slowly bring the voltage up to normal, all the while watching for problems.

To my amazement, the transformers all seemed fine. Later I discovered that there was a hard short in the main filament transformer, between the 866 filament winding and the 10-V winding that supplied the final and Class B modulators. No wonder the filament voltmeter was blown when I found the rig! There must have been quite a bang, which might have been the thing that forced the rig into its retirement.

By now, it was almost a year to the day since I bought the old radio, but all the individual units were now working. The rack cabinet had been cleaned up but there were still no power switches. I built an external interlocked control system into a small metal cabinet to place on my desk, complete with a time-delay for the plate volt-

age, to protect the 866s.

Now only a keying scheme and antenna changeover were needed. I had a T-R unit that was easy to adapt for the 30FXB. The circuit has sequencing, relay control, solid-state dc switching and sidetone.

At last everything was ready. I switched on the main power switch and the bright thoriated tungsten filaments lit up. After I heard the click from the bimetallic time delay, I switched on the high voltage. I heard a slight buzz from the power supply and saw a faint blue glow from the 866 mercury-vapor rectifiers. I tapped the key to send one dot, and saw the meters leap into life and heard the receiver briefly mute. Another phoenix had risen from the ashes!

After tuning up, I determined that the 805 produced 100 to 130 W output at 14 MHz with about 1100 V dc on the plate. *Excellent!* But—would anybody hear me?

I called CQ on 20 meters. As I sent, the hum from the power supply intensified a

little during each dot and dash. I could turn off the sidetone and monitor my sending by listening to the hum of the transformers. Everything seemed okay. Very okay!

I sent a final K and stood by, to hear the wonderful sound of W9RST calling me! After we exchanged signal reports, I told Matt that he was my first contact with this old rig. We chatted for a while and then finished the QSO. What a great moment! All that work was suddenly and completely worthwhile.

Then, a few minutes later, W7UN called CQ on the frequency. I called, and Bob in Washington came right back. I told him about the Collins. He told me that he had been on the air for 64 years. He was as pleased with hearing the 30FXB as I was to have it again on the air. My shack was by that time noticeably warmer. Those big tubes warmed the room up nicely—just as they warmed the cockles of my heart.

Many hams scoff at older technology,

techniques and equipment, quoting the myths that old radios cause TVI, take up too much space on the bands and so on. But there is nothing to prevent the signal from an old transmitter from being stable and clean, especially because the techniques for identifying, locating and correcting problems are perhaps better understood now than in The Good Old Days. I'm having great fun with my recycled transmitter, and sharing that fun with the hams I contact. And my signal is quite good, according to all reports, thank you!

Acknowledgment

While I was engaged in this project, many hams offered help, searched through their junk boxes for parts I needed, and offered suggestions without a moment's hesitation. In particular, I am extremely appreciative of the generous assistance of ZL2AYQ, ZL2THQ, ZL2AKW and ZL2BL.

Forward to the Past: Fixing Radios for Fun and Profit

Old-time radio in old-time Connecticut. Enterprising ham KR1U turned his life-long hobby into a thriving, in-demand business. That's not a boat anchor, son, that's a work of art!

Remember when you could work on your own car? When you could at least change the oil filter without putting the family chariot on a lift and using a special \$35 factory triple-hinged frammus wrench to reach it?

Remember when you chopped vegetables with a knife instead of a \$200 food processor? Or when you dug your garden with a spade, and shoveled your own snow?

People fixed radios, once upon a time, by identifying a problem and solving it with a new resistor, capacitor, or tube, instead of throwing away an entire circuit board in favor of a factory-fresh one.

Bob Eslinger, KR1U, fixes radios.

If you could be transported directly to Bob's hamshack, only a close look in the corners would tip you off to what he's up to with old radios. There's the usual HF transmitter (a TS-940), a multi-mode VHF/UHF radio (an FT-726R), antenna switches, keyers, rotator control boxes. The only vacuum tubes in the shack are in the SB-220 amplifier.

Pretty typical for an active ham who works every band but one from 1.8 to 420 MHz. But the only way to the KR1U console is through the house and down into the basement, a time-warp of a trip.

Come in through the garage and you pass an ancient test instrument sitting astride the door; a dozen or so plastic 1950s radios perch on the steps, the spoils of a recent expedition to New Jersey. "Not much of value here," Bob says, "except lots of parts to be scrounged."

The kitchen looks average, with the usual contingent of refrigerator magnets and so on. Except...a magnificent wood-console radio with folding front doors camps next to the chef's island, its finish very close to the kitchen cabinetry and its size about two-thirds that of the icebox.

Well, what's so unusual about a radio in the kitchen, anyhow, even if it's 60 years old? After all, this is Connecticut, The Land of Steady Habits.

Bob Eslinger earns his living by restoring other peoples' vintage vacuum tube radios to like-new condition. He works on consumer-style sets, which often have some shortwave bands on them, as well as resurrecting "communications receivers."

Bob's been mentioned in several newspapers, including *The New York Times*, and the local daily, the *Hartford Courant*, where a writer discovered him.

During a brief lull in the record-breaking "Winter of '94," I drove to remote Pomfret Center, Connecticut, to see Bob's home-museum.

Bob works only on vacuum tube radios. This is partly because, he observes, there's work to be had because technical schools these days don't teach vacuum tube technology.

"People will take the 50-year-old Zenith from their parents' attic to a 'modern' repair shop and be told that the repair person can't get parts for it and couldn't fix it if he could. Then they often just turn the



Looking down on the living room are: (l) an Air King Dutchess "Catalin" (1947); an Atwater Kent cathedral (1931, above) and a Zenith Super 7 (1924, below, an "early boombox"); and, on the right, top to bottom, a Grebe CR-9 battery set (1921); a Freed Eismann NR-5 (1923); and an Adler Royal Neutrodyne (1924).

old set into a bar, or throw it away.”

Bob Eslinger says “don’t ever throw anything away,” and tells the story of the person who found a large cache of vintage tubes and was using them for target practice.

Bob and I agree that tubes *sound better*. Go ahead and scoff, if you like.

Bob sits down at one of his own 1930s radios, fires it up, tunes in a broadcast station, and blisses out.

“Real radios glow in the dark,” he says.

Bob lives a couple of miles past the exclusive private Pomfret School; Robert F. Kennedy went there. Bob designed his own house and participated in much of its construction (in 1978). It incorporates a number of passive solar techniques as well as other energy-efficiency features that were fairly novel for its day. In the center of the house is a massive brick chimney with a home-brew woodburning furnace and fan-forced air. Cool! (er, *warm*).

There are old radios everywhere, especially in the living room, on the brick settee around the chimney, and in the sun room, where a botanical garden of plants wrap themselves around consoles and “cathedrals.”

An upright piano is topped with four more cathedrals, and a shelf on the stairway holds several of Bob’s prizes, including TRF (tuned radio frequency) sets from the 1920s, and horn speakers.

Although I faithfully read the bulletin of the Antique Wireless Association, I am no expert on old radios like these. I recognize the oldest ones—long and low with black panels, three or four knobs on the front, some with lift-lids. I know they are the oldest but don’t know if they are the most valuable.

Several console models remind me of the first shortwave set I ever heard, in the attic of a friend’s house in the late 1950s. I swear one of Eslinger’s is a duplicate. The bands were filled with Soviet jammers in those days, and my friend and I thought they were buzz saws.

“When I was a boy I thought they were airplanes,” Bob Eslinger says.

Bob offers to get out some books so I can identify that old console that I cut my shortwave teeth on, but I am sorely afraid. Afraid I might want one.

We get coffee in the kitchen. “Let me show you my squirrel zapper,” Bob says.

He picks up what appears to be a control for a garage door opener and points to a home-brew bird feeder out back. “See the metal plate around the bottom? It’s electrified. If I see a squirrel helping himself at the feeder I just hit the remote control and zap him. It doesn’t hurt the little bugger, but you should see him scramble.”

Bob Eslinger is 46. He grew up on Long Island and tells the story of visiting his grandparents in rural Connecticut (not far from Pomfret Center). “The Channel 3 TV picture from Hartford was so snowy we gave up and turned on an ancient console radio,” Bob remembers from the distant past. “I’ve never been the same since.”



The workshop. A 1930s Philco is on the bench.

“Indian Troubles”

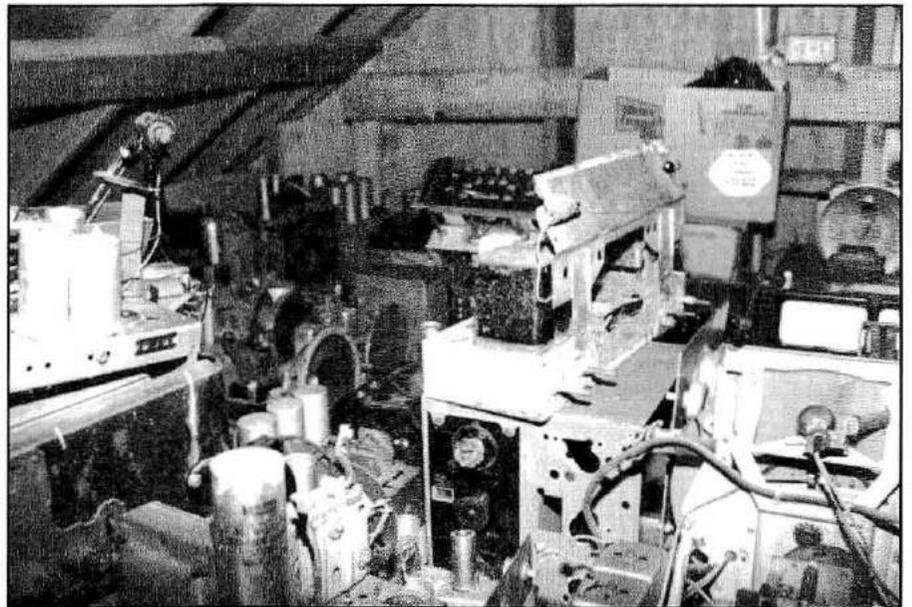
“Indian troubles” delayed the settling of Pomfret (of which “Pomfret Center” is just a postal address). Captain James Fitch bought 15,100 acres from them in 1686, but it was 25 years before the first settlers came to stay. A saw mill, a grist mill, then roads and bridges followed over the next four decades. A post office was established in 1795.

By the end of the 18th century industry was more evident in Pomfret than it is now, according to town historian Mary Page. Today, the area is countryside with widely scattered houses and little business of any kind.

Around 1800 or so, Pomfret developed a reputation as a summer resort, attracting the well-heeled from Boston, Providence and Newport.

Pomfret has been home to several well known schools; two of them, the exclusive Pomfret School and the Rectory School, continue to operate and to attract boarding students from around the country.

Gary School Road, home to Antique Radio Restoration and Repair, was named for early settlers to the area who later moved west and were involved in the founding of Gary, Indiana.



The graveyard: upstairs in the outbuilding (getting this photo was definitely hazardous duty!).

A Radio for Dave

What does the star of *The Late Show* with *David Letterman* give to his director of 13 years for Christmas? A 60-year-old console radio, of course!

David Letterman and Hal Gurnee, director and supervising producer of *The Late Show*, share an interest in old-time radio, especially the old programs. Letterman is a frequent shortwave listener as well. Both he and Gurnee have Lowe HF-150 receivers (small tabletop models made in England).

One day Letterman pulled out his *Passport to World Band Radio*, then called its editor, Lawrence Magne. Letterman had his heart set on a Philco Teledial. Magne contacted the Electronic Equipment Bank, got Bob Eslinger's number from them, and forwarded it to Letterman's staff.

Eslinger got the assignment and got busy, first faxing catalog photos of Teledials and similar models to Letterman. Then through his network of contacts he came up with a half-dozen Teledials, including one in New Haven. It had a good finish—a requirement since there wasn't time to send the cabinet out for restoration.

"The radio was working but not nearly as well as it could or should," Eslinger says.

Eslinger reworked the 1937 12-tube Teledial in less than two weeks, toiling long days right up to Christmas Eve, following the usual procedure for a working set:

Clean the tubes and their sockets and replace weak tubes; replace grid cap wiring; replace electrolytic and paper capacitors with mylar film caps; replace suspect resistors, with antique resistors if possible; clean the bandswitch, re-do suspect solder joints, put on a new line cord; tighten the speaker grille cloth, then clean the cabinet and put things back together.

Whew!

Barbara Eslinger put a red bow on the Teledial and they took a Polaroid photo just as the shipping service arrived to pick up Hal Gurnee's gift. Luckily, he lives just on the other side of Connecticut.

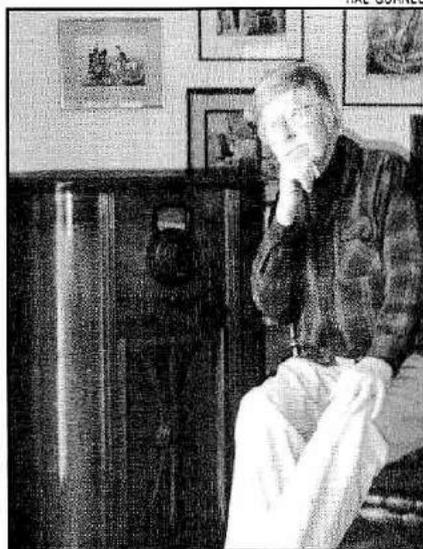
"I was completely surprised at the gift from Dave," Gurnee said. "It has great sound, reminding me of my parents' old RCA. I loved radio as a boy."

"Dave has a Telefunken from the

He eventually got a shortwave receiver—a Hallicrafters S-38C—from his uncle and soon became known as a sort of Young Mr Fix-It around the neighborhood, scouring it with his wagon for anything to fix up.

In 1966 Bob migrated to Peoria, Illinois, for a pre-engineering program at Bradley University. "I wanted to get away from home." But Bradley was pretty expensive and engineering was the wrong field.

"I wanted to be an inventor, not a drone carrying out someone else's commands," he says. "I decided I'd rather be a poor peon in the country than a rich man in the city."



David Letterman's friend Hal Gurnee listens to his Christmas present.

1940s," Gurnee said. "He and I often talk about the old radio shows, like Jack Benny's, and we both collect cassettes of those shows."

Gurnee admits to visiting thrift shops and recently bought a table model Philco at one. He plans to pay a visit to Bob Eslinger for a restoration. "And I have an old Hallicrafters communications receiver, too," he said. "I gave it to my Mom, who stored it in the box in the attic since the late 1940s. It's a creampuff. I had a Hallicrafters Sky Buddy once, too, but it's gone."

Hal Gurnee moved to New York City after college, where he worked for the old Dumont Radio Co, then moved to NBC where he was a director for Johnny Carson on the *Tonight Show*.

"I would love to work in radio again," he said, "for the nostalgia. My favorite radio station these days is the BBC-4 channel. Of course, that's subsidized by the British government. Radio in the US needs help from our government, especially public radio, to expand its format."

Hal Gurnee's "new" Philco Teledial is parked in his Connecticut dining room. "Visitors love the sound," he said.—*Jim Cain, K1TN*

Bob returned to Connecticut and lived at home while he worked—as an electronic technician—and earned a bachelor's degree in business in 1971, from Quinnipiac College, in Hamden, Connecticut. He met Barbara, who was from Woodstock, Connecticut, just up the road from Pomfret Center. They were married in 1970.

When they met, Bob was in college and had a rig set up in his parents' basement. "I thought Bob was a real character," Barbara says, "with a lot of diverse interests. I was fascinated by his radios and thought for a long time about getting an amateur license, but never have."

Twenty-four years later, Bob and Barbara are surrounded by radios. "It wasn't too bad until Bob began advertising and taking in more and more parts and tubes. We really have run out of room now. And dusting is a nightmare."

Bob worked for 10 years at a steel mill, climbing his way up from assistant office manager to office manager and general sales manager "before the US steel industry became dominated by cheaper and better foreign steel."

Bob also was for a time a product manager in the satellite industry, leading a team of engineers in the design and marketing of a sophisticated dish-positioning system for the home satellite industry.

"I was in upper management with some pretty responsible jobs," Bob says. "I got more and more tired of commuting and thus, because we live in the middle of nowhere, began working for smaller and smaller companies just because they were close to home. One day in 1990, two divisions of my firm consolidated. I was congratulated for my accomplishments and shown the door."

So, in 1990, he turned what had been a 30-year hobby of tinkering with old radios into an occupation, and Antique Radio Restoration and Repair was born.

Bob immediately began to take in more radios for restoration, and to advertise.

Barbara, who's a legal secretary over in the next town, is happy Bob no longer has a long commute to work every day. "And he doesn't have the insecurity of wondering if his job will be there next week, either," she says. "These days it seems like nearly everyone wonders about that."

There are 45,000 vacuum tubes in the Eslinger basement. It's best to take Bob's word for this, since two walls of his basement are covered with them, in drawers and bags. This is one reason Barbara is concerned about running out of space.

The cellar really is packed. Turn right into a roomful of radio sets waiting to be restored, tagged with owner's name and date promised.

Go straight and turn left, past the tubes, into the workshop, or turn right toward more storage. Then the KRIU hamshack appears.

Bob *knew* this is where his hamshack would be, so he pounded in a ground rod before they poured the basement floor.

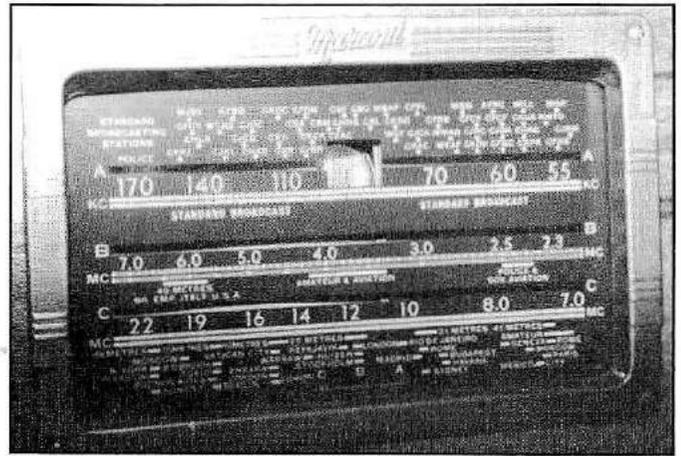
Upstairs, Bob points out a window directly over the bed. "I always wanted to be able to lie in bed and see the sky," he says, "especially to watch for aurora."

These are the small joys of living in a house of your own design. Bob says he enjoys working at home and it's easy to understand why.

Bob's ham gear includes bands from 1.8 to 432 MHz. A 50-wpm CW operator, he is active on OSCAR 13 and is on the verge of making the DXCC Honor Roll. His tribander was stuck north all winter, but that didn't stop him from working 3YØPI on Peter I Island for a new one back in February.



Bob Eslinger and part of his KR1U ham shack.



Front panel of a Canadian Marconi multiband tabletop; documentation on these radios is very difficult to come by. This one is probably from the late 1940s.

Out back is a 68-ft Rohn 25 tower with a Wilson System-1 triband Yagi. "Bob said the tower would be 'way back in the woods,'" Barbara says, "but it didn't turn out that way. And the woods are covered with wires, too. But all that pales compared to the satellite dish, which is truly ugly, don't you think?"

"My hearing isn't quite what it used to be [whose is?] and I find it more comfortable to crank in a narrow filter and listen to CW than to voice," Bob says. "I like to hang around the MUF (Maximum Usable Frequency) to work weak-signal stuff." Bob also is enamored of aurora and tropospheric propagation on the VHF bands, and says a 2-meter moon-bounce array is in the planning stage.

Bob was licensed in 1964 as WN1BZS. "I've been thinking about reconstructing my first station," he says, "a Heathkit DX-60 and Hallicrafters S-38C. And sometime I'd like to put on a 1930s ham rig, in keeping with the motif around the house. And I'd like to have a nice vacuum-tube AM rig for the ham bands on the air, too.

"For now the station is all modern gear because I like to be competitive.

"I've run out of space."

Also in the ham shack is some old hi-fi stuff and some cassettes. "I listen to tapes other people have made of vintage radio shows like 'The Shadow' and 'Amos and Andy.'

"A lot of people who are interested in old automobiles are interested in the old radios, too. Some of them make concessions and install modern radios and cassette players in their old cars, then make up for it by driving around listening to tapes of 50-year-old radio shows. That's where these tapes come from."

On the couch in the ham shack are a couple of boxes of tubes and some other goodies from the recent trip to New Jersey. On a chair in the corner is a National NC-183D receiver from the 1950s.

"I'm going to restore this old National," Bob says, "but I'm not looking forward to it. These are a bear to align." He goes into a spiel about how their alignment cans use some sort of Mickey Mouse arrangement, and he loses me.

Eslinger says it usually takes him about

a day's work to bring a radio back to life, "but that's not your 8-to-4 day. I'm a nightowl and sometimes I'll just keep working until I'm finished."

On a wintry Sunday morning Barbara is dusting; Bob is still in the sack. (Self-employed people punch a clock; it's just a different kind of clock.)

The only work Eslinger farms out is cabinet restoration, which he leaves to several retired craftsmen in the area. But he does stockpile wood. "You never know when you will need a scrap of Nicaraguan mahogany."

Some people will settle for a radio restored with modern parts, and some won't. Eslinger uses originals whenever possible

A Blast from the Past

It was a stroke of wonderful good fortune that I made two visits to Bob Eslinger's, for it was only on the second that I saw it: a steel and chrome anomaly in a forest of walnut and mahogany veneer.

Bob will pick up communications receivers when they are clean and interesting, often restoring inexpensive models for youngsters, to pique their interest in radio. And this was one of them—a 1960 or '61 Hallicrafters S-120—a five-tube 550 kHz to 30 MHz squealer with a 0 to 100 bandspread and a beat-frequency oscillator. (And vacuum tubes, of course!)

The very model this writer bought, with paper route income, for his first shortwave receiver. The very model he used as a Novice and early General. I left Bob Eslinger's house that second time a little poorer of pocket but much richer in spirit, the S-120 under my arm.

My first commercial transmitter, after a month or so with a home-brew TVI generator, was a Heathkit DX-20. A week after finding the S-120, I located a DX-20. It's a little rough, but fixable. It works, and my first contact was with KR1S, who loaned me two 40-meter crystals. See you on 7040, more-or-less.—Jim Cain, K1TN

but his thinking is that the idea is to make an old set work again, and if that requires substituting a modern part, so be it.

On his workbench is the chassis of a Philco broadcast set from the 1930s.

Condensers (in the spirit of the moment let's not call them capacitors) are doubled up in sealed units called "boats" (a Philco exclusive), and as a matter of course, Bob always rebuilds the boats. "This takes a lot more time but I'm happier, as it makes for a much neater-looking chassis."

Why the boats?

"They provided natural tie points, eliminating the need for terminal strips," Eslinger says.

But of course.

This is really a pretty simple set. Eslinger has no trouble understanding how these old tube radios work and seems to have no trouble fixing them—with the help of 45 feet worth of maintenance and repair manuals.

Another business major gone astray!

The Eslingers have two sons, Keith, 22, KA1MCY, and Neil, 20, KA1MCX. Both have Novice licenses and are in college.

Bob's outside interests revolve around the water. He's built two ice boats, and currently sails a commercial one on Lake Webster in Massachusetts (which is 800 feet above sea level). "It'll go nearly four times the wind speed," he says. Bob also scuba dives, and in the summer he and Barbara take a 17-foot powerboat to Webster Lake.

Bob Eslinger strikes the visitor as a happy man. "I was lucky," he says, "to have gotten in on the ground floor of what I think is a great resurgence of interest in things of the past.

"These old radios are works of art as much as appliances, and thousands of them didn't get tossed out the way we do modern appliances.

"They have beautiful workmanship as well as superb audio, sensitivity and selectivity."

So if you have an old radio, call Bob. Don't throw anything away!

Hello Again, to An Old Friend

Old friends and old radios—they're often one and the same!

My folks tell me that when I was old enough to pull a chair over to the old RCA Victor, I'd climb up and twist the knobs to tune in foreign broadcasts during WWII. They must have thought it was funny, because they let me continue without fearing that I'd damage the radio. What they didn't realize was that they were sowing the seeds for a lifetime of radio "knob-twisting."

We always had an all-band radio in the house, as did many families in those days. The big dials, printed with the names of exotic countries, were fascinating. My fingers became adept at fine-tuning the "magic eye" tuning bulb.

When the 1950s rolled around, my Dad brought home a small shortwave receiver that someone had given to him. I was in heaven! I saved my allowances, did odd jobs—anything short of begging—until I had enough money to "upgrade" to a better superhet.

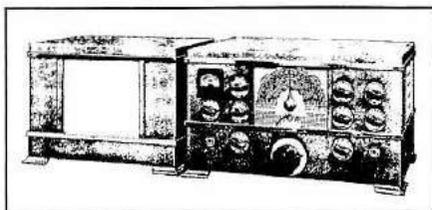
During my "radio craze," my parents voiced the typical concerns: complaints about all the wires coming out of my bedroom window; Mother chiding me to be careful not to put my hands inside that radio "box" while it was plugged in; and Dad rushing into my room when he thought the house was on fire because he smelled the fumes from the soldering iron. (I was forbidden to solder in my bedroom after that!)

Finally, in 1958, when I was a 16-year-old high school student in the Boston area, I had saved enough to buy a "real" receiver: a 1948-vintage National NC-240-D. National radios were quite common in Boston because the factory was in neighboring Malden, Massachusetts.

For the next 10 years, the old National and I were never far apart. Through high school, college, graduate school, marriage, the birth of two children and the beginning years of a career, I could always count on it to provide the solace, comfort and relaxation that we all need from time to time.

But with all the other priorities of young adulthood, the radio, now 20 years old, somehow got tucked away and stored at my folks' house when it came time to pick up stakes and seek my fortune in the world.

As 23 more years passed, and we moved to New Hampshire, Maine, England, Nebraska, and finally to Washington State, every time I'd visit my parents I would



The National NC-240-D, circa 1948.

make sure that the old National was still in its plastic bag in the garage.

Finally, when we visited last fall, I decided to ship my 43-year-old "boat anchor" back to Washington. With my Dad's help we carefully packed up my treasure, which weighed in at a hefty 67 pounds—just three pounds shy of the shipping company's 70-pound weight limit. We had to ship the speaker in a second box; it weighed another 20 pounds. (It cost only \$35 to ship both boxes from coast to coast. What a deal!)

Home at Last

Once home, I could hardly contain myself. Would the carton arrive in one piece? Would any of the tubes be broken? And—miracle of all miracles—would the radio still work?

When the day finally came, I carefully chose a spot on the floor of my shack that would be close enough to an ac outlet so I could plug it in without too much delay. After stripping the layers of cardboard away, collecting every one of those plastic peanuts and carefully removing the radio from its plastic cover, I connected the speaker and flipped the power switch. The tubes started glowing and I could hear the crackling and hissing sound of an antenna-less receiver. It worked!

A few days of fun with the '240-D passed and the excitement wore off a bit as my old friend assumed a position of prominence among the solid-state rigs that are the mainstay of my shack.

As I was casually thumbing through the owner's manual, however, something on the front cover caught my eye. In the upper righthand corner of the manual's front cover, crossed out and barely discernible, was a name and call sign: Ralph Morris, WIQUE.

I was amazed that I had never taken the

trouble to decipher this before! This ham must have been the original owner of the National and had probably put his name there more than 40 years ago. He had sold me the radio when I was 16 years old! I wondered...could he still be listed in the *Callbook*?

I was struck by the irony of old technology meeting new as I slid the Hamcall CD into my computer's CD-ROM drive and typed his call sign. Incredible! His name and address were still listed! I wrote down his address, picked up the phone, dialed information for New Bedford, Massachusetts, and immediately got a phone number. I dialed the number and a man answered the phone!

"I'm trying to track down WIQUE," I said. The spry voice on the other end of the phone line answered, "Well, you've found him!" I asked, "Ralph, did you ever own a National NC-240-D?" He said, "Yes, that was a great radio. I sold that to a kid about 35 years ago."

I couldn't believe it! After all these years, not only did I have my old radio back, but I had found its original owner and was about to make a new friend. Ralph and I reminisced about ham radio and "back-home" stuff for about 15 minutes. I told him I would send him a letter with all the details about where the old National had been during all those years. I also enclosed a QSL card and asked him for one in return, just to have as a keepsake.

Several months passed and I received a letter in an envelope with a return address of Margo the Magician. Yes, it was from Ralph. It was a long newsy letter and tucked in the envelope was a QSL card and some show tickets and memorabilia. It seems that he and his wife used to travel quite a bit and had a professional magic act that took them far and wide. He told me about his personal life and that he's still active on the bands. It was a super letter and caused me to reflect deeply.

Now, when I go to a hamfest or a flea market and see all the old "boat anchors" for sale, I say to myself: If those old radios could talk, what great stories would they tell?

The next time you're at a hamfest, try to imagine the people those old radios have brought together over the years and think about the quality they have added to their lives.

Five Meters or Bust

A young ham scrounges, experiments and innovates in the days when the junk box was king.

Amateur Radio affects people in different ways. Some have a casual interest, others are somewhere in between, and then there are the real nuts, like me. If the effects of Amateur Radio were known years ago, perhaps there may have been a campaign such as today's "Say No to Drugs." Needless to say, there is no known antidote, which is fine with me. If there were, I would have missed one of my greatest adventures.

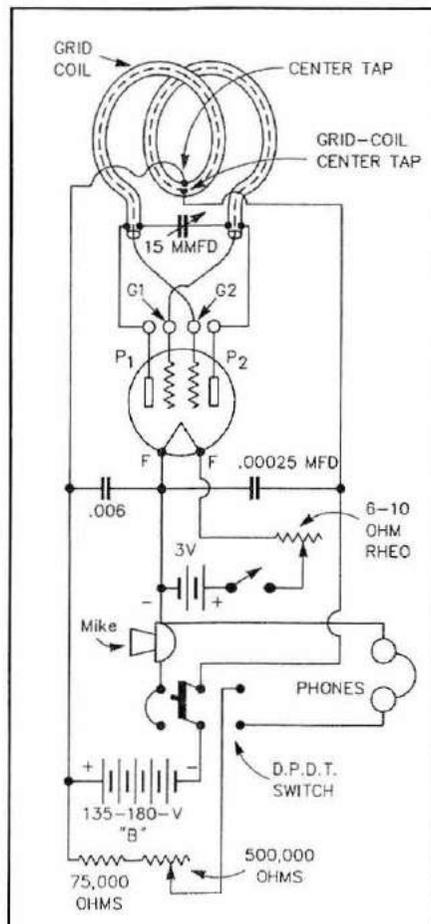
The early '30s was a mind-boggling time for a teenager living in the Chicago area. A neighbor (W9US) had been a contact station for the Byrd Expedition. The *Graf Zeppelin* had flown over our town, and in 1933 and '34, the World's Fair displayed all the scientific wonders of the day. If that weren't enough, Captain Kirk's ancestor, Buck Rogers, was in the newspapers and on the radio. The sciencefiction movies of the day—with their eerie high-voltage displays—had my mind in the clouds. I was wound up like a spring; I wanted something, but I didn't know what.

Hooked on Radio

On the way to high school, I passed a store that displayed magazines in its window. There it was—*QST*. The cover had a photograph of a breadboard transmitter with a 210 vacuum tube, a tank coil made of 1/4-inch copper tubing mounted on stand-off insulators, a Cardwell tuning capacitor and a Beede milliammeter. Wow, this was it. I stood there stunned for the longest time (something like being kicked in the teeth by a butterfly) not noticing the freezing weather. The radio was exactly what I was looking for!

Unfortunately, it was no time to get hooked on anything. The country was in the depths of a depression and I couldn't come up with a down payment on a postage stamp, which happened to cost 3 cents at the time. Clearly, I'd have to find a way to work around this problem. My only hope was trying to make something out of what others threw out.

Almost every day after school I would ride up and down the streets on my bike collecting old broadcast receiver parts. Soon, I had quite a collection and was spending an increasing amount of time



If you think today's technology has reduced the number of components in modern radios, check out this one-tube transmitter from the November 1934 issue of *Popular Mechanics*.

building and experimenting in the basement. My family began referring to me as "The Fiddler in the Basement" and feared I would end up with a complexion the color of one of those City Park statues that had turned green. They didn't mind that I was amusing myself, however, as long as it didn't cost any money (an exception was when an oscillator or regenerative receiver I built would "heterodyne" their favorite radio show, which provoked a lot of feet stomping on the floor).

My father was a wonderful man, but very much the "no nonsense" type. The thought of incurring his wrath evoked thoughts of consequences too dire to mention. My two older brothers referred to him as "The Boss." As such, he may not always have been right, but he was always The Boss.

What was about to happen could have resulted in my landing on the moon more than three decades ahead of our astronauts. Pleading insanity would do no good.

The Plot Thickens

My oldest brother would occasionally have enough money to buy a copy of *Popular Mechanics*. It had a radio section that I eagerly awaited seeing. The November 1934 issue featured a construction article by Frank C. Jones, W6AJF, for a 5-meter transceiver. This was a real bombshell. I had never heard of such a wonderful thing—a simple circuit that would receive and transmit. I had to have one.

The circuit used a single type 19 dual triode that was intended for battery operation (which would present problems; the first being that I did not have money to buy one).

A Challenge is Made

About this time, I almost abandoned the project. Then I remember a neighbor remarking, "You can't make anything good out of junk." Now it was a challenge, and the name of the game was "Five Meters or Bust." I suddenly had the perseverance of a Chicago Cubs fan. It was full speed ahead.

I decided to get around the type 19 tube by using two separate triodes, but put off the decision as to type and started gathering other components.

The tank coil was made of 1/4-inch tubing. I visited every auto repair shop around until I found a piece at the right price: free. I was no stranger to the telephone repairmen, either. They gave me the carbon microphone from an old desk style telephone, the kind they show in gangster-era movies. It had no mouthpiece or back cover, but the price was right.

The tuning capacitor needed was a 15-picofarad variable, but everything in my junk box was huge. I solved the problem with a hacksaw and shears. Finally, it was

time to solve the tube problem.

It was rumored that type 45 tubes would operate on 5 meters, and because they were commonly used in audio output stages, they seemed to be the logical choice (if the price were right, of course!). Hitting all the radio repair shops in town netted only one usable tube.

I had worked long and hard to get this far, and with success in sight, I had to forge ahead. Then it came to me. (If I was in my right mind, I would never have dared think of it, let alone do it, because of the consequences if the Boss found out.) Remembering that the family radio in the living room had a pair of push-pull 45s in the output stage, I wondered how well it would operate single ended. When no one was at home, I tried it. Much to my delight, there was only a slight drop in volume. I compensated by repositioning the volume control knob. I waited a few days. When nobody noticed the difference, it was full speed ahead once more.

The original circuit was battery powered and was probably a lot safer than what I ended up with. The double-pole, double-throw knife switch with 135 volts between the blades was bad enough, but my 400-volt supply made me wonder if I had the nerve to operate the rig if it did work!

Smoke Test

The rig was finished and I put my better judgment behind me and hooked up the power supply. I sat wide-eyed as the tube filaments turned bright orange. All of a sudden, a deafening sound—like someone had opened a steam valve—came from the headphones. Hot Dog! It was working. Would it transmit? I hurriedly fashioned a one-turn link with a flashlight bulb and held it by the tank coil. Carefully, I operated the change-over switch. Sure enough, it lit and flickered with modulation. I couldn't have been more elated. I had made something

out of junk that worked.

I was pretty pleased with myself. I had converted a battery-operated circuit to ac and thought I knew something. I was about to learn about the adage of a little bit of knowledge. Having seen many circuits using directly-heated tubes on ac, they usually had a center-tapped resistor across the filament supply, with a resistor and parallel bypass capacitor to ground. Doing the same, I had no idea I was shooting myself in the foot.

After the fascination of watching blue fluorescent glow on the glass envelope dance when I spoke into the carbon button wore off, I decided to try it on the air. It was a hot and humid summer evening, and I was home alone. I stretched a wire into the backyard and clipped the end directly onto the tank coil, hoping nobody would come home and get lit up by the 400 volts before I was done.

I hurriedly turned the power on, and much to my surprise, heard two stations in contact. My adrenalin was really flowing. As I listened, I felt like I was being bitten by mosquitoes on my neck. Perspiration was conducting through the earphone cord insulation, which was hot with 400 volts. I was unwittingly playing footsy with the Grim Reaper!

I wrapped my handkerchief around the mike and hoped for the best. I wanted to know if I could be heard. I waited for a pause in the conversation and made a quick reach for the knife switch. My sweaty hand came in contact with the blades. I learned two important lessons in that instant. Don't be in a hurry with knife switches and don't build anything using them, in which case, the first lesson can be forgotten!

At the next pause, showing proper respect for the switch, I transmitted a short burst of unmodulated carrier. One ham

said, "What was that?" The other said, "I don't know, but I've heard better cat fights." I shut down for the night.

The next day, I took my rig to a friend who had a 5-meter receiver to find out what was wrong. It turned out to be the cathode resistor and bypass capacitor that I thought I was so smart installing. Hurriedly, I got on my bike to speed home with the transceiver under my arm. When I was almost there, the transceiver slipped from my grip and hit the pavement accompanied by two loud pops as my precious 45 tubes imploded. It was bad enough that I would no longer be on 5 meters, but more frightening was the fact that I would not be able to return one 45 to its rightful place in the family radio!

I didn't hear anything about the missing tube for quite a while, and began to think I never would. Then my brother told me that The Boss had looked inside the radio the night before and discovered the empty tube socket.

My heart sank as I anticipated suffering some dire fate that would preclude me from graduating from high school in one piece. Ready to face the music, I asked my brother what had happened. According to my brother, at first, my father was angry and said, "Who took that tube?" In a few moments his frown turned to a grin and he said, "I know—that kid!"

A great weight had been lifted from my shoulders and I felt like looking for two more 45 tubes to continue my 5-meter adventures, but it was not to be. The FCC ruled that the days of modulated-oscillator rigs on 5 meters were over. No doubt the spark operators of yesteryear felt the same way when tubes made their gear obsolete.

A unique era in radio history was over, never to be repeated. At least I'd played a small part. I'd heard that modulated oscillators were still legal on 2½ meters, but that's another story....

The Lure of Classic Radio

If you think old tube rigs are doorstops or boat anchors, think again! Vintage radios are in vogue more than ever before. So get with the program!

The increasing popularity of vintage radio gear isn't all that surprising. An interest in things from the past is only natural, and Amateur Radio, with its rich tradition, is no exception. Remember, most of today's classic cars were once second-hand vehicles. And so it is with radio gear.

The popularity of vintage radio has been increasing over the past few years, and the signs are becoming more evident: Note *QST*'s Ham Ads. For some time there has been an "Antique-Vintage-Classic" section. Classic radio enthusiast Barry Wiseman, N6CSW, launched *Electric Radio* in May of 1989, a magazine dedicated to Amateur Radio of the vacuum tube era. Collins collectors have had *The Collins Collector's Magazine* since June of 1991. (See the sidebar, "Vintage Radio Resources" for info about the magazines, and see "Classic Rigs and Amplitude Modulation: Perfect Ham Radio Partners," by Paul Courson, WA3VJB, and Steve Ickes, WB3HUZ, in the February issue of *QST*).

Classic Radio Beginnings

Interest in vintage radio comes about in several ways. Some hams purchase vacuum tube gear to duplicate their first

ham setups. Others buy rigs they could only dream of owning when they were youngsters. A few hams acquire older gear because they can't afford the new equipment they desire. Some develop an interest while repairing older equipment they pick up at swapfests to resell at a profit to help support their hobby. The paths to vintage radio enjoyment are numerous and varied.

A few vintage operators would like to permanently move technology back three or four decades, but most collectors appreciate modern technology and its advantages: Accuracy, operating ease and reliability are only a few examples.

Modern VHF equipment makes mobile operation a pleasure. Working another station 150 miles away with one watt on 1296 MHz wasn't even a dream in the '50s! We will continue to look forward to technological advances.

There is a charm to vintage radio, though. The older equipment possesses a certain character that is missing in modern radios. The same is true of a steam-powered locomotive compared to a modern diesel. Glowing fire bottles (vacuum tubes) add an almost spiritual dimension—sort of

like the whistle on a steam engine. Ever seen the bumper sticker, "Real Radios Glow in the Dark"? Applying filament voltage is akin to stepping into a time machine and temporarily stepping back to another era.

For old-timers, antique radios bring back fond memories, and newer hams can experience the characteristics of vacuum tube gear and get a feel for a bygone era. Knowing how to tweak the phasing control on an old receiver to obtain single-signal selectivity, or how to tune a vacuum tube transmitter, requires skills no longer needed for modern equipment.

If you have an interest in this facet of our hobby, now is the time to get involved. Vintage equipment is in demand and availability is down. Prices are likely to increase significantly from now on.

What's Available?

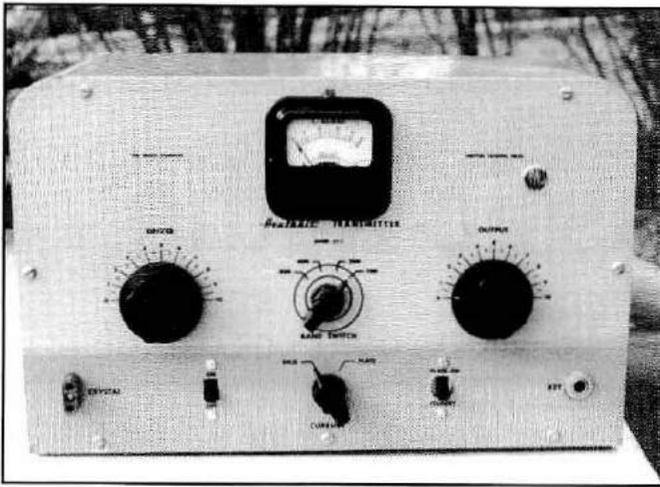
Some will balk at the thought of not having room to house the old "boat anchors," but the perception is not entirely founded. Not all vintage equipment is physically large. A Hallicrafters SX-96 receiver, for example, is about 18 inches wide, and a Johnson Ranger transmitter



David Bertman, AB7B, has quite a tidy classic station. The goodies include a Heathkit DX-100, a Collins 75A-4, a Hallicrafters HT-44, a Drake 2A, and a Johnson Matchbox antenna tuner. (photo courtesy of AB7B)



The coauthor's daughter, April Musgrove, with a homemade 6AG7-6L6 transmitter and a Hallicrafters S-38B receiver. This is a typical mid-'50s Novice station. (photo courtesy of Jim Musgrove, K5BZH)



Coauthor Marty Drift's restored AT-1 Novice rig shows the amazing transformations that can take place in the vintage radio biz. The little Heath transmitter isn't perfect, but it's light years ahead of the way it looked originally. You can see why it only cost a dollar! (photos by Marty Drift, WB2FOU)

about 15 inches. An operating desk of 36 by 28 inches will easily accommodate the pair. Some Novice stations, such as the Hallicrafters S-38C receiver and Heath AT-1 transmitter, are even smaller.

The truly grand rigs were few. The Collins KW-1, a refrigerator-sized monolith, is an awesome sight. Only 150 or so were made. A few more than 1600 Collins KWS-1s were produced, and records show that only 402 Johnson Desk Kilowatts were manufactured. These big rigs have a suitably large following, however, and they're in hot demand.

Some serious collectors have literally created museums in their houses. Some collections center on one manufacturer, such as Collins, Hallicrafters, Heath or National, and a few of these folks have rescued prototypes of equipment that, for various reasons, never went into production. A few examples are the Collins KWM-3, Elmac ATR-4, the Johnson Avenger sideband transceivers and the Hallicrafters HT-36 sideband transmitter.

There is a growing interest in AM gear, particularly from the '50s. Johnson Viking IIs, Heath DX-100s, Heath Apaches and Johnson Rangers fit nicely into this category.

Interest has also been generated in vintage sideband gear. The Central Electronics 10A was the most popular of the early sideband exciters. The 10B and 20A are later revisions. Thousands of these transmitters were sold and many still exist. They also do an excellent job on CW. A Central Electronics 20A is perhaps the best buy in the vintage transmitter market.

Many Novice transmitters are prized possessions. The Heath AT-1 may sell for well over \$100. Philmore's NT-200 commands a similar price. Other Novice rigs such as the Johnson Adventurer, Heath DX-35 and Globe Scout can be had for a lot less.

One category overlooked by many is home-brew equipment. These units can make excellent display items. Low-power transmitters with one or two stages were common in the '40s and '50s. Homespun

units were typically built on aluminum chassis, but some were assembled in wooden boxes, bread pans or even coffee cans. They occasionally appear at swapfests, but few collectors seem interested. How unfortunate—the homebrew rigs reveal a lot about the culture of Amateur Radio.

Early solid-state equipment is typically ignored, too. Don't forget, the transistor is well over 40 years old, and the integrated circuit is not far behind. Early equipment in this category includes the Hallicrafters FPM-300 and the Sideband Engineers SBE-33. Even better is the Hallicrafters FPM-200, which is a rare find.

Many of the vintage receivers still do a good job on the ham bands. Some that come to mind are the National HROs (definitely classics), the Collins 75A series, the Hallicrafters SX-101, Heath Mohawk, Drake 2B and National NC-300.

The Hallicrafters S-76 is a sleeper among early '50s receivers. Rather than the typical single-pole crystal filter at 455 kilohertz, this receiver relied on a 50-kHz IF amplifier that has one of the best passbands found in receivers of its time. The skirt selectivity is very good. In the 500-Hz or 1-kHz position, it does a nice job as a CW receiver. The SX-96 and SX-100 are upgrades.

If a vintage station doesn't interest you, then a display of keys, microphones, tubes, or crystals might be your cup of tea. These displays don't have to be large to be interesting. A collection of 10 or 20 tubes on a bookshelf adds class to your ham shack. A couple of vintage telegraph keys will further enhance it.

Where to Find Vintage Gear

So where do you find this stuff? Hamfests are probably the best places to search. Magazine ads, antique stores and garage sales are other sources.

If you aren't accustomed to playing technician, it would be wise to have a friend who is familiar with vintage sets accom-

pany you. Sniff the transformers. If they have a pungent odor, they are probably defective. Check for missing parts. It's usually wise to avoid sets with obvious unauthorized modifications. You might want to keep it in mind as a parts set, though.

When purchasing a vintage rig, try to get the original owner's manual. Larger public libraries often have Sam's Photofacts and Rider manuals which document many popular receivers. Vintage collectors can sometimes provide you with copies of manuals, and some dealers sell original manuals or photocopies (these can be expensive, so be sure to shop around).

A Tune-Up is Probably in Order

After purchasing a vintage set, you are likely to have some work ahead of you to put it back into good operating condition. Blow the dust out of the set. Clean the panel smudges. Check the tubes. Filter capacitors are prone to be defective, and paper coupling capacitors are usually leaky.

Most vacuum tubes are readily available on the used market and are reasonably priced (\$1-\$7), but a few have become difficult to find and command rather steep prices. The 7360, used as a balanced modulator in a lot of early '60s sideband equipment, typically sells for \$25 to \$40 on the used market. Similarly, the 4D32, used as an RF amplifier in several 100-watt transmitters such as the Collins 32V series, the Hallicrafters HT-20 and the Johnson Viking I, goes for \$25 to \$50.

Various surplus houses sell many of the components, including tubes, needed to keep the vintage radios alive, and finding the stuff isn't too difficult (see the "Resources" sidebar).

If you aren't familiar with vacuum tube theory, don't assume that you won't be able to gain the ability to understand the circuits. Ask one of the old-timers in your radio club or purchase any older *ARRL Handbook* and do a little studying.

A few cautionary notes are in order:

A Vintage Set of My Own

By Kirk Kleinschmidt, NT0Z

QST Assistant Managing Editor

The flood of vintage radio articles coming through the *QST* editorial office finally overcame my resistance—I had to “restore” a set of my own. Having dealt with “vintage” radios as a kid (crusty, musty and mostly junky ones), however, I knew I couldn’t settle for anything less than a “real” vintage radio—one that could be used on the air and enjoyed. (Working for *QST* and having access to all of the latest and greatest rigs had spoiled me. I didn’t want some drifty, buzzy and scuzzy rustbucket, but I didn’t want to spend a fortune, either....)

Well, as luck would have it, one of the guys at HQ wanted to part with his National HRO-7—a real classic, and one with a lot of potential—for only \$50! He even said it worked (three years earlier), which was true, after a fashion. A set of plug-in coils, a spare power supply, an owner’s manual, a matching speaker and a handful of extra dial calibration strips rounded out the deal. As they say, the price was right.

I took my battleship-gray beauty home, hoofed it up to my third-floor (penthouse?) apartment and plopped it (gently) onto my smallish workbench (which shares half of my home office and ham shack).

Before initiating the “smoke test,” I grabbed a can of “air” from my darkroom and “blew off” all of the controls, the inside (under the handy flip-top lid, where the tubes live) and underside of the chassis (where all of the melted wax capacitors live).

So far, so good. The inside was very clean—always a good sign—and because the 1946-vintage HRO-7 had plug in coil sets, there were no crusty, multi-wafer bandswitches to worry about. That was a bonus I hadn’t considered!

After the dust settled, I gently pulled out each tube and applied a drop of Stabilant 22 (the electrical connection miracle juice) to each pin before plugging it back in.

After giving the power supply and speaker connectors the Stabilant 22 treatment, I plugged the power supply into the ac power strip, stood back a ways (a handy thing to do when smoke testing old tube gear), and flipped on the filament power switch.

The meter lamp popped on (a good sign), the tubes lit up (an even better sign) and nothing hissed, snapped or exploded (the best sign of all). After a minute or so with no pyrotechnics, I carefully flipped the high-voltage toggle.

No prob! Other than the brain-numbing roar of 6V6-powered band noise (the audio gain control was maxed), everything looked and sounded fine! As I tuned the quintessential HRO tuning knob (these are really cool), frequencies changed, but everybody on 75 meters sounded like Donald Duck! No matter what I did, the BFO (called a CWO—CW

Oscillator in those days) wouldn’t work. A couple of short-wave AM broadcast stations near 4 MHz sounded okay, so I knew the radio was at least functional.

After disconnecting the power and letting the filter caps settle down for a few minutes, I started poking around “underneath.”

Sure enough, the 220 kΩ screen resistor in the BFO circuit had “gone infinite.” It literally tested as an open circuit on a meter that can measure 20 million ohms of resistance. Old carbon resistors do that sometimes. It’s part of the fun....

After replacing the resistor with a similar one (so I was off 30 kΩ—all of the other resistors in the set were, too. No big deal. Tubes can be forgiving), the BFO fired right up and SSB ops now sounded as expected. CW notes, too.

Because everything was working okay, I decided to hedge my bet and replace all of the rather melted, drippy wax and paper capacitors—electrolytics, too. If one of the melted caps shorts the high-voltage bus (a common-enough occurrence), bad things can happen.

The shiny new 0.1 and 0.01 bypass caps look like Barbie Doll parts compared to the bloated, leaking Havana cigar-size originals. Now, there’s a *lot* of extra room under the hood! The neon blue mini-caps look a bit out of place, but they’re tucked away where nobody sees them, and I know the receiver won’t suddenly “go south” because of a pooped capacitor.

I was really into the process now, so I called the friendly folks at Antique Electronics Supply (see the other sidebar), and for only \$35 I had a new set of tubes. (One of the original tubes was “microphonic.” If I tapped the side of the tube (with a plastic stick) or the receiver cabinet, the speaker reverberated with the sound of an iron-booted giant walking down a marble-floored hallway. This sometimes happens to older tubes as internal elements become loose and vibrate while amplifying.)

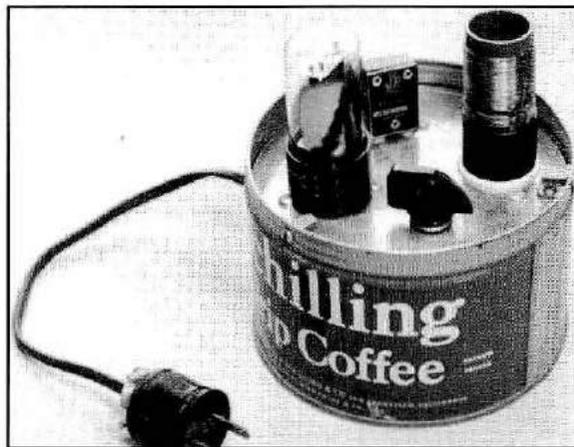
To make a long story short, the HRO-7 works like a champ. The dial calibration is accurate, the VFO (HFO in those days) is stable, the IF bandwidths are fine, CW notes sound smooth and pure—even SSB signals sound good. With proper fiddling with the crystal phasing control, proverbial single-signal reception is possible.

It’s not as crunch-proof as an Omni VI or FT-1000D, but few tube radios were, are, or likely will be. But it’s more than functional, and I get a lot of satisfaction from using it, all the while knowing that I dusted it off, fixed it up and gave it new life.

Yep, that nifty HRO is all mine!



Neil Wiegand, WA5VLZ, with his shack full of goodies. To the right of HRO “Senior” is a Stancor 20P. Next to Neil’s hand is a home-brew regenerative receiver in a wooden cabinet. (photo courtesy of Jim Musgrove, K5BZH)



Electric Radio publisher Barry Wiseman, N6CSW, recently acquired this one-tube transmitter built in an old-style coffee can. It’s an excellent example of vintage “homebrew.” (photo courtesy of N6CSW)

Vintage Radio Resources

Heathkit Repair and Parts
RTO Electronics
4166 Maple St
Berrien Springs, MI 49103
616-473-3201

Transformers—Repair & Custom Made
Peter Dahl
5869 Waycross Ave
El Paso, TX 79924
915-751-2300

Tubes, Parts, Books
Antique Electronics Supply
6221 S Maple Ave
Tempe, AZ 85283
602-820-5411

Collins, Paint, Parts, Rigs
Surplus Sales of Nebraska
1315 Jones St
Omaha, NE 68102
402-346-4750

Ron Foffmar—Collins Junk Yard
1409 West Willis
Alvin, TX 77511
713-331-1074

Manuals for All Rigs
HI Manuals
PO Box Q-802
Council Bluffs, IA 51502

The Collins Collector's Magazine
2645 W Chicago St
Rapid City, SD 57702

Parts, Equipment
Fair Radio Sales
1016 East Eureka St
PO Box 1105
Lima, OH 45802

Hallicrafters Manuals
Ardco Electronics
PO Box 95
Berwyn, IL 60402

Mosley Manuals & Parts
Mosley Antennas
1344 Baur Blvd
St. Louis, MO 63132

Electronic Parts
Newark Electronics
4801 N Ravenswood Ave
Chicago, IL 60640

Metal Inserts for Knobs
(Heath & Collins)
Charles Tabbott
13192 Pinnalle Ln
Leesburg, VA 22075

Electric Radio Magazine
PO Box 57
Hesperus, CO 81326
303-247-4935

• Mercury vapor rectifiers require special attention. If the equipment hasn't been used in a long while, filament voltage should be applied for a few hours prior to applying plate voltage. Refer to an older *ARRL Handbook* for details.

• Some older Novice equipment is "ac-dc" (transformerless). Be sure the cabinet and any exposed metal parts are isolated from the ac line before using or working with them. For an extra margin of safety, use an isolation transformer with these sets. The Hallicrafters S-38, a typical ac-dc receiver, requires only 30 watts of power, so large isolation transformers aren't necessarily required.

• The operating voltages found in tube-type gear should be respected. Exercise care in troubleshooting live sets. The old rule was not to work on any live circuit that exceeded 300 volts. The high-voltage supply of a 50-watt Novice transmitter is more than enough to electrocute you. Don't be paranoid, but be conscious of the dangers. Don't work on energized vacuum-tube equipment when you are tired.

Operating Your Vintage Gear

If your interest is operating vintage equipment on today's ham bands, there are some things to consider. You might

start with a middle-grade-or-better receiver and an AM/ CW or CW transmitter in the 50-watt range. If your interest is sideband, think about a 10- to 20-watt exciter (and perhaps plan to build a small linear amplifier).

AM operation is often found in the 75-meter band on 3880 and 3885 kHz. The 10-meter AM watering hole is from 29.0-29.2 MHz. You will note that the 75-meter group tends to filibuster and that 10 meters features a faster push-to-talk type of operation.

Vintage CW activity takes place throughout the CW subbands, and vintage sideband transmitters can be heard anywhere in the phone subbands. A vintage SSB net meets Sunday afternoons at 2000 UTC on 20 meters near 14.295 MHz.

Vintage sideband transmitters may require more bandwidth than their modern counterparts. If you are sensitive to this, use an audio bandpass filter prior to the transmitter's audio (microphone) input.

Many of the vintage transmitters do an excellent job on CW. Make sure you have a clean note with no chirps and you're all set. If one isn't included, an external VFO can be added for greater flexibility.

In the old days, because many rigs were crystal-controlled, operators typically tuned 10 to 15 kHz up and down the band after calling CQ. The resulting QSO would be "split frequency." These days, answering someone's CQ 10 kHz away isn't likely to result in a contact! If your transmitter is crystal-controlled, you may have to initiate most of your contacts by calling CQ.

Conclusion

We hope that you've enjoyed this introduction to vintage radio collecting and operating, and that you have an interest in the heritage of Amateur Radio. Our intention was mainly to help "set the hook" on those who may already be interested in classic radio, but if you're looking for something to spark your interest and enjoyment of our diverse hobby, vintage radio may be just what the doctor ordered.

We'll be listening for you with our HROs!

Classic Rigs and Amplitude Modulation: Friendly, Nostalgic Ham Radio Partners

The “Good Old Days” of AM radio (amateur and commercial) are alive and well—and you’re invited to join in the fun. The price of admission? An AM transmitter, if you please!

Ten-year-old Luke, KO4IQ, of Alexandria, Virginia, discovered something the other night on 75 meters—people are using AM! Carefully zero-beating the carrier he heard, he pushed the button marked “AM” on his nearly new rig, and was surprised and pleased at what sounded like something special going on.

“I didn’t know anyone used AM!” he said as he and his father leaned closer to the radio, “it sounds really good!” And with that, Luke summed up both the delight and the novelty a growing number of hams are enjoying in what’s becoming known as “The AM Radio Network.”

In the 1950s, about 30 years before Luke was born, a different generation of hams was primarily using AM on the HF bands. Typical stations in those days were mostly homebrew, especially the transmitters, many of which were patterned with an eye toward replicating the grand sounds of commercial broadcast stations.

Sandy, AC1Y, now near Raleigh, North Carolina, was on the air in those days. He spent recent years feeling somewhat unfulfilled using ordinary, narrowbanding SSB rigs. But he now says he’s back on AM having the time of his life with a 1940s Collins 32V-1 transmitter and its matching 75A-1 receiver. His return to the airwaves coincidentally was in the same QSO as Luke’s! The younger ham sure found an expert as Sandy explained the attraction.

Vintage radio equipment—used by many modern-day AMers—seems warm compared to today’s downsized microprocessor-controlled rigs. And it’s not just the thermal distinction that comes with vacuum tubes. It’s also the style of operating and the personal satisfaction that comes

Where to Hear AM

AM activity is most common around the following frequencies.

Band	MHz
160 meters:	Upper part of band.
75 meters:	3.885
40 meters:	7.290
20 meters:	14.286
15 meters:	21.390
10 meters:	29.000-29.200

with building or maintaining radios from a simpler time.

People on AM tend to “make transmissions,” which can be thought of as extended presentations, that yield a slower-paced and somehow deeper train of thought that many find enjoyable. You can sit and think about what someone is saying, collecting your thoughts in a storytelling manner rather than any rapid-fire back-and-forth exchange.

Audio fidelity is also a factor. People sound human; you can hear the subtle nuances of their voices, and the sounds of the rooms they’re in. Gary, N2INR, often puts his three-year-old son Austin up to the “guest mike,” and the youngster says Gary’s call letters at the right time. He’s even been heard talking with the seven-year-old twin daughters of Russ, WB3FAU, in what may someday become a DX romance between Erie, Pennsylvania, and Syracuse, New York!

If old-time commercial broadcasting conjures up the image of families gathered around a big radio console listening to programs long gone, then hams continue to enjoy that Golden Age with their own two-

way entertainment.

Dave, K3ZRF, and his wife Pam can often be heard Sunday afternoons around one of the AM gathering points (see the sidebar) discussing stories as diverse as their homebrew beer and Dave’s background as a sound man for big-stage rock bands in the 1970s.

Bill, W3DUQ, not far from Dave outside Philadelphia, is trained in sensory perception and how it relates to the tuning in of other worlds. He can be heard on 75 meters leading elaborate QSOs on research and speculation in the field. It seems the use of AM—with its related, inviting pace—encourages and contributes much to the conversations.

You may have even heard a two-way radio talk show on the ham bands that rivaled the energy of any “Oprah” or “Sally Jessy.” One of the authors, Paul, WA3VJB, staged a series of weekend roundtables with his friend Debra Daigle, as they called on their skills as professional radio journalists to coordinate lively debates among hams on various issues.

AM lends itself to such conversations. A certain entertainment factor is obviously translating from what’s found in broadcasting, but it’s far more exciting to take part than be a passive onlooker.

There is also plenty of stuff for the technically minded, especially when it comes to using the vintage gear many AMers use. A typical AM QSO might focus on restoration tips, problem-solving and the sharing of hands-on experience.

“You can get in and horse around with it,” says Craig, VE3NCC, of Sherston, Ontario. “It’s much more risky to work on the circuits of a \$2000 modern rig,” he



Author Paul Courson, WA3VJB, sits at the controls of an AP Radio network console (at work) and at the controls of his shack. Which is which? The ham gear and the red "hot phone" are in his shack...which, as you may have guessed, doubles as an audio production studio!



adds, "but if you take that 50-year-old AM rig and burn it up or blow it up, who cares?" And he says you'll have learned something in the process.

Eric, WB2CAU, of Dix Hills, New York, adds to the point by noting that a large percentage of AM operators still homebrew their own equipment. "The simplicity of design of an AM transmitter makes it perfect for the ham who wants to 'roll his own,'" as Eric puts it.

Many AMers like to mix a little state-of-the-art technology with their vintage pursuits. Synchronous detection—formerly found only in the most expensive shortwave receivers—is one such hotbed of experimentation. Even though synchronous detection has been around for decades, modern circuitry not possible during the tube era enables new, sophisticated ways of achieving a static-free, non-fading signal on the shortwave ham bands.

Amplitude modulation itself is also taking advantage of advanced circuitry not even dreamed of when high-level plate modulation was the rule. Hams experimenting with Pulse Duration Modulation helped perfect the method for use in modern AM broadcast transmitters—saving commercial stations a bundle! Solid-state, high-power audio circuits have also increased the efficiency of AM by a substantial amount.

AM takes an appropriate place within the amateur service as a specialty mode—one of many facets hams can pursue. It's not meant to be a primary communications medium, but instead a nostalgic piece of our radio heritage—with a nod toward the technical advantages of SSB for routine and emergency communications.

Many of today's hams joined the hobby

long after SSB's struggle for acceptance, and some people like Luke—who was born in 1982—know only the solid-state era of technology. Most get a kick out of checking out the world of vacuum tubes, the "big" sound, and the friendly group of hams on AM who are delighted to share the festivities with a newcomer.

AM operation also draws people from outside the hobby. More than a few hams started as shortwave listeners (SWLs) who were introduced to Amateur Radio via AM QSOs. Author Steve, WB3HUZ, notes the typical shortwave radio cannot demodulate SSB. "Although I was unaware of it," Steve recalls, "I had tuned across the ham bands as an SWL."

"Unfortunately," he continued, "all I heard were strange-sounding, indecipherable signals that I would later learn were SSB operators." He said that "one day I tuned across some AM operators in the 75-meter band, and the rest is history!" Today, with many inexpensive receivers available to the public, AM can continue to play a role in recruiting new hams.

Getting Started

Okay, so how do you get into this little specialty? First, it's easy to take a modern transceiver, push the "AM" button as Luke did, and listen in. There's no need for a vintage receiver/transmitter combination right off the bat.

For transmitting, some care will need to be taken with modern rigs to get the right mix of audio and carrier levels. Few of today's transceivers are capable of producing the level of carrier to match the potential audio used on SSB. Instead, a rule of thumb is to adjust the mike gain to about 30% of what you'd use on sideband, and set carrier to whatever power level the manufacturer suggests—usually about 50% of your rig's rated PEP output. [The grapevine tells me that the Kenwood TS-930S makes particularly good-sounding AM for a modern "low-level modulation" rig.—Ed.]

Also, to fully enjoy the quality of the audio most AM stations are transmitting, you'll need the kind of receive bandwidth that makes a typical shortwave station sound good. Narrow SSB filters are unsatisfactory, and will make an AM station sound muffled.

Communications-quality speech processing sounds bad when transmitting AM. Turn it off in favor of a carefully adjusted mike gain. Other AMers are glad to talk you through the initial settings to get your rig sounding good, and then you can mark those positions for the next time you join in. Ideally, you would use a monitor scope for the initial tune-up.

So You Want a Vintage Set of Your Own!

Finding a vintage radio of your own may be the next step. There are swap nets on both East and West coasts catering exclusively to older, AM gear. The "AM Swap Net" serving the Northeast and Mid-Atlan-

Magazines and Newsletters for Vintage Radio Enthusiasts

Electric Radio

PO Box 57
Hesperus, CO 81326
Published monthly, with good artwork for technical articles and quality photos of classic rigs and vintage stations and a large classified section. \$24/year.

AM Press Exchange

2116 Old Dover Rd
Woodlawn, TN 37191
Published bimonthly, an editorial forum and debate on the role of vintage radio today. Also a variety of technical contributions on both new and old technology related to AM. \$15/year.

AM International

9 Dean Avenue
Bow, NH 03304
A revival of a group formed in 1967 to preserve AM as a well-regarded part of Amateur Radio heritage. An organizational advocacy group of active AMers.

Ham Equipment Buyers Guide

Barbara Wixon
189 Kenilworth
Glen Ellyn, IL 60137
Volume One tabulates transmitter and receiver data for units made from 1946-72. Pictures, specs, tube complements, production differences. An important identifying tool.

AM Radio Network

Box 73
West Friendship, MD 21794
Informal association of members active in the AM community. Handles SWL inquiries, coordinates social gatherings, acts as a liaison to commercial media outlets on feature stories.

I'm Waxing the Transmitter!

By Paul S. Courson, WA3VJB

Shirt-pocket FM transceivers and HF rigs the size of nightstand clock radios remind us how far we've come from the days when a room full of tube-type gear made up the typical ham station. But it wasn't until a call from my girlfriend, one dreary, wet day, that I realized why I'm still drawn to that old, glowing gear.

I was putting a coat of wax on the massive front panel of a commercial broadcast transmitter that I had picked up this past summer. And when she asked what I was doing, it seemed just as natural to be waxing the transmitter as it would have been to, say, be waxing the car.

This 1946 Collins has the same kind of chrome, metallic paint and high-gloss finish as any automobile of the era, plus large viewing windows for passers-by to watch the light of a quad of old 810 triodes.

But this isn't a car, it's an old transmitter. Pam didn't say much as I told her I was waxing the transmitter, and it then dawned on me that perhaps not everyone understands. Luckily, she already knows most of the equipment in my station is older than she is, so she easily assumed that this latest activity was connected.

The old car analogy is a good one, actually. My original Novice transmitter, a Collins 32V-2, is still with me some 20 years later. It's like hanging on to my first car.

When my Elmer sold it to me, he said, "This will be a fine CW rig until you get your phone ticket," his idea being that SSB would be in my future—something this transmitter did not produce. But I became absolutely hooked on those glass, glowing things inside, where I could see (or so I thought) the electrons creating a signal for me as I worked my first contacts.

Perhaps my first feeling of "warmth" related to old radios came with sitting down at the rig, my new license posted nearby, having just come in from the winter cold to test if I'd properly trimmed the antenna. I would put my hands on the transmitter cabinet to warm up!

My grandfather used to watch me operate, knowing the rig was old. It usually got him telling a story about the early days of radio, and he'd often ask me, "Did you get California?" on my wireless, since to him that seemed like a huge distance. He was never a ham, but he understood even better than my parents the magic in signals from points far away.

So the memory of our heritage, both family and of radio, is another part of the warmth with this vintage equipment. I think back to my grandfather, and what radio must have been like when he was growing up, and somehow I feel connected when my own storytelling unfolds as I get on the air with others who share an appreciation of "classic" radio.

But the event that really convinced me this 32V-2 would not be cast aside for a new SSB rig as my phone ticket arrived was the discovery of a group of hams on 75-meter AM. There was a certain incentive licensing at play that took me to Advanced instead of just General, since this group was congregating around 3.885 MHz, which at the time was in the segment reserved for the highest grades.

It once meant a trip to an FCC office for an upgrade from Novice. My grandfather took me in his big 1964 Buick

Electra, trying to reassure me that I'd do fine on the exams. He was right, but then there was the dreaded wait until the actual license came in the mail—no instant upgrades!

I spent the weeks with my receiver parked on The Big 85, trying to remember the names and call signs of people I'd soon be working. They were all using older radios, some just like mine!

Oh, sure, I lusted after the then-new Yaesu FT-101 as the most wonderful rig around. And I even hoped someday I'd be able to afford a Collins S-Line. But those thoughts faded quickly as I spent time with my new mode and this old radio.

My storytelling skills improved, even to the point I later majored in journalism in college and ended up with a career as a radio news reporter. Early in my career, I worked at a daytime-only AM station and was also an assistant engineer. It seems the chief put enough faith in my ham radio technical skills to set me off on some routine chores.

It was then that I got an appreciation of big AM transmitters as perhaps the step beyond the 32V-2. But it would be another decade before I'd realize my dream of a true "Big Rig" in acquiring the transmitter I was waxing the other day. Another daytime AM station had changed hands, and the new owners were preparing to scrap this wonderful rig as part of a station move! I got it just weeks from the scrap yard.

This is the station's original transmitter, and reportedly Art Collins himself, then W9CXX, was one of the site engineers who helped put the station on the air with his

broadcast rig, a model 300G-1. It's been replaced these days by a solid-state unit about the size of a kitchen microwave oven. The station is saving a lot on its electricity bill.

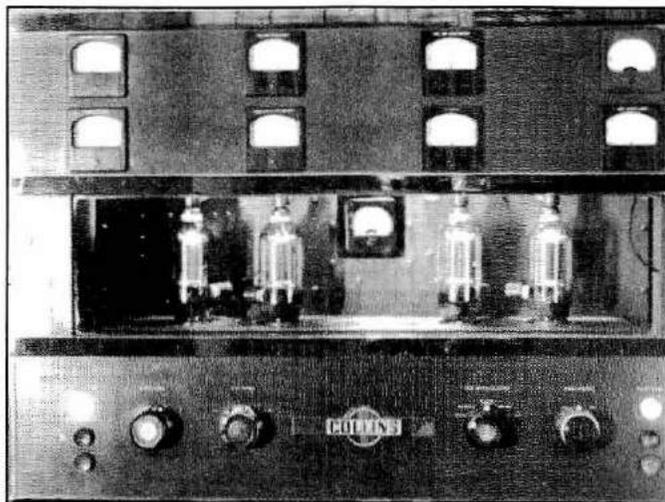
Mr Collins made it easy for me to bring the rig up to 75 meters by using a pi-network output. The retune involved mostly some sequential adjustments in existing variable inductors. To round out my "dream" station, I use a Yaesu FT-101 as the exciter.

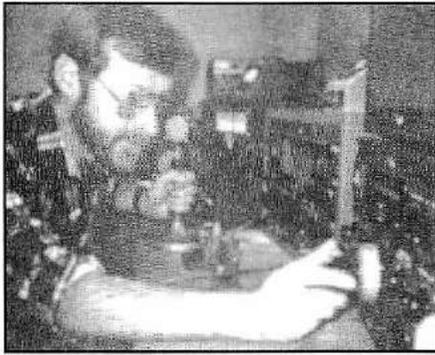
Older hams tell me it was a common goal years ago to combine a first-rate amateur station with audio that approached broadcast quality. So I took the idea to the next logical step—given my career—and built myself a replica 1960s broadcast station.

I use a lot of this old but functional equipment for producing audio news tape, which helps justify such an elaborate setup. But when I'm not working on an assignment, it's great fun to use it on the ham bands.

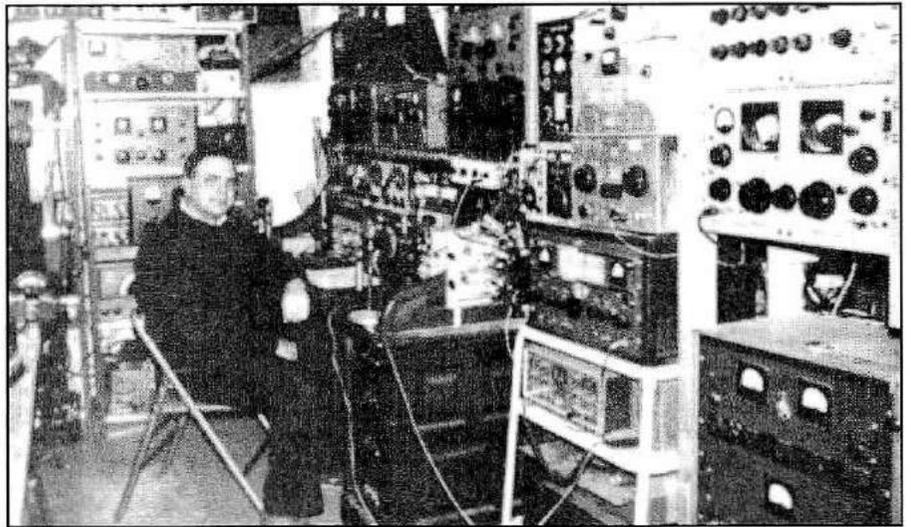
I am fortunate to live near the Chesapeake Bay, which helps my antenna system radiate effectively. Based on letters I get from SWLs around the region, my station is doing its part to recruit new hams. Many listeners say they just happened to pick up our AM conversations while looking for new shortwave stations. They ask how they can join us.

Ultimately, putting together a vintage radio station involves more than just a cash outlay, compared with someone who might simply go out and buy "the best" of today's offerings. There is a very important sense of accomplishment gained from setting up a station that's out of the ordinary, if you've ever waxed a transmitter, you know what I mean.





QST author Joel Thurtell, K8PSV, has a lot of vintage AM gear at his Plymouth, Michigan, QTH—so much, in fact, that his wife recently “suggested” that he move some “AM iron” out of the way so she could park her car in the garage! (photo by 11-year-old Adam Thurtell, courtesy of *Electric Radio* magazine)



As you can see, Jim Hanlon, W8KGI, of Sandia Park, New Mexico, takes AM operation and vintage radio seriously! (photo courtesy of *Electric Radio* magazine)

tic regions gathers each Thursday evening at 7:30 Eastern Time around 3.885 MHz. It covers as far as the Great Lakes and Florida.

Left Coast hams wanting to join the AM Radio Network with vintage rigs can join the swap sessions held every Wednesday at 9 PM Pacific Time on 3.870 MHz. This net serves California, the Southwest and the Pacific Coast states.

Also, be sure to check out the variety of publications serving the market for older gear (see the sidebar, “Magazines and Newsletters for Vintage Radio Enthusiasts”). Many have classified sections dedicated to such equipment. *The Ham Radio Equipment Buyer's Guide, Vol I* is a gold mine of pictorial, descriptive information on receivers and transmitters made from 1946-72, including specifications and main tube types used.

Classic Rigs You'll Find

An in-depth discussion of which vintage rigs to look for and how to return them to good operating condition could easily fill an article or two on its own [which it will, in upcoming issues.—*Ed.*]. In the meantime, here are some rigs and options to consider. Among the more popular classic radios found on the bands these days are units made by the E. F. Johnson Company of Waseca, Minnesota. The “Ranger” is often heard, as are the “Viking” and the “Valiant.” These and other E. F. Johnson AM transmitters sell at hamfests for about \$100. Heathkit made some rugged transmitters, too; look for the DX-100, the TX-1 “Apache” and the “Ma-rauder,” among others.

Already mentioned are the Collins transmitters that sat on many tabletops in the 1950s. The 32V series was considered

top of the line for audio quality, circuit fortitude, and ease of operating. The latest version, 1953's 32V3, also featured extensive TVI suppression—something that's still important today.

If building something sounds appealing, you could start by modifying an existing transmitter for better audio. Heath's “Scratchy Apache” is a popular candidate for such an upgrade since stock units deserve the nickname! Old *QST* articles and *ARRL Handbook* projects from the era are invaluable reference material.

This facet of the hobby also has its share of premium rigs that still command top dollar. The Collins KW-1 and 30-K, and the Johnson Desk Kilowatt and “500” models are good examples.

There are also some ex-military transmitters that do very well reviving that feeling of Classic Radio. The WWII-vintage BC-610 is common, and typically sells for a couple of hundred dollars. Its younger sister, the T-368, is also popular.

Lately, as AM broadcast stations find it harder to justify the high electricity and maintenance costs of running older transmitters, some truly “hi-fi” rigs can be had—often for the asking! Long-time community stations are the best source (see the sidebar, “I'm Waxing the Transmitter!”).

Vintage receivers are nearly as hard to recommend as transmitters, since it's so easy to overlook someone's favorite. Hammarlund unquestionably produced some of the best, including the SP-400, the SP-600, the HQ-170 and HQ-180. Others are also found, but these are the most com-

mon models. Hallicrafters offered the SX-101, the SX-100 and the SX-110, among others, and National Radio's HRO series still commands top dollar among collectors. Also, look for National's NC-300, NC-303 and NC-183 receivers.

Collins Radio's 75A series was the most definitive from Cedar Rapids, at least among those marketed to the amateur community in the 1950s. The 75A-1 and 75A-2 are less sophisticated than the 75A-3, which, along with the 75A-4, includes the renowned Collins mechanical filtering.

Among military receivers, the R-390 and R-390A provide some of the best audio around. They feature an extended audio frequency response and low distortion, while also sporting mechanical digital read-outs and a variety of filterbandwidths. Also check the R-392, the R-388, the 51J series and the BC-348.

“Real radios glow in the dark,” says Sam, W6H DU, who believes the best examples of a given transmitter or receiver have already been snapped up by members of the AM community. “The good stuff does not show up anymore,” he explains, “and you may have to approach someone on the bands to buy a quality piece.”

But the effort will be worthwhile, as thousands will testify. A vintage radio station will not only foster a sense of history, it also may revive a feeling of excitement in communicating that might be missing for some people. Moreover, the “Golden Age of Wireless” is alive and well—on The AM Radio Network, and you're invited to join in the fun! See you in the “AM Window!”

Mastodons, Mummies and Magic Eye Tubes

Kids, little optimists that they are, spend a lot of time looking up. Some of my earliest memories are of doing just that—peering through the display case at the Egyptian mummy in the Wayne County Historical Society museum, and craning my neck to take in the mastodon skeleton in the Earlham College science museum.

I've been a pushover for libraries and museums ever since. They were my childhood sources for the book *Marconi, Father of Radio*, and for a chunk of galena, on sale for a quarter at the college.

About the time I became a Novice, a local ham—a counterman at the radio parts store—invited me to his own personal museum: his hamshack. This was in 1961, and his gear was mostly pre-war. My first transmitter was a copy of a *QST* design from 1938 ("The QSL Forty," *QST*, Feb 1938, p 24), which Les Fraser, W9DD, helped a 12-year-old put together.

The theory behind wireless—radio—is so elegant it makes you wonder who designed it. Over here, make waves by stirring up some electrons. Over there, snatch those waves and do what you want with them. The beauty of early wireless gear is that one glance almost intuitively tells you how it worked. But it is unlikely you'll find a spark transmitter and coherer receiver in any science classroom.

Fortunately, thousands of visitors every year can see and touch such apparatus in museums. Not too long ago, I visited one of the very best, the Antique Wireless Association's Museum in East Bloomfield, New York.

The AWA Museum looks like a museum, smells like a museum, and its floors creak like a museum. But what strikes the visitor with radio on his mind is that everything looks like radio—the spark transmitters fill the air with glorious ozone, and signals emerge from 50-year-old receivers just as cleanly as from the latest product of the 1990s.

While museum curator Bruce Kelley, W2ICE, sings the praises of a host of local volunteers who help out around the Museum, it is clear that Kelley himself is its guiding light.

About 1936, the young Kelley began collecting radio tubes and old gear while living in Rochester. In 1948, Kelley, then 34, set up a museum in his barn in Spencerport. Kelley, who worked for Eastman Kodak, began putting on shows combining equipment and slide presentations at club meetings and hamfests. These began taking up so much of his time that, in 1952, Kelley founded the Antique Wireless Association with George Batterson, W2GB, and Linc Cundall, W2LC.

"Bruce came over," Batterson later wrote, "and I told him that I had a lot of old gear. We went out to the garage and when he saw the spark transmitter he just fell in love with the thing. So I suggested, why don't you take all this equipment home and let's get a museum started there."

While the AWA grew in membership, Kelley and his museum moved to a new home and a new barn in Holcomb. The *Old*

Timer's Bulletin was founded in 1960, the AWA National Conference debuted in 1963, and in 1972 the AWA was incorporated as a not-for-profit organization.

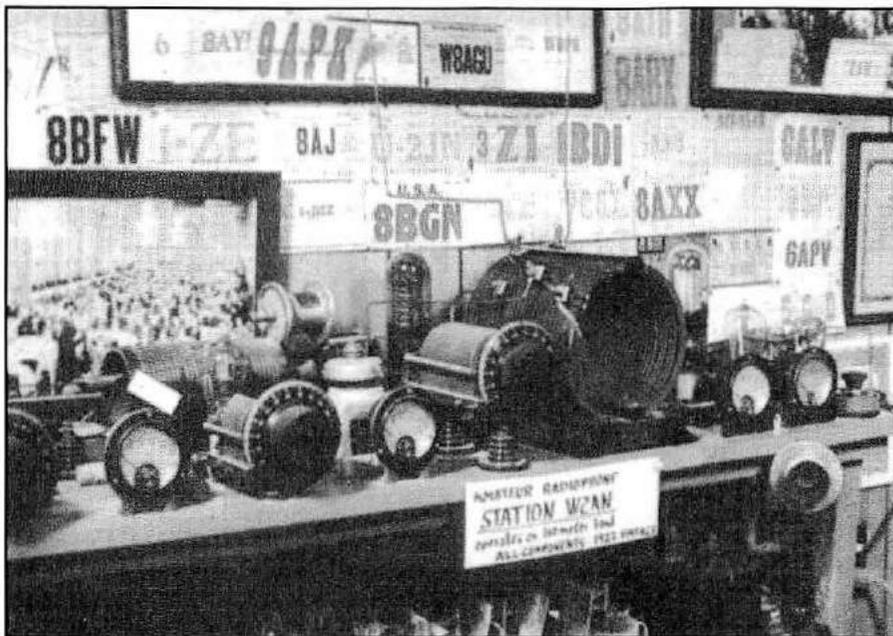
By 1970, Kelley's barn was overflowing (it still is!) and the AWA was able to lease about half of the Bloomfield Academy building. Following renovation of the 1837 structure, the AWA museum moved in alongside the museum of the Historical Society of the Town of East Bloomfield, which occupies the other half of the former school.

The Museum is a little off the beaten path; East Bloomfield, about 20 miles from Rochester, is one of the oldest settlements in western New York. Townsfolk in Bloomfield and Holcomb (where Kelley lives, a town settled just after the American Revolution) continue a centuries-old feud over just where their borders belong.

The Museum building sits next to a town



Jim Lamb's original single-signal superhet is in the foreground; directly behind it is a typical 1920s-vintage transmitter, and to the right a '20s receiver. (Jim Kearman, KR1S, photos, except as noted)



An early 160-meter 'phone transmitter from about 1922. Note most of the QSLs are for call signs beginning with a number; no letter designator was required. Some hams, such as U2JN, added "U" for "United States." 1BDI was Ed Handy, author of the first *ARRL Handbook* and ARRL communications manager from the 1920s to the 1960s.

Creampuff

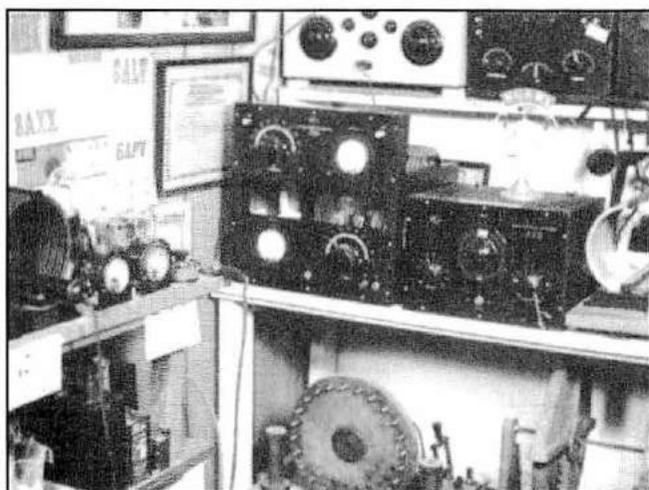
Page one of *The New York Times* for November 3, 1907, featured 26-year-old Walter Willenborg of Hoboken, New Jersey, a student at Stevens Institute. "New Wonders with Wireless—And By a Boy," the banner headline proclaimed. The *Times* reporter was enthralled by Willenborg's ability to listen in on traffic between the Marconi stations at Glace Bay, Nova Scotia, and Clifden, Ireland. "Messages from everywhere to everywhere and back buzzed into our receiving instrument," the story said (and as reported in *Inventing American Broadcasting*, by Susan J. Douglas, the Johns Hopkins University Press, copyright 1987.)

Willenborg had bought his wireless equipment in France (most commercial gear was made in either France or England), and after his fling with fame, in 1920 he gave up radio and locked up his essentially unused station in the attic of his home, where it would lay for nearly 60 years.

In 1979, Walter Willenborg's son, along with Brother Patrick Dowd, an AWA member and avid collector himself, opened that room. What they found was Walter's equipment, ranging from 1906- to 1912-vintage, in pristine condition and complete in every respect. It is now on prominent display at the Museum. Kelley believes it to be the oldest intact amateur station to be found in recent years.

Eighty-four years later, daily newspapers once again are putting Amateur Radio on the front page—"Hams tune in to events in gulf."

After four generations, the public is still fascinated by what hams—and only hams—can do.—K1TN



Commercial gear: On the left is a late 1920s Radio Engineering Labs 'phone transmitter for 80 meters; on the right is a companion REL regenerative receiver.

green graced by Victorian, Federal, and Colonial period homes, inns and churches.

A pamphlet describing a walking tour of the area notes 47 historic stops within less than a mile, so visitors can investigate the Bloomfield Academy museum and the tour sites as well as the AWA Museum.

All this is up the road just a few miles from the resort town of Canandaigua, where you can boat, fish, golf and so on. Your travel agent will refer to the entire area as the "Finger Lakes Region."

Last year, the annual AWA convention drew about 1000 people, and it is moving from Canandaigua to Rochester to accommodate the crowd. It's scheduled for September 25-28, 1991.

On the way to East Bloomfield from the east, you might want to take a side trip to the Womens Hall of Fame and the Womens Rights National Historic Park, both in Seneca Falls.

The AWA Museum is open from May 1 to October 31 (this part of the country measures snowfall in meters). Some 4000 people visit each season. "Licensed hams long ago ceased to be our best 'customers,'" Kelley says (admission to the Museum is free). "We encourage tour groups and they range from school classes and scout troops to retired folks, antique auto caravans and even motorcycle clubs."

Let's go in.

The main floor and biggest area of the Museum is what could be called the "consumer electronics" section, with everything from Victrolas and early televisions to a caseful of telegraph keys. The control panel for the Museum's high-tech security system is as out of place as a typewriter in a computer store.

One thing you'll notice is that there are very few display cases; most of the stuff is out where you can (gently) touch it and sniff it. One display case is brimming with 1950s and '60s transistor radios, by more manufacturers than you ever knew existed. I searched without success for my 1958 Zenith seven-transistor model—the one I used to learn about inductive coupling by wrapping wire around the outside of the plastic case (this is called having DX in your blood).

In an earlier story on his museum (*QST*, May 1959, pp 92-94), Kelley explained why even then (when the Museum was still in his barn) some commercial equipment was displayed as well as taken to shows and hamfests:

"In the early days of wireless, the amateur's transmitting range was limited. Hence, DX was strictly on the receiving end, and calls such as CC, FL, POZ and NAA [early commercial and military stations—*Ed.*] were as familiar as W1AW is today."

Kelley also noted that before licenses were required, amateurs and commercial wireless stations would often talk to each other—and sometimes interfere with each other!

One of the keys displayed on the main

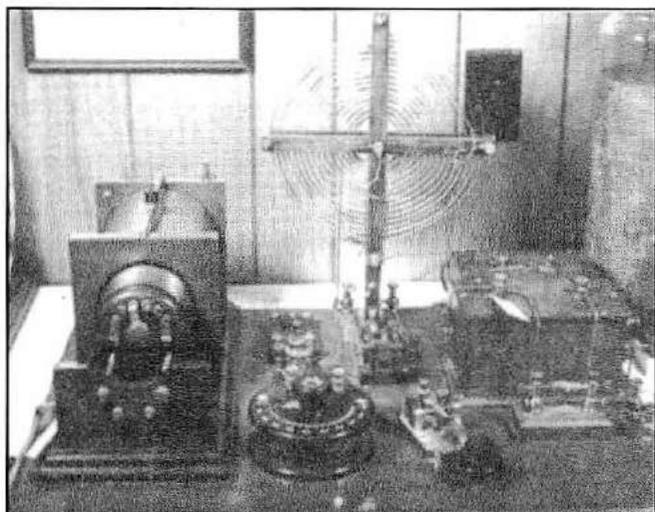
An Empire of the Air

If you can't get to the AWA Museum this year, two alternatives are in the works. The photo is a "still" from an upcoming movie, *Empire of the Air*, by Florentine Films, produced by Ken Burns (who made *The Civil War*). A book of the same name, by Tom Lewis of Skidmore College, also is near completion. Both are due out this fall.

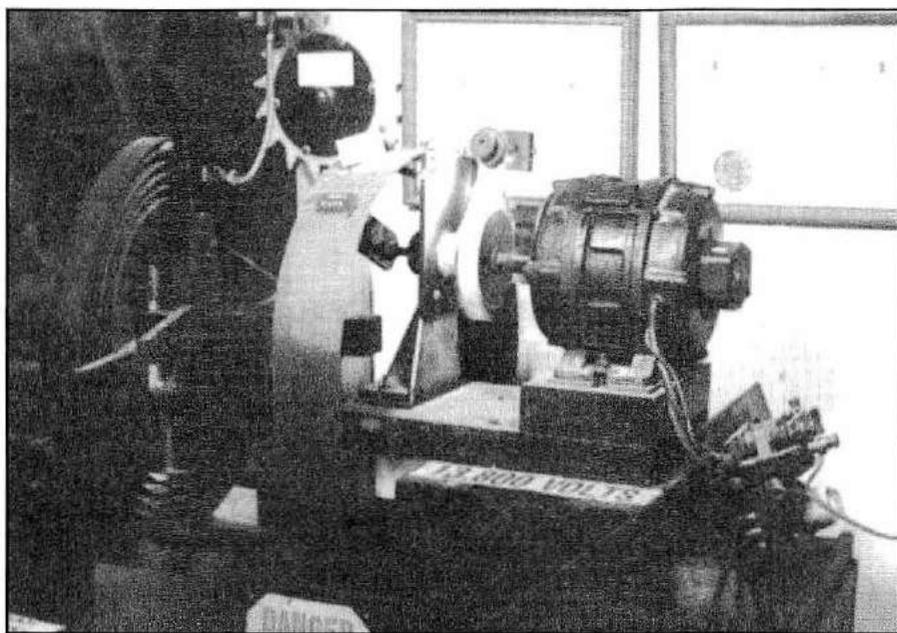
Several filming sessions for Burns' movie have taken place at the AWA Museum. During one of them, a spark transmitter was fired up on the third floor while a vintage receiver was used on the second. Everything went fine, once the problem of RFI from the spark rig into Burns' 16-mm equipment was solved!—K1TN



A "still" from the film *Empire of the Air*.
(photo courtesy of Florentine Films)



From the 'teens: On the left is a cat-whisker crystal receiver; on the right is a low-power spark transmitter.



The 8TC spark transmitter (see text). To achieve synchronization, the motor of a spark rig has to run at a multiple of the ac line frequency; this one runs at 3600 rpm.

floor is reputedly Hiram Percy Maxim's personal key. Take a breath and imagine The Old Man, hand on the knob, gently explaining to a newcomer the difference between AR, K, and KN.

School kids are mesmerized by television sets the size of washing machines with three-inch screens, by the lifesize RCA Dog and by a pair of (working) crank telephones.

Astride the main area are several anterooms. One is the 1925 radio parts store, set up with a counter, cash register and shelves and cases of ancient components (nothing in the "store" is actually for sale). One of Kelley's favorite spots seems to be behind the counter. Tell him what you need and chances are the store has it in stock, often in its original carton.

Ask a question about a component and you may get a half-hour dissertation on it, from Kelley or another of the museum's volunteer tour guides.

Next to the store is a Western Union station, with a pumphandle key and telegraph sounder, and several other complete 'teens and '20s stations.

Also on the main floor, in what could best be called a walk-in closet, is the National Radio Company room, featuring a number of the famous HRO receivers and several historic documents. Very historic documents, actually, including Kelley's original prints from the 1921 Transatlantic Tests ("Oh, Mr. Printer, how many exclamation points have you got?").

James Lamb's original, groundbreaking "single signal superhet" receiver (from *QST*) is here, too.

Now climb the steep, narrow stairway to the third floor, turn left at the wallfull of old headphones, and enter W2AN—the Inner Sanctum for us hams.

Up here are several ham stations from different historic periods. Even the Museum's "modern" setup uses gear that's 30 years old, including a 2-meter FM trans-

ceiver from Inoue Electronics, known today as ICOM.

The highlight for many visitors is the Museum's kilowatt synchronous rotary spark transmitter ("the Rolls Royce of spark rigs, with a distinctive, musical note").

"Never have I seen, heard or smelled anything so wonderful!" wrote Jim Hanlon, W8KGI, in a recent issue of *Electric Radio*. "Talk about real radios glowing in the dark; this one shatters the spectrum from audio to RF to light, and generates ozone to boot."

The noise from this monster is so intense, Kelley wears a pair of headphones as ear protectors when he fires it up.

This sputtering transmitter, originally used by 8TC from 1917 to 1921, was first reactivated in 1958, at the ARRL National Convention in Washington, DC. FCC secretary Mary Jane Morris, in a letter granting permission to fire up the rig, wrote:

"...the proposed operation would afford hundreds of persons attending the convention their first opportunity to view amateur spark operation typical of the early days of amateur radio operation."

Like all museums, the AWA rotates its exhibits. And like all museums, there always is too much stuff. Down the road a piece, next to the American Legion ball field, stands the Annex, "The Bruce Kelley AWA Research Center," a 2400-square-foot building.

While the Museum itself is the showcase, the Annex is where the work gets done. From volunteer parties of local hams refurbishing equipment to researchers using the Annex's extensive library, the place is busy year-round. A large quantity of vintage ham gear is kept in the Annex, along with stockpiles of magazines and books. We were particularly taken by some early military portable sets, packaged for front and foxhole.

In the attic of the Annex are some 50,000 spare vacuum tubes, which are used to restore old radios.

The Annex is just about full, but the



A visitor inspects the "Wall of Headphones."

Museum doesn't turn much down. "Our greatest resource," says Kelley, "is the guy retiring to Florida or moving into smaller quarters."

"We also have received substantial gifts of equipment from schools such as Union College, Cornell University, and the Rensselaer and Worcester Polytechnic Institutes. Old alums remember where stuff was stored and eventually we end up with it."

According to Kelley, although the AWA Museum (along with others in the US) has many interesting and valuable items, "the best stuff is in England." For example, AWA has the oldest vacuum tube in North America—a 1905 Fleming Valve, but England has one that's older: a 1904 version of Fleming's tube, displayed at the British Science Museum in London.

An interesting chart on the wall shows the value of old *QST*s. Those from the 1930s on are essentially worth little to collectors because plenty are available. From 1930 back, however, the value increases, with a few exceptions. "The first issue of *QST* was overprinted" (because the League's founders were speculating on response), "and not as valuable as, say, early 1916 issues," Kelley says.

Last winter, a complete set of *QST*s came on the market for \$3000. That works out to \$3.33 an issue (for 900), compared to the current cover price of \$3.

Asked about the value of rare pieces of wireless gear, Kelley compares them to works of art. "An 80-year-old Marconi receiver might be worth \$25,000," Kelley says. "On the other hand, a one-of-a-kind radio is priceless."

Bruce Kelley let us see his barn collection. My first thought on entering was of Frank Zappa's album *Joe's Garage*, and of Ken Kesey's *Garage Sale*.

Songwriter Neil Young, who spoke recently in *Newsweek* about his *Ragged Glory* album, says he wrote some of the songs "out in my barn in front of 15 old cars with their hoods up. Just me and all these old cars. And the spirits of the people who were in them."

Bruce Kelley's barn speaks of the man himself—it's the dream junkbox. Kelley opens a special case, extracts a DeForest Audion, and cradles it in his hand, a hand that has held more Amateur Radio history than probably any other.

The Audion, a watershed in the development of radio, is—at 80—just slightly older than Kelley.

It was difficult to decide if that Audion gave power to Kelley, or vice versa. Maybe a little of both.

The opening scene from Stanley Kubrick's *2001, A Space Odyssey* came to mind, and I went away with the strains of *Thus Spake Zarathustra* in my inner ear.

Like I said, I'm a pushover for museums.

The Bullfrog

Why fix it—or replace it—if it ain't broke? This ugly rig has yet to "croak!"

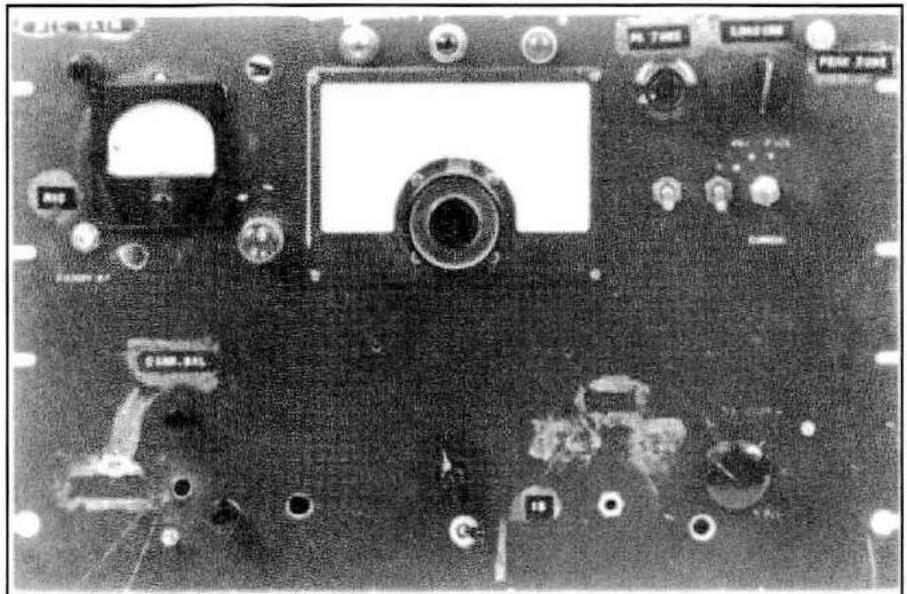
Just after sunrise on a day in early April 1950, I was delighted to hear someone with an Aussie accent testing an SSB rig on 20 meters. VK7DH had just connected his new rig to an antenna for the first time. I was on his frequency in about 10 milliseconds and the QSO that followed turned out to be the first transPacific two-way SSB contact between amateur stations. This was confirmed when a card arrived from By Goodman, W1DX, of the ARRL (Editor of *QST*'s How's DX? column until February 1947), who reported that no earlier contacts had been claimed. I still use that rig. It's almost 43 years old and had been in use for about two years when the VK7DH contact was made.

When I tell people my SSB rig is a 42-year-old filter-type, the usual comment is, "Who are you kidding?" My transmitter is often older than the party on the other end of the QSO. Occasionally, I'm advised that SSB did not exist in 1947. To that latter crowd, perhaps I should mention that SSB was used by AT&T in the '30s, maybe even earlier.

I've never been partial to store-bought ham gear. I have some, but I try to keep quiet about it. Anybody can own a ham station and an antenna farm that looks like a Voice of America installation. All it takes is money, but where's the fun?

I've chosen to stay with my home-brew transmitter and, until a few years ago, a home-brew receiver as well. The description of my ancient equipment is not a tale intended for the faint of heart. It began when I overheard a discussion of SSB during a 20-meter contact. The year was 1947. At the time, I was employed by the Western Electric Co. the manufacturing arm of AT&T. Consequently, I had access to lots of "hush-hush" information and in no time at all, was bashing holes in aluminum boxes, wearing out Greenlee punches, 3/8-inch drill motors and cornering the market on rattail files. Work began with rudimentary drawings, namely a block diagram, schematics only for the VFO and a couple of the mixers, and no mechanical sketches at all. It's a construction method known to the trade as "orthodox haphazard."

In any voice transmitter, the trick is to



After warming 20-meter SSB for 43 years, the K4CX "Bullfrog I" looks a bit shabby—an ingenious strategy designed to keep other hams from suspecting its true capabilities! (K4CX photo)

get from the microphone to the antenna or, to put it another way, the builder must somehow get from AF to RF with a minimum number of detours.

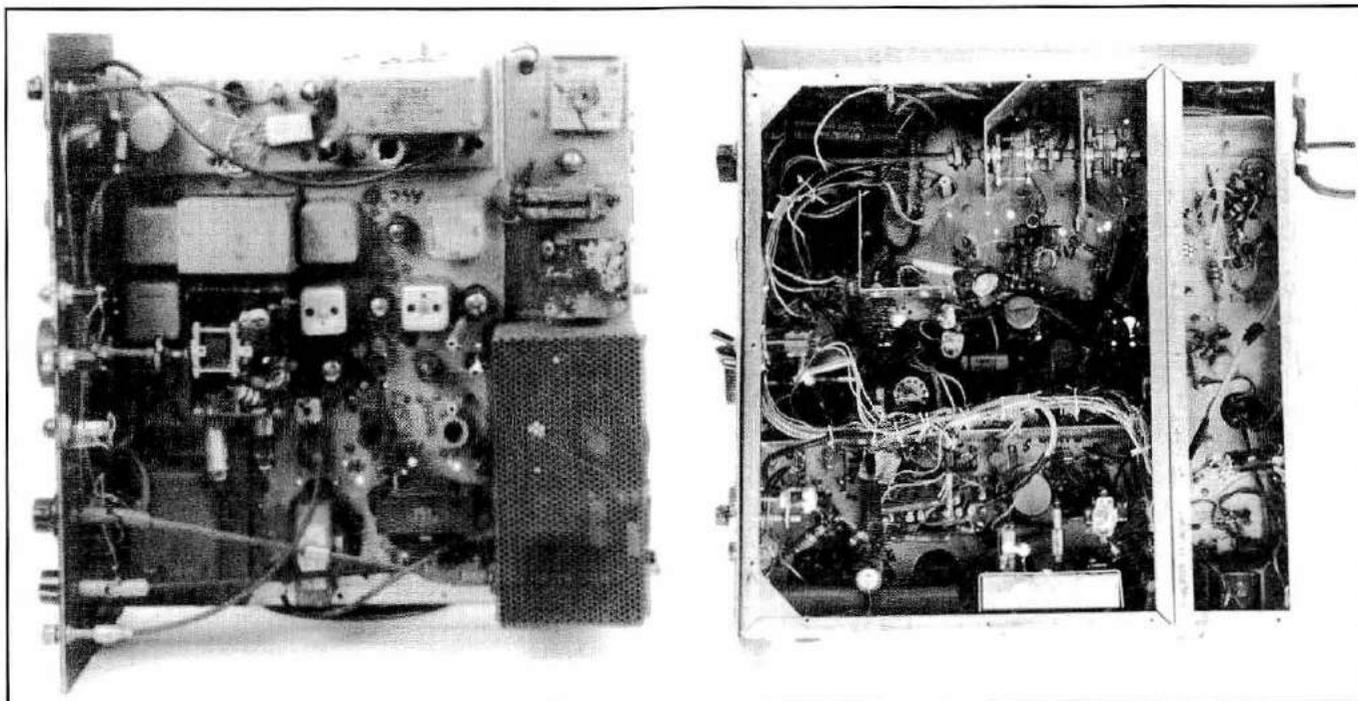
In conventional amplitude modulation (AM), it's a one-step process—build up lots of audio watts and use a modulation transformer to couple those watts to the high-voltage dc lead of an RF amplifier capable of producing even more watts. Having done that, we've produced a big whistle and two sidebands, both saying the same thing.

SSB is another kettle of fish. It was earlier called single-sideband suppressed carrier (SSBSC), but that terminology fell into disfavor when it was universally agreed that the carrier would be suppressed in any case. Thus, we call it SSB, or just sideband, and to get from AF to RF in this instance demands a few more bits and pieces, better shielding, more holes in the chassis and a fresh supply of rattail files.

Keep in mind that I'm describing events in 1947, a time when I'd already been licensed for 15 years. It would be a few

more decades before the marketplace would feel the full effect of the research efforts of an army of physicists and other expert killjoys who took all the fun out of home projects by creating little gray and black things with as many as twenty legs on a side, designed to byte and chip (pardon the pun) away at the nostalgic mental images of mercury vapor rectifiers casting their garish blue shadows on the ham shack wall. A plague on the lot of them!

Not only did they bring on the demise of the true home-brewer, they also put an end to the thrill of self-incandescence, an experience encountered by many of us when we inadvertently got tangled across a fully charged 8- μ F 4-kV filter capacitor. Those marvelous high-voltage, low-current companions of yore have been replaced by low-voltage, high-current clumps of plastic, packed with invisible stuff, that just sit there doing whatever it is they do, without exhibiting any evidence of personality or conscience. Oh sure, their heat sinks can raise nifty blisters, but blisters hardly compare with the thrill of being slammed



The carefully guarded details of this "Siamese-twin" design remain shrouded, but it's clear that this was a pioneering effort in advanced modular design.

against the wall and developing that funny copper taste under the tongue that accompanies a near-death encounter with real honest-to-God equipment that glows in the dark!

Being the logical sort, I decided to build the audio and VOX circuitry on a plug-in chassis. At least it was logical at the time, but four decades plus two years have vanished into the mists of history and I seem to have forgotten just why it was so logical. I won't apologize for that! Incipient senility is only a minor sin when compared with deliberate interference by addle-headed nitwits.

The construction was straightforward. I mounted various bits and pieces for a stage or two, wired things up, checked them out with an external power supply and continued straight across the chassis until space ran out, then banked things around 180° and started building in the opposite direction.

It doesn't require much of an IQ to recognize the hazards of this method. The ultimate objective of orthodox haphazard construction is to arrive at the RF output jack with enough room on the chassis to mount the jack somewhere, and with no vital components still in the goodie box. It didn't surprise me to come up short of space here and there. That explains why one or two of the injection oscillators found homes beneath the chassis. It also explains the additional chassis bolted to the larger one (see the photos).

The need to Siamese-twin one chassis to another was created by the wish to incorporate certain highly technical refinements. Regrettably, I don't recall just what these refinements were, but they were vital at the time and I'm reasonably certain they made a difference. Some secrets are better

left undisturbed.

Nonetheless, I can reveal that the first mixer is a ring modulator (four diodes), the SSB filter uses 16 quartz plates (four full-lattice sections) with an insertion loss easily recovered by tandem 6BH6 vacuum tube amplifiers operating class A (refer to any vintage *ARRL Handbook* for information under the heading, "Tubes, Vacuum, Straight Skinny On").

The fixed capacitors came from Cornell-Dubilier and Sprague. All composition resistors are from Allen-Bradley and the wirewounds are Ohmmites. The tubes are from GE, Sylvania and RCA. I'm happy to report zero component failures in 42 years, aside from vacuum tubes, and only three of the latter have expired, one of which was a 6AL5 that died of boredom in the VOX circuit. The other two were 12AT7 twin-triodes that decided enough was enough.

No audio speech processing was incorporated, but there is however, about 10 dB of straight old-fashioned negative feedback that provides plenty of talk power with no evident trash bordering the signal. The main tuning control isn't calibrated, for several reasons. First, I operate almost exclusively on 20 meters, and just about 100% of the time, I let the other guy call CQ and I chase him on his own frequency. My receiver has band-edge markers, so if the other lad or YL is inside the band, so am I! And I call CQ about once every two years.

The exciter provides about 90 watts PEP output and has been heard in more than 310 countries. You'll note that the front panel has several vacant holes. Because the exciter works nicely without whatever was once controlled through these holes, it's

obvious their removal was an astute move for which I take full credit!

Upon retirement of my home-brew receiver (a rough copy of one of the best Collins receivers), I decided on a slightly modified version of the Drake 2B. Why? It's simple; in vital areas, it's far superior to the three modern solid-state receivers I compared it with. I haven't found any receiver with an AVC system that comes close to that in the 2B. Inside-by-side comparisons, using the same antenna, perfectly readable signals on the dandy new versions with the bells and whistles were wiped out almost completely if a signal 15 dB or more stronger appeared closer than 3.5 kHz on either side. With the 2B, the copy was still better than 90%. So what if it looks like a kitchen AM radio perpetually tuned to a station playing Merle Haggard tunes—who cares? And so what if it doesn't tell you where you're tuned within ± 1 cycle. Who needs it? When I need a frequency meter, I'll buy one!

Overseas ham friends have asked if I've given the rig a model number or name. Until now, I haven't done so, but if it had a name, I suppose it would be *Bullfrog 1*. Like a bullfrog, it's ugly to the bone, but in the swamps of 20 meters, its voice is frequently heard above those of the smooth, young crickets.

And if it ever develops an evil pox of some sort, I'll not be forced to ship it off to Mars or some place 400 miles east of the Great Wall for repairs. I'll get the guy across the street (a health nut who lifts weights) to muscle it out to my workbench in the garage. After that, I'll heat up the old soldering gun and get to it. Darn—I wish I'd made a schematic!

A 1935 Ham Receiver

Radio childhood for many hams meant experiencing the magic of the regenerative receiver. You *can* go home again—if you know where to get the parts.

In 1935 I was 15 years old. I had graduated from building crystal and one-tube broadcast sets to making two- and three-tube shortwave receivers. I knew that there was such a thing as Amateur Radio, but I knew no hams. Using a door buzzer and a straight key built from parts of an old Erector toy set, I had memorized the code to the point where I could pick out an occasional word from the hams or commercial stations I heard.

The shortwave sets I built did not look like much; I had neither the money nor the skill to do better. My sets were made mostly from parts of discarded broadcast sets of the 1920s, suitably modified. I built these sets at the rate of about one a month. Whenever I acquired an interesting new part or read of a new circuit, I tore apart the older set and rebuilt it. The "chassis" was wood, and the panel was a piece of scrap metal that I had managed to straighten out and paint. I had only a few simple hand tools and no test equipment whatsoever. Getting a set working involved a lot of guesswork. But I read *QST* and *The Radio Amateur's Handbook* at my high school library, and I learned a lot. It was all fun.

In my dotage, my mind turned to those happy days. Nostalgia overcame me. Would it not be fun to build the set I would have liked to build in 1935, if only I had had the money and ability?

First, I needed a circuit. This was no problem; regenerative receiver circuits are engraved indelibly in my mind. I decided to use two stages of audio, since it is always easier to reduce gain after a set is built than to increase it. I also put in more filtering and decoupling than I would have thought necessary in 1935; I have learned something since then! The circuit I decided on is shown in Fig 1.

Since I wanted the set to be authentically "1935," I established the rule that all parts I would use had to have existed then. This was not possible in all cases. About ten years ago, I decided that never again would I build anything that was not 100% solid state, and as a result I gave away all of my large stock of tubes, sockets, high-voltage power transformers and other parts



unique to vacuum-tube circuits. Fortunately, I kept parts that might be useful in building more modern gear, including variable capacitors, dials, and switches. But I saved no "30s" under-chassis small parts, including resistors and fixed capacitors—and these are hard to obtain today. Even new fixed capacitors capable of withstanding a couple of hundred volts are hard to find, but a source was uncovered.¹ I got tubes, sockets, fixed mica capacitors and one plug-in coil form from ham friends, who were all enthusiastic about my project and helped gladly. And so I accepted this compromise: In my re-creation of a 1935 receiver, modern components are used where necessary, but all parts on the front panel and above the chassis are just as they would have appeared in 1935 (see title photo and Fig 2).

I decided to wind my detector coil for the 7-mc. band, since there is activity on

that band day and night. When the set was wired and ready for a test, I reviewed in my mind the technique of tuning a regenerative receiver. I had not done this since before WW II. Let's see: "Advance the regeneration control slowly until the set goes into oscillation. Hold it just above that point, then tune, re-adjusting the regeneration control as necessary."

I did not get that far on the initial trial, because the first thing that greeted me when I turned on the power was a loud hum. When I removed the detector tube from its socket, the hum went down to a low level. My immediate suspicion was heater-to-cathode leakage in that tube. I went through six tubes. Two of these tubes produced no hum, but they did nothing else, either—they were dead!

When I held my hand near the detector tube, the hum increased greatly, so I decided that I needed a tube shield. Pentode detectors in regenerative receivers of 1935 were almost always shielded. I had thought of this, but had not been able to locate a

¹Antique Electronics Supply, 668 W First St, Tempe, AZ 85281.

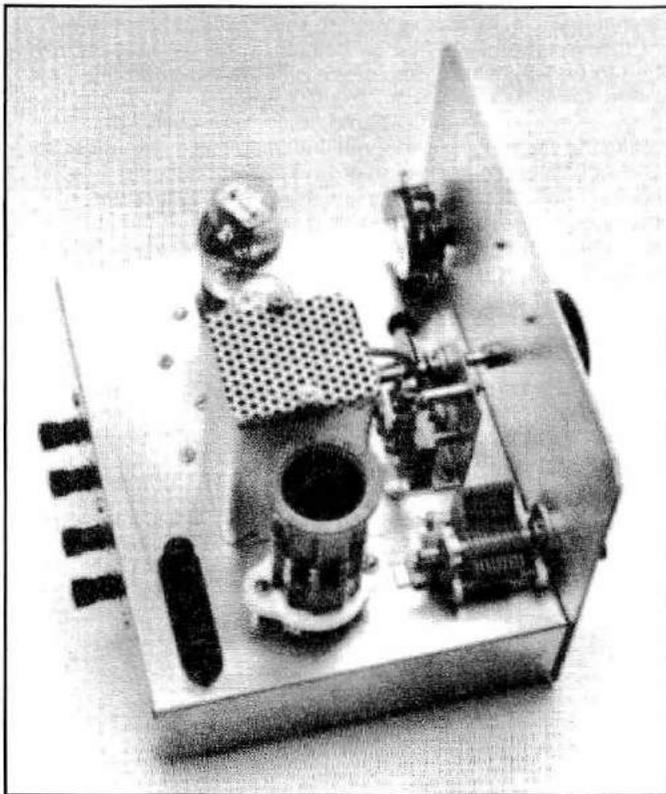


FIG. 2— A GLANCE BEHIND THE FRONT PANEL OF THE 1935 RECEIVER SHOWS THE MODEST CONSTRUCTION THAT MADE REGEN PERFORMANCE FAMOUS

The detector is a 77, hidden from view in the improvised shield can just above the plug-in detector coil. A pair of 76's takes care of audio amplification chores. Panel controls, from top to bottom, are regeneration, bandspread tuning and bandset tuning. The detector grid coupling condenser (C5) and grid leak (R₁) are mounted on the bandset condenser bracket. The three binding posts to the left of the detector coil are antenna terminals; connections for plate and heater power are made via the four binding posts at the rear of the set.

How Regenerative Detectors Work

Regenerative detectors get a lot done with relatively few parts—and in the lean '30s, those were the magic words responsible for the great popularity of the "regen," or "blooper," as it was sometimes called. What made it tick? The usual regenerator was a grid-leak detector with RF feedback. Fig A shows a triode grid-leak detector. When an incoming signal drives V1's grid positive with respect to cathode, current flows from cathode to grid and returns to the cathode via R₁, the grid leak. This is rectification, here called *detection* because it results in demodulation of the incoming signal. Rectified RF charges C₁. C₁ is usually 50 to 250 pF or so, and the resistance of R₁ is between 1 and 10 megohms. Though the charge on C₁ tends to "leak off" through R₁, the R₁C₁ time constant is many times longer than the period of the applied RF signal, providing steady bias for V₁. C₂ and the RF choke bypass the plate for RF.

Rectification of any AM sidebands on the incoming signal—containing, say, speech or music—causes V₁'s bias to fluctuate at the modulating frequency, since the R₁C₁ time constant is too short to smooth audio-frequency bias variations. Plate current thus varies in step with the modulation envelope, and audio may be recovered across V₁'s plate load. The triode grid-leak detector combines diode detection with a stage of audio amplification—an arrangement much more sensitive than a diode. A pentode grid-leak detector would afford even greater sensitivity.

As sensitive as the grid-leak detector may be, however, it can detect only relatively strong incoming signals. And if we want to receive CW or carrierless signals such as SSB, we're out of luck because we need a beat frequency oscillator (BFO) to demodulate them. All we need do to solve both problems is add RF feedback to our grid-leak circuit—and we have a regenerative detector.

Fig B shows the circuit. Now, V₁'s plate is kept above RF ground, and a small inductance in the plate lead—a tickler coil—is placed near the grid tuned circuit to provide in-phase RF feedback. This results in the amplification of the incoming signal many thousands of times before detection. V₁ may even oscillate if feedback is made strong enough. When it does, we're ready for CW and SSB reception, with V₁ simul-

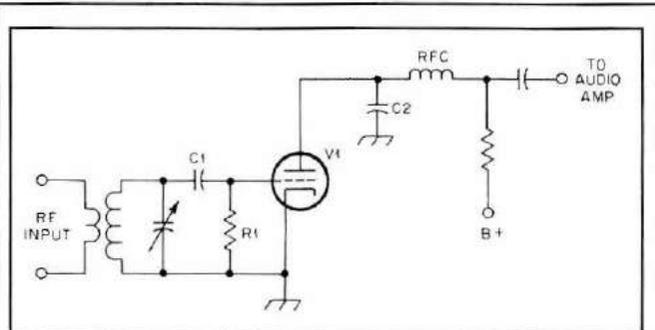


Fig A—A grid leak detector. Action of numbered components is discussed in the text.

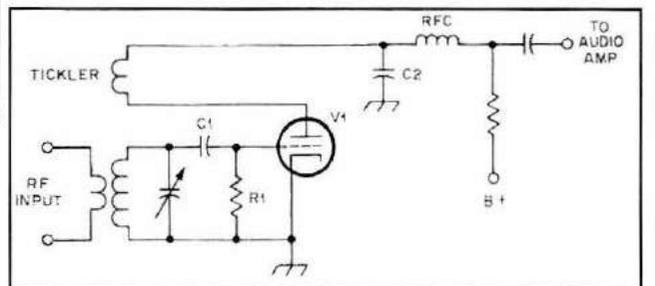


Fig B—Regenerative detector. Addition of a tickler coil provides RF feedback.

taneously serving, as AF amplifier, detector, audio amplifier and BFO. Detector sensitivity is maximum at the point just below oscillation—at critical regeneration. Feedback may be controlled by varying the reactance of the plate bypass, C₂, or plate voltage.

Just about any oscillator circuit could be used as a regenerative detector. W7IV's circuit is a Hartley regenerator: In his receiver, the oscillator anode (pentode screen) is held at RE ground, and positive feedback is supplied from the cathode to a tap on the grid coil—a Hartley oscillator. Feedback is controlled by varying detector screen voltage.

Regens had their drawbacks. Audio from local broadcast stations might be audible across a regen's entire tuning range because of cross modulation. A random-length wire coupled to a regenerator might "suck out" enough energy from the detector grid circuit to stop oscillation—and as the antenna swung in the wind, its varying capacitance to ground might shift detector tuning. Receiver shielding and grounding were critical if similar frequency shifts with hand movement were to be avoided. If detector RE got to the rectifier anodes in—a regen's power supply, re-radiation after intermodulation with line-frequency ac might result in "tunable hum"—tunable because it varied in severity as a receiver was tuned. Worse, all the hams in a neighborhood could hear each other's receivers, since an oscillating detector coupled right into an antenna was also a GAP transmitter!

It was tough to receive weak signals in the presence of loud local amateur stations: A weakly oscillating detector might stop oscillating ("block") or be "pulled" toward or onto the frequency of a strong signal. (This was why so many

regen users tended to listen to their CW at quite high pitches—less pulling that way!) Impedance coupling between detector and audio amplifier sometimes gave rise to “fringe howl,” an audio oscillation caused by a negative-resistance effect in the detector plate circuit near critical regeneration. Detector tubes were often highly microphonic.

Sure, you could put a stage of AF amplification ahead of a regenerative detector and pretty much cure radiation and suckout. But the regen still had its problems with overload, was relatively unstable, and wasn't as good for radiotelephone reception as the superheterodyne receiver. Maximum sensitivity for AM phone, just short of detector oscillation,

resulted also in excessively sharp selectivity, to the detriment of recovered audio. With the detector oscillating, selectivity had to be achieved at audio—or with the ear-brain filter, as W7IV says.

Once the single-signal superheterodyne receiver made the scene—“single signal” meaning that it responded to CW signals on only one side of zero beat, something a regen couldn't do—the writing was on the wall for the blooper. Still, the sheer simplicity and economy of the regen made it the receiver for many hams in the '30s.—*David Newkirk, AK7M, Assistant Technical Editor, QST*

Telegraph Keys: "As American as Pumpkin Pie"

From the early days of railroading to manned space flights, telegraph keys have been chattering away for nearly a century and a half. Louise Moreau's collection is one of the finest in the world.

Despite the electronic marvels we all now take for granted, the humble telegraph key lives on as a basic part of nearly every amateur's station. Conceived decades before the Civil War, it still gets a signal out better than just about any other means of communication:

Louise Moreau, W3WRE, doesn't have to explain what she likes most about amateur radio to people who visit her shack. After gazing at the 249 keys that adorn it, they usually get the idea. Mrs. Moreau is surrounded by telegraph keys, and she wouldn't have it any other way.

As one of only five or six people in the world who specialize in collecting the brass machines that helped change the course of history, Louise is justifiably proud of her collection, and is in demand as a speaker at amateur radio clubs around the country. "They're as American as pumpkin pie. Do you realize that the same mode of communication that was used to relay news of Lee's surrender at Appomattox and Custer's Last

Stand is used as a back-up on manned space flights?" she tells them.

In a recent interview, Louise conveyed her enthusiasm for the entire history of communications as well as the code. But she is clearly most intrigued by telegraph keys, those fascinating little machines that are still in widespread use after nearly 150 years.

QST: Where do you find the keys you collect?

Moreau: For the most part, I'm given "grandpa's old one." Very few of them were purchased. If you let people know you're after one and walk around a hamfest with a key in your hand, people will often remember you and bring them next year. I get as many as six at a time at hamfests! Old barns are another good source.

QST: Describe some of the ones you're most proud of.

Moreau: I started out with a J-38 telegraph and bug. I now have 249 different keys, dating back to 1848. Let's see — there's a Vibroplex no. 1, the prototype of

every Vibroplex ever made, from 1904. I have a key found in the ruins of the Johnstown, PA, Western Union office after the 1889 flood. Then there's the key that was on the desk in the flag office of the USS California, sunk at Pearl Harbor, and one used on the USS Nautilus. And there's one from the press desk at the Dempsey-Tunney fight.

QST: What do they look like?

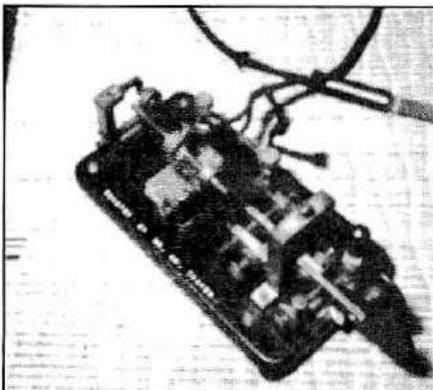
Moreau: There's one only an inch long and a big old spark key. Each one is somehow distinctive.

QST: What do you use?

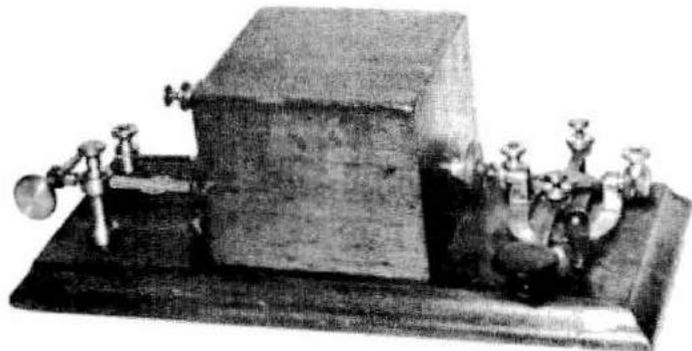
Moreau: An electronic keyer! Why? It's the lazy man's way to send cw. You can send and send for hours at a time and never get tired. I can do 40-words-per-minute solid copy in the Continental code, and 25 wpm in the old Morse.

QST: What appeals to you so much about cw?

Moreau: I find cw contacts more interesting. And the people themselves are



The first Vibroplex, made by Horace G. Martin in 1904. Its price? Five dollars!



A vintage 1883 box relay and key on base. J.H. Bunnell manufactured this arrangement, patented in 1881. Notice that the key is in the style of modern straight keys.



Sporting brass contacts, the first curved lever and no coil spring or tension adjustment, this "Camelback" key was made by Thomas Hall of Boston in 1848.

more interesting! Yes, I work phone, but about 99.99 percent of the time you'll find me on cw. At one time I was even on 2 meters on the West Coast.

On cw, fists are as individual as voices are on phone. I don't think we should ever lose that. It's just another language, that's all it is. Look what you can do with it in disasters. And look what it's doing for some of the handicapped who have speech problems. There's a blind and deaf woman in California who works cw magnificently. One of the most outstanding people I've ever heard on a traffic net has muscular dystrophy. He sends with his feet!

QST: How did you get started in amateur radio?

Moreau: I learned code when I was a Girl Scout at age 12. My original job was as a telegrapher, but they put printers in soon

afterwards. I didn't get my ham license until 1953. It started out as my husband's hobby. I was helping him try to get his code up.

We both took the test and became Novices. I never really meant to be one, but oh, do I love it!

QST: Do they really use cw in space?

Moreau: They sure do! I remember hearing John Glenn say, while he was orbiting the earth, "Want me to go to the key?" I asked NASA if they really use telegraph keys in space, and astronaut Owen Garriott, W5LFL, called me on the phone. "Yes, they do have facilities for code transmissions from space," he said. It's done through the umbilical used for voice control. If voice communications should ever fail, it's used as a back-up.

After all these years, code is still kind of necessary.

“Old Radio” QST Columns by John Dilks, K2TQN

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Microphones

Probably the best-known ham microphone is the D-104 by the Astatic Company. Since the 1950s, when I first became interested in ham radio, it is the one microphone that I remember best. It seemed like every older ham had one in his shack. I wanted a D-104, but of course I couldn't afford one at the time, which made it even more desirable.

Today I have a few of them and I feel much better now.

I'm not alone. Most of my collector friends have at least one in their collection. They are easy to find. At just about every hamfest they can be found for as little as \$20, making them easy to bring home.

I remember one old-time ham who bought a D-104 every time he went to a hamfest. He had almost 30 of them on his shelf. It was impressive.

In preparing for this column, I searched on the Internet and found www.astatic.com. I found that Omnitronics LLC now owns Astatic. The Web page has good information about the D-104 and there is a support forum where you can ask questions. They also have a short history of the company compiled by Keith P. Graham from the 1946 Astatic Catalogue where I found the following information. Please visit the Astatic Web page for more.

In 1930 the Astatic Company was started in Youngstown, Ohio by two radio amateurs, Creed Chorpeneing, W8WR, and F. H. Woodworth, W8AHW. Before 1930 they had been using carbon microphones. When they learned about the new condenser microphones, they built a few. Soon friends were asking, could you build one for me? So they formed a partnership and went into business.

An old friend, Charles Semple of Cleveland, asked them to visit him at the Brush Laboratories, where he worked. He had been experimenting with phonograph pickups using Rochelle salts (sodium potassium tartrate), and thought they would be interested.

Through [Charles] Semple, the two visitors met A. L. Williams, electrical and mechanical engineer, and Dr. C. B. Sawyer, scientist, who demonstrated the action of these new elements in relation to microphones, phonograph pickups, speakers, recording heads, earphones and other devices where it was desired to transform mechanical energy

into electrical energy or the reverse. Here, it seemed, they had found the answer to a simple, low-cost, dependable "mike" for the "ham rig."

In 1933 they incorporated and started building Crystal Microphones and Crystal Phonograph Pickups. Charles Semple joined the company as designer and later became the general manager.

The first advertising for Astatic I found was in the November 1933 issue of *QST* on page 83. It said:

There is something new under the sun. It's the PIEZO-ASTATIC Crystal

Microphone. A highly developed general-purpose microphone ruggedly constructed having excellent frequency response. Cannot be overloaded acoustically. No adjustments required. No carbon rush or internal noise. No blasting or freezing; no button or field current; no polarizing voltage. Connects direct to grid or may be used with matching transformer. Chrome plated, 3" diameter, 1" thick, with 6 ft. shielded cord. **THE MOST PRACTICAL MICROPHONE EVER OFFERED.** Licensed under Brush Development Co. patents.

They offered it initially for \$17.50 in a suspension or stand mounting. By the following November the list price had risen to \$21, but was offered to hams for a net price of \$12.60.

By the end of 1934 they claimed thousands of sales to amateurs. I own one of the early D-104 microphones, serial 15,559, and based on Astatic's claims, I figure it was made in 1934 or 1935. It is the suspension mount version and was well used.

I remember reading in *QST*, I think, in the 1960s, that Astatic celebrated an anniversary and was searching for the earliest serial number still working. They offered some sort of a prize. I was not able to find this data, but it would be interesting to ask readers to let me know your early serial number, and whether it is still original and working. I'll print the best found in a future column.

How can you tell the early ones from the later models? Figure 1 shows three D-104 labels. The top one is my early 1935 version, the middle is from the 1960s and the bottom one is from the 1970s or 1980s. You can see the differences. The early ones have ID plates with a serial number and rivets, while the newer ones have a sticker label, without a serial number.

D-104s are still used on a regular basis in many ham stations today. Wiring diagrams and hook-ups are available on the Internet so they can be adapted to almost any radio. They are especially popular with the radios of the AM era and early SSB rigs. They often show up at garage sales, flea markets, antique shops and on the Internet, so good hunting. Replacement elements are available from many sources if yours doesn't work. And there is enough room inside to adapt almost any modern pickup in there.



Figure 1—Three labels from various models of the D-104. The mikes are from 1935, 1960 and the 1970s or '80s.

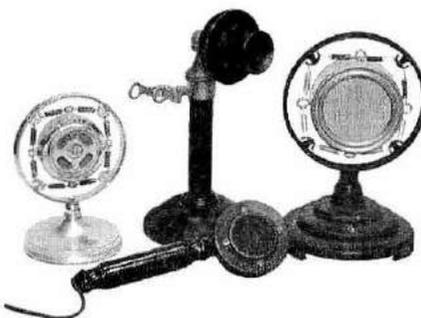


Figure 2—Two examples of a suspension microphone, a Shure 5B on the left and the Amplion GM on the right. The taller one is an old "Conn Tel & Elec Co" telephone converted into a mike, and the hand mike is an Amplion MH from the late 1920s or early 1930s.



Figure 3—Several popular mikes designed for Amateur Radio use.



Figure 4—Several models of RCA microphones, which were popular in ham shacks for many years.

Microphone Collecting

I've included several photos of microphones in groups, to help you identify mikes worth adding to your collection. If you aren't collecting yet, here's a great place to start. I'll begin with the earliest microphones, which tend to be fairly expensive as they become harder to find.

Suspension, or "ring" microphones, are always fun to find. They look great displayed anywhere in your ham shack. Figure 2 shows two, a more common Shure 5B on the left and a rare Amplion GM on the right. The Amplion GM was probably used in commercial broadcasting. (It is serial number 4 by the way, very early). The taller one is an old "Conn Tel & Elec Co" telephone, which some ham adapted to his early 1920s transmitter. The hand microphone is an Amplion MH from the late 1920s or early 1930s.

Figure 3 contains a representation of popular "ham" mikes. These are available at most hamfests from time to time. From left, Shure 737A, Turner CX, Astatic 77, Electro Voice 630, Shure 555W, American D4TZ, Astatic D-104, Western Electric 633A (also known as the "Salt Shaker") and finally an Electro Voice 638. Each company mentioned has many models, so look for others.

Commercial grade microphones are really great to find. Most of these types originally cost a lot more than ham mikes, and will still cost you more today. Figure 4 shows some of the popular RCA microphones. From left, model 46 (also called the "Paintbrush"), MI-6226, a chrome "Aerodynamic," MI-6204 (an early ribbon mike), MI-2016 a two-tone Aerodynamic, model 45B, model 88 and an MI-12021. Note the stands they are on. The two chrome bases and the black stand under the 6204-ribbon microphone are early stands. You should look for these types to properly display your earlier mikes. The large stand in the center-front is modern, from the 1970s.

Art-deco microphones really stand out



Figure 5—A selection of cool Art Deco style mikes.



Figure 6—At the left and right, two inexpensive Japanese mikes, with a suspension mike in the center.

in your shack or display. In Figure 5, from the left, a Rauland W-1247C (also sometimes labeled Webster 1248), Amperite PGL "flying saucer," American D33 and an Altec 639B "Birdcage," also made earlier by Western Electric. Altec was a spin-off of Western Electric when they were made to divest themselves of the movie

sound business. Altec later became Altec-Lansing.

The saucer-like disc on the Amperite microphone was said to increase the output of the microphone 4 dB. It was typically used on stage where the speaker was more than 12 inches from the mike. This microphone was also popular in ham shacks, with and without the ring. The plastic ring snaps on and was sold as an accessory.

In 1958 when I was getting started in VHF, I needed a microphone. Still in high school, I found that the Japanese manufactured affordable microphones. Figure 6 shows two of them. On the left is a Crown MC-60 dual crystal element mike, designed to look like an expensive RCA model 77. It sold for under \$10. On the right is a single element crystal mike, a Herald M105. This was available for under \$5. Both of these mikes were sold by many of the chain stores, under several names: Aiwa, Argonne, Calrad, Fen-Tone, Midland, Olson and Philmore, to name a few. They all looked the same, except for the name labels, which were glued on.

In the center sitting on a coffee cup is an old suspension mike from Japan, supposedly brought home by a GI after WW II. I have not yet been able to find any information on it. The English lettering says "LA-1" and "NO 168." The rest is in Japanese. It is a heavy piece, with the body carved out of white marble, and the works set inside. I'm guessing it is from the 1930s.

Microphone 101

So there you have it—Microphone 101. I hope you will be successful finding suitable ones for your collection. One note though: I occasionally get e-mails asking how much a mike is worth. I'm not a good person to ask, as I have not researched prices. I go by the rule *if I like it, if it is reasonably priced and I can afford it at the moment, I purchase it*. What I would pay is probably different from what others would pay.

Look for my hat at the hamfests, and say hello.—K2TQN

1922 Armstrong Transatlantic Letter Found

You never know what you're going to find or where you will find it.

I purchased the remnants of a ham's estate a couple of years ago. He had become a SK about 20 years earlier and most of his station and collection was sold shortly thereafter. His home was now being sold and the few remaining ham items and more than a few boxes were offered for sale from the cellar. I purchased all that was left from the family a few days before the sale, and just before the dumpster.

Cleaning out a cellar is hard and dirty work. After 20 or 30 trips up the stairs with heavy boxes, you tend to want to get done and get out of there. This day was no different.

The larger items were loaded into my van and we were bringing up the cartons of parts he had on shelves. We were almost done when I noticed one more shelf with small boxes, including a nice looking cigar box. I had room in the last carton, so in they went. I looked into each box first, and if it wasn't radio related, it went back on the shelf. Some had wood screws and nails and other heavy odds and ends. The cigar box went in last because there were two old tubes in it along with some paper junk. I figured I would sort it later, throw away the junk and just keep the tubes.

It took a few months to get around to sorting that last carton. When I finally opened the cigar box I was sitting on my couch and watching TV with my wife. After the tubes were removed, I started going through the paper. There were several interesting letters, a few 1920s QSL cards, some pins and a couple very old hamfest tickets. About half of the box contained papers that once belonged to Homer E. Nichols, WIBM, Life member of ARRL, Director of Nichols Manufacturing Company and Section Communications Manager of Connecticut, 1926-1928.

I started to read the letters. One was in response to a letter that WIBM must have written to Edwin Armstrong about the December 1921 Transatlantic Tests. It was hand-written on January 5, 1922 and signed by Armstrong. It read:

My Dear Nichols,

I hope you will pardon my delay in answering your letter—I have been ab-

solutely buried and I did not remember, after reading it the first time, that you asked about coming over to see the station. I am particularly sorry because we had a visitors day the Sunday following the tests when Prof. Pupin, Sarnoff, Goldsmith and a bunch of radio boys came up to look us over. Right now the station is down—the transmitter is at Columbia and will probably be on exhibition in N.Y. for a while but if you ever hear IBCG on the air again at any time give us a call and make your own arrangements for coming over. We will be glad to see you any time up to 5:30 A. M.—or was it 5 A. M.

In respect to 1AAY it appears that there was an error in the coding of this call and that it should have read 1AAW. This station, however, did not transmit, so I don't yet know the answer.

Best of 73's and hope next time I see you will be after 6 A.M. at least.

Sincerely,

(signed) E. H. Armstrong

I read and reread the letter. What luck to have saved this from the dump—what a historic letter! I was so excited I called a few friends right away. Everyone thought

it was great.

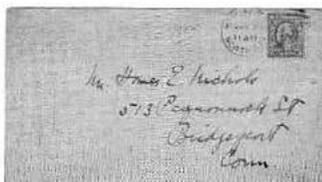
Next, I dug out my book on the Transatlantic Tests and read it again. Yes—the things mentioned in the letter Armstrong later put into writing for the Radio Club of America's *Proceedings*. You might want to get a copy of this book for yourself; it is available from the Museum of Radio and Technology.¹ This book has the whole story from several different publications and from many notable radio hams who were there. It includes an introduction from Armstrong, the history of IBCG including many great photos of the station and radio equipment, recollections of a Member of the Engineering Staff of IBCG, the electronic details and schematics of IBCG and the Superheterodyne receiver Godley used, Paul Godley's story from the other side, a complete reprint of the February 1922 *QST* article, clippings from newspapers and magazines, and much more.

¹1640 Florence Ave, Huntington, WV 25701. I paid \$10 for mine at a radio meet, but I suggest that you check with them first for actual cost, shipping, etc. This is a good quality 8 1/2 x 11, 78 page reprint whose title is *The Story of the First Trans-Atlantic Short Wave Message, Proceedings of the Radio Club of America, Inc., IBCG Commemorative Issue, October 1950.*

Pupin comes to visit the station—Professor Michael I. Pupin of Columbia University came to Greenwich with Mr William Deegan of the Postal Telegraph Co "to see what you boys are doing," as he put it. Front row, left to right—Armstrong, Burghard, Dr Pupin, Cronkhite, Grinan. Standing rear, left to right—Tex McBain of the Greenwich Fire Department, George Brillhart, John Hobe, Carl Trube, William Deegan, R. H. McMann, V. A. Hendrickson, Jack McWilliams. Far rear—John Cullen, Fire Department. Photo used with permission from the Radio Club of America.

FROM THE STORY OF THE FIRST TRANS-ATLANTICS





1032 Wabuntollee
Yonkers N.Y.
Jan 5, 1922.

My dear Nichols,
I hope you will pardon my delay in answering your letter - I have been absolutely buried and I did not remember, after reading it the first time, that you asked about coming over to see the station. I am particularly sorry because we had a visitors day the Sunday following the tests when Prof. Payson, Samoff, Goldsmith and a bunch of radio bugs came up to look us over. Right now the station

Edwin Armstrong's 1922 letter.

is down - the transmitter is at Columbia and will probably be on exhibition in N.Y. for a while but if you ever hear 1DC9 on the air again at any time just us a call and make your own arrangements for coming over. We will be glad to see you any time up to 5:30 A.M. - or was it 5:00

In regard to 1DC9 it appears that there was an error in the coding of this call and that it should have read 1DC4W. This station, however, did not transmit so I don't yet know the answer.

Best 73's and hope next time I see you will be after 6 AM at least.

Edwin Armstrong

82 ELMWOOD AVE.		BRIDGEPORT, CONN.	
RADIO	UR	SIGS	WKD
AUD	QSB	QSS	QRN
TRANSMITTER	RECEIVER		
WATT	Tuner		
CKT	AMP.		
W. Input	QSR Always		
Volts	PSE QSL		
Antenna	VY. 73 S		
Long	REMARKS:		
High			
CTPR:			OPR.

Homer Nichols' 1922 QSL card.



The cigar box that contained the Armstrong letter, among other interesting items.

Homer Nichols, W1BM

I have learned a little more about Homer Nichols, W1BM, since then but not a whole lot. Thanks to Bob Merriam, W1NTE, of the New England Wireless and Steam Museum, I received a copy of a QSL card Homer had sent to Stew Perry, W1BB, in 1950. In part he said on the card, "BM was assigned to a ham in Bridgeport back in 1912 but he went to college and after 1st World War I fell hair [sic] to it. Hiram P. Maxim was the 21st ham in New England District to get a license and mine was 23rd." Clearly, Homer Nichols was a very early ham and his call changed to 1BM after the War.

In 1950 he was running a Collins 30J at 400 W and using a National HRO-5 receiver. He worked Stew on 3535 kHz. He still had the same station in 1959, as indicated on another card.

Homer was also a mentor. I received an e-mail message from Seth Horen, K1LOM, that said:

Homer Nichols was my Elmer. When I got interested in ham radio at age 12 (1957) he was the one who helped me get my novice license and even gave me the test! He also came to my house and put up my first antenna, climbing ladders and trees at about age 65! He also was responsible for my father getting his license a couple of years later.

If anyone knew Homer Nichols, W1BM, has a photo of him or can add to this story, please e-mail me. I'll share the information with K1LOM.

I'm not sure why the SK had the cigar box with Homer's papers; perhaps he had purchased them from W1BM's estate years earlier.

There are still a couple of other items in the cigar box to tell you about, but I'll save them for another day.

Look for my hat at the hamfests and say hello.—K2TQN

Old Radio Magazines

My collection of magazines continues to grow. Every month I try to add at least one more to the collection. Some months are better than others, as I may find an entire box of them at a hamfest or club meeting. One of the best ways to find large quantities of magazines is when an estate is being sold off or thrown out (thrown out happens all too often). Here's one short story we can all learn from. I know I did.

A few years ago I was moved into a new office in our building. It was a larger space with no windows. Since my work involved the use of many handbooks and manuals, the office had been equipped with a large number of bookshelves along two walls; and as it turned out, the boss ordered twice as many as necessary. This provided me with some display space for my old radios.

One of my co-workers from the field stopped in one day and noticed all the radios. He asked if I collected radios, which led him to tell me about his wife's uncle who was a radio ham. This uncle had been placed into a care facility because he was very sick and not expected to recover, and his home was being sold. I was asked if I wanted the ham radios, as they were going to throw them out that weekend. I said yes and we agreed to meet on Saturday at the home.

The rest of that week, I cleared out my van and gathered some strong cardboard boxes. I was ready. On Saturday morning I hit the road early. Arriving there I was greeted by my friend, his wife and mother-

in-law. On entering the home the mother-in-law told me that she had saved me a lot of time the day before. Knowing I was coming "just for the radios," she removed piles of old books and magazines and had set them out for recycling, which was that Friday. They were all gone. It had taken her several hours to carry everything out front. I was heart-broken.

There were some nice radios and station accessories gathered, but all of the manuals and other paper items were missing. The lesson I learned that day, was to tell everyone, anyone, associated with cleaning out radio estates, not to throw anything away until I get there.

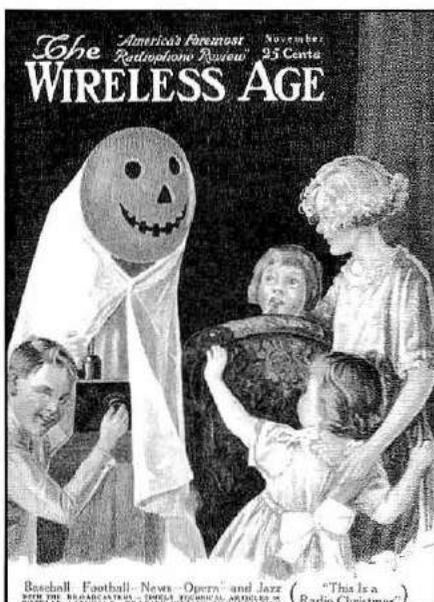
Magazines to Look For

Anytime something new comes along, magazines about that subject come along, too. In the early days of radio, this was true. The earliest magazines covering radio were scientific or mechanic-related with articles in them about radio.

Some of the early magazines worth looking for are *Science and Invention*, *Everyday Mechanics*, *Science and Mechanics*, *Popular Science*, *The Experimenter*, *Technical World*, *Scientific American* and *Modern Electrics*. These will provide many enjoyable hours reading articles reporting on the latest experiments and developments. It is fun to read the many predictions about radio (or wireless, as they called it back then) and what the future would bring.

Some of these predictions have come true, and some have not—not yet.

Once ham radio became popular and operators began to transmit to each other, many magazines had ham sections in them. One of my favorite magazines to collect is *Radio News* and its many versions. *Radio News* started in 1919 as *Radio Amateur News*. It had grown out of the many publications owned by Hugo Gernsback, an





early radio entrepreneur who knew how to catch the attention of his readers. His magazines had the most interesting covers.

The March 1920 cover shown in this column is typical. Illustrated by his friend Howard Brown, it shows a terrier with his foot on a spark key, scaring a black cat that was nosing around the rotary spark gap. Think back to 1920. How could anyone see



this on a newsstand and not buy it?

When you looked inside you would not be disappointed—it was loaded with photos of ham stations, articles on how to build the latest circuits and many pages of advertising. Much of the advertising was from Gernsback-owned companies.

Over the years *Radio News* merged with several magazines. It continued into the television era and was one of the dominant

radio magazines of the century.

Of course we all know about *QST*. Started prior to World War I, it certainly is one worth collecting. There are others.

The West Coast-based *R9* ham radio magazine arrived in the 1930s, and in 1936 it merged with *Radio*. *Radio* began publication in the 1920s and changed its focus several times over the years. By the early 1930s it was a 100% ham radio magazine. It continued into the 1940s. You will find good construction articles in every issue. *Radio* was purchased by *CQ* magazine when they started up.

Other magazines worth looking for are *Popular Radio*, *Short Wave Radio*, *All-Wave Radio*, *Radio Craft*, *Radio Broadcast*, *Radio Age*, *Radio Design*, *Short Wave Craft*, *Short Wave and TV*, *Radio and Television*, *Television*, *Modern Radio*, *Electronics*, *Popular Electronics*, *The Wireless Age*, *Citizens Radio* and *Radio Engineering*.

You can find these wonderful publications at hamfests and on the Internet. The book dealers I mentioned in the June 2003 column also carry old radio magazines. Have fun reading.

GATHER YE RADIO PARTS WHILE YE MAY

Fall is here, and it's time to get your antennas ready for winter operating. There are a few hamfests left this year to gather parts to rebuild your old radios and put them on the air.

Look for my hat at the hamfests, and say hello.—*K2TQN*

A Classic Weekend for Old Radios

The long weekend of September 26-29 will be exciting for "Old Radio" readers, as two of the fastest growing ham radio operating events will take place. First it's AM International's Discovery Weekend, which begins on Friday evening, September 26 and ends Sunday evening, September 28. Then second, it's the Classic Exchange contest, which will run from early Sunday morning, September 28, to early Monday morning, September 29.

The AM Discovery Weekend brings

together many classic AM transmitters on the air and raises the awareness of the presence and fun of AM. Details of scoring and awards are in the August issue of *Electric Radio* magazine.

The Fall Classic Exchange (CX) will be held concurrently with the AM International AM Discovery Weekend to encourage more participation in both events as well as addressing the desire for more classic ham radio operating time.

For those of you who are too young to

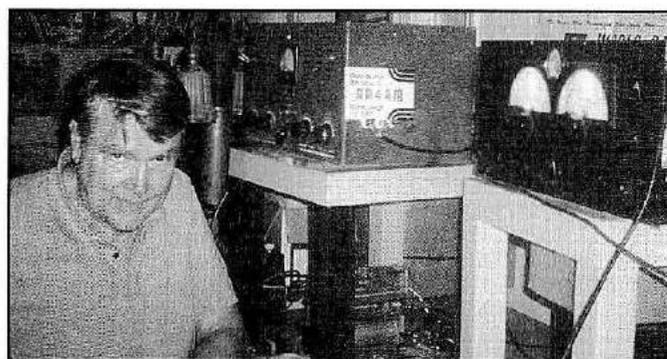
have listened to ham radio in the 1930s through the 1960s, this weekend is for you. You will hear hundreds of classic radios on the air at the same time.

For those of you who have an old radio (or two), now is the time to dust it off, get it hooked to an antenna and put it on the air. Experience the thrill of CW, AM and early SSB.

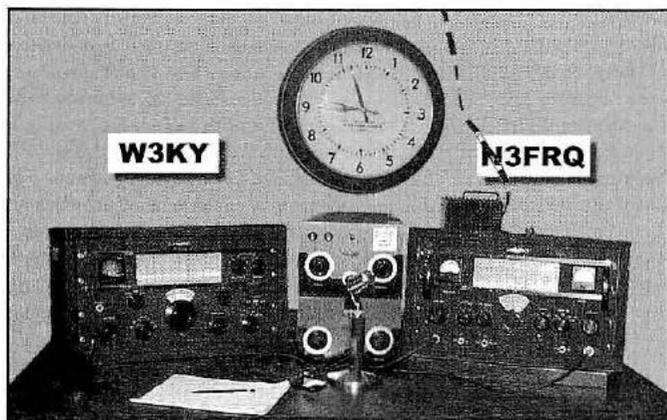
To help you recognize what the old transmitters sound like on CW, listen to the note. It probably won't sound pure like the modern radios do. In fact it may have a dis-



Howie Holden, WB2AWQ, will be operating the TBW transmitter at the NJ Naval Museum/USC Ling, SS297, shown here in its debut for Submarines on the Air, April 2002.



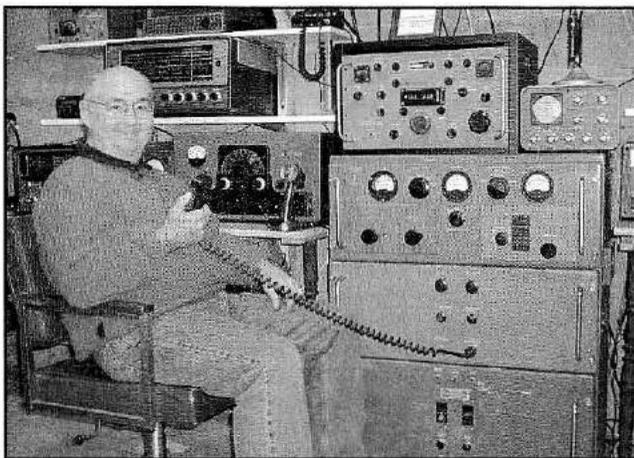
Marty Reynolds, AA4RM, will be on with his very rare Stancor 69 transmitter and RME 69 receiver. (If you have a Stancor 69, please let me know—we are trying to find out how many are out there.—K2TQN)



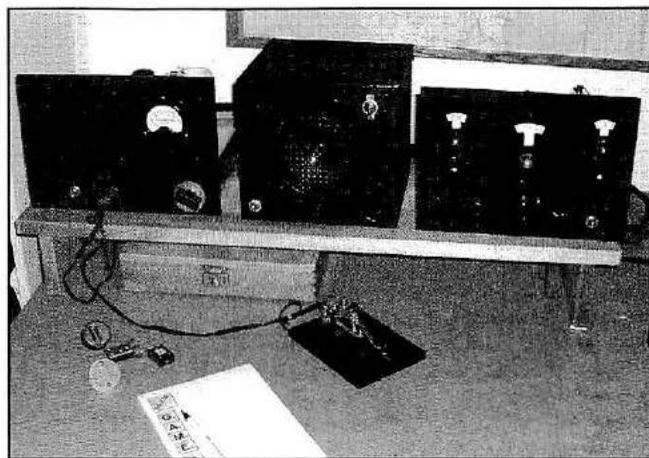
This is the AM station that Al Klase, N3FRQ, restored for my Old Radio museum. It is a Collins 75A1 receiver on the left and a Collins 32V3 transmitter on the right. Look for us on AM and CW.



George Silva, WA6HCX. The transmitter on the left is a Collins 30K1, vintage 1947. It was the first big amateur transmitter built by Collins after the war. The final is a 4-125 modulated by a pair of 75TH's. Frequency bands are 80-10 with an AM output of 250 W. On the desk next to it is the 310B3 matching exciter/vfo. George built the console and cabinetry out of walnut. The receiver is a Hammarlund HQ200. The transmitter on the right is a Globe King 500B, which he uses on 160 meters. For several years now, George has operated almost exclusively on AM.



Mike Warren, K0MAZ, sitting in front of his primary AM station: Collins R-390 and a military T-368. Behind him is his Hallicrafters SX-101 and EF Johnson Viking Valiant transmitter. Look for Mike on 3885, 14,286, 29.0 and 50.4!



Niel Wiegand, W0VLZ, will be using his homebrew station.

tinct click or thump sound sent with each dit or dah, accompanied with a somewhat raspy note. Some of them may sound as bad as a buzzer. Remember to set your receiver filter to wide, because they may be drifting up and down the band as their tubes warm up and cool down. Keep one hand on the tuning knob so you can follow them.

If you are new to all of this, try to work some of them and find out what they are using. Then later on, you can search the Internet with Google, or your favorite search engine, and find out about the different radios you heard. Many collectors have Web pages loaded with photos and descriptions of their radios.

About CX

The CX is a no-pressure contest celebrating the older commercial and homebrew equipment that was the pride and joy of ham shacks many decades ago. The object is to encourage restoration, operation and enjoyment of this older "Classic" equipment.

The traditional CX contest, including CW, SSB and AM will be on Sunday. There will be CX recognition for high scores in AM, SSB and CW as well as overall. AM QSOs exchanging the usual CX data may be made for CX score throughout the weekend.

You need not operate a classic rig to participate in the CX; you may use any rig in the contest although new gear is a distinct scoring disadvantage. You can still work the "great ones" and join in the fun with your modern equipment.

Operating in the CX Contest

The traditional CX will run from 1300 UTC September 28 to 0700 UTC September 29 (9 AM Eastern Time on Sunday to 3 AM Eastern Time Monday).

CW: Send CQ CX

Phone: Call CQ Classic Exchange

Suggested Frequencies (MHz)

CW: 1.810, 3.545, 7.045, 14.045, 21.135, 28.180 MHz.

AM: 1.890, 3.880, 7.290, 14.286, 21.420, 29.000 MHz.

SSB: 3.870-3.875, 7.280-7.285, 14.270-14.275, 21.370-21.375, 28.490-28.495 MHz.

Exchange your name, RST, QTH (state US, province for Canada, country for DX), receiver and transmitter type (homebrew send final amp tube or transistor type), AMI number if available (AM only) and other interesting conversation.

The same station may be worked with different equipment combinations on each band and in each mode. Nonparticipating stations may be worked for credit.

Scoring

Calculate your score for each mode (CW, AM, SSB) and total those scores for your overall CX score.

Individual Mode Score Formula

Multiply total number of QSOs (on all bands) by the sum of the number of different types of receivers plus the number of different transmitters you worked (transceivers count both as a transmitter and a receiver) plus the number states/provinces/countries worked on each band. Multiply that product by your CX multiplier.

Your CX multiplier is the total years old of all receivers and transmitters used. Each receiver or transmitter must be used in a minimum of three QSOs to be counted in the multiplier. If the equipment is homebrew, count it as a minimum of 25 years old, unless the actual construction date, or the date of its construction article, in case your "reproduction" is more than 25 years old.

Total QSOs all bands (times) RCVRs + XMTRs + states/provinces/countries (total each band and mode separately; add totals together) (times) (the CX multiplier):

Score = QSOs × (RX+TX+QTHs) × CX multiplier

Certificates and appropriate memorabilia are awarded every now and then for the highest score, the longest DX, exotic equipment, best excuses and other unusual

achievements. Send logs, comments, anecdotes, pictures, etc. to J. D. "Mac" MacAulay, WQ8U, at WQ8U@arrl.net, or by mail to WQ8U, 6235 Wooden Shoe Ln, Centerville, OH 45459.

The CX Newsletter and announcement of next CX will be posted on their Web site: qsl.asti.com/CX and distributed via e-mail to those submitting reports via e-mail. If you submit a report via postal mail, please note if you want a paper copy of the CX newsletter.

My thanks go to Howie Holden, WB2AWQ, and to Ray Osterwald, N0DMS, for their help providing this information.

Great September Hamfests

You will be able to see my Old Radio museum at the following hamfests that will have a high percentage of classic radios:

Maryland: On September 6 and 7, I will be at the Fall-Fest, home of the 2003 ARRL Maryland-District of Columbia Section Convention at the Howard County Fairgrounds, West Friendship, Maryland. There will be a huge AM ham radio display; meet and talk to the experts. For more information, see www.fall-fest.com.

New Jersey: On Sunday September 14, 2003 the Delaware Valley Radio Association (NJ) and the NJ Antique Radio Club will try something new (actually old)—a combination vintage style hamfest and an Antique Radio Meet. The DVRA has returned to their old hamfest location, the National Guard Armory in Lawrenceville. It is a huge building with inside displays and a large area outside for tailgating. Plenty of parking on site is available. It is just off Rtes 95 and 206, and easy to get to. They have invited the NJARC to participate with them to make this a hamfest loaded with old radios and related displays. For more information: www.w2zq.com/hamfest.html.

See my Web site, www.eht.com/oldradio/arrl/index.html for more information and the latest links to the hamfests. Look for my hat at the hamfests and say hello.—K2TON

The One Eyed Monster...or How Television Changed Ham Radio Transmitters Forever...

Our example is the Johnson Viking I. Introduced in 1949 with a kit price of only \$209.50, Amateur Net—less tubes, crystals, key and mike—could also be purchased for \$259.50, wired and tested.

It came in a classy looking cabinet with a modern, yet reliable and proven circuit. The tubes used were well-known at that time and readily available on the war-surplus market at reasonable prices. It had a 6AU6 crystal oscillator, 6AQ5 buffer/doubler and a Raytheon RK-4D32 final amplifier. The 4D32 was also chosen by Collins Radio as the final amplifier tube for their 32V series of transmitters. It was a popular and well-advertised tube of the time.

The modulator consisted of a 6AU6 speech amplifier, driving another 6AU6, which in turn drives transformer coupled class AB2 push-pull 807 modulators. If it was planned to use the Viking I as an exciter for a higher-powered amplifier later on, an additional 500- Ω audio output was possible from the modulation transformer to drive a larger modulator in the amplifier. This would encourage hams to buy the Viking I because it was expandable. The final tube would be link-coupled to the amplifier.

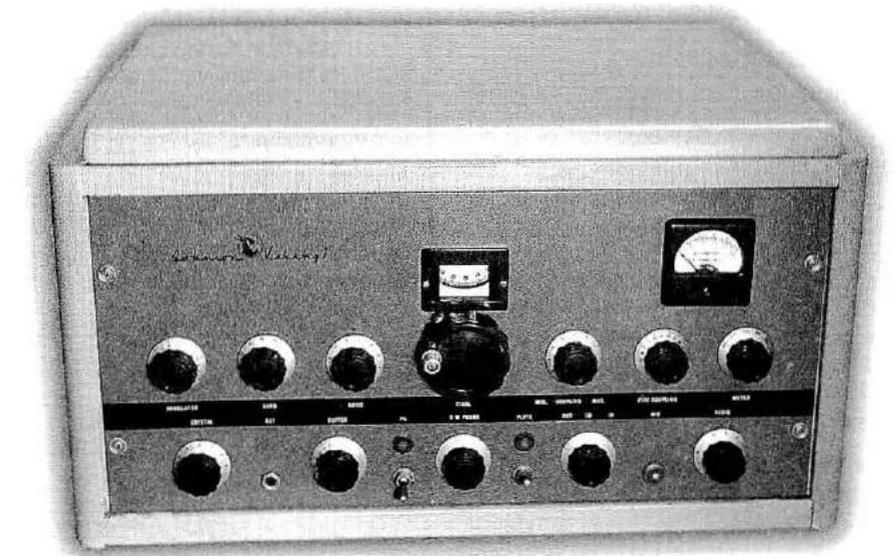
The power supply was very well designed with a pair of 5R4 high voltage rectifier tubes, a 5Z4 low voltage rectifier and a 6AL5 bias rectifier.

Provisions were made for VFO control, and Johnson would offer the model 122 VFO, also available in kit form or wired.

Fred Wahlquist, now AA2P, purchased the kit version early on after much reading and research. Fred figured the Viking I was well worth the money. He also purchased the VFO.

Fred said, "It didn't take me long to put it all together, once I got started."

"My first antenna system was a clothesline that had a metal wire in its center," he continued, "and I used the metal water



pipes in my home as the counterpoise. Nobody knew I had a ham radio. It really got out, too."

But being a good neighbor, Fred knew that their television sets might be having some interference. So when *QST* came out in June 1952 with a great article titled, "TVI-proofing the Viking I," by Phil Rand, W1DBM, he decided to improve his transmitter.

Rand also published a handbook called *Television Interference*. In the third edition he reprinted his *QST* article on the Viking I. (It's the one with the red cover and it's worth reading.)

Fred dove right in, taking apart his transmitter and painstakingly following the directions, step-by-step, until he completed the wiring changes and a replica of the shield in the article using rabbit cage wire. Like the one in the article, Fred had a

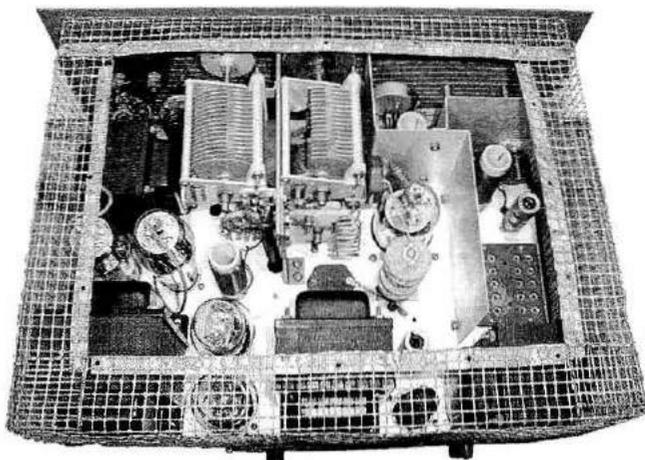
"clean" transmitter, one he and his neighbors could live with. You can see the neat and orderly job he did in the shielding in the photo.

When I disassembled the Viking I to dust it off and prepare it to be photographed, I was impressed with Fred's construction of the original kit. It was neat and orderly, as good as you might expect from a "factory-wired" job. It really is picture perfect. Except for its age and obvious use, it is almost like new.

By now, you Johnson collectors have probably noticed the cabinet color doesn't look correct. It's not. Fred told me he really didn't like the Johnson maroon color, so he painted it his favorite color, Navy battleship grey. Fred's an ex-Navy radio operator, having served in World War II. So this new color looked great to him, and I kind of like it, too. It may get a new paint job some



Fred Wahlquist, AA2P, in the 1970s.



Viking I TVI shielding with the top cover removed.

day, after I finish restoring the older components and test it on the air. If I do, it will be a fresh coat of battleship grey.

The TVI shielding will also remain as a testament to all those hams who really tried to keep peace in the neighborhood, and modified their beloved transmitters.

Other TVI'd Rigs

I have seen some once-beautiful radios hacked up by prior owners using copper window screen, soldering it to the cabinet and front panels. I've seen cabinets with screen and aluminum shielding riveted and sheet metal screwed through the sides, tops and bottoms. And I have seen entire shielded enclosures for the whole transmitter, with small doors that open for knob turning. These are the ones that are always the last to be sold at hamfests, sold cheaply and most likely to become parts rigs for other non-modified transmitters.

The Viking II and other Later Transmitters

In 1952 when the redesigned Viking II came out it was advertised to be "TVI suppressed" by using special shields and built-in filters.

Collins redesigned the later-version 32V series transmitters and cabinets. An internal aluminum shield was added around the RF deck, and it had a new cabinet without the larger openings found in the earlier models.

World Radio Labs started to add shielding on the Globe King 500A's and future 500 models.

From then on, as much of the engineering time went into designing the TVI-free part of transmitter as went into the rest of the circuits. The new single sideband transceivers allowed the manufacturers to over-

From Phil Rand's 1996 QST Obituary

Philip S. Rand, W1DBM, died November 17, 1995, in Lebanon, New Hampshire, at age 89.... He was an electronic engineer for the Remington Rand Corporation in the late 1940s, when Amateur Radio faced a crisis in the form of interference to the early VHF television sets. Rand worked with the ARRL to develop TVI suppression techniques for channels 2 through 6.

ARRL's then Technical Editor George Grammer, W1DF, designed high-pass filters for the primitive TV sets, while Rand developed new methods of shielding for amateur transmitters.

Rand published articles in *QST* spanning 50 years, from "A Shack on Wheels" (1933) to "The Beeper, An Audible Frequency Readout for the Blind Amateur" (1983).

During the TVI days Rand lived in Redding Ridge, Connecticut, and worked closely with ARRL staff member Lew McCoy, W1ICP (now retired). McCoy remembers Rand displaying in his office a computer that used 12AT7 vacuum tubes—it was the famous UNIVAC. McCoy called Phil Rand "my tutor in TV interference"....

haul their lines completely. The newer rigs were much better, we were told. But the big chassis and cabinets and new AM transmitters became part of the past. They became Boat Anchors.

AUGUST OLD RADIO MEETS YOU'LL LIKE

Rhode Island—I won't be able to get to one of my favorite places on Saturday, August 2, but if you're in the New England area you can. It's the "Yankee Radio Tune Up" at the New England Museum of Wireless and Steam. They host an annual radio flea market at 8 AM, and a small auction at noon. You can find them at 1300 Frenchtown Rd, East Greenwich, RI 02818, tel 401-885-0545. It is located about 10 minutes south of Route 95 (it's easy country driving). They have a wonderful display of radios there; you'll want to bring a camera and stay all day. I prom-

ise you, you'll be glad you went. For more information and a Web link, see my Web page, www.eht.com/oldradio/arrl/index.html.

Virginia—On August 2 and 3, I will be in Berryville, Virginia with my mobile ham radio museum. It's the Shenandoah Valley Amateur Radio Club's 53rd Annual Winchester Hamfest and Computer Show Sunday, August 3, 2003 at the Clarke County Ruritan Fairgrounds in Berryville, Virginia. There will be some overnight camping the night before. Listen on AM for the new museum Collins station/exhibit around 3885 on Saturday night. The Museum's call is W3KY. Then come by on Sunday and see it live. It's a 75A1 receiver and a 32V3 transmitter that was made operational by collector Al Klase, N3FRQ. See my Web site for more information and a link to the Hamfest. Look for my hat at the hamfest and say hello.—K2TQN

A Spy Radio

Just the saying the words "Spy Radio" brings a quickening to one's heartbeat. The first time I saw one, it belonged to a ham friend who lived in the Washington, DC area. He showed it to me one evening when I was visiting. This was in the early 1990s.

Building suspense as he opened the drawer where he had it stored, he told me he found it under a table at a local hamfest, wrapped up inside a canvas bag. It appeared larger than I first thought. It was an RS-6.

He pulled out the four pieces—a receiver, a transmitter, a universal power supply and a filter assembly. He showed me how they all plugged together to make one complete transmitter-receiver. In no time at all he had it tuned up on 40 meters and was calling a W4 in North Carolina.

In 1995, I had the good fortune to find an unbuild Knight-Kit receiver. After having it a while I offered it on an Internet newsgroup. I said in my offer I would trade it for something interesting. A ham from California came back with an offer of an RS-6. I made the deal.

Finding Spy Radio Information

Don Reaves, W5OR, runs an excellent Web page at www.MilitaryRadio.com. One of many areas on his site is Peter McCollum's research paper, *U.S. Clandestine Radio Equipment*. It's a great history about the use of radios and spying. There you will find the history of many spy-type radios, including the RS-6. Peter has given me permission to quote information from his research paper.

The RS-6 Station

The RS-6 is made up of four units: receiver, transmitter, power supply and power supply filter unit (which also provides storage for some accessories). It uses sub-miniature tubes in the receiver and power supply regulator, and a miniature tube is used as the transmit oscillator.

The Transmitter

The RT-6 tunes 3-16.5 MHz (or 4.5-22 MHz in the RT-6A) in two bands with up to 10 W output. The crystal oscillator is a 6AG5 (or a 6AK6 in the RT-6A). The final tube is a 2E26. Maximum keying speeds are 40 WPM with the built-in key or an external hand key (in either case using the internal keying relay), or 60 WPM with an automated keyer that drives the tube cathodes directly. This circuit is not too different from some 1960 Novice rigs.

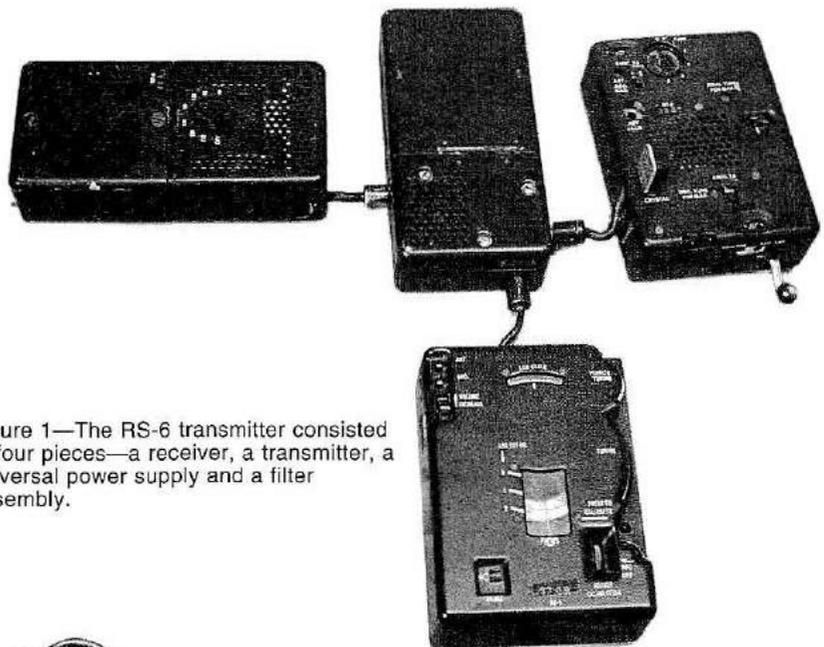


Figure 1—The RS-6 transmitter consisted of four pieces—a receiver, a transmitter, a universal power supply and a filter assembly.

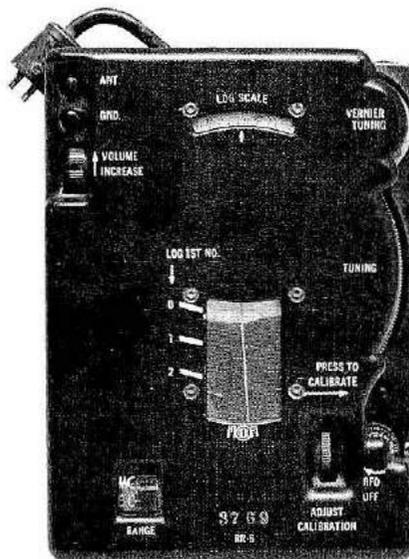


Figure 2—The RR-6, an eight-tube superheterodyne two-band receiver.

There is a small, built-in CW key that swings out of the body of the transmitter. This allows for normal hand keying. There are provisions for attaching an additional key, such as a semi-automatic bug for up to 40 WPM. A tape keyer may also be inserted into the key jack, and by folding the hand key in to the body the keyer bypasses the

keying relay, allowing for high-speed CW.

Tuning is fairly easy, as neon indicators are provided allowing you to "tune for maximum" brilliance. You can pre-tune without the antenna by turning the antenna impedance matching switch to 0, keeping the signal off the air until needed. The last tuning operation is to tune the impedance matching switch for maximum brilliance.

The Receiver

The RR-6 is an eight-tube superheterodyne two-band receiver. It has one stage of tuned RF and the IF is 455 kHz. It tunes 3-15 MHz (or 4.5-22 MHz in the RR-6A), with either VFO or crystal control. It can receive AM stations and also has a BFO for CW. There is a 500 kHz crystal calibrator built-in so you can calibrate the dial.

Placing the TRANS switch in the transmit position will allow it to receive when the transmitter is not keyed. When the transmitter CW key is pressed, the keying relay automatically switches the antenna to the transmitter. This allows the operator to listen between characters or words if he wishes. Means are also provided for the RR-6 to have an antenna separate from the transmitter. It was pretty well thought-out.

There is an earphone jack for listening. A small pair of earphones comes with the

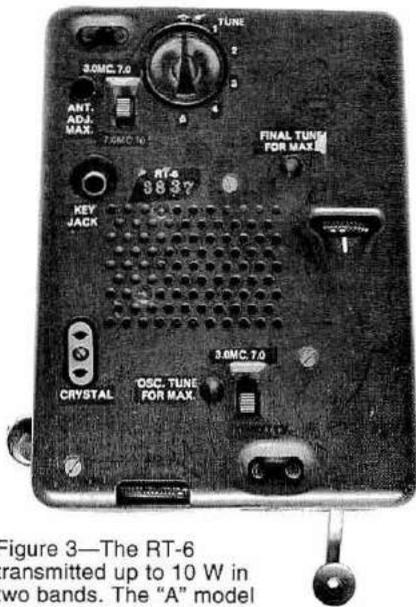


Figure 3—The RT-6 transmitted up to 10 W in two bands. The "A" model provided wideband capability.

RS-6, but any earphones will work in there. There's plenty of volume.

The Power Supply

Being able to use the radio anywhere in the world was important. So the power supply operates from 70 to 270 V ac, 42-400 Hz, or from 6 V dc. The ac power switch starts at OFF position, then switches ON to 270 V, then 230, 190, 150, 120, 95 and 70, until you match the supply voltage. When the neon lamp glows, you have the correct setting. By starting the switch at the high end, it prevents placing too high a source voltage on the set. It was built this way because at the time parts of Hungary and Thailand used 100 V power; areas of Albania, Bulgaria and Colombia had 150 V, and sections of Libya used 270 V.

There is a 6 V dc vibrator supply providing the 400 V needed for the set, by using the dc connector and a car battery. Clamps were provided to tap the car battery at 6 V.

It was also possible to use a hand crank generator, such as the Signal Corps GN-38 (or GN-58). This unit is large and hard to conceal, but it allowed the radio to be operated anywhere without depending on any local power sources.

Who Used These Radios?

Anytime this radio is mentioned to more than one person, it always causes a debate. The debate centers on whether spies used this radio. Some say there is no documentation to prove that our spies carried these radios around. Others say real spies don't talk or leave paper trails. It doesn't really matter—it's still a great radio.

Peter McCollum's research has found the following:

It is reported that the RS-6 was made by GTE in Waltham, MA. A ham that traded McCollum an RS-6 set said that a friend of his recognized it, and said that he used to work in the Waltham plant

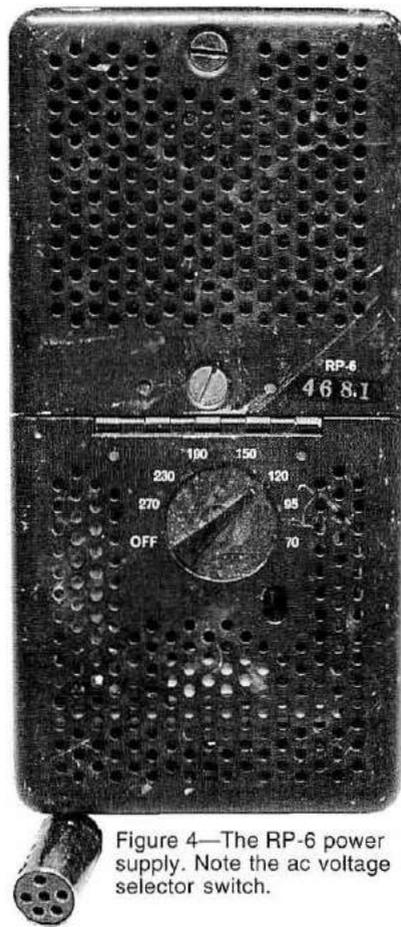


Figure 4—The RP-6 power supply. Note the ac voltage selector switch.

where they were built. GTE has been contacted about this. They said that their Waltham plant was making that sort of thing (secret military comm gear) in the '50s or '60s, but they didn't know specifically about the RS-6.

The RS-6 is known to have been on-board equipment in the following aircraft: B/RB-47E, B-47 ECM, and B/RB-52. A SAC manual (Manual 64-1) has been seen that specifically lists the RS-6 as required equipment during certain types of missions. It is listed as "Radio kit, long range, type RS-6." The contents of the kit include a nylon container (not the same as the bags for the individual RS-6 components), and a GN-58 generator (the manual says "GN-68," but that is presumed to be a misprint). [The information in this paragraph is courtesy of McCollum's friend, Danny Cahn.—Ed.]

One story is that RS-6's were mounted on the bottom of B-47 ejection seats, and that the crew would use them to call for a pick-up after they had released nuclear weapons on a Soviet target. This would be needed because a B-47 wouldn't have enough range to hit the USSR and return, so it would have to ditch on the way back home.

How Many were Built?

McCollum says:

Based on the observed serial numbers, a large number of RS-6 sets were manufactured—probably about 10,000 sets of

RS-6 and RS-6A combined. RS-6 components are known to number from 33 to over 10,400. The RT-6 and RR-6 units are seen in the range up to about 8000, while RT-6A and RR-6A units cover the 8000-10,000 range, and RP-6 and RA-6 cover the entire range of numbers (there is no RA-6A or RP-6A). So it appears that RS-6A manufacturing continued the numbering where the RS-6 left off—the numbers were not reset to 0 when the A model was introduced.

It is unknown how many were made for the CIA, as compared to SAC or other users. It is interesting to note that all of the observed serial numbers (except for one early set) are above 2300, although the manual (or the Addendum) mentions numbers as low as 33. Perhaps the low-numbered units are the ones that were delivered to the CIA, and the remainder were delivered to the military and thus found their way into surplus channels via the MARS program, etc.

The RS-6 may have started production in about 1951. An early unit appears to have component date codes in 1951. Most other units have codes for 1952 and 1953. By observation of markings in the RR-6 receiver, the IF transformers are marked with a number such as "119-3-25"—the "3" represents 1953, and the "25" is week number for that year. The Manual Addendum is dated May 1953, and mentions serial numbers up to 2614 with certain hardware differences. Production of the RS-6A probably stopped about mid-1954, as determined by the "119-4-14" marking seen in an RR-6A.

Conclusion

Peter McCollum is collecting statistics such as serial numbers and IF can numbers. He would appreciate any information you can contribute. You can contact him via his Web page, at www.MilitaryRadio.com. Also, my thanks to Ludwell Sibley, KB2EVN, for providing me with information on the RS-6.

EXHIBITS AND HAMFESTS

A large 1930s "Plug-in Coil" Receiver Exhibit will run through the entire summer at the New England Wireless and Steam Museum, 1300 Frenchtown Rd, East Greenwich, RI 02818, tel 401-885-0545. This is a wonderful place to visit. A link to the museum Web site and the hamfests below can be found on my Web page, www.eht.com/oldradio/arri/index.html.

Thanks to Al Klase, N3FRQ, the K2TQN Museum has a new exhibit. Al refurbished a Collins 32V3 AM transmitter and will have a working Collins AM receiver to match it. Plans are to have it on the air this summer. You can see it at the 53rd Annual Winchester Hamfest, August 3, 2003, at the Clarke County Ruritan Fairgrounds in Berryville, Virginia; at the Fall-Fest, home of the 2003 ARRL Maryland/DC Section Convention, September 6-7, Howard County Fairgrounds, West Friendship, Maryland, and the Delaware Valley Radio Association and the NJ Antique Radio Club Hamfest/Antique Radio Meet, September 14, 2003. More on this event next month.

Look for my hat at the hamfests and say hello.—K2TQN

Radio Books

When I started to collect radios, I found that the only place to really learn about radios was from old books and magazines. These were published as our radio hobby evolved. What you read in them now, was as it was happening back then. Their photos and diagrams really help you understand and appreciate what our predecessors went through to get on the air. Many of them built their own parts as well as building their radios. They all owned books like these.

This month I have compiled a list of affordable books that you can still find. These books will provide a great foundation for your library. I have all of these books and recommend them. A few of them are "Pricey" and are so noted, but for the most part you should be able to find most of them for \$20 to \$30 or less. And they can be a lot less if you look hard for them at hamfests and at used bookstores.

In a future column, I will recommend some of the older magazines for your collection.

I often wished that I had a list like this when I got started.

Recommended Books

Antenna Engineering Handbook, Jasik, Henry. First Edition, 1961. Edited by Jasik, this book has no less than 39 renowned contributors, all specialists in the field of antennas, from long wire to complicated arrays. Containing over 1000 illustrations and line drawings, it is one of the most complete treatises on antenna theory and application. 987 pp. Scarce. Pricey.

Below Ten Meters, The Manual of Ultra-Short-Wave Radio, Millen, James and

Kruse, Robert S. First Edition, 1932. One of the first manuals on ultra-short-wave radio, it is profusely illustrated with many photos of early experiments, as well as details on the history and commercial applications of this part of the frequency spectrum. A chapter on the cathode-ray television at 5 meters, complete with photos proves very interesting. A scarce volume! 68 pp. 55 photos. 67 illustrations. Softcover.

Notes on Amateur Radio Transmitter Design, Millen, James. First Edition, 1937. A fascinating collection of ideas and handy data for the amateur planning to upgrade or change his station equipment. Construction details for many circuits are shown, as well as many photos of vintage National equipment, their specs and schematics. A nice 20 p catalog of National Equipment is included. 118 pp. Scarce. Softcover.

Hammarlund Short-Wave Manual 1939, Hammarlund Manufacturing Company. The theory of design, construction and operation of short-wave radio. Includes a listing of S/W and land stations throughout the world working below 100 meters. Construction details for a one, two and three tube short wave receiver are included, as well as a 6L6 transmitter and 5-meter apparatus. 32 pp. 65 illustrations. Scarce. Softcover.

Two Hundred Meters and Down. The Story of Amateur Radio, De Soto, Clinton, West Hartford, CT: The American Radio Relay League, Inc. 1936. Paper wraps. First Edition. The fascinating story of the early days of Amateur Radio and the

establishment of the ARRL. 184 pp.

Radio for All, Gernsback, Hugo. Philadelphia and London: J. B. Lippincott Company, 1922. Cloth. First Edition. "In writing the present volume the author has continually had in mind a book for the public at large, as yet not acquainted with the radio art." Contents include History; Transmitting; Receiving; Receiving Instruments; Tuning; Radio Telephony. 292 pp, 13 halftones, 133 line illustrations.

Radio up to the Minute, Irwin, John R. & Nilson, Arthur. New York: Edward J. Clode, Inc, 1927. Cloth. "A practical manual with questions and answers." 382 pp, 92 illustrations and photos of apparatus, circuits, etc.

Principles of Radio Telegraphy, Jansky, Cyril M. New York, NY: McGraw-Hill Book Company, Inc, New York. First Edition, 1919. Covers the theory and practice of radio transmission and reception. 242 pp with 179 illustrations, several of which are of radio apparatus.

Radio Simplified, What It Is—How to Build and Operate the Apparatus, Kendall, Lewis F. and Koehler, Robert Philip. Philadelphia, PA: The John C. Winston Company, 1922. Decorative cloth. First Edition. 271 pp, 95 illustrations. Illustration shows a family listening to a radio with an external horn speaker.

Radio Theory and Operating, Loomis, Mary Texana. Washington, DC: Loomis Publishing Company, 1928. Cloth. Fourth Edition. 992 pp, 795 illustrations, plus charts, tables, etc. Supplementary circuit diagram of GE Master-Oscillator Trans-



K2TQN found that an antique bookcase helped get wife approval for storing the books in the living room.



Old radio books really look nice in your shack.

mitter with radiotelephone.

Wireless Telegraphy and Telephony, Morgan, Alfred P. New York: Norman W. Henley, 1916. Cloth. Third Edition. "A practical treatise on wireless telegraphy and telephony, giving complete and detailed explanations of the theory and practice of modern radio apparatus and its present-day applications, together with a chapter on the possibilities of its future development." 154 pp plus 32 p catalog; 156 illustrations and photographs.

Wireless Telegraph Construction for Amateurs, Morgan, Alfred Powell. New York, NY: D. Van Nostrand Company, 1914. Cloth. Third Edition. 222 pp plus 16 p book list; 167 illustrations, including 6 black & white plates. "In this book, the author has endeavored to present a book embracing practical information for those who may wish to build for private or experimental use a set of wireless instruments which are more than toys but yet not so expensive as commercial apparatus." Chapter titles include The Apparatus; Aerials and Earth Connections; Induction Coils; Interrupters; Keys; Oscillation Detectors; Telephone Receivers and Headbands," etc. Scarce. Pricey.

Radio's First Voice. The Story of Reginald Fessenden, Raby, Ormond (Bio). Toronto, ON: Macmillan of Canada, 1970. Trade paperback. First Edition. The biography of the first man to transmit the sound of the human voice without wires. 161 pp.

Radio Engineering, Terman, Frederick Emmons. New York: McGraw-Hill Book Co, 1937 or later, hard covers. Any edition is great. 813 pp with many illustrations, drawings, charts, diagrams and tables. Later editions reflect changes and advances made in the radio industry. This is a "must have" book. Other titles by Terman are equally useful.

The Principles Underlying Radio Communication, US Army Signal Corps. Washington, DC: US Army Signal Corps, 1919. Cloth. 355 pp, 268 illustrations and black & white plates.

The Complete Radio Book, Yates, Raymond Francis, & Pacent, Louis Gerard. New York, NY: P. & F. Collier, 1922. Cloth. First Edition. An early book for the lay reader, one of the "Popular Science Library" series. Covers the history, basic theory and application of radio. 330 pp, 77 illustrations, 1 foldout map showing worldwide submarine cables.

Short Waves, Leutz, Charles R. and Gable, Robert B. Altoona, PA: C. R. Leutz, Inc, 1930. Cloth, gilt titles. First Edition. First book devoted exclusively to high frequency currents as related to radio communications and associated fields—radio, television, ship-to-shore, directional antennae, aircraft radio equipment, short-wave receivers, UVF [medical] and amateur short-wave.

Where to Find Them

I have purchased books from the following old book dealers. They specialize in radio books, and will help you find that special book.

Old Authors Bookshop, PO Box 1176, Ogdensburg, NY 13669; tel 613-543-3337; authors@mor-net.on.ca; www.oldauthors.com.

New Wireless Pioneers, 1541 Bronson Rd, Grand Island, NY 14072; tel 716-773-4999; wireless@pce.net. Write for catalog.

Play Things of Past, 9511 Sunrise Blvd, #J-23, Cleveland, OH 44133; tel 216-251-3714; gbstopt@aol.com; www.olderadioparts.com.

384 pp, photo illustrated, diagrams.

Modern Radio Reception, Leutz, Charles R. New York: Leutz, Inc, 1928. Revised First Edition. Covers radio receivers and accessories, radio reception, laboratory apparatus, tube data and radio standards and definitions. 384 pp.

Modern Radio Servicing, Ghirardi, Alfred A. New York: Radio & Technical Publishing, 1935. Hard cover. First Edition. A practical text on the theory, construction and use of modern radio servicing equipment; the rapid, systematic methods and technique of radio servicing in all its branches, and tested methods of selling radio service work to the public. With 760 black & white illustrations. Navy blue cloth boards with gilt spine lettering. 1302 pp, including index. [This book is a "must have"—you will learn so much from it.—Ed.]

Radio for Everybody, Lescarboua, Austin C. New York: Scientific American, 1923. Hard cover. Revised and Enlarged Edition. Brown cloth, gold spine/cover lettering, x-354 pp, black & white photos and technical drawings. "Being a popular guide to practical radio-phone reception and transmission and to the dot-and-dash reception and transmission of the radio telegraph."

Radio Telephony, Goldsmith, Alfred N. New York: The Wireless Press, 1918. First Edition. Hardcover cloth, 247 pp, well illustrated. [One of the best early books.—Ed.]

History of Radio to 1926, Archer, Gleason. New York: American Historical Society, Inc, 1938. Cloth. First Edition. One of the best histories of radio, this book covers the development of the electric telegraph, wireless telegraphy/telephony and broadcasting. 421 pp, with 20 illustrations. Pricey.

Big Business and Radio, Archer, Gleason L. New York: The American Historical Company, Inc, 1939. Cloth. First

Edition. "Do not think that the present volume is a mere continuation of *History of Radio to 1926*. On the contrary, much of the struggle from which this volume takes its name was fought and won prior to July 1926. The bulk of this volume consists of a story based upon records opened for the first time to any historian." 503 pp, with illustrations. A scarce title. Pricey.

The Radio Manual, Sterling, George. New York, NY: D. Van Nostrand Company, 1930. Cloth. Second Edition. "For radio engineers, inspectors, students, operators and radio fans." 20 chapters, covering broadcast transmitters, marine R/T equipment, aircraft and ground equipment, auto alarms, police transmitters/receivers, etc. 797 pp, with 248 figures, many of which are photographs of radio equipment. [Another "must have."—Ed.]

Practical Wireless Telegraphy, Bucher, Elmer E. "A Complete Text Book for Students of Radio Communication," NY: Wireless Press, 1917. Green cloth with black lettering. Numerous photo and drawing illustrations. The functioning of present-day commercial wireless telegraph apparatus. Black & white illustrations. 336 pp. Second Revised Edition. Hardcover.

The Wireless Experimenter's Manual, Bucher, Elmer E. Incorporating *How to Conduct a Radio Club*. New York: Wireless Press, Inc, 1920. First Edition, completely revised and rewritten. 350 pp plus 7 pp related advertisements. Over 300 drawings, diagrams, tables, equations, pictures, etc. "Describes parliamentary procedure in the formation of a radio club, the design of wireless transmitting and receiving apparatus, long distance receiving sets, vacuum tube amplifiers, radio telegraph and telephone sets, the tuning and calibration of transmitters and receivers, general radio measurements and many other features." Index, Useful Table for Determining the Wave Length, Frequency and Oscillation Constant of Radio Frequency Circuits.

Vacuum Tubes in Wireless Communication, Bucher, Elmer E. 1919. 202 pp plus 7 pp advertisements. 148 illustrations in the text, including some halftones. "A Practical Text Book for Operators and Experimenters." 202 pp, First Edition. Cloth.

The Outline of Radio, Hogan, John V. L. Little Brown, 1923. 256 pp. Black & white photos, illustrations and diagrams. First Edition. Hardcover. [One of my favorite books. I have the first chapter online. You can read it by visiting my Web page at www.eht.com/oldradio/arrl/index.html.—Ed.]

Good luck finding your books. I know you will enjoy reading them, and don't be surprised if you catch yourself reading them over and over.

The National NC-183D

Just after the war, in early 1947, the National Company introduced the NC-173 receiver with a price lower than their popular HRO-5A1 and NC-2-40D models. It was considered a better receiver by many and had a new look with its smooth painted gray finish. This radio had one stage of RF and a single 6V6 tube producing 3.5 W of audio.

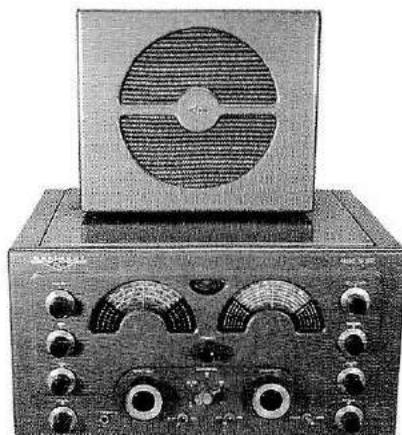
In December 1947 National introduced the NC-183 with an additional RF-stage, circuit and shielding improvements and a greatly improved 8-W audio output stage using a pair of 6V6 tubes in push-pull.

National announced an all-new design in 1952, the NC-183D. It had the appearance of the earlier models, NC-173 and NC-183, but it was a significant improvement. It's said the "D" was to denote "Dual Conversion."

The description from the National manual really explains why hams bought these radios:

The new NC-183D is a deluxe radio receiver featuring performance and versatility 'plus'. Two R.F. stages, three I.F. Amplifier stages and two frequency conversion stages give this new series that extra measure of sensitivity and image rejection so often needed to insure uninterrupted reception at the high frequencies. A double diode noise limiter reduces interference caused by external noise pulses and a voltage regulated converter and C.W. oscillator circuits assure a minimum of frequency drift for both phone and code reception. The selectivity characteristic of the NC-183D is adjustable over a wide range from broadcast requirements to sharp amateur single signal reception. The push-pull audio system delivers the utmost in audio frequency response and undistorted power output from the built-in output transformer.

Fifteen tubes, plus a voltage regulator and a rectifier, are utilized by the NC-183D in a superheterodyne circuit for the reception of phone and code signals throughout its frequency range of 540 khz. to 31 mhz. and 47 to 55 mhz. Calibrated bandspread tuning is furnished for the main amateur bands i.e., 6, 10-11, 15, 20, 40 and 80 meters. Separate directly-calibrated dial scales and associated controls are used for general coverage and bandspread tuning, respectively. An S meter, with a semi-permanent sensitivity adjustment at the back of the receiver, is mounted on the front panel



for signal strength readings of both phone and code signals.

An accessory socket is mounted on the receiver chassis to accommodate such accessories as a National Type SOJ-3 Select-O-Ject, a National Type NFM-83-50 FM adaptor, etc. At the rear of the receiver a socket is available for external use of a battery power supply. Other highlights include a six-position crystal filter, maximum bandspreading of the amateur bands, a quick-action band switch, a phonograph input jack and a terminal panel to permit series or parallel remote standby-receive switch connections.

The NC-183D features a push-pull output amplifier using inverse feed-back. The matching transformer located inside, the receiver provides two audio output circuits as follows:

(1) The transformer secondary leads are brought out to a three-terminal output board located at the rear of the receiver, having both 8 and 500-ohm terminals and a common ground terminal. The 8-ohm terminal provides output for the speaker voice coil and the 500-ohm terminal is available for connection to a 500-ohm line. Approximately 8 watts of undistorted audio output power is available while the maximum power is 11 watts. The audio output terminal board is located on the back of the receiver cabinet and is shielded by a metal cover, which must be removed to gain access to the screw-type terminals.

(2) A headphone jack is mounted on the front panel and is wired so as to silence the loudspeaker on the insertion

of a phone plug. The headphone load impedance is not critical allowing a wide range of headphone types to be used.

The NC-183D is one of the finest general coverage and ham band receivers made by National. It was impressive to see and easy to use. This is one radio that many hams held on to as they moved up into SSB and bought transceivers during the 1960s and 1970s. They continued to use this for shortwave listening because it really sounded good. And many of the early SSB transceivers were ham band only; they didn't cover the shortwave bands.

Profile W2LS

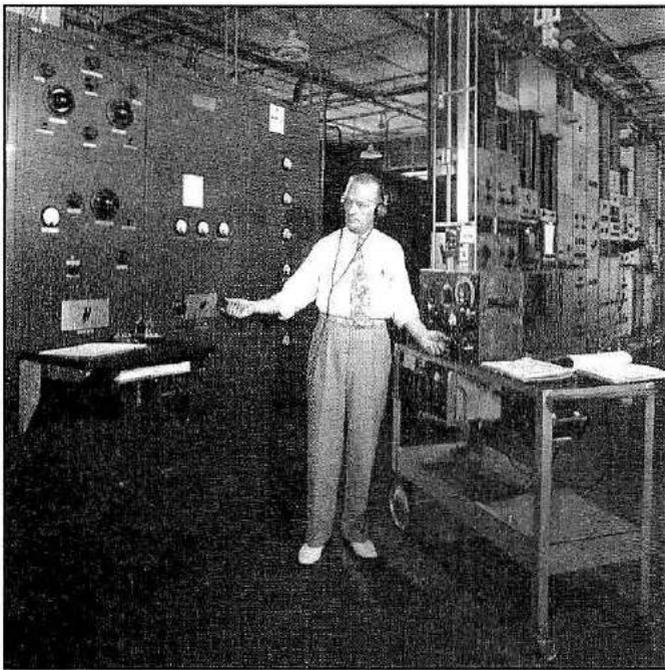
My first Elmer was Bill Savell, W2LS. He purchased a NC-183D new in 1952. He had some television interference issues with it and National had him return it to the factory for troubleshooting. Unable to locate the exact problem, in 1953 National offered him another new one with some upgraded circuits in exchange, which Bill gladly accepted. He talked about this for years, about how professionally National had treated him. He treasured this radio until last year when he gave it to me.

Bill is almost 95 years old now and is in fairly good health. Except during WW II, he has been licensed continuously since September 8, 1923—that's almost 80 years in ham radio. He was awarded a nice 75-year plaque by the QCWA in 1998.

He was introduced to ham radio while listening on a crystal set and heard his Sunday School teacher's voice. The next Sunday he asked all the right questions and was pointed to a hobby that would later



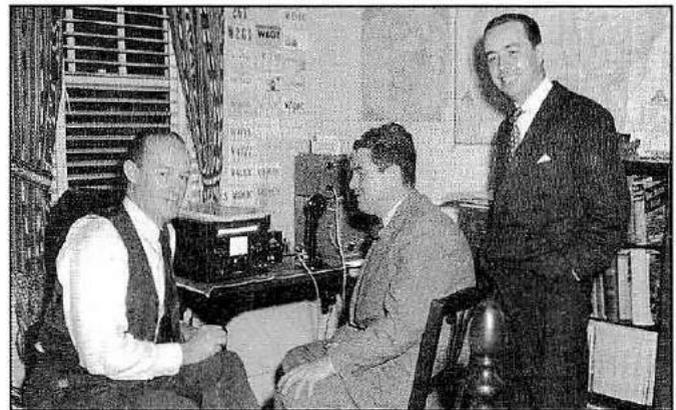
QCWA "75th Year in Ham Radio" plaque presented by Robert Buus, W2OD.



Bill Savell at work adjusting the LC receiver. The 3-bay double conversion Western Electric receiver covered 4-28 MHz. It was tuned to frequency using a chart. It received 4 channels, 2 USB and 2 LSB. AT&T had 15 of these 3-bay receivers in Manahawkin. (This receiver matches the LD-2 transmitter featured in last month's column.)



Bill's 1954 station: receiver NC-183D, transmitter behind his shoulder is a Stancor model 69. The BC-221 frequency meter was used as a VFO and also was used for ARRL frequency measuring contests and when Bill was an Official Observer.



W2LS with two visitors during the 1947 Atlantic City International Radio Conference.

become his career.

He quickly became an accomplished builder and operator. I have one of his early "3CJJ" QSL card confirmations from station "F-1BX" in Paris, France. The date was December 14, 1924. (That's not long after the Transatlantic tests.)

His father was a school photographer and they relocated a few times, moving between the Atlanta area and Virginia while he was growing up. Eventually he moved back to southern New Jersey bringing his new bride, India, with him.

He went to work in the telephone industry, first with Western Electric, then with AT&T. He was assigned to the Manahawkin, New Jersey, radio-receiving site, station WOO. His duties were to maintain the receivers and to set them to the required frequencies for point-to-point communications with countries all over the world. They were used for overseas telephone conversations.

One night while I was waiting for my Novice license to arrive, Bill took me and my NC-81X receiver to work with him. After he set up AT&T's receivers he had a couple of hours to go over my radio. Using the finest test sets available, he carefully aligned my receiver until it was as good as

new. Of course I was overwhelmed with the enormity of all the Western Electric and AT&T equipment there.

Outside the building, it was even more impressive. There was a huge field of Rhombic antennas pointing around the world at every 14 degrees. Bill would switch antennas by patching some cords in the control bay to pick the proper antenna for the country he was working with. I made up my mind that night; that was the kind of work I wanted to do.

Bill was very active chasing DX most of his life. Always a gracious host, he made many friends through ham radio and always-invited foreign hams to visit and stay with him when they were in the area. And they did.

In 1947 Atlantic City hosted the International Radio Conference where representatives from many countries would meet and decide the future spectrum use. (ARRL was an active participant throughout the proceedings. You can read the reports in many of the 1947 *QST* maga-

zines.) Bill and other local hams were assigned as hosts to the visitors.

Many who were in town to attend the international conference were also hams. And many of them visited Bill's station and stayed for a home-cooked dinner expertly prepared by Bill's wife. A few hams also stayed overnight with Bill during the weekends and when they had time off.

The year 1947 also brought forth the "First Annual Hamfest" in Atlantic City. With so many hams already in the area, it was a popular event. In the photo of the Hamfest there are 65 hams, with Bill in the front row, right in the center.

Bill retired from AT&T in the 1970s to enjoy his hobbies. Besides ham radio, he was a member of the Audubon Society and enjoyed bird banding. Bill is now residing in an adult care facility. I enjoy visiting him and talking about the old days.

You can visit my Web site for some additional photos: www.eht.com/oldradio/arrl/index.html. See you at the hamfests. Look for my hat and say hello. —K2TQN

April Fool's

The April issue of many magazines occasionally inserts an "April Fool" article to see how sharp their readers are. I admit to falling for more than one, most notably the "Fuse Tester" back in the 1970s in one of the magazines. It was a circuit that had a box, a switch, a light and a fuse holder. The box said, "If the light lights, fuse is good." But if you pushed the unlabeled switch, which was wired across the light, the fuse would blow.

I built a safer version with an isolation transformer later on and had a ball with it at work. I put it on the break room table at the local telephone company, with a pile of new fuses by its side. It was fun watching the puzzled looks on my friends' faces, as the fuses would blow, one right after the other. Usually by the second or third blown fuse they would catch on, and everyone had a good laugh. Of course the date was April first.

The "Milkotron"

I always enjoy reading the early *QST* magazines. Sometimes I spot an "April Fool" type article in an issue other than April. Such an article appeared in the November 1930 issue of *QST* on page 31, and until recently I thought it was a joke. It was titled, "The Milkotron, as told to the Old Connecticut Yankee, by Woody Darrow, W3JZ, of Philadelphia." It is about a strange tube built inside an old milk bottle by the De Forest Company. If you have an old *QST* or the 1930-39 *QST* View CD, read it and you'll see what I mean.

Recently my friend Jerry Vanicek found a Milkotron tube and wrote about it in the *Tube Collector*, the publication of the Tube Collectors Association. I'll let him tell you the story.

The MILKOTRON, Another De Forest Invention?

By Jerry Vanicek

Very little is written about one of the rarest of the De Forest tubes, the MILKOTRON. The writer first became acquainted with this device in 1964, while reading through a stack of old *QST* magazines. At that time I thought that the tube must have been long since destroyed.

However, in the 1970s I found a second reference to this unique device. The subject of the MILKOTRON came up while visiting Gerald Tyne. [Gerald Tyne, ex-8KN and a SK, was an expert and well-known author on tubes. His book, *Saga of*

the Vacuum Tube is highly regarded.—Ed.] In answer to my questions, he produced a De Forest Company photograph of the tube. In the picture, the tube type is spelled in two different ways. The label on the envelope (one-pint milk bottle) states "MILKATRON," while the label on the base says "MILKOTRON."

Until recently, the writer had found nothing more on the MILKOTRON. However, I recently bought an early De Forest Oscillation from a dealer selling

on eBay. The dealer was from New Jersey, only a stone's throw away from Passaic—the latter-day home of the De Forest Company's tube factory.

After buying the Oscillation, I instinctively asked him if he had any other old tubes for sale. He replied that he had sold most of them but still had a De Forest AUDION, VT-4-B which "some fool had stuck in an OAK FARM milk bottle."

I immediately purchased the tube. While awaiting its arrival, I wondered if this could be the long-lost MILKOTRON. I located Tyne's photograph. The tube pictured did have an OAK FARM milk bottle for an envelope. I also located the *QST* article. To my surprise, the MILKOTRON pictured in the article differed from that in the De Forest Company picture. There were two MILKOTRONS! Was De Forest capable of capitalizing on the idea of another inventor?

The MILKOTRON arrived after several days. It is the exact one pictured in the De Forest Co photograph. It had fared reasonably well during the last 70-plus years. The label on the base was missing. The upper label on the bottle is brittle and darkened but still bears its typed DE FOREST



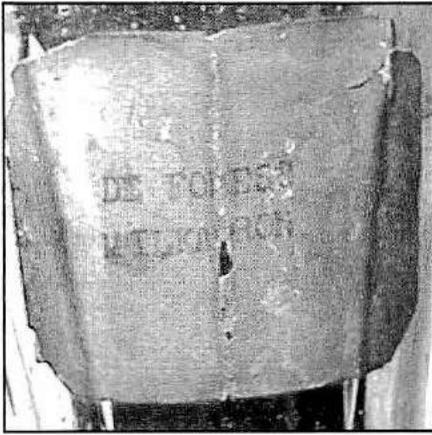
Milkotron tube from November 1930 *QST* article.



Jerry's Milkotron tube.



De Forest company photo of tube found by Jerry Vanicek.



Close-up of the label on Jerry's tube.

MILKATRON legend. The creases on this label are in the same exact locations as those in the De Forest Co photo.

Jerry is still seeking information on this unusual tube. Did the De Forest Company use the picture in an advertisement or circular? Hopefully more will turn up. You can reach him by e-mail at audion@ameritech.net. For more about the Tube Collectors Association, please check their Web site at www.tubecollectors.org.

WESTERN ELECTRIC

In 1963 I went to work at Western Electric, installing telephone offices. It was my ham radio background that drew me to this industry. I heard about the Overseas Radio stations in New Jersey belonging to AT&T, and had visited one once when I was 15. I wanted to work on the radios there. As luck would have it, I quickly found a niche in the emerging Electronic Switching Systems, a telephone office switch, and didn't get to the radio stations very often.

The AT&T sites were awesome. Outside there were huge fields of antennas; inside: long rows of large receivers in the Manahawkin location, and even longer rows of very large transmitters at their Oceangate and Lawrenceville locations. When I was younger I dreamed of owning one of these big transmitters some day. Recently AT&T shut down Oceangate, their remaining New Jersey radio transmitting station, and it is currently awaiting its fate as the building finds new owners.

When my January *Electric Radio* (ER) magazine arrived, I was "blown away" by an article about Mark Richardson, W7HPW, who had one of the huge Western Electric LD-T2 transmitters, on the air, in his home. With his permission, here is a short version of how he came to own such a radio. (For the entire story, you can purchase the January 2003 issue from ER by contacting Ray Osterwald, NØDMS, at PO Box 582, Pine, CO 80470-0582. Single issues are \$3.75. Their Web page is www.ermag.com.)

World's Largest Ham Radio?

In 1985 Mark was attending Utah Valley Community College, whose building used to be a technical school back in the 1950s. In

Profile: Jerry Vanicek

Jerry Vanicek is a graduate of Southern Illinois University with a degree in Electrical Engineering. He is retired. Although not presently licensed, he has held the Amateur Radio calls WA9RJD and KC9JS.

He is a Founder, Board Member and currently President of the Tube Collectors Association.

He collects items pertaining to, and has researched, the field of radio and radio related items for the past 38 years. He has been a member of the Antique Wireless Association (AWA) since 1968. He was awarded the AWA's highest honor, The Houck Award and has presented several lectures at National AWA conventions.

An author, he has written numerous articles for the following publications: AWA's *Review* and *Old Timers Bulletin*, *Antique Radio Classified* and the *Tube Collectors Association Bulletin*.

He has contributed a great number of exceedingly rare tubes to The Manhattan College Tube Display, which is one of the best in the country. For the past six years he has worked part-time as a volunteer for the Museum of Science and Industry in Chicago. His work there is in the Special Collections Department.



Jerry Vanicek with his Milkotron tube.

Mark Richardson, W7HPW, with his big station. Shown from left are the Western Electric LD-T2, Johnson Desk KW, Johnson Viking II, Johnson KW Matchbox, Johnson Ranger I and his Hammarlund SP-600-JX-17 receiver.



1964 the school purchased the transmitter, serial number 11, for use as a teaching tool. In 1985 it became surplus and was to be scrapped. Mark submitted a bid of \$100 and took it away piece by piece, as it was too large to move intact. He was lucky to find all of the prints and original paperwork in a closet.

He placed it in storage for several months, then moved it, piece by piece, to a machine shop where he worked nights. After it was back together, he hooked up the 230 V, 3-phase primary power, and it came to life. He used the transmitter as a communications project and received an A.

Loaded onto a trailer, it was placed back in storage until he purchased a home in 1993. There he disassembled it again and reassembled it in his basement. This took until 1997.

The LD-T2 weighs 4500 pounds and covers 4-24 MHz, using AM, USB and LSB. It is capable of 4 kW PEP output using a single 3X2500F3 final, driven by a pair of 4-400s.

This Man Loves His Radio

In 1998 Mark's neighbors were unhappy

with his antennas and he was forced to move. He found a new location and built a home there. The transmitter was disassembled again, and then reassembled in his new home.

Since 1997 he has put 400 hours on the transmitter and used it with his club, the Utah Amateur Radio Club's Olympic special event, logging 2165 contacts on all bands from 80-10 in 48 hours of operation.

A WE Linear?

My friend at AT&T tells me that Western Electric made the LC-T1, a 60 kW linear in the late 1930s. It took four water-cooled triode tubes, was 6 feet tall, 4 feet deep and about 12 feet long, and weighed over 6000 pounds. One was installed in the Lawrenceville station for the Moscow circuit, and was used until about 1972. The high voltage transformer was located outside the building and provided 14,000 V at over 10 A.

If anyone knows where one of these is, please contact Mark. He'd love to find one and add it to his cellar, just for looks of course.—K2TQN

"Sparks"

As radios were being placed aboard ships in the early 1900s, it created a job market for radio operators. Many a young ham ran away to the sea, to become known as *Sparks*. *The Old Man* (the Captain) would assign him to duty in the *shack* (many times it was a quickly constructed room out on the deck of a ship, a ship that was built long before the use of radio). As he *tickles his bug* he hears his rotary gap, the *Rock Crusher*, beat out his transmission. Sometimes radiomen would give up the sea, but would continue to work at *land-side* stations.

This month we are treated to such a story about a young man who ran away to the sea, and later became a radioman and known as *Sparks*. It is written by his son.

His Handle was Al

By Carl E. Hammond, W7WQA

Al Hammond was raised in Tacoma, Washington and ran away to sea aboard the lumber schooner *Lottie Bennett* as a cabin boy. That was in December of 1911. Eighty-two days later the ship tied up to the pier at Sydney, Australia. Al became a "man" during that passage. He stuck with the merchant marine service for the next 20 years and ended his sea-going career as a radio officer. According to his "World Wide Wireless, Service Record and Identification Certificate of Radio Operator," part of which still remains intact, he served on the *SS Hegira* (7/29/26 to 4/26/27) and the *SS Lurline* (10/21/27 to 11/18/27). There were other ships and owners for whom he worked as a radio operator—including the Federal Department of Revenue during the Prohibition era. However, one of the most interesting stories was about his stint with Libby McNeil & Libby, a pioneer commercial salmon fishing and canning enterprise in Alaska.

The 1924 photograph was taken inside his one room cabin and radio shack at the Libby cannery site in Yakutat, Alaska, during one of his several seasons there. His radio log for the 1925 season is the only record that remains of his experiences at Yakutat. As a boy, I can recall many stories of this period in his career that are not recorded in the "log." Two years earlier on his first trip to Yakutat, he with the aid of some local natives, erected huge antennapoles for the long wire antenna system. As you can see from the photo the radio station equipment was primitive by our standards today. It was a "spark-gap" transmitter,

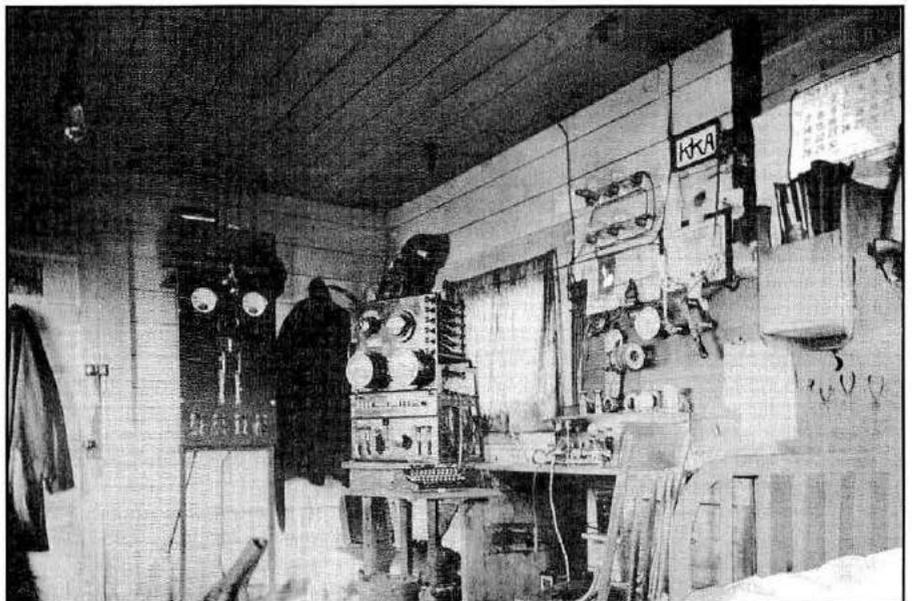
with power supplied by a motorcycle engine driving a generator.

According to Al's surviving radio log, he arrived at Yakutat that year on April 8, 1925, aboard the *SS Libby Maine* to put station KKA on the air for the forthcoming

fishing season. The snow was deep and the weather was foul. It was blowing and snowing too hard to get needed equipment off the ship and into his shack. As the storm lessened, the parts and pieces were landed from the ship. The generator powered by a



Al Hammond, K7IJJ, using his son's Heathkit AT-1 and Hallicrafters S-38.



The Libby McNeil & Libby Yakutat Alaska Salmon and Cannery Radio Station. Taken in 1924, it shows the combination radio shack and living quarters for Operator Al Hammond. This was pretty good accommodations for 1924 Alaska. If you look closely at the desktop you can see his key, and just to the left his *mill* (typewriter). The spark gap transmitter, behind the mill is the same as found aboard ships of that time. Behind his key is an early tube receiver that may be an early De Forest, but it's hard to tell. At the right, just under the calendar, you can see the butt of the pistol he used to scare off wild animals who showed up from time to time. He kept that handy, just over his bed. I have posted this photo on my Web page (www.eht.com/oldradio/arri/index.html) so you can look at it more closely. If anyone has other photos of the Yakutat Station, please contact me by e-mail.—K2TQN

A Microphone Story

The most popular early microphone was the "carbon" type. Most hams purchased their microphones or adapted older telephone mikes. Carbon mikes were fairly inexpensive. *QST* and other magazines had numerous articles showing how to make mike stands and how to use suspension springs to keep the carbon mike from picking up annoying vibrations from the room.

In 1916 Edward C. Wentz (at Western Electric and Bell Labs, 1914-1954) devised the condenser microphone, the first microphone with a flat frequency response suitable for music. With amplification, this microphone was initially used over telephone lines for music.

After 1921 the number of commercial broadcasting stations grew and there was a need for better microphones for use with music and singing. Large companies, such as Western Electric and GE, began developing new types, not using carbon. One type, the condenser microphone, quickly became popular.

At the same time more hams began using microphones to broadcast voice. They too desired to sound better than the carbon type would allow. As commercial condenser microphones were very expensive, hams began to make their own.

Then in the November 1932 issue of *QST* there was an article by Howard Anderson, WIBVS, called "A Sure-Fire Condenser Microphone." Anderson said, "The materials used for this job require a minimum of machine work and are of a type that is generally available, the whole thing being built around an obsolete magnetic loud-speaker unit of a type widely distributed in years past and still to be found kicking around radio shop 'grave-yards' in goodly numbers. As an alternative to this unit, the whole head can be machined to the specifications given in the drawings."

Also in the article was a schematic for a one-tube amplifier necessary to make the microphone function well. A small cylindrical case was also shown, to house the microphone and the amplifier as one complete unit.

In the same issue was an ad for "A Real Condenser Microphone with a 2-stage amplifier by Sound Engineering of Chicago for \$65." Several pages later there was another ad from United Radiobuilders, a New Jersey firm, saying: "Complete parts for making a condenser mike head, with instructions for \$4.50." So if the ham wanted one badly enough to build one, they were now affordable.

In 1934 the Philadelphia M&H Radio Company featured the "Bruno" microphone kit in their catalog. It was really inexpensive, \$2.94 in kit form, or \$5.88 completely assembled and factory wired.



Condenser microphone from the 1932 *QST* article.

The W6CKF Condenser Microphone

Thomas J. Imler, Jr. of Phoenix, Arizona was first licensed as W6CWI on April 30, 1929. The following year he picked up a second station license, W6EXC, for "Portable operation in the sixth radio district only." (It was common back then to have a second call, good only for "portable" operation. These were issued as a "Station License.") His next call sign was issued in mid-1932, W6CKF. At the same time he dropped the other, older calls, and they were reissued to other hams. On page 60 of the November 1932 issue of *QST* he is mentioned as helping W6FEA construct a

AT LAST!

A Real
CONDENSER MICROPHONE
at a price you can afford

Model S-2
\$65.00
LIST

Dealers: Write for details

Comes complete with 2 stage amplifier and 25 ft. cord

OUTPERFORMS ALL CARBON TYPES

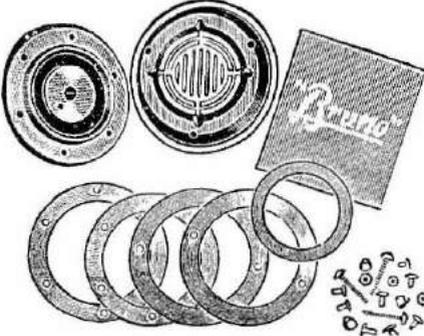
Send for Catalog on Sound Equipment, Microphones and Accessories

SOUND ENGINEERING CORP.
20 N. Wacker Drive Chicago Woolworth Bldg. New York



This ad for the Sound Engineering condenser mike is from page 76, Nov 1932 *QST*.

BRUNO CONDENSER MIKE KIT

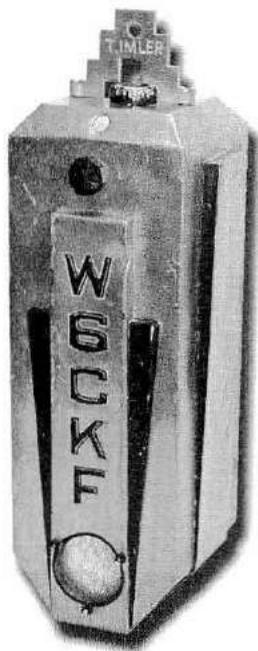


A truly professional instrument, made with micrometer accuracy, can be used wherever perfect reproduction is required. No hiss or other extraneous noises. Selected alloy sheet, 0.002" is used for a diaphragm, fully encased, protected against moist, dust and climatic changes. Complete with easy method of assembly.

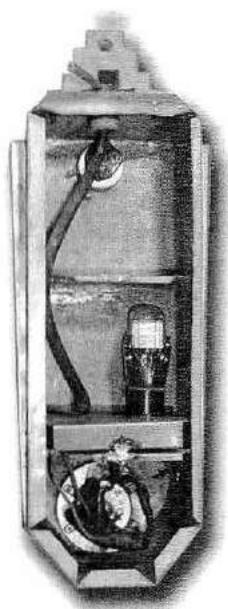
List Price, \$5.00
Your Cost, \$2.94
Your Cost, \$5.88

Completely assembled and factory wired.

Completely assembled and wired for \$5.88!



The W6CKF mike is a beautifully crafted instrument.



Rear view of the microphone with cover removed.

200-watt c.c. (phone) rig. He held this new call for a few years, and by 1939 his call was no longer listed.

Little else of Imler's ham radio career is known, but his legacy will live on, thanks to one very beautiful microphone he constructed. His family owned the first sign shop in Phoenix, and I'm assuming he was active in the business and familiar with metalworking. The workmanship on the microphone is outstanding.

Not satisfied with the usual cylindrical housing, he constructed an Art-Deco cabinet out of heavy sheet copper. Seventeen inches tall overall, it has a lower compartment for the "Bruno" condenser microphone, a center compartment for the one-tube amplifier, and a third compartment at the top to hold the batteries. The cabinet itself measures 15 inches tall by 6 inches

wide and 6 inches deep. "W6CKF" is embossed down the front and his name, "T. Imler" is engraved at the top, into the hanging bracket. The back panel slides up and off to expose the interior; no screws are used. Design wise, I think it has a Southwest look.

There appears to have once been a two-tube amplifier in it, as there are cutouts for two tubes. The knob at the top at one time controlled the gain as well as functioning as an on-off switch for the batteries.

Can you imagine how it must have felt, sitting in front of that microphone, calling CQ? It makes me wonder what the rest of his station looked like. I'll bet it looked just as good.

The microphone came with his two early licenses and his W6CKF logbook. His log covers from August 26 to July 8 with no

year shown. I think it's safe to assume it was in the 1933-1934 time frame, consistent with the 1933 and 1934 call book listings.

He worked stations from as far away as Japan and Australia as well as locals from the sixth district, and quite a few QSOs from the fifth, seventh, eighth and ninth call districts. There were just a couple of ones and threes listed. The two bands operated were shown as 40 and 20-meters. Strangely, there were no comments, no operator names, cities, states or times listed in the log.

How I Got the Microphone

This mike was listed on the on-line auction site eBay in 1998. I bid on it, but did not bid high enough to get it. My friend Brad Jones, a microphone collector, was the winning bidder. Realizing what a mistake I made, I contacted him immediately and let him know that I was interested in the microphone, if he ever decided to sell it. Eventually he did decide to get rid of it, and I traded some things for it.

To finish the microphone for display, I'm hoping to find a W6CKF QSL card to put with it. And maybe someday I'll find someone who knew him or worked him.

Condenser microphones are still in use and popular in the music industry today. Some recording artists closely guard their own personal mikes and only use them for their own recordings. They feel it provides the sound the artist wants. Good condenser mikes today can cost well over \$1000, with many manufacturers producing them.

Hamfest

Weather permitting, I'm planning to be at the Richmond (Virginia) Frostfest on Sunday, February 9. This hamfest always has a good selection of older ham gear and parts, and it's inside and warm. The last time I was there I found a couple of great radios. See their Web page, www.frostfest.com.
—K2TQN

Saving History

Lomoni and Ames, Iowa; KH6JU of Honolulu, T.H.; W3PDA of Philadelphia, Pennsylvania; and finally WA2IIB of Mt Laurel, New Jersey—and what he accomplished—might have been lost forever if it were not for one last telephone call. One of his neighbors knew that Bob would not like to have his treasured ham radio station thrown away, as the house was being cleaned out, in preparation for it being sold. She finally contacted Phil Vourtsis, President of the New Jersey Antique Radio Club.

The NJARC is a radio-collecting club whose members have varied radio interests. Because I was one of the ham members, I was asked (along with Marv Beeferman, secretary of the club) to inspect the station. Upon discussion with the neighbor and the club's board members, it was decided to make an offer for the radio equipment, and our offer was accepted.

We immediately stopped the throwing out of all the radio room "junk," as the neighbor-volunteers who were helping to clean up the property called it. They didn't know we wanted that stuff too. A few items were lost to the trash man, but most of the usable papers and parts were saved.

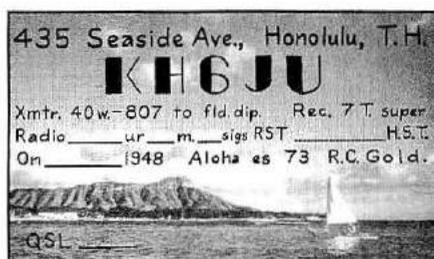
It's important to note here that we all need to spend some time when cleaning out a SK's ham shack to preserve what we can. If you get the opportunity to purchase some or all of an estate, ask your friends for help. Look for photos and papers that show parts of our hobby's past. Once it's thrown away, it's too late. If you're not interested in the history, please find someone who is and ask them to go along.

As our club members went through the piles of papers, we found that Robert C. Gold was an engineer and a significant player at RCA during the early days of color television. Among the papers were manuals, schematics, design notes and project reports on the development and early marketing of color TV. There were some 35-mm slides of the RCA "TV Road Show" taken at various locations around the world. Unfortunately, some of the papers were damp, moldy and in some cases unusable. There had been a minor flood at one time.

Bob had become ill in the 1980s, and then was in a nursing home for a while before he became a SK. His bride and love of 53 years, Jean, also became ill and is still in a nursing home. Without children, and with no local relatives, there was no one to look after the home.



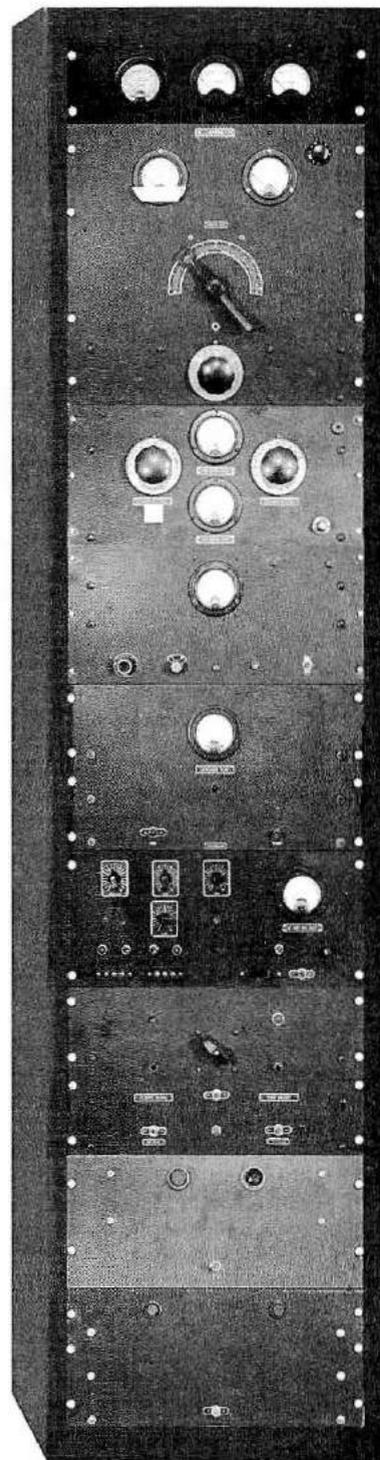
Robert Gold, KH6JU, at his Honolulu station in 1947. Bob was returned to Hawaii for a few years after the war by RCA to help straighten out its property and equipment used by the Navy.



Robert Gold's QSL card from Honolulu, Territory of Hawaii, in 1947.



Robert Gold working on his antenna in Lamoni, Iowa in 1939.



All the black front panel parts from the last station were placed in the 6 foot 6 inch cabinet for this photo. K2WI intends to try to rebuild this rig as close to original, as the present condition of the various units will permit. Most units have been modified over the years.



Robert Flory, K2WI, peeking through the racks, as units are being removed.



This is Robert Gold's friend, Stewart Wight, W9NMA, handling ARRL traffic from Iowa in 1939. The transmitter is one designed by Gold.

Some Memories of my Brother, Robert C. Gold

By Myra Gold Steinbrink

When 13-year-old Robert Gold was in the 8th grade he designed and built an electric map of the United States. I don't remember exactly how it worked, but there were two wired pointers, and when the state or capital was touched the corresponding state or capital would light up. Everyone marveled at his invention.

In 1932 when Robert was in high school (probably 15 or 16) he built a radio and walnut cabinet to house it for our parents. They had this radio for over 30 years. In 1937 on my 16th birthday (Robert was 21) my brother let my girlfriend and me spend that Sunday talking to ham radio operators all over the country. He had recently built his first "rig," which took up one whole little room on the second floor of our house. He later built a combination shop/ham radio building in our back yard. There was always a steady stream of friends who spent a lot of time in that building.

I remember he erected two very tall antennas for that equipment, one on top of the building, the other in a pasture across the street. Electrical storms were always a concern, and I remember when one was struck by lightning. There was also a fire in the radio building. On both occasions Robert got the fires out before the local fire department arrived.

Robert joined RCA in the summer of 1941. I rode with him in his new car to Kansas City, Missouri, where he was first assigned, but not for long. He was one of the first persons chosen by RCA to be taught the complexities of radar and sonar. A short time later while still working for RCA he was assigned to the US Navy as a Naval Technician, a post he held all during World War II.

After the war Robert was stationed at the New York City office and I remember him telling me when there were only 50 TV sets in the whole city and he was assigned to service them. He knew David Sarnoff (head of RCA) and worked a number of times with Dwight Hemion, winner of 24 Emmy Awards, who directed some of the "specials" that NBC produced. Robert mentioned having been the first to televise the birth of a baby for a hospital or medical school.

In 1957 he traveled to Japan for RCA, to introduce color TV. He said, that at that time the Japanese were having trouble getting color to work properly. He spent quite a bit of time working with the engineers there; some of that long time was because of the language differences. Eventually the Japanese figured it out with his help.

RCA was always sending him to international trade fairs in such places as Greece, Italy and Germany. Robert and his crew received an Emmy for the process that connects a number of unrelated commercials together—something we naturally take for granted now.

He was at the Berlin Wall, on May Day just after it was built, broadcasting this event to the world. On the other hand, in 1950 he broadcast the 50th anniversary of the Nobel Prize, and demonstrated the same for the King of Sweden and Sweden's Parliament. Later he was in charge of building the television display for the Museum of Science and Industry in Chicago. He also authored several technical manuals for RCA.

When he traveled to other countries, he made it a point to look up and find fellow hams. He would visit them and see their stations. It is my feeling that during the 40-plus years spent working for RCA, he never really lost his love of being a "ham" radio operator.



Robert Gold in his US Navy Technician uniform. He was employed by RCA and assigned to the Navy during WW II.

One Word of Caution!

Upon entering the shack on the first trip, I found the ac power still turned on—on the operating console and to all the equipment. In all that time—perhaps as long as 15 years—no one had turned it off. I carefully removed the plugs, one by one. Even though Bob was an engineer, and over-designed his station for safety, in later years he used lamp cord extensions. Never assume the power is off. In situations like this, take your time to be safe.

Removing the Equipment

Luckily, many hands make light work. We had a good turnout to remove and haul away the station and other radio items of interest. Also fortunate is the fact that there are so many varied interests in our club. All the papers will be examined and reviewed with knowledgeable eyes. I'm sure there will be a few good articles written on their contents, and eventually the more important papers will be placed with an appropriate museum or library.

Bob was also quite a transmitter designer. In 1938 he, with lifelong friend Stewart Wight, W9NMA, started a custom manufacturing shop. Several of their designs were built, sold and used on the air. They had customers from California to Rhode Island. After college they dissolved their company, Gold & Wight, and went on to their own radio and electronic careers. Many of his early designs have survived.

In a future column I will feature some of his ham designs and station equipment. If you would like to see more of Bob's station, visit my Web site: www.eht.com/oldradio/arrl/index.html.—K2TQN

It's a Heathkit Time of the Year

Every December I think way back to the days when I would receive the Heathkit Christmas catalog. Of course two or three things would be placed on my gift-wish list. Dad was always hard to convince, but I remember well the Christmas I received my first Heathkit from him, an AC-1 antenna tuner. It was the first of about a dozen Heathkits I would build over the years. I miss those kit-building days.

The most complex kit, and the last one I ever built was the SB-101, an 80 to 10-meter SSB transceiver. I used it on the air for years. I still have it and it still works very well.

A few weeks ago I purchased several ham radios from an estate sale. Included was a pair of Heathkits. These were much newer than those I had built; they had transistors in them and digital readouts. In no time at all I had them apart and was inspecting the construction and reviewing the step-by-step instructions.

HR-1680 Receiver

The HR-1680 replaced the HR-10B receiver with a new look. All solid state and with a digital display, it was sold from 1976 through 1982. Sensitivity was advertised as 0.5 μ V on the 80, 40, 20, 15 and 10-meter bands. Modes are USB, LSB and CW. The controls are simple and easy to use. It also has a preselector. The power supply is built in.

As you can see in Figure 1, the inside is spacious with modular printed circuit board construction. This should allow for easy maintenance as needed. The manual provides alignment and testing procedures with no exotic test equipment needed.

HX-1681 CW Transmitter

The HX-1681 is the matching (CW only) transmitter for the HR-1680. Introduced in 1979, Heath sold them until 1982. The original cost was \$239.95. Together they make a great looking pair.

The HX-1681 replaced the popular DX-60 that was sold for many years. It is a great transmitter for the CW operator. It features a solid-state VFO with less than 100 Hz drift in 30 minutes after warm up.

Break-in keying with automatic antenna switching and muting of the HR-1680 receiver make this pair easy to use together.

In Figure 2, on the right you can see the driver and final tubes. (I removed the safety cover for the photo.) The driver is a 12BY7 and the finals are a pair of 6146s. The VFO is under the aluminum cover that has the Danger sign on it.

The Station

As you can see in Figure 3, both front panels are well laid out. One gets familiar with each control very quickly. Tuning the transmitter (shown on the bottom) is easy into a 50- Ω load. An external antenna matcher is needed for antennas with high SWR.

Power for the transmitter is provided with the Heath SB-23 power supply, available separately. A matching speaker is the HS-1661, which was originally sold to go with the HW-100 series.

I found this transmitter and receiver pair to be much like my older SB-101. Many of these are still on the air, not just collecting dust on somebody's shelf. I have seen several for sale recently in the \$100 range (each), inexpensive enough to add to your collection. For more information, product reviews were in the following issues of QST: HX-1681, March 1981; HR-1680, January 1977.

Have more fun this holiday season by using your Old Radio.—K2TQN

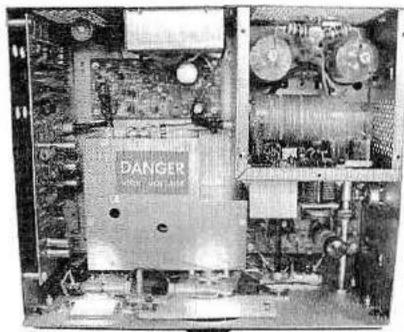


Figure 2—The Heath HX-1681 transmitter.

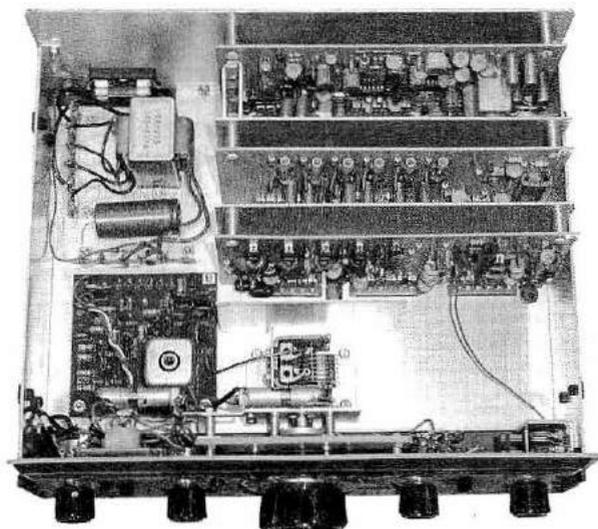


Figure 1—The HR-1680 receiver.



Figure 3—The pair of them together.

The Black Box

In the days when most hams built their own stations, every winter ARRL would provide great construction projects in *QST*. January 1949 was no exception. On page 48 there is a nice 35 to 50 W rig. The basic circuit, still popular with collectors today, is a 6L6 oscillator driving an 807.

Albert Hayes, W1IIN, ARRL's National Emergency Coordinator, writes that the acquisition of a war surplus PE-103A dynamotor got him thinking he needed a portable/mobile/emergency transmitter. The dynamotor is a motor-generator that runs off of a car battery and delivers 500 V at 160 mA. This would provide enough power for a two-tube rig.

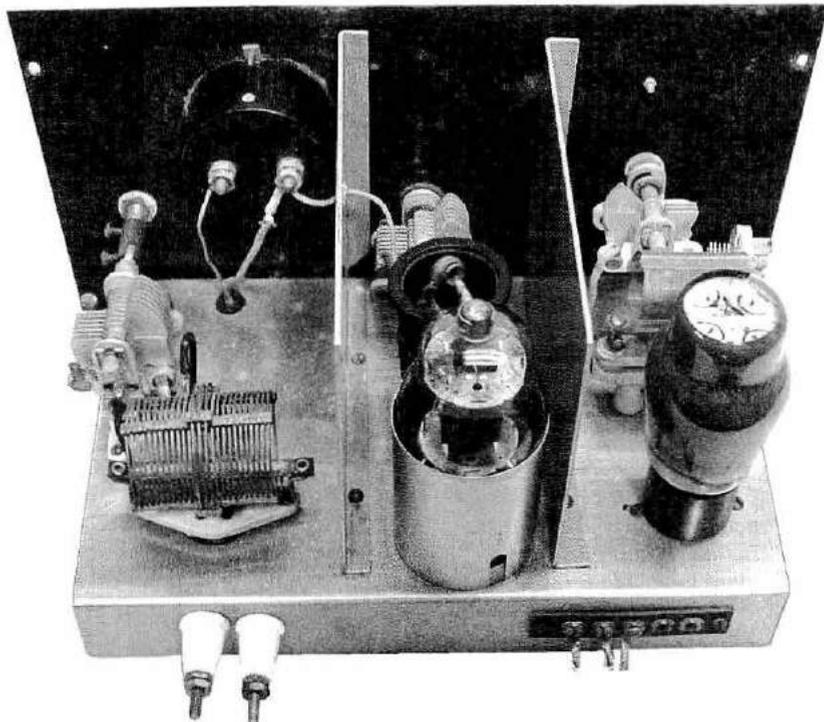
He decided on using the popular 807 tube as a final, probably because they were plentiful and inexpensive. He determined the rugged 6L6 would have enough power to drive it. The 6L6 would also be a VFO so he could change frequency. It would be used on CW in the 80 and 40-meter bands.

W1IIN also placed a nice antenna tuner in the circuit. It is designed to be used with a 135-foot antenna fed at the center with 300-ohm twin-lead, providing series tuning on 80 and parallel on 40 meters.

Mine is constructed on a $6\frac{1}{2} \times 10 \times 2$ -inch chassis. The oscillator and antenna tuning circuits are shielded by two stationary aluminum partitions bolted to the top of the chassis. The cabinet is made by Bud, and is $7 \times 7\frac{1}{2} \times 12$ inches wide. (The article's chassis and cabinet is each 2 inches larger.) The cabinet also has a lid to make it convenient to change the plug-in coils for each band. As it is a low power rig, it would be an easy radio to replicate today with some junk box parts. Every part is common or easily substituted with something similar. A few trips to some local hamfests should produce enough parts to make a nice copy.



Front view of the 6L6/807 transmitter from an article in a 1949 issue of *QST*.



The inside view.

The radio in the photos was built from that *QST* article. My friend and fellow collector Pete Grave, an SWL from Pennsylvania, found this at a hamfest and thought it would be a good subject for the Old Radio column. He was right—when he called on the phone, I immediately drove over and picked it up.

I plan to “recap” and resolder the parts to insure a good solid circuit. Then I plan to get on 80 this winter and have some fun with it using a transformer power supply I have lying around. (W1IIN also used his in his home with a transformer power supply that gave it a solid 50 W out. He said he had a weekly schedule with HH2BL on the low end of 3.5-MHz band with it.)

“Recapping” is the process of replacing the older paper capacitors with new ones. The original ones in this transmitter are wet with oil that has leaked out of the parts and would cease to function in short order. For a few dollars I can put in new ones that will last for years.

It's always fun to find a radio built by a ham that was featured in *QST*. It's interesting to see how closely the builder followed the original circuit and layout—or not. Many times you will see substituted parts and small improvements. Sometimes you

From January 1949 *QST*

This comment was attached to the original article.

“With surplus vibropacks and dynamotors still readily available, there is no reason why every amateur should not provide himself with a transmitter which can serve his community when the wires go down in time of emergency. The little rig described in this article was tailored specifically for a popular surplus dynamotor, but readily adapts itself to almost any portable supply you may have available. Give it a try—you'll find it a lot of fun to build and use, and you will be preparing yourself to be of public service when your neighbors need you most.”

will find extra holes where he moved parts around trying to get it to work.

If anyone needs a copy of the schematic, I'll place it on my Web site: www.eht.com/oldradio/arrl/index.html.

Time to get your antennas tuned up for winter. Look for me on the bands and maybe at a winter Hamfest.—K2TQN

Ham TV in 1930

Nicholas Bozzay (SK) helped form the radio club at the Grover Cleveland High School in Caldwell, New Jersey, around 1928. Even though there were no licensed amateurs there, he and his friends studied all about ham radio. He graduated in 1932, still without a license. It was about this time he picked up his first television receiver.

Mechanical TV was the big thing in radio back then. Everyone wanted to see moving pictures in their home. Living near New York City provided him with several sources of broadcasted experimental video. He constructed a radio receiver and hooked it to his model "T-3 Pioneer Scanner," as it was called.

He was successful and had many exciting evenings viewing the small objects that were broadcast. He also found others, hams, who were doing the same. By 1938 he held the license W2LVD.

Nick joined the Navy when war broke out. He was a radio technician aboard the USS *Manila Bay* when a Japanese suicide plane struck it. That crash knocked out the ship-to-ship communications. He was later cited for his resourcefulness and quick thinking for hooking up a plane's radio on the deck with special extension cables he

used for working on them in the shop. This allowed the *Manila Bay* to continue in the battle instead of retreating.

Pioneer was a local company to Nick, based in Jersey City. They advertised the T-3 in early radio magazines for \$8.50, less tube. The special "Neon" type tube sold for about \$3.

The T-3 consisted of a series wound brush type synchronous 1200 r/min motor. It had an on-off switch (bottom) and a special switch (top) to open the brushes, allowing the motor to coast until it could be synchronized with the incoming picture. See Figure 1, a close-up view of the motor. One had to be careful, as a misplaced finger would result in an electrical shock.

The 16-inch black-painted aluminum disk had two series of 60 holes, cut in a spiral. This allowed the tube to be moved up and down to also adjust the incoming picture, once the speed was set. It took 60 holes to spin past the tube to make a picture. The light emitted from the holes formed a $1 \times 1\frac{1}{2}$ -inch, 60-line picture. The picture viewed was made up of either orange light or dark spots, making the two tones. The resolution was poor, but great for the time.

A complete set-up is shown in Figure 2. Here is a 1928 Silver-Marshall Around the World Four receiver. The audio output feeds the Mutter three-tube amplifier. The amplifier raised the signal voltage to about 200 V, which fires the neon tube. The tube has a large 1-inch-square plate that glows when the signal is right, then goes dark for the black part of the picture. All this happens at a high rate of speed, allowing the eye to see a moving picture.

By changing the neon tube to a bright bulb and using a photocell, a ham could send pictures to his friends. The photocell output was hooked to the ham's AM modulator causing a buzzing sound to be transmitted.

Visit my Web page, www.eht.com/oldradio/arrrl/index.html, for more on mechanical TV. I will have two great Web sites listed, each with many examples of early television. There will also be a demonstration picture to help you visualize exactly what it looked like back then.

My thanks to Robert Bozzay, WB2UXA, for his father's interesting story, Tom Genova at the Television History site and Steve at the Early Television Foundation for providing information for this column.—K2TQN

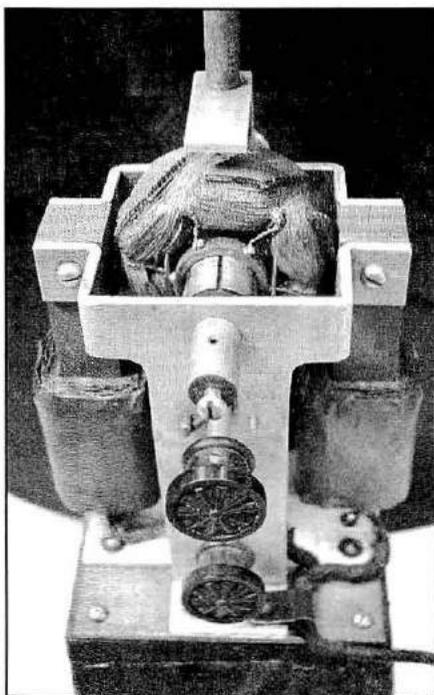


Figure 1—A close-up view of the motor.

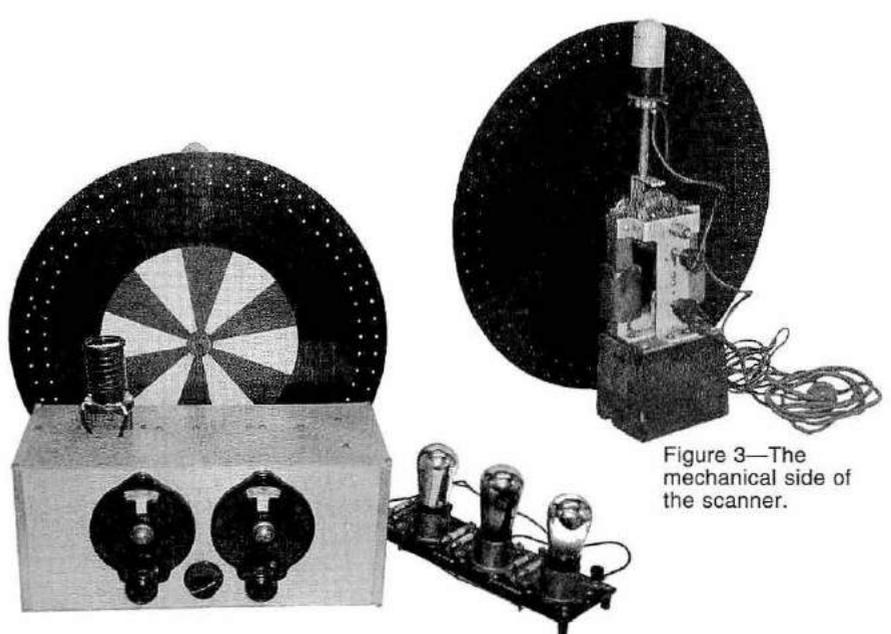


Figure 2—An operating station to receive 1930-era TV. The three main parts are the radio, the scanning disk and the three-tube amplifier.

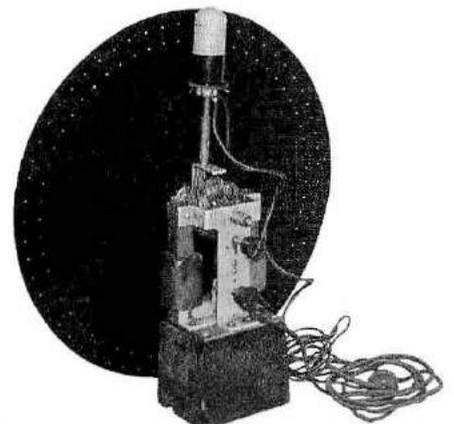


Figure 3—The mechanical side of the scanner.

The 1937 Haynes RSR Clipper

Historic "Radio Row" in New York City has been getting some press lately. One of the most interesting was on National Public Radio's feature, *All Things Considered*. The June 3 show titled: "Radio Row": *The neighborhood before the World Trade Center*, featured sound bites and interviews from the early days before it was all torn down in 1966. You can listen to the story and read about it on NPR. Find the June 3, 2002 *All Things Considered* show on their Web site at www.npr.org. Additional links, information and sounds may be found on my site, www.eht.com/oldradio/arrl/index.html.

One of the men who helped make Radio Row in the early days was A. J. Haynes. Claimed as the earliest radio kit designer, in 1922 he designed the first regenerative kit called the "Haynes DX Circuit," and in 1924, the first Superheterodyne kit. He was an excellent writer. His circuits, articles and kits were in many of the early magazines.

His first RSR, "Regeneration-Super-Regeneration" receiver was in the June 1936 *Radio-Craft* magazine. Called the "Haynes R-S-R," it had an impressive tuning range covering from 2½ to 555 meters with four tubes and a rectifier. It featured band switching and separate fine-tuning for the 10, 5 and 2½-meter bands. Priced at

\$14.95 in kit form, less cabinet, and \$24.95 for a completely wired set with cabinet and speaker. The "Radio Row" company selling it was Radio Constructors Laboratories, at 136 Liberty Street. It was an ac-dc set.

An improved model, the "RSR Clipper" was in the April 1937 *Short Wave & Television* magazine. This set covered from 3 to 555 meters and had a similar circuit as above. One new feature was the big 6L6 Beam Power tube in the audio output, which they said, "produces excellent quality sound with low harmonic content." It also had a power transformer with an 80 tube as a full-wave rectifier. The most important new feature was the separate "Extreme" band spread tuning on the low bands, through 15 meters. One owner wrote in to say how valuable this was for "tuning the 20-meter band where stations are very crowded and hard to separate on a regular dial."

To use the RSR Clipper on the higher bands, the band switch was placed into the fifth position. Here the low frequency coils and main tuning capacitor were switched out. A jumper was removed and one of three supplied coils was installed. This allowed coverage from 10 to 3 meters. Homemade coils could also be used for experimentation. The band spread capacitor then became the high frequency tuning control. Its size was small providing good

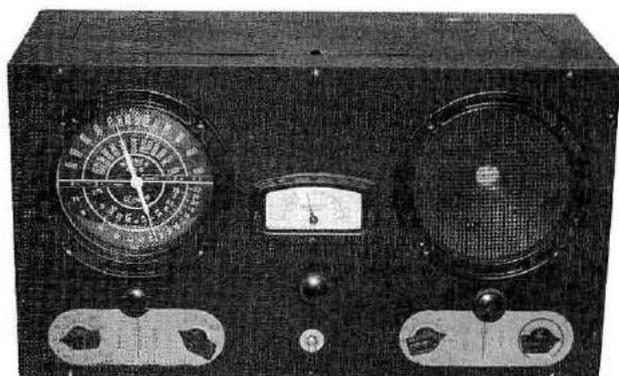
station separation.

This model was sold wired, with cabinet, tubes and speaker for \$28.85. A kit was not listed at this time, although later on as sales dropped off, he offered a kit.

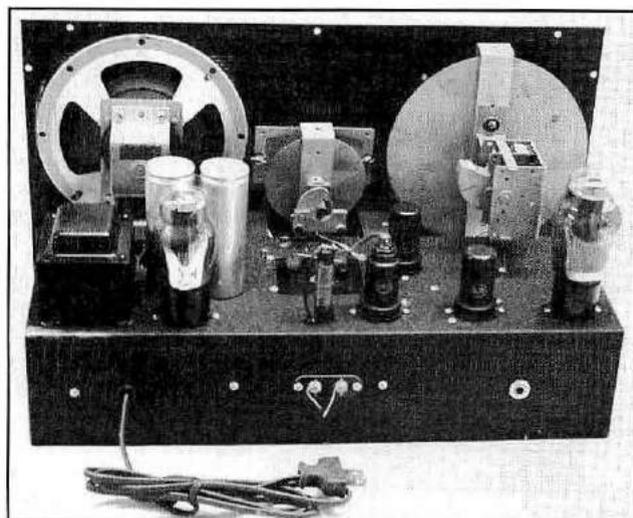
The RSR Clipper shown here was lovingly restored by my friend John Kelly, N3GVF (SK). (See my column in July 2000 *QST*.) John completely stripped the chassis and cabinet. He repainted it in its original black wrinkle finish, and then reassembled it using mostly vintage parts where practical. When I purchased it after his death, it looked like brand new. He also hand drafted the dials, paper labels and lettering. The detail on the main dial is extensive. In all, it must have taken him a hundred hours to complete. Look for this radio in my mobile museum.

AUGUST HAMFEST

I'm planning on taking the museum to the 52nd Annual Winchester Hamfest in Berryville, Virginia on Sunday, August 4, 2002, www.Vvalley.com/svarc/hamfest/. Last year I attended this hamfest for the first time and had a ball. It's well run and fun, has great food and you can find boat anchors everywhere. I'll be arriving on Saturday. Look for my call letters on my hat and say hello.—K2TQN



A. J. Haynes, a Radio Row pioneer, designed the Haynes R-S-R receiver.



The Harvey-Wells Bandmaster

John Wells, W1ZD, and Clifford Harvey, W1RF, came together to start the Harvey-Wells Electronics Company in Southbridge, Massachusetts in 1939. During World War II they produced many items for the war effort, earning the prestigious "E" award. After the war they would go on to produce ham radio equipment, including the popular Bandmaster transmitter.

John Wells started in ham radio while in high school during 1919. His call then was 1BQJ. Wells went to Harvard and was active in their radio club. In 1926 he developed a crystal-controlled transmitter and wrote an article in the June 1926 *QST*. He was one of the first to use crystal control, grinding his own. During WW II his crystal expertise would come in handy, as the Harvey-Wells Company produced thousands for the Army and Navy. His call became 1ZD in 1926.

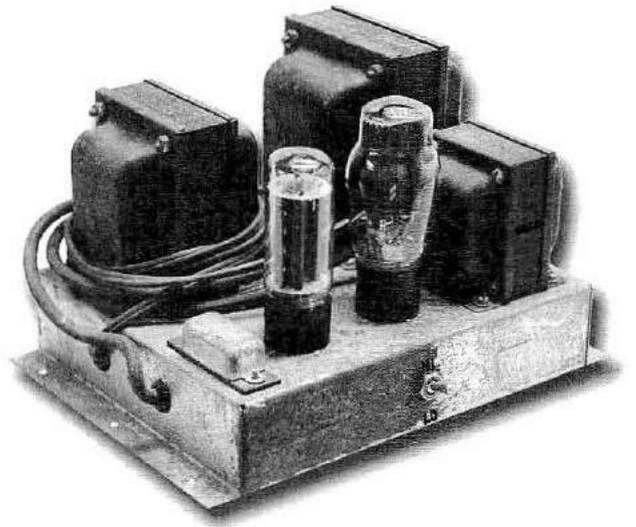
Also a pilot, in 1932 Wells flew his autogyro aircraft to an altitude of three thousand feet to experiment in the "56-mc Eclipse Expedition" (October 1932 *QST*). While there he met Paul Hendricks, W1AXV.

Hendricks was at that time entering into a partnership with Clifford Harvey. Their company, Hendricks and Harvey, built the "Single Signal Receiver" that was advertised once in 1932 in *QST*. It is believed that this is where Wells met his future partner, Clifford Harvey.

Clifford Harvey was born in Philadelphia and went to college at MIT. He graduated in 1931 as a radio engineer. Shortly after his partnership with Paul Hendricks, he would go on to found Harvey Radio Labs. In 1939 Harvey and Wells formed their new company.

When war was winding down, they planned new radio products to sell. They produced radios for marine, aircraft and, of course, ham radio. The 1947 Bandmaster would become one of their most popular, with many being sold. The one shown here, model TBS-50D, serial number 5573, was produced after 1950.

There were three basic TBS-50 models. The "B" or Junior version was CW only at \$87.50, the "C" or Senior was for mobile operation with a carbon microphone at \$111.50, and the "D" or Deluxe model with



additional audio preamps for crystal microphones was offered at \$137.50. Optional power supplies for mobile or fixed station operation were offered, from \$39.50 for the ac supply to \$87.50 for the 6-V mobile supply. Shown is the ac supply.

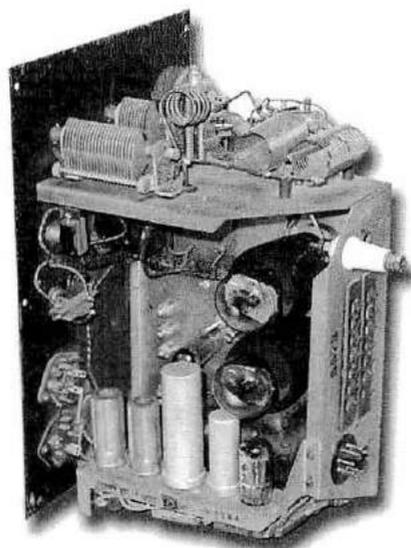
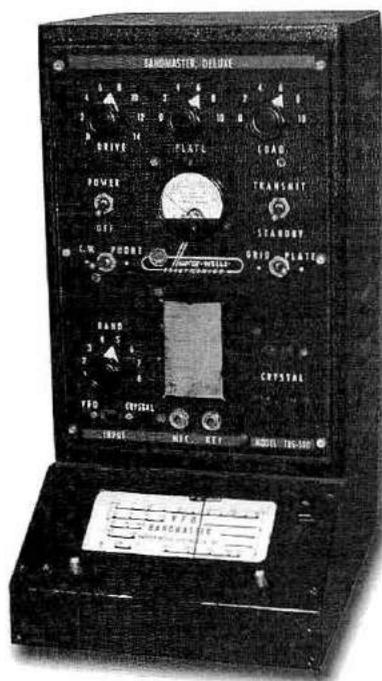
As you might expect, it was physically well designed and used many parts that were on the "surplus market" to keep costs low. Shown in the interior view is the heavy-duty modulator with a pair of 6L6s in push-pull. They would modulate the single 807 final to a full 100%.

You can see the various final coils on the top. This transmitter had band switching and would cover from 80 to 2 meters. That was a lot of spectrum and as you might expect, with the increasing popularity of home television, they became less popular with hams. I had one back in the late 1950s and tried to use it on 6 meters. I was into every television in the neighborhood. In no time at all, my mother encouraged me to sell it and get another one "that wouldn't bother the neighbors."

The VFO shown at the bottom of the transmitter is a hard-to-find accessory today. The transmitter is still popular with the AM crowd and makes a decent "first" vintage restoration project, as parts can be easily found at hamfests. It looks good, too.

My thanks to Peter Laur, SM5HUA, for helping me find some of the historic information. For more history, schematics and photos of the Bandmaster and Harvey and Wells, visit my Web site www.eht.com/oldradio/arrr/index.html.

Look for my hat at the hamfests and say hello.—K2TQN



"The Fight of the Century"

On July 2, 1921, hams created the first Sports Network to broadcast "The Fight of the Century," the Jack Dempsey-Georges Carpentier heavyweight championship fight held in Jersey City, New Jersey. Because of the hams, 300,000 people heard the broadcast up to 400 miles away.

The entire broadcasting arrangements, both transmitting and receiving, were under the direction of the National Amateur Wireless Association (NAWA). This group of hams was resourceful and influential. Many of them lived in the area, which allowed them to participate on fight day. NAWA was also associated with *Wireless Age* magazine.

Through the courtesy of Tex Rickard, promoter of the big fight, radio proceeds and donations collected benefited the American Committee for Devastated France and also the Navy Club of the United States.

How did the Hams do it?

J. O. Smith, 2ZL, well-known ham and former director of ARRL, handled the installation and testing. The transmitter used was the most powerful commercial wireless telephone set ever built up to that time. It was donated by the Radio Corporation of

America and built by hams at the General Electric plant in Schenectady, New York.

The transmission was on 1600 meters, or about 187 kilohertz. This was a Navy frequency for which special permission was requested and granted. This frequency was chosen because it was reliable and the then current technology supported it.

The tower at the Lackawanna Railroad Terminal was used for the antenna of six wires, on 30-foot spreaders. It was connected between the 400-foot tower and the

clock tower of the terminal building. The antenna was 680 feet long, and had a natural period of 850 meters. The antenna current was between 20 and 25 A, representing approximately 3.5 kW.

The Day of the Fight

Using a telephone line constructed by AT&T, Mr J. Andrew White, acting president of the NAWA, with the help of Mr Welker, his observer, described the preliminaries and the main bout, talking over the direct wire from ringside. J. O. Smith then repeated this description word for word into the radiophone transmitter located in nearby Hoboken.

Hundreds of hams, mostly using their own equipment, constructed all the receiving sites. Along with their receivers, they also constructed loud speakers and amplifiers suitable for the size of the room or hall where they were located.

Reports received by the NAWA after the fights were complimentary.

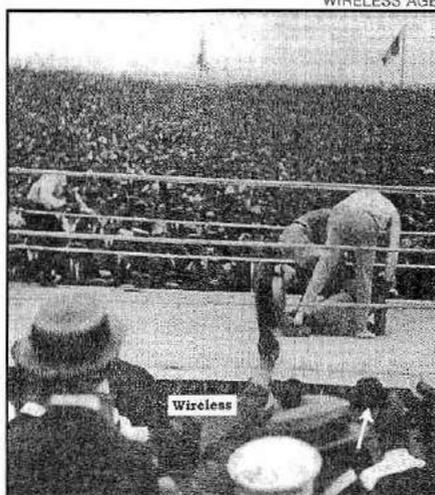
From C. R. Vincent of the Plainfield Radio Association: "I arranged for the reception of the returns at the Golf Club in Westfield, NJ. The entire voice description of the fight was clearly received and every body was surprised and delighted. A check for \$50.00 was sent in to the fund."

From William F. Diehl, 2CY: "The broadcast was received with remarkable intensity and clarity. The output was transferred to a Western Electric loud speaker, which made the voice easy to understand in any part of the arena, which by the way seats 8,000 people. It might interest you to know that not a single interruption of the voice was noted during the entire broadcast. Every word was clear and distinct. Not one person could be discovered in the crowd who had ever witnessed a demonstration of radio telephony before, and one could hear a pin drop, it was so quiet during the performance."

To read the original articles from the 1921 *Wireless Age* magazines, visit my Web site at www.eht.com/oldradio/arrl/index.html.

K2TQN's Mobile Museum

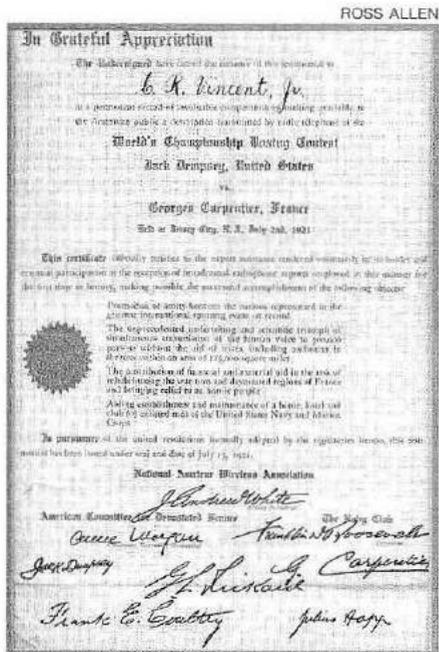
You can see my museum with some new displays at the Raritan Valley Radio Club Hamfest on Saturday, June 15, at the Columbia Park in Dunellen, New Jersey. Look for my call letters on my hat and say hello.—K2TQN



This photo was taken immediately after the final 10 was counted. It shows the wireless booth at the ringside. The arrow points to Mr J. Andrew White who described the contest for the radio audience."



View of the 3-kW GE transmitter and the operator reporting the fight.



Tube Lore

Tube collecting is really catching on. One popular tube that hams have used and collected for years is the 813. I've asked Ludwell Sibley, KB2EVN, tube expert and well-known author to write about it this month.

The Famous 813

The 813 transmitting beam power tube served in amateur transmitters over a remarkably long time span. Introduced by RCA in November 1938, it was a "big brother" to other beam tubes like the 6L6 and 807 (1936) and the 814 (1938).

It offered several design innovations: a "giant" seven-pin base, a rugged hard-glass bulb, a zirconium-coated graphite anode, and especially "button-stem" construction. In this construction, thick tungsten leads were sealed individually into a glass "dish" base. The 813 seems to have been the first tube to enjoy this construction, which enhanced VHF tubes like the 815, 826, 829B, and 832A. The result was quite a compact tube for its power rating, able to take full power up to 30 MHz. Its short element leads were always welcome. The screen grid was aligned with the control grid so as to draw minimum screen current.

This was a powerful tube, good for 100 W dissipation in commercial use and 125 W in intermittent/amateur service. A pair of 813s would "officially" handle 800, 900 or even 1000 W input in ham use.

Most triode-based final amplifiers had to use neutralization to balance out the grid-to-plate capacitance and assure stable operation. RCA claimed that, with its internal shields and tetrode construction, the 813 didn't need neutralization. The circuit designs in their early construction literature were un-neutralized, although many 813-based transmitters in the ARRL *Radio Amateur's Handbook* did employ it.

The 813 enjoyed heavy use in commercial and military HF transmitters in WW II, as in ground-to-air or ship-board service. Renamed VT-144, it acted as driver or final amplifier in the Signal Corps BC-303, BC-339 and BC-401. The Navy used it in the TCK and several other transmitters, and as the pulse modulator in the SJ radar on submarines. Perhaps its most

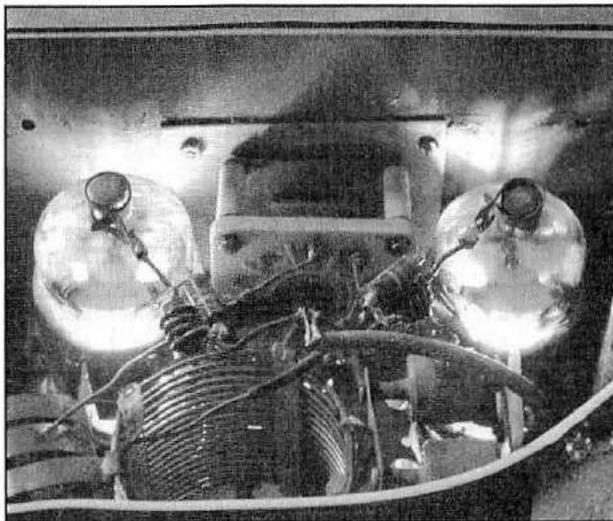


Figure 1—Kilowatt homebrew HF 813 amplifier, 80-10.

BOB DUCKWORTH, WB4MNF

famous application was in the AN/ART-13 transmitter, "standard equipment" in PB4Y and B-29 bombers.

The 813 was more of a communications tube than a broadcast type. Only the Amperex version was listed on the FCC's 1949 list of broadcast-approved tubes, for transmitters up to 125 W output. The 833 and 833A triodes, from 1939-40, were better suited to the 500-W and 1-kW broadcast market.

A wide spectrum of tube makers besides RCA offered the 813, among them Amalgamated Wireless Valve (Australia), Amperex, Canadian Marconi, General Electric, General Electronics, Ken-Rad, Machlett Labs, North American Philips, National Union, Raytheon, Sylvania, Taylor, United Electronics, and Westinghouse. The Soviet tube industry in later years made a tube remarkably similar to the 813.

RCA promoted its tube in the amateur world, including a transmitter design advertised in 1939 with a single 813 as 150-W crystal oscillator (crystals were more robust then!). However, the tube didn't really get big amateur use until the postwar era—in part because its list price fell from \$22 (1941) to \$14.50 (1946). At that point, the availability of inexpensive ex-military tubes and the need to prevent television interference led to considerable

use. The 813 had the advantage of much higher power gain than triodes, needing only 1 W of drive for 250 W output. In a TVI environment, low drive power (and low radiated harmonic energy) became an important advantage. The *Handbook* from 1948 to 1968 consistently included one or two transmitter designs using an 813 or a pair of them. Twenty years is a remarkably long time span for any tube!

813s are still widely available and remain popular in the "boatanchor" community.—KB2EVN

Ludwell Sibley, KB2EVN

His book, *Tube Lore*, published in 1996 is intended to aid the present-day user and collector of electron tubes by providing historical insight and specific technical data. Sibley has just released Supplement 3 to his book. He can be reached at tubelore@internetcds.com for more information. In addition to his book, he has written many articles for radio publications and was Editor of the AWA *Old Timer's Bulletin* for several years. He is a collector of telegraph, radio and early technical publications.

Tube Collectors Association

KB2EVN also edits the *Tube Collector* bulletin of the Tube Collectors Association, now in its fourth year. This group maintains a Web site at www.tubecollectors.org. They welcome new members and can be reached by mail at: PO Box 1181, Medford, OR 97501.



The National NC-81X

When I was 14 my mother had a small soda and hot dog stand at a local lake. That summer I made almost 60 dollars working in the store and renting old automobile inner-tubes at 10 cents a half hour to the kids that swam there. That was big money for a kid back in 1955. It was a good summer.

Entering high school that fall and finding they had a ham radio club, I joined. One of the members, a senior, was already a general class ham and had his old receiver for sale. It was a National NC-81X. He wanted \$35. Since my mother was helping me save for college, I had my work cut out for me getting the money from her. Luckily my father intervened and I bought my first receiver.

What a wonderful receiver for a Novice back then. It was a ham band only receiver that covered 160, 80, 40, 20 and 10 meters. It had over 1/2 inch spread on the dial in the 80-meter novice band, and a similar amount on 40.

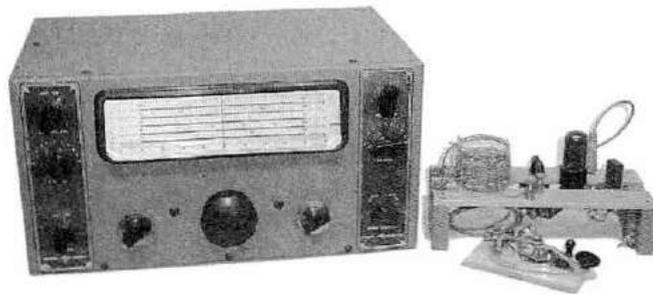
I first put it to work copying the ARRL code practice on WIAW every other night. Before long I was up to 7 wpm and was ready for my test. I learned to use the Crystal filter to remove the QRM that always seemed to be close to the WIAW frequency.

On the other nights, I would listen to the local hams on 160 AM phone. I heard about antennas, electronics, building equipment and I absorbed the proper ham radio operating procedures from them. Later one of them would give me my Novice exam.

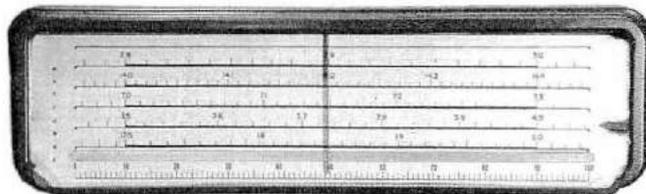
Rare today, the 1937 NC-81X and the NC-80X, its general coverage twin, still make good CW and AM receivers. My original was traded away to a friend when I found a newer receiver in 1956. Since the mid-1990s I searched for several years before finding the replacement I now have. Robert Enemark, W1EC, a well-known collector in Massachusetts had restored it. I'm grateful he sold it to me when he was thinning out his collection.

These two receivers were designed to be less expensive but still work well like the rest of the National line. To accomplish this National's designer, James Millen, eliminated the expensive "HRO" type dial, the big plug-in coils, the S meter and the power transformer. These sets were ac-dc powered, and designed to run at a lower B+ voltage.

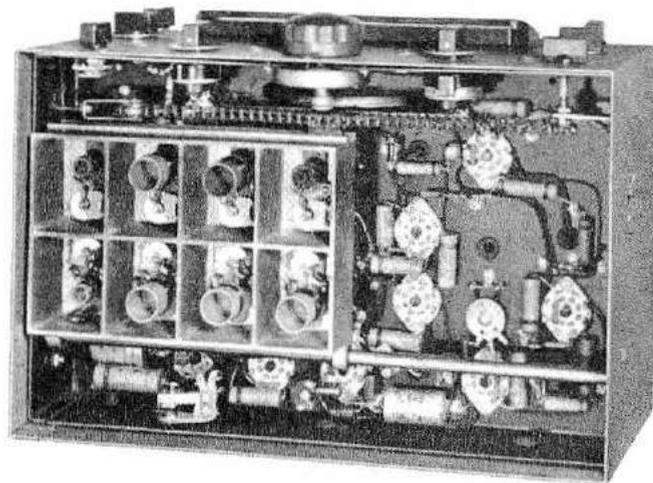
Millen also designed a new "slide-rule" type dial with a dual vernier reduction drive knob, which provided a 55 to 1 reduction over any narrow band of frequencies with an automatic shift to 11 to 1 reduction for rapid moving of the pointer to another sec-



The replicated 1956 station of KN2TQN. The transmitter is from ARRL's *How to Become a Radio Amateur*. It was built by Ray Morgenweck, K2QQF.



The NC81-X dial showing about 1/2 inch on the old 80-meter Novice band, 3700-3750 kHz. With the 55:1 reduction dial it really separated the stations.



Bottom view of the NC-80X, with RF coil shield removed. As shown, the broadcast coils are plugged in.

tion of the dial. This was quite an innovation. It made fine-tuning a snap.

The large plug-in coils were replaced with a sliding coil tray, under the receiver. This provided a high quality plug-in type of coil system for less money.

The big addition to this receiver was a new Crystal filter designed to cover a range of selectivity from 300 Hz to 7 kHz and to work with a higher intermediate frequency of 1560 kHz, instead of the normal 456 kHz.

I found that the combination of the reduction dial and the sharp crystal filter allowed me to really separate the CW signals. My early Novice days and hundreds of QSOs were most enjoyable with this receiver.

If you find one of these ac-dc sets, it is well worth bringing home. It seems the dial escutcheon is usually broken because someone lifted it wrong. There are no replacements for them, so you'll have to glue the pieces back together. Try to get the original speaker, too. The radio will not run without it, as the transformer is mounted within the speaker box.

I'm still looking for your vintage station photos for my Old Radio Profile. Send them to my address below, or my e-mail address.

I'll see you at the hamfests. Look for my call letters on my hat and say hello.

—K2TQN

Displaying Your Collection

Small displays of radio related items could really dress up your shack. Hams with small apartments or condos sometimes don't have a lot of room for equipment, so they have to look for small things to collect. If you have more room, you probably have more stuff, but you still need a few wall displays to contrast with the bigger things.

This month I have a "Shadow-Box" display with most of my ARRL pins and ribbons in it. I have found these over the last 10 years, mostly one at a time. The display box was purchased at A. C. Moore, a local craft store. It originally had some fake golf junk in it and was on clearance sale. It was well made, about 15 inches square, and I knew it would look great hanging on the wall. Out went the golf junk and in went my ARRL ribbons and pins.

Finding Ribbons and Pins

Many of you emailed me about the 1925 hamfest column a few months back, wondering how often the old pins and ribbons show up. My answer is: often enough if you look for them. You have to be patient, though. Here are a few suggestions:

At hamfests, look for someone selling a ham's estate, or someone who is cleaning out his or her cellar. You can spot these kinds of sellers, as they tend to bring much more than they can possibly sell in one day, nothing is priced and everything is a mess. They usually have a lot of boxes full of small items. Look through all the junk boxes. Look for boxes that have items in that might have once been in a desk, dresser or workshop drawer.

At estate sales and moving sales, ask the owner if there are any retirement pins, tie clips, organization pins or lapel pins. If you're lucky maybe someone there had worked in radio at one time. Many did during WW II, and then went on to other careers after.

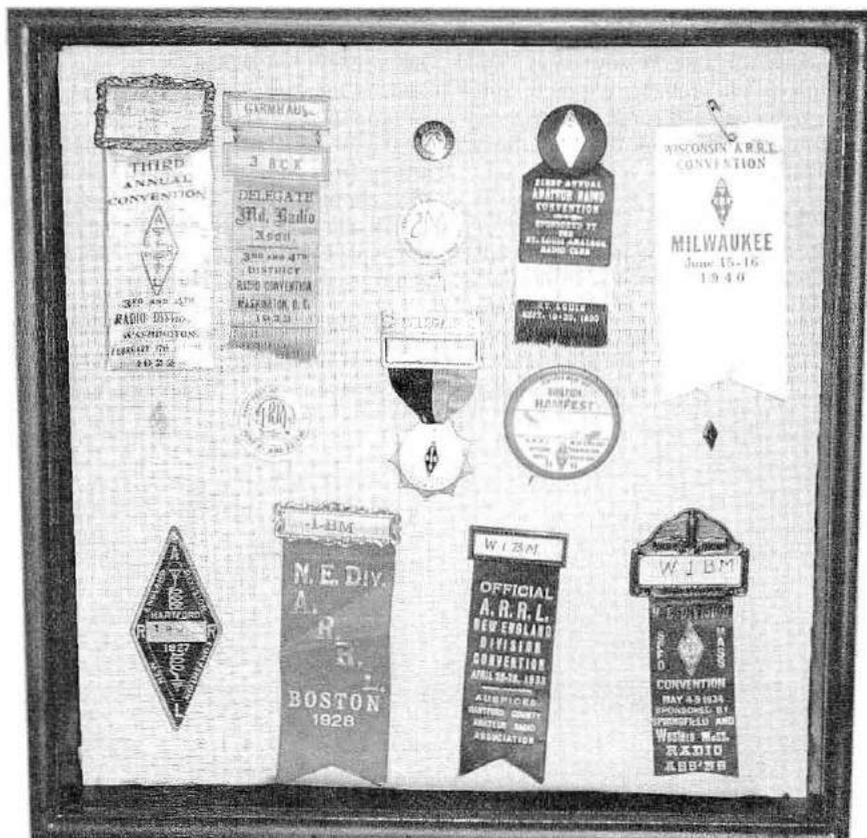
At Antique Malls and Shops, check out the displays of costume jewelry and fraternity pins. I've been lucky here.

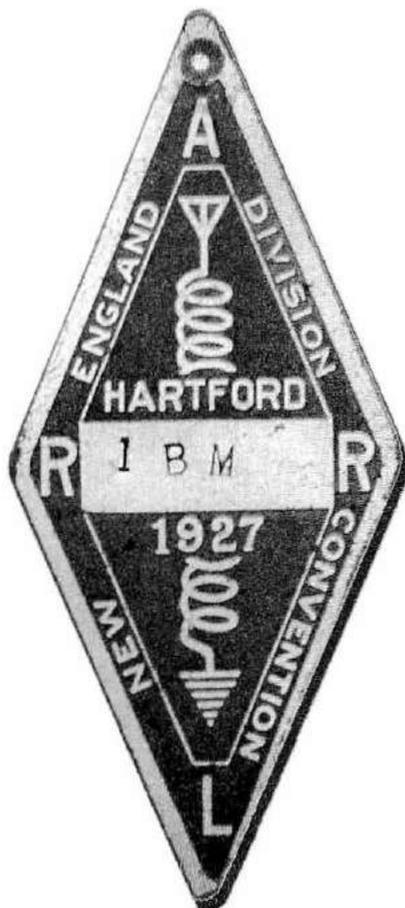
Go to Auction houses, the kind that sell household items. Much of their stock comes from dealers and gleaners who make a living cleaning out old homes. Look through the boxes before the sale and bid

on the ones that look most promising. You might find a few nice old radios here, too.

Talk to your friends. Let them know what you're looking for. You'd be surprised how often friends find things for you.

I have found radio pins from old radio schools, radio shows (like Orphan Annie and Gene Autry), manufacturer product pins, employment pins and trade-show pins. The ones I treasure the most, and I only have a couple, are pins from radio clubs. If you look through the 1920s and 1930s QSTs you see ads from companies that made and sold pins to ham clubs. There were also local and national Short-Wave club pins, some dating back to the late teens and early 1920s. Some are really attractive and you'll catch yourself wearing them from time to time.





One pin that you really want to find is the First National ARRL Convention at Chicago in 1921 (shown here, along with several others). I found this one at an estate sale and have seen one other at a radio auction that was converted into a watch-fob with a small leather belt. I have heard of a few others, but they are rare. How rare?

In the October 1921 *QST* there is a 16-page convention report. It says that, "there were twelve-hundred amateurs from out of town, representing every district and almost every state, augmented by several hundred local fellows," attending. Additionally there were 50 commercial booths, each manned by several persons. All the photos show everyone wearing a pin. So my guess is that about 1600 to 1800 badge/pins were given out.

On page 121 of the same issue there is an ad offering a "limited number" of left over badges for sale as souvenirs. This means there were probably a total of 2000 of them given out, and some went to every state. You'll want to look for them. Some are still around.

The 1921 Convention

It was a huge success. It was the first national gathering of hams, and by the numbers mentioned above, a great percentage attended. All of the ham pioneers were there. They had a great program full of speakers on all subjects, lunches, dinners

and banquets. It lasted four days, and all had a good time.

Sales were brisk by the manufacturers and vendors, with many hams picking up some of the very latest radios and accessories to take home.

If you get a chance, get a copy of the article from the *QST View* CD-ROM and read about it. There are seven additional pages about the new products that were introduced there. (I sure would like to have one of each.)

Other Small Displays You Can Build

Small tube collections display well inside a shadow-box. This helps keep little

fingers from removing valuable tubes and causing damage. One friend of mine had over 15 displays about 2 feet square and about 6 inches deep, all filled with tubes. His display went from early De Forest to the latest RCA and GE. He would take them to ham clubs and give talks, then return home and hang them back on the wall.

He also had similar displays of resistors, capacitors, relays, IF-cans, old audio transformers (small ones) and Morse telegraph keys. It was always fun to go over for a visit. He'd show me the latest display he had built and I would learn from him.

What I'm saying is, you can have fun collecting almost any radio item, and making a nice display finishes it. You'd be surprised how many different resistors my friend had in his display. Once you start, you'll find more pieces and you'll learn too.

HAMFEST SEASON

This year I'm going to try and get to more local hamfests. I won't always have my museum with me, so if you'd like to see it, check my schedule the week before the hamfest. I'll try to keep it up to date. You can find my Web site at www.eht.com/oldradio/arrl/index.html. Click on my Museum to see the schedule.

Good hunting. Look for my call letters on my hat and say hello.—K2TQN

Learning the Code

One of the most written about radio subjects is Learning the Code. The earliest magazines and books I own, from as early as 1910, have articles of instruction and many different methods to learn. Since the early days hams have spent many hours reading and practicing.

Code predates radio. Young prospective Telegraphers in the mid to late 1800s would get jobs delivering messages. They would sit quietly in the telegraph office between deliveries, copying the messages for practice. As soon as they could qualify, they could move up to the position of Telegrapher.

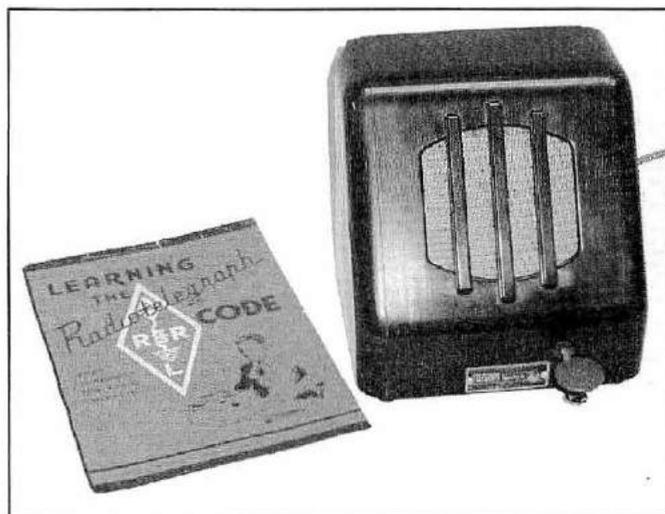
Learning usually meant practicing together with a friend or in a small group. Each would take turns sending and receiving using a hand key and buzzer or sounder. Radio schools started teaching code so students could get commercial licenses. Early on it was discovered that some sort of automatic means for generating code characters was needed.

Enter the Omnigraph

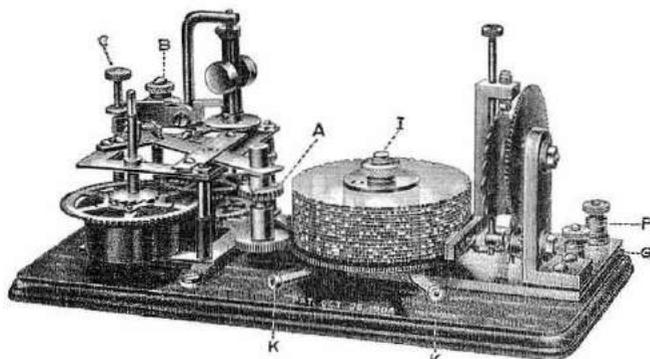
My Omnigraph was patented on October 25, 1904. It consists of a variable speed spring-wound clockworks motor driving a gear train, turning a horizontal wheel. The wheel is made up of several pre-coded aluminum platters—stacked one on top of the other. A small pin follows the wheel edge and operated a set of keying contacts. The contacts in turn key a sounding device for the student. These were used for many years.

Other Devices

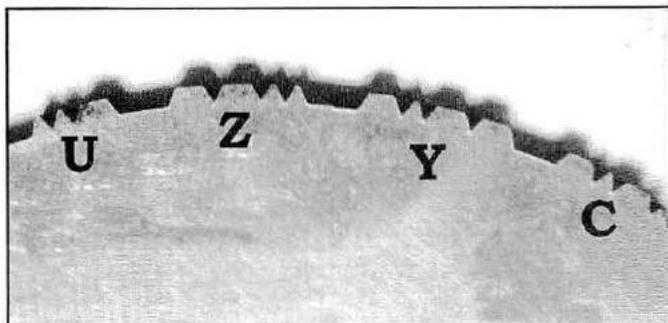
Later paper tape machines were invented, like the Instructograph. These were cheaper than Omnigraphs and came with long paper tapes, which were run through a set of contacts. The early ones came with a spring-wound motor. Eventually they



The popular Telegraph Apparatus oscillator with built-in practice key.



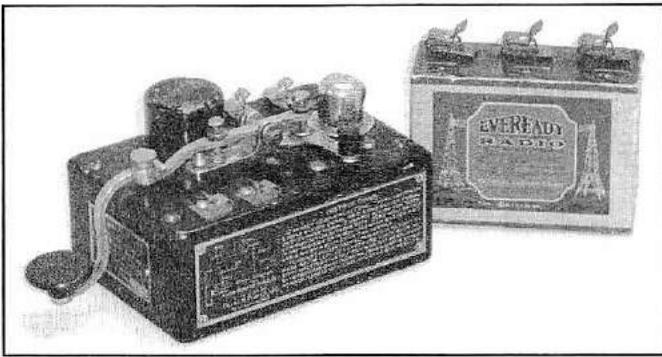
The Omnigraph, a clockworks motor and pre-made code wheels...



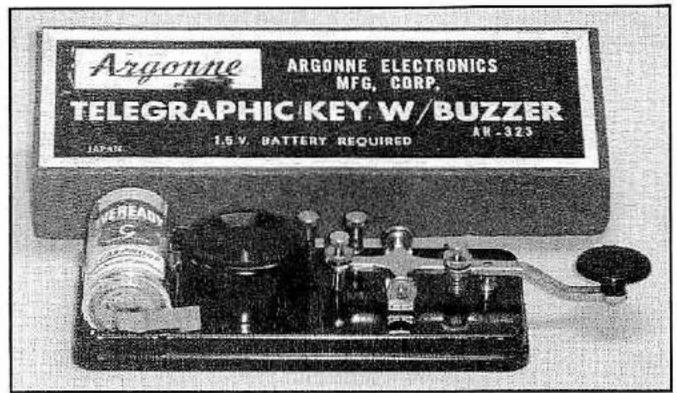
...and the Omnigraph wheel. Note the code letters in edge of the aluminum wheel.



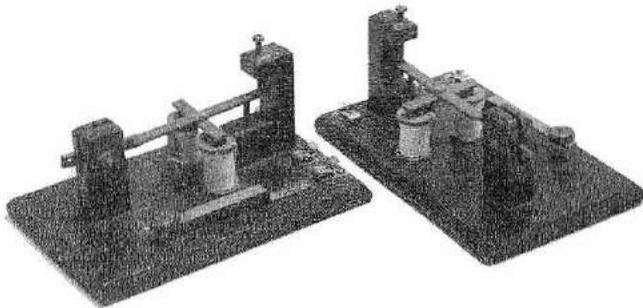
The Instructograph with practice tape in place.



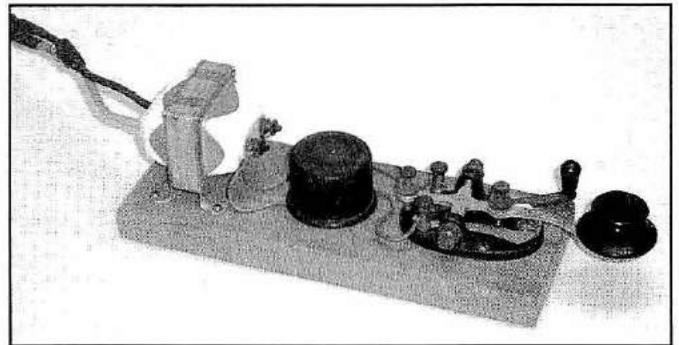
This 1918 practice set was made for training operators during WW-I. It had a light and a buzzer and could be connected to others via external wiring and using a battery like that shown. Hams bought these from surplus companies after the war. Note the extension on the key to bring the knob down to regular height.



This early "Made in Japan" key is typical of those sold from the early 1950s through the late 1980s. Many hams owned one of these.



A homemade pair of telegraph practice keys and sounders.



This late 1940s key is typical of those from the 1930s through the late 1970s. The doorbell transformer supplies voltage to the buzzer, which is keyed by the surplus WW-II key.



A popular 1950s code oscillator. Thousands of these were sold to hams.

added electric motors. There were more expensive and elaborate devices used by the military for training. Many of them worked just like the Instructograph. Phonograph records were also used.

Today a prospective code student has many methods to learn, such as audio tape, CD-ROMs and computer programs. Take a look at some of the early code practice devices. I'll keep it short this month so we can get in more photos. These photos should bring back some fond memories for the old-timers and enjoyment for the computer generation.

Please visit my Web page, www.eht.com/oldradio/arrl/index.html.—K2TQN

A 1927 TGTP Transmitter

A popular transmitter circuit from the late 1920s was called the Tuned Grid-Tuned Plate, or TGTP. March 1927 *QST* had a very complete article on this popular circuit, called "A Flexible Transmitter." It was described "as one of the best circuits for short-wave transmission because of its inherent steadiness, efficiency, and ease of adjustment. It can be entirely controlled by two variable condensers, one in the grid and the other in the plate circuit, and is nearly foolproof."

Another reason for its popularity was its "small size and pleasing appearance," the writer said. "It can be placed in the corner of a small room without undue crowding." He was comparing it to the older, noisier and much larger spark transmitter of the past.

F. J. Marco of the Aero Products Company, manufacturer of coils and other radio parts wrote the article, and of course Aero was selling a kit version of this transmitter. He described it in great detail. In fact it is so well written, that anyone today contemplating building or operating one of these vintage transmitters should read it, study it, and understand it completely before attempting to put one on the air.

I have admired this radio in the past, reading about it and seeing the ads in many magazines, but have never seen one in person. Gross Transmitter Kits also sold the same circuit, with their own version of coils. AEROS were made on plug-in forms and wound with enameled number 12 wire. Gross used 1/4 inch copper tubing in theirs. Copper tubing coils were also popular with hams who built their own transmitters. It was fairly easy to obtain, wind and mount.

When I first saw my transmitter advertised in California, I thought it was an Aero because of the shape. Then I thought it was a Gross because of the coils. Finally I realized it was a homebrew with the best of both designs. I bought it as quickly as I could.

It is a classic ham radio from the past. Many collectors have similar TGTP transmitters in their collections and use them on the air from time to time. Many hams are still building this circuit, using the original number 10-type tube, or substituting other available, compatible tubes. Often they are powered by more modern power supply designs.

This particular transmitter would be easy and fun to replicate, due to the few number of parts needed. The hardest part to find is the original Aero coils. They turn up



The TGTP CW transmitter from 1927. See the close-up on the cover of this month's issue.

fairly often at hamfests and vintage radio meets. You have to be careful, though, because Aero also made receiver versions with smaller wire. Make sure you get the heavier transmitter version.

Or you can make the version like mine with the copper tubing coils. This might be the easiest to build, as copper tubing is available in almost every home plumbing supply store. If you want to get started, here is the information for constructing the wooden frame.

Building the Frame

The transmitter is a double-decker, with the heavy power supply going on the bottom level and the transmitter on the upper. I'll provide the dimensions from

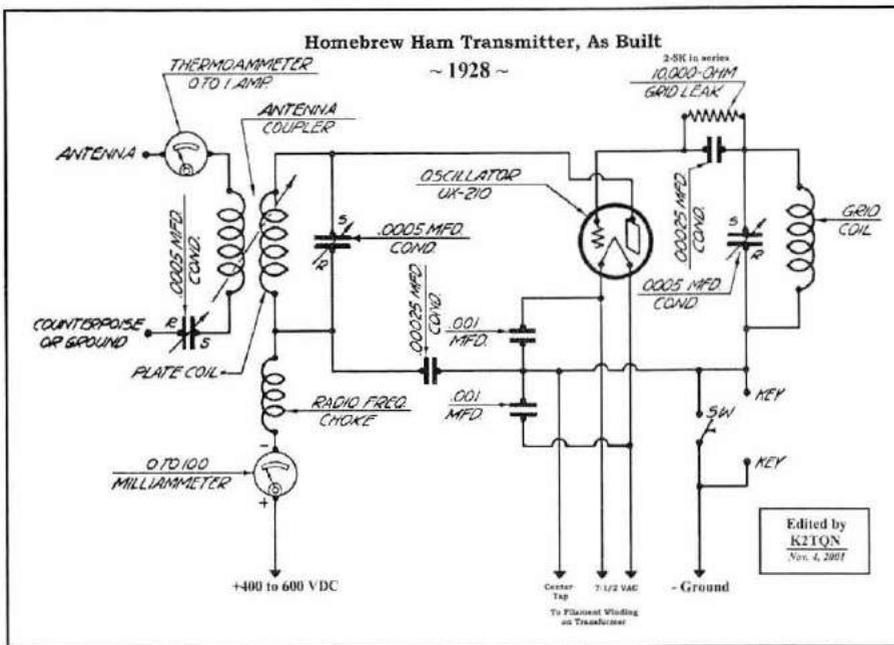
mine, which match the Aero exactly. The wood is hard pine, knot free and stained dark with a lacquer finish.

It is built much like a chair. The height overall is 16 inches. It is 18 inches wide, and 10 inches deep, not counting the front panel. The top transmitter board is 6.5 by 16.4 inches. The bottom power supply board is 10 by 16.4 inches.

The four legs are made from 1.5 by .75 wood. You need two each, 12 inches and 15.5 inches. Four shelf brackets are made from 1.5 by .5 wood 10 inches long. The top piece is also from 1.5 by .5 wood, 18 inches long.

Everything is fastened by brass slotted wood screws of the proper lengths, and is pre-drilled to keep the pine from cracking.

After you have everything fitted and



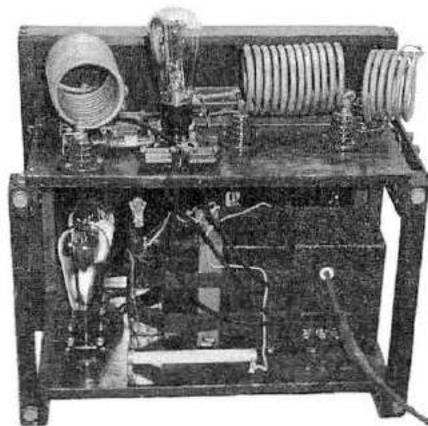
The schematic, from the original *QST* article.

together, remove the two wood boards so you can build the power supply and transmitter on your workbench. Again, pre-drill all holes for the screws to prevent cracking.

The front panels on mine each had an earlier life. The top panel at one time was a three-dial receiver. You might be able to find a junker-radio and use that panel and the three condensers and knobs that should come with it. An alternative would be to use a thin wood board or black Plexiglas. (Do not paint the panels with conductive paint!) A clear finish on wood would look just great and be better electrically. Both panels should be about 18 inches wide and each about 7.5 inches high. You're trying to cover 15 inches vertical, leaving one inch open at the bottom.

I should add here that my radio is CW only, which is fine with me. The Aero circuit had an early version of plate modulation. I would suggest you build the CW version first. Later if you want to try Phone modulation on an oscillator, it might be easier to build one separately and add it into the high voltage lines.

On my web site I will have the parts lists and both schematics, for the 1927 Aero and my old homebrew as built 75 years ago. I will also have a link to a four-page 1928 magazine article on building the Aero version, complete with layout drawings for all the parts. See it at www.eht.com/oldradio/arrrl/index.html.

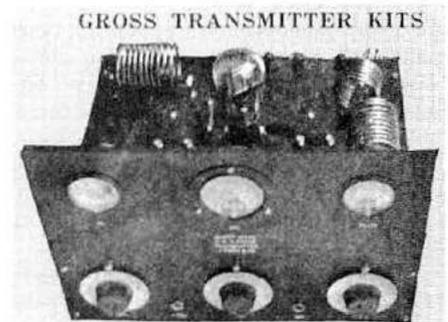
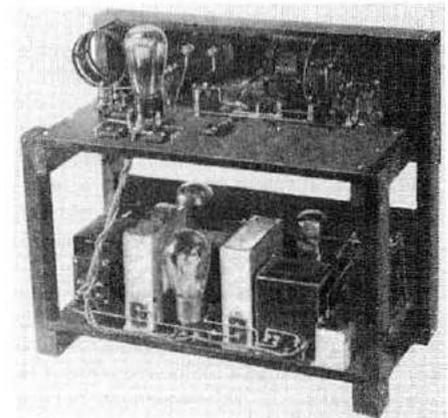
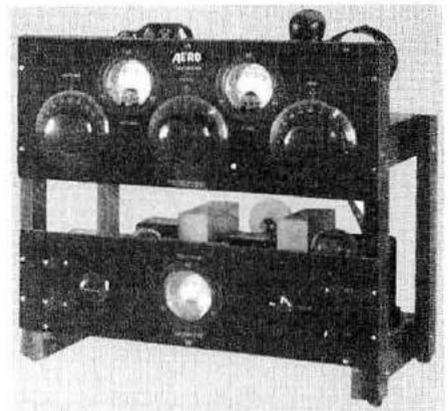


The rear of the transmitter shows its array of fascinating components.

Putting it on the Air

The original filter capacitors in mine are defective. I don't want to tear them apart and rebuild them with new parts, so I've decided to substitute new capacitors in a small module hidden behind the front panel. I'll disconnect the old ones, leaving them sit in place, and connect the new ones into the circuit. This way I can return it to original if I want to enter an old equipment contest. I am going to have to resolder some of the connections, though; many of them are broken or coming apart.

By the time you read this, I hope to have had mine on the air in the Bruce



Three photographs of the commercial version of my homebrew transmitter.

Kelley Memorial 1929 QSO Party in December. I will also try to have it on the air in the Linc Cundall Memorial Old-Time CW Contest January 23, 24 and 26, 27. For information on these contests contact John Rollings, W1FPZ, HC 33 Box 150, Arrowsic, ME 04530. Please include an SASE for his reply.

This column is starting its third year. I have received many hundreds of e-mails and letters from you since the beginning. Your comments and suggestions are always appreciated. I am hoping to include more photos of your radios and your collector profiles this year, so keep sending them to me.

Hamfests, 1925 Style

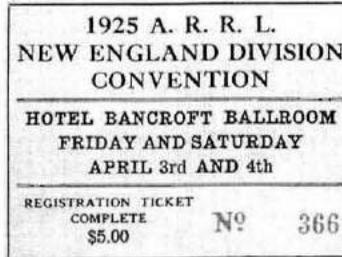
I enjoy hamfests for the social aspects as well as the flea markets. I often wondered what they were like, way back. This spring I had the good fortune to acquire the remnants from an old ham station.

Bill Gould, K2NP, became a SK back in 1983. His station was sold then, but his cellar was never cleaned out. It was a wonderful find, full of old papers and some equipment. Later while organizing the papers I found the program, his ticket and his badge, all shown here, in three different boxes. Let's see why he went and what the convention was like.

Seventy-six years ago last April, hundreds of hams gathered at the Hotel Bancroft in Worcester, Massachusetts, for the "New England Division ARRL Convention." Announcements preceded the event in *QST* and the New England clubs all notified their members. Everyone who could, showed up.

At a cost of \$5, it was a two-day event loaded with talks and activities. Friday April 3 was a fun day. The first events were trips to three of the local "Super-stations", 1XZ, 1YK and 1BKQ. Hams were told to bring their "Wavemeters" for calibration at 1YK. Many other Worcester stations were also available for inspection by visitors.

That evening they had a "Code Contest," and entertainment such as "Stunts by



Radio Clubs," Movies by RCA, a "Liars Contest," a "Cracker Eating Contest" and a "Wire Untangling Contest."

Activities on Saturday, April 4 started at 10 AM with more ham station trips and one to WCTS, a local commercial station. At 2 PM the ham sessions started given by the following well-known speakers: R. S. Kruse, Technical Editor, *QST*; John Reinartz, 1XAM; Dartmouth Prof Elliot White, also the ARRL New England Division director; and Hobart Newell, Prof in Radio at Worcester Polytechnic Institute.

At 6 PM the banquet started with the following speakers: Toastmaster Dr H. Eugene Watkins; A. A. Herbert, ARRL Treasurer; a representative from RCA; Radio Inspector E. H. White; R. S. Kruse; and Irving Vermilya, the NE Division Manager. Lee Bates and his radio band, the High Frequency Syncopators, provided music during dinner.

At 10:30 PM, as reported in the June 1925 issue of *QST*, "The closing event of the convention, and one which made a

New England Division Convention

APRIL 3rd and 4th, Friday and Saturday, are the dates of the New England Division A.R.R.L. Convention in Worcester, Mass. Headquarters will be at the Bancroft Hotel. There will be many worthwhile events and among these we might mention: Technical Meetings on Friday afternoon and Saturday morning;

A portion of the New England Division Convention announcement that appeared in the March 1925 issue of *QST*.

very strong impression, was the holding of a conclave to confer the degree of the Royal Order of the Wouff Hong on about 150 members of the League. The Worcester boys, who did so well last year in Springfield, again showed their histrionic talent. It would be hard to equal their performance."

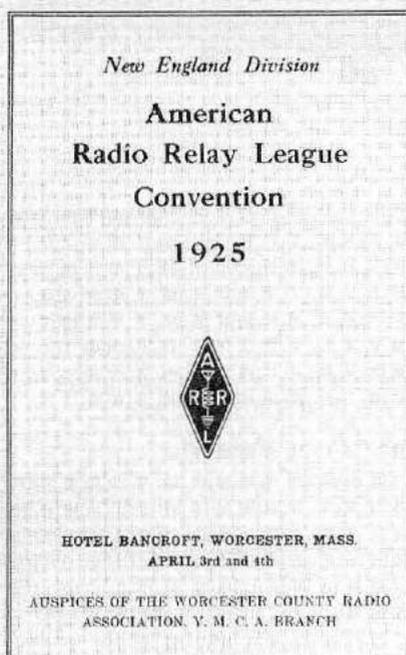
There was no mention of any swap area. If you think about it, in 1925 there were no major highways, and many hams did not have cars so they traveled by train. This would have limited what they could carry. But knowing hams, I'll bet there was some swapping going on. If any readers happen to have this information, please contact me.

INFORMATION WANTED

I am looking for additional information on Bill Gould. He was a very early ham, first licensed as 1NP. He attended Worcester Polytechnic Institute and was the chief operator of the college ham station, 1YK. He participated in the Transatlantic tests from there, and later as W1NP worked in the Boston area. Around 1940 he moved to New Jersey and worked for the government at Fort Monmouth and Camp Evans. His New Jersey call became K2NP. He had many ham friends and was a great friend to ham radio. I am also looking for information and 1920s photos of station 1YK, the Worcester Polytechnic ham station.

I am putting Bill's biography together for a later column. If you have any photos or information, please contact me at my US mail or e-mail addresses below.

Check my Web page for more information about this column: www.eht.com/oldradio/arrl/index.html—K2TQN



A 1927 Homebrew Receiver

Last January I went to the "all-indoor" Frostfest in Richmond, Virginia, to exhibit some of my early ham radios. Sherry, my XYL, went along to help. This usually means trouble for me if I try to purchase too many radios. She keeps telling me that I have enough. Sometimes I'm able to slip them into the car when she's not looking. Today would not be one of those times.

After I set up my exhibit, with Sherry busy manning the display, I walked around to see what I could find. One of the first things I spotted was a table loaded with homebrew 1920s wooden-cabinet radios. I have been trying to avoid buying early broadcast radios lately, concentrating on ham equipment instead, but they were priced cheap, so I started lifting lids. The second radio I checked was very heavy and had extensive copper shielding installed. This was unusual I thought, for a broadcast radio, but then I recognized it. I remembered reading about this in one of my old *QST* magazines. It was the Shield Grid receiver.

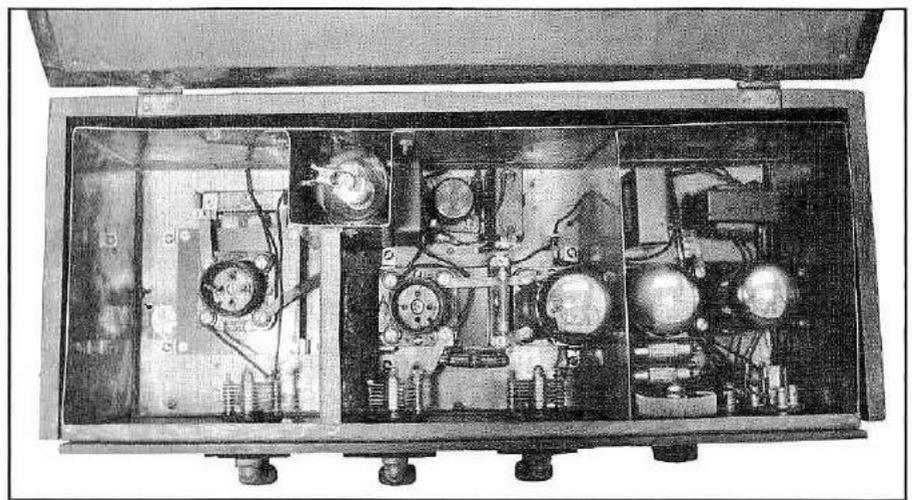
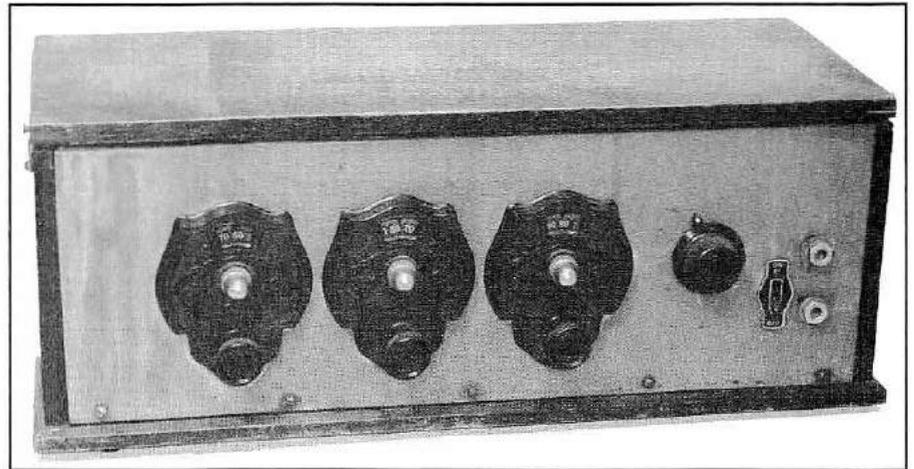
I quickly paid for it and headed for the door. I waited until Sherry was busy talking to a collector and scooted by her and put it under a blanket in the car parked outside. When I returned I found a couple of my friends laughing. They told me that I should have seen her face when she spotted me carrying the radio.

The Shield Grid Tube

The Shield Grid Tube was introduced in the December 1927 *QST*. That issue had several articles about the UX-222, complete with example schematics. The UX-222 tube would be the subject of many articles and receiver designs in *QST* over the next few years. For the first time this new tube made real RF amplification possible at 15 meters.

It was the first American-made two-grid tube.

Also in that *QST* was an article by R. B. Bourne, W1ANA, about the experimental radio I just found: "Getting the Most Out of the UX-222." It used the UX-222 as an



The UX-222 tube is at the top left, inside the small copper shield.

RF amplifier in a distinctively designed square shielded compartment of copper. That compartment was in turn, inside the antenna coupler compartment. It was this square shield arrangement that I recognized at the hamfest.

Comparing the article to my radio I noticed mine has an extra shield for the regenerative detector stage, separating it from the audio amplifier stage. The shielding of each stage was a great idea and continues today. There are some additional differences, such as an added stage of audio and some missing battery filtering, but it is essentially the same radio. A 15-meter coil set came with it.

One of the lessons here is to get as many

old magazines as you can and read them over and over. If I had not recognized the unique shielding, I might have passed it up. Instead, I have a really interesting radio, one with some history attached to it. I asked the seller if he knew who built it. Unfortunately, he bought it at an auction, so the prior owner is unknown.

See it in my Museum

If my new job and the weather permit, my mobile "Old Radio Museum" will be at the Connecticut ARRL State Convention and Nutmeg Hamfest on Sunday, October 7, 2001 in Wallingford. I'll bring this radio along so you can see it. Look for my call letters on my hat and say hello.—K2TQN

Thordarson 1938 100-W Transmitter

Transformer companies made their money by selling transformers. Early on they found that providing schematics of well-designed transmitters using their products increased sales. Thordarson Electric Mfg Co was one of the most successful. Starting in 1934 they provided a giveaway publication called the *Transmitter Guide*. It was loaded with great photos of ham stations and transmitters. It also contained articles, parts lists and schematics of transmitters from 20 W all the way up to 1-kW.

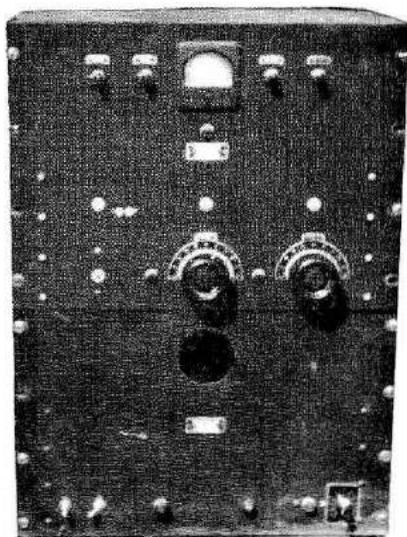
Thordarson's introduction of a "new" 100-W transmitter, "designed specifically for Ham requirements," in the September 1938 issue of *QST* caught everyone's attention. Their two-page ad was followed with 12 additional ads from many of the ham stores. Harvey Radio's ad said in part, "[It] is available in "Foundation Unit" form with complete instructions for assembly and operation. Chassis, panels and chassis brackets are supplied completely punched for easy assembly.... Approximate price complete including Cabinet, but less Tubes and Crystals is \$139.50."

The RF tube line-up is 6L6, 6L6, to a Taylor TZ-40. The modulator line-up is a 6J7, 6F6, 6F6, driving two 6L6s in push-pull. It was designed as two self-contained units, each with a built-in power supply. The transmitter section could be used alone for CW or as an exciter. The modulator could be added later, saving an initial outlay of cash. The modulator could also be used with other transmitters.

Recently Vance Gildersleeve, K5CF, found a 100-W transmitter in need of a complete restoration. It had belonged to Louie McMurray, WA5MDK of Plainview, Texas and was given by his son to Ed Mickle, KESOB. Ed passed it on to Vance.

It was really dirty from years of sitting around. Vance cleaned it using Naval Jelly on the rust spots, and with a lot of scrubbing using damp cloths and Q-tips it started looking good again. He spray painted the rust spots and the cabinet, replaced the rusty hardware and installed the missing 300 mA meter in the modulator. Next he went through the components and replaced all the defective ones.

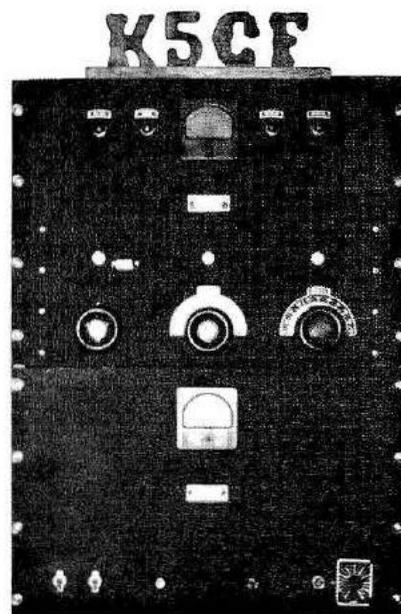
Now operational again, Vance uses it primarily on CW in the Antique Wireless Association's Old Timer contests. He says



Thordarson 100-W transmitter as found.

it works great with either crystal or VFO control.

For more information on K5CF and



Thordarson 100-W transmitter after restoration.

this transmitter, including schematics, please visit my Web page at www.eht.com/oldradio/arrrl/index.html.

Collector Profile K5CF, Vance Gildersleeve

Vance says, "I first became interested in radio while still in grammar school. I still have the little crystal set that my father bought me. In high school I became a Boy Scout and learned the Morse code. I bought a Gross CW25 kit and put it together. My original receiver was a Hallicrafters Super 7.

"After graduating from high school in May of 1937, I went immediately to Port Arthur College, in Port Arthur, Texas. There I studied radio/electronic theory to obtain a 1st Class Radiotelephone License and a 2nd Class Radiotelegraph License."

He was first licensed as W5GST on October 12, 1937 and has held numerous other calls since then, having moved around the country. In 1940 he worked as a broadcast engineer at KTEM, his first job. This picture was taken there, where he was rooming with a family in Temple, Texas.

Now retired, Vance had an interesting career in radio. From 1941 to 1949 he was a Flight Radio Officer

with Pan American World Airways, flying out of Brownsville, Texas, New Orleans, Los Angeles and San Francisco. He was a Broadcast Engineer at KRON-TV, later with Eimac as an Electronic Technician, and retired after 18 years with Ampex Corporation as a Senior Field Service Engineer and Office Manager.



1940 station of W5GST. The 40-20-10 meter RF section at the top of the rack was built around the Gross CW25 chassis. It consisted of a 6V6G tritron crystal oscillator, an 807 buffer/doubler and a Taylor T40 final. It ran 100 W on CW and about 75 W on phone. His receiver was a Hallicrafters SX 16.

The Hallicrafters SX-23

Hallicrafters introduced the SX-23 in the March 1939 *QST* in a big way. With a total of 10 pages of advertising, including a two-page-wide photo of the receiver, the debut was noticed by everyone. In the ad Bill Halligan, president of Hallicrafters, said, "Today we find ourselves building this ideal receiver, different from anything the Hallicrafters have produced in the past—new in conception, new in design, new in performance. Because its design is based on functional principles, and because it embodies the newest developments in the art of building communications receivers, it is extremely unconventional as compared to receivers designed even as late as a year ago."

Halligan didn't stop there. He also had the enclosure specially designed. The art deco styling of the cabinet and speaker is striking and makes it unique among communications receivers of this period. In fact, it is my belief that this may be the most beautiful receiver ever designed. Ironically, Hallicrafters never continued this elegant design in later receivers.

How the SX-23 was Developed

According to Halligan, it was several years earlier, in the wee small hours following a typical hamfest, that several well-known amateurs and communications engineers sat in a smoke-filled room discussing the ideal communications receiver. Each had his own pet ideas but, strangely enough for radio engineers, they agreed on several basic principles.

Returning to Chicago, two of the Hallicrafters engineers started to build this ideal receiver as a separate, private project of their own, purely experimental. As time passed the project grew and became the pet of the laboratory. At that time the design was far ahead of manufacturing techniques of the day, so it remained in the lab reminding everyone of the challenge they faced if they hoped to someday produce it.

As 1939 approached, manufacturing techniques had advanced to the point where the SX-23 could be built as a Hallicrafters receiver, at a price within the average amateur's purse. The company decided to go ahead with the project.

The introductory price was around \$115. In succeeding months, *QST* ads show that many of the radio stores had

affordable "time payments" for hams.

There is a Story...

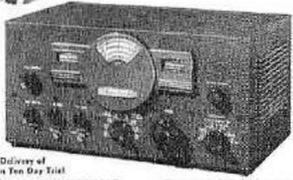
When I picked up my SX-23, I was told

***** Slider 23 *****

Buy HALLICRAFTERS

FROM

Robert Henry
W9ARA



COMPARE MY TERMS WITH ALL OTHERS

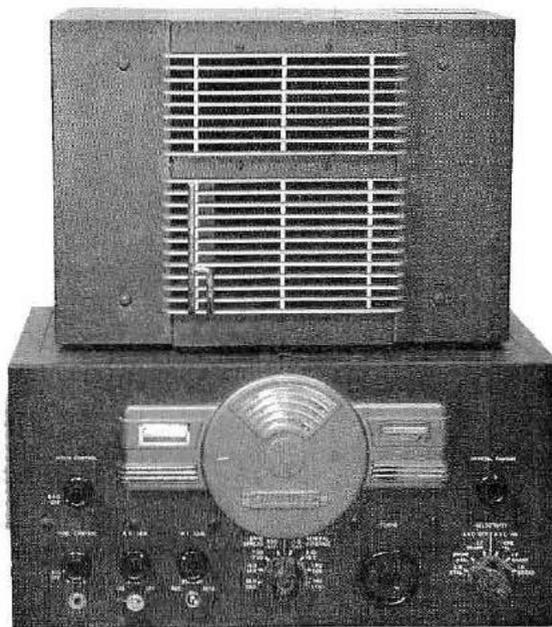
Model	Cash Price	12 Months
SX-23	\$115.00	\$12.18
S-27	\$115.00	\$12.18
S-24	\$95.00	\$10.00
S-25	\$75.00	\$8.00
Slide Rule Model	\$115.00	\$12.18
Slide Rule Model	\$95.00	\$10.00

Bob Henry
W9ARA

HENRY RADIO SHOP
BUTLER, MISSOURI

***** the hallicrafters inc. *****

This is just one portion of the SX-23 advertising blitz that consumed 10 pages in *QST*.



The Hallicrafters SX-23 receiver.

that Jim Robertson, K2EA, purchased it in March 1939 directly from Leo Meyerson, at his World Radio Labs in Council Bluffs, Iowa. Then a young engineer, Jim was traveling through Council Bluffs between work locations and missed his connection. Looking for something to do while waiting for the next bus, he visited WRL. Prominently on display was the radio he would fall in love with and purchase using Leo's "easy time payments of \$15 per month."

The SX-23 became part of his travel baggage that spring. Eventually, when his work was done, he journeyed back to his New Jersey home by train.

His train arrived at the station late at night. Unable to carry everything, Jim left the receiver and speaker sitting on the station's platform while he walked several miles home. Returning an hour later with a relative's car, the SX-23 was still there waiting for him. A testament to Jim's care, the radio still looks almost new.

Conclusion

There are no official Hallicrafters records available, but it is believed that fewer than 5000 SX-23s were built, making it hard to find the radio today.

I want to thank Bill Kleronomos, KDØHG, and *Electric Radio* magazine for contributing to this article. I would recommend anyone interested in the SX-23 to read Bill's extensive article in the March 1992 *Electric Radio* (issue 35). Back issues are available for \$3.25 delivered in the US. Please contact Electric Radio, 14643 County Rd G, Cortez, CO 81321-9575.

I will have the ten pages of SX-23 ads mentioned above, along with additional SX-23 information, on my Web site at www.eht.com/oldradio/arri/index.html.



The "birth" of the SX-23 was announced in the March 1939 *QST*.

The Allure of Novice Stations

One popular aspect of collecting is replicating your old Novice station. We've talked about this before. There also seems to be a growing number of hams who were never active on the Novice CW bands who are now gathering, building and operating vintage Novice stations! Mike Silva, KK6GM, sent an interesting article about his station. Mike operates his Novice gear as often as possible. Listen for him on the air.—K2TQN

The Conar Twins

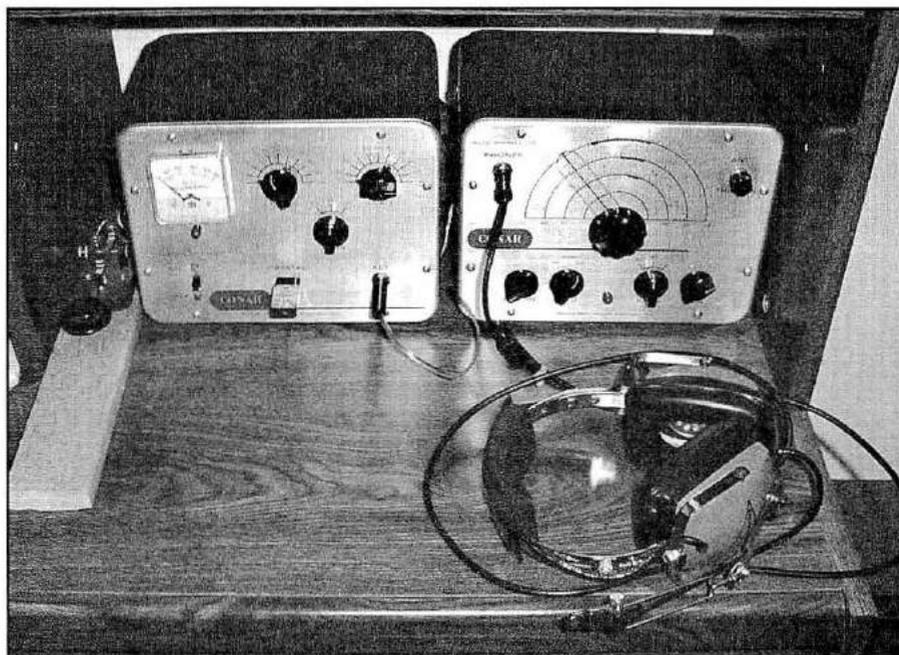
By Mike Silva, KK6GM

Anybody who entered Amateur Radio in the '60s probably daydreamed at some time over the "Conar Twins": the model 400 transmitter and model 500 receiver. The rigs were available both directly from Conar and as part of home-study courses offered by National Radio Institute. Both covered the 80, 40 and 15 meter bands, and were available both as kits (each under \$40) and assembled.

A pair of Twins recently popped up for sale and I jumped at the chance. What I found was not bad, not bad at all.

The Transmitter

The Conar 400 transmitter is a one-tube

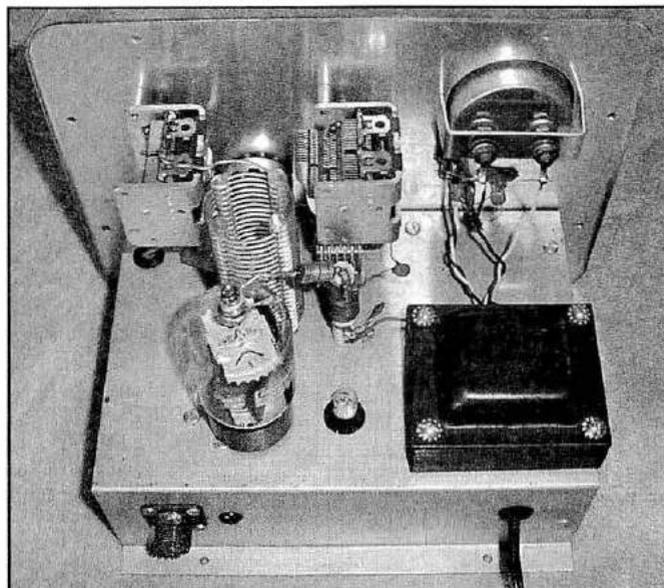


affair using the (then) popular 6DQ6B TV sweep tube. (For more than 10 years the transmitter in the ARRL's *How to Become a Radio Amateur* was based upon the same tube.) It is crystal controlled and has a power input of 25 W. The controls are very basic: **ON/OFF**, **Band**, **Tune** and **Load**. There is a crystal socket and a key jack on the front panel, an antenna jack on the back, and that's it.

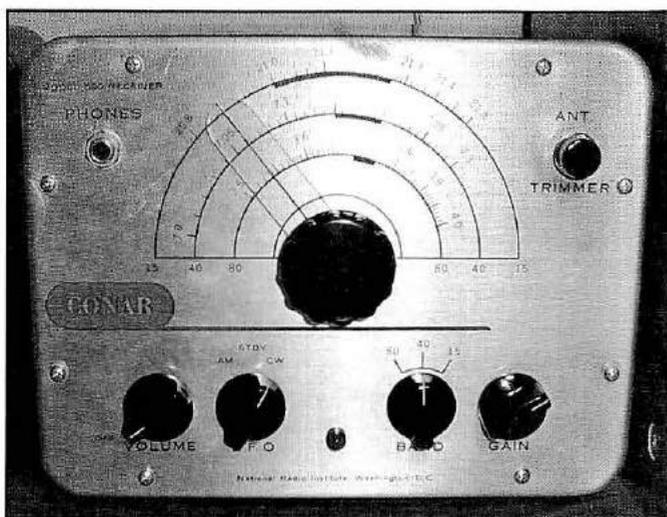
As soon as I had the 400 out of the box I naturally started twiddling the knobs, and did I get a surprise! The tuning control made a terrible metal-on-metal sound, and felt as though somebody had taken a pair of Vice Grips to the Tune cap. I quickly opened the rig and found the problem. The pi-net coil is held in position only by its leads, and it had shifted during shipment so that the Tune cap rotor plates were rubbing against it. I just



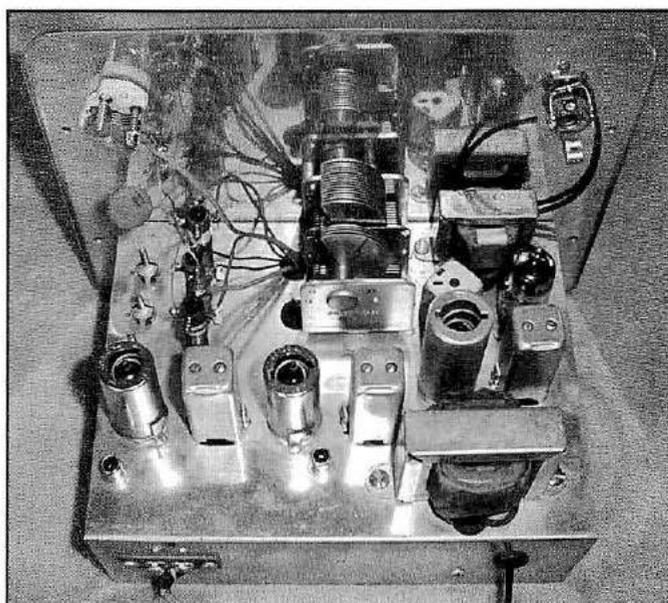
The Conar 400 transmitter.



The clean interior layout of the 400 transmitter.



A front view of the Conar 500 receiver.



On the "inside" of the 500 receiver.

Collector Profile

Mike Silva, KK6GM, was first licensed as WN6RRE in 1971. After some years of hamming, mostly with a Heath HW-101, he drifted into the computer field and has only become active again in the last few years. He has been drawn back to his Novice tube days and is determined to homebrew every rig he couldn't afford or understand in his previous WN6 life. When not building or operating he enjoys hanging out on the Glowbugs e-mail reflector (see main text).



Great Stations of the Past



Wouldn't you love to own this setup from 1961?

bent the coil back into a safe position and all was well. While I had the rig open I checked it over and took a few pictures.

After bringing up the rig on a variac, I plugged in a key, a dummy load and a 40-meter crystal. Setting the load cap to full mesh and pressing the key, the plate-current meter took off swinging unlike any I've ever seen. It took about 6 seconds to settle down. This is one high-Q meter! The manual calls for loading the transmitter to 90 mA, and at that plate current it was putting out almost 16 W. (For some reason other reviews I've seen of the 400 claim only 10 W out, though the manual does say 15 for straight-through operation.) Backing the plate current down to 80 mA still gave 15-W output. Listening to the rig on a receiver showed that my 400 had a case of the oft-mentioned Conar chirp. Looking at the schematic gave a clue as to where the problem might lie: the screen voltage drops almost 50%, from 320 V to 170 V, on key-down. As they say, "That's gotta hurt!" The 400 is defi-

nately a candidate for a VR tube on the screen, and a feedback adjustment trimmer cap as well.

The Receiver

The Conar 500 receiver is a single-conversion design using four tubes plus a selenium rectifier and a semiconductor diode detector. The IF is 455 kHz, and the receiver has two IF stages, unlike the single IF stages most cheaper receivers offered. The tube lineup is: 6BE6 converter, 6BZ6 IF amplifier, 6U8 (pentode section) IF amplifier, 6U8 (triode section) BFO, and another 6U8 AF triode section driving a 6U8 pentode for audio output. The controls are again quite basic: **AF Gain** (with **ON/OFF**), **RF Gain**, **Band-switch**, **Mode** (called BFO) **Ant Trimmer** and **Tuning**. The dial is silk-screened directly on the face of the receiver.

With two IF stages the receiver hears quite well, especially on the two low bands. Frequency drift settles down after about 10 minutes. The tuning rate is good for CW

and AM on all bands. Audio output to the built-in speaker from the little 6U8 stage is adequate, and of course with phones it's more than enough. There is a modest amount of hum, and two modifications have been recommended for the 500s with this problem. It involves replacing the single rectifier diode with a bridge rectifier, and beefing up the filter capacitance.

Summary

A Novice in the '60s could have done a lot worse than a Conar setup. The receiver, especially, is a fine balance of decent performance and low price. I look forward to spending a lot of time with the Twins after tweaking them up and installing the modifications. Maybe I can even wear out the RadioShack 6DQ6B and have some fun trying to collect on their lifetime warranty!

For Conar schematics and manuals, or to subscribe to the tube and homebrew Glowbugs e-mail reflector, check K2TQN's Web page at www.eht.com/oldradio/arrl/index.html.

Collecting History: Logbooks and Callbooks

Old logbooks contain information about ham radio of the past. Many of these old logs have been lost, but some show up every so often. I have a small collection of station logs and find them fascinating. Many contain notes by the station operator, effectively creating a diary of early equipment and interests.

Old *Callbooks* contain the names and addresses of amateurs throughout the country. Using them in conjunction with logbooks increases your understanding of their activities and friendships. Sometimes you feel like you were there, operating those great rigs of the past.

Recently my friend Ray Chase, KA2JQG, purchased a quantity of antique Amateur Radio gear discovered in an attic in Trenton, New Jersey. The collection originally made up the station of William Burroughs Jr, W3AID, and included some nice early homebrew and commercially made radios, station accessories, magazines and books. He also found Burroughs' early logbooks and passed them on to me.

From W3AID's 1930 Logbook

Bill Burroughs Jr received his license and started operating on August 11, 1930. His first transmitter was a single WX-112 tube oscillator in a TNT circuit. A Pilot Wasp receiver rounded out his station. His first call was a CW test on 80 meters at 8:45 PM. He noted that the transmitter was running cool and everything appeared to be okay. The next evening he tested again, this time on phone with his friend "Clyde," W3EM, also of Trenton.

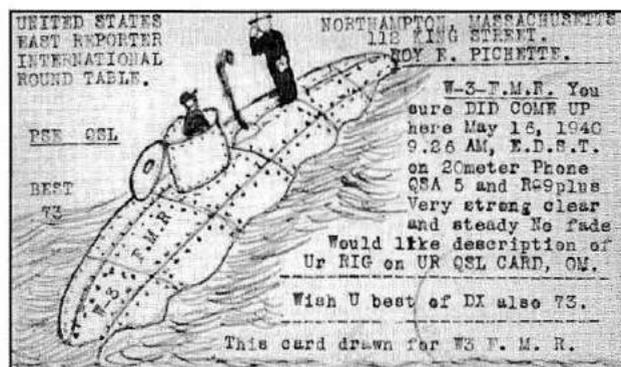
For the rest of the month he contacted W3EM almost every night. On August 27 his power supply went bad and he substituted a 45-V battery. On the August 29 he was back on with a new power supply. Starting in September he worked stations in Pennsylvania, New York and Massachusetts.

On November 30 he noted that Robert Durrett, W2CEE, of Brooklyn "doesn't QSL, so that's that! GRRR!"

As he gained experience his station changed. January 1931 brought a new homebrew receiver to the shack, "Built A.C. Receiver, Screen-grid Detector 1 stage (227) impedance coupled audio F.B. all aluminum except doubler which is a copper box I constructed."



The station log of William Burroughs Jr, W3AID.



W3AID received this hand-drawn QSL card that depicted submarine activity—a subject on the minds of many as war enveloped the world in 1940.

September's station included, "using TNT Oscillator using 201A. Antenna Hertz 134' long end fed. W.E. Single Button 'Mike' 2-27 Speech Amp transformer coupled 2-71s in parallel as Modulators."

In January 1932 he noted, "Have rebuilt receiver. Now using 1 stage '24 untuned RF Shielded 1-'24 Det shielded."

In July 1932 his new transmitter was, "Built Tuned grid Tuned plate xmitter using '45 tube with about 250 V. Seems to be plenty of Soup in the outfit." At this point his log begins to indicate contacts with more distant states in the 1, 3, 4, 8 and 9 call areas.

The last two entries in this log were on January 26, 1934, "11:15 A.M. W2GGW, 5-8, 5-7. Had quite a QSO. Had to QRX a minute while guy was in insurance. 11:40 A.M. Signed off QRM heavy WX getting sunny and warmer." Even though there were many more empty pages, it ends here without explanation.

Ships and Coastal Stations Log

His other logbook chronicled his monitoring of ships at sea and coastal stations. It was started on December 20, 1937. Even though this is a SWL logbook, he indicated his call letters as W3AID, so I assume he was still active in ham radio. A typical entry read, "Call WTCH "Robert E. Lee" 600M, QSA 4-5, WX cool, 12:52A, Nice note."

On June 22, 1941 there is an interesting entry, "WCWM, name not listed, 600M, 5-8, WX hot, 4:00A, called WNW. Did not learn nature of distress at this time. While

listening to this heard Germany declared War on Russia. Signed off at 4:34 A.M."

He continued listening almost every day until December 7, 1941 where he commented, "600M Listening with Clyde at 8:30. Nothing of Importance." Then he noted, "1st day of War."

On January 14, 1942 he reported the first of many war-related entries of "Sending SOS said ship torpedoed." On January 19 he reported another torpedoing.

January 29, "KUDQ 'Gulfwax' Reports SOS, 100 miles from Barnegat Light, being followed by low light heading 60 degrees true speed 12 knots."

April 4, "HPKT 'Halcyon' 34N20 59W16 being bombarded by Raider."

February 18, 1942 a sad entry, "KUTS 'Vacuum', SOS, being followed." Apparently the ship came under fire and the following comment was entered, "This was the 'Vacuum' and the op is my friend Paul Solomon, W3GRW." (I don't know if W3GRW survived the attack or not. There were no further entries about him.)

World War II

During WW-II many hams served as radio operators, both in the armed services and in the Merchant Marine. Many did not come home.

It is my assumption that W3AID was listening for SOS calls that might not be answered, so that he could assist in some way. His log, long forgotten in a dusty attic, is a personal testament of radio history.

modulated the radio wave. This worked, but it needed improvement.

The following is quoted from a 1922 radio catalog: "Long experience in the use of audio frequency buzzers to modulate the output of a tube set to produce damped wave trains has proven that this method is not entirely satisfactory, principally for the reasons that the operation of the buzzer is not constant, necessitating frequent adjustment, and that great care is required in adjusting the circuit to obtain 100 percent modulation.

"The Rotary Chopper, PX-1638, has been developed primarily to overcome the above objections. When used to secure interrupted continuous wave, or ICW telegraphy, the motor-driven interrupter, or rotary grid chopper, has the following inherent advantages over the other methods:

"(a) Gives positive interruption, requiring no adjustments. The note obtained can be varied to any desired pitch by changing the driving motor speed, typically at 600 cycles.

"(b) This system of securing damped wave trains does not require modulating tubes, the interrupter being used in series with the transmitting key.

"(c) The system inherently gives 100 percent modulation, since oscillations can be completely started and stopped at audio frequencies.

"(d) The output obtained from a given number of oscillators is in general greater than if some of the tubes are used as modulators.

"The interrupter wheel is built with 34 conducting and 34 insulating segments, making 34 interruptions per revolution. The insulating segments are molded in a single piece."

The cost for the wheel and electrical contacts, without a motor, was \$7.25 in 1922 dollars. To see how it was connected, see Figure 1.

The Magnetic Modulator

This device is essentially a transformer wired in series with the ground leg of the antenna circuit.

From the 1922 radio catalog: "One of the most important inventions brought forth in the field of amateur radio telephony during the past year is the Magnetic Modulator. This development has resulted from RCA's experiments with the Alexanderson Magnetic Amplifier, a device that is used at all its high-power transoceanic stations to control the output of 200-kW radio frequency alternators. The same fundamental principle has been adopted here....

"[The modulator] utilizes the properties of iron at radio frequencies to control or modulate the output of an oscillating vacuum tube.... It simply acts as a variable resistance connected in series with the antenna circuit."

Three models were manufactured: UT-1643, for $\frac{1}{2}$ to $1\frac{1}{2}$ A antenna current, \$9.50; UT-1357, for $1\frac{1}{2}$ to $3\frac{1}{2}$ A, \$12.00; UT-1367, for $3\frac{1}{2}$ to 5 A, \$17.00 in 1922 dollars. The one shown here is the UT-1643 model.



A magnetic modulator, circa 1922.



K2TQN's early transmitter parts. From the left: a filament transformer; an oscillation transformer (coil); a 50-W filament rheostat; a 5-W 202 tube and socket; a 50-W 203 tube and socket; a blocking condenser; a rotary chopper, an old tube transmitter panel with various meters; an early microphone; and a magnetic modulator.

Conclusion

The time spent studying will pay off when you spot a goodie sitting on or under a hamfester's table. You'll recognize it immediately and be able to beat out the other collectors.

Don't expect to complete your search for parts overnight. Patience pays in radio collecting. It may take you several years, depending on where in the country you're located, and how many hamfests you get to. Also, read the classifieds in *QST* and in the specialized collector magazines. I hate to say it, but eBay (www.ebay.com) may be a place to find those elusive parts, at higher costs, though.

An alternative: you can build this or a similar transmitter with all *newer* parts. This will give you great satisfaction and an opportunity to learn about older circuits.

A note of caution: Not all old circuits are legal to run on the air under today's communications laws. Please be careful. Make sure you check your transmitter for spectral purity before attempting to put it on the air.

Additional information and a parts list are available on my Web site: www.eht.com/oldradio/arrl/index.html. Good hunting, and look for my call letters on my hat at the hamfests and say "hello."
—K2TQN

The Legacy of the Globe King

When World War II was over, surplus equipment and parts flooded the market and the country was ready to play radio again. Some of the rigs from pre-war times came back to life. Many hams wanted to convert war surplus radios, and others wanted brand new rigs. The surplus parts that enticed the home-brew builders also stocked the manufacturers' shelves. These surplus parts became the basis for many new radios.

World Radio Labs (WRL) of Council Bluffs, Iowa, was a manufacturer in the right place at the right time. Investing heavily in war surplus material, WRL owner Leo Meyerson produced some of the first post-war transmitters. His popular low-power Globe Trotter was one of those transmitters.

With hams asking for more powerful rigs, WRL prototyped a 1/4-kW transmitter. By 1947, it was ready. Designing it around a pair of United V70D triodes operating in class C, the Globe King was born. It produced over 250-W output on AM.

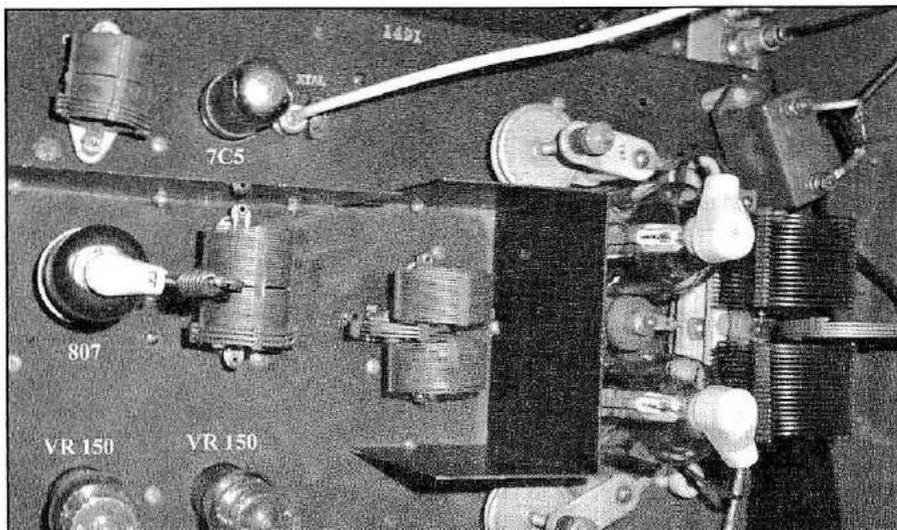
Within a year, the Globe King had already been redesigned. The original version had a modulator with four 6L6s in push-pull parallel. WRL found that by designing a new modulator, the RF power could be increased to 300-W output at 100% modulation. The new Globe King 400 ran the same United V70Ds in the finals and a pair of Hytron 5514s in the modulator stage. A few additional changes in the Globe King 400 series occurred, but they continued to use the same RF and modulator tubes, and plug-in coils.

THE STORY OF ONE WRL GLOBE KING 400B

By Steve Marquie, W8TOW

In the fall of 1951, John Eisenman, W8URM, decided he would become a proud owner of a Globe King 400. Now deemed a Globe King 400B, John's new radio included TVI shielding, an improved speech amplifier and some minor RF circuit changes. John was a CW man, though, so he never tried it on phone. Instead, he concentrated on getting his DXCC by running the Globe King 400B only on CW. I am sure he commanded the DX end of the bands!

After almost 30 years in suburban Detroit, John finally sold the rig in 1980. The transmitter was relocated to Mike Beachy,



The Globe King RF deck: 7C5 oscillator, 807 driver and two V70D finals.



The station of Steve Marquie, W8TOW. His restored Globe King is at the far left.

Old Radio Profile: Steve Marquie, W8TOW

Steve Marquie, W8TOW, became interested in operating AM early on. Originally, he operated CW/SSB like many newcomers to ham radio. Then, in 1977, *CQ Magazine* ran an article titled "No, Harry, AM isn't Dead!" This sparked his curiosity. Within months, he had restored a Viking I transmitter and a 51J2 Collins receiver. He used them in the 40-meter "AM Window." Other AM rigs followed, but eventually the DX bug bit him. Later, he moved to a new home and fell out of radio for a while. In 1997 he rediscovered AM. This time he chose to focus only on AM/CW with vintage radios. This led to an opportunity to restore some of the "big rigs" from yesteryear. Among several home-brew transmitters, his favorite is the 1952 vintage WRL Globe King 400B.

Replicating the Round-the-World Four

In the June 2000 *QST* I said of the Silver Marshall 'Round-the-World Four,' "This radio would be a good candidate to replicate today with old parts...and the cabinet is assembled with small sheets of aluminum. If anyone has already done this, I would like to hear from you."

Well, reader Tom Provost of New Jersey took the challenge. "My recreated Round-the-World Four, circa 2000, is up and running. I completed it last week and powered it up. The first station I received sounded like Radio Japan. Tuning

around, I heard some other international broadcasters. I am pleased with its ease of operation," Tom said.

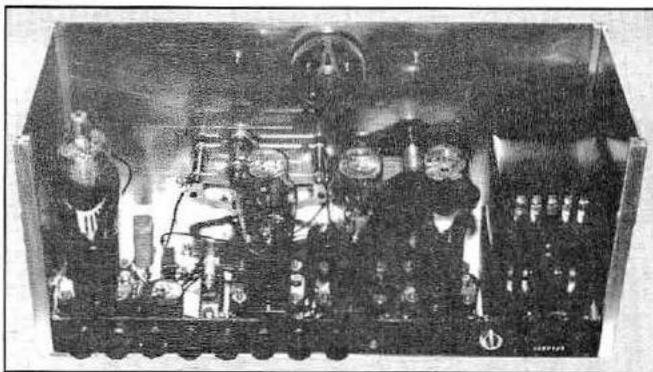
He indicated that some differences in his replicated version were required because he was unable to find all old parts. He wound a set of four coils for it on National 4-pin forms instead of the 5-pin coils used by Silver Marshall. The audio transformers were impossible to find, so he made his own using miniboxes from RadioShack. He placed barrier strips on them to connect the wires and placed new 3:1 transformers inside each one. He also made the RF chokes, placing them inside small plastic pipe caps so they would look the same as the originals.

For tubes, he used slightly newer ones—1930s 4-pin tubes. The lineup is a 32, 30, 30 and a 31 in the audio output.

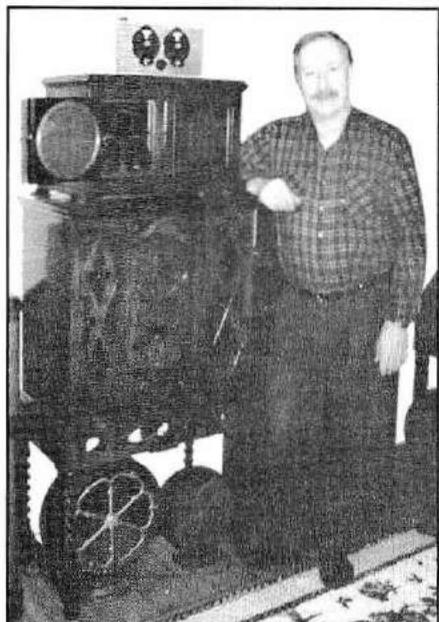
The cabinet was made from some pieces of scrap aluminum. The four corners were machined from aluminum square stock using a slitting saw on a lathe. The aluminum stock was acquired at McMaster-Carr. Visually comparing his new radio to an original, I found they are very close in appearance.

For dc power, he made a "B" battery from 64 AA cells. He placed them in a plastic box and used connectors for the wires. For filament power, he used 2 D-cell batteries.

Tom isn't a ham yet, but loves to restore old radios; he has some impressive receivers in his collection. Among them are a Pilot Super Wasp, a Hammarlund Comet Pro, a National SW-3, a couple of HROs, several vintage Hallicrafters and a Technical Material Corporation GPR-90. Additionally he has many early home broadcast radios.



An inside view of Tom's version of the Silver Marshall.



Tom Provost standing next to two broadcast radios, with the replicated Silver Marshall on top.

N8ECR. Mike, an avid AMer, made efforts to restore the rig and get it on AM phone.

The class C power supply and the modulator were both giving Mike some problems. He realized some success by replacing the high-voltage bleeder resistor. The transmitter was delivering over 300-W output, with 1450 V dc at 300 ma, but the modulator still refused to work. Power supply problems, together with distorted audio in the speech amp, kept the Globe King silenced for many more years.

Being active on AM early in my ham career (1976), I decided to revisit AM again in the '90s. Motivated by the smell and glow of the tube gear, I convinced Mike to sell the Globe King 400B to me in 1996. Mike and I had been AM buddies for many years. He knew that I wouldn't sleep until it worked, so he agreed to part with the old relic. On a cold Sunday in January 1997, I drove through drifting snow to Pigeon, Michigan, to purchase the transmitter. Six hours later, the fun began!

What I Found

After removing some layers of dirt and crud that had accumulated over the years, I tried an on-the-air evaluation. The results weren't promising, so I decided to dig into the radio.

At 375 pounds, the Globe King is not a lightweight. Working on it requires some planning. The RF chassis, modulator, and the high voltage power supply are on individual decks, all housed in a 3-foot cabinet.

The modulator has its own 1000 V dc power supply, using 866JR mercury vapor rectifiers. This part of the rig was sick. Isolating the modulator's B+ supply by lifting the wire that exited the bleeder resistor, I tried it again. I saw sparks!

Okay, maybe there are other problems. I checked the filter cap. It was good. The choke was good. What next? I had no other 866JRs, so I chose to eliminate the tube rectifiers, replacing them with solid state components. This would also eliminate the filament transformer. I tried again. Now I had 1100 Vdc. Careful inspection identified two problems: (1) the filament transformer was bad, and (2) the tube sockets for the 866JRs were miss-wired from the factory.

On to the speech amp, and more problems. I did put the rig on the air, but the reports were less than favorable. Reports of distorted audio and splatter abounded. Many hours later I had those problems solved. I found that the old carbon resistors

had changed value over the years and none of the tubes in the speech amp had the right voltages. I also discovered that the phase inverter tube (6N7) had been miss-wired at the factory. This meant there had been two wiring problems on the same deck. If the original owner had been a phone operator, I'm sure it would have been fixed years ago. Finally, after 45+ years, the Globe King was on the air.

Over the next few months some other minor problems surfaced. Eventually, I replaced every capacitor and resistor on all three decks. All the plug-in coil sockets were cleaned and the tubes were checked and replaced. This work has led to many trouble-free hours of operation and enjoyment. Restoring the 400B was a lot of fun. I may never get DXCC running the Globe King 400B as W8URM did back in the 1950s, but I am getting close to WAS on AM. The 400 is still the "King" to me.

MORE GLOBE KING INFO

For more information on the WRL Globe King transmitter, visit my Web page at www.eht.com/oldradio/arrrl/index.html. Hamfest season is now here. As always, look for my call letters on my hat and say hello.—K2TQN

BC-625 Surplus 2-meter Transmitter

After World War II the VHF bands changed. Gone were 5 meters and 2½ meters. Replacing them were two new bands, 6 meters and 2 meters, both still popular today. One of the reasons 2 meters became popular was the availability of inexpensive war surplus radios such as the "SCR-522 VHF XMTR-RCVR" used in American and British planes.

For \$39.95 or less you could purchase the 100-pound SCR-522, consisting of a BC-624 receiver and a BC-625 transmitter in "excellent" condition, complete with conversion instructions. Various magazines published articles about using them, and included conversion instructions as well. Ham clubs around the country encouraged members to pool their funds and turn the conversions into club projects. Soon they were heard everywhere on 2-meters.

Conversion Details

According to the *Surplus Radio Conversion Manual, Volume 1*, (1948) one of the first things you would do is remove and discard the mechanical tuning arrangement. Mechanical modifications would include a new front panel designed to accommodate a new 4-position crystal switch, a panel meter and microphone and key jacks. Detailed drawings indicated where the panel holes were to be drilled for the new controls so that they would align with the existing transmitter metering and tuning controls. Extension shafts from the controls would allow tuning knobs to be added to the panel. The

panel was attached using brackets mounted on either side of the transmitter chassis.

Individual options and designs were all different, due to different needs of the owners. The one pictured in this column has additional controls and switches: an audio gain control, an MCW/phone switch, a power

switch, a **PLATE ON** switch and an external crystal jack instead of the 4-position switch.

Two BC-625 Gems

I own two modified BC-625s. The unit shown in this column is the best looking one I have ever seen. The unknown builder was extremely talented and attended to details such as the hand-drawn paper labels and tuning-control indicators. He placed the radio in a "Bud" manufactured cabinet; it must have really looked good in his station. The other BC-625 that I own is plain and functional without indicators or a cabinet. Both worked very well for the owners, I'm sure.

Power Supply

After the transmitter modifications were completed, the only other required item was a power supply. Three voltages were needed: +300 V, -150 V and 12 V (for filaments). This is an extremely simple power supply to construct, making the entire project an easy one for the new ham.

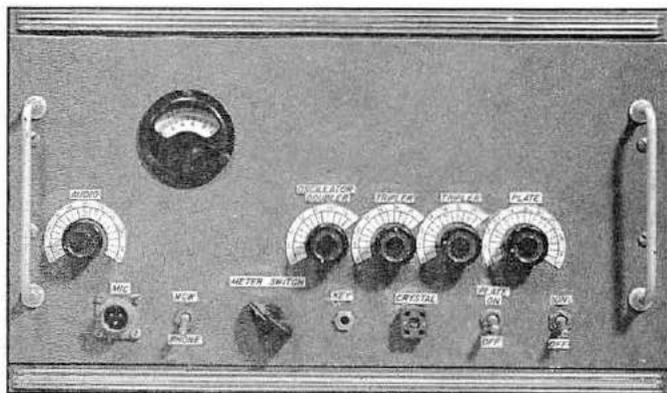
The SCR-522 could also be used mobile with a 28-V PE-94A dynamotor for high voltage, and by adding an extra 28-V battery and charging system to the car. The BC-625 itself would reside in the trunk with the BC-602 remote control box near the operator. Our modern miniaturized mobile rigs make BC-625 mobile installations look extraordinarily bulky and complicated by comparison! Visit my Web site at www.eht.com/oldradio/arrl/index.html for more images of the BC-625.—K2TQN

SCR-522 VHF XMTR-RCVR for all-purpose work at 100-156 MC



Used on all AAF and RAF planes—now yours at a fraction of cost. Ten-tube crystal-controlled superhet has 3-microvolt sensitivity at 10 mw output. 7-tube temperature-stabilized xmtr delivers 15 watts. Remote push-button tuning on 4 crystal-controlled send-receive channels. 28 volt d-c dynamotor powers entire rig. Complete with tubes, plugs, instructions for conversion to 110 volt a-c operation. Excellent condition. Weight, about 100 lbs.

This advertisement for the SCR-522 appeared in May 1947 QST.



A close-up of the converted BC-625. Notice the intricate detailing of the paper labels.



A view of the entire converted BC-625 in its Bud cabinet.

W2DST—A Station Lost in Time

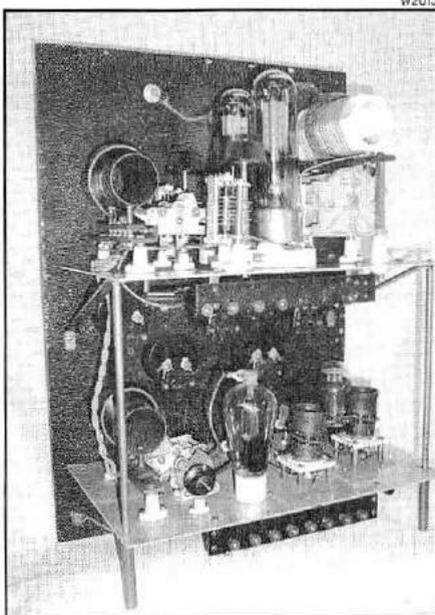
Joseph M. Hoffmann was born in 1878 in New York City. He was a bright teenager, studying chemistry and math. He was also interested in telegraphy and went to work for the New York Central Railroad and Western Union as a telegrapher. Sometime between 1898 and 1900 he became interested in wireless and built his own spark-gap ham radio transmitter. Operating as "JMH," he quickly became more knowledgeable and built bigger and better stations.

New York City was a hot bed for early radio. Hoffmann personally knew Tesla, Armstrong and had met Edison. In 1909 he was a charter member of the Wireless Institute along with such notables as Lloyd Espenschied of AT&T; Phillip Farnsworth; Alfred Goldsmith, director of the Radio Research Laboratory; Robert Marriott, Radio Inspector, Department Of Commerce; A. Parkhurst, superintendent of the Tropical Radio Telegraph Company; Greenleaf Pickard, vice president of the Specialty Apparatus Company; and Roy Weagant, design engineer for Marconi Wireless Telegraph Company. This organization of radio pioneers in 1912 became the Institute of Radio Engineers (IRE).

Joseph Hoffman's other hobbies were building motorboats and playing with automobiles. Around 1912, he took over his father's cooperage business, building large water tanks for city buildings. He continued to expand the business and became financially well off. A researcher, he was one of the principal inventors of the modern spark plug. He manufactured spark plugs during the 1920s and 1930s until AC-Delco bought the patents.

In the mid-1920s Hoffmann designed and built a new home in the country for his family at 57 Grandview Ave, White Plains. There, Joseph M. Hoffmann, now W2DST, would enjoy his hobby of ham radio with his son, Joseph A. Hoffmann, W2DIJ.

Drawing on the knowledge of the IRE engineers and designers, and having access to machine and woodwork shops, he built increasingly advanced ham stations over the years. He would continue operating and building until December 7, 1941, the start of World War II. Then, he immediately went off the air, took down all his antennas, disconnected the power supplies and locked the door to his attic station.



The elder Hoffmann's 40-meter transmitter.



Joseph A. Hoffman, W2DIJ.

It remained untouched for nearly 55 years.

The Discovery

Sometime after his father died in 1964, Joseph A. moved south and rented out the family home. Eventually deciding to sell it, he wondered what to do with his and his father's beloved ham radio station. Some mutual friends in Florida heard about the problem and called Lou Leonard, W2UIJ. They knew Lou had been seriously collecting radios for about five years and lived near the Hoffmann home. Of course, Lou was interested. He immediately telephoned Joseph A., now almost 80 years old, and made arrangements to see the station.

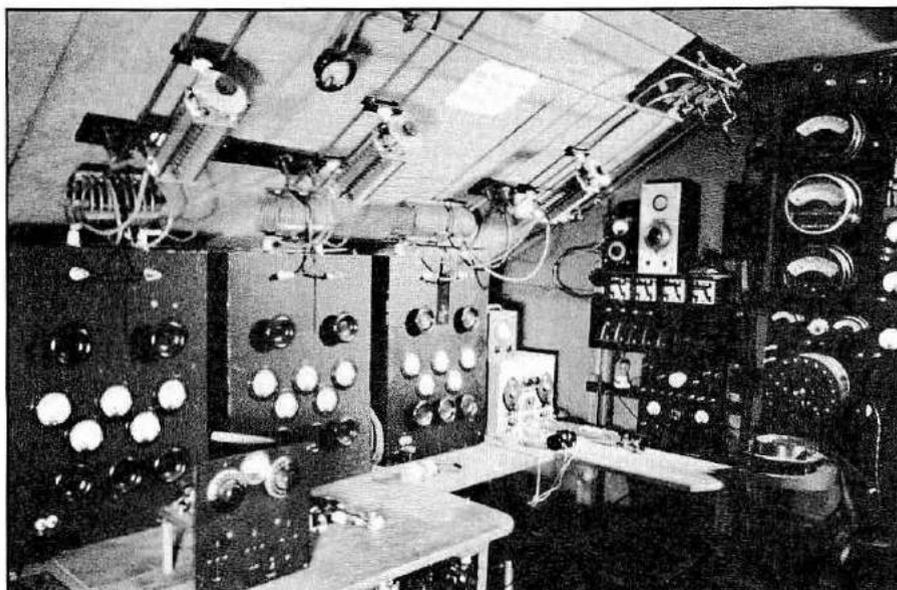
On July 15, 1996, along with his close friends, Bill Henneberry, KN2X, Bob Brannigan, W2EJG, and Bob Handel, WB2ICQ, Lou went to the White Plains home. Met at the front door, Joseph A. Hoffmann took them up to the second floor and pulled down the attic stair. Lou later said, "At the time, I wasn't sure what we would see." They entered the attic with flashlights and after pushing aside the 1869 steamer trunks of Hoffmann's grandfather, Augustus Hoffmann, the ham shack door was unlocked. Joseph A. said, "You are the first persons outside the family to see this since it was turned off in 1941." Then he added, "I'm selling the house in one month. So what are you going to do about it?"

It was a remarkable sight. For a moment, they all were speechless. Before them was an untouched 1920s-1930s ham radio station of significant size and beauty. Almost immediately they noticed the three large transmitters, electrical controls panels with large meters, power supplies built in wooden boxes on the floor, other radio chassis scattered around, and an assortment of homemade test equipment on shelves.

Anticipating a wonderful find like this, Lou had brought his 35-mm slide camera along. He plugged in a drop cord and turned on the floodlights. Joseph A. started to tell the visitors about his father and the history of the station. While this was going on, Lou took hundreds of photographs before anything was disturbed.

The Transmitters

The three large transmitters appeared



The W2DST station. This photo was taken only minutes after opening the sealed attic door.

identical. Upon closer examination, it was noted that they were for three different bands: 80, 40 and 20 meters. An engineer himself, Lou admired the work of this master builder. "This was a first-class job," Lou said, "He didn't use plug-in coils like many other hams, he switched transmitters instead."

In the late 1920s, when these were built, panel meters were very expensive. Most hams had only one, which they jacked in and out of the various circuits to take readings. These transmitters each had five meters, one for every important circuit. The operator could tell at a glance just how everything was performing and make adjustments as necessary.

All three transmitters have similar internal construction. All stages are loop coupled. The crystal controlled oscillator in the 40-meter rig is an RCA 6L6 driving a Taylor T-20. The finals can be viewed through a screened window. They are a pair of General Electric PR-3-B tubes (the GE version of the classic UV-203A). Wired in push-pull, they are link-coupled to the feed-through insulators near the top of the front panel and then to a large coupling coil on top of the transmitter for matching to the antenna lines.

Hoffmann modified the transmitters from time to time, always trying the latest tubes or circuits. The 20-meter rig had been modified in the late 1930s to use an RCA 813 in the final for higher output power.

The cabinets are actually large wooden boxes that have been very carefully lined with copper sheeting, making them well shielded. The front panels are made of heavy aluminum and have been painted black-wrinkle. The two custom chassis inside are carefully cut and bent from sheet aluminum. All of the parts used are top quality and the construction is very professional.

There were no modulators for this station because Hoffmann used CW almost

exclusively.

There was quite a switching system for the power. Two large power supplies would provide the high voltage. The smaller one was used for moderate output of 100 W, or for higher power the larger could be switched in for 300 W. A very organized set of knife switches did the job. Everything was well marked and documented. Lou felt that if he wanted to, he could have powered up the station and put it right on the air, if the antenna still existed.

The power supplies are also well built on sturdy wooden breadboards. They are placed into custom-made wooden boxes that open for inspection and to allow the operator to replace the two 866 mercury-vapor rectifiers.

The Receivers

All of the station's receivers had been earlier relocated to bedrooms or to the garage and cellar. A visit to the cellar revealed a "pile of Pilot Super-Wasps," which Hoffman cherished. Over the years a large number of early commercial and homebrew receivers had been used. In later years an RCA AR-88, as well as several Nationals were in use there.

Switching Antennas

A series of large "Trumble" knife switches, coupled by copper tubing, allowed each transmitter to be switched in or out of the feed line. An RF power meter was built into the feeders to help adjust each transmitter for maximum output. The feed line ended in yet another antenna matching device, mounted on the outside wall with two large brass feed-through rods to the antenna. Two large light bulbs were also in the circuit. They were probably used for tuning purposes or to act as dummy loads. Another knife switch allowed the antenna to be switched to the receiver while listening.

The Power Meters

The board with the large meters was a carryover from Hoffmann's early spark transmitters. Due to the noise and the smell that was generated, they were usually located in a cellar or some other remote location. The speculation is that he brought this from his earlier home in the city. It was still functional and an accidental bump of one of the wall-mounted knife switches brought them quickly to life, surprising the visitors. Lou carefully disabled the ac on his next visit.

160-Meter Transmitter

In the garage, a carefully constructed breadboard 160-meter transmitter was discovered. It was dirty, but was all there and is restorable. Built by Joseph A., it was featured in *How to Become an Amateur Radio Operator*, by Lt. Myron F. Eddy, a *Short Wave Craft* Publication, 1933-1934. Joseph M. modified it for 160-meter use only.

Other Treasures

Uncovering layer after layer in the garage and cellar revealed rare and wonderful spark transmitter parts. Antenna resonators, sealed glass capacitors in wooden boxes, a 500-W spark coil, a Massie wireless key and slide potentiometers were found and are presently being restored. Many of these came from the E.I. Company, a well-known manufacturer of spark transmitters and parts. Early tubes were also discovered, such as the Western Electric 205-D and some very early Audions.

The attic revealed Joe's set of *IRE Journals*, starting with Volume 1, Issue 1.

In the station's 1885 oak roll-top desk, a pile of QSL cards were in place, as if waiting to be filled out. The drawers revealed a 1932 radiogram, scientific instruments, receiver plug-in coils and replacement parts for various radios. A Browning-Drake oscillator was on the top and used as a VFO.

A Millen transmitter, in the form of several chassis, was found on the floor. This was believed to be from Joseph M.'s city office. He would use this to contact Joseph A. at home during the week.

This station was truly a "time capsule."

In addition to those mentioned above, Lou Leonard would like to thank Tom Perera, W1TP, Pete Malvasi, W2PM, Stuart Mount, W2AO, and Jim Kreuzer, N2GHD, for their help in researching and identifying items from this station. Lou Leonard provided much of the information used in this article.

Conclusion

I own the Hoffmann 40-meter transmitter and have it in my Old Radio Museum. To see it, check my spring schedule on my museum page for hamfests I will be attending. Look for my call letters on my hat and say "hello." Also, for more photographs of the W2DST station visit: www.eht.com/oldradio/arri/index.html.—K2TQN

Collecting History

Early ham newsletters and magazines are a wonderful way to collect and learn about early Amateur Radio history. The following excerpts are from *Radio News*, a ham club newsletter dated September 3, 1915, from Atlantic City, New Jersey. I was very lucky to come across seven early issues covering up to January 7, 1916, at a radio estate auction.

RADIO NEWS

Published the first and third Friday of each month. Offices at 2011 Atlantic Ave and 145 St Charles Place. Jerome Haas, Editor, Earl Godfrey, Associate Editor. Advertising rates upon request.

Local Amateur News

Mr. Neveling has purchased a DeForest audion and is having remarkable results.

Mr. Doughty's aerial has fell down several times recently but is up again. He has also burned out his transformer.

Mr. Albertson has erected his aerial again at his home in Pleasantville and will be ready for business soon.

3IF and NJ will be back at 145 St Charles Place after the fifteenth of September.

Mr. Seymore's station, 3IT, is hampered by having the front of the aerial only 8 feet above the roof. CS was afraid the pole would fall in the street and someone mistake it for slivers.

Mr. Cook has established a station at Little Beach. They will use a 3-inch coil. Everybody listen for CM.

Do not use linoleum on the floor of your station if you do much transmitting. Messers Jeffreys and Haas were badly shocked recently on account of the ground wire making circuit thru the linoleum.

In all probability the Pier station [the Million-Dollar Pier on the Boardwalk] will be closed after the first of October. Here's hoping old man Neptune leaves it there for next summer.

In later issues there are updates on stations, news of a 350-foot aerial at Haas' station, and listing of new hams and members. It appears that there were about 26 members by January 1916. It is also rich with hand drawn schematics of various stations and new designs for antennas. And on the last

HOW I STARTED IN WIRELESS

By J. Haas (September 3, 1915)

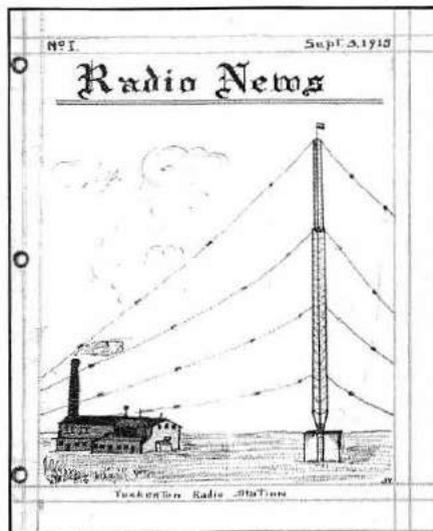
I have been interested in wireless since 1908 and from that year on, I purchased *Modern Electrics* and read many articles in it that interested me. Yet, I did not care to install a set. I knew of no amateurs in this city [Atlantic City, New Jersey]. In 1910 during a short visit to Newport, R.I., I saw the government station and determined to put up a station of my own. While the Marconi station was on the air I became acquainted with Mr. Lessenco and by watching him send press in the evening I learned the code. I bought a cheap set in Philadelphia in the fall of 1912. The only stations I could hear were AX and a few ships. I improved my set rapidly after that. At first I had only 2 wires 50 ft. long.

Mr. Lessenco gave me a letter of introduction to Mr. Jeffries and in March 1913 I joined the Association. After that I put up two spiral aerials and made a 4 slide-tuning coil. During the summers of 1914 and 1915 I worked in the station of the Jeffries Young Antenna Co., on the pier, which gave me some experience. In January 1915 I took the examination at the Philadelphia Navy Yard and was given 3RQ for a call letter.

This about finishes my story with the exception that I have planned for a fine receiving set this Fall and intend to install a high power station at the Drexel Institute in Philadelphia, for which we have asked for a special license.



Jerome Haas, 3RQ, circa 1915.



The cover of *Radio News* from the Atlantic City 1915 ham club. The sketch shows the Tuckerton Radio Station, built by Germany before World War I.

page of every issue there are advertisements for slide tuners, galena crystals for detectors and large slinky-type antennas. These enterprising teenagers made almost everything themselves.

Jerome Haas went on to Drexel Institute [now Drexel University] and into an

WIRELESS APPARATUS MADE TO ORDER

Complete receiving set with phones.....	\$10.00
Double slide tuner.....	\$2.00
Loose couplers \$7.50 & \$15.00	
Detectors.....	\$1.00
Fixed condenser.....	\$1.00
Variable condenser	\$3.75
Telefunken galena.....	\$.10
Cerussite.....	\$.20
Supersensitive silicon	\$.10
Construction of the Audion	
Amplifier 25 pages.....	\$.50

Jerome Haas
2011 Atlantic Ave.
Atlantic City, N. J.

An advertisement from *Radio News*.

Engineering career. I found his photo in a 1920 issue of *The Radio Amateur*, a small magazine from the Midwest. At the time he was Technical Editor. He was resigning to become a married man.

Conclusion

If anyone has more information on Jerome Haas or any other early southern New Jersey hams, I would be interested in hearing from you. Check out my Web page for some additional newsletter scans at www.eht.com/oldradio/arrrl/index.html.—K2TQN

The Heathkit AT-1

Few doubt that 1951 was an exciting year for ham radio. The introduction of the Novice class license made it possible for many to join our hobby. A good number of those joining were teenagers and young married people with limited amounts of money to spend. All of this helped the Heath Company enter the ham radio market.

Until that time, Heath had been successful selling surplus electronic parts and had just recently started selling test equipment kits such as their vacuum tube voltmeters and oscilloscopes. With all the new hams getting their licenses they determined that a good, inexpensive, transmitter kit was needed. The AT-1 would fill the bill.

The Genesis of the AT-1

Roger Mace was hired to design the transmitter and help Heath get their ham radio product line started. *QST* and the *ARRL Handbooks* had many designs that were popular and reasonably inexpensive to reproduce. Many of these designs had plug-in coils. Heath had tons of war surplus parts on hand and putting together a kit with these parts meant the selling price could be kept very low. Roger knew that adding band switching would be a plus.

One *QST* article of note was "How to Lay Out a Transmitter" by Byron Goodman in July 1951. It was centered on a 6AG7/6L6 transmitter designed earlier by Don

Mix in the April 1950 *QST*. This classic transmitter had a similar appearance to the AT-1. I can't help but believe that Goodman's 1951 article influenced Mace.

The AT-1 kit was introduced just in time for Christmas 1951. At \$29.50, it was an immediate success. It had everything one needed to build and finish it without having to purchase any additional parts. Its main features were: a built-in power supply, band switching, a built-in meter (switchable for either grid or plate measurements), a front-mounted crystal socket, a complete cabinet and a well designed front panel that was pleasing to the eye. It also included complete documentation on how to use the transmitter, and step-by-step instructions and drawings on how to assemble the transmitter. (This was important to a first-time builder.)

The band switch had four positions: 80, 40, 20 and 10 meters, but it also covered 15 and 11 meters at the 10 meter position (11-meters was still a ham band at this time and 15 meters did not become available until May 1, 1952). This meant that when the new Novice passed the General test, the transmitter would put him on the General bands. It was upgradeable; there are two octal sockets on the rear of the chassis, one for an accessory VFO and one for a modulator. Heath would later offer a VFO kit, but only offered information on how to connect the modulator to

the transmitter. Ham magazines offered many modulator designs for the AT-1 over the next few years.

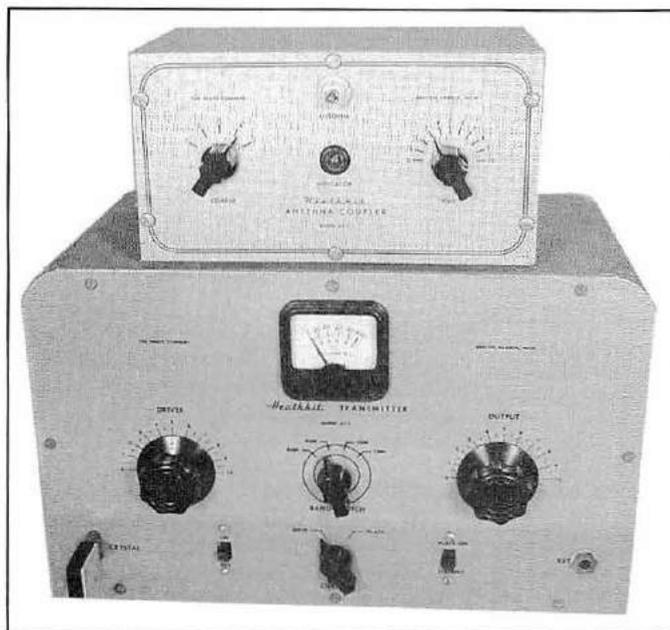
The RF circuit was the popular 6AG7 oscillator driving a 6L6 amplifier. Designed primarily for CW, it produced about 12 to 16 W output, depending on the band. The power supply used a transformer to a full wave 5U4 rectifier tube, with four filter capacitors and a choke. Two front-panel switches were provided: one for ac power and one for transmit or stand-by.

Heath later sold a model AC-1 antenna coupler for the AT-1. Priced at \$14.50, it too was immediately popular. Designed for use with a random lengthwire antenna, it covered 80 through 10 meters. There is a neon bulb in the front panel that indicates rf output. Tuning is simple; just tune for maximum brightness.

Conclusion

It's not known how many AT-1s were sold, but estimates are several thousand. The AT-1 has become very collectable and owners continue use them on the air. There are many AT-1 to AT-1 QSOs every month. Find one and join in on the fun.

I would like to thank Chuck Penson, WA7ZZE, author of *Heathkit: A Guide to the Amateur Radio Products*, for his help in providing historic information for this article.



Front and rear views of the AT-1.

The Hallicrafters S-1

One of the best known and respected names in ham radio is Hallicrafters. Founded in 1932 by William J. Halligan, the company name was chosen as a composite of the two words: "Halligan" and "handcrafted." "Handcraft Makes Perfect" was the first logo of his enterprise.

In 1933 Halligan acquired the use of the bankrupt Silver-Marshall company's name, factory, and most important, the use of their RCA license. With the help of Kendall Clough, former engineer from Silver-Marshall, they designed the first of a new line of ham radio receivers. First announced in the April 1934 issue of *Radio News*, the "S-1 Skyrider" sold for \$39.95, about the same price as popular kit radios. A few were built in small production runs of 50 or 100 sets. Each one was handcrafted and signed by the assembler.

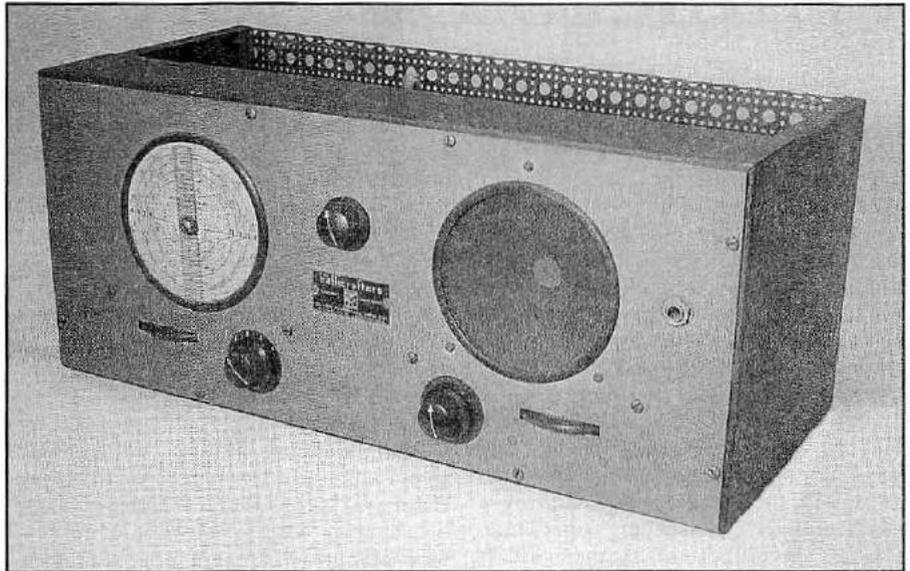
To become a successful manufacturer in the Depression, cost had to be kept to a minimum. The 4-tube circuit was a tried and well-tested design. It had one stage of tuned RF (using a 6D6), a regenerative detector (another 6D6) and two stages of resistive-coupled audio (a 6C6 followed by a 42 in the output). The set was built in a small cabinet complete with a speaker and a built-in ac power supply using an 80 tube.

The S-1 introduced several innovations into ham radio receivers. Most receivers up until then had plug-in coils. Alternatively, the S-1 offered band switching. Four positions covered from 1.6 to 22 MHz.

Micro-vernier, anti-backlash tuning was introduced with a reduction ratio of 18:1. Tuning was accomplished by turning the lower left horizontal tuning knob with your left thumb, the rest of your hand wrapped around the left side of the cabinet. It is a comfortable tuning position for a right-handed person. This allowed the other hand to be used for adjusting the dual controls for RF sensitivity and audio gain.

The antenna input circuitry was designed for use with standard antennas, or to utilize the advantages of "doublet" antennas. An additional ground wire was provided for easy attachment.

Because so few S-1s were built, not many survive today. I'm happy to tell you that my Old Radio Museum will have the S-1 on display starting late this fall. For more information, you can read a radio magazine engineering report on the S-1, see additional photos and some early Hallicrafters S-1 advertising on my Web site: <http://www.eht.com/oldradio/arr/index.html>.



The S-1 model was quickly followed by the S-2, which added a bandspread control and a send-receive switch to the front panel. The S-1 through S-6, made in small quantities, took Hallicrafters into 1935. By late 1935, they started producing communications receivers with the name "Hallicrafters" in their new factory. The

1935-36 SX-9 "Super Skyrider" was the first model to be produced in significant quantities. By 1938, Hallicrafters had produced 23 different models.

My thanks to Chuck Dachis, author of Radios by Hallicrafters, for his personal help with the history of this radio and the Hallicrafters company.—K2TQN

Old Radio Auction

Every so often, you hear about radio auctions. This is a short report on one.

I just returned from the annual Antique Wireless Association meet near Rochester, New York. It is held every year around Labor Day. You will always find a large 3-day flea market, interesting radio presentations, an old equipment contest, seminars and two auctions there.

The first auction is the Communication Equipment Auction for ham radios and boatanchors only. AWA Museum Curator "Col" Ed Gable, K2MP, is the Auctioneer.

Radios and their selling prices in the accompanying, are from left: an RCA ACR-136 went for \$70; the National NC-57 with the slant base and meter went for \$22 and the Howard 663 went for \$47. That's



Ed taking the bids in the accompanying photo.

The second auction is the main auction, held in three parts. First, there is a vacuum tube auction, then a paper collectables auction, and last, the general auction. Here you will find rare and expensive items, as well as early ham radio gear.

If you are interested in the results, check my Web page.

Finding M. H. Dodd's 1912 Wireless Station

Imagine for a moment that you just received a telephone call from your friend Steve, who buys household antiques. He tells you that he just purchased a whole bunch of old radio parts and one old Radiola radio for you from the 1920s for \$275, and says to come over tomorrow and pick them up at this yard sale in Reno. Steve adds, "You get all of the radio equipment and all of the parts in this deal." This actually happened to Henry Rogers, WA7YBS, last November.

Arriving early the next morning, Steve said, "All of your radio stuff is in that corner of the yard covered with an olive-drab tarp." Pulling away the tarp, Henry saw a nice Radiola 26 and matching battery box, a decent Atwater-Kent 40, three 1920s crystal sets and many boxes of radio parts from the 1920s.

Henry then struck up a conversation with Pat Doherty, who was running the yard sale.

"Oh, you have a radio museum," Pat said. "Well, you know, my stepfather had a radio station before World War I. He was a balloonist and in the Signal Corps during WWI." Pat continued, "He was interested in radio up into the twenties, but then dropped it. He was always trying new things." Pat paused for a second and then added, "You know, I think he had some old tubes in a trunk in that shed over there," pointing to an old metal backyard storage shed that had been "off limits" to the yard sale.

Discovering a 1912 Wireless Station

They followed Pat into the shed. On the floor amidst old furniture and junk car parts were three large steamer trunks, all with several layers of sheet metal and debris piled on top. Rogers gave this account, "After moving the obstacles from the top of the first trunk, we found it contained personal papers, letters and envelopes. The second trunk was found to be empty. After moving the miscellaneous junk from the top of the third trunk, I opened its lid. Wow! The first thing I saw was an enormous spark era helix! Then spark coils and a large antenna switch! It was extremely difficult to remain composed! The trunk was literally full to the top with the parts comprising a very early wireless station. I asked Pat if this equipment went with all of the parts we had already purchased and loaded in the van?"

"Sure," Pat replied. "If you don't take it, it's going to the dump."

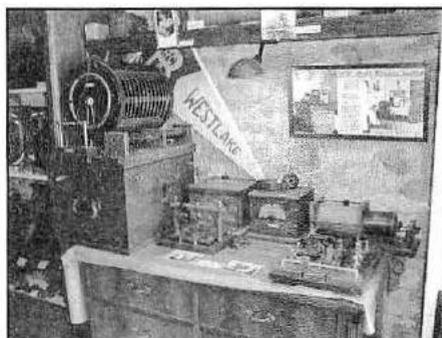
The following Monday, Henry received another call from Steve. "I found you another part that goes with that station and some photographs too!" He was excited.

Another call from Steve came the next day. "You have to get with Ted Moore. He bought a photo album at that yard sale that has pictures of the station. He says there's even one of Dodd with headphones on!"

Putting the Station Back Together

Having actual 1912 photographs of Dodd's Wireless Station will provide Henry with the opportunity to recreate the station, set up as accurately as possible, for display in the Virginia City Radio Museum in Nevada, which he runs. It is set up temporarily now.

"It is difficult to express the eerie feelings that one has when first viewing the 1912 photographs," Henry said. "And then looking at exactly the same items in person." His attention to detail will give visitors the



Dodd's station as it looks today.

unique opportunity of seeing Dodd's wireless station almost exactly as it was in 1912!

Seeing it Yourself

The Virginia City Radio Museum, privately owned by Henry and Sharon Rogers, is the result of over 36 years of collecting. They display wireless and radio apparatus from 1910 through the 1950s. It is located at 109 South "F" St, Virginia City, Nevada. The mailing address is PO Box 511, Virginia City, NV 89440; tel 775-847-9047; hands@radioblvd.com.

Profile: Marion Henry Dodd

By Henry Rogers, WA7YBS

Marion Henry "Hank" Dodd was born in 1890 Cortland, New York. His family moved to southern California in 1907, settling around San Bernardino.

Hank Dodd became interested in wireless about 1910, probably when going to Baptist College in Westlake, California. One of his first jobs was with the San Bernardino Fire Department. His wireless interest was just one many hobbies. Others included photography and taking trips on his Indian motorcycle. When the US became involved in WWI, Hank Dodd joined the Army and became a lieutenant the 316th Field Signal Battalion, 91st Division.

After WWI, radio was still his primary interest and Dodd became involved in a radio business in Los Angeles. Dodd's interest in fast-evolving radio technology business was soon replaced when he became involved in an automobile dealership for the "Wood's Mobilette." Only seven Mobilette automobiles were built and the business went under. Again, moving on to other interests, Dodd went into real estate.

After many years of taking trips into the Sierras, the Dodd family moved to Lake Tahoe, Nevada in 1945. Dodd Realty Company was quite successful in the Tahoe area for many years. Entering his senior years, Hank found that the harsh Tahoe winters were too much for him. He moved to Reno sometime in the 1960s, bringing along a lifetime collection of material and equipment that he had saved and stored in trunks since before WW I. Dodd died in 1985, well into his 90s, leaving the bulk of his well-documented lifetime of hobbies and interests stored in his Reno house and the backyard shed.



The Stancor ST-203-A

First offered as a kit in the late 1940s, the ST-203-A 10-meter transmitter became a popular rig because of its size and innovative design. Hams were experimenting with 10-meter mobile operating at the time and the Stancor Transformer Company, which was already famous for their pre-war transmitter kits, decided to produce a rig for this "market."

Kit building was becoming a big part of ham radio; it was fun to do and saved money. The ST-203-A kit came with 94 detailed step-by-step building instructions. Clearly worded instructions and diagrams showed the operator how to set up the ST-203-A and interconnect the power supplies, antennas and receivers. There were also several paragraphs on how to tune and operate the radio.

Ruggedly constructed with an easily removable bottom plate, the ST-203-A was convenient to place in the trunk near the antenna. The built-in relay switched the antenna between the transmitter and receiver and activated the B+ power supply. Either a vibrator power supply or a (then) readily available PE-103-A war-surplus dynamotor supply could power the ST-203-A. It could also be powered by an ac supply for fixed operation.

Many collectors still put their ST-203-A on the air today. It is capable of 100% AM modulation, transformer coupled, with a pair of 6V6 tubes. The microphone for this radio is also surplus—a popular T-17-B. At the heart of the RF section is a 6V6 crystal oscillator driving a 2E26 in class C.

Is anybody still running one of these old radios mobile, perhaps in a vintage auto? Please let me know, and send a photo. I'll have more on the ST-203-A on my Web site: <http://www.eht.com/oldradio/arrl/index.html>.

K2TQN'S OLD RADIO MUSEUM SCHEDULE FOR LATE AUGUST

K2TQN's Old Radio Museum will be on exhibit Saturday, August 19, along with the operation of special event station W2T by the Old Barney ARC. This will take place on the International Lighthouse Activity Weekend, August 19-20, from the Tucker's Island Lighthouse in Tuckerton, New Jersey. The lighthouse is a full-scale replica of the Tucker's Island lighthouse, which succumbed to the Atlantic Ocean back in 1927. It is the focal point of the new Tuckerton Seaport project, a working seaport built to preserve, present and interpret the "Baymen" and their way of life.



The Stancor ST-203-A with the cover removed.

(Right) The Almo Radio Company ran this advertisement in the December 1949 QST promoting the Stancor ST-203-A.

ALMO **SPOTLIGHT SPECIAL**

Stancor X-Mitter Kit
\$44.70

ST-203-A offers AM on 10 and 11 meter bands. 27.5 watts amplifier input. Two 7 mc. crystals. Kit, all parts and instructions, \$44.70. Wired and tested, \$58.90.

10% CASH WITH ORDERS



ALMO RADIO CO.
509 ARCH STREET • Philadelphia
6205 MARKET STREET • West Phila.
61h & ORANGE STS. • Wilmington
4401 VENTNOR AVE. • Atlantic City

Homebrew—1943

Hal Murken was a student at his Ramsey, New Jersey high school when he built this station in the very early 1940s. He was 17 years old with a class "B" ham operator's ticket, but no station call. He said it was frustrating not being able to use the transmitter because of the war.

His transmitter was a type-47 oscillator with two type-46 tubes in the final. On the desk, he used an autodyne regenerative receiver that consisted of a type-24A RF amp, type-27 detector and two type-27s in the audio section. He had a set of plug in coils that covered 150 kHz to 30 MHz. Just above was his 5-meter superhet receiver, which had a resistance-coupled IF. He also had a 5-meter "rush-box" transceiver for local work (not shown.) His key was an already old Vibroplex. A pair of Brandes headphones rounded out his homebrew station.

As part of the war effort, the Navy gave a code test at his high school. Hal received a score of 100%. The Navy was quick to visit Hal's parents, and inspected his ham shack. At 17½ years of age, Hal was off to teach radio for the Navy in Louisiana. Later he found himself on the staff of Admiral Sowell and served aboard the battleship *West Virginia*, BB48.

After the war he received the call W2QKM, went to college, became an engineer and ran his own engineering firm for 31 years. He's still active as NQ2Y, supervises two local repeaters, is vice president of his ham club and operates HF with a Kenwood 950 transceiver, a linear amp and a beam antenna. Hal is hoping to hear from some of his old buddies.



W2T operation will be from 1300 UTC on August 19 to 0300 UTC on August 20, and on August 20 from 1300 UTC to 2000 UTC. Frequencies to monitor are 7265, 14265, 21365, 28465 +/- QRM. Also, 146.835 (-600/PL-3A) and 146.52 MHz simplex. QSL via N2OO, PO Box 345, Tuckerton, NJ 08087. SASE (or SAE with IRC) for QSL. Send 9 x 12-inch SASE with

appropriate postage/IRCs if you want a certificate with your QSL.

On Sunday, August 20, the museum will be at the Gloucester County ARC Hamfest in Mullica Hill, New Jersey. See <http://www.gcarc-w2mmd.org/events.html> for more information.

Look for my call letters on my hat and say hello.—K2TQN

Vacation Time and Radio Museums

Many collectors make it a point to visit radio museums when they travel. One of the best is located midway between Boston and New London, Connecticut, in historic Rhode Island. It is the New England Wireless and Steam Museum, situated in East Greenwich, only 10 minutes south of I-95 at exit 8.

Founded by a group led by Bob and Nancy Merriam, it was officially opened in 1964 by then Governor John H. Chafee. It started with a single building on their farm, a converted cow barn, and now consists of five buildings filled to capacity. Bob Merriam, W1NTE, has been a continuous member of the League since 1939 and a Life Member for many years.

What's There

The wireless building shows the span of electric communication from telegraph to TV. It features ham radio receivers and transmitters from the earliest days through to the 1960s. Also on display are keys, sounders, crystal sets, tubes, microphones, ocean cable instruments, spark transmitters, detectors, an 1881 Dolbear receiver, an 1899 Marconi coherer and a jigger, and a Marconi spark set exactly like the one used to call for help on the *Titanic* in 1912.

The foremost exhibit is the Massie Wireless System station, "PJ." Built in 1907, it is the oldest surviving working wireless station in the world! It was moved there in 1981 by museum volunteers to avoid demolition. The original location was on the beach in Point Judith, Rhode Island. Most remarkably, all of the equipment on display in the station is original to the station, except for the changeover switch that was assembled by collector and author Alan Douglas from original parts. The pump handle key, the Massie Resonaphone tuner and the operator call box are sitting on the original table. The condenser cabinet with its helix and straight spark gap are also on display. On the left wall and above the helix there is a hot wire ammeter and anchor gap.

Downstairs at the Massie building you will find a vintage working ham radio station maintained by the Fidelity Amateur Radio Club. Also in the station is the original 160-meter transmitter made famous and built by Stew Perry, W1BB.

In another downstairs room you will



Museum Director Bob Merriam, W1NTE, in the Fidelity Amateur Radio Club station, K1NQG, on the first floor of the Massie building.

find the movie set from the 1999 PBS special, "Rescue at Sea." It is a replica of the steamship *Republic's* wireless cabin, complete with original wireless equipment of the same type used by the *Republic*. It became famous when the *Republic* had to call for help after the collision in 1909 with the steamship *Florida* in dense fog.

Visiting the Museum

The New England Wireless and Steam Museum is run entirely by volunteers. Therefore, their efforts are mainly directed to hosting scheduled groups such as school classes, engineering societies, radio clubs or association meetings, etc. They do not have the staff to handle walk-in visitors except by prior arrangement. Thursday is "Volunteer Day," and there are usually people there between 9 AM and 4:30 PM. They ask you to please call 401-884-0545, fax 401-884-0683 or e-mail news@ids.net for an appointment.

July 29—Radio Meet at the Museum

The annual radio meet is the "Yankee Radio Tune-Up" on July 29, 2000. The gate opens at 8 AM (no early entry) and the meet runs until 3 PM. Admission is \$10 with free parking. There will be an Antique Radio Flea Market with Tailgaters selling a variety of radios and parts. The Fidelity Amateur Radio Club station, K1NQG, will be on the air in the Massie station building. A silent auction will be held during the morning to raise money for the museum, and it will feature some rare items. Coffee, donuts and soda are available. Bring your own lunch. Also, on July 22 the Yankee Chapter



Some of the early ham radio receivers on display in the wireless building.



The 160-meter station of Stew Perry, W1BB.

of QCWA will meet at the Museum.

Joining or Helping

Generous financial help from individuals supports the museum. So do admissions and proceeds from museum functions. The museum solicits no government grants, although the IRS recognizes it as a 501(c)(3) nonprofit institution. This museum deserves our support.

For more Information

Please write: Robert W. Merriam W1NTE, Director, The New England Wireless and Steam Museum, 1300 Frenchtown Rd, East Greenwich, RI 02818-1424; tel 401-885-0545. You can also visit the museum's Web site at: <http://users.ids.net/~news/index.html>.—K2TQN

Building A Fine Old Radio Today

In last month's column I talked about the "Around the World Four" receiver by Silver-Marshall. At the end I mentioned that this would be an easy antique to replicate due to its use of standard old parts that can still be found at hamfests. In fact, replicating old radios is a very popular part of collecting. Sooner or later, many collectors build their favorite radio from their own spare parts and, with a little hamfest shopping, they are able to get the rest.

This month's column is about a replicated radio built in 1997 from the 1941 edition of *ARRL How to Become a Radio Amateur*. It was a popular design of the time—a two-tube regenerative receiver with plug-in coils. It could be powered two ways: by ac with an attached power supply, or by dc with batteries. (Remember that in 1941 there were still many rural homes and farms without commercial power, so their radios had to be battery powered.)

The receiver shown here was built by collector and "Master Craftsman" John Kelly, N3GVF (SK). John was well known for his immaculately restored collection, which contained over 300 ham radio receivers and transmitters, hundreds of Morse keys and sounders, as well as microphones and other ham radio accessories. He also had a radio library containing thousands of books, old radio magazines, radio manuals and schematics for most of his collection.

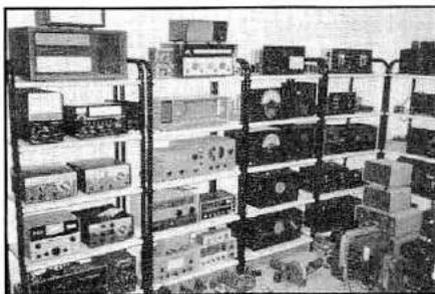
This was last radio that John built. He died unexpectedly just after finishing it, before he could complete the matching transmitter from the same publication. He intended to enter the pair into the Antique Wireless Association's annual contest. I entered this radio for him in 1999, after acquiring it a year earlier from an auction. It won the prestigious AWA "Ellie Craftsman" award for outstanding construction techniques.

The ARRL construction article describes two ways to build it. One approach used a nice metal cabinet and the other, which John decided to build, used a wooden base with an aluminum plate attached to mount the parts. An additional piece of aluminum provided the front panel where the various controls and variable capacitors would mount.

The article is well written with many photos to help you with parts placement. There is an easy-to-follow schematic and a com-



The 1941 edition of *How to Become a Radio Amateur*.

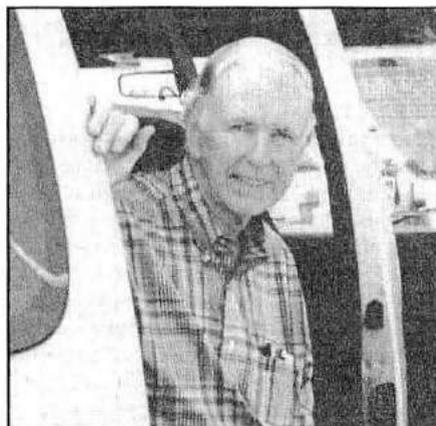


John was well known for his immaculately restored collection, which contained over 300 ham radio receivers and transmitters.

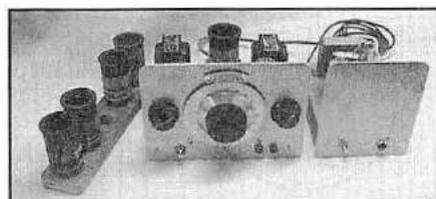
plete parts list. The table with coil data is shown with well-drawn examples on how to construct the five plug-in coils. This radio covers from 1.55 to 33 MHz in five bands. The coils are designed to place the center range of the tuning control in the center of the 160, 80, 40, 20 and 10-meter ham bands.

If you decide to construct one yourself, you won't be sorry. This radio works very well. It will pull in weak stations quite nicely on the lower bands. Match this up with a homebrew single 6L6 transmitter, throw in a nice 40-meter dipole, add an old-fashioned knife switch to change the antenna from receiver to transmitter, and you'll have great starter station that graced many shacks from the late 1930s through the mid 1950s.

During the year there are contests for



"Master Craftsman" John Kelly, N3GVF (SK).



John's handsome version of the two-tube regenerative receiver with plug-in coils from *How to Become a Radio Amateur*.

vintage stations by various groups. This is a fun way to contact others with similar stations. If you know about a vintage or Boat Anchor type contest, please send me the information by e-mail, and I'll place a vintage contest schedule on my Web page.

Building It Yourself

With the permission of ARRL, I have scanned the entire 11-page article, which contains the construction portion and the details on how to operate this radio. (There is also information for building the all-metal version there if you so desire.) It is located on my Web site for you to download and print. I have also placed additional photos of John's radio so that you can study his construction techniques. The site URL is: <http://www.eht.com/oldradio/arrl/index.html>. Please let me know how your project turned out!

I'm looking for other nice homebrew radios to feature in this column from time to time. If you have something to share, please let me know. These could be radios your dad built way back when, or something you found in an old *Handbook* or magazine article and built yourself.—K2TQN

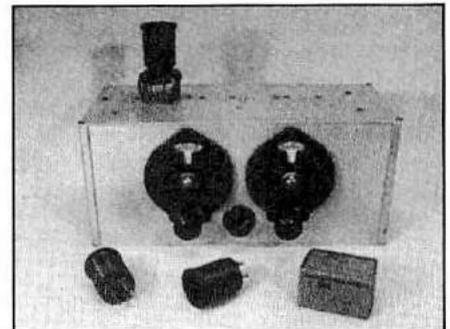
The Silver-Marshall "Round the World" Four

There are many photos of ham stations in the early 1930s *QST*s and I've always enjoyed reading those station descriptions. One receiver that showed up in many photos was the Silver-Marshall model 730 series "Round the World" Four.

First advertised in the September 1928 *QST*, the "Round the World" Four quickly became popular. The ad declared, in part, "9BBW, receiving on the 'Round the World' Four," worked in one evening stations in Germany, France, England and Italy. Low-power amateur code stations over the U.S. and Canada are received

regularly on the 730. And for television work, it's ideal." The rig covered all the active short-wave ham bands, 17.4 to 204 meters.

The 730 was a four-tube receiver consisting of one stage of screen-grid RF amplification, a regenerative detector and two stages of extremely high-gain audio amplification. It was available three ways: a basic kit, the model 732, which sold for \$16.50 (just essential parts); the model 731, an intermediate kit with an RF amplifier, detector, adapter plug, cabinet and four



The Silver-Marshall "Round the World" Four. The left-hand vernier dial controls the tuning, the right-hand vernier dial controls regeneration. The small lower knob regulates the detector filament voltage and at the extreme anti-clockwise position turns the entire set off. Four different plug-in coils cover from 17.4 to 204 meters.

plug-in coils for \$36; and the full kit, model 730, which was available for \$51. This variable pricing structure made it very affordable and hams were quick to respond.

These sets are hard to find in good condition. I have only seen two for sale in the last four years, one of which I purchased. This radio would be a good candidate to replicate today with old parts. The com-

ponents were fairly standard and the cabinet was assembled with small sheets of aluminum. If anyone has already done this, I would like to hear from you. For anyone planning to build one, I have more information, schematics and photos of this radio on my Web site at: <http://www.eht.com/oldradio/arrrl/index.html>.



"ROUND THE WORLD" FOUR

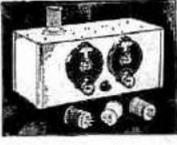
Just What the Name Implies!

The trimmest short wave set ever—that's the verdict everywhere on the new 730 SM "Round-the-World" Four. It does everything you expect of a short-wave receiver—everything, even, that you expect of an SM receiver. The Radio Broadcast Laboratory, in initial tests of the 730, received English SSB daily on the speaker, during afternoon hours. 9BBW, receiving on the "Round-the-World" Four, worked in one evening stations in Germany, France, England and Italy. Low-power amateur code stations over the U.S. and Canada are received regularly on the 730. And for television work, it's ideal!

The "Round-the-World" Four is a complete four-tube regenerative, non-radiating short wave receiver kit with aluminum shielding cabinet. It has one screen grid r.f. stage, a regenerative, non-radiating detector, and two high-gain Clough audio stages. It tunes from 17.4 to 204 meters with four plug-in coils. The kit is \$51.00, complete with cabinet, four coils, and full instructions—ready for immediate shipment.

The 731 "Round the World" Adapter is the two-tube, r.f. amplifier and detector, less the two stage a.f. amplifier of the above set. With an adapter plug, it converts any set to long-distance short wave reception. Price, complete with cabinet and four coils (17.4 to 204 meters) \$36.00. The 732 "Round the World" Essential Kit contains the two tuning and tickler condensers, the four plug-in coils, coil socket, and three r.f. chokes, with full instructions for building a one, two, three or four tube short wave set. It costs but \$16.50 complete.

And it leaves anything for getting out into the short-wave "Thrill Band." Choose the kit you prefer—and "step out!"

New SM 731 Plug-In Coils (used in the 730) wound on moulded bakelite. Fit any 5-prong tube sockets. Wound, \$1.25, or Blank, 90.50 each.

Collector Profile

"Start early and don't stop," is the motto of Tom Anderson, K5HPF. Tom started at the age of three when his dad built him a crystal receiver. The crystal set didn't last long, but the radio bug had bitten. At age five Tom built his own crystal set and at six he learned to solder. By the time he was seven years old, Tom had built a one-tube radio. A superregen short-wave receiver followed three years later.

After a couple of years as a short wave listener, Tom was licensed as a Novice as KN5HPF and later upgraded to General. His first station consisted of the superregen he built at age 10 and Knight Kit 50-W transmitter, Knight VFO and a home-brew modulator. A Speed-X key and JT-30 Astatic microphone rounded out the collection.

Tom went on to get an engineering degree and worked at NASA and IBM. He now owns an engineering firm in Corpus Christi, Texas.

He says, "Vintage radio is my mid-life crisis! I can now afford to own the rigs I always wanted as a child."

All that is left of the original station is the JT-30 microphone. Tom enjoys his Viking Valiant transmitter and a Hammarlund HQ-170A receiver. He also has a Heath SB-10 SSB adapter for vintage SSB operation. As backup, and for portable operation, he has a Multi-Elmac AF-68 with the PMR-8 receiver and the matching M-1070 power supply. On 2-meter AM he enjoys using his Gonset Communicator with his JT-30 microphone.



Collecting Vintage QSLs

An enjoyable part of ham radio has always been the exchange of QSL cards. It started in the early days of the hobby when operators wanted confirmation of their contacts. Over the years many of these earliest confirmations have been discarded or lost. Now it has become popular to collect them.

I collect vintage QSLs. I like them all, but I specialize in cards from southern New Jersey because I'm writing a history of Amateur Radio in my area. QSL cards are rich with history and information, and form the corner stone of my book. When the book is completed, I will have a page dedicated to each ham showing his or her QSL card, photo and any personal information I can find. Additionally, by researching *Callbooks*, I will add information on other calls held by that operator. With luck it will grow to be several pages on each ham. This history will be copied and donated to local historical societies and radio museums. It is my hope that someone in the future will continue to gather information and add to what I have done.

Your Own Collection

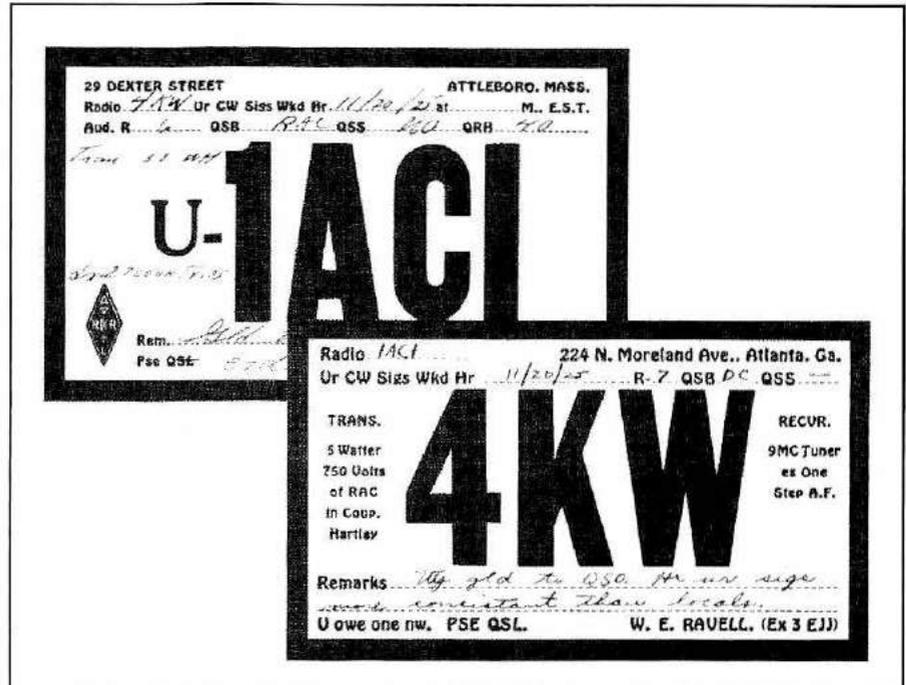
You can begin your QSL collection economically. An easy way to start is to ask some of your friends if they would consider selling you a few of their old cards. You may find more sources by placing an ad in your local club newsletter. You can also ask fleamarket vendors at hamfests.

Estate sales can be productive. Many times the cards and other important papers are considered trash. If you're lucky, they may just give them to you. Occasionally, you can find QSLs in antique shops, although they tend to be more expensive.

There are several collecting *themes* you might like to try. Local cards are a great way to generate interest at your club meetings. The old timers will remember some of the calls and start telling stories about them. Another idea would be to get a card from every state for each decade. How about YL QSLs, photo cards, or original art cards? Use your imagination to make your collection unique.

An Interesting Story That Started In 1925

On a trip to New England last year I attended a radio meet. A seller showed up with a pile of radios from a local auction house. Among the pile was a shoe box full of QSL cards. Someone told him they were worth a fortune and he wanted a lot of



Confirming a contact between my Elmer (4KW at the time) and 1ACI almost 75 years ago, these QSLs hold a place of honor in my collection.

money for them. I asked if I could look through the box.

The cards were from the 1920s and 1930s. About half the way through the box, I spotted a 4KW card from one of my Elmers who had been operating as a young boy at the time in Atlanta. The card was dated November 20, 1925. He had sent it to 1ACI in Attleboro, Massachusetts. I became excited and tried to buy the card. The fellow let me have it for a buck after I told him why I wanted it so badly.

After returning home I visited my Elmer at the first opportunity. He had just celebrated 75 years in ham radio, so there was a lot to talk about. Later, I said I had something to return. I gave him the card and told the story of how I had acquired it. We talked about 1ACI and the QSO. Atlanta to Massachusetts was a great contact for a 5-W station in those days.

As I was getting ready to leave, he asked me to wait. Reaching under his desk, he pulled out an old shoebox. Inside, organized in perfect order, were his 1920s QSL cards. In a few seconds he located the matching QSL card from that QSO so long ago. He told me to place both QSLs in my

museum, which I was honored to do.

Experiences like these make collecting so much fun. You never know when you will find something special.

Please check my Web site for additional QSL card information, including some interesting and rare cards on display at: <http://www.eht.com/oldradio/arri/index.html>. I also have a schedule there for the Old Radio Museum.

K2TQN'S OLD RADIO MUSEUM SCHEDULE FOR MAY 2000

I was invited to bring the Old Radio Museum to the Trenton Computer Festival, in Edison, New Jersey on May 6 and 7. This is their 25th anniversary and they are planning, as part of this year's show, a large display of vintage computer equipment, my Old Radio Museum, and a display from the New Jersey Antique Radio Club. There are many Amateur Radio activities scheduled, including VE testing. For more information, check their Web site at: <http://www.tcf-nj.org/>. This is a big show with 500 inside exhibitor spaces and 1000 tailgating spaces. Look for my call letters on my hat and say hello.

Hamfests and Collecting

With the hamfest season starting, you need to do some planning if you want to start a collection. Attention to details will bring success.

Getting Started

I'm often asked, "How do I get started collecting and how much should I pay for something I know nothing about?" The easy answer is to start a collection by buying your first piece without spending too much. A better answer would be to follow this advice:

Plan to spend some time learning about old radios. Read *QST* and other radio classifieds to see the asking prices of equipment. Search the Internet for radio-collecting news groups.

Ask your friends if they know anyone who collects. Then visit someone who has a collection and listen to what they tell you. If asked, your new friend should gladly tell you how he found his first old radio. Maybe he'll tell you about the time when he was in the right place and found a favorite radio. During your visit, when you see something you like, ask what it's worth and where you could find something like it. Ask about other local collectors. I have found collectors to be very friendly. They really enjoy talking about their collections and are anxious to share information.

Find out if there are any clubs nearby

for radio collectors. Meet as many collectors as you can by visiting a radio-collecting club. It probably won't be a ham radio club, but you will find hams there. Meeting and getting to know other collectors is very important. It's called networking and you need to do this.

Most collectors will have some radios, or other radio items, they no longer need or want. Collectors usually trade and sell things from time to time, and as time goes by, their interests change and they want to make room. This can be a good opportunity for you. Ask!

Browse through old magazines and books. Just as *QST* today reports on all the new products and modes of operation, the magazines and books from the '20s, '30s, '40s and '50s did the same thing. Reading the "ancient" advertisements and studying the photos can help you recognize good radios and accessories at a glance. This is very important at hamfests, where the collecting competition is sometimes fierce. The first one to pick up the radio often ends up owning it.

How Much Should I Spend?

Accept the fact right now that in the beginning you will probably pay too much from time to time. Everybody does. Even experienced collectors go over the top once in a while! (This may make you feel a little

better.) Of course, it's always nice to find a bargain, but if you see something you really want, and the price is affordable, then buy it and enjoy. In time, your experience will improve your collecting savvy and negotiating. Several genuine bargains later on will make up for those early mistakes.

There is no hard-and-fast list for radio values. There just are too many factors involved, such as appearance, working condition, documentation and historic value (i.e. owned by somebody famous). The values of radios seem to change as often as the wind direction. This is where your experience and research pays off in knowing what to spend.

The value of collectable radios is on the rise. If you buy wisely, you are actually making an investment! The good thing about this kind of investment is that you can enjoy using it while its value appreciates. For additional collecting tips visit my Web page at <http://www.eht.com/oldradio/arrl/index.html>.

K2TQN's Old Radio Museum Schedule for April 2000.

I'm planning to take my mobile Ham Radio Museum to the Penn-Del Hamfest 2000, host to the ARRL Delaware State Convention on Sunday April 30, 8 AM-1 PM at the Nur Temple in New Castle, Delaware. Look for my call letters on my hat, and say hello.— K2TQN

Collector Profile

One of the great things about Amateur Radio is its diversity. Another is how patiently it will wait for you while other interests, like jobs and family, occupy your time. When you are ready to return, Amateur Radio gladly accepts you back into the fold.

Stephen Aug, W3DEF, discovered this fact first hand. His ham radio experience started in 1953 as K2EOF. Like many of us, his teen-age years were exciting as he discovered radio. In the first eight to ten years he owned (and still has) a National NC-125 receiver, a Shure 55S and a D-104 microphone and a Bud FCC-90 100-kHz frequency calibrator.

Next came a busy career as a business reporter and editor at the old *Washington Star*. Radio took a back seat as he continued as a business and economics correspondent at ABC News. When the "ABC Early Morning News" started in July 1982, he began his long morning career. For 6 years he also participated on the "Business World" show, anchoring it for its final year and a quarter.

"Since I retired in 1995, I've become a lot more active in ham radio," Steve said. "Most of my time is spent with older rigs." In 1990 he began to collect, starting with a Collins 51J-4 receiver and 312-A-1 speaker. In refurbishing his radios he found that he needed to re-learn what he knew about vacuum tubes. He received much help from his friends, he said.

Since then he has added a B&W 5100-B transmitter with a 51SB-B phasing SSB generator. This along with the 51J-4 is one of his favorite stations, where he enjoys AM as well as vintage SSB operation.

"Changing bands on the B&W takes almost five minutes. There are about 19 dials, knobs and switches that must be manipulated if you're operating sideband," he said. "Phasing out the carrier with those tiny pots can be very challenging, but it's still fun."



Old Radio Profile

A 1934 Clough-Brengle, model 4581 transmitter.

Every collector dreams of finding a rare radio. The rarest is the "one of a kind." This month's feature radio is truly "one of a kind."

The project started when Ron Lawrence, KC4YOY, bought his first vintage transmitter from the estate of his good friend, and a long time ham, Bob Van Sleen, W4AGO. "I had been admiring Bob's Clough-Brengle transmitter for a long time," Ron said, "And when his widow asked our club to help dispose of his collection I knew which piece I wanted."

This transmitter is apparently a pretty rare bird. Ron has spent a lot of time searching for information about it. He found there are a lot of advertisements for Clough-Brengle test equipment in the 1930's magazines, but not one mention of a Clough-Brengle transmitter.

One of the best opinions Ron has heard was from AWA Museum Curator Ed Gable, K2MP. Gable thinks that it might have been built to bid on a government contract that didn't get approved, and that this might be the only one there is. Ron doesn't really know, but if anyone out there does, he would sure love to hear from you.

Soon after getting the transmitter home Ron decided that he needed a vintage receiver to go with it. Since most hams back then built their own transmitters, he figured that whoever had that transmitter would have had the best receiver they could buy. Another good friend and long time ham, Tom Boone W4COC, was asked, "What was the best receiver in 1934?" His answer, "Why, an HRO, of course."

Ron will be displaying this transmitter at the CC-AWA Spring Meet, on March 23-25 at the Sheraton Airport Plaza Hotel, I-85 at Exit 33 on the Billy Graham Parkway, Charlotte, North Carolina. This is a good radio show if you are interested in collecting and learning about old radios. There are forums, equipment contests, a flea market and an auction. For additional meet information, please visit <http://www.cc-awa.org/index.html> on the Web, or e-mail Ron at kc4yoy@trellis.net. Ron is President of the CC-AWA.

For additional information about this transmitter and to see other photos of Ron's collection, please visit my Web page at <http://www.eht.com/oldradio/arrl/index.html>.

K2TQN's Old Radio Museum Schedule for March 2000.

The first display for this year will be on March 25-26, at the ARRL Maryland State Convention, the Greater Baltimore

Hamboree & Computerfest, at Timonium, Maryland (<http://www.gbhc.org/index.html>). Look for my big 28-foot white museum with a flat-wire antenna in the main flea market area. Please stop in and say hello.

Collector Profile:

Ron Lawrence, KC4YOY

Ron's hobby of radio collecting began in 1969 when he was in high school. His best friend talked him into changing plans from taking a course in machine shop to taking electronics. He was told there was a new electronics teacher coming next year. Ron had played around with CB radio for some time and was sort of interested, but didn't know what he was getting into.

Rick Bilbro, K4KAV, was the new electronics teacher. He was just out of the Army and this was his first teaching job. Almost instantly they became friends, a friendship that has now lasted over 30 years. Rick tried and tried to get him started in ham radio back then but it wouldn't be until 1991 that Ron would finally get around to getting his ticket.

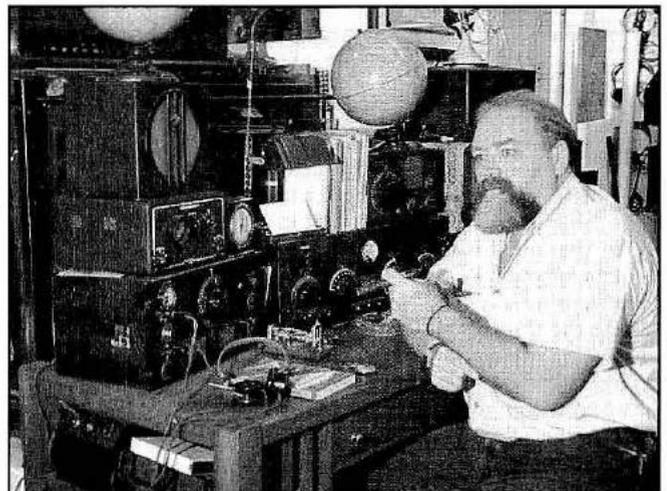
Rick brought some back issues of *Popular Electronics* into the class. In the July 1969 issue there was an article titled "Whatever Happened to Atwater Kent." This was the first time he really knew anything about early radio and was fascinated. The next spring his mother took him to something new in their area, a "flea market". There he spotted a radio and recognized it from the article in *Popular Electronics*: an Atwater Kent model 20. Looking inside he found the tubes were missing, but there was a real nice pair of Western Electric headphones with it. The price tag read \$15.

Looking in his wallet he found only \$10. He rushed to his mother and asked to borrow \$5 so he could buy the radio. She said there was no way she would give him \$5 to buy an old junk radio and that if he really wanted it he should try and haggle the man down to \$10. "It worked," Ron said, "and I was ruined." A newspaper columnist who later wrote an article about his collection said, "from innocent beginnings do dark obsessions grow".

"Boy, was he right," Ron said. "I still have that first Atwater Kent and that issue of *Popular Electronics*. They have a place of honor in my collection that now contains nearly 500 radios plus several thousand other pieces including tubes, speakers, headphones, vintage magazines and books on early radio."

Since becoming a ham in 1991, Ron is more and more interested in the history of Amateur Radio.

"There are a lot hams out there that have no idea what kinds of radios came before their pocket sized HTs," Ron said, "To help them learn, I have set myself a task of assembling representative amateur stations to show the development of ham radio through the years."



Old Radio Profile

The Mystique Of The HRO-500—Only The Dial Remains The Same.

Contributed by Al Klase, N3FRQ

Many of us remember the introduction of National Radio Company's HRO-500 general-coverage communication receiver in late 1964. If we discount the consumer-oriented Heathkit GC-1A Mohican, the HRO-500 was probably the first full-featured all-solid-state communications receiver. This was a revolutionary step in a succession of National HRO receivers dating back to 1934.

By the early 1950s and the introduction of SSB operation, the nearly legendary HRO design was clearly obsolete by amateur standards. However, the double-conversion HRO-60 had soldiered on into the 1960's as a commercial "laboratory-reference" receiver due to its wide frequency range and stable performance.

While few amateurs actually got to use HRO-500s, everyone knew about them. Their \$1500 price tag was intimidating. (In 1964 you could almost buy a complete Collins S-line station or a modest automobile for \$1500!) Despite the price, the wide frequency coverage and solid performance of the HRO-500s carved a substantial niche in the commercial and military market. Over the years a fair number of these sets have made their way out of the laboratories, maritime installations, and military supply depots and into the hands of mere mortals. Through the vintage-radio collecting hobby we're finally able to own and appreciate treasures of this sort.

The HRO-500's frequency range extends from 30 MHz all the way down to 5 kHz with the optional LF-10 low-frequency preselector. The first conversion oscillator is controlled by a phase locked loop referenced to a single 500-kHz crystal, and provides a level of frequency accuracy and stability unparalleled in earlier HROs. The overall frequency range is divided into 60 500-kHz frequency bands tuned by the distinctive HRO knob, which controls the tunable IF. This control covers the 500 kHz range in five turns with 1-kHz accuracy. The center knob offers an additional 5:1 reduction ratio for easy SSB tuning.

While the 230-kHz LC filters in the final IF do not have the extremely steep skirts we've come to expect from crystal or mechanical filters, their 2.5:1 shape factor is adequate for all but the worst band conditions. Additionally, the LC design allows the passband of the 2.5 kHz and 500 Hz filters to be tuned continuously to



The legendary HRO-500 receiver.

either side of the crystal controlled BFO frequency. The 5 kHz and 8 kHz AM filters are fixed. A highly effective tunable notch filter is available in all modes.

While normally powered by an internal 115/230-V ac power supply, this receiver may be operated from a 12-V dc external source. A front panel switch turns off the dial lights, holding current consumption to a mere 200 mA (about enough to power the heater in one decent vacuum tube). A NiCd battery pack was available as an option.

On the air the HRO-500 gives a good account of itself even in the late twentieth century. Tuning is smooth and accurate.

Selectivity is very good, and the passband tuning and notch filter let you dodge serious QRM. The set has a proper product detector and automatic gain control for good SSB performance. The 5- and 8-kHz AM filters provide the proper bandwidth for almost any occasion. The vintage solid-state circuitry is somewhat prone to overload on really strong signals, but the **AGC THRESHOLD** knob controls a highly effective front-end attenuator.

Tune-up does require some operating skill. The **BAND MC** switch selects one of five broad frequency bands. The appropriate 500-kHz band segment is selected by turning the **SYNTHESIZER TUNE** control until the desired frequency appears in the synthesizer-tune window and the red **PHASE LOCK** lamp stops flashing. Then the **PRESELECT TUNE** control is set to the approximate frequency and the station is selected with the main tuning knob. Finally, the preselector should be touched up using the S meter.

After all these years, it certainly is nice to lay a hand (and an ear) on one of these fine instruments. If the opportunity presents itself, take it!

For additional HRO-500 information on the Web, visit: <http://www.eht.com/oldradio/arri/index.html>.—K2TQN

Collector Profile: Al Klase, N3FRQ

Al is a vintage radio collector, restorer and historian specializing in communication receivers. As Al tells it, "At the tender age of about three, I got a look inside my grand-father's 1930 McMillan radio—a gigantic wooden box filled with glowing vacuum tubes, and other mysterious objects. I've been in electronics ever since." General tinkering, engineering school, the US Army Signal Corps and many years as an electronics design engineer helped him further this early interest.

In a world where one can hide a quarter-billion transistors under a fingertip, Al finds working on vintage gear a welcome change from his work as a field applications engineer for a major semiconductor company. He has also done extensive investigations on the technical aspects of crystal radios, and feels the deceptive simplicity of crystal sets is an interesting counterpoint to the complexities of the high-end shortwave sets.

Al is presently program chairman for the New Jersey Antique Radio Club and newsletter editor for the Delaware Valley Historic Radio Club. Al has been licensed as N3FRQ since 1987.



This is a new column about old radios, old ham radios to be exact. Sometimes they're called *boatanchors*. Sometimes they're called antiques. Whatever you want to call them, if you like old radios and radio history, this is your column! Each month we will try to cover another area of collecting, profile a collector and profile another old radio.

John Who?

First, I would like to tell you a little about myself, John Dilks, K2TQN, and how I became interested in ham radio and in collecting radios.

It began the summer I turned 12. My dad borrowed a National NC-100-XA receiver for the summer from one of his friends. We set it up in the workshop, put up an antenna and turned it on. The sounds of 80 meters came flooding out of the speaker. I was amazed to hear people talking to each other. I was forever hooked. A couple years later, in high school, I finally got my license: KN2TQN.

My first station consisted of a homebrew single-6V6 oscillator, made from ARRL's *How to Become a Radio Amateur*. It was exactly like the one in the October 1999 *QST*, page 29 ("Regeneration and Crystal Control," Jerry Svoboda, KB2QIU). The first receiver I owned was a 1937 National NC-81X. I paid \$35 for it from an older ham. I didn't realize it then, but I had just purchased my first old radio.

When you're a new ham, people tend to give you things. My first *really* old radio was just such a gift: a Pilot Super-Wasp made in 1929. I looked it over and decided to dismantle it and build something else with the parts. This is where my dad stepped in and explained what an important radio this was and how he would have given a right arm for such a radio when he was my age. We (mostly my dad) decided to keep it intact and store it in the attic where I wasn't allowed to touch it.

A few years after high school I started to collect, slowly at first. I found Morse keys were inexpensive (this was the 1960s) and nice to have. Then came an occasional receiver and transmitter. Over the years I found tubes, microphones, speakers, magazines and books, which all followed me home.

Over the last few years I have had a strong desire to display my collection. I started by hauling a vanload of heavy boxes to local ham club meetings. It took a long time to set up the display, and afterwards a long time to repack everything. The talk usually lasted 20 minutes, followed by a hands-on look at the collection by those in

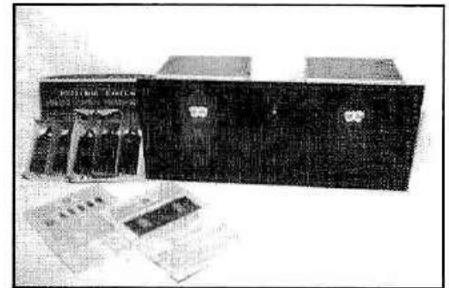
attendance. After arriving back home, I had to remove everything from the van and store it. It was becoming a real chore. I had to find a better way to display my collection.

The solution came in the form of an old RV-like mobile office. A collector friend told me about such a vehicle in an upcoming auction. It was a 1973 Dodge-powered, twenty-seven foot long office with only 39,000 miles on it. After purchasing the RV, I spent the next eight months building the display in it. Since August 1998 I have traveled over 12,000 miles to hamfests and radio events. (See September 1999 *QST*, page 71.) Perhaps we will meet at a hamfest or radio event this year!

Old Radio Profile: Pilot Super-Wasp, 1929

First advertised for \$29.95 in the June 1929 *QST*, the Super-Wasp was an immediate success. Here was an affordable kit radio designed by Robert S. Kruse, W1BAO. Amateurs were eager to move up to the short waves, and this radio would do it in style!

Popular features included: increased sensitivity and selectivity made possible by the "tuned" screen-grid RF stage, universal wavelength range—it tuned from 14 to 500 meters and absolutely no "hand capacity" effects (completely shielded). The package included an easy to assemble kit of parts with large blueprints showing part placement and other details.



Many of the popular radio magazines of the day carried articles touting the features and successes of this radio. Hams and short-wave enthusiasts everywhere were buying or duplicating the Super-Wasp. Thousands of kits were sold. Many young hams bought kits and assembled them for less-talented neighbors and friends. This created a "cottage industry" and a little extra spending money for more ham radio equipment.

The Super-Wasp pictured here is the one given to me in the 1960s. For more detailed information you can visit my Web page at: <http://www.eht.com/oldradio/arrl/index.html>.

Conclusion

In the future I hope to hear from you. If you have something to share, take a photo, write a short description and send it in. If you'd like me to address a particular subject or piece of hardware, I want to hear from you. Just drop me a letter or e-mail at the address shown on this page.

Collector Profile: Paul Wolcott, N2JTD

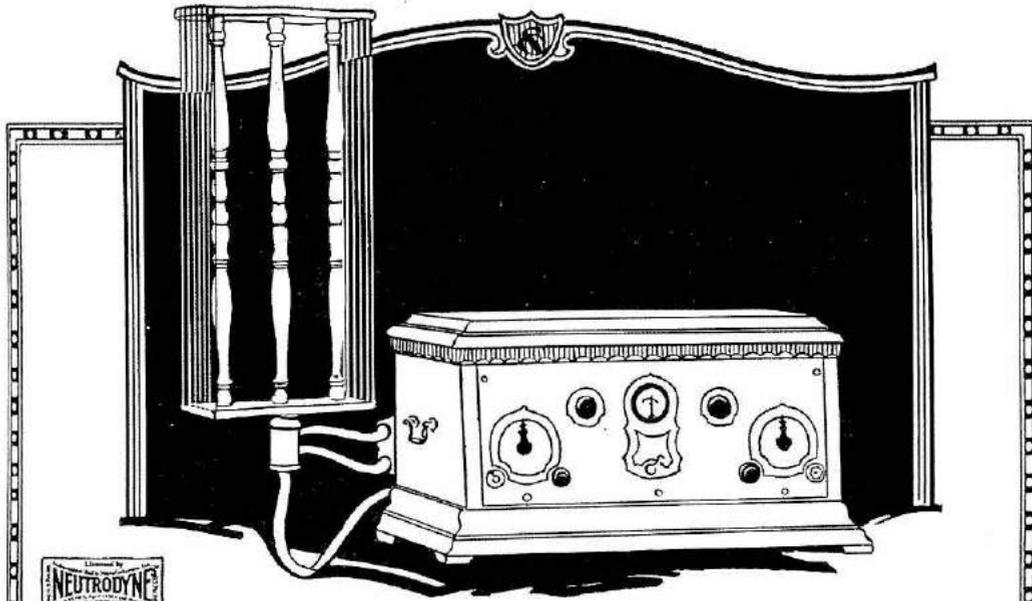
Paul enjoys collecting, restoring and operating his old radios on the air. Everything in the accompanying photo is operational. Shown are two of the favorite stations he uses in the "AM Windows" on the 160, 80 and 40-meter bands. The Heath DX-100 transmitter and Collins R-390A receiver is his favorite AM combo. Paul also uses the Heath DX-60 and Ameritron AL-811 amplifier on 80 and 40 at times. The Kenwood TS-450S is used for his SSB contacts and the Kenwood 231A for local 2-meter work.

"I find that the reliability of the older radios is amazing," Paul said. "They keep on going, and they are fun to operate. I like Heathkit gear the best. They have good manuals, which makes them easy to work on. For this reason alone, Heathkits should be considered by new collectors."

During the 1960s Paul discovered ham radio while in middle school. During a visit to the school library he found a copy of *QST*. As Paul thumbed through the magazine he became more and more excited about Amateur Radio. Every month, as the new issues appeared, Paul would be the first to check them out. He particularly remembers the photos of all those great stations and the fun their operators appeared to be having. So for him, collecting old radios comes almost naturally.



Classic QST Advertising



This Receiver has **many "UNIVERSAL" FEATURES**

These features, perfected by the Stromberg-Carlson Engineers, give an adaptability to the receiver which insures successful operation under all of the varying conditions of location and installation.

In this model by an ingenious arrangement of circuits and wiring, a loop may be employed—instead of an outside aerial—thus making possible successful operation in steel buildings and other locations where a fixed antenna is impractical.

Any of the various sources of operating power, socket or battery or a combination of both can be utilized with equal facility. All of the new power tubes—the new external power amplifiers, and any type of reproducer—will operate efficiently with this magnificent new instrument.

No. 601 Receiver, treasure chest type, 6-tube; totally shielded; dual control; Equipped with voltmeter; solid mahogany.

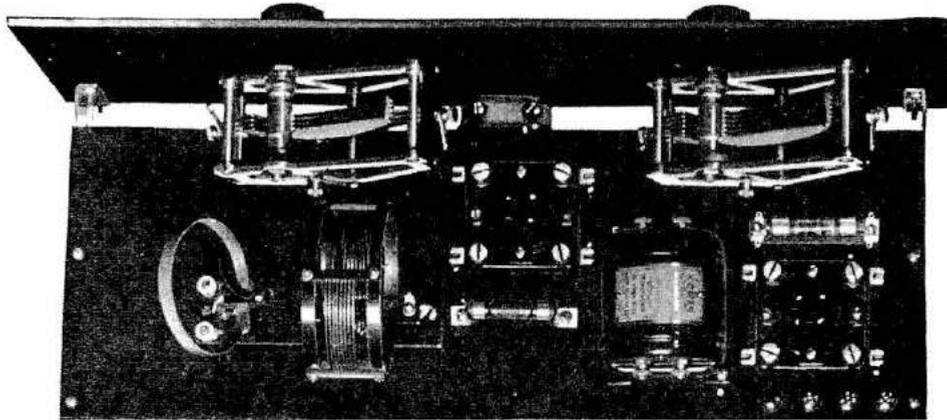
Furnished in both regular and Universal models.

Prices, less accessories:	East of Rockies	Pacific Coast	Canada
Receiver, Regular	\$210.00	\$225.00	\$290.00
Receiver, Universal (Loop extra)	225.00	240.00	315.00
No. 101-A Loop Outfit	22.50	25.00	31.50

STROMBERG-CARLSON TELEPHONE MFG. CO., Rochester, N. Y.

Stromberg-Carlson

You'll Use Karas *Condensers* In Your Short Wave Set



Put in a Karas *Transformer* Also

Karas Orthometric condensers with their straight frequency line tuning characteristics are the choice of the leaders in short wave work. Both theoretically and in actual use they have the lowest possible losses—at any frequency. Stations are spread evenly by kilocycles from end to end of the tuning range.

A Karas Harmonic transformer will pass the greatest possible power from detector to audio stage—on any beat note you choose—with the least distortion if you're using voice. Make it an all-Karas job and get the benefit, in the head phones, of every bit of energy reaching your antenna.

5-plate Orthometric (.0001) price \$6.50;
7-plate (.00014) price \$6.50; 11-plate
(.00025) price \$6.50; 17-plate (.00035) price
\$6.75; 23-plate (.0005) price \$7.00.



Karas Harmonik Transformer \$7.00

Order Through Dealer or, Direct on This Coupon

Karas Condensers in the 23, 17 and 11 plate sizes are sold by good Radio Parts Dealers in most cities. The 7 and 5 plate sizes are not so widely stocked by dealers. Orders will be filled direct, or may be placed through your dealer and his jobber. If you prefer to order direct, use this coupon. Send no money. Just pay the postman the price plus a few cents postage.

KARAS ELECTRIC CO.
Manufacturing Plant: N. Rockwell St.
Offices: 1070 Association Building
Chicago, Ill.

Karas Electric Co., 1070 Association Bldg., Chicago.

Please send me.....Karas Harmonik Transformers and

.....Karas Orthometric Condensers,

sizes as checked below. I will pay the postman the price plus postage upon delivery. It is understood that I have the privilege of returning these condensers and transformers for full refund any time within 30 days if they do not prove entirely satisfactory.

...5 plate; ...7 plate; ...11 plate; ...17 plate; ...23 plate.

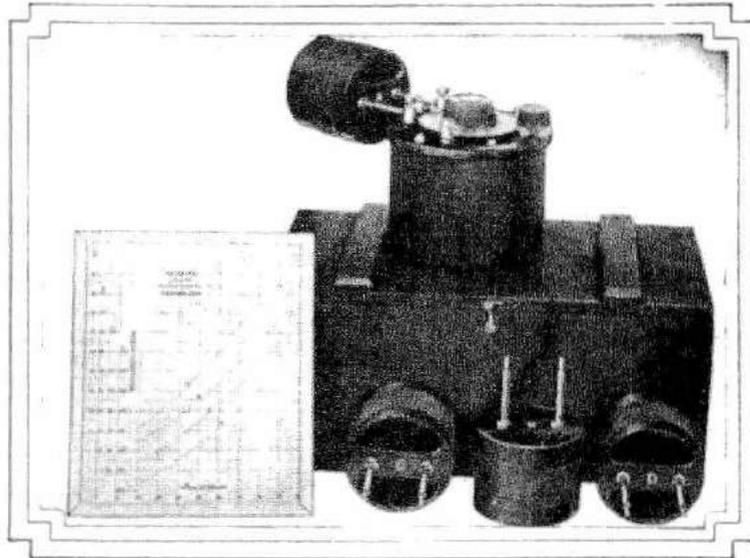
Name

Address

If you send cash with order, we'll ship condensers and transformers postpaid.

Q - R - H ?

(What is Your Wavelength?)



The General Radio Type 358 Wavemeter

The type 358 wavemeter is designed particularly for experimental use. As it covers a wavelength range of 15 to 225 meters, it covers all the amateur bands in common use. The wavemeter consists of a set of four mechanically rugged coils of low loss construction mounting interchangeably on the binding posts of a shielded condenser of 125 MMF capacity. A resonance indicator lamp is connected in series with the condenser and coil. When the lamp is removed the socket in which the lamp is mounted becomes short circuited.

The wavemeter is equipped with the following coils calibrated with an accuracy of within 1% ;

Coil A	15 to 30 meters
Coil B	25 to 60 meters
Coil C	50 to 115 meters
Coil D	100 to 225 meters

Coils A, B and C are space wound on threaded bakelite form to maintain accurate calibration.

Ask your dealer or write for our descriptive folder 358—Q.

Price of wavemeter complete in wooden carrying case \$22.00.

GENERAL RADIO CO.,

Cambridge, Mass.

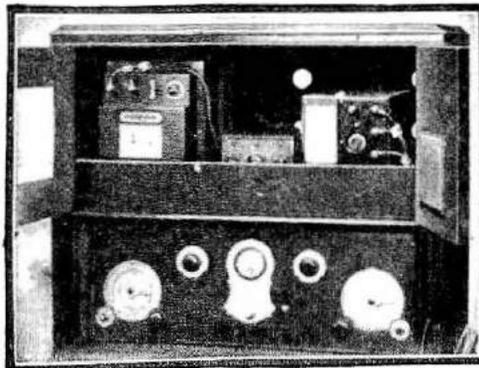
GENERAL RADIO

INSTRUMENTS

"Behind the Panels of Better Built Sets"

New Socket-Power Equipment for Stromberg-Carlson Receivers

Built solely to meet the exacting operating requirements of Stromberg-Carlson Receivers—with no detrimental compromises to permit use with other instruments.



The picture shows the Stromberg-Carlson power equipment neatly installed in a Console model Stromberg-Carlson Receiver.

The tonal excellence, the volume, the range, for which Stromberg-Carlson "Shielded" Receivers are celebrated, is best brought out through the use of only Stromberg-Carlson Accessories. These accessories—with a Stromberg-Carlson Receiver, will enable the earnest amateur to obtain results unattainable in any other way.

The "A" Socket-Power Unit (Gould Uni-power)—manufactured to comply with Stromberg-Carlson requirements, this unit represents the most convenient and reliable source of "A" power available. Several trickle charge rates, controlled by a switch, allow an unflinching current supply under a wide variation of service use. Once the correct setting is determined, no further attention need be given, except for the occasional replenishing of the evaporated water.

The No. 401 "B" Socket-Power Unit—perfected to meet the exact operating requirements without adjustment of the output voltages, there is no danger of unknown voltages unbalancing the neutralization of the radio stages and producing audio distortion through the failure of the "B" voltage to match the negative bias provided by the "C" batteries.

Reserve power, to meet any sudden demands, is made possible by a large capacity condenser across the output leads of the unit. The use of wire-wound resistors imbedded in vitreous enamel prevent any big changes such as occur in units employing the carbon type resistors.

The No. 301 Power-Switching Relay—bridge-wound to insure a uniform pull on its springs irrespective of the number of tubes employed, this relay automatically operates the "A" unit, "B" unit, and an external amplifier (if used)—all from the single switch on the panel of the Receiver.

Although these units were designed primarily for use with Stromberg-Carlsons, certain other Receivers with the same type and number of tubes similarly arranged, may enjoy the advantages of this superior equipment.

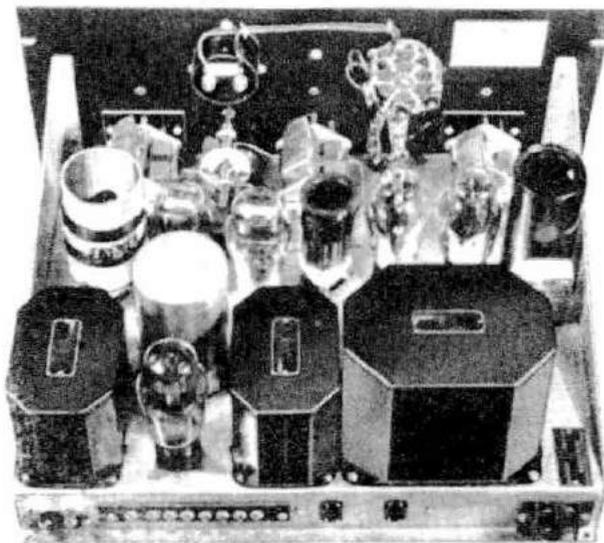
STROMBERG-CARLSON TELEPHONE MFG. CO.
ROCHESTER, N. Y.

Stromberg-Carlson

Makers of voice transmission and voice reception apparatus for more than 30 years
SAY YOU SAW IT IN Q S T—IT IDENTIFIES YOU AND HELPS Q S T

85

Start with This!



ACT-40-R, the r-f unit of the 40-watt RCA amateur transmitter. Net price to amateurs, \$110, f.o.b. Camden, with one set of coils but less crystal and tubes.

AMATEURS who wish to acquire complete RCA factory-built and factory-tested transmitter equipment recently announced may begin with the RCA ACT-40-R. This is a complete r-f unit, including power supply. With a minimum of accessories it can be used as a 40-watt C-W transmitter, giving you in every respect the highest standards of quality and performance. The ACT-40-R is particularly useful as an exciter unit for high-power stages, eliminating the necessity of building your own multi-band exciter unit. The unit may also be used as

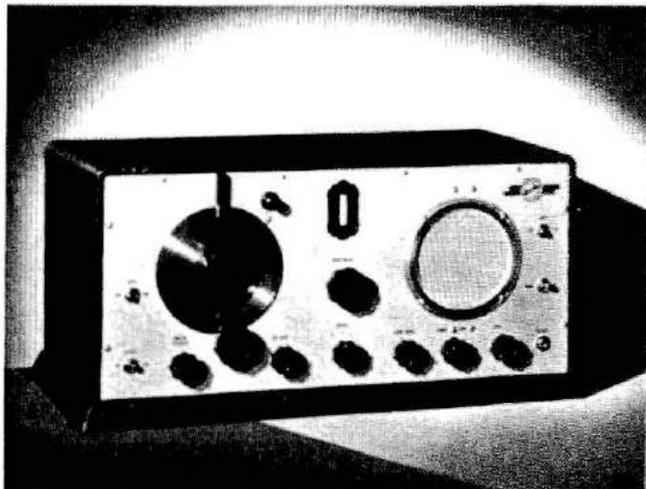
the power stage in association with your present modulator and antenna coupling units, if desired . . . Plug-in coils permit operation on 160, 80, 40 and 20 meters. No change in neutralization is usually required when shifting to adjacent bands . . . This rugged, convenient unit permits you to go on the air at once with RCA dependability. Later, other RCA units may be added for operation on phone as well as C-W, with 40 or 200 watts. Thus the RCA unit plan of construction again demonstrates its great advantages to you. Write for complete details.

AMATEUR RADIO SECTION



RCA Manufacturing Co., Inc.

Camden, N. J., a subsidiary of the Radio Corporation of America



the
**SUPER
 SKYRIDER**
 is
COMPLETE!

THE HAM that buys a Super Skyrider with Crystal Filter at \$89.50 is buying all that he needs for short wave reception. Here is a receiver that covers the radio spectrum with unsurpassed efficiency, including the standard broadcast band and the 10 meter band, so active of late. Recent Hallicrafters' laboratory developments have greatly increased the Super Skyrider efficiency on this particular band.

It's complete, without a single extra to buy, with a convenient band switch (no cumbersome plug-in coils), controlled Crystal Filter Circuit (an absolute necessity on any receiver because of amateur band congestion), 9 Metal Tubes with their superior performance characteristics, Iron Core I. F. System (first used on the Super Skyrider) and a dozen other exclusive Hallicrafter developments.

Think of these features when you're buying short wave reception, and see the Super Skyrider at your jobbers today. It's supreme for short wave reception and complete at a single moderate price.

- **9 Metal Tubes** — Dovetail perfectly with our efforts to improve signal to noise ratio — eliminate noisy tube shields — reduced inter-electrode capacitances and shorter leads afford greater gain.
- **Iron Core I. F. System** — greatly increased sensitivity and a signal to noise ratio unattainable with an air core system.
- **Duo-Micro-Vernier Band Spread** — provide improved logging accuracy — provides electrical band spreading and micro-vernier tuning in an exclusive and distinctive dial.

- **More efficient Crystal Filter Circuit**, controlled by variable knob on front of set gives one signal selectivity — without reducing sensitivity.
- **Beat Oscillator** with continuous range.
- **Modern Band Changing System** — any desired bands in the short wave spectrum with the turn of an exact positive switch — no cumbersome plug-in coils.
- **Compact** — all completely enclosed in one convenient and efficient cabinet 19 1/4" x 10" x 10".

**Hallicrafters
 Mileage
 Marathon**

The judges are swamped with reception reports from busy hams working the world to win the Mileage Marathon. It's the biggest event short wave radio has ever known. We tried, in vain, to check these reports as they came in but we're way behind. However, we are working night and day and hope to announce the winner in next month's QST.

SEE YOUR JOBBER TODAY OR WRITE FOR COMPLETE DETAILS



the hallicrafters

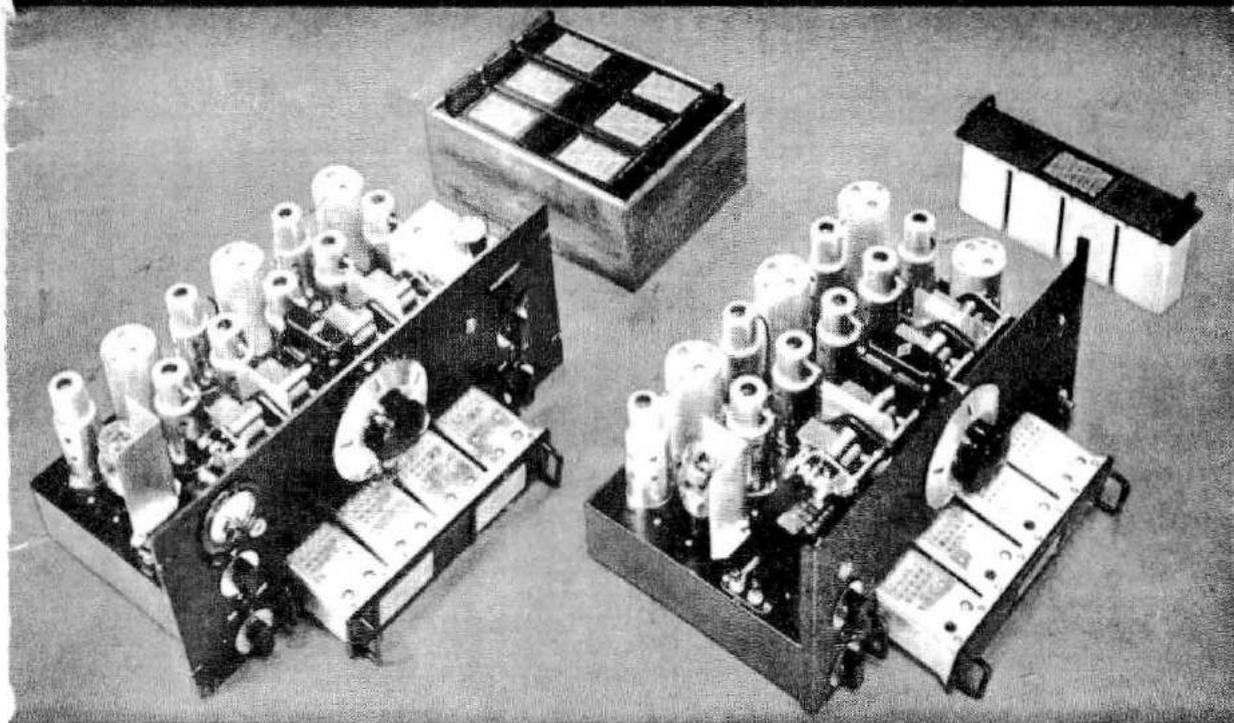
3001-Z Southport Avenue, Chicago, Illinois, U. S. A.

Cable Address: "LIKEX—New York"

Say You Saw It in QST — It Identifies You and Helps QST

55

DIFFERENT ONLY IN VERSATILITY AND IN PRICE



THE STANDARD HRO :: THE HRO JUNIOR

ANY night on the amateur bands you will hear a better advertisement of the Standard HRO than we could write. The unqualified enthusiasm of men who have spent years mastering the fine points of high frequency communication counts for more than a long list of unusual details, even though those details include such items as the PW Precision Condenser, calibrated band spread and a crystal filter as effective on phone as c.w. The demands of modern radio are rigorous, and the proof of the pudding is in the eating.

THE attractively priced HRO Junior is the Standard HRO stripped down to its straight superheterodyne circuit by omission of the calibrated S-meter (and associated circuit), the single-signal crystal filter, the extreme electrical band spread, and the engraved aluminum relay rack panel. The chassis, all other parts, and the fundamental circuit are identical. The general performance of the HRO Junior is in every way equal to the magnificent performance of the HRO. The crystal filter and the S-meter, may be added at any time.

An illustrated folder describing both receivers will be mailed on request

NATIONAL



COMPANY

YOU can win this Transmitter Phone - CW Kit, fully mounted, ready-to-wire

The 50-watt input variactor controlled carrier kit shown will be given FREE to the amateur who suggests a name that will best describe this series of kits. Contest closes July 1st, 1936. Judges are L. M. Cockaday and Frank Jones, two nationally known radio editors. Mail suggested names direct to UTC.

While priced within the reach of every amateur, these variactor controlled carrier kits represent the finest in transmitter design. The conservatively rated components come from the finest manufacturers in radio: UTC, Cardwell, Cornell Dubilier, Hammarlund, Isolantite, Aerovox, IRC, Triplett, Yaxley, Johnson, Electrad, etc. . . . Tubes by RCA. These units are furnished completely mounted in rack panel construction, with etched metal overlay plates.

50 CW RF UNIT

Consists of Crystal-controlled pentode oscillator, pentode buffer-doubler, push pull final amplifier and choke input mercury vapor rectifier system having a regulation better than 5%, readings on 5 circuits instantaneously through one meter. Used by itself this unit is a highly efficient 50-watt input CW transmitter. 50 CW RF unit completely mounted ready to wire with one set of coils (specify band desired) including dust cover, less tubes and crystal. Tubes required: 2-2A5's, 2-46's, 1-83. Net to hams \$68.40
Extra set of coils (either for 20, 40, 80 or 160 meters). Net to hams \$4.80

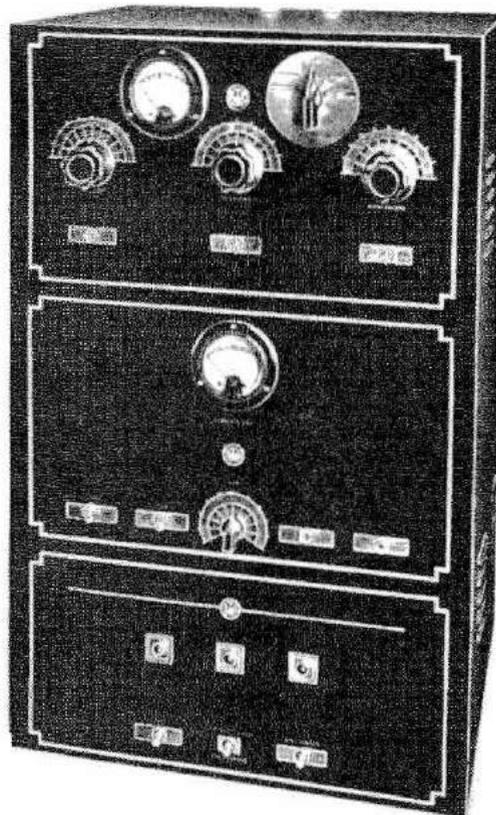
30 AF MODULATOR ASSEMBLY

Consists of a high gain speech amplifier and Class B modulating stage. It has an output of 30 watts, and when used to modulate the RF amplifier at 100% modulation the distortion level is less than 5%. This amplifier is designed for use with high level crystal microphones and will operate with any of the carbon type. 30 AF Modulator assembly completely mounted, ready to wire, including dust cover but less tubes. Tubes required: 2-57's, 3-46's, 1-83. Net to hams \$39.60

50 CC VARIATOR CARRIER CONTROL

Has a separate power supply for 50-watt input class C stage and Variator units for carrier control. Instantaneous switchover provided from carrier control to constant carrier. When used with 500-watt class B Linear stage DX coverage is increased, efficiency of the Linear stage is easily doubled. Reduces interference between stations tremendously. 50 CC Variator Carrier Control unit completely mounted, ready to wire, with dust cover, less tube. Tube required: 1-83. Net to hams \$33.60

Full Scale Working Print Brochure covering all constructional plans for the 50-watt, 500-watt and 750-watt input units may be purchased from your distributor or direct for 25c. Free with purchase of each sectional unit.



THE NEW UTC CIRCULAR SLIDE RULE

The most useful instrument a radio engineer could have. Here are some of the electrical and mathematical problems to which it gives direct answers: Multiplication . . . Division . . . Proportion . . . Reciprocals . . . Squares . . . Square Roots . . .

Voltage Drop in Resistors . . . Wattage in a Resistor for Given Voltage or Current . . . Impedance of an Inductance at Any Frequency . . . Impedance of a Condenser at Any Frequency . . . Resonance Calculations . . . Effective Capacity of Condensers in Series . . . Effective Resistance of Resistors in Parallel . . . Calculation of Bias Resistors . . . Power Level Conversion to DB . . . Voltage or Current Ratio Conversion to DB Gain . . . Sound and Light Calculations . . . Circumference and Area of Circles . . . Stroboscope for Checking 33-1/3 or 78 RPM Turn-tables. Due

to its 16 inch effective length, the accuracy of this rule is greater than many of the standard rules selling at 30 times its price.

NEW TRANSMITTER BULLETIN

Covering circuits and laboratory built transmitters from 5 watts to 1,000 watts output.

ALL LABORATORY CIRCUITS

As they are released over a period of one year covering new amplifiers and variactor controlled carrier RF transmitters.

NEW 48 PAGE TECHNICAL BULLETIN

which includes data and circuits on amplifiers from 1/2 watt to 1,000 watts output, chapters on audio transformer design, application of power transformers and filters, also charts on decibel conversion in terms of watts and conversion of power or voltage ratios to DB, reactance data, filter ripple calculations, etc. . . .

UNITED TRANSFORMER CORP.
76 SPRING STREET NEW YORK, N. Y.
EXPORT DIVISION - 15 LAIGHT STREET, NEW YORK, N. Y.



THE 1-10A

The ONE-TEN-A is a complete redesign of the ONE-TEN, retaining all the proven design features of the older model but with improved performance and smoothness of control. For many years the ONE-TEN has been the "standard" receiver for work in the range from one to ten meters. Although many advances in high frequency technique have been made since this little receiver was first introduced, it has easily held its place in the affections of experienced amateurs by its consistent dependability under actual operating conditions and its high usable sensitivity.

The new ONE-TEN-A inherits the fine qualities of its predecessor brought up to date by a complete restudy of circuit, mechanical arrangement and constructional details.

The ONE-TEN-A is a fine receiver.





HERE'S the new RME 84 you'll be hearing a lot about during future QSO's. It's a precision instrument built to RME's tradition of expert engineering and quality components.

No compromise has been made with quality. An all gear and planetary tuning mechanism is used—no strings, no pulleys! Tubes are the new "lock-ins" resulting in high signal to noise ratio and exceptional performance in the higher frequency ranges.

For sensitivity and selectivity, the RME 84 out-performs anything in its price class.

NET PRICE \$98.70

8-99005-M

Features

- Four tuning ranges 54 to 44 MC
- One Preselection Stage
- Smooth Vernier Tuning Control
- Bandspread Scale, arbitrarily calibrated from 0 to 100
- Bandspread, positively geared to main tuning control for accurate logging—no backlash!
- Automatic Noise Limiter
- Beat Frequency Oscillator—continuously variable by panel control
- Self Contained Shock Mounted PM Speaker
- Headphone Jack
- Standby, Receive & B F O Switch
- Antenna Input Terminals, provision for doublet or single wire
- Cabinet of heavy prime furniture steel beautifully finished in two-tone grey
- Plug connection provided for low drain battery operation
- Eight tube superheterodyne circuit

Specification Sheet
on Request



RME

FINE COMMUNICATIONS EQUIPMENT

RADIO MFG. ENGINEERS, INC.

Proven 6, Illinois U. S. A.

SUPER PRO

Series 400



Less QRM---Phone or CW

When the bands are active it only takes one minute to find that you need Hammarlund's patented variable crystal filter to have a successful QSO—either phone or CW.

Look to the future! When the number of Hams doubles or trebles you will need the crystal filter that weeds-out the QRM... If you can't hear 'em, you can't work 'em!

Price (SP-400-X)

\$342.00

Including Speaker



HAMMARLUND

THE HAMMARLUND MFG. CO., INC., 460 W. 34TH ST., NEW YORK 1, N. Y.
MANUFACTURERS OF PRECISION COMMUNICATIONS EQUIPMENT

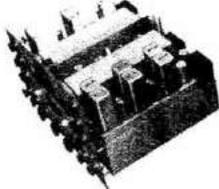
A Triumph in
COMMUNICATIONS ENGINEERING



The New Improved
KP - 81
Receiver

DESIGNED by Karl E. Pierson, creator of the famous PR series of receivers, the new KP-81 is now in production. We promise you this receiver will establish new standards of excellence in the field of radio communications. KP-81 incorporates many of the advanced features born of wartime research, and is years ahead in design, engineering and performance.

We are making every effort to meet the heavy demand for the new KP-81 receivers. However Pierson Electronic Corporation will adhere to their policy of precision construction, and suggest that you place your order well in advance.



New Automatic Noise
Silencer
Two Pre-Selector Stages
Turret Band Change
Four Gang Tuning and Band
Spread Condensers
Series Parallel Crystal Filter
Calibrated Band Spread
Built-In Crystal Calibrator
Single Signal At All Times
Variable Hi and Lo Pass
Audio Filters
550 Kilocycles to 40
Megacycles

PIERSON ELECTRONIC CORP.

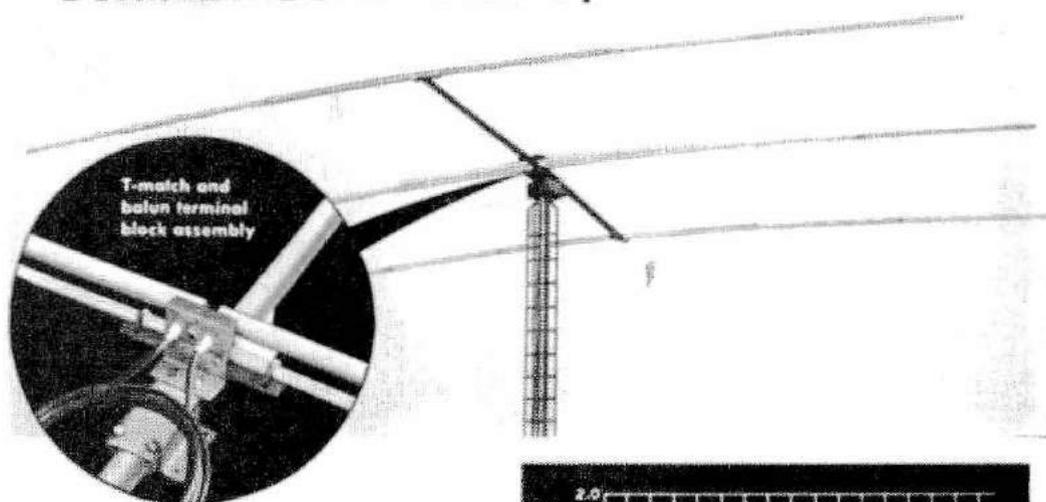
533 EAST FIFTH STREET • LOS ANGELES 13, CALIF.

Manufacturers of Communication and Commercial Radio Equipment

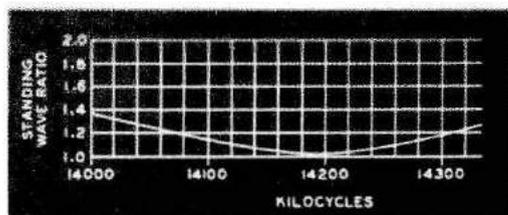
Export Department: FRAZER & HANSEN, 301 Clay St., San Francisco 11, Calif., U. S. A

Just released!

Johnson Semi-Wide Spaced Beams...



PRE-TUNED 20, 15 AND 10 METERS



SWR plot for 20
meter antenna

Completely pre-tuned with balun matching sections, Johnson's new Semi-Wide Spaced Beams have shown in recent tests that they will outperform all other commercially available pre-tuned beams. No adjustments necessary... simply assemble, connect your coax feedline and you're ready to go!

- Greater than 9.0 db gain over dipole.
- Pattern is uni-directional, less than 55° beam width.
- Greater than 27 db front-to-back ratio.
- Covers entire 20 meter band with lower than 1.4 to 1 SWR.
- Extra rugged construction—beam clamps eliminate drilling and subsequent weakening of structural elements. Boom is galvanized steel—extra heavy element construction.
- No loading devices needed for flutter dampening or corona discharge.
- Most arrangement permits stacking of up to three beams.

Boom lengths as follows: 20 meter beam—20'; 15 meter beam—13'7"; 10 meter beam—10'.

Cat. No.	(Complete with beam, boom and balun)	Amateur Net
138-420-3	3 elements, 20 meters	\$139.50
138-415-3	3 elements, 15 meters	110.00
138-410-3	3 elements, 10 meters	79.50

- Higher Gain!
- Greater Bandwidth!
(Lower SWR)
- Higher Front-to-Back Ratio!
- More Rugged Construction!



E. F. Johnson Company

2809 SECOND AVENUE S.W. • WASECA, MINNESOTA

CAPACITORS • INDUCTORS • KNOBS • DIALS • SOCKETS • INSULATORS • PLUGS • JACKS • PILOT LIGHTS

**HEATHKIT
DX-100
PHONE AND CW**

transmitter

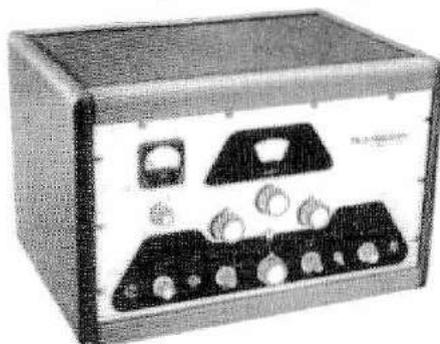
KIT

FEATURES

- Design proven through actual signal reports.
- ★ Only top-quality components used throughout.
- ★ 5-point TVI suppression, and pi network output to match 50 to 600 ohms.
- ★ Detailed construction manual for simplified assembly.
- ★ 100 watts output on 160, 80, 40, 20, 15, 11, and 10 meters.
- ★ Attractive and functional physical design.

The Heathkit Model DX-100 Transmitter is rapidly becoming the "standard" ham rig in its power class. The high quality and outstanding performance it offers can be matched only in equipment costing many dollars more. It features a built-in VFO, modulator, and power supplies, and is handswitching for phone or CW operation on 160, 80, 40, 20, 15, 11, and 10 meters. The kit includes a detailed construction manual, the cabinet, all tubes, pre-wound coils, and all other parts necessary for construction.

Push-pull 1625 tubes are used to modulate parallel 6164 tubes for RF output in excess of 100 watts on phone, and 120 watts on CW. May be excited from the built-in VFO or from crystals. Features pi network output circuit, illuminated VFO dial and meter face, and 5-point TVI suppression. High grade, well-rated parts supplied. Schematic diagram and technical specifications on request.



**MODEL
DX-100**
\$189⁵⁰

Shpg. Wt. 107 Lbs.

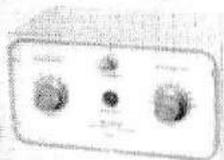
Shipped Motor
Freight unless
otherwise specified,
\$50.00 deposit
required on all
C.O.D. orders.

**HEATHKIT
antenna coupler
KIT**

**MODEL
AC-1**

\$14⁵⁰

Shpg. Wt. 4 Lbs.



In addition to matching a low power transmitter to an end-fed long wire antenna, this antenna coupler incorporates a 3-section low-pass filter, to attenuate output above 36 mc and reduce TVI. Handles up to 75 watts, 10 through 80 meters. 52 ohm coaxial input—tapped inductor and variable capacitor—semi RF indicator. Ideal for use with the Heathkit AT-1 Transmitter.

**HEATH
COMPANY**
A Subsidiary
of Daystrom, Inc.
BENTON HARBOR 9, MICHIGAN

**HEATHKIT
grid dip meter KIT**

The Model GD-1B is a time-proven instrument. It will enable you to accomplish literally hundreds of jobs on all types of equipment. Frequency range is from 2 mc to 250 mc. A 500 ua meter is employed for indication, and a sensitivity control and headphone jack are provided. Includes pre-wound coils and rack. Indispensable for the ham, serviceman, and engineer. Extra coils available to extend frequency down to 450 kc.



**MODEL
GD-1B** **\$19⁵⁰**

Shpg. Wt. 4 Lbs.

**HEATHKIT
antenna impedance
meter KIT**



MODEL AM-1

\$14⁵⁰

Shpg. Wt. 2 Lbs.

Used with an RF signal source, the AM-1 will enable you to match your antenna-receiver-transmitter system for optimum operation. Will double as a phone monitor or relative field strength meter. Uses 100 ua meter, and covers 0 to 600 ohms. Frequency to 150 mc.



MOBILE TWIN

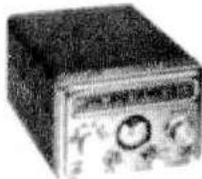


**G-77
MOBILE
TRANSMITTER**

**G-66
MOBILE
RECEIVER**

Gonset's new Mobile Twins, G-66 Receiver and G-77 transmitter, represent the perfect mobile combination. Outstanding multi-band performance—beauty of appearance—finger-tip control—6 and 12 volt operation—compactness without compromise! Typical Gonset dollar-for-dollar value—real "owner satisfaction".

G-66 RECEIVER



6 BANDS: 540-2000 kcs. 3500-4000 kcs. 7000-7300 kcs. 14,000,14,350 kcs. 21,000-21,450 kcs. 28,000-29,700 kcs.

AM, CW, SSB RECEPTION: Highly stabilized HF and BF oscillators and xtl controlled 2nd conversion oscillator.

STEEP SKIRT SELECTIVITY: 265 kc 2nd I.F. 8 high Q tuned circuits. 3.5 kc I.F. bandwidth at 6 db down.

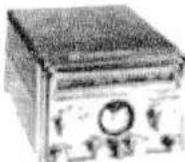
DOUBLE CONVERSION ALL BANDS: 2050 kc 1st I.F. Double input tuning (3 tuned circuits) on high bands for high image rejection.

AVC—Noise limiter—Panel S meter—antenna trimmer—BFO pitch—Audio-RF gain control—slide rule dial—3 watts audio.

G66 RECEIVER (less power supply) (#3046) net 169.50

"3 way" (6V-12V-115V AC) Universal power supply/speaker... net 39.95

G-77 TRANSMITTER



FREQUENCY RANGE: 80-40 20-15-10 meters. VFO or xtal, switchable. Highly stable VFO, each band spread over most of slide rule dial.

FULL BANDSWITCHING: Exciter ganged with VFO, pi network output.

POWER INPUT: 50-60 watts, modulated. CW provisions. 6146 tube in output. New modulator has integral speech clipping. High gain speech for PA-type dynamic, reluctance, ceramic or xtl mikes.

POWER SUPPLY: Heavy duty, vibrator, 6 and 12V DC. Output voltage 500-600V full load, Selenium rectifier, low drain both on standby and transmit. Power supply is a separate compact unit.

NOT YET RELEASED, G77 WILL BE AVAILABLE SOON AT YOUR DISTRIBUTOR.

GONSET CO. 801-SOUTH MAIN STREET, BURBANK, CALIF.

AVAILABLE NOW...



SSB-100A EXCITER/TRANSMITTER

Specifications

100 Watts PEP output SSB
25 Watts AM carrier output
Frequency Range: 80 meters 3,500-4,000
40 meters 7,000-7,300
20 meters 14,000-14,350
15 meters 21,000-21,450
10 meters 28,500-29,000*

* Other 500 kc. ranges available by inserting proper crystal.

TYPE OF EMISSION: CW, AM, LSB, HSB
DIAL ACCURACY: ± 2 kc. after calibration
FREQUENCY STABILITY: 500 cps after warm up
OUTPUT IMPEDANCE: Pi-network output with 52 Ω 75 Ω normal load impedance
FINISH: Black wrinkle enamel
CABINET: Receiver type table model with hinge cover

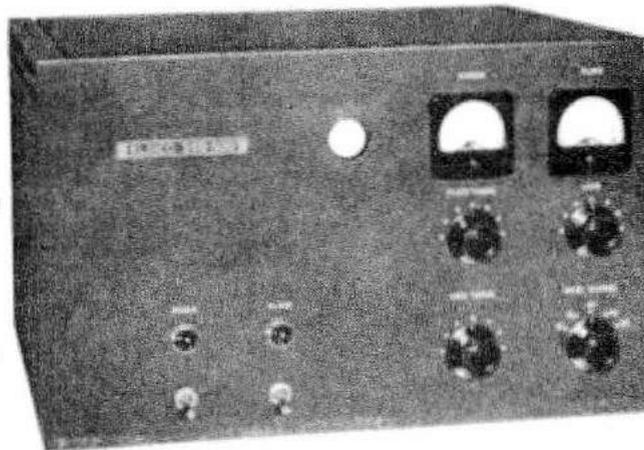
Amateur Net \$745.

SSB-500 LINEAR AMPLIFIER

Specifications

FREQUENCY RANGE: 80, 40, 20, 15, 10 meters
TUBE LINE UP: 8 tubes, two 866, two 6A-2, one
6B 2, one 6AU6, one 1CP1, one 4X250B
POWER RATING: 500 Watts PEP input
300 Watts AM input
FINISH: Black wrinkle enamel
CABINET: Receiver type table model with inter-
locked hinge cover

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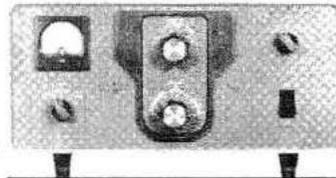


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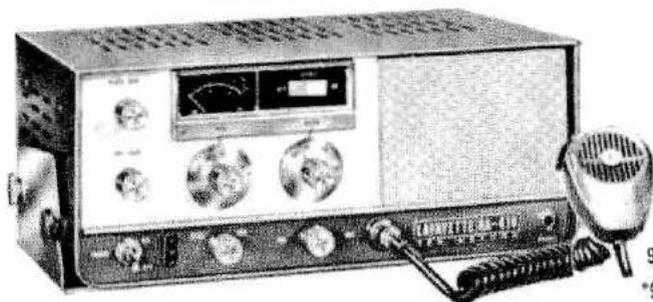
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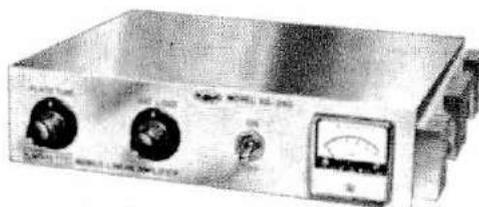
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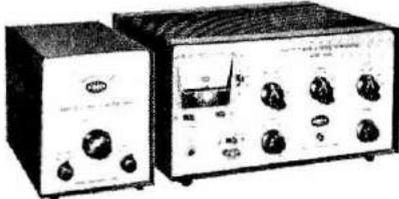
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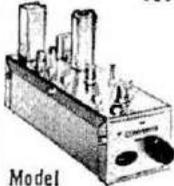
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Has 3 Nuvistors (2 RF stages & mixer) and 616 osc. Available in any IF output and do NOT become obsolete as their IF is easily changed to match any receiver. Average gain — 45 db. Noise figure — 2.5 db. at 50 Mc., 3.0 db. at 144 Mc., 4.0 db. at 220 Mc. Power required 100-150V. at 30 ma., 6.3V. at .84A. See PS-1 Power Supply. Model CN-50W, CN-144W or CN-220W wired, (specify IF.) \$49.95. Model CN-50K, CN-144K or CN-220K in kit form. (specify IF.) \$34.95

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2 Nuvistors in cascade give noise figures of 1.5 to 3.4 db. depending on band. Weak signal performance, image and spurious rejection on all receivers are greatly improved. PCL's overall gain in excess of 20 db. Panel contains bandswitch, tuning capacitor and 3 position switch which puts unit into "OFF," "Standby" or "ON," and transfers antenna directly to receiver or through Preamp. Power required — 120 V. at 7 ma. and 6.3 V. at .27 A. — can be taken from receiver or Ameco PS-1 supply. Size: 3"x5"x3".

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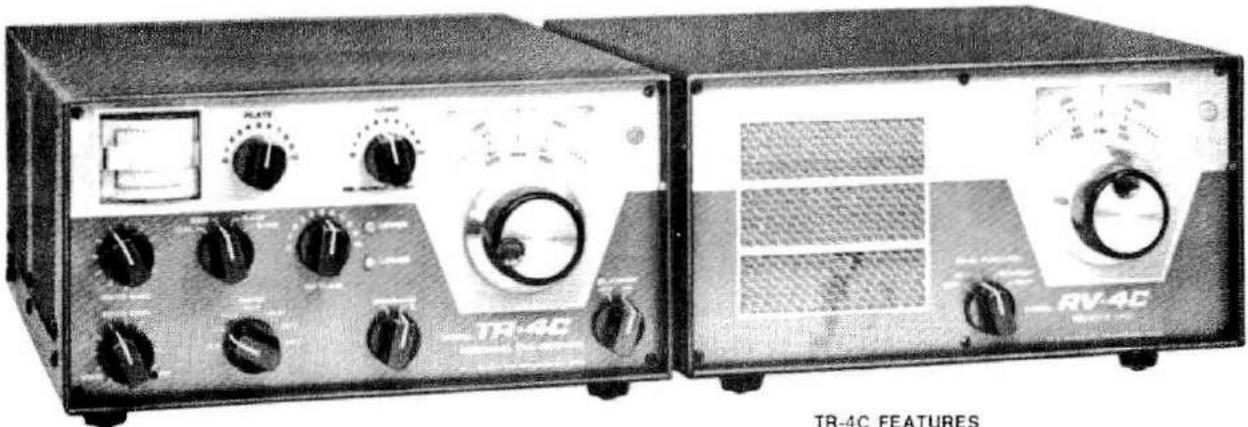
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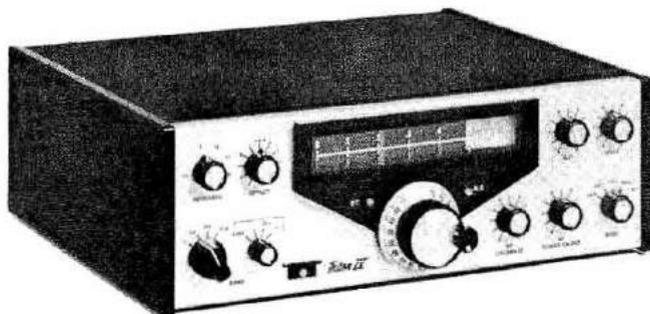
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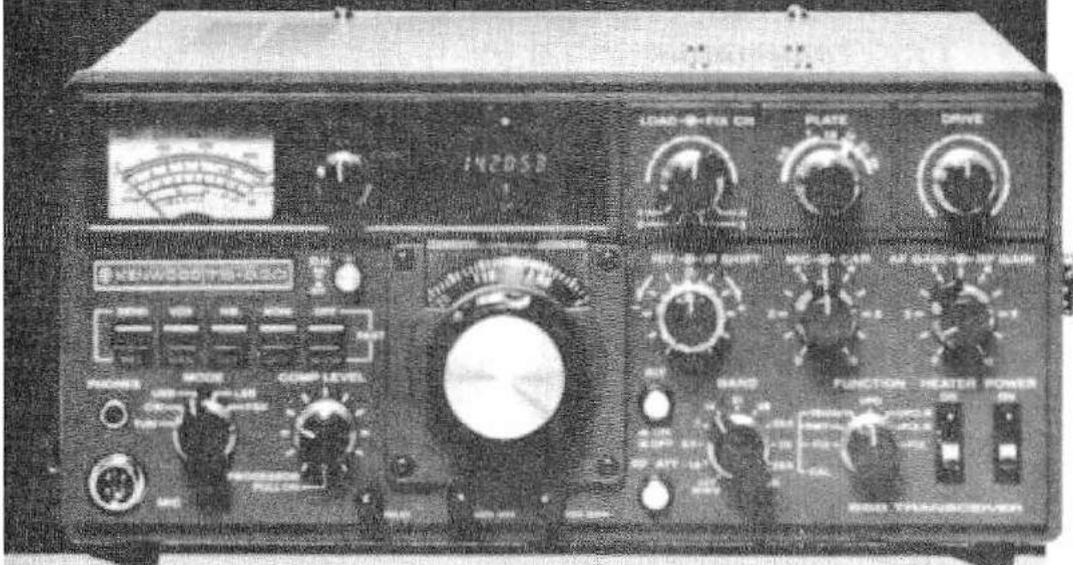
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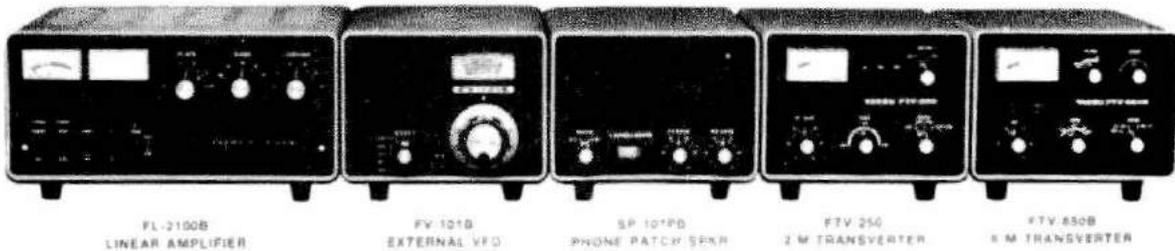
Let's take a closer look at some of these important features. This month the Digital Readout:

The Digital Display Readout directly

indicates the transmit and receive frequencies by counting the carrier, VFO, and heterodyne signals. Unlike dials using a VFO signal only, it indicates the accurate frequency in any operating mode. The readout accuracy is determined by the standard 1 MHz oscillator which is calibrated to WWV. The counter actually figures the frequency down to 10 Hz and the digital display reads out to 100 Hz. Frequencies are displayed in Kenwood blue digits for long operation without fatigue.

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About the ARRL

The seed for Amateur Radio was planted in the 1890s, when Guglielmo Marconi began his experiments in wireless telegraphy. Soon he was joined by dozens, then hundreds, of others who were enthusiastic about sending and receiving messages through the air—some with a commercial interest, but others solely out of a love for this new communications medium. The United States government began licensing Amateur Radio operators in 1912.

By 1914, there were thousands of Amateur Radio operators—hams—in the United States. Hiram Percy Maxim, a leading Hartford, Connecticut inventor and industrialist, saw the need for an organization to band together this fledgling group of radio experimenters. In May 1914 he founded the American Radio Relay League (ARRL) to meet that need.

Today ARRL, with approximately 170,000 members, is the largest organization of radio amateurs in the United States. The ARRL is a not-for-profit organization that:

- promotes interest in Amateur Radio communications and experimentation
- represents US radio amateurs in legislative matters, and
- maintains fraternalism and a high standard of conduct among Amateur Radio operators.

At ARRL headquarters in the Hartford suburb of Newington, the staff helps serve the needs of members. ARRL is also International Secretariat for the International Amateur Radio Union, which is made up of similar societies in 150 countries around the world.

ARRL publishes the monthly journal *QST*, as well as newsletters and many publications covering all aspects of Amateur Radio. Its headquarters station, WIAW, transmits bulletins of interest to radio amateurs and Morse code practice sessions. The ARRL also coordinates an extensive field organization, which includes volunteers who provide technical information and other support services for radio amateurs as well as communications for public-service activities. In addition, ARRL represents US amateurs with the Federal Communications Commission and other government agencies in the US and abroad.

Membership in ARRL means much more than receiving *QST* each month. In addition to the services already described, ARRL offers membership services on a personal level, such as the ARRL Volunteer Examiner Coordinator Program and a QSL bureau.

Full ARRL membership (available only to licensed radio amateurs) gives you a voice in how the affairs of the organization are governed. ARRL policy is set by a Board of Directors (one from each of 15 Divisions). Each year, one-third of the ARRL Board of Directors stands for election by the full members they represent. The day-to-day operation of ARRL HQ is managed by an Executive Vice President and his staff.

No matter what aspect of Amateur Radio attracts you, ARRL membership is relevant and important. There would be no Amateur Radio as we know it today were it not for the ARRL. We would be happy to welcome you as a member! (An Amateur Radio license is not required for Associate Membership.) For more information about ARRL and answers to any questions you may have about Amateur Radio, write or call:

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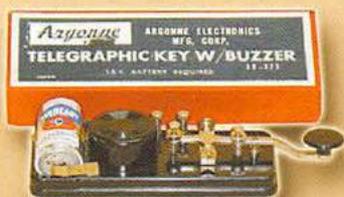
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