AUTOMATA MAGAZINE

Andrew Woodward's *Sol*

2/3—May/June 2020

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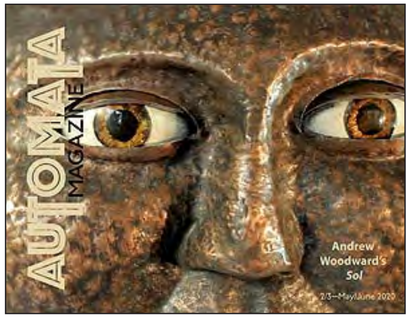

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EDITORIAL

Strange times

by Marc Horovitz

Who could have thought, when the last *Automata Magazine* came out just two months ago, that the world would become such a different place in such a short time? Life has changed in circumstances that are unprecedented in living memory.

I hope that you and yours are all well and safe. My world continues on, although in altered form. In addition to putting together the magazine and working on an automaton, I have been sewing cloth masks to donate to friends, family, and local health workers.

We all must do whatever's necessary to stay healthy. Social distancing, on the surface, seems like an obvious and easy thing to do. In reality, though, it can be stressful, upsetting, and disorienting, even if there are no financial considerations attached.

It's also important to remember, in the face of this adversity, to try to maintain a happy place, be it an actual physical space to which you can retreat or a mental one in which you can relax and focus on positive things. As automatists, spending time in the workshop is a great way of temporarily shutting out the world and rejuvenating ourselves.

We hope that *Automata Magazine* can feed your happy place, too. To an outsider, making an automaton may seem a silly, pointless pursuit. However, for enthusiasts and artists, creating an automaton represents so many valuable things—creativity, originality, conceptual thinking, skill in construction, an ongoing pursuit of excellence, a profound learning experience, and an expression of self, to name a few.

The automata world is relatively small. Even the bigger players have mailing lists that reach only about 4,000 people worldwide. *AM*'s current circulation is around 650 and still slowly growing.

It has so far been a wonderful experience for me to communicate with so many creative and enthusiastic people. It has also been a great pleasure and an honor to have been able to present so much fine work to so many other like-minded people. The response to the magazine has been gratifyingly positive.

For a magazine to continue to exist, though, it must have a steady flow of material to publish. To date, that material has been forthcoming and I've enjoyed putting it into print. However, in recent times, it has shown signs of diminishing, which is cause for concern.

I feel that *AM* and its readers comprise a community. We need each other. Producing the mag is a group effort. I enjoy putting it out but cannot do so without your active participation.

I know I have asked, more or less on a continual basis, for articles about your automata, your collections, and places you've visited. I sincerely thank all of you who have already responded and provided material for publication. This has made the magazine what it is, as well as tangibly increased the body of available knowledge. I hope that you'll continue to write about your experiences.

If you've not written before, we'd all like to hear about what you're doing, how you're doing it, and what inspired you. There's a lot of good work out there. So if you find that you've got some extra time on your hands just now, why not write something for *AM*? Please drop me a note at *automatamag@comcast.net*.

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Because of outside stresses indirectly related the COVID virus, Sarah Reast will be taking a break from her "Automata for Beginners" column in this issue. We wish her the best and hope she'll be back with us soon.

Marc

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NEWS

Cabaret Mechanical Theatre has a new automaton by Paul Spooner. *Fool*, in an edition of five, is driven by a "foolishly simple" mechanism. There are variations in the bodies and heads. The artist says, "While I was making these objects, the end of March and the beginning of April happened, so I've date-stamped them all 1.4.20. Each one has a hand-drawn fact sheet explaining something vital to one's understanding of horse-flesh." A donation of 10% of the proceeds will go to a UK food-bank charity, the Trussell Trust. The automaton can be seen in action here: *https://youtu.be/gjDzXZf-c30* Price: £1,800. Email: *sarah@cabaret.co.uk*. Website: *www.cabaret.co.uk*

Cranky Heart Automata is a new company producing snap-together, laser-cut wooden kits. These are designed by award-winning automata artist Cecilia Schiller. Three different kits are currently avalable: *Goofy Bird*, *Prima Ballerina*, and *Love Flies Across the Sea* (shown). There are no plastic parts or packaging. Introductory price: $55US (normally $65). Email: *cecilia@ceciliaschiller.com.* Website: *www.crankyheartautomata.com*

Shasa Bolton (see the Jan.-Feb. 2020 issue of *AM*) has put together a video describing how he designed his writing automaton. See it here: *https://youtu.be/LWSE_TI-Vw0*

Paul Clarke is interested in becoming a supplier of Kazuaki Harada's book, *Stories Without Words*. A single copy, ordered from the publisher in Japan, is around £36.50 in the UK, of which £16+ is postage and packaging. With sufficient interest, these could be supplied for under £30 each in the UK or €37.50 incl. to Europe, and around $39US to the US (and possiby Canada). If interested, contact Paul: *paul@thefirstgallery.com*.

EVENTS

Morris Museum presents **A Cache of Kinetic Art: Tiny Intricacies** March 13-August 16, 2020. Morris Museum, 6 Normandy Heights Road, Morristown, NJ 07960

Contemporary mechanical works in *Tiny Intricacies* are designed to delight and surprise. Some employ traditional construction—wood, metal, and paint—others reflect more technological advancements, utilizing electronic components. Pieces are installed alongside 19th-century novelty pieces from the Guinness Collection known as "precious smalls." They embody the spirited sense of imagination and curiosity of artists from the past and the present. Cost: free with admission Info: Michele Marinelli, *mmarinelli@morrismuseum.org*. Website: *https://morrismuseum.org/*

Cabaret Mechanical Theatre (CMT) presents: **Mechanics Alive!**, iexplora!, Albuquerque, New Mexico, USA. Through 2020. More info: *https://cabaret.co.uk/exhibitions/current/*

AutomataCon, Hosted by the Morris Museum: May 21-23, 2021. More info: *http://www.automatacon.org*.

CALL FOR ENTRIES

Morris Museum—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. Prospectus and entry forms for both exhibitions: *https://tinyurl.com/MMentries*. AM

GALLERY

Swansea College

by Lee Hutchinson
Hope Valley, Derbyshire, UK
Photo by the author

I'd given up on this piece until reading the interview with Carlos Zapata in the last issue of *Automata Magazine*. In it, one of his automata has the crank centered in a person's torso. So I thought, why not—does the crank always need to be at the bottom or on the side?

In the tradition of Magritte, the title of this piece bears no relation to the automaton itself. There is no deep meaning—I just thought it was a good subject to have doing a simple silly thing. I, too, like pipes, bowler hats, and nonsense.

See it in action here: https://www.youtube.com/watch?v=q-DLqIciLEk

Write an article!

Automata Magazine needs authors. Everyone has a unique story. Writing it down isn't as difficult as you might think. If you're unsure, check out the guidelines we've prepared: http://automatamagazine.com/write/

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

In the next issue of AUTOMATA MAGAZINE

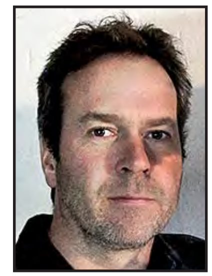
- **Cecilia Schiller** details the creation of her complex, multi-function automaton, *Il Mago*.
- **Li Zhanlong** discusses his journey into automata and the construction of his *Security Conference*.
- **Marc Horovitz** explores the design of a gravity-powered automaton.

Follow *Automata Magazine*…

1. *Sol*, photographed in 1997, when the solar system had just formed.

SOL

An orrery automaton



by Andrew Woodward
Buckfastleigh, Devon, UK
Photos by the author, except as noted

Recently, a couple of my automata came back to me after six years on display at The Mechanical Art and Design Museum (MAD) in Stratford-upon-Avon. *Sol* (**photo 1**) is one of my first larger mechanical sculptures, built in 1997. Over the years, it has toured the country in various exhibitions. During its stay at MAD (**photo 2**), they reckon it had been viewed and operated by literally a hundred thousand people, mainly school children, and it survived mechanically pretty well. I hope that it has spread some inspiration. Its return was a good chance to give it an overhaul and reexamine my engineering from twenty-two years ago!

I've always loved those old medieval anthropomorphic depictions of planets or forces of nature—the wind, the Moon, or human faces on animals. As a teenager, I was interested in alchemical art. My thesis at college examined the influence of it on modern art, and alchemy's role in the invention of modern science. Medieval and alchemical art is fascinating and often deeply strange (**photo 3**)—salamanders in fires and castrated kings—that sort of thing. I love the sense of humanity's close connection with the natural world that comes across from that time; we have largely lost touch with that connection in the modern world.

Photo courtesy of CHRIS FOSSEY PHOTOGRAPHY

2. *Sol* on display at The Mechanical Art and Design Museum.

3. The green lion devouring the sun, an illustration from the alchemical text *Rosarium Philosophorum*, 1550, now in the public domain.

4. *Clockwork Sun*, one of the author's first automata, included papier mâché, flexible cotton eyelids and lower lip, and an adapted brass clock mechanism.

The solar system

Sol is a basic orrery, depicting the Earth and Moon orbiting the Sun. In true medieval style, the Sun has a face. It slowly opens and closes its eyes during each orbit, giving us all a beneficent but examining look.

Sun faces and orreries have been a recurrent theme for me since I built my first sculptures and automata as a teenager in the 1980s. These included a papier-mâché Sun face (mounted on a wooden frame), which opens its eyes and mouth (**photo 4**). I had it in mind for the Sun to appear to awaken and emit the "music of the spheres."

Working off grid

Sol was actually the second large, mechanical-sun automaton I built. The first was sold to a German collector many years ago. I built that one in the early 1990s, when I lived for three years in a cabin in the woods on Dartmoor, in Devon. Despite having no electricity or power tools, that was a prolific time for me. There were no distractions, I guess. As there were no computers or mobile phones in those days, I survived on radio. There were many nights when I worked by lamplight until the shipping forecast came on Radio 4, and the strange and evocatively old-fashioned tune, "Sailing By," played at closedown.

I did a lot of landscape and animal paintings at that time, and copper automata. All of my metal work—soldering and brazing—was done with a blow torch and hand tools, or with 12V tools running off a car battery. Lit by paraffin lamps and candles, among the badgers, foxes, and owls, I was definitely off grid.

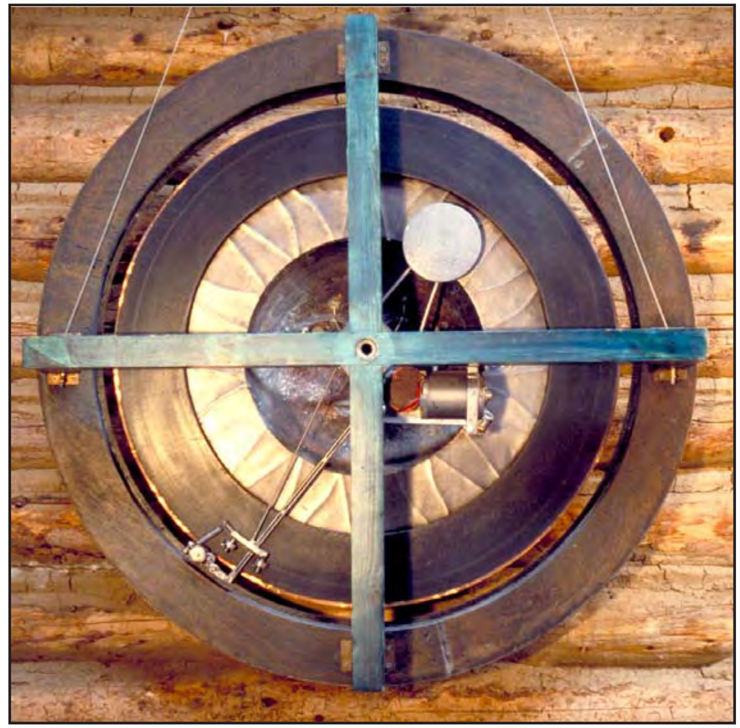
The first Sun sculpture was operated by a hand-cranked handle but this second piece runs off a car windscreen-wiper motor (**photo 5**). This is always a useful drive system, one I've used in many of my pieces. They're geared down, usually with a right-angle drive, which makes them compact, and they exist in varying shapes and sizes. They're also safe and robust. This old Ford motor would have come out of something like a Cortina or Sierra. In those days, everything on a car was serviceable. I barely dare to look at a car engine anymore!

Now, stripping the sculpture down (**photo 6**) gave me the chance to properly photograph it digitally. I think I was still taking slides when I built it. Regrettably, I let many of my pieces go with only a poor photographic record, or none at all.

Beaten copper

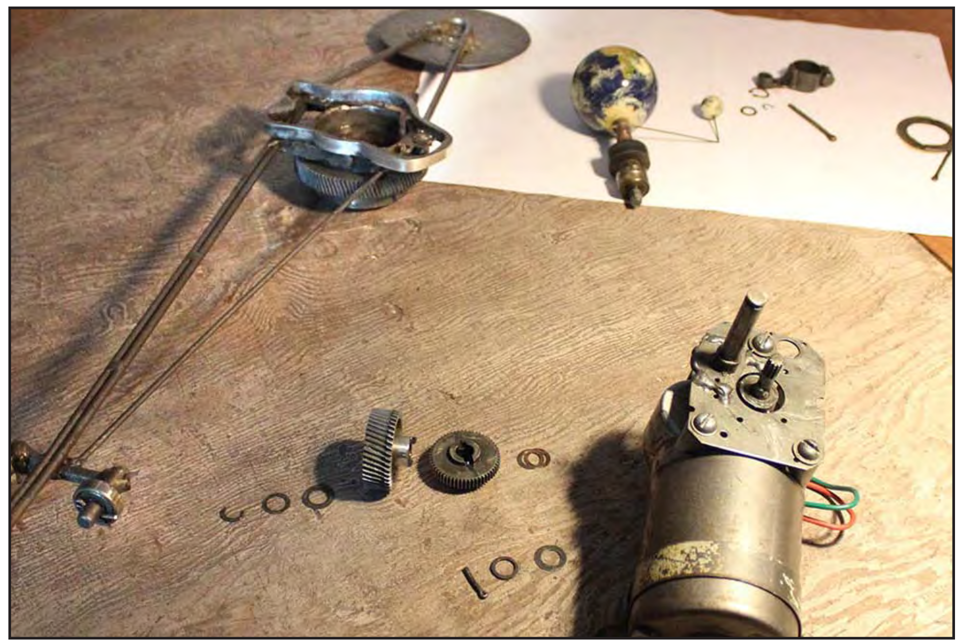
The beaten-copper face and surround was made from a hot-water tank. I always use old, recycled materials whenever possible. I do this on the principle of reusing the waste around us, and also because I was broke! As many contributors to this magazine will know, if you can find existing mechanical parts to do the job, it's a lot easier, quicker, and cheaper than fabricating parts.

The craft of beating metal into relief is called repoussé. It's tradi-



LEFT: 5. The reverse side of *Sol*, showing the windscreen-wiper motor (lower-right quadrant) and cast-lead counterweight (upper-right quadrant).

BELOW: 6. The whole mechanism stripped down. The Earth and Moon can be seen at the top of the photo.



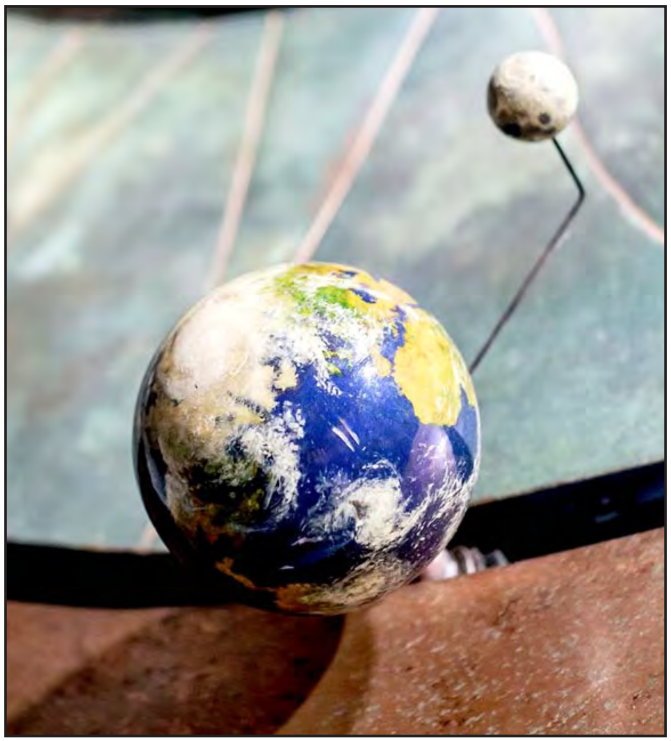
tionally done into a pitch medium that gives with the metal's deformation but provides support. I didn't have access to such luxuries at the time, so I managed the form of the face by beating it into sand-packed sacking and firm clay.

I developed a method for making eyes, which I employed in several pieces at that time, using heat-molded plastic with inset cast-resin corneas. For the rest of the eyes, I used cassette-tape boxes, boiled in water to soften them, then pressed between spoons. I experimented with gold leaf and foils for the irises, set in the resin. Pupils were back-painted black (**photo 7**).

The Earth and Moon (**photo 8**) rotate around the Sun on a sprung, counterweighted arm, using skateboard bearings that run on the wooden rim, and a rubber wheel from a reel-to-reel recorder that follows the outer rim of the Sun's face (**photo 9**). That wheel spins the Earth and Moon.

Facing the sculpture, one looks down on the Earth's North Pole (apologies to Southern Hemispherians), and the counter-clockwise direction around the Sun is astronomically correct. I like my sculptures to be a communicator of science, at least in some small way. Since I

7. The automaton's eyes, made primarily of plastic and resin, slowly open and close as the cycle progresses.



8. The Earth and Moon.

9. The Earth-Moon carriage, running on skateboard bearings.

was a kid, I've always loved thinking about the way our universe works. When you first see that our Moon, Sun, and planets all move along a curved line across the sky—the ecliptic—or when you first look at the Moon through a telescope, those epiphanies put you in your place! A physical model in front of you really helps in understanding concepts like orbits, seasons, and eclipses. The ancient Greeks and others somehow worked it all out without even a pair of binoculars.

I didn't have the Earth spinning 365 times an orbit, because it would have been too fast to see the continents and clouds, which were painted on a three-inch wooden ball. On the Earth, I varnished the painted oceans and continents a couple of times before the clouds were painted on, then I varnished over the clouds. This, on very close inspection, gives a slight sense of the clouds being above the land. I've heard it said that, if the Earth were the size of its picture in a magazine, the atmosphere would only be as thick as the ink on the page. This does make you feel a bit vulnerable. My Moon is a small, painted ball, showing the major mares and craters.

The counterweight that balances the Earth-Moon carriage is a shallow, concave lead weight (**photo 10**). I made this by pouring lead into the upturned base of the copper hot-water tank. The casting came out with a few bubbles and imperfections, which appropriately gave it a lunar quality.

10. The lead counterweight on the arm assembly, with the central car-wheel bearings.

11. The *Dartmoor Pony of the Apocalypse*, 2005, awaiting care and attention.

Check out the author's website and Vimeo page.
Website: *https://www.andrew-woodward.co.uk*
Vimeo: *https://vimeo.com/andrewwoodward*

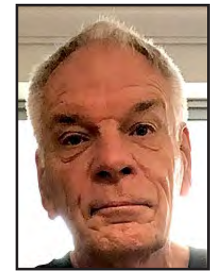
Reassembly

In stripping the sculpture down, I found that a couple of the skateboard bearings I'd used were dry and stiff, so I replaced them. There was a crack on the cam for the eyes that needed repair and I had to re-bore and pack out the pivot on the Earth carriage with some .002" brass shim.

Otherwise, the sculpture really just needed cleaning and lubricating. The whole arm assembly turns on recycled car-wheel bearings that happened to perfectly slide onto a stainless-steel vacuum-cleaner tube.

My other sculpture that came back from six years at MAD was the *Dartmoor Pony of the Apocalypse* (**photo 11**)—a horse skull I found on the moors in the early 2000s that I "reanimated" (it was too late for the vet). The horse has survived a hundred-thousand kids pretty well but definitely needs some care and attention. That's next on my to-do list. A1

Time to Spend a Penny



Working models and coin-in-the-slot automata at the Rye Heritage Centre

by David Soulsby • Billingshurst, UK
Photos by the author

The Penny Arcade at the Rye Heritage Centre, in the UK, has a wide variety of coin-operated arcade machines.

Coin-operated automata, or "working models" as they were known, were popular in the UK from the late 19th century until the early 1970s. Each machine presented a scene in animation, which usually lasted no longer than twenty seconds. Inserting a coin into the machine would set it in motion.

1. *The Drunkard's Dream* Working Model, by Bolland, c. 1952.

The automata were housed inside glass-fronted, freestanding cabinets. They had such exotic titles as *The Egyptian Tomb,* or *The Drunkard's Dream* (**photo 1**).

These automata were invariably presented at seaside venues throughout the country and were typically located at the end of a pier. Many models were crudely rendered in papier-mâché and fabric (**photo 2**), although some had figures made of wax, with considerable detail (**photo 3**).

2. Detail from *Drunkard's Nightmare*, by Kraft Industries, 1952. The figures are crudely made from papier-mâché.

The idea of using automata to provide short, animated entertainments in fact originated much earlier. Exhibitions and shows were held throughout the 18th century and midway through the 19th. The public paid a small entry fee. An attendant would often escort the audience around the animated exhibits.

The next development was to enclose the tableau within a wooden case and add a coin-release mechanism to set the scene in motion. Machines were originally powered by clockwork but many were converted to run by electricity in later years.

3. A well-detailed figure from *Haunted House*, by Canova, c. 1910.

Themes presented by automata in the dioramas were often somewhat grisly. Executions were always popular. An English scene depicts a prisoner being

4. *English Execution*, by Ahrens, 1930. The prisoner has just been hanged.

5. *French Execution*, by Kraft's Automatics, c. 1954. After the bloody blade falls, so will the man's head, into the basket.

6. *American Execution*, by Canova. The victim's head lights up as he's given the juice.

given the last rites by a nodding priest, after which a trap door is released by guards, and the unfortunate is hanged (**photo 4**). In a French scene—i.e., the one from Kraft's Automatics—after the tolling of a bell, the doors of the prison swing open to reveal the prisoner, his head bowed beneath a guillotine (**photo 5**). Again the last rites are administered by a priest, whereupon the blade falls and the victim's head drops into the waiting basket.

Another grisly scene is the *American Execution*, by Vincent Canova. The prisoner in the chair, ready for electrocution, has a cap placed on his head. His head lights up upon the throw of the switch (**photo 6**).

Other fashionable themes were haunted houses and churchyards. All sorts of ghosts and ghouls popped out of doors and cupboards, to the delight of the customers (**photo 7**).

One of the earliest creators of these attractions was John Denison, a mechanic from Leeds. He was soon joined by a number of other manufacturers, as the launch of coin-op machines for amusement purposes became popular in Britain. Many of these names have not survived the passing years, but among those that have are Nelson and Leonard Lee, Markie Kraft, and Charles Ahrens.

One of the most diverse ranges of working models emanated from the Bolland family. Frederick Bolland came from Peckham, London, and established a successful business in dealing and operating amusement machines. His younger brother Arthur assisted Fred in purchasing old cabinets that had previously housed the once popular claw "grabber" machines. After WWII, merchandise to stock these machines was in short supply, so the machines became useless and their cabinets were readily available. The Bollands used them, already fitted with coin-in-the-slot mechanisms. They also cannibalized some of the innards to manufacture and house the working models that they developed.

Over 400 machines are believed to have been built by the Bollands, between 1948 and 1975, with a wide range of themes and high-quality animation. Many were one-offs. Machines with the same title often had differences in the dioramas. Unfortunately, many were lost or scrapped, or had their scenes altered or replaced. Those that remain today are mainly in heritage museums and small collections.

Other types of automata were larger and featured more lifelike figures, often with voice or musical accompaniment. The *Laughing Sailor* or *Clown* were particularly popular, as was *The Gypsy Fortune Teller*.

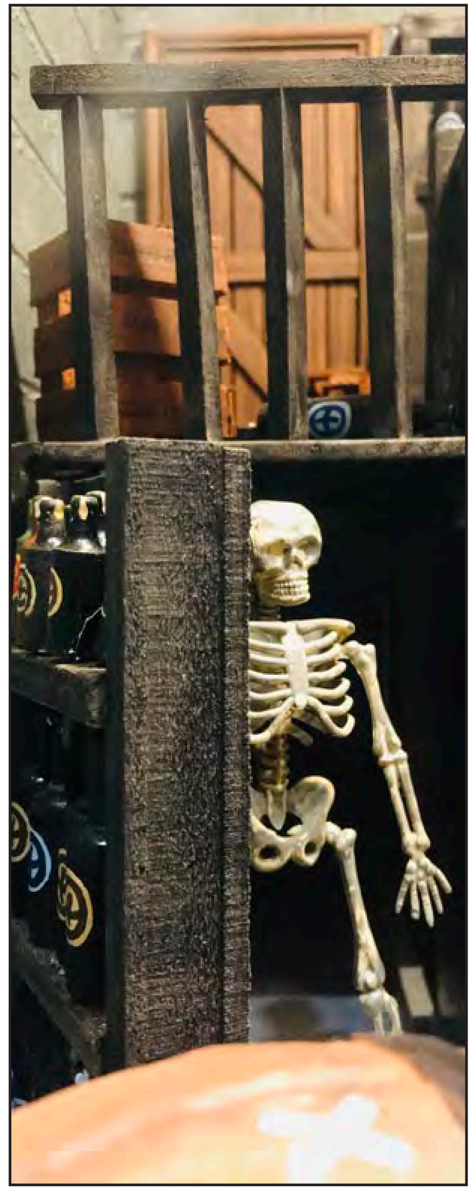
I decided to take a trip down memory lane, to revisit the machines that I had enjoyed as a boy. I chose the Rye Heritage Centre, in East Sussex, to view the large collection of coin-in-the-slot machines. These were previously in operation on the pier but have long since been replaced by arcades filled with video games and pinball machines, fed by pound coins, rather than pennies.

7. A ghost appears from the closet, in Bolland's *Haunted Room*, c. 1950.

The Old Penny Arcade is on the first floor of a converted 19th-century sail loft and contains over thirty working models, designed and built by a number of 20th-century constructors (see the **lead photo**).

The thrill of seeing so many wooden cabinets, with exotic names like *The Haunted Graveyard* or *Davy Jones Locker*, was mind boggling. Before I could put them into action, I first needed to get some old pennies. These were dispensed from a change machine with the rather inflated exchange rate of seven pennies to the pound. For my investment of £5, I received a fistful of coins that weighed a ton and made a serious bulge in my pocket.

The first machine that I remembered well was the ubiquitous *Drunkard's Dream*, by Bolland



8. In Bolland's *Drunkard's Dream*, c. 1952, the drunkard (upper left) stares around as demons emerge from beer barrels, and a skeleton appears from the cellar in the door under the stairs.

(**photo 8**). The drunkard is in his beer cellar, about to experience his recurring dream. I selected a grimy penny from my stash and pushed it into the slot. The well-oiled figure, in a rather smart suit, is surrounded by crates and barrels of beer. He lifts a bottle to his lips several times, as a rat scurries across the floor. The door under the stairs swings out, revealing a skeleton. Several demonic figures then appear from the barrels, one by one. Finally, the fourth barrel swivels to reveal that Beer is Best, printed on the side of the barrel, has been replaced by Left Alone.

Another machine that I spotted was *Our Firefighters*, manufactured by Charles Ahrens. As soon as I dropped a penny into the slot, the three-story building appeared to go up in smoke, with the flames simulated by lights flashing on and off at the windows. There is apparently a baby trapped inside. The noise of the fire engine can be heard but one of the firefighters has already shot up the stationary ladder before the fire engine has even driven out through the doors of the fire station, conveniently located alongside the burning building. In double-quick time the rescuer slides back down with the baby

9. *Our Firefighters*, by Ahrens, 1930. No worries—the baby is rescued by a fireman who happened to be fortuitously on the spot at the right time.

10. In *The Beauty Contest*, by Peerless Enterprises, 1950, four ladies display their charms on a revolving carousel. That last one, who shows her undies, is the winner, of course.

in his arms, and the fire engine reverses back into the station (**photo 9**).

The Beauty Contest, a rare machine from 1950, by Peerless Enterprises, was also on display (**photo 10**). Four different ladies individually appear, as the stage rotates. The heads of the judges turn to inspect each one. The last contestant is bent over, showing her underwear, and the judge raises a sign indicating that she's won first prize—"1,000 Nicker" (£). Considered non-PC in our present era, the reference is an example of typical 1950 British humor!

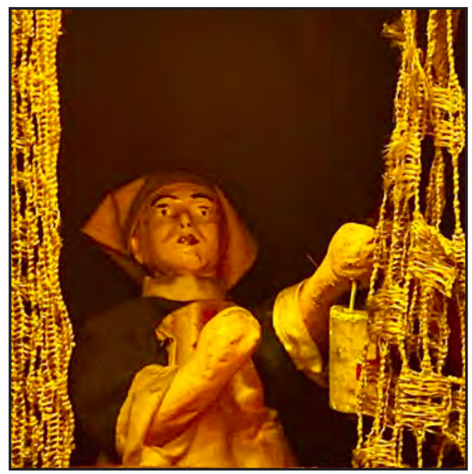
A number of Bolland machines are included in the display. In *The Burglar*, from 1952, a man in bed, with oversize feet, awakes to find a burglar with an oxyacetylene torch, opening his room safe. The man waggles his feet in distress while the burglar reveals a stash of money in the safe. This rather

11. *The Burglar*, by Bolland, 1952. A man with prominent feet lies terrified in bed, while a felon burgles his safe. A pair of enormous handcuffs is conveniently waiting in the cupboard. Then a policeman shows up in the nick of time.

bizarre scene continues with a cupboard door swinging open, to reveal oversized handcuffs inside. Then a policeman appears at a side door (**photo 11**).

Another offbeat model was *The Miser*, who is seen in a rather dilapidated room and is counting his money. The safe swings open to show more bags of cash. Suddenly a nurse appears at the window, collecting for charity. The miser turns, his expression indicating his annoyance and that she had better hop it. Then, at the same window, the Devil appears, waving a bag of gold, for which the miser sells his soul. The safe reopens, but this time it is empty (**photo 12**).

The exhibition, including additional automata from Ahrens and Lee, finished with some larger, more realistic models: *Cry*



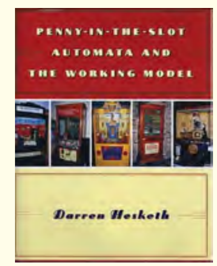
12. *The Miser*, by Bolland, 1952. As the miser counts his money, a nurse asking for a charitable donation appears at the window. She is replaced by the Devil incarnate, to whom the miser sells his soul.

Baby, from Modern Enterprises (c. 1950, **photo 13**), and the same company's ever-popular *Laughing Sailor* (**photo 14**).The sounds of the crying baby and chuckling sailor originally came from 78 RPM records but have now been converted to 8-track tapes.

I invested my final penny to hear the crying baby and was heartened by the note on the cabinet indicating that, in order to save the wear on the cams and model, the time cycle for the animation had been reduced from the original to only thirty seconds. Even with this restriction, the noise was incredibly annoying in the confined space. Dumbstruck, I decided to leave the sailor and I moved on to another area, which contained non-moving displays.

The Rye Heritage Centre's museum provided a really comprehensive peek into vintage arcade machines from yesteryear. It was reassuring to see so many machines on display without a single "Out of order" sign anywhere. This museum is one of around twenty in the UK that displays working models that are actually still working, which proves, I think, that nostalgia is not just a thing of the past.

LEFT: 13. The annoying *Cry Baby,* by Modern Enterprises, c. 1950.
ABOVE: 14. *Barnacle Bill, The Laughing Sailor*, a popular automaton by Modern Enterprises, 1950.



More about working models

Penny-in-the-Slot Automata and the Working Model, a book by Darren Hesketh, published in 2005 by Robert Hale, London, is *the* reference for all enthusiasts of the topic. Included are details of the makers plus over 300 color photos of coin-operated models from the 1860s to the 1970s.

WALTER RUFFLER

Paper automatist: Part 1

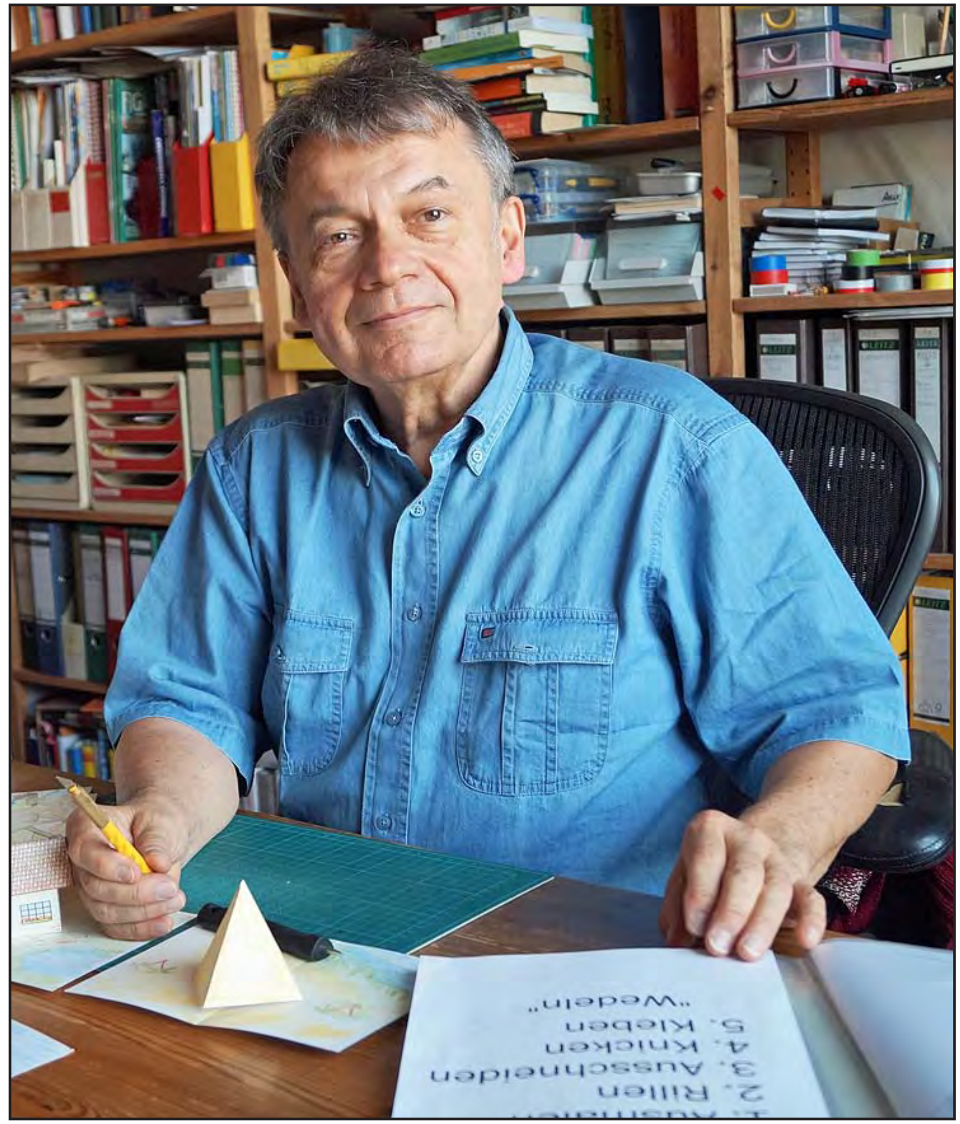
by Ellen Rixford • New York, New York
Photos by Walter Ruffler,
except where noted

Walter Ruffler is famous around the globe for his clever, imaginative, and delightful paper automata. In a world where automata are made mostly of wood and metal, Walter's work has made paper one of the fully accepted media for building moving figures.

That his figures are made of paper is a stroke of good fortune for his clientele; his pieces can be purchased as moderately priced kits. His sheets contain detailed directions and printed parts, which the customer can cut out and glue together. Without breaking the bank and with some very enjoyable working days, a dedicated collector can assemble a wonderful array of "Rufflers." And, while building them, will learn plenty about how mechanical movement works!

* * * * *

Ellen: How did you start your career as a paper mechanic and paper-automaton builder? What kind of background and education do you have, and what were your influences?



CHRISTINA RUFFLER

Walter Ruffler in his studio in Bremen, Germany.

ELLEN RIXFORD

1. Fritz König's paper-model shop, Atelier GAG, in Bremen, Germany.

2. *Off Road* in its final form.

Walter: Since childhood I have been interested in drawing and model building. For several years I attended sculpture courses at the Bremen sculpture museum—Gerhard Marcks House—and drawing and painting courses at the Bremer Volkshochschule, to encourage my own creativity and to learn and practice working techniques. In 2017, I completed my postgraduate studies in Creative Art, at the University of the Arts and the University of Bremen, with a certificate.

I have lived in Bremen since 1978. For twenty-five years I was a teacher in a trade-union training facility. Two of my subjects were technical drawing and technical mathematics. Sometimes, in the workshop, my students built mechanical things that we had previously developed in theoretical classes, so my job and my artistic interest were closely related.

My teaching job involved me with mechanical principles and machines, and I developed a preference for mechanical sculptures. I especially liked those of the Swiss artist Jean Tinguely.

In 1999 my wife and I visited the Swiss Science Center Technorama, in Winterthur. There we saw the exhibition *Kabinett der Mechanik*, which included thirty exhibits from the Cabaret Mechanical Theater in London. These were funny little machines, made of wood and metal, driven by a crank that moved the small figures—a bird watcher, a lion tamer, poisoned milk, a skiing dog, a wave machine, etc. The title of each told the story and each mechanism was visible in the base.

I bought the book that accompanied the exhibition, *Cabaret Mechanical Movement*, by Aidan Lawrence Onn and Gary Alexander. The book came with a list of literature in German, compiled and commented on by Falk Keuten of Bonn. This list also contained a paper-techniques section, including a reference to Fritz König's paper-model shop, Atelier GAG, in Bremen.

Back in Bremen, I visited the Atelier GAG (**photo 1**) and bought a lot of paper automata by Paul Spooner, Peter Markey, Keith Newstead, Rob Ives, and others. I analyzed the mechanisms used and consulted other technical literature. I liked the paper mechanics so much that I started to design paper machines myself. They do not try to reproduce reality as realistically as possible on a smaller scale. Their basic principle is an idea of movement or a story to be told. In this respect they are originals at a scale of 1:1.

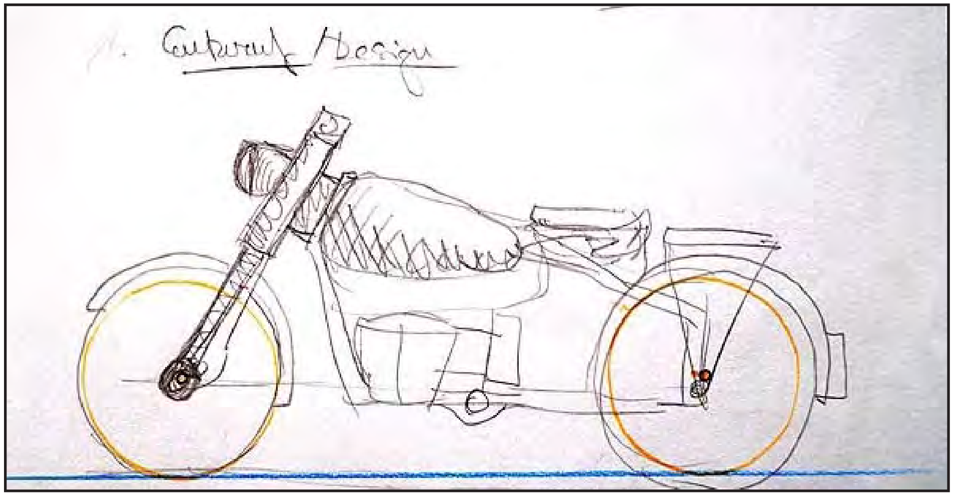
Ellen: How do you implement an initial concept for a finished product that you could market and sell?

Walter: To best answer that question, I'll tell you about the first paper automaton I developed. Titled *Off Road*, this was a motorcycle rider set in motion by a crank (**photo 2**). The model was intended for a friend who likes to ride his motorcycle cross-country (and over a lot of bumps).

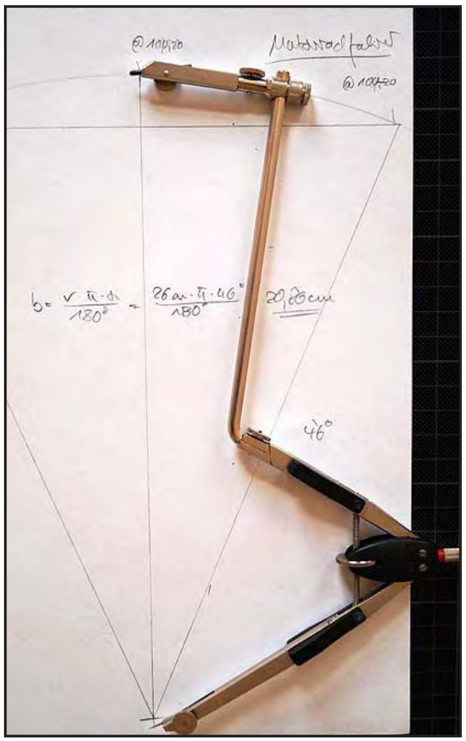
The mechanism consists of a crank that, when rotated, moves a lever (a wooden shish-kebab skewer) up and down and to the right and left. The skewer goes through the base, through the motorcycle, through the body of the rider, and is glued inside his back. The technical term for this is a crank slider.

When you turn the crank, the body of the rider is raised and pulls the motorcycle up. First the front wheel goes up, then the rear wheel lifts off—the machine flies and jumps over an imaginary obstacle. Then the front wheel sits back down on the base, then the rear wheel, then the driver sits down on the seat again, until another crank rotation causes another jump. I tried to imitate the way a real motorcycle (and rider) behaves when it goes careening at top speed over a bump.

First, I used photos to determine what motorcycles look like. Then I used a freehand sketch to design my own classic "Ruffler" motorcycle (**photo 3**). It was not important to reproduce a real motorcycle of a certain make, but to



3. Walter Ruffler's first sketch when designing *Off Road*.



4. Initial drawings were made using traditional drafting instruments.

a produce a strong design that everyone would identify as a typical motorcycle. The most important elements were the frame with the tank, the seat, the luggage rack, the rear fork with the rear wheel, the handlebar with the front fork, and the front wheel and headlight. Footrests were made of a toothpick and, together with the handlebars, were the connections to the driver. I also made sketches of the driver, the base, and the mechanism, and I determined the approximate size of these parts.

I used 160g paper but I wanted to install a kebab skewer as a lever. Pivots for the joints, the crankshaft, the handle of the crank, and the crank pin were wooden toothpicks, as were the handlebars and axles for the wheels. The crank rotated in a bearing in the base.

The second step was to make scale drawings of the base, the parts of the drive (crank and crank bearing), the motorcycle, and the driver. In addition to pencil and paper, I used a drawing board, a triangle, and a ruler for these drawings.

I also tried to estimate the extent of the lever movement and thus the movement of the motorcycle. I understood that the movement of the free end of the kebab skewer would describe a circular arc. Using what I knew of geometry, I did some calculations and, with a ruler and compass, drew the arc (**photo 4**). In fact, the end of the kebab skewer moved in the form of an ellipse, the shape of which depended on the size of the pivot point (the opening in the cover plate of the base) and the length of the lever arms, so I was wrong.

All of the individual parts were measured to determine their sizes. The parts of the model were mostly pieces that had to be formed from paper by cutting out the shapes, then bending and gluing them together. It was also important to find a solution for a secure connection of the individual parts.

I used adhesive tabs to connect parts made of paper. But how should the wooden kebab skewer be connected to the toothpick crank pin? Here, a paper connector was necessary, and to this the kebab skewer was glued. The connector also had a hole in which the crank pin could turn. These constructive details had to be worked out through experiment.

In the third step, I designed the 2D shapes and dimensions of the components. I thought in terms of transforming 3D forms into 2D paper shapes that could then be cut, folded, and glued together to make the 3D shapes. For example, the base was to consist of six parts—a base plate, four supports, and a cover plate.

The upright supports needed to have a triangular cross section because that is the most stable. The development of the triangular column consisted of three strips of cardboard for the walls of the column, a narrower strip of cardboard for a long adhesive flap, and three smaller adhesive flaps at the upper end, with which the cover plate could be attached. After all the parts had been developed and designed, I transferred the drawings to my computer using a drawing program and printed them out.

5. The first quickly made, hand-painted protoype for *Off Road*.

I assembled the first prototype and…whoops! The base I had designed was much too short and the jump of the motorcycle went far beyond it. I extended the base at the front and back with paper, which I cut to size and glued on until everything worked as I had imagined. I then painted the finished prototype with watercolors (**photo 5**).

I transferred all of the changes to my computer files and printed them again, this time in color (**photos 6** and **7**). The motorcycle got a red frame and a gray engine block; the motorcycle rider wore a green sweater, black pants, and black boots.

In my first drafts, the motorcyclist was wearing a full-face helmet, which looked too impersonal to me. That's why I made a cylindrical head out of a roll of paper. I glued on a nose and put on a shell helmet. This looks a bit more old-fashioned and personal. The helmet is formed from a round base plate with two truncated cones and a smaller cone on top, resulting in the rounded shape of the helmet.

To design the kit for sale, I had to number all of the parts in the order of assembly and place them on the cut-out sheet so that related parts would be found together. I also had to write assembly instructions, with step-by-step drawings and brief text explanations.

I wrote some of the assembly instructions directly on the cut-out sheets, in both German and English: for example, "*auf 2 kleben*/glue on 2." If large areas were to be cut out, I marked them with a red cross: "*ausschneiden*/cut out."

A "line code" is important for the assembly. A continuous outer line means "cut out;" a broken line means "mountain fold" (crease and fold the parts backwards); a dotted line means "valley fold" (crease and fold parts forward); a red dotted line means "stick another part on here," and so forth.

6. The second prototype, printed in color from the computer.

7. The third prototype, after further modifications.

My wife Christina did a control assembly and checked that the instructions were logical and practical, and that the numbering in the assembly instructions matched the numbering of the parts on the cutout sheet. If there were any assembly difficulties, I corrected the files on the computer accordingly.

It was also necessary to design a cover sheet or envelope, with photos of the completed model and brief descriptions, so that the customer would be interested and informed about the product. All sheets were packed together with the kebab skewer and required toothpicks, in a sealed, transparent-plastic bag.

At first, the motorcyclist had a white base because I printed out the sheets on my inkjet printer and I wanted to save ink. But when the demand increased, I had an offset printshop print 5,000 pieces, with a colored base. There were some other modifications, too. For instance, toothpicks were no longer used as the crankshaft and handle. Instead, these parts were built from paper as square profiles with diagonal bracing for stability. This construction could absorb greater force. The motorcyclist also got an attractive friend as a passenger, who could also take the place of the driver! The motorcyclist received a small backpack that covered the spot of glue from attaching the skewer to his back. AM

The second part of this conversation will be in the next issue of *Automata Magazine.*

Visit Walter Ruffler's website at *http://www.walterruffler.de*

AN AUTOMATON FOR A SIGN COMPANY

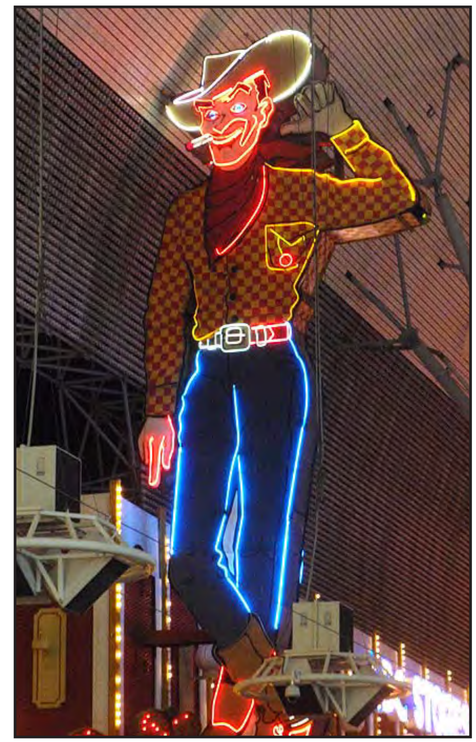
Creating an animated display

by Gary Johnson • Basking Ridge, New Jersey, USA
Photos by the author, except where noted

I am a sign maker by trade and have always been fascinated by the mechanical signs I saw in my youth. These included Vegas Vic (**photo 1**), with his moving arm, welcoming visitors to Las Vegas, or the famous Times Square Camel Cigarettes billboard, which blew smoke rings down Broadway for 25 years. So, when I was invited to create a display for a booth at the International Sign Expo in Orlando in 2018, I jumped at the opportunity to mechanize my creation.

After being invited to participate, I was eager to get started.

LEFT: The finished Great American Sign Company's automaton. The eagle's head turns intermittently, the wings wave, and the "S I G N" letters move in and out.



JOE GAUDER

1. *Vegas Vic*, a large, animated sign, welcomes visitors to Las Vegas.

LEFT and ABOVE: 2 and 3. Computer drawings of a wall of the building and the company's logo. These designs would be rendered in high-density urethane foam by a CNC router, then backed with plywood.

LEFT: 4. A wall being finished. After the carving was done with the computer-controlled router, the walls were painted and weathered.

I had about five months to prepare and, as it turned out, I needed every second of it. This projct made me wish I'd paid more attention in physics class, because I had no idea how to put together gears, levers, ratchets, pulleys, or cranks to make my idea a reality. I had never worked on a car or repaired anything in my life.

Fortunately, I live just a few miles from the Morris Museum, in Morristown, New Jersey, the home of the Guinness Collection of Automata and the host of AutomataCon. The museum was a great place to start, and it led me to the internet, where I discovered a wealth of information from modern-day automaton artists in the US and UK. I picked the brains of greats, like Matt Smith, Philip Lowndes, Rob Ives, Michael Croft, and Dug North. I read their blogs, watched their videos, and even bought a few of their automata to understand how they animated their creations. I could study this subject forever but there came a point when I had to make decisions on what to do and how to do it.

My idea was to animate my company's logo and place it on top of a model building, in the style of so many 19th- and early 20th-century factories, many of which can still be seen here in New Jersey. The vendor limited the size of my display to 2' x 2' x 6', setting the scale of my creation to 1:14.

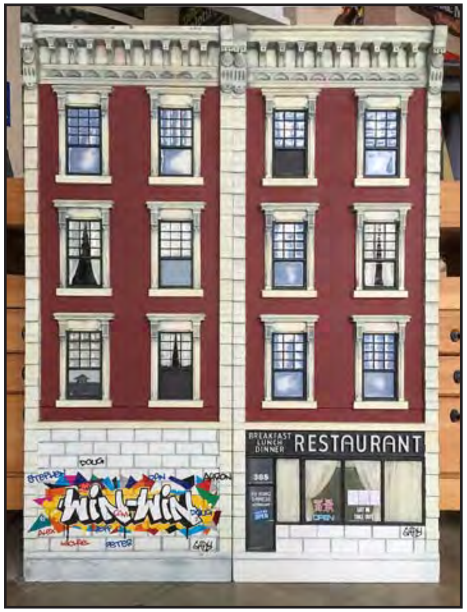
The building

On the internet, I researched drawings of late 19th- and early 20th-century structures in New York City. I was looking for a building that was ornate but would be easy to replicate. I did not want to spend so much time making the building that there would be no time left for the animated sign on top.

A building I found on the corner of 6th Avenue and Waverly Place fit the bill. It was decorative but all the elements, including the windows, cornices, and ledge details, were repeatable. I just needed to create one of each, then repeat however many were required. The surface of the structure was smooth, which would be easier and quicker (than textured) to carve, paint, and age. I'd originally planned for the first-floor store to be the Great American Sign shop, but changed my mind when I realized that this building, in fact, housed the famous Waverly Diner, in Greenwich Village.

I created the building and logo using Vectric, a 3D software program (**photos 2** and **3**). Using my Multicam CNC router, I carved most of the elements out of high-density urethane (HDU), which is a lightweight and easy-to-carve material we commonly use in dimensional sign making (**photo 4**). Plywood was used for the gears, and also to back up the HDU, adding strength and rigidity.

The building is essentially a rectangular box of HDU, reinforced with ½" MDO (medium-density overlay) plywood. The sides of the building slot into the sidewalk baseplate and are further held together with Komacel PVC braces on the inside, and a PVC cap that forms the roof. The



5. A pair of the finished walls, painted and weathered. Graffiti and other lettering was done with decals.

building was painted with Benjamin Moore exterior latex paints and aged with glazes. Lettering and graffiti on the walls and doors are printed decals. Finished walls are shown in **photo 5**.

The sign

Once the building was completed, I was free to work on the mechanical model above it. I was running out of time, so I had to keep the mechanics simple. I decided to animate the head, wings, and "S I G N" letters of the logo. Like the building, the logo is

6. The logo, cut from foam with a plywood backing, under construction. Holes in the center are for push rods to animate the sign letters.

carved from HDU with a plywood backer (**photo 6**).

The wings and head were the most difficult parts to carve. I needed to create a double-sided, fully rounded eagle head from a single-sided 3D image. I achieved this by mirroring the original right-facing artwork and adding a wedge of filler HDU between the two images (**photo 7**). I blended the three pieces together with hand carving.

The wings required a considerable amount of hand carving. Since they pass both in front of and behind the company's banner (see the **lead photo**), it took a considerable amount of reconfiguring the original artwork and a lot of hand

7. The eagle's head was built up of three parts. A foam wedge (blue, in the photo) gave the head the required proportions.

carving, with some trial and error thrown in, to make these parts operate as I envisioned.

The "S I G N" letters were also a challenge. Unlike the motion of the eagle's head and wings, which could be tinkered with, the movement of these four letters would have to be precisely engineered.

Modern Masters metallic paints were primarily used on the logo. The scaffolding holding the sign was naturally aged steel angle, welded together. This also served as the framework for the mechanics.

The mechanics

Animation of the logo is achieved by four rotating shafts. The first shaft is activated by turning a simple hand crank. On that shaft is a small gear with just seven teeth. This turns a 21-tooth gear on the second (main) shaft, above it. The 3:1 ratio gears down the speed of the main shaft. This second shaft operates the wings by pulling a string, with the help of a center crank and gravity.

On the other end of this shaft is a 17-tooth gear that rotates a 21-tooth gear on the third shaft, slowing the operation a bit more with a 1.234:1 gear reduction. This third shaft carries four cams that control the in and out movements of the "S I G N" letters. Each letter has two dowels that connect it to a "push button." Oval-shaped cams, each offset from the next by 45°, push the buttons out, while springs return them to their original positions, creating a wavelike in-and-out action of the four letters.

The final shaft at the top operates the eagle's turning head, with a four-place Geneva wheel. The Geneva wheel causes this fourth shaft to rotate just one quarter of a revolution for every turn of the third shaft, reducing the continuous rotation of the third shaft to an intermittent turning of the fourth. A center crank with two springs on the fourth shaft turns the eagle's head back and forth. The mechanism can be seen in **photos 8** and **9**.

The mechanics required a lot of tinkering and improvising, in order to get every part to operate smoothly and in unison. A little grease, oil, candle wax, and a lot of luck were important components.

Just when things seemed to be going so well, we here hit with back-to-back storms called nor'easters. The first brought high winds that knocked down a lot of trees and caused me to lose power for three days. The power came back for two days, then I lost it again for another three, when the second nor'easter hit, with heavy, wet snows that again broke branches and toppled trees.

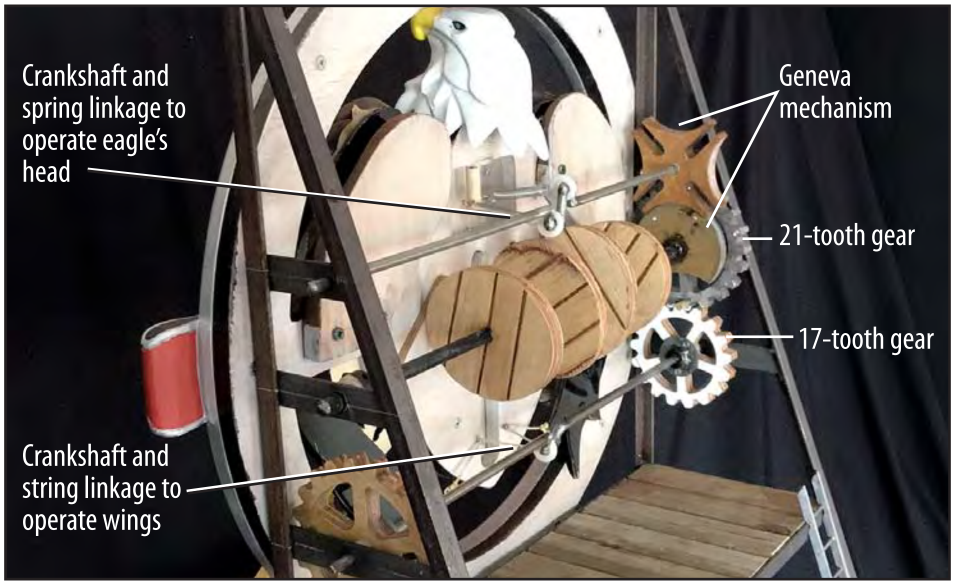
I could not afford to lose the time, so I worked in the cold and dark, with just a few lights and a space heater, all the time keeping my generators fed with gasoline. The storms also created a backlog at UPS, so I had to crate up the building and ship it to Orlando a week early to ensure that it arrived on time.

At this point, the logo had not yet been assembled. I finished the mechanical sign just an hour before I needed to leave for the airport! It wasn't until I was on the floor of the Orlando convention center that I could relax and enjoy my creation, fully assembled (**photo 10**).

Now that this is over, I would say that creating this display was a fun and challenging learning experience. I came away with a basic knowledge of mechanics that I can apply to future projects; I have a kick-ass display for my showroom, as well as a lot of great memories of people from whom I had the pleasure of learning along the way. AM

To see a video of this sign in action, visit *https://youtu.be/XJuZXgChqlU*

8. The mechanism that powers the action. The four different shafts, starting from the bottom, can be seen in this photo. Gears and cams are made of plywood.



9. The mechanism, as seen from the opposite side.

10. The finished automaton at the convention.

Street automata in France

Outdoor action in Nantes

The hairdresser.

A woman trying on a dress.

by Kim Booth • Berlin, Germany
Photos by the author

"Le Voyage à Nantes" is a regular summer event, designed to promote the currently not-very-well-known city of Nantes, France's sixth largest city, which is near the Atlantic coast and the Bay of Biscay. In 2019, this festival took place from July 6th to September 1st. A long green line painted on the ground leads visitors through the streets, passing both temporary and permanent artworks, including the amazing giant elephant that David Soulsby described in the January 2019 edition of *Automata Magazine*.

Couple eating.

Woman sewing.

Guitar player.

Girl choosing a book (above the bookshop).

Detox.

Man eating a fish.

Girl eating a hamburger.

Disc jockey.

The green line leads you through the Rue du Maréchal Joffre. This small, trendy French street includes a baker, hairdresser, bookshop, and burger joint, which is no surprise; but if you look up a little, you find that things are on the move.

Over the hairdresser's shop is a barber, with that curious, critical pose that is so typical of his trade, all the while his scissors snip incessantly. In the base, with its transparent cover, a giant comb moves back and forth.

Above the vintage-clothes shop,

Smoking couple. The caption says, I say no to cigarettes but they don't listen to me.

A passerby gazes at two automata, both over eating establishments.

Kissing couple. These same characters appear in different automata along the street.

a woman keeps trying on the same red-and-white spotted dress, the gearwheels of indecision spinning beneath her feet. All along the street there are a good dozen of these creations, which can be seen during the annual event.

The automata were designed by Nantes-based English artist and illustrator, Gavin Pryke. He is quoted as saying, "I like the idea of making an interactive work that appeals to children and their grandparents alike." Implementation of the full-size automata started in December 2014. A team of eight people were involved in their production and installation.

Positioned above shops and restaurants, the large automata can be easily seen and enjoyed from across the street. Their bases are reminiscent of those of table-top automata, where turning a handle visibly puts cogs and levers into motion. In Rue du Maréchal Joffre, the actual mechanics of the automata are concealed. The bases have transparent fronts that reveal mechanisms that are part of the show but do not actually make things move.

It's a hard life as an outdoor automaton, so these are only installed for the duration of the Voyage à Nantes event during July and August. At night, the wooden performers are allowed to rest, to get ready for their next action-packed day. After the event, the automata are taken down and moved indoors for some tender loving care to make them fit and ready for the next year.

There is a short film of the street's automata in motion here: *https://youtu.be/bNFZ6Ya0MsM*.

A conversation with

Carlos Zapata

An in-depth discussion with a well-known artist: Part 2

by Marc Horovitz • Denver, Colorado, USA • Photos by Carlos Zapata

This is the second part of a delightful discussion I had with Carlos Zapata last year about his work. The first part appeared in the March-April 2020 issue of *Automata Magazine*.

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Marc: It appears that you like to work primarily in wood.

Carlos: Yes, I do like wood, although I quite like metal too. I just did a job for a place in Finland that pushed my boundaries because it involved a lot of electricity, which I don't like. There

The Elephant (2010)

The elephant is one of my favorites. I believe it is somewhere in Texas now, in a private collection.

I began by making the elephant itself. My inspiration came from some elephant models I had seen that were made in Thailand. The skin was extremely realistic but you could see that it was done by pressing a pattern into the wood, almost like a print, so I tried to recreate that. I added color and I really liked it.

Then I wanted to illustrate something personal about the elephant inside it. I managed to cut into the elephant and create a kind of a little room in its guts. There is a door that you can open. I will tell you in a minute what is inside.

When you crank the elephant, you see three characters on top. They represent the British when they were in India. Two of the characters are British soldiers, waving the flag of the British Empire. They represent Britain over India, so the elephant represents India. Then there is a pet monkey, which I didn't like to use, but in this case

(*The Elephant, continued*)

it's just precisely that—an animal for amusement. On the ground is an Indian boy who is holding the elephant and feeding it bananas. The eyes of the elephant move as well.

After you have been entertained by all of the movement, suddenly the door in the elephant's side opens and you see the elephant when he was small, in the jungle, when he was free. It's kind of like the elephant never forgets, so he remembers when he was free.

was a lot of lighting and things like that, and I had to use a lot of metal for the mechanisms.

But I quite like the fact that the piece is just wood. It's kind of a primitive machine, as compared with a clever telephone. It is clever, but you really don't understand in general what's going on inside. I love to watch people's eyes when they just turn the handle, whether they are three years old or ninety. They travel through the whole mechanism and then they see the figure moving.

Friendship (2011)

This one is in South Korea, in a museum. There is just a guy who is holding a metal structure. On the first level you see a mother with a baby—it's about the relationship between the mother and the baby. There is a parrot as well. This is about the friendship between humans and the animal, who is meant to be free.

On the top are two very polite men who are saying hello to each other in a traditional way, bowing to each other, like the Japanese, in a respectful way. There is also a pair of hands. One is dark skinned and one is light skinned, and they are shaking hands.

Marc: Do you do a lot of commission work or mostly make your own designs?

Carlos: During the first ten or twelve years, I had the luxury of doing whatever I wanted—pieces that were to be sold. Since then there has been a change and I began to live more from commissions. I don't know why. Now days I don't really do work that is *not* a commission, in case it doesn't get sold.

Marc: I know each piece must take a different amount of time to construct, but on average, how long would you say it might take you to do a single automaton?

Carlos: That's not an easy question to answer. I work on many pieces at the same time. I could spend half an hour on something, then leave it because I feel it's not getting anywhere. I might come back the next day, or in six months, or in a few years, before I know what to do next. Then I might spend another half an hour, or seven hours. That's the way I work. And it's not

Adam and Eve (2012)

This started as a very, very simple piece. It wasn't originally Adam and Eve, it was just a man and a woman. He says "yes" and she says "no," because we are different. We're meant to be different. I gave that one to Karen [Wilkinson], at the Exploratorium in San Francisco, when I was invited there as Artist in Residence, back in 2004 or 2005.

Then I thought it would be a good idea to again use that idea, but make it a bit more complicated, so I chose Adam and Eve. Before this, I didn't want to use any religious material, so I used Albrecht Dürer's masterpiece *Adam and Eve* as an example. I liked the two figures because they are quite naive, in a way—I like that kind of style, instead of, say, Italian Renaissance.

So that was the visual base. I then did what I usually like to do, which is to add a kind of a story. I also like to add figures to the mechanisms because that emphasizes the idea or it helps to narrate something. I again made her saying "no" and him saying "yes."

At the top is a snake to show temptation. Underneath are three about size, either. I have made really complicated commissioned pieces in a month and a half, for example, but I could spend two years making a very small piece. So it's difficult to answer how long will it take.

Marc: Where does your influence come from?

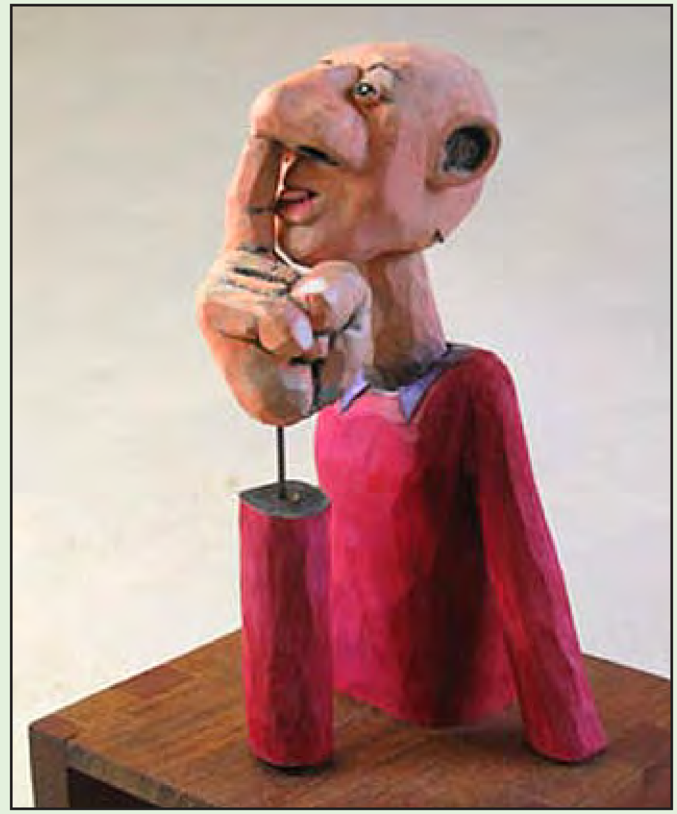
Carlos: Obviously, from what I call the Cabaret Mechanical Theatre School. There's no such school, of course, but I was very influenced by CMT and by being friends with the other automata makers there and by Sue [Jackson] and Sarah [Alexander]. They all have a good sense of humor and they all are nice people. So that's one.

I also went through a rebellious stage in the early 1990s, before I started making automata, when I was still painting. I used to be influenced by a lot of Western artists. But then I began to ask myself, as a Colombian, where are we? And I realized we are nowhere. If you come from a country where everything is [perceived as] negative, and the only thing people want to know about is drugs and things like that, it's extremely sad. You just feel sort of rejected. At the same time, the Spanish people here in Europe were celebrating five hundred years of their achievements in the Americas. You know, the conquests and all that.

As Colombians, we grow up proud of where we come from. But we don't actually want to go on and on about our history, because it is a very bloody history and we are a mixture of that clash of cultures. Colombia wouldn't be Colombia without that mixture of African, American Indian culture, and European. We are told that we come from only Spanish background but we do not. The majority of us are a mixture, and so is our culture.

(*Adam and Eve*, continued)

guys who are jumping, trying to reach some hanging apples. But as they try to reach the apples, they fall back again. They all try at different times. If you look closely, you see that some of the apples have already been bitten.



The Bogie Man (2014)

With this one, I really struggled because I tend to make my mechanisms quite simple. They're not always simple but they tend to be, and I am proud of the fact that they are simple.

I began with the character and I wanted him to have a big nose. I then thought about how I am going to make him put his finger up his nose while at the same time twisting his hand. By happy accident, he did that, and his hand goes down as well. As it goes down, out of his nose, the finger happened to be near his mouth, so I thought I'm going to make his tounge stick out, as well, so it looks like he is licking his finger. I just love that because it makes us look like we're still like monkeys, not as clever as we think we are.

Angel Apprentice (2016)

Funnily enough, that one began with a cage. I first put this angel in a cage that I had bought—a craft-type of cage made in India. I don't like cages. I never do animals that have been used for entertainment. If I include animals in my automata, they are free, not animals in a circus.

The angel's wings are made from real birds' feathers, so it looks like he home-made his own wings out of two feathers. Then I got rid of the cage because I don't like them, but also because I saw that the cage was too small and didn't work very well visually in the composition. Without the cage it worked far better.

I added the chair for him to stand on because I needed something there to make it look like he wasn't quite flying yet—he's just learning to fly. When you turn the crank, he starts moving his wings and, after a few seconds, he rises a bit but quite soon comes down again. He's not really making it. He's trying his best but it's not quite working.

So I turned my back on the Western influences and began to see mostly Latin America and South America in general. But to see African art, I began to go to the museums where it could be seen. Asian art, as well. And that just suited me because, by then, I also began to discover automata.

So that's where much of my influence comes from. But it also comes from American art that is not appreciated in Europe very much. I know in America there are museums dedicated to art made by untrained people. There are often very touching pieces that people have made. For example, there is a fisherman who knows fish very well. All his life he fished and now he is an old man and decided to start painting. So he paints amazing fish because he knows them so well. That's just an example of the kind of artist that I really like. Or people who have been in institutions because they have some kind of mental illness, and they begin to work on something. It's called *art brut* or primitive art or outsider art. Those things have been a big influence on my work.

Marc: To wrap up, what questions have I not asked you that I should have?

Carlos: I want to go back to what I was saying about returning to the essence. You know, when you are a child, you've got really good ideas in your mind. You are very daring and you just go for it. As you get older, you become less daring. I want to go back and look at my earlier pieces, and do new versions. It's like trying to get something fresh again from those ideas.

Fiddler and Cat

Great action from a simple automaton

by Barry Falkner • Otley, West Yorkshire, UK
Photos by the author

This design started out as a rope-skipping cat and a fiddler. A bent-wire axle/skipping rope was intended to lift the cat and move the fiddler's bow arm. However, what soon became apparent was that the speed of the jumping cat was too slow, relative to the fiddler's action, so the

Fiddler and Cat. The cat dances while the fiddler fiddles.

design morphed into a three-cam, one-axle version, with a jigging cat. Adding a rocking head to the fiddler seemed an obvious improvement. This is shown in the computer model (**figure 1**).

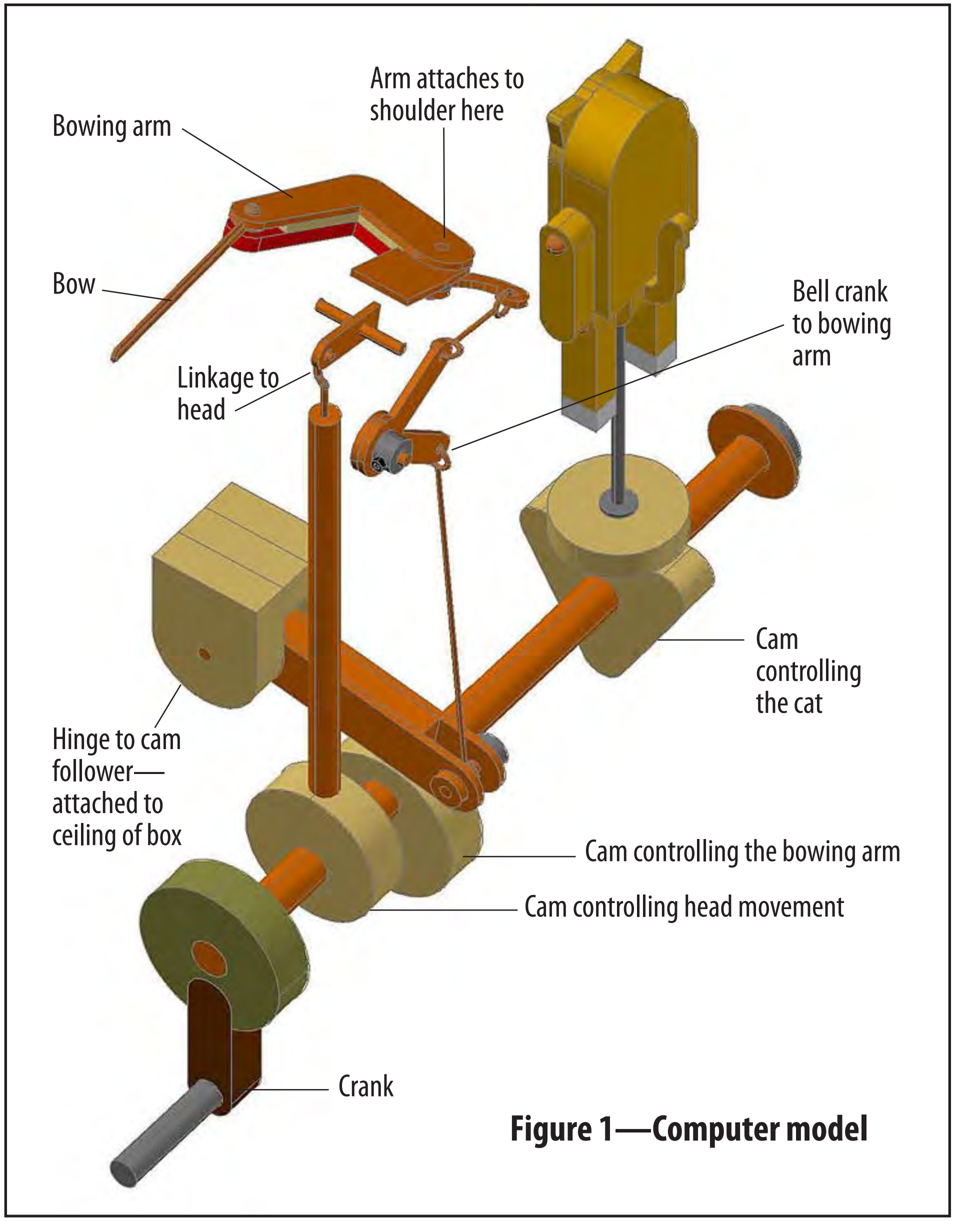


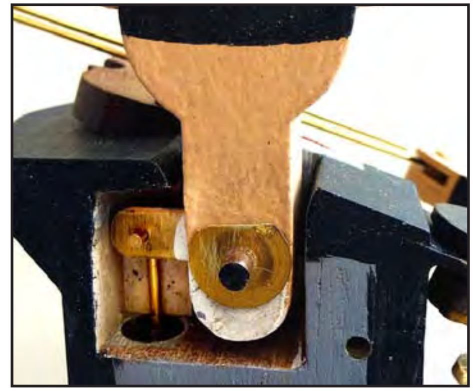
Figure 1—Computer model

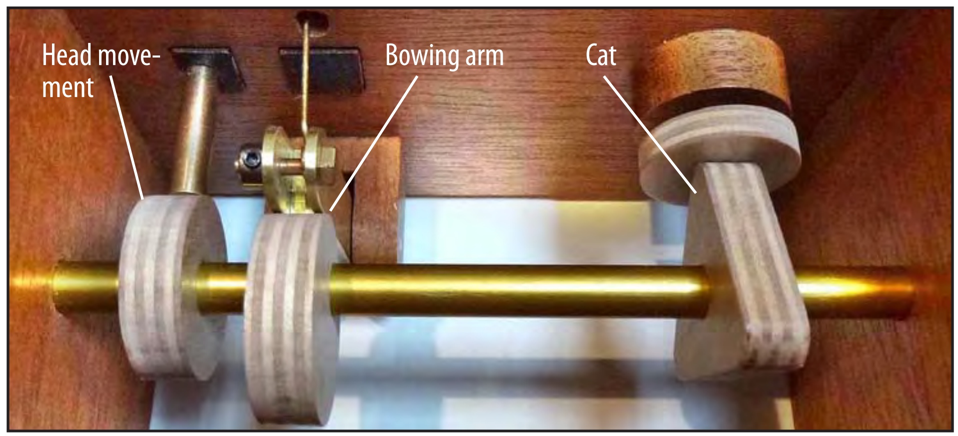
For this project, I got some inspiration from the internet. Schuco made a nice mechanical-pig violinist and Carlos Zapata has made a wonderful foot-tapping violinist automaton. I do not attempt to carve my automata or try for much realism. This restriction results in the absurd, clunky figures that I like.

The fiddler

The fiddler's body is 11mm-thick (7⁄16") softwood, with a cutout at the top to receive the neck. The body's front and back are made of plywood. I thought I would need a spring to get the fiddler's head to return to its starting position. However, I decided to use a 6mm (¼") brass-rod lifter to rock the head (**photo 1**). The rod is housed in an aluminium tube running up a groove in the fiddler's left leg. The rod had enough mass to drop back under its own weight.

The head is made from four layers of 4mm (5⁄32") plywood, which made the ears easy to fabricate. The lifting rod only needed to rise 3.5mm (9⁄64") to rock the head, so the right-hand round plywood cam needed an offset of 3.5mm


1. The linkage that operates the side-to-side movement of the head.



2. Inside the box, looking at it from the back. The camshaft is made from an old archery arrow.

(**photo 2**). The left arm is made from two pieces of plywood—3mm (1⁄8") and 4mm.

Pictures of violinists suggest that their violins are held at an angle, so I decided on an angle of 22°. The bow arm has a 1.5mm (1⁄16") brass top, 1.5mm plywood middle, and a 3mm plywood underside. This sandwich provided a good slot for the brass-wire bow (**photo 3**).

A brass peg, riveted to the brass arm top, locates the arm in a brass shoulder bracket. A brass lever was soldered to an R/C-aircraft wheel collet, which attaches to the arm peg.

I cut out the hardwood violin on my fretsaw. Once the violin was attached to the fiddler's left arm and shoulder, I could measure the amount of movement needed for the bow arm. This turned out to be 42mm (1 21⁄32"—**photo 3**).

A bell crank (**photo 4**) was necessary to transfer the vertical lift of the central plywood cam to a horizontal movement. It worked out that the central cam needed a 14mm (17⁄32") offset to raise a brass lever enough to push the bell crank, via a brass wire, up by 20mm (25⁄32"), thereby moving the bow arm the right distance. The brass bell crank has enough mass to drop back down, returning the bow arm, so no spring was required.

LEFT: 3. The bowing arm at full extension.

ABOVE: 4. A bell crank changes the direction of motion for the bowing arm.

The cat

The cat is made of plywood. The triangular, plywood cam (**photo 2**) simply lifts a plywood disc (cam follower), which pushes up the 2.5mm steel rod that moves the cat up and down 8mm (5⁄16"). This cam could have been oval or square, but the triangular shape gives a good jigging action. To get a good fit where the 2.5mm lifting rod for the cat goes up through the top of the box, I bought and used a 2.6mm drill.

The camshaft is an 8mm aluminium tube from an old, broken archery arrow. None of the parts needed lubrication. I made the box from recycled mahogany, reduced to 10mm (1⁄4") thickness. The back is of 8.5mm (5⁄16") Valchromat, a colored MDF alternative.

I usually just use beeswax to finish mahogany boxes. This time I achieved good results with Rustins Scratch Cover—a proprietary scratch-cover polish—and a light-brown shoe polish.

I really struggle with painting, particularly fine lines. I often have to try several times to get a satisfactory result. With the cat, I did the painting (acrylic) and varnishing first, then added lines with a pen. To paint the fiddler's eyes, I used the blunt end of a drill bit dipped in white paint, then a smaller drill dipped in black paint for the pupil.

Fiddler and Cat from the back side, with the rear wall removed.

Equipment wise, I have a Proxxon FET table saw, which is great for making the boxes. I made a jig to hold the box tops vertically for cutting the end grooves (and for keeping all my fingers!). I used a Proxxon DS scrollsaw to cut out the plywood cams and body parts. The saw was used to cut the 1.5mm brass, too. I have a Proxxon TBH bench drill. The last bit of gear I have is a Proxxon TG disc sander. I also do an awful lot of filing!

I love the end result. Being able to create such a lovely object absolutely amazes me. I particularly enjoy working out the designs and I love trying to fabricate them (although I have many finished designs that will probably never be made). They are well received by my family, especially the grandchildren. The main things required to make automata are endless patience, understanding or tolerance from one's spouse, and optimism—optimism because you're not sure if the design will work until you are virtually finished, and you are not sure whether or not the end result will have been worth all the effort! AM

Watch *Fiddler and Cat* here: *https://www.youtube.com/watch?v=zYnLmoNBxA0*

The Adventures of

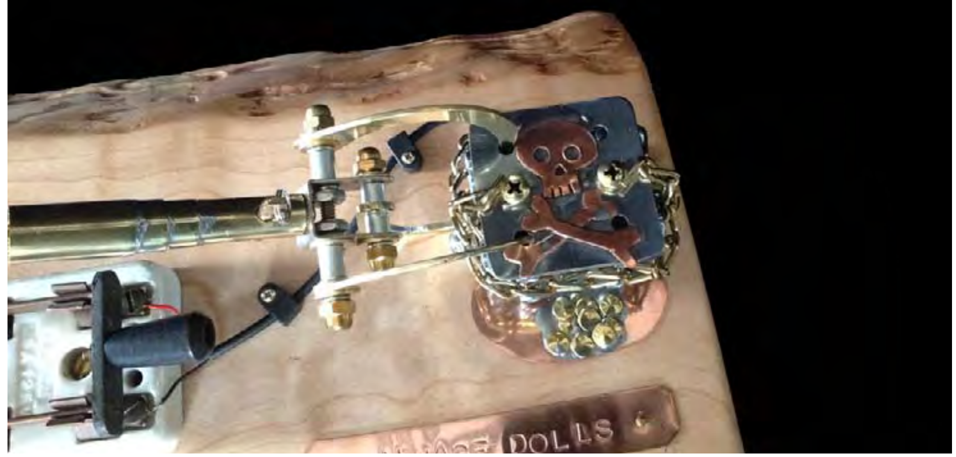
Baron von Steubon and Cromwell

Episode 4: Off to battle

by David Bowman • Mechanicsburg, Pennsylvania, USA
Designs, constructions, and photos by the author

1.

All is well again. Cromwell is fine and the baron has the golden treasure to finance his inventions. Maybe it is time to celebrate!



2.

After their new heads get a good polishing, the adventurers go to their favorite restaurant to enjoy a meal and listen to their favorite group, The Mechanical Trio.

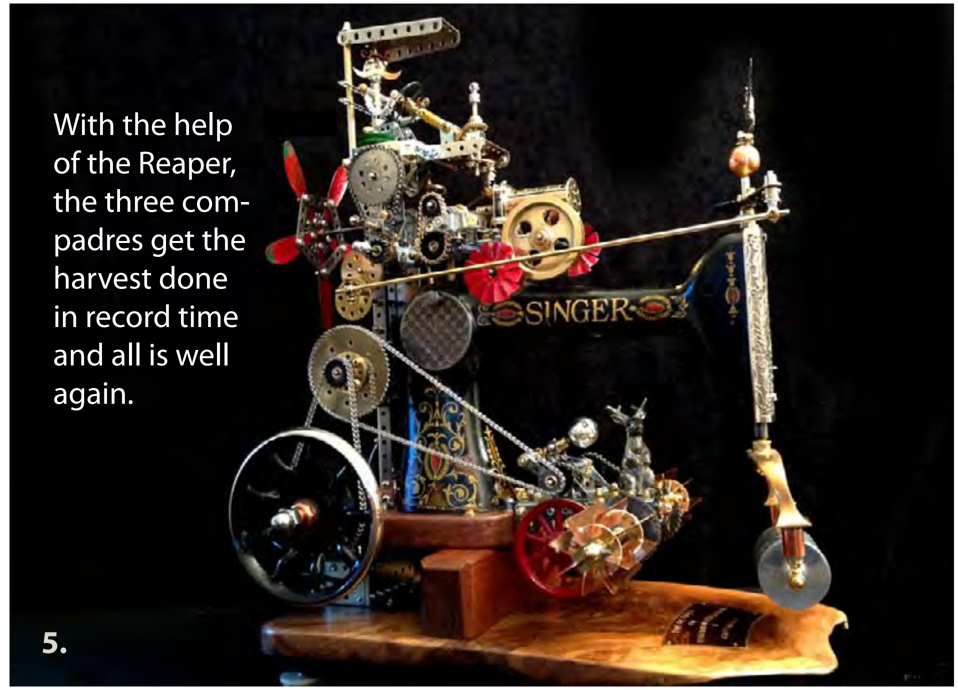
https://youtu.be/LePYH1kh_ZI

3. Bernard approaches the baron and explains that no one is available to help harvest this year's crops. If help cannot be found, all of the food will be lost. The baron replies, "Cromwell and I will take care of it!"

4.

Behold the Reaper!

https://youtu.be/hTXkwSefN6o



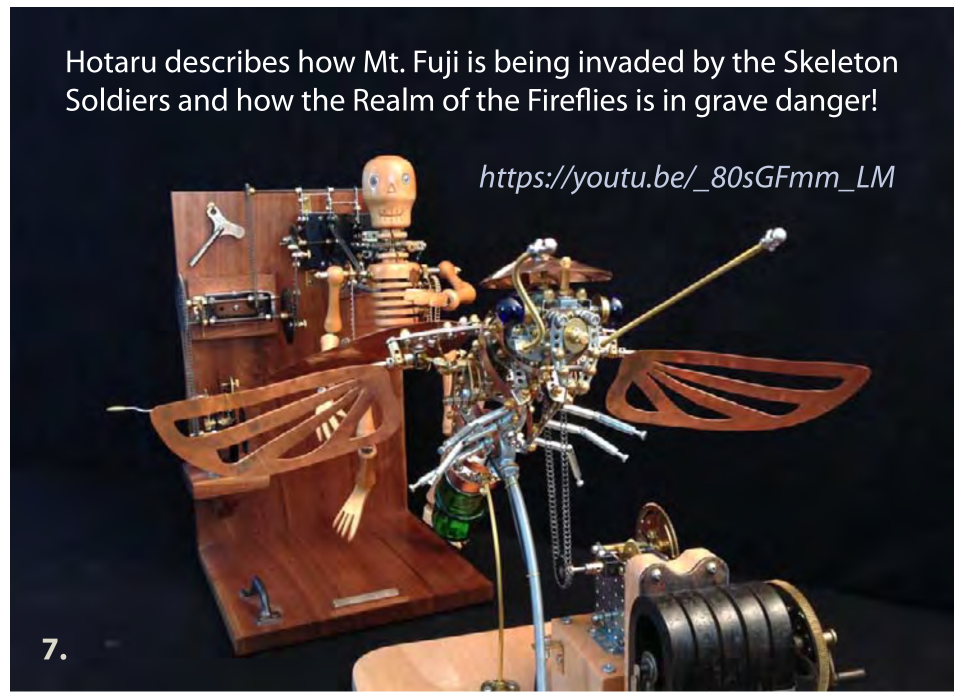
5.

With the help of the Reaper, the three compadres get the harvest done in record time and all is well again.

6.

Exhausted, our two adventurers head home for a well-deserved rest, but when they get there…oh no! Hotaru the Firefly (the baron's old friend) has flown here all the way from Japan.

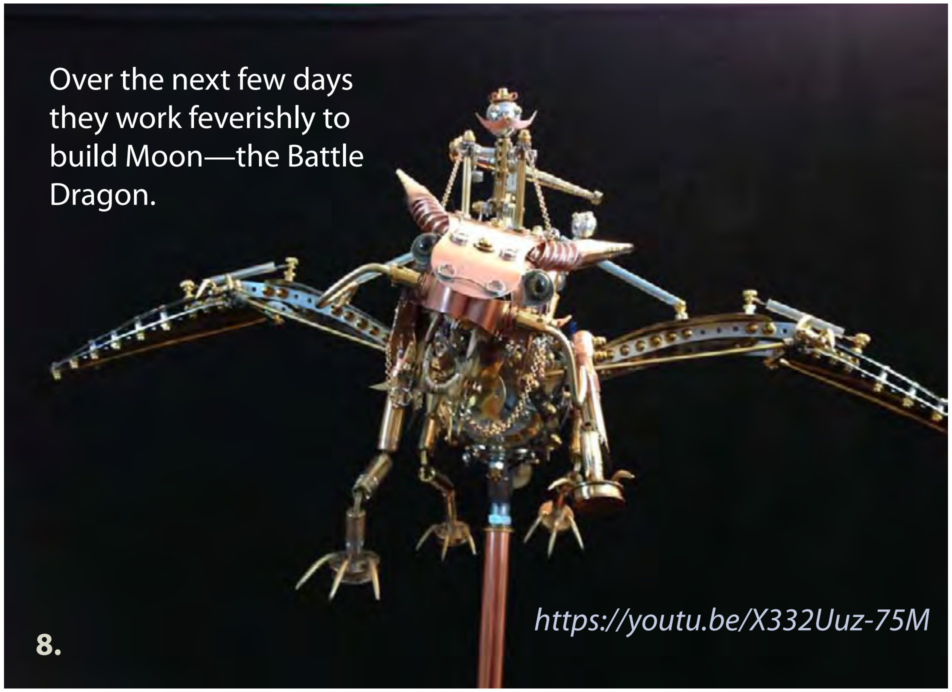
https://youtu.be/Wb4XWAPHpPo



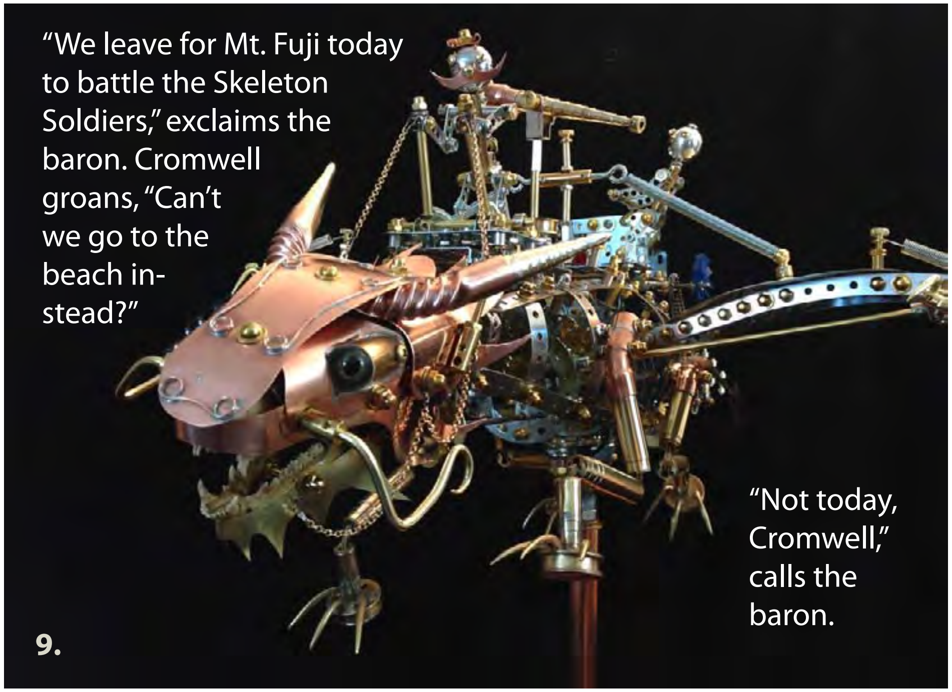
7.

Hotaru describes how Mt. Fuji is being invaded by the Skeleton Soldiers and how the Realm of the Fireflies is in grave danger!

https://youtu.be/_80sGFmm_LM



Over the next few days they work feverishly to build Moon—the Battle Dragon.
https://youtu.be/X332Uuz-75M
8.



"We leave for Mt. Fuji today to battle the Skeleton Soldiers," exclaims the baron. Cromwell groans, "Can't we go to the beach in-stead?"
"Not today, Cromwell," calls the baron.
9.

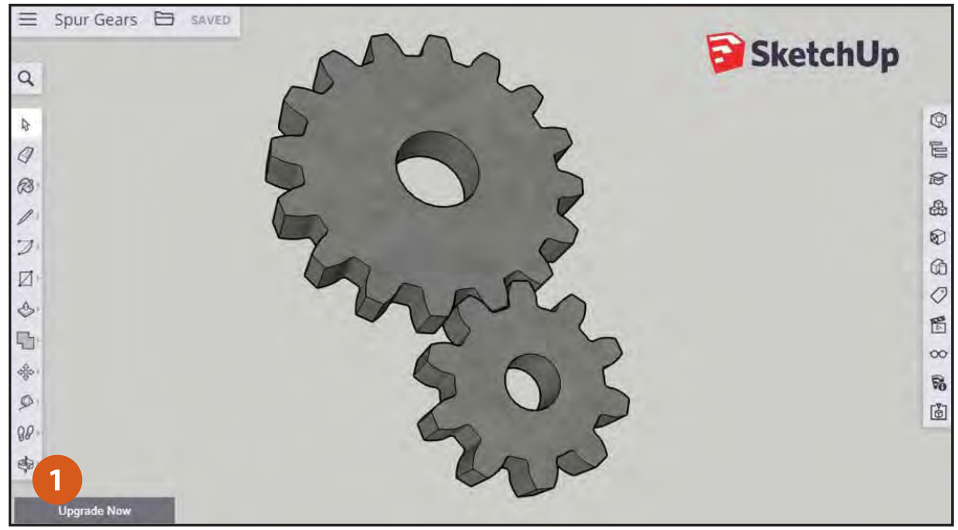
So off they go on another adventure!
10.

Thank you for following the Adventures of Baron von Steubon and Crom-well. This ends the current series.
11.

BUILDING BLOCKS

Gears: Part 3—making wooden gears

by Paul Giles • Sun City Center, Florida, USA



Now that you have a good understanding of when and how to use gears in your automata projects, it's time to start building. There are many tools available that will help you draw gears. There are even several solutions for making wooden gears with tools found in many home woodshops.

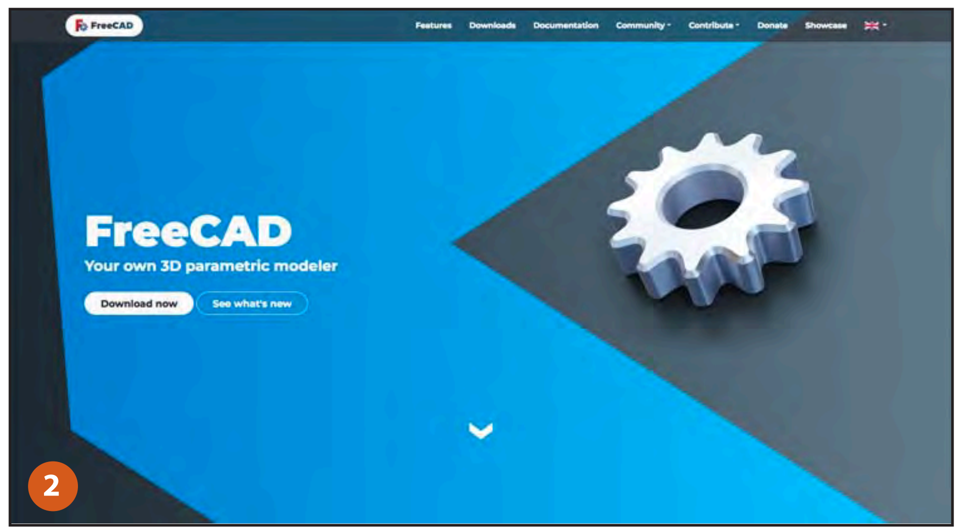
Fortunately, automata projects work well with home-crafted gears. We don't need the high-speed gears required by tools and machinery, nor do we have to worry about the large amounts of power that many metal gears must transfer. For automata, the main criteria of our gears (aside from them working well) is that they look good. Below are a few gear-design programs that are free and will appeal to makers with various skill levels and design interests.

Websites

• **SketchUp** *https://app.sketchup.com/*

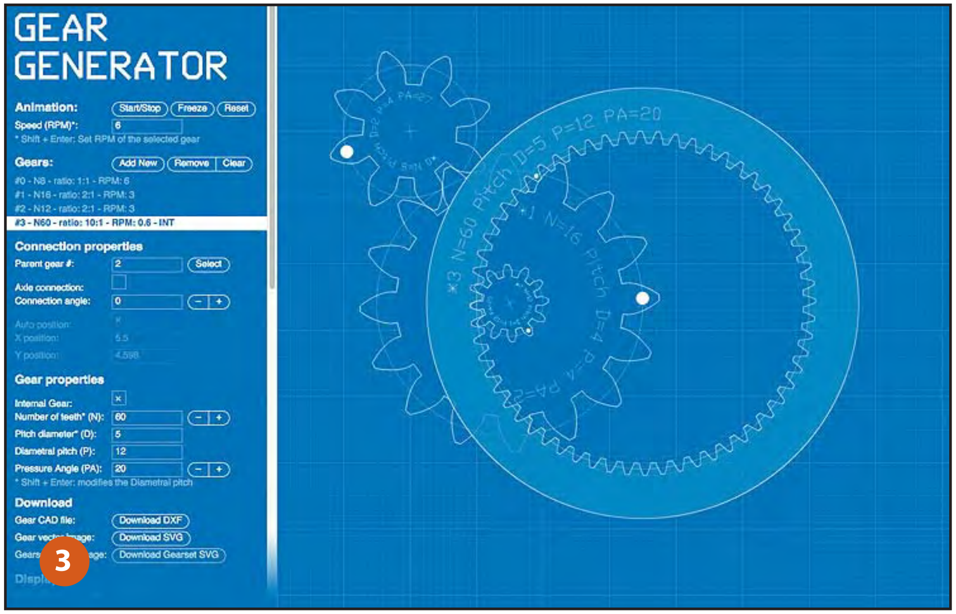
Your first thought for a useful internet-based gear-design software may well be SketchUp (**figure 1**). Besides being free to use for hobbyists, SketchUp is quite powerful and is capable of laying out perfect gear profiles. The outline of a gear tooth is actually quite complicated, being a constantly changing radius. To create that perfect profile, you'll need to be experienced with this app.

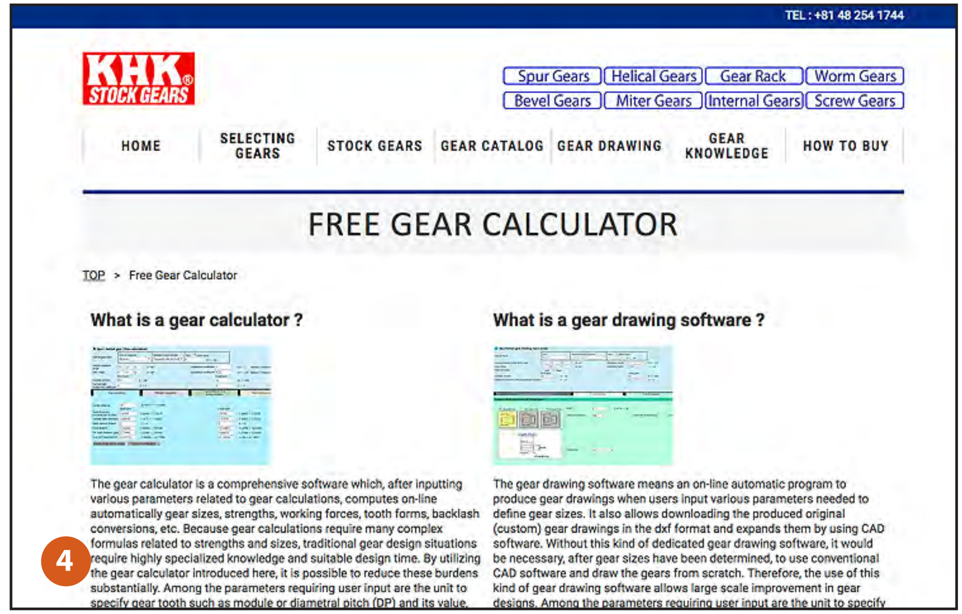
If you give SketchUp a try, I suggest that you create the profile of a single tooth and save that as your resource file. Then, using your initial drawing, simply create a circular array with the number of teeth required. Your gear diameter will then be automatically created. There are also add-ins available that can make the task easier.



• **FreeCAD** *https://www.freecadweb.org/*

FreeCAD (**figure 2**) is another excellent 3D modeler. Like SketchUp, it also has a relatively steep learning curve. While this free program will also give you excel-





lent gear profiles, you may find it to be most useful for creating three-dimensional, coarse models of your entire project.

• **Gear Generator** *https://geargenerator.com/*

Gear Generator (**figure 3**) does just one thing—gears—but it does it extremely well. Internal- as well as external-toothed gears are supported. Once designed, your gear system can be put into motion. Various driving gears may be selected, one at a time, to let you see the effect. Exact gear centers can also be located, which can save a lot of time during construction. Your creation can be saved as either a .dxf or a .svg file. Between these two file extensions, you will have a lot of flexibility in adding your gear train to other programs.

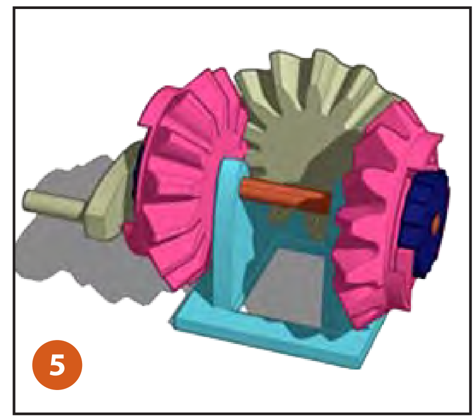
• **KHK Stock Gears** *https://khkgears.net/new/gear_calculator.html*

KHK Stock Gears (**figure 4**) offers a free service simply to attract businesses, hoping that users will purchase fabricated gears. This company offers both a gear calculator and gear-drawing software. While these programs are designed for engineers and demanding projects, they are still easy for the rest of us to use.

KHK supports the widest range of gears, including spur, worm, bevel, rack and pinion, screw gears, and internally toothed gears. KHK asks you to register with them and, at the end of your design process, they will ask if you want them to produce your creation. With simple "No thanks," you are free to save or print your project.

• **Tinkercad** *https://www.tinkercad.com/*

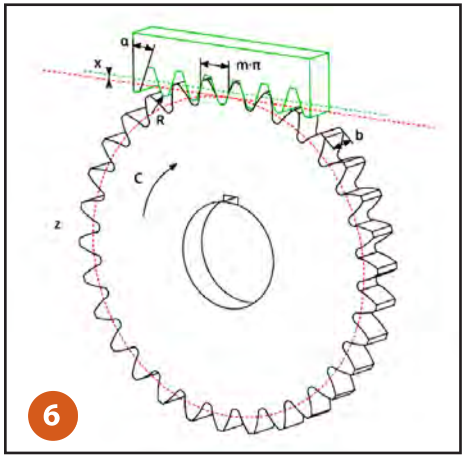
Tinkercad (**figure 5**) is a feature-rich 3D program associated with the Autodesk family. It also supports coding for the more computer-literate among us. This program is rotatable and it is also easy to add or rearrange components. Perhaps the greatest feature of this software is



the large number of tutorials available. It has a learning curve but the lessons get you working quickly and efficiently.

• **Me-Bac** *http://www.me-bac.com/index.php?task=gear*

Me-Bac (**figure 6**) is another



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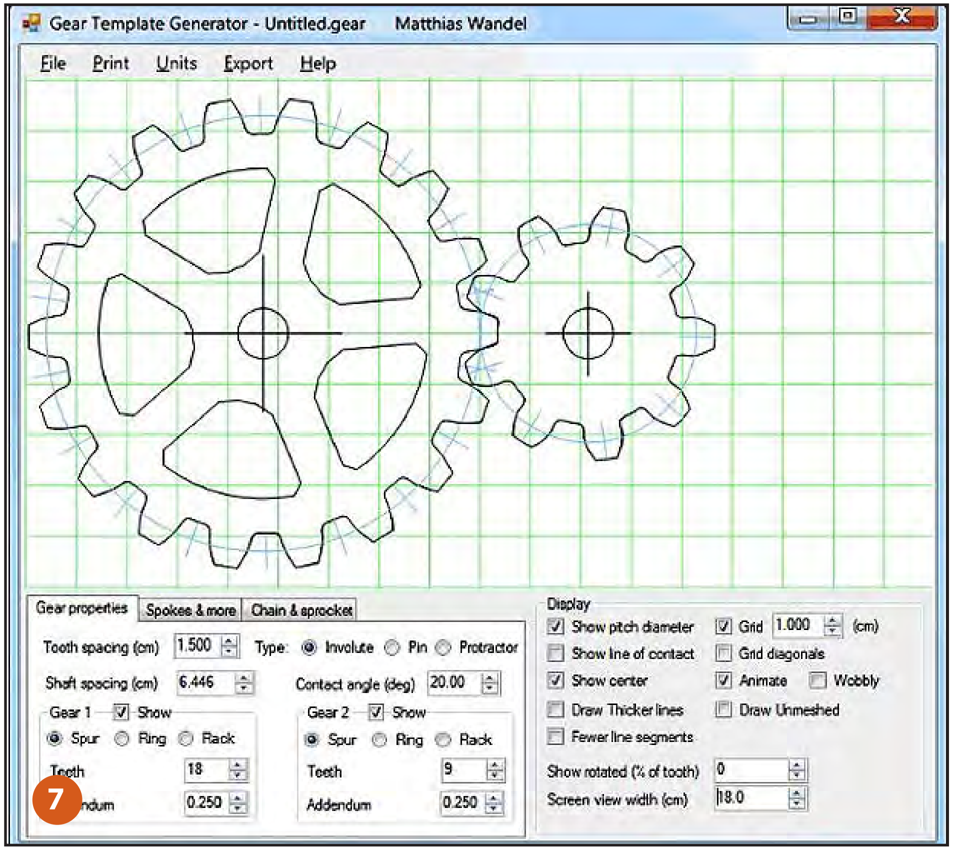
business-oriented website that allows us to use their free design software, while hoping that some customers will want to purchase metal or plastic gears. This package is a nice mix of easy-to-use design tools, with the benefit of improving gear designs for demanding tasks. You will also find a series of images that will give you options for printing and construction.

• **Woodgears** *https://woodgears.ca/gear/*

Woodgears (**figure 7**) is the one site on this list that is not free. There is a small cost to purchase the unrestricted program. It is complete and fully operable in its evaluation mode but printing will not be allowed. Also, be aware that this program will *not* work on a Macintosh computer.

This site is worthy of consideration because it has features that are not otherwise easily available. While spur gears are its bread and butter, the program will also allow you to design pinwheel gears (**figure 7a**), as well as chains and sprockets (**figure 7b**). Other benefits include a triangular grid pattern that can help you piece together multiple sheets of printed paper, when you have a need for a very large gear. As a bonus, this software can also provide spokes for your gears, if you need them.



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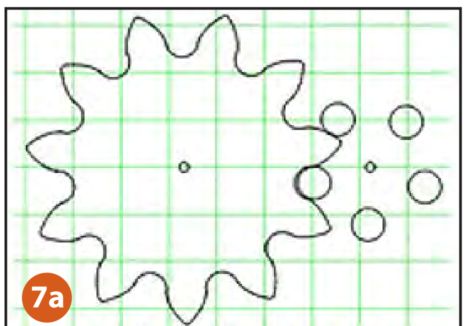
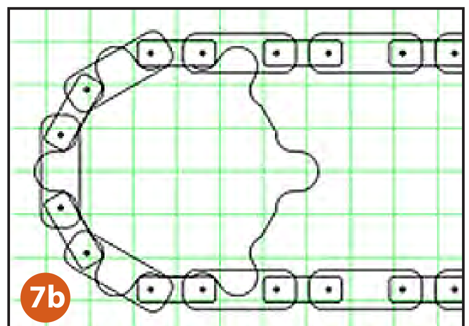


7a Lantern/cycloid gearing



7b Chain and sprocket mode

Four fabrication methods

Once you settle upon gear-design software that meets your needs, it's time to do some building. Four stationary-power-tool methods will give most home hobbyists the ability to make good-looking gears without a major new shop purchase. The bandsaw, scrollsaw, router table, and table saw are all worth consideration.

Numerous tips and tricks are available on the internet for each of these methods. Of course, any time that power tools are used, safety must be your first concern. For any of these four options, first cut the outer gear circle and discard the waste.

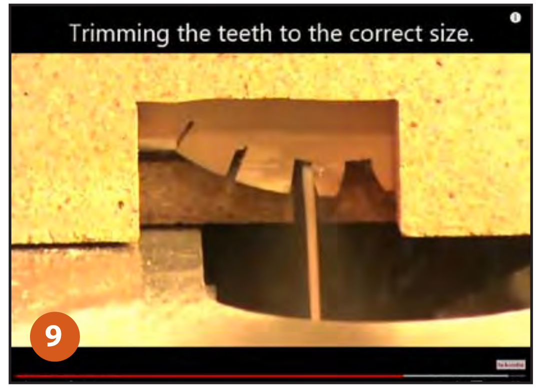
Bandsaw. To use the bandsaw, first glue the paper template to your plywood. Then roughly cut out the gear circle close to the line. Drill a hole at the base of each tooth, then cut out the teeth, one side of all teeth at a time. Finally, trim the top of each tooth at the outer-circle line. This video explains the whole procedure: *https://www.youtube.com/watch?v=oNuhr3htNWs*

Scrollsaw (figure 8). While the scrollsaw is the slowest option if you are making several gears, it is also the most accurate. Simply print your pattern full size and glue it to your gear material.

Make all of the gear's clockwise cuts, tooth by tooth. Don't be tempted to spin your gear blank and cut the entire tooth at a single rotation. The reason for this is that repetition improves your cuts. Some people call that muscle memory. After just a few repetitive cuts you will be following the profile much more closely.

When the first cuts are complete, simply remove the remaining waste with one more cut, repeating the motion at each tooth, this time for the opposite side of each tooth. Here's a good video, by Ron Walters, on cutting gears with the scrollsaw: *https://www.youtube.com/watch?v=AQ92urCdybU.* Also, check out his Gear Head series, starting with this video: *https://tinyurl.com/RWgearhead*

Gear cutting on the scrollsaw. Screen shot courtesy of Ron Walters.



Gear cutting on the table saw. Screen shot courtesy of Steve Garrison.

Table saw (figure 9). The table saw requires a jig to control tooth placement. The set up will also require an investment in time and patience. The table-saw method's greatest advantage is that, once the setup is complete, many identical gears can be cut with ease. This method will work best with a thin-kerf, fine-finish blade.

Carefully adjust the blade height to the maximum depth of the gear tooth. Pass a wide fence mounted to your cross-cut guide over the running blade to create a kerf. Then stop the blade and align the kerf over the blade so that the highest point of the saw blade is exactly one half the dimension of the gear-tooth width. A refinement here would be to add a channel perpendicular to the blade and the width of your gear blanks. The table saw will actually cut a very good profile because the rotating blank that will pass over the blade automatically cuts that continually changing radius on the tooth face.

The remainder of the setup requires that a mating gear profile be attached to the fence. Its location will equal the tooth spacing that is necessary for the gear. Once this profile is in place, all remaining teeth are cut by placing the previously cut profile into the mating profile, then carefully rolling the gear blank over the blade. Watch this video for complete details, cautions, and pointers: *https://www.youtube.com/watch?v=tDqc5xMM5cA&t=182s*

Router table. Creating gear teeth on the router table is similar to the table-saw method. The primary difference is that the gear blank is cut while on its side, not its edge.

The router table has both advantages and disadvantages over the table-saw method. The router method uses a thin-diameter router bit, making nicer-looking bottoms for the tooth cutouts.

The router bit is also this method's chief disadvantage. While the height of the table-saw blade is infinitely adjustable, there is only a limited selection of router-bit diameters. That means that the bottom of the tooth profile must match that bit diameter.

This setup is similar to that of the table saw. Adjust the fence so that the tooth depth equals the cutter distance of the cutting edge away from the fence. Roll the gear blank carefully into the cutter and cut your first tooth profile. Finally, add a tooth profile to the setup so that subsequent teeth will be properly aligned.

This video shows you one method of router-made wooden gears: *https://www.youtube.com/watch?v=FSVCaNIQt5o*. Here is also a website with a description of how to do it: *http://woodroutercenter.com/how-to-make-a-wooden-gear-with-a-router/*.

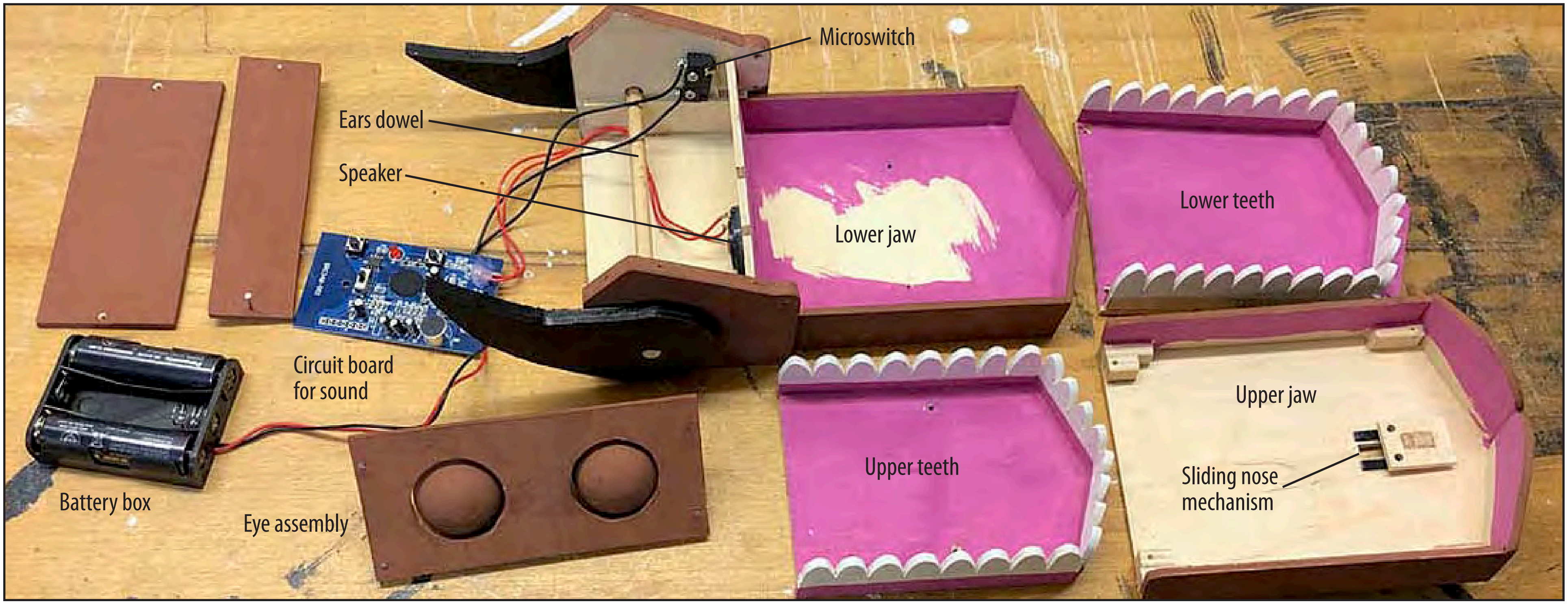
Get Moving

Sleeping-dog box

by Kim Booth • Berlin, Germany • Photos by the author

The author's dog box is benign when asleep but becomes fierce when abruptly wakened.

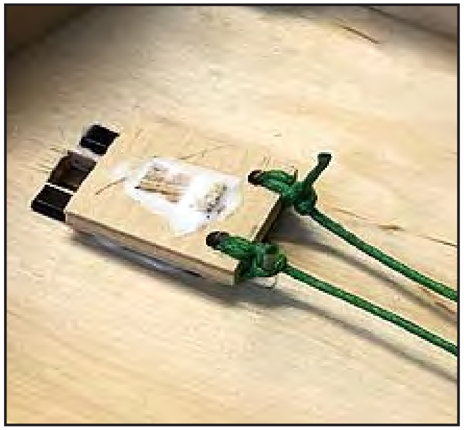
There is an English saying that discourages you from waking sleeping dogs. To do so is to risk provoking a defensive reaction—a baring of teeth and a concert of barks to wake the entire neighborhood. A sleeping dog sounds like it could be a great aid to safely storing your valuables, like keeping your favorite chocolate bar safe from your little sister. The only problem is that a real dog might like chocolate, too, so this would have to be a wooden dog—one that knows how to keep its jaws clamped shut until it wakes up, but then goes barking mad at any attempt to snaffle what's in its mouth. Man's ingenuity knows no bounds, so here is Berlin's high-tech animalatronic workshop's latest project: a sleeping dog!



1. Here are most of the bits that make up our ferocious friend.

This dog has false teeth! You can take them out, which makes them easier to align so that they overlap nicely without touching. Painting is much easier, too. Most of the parts that went into the dog can be seen in **photo 1**.

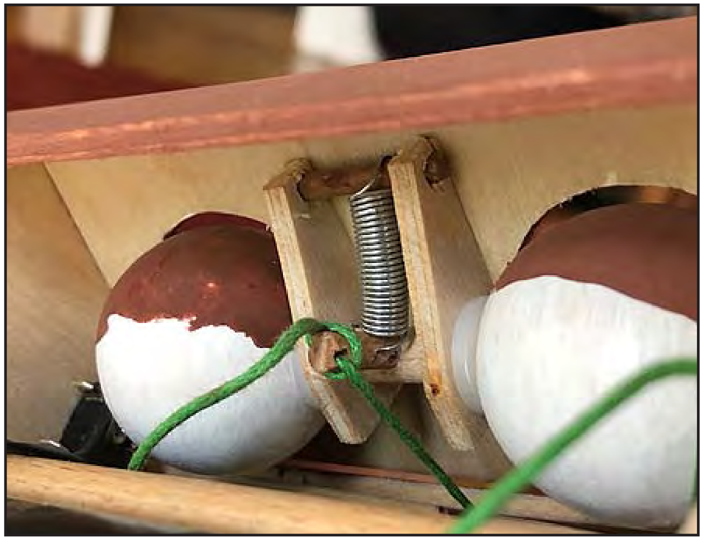
The upper set of teeth sits on wooden blocks to create a space above for two strings attached to the nose (**photo 2**); these move the ears and eyes. This space also hides the spring for the catch, which keeps the jaws locked together until the nose is slid forward.



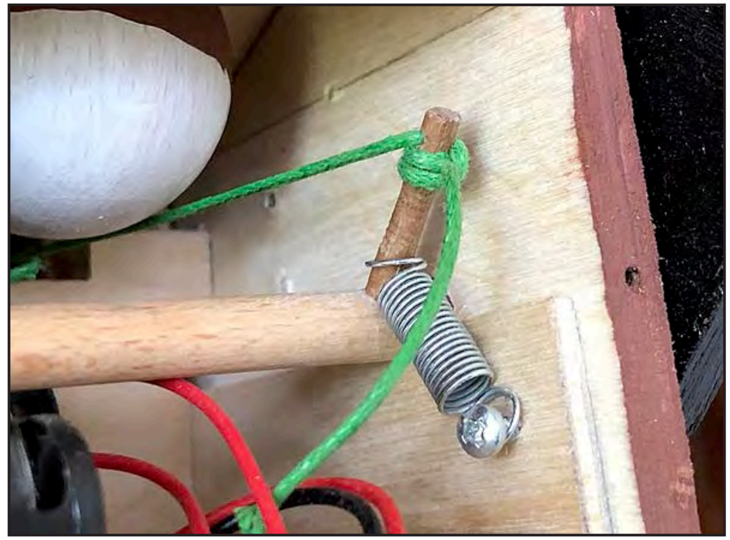
2. The underside of the sliding nose. Strings attach to the spring-loaded mechanisms for the eyes and ears. When the nose is slid forward, the eyes and ears are activated.

3. The eye mechanism. Eyeballs will be fixed to the dowel ends. Plastic washers reduce friction. The activating string will be attached to the lever.

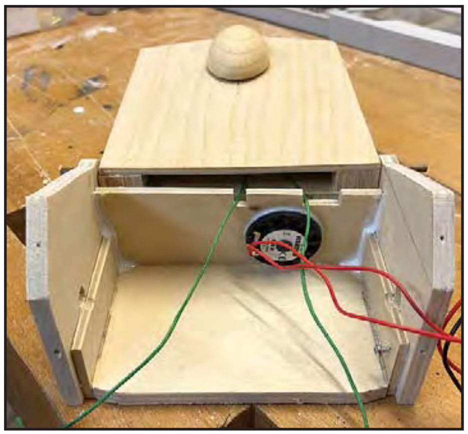
4. The eye mechanism ready to be installed. The wooden panel with the holes will form the portion of the top of the box through which the eyes will peer.



5. Eyes, painted and installed. The string from the nose has been attached. The spring returns the eyes to their sleeping position.



6. Behind the eyes is the spring-loaded lever that activates the ears. The second string from the nose is in place.



7. Slots through which the strings pass can be seen in this earlier construction photo. The little speaker that supplies the canine's voice has been installed.

8. The wire latch that holds the jaws closed is released when the nose is pushed forward. The spring keeps the latch closed until the nose is moved.

The eye assembly is held only in the center, on a piece of wooden dowel (**photos 3** and **4**). A spring keeps the eyes closed until a tug on one of the strings attached to the sliding nose pulls the lever to open them (**photo 5**). The eyes don't touch the top panel of the box, so the paint doesn't rub off. This fact also allows for alignment errors when drilling the wooden balls. Two plastic washers keep the friction down.

Ears are attached to one another by a dowel that extends across the same part of the box that houses the eyes. This can be seen in **photo 1**. Ears are activated by a lever (**photo 6**) attached to the nose by the second string, so they pop up when the nose is moved. A spring returns them to their sleeping position when the nose is relaxed. In the partition between the jaws and the eyes and ears are two cutouts through which the controlling strings pass (**photo 7**).

The dog's mouth is kept closed by a wood-and-wire latch on the upper jaw (**photo 8**), which engages a hook below. When the nose is slid forward, it presses against the wooden part of the latch, disengaging the hook and releasing the jaw, which can then be opened.

A small black microswitch is activated when the upper jaw is lifted. I bought a little ready-to-use circuit board from a hobby shop. This will replay your recorded sound when a microswitch is triggered. I replaced the standard speaker with a smaller, dog-sized one, and glued this to the partition. The sound quality is quite cheerful for our purpose, as we won't be playing Beethoven's 9th.

When the nose is slid back, the eyes spring open, the ears jump to their alert position, and the catch at the front of the box is released. When the jaws are raised, the microswitch is activated and the dog makes aggressive noises. Peace and quiet return when the jaws are closed and the dog resumes its slumber.

This vicious dog can be seen protecting its valuables here: *https://youtu.be/Y11gZDWjjIY*

REVIEWS

BOOK

Paper Models That Move: 14 Ingenious Automata, and More
by Walter Ruffler
2010, Dover Publications, Mineola, New York
$8\frac{1}{2} \times 11\frac{5}{8}$" (21.9 x *29.53cm*), 105 pp., softbound
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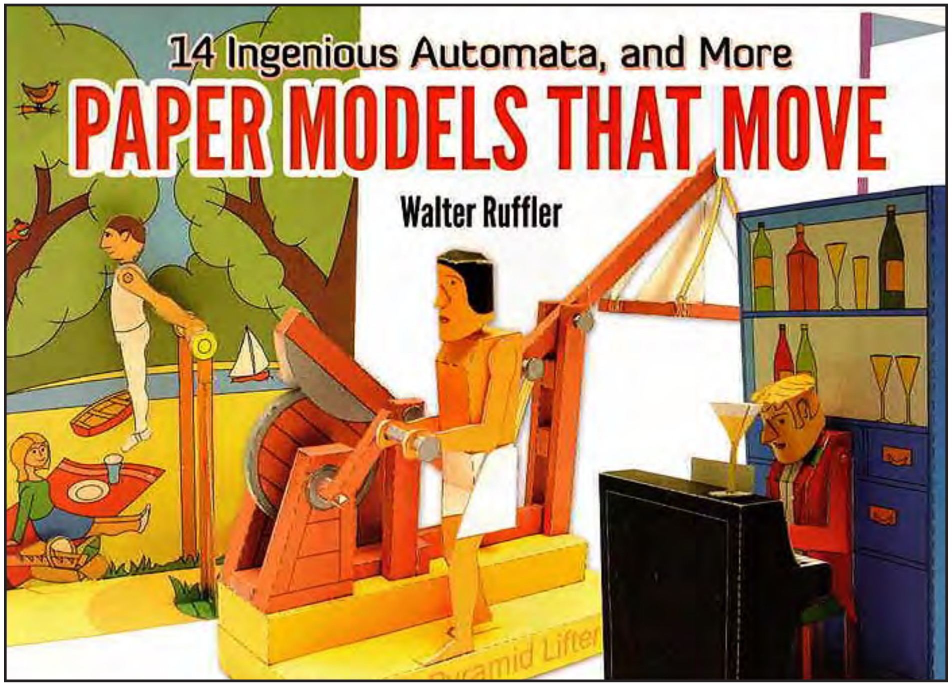

Featured in this issue, Walter Ruffler, of Germany, is a master of paper automata. *Paper Models That Move* (in English) provides an excellent introduction to this area of automata design and construction.

The book opens with an introduction that includes a little philosophy about automata in general, materials used in making traditional automata, and reasons why paper should be considered for construction. Some of these reasons are paper's workability, availability, and versatility, as well as its low cost.

A gallery of a dozen paper automata by three different designers, including the author, follows. In *Silent Night*, Santa is depicted riding a motorcycle. *Computer Control* spoofs the frustrations we've all experienced in working with computers. Three figures follow the ball in an exciting tennis match, in *Wimbledon*. A famous Edward Lear poem provides the basis for *The Owl and the Pussycat*. And, in *Ewe Boat*, a sheep rows a small vessel. Other automata, like two based on life in ancient Egypt, are more representational and illustrative.

An informative chapter on working with paper discusses scoring, cutting, and folding. We learn about creating strength in paper, making corners, constructing frameworks for bases, and more.

Then comes hard information about actually constructing different components exclusively from paper: making square rods, bearings to support rotating parts, triangular shafts, and round rods. The use of kebab sticks (the only non-paper material) is also discussed.

A long, informative section on different mechanisms—cams, crankshafts, sliders, linkages, hinges, gears, etc.—is covered in some depth. Sections on limiting movement, power sources—hand cranks, string, gravity, sand, and even water and air—and modeling with paper round out the first part of the book.

The second section provides eight paper mechanisms and six automata for the reader to cut out and build. The actual cutout pages (which are printed on heavier paper) are preceded by detailed construction drawings and instructions for each automaton.

The mechanisms, while not automata per se, are both colorful and helpful in getting the novice up and running with paper construction and the understanding of how things work. The automata include *At the Duck's Pond*, *Pyramid Lifter*, *Pianist*, *Gymnast*, and others.

The softbound book is printed on high quality paper and all illustrations are in color. If you have an interest in paper automata, Walter Ruffler's book provides a comprehensive, well written, and beautifully illustrated way to get started. AM

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 *AM*.

The End