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Journal of the

CALIFORNIA HISTORICAL RADIO SOCIETY

FOR THE RESTORATION AND PRESERVATION OF EARLY RADIO

FROM THE BIRTHPLACE OF BROADCASTING

California Historical Radio Society

HOME OF THE BAY AREA RADIO MUSEUM & HALL OF FAME

The California Historical Radio Society (CHRS) is a non-profit educational corporation chartered in the State of California. Formed in 1974, CHRS promotes the restoration and preservation of early radio and broadcasting. Our goal is to enable the exchange of information on the history of radio, particularly in the West, with emphasis on collecting, preserving, and displaying early equipment, literature, and programs. Yearly membership is $30 ($40 non-USA).

CHRS Museum in Alameda

CHRS has been fortunate, through the generosity of its donors, to purchase a home for the CHRS museum and education center. It is located at 2152 Central Avenue. The building was built in 1900 as a telephone exchange.

CHRS volunteers are actively restoring the building to make it optimal for use. Our goal is to create an environment to share our knowledge and love of radio and enable us to create an appreciation and understanding for a new generation of antique radio collectors and historians.

Please come visit us any Saturday 9am to 3pm. Visitors and groups welcome at other times by appointment; Contact Steve Kushman.

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Contact us:

CHRS, PO Box 31659, San Francisco, CA 94131
or info@californiahistoricalradio.com

Visit us at: www.CaliforniaHistoricalRadio.com

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Contents of the Journal

COLUMNS

FEATURE ARTICLES

From the Editor

In this journal, Steve Kushman gives us an update on all the work he and a few volunteers have done during the pandemic to make the studio and Hall of Fame Gallery museum ready. Next are messages from Chairman Mike Adams, and CVC's Mick Daniels. John Staples, John Stuart, and Jimmy Fink tell us how they have been making the CHRS studio operational. Norman Cox summarizes the escapades of Axis Sally. Mike Adams analyzes 1930s teen literature related to television. Joseph Bourbin offers approaches for inventorying and documenting a collection. And I walk through my efforts to build a set of small replacement IF transformers. I wish to thank all the authors for their articles, support, and scholarly contributions.

I am always in need of quality content related to broadcast radio, ham radio, and television. If you have something to contribute, I urge you to let me know. I am especially interested in technical content. It can be of two types, a narrow topic in depth or a more broad topic with less depth. Enjoy . . .

Richard Watts, jrchrs@comcast.net

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From The President

by Steve Kushman

Well here we are coming to the end of the year that wasn't one of the world's best. We want to wish well and better times ahead to all who have been affected by the virus. We encourage our readers to continue wearing masks, keeping your distance and washing your hands frequently. Do this and maybe we can open Radio Central again… soon.

Now, As far as CHRS… We are doing OK. Radio Central feels lonely without our Saturday volunteer days. Although we have been closed to the public and for large gatherings since March, a tiny group of volunteers has been coming Saturdays, one or two people sometimes come during the week to work on projects and Zoey and I have been spending a fair amount of days at RC per week. We have been sorting and emptying boxes and hanging art that has been packed away for 5 years, re-arranging our storage, adding new flooring and building out the Bay Area Radio Hall Of Fame, (BARHOF) gallery / studio and the KCHR vintage control room.

We recently used the control room and studio to shoot the 2020 BARHOF induction ceremony TV program which premiered on YouTube.

For this Journal instead of having a rambling message from me… We decided to show our readers what's been going on at Radio Central since March. So, enjoy these photos from my eye to yours.

But before I sign off, I'd like to remind everyone that CHRS has had virtually no income from our usual sources this year. No Radio Day and no donations for our radio gifts due to the cancellations of our regular venues such as the Alameda Antiques Fair. As I said earlier, we are OK, due to funds our Treasurer Richard Watts has been socking away. We have taken in donations that definitely help, but as we approach the year end we are asking for your support. We plan to tackle the Great Room restoration next year and the project will be expensive. Please go to our web site, www.chrsradio.com and make a large year-end tax deductible donation. Remember CHRS enjoys a 501(c)(3) educational non-profit status. While you view these photos, I hope you will be encouraged to donate as you see how your contributions have and will be used.

Remember I am always available for your comments or questions. (415) 203-2747 Steve@chrsradio.com

Best Regards and Keep Well, Steve

CHRS Bay Area Radio Hall Of Fame Gallery / Studio Northwest wall. The room is configured as the BARHOF Gallery. All of the 209 members will be displayed on the 3 TVs. From The KRE General Manager's couch you will be able to select the person or station you wish to be featured. Their picture will appear full screen in the center with their text bios beside and… an example of their audio will play. This is BARHOF for the 21st Century.

The Hall of Fame Gallery is now museum ready. This room was created to simulate an early radio broadcasting studio.

Note KFOG Legendary Station for 2018 Signed poster & Big Band KMPX signed poster.

In this view, notice the original tower top, donated by Chuck Waltman from Alameda's KJAZ when the antenna was located on the Bel Air building in San Francisco from 1959 through the '90s. Also see the two Packard Bell transistor table radios. This model with a cabinet handle and fake antenna attached was used on the 1960s TV show, "Gilligan's Island."

An early KRE Chapel Of The Chimes poster, an aerial photo of the KRE station and tower in Berkeley - 1940s, an original design sketch for the KRE station by General Manager Arthur Westlund - 1930s.

On and in this case are many Bay Area Radio station promotional items including two 1960s KYA 1260 transistor radios, the KGO RADIO and the KSFO truck featuring Carter B. Smith and signed by Buddy Hatton.

Northeast wall of the BARHOF studio / gallery. Note early ring and spring microphones - 1920s & '30s, Western Electric audio control console - 1930s, Victor Victrola VV-IX on rare matching record storage cabinet, Zenith Cobramatic - 1940s and One of our Electro-Voice Regency speakers.

Carlos Perez and Leon Alevantis show our beautiful newly restored Victrola and matching record cabinet. The solid red mahogany phono & cabinet were refinished by Carlos and the mechanicals were restored by Leon.

Posters about early radio created by Chairman Mike Adams.

CHRS' NBC/RCA Rangertone chime machine, Serial #002. Used for many years to generate the familiar 3 note tones on the NBC radio network. This unit is from NBC's West Coast 'Radio City' facility at 420 Taylor Street in San Francisco, home of KPO-AM, later becoming KNBC-AM. The chime machine was generously donated by Bill Newbourgh and restored by John Staples and John Stuart.

Three of the best microphones in the CHRS collection. The TV studio version of the RCA-77DX donated by Mike Adams, the early Turner carbon button mic with Western Electric element from the Ken Ackerman collection and from KPO/KNBC, the RCA-44BX donated by Dave Morey.

This is the CHRS Audio Transfer Service (ATS), where almost any form of analog audio can be digitized. This service will be offered to the public. The Mac DWS was donated by Philip Monego. The Bose powered speaker system was donated by John Stuart. Our modern transfer turntable is a rosewood based Technics SP-15. Electrical Transcription discs will be transferred from one of the 16” RCA 70-C turntables shared with the control room. In the corner is the source rack for our ATS. We will be able to digitize ETs, 78s, 33s, 45s, wire, R to R Tape, cassettes, 8-Tracks, DAT, 16" R To R logger tapes and broadcast cartridges.

View into the BARHOF studio / gallery. See Gates Dualux audio control console on proper Gates pedestal donated by Stephen Barncard, two 16” RCA 70-C transcription turntables, original ON AIR light from KGO-TV donated by Steve Kushman, two ITC cartridge machines restored & donated by Dan Healy, the Shure 55, Elvis mic, donated by Steve Kushman and restored by Jim Fink. And… "number please", our control room dial telephone!

An Otari MTR-10 donated by Harvey Stone.

A 16” Presto ET cutting lathe sits atop our Ampex ABR-10 15” station logging recorder.

The equipment supporting our KCHR radio station. The equipment is described in a following article *The New CHRS Studio and Control Room* by John Staples, John Stuart, and Jimmy Fink.

Radio Central lobby showing logos and graphics from some of our BARHOF Legendary Stations.

Zoey and her pal the President recently installed the central hall and stairwell flooring.

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From The Chairman

by Mike Adams

This is the story of the twice told tale.

It all began a year ago in the pre-pandemic world, a life where we seemingly knew the direction to which we were headed. We lived understanding our past while we planned for our future. Our future was a communications museum, one in which we used our historical objects to tell many important stories of how we humans first signaled crudely using smoke and wet blanket, finally to use our voices to inform and entertain using wired and wireless methods. Out of the wired telephone came the wireless, then came radio, freezing its evolution while we landed on the device called the smartphone.

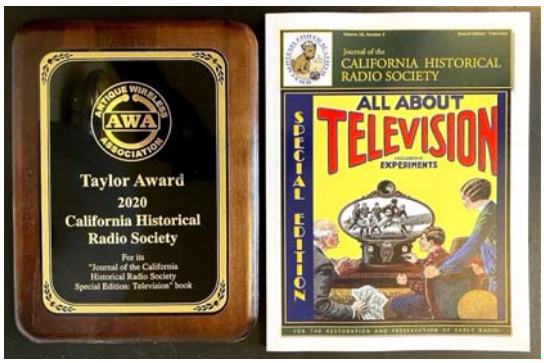
Out of this I had a story to tell. Working with President Steve, I offered to create some short stories to help illustrate the larger Bay Area Radio Hall of Fame. Out of this came short stories about Charles Herrold and Francis McCarty, both considered "pre-broadcasters," and both posthumous Hall of Fame inductees. I created a primer on the language of radio, and I wanted to tell the story of pioneer Bay Area FM station, KALW. I knew it was an early FM, broadcasting on the now-obsolete pre-war original band of 42-50 megacycles. KALW was said to be the first educational FM station west of the Mississippi.

I assumed that finding the history of this station would be like any other research project, so I began by looking at the station's web and found some very basic information, a good beginning. I called the station and no one there knew anything about their history. I asked for a callback but no one ever called. I was given the name and email of a retired engineer who was said to have the information I needed. He too never called back. I did contact the dean of Bay Area radio researchers, friend and CHRS History Fellow John Schneider. John immediately sent me all he had, including some newspaper clippings with early images. I had enough for a display which included a 1940 FM tuner, 42-50mc.

Meanwhile, like many of you I was amusing myself reading thirty plus years of CHRS Journals. Did you know, for example, that I was the club vice president in 1991. Must have been a typo because I don't remember it! My club brothers must have voted in my absence and I must not have been very productive, but I did serve under our first president-for-life Paul Bourbin. Being CHRS VP was probably a good career move. Other journals jogged my memory, mostly articles I wrote for the various issues which I did enjoy reading again. And here is the thing: To my surprise I stumbled on an article I wrote for the Spring 1992 Journal, Vol 16-2 titled: History of Broadcasting in the Bay Area Part 1, KALW FM, which I didn't remember writing.

Quoting a station publication, KALW, 50 Years of Pioneering Radio Service, "the station's roots go back to a demonstration FM station which was on display at the 1939-40 San Francisco International Exposition at Treasure Island. The demonstration apparently grabbed the attention of two district teachers who saw the long-term benefits of education by radio. Kenneth Nielson, an electronics engineer, and Ken Dragoo, both taught radio at the Samuel Gompers Trades School at 23rd and Bartlett Streets in the Mission District. They created a plan by which they could use a real radio station as a 'teaching aid' and applied to the Federal Communications Commission for an FM channel . . . The FCC granted the District a frequency of 39.9 megacycles. In 1940 they changed it to 42.1 megacycles." Obviously there is much more to say, and I will be searching for the most concise illustrated text I can find and verify for the Hall of Fame display.

And speaking of the Hall of Fame, I want to cite a tireless individual, the hardest working volunteer in our operation, President Steve Kushman, for his design and construction of the control room and studio for the Bay Area Radio Hall of Fame. No one has worked harder in the construction of Radio Central than Steve. I also want to thank Board member and Journal Editor Richard Watts for his service to our history. Richard has organized and posted on our web all of the CHRS Journals available for scanning, from the CHRS beginnings in the 1970s to the present day; more will be added as other issues become available. This collection shows us evolving from a parking lot swap meet collectors club to a museum of communications history scholarship. Thank you, Steve and Richard.



CHRS has been awarded the AWA Taylor Award, "given in memory of John P. Taylor, TV developer at RCA and Editor of the RCA broadcast News, for documentation or preservation of the history of television technology." The award is in part recognition for the recently published CHRS Journal Special Edition - Television. This award should be shared by John Staples, Richard Watts, and Gilles Vrignaud who created this book. The next AWA journal will have a review of our TV book. ◊

CHRS Central Valley Chapter News

by Mick Daniels

Like the rest of the world, and certainly like the rest of California, this has been a strange and difficult year so far for the members of the California Historical Radio Society Central Valley Chapter. With the restrictions regarding the Covid-19 virus, our activities have been severely curtailed. The very popular repair class has not been held in months. We have, however, held two of our monthly meetings in the open air outdoors on the lawn of our clubhouse, with masks and social distancing in place. The Chapter even had a "Best Mask" contest won by our treasurer Mike Loper with a unique radio-themed mask earning him a coveted prize of a four-pack of T.P. being awarded.

The Chapter welcomed its newest member Shawn McDaniel in May, and longtime member Bill Warner has retired from the Chapter and donated his extensive radio collection to the club. At our June meeting an auction was held of these radios, with half of the proceeds going back to Bill with our thanks for many years of his contributions to the Chapter.

But, just when we had the outdoor meeting routine figured out, the state-wide wildfire smoke resulted in dangerous air quality, putting our seasoned membership at additional risk. So, for the near future in-person meetings have been cancelled until further notice.

On the plus side, the membership approved by unanimous vote, the repair of the clubhouse roof, which was badly needed. Now we are ready for the rain, if only we could go back to meeting inside the clubhouse!

And finally, unfortunately, the Stanislaus County Fairgrounds in Turlock has cancelled both of the CVC's much anticipated big events due to Corona Virus concerns, the October Radio Swap Meet as well as the January Model A Swap Meet. This comes as a particularly hard blow, as these events are at the heart of the Chapter's yearly event calendar. Folks, please take care of yourselves and all we can say is, "wait till next year!"

For an update on all our activities, visit CVC at www.cvantiqueradio.com .

Mike Loper wins the “Best Mask” contest and shows off his winnings.

The Central Valley Chapter clubhouse with a new roof.

The New CHRS Studio and Control Room

By John Staples, John Stuart, and Jimmy Fink

The California Historical Radio Society is getting a new radio control room! From this facility students can practice radio production, learn about radio technology, and originate program material for local radio stations.

The 1960s was a transitional decade for broadcast radio. The "beautiful music" format of the 1950s was fading, and top-40 was taking its place. Television was starting to make an inroad to radio audiences, drawing them off to morning cartoons.

This was the decade of payola, of personality DJs, of short music playlists. FM radio had not yet made an impact and was still struggling, even though it had superior sound and most FMs were just duplicating the AM programming.

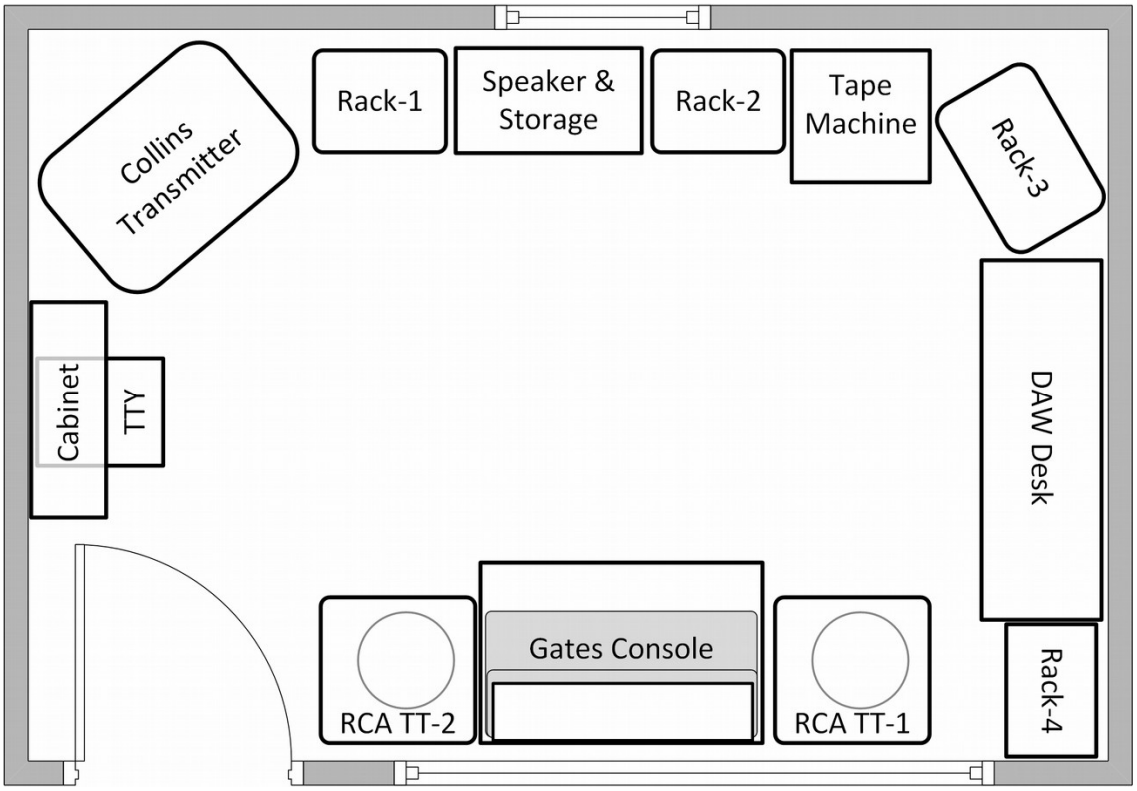
Union-based record turners of the early 1960s were being replaced by tape cartridge machines "carts", and DJs were starting to operate their own controls, or "board" in larger stations.

News programming on radio was disappearing, but the automation-based radio of the 1970s had yet to appear.

Our new CHRS studio and control room will reflect the technology of the 1950s and 1960s, similar to the facilities found in regional radio stations of the era.

Control rooms for regional stations of the time featured an audio board, surrounded by turntables, tape recorders and playback machines, and, starting in the 1960s, cart machines. The musical portion of the program would come from disc recordings and cart machines. Jingles, ads, promos were usually on carts.

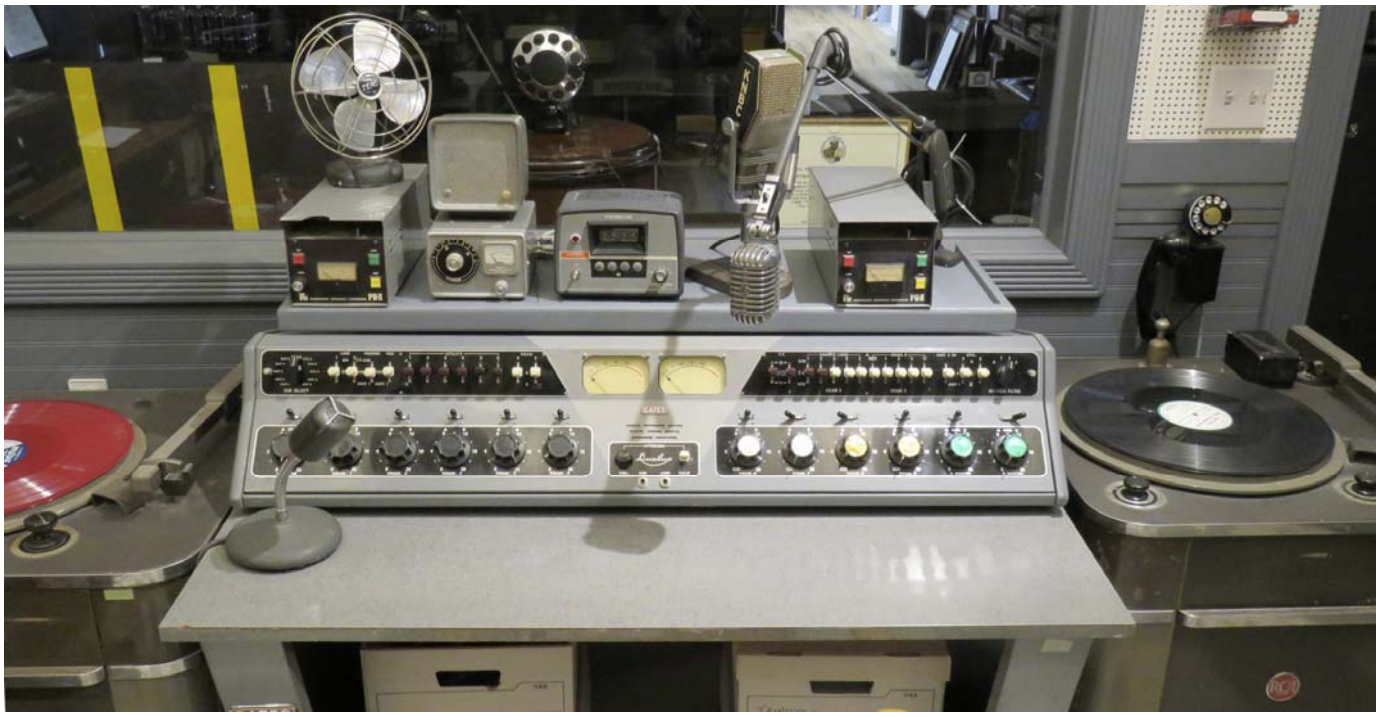
Often, the transmitter would be in the same control room. Up to the 1950s, transmitters had to be constantly monitored on-site by an engineer with a Radiotelephone First class FCC license. This requirement was finally removed by 1957, and transmitters could be operated and monitored remotely.



The Layout

The studio will feature the famous Gates Dualux, a two-channel board with an extensive set of capabilities. Dating from about 1956, this board would typically be used in an AM/FM combo operation where the programs to both transmitters would typically be the same, with separate inserts for each, station ID, for example. It's a two-channel board, but not a stereo board, as there are no provisions for stereo operation.

The control desk, a Gates Dualux console "the board" faces a window into the performance studio, the CHRS Hall of Fame room. This studio will be equipped with several microphones, playback and talk back facilities and will serve as a performance space.



Supporting the Dualux will be all the equipment typically found in a contemporary radio station control room, including the AM transmitter itself. Racks will hold technical equipment for operation and testing of the transmitter, audio processing equipment and record / playback tape equipment.

Two RCA transcription turntables (TTs) will be located on either side of the Gates board. These TTs accommodate 16 inch transcriptions, 33, 45 and 78 rpm recordings. Older large-format transcriptions, both vertical and lateral format recordings, will be played back through the original playback arms, and six EQ settings for transcriptions are selected at the turntable.

Newer microgroove recordings will be played by a second tone arm, wired for stereo playback. The RIAA-equalized preamplifiers are located in the base of the turntables. Stereo audio is provided to the nearby Transfer Facility (TF), and a mono mix is routed to the Gates. The board provides for cuing of the recordings, and the turntables are robust enough for slip-cuing.

Cartridge tape players started appearing in the early 1960s. These contained a single song, an ad spot, or a jingle. The continuous tape loop in the plug-in cartridge was long enough for the one song, and then would cue itself up to start at the song again at the next playing. Typically, for a top-40 format, an entire "set" would be carts plugged into a stack of cart machines, including the song, an ad or two or a PSA with the announcer adding a tag, then a station ID or jingle, going on to the next song. The board man, or the announcer him/herself would punch the buttons on the cart machines to proceed through the set. Some operations split the board man and the DJ, in smaller stations the talent would handle the entire operation. Cart machines had to start silently and immediately, as the microphone was usually open.

Another program source in the control room is the Ampex 354 tape player and recorder, which can accommodate ten-inch reels. The board feeds the record facility of the Ampex, so programs originated in the control room and the performance studio can be preserved on tape.

This Ampex recorder is at the top of Rack 2, located on the back wall of the control room.

The audio processing devices in Rack 2 are described next.

Audio Support Equipment

The program content generated through the board is usually processed to make it more suitable for modulation of the transmitter. This includes leveling of the output signal to fully modulate but not overmodulate the transmitter, and trimming the frequency response curve.

The old days of high-fidelity AM are over, and the RF spectrum bandwidth taken by transmitters in the AM broadcast band is limited to a restricted audio range. In the 10 kHz channel allocated to each station, each sideband extends away from the carrier equal to the maximum audio frequency. To protect the next neighbor station, a 5 kHz upper limit is often applied. (However, scanning the current Bay Area spectrum, there are stations that have sidebands extending beyond 15 kHz either side of the carrier and appear to be well-modulated with good audio.)

Left is the lower portion of rack 2 showing the devices mounted just below the Ampex 354. At the top of the photo is a one-third octave equalizer (EQ) that tailors the audio to simulate various choices of audio bandwidth.

To maintain a constant level of modulation (as DJs like to "pin the needle"), a Gates Sta-Level gated audio level compressor amplifier follows the EQ. This device acts as an automatic gain control, and tries to maintain a nearly constant output level.

This device is known as a "gated" compressor. If there is an interruption in the audio feed, the compressor gain will be held at the last value used during program, so as not to amplify up any noise during the break (the noise swoosh). When audio reappears, the Sta-Level will establish a new gain setting. The Sta-Level has a relatively fast attack time, but has a release time of several seconds, so it simulates an easy gain riding effect.

The relatively fast attack time of the Sta-Level is not fast enough to catch a very fast initial audio transit, such as a sudden loud musical passage. The device right below the Sta-Level is a CBS Volumax peak level controller, which is similar to the Sta-Level but has a very fast attack and release time. Its purpose is to prevent overmodulation of the transmitter, which sends "splatter" across the broadcast band. The Volumax applies an almost inaudible further compression of the audio, but is essential in meeting FCC regulations. The combination of the Gates and the CBS and their like is responsible for the loudness wars on AM (and now FM) radio.

Below the CBS Volumax is a 12-output audio fanout that provides processed audio to many destinations, the power supply for the Gates board, and a jack panel through which all processing devices go through, which allows testing and re-routing. At the very bottom is a 120VAC power distribution and master switch panel.

The Transmitter

The regional stations would typically have a low-power transmitter, frequently in the control room itself. CHRS has a 1957 Collins 32V-2 one-kilowatt AM broadcast transmitter, one of the most popular and nicest-looking among broadcast transmitters.

This transmitter uses vacuum tubes to provide a 100% modulated carrier of 1 kW and mercury-vapor rectifiers to supply the higher operating voltages.

The transmitter has been stripped of its high-voltage components, but the classic glow of the tubes has been recreated. Jim Fink accomplished this by illuminating the bases of various tubes with one watt surface mount LEDs that were coated with orange glass paint. A circuit was designed to gradually increase the brightness of the LEDs upon power up

and slowly dim them after power was removed, giving a very realistic effect of the filaments in operation. The lighting effect is shown below left.

The four power supply mercury vapor rectifier tubes glow with a purple-blue color. They glow brighter when audio modulation increases and more current is required.

Two blue 1 watt LEDs supply a constant background illumination for these tubes. Surprisingly, the reflected color is purple, not blue. These tubes were lightly sprayed with a blue fluorescent paint. This spray is clear under normal lighting conditions but glows blue under ultraviolet light. An LED strip composed of 30 ultraviolet LEDs is driven by the audio and causes the tubes to glow brighter with increased modulation. This audio also supplies a varying current to the modulator plate current meter.

The five front meters are illuminated by another LED strip consisting of 30 white LEDs. Their light passes through 2 layers of translucent plastic to diffuse the light. Four of the meters are set to read correct values by the selection of series resistors from a 12 volt Supply.

The antenna current meter is driven by a 2.5 volt transformer in series with a 0.68 ohm power resistor give a reading of 3.2 amperes. This represents a power output of 512 watts.

When the power buttons are pressed the unit makes an audible clunk, which sounds like the original transmitter.

A small high-frequency speaker was installed deep down inside that produces the sound of the modulation transformer lamination vibrating with the audio.

Transmitter Support Equipment

Several pieces of technical equipment are necessary to keep the transmitter on the air, monitor its performance, and to provide annual transmitter "proofs". This equipment is located in Rack 1, near the transmitter and is shown on the next page.

At the top of the rack is an off-the-air monitor tuned to the station that sounds an alarm if the transmitter goes off the air. (It's not uncommon for the operator to be unaware of a transmitter failure until the phones start ringing.)

Below that is a time sequencer. Many AM stations have a different daytime power and nighttime power, usually with a change in the directional antenna pattern as well. The time of change varies with the season of the year. The sequencer is a device that can automatically change the daytime and nighttime parameters of the station right on time, to avoid FCC pink tickets.

Right below the sequencer is a remote control for a separate transmitter. Even though an engineer has not been required to be at the transmitter site since 1957, the transmitter must still be controlled and monitored in a fail-safe way. The phone dial on the monitor selects one of several transmitter parameters to be monitored and to be displayed on the meter.

Below the remote control is the feared and hated Conelrad monitor. During the cold war in the 1950s, key broadcast stations were required to change frequency to 640 kHz or 1240 kHz and air public information programming. In urban areas, the highest-power stations would broadcast for a few seconds, and then another would take the frequency, in some sequence, to supposedly avoid being targets for enemy missiles. All stations were required to monitor the Conelrad frequency and either participate or get off the air. This was discontinued in 1963, but radios including car radios produced during this era display small Conelrad markers at 640 and 1240 on their dials.

Right below the Conelrad monitor is the off-the-air modulation monitor. FCC rules require that AM stations be within 10 Hz of their assigned frequency, and not modulate over 100%. Later, the upward modulation limit was increased to 125% as modern equipment can handle significant upward modulation without "splatter".

The modulation monitor and the distortion analyzer right below it were used in "proofing" the transmitter modulation performance, the distortion, frequency response and hum level.

The Wiring

The Gates Dualux board accommodates 60 mic, phono, tape, remote, loudspeaker, and intercom circuits. All of them will be functional, thus requiring approximately 180 solder post connections just inside the console, plus corresponding connections behind audio equipment and patch panel jacks around the control room. This creates a lot of wiring to keep track of during installation, and to access for maintenance and future additions.

Because the control room is only 150 ft^2, we could not afford to leave access room behind the console and equipment racks. Instead, we can roll them away from the walls, tethered by 6 ft. umbilical-cord cable bundles. The cables drop through small access doors in the floor onto cable trays suspended from the basement ceiling. The cable trays are simply low cost vinyl rain gutters, suspended with L shaped bicycle hooks screwed into joists.

Correctly installing all of these cable circuits required careful planning. John Stuart prepared a Cable Schedule spreadsheet that included every cable's origin, destination, type, function, ID label, and conductor termination points. Then the cables were grouped into Cable Pull Bundle lists and assigned temporary tag numbers. After laying the bundles into the underfloor tray system, the ends were terminated and wrapped with a permanent ID label attached at a visible location near each end.

Right, a portion of the Cable Schedule is shown.

CHRS RADIO STUDIO CABLE SCHEDULE							
CABLE				FROM		TO	
#	TYPE	SIG TYP	LABEL	DEVICE	TERM	DEVICE	TERM
1	1PR 22 SH	MIC	MIC-1	XLR PLATE	XLR-F-1	GATES CNSL	TB1-1,2
2	1PR 22 SH	MIC	MIC-2	XLR PLATE	XLR-F-2	GATES CNSL	TB2-1,2
3	1PR 22 SH	MIC	MIC-3	XLR PLATE	XLR-F-3	GATES CNSL	TB3-1,2
4	1PR 22 SH	MIC	MIC-4	XLR PLATE	XLR-F-4	GATES CNSL	TB7-5,6
5	1PR 22 SH	MIC	MIC-4B	JACK BOX-1	XLR-F-1	GATES CNSL	TB7-13,14
6	1PR 22 SH	MIC	MIC-5A	JACK BOX-1	XLR-F-2	GATES CNSL	TB7-7,8
7	1PR 22 SH	MIC	MIC-5B	JACK BOX-1	XLR-F-3	GATES CNSL	TB7-15,16
8	1PR 22 SH	PHONO	TT-1M	JACK BOX-1	XLR-F-4	GATES CNSL	TB8-5,6
9	1PR 22 SH	CART	CRT1 PLY	JACK BOX-1	1/4 TRS-1	GATES CNSL	TB9-11,12
10	1PR 22 SH	CART	CRT1 REC	JACK BOX-1	1/4 TRS-2	PATCH PNL-3	PP3-33
11	1PR 22 SH	PREAMP	TT1 LPL	JACK BOX-1	1/4 TRS-3	MIX/PAD	TB9-7,8
12	1PR 22 SH	PREAMP	TT1 LPR	JACK BOX-1	1/4 TRS-4	MIX/PAD	SAME
13	1PR 22 SH	LINE	RMT-3	JACK BOX-2	XLR-F-1	GATES CNSL	TB11-5,6
14	1PR 22 SH	SPEC	RMT-4	JACK BOX-2	XLR-F-2	GATES CNSL	TB11-3,4
15	1PR 22 SH	LINE IN	EXT MON	JACK BOX-2	XLR-F-3	GATES CNSL	TB8 7,8
16	1PR 22 SH	PHONO	TT2 M	JACK BOX-2	XLR-F-4	GATES CNSL	TB9-1,2
17	1PR 22 SH	CART	CRT2 PLY	JACK BOX-2	1/4 TRS-1	GATES CNSL	TB10-1,2
18	1PR 22 SH	CART	CRT2 REC	JACK BOX-2	1/4 TRS-2	PATCH PNL-3	PP3-34

What the new control room and studio provides for CHRS and its members

CHRS now has a new and unique facility. This will supplement the Transfer Facility, located in the same room, which will use state-of-the-art equipment to digitize program material on vintage and obsolete media. The transfer facility will be described in a future Journal article.

The control room, with its turntables, cart machine and tape playback provides the facilities found in typical region stations of the decade of the 1960s. In this transitional decade, the top-40 music format was perfected by personality DJs, and these stations also served smaller communities with local news, weather and entertainment.

We have equipped the Hall of Fame as a performance space with several microphone inputs where local talent can test out their formats and have them recorded, using 1960's monaural equipment to reproduce the technical limitations of AM radio.

The Gates board will also be able to supply program material to the Transfer Facility, and receive program material from the Transfer Facility though a wired link, which adds to its versatility.

We now have a facility that can be used to train future radio personalities from the local schools and get them interested in radio communications and radio technology. It is there for all of us to play with, and you can try out your pipes as a disc jockey.

Acknowledgment

Steve Kushman, without whose energy this project would never have happened. Steve created the vision for the Control Room and Studio, designed its look and functionality, and with the help of volunteers spent long hours and considerable effort constructing this space and detailing its fit and finish.

The Authors

John Staples, W6BM, DJ'ed at a 1 kW FM in the 1950s and ran the board at top-40 WJJD Chicago for three summers in the early 1960s, learning a lot of pop music. He received his First Phone ticket in 1958. This was back when radio was still a lot of fun!

John Stuart, KM6QX, had a 35 year engineering career designing and constructing instrumentation and control systems at PG&E in San Francisco. Since retiring in 2000, he has worked on radio and audio system projects at San Ramon Valley Fire District, and at the Lafayette Library Community Hall. He is a CA Licensed Mechanical, and Control Systems Engineer, and is the CHRS Resident Engineer for technical building systems.

Jimmy Fink, KE6GKB, worked as assistant engineer at FOG -FM and a recording engineer for The Kingston Trio.

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Radio Berlin Calling . . .

By Norman Cox ©2009

Hurry up and wait. Hurry up and wait. In Europe, U.S. World War II troops are fighting two enemies· alternately the Germans and then boredom. Radio is a favorite way to fill the slow times. One of the GI favorites is a sugar-tongued sweetie broadcasting shows aimed at them from Radio Berlin. The troops soon nickname her Axis Sally. Who is she and why is she so popular with the GIs? For answers follow this typical scenario of an Air Force corporal.

Excerpted from Saturday Evening Post, issue 1/15/44:

> Twirling the dials of his radio our bored corporal is hoping to hear just one hour of good old U.S. jazz. First he gets the doleful chimes of Big Ben followed by a booming impressive voice. "This is London Calling in the North African service of the BBC." A few teasing bars of swing and then a fadeout.
>
> Then the announcer comes on with "Good evening forces. This is your variety hour playing all your requests. Here's one from three airmen in Gibraltar who want to hear Glen Miller's 'Little Brown Jug.' We couldn't find that record boys so here's one we hope you will like as well 'The Flight of the Bumblebee' as played by the Aberdeen Bagpipe Band.
>
> Enough! ! Our corporal, twisting the dial, next hears a terribly British voice explaining something about the price of potatoes in Wales. Another spin of the dial and he hears a noisy dramatization of the heroics of a young Russian girl who strangled 75 Nazis barehanded while fighting on the Kharkov front. Assured that the Russian girl can easily take care of herself, he dials over to the next station where he runs into the results of the cricket match in Northwest Wembley. Mercifully the station signs off with the familiar music of "God Save the King."
>
> Then almost ready to give up, he runs into an old friend, Axis Sally. Now, for him, Sally is a different proposition. She's the sweetheart of the Second Allied Expeditionary Forces and she plays nothing but swing. In far off Berlin, Minister Goebbels thinks that Sally is rapidly undermining the morale of the American doughboy but our corporal knows that just the opposite is happening. He gets a bang out of her. All the U.S. troops love her.

Sally, who calls herself "Midge at the Mike" while broadcasting for Radio Berlin, never identifies herself by name. She is Mildred Gillars and was born in Portland, Maine on Thanksgiving Day, November 29, 1900. While attending Wesleyan University in Ohio, taking speech and drama classes, she was described as an attractive girl with black hair and piercing eyes who longed for the spotlight of a stage career. Dropping out of college she headed tor New York's Greenwich Village. There, playing small parts in various stock companies and vaudeville, she was mostly unnoticed.

Mildred next turned up in Camden, New Jersey. As a "Mrs. Barbara Eliot" she ran an ad in the local papers pleading for her "husband" to come home as she was soon to become a mother. After the ads were placed. reporters contacted her and she told them that she was a common law wife. Then, a few days later, she staged an elaborate suicide attempt on a Philadelphia bridge.

The police at the scene quickly determined that she was neither married nor pregnant and that her elaborate story had been made up to publicize a lurid movie entitled "Unwelcome Children." Next trying her luck in Europe, she worked as an artist's model in France and as an English translator in Berlin. In Berlin she joined a friend, former Hunter College professor, Dr. Max Otto Koischwitz from New York, who was broadcasting for the Nazis under the nickname of Mr. OK. He persuaded her to take a job in Dr. Goebbels' American section of Radio Berlin.

With her knowledge of the U.S. idiom as her primary asset, she soon found her niche. Nightly starting in December 1941 she began beaming her "Home Sweet Home" shows to the American troops in North Africa, Europe, and to the U.S. Listeners quickly bestowed upon her the nickname of "Axis Sally."

The main purpose of her show was to make the troops homesick. In between the popular records she inserted lots of references to the girls and wives left behind. "Hi gang. I was just wondering if your girl is sort of running round with all those 4-Fs at home? Throw down those little old guns and toddle off home."

These simple attempts to demoralize the GIs were a small price to pay for all the good jazz she sent their way. When she featured the sentimental German hit 'Lili Marlene,' the GIs picked it up and adopted it as their own. Record copies were becoming available from overrun German positions. The amount of people in the U.S. listening to the same 'Home Sweet Home' short wave shows had to be almost zero. However, there was one very interested group. Government monitors in Silver Hills, Maryland were recording all of her broadcasts.

Mildred and Koischwitz had become lovers and, together posing as international Red Cross workers, they made tours of the U.S. prisoner of war camps. There, passing out cigarettes and good cheer, they interviewed and recorded American prisoners. The soldiers were told the recorded interviews would be broadcast home to friends and family by short wave. "Trying to make the folks at home feel better, the prisoners often gave statements of good care and well being. Later these interviews would be altered and rebroadcast to the U.S. by Koischwitz and Mildred to give the impression that the soldiers agreed with inserted Nazi propaganda

G.I. USES RAZOR AS RADIO
(WITH THE FIFTH ARMY ON THE ANZIO BEACHHEAD)
April 27. 1944 (AP)

For foxhole entertainment, Pvt. Eldon Phelps of Enid, Okla. has invented a razor blade radio. Fellow infantrymen say it works. Both Rome and Naples broadcasts are reported picked up on the instrument which Private Phelps said can be constructed thus: "Stick a razor blade in a piece of dry wool. Attach a coil to the wool and connect it to a ground. Attach an aerial to the blade. Move a cat's whisker antenna coil against the flat surface of the blade to tune the station. It's the same principle the old crystal set."

The war was turning against Germany and with the certainty of the invasion of mainland Europe, Radio Berlin prepared an elaborately produced dramatic radio program entitled "Vision of Invasion." It was aired on May 11, 1944, turning out to be about three weeks before the Allies invaded France. One year later, in May of 1945, with the war winding down, she aired her last show. From then on, in Berlin she was constantly on the move from cellar to cellar, living on meager handouts and black market food, and hiding under assumed names.

Millard Gillars while in Army custody. U.S. Army photo, 1946.

When the U.S. Counterintelligence agents picked her up for questioning on March of 1946, her looks along with her money were gone and she was reduced to smoking scrounged cigarette butts. Once the highest paid person in Dr. Goebbels' American section of Radio Berlin, she was carrying one mark, 15 pfennig. She was released atter being held for nine months and then re-arrested when a case had been built up against her

In January 1949 she was in the dismal Washington D.C. District Court on trial for treason. Finally Mildred was to get her first U.S starring role. She entered the courtroom in a sleek black dress, her deep tan accented by a blue scarf and bright red nails and lipstick. Her awareness of being in the spotlight, obvious to all, she arranged herself next to her attorney, leaned forward and whispered in his ear while canting her head at a coquettish angle. During the jury selection she posed with her chin cupped in her hands and winked at courtroom spectators. Her trips up and down the aisle at recess were accompanied by considerable side to side hip movement.

On the fourth day of her trial, stacks of radio recordings made by the FCC were introduced. It was mostly tough

going for the jury of five women and seven men for the next couple of days. They did brighten up during the musical portions of the records. One of the records played was the radio drama "Vision of Invasion" which aired about three weeks before D-Day. The stated purpose of the show was to demoralize the waiting troops with grisly forecasts of staggering losses if the Allies dared to attack Hitler's Fortress Europe.

Mildred had the lead, playing the part of an "Ohio Mother" who dreamed that she had been talking to her son in England, finding out later that he had drowned in a fiery sinking ship during the invasion. The show opened with the sounds of heavy battle action. An announcer intoned "The D of D-Day stands for doom, disaster, death, defeat, and Dunkirk." The drama unfolded with more battle sounds cries of anguish and dismay, yelling, and chaos. The somber effect of the chilling radio broadcast was evident on the faces of the people in the courtroom years after its first airing.

When Mildred took the stand her testimony at first was accompanied by broad theatrical gestures shaking her long hair, fingers pressed to her forehead and smiling at the judge. As the trial wore on the seriousness of her position became more apparent to her and her testimony now included tears that finally did not appear to be play acting.

In March, the New York Times headlined "Axis Sally Found Guilty Of Treason." The jury acquitted her of seven of eight counts but found her guilty on one count of treason involving the "Vision of Invasion" broadcast. The judge asked her if she had anything to say before sentencing. She said that "Vision of Invasion" was written by (her lover) Professor Max Otto Koischwitz whom she described during the trail as "My destiny."

She contended that Professor Koischwitz was an American citizen when he wrote "Vision of Invasion" but had been exonerated for lack of evidence in 1947. So, she said she too should be exonerated. The judge cut her off saying that her lawyer had already presented the same information during the trial.

At the time anyone found guilty of treason could be sentenced to a minimum of five years in prison or given a death sentence. She was sentenced to serve ten to 30 years in prison and was fined $10,000. Pale and unflinching, she took the sentence with no apparent emotion. Her half-sister in court said "I don't think Ethyl Barrymore could have received the verdict any better."

As she walked from the court house through a barrage of flash bulbs, one of her escorting marshals remarked "It looks like you are going to have your picture taken again Sally." "I shouldn't be surprised" she replied. Thrusting her chin up. She waved to newsmen and photographers saying, as she entered the prison van, "Goodbye . . . Goodbye."

ADDENDUM

On July 10, 1961 Miss Gillars was paroled from the Federal Women's Reformatory at Alderson, W. Va. after serving twelve years. After her release she taught at a Catholic school in Ohio. In later years she obtained a degree from Ohio Wesleyan University. She died at 87 in June of 1988.

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THE AUTHOR

Norman Cox is a retired banker who grew up in the SF Bay area during the 30's, 40's and 50's with Father Barber, *Candy Matson, Johnny Modero,* Sam *Spade,* Bud Foster, Don Sherwood and Bert Solitaire as his local radio favorites. All listened to on the family Philco with its magic eye tuner.

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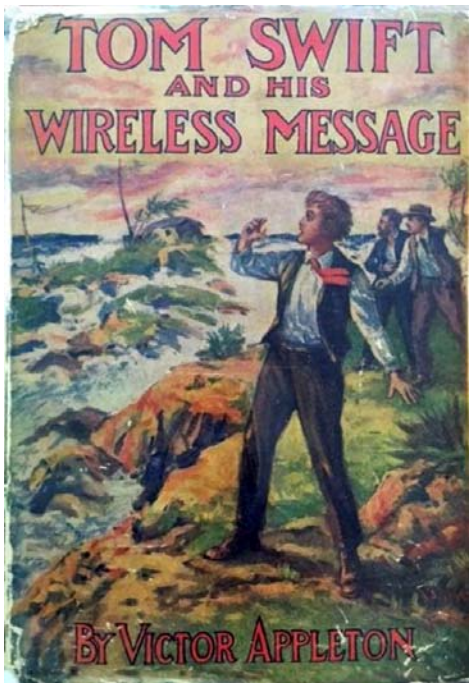
A Tale of Television

By Mike Adams

Analyzing *Tom Swift and his Television Detector*, 1933, Victor Appleton, Grosset & Dunlap

The Tom Swift Series, 1910-1941, was an Edward Stratemeyer Literary Syndicate creation of 38 titles with two ghost writers, Howard Garis and Harriet Adams, both using the name Victor Appleton. Adams was Stratemeyer's daughter who took over the business in 1930 upon her father's death, and it was she who wrote "Television Detector." You might say that the title of this 1933 story harkens back to the invention of early radio when the term "detector" was used beginning in early wireless and detection of wireless messages. Early receivers were based on what were called crystal detectors and vacuum tube detectors. So it was only natural that the new medium of television would follow and copy the name, thus television detector.

The Swift TV volume examined here was written by Harriet Adams who was broadly educated in the Arts and Letters, having graduated from Wellesley College in 1914. One can imagine her in an early class in communications history learning what Marshall McLuhan would suggest years later, that each new system of communication begins with the attributes/content of those that preceded it. An example: early film was a long shot of a theatrical stage. It would be a while before film developed its own language based on the shot and camera movement. Perhaps you remember how early television took all of radio's hit shows and added visuals. This has always been the way new media arrived, language-less and waiting for a new generation of creatives. Thus radio's content was live music performance and the reading of the newspaper, as television was the drama and variety of radio, call it "radio with pictures."



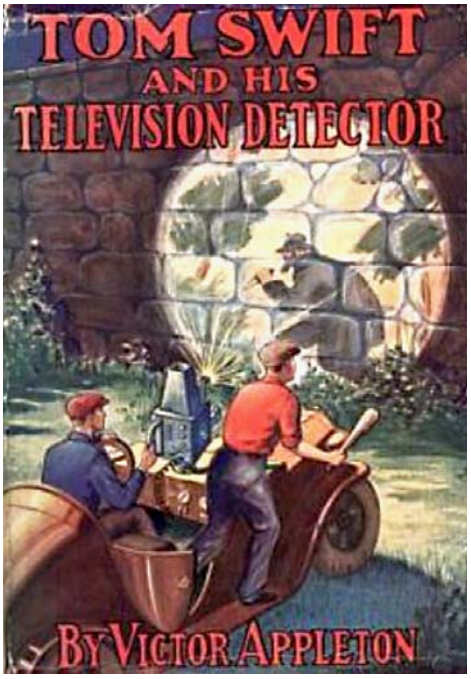
(Image) CHRS Journal readers may be familiar with the 1911 Swift volume, *Tom Swift and the Wireless Message or the Castaways of Earthquake Island*. Early wireless used to save lives at sea. This is the cover.

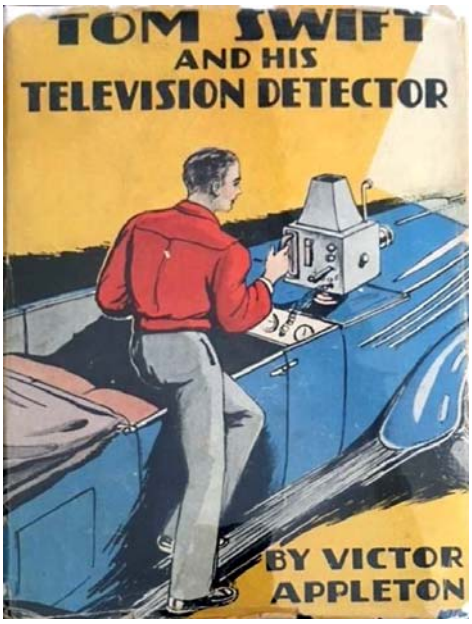
We know from the study of the Stratemeyer Syndicate (Hardy Boys, Nancy Drew, Tom Swift) that consultants with technical expertise would be called upon to add real information on which the science fiction of Tom Swift might be loosely based. And given the restrictions of the juvenile series format, much of what Ms. Adams needed to know had been developed in 35 previous volumes. Like any weekly TV series, the Swift stories were played out using an ensemble cast of friends, parents, boy and girl pals, law enforcement figures, preachers, shopkeepers, all of whom were small town America role models in the 1930s. Tom Swift lived in Shopton which some researchers have attempted to prove was somewhere in Upstate New York. Tom Swift's father, Barton Swift was a respected scientist in Shopton and would endure nearly 20 years of Tom being 16 and otherwise bequeath his laboratory to his son. Given the thousands of pages written by Garis these should be easy stories to write for Swift's eager young boy readership.

Along with Dad there was Mary, Tom's girlfriend who had likely never been kissed let alone touched by Tom. Tom's best friend was Ned who in real Shopton life worked in a bank and later became the administrator of the Swift scientific empire. Remember that none of these cast members aged one bit (In this volume Tom would have been 38 in real years).

Also in the cast was Mr. Damon, an older man, an eccentric who had the unfortunate habit of blessing every object, person and invention, and there was KoKu, a giant who was picked up along the way during a Swift adventure in the jungle. There was the all-too-common-in-the-era racial stereotype, Eradicate or Rad, who was always available for odd jobs around the lab. Others were added as needed including a housekeeper, (we know Mrs. Swift, mom, was deceased) and of course hundreds of villains, all of whom wanted to steal Tom's invention du jour.

Most of the Swift's stories followed this basic format: Cause a cast member or stranger to face a sudden peril, Tom Swift appears on the scene, he saves the man or woman in distress. My hero. This is generally followed by a summary of several similar saves in past volumes. This recap also begins to introduce the scene inhabited by Tom, Father Barton Swift and others at the Shopton lab and home. This setup serves to bring the new-to-the-series reader into the family and their adventures. In this volume, *Tom Swift and his Television Detector, or Trailing the Secret Plotters*, there is already an unintended mystery. It seems that for this book there are two distinctly different covers. Why would this be? It could be that this volume's cover, published just two years after Edward Stratemeyer's death, was reimagined by his heiress, daughter Harriet. Perhaps she felt cover one was too juvenile and needed more science fiction. It is also possible that cover one does not really suit the stories content. But thank you boys and girls for your patience. Please remove the professor and introduce the action. And Swiftly.





Two covers of *Tom Swift and His Television Detector* from two different publishers.

Chapter One opens in the darkened laboratory of the Swift Company as Ned is trying to get the attention of best pal Tom. "Listen Tom: The silence of the experimental laboratory was suddenly broken by a strange zizzing, buzzing and snapping sound which anyone familiar with 'spark' telegraphy would have translated into dots, dashes and spaces." Ned then asks Tom to translate what must be an important message, perhaps the setup for this story? Ned explains that the message is a code he has worked out and Ned's first message is only "I am in trouble, help me." Tom changes the subject, telling his pal that the secret code might come in handy one day when Tom is kidnapped, and here Ned suggests "I could send you a call for help in this secret code," but Tom has a better idea: "I'd have to invent some sort of detector to locate you, a kind of television detector." Little does he know how true this is.

Ah Ha. What Tom really wants to invent in the year 1933 is GPS, but we'll forgive his limited prescience. After all he is only a boy who has remained 16 for thirty-some years. Now the big reveal as Tom shows a secret door to Ned whereupon they enter and switches are flipped, the laboratory floor rattles and shakes, and the door of the top secret room opens to shock as it appears that an intruder has taken a secret formula for the "most deadly gasses ever known." Now the story takes off as Tom exclaims "who would have robbed my secret vault?" Many plans for new inventions are gone! It is here that the characters freeze in place while the cast is introduced and the series is summarized beginning with *Tom Swift and his Motorcycle*. This is followed by the entire Swift Oeuvre told featuring motorboat, airship, electric runabout (we can only guess what the inventor of the Tesla car, Elon Musk, read as a child.) Other Swift inventions included a war tank, a giant magnet, on and exhaustive on and on.

Return to the early mention of the television detector and how it might be used to track the bad guys, to which Tom replies "What television detector? I haven't any such apparatus." This of course leads to the story of how it is invented and used. Now the discussion we have all been waiting for, some clarification as Ned implores Tom: "Develop the television detector, after all what is television?" The answer to this simple question could really change the course of human history. Tom answers: "Tele-afar, vision to see – to see something that is far off." Tom will never replace Farnsworth or Baird. Tom tries again, this time successfully: "In television light waves transmitted from living persons moving in one room are sent through the ether in a sort of X-Ray manner, are transformed into wireless electrical impulses, and so enter a suitable reproducing machine in another room, perhaps in a distant city. To enable the receiver to see the persons at a distance, the electrical impulses are transformed back again into light waves, and we have television." Ta Ta. This is good enough for the reader of juvenile fiction, but not good enough to get accepted by MIT. Tom's version is more like Zoom. Tom also compares the television to motion pictures, the obvious difference that one is forever preserved on photographic film, available to see over and over.

Television may turn out to be the side story as the real problem is that in the burglary of the lab one of the important invention details missing is the formula for a deadly gas. Says Tom: "I must find the man who took it or he may kill off whole countries or states if he is a fanatic." Would we allow a 16 year old boy who has never kissed a girl to have such a formula? It is here that we chide Tom for not putting his secret data into the 1930s version of the cloud. Now, as is the custom in these stories, another break in occurs at the lab and a chase ensues, leading to escape. Even Koku the giant who was guarding the facility was somehow knocked out by what is believed to be a gas. The escapee was said to be a foreigner of European or Asiatic descent with a black beard. This security problem is one that Ned believes can be solved if Tom would hurry up and invent the television detector. It is here that your author must suggest to Tom that plans for a ready made television device can be found in the Hugo Gernsback magazine *Television*.

The first five chapters have turned out to be a major foot chase, into the secret lab, over the fence, all through downtown Shopton, and back to the lab. It could be that Stratemeyer's daughter Harriet who is the ghost writer is having trouble concentrating on the real purpose of this gambit, the invention of television. This is her first Swift after all. Returning to the secret lab, Tom and Ned hear a strange scraping sound – they think it comes from beneath the lab floor – perhaps a secret tunnel underneath it all. Koku the giant, who has again been called upon to guard the lab's entrance, vows to stop any intruder: "No make fool of me two times. I watch careful." Tom suggests that the intruders might be a well-known gang of European terrorists, introduced on page 45, here to steal the gas formula of Korbis Alhazar. Also note that the persons responsible are those modern day bad guys now noted by Ned: "Tom, it's something fierce if we have a gang of terrorists in Shopton!" Is there nothing new boys and girls? Tom calls the bad guy a "twisted foot foreigner" because his footprint indicates a damaged foot.

Meanwhile the pair are perfecting the secret code mentioned earlier and the small radio transceivers used to communicate with each other. The two begin a "footprint" search starting in the neighborhood they call slums, an area where many foreigners who were laborers in Tom's Father's plant lived, described as, "drab and dreary tenements and several old factory buildings that had been made into barracks for groups of men who shifted from place to place, working a few days or weeks and then moving on." Did someone mention "Union?" It is obvious here that Tom's family factories were not paying a living wage, and the itinerant workers situation was partially of his making. Also note the prejudice against the so-called European men. This 1933 story takes place in the middle of the Great Depression. So searching in the so-called "slums" for a footprint does expose them to hungry men on the dangerous side of town: "More than once it had been raided by the police when the ugly tramp population had grown menacing." C'mon Tom, these guys are hungry, they need a job with a living wage, they need warm coats, they need Socialism. Back to the point of the story. They believe that Twisted Foot is hiding within one of the foreboding tenements but they can't see inside and it is too dangerous to go inside. This calls for a portable television detector and Tom is newly energized: "I'll see if I can make a television detector that will enable me to look through a brick wall!" Tom rushes back to the lab to develop the new invention.

It sounds simple: "All the authorities would have to do is point the receiver at the building or suspected hiding place, turn on the power, and they could see, on a television screen, whether or not the man they want is here." And to further complicate the story, while the two young inventors were scouting the location, someone had scrawled on the side of their car the words, "Beware the Leopard League, Tom Swift." Tom continues to perfect his television detector while mindful of threats against him. Ned works on perfecting his secret code and during a test, he signals to Tom that he is actually in trouble: He's coming after me – the Leopard." They find Ned bruised and battered but alive holding the broken wireless set used to transmit and receive code. The batterer got away, but not before Ned noticed he was wearing a badge with the image of a Leopard. There is a race against time as Tom believes that the Leopard has the gas formula and he has to be found before the enemy uses the deadly gas on the local population. There is much at stake.

Tom continues to improve the television detector, "I'm pretty close, Ned. I just finished some new cathode ray tubes and they may turn the trick." This is a time to praise Tom on his use of the newest electronic television technology. The early 1930s found the TV inventing community leaving the mechanical spinning disc technology behind, realizing that the electronic systems using the cathode ray tube will be television's future. Still, de Forest, Baird and Jenkins were now reluctantly giving up their mechanical TV experiments and patents. Mechanical was a dead end. Tom too finally has a working television detector. He explains: "You know of course that television is due to electrical impulses combined with light waves. Well, I have been bothered with a large blotch of phosphorescent light on my plate where the electrons strike the end of the glass cathode tube." Something doesn't sound right?

He explains further but he is now in sci fi territory as he explains how his new device will see through walls like x-rays. He compares it to the fluoroscope that caused many youth hanging around shoe stores to develop foot cancer. He claims this for his television device: "When I point this gadget, which looks like a camera, at a brick wall or at a wooden or stone one, the rays in my machine penetrate through the barriers, bombard the objects beyond the electrons, flash back to me and show themselves on a screen." This is surely slow death by television! He tries the device on Ned and it works. The device is a cross between a camera, and an x-ray machine, but this one can see through several inches of brick wall: "Just as you have to set your camera lens at the proper distance to get a sharp image on the ground glass, you have to set this television detector lens to get the best results." Tom has also explained that he started with previous inventions like his photo-telephone and motion picture machine. The final piece of the inventing puzzle has just come into focus: "It lies in a radium tube. I'm going to attach it to my television detector. The radium rays will shoot out any distance and will illuminate the persons I want to see without their knowing it. Then I can see them in the dark."

The TV test is interrupted as a new figure enters the story, this time a Benson Banlot of the US Secret Service. At last, so to speak, the cavalry arrives. He is looking to apprehend an anarchist called Alex Kalhofski. He wants the help of Tom and Ned. Tom now believes that Kalhofski and the Leopard are two different individuals. Nevertheless, Tom and Ned return to the original plan, and that is they are taking the television detector to the abandoned factory to spy on the Leopard using their x-ray like television device. Their device warms up as Tom uses this bit of tech speak: "The double anode, high vacuum, cathode ray oscillograph tubes were well warmed by now by the electric current flowing into them from the car storage battery," Panning the camera around they discovered a group of scruffy men playing cards. They continued to pan to different floors looking without success for the Leopard, but they were able to focus on a group of "frowsy tramps" appearing to plan a dastardly crime. Alas, they never did find what they were searching for and gave up for the night.

Again, the Leopard was not to be discovered behind the walls of the tenement building, but while Tom and Ned were spying on the inside, the Leopard again left his mark in mud on the car door. The mud had trace of an element found at the nearby place called Crystal Cave. The plan was to improve the detector and then take the device to the cave and look around there for the Leopard. This is easy. They find him using the camera, and on the table next to him is the box of stolen papers and inventions taken from the earlier lab break-in. Tom's group entered the cave and while the Leopard escaped, the box with the secrets remained and is now in possession of the good guys. Gaining possession of the box of secret formulas may have ended the first goal of the television detector, but Tom still wants to capture the Leopard. After all, since the box was not opened it is believed that the Leopard was not aware that it held the secret gas formula.

Some one from the raiding party talked to the press and news of Tom's television detector was now public knowledge. Mr. Banlot of the Secret Service also read of Tom's invention and he now seeks help. Tom agrees: "It's our business to help our country in anyway we can." Leaving the Lab the two found this note attached to the lab door: "Keep away from us, Tom Swift, if you want your friend Ned Newton to go on living. This is our last warning. League of the Leopard." Because of the danger Tom insists that Ned carry the pocket wireless device to summon help if necessary. True to the threatening note Ned was kidnapped, leading to a frantic search by Tom, the Police and Secret Service. Now flashback to Ned who has a bag over his head, being transported to a secret location. Ned puts his hand inside his coat pocket and is relieved to find the pocket wireless set is still in his possession. Tied up but now locked in a small room, Ned waits for the chance to send Tom a message.

Now Tom is being pulled between searching for his best friend Ned and helping the Secret Service save the world, a values problem Tom sees as a mathematics problem: "On one side is the life of the best friend I have in the world, on the other side is the welfare of my country. What's my life, what's one person's life compared to the safety of my country and its 125 million inhabitants. Tom is sad but cares deeply for his country. This volume of juvenile fiction, as all the Nancy Drews, Hardy Boys and Radio Boys also seems to include values lessons whenever possible. Ned has now waited in captivity for several days, waiting for the opportunity to use his radio to call for help. He finally is able to send, and he uses the secret code that he and Tom agreed upon. Will he be heard? Will he be saved in time? The set's battery finally fails and Ned has failed to summon help. Is this the end?

Ned now has to find a source of power, and find it he does when his captors hooked up an electric lamp in his cell. His pocket wireless will send again! But before he can be successful The Leopard enters his room and tells the prisoner that he is just hours away from being dead. The success of the message is now of major importance. Send it he can but there is no indication that anyone is listening, and only Tom knows their secret code. With but a few dozen pages to go, in the end Ned must be saved, the Leopard must be found and the anarchist known as Alex Kalhofski must be in the hands of the Secret Service. So at exit, stage right, the Leopard leaves and the message is sent, this time using the new and more dependable electricity. (Never mind the transceiver needed DC and the power line was likely AC). Tom and the Secret Service continue to use the television detector to find the Leopard and other enemies of State. Tom got Ned's message but he can't tell Tom where he is because he was blindfolded during the capture, so Tom triangulates: "Seven miles in radius. We are the center of the circle and Ned is a prisoner in the same direction from here about seven miles away. All I have to do is draw two converging lines and where they meet will be the place where Ned is held."

That location turns out to be an abandoned water tower, converted into the hiding place for the Leopard gang. That's where they will find Ned. They had better hurry. Time is running out. Tom and his group will use the television detector, train it on the water tower to see where Ned is staying, and plan their rescue accordingly. Looking inside the tower the Secret Service men see both the Leopard and Kallhofski. The plan is to disguise Tom, Mr. Banlot and the other agents as bums and itinerant laborers who have come to tear down the tower under orders of the railroad. This subterfuge will allow them to get closer and enter the tower hide out and save Ned.

The rest is typical. Tom's inventions save the day. The government agents get their man, Tom's colleagues are saved and all is well as good triumphs over evil.

And the world is left with yet another useless television science project.

The Author

Mike Adams, a noted author and lifelong "Radio Boy." Mike is the Chairman of the CHRS Board of Directors.

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Organizing Your Collection

By Paul Joseph Bourbin

Let's face it, we are not getting any younger. We have spent a good portion of our lifetimes assembling and caring for our collections. We spend hours learning the history of our pieces, studying their quirks and special attributes and, maybe, even listening to them. Much of this knowledge is in our heads, or on paper that is hard to find when we need it. However, when we get upgraded to that great Museum-in-the-sky, our heirs may not share our enthusiasm for our stuff because they have no knowledge or appreciation of it. Some of the earthquakes in the Bay Area are probably collectors who are turning in their graves when they find out that their lifetime's work was sold to a "friend" for pennies on the dollar or, worse yet, the "junk" was heaved into a dumpster.

Also, in the event of a theft or destruction in a fire, or natural disaster, how easy will it be to convince the insurance adjuster that you really had 350 radios, 2000 tubes and ton (literally) of related material? Where is that list of serial numbers in case they are recovered? How much did you pay for each object and what is it currently worth? As we add to our collections, how easy is it for us to remember where, when and how much we paid for each piece?

I pondered these questions for some time and decided that I would do something about it right after I retired. After being retired for four years, and a number of half-hearted attempts, I had gotten nowhere. The task seemed daunting. It occurred to me that my sister-in-law, Maureen Bourbin, is a museum curator/restoration person who does a lot of free-lance work. I asked her if she would like a job working with me to organize my collection and she gladly accepted. I wanted it done properly so that: 1) My wife and son would understand the pieces in my collection and their stories and 2) It will be of sufficient quality to keep insurance adjustors and police investigators happy.

We first discussed what I wanted to accomplish. For record keeping, there were two main options. There are Internet Cloud-based companies that one can store information about one's collection. The advantages of this option are that the format is well-known and the information can be accessed anywhere there is an Internet connection. The disadvantage is that these companies charge by the number of pieces and one has to pay a monthly fee forever.

The other option is to create a database using Microsoft Excel to store the information. You then can access the information on your computer. The advantage is that you do not have a monthly fee. The disadvantage is that you are responsible for the storage of your data. I chose the latter because I have Cloud storage already and other ways to preserve data. More on this later. She also suggested that I attach a tag, with each item's accession number, to each item. That way there will be no question as to which item is which. She also advised me, that for each object, boxes, cases, accessories and anything that could be separated from the object (not tubes), should each have its own listing.

The database shows, for each object: a picture, an accession number, the object's description (make, model, color, serial number etc.), category, location on your premises, the materials from which it is made, how much you gave for it, when you purchased/received it, and the year it was made. She also had a cell for Provenance. Provenance is the life-story of that particular object: where, from whom and how you acquired the piece, who may have owned the piece ("It was my Grandmother's"), where it was originally purchased, anything you know about the object. This is very important; it was not plucked out of thin air. There is a section for notes. It is your database, put anything you want here: where made,

working and physical condition, what has been done to it etc. She also included "Loan In", "Loan Out" and "Exhibition" columns. These can be quite useful. I occasionally loan out something for an exhibit, to prop houses, for weddings and events. This allows me to keep track of things that go out of my home. It can also be used when something is sent out to be repaired etc. The "Exhibition" column is to list anytime the object has been put on exhibition at a museum, show etc.

The actual process is straightforward, but exacting. She came to my house and photographed each object and I told her all the information needed for the database. This was done object by object and took three days. She then created the database and entered all the data and pictures into it. When I did not have the needed information, I would find it and email to her. When done, she gave me a thumb drive with the completed database and also a folder with all the pictures she took, in case I wanted to use them for something else. Since I have the database on my computer, I can add/change information as necessary and it is not a problem to add more objects (as always seems to be the case!). I will probably not delete any objects. If I sell/dispose of something, I will note to whom, when and how much/what I got for it.

All in all, it was a pleasant experience. I have tied together a number of loose strings. The information is in a form that will be useful to my family, others and myself. When one considers the work involved, it is not that expensive.

A few thoughts: The database should be stored in more than one location. If your computer crashes, you do not want to lose everything. The backup information should be stored away from your residence lest it be destroyed by some disaster. You could send a copy to a trusted friend or family member who lives some distance from you. One could put a thumb drive in a safe deposit box. The database could be stored in the Cloud. Many people have free or inexpensive Cloud accounts. Also, the database must be kept up to date. Nothing loses credibility as quickly as an out-of-date database.

One can add a column for current value; I did. Arriving at current value can be a bit tricky. If you buy something on eBay, print out the listing after it has been sold. For other things, one needs to find Comparables. A Comparable is a fairly recent sale of a very similar object to the one you have.

Remember, the condition has to be similar; you can not expect your "suitable for restoration" radio to have the same value as a "mint in box with manual" set. One way to establish value is to print out copies of SOLD items on eBay or other auction sites, if they have clear pictures and/or descriptions. Items sold at CHRS' auctions can be another source. For expensive items, one should hire a qualified appraiser. Sales at swap-meets are probably not reliable as there is no printed documentation for backup.

I am glad to answer your questions anent my collection organization experience. I can be reached at (415) 648-8489 or paulbourbin@hotmail.com . If you are interested in having your collection curated, you may contact Maureen Bourbin at MBourbin@gmail.com . To see an exhibit she curated go to MayaWomenInArt.org.

The Author

Paul is an avid collector of radios, Hi-Fi, antique phonographs, and other items of interest like sewing machines. He is particularly fond of radios from the Bay Area, especially San Francisco. Paul has been very active in CHRS from its early years and was President of CHRS for almost six years. Paul is retired and worked for KMPX radio.

Paul has written for Antique Radio Classified, The Old Timer's Bulletin, Radio Age and, the CHRS Journal. He has been honored with the Doc Herrold Award and is a CHRS life member.

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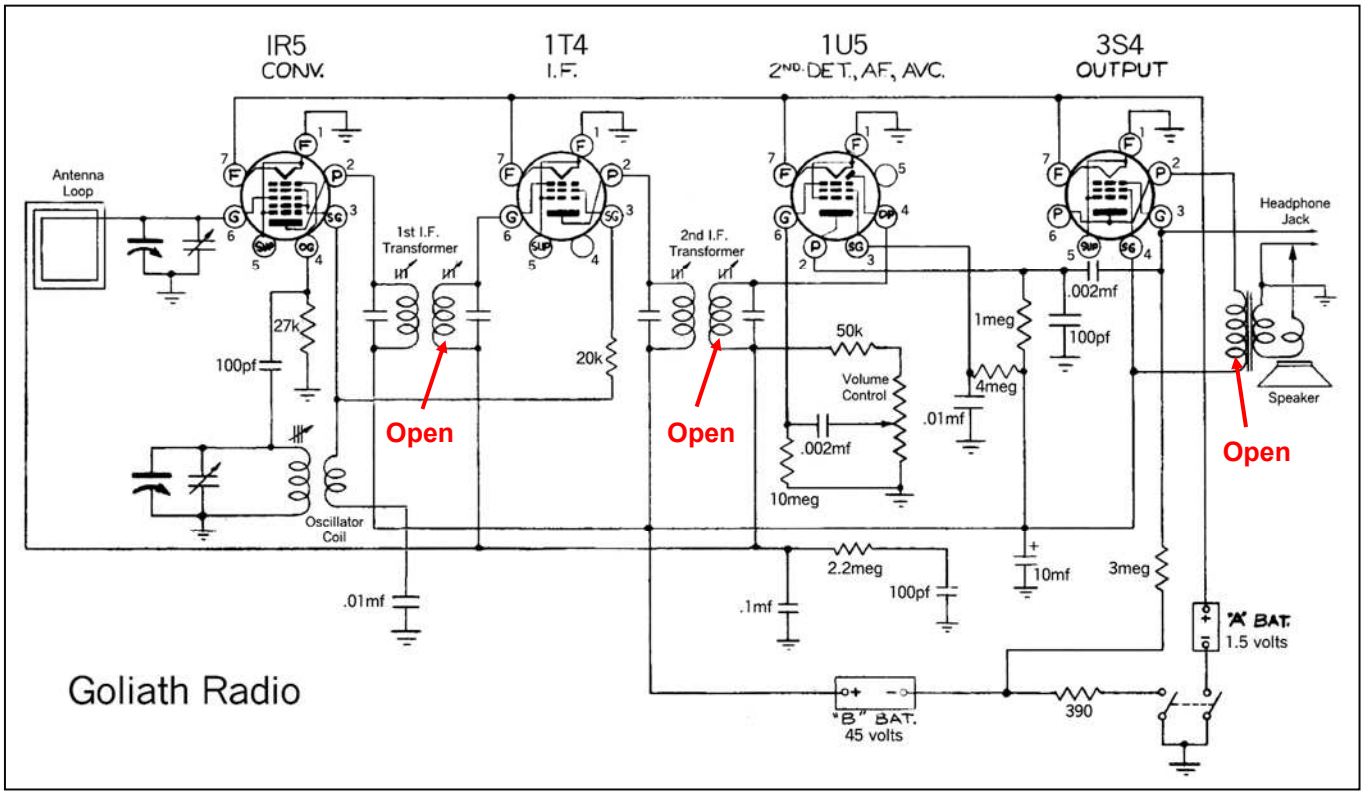
Making an IF Transformer

Richard Watts, N6CVS

Goliath P-156 radio.

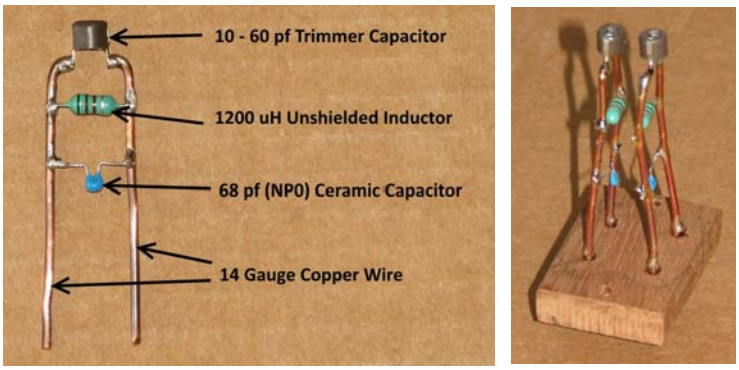
During the recent pandemic and Stay at Home order, I decided to repair the radios in my collection that I had neglected. One is a Goliath P-156 portable radio. The construction and electronics are typical of battery operated radios of the late 1940s and early 1950s. It requires a 45 volt battery for B+, and a 1.5 volt battery for the filament. When I triaged it, I found the 1.5 volt battery compartment was heavily corroded from a leaky battery plus the audio output transformer and both Intermediate Frequency (IF) transformer secondaries were open due to corrosion. I had an audio output transformer that would work, but the IF transformers were smaller and more slender than typical and it would be very unlikely I would find replacements that would fit the tight and cramped space. It seemed that replicating these transformers might be doable as their design was relatively simple having no additional circuitry, "tweet" filters, or winding taps for impedance matching. Even though this radio is uncommon and has some value, I usually wouldn't consider it to be worth the time or trouble to go any further; Normally I would just put it back together and forever relegate it to be a shelf queen.

But, hey, what else have I got to do? And I was pretty sure there would be something to be learned.

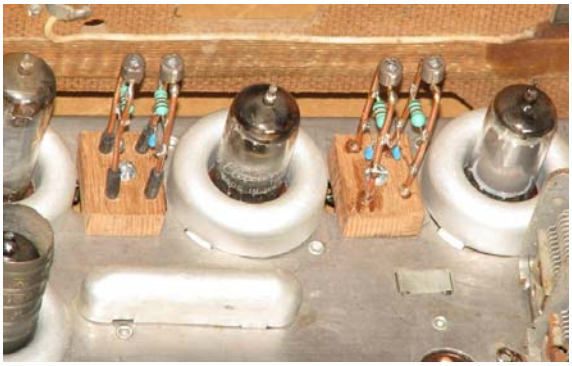


I could not find a schematic for the Goliath but its design is somewhat close to an RCA BP-10, so I traced the wiring and components, then modified the RCA BP-10 schematic accordingly. Both IF transformers and the audio output transformer were open.

In considering how to move forward, I did a little research. I read of instances where technicians had actually rewound open windings, but I ruled that out as I knew I didn't have either a suitable coil winder or the patience. I found sites on the web like Angelfire (http://www.angelfire.com/electronic/funwithtubes/IF_Can-1.html) that offered possible approaches. However, the approach I found most suitable for my needs was from Antique Radio Forum postings where off-the-shelf fixed inductors and variable trimmer capacitors were used; see https://www.antiqueradios.com/forums/viewtopic.php?f=12&t=320861. An example from a posting is shown in the photos below.

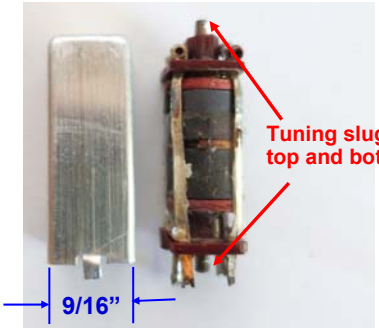


IF transformer for an AA5 built by Robert H. The two halves are positioned to provide space between the inductors for mutual coupling. (Images from the Antique Radio Forum).



The IF transformers mounted in a GE 551. The shields are not shown. (Image from the Antique Radio Forum).

The design of the replacement transformer needed to conform to the configuration and size of the original transformer. The original is slender at only 9/16" wide where typical All American Five tube radio (AA5) IF transformers of the era were typically 3/4" wide and taller. The smaller size will limit the probability of finding replacement components. The tuning slugs are at the top and bottom of the transformer which is typical for AA5 transformer, consequently the side-by-side trimmer positioning in the transformer above example wouldn't work. Instead, I wanted to design the transformer with a trimmer at the top and the bottom, and with the inductors positioned in the mid section aligned along their axis.



The original Goliath radio IF transformer.

Determining Component Values

In some radios, the design of the two IF transformers can be different due to the differing impedances of the circuits on the secondary side of the transformer. That is, the secondary of the 1st IF transformer is connected to the grid of the IF amplifier which is relatively high impedance, while the secondary of the 2nd IF transformer is connected to the detector which can have a comparatively lower impedance. Luckily, this wasn't an issue with the Goliath design; the IF transformers appear identical with the same manufacture part markings. Using a digital LC meter, I measured the good winding with the inductor tuning slug backed out as far as possible and found it to be 1.5 milli Henrys (mH).

IF transformers typically have a low turns ratio (i.e. the number of turns in the primary winding to the secondary winding), on the order of 1:1 to 1:3. Comparing other radios of that vintage and having a close look at the construction of the original IF transformers, I'm comfortable assuming that the Goliath transformer turns ratio was 1:1.

The IF transformer is a typical bandpass transformer where both the primary and secondary are tunable. Radio manufacturers of vintage consumer radios employed two types of IF transformer tuning:

1. Tuned capacitance where a variable trimmer capacitor is used and the inductor is fixed. This was often found in radios of the 1930s into the 1940s;
2. Tuned inductance where a ferrite slug is tuned into and out of the coil to change value and the capacitor is fixed; this was more prevalent in the 1940s and after.

The Goliath transformers used tuned inductance tuned to an I.F. frequency of 455 kHz which is typical of the era. However, I opted for tuned capacitance as it's easier to acquire variable trimmer capacitors rather than variable inductors.

The value of the capacitor can be calculated from the formula for parallel resonance: $f = \frac{1}{2\pi\sqrt{LC}}$

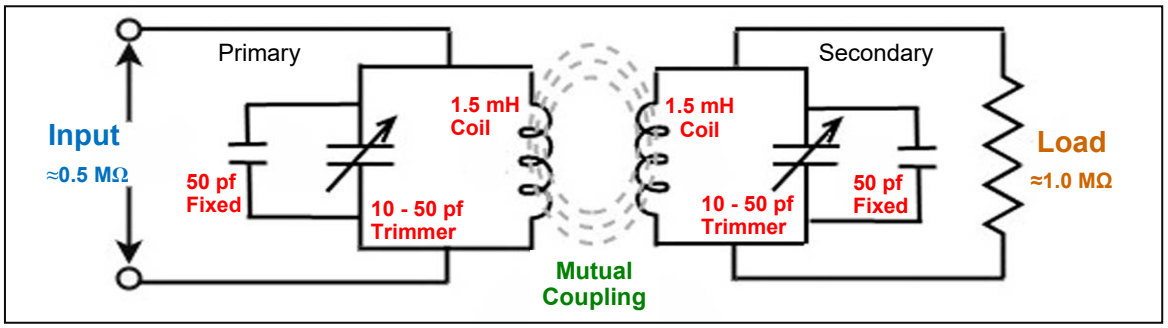
Where:
f = Frequency in Hertz
L = Inductance in Henrys
C = Capacitance in Farads

Solving for Capacitance → $C = \frac{1}{(2\pi f)^2 L}$

For this transformer:
f = 455 kHz
L = 1.5 mH

Then: → $C \approx 80$pf

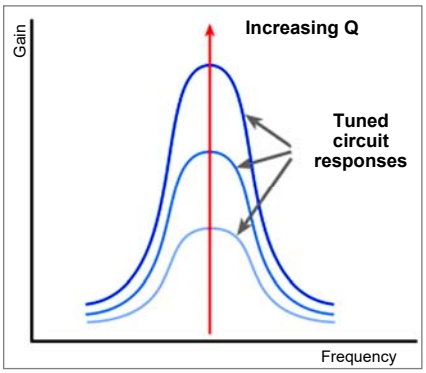
Thus the center of the tunable capacitance range needs to be 80pf. I chose a trimmer capacitor with a range of 10pf to 50pf. I added a 50 pf fixed resistor so that the actual range is 60pf to 100pf resulting in 80pf as center of range.



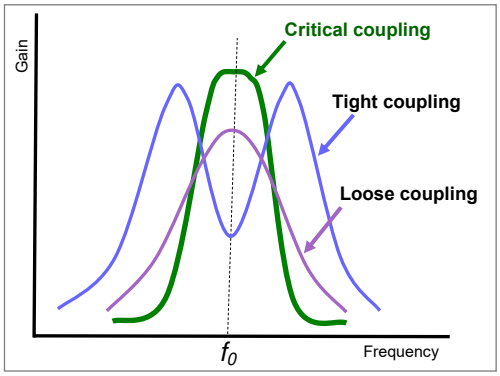
Simplified diagram of a capacitive tuned bandpass transformer where the primary and secondary inductors are mutually coupled. Component values for this project are shown. 80 pf is the center of the tunable range of the variable capacitor.

For acceptable sensitivity and optimum bandwidth there needs to be sufficient Q. The quality factor Q is a measure of the rate of energy loss — it's the ratio of the stored energy in a circuit to the energy dissipated in a circuit. Q is calculated as the ratio of the reactance of an inductor or capacitor to resistance at a specified frequency, in this case 455 kHz. For this calculation, resistance is the total of inductor and capacitor resistances plus the associated resistances in the external primary and secondary circuits.

For a bandpass filter the higher the Q, the less energy loss results in greater response and narrower bandwidth. The bandwidth needs to be just wide enough to pass the audio that is modulated in the IF signal, typically ±10 kHz or 20 kHz total, and the response needs to be sharp enough for acceptable sensitivity.



The effect of Q on a tuned circuit. Q is directly related to sensitivity and bandwidth.



Degrees of mutual coupling: Tight (Over) coupling, with two peaks, Critical coupling with a single slightly flattened peak, and Loose (Under) coupling.

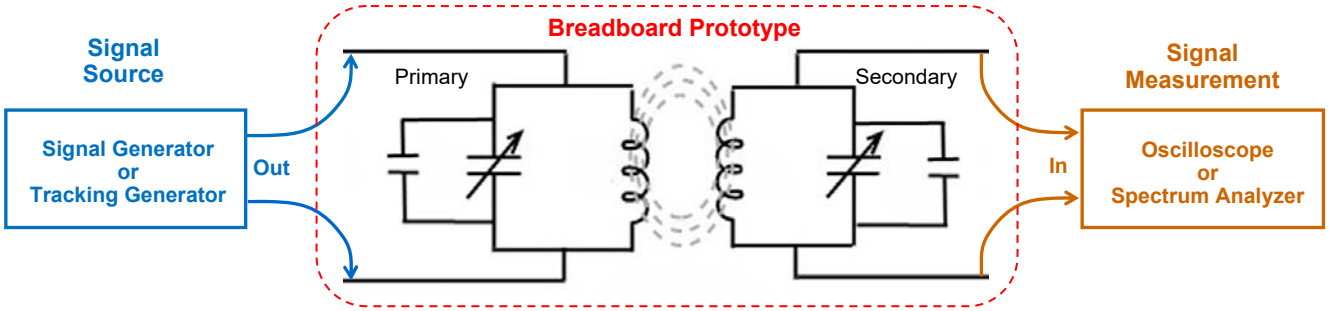
Directly related to Q is mutual coupling which depends on the physical distance between the primary and secondary inductors. If they are close, they will be very tightly coupled to the point of being over coupled. This will actually produce two peaks which is undesirable for this application. If the coils are positioned further apart, they will become loosely coupled and have a single peak with a more broad bandwidth. There is a sweet spot between the two that is "critical coupling" which is the distance between the coils where the two peaks barely come together to make a single peak with ideally a slightly flattened top. For IF transformers, this is the optimal distance between coils.

As mentioned, bandwidth and Q are related. The bandwidth of a single LC bandpass filter can be calculated as the resonant frequency divided by Q. In this case to have a bandwidth of 20 kHz at 455 kHz, Q is 22.75. For an IF bandpass transformer, due to the effect of primary-secondary mutual coupling, Q is further multiplied by a factor related to the desired attenuation and the degree of coupling; in this case the factor is 1.14 (i.e. $\sqrt{2}$) increasing Q to 32.2. The circuit designer would then use this value of Q to select values for transformer components and associated primary and secondary circuit resistances and impedances. IF bandpass transformer and circuit design is beyond the scope of this article, but if you're curious the elements of design are covered in depth in two excellent references, the *Electronic and Radio Engineering* by Terman and the *Radiotron Designer's Handbook* 4th edition by Langford-Smith.

It wasn't necessary for me to do further analysis for this project, but out of curiosity I decided to work through the design steps to verify if the values I had chosen would provide acceptable response and bandwidth. For that there are two sections in the *Radiotron Designers Handbook* that apply directly: **Coupled circuits — tuned primary, tuned secondary** (page 414), and **Critically-coupled transformers** (page 1026) which offer a step-by-step methodology. The analysis is clearly presented and straight forward, but more detail than I want to present here. For the resistive elements, I assumed 0.5 meg ohm for the primary input and 1.0 meg ohm for the secondary load. From this I determined that the values I had selected should provide acceptable response and bandwidth (±10 kHz to 3 dB down from the peak), which bolstered my confidence in component value choices. Again doing this analysis isn't necessary for this project since mutual coupling, bandwidth, and response can be assessed and optimized experimentally through measurement as discussed in the following sections.

Signal Measurement Instruments

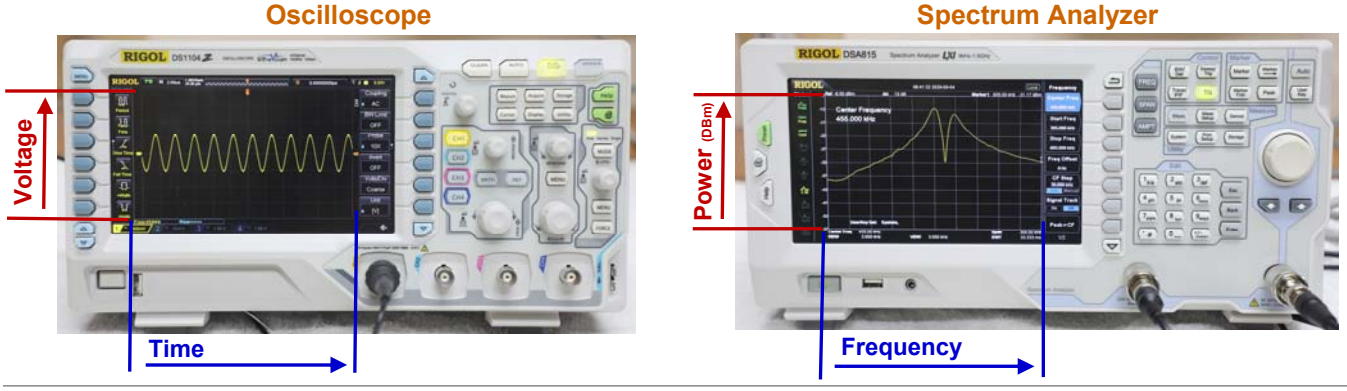
Next I planned to build a breadboard prototype and measure the performance of the design. The evaluation has to be done over a range of frequencies to make sure the transformer will pass the IF frequency of 455 kHz plus a bandwidth of ±10 kHz (i.e. 445 kHz to 465 kHz) and adequately attenuate frequencies above and below. The measurement can be done either with a signal generator and oscilloscope, or alternatively a spectrum analyzer with a tracking generator.



The signal source will need to produce a range of frequencies. In the case of a signal generator, the range of frequencies is produced by manually adjusting the frequency dial. On the other hand, a tracking generator will automatically sweep a specified frequency range which is much more convenient.

My first choice was to use my spectrum analyzer for making the measurements. For those not familiar with a spectrum analyzer, it displays the power amplitude of all the frequencies within a specified range (i.e. spectrum); that is, it displays signal content in the **frequency domain**, and the horizontal scale is in units of frequency. By comparison, an oscilloscope displays the changes in voltage amplitude of a signal waveform over time; that is it displays signal content in the **time domain**, and the horizontal scale is in units of time.

Again by comparison, the oscilloscope vertical range is a linear scale in units of voltage, while the spectrum analyzer vertical range can be either a linear or logarithmic scale. When logarithmic, the vertical scale is typically measured in decibel (dB) units of power, usually dBm. DBm is measured from a baseline where zero dBm equals one milliwatt (0 dBm = 1 mW). Since decibel measurements are logarithmic, adding decibels is the same as multiplying the relative power. For example, adding 3 dB in power represents doubling the magnitude of power, adding 6 dB is an increase of four times, adding 9 dB is an increase of eight times, and so on. In the Spectrum Analyzer display below right, the power



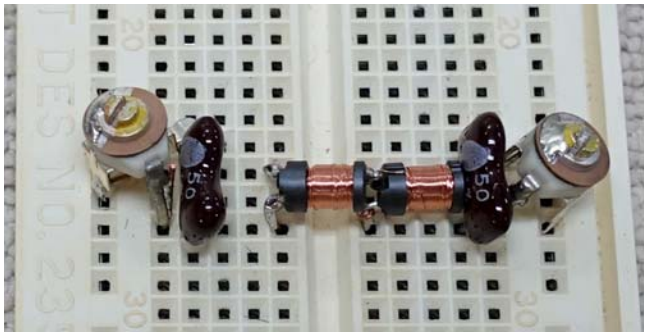
contained in the spectral frequencies are represented by the yellow trace. The trace shows two peaks, the frequencies at those peaks have relatively more power than their adjacent frequencies.

My spectrum analyzer has a built-in tracking generator which is basically a signal generator that sweeps the same spectrum of frequencies as the spectrum analyzer, and their sweeps are in sync. The output of the tracking generator is input to the device under test and the result is input into the spectrum analyzer that displays the spectral response of the device under test. Technically a spectrum analyzer with a tracking generator is a **scalar network analyzer (SNA)**. Having a tracking generator adds to the usefulness and capability of the device. If you don't have a spectrum analyzer and decide to get one I highly recommend spending a little extra for one with a tracking generator.

A **Vector Network Analyzer (VNA)** goes one step further. It's able to not only apply a signal to a device under test and evaluate the response as can be done with an SNA (like a spectrum analyzer + tracking generator), but a VNA can also evaluate phase characteristics and it can measure the reflected energy back from the load due to impedance mismatch. A VNA is very useful for RF measurement, antenna tuning, and impedance matching. A spectrum analyzer + tracking generator can provide some VNA functionality through the use of directional couplers. The NanoVNA provides this functionality out-of-the-box as described by John Staples in his article in the prior issue of the CHRS journal. The NanoVNA also provides a graphical display of **phase and magnitude** information (i.e. a **vector)** via a Smith Chart.

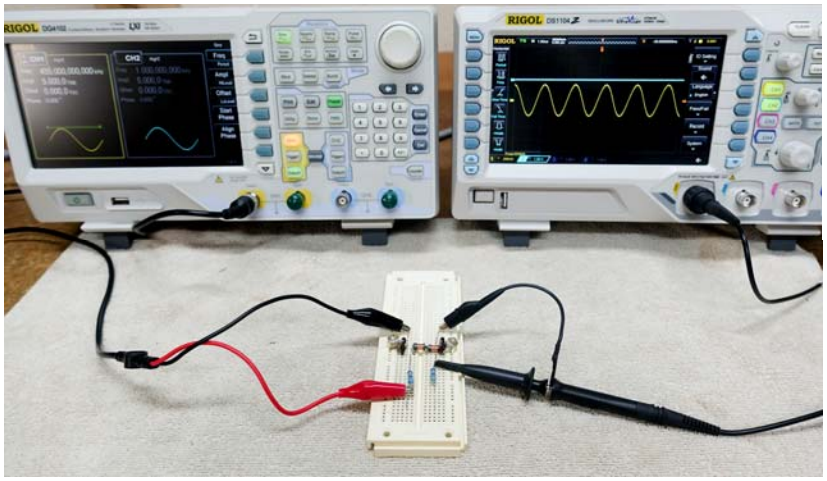
Prototype and Evaluation

I acquired the 1.5 mH coils with a nickel-zinc ferrite core from Mouser and 10-50 pf ceramic trimmer capacitors from another supplier and built a breadboarded prototype. My first measurement method was old-school. I used the signal generator set to 455 kHz and connected it to the primary of the IF transformer prototype through a 500k ohm resistor; The 500k ohm resistor was necessary because the signal generator, which has a 50-ohm impedance, would otherwise excessively load the transformer primary if connected directly. I then connected the oscilloscope probe to the secondary. The oscilloscope probe is high impedance so it did not unduly load the secondary.



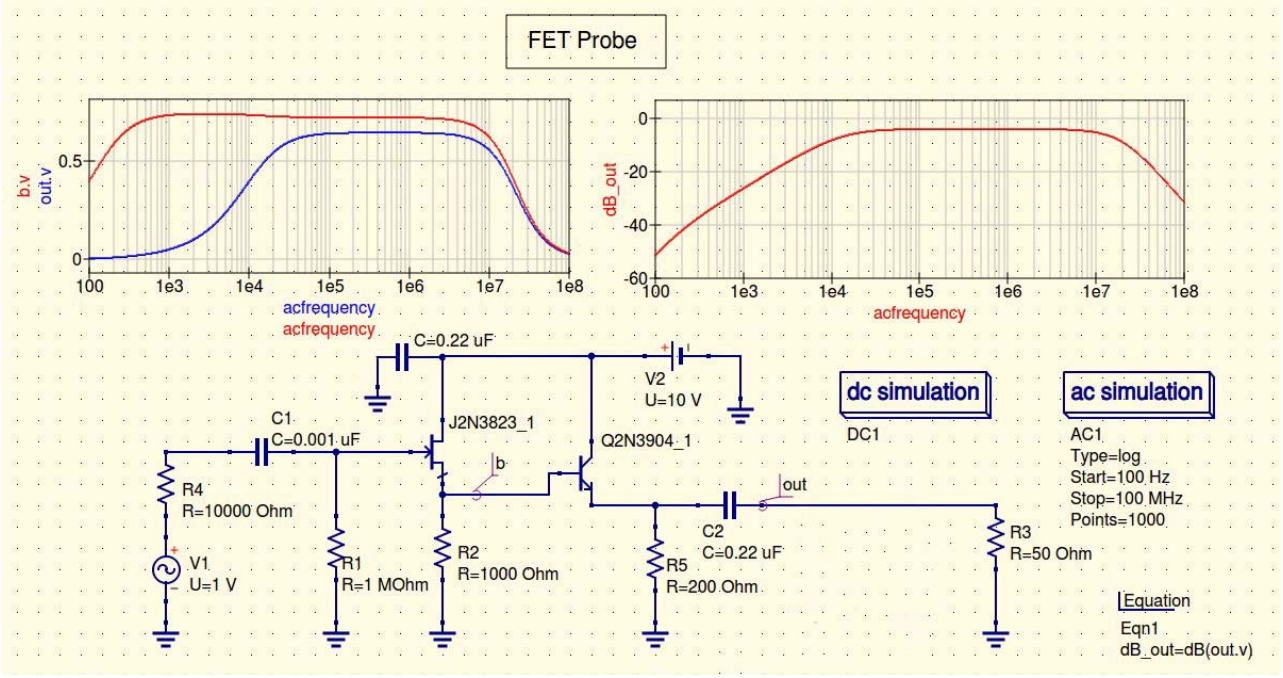
Breadboard of the two sections of the transformer. The two coils are axially aligned with windings in the same direction. I initially placed them very close together to insure mutual coupling.

With signal generator set to 455 kHz, I tuned both trimmers for maximum amplitude of the signal on the oscilloscope. Then, to get a sense of mutual coupling and bandwidth, I started with the signal generator set to 455 kHz and slowly adjusted (swept) the frequency of the signal generator first above and then below 455 kHz to assess the change in amplitude on the oscilloscope. During the sweep I found that there were two peaks — a larger peak above 455 kHz and another below indicating over coupling.



The setup to measure performance using a signal generator (left) and oscilloscope (right). The signal generator is connected to the primary through a 500k ohm resistor. Signal generator frequency was adjusted to sweep frequencies several kilohertz above and below 455 kHz to adjust the peak and assess coupling.

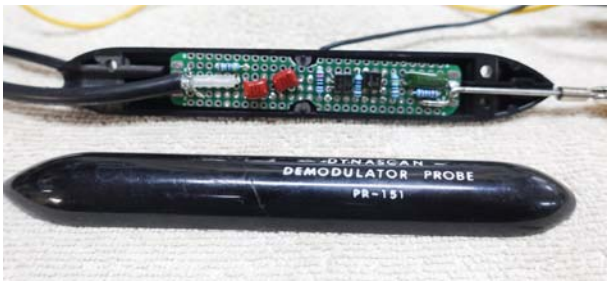
I initially had intended to use my spectrum analyzer but didn't because its 50-ohm input would be too much load for the transformer secondary if connected directly. John Staples was very helpful and recommended the use of a high impedance active probe for the input to the spectrum analyzer. An active probe is powered and has circuitry to maintain signal level while presenting a high impedance to the device under test and transforming the impedance to a low 50 ohms to match the spectrum analyzer 50-ohm input.



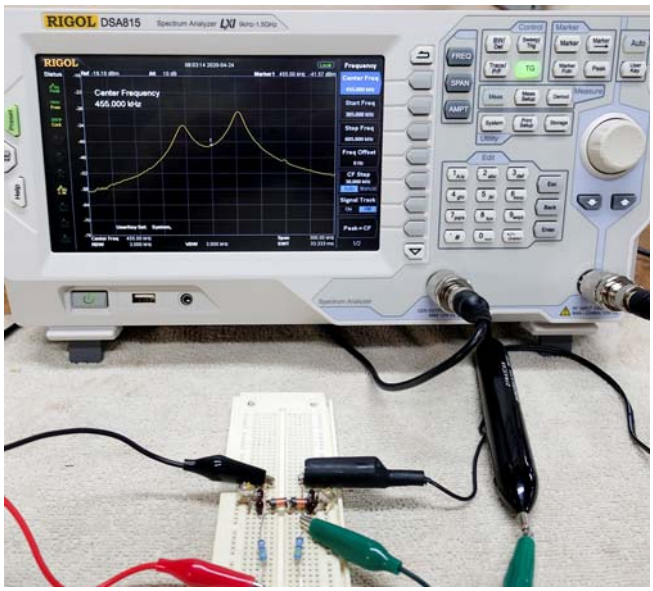
Schematic and simulation data for the active probe designed by John Staples.

John then shared the above schematic for a simple active probe he designed for the NanoVNA that has excellent response from 50 kHz to 140 MHz. The probe I built from his design is shown to the right. The schematic shows a 10 VDC power source, but in practice the power supply can be altered somewhat. I used a 9 VDC battery and the probe worked perfectly.

For this test, the tracking generator output is connected to the primary through a 500k ohm resistor. The spectrum analyzer input is connected to the secondary through the active probe.



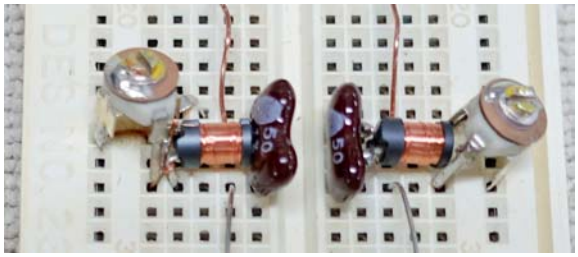
The internals of the active probe I built from John Staples design. I used the casing from an old TV test demodulator probe.



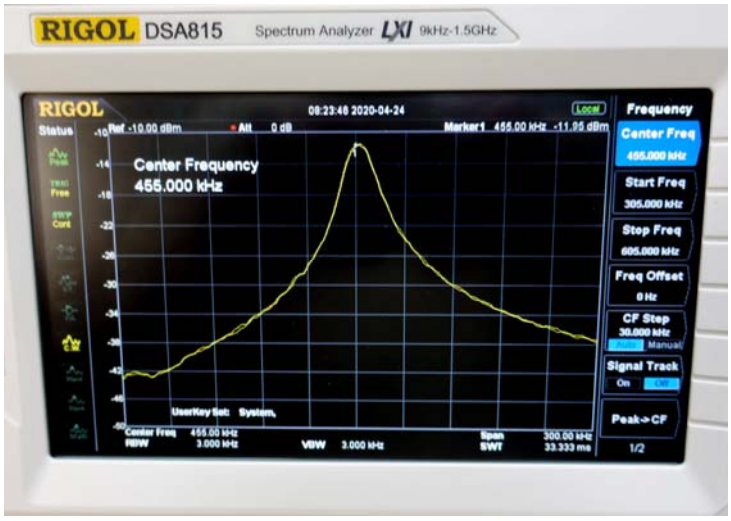
Setup with the spectrum analyzer / tracking generator. Tracking generator output connected to the primary through a 500k ohm resistor, and the spectrum analyzer input connected to the secondary through the active probe. Notice there are two peaks.

The spectrum was set with a center frequency of 455 kHz and the span set to 300 kHz. So the signal was generated and swept from 305 kHz to 605 kHz. The spectrum analyzer cleared showed the same two peaks confirming the coils were definitely too close and were over coupled.

I then rearranged components on the breadboard to incrementally add space between the coils until I could barely adjust the two peaks together into a single peak. At that increased distance the coils were critically coupled.



The breadboard with the components rearranged and repositioned to create more distance between the coils. At this distance, the coils are critically coupled.



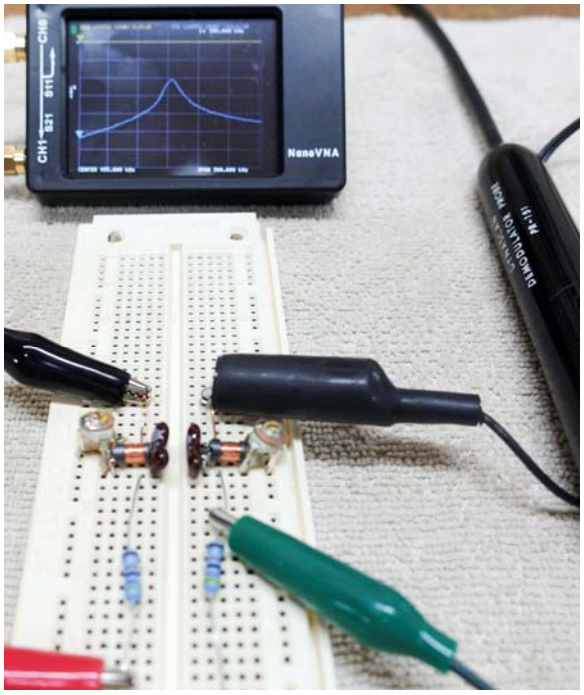
The distance between coils was increased and trimmers were repeatedly adjusted for maximum at 455 kHz until the two peaks converged into one indicating critical coupling.

Using markers on the trace, I assessed bandwidth by measuring relative attenuation at the points on the trace 10 kHz below and 10 kHz above the center frequency of 455 kHz. The attenuation measured -3dB from the peak which is exactly what the Radiotron analysis predicted.

I repeated measurements using the signal generator and oscilloscope and had the same result of experiencing a single peak as I manually swept frequencies with the signal generator. This setup also gave me a sense of bandwidth by observing the relative amplitude of the oscilloscope waveform at various points in the sweep like ±10 kHz from center. Either a signal generator and oscilloscope approach or a spectrum analyzer with tracking generator will work, but for me, the spectrum analyzer is more accurate and the result is easier for me to visualize.

The measurements can also be done with a NanoVNA. Details for setting up the NanoVNA are in the caption below left. I used the NanoVNA to make the initial measurement where coil spacing was too close resulting in over coupling. I then made a second measurement where the coils were critically tuned. I also experimented with altering coil positions and the NanoVNA worked nicely in guiding reconfigurations to converge toward critical coupling. I also used the NanoVNA to peak the response with the trimmers.

I've been very impressed with the capability of the NanoVNA. And it's only $60+.

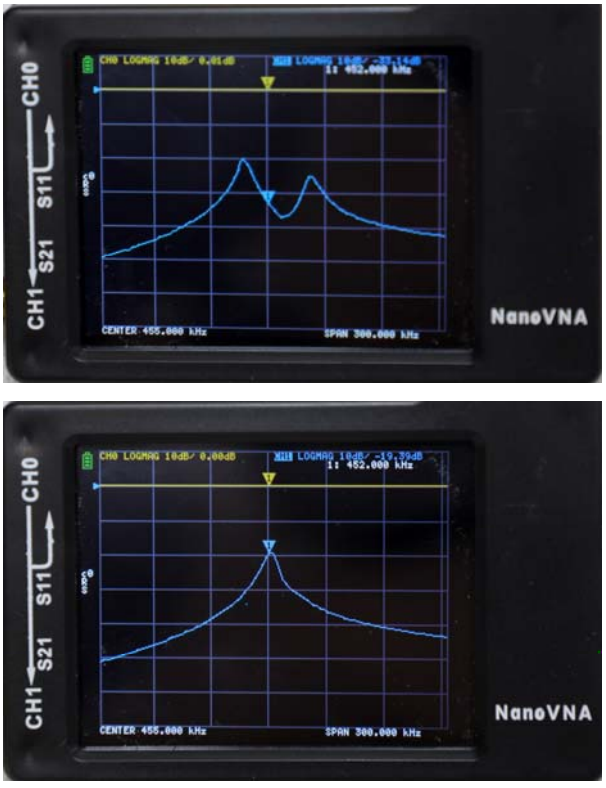


Setup with the NanoVNA:

CH0 acts as the tracking generator output and is connected to the primary through a 500k ohm resistor.

CH1 acts as the input to the spectrum analyzer and is connected to the secondary through the active probe.

Stimulus center frequency was set to 455 kHz and the span to 300 kHz. Unused traces have been turned off.



The image on the top is the initial measurement where the transformer was over coupled. Below is the measurement after spacing out the coils to achieve critical coupling.

Construction

I constructed the framework from some thin brass rod I had laying around. I considered heavy copper wire for the frame but chose brass rod as it would offer more rigidity. The base is black acrylic left over from another project.

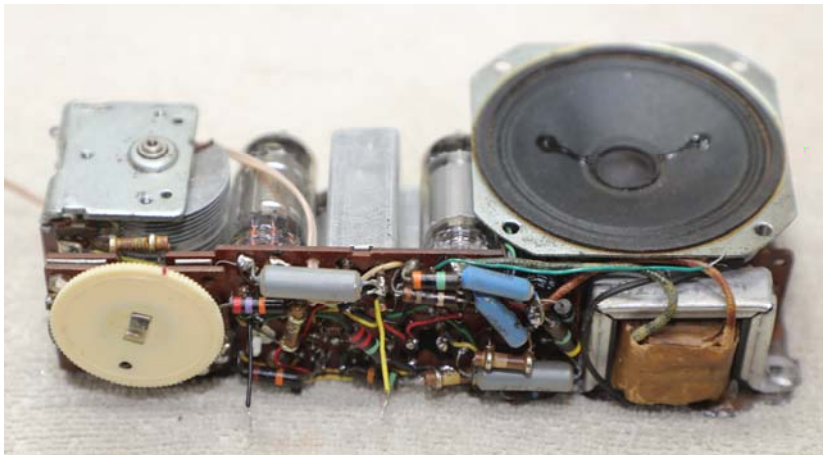
A trimmer is mounted on top facing upward and the other at the bottom facing downward with its adjustment screw accessible through a hole in the center of the acrylic base.

I had just enough vertical room to space the coils at the distance needed for critical coupling. I aligned them along the same vertical axis and have their windings in the same direction.

I opted to use small polystyrene capacitors for the fixed capacitors instead of the silver mica capacitors used in the prototype as the silver mica capacitors were too big to fit inside the can in the remaining space available.

Once built, I measured each assembly with the spectrum analyzer to make sure performance was as expected and to pre tune them so they will be in the ballpark when installed.

One of the two IF transformer assemblies.



The chassis with transformers installed. The audio output transformer at the lower right was also replaced. As can be seen, the component spacing is very tight under the chassis and removal and reinstallation of the IF transformers required considerable care around the other fragile connections. I couldn't find a schematic for the Goliath P-156 so I had to trace components and draw one.

Of course nothing is ever easy. The polystyrene capacitors are very stable and small, however, they won't tolerate much heat. You guessed it, after installing in the chassis, the transformers would no longer tune correctly. I was so careful soldering the components but the brass rod required a bit more heat than usual which was more than the polystyrene capacitors could bear. So, once again I had to remove the transformers, replace the polystyrene capacitors with small ceramic ones, test, and reinstall —again. The ceramic capacitors can be seen in the above transformer assembly photo. Thankfully that did the trick. After doing a final alignment all was well.

The Goliath once again plays great. And as I had hoped, I did learn a lot from this project. In that regard, restoring the Goliath radio was totally worth it.

Now a much happier Goliath.

The Author

Richard Watts is a retired computer scientist and business IT manager, a radio collector, and continually curious. In a much earlier time, he was a bench technician in a TV repair shop (remember those?). He is the editor of and occasional contributor to the CHRS Journal since 2012. He is on the Board and is the CHRS Treasurer and Membership chair.

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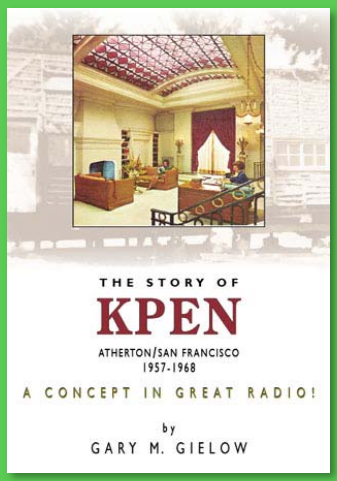
CHRS Publications

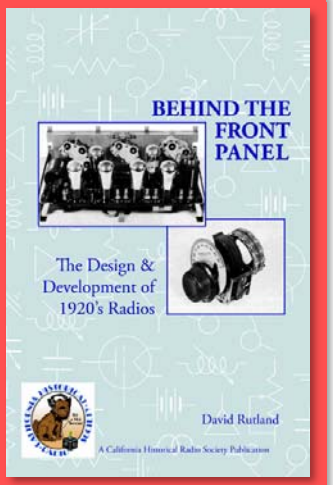
The Story of KPEN: A Concept in Great Radio! CHRS member and Broadcast Legend Gary Gielow has written a new book chronicling the tales of two young men from Stanford, he and James Gabbert, who brought Stereo and new ideas to the FM radio band in the late 1950s and 1960s. This book is the definitive history of KPEN 101.3 FM, the 2015 BARHOF Legendary Station. 100% of the proceeds benefit CHRS.

Available in the Museum Store or on the website.



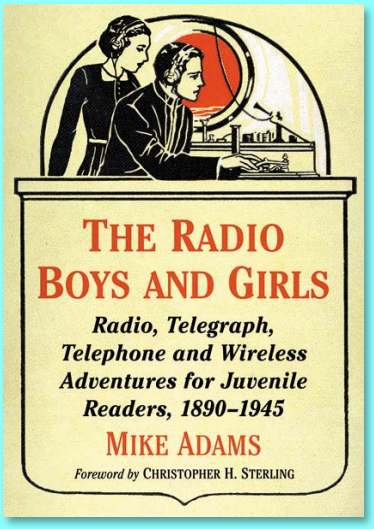
Behind the Front Panel: The Design and Development of 1920's Radio by David Rutland has been remastered by Richard Watts for CHRS. With emphasis on radio technology, Rutland describes the development of 1920s tubes and radio circuitry designs by De Forest, Marconi, and other inventors and manufacturers. A classic!

Buy at Amazon.com

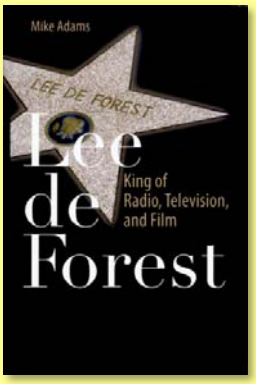


The Radio Boys And Girls—Radio, Telegraph, Telephone and Wireless Adventures for Juvenile Readers 1890-1945 covers more than 50 volumes of wireless and radio themed fiction, offering a unique perspective on the world presented to young readers of the day. The values, attitudes, culture and technology of a century ago are discussed.

Available at Amazon.com

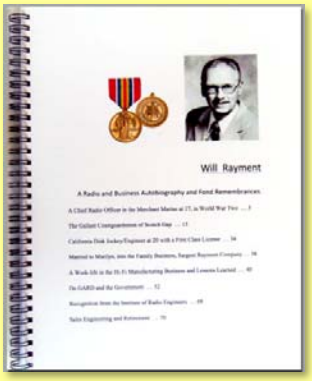


Also available in the museum store

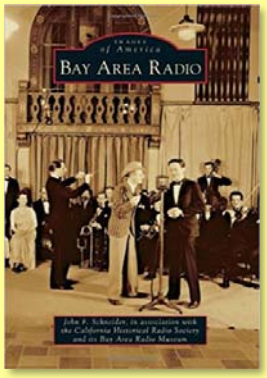


Lee de Forest

KSAN Live Jive CD



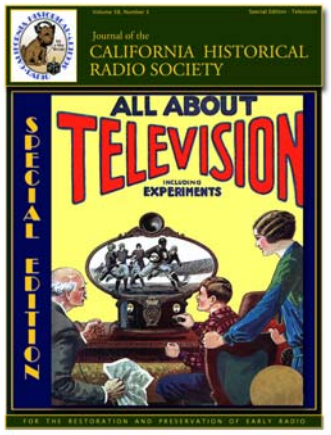
Will Rayment



Bay Area Radio

CHRS Journal Special Edition — Television a compilation of original articles on television, including articles by Malcolm Baird on his famous father, British television pioneer-inventor, John Logie Baird, Don Godfrey's historical bios on CF Jenkins and Philo Farnsworth, plus restoration and technical articles from John Staples and others.

Available at Amazon.com



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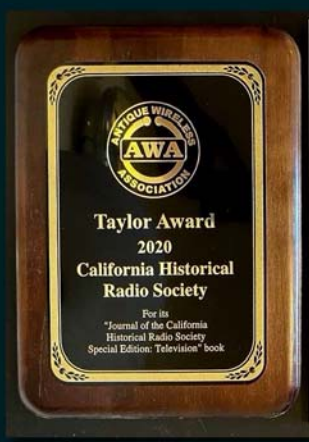
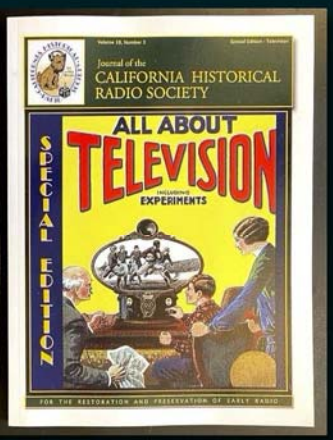
CHRS Television Gallery





CHRS awarded the AWA Taylor Award