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ELECTRIC RADIO

celebrating a bygone era

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Don Gies, W4GIT with son Stephen, N4AMD

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

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

Regular contributors include:

Bill Breshears, WC3K; Bob Dennison, W2HBE; Dale Gagnon, KW1I; Bob Grinder, K7AK; Jim Hanlon, W8KGI; Brian Harris, WA5UEK; Tom Marcellino, W3BYM; Ray Osterwald, NØDMS; Chuck Teeters, W4MEW; Bruce Vaughan, NR5Q.

Editor's Comments

Dayton Hamvention

If you are going to the Dayton Hamvention, be sure to take in three important events: the AM Forum at 3:30 pm on Friday, May 18 in Meeting Room #3, the informal AM dinner at Marion's Pizza on Saturday at 7:30 pm and the AM special event station in the outdoor exhibit tent area at space #813. If you are not going to Dayton, look for KW1I operating portable from the Hamvention on 3885 or 7290 kHz from late afternoon May 17 through mid-morning May 20.

Dayton Book Sale

Last month I announced that we were putting all of our books on sale until the end of May since we would not be going to Dayton. The response has been really great. See the list of books we sell on page 56. And for those of you considering buying a complete set of back issues I'll remind you that the price will increase by $30 on May 30.

Vintage Nets

I'd like everyone connected with any of the vintage nets listed on page 19 to check the information and if any of it is incorrect, please let me know. I'd like to keep this listing as accurate as possible.

Vintage Field Day, June 16 &17

Here's another reminder for Vintage Field Day. I hope by continually reminding everyone of the event that this year we'll have a decent turnout.

The other day it occurred to me that maybe the low interest/low turnout for VFD is due to the fact that most of us are getting old and moving/lifting the boatanchor gear to the car, from the car, back to the car, etc. is just too daunting. My answer to that is to suggest taking a younger person along to help (actually to do ALL the hard work). Maybe a younger neighbor could be induced to come along for the prospect of free beer and a barbecue or maybe there's someone at your radio club. And remember the WX is nice in June—fresh air, sunshine, etc.

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Cover: Don Gies, W4GIT and his son Stephen, N4AMD. Don, a well-known Collins collector, has five operating positions.

The Saga of a Collins KWM-1

by Deric Affleck, VY2DA
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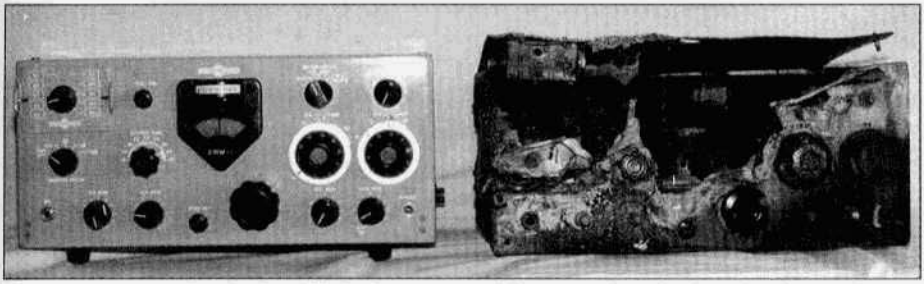
The ice storm of January 1998 which struck the northeastern part of North America will go down in the annals of history as one of the most devastating. The severest damage occurred in the southwestern region of Quebec, the southeastern area of Ontario and the northern New England states where several million people were without electricity and other services, in many instances for several weeks!

Gary Stewart, VE3GRB, and his wife of Russell, Ontario were among the victims of this catastrophe. The village of Russell is a small bedroom community located approximately 20 miles southeast of Ottawa, the capitol of Canada. Fortunately Gary had a fireplace in his home so being without heat or electricity was able to heat the house with wood. Ironically, this would also be his misfortune! One night the family pet, a Great Pyrenees dog, came into the bedroom and alerted the sleeping couple their house was on fire! They and the family dog managed to escape without injury but the upstairs of the house was gutted, the main floor and basement sustained heavy smoke and water damage. The couple lost virtually all their possessions with the exception of some items of clothing which they managed to gather up while the house was burning around them.

Amongst the losses was Gary's amateur radio station including his prized Collins KWM-1 transceiver, which he had owned for over twenty-five years. It was virtually destroyed by the intense heat later estimated to have been in the 2000 F degree or higher F range. Part of the front panel of the KWM-1 melted into blobs of aluminum as did some of the other cast aluminum knobs. The 516F-1 power supply with the much sought after Cannon multi-pin connector was totally destroyed. The local fire department later determined the fire was started by the fireplace chimney heating the wood floor joists to their flash point which, incidentally, had been lowered due to the natural aging process of the wood. Several days after the fire, remaining debris in the house was shoveled onto the rear deck, including the remains of the KWM-1 where it remained exposed to the winter elements. Fortunately Gary and his wife carried sufficient insurance to have their home rebuilt and all furniture, clothing and amateur radio station replaced. Gone forever were family photos and other irreplaceable treasures of a lifetime. While cleaning up the debris from the fire during the new house construction Gary found the remains of the KWM-1 and stored it in his garage where it was soon forgotten as he and his wife put their lives back together.

I won't go deeply into the historical significance of the KWM-1 as there have been several articles written about its development and use, but it is interesting to note it was the first true amateur "transceiver" using the same PTO to control the receive and transmit frequencies and operated on 20, 15, and 10 meters USB and CW[1]. It was manufactured by Collins Radio from 1957-1959 and within the first week of its introduction more than 500 orders were taken by telephone - sight unseen! It was quickly followed by the KWM-2 series in 1959[2]. Manufacturing records are no longer available from Rockwell-Collins to verify production numbers but it is estimated between 1,200 and 1,700 were produced.

This radio served with distinction around the world, and during Vice-



The KWM-1 on the right still had some usable parts despite having been almost destroyed in a fire.

President Nixon's trip to Venezuela in 1958 it saved the day when a hostile crowd imperiled the V.P.'s safety and all outgoing telephones lines from the country were tied up. A KWM-1 suitcase pack, owned by the V.P.'s pilot, was used to establish a communication link with Washington via the Strategic Command net to advise President Eisenhower of the Vice-President's predicament and what arrangements were in place for his security[2]. It also has been "officially" confirmed that KWM-1's were standard issue aboard the Lockheed U-2 surveillance aircraft[3]. Another bit of trivia I learned from a former Collins, Canada employee (name & call now forgotten): a KWM-1 was aboard the sailing ship used in the movie production of "Mutiny on the Bounty" starring Marlon Brando and Trevor Howard. When the replica of HMS Bounty was launched from Lunenburg, Nova Scotia and was setting sail to Tahiti for filming, the crew needed a compact HF radio to maintain contact with civilization during the voyage. A request went to Collins to find a KWM-1, however, none was available so Collins bought the employee's personal transceiver for the voyage. He never knew what became of the radio after filming was completed[4].

One evening in late February 2001, Jay K6MB, Dick, K2SZE and myself, all Collins Radio enthusiasts happened to meet on 20 meters and were discussing the finer points of operating and maintaining the Collins KWS-1 SSB transmitter when Gary, VE3GRB, joined the group. Gary had been listening to our conversation and described what had happened to his KWM-1. My interest was instantly peaked as I am the owner of a KWM-1 which was missing the PA cage cover and original PTO knob. It seems these two items are missing from a lot of KWM-1's for whatever reason. Perhaps the owners remove the PA cover to provide better ventilation of the finals and the PTO knob was replaced with a larger type for better tuning feel while mobiling? I asked Gary if these parts were on his destroyed transceiver. He said they were still there but were heavily covered in soot and grime and he wasn't sure if they could be used or not. Jay was also interested in the PTO assembly as he had been searching for one for a friend. It was agreed that Gary would send me the remains of the radio and I would make a determination if any parts could be salvaged and send the PTO assembly on to Jay. A few days later a parcel arrived containing the very sorry looking remains of a KWM-1.

The top lid was damaged beyond repair with the left front corner being melted away; the bottom cover slightly warped, could be straightened and repainted. The PTO assembly shaft would turn but the module was sooty & grimy and the condition of the internal components is unknown but in all likelihood are heat stressed and out of toler-

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The S-37 and its Predecessors:

The Surprising Extinction of Hallicrafters Ultra High Frequency Communications Receivers[1]

Part 1

by Robert E. Grinder, K7AK
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On the occasion of the tenth anniversary celebration (1943) of the Hallicrafters Company, Ray Durst, William (Bill) J. Halligan's partner, made the following remarks in tribute to Bill: "It is my good fortune to be close to Bill Halligan, my privilege to watch him work. I have seen him work under all kinds of pressure, but regardless of what he is up against he always comes out on top because his ideas are constructive and right." ("Old-timers Give Dinner," 1943). The eulogy stirred the assembled employees of the Company into a rousing ovation for its founder.

Ray Durst's abridged diagnosis of Bill Halligan's personality was on the mark. When he established the Hallicrafters Company, Halligan brought to the challenge years of experience as a radio operator in amateur, maritime, and naval services, as a reporter on events in amateur radio for the Boston Telegram, and as a radio parts distributor and retail store entrepreneur. He was as aware as any of his contemporaries of tribulations associated with pulling signals out of noise and interference. He was well-acquainted, too, with state-of-the-art refinements in shortwave receivers. Bill Halligan was thus on the threshold in 1933 of a successful career in radio manufacturing. The breadth of his background had enabled him to become a master salesman, astute entrepreneur, and prognosticator of significant trends in the amateur marketplace (Grinder, 1999, ER #106; Grinder, 2000, ER #136).

Bill Halligan's "constructive and right" ideas flowed profusely. He was thoroughly self-confident, he prided himself for his sensitivity to technological trends, and he praised his Company often in advertisements for its visionary approach. No one is perfect, however, and in one instance, at least, a product line of Hallicrafters imploded. For five years, from April, 1940 until November 1945, Hallicrafters proudly hyped a sequence of five ultra high frequency receivers of which the S-37 is the fifth.

The one-band S-37 receives either amplitude modulated (AM) or frequency modulated (FM) signals from 130 MHz to 210 MHz. It was introduced in 1945 as a receiver that "incorporates the latest developments in V.H.F. circuit design and provides sensitivity and selectivity . . . that is in every way comparable to the performance of fine communications receivers on the standard frequencies" [italics added] ("Advertisement," 1945a). Thus, "it is becoming a valuable instrument in the hands of all exploring the upper reaches of the high frequency ranges" ("Advertisement," 1945b).

Consumers paid dearly ($591.75) in 1945 for the presumed superlative qualities of the S-37. Surprisingly, then, the S-37, including the entire UHF line, was banished abruptly from the Hallicrafters scene before the end of 1945. The public pronouncements recommending the S-37, followed immediately by silence, symbolizes what can happen when there

Figure 1. Front panel of the S-37

is an enormous hiatus between exaggerated declarations and reality. Given the extensive publicity, what happened? Did Halligan and his engineers recognize belatedly that it was much less a receiver than they had they projected it to be?

The main intent of my paper is to review circumstances associated with the S-37 that led Hallicrafters to abandon it. My commentary is divided into four parts: (1) a review, to exemplify Bill Halligan's generally amazing foresight, of a few examples of significant features in his prewar communications receivers. These receivers enabled Hallicrafters to capture an increasingly sizeable share of the market; (2) an examination of the rationale at Hallicrafters for manufacturing a sequence of UHF receivers, which culminated in the S-37; (3) an account of features in the UHF receivers that preceded the S-37 and a comparison of these features with those of the S-37; (4) a Postscript to suggest events that led to the extinction of the entire product line of ultra high frequency receivers, including the S-37.2

Hallicrafters swift rise to eminence

Halligan's prophetic genius is reflected prominently in particular features that emerged successively in his line of communications receivers. Consider only a few of the more prominent milestones: His first communications receiver, the "Skyrider" [S-1] is a compact, five-tube regenerative set that Allied Radio marketed in 1934 to compete with low-cost receivers like the National SW-3. Hallicrafters proclaimed that the Skyrider possesses a host of "advanced engineering refinements." For example, its 7 1/2"x17"x7 1/2" cabinet encompasses a single tube RF and detector stage, respectively, a two-stage audio amplifier with an enclosed speaker, and a power supply. Four bands are switched from 1.5 to 25 MHz. Curves scaled in megacycles, corresponding to the bands, are printed on a five-inch airplane dial. A transparent traveling pointer, which is constructed with a rectangular strip of celluloid, provides pencil holes to allow listeners to log their favorite stations on the dial. An 18-1 ratio, micro-vernier thumb control facilitates making precise marks (Dilks, 2000; DeHenseler, 1991; "Review of Factory Receivers," 1934).

Halligan introduced in 1935 a series of superheterodyne models and, in the process, added substantially to his catalogue of special features. The more noteworthy begin with the S-9, which is comparable in size to the S-1 [Hallicrafters receivers have been designated "S" models; if w/out crystal

continued on next page

filter; "SX" if with optional crystal filter]. The S-9 features iron-core IF transformers, and the first use of a circular, German-silver, main tuning dial with "duo-micro-vernier tuning." The stunning dial became a defining characteristic of Halligan's models until 1939. The mold was broken with the ergonomic "Venetian Blind" dial of the SX-23, which was reported to be especially easy on the eyes of nocturnal amateur operators. The SX-23 is noted mostly for its compensated frequency stability, which Hallicrafters touted as eliminating drift.

Several months earlier, in 1937, the SX-16 appeared with the first signal-strength meter in a Hallicrafters receiver. The SX-16 also incorporates the German-silver tuning dial, and significantly, a new bandspread dial marked in 1,000 degrees via a spiraling line that circles around the dial. The latter, which is controlled with a flywheel, inertia tuning mechanism, rotates 32 times, to change the bandspread capacitor from minimum to maximum capacity, as degree numbers spiral downward from zero to 1,000. A narrow slit of light shining through a pilot-light cover illuminates about 20 degrees at a time as the light follows mechanically the path of the descending spiral.

A year later, 1938, in the SX-18, which is similar to the SX-16, the S-meter space in the front panel is utilized for a dial, which in turn operates a circuit that is designed to "effectively eliminate image interference" during phone reception (Miles & McLaughlin, 1938). The circuit involves putting two stages of pre-selection ahead of a specially designed Intermediate Frequency (IF) system. Karl Miles, Chief Engineer at Hallicrafters, described it as experimental, and in fact, it failed eventually to gain acceptance (Miles and McLauglin, 1937); nevertheless, it was presented in advertisements for the SX-18 as fait accompli (e.g., "Advertisement," 1938).

Nineteen thirty-eight proved to be a banner year at Hallicrafters. Halligan's first truly premier receiver, the dual-diversity DD-1, emerged—its circuitry was intended to minimize the effects of fading on signal readability. McLaughlin and Miles (1937) lauded it as a major breakthrough in receiver design. It was the first receiver of its kind manufactured expressly for the amateur market. It sold for about $500.

Halligan then brought forth in 1940 the noticeably attractive SX-28. He sought in the SX-28 to elevate operational standards for top-of-the-line superheterodyne receivers. The SX-28 incorporated conventional circuitry augmented by two stages of pre-selection on the higher frequency bands, high-fidelity output, calibrated bandspread, a wide angle "S" meter, and a wide range selectivity switch. Many amateurs across the years have nominated the SX-28 as Halligan's empyrean prewar accomplishment.

Bill Halligan's rationale for initiating a line of UHF receivers

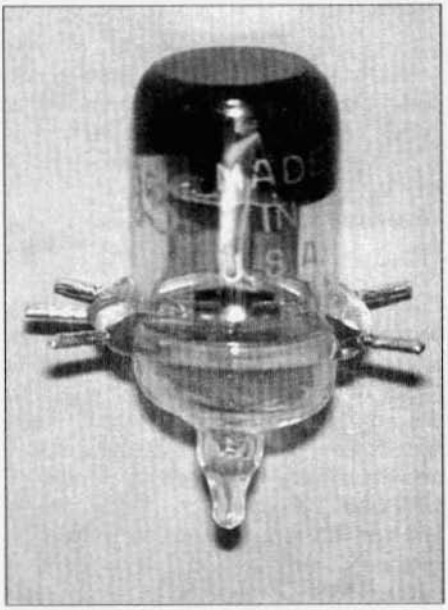
As a consequence of Bill Halligan's ambition and prescience, Hallicrafters was acknowledged nationwide in the late 1930s to be a major manufacturer of communications receivers. He had worked tirelessly to produce an impressive array of receivers that were generally priced modestly; moreover, each receiver usually offered features unavailable at the same price from competing manufacturers. Amateurs and short wave listeners thus flocked to his distributors to purchase his products.

Halligan had assured himself by 1939-40 that he had arrived at a marketing formula that promised success. Ceaseless momentum motivated him. Cohorts of amateurs, shortwave listeners, and agencies of government were clamoring for the equipment that he was manufacturing. The propitious times thus called for expanding the product line. Consequently, when Halligan became aware of emerging

trends in marketing factory-wired and tested transmitters, he lured Bob Samuelson away from the Collins Radio Company to design a line of high-frequency, amateur transmitters (Grinder, 2000, ER #136). At the same time, Halligan began to look covetously at opportunities for manufacturing receivers to cover the "ultra high frequency spectrum."

Shortly after Hallicrafters produced the first S-1, the Federal Radio Commission, September 1934, announced that all experimental services, including that of amateurs, were permitted jointly to operate temporarily on all frequencies above 110 MHz. The ultra high frequencies in 1934 were wholly uncharted territory-a no-man's-land largely bereft of interest in part because technical progress had as yet not produced tubes with satisfactory gain, stability, and signal-to-noise ratio, respectively, at such low frequencies. However, in 1935, RCA introduced for UHF work the 955, a triode which could be used as detector, amplifier, or oscillator. The 955 is literally about the size of an acorn enveloped wholly in glass. Its five terminals (two filament, grid, cathode, and plate) are arranged around the circumference of the tube. Their leads protrude horizontally from its tiny glass base, and thereby the tube possesses very low interelectrode capacitances and lead inductances. The 955 was followed, also in 1935, by the 954, a pentode with the same type of construction and appearance as the 955, for operation as an RF amplifier at wavelengths as short as .7 meters.

James Millen, chief engineer at the National Company, recognized immediately that the new acorn tubes would function effectively in a wide-range superregenerative UHF receiver; specifically, he urged his design engineers and technicians to construct a receiver for experimenters that would cover the range from 28 to 300 MHz. The task



The 955 was introduced by RCA in 1935

proved to be exceeding difficult. Every piece of hook-up wire functioned either as a capacitance, an inductance, or an antenna. Painstaking attention to detail led eventually to a four tube, superregenerative receiver [954 RF stage, 955 detector, and 6J5, 6F6 audio output] that would operate as effectively at 300 MHz as at 28 MHz. Once the stubborn problems were resolved, the National Company named it the One-Ten, and offered it as a low-cost receiver [about $50] so that amateurs could investigate the ultra high frequencies. Millen's gamble paid off. The deftly engineered National One-Ten was manufactured subsequently without modification for a decade; it enabled hundreds of amateurs to explore UHF and to provide a foundation for technical developments throughout the latter years of the 1930s. It served the end for which it was designed so effectively that no other company during the 1930s so much as attempted to manufacture a comparable UHF receiver (Grinder, 1997, ER #97).

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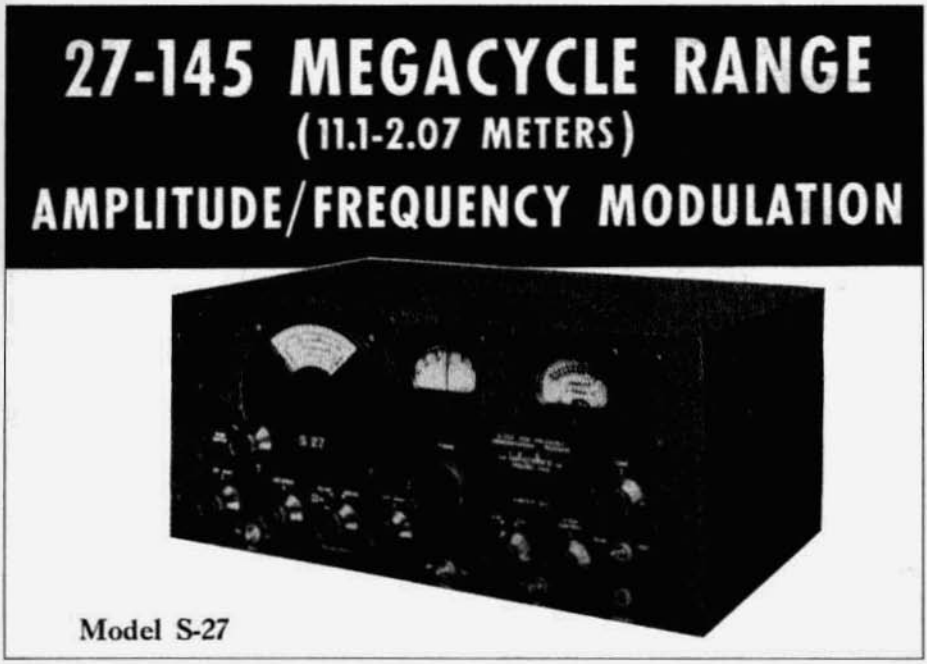
Bill Halligan did not consider producing a receiver that would compete with the National One-Ten for two reasons: on the one hand, the technical state of progress above 110 MHz was highly primitive during the early 1930s—a survey showed that 95% of amateurs preferred to operate the lower four amateur bands (American Radio Relay League, 1965); on the other hand, the survival of his fledgling company during the difficult depression years preoccupied his attention—he had to focus on where purchasing power in the amateur community was concentrated. Toward the end of the decade, however, circumstances associated with UHF had changed dramatically. A declaration of the new Federal Communications Commission (FCC) on December 1, 1938, decreed that radio amateurs were to be restricted to 112-118 MHz and 224-230 MHz ("New Regulations," 1938). Subsequently, in April 1939, the FCC issued a new allocation of frequencies from 30-300 MHz. The amateur 2-1/2 meter band was reallocated to 112-116 MHz. Furthermore, the FCC organized other frequency allocations from 30 MHz to 401 MHz as follows: 30-42 MHz—Police, government, relay broadcast, coastal and ship harbor, miscellaneous; 42-50 MHz-Broadcast and educational (FM); 50-56 MHz-Television, fixed; 56-60 MHz-Amateur; 60-112 MHz-Government, television; 116.110-139.960 MHz-Broadcast, government, aviation, police, miscellaneous; 140.100-143.880 MHz-Aviation; 144-400 MHz-Government, television, miscellaneous; 400-401 MHz-amateur; 401 MHz and above-experimental ("New Frequency Allocations," 1941).

Although the FCC in 1939 allocated frequencies above 30 MHz with apparent forethought and precision, the actual bases for the allocations were illusory. Indeed, auroral, ionospheric and tropospheric propagation patterns of wavelengths above 110 MHz were still largely uncharted. Questions pertaining to the variability and reliability of long- and short-distance communications stood out: What factors are associated with transequatorial propagation? What are the effects of (1) the reflection of UHF radio waves from the auroral curtain in the northern skies; (2) the reflection of waves by dense patches of ionization in the E region of the ionosphere (Sporadic-E propagation), roughly 50 miles above the earth; (3) the reflection of waves (tropospheric bending) as a function of changes in such atmospheric gradients as humidity and temperature inversion and in propagation over various types of terrain and water surfaces (Radio Propagation, 1943).

Bill Halligan and his receiver engineers were cognizant of the increasing popularity of the 10, 5, and 2 1/2 meter bands, the recent assignment of frequencies for aircraft use between 75 and 140 MHz, and the growing interest in FM broadcasting (Schor, 1940). They were also aware that myriad unanswered questions impeded utilization of the frequencies to their fullest extent. Therefore, in 1940, Halligan decided that technological and economic factors warranted manufacturing a new line of UHF receivers. Halligan was wholly disinterested in marketing receivers that would compete with the National One-Ten, which as late as 1940 was the sole commercial receiver available to experimenters operating in the UHF region. Instead, he aimed to manufacture UHF superheterodyne receivers that would be as equivalent feature-wise and as effective operationally as traditional communications receivers. He hoped, ideally, to cement in the minds of prospective consumers the view that Hallicrafters, as with high-frequency transmitters, was at the forefront of a new line of receivers that supersedes the products of competing manufacturers.



Model S-27

Consequently, from April, 1940 through November, 1945, advertisements in Radio, Electronics, and QST lauded hyperbolically the Hallicrafters Company for its vision and five UHF receivers, the S-27, S-27B, S-36, S-36A and S-37, for their extraordinary qualities. For example, readers were informed in 1945 that "engineering imagination at Hallicrafters is reaching out beyond the next five years, beyond the present known limits of radio technique so that Hallicrafters equipment will continue to be always ahead of its time, above and beyond your best expectations." ("Advertisement," 1945c).

The features of the UHF receivers leading to the evolution of the S-37

The S-27, which was announced April 1940, was promoted as the first general coverage UHF communications receiver to incorporate both FM and AM ("Advertisement," 1940). It is the archetype in the product line of four more sequential UHF receivers, S-27B, S-36, S-36A, and S-37. Ferd Schor, lead receiver engineer at Hallicrafters in 1940, and certainly one of the more brilliant electronic scientists and radio technicians of his era, was Halligan's designated leader in creating the line of UHF receivers (Schor, 1940). The five receivers represent progression along a level plane rather than linear progress. Only slight modifications in physical appearance and circuitry distinguish the receivers through the S-36A; the S-37 differs markedly in physical appearance from its predecessors; however, in a frank admission, Hallicrafters admitted that the S-36A and S-37 are "basically similar" in circuitry ("Advertisement," 1945a). Yet the S-27 and S-27B were advertised at $195 in 1940-41; the wartime price of the S-36 and S-36A was $307 (DeHenseler, 1991), but in February 1946, Allied Radio offered the S36A for $415 ("Advertisement," 1946). Extra-stringent standards for "a prime instrument of experiment and research in marking out the new directions that all radio will take" elevated the price of

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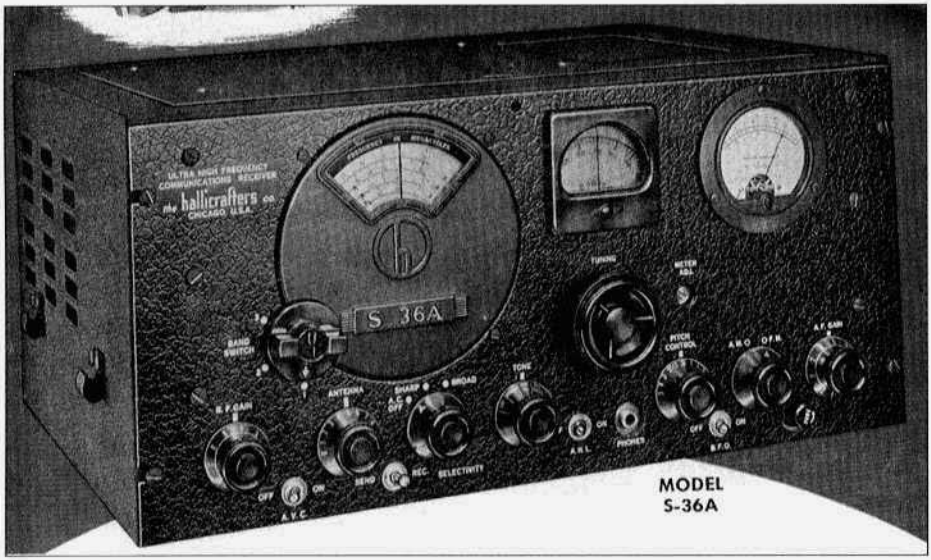

the S-37 in 1945 to $591.75 ("Advertisement," 1946; DeHenseler, 1991).

The S-27 copies AM, FM, and CW in three bands: 27 to 46 MHz; 45 to 84 MHz, and 81-145 MHz. Hallicrafters presented the S-27B UHF receiver in March 1941 ("Advertisement," 1941). It is identical to the S-27 except that it covers a greater frequency range in three bands: 36 to 60 MHz, 56 to 94 MHz, and 92 to 165 MHz. The range of the S-27B was extended to cover FM relay frequencies at 158-162 MHz. The two receivers share the same 15 tube complement: three acorn tubes in the RF section, an 1852, 1853, and 6SK7 successively in the three IF amplifiers, 6H6 second detector and noise limiter, 6H6 FM discriminator, 1852 FM limiter, 6J5 BFO, 6C8G and pp 6V6s in the audio stage, and 5Z3 and VR-150 in the power supply.

The S-36 was developed during the war, and distributed to military services as the BC-787 and ARR-5. The amateur market became aware of it in June 1945, as WW II was drawing to a close. An advertisement in QST stated that "equipment of this type was introduced by Hallicrafters more than five years ago and clearly anticipated the present trend toward improved service on the higher frequencies" ("Advertisement," 1945d). Readers are informed exuberantly that "the model S-36 is probably the most versatile VHF receiver ever designed." The S-36A, in turn, was also advertised in 1945, not in QST, but in CQ, RADIO, Hallicrafters catalogue #36, and the American Radio Relay League (ARRL) 1945 Handbook. The two receivers differ in external appearance in that the S-meter case of the S-36, as well as those of its predecessors is square, and matches that of the bandspread dial whereas the S-meter case of the S-36A is round and does not match its square bandspread dial case. Further, whereas the S-36 front panel layout of switches and of knobs for variable controls is identical to that of the S-27, these items are rearranged on the front panel of the S-36A.

The S-36 and S-36A are distinguishable from the S-27 in two additional respects: first, both cover from 27.8 to 143 MHz, a slightly less range of frequencies, which has forced amateurs, with either one of them, who operate the two-meter band, to build an auxil-

iary converter (Hadlock, 1946); second, the tube complement is updated somewhat-minor changes are 6AC7 1st IF, 6AB7 2nd IF, 6SL7 audio voltage phase inverter, and 5U4 rectifier; recycling includes the three acorn tube RF section, 6SK7 3rd IF amplifier, 6H6 AM detector and noise limiter, 6H6 FM discriminator, 6J5 BFO, pp 6V6s power output, and VR-150 voltage regulator.

Importantly, the S-27 and its clones through the S-36A share in common several features: (1) an intermediate frequency of 5.25 MHz; (2) a single RF stage, mixer, and high-frequency oscillator constituted, respectively, with three acorn tubes; (3) an RF section built as a unit on a separate chassis; (4) a selectivity factor in the three IF stages which automatically sharpens for AM reception and broadens for wide-band FM signals; (5) an S-meter calibrated in S units for AM and a zero centering position to indicate best setting when receiving an FM station carrier; (6) a three position ceramic band switch; (7) a high fidelity audio amplifier; (8) an antenna trimmer; (9) and an enclosed power supply. The front panels of the four receivers have in common, too, variable controls for RF gain, IF selectivity, CW pitch, volume, tone, and antenna, and additionally, switches for power, AVC, beat oscillator, automatic noise limiter, AM-FM, and send-receive. All of the receivers share a cabinet size 19"W x 9"H x 14"D and all require an external speaker.

The S-37, starting with the S-1, is the forty-eighth receiver that Halligan produced. As the engineers at Hallicrafters toiled, readers are reminded that they "are continually striving for new heights of perfection in high frequency development work. The model S-37 is one example of the progress they have made" ("Advertisement," 1945e).

The S-37 is an AM/FM receiver that operates from 130 to 210 MHz; the entire range of the receiver is covered without band switching. The S-37 dial, which is a four-inch, German-silver disk, incorporates a flywheel tuning mechanism and a "new pre-loaded gear drive" so that the bandspread dial operates in tandem with the tuning disk. The circumference of the disk is a logging scale marked in equal divisions from one to twenty-four. An inner circle is calibrated from 130 MHz to 210 MHz. The bandspread dial rotates 24 times to one revolution of the disk. Paper capacitors are either molded plastic or oil impregnated, transformers are hermetically sealed, and wires are moisture proofed to make the S-37 suitable for any climate.

Although the S-37 is much more robust mechanically than its predecessors, its circuit differences with them are minimal. For example, (1) a second RF stage is added; (2) the IF frequency is moved to 18 MHz to assure a high ratio of image rejection; (3) the beat-frequency oscillator is omitted; and (4) the pushpull audio output stage is eliminated. Controls on the S-37 are the same as those of the earlier models, except that the switch and control for CW are omitted. The fourteen tube lineup is the same as that of the S-36A, except for the addition of a 954 RF stage, the elimination of the 6J5 BFO, and the reduction of one of the pp 6V6s to create a single-ended audio power output stage.

Part 2 will be in next month's issue.

TUBE COLLECTORS GROUP FORMED: The new tube collectors association is now in operation. This is a non-profit, non-commercial organization of collectors & history enthusiasts focusing on all phases & vintages of tube design. The founding president of the group is Al Jones, W1ITX, who is known for his award winning tube collection. For more details & complimentary copy of the association's bulletin contact Al Jones, CA, (707)-464-6470, Ludwell Sibley, OR, (541) 855-5207, or mail request to POB 1181, Medford, OR 97501.

An AGC Amplifier Using Remote-cutoff Pentodes

by Ken Hale, K6CJA
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Introduction

In all voice radio communications, and particularly with classic amplitude modulation (AM), it is desirable to maintain a uniform, high audio level to override natural and man-made noise sources in reception and, at the same time, prevent the transmitter from being over-modulated by sudden, loud passages. Old-time radio accomplished this aim by means of a studio engineer who kept one eye on the announcer and his microphone, another eye on the audio level (VU) meter and whose nimble fingers were constantly caressing the microphone gain control on the console. It soon became apparent that this "gain-riding" function could, in part, be done automatically, and thus was developed the audio automatic-gain-control (AGC) amplifier. This amplifier functions by measuring its own output level and adjusting its gain up or down to bring that level back to a predetermined value. It is tempting to envision this process as a Rube Goldberg mechanical hand coming out of the amplifier and fiddling with the gain-control knob on the front panel. But, in fact, the operation is completely electronic. The output level is "measured" by rectifying and smoothing the AC audio signal into a fluctuating DC voltage. That DC voltage then acts as the gain control when it is applied as grid bias to the tubes in the first stages of the amplifier. The gain of all vacuum-tube amplifiers varies, usually radically, with grid bias. However, special tubes, remote-cutoff pentodes and variable-mu triodes, were developed to make this bias gain control smooth and predictable. All AGC amplifiers use these tubes for their variable-gain stages, as does the design discussed herein.

Requirements and Sources

The present requirement was for a relatively simple AGC amplifier, implemented in vacuum-tube technology (of course), that could be inserted into the audio chain between the microphone mixer and graphic equalizer at Amateur Radio Station K6CJA. It would have a minimum gain-control range of 20 - 30 dB (30 - 50 dB would be better), not introduce gain-control artifacts into the signal, and use commonly available tubes and other components.

Jim Tonne, WB6BLD (ex-W5SUC), described such a unit in the Sept. 1956 issue of "QST"[1] and that design became the starting point for this development. In addition to an AGC amplifier, Tonne's design included a fast, post-compression clipper, several shaping filters and a high-level buffer stage. These were omitted from this implementation since their functions were being performed by other subsystems in the audio chain. Tonne's article also went into substantial detail on AGC amplifier design. Those issues will not be treated here, but reprints of his original article are available from K7JEB for an SASE.

Circuit Description

The first stage is a conventional, common-cathode preamp using 1/2 of a 12AX7 (V1B) for a voltage gain of approx. 20 dB.

The audio signal is then transformer-coupled to the variable-gain, second stage consisting of two 6BA6, remote-cutoff pentodes (V2, V3) in push-pull class-A operation. The AGC bias voltage, generated in the rectifier section, is applied in parallel to the control and suppressor grids of the 6BA6's as a common-mode DC signal. This AGC voltage, ranging from 0 to -20 volts, varies the plate current, and therefore the transconductance and voltage gain, of the 6BA6's. Its presence in the output signal is cancelled out in the center-tapped output inductor (L1) by means of equal-but-opposite, bias-induced currents flowing through the windings to ground. Precisely balancing these currents is accomplished by varying the cathode bias voltages on the tubes with the COMP BALANCE potentiometer, R8. The decrease in the combined cathode current of the two 6BA6's as the negative AGC voltage is applied gives an indication of the degree of gain reduction. This DC current is monitored with milliammeter M1 and calibrating shunt resistor R5.

The third stage in the audio signal path is a somewhat conventional, common-cathode amplifier providing a small amount of gain and implemented with 1/2 of a 12AT7 (V4A). The low-impedance audio output signal is capacitively coupled from V4A's unbypassed cathode resistor. The amplitude is approximately 1 volt rms, suitable for driving the high-impedance input of a distribution amplifier. A higher-gain signal is capacitively coupled from the plate load resistor R17 to drive the phase-splitter of the rectifier section.

The other half of the 12AT7 (V4B) is used as a phase splitter for the rectifier amplifier V5. This push-pull amplifier uses both halves of a 12AU7 dual triode and increases the audio level to approximately 100 volts p-p for both polarities of the signal. The push-pull outputs of this stage are capacitively coupled to the AGC rectifier, V6, a 6AL5 dual diode. This rectifier does not conduct until the peak amplitude of the audio signal exceeds the bias voltage set by voltage-divider resistors R34 and R35. This produces a desirable "delayed AGC" or threshold action. When the rectifier does conduct, it does so strongly, quickly charging C11 (.2 uF) to a negative voltage with respect to ground. This negative voltage, the AGC control voltage, is fed back to the variable-gain stage grids. This action closes the AGC loop. The overall audio gain is reduced until the rectifier no longer conducts and the audio output level is prevented from exceeding the fixed point at which this occurs.

C11 would retain its negative charge for a long time, and the audio gain would be reduced accordingly, if not for the discharge path provided by R36 and R37. These resistors bring the AGC voltage back to ground potential over a period of a few seconds so that the audio gain "recovers" to its maximum value in anticipation of the next burst of audio signal.

The recovery time constant (C11 X (R36+R37)) is rather short when R37 is at minimal setting, making this implementation fairly aggressive in 'squeezing' the station audio. A less aggressive (and less intrusive) mode of operation, tending more towards gain-levelling, can be had by increasing C11 to 0.5 or 1.0 microfarad. It is inadvisable to increase R37 past 5 Megohms.

Implementation notes and comments:

This unit was built up from junk-box parts on a chassis and front panel left over from a previous, different project. Component and controls placement was based on reuse of existing holes and not

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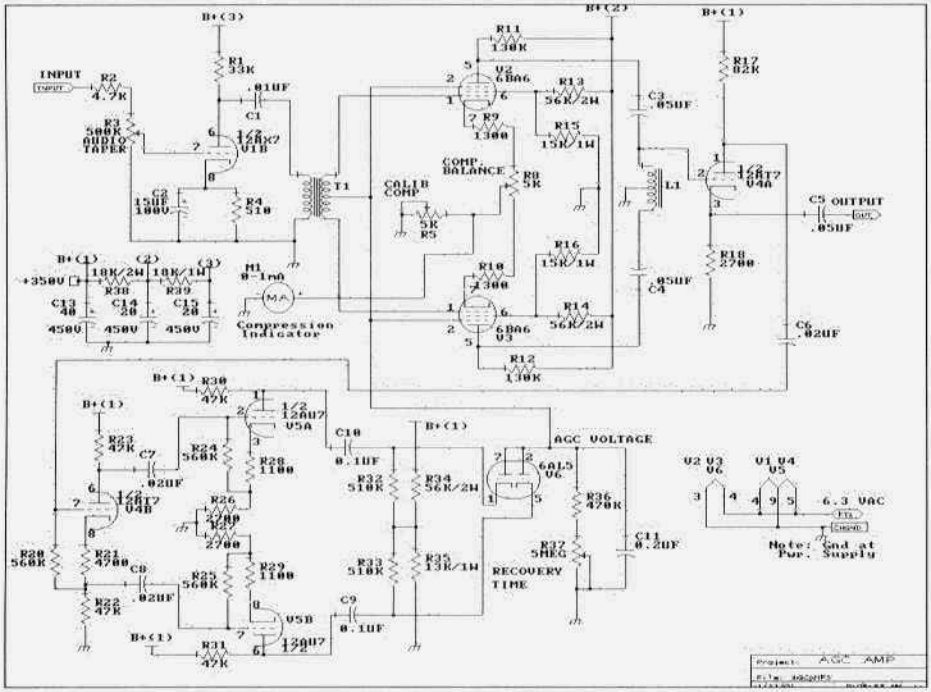

especially pretty or ergonomic. The only critical components are the center-tapped inductor L1 and interstage transformer T1. The criticality involves the placement of the center tap in both cases, which affects the balance obtainable in the variable-gain stage. This unit used the secondary winding of an audio interstage transformer "liberated" from an SCR-522 for L1 and a "found" interstage transformer roughly in the 50 K-ohm range for T1. If a center-tapped transformer could not have been found for T1, a single-ended version could have been used. In this case, the AGC voltage would have been fed to the control grids of the 6BA6's through a pair of 510K resistors, one for each tube. It was tempting to try to replace T1 with a phase-splitter stage, but this would have been ill-advised since it would require the AGC voltage to charge and discharge the coupling capacitors from that stage. The result would be to lengthen the AGC attack time, the time it takes to fully reduce the amplifier gain in response to an audio level increase. Ideally, this should be as short as possible.

Gain-reduction and audio-level setup are straightforward. Audio at the nominal input level is fed to the AGC amplifier and the input gain control (R3) is advanced until approximately 10 dB of gain reduction takes place. Then the gain of the following subsystem (in K6CJA's case, the graphic equalizer) is set to produce 100% transmitter modulation. At this point of adjustment the amplifier will increase its gain up to 10 dB on low passages and gain-reduce up to 20 dB on louder ones. For more aggressive gain compression, the input gain control is simply increased.

A more critical adjustment is gain-balancing the two tubes of the variable-gain amplifier to eliminate AGC "thump". There are several ways to do this. One method capacitively couples the 6.3 VAC from the "hot" side of the

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Souther California AM'ers Cook Up a Good Time

by Joe Tyburczy, W1GFH
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While the rest of the country sleeps, AM'ers on the West Coast are wide awake launching enviable signals into the ether most every night of the week. But Wednesday evenings are special. Beginning at approximately 8 PM PST on 3870 kHz, everything from modest Johnson Rangers to venerable Gates BC1-T's can be heard gracing the airwaves during the West Coast AM International Net. Wagonmasters of this weekly Wild West roundup are alternating net controls John, W6MIT and Ken, K6CJA. Recently Ken volunteered to host an informal get-together of net regulars in the southern end of the state, and the first WEST COAST AMI BARBECUE BASH was born.

On Saturday April 28, a group including the author converged on the spacious K6CJA Ranch set amid the stunning high desert splendor of Hesperia. Attending were Ron, W6OM; Skip, K6LGL and XYL Roma; Mickey, WA6FIZ and XYL Barbara, KF6JXV; Dennis, W7QHO; Don, W6BCN; Bill, N6PY, and Trevor, KG6CYN. For many, this was the first eyeball-to-eyeball encounter we'd ever had with each other. But faces were quickly matched with voices, steaks were set to sizzle on the grille, and chilled 807's became the order of the day.

Highlights of the event included a tour of K6CJA Studios where guest ops took turns keying the B+ of Ken's legendary homebrew transmitter, "Hercules" (a 4-400 modulated by a pair of 4-250's), plus a mini-Swap Meet held West-Coast style in the carport. We even managed to raffle off a "door prize":

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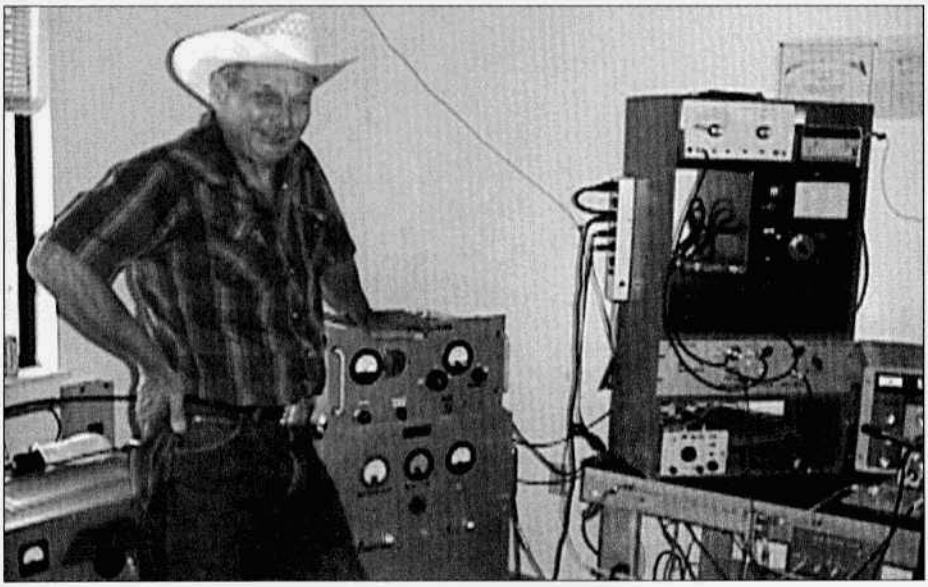


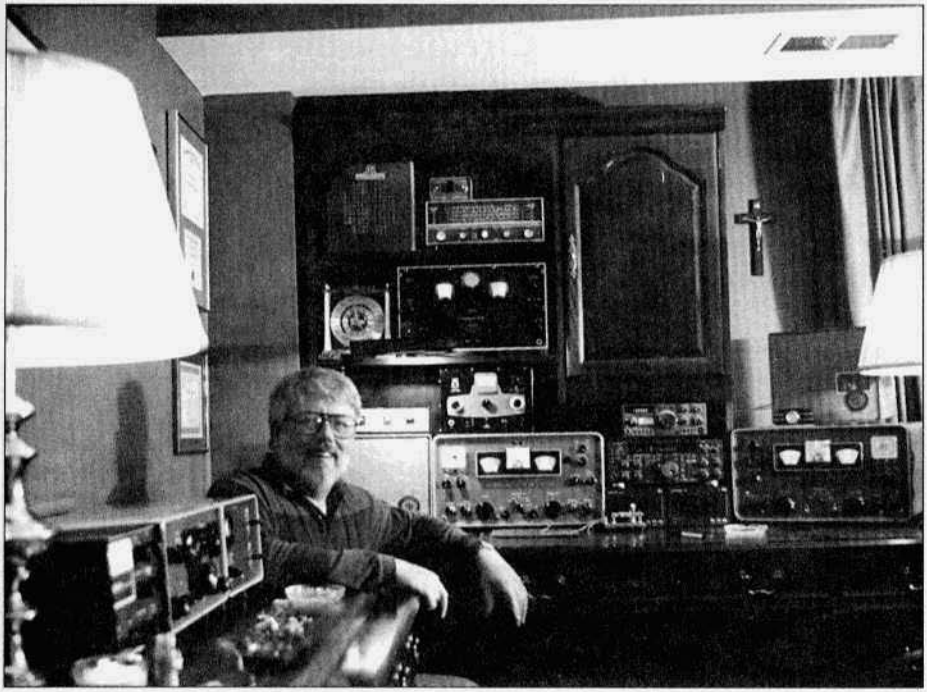
Ken, K6CJA takes a break from the AMI BARBECUE BASH to pose before his homebrew transmitter, "Hercules", a 4-400 modulated by a pair of 4-250's. *Photo by Ron, W6OM.*

Greg Carter, KX4R, with his two 100-watt AM stations. The Viking II is paired with the HQ-150 and the DX-100B is paired with the HQ-140XA.

WØCAR

John B. Curtis
7939 S. Poplar Way
Englewood,
Colorado 80112

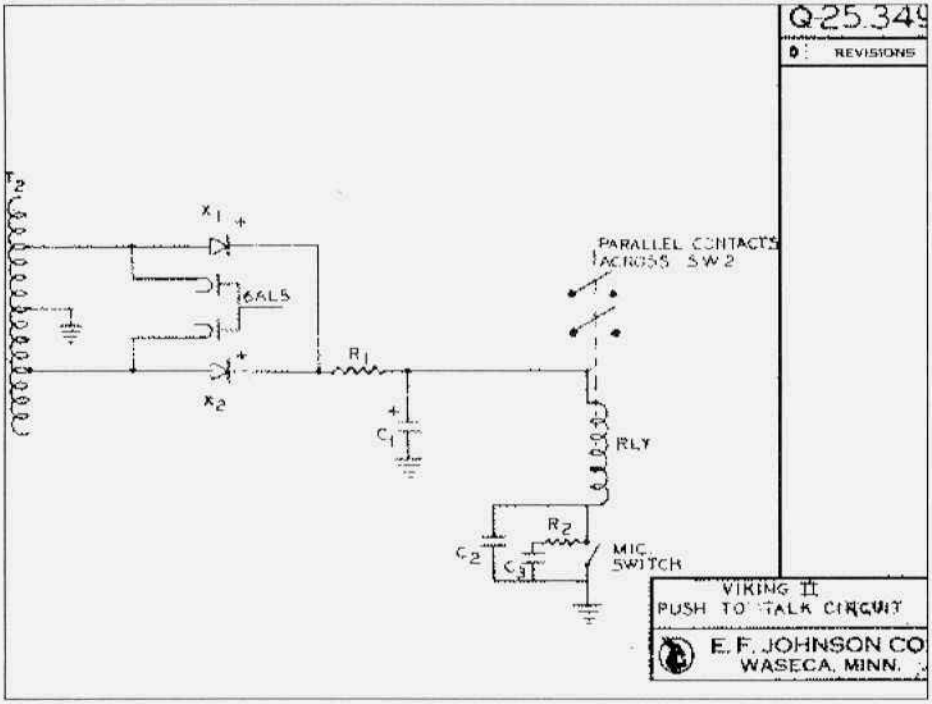
A nice QSL card from John Curtis, WØCAR showing some of his vintage equipment.



James Stoneback, K4AXF, in his hamshack.

James D. McWilliams, K6IHP back in 1956. The station back then consisted of a DX-100 transmitter, HQ-129X receiver, Johnson Matchbox and Heathkit Q-multiplier. His antenna was a 120-foot wire v-shaped that he says worked beyond belief.

A Push to Talk Circuit for the Viking II



Parts List

X1, X2 - 15-35 mA selenium rectifier
R1 - 3,300 ohm, 1 watt resistor
R2 - 100 ohm, 1/2 watt resistor
C1 - 150 mFd, 150V electrolytic capacitor
C2, C3 - .005 mFd disc ceramic capacitor
RLY - 10,000 ohm DC relay such as Potter Brumfield type LM-11

Replace mic connector with 3-contact type

This circuit was found in the form of a schematic blueprint at the estate sale of the late Stu Meyer, W2GHK. At one point in his career (he is mostly remembered for being the last president of the Hammarlund Company) he worked for the E.F. Johnson Company. I wonder if this circuit has ever been published before.
Tony Stalls, K4KYO

VINTAGE NETS

Arizona 40M AM Group: Meets on 7293 kHz at 10:00 AM MST (1700 UTC) on Sat. and Sun.
West Coast AM Net meets Wednesdays 9PM Pacific on or about 3870kc. Net control alternates between John, W6MIT and Ken, K6CJA.
California Early Bird Net: Saturday mornings at 8 AM PST on 3870.
California Vintage SSB Net: Sunday mornings at 8 AM PST on 3860 +/-
Southeast Swap Net: Tuesday nights at 7:30 ET on 3885. Net controls are Andy, WA4KCY and Sam, KF4TXQ. This same group also has a Sunday afternoon net on 3885 at 2 PM ET.
Eastern AM Swap Net: Thursday evenings on 3885 at 7:30 ET. This net is for the exchange of AM related equipment only.
Northwest AM Net: AM activity daily 3 PM - 5 PM on 3875. This same group meets on 6 meters (50.4) Sundays and Wednesdays at 8:00 PT and on 2 meters (144.4) Tuesdays and Thursdays at 8:00 PT. The formal AM net and swap session is on 3875, Sundays at 3 PM.
K6HQI Memorial Twenty Meter AM Net: This net on 14.286 has been in continuous operation for at least the last 20 years. It starts at 5:00 PM PT, 7 days a week and usually goes for about 2 hours.
Arizona AM Net: Sundays at 3 PM MT on 3855. On 6 meters (50.4) at 8 PM MT Saturdays.
Colorado Morning Net: An informal group of AMers get together on 3876 Monday, Wednesday Friday, Saturday and Sunday mornings at 7AM MT.
DX-60 Net: This net meets on 3880 at 0800 AM, ET, Sundays. Net control is Jim, N8LUV, with alternates. This net is all about entry-level AM rigs like the Heath DX-60.
Eastcoast Military Net: It isn't necessary to check in with military gear but that is what this net is all about. Net control is Ted, W3PWW. Saturday mornings at 0500 ET on 3885 + or - QRM.
Westcoast Military Radio Collectors Net: Meets Saturday evenings at 2130 (PT) on 3980 + or - QRM. Net control is Dennis, W7QHO.
Gray Hair Net: The oldest (or one of the oldest - 44+ years) 160 meter AM nets. It meets on Tuesday nights on 1945 at 8:00 PM EST & 8:30 EDT. http://www.crompton.com/grayhair
Vintage SSB Net: Net control is Andy, WB0SNF. The Net meets on 14.293 at 1900Z Sunday and is followed by the New Heathkit Net at about 2030Z on the same freq. Net control is Don, WB6LRG.
Collins Collectors Association Nets: Technical and swap session each Sunday, 14.263 MHz, 2000Z, is a long-established net run by call areas. Informal ragchew nets meet on Tuesday nights on 3805 at 2100 Eastern and on Thursday nights on 3875. West Coast 75M net that takes place on 3895 at 2000 Pacific Time.
Collins Swap and Shop Net: Meets every Tuesday at 8PM EST on 3955. Net control is Ed, WA3AMI.
Collins Collector Association Monthly AM Night: The first Wed. of each month on 3885 kHz starting at 2000 CST (0200 UTC).
Drake Users Net: This group gets together on 3865 Tuesday nights at 8 PM ET. Net controls are Criss, KB8IZX; Don, W8NS; Rob, KE3EE and Huey, KD3UI.
Swan Users Net: This group meets on 14.250 Sunday afternoons at 4 PM CT. The net control is usually Dean, WA9AZK.
Nostalgia/Hi-Fi Net: Meets on Fridays at 7 PM PT on 1930. This net was started in 1978.
K1JCL 6-Meter AM Repeater: Located in Connecticut it operates on 50.4 in and 50.5 out.
JA AM Net: 14.190 at 0100 UTC, Saturdays and Sundays. Stan Tajima, JA1DNQ is net control.
Fort Wayne Area 6-Meter AM Net: Meets nightly at 7 PM ET on 50.58 MHz. This net has been meeting since the late '50's. Most members are using vintage or homebrew gear.
Southern Calif. Sunday Morning 6 Meter AM Net: 10 AM Sundays on 50.4. NC is Will, AA6DD.
Old Buzzards Net: Meets daily at 10 AM Local time on 3945. This is an informal net in the New England area. Net hosts are George, W1GAC and Paul, W1ECO.
Canadian Boatanchor Net: Meets Saturday afternoons, 3:00 PM EST on 3745.
Midwest Classic Radio Net: Sat. mornings on 3885 at 8AM Central time. Only AM checkins allowed. Swap/sale, hamfest info and technical help are frequent topics. NC is Rob, WA9ZTY.
Boatanchors CW Group: 3546.5, 7050, 7147, 10120, 14050. 80 on winter nights, 40 on summer nights, 30 and 20 meters daytime. Nightly "net" usually around 0200-0400 GMT. Listen for stations calling CQ BA, CQ GB.
Wireless Set No. 19 Net: Meets the second Sunday of every month on 7.175 +/- 25 kHz at 1900Z (3760 +/- 25 kHz alternate). Net control is Dave, VA3ORP.
Hallicrafters Collectors Assoc. Net: Sundays, 1730-1845 UTC on 14.293. Net control varies. Midwest net on Sat. on 7280 at 1700 UTC. Net control Jim, WB8DML. Pacific Northwest net on Sundays at 22:00 UTC on 7220. Net control is Dennis, VE7DH.
Nets that are underlined are new or have changed times or frequency since the last issue.

The Story of Two Radios

The end of one and the beginning of another...

by Bruce Vaughan, NR5Q
504 Maple Drive
Springdale, AR 72764

Of all things made by the genius and hand of humans, the regenerative receiver must be one of the most remarkable. Elegant in its simplicity and nervous in temperament, it responds to the hand of the builder and operator more like a fine violin than a piece of engineering.
Barry Kirkwood, PhD, ZL1DD

Part 2

I have built my favorite regenerative circuit so many, many times that I seldom need refer to either a schematic or a handbook while building. Still, when a final check of the wiring is made a schematic can be of value. I find nothing quicker or more accurate for that final check before applying power than marking off each component and its associated connections using a 'highlighter' on a fresh schematic diagram-one with no other markings on it.

I do not remember ever building a set exactly like a schematic. I make small changes as I progress with the wiring and with the troubleshooting. How then, can I furnish readers, the ER Editor, or myself with a schematic? Last month I discovered a computer program, written by a fellow ham, that makes this job much easier. The program is called 'Klunky.' Best of all, this is a free program and can be downloaded from this site: http://butler.QRP.com/~WD9EYB/klunky/

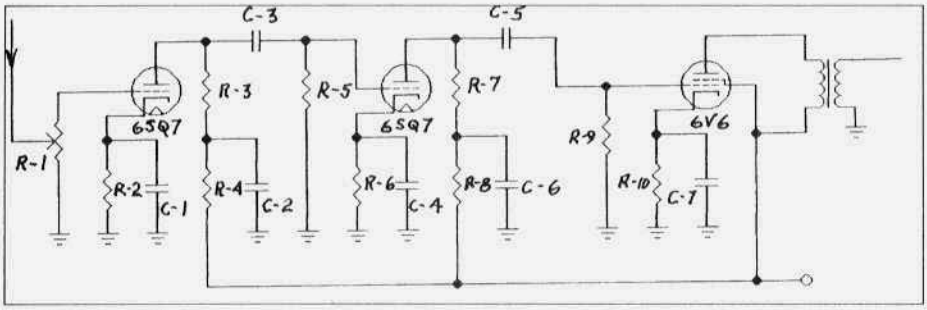
I think you will find the program easy to use and ideal for simple schematics. It is not designed for those schematics that involve hundreds of parts. I have attached two schematics of my receiver drawn with 'Klunky.' One schematic is for the 6J5 detector circuit, and the other is for the audio stages.

Occasionally you may encounter a little frustration while doing a 'Klunky' schematic. This is especially true if you try to place components too closely together. On both schematics I found it necessary to draw in a line or two that 'Klunky' simply refused to put where I needed it. Overall, the program is great. I can draw schematics now in a fraction of the time needed to do the job with my drafting tools-and the finished product looks much better.

How does 'Klunky' work? When you go into the program you will see a screen split horizontally into two equal sections. The upper section has small squares, each containing one schematic symbol-a fixed capacitor, variable capacitor, resistor, inductance, tube base, etc. The lower half of the screen is totally blank. This is your drawing board.

To insert a symbol, simply click on it. For example, click on a triode tube base, then move your cursor to the lower screen and hold the arrow where you want to place the base-one click and the base is there. Now if you want to attach a capacitor to the grid, click on the capacitor in the upper screen and hold your arrow near the grid of the diagram under construction. Click, and the capacitor symbol attached to the grid appears. Pretty darn neat, huh? It took me about 15 minutes to draw the detector circuit shown.

Let's discuss the schematics—first the 6J5 detector. You notice that I left out



Audio Amplifier

the antenna capacitor. If you are using some sort of swinging link or variable coupling then you do not need a capacitor in the antenna lead. If you choose to use a fixed antenna winding then by all means insert a variable capacitor of 35/50 pF between the antenna post and the top of the L-1 winding.

The values for the grid leak (R-1, and C-3) are not as critical as once thought. In the early days of radio, builders and experimenters thought of the grid leak as almost magical-something akin to the 'hot spot' imagined to be lurking somewhere in a hunk of Galena. I use a resistance of around 4 megohms-4.7 meg if I have such in my possession. A 100-pF capacitor works well at C-3. However, I have used everything from 25 pF up to 100 pF with good results.

Resistance values for R-4, R-6, and R-2 are determined by the VR tube you choose to use, and by your plate supply voltage. Suppose I give you a good starting place. I measured resistances in one of my better radios that employs a 150-volt regulator, (VR-150, OD3) and a power supply that delivers a solid 280 volts DC. Resistances measure as follows: R-2-25K, R-4-150K, R-5-2200, and R-6-25K. I used a 5-watt resistor for both R-5 and R-6. I like my sets to run cool. R-3, the volume control is a 1/2 meg audio taper. Tweaking of one or more of these resistances may be needed for optimum results.

Now to the audio amplifier circuit. R-1, the volume control (shown as R-3 in the detector schematic) is a Radio Shack 1/2 meg, audio taper control. Capacitors C-1, C-2, C-4, C-6, and C-7, are all 8 mFd. 250 volt, caps. That happened to be what I had available. I have used everything from 2 mFd up to 16 mFd, depending upon my stock on hand. Coupling capacitors, C-3, and C-5 are anything from .01 to .05.

R-3, R-4, R-7, and R-8 are 47K, 1 watt, R-10 is 390 ohms. R-5, and R-9 are 1/2 meg. R-2, and R-6, are 1000 ohms.

For what it is worth, those are the resistances used in the set under measurement. The resistances in the converted National receiver will be close but I will need to change R-4, and R-6 to adjust for the lower plate supply voltage.

I have not shown filament bypass capacitors. I use .01 ceramics and bypass the filament leads. You may get away with grounding one lead of a filament transformer, and running one filament lead. I have never been able to do so successfully in a regenerative circuit. I find a 6-volt, center tapped, transformer with CT grounded, and both six volt leads twisted and kept close to the chassis will normally result in a lower hum level in regenerative receivers. I think that about covers the values for the schematics.

My first attempt, the one I just removed with solder wick, used a SPDT switch in the antenna circuit so that I could choose an antenna input to either the swinging antenna link I have be-

continued next page

came so fond of, or a conventional coil with antenna winding. It seemed to me there was some loss in sensitivity. Perhaps it was my imagination, but I elected, at least for the present time, to do away with anything that could present a resistance to the weak amount of RF entering the detector.

But what about the room required for the swinging link gadget. The very best placement for the antenna link left me no choice other than the adjustment knob would be out the rear of the set. This negates my using the link to 'fine-tune' SSB signals-one of the advantages of the unit. I considered my reason for building this project and it's probable future use.

About five years ago I build two CW rigs using 1938 technology. They both end up in a pair of PP 807's. Since building them I have wanted to construct a companion piece—a receiver to go with them. My plans are to put one on the air and see if I can WAS without the luxury of a VFO. Back in 1938 when I was first licensed, VFO's were as rare then as courtesy in a 20 meter DX pileup is today.

So...SSB reception is of little importance to me in this receiver. The antenna link is mostly adjusted for band conditions-and to tune out the megawatt commercial stations that splatter all over after darkness. The slight inconvenience of a back adjustment would have to be tolerated.

I have not regretted my decision. Now the detector is well shielded and I have found the inconvenience to be negligible.

I was concerned that the 190 volts supply voltage I ended up with might be on the low side. It turned out to be very near ideal.

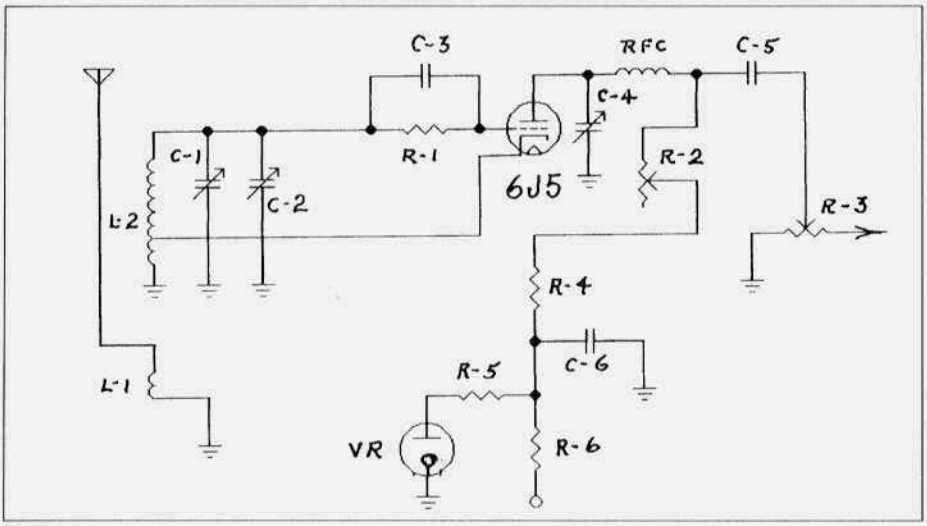
I've found that even slight differences in receivers, those using identical circuits, will result in a small difference in the ideal detector plate voltage. My last receiver using the same 6J5 detector preferred a voltage of 16 volts. This one seems to like about three volts more. It reaches its peak sensitivity and smoothest regeneration when I use 19 volts on the plate. This is the reason I am reluctant to assign resistor values on plate resistors. Use of a 25K (variable resistance in the plate line is highly recommended. Tweak other resistances to work with your particular detector and VR tubes.

Where do I find coil forms? I buy 1-1/4" PVC pipe in ten-foot lengths at my home supply store. I cut this into 3-inch lengths and square the ends on my sander. Then I take inoperative 4, 5, 6, or 7 pin glass tubes and saw the base off leaving about 1/4 inch of 'bakelite' or whatever above the pins. File the base clean and use a solvent to remove any dust or oil. Use a good contact cement to attach the PVC to the tube base. I prefer these coil forms to the old National and Bud forms.

Why did the second version of this receiver turn out well when the first one was so terrible? Parts layout is the only logical conclusion. I've found it very important to keep leads short-especially those in RF and detector circuits. In the first attempt, I made far too many concessions to accommodate existing holes and dividers. Parts layout should be such that all components of the detector are in close proximity to each other.

Now that the set was working I proceeded to the calibration markings. My first step was to have copies made of the blank calibration dial that came with the National ACN. I had the copy shop make them on a medium light card stock paper. After trimming to an exact fit-very little trimming was needed—I attached the paper over the present metal dial.

I found I could cover everything with three coils, coil 'A' covers 30 and 40, coil 'B' covers 18 and 20, and coil 'C' the 15-meter band. I have little need of 80 because of my noisy location. I have not



6J5 Detector

tried to push the set up above 15 meters, as the efficiency would be less than acceptable.

The set was placed alongside my Kenwood and the dial calibrated by zero beating the regen against the Kenwood. I marked the dial with a pencil as each band and WWV was calibrated. When calibration was complete I placed the pencil marked dial on top of a fresh copy being careful to keep them in exact register. I used a large needle to stick thru the marked copy and into the fresh copy. Then, the dial was carefully marked with a black ink felt tip pen. Lettering was done on the computer, cut out, and pasted onto the copy. After all was complete, I made another trip to the copy shop and had more copies made. The CW portion of each band is marked out with a different color magic marker.

After all the construction was complete, I wired up the crystal marker. It was calibrated against WWV. Now, when I turn on my latest receiver all I need do is check the low end of the band against my marker and I can read calibration well enough for serious ham usage.

This time the receiver works fine-very few bugs and practically no tweaking. At the present I have one unsolved problem-and it is so minor I may let it remain unsolved. I have a slight amount of induced hum on the 20-meter band. Difficult to hear when listening to a signal, but it is there. The ARRL handbook tells us that this is something to be expected and normal with this type of circuit-yet I have a number of sets that do not exhibit any hum at all. It is probably due to placement of parts. I added a hum-bucking variable resistor to the filament leads and it helped.

For newcomers' information, a humbucker is nothing but a low resistance pot with each side connected to a filament lead, and the CT to ground. A 5 to 10 watt, wire wound, 20 to 50 ohm control is ideal.

Properly built this simple receiver will amaze you. I sometimes turn on my Kenwood 930 and find that the bands are in poor condition-just a few sigs coming thru on 20, for example. When this happens I often turn on one of the regens and see if I can hear anything. Normally, I hear about as much on the regen as I do on the Kenwood-though

continued on next page

the Kenwood is far better on selectivity and holds weak DX with less fading.

This circuit is as foolproof as any I have encountered in almost 70 years of building radios. If you have the urge to build a usable ham receiver try it. It will work just as well as you build it—no better.

If you are considering a first building project I'll bet you are wondering, "What can I honestly expect from this circuit if I build it sturdy, use good parts, and follow good construction practice?"

On practically any day you can expect good readable signals on twenty. Now, when the cycle is good, those signals—especially European DX—should be pounding in until all hours. Unfortunately, daytime CW activity on 40 is much less than it was years ago. I find 40 alive in early morning hours and late afternoon hours. By dark, the 40-meter BC stations are a pain. But let's talk about 20. You should be able to tune in several countries with ease and with loudspeaker volume to spare. Selectivity is good enough that on contest weekends I am often able to separate and identify over 40 stations between 14,000 and 14,060 KHz. To do this it is necessary to use the audio filter built in between my ears.

You should expect a readout to within at least 10 Khz even when using inexpensive vernier dials. With care this can be reduced to 5 KHz. Regeneration should be silky smooth with no hand capacity at all. The CW notes should have a very pleasant sound-better than the normal transceiver. Drift should be similar to most boat anchor receivers. You may experience some spill-over from the megawatt propaganda stations that clutter up forty and vicinity. A cheap antenna tuner or simple homebuilt wave trap can help a lot if this is a problem.

So the receiver works good on 20 meters-what kind of reception can I expect on other bands? If 40 meter signals are present on any receiver, you will do well. It is a pleasure to use on 30 meters, and is very acceptable on 17 meters. Don't expect too much on frequencies above 21 MHz.

I am located next door to a very large hospital and medical complex. A noise level of S4 to S5 eliminates most of my operation on the 80 meter band-an honest evaluation of operation on this band is not possible. I can tell you this on 80 expect to use the 'band-set' capacitor for tuning as the small 'bandspread' capacitor covers only a small portion of the band.

I have an idea that many readers are thinking-so what? You have spent a lot of hours building a receiver that may have been 'hot stuff' sixty-five years ago, but today it is only an interesting piece of history. You are quite correct. Ham Radio is a great big diverse hobby. If you enjoy looking at three full pages of ragchews in the station log more than listening to a radio you built from scratch, more power to you. I have no compelling arguments to offer in defense of building old radios. All I can tell you is that the thrill of listening to a home built receiver is one that for many of us never ends. Each new building project is like discovering ham radio all over again.

As usual, letters, questions, pictures, brickbats, or a friendly exchange of ideas are welcome. I make an effort to answer all e-mail promptly. Replies to snail mail (CBA) may take a few days. E-mail to NR5Q@AOL.COM **ER**

Addendum

Because coil winding is so beautifully simple for this little receiver I forgot to make mention of it in the article. Please deliver me from those articles that imply the antenna coil must be wound with #28.75 double silk covered wire-magnolia leaf green color, and that the grid winding must be #32 triple

enameled wire coated with a wax made from Monarch butterfly wings, and spaced exactly .86 inches above the antenna winding. In my sixty plus years of building I've found that coil winding is not all that critical. True, accurately wound coils work much better, but there is a reasonable degree of tolerance.

For simplicity, I use #22 tinned bus* available for four bucks a roll from Antique Electronic Supply**. I wind my coils with the antenna winding on the bottom. For 15 meters down through 30 meters, I use about 1-3/4 turns.

I space my grid winding about 1/4 inch above the antenna winding. I use a simple mental rule of thumb—7 turns for 20 meters. 40 meters should take about two times that, or 14 turns, and it does. 15 or 17 meters should require fewer turns, and it does. I think you will find that five turns will do nicely.

What about the tap on the grid winding? This should be placed up from the ground or bottom end of the coil—1 1/2 turns appear to work well for the higher frequencies, 2 turns for 40 meters, and 4 turns for 80 meters. You will soon know if you have the tap in the correct place. If the set refuses to go into regeneration the tap is too low-if it goes in with a 'thud' it is too high. When the tap is correctly placed, regeneration should be silky smooth.

As with any regeneration receiver, both windings should be wound in the same direction. That's it. With experience, you will be able to wind a coil for this receiver in about fifteen minutes. When the coils are 'finalized' I coat them with one coat of plain old Radio Service Cement. I prefer it to coil dope. It too is available from good ol' Antique Electronic Supply.

* Wire, Bus, #22, 100 ft. spool, $3.95. Solid tinned copper bus wire.

**Antique Electronic Supply, 6221 S. Maple Ave., Tempe, AZ 85283

An AGC Amplifier from page 14

filament supply to the AGC Voltage line as a common-mode signal generator while monitoring the output with a sensitive AC voltmeter. With the jumper capacitor in place, the compression balance control, COMP. BALANCE, is adjusted for a null on the voltmeter. Another, more realistic, method is to connect a sensitive DC voltmeter to the output and feed the AGC amplifier from its usual microphone source. COMP. BALANCE is adjusted so that strong voice peaks result in neither a positive nor a negative deflection of the DC voltmeter. The RECOVERY TIME control, R37, is set to minimum to enhance the effect of the voice peaks.

Conclusion

Audio compression is an essential element of AM operation with vintage gear. Not only does it maintain close to 100% modulation, it also prevents overmodulation and splatter, making AMer's good neighbors on our crowded bands. This AGC amplifier, by assuring a constant average station audio level, is the first step toward realizing those goals. With its easy-to-build vacuum-tube technology, it is an ideal experimental platform for examining the common compression effects of recovery time and gain-reduction threshold on overall station audio. It isn't the whole story, of course. It needs to be followed by a fast limiting amplifier and, perhaps, a clipper with its associated filter. Those units are each worthy of an entire, separate article. ER

(1) Tonne, J. L. (1956, September). Compression and Clipping. QST, Vol.XL No.9, pp. 34-39

Clatternet: 850 shift RTTY roundtable, on 10137 kcs USB Saturday, starts 0930-1000 Pacific time.

How to Repair a Receiver
Part 3

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IF and BFO alignment

You should start by aligning the IF amplifier stages. What you will be doing here is to peak the response of all of the IF transformers at the nominal IF frequency of the receiver. Attach your signal generator through a 0.01 microfarad, 400 volt capacitor to the signal grid of the mixer tube (point IF) as described earlier in the Applying Power section. Tune your receiver to a frequency at the low end of its lowest tuning range where there is no on-air signal. Set the signal generator to the receiver's nominal IF frequency and turn its modulation on. Attach your VOM/VTVM to a source of audio output (point AO), either across the speaker or the headphones output jack and set it to a low AC volts scale. You will be peaking the IF stages on the meter and listening to what's going on as well. Set the receiver selectivity to its broadest position, turn off the crystal filter if there is one off, turn the AVC off, set the RF gain full on, and set the audio gain as needed for adequate deflection on your meter. Back off the signal generator output until the IF stages come out of saturation, as indicated by the output meter rising and falling as you change the signal generator output level. Now adjust the trimmer capacitors or coil slugs on each IF transformer (L1 through L6 on the NC-57) for maximum output as registered on your meter. I usually start with the input transformer between the mixer and the first IF stage and proceed through the output transformer on the last IF stage. You may need to reduce the signal generator output in this process to keep the IF stages out of saturation. You should go through the sequence several times as the adjustments may react with one another.

As I mentioned earlier, if you happen to get a receiver like my EC1 with its IF so badly misaligned that you cannot hear the signal generator at the nominal IF frequency, start by setting the generator to a frequency where it can be heard and peak all of the stages there. Then move the generator frequency closer to the nominal frequency but not so far that you can't hear it and repeat peaking the stages at that frequency. It may take several steps, but you will eventually walk the alignment over to the proper frequency.

Once you have made these adjustments you are finished unless your receiver has a crystal filter, and you can jump down to the BFO alignment in the next paragraph. If you have a filter, turn it on to its most selective position, turn the signal generator modulation off, turn the receiver bfo on and adjust it for a comfortable tone, and then very carefully adjust the signal generator frequency for the peak frequency of the filter. You will hear a peak and see it on the audio output meter. Once you have the generator set to the peak frequency, turn the filter off and readjust the IF transformer trimmers or slugs for maximum output.

Finally, with the signal generator at this same filter peak frequency or at the nominal IF frequency if there is no filter, set the BFO pitch control on the

front panel to zero or to its mid-range position and then adjust the bfo trimmer or slug in the bfo transformer (L7 slug in the NC-57) for zero beat. Now you have completed the IF alignment and you are ready to proceed to align the RF amplifier and mixer stages.

RF alignment

In this section you are going to adjust the local oscillator so that the receiver calibration is correct at frequencies close to the top and bottom of each of the bands the receiver tunes. You will also peak the mixer and the RF amplifier stage tuned circuits for maximum signal at these same frequencies. Once that has been done, the "tracking" designed into these tuned circuits will keep the calibration and gain close to optimum across the entire band. You want to adjust the calibration to be correct after the receiver has gone through its warm-up drift, so it is best to start this alignment procedure after the receiver has been warming up for a half hour or more.

Attach the signal generator to the antenna terminal (point RF). Many manuals specify that a resistor or some other components be connected between the signal generator lead and the antenna input, for example a 300 ohm resistor. Attach the ground side of the signal generator to the receiver ground terminal. If your receiver has two, "doublet" antenna terminals like the NC-57, make sure that the one nearer the ground terminal is connected to the ground terminal. As with the IF alignment, attach your VOM/VTVM to a source of audio (point AO) and set it to a low AC volts scale. Set the receiver selectivity to its broadest position, turn off the crystal filter if there is one, turn the AVC off, set the RF gain full on, and set the audio gain as needed for adequate deflection on your meter. If your receiver has a bandspread capacitor, set it all the way open, that is for minimum capacitance. If your receiver has a front panel "Antenna Trimmer," set it so that its capacitor is half way closed.

Start with the lowest frequency band. Set the signal generator to a frequency near the top of the band and turn its modulation on. Tune in the signal on your radio. Adjust the signal generator output level as you did in your IF alignment until the receiver is out of saturation. If the radio tuning dial indicates a frequency different from the one the generator is set to, adjust the local oscillator padder capacitor associated with that band until the signal comes in on the proper frequency. The padder is the capacitor that is in parallel with the local oscillator coil, marked "LO,P" for the E band in the NC-57. I usually start with the receiver tuned to the signal generator, then offset the tuning a small amount in the direction that I need to go to correct the calibration so that I can still hear the signal, and then adjust the padder until the signal comes into tune on that new frequency. Several steps like this get me to the desired calibration point. Next adjust the padder capacitors on the mixer input tuned circuit (M,P) and the RF stage input tuned circuit (not present in the NC-57) for maximum output. Once again, the padder capacitors are the ones in parallel with their respective coils. (When you repeat this procedure on the higher frequency bands you may find that the mixer adjustment detunes the receiver somewhat. You will need to keep one hand on the tuning knob to keep the signal tuned in while you adjust the mixer padder for maximum signal strength if this is the case. I usually set the Main Tuning capacitor to a little higher frequency and then tune in the signal with the Bandspread capacitor when I'm peaking the mixer, because it is easier to keep the signal tuned in using the bandspread capacitor. Having peaked the mixer, go back if necessary and reset the local oscillator for correct calibration.)

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Once you have set the calibration at the high end of the band, reset the signal generator to a frequency near the low end of the band. If the tuning dial indicates a frequency different from the one the generator is set to, adjust the local oscillator trimmer capacitor (in series with the coil) or the slug in the local oscillator coil (LO,L) so that the signal comes in at the correct frequency. You may want to use the same technique of starting with the receiver tuned to the signal generator and walking the tuning toward the correct calibration point that I described above. Next adjust the trimmer capacitors or coil slugs on the mixer (M, L) and RF (RF, L) amplifier stages for maximum output.

You may think that you are finished, having adjusted the calibration and gain at both the top and the bottom of the band, but you are probably not. The top and bottom frequency adjustments usually interact with one another to some extent, so you will need to go back through them several times before they are both correct. Reset the signal generator to the high frequency end of the band again and trim up the oscillator, mixer and RF stage adjustments up there. After that, reset the generator to the low frequency end of the band and readjust the trimmers or slugs for proper calibration and maximum output down there again. You will have to bounce back and forth between the high end and low end adjustments several times, and eventually you will converge on a set of adjustments that give you correct calibration and maximum output on both ends of the scale.

Once you have the lowest frequency band aligned, switch through the higher bands in succession and repeat the alignment process on each of them.

Note that some receivers, in particular the less expensive and mid-range ones, may not have all of the trimmer capacitors or coil slugs I refer to above. Almost all decent receivers have at least the high frequency set of padders for the local oscillator and mixer stages, but some of them just leave the low frequency calibration to the goodness, or lack thereof, of the local oscillator coil as wound in the factory. And, like the NC-57, they rely on the front panel Antenna Trimmer control to peak the RF amplifier wherever the receiver may be tuned.

Once you have gotten the knack of RF alignment by your adjustments on the lowest frequency band, all you have to do is repeat the procedure on each of the higher frequency bands. You do exactly the same thing, setting the local oscillator for correct calibration near the high end of the band and peaking the mixer and RF amplifier there, and then resetting for proper calibration and peak output near the low end of the band.

There will come a point, certainly on the highest frequency band and perhaps on one or two below it, where the receiver "image" becomes important. As mentioned earlier, the receiver local oscillator will be either above or below the desired signal frequency by an amount equal to the IF frequency. On most receivers and bands it is usually higher than the signal frequency, but check your instruction manual to be sure. It is possible for a signal on the "other side" of the local oscillator by an amount equal to the IF frequency also to be mixed down to the IF frequency. This is known as an "image" signal. It is usually well attenuated by the tuned circuits in the mixer and RF amplifier, but as the received frequency goes higher and the percentage difference between the image and the desired frequencies gets smaller, the attenuation of the image decreases to the point where it may be only 10 or 20 decibels (2 to 4 S-units) less than the desired signal. You need to be sure, especially when you are making the adjustments at the high frequency end of a band, that you

are listening to the desired signal rather than to the image signal. If the local oscillator is supposed to be set higher than the desired signal, the usual case, the desired signal will be the lower frequency response on the tuning dial and the image will come in when you tune the receiver to a frequency higher by an amount that is twice the IF amplifier frequency. Be sure to do your calibration and peaking adjustments using the lower frequency response. If on the other hand the local oscillator is supposed to be on the low frequency side of the desired signal, then the image will come in at twice the IF frequency lower on the tuning dial. In this case, you want to make your calibration and peaking adjustments using the higher frequency response.

Once you have completed the RF alignment on all of the bands, you are finished! You have returned your boatanchor receiver to its original, pristine operating condition. It is now ready to use and to enjoy on all the bands. But as you may have suspected from my loquaciousness, I have a few more things to say.

Tips on things to look for

One additional application where a capacitor might make trouble is when it is being used as a coupling capacitor (dc block, AC pass) between the plate of one stage and the grid of the next. If it becomes leaky it will pass a small amount of dc current to the grid circuit causing the bias point to shift in a positive direction. That will make the second stage do all sorts of strange things, from distorting the signal to drawing too much power and running the tube hot.

The mica and ceramic capacitors in a receiver are usually much more reliable than the paper capacitors, but occasionally they do fail. My SX-43 developed a "popping" sound that I would have thought was just an external source of noise except that I didn't hear it on another receiver running right beside it on the same frequency. The culprit turned out to be a 22 picofarad molded mica capacitor wired between the mixer plate and ground. It was bouncing between 22 and 0 pF and causing a pop each time it did. That particular capacitor was one of those parts that you could see but not get to, something of a specialty in Hallicrafters receivers of that era. There was not a soldering iron in the world that could get into the joints on that capacitor without burning holes in several other parts and wires, and I could just barely reach the capacitor leads with my longest, skinniest needle-nosed pliers. I finally just grabbed the leads to the capacitor with those pliers and twisted them until they broke. I replaced the capacitor above the chassis by soldering one lead to a ground lug and twisting the other lead around the plate pin of the mixer tube. It's a little ugly, but it works.

I've leaned pretty heavily above on bad capacitors, but so far I haven't mentioned resistors. The lower power resistors in your receiver are probably "carbon composition" types. Their resistance tends to drift upward with age and use. For most purposes a resistor that is within 20% of its original nominal value is still quite satisfactory, but if all the resistors in your receiver have gone high, as they did in my 60 year old NC-200, the result will be lower voltage on the plates and screens of the RF and IF amplifier stages and correspondingly lower gain. I don't advocate wholesale replacement of either resistors or capacitors in a receiver, but if you notice that the old set just doesn't have the bounce that it used to and all of the tubes test OK you might have a look at the voltages on those tubes. If the screen voltages in particular are drooping, its an indication that you need to replace some resistors or put some new ones in parallel with the old ones to "help them out" as I did with my NC-200 recently.

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You can figure out what value of parallel resistance to put across an existing resistor with the following formula. If R is the desired resistance, R1 is the measured value of the existing resistor (higher than R), and R2 is the resistor you are going to put in parallel with R1 to make the pair equal to R again, then $R2 = R \times R1/(R1 - R)$.

Speaking of that NC-200, it taught me another interesting lesson about 20 years back when I acquired it. It was unstable on several of the higher frequency bands, the local oscillator was really bouncing around. I nearly drove myself nuts looking for a common component that was the cause of the trouble, and that's because it wasn't a single component. It turns out that there were several pink ceramic padder capacitors, the same kind on each of the ranges where the bouncing was occurring, that were unstable. The metal plates in those capacitors were formed by a very thin layer of silver deposited onto the ceramic. Over the years that silver corroded to the point where it no longer was making good contact, hence the frequency instability. It was not one single part that was bad as I first suspected, but several parts of the same kind. So if you are having frequency instability, first look for a fixed mica or ceramic capacitor associated with the local oscillator tuned circuit. But don't overlook the possibility that more than one part might be involved.

My next tip is, watch out for sabotage! I've had several instances of things not working because some previous owner "fixed" things for sure. My HQ-180 just wouldn't tune above about 23 mc on the highest band when I first tried to align it. It turned out that some goofball had put a fixed mica capacitor across the local oscillator section of the bandswitch associated with that range. My RME-70 had the B+ feed to the local oscillator rearranged so that the tube plate was just one, 20 ohm resistor away from a very good bypass capacitor to ground! The sensitivity was absolutely miserable on the two highest ranges until I checked and corrected that bit of creative wiring. My RME 69 had a nagging hum, especially on 10 meters CW. I replaced the local oscillator tube several times until I found one that did the best job, but that darned hum was still there. One day after living with it for a couple of years I decided to have a look at the power supply filter capacitors, only to find out that they weren't there! The previous owner had removed them and never replaced them. Once I put new filters in, the hum went away. My S-20R behaved strangely on 20 meters. In addition to the amateur signals that were supposed to be there, another set of signals was coming in as well and they weren't images. It was almost as though there were a second local oscillator running in the receiver. Sure enough there was, it was the RF stage that was oscillating because a previous owner had removed the screen bypass capacitor and neglected to replace it. Once I put a new one in, the old Sky Champion settled down and worked like it should.

This is not to say that all modifications that you may encounter are bad. I upgraded the HRO-50 that I've had since 1950 several times. It has a fancy crystal calibrator, mechanical filters and a Collins 75A-4 style T-notch in the IF as well as another IF stage to make up for the filter loss, a product detector and an RF derived AVC system and noise limiter that I borrowed from the NC-303, and regulated filament voltage on the bfo, local oscillator and mixer. And it works very well, thank you. But do look around for modifications and missing parts when something isn't working right. They've bitten me several times.

Dirt can do strange things to a receiver. My SX-43 had a short from the stator plates of the bandspread capacitor to ground that was caused by some

conductive crud on the insulator holding those plates. It did the strangest things - basically it would work only on the bands where the bandswitch cut out that particular section of the bandspread capacitor. I finally realized what was happening while I was sitting at a wedding on a Saturday afternoon.

The HRO-50T1 and perhaps also the HRO-60 comes complete with a paper bypass capacitor from one of the rectifier plates to ground. When that capacitor shorts out, it shorts half the secondary of the power transformer! Naturally that causes the transformer to lose hermeticity and to release its smoke. My HRO-50 has gotten along for 50 years just fine without that bypass, and I strongly recommend that if you acquire a 50T1 or 60 or any other receiver with a paper bypass capacitor on the HV secondary that you remove it immediately if not sooner.

Many receivers have capacitors bypassing both sides of the AC power line to chassis ground. That was probably put in to keep stray RF from entering the receiver via the AC line, but it can also make the receiver chassis hot to ground especially as the capacitors get older and leaky. Because I run many of my radios in my garage where I have a ground fault breaker on the power line that does not like "leakage" to ground, I regularly disconnect such power line bypasses. So far none of my receivers has suffered from the omission. You might get away with keeping them if you are on a power line that does not use a ground fault breaker and if you wire all of the chassis in your shack together and to ground. But watch out for them, they could be trouble.

Some receivers, primarily from the prewar era (the BIG one, son), use an electrodynamic speaker with a powered field magnet coil instead of a permanent magnet. You can tell these guys because there are four wires going to them instead of the usual two. The field magnet coil usually derives its source of current by acting as the choke coil in the power supply filter. New electrodynamic speakers are almost impossible to find. Should you have to replace one you can certainly use a permanent magnet speaker, but you will have to find something else to do the job of the filter choke. AES and Fair Radio among others (see below) still supply filter chokes. If there is room to fit one in, it is the best solution. If there is no room for a choke, I'd suggest using a resistor. Something around 200 ohms, 5 watts for a lower power receiver or 100 ohms, 10 watts for a receiver with a push-pull audio output stage should be sufficient. You may also want to increase the size of the power supply's output filter capacitor as well to keep the hum in check.

Speaking of speakers, it is possible to fix a rip in a speaker cone. I just put a little "airplane" glue on a small tear. That usually keeps it from getting any worse at the expense of somewhat more tinny sounding audio. A badly damaged speaker cone can be replaced, something you might want to consider if you can't find an appropriate replacement speaker. Check out the Professional Loudspeaker Reconers of America at http://www.recone.com. I have no personal experience with them, but one of the Boatanchor Reflector members has reported a good experience with their representative in Fort Wayne, Indiana.

I've run across one case of a dead S-meter in an SX-73 that I was able to fix. I'm not much of a meter mechanic, so I went looking at my local electronic surplus (junk) store for another meter by the same manufacturer, Simpson, that had a movement that would fit into the dead meter's case. It really wasn't too hard to find. Most meter manufacturers make common movements that fit into several different round and square cases that they are building, rather like making the same insides for a variety of

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wrist watches. I switched the S-meter scale for the milliamp scale and then transplanted the good movement into the S-meter shell. The SX-73 is now reporting signal strength with the best of them.

Beyond repairs, other things you might (not) want to do

Older radios are more likely to develop problems, like shorted capacitors for example, which have the potential of causing other serious damage to other parts. It is a good idea to install a fuse or two for protection. One place for a fuse is, of course, in series with one side of the AC line. I'd suggest you put it in the hot, ungrounded side of the line and that you use a polarized plug (see AC/DC receivers above) so that you don't wind up with a hot chassis if the fuse blows. You can estimate the current rating for your AC line fuse by the power rating for your receiver. For example, my Echophone EC1 is rated at 48 watts. Current equals Power divide by voltage, so it should draw 48/120 = 0.4 amperes. To avoid false blows due to warm up, I would use a 1 ampere fuse, perhaps even a "Slo-Blo" type. Another place for a fuse is in series with the B+, between the rectifier tube and the filter capacitors. A shorted filter or bypass capacitor can easily destroy a rectifier tube and perhaps even a power transformer. You can measure the current drawn from your rectifier with your VOM if you like. The lowest current fuse available from the AES catalog is rated at 1/4 ampere and will probably be sufficient for this purpose.

Some folks think it is a good idea to replace the rectifier tube with solid state diodes. After all, that tube gets awfully hot and heat makes the receiver drift and accelerates the aging on all of its parts. While this is true, the heat developed by the rectifier is largely because there is a substantial B+ voltage drop across it, perhaps 50 volts, that will almost completely disappear if you replace it with silicon diodes. The result will be higher B+ voltage on every circuit that may do even more mischief than the rectifier tube's heat. If you absolutely must use silicon diodes, put a resistor in series with them, between their common junction and the input to the first filter capacitor, to drop the B+ down to its originally intended value. A good starting resistor to use would be 50 ohms, 2 watts for a 5Y3, 5Z4, 5W4, or 80; 100 ohms, 5 watts for a 5V4; and 170 ohms, 10 watts for a 5U4.2 Also make sure that the peak inverse voltage rating on the silicon diodes is at least three times the rms AC voltage measured from one side of the power transformer's high voltage winding (connected to the rectifier plate) to the grounded center tap.

Many highly reputable people who restore old receivers start off by replacing all of the "paper" bypass capacitors. They don't bother to check them; they just assume that they are either bad or will go bad shortly so they replace them all. I am not one of those people. At this writing I have 24 receivers and transmitters ready to go on the air in my Classic Exchange stations, and I've returned another ten or so receivers to operating condition beyond that. In all of those receivers, I personally have seen massive, end-of-life failure of the paper capacitor population in only two sets, an SP-600 Super Pro and a war surplus BC-453 "command set." Interestingly, two other BC-454 and BC-455 command set receivers that I use along with the BC-453 still have all of their original capacitors, and the BC453 replacement parts that came from another, junked command set receiver are all working fine. So I cannot conclude that all command set paper capacitors are reaching the end of their life, but rather only that my BC-453 must have been built with a substandard batch of capacitors. Also I have among many others a National FB-7, vintage 1933, and a

Hallicrafters SX-28A, vintage 1945, that both have all of their original paper capacitors, and they are still working fine.

There are only three receivers that I would recommend for a wholesale replacement of paper capacitors, the Hammarlund SP-600 Super Pro, the military surplus BC-348, and to some extent the Hallicrafters SX-42. In the SP-600, the original "paper" capacitors are round, black, molded plastic jobs with color-code stripes. Every one of them failed in my SP-600 over the span of about 2 years after I acquired it, and I have heard similar stories from other Super Pro owners. The BC-348 uses box-shaped, black molded capacitors that are also notorious for shorting out. If you are going to operate your BC-348 as opposed to making it a museum piece, replace all of those capacitors. The Hallicrafters SX-42 switches out one of its RF amplifier stages below band 3, and that makes B+ appear on its bandswitch. If one of the bypass capacitors associated with that RF stage shorts, the bandswitch is likely to get fried and it is nearly impossible to replace. Several good, SX-42 mechanics on the Boatanchors reflector recommend replacing all of the paper capacitors in that receiver at the start. The next time I get into my SX-42, I am going to replace at least the paper capacitors associated with that bandswitched stage and I will install a fuse in the B+ line as recommended above.

Where to find parts

When my friends find out that I keep two dozen old radio transmitters and receivers working and on the air, they always ask me if it isn't hard to find parts for them. Well it really isn't much of a problem so far if you just know where to look. Antique Electronic Supply (AES), whose catalog you will find at http://www.tubesandmore.com/ on the internet offers a complete selection of tubes, resistors, capacitors, transformers and a lot of other things. Fair Radio Sales, with an internet catalog at http://www.fairradio.com/, has a lot of tubes and other spare parts available as well as a giant collection of military and industrial surplus. Their catalog is a great read. I use both AES and Fair regularly and I've always been happy with them.

The following list of parts sources was contributed to the Boatanchor Reflector last February by Ed Sieb, VA3ES. As of this writing all of the listed sites do work, and they look like some pretty good tips.

Here's a place to start your search: http://www.thebizlink.com/am/resou.htm#parts. This is a list of good parts sources. Some of those links don't work, so here are a few others that do work:

Paints, and restoration parts:

ALO Restoration: (Bought former R&R Parts): http://www2.southwind.net/~n0alo/

Cardwell Condenser:

THE Main National, Johnson, Hammarlund parts source; Coils, capacitors, etc. http://www.cardwellcondenser.com/

Daburn Electronics.

Must be seen to be believed! Has everything a BA enthusiast might want. Ceramic parts, Porcelain stuff, insulators, hardware, etc. etc. etc. EXCELLENT! http://www.daburn.com/~daburn/

RF Parts Co. — transmitting parts: capacitors, coils, tubes Good Source. http://www.rfparts.com/

Murphy's Surplus — Another good source of "stuff": http://www.maxpages.com/murphyjunk

SBE Electronics - these people make the Orange Drop(r) capacitors!! http://www.sbelectronics.com/

Hammond Corp.

Transformers, Cabinets Has a line of "Classic" transformers http://www.hammondmfg.com/index.htm

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May 2000 - April 2001
(Issues 133-143)
Compiled by Don Buska, N9OO

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Saga of a Collins KWM-1 from page 3

ance. Unfortunately the 3.1 kc mechanical filter was fused into the plug-in socket. When I finally got it removed to test it in a 75A-4 receiver it was dead. The filter's normally bright chrome case was discolored cobalt blue. Remarkably, the two small roller inductors used in the final stage for tuning and loading would still rotate but their ceramic coil forms may have been damaged from the heat. I tested some of the tubes, many were dead and some only tested marginal; other components were not tested.

I had been searching for the PTO knob and PA cover for a long time and finally found them! The PA cover cleaned up like new but the printed: "DANGER 800 VOLTS" and "DISCONNECT POWER BEFORE REMOVING THIS COVER" were now black instead of the original red! The fire had baked the paint, turning it black! The PTO knob, although sooty, survived with the black anodized finish still intact. The wiring harness insulation was baked to the point of being brittle and would crumble to the touch; the same with other components, resistors, capacitors, etc. Although not a whole lot was salvaged from this radio, I was able to return my KWM-1 to its original condition. Sometimes one man's misfortune can be another's good fortune, in this case mine, in locating the needed parts for my KWM-1! This also reinforces the need to maintain the Electric Radio Parts Unit Directory to keep the old rigs alive. To Quote Barry N6CSW, "Your dead rig can bring other rigs back to life." If Gary had thrown his KWM-1 into the trash I might never have been able to locate the parts to restore mine! ER

(1) Electric Radio, Issue #34 by Mike O'Brien, NØNQL.
(2) The first Fifty Years - A History of the Collins Radio Company and the Collins Division of Rockwell International - reprinted by Electric Radio.
(3) A Pictorial History of Collins Amateur Radio Equipment by Jay H. Miller, KK5IM.
(4) Authors notes.

Electric Radio
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A 1939 Novice

by Chuck Teeters W4MEW
841 Wimbledon Drive
Augusta GA 30909

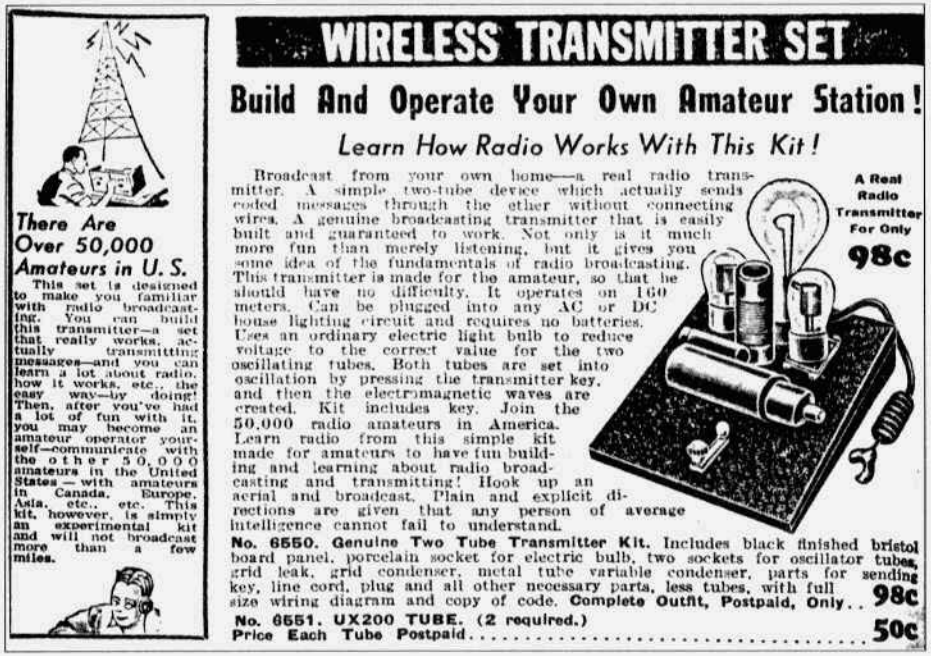
It was the spring of 1951 when I heard WN2OIB calling CQ. I racked my brain trying to remember which of our possessions had a WN prefix. The signal was weak, the keying slow and it chirped a bit. Sure sounded like DX. I knew that Hawaii was KH and Guam was KG. I was pretty sure that they all started with a K but just in case I didn't pass up a rare one, I answered the CQ. Turned out that WN2OIB was a brand new novice in Oceanport, N.J. about 4 miles away. Allen was the first novice I had heard and I had a chance to meet him later at the Fort Monmouth Radio Club. Thinking about that QSO with Allen and his new novice license 50 years ago got me reminiscing about my novice days. It was before FCC Docket 9295, Jan 31, 1951 authorized the novice class license. I believe my novice operation would have been classified by the FCC as illegal and most would have called it bootlegging. Thank goodness not all hams did.

My route to novice operation started in 1939 when my father took a Philco cathedral apart to repair the cabinet and left the chassis and speaker on his basement workbench. I started playing around with it, got shocked, and found I could change the tuning by touching the top of one of the tubes. My next door neighbor, who had some radio smarts, gave me a Johnson Smith & Company catalog that listed crystal sets, headphones, and aerial kits. I sent away for a Little Wonder crystal radio, 89 cents, headphones, $1.79; and an aerial kit, 79 cents. I could listen all night to WKBW on 1480. Their 5000 watts boomed into my headphones.

About this time I met a fellow student at Amherst Central High School, Warren 'Windy' Brenner, who wanted to learn code. He had a Tri-Signal Telegraph outfit, which had a pair of keys and buzzers that could be connected together to send code back and forth. We lived about a mile apart so we decided to run a wire line between our houses. We had just enough wire for a single run so we used a ground return. I would guess that our telegraph line had 100 splices, none of which were soldered. Never could make it work, I guess we had a bit too much resistance.

My family had a wireless phonograph that transmitted record music on 580 kHz to a nearby radio. I found that by connecting the wires from the tri-signal buzzer to the phono pick up wires I could transmit the buzz to the Philco radio on 580 kHz. I hooked the end of our mile long telegraph line to the end of the 3' antenna of the phono oscillator and told Windy to hook his end of our wire to his radio and see if he could hear it. He could so we had a one way CW circuit for practice. I would send to him for 15 minutes and then take the phono oscillator over to his house and he would send back to me. Not a very efficient communications system, somewhat like the 'buzz me Miss Blue' intercom of Amos and Andy, but it sure was good for learning the code and building up the leg muscles. Windy had polio, so I got to do all the running back and forth. We were getting good and had our speed up around 10 wpm when several neighbors asked about our wire and interference to WGR on 550. My Father suspected it was our telegraph stuff so he put an end to our code practice.

The Johnson Smith catalog had a 160 meter wireless transmitter set and my Philco had a "police" band that covered the 160 meter ham band. The catalog said "Build and operate your own Amateur Station with a complete outfit, less tubes, postpaid for 98 cents". The two tubes required, UX200s, were 50 cents



The author's first transmitter

each. The advertisement said it was complete with all necessary parts, including a sending key, line cord and plug. There was not a single word about the FCC or any license being required. The closest they came was in a side bar that said "after you have had a lot of fun with it, you may become an amateur operator yourself—communicate with the other 50,000 amateurs in the United States". I guess they were implying that with this kit you were not a real amateur and more was required, but the meaning didn't get through to me. My $1.98 was in the mail post haste. Apparently product liability was not a big thing in 1939 as Johnson Smith is still in business, no longer in Detroit but in Bradenton, FL.

The transmitter arrived in due time and I was off on my very first construction project. A masonite panel mounted on wooden wedges held 2 four-pin sockets and a lamp socket. As I remember the UX200 filaments were in series with a 100 watt lamp. The two triodes were connected in parallel in a series fed Hartley oscillator. The most ingenious part was the variable condenser. Two 4" sections of metal tubing telescoped inside each other, similar to Johnson neutralizing caps. Friction tape insulated the inner from the outer tubing. The 110 volt AC line was connected directly to the UX200 plates. They called it a self-rectifying oscillator. The raw AC on the oscillator plates must have modulated the signal 200% at 60 hertz. The signal it put out sounded great to Windy and I as it was the same as the buzzer/wireless phono combo.

We now could continue our code practice on 160 meters without bothering any broadcast receivers. We still used our old telegraph line as the interconnection between our houses. Of course it was also an excellent aerial, receiving and transmitting. We were using our initials for calls as we were not sure how you got a call. We were getting

continued next page

good enough that we could send homework answers over our CW circuit now. We practiced almost every afternoon after school. We were planning on getting a second transmitter, as it was very time consuming carrying the transmitter back and forth. Then we could talk back and forth without the 20 minute delay caused by moving the set.

We were in the midst of checking our financial resources and looking for possible parental assistance when a third party joined in. The very authoritative voice of W8SUY came booming out of our speakers. We both heard him asking who we were. I was so surprised by the voice that the only thing I could send was "Chuck". W8SUY said hello Chuck and that his name was Herb. He also asked would I please send my phone number. I managed to send my telephone number. About 15 seconds later the phone rang in the hallway. When I answered the phone I was talking to that same voice that had come from the radio.

Herb and I talked for about 15 minutes, during which time Herb asked about our operation. He offered to help us out as he said our signal sounded like a spark which was not legal, and that we needed licenses. He asked if we could come over to his house, and bring our wireless transmitter. The distance was out of bicycle range, and since Windy couldn't walk very well, I approached my Mother about chauffeuring us. A telephone call the next day, coordinated with my Mother, got us an invite and a ride to W8SUY's QTH.

A real ham shack, with stuff we had never seen before left us speechless. Herb gave us a run through of all his equipment, but the only thing I can remember was his chrome dial Hallicrafters. He took a look at our Johnson Smith transmitter and said it needed a few more parts. If we would leave it for a few days he would see what he could do with it. When I told him about my Philco receiver he told me to twist an insulated wire around the grid caps for feedback to get a tone on CW. He gave us a license manual, a 1935 6th edition from the ARRL, and a 1933 ARRL Handbook to read and study. I still have both. Windy and I left feeling like we had just found the Holy Grail of wireless.

Three days later I got a call from Herb that he and a friend had fixed up our transmitter. If we could come over he would show us how it worked now. Some fast coordination with the transportation department and Windy and I were at Herb's home that evening. One of Herb's friends was there, Ed, W8SJV from nearby Tonawanda. They had made an adapter to fit under a tube in my Philco. They said it would provide DC for our transmitter. Ed and Herb showed me how to connect it to the Philco and how it worked.

Ed explained operating signals like K, AR, SK and some Q signals. They wanted to know if we were studying the license manual, and asked questions. I guess they were satisfied as they said keep it up and in a few months we could go downtown to take the ham test. Herb said keep up the code practice, but quit before 5 PM, and disconnect the telegraph wire antenna.

Windy and I continued our CW practice, with a second Johnson Smith transmitter, modified by Herb and Ed. We studied the license manual aided by tutoring from Herb and Ed. Herb would occasionally break in on us using phone, while Ed would join in on CW. Thankfully school closed for the summer, because our grades were plummeting. In the fall Herb said we were ready to try the test. Exams were given in Buffalo once a month on the 1st Friday. Windy and I were there in December, but nervousness won out over ability. We both failed the code test. Other than our pride the only loss was the notary fee, 25 cents and the streetcar fare, 10 cents.

My parents announced we were going to the New York Worlds Fair. Herb said study and practice code, as I could take the test in New York. So I passed up a day with the Trylon and Perisphere at Flushing Meadows to go to the Federal Building. This time I passed both receiving and sending. I got an OK from the examiner on the written. He said I would receive my license in about 6 weeks. I don't remember much about the Worlds Fair, but I sure can describe the inside of the FCC test room in NYC.

Eight weeks later I became W8WJK. My first legal 160 meter QSO was with Ed and in the evening with Herb. Windy never took the test again that I know of and I lost track of him when I moved from Buffalo. I also lost track of Ed and Herb during the war. I know that Herb changed his call after the war when Western NY became part of the second call area, and is now SK. I never could trace Ed. Herb was a Buick dealer in Buffalo. I never knew what Ed did. He was younger than Herb and probably went off to the war. But I will always remember what Ed said the last time we talked. Ed said anyone who bootlegs on CW deserves a little help. He said someday the FCC will get smart and set aside some frequencies to practice CW. How right he was. ER

How to Repair a Receiver from page 33

Surplus Sales of Nebraska: All kinds of serious parts. Good source. http://www.surplussales.com/

William Ford Surplus. Always an excellent source for both surplus (rigs, etc) and parts. http://www.falls.igs.net/~testequipment/

C & H Sales Inc. Not specifically electronic parts, but is a general surplus dealer. Good catalog, always has some unusual, but useful items. Good source for mechanical parts, hardware, tools, etc. http://www.aaaim.com/CandH/index.htm

Where to find help

Outside of finding a local "Elmer" to help you restore your receiver, the next best thing I can recommend is the bunch of very good people who hang out at the Boatanchors reflector on the Internet. The accumulated wisdom in that group is fantastic. You can join the group by contacting Jack Hill, W4KH, at listown@nanniandjack.com .

Repairing an old receiver is well within the capabilities of any intelligent reader of ER. I started doing it on WN8SBW's Howard 435A as a High School Sophomore in 1954, so it obviously doesn't take overwhelming talent or background. Take the plunge. If you get stuck ask for help. Have patience and be persistent. Your reward will be a feeling of real accomplishment when you've brought that dead junker back to a second life and the enjoyment you'll get using it in your ham shack.

And as a final last word, I want to say thanks to John, "Stuck Knob" MacAulay, ex WN8SWB and now WQ8U, for reading this tomb and making some very good suggestions for improving it, and also for getting me involved with fixing that Howard 435A back in 1953 or so that got me started on all of this insanity. It's been a lot of fun, Mac! ER

1. Big Bath and DeOxit are a "cleaner/degreaser" and a "contact restorer" that are available from Antique Electronic Supply.
2. Thanks to John Sehring, WB0EQ from the Boatanchor Reflector for finding these recommendations in a "Cordover SS Modules Inc paper," vintage early 60's.

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AM'ers Cook Up from page 15

a pristine ARC-5 transmitter – appropriately won by military radio buff W7QHO.

AMI BARBECUE BASH contacts originating from K6CJA on 3870 kHz were made with stations statewide and as far away as Arizona. 3870 is used as the California "AM Window" (despite vigorous and often "creative" SSB interference) rather than 3885 to avoid QRM to Midwest and East Coast AM stations during long skip conditions.

The cookout was notable as being one of the first AM-centric social events in Southern California in quite a long time, but you can bet it won't be the last. There's already talk of a combined Northern/Southern California AM get-together in the works. Perhaps K6CJA summed it up best with a toast that "AM is here to stay!". ER

A complete index of the entire 12 years of ER is available for viewing or downloading at the following website: http://www.qsl.net/n9oo

Editor's Comments from page 1

In years past I've always arrivedat my VFD site (Muley Point in Utah, about 90 miles from here) early on Saturday morning. By noon I've got my gear set up on a table, the antenna erected (an inverted V hung up about 40 feet on a telescoping TV mast) and I'm ready to go. The last couple of years I've taken a DX-100, a Viking II, an HQ-150 and an R-390. I rent a big generator for the weekend. During lulls in the afternoon Shirley and I will set up the tent and get other campsite chores done.

I start on 10M. I'll stayon 10 until late afternoon when I move to 14.286. Every year this has been one of the best places to work a bunch of stations. After 20M activity dies out I'll go to 40 (7290 & 7160). Late in the evening I'll move to 75M. On Sunday morning I start out early about 5:30 on 75 with the Arizona AM'ers. I'll also check in that morning with theColorado Morning Group.

It sounds like a lot of fun doesn't it! N6CSW

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Deadline for the June Issue: June 1

FOR SALE: Repair and restoration on all vintage equipment, 45 years experience. Barney Wooters,W5KSO, 8303 E. Mansfield Ave., Denver, CO 80237. (303) 770-5314

FOR SALE: Radio books, magazines, catalogs, manuals (copies), radios, hifi, parts. Send 2 stamp LSASE. David Crowell, KA1EDP, 40 Briarwood Rd., North Scituate, RI 02857. ka1edp@juno.com

FOR SALE: KWM-2 fan bracket - $12 ppsl. Dave Ishmael, WA6VVI, 2222 Sycamore Ave., Tustin CA 92780. (714) 573-0901.

FOR SALE: New Ranger I, Valiant I, & Navigator plastic dials, freq numbers in green, with all the holes just like orig. - $17.50 ppd. Bruce Kryder, W9LWW, 336 Sliders Knob Ave., Franklin, TN 37067

FOR SALE: Swan 350 w/Swan sply - $175; HW101 w/Heath sply - $175; Hallicrafters SR-46 6M AM - $125. Ken, K8TFD, MI, (734) 453-7658

FOR SALE: HRO-50T, coils A, B, C, D & wood box - $295; Eldico S-119 S-line clone (rx, tx, ps, station ctrl/wattmeter/ph,patch) sw1 & warc stals - $595. Dale, K5AJZ, OK, (918) 596-7778. lestourgeon@webzone.net

FOR SALE: Vintage Radio Service. We repair radios, record changers, radios home, auto, tube & transistors. 1930-1980. Ken Hubbard, KA9WRN, POB 792, Beloit, WI 53512. (608) 362-1896

FOR SALE: Collins S-Line aluminum knob inlays: small (exciter/PA tuning) - $1; 30L-1 - $2; spinner/plain (main tuning) - $3. Charlie, K3ICH, 13192 Pinnacle Lane, Leesburg, VA 20176. (540) 822-5643

FOR SALE: Hallicrafters, RME, Gonset, others. Also some military, test equipment, VHF/RF amps, more. LASE, Don Jeffrey, POB 1164, Monrovia, CA 91017.

FOR SALE: 30 yr accumulation of radios & parts (xcvrs, rcvrs, amps, pwr splys). Call w/wants. Donald Baird, WB7VNC, AZ, (602) 953-0279.

FOR SALE: R.L. Drake repair and reconditioning, most models including TR-7's, 35 years experience. Jeff Covelli, WA8SAJ, (440)951-6406 AFTER 4 PM, wa8saj@ncweb.com

FOR SALE: New Collins winged lapel pin, still have meatball version, either type - $5.95 + 75¢ s/h. W6ZZ, 1362 Via Rancho Prky, Escondido, CA 92029. (760) 747-8710

FOR SALE: Professional Video Sourcebook, third edition - $15 ppsl. Heath Electronics Learning Dictionary - $15 ppsl. Bill Riley, 863 W. 38th Ave., Eugene, OR 97405. (541) 345-2169

FOR SALE: Q meter, Boonton model 190-A w/manual, exc condx, 20 to 260 MHz. L. Gardner, 458 Two Mile Creek Rd., Tonawanda, NY 14150. radiolen@aol.com

NOTICE: T-368 Registry. For info w2zr@aol.com. Subscribe to the T-368 & BC-610 reflector at: http://groups.yahoo.com/group/T-368_BC-610

MESSAGE: Radio Yard Sale. Seventh Annual Spring Blowout. Vintage Radio & communication gear, old test equip, tubes, parts, literature (including Ryders & Sams) and a whole lot more. May 19 & 20, 9AM to 5PM. Rain date May 26 & 27. Jim Koehler, 242 Gay Lombardo Ave., Freeport, NY 11520. (516) 623-0035

FOR SALE: Lots of old radio & related books. Eugene Rippen, WB6SZS, www.muchstuff.com

FOR SALE: 20% - 50% discount on unsold books, courses, magazines and parts. Free list. Bob Eckert, 133 East 7th Street, Clifton, NJ 07011. (973)-340-0529

FOR SALE/TRADE: Transmitting/rcv'g. tubes, new & used. 55¢ LSASE for list. I collect old & unique tubes of any type. **WANTED:** Taylor & Heintz-Kaufman types & lge tubes from the old Eimac line; 152T thru 2000T for display. John H. Walker Jr., 13406 W. 128th Terr., Overland Park, KS 66213. (913) 782-6455, johnh.walker@honeywell.com

FOR TRADE: Two good RCA 833A's for one Taylor 833A; also looking for Taylor 204A, 813, 866B. John H. Walker Jr., 13406 W. 128th Terr., Overland Park, KS 66213. (913) 782-6455, johnh.walker@honeywell.com

FOR SALE: Heavy duty Fairchild playback turntables, 45 & 33 speed. Include Pabst hysteresis motors, large wood bases. One w/Empire playback arm; one w/o arm. Request photo, specs - $300 - $400 ppd. Charles Graham, 4 Fieldwood Dr., Bedford Hills, NY 10507. (914) 666-4523

FOR SALE: Strong steatite antenna insulators. Lengths from two to fifteen inches. SASE for list. John Etter, W2ER, 16 Fairline Dr., East Quogue, NY 11942. (516) 653-5350

WANTED: Globe King 500/A/B/C xmtr. Will pick up anywhere near Chicago. Jim Jorgensen, K9RJ, 1709 Oxnard, Downers Grove, IL 60516. (630) 852-4704. JandRJor@interaccess.com

WANTED: Johnson Desk KW. Scott Freeberg, WA9WFA, (651) 653-2054, scott.freeberg@guidant.com

WANTED: ARC-5 rcvrs, racks, dynomotors. Jim Hebert, 1572 Newman Ave., Lakewood, OH 44107.

WANTED: HRO power supply 697, any condx. Ivan, WA6SWA, POB 248, Reno, NV 89504. (775) 329-7738, idh@cs.unr.edu

WANTED: Millen coil's 74001 or 74002. Mike, w1jz@hotmail.com

WANTED: TCS pwr sply, need not be pretty. Dennis Olmstead, WB9EMD, 431 Ridgewood, Glen Ellyn, IL 60137. phone/fax (877) 469-0531

WANTED: SCR-522 channel selector, controler and cable with connector. Yokohama WW-2 Japanese Military Radio Museum, Takashi Doi, 1-21-4, Minamidai, Seyaku, Yokohama 246 Japan. Fax 011-8145-301-8069, takado@carrot.ocn.ne.jp

WANTED: Old Callbooks, especially those covering the years before 1930. Alan, W3BV, PA, (215) 795-0943 or W3BV@arrl.net

ER Book Sale
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See page 56

Electric Radio Tuning Meter

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FOR SALE: Manuals for old ham gear of the '30s to the '70s. Check WEB Catalog. www.hi-manuals.com

FOR SALE: NOS TCS baseplates still in factory shipping wrap - 2/$15 plus shpg. Carl, KN6AL, POB 3531, Laramie, WY 82071. (307) 742-0711 kn6al@uwyo.edu

FOR SALE: 2001 COLLINS CALENDAR now shipping. 15-months, all color! $14.95 postpaid USA and Canada. Trinity Graphics, 5402 1/2 Morningside, Dallas, TX 75206. www.kk5im.com

FOR SALE/TRADE: Misc. parts, tubes, for tube gear. Sandy Blaize W5TVW, 40460 Edgar Traylor Rd., Hammond, LA 70403. ebjr@i-55.com

FOR SALE: Vintage equipment at the K8CX Ham Gallery Classified Ads section. Visit the largest Antique QSL Card Gallery http://hamgallery.com

FOR SALE: Drake TX-4 - $150; Hallicrafters SX-111 - $175. **WANTED:** Yaesu FL2100. Robert Braza, W1RMB, MA, (508) 222-5553

FOR SALE: Equipment from discontinued museum display. Over 300 items amateur and antique radios plus from early 1900's to 1970's. Send 9x12 SASE ($0.78) for list. Tangier Amateur Radio Shrine Club, 4572 Trail Ridge Rd., Blair, NE 68008. K0GH@arrl.net

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FOR SALE: QST binders, small $5 + $2 shpg; large $6 + $2 shpg. R.J. Eastwick, W2RJE, 400 N. Haddon Ave., Unit 109, Haddonfield, NJ 08033. (856)429-2477

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FOR SALE: Books, all electronics related; 300 titles; SASE. Paul Washa, 4916 Three Points Blvd, Mound, MN 55364. wwtok@email.msn.com

FOR SALE: Build your own "Midget" bug replication by KØYQX, ca 1918, featured by K4TWJ in CQ Magazine, May, '98. 10 detailed blueprints. FAX (507) 345-8626 or e-mail<bugs@mnic.net>

FOR SALE: Parts, tubes, books, ect. Send two stamp SASE or email for list. Wayne LeTourneau, POB 62, Wannaska, MN 56761. wb0cte@arrl.net

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FOR SALE: Hallicrafters HT-44 & PS - $225 + shpg. Ed Sauer, 787 N. Peterman Rd., Greenwood, IN 46142. (317) 881 1483

FOR SALE: E. F. Johnson Viking Thunderbolt amplifier w/orig shipping box. One owner. Charles J. Stinger, W8GFA, (513) 867-0079, w8gfa@aol.com

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

FOR SALE: Tubes, NIB or tested good, priced low. SASE for list. WA7HDL, 167 Hwy 93 S, Salmon, ID 83467

WANTED: Collins – Amateur catalogs, sales literature, manuals, promotional items & Signals. Richard Coyne, POB 2000-200, Mission Viejo, CA 92690.

WANTED: Howard radios of any type. Andy Howard, WA4KCY, 133 Carlbody Rd., Carlton, GA 30116. andy@wa4kcy.com

WANTED: SW3 #33A and #35 coils. I will trade my extra coils SW3 coils. Hank Bredehorst, 2440 Adrian St., Newbury Park, CA 91320. (805) 498-8907

WANTED: Parts for a TMC GPT-750 xmtr. I need the AM modulator deck and other parts to restore this unit. John, KF2JQ (716) 873-0524 jpruss@acsu.buffalo.edu

WANTED: Long wire ants AT101, AT102, GRC-9; DY88/105; PP327/GRC9; counterpoise CP12 & 13 GRC9; BC348 pwr conn PLQ102/103. KA1ZQR, 348 N. Main St., Stonington, CT 06378.

WANTED: Globe King 500 B/C; Viking Valiant I/II; Viking 500; Heathkit Mohawk. Frank, (916) 635-4994, frankdellechaie@sprintmail.com

WANTED: National SW-3 model I, version 3. Uses 32-32-30 tubes. Dean Showalter, W5PJR, 72 Buckboard Rd., Tijeras, NM 87059. (505) 286-1370

WANTED: Collins 32V & Collins 75A series; Globe Scout; National SW54. KBOW, CA, (916) 635-4994, frankdellechaie@sprintmail.com

WANTED: Rhode and Schwarz model EK07 rcvr. Harry Weber, 4845 W. 107th St., Oak Lawn, IL 60453.

WANTED: Radio News, Electron 1940 to '50. Alan Mark, POB 372, Pembroke, MA 02359

WANTED: Surplus conversion manual, #2, state condx & price, pwr plug for LM-7 equip. Louis L. D'Antuono, 8802 Ridge Blvd., Brooklyn, NY 11209. (718) 748-9612

WANTED: Acc. for BC-610E; BC-614, BC-639, tank coils xtals. Frank, K4BVQ, POB 35430, Charlotte, NC 28235. (704) 348-6488

WANTED: Schematic for Realistic DX-300 rcvr 20-204. W7ISJ, POB 18436, Tucson, AZ 85731. (520) 886-3087

WANTED: National Company emblems, escutcheons, logos from equipment. Also WW II rcvr's manufactured by National. Don Barsema, 1458 Byron SE, Grand Rapids, MI 49506. (616) 451-9874, dbarsema@prodigy.net

WANTED: 1963 WRL, 1954 Radio Shack catalogs; **FOR TRADE:** All WRL catalogs 1953-1962. Bernard, POB 690098, Orlando, FL 32869. (407) 351-5536

WANTED: Amplifier AM3007 for T-827/FR-1059B AN/WRC-1 Set. Don, WA2ELD, KY, (859) 254-1886, wa2eld@myexcel.com

WANTED: Spkr for RAS/HRO-1-5, table top or rack type. RAO spkr, ARC-5 controls- C-26, C-29, C-48, C-38, C-30, C-24, J-22; new/used tubes: 807, 2E22, 7360; coils: B&W touret output, GF-11 TX coils; GRC-9 radio & all acces'; manuals: SCR-274N, TCS, RAO. Greg Greenwood, WB6FZH, POB 1325, Weaverville, CA 96093. msg* (707) 523-9122, wb6fzh@arrl.net

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

WANTED: Heath Gear, unassembled kits, catalogs and manuals. Bill Robbins, 5339 Chickadee Dr., Kalamazoo, MI 49009. (616) 375-7978, billrobb@net-link.net

WANTED: I wish to correspond with owners of National HRO/HROA/ACS coil sets. Jim, KE4DSP, 108 Bayfield Dr., Brandon, FL 33511. j.c.clifford@juno.com

WANTED: PreWW-II Iowa QSL cards; materials of 1920s Iowa Radio Relay League. Will trade or purchase. Bill Smith, W5USM, w5usm@aol.com

WANTED: Hallicrafters SX88 or SX115. Larry Redmond, 413 Bedfort Dr., Duluth, GA 30096. (770) 495-7196

WANTED: Any info on the Eldico company and the Eldico SSB Twins for future article. Joel Thurtell, finder@radiofinder.com

WANTED: 1930s Army Navy control boxes, pwr splies, dynamotors - any wierd types. William Donzelli, 15 MacArthur Dr., Carmel, NY, 10512. (845) 225-2547, aw2886@osln.org

WANTED: Back issues of QRP or RADIO AGE magazines. Gary Fender, W5UUO, 450 Cunningham Rd., Celina, TN, 38551. (931) 243-5323, gdfender@multipro.com

WANTED: Antique tubes. Paying $40 ea for good used type 201 tubes (not A). Buy list & new 2000-2001 catalog of collector tubes available. See fathauer@home.com. George H. Fathauer & Assoc., 688 W. First St. Ste 4, Tempe, AZ 85281. (480) 968-7686, tubes@qwest.net

WANTED: HQ170/180X noise silencer and crystal holder/switch; tuning knob for HX500 (Hammarlund). Ed, N5BFW, (817) 222-5355, ecuevas@juno.com

WANTED: GP-7 WWII Navy xmtr, MT-284 shockmount for ART-13, Eldico SSB Twins T-102 TX w/ACPS and R-102 RX. Steve Davis, KD2NX, 11 Vineyard Ave., Middletown, NJ 07748. (732) 495-3241, kd2nx@worldnet.att.net

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516-294-4416, mauricsch@cs.com

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FOR SALE: Hallicrafters SX111 rcvr w/R-48 spkr - $100 plus shpg. Earl Wilson, K6GPB, 5319 Sierra Vista Rd., Murphys, CA 95247, earlw@goldrush.com

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WANTED: BC-186 plug in coils, pwr conn. parts set. Fred Stillwell, AA8S, 38565 Biggs Rd., Grafton, OH 44044. roswell@apk.net

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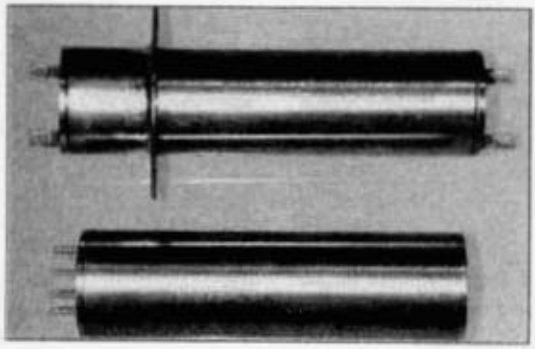

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WANTED: Mics: Astatic JT 30/40; UT-48; Shure CR80/81/41; 707A; Turner VT-73; CD/BD; parts for same. Tom Ellis, Box 140093, Dallas, TX 75214. (214) 328-3225. tomsmics@flexcomp.com

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WANTED: Tektronix memorabilia & promotional literature or catalogs from 1946-1980. James True, N5ARW, POB 820, Hot Springs, AR 71902. (501) 318-1844, Fx 623-8783, james.true@ibm.net

WANTED: 80 & 40 meter xtals in FT243 holders. Howard Weinstein, K3HW, 4041 Ridge Ave. Apt 4-405, Philadelphia, PA 19129. (215) 843-1180. k3hw@arrl.net

WANTED: Collins promotional literature, catalogs and manuals for the period 1933-1993. Jim Stitzinger, WA3CEX, 23800 Via Irana, Valencia, CA 91355. (661) 259-2011. FAX (661) 259-3830

WANTED: Electric Radio, Antique Radio Classifieds, Old Timers Bulletin. Alan Mark, POB 372, Pembroke, MA 02359

WANTED: WW II military remote control rcvrs #ARW/CRW, xmtrs, dynamotors PE186 PE126, joy sticks, Gyroscopes for the GB, Azon glide bombs. Maurice Schechter, NY, (516) 294-4416 or mauricsch@cs.com

WANTED: Cash for Collins: SM-1, 2, 3; 312A-1, 2; 55G-1; 399C-1; 62S-1; KWM-1; 302C-3; 51S-1; 75S-3C; 32S-3A. I buy any Collins equip. Leo, KJ6HI, CA, Ph/Fx (310) 670-6969. radioleo@earthlink.net

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FOR SALE: Kenwood twins R-599 & T-599, mint, in orig factory cartons - $500/pair & shpg. Richard Cohen, K4UTI, FL, (813) 962-2460

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FOR SALE: RCA tube manuals, RC-15, RC-20, RC-25; ARRL Handbooks, 1965, 1968, 1972 & 1978. LSASE for list. Charles Brett, 5980 Old Ranch Rd., Colorado Springs, CO 80908. (719) 495-8660, brett37298@aol.com

FOR SALE: Collins drum overlays, 75A-2, 3, 51J#. For 75A-4 & KWS-1, specify new/old - $8.50 ea. 2/$15 ppd. Correct colors. Charlie Talbott, K3ICH, 13192 Pinnacle Ln., Leesburg, VA 20176-6146. (540) 822-5643.

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FOR SALE: Heath Nostalgia, 124 pg book contains history, pictures, many stories by longtime Heath employees. (See BOOKS inside back cover.) Terry Perdue, 18617 65th Ct., NE, Kenmore, WA 98028.

FOR SALE: 5" Electro Dynamic spkr 1000 ohm field - $10; 8" magnectic cone spkr, exc, no cabinet - $12; Rla 8" PM spkr, very heavy - $10; Electro Voice A-20C high fidelity mono amplifier, very clean, 5 inputs, PP 6V6 ets - $50; 10" Electric dynamic spkr, 1000 ohm field, needs reconing - $10. All + UPS. Onorio Salvetto, W8PTU, 1717 Burgess Rd., Cleveland, OH 44112. (216) 481-1036

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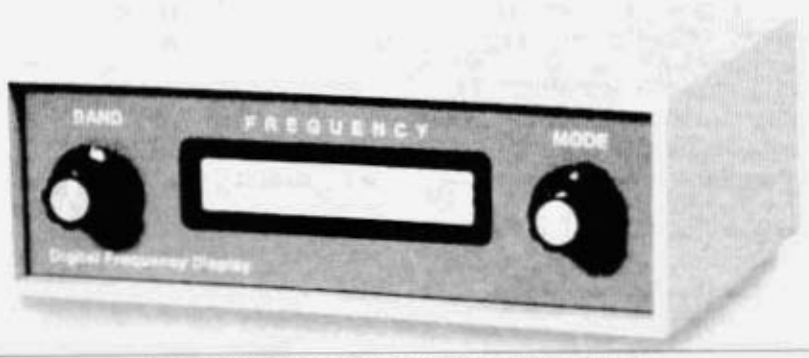

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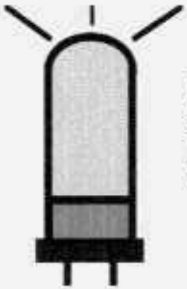

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