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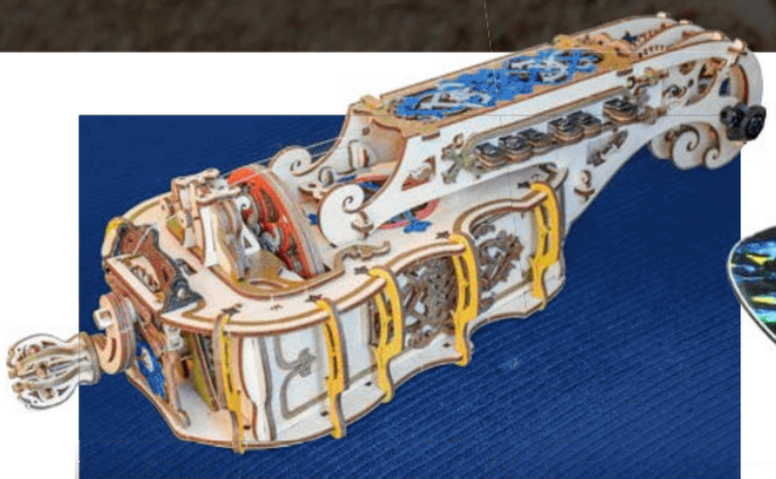

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TAKING A MOMENT

When prepping this issue, I had one of those moments when I think, *Gosh we have a lot of clever buggers in this magazine*.

It hits me every now and again, when I just get astonished by the skills and diversity of the sheddies we feature here, as it did again with this issue. Our cover story features Greville Wills, a miniature steam and electric train builder. His working life has been about as varied as a bloke could squeeze into one lifetime, but trains have constantly been there as his major passion. His skills and workshop are something to behold, and our Jason Burgess does his usual amazing job of getting us all the good oil on another great Kiwi sheddie.

We have three articles from longtime *The Shed* engineering contributor Bob Hulme. Bob is now retired, but his articles in this issue are a varied bunch as well. Making black oxide, 3D printing, and a *Shed* quiz. Being bored will never be a problem for Bob.

We visit a local wooden tool handle-making business that has been supplying workshops with its well-made products for over 70 years, and we have Paul Barton, soldiering on, rebuilding an old AJS on a very limited budget. The lengths to which he goes to have a crack at most aspects of the bike's rebuild are to be applauded. Nothing, whatsoever, seems to really faze him.

Chris Gordon is back sharing another one of his fun, what-the-heck projects that allow him to be creative and have a heap of fun, again for not very much money. Our clever-as electronics guru, Mark Beckett, continues sharing his expert knowledge of electronics and Arduino; his understanding of electronics is a great asset to all of us who like to tinker with this ever-useful microcontroller.

Ritchie Wilson visits the legacy of Roger Mahan in Geraldine, the Roger Mahan Heritage Centre. A wealthy man, Roger amassed a huge mechanical collection via his earthmoving business, and it's as diverse as you could ask for. From bulldozers to stationery engines, vintage cars to cranes, Roger donated his huge collection to the New Zealand public to enjoy for generations to come in a huge purpose-built shed. Sadly, this type of generosity is not as common as it once was, and I urge you to visit when you're down that way; it's a very impressive collection.

The Shed magazine founder Jude Woodside has not been in our pages much these past few years, and you can see what's been keeping him so busy in the final part of his dream shed build article. That will soon be a very busy and industrious shed. Our inspiring *Shed* shrink finds a street artist who gave him real inspiration, and the always busy sheddie Andrew Broxholme shares a worthwhile project with us, building a simple recycling trolley.

We close the issue with another sheddie, Leon Deverick, who has had a busy and varied working career. Leon has now found his niche as a blacksmith, making a name for himself and building a successful career as a specialist armour maker. Who'd have thought?

What gives me enormous pride is how we showcase so many sheddies of senior years still doing it and still having fun. That pride grows even more when I learn of younger inspirational sheddies like Leon or the 12-year-old Zachary Hopkins, who is an RC model fan and wrote in and told us how much he enjoys the magazine.

Some days are just the best of days here at *The Shed*.

Greg Vincent
editor@the-shed.nz

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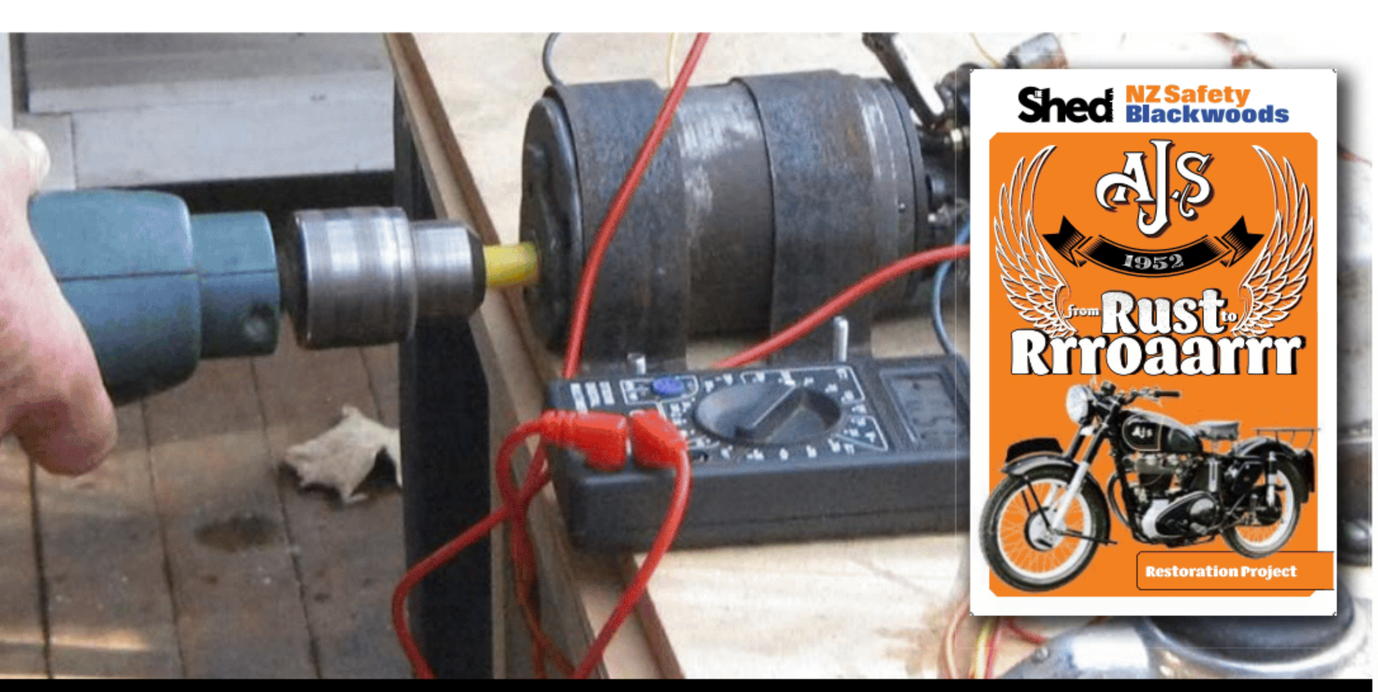

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KEEP ON ROLLING

Growing up near a railway station sparked Greville Wills' lifelong love for trains. Throughout his working career, he has experienced a diverse range of jobs. Today, he identifies as an old-school tinkerer, a model engineering enthusiast, and a Mr Fix-It

By Jason Burgess | Photographs: Jason Burgess

Greville with his homebuilt Bjax steam locomotive, Lady Godiva

Greville in front of his “single person’s workshop”. Above him, a couple of neon signs he made and rented throughout the country during the early 1990’s

Space is definitely at a premium in Greville Wills' garage workshop.

On first look, the visual jumble of tools, projects, ornaments, neons, and former business equipment is confounding. Yet despite the wriggle room between the maze of workstations, there is an underlying order.

Greville is an old-school tinkerer, model-engineering enthusiast, and a Mr Fix-It to his neighbours. He always knew the space here was going to be tight, so before he moved in, he pre-measured and drew a plan for everything from machine placement to car park spaces, factoring in ergonomics and power supply locations to make certain everything would fit and work efficiently.

He is adamant that the layout suits his needs and says, "When I'm making things, everything is here. It is a single person's workshop, where I can do most things. If assembling or constructing something of size, I just push the cars out to use that space temporarily."

The things that interest Greville are as eclectic as his career choices, which he admits, "Makes for a very chequered history." But whether as a Wellington grocer in the '60s, a Xerox technician in London and South Africa in the '70s, or as an Auckland accountant from the 1980s onwards, there is one consistent thread that chugs along in the background of all Greville's workshop undertakings, and that is model trains.

Hear the whistle blowing

"As a boy," he says, "we lived near Ava Station in the Hutt Valley.

I can remember the steam engines before they were replaced in 1955. My grandfather worked for the railways as an engine driver." He has a clear recall of his first train set too, a wind-up Hornby. He says he knew a "rich kid" with an electric Hornby, something Greville could only aspire to.

One day, he and a good friend tried to electrify his own lines. "We ran a wire," he laughs, "from each rail over to the power point. *Bang!* went the fuse. Mum comes running down the hall, 'What are you boys up to?'

"We could have electrocuted ourselves. I now have a healthy respect for electricity. As a technician, I had some serious belts from the mains. You can't hear it, you can't see it, but when you feel it, then it might be too late." ▶

His interests are as eclectic as his career choices.

In the attic messing with his Märklin collection

Just the ticket

In one corner, a wall ladder disappears into the attic above the garage.

In the sloping cavity between the ceiling and the rafters lies an immense deconstructed railway set. The set is entirely vintage, German-made Märklin, a collection that began as soon as Greville was earning coin in the late ’60s.

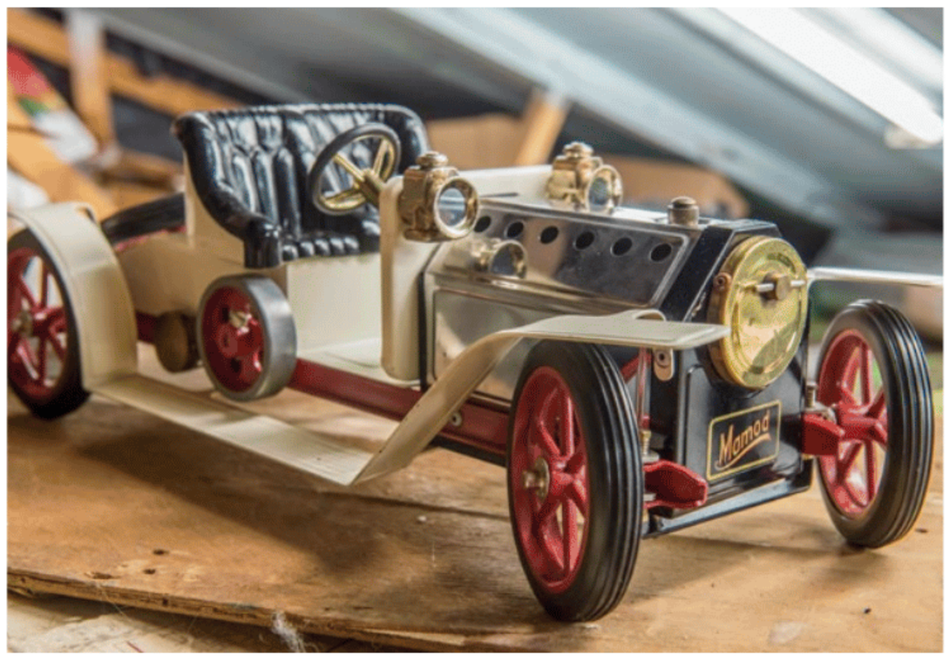
He chose Märklin over Hornby because “they ran AC on the track. With Hornby, it was DC. Running DC on a loop track, you have to have an isolating system and be able to flip the polarity to make the engines carry on in the same direction. To me, it was a no-brainer; if it was AC on the track, it doesn’t matter, as the engines themselves have the reversing mechanism.” The layout in the attic was originally designed on and fitted to old car packing cases when he was 18, about the same time he started building the six-track controller unit, all of which are still fit for purpose today.

Sidetracked

In the early ’70s, Greville’s Märklin collection grew exponentially when he and his wife Janet embarked on a European roadie in their Ford Transit Dormobile. When the couple hit Germany, their camper filled like a freight carriage, full of scale-model railway tracks, parts, and rolling stock. As a working train set, Greville’s layout includes a circuit of four floor-level tracks with an additional two tracks running over a viaduct about six inches above. He had planned to re-establish the set-up when he moved here about a decade ago, but admits that he has been sidetracked by age, flexibility, and family issues. He says, “I have run out of oomph! I need a younger person to help.”

Scaling up

Greville is a life member of the Auckland Society of Model Engineers (ASME). He joined in 1979 and is still engaged in



Among other things stored alongside the tracks in the attic are family mementos and Mamod scale models — plus, of course, boxes of vintage Märklin rolling stock

The homemade six-way controller unit

“I have run out of oomph! I need a younger person to help”

all facets of running the society, from accounting to rostering and being stand-in editor for the newsletter.

On weekends, he oscillates between on-track engine driving and train control at the society's model railway in Panmure, which is open to the public on Sundays. Fares from train rides raise money for the society's running costs, including all insurance and maintenance.

As well as making and repairing his own model engines he also built a dynamometer wagon for the ASME, which he later converted to an electric-powered pushing wagon for the leaf sucker. It is used for track clearing. He also upgraded and re-gauged four of the A&G Price five-inch-gauge passenger trolleys to 7.25 inches to run on the ground-level track.

Greville usually operates one of his two locomotives on the line: the self-built 'Lady Godiva', a coal-powered 'Bjax' (see breakout box later in article) steam engine, or his electric Santa Fe, which he refurbished and modified after purchase from the deceased estate of a member of the Hamilton Model Engineers Society.

Iron horses

He admits that the Lady Godiva was a long time in the making.

The 20 pages of plans and his own ideas of personal customisations may have delayed his initial progress, but it was another locomotive – 'Smokey', a Simplex – that he was running at the time that really held him up. He recounts, "I started the Bjax hoping that I would have it ready for when my son was about 10 or 11 years old. But that wasn't going to happen; I wasn't building it quickly enough, so I bought Smokey and ran that for 30 years. But the maintenance on that took up all my spare time, and I wasn't finishing my loco. I sold the Simplex, then had time to finish mine."

For convenience and ease of use, Greville these days prefers to run his electric Sante Fe. While it runs smoothly now, there were some issues to iron out. "The power bank comprises two deep-cycle batteries. Similar to truck batteries with a 24V charger," he says. "The controller was getting very hot – it gets up to 30°C, and you don't want it any hotter. So, I installed a computer fan which pushes cool air through a hole in the roof. I put a temperature gauge on the controller and mounted the controller on fins, which allows cool air

Tunnel vision: Greville has been riding the ASME railway since 1979

"I can do just about everything I want to do in this garage"

through." There is a wheelchair motor in each bogie of the Santa Fe, and when he took possession of it, he dismantled each motor and repacked the gear-boxes with new grease, as the old grease was coagulated, and getting "hard and horrible".

The workshop

Whether he is mending model engines, making wine in the adjacent laundry, repairing the cul-de-sac's water pumps, or building computers to boost the processing power of BOINC (Berkeley University's Open Infrastructure for Network Computing), Greville is comfortable with taking on new challenges.

Mostly, he enjoys fixing things. In his workshop, he has customised his tools and space to suit his needs. He made a power supply and a load box, and in one corner constructed a wire brush and a cut-off saw that he pulled together using a 2hp motor and a pulley system.

In the days before variable-speed trigger power tools, he made up a variable-speed controller wall unit for all his power tools, which he admits is now redundant.

Before inbuilt car alarms, he modified the ignition system of an old Toyota Corolla with a hidden switch to protect it from theft. He had to refit his current SUV with a false floor, rail tracks, and latch systems to secure the Lady Godiva and the Santa Fe for transport. He has made saddle stands for a neighbour's saddlery, is currently finishing a

Loading up the electric Sante Fe locomotive for transport on fitted tracks in the back of his car

The ‘Electrical Department’

repair on a sewer pump overflow controller, and is attempting a rebuild of his granddaughter’s smashed Garmin Navigator.

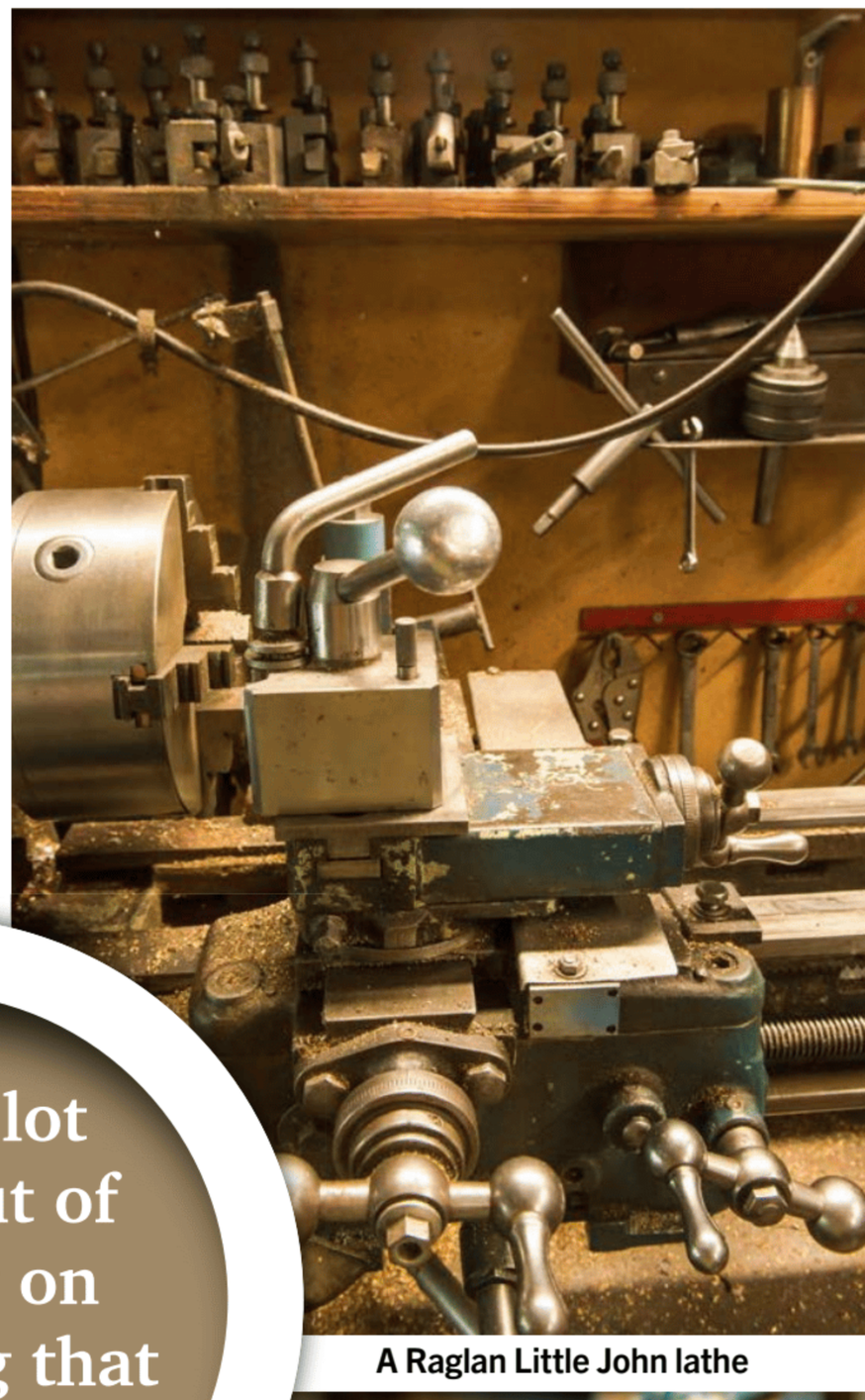
Processing power

While Greville loves working with his hands, he is no stranger to digital technology.

Around the garage, there are various computer screens and hard drives, some running his music library, others processing data for BOINC. He cut his teeth as a technician for Xerox, working in the field, keeping their machines running. He says that is where his electromechanical bent came from. He says, “I get a lot of fun out of working on something that actually works. Xerox machines were electromechanical, so that is where my interest comes from. I have folders of circuit diagrams, and that is where I get a lot of ideas on how to make things.”

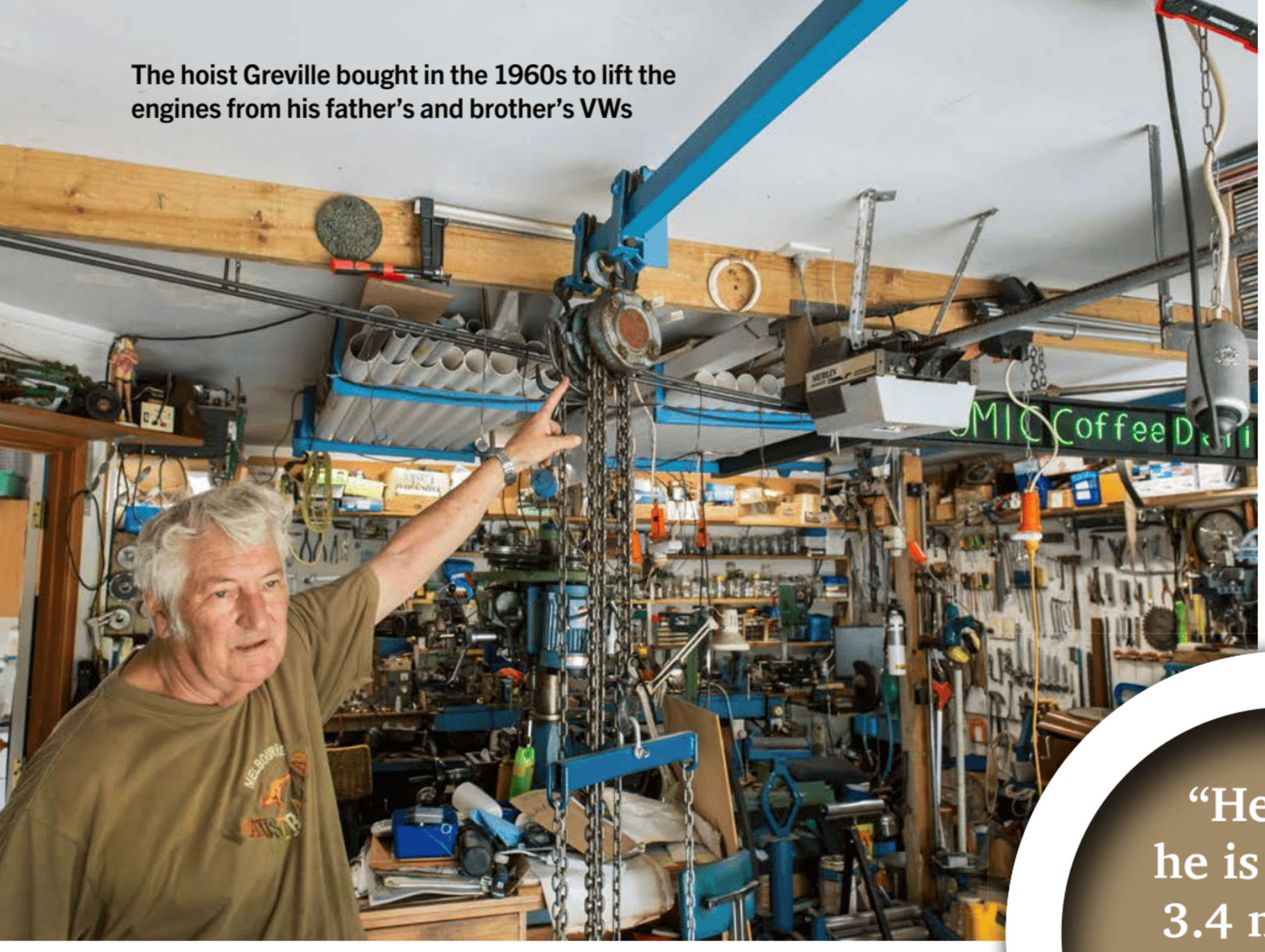
He installed the very first fax machines in New Zealand in Wellington

> “I get a lot of fun out of working on something that actually works”



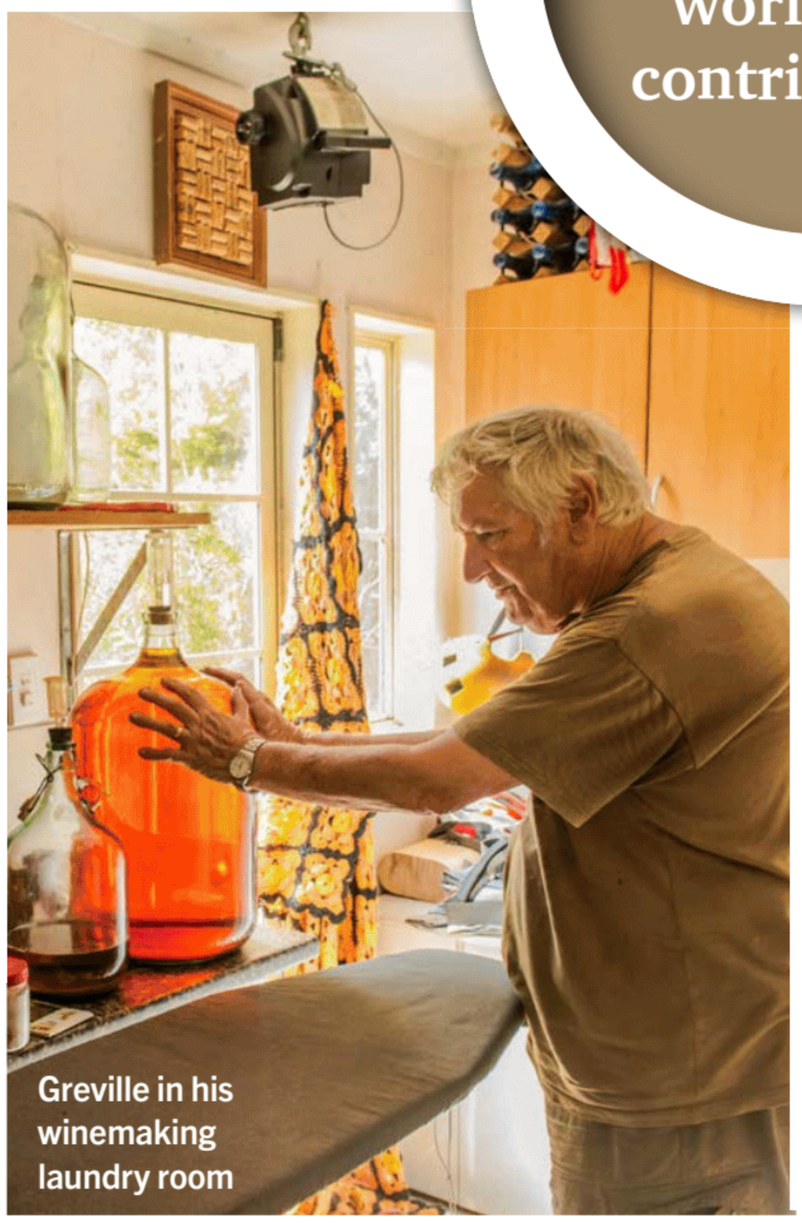
A Raglan Little John lathe

The hoist Greville bought in the 1960s to lift the engines from his father's and brother's VWs

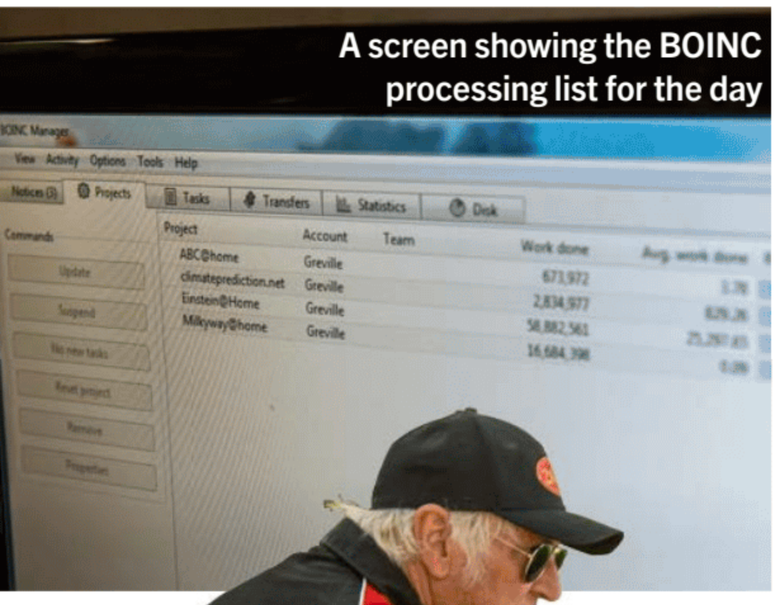


"He says he is one of 3.4 million worldwide contributors"

A homebuilt wire brush and a cut-off saw, made using a 2hp motor and a pulley system



Greville in his winemaking laundry room



A screen showing the BOINC processing list for the day

– at of all places, NZ Railways. "They were the first to get them. You had to wander out into the middle of the yards to a little signal box to do a service call. The fax machines gave the railway staff a physical piece of paper, giving authorisation for a train to run. When I was promoted to national product manager in Auckland, Xerox launched the first colour photocopiers in NZ." He was responsible for training the technicians to install and service these first colour copiers.

Computers for good

As for computers, Greville has been building hard drives for different

Getting the Santa Fe up to speed

Coupling the rolling stock

purposes for many years.

He has been involved with BOINC since 2009 and once ran 13 shed-built computers throughout his home and garage, helping power the BOINC data flow. He says he is one of 3.4 million worldwide contributors and, "I am in the top one per cent of contributors in the world in terms of the number of transactions executed."

He chooses the ventures he wants to be involved with and currently runs ABC at Home, Climate Prediction, Einstein at Home, and Milky Way. He enjoys the fact that his machines are donating to productive projects rather than sitting idle.

From the vine

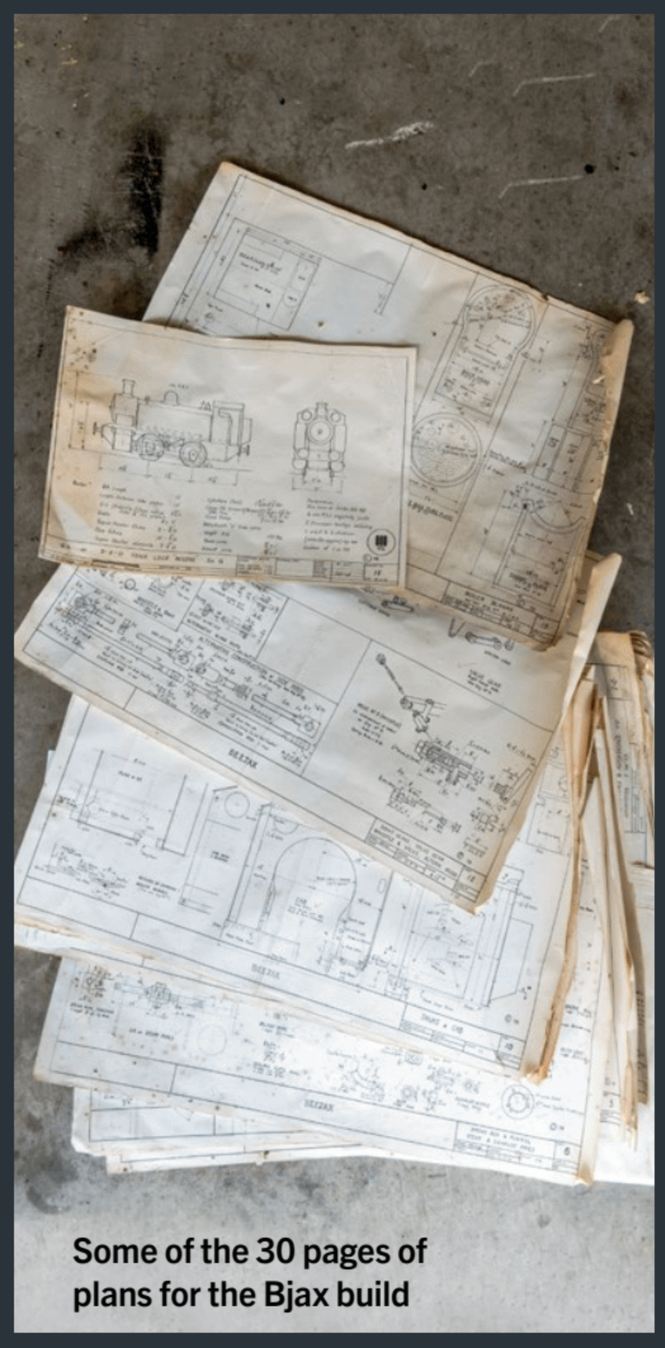
Full bottles of wine and wine racks are not such a common sight in most sheds. ▶

A BJAX

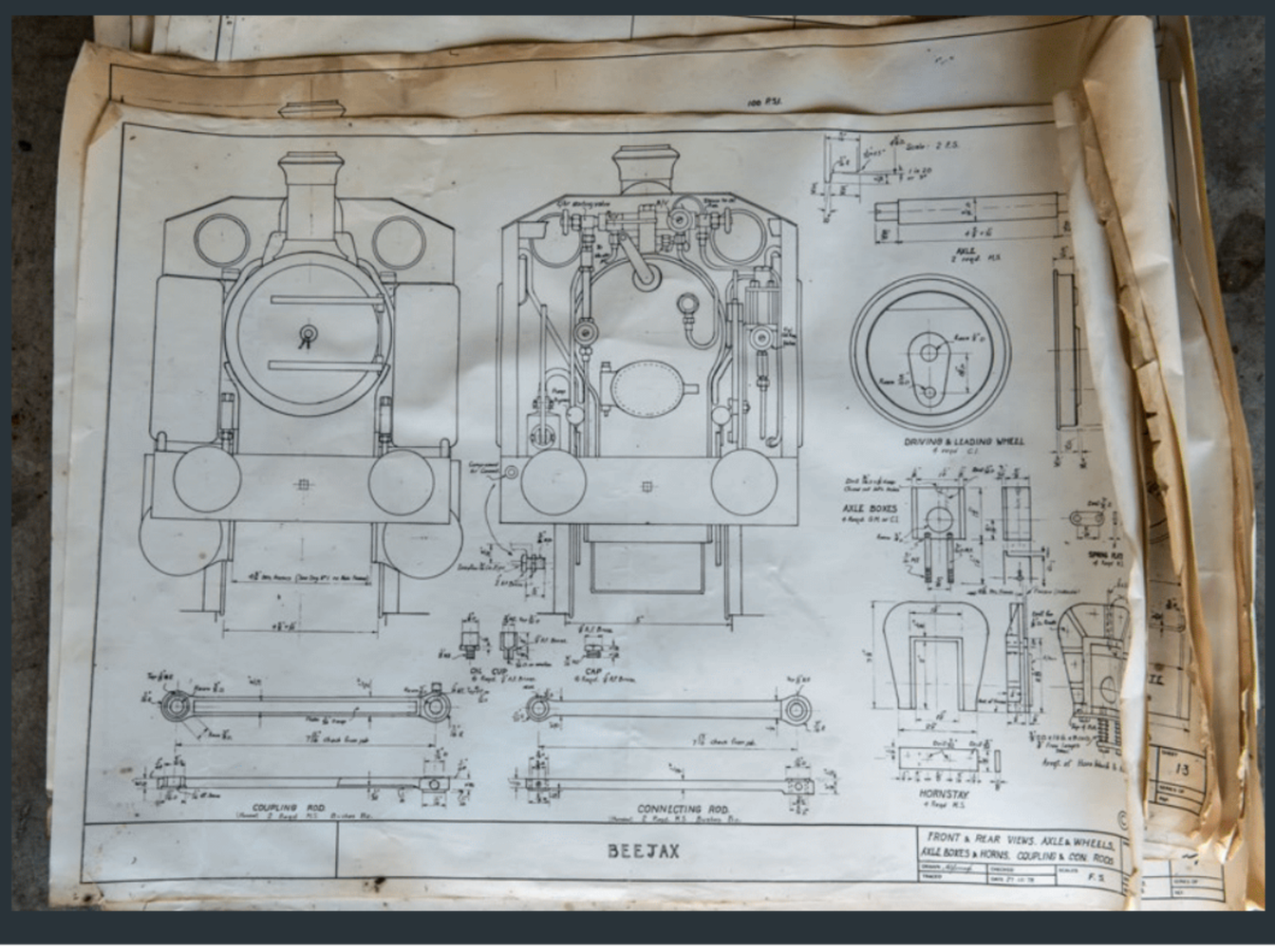
Greville acknowledges local model engineer Geth Creagh as the creator of the Bjaxes.

He says, "Geth used to run an Ajax engine, then redesigned and simplified things so that beginners could make things more easily. He called it 'Bjax'."

The life-size Ajax steam locomotives that they are based on ran in the early 1900s in England. Geth makes his kitsets with wooden patterns for things like the cylinders, the horn blocks – these hold the springing arrangement for the wheels – and the spacers across the two frames, as well as the castings, which model engineers then turn, drill, mill, and finish. Once all the components are ready for assembly, they are then silver-soldered, welded, and bolted together.



Some of the 30 pages of plans for the Bjax build



BOILER INSPECTION

To open its line to the public, ASME adheres to WorkSafe rules.

All engines and locomotives used in public settings need to have a current WOF, and ASME has a rolling stock inspector who performs the checks.

The society is audited every two years to assess the safety systems. For a WOF, boilers are inspected and hydraulically tested, initially at twice their working pressure. "When you get to the stage of steaming it up, you do another accumulation test to prove that the safety valves will stop the pressure from going over 100psi. You have your blower on full because the valve is sending steam through three little jets to draw the fire. The inspector wants to see them go off at 100psi, so that the pressure doesn't go any higher. If you make the safety valves purely to scale, they are not really big enough. They really need to be oversized so that when they go off, the pressure doesn't go above the 100psi," explains Greville.

Lady Godiva's boiler logbook with maintenance records and the locomotive's WOFs

> “The effort is worth it, just seeing the smiles on the kid’s faces on a Sunday”

ENERGY EFFICIENT

The ASME drivers used to run ray-carbo coal, which was manufactured at a factory in Mercer, but after the factory burned down, they had to import a similar coal from Australia.

On average, it takes a model steam engine about half an hour to steam up and an hour to clean up afterwards. According to Greville, there is a real trick to steaming up for efficiency: “You need to set off from the station, go around and come back to the station with a full head of steam. If you can do that, then you can run all afternoon [three hours] on about two ice-cream containers of coal.”

Double tunnels on the ASME railway. Inset: Hamilton Model Railway track layouts. Greville handles the accounts for the Hamilton club

For Greville, though, wine is something he has been making every year since 1976 and he has kept notations on each vintage since.

He uses locally grown grapes known as 'Albany Surprise', which he sources from nearby orchardists. He admits these grapes are, "Not technically a wine-making variety, but a lot of it is grown around here. I used to make wine from my own vine in our last place, but the vine here has not gone so well."

The grape juice ferments in huge 28-litre jars on a dark shelf high in his adjacent laundry. Because each jar weighs about 35kg when full, Greville says that these days he struggles to lift them to the highest shelf. "So, I developed an electric winch system to lift them to the top shelf. The idea is that then you can siphon the wine from the sediment to the next shelf down."

And, speaking of heavy lifting, one of the first tool purchases Greville made was a two-ton Elephant Chain pulley, which he originally bought when he was living with his parents and still uses regularly.

He used it then to help his father and brother lift their respective Volkswagen Beetles off their motors. "I used to help fix them. Dad had an office job, but he was a practical man. We used

Greville moving a section of track to get his engine from the car onto the ASME line

to belong to the Hutt Valley Motoring Club and go on car trails. I didn't have VWs; my first vehicle was a Morris J4 van, for grocery deliveries." According to one of Greville's accounting clients, Greville still makes deliveries of a sort. Every Christmas, he personally delivers a bottle of wine to the door of his top 10 clients.

Keep on rolling

For Greville, the biggest kick he gets from rolling on the ASME railway track is the reactions of the public. "The effort is worth it," he says, "just seeing the smiles on the kids' faces on a Sunday. We had a train load of kids recently who screamed the whole way around." It is not just small children hooting and laughing. Whole families are often observed disembarking with grins and quickly rejoining the queue on the platform for another ride around the tracks.

The track is open to the public every Sunday afternoon, weather permitting. For more, see https://asme.org.nz/train-rides/.

Greville keeps on rolling

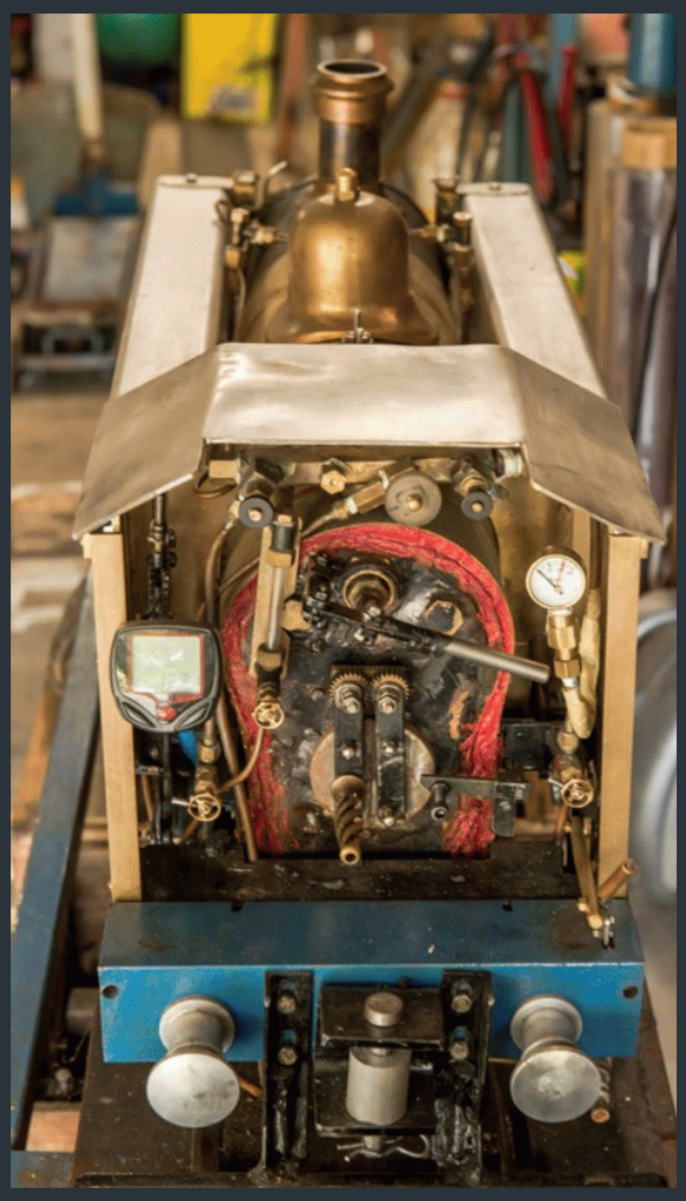


Photo: courtesy of Heather Wilson

LADY GODIVA
STEAM LOCOMOTIVE

While coal might be a dirty word for some, many people still love to see steam trains running, and to ride behind them on the ASME track. Yet even at the scale-model level, there are some serious considerations and regulations to abide by when building and running steam engines like the Lady Godiva safely and efficiently.

Lady Godiva is capable of towing two trolleys with nine people on the back. A WorkSafe requirement demands that speedometers be fitted and that the maximum speed is 10kph.

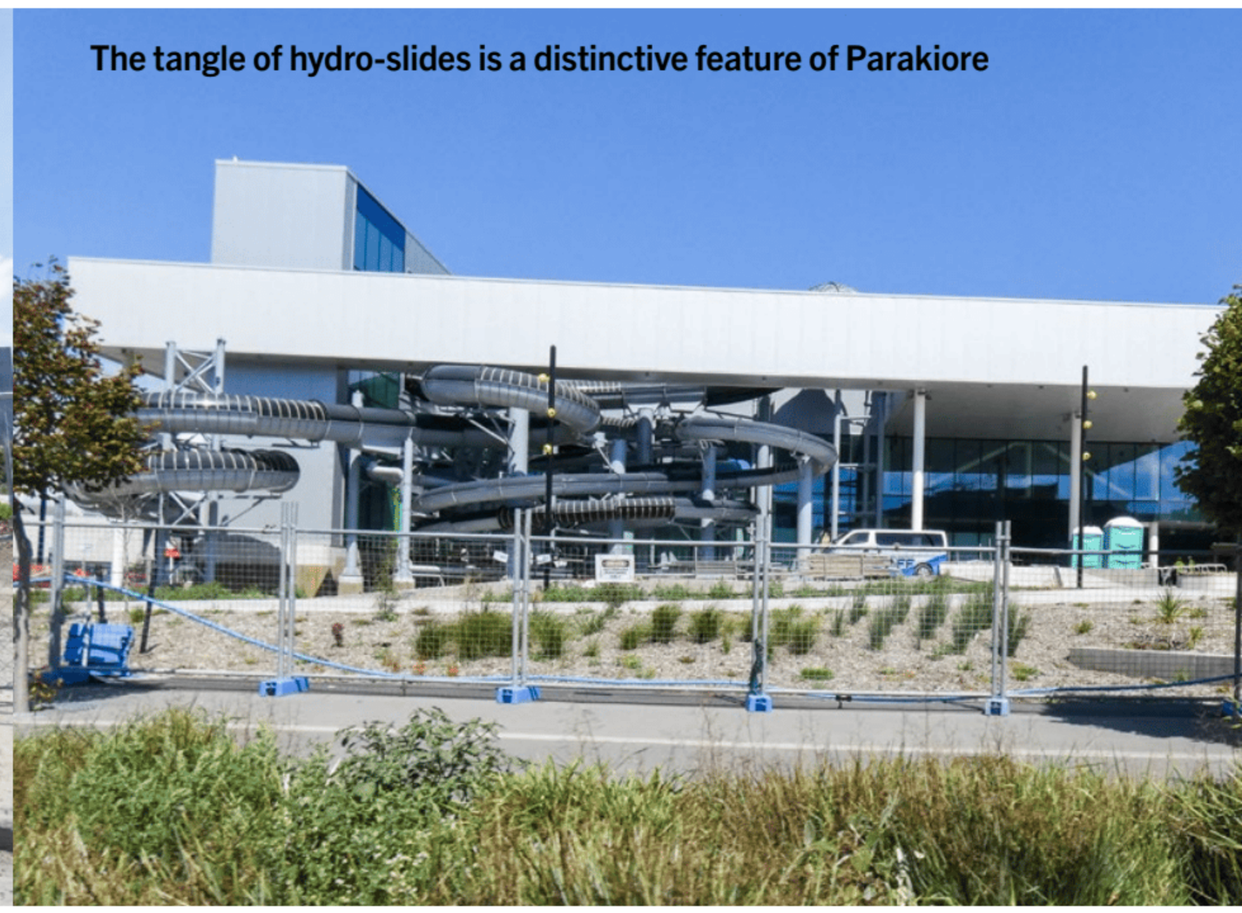
Greville reckons, “If you pushed this, you could probably get 18kph. They have got tons of power, but what they lack is adhesive weight. Some guys in the club make everything to scale. I did not.”

Steam engines are defined by their wheel arrangement. Greville has modified his to a two-four-zero arrangement: two bogies, four drivers, and no bogies at the back. The standard Bjax does not have a bogie at the front. There are other Greville touches too, including a larger hole for the coal and Meccano gears for quick and easy opening and shutting of the coal door.

He also added weight because “the more weight you have on the driving wheels, the better the traction on the rails. The cab was designed to be aluminium, but I have made everything out of heavier materials: (that is, not to scale) steel and brass with a copper boiler.”

Photo: courtesy of Heather Wilson

The north-eastern corner of the sports complex with one of the five hydro-slides snaking out and back in



The tangle of hydro-slides is a distinctive feature of Parakiore

Using sewage to heat Parakiore Sports Centre

By Ritchie Wilson | Photographs: Ritchie Wilson

Clever technology brings huge annual savings on power bills for this brand-new sports complex

The largest indoor aquatic and sports centre in New Zealand is scheduled to be opened in Christchurch at the end of this year. The heat source for its heating system is a first for New Zealand.

The Parakiore Recreation and Sports Centre will house a 50m pool; a diving pool; learner and spa pools; five hydro-slides; an aquatic sensory space; a birthday party room; a weights room; nine netball courts; offices for sporting organisations and venue administration; a café; and, of course, a VIP suite.

The car park has been laid, and the court floor is being marked for various sports such as netball, badminton, futsal, and volleyball, so the opening can't be that far away.

Anchor project

The Christchurch Metro Sports Complex is one of three 'anchor projects' – primarily central government funded, initiated after the 2010–'11 earthquakes – the other two being the Te Pae convention centre, which opened in late 2021, and the Te Kaha stadium, which is due to open in April 2026.

Swimming pools used in Olympic competition should have a temperature of around 27°C. Achieving and maintaining this can require some sophisticated engineering.

The water which emerges from Christchurch taps comes from deep aquifers and is warmed by geothermal heat, so it has a temperature of about 10°C year round. A huge amount of heat is required to increase the water temperature in an Olympic-sized pool by 17°C. Possible sources of this heat are the traditional fossil fuels (natural gas, coal, and petroleum) or electricity. These are costly and likely to get more so. Biogas or wood would be more environmentally acceptable but, again, expensive.

What is the best heat source?

Heat pumps are the obvious solution.

Powered by electricity, they are an efficient way of heating and are non-polluting. The question is: What is the best source of the heat which the heat pump will pump into the pool's water?

Domestic heat pumps usually use the air as the heat source, but this can have problems. The fans used to move the air through the heat pump's heat extractors can be noisy, and the amount of heat the air contains changes with its temperature.

As the air cools on a frosty night, there is less heat in the air for the heat pump to access. In places where the air temperatures can be really low, the heat in the ground, below the frost level, is used. It is accessed by having water-filled pipes buried metres deep in the backyard. Disappointingly, to extract very large amounts of heat, a very, very large pipe array is needed.

The new Christchurch Central Library, Turanga, uses artesian water from a shallow aquifer as a heat source. The water is pumped up, some heat is removed, and then it is pumped back into the aquifer. This process can have problems. For example, the water table – the depth at which you strike water when you dig a hole – can be changed, perhaps causing flooding problems in neighbouring basements.

The Christchurch Town Hall used to use water from the adjacent Avon River as a source of heat but now also uses artesian water.

The long western frontage. The small building in the foreground contains the equipment which extracts the heat from the adjacent sewer

A sewer is right underneath

The northern boundary of the new sports complex is Saint Asaph Street, under which a large sewer lies. Could the sewerage flowing through this sewer be a source of heat for the complex's pools?

One of the advantages of sewerage as a heat source is that, like artesian water, it has a fairly constant temperature throughout the year; another is that the sewerage is quite warm, at about 17°C, so it contains a good amount of heat.

Where does this heat come from?

The wastewater that enters the sewer is from things like baths and washing machines. The water used in these appliances has been expensively heated and is still quite hot when it goes down the drain. Even the water in toilet cisterns has absorbed some heat from the house's air, so a toilet flush is also reasonably warm. The buried sewer loses only a small proportion of this heat to the surrounding ground.

A heat exchanger

Parakiore is to use screened sewerage, which is going to be diverted from the sewer and then passed through a heat exchanger before going back to the sewer.

The screening is to divert solid objects in the sewerage, like false teeth, watches, etc., which could clog the heat exchanger. Some overseas systems have the heat exchanger as the internal surface of the sewer to avoid this problem. This type of heat exchanger has to be really large to be effective.

A liquid carries the heat absorbed by the heat exchanger to other heat exchangers in the pool's water, where the heat flows to the colder water, heating it.

A determined effort is also being made to minimise heat losses from the heated water.

Air con

Heat exchangers also heat the air in the pool enclosure to 27°C, the same as the water, so heat shouldn't move out of the water into the air.

As water leaves the pool as water vapour, it takes heat with it. The humidity of the air above the water is to be kept at 100 per cent so that evaporation from the water's surface – and heat loss – is kept to a minimum.

The pool enclosure's walls are very well insulated so that they are never cold enough that liquid water condenses on them. Covered pools which have condensation on their internal walls are notoriously short-lived.

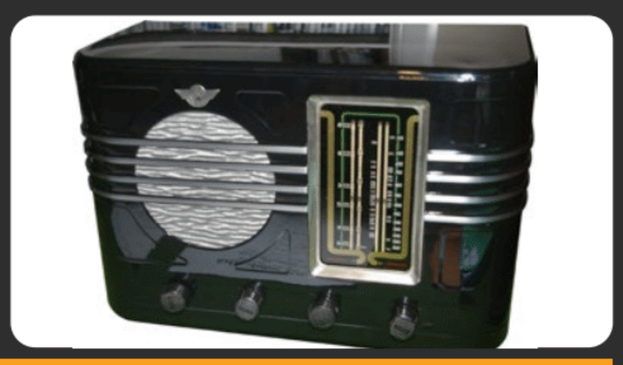
Air extracted from the pool enclosure by its ventilation system also passes over a heat exchanger, transferring the exiting air's heat to incoming air.

The $1.5M system, designed by the Australian firm Environmental Technology Solutions, will extract 3500kW of energy per year from the sewerage, saving $100K annually on the pool's heating bill.

THE SHED ONLINE

What's happening online at the-shed.nz?

Every week, we upload new content onto The Shed *website to add to the hundreds of articles and videos already on the site for readers to discover, learn from, and enjoy. Some uploads of the past few months include:*



Valve radios: retro radio magic

Bluetooth and 3D printing are harnessed to help breathe life back into radiograms and hi-fis
https://the-shed.nz/valve-radios-retro-radio-magic/

Futuristic fabrications

Junk is made into futuristic fabrications by a talented man of all trades
https://the-shed.nz/futuristic-fabrications/

Child's play

A retired carpenter loves his new 'job' crafting vintage wooden vehicles
https://the-shed.nz/childs-play/

A man of many sheds

Lindsay Murray loves old hand tools, real wood, and proper joints
https://the-shed.nz/a-man-of-many-sheds/

editor@the-shed.nz

BE AWARE OF COLOUR BLINDNESS – IT'S OUT THERE

Hi Greg,
Copy received as a birthday present. I'm enjoying it.

I've done a bit with Arduinos, microprocessors, and LED displays over the years (not to Mark's level). So I read it [Arduino 102, Displays, *The Shed* Issue No. 120] with interest.

We learn he's developing a 3rd version of his Mt Lyford ski field 'Trip Controller'. He states he will use LEDs with red, green, and orange colours. Beware!

I'm red/green colour blind, like around 7–8 per cent of European males. I've known it since I was a kid. No surprises for me. And I do know, depending on a host of variables, to those so affected, perception of the above LED colour information could vary between 'clear', 'unsure', 'confusing', or just 'plain wrong'.

I've an example.

In my younger days, I did some flying training out of Sydney's Bankstown airfield in order to gain a private pilot's licence. As part of that, a medical clearance was required. I informed the examining doctor of my colour vision status, he ran a few tests, and said, "You're not that bad, give the official (DOT) test a go".

And I did. I duly arranged a DOT appointment, and they sat me in a room about 6m from two small lights that could be any combination of red, green, or white. There were 20 test combinations, and my verbal response to each test was recorded over a set period of time.

After the 3rd combination, I told the examiner I was guessing. Couldn't fake it. I was lost.

It hasn't gone away. I did an engineering degree, spent a part of my working life looking at drawings, charts, and graphs. Colour confusion (a more accurate term than blindness) always lurked.

Mark may be aware of the above, and the gear he is developing has no safety aspect. If it does, I urge him to take care with his LED display.

Regards,
Andrew Buchanan

Ps. My grandfather and father-in-law both were, and two of my three sons are 'red/green colour blind'. It's out there. A cousin, too.

Genetic inheritance is through the mother (my dad was a milliner and had excellent colour vision). That's why I have it, my sons have it. Not my fault.

Girls are unlikely to get it – recessive alleles are on the X-chromosome, and they have two.

Mark Beckett replies:

Thanks, Andrew, for your letter and warning.

I recall being tested when I started my career, in this case, it was a 50 pair telephone cable, and some of the colours were similar without having colour blindness. As I understand, the stripe was added to the earth in the mains cable to avoid the red/green issue, so there are some alternatives.

As someone who isn't colour blind, it hadn't crossed my mind until your warning.

I'll have a chat with the ski field manager, and have a play with an alternative colour so we can avoid the 'unsure', 'confusing', or just 'plain wrong' bits.

PLANE TALKING

Dear Greg,
Issue No. 120 of *The Shed* magazine had an article about hand tool collector Des Barnes.

Our shed recently had a job where nearly a dozen wooden discs, platters, 60 or 70cm in diameter, possibly 5cm thick, needed refurbishing. The person doing it had a "handful" of planes on the bench. They were just about all Stanley planes.

These are the most common make, but have you ever looked closely at one and spotted the name 'Bailey' cast in the body of the plane? Plainly, it needed more plane research.

Wikipedia has this to say:

"In the mid-1860s, Leonard Bailey began producing a line of cast iron-bodied hand planes, the patents for which were later purchased by Stanley Rule & Level, now Stanley Black & Decker."

It is quite plain that the plane you thought was Stanley is plainly a Bailey.

https://en.wikipedia.org/wiki/Plane_(tool)

Note that the Wikipedia article mentions planes from earlier periods, well before Stanley, nearly 2000 years before Stanley, but obviously not made in the US. It might also be noted that there are two Scottish plane makers with links to them, both before Stanley.

Sandy Ferguson
Rolleston Men's Shed

UNHAPPY SHEDSMAN

Dear Editor
Disappointed to see political opinion appear in *The Shed* (Issue No. 120).

Particularly personal and uninformed views.

Everybody has the right to their own opinions, but a publication should provide balanced and informed writings, or preferably avoid politics, women, and religion as topics.

Long-term shedsman,
Gil Barker

Thank you for your letter, Gil, but I must respectfully disagree with you. This magazine celebrates creativity and skills over 131 pages, and for a bit of fun, we include a column called Back o' *The Shed*, written by Jude Woodside, the founder of *The Shed* magazine.

Jude has been an integral part of the publication since its inception 20 years ago. If he wants to express his opinions or poke fun at anyone or anything, I fully support that, and I believe most of our readers do as well. The column is meant to be light-hearted, and as we sheddies get older, we often find more things in life that can make us grumpy or even horrify us. Let's enjoy what irks him, even if we don't always agree.
Also, I just want to clarify that we will always showcase female sheddies in the magazine. – Ed.

LETTER OF THE MONTH

Zach's crawlers

MORE RC ARTICLES, PLEASE

Hi guys,
I love reading your magazines and think they're simply great!

I am a 12-year-old boy from Taranaki. Recently, I have been creating a 1/18-scaled caravan to tow behind my RC [radio-controlled] Traxxas mini crawler. The caravan is a Swift Celebration.

I have two RC Traxxas mini crawlers and a Volantix RC aeroplane, which I am still learning to fly. I have a small space in my dad's shed where I like to build things and work on my projects. I am wondering if you would like to put more articles on radio control, since it is a subject I'm interested in.

I am a big fan of your magazines. Keep up the good work!

Regards,
Zachary Hopkins

LETTER OF THE MONTH PRIZE

Every issue, our Letter of the Month winner will receive a copy of *Best of* The Shed *1* and *2*. More top projects from 15 great years of *The Shed* magazine.

Odd Jobs

Hang out on your own DIY swing chair!

Elevate your outdoor entertainment area with your very own DIY swing chair. This is a satisfying weekend DIY project that you and your family and friends can enjoy for years to come.

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- ✔ **Paint with Resene Lustacryl in your chosen colour**
- ✔ **Suspend your chair and hang out!**

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MasterStroke by Resene

Ingredients for success: mixing up the oxide broth

The end result – a classy, darkened finish

TURNING BLACK AND BLUE

How to achieve a black oxide finish

By Bob Hulme | Photographs: Bob Hulme

Putting a durable finish on steel components is usually the last step in a project, but it is one that needs to be thought out at the beginning.

The thickness of the coating may have to be allowed for when machining, holes may have to be incorporated to hang the part from during a finishing process, etc. The particular process we are looking at in this article does not effectively alter the dimensions of the part, as it etches into the surface rather than deposits on top.

Black oxide finish is sometimes called 'parkerising', and it is common on components such as gun barrels because it does not involve high enough temperatures to cause distortion, and there is no dimensional change.

While strictly speaking not an anticorrosion coating on its own, it does perform well due to its microscopic porosity. The final step in the black oxide process is to wipe the part liberally with oil, which soaks into those pores and tends to stay there even after the excess is wiped off. Just don't put it in the dishwasher!

The motivation

The inspiration for this article came from the need to put a black oxide finish on some components we were making for a major foundry client.

They are tools for fitting location dowels to casting boxes to ensure proper alignment. The dowel system is from the US and quite good, but for one of the dowel sizes, the fitting tools have a tendency to break too easily. We redesigned the tool to give it better strength and made it from high-tensile steel, which was then nitrided to give a hard surface.

The customer was keen to have a black oxide finish on them, but I was dubious about how this would go over the nitride surface. When I put the question to a local company that specialises in these types of finishes, it didn't know the answer, so I decided to give it a go myself. At least I could control the process and just do one on

its own first as a trial. As you can see, it turned out fine. The only issue is that the cross pin, made from silver steel, did not take the etch as readily as the body of the tool, so it is slightly lighter in colour.

Preparation

The part must be completely free from any oiliness or greasiness, if I can put it that way. Cleanliness is absolutely vital.

I have a small (well, quite tiny) sand blasting gun that is great for small parts like these. Unfortunately, it still makes a lot of mess and the sand goes everywhere despite trying to contain it using a plastic fish bin. Do the grit blasting as close to the time you are going to treat the part to avoid any surface rust starting. I used a fine grit. In hindsight, a medium grade would have been better and may have been less dusty.

The main piece of equipment I used for this was an old slow cooker (crock pot). The pot where the cooking is done is a glazed ceramic pot that is removable from the main body of the cooker, so it is separate from the electrical circuitry and heating elements.

Being glazed ceramic, it is like a glass vessel and unaffected by acid. When I decided to use one of these, I checked the usual trading websites for a used one without much joy. In the end, I surprised my wife with a new one and commandeered the old one for this project. It helped that her old one was getting a bit scruffy, and I found new ones on sale at a very good price.

Back to equipment. Using some scrap pieces of steel, I made a Z-shaped bar to suspend the parts from and clamped it to the table. Parts to be black oxide finished are best suspended into the bath so they don't touch the bottom or the sides. Some soft black steel wire is ideal for a hook. I used some 1.5mm diameter welding filler rod. Don't use a wire coat hanger, as they are zinc plated and will contaminate the bath.

Working in a plastic fish bin in an attempt to contain the mess . . .

"Don't use a wire coat hanger, as they are zinc plated and will contaminate the bath"

Ready to start mixing the ingredients in the crock pot, with the bar set up to suspend the parts from hooks

. . . created by sandblasting the parts . . .

. . . a vital step to ensure they are free of any greasiness

Ingredients

- 3.5 litres filtered cold water
- 40mL phosphoric acid
- 50mL manganese dioxide
- 1 x fine-grade steel wool pad
- 400g baking soda (to neutralise acidity)

Getting started

The capacity of my slow cooker is specified as five litres. I poured in 3.5 litres of filtered water so there was room down from the rim if there was any frothing or bubbling.

If you have access to deionised water, that is better, but water from a household under-bench filter or similar is still good. Just don't use unfiltered tap water – it contains too much other material that can disrupt the process.

With all the protective gear on (see side panel), add 40mL of phosphoric acid to the water in the slow cooker bowl. You must always add the acid to the water and not the other way around. There can be heat produced when acid contacts water (exothermic reaction). If you add water to acid, the heat will cause the water to flash steam, pop, sizzle, and generally spray everywhere, including all over your good self. However, when you add acid into the body of water, the heat is conducted quickly away into the water and is kept cool.

Next, tease out one brick of fine-grade steel wool a little. This must be the stuff sold for sanding wooden objects, not the stuff used for cleaning pots and pans in the kitchen. There must only be steel wool, no soap impregnation.

Put the steel wool into the crockpot. Add 50mL of manganese dioxide to the mixture – there's no need to stir. Now you can put on the lid, switch the slow cooker on to high, and wait for it to come to almost boiling point.

This took about 1½ hours in my case, but times will vary according to the particular appliance you use.

Use this time to do the grit blasting of the parts while keeping a watchful eye on the slow cooker. Give the parts and the

It's important to add the phosphoric acid to the water, not the other way round

wire hangers a squirt with brake cleaner and set them aside on a clean paper towel. They should only be handled while you are wearing disposable gloves at this stage to keep them completely free from any contamination. It is also a good idea to put up a notice to warn anyone that you are working with hot, dangerous acid. Also, ensure that no children or pets can get access.

The process

Once the mixture is close to boiling, remove the lid and gently lower each part into the hot acidic broth using the wire hooks. Hook them over the bar set up to suspend them. This needs to be done very carefully, with all your protective gear on. This is the most dangerous time, when the lid is off and the mixture exposed, so keep all inquisitive creatures away and keep yourself well protected.

> "This needs to be done very carefully, with all your protective gear on"

The parts will react straight away with the hot acid, and there will be lots of fine bubbles fizzing around them. Leave them in there for 30 minutes with the cooker still on high setting. The temperature will slowly decrease as the heat being lost with the lid off will be greater than the ability of the element to replace it.

Stay in the vicinity so you can make any changes to the heating if necessary. After 30 minutes, carefully lift each part out in turn using its hook, then dunk it in a bucket of clean, cold water. Then give each part another dunk in the other bucket of cold water. Lay out each part on a paper towel to dry.

As the parts dry, they will become a grey colour and even appear to be developing some crystals on the surface. This is OK. As soon as they are completely dry, either dip them into an old tin full of oil, wipe them with an oil-soaked rag, or spray them with a light oil such as WD40. I used a 32-grade hydraulic oil, as that is what I had on hand. Ideally, a product that is sold as a gun oil should be the best, but the result from the hydraulic oil was very good. Leave these parts to soak overnight before wiping off the excess oil with a lint-free rag.

If you have more parts to do than will fit in the slow cooker bowl in one go ▶

Measuring out the manganese dioxide . . .

. . . and adding it to the mixture

SAFETY FIRST

Protective gear is essential when handling the hazardous materials used in this process.

As an absolute minimum, you will need disposable gloves, a face shield, and safety glasses. An apron made from an acid-resistant material would be good too. I figured that my dust coat would be easy to drop off quickly if it caught any acid splashes, but an apron made from an impervious material would have been better.

A well-ventilated place should be prepared with no tripping hazards. Have at least two buckets of cold water handy. Have a plan of what to do if acid spills on you – for example: Grab a bucket, go outside, and pour it over the area affected. Then quickly remove all clothing, rush inside, and get under the shower. Alternatively, have the garden hose at the ready.

If, after taking all the precautions, you do happen to get some acid on yourself, rinse it off with copious quantities of water. That's where the garden hose will come in handy. Your eyes are the most vulnerable organs, and protecting them is vital, so make sure you use safety glasses or goggles as well as a face shield.

It is a good idea to put up a notice to warn anyone that you are working with hot, dangerous acid. Also, ensure that no children or pets can get access to your working area.

The most dangerous time is when the mixture is close to boiling and you have removed the lid from the crock pot and are lowering each part into the hot, acidic broth using the wire hooks. This needs to be done very carefully, with all your protective gear on. Be sure to keep all inquisitive creatures away and keep yourself well protected.

When you've finished, you can't just tip the acidic mixture out anywhere. You need to add baking soda to neutralise it, and check with your local authority for its rules on disposing of material like this.

A helmet and goggles are essential safety gear

without them touching each other, you will need to do successive batches. What I found was that the process was beginning to lose power due to the lowering acidity and the temperature lowering.

My solution was to leave each successive batch in longer. I used 45 minutes for the second batch and 1¼ hours for the third batch. When you have taken out the last batch of parts, switch off the slow cooker and put on the lid. Leave it to cool overnight.

Disposal

While the mixture will have lost some of its acidity, it will still be quite strongly acidic and able to inflict some serious harm. So you can't just tip it out anywhere. You will need to add baking soda to neutralise it. I found that 400g of baking soda did the job. The important thing here is to add the baking soda just a bit at a time, as it really gets fizzing, and if you add too much at a time, it will come over the top of the bowl and make a hell of a mess. Check with the local authority where you live for its rules on disposing of material like this.

The end result

You can see that the end result is a lovely darkened finish that is much classier than bare steel, and it does provide some degree of protection from rust. Unfortunately, this process only works on steel and not on other metals – not even stainless steel. The good news is that we have proven that it does work on heat-treated steel (nitride in this case).

This is a simple process that is effective on small parts where an attractive finish is required, but where other finishes, such as painting or electroplating, are not appropriate. In this case, electroplating was not satisfactory, as the parts had been heat treated, and electroplating causes a phenomenon called 'hydrogen embrittlement'. As the name suggests, it makes the items brittle, and they tend to break easily. There is a de-embrittling process offered by some electroplaters, but this has not been entirely successful in my experience. Also, the finish is dulled off.

Suspending the parts from hooks is the most dangerous part of the process

> "My solution was to leave each successive batch in longer"

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PRINTING THE FUTURE

FORMTECH BRINGS PREMIUM 3D PRINTING MATERIALS TO KIWI MAKERS

Nestled in the industrial heart of Christchurch, Formtech is quietly changing the game for Kiwi makers, inventors, engineers, and anyone with a 3D printer and a vision. With a deep commitment to quality, community, and hands-on expertise, this New Zealand–owned business has become a key player in the country's growing 3D printing scene.

Whether you're a hobbyist tinkering away in the shed or a professional developing prototypes, Formtech is more than just a supplier – it's a launch pad for creativity and innovation. Specialising in premium 3D printing filaments and accessories, Formtech offers a carefully selected range of materials from top-tier global brands such as 3DXTech, Polymaker, iSANMATE, and Fusrock. From standard PLA to high-performance carbon-fibre-reinforced materials, the catalogue is designed to meet the demands of everyone, from weekend warriors to advanced manufacturing teams.

Behind Formtech is founder and director Jason Tweedie, a man whose impressive 25-year background in technical industries – including geotechnical engineering and rope access – shapes everything the business stands for. Jason knows what it means to work with precision, reliability, and the right materials. That experience translates into a business where expert guidance is not just available – it's a core service.

"It's not just about selling a spool of filament," Jason explains. "It's about helping people get the most out of their machines and their ideas. We see ourselves as partners in our customers' projects, whether they're making a model, a prototype, or a functional part for the field."

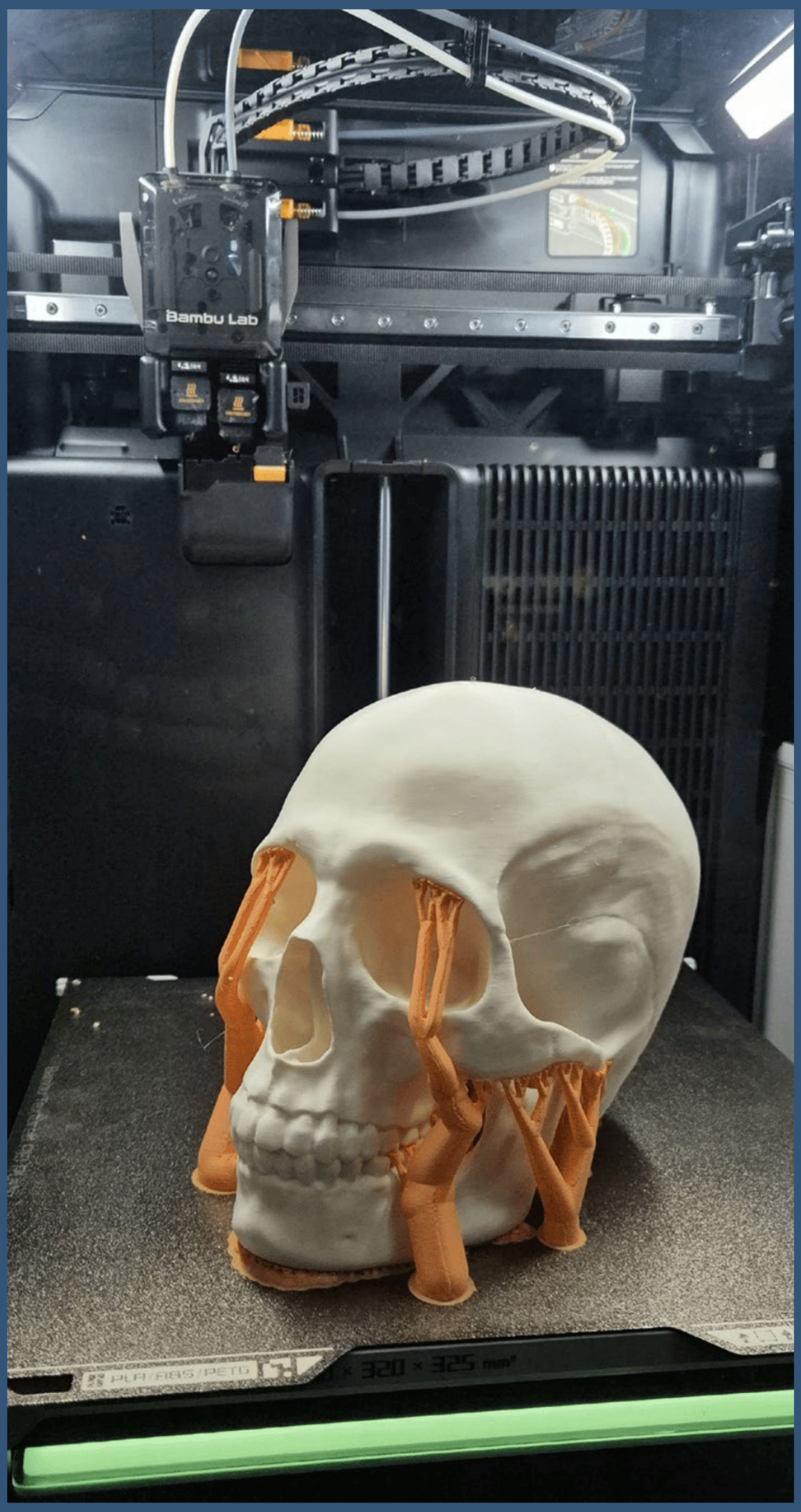
That ethos is reflected in Formtech's service model. Beyond its well-stocked online store, Formtech offers real-time support and advice, helping users select the right material for their printer and application. Got a print failing halfway through? Not sure if your extruder can handle a high-temp filament? Chances are that Jason and the team have seen it before – and can talk you through it.

One of the standout products on Formtech's shelves is Panchroma™ by Polymaker, a filament line exclusive to Formtech in New Zealand. Known for its vibrant colour range and aesthetic versatility, Panchroma™ is a favourite for artists, designers, and anyone wanting to make their prints pop. Whether you're crafting a display piece or adding a custom touch to a functional part, Panchroma™ opens up a world of creative possibilities.

While many businesses have gone fully online, Formtech still maintains a physical retail space in Christchurch, and plans to open in Auckland soon. Here, customers can get hands-on with products, ask questions in person, and even get help diagnosing printer issues. It's a rare and valuable resource for locals – particularly those new to the 3D printing world.

For those further afield, the online experience doesn't disappoint. Orders are processed quickly, with fast shipping across the country, and North Island customers frequently praise the prompt delivery and excellent customer support. It's clear that no matter where you're printing from, Formtech is committed to keeping your projects moving forward.

What truly sets Formtech apart, however, is its community focus. The company is actively involved in the New Zealand 3D printing scene, running a dedicated Facebook group for local users to share ideas, seek help, and show off their work. It's this kind of grass-roots engagement that keeps Formtech closely connected to the needs of everyday makers and helps drive product innovation and customer satisfaction.



In a world where DIY innovation is more accessible than ever, Formtech stands at the forefront, ensuring that Kiwis have access to the best tools, materials, and knowledge to bring their ideas to life. Whether you're just starting out with a desktop printer or managing multiple industrial machines, Formtech is your local ally in the ever-evolving world of additive manufacturing.

You can visit it online at formtech.co.nz or stop by the Christchurch store to chat with the team, check out their materials in person, and take the next step on your 3D printing journey.

FORMTECH
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Wood-turning

WOODEN TOOL HANDLES

By Ritchie Wilson | Photographs: Ritchie Wilson

A small local business supplies wooden handles and more for various tools and has done so for over 80 years. With its expert knowledge and skills, the global move to shopping has not deterred this company from growing and being a real asset to Kiwi sheddies

Currently, Christchurch appears to be in the midst of a building boom, with large subdivisions being developed on the fringes of the city.

Within the city, old houses are being demolished and replaced with rows of apartments. Many of the replacement dwellings are sophisticated and attractive, though small. To the casual observer, the question inevitably arises: “Where are all the buyers going to come from?”

At the same time, some older houses are being extensively refurbished, with much of the building’s fabric being replaced: interior linings, weatherboards, roofing iron. Some houses are taken back to just a roof supported by rows of studs, making it possible to see right through the building from one end to the other. Often, an extension is added. The final result is well up to modern insulation specifications; is large (perhaps very large); has a garage; spa pool; hopefully a separate workshop; and, usually, an extensive garden with a glasshouse and potting shed.

Sought-after homes

Some suburban streets in Christchurch have several 1900s villas being expensively renovated simultaneously.

A desirable feature of the classic bay villa is its verandah; those with a ‘return’ verandah (which runs around two sides of the house) are especially sought after. Verandah posts often have decorative infills on each side at the top, which are called ‘brackets’. When these old houses were new, some brackets were made from cast iron and were shipped from foundries in the UK. Others are wooden and would have been bought from catalogues published by businesses such as Auckland’s Kauri Timber Company.

After a century or more, many have deteriorated or been damaged and need to be replaced. This isn’t always straightforward because many of the wooden ones featured turned wooden ‘bobbins’.

Luckily, a local company called ‘Leech Timber Products’ specialises in wood-turning and can exactly reproduce the missing bobbins.

The firm was started by Phillip Leech at its present site, about 50km south of Christchurch, in 1952. The building originally housed a joinery shop making windows, doors, and kitchens for Phillip’s house building business, but when one of the regular, seemingly inevitable, downturns in the building industry occurred, Phillip branched

House, circa 1905, being extensively renovated in a Christchurch suburb

out into making tool handles and bar stools on his hobby lathe.

A kit kicks off a new business

Phillip had made a wooden-bed wood lathe during WWII after buying a kit which included a tool rest and head and tail stocks, all made from cast iron.

A set of wood turning chisels was included in the kit. As a schoolboy, he used the lathe to make wooden chisel handles, which he sold to Christchurch hardware shops, which could no longer source British-made ones because of wartime shipping difficulties.

In the days of wooden-handled chisels – before more durable plastic-handled ones were available – replacing worn, split chisel handles would have been a regular task for woodworkers. So, when demand for houses dried up, Phillip dusted off the lathe and started making and selling garden tool handles, bar stools with turned legs and tops, and wooden curtain rails.

In the days before globalisation, shovels made in Britain and shipped halfway around the world to New Zealand were expensive. It was usual for a broken shovel handle to be replaced rather than the shovel thrown away as often happens today. It was not uncommon to see replacement handles fashioned from a tree branch. Phillip started turning shovel handles on the lathe, steam-bending the end to fit the shovel's socket. Eventually, he imported a specialised machine from Italy, which automatically shapes the whole handle, including the socket end.

Business grows

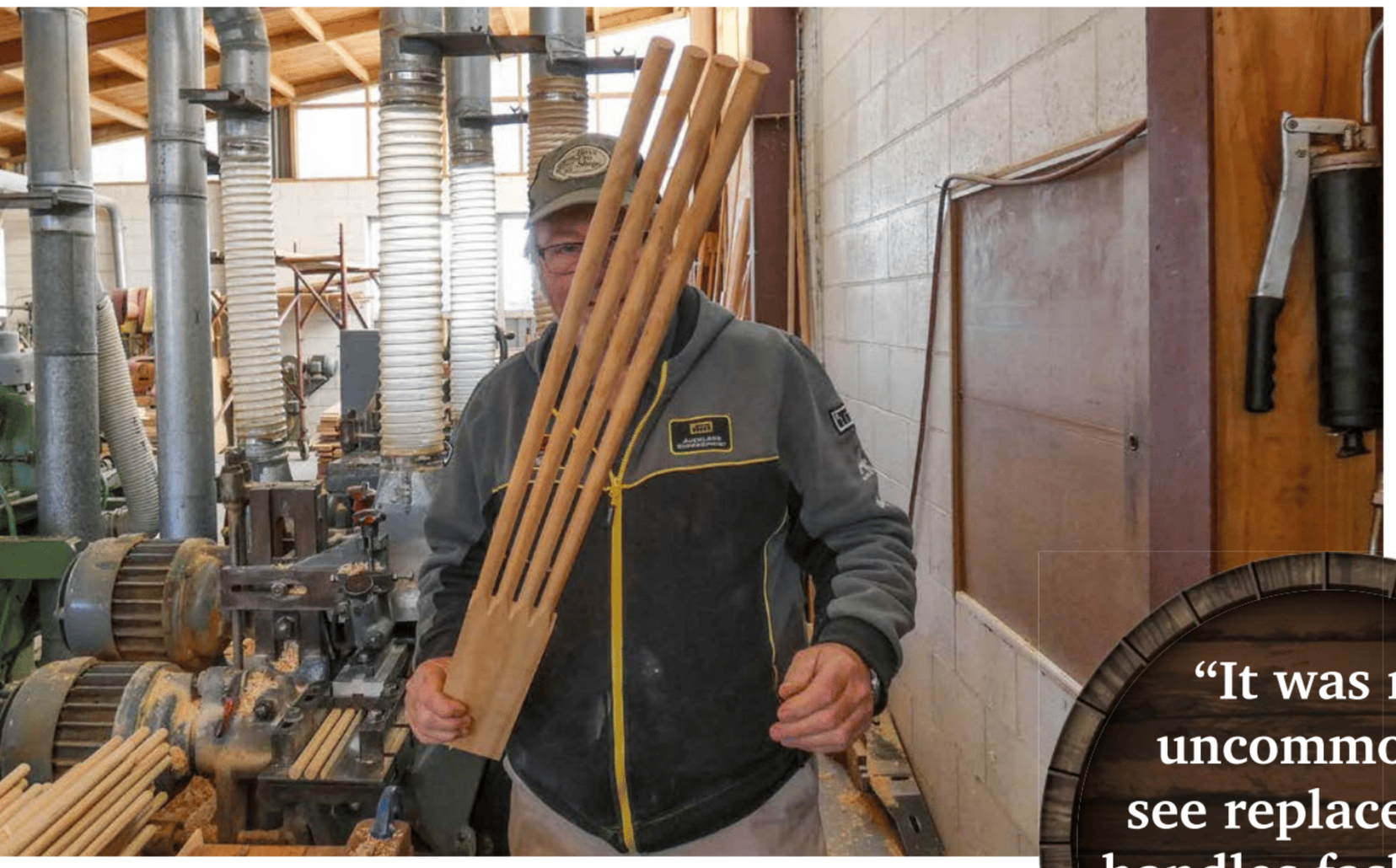
Over the years, he extended the factory buildings and purchased other machines, mostly Italian, including some second-hand ones which were refurbished by local engineering firms. These were used to make dowels and the handles for hammers, axes, brooms, rakes, picks, and so on.

Attempts were made over many years to source suitable, locally grown timbers, but the volumes available were never sufficient. Today, timbers imported from the US, such as hickory, ash, and beech, are mainly used. These timbers are able to stand up to the very great demands imposed upon them.

American hickory is unsurpassed for making hammer handles because it is not only very strong, but it will also tolerate the shock loads of hammering much better than other woods. Supplying hickory for tool handles is a very big business in America. New Zealand black beech is also good

Mark Leech and his father's wood lathe . . .

. . . made by Mark's father when he was a lad



A test section of a large-diameter dowel showing a small length of the original rectangular wood the dowel was cut from

> “It was not uncommon to see replacement handles fashioned from a tree branch”

for hammer handles. Leech Timber Products has made panel beating hammer handles from the local timber that have stood up well to use, but panel beaters don’t seem to break many hammer handles, so they aren’t a big seller. Shovel handles aren’t subjected to significant shocks, but are constantly being bent. American ash is able to withstand constant bending without delaminating and failing, so it is preferred for shovel handles.

Dad retires

About a decade ago, Mark Leech, Phillip’s son, took over the business. Mark had worked for his father for many years after completing a building apprenticeship with him.

For a long time, wooden dowels were the principal product of the company. The dowel is made from rectangular timber of appropriate dimensions in a large machine, which Mark says is older than he is. The machine has been completely rebuilt by a local engineering business.

Often, folk wanting some innovative gizmo made in wood will find their way to Mark’s workshop. He has made cricket trophies, board game counters, milk bottle racks, and a device which turns a newspaper page into a seed-raising container.

When *The Shed* visited, a large part of the workshop area was filled up with dozens of what appeared to be small tables on turned legs. These were actually for a local boarding kennel and were for resident dogs to rest on. It seems that the canines prefer to rest on elevated surfaces. ▶

A milk bottle carrier

A wooden former for making paper seed-raising containers

Dowels

One of Mark’s principal products is wooden dowels – the short, round lengths of wood which are mainly used to strengthen the glued joint between the edges of wooden boards which are being joined together to make a wider board.

His machines, which make the dowel, also cut it to length and bevel the ends so that it is easy to insert into the snug holes in the board’s edges. The sides of the dowels are grooved to allow room for glue and to let air escape as the dowel is inserted. It was surprising to learn that dowel isn’t turned on lathes but is rather formed by two opposed semi-circular cutters, each shaping one side to form the round wooden rod.

If you look closely at a length of dowel, it is not possible to see where the surfaces cut by the two cutters meet on each side because the actions of the cutters overlap. The wood that is fed into the dowel-making machine is cut to very precise thicknesses on a large bandsaw which has a hydraulic fence.

The bandsaw leaves a very slight roughness on the timber’s surface, which is beneficial because it allows the dowel machine’s drive rollers to grip the timber better. A larger dowel requires thicker timber.

The most common diameters of dowels made are 8mm and 10mm. The machine forms 10 lengths of 8mm simultaneously or eight lengths of 10mm. Dowels with imperial dimensions are not made at present. The main timbers used for making dowels are *Pinus radiata* and Southland beech, but many other timbers can be used.

Dowel has other uses besides joining timber or forming the tines of a rake. For instance, Mark supplies Lincoln University with dowels, which they use to inoculate growing grapes with yeast. The yeast converts grape juice into wine.

Lengths of dowels for joining boards together. Note the grooves and the bevelled ends

Hardwood mauls

Wooden sections which can be joined together to make the most complicated banister

A wooden axe and shovel handles

Axe handle showing Leech's RITI label. 'RITI' is the affectionate name Mark Leech's great-grandfather's Māori farm workers gave him

Wooden rake for golf course sand-traps

> "Replacing worn, split chisel handles would have been a regular task for woodworkers"

Design changes

Mark says that he usually discusses potential jobs with clients because small changes to the original design can make the product much easier – and cheaper – to make.

One recent job was to make wooden racks, about 30mm wide, for storing cores extracted from trees. The growth rings seen in the cores give information about the growing conditions the tree experienced in past seasons, allowing the dendrologists to estimate climatic conditions in centuries past.

Complete tools are also made. One is a maul with a tough, iron-bound, hardwood head. Another is a wooden rake, which is used to smooth bunker sand in golf courses. The teeth of the wooden rake are dowels. The mauls are sold in hardware shops but are also bought in bulk by contractors. They have the advantage over sledgehammers that the striking surface is not made from hardened steel, and so there is no danger of shards of metal being ejected from the face of the hammer if it hits steel which is also hardened.

Mauls are the preferred tool to drive wooden stakes into the ground. The traditional English wooden rakes are the preference at top-tier golf courses.

Always innovating

One recent innovation is making wooden banisters of circular cross-section for staircases.

These are machined in long straight sections and in much shorter bent sections. The shorter pieces are cut to shape from solid timber slabs before being machined to the circular profile and finely sanded. They come in two diameters: 40mm and 45mm.

Various curves and straights can be glued together to form a continuous wooden banister for the most complicated set of stairs. The

final sinuous result is finished in paint or varnish. The machines which do the shaping and sanding are made in Verbania, northern Italy, by the Brusa & Garboli company, which has supplied Leech Timber Products with several machines, including the original shovel-handle shaper.

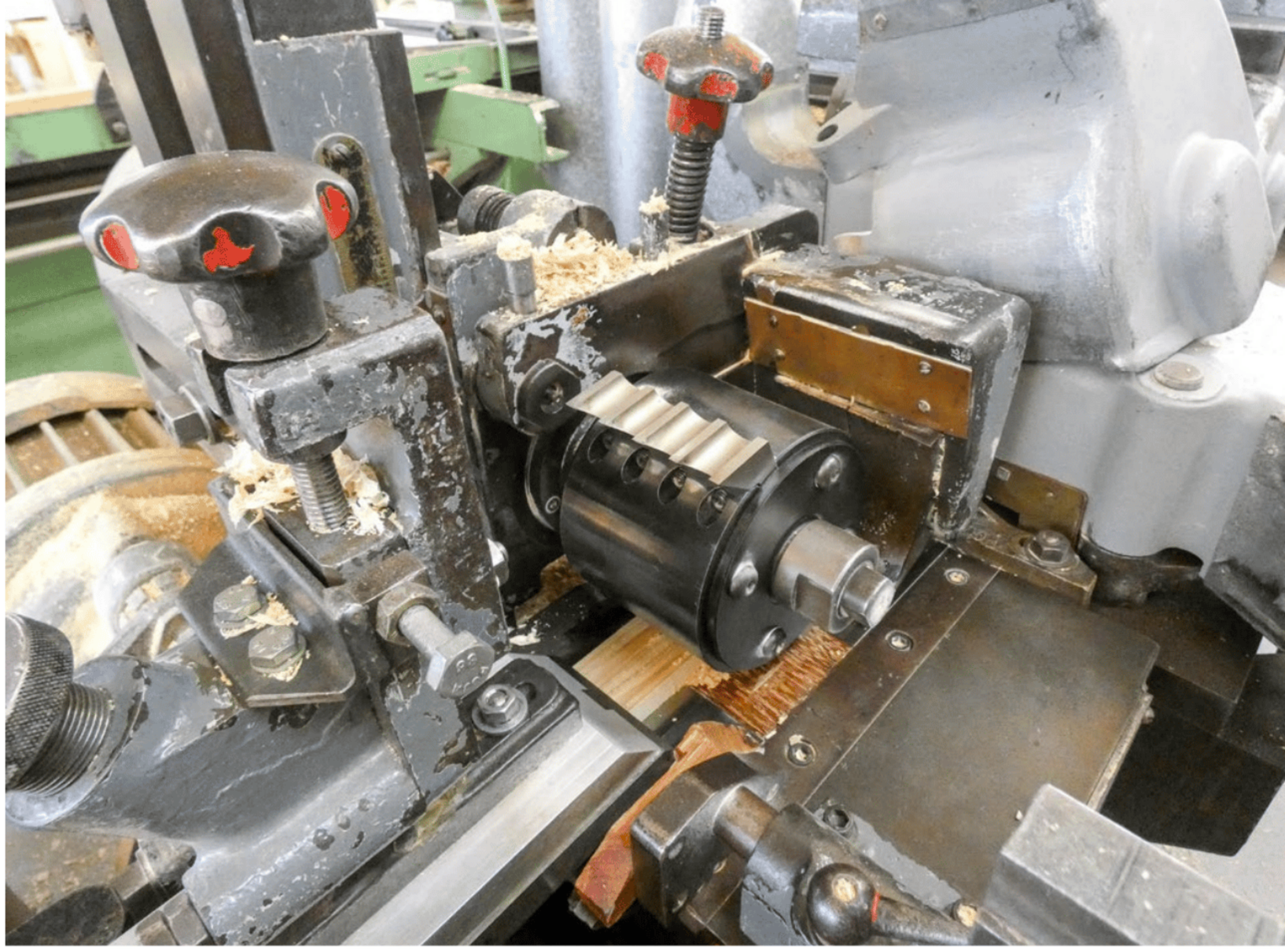
The tool-steel cutters, which do the shaping, were made by a North Island company which has recently changed hands and has – hopefully temporarily – stopped casting and machining the cutters. Mark Leech is very complimentary about the quality and durability of the New Zealand–made cutters and is reluctant to source possible replacements from overseas. He thinks that manufacturers in this country, such as the cutter maker and local joineries, are under pressure from many directions, and he worries about the loss of skills which result from the closure of businesses like these.

Small Kiwi businesses

One thing Mark really likes is meeting new customers. He mentioned that he got real pleasure in dealing with the genuinely larger-than-life, but sadly now deceased, owner of a local fireworks company. He remembers each of his visits vividly. Mark used to make the custom-made wooden bungs used in making the cardboard pyrotechnic containers for the man's public Guy Fawkes and other displays.

The advantages of a local business such as Mark's are that it can consider unusual projects, can offer knowledgeable advice, can meet urgent demands for smaller amounts, and can develop trust with customers. The numerous specialised machines and the skilled, experienced workers in Leech's woodworking operation enable it to produce relatively small numbers of specialised items, but also large runs of tool handles.

Mark says that he gets a smile on his face when he happens to see one of his shovel handles being sold at the neighbourhood Mitre 10. ▶



Dowel-forming machine showing one of the two cutters which form four dowels simultaneously

A doweling cutter which forms eight lengths of 10mm dowel

Turning chisels which came as part of the kitset to make the WWII-era wooden-bed lathe

1

2

3

5

1. Shaping the head of the hammer handle with a spokeshave, rasp, and file. 2. Cutting the slot in the head of the hammer handle for the wooden wedge. 3. Hatchet handle and the tools used to shape its head. 4. Hammer handle head being reduced so that it is a snug fit in the eye of the hammer head. 5. Two carpenter's hammer handles and an engineering hammer handle. The handles of the carpenter's hammer are much more curvaceous and have a pronounced swell at the base. They were made from Indian Hickory in Sequatchie, Tennessee, by Sequatchie Handle Works Inc. They were supplied with wooden and steel wedges

FITTING A WOODEN HAMMER HANDLE

Many different materials have been used for hammer handles over the years.

I have hammers with steel, fibreglass, and wooden handles. Wooden handles are good to use, with a pleasant feel. They absorb vibration quite well but have a relatively short life compared with steel and fibreglass handles.

The usual site of failure is the handle-head attachment. The friction between the metal hammer head and the wooden handle, which holds the head in place, is increased by the use of wooden and steel wedges. They jam the top of the handle against the sides of the head's eye and fix it in place. Over time, the part of the handle in the eye can shrink (as wood tends to do), the friction decreases, and the head becomes loose on the handle.

This is potentially dangerous, and a new handle is the solution.

Making wooden handles

Wooden hammer handles can be made from scratch using a saw, spokeshave, wood rasp, and abrasive paper.

Re-handled panel beater's hammer and a new handle, both made of native black beech (*Fuscospora solandri*) - also known as 'tawhairauriki'

A 0.9kg ball peen hammer sold by the Mexican Truper company. The steel wedge is complex, and the hammer's eye is filled with epoxy. The hammer was made in China

An English Cheney carpenter's hammer showing the wooden and steel wedges

4

The shape desired is marked on the wood and cut out with a bandsaw or coping saw. While being held in a wood vice, the wood is rounded and shaped with a spokeshave and/or rasp. Attention needs to be given to getting the grip (the cheek) comfortable and the bottom (the swell) shaped so that the handle doesn't slip from the hand during use. The handle's top part, which sits in the hammer head's eye, should be a snug fit in the eye. The whole process is time-consuming, but can produce satisfactory results. Getting suitable wood can be a problem. I have used a bit of broken shovel handle – probably American ash – to make the handle for a ball peen hammer which, so far, has performed satisfactorily.

The handle for a carpenter's hammer is of a quite complex shape with an oval rather than a circular cross-section. The ones which used to be available in hardware shops were made in the US from hickory and had a very pleasing, ▶

Hanging the head of a hammer. The hammer is held in one hand, head down, while the base of the handle is struck by a sharp blow with a hammer held in the other hand. It works very well

Mark test-fitting the new handle for a mason's hammer

Plumb hammers

One of the fibreglass-handled hammers I own is a Plumb, which was made in the US.

Old advertisements, from the days when Plumb hammers had a red-painted wooden handle, make much of Plumb's unique wedging system: it used a wood screw as a wedge. If the handle became loose, it could be tightened by turning the screw, driving it further into the handle, expanding the head.

Most older sheddies would have seen hammers with ordinary wood screws inserted in a, usually vain, attempt to tighten the handle–head junction. This, in my opinion, is a bodge, a bad idea, so it is instructive to see that it was once the celebrated method of a prestigious manufacturer.

A Swedish Sandvik hammer with three wooden wedges

A mason's hammer with one wooden and two steel wedges

silky finish. I have bought several on online auctions, which were old but unused: new old stock (NOS) if you like. Because the eye in the hammer head can vary a lot from make to make, the head of these handles is quite large and usually has to be extensively trimmed to fit the eye. I find that the best method is to measure the eye, mark the top of the handle with the eye's dimensions with a felt-tipped pen, and use a tenon or coping saw to cut vertically downwards, removing much (not too much) of the unwanted wood. Rasps and abrasive paper are used until it is possible to insert the head of the handle very snugly into the hammer head, so that about 10mm of handle is sticking out of the top of the head.

Distance is important

Measure the distance from the top of the protruding handle to about 5mm above the bottom of the hammer head. This distance is important: it will be the length of the hammer's wooden wedge and it will be the depth of the cut – with a somewhat wide kerf – made down the handle in the middle of the handle head's long axis. Perhaps I should have mentioned the cut for the wooden wedge before.

The word in the trade for fitting a hammer handle is to 'hang' a handle. This is an exact description of the process – the bottom of the handle is struck with another hammer as the hammer is held in the other hand, head down. The shock of the hammer blow forces the head and the handle tightly together. Knocking the head downwards onto the handle is not as effective.

The wooden wedge – made from a hardwood like poplar or hickory – is driven into the handle as far as it will go. A saw is used to trim the handle just proud of the top of the hammer head. Some people use glue on the wedge, which is probably not needed but does provide lubrication.

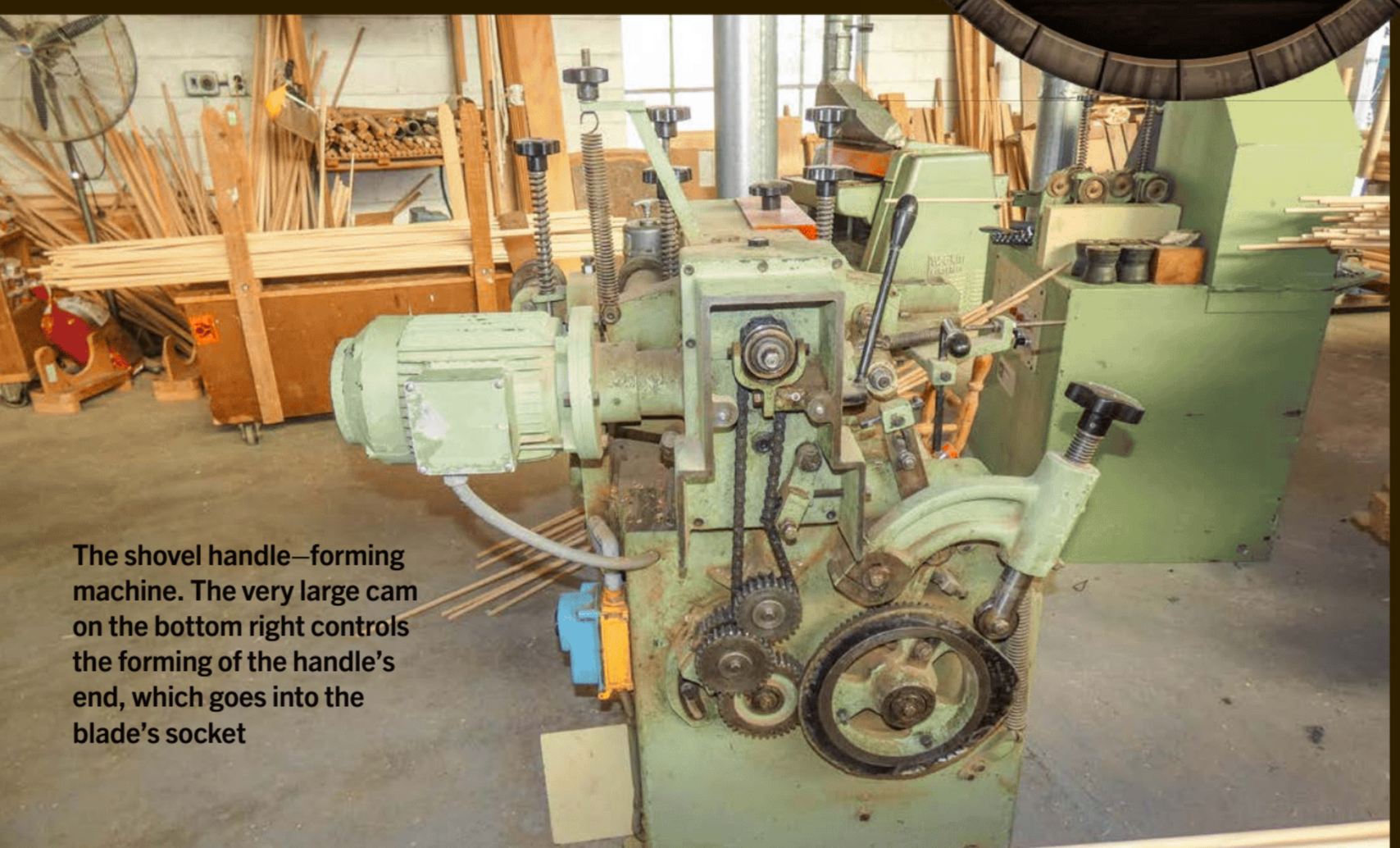
Lastly, a steel wedge is driven into the handle top at right angles to the wooden one. Wood appears to be making something of a comeback as a material for hammer handles, especially top-quality ones. Modern wooden-handled hammers often use a steel wedge which is circular, so it exerts force in all directions as it is driven into the handle, not just in two.

Steel wedges used to be stocked by every hardware shop in the land, but are now hard to come by. I have a carefully husbanded stock of steel hammer handle wedges which I was given by a local Menzshed member; I have also bought them in Japan. Mark Leech bought the entire wedge inventory of a very long-established local hardware business, Ashby Bergh and Co., when it closed its high street store at the end of last century.

Three hammers showing three different wedging styles

Mark and a newly re-handled trenching shovel

"The word in the trade for fitting a hammer handle is to 'hang' a handle"



The shovel handle–forming machine. The very large cam on the bottom right controls the forming of the handle's end, which goes into the blade's socket

The trenching shovel's blade

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The dynamo parts needed for the rebuild. New bearings, armature rewound, and commutator reassembled (see part four)

Partially rebuilt: the field coil has new leads with heat-shrink insulation

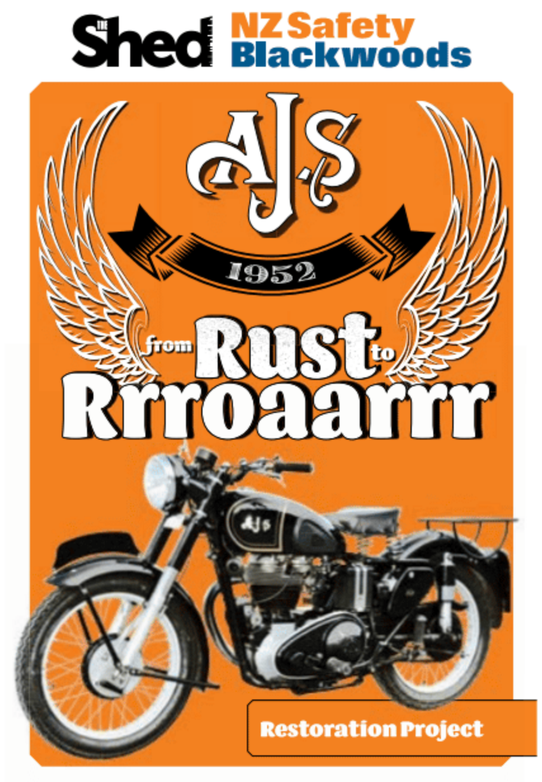
RESTORING A 1952 AJS

THE ELECTRICALS, SEAT, AND TANK REFURBISHMENTS CONTINUE

Patience and humility are needed as Peter faces stubborn electrical issues, and tasks taking longer to complete than anticipated mean that the restoration timeframe may need to be extended

By Peter Barton | Photographs: Peter Barton

Part 5



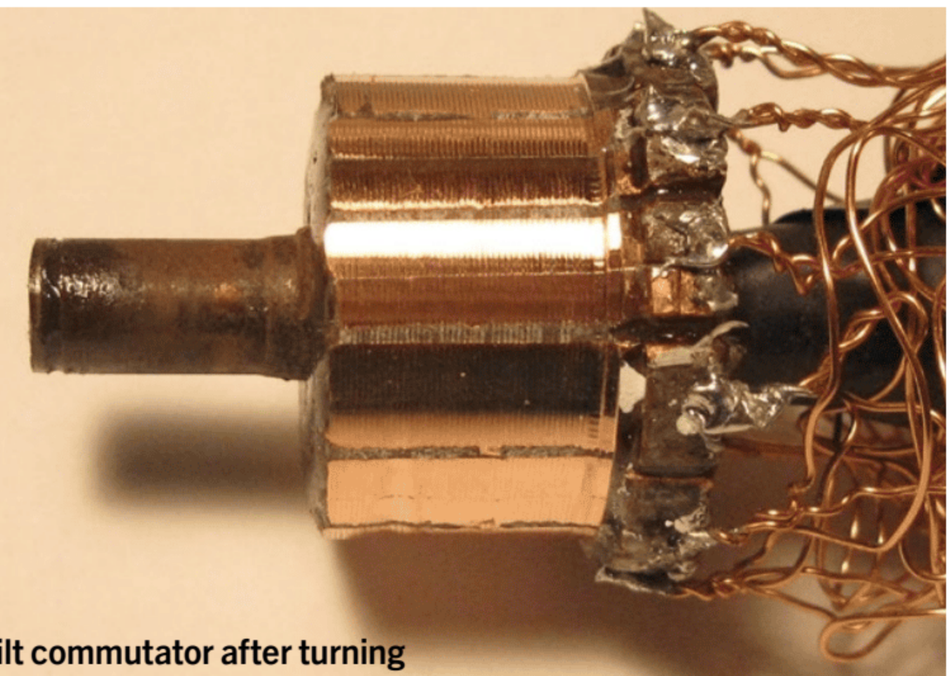
About two years ago, I unpacked an old motorcycle (of about a 1952 birth year, Year of the Dragon, AJS 18S 500cc single) and started to rebuild it.

I had stored it, partly in pieces, for about 50 years. Web searches on part numbers showed me that many parts were inconsistent in age: the machine is a bitzer. The upside to that is that I feel free to adapt parts and not remain true to the marque. This may result in some compliance issues later.

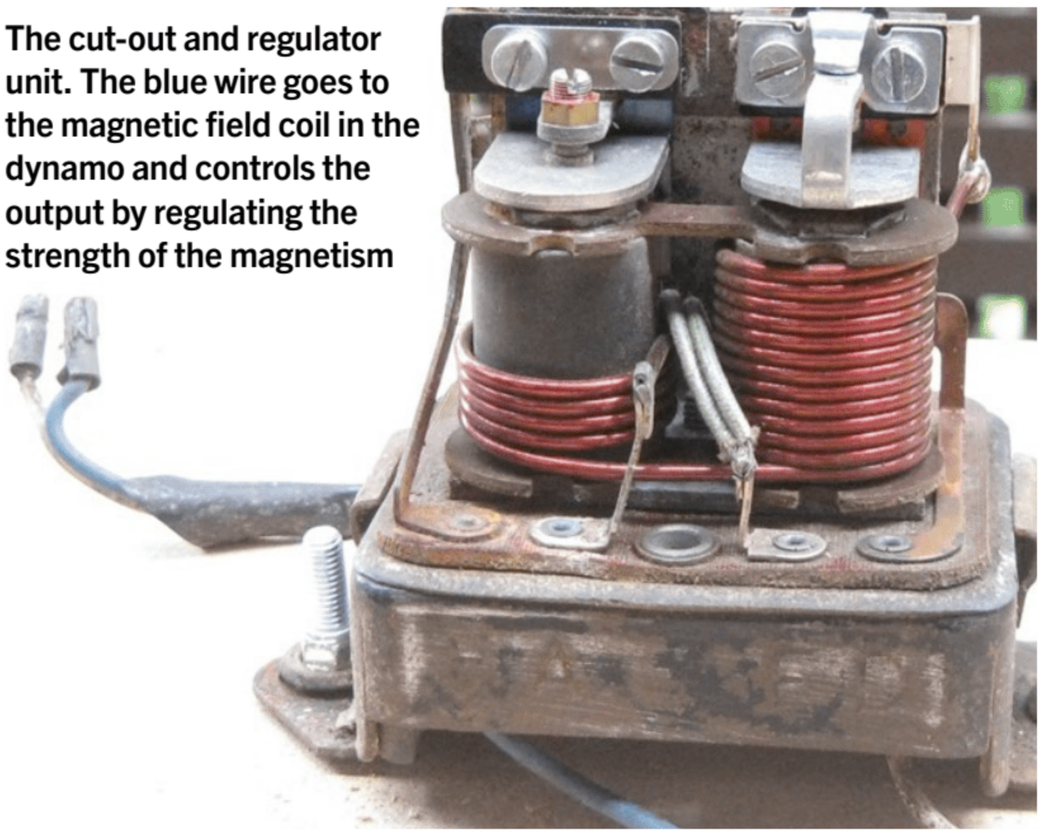
Some months into intermittent work, I thought that I could write about it for *The Shed*, and here is the fifth article describing what I have been doing. I now wish I had taken more photos before commencing.

A bit of a recap

In the first article, I wrote about nickel welding repairs to a broken cast-iron cooling fin (parts from a barbecue hot plate), magneto check, head repair, valve work, and nickel plating the push rod cover tubes. The second article was mainly about how I developed nickel and copper plating, with a little bit about kick-starter repair using nickel plate on a worn shaft, and grinding teeth. Third article, the start of frame painting;



The rebuilt commutator after turning in a lathe. To get an output from the dynamo, the soldered joins between the commutator bars and the enamelled wires had to be shifted: the wires were moved two joins downward, as seen in this photo



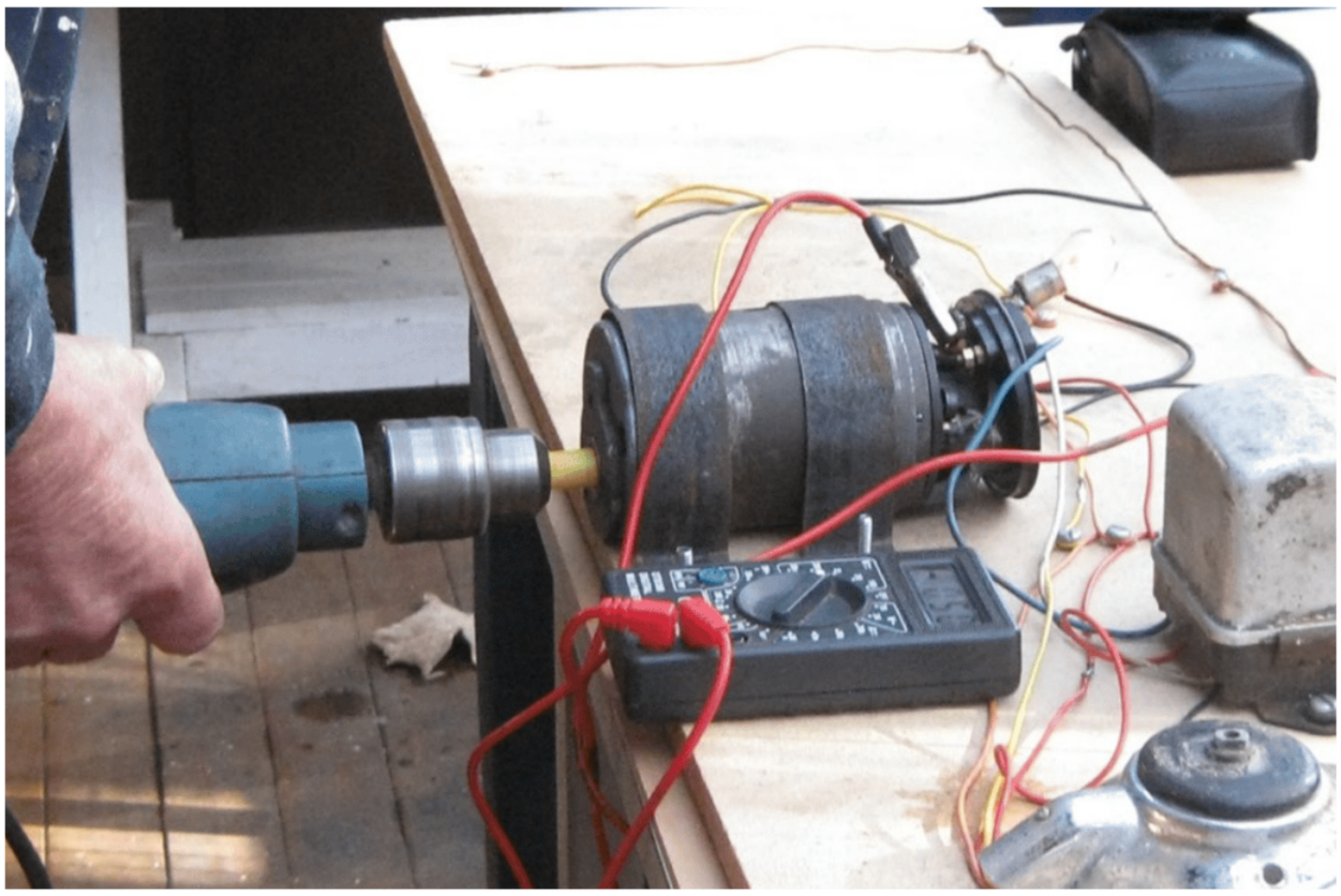
The cut-out and regulator unit. The blue wire goes to the magnetic field coil in the dynamo and controls the output by regulating the strength of the magnetism

"BUT BEING THIS AJS-RESTORING SHEDDIE MEANS TRYING TO HAVE HUMILITY, PATIENCE, AND A LITTLE WRY HUMOUR WHEN CONSIDERING PLANS AND INTENTIONS"

engine, clutch, and gear-box assembly and installation, with magneto timing.

In my last article, part four of the series, I described my efforts to rebuild the bike's dynamo (generator) by reconstructing the disintegrated commutator, rewinding the armature, replacing the bearings, and then testing. Sadly, with no success.

I have achieved a little bit of progress with fixing the fuel tank and the seat, but I have not really met any targets. When I started this series, I expected that by this article, part five, I would be writing about fixing the famous 'Jampot' and Teledraulic suspensions, and at the end of part six, I would have relaced the wheels, having nickel-plated the spokes, rims, and hubs ready for a trial ride.



Using a drill to spin the dynamo. Yellow insulation tape was wound onto the threads for their protection

Some humility and patience are required

But being this AJS-restoring sheddie means trying to have humility, patience, and a little wry humour when considering plans and intentions. Instead of taking a year to do the rebuild, I now think it will be more like 16 months – that is, about eight of these articles.

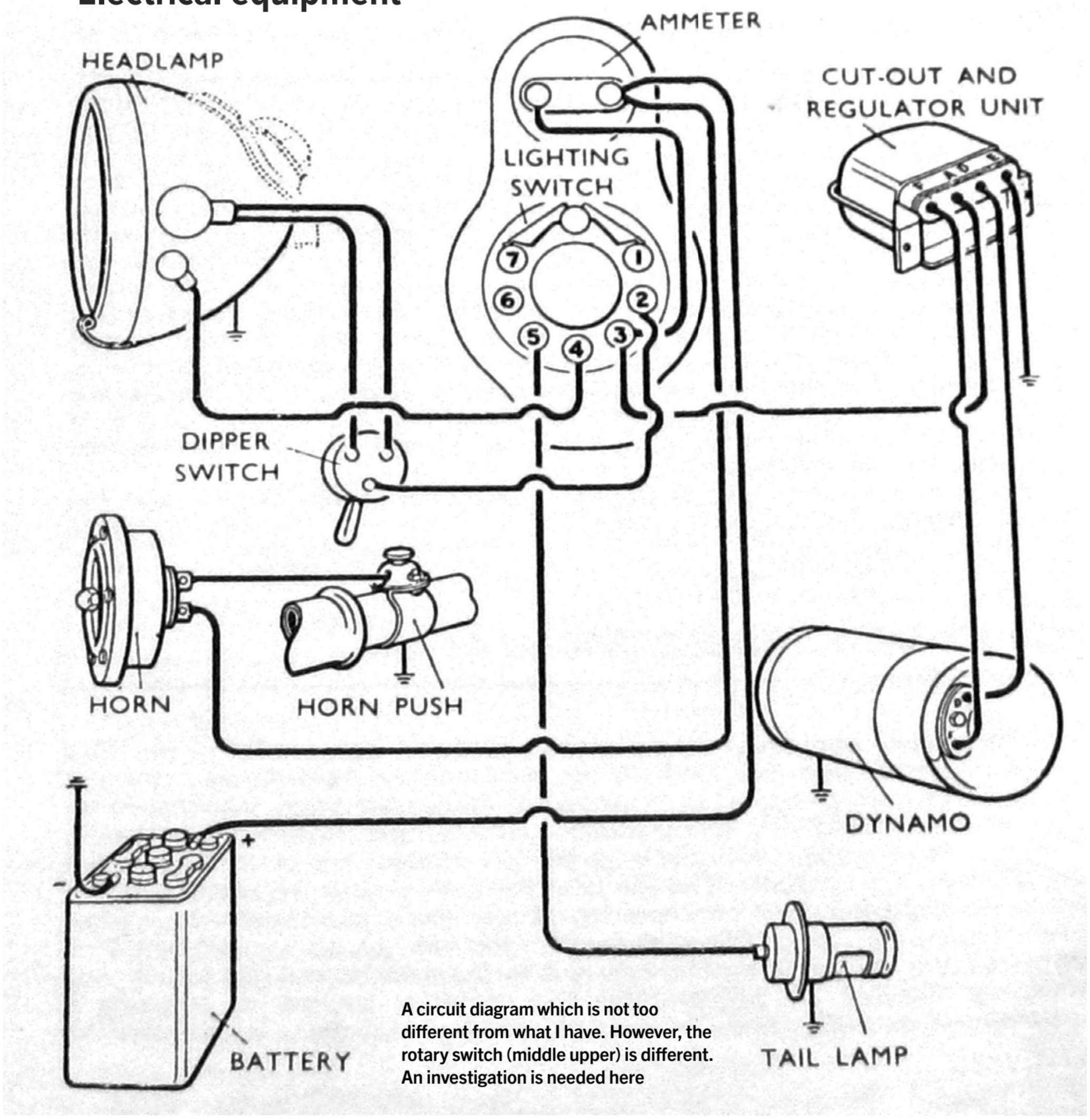
I spent hours on the dynamo, as readers of part four will appreciate. I had a lot of trouble with building, stripping, and rebuilding the commutator. First, there was a short circuit, probably in the old insulation. Then, after the second build, I still just couldn't get it to work: zero voltage output reading on a voltmeter (and on an oscilloscope). The best thing I did after the disappointments was to put the whole electrical system in a corner and leave it for a couple of weeks. Building up my reserves of patience.

What is the problem here?

Back to the problem.

I knew that the field coil inside the dynamo case was good: no short-circuit to the case, good resistance reading between the terminals, a simple retest with a steel screwdriver showed some permanent magnetism, and when I switched current through the coil the screwdriver was very well attracted and a search coil gave a flicker of voltage.

The soldered joins between the commutator bars and relevant armature coils were good (I tested with a multimeter). No shorting in any areas. Perhaps the two brushes were no good? But there seemed to be good continuity



A circuit diagram which is not too different from what I have. However, the rotary switch (middle upper) is different. An investigation is needed here

between the leads to the brushes and the relevant commutator bars – that is, good conduction. (However, I was tempted to buy and try new brushes.)

The commutator had been turned in a lathe and then sanded; the brushes should not have been bouncing. I then put current directly into the field coil from an old computer 5V power supply, and gave the dynamo some high rpm from a drill: still no output.

At last, volts!

Twelve different coils had been lap wound in different positions around the armature, repeating the original (I think).

Each coil connects to two commutator bars. Each coil develops maximum voltage when it's rotating through the correct part of the magnetic field. When a coil has maximum voltage, that's when its two connected commutator bars should have rotated into place, to connect with the brushes and therefore send the current through the brushes to the outside world.

I tried desoldering each of the commutator bar-to-armature connections and then resoldering the armature coils to different bars and then test. Jackpot! Seven volts: not as much as I would have liked, but I'll take it. Humility: I should have thought of this re-soldering earlier.

Woven fabric insulation

That was the good news.

The bad was that the leads to the field coil (post-war woven fabric insulation) were getting very frayed, and the test showed that the field polarity had to be

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reversed for the negative earth system. When I joined the dynamo output 'D' to the field coil input 'F', and these to the positive of the power supply (see part four), the dynamo indeed motored, but clockwise instead of the required anti-clockwise.

Some time had to be spent replacing the field coil leads with modern plastic insulated wires, with heat shrink insulation over the joins. A reversal of the lead connections to make the coil consistent with a negative earth (the bike frame). Further testing. A reasonable voltage on the multimeter, which shows an average, an oscilloscope trace (yet to be done), may, possibly, show one or two armature coils soldered the wrong way around.

No electric starter here

I had bought a small 6V sealed lead-acid battery from Jaycar.

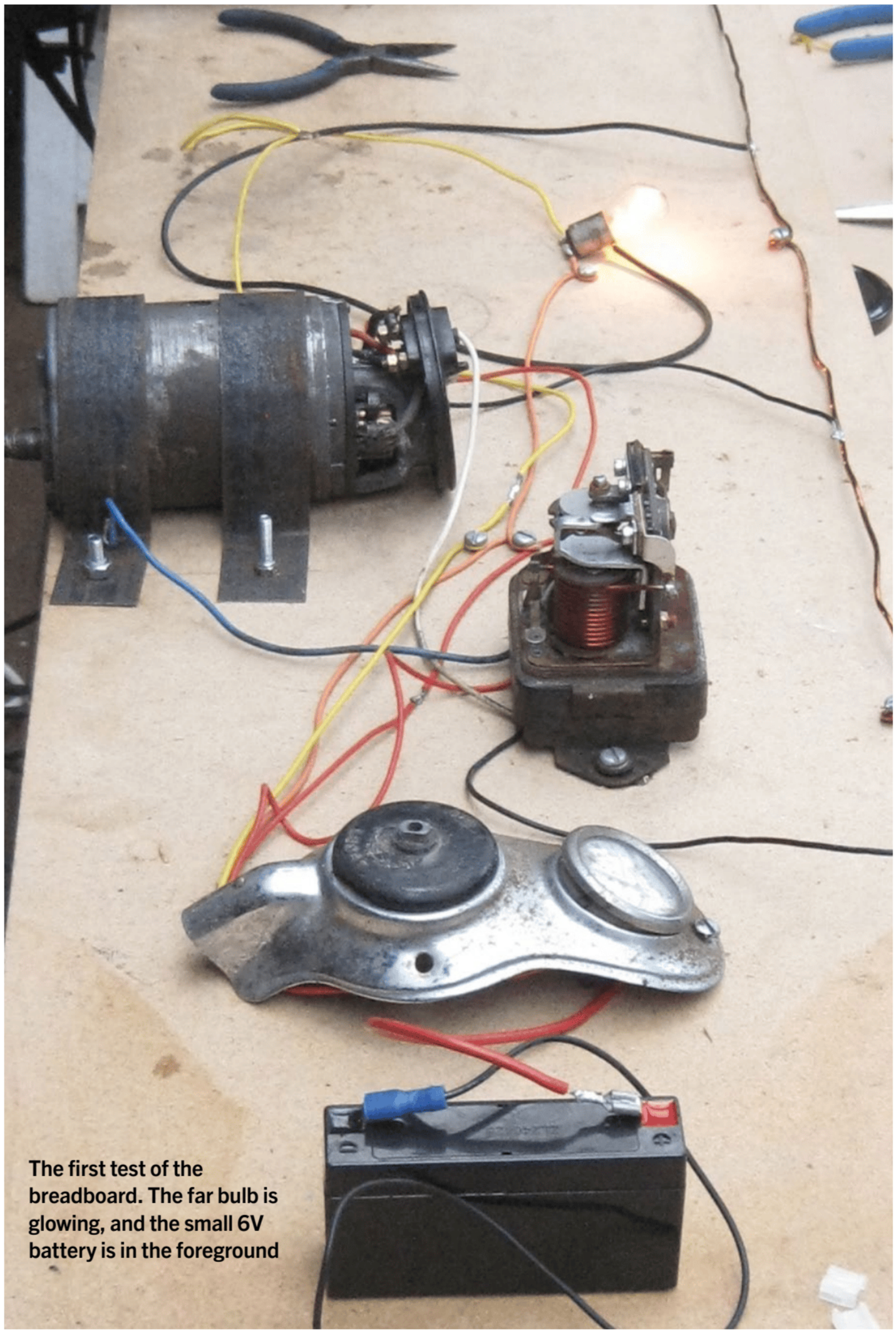
In my discussions with the sales assistant, he queried my choice of the small size, no doubt assuming that the bike had an electric start.

I appreciated his concern (still do), but I was able to reassure him that this bike dates from way before such luxuries. Indeed, the battery has to do very little: limited lighting, horn, and that's all, apart from supplying the field coil (via the regulator: see part four) in the generator with current to build up the magnetic field.

The wee battery could fit inside one of the toolkits, instead of hanging out to the side of the bike like the original did. Looks can be important.

The dynamo is now the centre point of my 'breadboard': the story goes that in the early days of ham radio, experimenters would hammer (copper?) nails into a breadboard snuck out of the kitchen, and then solder on their bits to make up their receivers.

In the electronic world, the term has survived for a form of prototyping. I decided to use this approach for checking the electrics, as it makes any troubleshooting and repair much easier; bits are more accessible while not yet being on the bike. The dynamo shaft hangs out over the edge of the board so I can spin it with a drill. In the bike, this shaft will have a sprocket on a keyed taper, with a chain drive from another sprocket on the crankshaft.



The first test of the breadboard. The far bulb is glowing, and the small 6V battery is in the foreground

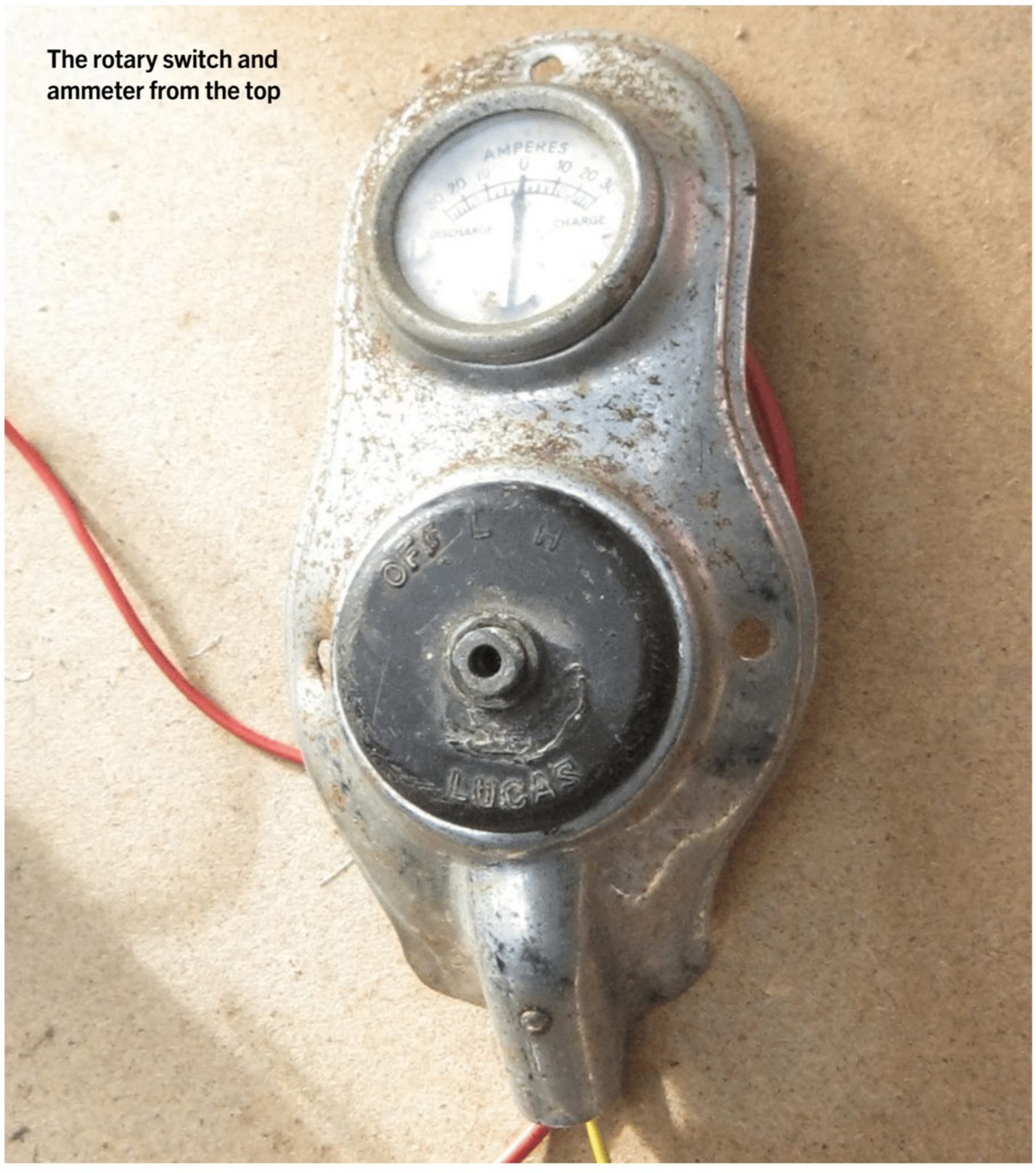
Other breadboard testing

Also on the breadboard are the cutout/regulator, the battery, ammeter and lighting switch combo, lights, horn with its switch, stoplight with its switch, and a bulb for the indication lamp in the speedometer (a genuine Smiths of Enfield Chronometric).

To imitate the bike frame (the negative earth of the system), and to keep things somewhat tidier, I have put a long copper wire (enamelled, unwound from an old transformer) around the perimeter, as a bus bar. I scraped off the enamel and soldered it where the connections are needed.

Amongst the electrical bits and pieces I took out of storage was a two-way

Rust to Rrroaarrr NZ Safety Blackwoods

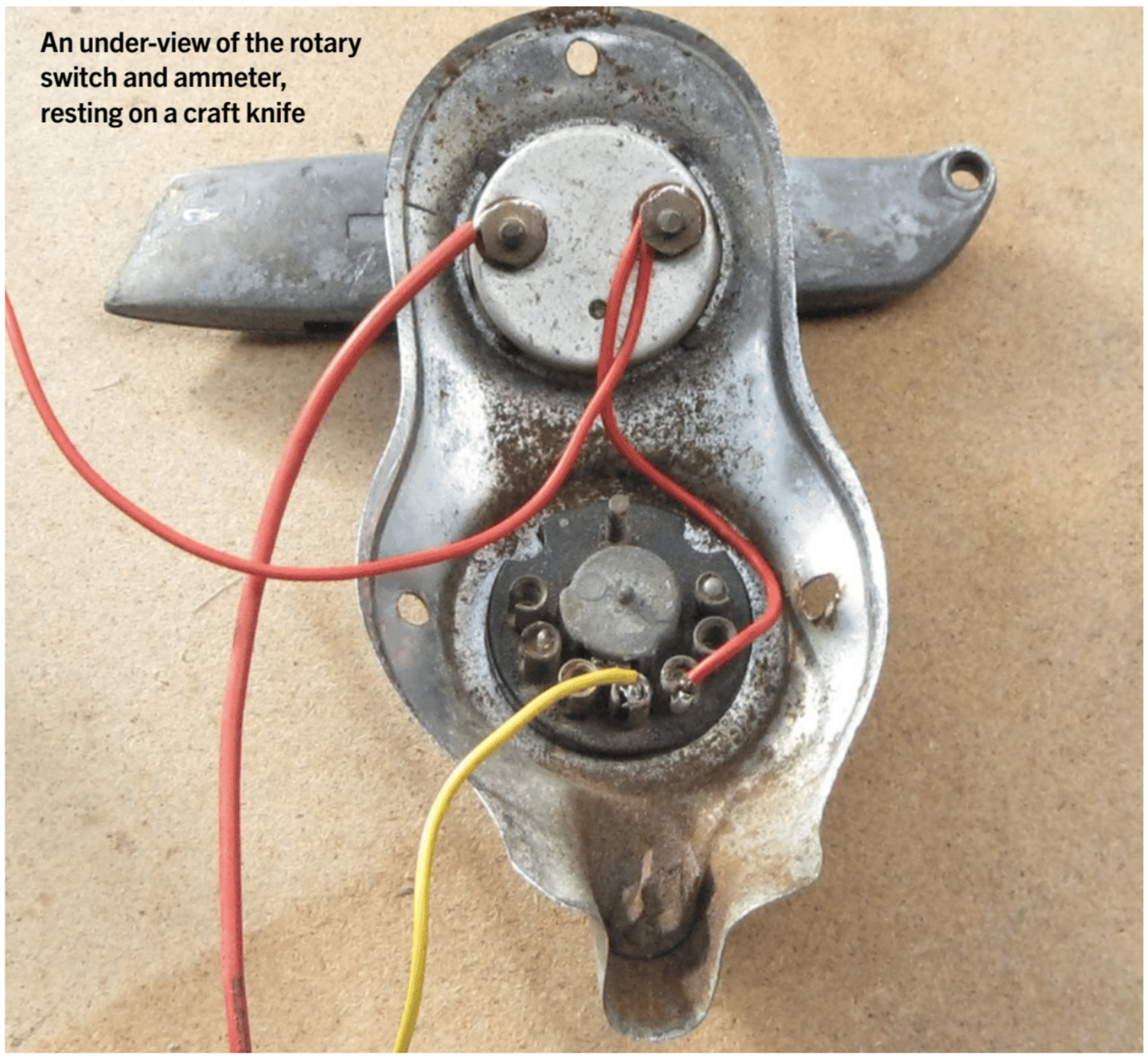


The rotary switch and ammeter from the top

The ammeter: safe for up to 30A?

switch with a push button on top. Its layout suggested that it could be mounted near the throttle twist grip, so that the switch could be thumb operated to choose dip or full beam lighting.

The push button for the horn, again within thumb reach. Being an old unit, I could easily take it apart to clean the contacts: as I've said in other articles, it's the beauty of old machinery that it's so dismantlable. And I can easily nickel plate the shell when it is without its innards.



An under-view of the rotary switch and ammeter, resting on a craft knife

The ammeter

Interestingly, the ammeter is scaled up to 30A current in either direction.

The ammeter is mounted in tandem with a rotary switch, which has seven terminals. There are, however, only three positions for this switch, and they are labelled 'Off', 'Low', and 'High'. I wonder if this switch was meant to function as a dip switch?

The switch and ammeter were mounted on top of the headlight, meaning that whilst riding at night, a rider would have to go one-handed for dipping lights … can't be. Low must be for the tail, speedo, and pilot lights. High for the headlight. But if you were to switch to High, then the tail, etc., lights would go off?

But if the High terminal was also

NZ Safety Blackwoods Getting to the nuts

connected to the tail, etc., then when the Low is switched on, then some current would get to the headlight anyway? Further thought needed here. A power diode would easily solve the problem, but this would have been beyond the era of the bike. There must be circuitry within the switch, using the remaining four of the seven terminals, which I am not aware of. More logic testing to be done; easier on a breadboard.

Direct battery-powered

The brake light and the horn are each powered directly from the battery with their respective switches earthing the tails of their circuits.

These circuits have the potential to short out onto the bike frame when least expected. I will design a fuse block for the bike, for the other circuits as well, within the toolkit.

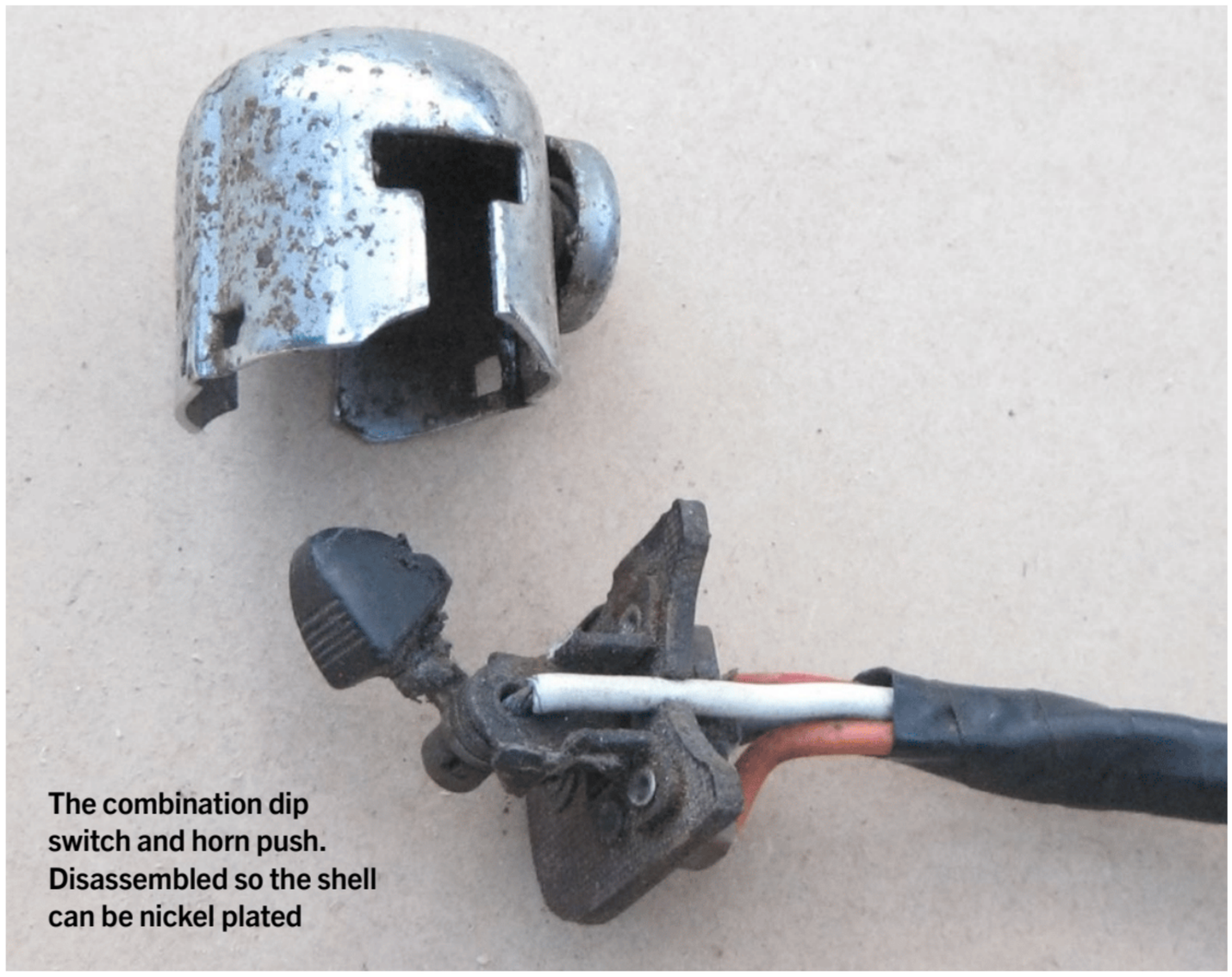
A further point with regard to the virtue of having a breadboard. I want to develop direction indicators which can either clip onto the bike or indeed be more permanent. Plus, a suitable switch for the handlebars. These can be prototyped on the board before mounting.

So I'm not yet ready to transfer the electrical system to the bike itself, but I have got to the point where I'm ready to consider the loom (probably a spiral casing from Jaycar) and that will of course fit under both the seat and the fuel tank. Progress.

The seat: small measures of patience

In my last article, I wrote about getting some foam rubber from a Para Rubber shop, and how it cut it for me, using a paper template I made of the steel seat pan. (I had tried doing some other upholstery a few years ago and found it very difficult to cut foam rubber myself with any accuracy or finesse.)

The seat pan has a downturned edge of about one centimetre all the way around. When I took the old seat apart (removing the vinyl cover, etc.), I found



The combination dip switch and horn push. Disassembled so the shell can be nickel plated

The wee 6V battery next to a toolkit; fitting one inside the other would give a neat finish

"I WANT TO DEVELOP DIRECTION INDICATORS WHICH CAN EITHER CLIP ONTO THE BIKE OR INDEED BE MORE PERMANENT"

s & bolts of it with NZ Safety Blackwoods

The upper (right image) and undersides of the seat cover, foam rubber, and steel pan; luckily, I have a spare pan. The old foam is like hokey-pokey

New foam rubber, alternative pan (rust-treated), and the old cover

that the old foam rubber (hokey-pokey like) had been held in place by the cover, which folded over the pan edge and which was held by some spring steel clips. A couple of problems here: about half of the spring clips were choked up with rust and old, torn vinyl and were unusable; the vinyl cover itself demonstrated its age by tearing in some places when I tried to hammer down the clips. (Would there be a special tool for fitting the clips?)

Since the seat pan is designed as slightly banana curved, I started the clipping down at the tank (front) end of

The cover clipped over the pan and foam rubber; attached fore and aft

Hammering on the clips down the side of the seat. Some body weight needed here to compress the foam for a good cover fit

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The completed seat. It looks OK from a distance

the seat and then at the rear. Wrestling was then called for. The seat upside down, a block of wood under the vinyl in the curve, my body weight on top to compress and shape the foam, and then pulling on the vinyl and clipping the sides.

At times, the vinyl tore. As the photos show, the result is a serviceable place for me to perch, but I do think that later I will get a better-looking job done.

That bicycle seat still appeals

In the last article, I mentioned my vision of having a small single black leather seat down low between the rear mudguard and the fuel tank: stylish.

This vision has not yet been abandoned, but I'm going for the easier seat, in my impatience to get the bike on the road. Low-hanging fruit and all that.

The fuel tank had nasty dents in several places, and it would have been possible to cut out the underside of the tank, beat out the worst of them, and then replace the underside, having dealt with possible rust as well. However, I would still have to use some filler (bog), and I was keen to move faster. So the dents were bogged.

This process was still a bit sheddie testing, though. Several applications of filler, and each time sanding – power tools to begin with and then by hand. Then some painting, to see how visible the repairs still were, and then filling and sanding again with water and finer-grit wet-and-dry paper. Then, painting again.

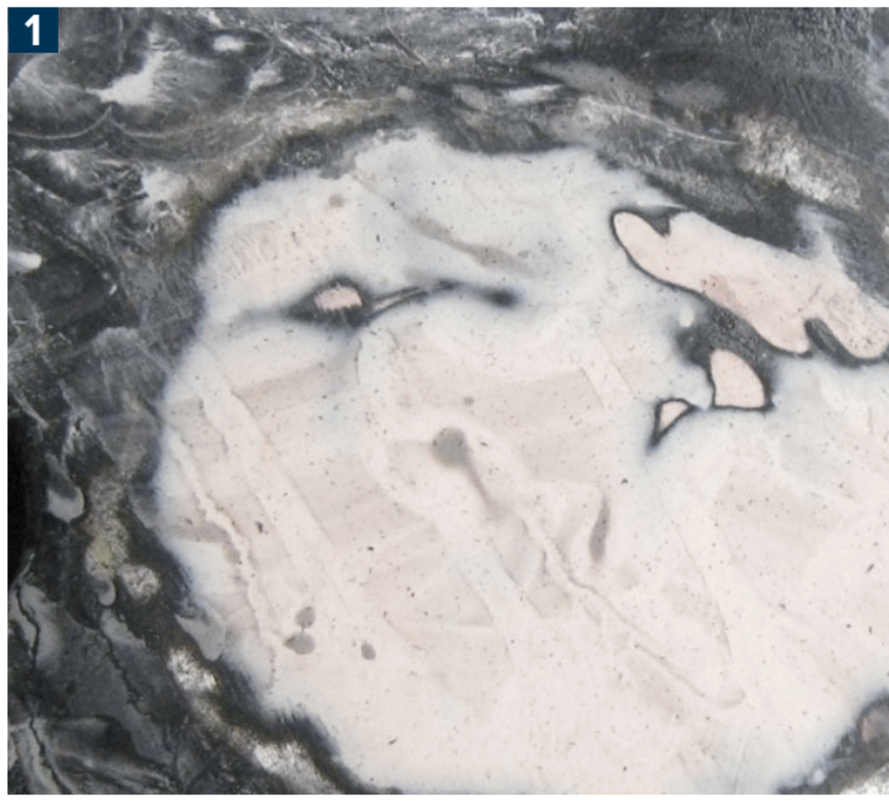
Eventually, I got to the point where I decided that further, relatively minor, work could be postponed until after the bike is on the road. Other road users would probably not notice the now-minor dimples. It will be easy to remove

The tank as it comes out of storage

The underside of the tank

Rust to Rrroaarrr NZ Safety Blackwoods

Primer, filler, and some sanding on the tank



1. Layer of top coat paint showed areas which needed sanding. 2 and 3. More sanding: different layers of filler alternating with paint can be seen

"I HAVE STARTED DISMANTLING THE SUSPENSION BITS, AT THIS STAGE, TO GET AN IDEA OF WHAT I MAY BE UP AGAINST"

the tank from the completed bike later for those little finishing touches.

The suspension. What am I in for?

I have started dismantling the suspension bits, at this stage, to get an idea of what I may be up against.

Again, the fortunate fact about these old machines is that the suspension units, like many other components, can be stripped down and rebuilt. Prior to the Second World War, bikes mainly had 'girder' front suspension, hard or

NZ Safety Blackwoods Getting to the nuts

A topcoat which, possibly, will not be the last. Satisfactory for now, though

rigid rear ends (no springs at the back), and sprung seats.

During the war, AMC (AJS. and Matchless bikes) developed 'Teledraulic' front suspension, which was based on a long coil spring with internal hydraulic piston–type shock absorbers. The rear wheel suspension was much the same principle, but in its (second) design was shorter and fatter and hence called 'Jampots'.

The front suspension used to work OK, from memory; the interior working parts look good, although there is superficial rust on the upper parts of the main tubes. Some plastic spacers need replacing. And there is the work detailed following.

The Jampots

I got the jampots as spares when I bought the bike; the bike ran with what I think (I can't find any markings) are Girling units.

What I've seen so far of the Jampots is that they will need a lot of work; at the very least, the seals will need replacing. I've made a tool for dismantling the inner parts.

The front and rear suspension units have painted parts, plated parts, and alloy parts. The painting must be redone, of course, and there will be some filler first. The plating is more serious. There are dents and much rust on all the parts. Sanding and then brass filling into the dents will be needed.

Then, filing, sanding, polishing, and plating. I have already done some plating on the front tubes (see part two about the nickel plating).

There is also an issue with some of

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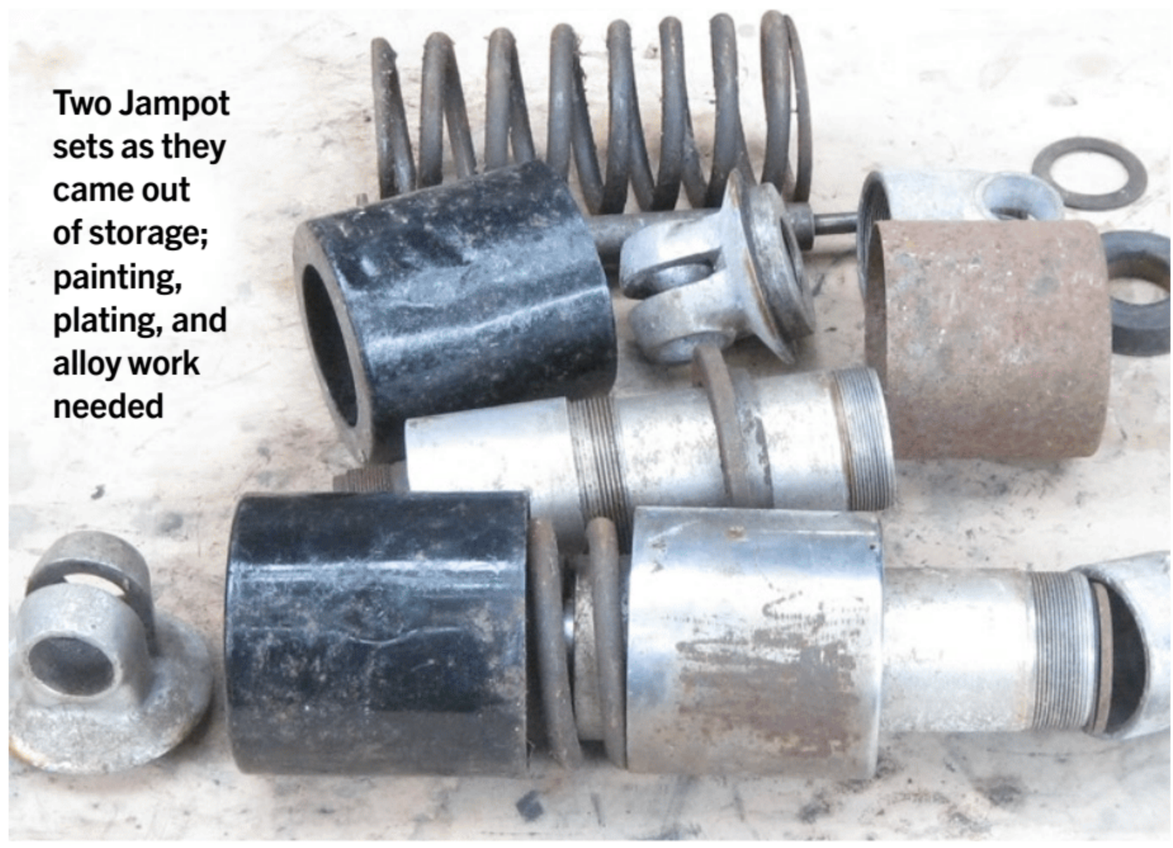
A front suspension leg, minus a plated tube. De-rusting, painting, alloy cleaning, and some alloy building required

Front suspension tube to be de-dented, polished, and plated. Tape is there to protect threads

Looking ahead: two rear-wheel axle assemblies in bits – cleaning, polishing, and some plating are needed here



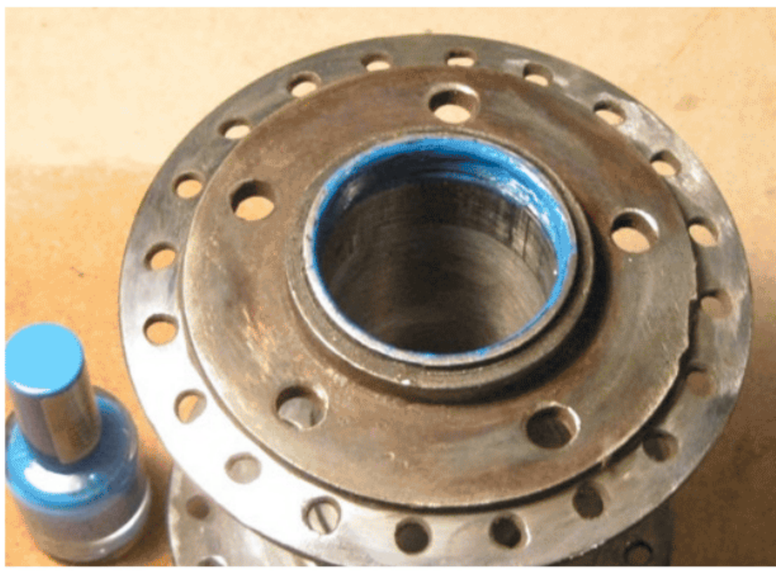
Two Jampot sets as they came out of storage; painting, plating, and alloy work needed

the alloy parts. A lug on one of the front members (to anchor the mudguard) has broken off and will have to be built up and rethreaded. I don't have a cycle-thread 26tpi tap, quarter inch (hard to get it seems), so I will have to go for a 6mm metric thread. A shame. The rear alloys have some bad wrench marks bitten into them, so ideally, some alloy filling will be called for here.

Coming up next issue, part 6

There will be further work on the lighting logic, wiring, and toolboxes; some suspension rebuilding; and diving into the oil and fuel systems.

The chosen hub ready for plating



The thread in the hub is protected by nail polish, ready for plating

The parts to be plated: general polishing and brass dent filling are needed before some nickel plate is applied

The exhaust header has been dechromed. It needs further polishing before I brush the plate with nickel (see part two)

Solder on with NZ Safety Blackwoods

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Skateboard project

THE Skate BANANA

As a youngster, Chris Gordon pinched his sister's roller skates to create a skateboard, igniting a lifelong passion for boards on wheels. Now in his 60s, nothing has changed for the ever-busy sheddie

By Chris Gordon | Photographs: Chris Gordon

Coming to a footpath near you. Maybe

The year 2024 finished with mixed emotions. I had just completed one of my favourite builds: Big Finks 498cc V8-powered Sidewalk Surfer skateboard, a homage to Ed Roth's 1960s Kustom Kulture.

However, issues at work cast a dampener on the festive season. Ongoing inclement weather during late December and January didn't help. What better way to release me from my end-of-year malaise than a trip to the Christchurch City Council's EcoShop?

My happy place

This place has been my go-to source for several recent projects, so hopefully it will provide some inspiration.

A destination suggestion in mid January incurred the obligatory eye roll from her in the passenger's seat, but nevertheless, we headed west to see what was on offer.

Strolling around the myriad of shelves and bins, I spotted a rather nice-looking snowboard. Blue, and with orange – my favourite colour! Interesting, but not feeling it. A few steps further on, someone had dropped off two roller storage bins full of racing inline skate wheels, all in sets of eight and in all colours of the rainbow, including orange. Gears are starting to turn. Wonder if there are any skateboards available? Sure enough, three to choose from, including, you guessed it, an orange one, albeit somewhat faded. Kismet. I'll have that.

Retracing my steps, I uplifted two sets of 110mm orange skate wheels and a set of blue ones in case a contrasting scheme might look appropriate. On the way to the counter, the orange snowboard was placed under my arm. In less than 10 minutes, not only had a plan been hatched, but I also had all the major components to realise it. All for less than $50. What malaise? On the way back to the car, the other half had found an 'as new' Simon Gault frying pan, so she was somewhat pleased she had come.

Getting after it

The snowboard was manufactured "near Canada" in the US as part of Lib's 2010 range, originally selling for around NZ$800.

MPC, also from the US but not claiming to be near Canada, manufactured the Road War inline skate wheels specifically for speed racing, selling for around NZ$30 each when new. The small skateboard was a Chinese-made, cheap and cheery Warehouse special that would have taken about NZ$30 from a trepidatious parent's coffers.

Back in the shed, I had already formulated the path forward. With a 'Skate Banana' moniker, it would be rude not to have the board live up to its name. A traditional skateboard layout, but all exaggerated. Four wheels in each corner to help balance the aesthetics and keep everything in proportion. The trucks would be salvaged from the small skateboard. A few other bits and pieces. All that remained was to do it!

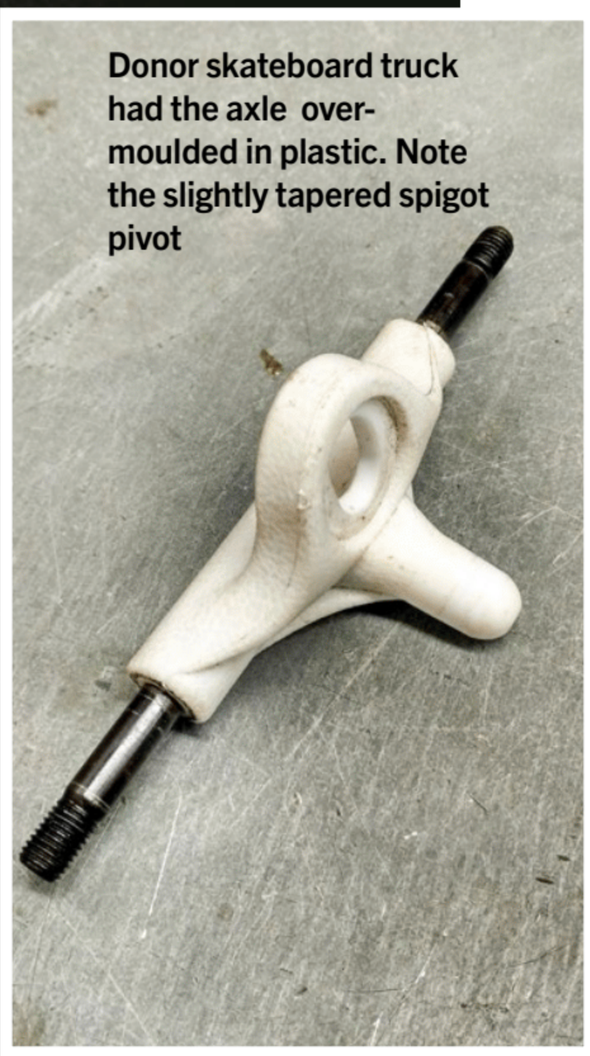
Laying out the components on the workbench in their general positions was followed by making a list of parts to be ordered. Thirty-two type-608 shielded wheel bearings from AliExpress for the 16 wheels and four M8x160mm 12.9-grade socket-head cap screws from The Boltholder for attaching the wheels to the axle main sections. Both are underway in short order. ▶

“THE SKATEBOARDING CRAZE REALLY BEGAN TO GAIN MOMENTUM IN THE LATE 1950S AND WAS A LAND-BASED REPLICATION OF WHAT WAS HAPPENING OUT IN THE OCEAN”

To keep the proportions right on such a large board, four wheels were used in each corner.

Axle assembly during construction. Note new spigot pivot

Completed truck and axle assembly fitted to the board



Donor skateboard truck had the axle over-moulded in plastic. Note the slightly tapered spigot pivot

Experiments with extensions to the original axle assembly were not successful

A quick trip to the local Vulcan Ullrich Aluminium branch and a bisected length of 32x25x3mm aluminium channel was in the back of the car.

What truck is that?

The defining feature of any skateboard is its trucks.

Trucks consist of a baseplate that is attached to the underside of the deck (that the rider stands on); an axle assembly complete with wheels, which pivots on two urethane bushings; and a pivot point.

When assembled, the truck enables the axle and wheels to turn in a defined arc, allowing the board to turn. Tilting the deck acts as a lever on the truck baseplate, which causes it to swing about the pivot points and, in doing so, turns the axle and wheel assembly.

An interesting fact is that the trucks at each end of the board operate in opposite directions. When moving forward, tilting the board deck to the left causes the front axle and wheel assembly to rotate counterclockwise about the centreline of the deck. Conversely, the rear truck causes its axle and wheel assembly to rotate clockwise. The net effect is that the board steers left with the front wheels following the left turn arc. Rear wheels speed up the turn by swinging the back of the board around to follow the front, essentially, but in a larger arc.

The birth of the skateboard craze

The skateboarding craze really began to gain momentum in the late 1950s and was a land-based replication of what was happening out in the ocean.

As surfing gathered momentum, so did skateboarding, with roller skates often cannibalised to create the skateboard. The front and rear sections of a single skate would be separated and attached to a wooden plank. In my younger days, I found from first-hand experience that this procedure was unpopular with the skate's owner, my sister. But needs must.

Like most things, this very basic arrangement quickly advanced and specialised skateboard trucks evolved. Over the decades, development continued. Today, trucks are manufactured for every imaginable use, from the low-cost beginner knee-grazers to special heavy-duty all-terrain types, to electric long boards, to finely tuned world championship–winning designs.

No matter what their design or cost, they all share the same principle. Whether it be your neighbour's children or world champion Tony Hawk. Tilt the deck, and the skateboard turns – all due to the trucks.

Skate Banana's trucks

I purchased the small skateboard specifically for its trucks.

Initially, I thought that I would be able to extend the original axles by way of short lengths of steel bar, duly counter-bored and threaded to slip over each axle stub. Although the original axle is a solid piece from side to side that has been over-moulded in plastic to create the assembly, the steel used was quite soft and not much better than mild steel. This deflected considerably with the axle extensions in place when pressure-simulating weight on the wheels was applied. A new idea was needed. This came in the form of completely new, fabricated axle assemblies that would integrate with the original small skateboard's truck baseplates.

Forming the main section of each axle was a 300mm length of heavy-wall seamless steel tube, 22mm in outside diameter. The outer ends were fitted with pressed-in mild-steel ferrules, each 60mm long with an 8mm diameter by 30mm counterbore and 30mm of M8x1.5mm thread. The counterbore receives 30mm of the cap screw's plain shank to provide support and the threaded section secures the cap screw into the ferrule. Each ferrule was left with 3mm protruding from the tube end. These were brazed to the end faces of the tube with Easyflow low-temperature silver brazing alloy.

More out of habit than necessity, the inboard ends of the ferrules were rosette brazed with Easyflow to the outer tube.

A rosette weld, or plug weld, is often used on overlapping joints to join them together. It comprises a small hole of about 6 to 8mm in diameter in the outer material, which is sweated and overfilled with weld or braze material to join both parts together. The weld/braze is finished off flush with the outer material and, when painted, is invisible.

The main axle sections now completed, the two pivot points of the original axle assembly needed to be replicated. These comprised two parts: the spigot pivot and the bushing

Mock-up during manufacture

plate. First, the spigot pivot.

The original axle assembly, being an over-moulded plastic piece, had a slightly tapered plastic spigot for the pivot that fitted into a counterbore in the truck baseplate. A soft plastic bearing was used in between.

The actual pivot point is where the extreme end of the spigot makes contact via the plastic bearing with the base of the counterbore in the baseplate. The issue I had with this original design was that the spigot was tapered, getting larger in diameter as it extended away from the pivot point end. As the axle and wheel assembly swung about the pivot point, the larger section of the spigot impinged on the bushing and sides of the baseplate counterbore. Distortion of the baseplate material resulted.

Fitting a ball end

To alleviate this, I considered that a ball end on the spigot pivot would be superior. As the axle shaft was steel tube, it made sense to use steel for the other axle assembly parts.

A short length of 10mm diameter steel bar was turned down to form a ball end on the outboard end. A waisted section above it would relieve any side pressure on the baseplate as it pivoted. The axle end was filed to suit the axle profile.

Next, the bushing plate. Working in conjunction with the spigot pivot are the two urethane bushings, mounted on each side of a flat plate that's attached to the axle. A central bolt extends through the bushings and plate into the baseplate to provide the second pivot point. For my axles, the interfaces between the axle tubes and the urethane bushes were fashioned from small triangular pieces of flat 5mm mild-steel plate. After filing to shape and a hole drilled for the through bolt, these were brazed to the midpoint of the axle tube with bronze welding rod. Due to the high loading on the spigot pivot and small contact area to the axle, Eutectic 16 high-strength brazing alloy united the two.

Finishing the axles

Brazing done, all traces of flux were removed, joints tidied, and the entire axle assemblies cleaned up, ready for paint.

Two coats of CRC black zinc, my go-to due to its easy application, satin finish, and good weathering properties, were applied. This completed the most involved facet of the build.

Determining the positions for the

One of the axle assemblies during manufacture. Note the rosette welds

Using the milling machine and DRO to ensure correct alignment of the truck baseplates

two truck baseplates on the board deck involved no particular science, apart from aesthetics. The board centreline was determined, and each baseplate was located equidistant from each end. Wanting to get the holes in direct alignment, I mounted the deck exactly in the middle of my milling machine's table. Triangulating the outward end of the board to each end of the table ensured both centrelines were perpendicular. Although made in China, the baseplates appeared to follow their American roots and had imperial measurements for the mounting hole pitch: 1⅝x2½ inches. Using the mill's digital readout (DRO) provided accurate locations.

Less bending, please, Mr Banana

A requirement for a snowboard is flexibility.

All sorts of engineering goes into ensuring that a completed board is fit for purpose and capable of handling the rigours out on the slopes. This includes having a fair degree of flexibility. Unfortunately, this is counter to the requirements of a skateboard.

Snowboards are usually furnished with colourful graphics on both sides, and the Skate Banana was no exception. Initially, the plan was to attach plywood to the underside of the board to provide stiffness. However, I wanted to retain as much of the logo and blue/orange underside as possible.

The decision was made to reinforce the underside with aluminium channels instead, with one on each side running for most of the board's length. Once the channel length was decided, each end was tapered, primarily for aesthetic reasons, but also to enable the board to slide over an obstacle, if that need arose. Holding one channel at a time in a vice bolted to the bed of the milling machine, an 18mm diameter end mill in the chuck removed the surplus material.

Time to adapt

Thin in section, especially at the ends, the boards "experimental H-Pop wood alloy core" didn't seem to lend itself solely to wood screw fastening of the channels.

A hybrid system was adopted. To provide effective clamping, each channel end was fitted with three M4x16mm countersink screws at 50mm pitch. These screws had holes drilled through the board and were countersunk on the top of the deck. Serrated flanged nuts on the channel side provided effective clamping at the points of most stress. Another two screws straddled each side of the midpoint. Five large-flange coarse-pitch 8Gx13mm wood screws at 50mm intervals provided infill between the M4 fasteners.

Holes drilled and fasteners sorted, the channels were deburred, rubbed over with a ScotchBrite pad, and cleaned with thinners. Two coats of my go-to paint on the visible surfaces were left to harden in the sun. The channel's flat underside was sans paint for better glue adhesion.

Removing old wax

Undersides of a snowboard get a hammering in use.

Rocks aren't always dodged. Gravity makes its presence known in gravel carparks, attracting anything that's not held securely. Gouges and nicks flourish. Some people shouldn't have nice things. It is common practice for wax to be applied to the underside of a snowboard, chiefly to provide a lower coefficient of friction between snow and board, but also to fill in blemishes. Skate Banana had suffered. Its "sintered UHMWPE" (ultra-high molecular weight polyethylene) base was consequently in ownership of a heavy coating of wax. It looked sub-optimal.

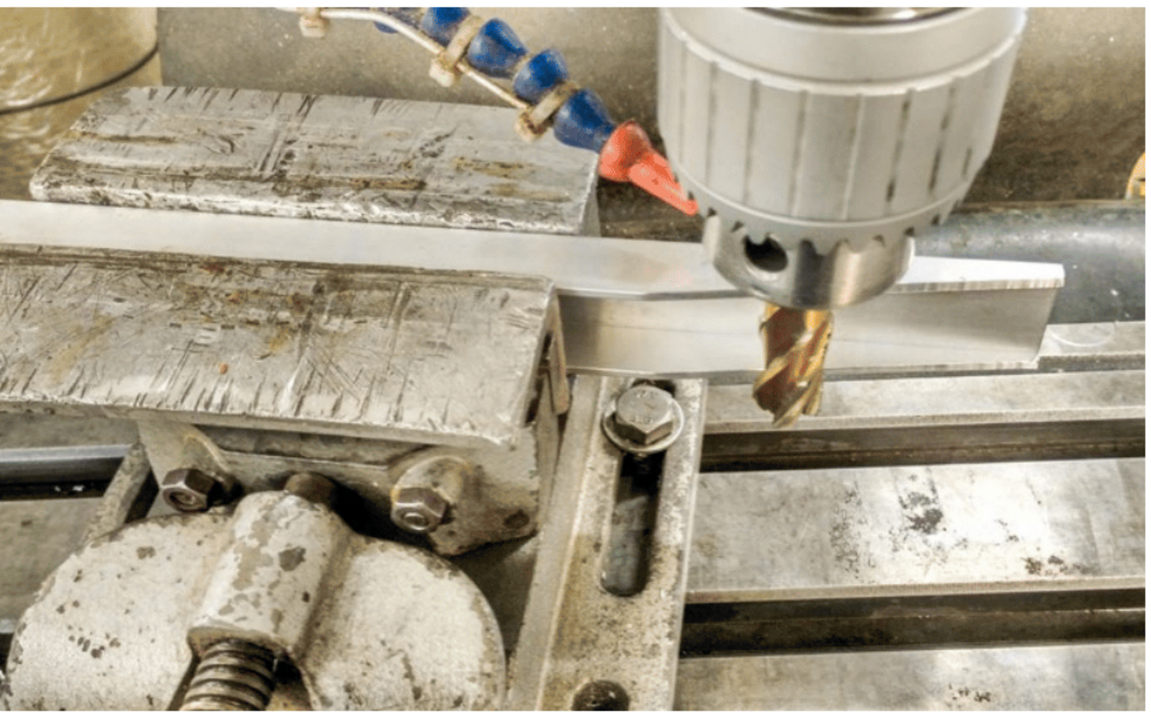
Time-consuming scraping removed the bulk of the wax, with the underside taking on a much brighter appearance afterwards. As the channels would be screwed and glued during final assembly, having the wax removed would improve the success of this bonding.

Wheels do another round

As the fabrication work drew to a close, the bearings arrived from AliExpress. Perfect timing.

Making the spacers that go between each bearing was relatively straightforward. A short length of 12mm diameter 6061 aluminium alloy bar was loaded into the lathe and given an 8mm diameter hole throughout its length. Lathe tailstock set to provide a stop, the sixteen 10-millimetre-long bearing spacers were quickly parted off the hollowed bar stock.

While at the lathe, 16 thin spacers were machined up. These 12x8x1.6mm steel washers space each wheel from its neighbour to ensure no interference between the wheels during operation. Another is installed between the inboard wheel and the axle to prevent the



Held in the vice, the ends of each channel had tapers cut using an 18mm end mill cutter

Donor parts from EcoShop

Manufacturing completed, all parts were readied for final assembly

bearing shield from rubbing on the axle face.

Although no longer required by their previous owner, I was grateful to them that they had the good sense to make them available for someone else to use by dropping them off at the local recycling centre. Deciding the blue variants would be put aside for now, the orange speed skate wheels cleaned up nicely after a quick wash in the sink. Installing the bearings and spacers was a very simple task, made easier still by using the quill of my drill press to push each one into position in the wheel hub.

Final assembly

All remaining parts were cleaned, painted, and arranged for final assembly.

First to be installed were the two support channels. Epoxy glue was mixed and sparingly applied to the mating surfaces. All of the M4 screws and nuts were loosely installed to provide alignment, followed by the large-flange woodscrews. Tightening all fasteners and removing the surplus glue that had oozed out completed the job.

Four oblong rubber bushes were sourced from Bunnings to act as axle bump stops. Installed near each end of the channels on the outboard sides, these were positioned so the axle made contact with them and not the deck – not only to provide some cushioning but also to prevent any harsh noises emanating from the board during sharp turns.

Next, the truck baseplates met their new homes and were tightened into position. Pivot bearings, urethane bushings, and axle assemblies were pressed into position and fasteners were fastened.

Cap screw, wheel, spacer, wheel, spacer, wheel, spacer, wheel, spacer, axle. Repeat, repeat, repeat.

Voilà

So there you have it.

Seventeen days and a little over $100 later for the parts used and a disparate grouping of abandoned parts was recycled into an oversized, left-field skateboard.

How does it perform? Well, the racing wheels have certainly lived up to their name, too much so for my three score and some. But really, that wasn't the point. What has been achieved, though, is proof that with some time and effort and not a lot of money, one's demeanour can be vastly improved in the shed.

Tony Hawk, eat your heart out

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TRIUMPH

FOR THE RIDE

By Bob Hulme | Photographs: Bob Hulme

FROM IDEA TO REALITY

Part 2

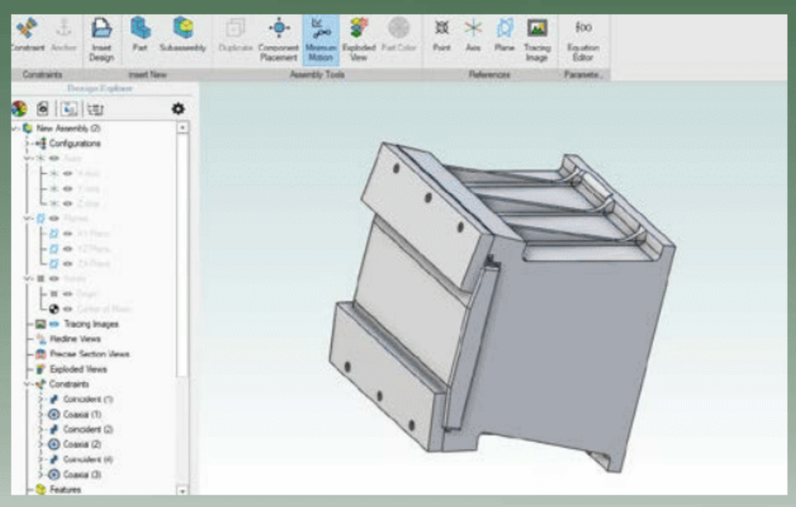
Bob has completed the 3D digital model of a visor for a digital SLR camera using Alibre Atom 3D software. Now, he needs to create it using a 3D printer. Dilemma: should he purchase a printer or use a local 3D printing service?

In the last issue, *The Shed* No. 121, we created a 3D digital model of a visor for a digital SLR camera using Alibre Atom 3D software.

The design was done with 3D printing in mind as a cost-effective way of manufacturing for making just one visor. The process of turning this imagined part into reality is remarkably simple due to how easily 3D printing programs and 3D CAD programs talk with each other.

Through the slicer

The programs that prepare a 3D file (of an item to be made) so they can be



3D digital model of the camera visor completed using Alibre Atom 3d software

produced using a 3D printer are called 'slicing' programs.

This is because they slice the digital model of the part to be made into thin slices representing each layer of material applied by the printer nozzle. From those slices, the program then issues instructions in G-code to the 3D printer to define its movements for each layer. G-code is a common language for CNC machines like lathes, milling machines, routers, and laser profile cutters.

No printer, no problem

I do not have a 3D printer myself, even though I would love to have one.

So, a brief Google search turned up businesses that offered a 3D printing service. To my amazement, there was a company near my home that offered a range of services, including some different 3D printing types and a variety of material options. Its website was even more amazing, as there was a feature that provided a quote for making the part almost instantly. All that was necessary was to upload the Alibre file of the part and select the type of material and colour, as well as the type of 3D printing process. Check it out: makethis.nz.

The preferred file format is STL. While this is not the format that Alibre normally uses, it is a simple task to resave the file in the STL format to make it ready for sending to your chosen 3D printing service.

Which material?

Choosing the best material to make the visor from was governed by my wanting to use the lowest priced 3D printing process. So, the plastic filament-fed process would be the choice, as I was not too concerned about achieving a high standard of finish.

The choices were:

PLA: Usually the lowest cost material made from corn starch or sugar cane. The least resistance to temperature or UV deterioration.

ABS: High impact resistance and generally good overall resistance to temperature and environmental factors. However, it readily dissolves in acetone.

PETG: Easy to print with. Good durability and chemical resistance.

Nylon: A well-known plastic material. There are several types of Nylon with different uses. It can absorb moisture, which can be significant in some applications.

TPU: A flexible type of material that is good where some degree of flexing is necessary.

I chose ABS, as it met the impact resistance and UV tolerance suited to the task at the minimum cost. Exposure to acetone was deemed to be a very low risk.

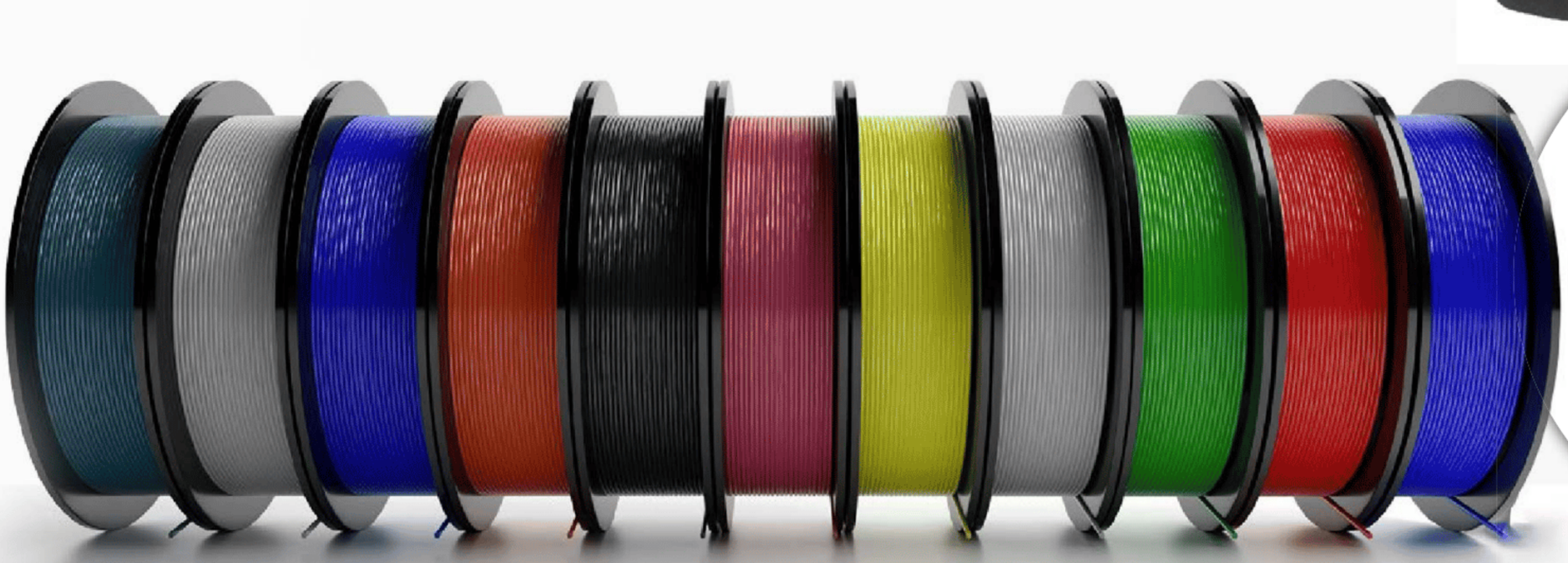
Helpful feedback

After I had submitted the file containing the design of the visor and

PLA

Photopolymer resin

TPU



"I do not have a 3D printer myself, even though I would love to have one"

Glare is not a problem with the shroud fitted

keeper plate with the OK to go ahead, I had a call from Andrew suggesting a change.

You may recall that I unashamedly included some lettering on the side of the visor with my surname. Andrew explained that it would give a better result if the lettering were inset rather than protruding from the surface. This was because of the size of the lettering and the type of 3D printer selected. Good advice. I modified the design and resent the file.

Two days later, the parts were ready to collect. (Normally, the parts are couriered to wherever the customer lives, but I wanted to discuss the result.) Turns out, I was delighted with the parts, and Andrew had no issues producing them.

Assembly

Putting the keeper plates onto the visor body was straightforward.

Stainless-steel self-tapping countersunk screws (that's a mouthful!) were purchased ahead of time, as I had designed the parts to suit a particular size of screw.

However, while I had designed the holes in the visor body to suit the threaded end of the screws, I had just specified a nominal size for the clearance holes in the keeper plates. This was because I was unsure how they would turn out, being 3D printed. Anyway, I need not have worried. What this meant was that I had to drill them out to a size where there was some clearance on the screws, but still snug for a good location.

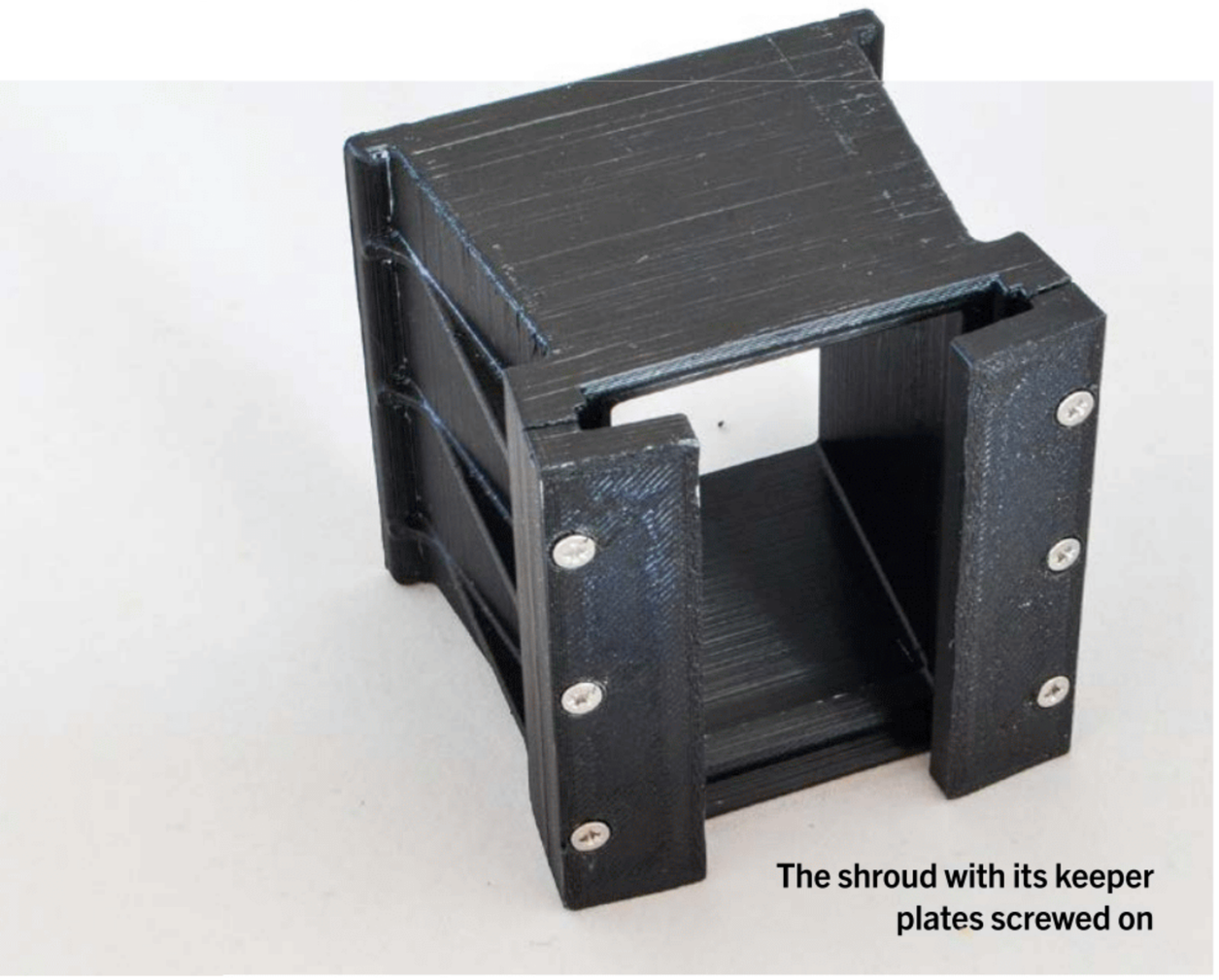
I also elected to countersink the holes as a post-printing operation. This worked out fine, and the holes on each part lined up perfectly. The nominal holes included in the 3D-printed parts served as pilot holes for the drilling.

"Good advice. I modified the design and resent the file"

Fitting to the camera

At first, I was elated when sliding the visor onto the swing-out viewer of my Nikon camera. The fit was perfect.

It slid on with a bit of resistance, so that it was easy to attach yet tight enough that it could not slip off on its own. However, my joy turned to dismay



The shroud with its keeper plates screwed on

Glare on the camera's viewing screen

when it did not slide all the way on. Close inspection showed a slight bump shape at the hinge end of the camera's viewer that I had missed when creating a 3D model of it in Alibre. Anyway, a few minutes with a half-round file corrected the visor shape at one end. I carefully measured the change I had made and corrected the 3D design in the Alibre program. So easy! So much easier and less messy than rubbing out and changing a pencil and paper drawing. Now the design is improved and ready to go if I want to get any more of them made.

Doing it yourself

Many libraries around New Zealand now have maker spaces or 'creative spaces that feature 3D printers available for use by the public.

The machines tend to be small and basic due to cost and are intended as a means of learning about the process rather than serious production facilities. Check out what is available in your area, and if they are not available, ask why not. Our young people (as well as anyone who wants to know) need the resources to learn. Books are, in general, losing favour as we use digital means for our reading needs. Libraries can maintain popularity by adding features like 3D printers and computers with design software installed.

3D printing: what's it all about?

3D printing has been around for a while now, but is just starting to really get into its stride. There are a range of machines available for manufacturers, as well as some suitable for use in the shed at home.

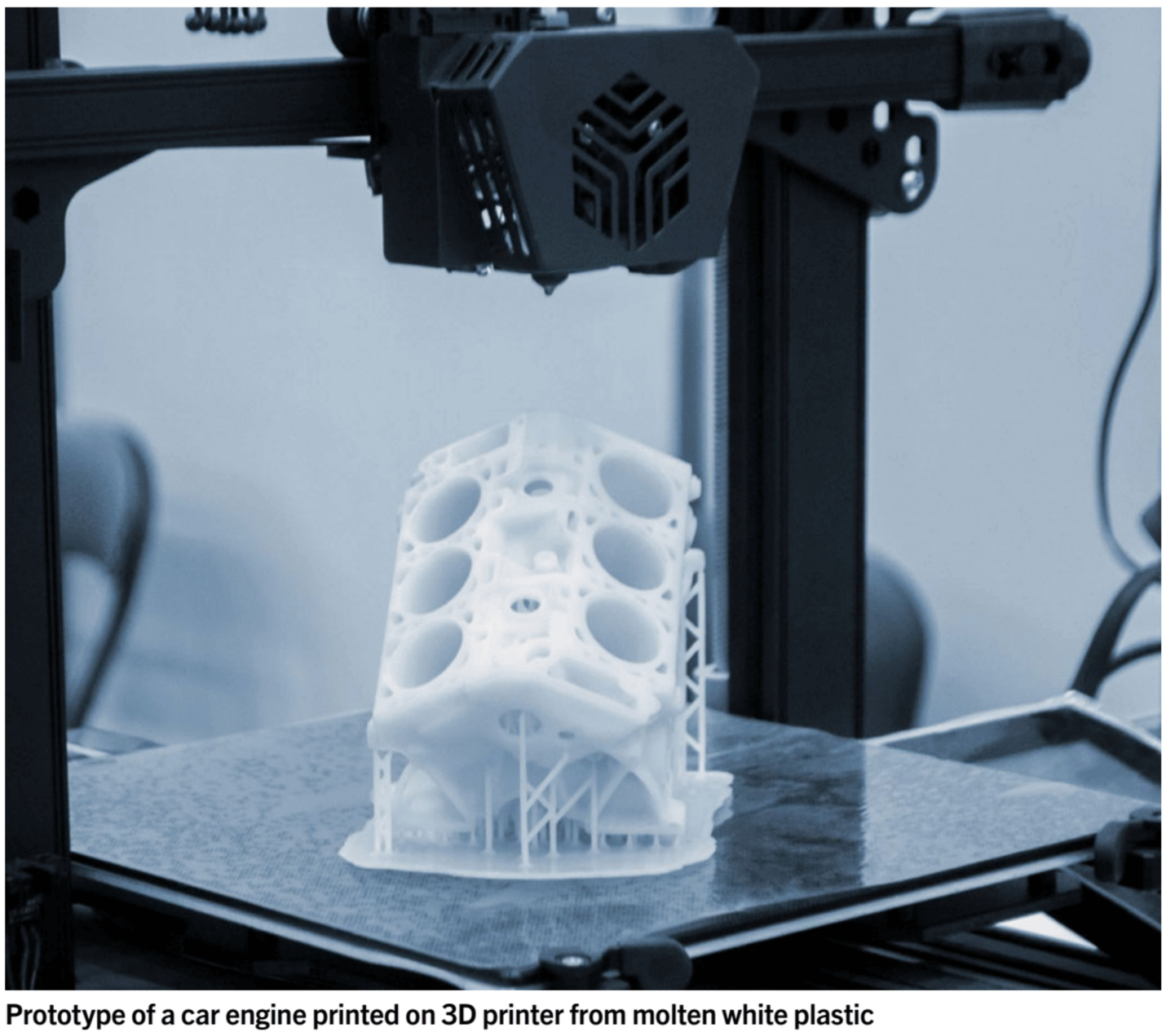
The beauty of this manufacturing process is how quickly designers can make a working prototype from their 3D CAD drawings. Shortened development times represent huge cost savings for manufacturers. That's not all. 3D printing makes it much easier to produce one-off items such as customised implants and prosthetics in the health sector. At home, you can make replacement parts when making repairs to a range of household appliances.

Additive manufacturing

When metal parts are made on a

A modern 3D printer printing a metal turbine. The future of machine part manufacturing

3D bioprinting for tissue engineering may be a reality in the near future



Prototype of a car engine printed on 3D printer from molten white plastic

metalworking lathe or milling machine, material is cut away from a slab of metal to produce the required item. Therefore, this can be referred to as 'subtractive manufacturing'.

The process of 3D printing is termed 'additive manufacturing', because it adds material to make the required item.

Basic principles

If you imagine an inkjet printer, like the one you probably have hooked up to your home computer, that is filled with a thick ink.

This thick ink is squirted through the ink nozzle onto the page when you hit the print button to print a document. The ink is so thick that you can easily feel the bumps of the words and lines printed on a page. Imagine if you were to put the same page through that inkjet printer several times, the buildup on the page would get higher and higher. That is the basic principle of 3D printing.

To make complex parts, the print nozzle is moved over a stationary bed plate to build up a layer of molten plastic material using the same technology employed in CNC machine tools. Each printed layer varies from the previous layer to make the required item. Special slicing software cuts the item's design into layers that tell the CNC software where to move the nozzle during each successive layer.

Variations

Having just described the basic process, it would seem like this is a simple, straightforward method. Nope! 3D printing has morphed in a number of directions. There are machines that can make items from metal, ceramics, thermoplastics, and even liquid resins. As you read this, there is research ongoing into 3D bioprinting for tissue engineering to make replacement animal organs.

Let's take a look at the different types of 3D printers.

Raw material

It is probably easiest to group the types of 3D printers by grouping them according to the form of the raw material they use.

1. Plastic filament

Plastic filament, much like the plastic string used in your weed eater, is fed into a heated nozzle, which builds up the layers across a bed plate in a similar way to that described using the inkjet printer analogy earlier.

Usually, there are no further processes needed, and the required item is finished. This type of 3D printing is known as either 'FFF' (fused filament fabrication) or 'FDM' (fused deposition modelling). As this technology has grown, some brands of 3D printers seem to have come up with their own terms! Generally, the object being made remains still on the bed plate, while the nozzle depositing the plastic material moves just above and across the face of the bed plate according to the directions from the software for that particular slice.

Once each slice is completed, the nozzle lifts a small amount and immediately starts building up the next slice. This sequence repeats until the object wanted is complete.

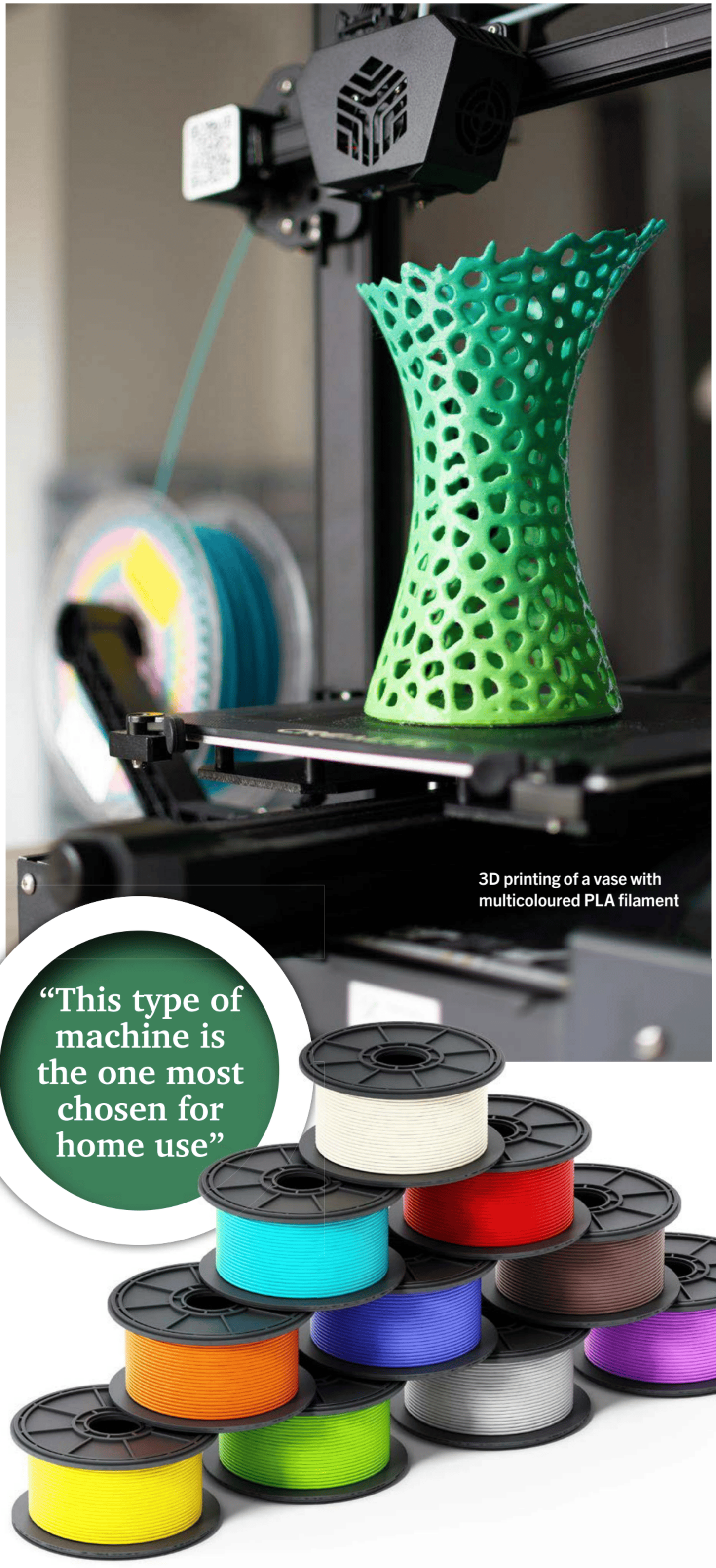
This type of machine is the one most chosen for home use. The price increases with bed size, height, and other features. Adding an enclosure to shield the process from draughts is often done by sheddies, who have started with a basic machine, then made their own enclosure. Another helpful feature is a heated bed plate, which slows the cooling of the printed object to alleviate warping.

2. Liquid resin

This type of 3D printing uses UV-curing liquid resins instead of plastic filament.

The process happens upside down compared with in the filament machines. The bed plate is suspended from above and into the tank of resin. The light beam nozzle moves within the tank, pointing upwards at the bed plate and close to it (the slice thickness initially). Its movements are much the same as those of the filament nozzle. When each slice is finished, the bed lifts up by the slice thickness.

This is referred to as 'SLA'



3D printing of a vase with multicoloured PLA filament

> "This type of machine is the one most chosen for home use"

“Objects made this way have a better finish, and more intricate detail is possible”

(stereolithographic) or ‘DLP’ (digital light processing) printing and is actually the oldest form of 3D printing.

A later development of this is where the light beam nozzle has been replaced with a flat screen, which emits light that forms the picture of the whole slice. Imagine it being like an LED TV screen. This means that the whole slice of resin is UV cured in one go. A huge time saver.

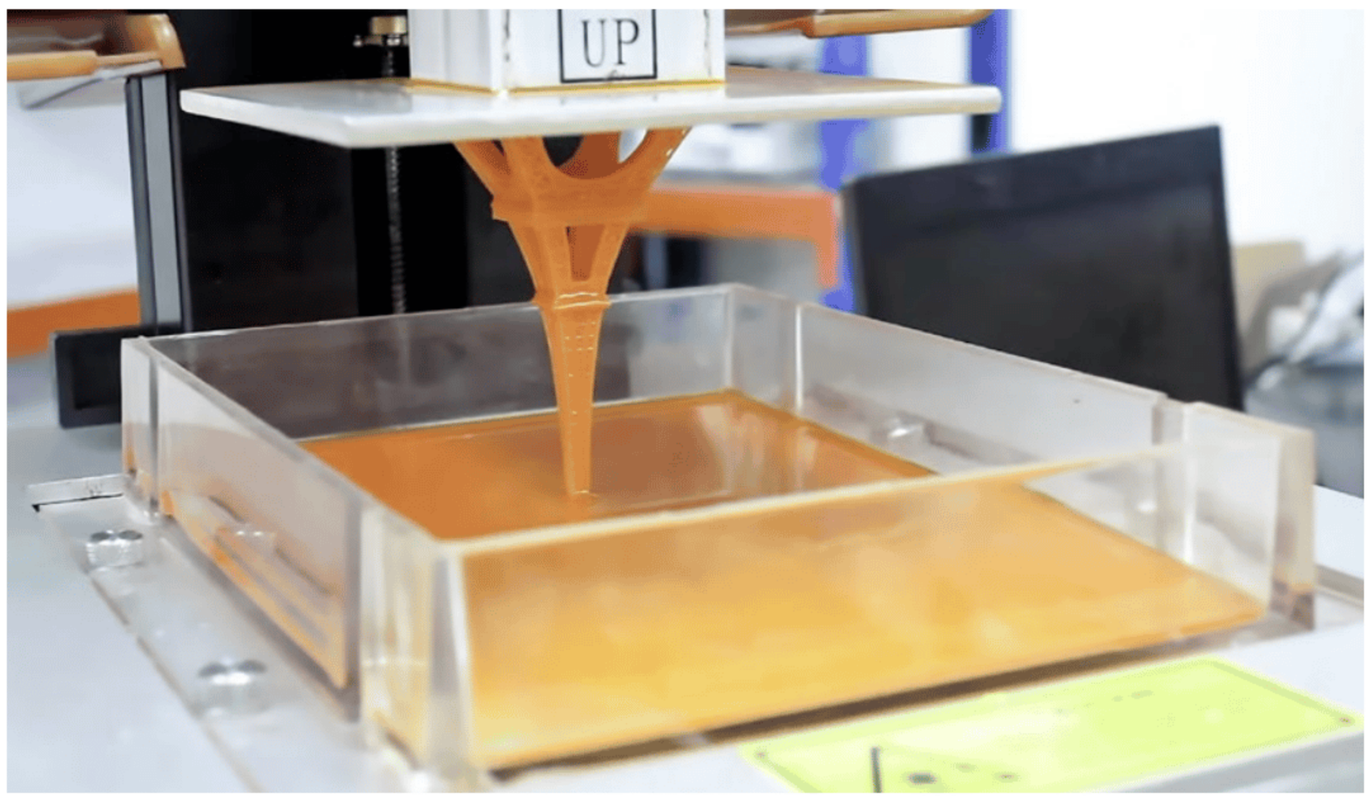
Objects made this way have a better finish, and more intricate detail is possible.

3. Powdered material

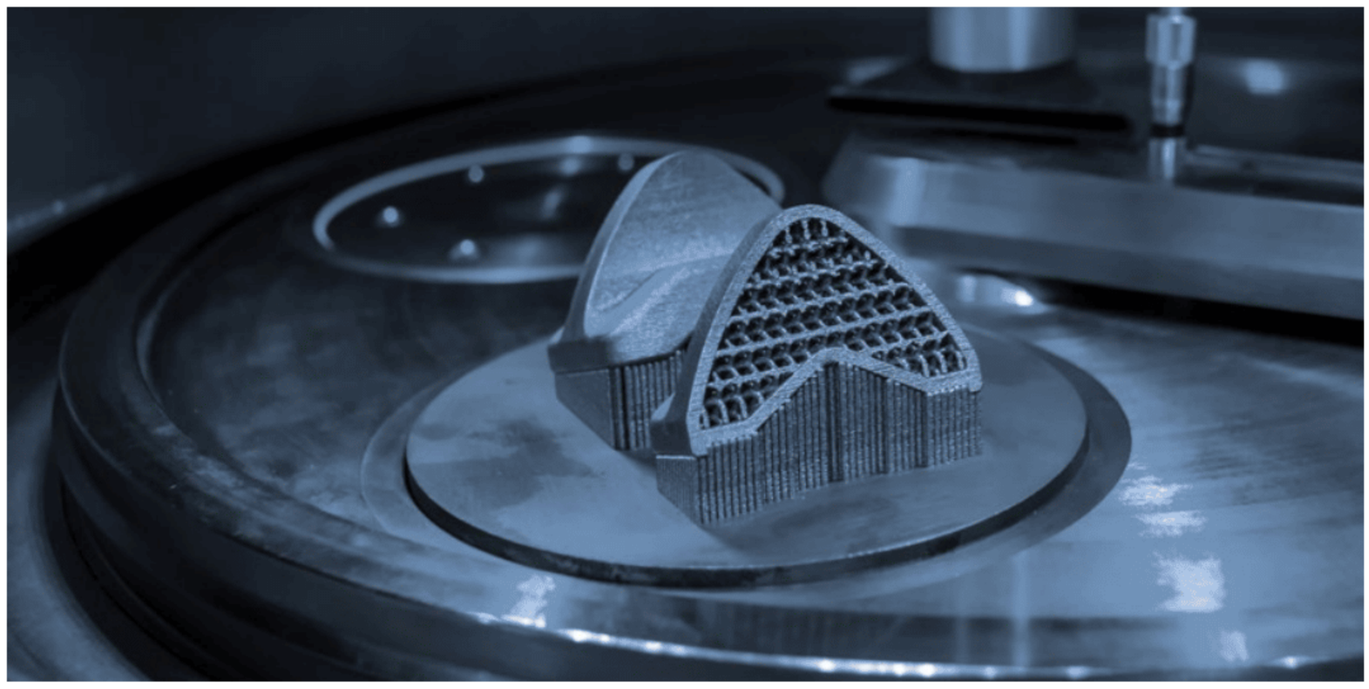
Printed objects are possible from metals and ceramics using powdered forms of material and laser beams to fuse the particles together. The process is known as ‘SLS’ (selective laser sintering) or ‘PBF’ (powder bed fusion). The main advantage is that objects can be made from materials not possible by using other methods. The disadvantage is that these machines are the most expensive.

Exciting technology

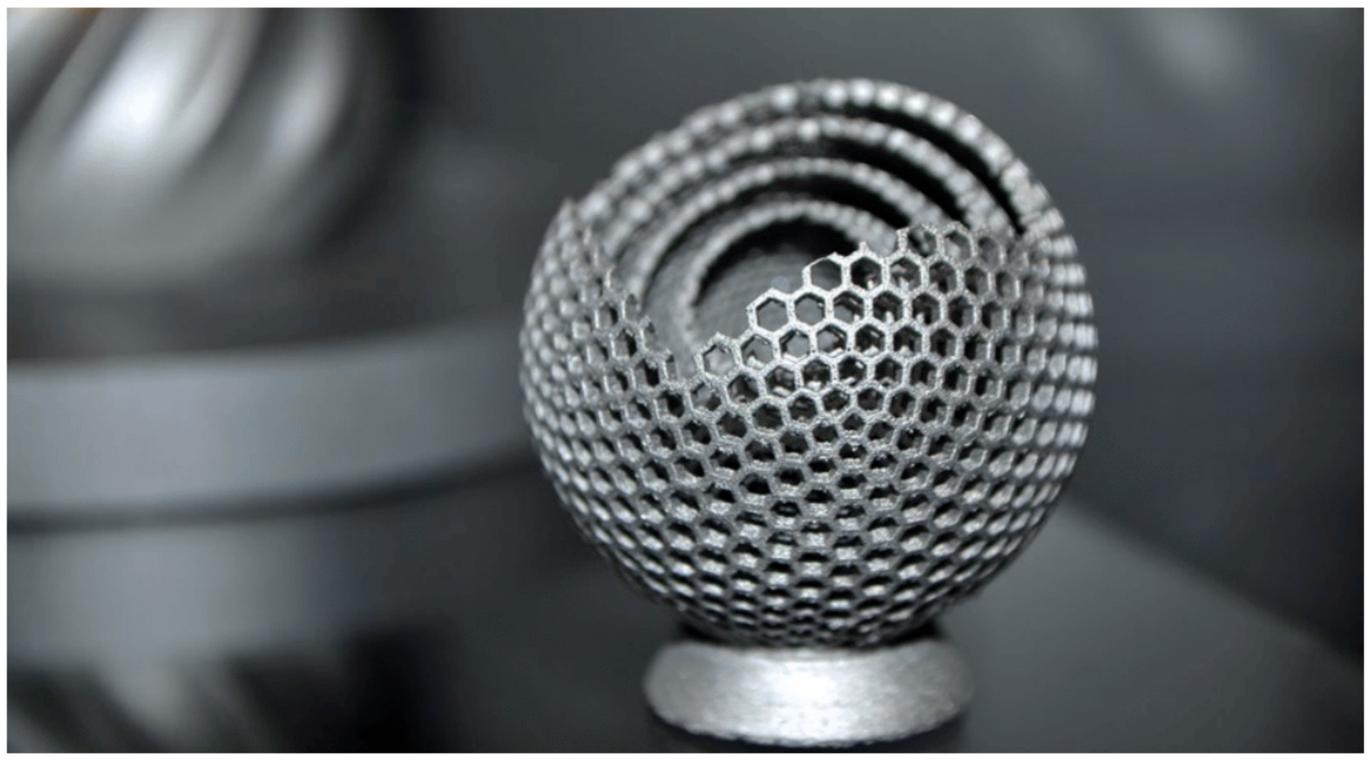
3D printing is one of the most exciting technologies for making anything physical at the moment. The process has taken a relatively slow path from idea to commonplace in the manufacturing industry. The development is continuing, and the future promises amazing developments such as printed animal organs; greater accuracy; and of course, food. Imagine a future where we can download a program to print a spare part on our home 3D printer rather than waiting for a parcel to arrive. Bring it on!



Making an Eiffel Tower model using a liquid resin type printer



Object ready to be removed from a powder 3D printer



Object printed on a laser sintering metal 3D printer

Metal 3D printer

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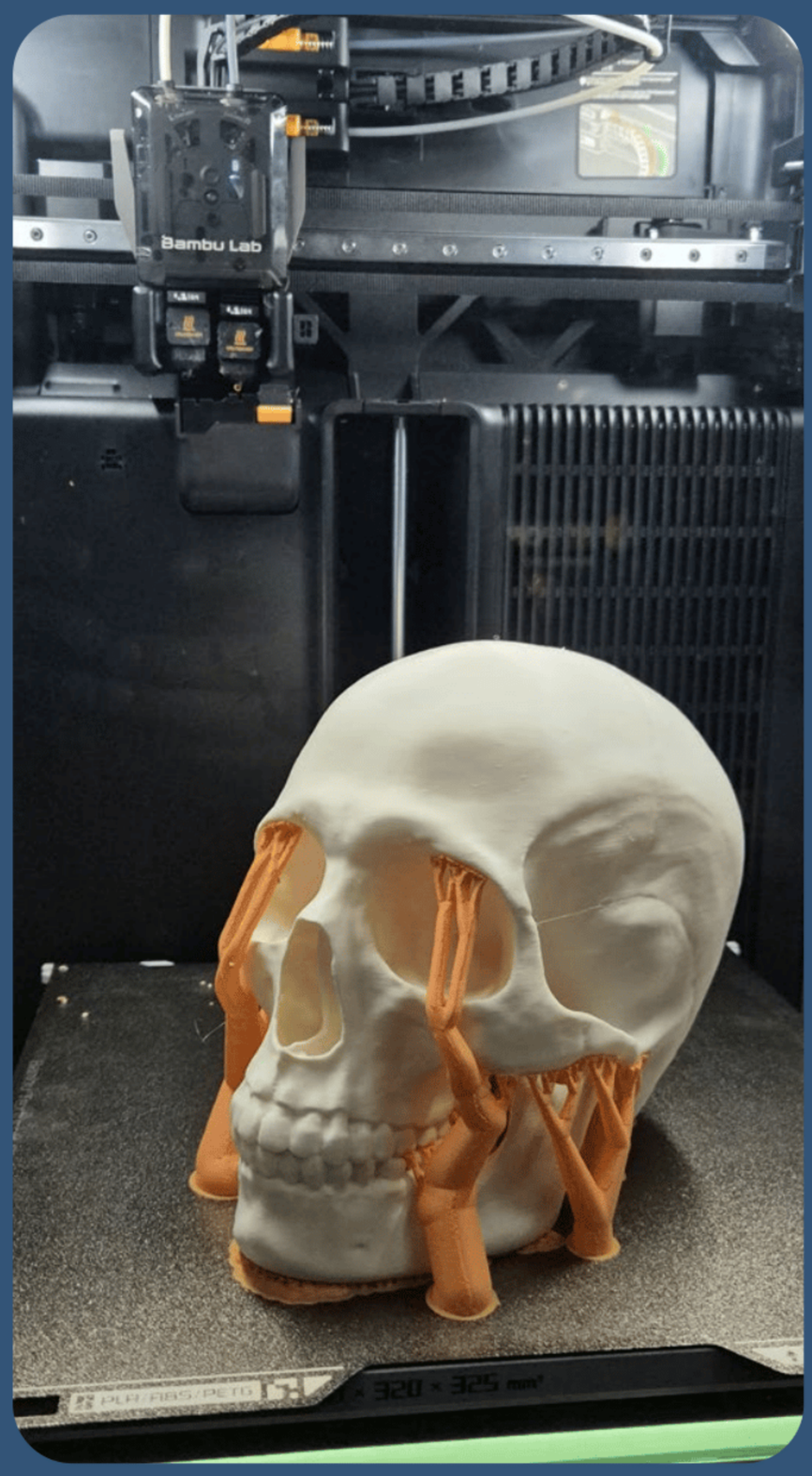

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THE ROGER MAHAN HERITAGE CENTRE

Roger Mahan was an earthmoving contractor who considered any job involving rock between Bluff and Cape Reinga his domain. Concerned about historically significant tractors being sold overseas, he decided to gift his extensive collection of cars, tractors, and earth-moving equipment for the public to enjoy

A busy tourist trail runs south from Christchurch on State Highway 1.

At Rangitata Junction, south of Ashburton, it turns onto State Highway 79 (called 'Route 79' locally) through Geraldine to Fairlie and then over the Lindis Pass on State Highway 8 to the southern lakes, Wanaka and Queenstown, the tourist playground.

Travellers typically break their journeys in the trail's small towns only long enough for a toilet stop and a pie. In the case of Geraldine, they may be making a mistake, because the pretty town, nestled at the edge of the foothills of the majestic Southern Alps, is home to a cluster of museums which would strongly appeal to your average sheddie.

Geraldine is Museumville

There is the long-established Geraldine Vintage Car and Machinery Museum at 178 Talbot Street (featured in *The Shed* Issue No. 100, Jan./Feb. 2022), Geraldine Military Museum at 1 Talbot Street, Paul Robin's Route 79 Museum at 10 Craig Road, and the Geraldine Historic Museum in the centre of town.

In 2020, on the northern side of the town, the Roger Mahan Heritage Centre on State Highway 79 opened. It is owned by the New Zealand Cultural Heritage Charitable Trust and is run by a five-member management board chaired by Peter Lyttle.

The trust was set up in 2003 by Roger Mahan after he became concerned about historically important tractors being sold overseas; its purpose is to preserve vehicles of historic significance in New Zealand. The trust eventually purchased 9ha of land to the north of Geraldine and had Thompson Construction and Engineering of Timaru build a 5600m² industrial building there. Roger gifted his very considerable collection of earthmoving machinery, antique automobiles, and other items of interest – "He was interested in many things," Peter Lyttle tells me – to the trust, where they make up a significant portion of the large number of items on display at the Roger Mahan Heritage Centre.

Rock was his province

Roger Mahan was an earthmoving contractor who, in his day, regarded

any job between Bluff and Cape Reinga which involved rock as his province.

He started lime production at Hilton in South Canterbury and then restarted lime and phosphate production in Milton, south of Dunedin, at the old Milburn Cement works. He ran quarries all over the South Island and installed water supplies and fibre-optic cables in many districts using equipment for which he held the patent. By any standard, he had an outstandingly successful career. He died at the age of 86 earlier this year.

In 1969, when he was 31, he won a contract from the New Zealand Government to install breakwaters and over 100km of road on Chatham and Pitt Islands. His account of fulfilling the contract reads like an adventure story. He was planning to use gear he already owned on the job, but – and this turned out to be crucial – he also bought from the International Harvester Company six new tip trucks, two new TD15 bulldozers, one 75 drop-loader, and a 65 off-loader.

The Chatham locals were not happy

There was opposition on the islands to the roading work being done by non-islanders and protests on the Timaru wharf as the ship, chartered by Roger and filled with his machinery and gear, including several tons of explosives, was leaving.

The ship's crew, at the last minute, declared that it wasn't taking the ship to sea in solidarity with the protesters. Roger's insurer then decided that a striking crew was a risk it hadn't allowed for and cancelled his insurance.

Things were getting serious

Help came in the form of the International Harvester Company. Roger met with the New Zealand management of the company in its Wellington glass tower. They rang Chicago, getting a director out of bed. Roger could hear him on the phone; perhaps the man had raised his voice.

"Let the lad go!" he said, "We'll appropriate all the finance! We'll take over the insurer!"

The opposition melted away. The islanders turned out to be friendly and

John Welsh, chairman of the trust, in the fireproof archives room

Some of the extensive collection of high-quality models on display

This is an early photo of the local 1907 De Dion which is on display and still in original condition

1944 Caterpillar D81H

helpful, and the Chatham Islands County Council Chairman and Roger got on exceptionally well. They worked out between themselves the best route for the roads, not following the less practical 'paper roads' which had been drawn on earlier maps. The roads were surveyed and designated as legal roads after they were built.

The new equipment was paid off in less than 18 months – Roger was on his way.

A love of vintage machinery

Roger had an appetite for taking on big projects, excellent skill in blasting rock out of a quarry, and a lifelong love of old machinery.

He had a 1922 Model T Ford and a 1904 Argyll while still at school. He regretted selling the Argyll and only recently managed to buy it back. Both cars are on display at the heritage centre. Before the heritage centre building was built in Geraldine, he had earthmoving machines from his early contracting days stored at various locations. Some were on public display at his Milburn Lime company in Milton.

The trust has bought machines of the type Roger used in his business which it didn't already have an example of. Other vehicles have been loaned or donated.

The vintage speedway cars are owned by Peter Lyttle. One is No. 36, 'The Zottarelli Special', built in the US in 1939. It is completely original and is possibly the oldest running speedway car in New Zealand. It has a 120 cubic inch Ford 9N tractor engine with a 'Babe Stapp' high-compression alloy head and twin Winfield carbs.

The other was built by Kurtis Kraft in America in 1947 and is powered by the legendary Offenhauser four-cylinder racing engine. Peter's 1939 MGTB (the predecessor of the iconic MGTC) and 1924 Beardmore Supersports sprint car are also displayed. The Supersports is thought to be the only survivor of the 11 built. Cyril Paul drove a modified Supersports to the fastest time of the day up the famous Shelsley Walsh Hill Climb in England in 1925, beating all comers. Second was Raymond Mays in a Brescia Bugatti.

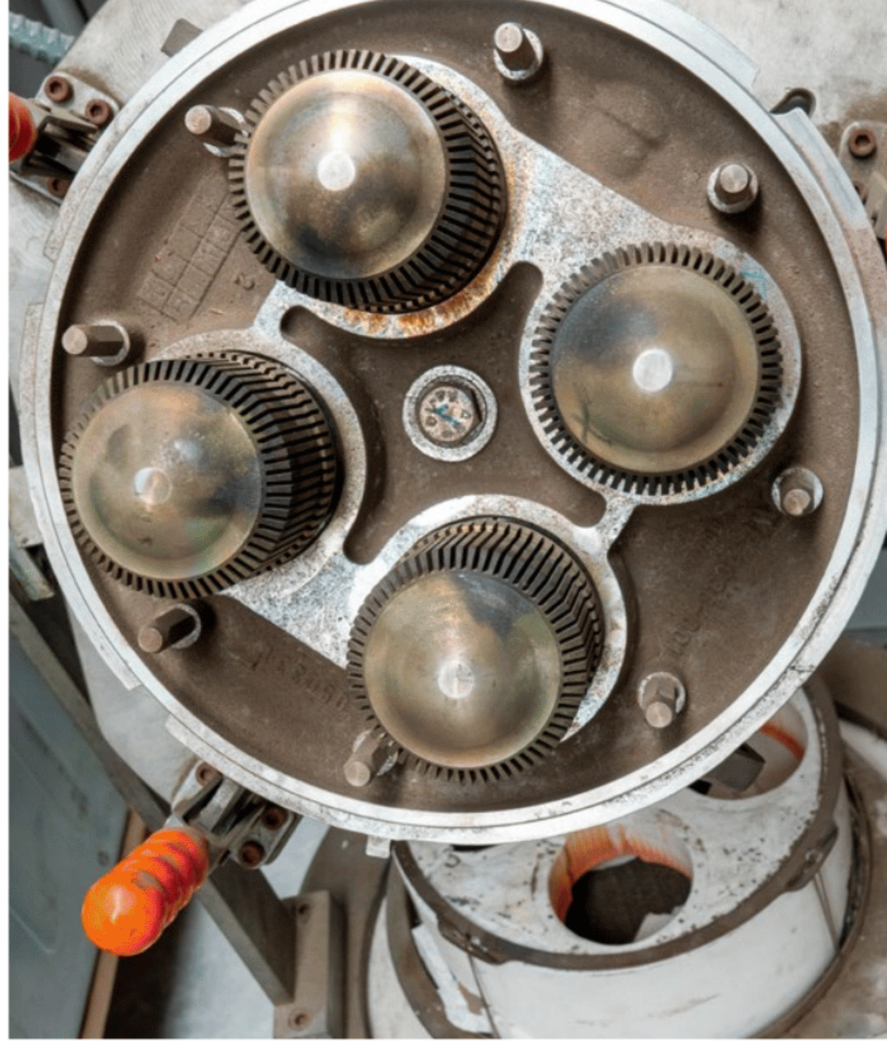
The heritage centre grows

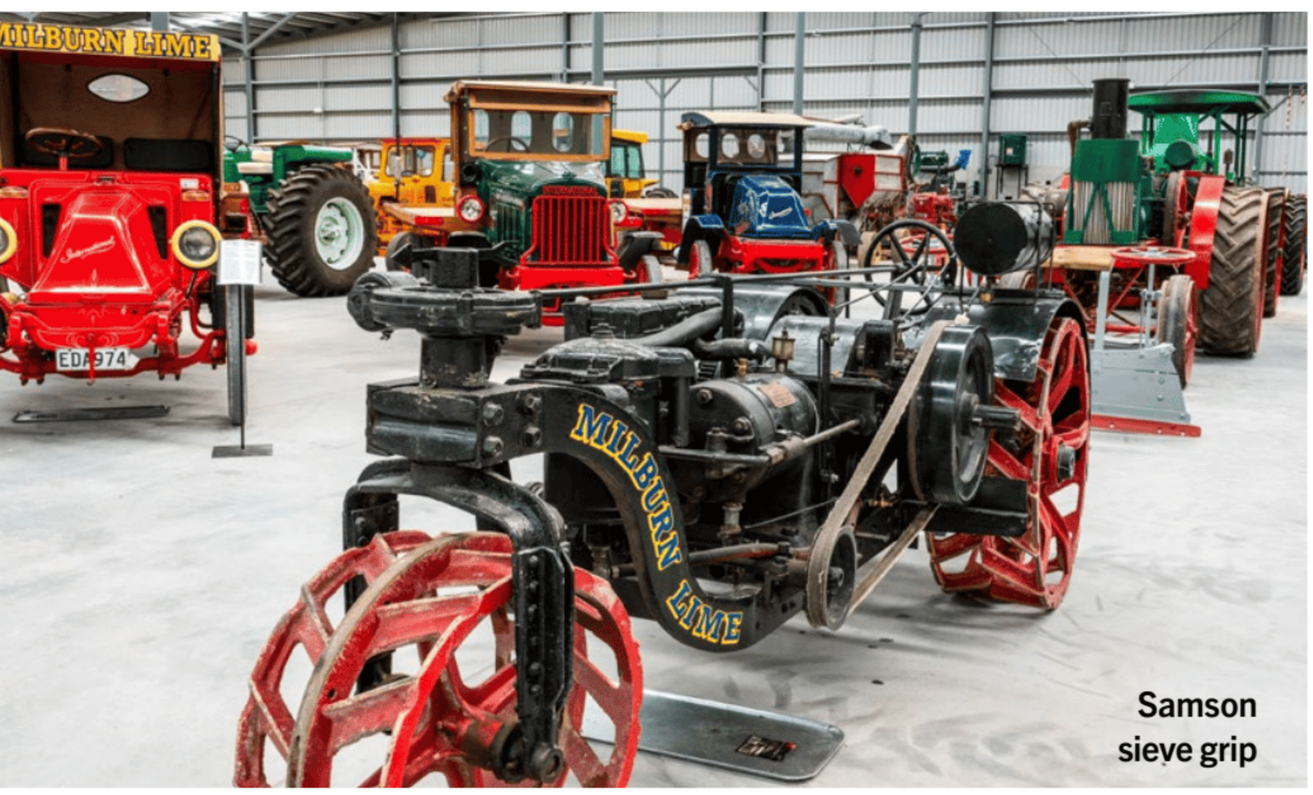
Behind the Heritage Centre are storage sheds, some of which hold a few of the

Two of the several veteran Darracq cars in the collection, dating from 1904

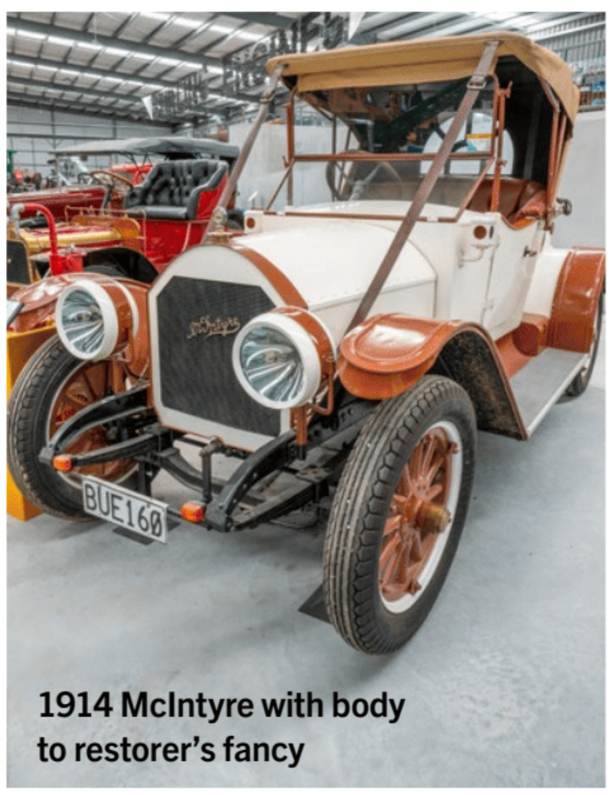
Ericson hot air pumping engines

A rare sight is the three rigged draglines in a museum building

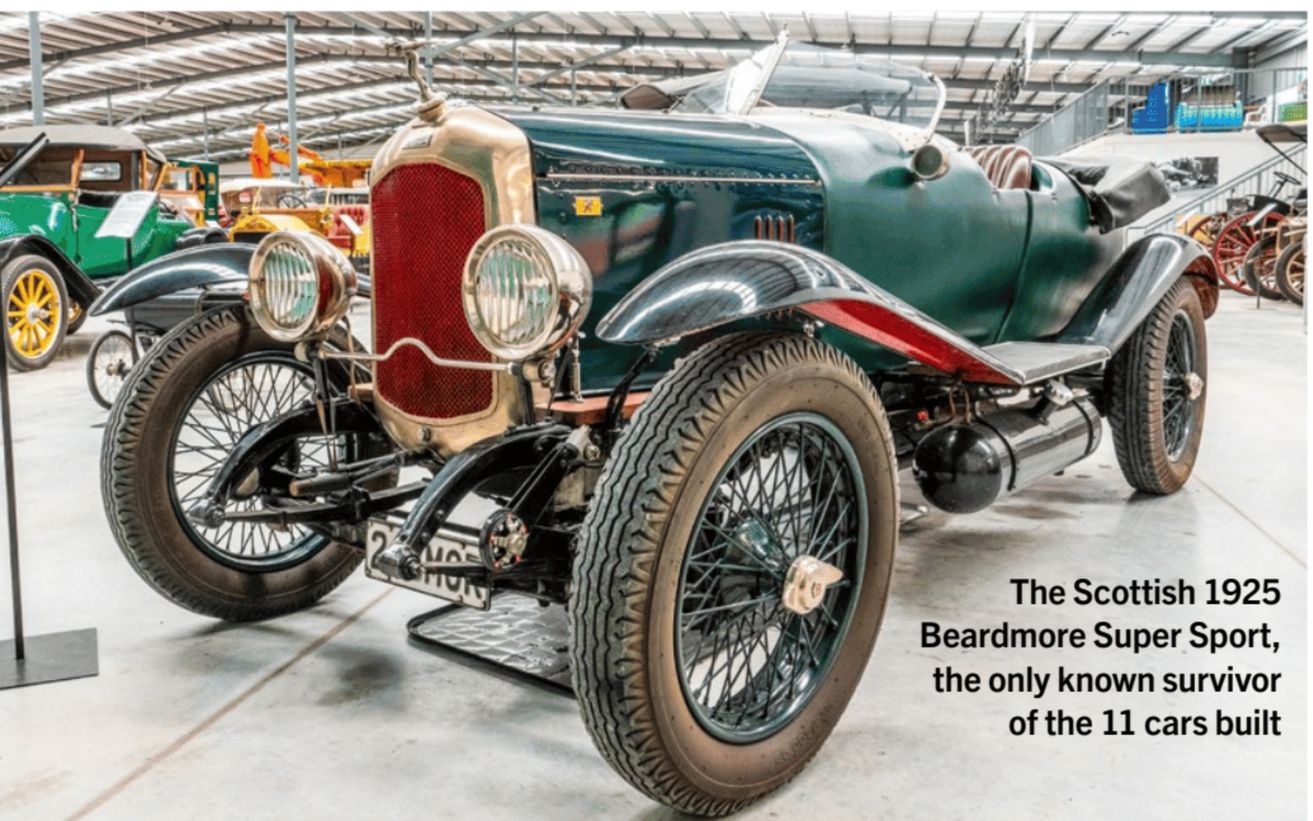




Samson sieve grip



1914 McIntyre with body to restorer's fancy



The Scottish 1925 Beardmore Super Sport, the only known survivor of the 11 cars built

vehicles of the Forest and Rural Fire Heritage Museum.

Its head, Steve Ochsner, aims to eventually display vehicles and equipment which tell the history of rural firefighting in New Zealand. There is a Mahan family connection here, as Roger Mahan's father started the Peel Forest Fire Party in 1954.

Thompsons have carried out a lot of building work over the last year or so at the heritage centre: a stylish entrance and reception area (under construction), a rugged mezzanine area for the World Stirling Engine Collection, and a climate-controlled 720m2 carriage house to display some of the horse-drawn vehicles of the National Carriage Museum of New Zealand.

The carriage house is constructed with large 100mm thick prefinished insulated panels. Because these panels are structural, the steel framing has been significantly reduced, giving the building's interior a striking, almost severe simplicity.

There are no windows. Bright electric lights are automatically switched on when visitors enter the building; the rest of the time, the exhibits are in total darkness, safe from the deterioration of wood and fabric caused by ultraviolet light. The aim is to preserve the gigs, buggies, coaches, and other carriages displayed, many of which still have their original paintwork and upholstery, in optimal conditions, while still making them available for viewing and study.

Roger Mahan's legacy

A replica of a repair shop for contracting equipment from about 1950 is being built in a corner of the main building, with Geraldine locals and others further afield donating some of the gear which will equip it, such as old lights, tools, and an ancient petrol bowser.

A model of the lime extraction operation at Milton is also under construction. A children's lime play area is a popular attraction.

A group of volunteers works at the heritage centre on Saturdays, and Roger Mahan would usually call in to chat with them, tell stories, and talk to visitors. His last visit was only a couple of days before he died.

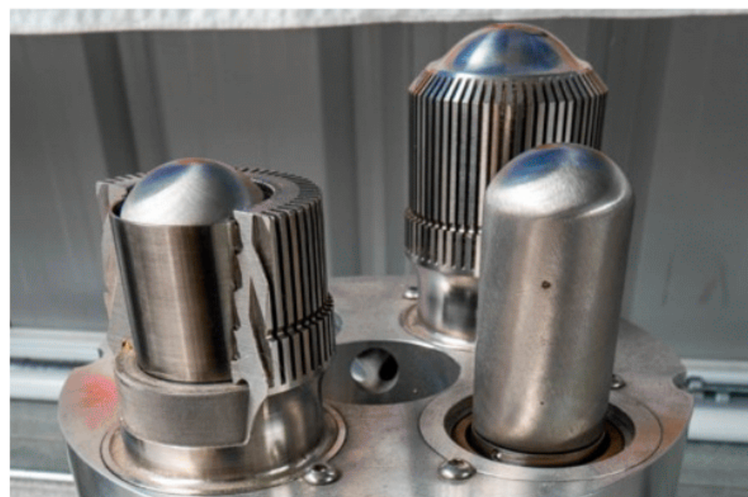
There is no doubt that the heritage centre fulfils Roger's original intention of providing a secure location where historically significant machines are preserved within New Zealand.

It is also a varied and absorbing visitor experience.

1925 Harley-Davidson hearse with local history

A gentleman's launch powered by a Stirling hot air engine

Stirling engine–powered fan made by Jost in Germany, circa 1910



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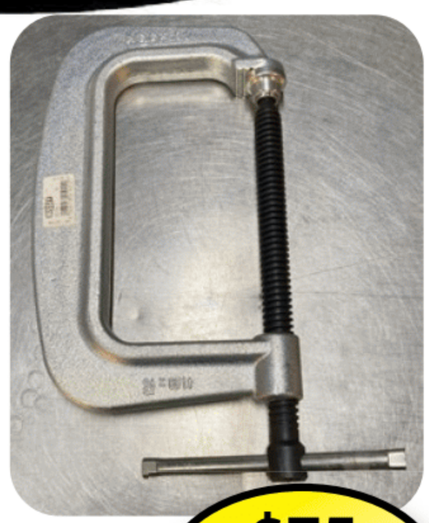

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BUILDING THE DREAM SHED

Part 2

Our hero continues his odyssey, erecting a temple to craft

By Jude Woodside | Photographs: Jude Woodside

The girts are nearing completion

The fly bracing on the roof

After a slow start due to the weather, I had the pad done and the portals erected. The frame was up and the purlins were all screwed down. There was also a cross brace from a galvanised-steel strip to put in place on two roof bays. I had to fix strips to every second purlin as fly bracing on the roof. Fly-bracing was also called for on the walls attached to the girts, but I reasoned that since I was cladding the interior, it would be unnecessary.

Girts

So now I could concentrate on the girts.

The girts are zinc-coated C-sections of high-tensile steel with broad flanges, the same as the purlins. They are each 4.5m long and attach to the uprights with Tek screws. They flank the building, projecting out 100mm, and provide the base to anchor the powder-coated cladding. They also add rigidity to the frame.

I attached the first one close to, but not touching, the concrete base, and all the others were positioned at approximately 800mm between centres. They don't quite reach the top; an eave purlin is installed there. It wasn't on the plans, but I didn't like the idea of the girts being in contact with the concrete, so I bought some rubber waterproof strips to lay between the girts and the concrete.

The author attaching the last column to the roller door portal

Brian Hill cutting off the concrete overhang to make the cladding flush with the edge of the pad

The girt installation on the ends was different. The girts are fastened to brackets that are attached to the interior flange of the columns. The girts do not project out as the wall ones do. I had not noticed this in the plans, but having put the outer portals on the wrong way in the first place, I was pleasantly surprised to find that when we turned the portals around, they were within 25mm or so from the edge. We later cut this off with a concrete saw.

By now, I had become very familiar with the scissor lift. An essential piece of kit if you plan to build a shed; factor in at least two weeks of hire time. The lift made the job flow easily, even where the still swampy ground meant we had to lay boards. I did quite a bit of the installation on my own, especially the lower girts. However, things progressed much faster with the lift and someone else's help.

Brian Hill helping with the wrapping. A good assistant is indispensable

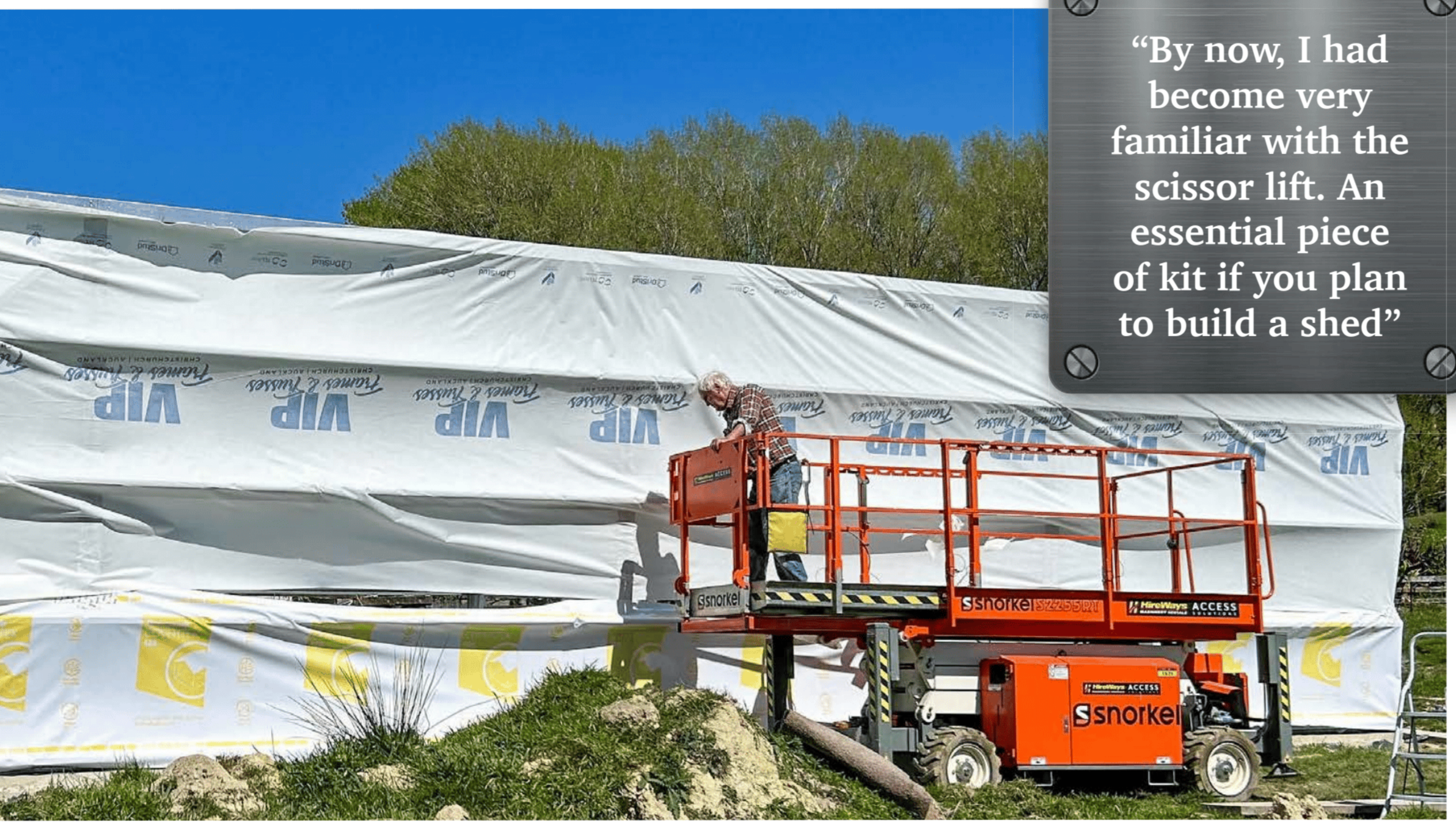
Roller doors

Eventually, the girts were done, and I worked out the openings for the roller doors at opposite ends of the shed, the access door, and a window.

The roller door openings caused some confusion. The plans weren't clear to me, and they included some members that, if I had installed them, the door wouldn't have been able to fit. This was something that I couldn't figure out, and neither could Affordable Sheds, so we opted to leave them out. I don't think it compromised the strength at all. Fortunately, the building inspector agreed.

Cladding

We were now ready to start cladding. Wall wrap wasn't included in the kit; since it's an unlined shed, I had to find some. I was very fortunate to find a wholesaler who sold seconds of building wrap. It was a relief because I hadn't considered the cost of the stuff. I bought a few 3m rolls and used some of the roof wrap material, which I later had to replace. The wrap was expensive, even at the discounted price,



Wrapping the structure

> **“By now, I had become very familiar with the scissor lift. An essential piece of kit if you plan to build a shed”**

but paled in comparison to the cost of sill tape. Again, I was lucky; Insulation Wholesalers could supply it at least $100 a roll cheaper than retail.

The big issue now was the weather. It was now October 2023, a time of year notorious for wind, especially here in one of the windiest parts of the country. We were dealing with material 3m wide and 16m long. An enormous sail.

It was another process that could not be done alone, so I managed to recruit my friend Brian and my partner Annie to help out. I paid particular attention to the weather, and we worked on those days when we were sure of little to no wind. Handling a sail that size in even a light zephyr is no joke. However, we soon established a pattern of spreading and taping as we went, sticking the wrap to the top eave with sill tape, which is undoubtedly strong. Annie, with her more nimble fingers, peeled off the tape and handed it to Brian and me on the scissor lift and ladder. The end of the shed was awkward, but we managed. It didn’t have to be beautiful.

Short-lived joy

Now, we could begin the actual cladding.

This was an exciting moment for me; I felt that, at last, I was on the last leg of what had been a strenuous journey. I was wrong, as usual.

Brian and I began to fix the cladding. He was on the ground, and I was in the scissor lift. We wrestled the sheets into position, and I got the first two screws in. Then, using a pencil and a level, I marked out the positions of the girts, which were otherwise invisible, using the ones I could see. Then we both proceeded to screw the cladding on.

Despite these precautions with the level and pencil, we still occasionally missed the girts, thankfully not too often. We made significant progress and managed to finish the two long walls, excluding the bay where the door and window were located. We were well pleased with our efforts, and the building looked good. However, as with all things, my joy was short-lived when

Nearly finished the cladding. Note the hard lines at the edge of the sheets. That is the rain gutter that should have been under the overlap. We returned the next morning to redo all these sheets

Brian discovered in conversation with his builder mate that we had put the sheets on the wrong way round! There was a right and wrong way; who knew?! Brian's mate, apparently.

On one edge of the long runs of cladding is a tiny uplift that serves as a kind of rain gutter, and this needs to be on the inside of the overlap.

Fortunately, being the practical person he is, Brian also had a solution, because I was despairing of having to undo all our work. We only had to undo one line of screws and change the overlap on each sheet and invert the last sheet. Another lesson learned the hard way.

The walls were relatively straightforward after that, but the ends were another issue. There were no girts at the upper end. And in parts, it was necessary to screw to the narrow flange on the rafter. Through trial and considerable effort, we managed it, though.

The roof

Now, we needed to tackle the roof. Although I was accustomed to heights on the scissor lift, tackling the roof was another thing altogether. I had recently purchased a new scaffold unit primarily to reach the roof for the gutters and for safety for the roofing. I realised that the roof was beyond me. So I hired a roofer who duly turned up with two others and proceeded to walk about on the purlins as if it were a footpath. They had the roof installed in one day, and the next day, they came back to install the flashing. They also helped me out by measuring the trim I needed and showed me how to install it.

The roofers: I know that the health and safety people will not be best pleased, but these guys seemed perfectly at ease in this environment

While it cost me, the speed of the work and the proficiency of the installers were well worth it. I decided to hire an installer for the roller doors as well. Although the instructions for installing them were clear, I was growing weary at this stage.

The door and window

Now, it only remained to install the door and window, which, again, with Brian's help, we managed in a day or two. I had ordered the trim; this was supplied later because all kinds of vagaries can crop up with the building. None of our corner flashings was the same size. This, too, is a job that requires two people.

The trim is riveted onto the cladding with matching coloured rivet heads.

> "It was then I realised we still had a considerable quantity of material left over, and I wasn't sure what it was for"

Then, the door and window flashing had to be sorted. For this, I needed the help of Affordable Sheds' design guru, Rewa Pomare. I couldn't make head or tail of the process, but she very patiently led me through it.

Cladding finished and ready for the roof. We let the roofers cut the sheets to the roof profile

The interior with the roof on. The roller doors, access door, and window are yet to be installed

We had made a few issues for ourselves with the installation of the window; who would have guessed? Furthermore, my measurements for at least one piece were wildly off, and it had to be remade, but we eventually got it right.

It was then I realised we still had a considerable quantity of material left over, and I wasn't sure what it was for. It turned out to be an anti-rodent barrier that should have been installed before the cladding was applied. However, having become adept at finding after-the-fact solutions, I set about retrofitting it, sliding it under the sheets in some cases and pushing it through from the inside in others. It did make a difference, and I can attest that it really does work. It blocks access to the raised bits of the corrugations. ▶

The cladding going on. Note the girts are filled, and I have added another 100x50 for the wiring

Halfway through the internal cladding. Note the shiny melamine – 'whiteboard' to be

The wall, insulated and ready for the electrician

Gutters and plumbing

Finally, I had a shed to the lock-up stage.

We weren't finished yet. There was the business of the gutters. They are powder-coated steel box gutters supplied with the kit. Brian and I had attempted to tackle these, but after fumbling about with trying to connect them with little success, I decided to hand this over to the plumbers. They weren't exactly overjoyed. They would also have to plumb the tank, which I had installed on a bed of sand that I had excavated carefully with a digger. I left them to it and went away for a few days. I returned to a tank that was plumbed in and had working gutters. They reminded me that, at this stage, while the drains were exposed, I would need an inspection.

We combined the inspection of the drains with the inspection of the building as well. Aside from some minor amendments to the window flashing and the installation of an outlet pipe for the tank to drain, we passed. At that point, I actually breathed a sigh of relief.

Interior lining

Now, it was time to line the interior. I prevaricated over whether to install a complete frame to attach the lining, to using 100x50 or attaching slats to the steel.

I wanted to insulate; it gets very cold here and very hot in summer. My last shed used to drip from condensation in winter. I had found insulation from Bunnings that would do the job for around $1500. The insulation fitted easily into the gap between the girts and the exterior cladding. So I wouldn't need much of a frame. I didn't want to screw the internal cladding directly to the girts, though.

I had been accumulating cover sheets for some time. These are sacrificial sheets that accompany packets of melamine or MDF delivered to joiners, and you can pick them up relatively cheaply. The drawback is that they can vary in thickness and quality. I had enough to clad the shed.

I found some very cheap plywood, 12mm thick and of questionable quality, but I thought it might be suitable for making the slats I needed. However, I was concerned that these alone wouldn't be enough to hold the heavy sheets, especially those on the top layer. I was also worried that the sheets themselves would not be able to carry heavy cupboards or shelves.

I discovered that by machining a piece of 100x50 at precisely 11.5 degrees on

Still a work in progress, but the walls and the electrical work are done

> “At that point, I actually breathed a sigh of relief”

each side, they would fit, with a bit of persuasion, into the girts themselves. I could then secure them with screws, thus providing me with four solid areas to anchor the sheets to. They would also serve to anchor the French cleat I wanted to add all around, so I could hang cupboards for storage.

My electrician later rightly berated me for using the thin ply. He couldn’t get wiring down it and had to drill the girts. He told me I should have used 30x30mm battens. In hindsight, I should have used 17mm ply for the cladding too.

I wouldn’t be able to start the cladding until the electrician had finished the prewiring. So, I set to work installing slats and then fitting the insulation. The insulation I used is excellent; it’s not as itchy as some, but I soon found I needed a mask. Cutting the stuff releases a shower of tiny glass splinters that end up in your nose.

The electricals

The electrician finally arrived, and we began wiring the walls.

In my enthusiasm, I made a map of outlets with specific tools in mind. What I had forgotten was that each outlet would be a double plug. As a result, I have nearly twice the outlets I need. Better than not enough.

While the electrician did his thing, I bought some thin sheet metal and had it cut into appropriate sizes for light shades. I bent each of them, seamed the edges, and spray-painted them white on one side and the same green as the shed on the other. I had previously purchased some eighteen 1200mm 40W LED lights, which I attached to shades to give me four lights per bay. The light shades were intended to help focus the light, and they work.

I was now able to begin the internal cladding in earnest, which I did with some help. Painting required some thought. I didn’t want to paint the walls white because I plan to use the shed to make videos, and white tends to burn out. On the other hand, mid grey, which is the recommended colour, is too dark overall, so I opted for something in between mid grey and white – sufficiently grey not to cause the background to burn out but light enough that I don’t have to add artificial light.

Some of the panels I had were melamine. Some I retained for whiteboards, and two were black, so I painted them over with blackboard paint. One was bright orange. I liked it so much I decided to make it a theme, and I have incorporated a bright orange stripe all around the shed at bench height.

With the cladding complete and the outlets all installed, I was able to move all my tools from the dank shed they had been in for too long to their new home. The most difficult was the lathe, which required a crane truck. But at last, it is beginning to take shape. There is still a way to go yet. I have benches to make, cupboards to build, and a tonne of fastenings to find homes for.

Stay tuned. I’m making a mitre saw bench first.

So, my final thoughts

Overall, if I were to do this again, with everything I now know, I would get someone in to build it. It would have been faster and, I suspect, cheaper than what it has cost me.

You have to factor in the cost of the foundations, the concrete pad, the hire of diggers and scissor lifts, extra help and other factors like electrical work and plumbing. The weather didn’t help, and I’m sure that without the inconvenience of those two lost years, it would have been built far faster. Additionally, I had a significant amount of civil engineering work that I hadn’t initially accounted for.

In the end, despite the errors, I am satisfied with what I have made. It’s been a huge learning curve, but it is an asset and a bridge to bigger things. I hope this serves as some inspiration for others. If I can make it in my own clumsy way with very little knowledge, you can too.

I would also like to acknowledge all those who helped me get here, especially the indefatigable Brian Hill – without him, I’d still be building it.

THE Shed QUIZ NO. 4

You've got a shed, and you know how to use it – but do you really understand how everything works? Test your sheddie knowledge here

1

What tool is shown in the picture?

a) A Quickee driver

b) A Twistee driver

c) A Yankee driver

2

What is the main structure of a drilling rig called?

a) Rodderick

b) Derrick

c) Frederick

d) Broderick

3

What is the hammer shown in the picture known as?

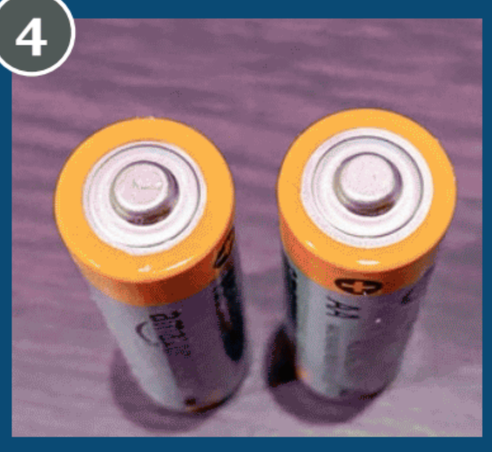
a) Dead blow hammer

b) Soft face hammer

c) Thor hammer

d) All of the above

4



Is a battery heavier when fully charged?

a) Yes

b) No

5

Why is this pipe wrench called a Stillson?

a) Unknown – maybe a nickname

b) Invented by a Mr Stillson

c) Brand of the most well-known manufacturer

6

How is the size of a Stillson wrench specified?

a) Maximum pipe size it can grip

b) Its weight

c) Length of the jaws

d) Length of its handle

7

What language is used to program CNC lathes?

a) Basic

b) C++

c) G-code

d) CAD

8

What nuts and bolts do American cars use?

a) Mostly metric

b) Mostly imperial

6

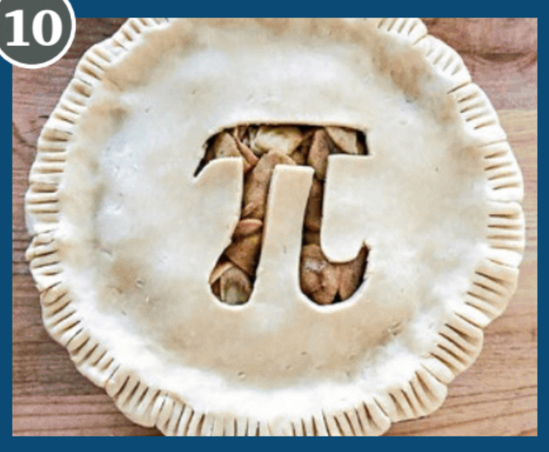
If you bought a gross of M20 nuts, how many would you get?

a) 13

b) 200

c) 144

10



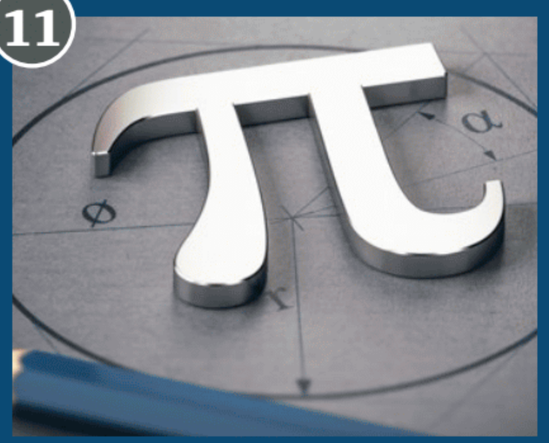
What is the value of pi?

a) 3.142

b) 3.0

c) 22.22

11



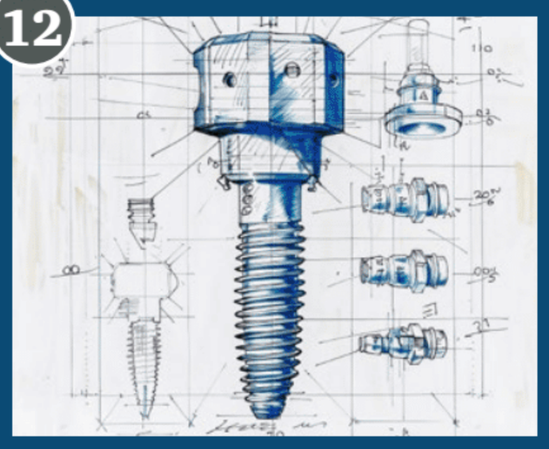
How many digits after the decimal point does the value of pi have?

a) 40

b) 100

c) 100 trillion

12



Is a thumb screw the same as a wing screw?

a) No

b) Yes

Answers

1. (c) A Yankee driver. Yankee is a brand of North Bros Manufacturing and is also licensed to Stanley Tools. It has a helical track that spins the screwdriver bit when you press down on the handle. There is also a ratchet function.

2. (b) Derrick. It is the tall structure that holds the drilling shaft vertically and is also used for withdrawing the drill.

3. (d) All of the above. The one shown is the popular Thor brand and is often referred to as a 'soft-faced hammer' for obvious reasons, as well as a 'dead-blow hammer'.

4. (a) Yes. Using the formula $E=MC^2$, the mass must increase as the potential energy of the battery increases. However, in the case of an AA battery, it is an extremely small increase in weight from flat to fully charged.

5. (b) Invented by a Mr Stillson.

6. (d) The length of its handle. Usually expressed in inches.

7. (c) G-code. This is common to all CNC machines, including 3D printers.

8. (a) Mostly metric. During the 1970s and 1980s, American auto manufacturers began changing over to metric to align with the rest of the world, as some car components they used were imported, and metric became more common in the US due to the number of European vehicles on the market there.

9. (c) 144.

10. (a) 3.142. This is the practical value of pi for most workshop calculations.

11. (c) 100 trillion. This is the number that pi was calculated to using computer technology in 2022. Pi is technically an irrational number because it is non-terminating (it never ends) and is non-repeating (it does not have a pattern).

12. (a) No. A thumb screw has a round knob which is usually knurled for grip. A wing screw is much like a wing nut. There is a flattened part of the screw head.

ARDUINO 102: LIBRARIES

It’s time to learn about libraries. A ‘library’ is a collection of code that provides specific functions or a method for communicating with particular hardware. In this latest installment in our series, our Arduino guru explains why we use libraries and highlights some potential pitfalls to be aware of

By Mark Beckett | Photographs: Mark Beckett

In the last few issues, we've covered a range of subjects, including errors in the previous issue. During these articles, we've used added code called 'libraries', so it's time to explain why we use them and some of the pitfalls.

Arduino has the big advantage of being 'open source', which is where a manufacturer or supplier doesn't have control, and the public can freely use and contribute to the software. That's not to say manufacturers don't contribute, but they share their offerings for all to use without a licence or restriction (apart from the credit).

The size of the Arduino ecosystem proves that open source works.

What is a 'library'?

Many years ago, you'd have said it was a place that held and lent books (and other materials) to any registered user. These were often council-run facilities and covered just about any subject.

Some served as archives where historical material was housed, while others popped up on vacant lots after the Canterbury earthquakes as community-based book swaps.

In the context of Arduino (and other software IDEs), a library represents a piece of code that provides a function or a way of communicating with specific hardware.

In the 'Display' issue (No. 120, April/May 2025), we used two libraries: one to communicate with an LCD, and the other to control NeoPixels. Using these libraries meant you (or we) didn't have to write extra lines of code in the sketch or tackle the more challenging task of understanding how to interact directly with those components.

Introducing pupils to Arduino

An analogy we used when introducing pupils to Arduino was to ask for a volunteer (or sometimes we picked one). We'd grab a chair and place it behind them, then ask them to sit on the chair.

Without fail, they would perform the task without any problem.

We'd then ask the class to describe what they had just witnessed, focusing on what the 'poor victim' had done in response to the simple instruction 'sit' and the object 'chair'.

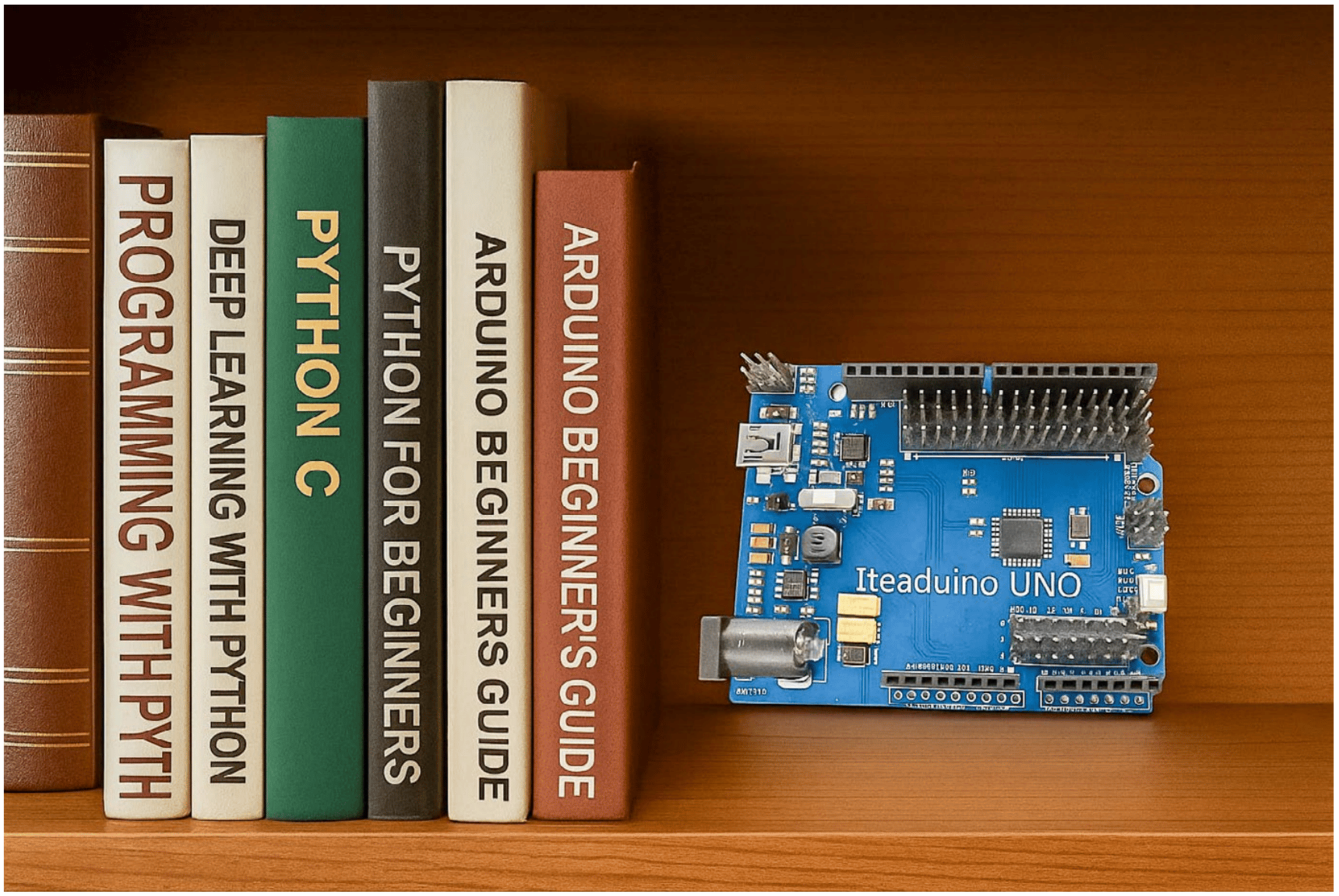
In reality, this was a demonstration of a built-in library. The pupil would turn and move to the chair, then turn, and then bend their knees to lower themselves onto the seat. This was usually accompanied by either bewilderment or a smug look of success.

It's a relatively simple example of how we use libraries – or learned processes – every day.

Using libraries

Adding libraries (or using the built-in ones) is the easy part. Getting it (or them) to do what you want can be the tricky bit.

When you include a library in your sketch, the IDE will insert an '#include' statement at the top of the sketch for each header (.h) file in the library's folder. These statements make the public functions and constants defined by the



library available to your sketch.

They also signal the Arduino IDE to link that library's code with your sketch when it is compiled or uploaded.

Libraries need information in order for the software to act and pass the instruction onto the particular piece of hardware that you're using.

Using the NeoPixel example from our earlier article, the NeoPixel library needs two things: the pin number they are attached to, and how many are in the strip.

```
#define PIN 2                    // NeoPixel connected to Pin 2
#define NUM_LEDS 8               // How many LEDs in your strip?
```

NOTE: We defined these before we enabled the library.

```
Adafruit_NeoPixel strip = Adafruit_NeoPixel(NUM_LEDS, PIN, NEO_GRB + NEO_KHZ800);
```

The last two definitions relate to the colour order and speed of communication. This is fine, but the example code uses various keywords (instructions/functions).

strip.setPixelColor strip.setBrightness strip.show() setBrightness

Using these correctly is the hard part, but every library I've downloaded has built-in examples. Although the code between examples is not always consistent, it does give an idea of how to use it for your purpose.

I tend to load an example, then modify it until it works for me (and I understand it), before adding it into the larger sketch I'm working on.

There are plenty of examples on the internet where someone has created something that uses the library you need/want. However, understanding what and why they coded it like that can be a bigger headache than playing with the examples yourself.

Which library?

As with any open source, there is always someone who creates a different version. Sometimes they are improvements to simplify the library, while others may improve the speed or communicate with alternative or newer hardware versions.

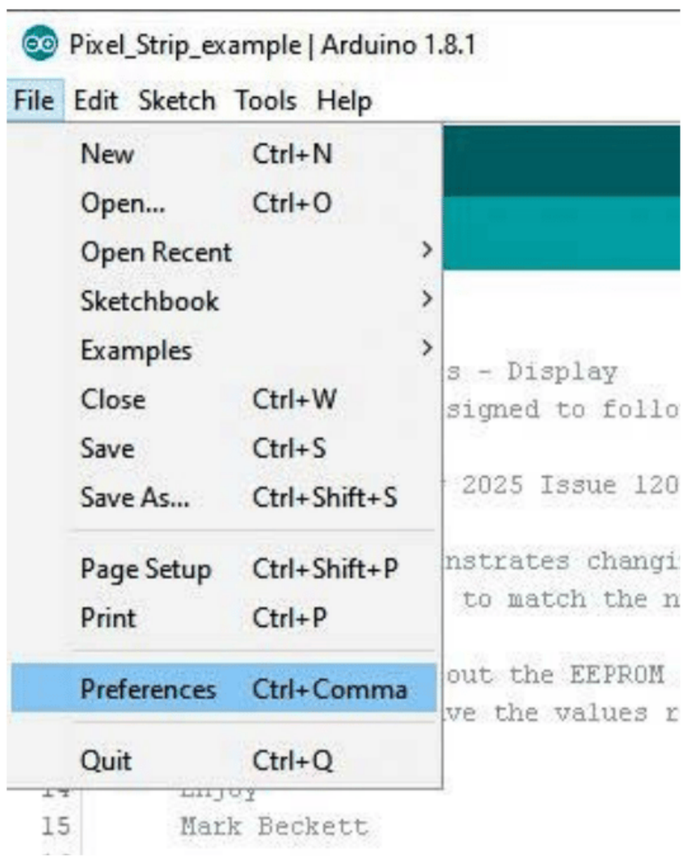
Often, these library versions may not be backwards compatible, so the code you wrote a year or more ago uses different instructions from this version, or that instruction is not used. If you're having problems, bear this in mind and check if the original author provided links.

In earlier versions of the IDE, I would save the library with the final version of the code to ensure I had everything I needed for it to run. Luckily, the latest library manager does allow for version choice, but it's still something to keep in mind.

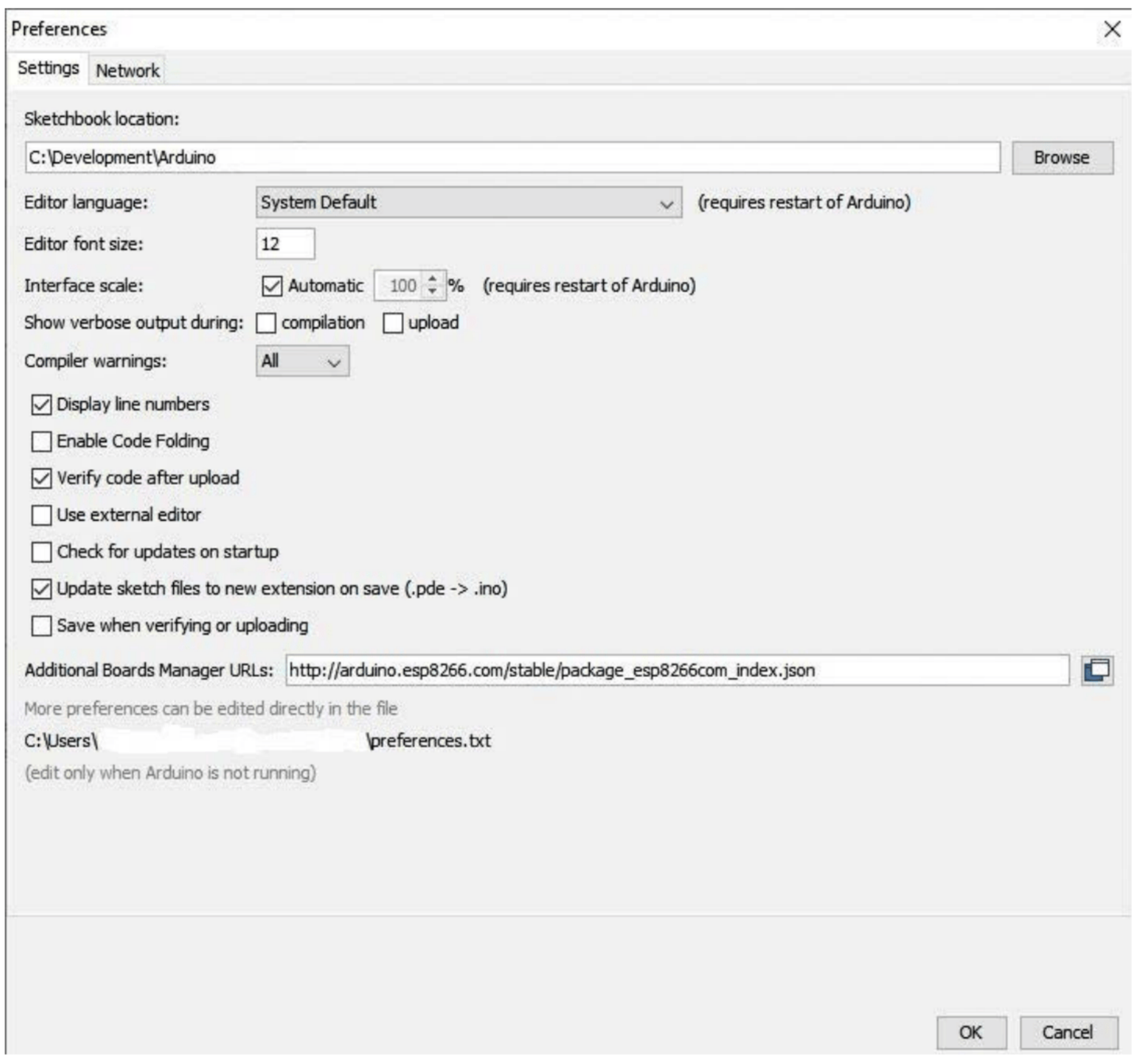
Library manager

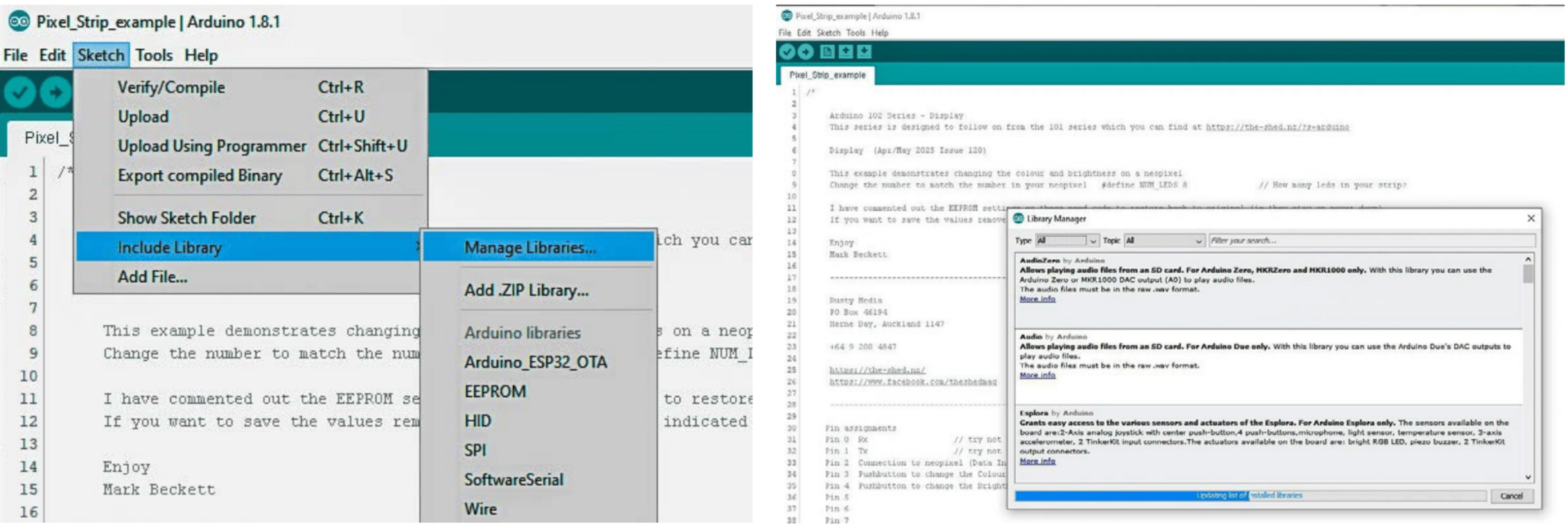
The Arduino IDE includes a manager that can find, download and install most libraries. You find this by opening the IDE, then select 'Sketch', scroll down to Include 'Library', then sideways to 'Manage Libraries.'

After a short time, a list will appear. You can type in 'Filter your search' and it will list all the libraries available to download. In the image shown here,



"Libraries need information in order for the software to act and pass the instruction onto the particular piece of hardware that you're using"





I typed ‘NeoPixel’, and there were 36 different varieties.

Some libraries are designed for boards/microcontrollers other than the Arduino. You’ll note the ‘Installed’ label on some, along with ‘Update’ and ‘Select Version’ options on others.

Many libraries are deposited on GitHub and may not be linked to the Arduino IDE library manager. You can install these by opening the IDE, selecting ‘File’, then scrolling down to ‘Preferences’. This opens a window with various settings you can choose or alter.

Add the link in ‘Additional Boards Manager URLs.’ The picture shown here is an ESP8266 package.

Limor Fried has written a very good guide (albeit using a Mac rather than Windows): https://docs.arduino.cc/software/ide-v1/tutorials/installing-libraries/.

There is a list of the 7597 libraries recognised by Arduino Library Manager at arduinolibraries.info/.

Library pitfalls

Most times, you grab some libraries, add some code to a sketch and compile, then download it into your board and it all works, but there may be a time with a larger sketch and lots of things happening, you can suddenly find it stops working at certain points, or when you interact with it.

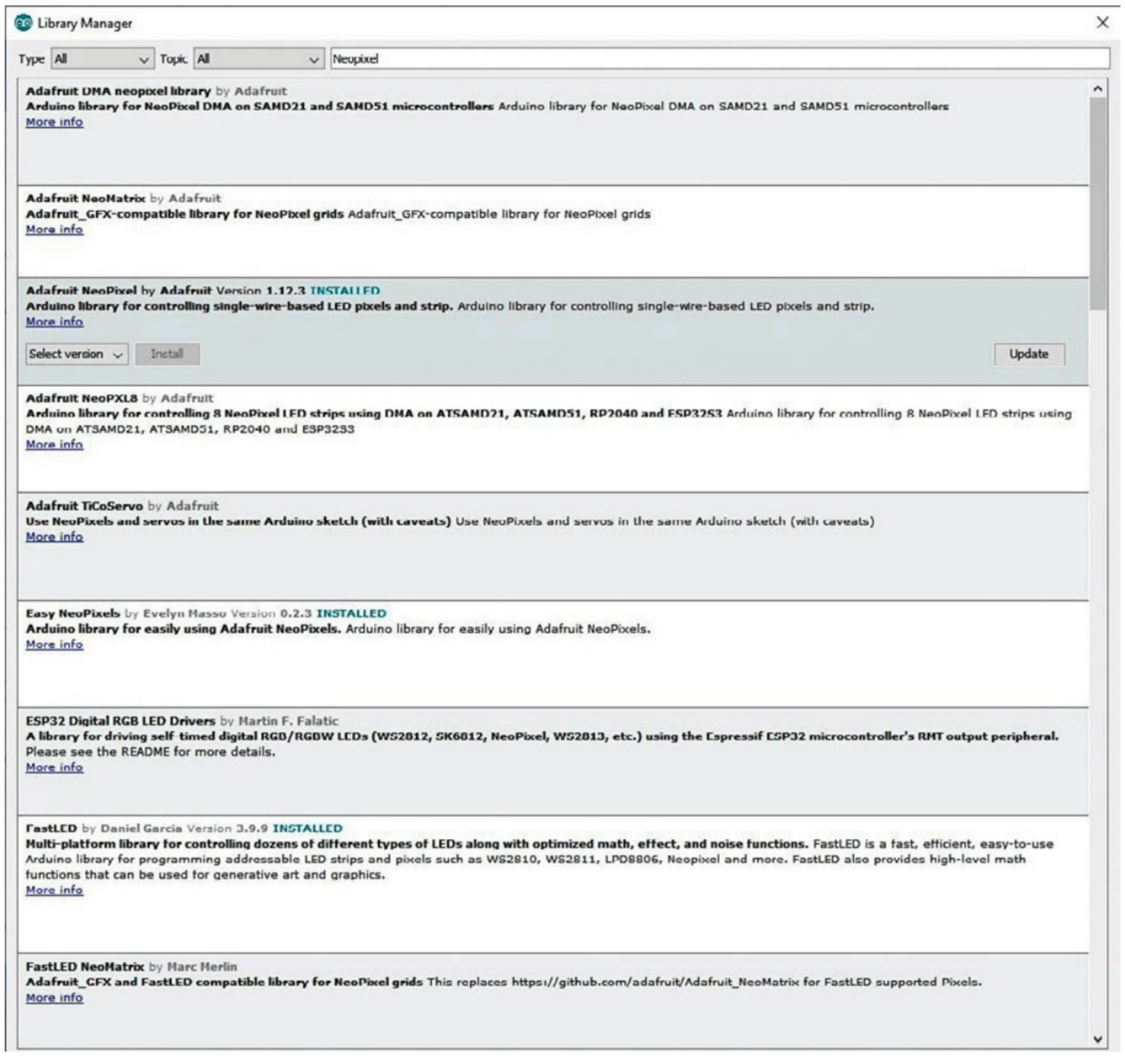
When you compile it, the sketch size and dynamic memory size are shown, but this is not the memory used when the sketch is running. The dynamic memory can grow and exceed the availability, which may halt the program or give unexpected results.

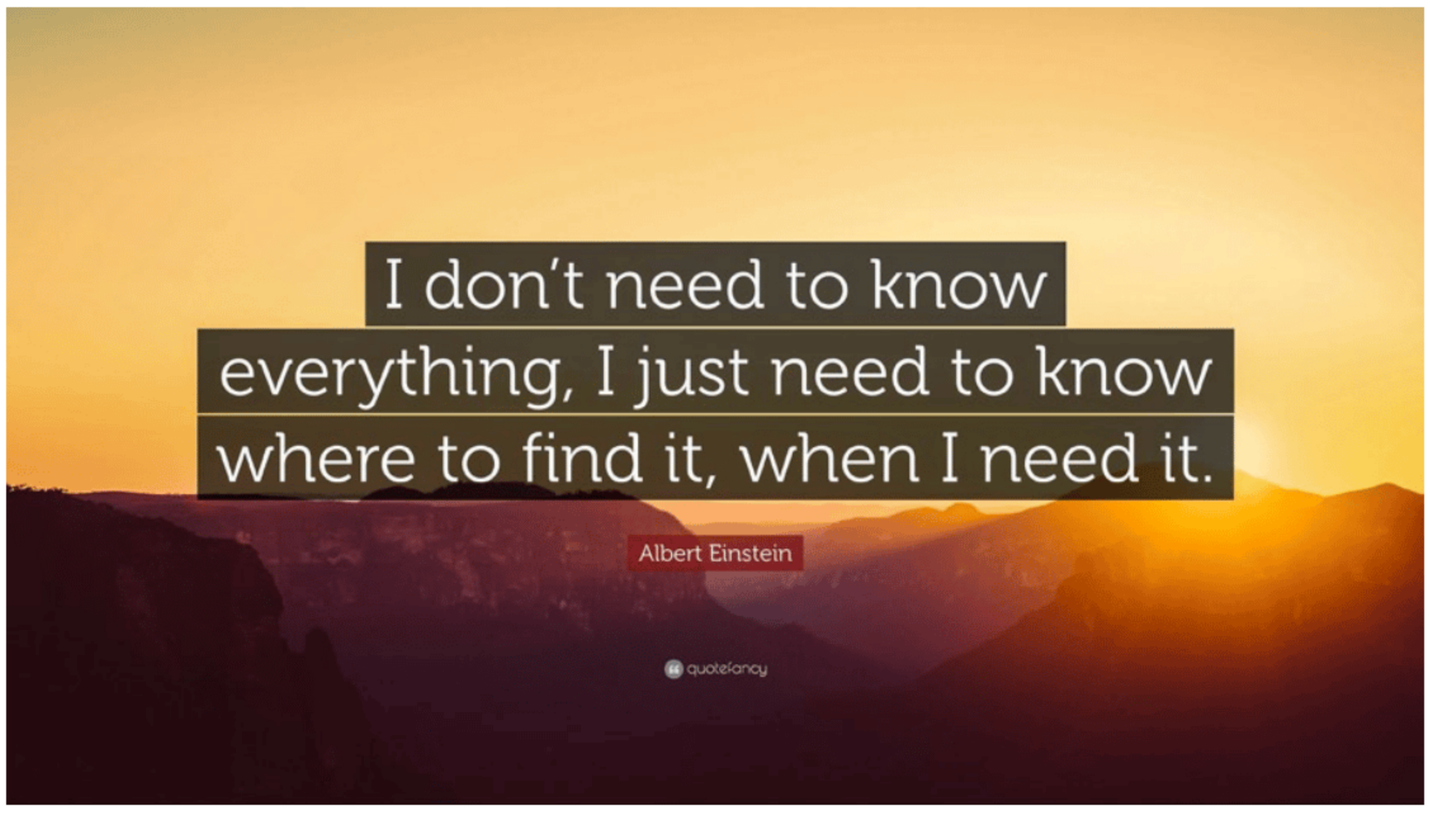
Many libraries have lots of features you won’t use, and they have reserved space for these features. Once you’ve included several libraries, you may find the reserved space is just underneath the limits, so it compiles, but it crashes when you run it.

A good analogy is having a pool big enough to hold six people. Three or four people get in and start sloshing around. A few others see the fun and get in, but when they start moving around, it starts to overflow. As soon as they stop, it’s fine.

One of the big memory suckers is displaying text and graphics. If your sketch has lots of ‘Serial.print’ for debugging or displaying, it can take up some of that memory. As you try to debug it, the problem becomes worse. The solution is to comment out everything you don’t need and try again.

I did a ‘home minder’ project way back in Issue No. 46 of *The Shed* (December 2012 / January 2013) to control wireless plugs to make it look like someone was at home. I failed to make the initsial deadline, as the code would crash. It





used a number of libraries, and the final solution was to modify two libraries to reduce their dynamic usage. One of them included receiving capability and controlling groups of units, so both were removed.

The main point is to be careful of the version and the number of '#include' you have in your sketch.

A good reference is here: https://docs.arduino.cc/learn/programming/memory-guide/, with the practical suggestions starting at Optimising Memory Usage in Arduino-Based Systems.

Another little trap is which pins they communicate with. I did some work using nRF2401 Wi-Fi boards, and it was getting a little frustrating that it just wasn't working. Searching the internet suggested the voltage regulator and long leads, which all proved incorrect. It was simply that the wiring example and the code used a different pin for one of the connections.

Unfortunately, most of the examples didn't include what connections, and there was no drawing or schematic supplied. That's two weeks of my life that I'll never get back, but I did learn some more tricks and had a much deeper understanding for the next time.

Where are the libraries?

I tend to use Arduino 1.8.1, as it has some features that seem to have been removed from later versions. In this version, the installed libraries are in a subfolder 'Libraries' off the directory where your sketches are saved to. Check your preferences file if in doubt. I preferred the old method where they lived with the Arduino IDE, so you could simply pick up everything and run it from a memory stick or copy it onto your other computer/laptop.

Limor explains how storing it within the sketchbook allows a different version to be used, so bear this in mind if you need to use a specific version for your sketch: https://docs.arduino.cc/software/ide-v1/tutorials/installing-libraries/.

Hopefully, this has resolved some of the mysteries around libraries in the Arduino and other microcontroller workspaces. They are very useful once you overcome their particular needs. I suggest you try using them – and you can start with the ones we've already covered in previous issues – before getting stuck into your own.

WIN STUFF

The Shed has an UNO Microcontroller (plus extras) to give away to one lucky reader. To qualify, simply write in and tell us something interesting about your project or an aspect of the Arduino series we've been running.

We also have three Raspberry Pi cases to give away. Again, simply write in and tell us how you would use them in your project, and we'll enter you into the draw.

The winners will be announced in *The Shed* Issue No. 124.

Email **editor@the-shed.nz** to enter.

"But I did learn some more tricks and had a much deeper understanding for the next time"

It's a gas

Use industrial gas for your shed projects? Chances are that you're paying ongoing cylinder rental fees whether you're using the gas or not.

Eziswap Gas works differently. It operates a 'cylinder swap' system. Customers initially buy a full cylinder of their required gas or gas mix, use the gas, then swap the empty cylinder for a full one, paying only for the gas used. This way, customers avoid paying any ongoing cylinder rental fees.

Worried about the initial cost? You can buy a cylinder of your choice from the Eziswap Gas website (eziswapgas.co.nz) and check out with Afterpay. Using Afterpay, you can spread the cost over eight weeks (conditions apply).

With more than 57 swap centres nationwide, Eziswap Gas is a better way to purchase industrial gas. It's also New Zealand's only 100 per cent Kiwi-owned, nationwide industrial gas provider. Win-win!

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The Viking Arm gives you unlimited possibilities to work more efficiently and with less manpower.

With a lifting capacity of up to 330 pounds (150kg) and the ability to lift and lower with millimetre precision, the range of applications is virtually unlimited. Available from Hi-Q Components.

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Industry insider

A NEW CHAPTER IN CLASSIC VEHICLE INSURANCE BEGINS

New Zealand's classic vehicle enthusiasts received some notable news in December 2024: Protecta Insurance, a long-standing name in motor insurance, officially rebranded to Assurant

The change follows the 2022 acquisition of Protecta by global insurance leader Assurant Inc., signalling a new chapter for the company's future – and for thousands of classic vehicle owners across Aotearoa.

For over 35 years, Protecta has built its reputation as a reliable, locally focused provider of motor insurance, offering tailored coverage to suit everything from daily drivers to Sunday cruisers. The shift to Assurant doesn't erase that legacy – instead, it enhances it. Now operating with the backing of a Fortune 500 global brand, Assurant combines Protecta's deep local roots with international resources and innovation. The result is a broader, more seamless experience for customers, with a continued focus on the classic and vintage vehicle market.

Real enthusiasts, real stories

Among those in the community, Alan Walker from Assurant – a former president of the New Zealand Hot Rod Association (NZHRA) – is a familiar face.

Known for building numerous hot rods and always having several projects on the go, Alan remains active with his club and is well respected in the classic scene.

Another notable enthusiast is Alan's colleague Carey Marsh, who built his Fraser from a kit. Carey often heads out on runs with the New Zealand Cobra Club, and is also active in the American Muscle, Street and Custom Club Whitianga and the Whitianga Classic Car Club.

Expanding coverage for classic collectors

Assurant's classic vehicle insurance policy remains one of the most comprehensive offerings available in New Zealand. Whether you're safeguarding a 1960s Mustang, a '40s Indian motorcycle, or a restored Holden Kingswood, the policy is designed with the collector in mind.

Key features include:

- 24/7 roadside assistance, including flat tyres, dead batteries, and towing.
- Agreed or market value sum insured, ensuring fair and accurate payouts. Unlike several other classic insurance providers, 'agreed value' means 'agreed value' – not a lower amount if they decide your vehicle is worth 20 per cent less.
- Your choice of repairer, so restoration quality stays in your hands.
- Spare parts coverage up to $5K.
- Windscreen and glass cover, no excess required.
- 24-hour claims support, because mishaps don't keep business hours.
- Salvage rights, meaning you can retain ownership of what's left with salvage from anywhere in NZ.
- Multi-vehicle discounts for those with more than one beauty in the garage.
- Laid-up cover for vehicles undergoing restoration or not in regular use.
- AND – as long as all modifications that need to be certified are certified, Assurant accepts modified vehicles – unlike some competitors who won't insure any mods at all.

Assurant's approach recognises that classic vehicles aren't just transport – they're passion projects, heirlooms, and investments. That philosophy is woven into its insurance products.

How value is determined

When it comes to insuring a classic, getting the value right is everything. Unlike regular vehicles, whose market value depreciates over time, classic and vintage vehicles may appreciate or carry sentimental and collector value that far exceeds book price.

Assurant offers both market and agreed value policies. For agreed value, the process is simple: you provide current photographs and relevant documentation, and Assurant works with you to set a realistic and fair valuation. This ensures peace of mind in the unfortunate event of a total loss, knowing your payout will reflect the vehicle's true worth.

Beyond insurance: a digital overhaul

The rebrand also introduced Assurant Vehicle Care®, a suite of integrated automotive insurance products. This includes not only classic vehicle cover but also mechanical breakdown insurance, motorcycle insurance, guaranteed asset protection (GAP), and payment protection insurance.

As part of the rollout, Assurant launched a redesigned customer website and an upgraded dealer portal, making it easier than ever to manage policies and explore coverage options. It's a modern digital experience that still understands the classic vehicle culture.

A strategic step for the future

Assurant's expansion into the New Zealand market – and the seamless integration of Protecta into its global operation – signals long-term confidence in the local automotive sector. It's more than a name change. It's an investment in better service, smarter technology, and more comprehensive protection for customers.

By combining decades of Kiwi motoring know-how with a world-class infrastructure, Assurant is well-positioned to meet the evolving needs of vehicle collectors and everyday motorists alike.

Driving ahead

For classic vehicle owners, this rebrand means more than just a new logo – it's about continuity, trust, and even greater support. Assurant has made it clear: it's not here to change the passion behind classic motoring – it's here to help protect it, every step of the way.

To learn more or get a quote, visit **assurant.nz**.

THE PLEASURE OF PRESSING PARTS

By Murray Grimmond | Photographs: Murray Grimmond

Here comes the hurdy-gurdy man, and it's not Donovan. Murray shares his new passion for making models by pressing parts together and commences with that mysterious instrument, the hurdy-gurdy

When I get too old to … what was it again?

The lesson I've taken away from the following little exercise is that if I get too old to make it out to the workshop, I need not stop making things. Indeed, if push came to shove, this activity could even be done in bed!

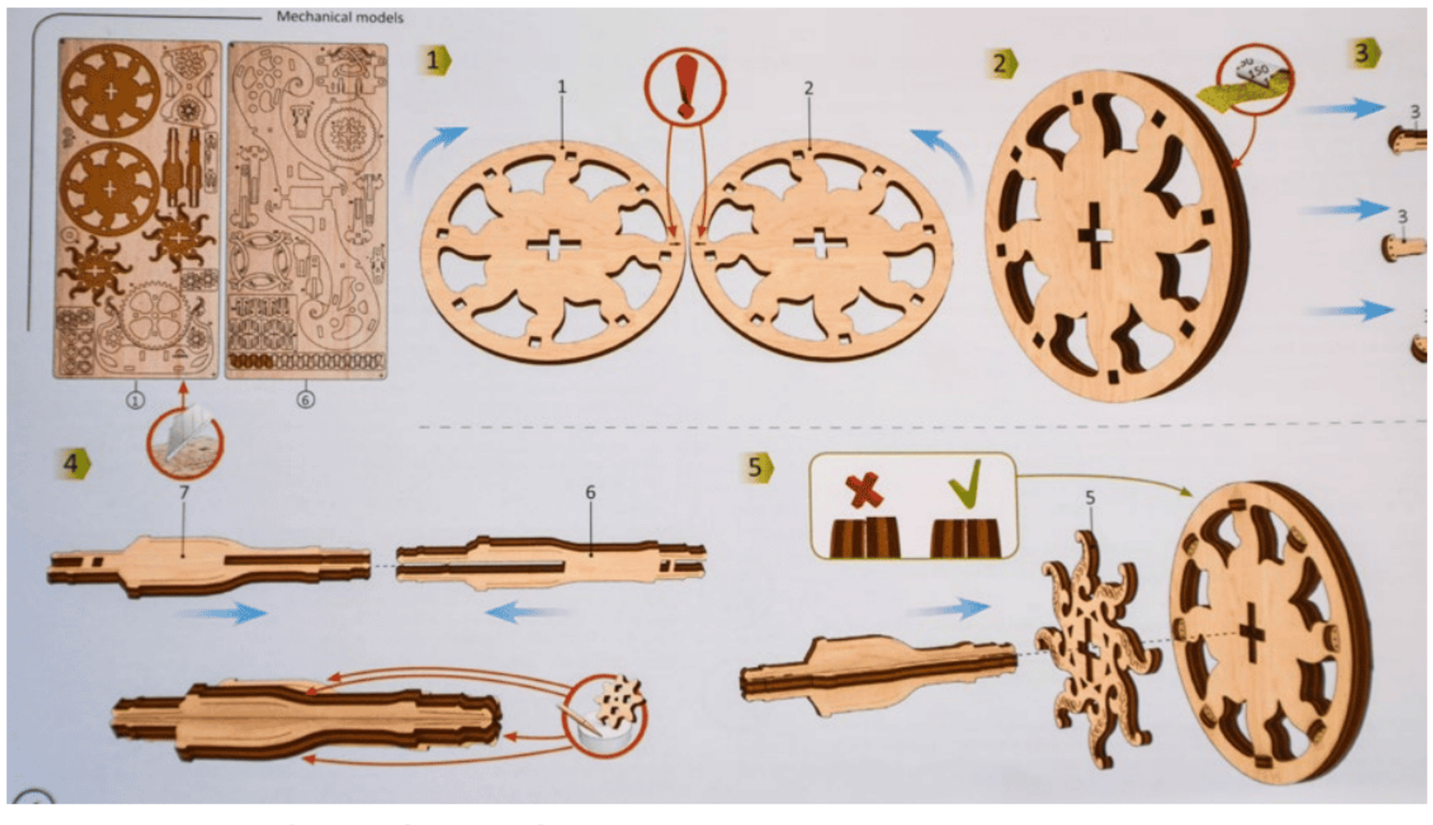
Delayed reaction

It all started when I went to a Donovan concert somewhere around 1972, and came away with his Hurdy Gurdy Man song as an earworm. After a slight delay – 50 years, give or take – it occurred to me to find out what a 'hurdy-gurdy' was. That led to getting onto YouTube, eventually coming across 'hurdy-gurdy reverse dance' (check it out for yourself!) and getting gobsmacked, haunted, stunned. And immediately wanted to build one, as you do.

Hurdy-gurdies – a history

Hurdy-gurdies are very old – 12th century at least, maybe 9th – pre-dating many instruments, which is surprising given their need for accurate manufacturing. They are essentially violins with continuous bows – wheels with the horse-hair (or whatever) wrapped around them – and with keyboards rather than frets. Most have switchable drone-strings a la bagpipes.

One of the earliest forms was the 'organistrum', a large instrument with a guitar-shaped body, a single melody string, two drone strings, and a small wheel. It was played by two people; one turned the crank, the other played the keys. The more portable one-player 'symphonia' variant appeared in the 13th century; a convenient instrument for itinerants, it became associated with the lower classes. Later, the French aristocracy took it up but soon lost interest, along with their heads. Modern



The near-wordless instruction book is easy to follow

building, use, and enthusiasm mainly stem from the Donovan song.

A round to it

The idea got parked (too many other things in the build list), but it kept resurfacing.

Sometimes I'd look for plans (the Nerdy Gurdy merits serious appraisal) and other times wonder about coming up with a low-tech DIY version, maybe by cannibalising a guitar. Years ago, the old man made a music-teaching instrument using a pegboard over some stretched wires, themselves just off some copper strips.

His physical music notes had two prongs apiece, corresponding to two pegboard holes. Put a note in on, say, the F-line, press it; the wire got pushed onto the copper (by the prongs) and 'F' sounded from the speaker. It occurred to me that one could do the same thing with a flat (horizontal) set of holes/keys over a guitar fret, and you'd be playing a guitar but with solid fingers … Thus does one's unfettered mind drift when left unfettered!

ROKR and Ugears

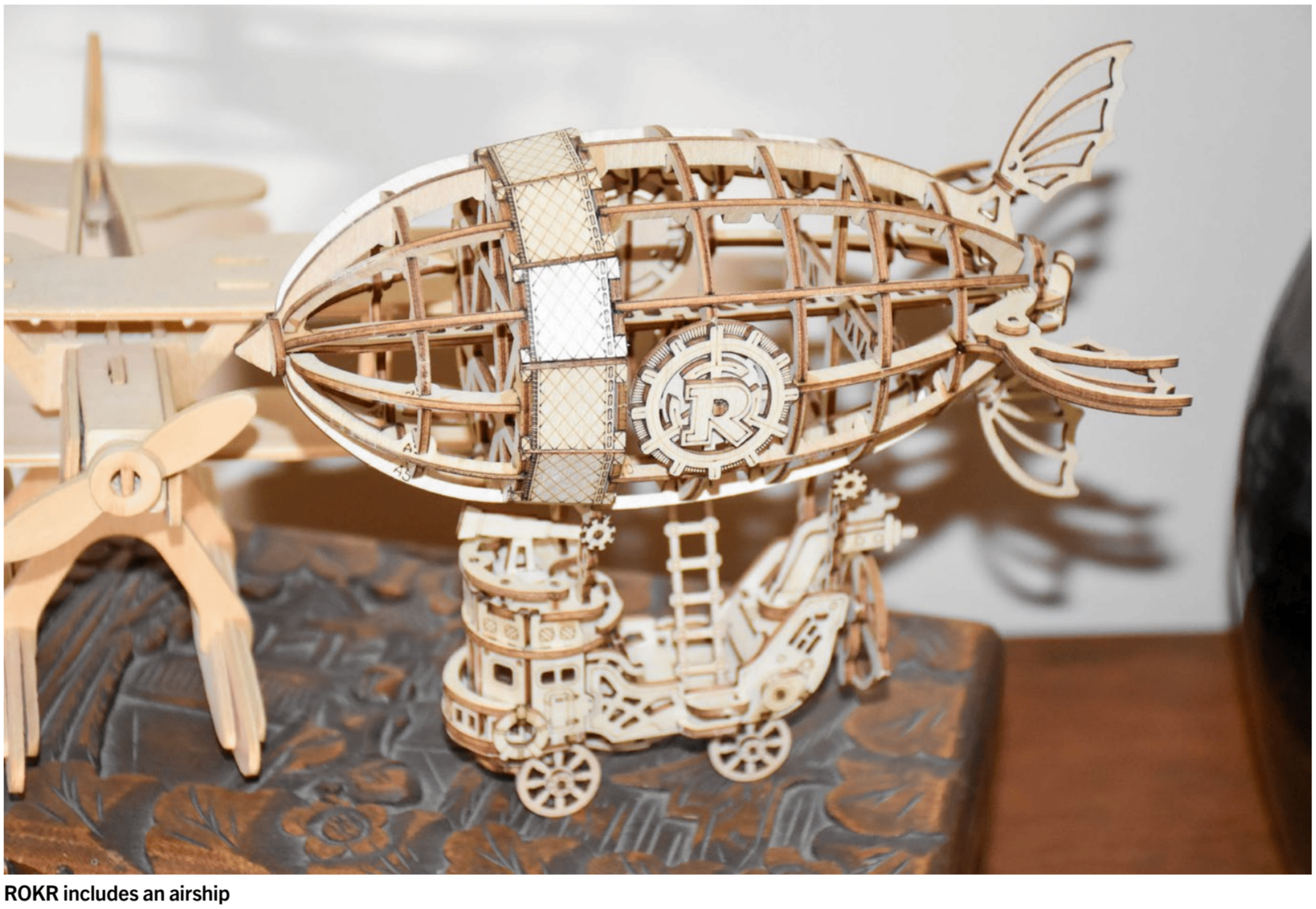
During that period, a friend had a bout of ill health and started assembling some interesting little concoctions as therapy.

His models are from an outfit called ROKR, hailing from China. I watched my friend's collection evolve: an airship, a gramophone, a movie projector, a stunning locomotive, and more.

This is a fellow quite comfortable building full-size houses, boats, and motorcycles, but he was obviously getting a great deal of pleasure from those wee concoctions. One evening, I did a search for them and came across another manufacturer in the same arena – Ugears.

This is a Ukrainian company – the 'U' stands for Ukraine – which started making its kitsets back in 2014 (one wonders if its does a drone, but maybe that one flies under the radar!). Scanning the company's list of more than 100 models in three main grades of difficulty, I spotted a hurdy-gurdy!

It just had to be, and I convinced her-with-the-purse-strings of the


ROKR includes an airship

absolute priority, nay necessity, of said purchase. In the interim, I watched a lot of assembly videos, and came to the conclusion that the sound was going to be about as good as you could expect from such a construct; mentions of cats and caterwauling suggesting that that Albert Hall dream might still be some way off.

The build

It arrived, not too far ahead of a *The Shed* deadline and in the midst of a bigger project (more on that next issue), so I plumped for a clock-watching crash-build – but couldn't resist a little colouring-in … First, I sealed all the plywood with a wash of acrylic varnish, a move which partially bit me in the bum by making it slightly harder to remove parts.

Ugears is pretty onto it; there are spares of some of the smaller pegs, collars, and likely-to-break parts – I doubt there has been an accident-free build yet – and a hammer to assemble as a pre-build exercise. At a pinch, one could fabricate a replacement for the smaller pieces out of the scrap. I went close, breaking both the right-hand tension key and its spare, needing to resort to Plan C.

There's a lot left over

I also broke three of the two spare body clips and had to rescue one with superglue.

For the record, I didn't count the total supplied, but there are 292 parts needed and I ended up with 47 'spares'. The laser cutting is pretty accurate, and you learn to work pieces out of the plywood sheet a little at a time, back and forth, press and pull, to separate them; seldom is a knife needed.

The near-wordless instruction book is easy to follow, but (I found) the pressing together of parts usually required more than the wee hammer. I used sandpaper, a knife, a real hammer, a vice, a G-clamp, and long-nosed pliers in turn; of those, only the pliers caused some minor tab-crumbles.

The biggest crumble happened when I was pushing the retaining peg for the longer of the two tensioning knobs. It was barely accessible, so done largely by feel, and as I increased pressure, it became mush.

No worries, I thought, *I'll just press the spare one out*. Oops. There went the spare … So I ended up using a spare-from-somewhere-else collar, further along the peg. No biggie; does the job.

The steampunk rabbit hole

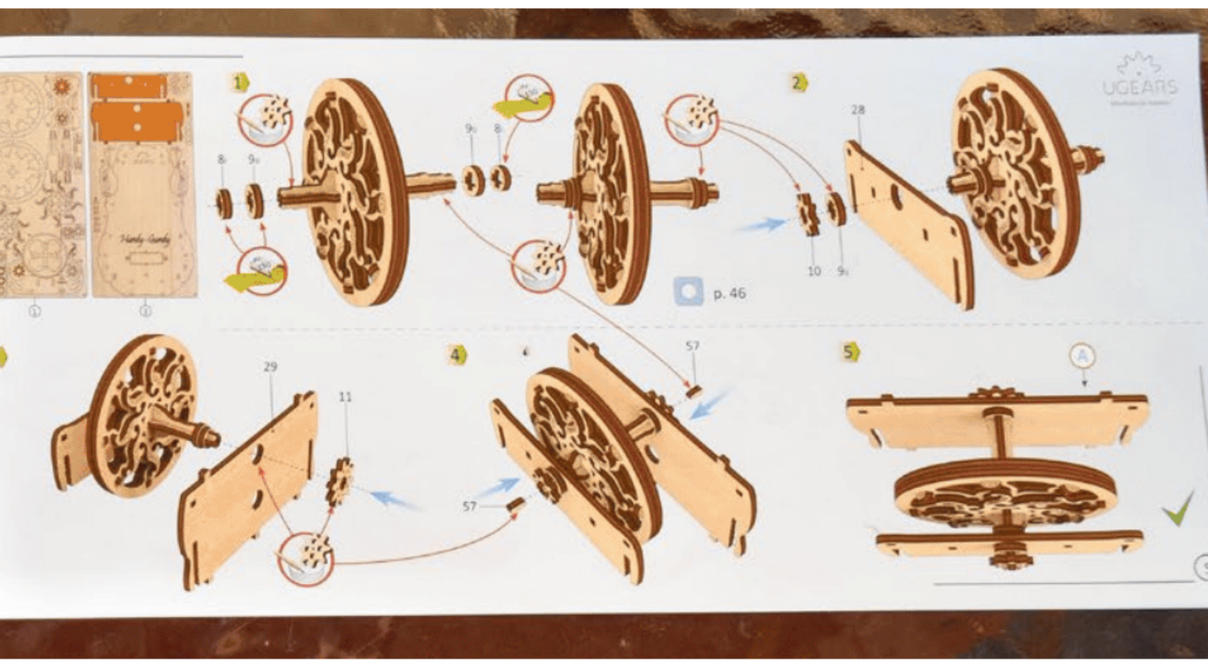
In the middle of the hurdy-gurdy build and having unloaded some of the big project's pressure, we took time out to attend the 2025 Steampunk Festival in Oamaru.

Long-time readers will know I have a more-than-passing affection for the genre, our chandelier and brazier having graced these pages in the past. After starting 15 or more years ago with a hiss and a roar, it seemed to me the steampunk impetus was fading. I was pleasantly mistaken; evident were lots of people, lots of costume get-ups, a great vibe, and some seriously good organising.

The display of vehicles (many mobility scooter based) was fresh, and the ranks of dioramas entered in the Cabinet of Curiosity (see side panel) competition were stunning. Tea Duelling and Tea-Pot Racing provided hilarious entertainment, but it was the Steampunk Market where I went down another rabbit hole.

Steampunk – random accuracy at its finest

The warm-up exercise: a hammer.



Unlike ROKR, Ugears models have no metal or plastic parts; everything – including axles – is wood

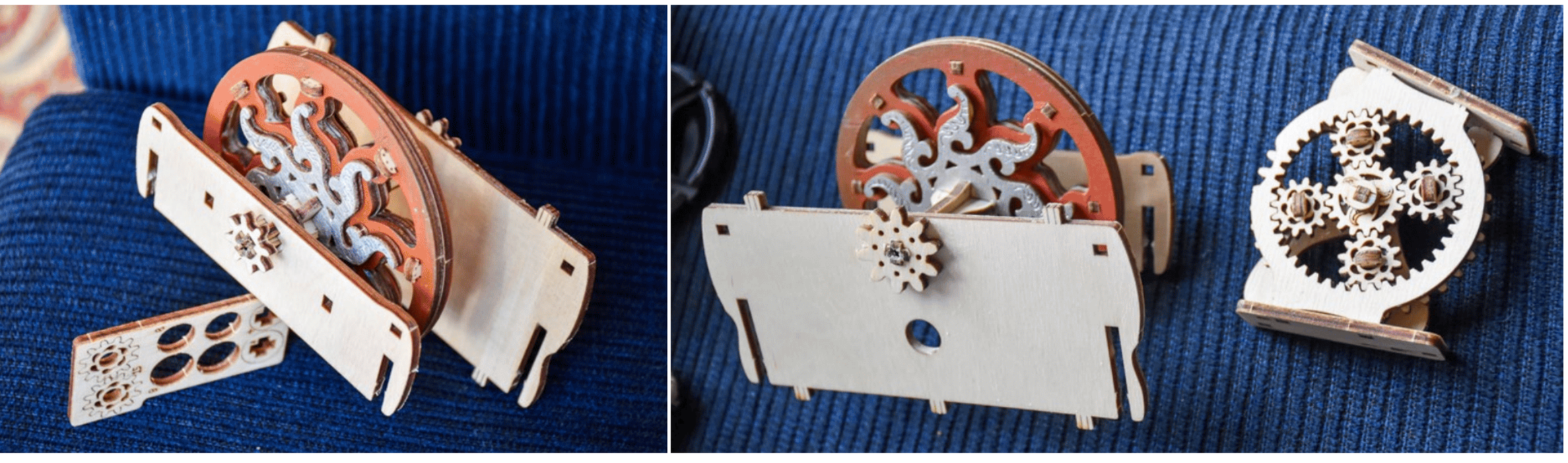
Uncle Peter's Warehouse – and other things ...

At the market, an intriguing little boxed diorama caught my eye. Inside, was a steampunk workshop scene, complete with LED lighting and amazing detail (and scope for even more, should you be so inclined).

It just so happened that the diorama had an airship moored up near the ceiling. And I have a thing about airships, as you know. I convinced her that it had to be added to the hurdy-gurdy article – and didn't hear 'no' (tinnitus can occasionally be your friend). Offered an assembled version or a kit, I didn't hesitate in choosing the latter – assembly being more than half the fun.

This offering tells us there are more variants of the plywood-parts kit format out there (Woodtrick is another worth a look). Unlike the Ugears and ROKR offerings, this one has printed-and-stuck-on artwork, so it is really just a build. But fun, for all that. I had a vivid mental flashback. At one point, I saw a 9-, 10-, or 11-year-old me glueing

"Scanning the company's list of more than 100 models in three main grades of difficulty, I spotted a hurdy-gurdy!"



The gears spin around looking cool but are of no melodic use whatsoever

Uncle Peter's Warehouse assembled (note the airship)

Why simplify that which can be made complicated?

pictures onto scrap hardboard and fretsawing them into jigsaws for sale at school fairs. Surely, the apple never lands far …

Conclusion

My completed result is to hurdy-gurdies what my Jaycar-sourced kit Theremin is to real Theremins; a taste, but a long way off the real thing.

With musical instruments, you tend to get what you pay for. But as a piece of fun, as a maker-teaser, and as a method of relaxation, it's hard to beat. As I said at the beginning, if I somehow end up bedridden or just workshop deprived and space curtailed, this is the kind of thing I'd turn my making urge to.

It rewards you quicker than scratch-build modelling does, and isn't as messy. How does it compare with plastic-kit modelling? Just different, I guess; both have their place, whatever squirts your glue.

Dioramas and models – kit or scratch-built – are definitely something I'll keep in mind for when/if I can't get to the workshop anymore. Hopefully it won't happen; my old man always reckoned he wanted to go out mid project (he also wanted to go out with demerit points!) and I reckon there's something in that. Oddly, at the time of writing, the Albert Hall booking manager has yet to get back to me about my hurdy-gurdy concert debut. Very strange.

> "It rewards you quicker than scratch-build modelling does"

My friend's collection. Maker therapy writ small, but the turntable and music box really play, and the projector really projects

Cabinets of Curiosity

If for no other reason, I'd go to the next Steampunk festival for the cabinet displays. Check out the entry-form here: **steampunk.org.nz/cabinetofcuriosity.**

Left-field, intricate, simply stunning.

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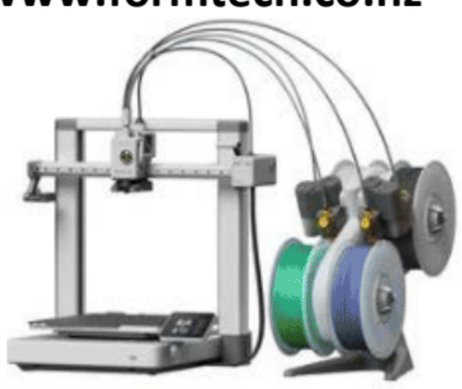

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By Andrew Broxholme | Photographs: Andrew Broxholme

MOBILE RECYCLING TROLLEY

A neat and tidy shed is just one of the reasons for this recycling project. The environment and local council fees were also a factor. Necessity, as they say …

My wife and I have always taken full advantage of council recycling facilities. While I'm not a tree-hugging environmentalist, I don't like to see things that can be recycled or repurposed buried in a landfill.

While living in urban Whakatane, we usually filled the plastic and glass recycling bins, made heavy use of the green waste collection, and rarely got close to filling the general waste bin (which was half the size).

Country life

When we moved out to our lifestyle property, 12km out of town and a kilometre down an unsealed road, there were a couple of impediments to continuing our recycling efforts.

First, the council would not travel down our road. If we wanted our bins emptied, they had to be taken to the highway end of the road each week. In addition, at the time, there was a monthly charge of around $70 for even that limited service. So we decided to see if we could simply collect up the recyclable material and take it into town and drop it off free at the waste transfer station. They charged at the time $4 for a bag of general waste (now increased to $5.50).

My solution

With a nice big shed, it wasn't hard to create an area to store the waste in whatever bins we had to hand, but as the shed filled up it was an increasingly messy process, and about a year ago I decided to organise things a bit better and make a trolley that could hold the recycling bins as they filled up. This is what I came up with.

The first step was to work out how big the trolley needed to be. Here is the first shelf with the plastic crate determining the size. As is usual, I dug into my stockpile of timber first to avoid buying wood if I didn't need to. I found enough 75x25mm rough-sawn timber that had previously been used to box up a concrete driveway. It took a bit of tidying up, but being treated, it was otherwise good wood and a shame to waste

I needed space for four bins, so I needed five identical-sized shelves. Once the parts were cut, I just built them into a stack; they were then glued and screwed together. As is usual with my make-it-up-as-you-go projects, I simply stacked the shelves once built on top of the bins and then put spacers in to determine the height of the unit

"I don't like to see things that can be recycled or repurposed buried in a landfill"

Figuring out how long the side rails had to be to make it easy to get the bins out, even if full

The first three shelves fitted. It's kept nice and square and the shelves are level. No fancy joinery, just glue and screws

I put in the spacer timber, put the shelf on top, then glued and screwed the shelf in. I used a level as I worked my way up but didn't need to adjust any positioning, as it all stayed square and level as it was assembled

I left it alone overnight. The next day, I laid it down on the floor and fitted rails to the back to prevent the bins from sliding out the back and to add some rigidity

"In addition, at the time, there was a monthly charge of around $70"

The shelves all installed. I trimmed the two taller side rails later

I put wheels on almost everything; it makes it super easy to move around, but I also chose some nice vintage rollers that can handle more weight than I expect to ever load on the unit. I left it alone for a couple of days before deciding it was done for now. I thought about fully enclosing it with some sheet material, but couldn't see much benefit, really. I also haven't bothered to paint it. As you'll see later, I've since added some side shelves, which would have been harder if I had enclosed it earlier

> “With a nice big shed, it wasn’t hard to create an area to store the waste in”

The completed unit with bins installed. I’m currently putting mixed paper, plastics, tins, and glass in the top three containers; the bottom one is for scrap steel

I’ve now added two side shelves for additional smaller crates, which I’ll fill with scrap metal (copper, aluminium, and brass), so they need a bit of strength to carry the weight

The upgraded recycling centre with some additional braced shelves. A future upgrade might involve a pair of shelves on the other side to make it symmetrical, but at this stage, it isn’t necessary. I’m also thinking of some sort of attachment to fit and hold open a plastic rubbish sack on the other side for general waste. The whole unit likely cost me less than $20 in screws, glue, and the wheels it rolls about on, and it takes up a lot less space. A plus is that it’s easily moved to clean up around it as necessary

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CREATIVE SOUL WITH A MASTER PLAN

By Mark Seek | markseek@rocketmail.com

Our *Shed* shrink draws inspiration from a dedicated painter and decorator who spends his days in a nine-to-five routine, then transforms city walls into vibrant canvases as a street artist during his spare time

The earthquakes in Canterbury devoured much of the old established city, leaving layers of rubble, red brick façades, and cinderblock walls.

But the lining couldn't be more silver for Christchurch City's street/graffiti artists. They have offered a cheerful juxtaposition against a dreary, battered landscape. These creative souls with a master plan have taken over the city, one wall at a time.

Every bus trip into town now reveals generous tributes to our national heroes of the past, with a new contemporary vibrancy. Iconic renditions of Christchurch's John Britten and Sir Ed, and many, many more. The sheer scale of these masterpieces is quite remarkable, especially how lifelike they are.

Not knowing the community of artists involved in this rebirth of Christchurch, I was stoked when I was introduced to Sholto, who has some connections with this world.

Meeting an artist

I was intrigued and a little apprehensive, to be honest. These artists are a kind of cool bunch, sort of aloof and mysterious.

Our first introduction was helped due to our mutual appreciation for Mooneyes, Vans shoes, old Ironhead choppers, and all things relating to lowbrow art. This rendered our difference in age no barrier.

> "These creative souls with a master plan have taken over the city, one wall at a time"

1) Gearhead art. 2) An example of Sholto's creative flair. 3) Sholto, tradesman/artist. 4) Sticker-bombed toolbox of course! 5) Sholto's small space where he grafts away. 6) Custom T-shirt

So, I got an opportunity to visit his shed and have a yarn about his craft recently.

I got a call from the man himself to meet me at the industrial site where his creations are conceptualised and his Big Cartel orders are shipped from. Sholto rents a smallish space within a large shed. It has an ambience unique to him; the walls are adorned with his collections/trinkets. In the background, familiar ZZ Top tunes were playing, and immediately, I was relaxed.

A goal to be the best

Sholto is a straight shooter, and I admire his conviction to be the best he can be in all aspects of his life. Recent sobriety has offered this first-time dad an opportunity to be less impulsive and more "in the moment", most of the time, he says candidly.

He tells me his painting and decorating gig keeps him honest five days straight, then there's his side hustle of street/graffiti art, which includes online sales of limited-edition runs; stickers, T-shirts, and other lowbrow art pieces.

"My creativity has become less fragmented and now I am able to produce work I am proud of," he says. "Things I thought were beyond my reach are now realistic. I find that with improved confidence, my world has opened up many more possibilities."

The term 'blue collar' is rarely celebrated, but Sholto seems to wear it like a badge of honour. He is honest that he didn't always have a positive attitude to work. But creating a sole-trader position has allowed him to have time for his side gigs and still balance life. "It ain't luck; its taken a positive mind shift," he says. And good on him.

Less stress

So, how does he find time to balance everything? "The answer is I don't stress as much as I did in the past. I get up each day and stay focused. In my former years, well, this was difficult, but now I just get shit done. There's less distraction," he says.

I ask how he was introduced to street/graffiti art (as most of us probably have no clue). He tells me that he has been into it for some time, but recently someone admired his drawings. They thought his style had a unique quality, and it might expand well into large-scale pieces using 'rattle' (aerosol paint) cans. Sholto says people make it look easy, but it wasn't easy at first; he caught on though, and now this is one of his favourite methods.

He points to some large signboards leaning against an old Holden. "This is for a client who wants me to create a sign for his company. I get a certain brief, but because the client trusts my work, I have relative freedom to do my thing."

Inspiration

Sholto shows me some of his animal creations.

They are manufactured one at a time, and no two are the same. I can't help but notice there are so many differing styles and applications, so where is this source of inspiration? Sholto tells me it's all around him constantly; music, art, and influences from the past, as well as tattoo designs, are of particular interest to him, especially vintage styles.

There is something familiar about his art. I guess it's timeless and pays homage to artists from the past.

It is great to hang out, but I am acutely aware that this guy has some work to do, so I thank him for being generous with his time.

I glance over at another fixture in the building as I head for the roller door: a trusty Toyota wagon which looks like it has had some love poured into its bones. Impressed with what I see, I am sure that once some tasteful modifications are completed, it will be a rolling piece of coolness as well.

If the workshops around him are anything to go by, he's in the right place and the right time to fulfil his dreams and be true to who he was created to be.

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A BLACKSMITH AND HIS SHINING ARMOUR

Part 1

Leon Deverick's journey from circus performer to blacksmith has been both eventful and adventurous. His enduring passion for armoury has ultimately guided him to his current profession as an armourer, a role he has embraced for the past 10 years

By Helen Frances | Photographs: Helen Frances and Leon Deverick

Inside a large red brick warehouse on Heads Road, Whanganui, sparks fly and metal clangs as armourer Leon Deverick plies his trade. Metal coverings for body parts hang from the walls – there's arm and shoulder, thigh and calf armour, and a pair of gauntlets lie on the workbench.

Three large tree stumps are placed within easy reach of a small forge; the walls lined with a selection of rather esoteric-looking tools.

Leon, 35, makes armour for medieval re-enactors and fighters in 'Buhurt', a full-contact medieval fighting sport. He also makes a range of other items such as letter box numbers, trivets, leather water bottles, belts, creatively shaped wooden pipes, and anything else he or his customers want him to make with his eclectic set of skills.

Leon's smithy uses a tiny portion of the heritage-listed former woolshed, built 1918–1919, so he has plenty of room among the "dusty old warehouse vibes" in which to display his wares, see clients, give metal work and armoury lessons, and lease space to craftspeople and other artists.

The road to becoming an armourer

Leon has a varied background in science, circus performance, and an occasional very active interest in stunt work, but his time abroad nurtured an abiding interest in armoury, which led to his current career as an armourer, work he has been doing for the past 10 years.

Leon lived in Auckland for the first 18 years of his life. While at high school, Internet searches piqued his interest in circus acts, and he practised on his own. Then he joined the University Circus Club while studying at Otago University in Dunedin and did performances for fun. This mainly involved what he calls ground-based object manipulation, such as juggling and a bit of clowning.

"I eventually got good, and people started paying me to do it," Leon said.

His interest in armour and its construction started then through making stage costumes in chain-mail and leather for circus performances with the Dunedin circus group.

After completing an arts degree in classics and a science degree in microbiology, he worked for the university's pathology

The anvil is set into the tree stump. The chains muffle the higher pitched tones when striking the anvil and so reduce hearing loss. Hammer and tongs are within easy reach

Leon demonstrates his Crab Knight arm armour with fluted spaulder, upper arm, elbow, and forearm

Work in progress on the Fire Giant for De Vuurmeesters in Belgium

Fiery fun in gigs overseas

Sigmund the Knight – another project done in Belgium for De Vuurmeesters

department doing cancer research. Then, after eight years studying and working in Dunedin, an OE called, and he took off overseas, travelling around the world doing circus performances to pay his way. He also does a fair amount of fire performance that ranges across pyrotechnics and special effects to stuntman work, such as full-body burns.

A life on fire

In Ghent, Belgium, he was involved with a 7m tall articulated puppet, the 'Fire Giant', crewed by a team of five, and then as the 'Fire Knight', he was encased in a seven-foot-tall suit of armour.

He explains that the wearer looks out through the breastplate through a mesh of chain-mail. They have a head rig that attaches to the helmet above. When the performer turns the head within the costume, the head above turns, and the head, which is designed to be set on fire with a fire prop, bursts into flame. The accelerant is mainly paraffin-based liquid fuel, like lamp oil, used in Belgium.

"There is drip protection and then an air gap, because heat will tend to rise upwards. We'd have to have more insulation if the fire were below the performer. But if it's above, you don't need as much insulation, just a few barriers to prevent fuel dripping down in case they overfill the wicking."

While travelling and performing in circus gigs, Leon became friendly with an event organiser in London.

"I mentioned my interest in armour to him, and he said, 'Oh, I know this guy up in Liverpool. Would you like to go there and

learn a bit?' And so I went up to Liverpool, stayed with a guy called Fred Ryall, who is a professional armourer there."

Back home and now making armour

During the course of a week-and-a-half, Leon learned techniques with Fred, making mid-15th-century and German helmets. He liked it so much that on returning to New Zealand, he set up shop in Auckland and started making armour for people doing full-contact medieval fighting, working as a science technician on the side.

"You get a lot of big, strong guys entering it hyped up on, like, nerd rage and adrenaline. And so the armour needs to be built to different tolerances than you do for like, reenactors or jousters," Leon explains.

He says that Buhurt is less about looks, which is important for the reenactors, and more about the practical side of things. There are also safety considerations. Swords, axes, and maces are used in the fighting, which deliver heavy blows to the opponents' armour and require frequent repairs. So, affordability, simplicity of design, and ease of repair are important.

"Buhurt armour departs significantly from historical armour. They tend to have it looser and simpler. It also needs to be overengineered more than historical armour, which was designed to protect against different sorts of attacks," he says.

Leon enjoys problem-solving, research, and history, particularly with a tangible outcome. In making armour, these skills combine to produce results. Armoury and associated objects like leather drink bottles, shoes, and belts bring the past to life in the present.

"A lot of other people in New Zealand and overseas have almost a fixation on European history. Well, that's also somewhat to be expected because we are a very European-dominated society here. But there are other time periods and other cultures that have really fascinating ideas – like I find southern Filipino armour absolutely gorgeous and fascinating. But then, good luck finding anyone in New Zealand who's willing to pay for that," he says.

Europe beckons again

Leon, from Norman French descent on his father's side, has ancestral connections in Europe. His lineage can be traced back to the Norman Conquest of Britain, and his

Above: Leon makes a variety of other objects such as trivets, leather drinking bottles, pipes, and shoes

ARMOUR TERMINOLOGY

Sabaton – covers the foot

Greave – shin/lower leg

Poleyn – knee, though often attached to the cuisse

Cuisse – thigh

Gauntlet – hand

Vambrace / Lower cannon – forearms

Couter – elbow

Rerebrace / Upper cannon – upper arm

Spaulder – shoulder

Arm harness – when arm parts are attached to each other

Pauldron – shoulder, but larger and covers part of the torso as well

Cuirass – chest

Faulds – folding lames over hips

Gorget – upper chest and throat

Bevor – upper chest, throat, and jaw

Helmet – head

Armouring up takes time. The armour pieces are attached to a padded undergarment

Located in a vast former woolshed, Leon's smithy has all he needs within easy reach

The chemical cabinet on a work bench outside the smithy

surname 'Deverick' is a version of the French 'Devereux'.

Europe called again. After spending three years working in Auckland he moved to Belgium where he worked for five years, dividing his six-day work week between several very different occupations: working as a mycologist for an edible mushroom company; performing the occasional circus gig; and crossing the border into Clinge, the Netherlands, to blacksmith – making armour and creating fire sculptures.

Leon has been back in the country working full-time in his shed in Whanganui for the past two years. On his last return to New Zealand, he walked the Te Araroa Trail. He arrived in Whanganui during Vintage Weekend, a festival held every January, and loved the vibe in the city.

"There are interesting, creative things happening here," he says. "It reminded me a bit of South Auckland, where I grew up."

So he settled in Whanganui, joining his sister and cousins who had already moved there.

Making armour

Blacksmithing is the key skill of an armourer, and as Leon points out, there are different

Cutting a titanium ‘cuisse’ or thigh piece prior to using the angle grinder to make it a more comfortable fit

specialities within the trade. Making armour, swords, knives, or horseshoes, for example (not to mention shoeing the horse), requires different approaches and techniques.

Apart from his brief apprenticeship with Fred Ryall, Leon is self-taught, finding YouTube demonstrations to be an excellent learning source, along with online forum discussions about various techniques. As blacksmiths do, he has made some basic tools himself and continues to do so as required.

“For blacksmithing, you can be very lean on the equipment, and then you just tend to accumulate and make tools all the time.”

He says the minimum equipment required includes an anvil or stake to hammer on, a heat source and tongs, a hammer, and some way of cutting the metal. He does most of the work by hand, which includes all the shaping, but uses electric drills for drilling rivet holes and angle grinders for cutting out and smoothing off edges.

As for a heat source, he says that it depends on the type of armour and steel used.

“A lot of armour can be cold forged, depending on the tolerances you want it to be. It depends on the type of metal. If you’re working with mild steel, you can do a lot of this stuff cold because it’s going to bend before it cracks. Whereas if you’re working with mid- to high-carbon steels, then you definitely need a heat source if you’re going to be doing any shaping in the round.”

A reconstructed trade

As armouring in the European tradition died out around the late 1800s, and there was no line of masters teaching apprentices, he says it is very much a reconstructed trade, particularly for medieval-style armours.

“Around 70 to 80 per cent of it is silversmithing techniques. And then the other 20 per cent is going, ‘Well, we know we can do this, and it roughly works based on the images we have in medieval manuscripts of the armourers’ set-ups. We do have a few engravings of people in the workshops, and we can see what tools are available, and that gives us an idea of what they’re doing and how they’re doing it.’” ▶

ARMOUR STYLES

Humans, both a highly cooperative and naturally territorial and aggressive species, have long developed ingenious methods to protect our vulnerable bodies from the attacks of enemies.

Armour styles have evolved throughout history, from simple leather and hide to complex, full-plate armour.

Leon has researched the many different styles of armour, taking photographs of all kinds in museums – Filipino (horn and brass chain-mail); centuries of European plate armours – German Gothic; French; Italian – Japanese (leather and lacquer), Inuit, Kiribati, and more.

He finds the designs and materials of indigenous peoples’ armour ingenious. “Otago Museum has a Kiribati suit of armour that is like a coconut fibre onesie with a head protection board. They used pufferfish to make spiked helmets and swords that had shark teeth sewn into them.”

Maximilian-style armour – breastplate and helmet at the Burrell Collection, a museum in Glasgow

Gauntlets, Visby style

Fantasy armour made in India that Leon is adjusting the fit of for a client

Leon often makes armour for commissions, sitting down with clients, finding out what historical period they want, and matching that with the changes in fashion and techniques of the times.

"With European armour, you can often date a suit of armour to around 10 years or so. I'll find pictures of surviving armour, either in museums or by looking at what other people have made. If I'm lucky, I'll have a series of photographs of the piece that I'm recreating from several angles and measurements."

He takes clients' body measurements, likening the process to tailoring, with the proviso that there is much less leeway, much less give in working with steel than with fabric. There are also different types of articulations with a full suit of armour that is made up of many single pieces interlinked and joined together with rivets or leather.

Padded protection

The different metal pieces of armour are attached to a gambeson with leather straps and buckles (see photograph of Leon attaching pieces of his 'Crab Knight' armour).

Under medieval armour, combatants often wore this padded, quilted jacket that provided protection against blows and reduced friction with the armour. Leon does not typically make this undergarment, as clients provide their own; however, he does make the padded canvas linings inside helmets.

When making small parts of a suit of armour, Leon will make patterns, draw on the steel and cut them out. An example is a 'lame' (thin band of steel) that does not always require much shaping if it is bent along one plane; however, lames can also be shaped on several planes to enable them to slide smoothly over one another.

To make a heavily shaped part, such as a helmet, he cuts off a large piece of steel and goes hammer and tongs.

"With small pieces, patterns can be really important to get the shaping right," he explains. "If you're shaping it deeply, the more you're shaping a piece of metal, particularly if it's in two dimensions at the same time with synclastic or anticlastic curves, then the pattern is a lot less important."

'Synclastic' refers to metal that bends in two directions, curving towards each

Leon makes pipes, fashioning them in different shapes out of blocks of wood

Bevor, Gothic

Great Helm, helmet

other at the same time, as in a bowl-type shape. 'Anticlastic' is where two opposite curves bend away in opposite directions, such as on the inside of an elbow joint.

"Because they oppose each other, they impart quite a lot of strength to the metal part."

Metal matters

Leon buys large, flat sheets of metal. He says low-carbon steel is cheap and available, which suits the New Zealand market.

"Often, people in New Zealand aren't so fussy about the tolerances they're getting. If it's for re-enactment, for people who are fighting semi-professionally or professionally, then they're going to be wanting heat-treated spring steel like mid-carbon steels or titanium."

The tougher heat-treated metals, which are more costly, are sourced from overseas. Titanium is the lightest and most expensive metal he works with, but it provides a good balance of protection, weight, and durability. It has a high strength-to-weight ratio and is also resistant to corrosion.

Cold and hot

'Cold working' or 'stress hardening' metal is a process by which a metal is deformed beyond its elastic limit to increase its hardness and strength.

Techniques such as hammering and rolling introduce imperfections into the crystal structure of the metal, increasing its strength and hardness. In armour making, this process is crucial for shaping metal plates, making them more resistant to impact and penetration. It is also quicker than heat treating.

"The more you work it, the more stress you introduce to the piece of metal. This increases the risk of it cracking when it fails, as opposed to denting or bending.

It's important to know how the metal is going to fail. When it does fail, there are some parts where you want the metal to crack. Other parts you want it to bend and dent when it fails, such as helmets, where the fact that it bends takes some of the force out of the blow, which is the same idea behind modern crumple zones in cars. If the metal is deforming, that takes some of the force away from the squishy occupants on the inside."

Heat treating

'Thermal hardening', also known as 'heat treating' or 'quenching and tempering', is a process used to increase the hardness and tensile strength of steel or other metal alloys by manipulating their crystalline structure through heating and then cooling.

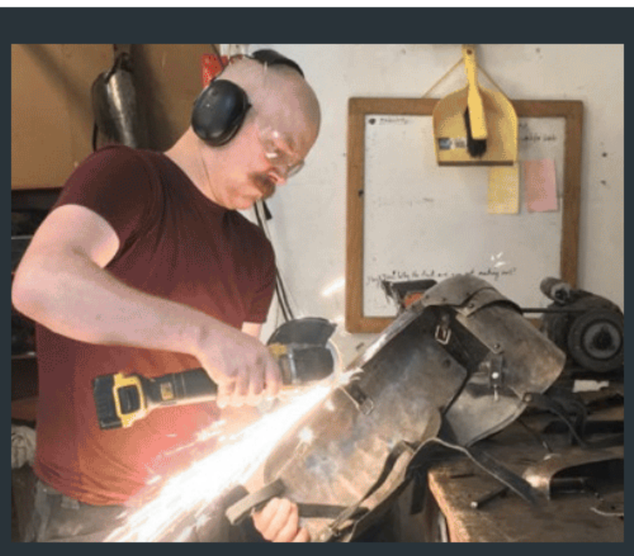
The steel is heated in a forge to a temperature above its critical point, changing the ratios of ferrite to austenite and altering the internal microstructure of the steel.

Quenching, the next step in the process, makes ferrous metal hard and brittle.

The heated steel is rapidly cooled in water or oil – Leon uses Canola. While the quenched steel is extremely hard, it is also brittle (snaps and shatters like glass) and prone to cracking.

"Often, ideally, you only want to quench once. You might anneal it multiple times [slowly cool], but you only want to have a single quench stage, because that's a risky stage where you might get cracks forming, as, when you quench it, the metal becomes very hard, but brittle," he says.

The empering that follows quenching makes armour durable and resistant to damage from impact. It involves reheating the steel to a lower temperature and keeping it at this temperature for a certain length of time. This process makes the steel more



TITANIUM FIREWORKS

Leon uses the angle grinder with a narrow cutting disc to remove metal from the inside edge of a titanium cuisse, as it came around too far into the crotch and was pinching the wearer.

He says, “This is very common for thigh armour, particularly if people gain or lose weight. That means when people bring their legs together, it can pinch.”

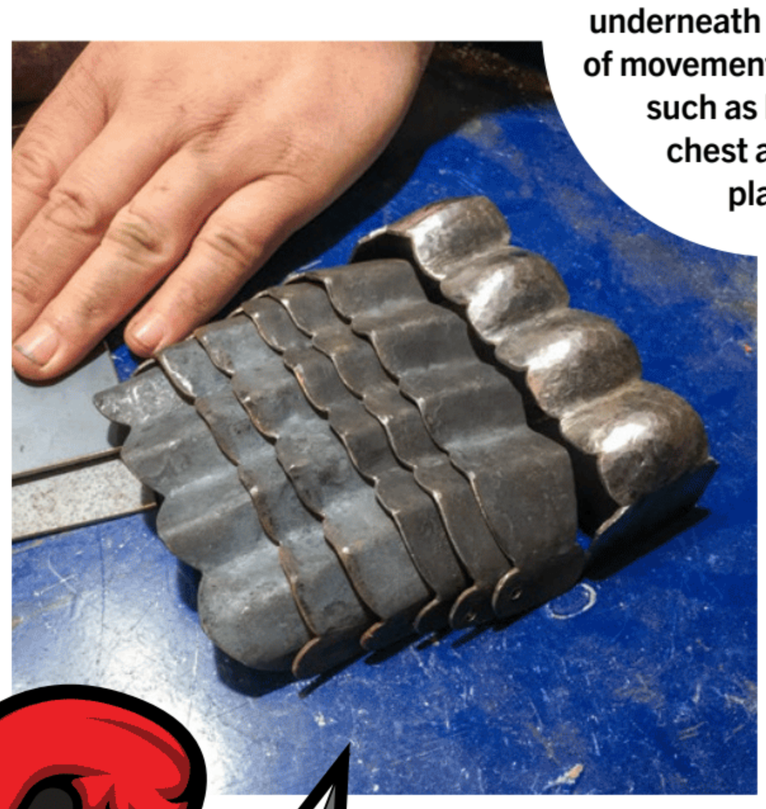
He says titanium tends to produce whitish sparks when it is ground, similar to the colour in white fireworks.

“They use titanium as a colourant. If you’re grinding steel, you’ll tend to have more yellowish colours and different types of sparks. Some steels produce spark flowers, others are more linear.”

While titanium is expensive, it is an excellent choice for armour, as it is highly resistant to corrosion across a wide range of environments. It is very durable and significantly lighter than steel.

Cuisse showing layers that allow for movement

Many armour parts are segmented and joined by leather straps underneath to allow ease of movement. Other parts such as back and chest are solid plates



“It removes a lot of the brittleness of the steel so that it’s still fairly hard”

ductile and less sensitive to cracking without significantly reducing its hardness.

“You can temper things in an oven. Tempering is bringing it back up to low temperatures,” explains Leon. “Depending on the type of steel, it’s usually between 220 and 320 degrees, and holding it at that temperature for about 40 minutes or so.

“You might do this multiple times.

“What tempering does is it takes off a little bit of the hardness that you get from quenching it, but it removes a lot of the brittleness of the steel so that it’s still fairly hard, but it’s a lot more flexible and it’s less likely to snap if you put any type of tensile pressure on it. Essentially, it’s the same process they use to make springs. Different tool steels will be tempered at different temperatures, depending on the relative hardness versus springiness or toughness that’s required.”

Articulation

Armour has to allow the wearer a full range of motion while providing

Crab Knight armour with ‘gorget’ – upper chest and throat – and ‘cuirass’ – chest

protection. Rivets, straps, sliding rivets, and overlapping plates are used to join segments of armour.

At the time of *The Shed* interview, Leon is repairing a ‘sabaton’, or medieval safety shoe. This particular style covered the front half of the foot and had leather straps around the bottom and the back of the heel to secure the articulated parts, which are made of several lames or thin plates.

He says, “You have the individual plates riveted to strips of leather, and that is known as ‘floating articulation’. The leather bunches up accordion-like as it compresses. So you can get quite a wide range of motion with this. The downside is that when it’s done poorly, you get fairly large gaps between the plates. That’s because you need to have looser tolerances for the amount of articulation for this particular style. Gaps are not so great when you’re getting in close fighting with pointy objects.”

Historically, Leon says the way to defeat someone wearing plate armour was not to cut them – impossible through the metal sheet. The idea was to get up close, wrestle them, and then get through the gaps in the armour, prying them open with a knife or a dagger and stabbing them. Nowadays, there are strict rules that prohibit stabbing in armoured combat.

Other styles of sabatons might wrap around to cover the ankle and the heel.

The sabaton may be separate from or integrated into the ‘greave’, which protects the lower leg.

Spaulders and pauldrons

A ‘spaulder’, or armoured arm protection, covers the upper arm and the top of the shoulder, whereas a ‘pauldron’, while also protecting the shoulder joint, covers more of the upper chest and the armpit region.

The ‘spaulder’, made of lames and plates of metal, is articulated so the wearer can move in several directions. On the inside, it is articulated, not by using leather, but with rivets.

“One part of the lame has a slot cut into it so that the rivets can move up and down while also moving. So that gives you more range of movement,” he says. “With this type of articulation, you can have a much smaller gap in the space between lames, so it’s a bit more protective against thrusts and the like.”

The curved shoulder plate also has ‘fluting’ – the word varies depending on which language is being used. (A lot of English terminology for armour is borrowed from other cultures. There are a few purely English terms for armour, but a lot of it is French, Italian, or German.) Fluting adds strength to the steel plate, similar to the function of ridges on corrugated iron. It provides strength in the longitudinal direction and also directs a pointed weapon away

“It’s a quicker way of making helmets”

CRAB KNIGHT

Leon made a crab knight armour for a local festival in Hunterville based on research that his marine biologist friends have been doing on creatures that mimic true crabs through a process of carcinisation.

“They’re not true crabs, but they evolve crab-like characteristics because it’s just a very advantageous body form in that environment,” he explains. “I already had a suit of armour that I was working on, and I had a week spare, so I decided, since I already specialise in making exoskeletons and carapaces and the like, I may as well just make a creature that reflects that.”

While he does not do battle in his crab knight gear, Leon does practice Historical European Martial Arts (HEMA), which he says is more like fencing using historic weapons. He also dresses in medieval costume to attend re-enactor events and keep in touch with his clientele.

from vital body points.

"This fluting is very characteristic of the early Maximilian style. Looking at this piece [see photograph], you can date it between 1510 and 1530," Leon says.

Spaulders evolved into pauldrons, which became larger and sometimes included parts of the chest and back. They are usually made of metal plates, often overlapping to provide flexibility while maintaining coverage.

Helmet-making techniques

The afternoon *The Shed* visits, Leon is making a helmet using a modern technique of making two parts, then welding the two halves together.

"It's a quicker way of making helmets," he says, "because you don't have to do the depth of shaping that you would for a historically made helmet. If I were making a helmet, historically, I'd start off with a flat sheet and then raise all that metal down. That takes a lot of time and effort to do, because you have to compress the edges of the metal down so you don't thin the metal too much."

Leon's work brings in a varied clientele. A food truck that cooks rotisserie chickens needed extra metal bits on the rotating parts, so the chicken doesn't "flop around", and another client brought in a bedpan from the 1800s to repair. "Their son had dropped a fire poker on it and put a giant dent into the copper. If people have metal that they care about that's got some emotional attachment, then you can start to get closer to the original form."

He is usually careful not to leave hammer marks, although he says people often like to see hammer marks in the work he does because it shows that it's been handmade.

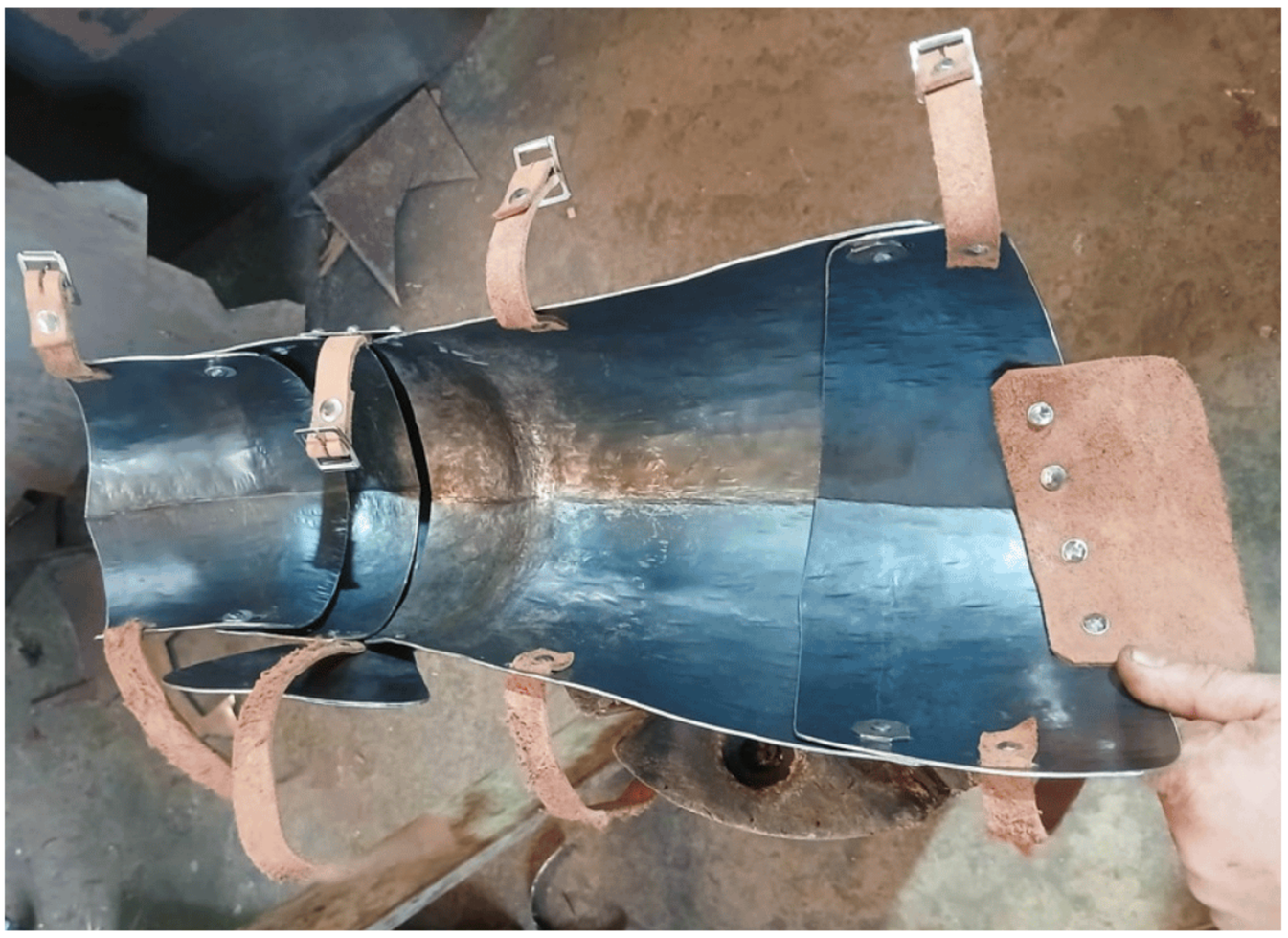
"Historically, if you left hammer marks in your piece of work, it would be seen as poor craftsmanship, and they'd expect you to polish it out."

The afternoon sun streams through the warehouse door at Heads Road as Leon prepares for his next client – another young man keen to start learning the basic skills of blacksmithing.

In the next issue of *The Shed*, Issue No. 123, Leon talks tools and demonstrates some blacksmithing techniques in making an 'awl', a pointed tool he uses to make small holes in leather, and a 'cuisse', or thigh cover.

Contact: leon.deverick@gmail.com

Sabaton interior, showing floating articulation. Right: Sabaton, foot armour



Interior of cuisse and poleyn (thigh and knee)

Gothic-style armour at a Brussels military museum

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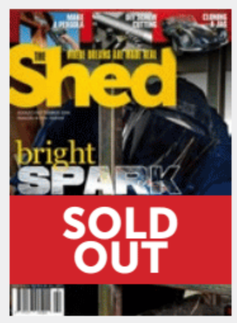

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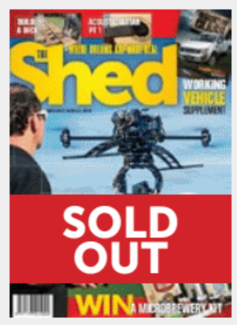

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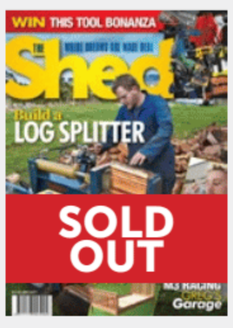

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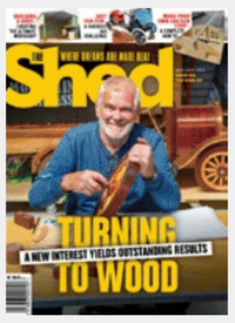

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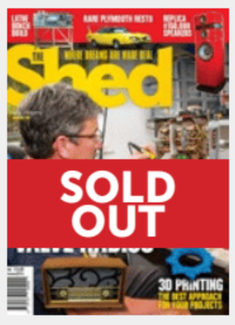

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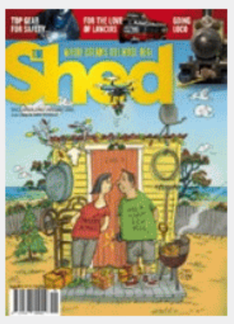

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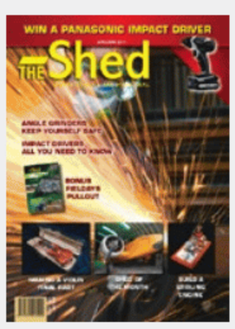

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If you can't get a decent return on your investment, is solar worth it?

THE POWER AND THE GLORY

By Jude Woodside

The independent power retailer Flick has been gobbled up by one of the mega electricity gentailers. Jude wonders what now for our country, its consumers, and our energy needs

Our dysfunctional electricity industry has resurfaced to torment me again.

Flick Electric has been sold to Meridian. A monopolistic company swallowing its competitor, yet again.

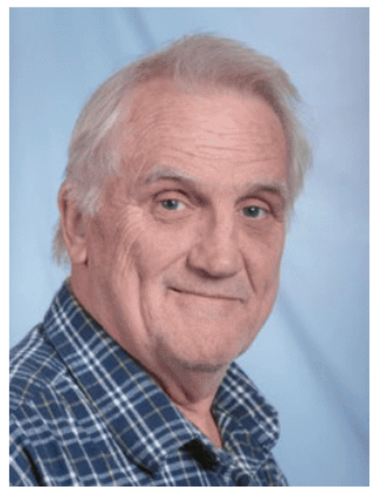
I am a customer of Flick. This means my power bills will increase, and I will no longer get a reasonable price for the power I generate. It is probably not a coincidence that at the same time as Meridian swallowed Flick, Genesis reabsorbed its version of Flick, Frank. It felt it no longer had to compete.

The partial privatisation of the power industry has proved to be a disaster. The gentailers have operated as a cartel, colluding on prices and actively seeking to game the system by running down the hydro assets to burn coal. Why, you ask? Simple. When Huntly is operating and burning coal, the spot price of power leaps up, and all the generators can now claim this new tariff.

Whistle blower

Ominously, Flick Electric was one of those who blew the whistle on Meridian doing just this.

Meridian was fined, but not enough to offset the profit from doing so. Its rationale is no longer about achieving a consistent energy environment for the economy, but is focused on shareholder reward. That is evident from the fact



Jude Woodside

that, despite record profits, it has failed to invest in any serious generation development. True, it has added a few wind farms here and there, but there has been little in the way of real investment in additional assets. Yet we remain short of power at crucial times, especially in winter.

I was with Flick because it paid me the same rate for my solar power that it paid the generators, the average spot price. That ranged from a few cents to 29c per kWh. Not huge, but significant. In contrast, the behemoth that is Meridian is offering 17c if I sign up exclusively for three years. I will stop exporting to the grid and buy another battery.

We need a meaningful price

Remember, this company will charge me somewhere between 29c and 35c per kWh. Until consumers are paid a decent price for their domestic electricity generation, there is unlikely to be any significant uptake. Domestic solar will not fill the gap, but it could lighten the burden, especially during the day.

If every new house in New Zealand had a minimum of 5kW of solar, we could save enough to avoid building another power station. But without a meaningful price, no one will be bothered. The gentailers now control the entire industry.

Their greed has already led to hundreds of jobs and export earnings lost due to their intransigence in wholesale power prices. They have even threatened the government with a 25 per cent increase in the price of power if they dare to intervene in their wholesale pricing. That's a cartel in action!

It's time the gentailer structure was unravelled and the retailers split from the generators.

Then, we might have a competitive model. However, I am very sceptical that a competitive market in a crucial industry like power is a good thing.

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