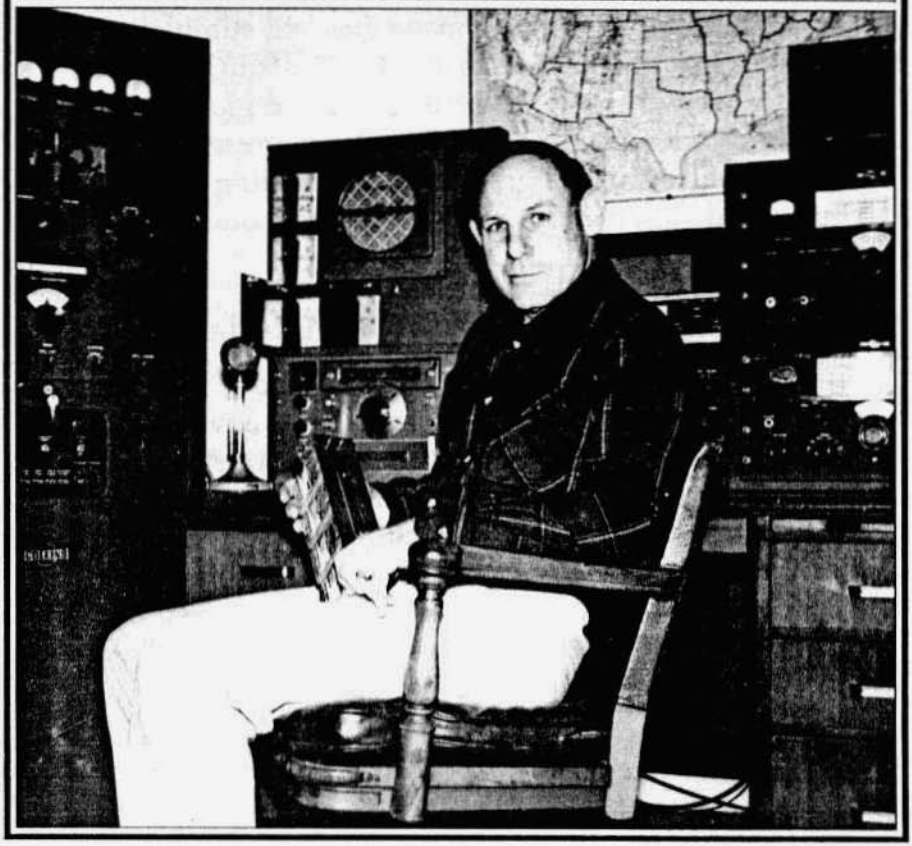
# ELECTRIC RADIO

celebrating a bygone era

Number 11 March 1990



**ELECTRIC RADIO**

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## The Purpose of Electric Radio

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

## Electric Radio Solicits Material

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

# EDITOR'S COMMENTS

**Barry Wiseman N6CSW/Ø**

Thorn L. Mayes, W6AX - who spent the last few years of his life in Durango - was an engineer who grew up during the spark gap era, when radio was just getting started commercially. Over the course of his life he carefully documented - with letters, interviews and photo's - this period. His book, " Wireless Communication in the United States", is the best 'radio' book that's been published in recent times. The book was prepared for publication - after his death in 1987- by Arthur C. Goodnow and Robert W. and Nancy A. Merriam. They've done a great job. The book was published by The New England Wireless and Steam Museum, Inc., East Greenwich, R.I. and is available from Antique Electronic Supply (see their ad on page 40) for $29.95.

Thorn L. Mayes Jr. W7HWA, son of the author (he lives in Durango) is a good friend of mine and has shown me apparatus and gear that belonged to his father. Perhaps that'll be a story for a future issue.

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**Cover: Sam Thompson, W6HDU at his operating position. The transmitter is a Collins KW-1 and the receiver is a National HRO-60R. The 'R' indicates the receiver as a rack model. In future issues we will have a story from Sam on the RCA AR-88.**

# Reflections Down the Feedline

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

Bootlegging has become a lost art. For one thing, the incentive is no longer there. Nowdays, with 400,000 licensed amateurs, its simpler and easier to get your ticket first, before going on the air. It used to be the other way around for a few young eager-beavers who would jump the gun and commence transmitting on 5 or 160 meter phone, without the formality of applying to the FCC. But they all became licensed eventually.

There was also another kind of bootlegger - the 'probably' licensed clandestine operator. In the late 1930's, I worked B4UP and B1T00 on 40 CW. It was as exciting as working some rare DX!

In 1945, I was radio operator aboard the M/V Cringle Reefer, a small refrigerated cargo ship. We sailed from New Orleans with a cargo of meat and potatoes, bound for the Philippines via the Panama Canal. After 5 weeks we arrived at Zamboanga - the place where the monkey wrapped his tail around the flag pole - if you remember patriotic songs.

The ship went from island to island, distributing cargo to the military bases. The meat went fast but the potatoes were not much in demand. After a month of going around the south and central Philippine Islands, the potatoes started getting pretty ripe and the ship was enveloped by clouds of tiny potatoe flies - thousands of them, and life aboard ship became miserable.

So, the potatoes had to be dumped overboard and the flies went away with them. The ship anchored out, awaiting further sailing orders. Around this time, the Japanese surrendered and military hostilities were over.

While tuning around on the ship's HF receiver, I noted amateur operations going on, on 40 meter CW. There were all these "KA" stations hamming it up. Before the FCC "improved" our call sign system, KA was the Philipppines and AC4YN was in Tibet.

I figured that if the Army and Navy could do it, why not join in the fun. The ship's HF transmitter was powered by a noisy motor generator. If I used that, the Captain would want to know what the hell I was doing by sending radio while in port.

There was a wooden box in the radio room containing spare parts for the ship's direction finder receiver. So, using these parts, I threw together a one tube oscillator, with a piece of cardboard for a chassis. A small Pioneer dynamotor, also from the spare parts, supplied the plate voltage.

In a couple of hours, I was on the air with the other guys; signing 'KA8FX' and having a ball with one watt of RF output. My best DX was a QSO with a VU station in India.

But, it was too good to last. In a week's time, the boom was lowered on the whole operation. On my regular radio watch, I copied a broadcast message from Naval Headquarters addressed to all Army and Navy commanding officers and merchant ship masters directing them to immediately terminate all informal amateur radio communications.

Before I placed the message copy on the Captain's desk, I took the precautionary measure of taking my little transmitter apart and putting all the pieces back in the spare parts box. I also tore up the cardboard chassis.

When the Captain saw the message, he came into the Radio Room and wanted to know what I had been up to. I feigned innocence and told him that I didn't know anything at all about it. The incriminating evidence had all been disposed of and so ended my short career as a 'dyed in the wool' bootlegger.

# AUDIO RESPONSE
## How much do you really need?

**by Bill Kleronomos, KDØHG**
**POB 1456**
**Lyons, CO 80540**

Many of us have made modifications to our AM transmitters or added outboard speech equalizers or pre-emphasis for two main reasons - first, to improve our on the air intelligibility, and secondly, just to have that sought after "broadcast quality audio". The latter goal of broadcast quality audio is easy to define by just checking the FCC rules and regulations, or with a BC station engineer. It is an audio bandwidth of from 50 to 7500 HZ with low distortion. This seems like a wide bandwidth, and it is. After all, broadcast stations generally transmit music as well as speech. The FCC rules and regulations are not clear as to the maximum bandwidth allowed in the amateur service but having an occupied bandwidth of 15 KC due to the above audio response is not a good idea if you plan to be a good neighbor to others (both AM and SSB) on the air. Most communications receivers won't have sufficient response in their AM bandwidth to pass audio up to 7500 HZ, anyway. So, the question remains, what kind of audio should I transmit for maximum intelligibility?

I like to deal with facts and not opinion, and in the 1940's, studies were conducted on this very topic. A number of subjects were given speech to listen to while both high pass and low pass filters were used in the speech path. The accuracy of the subjects in determining what they had heard was measured. Words that sound very similar with just slight differences were used (i.e., fee and three, etc.). The results of these tests can be tabulated in a table of frequency cut off versus accuracy.

| ACCURACY | HIGH FREQ. CUT AT: |
|---|---|
| 98% | 7,000 Hz (or better) |
| 96% | 5,000 Hz |
| 94% | 3,900 Hz |
| 90% | 3,000 Hz |
| 80% | 2,300 Hz |
| 70% | 1,970 Hz |
| 60% | 1,700 Hz |

As is clearly evident, the intelligibility of speech becomes impaired once the audio bandwidth is narrowed with a cut off at 7 KC or less. No subject was 100% accurate, of course. It is interesting to take note of what the table really says - one only loses a small amount of intelligibility (4%) by reducing the audio bandwidth from 7,000 Hz to 3,900 Hz, a reduction of 3,100 Hz. However, another 4% intelligibility is lost by chopping the audio only another 900 Hz, from 3,900 to 3,000 Hz.

Now, you may say that you don't personally miss one out of every ten words when listening to a SSB transmitter with 3 KC audio response. You don't. What your ears have a hard time perceiving, your brain figures out by the context the questionable syllable was in. So while you might have a 10% error rate in "decoding" certain words and syllables, as long as there are surrounding words to provide continuity of context, you usually get the picture.

Subconciously, tho, this is tiring for your brain to do. Listening to restricted speech is not very relaxing as a result. Listen to SSB traffic nets sometime and see how many times repeats and phonetics need to be used even on strong signals where there is little context for your brain to use in figuring out what a particular word is.



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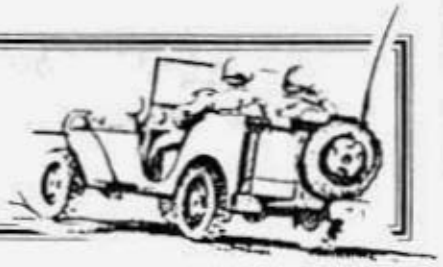
# ELECTRIC RADIO IN UNIFORM



by Walt Hutchens, KJ4KV
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Arlington, VA 22207

**'Command' Sets -- Part 1**

It tells you something about this month's featured radio that most readers know what it looks like. Indeed, these radios had the greatest total production of any military set in history. Because of the huge production, many found their way into the hands of post-war hams and they are also the most converted radios in history. And as we shall see, they are remarkable for other reasons as well.

For all that, our beloved 'command sets' are hardly more than a footnote in the history of military radio. How that came about, we will see this month as we review their history and design. Next month, we'll look at restoring and using them as ham sets.

## DEFINITIONS

In military use, to call a radio a 'command' set is to say that it is used between cooperating aircraft. What hams usually call a command set (and the subject of this month's column) is actually a particular generation of radios performing that function.

The other type of aircraft communications radio is a 'liason' set, used between an aircraft and its base. Examples of liaison equipment are the ART-13, the transmitter for the B29 bomber, the BC-375, the transmitter used in the B-24 and B-17, and the ARC-58, the transceiver used in the B-52.

Since only short range is desired, command transmitters are relatively low powered -from under five to perhaps 20 watts. Liaison sets operate at longer ranges so AM liaison transmitters have outputs from around 30 watts to over 100; the SSB ARC-58 is capable of 1 kw PEP.

The distinction between 'command' and 'liaison' radios isn't black and white. Fighters and other small single place aircraft often used the command radio for both jobs and the command set of a larger aircraft could be pressed into liaison service if the liaison radio failed.

## OVERVIEW

The radios usually called 'command sets' are a series of continuously tunable single band transmitters covering 500 kcs to 9.1 Mcs in eight ranges and a similar series of receivers covering 190 kcs to 27 Mcs in seven ranges. A crystal controlled VHF transmitter and receiver covered 100 to 156 Mcs; these will be covered in a later column.

In addition to their communication functions, the receivers of these sets were used for navigation. The most common such function was reception of homing beacons and weather stations in the 190-550 kcs band. The LF R-23/ARC-5 receiver could also be used for direction finding. These jobs kept some sets in production into the 50's and in our military aircraft at least into the 60's.

**Command Sets** -- Top row (L to R): AN/ARC-5 receiver; transmitter, and modulator. Bottom: C-30A/ARC-5 control box for up to four transmitters, one of which is VHF; RE-2 antenna relay; and C-38 control box for up to three receivers and an ARR-2 navigation set. Note covers over unused controls on C-38; this was a common way to adapt a control box to a specific installation.

A less well known use of the BC-946 (520 -1500 kcs) command receiver was as a 'tail end' for the (VHF) ARR-1 which I believe to have been a 'somewhat secure' navigation system of 1939 vintage. If there's a reader out there who really understands how this system was used, I'd be pleased to hear from him.

Command transmitters measure 7" x 5" x 12" (H x W x D); receivers are 5.5" x 5" x 11". Except for frequency determining parts, all receivers are nearly identical; likewise all transmitters. Receivers have a dynamotor on the rear deck; transmitters draw high voltage from a dynamotor on the separate modulator unit which is shared among all transmitters of an installation.

Different aircraft used many different combinations of receivers and transmitters, all the way from a single receiver to as many as eight receivers or combinations of up to four transmitters and four receivers. While both receivers and transmitters can be operated from the front panel, in most cases they were not. Receivers were usually either tuned remotely via a flexible shaft or 'lock tuned' - set to the desired frequency before the flight. Transmitters can not be remotely tuned and thus were either locally controlled (in bombers and large patrol aircraft) or lock tuned.



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ER in Uniform from previous page

## HISTORY

Command set history is easier to trace than that of many other radios because of the work of Gordon Elliot White, who in the 1960's and 70's researched and wrote several articles on the subject for CQ magazine. The discussion here will draw on those articles.

Prior to WW II, both command and liaison functions used HF radios. The first generation of command radios to be built in large numbers (early 1930's) is represented by the Army's SCR-183 (BC-229 receiver, BC-230 transmitter) and the Navy's RU receiver and GF transmitter of slightly later design.

Our subject this month is the second generation of 'command sets', consisting of four closely related groups of radios. All of these were designed by Aircraft Radio Corporation, beginning in 1936/37 and are similar enough that if the nameplate is missing, they're easily confused.

The first group of sets to be produced consisted of two series of receivers, RAT (two sets covering 13.5 to 27 Mcs) and RAV (eight sets covering 190 kcs to 27 Mcs), built under a 1939 contract for the Navy. Like most prewar equipment, these were not produced in large quantities and they are rarely seen today.

In June, 1940, the Navy began procuring sets of both transmitters and receivers under the nomenclature GT (transmitters) and RBD (receivers). That nomenclature did not last long; I have sets made on the June 1940 contract and they all have the later nomenclature - ATA and ARA for transmitters and receivers, respectively. All ATA/ARA units have a black wrinkle finish.

During this period the U.S. Army was trying to unsuccessfully develop its own 'new' command set. When President Rosevelt announced in May, 1940 that the Air Corps would expand to 50,000 planes, the Signal Corps (responsible for development and procurement of all Army communications gear) swallowed its pride and bought the ATA/ARA equipment without significant change under the nomenclature SCR-274N. (The "N" stood for "Navy".) Some of these sets have a black wrinkle finish and others are natural aluminum.

As with anything procured for the first time in quantity, small shortcomings were found. From about 1943 on, the Navy bought an improved version called the AN/ARC-5. All LF/MF/HF ARC-5 sets are finished in black wrinkle paint. There is also a VHF transmitter and receiver; these are in natural aluminum finish.

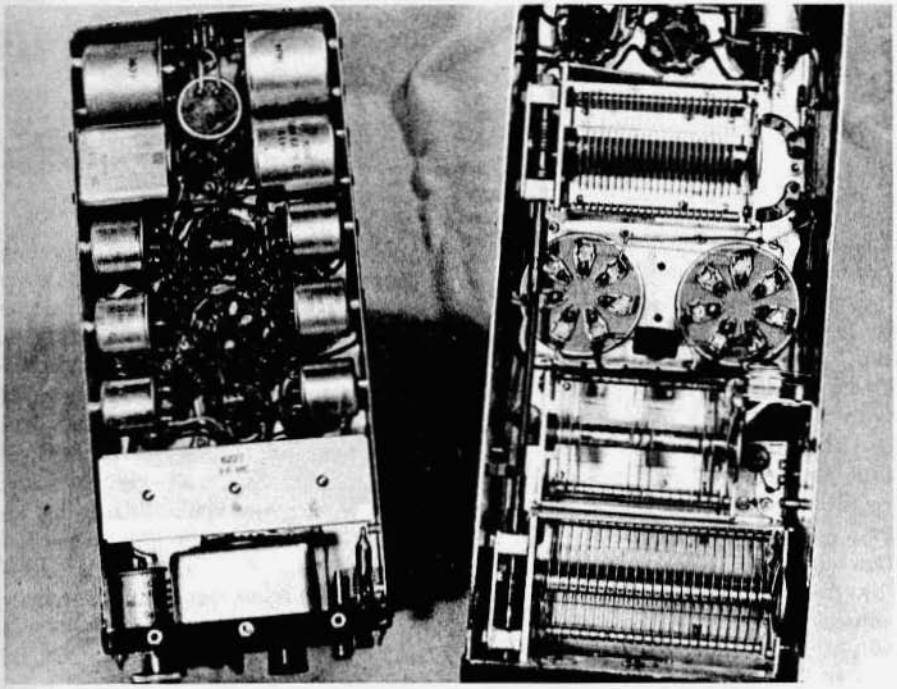
ATA/ARA, SCR-274N, and ARC-5 sets were produced in huge quantities all through the war years, at least 1,450,000 receivers and transmitters being made. Aircraft Radio, Stromberg Carlson and Western Electric were the largest producers; Colonial Radio built BC-946's.

After the war, production fell to near zero, but a trickle of the LF navigation receivers continued into the early 50's.

## COMMAND SET DESIGN

You will find no brilliance here, but the use of basics is outstanding. Both receivers and transmitters are calibrated directly in frequency and the scales are nearly linear. Bandspread on the receivers is a lot less than one would want for general communications use; for example at 3800 kcs, 100 kcs occupies about 3/16".

The receivers are six tube superhetrodynes of conventional RF - mixer/oscillator - IF -F 1 - detector/BFP-F design. They have only four controls: tuning, antenna tuning, and BFO ON/OFF switch and RF/IF gain control lines which can be connected to either remote or local control boxes.



Command receiver (left) and transmitter underside views. In the receiver, note the capacitor cans along the sides, the output transformer and HV filter choke at left and right top, and the BFO coil, second from top on left. The transmitter PA tuning capacitor at the bottom is connected to the MO capacitor by the flexible shaft along the left side.

Transmitters are equally simple: a triode master oscillator driving parallel 1625's - this tube is an 807 with a 12 volt filament and a seven (instead of five) pin base. ATA and SCR-274N units are screen grid modulated; ARC-5 sets are plate and screen modulated. Rated output ranges from five watts to over 20, depending on the model and frequency range.

The master oscillator and PA tuning are ganged so the final is always 'dipped'. The only other controls are for antenna loading and tuning. One relay in the transmitter grounds the PA cathode and connects the MO to the 200 volt line; another connects the antenna terminal to the PA output circuit. These relays are energized when the transmitter is selected at the control box. Keying the mic turns on the dynamotor and keys the transmitter high voltage; on CW the dynamotor runs continuously and the transmitter high voltage is keyed.

A separate relay unit switches the antenna between transmitters and receivers; this unit has an RF ammeter to facilitate tune-up and a 50 uuf vacuum capacitor which can be manually connected in series with the antenna lead if the antenna is not already capacitive.

The transmitter circuit is so simple that it is easy to overlook the degree of refinement. The master oscillator ('VFO' in ham use) is a Hartley circuit. However, there's a twist: one side of the filament is connected to the cathode, and thus to the tap on the coil. The other side of the filament goes through a separate winding having the same number of turns as the tap point on the coil.



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# RECOLLECTIONS OF A RADIO ENGINEER (Part II)
## (From Collins to Hallicrafters)

**by Dr. R.E. (Bob) Samuelson**
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**Phoenix, AZ 85018**

### COMING EVENTS CAST THEIR SHADOW BEFORE!

Looking back a bit: One summer day in 1934, a local distributor stopped by the lab at Collins Radio Company in Cedar Rapids, where I was gradually becoming a RADIO ENGINEER (for pay, sort of) to demonstrate a new product: a little 5-tube TRF/regenerative radio receiver. It covered the short-wave and ham bands from 160 down past 20 meters. It carried the presumptuous name "Skyrider" - the manufacturer's name slipped me at the time - ("Roycrofters" as per Elbert Hubbard?) (Happycrafters"?) The local rep asked: "Since you guys are becoming famous for your short-wave and amateur transmitters, don't you sometimes need a receiver to go along?" A quick look showed some interesting features: (1) it switched bands instead of using plug-in coils, (2) it's cost was amazingly low - $39.95, and (3) even though not a super-het, it's TRF and regenerative detector were very sensitive. (Note: A superhet, the S-4 SuperSkyrider, did come along shortly after.)

Unfortunately, our group was saturated with pride in our 30FXB and 2-KW 20B transmitters (some en-route to the South Pole with Admiral Byrd). They had impressive solid, reliable, rack-and-panel construction. In contrast, this apparently flimsy product, with its lightweight panel, cabinet, paper dial and pointer, did look like a home project from "Popular Radio". We all sneered! The distributor, realizing he was dealing with a bunch of engineering snobs, soon withdrew. (Trying to be "one of the guys", I suppose that I went along with the others in their quick assessment.)

Little did I know that I'd be eating these words four years later! Let's jump to early 1938. Hallicrafters had become a very well-known name in ham circles. The EIGHTH "Super-Skyrider", the SX-17, was announced and was getting into production. Bill Halligan's company had an active and enthusiastic network of reps and distributors all over the county; sales were going well. (Maybe his receivers didn't have the glitz of the National HRO or the Hammarlund Superpro, but he gave value for the money and sold a lot more sets!) Then his reps - all good friends - said "Bill, you should also make ham transmitters!" Bill discussed this idea with his partner Ray Durst, and others of his staff; all were in favor. Then an old friend from college, who was now Chief Production Engineer for Hallicrafters, suggested my name, citing proven transmitter and receiver experience with Art Collins. Out of a clear sky, I received a challenging request: to meet and talk with Bill Halligan about designing some Hallicrafters radio transmitters.

### MEETING BILL HALLIGAN

In early March, I drove into Chicago and met Bill for the first time; an impressively friendly and gregarious individual. He quickly outlined what he had in mind. He reviewed some of the improvements and advances which had made the received product line so successful: Band switching, band spread on ham bands, S-meter, Xtal filter, etc. The metal engraved "pie-plate" dial was copied from General Radio lab test equipment for a more scientific appearance.



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Bob Samuelson as Chief Engineer of Hallicrafters in 1942. Lapel pin is "Army - Navy E"

Recollections from page 8

Then the addition of the Broadcast band, together with many improvements in appearance: rounded corners, chrome trim, etc., allowed the sets to be accepted in living areas. Best of all, there was a radio to fit every pocketbook, and each price level gave the best performance Bill's engineers could create for the cost. The forthcoming DD-1 Dual-Diversity Receiver would really put glamour and "high-tech" appearance into the line, and would be an asset to any ham's living-room, especially when mounted on its companion console bass-reflex speaker cabinet! Bill's enthusiasm was infectious. (It has always been so, through the years that we've known him!)

Then the real subject of the meeting: wasn't it time for the transmitter to come indoors from the garage/tool shed/ham shack (where the YL had banished it)? A few articles were appearing in QST and other ham mags, suggesting ways to build transmitters into closets, furniture, and even old refrigerators. Also, most hams were still building their own xmtrs from kits or from scratch. Bill felt that the time was ripe for a manufactured transmitter at a reasonable price. He visualized ham transmitters having attractive appearance, clear AM signals, clean CW keying, and band-switching. Good power out - 50 or 100 watts for the first model. And a good price! $197.50? Could something like this be done?

Fortunately, since 1935, I had been keeping a personal notebook which contained transmitter circuits that had been successful in Collins aircraft and ground equipment, and another section: "Transmitter Circuits I'd Like To Build". As I encountered or read of new tube types and new circuit ideas, I'd sketch out a circuit, and work out the component and performance values. (Incidentally, I had become a fan of plate modulation of Class-C output stages, versus grid or suppressor-grid modulation; our aircraft experience had confirmed this through enthusiastic reports by airline pilots, beginning with the 17D Autotune.) Bill and I discussed a number of ideas and possible approaches. Somehow we must have been speaking the same language: soon after returning to Cedar Rapids, I received an attractive offer, accepted, wound up affairs at Collins, and Marcy and I moved to Chicago.

## IN THE BIG CITY

I'd like to digress a bit to tell you about my new "home-away-from-home". Hallicrafters was located in an 8-story "loft" building (brick walls, wood and timber floors) on the corner of 26th Street and Indiana Avenue on Chicago's near South Side. A few blocks East was the Outer Driver Parkway and Lake Michigan. To the West, a few blocks, was Chinatown. Less than 10 years earlier, during Prohibition Days, this area had been Chief Gangster Al Capone's stomping ground, and rumors persisted about the nearby Metropole Hotel: (a) some of his henchmen still controlled all the rooms on the 5th floor; (b) he had a large treasure in cash and jewelry in a subterranean safe! Both later disproved, but fun for impressing visitors!

Our offices, Engineering labs, and Model Shop were on the 6th floor, reached by a small, rickety passenger elevator. Freight elevator and wooden staircases were in the rear. Manufacturing, phasing, final test and stockroom were on the 7th floor. "Shipping and Receiving" were at ground level, as were a couple of taverns. (No connection, except at times of stress!)

The Manufacturing area was neatly laid out, with long, well-lighted production benches. Each section was devoted to production of some current model, typically by 10 to 30 assemblers and solderers. After every few stations was an inspector, checking that work was properly done.



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Picture taken in Bill Halligan's office early in 1939. From left to right: Fred Stromatt - Sx-32 receiver engineer, Royal Higgins - Sales, Ed Corcoran - Purchasing, Bill Halligan - President, Loren Toogood - Production Engineer, Ray Durst - Vice President, Joe Frendreis - Controller, Herb Hartley - Production Manager, Bob Samuelson - Chief Engineer, L. A. McLaughlin - DD-1 Engineer and Designer. Missing; Ferd Schor - Lead Receiver Engineer.

Bill Halligan, W9WZE with a ham station set up in his office. The transmitter is HT-4 serial #1

# Watch Your Modulation!

## Use a 'Scope

**by John Staples, W6BM**
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**Berkeley, CA 94708**

One of the outstanding characteristics of AM, as we all know, is its fine audio quality. Nevertheless, many AM signals on the band are under- or overmodulated due to lack of suitable monitoring. An oscilloscope with a trapezoidal modulation display is a surprisingly simple and effective way to monitor modulation depth and audio quality. It is a good tune-up aid for checking parasitics and harmonics, and to some extent, distortion in the audio chain.

### WHAT IS A TRAPEZOIDAL DISPLAY?

A trapeziodal display shows the relationship between the instantaneous modulation voltage and the carrier voltage. The carrier voltage must be linearly related to the modulating waveform for proper operation of an AM transmitter. The display can show modulation depth, non-linearities in your transmitter, under- or overmodulation, parasitics and other problems.

To use an oscilloscope as a trapezoidal monitor, a sample of the modulated r.f. from the transmitter is used to deflect the beam vertically, and a sample of audio from the secondary of the modulation transformer deflects the beam horizontally. With no modulation, a vertical line, representing just the carrier, will appear on the screen as shown in Figure 1.

Let us assume that the positive audio peak deflects the beam to the right. As the audio deflects the beam horizontally across the screen, the vertical deflection by the modulated r.f. increases to the right. During modulation, the r.f. pattern will be swept horizontally across the screen and the result will be a bright triangle on the screen with a vertex on the left, corresponding to the negative peak and larger vertical deflection on the right, corresponding to the positive peak. Figure 2 shows 100% modulation, less than 100% in Figure 3 and overmodulation in Figure 4 with a tail extending off to the left.

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Fig 1

Fig 2

Fig 3

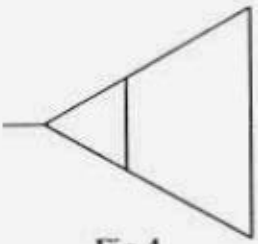
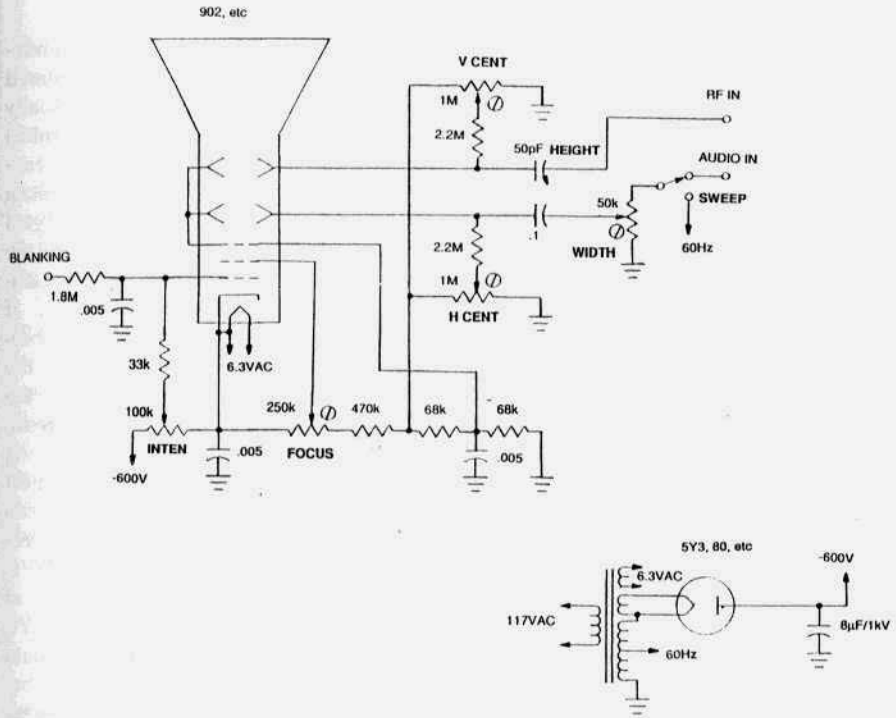
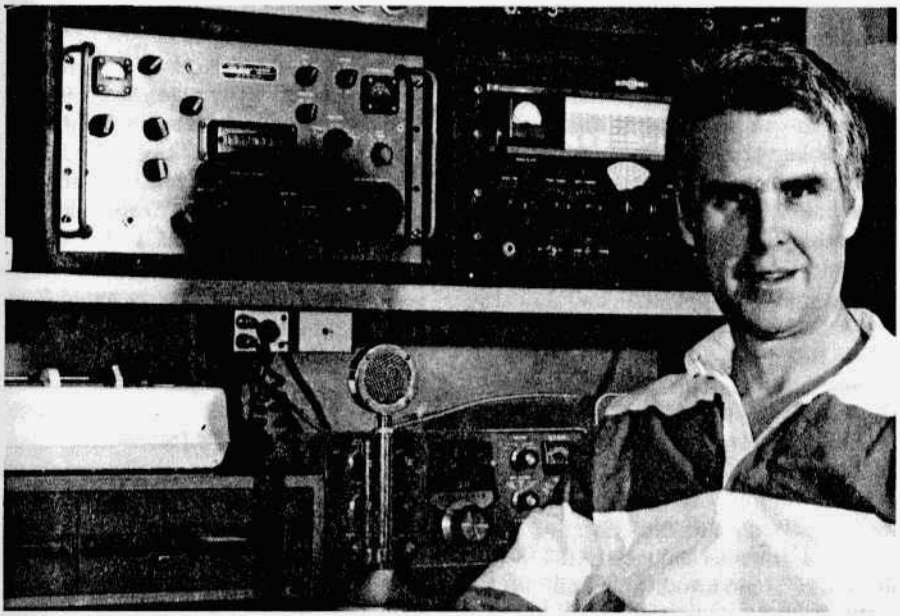


Fig 4



John in his hamshack

Modulation from page 12

If the relationship between the modulating waveform and the r.f. output voltage is not linear, the top and bottom of the triangle will not be straight. A plate modulated screen grid stage, for example, shows nonlinearity if the screen is not modulated along with the plate. (Usually the screen is allowed to self-modulate by placing a resistor or choke in series with its supply.) Insufficient grid drive or low cathode emission can also result in modulation nonlinearity. In any case, this can result in splatter, poor audio quality or carrier shift during modulation.

## HOW TO BUILD IT

The schematic shows a typical circuit, similar to those found in any old edition of the Radio Amateur's Handbook or Radio Handbook, which also shows several types of trapezoidal patterns. You may even have an old 'scope around your shack that you can modify by accessing the deflection plates directly through coupling capacitors and bypassing the built-in amplifiers. A trapezoidal monitor doesn't need d.c. coupling to the deflection plates.

Small electrostatic deflection cathode ray tubes can be found at flea markets for a dollar or two. My power supply uses a TV power transformer with a 5Y3 in a half-wave rectifier configuration supplying about 600 volts negative to ground. The 'scope deflection plates are kept near ground potential, and the cathode at far negative potential.

The CRT I use, a 2 inch RCA-902, is an unbalanced deflection tube: one horizontal and one vertical deflection plate are brought out through the base. The other horizontal and vertical deflection plates are tied internally to the final accelerating grid. While this does not give quite as fine a trace as balanced CRT's, the unbalanced ones are cheaper and the circuitry is simpler.

During receive, the beam is undeflected and appears as a spot centered on the screen. Since this will eventually burn the phosphor, the beam is blanked with a circuit using an additional contact on the T-R relay. On transmit, a large resistor tied to the CRT control gird is grounded, pulling the control grid up toward ground from the negative cathode potential, unblanking the tube. If you have a grounded contact that is broken during transmit, you can move the blanking circuit to the cathode of the CRT. Adjust the value of the large resistor to provide sufficient intensity during transmit with the beam just blanked off during receive. The intensity control can be used to override the blanking to provide a spot for adjustment of the CRT.

The intensity and focus controls, at high voltage potential, are placed on a lucite subpanel mounted behind the main panel. Insulated couplers are used between the pots and the knob control shafts. The small variable capacitor used to control the vertical deflection amplitude is mounted and insulated in the same way.

The centering controls are essential. I have collected quite a number of spare CRT's and each one has a different beam spot position. The centering controls and the focus control need be adjusted only once for each tube. They can be located on the rear of the chassis.

The power transformer is mounted well away from the CRT to avoid hum pickup. If necessary, surround the tube with mu-metal or a piece of soft iron pipe.

## HOW TO WIRE IT IN

I tap the audio from the high end of the modulation transformer of my 32V-3, remove the d.c. component with a 0.1 microfarad capacitor with a high voltage rating, and attenuate the a.c. component with a resistor string sized to handle the peak voltage.

The audio signal is applied to the horizontal deflection plate through the horizontal sensitivity potentiometer. Many transmitters bring the high side of the modulation transformer secondary to the rear panel to use as a driver for a high power final and modulator. The 32V series and the Viking Ranger among others have this feature.

To use the monitor for SSB and CW, a 60 cycle sine wave from the power transformer center tap deflects the beam horizontally for a conventional r.f. envelope display. A small sample of r.f. is tapped off the antenna feeder through a small variable capacitor and applied to the vertical deflection plate. The variable and distributed circuit capacitance form a frequency independent voltage divider.

## WHAT ELSE CAN IT SHOW?

I used a trapezoidal display when I put my first AM transmitter on the air in 1956: a 6L6 modulated by a pair of 6L6's driving a pair of 814's in linear mode. The display was essential in adjusting the drive, bias and loading of the linear amplifier as well as monitoring the modulation depth. Soon afterward, I added a high level plate modulator using a pair of 211's and the 814's were the driven class C. The audio pick-off point was moved to the high level modulation transformer secondary. That transmitter has since then been replaced by a 32V-1 and a 32V-3. The display has served me to this day and is probably responsible for the good audio reports I get on the Collins rigs.

I noticed a slightly distorted 'scope pattern with the 32V transmitters. I found that some of the audio from the modulated B+ line to the final was coming through the 1000 pF r.f. coupling capacitor to the antenna and to the vertical deflection plate of the monitor. This is a potentially dangerous situation, as a short in the r.f. coupling capacitor will place full B+ on the center conductor of the coax, and on one-half of the dipole itself. In addition, the presence of a large audio voltage could increase the chance of sparkover in the antenna circuit.

I placed a 2.5 mH r.f. choke from the antenna terminal to ground in both transmitters. This will act as a static drain, will remove the modulated audio, cleaning up the trapezoidal display, and will cause the primary fuse to blow should the coupling capacitor ever short out.

I noticed that my voice waveform is somewhat asymmetric with negative modulation peaks more pronounced than positive. I reversed the phase of the audio and, according to reports, increased my "talk power" without overmodulating. The modulation monitor now clearly shows larger positive peaks.

On the 32V transmitters, the audio phase can be easily inverted by switching the leads from the 807 output stage plates to the modulation transformer. The 32V transmitter uses no negative feedback so switching polarity anywhere in the audio chain is permissible. The Viking Ranger, on the other hand, uses negative feedback from the modulation transformer back to the driver stage. In this case, the audio phase must be inverted elsewhere. It can be done at the microphone element itself, or perhaps on the secondary winding of the modulation transformer. Don't make the change unless you first find out that your downward modulation peaks are somewhat stronger than the upward peaks.

R.F. harmonics in the transmitter output show up as non-uniform brightness of the pattern. The 32V-3 has a pi-L output network with good harmonic rejection, but the 32V-1 has only a pi-net, which when not properly tuned allows considerable harmonic energy to come through to the antenna.

SSB transmitters used on AM could profit by a 'scope display. AM'ers can usually detect when a SSB transmitter is being used on AM from the marginal



continued next page

RF Deck from previous page
audio quality and the low modulation depth. While it is usually not possible to display a trapezoid pattern in this case (no high-level audio signal is available for the horizontal axis), an envelope display with a 60 Hz sinusoidal sweep will help to tune the transmitter and linear amplifier, and to maintain adequate modulation. (If you have a 'scope with amplifiers, perhaps you could tap off the low level audio from the balanced modulator driver and develop a trapezoid display that way.) I have heard some very good AM from SSB rigs, which shows that with proper turning good AM is possible.

## TRAPEZOIDAL DISPLAY FOR RECEIVING

A trapezoidal type of display can also be used with your receiver to monitor received AM signals. I have found this not quite as useful, as the narrow bandwidth of the receiver i.f. cuts off some of the sidebands, reducing the monitored modulation depth. Noise and QRM reduce the effectiveness of the monitor. Nevertheless, with a strong signal and the i.f. bandwidth opened up, you can get a useful display of the received signal. What you can not see very well is overmodulation (no tail to the left will be produced) or nonlinearity in the transmitter. These must be detected at the transmitter itself.

To produce a trapezoidal receiving display you will need an oscilloscope with a d.c. coupled amplifier in the horizontal channel. (An a.c. coupled 'scope can be used, but the display will bounce around a bit.) Many receivers have an i.f. output jack, which is connected to the vertical amplifier input, and a d.c. coupled diode detector output, which is connected to the horizontal amplifier input.

Practically anything you tune to, even noise, will produce a trapezoid pattern. You must have a strong signal with no QRM for accurate measurement. A trapezoidal receiving display is somewhat useful, but nothing beats a monitor on the transmitter itself.

## HOW ABOUT YOU?

I hope I've gotten you to think a little about monitoring your signal with this very effective type of monitor. Thirty years ago, I used to monitor a 50 kW broadcast transmitter with just the same kind of display described here. Once you get used to it, you will wonder how you ever got along without it.

**Editor's note:** John Staples, W6BM has been on the air for 34 years. Besides vintage equipment - his main interest - he also operates state of the art VHF/UHF gear. He has a Ph.D in nuclear physics and works at the Lawrence Berkeley Laboratory of the University of California. His job takes him around the world and he spends a lot of time in Japan where he is licensed as 7J1AFX. John is on almost nightly with the WestCoast 75 meter group.

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## DAYTON HAMVENTION APRIL 27, 28, 29

## PLAN TO ATTEND

**SPAM Forum Saturday, April 28**
The program will include :
A SPAM update
Hi-Fi audio mods
AM power issue update
"Meet the AM'ers Photo Display"

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# What Ever Happened to Channel 1?

**by Bill Kleronomos, KDØHG**
**POB 1456**
**Lyons, CO 80540**

In 1944, the FCC completely reorganized the frequency allocations in the VHF spectrum to accomodate that new technological marvel, television, which had progressed from a curiousity using experimental frequencies to a viable medium of communication. It wasn't only TV that needed spectrum - other services that had benefited from wartime technical developments were waiting in the wings, such as business radio; as by 1944 it became technically possible to build a stable VHF mobile radio. FM broadcasting was ready for the big time. Civilian aviation had tremendous growth and needed spectrum for communications and radio navigation.

The FCC's plan of 1944 included the creation of 13 VHF television channels, each 6 Mhz wide, with Channel 1 at 44 - 50 Mhz, and Channel 13 ending at 216 Mhz. Other radio services were to be sandwiched between TV channels; the new six meter amateur band was placed between channels 1 and 2, fixed and business radio was assigned slots at 72 - 76 Mhz, between channels 4 and 5, and from 150 to 174 Mhz. Other services, such as aviation and government were assigned 108 to 144 Mhz, and FM broadcasting was assigned 88 - 108 Mhz. The pre-war amateur bands at 56 and 112 Mhz were replaced by our present bands at 50 - 54 and 144 - 148 Mhz.

At the FCC hearings on the new allocations, the League argued long and hard that amateur bands should continue to remain in harmonic relationship to each other as had been long established practice, and that there would likely be problems caused to the new channel 2 allocation by harmonics of amateur transmitters. In those days, no one had a "TVI proofed" transmitter - after all, there was no TV! Unshielded class C amplifiers were the rule in '40s amateur transmitters. Low pass filters were unknown to most hams.

The League lost out, and the new allocations went into effect. The era of television broadcasting as we know it today had begun. It didn't take long for the problems many had predicted to become apparent.

Early television receivers were extremely crude, by today's standards. Front end and IF selectivity approached awful. TV receivers were designed with lots of gain and broad band-width for the best possible picture. And then, as now, manufacturers were reluctant to spend any extra time or money in providing shielding or out of band selectivity. It was TV channels 1 and 2 that were the first disaster areas. A television set tuned to channel 2 was immediately clobbered by any amateur operating on ten or six meters within a radius of a half a mile or so, even by those hams with 'state of the art' transmitters. DX records were set for TVI - hams were received on TV sets at distances of 5 to 10 miles! To make matters worse, channel 1 was periodically clobbered by skip.

These problems became so intolerable that in June, 1947, the FCC convened a special conference of the technical minds of the day to figure out how to fine tune the VHF spectrum allocations. As a result of these conferences, the FCC decided to abolish channel 1, and to move some of the commercial users occupying



**continued on page 28**

# Collecting/Repair/Restoration...TIPS

I recently made the modifications to my Ranger I, as described in the article,"Broadcast Quality Audio and the Ranger II" written by WA6ZJC in ER#9, and I've got some observations to pass along. First, yes, the audio circuitry in the Ranger I and II are almost identical, so John's ideas can be implimented in either. On the air reports I have received since making the mods have been gratifying - "very clean - lots of presence -- you sound better than the local BC station --". I did however encounter a problem that I want to pass along.

Everything was fine until I removed C69, a .02/1600 VDC capacitor across the secondary of the modulation transformer. I then encountered an audio oscillation in the 10 - 20 Khz range coming from the modulator section. The level of the oscillation wasn't great, but it was definetely there and causing a problem. My fix was to compromise with John's suggestion to remove this cap, instead replacing it with a 1005 Uf/2KV disc ceramic. The oscillation was completely cured. Another comment is that while I was into the audio section I found several of the original paper coupling and bypass caps had become leaky, upsetting the voltages and bias of the audio driver. I suggest checking these caps - I'm sure my Ranger isn't the only one with this problem. KDØHG

Many times we need to pick off a reasonable amount of RF from the coax output of our transmitters to run gadgets such as scopes, modulation monitors, and counters. A way to do this is to construct an iso-tee. Procure two coax connectors - one being a UHF "Tee", and the other a double female. Unscrew the center pin from the male connector of the tee, and cut the pin off the threaded stud. Replace the threaded stud. The male connector will now be pinless. Screw the double female onto the male connector of the tee. Connect the tee connector into the feedline from the transmitter via it's two female connectors. You now can use the free end of the double female for a source of a low level RF sample of the transmitter's output. As you can guess, you have just constructed a capacitive RF sampler. KDØHG

Mike Palmer, K5FZ recently sent me a video tape that he had made of the restoration of his prototype KW-1. One thing that he and Darrell,WD5VGO - his partner in the restoration project - did that I think is worth passing along regards their use of a Cantenna dummy load. As we all know the oil - and the can - gets very hot when we run medium or high power into it for even a short period of time. What they did to keep the oil and can cooler was to suspend it in another container partly filled with water - in their case a plastic garbage can. They had water up to about a couple of inches from the top of the can. It occured to me that it might also be worth trying some ice in the water. N6CSW/Ø

Looking for a good deal? What about an Eimac tube in a factory sealed carton for $12.50 plus shipping?

On page 20 of the 1989 Fair Radio Sales catalog is shown this "Sleeper". The Eimac 2-450, high vacuum, HV rectifier, is truly magnificent, and huge. The catalog picture doesn't do it justice. For collectors or just for a conversation piece, this is it. Made in 1972, about 10 lbs including carton, over a foot high. W6RNC

**Got a good tip? Please send it in.**

# AM FREQUENCIES

**2 Meters** - - - 144.4 - calling frequency Activity in most cities.
**6 Meters** - - -50.4 - calling frequency
**10 Meters** - - - 29.0 - 29.2 operating window. Most activity occurs here, although there is some activity around 28.325
**12 Meters** - - - 24. 985 - calling frequency
**15 Meters** - - - 21. 385 calling frequency
**17 Meters** - - - 18.150 calling frequency
**20 Meters** - - - 14.286 nightly SPAM net starts around 5:00 PM CA time.
**40 Meters** - - - 7160, 7195, 7290 - main operating frequencies. Westcoast SPAM every Sunday afternoon on 7160. Starts at 4:00 PM CA time.
**80 Meters** - - - 825 - 3850, 3870 - 3890 main areas of operation. Westcoast SPAM net , Wednesday evenings, starting at 9:00 PM CA time. The frequency is 3870. The Northeast SPAM group meets Thursday evenings , starting at 7:30 EST. The frequency is 3885.

The Northeast SPAM group operates a swap net on their Thursday night net, and just recently Fred Huntly, W6RNC - who acts as net control for the Westcoast group - has also started devoting part of the evening to swapping gear.

I'M JUST TRYING TO DO YOU A FAVOR --- YOU WERE COMPLAINING ABOUT HAVING TO BUY CONTACT CLEANER FOR THIS DUSTY OLD RADIO!

# AWARDS

Electric Radio is now issuing certificates for, Worked All States, Worked All Canadian Provinces, and Worked All Continents. Perhaps later we will get into a DXCC type award. The rules are the same as those at the League except that all cards for the ER awards will have to indicate a 2-way AM contact. Next month we'll publish the rules for those of you unfamiliar with the League rules.

At the moment I'm working on certificate designs and I'm hoping that they will be pleasing to everyone. So start collecting QSL cards towards a certificate. Each certificate will be numbered from number 1 and from time to time we'll publish a list of those who have gained certificates. I don't expect the list will be a long one for some time to come.

There will be no charge for the certificates but I do require return postage to accompany the cards sent in for verification.

I would hope that the AM'ers in less populous states and provinces aren't greatly inconvienced by what I am promoting. I hope everyone will accompany their requests for QSL cards with an SASE.

## Contests

In the very near future I'm going to announce the details on a program of contests that I'm going to sponsor. I think that generally they will follow the AWA format with extra points or multipliers for older, homebrew and low power equipment. We will be operating AM exclusively however.

I think the first contest I'm going to sponsor is an "All Nighter" on 20 meters. The contest would start at midnight CST and continue till 8:00 that morning. The band would be relatively less crowded during these hours and we'd have a good opportunity to work some DX. I'd like to have some input on these ideas. Drop me a line if you have any comments.

ER in Uniform from page 7
The filament is thus at the same RF potential as the cathode so heater/cathode capacitance and leakage doesn't matter.

There's a second independent winding on the oscillator tank; one end drives the PA, a center tap is grounded for RF, and the other end is connected to a neutralizing capacitor. It isn't essential (at these frequencies) to neutralize a 1625 to prevent instability but doing so cancels capacitive feedback from the final plate and hence reduces the effects of antenna tuning on the frequency - an important consideration in an MO-PA design.

One builds a stable oscillator by minimizing the unstable elements - such as vacuum tubes - in the frequency-determining part of the circuit. At the end of the era of vacuum tubes, designers relied on the use of high gain tubes (6SJ7, 6AU6, etc.) and loose coupling to the tank circuit to accomplish this; the command transmitter shows us how to do it with a low mu triode!

How stable is it? When I tested the KJ4KV T-19/ARC-5, the transmitter drift (on 'PHONE', after five minutes warmup) was -372 cps at 3885 kcs during 30 minutes of one minute transmit/4 minutes receive cycling. During 10 minutes key down, drift was an additional -317 cps. A second transmitter drifted +50 cps and then -175 cps on this test. These results are darn good for 1939 - among WW-II sets tested so far, only the ART-13 does better.

Detuning the antenna by enough to reduce power output by half, changed the frequency by about 200 cps - excellent for an MO-PA design.

There are several types of thermal stability, of course. What we measure here is 'warm up stability' - how much does the radio change frequency as it warms up, after a brief initial period. That's the number most likely to interest hams, and also the one most easily measured. But in military use, stability with changes of ambient temperature is usually more important. An aircraft set might be turned on on the ground at an ambient temperature of 120 degrees Fahrenheit (sun on radio compartment, outside air temperature 80 degrees) and climb in minutes to 30,000 feet where the temperature is -25 degrees.

These two types of thermal stability are the same if all oscillator parts are kept at the same temperature - as in the Collins PTO's of 1944 and after. If everything isn't kept at the same temperature then the distribution of temperatures among the various parts will depend on where the heat is being put in or removed - which will be different if warming up in a ham shack than if climbing to 30,000 feet. Thus an older radio (without equal temperature design) built for one set of conditions might not do so well in the other situation.

After five minutes warmup, my ARC-5 receiver drifted about -200 cps in 40 minutes at 3885 kcs. An ARA unit drifted -800 cps on the same test. The difference between the performance of these units is probably design: the ARC-5 receiver has an extra negative temperature coefficient capacitor and other improvements.

There are only a few instances of electronic cleverness in these radios. One is the use of a 'magic eye' tube to indicate when the transmitter is tuned to the frequency of a crystal in the set; this allows checking calibration without an external frequency meter. Another is designing the oscillator so that the variation of frequency with plate voltage changes is approximately zero at the operating voltage, simplifying the regulation requirements.

The packaging of these sets is impressive. I defy anyone (working with the tubes and parts of the late 30's) to put better radios in units of this size. Among packaging innovations is the use of plug in IF and RF coils in the receiver - a practice adopted by Collins Radio after the


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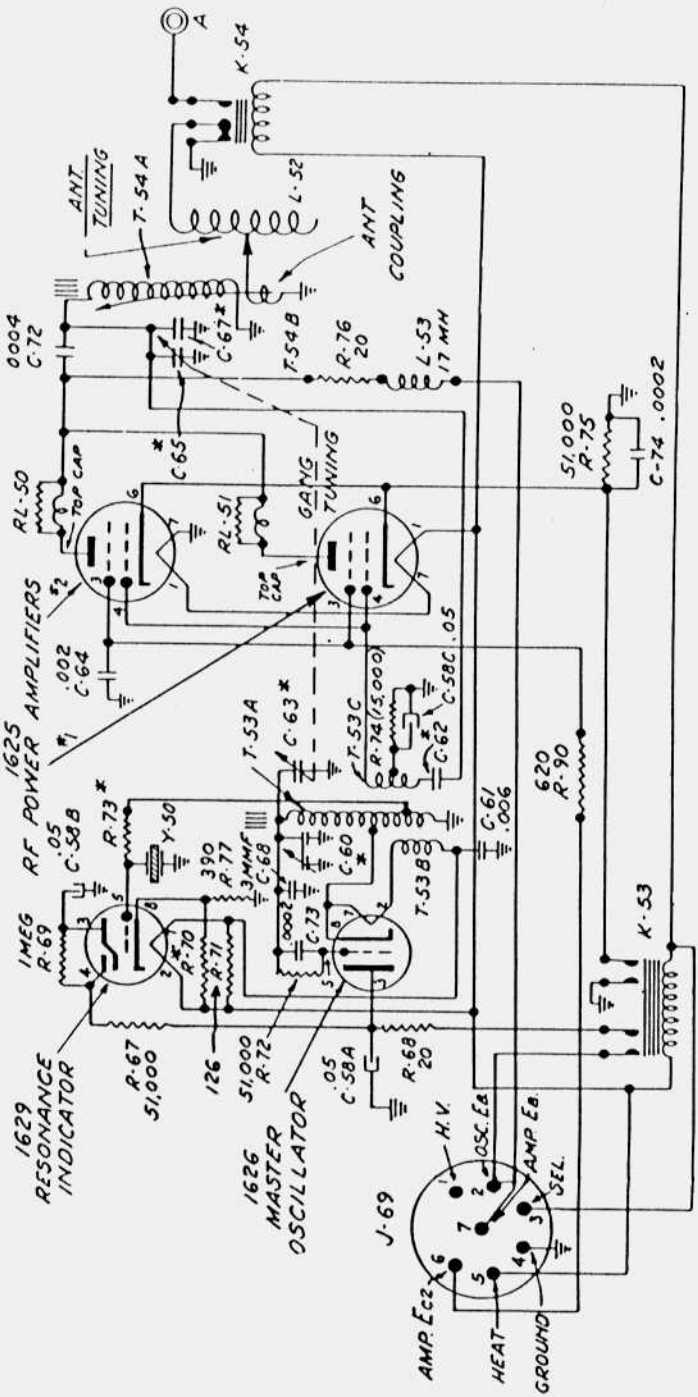


**Circuit of ARC-5 command transmitter**

ER in Uniform from page 20
war and often associated with their equipment. Gains in reliability and maintainability came from the sealing of paper capacitors, chokes and small transformers in squat cylindrical brass cans. Because grounds are made inside the can, this technique also reduced the amount of chassis wiring. Similarly, 1/2 watt resistors are collected in groups of four on small mica or bakelite terminal boards. Since some connections can be made on the boards, this further reduces the amount of wiring. It also makes it easy to replace a bad resistor - if you heat the leads, they just slide out. This is the first use of this technique of which I am aware.

But it is when you look at a complete installation that these radios really stand out. Transmitters and receivers slip into racks; all connections except the antenna are made by a plug at the rear of the rack so it takes about five seconds to replace a unit. Everything fragile is shock mounted. Connectors are of a unique type, with small banana pins and short screw collars. They're sturdy and reliable, yet much easier to insert and remove than other designs in use at the time.

To a greater degree than any other radio until quite recently, this is a modular system, allowing almost any configuration you could imagine without special parts or adapters other than control boxes.

Because there were many configurations, there are many control boxes. There are several types of transmitter boxes, boxes for one, two or three receivers, boxes to control command receivers and an ARR-2 (VHF navigation) receiver, boxes which set frequency and RF gain and those which set only gain, boxes with phone jacks and without.....

Command set installations were usually connected to other equipment. Those smaller aircraft which had a radio operator often had a multiband communications receiver such as the ARB interconnected with the command sets and (sometimes) also an ART-13 or other liaison transmitter.

## DOCUMENTATION

Each of the groups of sets has its own technical manual covering all receivers, transmitters, control boxes, racks, and other accessories. All are good, giving you everything you need to operate, understand and service the sets.

Schematics and 'Partial Repro' manuals (omitting parts lists and some other information not considered essential to repairing the set) are available from Fair Radio Sales.

Roberts Downs, WA5CAB, (713) 467-5614, has excellent repro manuals for RAT, ATA/ARA, SCR-274N, and ARC-5 sets. The only source I know of for original manuals is fellow collectors but so many manuals were printed that a classified ad should bring results.

Original schematics of one or more of the main groups of sets were published in the 40's and 40's in several 'surplus conversion' manuals. My favorites are 'Surplus Schematics Handbook'(Cowan Publishing Corp., 1960, large format red/black/white cover); 'Surplus Radio Conversion Manual - Volume 1' (Editors and Engineers, 1948, small format, orange cover); and 'Command Sets' (Cowan, 1957, small format, yellow/black/white cover). All of these are long out of print but they can be found at hamfests or by a classified ad.

## CONCLUSIONS

The ATA/ARA and SCR-274N sets have several weaknesses: like other grid modulated sets severe distortion results if antenna loading isn't right; that's a real problem on folding wing aircraft. The tuning capacitor stators are supported on glass balls which pop out if the set gets a severe shock.

There's no AVC, so strong signals cause 'blasting'. The 7 - 9.1 Mcs receivers have single tuned IF transformers, making the 10 Db selectivity 24 kcs - very wide even for a military set. All of these were improved in the ARC-5 sets.

Overall, the command sets provide a good example of 'simple things done well'.

1. The quality of the construction is outstanding - the result of good basic design and great attention to detail in production development.

2. The design is both very compact and easy to service.

3. The sets can be mass produced at minimum cost - stamped and drawn parts are used extensively and little machining is required.

4. For a low cost set, both reliability and stability are excellent.

5. Highly modular design makes many configurations possible without 'custom' components and further simplifies maintenance.

6. The sets are light in weight and rugged. Moreover, there are few precision mechanical parts; if a set gets 'bent' you can probably just hammer it out, to Keep 'Em Flying.

7. More plug-in parts are used than any other set of the period. That makes for good access to surrounding parts and simplifies repair.

8. There are a bare minimum of controls and they are simple and logical.

But despite the outstanding quality and the amazing production numbers, the command sets' time came and went, almost overnight.

The problems were fundamental: using HF for the 'command' function is a dreadful idea because ranges in the thousands of miles often occur even with low power, allowing your enemy to listen. Almost equally bad, there aren't enough HF channels - especially when you consider that HF frequencies are needed for long range circuits.

In the 30's, VHF radio was brand new - of interest mainly to hams and a few technical specialists. Our conservative peacetime armed forces upgraded their tried-and-true HF communications circuits to MO-PA sets, added buffer amplifiers in some cases, went to crystal control, and in the late 30's introduced the superhetrodyne receiver. Except for the Navy's multi-hundred pound TBS (60-80 Mcs, late 30's) VHF military sets were either experimental (mainly radar) or hand carried portables, less effective than the cheapest Radio Shack walky-talky.

Our HF command sets were excellent radios for their job, s that job was understood by our peacetime military. The British, however, were controlling fighter aircraft in combat eighteen months ahead of our entry into the war. Their development of air search radar and voice radio control of fighters made it possible for only five hundred fighters to defend the British Isles against several times as many German bombers and supporting fighters in The Battle of Britain, July - September, 1940.

The swap of our methods for radar antenna T/R switching for their cavity magnetron is well known. Less appreciated but I believe equally important to the outcome of the war in the Pacific was our access to British techniques and tools for air warfare - including a working VHF fighter radio.

The Navy contracted for the ATA/ ARA sets in June, 1940. That same year the Naval Research Laboratory at Anacostia tested the British VHF set. It worked well, and after a mad scramble, our services equipped combat aircraft with both VHF (100 - 156 Mcs) and HF command radios in various combinations from Summer 1942 on. I have been told that in the Pacific this change occurred between the Battle of The Coral Sea, May 1-8, 1942 and the Battle of Midway, June 4-6.



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**ER in Uniform from previous page**

Thus, by the time the HF 'command set' production lines really started to roll, the state of the art had swept past them. Nearly every 'warbird' was equipped with them, but most of the roles were secondary - backup to a liaison set, compatibility with military units not yet on VHF, and navigation. The command sets became an outstanding solution to a problem which no longer existed.

## WHERE ARE WE GOING?

By now, perhaps, the "In Uniform" pattern is becoming familiar. We are making a hopscotch tour of smaller U.S. military radios designed between about 1930 and 1960, looking at their 'triumphs and tragedies' and other points of interest and at the history surrounding them, so far as I can learn it.

The rules about what gets in here and what doesn't are simple. The first is - I don't write about sets I consider boring, for example, most test equipment and most commercial radios purchased by the military.

Second, manuals at best tell you 'how it works', and company histories never seem to say, "We did a lousy job on this one"! Because the truth about a radio is often visible only by the light of its tubes, I only write about what I have my hands on.

These rules set a limit, but we won't hit it for a while. A rough count (during a wee hours command set QSO) came to about sixty sets, of which the command sets are number five .... Tune in next month for part two.

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**J. Earl Scaramella,** Woonsocket, RI, sent me a note last week saying that because of health problems he was phasing out his schematic business. He wanted me to thank everyone for the work they have given him in the past. Ed.

**Editor's Comments from page 1**

More about the book: first of all it superbly printed- the photo's are all clear and sharp. Some of the photo's are truly unbelievable; a 500 KW wave changing switch about 15 feet tall, an antenna loading coil 6 feet in diameter, plus dozens of other photos of early spark gear that are almost unrecognizable as radio equipment. The real essence of the book however is the stories of the individuals who developed the radio technology, formed companies and tried to make it commercial. A lot of these individuals - too many to name - are getting recognition for the first time. Great book... buy it.

Against the advise of some ham friends - who think I'm creating a lot of work for myself - I'm going to start issuing certificates for Worked All States, Worked All Canadian Provinces and Worked All Continents. The full details are on page 19 but basically the program at ER will operate just like the one at QST; with one major exception and that will be that all cards will have to indicate a 2-way contact on AM. Operators will send me their cards - with return postage - and I will inspect the cards and issue the certificate. The certificate that I'm designing is going to be very unique and interesting - on high quality paper- and should look 'fb' in anybody's shack.

I'm sure that "Ubiquitous Bob", W5PYT, Jack, KH6CC, Andy, N5JBT, Rick, K8MLV/Ø - just to name a few - have worked all states, all provinces and all continents, maybe a couple of times, but there are others who have not, and to whom this will be a great challenge. I'm hoping that it won't be too long until I'm issuing Certificate #1 in one of the three categories. I hope this program doesn't create a problem for the guys in Wyoming, Rhode Island, Alaska, etcetera. I think that we should make it standard procedure to send an SASE for a QSL card.

On to number 12.... a year goes by fast when you're having fun!

Recollections from page 10

At this time, to help pay the rent, Hallicrafters supplemented the production work with "private-label" work: "vanity receivers" and modules for Silver Marshall; DeLuxe radio/phono chassis for Capehart; private label P.A. amplifiers for Montgomery Ward, and others.

## THE NEW BOY CHECKS IN

On April 4, 1938, I walked into the Hallicrafters lab as the "new boy in the block". I was welcomed by Karl Miles (Chief Engineer), and Ferd Schor, (Receiver Engineer); - not quite sure what to do with me, but they offered to help. This was obviously a busy place; I soon found out why, and will explain later. Karl could only apologize for the crowded and cluttered condition, and could only offer me a 20' lab bench-piled with abandoned chassis, parts, papers, wire and scraps. Within a day or two I had the bench cleaned off (and washed!), and had located a desk for my papers and a table for doing layouts and drawings. With the help of Miles, Schor, and Toogood, I was soon able to find my way to the stockroom, model shop, tool shop, (and the etc. also!), and to meet many of the people I would need to contact: Ray Durst (Bill's partner and VP), Ed Corcoran (Purchasing), Herb Hartley (Manufacturing), Royal Higgins (Sales/Service), Joe Frendreis (Accounting), et al. (We all became good friends).

I soon found out why the lab was such a hotbed of activity; the SX-17 "Super Skyrider" had just been advertised as a greatly improved replacement for the SX-16 "1938 Super Skyrider", and was frantically being phased into production. The SX-18 "Sky Challenger II" had just replaced the SX-15, and was still being babied. The S-19 "Sky Buddy" and the S20 "Sky Champion" had just been announced in the May QST; the engineering models were getting final refinements, parts were being ordered for production, and the factory was trying to brace for its next labor pangs! As if this weren't enough, Jim McLaughlin, with Toogood's help, was rushing to get the DD-1 "Dual Diversity" receiver ready for the forthcoming June Radio Trade Show at the Hotel Stevens, where new products got their best exposure of the year. Besides its circuit novelty, the DD-1 had a really elegant cabinet design, sort of a wide sweep with horizontal chrome-plated stiffening channels. (More on this later.)

As time went by, and as my first designs began to emerge, I learned first-hand of the Halligan phenomena that often kept us up nights: Bill was a believer in having new models at regular intervals, to bring out new, attractive features. When someone came up with an idea, such as a better band-spread, noise limiters, better sensitivity, selectivity, new and better dials, etc., etc., Bill would have us make a mockup, list the features, and photograph it, sometimes with a fake paper dial and lettering. Unfortunately, for us engineer, the next issue of QST would carry an ad, with photo, features, and price. Now we'd have to scurry around, complete the design, order parts, and get it produced! The confusion I observed when I first arrived on the scene (see above) was a perfect example. The new transmitter line soon joined the party! QST announcement ads for the HT-1, HT-3, and HT-4 appeared in the August, September and October issues respectively. With typical deadlines, this must have called for photos and ad copy by mid-June, July, and August. (No wonder Marcy's diary often says "Bob worked late!")

## THE HT-1: TIME FOR ME TO GO TO WORK!

Bill Halligan and I reviewed our previous discussions: what he wanted in Hallicrafters transmitters, and our tentative ideas for the first one, to be called the HT-1.



continued next page

**Recollections from previous page**

My dandy notebook of new design ideas yielded a circuit diagram that seemed to be a good starting point. It was based around the new Raytheon RK-47 beam power tube, to provide 100W of CW output, and 50W of clean AM phone signal using 4-6L6 tubes as PP parallel class AB modulators. Other elements were straightforward: Exciter - two 6A6 as crystal oscillator and doublers. Audio - 6J7 mike amp and 6J5 driver. Plate xx supply-2-866, 2-5Z3 and 1-80. So far, so good! There should be no electrical gremlins!

Now we need the Mechanical Engineer to show how to build it and how to put it together, once we know what it should look like! It should have a solid, professional appearance; it should look well on a table next to an SX-17, or a DD-1. A DD-1? Hey, how about the DD-1 cabinet design? Quick figuring said it was about the right size for the HT-1 innards. We commandeered the only spare DD-1 outer cabinet (all systems had the DD-1 aimed at the forthcoming June show), laid out an arrangement of meters and switches on blank front panels, and LO! we had a mockup of the HT-1! I know we had this model on display at the June Radio Trade Show (possibly operating, but doubtful). In any case, we met the deadline for the announcement ad in the August QST, and I really had to go to work!

One of Bill's requirements was tough: all stages, including the final, were to be band-switched; to any of three bands from 160 to 10, as ordered by the customer. I preferred plug-in coils for the final, because of high voltages involved, but I bravely set out to find a way to go along with Bill. I won't bore you with the details, but with the help of the guys around me, I did end up with a pretty good radio. It was overdesigned and a bit heavy, but it worked great; clean CW and clear AM! Centralab had built me a special band switch, with extra spacing for the high voltage final tank circuits; we cautioned - "Don't switch bands while transmitting!" (Guess how many replacement band switches were ordered!)

The HT-2 was a CW version, with all audio circuits omitted; only one production run was made. However, the HT-1 ran well for almost two years (1939 ads - the "Famous HT-1") until I replaced it with the HT-9, which kept HT-1's good points, but simplified it electrically and mechanically, and replaced the RK-47 with the newer and better 814. The HT-9 found many uses, and was produced through most of WW-II.

## THE HT-3 MARINE TRANSMITTER-RECEIVER

Bill in his younger years had been a seagoing wireless operator, and knew many maritimers in the Boston area: fishermen, transporters, yachtsmen.Word reached them about plans for transmitters in the line; strong pressure came for a seagoing radio. The concept for the HT-3 surfaced before the HT-1 design was finished, but as time permitted, it began to take shape in the same "DD-1" cabinet envelope. We decided on 3 pre-set frequencies in the 2Mc Marine band, with a tunable receiver (also a broadcast band to keep the crew awake!). Power out - 50 watts output, plate modulated AM carrier, powered from a 12 or 32v battery, with a vibrapack and dynamotor for high volts. I lucked out on this one: specs and operation would be similar to my aircraft transmitter/receiver experience, going all the way back to the 16A sets I built and installed for Collins in 1935, down in Columbia, where my bouts with humidity also gave me guidance in designing for marine humidity protection. The xmtr design fell into place; two RK-39's in parallel, plate and screen modulated by our now friendly PP-parallel 6L6G's. The receiver design, with Schor's help, was lifted (using most parts as-is) from the current S-20 and S-22.

Design and checkout of the first HT-3 was well along by mid-July, in time for the first ad to appear in the September QST. The radio found favor with many commercial skippers and yachtsmen; although production quantities were only 10's or 20's, it was popular until 1940, when the HT-12 took over as the 50-watt marine set.

One amusing incident comes to mind. Standby reception was through the front panel speaker, until the skipper picked up the telephone handset to communicate, by pressing the push-to-talk button on the handle. I got to thinking about a better way to do this, and worked out a voice-operated send-receive relay circuit, and included this for a few of our customers. Unfortunately, some skippers, holding the handset, would be giving orders in a loud voice to some deckhand, using lurid, explicit terms, and not realizing he had put himself on the air. After a few nasty letters from the FCC, my nice little circuit was discarded.

**THE HT-4**

Some of you may have read "The HT-4 Goes To War", a little publicity book written for Bill Halligan in 1944, six years after the HT-4 was born. Most of the history of the BC-610 and the SCR-299 is fairly factual, but the writer went way overboard in dramatizing the HT-4 itself. He had a large group of us begin with some existing monster; quote: "Bob Samuelson and his engineers spent months over wiring diagrams, pots of black coffee and yawning wastebaskets in an effort to develop a truly simplified design." "The boys in the laboratory designed and experimented with hundreds of circuits variations, each less complicated than it's predecessor." "Beginning with a (one ton) transmitter seven feet high, they reduced it to thirty-seven inches (and 550 pounds)." "Starting with seven individual sources of power, they boiled it down to three", and so on.

I can only comment that any engineering group that worked on such a trial-and-error basis would be summarily fired! Back to reality.

The following paragraphs are not intended to be a comprehensive history of the HT-4 and its well-known successor, the BC-610; rather, I'd like to give you a brief introduction to the origin of the HT-4, and what was the real story. (Note: Cy Read's article in QST - December, 1943, is about the best.)

During the first months on the job, Bill and I had kicked around many ideas for possible transmitter models beyond the HT-1 and 2. Sometimes a visiting "rep" would sit in - (the HT-3 came out of one of these). One recurring idea - how could we get a higher-powered xmtr into the living room - not in an ugly six-foot rack, but in some kind of a pleasing console? One day Bill said "Look at that DD-1 receiver on that floor mount speaker cabinet! Doesn't that look great?" Then sometime later: "Hey, let's set the HT-1 on the cabinet, and imagine it all in one piece!" "Hey, Bob, see what you could do with something this size!" I got enthusiastic; I had been itching to do something with higher power triodes: Class C final and Class B modulators, as I had used in a project at Collins a few months before. I already had most of the circuit designed using new tube types - RK-63 final driven by a pair of RK-39's (already in use in the HT-3); and RK-38 modulators. One circuit simplification might be of interest: I needed a well-regulated negative bias supply for the Class-B mods and the grid of the Class-C final, also for the plates of the 2A3 pushpull Class-A drivers to the mods; so I operated the entire latter subsystem below ground; made it do both jobs and saved a separate bias supply. In the mechanical configuration, I needed three decks; the top one for RF, in what looked like the DD-1, a second one for audio drivers and modulators, and the bottom (heaviest) for power supply.



continued next page

**Recollections from previous page**

Similarity to the DD-1 was cosmetic only, since with the weights of the power supply, modulation transformers, etc., I had to apply some of my Collins experience with aircraft radio and my college studies in Mechanical Engineering to design a stressed skin/braced chassis structure to minimize weight. (Later, for the BC-610, I took out the decorative chrome strips and further simplified it, but for now, it was just what Bill wanted).

I did not have a bevy of engineers to help convert the concept to a producible, beautifully performing model; I had a good draftsman and some good technicians to help with details; our suppliers vied with themselves to provide special parts such as transformers, RF coils, band switches, etc., our own model shop and our outside sources provided sheet metal and other mechanical parts as they were designed, and the other fellows around me provided all sorts of help and counsel. There were minor bugs to work out, of course, but it was not too long before Bill Halligan took it to his home ham shack, and W9WZE was on the air with 325 watts of phone and 450 watts CW. Best of all, we were able to show it to the hams at the ARRL Convention in Chicago in September.

I cannot close without adding my sincere thanks: to "OJ" Jenkins (KØOJ), who lent me his complete 1938 QST file to help recall dates, ads, and the way things were: to Art Rideout, who has lent me his BC-610 manual- (mine was lost long ago), and to Chuck Dachis, bless him, for his inestimable help in making copies of instruction books for the HT-1 thru HT-11. (Incidentally, Chuck's history of Hallicrafters (ER Jan 90) is the best and most factual that I've seen!)

Other Hallicrafter's stories which come to mind: Other XMTRS, HT-5 to 12; Recvrs SX23 - SX-42; War clouds gather (1939-40); The HT-4, BC610, SCR-299; Hallicrafters in the war years. Maybe later!

**Audio Response from page 3**

Verbal code groups, I call it. Can you see how you could miss up to one word out of ten with a 3 KC upper frequency limit? You do! Traffic nets ought to use high fidelity AM - they'd save time.

So it appears almost imperative to have reasonable audio response out to 4 KC, at least, if you want to sound good as well as have good intelligibility. The audio spectrum between 3 and 4 KC is very important for good speech articulation. But use good sense. As WA6ZJC said in his excellent article in ER #9, going above 5 KC is pushing the rules a bit, and you gain nothing as few receivers will reproduce signals wider than 10 KC. Lets sound good and be good neighbors to each other.

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**Channel 1 story from page 17**

the 72 - 76 Mhz slot to this former channel 1 allocation. The action was intended to solve the TVI problem to channels 4 and 5, as well as the problems with channel 1. The League had proposed that channel 2 be abolished, instead, and for moving amateurs from the new 6 meter band back to the former 56 Mhz band, thereby solving the harmonic problem from operations on ten meters. The League also pointed out that there were only two known U.S. broadcasting stations on channel 2 at the time, so the impact on broadcasting would be minimal. The FCC rejected the League's suggestions, and went ahead with their plan instead, which had the support of the broadcasters. Channel 1 was no more.

As the radio announcer says - and now you know the rest of the story.

Doc Metke,K6HLO with his recently restored Johnson Desk KW

Joe Saah, WB5ZPQ/4 with 'heavy' R 274

# VIBROPLEX BUGS

**by Tom French, W1IMQ**
**120 Great Road**
**Maynard, MA 01754**

For years, key collectors ignored bugs in favor of early telegraph and spark keys. Thirty or forty years ago, with the rising popularity of paddles and electronic keyers, bugs were not collectible, they were merely obsolete.

Today, they are evocative of an earlier era, and are joining tubes, plug-in coils and crystals on the display shelf. The classic ham shack is incomplete without a mechanical bug. The Vibroplex bugs, in particular, have a popularity and fascination that others don't possess. I think this is because they trace their ancestry to the first bug, Horace Martin's Vibroplex, and because over the years they were sold in such quantity that they are available to potential collectors at a reasonable price.

About now, any "young squirts" reading this might be wondering if a bug is anything like the Bencher on their desks. No, sonny, it's not. A bug, sometimes called a speed key, and more formally referred to as a semi-automatic key, is a purely mechanical instrument that produces dots and dashes manually with each press of the lever to the other side, and produces dashes manually with each press of the lever to the other side. You don't need that electronic keyer to use one. They are called bugs because, just as today's mistake-prone operator may be called a "lid", an incompetent telegraph operator at the turn of the century would be called a "bug". It wasn't long before they were calling Horace Martin's new-fangled key itself a bug.

The mechanical semi-automatic key was a terrific invention back in 1904, when Martin filed his patent. Prior to that, telegraphers used a straight key or a sideswiper. Also available was the Autoplex, a device which Martin patented in 1902. This sending instrument was worked like a bug, but relied on a battery and electromagnets to produce the dots.

Martin's goal in his work on semi-automatic keys was to eliminate the "terrible nervous strain" suffered by professional telegraph operators in working with the straight key. This wasn't mental strain, but muscular nerve exhaustion caused by making an average of 360,000 up-and-down movements on a straight key in a typical working day. It led to "telegrapher's paralysis," also known as glass arm. Thus afflicted, the operator would completely lose control over the key. Martin's aversion to the straight key explains why Vibroplex never made one.

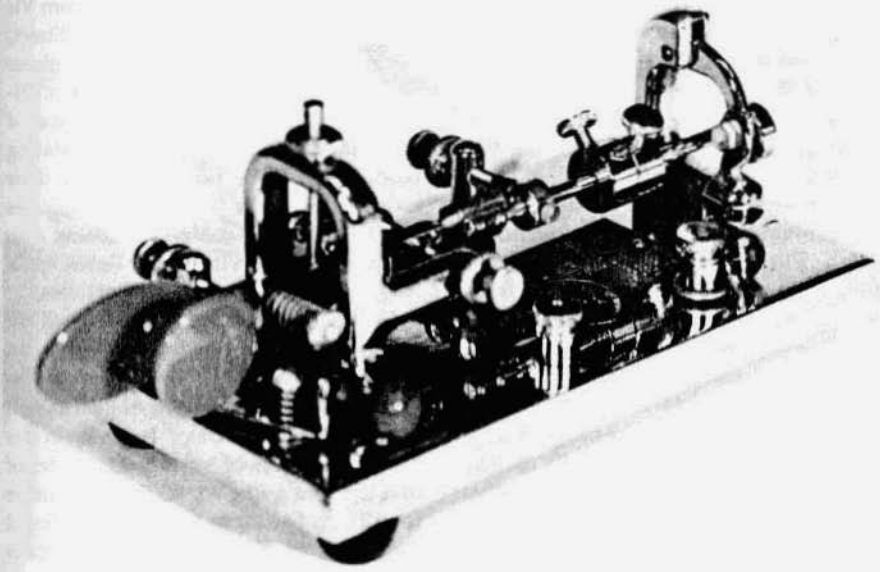
As Martin said of his 1904 instrument, it "may be made more cheaply and is more simple in construction" than the Autoplex. The new design, said Martin, "produced an instrument pleasing in appearance and easy to operate." This first bug used a mechanical pendulum (or vibrator) rather than electromagnets and was marketed as the "Vibroplex."

In 1907, and again in 1923, Martin obtained patents on improvements to the Vibroplex. Finally, in 1940, the De Luxe model was offered, with the jeweled pivot bearings described in John La Hiff's patent issued the same year.

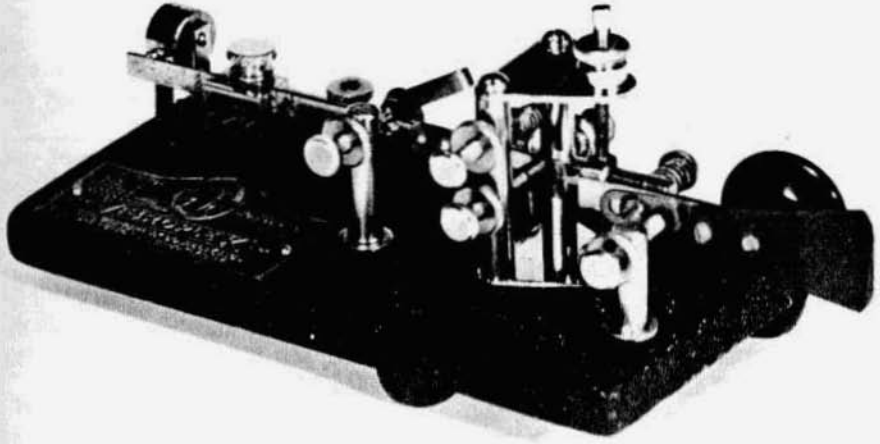
Between 1904 and 1948, The Vibroplex Company, Inc., introduced other models. There were three oddball designs that are easily distinguished from the initial Vibroplex.



continued on page 32



One piece frame and large base identify the Vibroplex Original. Shown is an early 1940's De Luxe, with its chrome-plated base and red knobs. The mechanical improvement is the jewel bearings supporting the pivot.



The Champion, introduced in 1939, was the lowest-priced bug; it sold for $9.95. It was available only with the painted base. A De Luxe Champion was never offered.

**Vibroplex Bugs from page 30**

The Two-lever of 1911 had separate dot and dash levers; the Model X of 1912 had a single contact used for both dots and dashes; and the Upright, or Wire Chief's Key, of 1917 was a vertical bug that used the single-contact mechanism of the Model X.

There were also seven models based on the initial split-key-lever, two-contact design. These are the Vibroplex (later called the Improved Vibroplex, and then the Original), Blue Racer (No. 4), Lightning Bug (No. 6), Martin Junior, Champion, Zephyr and Presentation. (Today, the Presentation is cataloged as a "model," or variation, of the Original.)

There are three or four ways to distinguish between the seven models of the basic Vibroplex bug. The Presentation is given away by the gold-plated brass plate on its base. The others differ in their base size (large or small), the type of damper support (there were four types), and the frame or pivot support style (one piece or assembled).

In all, there were ten models, but if you want to collect every variety, you have quite a job ahead of you. The 1904 Vibroplex acquired mechanical improvements over the years. Bases came in black, gray, nickel plate and chrome plate. Even colored bases (red, green and blue) were offered in the early thirties. Many of the other models had similar changes and options. One collector has counted over 75 different variations of Vibroplex bugs.

Many of the older models have disappeared from the catalog, and no significant changes have been made to the Vibroplex bugs since the Presentation, with its adjustable mainspring (also contained in La Hiff's patent) appeared in the late 1940's. To remain competitive in the shrinking bug market of the fifties, the company added paddles to their line starting with the Vibro-keyer in 1960, while continuing to offer bugs.

The Original is still available from Vibroplex (now located at 98 Elm Street, Portand, Maine 04101) in three variations: Standard, Deluxe and Presentation. Vibroplex is the only U.S. manufacturer of bugs today. These newer bugs, dating from 1979, have no address on their nameplates, while the earlier nameplates carry a New York company address. Also available are the Vibrokeyer (latest spelling), Iambic and Brass Racer paddles.

Collecting the Vibroplex bugs need not be an expensive hobby. Depending on the model and condition, I've seen asking prices from five or ten dollars to well over a hundred. Dave Ingram, in his 'Golden Classics of Yesteryear', writes of one Upright going for $800, and another found at a yard sale for $25. That model and those prices are exceptions, but it does illustrate the virtue of patience.

If you're just getting into key collecting, set a low spending limit until you've gained some knowedge of availability and value. I've been able to obtain the common models (Original, Lightning, Bug, Champion) in excellent condition for thirty or fourty dollars each. Asking prices may vary depending on where you live, but they are never engraved in stone. I haggle and dicker, and pass up the keys I consider overpriced. For me, finding a nice key at a modest price is the challenge that makes the hobby enjoyable.

If you start collecting them, I wish you good luck, and I'll see you at the flea markets.

Editor's Note: Tom, W1IMQ, is the author of the Vibroplex Collector's Guide, available from Artifax Books, (Box 88-M, Maynard, MA 01754) for $14.95 plus $2 handling.

# CLASSIFIEDS

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**DEADLINE FOR THE APRIL ISSUE: APRIL 5**

**FOR SALE:** New GE 6146A and 2E26 tubes - $10 each; **WANTED:** Pilot and foreign radios. Bill Moore, 1005 Fieldstone Ct., Huntsville, AL 35803. (205) 880-1207

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**WANTED:** Top right panel with RF meter and roller coil for BC-191/375 set. Robert Enemark, Box 1607, Duxbury, MA 02331.

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**FOR SALE:** Johnson Viking 122 vfo - $25; Johnson 6N2 receiving converter - best offer; VG Gonset G-50 - best offer; parting out 75A-3, 32V-3, Viking II, Ranger and Valiant. Joe Sloss, K7MKS, 4732 119th SE, Bellevue, WA 98006. (206) 747-5349

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**WANTED:** Schematics for Gross standby shortwave receiver using plug-in coils. Also schematic for Jackson tube tester model 435-A. Charles Ahr, 2291 Sylved Ln., Cincinnati, OH 45238.

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**WANTED:** UTC modulation transformer CVM4 or CVM5; instruction sheet for UTC VM3; meter for Ranger II. Carmine Iannace, KA2PAP, 239 Saint John's Ave., Yonkers, NY 10704. ( 914) 476-2172

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**FOR SALE:** Viking II; portable transmitter A-54 by Multi-Products; Hallicrafters S72R; (2) Hallicrafters S-38's; (2) Hallicrafters S-120's; Heath VTVM model V-5. **WANTED:** Diagrams/manuals for: Heath IT-11 capacitor checker, V-6 VTVM, "RF Signal Generator", Eico 147A signal tracer, Knight "Span Master"2 tube regenerative receiver, Lafayette HA-800B receiver. Eric Jones, N4TGC, Rt. 11, Box 492-J, Florence, AL 35630. (205) 764-0675

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**FOR SALE:** AR-88, Collins 75A-4, Drake 2B. Will trade for a Collins pre-WW-II transmitter or what have you. WANTED: S20R parts or working Howard 430, Hallicrafters HT-6. Russ Olmsted, K4UJZ, 608 W. Thompson Ln., Murfreesboro, TN 37129

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# CLASSIFIEDS

**FOR SALE:** Viking II with 122 vfo - offers. **WANTED:** Valiant II, R-5000 and R-2000. Bud, W7IYG, (208) 466-2803 after 9:00 PM MST.

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**WANTED:** Taylor T-125 tubes to use in restoring my grandfather's old HB AM xmtr. Also need good 810's and Thordarson multi-match driver xfmr. with low ratios. **FOR TRADE:** 211's, 803's, 813's and others, tested - SASE for list; Radio Shack SWL receiver, DX 440, 150 Khz to 30 Mhz, digital, w/man and original box - $100 u ship; HB 4-1000A linear amp. w/3200 v p.s and spare 4-1000A w/lo hours - $400 or swap for mint 75A-4 w/ AM filter, (u pick up). Mike Carroll, NI4M, 108 Wessington Ct., Hendersonville, TN 37075. (615) 822-0082 6-9:00 PM CST.

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**WANTED:** 7094's (new or good used) for Hallicrafters HT-41 or substituition information. S. Kiraly, WA2O, 51 Ramon Blvd., Freehold, NJ 07728. (201) 462-2705

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**WANTED:** AX 9909 tube for Globe Champion, Amperex 6083 and 8643. Bill Smitherman, KD4AF, Rt. 4, Box 79, East Bend, NC 27018.

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**FOR SALE:** Two Lafayette HA-460, 6m AM transceivers in nice condition with manuals, power cords, microphones and crystals - $100 for both. Harry Schools, KA3B, 1606 S. Newkirk St., Philadelphia, PA 19145. (215) 468-1512

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

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**FOR SALE:** Antique radios, parts, tubes, books, vibrators, knobs, amateur, testers, transmitter crystals, etc. Want lists? LSASE plus $2 cash (no checks). Richard & Rose's Radio Mart, POB 691443, Tulsa, OK 74169

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**WANTED:** Speakers for National NC-44, NC-46 and NC1-10A. Still looking for early National receivers: NC-45, 80/1, 100/1, etc. Steve Sauer, WA9ASZ, 1274 Londonerry Ln., Greenwood, IN 46142. (317) 882-4598 eves. after 8:00 EST

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**WANTED:** Navy GP-9 set, connectors for ART-13 (U-7, 8, 11), Bendix TA-12, clock for HQ-180 and manuals for RBM-5 and RBS-1. Paul Gregg, W9POC, 725 College Way, Carmel, IN 46032.

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**FOR SALE:** (7) 6B4 tubes - $40 plus UPS. Marcus Frisch, WA9IXP, Box 28803, Greenfield, WI 53220-0803. (414) 545-5237

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**WANTED:** Instruction and service manual for AN/ARC-1 transceiver, also 100 watt modulation transformer tapped to cover a variety of matches. Rodney Schrock, KD3OR, 402 Lincoln St., Somerset, PA 15501. (814) 445-8187

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**FOR SALE:** January 1990 catalog of Radio/Wireless and Broadcasting books now available. Send SASE to Rainy Day Books, POB 775, Fitzwilliam, NH 03447. (603) 585-3448

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**FOR SALE:** GR resistance limit bridge, type 1652A - $50 ppd; Multi-Elmac model R-27, style B - $25 ppd; NIB toy telegraph set - $25 ppd; Philmore C-R sub box RB-15 - $7.50 ppd; National Radio type ACN dial, NIB, -$25;Bendix type MP-74A power supply with dynamotor and plug - $20. James Fred, Cutler, IN 46920.

# CLASSIFIEDS

"REAL RADIO GLOWS IN THE DARK" BUMPER STICKER-$1 each with a #10 SASE. We service American made amateur radio equipment, circa 1940, 50, 60 & 70's. Collins, Drake, Swan, Hallicrafters, Hammarlunds, National, B & W, Johnson, Gonset, WRL, Millen, Technical Materials Corp, Harvey Wells and so forth. QRP to QRO. Call or write for a quote on your servicing. **CLASSIC RADIO**, PO Box 3486, Eureka, CA 95502. 24 hr phone (707) 444-3911.

**FOR SALE:** Hallicrafters Skyrider Jr., S41G; Echophone; S38E; S38M; SX-117 with HA-10 LF/MF tuner and speaker. SASE for list. K4LJZ, 608 W. Thompson Ln., Murfreesboro, TN 37129. (615) 893-5344

**WANTED:** DY-150 dynamotor for the ARN-59, the spline shafted cable that connects MN26 and MN280 control and related power cords; the eight pin female plugs for the RBM-4. Brian L'Huillier, Box 37, Brownville, NY 13615. (315) 782-9475

**FOR SALE:** Hammarlund HQ-100 - $85; Johnson 6N2 - make offer; Drake C-4 - $395; Drake MN-2000 - $225. Don Bishop, NØEA, Box 4075, Overland Park, KS 66204-0075.

**WANTED:** Shipboard, aircraft, and other military radio sets, collections, connectors, power supplies, parts kits, cables, dynamotors and military films. Charles DiCecca, 501 Mystic Valley Pkwy, Medford, MA 02155. (617) 396-9354

**WANTED:** A "Geloso G-209" receiver, in good condition, complete and working. D.H. Moore, K6KFP, POB 521, Palo Alto, CA 94302. (415) DA2-2728

**FOR SALE:** Gibson Girl Kites, M-357A, with two baloon inflation tubes and case, used - $30. Kite only - $25; RC-292 Antenna sets, 55 lbs, used - $95; AB-35 mast sections - $3.50, set of 12 for 30 ft - $36; AB-12, 22, 23, 24, antenna elements - $2 each. URM-120 wattmeters, used, 20 lbs - $140 plus shipping. Tartan Electronics Inc., POB 36841, Tucson, AZ 85740. (602) 577-1022

**WANTED:** Federal parts, radios and restoration info; loose coupler; VT-2's (good). Send SASE for my old QST and book list. Glen Fritz, N4WDX, 1516 1st Place, Vero Beach, FL 32962.

**FOR SALE:** Signal Generators, URM-25D, 10 Khz - 50Mhz, AM/CW; URM-26A 3 - 405 Mhz, AM/CW; other makes, styles, hundreds available, from $30. Send for list. URM-127 Audio Oscillator 20 - 200 Khz used Ex, 15 lbs - $45 plus shipping. Tartan Electronics Inc., POB 36841, Tucson, AZ 85740. (602) 577-1022

**WANTED:** Tube era audio gear, audio transformers, W.E. gear and parts. Joe Roberts, N4WQC, Box 19302, Alexandria, VA 22320. (703) 683-2955

**WANTED:** Telegraph bugs, keys and old paddles for private collection. I need most models pre-1960. I also need old bugs for parts. Herb Spivey, NF5Y, Box 27, Baldwyn, MS 38824. (601) 365-5594

**FOR SALE/TRADE:** Hard bound volumes of QST's: 1925 - $30, 1934-$20. **WANTED:** SW3 coil set 14A; National Radio equipment or printed material. Niel Wiegand, WA5VLZ, 911 North Bend Dr., Austin, TX 78758. (512) 837-2492

**FOR SALE:** Receiving tubes, power tubes, crt's older models plus late numbers UL and CSE recognized. Donna O'Connor, 824 Main St., Belleville, NJ 07109. (201) 751-2591

# CLASSIFIEDS

## FAIR RADIO SALES

**1016 EAST EUREKA STREET,**
**POB 1105, LIMA, OHIO 45002** **419/227-6573**

**R-388/Collins 51J3 HF receivers,** 0.5 - 30.5 Mhz, AM - CW in thirty bands on wide 6" linear scale; 500 khz IF. Rack-mount-style without top cover; 55 lbs sh wt.Used-checked, $350.00; manual, partial repro, $10.00
**Hammarlund SP-600JX receiver*,** 0.54 to 54 Mhz in six bands with crystal control feature; 455 khz IF. Rackmount; 73 lbs sh wt. Used-checked, $345.00; manual, partial repro, $10.00
**SP-600JX-21A*** Last model of the series features USB & LSB operation; includes original cabinet and manual. Used-checked, $650.00 SOLD
**SP-600VLF*,** like JX- series except 0.1 to 54 Mhz. Hammarlund-made, but with Dero Mfg. tag; rackmount. Used-checked, $395.00

* Note: SP-600's must be shipped via motor freight or bus!
All prices F.O.B. Lima, Ohio. Cash, VISA or Mastercard payment required.

**FOR SALE:** T368/URT transmitter 1.5 to 20 Mhz, 400 W AM/CW/FSK, 115 VAC - $425. See page 10, Sept. Electric Radio. Ken, 1406 Novella St., Opelika, AL 36801. (205) 745-3761

**FOR SALE:** RAO-7 receiver - $150, pick up only; BC-939 (BC-610 tuner) - $100; Radio Marine AR-8712 DF receiver - $40; ARR-15 receiver - $60. **WANTED:** Manuals or copies of for BC-348K, TBW, RAX, SB-10, Johnson Matchbox. Will trade for items above. Still looking for RAX receivers. Steve Davis, KD2NX, 2372 84th St., Brooklyn, NY 11214. (718) 265-2390

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

**WANTED:** Supplemental tube testing data charts or copies for Hickock 933, 933DM, 934, 934A tube tester. Chuck Bennett, KA6UUP, 1501 Argonne Dr., Stockton, CA 95203. (209) 465-6542

**FOR SALE:** Pair 810 tubes - $75; 833A - $45; Manuals: TMC AN/FRR-49 receiver - $10; TMC ant. multicoupler AMC 6-5 - $10; TMC mode selector receiving unit, model MSR-4, MSR-5 - $10; TMC com. receiver FFR - $10. All for $25. Pete, VE7FY, 12347 Davison St., Maple Ridge, BC V2X 5N5. (604) 463-4904

**WANTED:** The following AN/ART-13 items: DY 11 or DY 17/ART-13 dynamotors, U-7/U, U-9/U and U-10/U cable connectors, calibration book. Pete Hamersma, WB2JWU, 87 Philip Ave., Elmwood Park, NJ 07407.

# CLASSIFIEDS

**WANTED:** Hallicrafters HT-37, SX-99, Hurricane, Globe King 400, Viking Ranger II, Drake L4B linear. Jo Sanford, WA6UCI, 5779 N. Date Ave., Rialto, CA 92376. (714) 874-8849

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**FOR SALE:** 19" rack mount enclosures - two left - $36 and $40 inquire; 15 amp Variacs, 115 volt AC - $45 each; 2 KW isolation transformer - 115 to 115 volt; Drake 1 KW low pass filter - $20; Heathkit monitor scope - $87; Heath Station Control - $86; beehive stand-off insulators - white - $1 each; 813 tubes - $20 each. Levy, 7600 Blanco Rd., # 6086, San Antonio, TX 78216. (512) 341-9549

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**WANTED:** 6 meter cyrstals; Echophone (pre-war) EC-1, 2 or 3; Viking Adventurer. Joe Cook, K5VDO, 2151 FM 740 N, Forney, TX 75126. (214) 722-3551

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**WANTED:** Clean Viking Navigator; Johnson 122 vfo manual (xerox ok); E.F. Johnson bug; 160, 80, 40 meter crystals; LF coils for HRO-5. Brian Roberts, 3068 Evergreen, Pittsburgh, PA 15237.

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**FOR SALE:** Gonset G-76 transceiver, 160 - 6 meters, reconditioned 1989 by Classic Radio, AC supply with speaker, solid state DC supply, original manual, cables, spare set of tubes - $200; Clean Heath VTVM, model IM-11, assembled 1960, plus Heath AC/DC experimenters chassis, manual - $60. I'll UPS. Bob Lemanek, K8HVG, 14565 Garfield, Allen Park, MI 48101.

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**FOR SALE:** Vibroplex Collector's Guide. W1IMQ's new illustrated reference includes key histories, identification guide, patents, more. 87 pages. Only $14.95 plus $2 s/h. Free info. Artifax Books, Box 88-E, Maynard, MA 01754

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## WANTED

TRANSMITTING TUBES
FOR MUSEUM

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

**Al Jones K6DIA**

**Ye Olde Transmitting Tube Museum**
**P.O. Box 97, Crescent City, CA 95531**

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**FOR SALE:** Johnson Valiant I in excellent condition - $175; Hammarlund HQ-170A receiver - $125; HQ-129X receiver - $100; and HQ-100 general coverage receiver - $125. **WANTED:** to correspond with anyone that has a Hammarlund HQX-300 transceiver. Please write or call Charlie Vaughn, KD4AJ, 1968 Huntington Hall Ct., Atlanta, GA 30338. (404) 396-0276

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**WANTED:** CW & AM filters for Collins 75A3 - F455B-08 & F445B-60; also 8R-1 100 kc calibrator. Parting B&W 5100B and 51SB-B. WA7IHN, POB 442, Aumsville, OR 97325. (503) 749-1149

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**WANTED:** Bell System mobile telephone items, pre-1960, including manuals, selector sets, control units, cables, junction boxes, etc. Any condition. Geoff Fors, WB6NVH, 769 Pacific St., Monterey, CA 93940.

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**FOR SALE:** Radio service instruments and parts of 1940 -50. Cabinets of coils, resistors, capacitors, switches, transformers, tubes, speakers, signal generators, tube testers and alalyzers. Francis Yonker, 7 Old Farms Road, Saddle River, NJ 07458.

# CLASSIFIEDS

**WANTED:** German, Japanese, Italian WW-II radio equipment or parts, any condition, and any informational paper. My special interest is in restoring to on-air operation the less-known equipment of that era. Also interested in U.S. Coast Guard, Forest Service equipment, also type ARQ-, ARR-16, AXR-1 and HF CW equipment with PRC-, TRC-, SS- nameplate. **FOR SALE:** E-Z restore HRO-5; 2 ancient, dusty, CBs and an RCA CRMP3B. Thank You. Hugh Miller, KA7LXY, 6400 Maltby Rd., Woodinville, WA 98072-8375.

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**FOR SALE:** Collins Manuals: Mint condition, latest edition (not copies) of KWM-2A transceiver (9th edition, 15 Jan 78) - $40, 516F-2 power supply (15 Jul 74) - $15 and 312B-4/5 VFO speaker wattmeter (7th edition, 15 Mar 78) - $15. Complete set of three manuals - $60. All items postpaid. Bill Mills, KC5PF, 1740 Tonys Court, Amissville, VA 22002. Office: (703) 818-3955 Home: (703) 937-4090

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**FOR SALE:** Transmitting/Receiving tubes, new and used, mostly old surplus. Exa: OC3, 2X2, 3B28, 4D32, 4X150, 4-125A, 4-250, 12A6, 809, 810, 811A, 813, 815, 829, 832, 836, 872, 1625, 1626, 5894, 6130, 6146, 6336, 9003 plus others. SASE for list. I also collect old and unique tubes of any type. Maybe you have something to trade? John H. Walker Jr., 16112 W. 125th St., Olathe, KS 66062. (913) 782-6455

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**WANTED:** B & W MEL, JVL, TVL, inductors for 160 and 80 meters; also wanted Globe King 500 modulator. Bill Beatty, K7CMS, 4721 N. Bamboo Circle, Tucson, AZ 85749. (602) 749-5773

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**FOR SALE:** Elmac AF-67, excellent, with AC supply and manual - $125. plus UPS. Thorn, (303) 259-0562

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**FOR SALE:** Grundig Majestic 1060 w/ instructions, good - $100; Callbooks, U.S. and Foreign - $40. Levy, 8 Waterloo, Morris Plains, NJ 07950. (201) 285-0237

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**FOR SALE:** HT-32B, near mint - $225; NC-300 - $125; Gonset G-28, 10 meter AM, beautiful - $100. **WANTED:** Collins 32S3A. Parker, W1YG, 87 Cove Rd., Lyme, CT 06371. (203) 434-7783

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**FOR SALE:** RME 4350, excellent, with manual and matching 4302 speaker - $185. **WANTED:** Knobs for SX-71 and coils for McMurdo Silver 801, 801B, 802. Al Bernard, POB 690098, Orlando, FL 32869-0098. (407) 351-5536

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**WANTED:** Stancor output transformer A-3801 or A-3885, driver A-4752. Subs ok. James T. Schliestett, W4IMQ, POB 93, Cedartown, GA 30125. (404) 748-5968

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**WANTED:** Telegraph bugs, keys and old paddles for private collection. I need most models pre- 1960. I also need old bugs for parts. Herb Spivey, NF5Y, Box 27, Baldwyn, MS 38824. (601) 365-5594

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**FOR SALE:** Rider "Chanalyst" model #11 made by Service Instruments of New York. Also making obsolete parts of metal, phenolic, nylon. SASE please. Universal, Box 5044, Greeley, CO 80631. (303) 353-8561 8 to 11:00 PM

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

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**Back issues of Electric Radio are available for $2.50 each, delivered 1st class.**

# CLASSIFIEDS

**FOR SALE:** WW-II RBL-3 receiver, 15kc to 600kc - $50; Triplett model 625NA VOM, real nice - $21; Master Mobile 12 VDC antenna tuner - $12. Ward Becht, 625 Tufts Ave., Burbank, CA 91504. (818) 842-3444

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**FOR SALE:** Hallicrafters manuals, copies - $4.50 postpaid. Some Hammarlund, Gonset, Johnson. **WANTED:** Regency ATC-1 shortwave converter for car. Miller Radio, POB 6604, Erie, PA 16512.

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**FOR SALE:** Rockwell/Collins authorized reprints of S-line manuals available for the following models: KWM-2/2A ($35); 75S-3B/C, 32S-3A ($30); 75S-3, 32S-3 ($25); 312B-4/5 ($20); 516F-2 ($10). For U.S. orders, include 7% of total purchase for shipping and handling (Canada and Mexico 12%). Ohio residents add 6% sales tax. Vista Technology Incorporated, 3041 Rising Springs, Bellbrook, OH 45305.

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# SPAM

**THE SOCIETY FOR THE PRESERVATION OF AMPLITUDE MODULATION**

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**SPAM**
**BOX 27**
**POTRERO, CA 92063**

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

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

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

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**FOR SALE:** ARRL Radio Amateur's Handbook, 1927, Third Edition, paperback, VG condition - best offer or consider trade for AM HF TX. KC3ZQ/9, 705 S. 13th, Quincy, IL 62301.

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**WANTED:** Very old or unusual Hallicrafters equipment, entire 1934 "H" and "Z" line of Silver Marshal, parts, memorabilia and manuals. Chuck Dachis, "The Hallicrafter Collector", WD5EOG, 4500 Russell Dr., Austin, TX 78745.

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**FOR SALE:** Electron tubes, all types - microwave, transmitting, receiving, obsolete, military -- Large inventory. Daily Electronics Corp., POB 5029, Compton, CA 90224. (213) 774-1255; (800) 346-6667

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

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**WANTED:** Shawplex bug keyer made in St. Jo, MO. Others also wanted. Please write. Frank R. White, KBØTG, Box 2012, Olathe, KS 66061.

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**FOR SALE:** TM repros for Command Sets, ART-13, BC-348, TM 11-487, other TM 11's to 08's, AN 08's. Replacement pages and some originals available. LSASE for list. Robert Downs, WA5CAB, 2027 Mapleton,

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