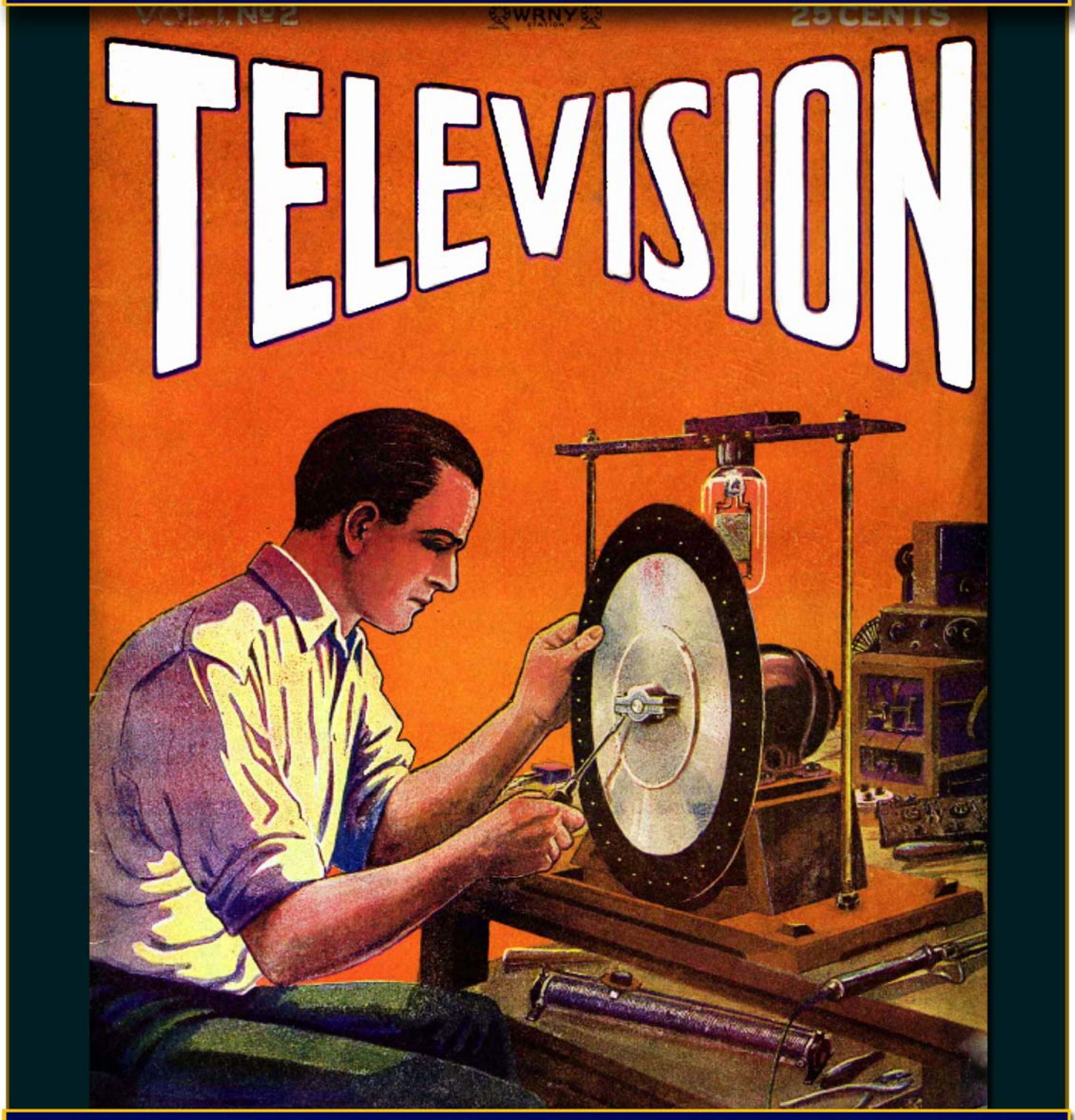
Volume 37, Number 1 Spring/Summer 2018

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 to 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.

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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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Larry Clark	– Technical Advisor & Librarian

Contents of the Journal

COLUMNS

FEATURE ARTICLES

Front Cover: Image of the Hugo Gernsback 1928 publication Television.

Back Cover: Recent activity at CHRS.

From the Editor

Recently as the end of construction projects can be anticipated, the CHRS Board has been shifting its attention to what comes next. That is, how do we create and sustain a center for education, fellowship, and history of radio. Given this, I invited the Board Chairman, Mike Adams to present his views.

In this issue John Staples details the restoration of a very rare 1928 Western Visionette mechanical television. Mike Adams presents a time line of early television. And Bart Lee presents the first two of four parts of his recent European trip where he visited notable communications related museums. Once again I've had the pleasure of working with very generous and capable contributors.

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

A couple of notes about the goings on at CHRS. At this writing we have begun construction of Phase 2 of our lower floor renovation. It all started in early 2017 with a 'century' rain and flooding after years of drought. Well our 117 year old concrete basement floor couldn't keep the water out. So we raised needed funding and replaced the ancient cracked floor with a new 6" concrete slab utilizing 5 forms of waterproofing. Underneath, we excavated for a drainage system of 4" wrapped finger drains imbedded in 39 tons of drain rock! Ground water flows into our new sump and multiple pumping systems. Water then flows under our front garden and out to the street. These systems work perfectly and our basement floor is as dry as a bone. And, our underground water collection system pumps out several times a day… even in dry weather.

And now Phase 2 has begun. Cliff Farwell with help from Robert Swart and Walt Hayden have framed out the new CHRS office and utility room. Now our main builders, B.A. Morrison Construction is demolishing a huge wall then will build the shaft way for our handicapped lift, new stairways, ADA ramp and access door. Valley Construction is installing our 4 new Marvin windows this week. Our great CHRS volunteer craftsmen will do the inside finishes after sheetrock is installed.

Now that work has begun on our final phase of this project, we should thank all the people involved that made it happen. None of our projects at Radio Central could have been accomplished without the hours of time and effort donated by our Structural Engineer, Vincent Wu. The help provided by Vincent has been invaluable. CHRS' John Stuart has tirelessly donated hours to measuring, drawing and refining the 11-page plan set that we submitted. Thank you Vincent & John! And thanks to our Architect, Mark Hulbert of Preservation Architecture, for his input into the project. Also due thanks is City of Alameda Chief Building Official, Greg McFann who helped CHRS over the last hurdle to obtain our building permit. And of course we must thank Walt Hayden for his input in planning and creating the electrical plan. And speaking about electricity, let's not forget Kevin Payne, who has been making the long commute from Oregon to work on our electrical systems. Thank you Kevin. Also we owe thanks to Sandy Figuers for his geological and hydraulic advice. And to our Phase 1 vendors, Dan Long's Concrete, Superior Sandblasting and Authentic Restorations, thank you. All did fine work and are highly recommended.

Next projects include renovation of our great room including vintage operating control room and a new roof plus the Bay Area Radio Hall Of Fame gallery. Stay tuned and watch CHRS grow and thrive… with your help. Our members, supporters, donors and volunteers are the backbone of this finest vintage radio historical society… anywhere.

I am always available and encourage your questions and comments.

Best Regards, Steve (415) 203-2747 Steve@CHRSRadio.com

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Save the date, July 21, 2018 . . .

From The Chairman

by Mike Adams

It has been an exciting and fulfilling two years as we have worked with a dedicated group of volunteers to build a place for all things radio. It amazes me, it warms the heart, to watch our volunteers not only construct but buy the building materials, bring their own tools, and complete some very nice spaces. There are a lot of talented volunteer building tradespersons proud of their work, and it shows.

Now, as we complete the renovation and can finally move beyond major construction, I want us keep our eyes on the goal – a history and education facility that makes a difference in people's lives, that serves not only our core radio hobbyist, but makes us a useful public museum. We need to attract new patrons who leave our facility saying, "now wasn't that interesting." We need to serve all the public. As the director of the New York-based Antique Wireless Association museum told me, "We cannot build it for us." We must build for a future of the curious, both technical and non-technical, we must show the significance of communication in our lives, past, present and future. We must present the cultural and social meaning of our radio science and art. We must inform and excite. We must lead. We will lead.

Our very talented Board of Directors have been working with President Steve Kushman as we expand our focus in envisioning and planning our approach to exhibits, work spaces, conversation spaces and events that will appeal to our membership, the community, and the inquisitive public. We are committed to designing messages and experiences that will have lasting impact and that will bring people back for more.

We have been very fortunate to have the financial support that reinforces our volunteer efforts. Through the generous support of individuals committed to our vision, we are well on the way toward the creation of the California Historical Radio Society's West Coast center that will be a place of record for radio invention, radio as the first social media, radio in our lives. While we have always thanked our contributors, we especially want to publicly and proudly recognize our four largest contributors. They are builders, scientists, engineers, business leaders - all with the vision of the completion and future viability of 2152 Central Ave, in Alameda, Radio Central, a place for all things radio. Thank you.

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CHRS Central Valley Chapter News

by Richard Lane

Richard Lane was elected as Chairman of the CHRS Central Valley Chapter effective January 1, 2018. Rich served as a chapter officer for many years. Rich replaces Eddie Enrique who served as Chairman since the founding of the CVC.

The Editor

Eddie Enrique Honored at CVC Luncheon: The Central Valley Chapter was established by Eddie Enrique in 2006 after annual collector meets in Merced ended. Eddie's goal was to go beyond collecting and restoring radios to bring people together in a common interest to enjoy each other's company, have fun, and to learn. CHRS Central Valley Chapter members and families came together on January 6th at Las Casuelas restaurant in Turlock to honor the 11 year tenure and legacy of chapter chairman Eddie Enrique. Eddie was presented with a plaque in recognition of his leadership in founding the chapter and establishing various activities like the annual swap meet that had in 2017 celebrated its 13th year.

Many Visitors Come by CVC Booth at Model A Meet: Once again Central Valley Chapter members were in attendance at the annual West Coast Model A meet and many attendees were attracted to the booth to listen to the many playing radios that had been restored by CVC members. The exhibit included a 1928 Philco console that was prominently displayed at the front of the booth. The exhibit was set up by John Wallin, Archie Durham and Scott Scheidt. The radios played big band, jazz and other vintage music via a portable CD player and AM transmitter. A steady stream of people came by the booth to ask questions and buy radios.

Central Valley Chapter booth at the Model A Meet.

Checking out the Philco.

Scott setting up the display.

Archie demonstrates radio repair.

CVC Website Revamp:
Webmaster Scott Scheidt recently completed a website make-over and updated many aspects of the website. Thanks, Scott" Here is the link: http://cvantiqueradio.com/news-events

"Radio Buzz" Newsletter in Third Edition: The Central Valley Chapter has created a newsletter called the "Radio Buzz". In its third edition, the Radio Buzz features information on club activities, restoration, new finds and want ad section of radios for sale by the membership. This modest publication, in tongue and cheek style is called "The Official Word of the Nerd Heard." Current editions are posted on the CVC website at News/Events: http://www.cvantiqueradio.com/ Submitted by Rich Lane CVC Chairman.

Membership meetings are held on the 3rd Saturday every month in the CVC clubhouse at the corner of Bradbury and Commons just Southwest of Turlock. Start time is 1:30 PM in Winter and 10:30AM during the Summer, consult the website exact times. ◊

Radio Central Renovation Update

Original circa 1900 exterior front elevation of 2152 Central Ave.

Downstairs Gallery: The 100 year-old floor downstairs was removed and replaced with a new 6" thick concrete floor. Before the floor was poured, a drainage system was installed followed by a water proof layer to insure that water incursion will no longer be a problem. Next, the stairwell and walls will be reconstructed and an ADA wheel-chair lift will be installed. Then the room can be finished and configured for museum displays and a meeting area.

Driveway: Initially it was intended to repair the long asphalt driveway and changing its slope to keep water away from the building. Upon further investigation, it was prudent and more affordable to replace it with a reinforced concrete driveway This project included replacing the water main to the building which runs under the driveway.

Storage Building: Because the old driveway had to be removed, regrettably it was necessary to remove the newly completed Sales Shed as well. Philip Monego generously donated a replacement metal building constructed from a large surplus shipping container and configured with several roll up doors. The building is being fitted with shelving and will be used to store surplus items and items available for sale or disposal.

Newly poured driveway.

Landscaping the front yard.

Replacement storage building being delivered.

Pouring the downstairs floor. ◊

The Western Television Visionette Mechanical Reproducer

By John Staples, W6BM

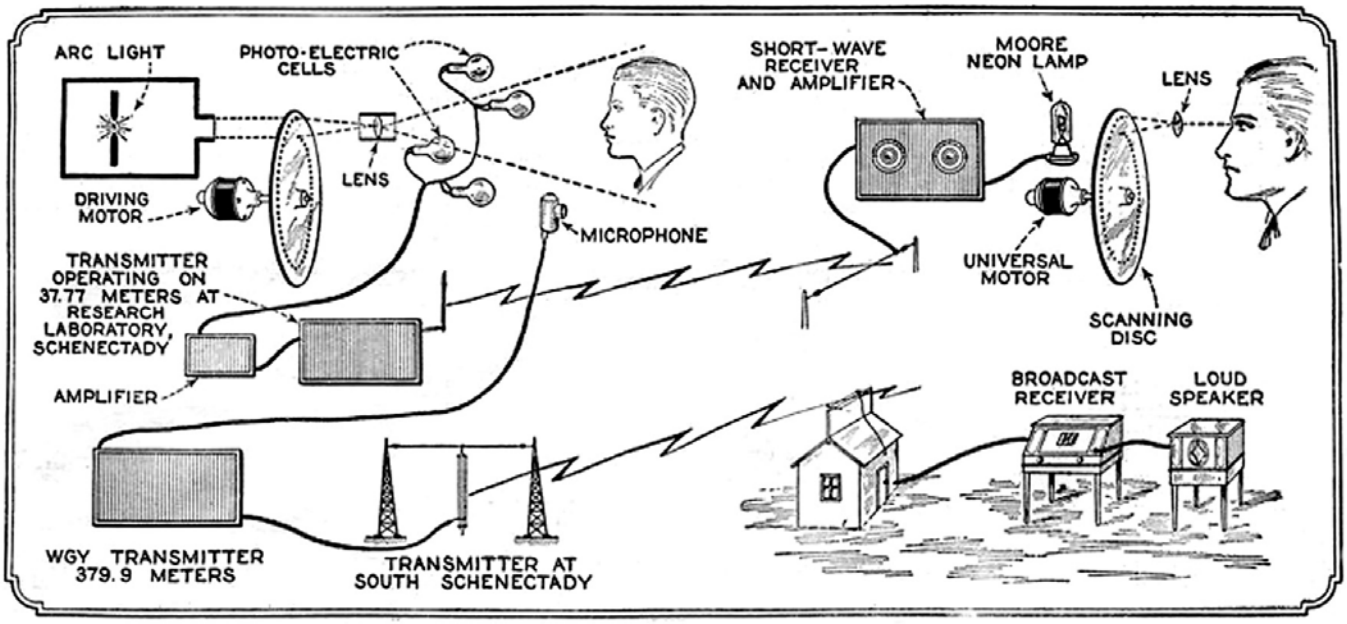
As broadcasting emerged in the early 1920's, kids were making crystal sets, winding coils on Quaker Oats cereal boxes. A decade later, kids were making mechanical television receivers with spinning discs and motors possibly "borrowed" from the family washing machine. These kids were the pioneer TV junkies.

The Western Television Visionette, released in 1929, was one of the most advanced mechanical television reproducers sold at that time.

A short primer

But first, a short primer on how analog television works. Digital television, our current standard, processes the video signal very differently than analog, which transmits a serial signal from the camera to the viewer that represents the brightness and color of a scene, one pixel at a time.

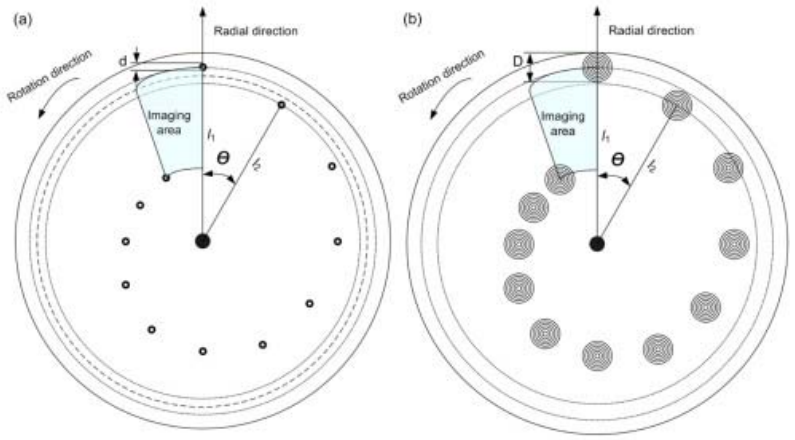
A *pixel* is a small element of the scene that is scanned, usually left-to-right, top-to-bottom that produces a serial video brightness signal. The scene illumination of that pixel is transmitted to the receiver which duplicates the scanning process, one pixel at a time, and if the scanning process is fast enough, the *persistence of vision* of the eye forms a visual image of the original scene.



"A diagram of the Alexanderson method of operation in the transmission and reception of television. At the upper left are the transmitter for the image and the microphone for the voice, which is broadcast on a different wavelength. At the right are the receivers for television and speech. " From Radio News for April, 1928.

One method used by mechanical television camera scans the scene using a motor-driven wheel with a spiral array of holes or a set of rotating mirrors.

The spinning disk is known as a *Nipkow disk*, and one revolution of the disc scans the entire subject which corresponds to one *field* of the image. The set of lines that forms the image is called the *raster*.



Nipkow disk with its spiral of holes through which each line of the image is projected. When spun sufficiently fast, the image will appear in the area shown.

In some scanning disks the small holes are replaced with lenses to increase the amount of light transmitted from the scene to the photocell.

Two different scanner configurations have been used:

1. bathe the subject in a very strong light, and place a scanning disk between the subject and a photocell that records the instantaneous bright level. The output of the photocell is the video signal. The photocells and video amplifiers following the photocells were not very sensitive, so a massive amount of light was required on the subject. This was very uncomfortable for the subject, but allowed sunny outdoor scenes to be televised.
2. bathe the subject with a bright moving pencil-beam of light, directed through a scanning disk, and pick up the light reflected from the subject with a multiple bank of photocells. This improves the signal-to-noise of the video, but the subject feels like he being blinded by looking into the lens of a powerful movie projector. Except for the scanning pencil beam, the subject had to be in darkness.

At the receiving end, the scanning process is duplicated in synchronism with the sending end. The video signal modulates the intensity of a large-area light source, usually a large neon bulb, and a scanning disk is placed between the light source and the viewer. As the light source is modulated by the video signal, its intensity duplicates the intensity and location in the scene as seen at the sender.

The persistence of vision welds the pixels together to form an impression of an image. Movies, for example, present 24 frames per second, which is slow enough to present a flicker, if it were not that each frame is presented twice, so the flicker rate of a movie from film is actually 48 frames per second.

Bright images need even a higher frame rate to overcome flicker.

However, early mechanical television presented images at a frame rate of 12.5 up to 30 frames per second. The revolution speed of the disk has practical limits, and the *video bandwidth* required to transmit the signal increases with the frame rate. Therefore, all the early mechanical television images suffered from considerable image flicker.

The video bandwidth describes the highest frequency of the video signal that is transmitted from the camera to the receiver. An image with more lines and a higher scanning speed will produce a video signal with a wider range of frequencies that must be sensed by the photocells, the video amplifier and the radio transmission system to the receiver. The faster the scan, the less time is spent on each pixel, so less light is collected for each pixel, and the noise of the photocells and amplifier chain becomes more significant producing a poorer signal-to-noise ratio.

All these effects limit the scan rate, sensitivity and resolution of any television system. They are particularly severe for the early technology of mechanical television systems.

Progressive scanning means the scene is scanned, one line at a time, starting at the top, and progressing line-by-line, to the bottom to produce one frame of the image. A typical rate could be 15 frames per second.

If image rate could be doubled, say, to 30 FPS, the flicker would be reduced. *Interlaced scanning* does this with the same rotational speed of the scanning wheel. In double-interlaced scanning the spiral holes in the wheel are divided into two spirals, each occupying one-half of the wheel circumference. The first half scans all the odd numbered lines, and does this 1/30th of a second. The second half the wheel fills in the even lines in another 1/30th of a second, and each half image fills the field of view in 1/30th of a second, reducing somewhat the flicker, instead of waiting a full 1/15th of a second for the full field of view to be presented.

Each half-scan is called a *field*, and the two fields together form a *frame*. This technique allows the bandwidth requirement to be halved for the same frame rate as progressive scanning.. This technique was used in our old NTSC 525i television system all the way up to the digital transformation, but produces "line crawl" in the image as a result. The 525 indicates the number of lines in a frame, and the "i" indicates interlaced scanning. Our present HDTV image is typically 1080p, 1080 lines, progressive scan. The newer 4K pushes line counts even higher.

The Visionette goes interlacing one step farther: it uses triple-interlace, with a basic frame rate of 15 per second, with each of three fields presented in 1/45th of a second each. I leave it up to you to see if line crawl is an issue.

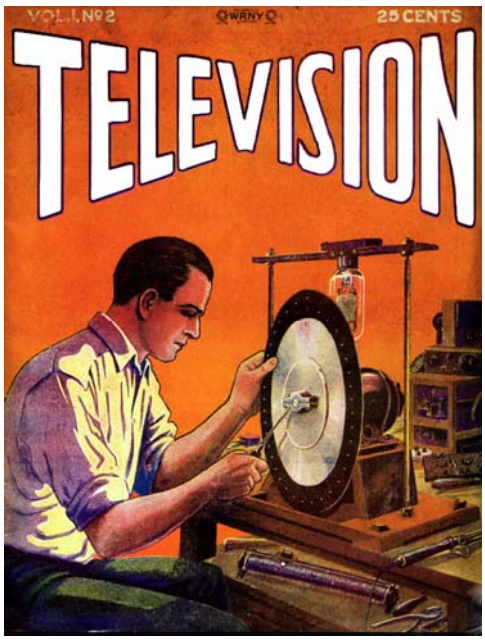
Synchronization

The disk at the receiver must be in synchronism with the disk at the sender. No standards for synchronization or sync pulses had yet been established. The earlier 30 line systems relied on the periodic nature of the video waveform to try to establish a sync signal, but often the motors used were variable-speed induction motors, and the viewer had to regulate the motor speed by hand, either literally with his thumb, or with a variable resistance in the power supply for the motor.

The Visionette standard used a different method. Its 45-3i triple-interlace 45-line 15 FPS standard used a synchronous motor synchronized to the local power line frequency. If the sender were using the same power company, then the scanning disks would be in synchronism. However, since the signals were in or just above the AM broadcast band, TV DX (distance) reception was popular, and this was before national power line grids with wide-area consistent phase and frequency were wide-spread, synchronization using local power was not always reliable.

Programming

Like the crystal-radio phase, home-brew television sets were a hot item ten years later. Many popular magazines contained "how-to" construction articles.



Television was a 1928 Hugo Gernsback publication devoted to the television hobbyist.

Article in Science and Invention magazine (Nov. 1928) describing how to make a mechanical television using a standard radio set.

Programming came from local AM broadcasting stations, mainly on the East coast and Midwest.

The low video bandwidth requirement of up to a few kHz for the 30-line, 12.5 FPS systems allowed it to be broadcast on a local AM station, usually after usual broadcast hours.

When slightly higher-definition standards emerging, the video bandwidth approached 50 kHz, so the 1927 Federal Radio Commission, the predecessor of the FCC, assigned 4-5 100 kHz bands in the 2000 kHz to 2950 kHz part of the spectrum.

Television Time Table

Call Letters	Lines per Frame	Power in Watts	Company	Location
			2000-2100 kc.	
W3XK	48	5000	Jenkins Laboratories	Wheaton, Maryland
W2XCR	60	5000	Jenkins Television Corp.	New York, N. Y.
W2XAP	48	250	Jenkins Television Corp.	Portable
W2XCD	48	5000	DeForest Radio Company	Passaic, N. J.
W9XAO	45	500	Western Television Corp.	Chicago, Ill.
W2XBU	48	100	**Harold E. Smith	Nr. Beacon, N. Y.
			2100-2200 kc.	
W3XAK	60	5000	National Broadcasting Co.	Bound Brook, N. J.
W3XAD	60	500	R C A Victor Company	Camden, N. J.
W2XBS	60	5000	National Broadcasting Co.	New York, N. Y.
W2XCW	—	20000	General Electric Co.	South Schenectady, N. Y.
W8XAV	60	20000	Westinghouse Elec. & Manufacturing Co.	East Pittsburgh, Pa.
W9XAP	45	1000	Chicago Daily News	Chicago, Ill.
*W2XR	48	500	Radio Pictures, Inc.	Long Island City, N. Y.
			2750-2850 kc.	
W2XBO	—	500	United Research Corp.	Long Island City, N. Y
W9XAA	48	1000	Chicago Fed. of Labor	Chicago, Ill.
W9XG	—	1500	Purdue University	West Lafayette, Ind.
W2XAB	60	500	Atlantic Broadcasting Co.	New York, N. Y.
			2850-2950 kc.	
W1XAV	48	500	Shortwave & Television Lab., Inc.	Boston, Mass.
W2XR	48	500	Radio Pictures, Inc.	Long Island City, N. Y.
W9XR	24	5000	Great Lakes Broadcasting Company	Downers Grove, Ill.

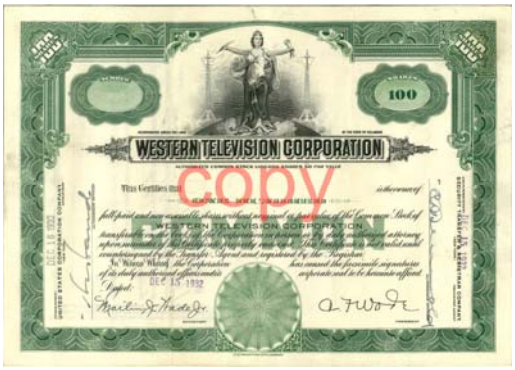
** 1 hour daily (1 to 2 P. M.)
* Subject to operation between 5 and 7 P. M.
Subject to shared operation after 10:00 P. M. and before 2:00 P. M. by agreement with other licensees within 150 miles of W2XR.

Television stations in the mechanical television era.

The Visionette

The Western Television Corporation Visionette premiered in 1929. About 250 to 300 of the sets were manufactured by Echophone, the manufacturing arm of the Western Television Corporation in Waukegan Illinois. Two radio stations in Chicago provided programming until 1933, when frequency reassignment was made in the AM band for the stations providing an audio channel resulted in closure of the mechanical television operations.

The Visionette arrived at CHRS complete, but in relatively poor condition. The set comprises a tall wood cabinet with a 4 inch lens in front to view the image. A 17 inch diameter wheel shock-mounted on a 1/100 horsepower synchronous motor sits inside the cabinet.



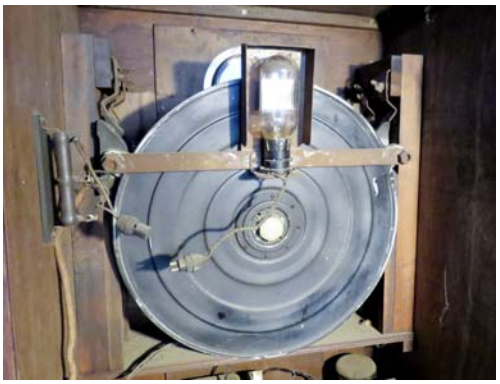
1932 Western Television stock certificate.

The Visionette as it arrived at CHRS. The outer cabinet had water and wear damage. Notice the wheel below the lens that is used to synchronize and frame the image.

The rear view to the right shows the large Nipkow disk mounted in a frame. Behind it is the neon lamp. Below is a modified Crosley receiver.

The cabinet base contains a Crosley 41S receiver, modified to tune from 1.5 to 3.0 MHz, covering the 1927 television bands just above the AM broadcast band. The receiver uses a three-stage tuned radio-frequency circuit, using UX224A tetrodes in the RF section. The RF section is followed by a UX227 detector resistance coupled to a UX227 audio driver and a pair of UX271 in parallel in the output stage. A Kino lamp neon lamp is placed in the plate circuit of the UX271s which can provide up to 60 mA to the lamp.

The modified Crosley 41S receiver.



The 17 inch wheel with Kinolamp.

The neon Kino lamp.

Some scanning holes visible in the wheel.

The three major subsystems were removed and restoration started.

1. The scanning disc subassembly was in the best shape and moved to the W6BM shop for restoration and installation of modern electronics to enable an image to be demonstrated.
2. The modified Crosley 41S receiver will not be used in the demonstrations, but was made operational but not cosmetically restored.
3. The cabinet was removed by Philip Monego to have it very capably restored by Carlos Perez.

Restoration

Although the neon Kino lamp will not be used, it was excited by 50 mA of current for a test. There is evidence of considerable sputtering of material on the inside of the glass, which has darkened it significantly. Used in the set itself, the illumination would be so low that it could only be viewed in a darkened room.

In addition, the material is sputtered on the inside of the glass in an irregular pattern, which would be visible in the reproduced image.

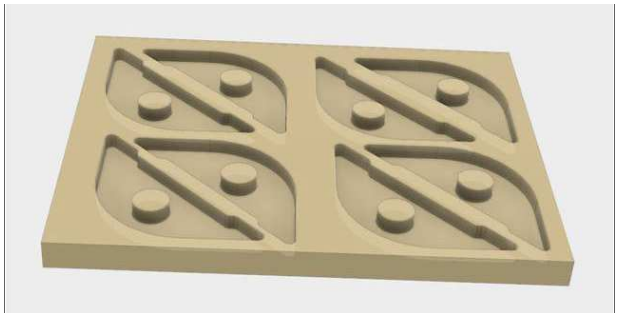
It did not seem practical to try to use the Kino lamp in the restoration.

The neon Kino lamp was able to be illuminated but not usable.

Fig. 1: Eclipse path.

The Nipkow disk mounted in a temporary frame.

The original rubber isolation mounts.



The mold created by John Stuart to reproduce the isolation mounts.

With the scanning subassembly removed from the cabinet, a temporary frame was constructed to hold the motor and wheel assembly safely.

The mounting hardware and motor were disassembled and cleaned, and the wheel itself was left in its original condition, which was good.

The original rubber vibration isolation mounts between the wheel assembly and the cabinet had hardened and had to be replaced.

John Stuart designed and machined a mold to produce new rubber vibration supports for the disk assembly. The dimensions of the cabinet will be reproduced in the cabinet restoration so that the new vibration dampers will fit properly.

The isolation mount reproductions being test fit.

Operation with Image Demonstration

No original signal sources or radio transmissions are available, so the restoration to provide an image similar to that seen originally will use modern electronics.

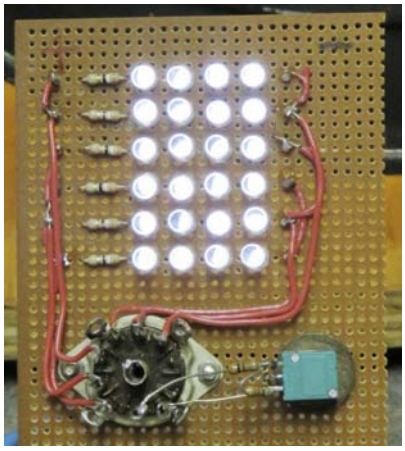
In place of the original Kino lamp light source, an array of LEDs and a ground-glass diffuser will supply the variable light source.

The LEDs provide an image bright enough to be easily observed in a lit room.

The LEDs are arranged in a 4-by-6 array, which has the same form factor as the 1-by-1.5 inch display at the surface of the wheel. Each string of LEDs is pulsed to a maximum current of 50 mA.

The source of the images is selected to be most appropriate for the 45-line scan of the Visionette. Several video sequences have been selected to demonstrate the display.

Due to the low resolution of a static image, image motion is important to recognize the image.

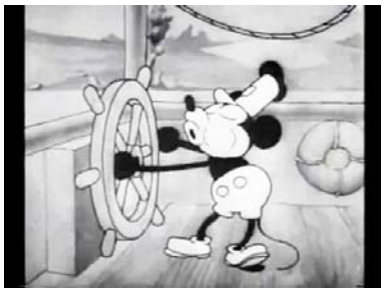


The LED light source.

Some of the moving images selected are:

1. Clips from the 1942 movie Casablanca, which feature head shots which are recognizable with the 45-line resolution. The lighting director of this movie used illumination that gave a very good gray scale to the images which helps with a low-resolution display.

2. The 1928 Walt Disney cartoon Steamboat Willie, which combines line drawing with motion. Both of these clips include sound, which may be reproduced with the addition of an amplifier and speaker.



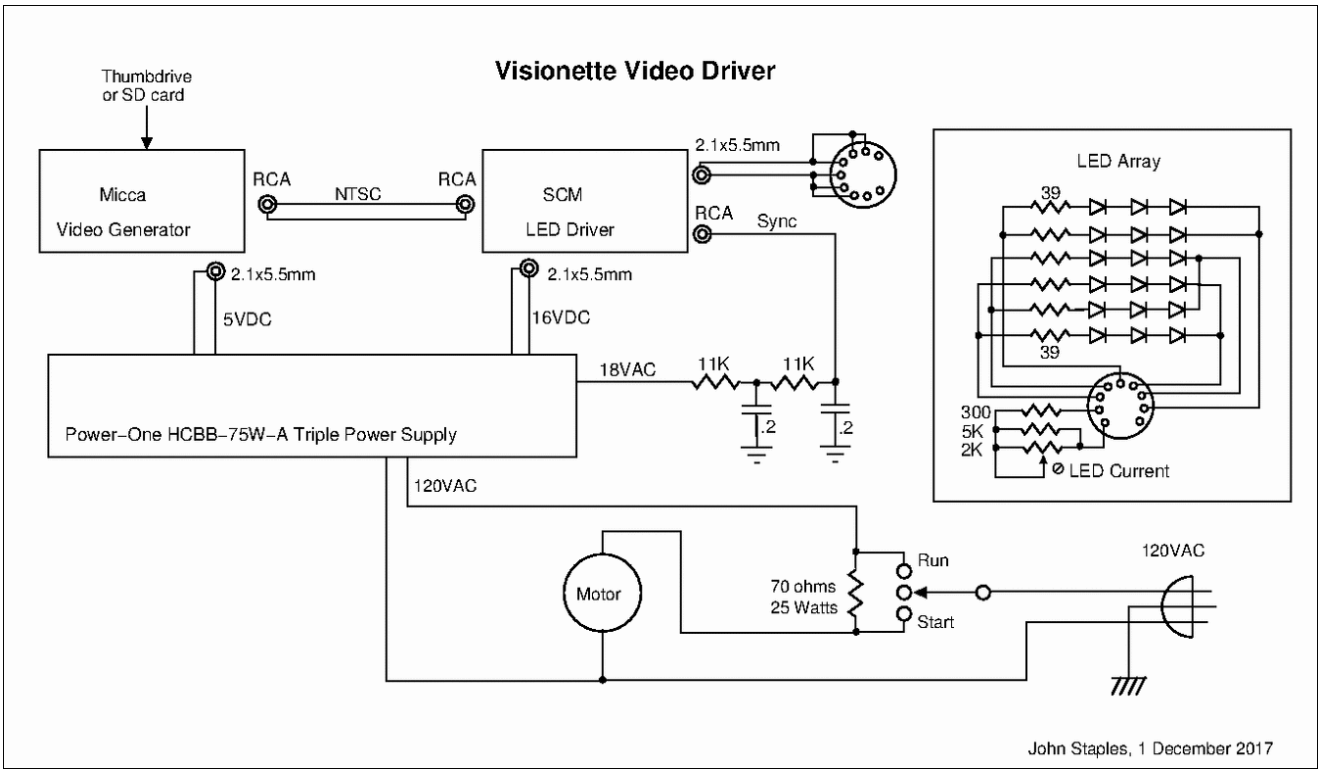
3. Clips from an original video recording by John Logie Baird of a female subject Miss Pounsford, This recording was made to an acoustical disk by Baird in 1928, and recovered by Donald McLean decades later using computer-aided reconstruction of the very crude image. This is the oldest known recording of a video image and is historically significant.

The video images are available in standard NTSC format and are converted to the 45-line scan format by a format converter.

Two electronic modules are used: a Micca video generator that converts a video file on a thumb drive or smartcard to a baseband NTSC signal.

The NTSC video signal from the Micca is then converted to the 45-line triple-interlace waveform by the Aurora Design SCM standards converter, which can supply the video for 12 different mechanical standards. The LED current driver is contained within the SCM format converter. The Micca video generator and SCM converter are both powered by an open-frame power supply.

Left is the Micca video generator. Right is the Aurora SCM video format converter.



Block diagram of the video source and conversion.

The synchronous motor for the wheel is not self-starting.

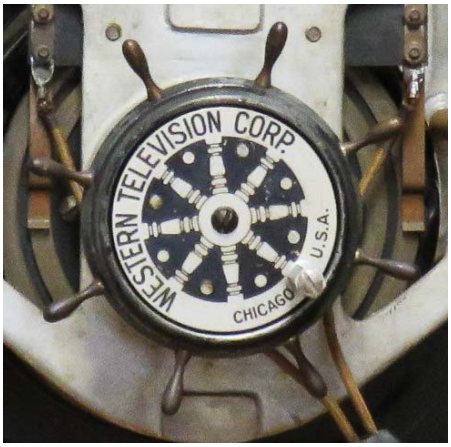
A starting crank is provided in the front of the cabinet inside the framing wheel to start the wheel rotating in a CCW direction. After the rotation is started, power is applied to the motor to bring it up to full speed.

At full voltage, the motor is rather noisy, so after the motor is locked to the 60 Hz power line phase, the starting switch is moved to the operate position, reducing the voltage on the motor to 80 volts, resulting in quieter operation.

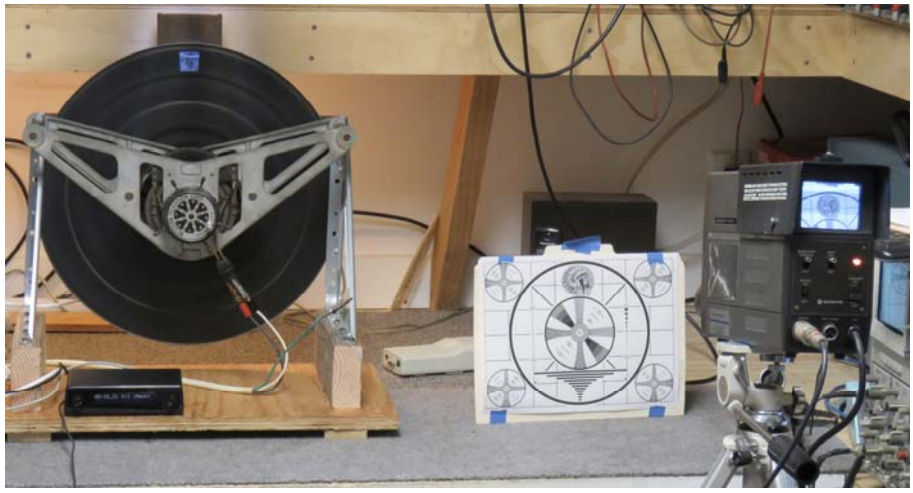
The image is framed by moving the outer wheel to bring the correct image frame into view.

If the entire rotating wheel were illuminated, 45 images would be presented, each displaced by three lines from the next. Only one of the 45 images is the correctly framed one, and is selected with the framing adjustment wheel. The next time the display is started up, the framing must again be re-established.

The setup during restoration used several signal sources, including a small studio TV camera to generate the images.



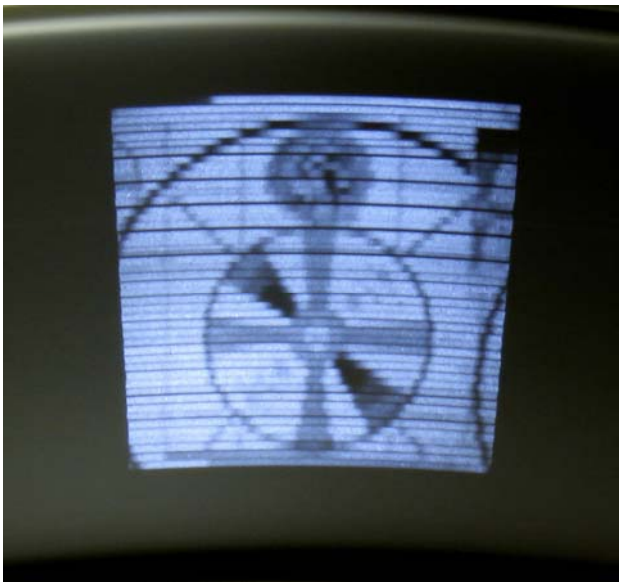
This wheel is turned by the user to initially start the motor. Then its used to frame the image.



Test setup including the small camera.

So, how do the images look?

A photograph of the image does not do it justice, as motion is an important part of the perception of the image, both motion in the image itself, and the motion of the line scanning structure that generates the image.



The image is clearly visible with moderate ambient lighting in the room. The 15 frames-per-second image rate clearly flickers, and the triple-interlaced line structure produces significant line crawl.

I have experimented with progressive scan, double and triple interlaced images with the same frame rate and my opinion is that the progressive scan format is easier to view. Most mechanical television standards of the day used progressive scan, up to 48 to 60 FPS. Later in the development of mechanical television, Baird was using a 240 line, progressive scan at 25 FPS as a last resort before the end of the mechanical era.

Programs were transmitted from two stations in Chicago using the 45 triple-interlaced standard for up to three hours per night, so there must have been some entertainment value, even though the whole enterprise was mainly for hobbyists until the demise in 1933 of the Chicago-based transmissions.

The Visionette probably sold more mechanical reproducers than any other manufacturer or for any other scanning standard, and could be considered as the pinnacle of US-based mechanical television available to the public. The development of electronic (non-mechanical) television needed electronic camera tubes and cathode-ray display tubes to be suitably developed, which was well under way in the 1930, but television had to wait until after WWII to be available to the public. Since then, advances of expanding to the UHF band, compatible color, satellite and web delivery and digital television have transformed television technology, and it continues to technically advance.

The Author

Dr. John Staples, W6BM, designs and builds particle accelerators at the Lawrence Berkeley National Laboratory. He received his Extra Class ham license and First Class Radiotelephone and Radar licenses in 1958. Besides being an avid collector of vintage electronics, he has been a passionate motorcyclist for over 50 years.

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Television Arrives: Hugo Gernsback Says So

By Mike Adams

Later this year television arrives at the CHRS radio museum in Alameda. For our first exhibit, John Staples has guided and directed a small band of television experimenters and enthusiasts in the creation of an exhibit of vintage television. They include Gilles Vrignaud, Richard Watts, Steve Kushman, Tom Bonomo, and the author of this paper. There is also a story to tell: When did radio's audience begin to accept and embrace television? How did it all begin? The CHRS museum will present the television as imagined by two existing media formats, cinema and magazines.

The story of the development of television and the realization of what it might become unfolded rapidly in the decade of the 1930s, those years between the maturation of radio broadcasting and WWII. The 1930s began with the failing remnants of the various mechanical TV systems. By the time of America's entry into war in 1941, an all-electronic system was standardized and set aside until after the armistice.

What did people know about the race for television and how did they know it? Many read about the nascent media format in the radio and TV hobby and news magazines published by Hugo Gernsback. But Hollywood cinema also contributed to our attitudes about their competing interloper in a collection of "B" movies with television playing an integral part of the story.

To illustrate this exhibit, working examples from the evolution of the television from the late 1920s to the 1950s are featured. Here is one story behind television's arrival.

The Prescient Publisher

In one of only two 1927-28 issues of his new magazine *Television*, the famed and successful publisher of *Modern Electrics* (1908-1914) and *Radio News* (1919-1958) Hugo Gernsback, wrote in his editorial in *Television* vol 1 no 2: "When we brought out the first issue of this magazine in the Fall of 1927, it was thought in many quarters that we were rushing a new art unduly. At that time, it should be remembered, that no broadcast station was transmitting television impulses." He explains that the television is still in the experimental stages. He makes the point that "a beginning had to be made somewhere." He reminds the reader that when he started *Radio News* in 1919 there were no radio stations. Gernsback, the publisher of the first science fiction magazine, *Amazing Stories* in 1926, was early in introducing new technology-based art forms to largely hobbyist audiences. The stated purpose of the magazine *Television* was to present clear directions for building a set. He admits it is crude and compares it to his 1908 *Modern Electrics* construction articles based on the coherer and spark coil.

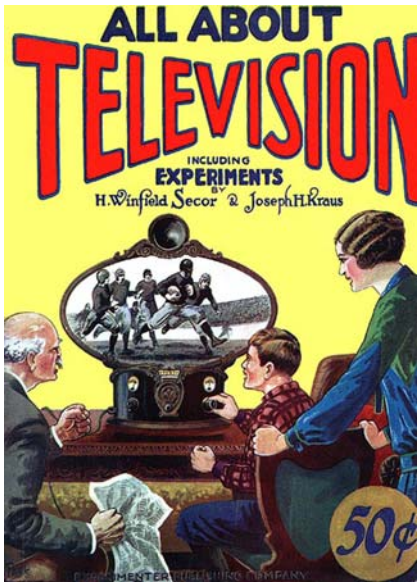


Fig. 1: Gernsback's first television publication.

All About Television (figure 1). This is the prequel to the Gernsback publication *Television* of 1927- 1928. Only two issues followed. Volume 1 number 2, the second and last of the series, is on the cover of this Journal. It features a young man building the basic mechanical TV, the television experimenter's crystal set.

What could the 1928 reader expect to learn from this second and final issue of *Television*? It shows the experimenter how to construct the basic scanning disc television receiver. It is the crystal set of television, and if you were near a large East Coast city, it was possible to receive the occasional and haphazardly-scheduled experimental broadcasts. Remember that early radio broadcasting stations like KDKA were on the air irregularly in those last months of 1920. The television builders in 1928 would resemble their older brothers, the wireless enthusiasts and radio set builders of 1920. That hobbyist work led to radio broadcasting for all. The schematic in figure 2 is an example of a hobbyist approach for a scanning disc receiver.

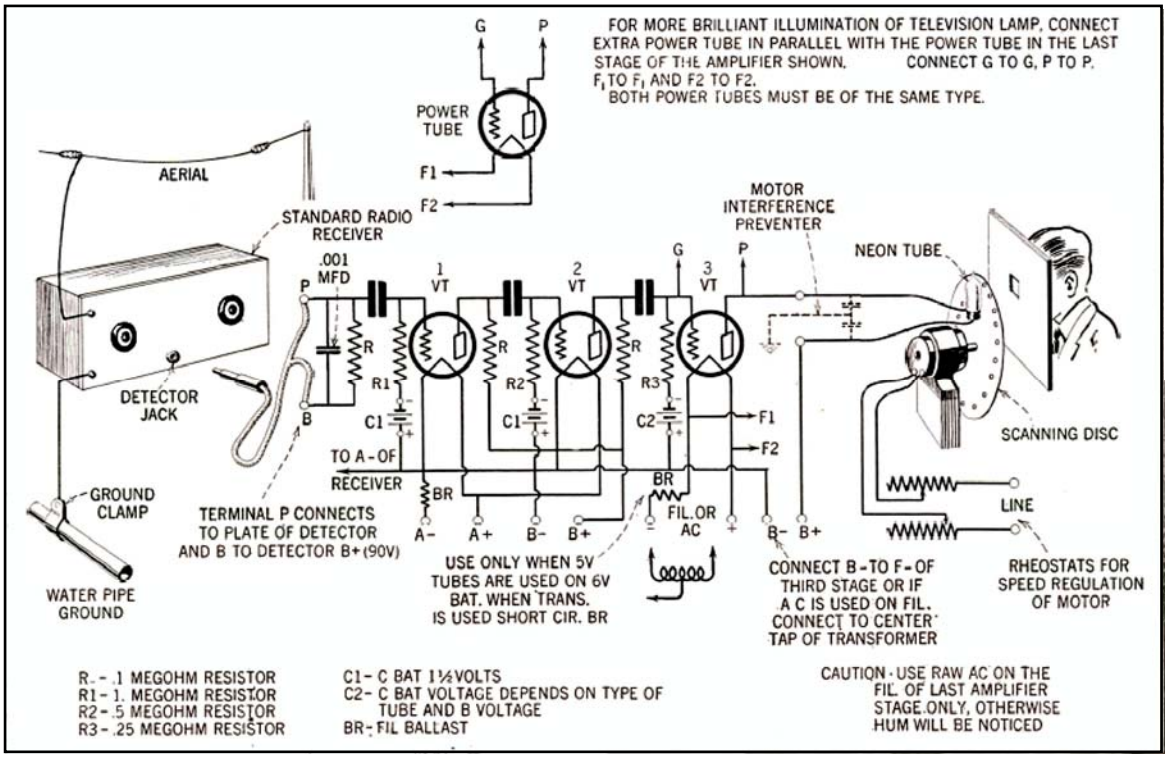


Fig. 2: Pictorial example of a very basic scanning disc receiver, a boys first television.

And while Gernsback did twice introduce all-television magazines, he did between 1926 and 1928 use a half dozen issues of the existing and popular *Radio News* to feature television covers. He even went as far as to put a graphic around the edge of several future covers, alternating the words "television" and "radiovision." Most were fanciful, showing TV screens that were impossible at the time. One such issue (figure 3) from 1926 predicted "Radio in 1935," but omitting the term "television." Because of radio's popularity this prediction can only be thought of as "radio with pictures."

Fig. 3: Example of optimistic predictions for the adoption of television.

So it was expected that the first experimenters and the early programmers of television would be the established radio stations. They had audiences already, they had singers and speakers, and they had the knowledge to construct a transmitter of pictures. It was natural that the addition of the image of the singer or orator would add to the radio experience. It was called television but in the beginning it was just "radio with pictures." This was expected. After all, every new media format began with the content of the previous media. The movies filmed stage plays, live music became the phonograph, television would utilize the mostly entertainment content of radio. It would be up to others to create what we now understand as television programming; the technology provides the means, while the singers, actors, writers, and news reporters provide the content. Two radio stations of some influence got into television early, among them the Chicago Federation of Labor's WCFL (figure 4) and WGY (figure 5), the General Electric station in Schenectady.

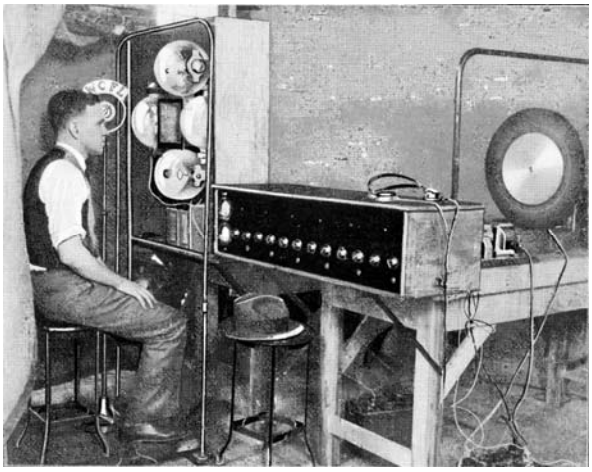


Fig. 4: WCFL, a Chicago radio station with its 1928 television transmitter.

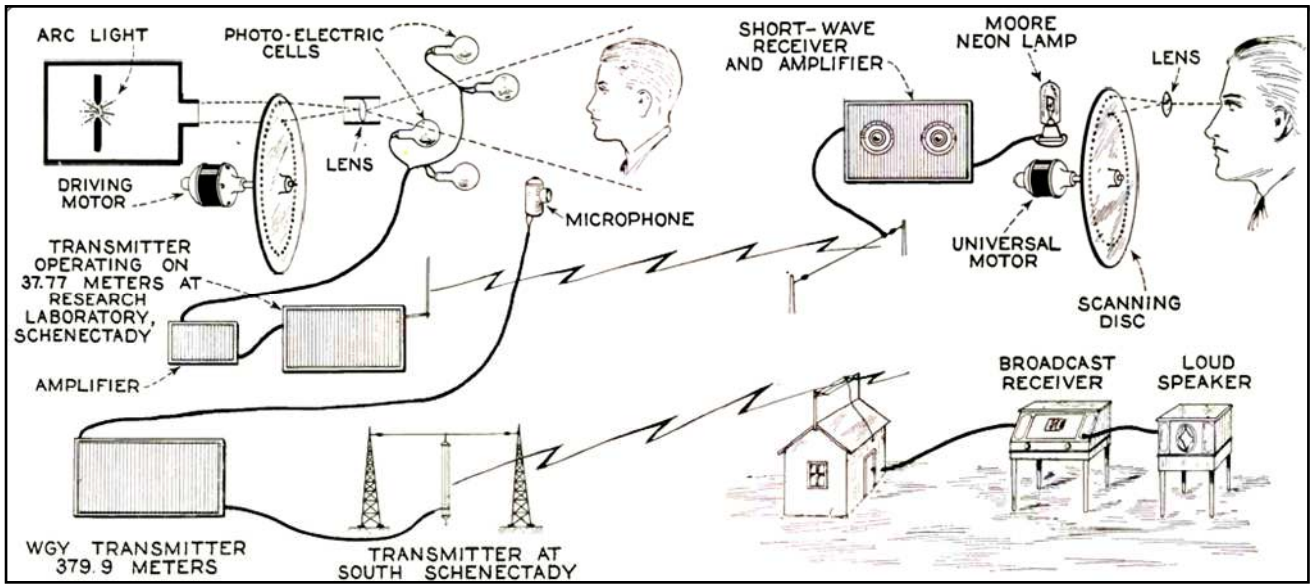
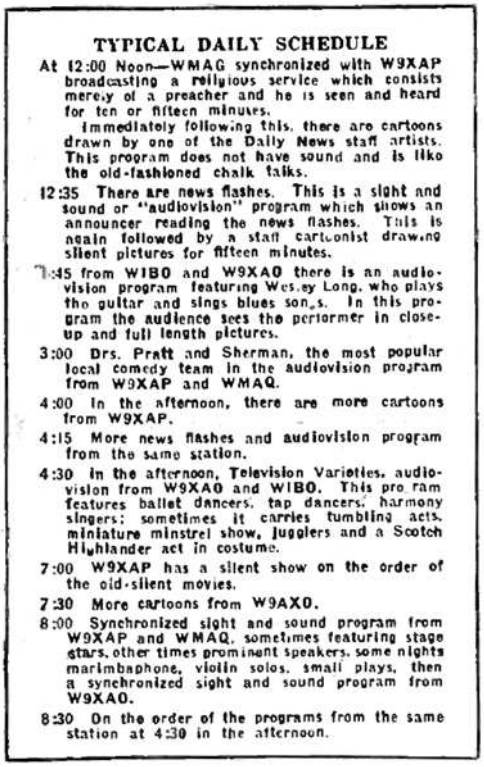


Fig. 5: WGY, a pictorial diagram of 1928 television from GE and Alexanderson.

A "typical daily schedule" of Chicago TV in 1928 (figure 6)included: "At 12 noon, WMAG (surely a typo for WMAQ cited at the end of this schedule) synchronized with W9XAP broadcasting a religious service which consists merely of a preacher and he is seen and heard for 10 or 15 minutes."



TYPICAL DAILY SCHEDULE

At 12:00 Noon—WMAG synchronized with W9XAP broadcasting a religious service which consists merely of a preacher and he is seen and heard for ten or fifteen minutes.

Immediately following this, there are cartoons drawn by one of the Daily News staff artists. This program does not have sound and is like the old-fashioned chalk talks.

12:35 There are news flashes. This is a sight and sound or "audiovision" program which shows an announcer reading the news flashes. This is again followed by a staff cartoonist drawing silent pictures for fifteen minutes.

12:45 from WIBO and W9XAO there is an audiovision program featuring Wesley Long, who plays the guitar and sings blues songs. In this program the audience sees the performer in close-up and full length pictures.

3:00 Drs. Pratt and Sherman, the most popular local comedy team in the audiovision program from W9XAP and WMAQ.

4:00 In the afternoon, there are more cartoons from W9XAP.

4:15 More news flashes and audiovision program from the same station.

4:30 In the afternoon, Television Varieties, audiovision from W9XAO and WIBO. This program features ballet dancers, tap dancers, harmony singers; sometimes it carries tumbling acts, miniature minstrel show, jugglers and a Scotch Highlander act in costume.

7:00 W9XAP has a silent show on the order of the old-silent movies.

7:30 More cartoons from W9AXO.

8:00 Synchronized sight and sound program from W9XAP and WMAQ, sometimes featuring stage stars, other times prominent speakers, some nights marimbaphone, violin solos, small plays, then a synchronized sight and sound program from W9XAO.

8:30 On the order of the programs from the same station at 4:30 in the afternoon.

Fig. 6: A typical daily schedule.

This issue of *Television* presents a very good textbook-like series of articles on television technology as it is known in 1928: The Jenkins Radio Movie device, how photocells work, the problems of synchronization, photo transmission - the very basics of TV as it was then known. The superior cathode ray tube and a perfected all-electronic scanning system were five or more years away. Most of the systems profiled in this issue were based on a low resolution scanning disc, making it impossible to know whether the head transmitted was that of a man, woman or child. It was just too crude, not close to being ready for prime time. You had to use your imagination. As Gernsback indicated, these articles were meant to interest and educate the experimenter, the would be scientist, the curious.

There were, in the final pages, as almost an afterthought, stories of electronic systems in the concept stage. "It must be possible" said Campbell -Swinton in his 1924 scientific paper. His updated 1928 system (figure 7) employs triode thermionic oscillators, cathode ray tubes and photo-electric cells. "It is the feeling of the editors that this idea of using a stream of electrons will one day be perfected by some genius." In the same issue Clarkson utilizes a cathode ray tube and a beam deflection system, much like the system that would be in place by the end of the 1930s. It is also similar to the Farnsworth system, as it is all-electronic, no spinning devices.

Heavy on redundant scanning systems, this final issue of *Television* did show several more modern ideas using cathode ray tubes. Those still experimenting and making small improvements to the mechanical television must have felt the pressure to try something, anything new. For the scanning disc would never be more than a curiosity, and those who experienced a "program" on a mechanical TV surely knew as its inventors knew, that it was a dead end. This would be the last issue of Television. It was felled by the Great Depression. News specifically for the TV experimenter and curious public would have to wait two years until March 1931 for the new Gernsback publication, *Television News*.

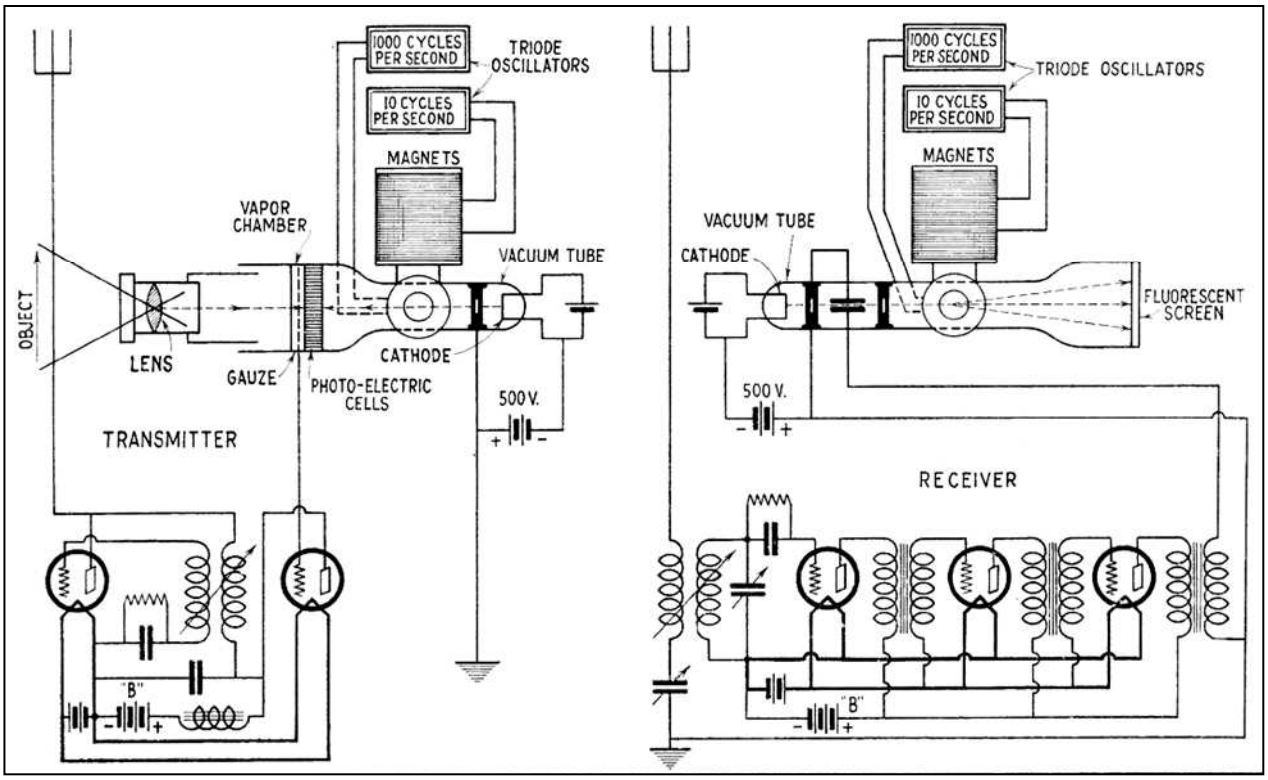


Fig. 7: Electronic scanning slowly begins to replace mechanical scanning. This is the Campbell-Swinton system in 1928. Electronic scanning would be the right track.

A New Beginning for Television

After a several year hiatus, the new magazine would have to separate itself from its 1928 parent; it could not feature a repeat of the dozens of similar low-resolution scanning systems featured in the 1928 *Television* or in the occasional *Radio News* issue. There would have to be less experimenting and more talk of the purpose of broadcasting to the public using a more-developed all-electronic system. There would have to be serious consideration of program content, more than simply radio with pictures. There were several promising electronic experiments in Britain and Germany, and these were higher resolution than known previously. *Television News* would have to speak to an audience wanting more than just parlor tricks. If television was to compete with radio and the movies, a viewer would have to recognize the images without straining, to see people not silhouettes. It would have to be better than good.

Fig. 8: *Television News*, March 1931.

Did Gernsback meet his goal for the new publication? The cover of the March 1931 *Television News* (figure 8) would indicate that he was now of the opinion that the television would never be successful if the viewer was forced to look at a one inch square image of 30 lines. But it also showed that television was just an improvement on the radio, featuring the familiar console radio with a built-in TV screen. And the cover also promised the old with the new as it listed articles by Jenkins of scanning disc fame and Farnsworth of tube fame. Only one of those systems would be in television's future. So the cover text is a bit of a contradiction, a mix of the nearly obsolete, and a great but unspecified hope for the future.

In Mr. Gernsback's first *Television News* editorial he states up front: "It is felt in many quarters that the art of television has been, so far, somewhat of a disappointment to the industry." He claims that the radio industry is too impatient, and that the general public has not embraced it either. And even though there are in 1931 nearly thirty television broadcasters on the air, the programming was still experimental. Gernsback does state what should in 1931 be obvious: "I do not believe that the rotating disc will finally prevail." A line in the sand. He cites recent research into tube-based,

electronically rendered pictures as opposed to mechanically scanned TV, and to his readers this will be the future. It is only then that television can grow into a new art form. He also criticizes some of the major radio companies for holding back television to save their very successful audio-only franchises. Gernsback tells his audience: "It will be the mission of the new magazine to portray television from each and every angle and to show the reader what work has been done, not only in this country, but the world over." And so begins a two year run of *Television News*, an every two month publication.

Fig. 9: *Television News*, March 1932.

The past refuses to go away. On this March 1932 cover of *Television News* (figure 9) the scanning disc remains viable, barely hanging on, still a possibility for the hobbyist.

Some of the articles are think pieces, "And What of Television" by Alfred Goldsmith, and "What I Think of Television" by Louis Pacent. Dr. Goldsmith of the Radio Corporation discusses three types of receivers, all based on mechanical methods, and he pronounces them not ready, primitive, with their pictures of limited detail. It is clear that he believes technical breakthroughs are several years away. He also reassures radio owners that they "need not worry about the effect of television on their business in the next few month, nor need the public concern itself with the matter." Move on, nothing to see here. Radio manufacturer Pacent compares television in 1931 as "in the same state of development that radio was when the crystal detector and coherer were used for radio reception." He believes that perfection in television is in the far future and will come out of the lab of a dedicated independent experimenter rather than a large corporation.

The lone dissenter seems to be the independent San Francisco inventor Philo Farnsworth. His article is "Scanning with an Electric Pencil." It is prefaced by an editorial introduction saying that Farnsworth is honest in his appraisal of the current collection of television devices: "It has long been apparent that the full development of television requires a scanning device free from the mechanical limitations which are inherent in the motor driven disc or drum." He explains that his work with a tube "with its 'weightless beam,' has been the obvious solution." His tube (figure 10) is called the image dissector and his system which is known as interlaced scanning would become the closest to an all-electronic system of television. Combined with Zworykin's superior pickup tube, a superior electronic system would be in place by the end of the decade of the 1930s. Farnsworth describes one of the problems of his system, the very wide bandwidth needed to carry an electronic image, one he estimates to be 1200 kilocycles wide. It is clear from the writings of the technical television fraternity in 1931 that while improvements to scanning systems are touted, a limit has likely been reached. There will not be a television industry based on mechanical methods.

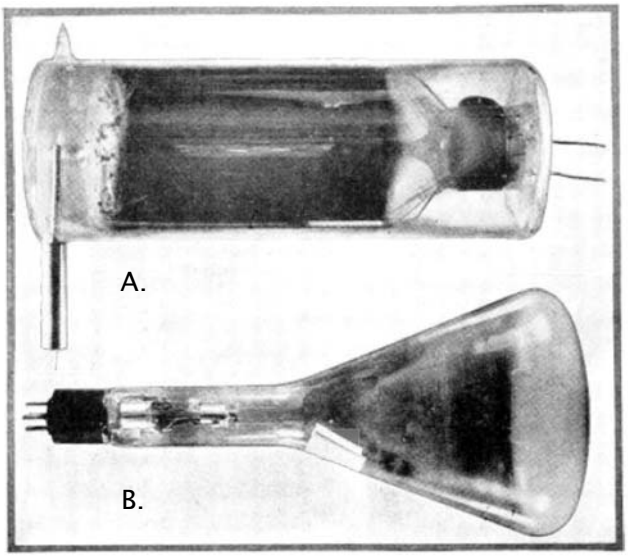


Fig. 10: Farnsworth tubes:

A - is the dissector tube with its target at the left, used for transmitting;

B - is the "oscillate" or receiving tube, the image appears on the flat surface at the end of the bulb.

The second issue of *Television News* titled its cover, "The Television Receiver of Tomorrow." It was an electronic, tube-based system. But what was on Gernsback's mind was not the standards war, but a Federal Radio Commission rule that the experimental television broadcasts could not be commercialized. Gernsback indicated that had such a restriction been placed on early radio, we might not have the successful media we take for granted. Still, the fact was that the 30 plus stations broadcasting TV fare were still all-mechanical, experimental, very low resolution. In this issue the editor promised that the next issue would be tube-oriented. He asks: "Are you familiar with cathode ray tubes? More articles

will be in the next issue explaining their use in television. The cathode ray tube is going to solve our scanning problems. Better be versed in its technique."

Two months later in the July-August issue there were many more articles leaving the basic all-mechanical system mostly behind. There were Braun tubes, cathode ray tubes, glow tubes, and the photoelectric cell used in sound movies. And Gernsback has a new idea – He calls it television technique. Now that the technology is being improved in the right direction, how about concentrating on the quality of picture, the script, the acting, the set, the lighting, the sound pickup? He is really arguing for the television program the same standards used in motion pictures.

Fig. 11: *Television News*, July 1931.

Television News July-August 1931 cover (figure 11) featuring a mechanical TV projector. As with all mechanical images depicted on these covers, they were all done by the cover artist to look real. But in real life all mechanical systems had such poor image quality that eventually none were viable. The manufacturers would never make it and the viewing public would never embrace it.

Television News would publish 12 issues between 1931 and 1933. The stories gradually changed from all mechanical to all electronic. It is likely that as the young experimenters tired of watching the two inch low-resolution scanners, the large companies, seeing a real commercial value in the television, now created most of the technical breakthroughs. While radio broadcasting seemed to explode on the scene several years after the carnage of WWI, it was fully established by 1922. But its progenitor, the wireless telephone, had been around since before the war and was perfected enough to make radio technology good enough for a the family listening experience. All that had to happen to complete radio was programming. Television is different. Inventors spent too much time in the 1920s on mechanical systems, not realizing they would never be good enough to carry the quality of programming viewers would demand. Then the great depression stalled TV development for a few years. Fortunately, television would be mostly developed technically before the next war demanded the attention of the electronics industry.

The final two issues of *Television News* were of conflicted purpose as they had different titles, no longer just Television News. It was obvious that it was dying, not getting the audience they had hoped for. I believe that this may have been the direct result of television's uncertain future, a stall in technical breakthroughs. The two final issues were called *Radio Review Television News*. Both of these final issues had drawings of schematics on the cover, both identical, neither had the usual artists concept-like image of a tube or mechanical set. It was a low budget cover. While *Radio News* and *Radio Craft* still had a smattering of television articles, by 1948 television content would be officially folded into radio, the result being the very successful *Radio and Television News*. There is a great deal of redundancy in the final years of *Television News*. The covers seemed to alternate between the various permutations of mechanical TV and fanciful future set using a tube. In all cases, like the cinematic depictions of a TV picture, the images were drawn in as actual images were still not ready for prime time.

Fig. 12: *Radio Craft*, August 1938. An instructor teaches fellow repairmen.

In the Gernsback monthly *Radio-Craft* (1929-1948) there were issues that featured televisions on the cover. Perhaps he thought the occasional story in this publication or his flagship *Radio News* would be enough for the TV news fans. *Radio Craft* did have several 1930s issues that featured television stories. But the August 1938 issue (figure 12) had the most realistic depiction of what would be a common design. On the cover was a group of TV service men replacing a tube in a mirror-in-the-lid set, a 1939 RCA TRK 12 (figure 13) look-alike. That set would be available the next year for a price of $800. Mechanical TV would be no more.

The way it would be. The February 1937 *Radio News* cover (figure 14) shows the reader what the television studio would look like. It looks just like the

sound stage of the existing media, the motion picture. Substitute a larger boxy TV camera for the 35 mm film camera and voila, television.

Hollywood Tries on Television for Size

While the Gernsback publications of *Radio News*, *Radio Craft* and *Television* and *Television News* were aimed at the hobbyist, the experimenter, the radio repairperson, as well as the citizen audience interested in the technical and programming futures of radio and television, Hollywood cinema also used the television in several story lines. In 1930 there was a futuristic film that portrayed scenes of the future as guessed by 1930 script writers to exist 50 years in the future. It was called *Just Imagine*, and according to IMDB.com, "New York, 1980: airplanes have replaced cars, numbers have replaced names, pills have replaced food, government-arranged marriages have replaced love, and test tube babies have replaced ... well, you get the idea." And what was television's role in 1980 as imagined in 1930? It seemed to feature what resembles a TV set common in a living room, but uses video and its audio as a communicating device, a video-phone.

Fig. 13: An RCA TRK 12 mirror –in-the-lid set, manufactured in 1940.

The 1933 *International House* featured a Dr. Wong, a Chinese inventor of a new television system he calls a "Radioscope." This was a bizarre film, starring W.C. Fields drinking his way through the plot, George Burns as a medical doctor with wife Gracie Allen his nurse. It is ridiculous until the scenes of television unfold. Its technology seems to show a device with both mechanical spinning disc and lots of tubes and meters and pictures from around the world, mostly travelogues. In the 1935 film *Murder by Television*, the television receiver, while showing a film insert for its picture, is allegedly generated mechanically, using a spinning device resembling an anemometer. The 1936 picture *Trapped by Television* (figure 15) again features an inventor, but this time there is an attempt to make it real as he solders in the final tube, the cathode ray tube. This is probably the first time the words "cathode ray" were ever uttered in a Hollywood movie!

Fig. 14: Radio News, February 1937, a very early look at how a television program is captured and sent live into the home.

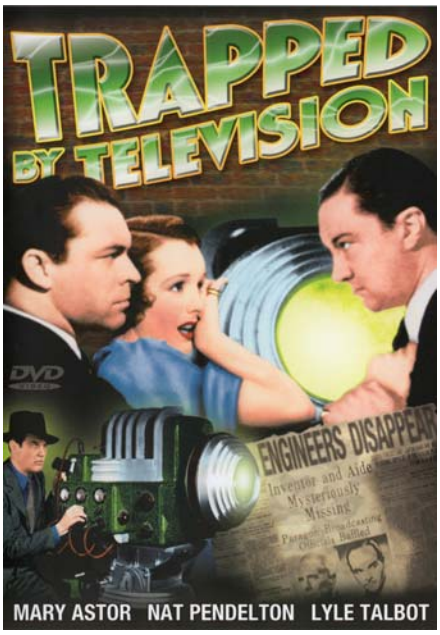


Fig. 15: This 1936 film, features an independent inventor hiding out from the bad guys who are trying to steal his electronic television system.

Excerpts of these films and other early TV content will be available for visitors to the CHRS TV exhibit to watch on demand.

The Rest of the Story

When the war ends, Americans are ready for a consumer and family future – raising children, buying a home and a car, getting a college education, and yes - buying something called a TV set. It's a bit familiar because it resembles the console radio of pre-war days. But it's pictures in the home, all without going out to the local movie house. Perhaps the wealthiest among us could afford the General Electric 901 AM-FM-Shortwave radio, phonograph, projection television (figure 16) soon to be featured in a CHRS exhibit. This mid-1940s behemoth costs in the thousands, enough to buy two 1947 Ford automobiles.

Fig. 16: The GE 901 projection set (1946). The dial includes both pre-war and post-war FM bands — very unusual.

The significance of the 901 is that it had every in-home entertainment and information service known to man. When this set was manufactured, 1946-48, the FCC was just getting around to re-allocating channels for television and the new high fidelity service called FM. The AM band had been in use since its allocation under the Federal Radio Act of 1927. The short wave bands had proved themselves during war time. But what of FM? Those few pre-war FM experiments were on a band of channels between 42 and 50 MHz. The mid-1940s allocation removed that band and initially assigned it to what would then become TV channel 1. Under protest by its inventor Edwin Armstrong, FM was forced to move to its current band, 88-108 MHz. The GE 901 had both bands for receiving those older stations still on the air. It also had TV channels 1-13, on the so-called VHF band. In a classic media war, Armstrong v. Sarnoff, the fight over channel 1 (42-50MHz), caused the FCC to reassign it to taxi cabs. It was the political unknowns of the era, channel-wise, that made the GE set guaranteed to receive whatever was broadcast. It also had a 78 record player, soon to be made obsolete by the CBS 33 1/3 rpm long play and the single song format RCA 45 rpm. Both were introduced in 1949.

Radio with Pictures

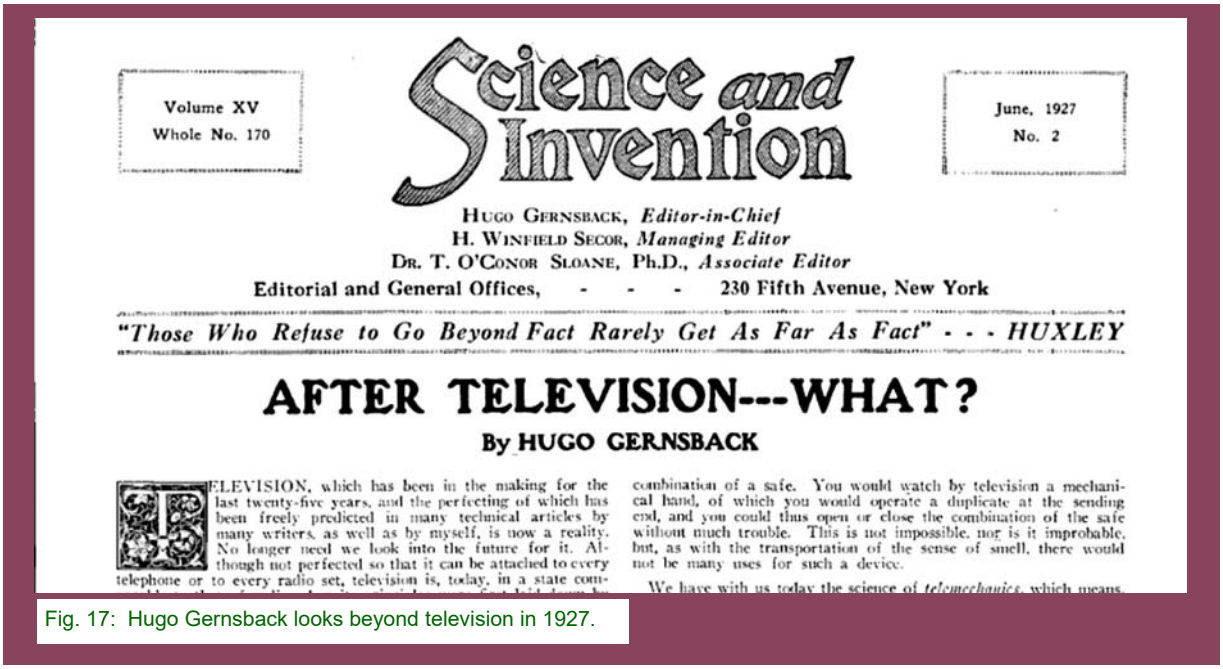
Just like radio used the existing entertainment forms for its programming, television began with popular radio programs adapted as TV. After all, the television industry looked like it would mostly be owned and controlled by the radio industry, so it was a natural to try out radio's favorite shows – Jack Benny, the Lone Ranger, Paul Whiteman's Orchestra – as programming sources for the newest media. Some local stations tried live sports, installing a bowling alley in the basement of the television studio, or a wrestling ring. The point was that there was nothing really new at the moment that could serve as programming for the very new television. Even early television news featured a radio news announcer sitting at a desk and reading news into a microphone, all while smoking a Camel cigarette on air.

So the development of television closely parallels that of early radio. To summarize: In 1920 there were a few radio stations on the air for a few hours a day. And they all had to share a single frequency, 360 meters. A few more channels were added later. By 1927 radio was a mess, as too many stations were crowded into too few channels. This led to massive interference meaning no one had a good radio experience. So in 1927 control of radio was moved from the Commerce Department to the newly-established FRC, the Federal Radio Commission. The major outcome of the 1927 Radio Act was to introduce a much larger collections of channels, 550-1600 kc AM, and assign power levels to three groups of these channels. Local channels were 250 watts, some daytime only, Regional were 5,000 watts, often directional, and Clear Channels 50,000 watts.

Television suffered the same growing pains, leading to the TV Freeze, 1948-1952. Like radio in 1927, television proved to be so popular that the existing channels 2-13 could never supply the demand for licenses. First the FCC stopped accepting (or froze) applications for new stations, then reassigned the existing VHF channels geographically to mitigate interference and introduced a larger group of channels, UHF 14-83. The original channels mostly went to large cities while the UHF was divided among medium and smaller markets.

And in the "no deed remains unpunished" category, what did the upstart television leave in its wake? First, and almost overnight, it became so popular in the 1950s that attendance at movie theatres dropped, and this caused the major studios to create new promotions to drag the public from their living rooms and into the theatres. Who can forget "dish night." Or Aroma-rama, smells piped into the theatre corresponding to the action on the screen. Television also had an immediate effect on its parent radio as many of the most listened to shows left that audio-only medium for a "radio with pictures" future. This caused radio to embrace the disc jockey and eventually radio reorganized its content, gave up long form programming of drama and comedy and became recorded music and news and talk as it is today.

Predicting the future of television has been ongoing since the beginning. In the June 1927 issue of *Science and Invention*, Hugo Gernsback declares that television, "although not completely perfected, . . . is in a state comparable with radio," and that it may take two to five years before every telephone and radio would have a television attachment. So he then asks "After Television — WHAT?" (figure 17). He goes on to imagine the incorporation of the other five senses including smell and touch.



Volume XV
Whole No. 170

Science and Invention

June, 1927
No. 2

HUGO GERNSBACK, *Editor-in-Chief*
H. WINFIELD SECOR, *Managing Editor*
DR. T. O'CONOR SLOANE, Ph.D., *Associate Editor*
Editorial and General Offices, - - - 230 Fifth Avenue, New York

"Those Who Refuse to Go Beyond Fact Rarely Get As Far As Fact" - - - HUXLEY

AFTER TELEVISION---WHAT?

By HUGO GERNSBACK

TELEVISION, which has been in the making for the last twenty-five years, and the perfecting of which has been freely predicted in many technical articles by many writers, as well as by myself, is now a reality. No longer need we look into the future for it. Although not perfected so that it can be attached to every telephone or to every radio set, television is, today, in a state com-

combination of a safe. You would watch by television a mechanical hand, of which you would operate a duplicate at the sending end, and you could thus open or close the combination of the safe without much trouble. This is not impossible, nor is it improbable, but, as with the transportation of the sense of smell, there would not be many uses for such a device.

We have with us today the science of *telemechanics*, which means

Fig. 17: Hugo Gernsback looks beyond television in 1927.

If the future could be seen from television's first so-called Golden Age, the 1950s, what would it predict? Perhaps that there would be a second television golden age in the 21st century that causes licensed broadcast over-air television to search for its purpose. With the HD large screen sets, the highest quality programming now comes from streaming services, Netflix, HULU, Amazon and pay cable. The programming is no longer created and realized by "television" writers, actors, directors, camera operators who were once separate from those who make movies. Now as categories blur, entertainment for your screen is done by a combination of the best talent from Hollywood and television. And like today's radio, television is now consumed on the TV set, the computer, the tablet and the smartphone.

Enjoy the CHRS television display, look into that 2 inch window of the 1930 scanning disc television and you'll see how far the art has progressed in less than a century. It all happened because a public audience existed for a service that could bring the faces of the radio voices into the living room along with the sports, the news, the live events, and eventually Hollywood-made movies and TV series with quality on par with anything offered at a local cinema. TV is about to eat its own. Again.

(Author Mike Adams is the board chair of the California Historical Radio Society, CHRS. He is Professor Emeritus of radio, TV, and film at San Jose State University. Images used are from the CHRS Maxwell Communications Library and American Radio History dot com)

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A Radio Odyssey (Part 1) — Popov Museum in St. Petersburg, Russia

By Bart Lee

Bart Lee recently traveled to Europe and visited communications-related museums. The first two visits are chronicled in this and the next article. The last two visits will be presented in a following issue.

The Editor

Russia presents one of its several museums of communications in St. Petersburg, the A. S. Popov Central Museum of Communications.[1] Housed in an old Czarist-era palace near the canal, its architectural mien suggests bureaucracy. The national post office occupied the building for many decades.

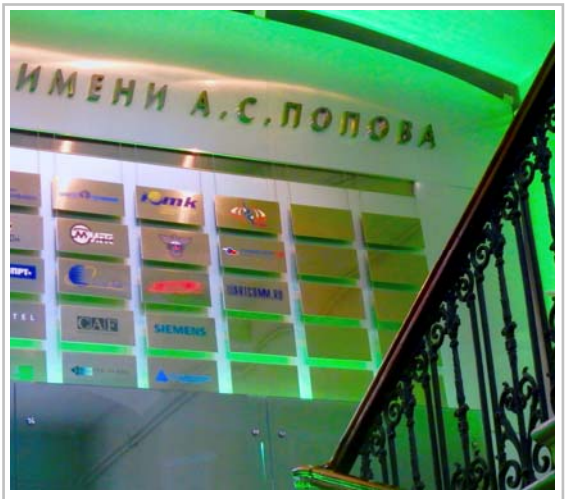

Fig. 1: Museum entrance.

But once in the doors, the modern age tells some very old stories. Colorful tiles line the grand entryway, proclaiming the names of its industrial sponsors, such as telecoms (figure 1).


Fig. 2: Communications satellite.

One enters on the ground floor. Two special exhibit atriums occupy much of the floor. The first atrium displays a quite large communications satellite (figure 2). About this, the museum's brochure says:

> "The museum's exhibit, the communications satellite «Luch-15», located in the atrium [designated as] «Museum's Services», symbolizes not only the future and striving for outside worlds, but also the openness of the revived A.S. Popov Central Museum of Communications to the outside world."

The second atrium devotes itself to "Modern Communications." (The museum also supports an amateur radio station). The Russian National Communications Agency is the Museum's proprietor. The Scientific Director is Dr. Nina A. Borisova.[2]


Fig. 3: Baron Pavel Shilling.

Russia is proud of its centuries-old ability to communicate across its vastness, from St. Petersburg in the west, to Siberia and Vladivostok in the east. The first exhibits of the Alexander Popov Museum tell the story of its postal system. Ice-sleds carried the mail. A world-class postage stamp collection resides in carefully arranged drawers for specialists to examine. But as one might expect of the museum honoring Alexander S. Popov, electrical communications soon capture the attention.

Russia has often claimed to be first in one technical achievement or another. This museum and its displays sustain some of these claims, at least to the level of: "One of the Very First." The invention of the telegraph illustrates this, and the historical

Fig. 4: Early telegraph devices.

Fig. 5: Operators gear and switchboard.

reality that many clever men often converge on similar new ideas, discoveries, inventions and systems at about the same time. In 1835 Baron Pavel Shilling (figure 3) put together a working telegraph circuit for the Russian Admiralty.[3] The museum devotes many exhibits to such early (and later) telegraphs. (figure 4, early gear; note the video display nearby). In this communications sequence, many telephone exhibits follow. (See figure 5, operator's garb and switchboard -- notice the Q-code for smartphone access to interpretive material and audio; figure 6 a later switchboard).

Alexander Stepanovich Popov (1859 - 1906) (figure 7) pioneered wireless telegraphy in Russia. He detected radio emanations from lightning as early as 1895, following the work of Hertz and Lodge. Popov transmitted messages as early as 1896. The museum honors his name, and tells his personal story (figure 8). It has collected, curated and displays much of his early experimental work and early devices.

Fig. 6: A later switchboard.

Fig. 7: Alexander Stepanovich Popov.

One of Popov's first receivers (figure 9) employed a filings coherer to detect an electromagnetic pulse from lightning. A bell made audible the detected pulse, and at the same time its clapper reset the filings so they could cohere for any next pulse. By thus detecting a storm well beyond the horizon, this receiver could provide an advance warning not otherwise available.

Fig. 9: An early Popov receiver.

Fig. 8: Popov and his family.

A similar 1895 device (figure 10), measuring 26 cm wide, 21 cm high and 36 cm deep, used the same system "for detecting and registering … electromagnetic vibrations." The museum further describes it as "the A.S. Popov first radiotelegraph receiver [for] wireless receiving radiotelegraph signals over long distance." In use, Popov screened the receiver with metal cage to avoid interference, according to Dr. Borisova.

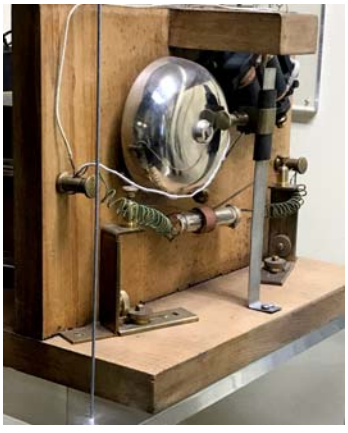

Fig. 10: An early coherer.

Fig. 11: A dipole antenna.

The transmitter keyed a Ruhmkorff induction coil to create a high voltage spark. The spark's oscillations at radio frequencies (more than 10 KHz, often much more) excited the antenna to send out electromagnetic waves. (Marconi did exactly the same thing at the same time). Popov built this transmitter during his time working at the Russian Navy Torpedo School at Kronstadt near St. Petersburg.

Fig. 12: A parabolic reflector.

Dr. Borisova[4] writes about this 1895 system:

> "Popov Radio System -- This wireless transmission system consists of a radio transmitter (Ruhmkorff coil) and a receiver with coherer to register electro-magnetic oscillations made audible by a sequence of sounds on an electric bell. If the transmitter button is pressed briefly, the receiver replies with a single ring, while if the key is held down, the receiver produces a series of rings. The coherer must be shaken to re-sensitize it, which happens automatically when the bell hammer taps the bell."

Dr. Borisova notes that Popov used vertical dipole antennas and parabolic reflectors. The museum preserves such apparatus. See figure 11, a dipole with ball ends for seagoing experiments (perhaps at about two meters wavelength) and figure 12, a parabolic reflector (around a dipole for perhaps 10 cm wavelength). Both of these experimental devices appear to position the spark gap in the cup in the middle of the antenna. These dipole antennas would both radiate and determine the frequency of the radiation.

Fig. 13: A diorama of a ship rescue.

The museum presents a diorama (figure 13) of the early (1900) and dramatic use of Popov's wireless system to rescue the crew of an ice-bound battleship, and ice-stranded fishermen. As another of its interpretive exhibits, it presents a large graphic of a Russian officer working a wireless telegraphy system (figure. 14).

Fig. 14: Russian officer working a wireless station.

Later Russian radio developments are well represented in static exhibits, *e.g.*, figure 15, the items to be found in an early Popov system wireless room. A very large, vertically rotating display features several varieties of Russian vacuum tubes (figure 16). The case moves like a three-meter high jeweler's display case. And in figure 17, a 1920s vacuum tube receiver.

Fig. 15: Russian wireless radio apparatus.

These historical exhibits are arranged chronologically on the second floor. (See figure 18). Two libraries, a reading room and a computer room take up the first floor. Very knowledgeable docents conduct tours.

The museum brochure notes:

> "The museum's expositions [are] created within the framework of the unified evolutionary approach «From History into the Future»… *** The exposition «The History of Communications Development» is a combination of rare exhibits and modern exposition supporting [both] ancient devices and modern design decisions of presentation. [The] Collection's display of terminal devices, telegraph apparatuses, telephones, radio receivers, TV-sets is completed in the hall of the history of communications lines and networks." [5]

Many of the visitors to the museum come in school groups. They enjoy many interactive exhibits illustrating physics principles, as well as the communications exhibits. Much of the museum highlights and explains the accomplishments of Russian (and Soviet) science and technology.

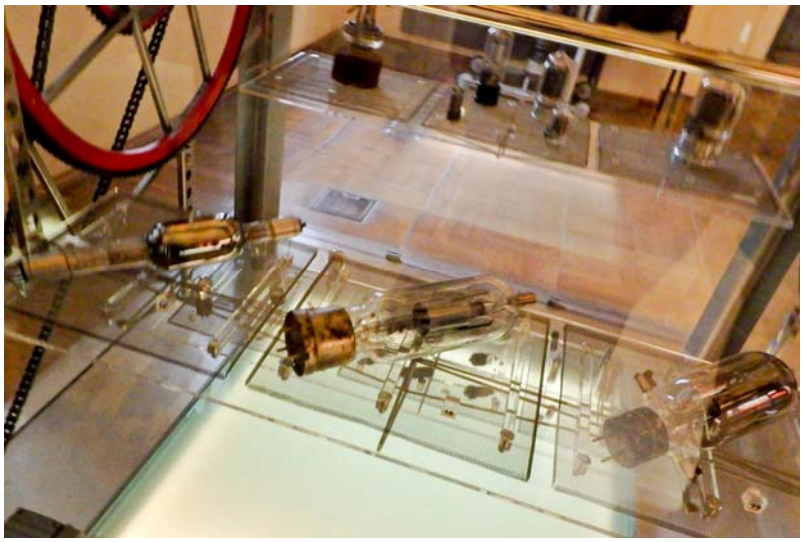

Fig. 16: A paddle-wheel style rotating display.

Fig. 17: An early vacuum tube receiver.

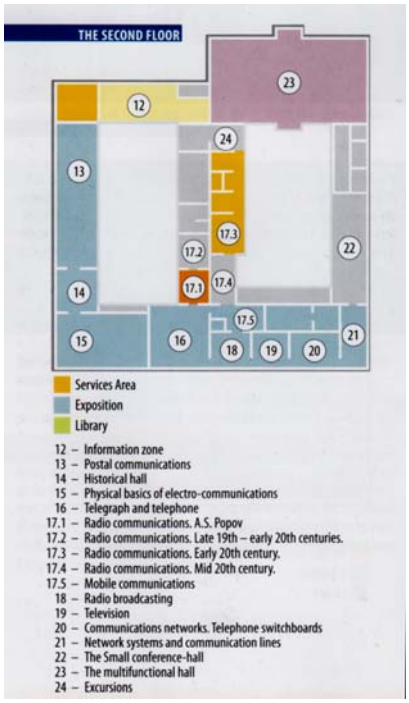

Fig. 18: Logical orderly layout of exhibits to best tell the story.

Notes:

1. The A. S. Popov Central Museum of Communications, No. 7, Pochtamskaya Ul., 190000, St. Petersburg, Russia. www.rustelcom.ru .
2. I am grateful to Scientific Director Dr. Nina A. Borisova for her welcome when I visited in 2017.
3. Dr. Nina A. Borisova, Shilling's Pioneering Contribution to Practical Telegraphy (2017) at p. 278 in N.A. Borisova, RUSSIA -- HOMELAND OF "ELEPHANTS" OR "CULTIVATION"? -- FROM THE HISTORY OF TELECOMMUNICATIONS, 1830 - 1930 (St Petersburg, 2017). The title in Russian likely contrasts men of genius with disciplined group work.
4. Ibid. at 286.
5. Brochures are available in several languages. Most of the interpretive information is in Russian only, so a guide and translator is useful. The museum docents speak Russian, but offer detailed information.

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A Radio Odyssey (Part 2) — OXA Museum in Denmark

By Bart Lee

As early as 1902 the Danish Navy sought to communicate with its vessels by wireless telegraphy. It acquired German equipment. Ferdinand Braun, Adolf Slaby, Count Georg Graf von Arco and others quickly followed Marconi as the high-technology entrepreneurs of the day. These German enterprises later consolidated into Telefunken. The Danish Navy radio station was known as Kobenhavn Radio OXA. A small building at a Navy base in Copenhagen housed OXA. With the passage of time, two wars intervened and all concerned lost track of the old wireless equipment, long obsolete and superseded.

Fig. 1: OXA Museum. The sign below is over the door.

Radio amateurs and businessmen in the telecommunications industry worked towards creating a Danish radio museum.[1] The Navy made the old station OXA building available (figure 1). The group arranged for it to be moved to a more accessible location (now just across the water from the Little Mermaid statue). And the story, (from guide and museum Director Ole Lauridsen -- figure 2), goes that one day the Navy, cleaning out an old jail, found some boxes of who-knows-what, but electrical things made of very nice wood and maybe of interest to the radio museum project…

As if preserved in amber, a 1902 wireless telegraphy station emerged from the boxes.[2] figure 3 show the Slaby-Arco spark coil on display. The spark gap appears as figure 4. Slaby-Arco also provided a coherer detector for receiving, figure 5. One rare piece is called a mercury turbine switch (Fig. 6, 1902). This acted as the interrupter in the primary of the inductance coil to create DC pulses. This device worked at a higher rate than any mechanical interrupter. Hence it is likely that spark signals from its associated inductance put out a more penetrating audio tone into the ether.

Fig. 2: Director Ole Lauridsen.

Fig. 3: Slaby-Arco spark coil. Below is the label.

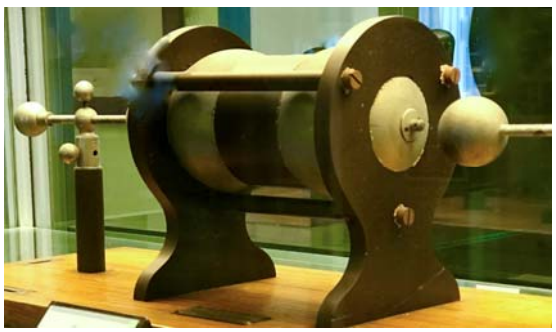

Fig. 4: Spark gap. Below is the label.

The museum also displays other wireless era artifacts, *e.g.*, several very substantial 1899 Ruhmkorff coil high voltage inductors for spark generation, and a complete compact spark system. In figure 7, a big Ruhmkorff coil is on the floor and the spark system receiver in the case to the left. An inker provides a record of the traffic. A large key is center foreground. A large antenna switch (DPDT) is in the center rear. To the right is a bank of cylindrical condensers for the spark transmitter.

Much of the museum's collection for the post World War One era reflects Danish companies and engineers. The M.P. Pederson company of Copenhagen (figure 8) pioneered vacuum tube broadcast radios in Denmark. It also made marine receivers, such as the 1939 B-142 (figure 9). The Danish fishing fleet made extensive use of this set. The later Sailor marine radios (figure 10, Model 66T, 1966) maintained the B-142's dimension in order to fit in the same place in the vessels. Another important company in the collection is Elektromekano. A stand-by marine distress ¼ kilowatt transmitter features a spiral inductance (figure 11). Many of the museum's exhibit relate to Danish seafaring and marine communications.

Fig. 5: Slaby-Arco coherer. Below is the label.

Fig. 6: Mercury turbine switch.

Fig. 7: Large Ruhmkorff coil on the floor and spark receiver in the case.

Fig. 8: M. P. Pederson company of Copenhagen, a pioneer in tube radios in Denmark.

Fig. 9: M. P. Pedersen marine B-142 receiver (1939).

Fig. 10: Sailor marine radio.

Marconi equipment features prominently in the displays, such as the receiver with both a tuner and a magnetic detector (figure 12). So too, German equipment is on display, from both war eras. A Telefunken radio direction finder stands about five feet tall (figure 13). The top dial says "feedback" so it uses regeneration somewhere in its circuits. The dial on the right says, "frame," perhaps some adjustment of bandwidth. The dial on the left says, "heterodyne" which may be a beat frequency oscillator for demodulation of Morse code (CW). The two rods on its top may be a sense antenna to resolve directional ambiguity.

A 1939 German *Torn. E. b.* long wave receiver seems to have had adventures in Greenland (figure 14). It sits atop a Danish M. P. Pederson all-wave superheterodyne covering 100 KHz to 22 MHz.

The Nazis invaded Denmark in World War Two. The Danish Resistance used shortwave radio to coordinate with the Allies. Several museum exhibits tell this story (figure 15). Figure 16, the British 1941 compact Paraset transceiver).

Hands-on teaching devices illustrate the principles of radio. One duplicates, in miniature, Marconi's first spark transmitter and coherer receiver (figures 17 & 18). The key creates a spark, and the coherer trips, lighting up a small red light.

Fig. 11: Elektromekano marine transmitter.

Fig. 12: Marconi tuner with magnetic detector.

Fig. 13: Telefunken direction finder.

Fig. 14: German long wave receiver.

Fig. 15: WWII resistance fighters in Denmark.

Fig. 16: British compact Paraset transmitter (1941).

A miniature Tesla coil shows radio frequency energy can light a small florescent bulb (figure 19). The museum also operates an amateur radio station (figure 20).

The museums' walls show many graphics relating to Danish radio history, *e.g.*, an early wireless station (figure 21). Of course, there's many a vacuum tube along the way, but also an extensive collection of early filings coherers that detected those early vibrations of the ether (figure 22). Signage is in Danish but mostly self-explanatory. Visits should be arranged.[3]

73 de Bart Lee, K6VK, Fellow of the California Historical Radio Society in History.

Fig. 17: Hands on teaching of the principles of radio.

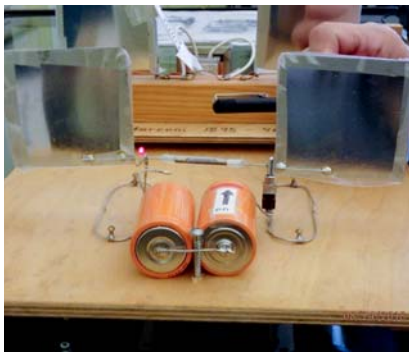

Fig. 18: Another view of on teaching exhibits. Small red light is lit.

Fig. 19: Miniature Tesla coil lighting a florescent lamp.

Fig. 20: Museum's amateur radio station.

Fig. 21: Photo of an early wireless station.

Fig. 22: Early filings coherers.

Notes:

1. See https://www.radiomuseum.org/museum/dk/kystradiostationen-oxa-kopenhagen/.html .
2. Likely the only surviving German wireless telegraphy station of the era.
3. A current contact is: Ole.Lauridsen@teracom.dk .

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Hints and Kinks Presentations

By Richard Watts

On March 4th, at the Hints and Kinks seminar held in the CHRS shop, six members offered to present their favorite tips and techniques.

Chris Potempa discussed his approach to making reproductions of early electrolytic housings from aluminum tubing. The housings made in two parts. First is a threaded base that can be mounted to a chassis like Mershon capacitors. Second is the tubing with one end sealed. The other end is threaded allowing it to be screwed to the base. If the capacitor ever needs service, the cap can be unscrewed allowing access to actual electrolytic. A very nice assembly.

Arden Allen showed how he uses a loop antenna, salvaged from a 1970's stereo receiver, to simplify the coupling of a signal generator to a radio for alignment. The loop antenna is attached to the signal generator, then placed near the radio. There is no need for direct coupling of the generator to the radio.

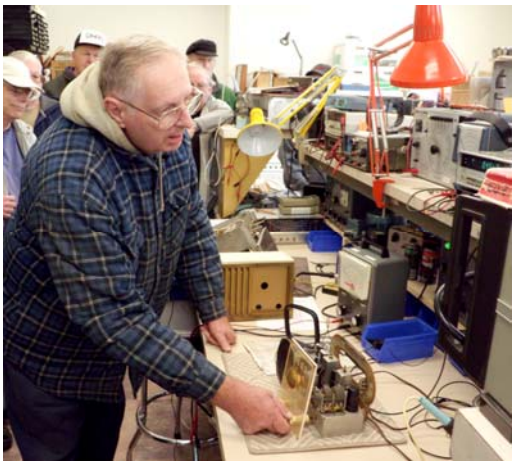
Seth Arp showed us he method for installing a Bluetooth receiver in vintage radios; he discussed the specifics of connections to the radio and safety issues.

John Staples presented an introduction of GNU Radio. He demonstrated Software Defined Radio (SDR) using an inexpensive $20 radio dongle. He also showed his use of the spectrum analyzer features to analyze audio wave forms.

Last John Stuart and John Staples gave a brief overview of their seismic detector projects. John Staples described seismic detectors he built and recent earthquake activity they detected. John Stuart briefly discussed his detectors including one based on a Raspberry Pi named Raspberry Shake, and its associated network with a server in Germany collecting hobbyist seismic data worldwide.

A most informative and interesting day.

Chris Potempa discussed his method of reproducing electrolytic capacitors.



Arden Allen's demonstrated a simplified and efficient alignment technique.

Seth Arp installed a Bluetooth receiver.

John Staples introduced GNU Radio.

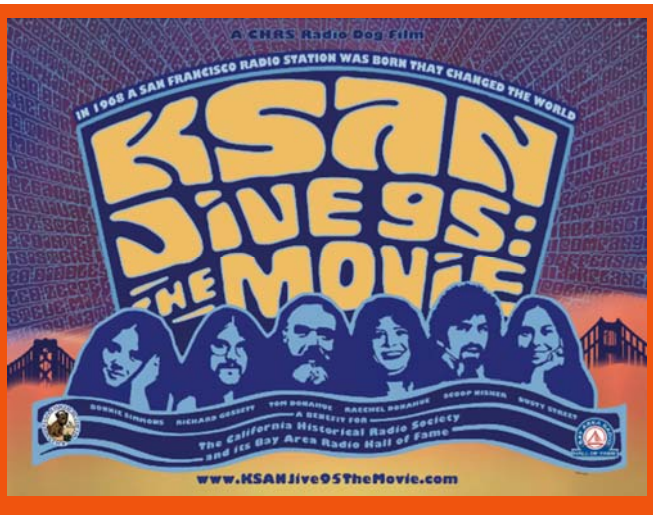
John Stuart and John Staples discussed seismic detection. ◊

KSAN Jive 95: The Movie

Our CHRS Radio Dog Production, **"KSAN Jive 95: The Movie"** continues in production. But making a feature length documentary is costly. We are seeking to raise $150,000 to produce this film. The KSAN Jive 95 story is perfect for CHRS to tell and immortalize in film as it is an important part of our mission to preserve and present local radio history. KSAN, during the period 1968-1980, was pivotal in the development of our popular culture. This film will raise awareness and refresh remembrances of a time when a radio station could create change and really make a difference in so many ways.

Part of our recent grant from the Rex Foundation was earmarked toward the KSAN Movie project. We commissioned famous poster artist Wes Wilson for a movie poster. Wes and his daughter Shirryl Bayless collaborated to create this outstanding poster.

Now it's your turn to help. Please visit www.ksanjive95themovie.com and see how you can get great perks for donating to this project and help to preserve the KSAN Jive 95 legacy.

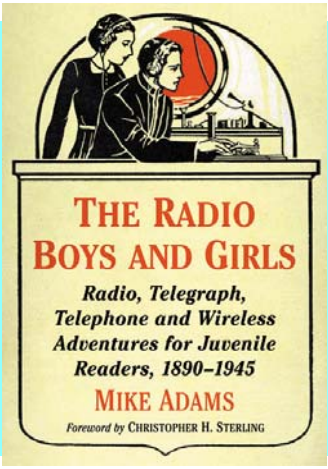


CHRS Publications

The Radio Boys And Girls—Radio, Telegraph, Telephone and Wireless Adventures for Juvenile Readers 1890-1945 is the latest book by Mike Adams, It captures the genre of series fiction about wireless and radio was a popular in young adult literature at the turn of the 20th century and a form of early social media. Before television and the Internet, books about plucky youths braving danger and adventure with the help of wireless communication brought young people together. They gathered in basements to build crystal. They built transmitters and talked to each other across neighborhoods, cities and states. By 1920, there was music on the airwaves and boys and girls tuned in on homemade radios, inspired by their favorite stories.

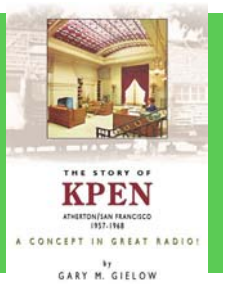
This book covers more than 50 volumes of wireless and radio themed fiction, offering a unique perspective on the world presented to young readers of the day. The values, attitudes, culture and technology of a century ago are discussed, many of them still debated today, including immigration, gun violence, race, bullying and economic inequality.

Available now at Amazon.com



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.

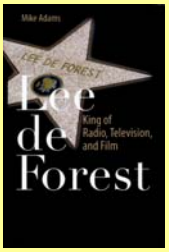
Available in the Museum Store or on the website.



Behind the Front Panel: The Design and Development of 1920's Radio by David Rutland has been re mastered 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!

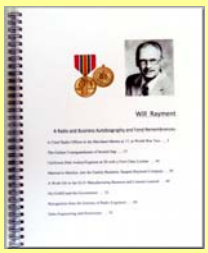
Buy at Amazon.com

Also available in the museum store



Lee de Forest

Bay Area Radio



Will Rayment

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