AUTOMATA MAGAZINE

Tom Haney's *Phrenology Head*

1/4—Jul/Aug 2019

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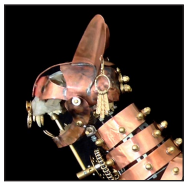
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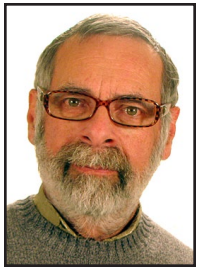


EDITORIAL

Planning an automaton

by Marc Horovitz

How do you plan your next automaton? There are many different approaches to this. Do you come up with an idea for a finished action, then figure out how to turn it into reality? Are you inspired by something that you've seen someone do? Or are you struck by a particular mechanical motion that you've found in a book or on a machine, then come up with a suitable action to fit it?

For my own stuff, I tend to come up with a concept for the finished product, then work out the mechanics necessary to make it happen. This way seems to work best for me. That said, though, it's never an easy path.

Some people I've spoken to just intuitively set to work on their project, after coming up with the idea. They use whatever is at hand to bring the piece to reality, modifying and adjusting as they go. The end result may or may not resemble the original concept, but however it turns out, it's interesting. I envy these people and haven't a clue how they do it. It's like brilliant extemporaneous speaking with no forethought to what will be said. I guess some folks just have a gift for it.

I, on the other hand, must laboriously plot out each part of the machine, figuring out in advance the placement of every part, all of the linkages, the shapes of cams, and the gear ratios. This means countless hours at the drawing board (whether real or virtual) before a single piece of wood can be cut or hole can be drilled.

Having done that, on a good day, the work usually proceeds more or less as planned. The ultimate goal is tangible and I have a roadmap for how to get there. The path is never smooth, though. There are always unforseen problems along the way, or perhaps problems that would have been forseen had I been paying more attention when I should have. However, once these blocks have been stumbled over and the piece is there, finished, in three dimensions on the bench in front of me, the satisfaction can't be beat.

But what about that original inspiration? Where does it come from? I have always admired Paul Spooner's sense of the absurd—familiar people or animals in odd situations. Many people today take a humorous approach.

In the old days, the objective of the automatist was to create lifelike action—to fascinate, baffle, and astound the observer. Automata that could write, draw, play a musical instrument, or even defecate were the norm. Life must have been more serious back then.

Nothing amazes us anymore, it seems. With CGI being applied to almost every movie, anything is possible, so we're more blasé about everything. Given that, perhaps seeing a little wooden figure doing something commonplace when a crank is turned *is* amazing to most people these days.

So few people now seem to have any idea of mechanics. Current products are not intended to be repaired—just discarded when they (all too soon) break down, so no one knows how things function or how to fix them. A working automaton, handmade by an individual, almost defies belief!

EVENTS

Siegfried's Mechanical Music Cabinet

Automata Festival: August 3-4, 2019. Siegfried's Mechanical Music Cabinet is celebrating its 50th birthday. In association with MMM Mechanical Musicboxes Manufactory, they have organized the first European Automata Festival. This will be held in Rüdesheim am Rhein, Germany. Further information can be had from *info@asbachgasse.de*

Morris Museum

A Cache of Kinetic Art: Simply Steampunk: March 15-August 11, 2019. The second installment of a four-year exhibition explores the theme of steampunk art, incorporating the aesthetics of 19th-century industrial design and steam-engine machinery. These creations exhibit marvels of design, engineering, storytelling, and fantasy that demonstrate the ingenuity of steampunk art. *https://morrismuseum.org*

Cabaret Mechanical Theatre (CMT) has announced the following touring exhibits:

The Mechanical Circus is a collaboration between CMT and Rijksmuseum Boerhaave, the Netherlands. Banbury Museum, Banbury, UK, May-Sept. 2019.

Puke Ariki Museum, New Plymouth, New Zealand. November 2019-April 2020.

Marvellous Machines features automata, hands-on interactives, workshops, and a series of artists events. Ipswich Art Gallery, High Street, Ipswich, UK.
July 20-October 31, 2019.

The Fantastic Fairground Factory is a new CMT Touring Exhibition. Peek into the Mechanical Marvels behind the Scenes at the Fair. Debut venue: Tullie House Museum and Art Gallery, Carlisle, UK. July-October 2019.

Poisoned Milk and Other Fairytales features automata, with a focus on extended workshop activities and tinkering opportunities. phaeno, Wolfsburg, Germany. November 2019-February 2020.

A Day at the Architects: Paul Spooner—New Works 2019 Rodić Davidson Architects, London, UK. Now through September 30, 2019. More info: *https://cabaret.co.uk/exhibitions/current/*

Automata auction

Life and Other Illusions. August 24, 2019. Potter & Potter Auctions, 3759 N. Ravenswood Ave. Suite 121, Chicago IL 60613. Over 150 vintage and modern automata from the collection of Michael Kam. Examples by Vichy, Lambert, Phalibois, and their contemporaries, as well as modern makers. Catalog, $35. For more information, contact Gabe Fajuri, *gabe@potterauctions.com* Website: *www.potterauctions.com*

AutomataCon

Hosted by The Morris Museum: May 29-31, 2020. More info: *http://www.automatacon.org*

CALL FOR ENTRIES

Morris Museum

A Cache of Kinetic Art: Tiny Intricacies: March 13-July 12, 2020

Timeless Movements: March 12-July 11, 2021. A multi-year juried exhibition series, *A Cache of Kinetic Art*, showcases contemporary automata and their inventive creators. For artists, the prospectus and entry forms for the 2020 and 2021 exhibitions can be viewed at *https://morrismuseum.org/mechanical-musical-instruments-automata*

Follow *Automata Magazine*…

In the next issue of AUTOMATA MAGAZINE

- **Federico Tobon** builds an automaton a day, for a month
- **David Soulsby** takes us on a visit to the amazing and baffling Sharmanka Exhibit in Glasgow
- **Lee Hutchinson** gives us another clothes-peg automaton to build
- **Marc Horovitz** describes two different methods for making worm gears for your automata

LETTERS

Support *AM*

Thank you for publishing *Automata Magazine*. I consider your magazine to be an important component of the automata community and I encourage all members of all facets of the automata community to actively support *AM*. I, for example, promote *Automata Magazine* on the "Favored Suppliers" page of my website and in blog posts. Thank you, Marc, for starting the magazine. —*Jim Coffee, Escondido, California, USA,* JamesCoffeeStudios.com

Mouseworks

I was intrigued by Brian Dunn's letter in the March/April issue of *Automata Magazine*, in which he inquired about the whereabouts of Juta and Jim McCord (Mouseworks, Canada).

Although I cannot provide any information on the couple's current whereabouts, I have been able to uncover some historic information, which may or may not be of use. An internet search suggests that the Mouseworks website was in use from around May 2003 to June 2008. Below is a link to an archived snapshot of the website before it was taken down: *https://tinyurl.com/mouseworks1*

I was most interested in the book Brian mentioned, *Contemporary Automata: A Continuum*, and would love to purchase a copy, but it appears completely unavailable anywhere. Several mentions of the book were made on Mouseworks' website, but the ISBN number given appears to be invalid.

Details of the book, along with the last website and published contact information, can be found at the following links: *https://tinyurl.com/mouseworks2* *https://tinyurl.com/mouseworks3*

I was also able to download an archived PDF catalogue from the original Mouseworks website. Although this is now for historic reference only, it does give a flavor of the automata kits and book that the McCords had for sale at the time. —*David Gell*

[*The PDF mentioned above is available to subscribers for download on our website. Click here.* —Ed]

Send your letters, tips, likes, dislikes, ideas, opinions, etc. to:

automatamag@comcast.net

GALLERY

Blue Heart

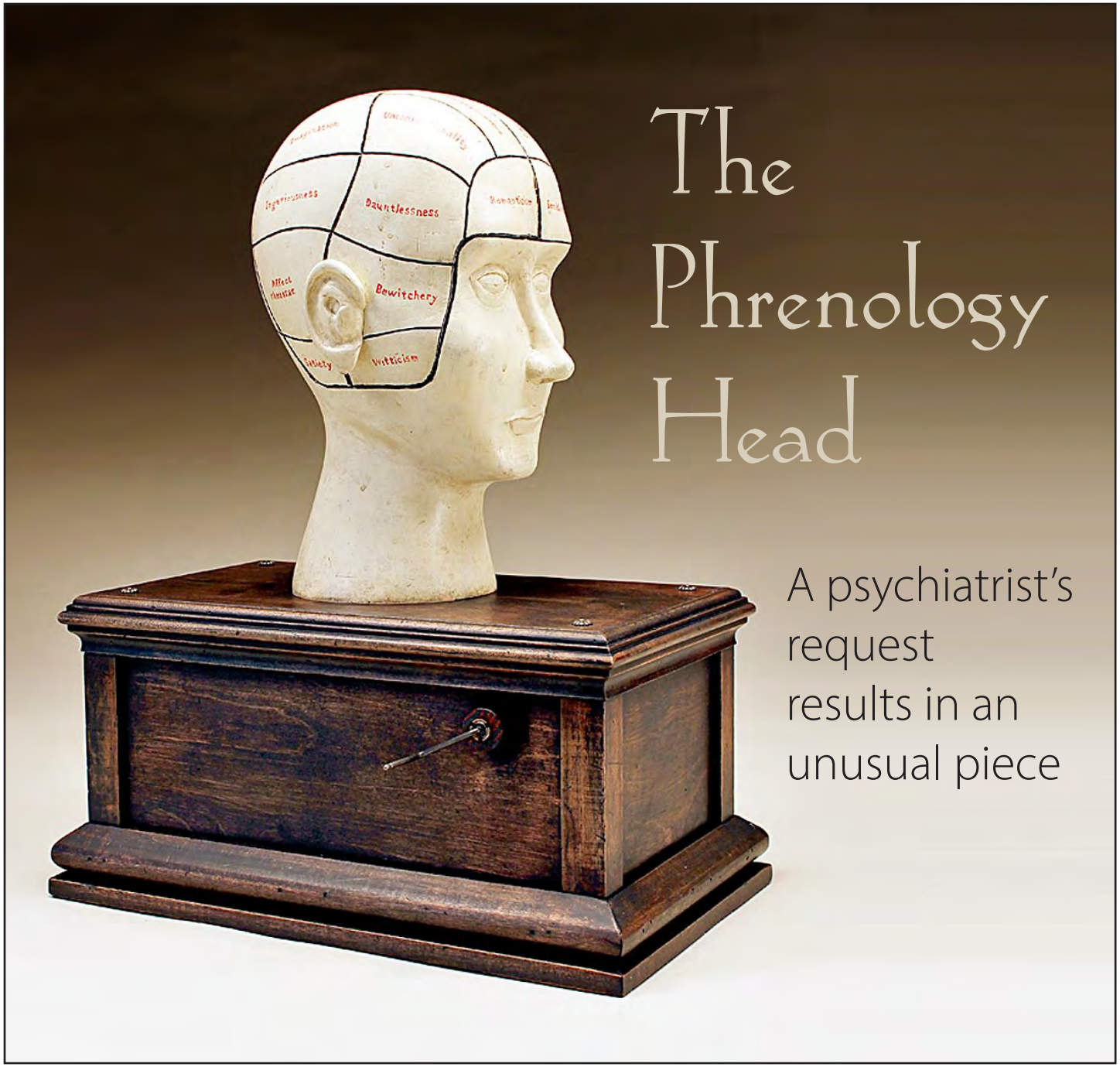
by Palomia Bravo

Madrid, Spain • Photos by the author

I'm a sculptress and a prop maker. I love automata and, two years ago, I made my first one: *Blue Heart*.

Blue Heart is the beating heart of a giant who lived in Spain in the 19th century. When you turn the crank, the heart beats—as yours does when you are next to someone special—with the rhythm of a metronome.

See *Blue Heart* beating on the author's website: *https://tinyurl.com/blueheart1*



The Phrenology Head

A psychiatrist's request results in an unusual piece

by Tom Haney
Atlanta, Georgia, USA
Photos by the author

Last year, one of my biggest collectors, who happens to be a psychiatrist, challenged me to make this unique piece. The concept was his and I carried it out. Originally, he was thinking about a piece that would include a doctor standing over a man on a table, and the man's brain was exposed. However, as the collector thought more about it, he opted for a larger head (he suggested three-quarter size) with a mouse/man inside, running on a wheel. I suggested making the head full-size so the mouse/man and the wheel inside would not be so small, as it's easier for me to work on larger things.

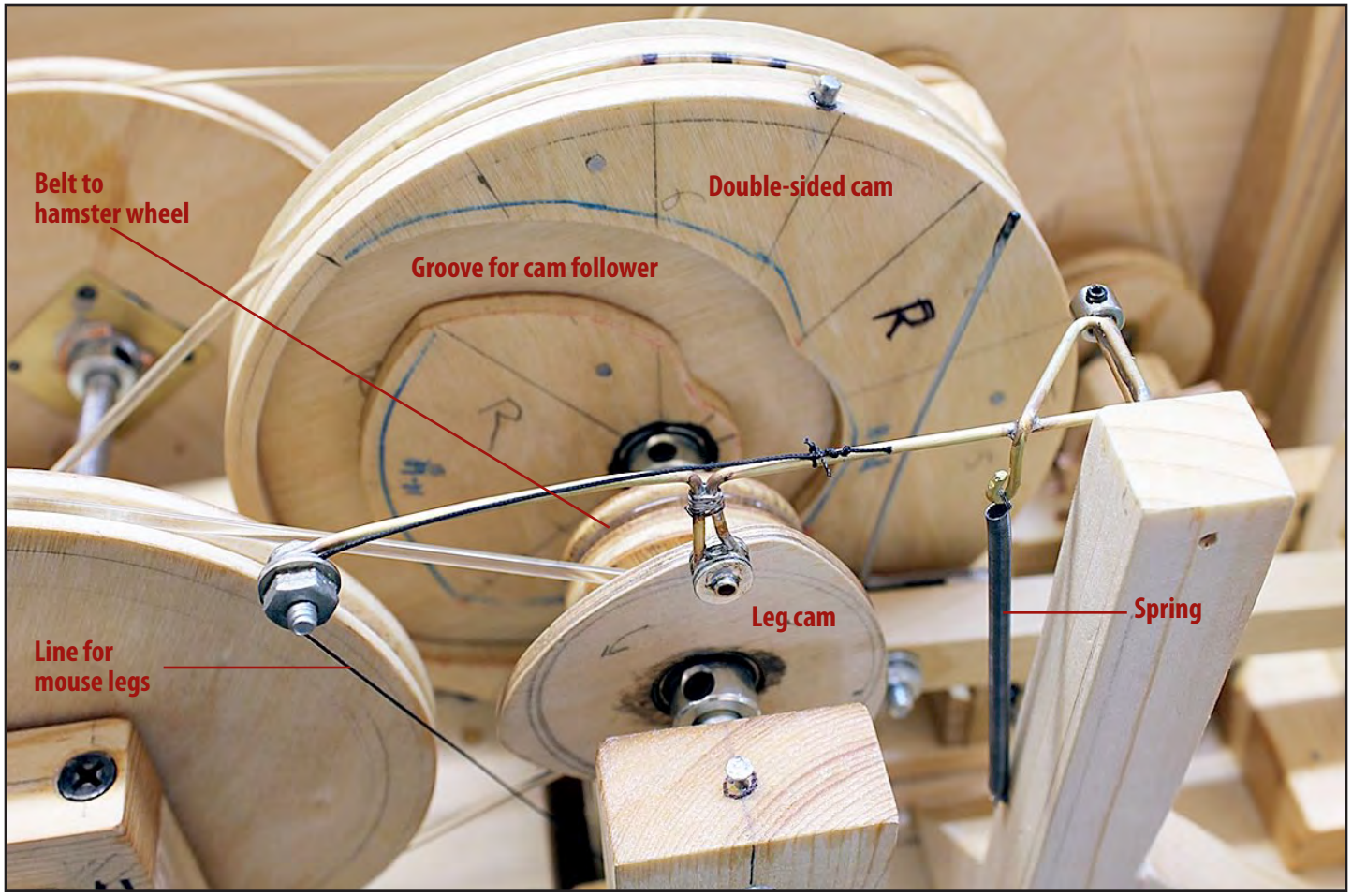
When he described this to me over the phone, I knew it was going to be an interesting build, as well as a lot of work, but I'm always up for a challenge. Just creating the head would involve lots of carving. I love to carve, so I was excited about that part. The mechanical part presented a whole different problem to solve.

The mechanism

One of the first things I had to figure out was how to produce three different movements—opening and closing of doors on the head, the rotational movement of the hamster wheel, and the motion of the mouse/man's legs. Also, the speeds needed for each, along with how to get these movements out of a simple hand crank, had to be established. After estimating a typical (speedy) crank rate, I worked out the size and number of pulleys needed to supply the various speeds at the other end of the gear train.

I decided I wanted the cycle to last 25 seconds, from the opening of the doors to their closing, with appropriate pauses in between. I estimated the following: a person will turn the crank at a speed of approximately 110 rpm; the hamster wheel should spin approximately 80 rpm; the pulley to operate the doors should turn at 2.4 rpm.

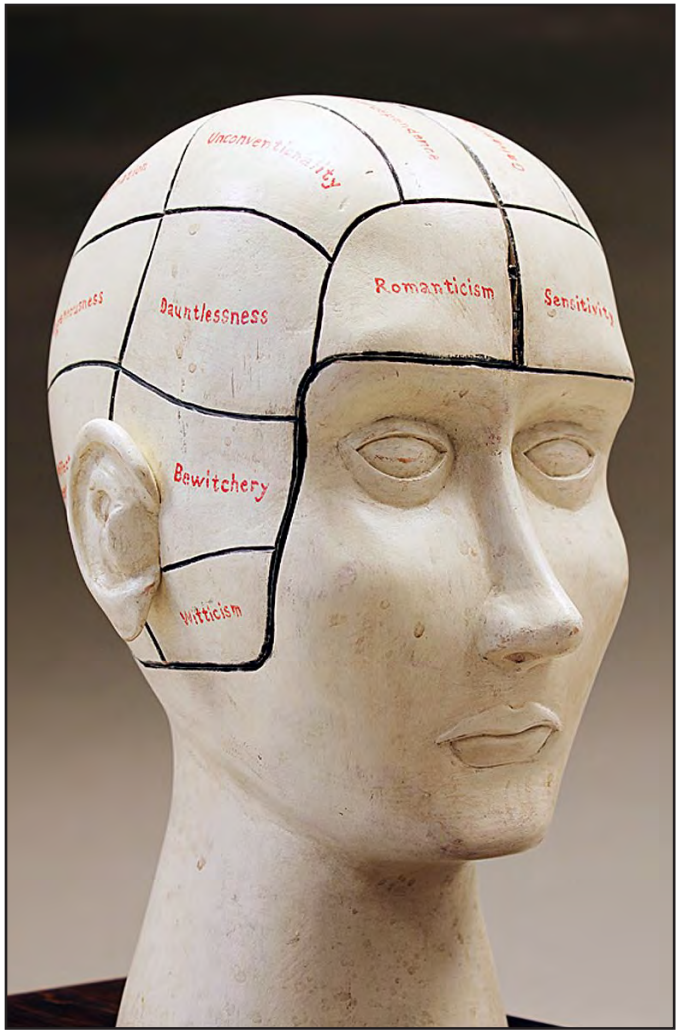
With those figures in mind, I was able to design all of the middle parts, including all of the pulleys and belts needed to make it happen. Everything was worked out on paper beforehand. As long as my math was right, I felt that this would be a fascinating piece.



The mechanism is made primarily of plywood. Seen here, it is upside down, mounted to what is the underside of the top of the box.

To add drama to the piece, I wanted the doors to open and close quite slowly. I thought a bicycle cable (or Bowden cable—a cable sliding in a flexible tube) would work well to push and pull the doors, plus I had one on hand. I made a small test piece to prove my concept, which worked well.

Given the configuration of the hinges and cables, and because the "pushing point" was so close to the hinges, I knew considerable force would be required to move the doors. I made sure my cams and levers would be beefy enough to handle the job. I could use the cable to both push and pull the doors, so I didn't have to worry about things like return springs. Also, I knew I could gently curve the cable to fit my needs. At the connection points, the cables are buried inside the head, actually coming straight out toward the viewer, taking a curvy 90° turn from the mechanism to the hinges.



ABOVE: When the crank is turned, the doors slowly open to reveal a mouse/man running in a wheel. Doors are opened by flexible push-pull cables.

LEFT: The head was carved from basswood and is painted like an antique phrenology chart.

Conversely, the force needed to move the man/mouse's feet would be slight but the feet had to move many times per cycle to make the motion believable. The other motion, the spinning hamster wheel (which had to work continuously), would be relatively simple.

Carving the head

For the head, I started with three 2"-thick sections of basswood. I cut out much of the interior of the center section on the bandsaw. Then I glued the three pieces together using a paper joint, which can be easily split apart later without damage. After I drew the pattern on the two sides, I started cutting slots in them with the table saw, removing areas that I knew were going away, mostly around the neck.

I carved away the bulk of the excess wood on the outside of the head with a sharp 1" chisel and a hammer. After that I used various rasps—flat and round—to refine its shape. Then it was on to sandpaper for finishing. When the outside of the head was to the point where I was satisfied with it, I split the seams of the paper joint

LEFT: The wheel revolves while the figure runs frantically. The different motions had to be carefully timed to be successful.

RIGHT: The elegant finished automaton now adorns a psychiatrist's office.

to separate the pieces, in order to carve out the inside.

I wanted to avoid carving out the entire inside of the head by hand. The middle section had already been cut out on the bandsaw. The door piece had to be hollowed out a different way. I removed some material roughly with my drill press and a Forstner bit. I then cleaned up the area with a power rasp in a hand drill. My original idea was to hand-carve it all but, because of how the grain ran, that was almost impossible. I was surprised, though, at how well I could carve with the power rasp. I was afraid it might gouge out the wood too much but it didn't—it worked well.

When finished, I glued the pieces of the head together permanently. The last piece was then cut in half, to become the two doors.

The motion

I built the box as well. The mechanism was constructed on the top piece of the box, which was turned upside down. When that was finished, I added the sides and the front of the box. The back and the bottom are removable.

As you turn the crank, there's a five-second delay before anything happens. Then the doors begin to slowly move—it takes six seconds for them to open fully. The doors stay open for another six seconds, then begin to close, which takes another six seconds. Two seconds after the doors are fully closed, a bell rings to signal the end of the cycle.

The *Phrenology Head* is atypical of my regular pieces, which are normally figurative narratives, either hand cranked or electrically powered. The finished size of this automaton is 14" x 22" x 8". I thought the piece came out great. If I had to do it again, the only thing I might do differently would be to carve the head's face a little more realistically.

To see Tom Haney's *Phrenology Head* in action, visit: *https://www.youtube.com/watch?v=2UBFB6SGV4s*

Fulco Automata

Two artists collaborate on a project

by Dina Priess dos Santos
with Daniel Fulco
Buenos Aires, Argentina
Photos by Daniel Fulco,
except where noted


ASTARITA

ROBERT SANZ

Daniel Fulco and son, with the *Teatro De Automatas Del Tango*, entertaining passersby at the Feria de San Telmo, in Buenos Aires.

Fulco Automata is almost an institution of the Feria de San Telmo, a Sunday antique fair in the barrio of San Telmo in Buenos Aires, Argentina. Its 270 stalls are visited by thousands of people every week. Antiques and local culture are the main attractions of the fair.

Feria de San Telmo is a must for tourists, and so it was for me when I started going, 20 years ago. On one of these excursions I discovered the artist Daniel Fulco. When I first met Fulco, the fair was much smaller and he was selling a stucco relief of an imaginary Buenos Aires building. I was not only impressed by the materials Fulco used but also by the detail and craftsmanship in his work, which

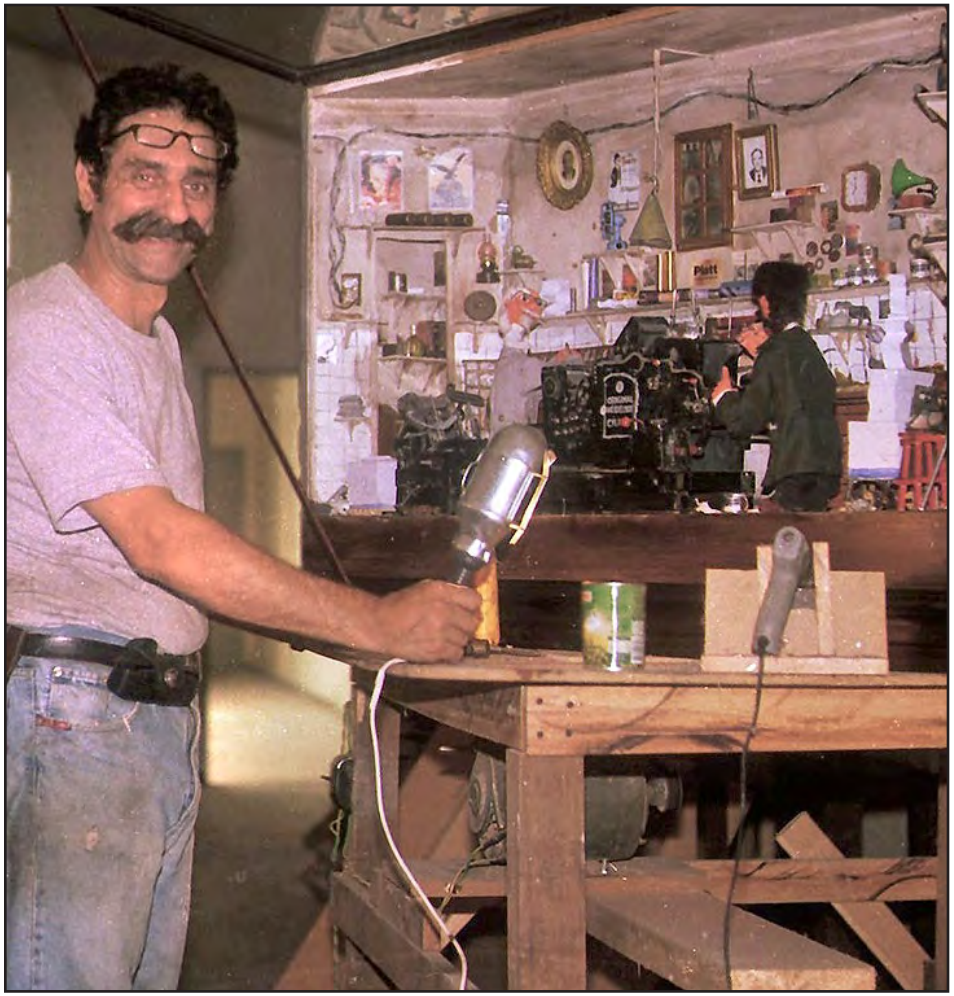
he likes to call "tango style."

I encountered Fulco whenever I went to the street fair on Sundays. He always had something new for me to explore or to be entertained by. I became a collector of his work. I finally stopped being a tourist and going to the Sunday fair. These days, Fulco and I usually meet at his workshop, which has changed in size over time, from small, to big, to unbearably small, according to economic conditions.

Fulco's automata

Fulco uses any material at hand for his pieces, including wood, steel, polyester resin, silicone, latex, paint, fabric—you name it. He has built automata with clockwork mechanisms, wooden mechanisms, and electronic mechanisms that were digitally programed. At the moment he is also making pieces for his automata using a 3D printer.

Like Gepetto, Fulco is a master (**photo 1**), always with open doors in his unspoiled, treasure-filled *wunderkammer* (a cabinet of scientific curiosities). He is incredibly creative and prolific, not only in his art but also in making tools and machines to enable him to build his pieces.



1. Fulco in his *wunderkammer* workshop, working on the *Print Shop*.

These include a vacuum-forming machine for plastic and a special papier-mâché mixer. He was a stage designer at the San Martin Theatre for quite some time and, to some extent, that is where he learned his trade. He also studied graphic design. He often wore a top hat, and when he took it off (like a magician saluting), ideas flew out of his head, as if from an exploding volcano.

On Sundays, besides showing (and once in a while selling) his automata, Fulco also likes to entertain his audiences with funny puppets, usually including a caricature of himself, while he acts as ventriloquist.

Teatro De Automatas Del Tango

Ever since Fulco chose automata as his medium, he wanted them to express his own personal artistic theme, the tango, which embodies something mystical, as do automata. The first subject he considered worthy of becoming an automaton was a cabaret, since the tango was born in cabarets.

The piece was named the *Teatro De Automatas Del Tango* (**lead photo**). There is a tango show on a small stage, with three bandoneons (a type of concertina, the emblematic instrument of a tango orchestra) in front, two violins in back, and a singer. A double bass, cello, and piano completes the more-or-less typical formation of an old tango orchestra. The bows of the violins go back and forth, the pianist lifts his hands and arms, and the singer moves his jaw.

Above the stage are two balconies. At the left, a young blonde woman has a mask that she puts on and takes off, and an older man throws a paper airplane,

surely a declaration of love, to a young lady below. Another man, obviously drinking, again and again raises his glass, while somebody who drank too much has fallen asleep. In the box on the right is a man who salutes, removing his hat, next to a couple of lovers repeatedly kissing. Someone else waves an Argentinian flag. Cams trigger mechanisms within each figure.

Below, near the piano, a cat waves its tail. In the center, behind the singer, is an oil painting that depicts a formal courtyard. Intimate lighting completes the scene when accompanied by tango music.

The cabinet is hand painted in a style called *filete porteño*. This traditional type of drawing and lettering—with stylized lines, flowers, and climbing plants—is unique to Buenos Aires. The *Teatro De Automatas Del Tango* is 300cm wide, 220cm high, and 45cm deep (9'10" x 7'2" x 1'5", respectively), and weighs about 400 kilos (880 pounds). Fulco discovered this when preparing the piece for shipping to Vermont, to the Joe Fish collection, which already housed a few of his works. The *Teatro* represents an entire year's work.

2. *Bandas*, a military band in which all members energetically play their instruments.

Bandas

Bandas, the band playing military music (**photo 2**), was an important piece to Fulco. When in the Argentinian military, he had been part of a band, which provided the inspiration. *Bandas* marked a turning point in his way of working. The band incorporates mechatronics—mechanics and electronics—controlled by an Arduino (a small microcontroller). This device

allows him to make more expressive pieces that would have taken much more time and effort using old techniques.

The piece has 12 military figures. At the top, from right to left, is a drummer beating a drum with a mallet. The cymbal player extends his arms, with a cymbal in each hand. When the tuba player blows, an LED in the center of the bell beats in time with the music. The clarinet also has a light at the end. The trombonist moves his slide with one hand. The saxophone also has an LED that lights every time it sounds.

In the front row (l-r), a trumpeter holds his horn, also with an LED. The drummer rhythmically strikes his drum with two sticks; a second drummer, holding mallets, works in the same way. The conductor, in the center, directs the band with his left arm. Another drummer plays a drum similar to a kettle drum, both hands moving rhythmically. At the far end is a flute player, with the flute's rhythmic light at one end.

3. *The Ice Cream Parlor* is a charming street scene. Patrons gossip, the shop owner fills ice-cream cones, and children play.

The Ice Cream Parlor

The Ice Cream Parlor (**photo 3**) was a commissioned piece. Its large cabinet (120cm wide by 200cm high and 40cm deep—47" x 79" x 15.5", respectively) was also decorated in the *filete porteño* style.

The scene comprises a side street on the left and an open-front building. In the street, under an old lamp, stands a vendor in a small stall, with an ice cream in each hand. His movement suggests licking the ice cream. To the right are two more characters sitting at a table—a man who has finished his ice cream but is still trying to extract more from the empty cone, and a lady eating her ice cream while fanning herself because of the heat.

A seated woman turns the handle of a phonograph; behind her a man offers flowers, his hand moving up and down. In the center of the scene is the ice cream man at a typical parlor counter, filling cones with a movement of his hand. Two children play, with a ball under one's foot. The one with the ball moves left and right from the waist. In his right hand is

the leash of a begging puppy. Behind the child is his little brother with a teddy bear, who tirelessly rotates his whole body.

At the far right, a man works an ice-cream machine, turning and turning it. The estimated weight of the automaton is 150kg (330 lbs.). Today it lives in an ice-cream parlor in Verona.

The Print Shop

The Print Shop (**photo 4**) was a commission from a printing company that now displays it in its lobby. The piece is 1m long by 70cm high, and approximately 25cm deep (39" x 27.5" x 10", respectively). The scene is of a workshop in full production.

Two crazy workers are dressed in typical protective clothing. They work among machines, paper, jars and other containers, tools, boards, posters, and portraits of the founders of the Platt company (including the man who commissioned the work). The gentleman on the left works feverishly setting type while the one on the right operates a Heidelberg press, which Fulco tried to copy as realistically as possible. The operator puts on his glasses, observes the impression, then removes his glasses again, while operating the master lever of the machine.

4. An active, if cluttered, print shop. One man sets type while the other operates the press.

The two figures are controlled by steel cams for optimum performance. The music for this automaton is also mechanical and it sounds as if it were a printing press working.

The collaboration

I stopped being a tourist around 17 years ago, when I started working part time at my job and enrolled as an art student at the university. I had always been an avid art collector, but that changed in 2013 when I stopped working altogether.

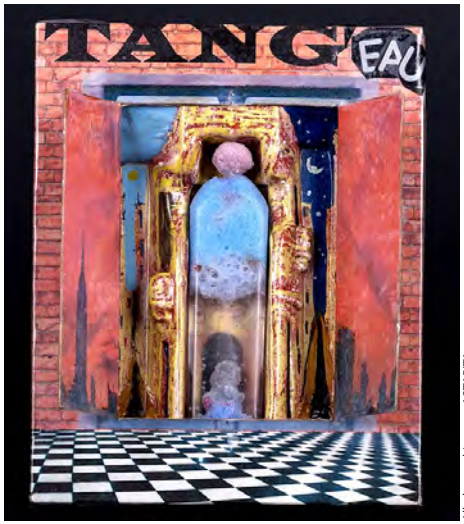
In 2006, I left the university and started specializing as a glass artist. I was attracted to glass by its transparency and translucency, as well as the possibilities it presented for more-three-dimensional expression. Besides doing sculptural work, I always enjoyed experimenting with glass. One day, when I was recycling glass paste, my kiln produced foam glass. It took me two years to analyze and improve the process, but I was finally able to produce a castable, bubbly, lightweight glass capable of holding scent for an extremely long time.

Fulco had once embarked on a perfume-packaging project that he eventually buried, but it had stayed alive in my memory. I had obtained one of his first prototype packages before it disappeared into his big heap of rejects. At least five years later, this became the seed of our first collaboration.

I asked him to prepare perfume packaging for me, using the packaging models he still had from his discarded project. I would make suitable perfume bottles from foam glass (**photos 5** and **6**).

Most of my family lives in Europe. On one trip there, I took one of my Fulco-packed foam-glass scent bottles with me. While in Germany, I visited an exhibition at a glass gallery, where I asked for the gallerist's opinion of my work. The gallerist immediately suggested an exhibition, where the scented glass would be the main focus.

Not all of the bottles were to be packaged, and spectators needed to be able to smell them. Allowing visitors to handle the fragile bottles was not an option, though. I started to think of a way to present the bottles using some kind of automaton. I showed an idea to Fulco. Funnily enough, before he had ditched his own perfume project, he had thought of an automaton similar to my proposal. Therefore, it was easy to persuade him to construct the *Perfumat*, with the bottles and the different, hard-to-fit stoppers I handed to him.

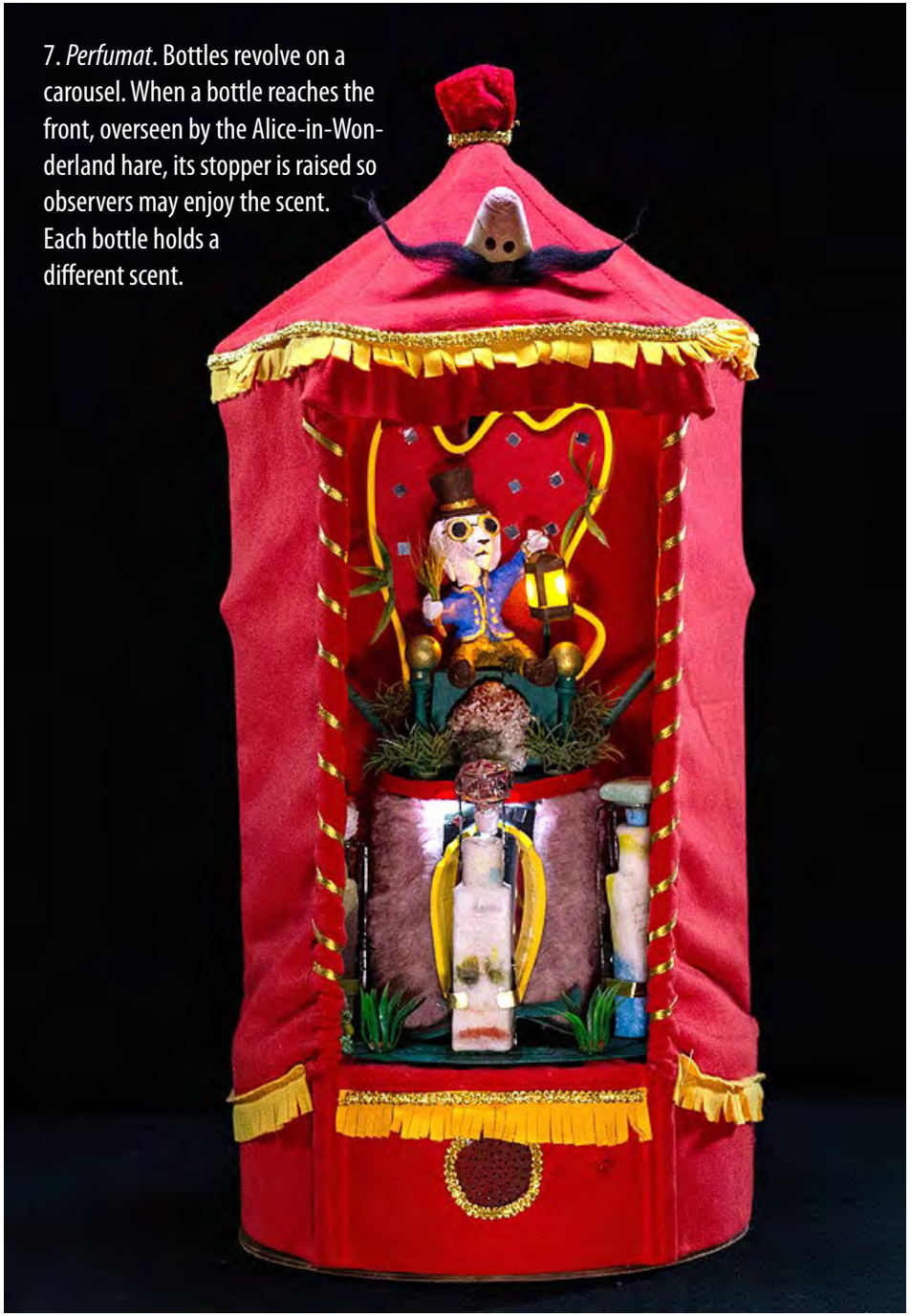


5, 6. The author's foam-glass perfume bottles, displayed in packaging by Fulco. The various names are plays on words. Above: *Sagittaire*. Below: *Tang' eau*.

All photos this page: ASTARITA

Perfumat

Perfumat is like a carousel under a circus tent (**photo 7**). On the rotating platform are six perfume bottles, each impregnated with a different fragrance, includ-



7. *Perfumat*. Bottles revolve on a carousel. When a bottle reaches the front, overseen by the Alice-in-Wonderland hare, its stopper is raised so observers may enjoy the scent. Each bottle holds a different scent.

ing strawberries, coffee, the unique tiare flower smell from Tahiti, and my favorite perfumes from an Argentinian perfume maker.

When a bottle arrives at the front of the tent, its stopper is lifted, under the supervision of the March Hare from Alice in Wonderland, sitting above. While listening to a music box playing the German anthem, spectators can become "smellators," delving into memories evoked by the much-older part of our brains where smell is processed, as opposed to our visual or sound perception, which occurs in the more-recent part of our brains.

Fulco and I designed *Perfumat* together. The engineering and construction of *Perfumat* was done entirely by Fulco. My only input included the gold tassels, the red pom-pom on top, and, of course, the bottles. Fulco also selected the music.

The automaton had to be transportable, as it was for a show in Germany. This meant it had to be easy to take apart and reassemble. The fabric of the circus tent was ideal for this.

Each week, I visited Fulco in his studio home, collaborating on the fit of the bottles and—especially difficult—the lifting of the very different stoppers. We exchanged materials and ideas, and tried to find compromises in the process, as we have different tastes and priorities.

The exhibition in Germany (**photo 8**) was titled *Wunderkammer, Odeaurama: Scents and Scenes*. The reception of the *Perfumat* at the show was amazing. It became the main attraction of the show, which was even extended for three more months.

Fulco and I have future automata in mind. At the moment, though, he is busy building his *Fulcorgan*, a harmonium automaton reminiscent of a street organ. I have started a new collaboration with another highly talented Argentinian artist, Guillermo Silpituca (Instagram: 3ddoitart), directly 3D printing glass paste to make a chandelier of glass tulips. I eventually hope to get Fulco to help, when my chandelier is ready for added motion. AM

Videos of Fulco's work

A tango automaton in a museum in Spain
https://tinyurl.com/Fulco1A
https://tinyurl.com/Fulco2

The Ice Cream Parlor
https://tinyurl.com/Fulco3

Perfumat
https://tinyurl.com/Fulco4

The Shoemaker
https://tinyurl.com/Fulco5

8. An English-language poster for the show in Frauenau, Germany, featuring the author's and Daniel Fulco's *Perfumat*.

AutomataCon

Retrospective and a look forward

John Gaughan talks about the infamous *Chess-Playing Turk*.

by Brett King • Cary, North Carolina, USA • Photos by the author

In May of 2018, several hundred automata enthusiasts from around the world again converged on the Morris Museum in Morristown, New Jersey, for the second AutomataCon, the only convention dedicated to the topic of automata. Artists, historians, restorers, collectors, and the curious spent the weekend immersed in the subject, attending panels, workshops, films, exhibits, and social gatherings.

The Morris Museum, home of the Murtogh D. Guinness Collection of Mechanical Musical Instruments and Automata, serves as the perfect venue for AutomataCon. Its staff members are also top-notch, enthusiastic participants in, and partners with, the convention. The museum's world-renowned historical collection was supplemented during the convention by *A Cache of Kinetic Art: Curious Characters,* the first in a series of four annual modern kinetic-art exhibitions.

Many of the artists of the pieces in the exhibition were in attendance at AutomataCon. The best-in-show winner was Geof-

frey Drake-Brockman's *Floribots*, a room-scale field of blooming mechanical flowers. Geoffrey was also a presenter at the convention. The second exhibition in the series, *A Cache of Kinetic Art: Simply Steampunk*, is currently running at the museum, through July 14, 2019.

When we held our first AutomataCon, in 2016, we were hoping to build a community of automata enthusiasts, which, up until then, had only existed online. For our second event, in 2018, we saw many of the same people returning from across the United States and five continents. That was wonderful! At the Friday-night opening reception, there was a strong sense of camaraderie and even family among the attendees. This event is the only place where some of our attendees meet in person, even though they may have worked together or known each other for many years.

The other great thing about the event is that it brings together people who have different perspectives on automata. These include historians and curators from a number of European museums, who share their expertise with modern automata artists and collectors. At the last event, Jörg Wendel, from Ger-

Floribots by Geoffrey Drake-Brockman.

many, spoke about the history of the Griesbaum singing-bird factory and his family's museum, which celebrates its 50th anniversary in August of this year. Vincent Giovannoni, curator for the Museum of European & Mediterranean Civilizations (MuCEM), in France, shared details of its collection of automata and dioramas. Marian van Dijk, Director of Museum Speelklok, in the Netherlands, illustrated the connections between self-playing musical instruments and robots. Finally, on the lighter side, Tim Griffiths shared his work on establishing a UK museum for Rowland Emett, whose fanciful designs were seen in the movie *Chitty Chitty Bang Bang*.

Attendees were also treated to panel discussions by some of the top hands-on historians in automata—the restorers and recreators: Jere Ryder, from the Morris Museum; Michael and Maria Start, from Scotland; and Philippe Crasse and Eve Chaillat, from France.

There has always been a strong connection between automata and the world of magic, and this is reflected in the programming at AutomataCon. John Gaughan, master illusion builder, shared the history of the infamous *Chess-Playing Turk* automaton,

The Android Clarinetist, by Cornelius Jacobus van Oeckelen, 1838, was brought to AutomataCon as an exhibit by John Gaughan, from his collection. The automaton is currently not functional.

and how he recreated the now-lost original, which, in its day, sat at the intersection of technology and illusion.

Along with panels by restorers and horologists, the programming helped to bridge the gap between 18th- and 19th-century historical automata and the modern maker. It encouraged modern makers to think about things like the artistic impact of their work, as well as its longevity, which is always a challenge with kinetic art.

For artists and makers, we had panels on classical tools, methods, and materials, as well as modern topics, like 3D printing and laser cutting. Some artists choose to work using the older methods, some use new methods (including robotics), and some use a mix. Fundamentally, automata are about creating the illusion of life in sculpture; we simply have more tools available now.

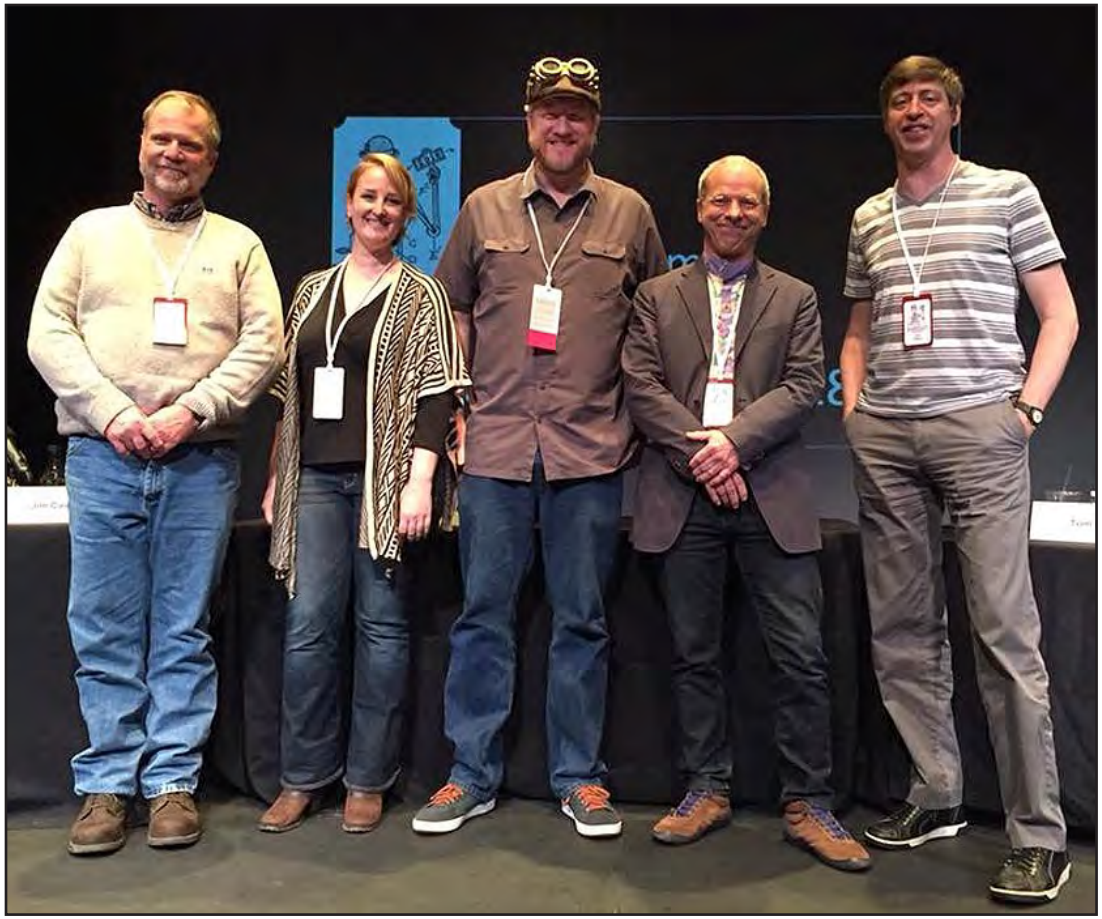
The documentary *Double Take: The Art of Elizabeth King*, by Floating Stone Productions, was shown in the museum's Bickford Theater. The film offered a personal look at the artist and her exploration of gesture and the human body.

Another aspect of the convention that has been quite effective

Artist Alan Conquergood demonstrates his works in the Exhibitors' Hall.

6. Artists Barney Stone and John S. Morgan greet attendees in the Exhibitors' Hall.

is the use of automata as a mechanism for encouraging interest in STEM/STEAM (Science, Technology, Engineering, Art, and Math) education. Building an automaton requires a little bit of all of those skills. We had a number of hands-on workshops, where kids and adults built automata out of cardboard, wire, and paper. These workshops were taught by actual automata artists, such as Aaron



The Modern Artists Panel. From left-to-right: Jim Casey, Samantha Cobb, Brett King, Chris Fitch, and Tom Haney.

Author Brett King, AutomataCon founder and Convention Chair, with his automaton, *The Aetherologist*.

Kramer and Sam Cobb.

We intend to continue to hold the event every other year, to make it easier for those who have to travel great distances to get there. The formula we've used for the first two events seems to be working pretty well for us, so we'll continue to build on it next year. The next AutomataCon will be held May 29-31, 2020, again at the Morris Museum, in New Jersey. The museum will be hosting its third kinetic art exhibit, *A Cache of Kinetic Art: Tiny Intricacies*, during the convention, so attendees will be able to see both.

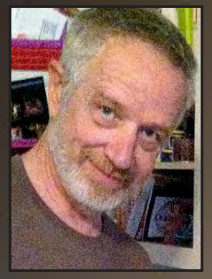
We have already reached a lot of the people who are involved in automata professionally, but there are more out there who still don't know about the event or haven't been able to make it to an AutomataCon yet. Given this, we hope to continue to expand the tent, with both professionals and newcomers alike. The success of the convention is ensured by the attendees and the passion that they bring to it. AM

You can learn more about AutomataCon on the website, *http://www.automatacon.org*

Three Muses

An automatist discusses his process

by Ken Draim • Pittsburgh, Pennsylvania, USA
Photos by the author



"Wow! This is amazing!" I would hear this daily while working in my automata gallery in Taos, New Mexico. I loved to watch kids, businessmen, little old ladies, tattooed bikers, hippies—just about everyone—turn the handle and bring the piece to life. They would smile as I watched them brighten up. Then came the dreaded questions. "How'd you come up with this idea?" and "How long did it take to make?" I had a hard time answering those questions. The process I use to build these crazy contraptions is as nonlinear and illogical as my inspiration.

"I begin with an idea, and then it becomes something else." —Pablo Picasso

I would stand there, surrounded by tools, covered in sawdust, with paint all over my hands, a piece of tape stuck to my shoe, and explain that I discovered automata when I discovered folk art and African art. I studied painting in college and painted my way through a struggling career. Finding automata opened many more opportunities to explore, not the least of which was my joy in seeing people interact with them.

Getting back to the question, "How long did it take?," can I include my time lying in bed at three o'clock in the morning, thinking about how to build a slider-crank mechanism with an eccentric cam or rebuilding a component three or four times to lessen the friction on such-and-such gear? And what about my endless coffee breaks? Well, maybe I shouldn't include those.

"How'd you come up with this idea?" The idea could have come from anywhere. I'll see an interesting gesture or movement and want to capture it; a geared mechanism might inspire me; a shape or color will take me somewhere I want to explore. I just struggle through, day by day, until an idea for an automaton starts bugging me, then obsesses me, and I have to build it and put it into motion.

The initial idea

My latest piece is of three women resting on a dock—three muses. I wanted the figures to be quietly introspective. They'd be dressed in white, diaphanous tunics. The overall look of the piece was to be a simple weathered dock, on which the figures rested and lazily lounged around.

The beginning of the dock, breaking away from the square gearbox.

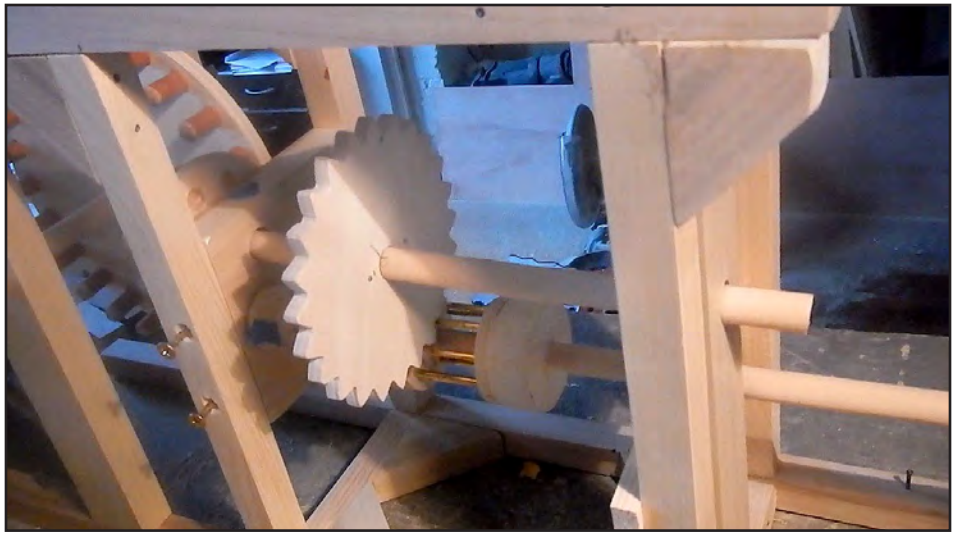

Pre-checking pinwheel gears on a separate scaffold. The author uses a gear-template generator to help mark the pin placement.


Initial work had begun on the left figure, before she was scooted further down, into the water. Figures are carved from basswood.

All of this would be bathed in warm Mediterranean colors: ochres, yellows, and olive greens. Below the dock is the waterline—cool blues. The gears would be mostly in this lower section. A large, horizontal pinwheel gear would slowly turn at the bottom, with little fish attached to it that would gently swim around. Back on the dock, two of the figures would dip into the water, bridging the gap between the two worlds. One figure's legs would be in the water, her arms resting on the dock, while the other muse would dip one hand while her hair gently swirled in the water.

I also knew early on that I was going to break away from just putting the gears in a box, with the action above, as I usually did. However, my pieces were starting to look a little static. The cantilevered dock was the perfect solution.

Now for the fun. I go up to my studio and put on some jazz music—Miles Davis or John Coltrane. Or maybe it's an NPR kind of day. I sit down on my stool in my newly cleaned studio…and panic. I'm thinking, I have to first build the dock, making sure I leave space for the gears, figure out the handle placement, decide where the figures will be, and 10,000 other things. I take a deep breath and… time for more coffee.



Placing the gears. Axles are left long, in case additional movement needs to be added. Screws are left halfway out, to prevent the screw holes from weakening when the piece is taken apart and cams are added. Painter's tape is left on some parts as a reminder that they still need additional work when the piece is disassembled.

The right-hand figure is being worked on. The figure is carved from basswood; head and hands are made of Super Sculpey. Joints are left intentionally crude. Her facial expresion is left vague, to keep her as an archetype, not a specific person.

Eventually, after heated internal fights with myself, I begin. The dock begins to take shape. I think I've left enough space for all the gearing and there is enough wiggle room to add more cams. I make the gears, which are progressively stopped down to slow the motion, then I start figuring out the cams and linkages that will best articulate the motion I want.

During all this technical stuff, I'm working on the figures, trying to make them etherial, not too earthly looking, and not too articulated. I want to keep them kind of fuzzy and not locked into the look of a specific person. The figures' joints will have a rough-hewn quality, so I don't work them to death. I have not figured out exactly how everything will be hooked up but I think I've left enough room for gears.

The process

I constantly make changes along the way, some for technical reasons, some for aesthetic. Initially, the larger pinwheel gear was to be horizontal, to allow room for little fish swimming in a circle. However,

I couldn't fit the gear comfortably under the dock, so I rotated it to a vertical position. Goodbye fish! The upper deck was a bit too short—it didn't look like it extended over the abyss, so I lengthened it. It looks better now.

I initially had the left-hand figure higher on the dock, but for her to be more in the water, I had to scoot her down so the lower half of her body was more under water. The middle figure was to be dipping her hand and hair into the water but I couldn't figure out how to do it well. Then I realized it wasn't necessary. It was too much motion up front and would distract from the gentle motions of the piece. The swaying of her legs was the only motion needed.

When the piece was pretty far along, the right-hand figure, bobbing her head, reminded my wife of someone listening to music on headphones. Eureka! That was an excellent idea. I stole it, and claimed it for my own. Well, I was thinking of it anyway…I think.

Then I decided on one muse reading a book while another has a sketch pad close by. These additions emphasize my initial concept and, in retrospect, make the piece and give it meaning. Now my muses represent art, literature, and music.

The artist distressed the deck of the dock using wire brushes and a hammer, and by gouging it with nails.

I realize that this working method is inefficient but it frees me to take the piece further and not be a slave to my initial concept. The accidents and treasures I find along the way are so much more than I could possibly dream of at the beginning.

Technical details

To be a little more improvisational, I don't lock the gearing in place. I just screw the cams in, so I can disassemble and work on

them when I have to. I leave the main axles much longer than necessary. I can always cut them off later, but I may need that extra bit of length to add something that I hadn't thought of before.

I'll often rip out something along the way, leaving just the ghost of its construction there. Sometimes I'll cobble pieces on for whatever reason. This look reminds me of a place where an old row of houses has been torn down. Its ghosts are still visible on the adjacent buildings—bricked up second-story doorways and windows, visible slots where joists were once placed, maybe an old sign painted on a building revealed. The history that once was and a sense of time is etched on the surrounding buildings. It's magical.

This is my own process. There is not just one way to do things. It is important for me, in following the process, not to see it as an excuse to shy away from difficult mechanisms or to try to justify vexing mistakes I've made. Rather, I listen to and communicate with the piece, letting it evolve naturally into what both it and I want it to be—a smoothly running machine that can bring a smile.

LEFT: A close-up of the left figure.

RIGHT: The right-hand figure has been painted, glazed, and varnished.

BELOW: The finished piece.

Watch *Three Muses* in action:
https://tinyurl.com/draim3muses

Awesome automata!

A spotlight on the Guinness Collection: Part 1

by Michele Marinelli, Curator of the Guinness Collection at the Morris Museum • Morristown, New Jersey, USA
Photos by the Morris Museum

Before the 18th century there were few commercially available toys made solely for the enjoyment and entertainment of children. New philosophies of 19th-century childrearing espoused the important role of toys and games, primarily as educational tools. With the view that "child's play" encouraged growth and development, including the ability to learn, the emergent toy industry marketed products to adults who wished to "improve" their children's lives.

In the first half of the 19th century, the United States experienced a burgeoning manufacturing industry, particularly on the East Coast. By mid-century this included the production of children's toys. The automatic walking doll, designed and patented in

1. Autoperipatetikos Soldier Walking Doll, c. 1862, by Enoch Rice Morrison.

2. Autoperipatetikos Female Walking Doll, c. 1862. American-made automaton by Enoch Rice Morrison, with original box.

1862 by **Enoch Rice Morrison** and distributed by Martin & Runyan (and others), was acknowledged to be the first mechanical clockwork-toy patented in America. Decidedly popular in the United States, it was also one of the earliest American toys sold in Europe. The American-made automata pictured in **photos 1** and **2** are the Autoperipatetikos Soldier—described as a "Zouave" (a soldier in a light-infantry corps in the French army) but representative of a then-current-day Civil War soldier in regimental uniform—and the Autoperipatetikos Female Walking Dolls, both c. 1862-65.

Alexandre Nicolas Théroude was employed as a Parisian toy seller in 1828. A few years later, with the financial assistance of his new wife's dowry, he opened his own shop and began making toys. Beginning in 1837, his nephew Adolphe Théroude learned and eventually mastered his uncle's craft. He would later open his own shop, assisted by his son, Emile.

Regrettably, the Revolutions of 1830, in Europe, impacted businesses throughout France for the rest of the decade and resulted in the elder Théroude declaring bankruptcy in 1840. However, by shifting his focus, Théroude began creating large automata that enabled him to successfully pay off his debts rather quickly. As his debt declined, his reputation grew.

3. Horse and Cart mechanical toy, c.1850, by Théroude, Paris, France.

Théroude exhibited his wares at the 1849 Exposition in Paris, while continuing to produce inexpensive mechanical toys and complex automata. He was especially recognized for improving automata by placing the mechanism inside the body of the figure and not in a base. Shown in **photo 3** is a Horse and Cart mechanical toy, c. 1850, that would have been the delight of many children!

Despite his accolades, Alexandre Théroude declared bankruptcy again, in 1878. He was an old man by this time. Adolphe, with his son, Emile, continued producing mechanical toys and automata into the late 19th century. After Adolphe's death in 1892, Emile maintained the business for several more years, until 1897. However, no record of the Théroude family exists beyond 1899.

Moving forward from 1865, the **Jerome Thibouville-Lamy Company**, also French, was a longtime manufacturer and distributor of various musical instruments, from cylinder musical boxes to pianos and organs—their own and those of other makers. The firm maintained headquarters in Paris, and branches were opened in London and New York. The company finally folded in 1970.

As a representation of commercial entertainment by a

street musician, or "opera of the street," the featured Barrel Reed Organ with Monkey automaton (c. 1875-85—**photo 4**) was possibly produced in Mirecourt. There is also a strong suggestion that the monkey automata were made by Phalibois.

Initially a cardboard manufacturer, **Jean-Marie Phalibois** (France) began crafting mechanical pictures or animated tableaux in 1881 and eventually created large, if not life-size, automata by 1884. His son Henri joined the family firm in 1887 and became the head of the comany upon the death of his father, in 1893. Henri continued producing automata but increasingly leaned more toward advertising automata and animated window displays. In 1925, Henri's son Raymond entered the family business, moving the company's direction more toward toys. As a toy merchant, he disposed of all of the automata stock, from molds to finished pieces, which went to Gaston Decamps.

Shown in **photos 5** and **6** are two objects produced by Phalibois: the rare Clown Emerging from Tambourine and the equally humorous Monkey Diner at Table animated tableau. Made in Paris, c.1875, the clown is gesturing—is he thumbing his nose at you or brushing away the fly?—in a somewhat ambiguous way, open to interpretation. The 1880 monkey tableau, complete with wine, pastry, and pipe, presents a comparable mocking of gentility.

LEFT: 4. Barrel Reed Organ with Monkey automaton, c. 1875-85, by Jerome Thibouville-Lamy & Co., Paris, France.

BELOW LEFT: 5. Clown Emerging from Tambourine automaton, c. 1875, by Phalibois, Paris, France.

BELOW RIGHT: 6. Monkey Diner at Table animated tableau, 1880, by Phalibois, Paris, France.

As with several prominent 19th-century Parisian automata makers, **Gustave Vichy** was the son of a watch- and clockmaker. His parents, Antoine and Genevieve, also made mechanical toys. Likely taught the trade of clockmaking by his father, Gustave continued the family tradition of making mechanical toys and musical automata.

Gustave Vichy married in 1864 and was then assisted by his seamstress wife, Marie Therese, who costumed the automata. However, by 1866, Vichy's interests were leaning more toward creating automata than making toys. Vichy is particularly known for his lifelike "genre" automata, such as performers, representations of exoticism, reflections of daily tasks, and fantasy pieces, which tremendously appealed to a delighted public.

The firm enjoyed much success, and in the early 1890s, Gustave's son Henry joined the family business. For a while they

continued to produce some of the most gorgeous and complex automata of the day. Gustave stepped back to allow Henry to gradually assume the leadership of the company. By 1900, though, father and son were estranged and Henry no longer participated in the business. Gustave once more ran the firm, until his death in 1904. Shortly after Gustave's death, **Auguste Triboulet**, a foreman at the Vichy factory, purchased the firm and took over its leadership. Upon his death in 1920, Triboulet's wife sold the firm to **Jouets et Automates Francais** (JAF), makers of electric advertising automata.

As Gustave Vichy was one of the preeminent makers of mechanical figures, here are a few typical examples of his work. Produced as a reflection of people's interest in exoticism, the Moorish Harpist (c. 1880—**photo 7**) sits upon a velvet-cushioned stool as she plays her instrument, emoting with her eyes and a twist of her head.

The Cuisinier or Drinking Chef (c. 1885—**photo 8**) is thought to be based on a French children's nursery rhyme about a woman,

LEFT: 7. Moorish Harpist automaton, c. 1880, by G. Vichy, Paris, France.

RIGHT: 8. Cuisinier (Drinking Chef) automaton, c. 1885, by G.Vichy, Paris, France.

9. Pierrot Ecrivain (Pierrot Writing) automaton, c. 1895, by G. Vichy, Paris, France.

Mère Michel, and her lost cat. While there are many variations of this story, both in print and song, our automaton represents a vengeful chef whose attentions are spurned by the woman he loves.

Pierrot, a character from European pantomime, was originally created as a lighthearted prankster who was acrobatic, proficient at tumbling, and quite a dancer. However, the character evolved into a sad, romantic figure, often with a tear painted on his white cheek. Considered a signature piece of the Guinness Collection, Pierrot Ecrivain, or Pierrot Writing (c. 1895—**photo 9**), laments over his love, Columbine.

The second part of this article, in the next issue of *AM*, will continue the overview of historic automata in the Guinness Collection at the Morris Museum. AM

The Morris Museum

The Morris Museum is the home of the Murtogh D. Guinness Collection of 750 historic mechanical musical instruments and automata.

6 Normandy Heights Road
Morristown NJ 07960
https://morrismuseum.org/

Tefnut

Building an Egyptian-cat automaton

by David Bowman • Mechanicsburg, Pennsylvania, USA • Photos by the author

As a kid, I always enjoyed free-style building with Erector sets but was always a little disappointed in the flimsiness of the girders and the lack of precision in the meshing of the gears. When I was about 13, my Erector set was banished to the attic and I began a new part-time career, in antique restoration. My grandmother was an antique dealer and she took advantage of my interest in exploring how things worked (or didn't work) and in fixing things. She exploited me as semi-slave labor. I did learn a lot, though, and developed quite a bit of experience in improvisational repair of old things.

I guess that I would fit into the category of a self-taught artist. I did take one art class as an elective in college, but the professor said I failed to "find myself" and I ended up with a grade of B-. This might have been due to the fact that I didn't wear sandals and dress in natural fibers.

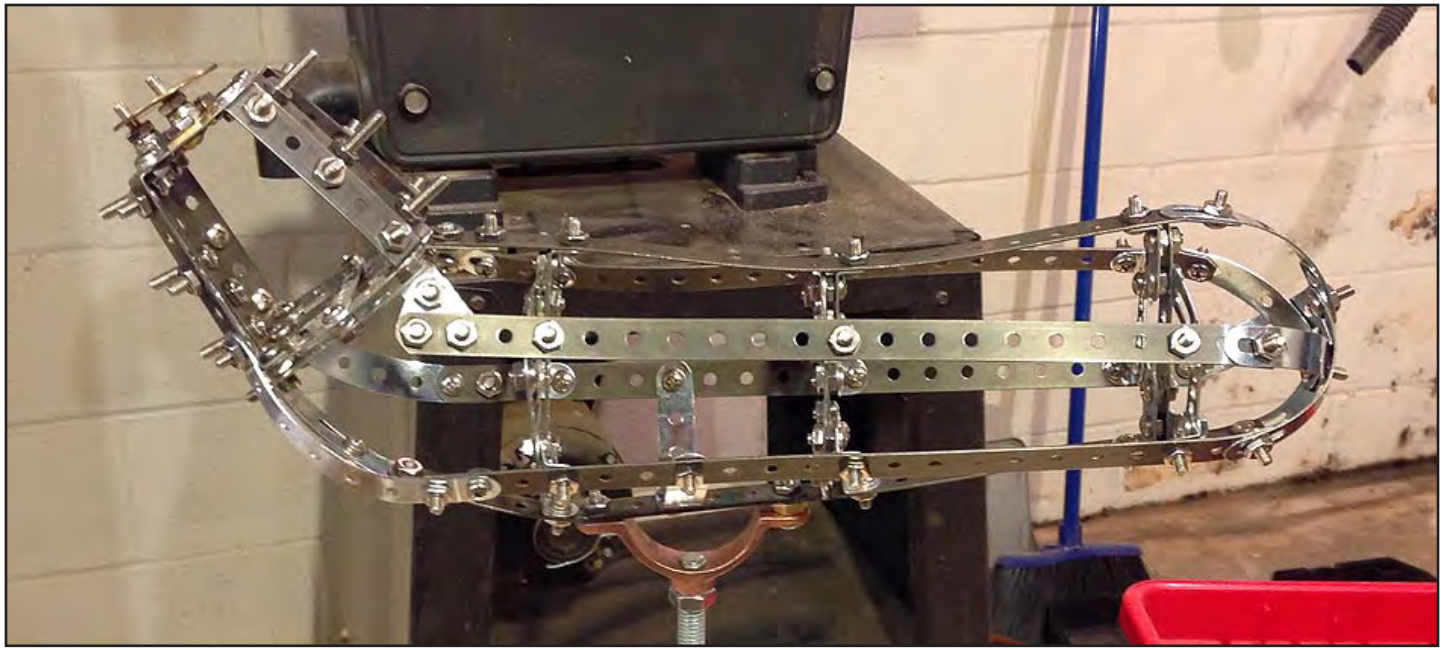
During high school and college, I also discovered a fascination with biology. I learned to perform

Tefnut, the Egyptian cat, was constructed of Meccano pieces and gears, salvaged copper, and the skull of a real cat.

autopsies on roadkill mammals and birds, which I collected to make study skins and skull preparations for my high-school and college museums. As the museum lab assistant in college, I really enjoyed doing taxidermy study skins, until my professor handed me a dead armadillo. After recovering from that challenge, I tinkered in amateur taxidermy for a while (excluding armadillos).

One thing that fascinated me was the mechanics of the skeletal system and how it was moved by the muscles, ligaments, and tendons. This led me to take mostly biology and physics classes in college. During these studies I became consumed by Nicola Tesla, and particularly the descriptions of how he could develop plans for his complex creations in his head, without writing much down. From this I learned to enjoy developing plans for creating and repairing things primarily in my head, letting the concepts evolve as I work on them. Oddly, a lot of my problem solving occurs at night, while I'm in a semi-conscious state.

I spent my career as a middle-school biology and pre-physics teacher (I loved the simple-machines unit and Rube-Goldberg contraptions); in summers I repaired period-antique furniture (with the occasional minor repairs to a tall clock thrown in). After that, I began thinking about what my next career would be.



1. The cat's body in the early stages of construction. Primary building components are Meccano construction-set parts, acquired via eBay.

In 2015, while cruising the internet late one night, I stumbled upon antique Meccano building-set pieces. This led to my current project, *The Mechanical Zoo*, which combines my love of biology, mechanics, and antiques. Other mechanical mammals, fish, birds, and insects can be seen on my website: *http://salvagedolls.net/*

The patina of the perforated strips from Meccano's nickel era (1920s), the precision of the machined, solid-brass gears and pinions, as well as the effectiveness of the sprockets and chains just screamed classical physics to me, and provided unlimited building medium for creations. As you will see in the photos, I enjoy having all mechanisms plainly visible, not shrouded in clothing or coverings.

Tefnut, the Egyptian cat

Tefnut started out in my head, as do all my creations. I had found a cat skull (no lower jaw) on a nature hike about 20 years ago. Recently, I ran across this skull in a box. It basically said to me, "Well, are you going to do something with me or do I stay in this box in the basement for another 20 years?"

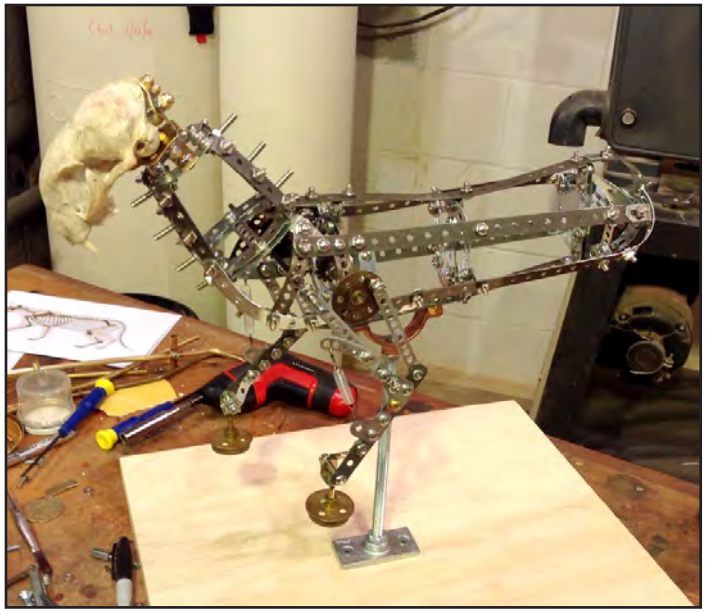
As with all of my automaton creations, I have no plans or drawings. Using the antique Meccano building-set parts from England (eBay UK is a great thing), I began fabricating a body (**photo 1**). The possibility of bringing the cat back to "life"—à la Dr. Frankenstein—was my driving force in this project.

Next came the neck and head, after which began the process of

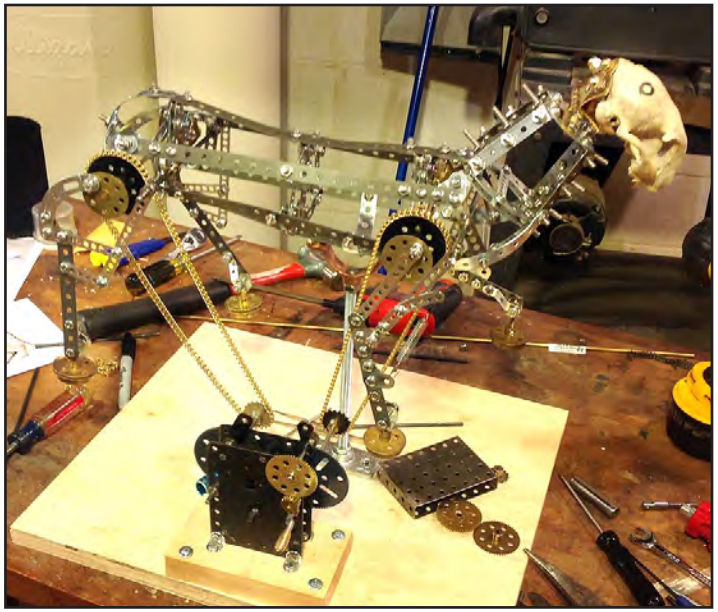
making the legs move. Trying to mechanically recreate the physics of how a mammal leg moves was much more difficult than I had anticipated (**photos 2** and **3**). When I am stuck on how to achieve a certain mechanical motion, I look through the sketchbook drawings of Leonardo da Vinci. His creative genius will usually provide a clue as to how to do it. A close-up of the mechanics of the forequarters can be seen in **photo 4**.

I like to use salvaged copper flashing from old chimneys in my projects. A pile of this material was acquired while I was restoring some vintage log cabins for clients. I normally beat the tarnished copper flat with a hammer, soak it in diluted hydrochloric acid, then scrub it with steel wool. Cleaned up, it looks great and still has some character.

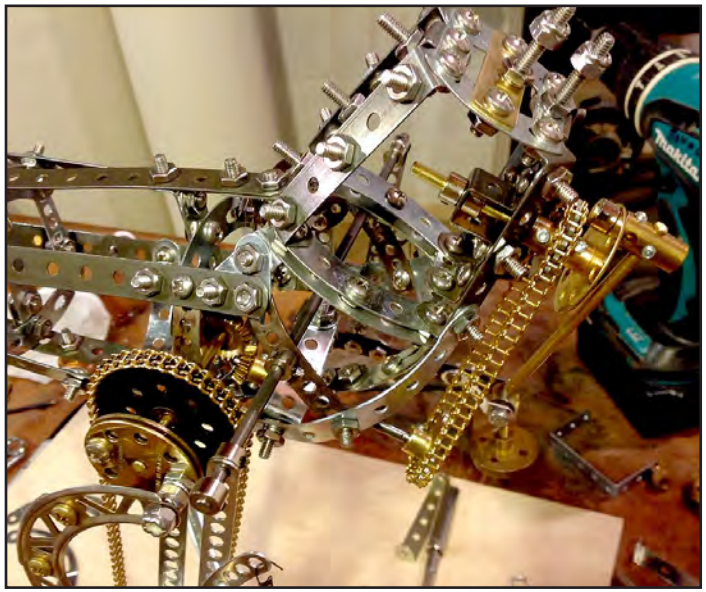
I form it with hand tools and a set of old hand-crank bending rolls. I use aviation shears to cut the shapes, and a propane torch for soldering. Final polishing is done with a buffing wheel and some red rouge. A brass hinge solved the challenge of a mechanism to move the cat's head up and down (**photo 5**). Using the recycled copper led to my business



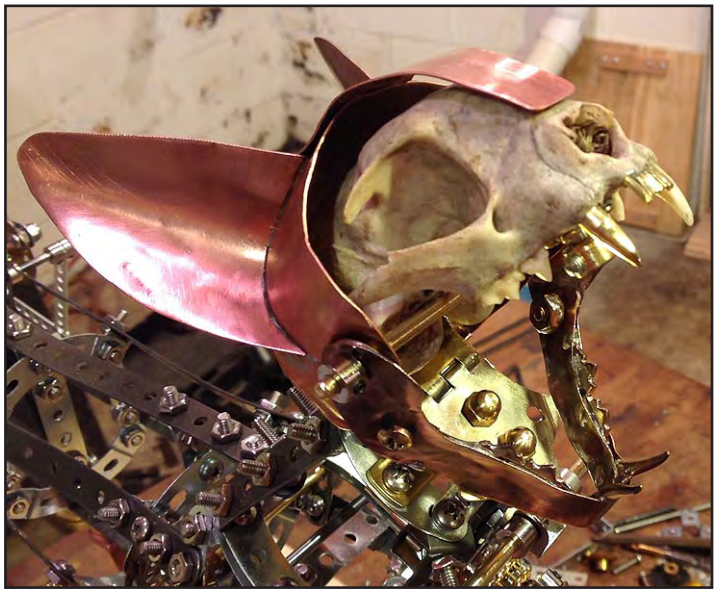
2. The forelegs, with mechanical linkages in place.



3. Rear legs have been added, along with sprockets and ladder chain, to control the motion.



4. A close view of the neck and forequarters, showing the mechanics. The head has yet to be added.



5. The copper head and mandible encases the skull, which pivots on a brass hinge.

name of Salvage Dolls—animated dolls mostly comprised of antique and recycled materials.

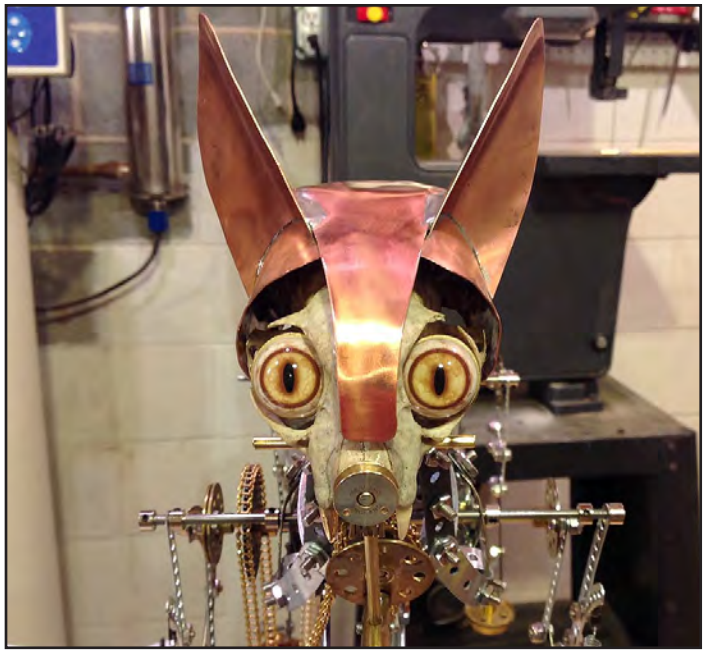
Designing the ears and head piece to give the cat an Egyptian flair was my next goal. I'm not really sure why the cat had to be Egyptian, it just did (**photo 6**). Studying photos of Egyptian-tomb cat statues guided me through this design process.

The glass eyes (Canadian lynx) from a taxidermy-supply catalog really started to bring the cat to life. Using more copper, I made body bands to dress up its carcass a bit (**photo 7**).

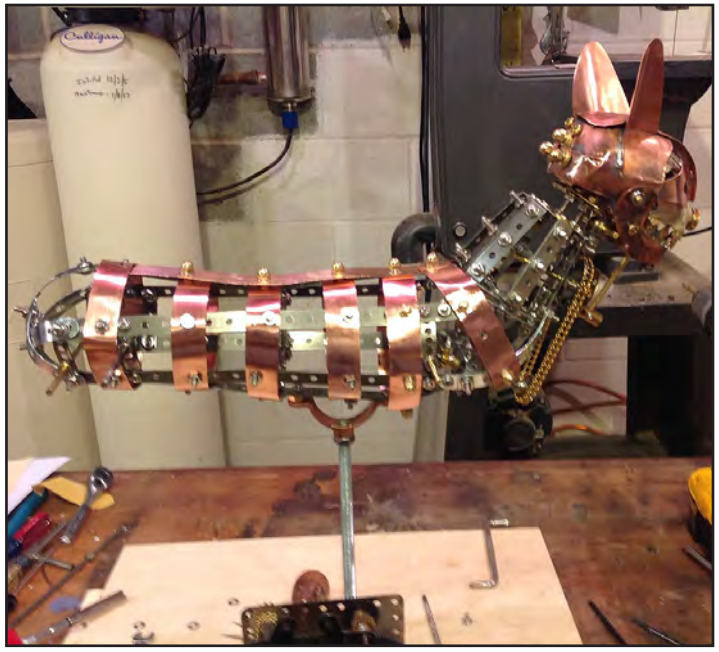
After watching my sister-in-law's black cat, I realized that much of a cat's personality is revealed in the flicking of the tip of its tail. This flicking tail was achieved— after much experimentation—by using a piece of flexible copper tubing and making some articulated copper pipe links (**photo 8**).

Earrings and a nose ring (from Cracker Barrel) finished off *Tefnut*'s final look (**photo 9**). The entire project took about 300 hours. Even though the creative process is fascinating and stimulating, it is also mentally exhausting! Some days you just have to walk away and do something else.

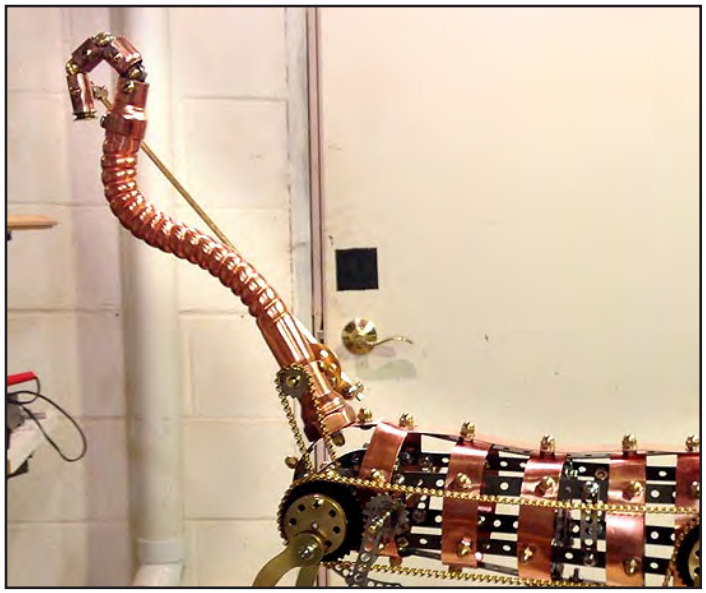
The motion of the cat is achieved



6. Taxidermy eyes help to bring the cat to life.



7. Copper bands round out the body, helping to give it form.



8. The tip of the tail has its own mechanics, adding to the cat's character and movement.

9. Earings and a nose ring adorn the finihsed head. Note the brass teeth in the lower jaw.

10. *Tefnut* on display at Baltimore's American Visionary Art Museum.

11. Installed in her final home, *Tefnut* entertains pets and their owners, at the Gettysburg Pike Animal Clinic.

either by a hand crank or by winding up a vintage Meccano clockwork motor. You can see it run using the spring drive here: *https://tinyurl.com/tefnutcat*

Tefnut spent about eight months hanging out at *The Great Mystery Show*, in the American Visionary Art Museum in Baltimore (**photo 10**). She now has found a "forever home" at the Gettysburg Pike Animal Clinic, in Mechanicsburg, Pennsylvania. Here, she greets and entertains patrons and their pets as they sit in the waiting room (**photo 11**). A1.

Making one-way cranks

Two methods for preventing counter-rotation

by Marc Horovitz • Denver, Colorado, USA • Drawings & photos by the author

Each of these automata was built with a one-way cranking mechanism.

With most hand-cranked automata, it doesn't matter which way you turn the crank, but sometimes the crank must be turned in one direction only. Suppose your automaton goes through a set of actions. If they were reversed by cranking backwards, the sequence might make no sense. Another reason for desiring one-way cranking is if the mechanism could be damaged by reverse cranking.

There are several ways to accomplish one-way cranking. Here are two relatively simple ones that can probably be achieved with hand tools.

The wedge

A separate device must be incorporated in the automaton's works to keep the crank from wrong-way turning. This is best installed on the crankshaft itself. One method involves a wedge.

There are two primary parts to this device—a wheel and the wedge that bears on it. The wheel is mounted on the crankshaft, just inside the box where the shaft comes through. The wedge is mounted on a spindle adjacent to this wheel (**figure 1**).

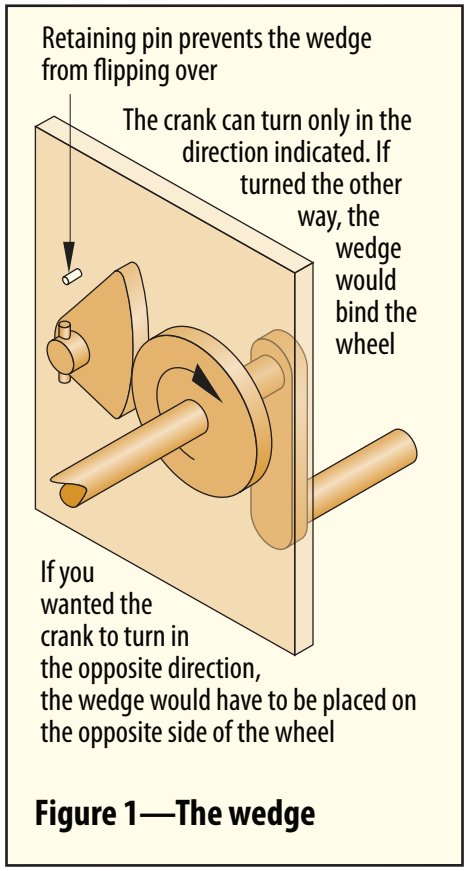


Figure 1—The wedge

The shape of the wedge is fairly important. A shape based on a spiral would be optimal, but this can be approximated, as shown in **figure 2**. In the drawing, the wedge is derived from two circles, one the same size as the adjacent wheel and the other twice the diameter. The larger circle is overlaid on the smaller one, with their

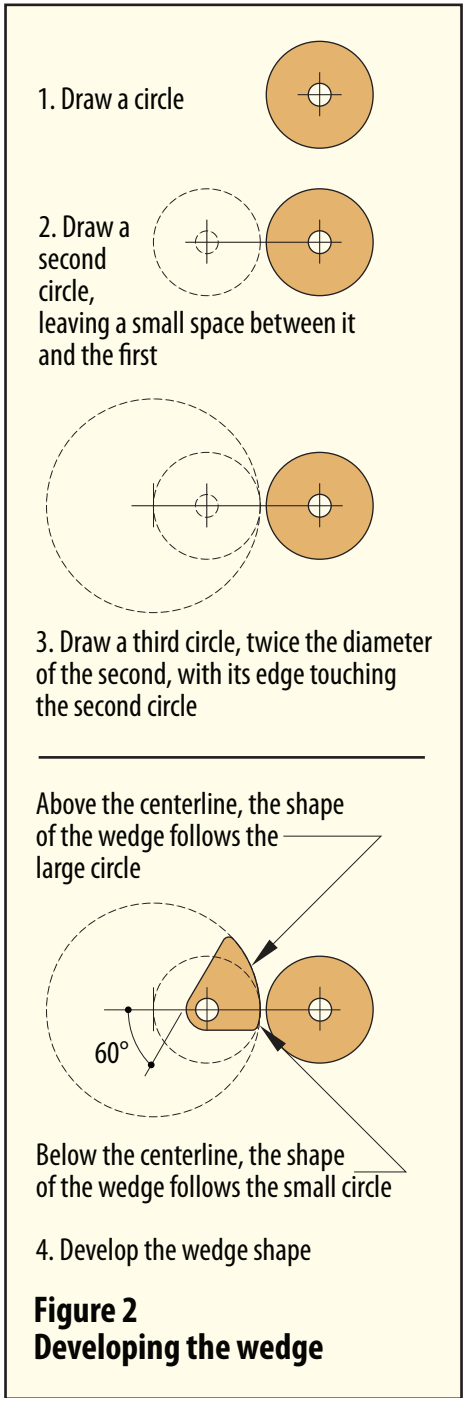
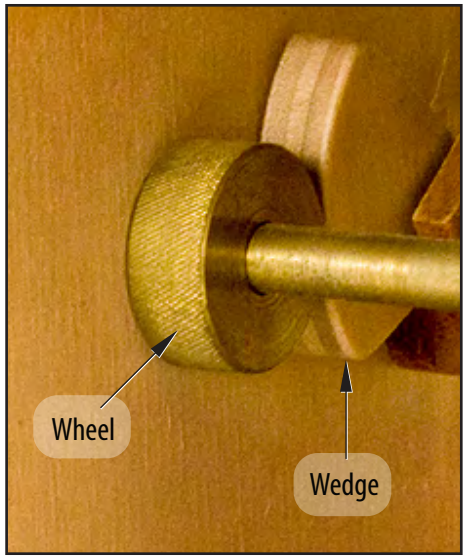


Figure 2
Developing the wedge



The wheel in this automaton is made of brass. To prevent it slipping against the wooden wedge, should the crank be wound backwards, the edge of the wheel has been roughed up.

edges touching. The upper part of the wedge follows the form of the larger circle, while the lower part follows the smaller. The pivot point of the wedge is the center point of the smaller circle.

Both the wheel and the wedge can be made of wood, probably the ideal material. Metal or plastic can present too smooth a surface to be effective. If you are using some smooth material, the contact faces could be covered with thin leather, rough side out, to compensate.

The wheel must be securely attached to the crankshaft. The wedge is hinged on a pin mounted in the wall of the box. The wedge must be mounted next to the wheel (not above or below it). Its pivot pin should be on the same horizontal centerline as the crankshaft and should be a loose fit so that, without the wheel in place, the wedge just flops down. With the wedge raised so that its lowest point is near the wheel, there should be a tiny amount of space between wedge and wheel. Ideally, when the wheel is in place and the wedge is dropped against it, the wheel should contact the wedge about a third of the way up from the bottom point of the wedge.

When the crank is rotated in the correct direction, the wedge is lifted slightly and does not affect operation. However, if the crank is turned in the opposite direction, the wedge immediately (and silently) becomes jammed against the wheel, preventing rotation in that direction. To unjam it, simply crank in the right direction.

This is a pretty foolproof method, but the wedge must be well made and properly positioned in relation to the wheel. A little experimentation may be in order.

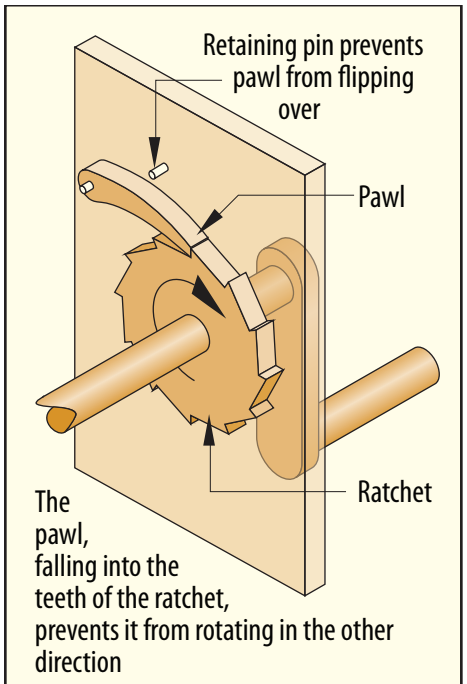


Figure 3—Ratchet & pawl

The ratchet and pawl

The other method discussed here is the ratchet and pawl. The ratchet is simply a toothed wheel. It can have any number of teeth—I have drawn it with 12, which is convenient. The pawl is just the little pivoting piece that engages the teeth (**figure 3**).

A ratchet wheel is easy to develop (**figure 4**). You can do it on your computer in a drawing program or with a compass and straightedge. Draw two concentric circles, one a little smaller

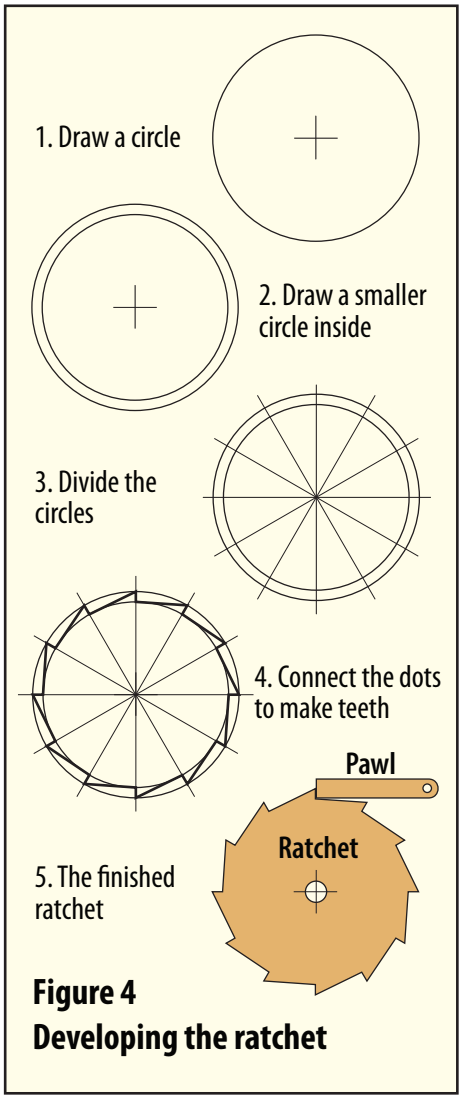
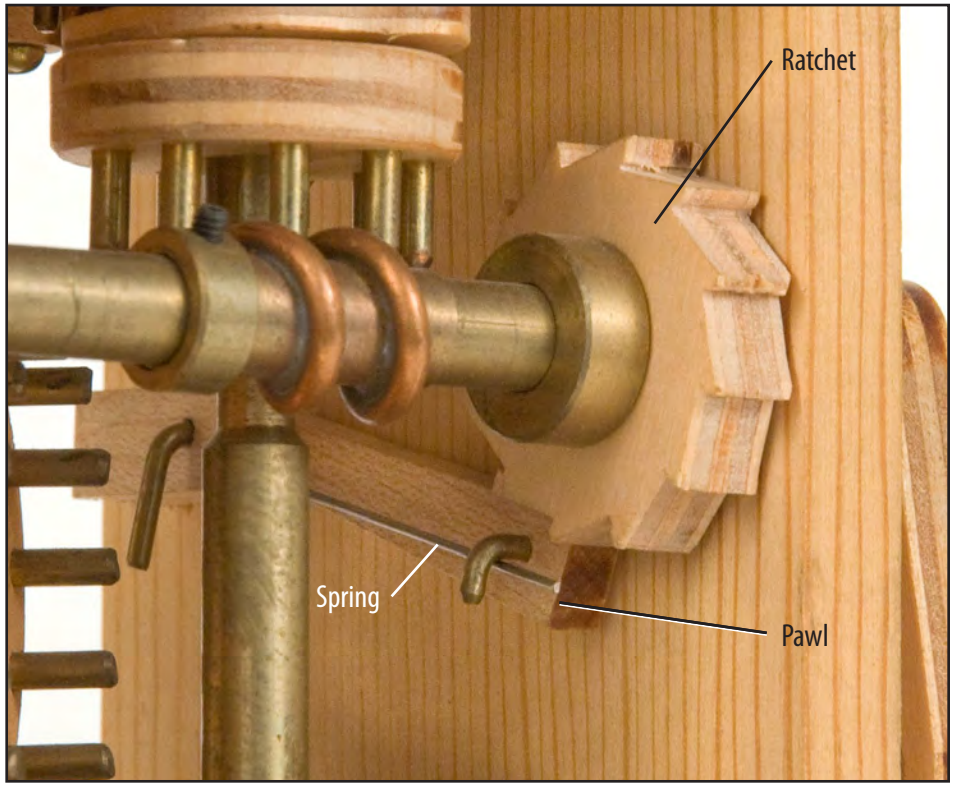


Figure 4
Developing the ratchet



This ratchet has a brass hub that is fixed to the shaft with a set screw. The pawl presses on the ratchet via a spring wire and makes a clackety-clack sound when the ratchet is turned.

than the other. Divide your circle into the desired number of segments using lines through the center points. Then just draw the teeth in, as per the drawing. The ratchet can be cut out with a coping saw, scrollsaw (fretsaw), or bandsaw. It need not be terribly accurate, as it will still work just fine.

The pawl can be as plain or fancy as you wish. In its crudest form, just a stick with a hole drilled in one end would suffice. If this doesn't appeal, it can be any shape you like, as long as it functions properly.

The ratchet should be secured to the crankshaft. The pawl, like the above wedge, should be mounted loosely on a spindle. This spindle should be mounted above the ratchet so that its business end more or less touches the vertical centerline of the ratchet.

When the crank is turned in the correct direction, the pawl will just ride across the points of the teeth. However, when the crank is turned the other way, the first available tooth will engage the pawl, locking up the whole mechanism.

Even a crudely made ratchet and pawl should work satisfactorily. There are a couple of other things to consider, though. One is the number of teeth, as this will determine the amount of "backlash" there is. Backlash, in this case, can be defined as the distance the crank will travel in the wrong direction before a tooth comes along to stop the action. The fewer the teeth, the more backlash, the more movement in the wrong direction. If this isn't a concern, you might be able to get by with as few as six teeth. If damage could occur immediately, perhaps as many as 24 teeth would be better.

One advantage to the ratchet-and-pawl system is the fact that the pawl can be positioned virtually anywhere around the ratchet (**figure 5**). However, if it isn't right at the top, additional measures may be necessary to get the pawl to drop properly. This can be via the use of weights, as shown in the drawing. If there isn't enough room for weights, a spring of some kind might be employed on the pawl. A by-product of using a spring, though, is the clackety-clack sound that will then be produced as the pawl passes each

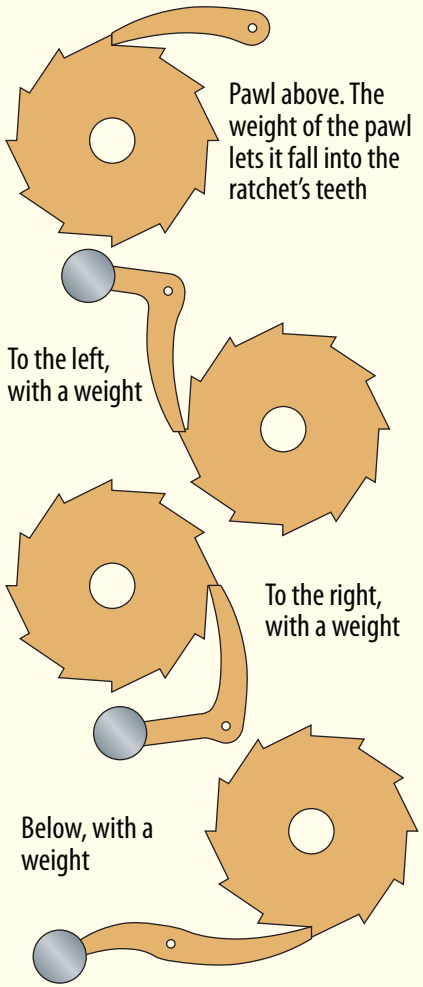


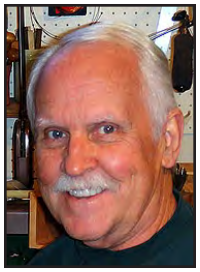
Figure 5—Pawl placement

tooth when the unit is cranked in the proper direction.

There you have it. If you need one-way cranking capability, one of the above methods should work well for you.

GALLERY

The Flasher by Michael Croft



Tucson, Arizona, USA
Photos by the author

In *The Flasher* (created in 2001), each arm is attached to a rod that drops through the floor and is attached to a disk on which is a protruding finger. A single cam passes between the fingers, spreading the figure's arms and opening his coat, thus triggering the flash. The flash is an LED inserted in the camera body and connected to a battery embedded in the figure.

Video
https://tinyurl.com/croftflasher

Cat by John Bryant

Georgetown, Kentucky, USA
Photo by the author

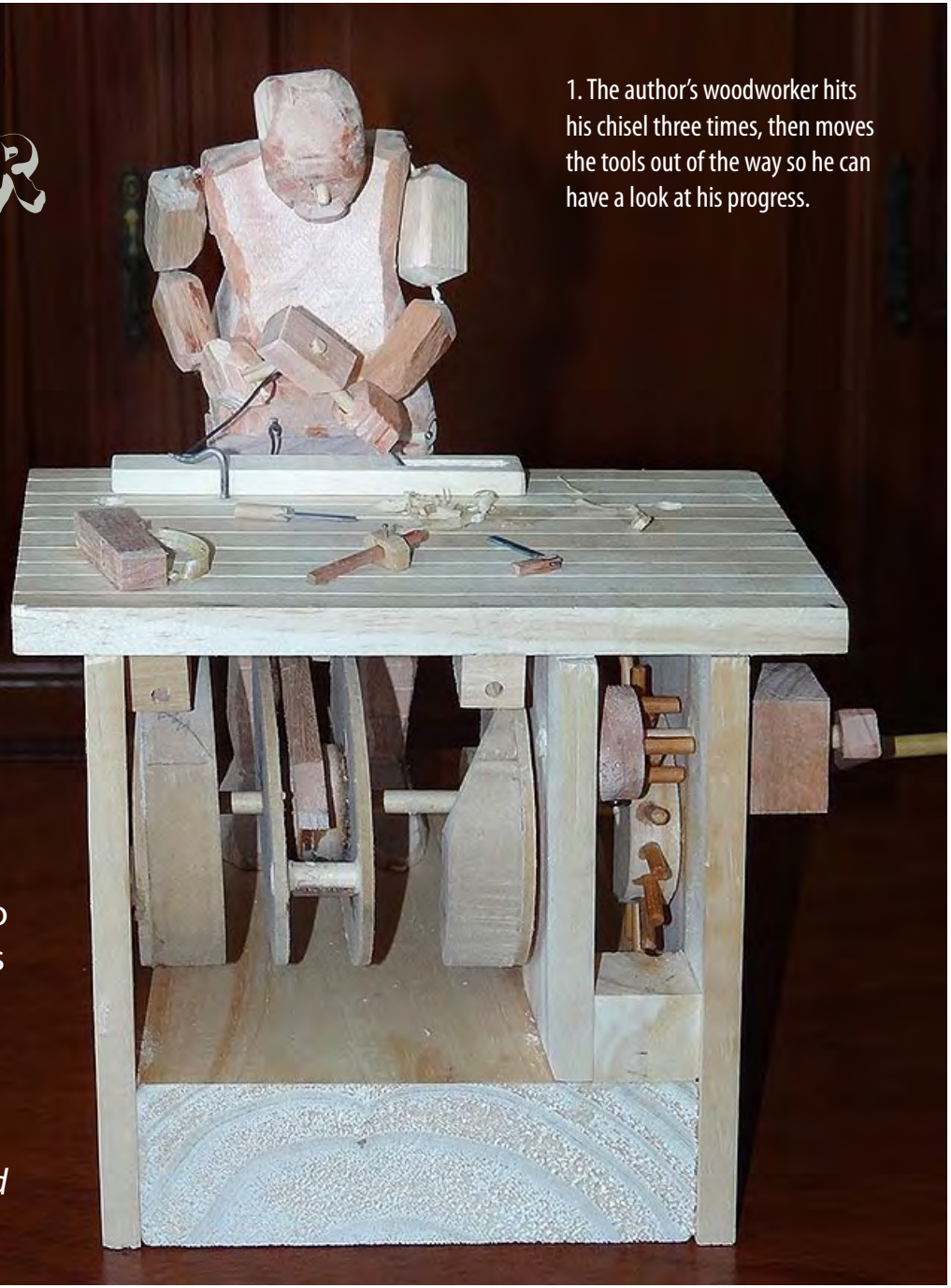
This is my first attempt at building an automaton. The idea was found online and the piece was made of poplar. Gears were made from 2"-diameter poplar dowel, purchased a the local hardware store.

Video
https://tinyurl.com/bryantcat

The Wooden Woodworker

My first automaton—and I hope not my last

by Alejandro Viegas Palermo • Buenos Aires, Argentina
Photos by the author



1. The author's woodworker hits his chisel three times, then moves the tools out of the way so he can have a look at his progress.

I'm a sixty-year-old retired Argentine naval aviator, and I now have some spare time. A couple of years ago, I embraced woodworking as a hobby and I enjoy making basic furniture and other things.

Last year, my daughter, Agustina, introduced me to the world of automata through some YouTube videos and by lending me a couple of books—*Wood Automata Tips and Tricks*, by Ken Schweim, and *Cabaret Mechanical Movement: Understanding Movement and Making Automata*, by Aidan Lawrence Onn and Gary Alexander. She also built Christopher Blasius's *Cat and Mouse* automaton from a set of plans.

The concept

I soon found myself searching for a simple repetitive sequence of motions that I could use to make an automaton. Later that week, while using a chisel to fine tune a mortise for a kitchen stool I was making, I repeated a hit-hit-hit-look sequence a couple of times and realized I had found the sequence of motions I was looking for!

The script would be: A woodworker stands at his workbench, mallet and chisel in hand, working on a mortise. The cycling movement would be: Hit-hit-hit, pause, spread the mallet and chisel out of the way to have a look, then repeat (**photo 1**).

I'd heard something about linking the movement "backwards," as in the mallet moving the hand instead of the arm and hand moving the mallet. I think I read this in an article by Paul Spooner about *Poisoned Milk*, where the "milk" moves the cat's tongue. That solved a lot of problems for me.

I modeled a rough mockup in SketchUp Make (version 17, the last free desktop version) and tried adding some movement with the MSPhysics plugin. I definitely did not master these programs but they gave me a good preview of my concept (**figure 1**).

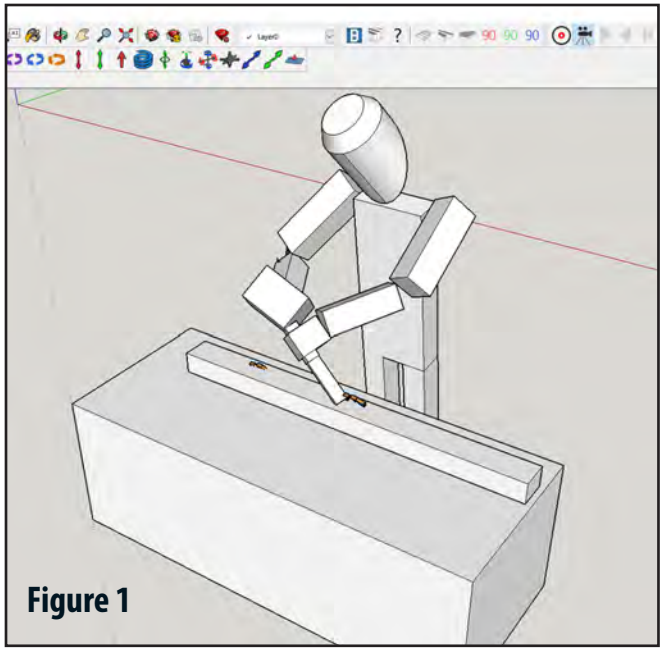
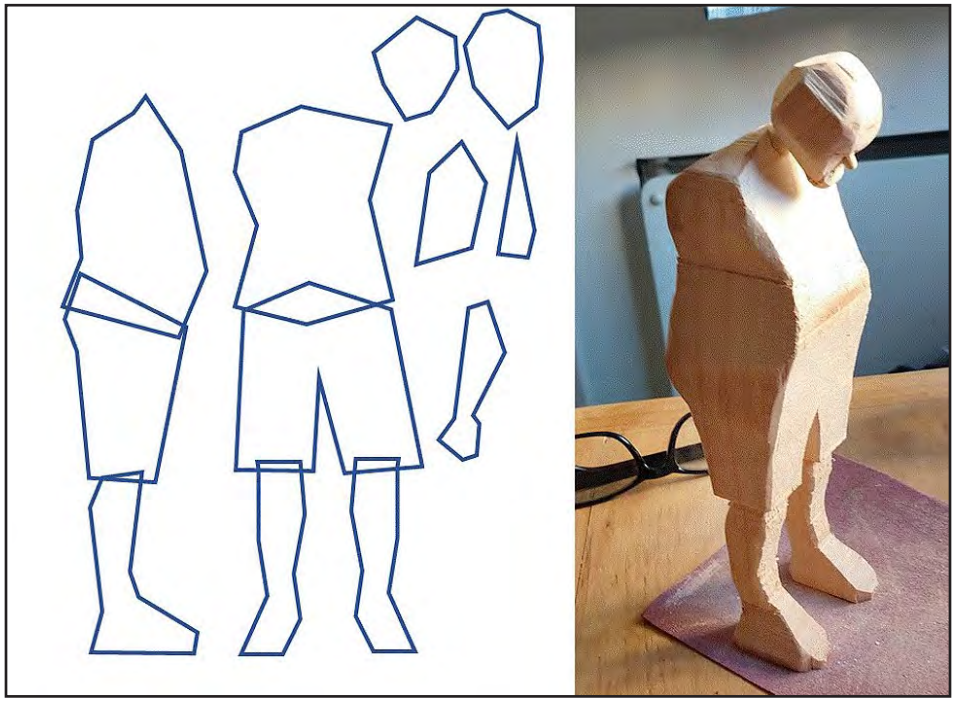


Figure 1

LEFT: A screenshot from SketchUp Make, showing the basic components of the automaton.



BELOW: 2. The author photographed himself as a model for his automaton, then outlined his basic body shapes as starting points for the various parts.

The tools I used for this project included a table saw, a bandsaw, and a drill press for the larger wooden parts. Also used were a small, flush-cutting Japanese saw for smaller cuts; pliers; a (very) cheap, (very) small carving chisel set; CA cement and standard wood glue; a wireless drill with 6.5, 6, 4, 1.5 and 1mm drill bits (1/4", 15/64", 5/32", 1/16", and #61, respectively); 0.9mm (.035") black wire; some small nails; a couple of rubber bands; sandpaper; and a small knife. I used some scrap pieces of construction lumber: 2" x 6" pine and 3" x 3" eucalyptus.

The figure

The woodworker figure is roughly based on myself—one's self is the most available model you can get. I fixed my phone to a broomstick with a rubber band (poor man's tripod) and took front and side pictures of myself standing at a marked spot near recognizable references, whose height I measured. I mimicked the positions I wanted for the woodworker. I then imported the pictures into PowerPoint and traced polygons over the main parts (**photo 2**). (Side note: While doing this, I saw my body's shape and decided

to start my diet on Monday. Okay, next Monday…maybe.)

I chose a scale of 1:7, just because it fit well on a standard A4 page. I then printed out the traced polygons, glued them to a piece of construction-grade 3" x 3" eucalyptus, and cut the shapes on my bandsaw. I rounded some of the edges with my general-purpose carving/marking knife (a paring knife from Ikea).

For testing, I used pieces of rubber band for the shoulder, elbow, and wrist articulations. This worked great—the joints were flexible but with just the amount of spring-back that I wanted. However, rubber gets brittle over time so I tried some alternatives. After some experimenting, I settled for *crochetina*, a thin synthetic cord that I found in my wife's sewing box. It has no spring-back at all but does give smooth movements.

I bored a hole in each side of the articulated joint, added a drop of wood glue in each hole, and poked the cord in with a clip or wire. I also tried CA cement. This worked, too, but I couldn't avoid moistening the whole cord with CA, making the articulation quite stiff when the cement set up.

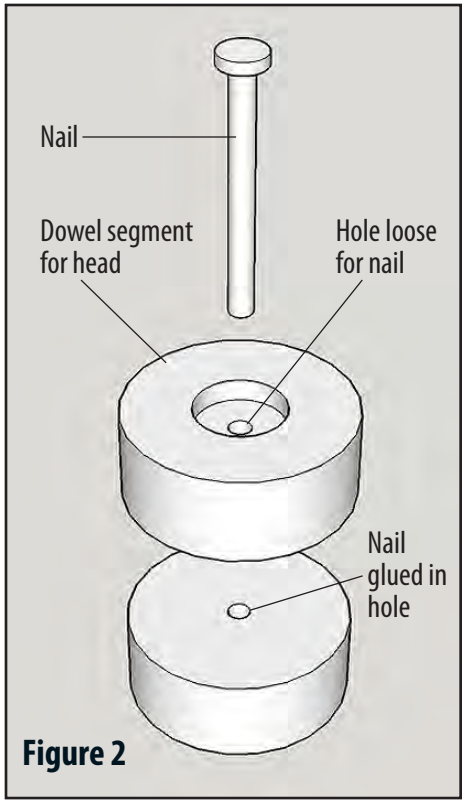


Figure 2

The drawing for the neck assembly. The hole through the top segment is a little larger, allowing the attached head to move freely.

While working on the head with a small carving tool, I chiseled out the figure's nose. I then bored a hole in his face and inserted a small dowel for the nose.

I wanted the woodworker to be able to turn his head sideways, so for the neck, I bored a hole through two short segments of 10mm (3/8") dowel and used a nail to connect them—loosely on the upper segment and fixed (with CA) to the lower one (**figure 2**).

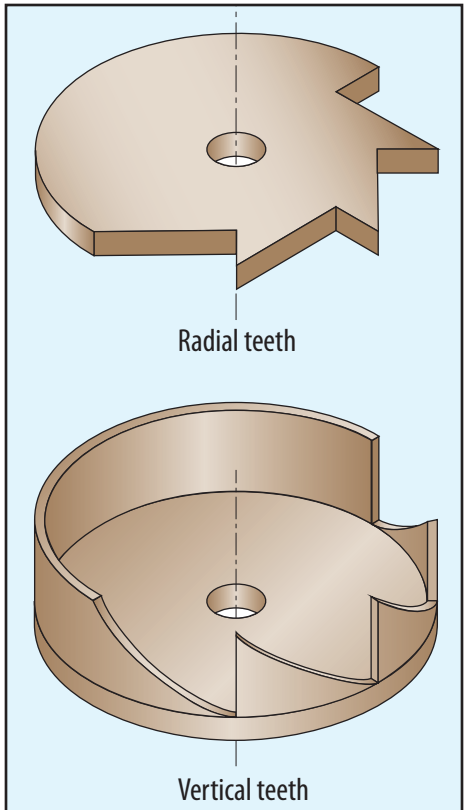


Figure 3
Radial teeth vs. vertical teeth

The mechanism

I also started experimenting on a mechanism that would make the three hits, spread the tools, then repeat the hits. I first tried a ratchet-like wheel, with a 180° smooth section for the "pause/look," and three teeth for the mallet hits. To get enough amplitude in the hammering and spreading movements in a single turn (actually, half a turn, since the pause-look phase takes half a cycle), the wheel radius was a little too big and the geometry of the whole thing was difficult to align with the movements I needed.

Agustina then showed me a video of an automaton called *Dorothy's Shoes*, where I saw that the teeth worked in the direction of the wheel's axis, not the radius (**figure 3**). That suited my needs better and saved a little space, particularly in height.

The first experiments in moving the mallet and chisel were encouraging, and after some refining, I got there. The final version encloses the two 80mm-diameter (3.15") driving wheels on a 6mm (1/4") shaft under the workbench (**photo 3**, **figure 4**).

A couple of nearly parallel shafts, tilted up 10°, actuate the chisel and the mallet. These are fixed to the underside of the benchtop. These shafts have 90° spring-loaded followers that ride the profiles of the driving wheels. The "spring" is a couple of rubber bands (**photo 4**), which I know will get old and brittle soon. I will

replace them, probably with some springs from an old printer I took apart (next Monday…maybe).

The mallet's drive wheel has three teeth arranged in a half circle that control the hits, and a smooth half for the pause/look position. The chisel has a smooth half circle aligned with the hitting mallet and the other half "out of the way" for the woodworker to look. The chisel's drive wheel just allows the chisel to rest, half a turn in the hammering position and half in the pause/look position. All the drive wheels are glued to the 6mm shaft with CA (**photo 5**).

Fixing a handle to the end of the shaft that held the drive wheels would do the job as far as controlling the action, but I felt that to get a more natural movement in the hit-look sequence, the handle had to be turned at an unnatural, super-slow speed. Because of this, I needed some reduction between the handle and the drive train. I tried to make some wooden gears I had drawn with SketchUp and the SPGears extension. I printed them out, pasted them onto wood, and cut them out on the bandsaw. They failed horribly. I'm not skilled enough yet to get a smooth-working pair of gears, so I down-

ABOVE: 3. This wheel controls the mallet striking the chisel.

RIGHT: The left wheel controls the mallet, while the right one controls the position of the chisel in its "work" and "pause" phases.

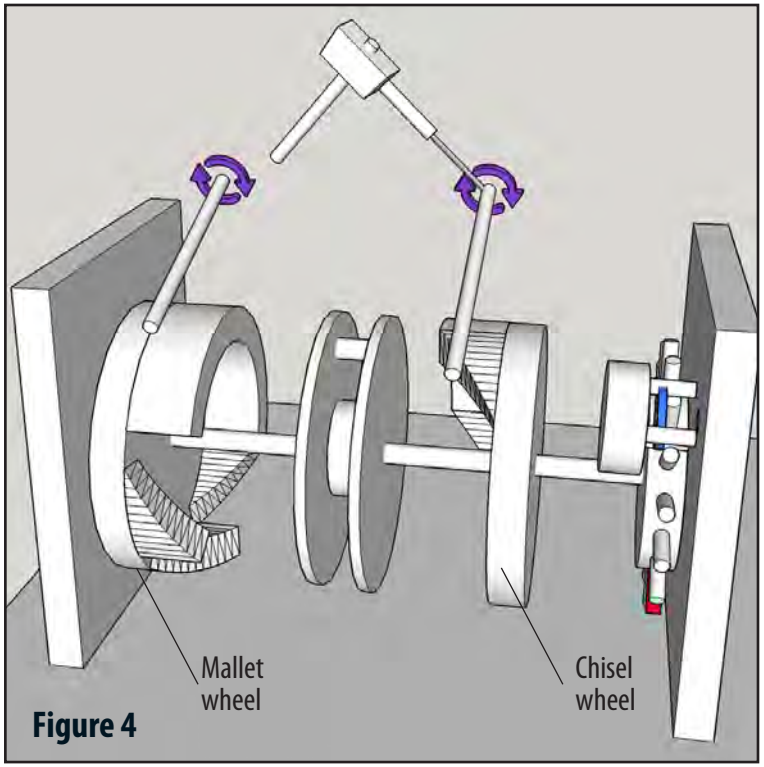
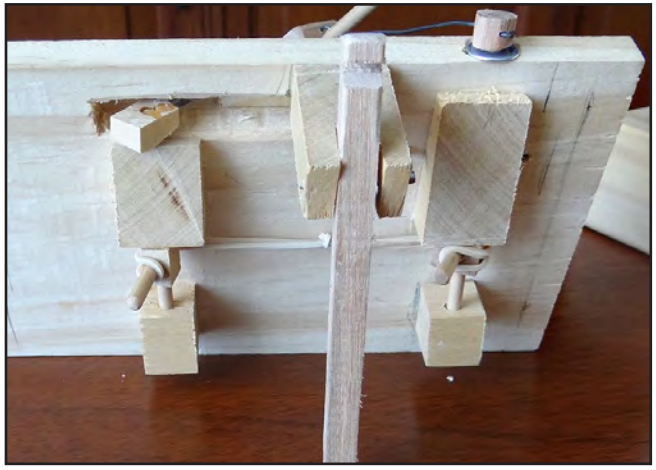
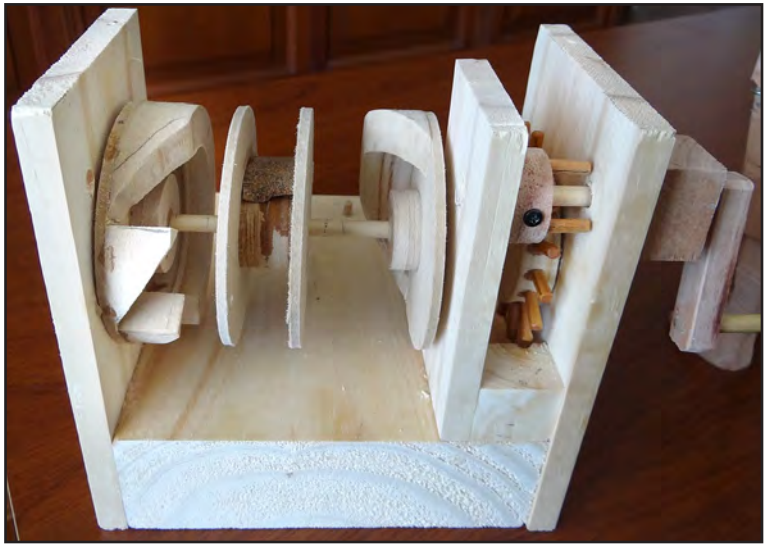


Figure 4



4. Seen from the underside, the shafts—around which the rubber bands are wound—are attached to the mallet and the chisel. The rubber bands will be replaced by a spring.



5. All of the wheels are fastened to the driveshaft with CA cement.

graded to pinwheels.

I tried using MDF for the wheels and 4mm (5/32") pine dowels for the pins, which went well (**photo 6**). I tried using solid wood for the wheel, but what I had available (pine and eucalyptus) made the drill bit "surf" the wood grain and I could not get evenly spaced holes, so MDF it was. Just to make things easy, I gave the wheels three and 16 pins, respectively, getting an "uneven" 5.33:1 ratio (**figure 5**). Surprisingly, in my head, that helped to unlink the lever motion from the woodworker's movement.

After some trials, I found a good working distance between the shafts that would not jam the wheels. Too close or too far made some of the slightly uneven pins jam, or not engage and skip a pin. In all, this pinwheel drive turns a little less smoothly but is much more forgiving than a gear drive.

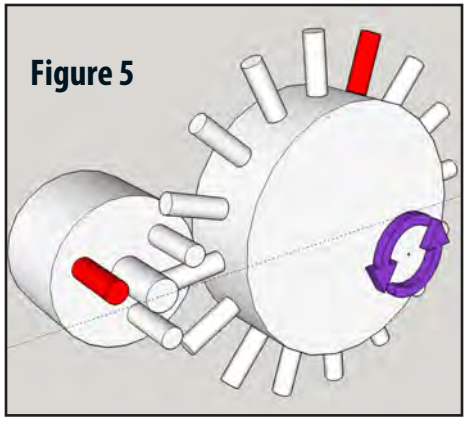
Assembly

I assembled the woodworker and tried the motions, mimicking the movements I needed it to do. From this experiment I realized the woodworker should bend a little at the waist. I bored a 6mm (1/4") horizontal hole through his body at waist height, diagonally from the front left "corner" of his body to the back right. Then I cut the figure in two at the waist, through the hole I'd drilled. I glued segments of 6mm dowel, with axial holes in them, into the hole halves in the body, to form a hinge. Since I had made the hole in the dowel before cutting it into segments, everything aligned well (**photo 7**).

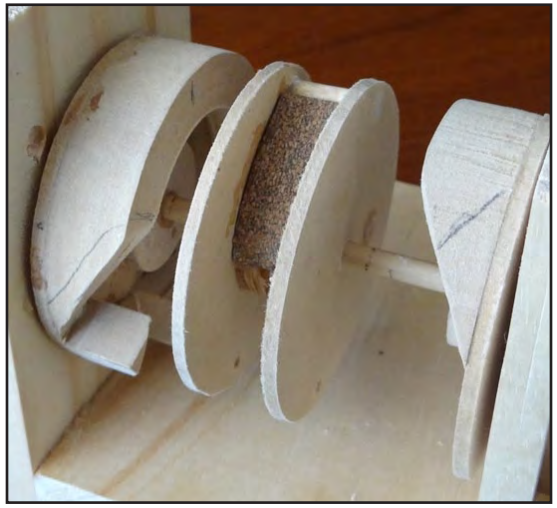
I then added a cam to the driving shaft. This pulls down a lever, which pulls the front of the woodworker's torso forward and to the right, so it appears that he is leaning over the piece he is working on. For this "lean forward/look" cam, I just added two 3mm-thick MDF disks, joined by a 12 mm-diameter (1/2") shaft. I drilled a couple of holes away from the shaft's axis to hold a piece of 4mm (5/32") pine dowel. The body's forward movement was a little too sudden with this arrangement. I added a piece of cork to form a ramp up to the lever, which made the movement more smooth and gradual (**photo 8**).

A fishing-line thread, fixed to the lower part of the figure, runs up his back. When the upper part of his body leans forward, the line pulls on the back of his head, making it turn a little to the left. A spring causes him look

6. An MDF gear blank being drilled for the dowel pins, in the author's drill press.



A screen diagram of the pinwheel gears. Note that, with the pins arranged differently on each of the gears, the shafts remain parallel to each other.



LEFT: 7. A wooden, waist-level hinge, made of dowel segments and mounted diagonally through the cross section of the woodworker's body, allows the figure to lean forward in a more natural manner.

ABOVE: 8. A ramp made of cork, seen in the center wheel, allows the figure's body to bend more smoothly.

back toward the front when he straightens up (**photo 9**). A rubber band pulls the torso back to a standing position when the lever rises. (Yes, a rubber band—but it's exposed in the back of the figure, so I can replace it when it gets old—**photo 10**.)

The mallet and chisel handles are made from 4mm dowel. I bored 4mm holes into the fists of the right and left hands so that I could fix the tools in place just by friction. I later widened the chisel-hand hole and put a metal ring in the chisel handle, to allow the chisel to move the arm more naturally (**photo 11**).

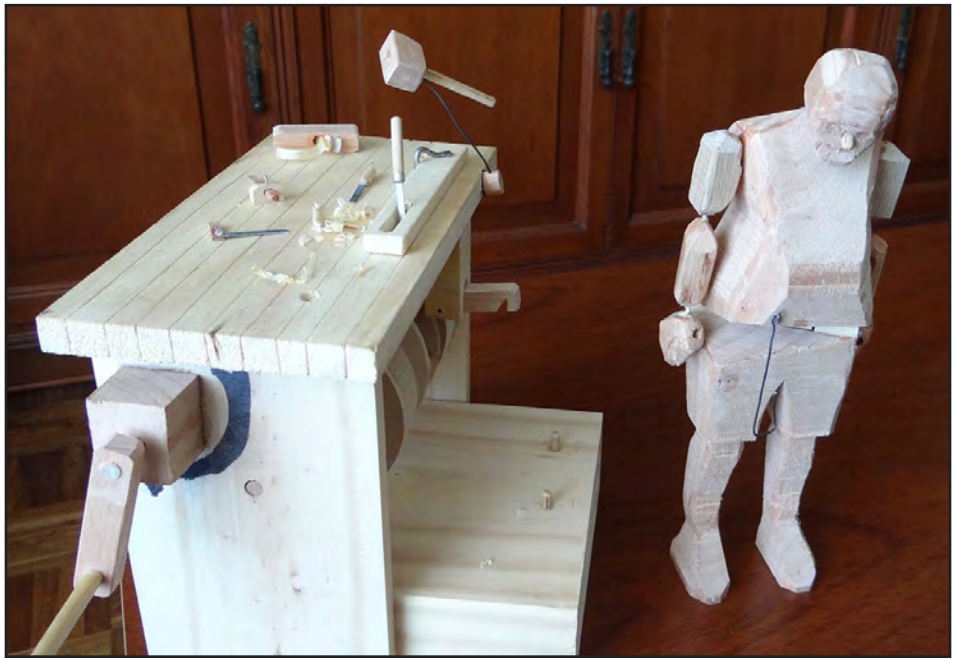
The woodworker's feet have a couple of holes drilled in their soles, which fit on pins in the base. The woodworker is held in place only by friction and gravity. A wire hook links the upper torso to the lever in the base/drive box/workbench. Since the hands are fixed to the mallet and chisel by friction and gravity, I can remove the figure (**photos 12** and **13**). I added some more woodworking tools and wood shavings on top of the workbench, just for fun (**photo 14**).

No wood finish was applied because I put the workbench/drive box together with glue and I am now afraid of sticking the moving

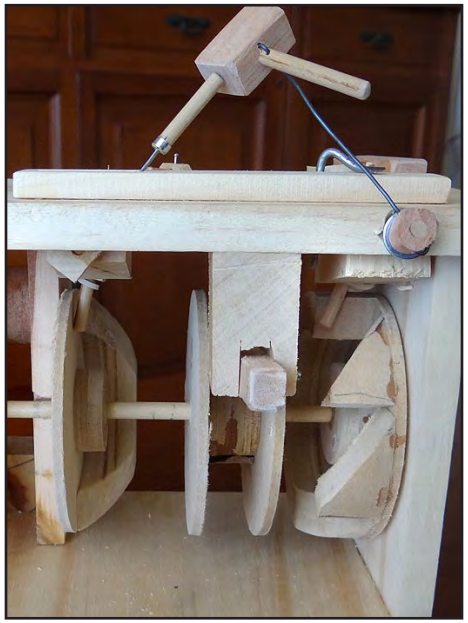
9. Fishing line (just visible) is attached to the figure's head and lower body. When he bends, the line causes the head to turn. The spring returns it to its former position.

10. A rubber band returns the woodworker to an upright position when he has finished examining his work.

11. The mallet and chisel are held in the hands by friction. The hole in the chisel hand was later enlarged so that the chisel would move freely, making the motion more natural.



12. The figure, held in place only by friction and gravity, can be easily removed.



13. The finished workbench, with the figure removed. The mallet and chisel remain in place.

14 . Additional miniature tools and wood shavings were added to the benchtop, as finishing touches.

parts together. Maybe I will use some floor wax to give it some protection (next Monday…maybe).

This project took about two months, from starting to look for an idea to the finished *Wooden Woodworker* automaton. A lot of that time was spent in trial and error (…and error, and error). Yet, I really enjoyed making the piece and I am already exploring new ideas for future automata.

An excellent video of the construction and operation of the author's automaton can be seen at *https://tinyurl.com/chisler*

Write an article!

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You could write about your projects, visits to places of automata interest, your collection, problems you have solved, or what-have-you. This fascinating field of endeavor encompasses all skill levels, and you don't have to be an expert or fine craftsperson to write about your work. With automata, charm and concept are often as important as craftsmanship (sometimes more so!).

And don't forget our Gallery. To be included, please send photos and descriptions of your projects.

automatamag@comcast.net
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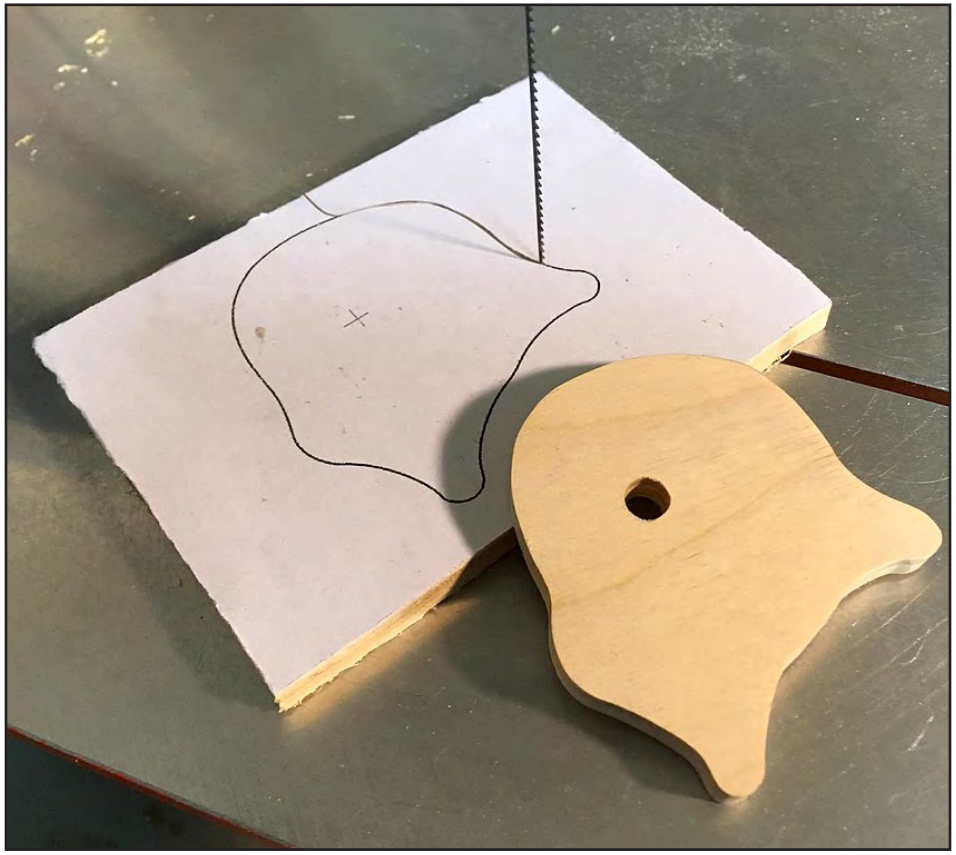
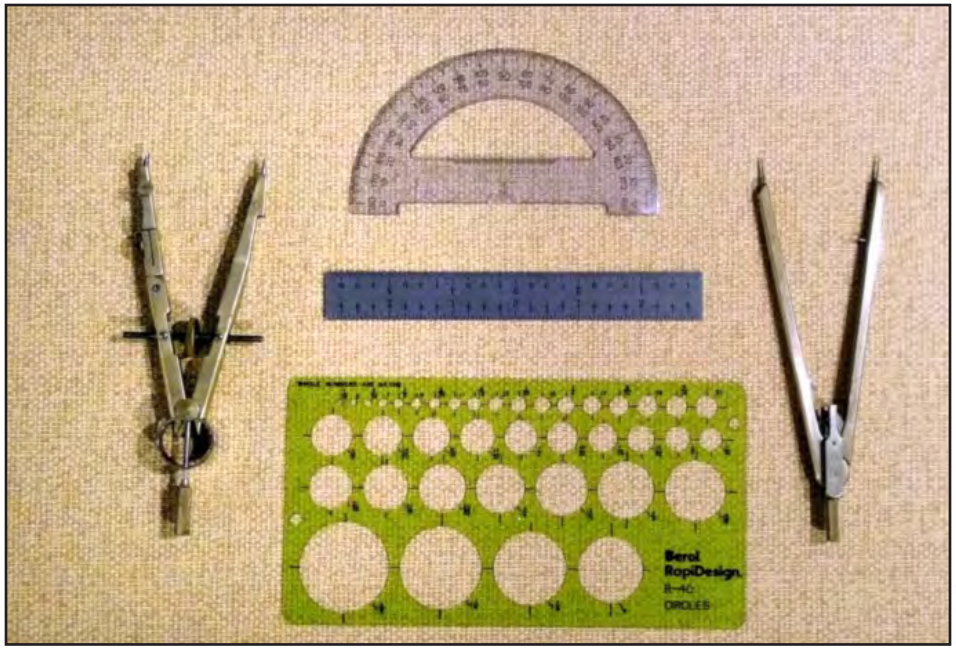
BUILDING BLOCKS

Cams: part 2—the build

by Paul Giles •Sun City Center, Florida, USA
Photos and drawings by Marc Horovitz, except where noted



Cams being cut out on the scrollsaw. Drawings can be done by hand or on the computer, then pasted to the wood to act as cutting guides.



PAUL GILES

Some simple drafting tools will help you get started. At the left is a compass. In the center, from top to bottom, are a protractor, a ruler, and a circle template. On the right is a pair of dividers.

In the first part of this article on cam design, I discussed planning the motion you wanted using a horizontal timeline. This time I'll talk about how to transfer that planned motion directly to the cam's profile.

Transferring the motion will be easier if you collect a few drafting tools (above). You'll need a ruler, a protractor, a drawing compass, a circle template, and maybe a pair of dividers. These don't need to be big or fancy. Just select sizes appropriate for your automata projects. For most of us, a compass and dividers that reach to about 4" (10cm) will be sufficient. You shouldn't need a circle template with holes larger than 1½" (3.8cm). It's important to keep those pencils and erasers handy!

As an alternative, you could certainly draw out your cam profile freehand with even modest artistic skills. We'll be doing a little freehand work anyway, which will even introduce an additional subtle movement within the cam profile. Think of freehand work as the difference between a beautiful hand-cut dovetail joint

and an assembly-line product. The commercial product is precise but lacks the same beauty of handwork. Just be wise enough to use those drawing tools when it makes sense.

Transferring the motion

Set a blank sheet of paper in front of you. Begin by drawing that nominal circle I talked about in the first part of the article (May-June *AM*). From our example, begin with a 1½" (3.8cm) diameter circle. To use the compass, divide the circle's diameter by two, giving you .75" or ¾" (1.9cm). This is the radius of the circle (the distance between the center point and the edge). Put the compass against your ruler and measure that radius with the compass by turning the center wheel. Then draw the circle on your blank paper. Make a small tick mark on your circle. I always put mine at the 12 o'clock position because I like the analogy of a timeline—just like a clock.

Look at your straight-line cam profile and determine how far, left to right, your gentle climb traveled. In our example, the gentle climb traveled left to right about one third of the way as it rose ½" (1.27cm). This increases the new circle diameter by that amount.

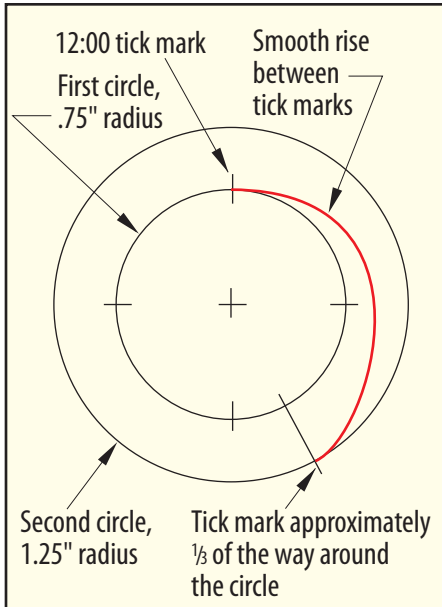


Figure 12—Laying out the first rise of the cam

Increase your compass radius by ½" and draw a second circle using the same center point.

Look at your original circle now and add another tick mark about one-third of the way around. Then extend that tick mark out to the larger circle. You need to create a constant, steady climb from the twelve o'clock tick mark on your smaller circle out to the new tick mark on the outer circle. To do this we need to increase the diameter of our compass at a constant rate between those two marks. It takes two hands and just a bit of practice before you have that curve that we want. Alternatively, just draw that gentle curve freehand (**figure 12**).

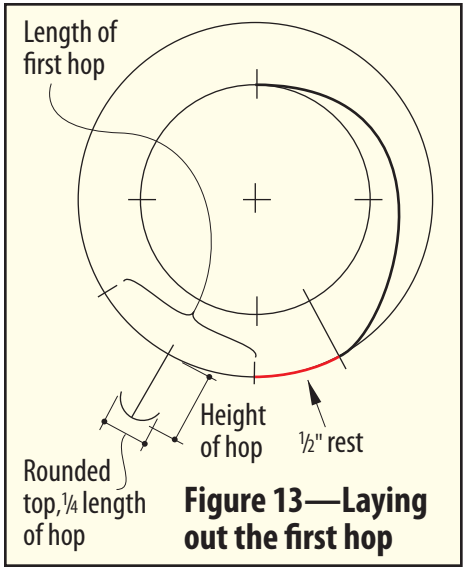


Figure 13—Laying out the first hop

The next item on the to-do list is the short rest. That one is easy. Just continue on the outer circle for the ½" of rest time. If you have a set of dividers, just space the points out about ¼" and walk them across the outside of the large circle twice. Most of the time that ¼" spacing will be sufficient, but if you ever want more precision, you can lay a piece of string on your straight line to find the exact length of a segment. Then, keeping track of that length, carefully lay out the string on the curve of the circle. Carefully cover over the line of the curve and you will have exactly transferred the distance that you need to maintain.

Next, you are going to create the two hops. Use the divider (or string) again to measure the length of the first hop and extend that distance along the outer circle. Add a tick mark at the end of this hop. Also place a tick mark at the middle of the hop and on the circle. This middle tick mark will be the location on the circle of the highest point on the hop. Then measure the height of the hop. Mark that height outside of the second circle. The compass is the easiest way to do this. The mark goes outside the second circle because we are still rising.

Reset your compass to about one quarter of the distance of the hop, not the height. This is done because the top of the hop should look smooth. Extend a line from the center of the circles through this mid-hop tick mark up to the height of the hop. At the point where your newest line crosses the peak of the hop, place your compass point and draw a small arc across this newest line. Now reverse the points of your compass and draw a segment of a circle that is roughly one quarter the length of the hop (**figure 13**).

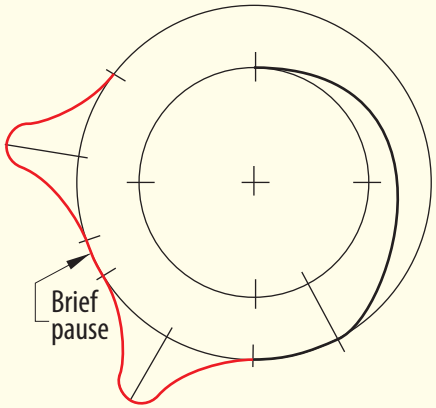


Figure 14
Both hops complete

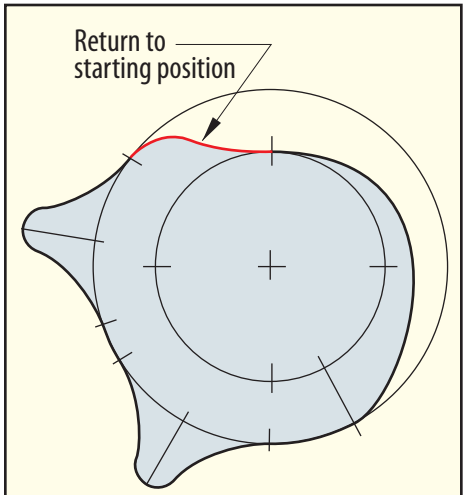
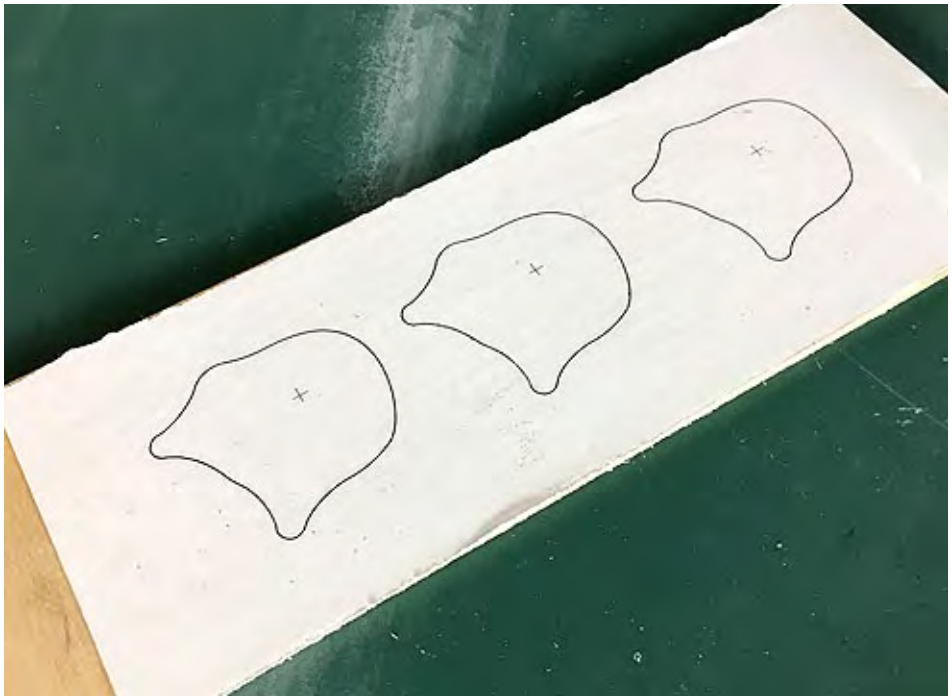


Figure 15
Cam design complete



Three cams have been drawn and glued to a piece of wood, ready for cutting out.

Freehand is best now. Draw a smooth, even S-shape from the start of the hop on the second circle to one end of the curve segment. Repeat this same S-shape at the far end of the curve segment so that it returns you to the outer circle.

The second hop is done exactly the same way—by measuring the length and height, then transferring them as before. Remember to leave that short rest along the outside of the second circle between the hops (**figure 14**).

All that's left is that quick return to the beginning. That quick return for me is looking like one of those counter-clockwise circles with a quick start and slower finish. The easiest way to accomplish that is with one more S-shape. This time simply make the halves of the "S" different sizes, the top smaller than the bottom half. You're back to the beginning and done (**figure 15**).

Now you can tape or glue your paper profile to wood, cut it out, and drill the shaft hole through the center point of the cam. Congratulations on a sophisticated-looking cam!

Final thoughts

Before you head off to the scrollsaw or bandsaw, look at your pattern on paper. Slowly trace every bit of the cutting path in your mind. Work hard again to visualize the movement. Do you see what your mind once envisioned? Look one last time for any sharp corners on your pattern. Use the circle template or a bit of freehand work to smooth these sharp corners into gentle transitions. Keep all of your lines smooth and curving so that they create a pleasing movement (except for that ratchet movement, of course).

Other ideas

Don't limit your imagination. You can use more than one cam to create your movements. Go back to my earliest discussion of the circle with an offset center. Connect two of these on the same shaft, with the high points opposite each other. But first cut out a cute little duck profile from some thin wood and place it on a shaft between the two offset cams. You've created a delightful waddling toy that any kid will love.

Get Moving

Magnificent Moggie, the circus cat

by Kim Booth
Berlin, Germany
Photos by the author

This ferocious beast does its tricks when the bottom of its base is pushed up.

Ladies and gentlemen, boys and girls, children of all ages! I present to you a fantastically ferocious feline who can be persuaded to meow on cue and will even wag her superior, striped tail! Recently returned from an amazing tour with Circus Kimicus, she is eminently suitable for the smallest of lion tamers. I give you *Magnificent Moggie*, the circus cat!

What's the brief?

Thumb-push puppets are classic toys that come in hundreds of variations, but they all seem to share the idea of something collapsing when you push up on the base. Horses, like the one in **photo 1,** are quite popular. When you push the base, the horse first lowers its head. Then, when you push harder, it flops down completely. Wooden toys like this are usually made of turned parts, to keep the price down.

I thought, why not make a thumb puppet that does something else besides flopping?

1. Thumb-push or push-up toys, like this horse, have been popular for ages.

I decided on a cat. To provide a reason for the round base, I thought she could be a circus cat, waiting for her tamer's command. When you push the front of the base, the cat opens its mouth; push the back and its tail moves (flops).

What makes a cat a cat? Is it those distinctive cat's eyes, with their vertical, ellipse-shaped slits? Whiskers? Big ears, a bushy tail, and stripes? Well, that was my recipe for cattiness.

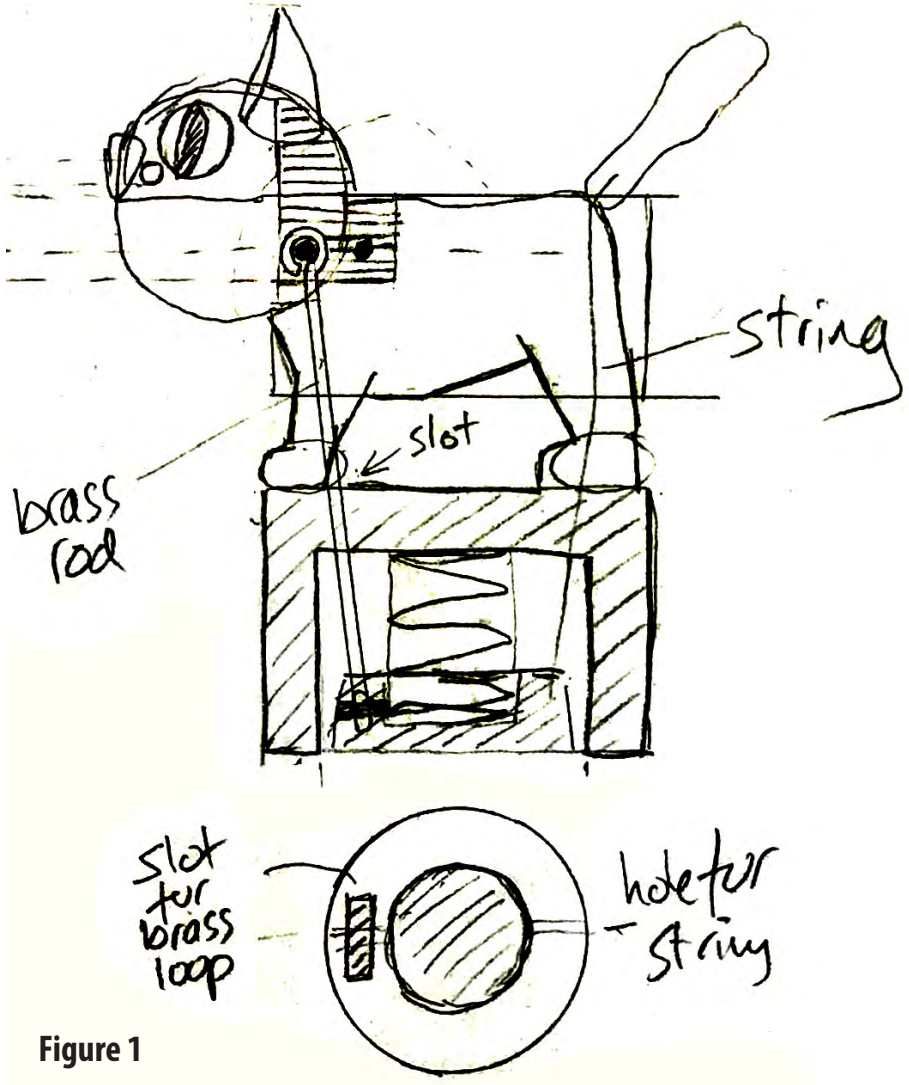


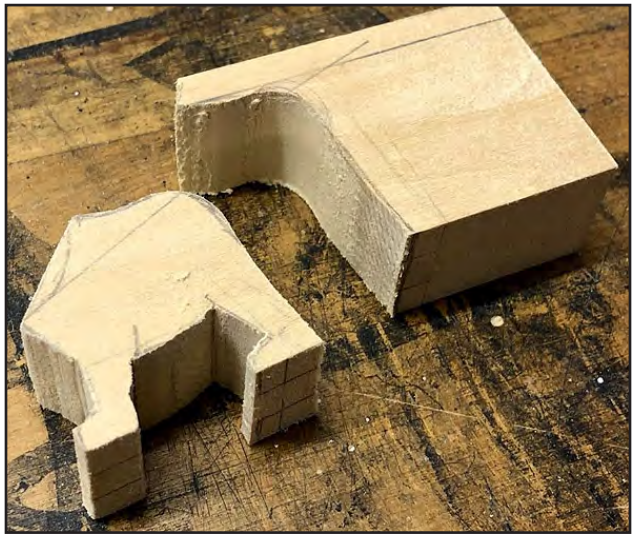
Figure 1

Rough design

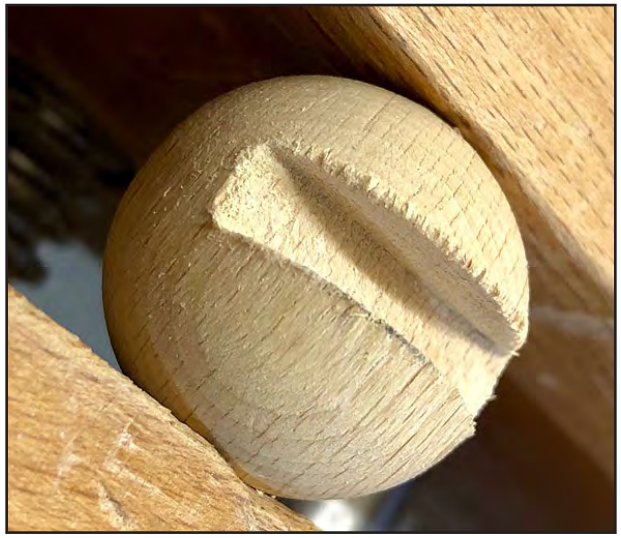
Figure 1 shows a rough sketch of the automaton. The single spiral spring in the cylindrical base tries to expand, applying a downward force that keeps the tail proudly erect via a piece of fishing line, which shouldn't break with such a small fish. This downward force also keeps the cat's mouth closed via a slim brass rod. When the base is pressed up, the tail will slacken and/or the cat's mouth will open. The operator is responsible for the meow.

2. Head, eyes, and nose are made from commercial parts. Ears are carved limewood.

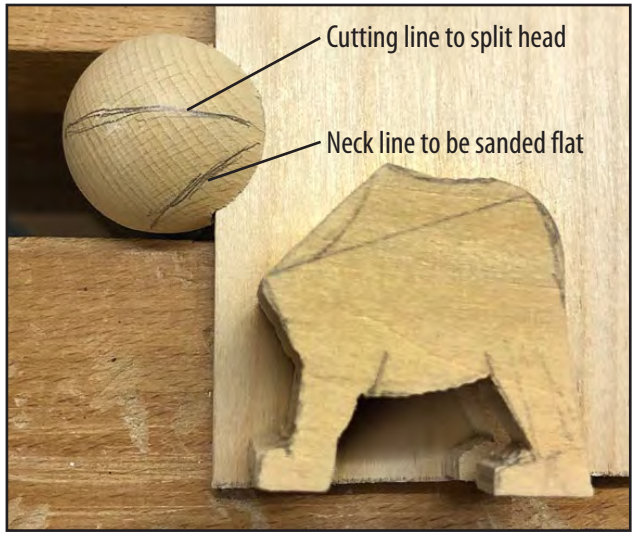
I chose a spherical head, huge hemispherical eyes, and a small nose, all made from beechwood (**photo 2**). The body, tail, and ears are made from carved limewood, as I won't be charging anyone for my time to do that little bit of carving. I reused an existing wooden base that had originally been turned on a lathe. Once the rough design was ready, this fairly simple toy only took a few



3. The body, before carving, rough cut on the scrollsaw.



4. A slot for the plywood hinge has been made in the head.



5. Head, temporarily slotted onto plywood, marked for cutting.

6. Head sanding was done on coarse paper laid flat.

7. The head, cut in two to form the upper and lower jaws.

8. The plywood hinge piece with the pushrod in place.

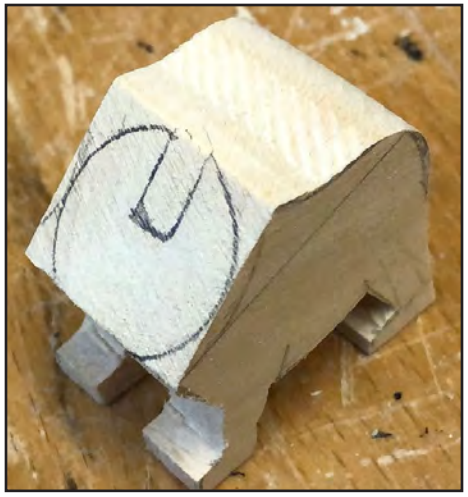
hours over a weekend to make, with a bit of fiddling about in the final assembly.

Making the bits

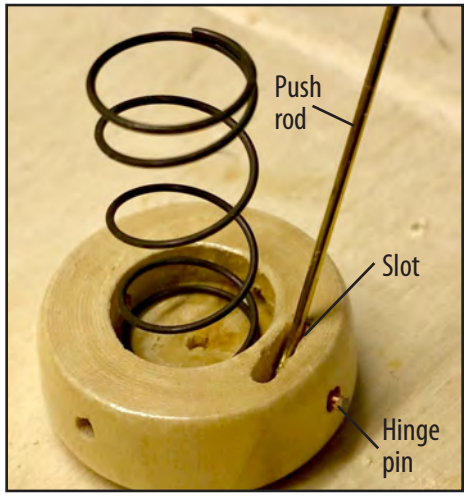
The body was first cut out using the scrollsaw (**photo 3**). The slot for the hinge was then cut in the head (**photo 4**). I next slotted the head onto the plywood that I would use for the hinge, and I marked the neck and mouth on the head (**photo 5**).

I sanded the head flat where it was to be glued to the body (**photo 6**). This I did by laying coarse sandpaper on a flat surface and rubbing the head against it. Next, I cut the head into two pieces so that the cat could meow (**photo 7**).

I made a hinge of plywood to be glued to the top half of the head (**photo 8**). There are two holes in the hinge—one in the edge for the pushrod (in place in the photo), and a second for the hinge pin, which is pushed through a mating hole in one side of the body. I then cut a slot in the body that loosely held the hinge, with enough space for it to move eas-



9. A slot for the head's pushrod has been marked on the body.



10. The brass pushrod is hinged to the moveable part of the base.

11. The hinge has been affixed to the head and put in place on the body.

ily. **Photo 9** shows the rough-cut body with the slot marked out.

I glued the hinge into the head, then carved the ears and glued them on. The eyes and nose were glued on next. I drilled holes in the head, into which whiskers could be glued. For the whiskers, I simply used pliers to pull two tufts of bristles out of a brush, then glued one tuft into each of the holes next to the nose.

I cut a slot in the movable part of the base to take the loop on the end of the pushrod. I inserted a brass hinge pin through a hole I made in the side of the piece to hold the loop in place (**photo 10**).

Putting it all together was tricky and required patience, as I could only bend the top loop on the pushrod after it had been fed through the body. With hindsight, I should have cut slots in the body, long enough for the loop to slip through. That would not have detracted from the general impression. That's life, though, innit? When you only make one of something, you never get it quite right.

I fixed fishing line to the movable base piece. While squeezing the spring in the base, I fixed the line to the tail. While squeezing hard, I pushed the pin into the head to catch the loop on the pushrod set into the hinge (refer to **figure 1**). Then, with the head in place on the body, I wiggled the hinge around until the holes lined up, then pushed another pin into the carved body, through the wooden hinge (**photo 11**).

That finished it. **Photo 12** shows the cat, ready to be painted. AM

12. The assembled cat, ready for its coat of paint.

A video of the cat in action can be seen here: *https://www.youtube.com/watch?v=eYXjcz8zUH4*

AUTOMATA FOR BEGINNERS

Cams

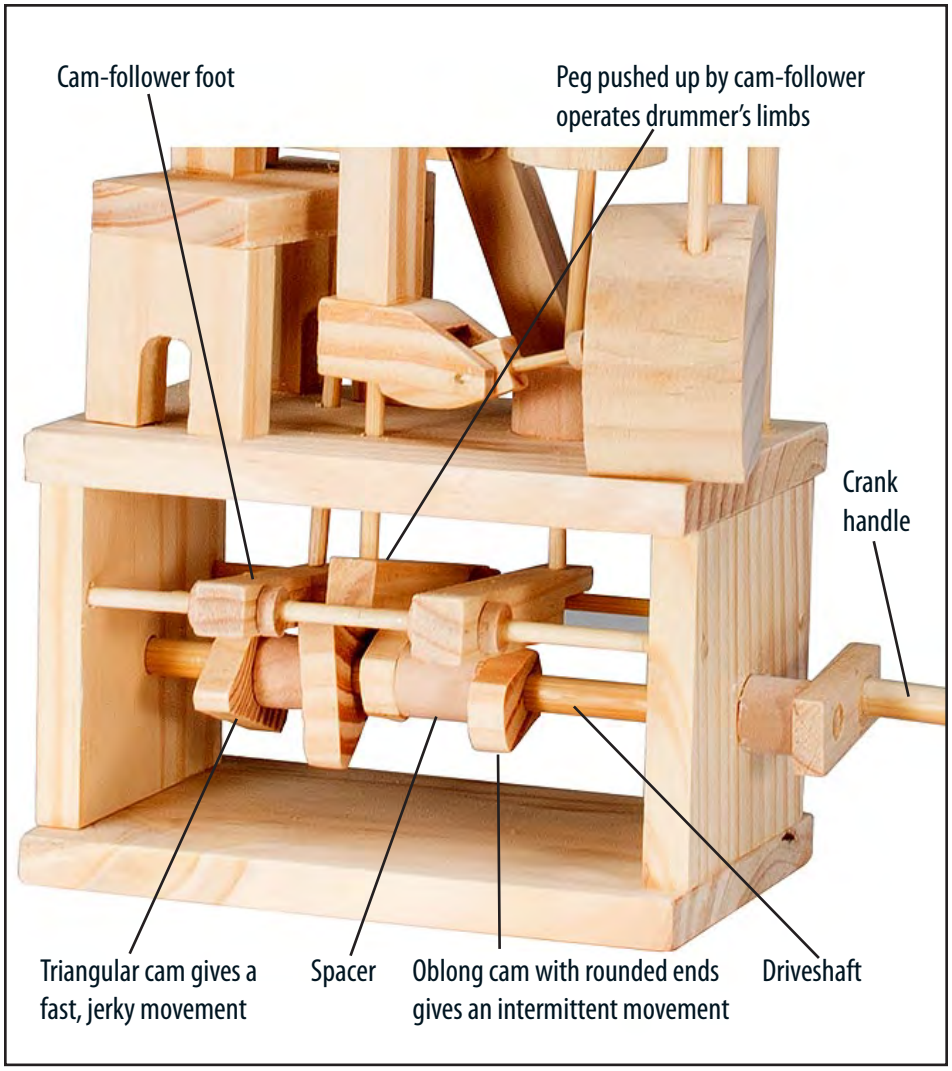
by Sarah Reast • Llanbrynmair, Wales, UK • Photos by the author

1. Cams come in all sorts of shapes and sizes.

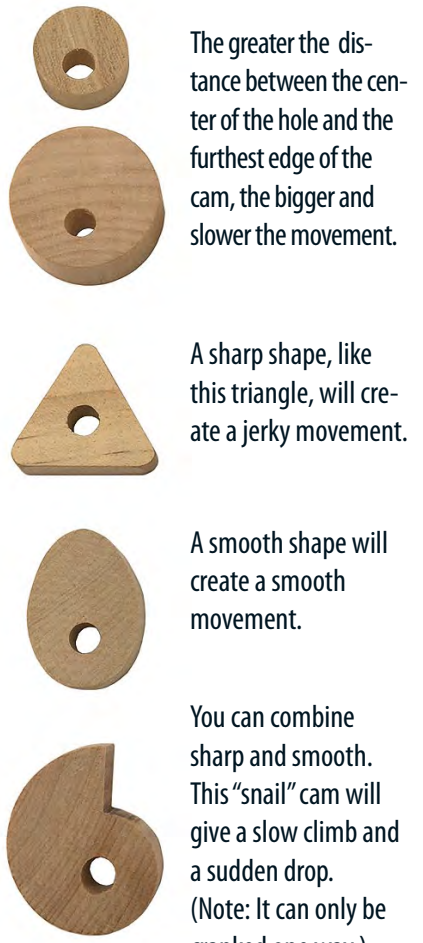
There are some basic mechanical principles from which all others grow. Once you understand them, you can start getting inventive by varying aspects of them and using them in combination with each other. Something that looks quite complex can always be broken down into simple components. In this issue we will start with cams (**photo 1**). This is aimed at people who are experimenting for the first time, without workshop facilities.

Cams mounted on a turning shaft will cause other components

2. This drummer goes through a surprising number of motions, all actuated by different cams on a single shaft.



3. This photo shows how complex movment can be broken down into simple components.



4. These are some of the basic cam shapes available, along with their functions.

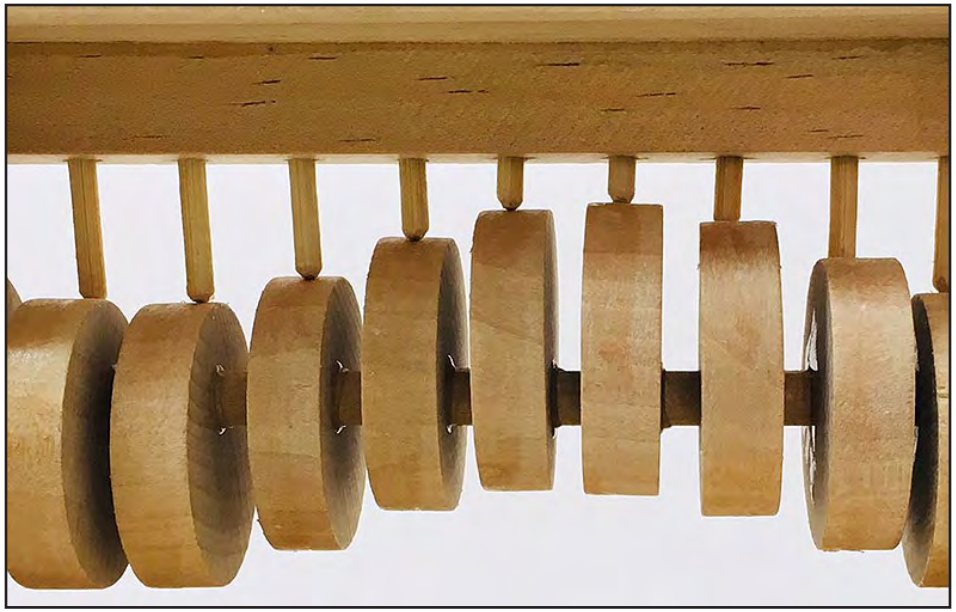
(cam followers) to perform a wide variety of movements, depending on the size and shape of the cams.

In **photo 2**, the drummer hits the drum, the cymbal, the bass drum, and operates the high hat, all off of a series of cams. **Photo 3** gives a closer look at the drummer's mechanism and includes a bit of terminology. Cam shapes shown in **photo 4** are basic but there is endless potential for variety. These possibilities combined will create up-and-down movements in a variety of styles—jerky, smooth, fast, slow, etc.

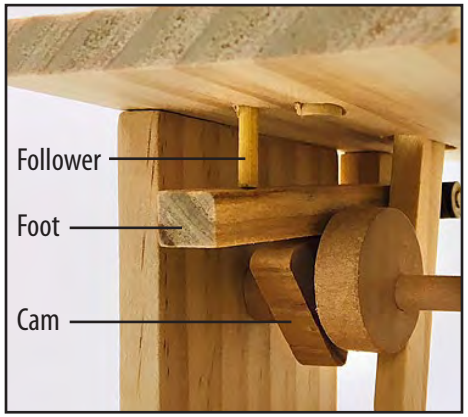
In **photo 5** on the next page, the snail cam lifts the cat hiding behind the bush, then drops it down again. The boy turns round and round by a friction wheel (explained below) and rises a little on a small cam, teasing the dog with the stick. The dog bounces excitedly up and down on its triangular cam. The small, round foot on the cam follower for the triangular cam helps it ride smoothly over the pointy bits.

Effective working of the cam also depends on the cam follower. The

5. *The Dog and the Stick.*



6. In this photo, the sticks—with rounded ends resting on the cams—are the followers.



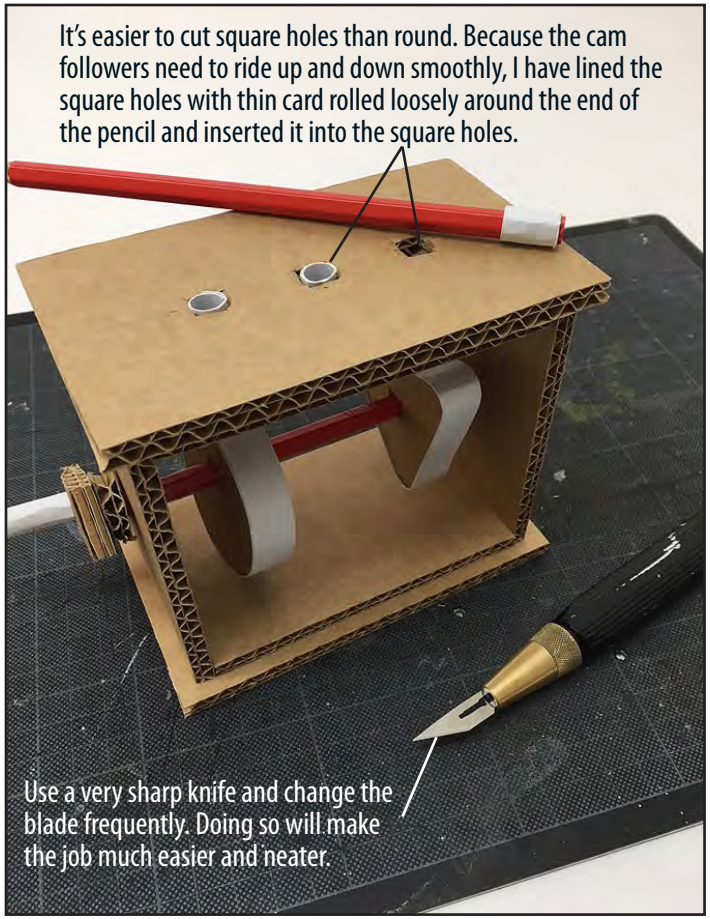
7. The wooden foot helps the follower get over the sharp corners of the triangular cam.

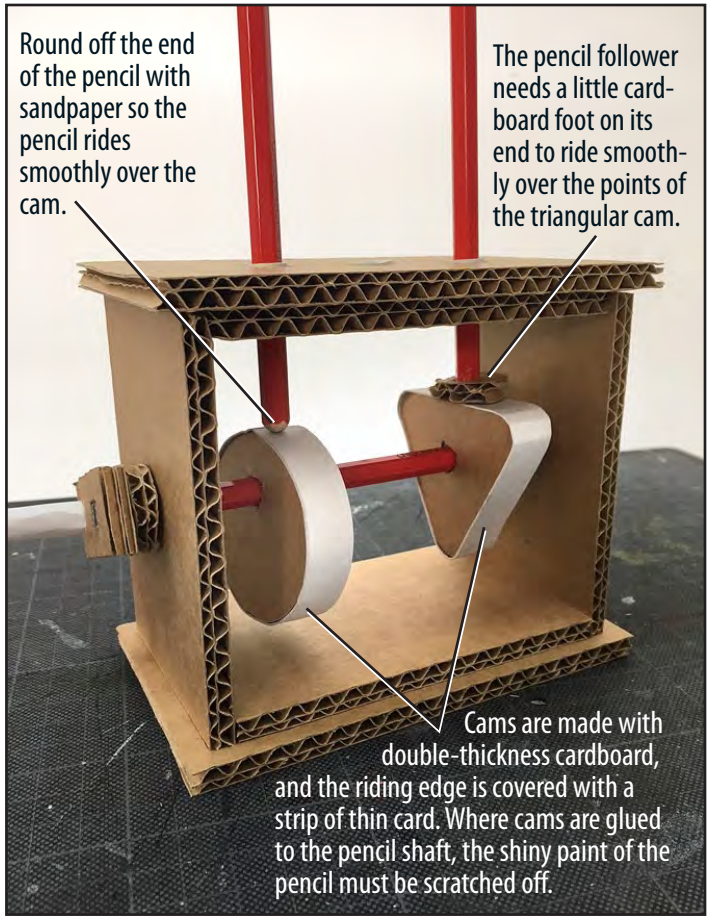
cam follower is any component that is directly acted upon by the cam. There must be no possibility of friction or snagging between the cam and its follower. If the follower is a simple peg, its end needs to be rounded (**photo 6**). When we work in wood, we use wax as a lubricant between the cam and its follower as well. A foot on the cam follower can help to ease it over a sharp cam (a triangle, in the example shown in **photo 7**), if there is sufficient room.

Friction

Friction can be your friend if you want to drive another wheel off a cam. This is also a way of turning the direction of movement 90°. The friction wheel, which rests on the cam, needs to ride with its

8. The frog's eyes are moved side to side by the action of the friction wheels. Pegs in the wheels, and extending down from the top of the box, limit motion.





9-10. Although cardboard is not an ideal material for building automata, it can be used successfuly for experimentation. This can include testing cam designs, linkages, motion ideas, and more.

outside edge touching the cam to get the maximum effect. In this instance, it is essential that the wheel and cam *not* be polished, waxed, or varnished, as that would reduce the friction.

You can combine several cams and friction wheels to achieve a side-to-side movement, as seen in **photo 8**. Notice the pegs that limit how far around the friction wheels can go. The first cam moves the friction wheel around one way, but the peg stops it. The second cam then comes up and moves the friction wheel back in the other direction, until it is stopped by the central peg, and so it goes on. The frog's eyes lift and then turn from side to side.

Materials and experimentation

Once the basic principles above are clear, the best way to proceed is to experiment. You can make a basic cam arrangement in cardboard but it is far better to use a solid base and solid materials. If you are still trying to work things out, you don't want to be fighting a flimsy material (like card) that causes stability problems.

It's worth spending some time on building your base. Here is an example, which I did make out of cardboard, using pencils for the shafts (**photos 9** and **10**). There are some handy hints there to help you along. I used thick card, doubling it in many places, as I didn't want my base to flex.

If you have access to a laser cut-

11. Timberkits offers lots of ready-made parts.

ter, you can cut your base pieces out of ply but, again, use a decent thickness. The charring effect of the laser cutting can cause friction, so sand the edges back a bit and wax them, if necessary. Timberkits supplies a basic frame and a variety of cams and wheels, which provide a good starting point (**photo 11**).

A note on glue

Use wood-strength PVA (water-based) glue rather than cardstock and paper strength, if you can get it. It dries faster and is good and strong. Fit your pieces together without glue first. When gluing a cam to the shaft, test its movement first by spinning it on the shaft. Does it create the desired motion? When you are satisfied, mark its position with a pencil, then slide the cam to one side, apply a small blob of glue to the shaft, and move the cam back into position, turning it as you go, to distribute the glue all around the shaft.

When when you're ready to do the modeling on top of the box, it's great to start with simple cardboard cutouts, but you can experiment with all sorts of materials. Keep the cam followers (sticks, pegs, dowel) as short as possible; very tall ones will bend and bind in the holes. We usually use bamboo food skewers as pegs/sticks.

Sometimes it helps to have more weight and sometimes not, so just experiment. You can tape coins to the backs of shapes, or model in modeling clay of some sort, to add weight. The most important thing, though, is to have fun!

Contacting Sarah

If you have questions or comments for Sarah Reast, you can write to her in care of *Automata Magazine*: *automatamag@comcast.net* Just put "Message for Sarah" in the subject line.

Sarah is the designer and director of Timberkits Ltd., which creates wooden mechanical models sold in kit form. To learn more about her company, visit *https://www.timberkits.com/*

REVIEWS

BOOKS

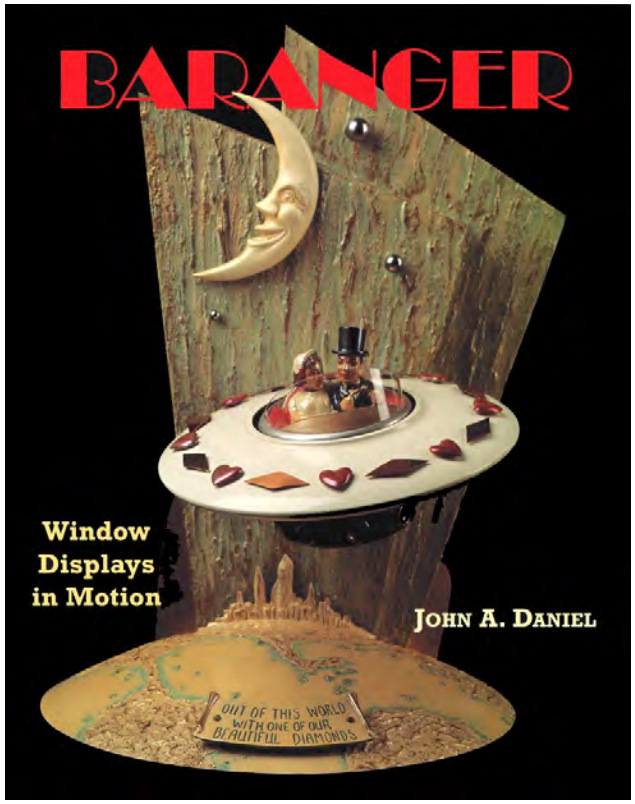
Baranger: Window Displays in Motion
by John A. Daniel
Zon International Publishing Co., 2001 (out of print)
9¼ x 11½" (23.5 x 29cm)
128 pages, hardbound
ISBN: 0-939549-26-3

Selling jewelry through traditional window-display techniques was evidently problematic back in the 1920s. While the jewelry itself was attractive, something more eye catching was needed to capture the attention of the passing pedestrian. Arch E. Baranger recognized this problem and came up with an unusual solution in the early 1920s, when he opened Baranger Studios in Los Angeles. The studios soon moved to South Pasadena, California.

Mr. Baranger and his staff created a wide variety of beautiful, eye-catching window displays, designed speficially to show off jewelry to its best advantage. Themes for these displays included Chinese, Japanese, Byzantine, Renaissance, Old English, Art Moderne, and other motifs.

The unique thing about Baranger's business is that he did not sell his displays—he rented them. A business would sign up with him and, in return, would receive a rotation of different displays so that his windows were ever changing and attracting new customers.

Baranger's original displays were static. In 1936, the company suffered a severe fire that destroyed its woodshop and in-house inventory of displays. However, due to the nature of the business, most of the displays were out of the studio, in the hands of customers, so business carried on. At this time it was decided to revamp the company's products into a line of action displays, which Baranger called "motions."



The book reviewed here is, I believe, the only book available on this subject. It begins with a history of the company, and some of its more prominent employees, who offer insights into the firm's workings and thinking.

Much of the book, though, is devoted to the animated displays, nearly all of which feature moving figures doing a variety of different things. Each motion is electrically powered and is heavily constructed to withstand continual operation, for hours and weeks on end.

The motions are divided into categories in the book. These include Amusements (rides and games), Musical (various bands, singers, and solo musicians), Aquatic Motions (boats, mermaids, fish, and divers), Weddings & Romance (giant rings, various weddings, and other romatic themes), Transportation (trains, a firetruck, cars, streetcars, and bicycles), Space (space vehicles and telescopes), Western (cowboys, stage coaches, wagons, square dancers, and horses), Stories & Fairy Tales (Humpty Dumpty, Old King Cole, Cinderella, etc.), and Craftsmen & Trades (painters, watchmakers, jewelers, sawmill, and goldsmiths).

A total of 167 different designs were produced, in numbers of around 30 each. Today they are highly sought after by collectors.

The text of the book is somewhat disjointed but still entertaining. Sadly, though, almost no mention at all is made of the various mechanisms used.

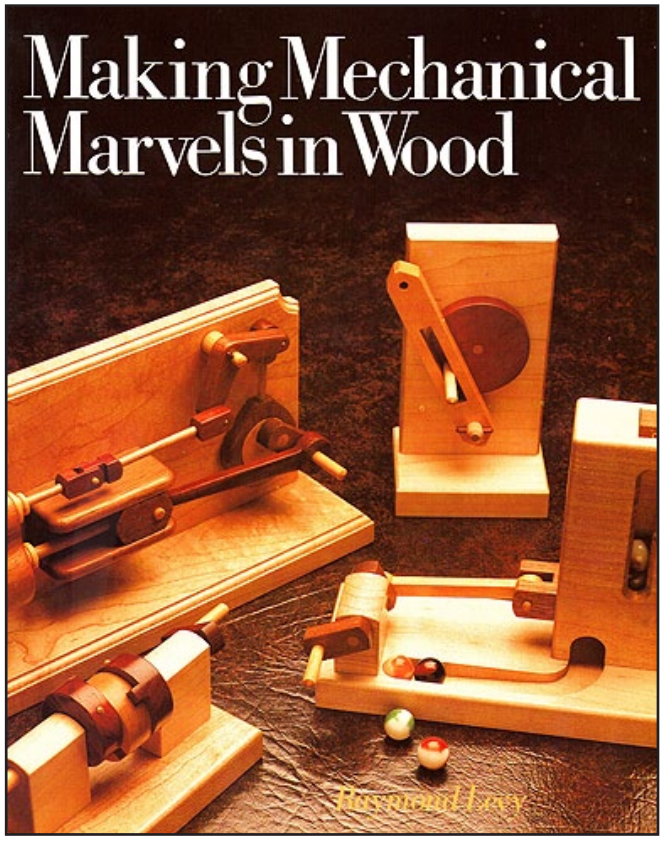
The volume is lavishly illustrated and the photography, printing, and paper are top notch. Every Baranger motion is illustrated. Descriptions of the actions are often a little lacking—I would like to have seen more about the movements of each piece.

There's a brief section about collecting and caring for Baranger motions. The collecting part

mostly mentions collectors who have displayed their pieces commercially. The caring-for part just gives some suggestions about cleaning the pieces—again, no mention is made of maintaining the mechanisms.

While the book is out of print, it can readily be found on Amazon and the used-book sites. For those interested in the history of automata, here's another avenue of exploration. —*M. Horovitz*

Making Mechanical Marvels in Wood
by Raymond Levy
Sterling Publishing Co., 1991
(out of print)
8 x 10" (20.3 x 25.4cm)
192 pages, softbound
ISBN: 0-8069-7358-7



This interesting book contains plans and instructions for building almost 20 mechanisms from wood. The end results are suitable for display when made of attractive hardwoods. Unlike many similar books, this one does not pad the pages with introductions to basic tools or other extraneous material. It assumes that you know your way around a woodshop, and it only recommends a handful of less-common specialty tools that the author has found useful. (The mechanisms were originally featured in *American Woodworker* magazine.) Then it gets right down to plans and instructions. Thus, it is not a good book for a raw beginner, as you will need familiarity with standard woodworking tools and techniques, as well as an ability to read measured drawings.

While this is not a book about making automata, per se, every machine here should interest the automatist because of its fascinating form and movement, which can give pleasure in motion for its own sake.

Many of these machines or submechanisms could be put to work in the reader's automata. The book is similar in this way to *507 Mechanical Movements* or the second half of Rodney Peppé's *Automata and Mechanical Toys*—it shows you how to implement a range of mechanical movements and couplings, leaving the incorporation of them into an automaton to you. That said, the projects are beautiful and some of them are complex enough to stand on their own beside "proper" automata.

The plans and instructions are clear and straightforward. Every page is illustrated with black-and-white photos, full-size dimensioned line drawings (either 2-D or isometric), or both. There is also a section of glossy color photos, of sixteen completed mechanisms, bound into the middle of the book.

The final chapter features plans for making three small hand tools especially suited to the fine work of automatists—a wedge vise, parallel clamp, and tapered sanding block. All in all, this is an attractive and informative book, and possibly the source of some very nice automata plans.

While this book is out of print, it is readily available and inexpensive from online used-book sellers, so it presents tremendous value at current prices. A word of caution, though: Levy apparently did not renew his copyright on the book, and there are "new" aftermarket copies being sold at nominally reputable places. These are much more expensive but reported to be poor-quality photocopies. If you search for this book online, look for the publisher, date, and ISBN above. —*V. Bass*

Many books about automata, and of interest to automatists, are now out of print. However, they are still valuable and most are available through the used-book market. We'll be reviewing more of these in upcoming issues of *Automata Magazine*.

The End