AUTOMATA MAGAZINE

The LEGO automata of Teun de Wijs

2/2—Mar/Apr 2020

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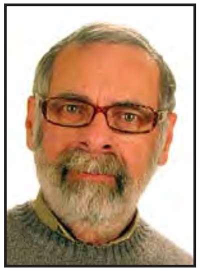

EDITORIAL

Do you want to sell your automata?

by Marc Horovitz

Would you like to sell your automata? Over weeks, or perhaps months, you plan and labor to create a unique piece of kinetic sculpture. It may be whimsical, demonstrative, or thought provoking, but it will undoubtedly take an inordinate amount of time and effort.

Many people build automata as a pastime, and do excellent and imaginative work. Their work is usually displayed in their homes or given to friends or relatives.

Some artists have added automata to their repertoire of work. While they are serious artists, they may or may not be serious automatists, producing only the occasional simple piece for sale.

Then there are those artists who are full-time automatists. These people rely on their art and craft for their living. Some make everything on speculation, relying on galleries to sell their work. Others have risen to the point where they are in such demand that they accept only commission work.

Making art as a living is a tough road. Only an exceptional few can achieve that. However, selling your work could provide a supplemental income to a greater or lesser degree. If you choose to offer your work for sale, there are several factors to be considered.

There are not many outlets available for automata, which are still largely unknown to the general public. You can always show your work at places like street fairs and holiday craft shows. You might also try selling your automata directly to enthusiasts online, using websites like Etsy. There is a lot of competition for attention on these sites, though—someone would have to be looking specifically for you.

If you are skilled at social media, that is a great asset. You could create a website, then use Facebook, YouTube, *et al* to drive people to your site or online store. But you may find that you spend more time marketing than creating.

Finding one or more galleries to represent your work could be a good way to go, if you could get in. Typically, a gallery will take a large percentage of the sale price. On the up side, the gallery has access to buyers and, through your gallery, you may be able to raise the sale price.

Do you do everything one-off or in multiples? Printmakers call multiples of a print an edition. I used to do editions of two to five of my automata and was represented by a small gallery. This gallery had no trouble in selling my work, and that was gratifying. On the other hand, I came to loathe the repetition of making multiples of everything, as I wanted to get on to the next thing.

I know of at least one automatist whose work was in a shop that had a lot of traffic but sold few of her pieces. Although she did good work, her art was just being shown in the wrong venue. Care must be taken in your choice of outlet. A good gallery owner will have a sense of whether or not your work would be saleable to their clientele.

How do you price your work? If you do one-of-a-kind pieces, you undoubtedly spend countless hours on each one. Even if you paid yourself minimum wage, few buyers could afford it. On the other hand, if you work in multiples, the time spent on each piece—especially if you use mass-production techniques—can drop dramatically, making the pieces much more affordable.

As mentioned above, there are a lot of things to consider and understand before hanging out your shingle as an automatist. If you do decide on this venture, we all wish you the best of luck. AM

Marc

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NEWS

Forum report

The *Automata Magazine* online forum allows automatists to have real-time (via email) interaction with each other. You can discuss projects, ask questions, comment on past and future issues of *AM*, and post images of what is on your workbench. This forum is provided at no charge by *Automata Magazine*. I personally have received many benefits from participating. Click *here* to explore past messages and/or to join the forum. Forum membership is free. —*Jim Coffee, Moderator*

EVENTS

Mutuality: Cecilia Schiller, 2019

Morris Museum presents *The Adventures of Baron von Steuben and Cromwell: A Kinetic Tale* by David Bowman. A series of 18 mechanical vignettes tells the story of two automata and their journey on land, sea, air, and into the past, as they encounter fantastic mechanized beasts, in their quest for long-lost family and treasure. November 14, 2019—March 1, 2020.

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
https://morrismuseum.org/

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

The Mechanical Circus is a collaboration between CMT and Rijksmuseum Boerhaave, the Netherlands. Puke Ariki Museum, New Plymouth, New Zealand. Through April 2020.

Mechanics Alive!, ¡explora!, Albuquerque, New Mexico, USA. Through 2020.

More info: *https://cabaret.co.uk/exhibitions/current/*

AutomataCon

Hosted by the Morris Museum: May 29-31, 2020. 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://morrismuseum.org/mechanical-musical-instruments-automata*. AM

Follow *Automata Magazine*…

In the next issue of
AUTOMATA MAGAZINE

- **Andrew Woodward** describes *Sol*, his large orrery automaton
- **David Soulsby** takes a trip down memory lane, with a visit to an arcade automaton exhibit
- **Gary Johnson** builds an animated sign for a trade show
- **Kim Booth** shows us street automata from the French city of Nantes
- **Paul Giles** discusses free websites with CAD programs for drawing gears

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MAKING AUTOMATA WITH LEGO

There's more to this than you might think

by Teun de Wijs • Amsterdam, Netherlands • Photos by the author

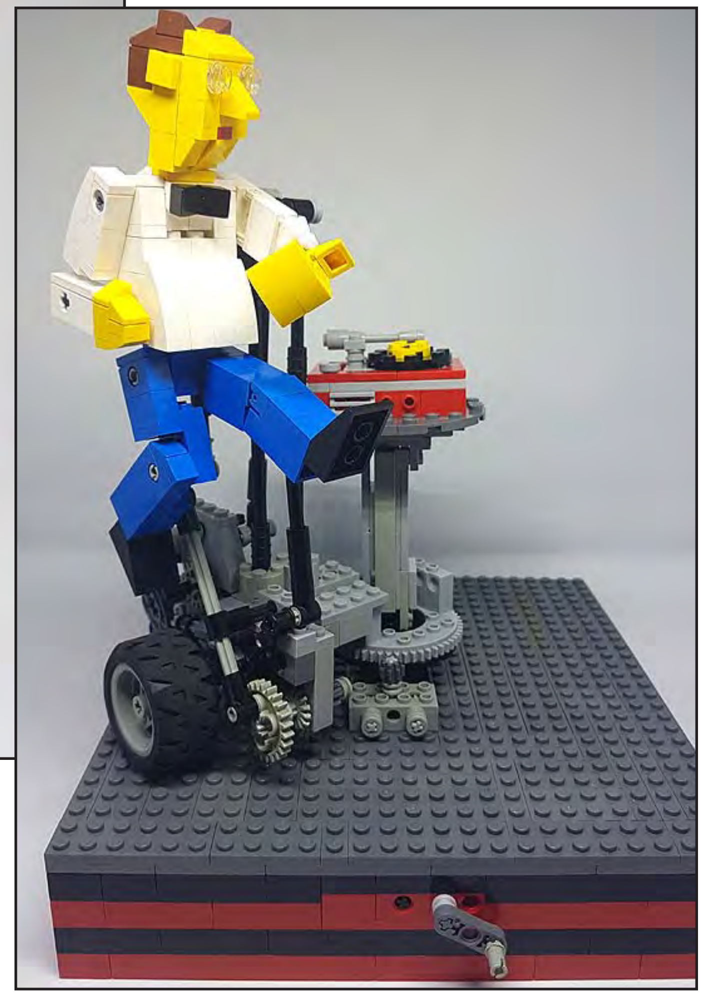
Inspiration. The top of the cranium opens and closes, giving the spectator a look inside the mechanized brain, which features turning gears and moving bits.

I have been fascinated by automata for a long time. In the late eighties, when I was around ten or so, I saw an article about the Cabaret Mechanical Theatre (CMT) in a Dutch children's magazine, and I was instantly mesmerized by these wonderful moving sculptures. I marveled at the creativity, the craftmanship, and the inventiveness behind them.

Lacking the funds to travel myself, I begged my parents to take my sister and me to London's Covent Garden to see CMT. The sweethearts eventually granted my wish. I can still remember walking through that dimly lit, magical museum, pushing every button, and being absolutely hypnotized by seeing the incredible works of Paul Spooner, Keith Newstead, and their esteemed colleagues come alive.

I immediately wanted to build my own models, but since I didn't have any woodworking or metal skills, I turned to the best available alternative and built my first automaton out of LEGO. I soon

Explorer. The ostrich strides along, moving its body and head, while its rider hangs on to the reins and intently scans the horizon from left to right.



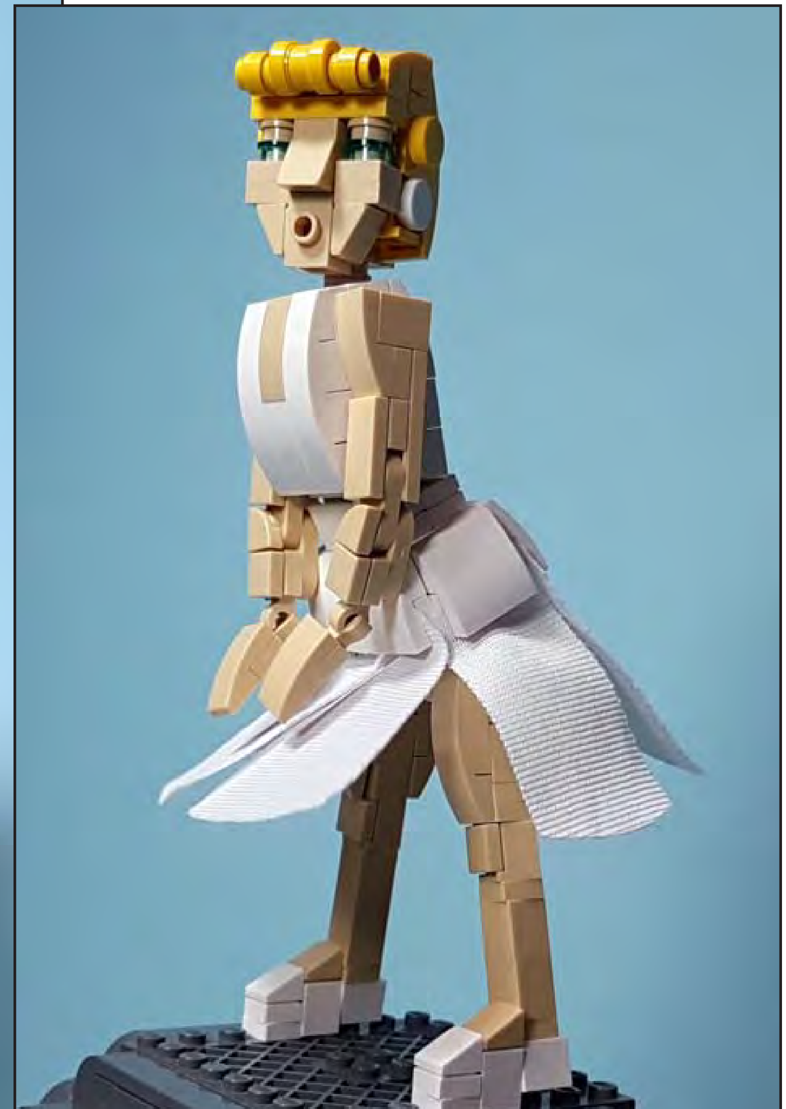
Rock on. An elderly rocker struts around his record player, playing air guitar in full Chuck Berry style.

grew dissatisfied with my crude results, though, and found other interests at that time. However, the dream of building my own automata never left me.

It was almost thirty years later that I rediscovered my love for LEGO by building with my son. He was three then and had just outgrown DUPLO. LEGO had evolved quite a bit during those thirty years, and I was amazed by all the new pieces and colors available. Suddenly, so much more detail was possible, and when I saw Jason Alleman's viral LEGO *Sisyphus*, I remembered what I wanted to do.

Raised on Tintin comics, adventure books, and old movies, I find that my automata inspiration is usually drawn from classic themes and characters, and from the pioneering work of my heroes from the Cabaret Mechanical Theatre, which made such a lasting impression on me.

I seldom make sketches of a model beforehand, but I usually have a pretty clear picture of what it should look like, as well as a basic idea of how to make it work technically. After I start building, it's just a matter of fiddling until I get it right.



Marilyn. The author's only motorized model. The figure stands still in her classic pose while an electric motor powers a fan that blows her skirt up. The skirt is made of fabric bridal veils for LEGO minifigures.

To me, LEGO is perfect for building automata. It provides both the material to sculpt and the mechanics to create movement. Compared to working with wood or metal, it has its benefits, but also disadvantages. No workshop, tools, or machinery are needed, so you can work at home. It's easy to build a quick mock-up or prototype, and to expand, alter, or disassemble a model. However, you can't simply drill new holes or sand off a bit, so creating round shapes, strange angles, and small details can be quite challenging. But for a LEGO builder, the puzzle of finding the right combination of pieces that will make a model work is where the fun is.

Currently there are around 9,000 different LEGO pieces available, in more than 50 different colors. It pays to have a solid knowledge of pieces and their possibilities as your toolbox, and to have a nice pile of LEGO to start off with. However, keeping every piece needed at hand would require a fortune and an enormous

Mariachi. A simpler automaton. The Mexican man and the cactus strum their guitars and turn from side to side. Instant fiesta!

Fisherman. An elusive fish swims around its aquarium as it is hunted by a fisherman who impatiently taps his foot. The cat switches its tail in anticipation. After a while, the fisherman pulls up the rod and both figures look up at the empty hook before trying again.

LEGO cave, so most builders, like me, start by building prototypes in various colors, then order the right pieces online as they go along. Sadly, this sometimes involves changing the original design, because not every part is available in every color, and rare pieces can be quite expensive.

Building bricks come in all shapes and sizes, but LEGO also offers a great collection of technical equipment. This includes axles in all sizes, many different gears and gear racks, chain link, rubber bands, all kinds of lift arms, and an impressive array of struts, pins, and connectors to keep everything together. In addition, LEGO has been selling electric motors since the late seventies, and today offers a whole line of remote-controlled, programmable motor units, complete with lights, sounds, and sensors. Even without these high-tech gadgets, the possibilities are virtually endless.

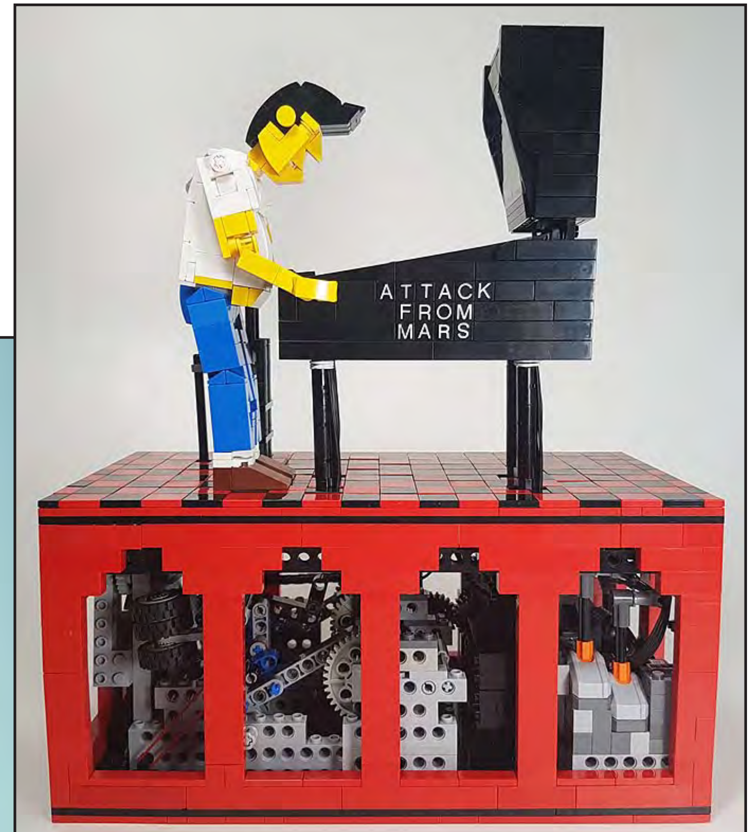
This makes it somewhat surprising to me that, with so many people making amazing things with LEGO, only a handful of them

Illusionist. This may be the author's most complicated build. The lady levitates by means of four moving struts underneath. These extend and retract in sequence while keeping her balanced, allowing the magician's hoop to move all the way from one side to the other before she floats down again.

Snake charmer. As the charmer plays his flute, the basket opens to reveal a hypnotized snake. A series of driven rubber wheels pushes the coiled snake up through a narrow passage and makes the snake extend to almost twice the height of the box.

are building LEGO automata. Besides myself, there is only a handful of others. These include LEGO legends Jason and Krystal from JK Brickworks, Josh DaVid, and Daniele Benedettelli (see the links below). Fortunately, there seems to be a surge in interest in this type of building, and in 2018 LEGO produced its first real automaton set—LEGO Forma—targeted specifically at adults.

Unlike the LEGO company and many MOC (My Own Creation) builders, I do not sell or offer instructions for my models. My free time is rather limited and I prefer to use it for building new models. However, I do hope to inspire others to venture into this style of building, as others have inspired me. The world needs more LEGO automata! AM



Pinball. In old-school-arcade style, this beer-bellied hooligan nudges and bumps the machine to help the game along, while an electric motor used as a small generator, and some mechanically activated switches, make the lights blink inside the machine. The YouTube video of this provoked quite a few dirty comments! *https://tinyurl.com/teunpinball*.

Castaway. The author's latest model. A stranded sailor makes the best of his situation by doing some light housekeeping. The waves around the island move up and down in a ripple effect, while the figure moves back and forth with the vacuum rod.

YouTube and other links

Teun de Wijs's YouTube channel
https://www.youtube.com/user/teun76
Sisyphus, by Jason Alleman
https://tinyurl.com/JASisyphus
JK Brickworks
https://tinyurl.com/JKBrickworks
Josh DaVid
https://tinyurl.com/JoshDavidChannel
Daniele Benedettelli
https://www.youtube.com/user/mentulatus
Jozef S391
https://tinyurl.com/JozefS391
LEGO Forma
https://tinyurl.com/LegoAutomaton
Bricklink. An amazing global network of new and secondhand LEGO sellers
https://www.bricklink.com

Stop motion and found art

A miniature automaton incorporates personal history

by Sue Sharp, Millarville, Alberta, Canada • Photos by the author

A Day at the Seaside: found shell, an antique drawer pull, a bird cut from a coin, and an old metal bead for the umbrella. A piece of shell is held in place in the window by a sterling-silver mount. Tiny beads of silver imitate rocks on the beach.

Making automata is a new art form for me. I graduated with a BFA in a jewelry-and-metals program, and my previous work had primarily been wearable items. As a student, I would tinker with found objects, but students are often thrifty, so this made sense. After graduation, I felt I had to leave these treasures behind and strictly work with precious metals, in order to be taken seriously.

I recently found myself drawn to the magic of mechanical toys, including steampunk inventions, sci-fi fantasy, whirligigs, folk art, found art, and illusions—most things that possess some element of motion. I wanted to bring my art to the next level, to see it become more intellectually and physically layered.

I have always loved found art and enjoy collecting seemingly useless, discarded items that pique my curiosity. When I find items from my past, or someone else's, I think about how the object was intended to be used. Now broken or obsolete, it sits in a junk pile, apparently useless. As the saying goes, however, “One man’s rubbish may be another’s treasure.”

How excited I get when I find some little treasure! I can honestly say that buying a sheet of sterling silver, from which to fabricate a piece of art, does not excite me in the same way. This raw material is simply necessary to complete a project and is completely void of a past. But a found object has history. As most of my treasures are found second hand in thrift stores, they clearly have pasts.

When I come across such a piece, a story begins to develop in my mind’s eye. My imagination allows me to see the piece in three dimensions; ideas begin to flow and I create mini movies in my head—this moving that way and that moving this way. Then I wonder how on earth could I make that work? It’s a puzzle, and I like a challenge.

For me, the hardest part of moving from static art to kinetic is in not understanding engine mechanics. I have the skills to make it but not the knowledge of how to animate it. I find that I look at objects differently now. I open them up, deconstruct them, and learn from others who have mastered

Old brass clock parts house the shell and gear. The “flying V” is the author’s signature—her family’s horse brand.

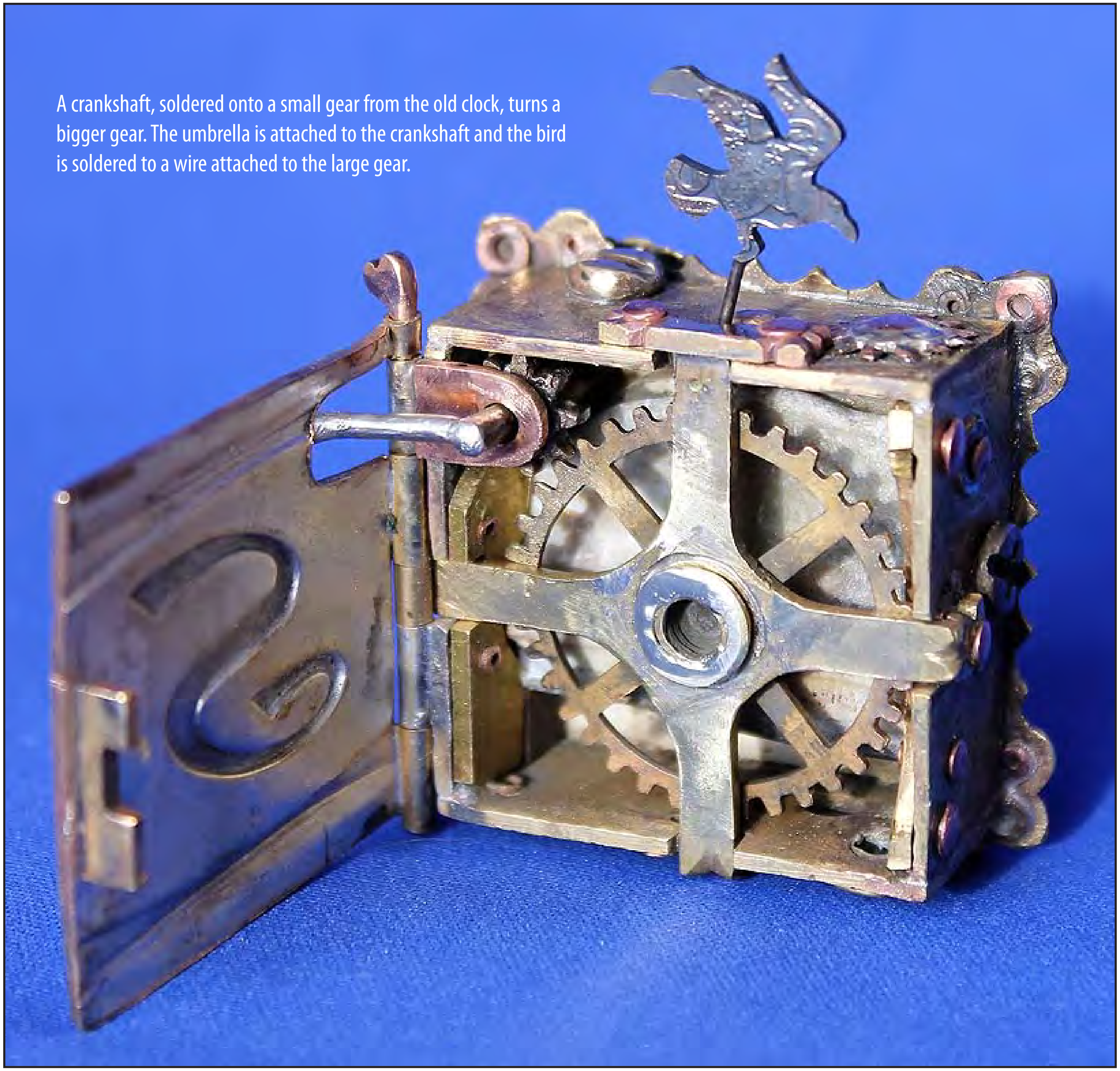
The author’s grandfather’s old belt buckle makes up the back of the piece. It is hinged and opens to reveal the inner workings.

the desired motion.

Most of my work begins with a handful of found things. In the piece shown here, a worn piece of shell pulls me in and I see myself standing by the seaside. An old, ornate drawer pull would make a beautiful frame. A bird cut from a coin naturally hovers over the sea, and an old metal bead, cut in half, reminds me of a beach umbrella, precariously spinning round and round, as the ocean breeze comes in with the waves.

The housing and gears consist of clock parts my mother gave me. These came from my great-grandfather's old clock. The hinged back panel of the piece was once my grandfather's belt buckle. I wonder what they would think of that!

Automata, for me, take me back in time to the first moving pictures. But instead of an audience sitting in awe of this magical experience, with automata there can be viewer participation, driving home the idea that one makes one's own illusions. Perhaps life itself is an illusion. I am reminded that the movies I watch are just that: a series of still pictures projected on a screen—an optical illusion.



A crankshaft, soldered onto a small gear from the old clock, turns a bigger gear. The umbrella is attached to the crankshaft and the bird is soldered to a wire attached to the large gear.

Collecting Sam Zell automata

Amazing year-end gifts

by Vincent Crisci • Florida, USA • Photos by the author

1995—*The Bureaucratic Shuffle* and 1996—*Let's Do It*

Imagine having 675 automata custom handmade to give away to your friends and business associates each year, every year with a different theme, each automaton reportedly costing $3,000-$6,000. And imagine doing this for almost 24 years! Who is rich enough, creative enough, or thoughtful enough to do this? The answer is Sam Zell, the famous Chicago-based real-estate investor. He began this program in 1994 and continued through 2015.

Sam Zell's automata were made in the studios of legendary model maker Grant McCune. McCune was hired by George Lucas to work on *Star Wars*, after the filmmaker saw the artist's uncredited model work on *Jaws*.

McCune shared a 1978 Academy Award for Visual Effects, for his involvement with *Star Wars*, which included finishing touches on the iconic R2-D2 droid. Creative teams McCune collaborated with also made models and/or did special effects for *Star Trek*, *Spaceballs*, *X-Men 2*, *Battlestar Gallactica*, *Batman Returns*, *Terminator 2*, as well as *Caddyshack*, *Die Hard*, *Firefox*, and *Ghostbusters II*. He and his model masters at Grant McCune Designs contributed to dozens of other award-winning films.

McCune died in 2010, after which his wife, Katherine, con-

1997—*Liquid Real Estate.*

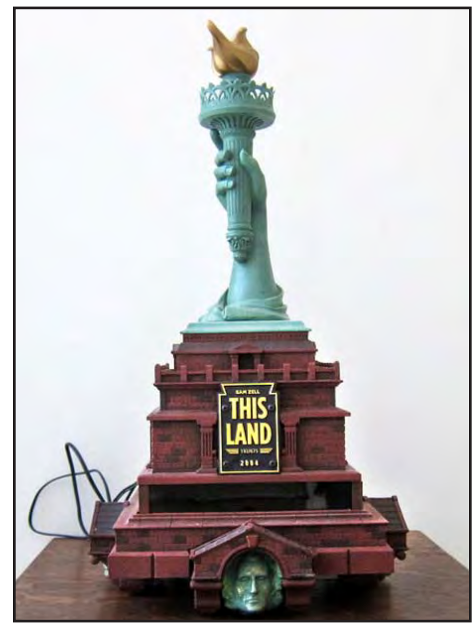
1998—*The Whole World in Our Hands* .

1999—*The Emperor Has No Clothes*.

2000—*No Free Lunch*.

2002—*Get Over It*.

2003—*Wired Exports.*



2004—*This Land*.

tinued the business until it was closed in early 2016. Sam Zell's last automaton, in 2015, was made by Synergy Design Concepts.

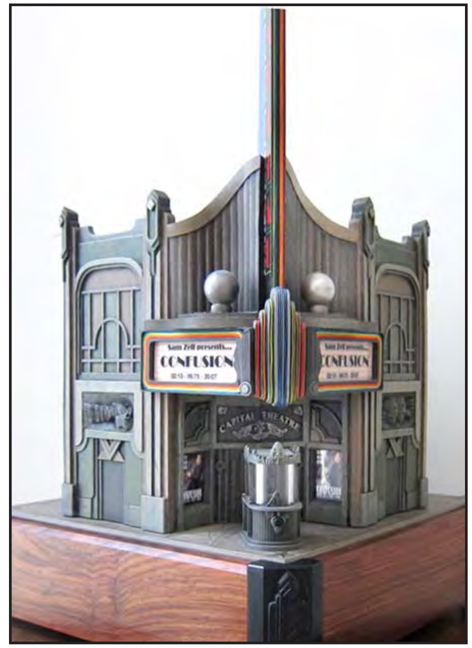
Each year, Sam Zell selected a different theme for his automaton. These themes reflected his thinking about real estate, the economy, political concerns, and the state of the world. He would select a popular song as theme music, then do a voice-over.

Zell's early automata were simple statues, some having only a few moving parts. Each year, however, they evolved in intricacy and detail. They came to include music, voice narration, videos, solid-state electronics, and multiple sequenced mechanical movements. Each automaton is a mechanical and electronic marvel—pure magic.

I have been collecting Sam Zell's automata for about a decade. My earlier, minor obsession with automata was rekindled by *Hugo*, the 2011 movie, in which a clockwork mechanical automaton is discovered, gradually repaired, and made to work. I'm a real-estate developer and had long been a fan of Sam Zell. I'd remembered reading about his annual gifts. So my hunt for these automata was on.

I found my first Zell automaton

2006—*Sarbox*.



2007—*Confusion*.

2010—*Think it Over*.

2011—*Tender Credibility*.

2012—*Quantitative Easing Ben Bernanke*.

2013—*Consensus*.

on eBay, in pretty poor condition. It had a rotted battery pack, which was easily replaced. But since then, being mechanically clueless, I have only bought fully working, undamaged pieces. They are very hard to get repaired.

These automata occasionally come up on eBay and typically sell for $1,500-$2,500, depending upon their condition. Do I have a favorite one? Nope—each is unique, special, and iconic in its own way.

Many of Sam Zell's automata can be seen in motion on YouTube.

2014—*How Low Can You Go*.

2015—*View From Above*.

Write an article!

PAUL SPOONER AUTOMATON—GARY ALEXANDER PHOTO

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!).

MORRIS MUSEUM

MARC HOROVITZ

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

automatamag@comcast.net

A conversation with

Carlos Zapata

An in-depth discussion with a well-known artist: Part 1

by Marc Horovitz • Denver, Colorado, USA • Photos by Carlos Zapata, except where noted

Late last year I had the pleasure of an extended chat with Colombian artist Carlos Zapata. He discussed his origins, his work, and his inspirations. I hope that you enjoy what follows.

* * * * * * *

Marc: Thank you for talking with me today. Can you please tell me where you're from originally and how you ended up in England?

Carlos: I'm from Colombia, South America. I came to England in 1984, when I was 21. I came by pure chance. I had finished my military service and I knew I wanted to go abroad to study art. I had in mind to go to Japan, but in those days it was difficult to make any kind of contact there. England turned out to be easier. I saw an advert in the newspaper that said Learn English. The USA and Canada were mentioned, but I'd been to the USA before and I had family there, so I wanted to go someplace different. Other countries, like South Africa and Australia, were also mentioned but I chose England because it was in Europe, and that sounded exotic to me. That's how I ended up in London.

Marc: Are you a full-time artist now?

Carlos: Yes I am. I've been a full-time artist since 1998. It wasn't easy to get there but I did in the end.

THOMAS ZAPATA

Carlos Zapata in his studio.

Marc: Where did you get your formal art training?

Carlos: I'm basically self taught. When I was in Colombia, I learned drawing from an artist, David Manzur, who was quite well known there. That was the extent of my formal training. After that, I came to England and always struggled to earn a living. I did all sorts of odd jobs but I always had a studio. I learned everything by visiting museums.

Marc: How did you become interested in automata?

Carlos: I was a painter. I did a bit of sculpture, but it was mainly painting. I was married at the time and was living with my wife in Wales. It was a pretty hard time because I was unemployed and was at a dead end. I knew that I wanted a change and I knew that I had to be creating things in order to be happy. I wanted to turn my back on painting as well.

Fortunately, when my wife was in London, she went to Cabaret Mechanical Theatre [CMT], which I had never heard of. She brought me three or four photos of the automata there, and I thought I would have a go at this. I made something like thirty small, very simple automata. I hadn't worked with wood before, so it was all challenging. I wrote a letter to Cabaret and sent some photos of the automata that I had made, asking if they were interested in selling them. By then we had moved back near London and I was working in a warehouse—nothing to do with art.

Sue [Jackson] responded, saying, "Carlos, I love your work. Why don't you come and talk?" So I went to Cabaret in Covent Garden and Sue said to me, "Why don't you come and work here? I won't be buying any of your automata because, to be honest, they need more work—more polish." I didn't have the right tools then, so the pieces were rough.

Sue asked me how much money I made in a five-day week in the warehouse, so I told her. She said, "I will give you four days' work in the theatre and I will pay you the same as you get for five days in the warehouse. The other three days of the week you can make automata."

So I began to work at Cabaret Mechanical Theatre. I started to learn a lot, not only about automata. It was a job where you had to be very hands-on with everything. Often,

Watermelon Man (2001)

I did an earlier piece, of a guy eating, and it makes a really nice noise. It has a triangular cam, so it makes a jump, but also his head moves, like he's eating. It makes a pleasing kind of noise, like biting really fast.

When I was a teenager, a friend of mine from Colombia gave me a beautiful book that illustrated a lot of fruits and vegetables, all painted—botanical illustrations. Those paintings are amazing. If you had a photograph of a fruit, it wouldn't inspire you as much as these paintings. They are full of detail and are just so beautiful.

I remember turning up my nose when he gave me the book. I said, "What am I going to do with that?" But it turned out to be one of my favorite books. Anyway, I did a lot of fruit, looking at this book. I did hundreds of all sorts of fruit in those days and I became quite good at watermelons. I did a lot of them, cut in different ways, so you can see the beautiful colors inside. Hopefully this makes you feel like you want to eat a watermelon.

the automata there didn't work well, so the only person to repair them was me. I had to actually get my hands on them and try to repair them before people would come to see them. I realized the importance of the work as well, because every day different schools would come to see the museum. I also got to know some collectors. It was a really intense but very nice time.

Then in 2000 they decided to close Cabaret because the rent got extremely high. There were a lot of problems outside the theatre that didn't help, either. So I said to Sue and Sarah [Alexander], "What am I going to do, now that you are closing?" They said, "What are you talking about, Carlos? You already earn a living from it!" There were two collectors at the time who were very keen about my work. They said they would keep me busy for a while. I will always be thankful to Sarah and Sue.

Marc: So you've been making automata full time since 2000?

Carlos: Yeah. Cabaret sold my work during the first seven years, or something. By then I began to know other collectors, too, so I didn't depend only on Cabaret sales. Each time CMT sent out an exhibition, I didn't even know where the exhibitions were. My own work was included in the exhibitions because CMT had also bought my work.

Marc: That must have been exciting for you.

Carlos: Yeah. It's nice to know that people on the other side of the world know about you.

Marc: How did you learn how to use whatever tools were necessary to build automata?

Carlos: Well, you just learn because you want to do it. The only help I received was when I went to live in Falmouth after Cabaret closed. I had told Sarah and Sue that I wanted to buy a house and they suggested moving to Cornwall. We had a baby in those days. So I came to Falmouth and I just loved the place. It was a countryside setting next to the sea. Through Cabaret I already knew Keith Newstead, Matt Smith, and Paul Spooner. They welcomed me, so I did well. If I had problems, they would advise me. But I had already learned more from Patrick Bond. Patrick was someone who had worked

Trans Andes (2002)

This is actually a very early work. I made two of these. This one belongs to a collector who I mentioned earlier, who said, "I will keep you busy for a while." I just did it because I like it. It was a wonderful commission to have, because I get too many commissions that have too many restrictions, where I have to do something very specific and it has to have this and that. This was the opposite. He said to me, "Just be yourself."

I was inspired by typical crafts that people buy when they go to Colombia. A ceramic bus is quite common. These are usually quite small and have fruit on top and people inside. They illustrate a typical bus from the countryside, from rural places. It will be full of people transporting their fruit and animals.

You can see the driver and his girlfriend, which is typical. He's more interested in the girlfriend than driving. In the back you can see different characters. There are two people on top, with chickens, eggs, and a basket of fish. It's very had to drive through the Andes—the topografor Cabaret. He's extremely modest and was the guy who had always been in the background there—the technician for big jobs. He was the one who motorized the automata for the exhibitions.

Marc: When you want to start a piece, how do you come up with your ideas?

Carlos: It's always different. For instance, I might see something that really interests me, like a situation. Let me give you an example—I haven't made this one yet. A guy eating an ice cream. He will be wearing shorts, even though it's always kind of cold here, though it's meant to be summer. In a typical British way, he is ignoring the real world. So I thought, wouldn't it be funny if his knees were shaking from the cold while he licked his ice cream?

That would be the first idea. Then I would do a basic sketch. My drawings are quite basic. I just do a general sketch that takes a few seconds, simply to work out the right proportions concerning the size of the figure and the box that will house the mechanism. That's as far as I will go.

Then I do another drawing, again very basic, where I work out, more or less, how I am going to make his knees shake, plus another cam or mechanism that will make his arm go up and his tongue go out and lick the ice cream. So that's how it works sometimes.

Sometimes, the whole thing won't work. In the old days, I used to just leave the piece like that. Now days, though, I get a bit more perfectionistic. If that doesn't work, I will dismantle or divide the mechanism into its parts. If I think the character is really good, I will put it aside. Sometimes a character will be waiting for his turn for a few years. He will become part of another automaton that probably hasn't got anything to do with licking an ice cream. Maybe I will use a similar movement or maybe I will change the whole thing, but I won't change the character.

The same is true with mechanisms. If I see that the box is quite good—a really nice mechanism but the figure just doesn't work—I will throw away the figure and leave the box to wait for its turn, until an idea comes.

There is something that always happens with everyone—I think Paul Spooner calls this happy accidents—something happens that you are not planning on. Maybe

(Text continued on p. 24)

phy is very steep and there are lots of accidents.

In the villages in the old days, if you produced carrots and onions or something like that, for example, you would take them to the market, maybe with chickens, and you would either sell them or exchange them for something that you need, in an old-fashioned way. Everybody did that every Thursday or Saturday. The only way to get there would be in one of those buses or by horse, because sometimes the roads are not so good. So this just illustrates that kind of day—traveling to the market.

I've been thinking about doing a new version of the same idea. At this point in time I feel I want to go back to the essence and start working again on some pieces. I do not want to try to copy or do the same ones that I did before, but do new pieces based on the same ideas, basically just for myself.

The Allotment Gardener (2004)

I wanted to do a guy walking. I did a few of those back in those days, so I was sure about the mechanism. But I didn't want to just do a guy walking—that would be too boring.

So I thought, Why not do a ridiculously big beetroot? It's all carved out of wood. It took me a long time to carve the leaves, as well. And I spent ages getting the right color. So that's it. I decided, Why not make him an allotment gardener?

Me (2006)

In this piece I was kind of emphasizing how selfish we are as humans. It's all me, me, me first. I first made it with a simple base, then I left it for a few months. I thought, There is something missing here. I came upon a beautiful lion from Nigeria and I just loved its shape and the way the head was made. I thought, This is really good—I want to do this lion.

As I began to work, it turned into more of a jaguar, because that is more from my background. I felt that he must be doing something because I could see that, in the way that I had cut him, his head must be moving. Then I saw, Yeah, that's it—I can put this guy on top of the jaguar because we, as humans, have exploited animals quite a lot. The guy is also moving his hand and head—it's like me, me first, then it's animals down there. As a composition, I saw that it was quite good.

Mother Earth (2008)

This automaton was in an exhibition in Spain about ten years ago and has been there ever since. I knew that I wanted to do a big carving. I don't think you can see the size from the photo but it's about 1.2 meters [47"] high. I quite like it.

I'm going back, by the way, and using fewer boxes to house the mechanisms. I want to do more figures where you can crank them from the belly, like this one, where the mechanism will be behind the figure. When you crank her, she moves her head, and her eyes move, as well, with gravity.

She's holding the world. The idea came because I had this floating weight that is inside toilets. It's an old-fashioned one made of copper, which turns such a beautiful green. I added a bit of acid, as well, to shape the continents of the world, so you can sort of see an atlas of the world. The world rotates a bit as she's holding it. There is also a little character, holding a tiny bird, standing on her shoulder.

(Continued from p. 22)

your piece doesn't work but you find something that just happened to be there. Maybe a figure, for example, is too big, so the mechanism is not attached to the end of the arm but is holding the beginning of the arm, and it turns out to be a far better movement. That's what's called a happy accident.

That often happens to me. Everybody thinks that you spend hours planning every single piece of the automaton in a technical way. But at least for Paul and for Keith and for myself, it's not like that. Especially for Paul. You would be surprised at the number of mistakes that are made during the making of an automaton.

Something else that is important is that, as you make the automaton (and especially the mechanism), because it is in three dimensions, you work out the mechanism as you are actually making it. I don't really make drawings. I have sometimes made drawings because I have to, to show people more or less what they want to see, but it doesn't work like that often for me, with precision.

There is nothing wrong with making drawings. I think it's about how your brain works. Some people need to work with precision. I have been asked, for example, about a piece that I did many years ago. The person is having difficulty understanding how I made the guy jump, or something. "How big is the radius of the cam?" That's impossible for me to answer because I didn't even measure the size of the cam. I worked it out extremely fast. I figured it probably would work, but if it didn't, I'd just make another cam that had to be slightly smaller, or something. That's how I work—very imprecise—intuitive more than rational. AM

Picasso's Morning Face (2009)

I felt obliged to do this piece about Piccaso. We all know Picasso for his Cubist style. I thought that I had to make a joke about it, although I understand and respect Cubism very well.

I thought I would make the joke from the point of view of somebody who really doesn't know about Cubism, and it looks like a morning-face kind of thing. We have all heard about morning face, when you wake up in the morning and your face has been squashed all night. One eye is looking one way and the other eye is looking somewhere else—the face is so twisted.

So I did a portrait of Picasso holding a brush. Down there is a poor guy who had submitted to being against the pillow. He kind of moves toward the pillow all the time, then goes back. It is a very simple movement. And he's got a Cubist face.

This discussion will be concluded in the next issue of *AM*.

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An automaton clock conversion

Modifying a clock to power an automaton

by Gerry Irwin • Southport, United Kingdom • Photos by Mike Palmer

I have always been interested in working with my hands and making and repairing things for children, so I took to making automata like a duck to water.

A long time ago, I was asked to repair a Black Forest automaton, a dumpling eater. If you're not familiar with this automaton, it's a strange-looking man feeding himself dumplings out of a bowl resting on his knees. This character sat on the top of a thirty-hour clock. After hearing that the clock was sold for £5,000, I thought I would make myself one, and I did. I still have it—it's a pity I can't make it a hundred years old!

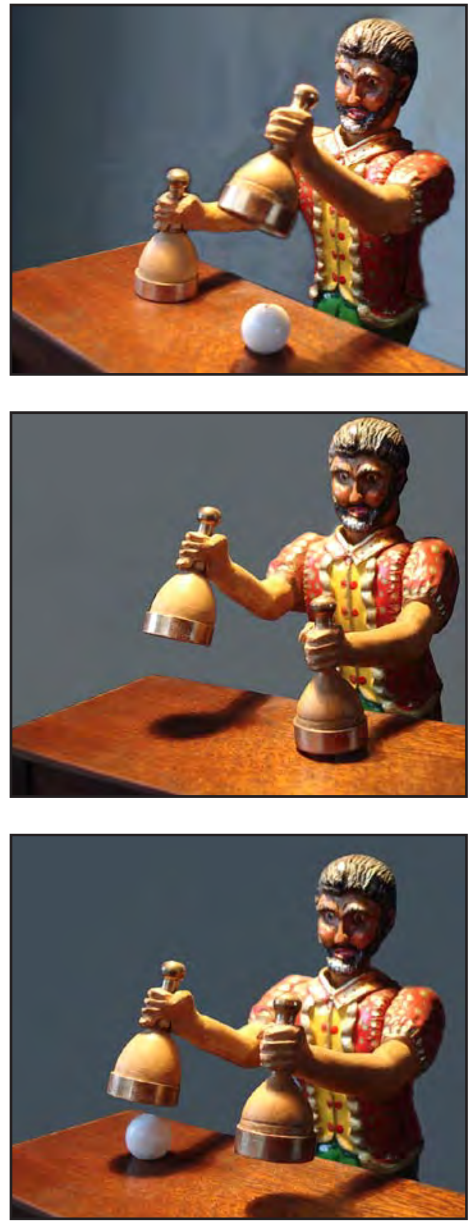
A big breakthrough for me came when my friend Mike Palmer worked out that, with some modification, a three train, Napoleon-hat mantel clock would make a good mechanism for a clockwork automaton, while still keeping the clock movement as a timepiece. The modifications were made and the result is the *Magi-*

This automaton clock started life as a plain mantel clock. The author modified the movement, as described here, built a new case for it, and added the magician. This magician performs his tricks every hour, on the hour, on top of the clock.

cian automaton (**photo 1**), integrated with the clock movement.

In a purpose-built clock case, the magician performs his act, on the hour, when a small music box starts to play, drawing attention to the clock. The stage then lights up, ready for the magician to perform. He lifts the cups, one at a time, revealing a ball under each. After replacing each cup, he then lifts them again, one at a time, to show that the balls have gone (**photo 2**).

1. The magician, his hat resting on a nearby rack, resides in his own house atop the clock.



2. Powered by the clock's movement, the magician raises and lowers his inverted cups. The balls beneath alternately appear and disappear.

The clock

A striking clock strikes only the number of the hour—it has no additional chimes. A chiming clock chimes every quarter hour and also strikes the number of the hour. The photographs accompanying this text show one of many variations of chiming-type movements. Although the layouts may vary in different clocks, the principles described here remain the same.

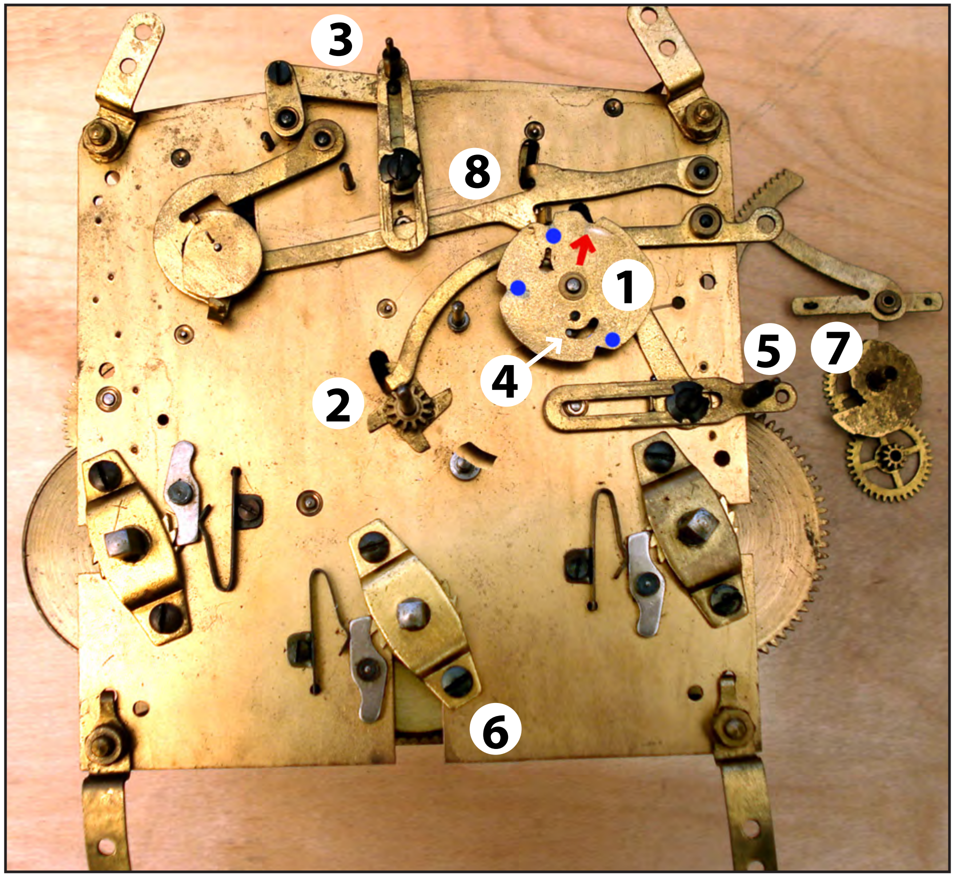
The old Westminster chiming mantel clocks of the 1930s are not masterpieces of horology, or anything else, for that matter. In fact, most people would say that in the main these are miserable and dowdy, and they make a not-particularly pleasant noise, too often. Plywood cases, peeling oak veneer, and spotty chrome bezels? No thanks.

However, some of them can be converted into something much quieter and vastly more interesting. You just have to be careful to select the correct type of movement. If you are not familiar with clocks, it would be a good idea to find someone who is, and ask them to find you a decent-quality one with a movement in good, working condition. This will avoid the trauma of later learning that you have bought a pig in a poke.

One important condition that makes the conversion easier is to use the type of movement where the cams and hammers extend outward from the back, rather than being slung underneath. Avoid the latter type.

Look for a clock movement that will run for eight days, strike on the hour, and drive a camshaft capable of operating an automaton every hour. The automaton must require no more energy to drive it than was necessary to lift the hammers in the clock's previous incarnation. Particular attention must be paid to making certain that the transmission of movement is as free from friction as possible. Where a weight in the automaton has to be lifted, ask yourself if that weight can be counterbalanced, so that it only just falls to its resting position. You must also bear in mind that someone might need to dismantel it for servicing one day. If you make that difficult, they could make a mess of it.

Bear in mind that these clocks are cheap to buy (in the UK) but expensive to repair or overhaul. This is because of the combination of three separate trains of wheels (gears) and springs,



3. **The under-dial view of a Westminster chiming and striking clock.** 1. The quarter cam; 2. Star wheel (or cam); 3. Rise and fall lever (not present on all clocks); 4. Self-correcting slot in quarter cam (not present on all clocks); 5. Chime/silent switch/lever (not present on all clocks); 6. Slots to allow the removal of the spring barrel (not present on all clocks); 7. Motion-work and strike rack (removed to clarify photograph); 8. Lever that stops the automaton train and frees the strike train to strike the hour.

The three short arms of the star wheel (2) are plainly visible in this photograph. Only these must be removed to prevent the chime (automaton) train from being started on each of the first three quarters of the hour. However, if that were the only alteration to be made, the chime (automaton) would stop when the lever (8) dropped into one of the three depressions on the edge of the quarter-cam (1, marked with blue dots). The depression indicated by the red arrow, as well as the rest of the cam, must be left as-is. Those depressions marked with blue dots must be filled before the automaton can run for the full duration.

along with their associated cams, connecting levers, etc. Unless you purchase a clock or movement that has already been overhauled and fitted with new springs, this might be necessary before the conversion begins, or trouble might ensue. Some of the conversion work can be done more easily when the movement is in pieces. The only other expense will be your time and the cost of materials used to make the automaton.

The conversion

Note: Do not attempt to dismantel a movement unless you are familiar with the amount of energy stored in a mainspring, and unless you know how to safely release it!

The sequence of actions in this type of chiming clock is as follows: On the first, second, and third quarter hours, a cam (or star wheel—Nº 2 in **photo 3**), located behind the motion work (the wheels upon which the hands are mounted), begins the action of the chime train by lifting a lever that "warns" the chime train by partly releasing it. When the lever drops off an arm of the star wheel, that train is freed to complete a portion of the chime relevant to the quarter displayed on the dial.

As the action of the chime progresses, a cam (the quarter cam—Nº 1 in **photo 3**) on the chime train turns. This has four unevenly spaced divisions, each separated by a notch. The divisions are unevenly spaced to correspond with the uneven length of time each quarter requires. At the end of each of the first three quarters, a lever falls into the notch, halting the wheels of the chime train. However, on the hour, an additional action takes place, when the quarter cam also trips the strike train but then holds back its progress with a lever until the quarter chime has sounded.

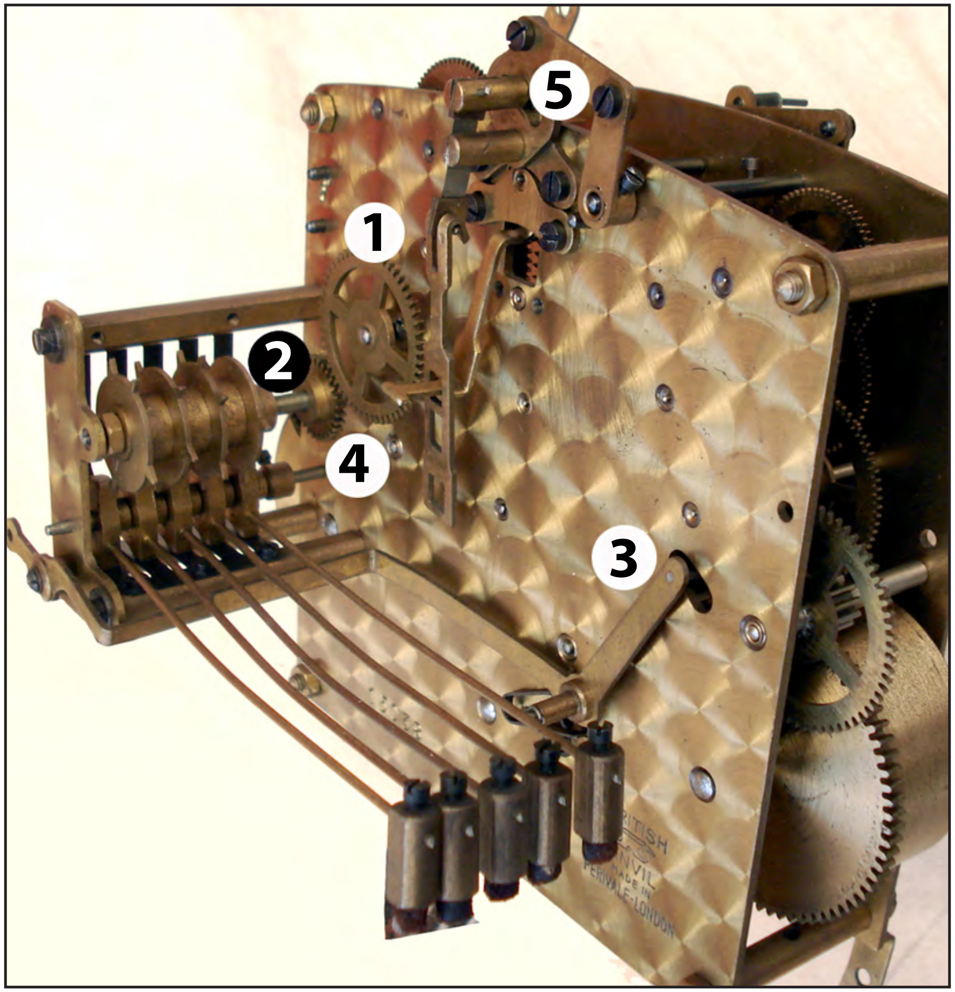
The strike action varies from clock to clock, but it normally ends with a link to one or more of the hammers, which strike the hours. There is usually a way to adapt a part of that element to sound a bell or gong, because after the conversion, there may be no room for any of the original hammers.

In order to utilize the chiming train to power an automaton's action on the hour, the three short arms of the star wheel (Nº 2, **photo 3**) must be removed. Star wheels are often fastened to what is known as a cannon pinion, and unfortunately they are often a very tight interference or press fit. After having been in place for many years, they can be quite difficult to remove for the alteration work. I have no idea why they were made to fit so tightly because they have little work to do in terms of the transmission of power or overcoming resistance. I have used a couple of curved wedges on opposing sides to remove them, but sometimes the front plate has to be removed to gain proper access. On clocks that I have converted, I have opened the hole slightly to make them easier to remove in future.

The quarter cam (Nº 1 in **photo 3**) must also be modified in order to prevent it from stopping the automaton when it presents its first three slots. This means that, once converted, the automaton will perform its act upon the hour, to be followed by the hourly strike. It requires no more of the chime mainspring (in terms of the running time) than it previously used when chiming the four quarters.

The quarter cam is altered by blanking-off the first three of the four slots (blue dots in **photo 3**). It follows, then, that the clock will produce its automaton performance once per hour, every hour, for as long as it runs.

With the star wheel and quarter cam having been altered, the ham-



4. **The back view of the movement.** 1. The drive to the cams; 2. The camshaft and cams; 3. The lever that lifts three hammers to strike the hours—it will need to be adapted so that it forms a single hammer to strike a bell or gong (this arrangement varies according to make); 4. The follower (hammer) pivot arbor. Remove the hammers but keep the pivot arbor for the new followers; 5. The rise and fall mechanism for regulating the pendulum (not present on all clocks).

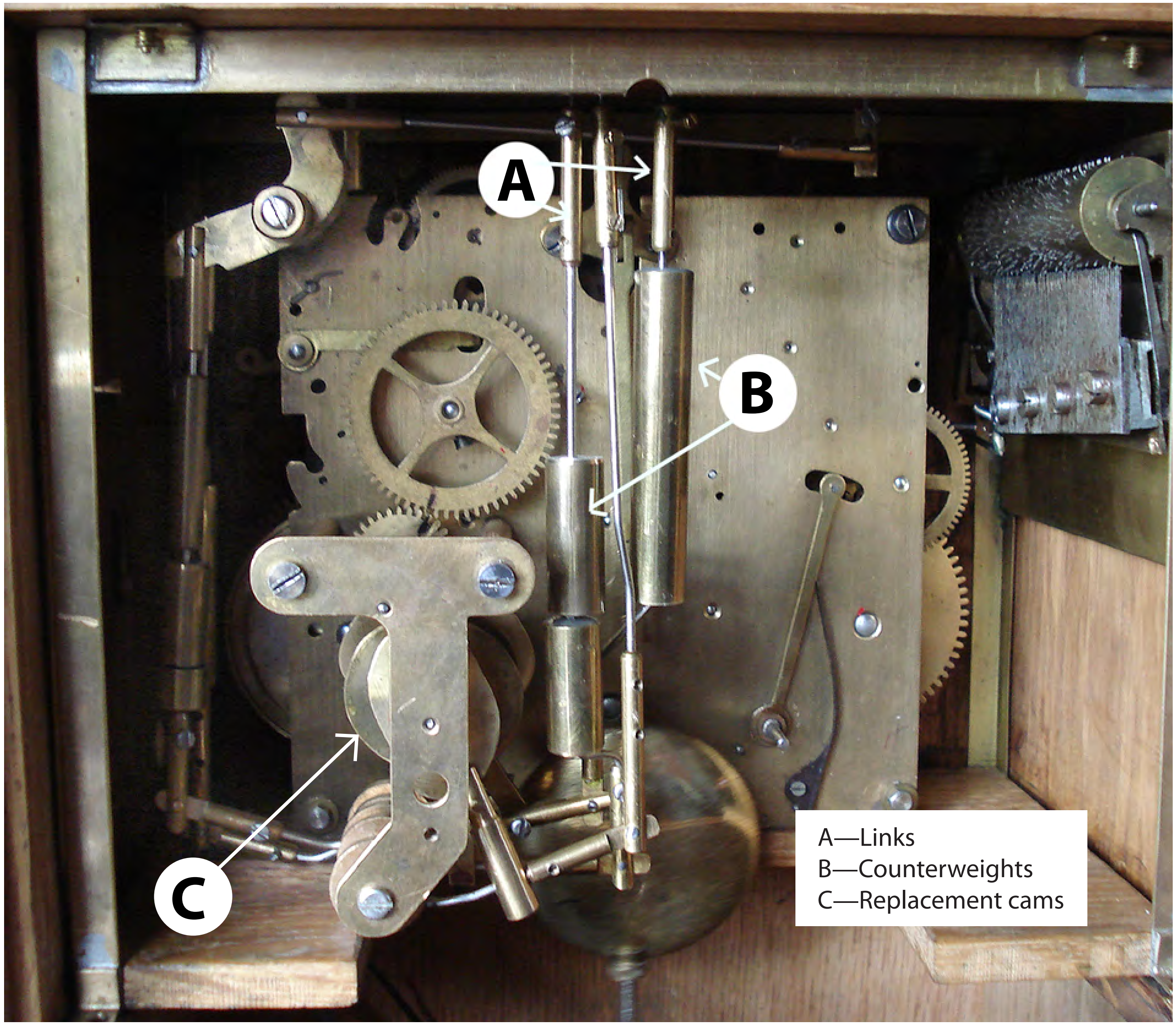
The cams (2) need to be removed so that they can be replaced or altered to suit the needs of your automaton. The method of holding them varies according to the maker, but they will all come off the shaft. Hammers are removed to make way for new followers, to be determined by the requirements of your automaton. On this particular clock, there are two strips of springs screwed to the cam-assembly frame. These will no longer be required.

mer cams (Nº 2 in **photo 4**) and hammers must be removed (some clocks have cylinders with pins instead of cams), but the camshaft is retained to receive the replacement cams that will be used to operate the automaton. The arbor upon which the hammers pivot (Nº 4 in **photo 4**) is also retained. This will be used to mount the cam followers. Spacers may be needed to line up the followers correctly with their cams. **Photo 5** shows the fully modified clock movement, with new cams, cam followers replacing the hammers, and links to the automaton above.

At this point it should be clear that the automaton is practically made! The only decision that remains for an imaginative mind is what the automaton is to do, in order to establish the required shape and number of the cams and followers.

I have successfully made two of these conversions by using the chime train to power an automaton on top of the clock. The other two trains (time and hourly strike) still serve their original purposes. AL

Gerry Irwin's magician can be seen doing his tricks here: *https://tinyurl.com/gerrysclock*



5. This is the converted Westminster clock movement, which now leads a new life inside the conjurer clock. The links shown are there to enable the movement to be separated from the automaton figure. The counterweights reduce the amount of energy required from the clock movement to operate the action. The replacement cams (C) are shown at the bottom left.

Building Blocks

Gears: Part 2—designing for speed

by Paul Giles • Sun City Center, Florida, USA
Drawings by Marc Horovitz

In our automata projects, the two most common reasons to use gears are speed changes or to precisely synchronize actions. A gear train will also transfer energy more efficiently than belts and pulleys, although belts and pulleys are certainly easier to make.

When we decide to use a pair of gear trains to coordinate two actions, or even a sun-and-planet gear system for many actions, we also have the choice of making each action spin in the same direction or in the opposite direction. This is done by simply putting an even number of gears in one train and an odd number in the second.

The most likely reason for using gears is to provide different speeds for portions of our project. For the moment ignore the number of teeth on a gear and think about gears as circles. We need an easy way to figure out how to make things move faster or slower. Imagine a hand crank on one of two circle-gears for a moment. That gear with the handle will be the driving gear. Think of it as the first gear to see your own source of power (from the crank). The second gear is the driven gear (**figure 1a**).

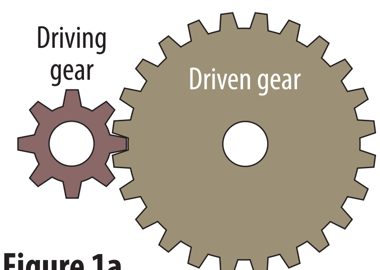


Figure 1a

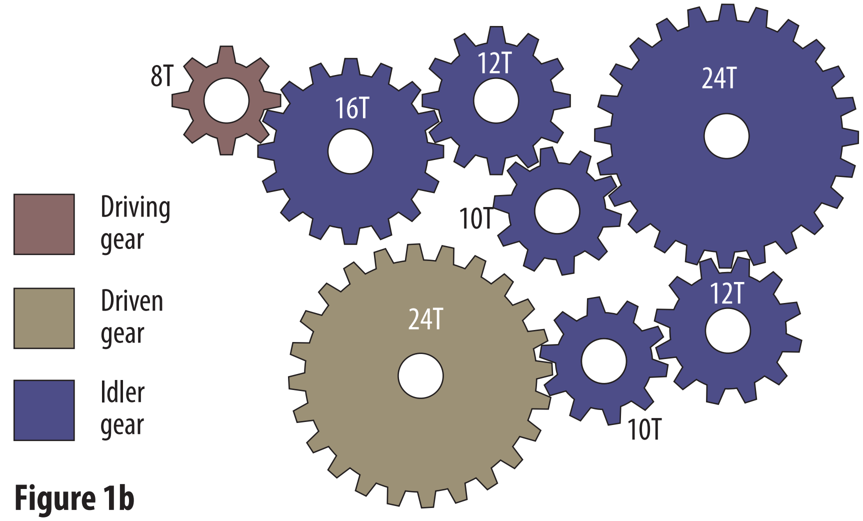


Figure 1b

Idler gears of any size in a gear train do not change the gear ratio between the driving and driven gears. Here, the ratio between the driving gear and the driven gear remains 3:1. However, idlers may change the direction of rotation of the driven gear.

If you connect several gears into a gear train, the last gear will always be the driven gear. Any intermediate gears are called "idlers." You can ignore all of those idlers when determining the final speed in a gear train. Idler gears, regardless of their number, do nothing more than transfer power to—and (possibly) change direction of—the driven gear (further down the line) and the action it controls on top of the box (**figure 1b**).

The two available options when changing speeds are to make the driven gear smaller or larger than the driving gear. If the driving gear is made smaller, the original speed will be decreased. Think of a red dot on the edge of the driven wheel and a green dot on the edge of the driving wheel. Remember that where they meet (where the teeth will be), both wheels must move at exactly the same linear speed. When the smaller wheel is turned, the red dot on the larger wheel will take longer to make a full revolution than the green dot on the smaller one (**figure 2**).

If the driving gear is bigger than the driven gear, exactly

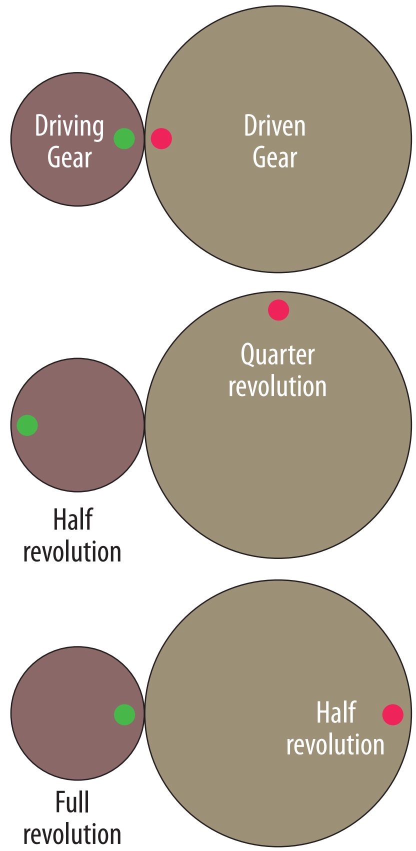


Figure 2

When the smaller, driving gear makes a full revolution, the larger, driven gear will make only half of one revolution.

the opposite will happen—the speed of the driven gear will be greater. Again, picture the green dot on the smaller, driven wheel and a red dot on the large driving wheel. The green dot will complete its loop faster this time because it has less circumference to travel. Always remember that big-to-small goes fast but small-to-big goes slow.

Speed changes

How is the speed change controlled? Mentally put the teeth back on the gears. If it helps, leave the red and green dots on a couple of meshing teeth. Everything else stays exactly the same. Close your eyes again and picture what you want from your movement. For instance, think about a frisky puppy running with a slipper in its mouth, as the poor owner tries to catch the dog. My own pup, sad to say, is easily eight times as fast as I am. That means that our speed difference is one to eight: 1⁄8 or 1:8.

For practical reasons, among them your own safety when cutting the gears, there needs to be a limit to the size of the smallest gears. Never go with fewer than six teeth. Using no fewer than eight teeth will make your gears look a bit more natural than six. Going back to the example of the playful puppy, we will be using a small gear with eight teeth. Wanting a speed change of eight times faster, the other gear will need

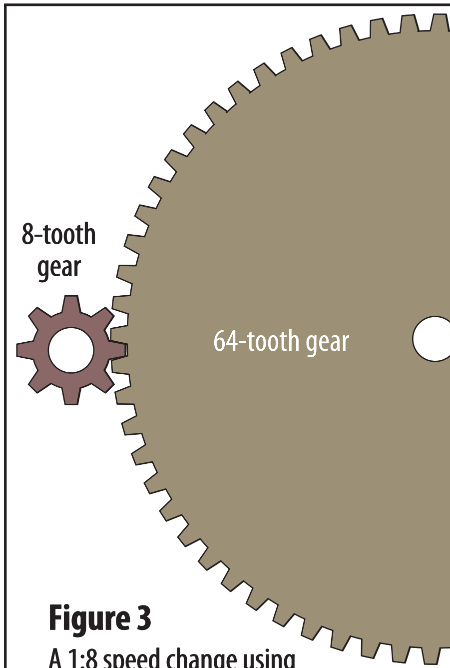


Figure 3
A 1:8 speed change using a single 8T and a single 64T gear

64 teeth. That's eight teeth times eight times faster.

You will quickly see that the second gear is going to be *much* larger than the 8-tooth gear (**figure 3**). If you have room in the mechanism for a larger gear, you can move on to your next task. But what if that huge gear just won't fit in the space available? You may need a series of interconnected, or joined (compound), gears. You don't need to change the speed by a factor of eight all at once. Instead, you can double the speed a few times: first to two, then to four, and finally to eight. That means that, with three pairs of smaller gears, you can still reach a total speed change of eight.

Beginning with a 16-tooth gear, connect it to an 8-tooth gear. That doubling of the number of teeth will also give you double the speed. You can see how much smaller this new gear will be over the original 64-tooth gear (**figure 4**). Doing this three times to

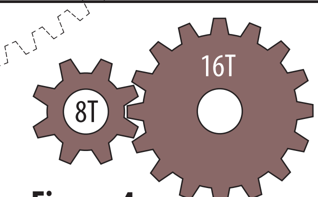


Figure 4
2:1 gear ratio

finally reach the 1:8 speed change means that you will need to use three of both the 8-tooth and 16-tooth gears.

Compound gears

The difference this time is that you will not be stringing all of these gears into one long line, like a gear train. Instead, the gears will be fastened together in pairs, making a compound gear. When you join two gears on the same shaft,

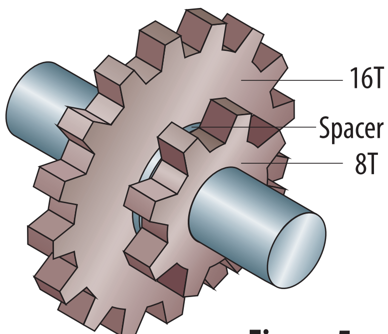


Figure 5
Compound gear

they are both forced to move at the same angular speed (**figure 5**). If you're using wooden gears, you might simply glue one face of each gear to the other. That will certainly work if the glue is fresh and the clamping is well done. Just add a spacer between the gears if you want to create a bit of clearance.

An alternative that would add some visual appeal, as well as greater holding power, is a square gear shaft. Either square wood or brass rods are suitable and each will add a bit of "wow" to your mechanism. A mortising bit is the easiest way to create square holes in wood. Even using a hand chisel to square a pre-drilled hole is quick work. The ends of the square wood rods may be rounded for mounting, to allow rotation of the shaft.

To create the entire speed change, you must now attach an 8-tooth gear to the 16. Do this twice. That gives a single 16, a single 8, and a pair of compound 8-to-16 gears. Assuming that you use a hand crank, it may make more sense if you attach the driven gear to the person in the center of the automaton, running in a smaller circle. To picture this movement of owner and puppy, think of laying the gears all on their sides, rather than standing up. A pair of pinwheel gears to change the direction of the shafts 90° will keep the crank in its usual position at the side of the automaton.

The single 16-tooth gear will be the driving gear. Set its teeth against the smaller gear in one of the compound gears. Place the second gear pair against the first so that, once again, the larger gear will drive the smaller. You have a choice here: make a line of gears or save space by doubling back in the direction of the original driving gear (**figure 6**).

You have now doubled the speed twice, from one to two, then two to four. All that's left is

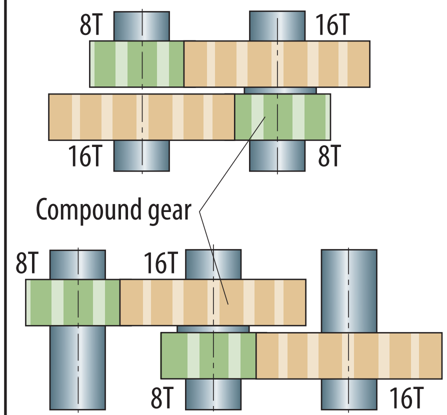


Figure 6
Two ways of laying out gears for 1:4 speed change

to place the final 16-tooth gear against the last 8-tooth gear, which will give the eightfold increase in speed (**figure 7**).

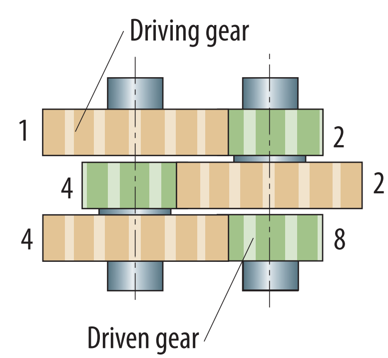


Figure 7
Gear layout, using two compound gears, for a 1:8 speed change

Another advantage of using multiple sets of gears is that you can create a wide range of speed changes with just a few common gears that you can keep in stock. As a quick example, consider just four gear sizes: 6, 8, 15, and 16 teeth. Using any two gears, you can create a dozen different speed ranges! Remember, too, that if you fix pairs together into compound gears, you will rapidly get into some extreme speeds or motions. If you combine any three of the four gears, without repeating, then the number of combinations increases to two dozen choices!

In the next installment of Building Blocks, I will discuss several methods of laying out gear profiles with free software, as well as several methods available for cutting wooden gears. Until then, never forget to constantly close your eyes and visualize the effects that you are creating. Can there be more? For instance, if the pooch is mounted to the edge of a circle that is also driven by a friction wheel, then the puppy can literally spin circles around its master. AM

BUILDING METAL AIRSHIPS FOR AUTOMATA

Modeling with discarded tin cans and copper flashing

by Randall Cleaver • Takoma Park, Maryland, USA • Photos by the author

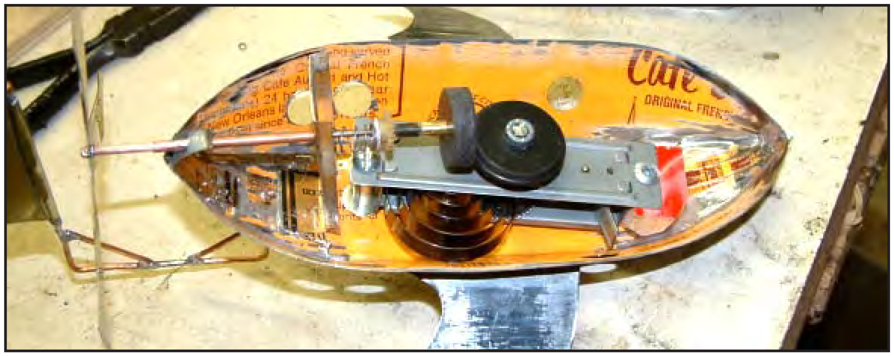
A few years back, I was asked by a friend to build her husband a birthday present (**photo 1**). I knew he loved airships, since they showed up in many of his paintings. I started searching the web for images that would inspire and/or help me, and I found Tinplate Girl (*www.tinplategirl.com*). This site has wonderful patterns and instructions, and I found an airship pattern that was perfect.

I bought and downloaded the pattern and instructions. For this piece I used olive-oil cans and coffee cans to construct the ship (**photo 2**). You do need to be comfortable with soldering to build this model.

I had to scale up the pattern for my first piece, since I wanted it to be around 16" (41cm) in length. I scaled up the gondola a bit more so I could add a windup motor to spin the propeller. In **photo 3** you can see that I used friction wheels—one on the motor and one on the propeller shaft—to spin it. Since the

1. The finished 16"-long airship. A clock (not in the plans) is mounted in its side.

2. A closeup of the backside of the airship. You can see its olive-oil lineage. The clock will be mounted in the can in its side.



3. A windup motor was mounted in the gondola of the airship to power the propeller. Friction wheels were used to change the direction of the motion.

4. The completed copper airships. The author used 60/40 tin-lead solder, then patinated the solder with Novacan copper patina, available at stained-glass shops.

5. The completed *Aero-Time*. Airships spin around the tower via a motor in its base.

wood did not provide enough friction, I glued rubber to the mating surfaces, and that worked well.

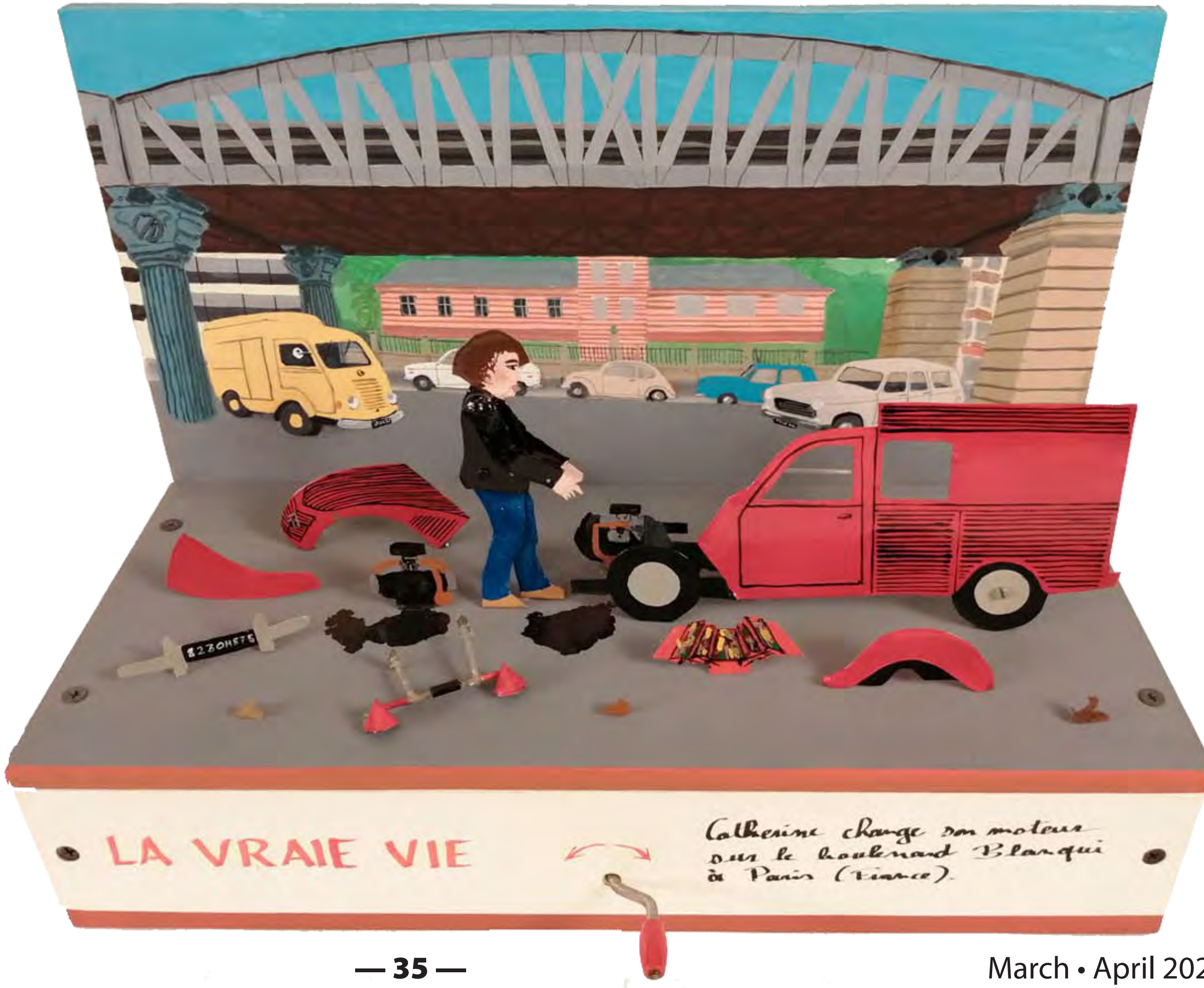
For my second airships, I used the same pattern but scaled it down. I wanted to make two airships, each around 5" (12.7cm) long, out of roofing copper (**photo 4**). Smaller is not easier, and using copper made it even more challenging, since copper heats up so much more quickly than tinplate. I had to use gloves to keep from burning myself. The end result (**photo 5**) came out well and was quite satisfying. AM

LA VRAIE VIE (REAL LIFE)

An automaton based on a true story

by Dominique Corbin

St. Denis, France • Photos by the author



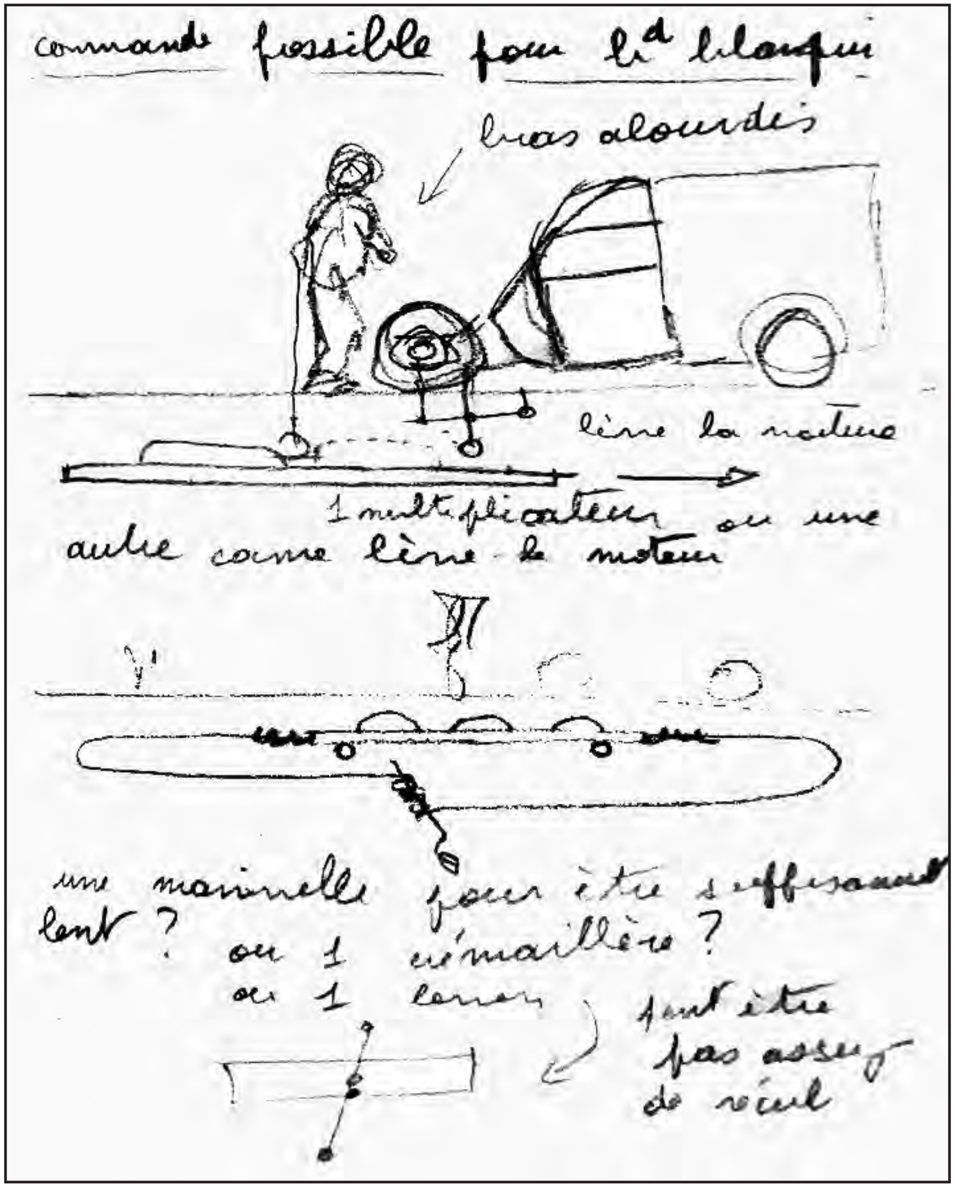
The author's automaton depicts his friend changing out the motor in her Citroën 2CV under a Paris metro bridge.

To design and build an automaton, you need three things. First of all comes the general idea, obviously. Then you must make some decisions about the aesthetic part: the materials used and the style of the sculpture. Then, finally, you must invent the mechanism.

For a long time, I had in my notebook (where I record all of my ideas before forgetting them) a project consisting of a series of automata about the amusing and useful things that I could do in my youth but which are now forbidden by social mores. An example of this would be repairing my car in the street in front of my house; or even, in the case of a Citroën 2CV, to build a car by combining the elements of different wrecks—something quite impossible now in the streets of Paris! My friend and I used to call these experiences *la vraie vie* — real life. As my friend's birthday approached, I decided to offer her the first of this automata series (a series that I'm not at all sure will continue!).

My idea was to evoke the time when she was changing out the engine of her 2CV under the Blanqui Boulevard elevated metro in Paris. She did it well, and more than once (and so did I)!

I remembered that when you tried to remove the engine from a 2CV, the car would rise on its super-flexible suspension, hindering the operation. Also, you had generally forgotten to disassemble something, so it was necessary to put the engine back in place in order to finish dismantling it. I wanted to put this in the automaton's movement—a nod to all those who



1. A page from the author's notebook, showing his original ideas for the automaton's mechanism.

have at least once repaired their 2CV on the side of the road!

As for aesthetics, I vacillated between a three-dimensional automaton and a tableau (flat) automaton. Finally, after seeing works of *art brut**, I decided to make a kind of diorama, which was another activity from my childhood that has completely disappeared but of which I have a good memory. These early dioramas were made by cutting sheets of cardboard, so all of the characters and sets were two dimensional.

For the mechanism, I did not want to use a conventional cam system. I wanted to try to find something simpler (in appearance)—a sort of drawer in which I'd install "bumps" to operate the mechanism. I also wanted to use the most basic solutions possible, like those that an artist of the *art brut* school might have achieved with limited means.

At first I thought about operating the drawer *like* a drawer, directly, but I realized that the movement would be much too violent. To slow the movement I thought of the system often used on old tube radios—a

***_Art brut_:** According to the Tate Museum, "*Art brut* is a French term that translates as 'raw art,' invented by the French artist Jean Dubuffet to describe art such as graffiti or naïve art which is made outside the academic tradition of fine art."

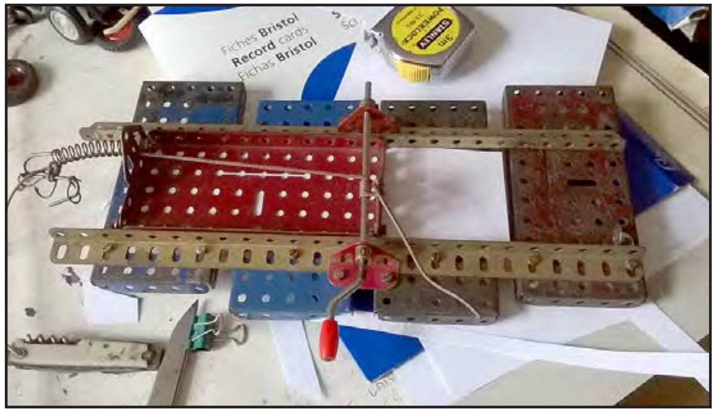
string stretched around a small shaft that could be turned. My first notes can be seen in **photo 1**. I used my trusty Meccano to test this solution (**photo 2**) and I found that it took several turns of the string around the shaft to have sufficient grip.

I then made a small-scale sketch of a Dinky Toys model 2CV van to fix the proportions and dimensions of the automaton car (**photo 3**). Once the dimensions were decided, I quickly made a full-size assembly study out of paper to determine the motions I needed and to figure the height of the base (**photo 4**).

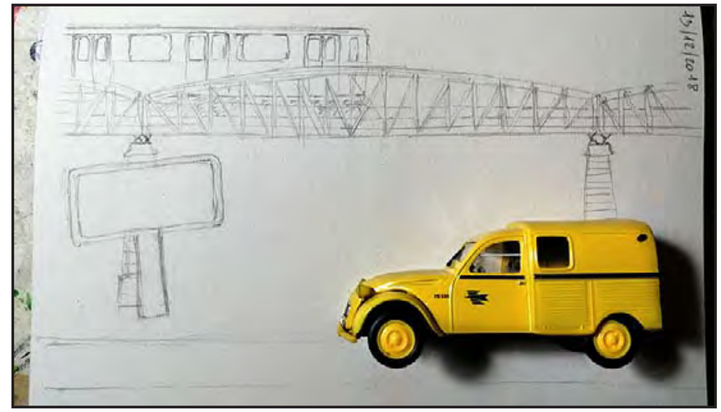
I could then begin the final construction. In general, I draw as few plans as possible, preferring to just build, even if I'm wrong! The base is plywood and the drawer and the "bumps" are galvanized-steel sheet, recovered from the case of an old PC. At the places where the string passed through the metal, I set grommets so that the string would not be cut (**photo 5**).

I reinforced the Meccano brackets of the crank with soldered-in, thick brass pieces to prevent them from wearing out too quickly. The two control rods are just ordinary galvanized wire. I was forced to strengthen the largest one by doubling the wire and soldering the two together. One wire moves the engine and the car, while the other moves the figure (**photo 6**).

The figure and other elements are made of tinplate, cut with a jeweler's saw (or fretsaw) or shear, then soldered together. Copious use was made of stop collars, made from the small brass parts found in termi-



2. Meccano mock-up of the drawer mechanism. The string wrapped around the crank axle moves the drawer from side to side.

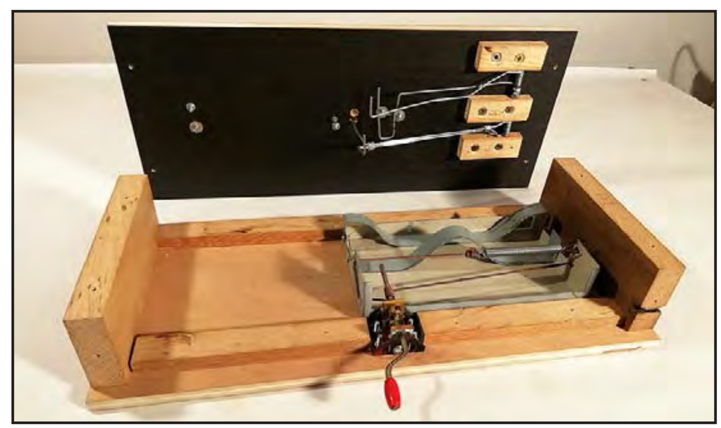


3. Using a Dinky Toys model for scale and proportion, the author drew the rest of the diorama.

4. A full scale mock-up was made to help determine the movements.

5. The actual base, with all of the mechanics in place.

RIGHT: 6. Wire followers in the top of the base are actuated by the "bumps" in the sliding drawer below.



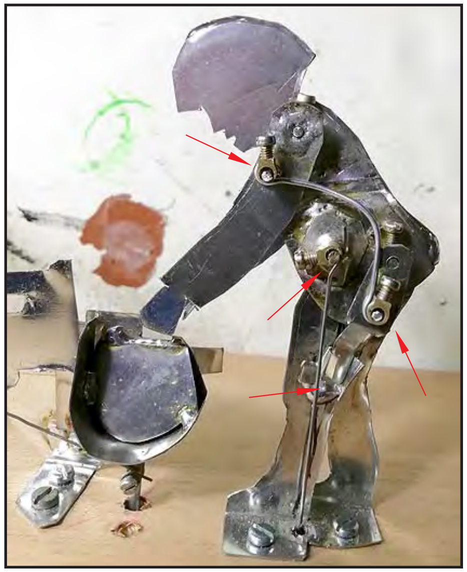
nal blocks, as described in the last issue of *AM*. To draw the car and its parts accurately, in addition to using my Dinky Toys model, I bought a detailed model of a Citroën 2CV, and I searched my memory.

The pivot points of the figure are ordinary nails. Wires are held in place by the brass terminal-block stop collars (**photo 7**). I thought at first that gravity would be enough to pull the figure's arms toward the engine. That did not work at all, so I had to make the mechanism more complex.

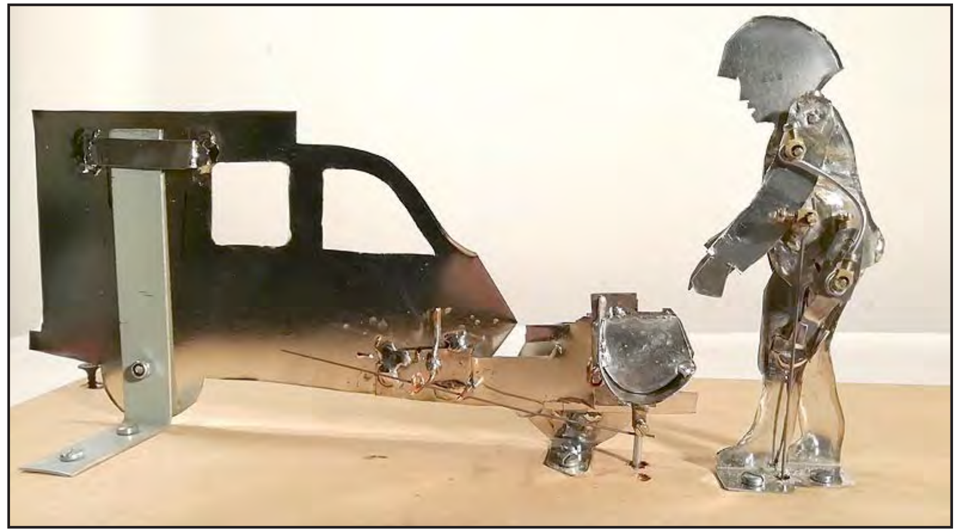
Finding a way to make the car rise was also not easy. Finally, I used a small piece of piano wire to connect the engine to the car. The finished mechanism can be seen in **photo 8**.

The rest of the work involved decorating and painting. First, I took some pictures of the place where the car was actually repaired, and this had not changed much in 45 years. For the background, I made a full-size watercolor of the place, and I then transferred that to the background plate. Then I populated the scenery with vehicles that were important to us at the time; those included my yellow Renault truck, the Renault 16 owned by my friend's parents, a Peugeot 404 Break, a Volkswagen, and a Gordini R8 that she also owned (**photo 9**). I used the internet to find information about these, and photos of them.

I first covered all the wood surfaces with a layer of white acrylic paint. Then I sanded them and smoothed them with ordinary water-based filler, where the result was not good enough. I then painted the base and background decoration with matt acrylic colors, which I use for painting stage sets. All of the tinplate elements were painted with Humbrol lacquer, with a first layer of white. Once the paint was dry, only wrapping the gift remained! AL



7. Detail of the figure's mechanism. Arrows point to the terminal-block stop collars.



8. A back-side view of all of the components in place. The author used only basic materials and techniques, as might be used in the *art brut* style.

9. The watercolor sketch of the backdrop panel. This was transferred to the actual backdrop.

See *La Vraie Vie* in action here: *https://youtu.be/7kj9_7NgfSA*

A note to French readers

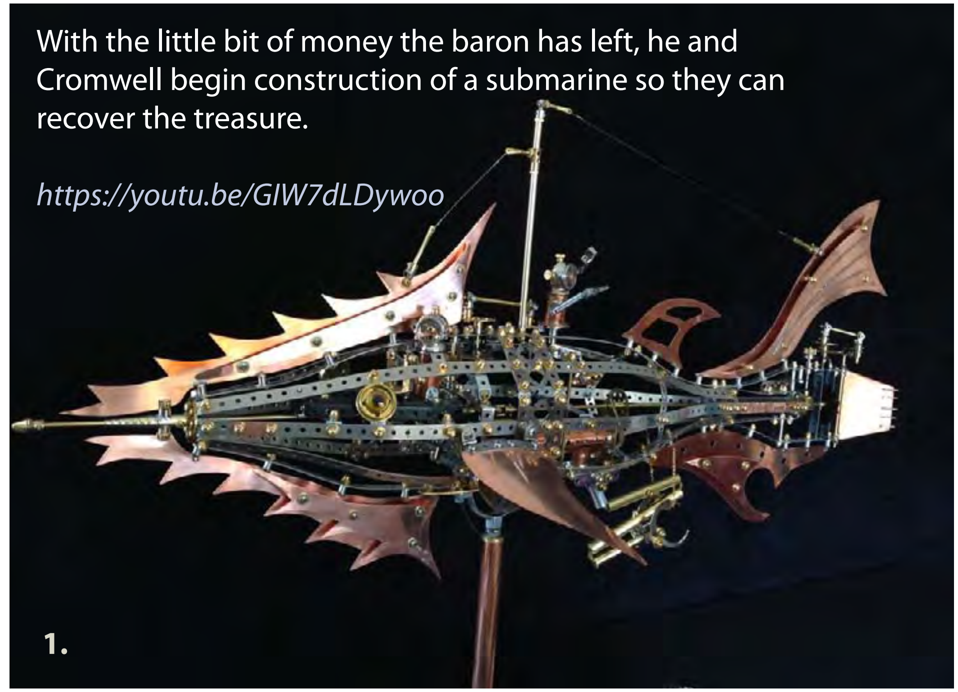
If you would like to read this article in French, click here: *https://tinyurl.com/CorbinFrench*

The Adventures of

Baron von Steubon and Cromwell

Episode 3: Treasure is found and new heads for everyone!

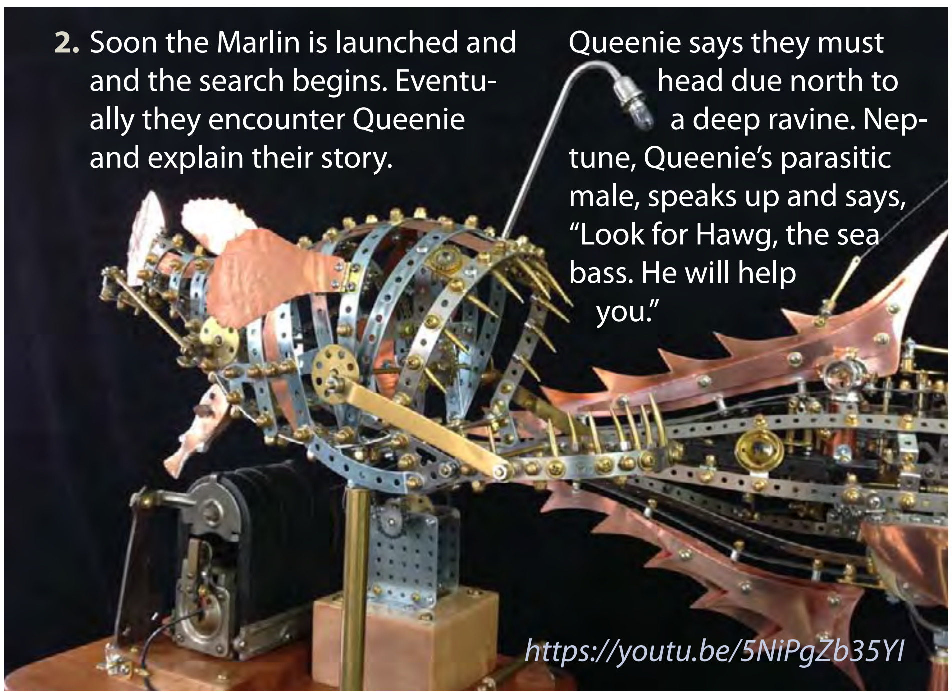
by David Bowman • Mechanicsburg, Pennsylvania, USA
Designs, constructions, and photos by the author



With the little bit of money the baron has left, he and Cromwell begin construction of a submarine so they can recover the treasure.

https://youtu.be/GIW7dLDywoo

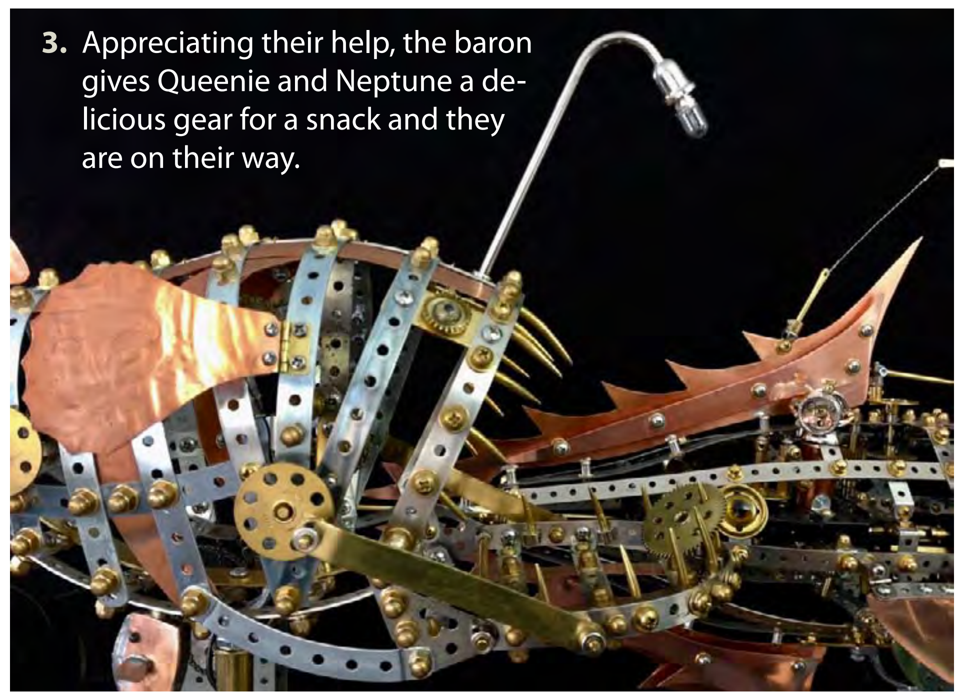
1.



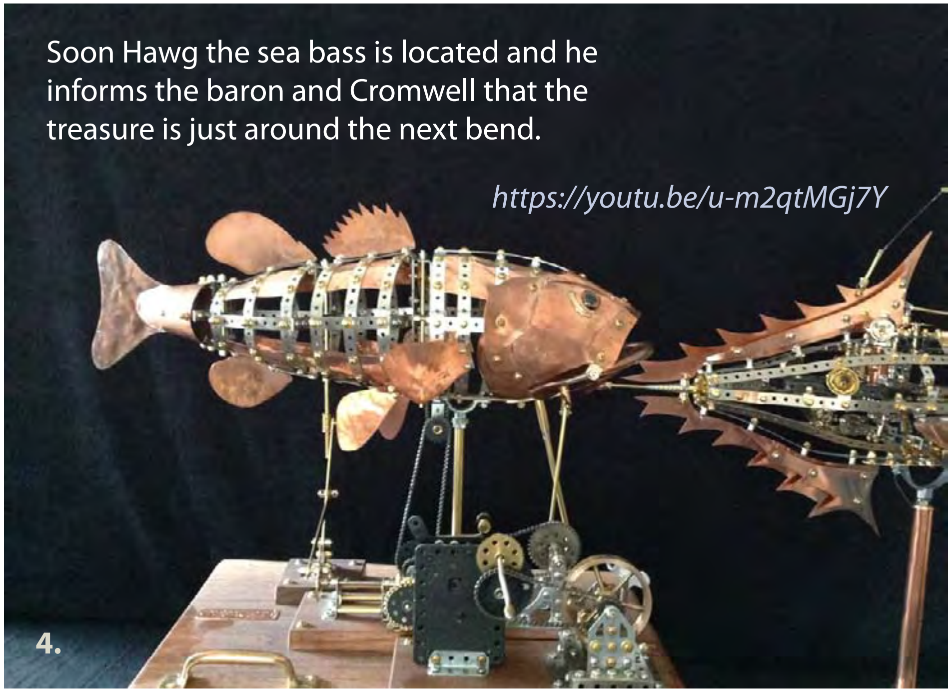
2. Soon the Marlin is launched and and the search begins. Eventually they encounter Queenie and explain their story.

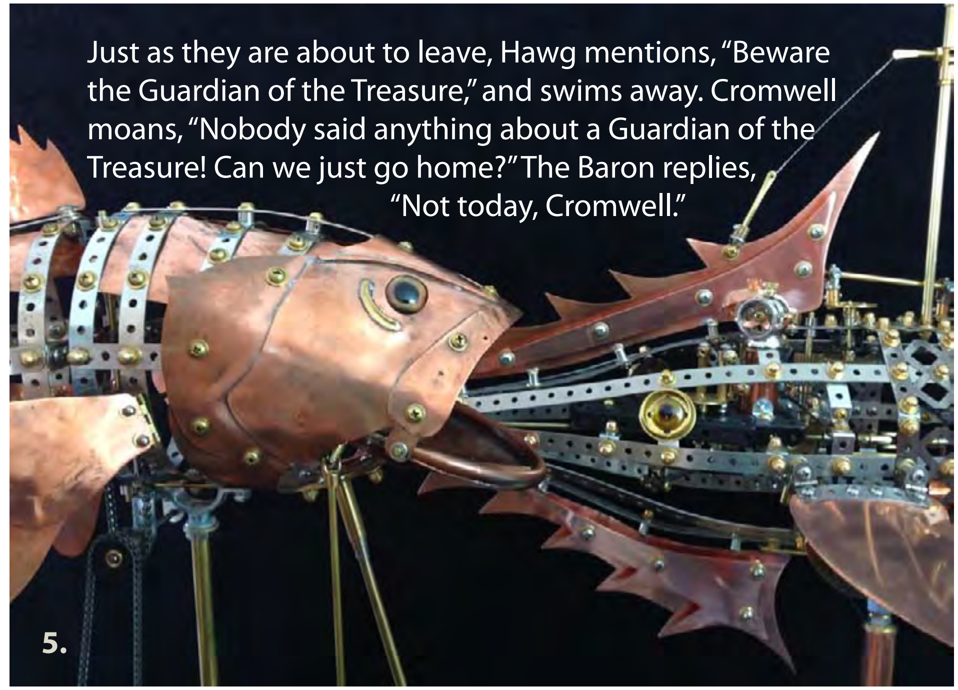
Queenie says they must head due north to a deep ravine. Neptune, Queenie's parasitic male, speaks up and says, "Look for Hawg, the sea bass. He will help you."

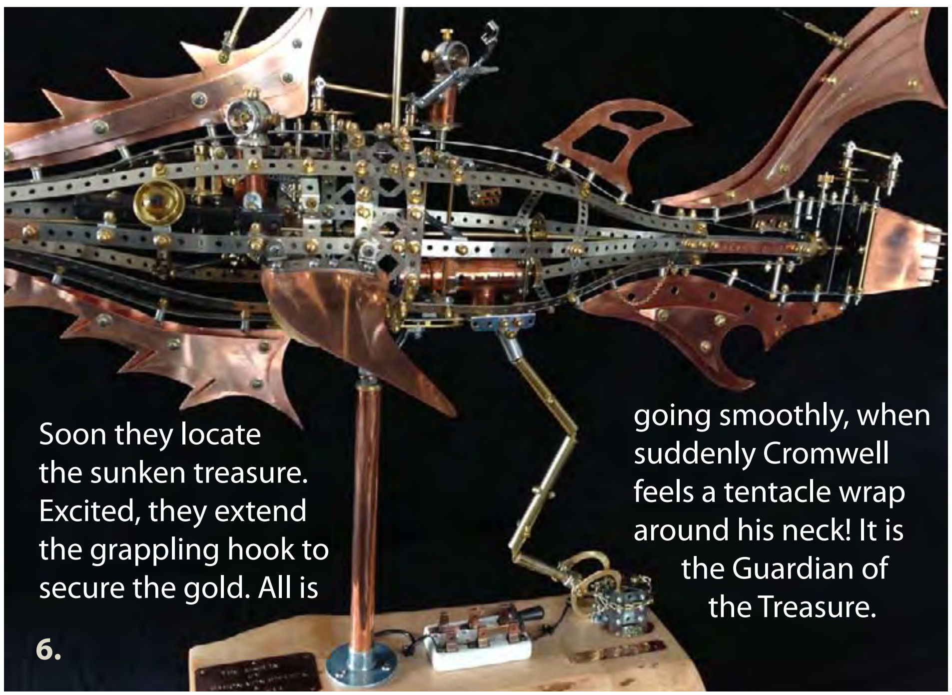
https://youtu.be/5NiPgZb35YI

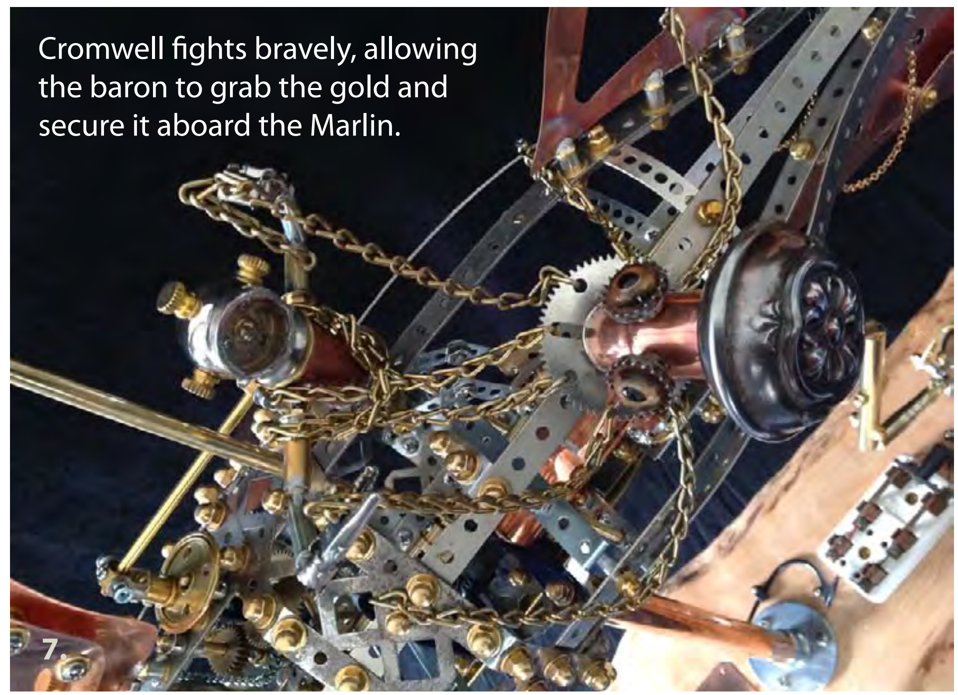


3. Appreciating their help, the baron gives Queenie and Neptune a delicious gear for a snack and they are on their way.


Soon Hawg the sea bass is located and he informs the baron and Cromwell that the treasure is just around the next bend.
https://youtu.be/u-m2qtMGj7Y
4.

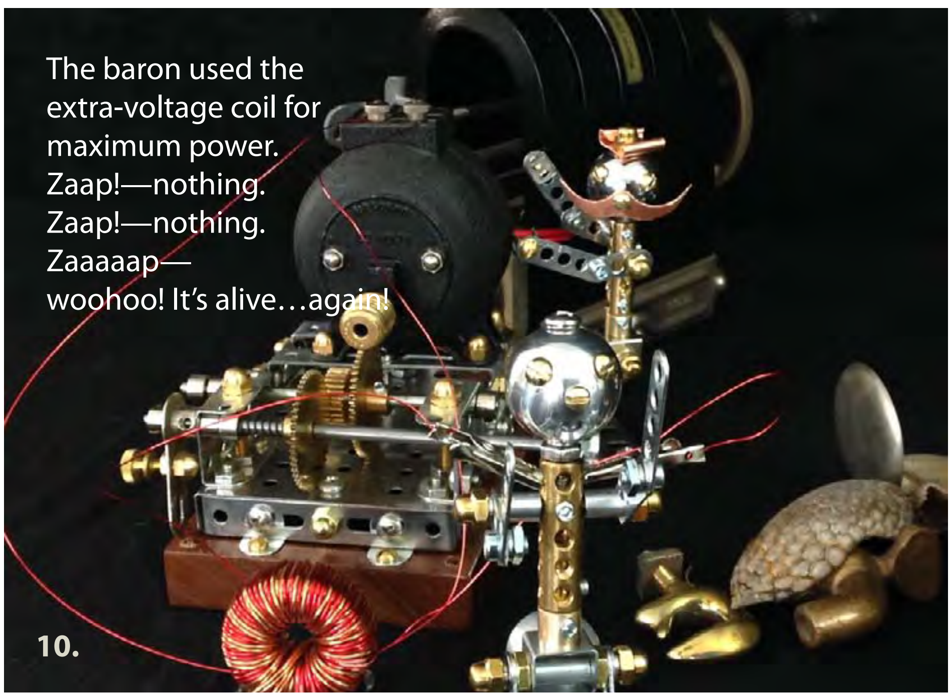

Just as they are about to leave, Hawg mentions, "Beware the Guardian of the Treasure," and swims away. Cromwell moans, "Nobody said anything about a Guardian of the Treasure! Can we just go home?" The Baron replies, "Not today, Cromwell."
5.

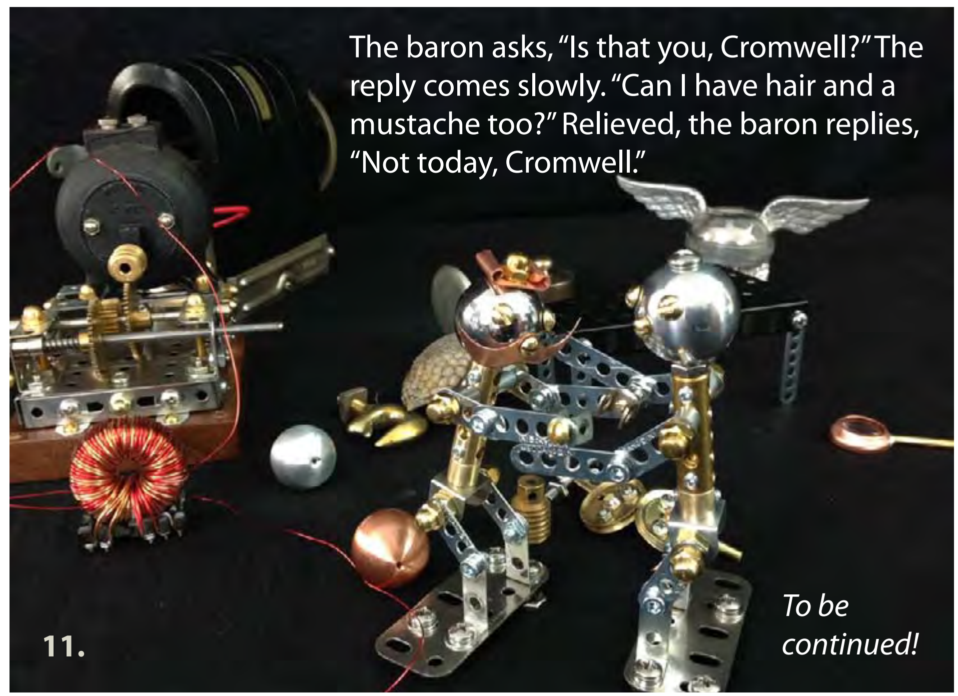

Soon they locate the sunken treasure. Excited, they extend the grappling hook to secure the gold. All is
going smoothly, when suddenly Cromwell feels a tentacle wrap around his neck! It is the Guardian of the Treasure.
6.


Cromwell fights bravely, allowing the baron to grab the gold and secure it aboard the Marlin.
7.


After limping the damaged Marlin home,
the baron drags what is left of Cromwell into the laboratory. Unsure of how to fix Cromwell, the baron decides he must increase his own brain capacity to carry out the complex repairs. So the first repair starts with himself.
8.


Now the work begins on Cromwell. Finally, the necessary repairs and improvements are completed. It is time to jolt him back to consciousness. The baron hopes that Cromwell will still be himself
after such extensive repairs and updates.
9.


The baron used the extra-voltage coil for maximum power.
Zaap!—nothing.
Zaap!—nothing.
Zaaaaap—
woohoo! It's alive…again!
10.


The baron asks, "Is that you, Cromwell?" The reply comes slowly. "Can I have hair and a mustache too?" Relieved, the baron replies, "Not today, Cromwell."
11.
To be continued!

Get Moving

In Seventh Heaven

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

What does it take to make us happy? How do we get to seventh heaven or even up onto cloud nine? It's really the small things in life that count. Upon seeing my wife enjoying a swing in the garden outside a mountain restaurant in the Alps, I thought a swing would be a great start.

Originally, I planned to put the swing in a birdcage, but then I thought, Who's happy being caged in? So I decided to use clouds to swing on instead.

There was recently an exhibition in Berlin about hippies and psychedelia, so I decided that a "strange bird" with a psychedelic Mohican haircut (**photo 1**) should sit on my swing—a strange bird who really knows how to enjoy life. To keep him company, I added some heavenly birds, who might even be storks just back

LEFT: 1. A psychedelic haircut helps to give the swinger character. Strings attached to the swinger's chest and shins help to control his movement.

RIGHT: A rare "bird" swings blissfully in *Seventh Heaven*, while celestial fowl fly overhead.

from delivering their latest load of babies. Pure happiness!

The basic mechanism

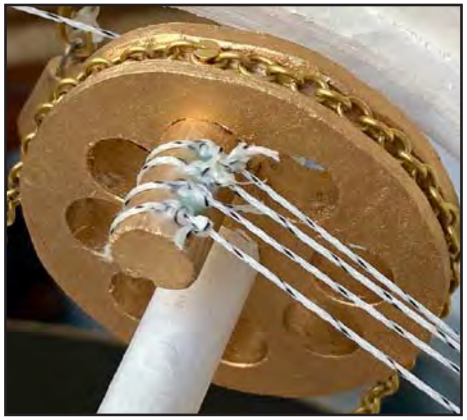
I decided to use a crank to turn a small wheel, which would then cause a larger wheel to first turn one way, then back the other (**photo 2**). A video showing the mechanism working is here: *https://www.youtube.com/watch?v=LYGhfcFeSac*.

To create an extravagant visual impression, I chose a golden (brass) chain to provide the drive to the top axle. This is screwed to the big wheel beneath the base, to transmit the motion to the top of the swing, where it is also screwed in place to a similar wheel. The top wheel, which makes the swing rock, also pulls four strings to make the four birds rise (**photo 3**). Strategically placed screw eyes guide the four strings to the four birds (**photo 4**).

The swinging man

The swinging man has to really enjoy his swing, as he is in Seventh Heaven. So, when moving forward, he leans back and pulls his legs up, with his mouth open, laughing (**photo 5**). Just at the back of his arc, and ready for his next swing, he sits up straight, with his mouth

2. The basic mechanism. The small central wheel is turned by the crank on the outside of the partition, causing the big wheel at the left to rock back and forth. Note the black plastic strips in the slot to reduce the friction. These are cut-down tie wraps.



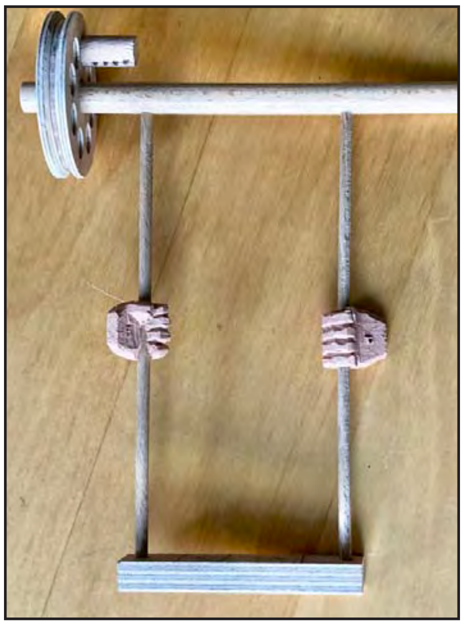
3. This wheel makes the swing rock back and forth and pulls the strings that operate the actions of the birds.

LEFT: 4. String threaded through an eyelet pulls up the brass rod, which lifts the bird's body. The gold-painted lead weight pulls it down again.

ABOVE: 5. Laughing, with mouth wide open, the man obviously enjoys his ride.

6. Separate wooden parts of the head and the carved ruff for the fashion-conscious swinger.

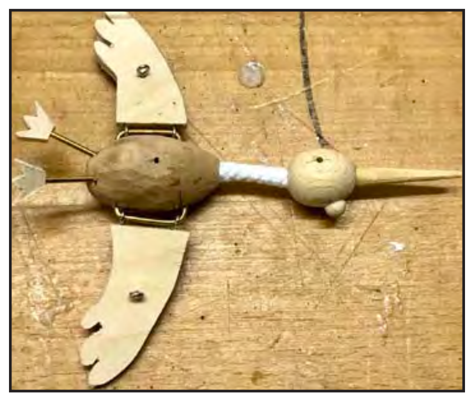
7. The head assembled onto the body. Cutting a curved smile into a beechwood egg required the egg to be held firmly in a clamp.



8. The swing, with drive wheel attached to the shaft and the swinger's hands permanently glued in place.

9. The arms, hinged with screws and plastic washers, and the hands that will hold the swing's axle ends.

10. One limewood leg, hinged at the knee by a 3mm (⅛") dowel.



closed and his legs hanging down. The parts of his head can be seen in **photos 6** and **7**.

Like a marionette, he has strings on his legs and a string on his chest. These are permanently tied to the framework. As the swing moves forward, the strings tighten to pull his legs up; as it moves back, another string tightens to pull his upper body erect on the seat. Gravity closes and opens his mouth. His hands are permanently glued to the rods (**photo 8**) and his arms are each made of two plywood parts, hinged to his body and hands (**photo 9**). His legs are hinged at the knee (**photo 10**) and his thighs are glued to the seat so that his body and lower legs can move freely.

The birds

There is a video that shows how the birds move: *https://www.youtube.com/watch?v=EuCOqCZR1_k*. Each bird's wings are hinged to its body, using screw eyelets and a piece of bent brass rod (**photo 11**). The neck is a piece of white cord that flexes nicely as the body

LEFT: 11. An unpainted bird. Wires in the body pass through eyelets in the wings to form hinges for the wings. Additional eyelets in the middle of the wings attach to the actuating rods on the frame.

moves relative to the head.

My harshest critic, a four-year-old neighbor, asked me why the birds don't fly around in a circle, although they are flapping their wings. She is quite right, of course, and a slightly more complex mechanism would have made that possible. I will tie a knot in my hankie, to remind me to have a go at revolving birds at some future time.

The supporting frame

The framework is reminiscent of a Roman temple (**photo 12**). Fluted columns are pieces of dowel with round-chiselled grooves. Naturally, everything is floating on clouds, so I chose the Roman columns to support an ethereally circular top. Giant golden hands firmly grasp the ends of the swing's axle (**photo 13**). It's all made of wood, but a lick of gold paint gives things that certain sheen, which we would expect in our *Seventh Heaven*. The hands were allowed to move at first, until trial and error revealed the best position for them to be glued. The golden hands were modeled in plasticine. This helped me visualize size, placement, holes, and more. Before the final shapes were carved, the holes for the dowel were drilled.

The driving wheel was cut with a bow saw and the groove in its edge was simply chiselled out. Drilled, round cutouts support the illusion of a metal wheel when the gold paint is added.

Lessons learned

It was fun making this automaton but, as always, I was much wiser at the end than I was at the beginning. I was initially quite casual about the dimensioning of the moving parts and had to beef things up a lot when I discovered my mistake. After some strengthening, the mechanism works, although turning the crank requires an uneven amount of force, depending upon its angle of rotation.

The finished item is quite large and the birds are easier to see than the main figure on the swing. Of course, the columns and circle at the top are required to support the top axle, but it is a pity that they do obscure our psychedelic hero enjoying one of life's simple pleasures. Maybe a simpler, inverted V-shape frame would have been better, without our feathered friends fluttering away up above. I still like it anyway! A.

Here is a video of the finished automaton: *https://tinyurl.com/KimsHeaven*

ABOVE: 12. The frame, resting on its bed of clouds, is reminiscent of a Roman temple.

LEFT: 13. Heavenly hands, yet to be painted gold, support the swing.

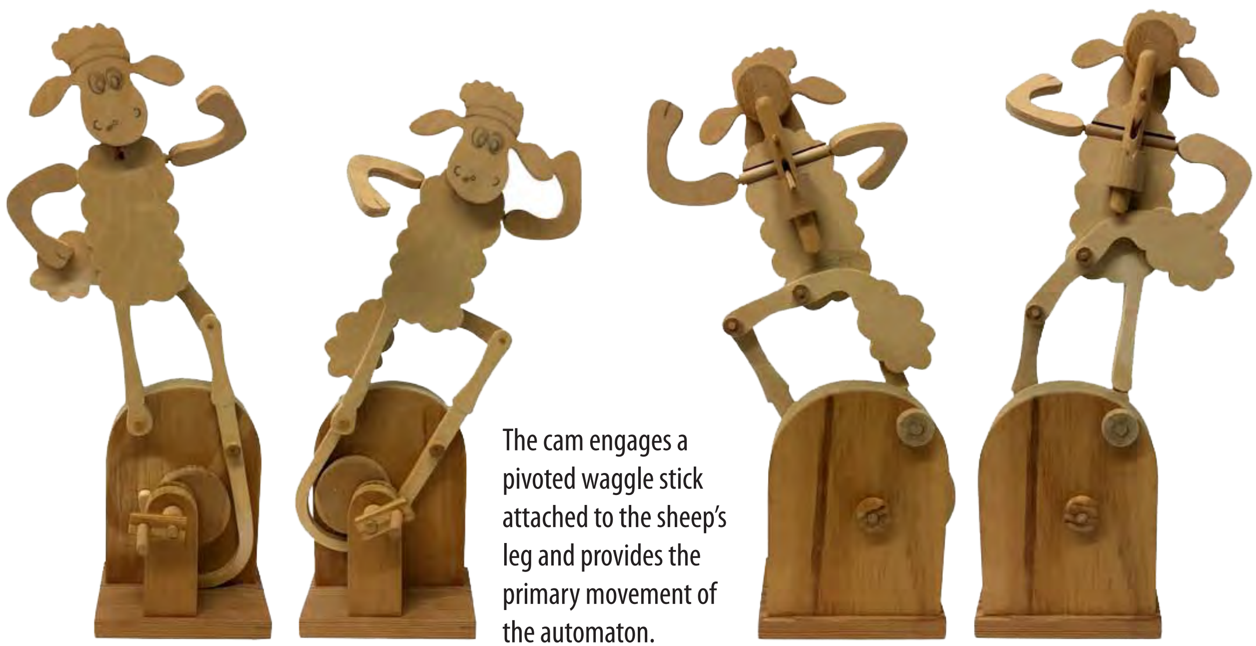
AUTOMATA FOR BEGINNERS

Waggle sticks

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

A waggle stick is one of the most useful bits of an automaton's mechanism. This is a stick of some sort and it waggles. In strict engineering terms it is a lever and a linkage, but if your business is to bring an inanimate object to life, then strict engineering terms don't quite cut it.

For the purpose of this article, we are seeking to achieve a side-to-side movement only. This is a reciprocal movement but I prefer the word "waggle." Precisely calculated and defined arrangements are necessary for robots but not always for automata. In many of my articles, I make the case for a unique language for our world. This is not meant as a denigration or corruption of engineering, but rather a way of adding character and quirk in order to entertain and surprise.

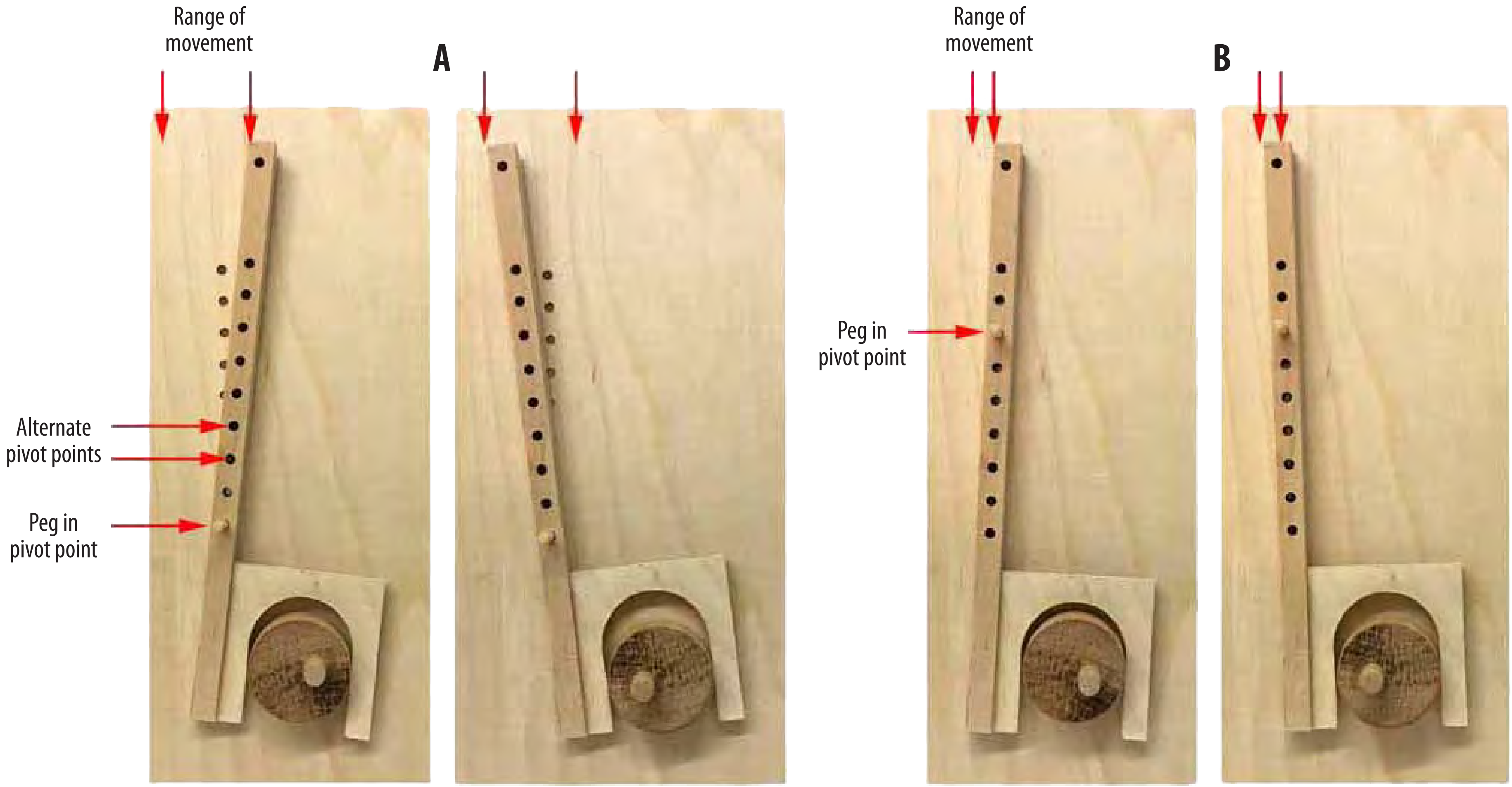


The cam engages a pivoted waggle stick attached to the sheep's leg and provides the primary movement of the automaton.

1. Sheep exercising.

In a simple automaton, a waggle stick is often used as the central core mechanism from which other linkages may pivot. It will often be articulated by a cam, as seen in **photo 1**, depicting an exercising sheep.

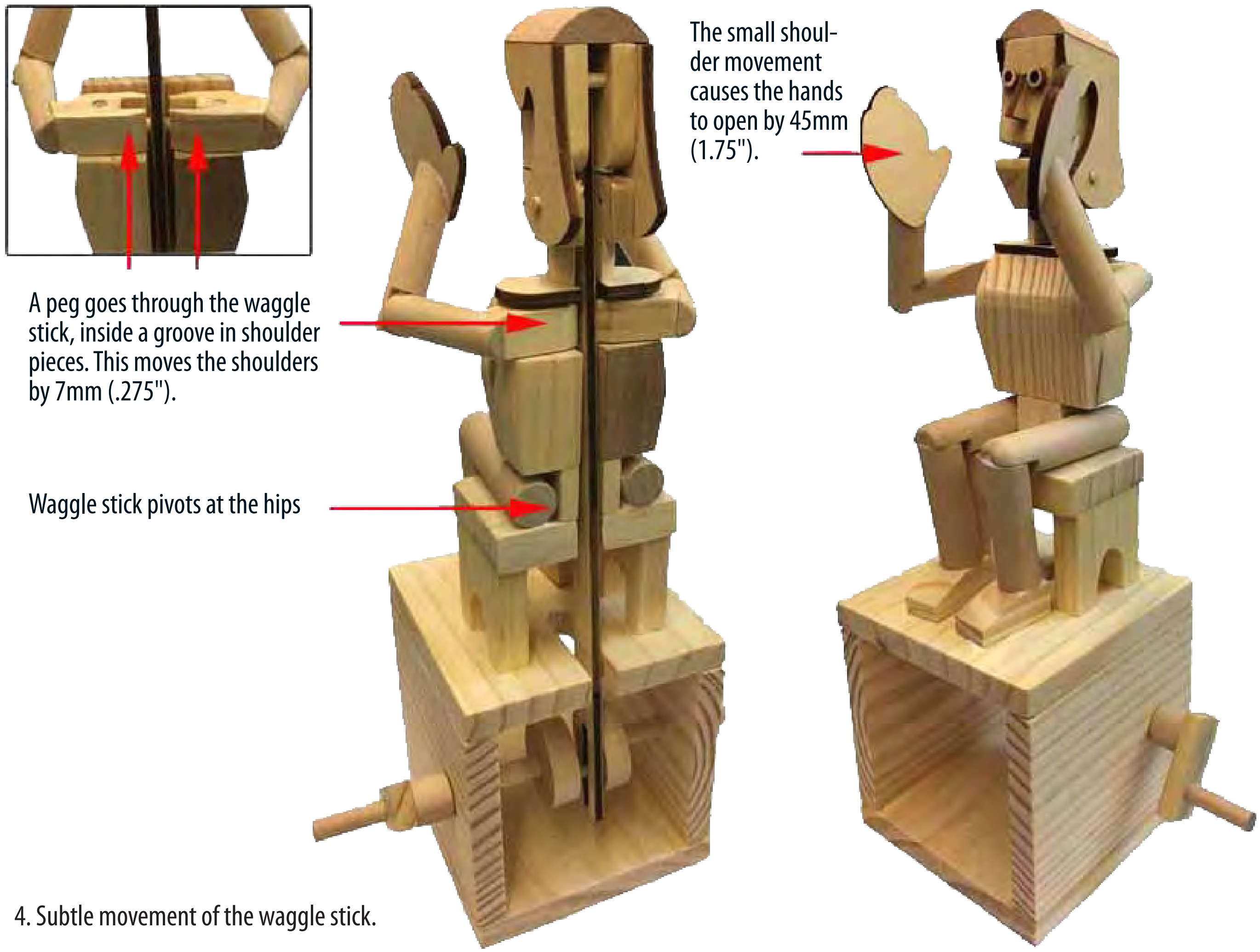
The extent of the stick's waggle will depend on the location of the



2. Range of movement.

pivot and the nature of the cam. If you want to use a waggle stick, it is useful to start with a test rig from which you can make some estimations. I use the word *estimations* rather than *calculations* because you shouldn't expect a waggle stick to behave entirely accurately. There can be lag and/or bounce caused at various points that can restrict or exaggerate its effect—more about that later.

In a test rig you start with known quantities, such as the size of the available cam, the height of the model, or the range of movement you need out of it, and you allow experimentation for the bits you don't know. In my rig in **photo 2**, I have provided a choice of different pivot points to find out what the range of movement might be. As you can see, the closer the waggle stick's pivot is to the cam,



4. Subtle movement of the waggle stick.

the greater the movement will be at the top of the stick.

Note that the distance your cam can push is shown by the arrows outside the red circle in **photo 3**. Both the size of the cam and the position of the hole for the driveshaft are what count.


3. Effective cam movement.

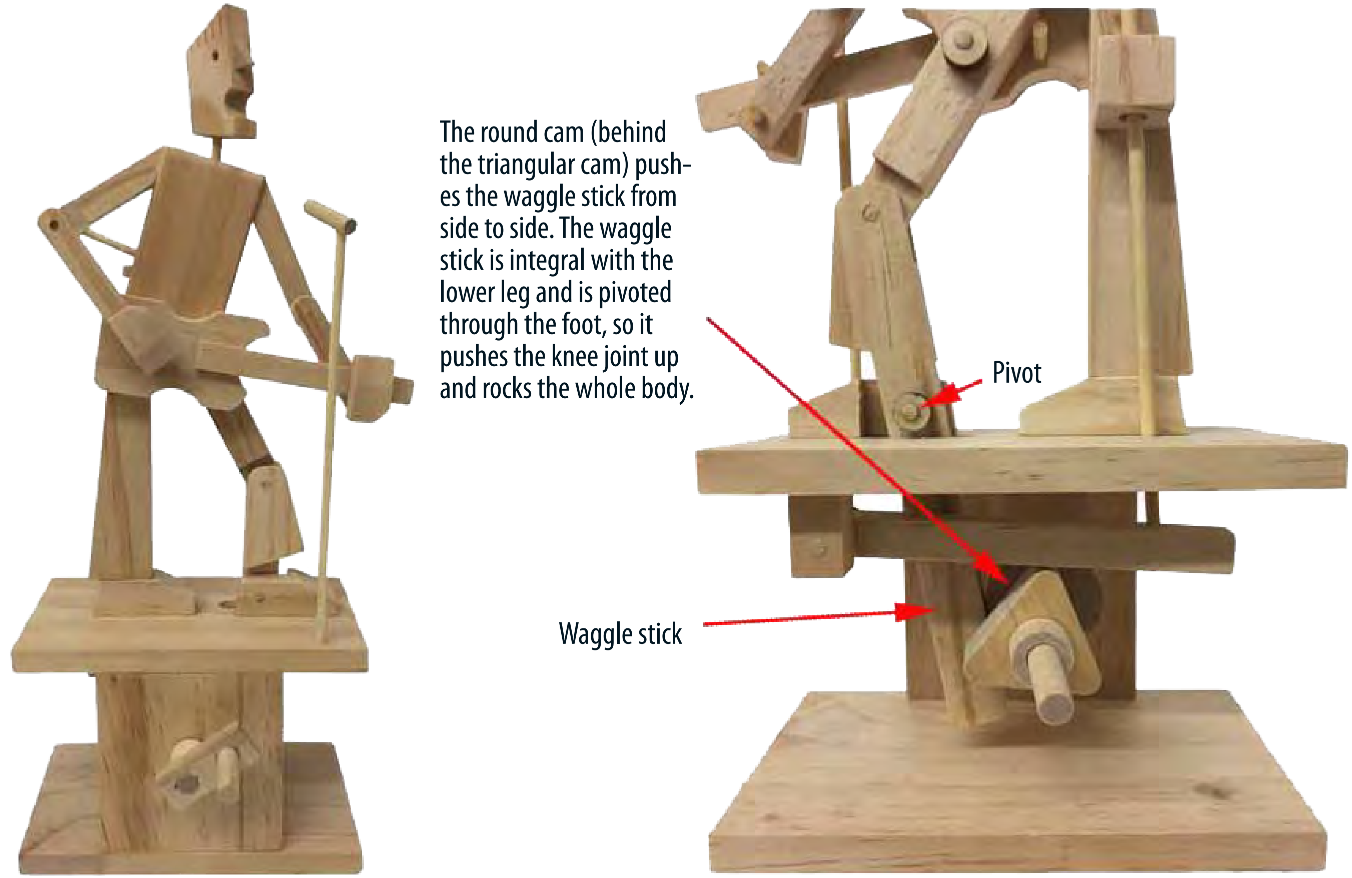
Subtle movement

You would be forgiven for thinking that the tiny movement achieved in test **B** in **photo 2** is hardly worth the bother. However, a tiny movement can go a long way, as seen in our clapping *Happy Hands* model in **photo 4**. The extent of the movement achieved by the combination of the cam, waggle stick, and pivot point is tiny, but it will still create significant effect when the long arms and hands are added.

Lag and bounce

Lag and bounce can happen when there is slack in the mechanism. When we design an automaton at Timberkits, we have to imagine many customers with varying abilities building our kits, and not all of the builders will be precise and tidy in their construction. It is easier for a model to accommodate a bit of accidental slack than for it to cope with a tight bind, so we tend to build-in the slack.

Slack can mean that the cam will spend some time not actually pushing or pulling anything, as it takes up the spare space available. We call this "lost motion." During lost motion, the mechanism may lag or delay, or it may bounce if there is enough energy or momentum behind it. This can often be turned to our advantage, as it creates a less regular and more organic movement (**photo 5**).



Because the waggle stick is not contained or constrained by any other structure, it cannot bind. In fact, it can bounce if the model is operated at speed, thereby giving the guitarist a very jaunty rhythm.

For most of the round cam's revolution, it is not doing anything, so this is lost motion. This allows the more rapid arm-strumming action, operated by the triangular cam in front, to have a contrasting rhythm.

5. Putting lost motion to good use.

I hope you have enjoyed these ideas on the subject of waggling. My next article will be about wiggling—from characters to critters! I kid you not. AM

Contacting Sarah

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

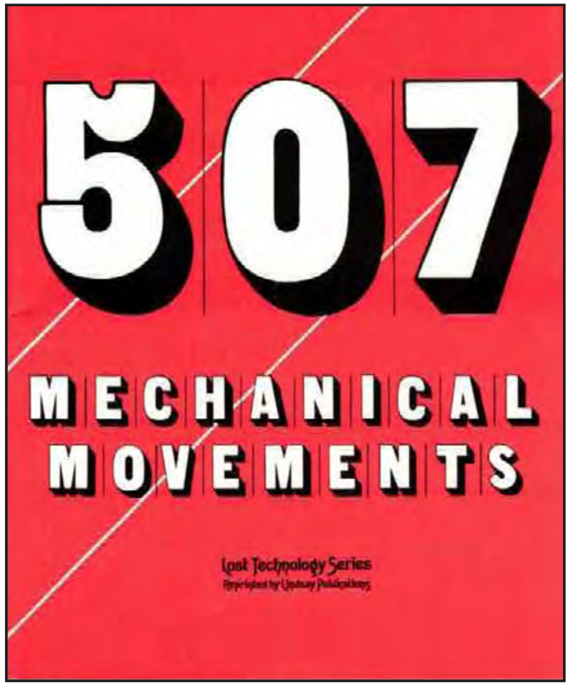
Sarah is the designer and director of Timberkits Ltd., which creates wooden mechanical models sold in kit form. To learn more about her company, visit *https://www.timberkits.com/*.

REVIEWS

BOOK
507 Mechanical Movements
by Henry T. Brown
Originally published in 1868
Edition reviewed is a reprint of the 17th edition (1893) by Lindsay Publications, 1984
6 x 7¼" (15 x 18.4cm), 128 pp., softbound
Out of print

507 Mechanical Movements is a classic. Originally published in 1868, the volume has drawings and descriptions of (naturally) 507 different mechanical movements. This by no means represents all mechanical movements that had been invented to that point. Instead, the author chose those that he felt would be of the most "practical value." In its original form, a quarter of the book contained movements that had, up to the date of publication, never been presented before in a volume.

The book has no table of contents, per se, but begins with a comprehensive index. The drawings and descriptions are arranged more or less by type. For instance, the index lists Cams (2 entries), Cranks (25 entries), Eccentrics (5 entries), Escapements (31 entries), Gearing (9 entries), etc.



Most pages contain multiple movements. On the left page are numbered drawings; on the right are the descriptions. Illustrations are all line drawings, neatly done.

If the drawing doesn't make clear what's going on, the descriptions usually (but not always) help. The language used in the descriptions is compressed, a little old fashioned, and sometimes takes several slow readings to fully understand the motion that is being described. However, it's worth taking the time to puzzle out the motions.

Some of the movements are surprising. For instance, did you know that "uniform traversing motion is imparted to [a] horizontal bar by the rotation of [a] heart-shaped cam"? I've seen this in action, as heart-shaped cams in times past were used to uniformly wind bobbins on sewing machines.

There's a certain amount of repetition in the book, as sometimes several variations of the same principle are shown. Also, some motions are derived from machines that are specific to certain jobs and would have little application anywhere else.

For the automatist, this book is a treasure trove of information. Most of the movements shown are elegantly simple, and many could be easily reproduced in wood and adapted to automata. Others are almost sculptural in their beauty and could inspire automata in their own right.

507 Mechanical Movements has been in the public domain for a long time now and has been reprinted by several publishers. It is readily available on Amazon for not very much money.

I can't close this review without mentioning the website *http://507movements.com/*. This has been put together by Matt Keveney (*info@507movements.com*). He has taken the entire book and created a page for each movement, with its drawing and description. The index is also reproduced, with live links to each movement.

However, the best part is that he is systematically going through the whole book and animating each movement. When you open any given page, the movement comes to life and you can see exactly how it works. His goal is to animate everything. Not all of the movements have been animated as of this writing. The ones that have been done are excellent.

The book and Mr. Keveney's website are indispensable. They should be at the fingertips of every automatist. —*M. Horovitz*

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. Given that, we'll be reviewing more of these in upcoming issues of *AM*.

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