

DRYDEN

WOODOIL THE NATURAL CHOICE
FOR YOUR TIMBER



[DRYDEN.CO.NZ](http://dryden.co.nz)

**PROJECT:
RIVER-
STONE
TABLE**

**CLEVER
MILLING
MACHINE
MODS**

**BORN
AND
BRED
SHEDDIES**

THE WHERE DREAMS ARE MADE REAL

Shed

MARCH–APRIL 2021

ISSUE 95

THE-SHED.NZ

DAMASCUS MAGICIAN

MAKING PATTERNS THAT ARE CONSISTENT AND REPEATABLE

MORE 3D-PRINTER TIPS

NZ \$14.95 INCL. GST
AUS \$16.95 INCL. GST



045002
771177
9

flexOvit®



**“OUR BEST
CUTTING WHEEL”
LASTS 20%
LONGER***



Matthew Redman
Product Manager Thin Wheels - Pacific



*Proudly since
1978*

YOUR SAFETY MATTERS

Flexovit is a registered trademark of Saint-Gobain Abrasives, Pty. Ltd.

* compared to Flexovit Megaline, the Pacific's favourite cutting wheel

flexovit.com/en-nz

KIDS

The effect adults have on young children should never be underestimated.

We have a couple of articles in this issue that reinforce that belief. One is a story of a father and son sharing time in the shed and working on projects together. The other is a tale of a dad who was a prolific inventor and builder in the '50s, approaching projects with initiative as well as making stuff for his children to enjoy. One youngster is getting his memories made for him as we speak; the other, as an adult, honours his clever, fearless, sheddie dad.

It is incredible just what goes into young minds. Even if they are not keen on getting on the tools themselves, it is always surprising what they pick up just watching you in the workshop. They can recall stuff from decades ago that you have long forgotten. Often the smallest action or task you undertake can make a huge impression on a young mind.

Holidays seem to go deep into the memory banks, too, I have noticed. I have very fond memories of an uncle taking us to the beach when we were just nippers as he had a car — such a rich man! And so it is with holidays that it's often not the big

flash trip to Disneyland that is recalled with ease in adulthood but more likely to be that trip to a swimming hole where everyone jumped in and swam together and had fun on a hot sunny day.

The key I believe is sharing time and tasks together, no matter how small or seemingly insignificant.

Personally, it always brings me joy to see the children of sporting icons following in the footsteps of their parents. Our combined joy is seeing the children in our lives follow us by taking the time to complete a project in their workshop — having gathered inspiration from us — on the tools, having a go, and thoroughly enjoying it.

So, never underestimate that time spent with youngsters alongside you in your workshop. Even if you don't get around to getting your projects featured in *The Shed*, your children may just showcase your talents in 40 years' time!

Make sure your workshop is always tidy when they are around and their phones are taking pics — the last thing you want to see from the grave is an untidy bench! 📱

Greg Vincent
Publishing Editor

the-shed.nz |   theshedmag | Subscribe  MAGSTORE.NZ

DISCLAIMER

No responsibility is accepted by Parkside Media for the accuracy of the instructions or information in *The Shed* magazine. The information or instructions are provided as a general guideline only. No warranty expressed or implied is given regarding the results or effects of applying the information or instructions and any person relying upon them does so entirely at their own risk. The articles are provided in good faith and based, where appropriate, on the best technical knowledge available at the time. Guards and safety protections are sometimes shown removed for clarity of illustration when a photograph is taken. Using tools or products improperly is dangerous, so always follow the manufacturer's safety instructions.

THE WHERE UNIONS ARE MADE REAL
Shed
the-shed.nz

ISSN 1177-0457

EDITOR

Greg Vincent, editor@theshedmag.co.nz

SUBEDITOR

Karen Alexander

TECHNICAL EDITOR

Jude Woodside

PROOFREADER

Odelia Schaare

DESIGN

Mark Gibson, Henry Khov

ADVERTISING SALES

Dean Payne, dean.payn@parkside.co.nz

ADVERTISING COORDINATOR

Emily Khov

CONTRIBUTORS

Murray Grimwood, Jude Woodside, Enrico Miglino, Bryan Livingston, Coen Smit, Ian Sharpe, Geoff Burgess, Bob Hulme, Dave Montgomery, Geoff Lewis, Jason Burgess, Hugh McCarroll, Clint Frater, Claire Ashton

SUBSCRIPTIONS

ONLINE magstore.nz

EMAIL subscriptions@magstore.nz

PHONE 0800 727 574

POST Magstore, PO Box 46020, Herne Bay, Auckland 1147

**parkside
media.**

EMAIL contact@parkside.co.nz

PUBLISHER

Greg Vincent, greg.vincent@parkside.co.nz

BUSINESS DIRECTOR

Michael White, michael.white@parkside.co.nz

GENERAL MANAGER

Simon Holloway, simon.holloway@parkside.co.nz

CONTENT DIRECTOR

Isobel Simmons

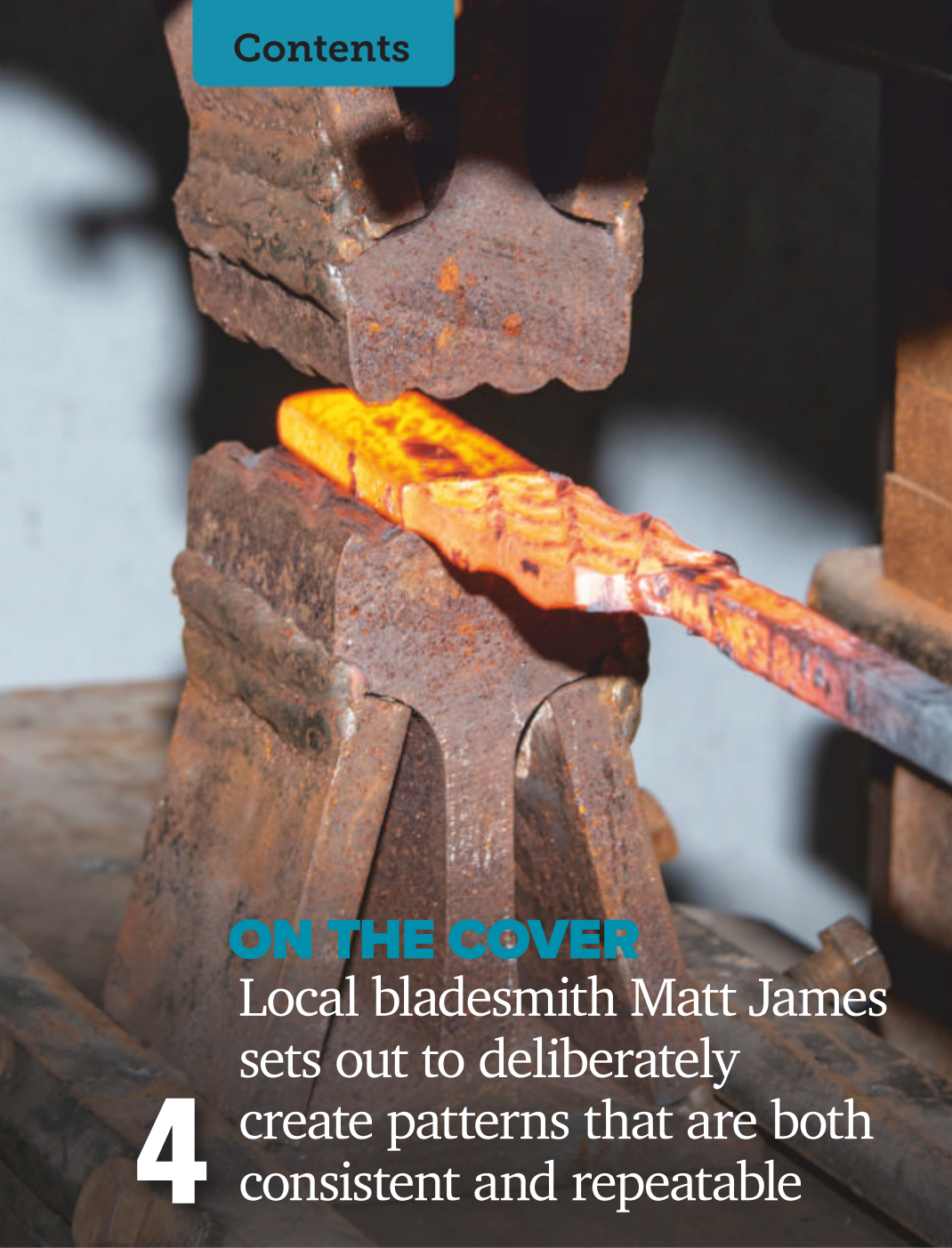
PRINTING AND DISTRIBUTION

Ovato

PHONE: 09 928 4200

NOTICE TO ADVERTISERS

Parkside Media uses due care and diligence in the preparation of this magazine but is not responsible or liable for any mistakes, misprints, omissions, or typographical errors. Parkside Media prints advertisements provided to the publisher but gives no warranty and makes no representation to the truth, accuracy, or sufficiency of any description, photograph, or statement. Parkside Media accepts no liability for any loss which may be suffered by any person who relies either wholly or in part upon any description, photograph, or statement contained herein. Parkside Media reserves the right to refuse any advertisement for any reason. The views expressed in this magazine are not necessarily those of Parkside Media, the publisher, or the editor. All material published, gathered, or created for *The Shed* magazine is copyright of Parkside Media Limited. All rights reserved in all media. No part of this magazine may be reproduced in any form without the express written permission of the publisher.



ON THE COVER
Local bladesmith Matt James sets out to deliberately create patterns that are both consistent and repeatable

4



48 Flying on water
Foil-board riders don't ride or sail; they fly



My shed
Father and son sheddies



Smart home project
The smart peephole — Part 2



Milling machine mods
Fitting a traverse drive to a milling machine table X axis



Off the grid
Three summer projects



Go back in time
The Shed visits The East Coast Museum of Technology



Adventures in 3D-printer land
Some useful user advice



36 Mastering the lathe — Part 3

A wall-mounted mower blade balance makes a fun lathe project



28 Game project

Make a tabletop push-penny game



62

Make a rivulet table

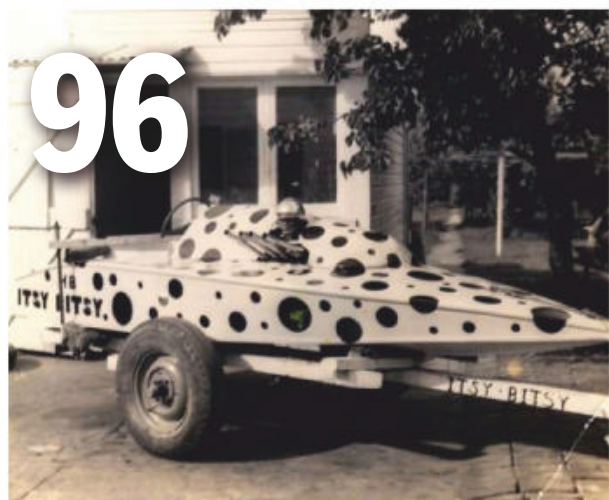
A little table to please the eye



70

Upcycling vintage tech

Magic radio — Part 3



96

The first jetboat?

A son puts his father's name into the ring as the builder of the first jetboat



102

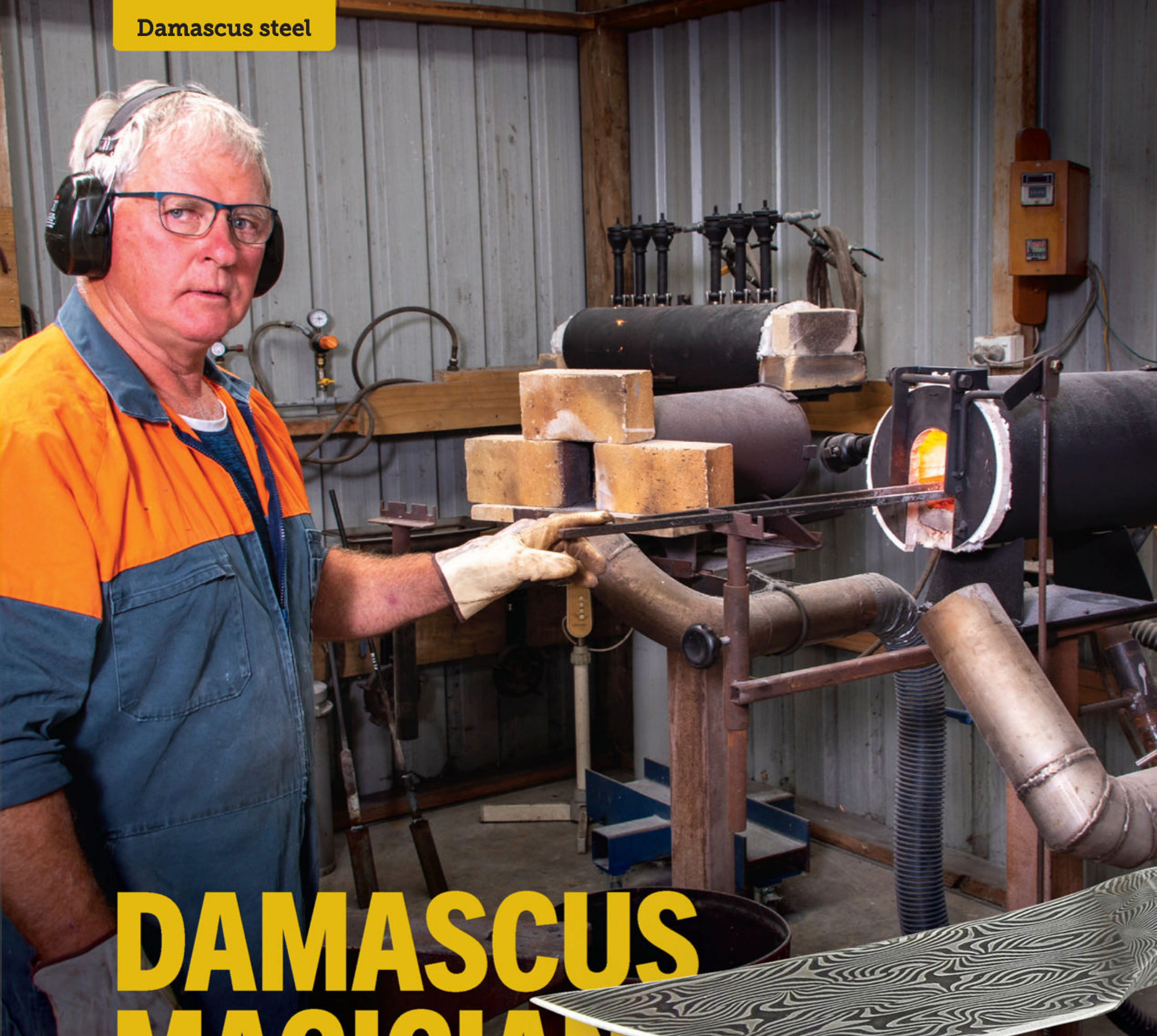
A model citizen

Ted Egan creates models of the Thames region's historic buildings

EVERY ISSUE

- 1 Editorial
- 12 News
- 14 Letters to the editor
- 16 Subscribe to *The Shed*
- 94 Brewers scoop
- 109 Bookcase — technical books for sale
- 110 Back Issues of *The Shed*
- 112 Back 'o *The Shed* — Jude looks back on his life from his metaphorical rocking chair

12



DAMASCUS MAGICIAN

When local bladesmith Matt James creates Damascus steel in his 21st-century workshop, he is following a tradition that goes back more than 1000 years and whose origins are the stuff of legends

By Jude Woodside

Photographs: Jude Woodside and Matt James

Damascus steel is a product about which there is as much myth as fact. It's nearly impossible to know where it originated; however, it is unlikely to have been the capital of Syria. Its origins are buried in archaeological time, along with the equally mysterious wootz steel.

The original Damascus was steel forged with wootz or high-carbon crucible steel imported from centres in southern India in the Middle Ages and forged in the Middle East. The blades that resulted were characterised by a pattern in the steel that in some resembled water —

in Arabic, *damas* is the root word for 'watered' — and in others ladders and other patterns. Traditionally, weapons made from this metal were rumoured to be phenomenally sharp, able to cut into armour, and difficult to break. Thus, a legend was born.

Matt James in his foundry. The welding kiln is on the right and his sword kiln is in the background. The tubes in front of the kilns deliver an 'air curtain' to keep handles and hands cool

Pattern welding

Nowadays, Damascus steel is recognised as an amalgam of several layers of steel forge welded together; however, technically, this is pattern welding. The result can have a purely decorative effect or it can contain properties that its components alone could not produce. The Japanese are famous for their forge-welded swords, knives, chisels, and plane blades, where a very hard and brittle base is wrapped in a protective blanket of softer steels to absorb shock. These tools are rightly famous for the keen edge they can

be sharpened to and the length of time they retain that edge.

Most knife makers like to make Damascus for decoration and, to be fair, there is very little science or planning in it. It is often simply a bundle of steels welded together, worked, and then etched to reveal the patterns made by the forging process. Some do use a bit of distortion of the metal to create patterns, but the results are usually random. There is one local bladesmith, though, who sets out to deliberately create patterns — patterns that are both consistent and repeatable. ►

Drawing out on the B&S Massey power hammer — note the isolating raft that the hammer is installed on to prevent the impact spreading through the shop

Traditionally, weapons made from this metal were rumoured to be phenomenally sharp



Heating a blank to working temperature

He was famous for being open and giving free advice

Catching the bug

Matt James has been making Damascus steel since the late 1990s. He picked up the bug in the late 1980s when living in and travelling through California. On a return visit in the 1990s, having read a copy of *The Gun Digest Book of Knives* — a publication that has influenced many knife makers — he sought out Bob Engnath, whose shop Blades 'n' Stuff in Glendale, Los Angeles, featured in the

book and was a magnet for many early bladesmiths. Engnath ground blades for his customers and sold blanks along with all the materials needed to make a knife. He was famous for being open and giving free advice and encouragement to would-be makers, and Matt got the opportunity to shape a blade with him. That got him hooked.

Purpose-built workshop

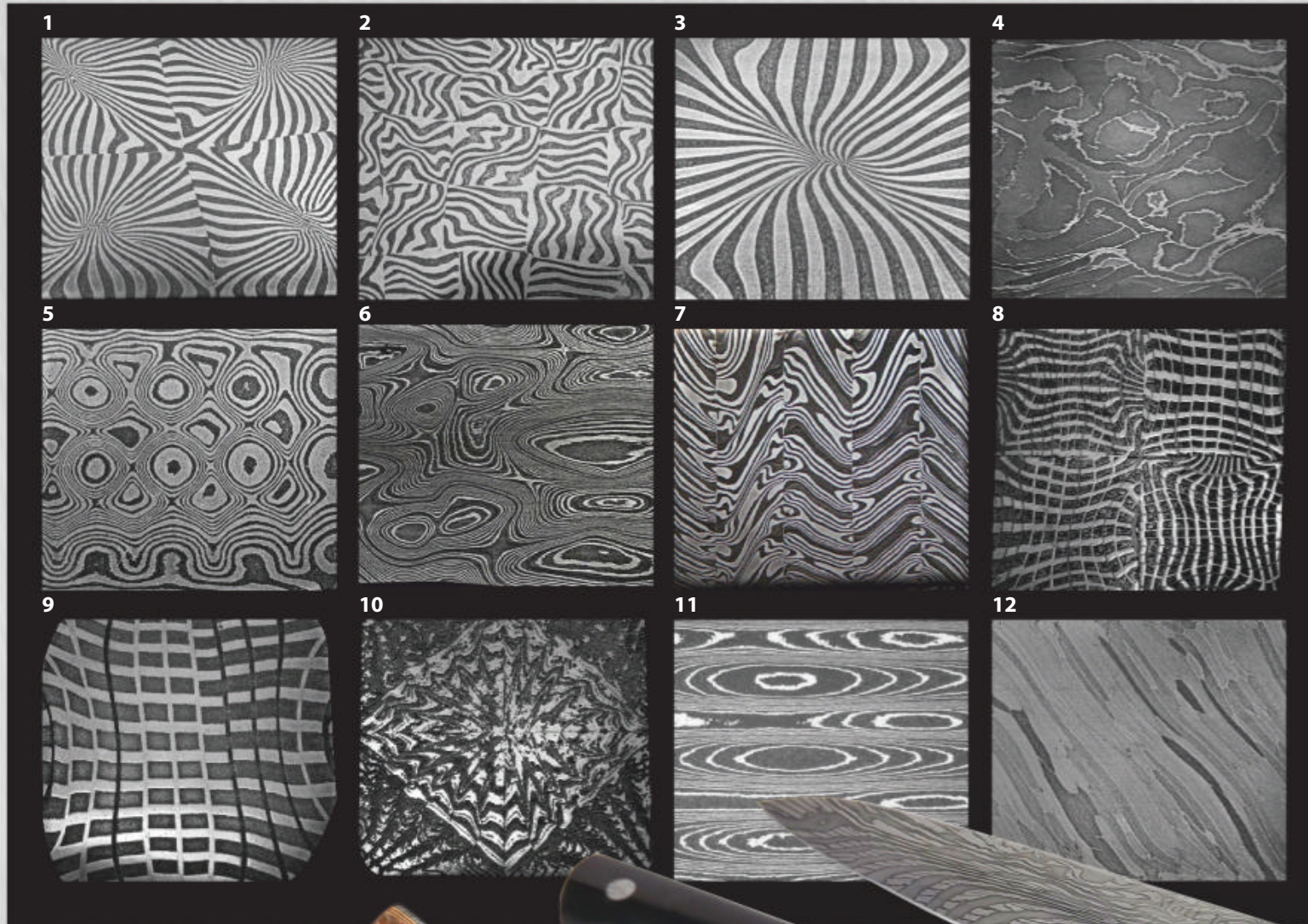
Matt's workshop is well equipped and spacious. It was purpose built on his lifestyle block and contains a restored B&S Massey power hammer — formerly in the railway workshop in Auckland — on its own isolated pad, along with four forges that Matt has made himself and two presses, one of which he custom made.

He has two forges for heating and one specifically for welding because he has found that the borax flux used for forge welding has a tendency to ruin the Kaowool lining of the heating forges. Matt's welding forge is lined with castable, heat-resistant cement, and is designed to get a hotter temperature ►



The roller mill Matt James built — note the foot-operated lever to engage the rollers, allowing one-handed operation

Matt James's work:



A gallery of some of Matt James's Damascus-pattern variations

1. Concertina
2. Lattice
3. Radial
4. Chainsaw chain
5. Raindrop
6. Devil's darts
7. Turkish
8. Confetti +
9. Confetti
10. Starfire
11. Ladder
12. Wire rope

Below: Chef's knife — confetti + pattern, confetti pommel, South Island beech handle



Left: Hidden tang, small hunter, feather-pattern blade and pommel, bronze spacers and wash, South Island beech burl

Above: Full-tang small bowie, raindrop pattern, bronze spacers, radial pins, black ram's horn, ostrich inlay

Pipehawk, curly maple handle, silver inlay

Below: Twist pattern, red beech handle, radial bolsters, radial pins

Above: Hunting knife, hidden tang, confetti pattern, confetti pommel, swamp kauri, basket-weave sheath

Above: Small hunter, hidden tang, Turkish pattern, horn handle, jelly-roll pommel, black sheath

Above: Turkish-pattern office knife, confetti pin, concertina bolsters



The device at the top of the mill is a fan to help cool the rollers in operation



Matt correcting any distortion in the blank on his home-made press

than his two smaller forges. He also has a custom forge for heating longer sword blanks.

A great addition

A recent addition to the workshop is the rolling mill. This allows Matt to roll out his steel to consistent thickness. The machine is almost silent in operation. It's also far quicker than hammering and gives consistent results with fewer irregularities. Matt built the rolling mill himself based on a design by the legendary West Australian blacksmith Hugh McDonald. This mill differs from others you may be familiar with in that it has a foot pedal to engage the driving roller. That means that you can also

disengage it and retract the piece rather than having to collect the hot metal from the other end. It is a great time saver as well as being easy to operate while holding a red-hot piece of steel.

The plans for the rolling mill are available from the Anvilfire website — anvilfire.com. Matt's version includes a fan to cool the rollers and a digital gauge to measure the roller gap. It comes into its own when Matt is forging longer blades — especially sword blanks, which he has found himself doing more of lately.

In an adjoining room even more spacious than the forge area that Matt houses his mills and three 2x72 linishers together with his latest home-made additions: two wet grinders that can

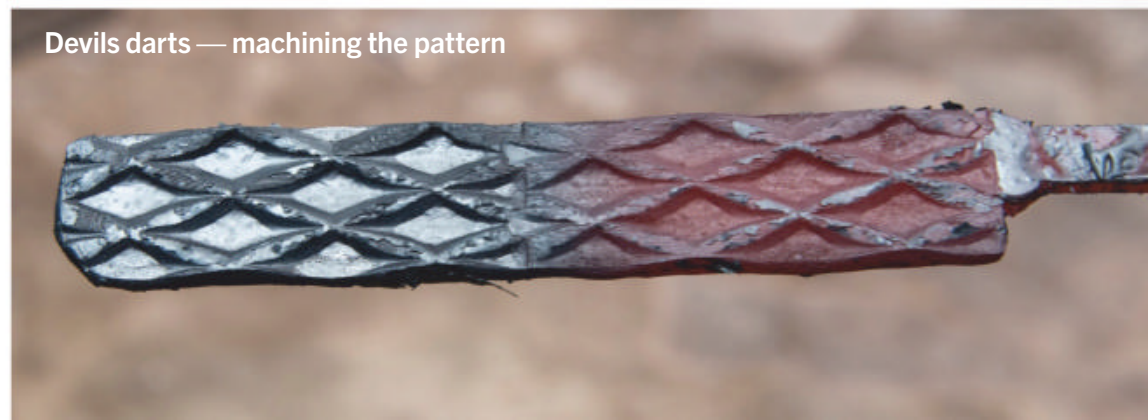
It is a great time saver as well as being easy to operate while holding a red-hot piece of steel



Matt uses his restored hydraulic press to add distortion to the blank



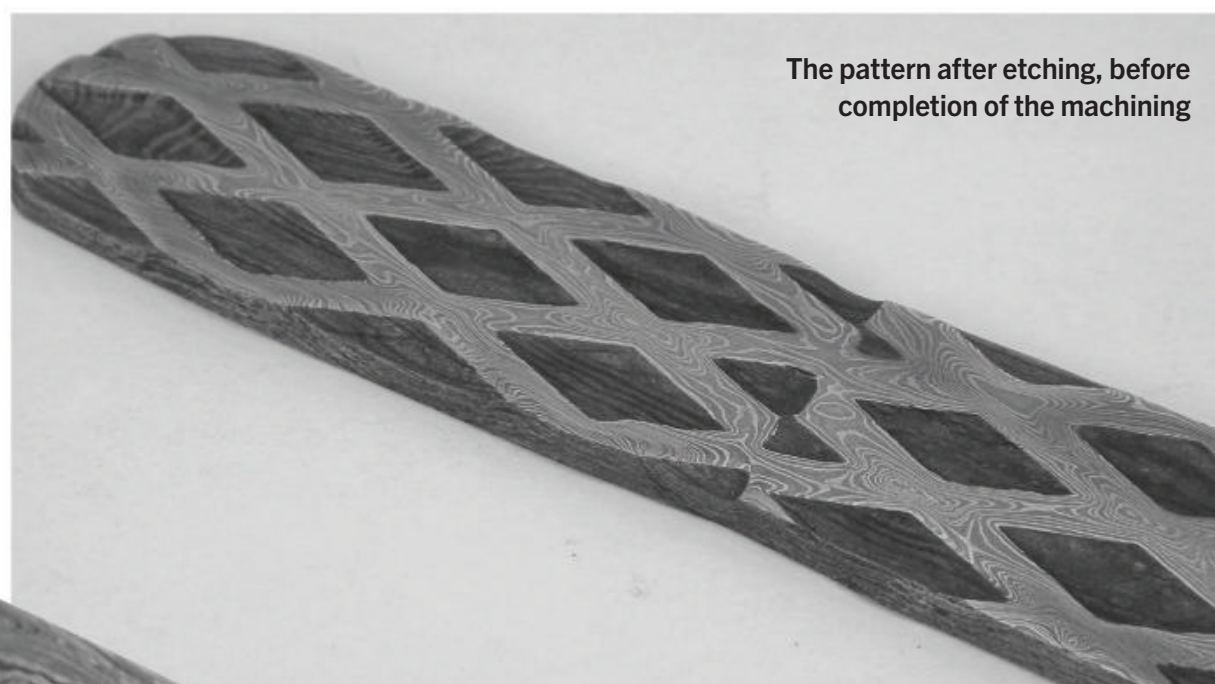
The pattern that becomes devil's darts after machining



Devils darts — machining the pattern



The pattern after etching, before completion of the machining



The pattern after etching, before completion of the machining



The final pattern after further machining

It has a high level of nickel, which gives it good impact toughness

accept Velcro-backed diamond papers to wet grind and polish blanks, knives, handles, etc. One is designed to tilt and incorporates an ingenious rubber shield that redirects the water from the wheel down the drain to be recycled rather than onto Matt's shoes.

Point of difference

What sets Matt James's work apart is the variety of his designs and their repeatability.

In general, most of the designs start with a 25-layer blank of alternate layers of L6 and 1075 steel. L6 is a versatile, oil-hardened tool steel. It has a high level of nickel, which gives it good impact toughness and imparts a bright look to the steel. L6 is often used for blades as it holds an edge well. It is similar to 15n20 for its nickel content. The alternating steel 1075 is a good general-purpose high-carbon steel.

"Knife steel must have good heat treatment and edge-holding qualities, and I like the contrast between these steels. In the past I have even used 1075 and nickel shim stock for the contrast," Matt says. "The brightness of the nickel seems to make the 1075 even darker, improving the contrast in the piece."

Both steels respond to the same heat treatment when forge welded together.

To make his distinctive 'confetti' grid pattern — which is the basis of much ►



Billets assembled in a jig to make the distinctive confetti pattern

of his work — Matt forge welds and hammers out a 25-layer billet to make a solid bar of about 40x40mm. This is cut into slices 3–4mm thick and these are laid edge to edge like a sandwich filling with fresh pieces of steel either side. This billet is then forge welded and the process can be repeated to make a pattern with a grid-like look that can be further disrupted with press templates or through twisting to create other patterns or distortions. Some of these can take on an almost surrealist appearance.

Devil's darts

Matt uses a variety of press forms to disrupt the forged billet and thus reveal other regular patterning through milling the raised parts of the billet flat. Using a ball end mill on the forged billet creates a ladder effect. His press for creating what

Similarly,
he uses a
dimpled
pattern to
create his
raindrop
effect

he likes to call 'devil's darts' is illustrated.

Similarly, he uses a dimpled pattern to create his raindrop effect, again by milling the raised portions off or even boring indentations in the metal with a

round nose ball mill. Matt machines his press forms from bits of railway track that are bolted into one of his two presses.

One of his favourite patterns is what he terms the 'Turkish pattern'. This is achieved by first forging and drawing a billet down to a long square rod and then applying a twist to it. Several of these pieces are then welded together and the whole thing is flattened and rolled out, creating the unique flecked look. The pattern changes the deeper you cut into the surface.

"As you get further into the twist pattern you expose a star-like pattern," Matt explains.

He is currently experimenting with a starburst look he calls 'starfire', created from four twisted elements forge welded and cut through, possibly for use as a bolster.

Matt sells Damascus billets in various patterns and can make them to order. He also produces a very nice line in Damascus knives. He was recently commissioned by an American customer to make a Native American tomahawk complete with a pipe bowl — commonly called a 'pipehawk' — all in Damascus.

Matt James's website has further examples of his work and billets for sale: damascus.co.nz. 📄



Matt's home-built wet-grinding system

YOU DON'T NEED A BIG ONE TO HAVE FUN.

Vehicles of all sizes, shapes, ages and models will be on show and in motion at Wheels at Wanaka 2021.

Register your head turning wheels today!



AT
**Wheels
Wanaka**
EASTER WEEKEND

2021

Wheels at Wanaka, Easter Weekend,
April 2nd – 4th, 2021



IF IT'S GOT WHEELS OR TRACKS IT'LL BE ON DISPLAY!



50 ACRES OF ENTERTAINMENT INCLUDING;

- Terra CAT Earthmoving Extravaganza
- Southpac Truck Show
- Tractor & Truck Pulling Comp
- Action Sports Dirt Pit – ATVs, Enduro Cross, 4WD Demos
- Steam Engines & Vintage Farm Fair
- Vintage, Classics and Modern Cars & Bikes
- Highlands Parade Ground all-wheels, history-in-motion, non-stop show

Plus so much more!

NZ'S BIGGEST ALL-VEHICLE EVENT; IT'S HUGE AND FUN FOR THE WHOLE FAMILY!

Terra CAT Mega Earthmoving ONLY Day:
10am–4pm Good Friday 2nd April

Wheels at Wanaka:
9am–4.30pm Saturday 3rd & Sunday 4th April
Kids 12 years and under enter for FREE

Buy tickets, register your unique wheels and learn more at www.wheelsatwanaka.co.nz



PRESENT YOUR IDEA TO THE DREAM FACTORY — FIELDAYS INNOVATIONS 2021

“These awards support ingenuity and creativity, the Kiwi can-do attitude, recognising people picking good problems or processes, and being creative in the way they solve or enhance them” — Gail Hendricks, Fieldays Innovations event manager

Is there a frustrated inventor in you? Got a great idea but no idea how to get it to market? Well, the Fieldays Innovations programme and awards wants to hear from you — and that goes double if your idea can be applied to the primary and agriculture sectors.

Fieldays Innovations bills itself as a launch pad, connecting innovators with industry professionals, investors, and corporate decision makers. Anyone with a great idea — individuals and companies,

big or small — can get the support, insight, plans, and commercial backing they need to take their idea to the next level, and the one after that.

New and established

Fieldays Innovations is also an annual awards event, held in conjunction with Fieldays. The award categories are arranged to suit innovations at different stages of their life cycle, from new innovations through to products

already established in the market. Being successful is no reason to exclude an innovation from the awards.

As the name indicates, the Prototype Award recognises an early or test model, or one that can be replicated for learning. Entrants in this category are ripe for the Innovations programme, which offers an opportunity to test and develop the product.

Next is the Early Stage Award for products or services that have been

commercialised for less than 12 months.

Lastly, the Growth & Scale Award is for successful productionised innovations whose owners are looking to expand into new markets, exports, or increase volume.

Present to a targeted audience

The action will take place at the new and enhanced Fieldays Innovations Hub. This is the ideal opportunity for entrants to test or present their innovation to a highly targeted audience and receive feedback from potential customers about further development.

The Innovations programme will also be on Fieldays Online, giving participants broader local and even international exposure.

Fieldays has seen many Kiwi innovations go on to achieve extraordinary success both nationally and offshore through the programme. Last year, Waikato innovator Hivesite took home the Grassroots Prototype

Award for its chemical-free, thermal hive treatment for varroa mite.

AgriSea won the Established Prototype Award for BioactiveN, a feed additive that reduces urinary nitrogen in cows by 18 per cent. The Innovation Launch Award went to Antahi Innovations Ltd for its Trusti Colostrum Management System, which helps preserve colostrum quality for feeding to calves.

“Innovation is vital for advancing the agriculture industry in terms of providing sustainable and productive solutions that drive economic progress,” said Fieldays Innovations event manager Gail Hendricks. “This is the groundwork for a better future.

“We are excited to reward this year’s top innovations with two \$10,000 cash prizes. The benchmark is set higher and higher each year, so we can’t wait to see what’s in store for 2021.”

Check out the entry criteria and apply online at www.fieldays.co.nz/innovations

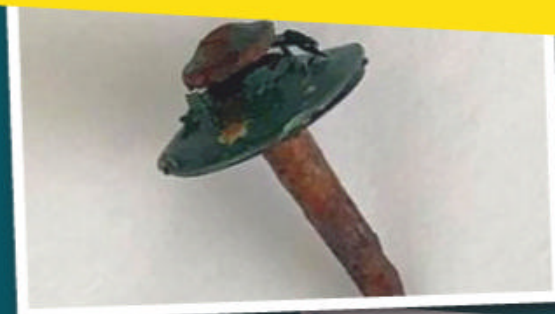
“Fieldays has seen many Kiwi innovations go on to achieve extraordinary success both nationally and offshore through the programme”



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. The uploads of the past two months include:

This is the nail! Some words of wisdom from sheddie Rod Kane for those who decide to undertake that very small repair job that can balloon into something akin to a real saga



How to make your own die nut — a useful workshop item for repairing threads



Project: make a lidded box. “The first thing that impresses me is the visual rightness of the piece. Then, when I pick a box up and try the lid, open it, and hear the ‘plop’ sound, the piece in competition is immediately worth more marks

Make a brazier. Some chunky truck brake drums take on a new life as a brazier



RUMOUR DISMISSED



Dear Ed,
Ritchie Wilson mentions in *The Shed*, Issue 93, November–December 2020, the Lyttelton road tunnel and the rumoured bank of V8 petrol-powered emergency gensets. The photos show they are but a rumour.

The genset since 1983 has been a 16-cylinder Detroit diesel (16V92TTA). It is in a V16 configuration having 92 cubic inches per cylinder with twin turbos, aftercooled.

Best regards,
Matthew Thomas
Christchurch

A NEAR-PERFECT READ

Dear Ed,
The latest *Shed* [Issue 94, January–February 2020] is well up to standard and its normal good read. I would like, however, to point out a couple of minor anomalies:

1. Comparing the cover picture with those on pages 5, 12, 13, & 16, the cover picture shows Gilbert working on what appears

- to be the left-hand side of the bike with the disc brake to the right-hand side of the front wheel and the turbo exhaust pointing to the right, while the remaining four pictures show the opposite. Looks like the cover picture might have been mirrored, borne out by the fact that the ‘right’ hand handlebar end sports what appears to be a clutch lever and no throttle twist-grip.
2. Page 57 and the lathe speed calculation. Circumference is correct as $2 \times \pi \times \text{radius}$ or $\pi \times \text{diameter}$. However, the move from line 3 to line 4 divides the top line by 3 but not the bottom line, which messes up the equation. The 94.25 should, in fact, be 31.415, which, in turn would make line 5 correct whereas 50,000 divided by 94.25 comes out at just under 600 rpm.

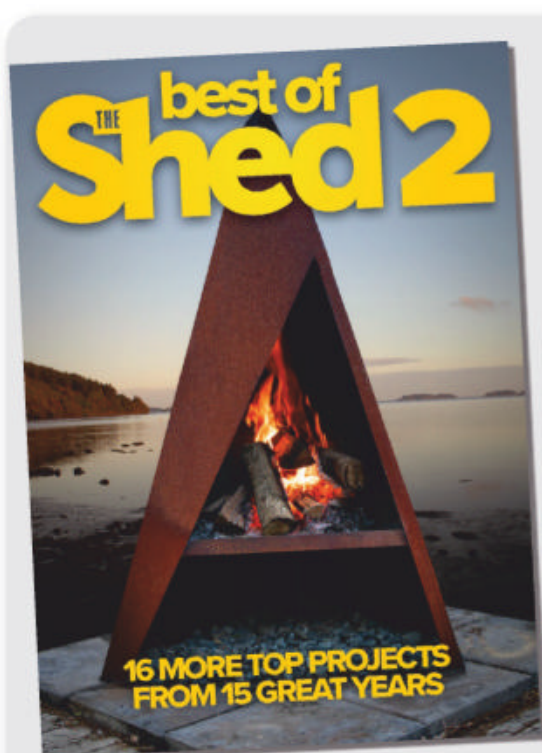
Small points indeed, but *The Shed* is a ‘cover to cover’ reading/study exercise,

so felt that your little test couldn’t go unnoticed.

Regards,
Steve Rowat

Thanks for your letter, Steve. Very well spotted on that cover photo. Occasionally our magazine designers feel the need to flop an image to make the cover look more attractive. It can work well — just not with technical subjects presented to technically astute readers! I hope it didn’t spoil the article for you.

Also very well spotted that conundrum with the “Mastering the lathe” article. However, there is unfortunately a typo on the second to last line. It should read 150,000 where it read 50,000. Our apologies for that typographic error.
Ed.



LETTER OF THE MONTH PRIZE

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

Letters should be emailed to editor@theshedmag.co.nz, or posted to Editor, *The Shed*, PO Box 46,020, Herne Bay, Auckland 1147.

The Sheddies





Reclaim your weekend.

Relax and enjoy more time to do the things you love, while your SILENO robotic lawnmower effectively mows your lawns with beautiful results. Quietly, reliably, precisely and automatically - rain or shine - with technology proven over 25+ years.



SILENO City 250
15001-38
Suits lawns up to 250m²



SILENO Life 750
15101-38
Suits lawns up to 750m²

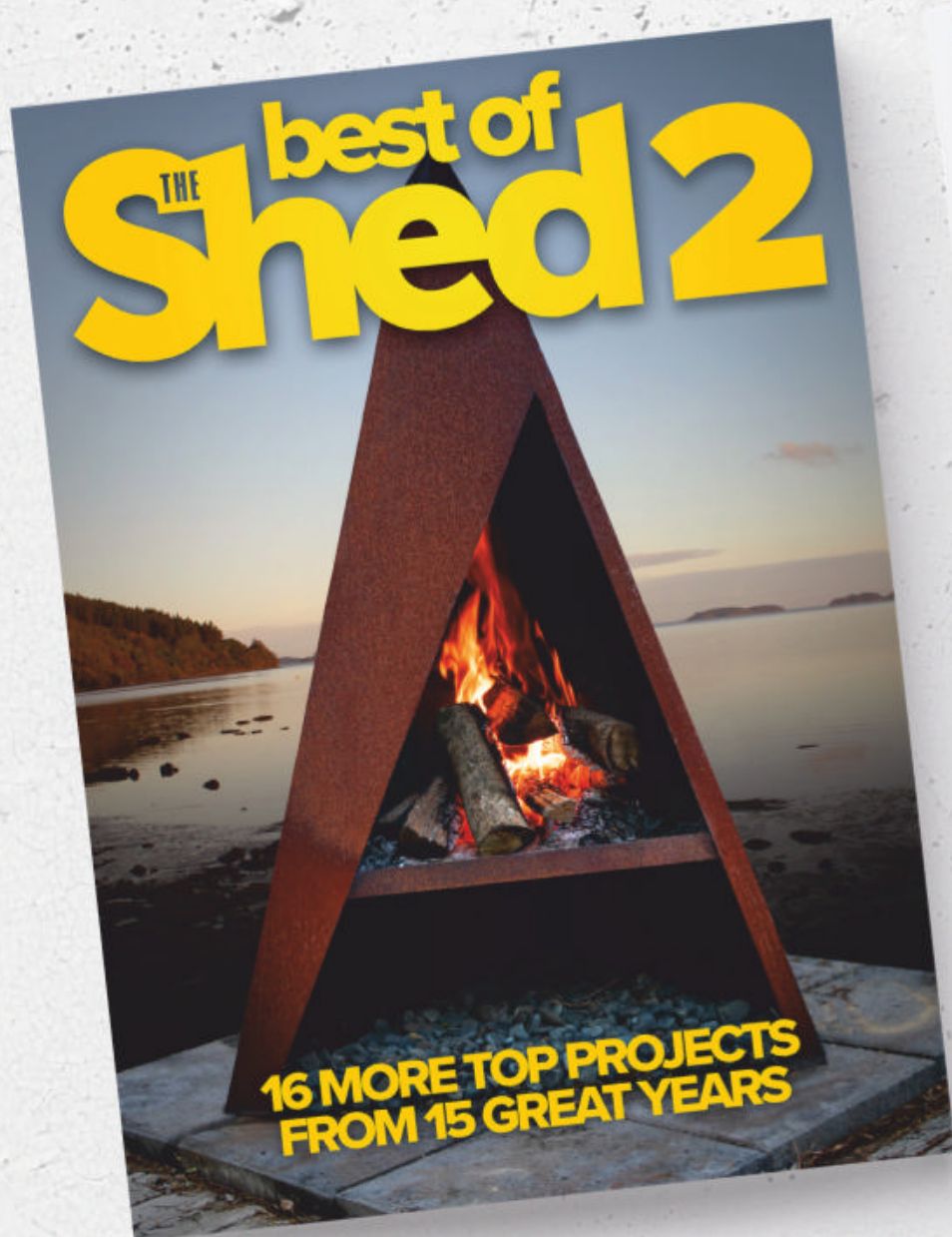
GARDENA.com

**SUBSCRIBE OR RENEW YOUR SUBSCRIPTION
TO THE SHED AND BE IN TO**

WIN ONE OF 20 COPIES OF BEST OF THE SHED 2

Want to make your own outdoor fire, bedside cabinet, or Damascus steel knife? How about an outdoor slow cooker barbeque or a ukulele? Maybe you want to learn how to make your bicycle electric?

These are just a few of the projects we have included in this new edition, Best of The Shed 2. All have clear instructions that demonstrate the build process and include diagrams and parts lists.



SUBSCRIBE TODAY



MAGSTORE.NZ

SUBSCRIBE TO

THE WHERE DREAMS ARE MADE REAL Shed



ONE YEAR

\$69

SAVE \$20



TWO YEARS

\$129

SAVE \$50

DIGITAL SUBSCRIPTIONS AVAILABLE FROM

\$29

TO SUBSCRIBE

WWW.MAGSTORE.NZ OR 0800 727 574

Offer ends Sunday, 18 April 2021

- 1) New Zealand delivery addresses only
- 2) Prize sent to subscription recipient unless specified otherwise
- 3) Offer available on print subscriptions purchased through Parkside Media only
- 4) Offer is not available in conjunction with any other offer
- 5) Best of The Shed 2 RRP \$22.95
- 6) See Magstore.nz for full terms and conditions

PHONE 0800 727 574 OR VISIT WWW.MAGSTORE.NZ



Sawing with shush

If you haven't heard these Tusk Silent Timber blades in operation, you can't fully appreciate what a difference they make. They are not silent, but they are significantly quieter and probably never squeal. These ultra-thin, deep-cutting, premium-quality saw blades are made especially for use on electric or cordless circular saws. They feature a patented sound and vibration cushioning design with a silver-fluoride coating and tungsten-carbide welded tips. They are especially useful in noise restricted environments, but they are better at any time. The dense solid-steel core design results in smooth, precise cuts, and the ultra-thin kerf reduces load for longer blade and battery life.

Pricing for 165/185 x 1.6 x 52T x 20/16 blades starts from \$70. See tusktools.co.nz to find Tusk stockists.



Cap it with confidence

When you are pulling apart engines, machinery, or hydraulics, you need protection to plug or cap fluid lines, ports, and threads. Happily, there is somewhere to go to get exactly what you need. Throw away the bags and tape and the crossed fingers and contact Hi-Q components. They stock thousands of plastic caps and plugs for furniture, metal fabrication, fencing, high-temperature masking, shipping protection, contamination control, and so much more. For more information or to request a catalogue, contact sales@hiq.co.nz, call 0800 800 293, or buy online at hiq.co.nz.



The good kind of CAD

Alibre says its Alibre Design version 22 provides the most bang-for-the-buck engineering CAD platform available today, with all the tools you need to design, validate, document, market, and manufacture. It will literally help you design consumer products through to heavy machinery and more, generating powerful 3D models. Precise manufacturing drawings and assembly instructions are just a few clicks away. Alibre Design's tool set has been developed over 20 years to power a broad range of applications. New licence prices start from \$323 for Atom3D, \$1535 for Professional, and \$2952 for Expert. For more information, visit www.baycad.biz, email enquiries@baycad.biz, or call 027 484 7464.

Get Eziswap Gas's Shed special

If you're looking for flexibility, Eziswap Gas has the answer with its user-friendly cylinder swap system. Buy a full cylinder of gas or gas mix, then swap the empty cylinder for a full one at one of more than 55 Kiwi-owned swap centres nationwide, paying only for the gas used. Prices vary, but for a limited time readers of *The Shed* magazine can go to eziswapgas.co.nz and use the 'shed20' code when checking out to get a 20 per cent discount on any full cylinder purchase.



How to save crumbling wood

Earl's Wood Hardener penetrates into soft and rotted wood fibres, restoring them to near original strength. It makes repairs possible to even the most fragile wood, ready for full restoration. Forget digging out rot. Earl's Wood Hardener will penetrate wood fibres, and once dry, you can patch and paint, if necessary. It's suitable for both interior and exterior jobs and is ready to use straight from the tub or bottle. There's no waste and no volatiles to avoid. Available in 250ml, 1L and 4L sizes from hardware and paint retailers nationwide. Visit hobeca.co.nz for more information.





Finish in one day with Cabot's.

Cabot's Aquadeck has a one hour recoat time, so you can get back to the things that matter most. To learn how you can finish your deck in one day, visit cabots.co.nz





FATHER AND SON SHEDDIES

This is a tale of two sheds as well as a tale of two sheddies

Tony Howse could well be described as a Kiwi version of the ‘universal man’

By Bob Hulme

Photographs: Bob Hulme

This is a tale of two sheds as well as a tale of two sheddies. The ‘home’ shed can be found on the farm nestled into the hills at the Paeroa end of the Karangahake Gorge. The other is a 50-minute drive away at Whangamata, a little way up the Coromandel Peninsula.

If ever there was an example that enthusiasm is contagious, this one is a standout. Tony Howse and his seven-year-old son Matt do a lot together in their sheds. Tony has more than one man’s share of enthusiasm and Matt has definitely caught a dose of it. His eyes sparkle when working on his own projects or helping dad Tony with his.

Swamp kauri

After the farm work is done, the shed work takes on its own life, with sculpting swamp kauri getting the lion’s share of the effort — the term ‘work’ probably doesn’t apply, as when you have this much enthusiasm it surely isn’t work.

Sculpting swamp kauri has been Tony’s dominant activity for 30 years, and he has a strong following of art collectors. He sources the kauri wherever he can and is always on the lookout for more, even if it involves coming up with inventive ways to extract it from where it has lain for over a century.

Both sheds are used for sculpting, but the

Whangamata site has a classy showroom for displaying the items for sale. Young Matt makes his own kauri sculptures and these are displayed on a dedicated section of wall in the showroom.

Sometimes pieces are made to order but mostly they are sold to tourists from countries such as Germany, Canada, and the UK. The recent lockdowns due to coronavirus have hampered sales, but the fact that more Kiwis travelling around, seeing more of their own country, has helped keep things ticking along.

All this sculpting and shaping chews through a lot of sandpaper. When asked



Kauri marlin



Working on the next design



A natural setting for the Whangamata showroom

how much he uses, Tony says he is no cheapskate when it comes to consumables like sandpaper. It's far better to discard it once it is past its best to reduce labour input. Here is a man who understands the value of his time.

Once a month, on a Sunday, Tony runs classes for budding sculptors, with a maximum number of just two people. That means he can give good time to each student to make sure they get the best from the sessions.

Here is a man who understands the value of his time

A hard grafter

Tony was born in Takaka, at the top of the South Island, and spent his life moving about the country because his

parents were a headmaster and a school teacher who taught at country schools and were moved around every four years. His work life started in silviculture and forestry, mostly in the Gisborne and Motu areas. He then became a fencing contractor.

"Nothing else was hard after that," says Tony — and it explains his 'can do' attitude.

Farm Park

Another side to business for Tony is the family's farm, which is a tourist attraction in itself. Bullswool Farm Park has been around for many years, and Tony has a programme of continually improving and revitalising. His creativity is clear to see in the play paddock. This is a pure fun area for kids of all ages. He has created a wooden pirate ship, bulldozer, digger, etc., that kids just love climbing all over. The digger and dozer have car engines in them — not functional, of course — so they look authentic, and the dozer even sports a dashboard out of a Holden. There is also a BMX-style track with bikes at the ready.

One feature that has the kids lining up



Whangamata showroom exhibits



Bullswool maimai. Note the levers for moving the targets.

is the mini shooting range, equipped with two air rifles that are securely mounted on swivels and housed in a mocked-up hunters maimai. There are levers for operating pop-up targets, cleverly using cables in plastic conduit tubing.

“Nothing else was hard after that”

However, the play paddock is just one facet of the farm park. There are also opportunities to get up close with a variety of animals. The award-winning native bird reserve is great for educational purposes as well as for anyone just wanting to see New Zealand birds in abundance. There are buildings housing museum displays of sheep shearing, early farming equipment, and kauri history.

Tony says that many people stop in on their way from Auckland to Rotorua or on their way up the Coromandel Peninsula. ►



Matt at work on his next sculpture



Pine outrigger canoe



Allways looking for more Hondas



Father and son sharing time in the shed

Honda mania

The farm shed is where Tony indulges another passion: Honda Enduro bikes. He buys neglected examples and restores them for future stars of the dirt to learn on. His favoured ones are XR75s, which he says are virtually bulletproof and great bikes on which to learn and develop riding skills.

Tony started buying XR and SL Hondas just three years ago when an issue with an Achilles tendon laid him low. He figured that working on the bikes was something he could do while sitting down — well mostly, anyway. Clearly this is not a man who can stay still for long!

At the time of writing, Tony had 11 bikes in his shed in various stages of

He buys neglected examples and restores them for future stars of the dirt to learn on



Honda motors about to be worked on



Teamwork



The boys in the shed

Father and son sharing time in the shed

RAISING A SON

They say that the first thing to understand about being a father to a son is that you are, and should be, his most important role model. A son learns by watching his dad. He learns about being a man from his dad's example.

SHARING TIME

Having a common interest is key to establishing one-on-one time. This may be a case of the dad involving the son in his particular interest, but could be something completely different that is new to both. Fishing is a good activity because there is plenty of waiting time. Camping is good because it involves activities that are learning opportunities. However, as we all know, a shed is a wonderful place for sharing a project. There is something quite magical about a boy being involved in a project bigger than himself. Working together on big, visible projects can really help strengthen a father and son bond, especially if the son is allowed to have creative input.

Whatever the reason for spending time together, it's important to use the time well. Listening is a skill that most men find less than easy. In general, we struggle with effective communication. When being told about a problem, we tend to listen for a minute or two, make up our mind what the solution is, and set about fixing it without delay. What we

probably should do is listen longer without judgement and without rushing off to fix things. By discussing the problem and asking your son what he thinks the solution might be, you are engaging fully with him and showing that you value his thoughts. Some say that, for quality one-on-one time, 25 per cent is a good guide for how much time a dad should be speaking, with 75 per cent listening.

SUCCESS OR FAILURE

Whether the project is a success or a failure is secondary to the process. In fact, it's valuable for a son to see his father experience failure as much as success. Learning by watching how his dad deals with failure means that the son will be better equipped to handle the inevitable moments of failure he will face in the future. This is probably more important, as schooling today appears to shy away from recognising any failures. He will see that it's OK to make mistakes. If he is not afraid to make mistakes, he will grow into a man who is able to accept and manage great challenges.

Boys look to their fathers for approval and validation that they are doing a good job of developing into an adult. If the approval isn't forthcoming, they assume that they are a failure and their self esteem crashes. Don't be shy about telling your son you love him and when you are proud of things he does.



The boys on their bikes

restoration. Most will be available for sale; however, a couple that are Tony's favourites will not be sold. They are rare XR80s that he imported from the USA and rebuilt.

Matt has a '79 Z50R on which he loves to scoot around the farm. He lends a hand after school with the restoration work — another ideal learning experience.

Music

Now, you could be forgiven for thinking that Tony wouldn't have much spare time considering what you now know about what he does. Well, think again, because there is a musical side to this guy. He plays in a band, Roadrunner, and at one stage even

taught music part time at two schools. He taught drums, guitar, bass guitar, and vocals to classes that sometimes numbered 62 students at a time. The

**He taught drums,
guitar, bass guitar,
and vocals to classes
that sometimes
numbered 62
students at a time**

band work has dried up with the advent of coronavirus, but should kick on again once we are all vaccinated and ready

to live normal lives again. Back in the late '90s and early 2000s, Tony toured all over New Zealand in the band Gerry Lee and the Desotos. They regularly did 12-week tours in an '83 Chevy Suburban — three guys in the front and all the gear in the back.

So far, Matt has not followed Tony's musical rhythm, but at seven years old there's plenty of time yet. With the highly infectious nature of Tony's enthusiasm, it's surely just a matter of time.

It's all good

Tony says he likes making good sculpture and good music and working on good bikes. You could easily add to that good nature — on the farm — and, above all, good times with Matt. 🏠



Wood'n it be great to have your own digger



There's an engine in the digger

HOT SUMMER DEALS OUT NOW!

Promotion
valid 1st Feb –
31 May 2021

LIMITED EDITION!

GEARWRENCH

243 PC. LIMITED EDITION JMAC RACING TOOL KIT + 26" CHEST & TROLLEY

MODEL GWJMAC71

INCLUDES

- 32pc Hex and Torx Bit Set in EVA
- 25pc 3/8" Drive Deep Socket Metric & SAE Set in EVA
- 18pc 1/2" Drive Deep Socket Metric & SAE Set in EVA
- 90pc 1/4", 3/8", 1/2" Drive Metric & SAE Socket Set in EVA
- 31pc Combination Long Pattern Wrench Metric & SAE in EVA
- 24pc Ratcheting Wrench Metric & SAE Set in EVA
- 14pc Screwdriver & Pliers Set in EVA



26" CHEST & TROLLEY
14 DRAWERS

METRIC SAE

1/4" | 3/8" | 1/2" DRIVES

120XP RATCHET

LIFETIME WARRANTY

\$2499

EXCL. GST

WRENCH SETS WITH BONUSES

STARTING FROM

\$299

EXCL. GST



NEW!

WRENCH SETS IN NYLON ROLLS

STARTING FROM

\$149

EXCL. GST



To view the full promotional offers and bonuses, scan this QR code.



NEW!

Electronic Torque Wrenches

STARTING FROM

\$539

EXCL. GST



To view the full range, go to www.gearwrench.co.nz



WAITING FOR THE PENNY TO DROP?

Making a tabletop push-penny might be your answer

By Dave Montgomery

Photographs: Dave Montgomery

I wanted to make something the grandkids could play with when they come to visit. Then, while I was watching a popular TV game show that features a monster machine, the penny dropped: I'd make a push-penny machine.

I decided to use bottle tops as the counters because, for some unknown reason, I had a growing pile of them in

the shed. These bottle tops contain trivia questions and answers — handy for when adults want to play with the machine.

The scale I used was based upon the diameter and thickness of the bottle tops. This scale is also suitable if you use Scrabble tiles. For tiles of a different size, the machine could be scaled up or down accordingly.

Design considerations

The push-penny machine had to be safe for kids to use, maintainable, easily stowed, and fun to use. I have mounted it on rubber feet for good stability and it has no sharp edges or corners. The strength of the servo motor and the small gaps for the sliding platter make it unlikely to injure little fingers. ►



Plywood
construction
technique using
layers of ply

I experimented
with the spacing
of the dowel
pegs on the
backboard and
opted for 50mm
horizontal and
40mm vertical
spacing

The acrylic sheet is held in place with removable rubber feet to allow for the removal of obstacles should the machine become jammed with Lego bricks or random bits of toast. The electrical components are low voltage and contained in a drawer, giving access for updating code or component replacement if required. The backboard lifts out from

the base and can be laid flat with the base on top for storage.

Plywood assemblies

Each plywood assembly is made from three or four layers of ply pegged together with 8mm dowels. I used a full 2400mmx1200mm sheet of 12mm ply and four metres of dowelling to make the

machine.

I wanted to accentuate the layers with alternate paint colours. Painting each component before assembly ensures perfect lines.

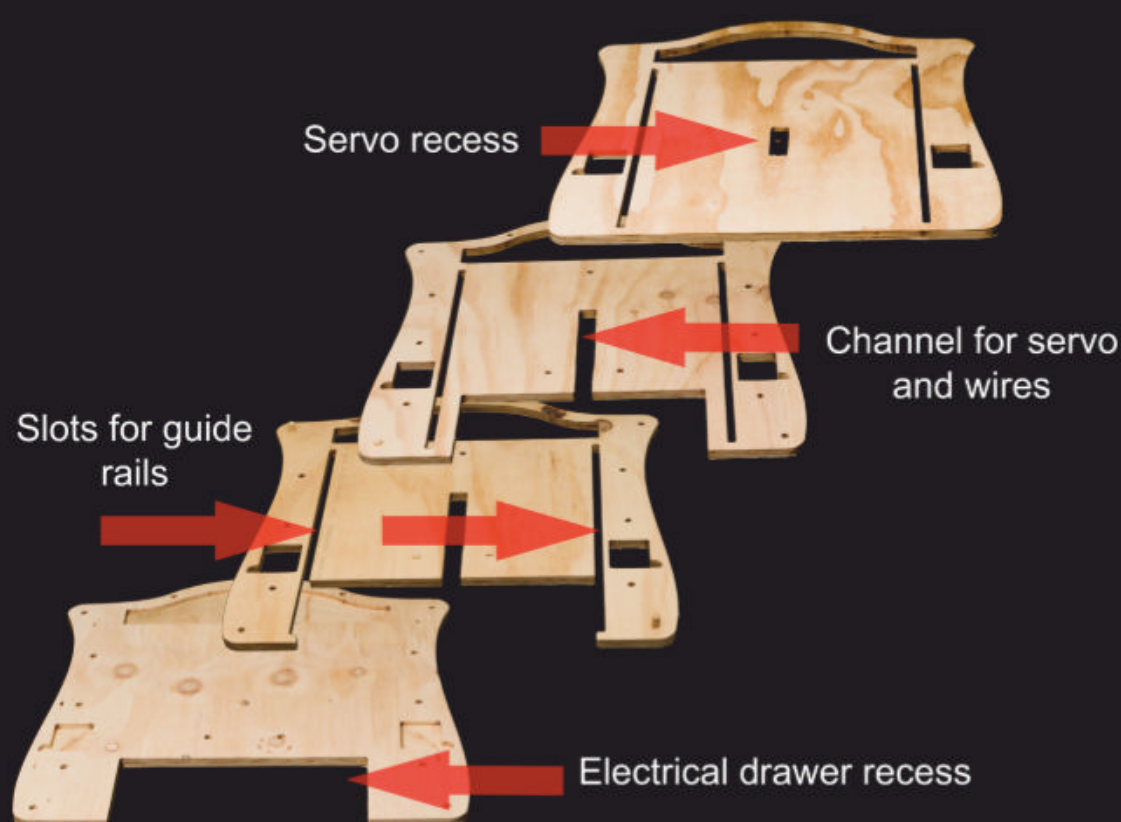
I experimented with the spacing of the dowel pegs on the backboard. The counters had to fall between them without getting stuck, and the pattern had to be such that there was no chance a counter could be dropped without hitting at least one peg on the way down. I opted for 50mm horizontal and 40mm vertical spacing.

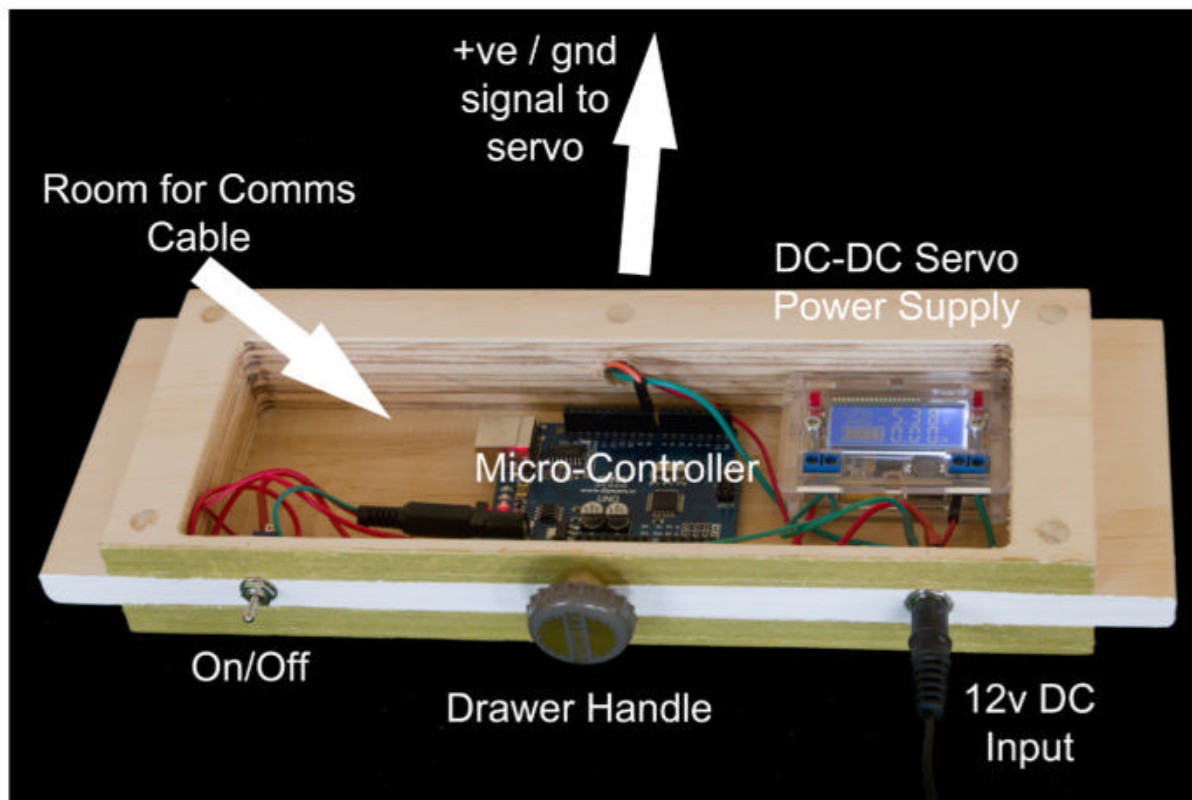
Sliding platter

I cut up a white chopping board to make the slides and guides. Made from high density polyethylene (HDPE), it was easy to mill and plane. A 45-degree bevel on both the slide and guide keeps the platter in place, greatly reducing friction and therefore the amount of work required of the servo motor.

The internal dimensions of the platter together with the length of the servo horn or armature determine the distance the platter moves — the stroke length. I made an extension for the horn that came with the servo from a bit of vinyl floor plank. This could also be made

Base construction detail





Electrical drawer housing power supplies and Micro-Controller

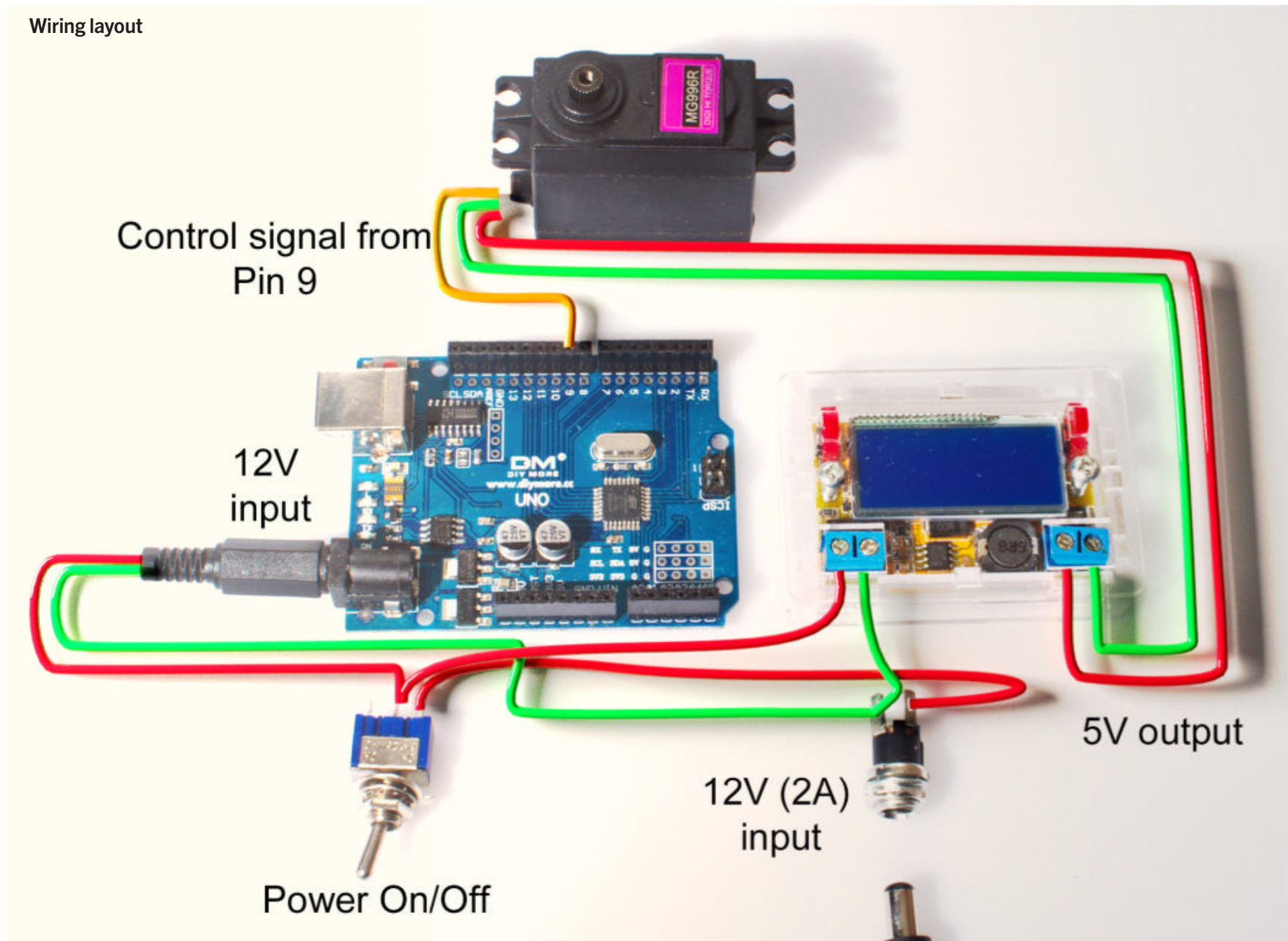
from an old paint tin lid or a vinyl record. The overall diameter is 100mm, with 80mm from the centre of the servo motor output shaft to the outer extremity of the horn. With an internal width of the platter of 110mm, a 50mm platter stroke length was achieved.

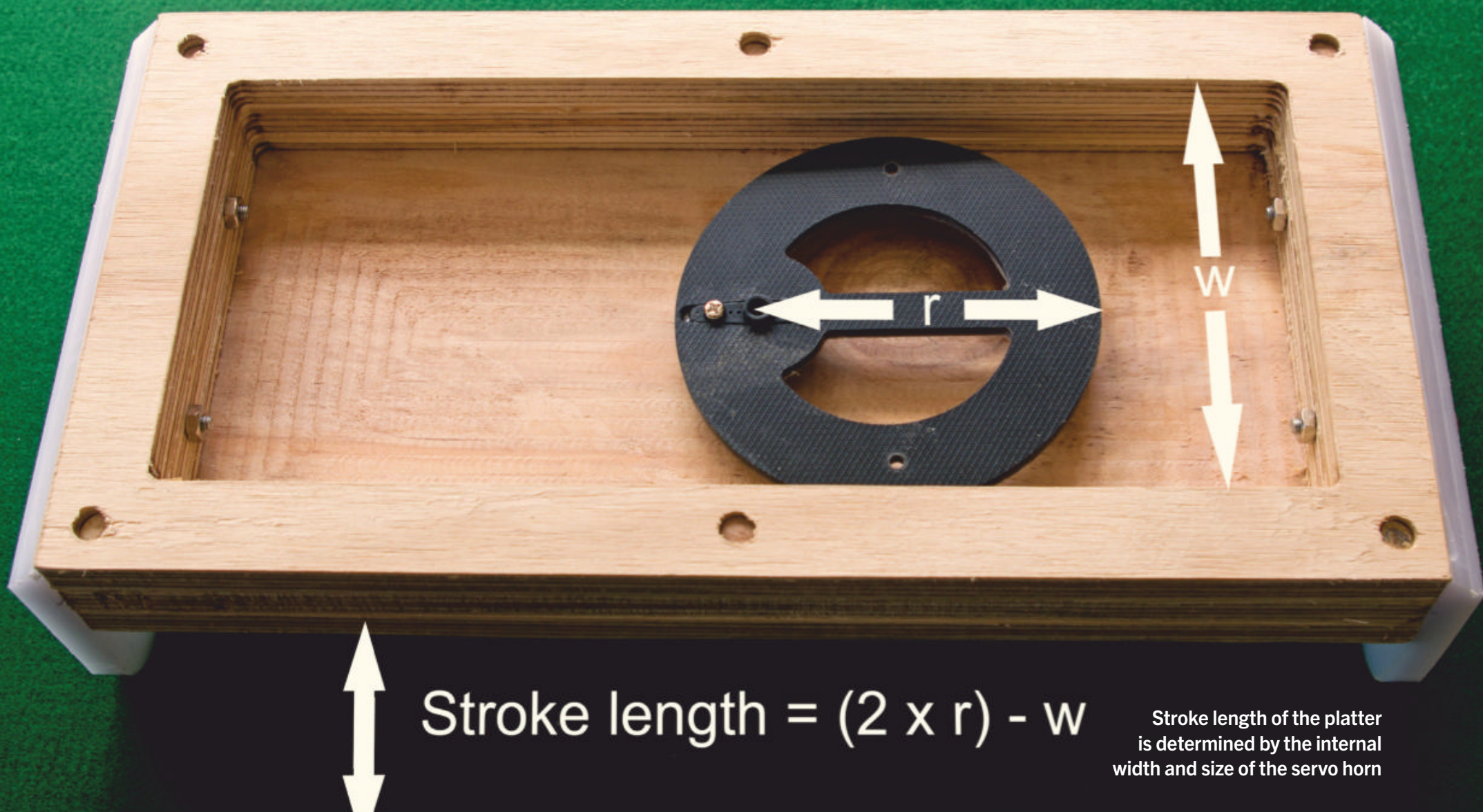
Servo motor selection

This is the first time I have worked with hobby servo motors. A huge range of

models and sizes is available. I needed one that could rotate 180 degrees but how powerful? Servo power is expressed by stall torque, normally expressed in kg/cm. I got three sizes to try: 3.5kg/cm, 11kg/cm, and 25kg/cm. The 3.5/kg servo struggled to move the platter and would easily stall. The 11kg/cm servo worked well and is the one I used. The 25kg/cm servo can crack walnuts. ▶

“Servo power is expressed by stall torque”





Servo motor set-up

The servo I selected can physically rotate 255 degrees before hitting the limits of the internal potentiometer. Driving the servo into the physical limits is frowned upon as apparently it may cause mass destruction!

Servo motors rotate to an angle determined by the pulse width sent from the microcontroller. A pulse width of $1500\mu\text{s}$ sets the servo to the midpoint; $500\mu\text{s}$ sets it at minus 90 degrees, and $2500\mu\text{s}$ to plus 90 degrees. Total range is $2000\mu\text{s}$.

Using the Arduino Servo Library, I uploaded the 180-degree-sweep sketch, and was surprised to find the servo swept only 167 degrees. Further research revealed that if minimum and maximum are not defined in the sketch, the defaults of $544\mu\text{s}$ and $2400\mu\text{s}$ are used. Setting the minimum to 500 and the maximum to 2500 allowed the servo motor sweep the full 180 degrees.

Push Penny Sketch

```
#include <Servo.h>

Servo myservo;

int pos = 0;

int servoPin = 9;

int min = 1000;

int max = 2000;

void setup() {
  myservo.attach (servoPin, min, max);
}

void loop() {

  int x = 1;

  for (pos = 0; pos < 180; pos = pos + x)
  {
    myservo.write(pos);
    delay(25);
  }

  for (pos = 180; pos > 0; pos = pos - x)
  {
    myservo.write(pos);

    delay(25);
  }
}
```

Comments

Include the Servo Library provided by Arduino.

Create servo object to control a servo.

Variable to store the servo position.

Assigns Pin 9 as the servo control pin

Arduino min default is 544 (represents 544 microseconds).

Arduino max default is 2400 (represents 2400 microseconds).
Adjust min & max to your own real world.

Note: Some servos may have only use a $1000\mu\text{s}$ range. If you do not know what your servo is exactly, play safe and use Min = 1000 and Max = 2000. Expand the range from there as required.

"void" A keyword denoting that no information is passed to the function that called it.

"setup" run only once to initialize and set the initial values.

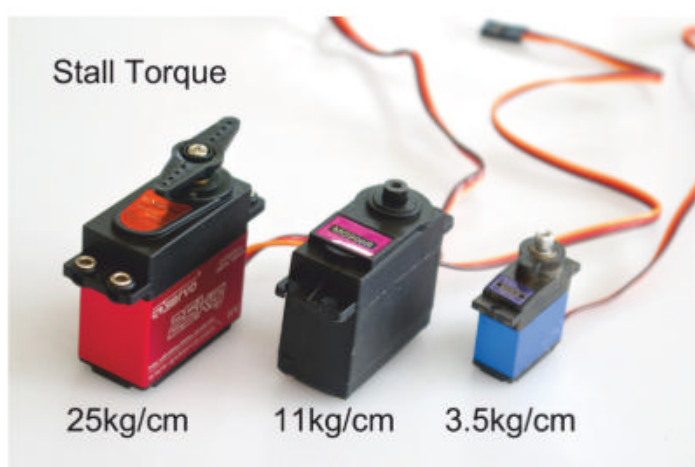
"loop" is to run forever baby, (or until the controller is reset or turned off).

Variable "x" is used for the step size in degrees.

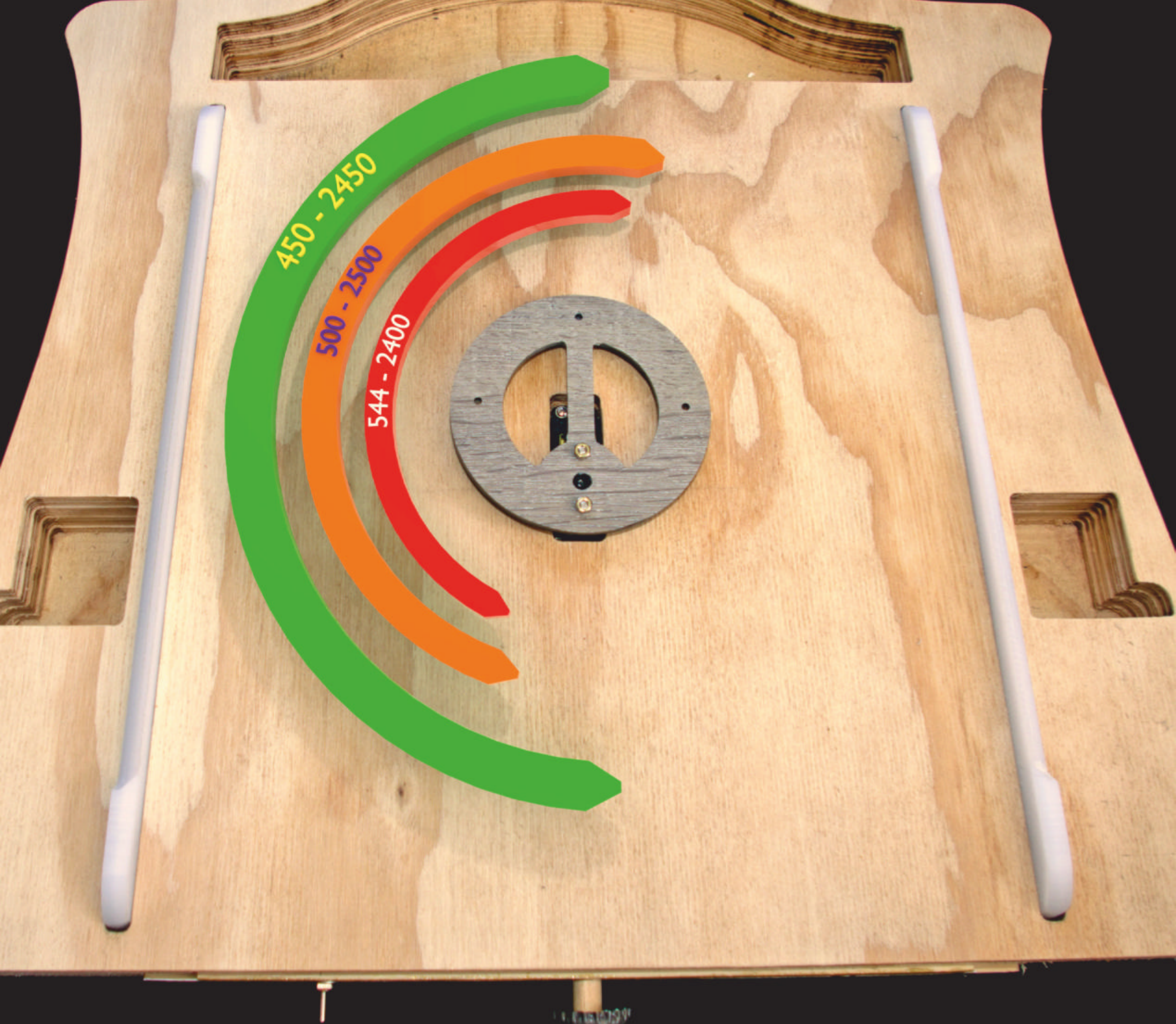
For (Initialization; condition; increment) statement.

"pos = 0" is the initial value in the "for" loop, used only once when loop begins. "pos < 180" is the condition tested and if true the increment is done and "myservo write(pos)," sends a signal to servo, controlling the shaft accordingly. If the condition is false the "for" loop is ended and next "for" loop starts. The cycle is repeated when the second "for" loop ends.

"delay" in milliseconds to allow time for the servo to move.



Left: The 11kg/cm servo moves the platter with ease



The range and sweep position of the servo is determined by the declared min and max values in the sketch

The next problem I encountered was that the horn would over-sweep at one end and under-sweep at the other. The output shaft of the servo motor has 25 teeth, on to which the horn is placed, making it 14.4 degrees between placements. Even by placing the horn as close as possible to the 0° position, there could be a misalignment to the real world by 7.2 degrees in either direction. To calibrate the servo position to the real world, I moved the 2000 μ S range down a little so minimum was now 450 and maximum was 2450.

A word of advice: bearing in mind the mass destruction warning above, one should not adjust the minimum further

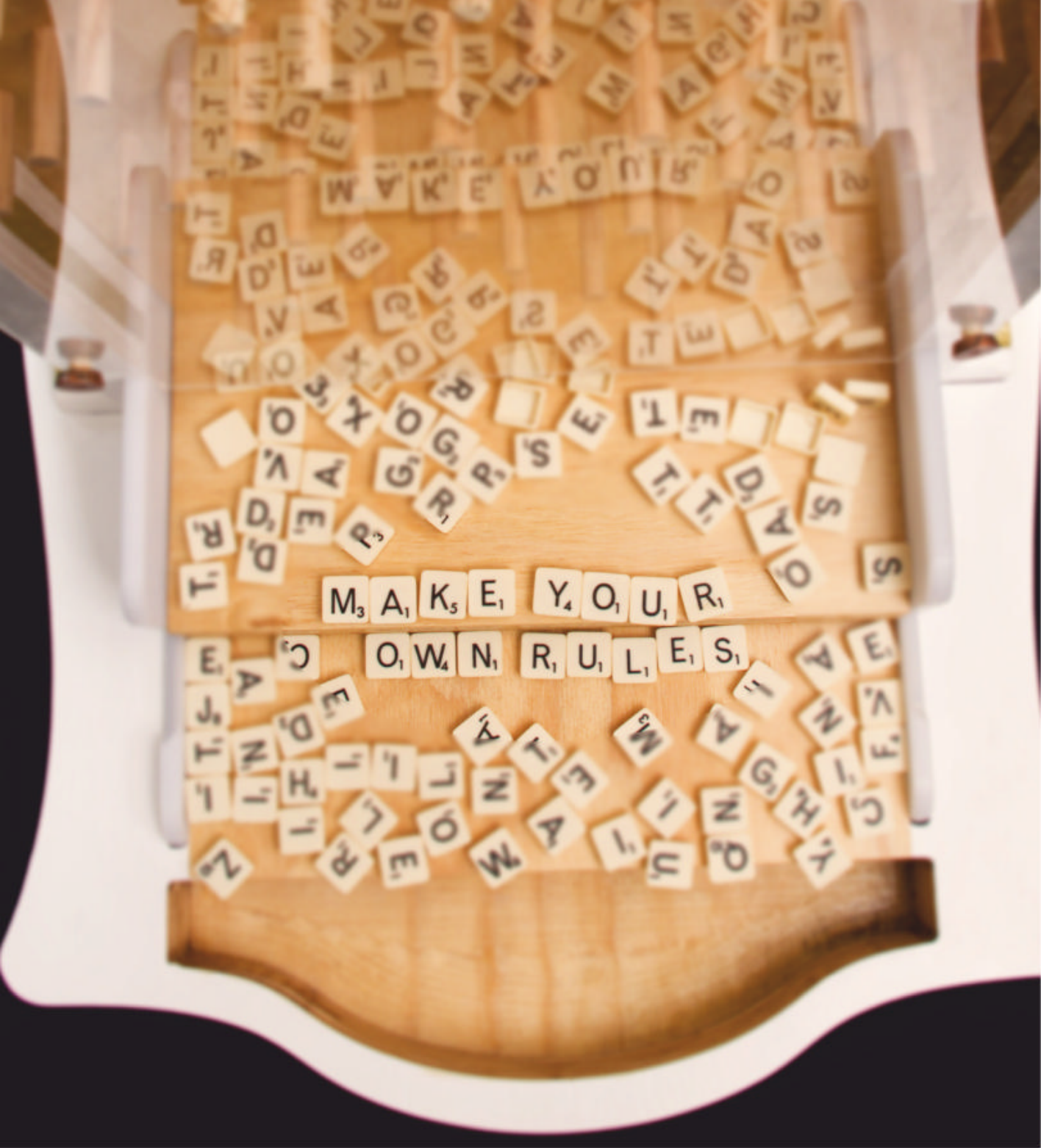
down than 420 and the maximum further up than 2580.

Note: Some servos may only use a 1000 μ S range. If you do not know exactly what range your servo uses, play safe and use min = 1000 and max = 2000. Expand the range from there as required.

The electricals

Things were starting to fall in place. With the servo motor selected, I now knew the power requirements. A mains 12V 2A power adaptor would power the push-penny. Providing power to the servo motor from the microcontroller board was not an option. A separate 5V supply was needed for this. When experimenting

“The next problem I encountered was that the horn would over-sweep at one end and under-sweep at the other”



“How do you play it? No idea — make up your own rules”

with different servo motors I used a DC-DC convertor that displayed both voltage and current, and, as it was relatively inexpensive, decided to use it in the final design.

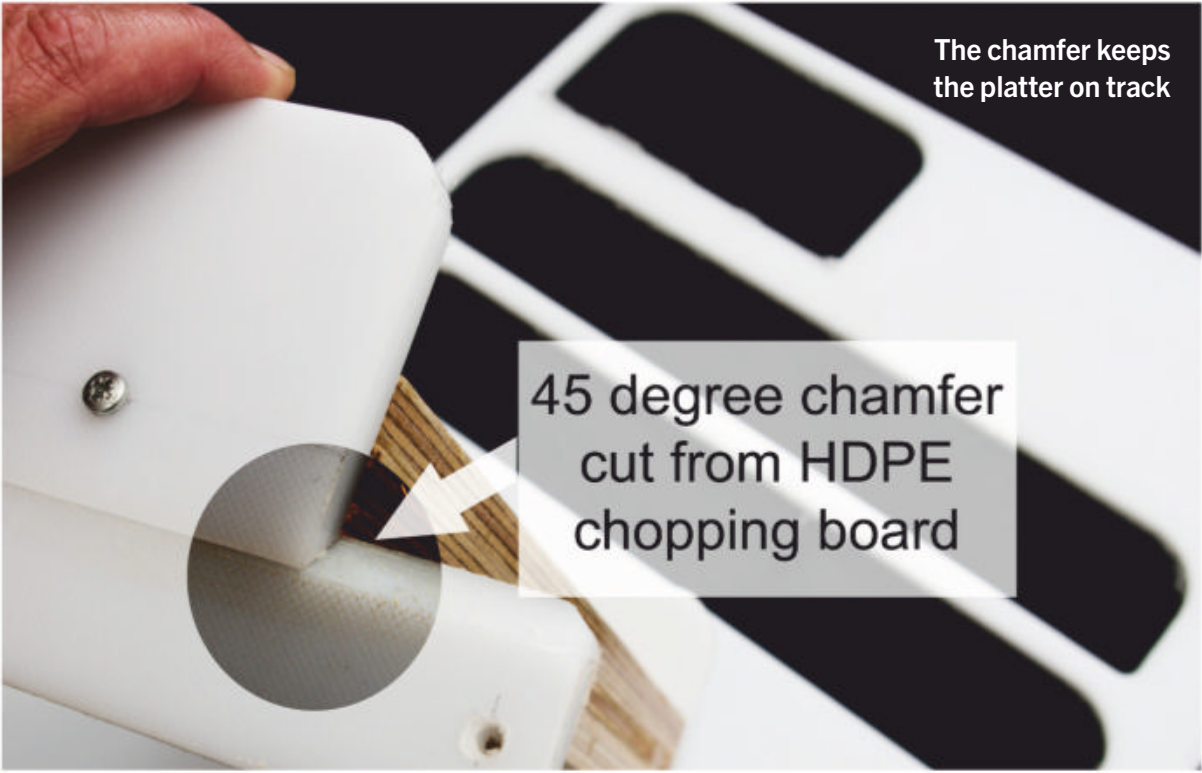
Playing the game

With your push-penny made it is time to play. How do you play it? No idea — make up your own rules.

As I used bottle tops or letter tiles, I have my own ideas. To get a chance of tipping a counter over the edge on the first drop, I found I had to load the platter and shelf with around 75 counters. Additional counters would be needed for the players to use. Two Scrabble sets would be about right.

With bottle tops, each player would have a set number. A player would ask the question from their stash and, if another player answered correctly, that player would get to put it in; otherwise the questioner would get to put it in. Players keep whatever falls out — these are kept aside. When all bottle tops have been played, the one with the most wins.

With letters, the tiles are placed face up on the push-penny so all can see the blanks and the high-scoring letters. Each player takes turns to drop a tile and keep those that fall out. Once all the tiles have been dropped, players have five minutes to make the most words, the longest word, or the highest-score word — or, or ... where are those grandkids? 📖



Scale of components suitable for playing with bottle tops

Approximate dimensions

Assembly	Width	Length	Thickness
Platter	300mm	150mm	3-ply (36mm)
Electrical drawer	260mm top & bottom 300mm middle	100mm	3-ply (36mm)
Base	460mm	460mm	4-ply (48mm)
Backboard	440mm	600mm	4-ply (48mm)



STAINLESS STORAGE SOLUTIONS

- 430 GRADE ANTI-FINGERPRINT STAINLESS STEEL.
- HEAVY DUTY CONSTRUCTION
- SOLID RUBBERWOOD TIMBER TOP
- HEAVY DUTY 150 MM CASTOR WHEELS
- 45KG DRAWER SLIDES
- SOFT DRAWER LINERS
- ALUMINIUM DRAWER HANDLES
- LOCKABLE DRAWERS
- STAINLESS STEEL HANDLES

ORDERS AND ENQUIRIES:
mitchell@paceeng.co.nz



95 KATERE ROAD | NEW PLYMOUTH | 06 281 1425



 /shedsandcabinsnz

 /barryshedsLtd

0800 004 142 | sales@barrysheds.co.nz
123 Kerrs Road, Wiri, Manukau

Our Sheds and Sleepouts are the environmentally friendly choice to space creation

Weather-resistant for use through every season, all year round Barry Sheds provide you with a space that is adaptable for your lifestyle. They even make a great home office! We strive to always use sustainable materials, energy-efficient processes, and natural resources to build eco-conscious cabins that are hard-wearing and fully tailored.

barrysheds.co.nz



MASTERING THE LATHE: III

A project to make a wall-mounted balance puts the fun into lathe work

By Bob Hulme

Photographs: Gerald Blacklock

This project involves using your lathe to check the balance of a mower blade after you sharpen it. Some of you may not be convinced about sharpening the blade to begin with. However, it makes mowing easier and saves fuel, which might just save the planet — even if it escapes my

comprehension just how extra carbon tax will change our climate. At the very least, using less fuel will save you money.

It is important to restore blade balance. Excessive vibration will shorten the mower engine's life and accelerate the wear on other components.

My design is for wall mounting.

Unsealed bearings are used to minimise friction so the balance is as sensitive as possible. The diameter of the spigot at the front can be sized to suit your own mower blade. The Masport blade I used had a pretty standard motor mower centre hole measuring 16.2mm diameter. The spigot was machined to 16.1mm diameter so that the blade could be slipped on and off easily but have minimal play when mounted. The fixed spindle or axle can be either welded to the back plate or riveted on if you do not have an arc welder.

How it works: The hex bolt and washer (bottom left) attach the mower blade to the spigot on the barrel (right). Inside the barrel, the ball bearing races with spacer (middle) enable the barrel and blade to revolve around the axle (left) which is riveted or welded to the back plate (bottom) screwed onto the wall

Planning

The key to producing good work on your lathe is to plan the job first. If you are going to rivet the axle into the back plate, plan to cut and drill the plate first so you can measure the centre hole and ensure the axle is a snug fit. Remember to keep bare hands away from swarf, whose razor-sharp edges give cuts that take ages to heal.

Plan to turn the axle first while there is plenty of material to grip in the chuck.



There is quite a bit of steel to machine off this part, so you can get used to cutting speeds and feed rates.

Next, make the thick washer followed by the bearing spacer. The hole in the washer can be drilled further into the material so that parting off can be done more easily — the spacer has a bigger internal diameter. The bearing fitting tool is made next using an ‘over-run’ from turning the diameters of the bearing spacer.

Grip the 50mm diameter bar in the three-jaw chuck with approximately 80mm protruding. If 50mm diameter doesn't fit down the inside of your lathe spindle, you will need to cut the bar first, leave 55mm protruding, and turn the larger diameter when you reverse the piece in the chuck to turn the back-plate spigot.

Cutting speed

If you are using tungsten carbide tools, a cutting speed of around 75 to 250 metres per minute is a suitable range, depending on how rigid your machine is. Start at, say, 100m/min and you can adjust speeds from there, depending on the result. To calculate the rpm of the lathe spindle, divide the cutting speed by the circumference of the job — in this case, 50mm. You should get the answer



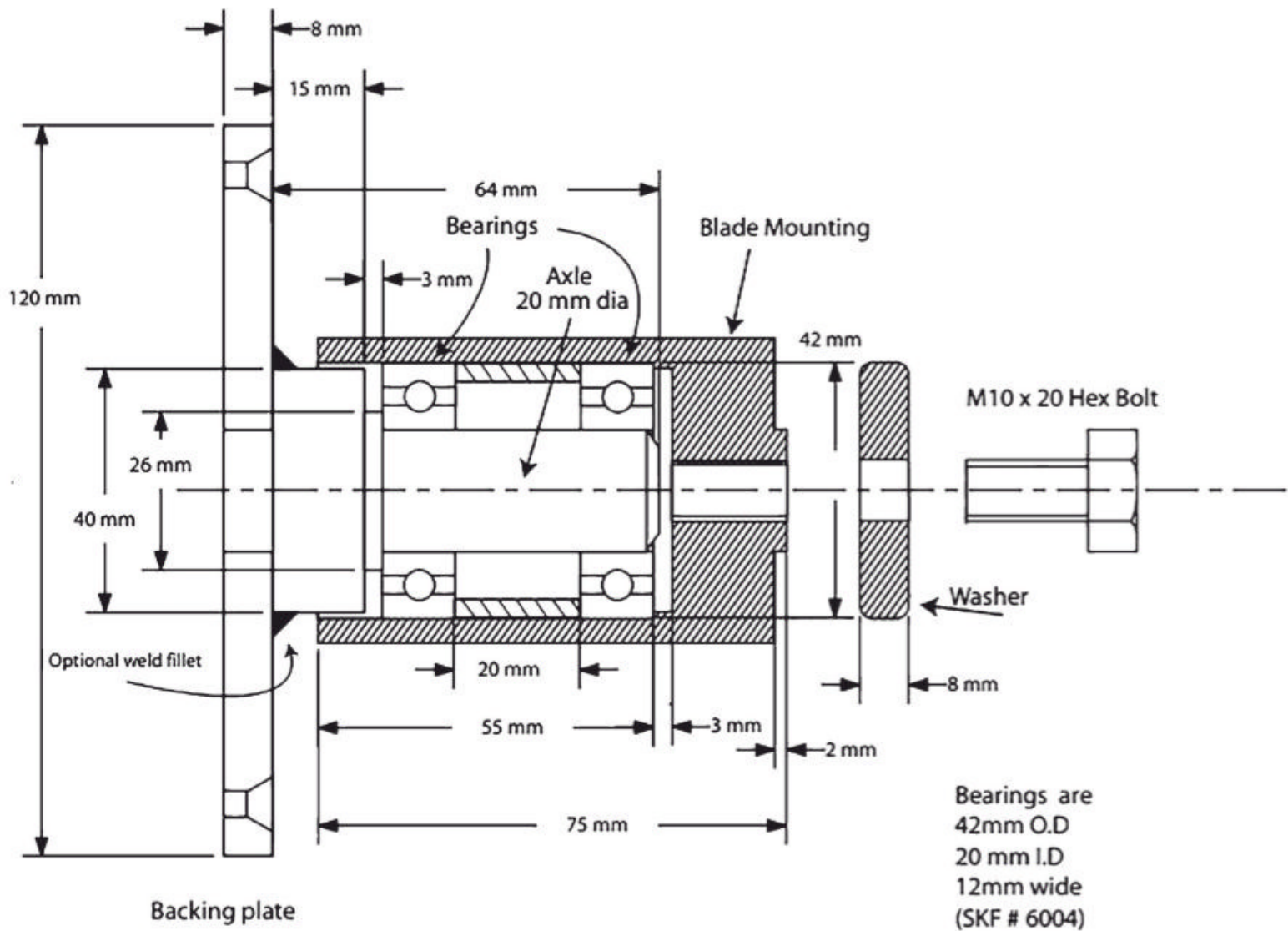
of 636rpm, so set your lathe to the speed closest to this.

Good finish

Machine the end face. With a centre drill in the tailstock chuck, drill a small hole into the end of the bar. Change the tailstock chuck for the live centre and use it to support the end of the bar. This

will help to achieve a good finish and a paralleled axle diameter.

Turn the larger diameter (41mm) of the axle along its whole length plus enough for the parting-off blade (say 75mm). This will take several cuts. The depth of each cut will depend on how rigid your lathe is but should be between 0.5mm and 1.5mm. ▶



Measure the size of the bar after each cut to get used to the graduations of the cross slide dial. When the bar is down to size, set the stop on the lathe bed. This ensures the cutting tool stops at the same place each cut and leaves a shoulder on the axle in the right place.

Stop tip

To use the stop, set a cut going along the job with the automatic feed and watch the saddle approach the stop. When it is within a millimeter or two, drop out the automatic feed and continue up to the stop using the hand wheel. Don't use the auto feed hard up on to the stop — you will end up breaking something.

Take this diameter down to around 26mm. This is to make sure the axle contacts only the inner race of the ball bearing and does not rub on the outer race.

Critical

After resetting the stop, turn the diameter over which the ball bearings fit. In this project, the bearings need to be a 'light tap fit' over the axle so that it is easy to take apart for cleaning. Unsealed bearings need to be cleaned with a kerosene wash when they begin to feel lumpy and don't spin freely.

This part of the axle is one of the most critical sizes in this project. Vernier calipers are fine for most of the project, but here a micrometer is needed for sufficient accuracy. We want a diameter between 11.95mm and 11.98mm.

Chamfer the nose of the axle and remove sharp corners with the square tungsten carbide-tipped tool followed by a touch with a flat file — held in the left hand so you don't get your sleeve in the chuck.

Parting off

If you have not already cut the bar so that it fits your lathe, it is time to 'part off' the partially complete axle. Parting off beats slaving away with a hacksaw any day, but it does require a sharp parting tool, set precisely on centre height, and plenty of cutting oil. Use the same spindle rpm as you did for the turning. If you have auto feed on the cross slide, then choose a feed of 0.15 to 0.2mm per rev. Set the parting tool close to the bar and move the saddle to put it in the right position to cut the axle to its overall length.

Lock the saddle and the compound slide in place, start the lathe, and feed in the parting tool with plenty of cutting oil flowing over the cutting area. If your lathe does not have auto feed on the cross slide, you can feed it by hand, but remember to wind it across with firm pressure and don't stop. Keep it constant from the start until the axle drops off when the parting tool reaches the centre of the bar.

Parting tools tipped with tungsten carbide make parting easy. Thin high-speed steel blades are still used but need skill in their sharpening. However, they can be useful for materials such as plastics and copper, as they can be ground to the ideal shape.

“Start the lathe, and feed in the parting tool with plenty of cutting oil flowing over the cutting area”

Axle diameter turned down for ball bearings in three-jaw chuck — note hole in end to support live centre and chamfered nose



Plenty of cutting oil to part off axle



Protect from chuck marks with aluminium drink can strip



Drilling a centre hole in the bar



Pressing axle spigot into back plate

Finishing the axle

To complete the axle, hold it in the chuck with the 11.98mm diameter to machine the spigot diameter for the back plate. A simple trick to prevent marking this surface with the chuck jaws is to wrap aluminium cut from a drink can around the axle.

Turn the spigot diameter to fit snugly in the hole in the centre of the back plate. If you are going to rivet the axle on, then drill a hole in the middle of the spigot to make riveting easier. Leave approximately 2–3mm wall thickness.

Washer, bearing spacers

Grip the bar with 50mm protruding from the three-jaw chuck. Face the end to clean up. Turn the bar to 36mm diameter — or to suit the washer size for your mower — for a length of 12mm. Centre drill, then drill a 10mm diameter hole

for approximately 20mm deep. Before parting off the washer, chamfer the outer corner using the square cutting tip as before.

For the bearing spacer, face the end of the bar again, then turn the outside diameter to 41.5mm for 30mm along the bar. Drill the centre of the bar with the nearest size you have, up to 34mm diameter for a depth of around 30mm to the drill shoulder. That's where the angle of the drill position meets the outside wedge of the drill.

To machine the inside size of the spacer out to 36mm, use a boring bar. This will give a better finish than a drilled hole and will be practice for boring the blade mount where size will be critical.

When the diameters are machined, take the sharp outer corners off with a file and the inner corner with a scraper or deburring tool. Part off the spacer to length.

The end of the bar now has a short part of the inner and outer diameters remaining on it. This will be perfect for fitting the bearings. Move the bar out of the chuck a little further — just enough to have room to part off the fitting tool, and leave 75mm for the blade mount.

Barrel

The barrel is essentially the part that rotates with the blade while the balance is being checked. It is important that it is in good balance and therefore all of its diameters must run true — i.e. concentric with each other. It can be made using a three-jaw chuck if your chuck is in good condition and holds the bar on centre. To check this, use a dial test indicator, 'clocking' — see part 2 of 'Mastering the lathe' in issue 94 of *The Shed* — to see if there is any run-out. If the bar has more than 0.05mm run-out, you will need to change to the four-jaw chuck. ►



Rivet axle spigot into back plate with ball-peen hammer



The boring bar — note stop at bottom of picture

Hold the bar in the chuck with around 10mm protruding, enough surface for clocking and sufficient because the outside will not be machined.

Bearings housing

Begin by facing the end of the bar, centre-drill the end, and drill a hole approximately 10mm in diameter and 58mm to 60mm deep at the shoulder of the drill. Select the tapping size for M10 thread (8.4mm) and drill to a depth of 80mm from the end of the bar. This will make parting off easier. The objective now is to create a bore that is 42mm in diameter and 55mm deep to house the bearings.

Remove most of the metal using a drill that's 38mm (1 ½ inches) in diameter — or the closest you have — to leave just 6mm (3mm per side). Use the saddle auto feed to machine out with the boring bar for an even finish.

The bore must be accurate and should ideally be measured with an inside

micrometer or alternatively a telescopic gauge and an outside micrometer. Vernier calipers won't give the same accuracy — it is impossible to get the same 'feel', that critical sliding tension when a micrometer is the right tightness over a component, indicating the exact size. To learn this, use the ratchet knob when tightening a micrometer, as it is set for the right tension.

I was told that the knob was added during one of the world wars to enable women in factories to get accurate readings — now ladies, please don't write angry letters; I'm just repeating what I have been told. If you don't have

telescopic gauges, inside calipers to measure across will be more accurate than the Vernier calipers, but practise on bores whose size you know until you get used to them.

Boring bar

When you are ready to start boring, set the stop on the bed to give the right depth on the bore hole. This depth is not all that critical — plus or minus 0.5mm is no problem — but where the cutting tip stops at the end of each cut must be consistent.

After a couple of cuts with the boring bar, and with approximately

“The objective now is to create a bore that is 42mm in diameter and 55mm deep to house the bearings”

1.5mm to go, consider making three final cuts 0.5mm deep. This will indicate the finish achievable on the final cut. Sizing will be more predictable because any 'springiness' in the boring bar will be the same each time.

If you find the finish is not good on the first 0.5mm cut, there is time to make changes, ensuring the final cut is better. Your choices would be:

1. **Slow the spindle rpm**
2. **Use cutting oil**
3. **Change the feed rate**

Sometimes too slow a feed can cause 'chatter' and a boring bar will start singing. A tungsten carbide cutting tip with a smaller nose radius will give a better finish.

When you have taken the final cut, you will find one of three possibilities. The bore size is spot on, too big, or too small. If it's too big, then I hope you have enough steel for another try; if too small, then we can fix it.

A finish within 0.03mm, you can polish out to size with emery tape. About 80 or 100 grit size should be ideal. If it is a bit smaller, take account of boring bar 'springiness', as you will be cutting less depth than before. I suggest you make the cut depth 80 per cent of what it theoretically should be. Measure again after the cut and decide whether to polish out the remainder or take another cut with the boring bar.

Step

Once you have the size, undo the stop on the bed, set the boring bar away from the bore by a few millimeters, feed it into the bore using the saddle hand wheel until it just touches the end inside the bore, wind it in a little further, then turn the cross slide handle to move the boring bar towards the centre — away from you. This will produce a step to clear the inner race of the bearing so that it does not rub. The depth of the step does not matter too much, as long as it clears. Remove the sharp edges then release the bar from the chuck.

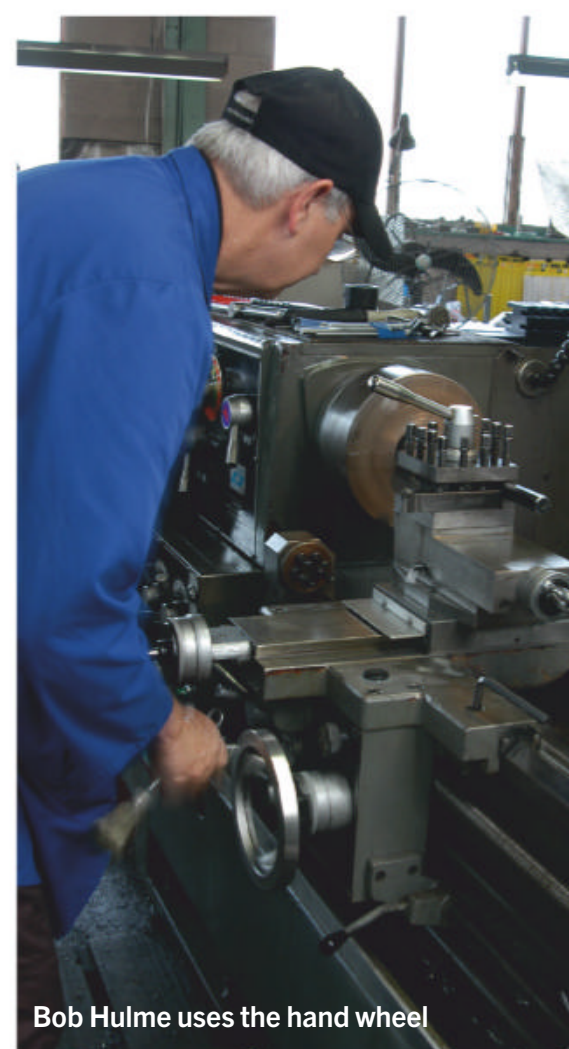
Tighten the chuck on it again when it is protruding about 80mm plus enough room to part off in front of the chuck. Part off the blade mounting at say 76mm long. This leaves a little material to face off to produce a clean end.

Next, grip the blade mounting the other way round in the chuck with approximately 10mm protruding. Check for run-out again with your Dial Test Indicator. Once it is running true, face the end, then, with the carriage locked to the bed, take progressive cuts on the face using the dial on the compound slide to set the depth up to 2mm.

The spigot diameter left in the centre should be sized to suit your mower blade. Make it just snug — not so tight that it is difficult to get on and off; not so loose that there is any play between the blade and the mounting. Cut the thread with an M10 tap. ▶



Creating a bore 42mm in diameter and 55mm deep to house bearings



Bob Hulme uses the hand wheel



Squeeze bearings in with bearing-fitting tool made from 'overrun'

The bearings fitted inside the barrel



Cut thread in blade mounting spigot with M10 tap



Mower blade to clean and sharpen

Cutting list



- 250mm of 50mm-diameter mild steel
- 120mm of 50 x 8mm flat mild steel
- 4 ball bearings SKF No 6004
- 1 hex head bolt M10 x 20
- 250mm of 50mm round bar

This may seem more than necessary, but you will need some to hold on to in the chuck, and it can be used as a tool for fitting bearings.

Assembly

Putting the blade balancer together will be like child's play after the nerve-racking time machining those precise sizes. First, put the backing plate on the axle. If you don't have an arc welder, it is a simple matter of riveting the end of the axle over, using an inverted ball-peen hammer, and hitting it repeatedly with another hammer.

To fit the bearings into the blade mounting, use the fitting tool to help get the first one in square. To get it started, lightly tap the tool with a hammer, then use the vice to push it in steadily until the bearing is below the surface. Put in the

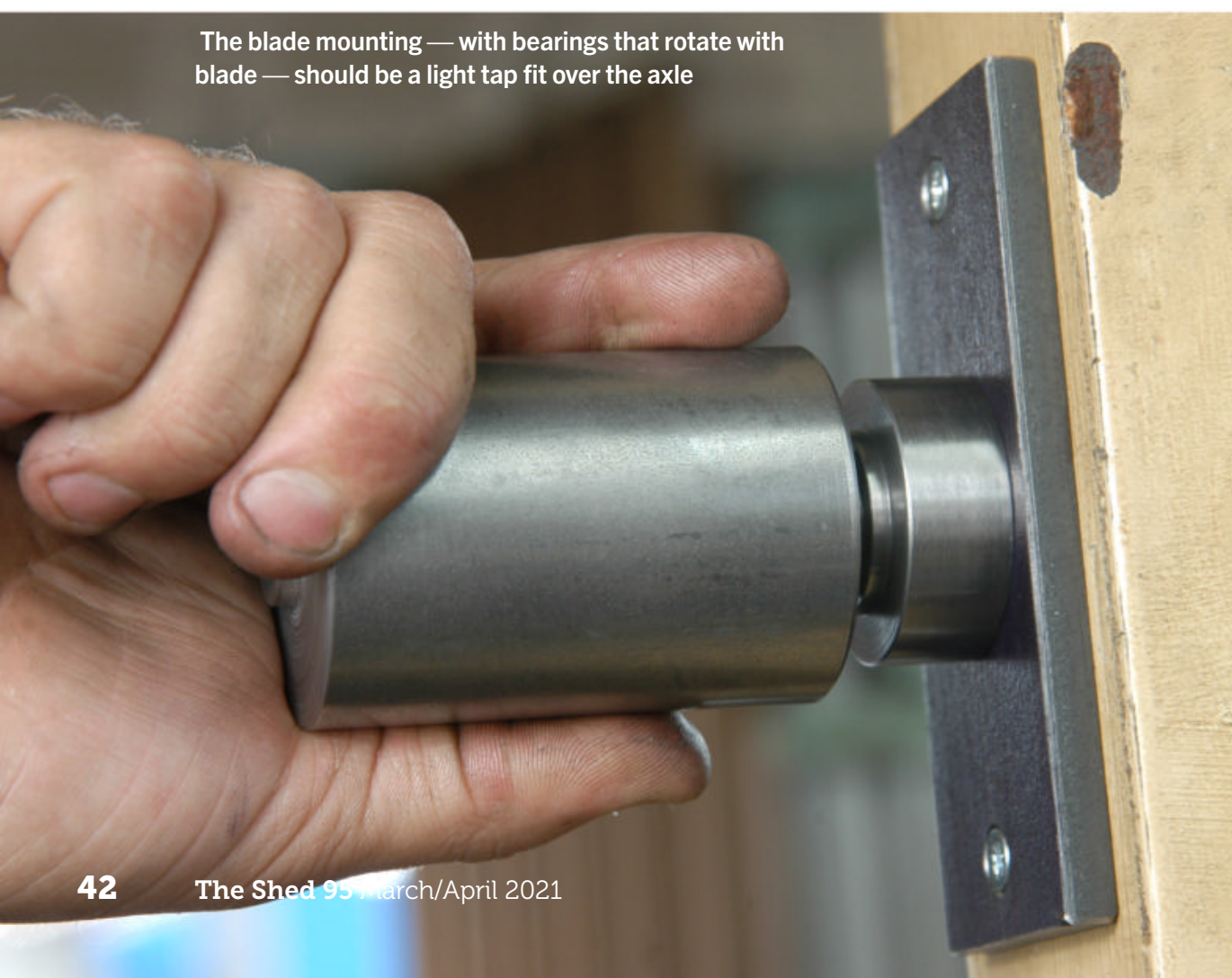
bearing spacer. Use the vice to squeeze both it and the first bearing further in, before using the fitting tool again. Lastly, push the second bearing in; push it in until the first bearing comes up against the shoulder.

The blade mounting with bearings should now be a light tap fit over the axle. Screw the unit to a suitable wall, and it is ready to use. You should resist the urge to paint it; varying paint thickness will upset the balance. I suggest you wipe it over with an oily rag. There are also several brands of lanolin-based products that are excellent for preventing corrosion on steel.

In use

Put the sharpened mower blade on the spigot and make the bolt with washer finger-tight. Position the blade horizontally at 2.45pm and let it go. The heavy end will probably head downwards. To check, rotate the blade the other way round to the 2.45pm position with the heavy end on the other side. The heavy end will again drop. Take some off the heavy end at the grindstone and repeat the process until balance is achieved. Your mower will run more sweetly and give fewer problems. 📄

The blade mounting — with bearings that rotate with blade — should be a light tap fit over the axle



Dave Wills makes the bolt finger-tight

Let blade go to check balance



TUSK FOLDING UTILITY KNIFE (TUK)



ORDER NOW!



PN: TUK 25
Utility Knife \$

TUK 25 - Trade Professional FOLDING Utility Knife is a combined safety knife, strap cutter and box opener. Folding feature for quick & easy one-handed opening/closing - safely folds to a compact size to fit in your pocket - or use the belt clip for convenient access. Includes 3 x Bi-metal blades in the handle. Designed for tool free easy blade changes. Made with anodised aluminium and high-impact polymer components for long life.

2pc knife set ON SALE NOW!



1. Convenient Strap Cutter Slot
2. Multi-position foldable blade offers variable cutting positions
3. Made with anodised aluminium and high-impact polymer components for long life
4. Quick tool-free blade changes - 3 replacement blades conveniently stored inside the handle

5. Quick safety button release - use, then fold away
6. Special black razor sharp blades made from premium quality Japanese SK2 steel
7. Hole for inclusion of lanyard strap and easy storage

5 x sharper and 3 x longer life than existing market blades

...TALK TO US - ADVICE IS FREE!

Contact us to locate your nearest stockist

www.tusktools.co.nz

Tel: +64 (9) 414 5678 Fax: +64 (9) 414 5679 Email: info@tusktools.co.nz

FOR THE PERFECT EDGE

TORMEK



Take advantage of the new Tormek 5 + 3 year warranty

TORMEK
Sharpening Innovation



Made in Sweden



0800 522 577 | Auckland | Christchurch | www.jacks.co.nz

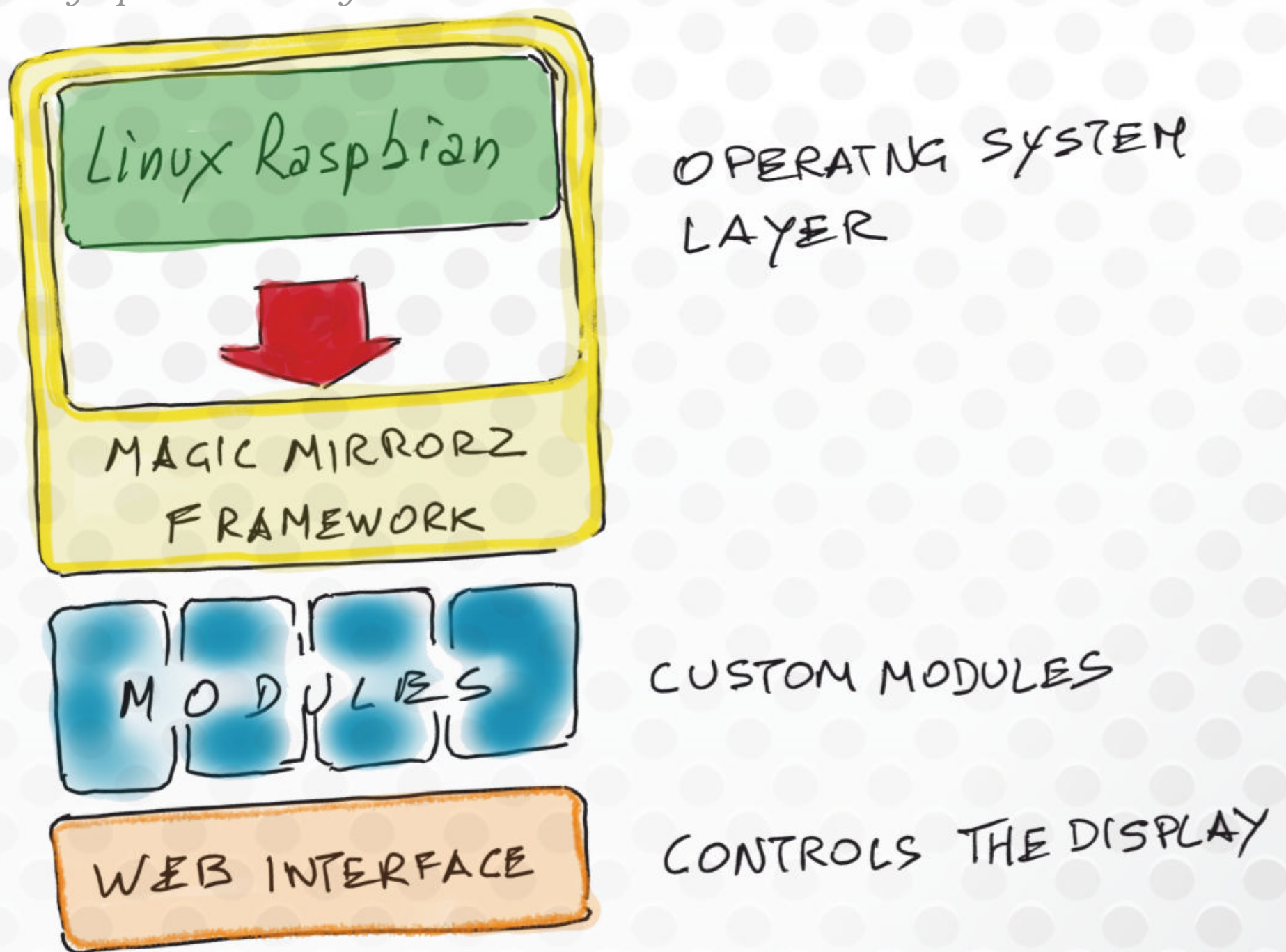
THE SMART PEEPHOLE

PART 2

It's time to tackle the challenge of setting up the software and testing it

By Enrico Miglino

Photographs: Enrico Miglino



This image shows how the Magic Mirror 2 platform acts as a layer running over the Linux operating system of the Raspberry Pi. Developed in Javascript and Node.js, modular and fully configurable, through the Node.js server the platform exposes a dynamic page on the screen showing text effects, animations, news feeds, weather reports, and many other media types, depending on the installed modules and how the user has configured the display

In this, the second part of the DIY magic mirror peephole, we see the most difficult part of the project: the software set-up and the mirror testing.

In part one — Issue 94 of *The Shed* — we mentioned the Magic Mirror 2 framework. This is the main application

that should run on the Raspberry Pi. To better understand the strategy I have used to make the software, it would be very helpful for you to study the sketch on page 74 of Issue 94.

The scheme of the Magic Mirror software architecture shows how the

components of the framework are installed on the system and how they take control.

Taking control

When the Raspberry Pi is powered, the boot section loads the Raspbian Linux operating system, then, as the computer

is ready, the Magic Mirror 2 framework — a set of applications and plug-ins — takes the control of the machine, showing the animated screen on the display. A black screen shows text, images, or other kinds of media, depending on the application configuration.

Behind this impressive visual effect lies the creation of an instance — a copy of a program running under certain conditions — of the browser shown without ‘decorations’ (buttons, web address, status bar, window border, etc.). The visual experience is a dynamic set

of information — such as the last news feed, the weather report, or a slide show — over a borderless black background.

As the rest of the background mirror surface is also black, it is almost impossible to distinguish the screen area; text and images float in the middle of the mirror, while the half-reflecting surface completes the effect.

Detailed information

The Magic Mirror 2 features and behaviours, as well as the third-party modules, are configured through a series

of Json files. Every available module is listed in the Magic Mirror 2 GitHub repository, with detailed information on the configuration and installation. To have an idea of the hundreds of available options, it is sufficient to cite the module categories:

- Alerts and notifications
- Calendars
- Clocks
- Text messages and textual effects
- Images, slide shows, and videos
- Newsfeed
- Weather forecast



A black screen shows text, images, or other kinds of media, depending on the application configuration

The smart peephole positioned in front of a window of my studio to test the final software set-up; when the camera ‘peephole’ is activated by the ultrasonic sensor, the Magic Mirror 2 interface is temporarily overwritten by the camera preview overlay

The official site

Both a complete description of the potential of the Magic Mirror 2 platform and the full documentation are available on the official site:
<https://magicmirror.builders>

The camera overlay is controlled by a Python application run independently by the Magic Mirror 2 in a separate Linux process. This image shows an example of the screen sequence changing about every five seconds; the content shown can be configured by the user from a choice of hundreds of modules created by community developers and compatible with the Magic Mirror 2 platform





Detail of the Pi camera showing the outside image with the classic 'peephole' effect. It is not a software effect, but the camera with the peephole lens mounted on top of the fixed-focus lens. Most of the quality of the image depends on the quality of the peephole's extra lenses. I strongly recommend using a good-quality product with glass lenses to achieve the best result

This means many users and developers build on the basic architecture of the framework, growing the original project and constantly creating new features

Both a complete description of the potential of the Magic Mirror 2 platform and the full documentation are available on the official site:
<https://magicmirror.builders>

Why is it important to know how the Magic Mirror 2 works inside the Raspberry Pi? The answer is simple: because we want to add more features to our smart peephole.

To implement the camera and ultrasonic features needed by the project, one of the possible options is to develop a new custom module to be added to

the platform. However, looking for the easiest and most efficient solution, I abandoned the new Magic Mirror 2 module option for two reasons: first, I thought there should be an easier way and, second, I want to make the smart peephole project available for those makers who decide not to use the Magic Mirror 2 solution — which is what I strongly recommend.

Sharing hardware resources

The Raspberry Pi runs on Linux, a multitasking operating system; the

approach is to exploit the powerful features of this operating system, working with multiple processes at the same time.

In addition to the Magic Mirror 2 platform and its components, it is possible to run other programs on the same machine, sharing the same hardware resources.

Stepping away the Magic Mirror 2 for a moment — if you press CTRL+Q, the interface is stopped and you gain access to the Raspberry Pi standard desktop — I have created a Python application to



The image shows an example of the sequence of different textual screens shown by the smart peephole. The text strings are shown by a module that is configured to change the text randomly from a list every five to ten seconds, with a fade-in, fade-out effect; to the left: the camera triggered by the sensor covering the screen

control the ultrasonic distance sensor. It is a device for measuring short distances of one centimetre or less.

With the Python RPI.gpio Python library, I have implemented a simple algorithm that converts the time needed by the receiver component of the sensor to detect the echo returned by an ultrasonic pulse periodically generated by the sensor emitter.

Knowing the speed of the sound through the air, it is not difficult to convert the time delay into distance units. This program runs continuously in the background as a separate Linux process, regardless of the Magic Mirror 2 application. When the sensor detects the movement of a subject at a distance of 50cm or less — this value can also be configured — it triggers a function that shows the Pi camera overlay on top of the screen interface.

Camera feature

The camera preview is a built-in feature of the 'raspistill' Linux command, available on the Raspbian distribution, to control the Pi camera accessory.

Thanks to this feature, I had no need to write any complex camera software; when the sensor triggers the subject movement in front of the smart peephole, the Python script only should launch the Linux command

```
$>raspistill -t 20
```

where 20 — this value can be configured by setting the desired duration of the camera on the screen — represents the duration of the camera preview image, showing the user who is outside of the door. 📹



An image of the set used for testing the smart peephole



Backstage shooting of a demonstration video of the finished project; the video will be soon available on *The Shed's* YouTube channel

Open-source software

The Magic Mirror 2 architecture has the priceless characteristic of being open source and community-driven. This means many users and developers build on the basic architecture of the framework, growing the original project and constantly creating new features.

The base framework is frequently updated and maintained by the team led by the application creator. Even though the platform can be installed from the GitHub repository: (<https://github.com/MichMich/MagicMirror>) without any special programming skills, it is worth having an idea of how this system works.

Magic Mirror 2 — compatible with all the Raspberry Pi versions from 2 to the most recent Pi 4 — runs on the most recent version of the Raspbian Linux distribution. (The specific Linux for the Raspberry Pi is available on the official site: <https://raspberrypi.org>)

The framework architecture is based on Node.Js, an open-source server environment based on Javascript that can deliver to the browser almost any kind of dynamic content. Not only that, but thanks to the powerful Javascript language a Node.js server can also easily interact with the operating system and other components, such as applications, operating system scripts, databases, and more.

FLYING ON WATER

Fancy skimming across the top of the waves as the America's Cup boats do? Maybe it's time to try foil-boarding

By Geoff Lewis

Photographs Geoff Lewis and supplied

The curious thing with foil-boarding is how a water sport is referred to in terms used in aviation. Board riders don't ride or sail, they fly — and when you witness this exciting technology in action, it is easy to see why.

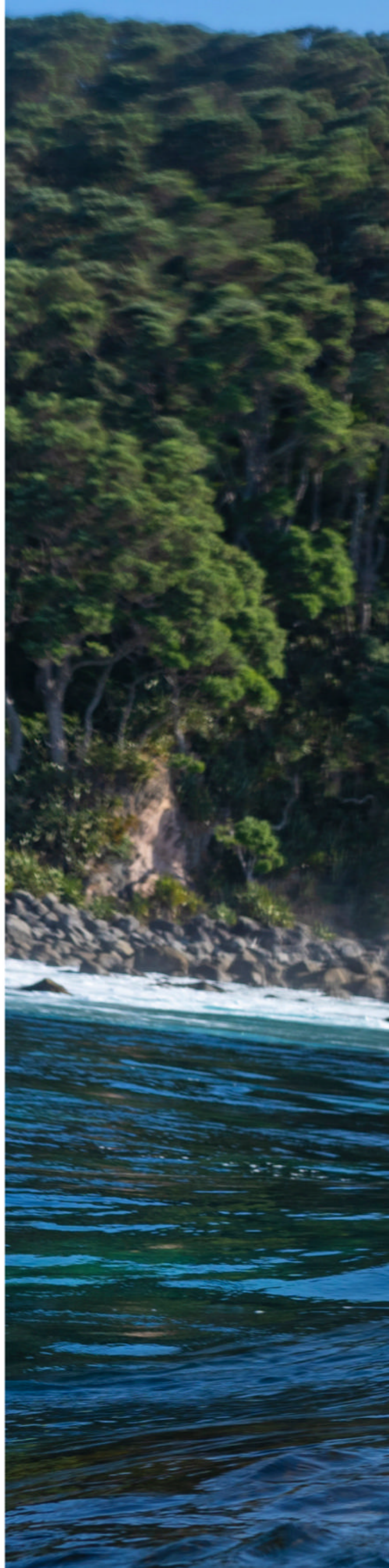
Many of you will remember the clamour around America's Cup racing in the 1980s when the 'boats' were built of aluminium or fibreglass, before the quantum leap in technology and materials which has led to the breathtaking performance achieved by foiling catamarans and, recently, by foiling monohulls.

It all started way back with the aerofoil — a simple concept which creates lift, aerodynamic or hydrodynamic, by the use of the aerofoil shape.

The same ideas have been breaking new ground in technology, and new water in water sports, in recent developments in foil-boarding and wing-foiling.

Armie Armstrong runs Armstrong Foils, where he designs and prototypes foil boards from a Westmere property rich in Auckland boat-building history. Armie grew up in and around the world of boats and sailing in New Zealand waters and internationally. ►

“Armie became addicted to surfing and moved to the surfing Mecca of Raglan”



America's Cup skipper
Pete Burling testing
an Armstrong foil off
Coromandel





A marine life DNA

Armie grew up in and around the world of boats and sailing in New Zealand waters and internationally. From an early age, he became familiar with tools, a dab hand at designing, making, and fixing things.

“I did science at uni and went into the film industry,” he recalls. “I worked with Sigmund Spath making marine movies. I used to build special underwater housings for the old-style film movie cameras. We worked in productions such as *Whale Rider*. Then digitals came along and everything became a lot lighter.”

Armie became addicted to surfing and moved to the surfing Mecca of Raglan in 2005. While he was in the west coast town, he met up with Ozone Kitesurf designer Rob Whittle.

“We did a lot of road trips and kiteboarding; we broke everything, so we thought, ‘Why not design something that doesn’t break?’ The kite-surfing guys used the same idea but with hydrofoils. That’s where foil-boarding began.”

Key to the development of the foil-



board has been the use of strong, lightweight materials, including carbon fibre and titanium. Titanium is ideal for fittings and fixtures due to its strength. However, as carbon fibre acts as an anode in seawater, the key advantage of titanium is its resistance to galvanic corrosion — a constant problem with fittings made from other metals, including stainless steel. The downside is its cost, as Armie explains.

“Even 316 stainless will start ‘fizzing’ after a few months. Titanium is super expensive, as it has to be made in huge

volume batches, but it lasts. The materials have been around for a while. The thing that made it possible was the original design concept, which was developed in California by Mike Murphy, the grandfather of the sport. Mike was a waterskiing instructor who tried all sorts of different designs and learned through trial and error.

“We looked at the America’s Cup, with its use of carbon fibre and titanium. Six years later, we have something that does what we want it to do, and now we’ve got the strongest rig on the market.” ►

**“Even 316
stainless will start
‘fizzing’ after a few
months”**



“Waves that were unrideable with traditional surfboards are now the focus of attention of foil-board riders worldwide”

Different strokes

Armie says that Armstrong Foils provides a range of board sizes and foils depending on variables, including the weight and experience of the rider, the performance the rider wants from the rig, and the water conditions the rider prefers.

“Different-sized boards and foils have different applications and riders have different requirements. Beginners start with a kite that can generate a lot of lift. This is a sensation-driven sport; foiling feels like flying through the water.”

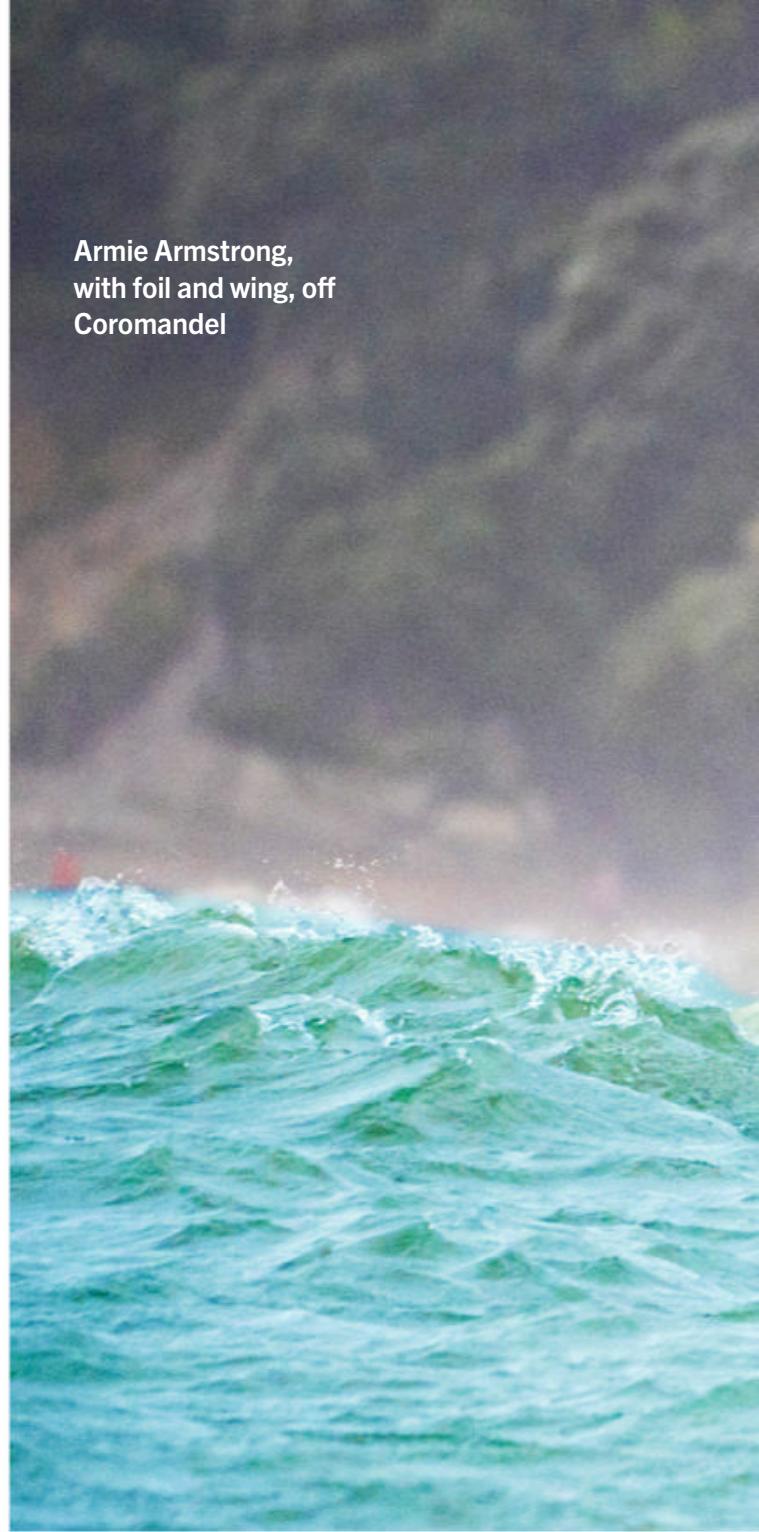
Foil-boarding opens up whole new horizons, with or without kites. Waves that were unrideable with traditional

surfboards are now the focus of attention of foil-board riders worldwide.

The foil board comes with front and back ‘wings’ or foils attached to a common ‘fuselage’ and vertical mast beneath the board.

The lift produced by the foils is calculated in the same way as in aircraft — density times velocity squared; this will give the lift of the wing. Water is far denser than air, so a much smaller foil surface will give the same lift. Not only that, but once up to speed, and up on the foil, the rider is scooting along a metre or so above the water. Drag is greatly reduced, and that creates the sensation of flying over the surface.

Armie Armstrong, with foil and wing, off Coromandel



Different foil designs



Armie with titanium fitting





Armie inflating wing

Hand-held wing

The latest thing in foil-boarding is the handheld ‘wing-foil’, an inflatable component also made of lightweight, high-strength materials. The wing removes the need to be towed out to a surfing spot and avoids the tangles that can come with the use of kites and kite strings, as the rider holds onto the wing directly.

The rider stands on the foil-board, and the wing provides lift. As speed increases, the board rises on its foils until the rider, board, and wing are almost ‘flying’ above the water. Wing-foil technology opens up opportunities for foiling on protected waters like rivers and lakes — Auckland’s Lake Pupuke is a popular spot, Armie says.

“The wing holds you up. The foil makes the wing work and gives you an extra point of balance. The wing makes foil-sports available to everyone.

“The idea of the wing comes from the rigid wings used in windsurfing. [They] had also been used on snow and ice, but no one had put them on water

until recently. But with the hydrofoil, all of a sudden it has become efficient technology. It comes from the people on Maui (Hawaii) and has exploded. It's simpler than a kite; there's no strings — you just walk out, paddle it, and away you go. It's like windsurfing but without the mast or the boom attached to the board." Armie explains.

TNZ foiling trials

Armie has been closely associated with New Zealand's America's Cup team, which is using similar technologies on a larger scale. The 2017 winning skipper, Pete Burling, and sailor, Blair Tuke, have trialed Armstrong's foil-boards off the Coromandel coast.

Trading as Armstrong Foils

International, Armie manufactures and distributes from China and Hong Kong — unfortunately, he tells us, the costs of manufacture and shipping from New Zealand are commercially prohibitive.

"If we want to sell into Europe or the US, we can't do it from New Zealand. We are already more expensive [than competing foils]. I've developed all the layout in the factories and employed full-time staff in China and Hong Kong. The key is quality control and to have people who speak the language and believe in the product. We are now battling some of the big water-sports companies and the only way we can compete is by scale. This year, our market share grew. It's a journey, a battle for product and space." 📄

Armie about to take to the water with foil board and wing at Westmere

CIGWELD

AN ESAB BRAND

WELDING MACHINES

FILLER METALS

PLASMA

GAS EQUIPMENT

SAFETY



Instagram Facebook Twitter YouTube | CIGWELD.COM.AU

A Brilliant Shine Every Time.
Clean, Polish and Protect.



AUTOSOL

Find Your Local Stockist at www.hobeca.co.nz

The toothed coupling with enough plain shaft behind it to allow the coupling to disengage if I want it to; the keyway had not been cut in the shaft at this point and the female coupling was secured to the shaft with two grub screws

FITTING A TRAVERSE DRIVE TO A MILLING MACHINE TABLE X AXIS

The Covid lockdown provided the opportunity for many long-dormant ideas to come to fruition. This one of them: a solution to a frustrating and monotonous task

By Rodger Kallu

Photographs: Rodger Kallu

Being a hybrid and of medium size, my milling machine has a manual drive for the X, Y, and Z axis. Like many sheddies with similar machines or mill drills, I have been frustrated by having to wind the longitudinal X-axis hand wheel a zillion times to set up work on either end of the table.

Opportunity knocks

When the Covid Level 4 lockdown arrived I was stuck at home, like everyone else. Looking for something to occupy myself, I decided to revisit my idea for a rapid traverse for the X axis. Some time earlier I had bought a 24VDC windscreen wiper motor, planning to fit it to the end of the table, opposite the hand wheel — until I realised I would need a clutch plus

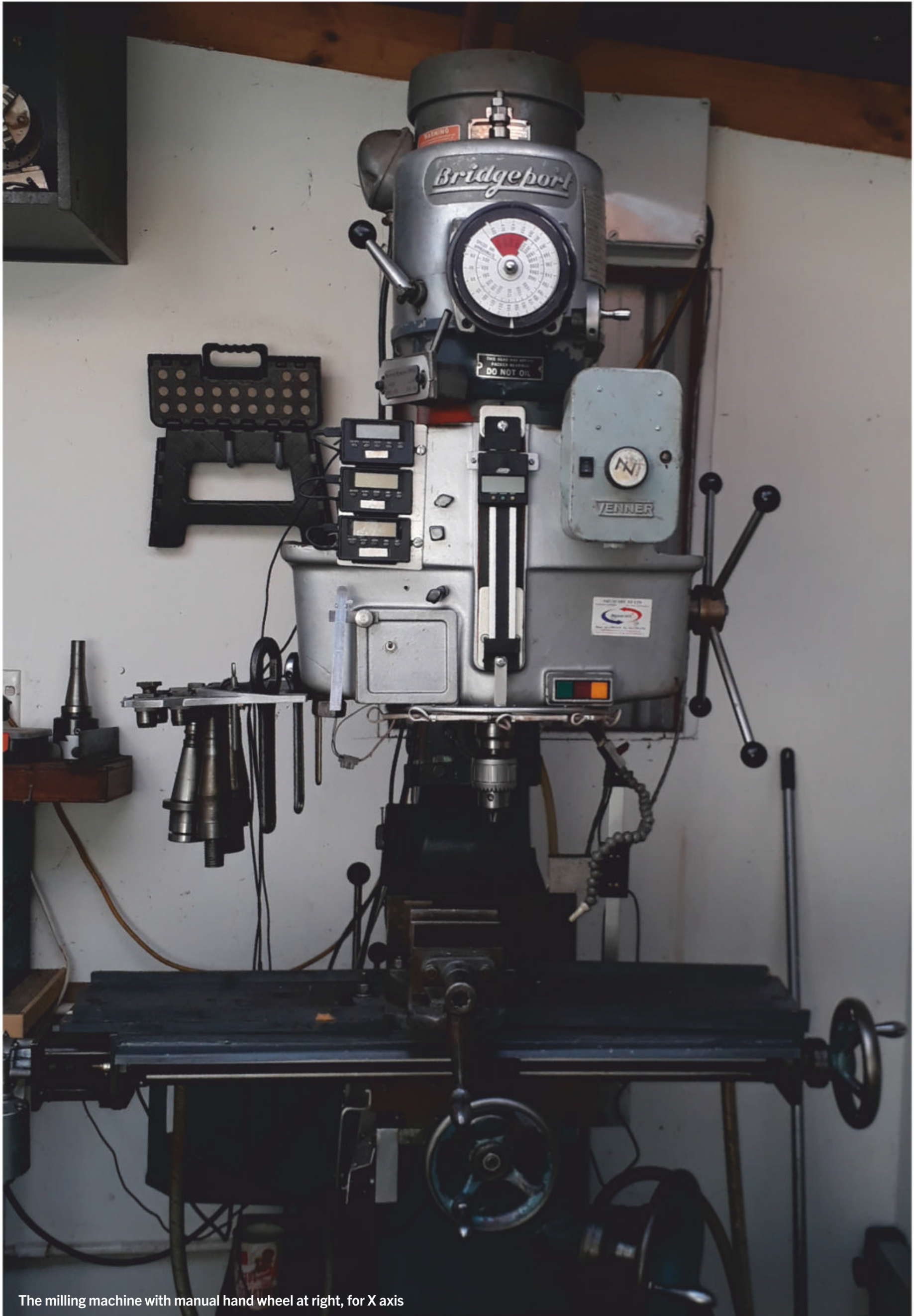
some sort of thrust bearing. Delving in my cupboard of the treasures, I also found a step-down transformer to 24VAC, a rectifier to change from AC to DC volts, a kitset DC speed controller with a forward/reverse /stop switch, and a toothed coupling that was an ideal size to use at a basic manual clutch.

When the Covid Level 4 lockdown arrived I was stuck at home ... looking for something to occupy myself

New shaft

Taking the end plate opposite the hand wheel off the table, I was surprised to see that the bearing on the end was a simple brass one that took only radial load not axial load, so the table thrust for both forward and reverse was handled by the hand-wheel end. The end of the X-axis screw had been machined down to below the root diameter of thread and this ran in the brass bush.

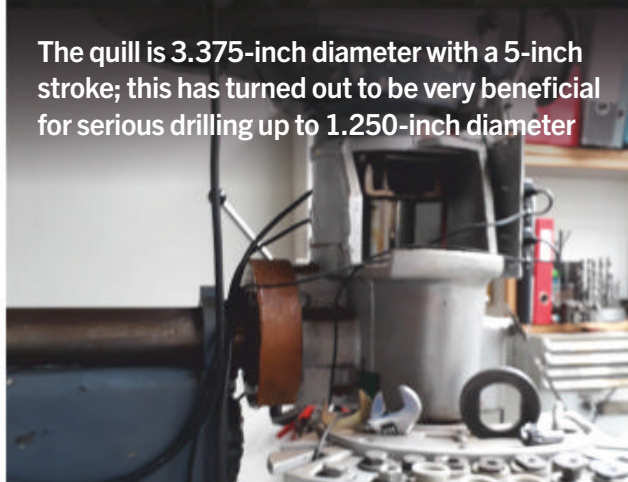
I made a sketch showing how a connecting shaft would run, with one end bored out to a tap on fit to the existing plain end on the X-axis screw shaft and fixed with two grub screws at right angles to each other. The shaft would run in a new brass bush located on the outside of the end plate, and



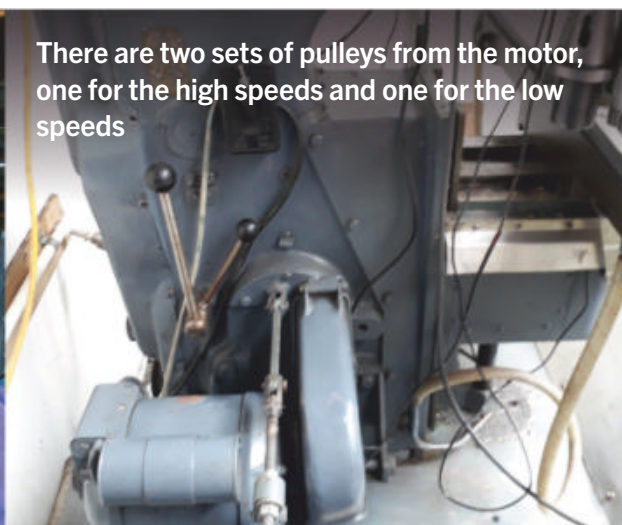
The milling machine with manual hand wheel at right, for X axis



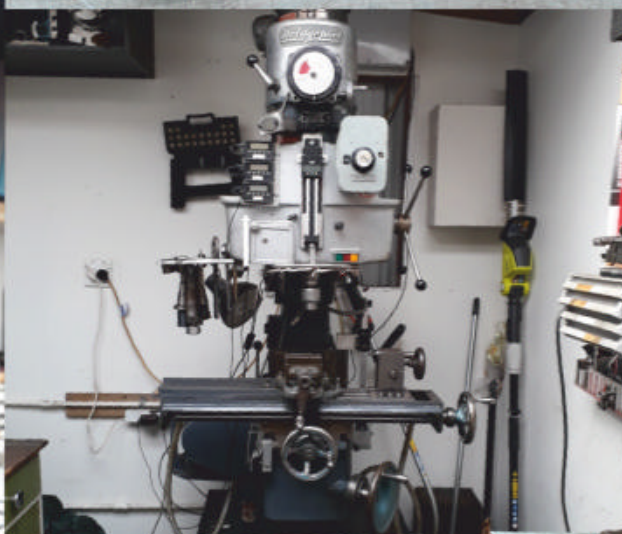
This was powered by a 1hp motor driven through a four-speed gearbox — see photo of gear levers and motor below



The quill is 3.375-inch diameter with a 5-inch stroke; this has turned out to be very beneficial for serious drilling up to 1.250-inch diameter



There are two sets of pulleys from the motor, one for the high speeds and one for the low speeds



The pulley speeds



The rpm dial



The back gear lever

Hybrid milling machine

I got the basic machine second-hand about 15 years ago. It seems to be made with a mixture of castings and other fabricated bits — no nameplate. If anyone can identify it, I would be pleased.

It came with a very light end mill attachment — not much more than a washing machine motor power driving through a single A-section belt. This was not rigid enough to be useful for what I wanted to do, so I sold it. It also had a horizontal arbor but no support bearing arms, so I made a couple myself (see photo).

I was still keen to have a vertical mill/drill arrangement, and found a Bridgeport one on Trade Me. The plan was to pick it up with my wife's MX5; however, at the last minute, I decided to use my Subaru Grand Wagon. The machine barely fitted into the wagon and it took two of us to load it. Fate had stepped in to improve my day!

EARLY PUNCH CARD TECHNOLOGY

The tool had massive hydraulic rams on either side of the head/quill and a vast array of pneumatic control gear. Apparently the Bridgeport arrangement was one of the first automated CNC-operated units controlled by punch cards.

You can see from the photo what I had to carve off the massive cast iron head to try and lighten it. You can also see the mating flange I machined up to connect the Bridgeport head to the

existing steel overhead shaft.

The spindle attachment taper was a Moog style, which is not quite NT40 with a parallel end above the taper. I stripped the spindle out of the head and had a local engineering firm machine the internal taper to NT40. I either buy NT40 attachments and machine-fit the parallel extension myself, or machine the whole attachment myself (see photo).

The good news is that it has a Reynolds-style variable-speed mechanism, which, when the back gear is being used, can run from 60rpm to 3500rpm without any belt changes. The 3hp motor is three-phase. However, I got a local sparky to make a single-phase to three-phase controller for it — this was before the VSD prices dropped dramatically. (See photos of the rpm dial and the back gear lever.)

The controller uses the original Bridgeport buttons for on/off/reverse. Unfortunately I had to remove the nodding head arrangement, as it was way too big to be any use for my mill table. The vertical slewing for the head is also too big to be of any use.

Because of the size and weight of the Bridgeport unit, it isn't practical to remove it to run the horizontal arbor. This hasn't been a problem, though, as I have an arbor that allows me to run a slitting saw in the vertical set-up.

Overall, I'm very pleased with the amalgamation and have frequently used the set-up.

would then drop down in diameter so that the female end of a toothed coupling could slide back and forth on it.

Process

I removed the end plate, setting it up in my lathe, then the old steel bush on the internal side, which housed the original brass bush. I machined a spigot into the end plate on the outer side. A new larger steel bush was then machined up, with a locating step to fit the internal spigot, and welded into place. The end plate was then set up in the lathe and the steel bush was bored out, and a brass bush pressed into

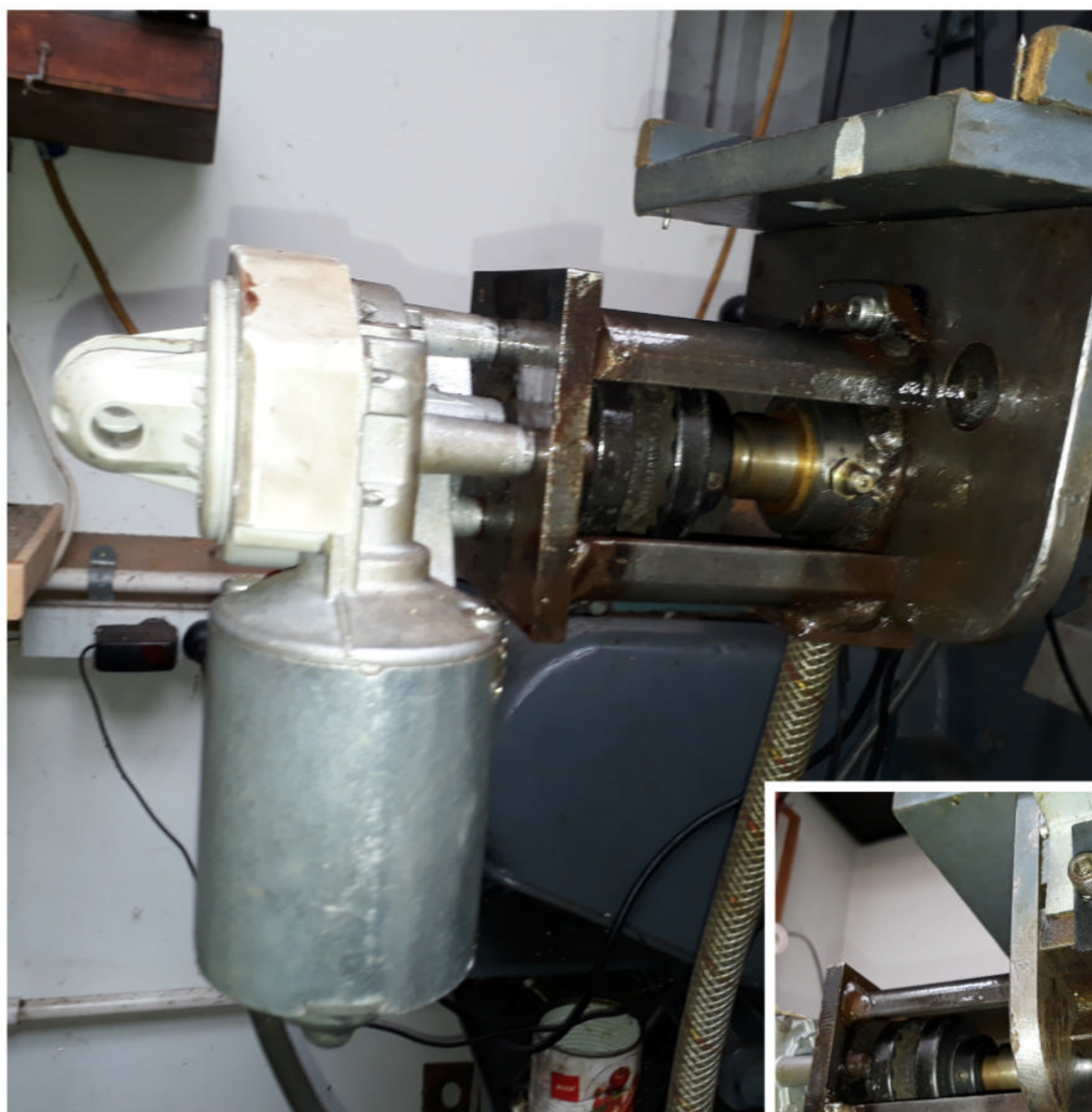
it. The internal diameter of the brass bush was then machined to a running fit, to take the new connecting shaft.

I machined a spigot into the end plate on the outer side

I made up a plate to hold and locate the windscreen wiper motor and fixed

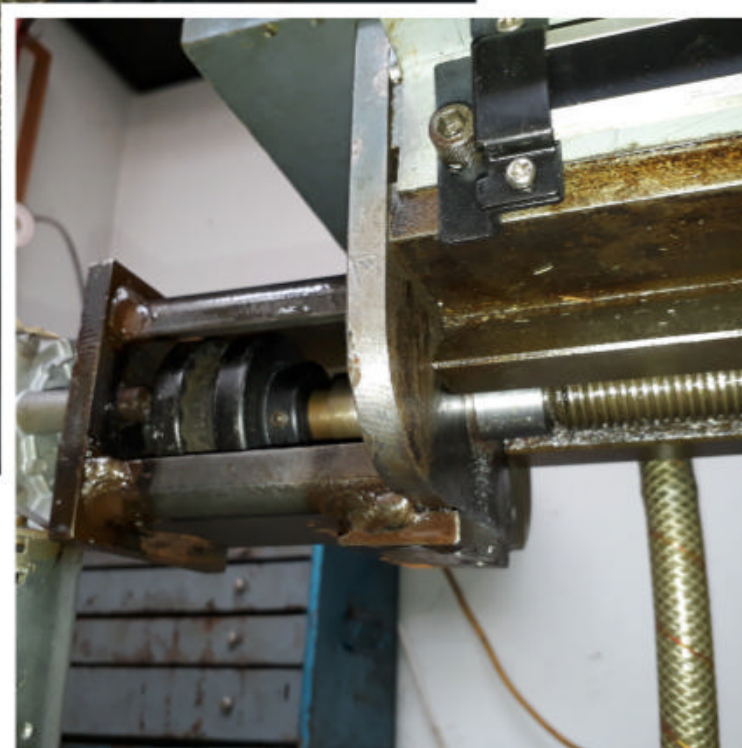
the male half of the coupling to the wiper motor. A piece of RHS was slotted for a spacer between this and the existing end plate, long enough to accommodate the toothed coupling I was going to use as a clutch. This was intended to be basic; the table would be stopped and the clutch either engaged or disengaged manually before starting up. The female half of the toothed coupling had a $\frac{3}{16}$ -inch keyway in it and I figured that, if I cut a longer

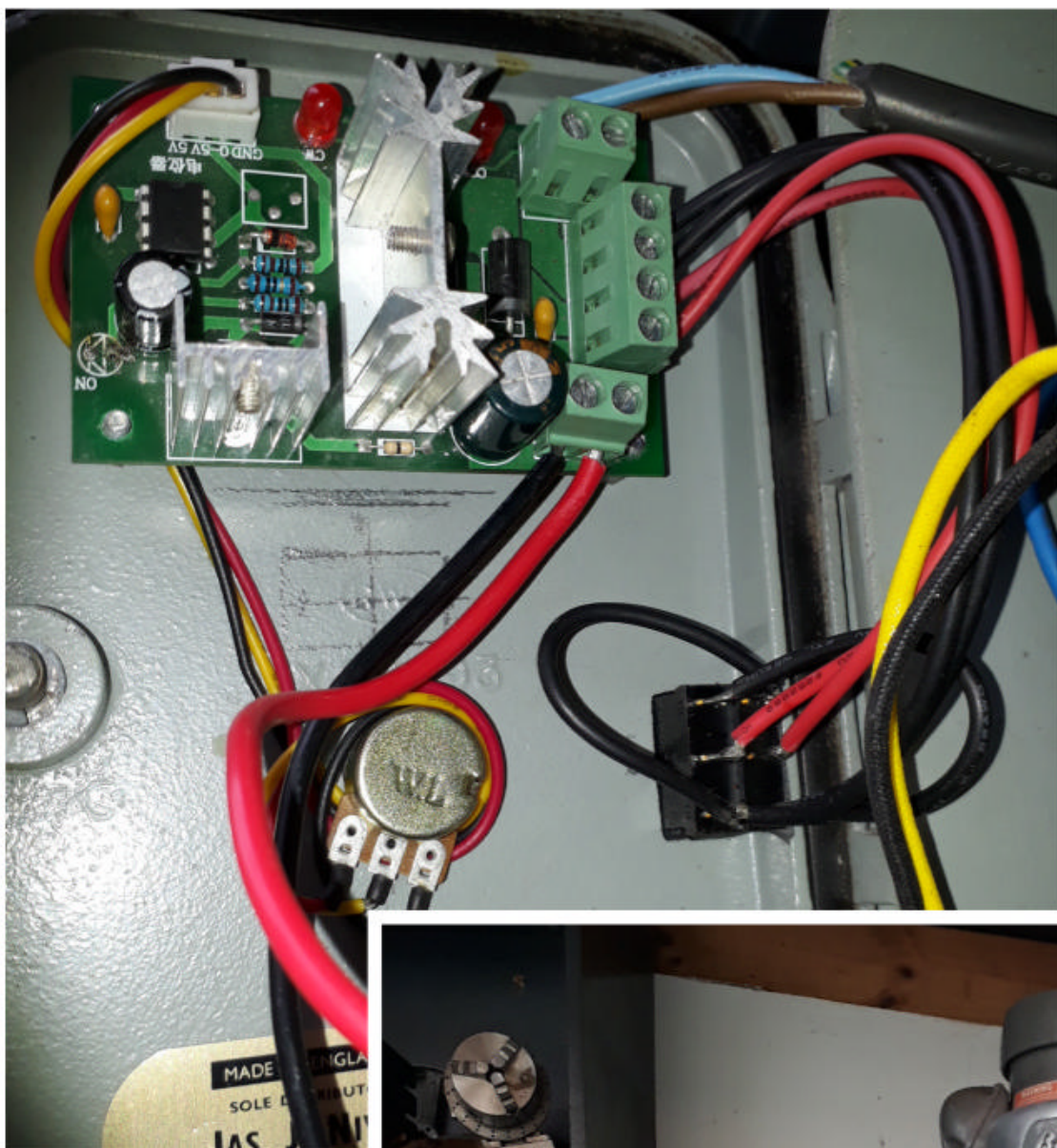
$\frac{3}{16}$ -inch keyway in the connecting shaft, the female coupling half could be moved in or out to engage or disengage the clutch, with a manual lever. ►



The new connection shaft attached to the existing X-axis screw

The toothed coupling is immediately to the left in the slotted RHS; the new steel bush with the brass locating bush is to the right





The inside of the control box showing the speed controller, below this actual control; to the left of this is the back of the forward/reverse/stop switch

Moment of truth

The wiper motor was wired up to the electrics and I gave it a go with the coupling locked together with grub screws on the female half to see how it would go before fitting the clutch with the keyway and a manual lever to engage and disengage it.

Much to my amazement the drive worked perfectly, so much so that, by slowing the drive down, I can accurately position work along the X axis without a clutch and manual positioning. I have been using it ever since, and it has transformed the milling machine. I can also take reasonable cuts with an 18mm end mill no problem. 📁



Much to my amazement the drive worked perfectly

The milling machine, showing the wiper-motor drive on the left-hand end of the table

**ON
SALE
NOW**

**AT ALL GOOD
MAGAZINE
RETAILERS**

THE **best of Shed 2**

**Grab Best of The Shed
1 & 2 for just \$29!**
Online only at magstore.nz



**WHILE
STOCKS
LAST!**

**16 MORE TOP PROJECTS
FROM 15 GREAT YEARS**

\$22.95

16 more great projects from our first 15 years of The Shed magazine

Want to make your own outdoor fire, bedside cabinet, or Damascus steel knife? How about an outdoor slow cooker barbeque or a ukulele? Maybe you want to learn how to make your bicycle electric? These are just a few of the projects we have included in this second edition

of Best of The Shed. All have clear instructions that demonstrate the build process and include diagrams and parts lists.

Get it from your favourite magazine retailer or purchase from our online shop, magstore.nz



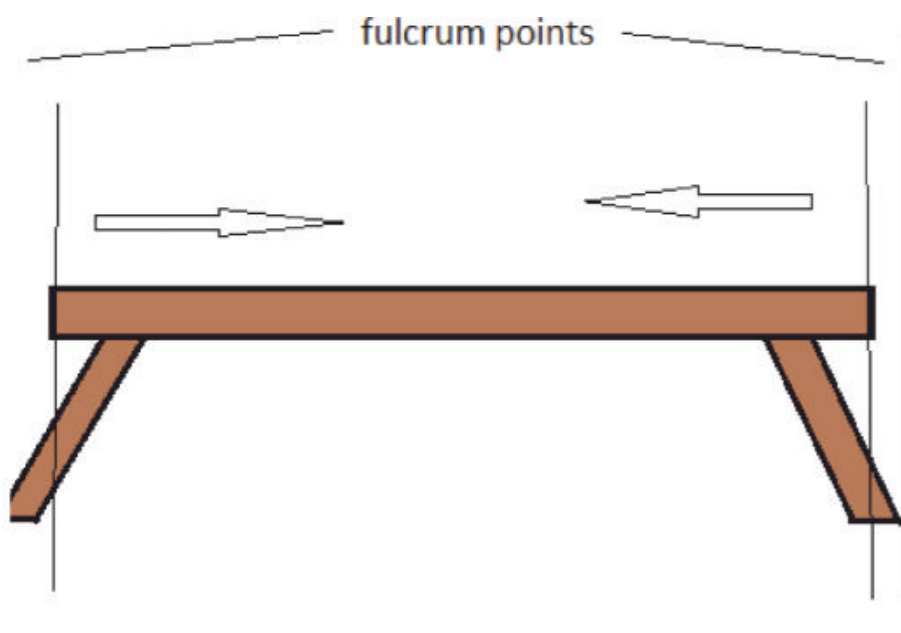
MAGSTORE.NZ



THE RIVULET TABLE

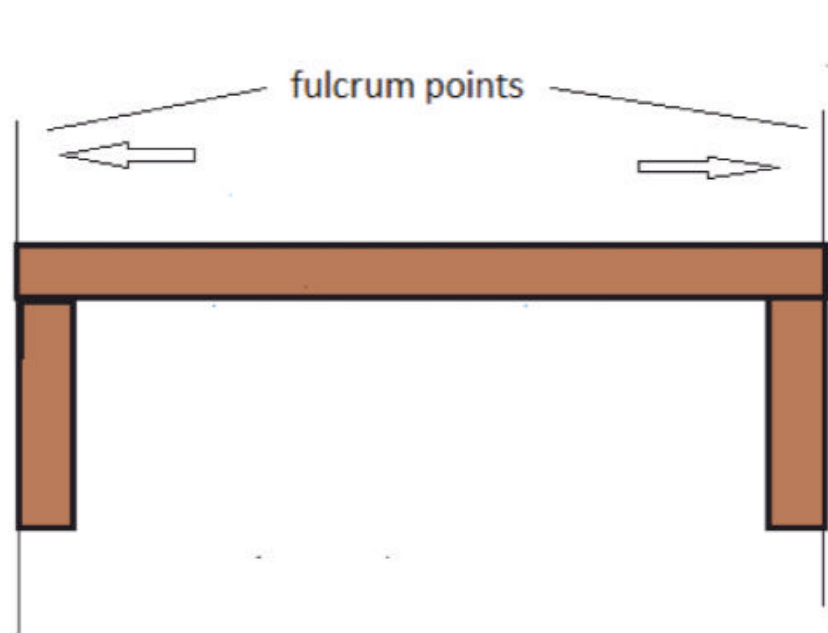
Form and function — Coen Smit makes a little table that will please the eye as well as provide a solid surface for your coffee cup for years to come

*By Coen Smit
Photographs: Coen Smit*



A small table with splayed legs subjected to weight applied at the edge of the top will transfer the force inwards onto the opposing legs.

The fulcrum is outside the edge of the table top so the table needs to be lifted before it will topple over.



A small table with vertical legs will topple over easily as the fulcrum coincides with the edge of the table top.

The arrows indicate the direction in which force will act if downward pressure is applied at the edges of either stool configuration.

Every sheddie owes it to him or herself to build one of these stools, which are called ‘knockabout stools’.

It’s the bit of furniture that has a multitude of uses around the house and shed, is easy to build, and uses up those odd bits of timber left over from grander projects. It doubles as a step to get to those things that always appear to be just out of reach, it acts as an extra little table to support the coffee cup you don’t want to spill over your laptop, it holds that extra book you want to keep handy, and so forth. In short, it’s a knockabout stool/step/table.

Because of the varied uses to which you will eventually put it, the stool needs to be sturdy and stable — capable of holding the weight of an adult without tipping over or disintegrating. Apart from those two basic requirements, there is

a multitude of scope to let your creative talents have free rein.

For this article I have chosen to outline the construction of my ‘rivulet’ table.

Gathering the raw materials is the first important aspect of the project

Inspired by nature

I love the free meandering features of small creeks and rivers as they wind their way through the landscape. The apparently haphazard way a stream forms itself around rocks and contours, yet is

always moving downhill and gathering strength as it goes, has an essence to it that I sought to capture in this piece.

As always, however, I try to abide by certain parameters in the items I make. Foremost, I want the finished piece to be visually appealing. Secondly, the scope of the project is constrained by the materials at hand and the tools at my disposal. Finally, it has to be functional in some way or other.

Gathering the raw materials is the first important aspect of the project. You will need an assortment of small stones that define ‘the rivulet’ and, rather than simply gather a range of different stones, consider how a normal stream moves through a range of geological areas; the rock formations a creek encounters progress incrementally from one type to another. Your collection will look more realistic if it reflects this rock transitioning process, especially if you are aiming for a degree of realism and want to avoid that Pebbletex look. The direction a rivulet



Building the legs

Tools

- Cut-off saw
- Thicknesser
- Biscuit cutter
- Bandsaw
- Drill
- Screwdriver
- Small and large routers
- Disc sander

Materials

- Leftover sections of Tasmanian myrtle
- Quantity of stones, pebbles, and sand collected from a nearby beach
- Clear acrylic resin (250ml approximately) and catalyst (3–4ml approximately)
- Various grades of sandpaper
- Woodworking glue
- Timber screws

takes is also determined by the rocks it encounters along its path, so some of your stones should be a little larger to act as turning points in the ‘flow’ of the creek. This helps develop the sense of the creek meandering across the surface of the table.

For this particular project, I wanted the colour of the stones to partially reflect the myrtle timber I used to build the table.

Once you have a range of stones, it’s a good idea to cut some paper the size of the proposed tabletop and arrange the stones in various ways to develop the best

‘look’ of the stream meandering across the surface. When you have settled on a design, keep the stones selected, separate from the rest, so that you can rebuild it in situ.

Building the table

It’s now time to turn your attention to the design specifics of the table itself. Given that the ‘rivulet’ will be the main feature of the finished table, it’s important not to distract from it by making other features, such as the legs, overly ornate.

Timber constraints have dictated that this will be a small table that will spend most of its life supporting a coffee cup or two, as well as performing occasional duty as a footstool, seat, or a step. It will therefore need to be sturdy, stable, and capable of coping with heavy loading if required. Also, I must confess that I’m a fan of strong chunky furniture that will require minimal further maintenance in subsequent years.

The use of thick sections of timber also means the table lends itself to the routing required to build the creek bed into the top. This in turn dictates the size of timber used for the table legs. In

keeping with the functional parameters, as well as the overall aesthetics, the legs should match the tabletop in terms of the size of timber used and to ensure overall stability.

As it is now very difficult to obtain wide sections of timber, I made the tabletop by biscuiting two smaller sections together. Normally this is a straightforward operation using a biscuit or domino cutter, gluing the two pieces together and, once the glue has properly set, running the top through the thicknesser to achieve a uniform surface for the joined pieces.

A stable structure

To construct the table legs, I first drew some basic designs that I thought might suit. To ensure that the table would be stable if I use it as a step, I angled the legs by 10 degrees so that the feet of the legs are slightly outside the top edge of the table. This means that even if someone stands on the edge of the little table, the weight remains inside the top’s tipping point, thereby making it more stable. (See diagram for a more detailed explanation.) ►



Outline of the rivulet

It's important not to distract from it by making other features, such as the legs, overly ornate

Using the small router to define the edge of the rivulet





Checking the surface



Bedding in the larger rocks

I ran a straight edge carefully over the top to check that all the stones were below the surface of the table



Placing the larger stones



The rivulet bed taking shape

Having built the table, it was time to take to the top with a small router and carve out the rivulet. I started by defining the edges of the stream with a fine drill-like router bit. I then used my larger router to carve out the main parts of the stream, being careful to stay away from the outer edge.

Having removed most of the ‘stream bed’, I reverted to using my smaller router to complete the job on the sides of the stream. The depth to which the top has to be routed will be determined by the average size of the smaller stones being used. All the stones should be below tabletop height and have at least 1mm to 3mm of resin covering them. If you router the stream bed to a general uniform depth, you will be able to construct the

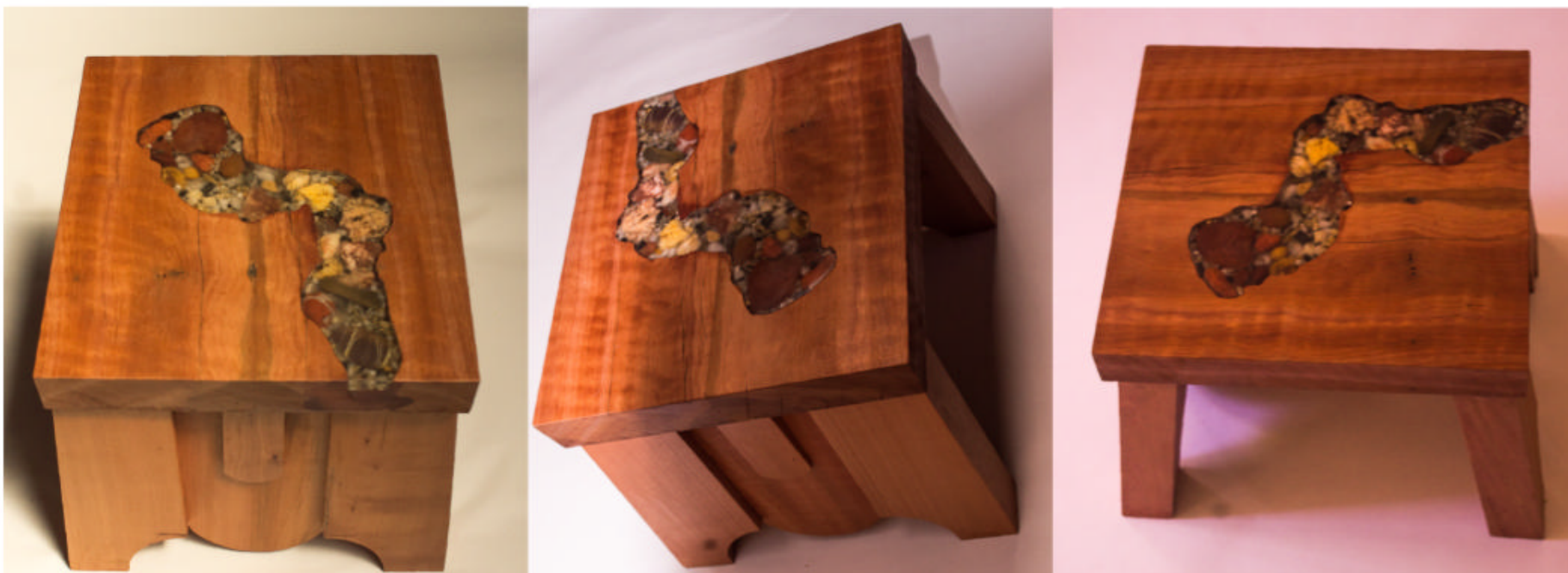
rivulet more realistically, using small amounts of sand and small underlying stones to create variations in depth that mimic the conditions found in the real thing. With the stones that were too high, I routed their final positions a bit deeper. This ensured the overall strength of the top wasn’t compromised unnecessarily.

Stone positioning

Once I finished routing and situated my collection of rocks, I ran a straight edge carefully over the top to check that all the stones were below the surface of the table. Using a solid piece of timber and a Perspex offcut — to prevent the resin from coming into contact with the clamping block of wood — I closed off the rivulet where it leaves the table and made

sure I had a level space for the table to sit on undisturbed, before preparing and pouring the resin.

I used clear casting resin, which — as the name implies — dries clear, rather than ordinary fibreglass resin, which has an opaque finish. The recommended ratio of hardener to resin in this instance was 7ml to 500ml, which gave me about 20 minutes to work with it. This ratio, and the time it gives you to work with it, is dependent on ambient temperature; it is often recommended to adjust the ratio slightly to suit the weather. Reducing the ratio means the resin will take longer to set, giving you more time to make sure all air bubbles have dissipated and you have the time to add small amounts until the ‘water’ level matches the tabletop. ►



Pouring resin

It is best to pour the resin in small increments to give it time to soak into the creek bed and let any air pockets bubble to the surface. As the creek bed fills up, check the level repeatedly against the table surface, adding a few millimetres at a time until the two match as closely as possible. Wipe up any spillage on the surface of the table with a clean cloth to reduce the amount of sanding required once the resin has hardened.

After I finished the pour, I left the table undisturbed for 24 hours for the resin to

After I finished the pour, I left the table undisturbed for 24 hours for the resin to set

set. As an added precaution, I checked the hardness of the leftover resin before handling the table.

Cleaning up and finishing the table meant carefully sanding any spilled resin

stains from the tabletop and softening the edge of the resin where the 'rivulet' leaves the table, as the resin formed a slight ridge where it met the Perspex barrier.

This was easily accomplished with a sharp scalpel blade and a fine file. I chose to oil the finished table to bring out the natural colour of the myrtle and because that makes it simpler to maintain the piece in the future. Myrtle can develop small surface cracks as the timber responds to changes in humidity; oiling helps to minimise these and also avoids the problem of cracked varnish. 📖



The underside of the table

BUY • SELL • TRADE

TOOL BARN

The Home Of Preloved Tools

NEW & USED TOOLS



\$449

Cammac guillotine
500mm x 1.2mm



\$249

Mitutoyo telescopic
gauge set 8-150mm



\$199

Mitutoyo depth
micrometer
0-125mm



\$125

Brown & Sharpe
inside micrometer
caliper



\$99

Mitutoyo ball anvil
micrometer 0-25mm



\$149

Girod-Tast dial
gauge 0.01mm



\$750

Dyco 450 bandsaw

45 Jellicoe Rd, Panmure, Auckland phone (09) 570 8064
email: toolbarn@xtra.co.nz

www.toolbarn.co.nz

The only welding machine you
will ever need. 4-in-1 welding
(MIG, Stick, AC TIG and DC TIG)
with a 10 amp Plug!

NEW PRODUCT



Ready to Weld Content Includes:
200M power source, MIG gun, TIG torch,
Electrode lead, Work return lead, Gas hose,
Regulator / Flowmeter, Input lead (3m) with 10 amp
plug, Drive roll 0.6 / 0.8 (solid), Drive roll 0.9 / 1.2
(cored) and manual. Product Number: K69074-1

**3 YEAR
LIMITED WARRANTY**

NEW PRODUCT

**Viking® 3250D FGS
Flip Front PAPR
Welding Helmet**

- > 4C® Lens technology
- > Perfect 1/1/1 optical clarity
- > 75mm x 108mm auto-darkening
- > Shade 5 side windows increases peripheral vision

- > Flame retardant head covering
- > Large integrated grinding shield
- > Anti-fog coating
- > 4 Axis headgear
- > Complies to AU/NZ standards

Key Features of the Powercraft® 200M 4-in-1 Multi Welder:

- > 200 amp power with 10 amp plug.
- > MIG, flux-cored, stick and pulse AC / DC TIG (including Lift TIG DC and High Frequency AC / DC TIG) with VRD for safety.
- > Easy to use LCD screen.
- > Includes EZYSET™ functionality – one dial synergic control for amps and volts.
- > TIG lift-arc welding and HF TIG capable.
- > Ideal for aluminium welding with the addition of a Lincoln spool gun*.



Find a Distributor Near You

Scan the code to the left or visit:
<https://lincolnelectricstorelocator.com.au/>



Like us on Facebook

Scan the code to the left or visit:
<https://www.facebook.com/LincolnElectricAustralia>

**LINCOLN
ELECTRIC**

*Optional accessories



MAGIC RADIO

PART 3

An autonomous sound machine that can be operated with an intuitive interface on the touchscreen and play music with a MIDI keyboard or controller

By Enrico Miglino

Photographs: Enrico Miglino

This third and final part of the Magic Radio project is slightly different from the vintage upcycling projects we have explored in the pages of *The Shed* until now. In fact, it is a brand-new application, as I mentioned in the second part of the project in Issue 93.

After the first experiments to find the best set-up to connect the upcycled radio to a Raspberry Pi, I moved on to the software side of the project.

As a reminder, the set-up scheme in the first illustration shows, all in a

row, the hardware components chosen to complete the project.

I am seeing the Magic Radio as a single project, for better understanding, but the

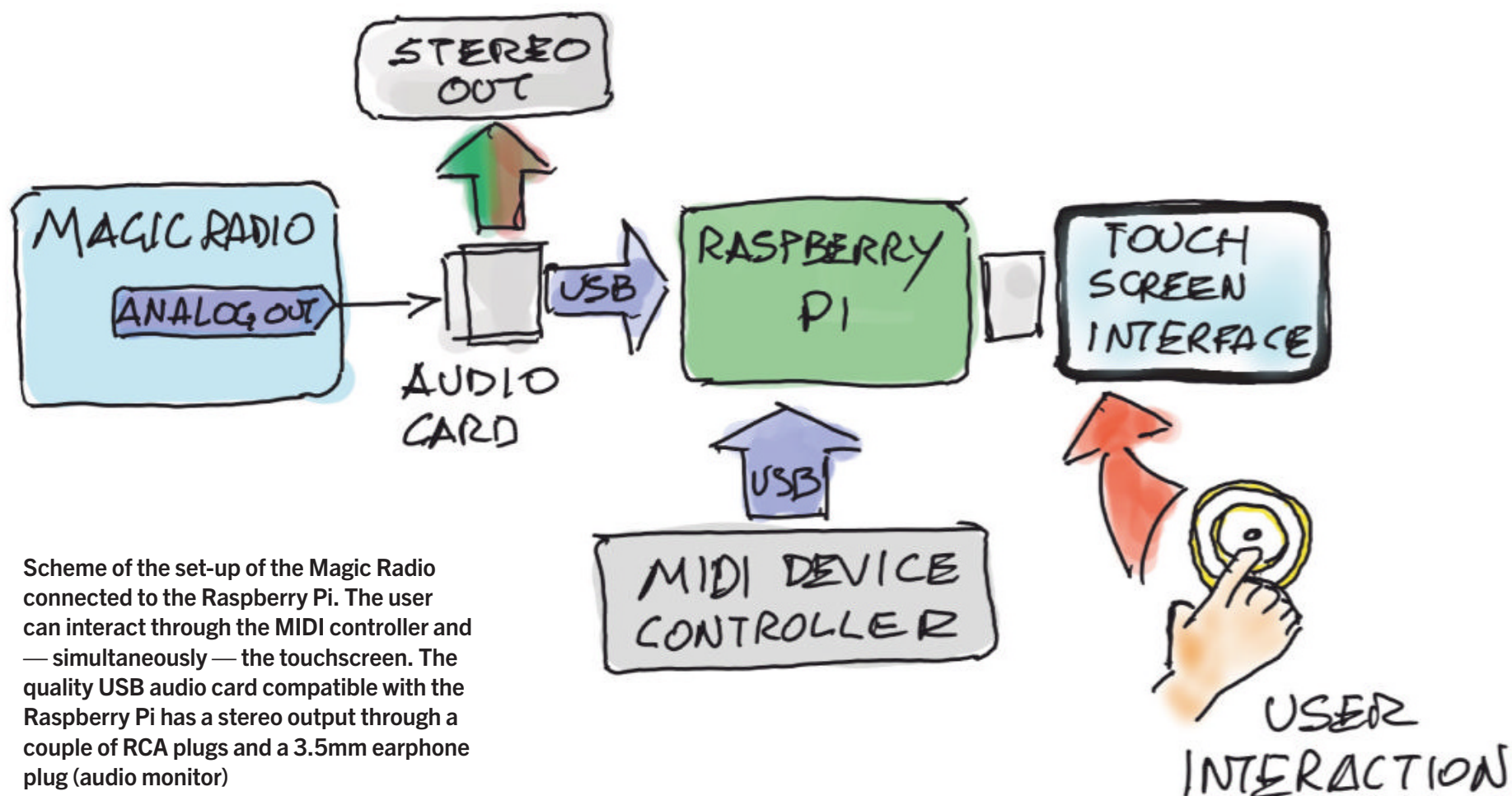
I aimed to make an autonomous sound machine that the user can operate with an intuitive interface

Raspberry Pi application can also be done as an independent one.

An intuitive interface

As already discussed in Issue 93, the Raspberry Pi can be easily used to make a sampling machine — it can run with any analogue audio source — using open-source Linux applications such as Audacity.

The idea behind this project is more complex: I aimed to make an autonomous sound machine that the user can operate with an intuitive interface on the touchscreen, as well as play music



Scheme of the set-up of the Magic Radio connected to the Raspberry Pi. The user can interact through the MIDI controller and — simultaneously — the touchscreen. The quality USB audio card compatible with the Raspberry Pi has a stereo output through a couple of RCA plugs and a 3.5mm earphone plug (audio monitor)

with a MIDI keyboard or any other MIDI controller device.

According to the hardware set-up just described, the challenging part of this project has been the development of the software and the interface design. Before a deep analysis of the software architecture, it is worth seeing how to connect the MIDI device; in my case, I used an M-Audio key station Mini 32, but any other kind of USB MIDI device will work as well.

Identifying with Linux

It is necessary to know how the Linux operating system recognises and identifies the MIDI device; after connecting the MIDI USB plug in one of the Raspberry Pi USB ports, from a terminal session type the command:

```
pi@RadioMagic:~ $ cat /proc/asound/cards
```

As shown below, the sound card —

mine, in this case — corresponds to device 2 and the MIDI keyboard to the device 1.

Write down this information as we will use them later to configure the application.

```
0 [ALSA      ]: bcm2835_alsa
                  - bcm2835 ALSA
                  bcm2835 ALSA
1 [K32       ]: USB-Audio -
                  Keystation Mini
                  32
                  Keystation Mini 32
                  Keystation Mini 32
                  at usb-3f980000.usb-
                  1.5, full speed
2 [Device    ]: USB-Audio -
                  USB Advanced
                  Audio Device
                  C-Media Electronics
                  Inc. USB Advanced
                  Audio Device at
                  usb-3f980000.usb-
                  1.3, full speed
```

The program — I wrote in Python

3 — is totally different from the test application I have used to play the samples [SamplerBox GitHub]. Instead, I have used the open-source Audio Engine component after applying some functional upgrades.

It is important to note that this component has been developed in C language and compiled with Cython, a Python set of libraries that can generate a compiled C class assembled as a Python library.

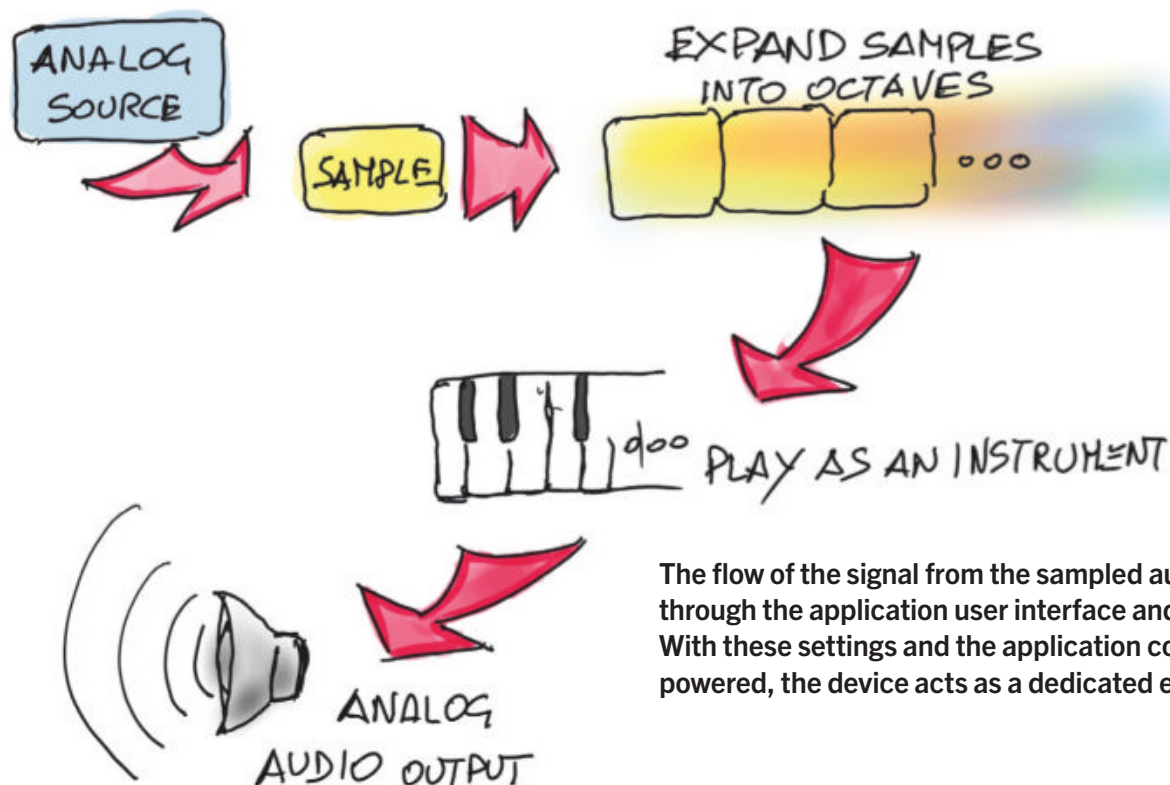
The program — I wrote in Python 3 — is totally different from the test application

How Cython works

The Cython tool has two roles: it optimises the Python code, and it integrates C classes as Python libraries. To enable this, it is necessary to install the component with the command:

```
$>pip3 install Cython
```

To be able to compile the C language as Python library, we need a configuration file. Both the already 'Cythonised' library



The flow of the signal from the sampled audio source to the analogue stereo output controlled through the application user interface and the MIDI device is fully controlled by the application. With these settings and the application configured to start automatically when the Raspberry Pi is powered, the device acts as a dedicated electronic musical instrument



The colour codes adopted for the User Interface buttons — every button changes its colour according to the action. For example, the empty notes buttons are yellow; when an audio sample has been assigned, the colour is light blue; when a note button is pressed, it becomes purple until it is not released.

The rightmost button of every row is the command to record an audio sample for the corresponding octave. Pressing the blue button makes the application ready to start sampling. As the user presses a note on the selected row (bank), the button becomes red and the sound is recorded until the button does not change colour to light blue

and the C sources, together with the configuration files, can be found on the Magic Radio GitHub repository. [GitHub].

More details on how Cython works, with an exhaustive guide and examples, can be found on the cython.org official site.

The User Interface

The user interface should meet a series of guidelines:

- Use only touch buttons; no mouse or settings are needed
- Adopt a simple colour coding
- Match the MIDI logic — notes, octaves, sound banks
- Be highly responsive
- Be parametric
- Be able to be represented on the seven-inch Raspberry Pi touch screen

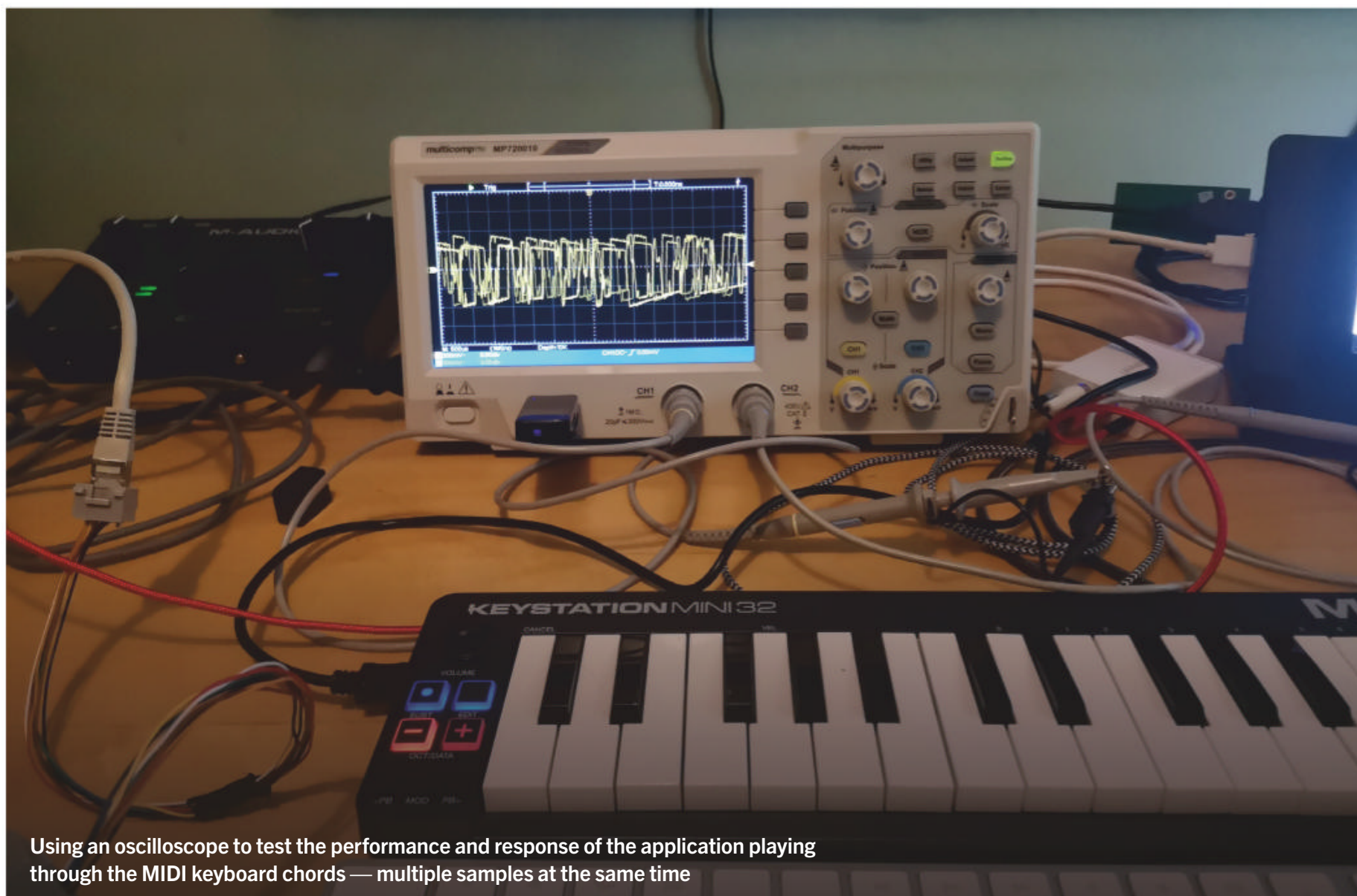
The requirements listed above have conditioned the behaviour and the graphic design of the application. The result has been a simple button grid that fills the entire screen. The grid is built with eight rows of twelve buttons each — from 'C' (bass note) to 'B' (acute note) plus an extra group of four buttons to the rightmost side of every row reserved for control commands.

The interface has been designed with Tkinter, a specialised Python library for designing highly reactive interfaces

The interface has been designed with Tkinter, a specialised Python library for designing highly reactive interfaces.

Tk is a graphical user interface toolkit that takes developing desktop applications to a higher level than conventional approaches. It is the standard GUI, not only for Tcl but for many other dynamic languages, and can produce rich, native applications that run unchanged across Windows, Mac OS X, Linux, and more.

Every touchscreen button has a different colour code depending on its current state and the function to which it



Using an oscilloscope to test the performance and response of the application playing through the MIDI keyboard chords — multiple samples at the same time



Panorama of the development set-up. From left to right: the magic radio, the MIDI keyboard, a dual-track oscilloscope, the Raspberry Pi, and a dual-frequency generator.

Using the frequency generator to produce a known wavelength audio sample, it is possible to test the delay (in milliseconds) of the system when playing the sampled frequency on one of the audio channels and the original frequency on the other

is dedicated. When the program starts, the interface is drawn parametrically on the screen, depending on the resolution. This makes it possible to run the application on different screen sizes and resolutions.

Get samples and play notes

If an audio sample is already loaded in correspondence with a note, the note is played when the user touches the corresponding button on the grid. If an entire octave includes fewer sounds associated with a single note, the sample's frequency is expanded or stretched accordingly to fill the whole octave.

Every note can contain a different audio sample, no matter what kind of sound it

is. When a MIDI device is connected to the Raspberry Pi, the application intercepts all the MIDI events from the device to play the corresponding note.

MIDI functions such as sustain and chords — multiple notes at the same time — are recognised and reproduced by the application.

Every note can contain a different audio sample, no matter what kind of sound it is

As discussed previously, it is possible to associate a different audio sample for every note up to a total of 96 samples: 8 ROWS x 12 NOTES = 96 SAMPLES (eight octaves). When a new sample is recorded on an existing note, the old sound file is automatically overwritten. The set of samples of one octave — whether or not

all the notes are filled with a sound — identifies as a bank.

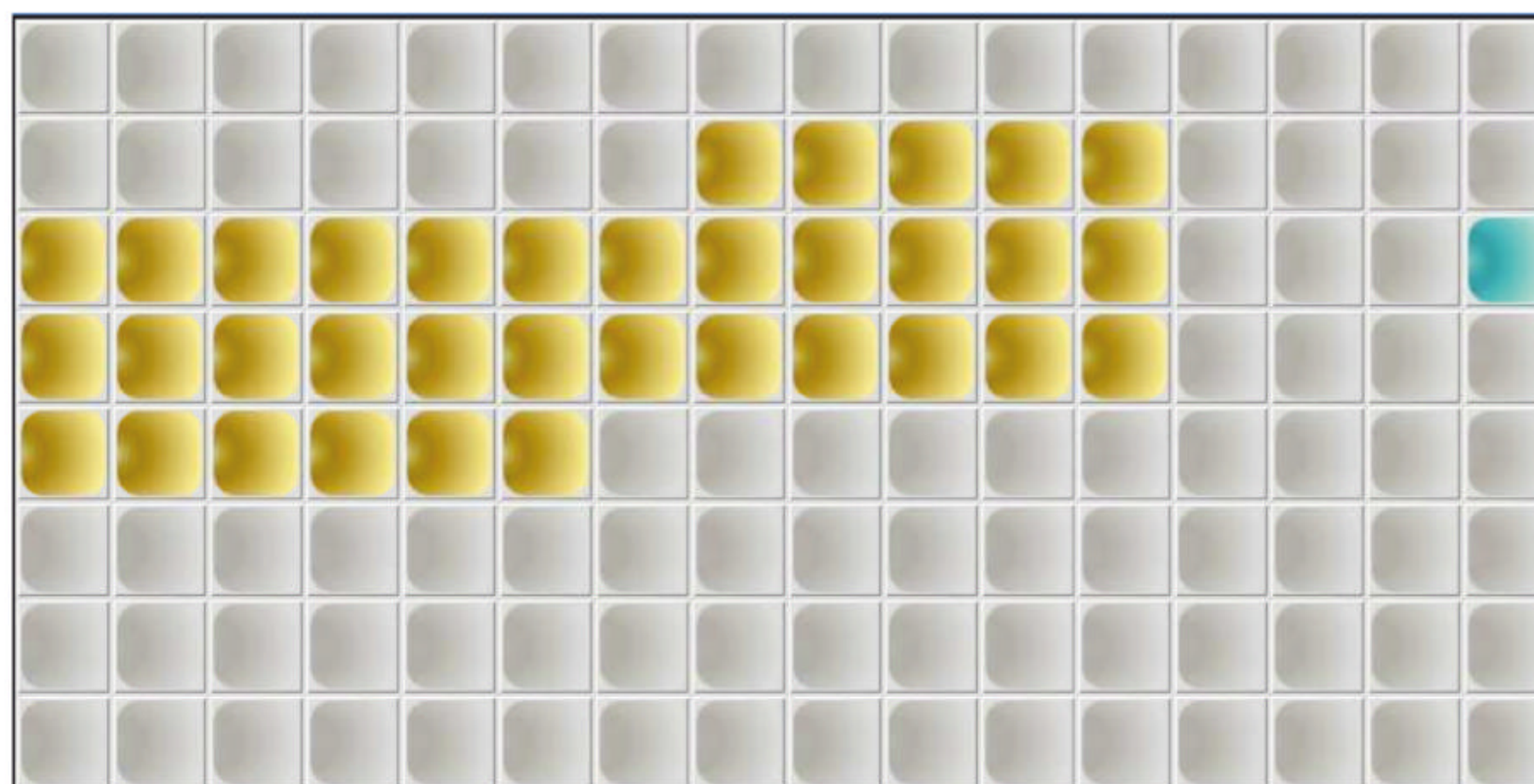
The whole set of notes available on the screen includes 8 banks, from 0 to 7. The sample file names — created by the application — in correspondence with the notes and other global parameters of the banks, are saved on Json-format configuration files.

The advantage of using the Json format is that the Json file can also be edited manually — for example, to change the 'volume' parameter affecting all the notes of the bank.

At any time, for any note of the eight octaves, it is possible to record a sound sample following this simple procedure:

The light-blue button in the rightmost column shows the currently selected bank. Press the left side blue button that changes to red.

- Press the desired note (column) in the selected octave (row) to start sampling
- When the sample ends the red button is back to blue 📄



A screenshot of the application interface as it appears on the Raspberry Pi touchscreen; the light-blue button on the third row (bank 3) indicates the selected bank ready for the acquisition of a new sample. The yellow buttons on banks 2, 3, 4, and 5 are the notes already containing a sample sound

THREE SUMMER PROJECTS

This month Murray learns you can't rest on your achievements — Murphy is always out there waiting

By Murray Grimwood

Photographs: Murray Grimwood

It doesn't pay to crow too loudly. No sooner had I sent off the previous article — smugly claiming great progress in resilience — when the micro-hydro went silent. Oh, it was there all right, just not turning around — which seemed to limit the juice coming up the line, which seemed to limit what went into the batteries. Then the Ohau fire sent some warning signals, especially to those of us who live in forests.

Also, we've been gaining increasing amounts of real estate from our upstream neighbour. Now don't get me wrong, we quite like soil; but, suspended in water, soil is mud. And mud fills tanks, clogs pipes, and abrades Pelton wheels.

Project No. 1

The Pelton wheel hadn't been taken apart for a decade. Not only did the lower

bearing turn out to be seized but the runner was frozen to the shaft and there was corrosion, rust, and accumulated dirt everywhere. Most impressive was the rust-swollen armature; maybe that is why it had started to sound like a Ford 10 running on three. This called for a ground-up rebuild using the copper-wound armature I'd been saving — Gentle-Annies are usually aluminium-wound — with a good cage and bearings. The resulting motor got several coats of protective paint.

The old runner was showing its 15 years of continuous abrasion, but was still good to go for a while yet. It took heat and force to remove; they're an impossible thing to get a puller onto. I should have applied the obvious fix then, but laziness came down on the side of stupidity and I didn't. I can't remember buying the original seals, but this time I trotted on down to Wilson Bros, asked for a couple of seals half an inch ID, with as big an OD as they had. Went home, pulled the old ones out, and found I must have made exactly the same request all those years ago. Mr Consistent, if nothing else!



There was corrosion, rust, and accumulated dirt everywhere.



More corrosion



Two tapped holes now allow pulling; much easier than this



A slinger made from an icecream lid



Coming together; plunger makes a great squirt-diverter



Ready for another decade of 24/7 service

Old faithful is back

With a slinger — cut from an ice cream tub lid — as a last-resort keeper of water from the motor, the stack got reassembled. Except that I drove the runner too far onto the shaft. Half an hour of attempted mental justification — squinting down the nozzle and trying to convince myself the bucket wasn't too far off centre — preceded doing what I should have done in the first place: drilled and tapped the runner either side of the boss, thus creating a permanently available puller by winding in a couple of 6mm bolts. Too easy.

With the bucket alignment sorted, I went a little further down the 'keep the motor dry' track. A section of six-inch plastic pipe extended the cast-aluminium housing downwards, and the rubber part of a plumber's plunger made a convenient spray deflector if the incoming pipe joints should decide to succumb to pressure. I finished the job off with something I've always been partial to: a shorter skirt. Apart from the fact that the bigger echo chamber has lowered the long-familiar note wafting up from the creek, old faithful is back in business.

Project No. 2

My second project was the mounting of a fire hose.

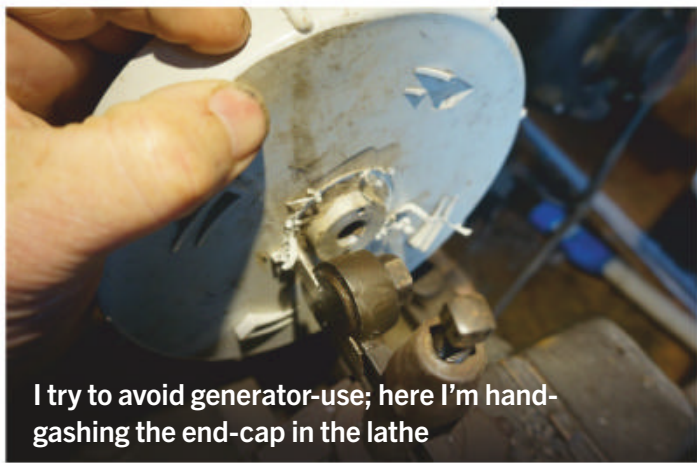
Surrounded by forest, we can't realistically expect to save the trees but the house and surrounds are worth the attempt. We have 70,000 litres of water in various tanks and it would be a pity if

it hadn't been emptied before the plastic melted.

Having acquired a reel, siting became a cross between tank proximity, main-feed proximity, and extended-hose radius. The optimal site turned out to be at the bottom of a low clay bank, sans infrastructure. ►



PVC tube as a roller, BMX handlebars as a guide and that bell will be handy one day



I try to avoid generator-use; here I'm hand-gashing the end-cap in the lathe



Ready to install

Fossicking around — remembering that a pile of junk is a resource library — I found a tanalised fence post with attached wheel rim that had done early duty as a garden-hose station. A few minutes on the hand-operated post-hole digger, a bit of clay ramming with the sledgehammer, and it stood unaided. Seemed a pity to lose the garden-hose facility, so the plumbing and tappery grew to suit.

We'd been suffering from low pressure in the lockdown glasshouse further along, so I took the opportunity to extend a one-inch feed away from the post, slung under a piece of alloy tube. As construction progressed, this tube got used to shield the water jointery from an unspooling hose, and it seemed silly not to slide a section of plastic tube over it as a roller; there's nothing like getting multiple uses from one component. The handlebars from a BMX — complete with bell, naturally — made a convenient hose guide and I gave the whole thing a 'roof' for a bit of UV protection. Job done.

A draining issue

The system works okay under gravity but it would take about 12 hours to empty, and I have yet to figure out how to transfer the pressure I'll undoubtedly be under to the water itself! So I have mounted a 1hp Onga impeller pump, which I will drive with our generator — no point in having yet another petrol motor, that would probably never be started until panic time, at which point the cord would undoubtedly part or somesuch.

This pump I will use to empty the lowest tank, while letting the higher ones drain into it. Rough calculations suggest five hours of flow, not counting any natural tank filling, but I suspect we'd also have every tap on the place open at that point. All hands to the pumps, so to speak.

Project No. 3

The recent increase in mud from upstream has been overwhelming our

little Arkal, the Israeli-designed filter that is a stack of grooved, washable, replaceable plastic washers. We needed a bigger, cruder pre-filter; a vertical column through which the water moves slowly enough that fines drop out — the way traffic fines should.

A piece of pre-used 150mm pipe — I suspect it of doing prior service as a spa pool filter — seemed a good starting point. Hung vertically it had good separation potential. With a baffle glued a bit below the top and a threaded 100mm cap glued to the baffle, I had the ability to screw in a coarse-filter cartridge made of 100mm waste pipe. I gave the cartridge a handle and wrapped it in fine wire mesh, clipped on with slices of the same pipe — the way old-time cyclists clipped their trouser legs.

A low-down inlet, a high-up outlet, a 150mm screw-on bottom cap — for long-term cleaning and cartridge access — and a quickly removable smaller cap for regular emptying, finished that little item off.

I must have a word with the chief list maker, though. The list's just as long as when I started. 📋

“The water moves slowly enough that the fines drop out — the way traffic fines should”



Filter mesh is clipped on with slices of PVC pipe. Note thread at the top, which locates the cartridge in the upper baffle



Hung in place on the side of the tank, input lower left, output upper right and the faithful Arkal in less danger of clogging

TRUST ON RUST!

KBS RUST PREPARATION, ERADICATION & COATING PRODUCTS



Use the **KBS COATINGS 3-STEP SYSTEM**

1. **AquaKlean**
(an industrial strength water-based cleaner/degreaser)
2. **RustBlast**
(a powerful rust remover/metal etch)
3. **RustSeal**
(a rust preventive coating)

to provide the most effective rust and corrosion prevention system available today.

Visit www.kbs-coatings.co.nz or call 09 273 3600 now!

Reseller enquiries also welcome.



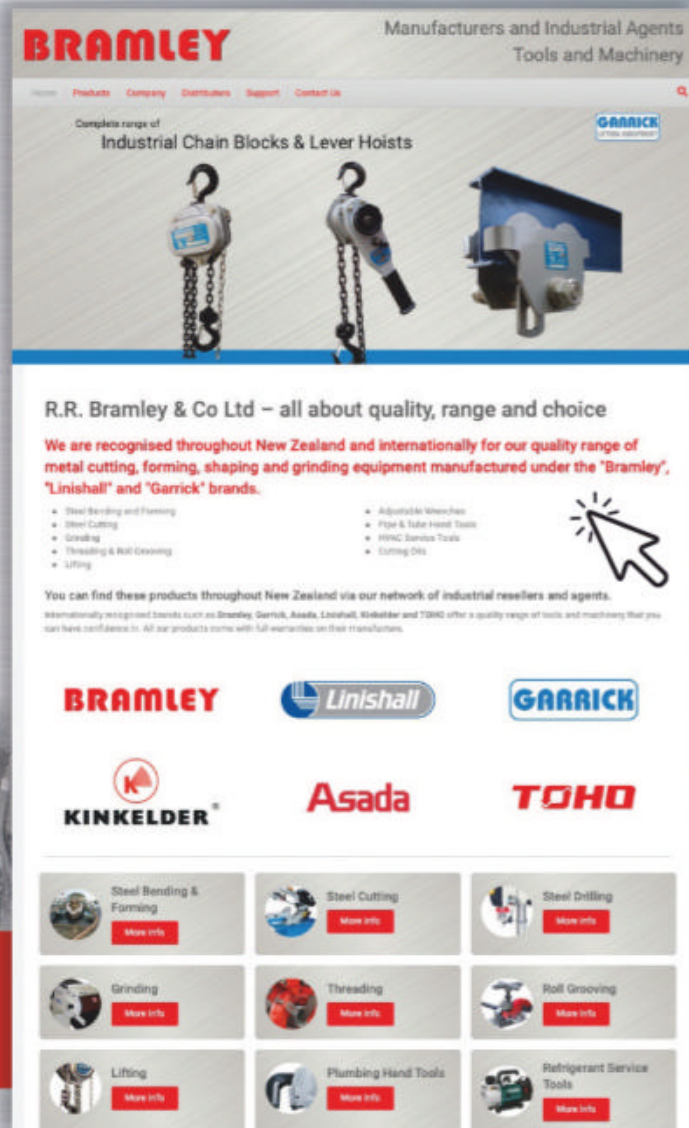
Looking for quality machine tools

...for your bending, cutting, drilling, grinding, threading, plumbing or lifting jobs?

Bramley have been locally manufacturing, and importing, the machinery that supports New Zealand tradesmen... for over 90 years!



Visit us at bramley.co.nz to view our product range, and to find your nearest distributor



BRAMLEY

(09) 579 2036 | sales@bramley.co.nz



Steel Bending & Forming • Steel Cutting • Steel Drilling • Grinding • Threading • Roll Grooving • Lifting • Hand Tools



Peter Omer, committee president, in the Radio Room

REMEMBER WHEN

This museum is a wonderland of where you just might spy a treasure no one realised was there

*By Jason Burgess
Photographs: Jason Burgess*

This sprawling diamond in the rough of a museum captures the imagination and holds more treasure than Ali Baba's cave



Anyone driving up through the gates of the East Coast Museum of Technology (ECMoT) could be forgiven for thinking that they had entered a movie lot. Turn of the century railway buildings and crumbling rolling stock look like props for a classic western showdown.

The main brick building — the former Kia Ora Dairy Factory — with vintage cargo lorries pulled up at the loading dock, could be the setting for a Mafia heist or perhaps some story of clandestine revolutionaries. The historic sledge house homestead and neighbouring enclave of buildings are reminiscent of a colonial street in a rural town with no name. Eclectic yes, and at times haphazard, this sprawling diamond in the rough of a museum captures the imagination and holds more treasure than Ali Baba's cave.

It's all here

Set on a 14-acre park on the western fringes of Tairāwhiti Gisborne, the ECMoT is overstocked with every kind of nostalgia-inducing reminder of yesteryear imaginable.

One can go from World War I cannons to Atari games in about 100 paces; and from ancient letterpress printing presses to a wall of household clothes irons and a primitive iron lung in the same building.

“Our museum is different,” explains the ECMoT's president, Peter Omer. “We don't have exhibitions, we have collections.” ►



Te Hapara church and steam engine

Do not expect neat display cases, housing out-of-reach items with carefully typed explanations. This is a fully immersive experience; careful interaction is welcome — and in some of the tighter passages, virtually mandatory.

“The museum represents 40 years of collecting,” says Peter. “The guys who preceded me have done a wonderful job in saving stuff but not such a great job of preserving and displaying it.”

Even the ECMoT volunteers admit that they still come across things they have never seen before.

A good move

The museum had its beginnings in 1969 when a group of transport and technology enthusiasts got together to mount a display of historical items from the East Coast, for the Cook bicentennial celebrations that year. From there they formed an incorporated, not-for-profit society and museum. The museum was originally housed in a barn close to town before later shifting out to the A&P Showgrounds, where another shed was added. In 1988, the society purchased the ECMoT’s present site — the



Domestic Bliss sitting room

Loading bay of the old Kia Ora Dairy Factory building





“We have some really important stuff here. It tells the story of how society has developed on the coast”



Steam engine in the Makaraka railway marshalling yards



Two-storey-tall 1919 Mirrlees three-cylinder marine diesel engine

former Kia Ora Dairy Factory premises at Makaraka. An added bonus was that the grounds also contained the old Makaraka railway marshalling yards. When the ECMoT moved in, the original barns came with them.

Tracing technological progress

The ECMoT continues in the vein of its founders, more or less tracing the technological progress through the Tūranga-nui-a-Kiwa / Poverty Bay and East Cape regions.

“From the axe and spade to the tractor and the plough,” says Peter, “we have some really important stuff here. It tells the story of how society has developed on the coast.”

The collections are often blurred by whatever else resides alongside them but

they can best be defined as: fire appliances and emergency vehicles, a quasi-military industrial complex, an agricultural and domestic vehicle shed, and an area known as ‘Domestic Bliss’. There is a stand-alone ‘IT Central’ with its adjacent radio shack — home of the Gisborne branch of the New Zealand Association of Radio Transmitters (NZART) — various outdoor agricultural displays, and random assemblages of industrial vehicles door deep in long grass.

History aplenty

Then there is the cluster of historic buildings. Among the notables are the historic and immense Kia Ora Dairy Factory, a centrepiece for all facets of Gisborne life.

On the fence line is the tiny, ominous, and impenetrable Ruatoria jailhouse ►



A 1928 White delivery truck that saw service in Te Araroa until 1955, in the Truck Barn



Rescued tractors awaiting a makeover

Originally, this behemoth of engineering was used to generate electricity for Gisborne's Edison trams

— infamous for an incident in the 1980s when some of the region's Rastas wound up there and received a heavy-handed drubbing from the local constabulary. The old Matawhero Railway Station, Makaraka railway goods shed, and Kings Road Railway Station feature along the museum's marshalling yards. One long-term proposal is to reconnect this rail line with Gisborne city centre, using the existing — but at present untracked — nine-kilometre section of trail that still marks the old route.

A behemoth of engineering

A current work in progress in the boiler house of the Kia Ora building is the restoration of a 1919 Mirrlees three-cylinder marine diesel generator. Originally, this behemoth of engineering was used to generate electricity for Gisborne's Edison trams and then to run the town's street lights. The local power board next commandeered it to lower the region's peak load.

"They once used half a dozen of these," says Peter. "We've had a couple of marine



A look into the machinations of the East Coast's Fourth Estate with various printing presses and parts from *The Gisborne Herald*



Vintage motorcycle line-up including a Mountain Goat, a Sachs, various mopeds and scooters

engineers working on this one; we hope to get it running again soon.”

In the same building is an old ammonia compressor from the Gisborne freezing works. Peter remembers it from his days working as a technician for the New Zealand Broadcasting Service.

“When this thing was working, the compression stroke drew so much current, it dropped the mains voltage in town. I saw the voltmeter on the rack panel of the local radio station falling wildly. TV pictures in the area used to pulse with voltage fluctuations,” he says.

A mountain of radios

As well as holding the reins at the museum, Peter is also president of the local NZART Radio Club. In the club’s wing of the IT Central building, a dazzling display of early electromagnetic tech is bookended by two floor-to-ceiling walls of domestic radios and vacuum tubes. It is one of the few areas with much in the way of descriptors. One suggests that a 1956 radio retailed for

28 guineas at the time — equivalent to more than \$1449 today!

Peter’s enthusiasm here is palpable as he outlines the history and uses of the various antiquated oscillators, TV signal pattern generators, resistance capacitors, and vacuum checkers.

“I remember when I first started in ‘ham radio’, people would be in awe when you told them you had talked to someone in Brazil or Russia. Nowadays, we all carry this technology in our pockets,” he says.

The radio room also features a collection of Morse code keys and sounders, some from the late 1800s. Peter suggests that, despite all the bells and whistles of our digital present, Morse code is still among the most reliable forms of transmission: “It will get through when atmospheric conditions can prevent voice messaging from being heard.”

Peter’s personal mission is to set up a private radio station in the museum using some of the museum’s technology, circa 1940s. ►



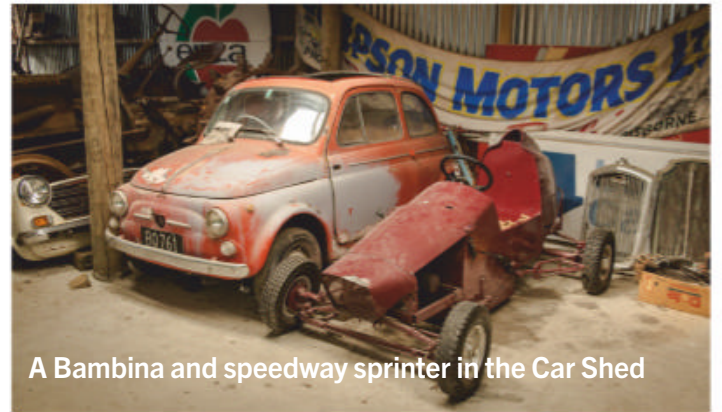
Lawn mowers in the Kia Ora Diary building



A Chevrolet C60 army truck in the Military Barn



Line-up of Commodore 64s in the Computer Room. The '64' signified the impressive 64KB of RAM



A Bambina and speedway sprinter in the Car Shed

The museum is
a reminder of
just how fast
technology moves
and how quickly
knowledge and
history are lost

Space, the final frontier

As ECMoT president, Peter declares, "All our volunteers are passionate about their areas of interest. We all want to see the museum succeed, as there is too much at stake."

One of the most difficult tasks ahead for them is culling.

"We are desperate for space, which sounds funny when you have got 14 acres, but we need to edit to show off the really good stuff. Naturally, there is some resistance to that but reality will dictate," he says.

With the right vision and funding, the ECMoT presents a host of economic

possibilities and visitor opportunities for Gisborne. For the rest of us, the museum is a reminder of just how fast technology moves and how quickly knowledge and history are lost.

While many of the time-worn artefacts are beginning to look barely salvageable, this adds a sense of wonder to the place. It is like stumbling into once-thriving workshops where mechanics and builders went home one night and never returned. The randomness of the ECMoT's eye-popping, full-to-the-gunwales sheds makes a visit here feel like a true journey of discovery. 📦

Stockpile of farmyard technology



Contact



**East Coast
Museum of
Technology**

67 Main Road,
Makaraka, 4010,
Gisborne,
New Zealand

ecmot.org.nz/

Tungsten Carbide Blade
Paint Scrapers

for every
tough
scrape
you're in



50mm
General



14mm
Corner



6/10mm
Radius

0800 LINBIDE
5 4 6 2 4 3

linbide.com

LINBIDE

Did you know you can
**CONVERT
YOUR BIKE
TO AN
E-BIKE?**

DIY kits and
installation available.

Go online or call to
find out more.



[www.e-bike
conversions.co.nz](http://www.e-bikeconversions.co.nz)

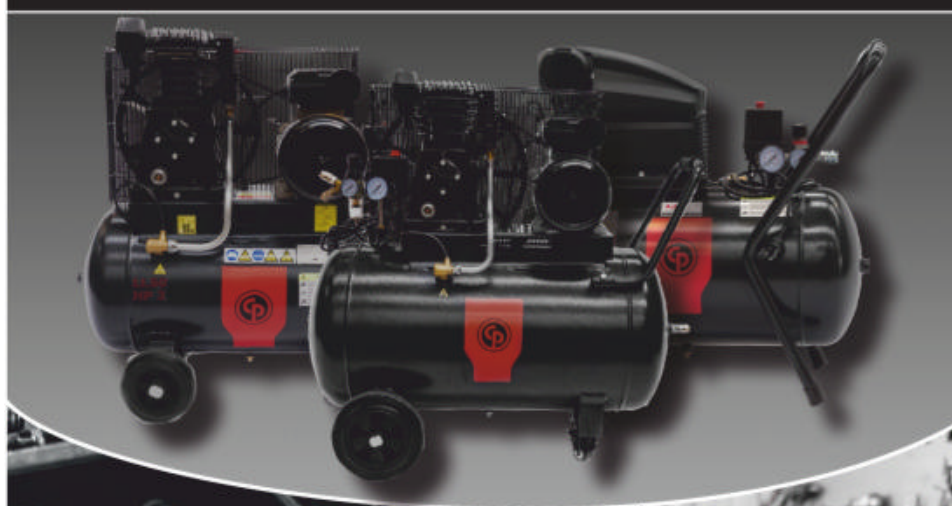
JASON

027 324 0963

info@e-bikeconversions.co.nz

The perfect solution for your
home and professional workshop!

View the range at www.nzsaftyblackwoods.co.nz



People.
Passion.
Performance.

 **Chicago
Pneumatic**

 **eziswap gas**
Industrial Gases

**Don't pay cylinder
rental fees again...
ever!**

Join our nationwide
industrial gas swap
system by purchasing
an Eziswap Gas
cylinder and stop
paying cylinder
rental fees.

0800 394 7927

eziswapgas.co.nz



100% New Zealand owned and operated







ADVENTURES IN 3D PRINTER LAND

A sheddie learns that creating masterpieces with your very own 3D printer is no longer the stuff of fantasy, and this space-age technology is available to (almost) Everyman

By Hugh McCarroll

Photographs: Hugh McCarroll

This is an account of my personal experience with one 3D printer over one year. My observations are specific to my machine, but they generally apply to other 3D printers. I've used the printer a lot during the year. It is marvellous to be able to have an idea, draw it up, and print it within a few hours — two or three iterations and a useful end result. Some items are very small, such as a spacer to move a hinge a fraction, a new band for my watch strap, or fixing the handle on a portable radio.

I have wanted a 3D printer for ages,

but was deterred by the price. Back then it was \$1000 to \$2000 for a basic machine. I was very tempted by a kit featured in *The Shed* a few years ago, and also by a small printer that was just over \$1000. But I held off and held off.

I used printing services for a couple of projects, and for a while convinced myself I didn't need a printer of my own. But the delay between uploading a design and receiving the printed parts made that less than satisfactory when I'm developing an idea. Rapid prototyping it isn't. ►

“I used printing services for a couple of projects, and for a while convinced myself I didn't need a printer of my own”



Original configuration showing the space between the control panel and the Y axis pulley and idler wheel — note the cable clips holding the ribbon cable neatly



The tools that come with the printer need be kept with the printer



The tray I downloaded and printed, and then modified to fit; it didn't slide out very far and is too small for the clippers — note; a test section for the new tray is being printed

The time eventually arrived

In August 2019 I was browsing the internet and came across a review of a new entry-level machine, the Creality Ender 3. It was a big hit in the USA at US\$200. Wow! It had a lot of good reviews and offered a big 230mm x 230mm x 210mm build volume. You can make a lot of stuff within those limits. The printer can be obtained here for about \$340. I succumbed and ordered one. It arrived several weeks later, all neatly packaged and ready to assemble. Assembly was pretty straightforward. The machine consists of a frame of 20x20mm, 20x40mm, and 40x40mm aluminium extrusions which have tracks for captive nuts on all sides, all pre-drilled and ready to assemble. The printer was up and running in less than an hour.

All the software comes on a micro SIM card in a USB adapter. The SIM contained 'the slicer' — the slicing software — the manual, and a number of ready to print samples.

I found a lot of sites on the internet, with reviews, tutorials on how to assemble the machine, suggested modifications, and how to fix printing problems. Looking at these sites, it was clear there can be problems. I'm sure some people must buy a 3D printer, print a few of the sample pieces, and then either lose interest or are put off by printing problems.

I found some most useful information on the "Tomb of 3D Printed Horrors" on YouTube. The very name tells you a lot. The presenter Tom Tullis sounds Canadian. He has a very agreeable manner and, like all good teachers, explains very technical material in an easy to follow way. He explains problems like bed levelling, under-extrusion, adhesion, and stringing, and how to fix them. The list of things that can go wrong is long. ►

Be careful with designs you download

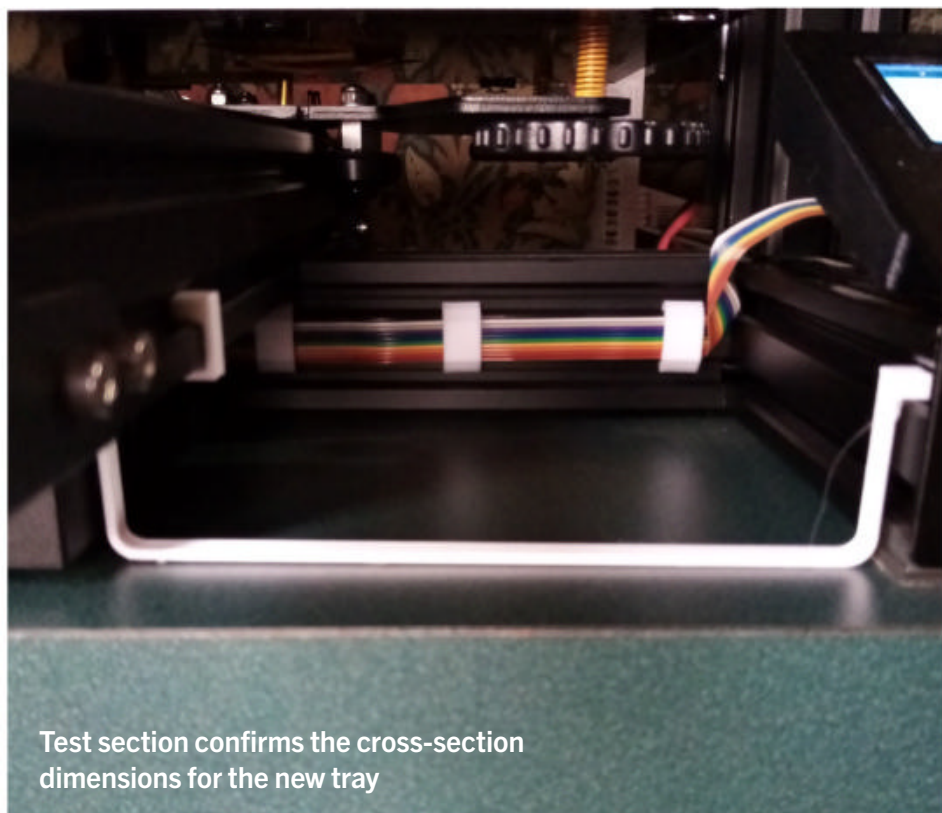
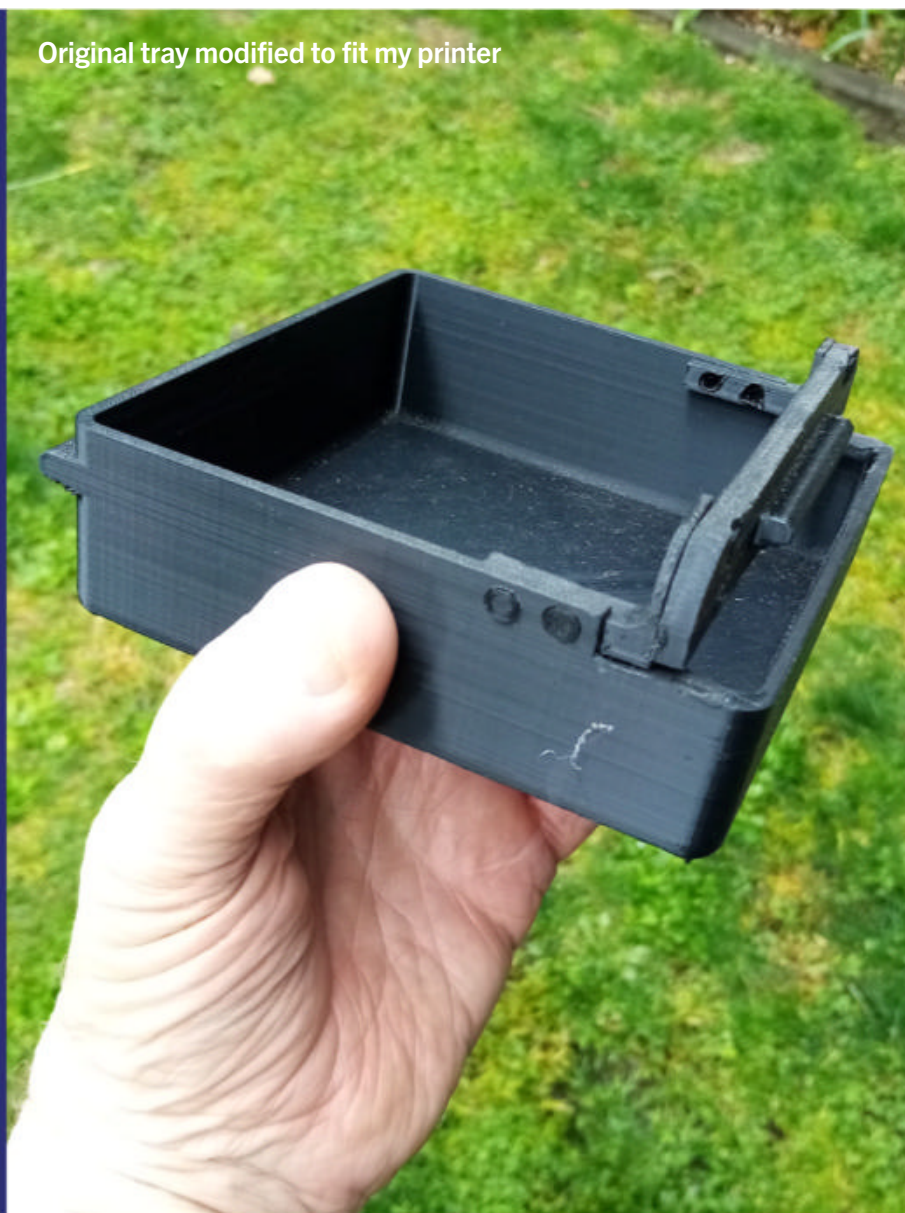
Tool tray

One of the recommended mods is a tool tray. The printer comes with two small spanners, four hex keys, a 0.4mm wire, a screwdriver, a spatula, and a pair of clippers. These need to be kept with the machine, so a tool tray is a very useful modification. I downloaded a tray design from the internet and printed it, but the slides on each side were too close together. I was able to modify the tray so that it did fit, but was not that happy with the tray design. It is slightly too small to fit the clippers and didn't slide as far out as it could have. I decided to make a new tray of my own design, to optimise the available space, slide out fully, and be big enough to hold the clippers.

Because larger prints take many hours to print, it's really annoying to complete such a print only to find that something is wrong. I have adopted a practice of printing test pieces to check before I commit to a big print. In this case, I made a thin section through the tray that included both sides, bottom, and the slides that run in the frame recesses. I had made a mistake in my CAD design: one slide was 15mm out of place. I made an adjustment to the test piece design and printed another sample. This time it was perfect, as was the final print. I recommend this practice.

The new tool tray took 9 hours and 41 minutes to print and used 75gm of filament. I started printing it late afternoon and it was waiting for me in the morning. Everything fits in and being white makes it easy to see the tray's contents.

Original tray modified to fit my printer



Test section confirms the cross-section dimensions for the new tray



Finished tray fresh off the printer with support structures still in place; these can be cut off with a sharp knife. Support structures can be switched on and off by ticking or unticking a box in the print settings of the slicer

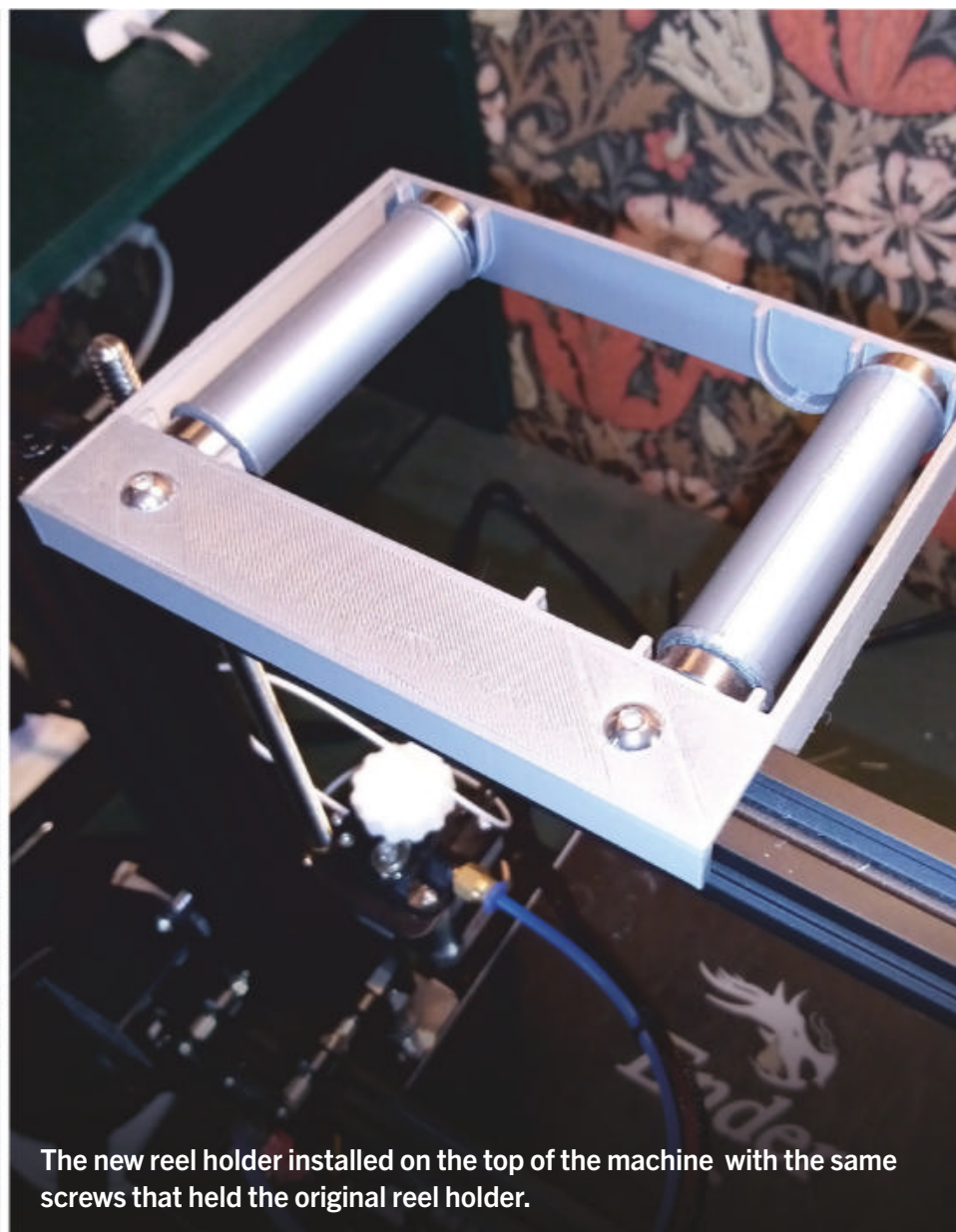


The new tool tray in place — everything fits in and is easy to see, and the tray slides out to the end of the Y rail





An easy mod is a cover for the PC board behind the control panel



The new reel holder installed on the top of the machine with the same screws that held the original reel holder.

How it works

Fused deposition modelling (FDM) printers like the Ender 3 have four stepper motors, one each for the X, Y, and Z axes and one for the filament feed. A 3D printer is basically a smart hot-melt glue gun.

Slicing software is the heart and soul of 3D printing. It converts a drawing file into G-code, which the printer uses. G-code is a sequence of instructions directing the stepper motors so a bead of the right amount of filament is placed in the right place, one layer at a time.

Because it's an entry-level machine, the Ender 3 lacks a number of refinements that are nice to have. There is a long list of modifications suggested by other users. The ribbon cables connecting the computer to the four stepper motors all hang loose and

should be clipped to the frame. There are several clip designs available. The control panel PC board is exposed, and there is a back cover you can print and fit over it. Also suggested is a tray for the tools that come with the machine.

I inserted that in the printer and pressed go. Seven minutes later I had my first print: a small 10mm x 12mm clip that holds the ribbon cable against the frame.

Piece of cake I thought, and printed six more before I used up the short length of filament that came with the machine. These

quickly brought order to the ribbon cables on the machine.

I then put a reel of black PLA on the support post and printed a storage tray, which fits in a gap at the front of the machine. It's about 120mm x 120mm x 40mm and took about eight hours to print. The tray was described as fitting my model printer, but it didn't; the support sliders were not in the right place. Bugger.

Fortunately, I was able to modify the tray so I could fit it in my machine, but it was my first cautionary tale. Be careful with designs you download.

I later made a new tray of my own design; it fits perfectly, maximises the use of the available space, and slides out a lot further (see panel). ►

“Because it’s an entry-level machine, the Ender 3 lacks a number of refinements that are nice to have. There is a long list of modifications suggested by other users”

My first projects

I didn't want to print any of the included sample models — a monkey pattern cup, a Klein bottle, a vase, a recorder, and a couple of mazes.

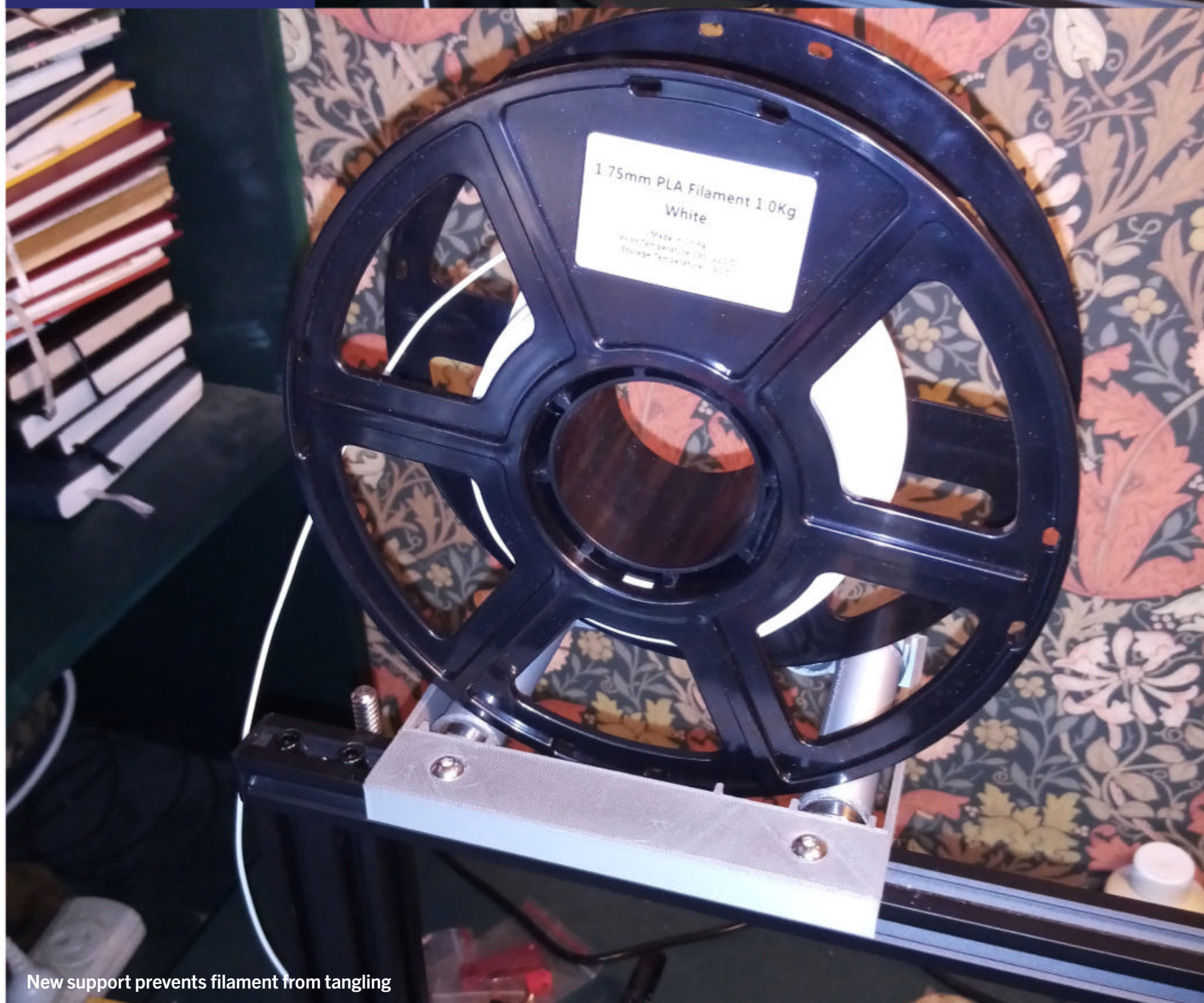
I downloaded a drawing file for a cable clip, loaded it into the slicer, and saved the resulting G-code onto the micro SIM.

Filament feeder post

The Ender 3 comes with a post that supports the reel of filament in use. It is mounted on a metal bracket that screws to the top of the machine. It's adequate for the job, but sometimes the filament gets loose and loops off the side of the reel. This can cause the filament to tangle and jam. I decided to make a new reel holder, where the reel edges sit on two rollers, rather than a post going through the middle. This stops the filament from getting loose. I used four ball races and printed cylinders to make two rollers. These sit in a rectangular frame that screws to the top rail of the printer. It prevents the filament tangling and rotates smoothly.



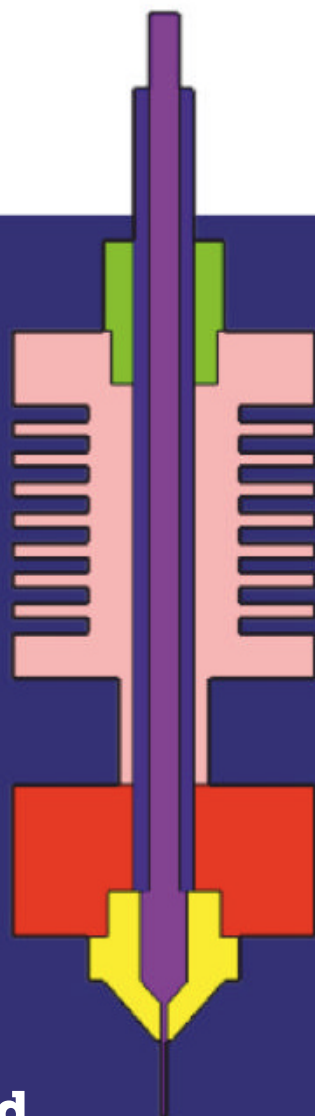
Original reel support post; filament can come off the reel and tangle, causing a jam



New support prevents filament from tangling

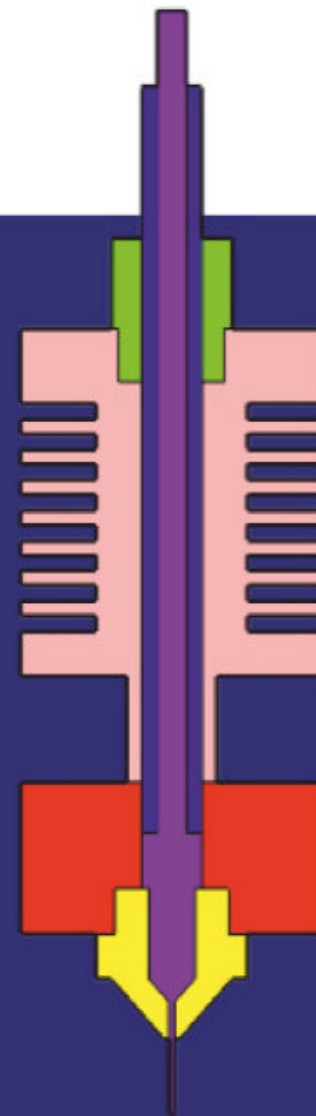
Hot end set up correctly

Filament (purple) goes through the Bowden tube (blue) which is held in place by the coupler (green). The nozzle (yellow) screws into the hot block (red) and butts tightly against the Bowden tube. A thin-walled steel tube joins the hot block to the heat sink (pink).



Incorrect installation

The Bowden tube does not touch the nozzle, and melted filament can ooze back up the outside of the Bowden tube. The hydraulic pressure closes the bore of the Bowden tube and makes it hard for the stepper to force filament through.



Fixing the hot end

Temperature control is critical for FDM. The filament needs to remain below the ‘glass transition temperature’ (about 65°C for PLA) in the Bowden tube until very near the nozzle, where it is heated to the temperature specified in the G-code (about 200°C–240°C) to extrude properly. Between the glass transition temperature and the melting temperature (about 180°C) the PLA is plastic and malleable.

I experienced under-extrusion a couple of months into using my new printer. There are several things that can cause it and it’s a serious problem affecting the integrity and appearance of the finished print.

The symptoms were the extruder stepper motor clicking as it slipped, unable to push the filament into the Bowden tube. The filament is gripped between a toothed drive wheel on the stepper motor shaft and an idler wheel so the stepper can move the filament forward and back as the printing proceeds. The slicer knows the filament and nozzle diameters — 1.75mm and 0.4mm for the Ender 3 — and the stepper is instructed to provide just the right volume of filament to the hot end to match the immediate requirements of the print.

The filament stepper is mounted at the left-hand end of the X axis rail, and connects to the travelling hot end by a 250mm-long Bowden tube. At the hot end, the Bowden tube abuts the top of the nozzle. The tube is held in place by two couplers that screw into the fittings at each end and grip the outside of the tube.

SUPERIOR COUPLERS

These couplers are tricky little devices in their own right. One of the recommended mods is to replace the original (cheap) couplers with superior couplers. They have a clamping ring inside that tightly grips the Bowden tube, and a flange needs to be depressed to release the clamping ring grip.

The hot end consists of a 20mm x 20mm x 10mm block of brass with a 6mm-diameter by 20mm-long heater cartridge secured in hole through the block, and a thermistor to monitor the temperature. The computer sets and controls the temperature as instructed by the G-code.

There is a gap of about 10mm between the hot block and the

heat sink above. They are connected by a thin-wall metal tube, with the PTFE Bowden tube inside that, abutting the top of the nozzle, which screws into the block from below.

Surrounding the heat sink is a shroud and two small fans, which blow air over the fins of the heat sink to assist cooling. There’s a lot happening in that small 40mm cube.

I suspected nozzle blockage and replaced the nozzle but the problem persisted. I tried clearing the blockage with the 0.4mm-diameter wire supplied with the printer, and that fixed the problem temporarily. I consulted the internet, watched a lot of YouTube videos, and learnt of the sensitivity to getting the end of the Bowden tube flush against the top of the nozzle.

THE PROCESS

The recommended procedure is first to clear the hot block of any filament that may have got into a gap between the Bowden tube and the nozzle. This requires removal of the shroud, nozzle, and Bowden tube while the machine is switched off, then heating the hot block to about 110°C, and passing a short length of Bowden tube through from top to bottom. Any filament in the hot end will be in a plastic state, and will emerge on the leading end of the Bowden tube, which is then wiped clean. This procedure is repeated till the Bowden tube slides smoothly through and emerges clean.

A new nozzle is screwed into the block tightly and then loosened about three-quarters of a turn. The Bowden tube is reinserted through the top of the heat sink until it butts against the nozzle. The coupler flange is then released to lock the Bowden tube in place.

The hot end is then heated to 200°C–240°C and when it is up to temperature the nozzle is retightened. This requires care, and it’s very easy to burn your fingers. The shroud and fans are then reattached and filament is fed through to check. It should emerge as a straight and smooth thread. If it curls and twists, you still have a problem.

I followed this procedure and haven’t had a hot end problem since — touch wood!



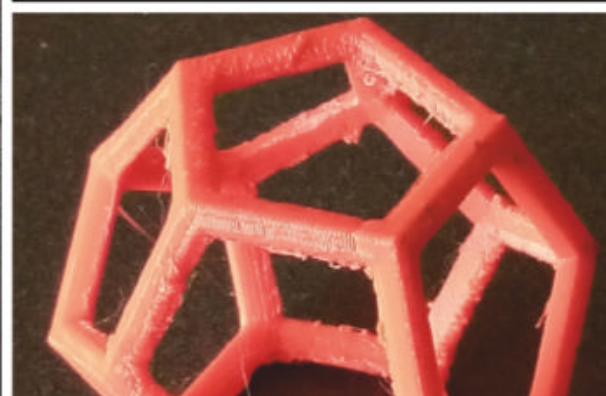
Fixing a watch strap



Replacing a broken handle on a portable radio — we've had these radios for years; the front one fell and broke the carry handle. A quick design and print and a short length of aluminium tube and it's good as new



An example of stringing — not serious for this motor mount, and can be cleaned off with a knife and a file, but it is no good if a top finish is needed and access space is restricted as in the dodecahedron below



Problems

The first real problem I encountered was under-extrusion, where the extruder doesn't feed the right amount of filament and the resulting print is ruined, or has a fault line through one or more layers, leaving gaps or a fatally weakened print.

This problem showed up when I was printing a new filament support frame. The extruder stepper would start clicking as it slipped, trying to feed the filament into the Bowden tube to the hot end. I suspected the nozzle was blocked.

I eventually sorted the problem and I learned a lot. In this case it was a hot end problem (see panel). Cautionary lesson No. 2: serious 3D printing requires commitment and patience.

Most problems seem to be due to lack of understanding of all the factors that can affect the final result. Along with getting the print settings right, you have to be careful when disturbing the hardware. You also need to buy a supply of spare nozzles, Bowden tube, and other recommended spares for when you do have a problem.

The slicer has a lot of variables and they all need to be specified; wall thicknesses, infill density, infill patterns, material, speeds, travel, cooling, support, adhesion, and mesh fixes. These are just the headings; each has a list of variables under it. There must be over a hundred of them.

Know your filaments

Every print requires all these variables to be defined. Normally they are set

at default values, but, when there is a problem, changing these settings can fix the problem, or make it worse.

One problem I encountered with a new reel of black filament was that it did not adhere to the build surface, so midway through a print it broke away and the print was ruined. I tried changing the temperature but that didn't work. Neither did applying masking tape to the build surface. I found, after about a week trying to sort the problem, that the filament reel was ABS, not PLA as I thought when I bought it — my mistake. I have read that ABS is trickier to use than PLA, so I have parked that reel and will have another go with ABS when I have more experience.

Stringing is another problem that may occur. It results in messy strings of material when the nozzle jumps a gap. As the nozzle nears a point where it should stop extruding while it moves to a new point and starts extruding again, a thin wisp of material connects the two points. It affects the finished appearance of the print.

The filament stepper should pull the filament back a few millimetres to stop this happening and then start extruding again at the new point. These settings are all adjustable, and it's impressive how internet nerds have worked out how to tune these settings to reduce and eliminate stringing.

One print I made didn't print properly. After a lot of checking, I discovered my CAD model had hidden internal surfaces that confused the slicer. You have to

really check out your CAD model to avoid hidden faces, extraneous lines, and discontinuous surfaces. A line that is actually two lines joined end to end can also confuse the slicer.

A curly one

One very odd problem I had was the slicer ignoring gaps in the item I was printing. For example, a part with a hole through it might be printed without the hole. I found other people had also had the problem and there were several chat rooms with advice — some useful, some not.

After reading a number of these exchanges, I decided to change slicers. The general view was that the slicer that came with the printer was not as good as the Cura slicer — from which it is derived. Cura is free to download and was an improvement, but I still had problems.

I read that some of the 'Expert' features in Cura — there to fix problems with grids that don't quite connect — actually remove the gaps, thinking they are mistakes. So much for machine intelligence! Simply unticking this feature fixed the problem.

Don't be put off by the problems, though. While it can be like going down a rabbit hole when you get into a problem, it's also very satisfying to end up fixing a problem and gaining a greater understanding of this new technology.

A 3D printer is a powerful tool for making useful stuff and can produce beautiful results that cannot be achieved any other way. My 3D printer is now an essential part of my workshop. 🖨️



NORDIC YEAST LOVES THE HEAT

Traditional brewers in one of the colder parts of the world have found the secret to brewing in warm temperatures

By Bryan Livingston

Photographs: Robyn Livingston

Summer is one of the hardest times of the year to brew a good beer. While the weather is great for holidays and camping, the summer heat often adds that cider-type ‘home brew taste’ to our beers.

This is largely because the ale yeasts that we brew with are best brewed at between 18°C and 22°C. Unless you are brewing in a temperature-controlled environment, it is hard in summer to keep the brew cold enough to stay within this range.

A breakthrough yeast

However, a new yeast strain has hit the market and its ideal brewing temperature is in the range of 30°C to 40°C. To brew that warm and have a clean, refreshing beer was the sort of

thing we brewers could only have dreamt about in the past. Now we can brew a pale ale or an IPA at 30°C without any off flavours, and it’s all done in three to four days!

To brew a clean, refreshing beer in hot weather was the sort of thing we could only dream about in the past

This new kveik family of yeasts originates from Norway, from traditional farmhouse brewers. These farmhouse strains were often dried and shared with wider family members.

There are many different strains within the kveik family of yeasts. Some add a fruity character and are best suited for traditional farmhouse ales, while others brew clean with a hint of citrus fruit. The latter has proved popular with international brewers. That is especially so of the ‘Sigmund Voss’ strain, named after Sigmund Gjernes (of Voss, Norway), who has maintained this culture using traditional methods since the 1980s and generously shared it with the wider brewing community.

Two international dried yeast

The beauty with craft beer is that there are no fixed rules

brands are now supplying the Kveik Voss strain to home brewers.

- Lallemand's new LalBrew range has Voss Kveik Ale Yeast as part of its core range.
- Mangrove Jack's recently added the kveik yeast to its crafted beer range.

So what to brew?

Now that we have choice and can easily get the Kveik Voss strain, what should we brew? I find hop-forward beers are best but you could also use it for other styles. The beauty with craft beer is that there are no fixed rules. Make the most of this hot weather and try a few different styles — perhaps a lager or even a stout brewed now for winter consumption; you are limited only by your imagination.

Why are hop-forward beers my preference? There are two main reasons:

1. Hop-forward beers are extremely popular, especially amongst craft beer drinkers. So, to be able to make one of these beers in under a week from grain

to glass is a real bonus.

2. Voss yeast is clean but has a hint of citrus. This works so well with both USA hops and New Zealand hops. Hops from both of those countries feature in New World pale ales and IPAs due to their tropical fruit and citrus flavours and aromas. This means Kveik Voss yeast and USA and NZ hops are a great marriage.

Voss put to the test

We wanted to create a test to compare the taste of the Kveik Voss yeast brewed at 30°C with two popular American Ale yeasts: Fermentis Safale-05 and White Labs WLP001, both brewed at 18°C.

To rule out any variation in the brewed beer we decided to brew a single 65L-batch and then split it into three separate fermenters. All brews were dry hopped with the same hop, same quantity in each, and all three were dry hopped at the end of fermentation.

The result was surprising. Three different beers, but we couldn't agree on which beer was the best. They were all great beers but each tasted slightly different. In summary, three awesome pale ales and a real surprise that one brewed at 30°C over three days stacked up so well against two others brewed at

18°C over two weeks.

The Voss Kveik yeast is perfect to brew in these hot summer months. Brew warm and brew fast! 🍺



Hot Voss IPA — extract version 23L

- 1 can Blackrock American Pale Ale
- 1 can Blackrock Light Unhopped Malt
- 1 x 1.2kg pouch Mangrove Jack's Light Unhopped Malt
- Hops: 175g Falconer's Flight Hops — 20g added in a boil at 40min, 30min, 20min, 10min, and zero minutes (flameout); 75g dry hopped on day three for three days.
- Yeast: Sigmund Voss Yeast — brewed at 30–35°C



Hot Voss IPA — all-grain version 23L

- 5.1kg NZ Pilsner Malt
- 600g Munich Malt
- 400g Dark Cara
- 200g wheat
- Hops: 175g Falconer's Flight Hops — 20g added in a boil at 40min, 30min, 20min, 10min, and zero minutes (flameout); 75g dry hopped on day three for three days.
- Yeast: Sigmund Voss Yeast — brewed at 30–35°C
- Grains mashed at 65°C for 60 min, then 60-min boil with hop additions as above. Cool to 30°C and transfer to fermenter before pitching yeast.

WHAT ABOUT MY DAD, TOM FRATER?

Was it something in the water? By all accounts, at the same time as Bill Hamilton was inventing his jet engine, other Kiwis were busy in their sheds devising methods of water propulsion to power their craft.

By Clint Frater



Two canoes Tom built for sons Ross and Murray

Reading the story in *The Shed*, Issue 91, about the development of the jetboat by Bill Hamilton, and the letter in Issue 93 titled “What about Uncle Alf”, about the Bill Hamilton jetboat and the design and development of a pump propulsion unit in a boat, brought back memories of my father, Tom Frater.

Tom, who was from Napier, was keen on boats. In those years, Ford 10s and flathead Chryslers were the engines of choice for propeller-driven boats. Tom got his first boat when he was about 20 and used it where Hawke’s Bay Airport is today — pre-earthquake, when that area was underwater. He served his

apprenticeship as a motor engineer and later as a diesel engineer, working for the Ministry of Works in Coote Road, Napier.

Home-made punts

In the ’40s and early ’50s, when I was growing up, having a family with three sons and one daughter was a struggle,

so we did not have much but we always found something to do. Living in Tom Parker Avenue, we had Marewa Park through the back fence and a pine plantation and creek over the road, so plenty of play areas. We boys used to enjoy exploring the creeks in flat-bottom, home-made punts built from scrap wood and flat galvanised. Those creeks went for miles, as they were dug out after the 1931 earthquake to drain the new land that had risen up. We always complained about having to paddle these punts and often suggested to Dad that we put an engine and propeller in the punt.

At night after dinner, the family used to sit around the dinner table talking about all sorts of things, but lots of times it was about boats and how to make them better, etc. In one of these discussions, the subject of installing a motor into the punt came up again, but Tom said it wouldn't work because the amount of stuff in the creeks would foul the propeller. The discussion turned into what other ways could we do it, and Tom suggested a pump inside, sucking up the

water and pushing it out the back. I think the idea came from a toy tin boat we had. The boat had a tube coil in it and when you put a candle under it, it sucked in the water and blew it out the back.

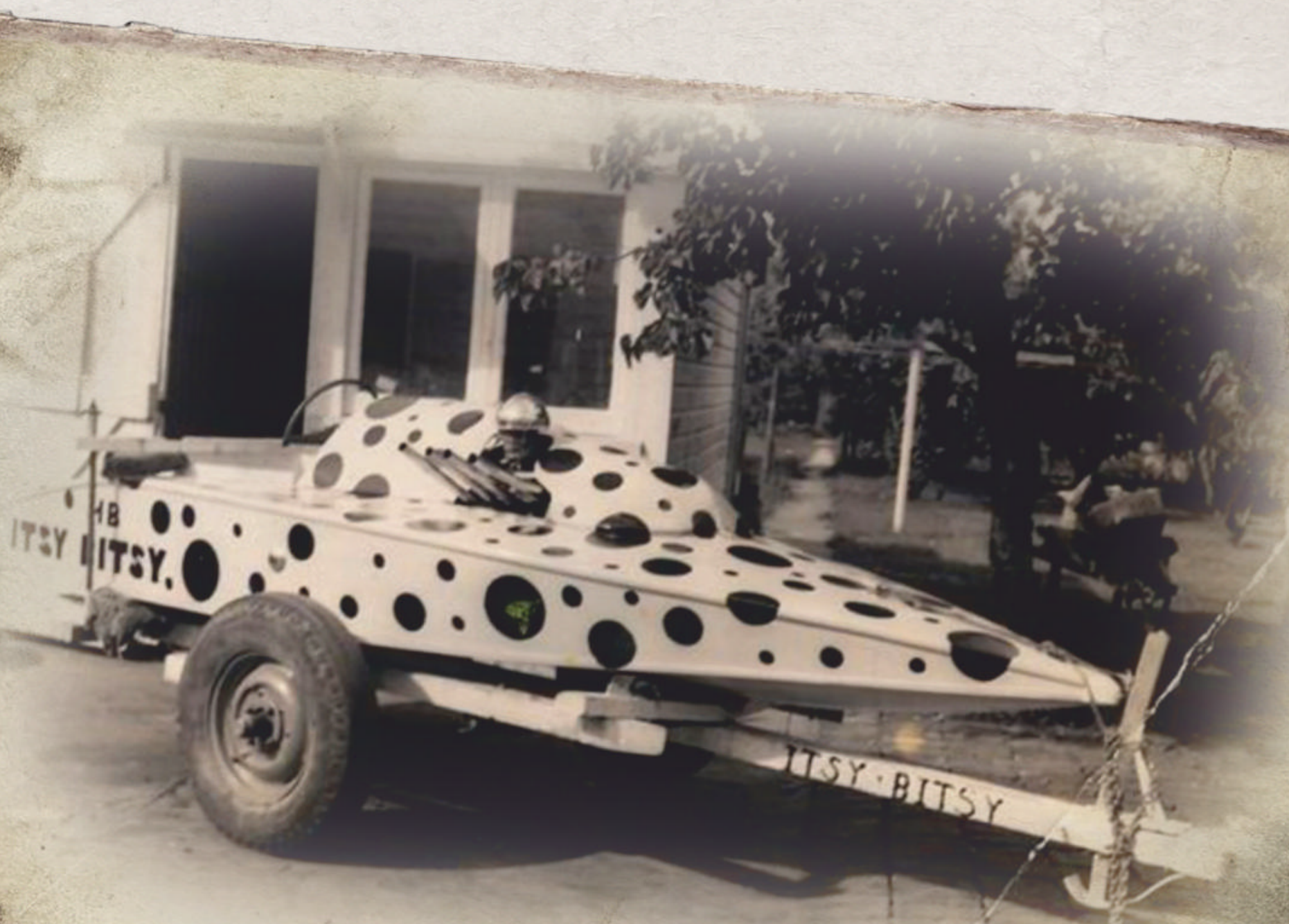
Tom gets stuck in

In the following weeks, Tom acquired a length of three-inch steel tube and a bend and began making a pump propulsion unit. As far as I can remember, he did not give it a name. He joined the tube and bent and welded in a gland where the shaft went into it. He made up a propeller out of steel and machined the ends to fit the inside the tube with a little clearance. He then raided the JAP engine from the lawnmower — which he had built — and fitted it all together onto a piece of wood that fitted across from the two sides of the punt.

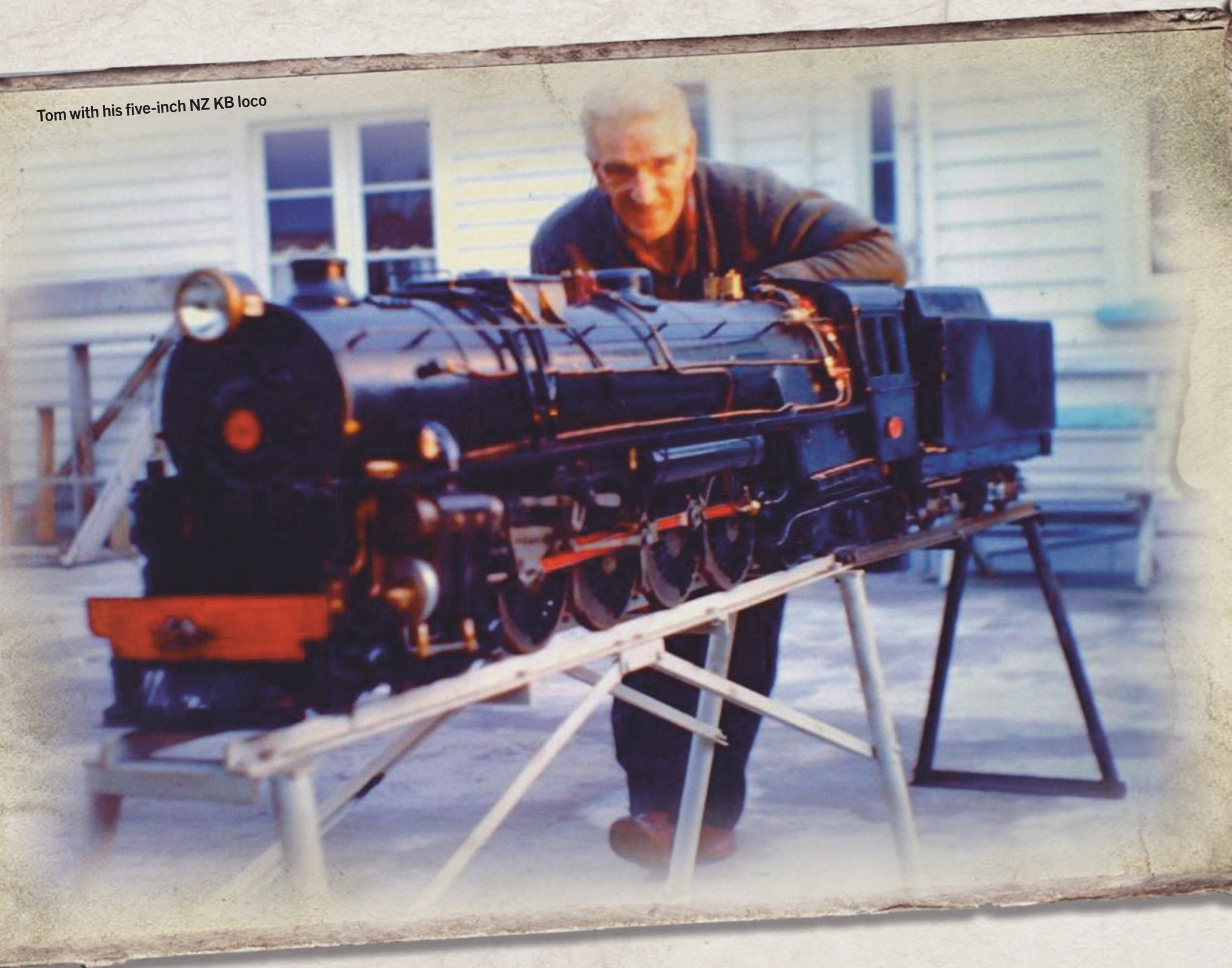
A hole was cut in the bottom and another in the transom of the punt to fit the ends of the tube. We were sent around to the tar-making plant to get some pitch, which was melted down and used to seal the gaps. ▶

“We often suggested to Dad that we put an engine and propeller in the punt”

Below: The first speed boat built by Tom: the Itsy Bitsy — powered by a Singer Nine engine



Tom with his five-inch NZ KB loco



I remember helping to drag the punt over to the creek and helping launch it. My older brother hopped in and started the motor, but nothing happened until he sat down at the back and the tube was consequently under the water. Away it went; no steering, so he grabbed the paddle and steered it with that. After about 100 yards or so, he turned it around. He found that if he kept the tube under the water level it worked well. The unit shook badly and many leaks appeared, so we took it all home, the engine was returned to the lawnmower, and the punt got cut up. What happened to the unit, no one knows.

Purpose-built boat

Over the following weeks, Tom took his design sketches to work with him and had the draftsman there draw up some blueprints of a tube with a propeller in it — a much sturdier design with bearings on the shaft and with a better-fitting

propeller. This was designed to fit onto a Ford 10 engine.

He planned to build a boat and fit one to it but, as we had no money to buy the ply and timber, it never eventuated. The drawings were shelved somewhere.

A few years later, we went to a speed boat race meeting in the river opposite the town centre at Wairoa. The announcer broadcast that a new jetboat was going to be demonstrated during the lunch break. As jet engines were being used in aircraft, everyone assumed that someone had fitted one to a boat. We stood on the banks waiting to see this jet-engine-propelled boat appear from under the bridge; all we saw was a little grey boat chugging up the river at about 25mph. The announcer was going on about how it worked, but it was only when the boat was driven through the bulrushes at the riverside that people realised that this was the jetboat. The driver, Bill Hamilton, took

“The unit shook badly and many leaks appeared, so we took it all home”

the boat very close to the banks and did some 360-degree turns on the spot. Most people went back to having their lunch.

Did Tom beat Bill?

Our uncle, who was racing a boat, went down to have a look at the boat as it was pulled out of the river and parked in the car park. I remember him coming back and saying, “Tom, that jetboat has a unit like you designed three years ago.” He advised Dad to go and have a talk to Bill Hamilton, who was open to discussion.

WHAT IS AVAXHOME?

AVAXHOME-

the biggest Internet portal,
providing you various content:
brand new books, trending movies,
fresh magazines, hot games,
recent software, latest music releases.

Unlimited satisfaction one low price

Cheap constant access to piping hot media

Protect your downloadings from Big brother

Safer, than torrent-trackers

18 years of seamless operation and our users' satisfaction

All languages

Brand new content

One site



AVXLIVE ICU

AvaxHome - Your End Place

We have everything for all of your needs. Just open <https://avxlive.icu>



The Capri built by Tom
— a 16-foot runabout
powered by a Ford V8

Tom explained to Bill about the unit he'd built and said he had a blueprint of what he'd designed. Bill wanted to see it and the following day he called in to see Dad and discuss it. Bill said to Dad that he should have built one, as it was earlier than his.

So, we assumed that Tom Frater built a 'jet unit so to speak' well before Bill Hamilton did.

What happened to the blueprints, we do not know; they are probably somewhere with the other propulsion unit Dad drew up: a stern leg driven by a car engine. The reason for that one? A neighbour, Alex, had bought an 18ft cabin

boat with a new Johnson 40hp engine on it. Alex complained to Tom about the amount of fuel the engine used and asked if anything could be done about it. Tom looked it over but did nothing. However, it gave rise to the idea of designing a drive unit utilising a leg from an outboard engine but using a car engine to drive it. Again, he worked with the draftsman friend to draw up a design using the outboard leg measurements. Tom thought the propeller should be at the front to pull the boat instead of pushing it. This was all being driven through a bevel gear onto a shaft to the back of a Ford 10 engine. It looks great on paper, but as Tom didn't

have the money or a boat, it was never built. It was a few years later that Volvo stern drives became popular in New Zealand.

We went inboard in the '60s

In the '60s, we did build some speed boats but all were fitted with the conventional inboard with a direct drive to the propeller shaft. We competed in quite a few speed boat races but preferred waterskiing and other fun times in our boats.

We were lucky having a father who was a motor engineer and a diesel mechanic by trade. He was always happy to sit



Egga Beeva



A couple more builds: Romeo and Capri



A 15-foot runabout powered by a Ford 10 engine

Maid of Kent, built by Tom Frater and Norm Findlay; Tom Frater is the driver



and talk around the table at night with us three boys. Tom was a tinkerer and a thinker; he loved designing things and making things work better. He loved steam engines and built several model steam engines and boilers and fitted them into model ships that he built. He later went on to building model steam trains — the first engine he and a friend built was the Maid of Kent, which is still being used today in Taradale to take people for rides.

Tom built four different engines: the Maid; Britannia: three-and-a-half inches; a five-inch KB, and then one of a three-and-a-half inches, which he

never completed; and this uncompleted one (pictured), which his grandson in Australia still has. The five-inch KB was too heavy for him to load onto a trailer and take anywhere. We believe it is now in Auckland.

It is a pity those drawings have long gone, so we do not have any proof of dates, but I can assure you that one propulsion unit was built and it worked. If we had had some money in those days, to develop those ideas Tom kept coming up with and take them into manufacturing, I am sure our lives would have gone in a different direction. 🏠

“I remember him coming back and saying, ‘Tom, that jetboat has a unit like you designed three years ago’”



Steam-driven model of the SS Rangitane built by Tom Frater; model length: five feet, five inches



The steam-powered Rangitane



Models of the Essex and the Rangitane



**Affordable 3D CAD
Software**

Alibre Design Version 22 For professional designers

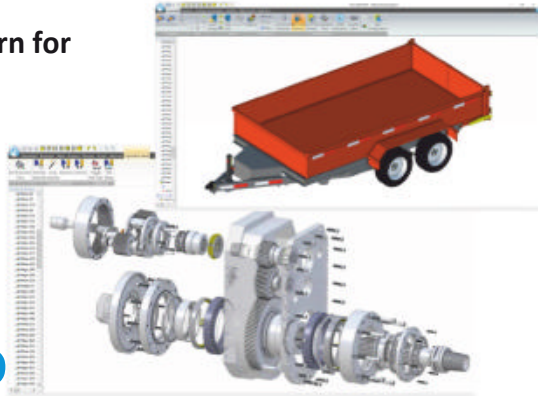
Low cost and easy to learn for
fast ROI. From \$1535.00

Lower design costs.

More productivity.

Not cloud based.

Own your license.



Alibre Atom3D For your Shed projects

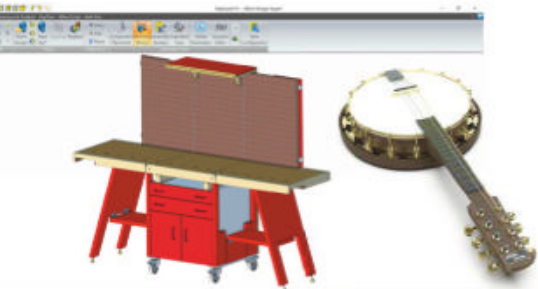
From NZ\$323.00 + GST

For hobby Designers and
Constructors.

Perfect for designing
your shed projects.

Make .stl files for 3D
Printer & CNC work.

Free training exercises.



For 30-day free trial please use this link:

<https://www.alibre.com/get-a-trial/>

bayCAD
services ltd

enquiries@baycad.biz
<https://www.baycad.biz>
NZ 0274847464
AU 61 274847464

The right component for your project



Plastic fixings, fastenings & hardware

Plastic protection caps & plugs

Electronic components & enclosures

Industrial operating elements

Toggle clamps

9000 component lines, 7.5 million items in stock

www.hiq.co.nz

Hi-Q Electronics Limited

sales@hiq.co.nz

0800 800 293

Hi-Q
components



W. Rietveld Ltd

NEW & USED MACHINERY DEALERS

www.rietveld.co.nz

SUPPLIERS TO SHEDDIES FOR OVER 50 YEARS!

- Electric motors and reduction drives
- Electrical components
- Hydraulics and pneumatics
- Transmission sprockets and chain
- Steel and non-ferrous metals
- General engineering supplies
- Plus much, much more!

03 453 6650 | info@rietveld.co.nz

44 Stone Street, Kenmure, Dunedin

rietveld.co.nz

WAGENER *Sparky*

THE CUTE WEE FIRE WITH A BIG HEART

He's built of solid
5mm steel, is multi
fuel, has a stove top
cooking surface and
optional top rails.

Fit Sparky in your
shed, mobile home,
cottage, holiday
bach or house boat
and he will keep
you cosy and warm.
Let him boil your
kettle for a cuppa
and even heat your
water for a nice
hot shower.

**CUSTOMIZE
WITH
COLOUR**



5 Allen Bell Dr, Kaitaia

(09) 408 2469
www.wagenerstoves.co.nz



A MODEL CITIZEN

Ted Egan could be said to be part of the history of the Coromandel — not only has he lived in Thames all his life, but he creates models of the region’s historic buildings, frequently using kauri that has also spent all its life on the peninsula

By Claire Ashton

Photographs: Claire Ashton

During the first Covid lockdown in 2020, Thames resident Ted Egan finally got on with a project that had been on his mind.

“If you mention something enough, as in ‘I’m gonna to do this’ or ‘I’m gonna do that,’” says Ted, “others will follow up on it; I got told to get on with it” — especially by friend, Kirsty, with whom Ted has the odd beer at the local bowling club.

Covid lockdown provided the time to do it, as Ted has a great workshop in the large garage underneath his house. Not that he is any dilettante when it comes to

making models; Ted has produced a great many models, some of which are housed in the Thames Museum. Ted says his favourite would have to be the old Bank of New Zealand. It takes Ted four to six weeks to do a piece, sometimes more. He never gives himself a deadline, though, as that would be a bit of pressure he doesn’t need. He likes taking his time and enjoys the quiet of the workshop, working methodically and being in his own world. He admits he found it difficult to let the Kopu Bridge model go to the Thames Museum for display — even if it was only on loan. ►



Making the lighthouse

Ted's models in
Thames Museum



BNZ model on display at Thames Museum - one of Ted's favourites



Ted gave a talk about the project at the Thames Museum

“It takes Ted
four to six weeks
to do a piece,
sometimes more”

Ted in his workshop with
lighthouse in progress





The little saw Ted made specifically for the wooden models

School days

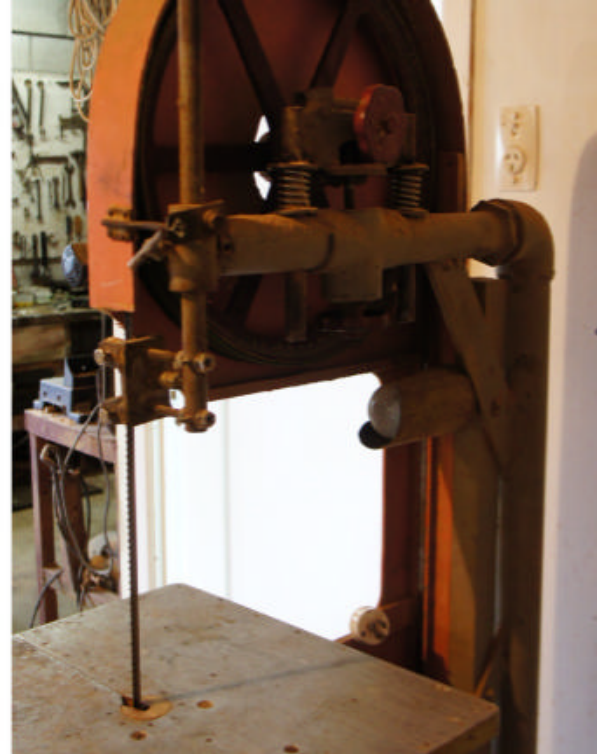
Ted's metalwork teacher at school, Harry Lang, was a no-nonsense man and a very good teacher. Ted can still feel him at his shoulder, keeping an eye on his work. He can even hear Harry's voice in his head with some helpful instructions — the voice is a guiding light rather than a critical one. Ted's dad was a carpenter, and Ted spent many hours in the workshop with him. He was also one of the last gold miners in town — but that's another story.

The Kopu Bridge model

The first decision was the timber. Ted's son-in-law works for Thames

Demolition, so he has a good source of decent wood. Ted loves working with recycled kauri, so kauri was his choice for the project. He finds kauri very good to work with — having built three boats from kauri, he should know. Choosing the piece was important. The size of the main piece in a way dictates the scale of the model and guides the choice of the next pieces.

Ted worked from a photo of the Kopu Bridge. The main focus and challenge was the swing span. He didn't do any drawings or sketches; one piece just followed another. He cut out all the wood on a little saw that he made for his model making. ►



Inside Ted's workshop

Metal lathe

Ted makes his own bolts on his metal lathe. More than 60 years old, the Companion brand lathe was produced by Johns Ltd, Auckland.

The small plate of measurements is useful, as when Ted is turning threads, the measurements tell him what gears to put on.

Bandsaw

The bandsaw is also 60 years old. Ted made it out of pipes after following the instructions in a Popular Mechanics magazine. The bandsaw was constantly used to cut the kauri for the bridge model.

Drop saw

Ted says the motor is 2.5 horsepower and is very versatile.

"If I want, I can change the faceplate and turn it into a table top. I can also put the router upside down and use it for routing as it makes a bench top."

Solder

This was used for parts of the Kopu bridge.

Skilsaw

Ted turned the old skilsaw into a steel cutter.

Wood lathe

This has been with Ted most of his life. He made it in high school under the guidance of his teacher.

Little saw

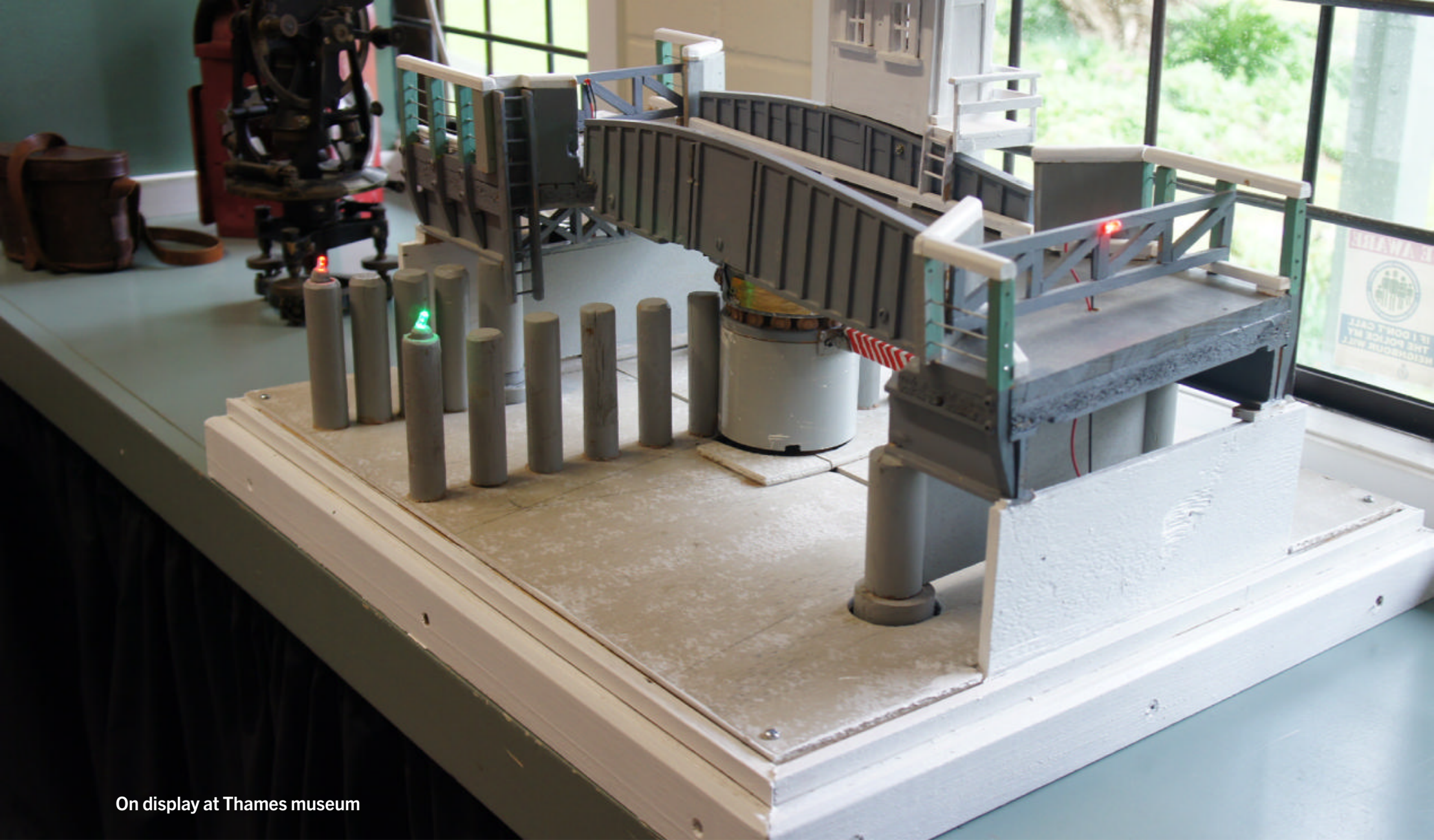
This fits easily on the bench. Ted made it out of a vacuum cleaner motor. It works on a wooden pulley system and is very handy for doing small stuff. Ted made it specifically for use on wooden models. He jokes that he hasn't lost a finger yet!

Sander

Ted uses the faceplate frequently and the sanding plate. He cuts all his own wood for models.



Drop saw face plate — turns it into a table top



On display at Thames museum



Kopu bridge mechanism

Kopu Bridge

After the new two-lane Kopu Bridge opened in December 2011, the old bridge was closed and under threat of destruction. Six years after that, in March 2018, after a long fight against demolition, NZTA gave community ownership of the old Kopu Bridge to the Kopu Bridge and Community Trust. The trust plans to restore the bridge as a pedestrian and cycleway adjacent to the Hauraki Rail Trail. Ted has a long time connection with the bridge, as his uncle used to relieve the key bridge operator, Mr Thomas.

Old Kopu bridge with new bridge in background





Wood lathe Ted made at high school with teacher supervision

“Most things are trial and error. I make mistakes and then I pull it to bits quite a few times; it is always a learning curve”

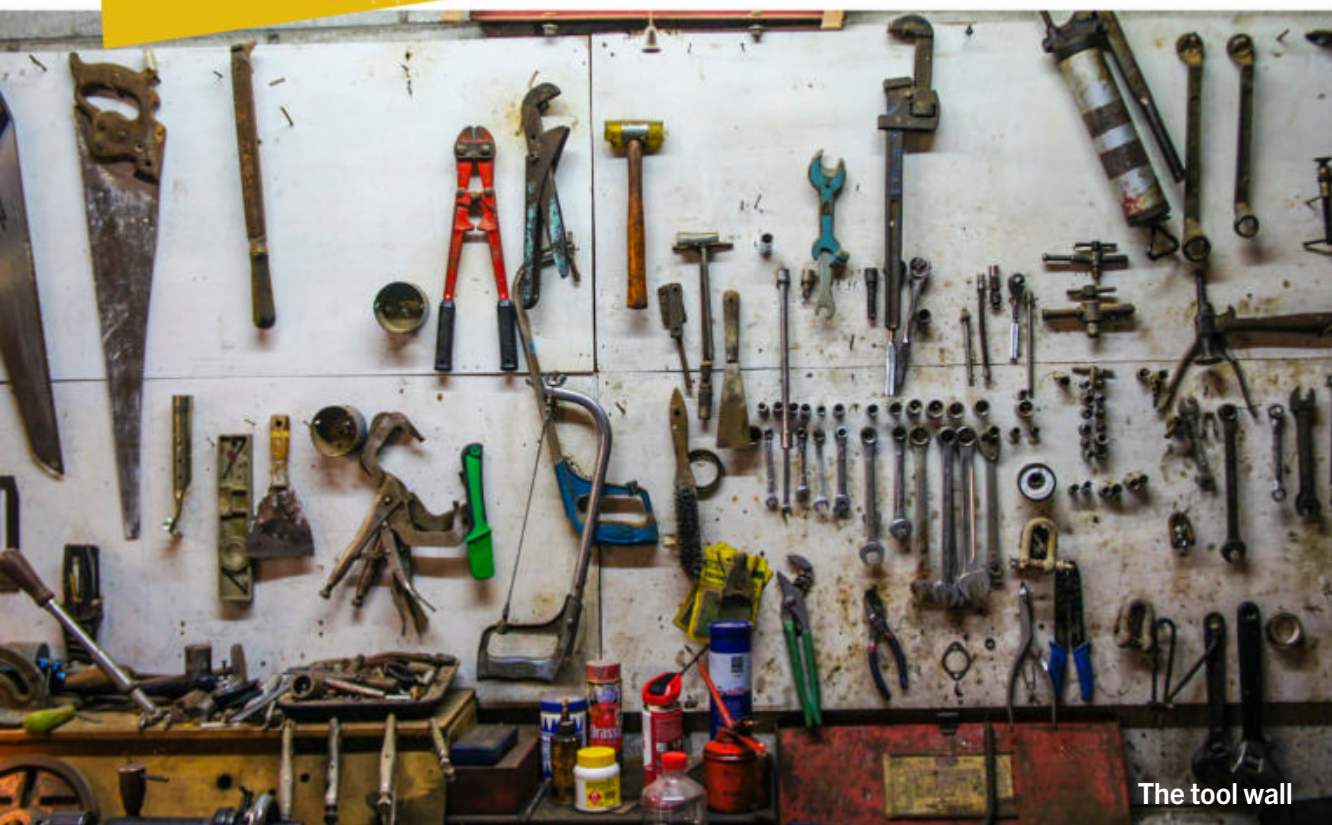
Problem solving

Ted already had a 9rpm motor. He buys a few at a time from a Chinese source; they cost around \$20. However, the motor wasn't quite doing what he wanted, as the arm of the bridge was too slow to work the swing span correctly — it would go to the centre and then stop. He had to rig it from being automatic to a manual override so he could have control over it. At this point, he also pulled it apart a few times to get the electrics right as well.

Working out the arc of the swing span proved tricky. It couldn't be square as the arm wouldn't work, but it could work if on an angle, so it took a while to get it right and it was a bit of trial and error.

“Most things are trial and error. I make mistakes, and then I pull it to bits quite a few times; it is always a learning curve,” Ted explains.

It sounds as if Ted is a bit of a perfectionist. It has to look and feel right to him — and to others. He aims for exact replicas. ►



The tool wall



Old skillsaw turned into a steel cutter



Ted and the bandsaw he made based on a *Popular Mechanics* article

Cape Brett Lighthouse

Ted's next project is a model of the Cape Brett Lighthouse. Interestingly, the lighthouse was originally made in the foundry in Thames.

Ted chose tawa for this model. He turned the first piece and, as with his other projects, the rest follows to that scale. The lighthouse light has been set to blink every 30 seconds. It is a round brass ring, and it blinks in the way real lighthouses function. Lighthouse lenses used to sit in a mercury bath instead of bearings, but that, of course, has gone out of vogue. They originally ran on kerosene.

Build process

- Use a spring loader out of a light fitting
- Turn wood
- Make brackets
- Use a water flange to turn rings
- Drill all holes with a 1.5mm drill
- Use the handy and humble toothpick for the railings
- Spray paint the toothpicks white





Ted made a merry-go-round for his grandchildren. It uses pulley systems



Ted and one of his granddaughters whom he makes models for

During the project, he pulled the bridge to pieces a couple of times, especially as the electrics were involved. He pulled out the relays that didn't work and will use them elsewhere. The bridge had to have lights port and starboard, white riding lights, red lights, and a gate. It also had a reversible motor.

The electrics board is connected through a main circuit. Ted admits he is

no electrician, so he reckons he probably put it together in a more mechanical way, due to his background as a motor mechanic.

For the painting, he started with white and mixed his own colours using Resene test pots of acrylic, aiming to make the paint job as authentic as possible — that's the main thing: staying true to the original. 📺



One of Ted's models on display at the Thames Museum — Hetherington's

Bookcase

CHECK OUT **PLUS** MAGSTORE.NZ
FOR THE SHED BACK ISSUES

Best of The Shed

Featuring 18 of the best projects from the last 10 years, The Best of The Shed includes all of our most popular projects. With step-by-step instructions, the 176-page book will take you through a variety of projects, including a pizza oven, a trailer, a rocking horse, and a knife.



\$19.90



\$55

The Complete Kiwi Pizza Oven

This 288-page book is the ultimate guide to Kiwi outdoor living. Including a step-by-step guide on how to build your own pre-cast oven, as well as profiles of 17 Kiwis' ovens, with their (often hilarious) experiences, recipes, and tips.

Handy Workshop Tips & Techniques

The ultimate workshop companion, this 320-page book is a comprehensive guide for anything crafted of wood and metal. With something to teach everyone, this book has ideas to encourage and inspire, and clear directions that'll lead you through a project every step of the way.



\$49



\$65

How to Weld

Learn how to weld with this best-selling book on the subject. Suitable for beginners through to experienced welders, this 207-page book will help you to transform ordinary steel into a blank canvas for invention.

Professional Sheet Metal Fabrication

The most detailed sheet-metal book available, this 304-page paperback includes clear instructions on a variety of subjects — including directions for using pneumatic hammers, an English wheel, and more. Learn how to form door seams and to make fenders, hoods, and other body parts.

\$75



Engineers Black Book - 3rd Edition

Boasting all of the information you need — including useful tables and templates — this 234-page pocket-sized book is the essential reference for machinists, engineers, designers, and makers.

NEW



\$85

ORDER FORM

Post To: Parkside Media, Freepost 3721, PO Box 46020, Herne Bay, Auckland, 1147

ITEM	PRICE	QUANTITY
Best of The Shed	\$19.90	
Professional Sheet Metal Fabrication	\$75.00	
How to Weld	\$65.00	
Handy Workshop Tips and Techniques	\$49.00	
Engineers Black Book	\$85.00	
The Complete Kiwi Pizza Oven	\$50.00	
Postage & Packaging New Zealand	\$8.00	☐
Postage & Packaging New Zealand Rural	\$12.00	☐
Postage & Packaging Australia	\$16.00	☐
Total number of items		
Plus Postage & Packaging		
Total cost		

PAYMENT DETAILS

Name:

Postal address:

Postcode:

Phone:

Mobile:

Email:

☐ Visa

☐ Mastercard

☐ Cheque

Cheques payable to Parkside Media Ltd

Name on card

Card number

Expiry date

Signature:

Terms and conditions: Only while stocks last. New Zealand billing addresses only. Offer available on direct purchases from Parkside Media. See magstore.nz for full terms and conditions.



ALSO

order online at **magstore.nz** or

Call: **0800 727 574**

Email: **subs@parkside.co.nz**



ONLY
\$15
EACH



Issue 94
Jan-Feb 2021



Issue 93
Nov-Dec 2020



Issue 92
Sep-Oct 2020



Issue 91
July-Aug 2020



Issue 90
May-Jun 2020



Issue 89
Mar-Apr 2020



Issue 88
Jan-Feb 2020



Issue 87
Nov-Dec 2019



Issue 86
Sep-Oct 2019



Issue 79
Jul-Aug 2018



Issue 78
May-Jun 2018



Issue 77
Mar-Apr 2018



Issue 76
Jan-Feb 2018



Issue 75
Nov-Dec 2017



Issue 74
Sept-Oct 2017



Issue 73
July-Aug 2017



Issue 72
May-June 2017



Issue 71
Feb-Mar 2017



Issue 64
Dec 15-Jan 2016



Issue 63
Aug-Sept 2015



Issue 62
Aug-Sept 2015



Issue 61
June-July 2015



Issue 60
April-May 2015



Issue 59
Feb-Mar 2015



Issue 58
Dec-Jan 2015



Issue 57
Oct-Nov 2014



Issue 56
Aug-Sept 2014



Issue 49
June-July 2013



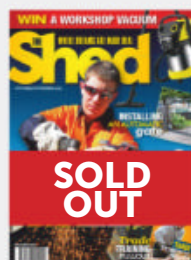
Issue 48
April-May 2013



Issue 47
Feb-Mar 2013



Issue 46
Dec-Jan 2013



Issue 45
Oct-Nov 2012



Issue 44
Aug-Sep 2012



Issue 43
Jun-Jul 2012



Issue 42
Apr-May 2012



Issue 41
Feb-Mar 2012



Issue 34
Dec-Jan 2011



Issue 33
Oct-Nov 2010



Issue 32
Aug-Sep 2010



Issue 31
Jun-Jul 2010



Issue 30
Apr-May 2010



Issue 29
Feb-Mar 2010



Issue 28
Dec-Jan 2010



Issue 27
Oct-Nov 2009



Issue 26
Aug-Sep 2009



Issue 19
Jun-Jul 2008



Issue 18
Apr-Mar 2008



Issue 17
Feb-Mar 2008



Issue 16
Dec-Jan 2008



Issue 15
Oct-Nov 2007



Issue 14
Aug-Sep 2007



Issue 13
Jun-Jul 2007



Issue 12
Apr-May 2007



Issue 11
Feb-Mar 2007

STORAGE BINDERS



ONLY
\$29
EACH

THE WHERE DREAMS ARE MADE REAL **Shed** Postal order form

Name: _____

Postal address: _____

Postcode: _____

Phone: _____

Email: _____

☐ Visa ☐ Mastercard ☐ Cheque

Card Number: _____

Cardholder name: _____

Expiry date: _____

Signature: _____

ISSUES

Tick Issue numbers below (black = sold out).

- | | | | | | | |
|-----------------------------|--|--|--|--|--|--|
| ☐ 94 | ☐ 81 | ☒ 68 | ☐ 55 | ☐ 42 | ☐ 29 | ☒ 16 |
| ☐ 93 | ☒ 80 | ☐ 67 | ☒ 54 | ☐ 41 | ☒ 28 | ☒ 15 |
| ☐ 92 | ☐ 79 | ☐ 66 | ☐ 53 | ☒ 40 | ☐ 27 | ☒ 14 |
| ☐ 91 | ☒ 78 | ☒ 65 | ☐ 52 | ☒ 39 | ☒ 26 | ☒ 13 |
| ☐ 90 | ☐ 77 | ☐ 64 | ☐ 51 | ☐ 38 | ☒ 25 | ☒ 12 |
| ☐ 89 | ☒ 76 | ☐ 63 | ☐ 50 | ☐ 37 | ☒ 24 | ☒ 11 |
| ☐ 88 | ☒ 75 | ☐ 62 | ☐ 49 | ☐ 36 | ☐ 23 | ☒ 10 |
| ☐ 87 | ☐ 74 | ☐ 61 | ☒ 48 | ☐ 35 | ☒ 22 | ☒ 09 |
| ☐ 86 | ☐ 73 | ☒ 60 | ☒ 47 | ☒ 34 | ☒ 21 | ☒ 08 |
| ☐ 85 | ☐ 72 | ☐ 59 | ☐ 46 | ☐ 33 | ☒ 20 | ☒ 07 |
| ☐ 84 | ☐ 71 | ☐ 58 | ☒ 45 | ☒ 32 | ☒ 19 | ☒ 06 |
| ☐ 83 | ☐ 70 | ☐ 57 | ☒ 44 | ☐ 31 | ☒ 18 | ☒ 05 |
| ☐ 82 | ☒ 69 | ☐ 56 | ☒ 43 | ☒ 30 | ☒ 17 | ☒ 04 |

☐ Storage Binder

Pricing:

Issues - \$15 each

Storage Binder - \$29 each (postage via courier)

Postage & Packaging:

\$4.50 for 1-2 issues

\$8 courier for 3 or more

\$12 rural courier

Total Cost: _____

Post to:

The Shed magazine, PO Box 46020,
Herne Bay, Auckland 1147

OR

ORDER ONLINE AT
MAGSTORE.NZ

Overseas orders please visit magstore.nz



Issue 85
Jul-Aug 2019



Issue 84
May-Jun 2019



Issue 83
Mar-Apr 2019



Issue 82
Jan-Feb 2019



Issue 81
Nov-Dec 2018



Issue 80
Sep-Oct 2018



Issue 70
Dec-Jan 2017



Issue 69
Oct-Nov 2016



Issue 68
Aug-Sep 2016



Issue 67
June-July 2016



Issue 66
Apr-May 2016



Issue 65
Feb-Mar 2017



Issue 55
June-July 2014



Issue 54
April-May 2014



Issue 53
Feb-Mar 2014



Issue 52
Dec-Jan 2014



Issue 51
Oct-Nov 2013



Issue 50
Aug-Sept 2013



Issue 40
Dec-Jan 2012



Issue 39
Oct-Nov 2011



Issue 38
Aug-Sept 2011



Issue 37
Jun-Jul 2011



Issue 36
Apr-May 2011



Issue 35
Feb-Mar 2011



Issue 25
Jun-Jul 2009



Issue 24
Apr-May 2009



Issue 23
Feb-Mar 2009



Issue 22
Dec-Jan 2009



Issue 21
Oct-Nov 2008



Issue 20
Aug-Sept 2008



Issue 10
Feb-Mar 2007



Issue 9
Oct-Nov 2006



Issue 8
Aug-Sep 2006



Issue 7
Jun-Jul 2006



Issue 6
Apr-May 2006



Issue 5
March 2006

GO TO **MAGSTORE.NZ** & CLICK 'BACK ISSUES'



THE GOLDEN AGE

Jude discovers that the “Glory Days” aren’t over yet

By Jude Woodside

I have recently received my SuperGold Card. It’s the new rite of passage into old age. I guess this means I am officially an OAP. Sobering thought — especially for someone who once sang along to The Who song “My Generation”, which concluded: “I hope I die before I get old”.

Fortunately, I didn’t get that wish because, after all, it doesn’t seem so bad, apart from not being as limber as I once was and the eyesight failing a bit. I enjoy having the depth of the lived knowledge of history and watch with bemusement the mistakes of the past being blissfully repeated by the naive, and the evil.

I grew up through the heyday of rock ‘n’ roll. Elvis, The Rolling Stones, and the Beatles were my background music. I don’t believe there has been any good music made since the mid ‘80s. The older I get the older my tastes become, so now I prefer jazz from the ‘50s and ‘60s.

Jack was as good as his master

I can remember vividly the egalitarianism of the early ‘60s, although I appreciate that this didn’t extend to the Maori population as much as populism at the time pretended. But there was certainly the perception that “Jack was as good as his master”. Businesses of the time recognised that they had a broader obligation to society as much as to their shareholders, and your class, such as it was, was less a defining demographic than now.

The late ‘60s and early ‘70s were my formative years. I experienced first-hand the dizzy hedonism and unbridled optimism of the hippy era. That, in some ways, has defined my world view; there are those who think I never grew out of it — sadly, I did.

I didn’t live in New Zealand through the ‘80s so I missed the Muldoon era; I left New Zealand in 1976, thus avoiding most of it, and landed in a shell-shocked



“He made \$300m but put the country back technologically by 20 years. The price of progress?”

Australia after the dismissal of the Whitlam government. I am grateful to Australia, and specifically to Gough Whitlam, for my university education. The Whitlam government abolished university fees in 1974.

I also owe a debt of gratitude to another venerable Australian institution, the Australian Broadcasting Corporation, for my career in broadcasting. There, I learned the importance of reportage based on fact and how adherence to that principle makes you the target of both spheres of politics.

So much new technology

I have been privileged to be at the cutting edge of the fastest technological change in history. When I started in the newsroom at ABCTV Sydney, we were still shooting news on film. I was there as that changed to videotape and now to SD cards. I have followed photography from the darkroom to the computer and I changed careers into another sunset industry, newspapers, as the electronic revolution came in. In the late 1990s, The New Zealand Herald banned URLs from

its advertising for fear it would lose its market.

Nowadays, I don’t even watch broadcast TV, and I lament that I cannot get another innovation in which I had some small part: fibre. I worked for Telecom in the mid 1990s when it was installing fibre to households throughout Auckland and Wellington. We had speeds of 10Mb/sec when the rest of the world was on dial-up. It was exciting, cutting-edge stuff, but short-lived when one of the main shareholders decided he wanted his money out so they terminated our department overnight to lift the share price for him. He made \$300m but put the country back technologically by 20 years. The price of progress?

For all its faults, the Internet has changed our lives for the better. Who remembers how we did research before Wikipedia? How did you keep in touch with friends and family before Facebook? The smartphone is only 13 years old, yet most of us couldn’t get by without it. This ramble can only end with the words of another song from the ‘70s: “What a long, strange trip it’s been”. 📱

NO ADS MORE MUSIC

9 - NOON WEEKDAYS



LISTEN ON  **iHeart**RADIO

GOLD
ALL THE GREATEST HITS