



Hugo and the Automaton continued next month part II
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○ # 04

○ Vol-24

○ 2019



NEW MEXICO

RADIO
COLLECTORS CLUB

Next NMRCC Meeting April 14th Crosley tube radio sets

When presented with the opportunity of a lifetime, Andrew Baron jumped in feet first, putting his keen sense of mechanics to use in bringing life back to a life-like automaton. The Maillardet automaton was also a key inspiration for the book

The Invention of Hugo Cabret and the Academy-award-winning movie Hugo . This is the first installment in a series of articles that will detail how Andrew is bringing the automaton back to its full potential.

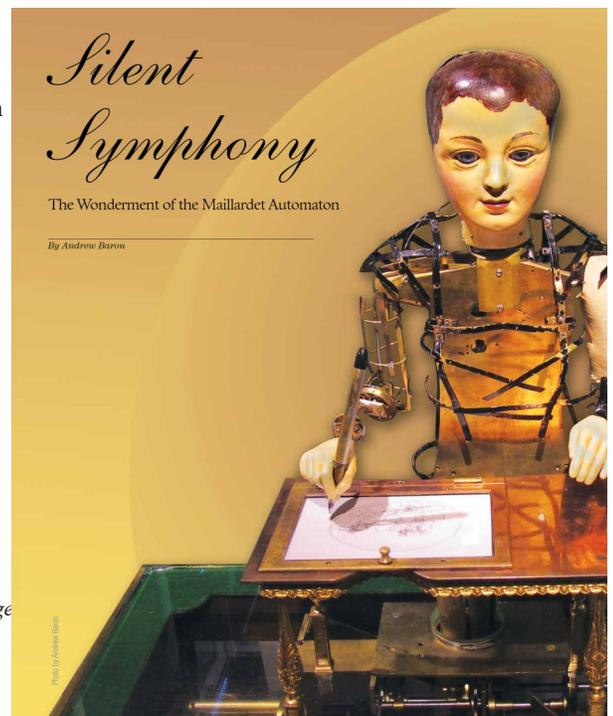
The Wonderment of The Maillardet Automaton By Andrew Baron

Where does one begin to write about a clockwork marvel that is nearly two centuries ahead of its time? We can approach it from an esoteric perspective, that here in the 21st century our modern technologies have only just begun to catch up to the extraordinarily natural movement that this hauntingly lifelike boy is capable of, as he adroitly writes and draws. Alternatively, connoisseurs of mechanism will take delight in its technical perfection: The 74 intelligence-encoded brass cams, the fusee chains with their graduated links harnessing the five powerful mainsprings, or the variable-rate, resistance-balancing drawing arm pressure compensation. To bring it more down to earth, perhaps the automaton's most compelling attribute rests in how its makers brilliantly configured otherwise conventional clockwork mechanism in singularly unconventional

ways, to produce astounding and sensational results.

I always like to comprehend an artifact that I'm engaged to work on from the point of view of its place in history: What set the stage for it, and its significance within the broader context of history. Allow me now to formally introduce the topic of this series, and share with you an intimate look at the Maillardet automaton, unquestionably the most advanced Writer-Draftsman to emerge from the revolutionary period between the twilight of the Enlightenment and the dawn of Romanticism. Our mechanical child's most graceful movements were lost for over a hundred years. Despite this, it pro-

(Continued on page



Tube Testers Tidbits by Chuck Burch

Over the years, there have been various types of tube testers made. Our club auctions have had several of the earlier tube testers which consisted of a set of meters you inserted between the radio and the tube. During the days of radios and TV with tube filaments in series, an inexpensive tester was sold that simply checked the continuity of the tube filament which you could have easily done with an ohmmeter. Probably, the most common tube testers were emission testers which basically test tubes as if they are a diode by measuring the strength of the cathode emission. This type of test is sufficient to identify bad tubes in

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NMRCC Meeting Minutes February 10, 2019 by Chuck Burch and John Hannahs

We had several interesting boxes of parts and tubes in our pre-meeting auction. The highlight though was a beautiful working 6J230 black dial Zenith tombstone.

The meeting was called to order by president John Anthes. There were 20 members present with no new members. John thanked our former president David Wilson for the excellent job he did as our president the past two years. Even though our January meeting was cancelled due to snow, nine members did not get the email cancellation notice, showed up, and had a great time discussing radios.

John suggested we limited the 2-minute roundtable to recent new members since we had quite a few display radios. Hopper Chu who just returned to Albuquerque after 18 years in Seattle reported that he had just finished restoring a Hallicrafters SX38. Mel Strong from the Bradbury Science Museum in Los Alamos discussed the museum and the desire to obtain some tube radios and test equipment that would have been typically used during the period of the Manhattan Project. He would like to have a working tube radio that kids could tune in stations using knobs as most kids today use touch screens and have never used a knob. He is also looking for a wire recorder as they have some wire recordings from the Manhattan project with unknown information that could include classified information.

The meeting theme was 30s Art Deco Radios, Chrome Chassis and Intricate Wood Design Radios. Chuck Burch showed his Zenith 4V31 radio that he got from Bill Shultz who had started NMRCC. Richard Majestic gave a brief history of the Grisby Grunow Majestic Company and showed his Majestic models 149, 49, 44B and 194 midget radios.

John Anthes showed his Teague-designed black lacquer and chrome cabinet Spartan 517 radio, a no-name mirror radio that Marc Toppo feels was made by Gilfillan, and a Spartan 557 blue mirror radio that was a 5 year project getting parts resilvered. Hopper Chu said he has resilvered mirrors and how important it was to have the surface perfectly clean. John said the person who did his resilvering had to redo it as his first attempt did not have the surface clean enough. David Wilson showed his 4 tube Sterling Deluxe carnival prize radio with the original Sterling tubes. His was blue in color, but it also came in ivory, green marble and maybe brown.

Marc Toppo discussed a 1996 newspaper

article with a picture of him with a subset of his collection that was a display as part of the 75th anniversary of the Phoenix KOY radio station. The article resulted in a phone call from a former TV repair shop in Wickenburg, AZ. When he arrived, there was a bunch of stuff spread out in a garage, but of most interest to him was a Zenith 835 radio that was part of Zenith's 1935 line of radios. Marc was able to get the 835A as well as all the stuff on the floor. The radio had been polyurethane which required him to completely disassembly it to strip. The polyurethane on the chrome of the radio seems to have protected the chrome over the years so his chrome after removing the polyurethane is all original and in great shape. The cabinet restoration turned out wonderful. He had the chassis restored by Dick Strong who had worked for Fender Guitar Amplifier Company from 1948 to 1953.

Les Davison showed several portable tube radios that he brought in for the January meeting's theme: Tube Portable Radios. He started out with a GE P671B which works well and was the type of radio he had as a kid. He also showed a Hoffman MP402 Nugget that has pencil tubes, (Pencil tubes were used in artillery shell proximity sensors), a 940 Philco PT87, an Excell N48 which was made in Japan and used miniature tubes, a Zenith M505 which has a pop-up antenna and a pop-open door, a Zenith 4K600 which was similar to a RCA "pocket radio", and a Westinghouse H457T6 Radiosonic which had a metal tripod allowing rotating the radio for best reception and an autotransformer to produce 200 volts for the plate of the 50L6 output tube. Steve Shepard showed several interesting lights, one which emitted a spark.

Marc's Zenith 835A was chosen as Best-of-Show.

Charlie Fullerton reported he has relocated and organized the electronic lab and ham shack at Quelab and is looking for a tube tester that could either be loaned or donated to the lab. Richard Majestic reported no progress has been made with the Goddard plague at New Mexico State University. He also mentioned he needed articles for the newsletter. Chuck Burch volunteered to write an article for the March newsletter and John Anthes volunteered for an article for

NMRCC 2019 MEETING DATES

January 13th '40s through '60s tube portable MW – SW radios

February 10th. '30s art deco radios, chrome chassis and intricate wood design radios

March 10th Techno Art and Techno Jewelry radio-electronics-science-related items that have been made into art or alternate-use objects, such as tubes made into lamps, fish bowls

April 14th Crosley tube radio sets

May 19th Spring Picnic - Don Menning's

June 9th Methods of casting, replicating, and repairing radio parts

July 14th Radios with odd construction

August 11th Wild Card Sunday

September 15th Test equipment and classroom demonstration equipment- tube testers, signal generators, oscilloscopes, bridges, meters and etc

October 13th Fall Ribeye Steak Picnic (Majestic's)

November 10th Magnetic tape and wire recorders

December 15th Holiday Party

April. Please help our newsletter by writing articles that share your interesting experiences and knowledge in any radio/electronic area.

The meeting adjourned around the scheduled 3PM.

NMRCC Officers for 2019

- *John Anthes: President*
- *David Wilson: Vice President*
- *Richard Majestic: Treasurer*
- *Chuck Burch-John Hannahs: Secretary*
- *Randy Gray: Membership*
- *Tony Marshal: Director*
- *Ray Trujillo: Director*
- *Mark Toppo: Director*
- *Don Menning: Director*
- *Richard Majestic: Newsletter Editor (President pro-tem)*

March NMRCC meeting minutes: The meeting started a few minutes after 1:00 pm with Chuck Burch conducting the auction. Around 25 persons were present. Folks were in a low spend mode. A nice Zenith console and Zenith am/fm table radio were offered, but no takers. Auctions need to warm up and sellers need to set low entry minimums. A fine set of QST magazines from 1937 and a QST handbook went for a few dollars each. Maybe our ham radio guests didn't know they could bid. Bring more after your spring-cleaning next month and remember it's ok to donate proceedings to the club.

Ham radio was today's presentation topic. Jerry Aceto K6LIE and Larry Elkin NY5L, officers from the High Desert Amateur Radio Club, presented a portable station based on the Icom 7000 transceiver connected to a 12 volt dc source and antenna. It receives up to 200 mhz and 400 to 470 mhz. All ham bands transmit between 35 and 100 watts. It also has a color display of all functions that can also connect to a video monitor. This small box can do incredible things.

Jerry used our video display screen to show how hams use satellite communication. Low earth orbit satellites (LEO) have been used for several years, but they come and go as they pass overhead. This complicates communication as the use period is only around 10 minutes. But using the geosynchronous satellites that are in a fixed orbit one can be in contact 24 X 7. All this means that with low power UHF a communication link is open for long ranges independent of horizon problems.

Samples of ham radio video were shown. Here photos are slow scanned and transmitted as audio over ham bands. The receiving end "reads" the scans and assembles them back into a photo. Lastly, we still have CW code, except the option is to type messages and let the pc convert to Morse code and interface to the transmitters key jack. Thus cw works better when interference is high and messages are hard to copy.

We are invited to attend the HDARC meetings that meet every 3rd Saturday. Check the web site: nm5hd.com

Show and Tell was about odd-ball entries. The most bizarre was Chuck Burch's "dual abacus" from some far off country. Richard Majestic brought 3 of his collection of 150. These being Art Deco table radios, two by Majestic and one by Grunow. They all look very different but have identical chassis. The black padded one with handle unit by Grunow was called the Knockabout. These radios were "transformers" and so the line cords were resistive to the tube filaments. Such cords are now noncompli-

ant, since the nichrome wire resistance is protected by asbestos.

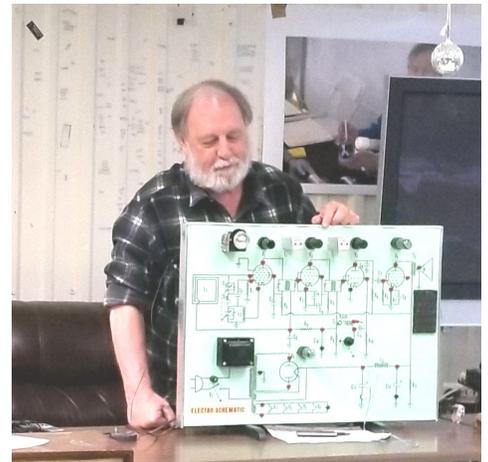
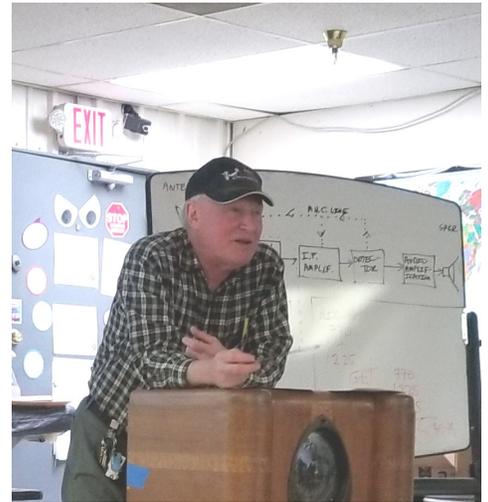
Steve Shephard brought a "All American" 5 tube radio with all the components mounted on the frontside and wired on the backside so as to be functional. Test points were at most connection intersections, 17 switches were at the rear so an instructor could inject a fault so that students could trace and identify faults. This was great for classroom teaching of radio repair.

Les Davidson used his version of the Simpson training board with a projected picture of the schematic and handed out a schematic that conformed to the radio in question. Today's "lecture" was focused on just the power supply and audio output circuit failure possibilities.

Less taught software for 30 years back in his career days and so we were the students. First he explained the theory of superhet radio and how we get to IF frequency of 456 kc and why it is such a superior feature. (good job).

Then he went through the probability of what usually goes bad first; an open tube filament being the usual culprit. Next we may hear hum which points to the need to replace the filter caps. Then we check the coupling capacitor between the AF tube and power output tube since it is critical to not being leaky. Then check the cathode bias resistor since it tends to overheat and change value. Either of these situations will decrease performance and tend to destroy the audio output tube. So stay tuned for next month's instalment.

Bits and pieces: Let's see how we can help the Bradbury Science Museum at Los Alamos create a radio display. Maybe we can work together to find radio devices that work well with the theme. Our treasury is now at \$4 and it took a long time to get there. April 14th is our next meeting . The theme is Crosley Tube Radios. May 19 is the Spring Picnic date which will be held at Don Mennings house in

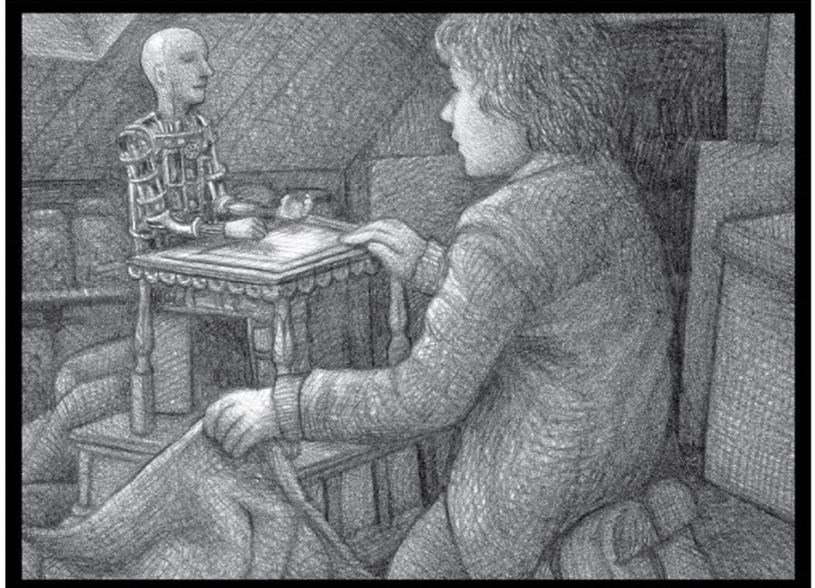


Albu-

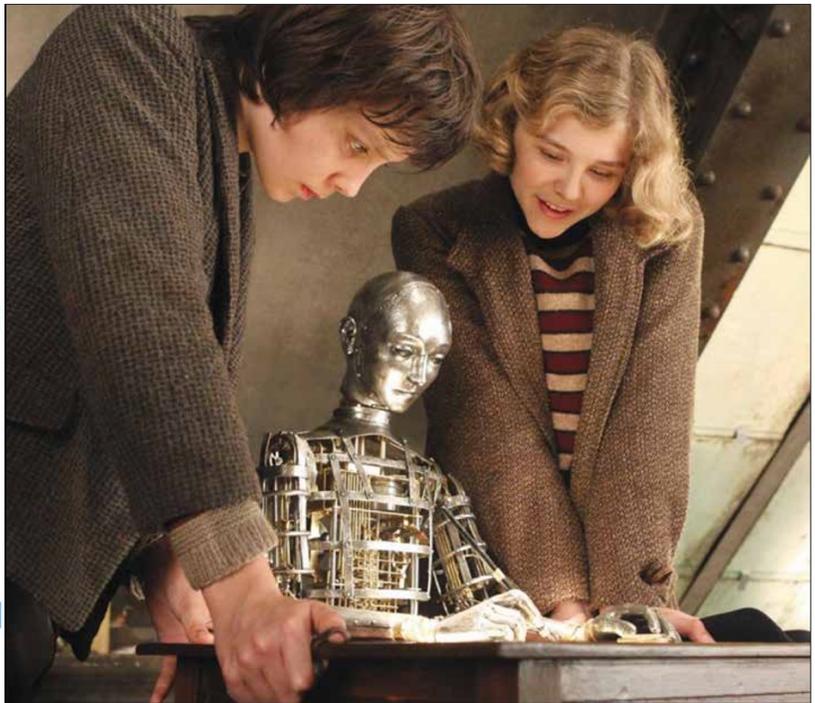


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duced thousands of drawings for the public for some 60 years in the 20th century. By the 1990s it was unable to run at all without injury, and could not produce a legible drawing. The Maillardet automaton first arrived in a poor state at The Franklin Institute in 1928. It was substantially rebuilt and prepared for live exhibition in 1932, “repaired” in 1953 and rebuilt again in 1980. It presents the appearance of a thoughtful young boy kneeling at a diminutive writing desk, situated atop a large, ornate chest. When its two motors are wound up and a small semi-concealed lever is lifted, the boy’s outward gaze will give way to a nod downward toward the blank paper placed upon his desk. His eyes will narrow perceptibly, his right hand will come to the paper, and he will begin to draw. First, an ornate scene with Cupid standing nonchalantly upon a chariot being pulled through the clouds by a pair of doves, and then a tall-masted British war ship with billowing sails, complicated rigging and ladders, miniscule cannon in 30 of its 44 portholes, and a tiny captain standing on deck. Two or three times per drawing, the boy’s head tips up, his eyelids lift, and if you look closely you’ll see his eyes roll subtly upward, stopping to gaze out as if to say “What shall I do next?” In this moment you observe that he has moved his hand away from the drawing, as he momentarily takes a rest from his efforts. After two or three seconds, he nods once more, head tipping back down toward the work, eyes narrowing and lowering, and he appears to consider his progress as his drawing hand glides back over to resume the work. While the artist toils, there are no sounds from the mechanism to distract during the minute and a half or so that’s devoted to each drawing interval. With broad sweeps of his arm in confident, showy flourishes, the boy draws big decorative borders around his work, and just as deftly fills in the minutest interior detail. Occasionally, his idle left hand moves just a bit, a little up, a little down, so you won’t mistake it for inanimate mass. After five or six minutes, he looks up for the last time and stops, his drawing hand resting beside his finished masterpiece. You can then lift the small metal frame that holds the paper in place, and retrieve the drawing for a close inspection and critique of the boy’s work. Should there be any lingering doubt as to the android’s capabilities, when next set in motion the artist becomes a writer, first drawing a precise oval about 3 1/2-inches wide, which he then tops with a little curlicue embellishment. Within the border he pens the following in a graceful, flowing copperplate script: “Unerring is my hand, though small” (a couple more peripheral embellishments for good measure, then a momentary pause while he looks up at you) and returning to his task, “May I not add with truth” (his hand glides back over to cross the t’s in truth), “I do my best to please you all” (another momentary gaze outward as though imagining how to finish) and then looking down at the paper again and narrowing his gaze, “Encourage then, my youth.” The poet finishes by drawing an expressive little double swash at the bottom of his verse, within which he then carefully pens in tiny, slightly stylized block glyphs: “THE AU-



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Movie still from *Hugo* © 2011 Paramount Pictures. All Rights Reserved.

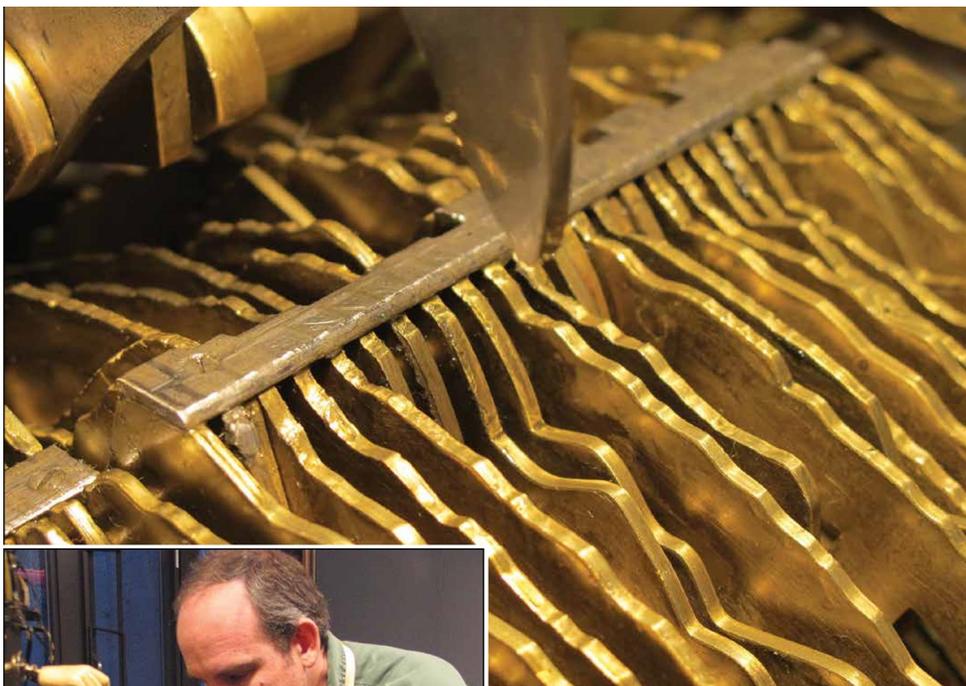
TOMATON, SCR” (SCR is a Latin abbreviation for Scriptor or Scriptoris).

The automaton has now completed the first three of seven dedicated selections stored within its aging brass memory. They will be followed by two more exquisite drawings, interspersed with two poems, this time written in French. The automaton has rendered these drawings and poems for more than 200 years, during which time it has sometimes forgotten how to write well or, on occasion, at all. Such was the case when I was first invited to The Franklin Institute in the early spring of

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2007, to coax the fatigued and injured automaton back to life. Made sometime between the late 1780s and mid 1790s, this automaton came from the London workshop of Henri Maillardet, a onetime business associate of the famed Jaquet-Droz. It is one of approximately 10 automata of the “writer-draftsman” class made in Europe between the mid 18th and early 19th centuries. Of the six known to have survived, the Maillardet automaton alone possesses an unparalleled naturalness of movement, drawing upon masterful mechanism to achieve an artfully expressive presentation. The very heart of the Maillardet automaton, and the feature that most deviates from conventional clock mechanism, is the horizontal row of 72 closely-spaced encoded brass cams that contain all of the memory required to produce the automaton’s full repertoire. An additional pair of cams at the far end of the primary set controls the movements of the head, and by extension the eyes, eyelids and left hand. Widely touted as having one of the largest mechanical memories of its time (think of it as a computer with a “read-only” memory), the Maillardet automaton represents a dramatic departure from the JaquetDroz “Draughtsman” (1774) which is its nearest operational relation, currently available for dynamic study and comparison. While it’s basic memory system had been worked out a generation earlier by Jaquet-Droz and Leschot, the Maillardet automaton’s most unique and significant attribute, in its own time and even by today’s standards, remains its elegant naturalness of gesture. The presentation is clearly meant to be experienced holistically; almost choreographed so the figure appears to casually regard its own act of creating. Even the occasional pretense of looking up and moving the writing implement aside during the natural progression of a work, was engineered to provide a clever camouflage to the mechanical interchanging of a trio of cams within the cabinet beneath the figure. Similar to a stage illusionist drawing your attention with a theatrical flourish of one outstretched hand, while he secretly pockets some contrivance with the other, the automaton’s momentary pause would risk distraction if not for the figure itself commanding our attention with its gaze. In its earliest years an opaque wooden panel, situated between the cabinet and the figure kneeling at its desk, likely concealed the interchanging of cams, whereas today we can observe the action taking place through glass. The automaton’s stagecraft doesn’t stop with gestures of the head, eyes, arms and hands, but even extends to the manner in which precious works of art are rendered. Not only do we see return passes across lines of poetry to cross t’s, dot i’s and pen an occasional punctuation mark, but when it comes to the illustrated renderings a living artist



A close-up view showing the intricately encoded memory in a portion of the 72 brass cams that convey movement to the automaton's drawing hand. The section represented here controls the X-axis movement of the figure's hand, while the section just in view on the far left controls the Y-axis. A third section (out of view to the right) adds Z-axis lift. The cams are original to the machine and most likely date from the 1790s.
Photo by Andrew Baron



Andrew Baron works with the automaton's main movement in the Curatorial Department of The Franklin Institute. The figure's hands are seen on the left. Photo by Carol Barton

appears to be at work. We watch, in the early moments of the chariot drawing, for example, as the industrious little performer abandons the tedium of filling in Cupid’s curly hair in favor of the more immediate gratification of rendering the tiny wings and feathers (he’ll go back and fill in the final two-thirds of the curly hair before the drawing is finished). This is just one of many examples of the unparalleled thoughtfulness that went into the automaton’s programming. The conscious goal seems always to have been avoiding any move or character of movement, that could even for a moment diminish the illusion of life.

Next Installment: As we continue this series, I’ll discuss the evolution of the writer-draftsman class of automata, and how the Maillardet automaton specifically departs from earlier endeavors. We’ll learn more about the various devices that give

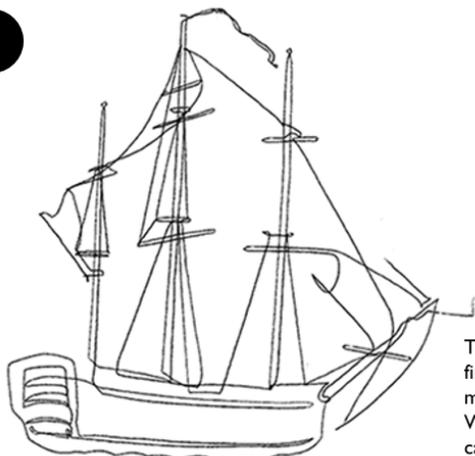
About Andrew Baron

Since age 12, Andrew Baron has been actively involved in the restoration of a variety of antique machines, both mechanical and electric. His expertise was sought by the Library of Congress when they wanted to obtain a cylinder phonograph ideally suited for transcription, and he has provided repair services and artifact documentation for a number of museums, including The Franklin Institute, in Philadelphia, PA, and The Musical Instrument Museum, in Phoenix, AZ. Baron is also an international award-winning paper engineer (pop-up and moveable book designer), with top honors in that esoteric field. A brief description of his work, as well as a detailed report of his restoration of the Maillardet automaton, can be found at www.popyrus.com/hugo.

the automaton its writing and drawing capabilities, and what enables the fluidity of movement that seems to be the sole domain of the Maillardet automaton.~

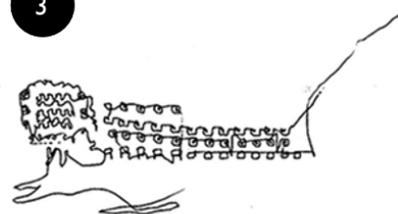
ANATOMY OF A MAILLARDET AUTOMATON DRAWING

1



The basic ship structure appears during the first rotation of the cams: Hull, bowsprit, masts, pendant, and the start of the rigging. With each subsequent rotation of the cams, additional details will appear.

3



After the third rotation of the cams, the portholes are finished, complete with cannon, the gallery is rendered, and the ocean waves begin to appear. Below, the combined result of the first, second and third rotations of the cams can be seen.

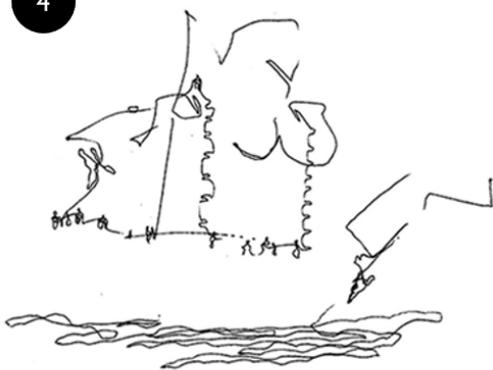
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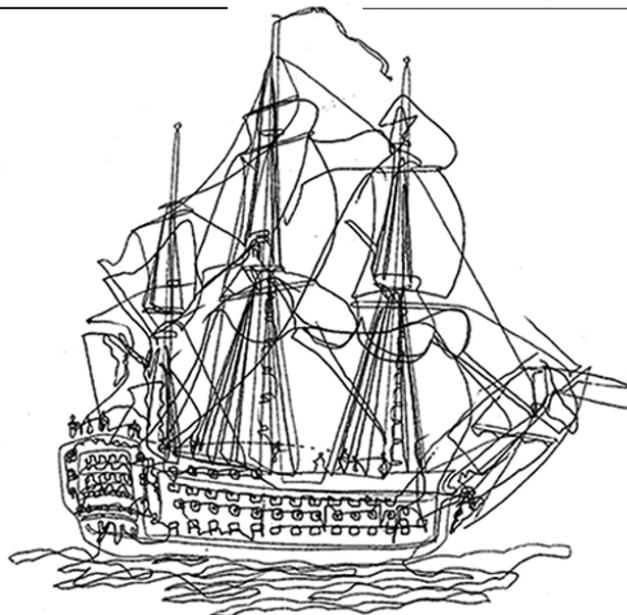
The view on the left shows, in isolation, the rendering produced by the second revolution of the cams. Rigging and sails are added. The ensign is drawn, and the first of the ship's 44 minuscule portholes appear. The right view reveals the combined result of the first two rotations of the cams.



4



On the fourth and final rotation of the cams, the sails and waves are completed, the ship is embellished with rungs on the ladders, a figurehead on the bow, lanterns on the poop deck, a nationality-identifying banner in the ensign, and crew. The final version of the drawing is shown at right.



The most popular selection in the automaton's memory, "Vaisseau" (Vessel), depicts a contemporary British Man-'O-War. It is the most complex of the seven selections, requiring four complete revolutions of the cams to complete the drawing. A total of 12 cams are traversed, entailing approximately six minutes running time to bring the illustration to completion.

(Continued from page One)

repairing most radios, but it does not test the actual operation of the tube. Emission testers are very easy and fast to use, usually tells if a tube will work OK in a radio, gives an indication of how long the tube might still be useable, and with some knowledge of tube technology, it is relatively easy to derive settings for an odd tube to test if it is likely useable or not.

Mutual conductance testers test tubes under a dynamic load which more closely duplicates how the tube performs in actual operation. They measure what is called the mutual conductance of a tube whose symbol is Gm which represents the response of the tube's plate current with a signal on the control grid. Gm is measured in units called micromhos—notice the mho at the end is ohm spelled backwards as it is related to the inverse of resistance. Conductance testers provide a more rigorous test of a tube, but they usually take more time to set up than emission testers, and most conductance testers do not give any indication of the life expectancy of the tube (although some I have seen have a life test where they reduce the filament voltage and see how the Gm changes). Both emission and conductance testers can check tubes for internal shorts between the tube elements. Some circuits require tubes with similar characteristics (like matched pairs in push-pull amplifiers) where you need to measure their Gm to select tubes with similar Gm's which you are unable to do with emission testers.

While tube testers give a good indication if the tube is useable or not, the real test is how well the tube works in the equipment it is in. I have seen tubes that test good but not work in a radio as well as tubes that test bad but work in a radio. I once tested a bunch of 12SQ7 tubes both on an emission and a mutual conductance tester and compared how well they worked in a radio. Tubes with the highest Gm did not necessarily have the best emission reading and vice versa. To my surprise, one of the tubes

with a rather low Gm reading actually performed the best of all the tubes in the radio. In general, I view a tube with a low emission test result as one with a likely short useable life. In radios I place a high value on, I will use tubes that

test well on both an emission tester and a mutual conductance tester.

I have several emission and mutual conductance tube testers. I mainly use a Triplet 3413 emission tester to quickly screen tubes to keep or toss. The design of the Triplet 3413 was copied by Eico, Knight, Heathkit and others for the design of their emission testers. In fact, I use one of the last Eico 625 tube charts available to get the settings to test tubes not on my Triplet tube chart. A simple emission test usually indicates if a tube is useable in a radio or not. But when I work on a more difficult radio repair, one of the first things I do is verify the tubes test good on a conductance tester. When working on hifi equipment or when I want peak performance, I usually test the tubes on a mutual conductance tester.

My favorite mutual conductance tester is the military TV-7. I have more exotic testers like the Hickok 539 B and 539C, but they take much more time to set up. I figure if the TV-7 was good enough for the military to repair and maintain their valuable equipment, then it should be good enough for me to repair radios. Around the end of WWII, the military decided to use the Hickok mutual conductance circuit design for all military tube testers. While Hickok built some of the tube testers for the military, many of the military tube testers were built by other contractors following specifications set by the military using Hickok's circuit design.

The predecessor to the TV-7 was the I-177 which was built from 1944 to the early 1950s. It is well built and a good tester. Seven pin miniature tubes were developed during WWII, but 9 pin miniature tubes were developed after the war. Consequently, the I-177 can test 7 pin miniature tubes, but it does not test 9-pin miniature tubes unless one uses an adapter which I find time consuming to use.

The TV-7 became available in 1952 and was produced until the early 1960s. They are well built, portable, fairly small size, extremely rugged and easy to use. It tests most tubes with common bases of the 1950s which includes most of the tubes found in radios. There are adapters for newer tubes like compactrons. As seen in the picture, the lid of the TV-7 contains a place for the line cord, has a book on tube test data and a 7 and 9-pin straightener. There are also storage places for adapters for special tubes used by the military. The manuals for TV-7's operation and repair are readily available and can be downloaded free from the Internet. Some repair parts are readily available and some surplus parts are still available. Sometimes you have to find a donor sets for needed parts, but fortunately a large number of TV-7s were produced. Unfortunately, the 83 tube used inside the

TV-7 is becoming more expensive to replace.

There were 5 different versions of the TV-7 (TV-7/U, TV-7A/U, TV-7B/U, TV-7C/U and TV-7D/U). The TV-7/U had phenolic switches and fixed elements which made calibration difficult. The TV-7A/U has ceramic switches and adjustable elements for calibration. The TV-7D added another scale to the function switch and other changes to allow testing of higher conductance tubes.

I got my first TV-7 for 5 dollars at a Hamfest which I still use. A Ham brought in a trailer full of ham equipment which was quickly swarmed upon. I noticed a TV-7 which no one seemed interest in, so I grabbed it, asked how much and quickly paid the \$5 asking price. Today, the TV-7 is in high demand with prices in the hundreds. The later model TV-7D/U is most sought after.

One of the criticisms I have heard on the TV-7 is the meter is a 0-to-120 scale rather than actual GM and the tube chart specifies a go/no-go values for the scale on the setup chart. It is fairly easy to get the actual mutual conductance from the TV-7 scale reading by a simple multiplication. To get the Gm on scale B multiply the meter reading by 25, scale C multiply by 50, scale D multiply by 125, scale E multiple by 250 and scale F(only available on the TV-7D) multiply by 500. For example, if a tube under test reads 70 on the B scale, the actual Gm for the tube would be 70 times 25 or 1750. Using the above multiplication factors on the acceptable value in the setup table gives you the minimum mutual conductance that the military considered acceptable for that tube.

If you ever get a chance to get a TV-7 (or any Hickok tube tester) in reasonable condition at a good price, I suggest snapping it up or you can call me (505 903-9812) with its location. ~ C Burch



Triplet 3413 Tube Tester



TV-7 Tube Tester



**NEW MEXICO RADIO
COLLECTORS CLUB**

New Mexico Radio Collectors Club

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Las Cruces NM 88011

E-Mail: rmajestic@msn.com
Phone: 575 521-0018

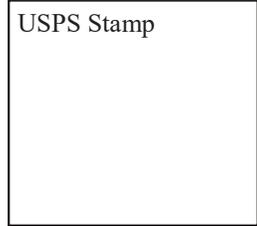
FOR INFORMATION CHECK THE INTERNET
<http://www.newmexicoradiocollectorsclub.com/>

The New Mexico Radio Collectors Club is a non-profit organization founded in 1994 in order to enhance the enjoyment of collecting and preservation of radios for all its members.

NMRCC meets the second Sunday of the month at The Quelab at 680 Haines Ave NW, Albuquerque NM, 1:00PM meetings start. Visitors Always Welcomed.

NMRCC NEWSLETTER

THIS PUBLICATION IS THE MONTHLY NEWSLETTER OF THE NEW MEXICO RADIO COLLECTORS CLUB. INPUT FROM ALL MEMBERS ARE SOLICITED AND WELCOME ON 20TH OF THE PRECEDING MONTH. RICHARD MAJESTIC PRO-TEMP NEWSLETTER EDITOR, SEND ALL SUBMISSIONS IN WORD FORMAT, PICTURES IN *.JPG FORMAT TO: RMAJESTIC@MSN.COM



Designed & Etched by T.Lane.

The Automaton Exhibition, Gothic Hall, Haymarket.

Published by G.Smith March 18