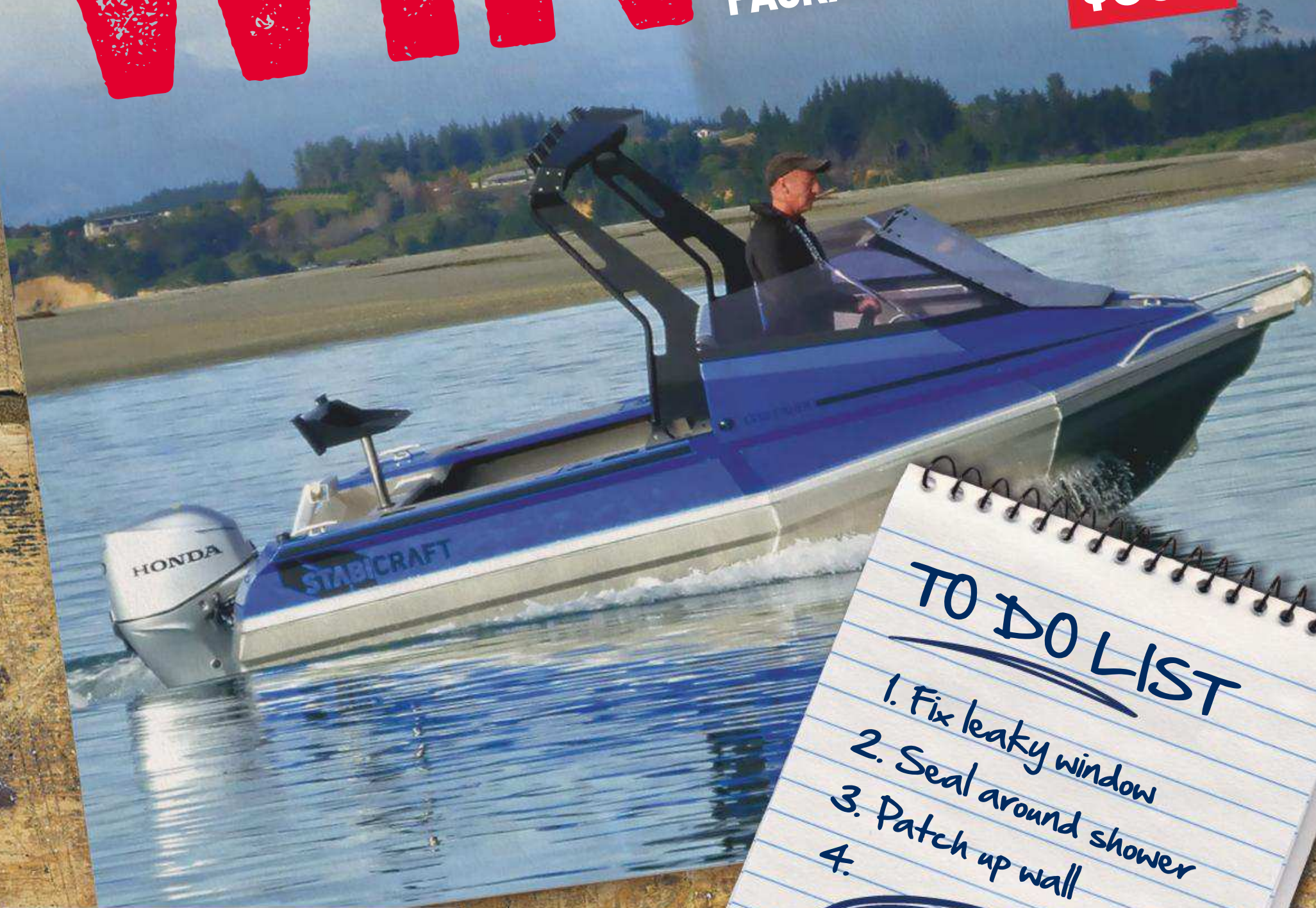


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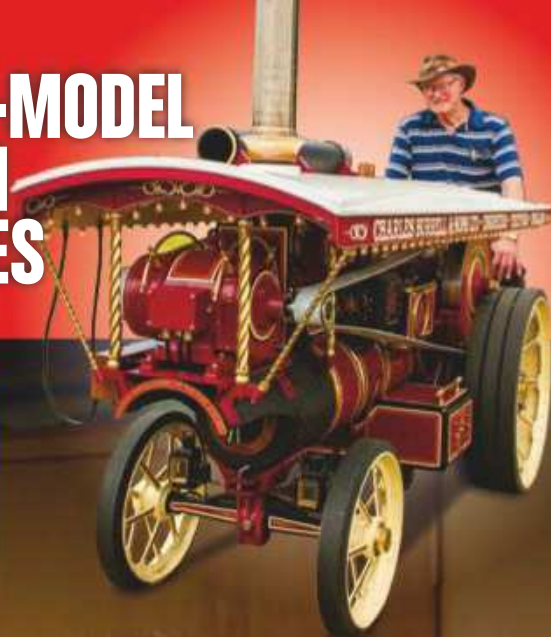
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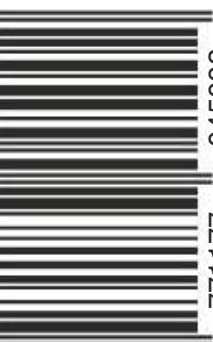
Shed

SEPTEMBER–OCTOBER 2018

ISSUE 80

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What a waste

Don't you reckon there always seems to be a new fad, something that suddenly we are all meant to be into, or all of a sudden doing and participating in?

Like drinking bottled water, installing a heat pump, wearing Crocs etc, etc. I hate fads and run as far away from them as I can. I like to find or create my own fads. It must come from my dad who always said to me, "Don't be a sheep." Looks like at least one tidbit of parental advice sunk in then.

One of the current fads doing the rounds is abolishing single-use plastic bags and this may be the first time I join in with everyone else and immerse myself in a current trend. Of course the single-use plastic bag is only the tip of the waste iceberg (vague pun intended) as it is becoming more apparent every single day that we all need to do more about controlling the way we think about and dispose of waste. The moment really has come when we all need to take responsibility and reuse and recycle, and ideally avoid excess waste product as much as we can.

There was a time when I was renovating houses and the amount of skips we filled with building and demolition material from one house in particular was mind boggling. When undergoing one 90-square-metre house reno we must have filled at least 12 of those orange 3m Flexibin disposable bags. Imagine those all on top of one another – that's a big stack!

I'm not trying to come up with a solution or daring to suggest one, just sharing with you

my concerns and that we need to give a lot more careful consideration to the amount of waste materials we all dispose of.

Is it best to get a length or two more timber than you need, or just enough, and grab more next time you are at the timber yard if you need it. One bag extra, or make do?

Friends have told me that in London they saw folks taking items out of the plastic that the supermarket had wrapped products in and leaving it at the checkout: "Your plastic, Mr Supermarket, your problem. I don't want the things I buy wrapped in so much plastic, thank you very much." What a great attitude.

I've heard in Canada they have tool libraries where you can borrow tools just like books. I love new tools, can never get enough of them, and I never know what to do with the old ones. They're not good enough to sell, but maybe I should give them to a charity to reuse.

This was all brought home to me when my granddaughter got me to take an old plastic bag to our favourite bakery so they could reuse it. She was so proud of our joint effort. It hit me then that it's really the next generation that we should be making real changes for. Anyway, let's see what us responsible sheddies can do to change. Let's give much more thought to reduce, reuse, recycle, and create less waste.

Greg Vincent
Publishing Editor
editor@shedmag.co.nz

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THE WHERE DREAMS ARE MADE REAL
Shed

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EDITOR

Greg Vincent, editor@theshedmag.co.nz

SUBEDITOR

Sarah Beresford

TECHNICAL EDITOR

Jude Woodside

PROOFREADER

Odelia Schaare

DESIGN

Mark Tate

STAFF PHOTOGRAPHER

Adam Croy

ADVERTISING COORDINATOR

Renae Fisher

ADVERTISING PRODUCTION

Danielle Williams

CONTRIBUTORS

Mark Beckett, Ray Cleaver, Jim Hopkins, Jude Woodside, Rob Tucker, Sue Alison, Juliet Nicholas, Ritchie Wilson, Enrico Miglano, Des Thomson, Nathalie Brown, Derek Golding, Coen Smit, Geoff Merrweather

SUBSCRIBE

ONLINE: magstore.nz

PHONE: 0800 PARKSIDE (727 574)

POST: Freepost Parkside Media Subs

PO Box 46020, Herne Bay, Auckland 1147

EMAIL: subs@parkside.co.nz

CONTACT US

parkside media
magazines • television • internet • events

PHONE: 09 360 1480

FAX: 09 360 1470

POST: PO Box 46020, Herne Bay, Auckland 1147

EMAIL: info@parkside.co.nz

PUBLISHER

Greg Vincent, gvincent@parkside.co.nz

GENERAL MANAGER, BUSINESS DEVELOPMENT

Michael White, mwhite@parkside.co.nz

GENERAL MANAGER, OPERATIONS

Simon Holloway, sholloway@parkside.co.nz

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Gordon & Gotch

PHONE: 09 928 4200

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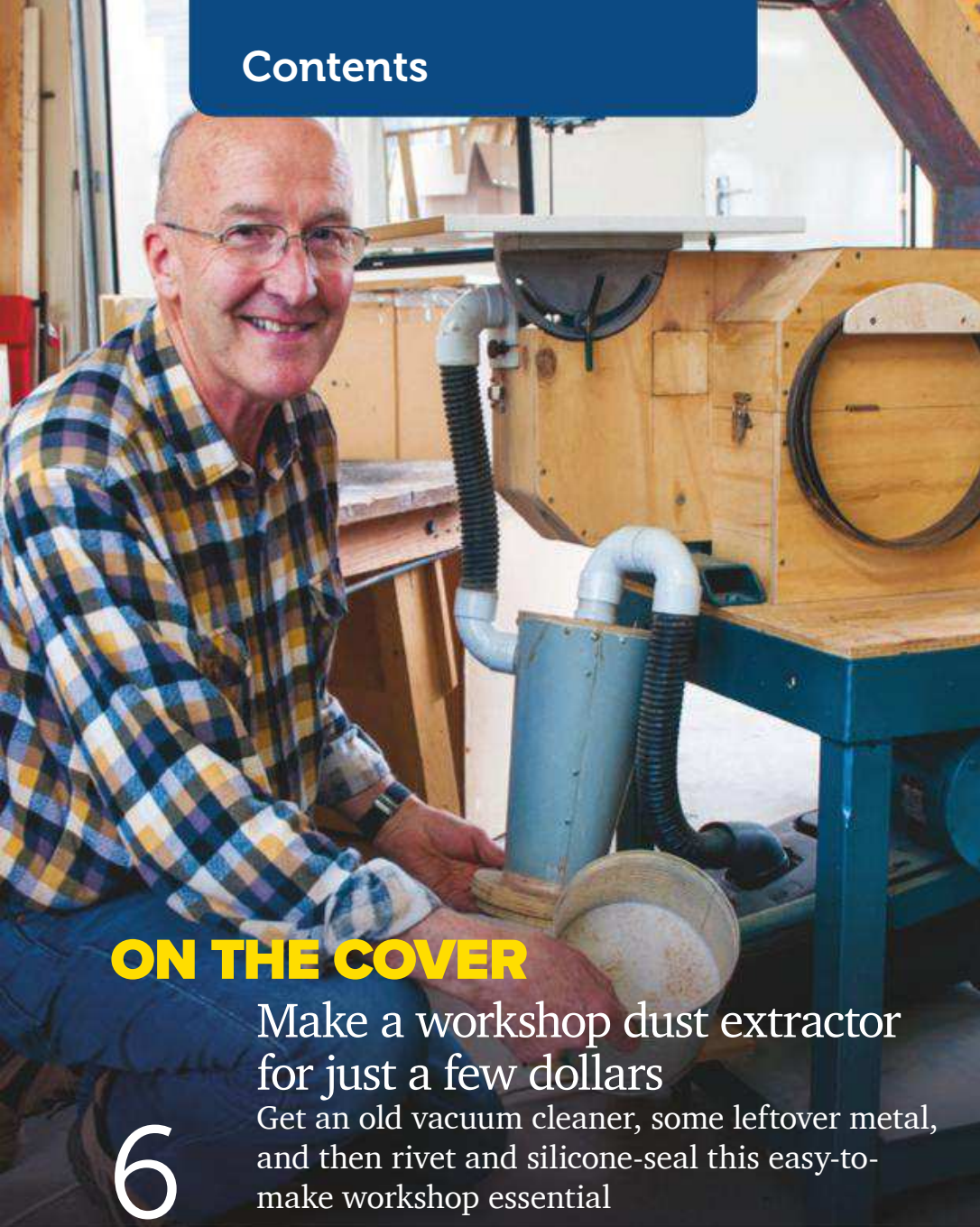
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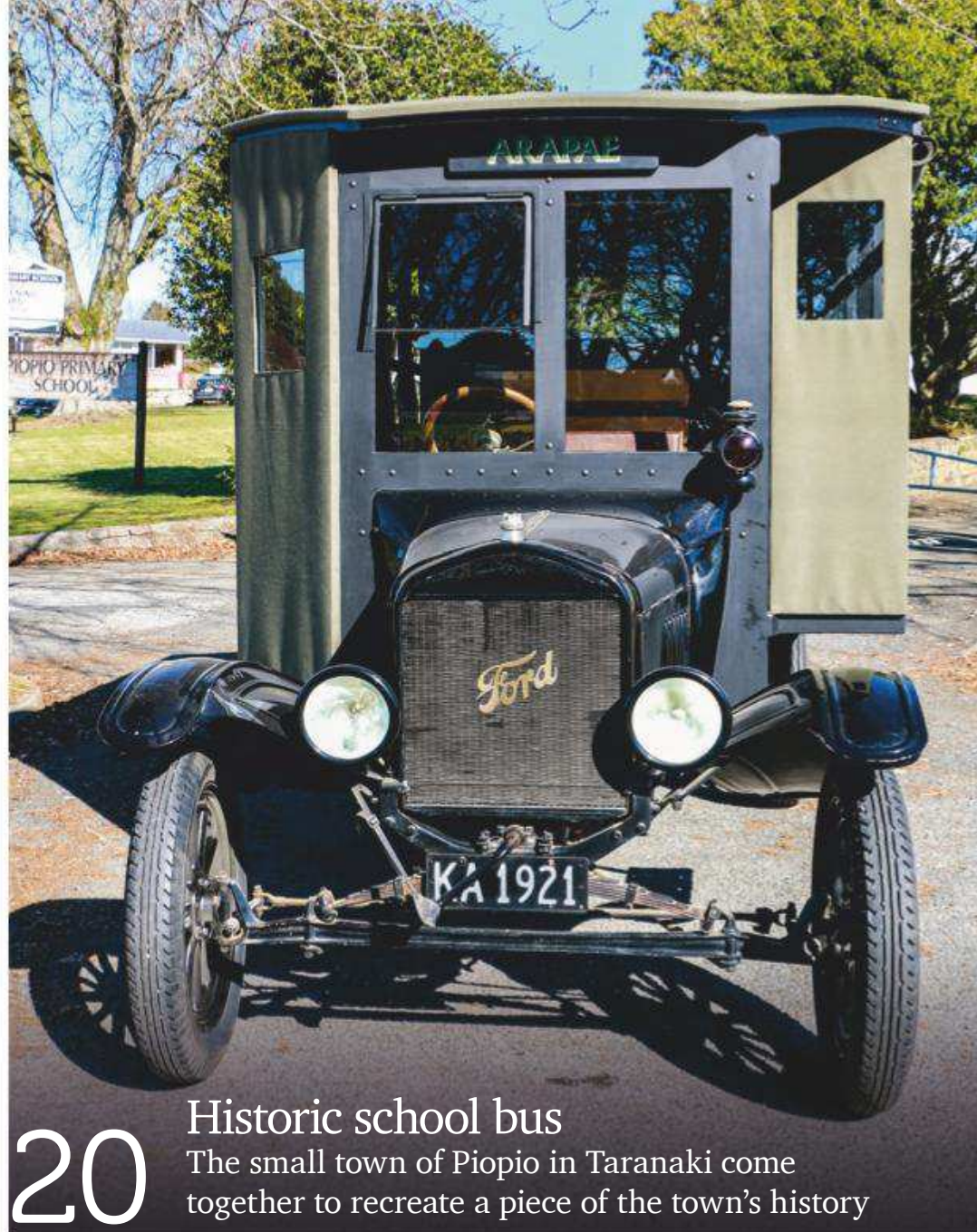


ON THE COVER

Make a workshop dust extractor for just a few dollars

Get an old vacuum cleaner, some leftover metal, and then rivet and silicone-seal this easy-to-make workshop essential

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Historic school bus

The small town of Piopio in Taranaki come together to recreate a piece of the town's history

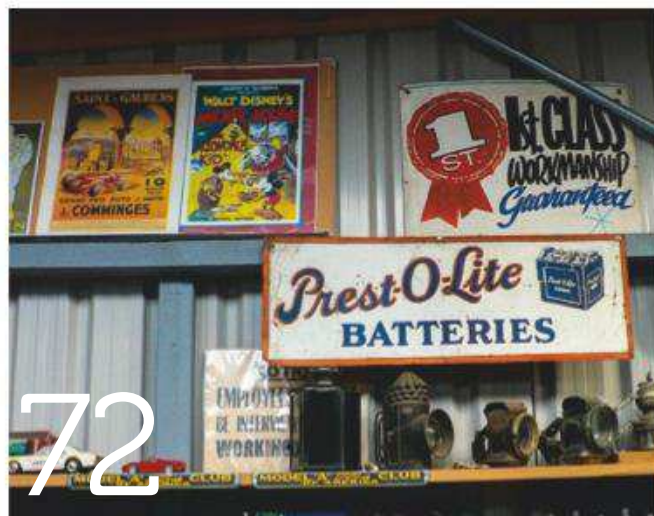
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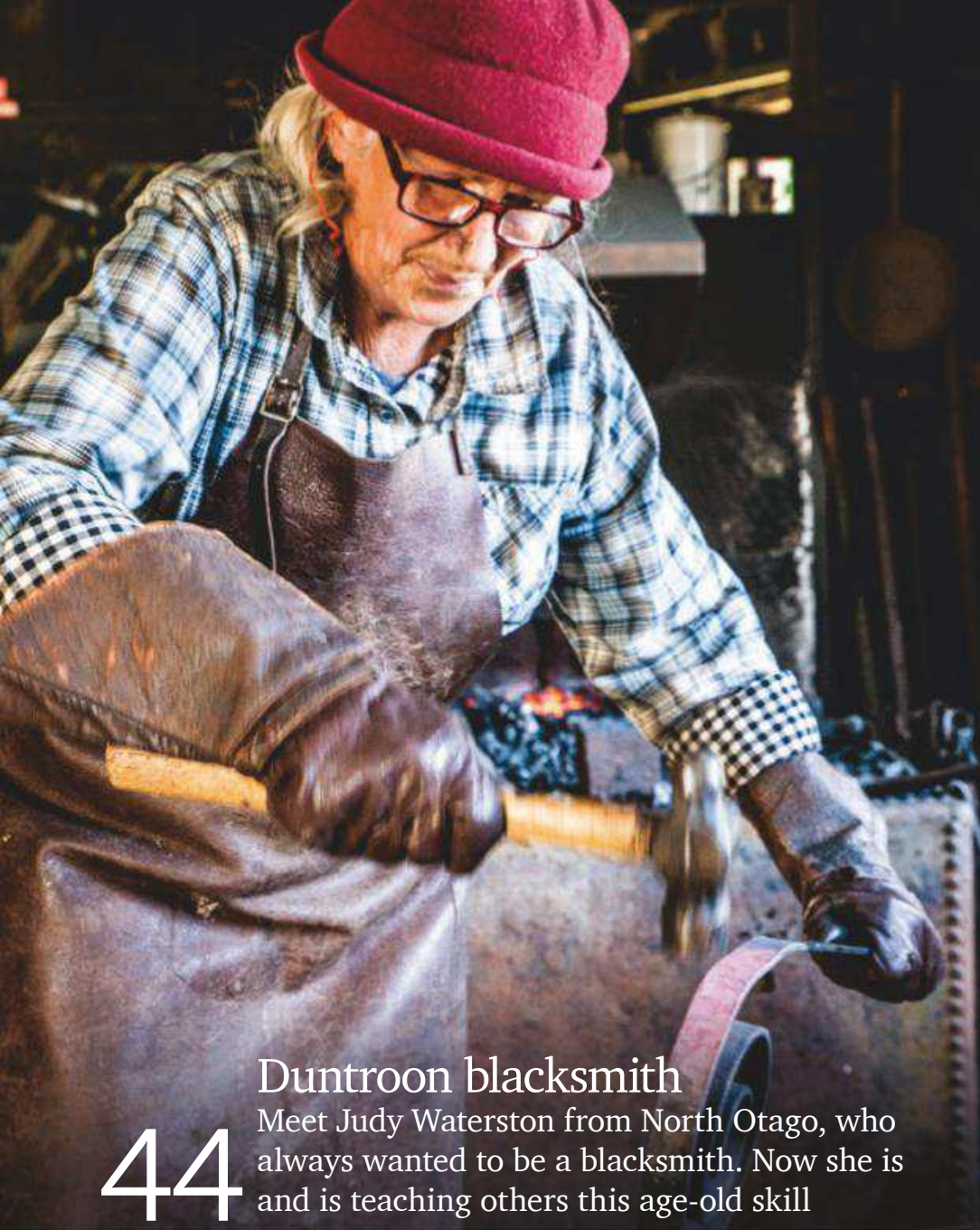
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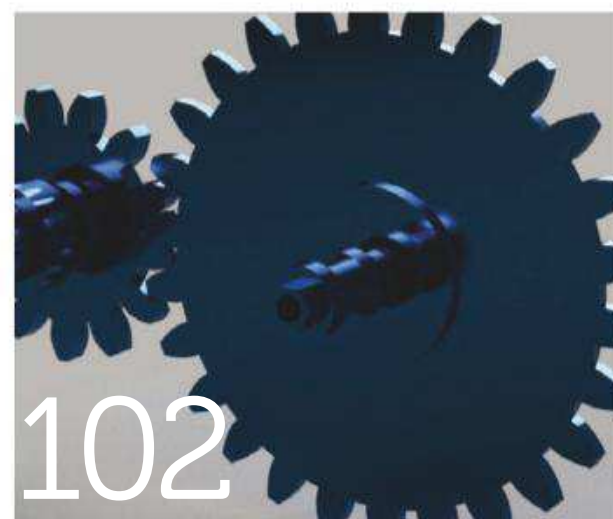
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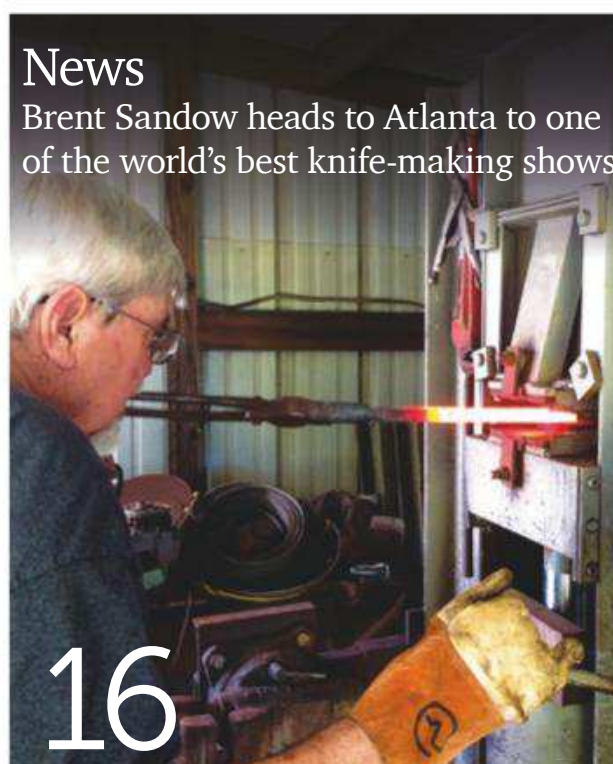
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EAT MY DUST



MINI CYCLONE AND VACUUM SYSTEMS ARE A WORKSHOP ESSENTIAL THAT WILL HELP TO KEEP THE PEACE

By Des Thomson

Photographs: Juliet Nicholas

In any workshop, dust is a health hazard and an annoyance, but when your workshop has direct access to the house it also becomes a matrimonial issue. My workshop takes up two bays of a three-bay attached garage so it is very important to keep everything clean so workshop debris does not end up being carried inside.

To keep dust under control I have fitted each of my woodworking machines with its own mini cyclone and vacuum system (*Image 1*). This means that when I need to move machines about to create work space the dust collection continues to work.

Cyclones are very effective at removing large and small particles of dust. The cyclones that I have made easily collect

sawdust from the saws as well as fine dust from sanding or jib stopping. When attached to an ordinary domestic vacuum cleaner the dust bag in the cleaner will last six months or more. In that time I will have emptied the 10-litre dust-collection pail many times.

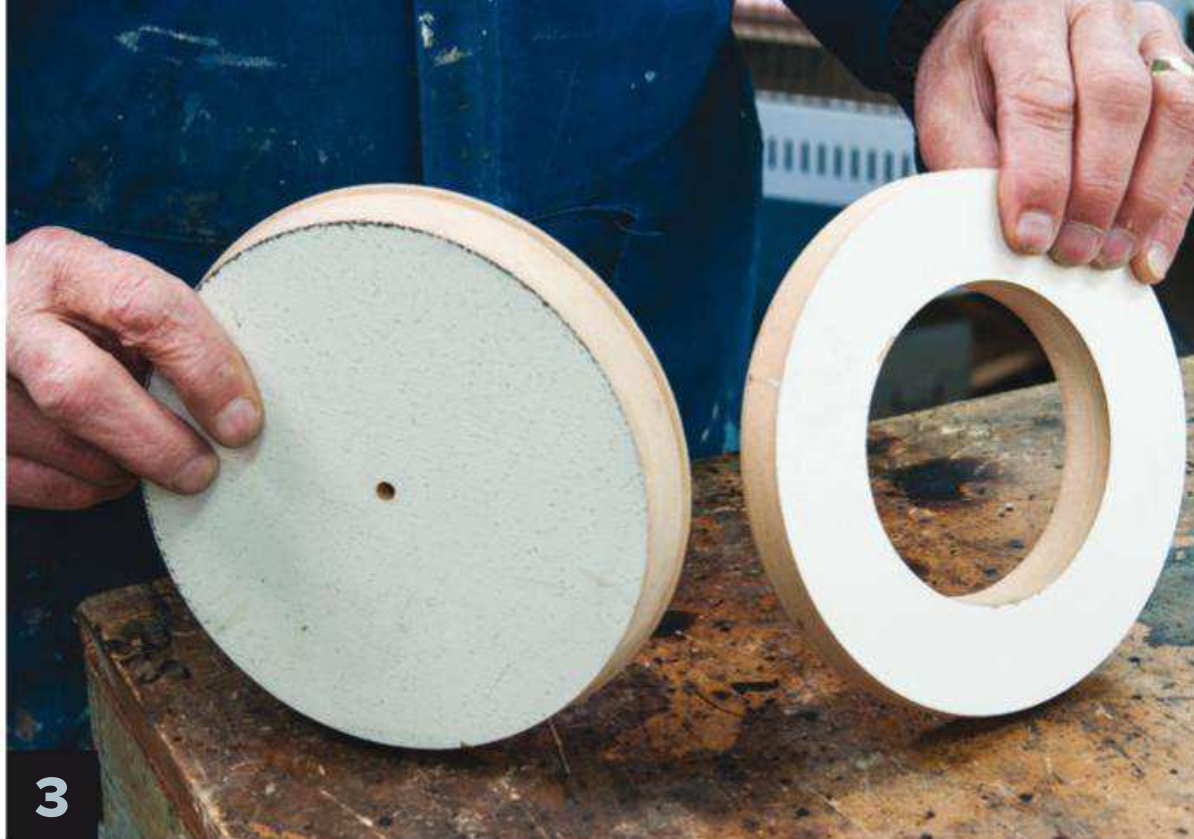
You can buy commercially made

Cyclones are very effective at removing large and small particles of dust

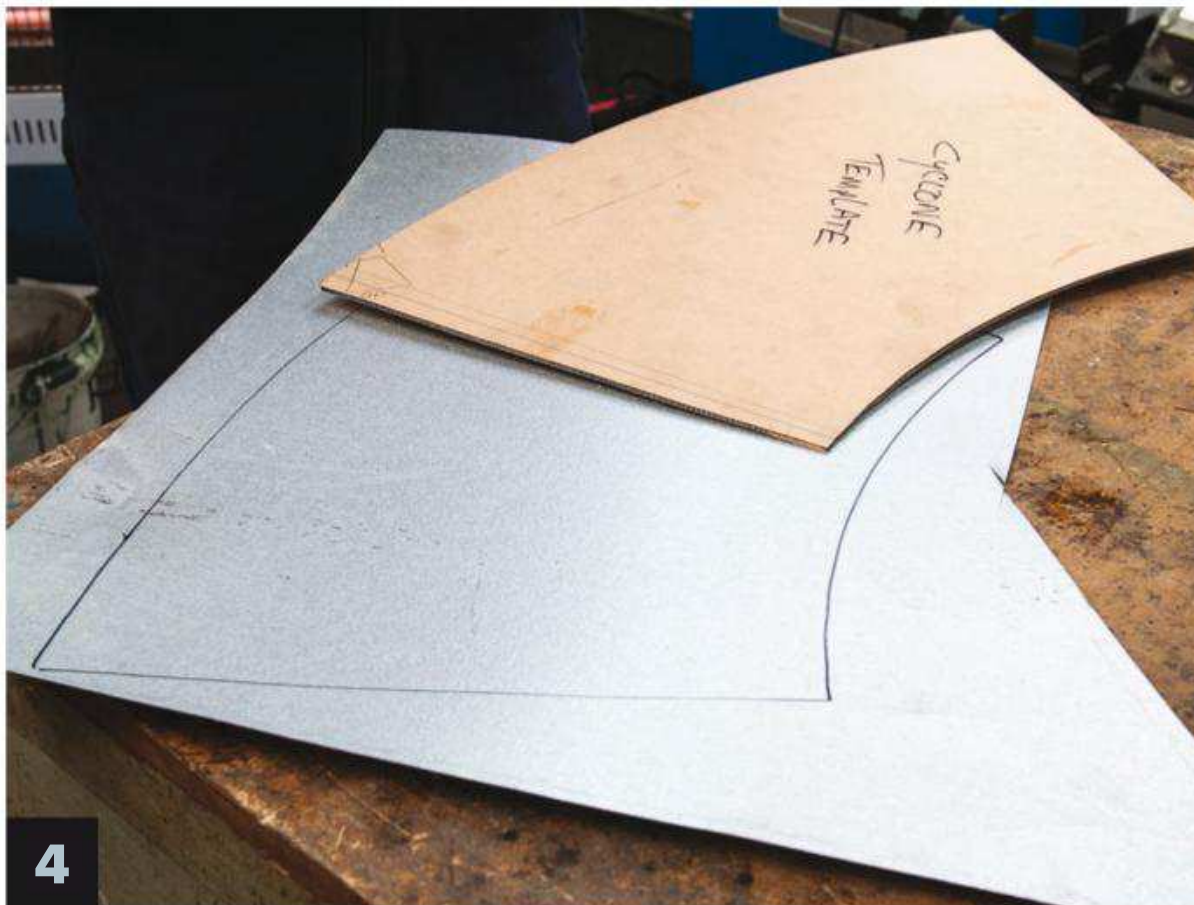
cyclones that fit directly onto a 10-litre plastic container, or you can easily make your own. In this article I will cover the four main aspects of building an effective system.

Cyclone design

There is a lot of very good information on the net about cyclone design. When I made the large cyclone for the Halswell Menzshed (featured in Issue No. 76, January/February 2018), (2) I got the design from the website of Bill Pentz (billpentz.com/woodworking/cyclone/). He has a spreadsheet in which you input the values and it will then give you the full development patterns for the sheet metal. ►

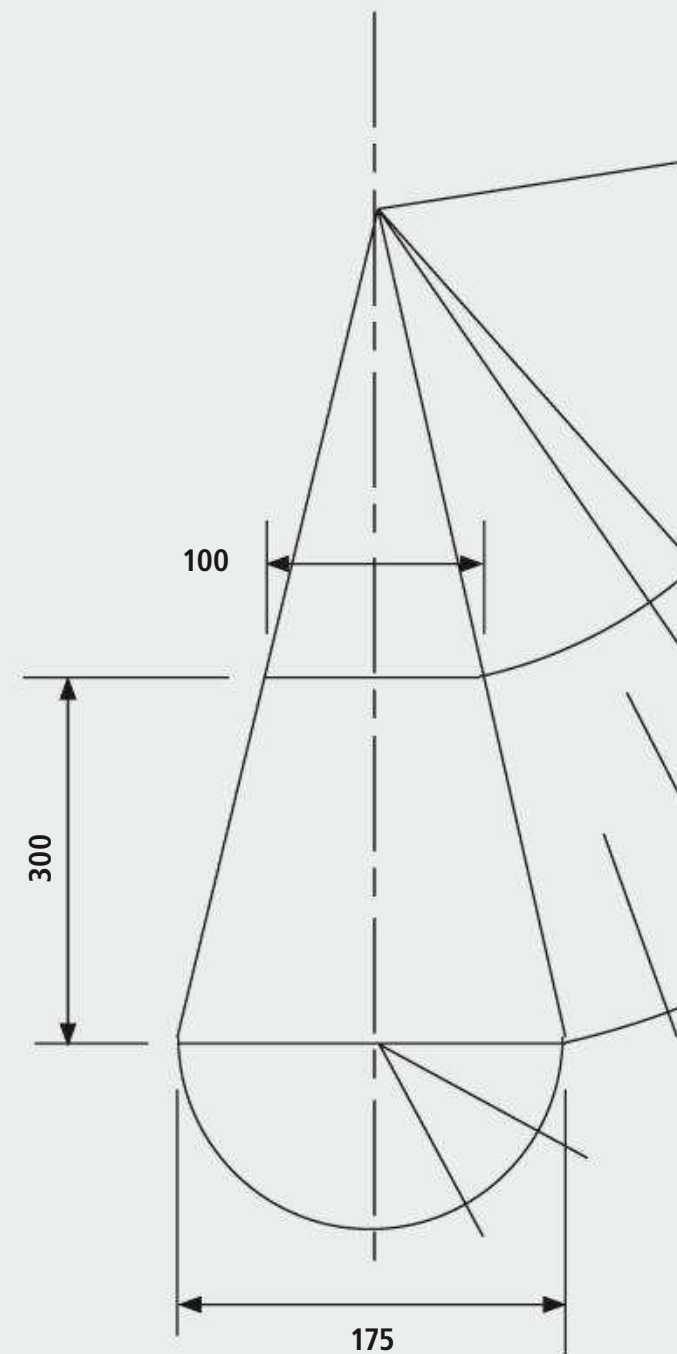


3



4

How to draw the development



► The proportions of my small cyclones are based on the approximate size of the commercially available Dust Deputy cyclone separator. Mine is 300mm high, 175mm at the top, and 100mm at the bottom. The dimensions are not critical.

The top and base can be made from 16mm MDF or ply (3). These can be cut using a jigsaw or turned in the lathe depending on what equipment you have available. I made mine on a lathe and left a small lip on the top edge of the top disc. The sheet metal of the cone comes up to this and makes a neat joint. Make the top and base before starting on the sheet-metal cone.

Making the cone

I used .6mm Zinalume for the cyclone sheet-metal cone. This is much easier to form into shape than Colorsteel. If you

approach a roofing manufacturer that rolls roofing iron you can get off-cuts for next to nothing.

You can mark out the development of the cone (4) directly onto the sheet, or do it on cardboard so that you have the pattern for reuse. If you have never done a sheet-metal development before there are some good resources on the net. A flat-top cone is called a 'frustum'. The webpage craig-russell.co.uk/demos/cone_calculator/ has a nifty calculator that will give you the development dimensions. You need to add an extra 15mm along one straight edge so that you will have enough overlap to enable pop-riveting of the joint.

If you have a small set of sheet-metal rolls you could roll the sheet metal but it is just as easy to form it around a length of scrap pipe held in



6

of the cone



Extra for overlap



If you approach a roofing manufacturer that rolls roofing iron you can get off-cuts for next to nothing





Don't be concerned if it is not too neat — a paintable silicone sealant is used to get a nice external fillet

a vice (5). Graham Wheel from the Halswell Menzshed (with 52 years of experience working in stainless-steel metal fabrication) demonstrates what is required. The first step is to remove all the sharp edges. Graham has a nifty tool (6) for this but a file and sandpaper will do just as good a job. A wooden mallet (7) is then used to put a slight roll on both straight edges. The rest of the cone can then be formed by progressively bending the metal over the pipe (8).

Attaching the cone

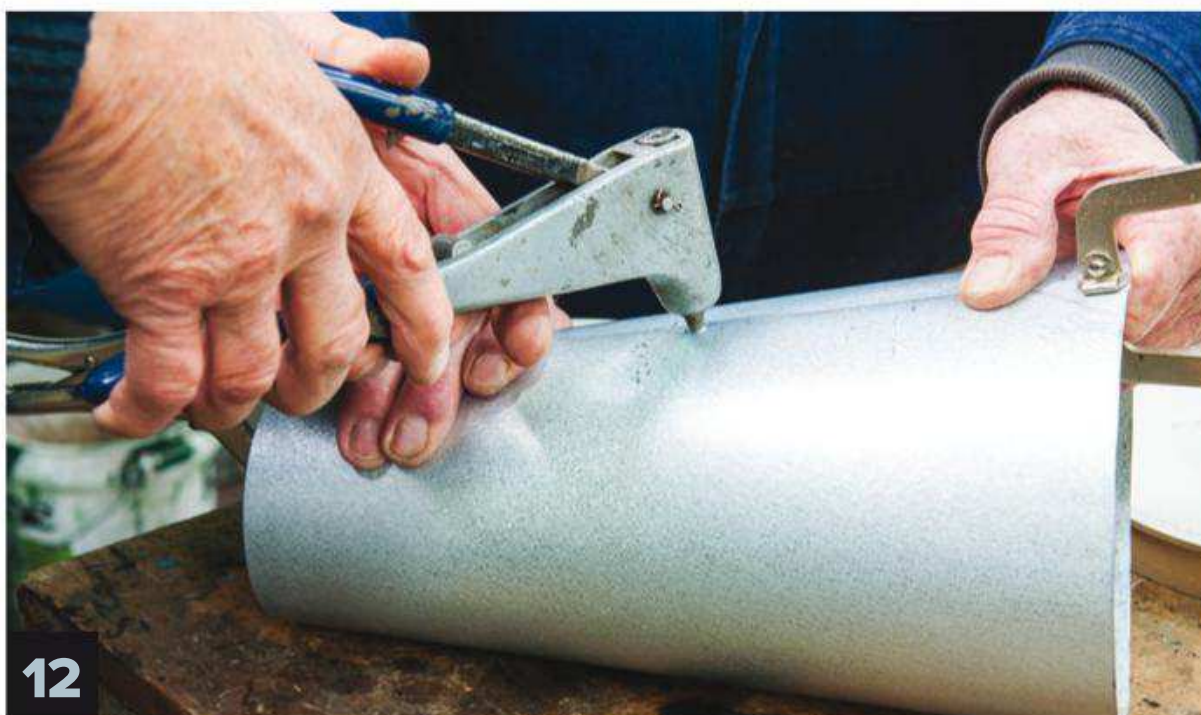
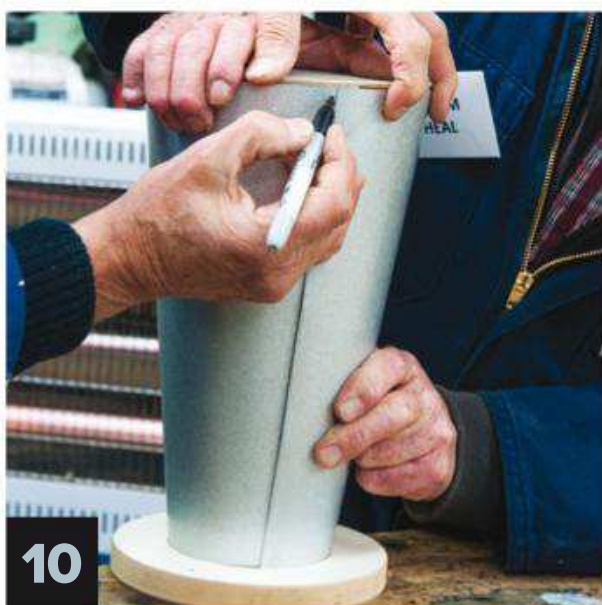
The next step is to insert the cone into the bottom ring of the cyclone and mark the edges of the join (9, 10). Do the same with the top. When you have done this, clamp the edges of the sheet to the marks and drill to hold it all together with four or five pop rivets (11, 12).

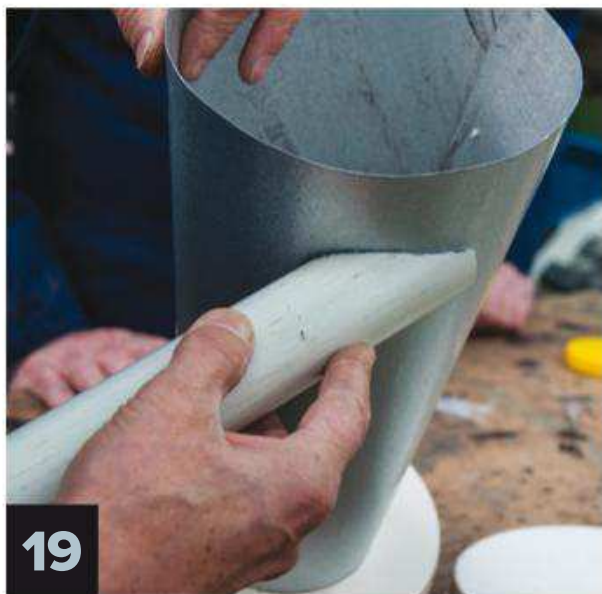
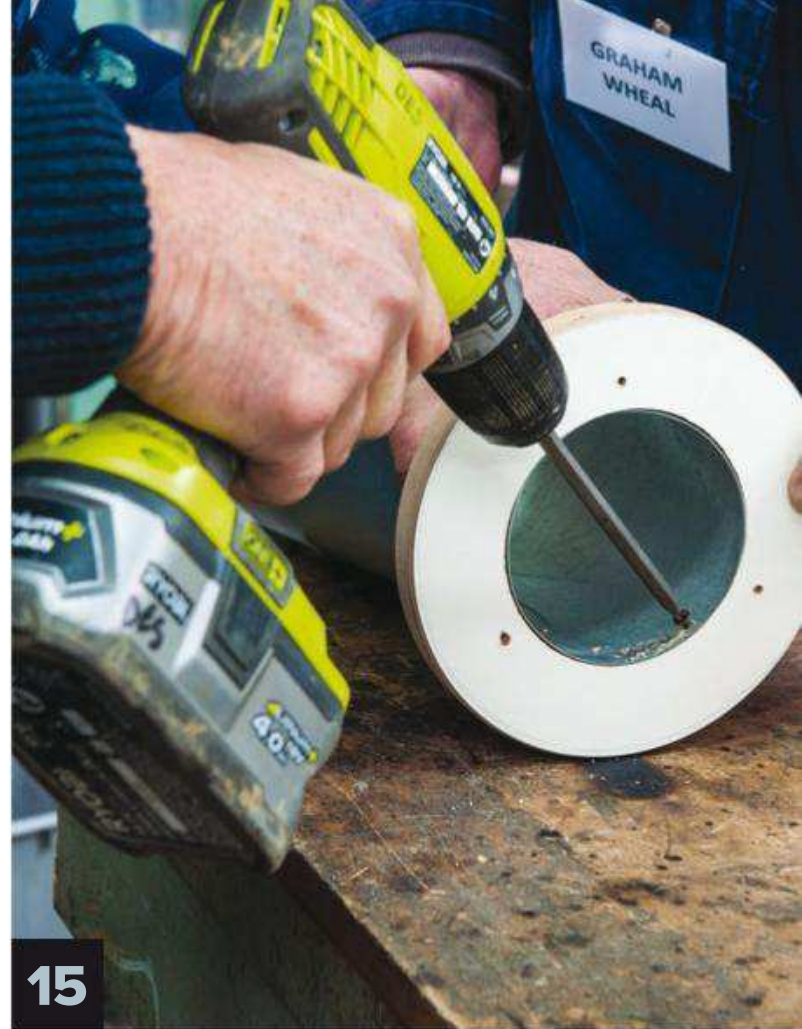
The base can now be attached by drilling and screwing. I use small wood screws for this (13–15).

The elliptical hole for the 40mm inlet pipe could have been worked out on the development and cut before forming the cone but there is another way. Take a length of pipe and by eye mark a radius on the end that matches the curve of the cone. Cut the pipe with tin snips to get a good fit to the cone and then use it to mark the ellipse on the wall of the cone (16–19). The hole can now be cut out using tin snips (20–22). If you take small cuts the job goes easily. Don't be concerned if it is not too neat — a paintable silicone sealant is used to get a nice external fillet.

Fitting the inlet pipe

It is now time to fit the inlet pipe. With tin snips make several 12mm long cuts in the end of the plastic pipe (23). The strips can now be heated with a hot-air gun and bent back with pliers to form tabs that can be pop riveted to the cone (24–26). ►







24



25



26



27



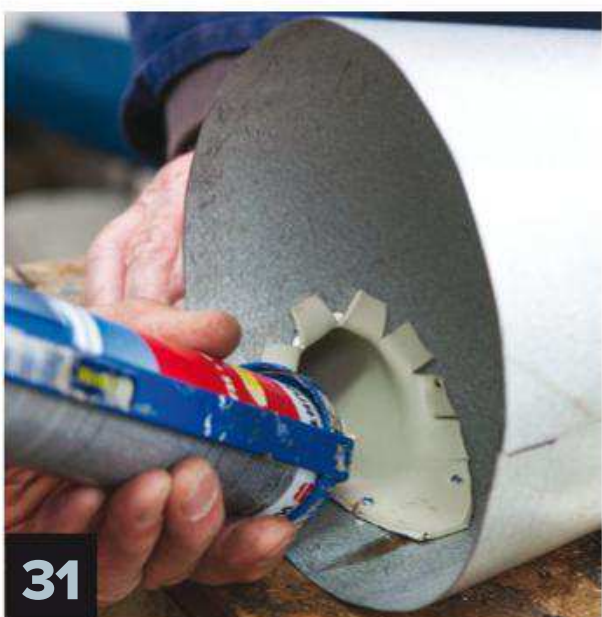
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31

If you take the time to make a cyclone dust collector you will wonder how on earth you managed without it

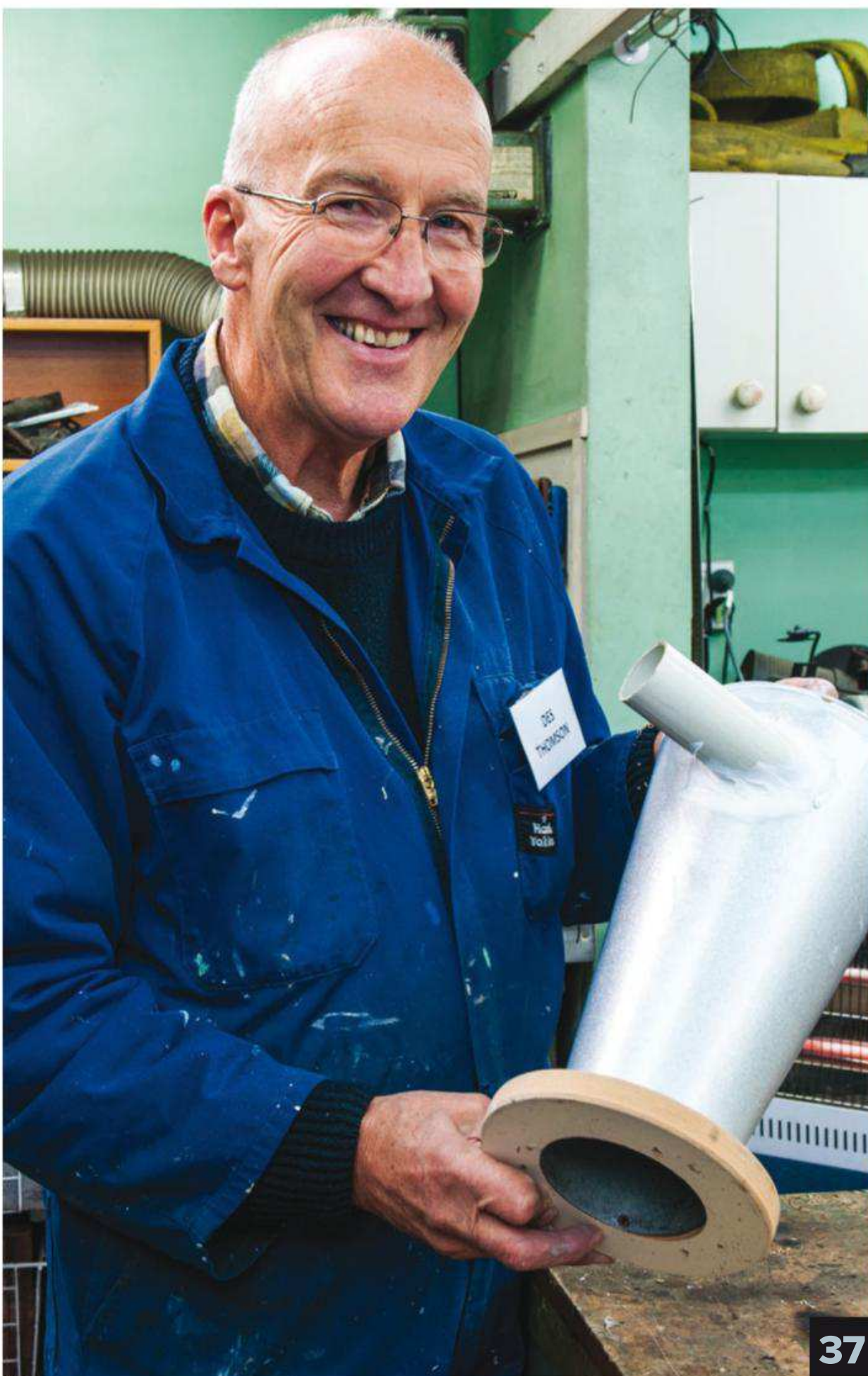
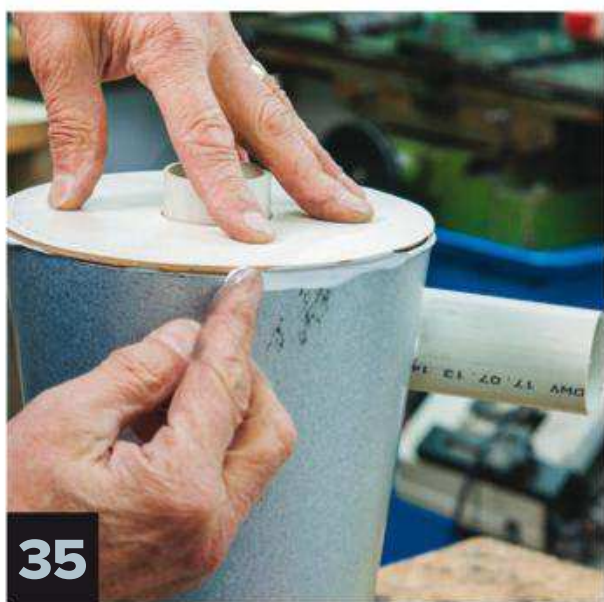
► Don't be concerned if some break off. All you need is sufficient to be able to get two or three pop rivets in place.

The inside of the cone where the inlet pipe enters can be smoothed over with silicone or body filler (27–31).

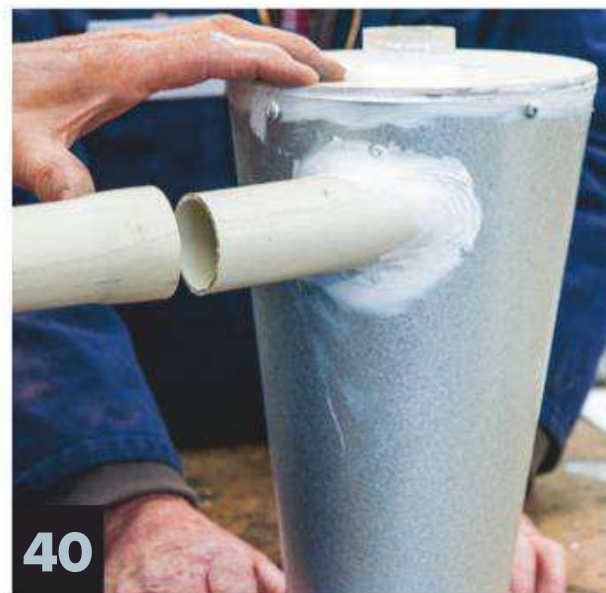
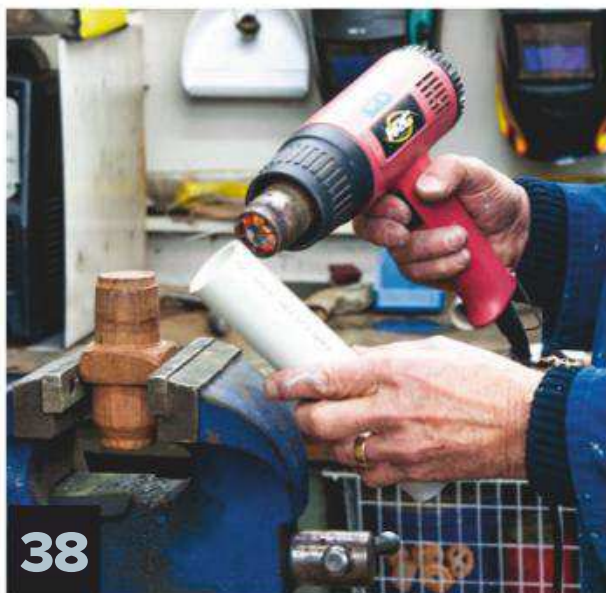
The outlet pipe leading to the vacuum-cleaner hose is fitted to the top plate next. This needs to extend into the body of the cyclone by 100mm. It is fixed by short screws into the top plate. Leave 20mm extended past the top (32, 33). The top can now be fixed in place with three or four screws and all the joins finished with a nice fillet of body filler or paintable silicone (34–36). You now have a cyclone that can be fitted to any 10-litre plastic bucket, four-litre can, or specially made box. I have found that it is not necessary to have any soft seal between the cyclone and the dust-collection bucket. I use a ply ring (37) to position the cyclone base in the right spot and the vacuum holds it down.

Hoses

I have three vacuum-cleaner hoses that can be joined together as required.



To make the push-fit connectors for each end of the hose is easy. ABS pipe is thermoplastic. If you heat it and form it into a new shape it will retain that shape when it has cooled. To make push-fit ends I have turned up a simple wooden former (38, 39) to push into the heated pipe. The die expands the heated pipe so that it will easily slide over the outside of another piece of pipe (40). Connecting these joiners to the vacuum-cleaner hose is done in the same way. Simply heat up the end of the joiner and push it over the



Any old vacuum cleaner will work

vacuum tube (41, 42). As it cools it will shrink to form an airtight seal.

Vacuum cleaner

Any old vacuum cleaner will work. Check out your local recycling centre or simply let friends and family know you are needing an old one for the workshop. I have been given two that were considered useless by the previous owners. With a new bag fitted and the filters blown out they work perfectly because there is such low air resistance through the cyclone.

Using the cyclone

Now that you have all the components made there are several options for using the cyclone. The first one that I made was a mobile unit. The body was made from 12mm scrap ply. Under the handle I mounted a double power point with a long extension cord wired in. The vacuum cleaner plugs into the power point leaving one spare for plugging in

whatever power tool I am using at the time. It is very good for collecting the dust from cutting MDF panels with the skill saw, or when using the orbital sander. I have modified the dust-collection ports on both of these tools (43) so that vacuum hoses will fit. I use this mobile unit all the time for general cleaning in the workshop.

A wall-mounted cyclone (1) collects dust from my disc sander and drill press. A 40mm pipe runs the length of the workbench with slide gate outlets at each machine. I used a four-litre tin can to collect the dust. This will last several weeks before needing to be emptied.

My home-made bandsaw and sawbench (44) each has a cyclone and vacuum cleaner that starts when the saw is turned on. Because of limitations of space on the table saw I made a rectangular dust-collection bin out of 10mm scrap ply.

If you take the time to make a cyclone dust collector you will wonder how on earth you managed without it.



Keep an eye out on our Facebook page and *The Shed* website for a video of this article



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Keeping sharp

THE BLADE SHOW IN ATLANTA IS THE ULTIMATE IN CUTLERY BUT AUCKLAND'S GETTING A TASTE OF THE ACTION TOO

By Brent Sandow

Every June I exhibit at the Blade Show in Atlanta, the biggest knife show in the world, and afterwards visit and work with fellow knife makers in the US. This year my host was Jerry McClure, a very talented knife maker from Oklahoma.

The Atlanta Blade Show is the world's largest cutlery show, which is open to the public for three days in early June, with some 750 exhibits dealing in everything cutlery related, with stands from

commercial knife companies, custom knife makers, knife-making suppliers, tooling, and engineering suppliers. There's nothing cutlery related that you can't get, whether it is carbon fibre, exotic handle material, or the latest grinders. Everything for fans of knives is here.

I always like to set up my stand on the Thursday, as it gives me a chance to not only whizz around and catch up with old friends and see all the latest trends but

also have chance to pick up the best handle materials and other supplies that I need myself before the doors open to the public on the Friday.

It was a hectic and very successful show.

We left Atlanta on the Sunday afternoon to head to Jerry's in Norman, Oklahoma, an 11-hour drive.

After recovering from the journey, we spent some days in his workshop forging Damascus billets, and we managed to finish a small kitchen-style knife from one of the Damascus billets that we made.

The completed one is made up of a 5160 hardened core with soft layers of rod iron and nickel each side. The handle is amboyna burl. The other one we worked on is much the same — I just need to handle it.

Jerry has an interesting set up, as he has four separate shops — namely the forging area, machine shop, grinding room, and



Left: Hanging with John Young — that's a dropped hunter that he made for me

his clean workroom, which is a 12m container, thankfully with air con, as it gets a wee bit warm in Okie.

We also drove down to New Mexico and Colorado to visit Eddie Baca, Michael Walker — inventor of the Walker Linerlock system — and Fred Otts, three extremely talented knife makers in their own right.

On my return to Jerry's, we spent time refining folder-making and assembly techniques. As always, I came away with some newly acquired knowledge that you only get by spending one-on-one time with truly skilled individuals.

All too soon it was time to come home. Where did those three weeks go?

Auckland Blade Show

Now remember, the first Auckland Blade Show is fast approaching. If you have any interest in knife making, collecting, or just have need of a good knife for outdoors or the kitchen this is a show you should not miss. In attendance will be knife makers; a knife dealer; Gameco — the knife-making supplies outfit from Masterton — and, of course, the official show sponsor, *The Shed*. All visitors to the show will go into the draw to win one of two knives donated by Shea Stackhouse and myself.

I look forward to seeing you there on 6–7 October at the Parnell Community Centre, 545 Parnell Road, Parnell, Auckland. For more info, email knifebug44@gmail.com.

Above: Hard to believe that some of the finest knives made anywhere emanate from this chaos

Below: Eddie, Jerry, and Marty picking out exotic handle materials at a place called Rare Woods in Atlanta



Jerry's chaotic machine shop



View of the Atlanta Blade Show



The Shed online



What's happening online at theshedmag.co.nz? Each week we upload new content on *The Shed* website joining the hundreds of articles and videos already on the site for readers to discover and enjoy.

The past two month's new uploads include:

- tackling stainless: a guide to welding stainless steel



- a video of master birdhouse builder Steven Price from Issue No. 79



- making a leather knife sheath



- a video of Whanganui glass artist, Carmen Simmonds from Issue No. 79.



These are just some of the new uploads to our website these past two months. Visit theshedmag.co.nz to enjoy even more.

The Shed is now on Instagram
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Letter
of the
MONTH

The abrasive material is sandpaper glued to a flat surface. I use the plate-glass top from a damaged set of bathroom scales and spray-on adhesive.

The drill bit is accurately positioned in the jig and pushed over the sheet of abrasive.

After a few passages across the surface the drill bit is repositioned and the other facet of the cutting surface is sharpened. The process is repeated until two good cutting edges are produced. It is rather a long and demanding procedure, but has the advantage that a completely inexperienced amateur can transform a blunt drill bit into a useful item.

I have seen seasoned metalworkers sharpen drills freehand on a bench grinder in just a few seconds and produce quality results. That is obviously a better way, especially for large bits, but requires skill which I suspect was hard won; there being plenty which can go wrong.

Steve Harris,
Christchurch

Drill sharpening

I was most interested in Andy Wilson's request for information about drill sharpening (*The Shed* Issue No. 74).

Pictured is the drill-sharpening jig [that] I use. It is the Eclipse 39, a British-made device whose inventor won the Invention of the Year competition for it in 1970. I have seen it described as "the best-value bit of kit ever".

Extraction info

In Issue No. 76 of the magazine was a story on Des Thompson and his camper-van build. In the story it mentioned Des built his own dust-extraction units for his machines.

I would like to learn more about how he made his units. Maybe it would make an interesting article to put in the magazine.

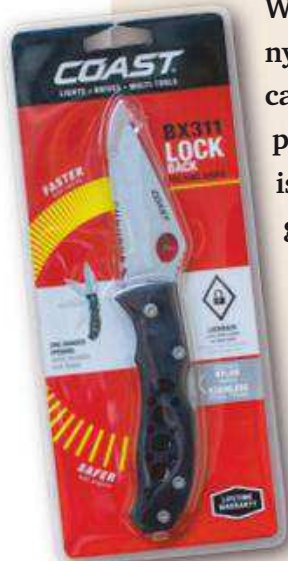
In anticipation,

Ken Eales,
Whangarei

Thanks for your letter Ken. Great minds think alike! As soon as we interviewed Des for that article, we too realized there was a story to be told about his unique dust-extraction system. Des is a busy man, but he has found the time to do an article for the magazine on his invention. See page 8 of this issue. — Editor



Letter of the month prize



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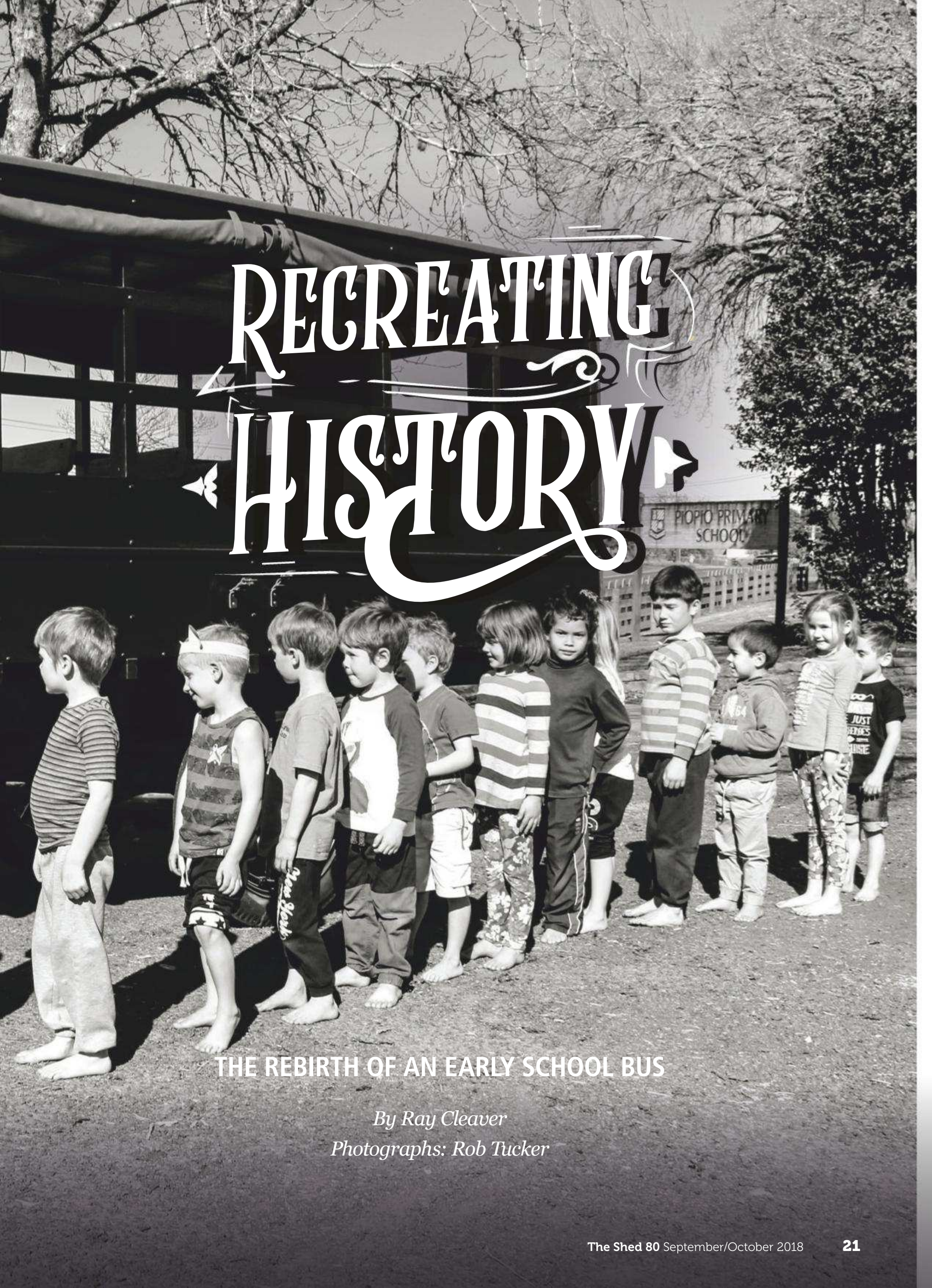


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Lining up for the new bus today



RECREATING HISTORY

THE REBIRTH OF AN EARLY SCHOOL BUS

By Ray Cleaver

Photographs: Rob Tucker



Above: The completed bus — seen as one to add to the series rather than a replica
Below: The project took Max Laver and Mark Carter eight months to complete.
Note the rear traverse springs — they make the ride a bouncy one



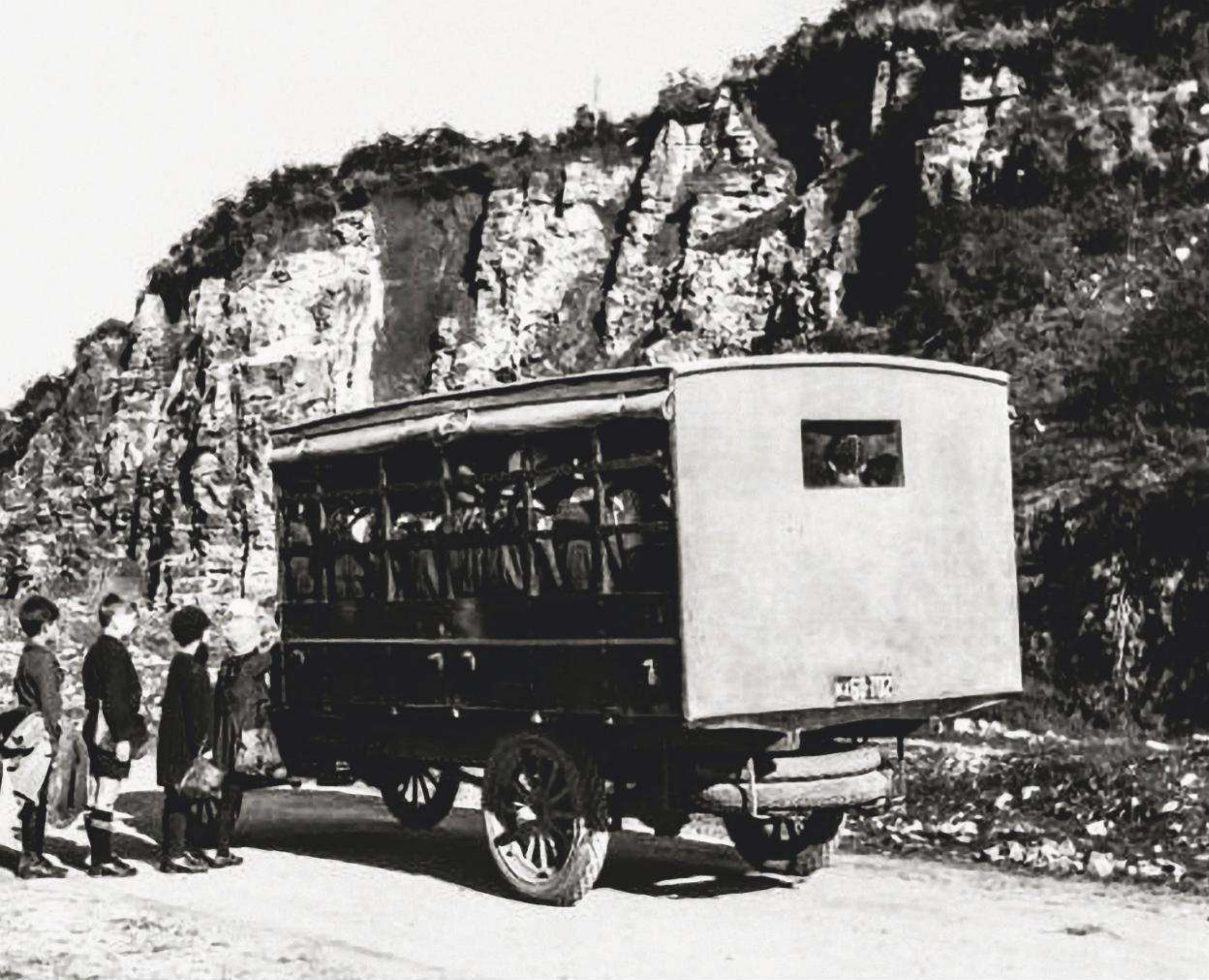
The first school bus in New Zealand was a Model T Ford (black of course), full of kids, that rattled down the bumpy roads of the little King Country town of Piopio in the 1920s.

In fact there were three of them back in the day, all Model Ts, covering the rural areas around the town. Each one was identical and carried up to 32 children.

Before that children walked or rode horses to local schools, and when Piopio school became the first consolidated school in the country in 1924, replacing many tiny rural schools, a bus service into the village was the way to go.

They were built by the Phoenix Bus Company and the three buses were delivered to transport children from the surrounding schools — Te Mapara, Paemako, and Arapae.

The original three buses have long



It began when Brian Tegg ... found a restored 1921 Model T Ford transport truck for sale in Auckland

since gone but now a perfect replica has emerged.

True community effort

It seems that the Phoenix Bus Company was well named, as like the phoenix bird of legend, the new bus has been reborn from the ashes of the old, so to speak.

A former principal of Piopio College, a local boat builder, and the whole

Mac timber

Max uses macrocarpa a lot in his building work — it's a wood that he's very familiar with.

For the bus, macrocarpa timber was used for the framing, sides, and roof. The mac bearers on the bus are shaped to be the same as the original and the frame was bolted and screwed together. The woodwork was then sealed and painted black in keeping with the original buses.

"Mac is an easy wood to work with," he says. "We use it a lot making furniture and boats. Oiled properly, it's very underrated for handling the weather. It stands the sun and rain OK and doesn't need treating.

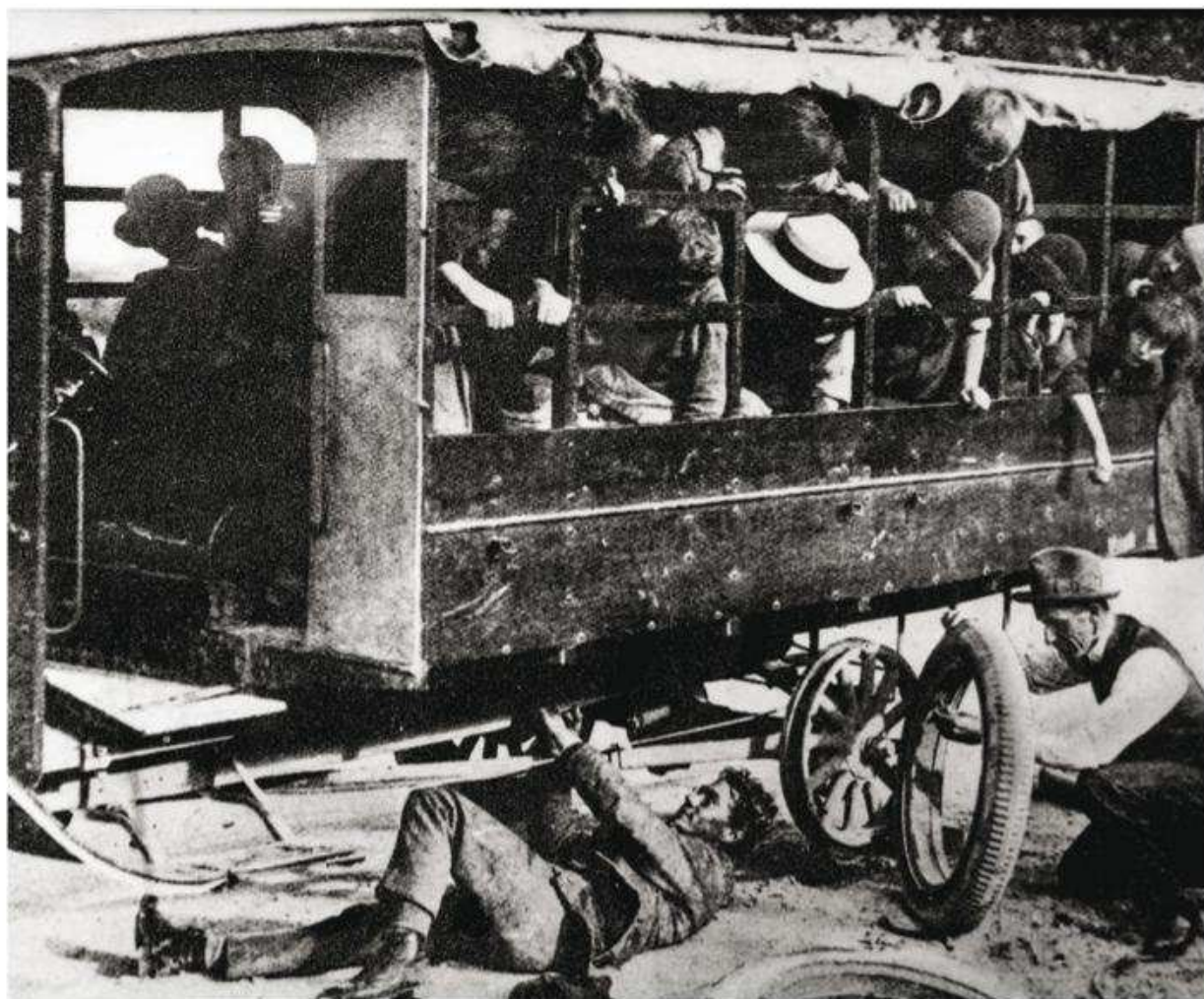
"The more I use it, the more I like it, and it's very easy on tools."



Max seals the versatile mac timber with his own blend of Danish oil.

He makes it up from one-third boiled linseed oil, one-third turps, and one-third Bondall Monocel clear timber varnish.

This mixture soaks well into the wood and may require up to seven coats.



Left: Changing a tyre in the old days looked a bit dangerous. Note the kids still on board
Below left: The three original buses at the school

A town's unique heritage

A pair of original Model T kerosene lamps were found and fitted, and the bus still has the original 6V electrical system it came with.

New canvas sides were made up.

Mark is a sailor and he obtained a roll of canvas and had the know-how to sew them up.

Max is a marine surveyor and boat builder. He and his wife Rachael run Laver Marine Ltd, based on the main street of Piopio. The company makes small, high-quality boats to order, and furniture.

One may well ask what a boat-building business is doing in a small landlocked town a long way from the sea. That question was answered in the last issue of *The Shed*, No. 79, when we featured Laver Marine's specialty boat building and its unique range of boats, built by hand with care.

"The bus was fun to build. I'd love to build a tram or train carriage one day," says Max.

The bus is taken out for local Christmas parades and other King Country events.

"It's a piece of the town's heritage," Max adds.



community rallied to recreate the Model T Ford bus, identical to its forebears.

It began when Brian Tegg, an ex-principal of Piopio College, found a restored 1921 Model T Ford transport truck for sale in Auckland and bought it on impulse three years ago.

Realizing that it was a unique opportunity to transform it into a bus, he got the Piopio College Trust and the local community behind the project.

Local fundraising by the Piopio College Trust, a Givealittle crowdfunding campaign, and support from many ►



The canvas sides



Max Laver sorting timber in his Piopio workshop

“I was a little concerned about the rear overhang but it had the supreme test when the completed bus was carted down to Parliament in Wellington to publicize the project”

The original buses were purchased as a chassis and front section with motor — originally, it took six weeks to build each one

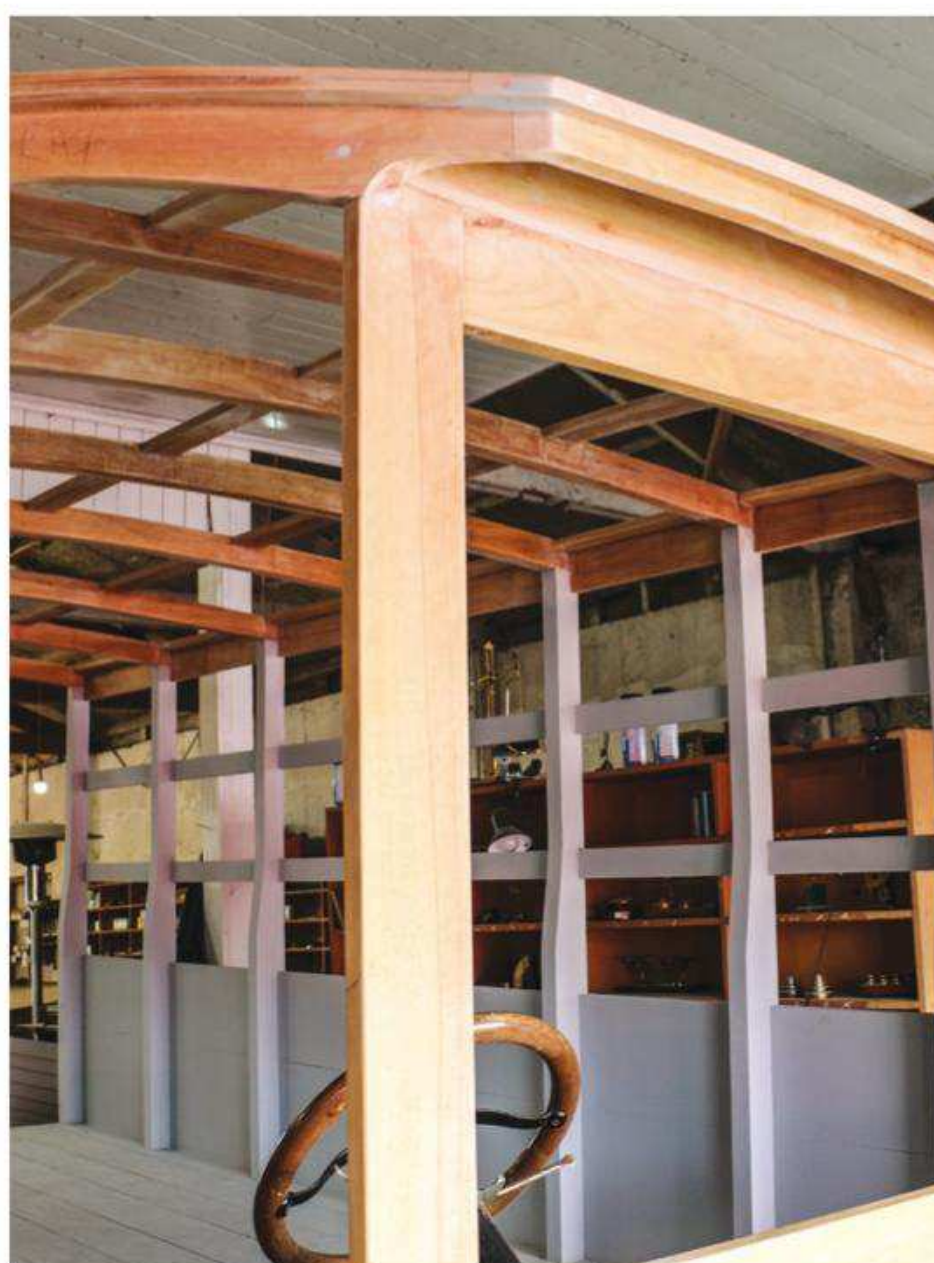
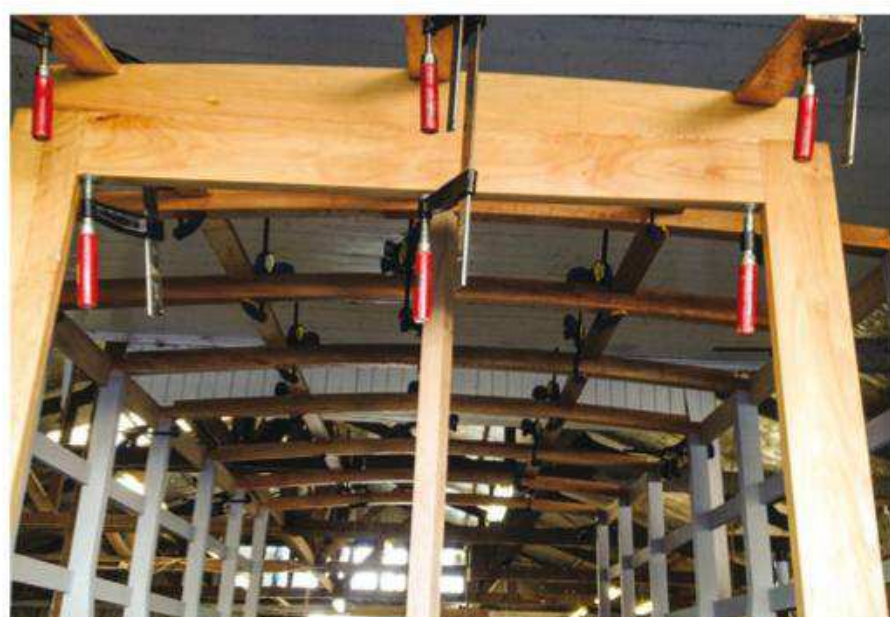




Piopio kids enjoying a ride



The interior of the new bus





Above: The specifications for the bus were sourced from Archives New Zealand and followed exactly

► local people and businesses made the project happen.

Piopio is a small town of just 400 people but they have pride in their history.

Local boat builder Max Laver became involved in the project, transforming the truck into an exact copy of the early buses.



The final stage



Brian Tegg said that while the replica bus is now completed as a result of generous local funding, the Piopio College Trust is about to embark on the final stage of the project. "This is the building of a display garage in the main street of Piopio to house the bus and outline — in pictures, print, and video commentary — its historical significance and reconstruction history.

"The discounted support of Totalspan, provider of over 400 rural bus shelters for students throughout New Zealand, in conjunction with Allied Concrete and New Zealand Steel, has brought this project almost to a close. "An extra \$3K will enable a higher quality of presentation. Donations to the trust's account (03 0449 0107019 01) would be much appreciated," he said.

Staying true to the original

Max was insistent on following the specifications from Archives New Zealand and photographs that were taken by the *Auckland Weekly News* in 1924.

Max said that wooden boat building and old-style coach building are not that far apart, especially the making of the wooden bearers, frames, and sides for the bus.

The project took Max and Mark Carter eight months to complete, and Max said

the finished product is a 95-per-cent accurate copy of the original.

The specs and the original tender information submitted by the Phoenix Bus Company — thought to be the successful tenderer for the buses — were used, but a lot of the sizing was taken from old photographs.

Politicians get on the bus

First the chassis had to be extended by 700mm. "I was a little concerned about the rear overhang but it had the supreme



The final stage of the project will be the building of a display garage in the main street of Piopio to house the bus and its reconstruction history

“We don’t see this bus as a replica. The Phoenix Company built three buses and this is the fourth”

test when the completed bus was carted down to Parliament in Wellington to publicize the project,” says Max.

“Twenty MPs jumped on for a ride. Some of them were of a good size and I got a bit of a fright. It was double the weight of a bus full of school children.

“The bus handled the extra weight well — it was quite a relief.

“The original buses were purchased as a chassis and front section with motor. I think it cost about £60 for the coachbuilders to make them into buses. It took six weeks to build each one. They had wooden sides with canvas drop-downs.”

“We don’t see this bus as a replica. The Phoenix Company built three buses and this is the fourth.”

The new bus has ‘Arapae’ written on the front, one of the areas the first buses serviced.

The Model T



Max and the completed bus

The famous Model T Ford, also known as the ‘Tin Lizzie’, was in production from 1908.

It had a top speed of 72kph and the 2.9-litre engine produced 15kW. On 1 October 1908, the first production Model T Ford was completed at the company’s Piquette Avenue plant in Detroit. Between 1908 and 1927, Ford would build some 15 million Model T cars. It was the longest production run of any automobile model in history until the Volkswagen Beetle surpassed it in 1972.

Henry Ford’s Model T quickly became

a kind of default American car; at one point it accounted for half the cars in the US.

Although the Model T was neither the first consumer car nor the cheapest, nor even the first assembly line-produced car, it was arguably the best combination of these elements. Ford made a sturdy car that could deal with the incredibly bad roads of the time, at a price that regular people could conceivably afford. His innovations with assembly line manufacturing further drove the price down and improved wages for his factory workers.

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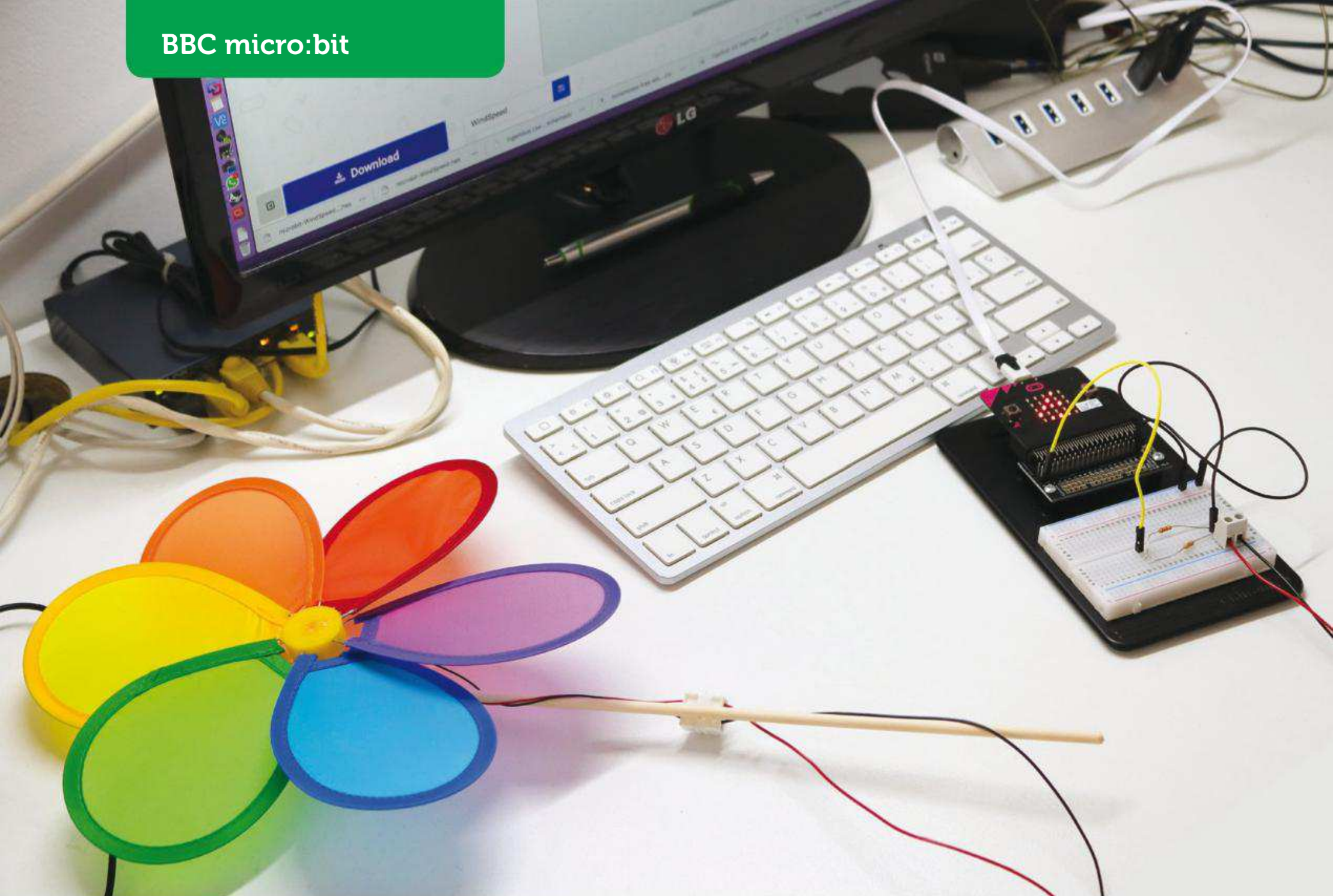


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BLOWING IN THE WIND

USING A KITRONIK KIT TO BUILD A WIND MACHINE

By Enrico Miglino

Photographs: Enrico Miglino

During the past couple of years, an entire ecosystem has grown around the BBC micro:bit board. Today, a wide choice of educational kits based on that microcontroller platform is available on the market. I will be presenting *Shed* readers with a different project every issue, exploring the available kits for the BBC micro:bit, their features, and possibilities.

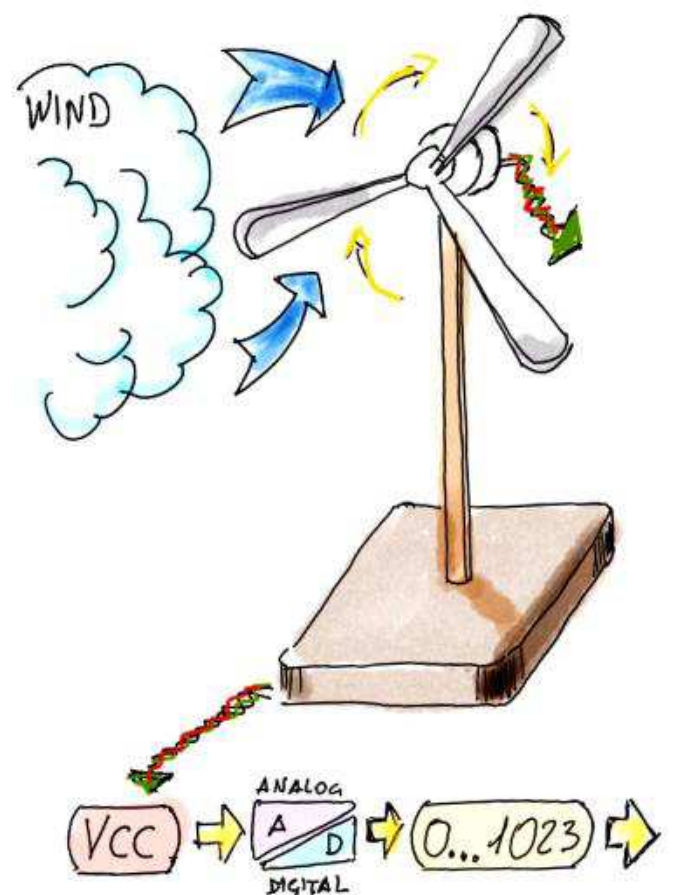
This issue's project is based on the Kitronik Inventor's Kit (kitronik.co.uk/5603-inventors-kit-for-the-bbc-microbit.html) used to create a wind machine, with the valuable collaboration of Xavi, a young enthusiast maker.

The kit

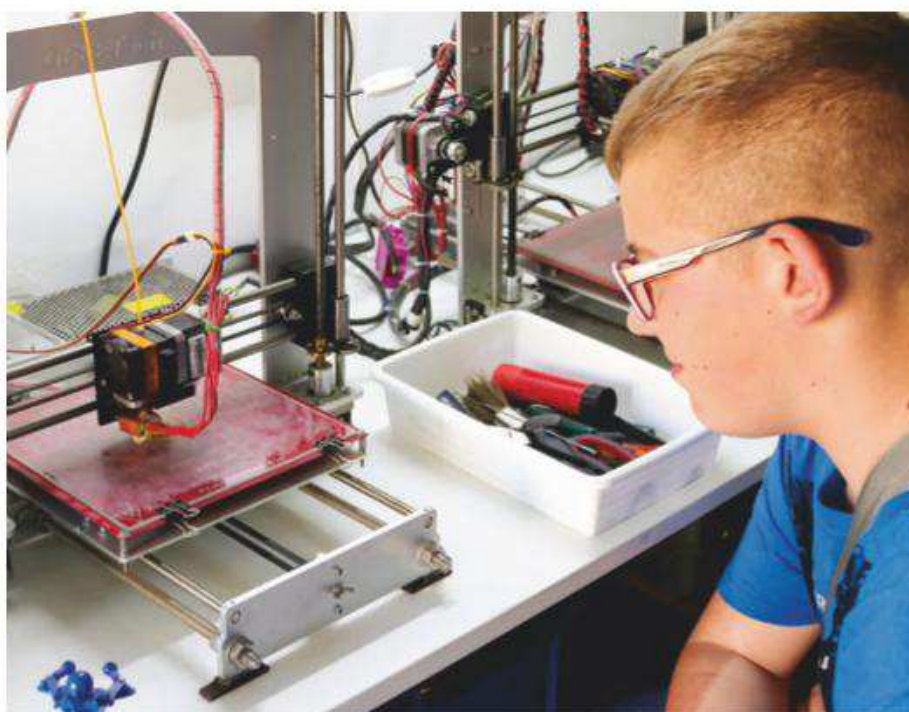
Kitronik's kit includes a considerable variety of components from which to create many different electronic projects. From resistors to capacitors and LEDs, to transistors, and more, the box contains all that is needed for a basic electronics course. The only detail that I found was missing is a servomotor with the included DC motor.

Power of the wind

The wind machine is a scale model of a wind generator. This will go some way to helping you understand in practice how the 'green' wind force can be converted into energy through a generator, in ►

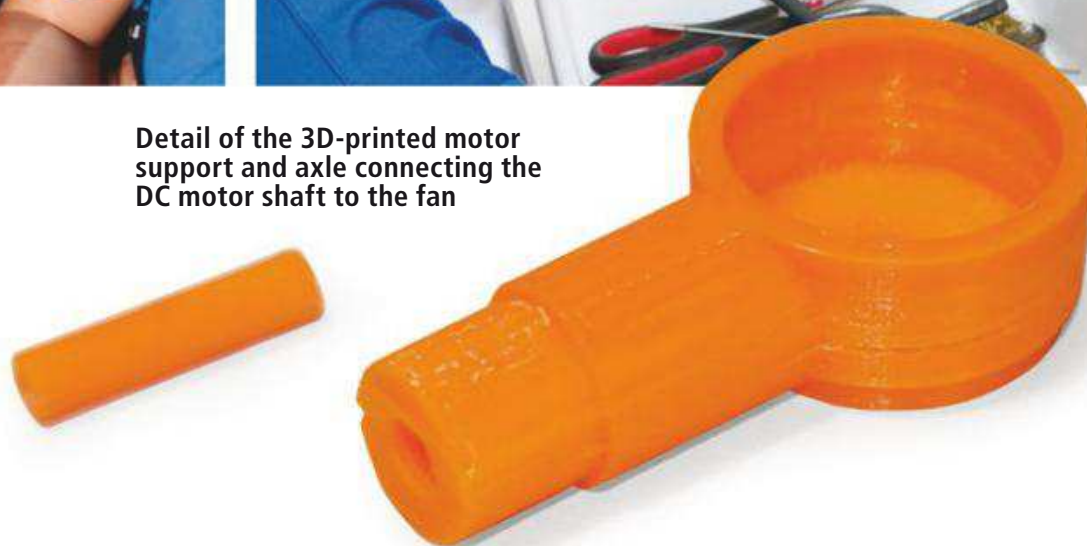


Above: The simple scheme I used to introduce the principle of generating energy using the wind, and how to measure the wind speed
Top: The finished wind-machine prototype with the micro:bit connected to the PC through the USB cable, ready for software coding



Above: Watching the 3D printer building an object before our eyes is always something hypnotic. We had to wait about 20 minutes for the generator support and the fan axle to be printed

Detail of the 3D-printed motor support and axle connecting the DC motor shaft to the fan



Below: The Kitronik Inventor's Kit components and the parts we added to build the wind machine. From left to right: the Kitronik micro:bit connector base with the breadboard, the fan (its original plastic pole has been removed), the wooden skewer pole, and the 3D-printed components

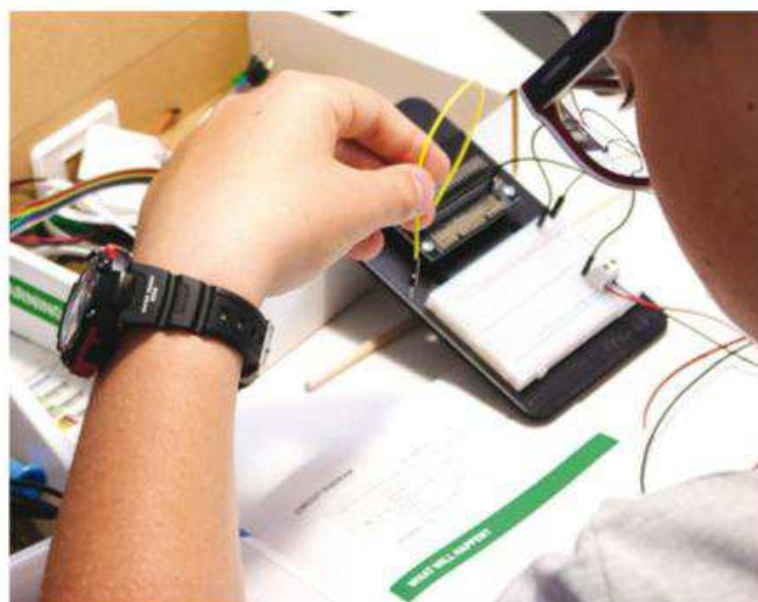


Below: Testing and mounting the motor and the fan together. To firmly keep the parts in place, the 3D-printed tube axle was hot glued to the DC motor shaft and the fan's central hole





After the moving parts were assembled, using the breadboard of the micro:bit connector base, the simple circuit of the generator was wired



► case the DC motor included in the kit.

As we can also use the micro:bit to measure the quantity of the converted energy (the increasing voltage), this same model can also be used as an anemometer to measure the wind speed.

Building the wind machine

To build our prototype, I sourced, as usual, some cheap stuff from my local Asian supplier and a hot glue gun.

A toy fan is perfect for connecting the

generator. To keep it in place, a small plastic support was 3D printed to hold the motor in the rotating fan, while the support pole was made from a 30cm long barbecue wooden skewer.

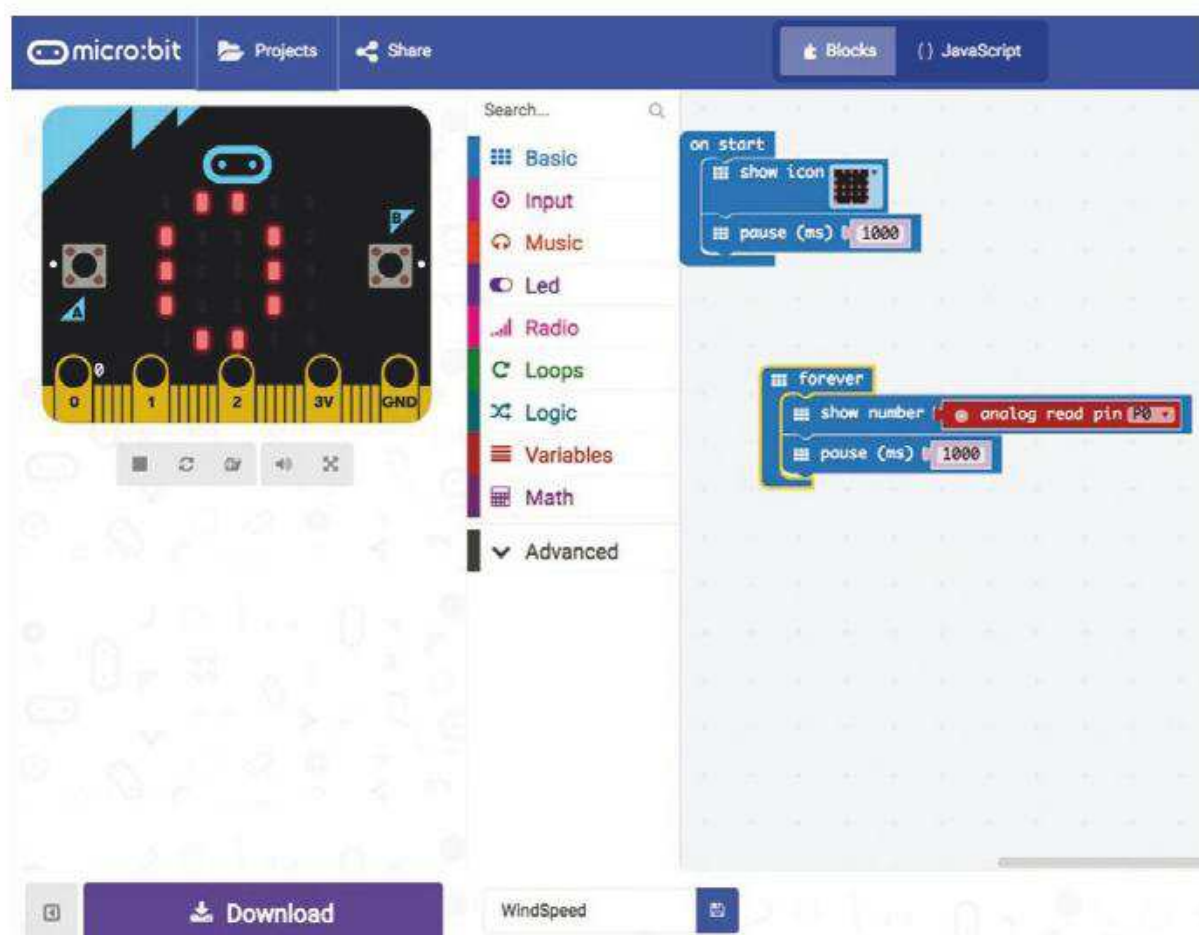
After preparing the wind generator with the help of Xavi, the next step was wiring the circuit. The connection to the micro:bit is made easy using the breadboard included in the microcontroller board support. The positive (red) wire of the motor (the generator) is connected to pin 0 of the board to convert the current into

a numeric value. As a matter of fact, pin 0 of the micro:bit is also an analogue-to-digital converter. The negative wire of the motor is connected to pin 1. Every time pin 1 is set to zero, the circuit closes and the current value can be read by pin 0, acting as an analogue-to-digital converter.

Instead of connecting the negative (Ground, or GND) motor black wire to pin 1, it is also possible to connect it directly to the microcontroller ground pin. Using the digital pin 1 helps save



Above: The very exciting moment when the wind machine ran as expected
Below: The simple code source for the wind machine written in blocks



the battery — the circuit is active only when pin 1 is set to low.

To enable the circuit, one of the micro:bit buttons has been programmed to change the status of pin 1 to low when it is pressed. The converted analogue value read from pin 0 can be displayed on the LED matrix display of the board.

As you can see from the photographs, after a few minutes of shyness, the building process with Xavi developed into the makings of a nice game. A very serious game, catching the attention of Xavi, who enjoyed the act of participating and actively contributing to the project. He is already a passionate Lego builder and enjoys any activities involving discovering and assembling new things.

On The Move





Above: Changing the polarity. The earth lead is switched to positive and the electrode to negative



Establishing the 90-degree corner

A MOUNTED STOCK CRATE IS STRAIGHTFORWARD TO MAKE AND SURPRISINGLY VERSATILE

By Jude Woodside

Photographs: Jude Woodside

Farm life, even on a pocket-handkerchief farm like mine, means that you will need to move stock from time to time. I run a few cattle beasts and a few goats. I plan to get a few sheep soon, too. The issue with stock is moving them. Moving the cattle is a different story but for the smaller stock I could carry them either on the tray of my ute or my trailer if either had a stock cage.

I decided that building a cage could be an easily achievable project and so it has proved. It has value even if you don't have stock — it certainly increases the options for your trailer. It is a lot easier collecting firewood with a cage, even transporting rubbish or green waste. In the case of the latter you might want



Tacking the joint

It has value even if you don't have stock — it certainly increases the options for your trailer

to make the end hinged rather than incorporate a gate, to make it easier to unload the waste.

Having spent a few weeks checking out every stock crate that passed me — and living in a rural area that's quite a few — I settled on a suitable design. At first I thought I'd go with a design

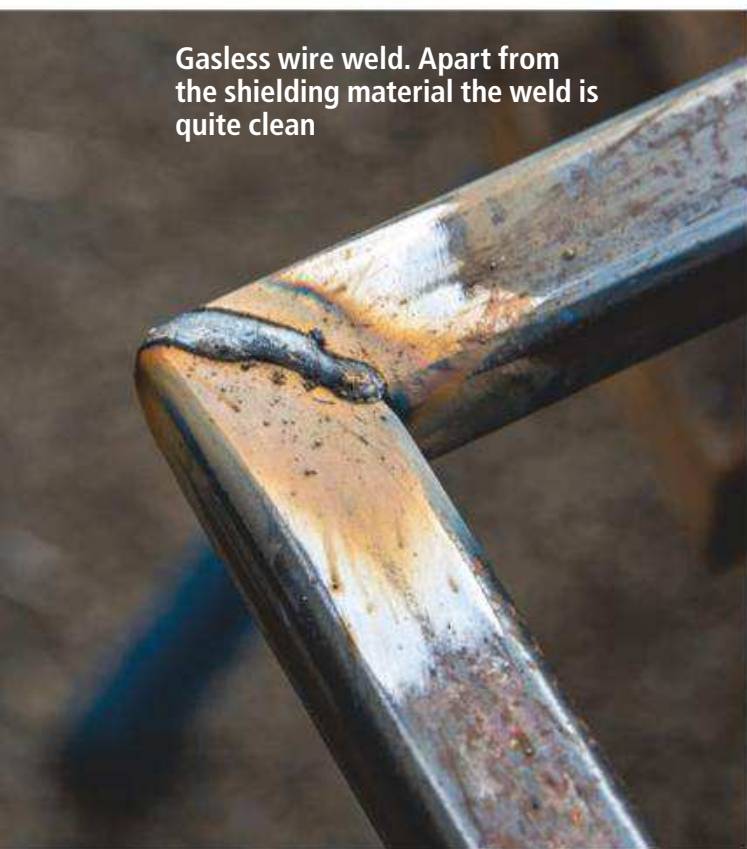
that featured a sliding door. They are quite popular, however in the process I changed the design to a hinged door for reasons of space and for ease of construction. The sliding door takes up more room both for the door and the hardware, rails, etc., to make it work.

Flux core

I elected to weld the parts together with gasless flux-core wire, specifically BOC SmoothCor GS. I figured that the size of the crate would mean that it was easier to work outside. Any kind of breeze can make gas-shielded welding ineffective especially outside so it was a no-brainer really. Flux core is similar to stick welding where the stick carries a



Welding the joint



Gasless wire weld. Apart from the shielding material the weld is quite clean



Above: Cleaning off the welds

Any kind of breeze can make gas-shielded welding ineffective especially outside so it was a no-brainer really

chemical that ignites from the arc and generates a gas that effectively shields the weld. In the case of flux core the wire is hollow and contains the chemical that shields the weld like an arc rod turned inside out.

The flux contains deoxidizers that scavenge oxygen out of the weld to produce a clean, solid weld. Slag forms over the weld as it cools to protect it from the atmosphere. The flux also contains arc stabilizers to produce a smoother arc and less splatter and vapour-forming compounds, which provide the gaseous shield needed to protect against oxidization. The wire itself contains more alloys of carbon, manganese, and silicon than normal wires for stiffness and better weld-metal properties. The gasless, flux-cored process does not have as fast a deposition rate as hard wire or

flux-cored wire using a shielding gas.

Gasless flux core does have a reputation for being able to weld over painted or rusty surfaces. It will handle galvanized surfaces, except the heavy depositions that hot-dip galvanizing leaves.

Polarity

The first thing you need to do for gasless welding is to reverse the polarity. The earth is now positive and the electrode is negative. On my machine there is a synergic setting for gasless wire but it is set up for .9mm wire and I only used .8mm. I figured it would work anyway and it did. I found it better to tune the machine to weld for about 2.6mm instead of the usual 3mm. That tended to slow the deposition down enough so that I could work easier with it without burning through. ►



The zinc was especially messy



Preparing to weld the centre support



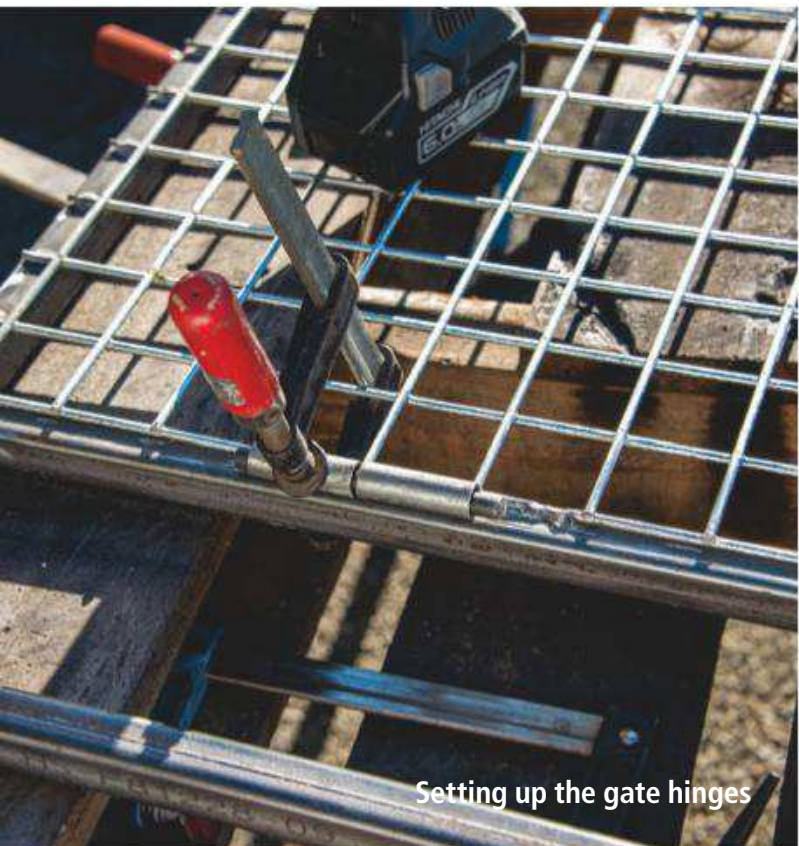
Cutting the mesh to size



Welding the inside joint



Attaching the mesh



Setting up the gate hinges



Welding the pipe hinge



Attaching the gate side hinge to its plate



Preparing to weld the back of the hinge

This was hot-dipped galvanized so the zinc was quite thick and tended to bubble



Welding the gate hinge in place

► Be careful that you don't crush the wire in the wire feeder. If you are changing from solid wire, back the tension off a few turns or reset it so that the tension is just enough to get the wire feeding, then add another quarter turn.

Gasless wire is exactly like arc welding in that the weld leaves slag that needs to be cleaned off. You can't simply weld over a bad joint. It must be cleaned first, either with a slag hammer or a wire brush, although I found I didn't have to use the hammer much. I tended to grind off the welds before welding over runs. As it does leave a slag you must alter your technique so as to drag rather than push the weld puddle — if it's slag you drag — as you would for arc welding.

Fumes

You should also avoid breathing the fumes, and there are plenty of fumes and smoke. It's probably not a bad idea to wear a respirator although I didn't, preferring to hold my breath when I needed to. The process is messy; it leaves a deposit on the work and on your helmet. I found that I had to stop and clean the visor regularly, removing the plastic protective lens and cleaning both sides. The fumes penetrated behind the lens. It is worse of course when it comes to welding galvanized steel as you also get the fumes from the zinc that you must avoid breathing. They are toxic and will give you zinc poisoning, which is not nice — it's a bit like a bad flu.

Getting started

I ordered some 25mm square tube as I'm only dealing with fairly small livestock. I had initially also ordered galvanized steel mesh, not thinking what a pig it would be to weld, but more of that later. Fortunately I only ordered two sheets of it and ordered black steel for the other two.

I started by cutting the steel for the two sides and one end. The internal sides for the trailer are 1800mm so I made the sides of the crate 1750mm to allow for the depth of the ends. In the



Attaching a hinge to the side and back

end I made one end fit inside the sides to give me more room at the tailgate end.

The sides were uneventful. I cut them to size, squared them up, stitched them together, and welded the ends. I have found that welding the outside edge of the mitre joint once you have the pieces tacked helps to prevent any distortion. The weld as it cools pulls the ends together but doesn't tend to distort the joint.

I then turned the whole thing over and welded the seams on the other side. Then I turned it back to clean up the tacks and weld the seams again.

With the seams welded and cleaned

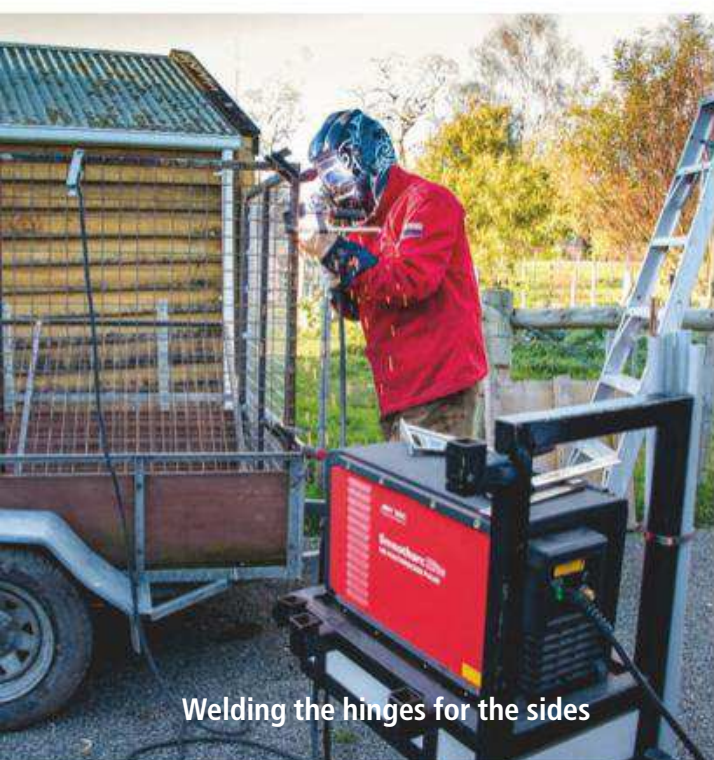
up I set the piece upright so that I could weld the inside seams. Then it was simply a matter of placing the mesh and cutting it to size and tacking the mesh to the frame. That took a bit of fiddling with the wire feed to get the right setting without burning through the 4mm wire of the mesh.

The end piece was similar but this involved galvanized mesh. Worse, this was hot-dipped galvanized so the zinc was quite thick and tended to bubble after the welding to create unsightly lumps and bubble under the welds to make craters. I tried to remove as much of the zinc as possible with a wire brush

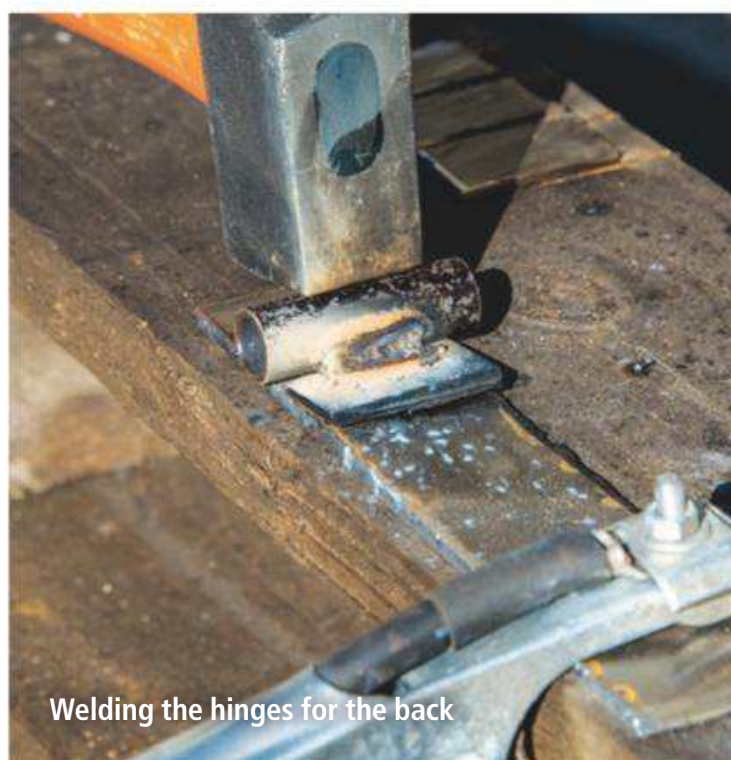
mounted on my angle grinder, to little effect. It just tended to shine the zinc.

Hinges

As mentioned earlier, the front section contains a door that was intended at first to be a sliding door. I elected instead to change it to a hinged door that fitted inside one half of the frame. To do that I welded two pieces of 3mm walled tube to the middle support using a piece of rod to keep them aligned. I then added the matching piece for the door that required a piece of 3mm flat steel to offset it slightly and allow me to weld that to the door. I used the piece of



Welding the hinges for the sides



Welding the hinges for the back



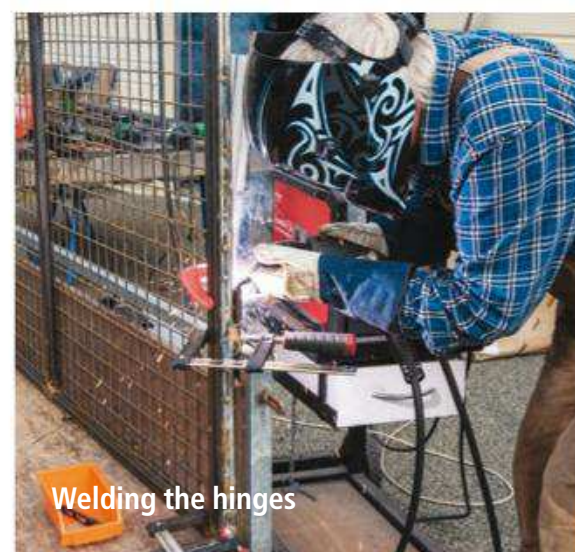
Attaching the hinge to the back



Fitting the front and gate to the sides



Clamping the hinge to the sides



Welding the hinges



The drop lock in place

*The pieces will now
have to be hot-dip
galvanized*

Holes

The last job was to disassemble the whole unit and drill 6mm holes at various places throughout the frame to allow air and steam to escape when it gets hot dipped. Putting the holes on the bottom also ensures that water can drain out later. Make sure that there are no enclosed areas because the heat of the hot-dip bath can cause the air to blow out explosively.

The final size of the cage means that I have to remove the rear door of the trailer but that is no real concern. I miscalculated the width of the end that fits between the sides because I forgot to account for the 4mm mesh added to each side. This meant that I had to use a hammer to get it to fit. However the upside is that it doesn't really need much tethering to the trailer. Later I will fit thinner sides to the trailer and alleviate the fit.

This is not the end of the process. The pieces will now have to be hot-dip galvanized, but the nearest hot dip is an hour and half away with a two-week wait, so that is a job for another time.

steel rod to keep the door hinges aligned with the hinges on the frame. I welded the steel hinge to the tube and then welded the back after I had removed it from the rod.

Once the hinges were in place I welded the mesh to the door.

I then tackled the hinges to hold the various elements of the cage together. I want to be able to remove this cage and store it so I used the same sort of pipe hinge that I used on the door on the sides — one pipe attached to one of the frames, and the other attached to a short steel

extension attached to the side or end.

I intended to keep the door latched with a simple anti-luce drop lock as commonly found on trailers. The one I bought was meant to be screwed on but that wasn't going to be practical, so I drilled a hole large enough to accept it and tacked it in place while I cut the end flush with the cage end and welded it in place. You can in fact buy weldable locks but my supplier didn't have any with a long enough tail. For the hasp, I cut a 20mm hole in a scrap piece of 3mm mild steel that I then welded to the door.

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HAMMERING HISTORY

VOLUNTEERS ENSURE THAT AN ORIGINAL SMITHY FLOURISHES
AS A RARE SNAPSHOT IN TIME

By Nathalie Brown
Photographs: Derek Golding

Judy decided that she wanted to be
a blacksmith when she visited this
blacksmith shop in 1972



Judy and Robert Mills, a blacksmith volunteer. There is a steady stream of students that attend the blacksmithing courses at Duntroon

You can probably count on the fingers of one hand the number of Kiwi women who have become blacksmiths in their 60s. Judy Waterston of Livingstone, inland North Otago, is one of them.

As a child Judy spent hours in her engineer-father's workshop sorting nuts and bolts, tidying away his tools, sweeping up, and watching him make things. She says her love of tools and machinery came from her dad.

The blacksmithing seed was sown in 1972 when Judy first saw Nicol's Blacksmith Shop in Duntroon, some 40km from Oamaru up State Highway 83. The building was being devoured by periwinkle planted 100 years before to act as a fire retardant. Most of the windows were smashed and it was draped in cobwebs.

It took her 20 years to escape the city and return to North Otago, near Duntroon

"I looked through the broken windows and when I saw the anvil and bellows they took my breath away," she remembers. "I've loved this building ever since."

Nah, that's bloke's stuff

Two or three years later, when the smithy faced the threat of demolition, four local farmers stepped in to buy the building and all its chattels. Then in 1984, when the forge had been cleaned up and was

open to the public as a static display, Judy ran a small arts and crafts shop in front of the building seven days a week. People would wander in and she'd tell them a bit about the history of the place and sell a few items. When friends suggested she should work the forge she waved the idea away. That was bloke's stuff, she'd said.

"But one day I had a go and it was fantastic! As soon as I started hitting hot metal with a hammer I was sold on the idea. I forged there for a while, but I had no real idea where to start because girls weren't accepted in metalwork classes at school in my day. Then I approached Noel Gregg, a master blacksmith who was at the Arts Centre in Christchurch at the time. Up to that point all I was doing was making pokers, but I got an Arts Council grant to learn different aspects of blacksmithing from him." ►



Left: No matter what you are making in a smithy, the work is hard and dirty

Blacksmith courses



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learn forging. I was a bit hesitant at first, not sure [that] I had the physical strength to do it. However, as soon as I started pumping the bellows and the fire was surging I thought, yeah ... the passion is still there.”

Teaching blacksmith skills

Judy is one of the volunteers rostered on over weekends. Last year, several North Otago tutors — all of who are artisans in their own right — conducted workshops to teach the volunteers specific skills. Dave Hamer, a retired master blacksmith, still teaches most of the blacksmithing, while Lindsay Murray (see *The Shed* Issue No. 16, Dec./Jan. 2008 for an article on Lindsay) was the tool-sharpening tutor, and his son Will taught knife making. Dugal Armour handled the copper smithing.

Judy finds that she learns better watching rather than by working alongside a tutor. “I’d rather do it in private. We had a couple of men come in to demonstrate welding a while ago and I’m really keen to do some by myself.”

An engineering company in Oamaru provides the trust with mild steel and they scavenge through scrap heaps for the high-carbon steel from old car springs. Some time ago Nicol’s Blacksmith Shop put out a call for the straight, thin, fencing standards made from wrought iron.

“The standards are different from the mild steel. They’re quite hard to work because the wrought iron is layered, and if you don’t get the heat right it delaminates. While the blokes handle it well, I find the wrought iron hard work on the anvil because it’s so thick,” she says. ►

► She spent a few months under Noel’s tutelage but forsook blacksmithing for office work because she needed to earn a living, and it took her 20 years to escape the city and return to North Otago, near Duntroon.

Forging ahead

Some time after her return, the four farmers who had bought the forge in 1975 decided to form a trust, which would allow them to apply for the grants they needed to fully restore the

smithy. Nicol’s Blacksmith Historic Trust was formed in December 2006. The idea was to create a heritage attraction, providing visitors with the experience of a working forge.

Says Judy, “Ten years after that, having finished the restoration, the trust threw Nicol’s Blacksmith Shop open to the community and said — ‘OK, what are we going to do with it?’

“We had a meeting and got about 12 volunteers, ranging from their 40s to 70s, who were prepared to come and

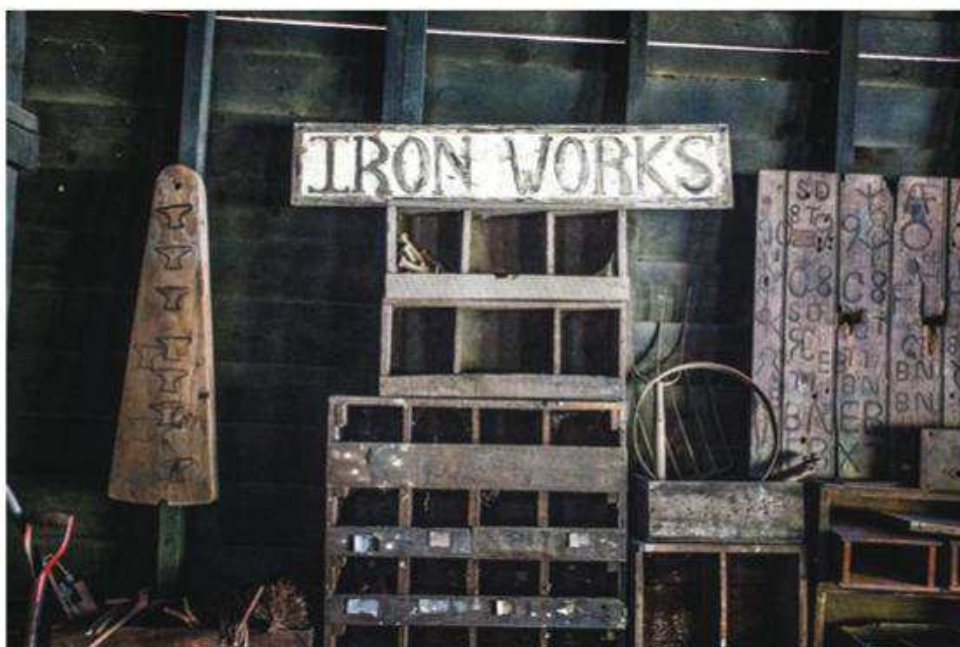


“The trust threw Nichol’s Blacksmith Shop open to the community and said — ‘OK, what are we going to do with it?’”

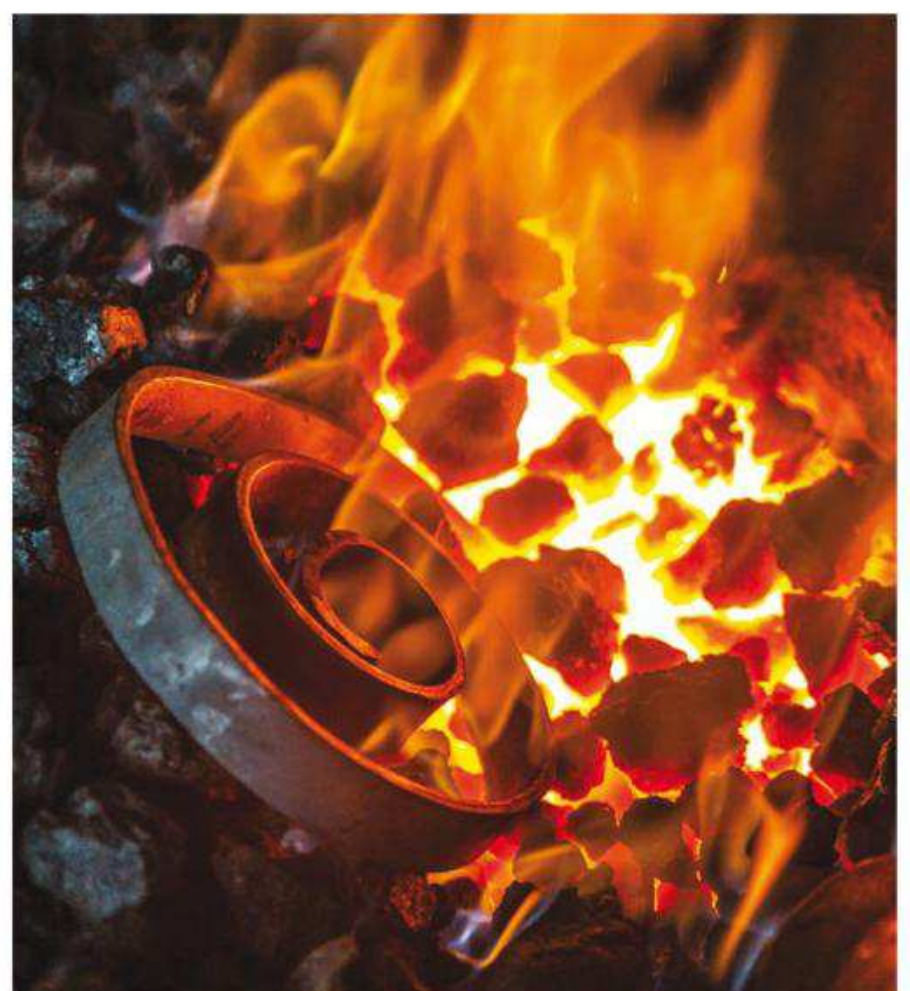




This blacksmith's shed was facing demolition until four local farmers bought the business in 1975



They can spend an hour making a piece and one moment's inattention can cause them to burn it and it's ruined



Nicol's Blacksmith Shop, Duntroon

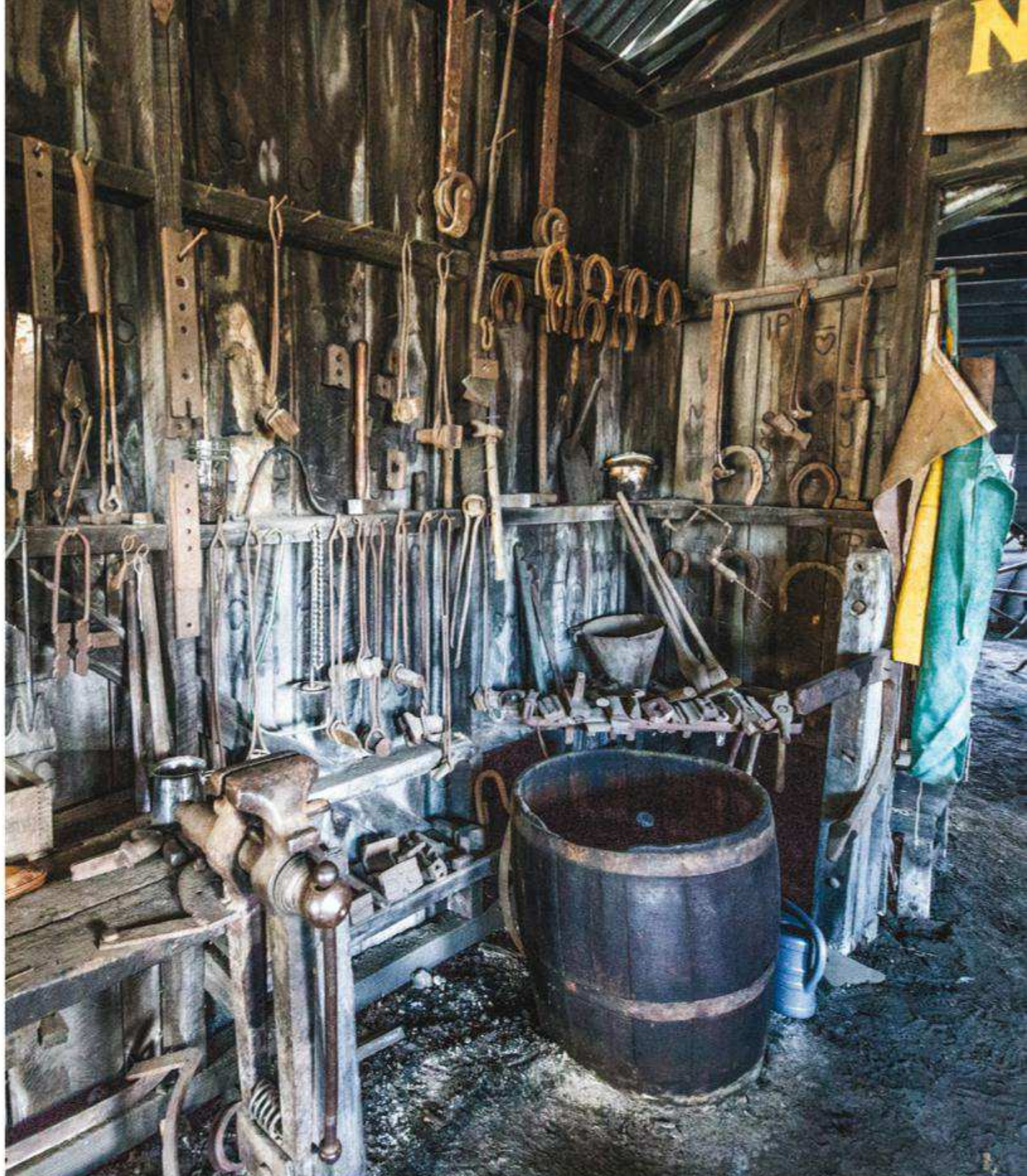
Nicol's Blacksmith Shop is the only easily accessible and authentic village blacksmith in New Zealand. It is located in the middle of Duntroon township on State Highway 83, some 40km north-west of Oamaru.

The building was facing demolition until four local farmers — John Hore, Burns Pollock, Bill Simpson, and Jim Harvey — bought it in 1975. As children these four men had spent many after-school hours with Nicol Muirden at the smithy and pumped the bellows for him. They wanted to preserve the history of the village. Ownership of the building was transferred to Nicol's Blacksmith Historic Trust in 2006.

New Zealand Historic Places Trust's 2009 classification of the building as Category 1 recognizes that it is as a place of national significance, emphasizing its authenticity and importance in telling the story of the role of the horse in the development of this country.

Architecturally, the building is typical of local smithies with a weatherboard construction over an earthen floor. Such buildings are now rare, as most have been modernized by adding wall-to-wall floors and other luxuries. The original smithies were not built for comfort but for function and Nicol's Blacksmith Shop provides an example of the working conditions of the 1870s.

Nicol's Blacksmith Shop is important because it is a very rare example of what was a vital service throughout New Zealand, and it lives on in its original building. It represents the workplace of a craftsman, who epitomizes many others who collectively kept the land-transport system and the farming industry working.



Moving with the times

The purpose of restoring the forge is to capture a slice of time, but the most regular work a blacksmith did in the old days was shoeing horses. It's very rare for people to bring horses in to be shod these days. Instead, the farriers use a small portable gas forge, so they can shoe the horses in their paddocks, and the blacksmiths at Nicol's forge make things like trowels and trivets, pokers, and garden tools.

No matter what you're making as a blacksmith, says Judy, the work is strenuous and dirty from the earthen floor, the coal smoke, and the sweat.

"Most smithies use their left arm to pump the bellows, and with the right arm they're banging metal, so they get really good arm muscles. There's no need to go to the gym. I find it very physical and can't forge for too long."

She makes fire tools for her own use. "I've got an outdoor fire, so I've made

a good long poker with a hook at the end because I find it easier to poke wood around and turn logs with a hooked end."

She also makes small hand tools for digging out dock and dandelion roots from the garden.

"Lately I've been making trivets for holding a pot or pan above the heat source when I'm cooking on a log burner and even on a gas cooker because sometimes it's hard to get a very low heat. I've got a low, medium, and high trivet; each one gradually takes the vessel higher above the heat. The high trivet is wonderful on the log burner. You can put your kettle on it after it's boiled, and it stays hot; and for pickles and sauces where you want that slow, long cook. I love doing spiral trivets. They have a lovely heft to them. I have a relatively small one that I've used as a hammer, but I also put it on the fire and stick it in my pocket as a hand warmer." ►



“We really need these young people. They’re our future”

Sharing the blacksmith skills

Judy’s time at Nichol’s Blacksmith Shop is mostly spent giving talks and demonstrating blacksmithing techniques to visitors. People love to see her twisting metal.

“We’ve got a small gas forge here too. We got it through a grant from Meridian Energy. Visitors love the coal forge, but the gas is instant and it’s a lot cleaner.”

Most of the items made by the volunteers are for sale although, Judy points out, Dave Hamer’s work is on display solely to show the volunteers what they might aspire to: handles, a toilet-roll holder, beautiful gate hinges, a coat hook made from car valves ...

Over the winter of 2017 three volunteers held working bees to put guards around the belt-driven drill press, power hacksaw, and grinding stones. “Even though it’s not quite authentic, it had to be done to comply with safety regulations.”

The forge is open weekends from Labour weekend in October to Queen’s Birthday in June. Judy mounts demonstrations for small groups and conducts beginners’ courses by appointment.

Blacksmith courses for young and old

One thing you have to know: don’t talk to the blacksmiths while they’re working at the forge because they can spend an hour making a piece and one moment’s inattention can cause them to burn it and it’s ruined.

“You can sometimes cut off the damaged part and start again, depending on where the burnt bit is, but you’ve just lost an hour’s work,” says Judy.

While she gets a lot of pleasure from working at the forge, more than anything



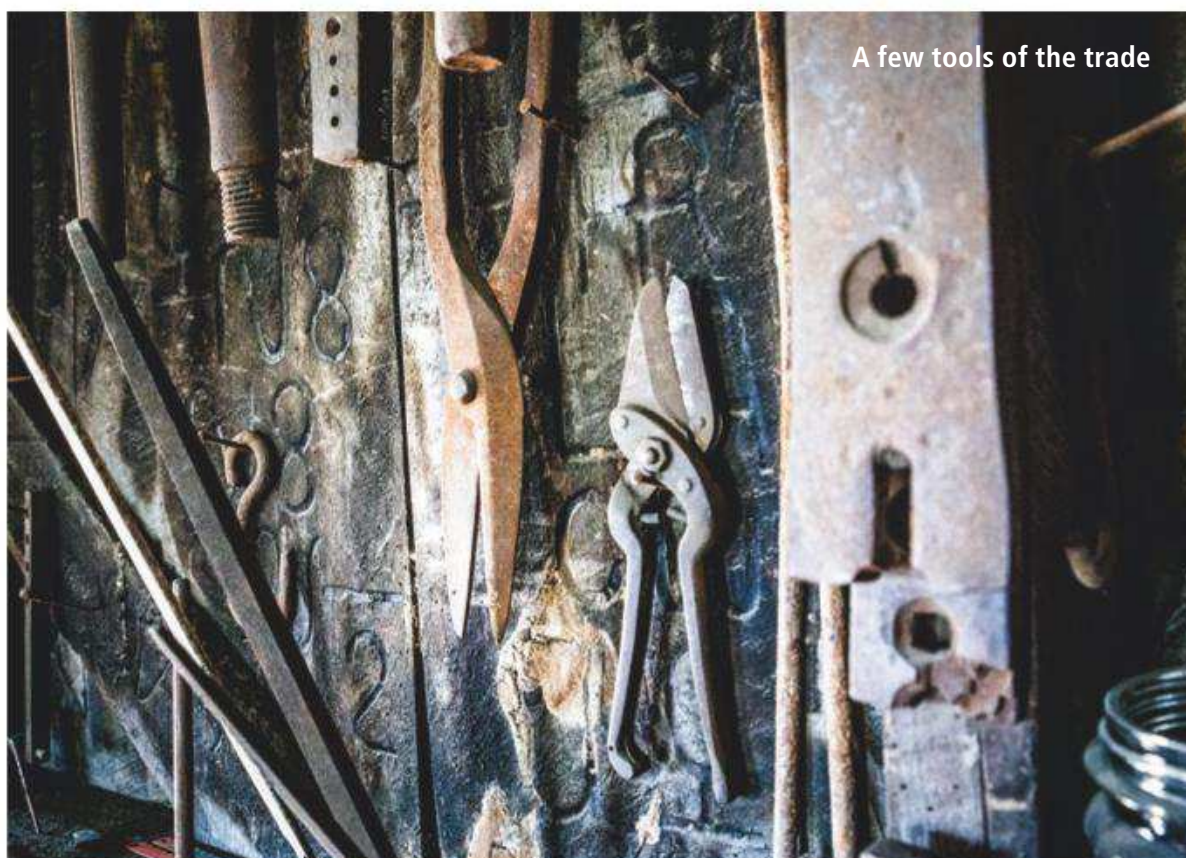
Visitors love to watch Judy bending and twisting metal

Judy is eager to introduce blacksmithing to young people.

“We’ve established beginners’ courses for the young ones, and their eyes light up when I kit them out with a leather apron, glasses, and gauntlets and get them going. They work the bellows and have a go at hammering the hot metal.

We really need these young people. They’re our future. We need them to be inspired.

“It’s so rewarding to pass on knowledge and skills. That’s where my passion lies. Because I can’t forge as much as I’d like to, I just want to get the young people involved.”



A few tools of the trade



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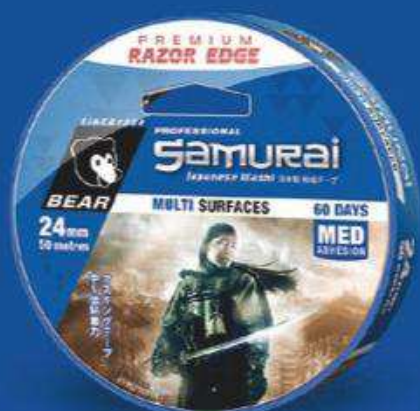
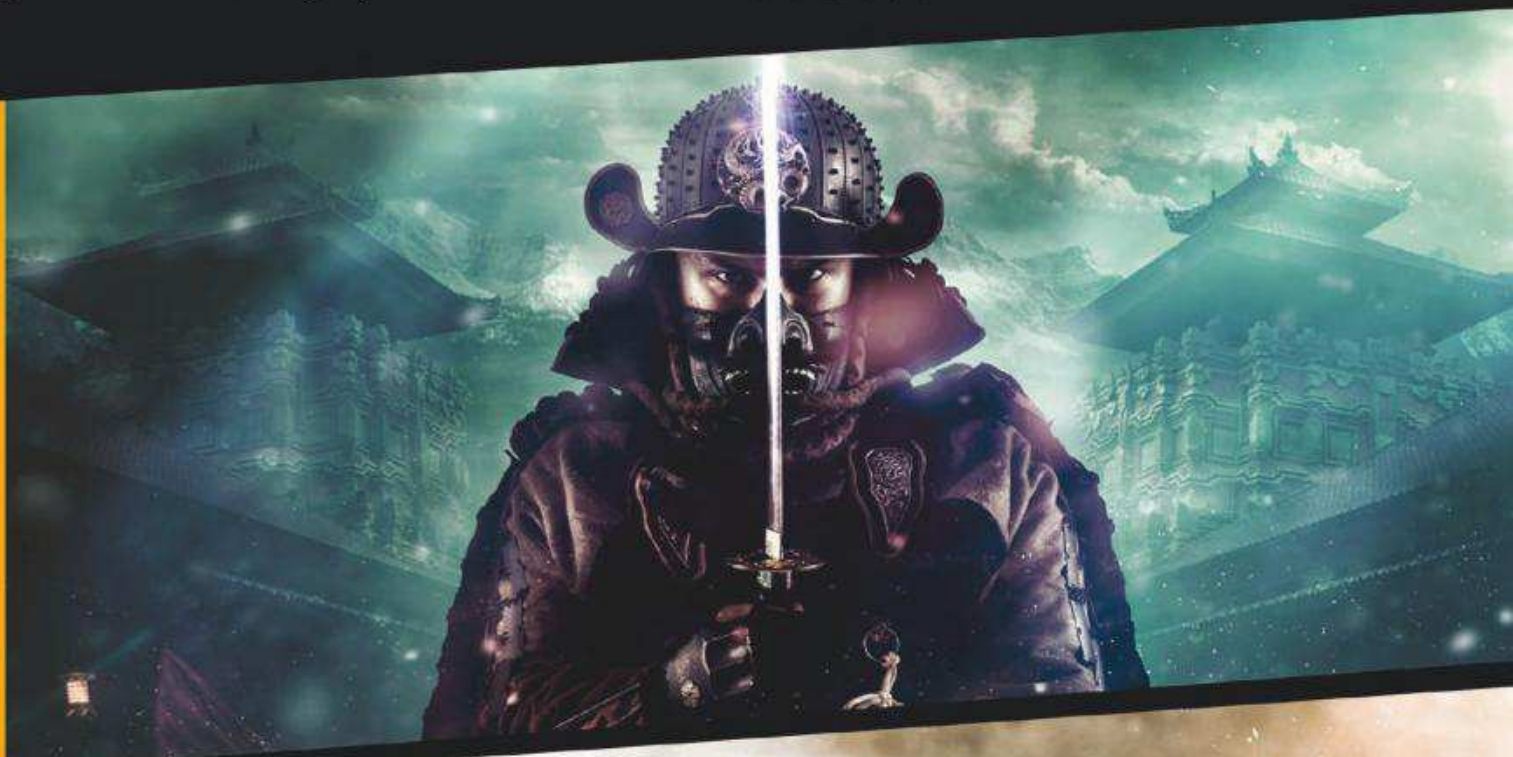
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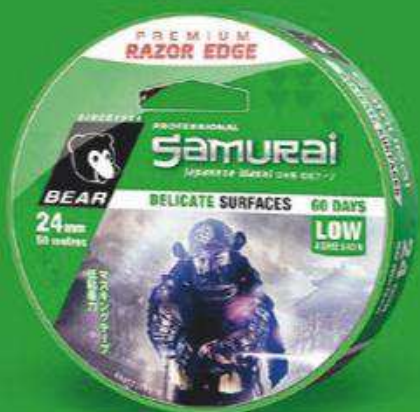
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LETTING OFF STEAM

THOUSANDS OF HOURS SPENT IN THE
WORKSHOP HAVE RESULTED IN THE CREATION
OF SOME EXTRAORDINARY WORKING REPLICA
SCALE LOCOMOTIVES

*By Sue Allison
Photographs: Juliet Nicholls*

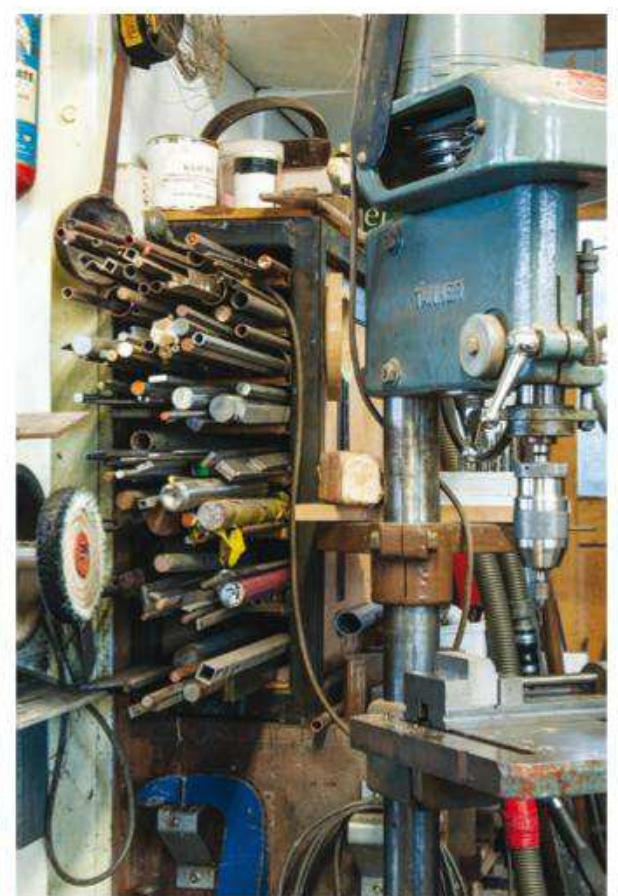




Clockwise from top left: Using a drill press with metal rack; cab view of the Pennsylvania Railroad A5S; drill press; tool tray; filing out a bell support



“It’s one thing to make a model that looks authentic and another to make it work”



“Steam is the only way to go,” says Win Holdaway, a Blenheim-based enthusiast who builds working models from scratch in his backyard shed.

Over the years, Win has spent thousands of hours constructing immaculate scale locomotives, including an 1870s Baldwin Standard T, BR Standard Class 9F, and a Burrell Special Scenic showman’s road locomotive. He is currently working on a 1½-inch (38mm) scale 1925 Pennsylvania Railroad A5S 0-4-0 switcher, complete with tender.

“It’s one thing to make a model that looks authentic and another to make it work,” says Win, whose working

models can all hold 90–100 pounds (41–45kg) of steam.

Win reckons that he spent around 5000 hours building his Burrell Special Scenic showman’s road locomotive alone. It is fittingly named ‘Lynette’ after his wife. While he probably spends more time in his shed than the house, she is his greatest supporter.

“It’s more than a hobby. This is his life,” says Lyn, a legal annotator who knows the importance of precision.

“I’m out here most days,” admits Win, who, if not in his own workshop, can often be found down at Brayshaw Heritage Park with fellow model-engineering enthusiasts.

A love of all things steam

His preoccupation with steam-powered locomotion was inherited from his father.

“Ever since I was about 10 I’ve been interested in steam engines,” says Win, who is a joiner by trade. As perhaps the most time-consuming and exacting part of constructing engines is forming the wooden patterns for casting, his joinery skills are invaluable.

Other talents picked up along the way have also stood him in good stead in a craft that involves multiple processes. Win spent time both building and working as an overseer with the Ministry of Works, along the way



Above: The A55 (on table at left) and NZR T-class (right)
Below: Lathe and milling machine



building his family a home. When the leaky homes revelations meant a change in the building code, he got out and went toolmaking. A head for maths certainly helps, as everything has to be scaled in three dimensions, with allowances made for shrinkage in the casting process. Add patience and determination to get things absolutely right and you have the ideal specifications for a successful model engineer.

"I like to push my own boundaries and not to take short cuts," says Win,

who spends hours nutting things out. "My father told me that if you don't know how to do something, make it your business to find out, and don't let up until you can do it. That's stayed with me," he says. "If you go delving around you can find these things out, but only ask people if you know [that] they know what they're talking about."

The internet, he concedes, can be a useful time-waster.

Machining tools in his well-organized workshop include a heavy-duty Colchester

Burrell Special Scenic showman's road locomotive



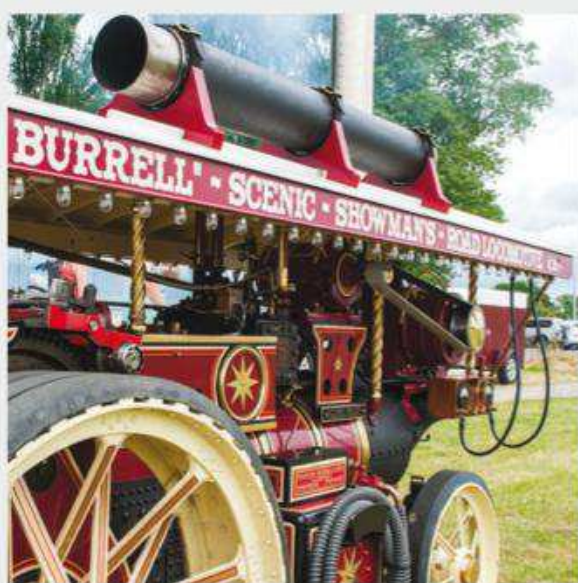
Win's award-winning Burrell Special Scenic showman's road locomotive has featured in Australian and English model-engineering magazines and been compared to the 1921 Lord Lascelles, regarded as one of finest on the UK rally circuit. The four-inch (103mm) model of the early 20th-century English traction engine is about eight feet long, or one-third full-size, and took Win around 5000 hours over six years to build. "I got a set of drawings out from the UK but there were quite a few mistakes in them which was frustrating," he says. He also realized that it was going to be a mammoth task involving making 86 wooden patterns before construction even began. He started off with the wheels, fitting

spokes to the centre castings before attaching rolled rims to the strakes and sending the wheels away to be rubbered. After machining out the front and rear axles, he got to work on the boiler, which was constructed to SGS M&I (General Society of Surveillance Marine and Industrial) certification standards. Win had the barrel plates rolled and welded before forming the tube plates, which involved drilling holes for the 18 tubes to be inserted. Once the firebox and stays had been formed and the tender bolted on, he set to work on the horn plate, rolled and fitted the smokebox, cast the cylinder block, and attached the pistons and rods. Win undertook all the motion work himself, fabricating the three-speed gears along with the final drive and

differential in his workshop. The biggest machining job on the traction engine, apart from the cylinder block, was the crankshaft. This was made out of a hulking piece of 4340 high-tensile steel, six inches round and 28 inches high (154x718mm), lathing it down from each end as it was too heavy to lift off the floor. At the other end of the scale, he hand-filed the small bronze bell after forming the outer shape on his lathe, and used a regular cross-hatch wood file to imprint the tread on the step. Once the crankshaft and bearings were in place, Win rolled the chimney, finishing it with a brass rim, and attached the gauges and sight glasses. One job that needed a little more consideration and help from his son, Mark, an electronics expert, was how to

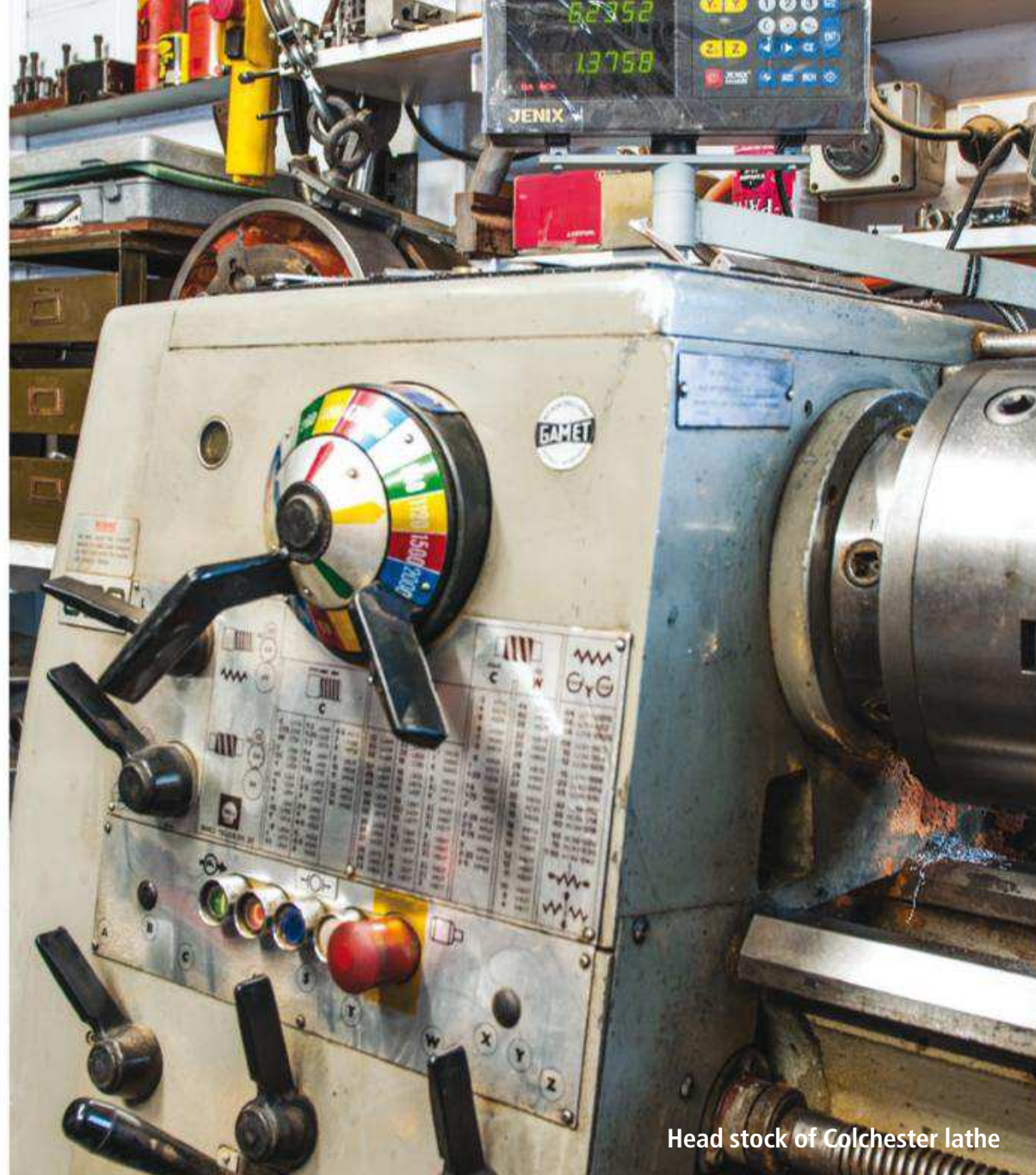


Clockwise from side left: Front view of the Burrell showman's engine; *Alius Fila* or 'another daughter' in Latin; driver's view; rear side view; the rear driving wheel is just on 1m in diameter



power the canopy lights without losing the authentic look of the traction engine. He mentioned this to Mark, and he came up with the idea of using two alternators in line, plus an exciter with a little DC motor. Win built a casing, complete with rolled brass handles on the sides to make it look like a genuine dynamo. When belted up to the flywheel, it pushes out 1.5hp (1kW) to light up 72, 12V bulbs each side of the canopy.

Win's joinery skills came into good use when building the canopy. He used European fir in strips, forming the ribs himself. To get an authentic paint coat, he got hold of some photographs of Lord Lascelles and matched the colours. He used number 3891 for his little road locomotive, one that he didn't think Burrell and Sons ever used.



Head stock of Colchester lathe

A head for maths certainly helps, as everything has to be scaled in three dimensions



metal lathe, small Harrison lathe, and large milling machine, as well as a comprehensive collection of hand files for fine work and finishing. His "office" alongside houses his computer and drawing board, as well as a pantograph for down-scaling and cutting more intricate components. "It's especially good for shapes that are hard to file," says Win.

Real project satisfaction

Win used to have a little coke-fired foundry in his workshop, which he converted to oil after the local gasworks closed down. "The A30 crucible could hold 85 pounds [39kg] of metal. When it's full it's something you don't play around with," he says. "I ran it for 30 years without having an accident but needed space for bigger machines and lost my nerve at the same time so closed it down." Luckily he's got a good friend with a foundry and casting shop in Christchurch, so now takes his patterns there. ►

Pattern making

Win's workshop shelves are packed with wooden patterns, from the tiniest fittings to the huge base for his Pennsylvania A5S tender. Pattern making is the starting point for building metal models and the success of the finished engine depends on its accuracy. Customwood is used in preference to wood as it is more stable.

"You can get sets of castings sent out from the UK but it's a horrendous price," says Win, who instead gets hold of the drawings and works it out from there.

"It's like making a huge 3D jigsaw," he says. It's not a simple matter of replicating the final form, as both shrinkage and the negative spaces have to be taken into account. "The metal shrinks when it solidifies so the casting ends up a bit smaller. The shrinkage is different for each type of metal so you've got to think it out and do the maths."

To make the moulds for casting, the Customwood patterns and cores are set in resin sand, with a gating system built in to channel the molten metal.

"It can be a bit of a brain-twister, especially getting the negative and positive shapes in the patterns. It's a painstaking process, especially making cylinders with complex coring. The pattern doesn't look anything like the cylinder, as it has outside core prints on it," says Win, who has built about 14 boilers in his time, the biggest for his Burrell traction engine.

"I make all the moulds and cores and fit them together so [that] I don't hold up the blokes at the foundry," he says. Once they have been cast, the metal castings are machined and filed to fit. On the bright side, if it all goes wrong, at least you can turn them back to liquid again, he says.



Tender bed castings for future projects

► Win admits that it's an all-consuming hobby but one that is immensely satisfying when things turn out well. "It keeps you off the streets and out of the pubs," says the enthusiast, who reckons he needs to live another 100 years to finish off his projects. The only certainty is that they will outlast him by a lot longer than that. ►

"My father told me that if you don't know how to do something, make it your business to find out"



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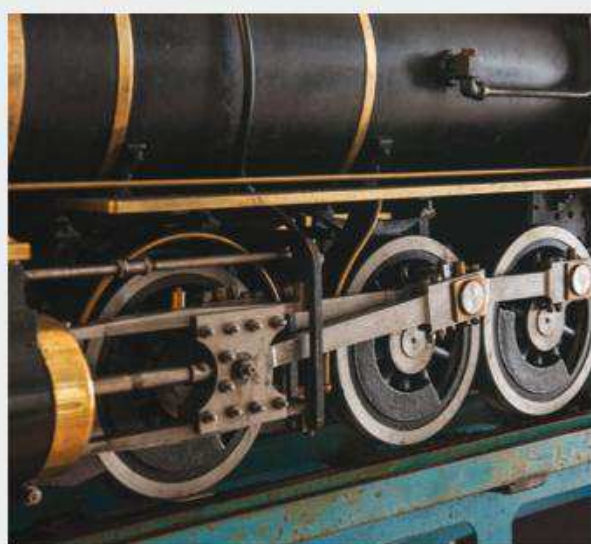


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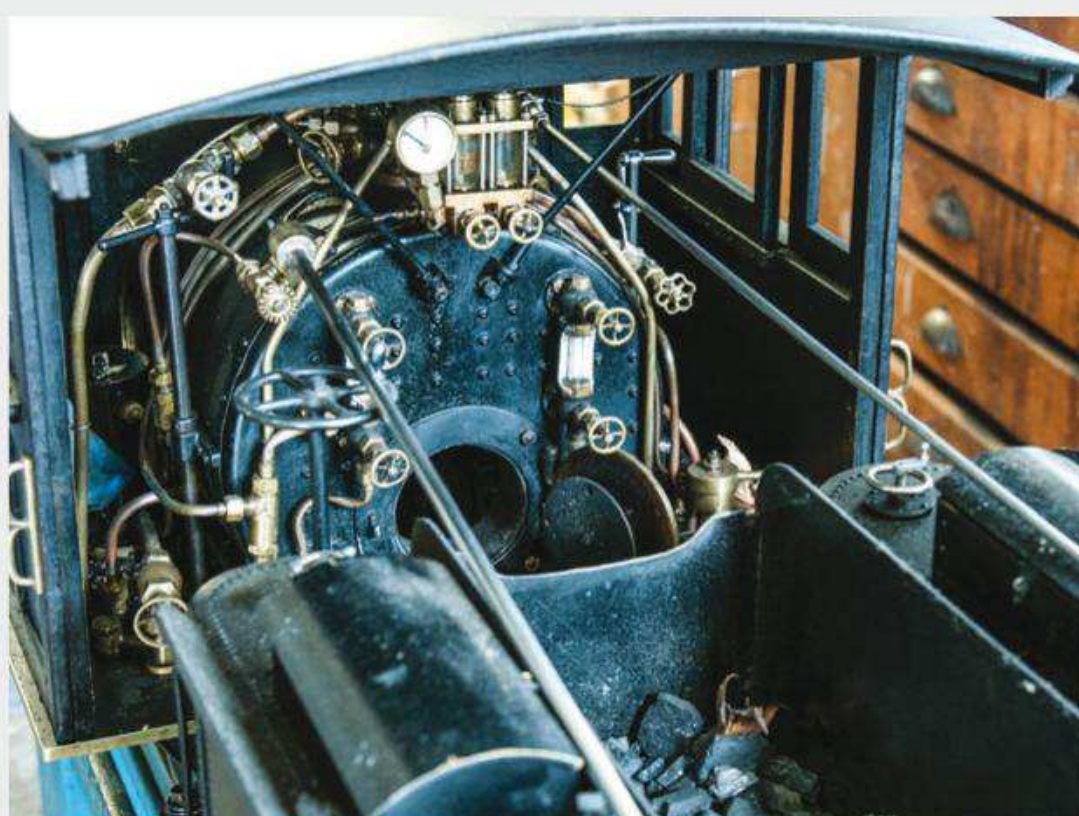
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Above: NZR T-class in 1.428-inch scale
Middle (from left): T-class; various drawings; T-class number plate
Bottom: T-class cab



Win's Baldwin Standard T locomotive is a live steam miniature built to operate on five-inch (128mm)–gauge tracks. New Zealand Railways (NZR) imported six of these small engines in 1879 from Philadelphia before domestic production began in Christchurch's Addington workshops in the late 1880s. "I managed to get some drawings from a chap who worked for NZR Wellington," says Win, who constructed it to the scale of 1.428 inches (36.615mm). Scaling it down presented major challenges, particularly the construction of the boiler. "I like challenges," says Win, who never counts his hours but reckons the locomotive would have taken him well over 2000 hours over 18 years and has had its problems. ►





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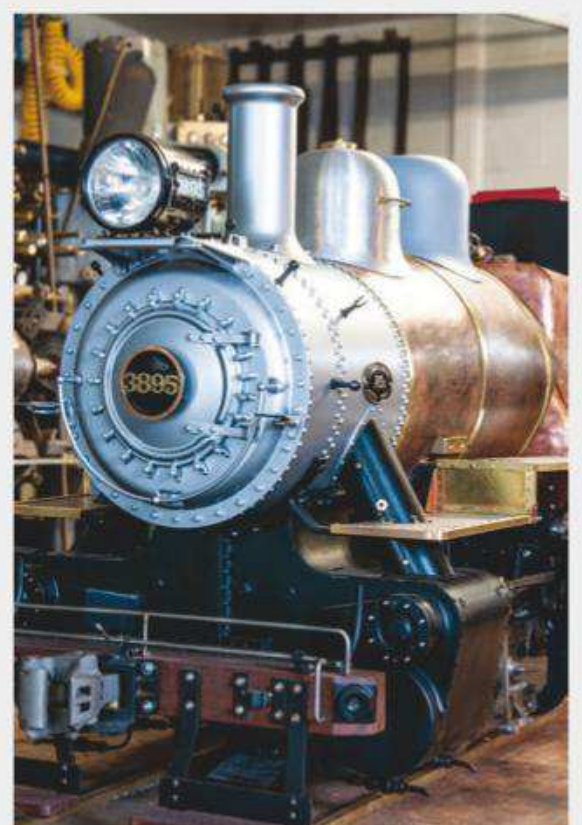
Unless you are a world class athlete like Tom Walsh, who can lift 250kg, health and safety recommendations are that two people are required when lifting a 40kg bag of cement.

Tom Walsh

New IAAF World Champion,
Olympian, NZ record holder,
qualified builder, NZCB member
and ITAB graduate.



Above: Rear view of tender and the A5S engine
Below: Left-side view of engine
Right (from top): Tender; A5S engine; front of A5S engine



Win is currently working on an A5S 0-4-0 switcher (or shifter), one of the last five engines built by the Pennsylvania Railroad in 1925. Win's working model is a 1½-inch (38mm) scale built to operate on a 7¼-inch (186mm) ground-level track. He has already completed the tender, which sits behind the locomotive and is designed to carry water or coal. The tender alone took him more than a year to build. 📁

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A TWIST ON TRADITION

Wagener Stoves have been warming Kiwi homes for over 35 years. As a third-generation family business, they have accrued a wealth of knowledge and experience, but are still small enough to care. Wagener offer a range of stoves that will make your home nice and cosy. From the very popular little Wagener Sparky to its big brother Leon, released two years ago, every stove is crafted to last and reflects the company's commitment to quality and design — and now they're available in a range of colours, including shimmering rose, metallic moss green, sky blue, and metallic blue, all in top-quality high-temperature Stove Bright paints.

Whether you're after a pop of colour or a loud splash, check out the range at FDFDwagenerstoves.co.nz, or call 09 408-2469. Priced from \$1592 for the Sparky and \$2925 for the Leon. wagenerstoves.co.nz, or call 09 408-2469. Priced from \$1592 for the Sparky and \$2925 for the Leon.



NANO TECH FOR YOUR VEHICLE

The Rislone Nano Prime Engine & Oil Performance Booster is designed to improve mileage and performance while decreasing emissions, and is compatible with all vehicles and oil grades. The nano-spheres are engineered with a unique round shape, creating a spring-like cushion for extreme protection. This works to reduce engine friction by 38 per cent in conventional oils and up to 25 per cent in premium synthetic motor oils. Internal wear is reduced by 37 per cent in conventional oils and up to 36 per cent in premium synthetic motor oils. For use once per year, or with every other oil change.

For more product or stockist info, phone 0800 227 422 or visit smitsgroup.co.nz.



COMFY CAT

Made from premium-weight cotton jersey, the Smart Iron track-type tee from Cat is versatile and comfortable. The spandex rib trim means that it retains its shape, and the wire management loop on the outside of the neck makes for added job-site safety. Made from 200gsm, 100 per cent cotton, ring-spun combed jersey, it features a tagless back neck for comfort, and branding on the pocket, back, and sleeve hem. Available from mid August for \$49.99 from catshop.co.nz.



PAIN IN THE NECK NO MORE

Trying to see into all the little nooks and crannies of your project can be a literal pain in the neck. The team at Machineryhouse feel your pain, and now offer the VS-1000 Portable Video Inspection Camera so you can see all those hard-to-reach places with no problem. The camera sits at the end of a one-metre flexible cable, featuring a 72x54mm colour screen, image rotation control, zoom, adjustable LED lights, a magnetic pick-up tool, and a 45-degree mirror for looking around corners. If you're after something palm-sized, the smaller VS-600 with 53x40mm screen is also on offer.

Find out more at Machineryhouse, or visit machineryhouse.co.nz/Portable-Video-Scope.

TRIED AND TRUE

Another great T-shirt from Cat, the Tried and True shirt is designed to work, relax, and play in. With contrast neck tape, rib collar with shape retention, not to mention the stylish retro Cat print on the chest, the Tried and True is available for \$49.99 from mid August. Check out catshop.co.nz.



BE PREPARED FOR BEER O'CLOCK

There's nothing like a cold brew after a day's DIY — even better if you have the satisfaction of making it yourself. Mangrove Jack's Starter Brewery Kit comes with everything you need to get brewing. You can start off simple, and then start experimenting with their large range of popular styles, from refreshing ales and punchy IPAs through to malty stouts. Put your own spin on a style with the variety of ingredients and brewing additions available, creating your very own flavour profile.

Just \$99.99 to get started. Visit mangrovejacks.com for more information.





PROPER KIWI GUMBOOTS

Red Band have been crafting gumboots by hand since 1958. They're not interested in those flimsy wear-to-the-mall boots, but instead produce the tough, tried-and-tested New Zealand icon that is the calf-length gumboot with cleated sole.

Made from high-quality rubber, and with a built-in rubber foam cushioned inner-sole, these boots are comfortable and durable. Priced at \$91 for men's gumboots, \$80 for women's, and \$29 for the kids. Visit redband.co.nz.

FROM WORK TO WEEKEND

Weekend style meets the job site with these modern industrial lightweight denim work pants. The Dynamic Pant is packed with handy features such as front reach-in pockets, a back ruler pocket for extra tool storage, and Oxford canvas knee overlays for added durability. They also have a bellowed side cargo pocket with a secure closure and a specific pocket for your cell phone. Aside from being practical, they're also comfy, with crotch gusset for optimal movement and a ribbed waistband with interior elastic and drawcord.

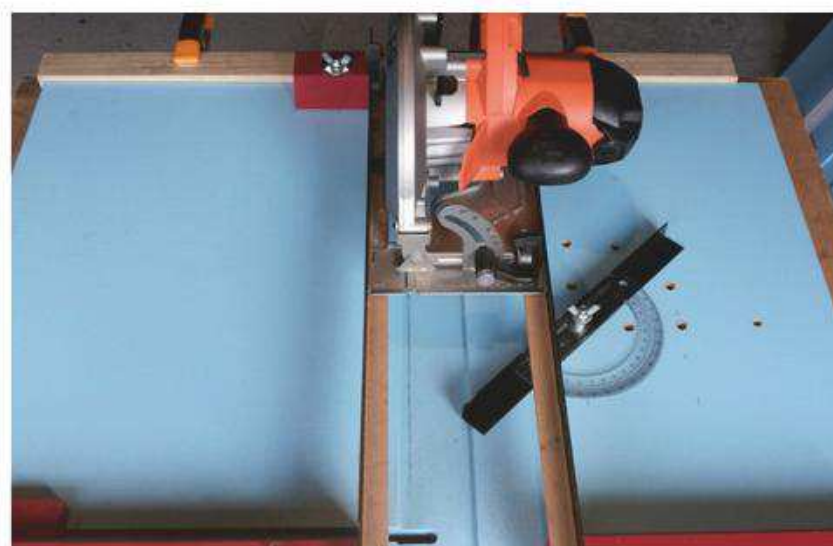
Visit catshop.co.nz — available from mid August for \$109.99.



ELECTRIC BIKES — CHARGE AS YOU GO

The Ezi Rider Vantage is ideal for those on the move. Because it folds up, it's perfect for adding flexibility to your trips away in the motorhome, or put it in your boot for those bike trails you've always wanted to do. Priced at \$1595, it offers a range of 70km on peddle assist, or 45km throttle alone. Or, if you want to take things further, grab their new model for \$2450 — it's identical, but has the added bonus of recharging the battery as you ride, reputedly the first recharging electric bike in New Zealand!

Visit their website, ezirider.nz or call 027 493 7025 for more information.



CUT LIKE A PRO

Can't justify buying a table saw? Well, there's no need. The JigMaker Circular Saw Sled is a jig that allows you to use your circular saw just like a table saw — at a fraction of the cost. The JigMaker sled is a safer and easier way to use a circular saw, performing consistent crosscuts and accurate mitres, and it's also portable and easy to store away. Adaptable to a range of sizes of circular saws, this saw sled is perfect for extending the use of your circular saw, performing tasks that would otherwise require additional tools.

Visit the website thejigmaker.co.nz for a range of how-to videos, check them out on Facebook, searching 'thejigmaker', or email thejigmaker@gmail.com for more information. Priced at \$165.

MAKE DAD'S JOB EASIER

First featured in *The Shed* in Aug/Sep 2011, the Slammer tool is an innovative New Zealand-made multi-tool that is now for sale in many different countries. Combining a sledgehammer, digging bar, and axe, it uses the downward force of the inner bar to slam the cutting blade through difficult roots and hard ground, rock, and even concrete. Ideal for fathers who are always out there working hard; building, landscaping, farming, and problem solving — take the stress off his back! The Slammer is incredibly durable, made from high-tensile and abrasion resistant steel — a gift made to last.

Different models and a range of blade heads for added versatility are now on offer, with the standard model priced at \$275, including delivery. For more information, visit theslammertool.com.



SHOW YOUR TRUE COLOURS

Let everybody know that you're in with the leaders, innovators, and visionaries of this world with the Cat brand #12 T-shirt. Featuring the Cat retro print on the chest, a rib collar with shape retention, and contrast neck tape, this special tee is available from mid August for \$49.99. Visit catshop.co.nz.



FULL STEAM AHEAD

Bring your model steamer to life on the water! The D48 two-cylinder Marine Steam Engine is a pre-assembled working engine for marine use. Now, those amazing model boats made by enthusiasts can be motorized simply and authentically. These motors are manufactured in Germany to a high standard by Wileco.

Priced at \$835.50, GST inclusive. For more details, visit boathousecollectables.co.nz and navigate to 'Ship Models Wooden' and click on 'Steam Engines'. Boathouse Collectables also sell a range of other marine items, so have a browse while you're there.

DON'T GET CAUGHT OUT

Supplementing your water supply by harvesting nature's reserves can really save on water costs, but in those drier months it can be a struggle to keep anything in reserve. The Hansen Rapidflo Rain Relief Valve is your insurance against an empty tank. Designed to supplement your rainwater tank by 50 or 100mm from an alternative source when your water level gets too low, it will ensure that you always have water on hand, but also allows enough space in your tank in case rain is on the way. Visit hansenproducts.co.nz for your local stockist and more info.

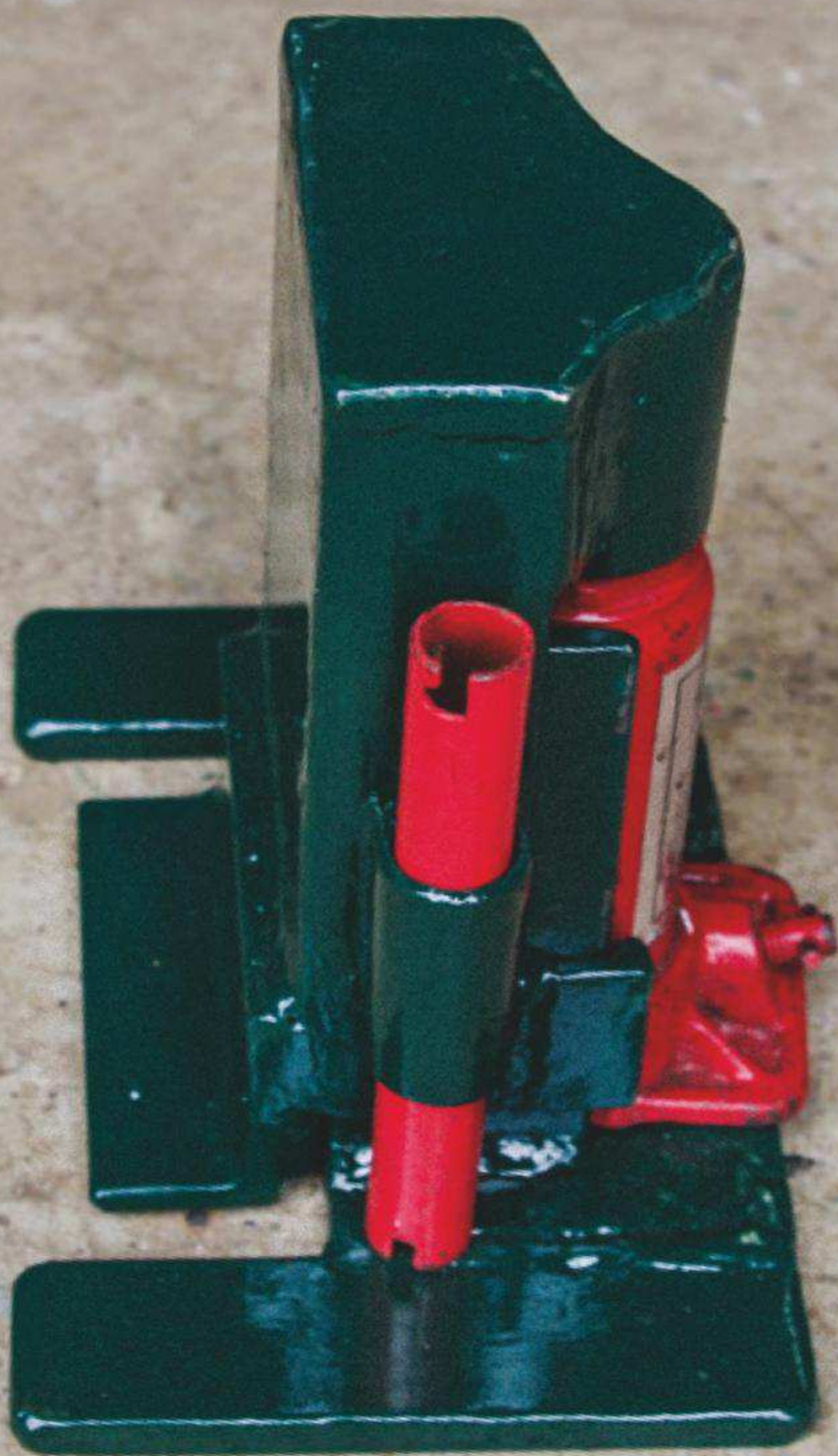


THE MULTITool SMARTPHONE

There's no need to jam your pockets full with various tools when your smartphone can do so much of what you need. The Cat S60 smartphone — featuring an integrated thermal imaging camera, laser-assistance distance measure, and an indoor-air-quality measure — is the tool to help to get any job done. The rugged construction means that it's drop-proof to 1.8m and waterproof to 5m. This Android 32GB phone also has exceptional display, sound, and comms features.

Priced at \$1,150, and in stock now. Visit catshop.co.nz and search 'Cat S60 phone'.





Aweighty subject

By Geoff Merryweather

Photographs: Geoff Merryweather

GIVE YOURSELF A LIFT BY MAKING A HYDRAULIC TOE JACK

One problem with working alone in the shed and having a liking for large pieces of Victorian cast iron is the difficulty of safely moving or lifting them.

They can be moved with load skates and pipes as rollers, but how do you lift the weight onto the rollers? Trying to push down on a crowbar while arranging pipe rollers under a machine is inviting trouble. A toe jack allows you to lift and hold the weight in the air as you arrange the rollers and put in safety blocks. It is not intended for great weights or high lifts due to stability, but it allows you to lift the weight.

Scoping the project

This toe jack was made out of leftovers in the shed and used the basic principle of shed economics — if it is on the shelf in the shed, it is free — so came in on a zero budget.

It is based on a two-tonne bottle jack left over from another project. Get the jack first, as it drives the dimensions of the rest of the parts.

Apart from the jack, there are two other main parts. The C-shaped baseplate with an upright channel, and a Z-shaped carriage that connects from the top of the jack to the low level with an angle that fits under the load. The jack fits snugly into a 100x50mm channel, which serves as the upright that guides the lifting carriage. A larger jack may need a channel fabricated or a larger size.



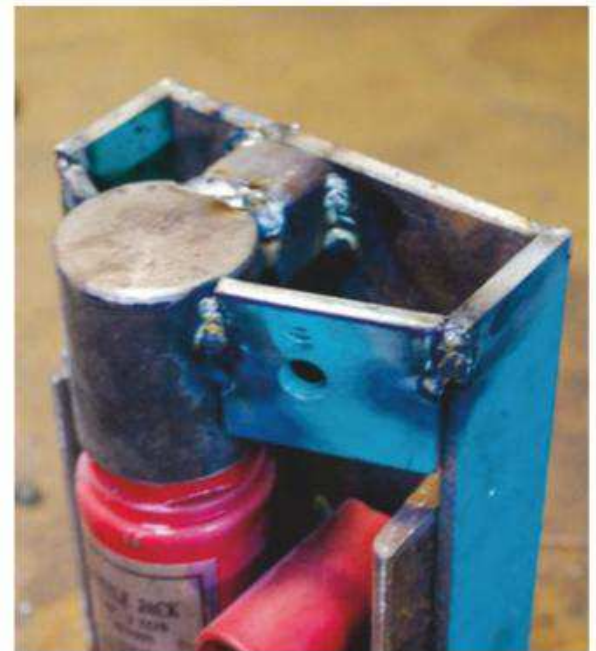
Main jack parts



The upright channel welded to baseplate



The sides of the carriage tacked to the front



The socket and connecting parts to the carriage front and sides

Fabrication

The first step is to make the baseplate and upright section. The baseplate is a C-shaped piece of 10mm plate. This one was welded from three pieces of steel, but could be cut from plate if you have any.

The height of the channel is the height of the jack body when fully compressed, so this will vary according to the jack you have. Vee the joins, tack them into place, checking that all is square and flush with the front edge of the baseplate, and then fully weld.

This toe jack ... used the basic principle of shed economics — if it is on the shelf in the shed, it is free

The lifting carriage has a socket that is a snug fit to the top of the jack ram and is made from 50mm round with a hole bored to match the ram diameter. The height of the carriage is from the

ground to the top of this socket and is made from 6mm flat steel. This forms a snug-fitting channel around the channel of the upright with an angle at the rear so it cannot wobble during a lift.

The lifting carriage

To make the lifting carriage, clamp the front and sides of the carriage and tack together. Weld on the connecting pieces from the socket to the sides of the carriage. These are 40x5mm flat to each side, and a piece of 25x50mm RHS to the front. Weld a flat plate on the top



Left: The angle on rear of the carriage
Below: The tongue welded to the front of the carriage
Bottom: Once the baseplate extensions are welded on, the jack is finished



Pay attention to make sure that it does not tip forward or slide off the tongue

and make sure everything is welded up well.

Weld on some angle at the rear of the carriage so that it cannot tilt forward when it is carried and a piece of 50mm angle on the front to make the tongue that goes under the load.

If you didn't cut the baseplate as

a C-shape, vee out the join and weld on the extensions that stop it tipping forward as it lifts. Make these longer than the tongue so that the load is concentrated behind the front edge of the extensions so it won't tip over.

Grease the moving parts and, if they have warped during welding, adjust with a hammer and paint to suit.

Using the jack

This hydraulic jack doesn't seem to move in use or as you are carrying it but you can drill through the jack base and bolt the jack to the baseplate with some cap screws. While I didn't fit a carry handle on this jack, it is heavier than it looks and a folding handle would make it easier to carry. A taller jack would give a greater range of movement.

To use the jack, use a crowbar to lift the load so that the jack can slide underneath, and then you can slowly lift while sliding wooden blocks under the load as safety blocks. Pay attention to make sure that it does not tip forward or slide off the tongue, and it is better to take slow, small steps using blocks of wood underneath so that if it does fall it cannot go far.



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- Cat Scale Models.

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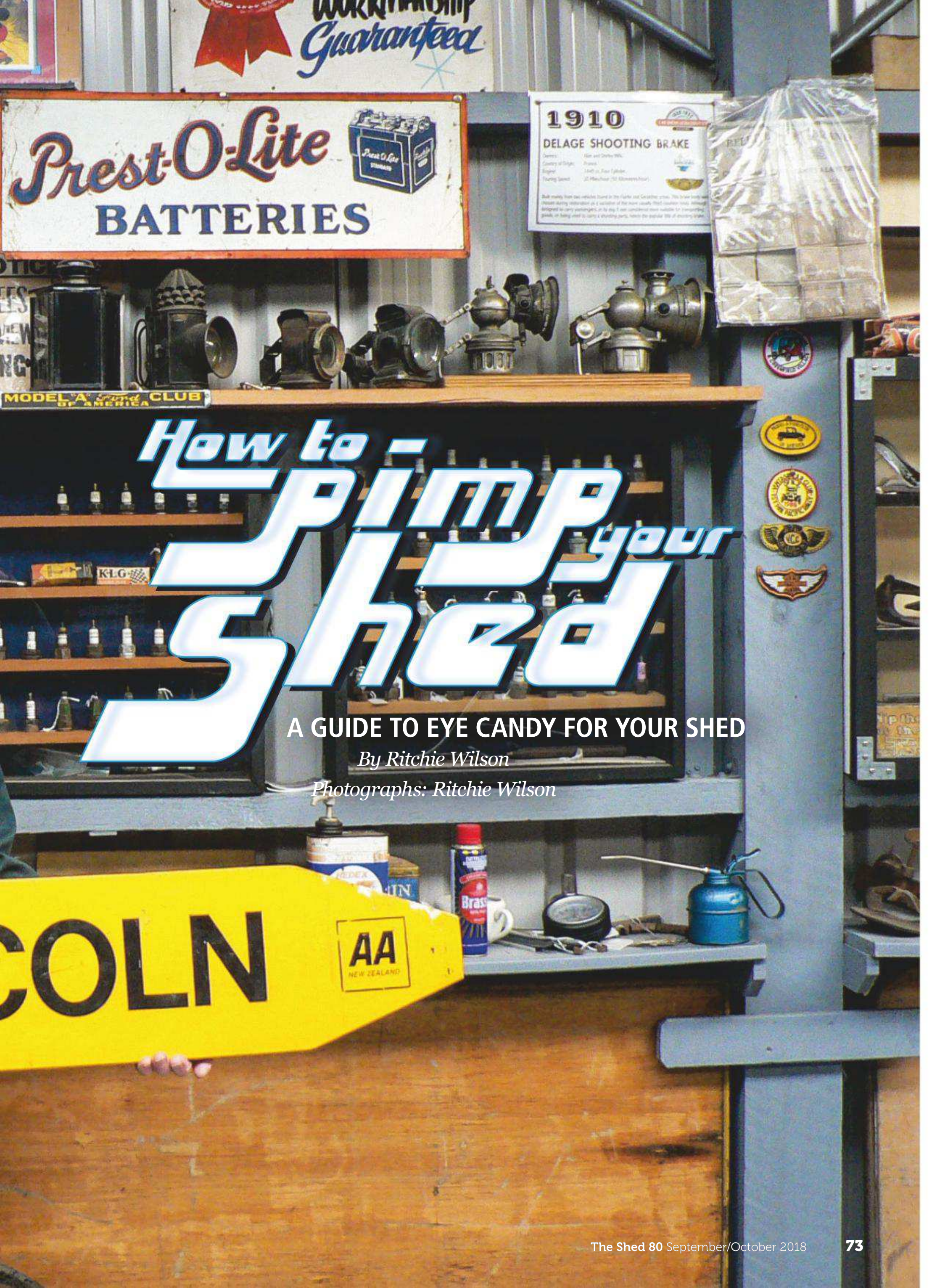
Available from Bunnings and leading rural retailers nationwide or visit redband.co.nz



 /redbands



Alan Wills and part of his extensive collection of automobilia



Prest-O-Lite
BATTERIES

1910
DELAGE SHOOTING BRAKE
Country of Origin: France
Engine: 1440 cc. Four Cylinder
Yearling Speed: 20 Mph (30 Mph with 1st gear)
Built mostly from two vehicles found in the Pacific and Caribbean zones. This is a rare find and should attract attention as a collector of the more costly, high quality cars, although designed to carry passengers, as they are considered more suitable for transporting goods, or being used to carry a shooting party, hence the popular 300 of shooting brake.

MODEL A CLUB OF AMERICA

How to - **PIMP** your **Shed**

A GUIDE TO EYE CANDY FOR YOUR SHED

By Ritchie Wilson

Photographs: Ritchie Wilson

COLN **AA** NEW ZEALAND



Below: Stu Weeber and his vertically parked Subaru rally car



Left: Prototype for a sign covering the whole of an outside wall of a shed by Richard Long

Our local bike shop in the 1950s had a huge wall poster of a young man on a bicycle being pursued by an African lion across the veld



The urge to decorate is universal, whether it be tattoos, floral designs on early Stanley rebate planes, or flames on hot rod hoods, and sheds are no exception.

Big or small, simple or ultra flash, sheds have one consistent feature — they all have decorations. These can be nostalgic, humorous, or more or less misogynistic (and often all three).

The mamo-centric female portraits that, in the past, were so common in garages and workshops are now rarely seen, perhaps because businesses that used to distribute complimentary 'girlie' calendars can't now risk the potential

bad publicity. Or shed owners are embarrassed at the thought of their wives, children, or grandchildren seeing them. Or perhaps we have all become a little more mature.

Feminist relatives tell me that the purpose of pin-ups wasn't decorative but to make woman visitors so uncomfortable that they wouldn't linger, creating a woman-free zone. Sort of like farmers draping the skins of killed predators on fences to discourage their kin.

Moving on

Reproductions of old advertisements

are now being manufactured in large numbers on metal sheet. These are copies of the sort of original old advertising signs that are so sought after by collectors and command surprisingly high prices. Liquor, cars, motorcycles, garages, and oil companies feature prominently on these signs. My favourites are bicycle advertisements. Our local bike shop in the 1950s had a huge wall poster of a young man on a bicycle being pursued by an African lion across the veld. It was produced by the export division of Raleigh Cycles and the happy expression on the cyclist's face showed that he wasn't worried



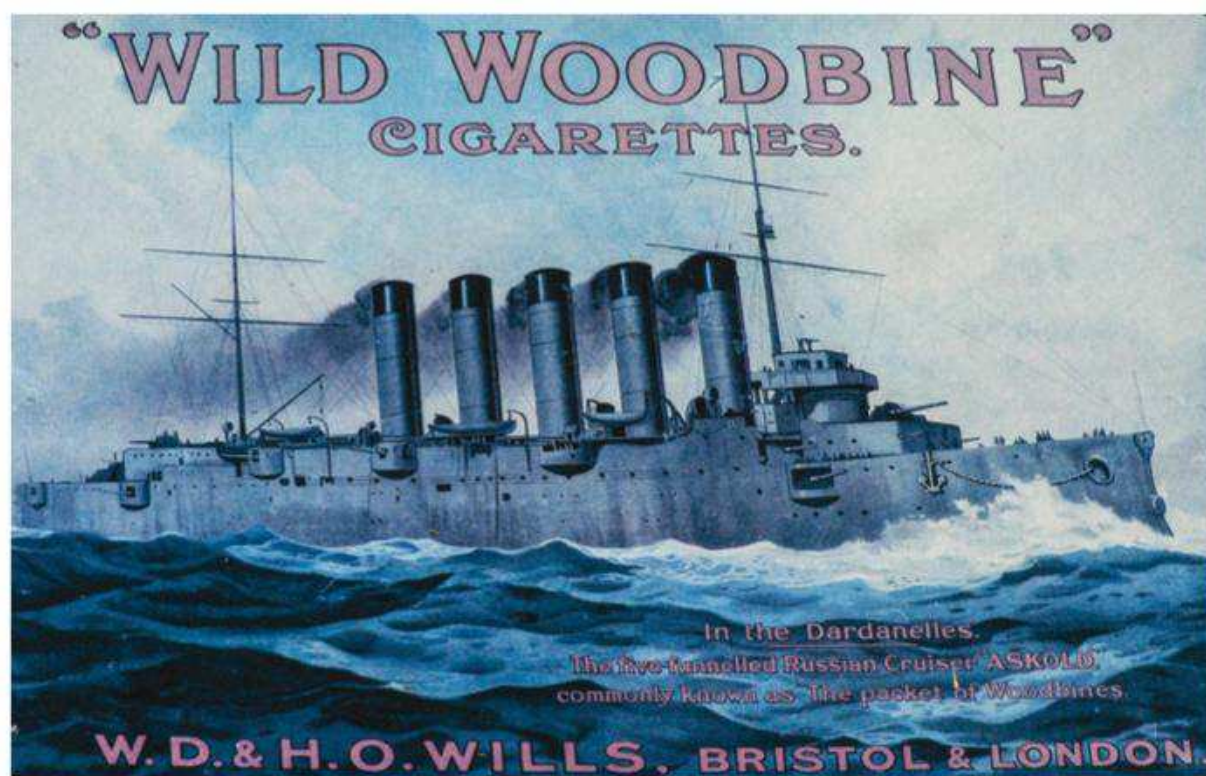
Some of the metal signs that Wayne Martin of Delray Autos has collected in the US



Above: One-off shed art at Bullseye Bulls
Below: Genuine 1910s shop sign



Reproduction of a 1930s shop sign



about the outcome. The modern-day reproductions of these iconic images have been shrunk to a standard size, but are still attractive and evocative.

Official signs or notices, such as those that adorn student flats (amid the road cones), are often seen. My shed doors have hand-painted notices on wood — one came with the doors, the other was salvaged from a skip. Two pieces on the doors are gifts: one from a mower shop, the other made by my son-in-law. It is common for sheds to have 'Assembly Points' or 'End of Works' notices, in my case rescued from the local river.

Large charts showing the sizes of drills

for tapping or the range of available metric and imperial fasteners make any shed look more productive and are available free from engineering supplies companies. Professional sporting teams also give away team photos, which are often seen in workshops.

We are all different

Years ago my children were friends with children in the next street. The family has long ago moved, but I well remember being shown around their brick outhouse by the father. Central to the small space was a Heidelberg letterpress printing machine of the kind used by the very

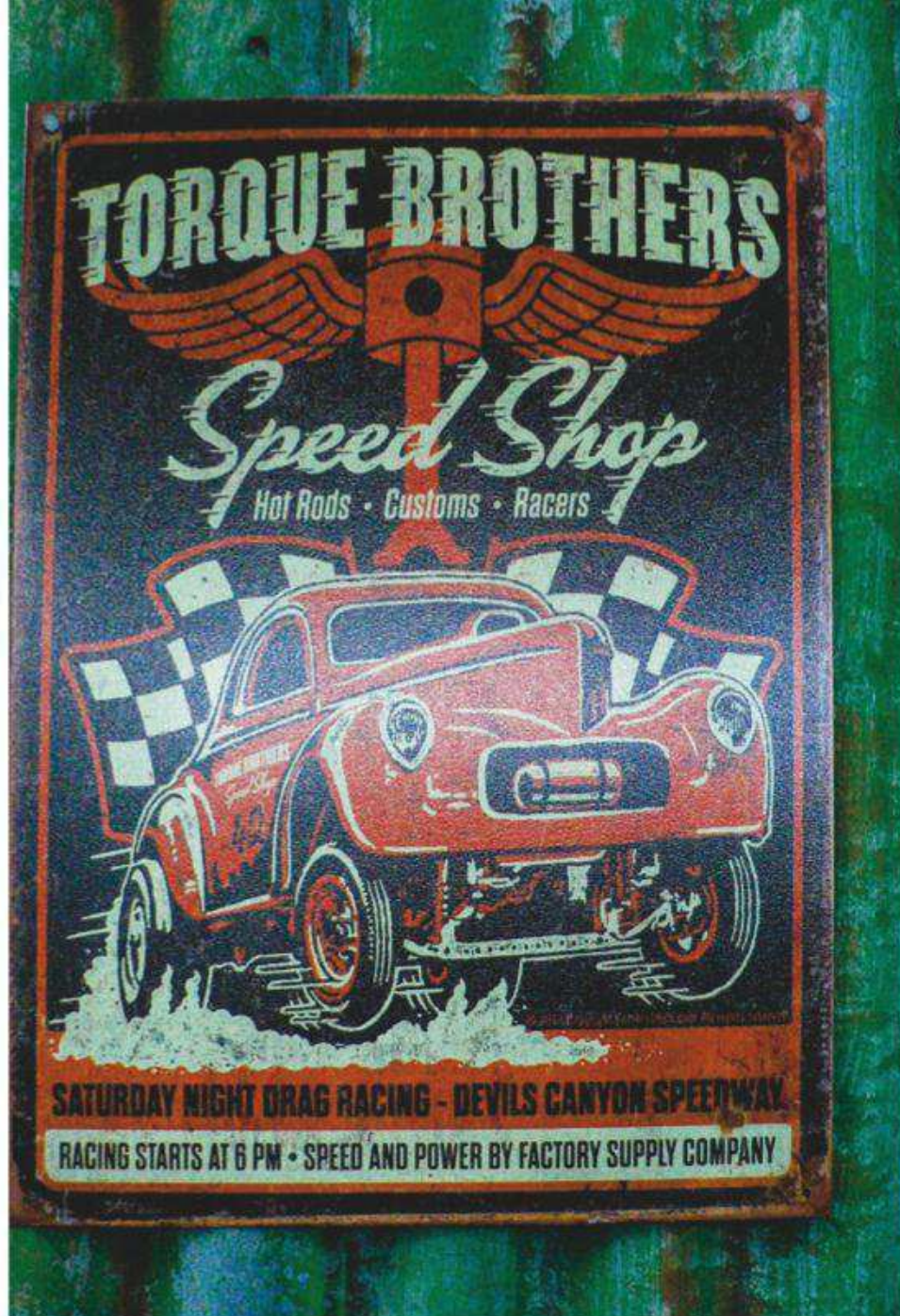
large printing and packaging company my father worked for.

Displayed on the interior walls were dozens of posters promoting radical political change, which had been set and printed in the room. I was given a humorous account of raids by the police on this disruptive focus of anti-government activity. The posters were colourful and confronting, and as well as being decorative were trophies of a conflict.

They were similar in a way to the rugby jerseys from British and French sides that my fifth form English teacher hung, for a few weeks, around his classroom. ►



Chart for Mazda automobile bulbs discovered under an old toolbox lid



Vintage vitreous enamel-on-steel battery sign



One of Paul Brenhelly's hand-painted-on-wood signs

“What do you buy for the person who has everything?”

Rock and roll

The covers (or sleeves) of vinyl long-playing records make interesting decorations and say something about their owners. The endpapers of Rolling Stone Keith Richards' autobiography featured part of his library of LPs — displayed spine out because of the very large number — which gave an insight into his musical influences. Sheddies who feature record sleeves on their walls could be forgiven for displaying them.

The danger is that records, books, perhaps even magazine covers used as decorations risk changing the shed into a 'man cave'. The most obvious difference between the two is the presence of a bar. A shed can have carpet on the floor but



Products of White Fire in Oamaru

if it has a bar it is probably a man cave. The exceptions would be spaces with bars where things (beer, say) are actually made. If the bar has a vice or two fitted then we are definitely talking about a shed.

My first attempt at shed building was on part of my family's vegetable garden. There wasn't an actual plan, but the design was based on a description of a 'den' in the 1956 annual of the British *Eagle* comic. Much was made in the story of the possible decoration of the boy cave. Cutaway diagrams of cars, warships, and aeroplanes from the centre page of the weekly comic were, of course, favoured and, perhaps as a consequence, when old copies of the comic turn up, the centre page is often missing.

Decorations for your shed

Meeting the demand for shed or man-cave decorations is an increasing business. Very large numbers of mass-produced signs and reproduction advertisements are being imported and sold in gift and novelty shops. The proprietor of such a

shop in our local mall told me that it had sold out of most of these items but more were on order.

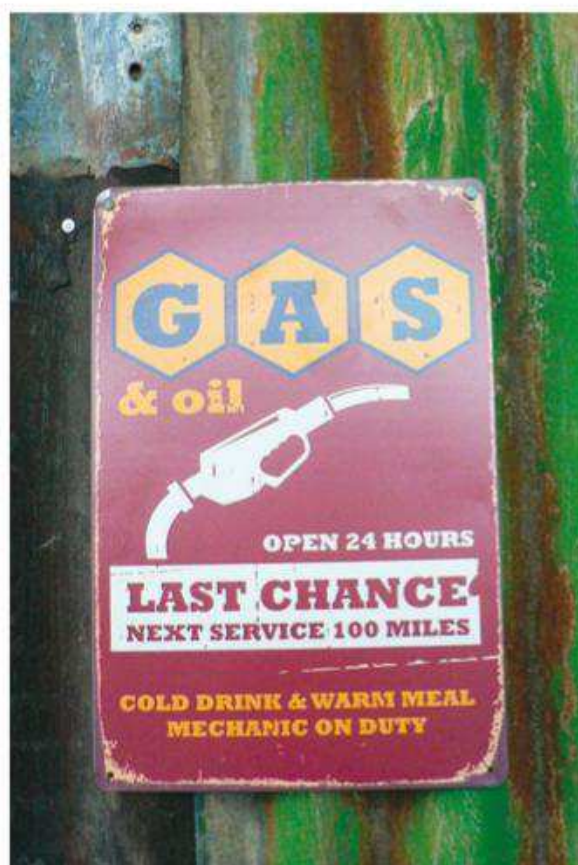
She volunteered the information that a lot of these signs were bought by the partners of the shed owners as gifts for the sheddie — what do you buy for the person who has everything?

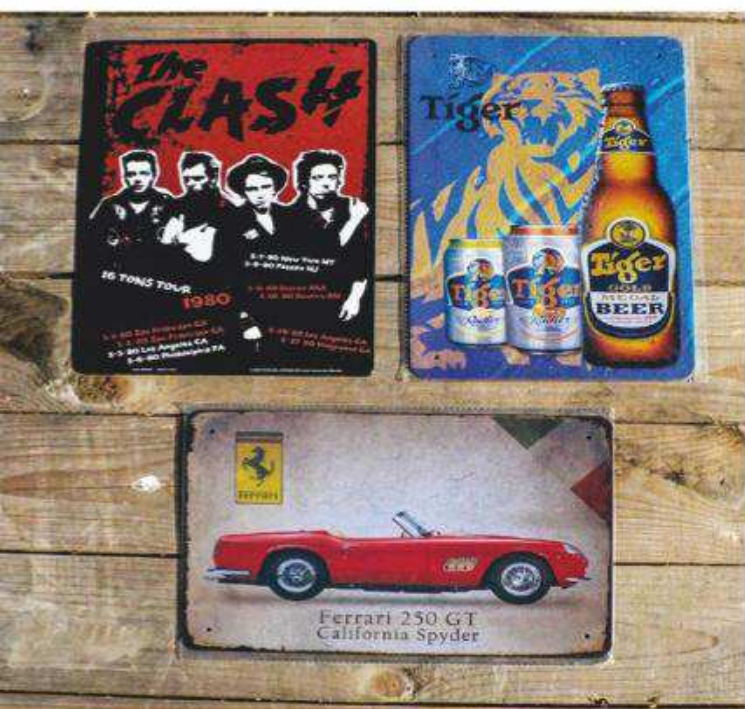
There are several New Zealand-based businesses that produce decorative items suitable for garages and workshops.

Spoilt for choice

Paul Brennelly is a very experienced tradesman signwriter who runs a shop called Bullseye in Bulls, which sells signs, each one unique, hand-painted on wood or on old saws. He describes them as “eye candy for sheds”.

Some of these are pricey, but he is making them for customers who can afford very expensive motorcycles or automobiles. He says that people with, say, \$50K motorcycles don't want “cheap, mass-produced signs printed on tin”. Being in Bulls (150km north of Wellington) he sees as no disadvantage either. He thinks that people with enviable cars and bikes





“Many don’t want cheap, mass-produced signs printed on tin”

want to use them and regularly drive for an hour or two on days off from their busy lives, so travelling to Bulls is something they easily do.

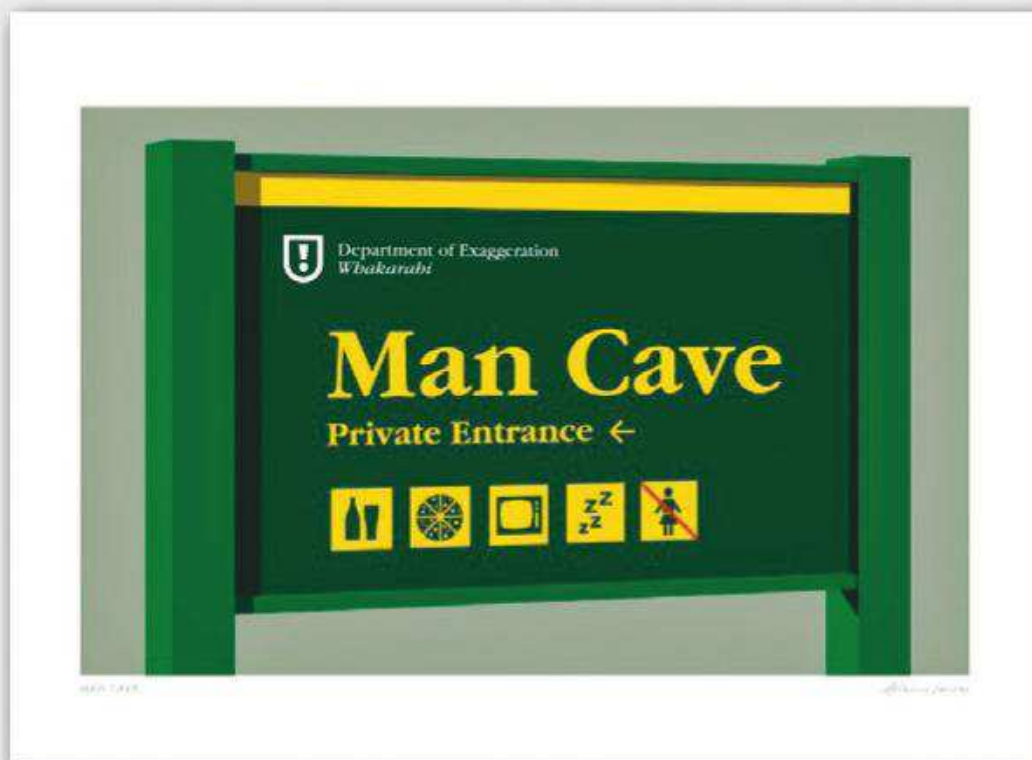
He also sells from his Facebook page to people as far away as Western Australia. He regularly sells to women who happily spend \$130 for a hand-crafted gift that is a one-off.

Bespoke signs

Shane Crossan has a large shed in Oamaru where he produces depictions of automobile, petroleum, or motorcycle logos and other designs in computer-numerical-control (CNC) plasma-cut 2mm sheet steel. “Made in a shed in NZ” is his motto. The finished items resemble metal stencils and are sometimes used as such. Customers paint the pieces, perhaps in the same colour as their car, or leave them fashionably unfinished. He adapts historic advertisements and signs on his computer, which then controls the cutting of the finished design on his American PlasmaCAM plasma cutter. He imported the machine from the US, assembled it, and taught himself to use it.

Shane first trained as a joiner in Christchurch. He developed his digital design skills while working as a fabricator for a company that made neon

Taste of Kiwiana



Glenn Jones is an Auckland-based designer whose business, Glenn Jones Art, sells his witty Kiwiana-inspired images from his website. He trained for a year in graphic design at the Auckland Institute of Technology (AIT) and then got a job at New Zealand Rural Press (NZRP), which produced titles such as *NZ Farmer*.

At the same time as they hired Glenn, NZRP invested in new computers. Assorted software was part of the computer package and when he started work, Glenn discovered an unopened pack of the then little-known Adobe Illustrator computer software programme. His very supportive boss allowed him to explore the programme when he wasn’t working on the design and layout of the publications and he was able to master the software by teaching himself. He still designs on-screen, using much more sophisticated programmes, but the underlying principles he learned 25 years ago still apply.

After returning from three years in London, Glenn worked on high-end design for a leading agency that had household brands as its clients.

Outside work hours Glenn created designs for T-shirts. The US website threadless.com produces T-shirts with designs that are submitted online, are voted for online, and the designs with the most votes are printed and sold. Glenn was the highest selling designer.

Thirteen years ago this attracted the attention of two entrepreneurial brothers from Austin, Texas, who formed a partnership, Glennz Tees LLC, with Glenn to produce T-shirts to his designs. The T-shirts are still in production and have been pictured being worn by many celebrities.

Three years ago, Glenn, now a family man, decided on a change of direction and he and his wife Julia now run Glenn Jones Art from their home. They used to print and frame the images Glenn produced in their shed, but the logistics of purchasing materials was time-consuming and cut into design time, so for the past year they have outsourced the printing and concentrated on design and sales.

His mock Department of Conservation track sign is an example of shed art with a Kiwi twist.

signs, using drawing programmes that he again taught himself to use. He sells his steel wall art in a local shop, from his web page, or at vintage car swap meets. Shane’s partner, Talia Pearson, works in a related field. She is a leading airbrush artist and signwriter, and often works on vans and hot rods.

Contact info

Bullseye Bulls: 76 High Street, Bulls; search ‘Bullseye Bulls’ on Facebook

White Fire: whitefirenz.com

Glenn Jones Art: glennjonesart.com

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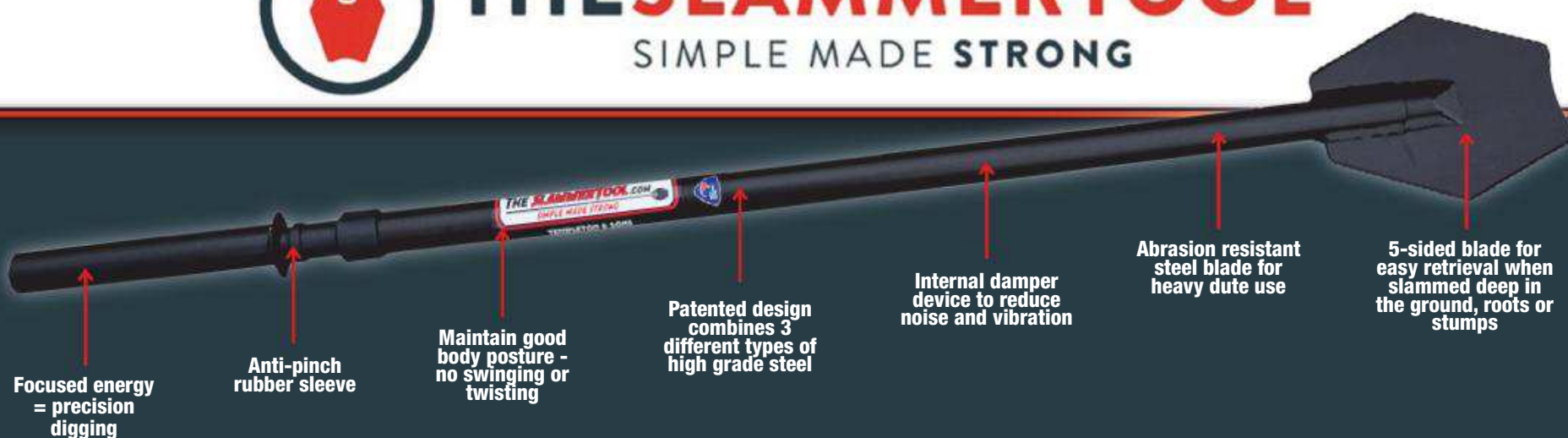


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Burn on celery pine

BURNING BRIGHT

BE CLEVER AND CAUTIOUS WHEN MAKING AND USING A LICHTENBERG WOOD BURNER

By Coen Smit

Photographs: Coen Smit

I recently became intrigued by Lichtenberg wood burners and their ability to make intricate burn patterns in wood — reminiscent of fine Chinese/Japanese paintings of trees, as well as fractal-like images.

Turning to Google as the fount of all modern knowledge I quickly discovered that it is relatively straightforward to build a Lichtenberg burner, if not exactly a safe thing to do, unless you are very careful about how you build it. You need to make sure to incorporate the sort of safety features I will detail in this article.

The heart of the machine is a transformer liberated from an old microwave oven. It can generate the necessary 2000–3000V required to start the burning process.

*The secret, of course,
when playing with
electricity lies in being
ultra cautious*

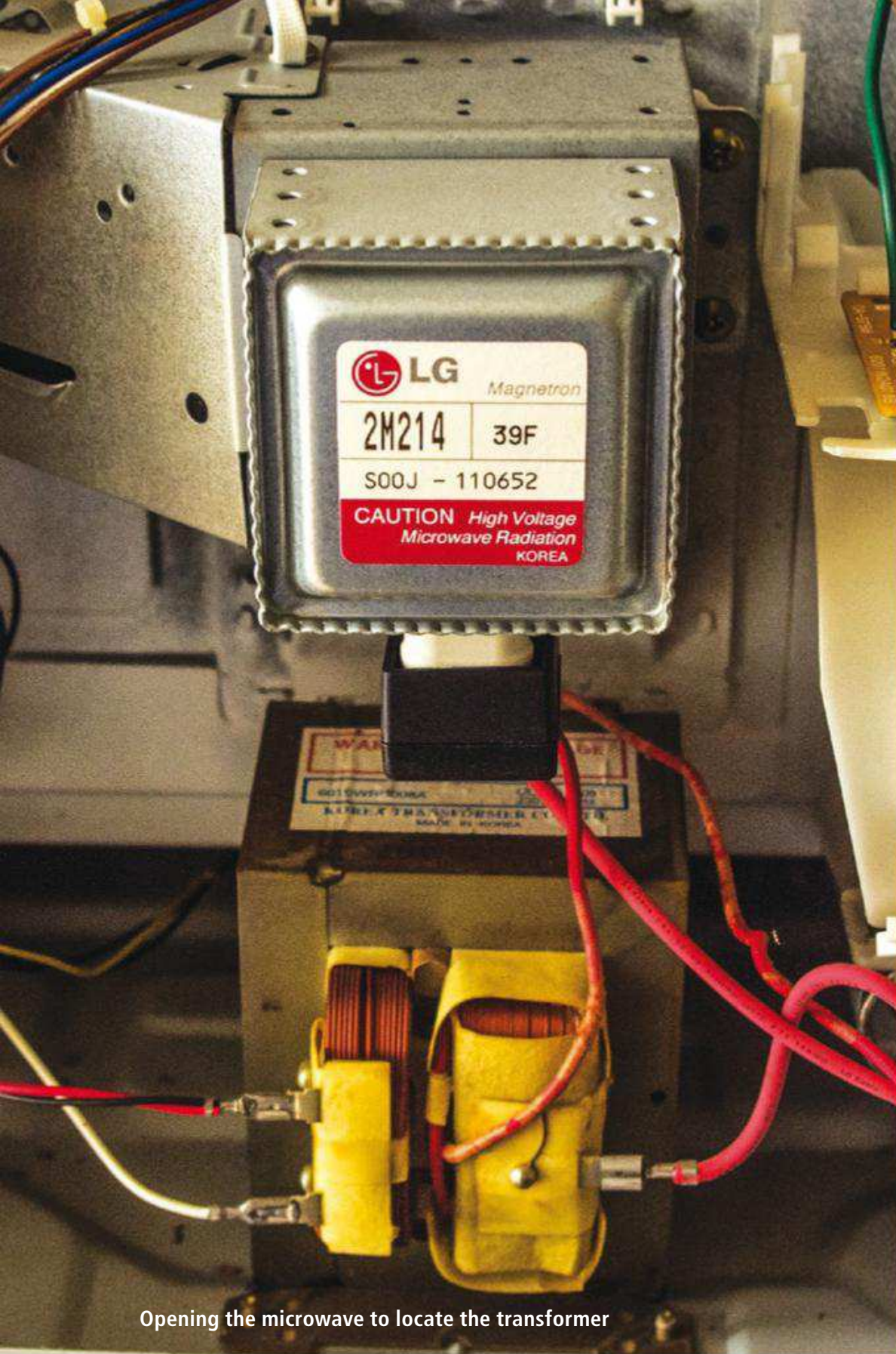
Sourcing your transformer

Unfortunately, it can just as easily generate the voltage necessary for you to shuffle off your mortal coil, which is a bit of a dampener and a drawback. Apparently, neon-sign transformers are more forgiving and are able to create effects that are more delicate, but they aren't as ubiquitous as the microwave version and therefore less appealing. Another option is using the transformer normally fitted to oil-burning heaters.

I haven't seen one of these for many years so I didn't attempt to track one of those down.

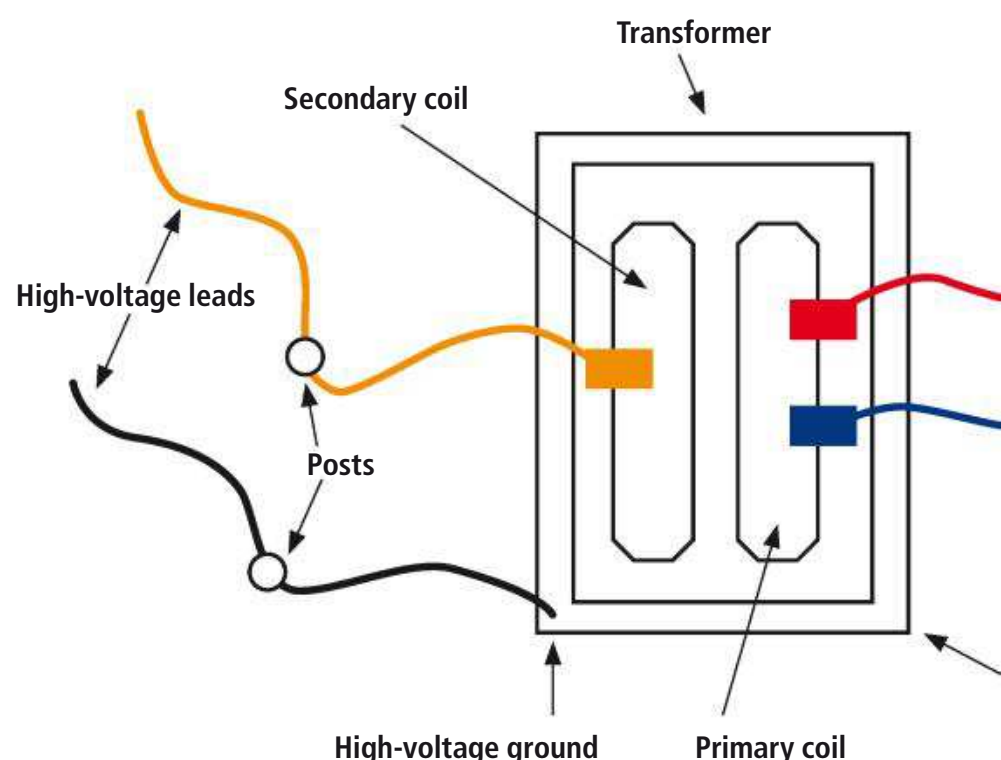
The secret, of course, when playing with electricity lies in being ultra cautious, being careful, and not taking shortcuts. It's simple really — electricity must be able to contact you directly or indirectly through a conducting medium for it to hurt you. Just don't give it a chance to do so.

Therefore, if you want to explore the world of Lichtenberg wood burning you should set up your equipment in such a way that you switch it on and off remotely at the power point, or a switch fixed to the burner's housing. Never reposition either of the burner leads unless the power is off at the switch, and preferably the power point as well. ►



Opening the microwave to locate the transformer

A warning clearly pasted on the transformer informed me that the capacitor needed to be discharged before handling it



Wiring up the microwave transformer

Having sourced your microwave, remove the casing and you will clearly see the transformer sitting below the magnetron and to the side of the oven itself. Beside it there should be a capacitor connected by a heavy-duty wire to the high-voltage side of the transformer (the secondary coil). When I picked up my donor microwave, a warning clearly pasted on the transformer informed me that the capacitor needed to be discharged before handling it. This bit of important information had been glossed over by one YouTube post with the simple comment that he didn't get a boot from the capacitor so he could proceed. I made the effort and googled 'how to discharge a microwave capacitor', then made

sure that I followed the advice before touching the transformer.

The easiest way to do this is by using a well-insulated screwdriver to short out the capacitor's two terminals, or jury-rig the screwdriver, wire, and an alligator clip so that each of the capacitor terminals can be shorted to the body of the capacitor. In the photo of my microwave before dismantling, you will clearly see a red, heavy-duty wire coming from the transformer, along with two other red wires heading to the right. These wires are going to the capacitor nestled under the white plastic framework evident in the picture.

Putting in a safety switch

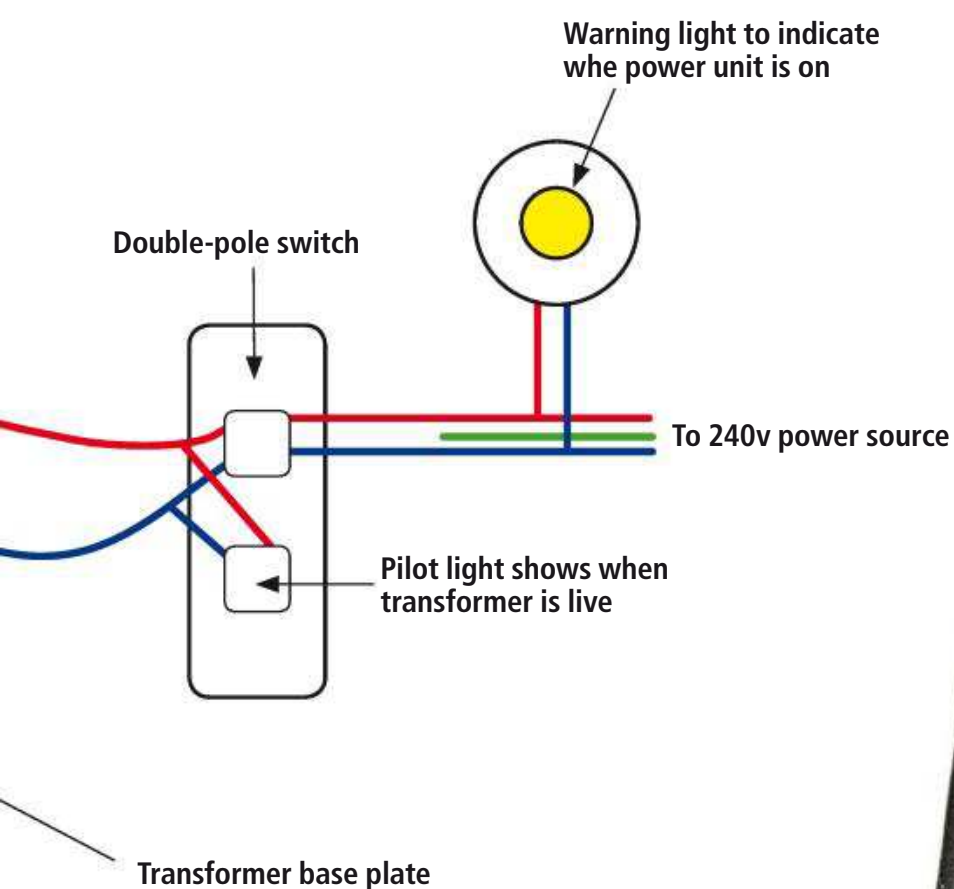
The transformer consists of a primary and secondary coil. Two spade terminals

protrude from the primary coil. These spade terminals are the positive and negative terminals for the 240V power supply. The secondary coil has a single spade terminal, which is the positive lead for the burner. The negative lead for the burner is connected to the base of the transformer unit after removing any paint from the connection point to ensure that a good contact is made. To prepare the transformer for its new function, cut and cap off any other leads coming out of either coil as neatly as possible, as they are not needed.

Taking a leaf from a YouTube video on making use of these transformers for this purpose, I purchased a double-pole double-throw switch. When this sort of switch is in the 'off' position, both the active and neutral are disconnected. I

Right: The Lichtenberg burner all wired up and ready to go

Below: Wiring diagram for the Lichtenberg wood burner



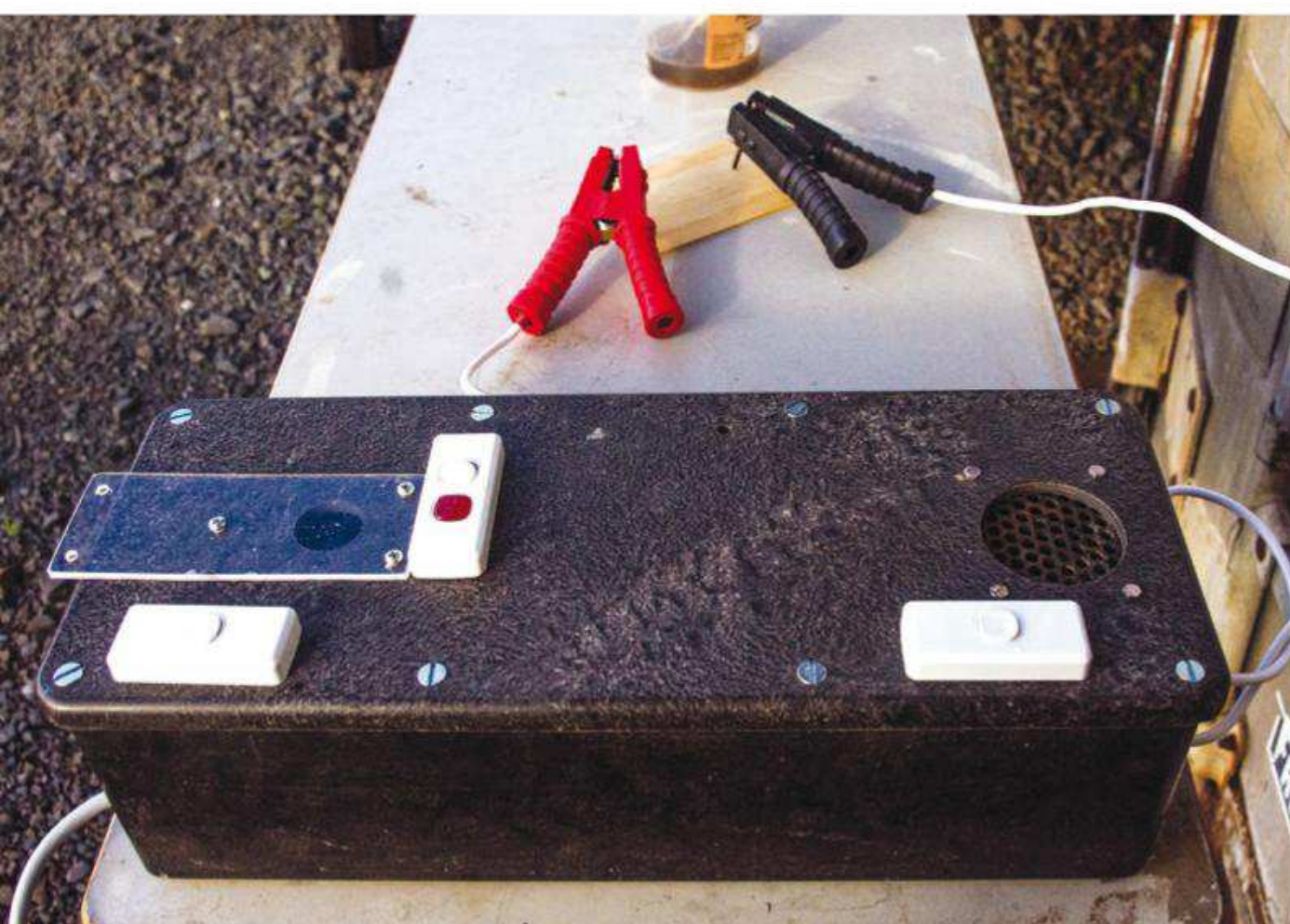
purchased a 240V light baton with a low wattage bulb to put in the circuit on the 240V side, as well as a red pilot warning light to fit between the switch and the transformer. The light before the switch warns me that there is 240V of power going to the unit, while the red pilot light, when it comes on, tells me that the transformer is ready to be activated.

Following some advice, I also fitted two 16A 250V bell-press switches at either end of the box and wired them in on the supply side of the primary coil of the transformer. They are spaced more than a hand-width apart and are wired in such a way that both must be held down for the transformer to be activated. It's a simple and effective way to ensure that I don't accidentally contact a live probe. ►





Above: Burn in progress on celery pine
Below: The final incarnation of the burner



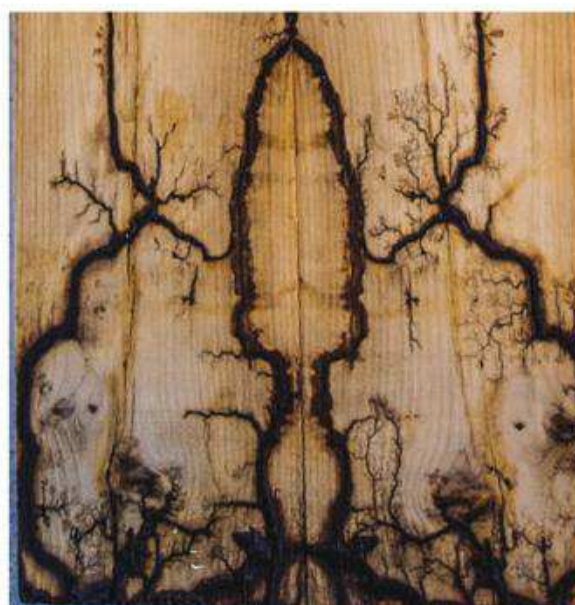
How to burn

Once you are set up with wood, probes in place, and solution applied, doing a burn is a three-stage process. Turn on at the mains power source and the pilot light comes on. Turn on at the double-throw switch and the red warning light is activated. Press and hold both bell-press switches and the burn commences. To instantly stop the burn, just let go of one, or both, bell-press switches.

I selected two 1m lengths of 10mm high-voltage copper wire as leads for the probes on the burner side of the transformer. However, I discovered an immediate problem caused by the rigidity of the high-voltage cable and the fragility of the spade terminal on the secondary coil. A couple of accidental wriggles during construction resulted in the spade terminal snapping twice.



Above: An internal burn
Left: Detail of burn in progress on celery pine
Right: A celery pine burn
Below: The result of the internal burn on celery pine



To remedy this, I purchased two posts and fixed them to the inside of the box so that the high-voltage leads were not directly connected to the transformer (see photo). This means that any pressure coming on to the high-voltage cables, when bending or positioning them, is transferred to the posts and not the spade terminal connection on the transformer, or the ground connection to the baseplate of the transformer.

Parts housing

I sourced a strong Bakelite box salvaged from the electrics of a 6m refrigerated container to house the various bits and pieces. In it I inserted a tight-fitting, rigid plastic baseplate to bolt the transformer to. This means that its mounting bolts are completely insulated and cannot possibly short to anything

Once you are set up with wood, probes in place, and solution applied, doing a burn is a three-stage process

that the unit happens to rest on. I then cut a hole in the side of the box and another in the top and covered them with mesh to provide ventilation for the transformer and stop fingers from being accidentally inserted into it. As a final precaution I used my voltmeter on its ohm setting to check for any potential short circuits during assembly of the burner and the posts, mesh, etc., as all required small nuts and bolts fitted through the Bakelite box. Electricians





Burn on Tasmanian oak

Frequently moving the probes, doing only short-duration burns, and carefully controlling the saturation level give you control over how deeply the tracks are burnt in the timber

will undoubtedly shake their heads and grin at my ultra-cautious attitude, but I was determined to eliminate even the smallest possibility of a mishap.

Choosing the probes

I next turned my attention to manufacturing the two probes that transmit the current to the wood. I spent some time thinking and planning the sort of probes I wanted, as this, after all, is the business end of the burner. Some examples on YouTube consisted of a probe and lead somehow fastened to a section of PVC pipe held and moved by the operator. Another used a couple of heavy-duty alligator clips clamped on to short rods. I'm not keen to hang on to anything with such high voltage

running through it, even though it is insulated.

I settled on buying a couple of heavy-duty, jumper-lead alligator clips, which can purportedly handle 600A. Their size makes them fairly stable when positioning on the timber with a short copper rod clamped in their jaws. They will also enable me to experiment with different metal sections in contact with the timber to create different burn effects. However, despite their high 600A rating, there are some metal parts exposed on each clip and the insulating plastic is quite thin, so I would strongly advise that you do *not* attempt to touch or move a probe while the burner is on. (They are designed for 12V and 24V systems, not 2000–3000V ones.) ►

Construction costs



I purchased a more powerful electric soldering iron and subsequently also had to invest in a gas-powered one to be able to solder the heavy lugs on to the high-voltage cables. This drove the overall cost of making the burner higher. However, both will undoubtedly be used in other projects as well, so it is inappropriate to add the cost of these items to this particular project alone.

The most expensive parts I had to buy were the double-pole double-throw switch and the pilot light, which together set me back around A\$50. The 2m of high-voltage cable cost around A\$10 and the microwave cost A\$8 from my local tip shop. The two jumper-lead alligator clips added another A\$25 to the total cost and the bell-press switches A\$40. The box and other bits and pieces I already had lying around the shed. As a rough estimate it would cost less than A\$150 (NZ\$164) to buy all the bits needed, and considerably less if you simplified, or left out, some of the added safety features that I incorporated into my unit. I could have eliminated the double-pole double-throw switch and the pilot light and just relied on the two bell-press switches to deactivate the transformer.

For the budget conscious, most of the examples I saw on YouTube were mounted in open wooden boxes. These are not suitable, as they allow contact with the mains, so you should consider a lid to make sure the box doesn't get wet, or you don't inadvertently place any metal tools, etc., across the open side! I am more cautious, and opted for the enclosed Bakelite unit, making it impossible to accidentally contact the transformer or inadvertently loosen any connections. All the 240V wires running between various components are completely enclosed and the only remaining hazard is the two probes coming out of the unit when it is switched on.



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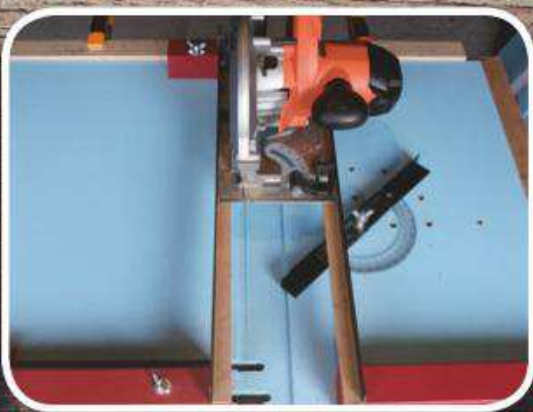
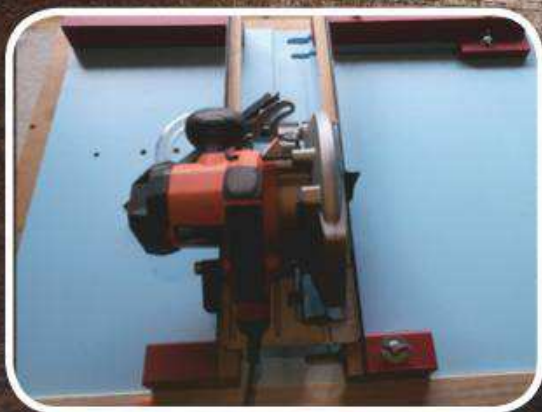
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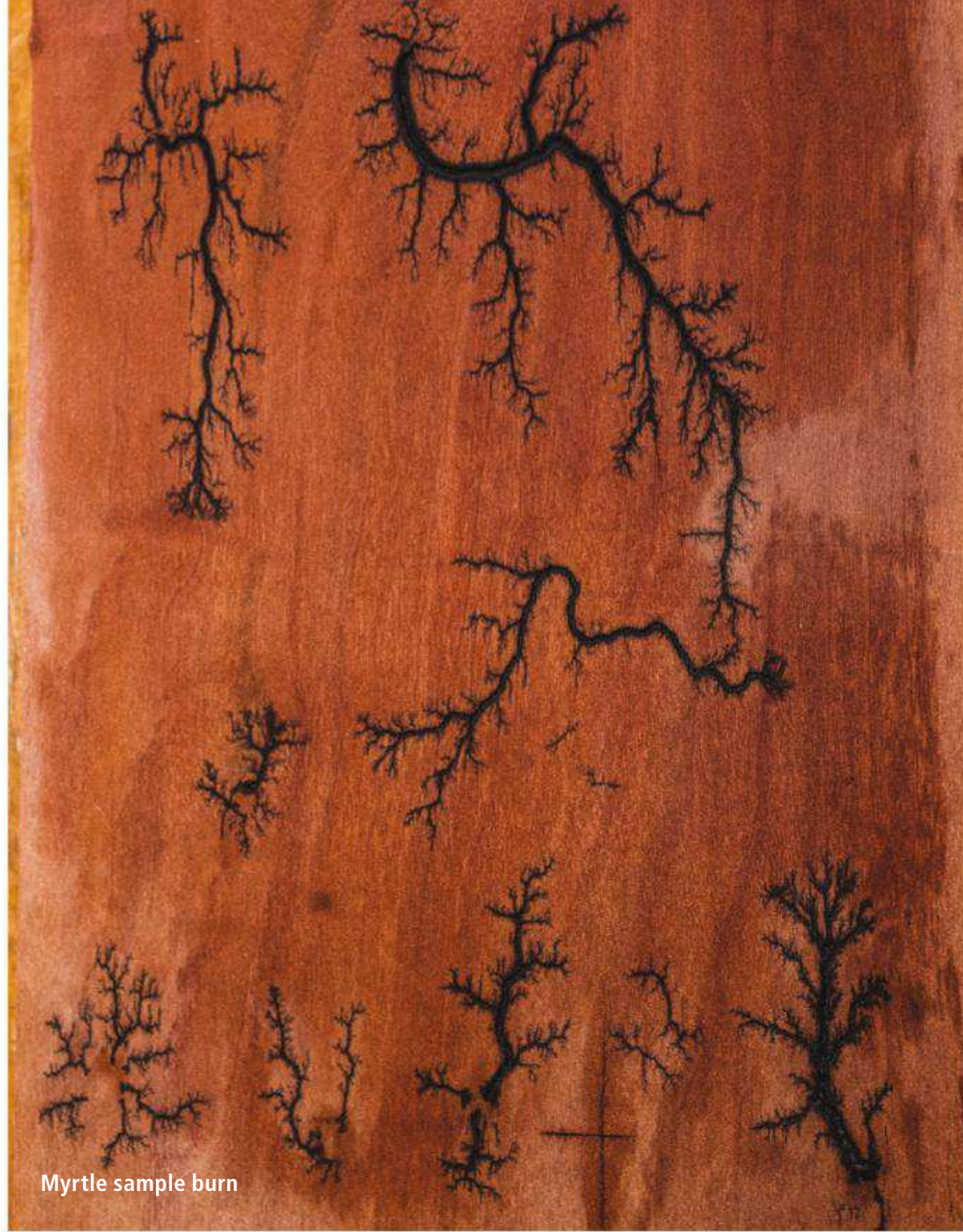


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Myrtle sample burn



Sample burn on plywood

Experimenting with the first burns

To get a feel for the process, I decided to experiment with some scrap pieces of timber and vary the duration of the burns, as well as the level of saturation of the timber with the borax solution. Using celery pine resulted in more finely detailed burns, clearly showing the small spidery tendrils as the electricity made its way between the probes. Tasmanian oak burnt more deeply and rapidly, and also lacked the fine detail of the celery pine. Tasmanian myrtle gave a similar result to the celery pine, and plywood gave a more coarse finish, but not as aggressive as the Tasmanian oak.

Frequently moving the probes, doing only short-duration burns, and carefully controlling the saturation level give you control over how deeply the tracks are burnt in the timber.

Apart from controlling the position of the two probes, the process of the burn itself is unpredictable, making every project unique and different. It

It therefore lends itself to adding further points of interest to bespoke items, such as wooden furniture and boxes

therefore lends itself to adding further points of interest to bespoke items, such as wooden furniture and boxes.

Can you trust YouTube?

As you will gather I have relied quite a lot on YouTube clips of Lichtenberg burners for inspiration for how to build my own. A word of caution needs to be raised here. Just because someone makes what seems to be a useful video and posts it on the internet does not necessarily mean that their approach is safe or even correct. Most YouTube sites recommend that you wet the timber

with a tablespoon of borax in 500ml or so of water before starting 'the burn'.

Presumably, the borax is important in causing the shorting process, which is necessary to 'get the burn'. One YouTuber blithely sprayed a mix of the solution on his timber while the burner was on when he felt "it was getting a bit dry".

If the borax is important to get the burn, common sense suggests that it conducts electricity, which to me at least means that happily spraying a mist of it from a hand-held bottle on something generating 3000-odd volts at the time may not be the smartest idea.

So I highly recommend that if you are enthused about making and using a Lichtenberg burner, you check out the YouTube sites devoted to them, look at their suggestions and how they go about demonstrating their burns, and run both through the filter of your own common sense first. This is one activity where your day can very rapidly be ruined if you opt for the wrong technique. ►



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Building a dead man's switch

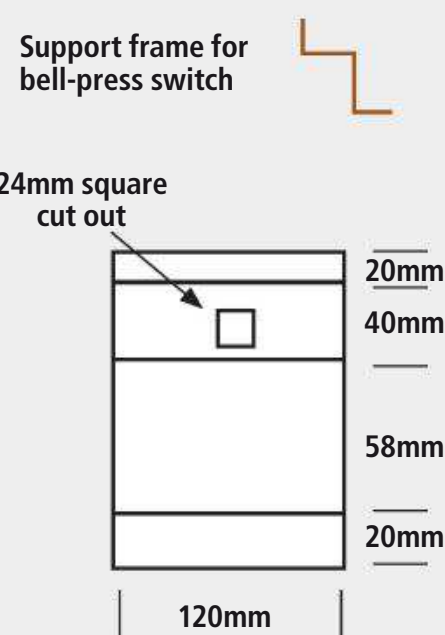
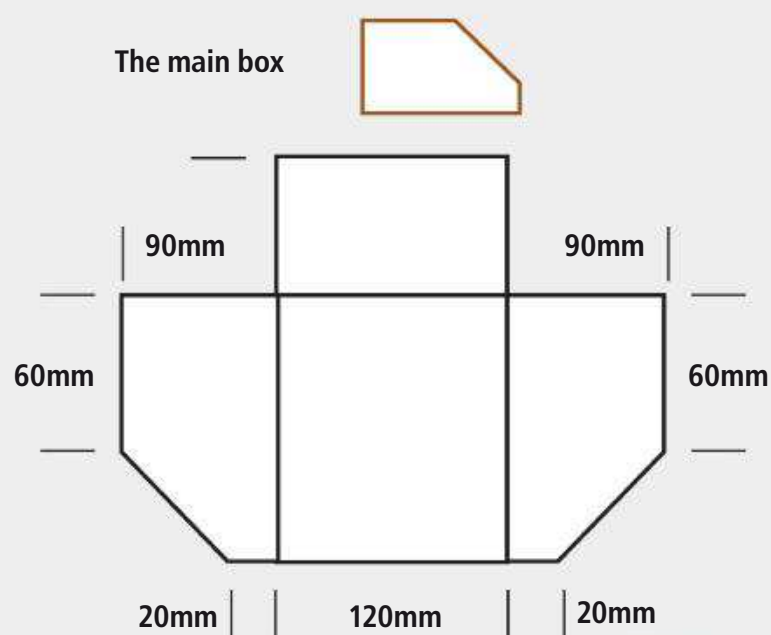
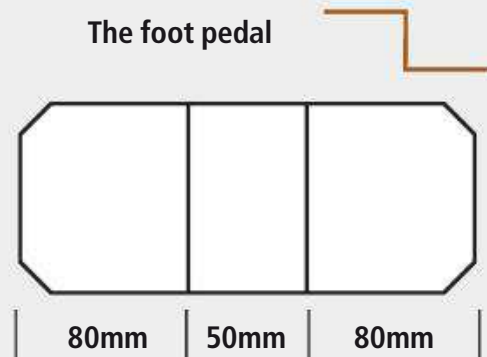


The parts for the dead man's foot switch

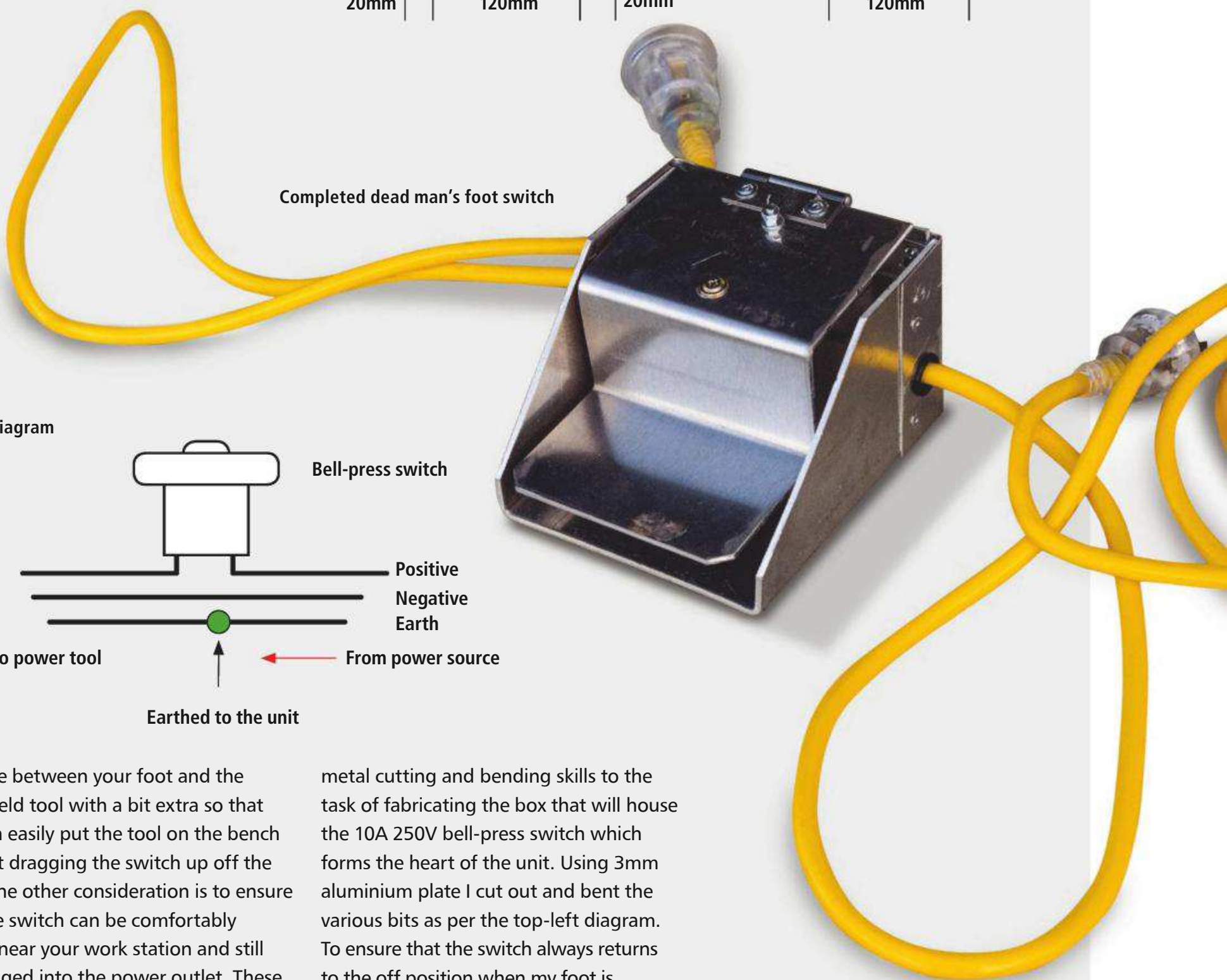
When submitting this article on the Lichtenberg wood burner to *The Shed*, the editor kindly pointed out that incorporating a fail-safe cut-out switch would be a good idea given the high voltages involved. As you can see, I have installed one of these for this burner but then it set me thinking — why not make a stand-alone dead man's switch? Such a device could be used in conjunction with a variety of workshop tools, making their operation safer and more user-friendly. After all, routers, power, and cut-off saws, as well as angle grinders, can all inflict very nasty injuries in a fraction of a second. I can still remember nearly breaking my wrist many years ago when a heavy electric hand drill, fitted with a one-inch drill bit, decided it was time for me to revolve instead of it! A foot-operated cut-off switch would have been just the ticket on that occasion. The 'dead man's switch', as I will call it, is a simple device fitted in between the power supply and the operating equipment that requires a foot kept on it at all times for power to be supplied from the source to the equipment. As it will undoubtedly spend a lot of its time on hard floors and possibly uneven surfaces, it needs to be robust, as well as big enough to accommodate your foot comfortably. It should also be rugged and well protected from the scuffs and knocks that it will undoubtedly suffer over the years. The simplest and, in my opinion, probably the most cost-effective way to build it was to purchase a heavy-duty workshop extension lead, cut it, and install the dead man's switch. The 5m lead I chose also happened to be bright yellow, making it easier to find among the tools and machinery, and less likely to trip over. This is important because if it's easy to locate, chances are that it will be used regularly, adding to overall safety in your shed. Most electric hand tools have reasonably long leads so deciding where along its length to cut the extension lead boils down to guesstimating the average



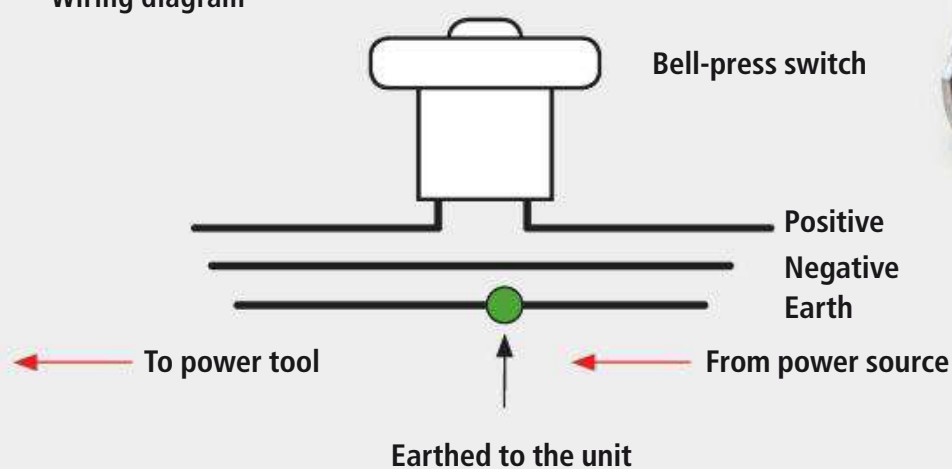
Diagrams of the parts for the dead man's foot switch



Completed dead man's foot switch



Wiring diagram



distance between your foot and the hand-held tool with a bit extra so that you can easily put the tool on the bench without dragging the switch up off the floor. The other consideration is to ensure that the switch can be comfortably placed near your work station and still be plugged into the power outlet. These parameters should determine the length of the extension lead you choose for your own switch.

As I am fortunate enough to have access to scrap pieces of aluminium, I put my

metal cutting and bending skills to the task of fabricating the box that will house the 10A 250V bell-press switch which forms the heart of the unit. Using 3mm aluminium plate I cut out and bent the various bits as per the top-left diagram. To ensure that the switch always returns to the off position when my foot is retracted, I purchased a compression spring to install ahead of the bell-press switch. The spring is kept in place on either end by nylon bushes turned up to suit it.

Having cut out and bent the aluminium to make the box, its paddle, and the support for the bell-press switch, I wired it in according to the top-middle diagram.



GOING SHOPPING

BUYING LOCAL WON THE DAY
WHEN CHOOSING A CNC ROUTER

By Mark Beckett

Photographs: Mark Beckett



Haas vertical mill



Logo completed

For a few years now I've been involved in element14's community and we have had the odd discussion and design challenge where someone has used their CNC router to make something. I'd decided that it would be nice to have one, but wasn't convinced.

Earlier this year, I'd had a discussion with my father, who was kind enough to make 50 Christmas-tree decorations for a friend — all by hand — and decided that it would have saved him a lot of work if he had had access to a CNC router.

When I was making edge-lit signs

(*The Shed*, Issue No. 75, November/December 2017), I hinted that a CNC router would make this a much neater and easier job.

So with the seeds of possible uses growing, I started to ask questions about what sort of machine to buy, and did some googling as well.

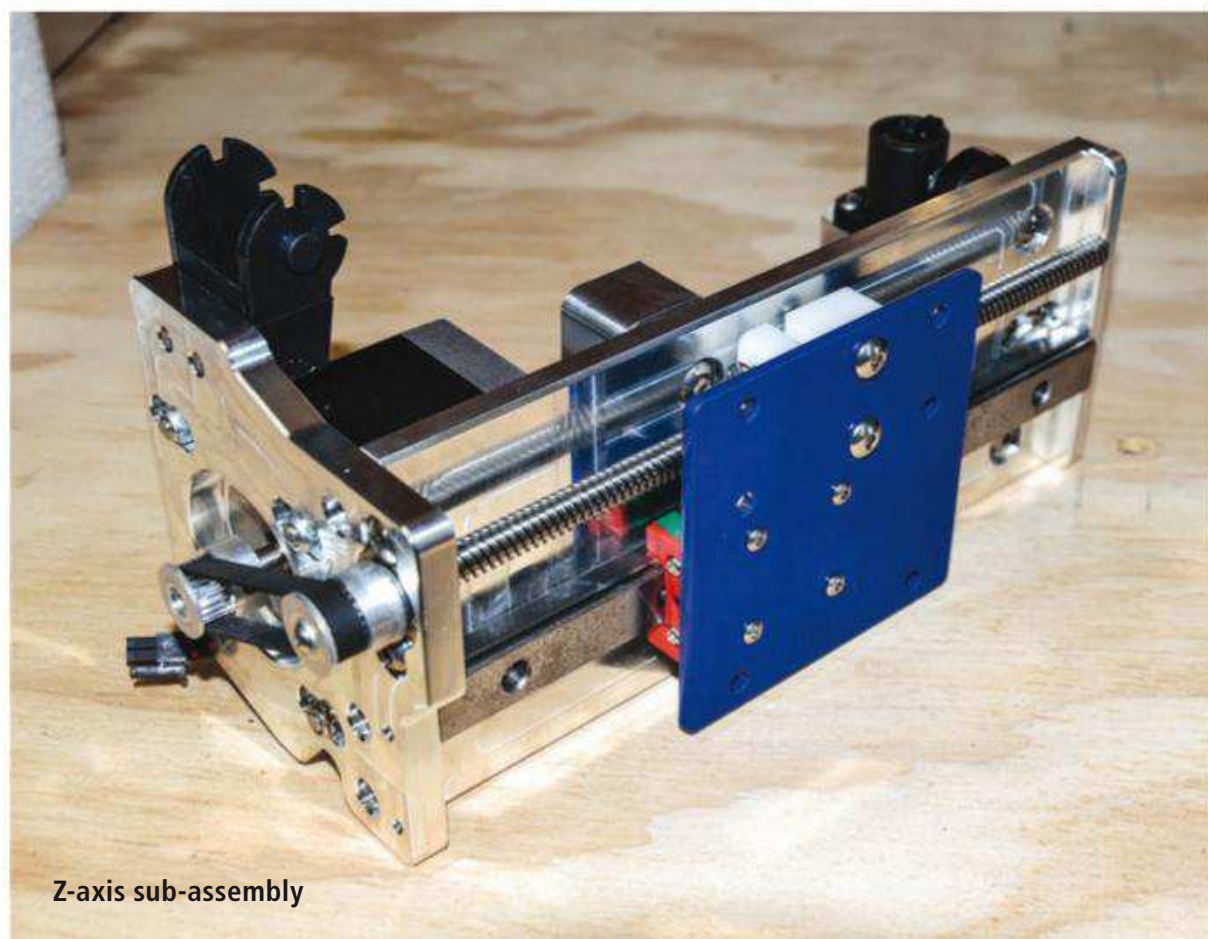
Typically your searches will return everything from the cheap option, which promises everything and has a working area that you just know is too small, to the large industrial units that require a new connection to the national grid, along with a new shed just to house one!

Why Westport?

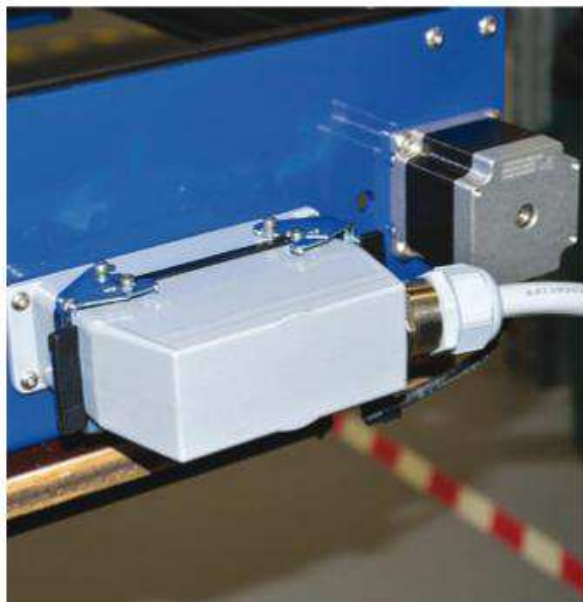
Eventually I decided on the M1 unit, one of the M Series made by Vertigo Technologies in Westport.

I decided that with some help from *The Shed*, I'd reach out and make contact with Brett Cottle from Vertigo Technologies. This meant a road trip to Westport from Christchurch to visit Vertigo, and that can never be a bad thing, can it?

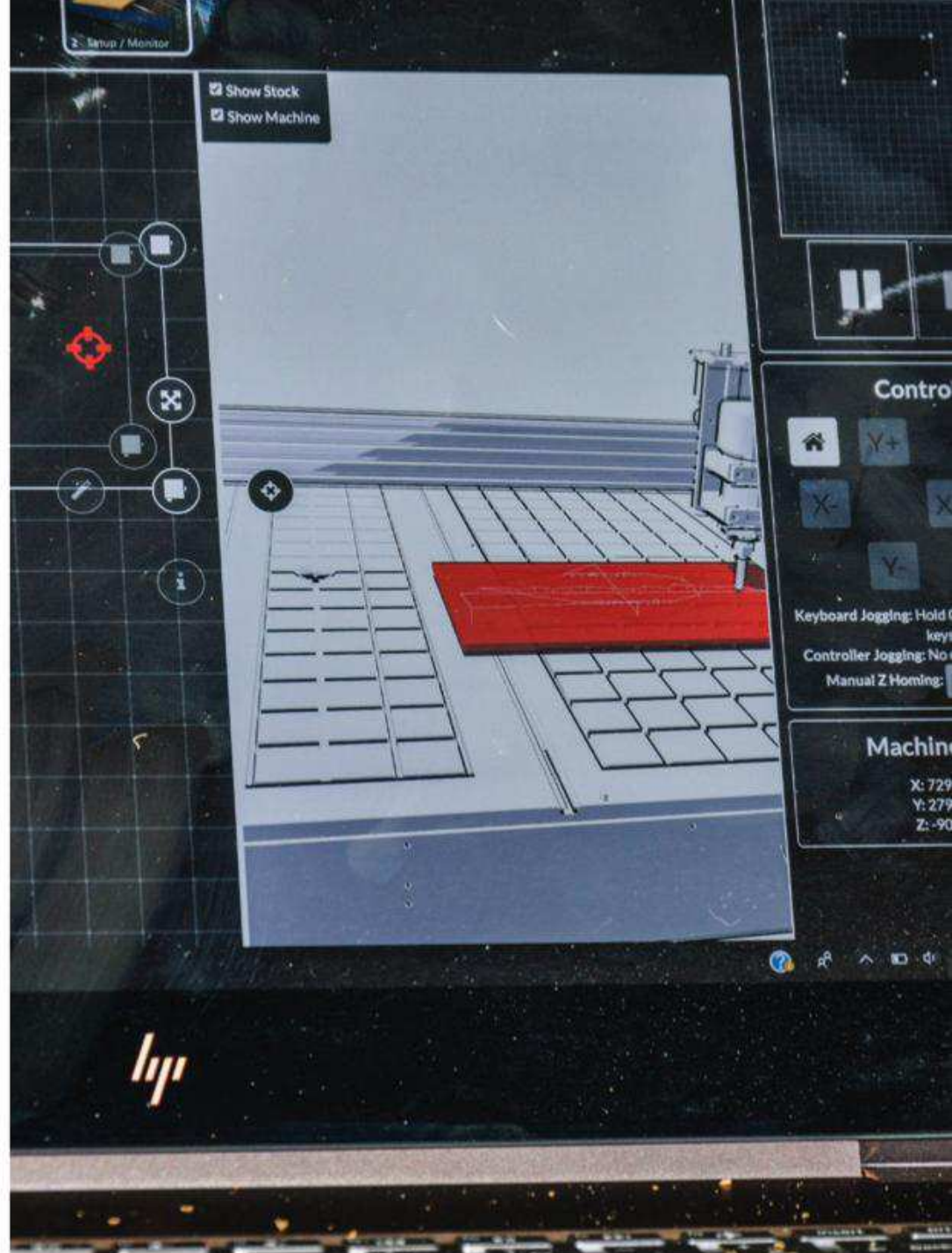
I had lots of queries about his products, location, business approach, and more:



Z-axis sub-assembly



Above: Roller cover featuring increased height and debris cover
Left: Connector for separating the controller, making upgrade/repair much easier
Right: Close up showing the real-time view of where the process is at. The 3D view on the right can be rotated and moved in real time



The Shed: Why Westport?

Brett Cottle: Lifestyle ... after all there few places in the world where you can cost-effectively set up a high-tech manufacturing plant surrounded by mountains with the ocean on your back doorstep. Westport may be remote, but it is also full of some really talented and supportive people. Staff-wise there were some challenges, but we we've been able to overcome this and they have qualities that suit us.

Do you make all the parts?

We don't make all our parts; we import the extrusion, rails, and lead screws, and some other parts are currently manufactured in Christchurch. All the high-precision componentry is made in-house on our Haas vertical mill. We're looking to purchase more machinery to overcome some supply challenges with external suppliers. But all the assembly, testing, and product development is done here in Westport.

Designing your own controllers must have been costly; why not use off-the-shelf (OTS)?

We did use OTS controllers, but

we found it limiting, and we really wanted our big point of difference to be developing smart machines that are easy to use. There has been some cost, but it has helped us to design in features that customers actually want. It has also helped to overcome supply issues

My father decided that it would have saved him a lot of work if he had had access to a CNC router



One logo engraved from some waste rimu



Starting the process using the new software

with the current driver chips [ICs that control the stepper motors — the four black squares in the photo of the current driver board on page 97], which are in worldwide demand, so we've been able to adapt to use an alternative in a very short time frame.

How did you arrive at the router sizes?

The sizes are based on [the] standard-size material — that is, 600, 1200, 2400 — [that] you can source. The goal was [that] we wanted to develop a machine people could use without fuss and pre-prep of material.

If someone wants a custom solution, can you provide it?

We have done a few custom builds, but it does contribute to assembly delays, so

“There few places in the world where you can cost-effectively set up a high-tech manufacturing plant surrounded by mountains with the ocean on your back doorstep”

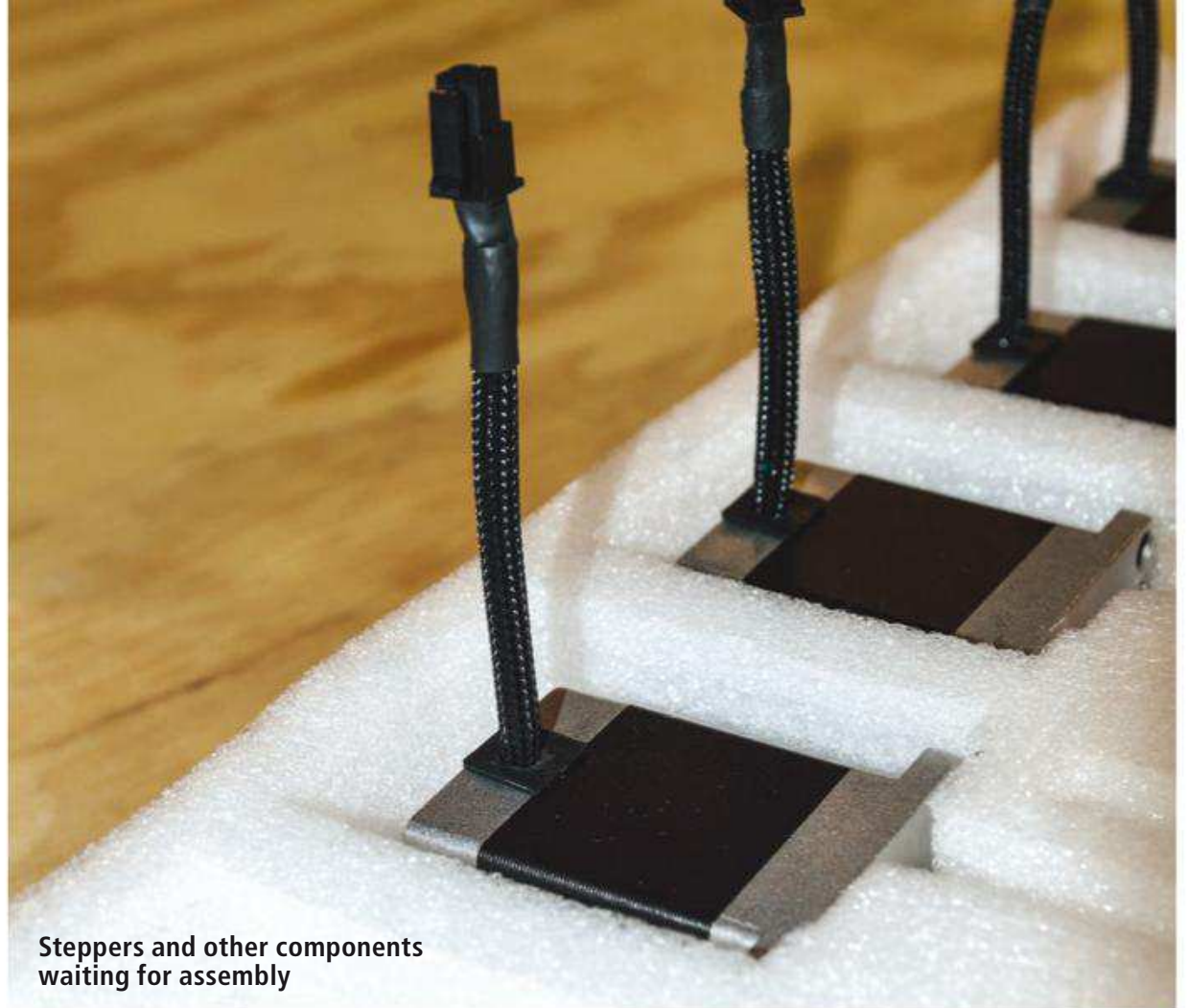
while we can do custom work it needs some discussion before committing.

One custom build we completed was a 6.5m CNC for drilling aluminium extrusion. That was a massive, awesome project to work on, and we learnt so much. It had a negative impact on production that we'd need to revisit before repeating.

Do you provide support and training?

Yes we do. We're always happy to do a TeamViewer [i.e., web-conferencing] session with a customer and there has been a few times when we've gone to Auckland or Christchurch to do training. **The current order time is seven weeks — why?**

The lead time is primarily due to external supplier time frames. We are currently working hard to invest



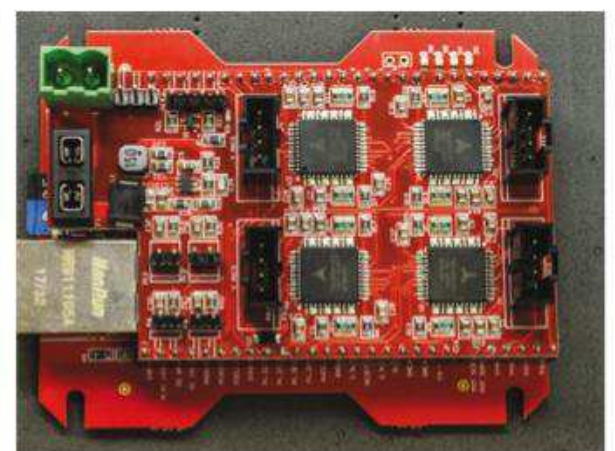
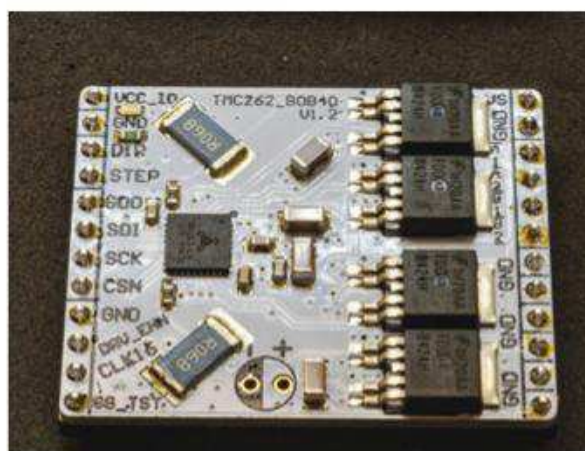
Steppers and other components waiting for assembly

Below: Vertigo is using a double-box arrangement, where each box holds enough for a week. The empty box is passed to procurement to refill, and goes at the rear. This approach ensures that the assembly line isn't short of parts

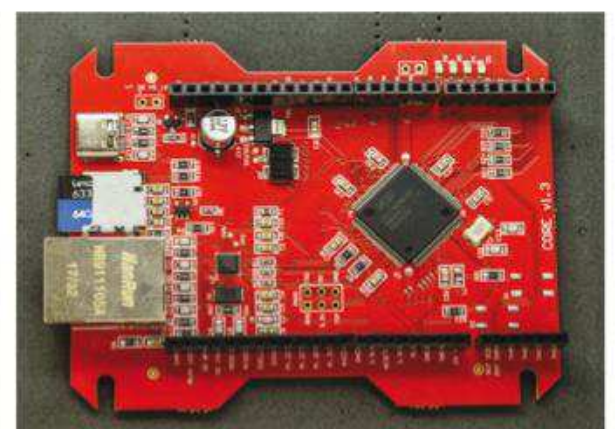


New driver board using MOSFETs to do the grunt

Current driver board



Below: Current Core controller board, front (left) and rear



in efficiencies to help speed up the assembly time without compromising build quality.

The current plan is to significantly reduce this by the end of 2018.

What is the return rate — what is failing?

We've had issues with 13 units (6.5 per cent) and only three required returning to base. As we've developed the product, we've upgraded some controllers that showed USB stability problems. Some were USB cables/ports. Other problems were faulty crimp connectors that have been resolved at production with a much more expensive crimp tool.

In each case we've made sure [that]



Finding the edge and height with the zeroing tool

the problem was resolved, and in one instance that involved sending a staff member to the North Island over the weekend to fix it ready for use on Monday morning.

Where do you see Vertigo Technologies in five years' time?

Currently we have a lot of interest from Australia and Canada, and we're working on raising capital to help employ and train more staff to meet the expected demand.

We've started implementing kaizen [see box on page 100] methods to allow increased production and increase our efficiency.

Our goal in five years is for Vertigo Tech to become a market leader worldwide in

desktop manufacturing tools, not just CNC routers but water jets, laser cutters, etc. We're well on the way to achieving this.

My visit to Westport

I was able to arrange a visit to Westport and observe what these guys and gals were doing and have a talk about the advantages and disadvantages of their products.

My first impression was the open and honest answers provided by Brett and the team. Normally you get the spin doctors who show and tell you what they want you to see and gloss over the other bits, but not here.

I was able to talk to everyone without

a 'minder' and their passion for working there showed.

I had a discussion with Brett and Josh Mclean about the advantages and disadvantages that they see and get from tyre kickers.

I enjoyed this, as it told me that they know where their product sits in the market and know other people's product, which can make a difference to a sale.

User suggestions for improvement

While the product itself is impressive, being local allows for New Zealand customers to make suggestions to improve the product. ►

Plus points of Vertigo routers

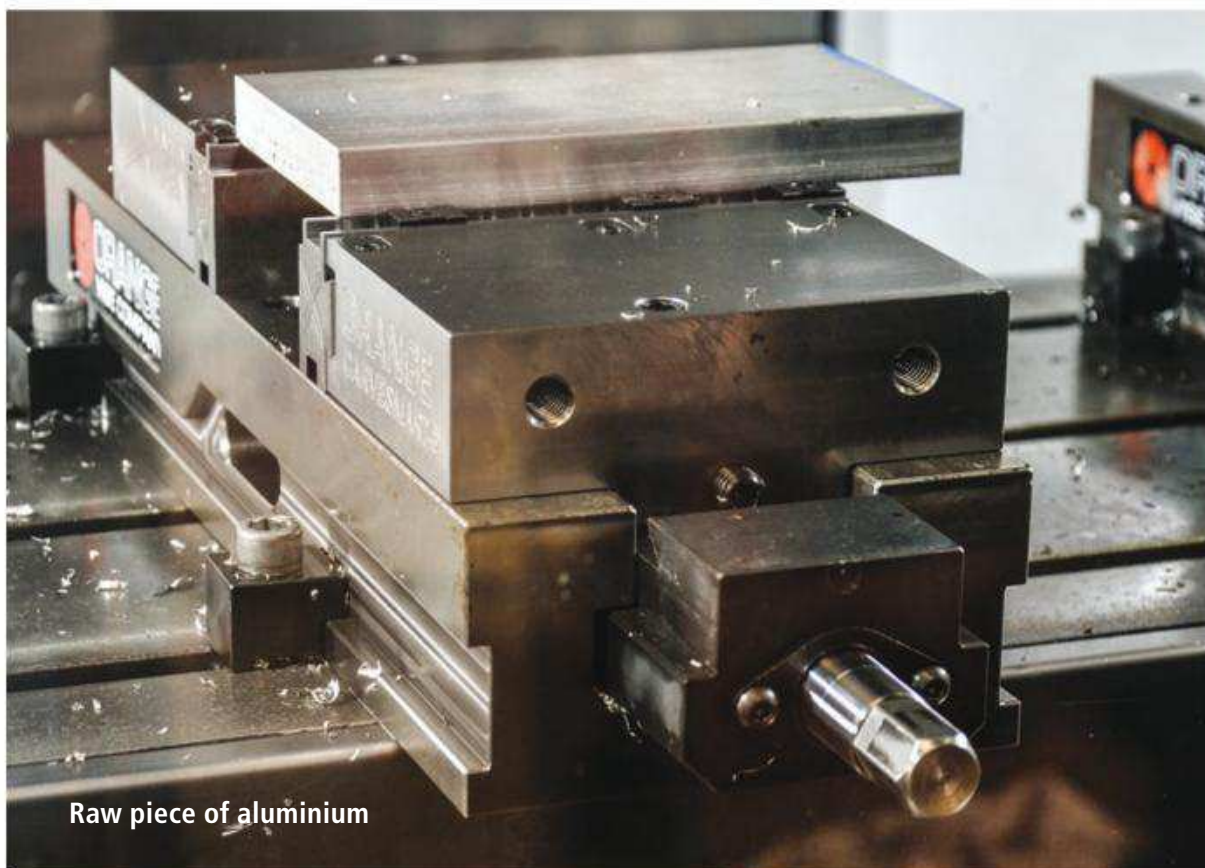
- Fully assembled and tested
- Twelve-month warranty
- ChipX router bits supplied with each machine
- Sized to fit standard material sizing (600, 1200, 2400)
- Lead-screw driven, which is more accurate, gives better repeatability, and more stable over wider temperature ranges
- New Zealand designed and manufactured
- Local support and training
- Spares on the shelf
- Wider range of materials (i.e., aluminium)
- T-slot base
- Uniboard bed, which allows coolant to be used (unlike MDF)
- Extended Z-axis travel (M1, 2=70mm, MZ2, 3=120mm)
- 150mm of travel on all machines allows for material of greater height

Minus points of Vertigo routers

- Higher price than smaller, less capable machines
- Increased lead time (planned to be reduced by Christmas)
- Currently limited in spindle options
- Uniboard bed is slightly noisier on some materials ... but nothing compared with the router



Above: Rear shows the Haas mill is serious engineering



Raw piece of aluminium

“We really wanted our big point of difference to be developing smart machines that are easy to use”

“That was a massive,
awesome project
to work on, and we
learnt so much”

► Vertigo Technologies will try the suggestion and integrate it if possible. This was the case with the roller mount — by incorporating a dust cover to stop the cutter debris from building up and increasing the vertical size, rigidity was improved where the rollers attach.

The latest improvement is to remote the controller. It increases the component cost, but reduces the assembly time, and allows for easier controller upgrade/repairs.

I was able to witness the new software being tested. This allows the user to design a job and then find any material that it will fit on, rather than having to find material before a start point can be defined and the CAM-tool path calculated.

It no longer requires a physical connection to the laptop/computer and provides 3D representation of the cutting process. You can even restart the PC and it will continue the update in real time.

The intention is to provide it with each Vertigo Technologies router and licence it for others, which will be a game changer in the CNC world.

Summary

It's easy to get hooked by the shiny bits, but seeing the Haas vertical mill in action was another thing.

Using *The Shed* logo I supplied, after about 10 minutes in Fusion 360 CAD software, Brett made this into an aluminium logo.

Vertigo Technologies uses the Haas to make all its precision machined parts, and it was amazing to watch it in action.

Having seen the dedication, passion, and build quality, how could I not purchase one of these?

So, for the next article in *The Shed*, I'll detail the process to cut a simple item



from wood using the Vertigo Technologies router and Cadpro's Fusion 360 (cadpro.co.nz/products/autodesk-software/cloud-services/fusion-360/) — this is free to hobbyists and available at a very

reasonable rate to commercial users.

You can use other software, but since it's used by the 3D-printing fraternity, it makes sense to join a wide user base from which you can get tips and tricks. 

Vertigo use the Kaizen methods

Most productivity methods give you tools to tackle specific tasks or projects in an organized way. 'Kaizen', which roughly translates to 'good change', is a Japanese productivity philosophy that helps you organize everything you do. It is a way of thinking and organizing everything — from the way you work to the way your team works together.

In productivity circles, the term is used to mean 'constant, continuous improvement', and it's a mindset you can apply anywhere, to any task or job.

Put simply, every aspect of an organization should, at all times, strive to do what it does better.

The philosophy first appeared shortly

after World War II, when several Japanese businesses embraced the idea that doing things the way they have always been done is a bad idea, especially when better options are available that can make the companies more competitive. Inspired by Western competitors and manufacturing methods, kaizen came to refer to company-wide efforts to improve and streamline business practices and manufacturing methods intelligently while at the same time respecting the product, craft, and the people involved in making it.

For more information, see lifehacker.com.au/2014/12/get-better-at-getting-better-the-kaizen-productivity-philosophy/.

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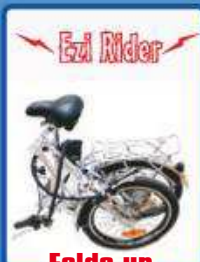
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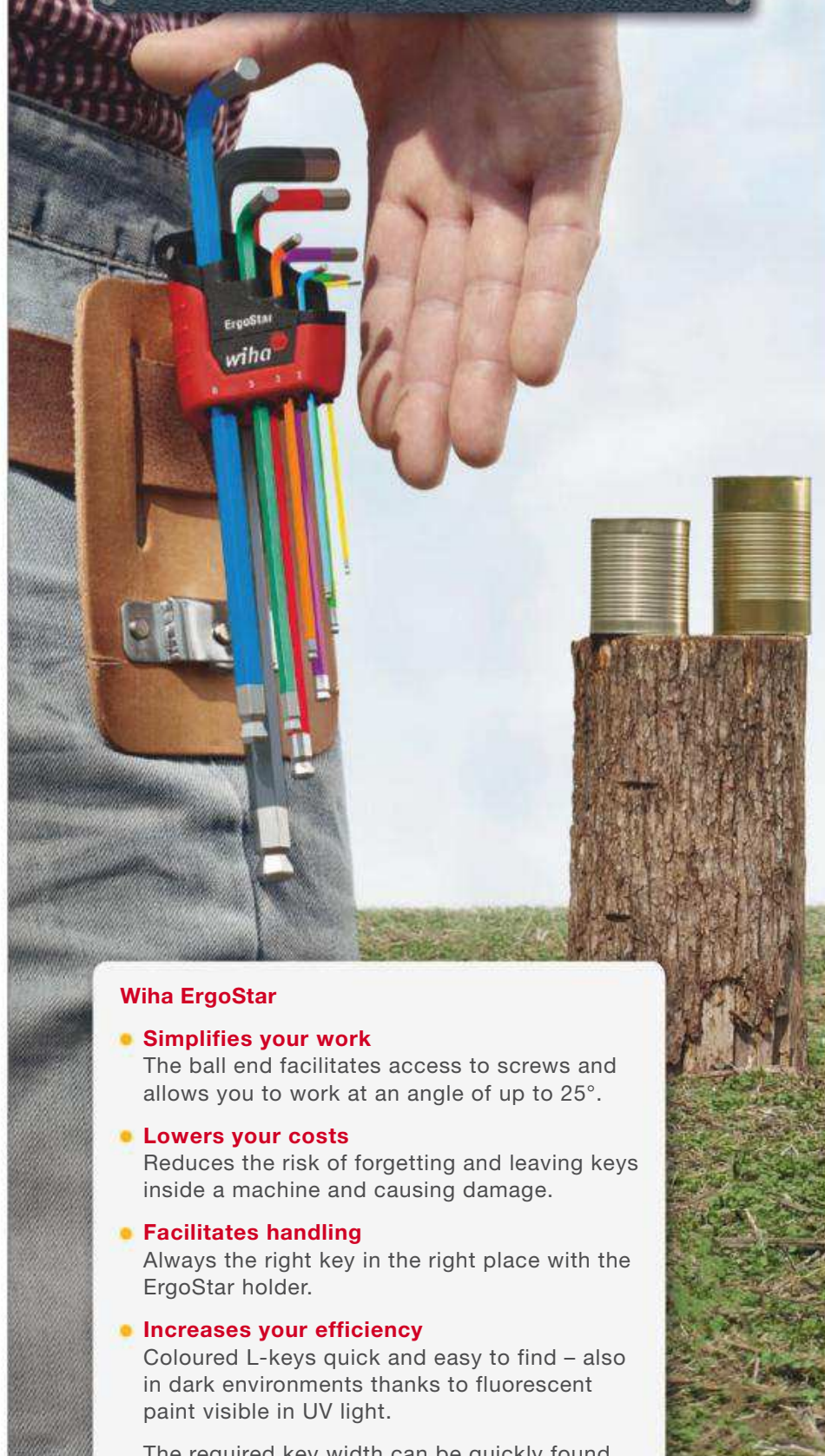
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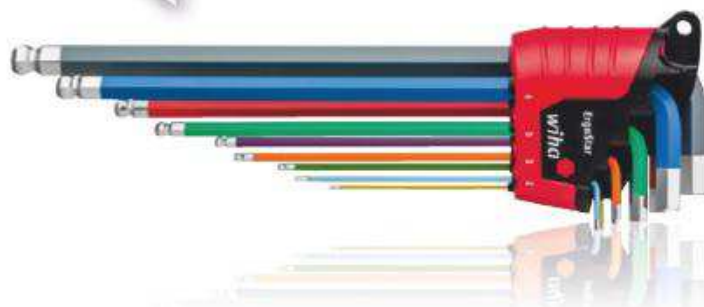


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STATE OF THE ART

By Enrico Miglino

Photographs: Enrico Miglino

**FUSION 360
HAS A MYRIAD OF
FEATURES TO GET
THE BEST 3D
PRINTING RESULTS**



In this last of our six-part series of articles on 3D printing we look at a second CAD design application: Fusion 360.

Together with Tinker CAD (discussed last issue, No. 79), Fusion 360 by Autodesk is the most useful professional CAD design for 3D printing, and also includes features for rendering and animation. It would

impossible to discuss all the features of the application here; however, it is important to discuss what we should expect from Fusion 360, how the programme can interact with the user, and where we should focus our attention to get the best results.

As well as the commercial licence, which may be expensive for students or hobbyists, Autodesk has a free

three-year student licence available. This is the licencing method that made this 3D design software so popular with the 3D-printing community.

Interacting and cooperating

As a registered user, you have access to the entire community — this means that you can share ideas and designs, get



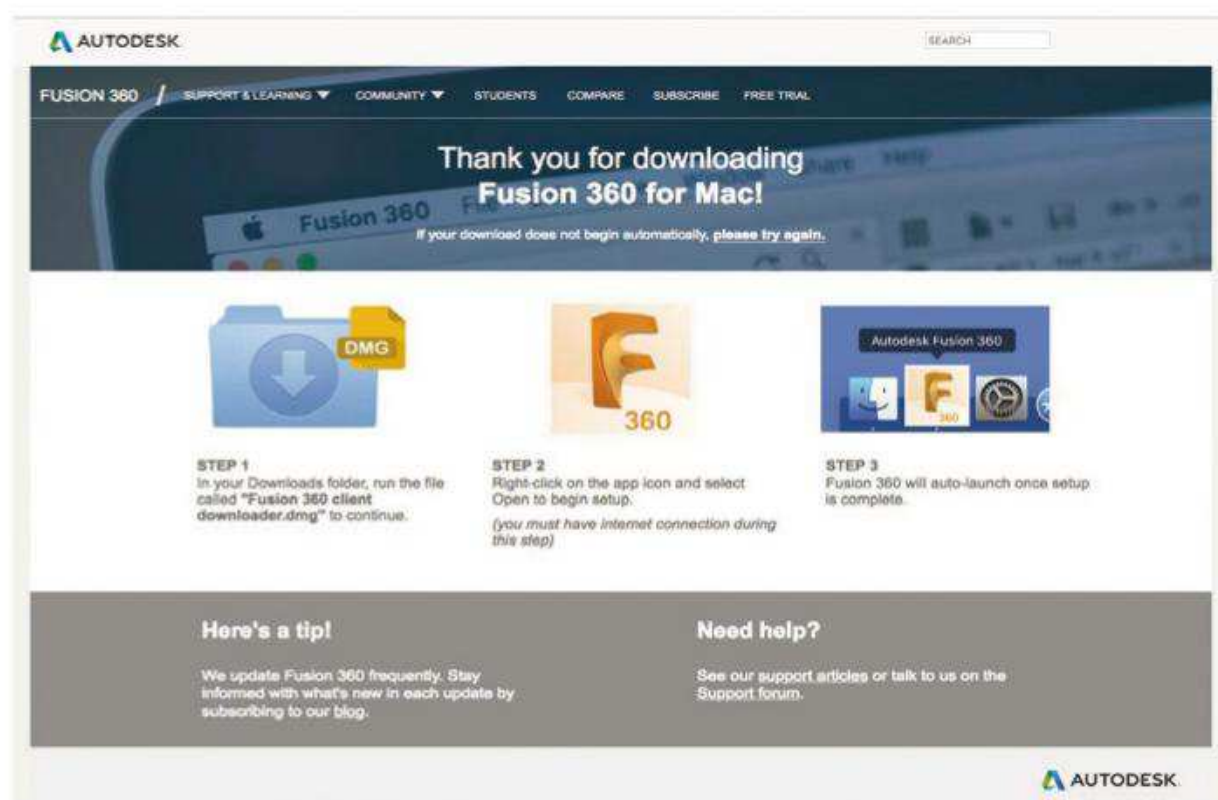
access to others' ideas and designs, and participate in the forum. I have found that the forum is one of the largest of its kind for shared content and sources of inspiration and advice.

As a matter of fact, if you prefer a more pragmatic learning path, Fusion 360 also contains a very wide knowledge-based platform, including plenty of videos.

Fusion 360 by Autodesk is the most useful professional CAD design for 3D printing

Power through the cloud

One of the key factors of powerful 3D CAD systems is the hardware platform you operate on. Processes like high-quality rendering and the option in Fusion 360 to send rendering and the heaviest processes to the cloud make it possible to use the programme on relatively slow computers. ►



Download

The download webpage showing the three easy steps to install Fusion 360. The Windows download page shows the same image — the choice of the platform depends on the computer from where you are downloading the programme

Format exchange

Fusion 360 accepts input files from a huge range of popular 3D formats. The programme can also open STL (stereolithography) files for editing, usually considered an output format ready for the 3D printer.

File formats not natively recognized by the application, like 3D Rhino CAD files, can be imported as well. Registered users can use the Cloud Import feature to convert non-natively recognized file formats.

Managing workflow

One of the features I have most appreciated in Fusion 360 is the possibility to choose the preferred workflow when designing. The top element of the design is the project, in which the user can define a set of documents in a folder-like structure. Every document consists of a 3D model built with one or more 3D objects.

Easy creation of the STL file

Creating an STL file from the model is easy: just select the object of 3D print to export and send it to the printer application, or to an online 3D printing service.

Fusion 360 workspace organization

Fusion 360 is organized in a set of tabs:

- Sculpt
- Model
- Patch
- Make
- Render
- Animation
- Simulation
- Cam
- Drawing.

Any of these options gives access to a dedicated workspace. The user interface changes its look-and-feel setting to the most comfortable environment to work with these features.



Install

The installation process of the client programme requires a couple of minutes. Fusion 360 is compatible with Mac OS X and Windows. Windows 10 is recommended, but it also works well on Windows 7. Installing is an automatic procedure, which is easy for the user as very little interaction is actually required. Client installation does not mean that the programme does not run locally, but that it is powered by some extra features accessible through the Autodesk application Cloud, such as file conversions

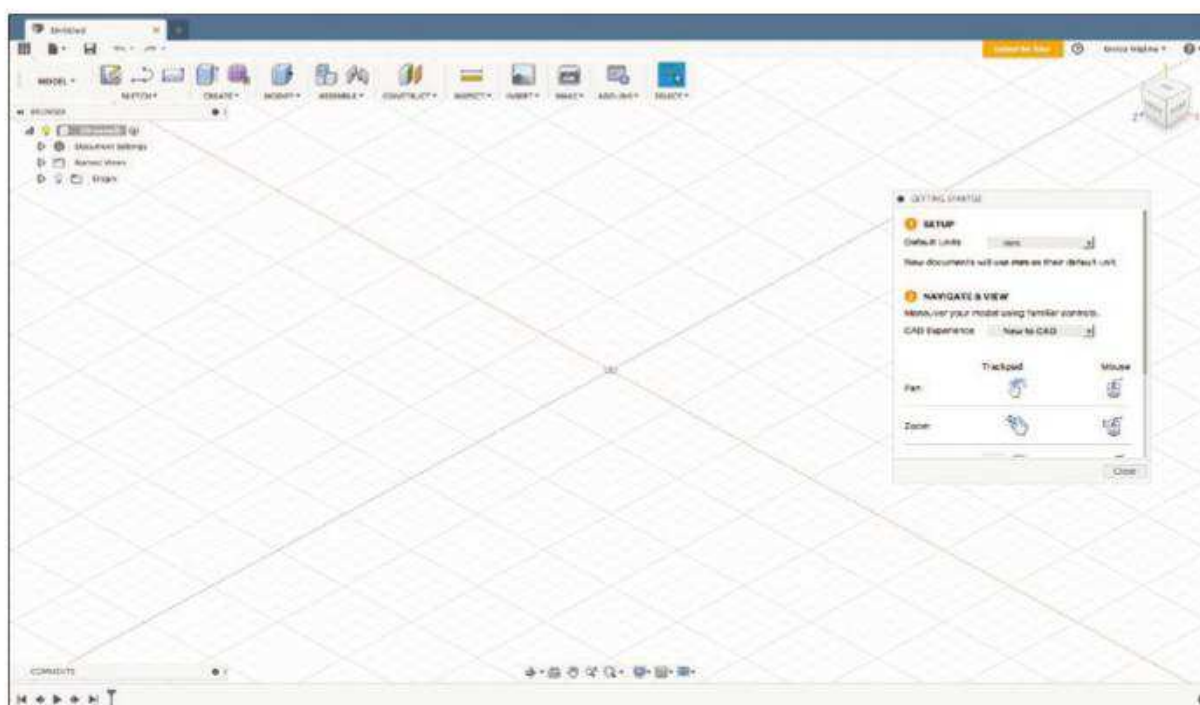
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Registering

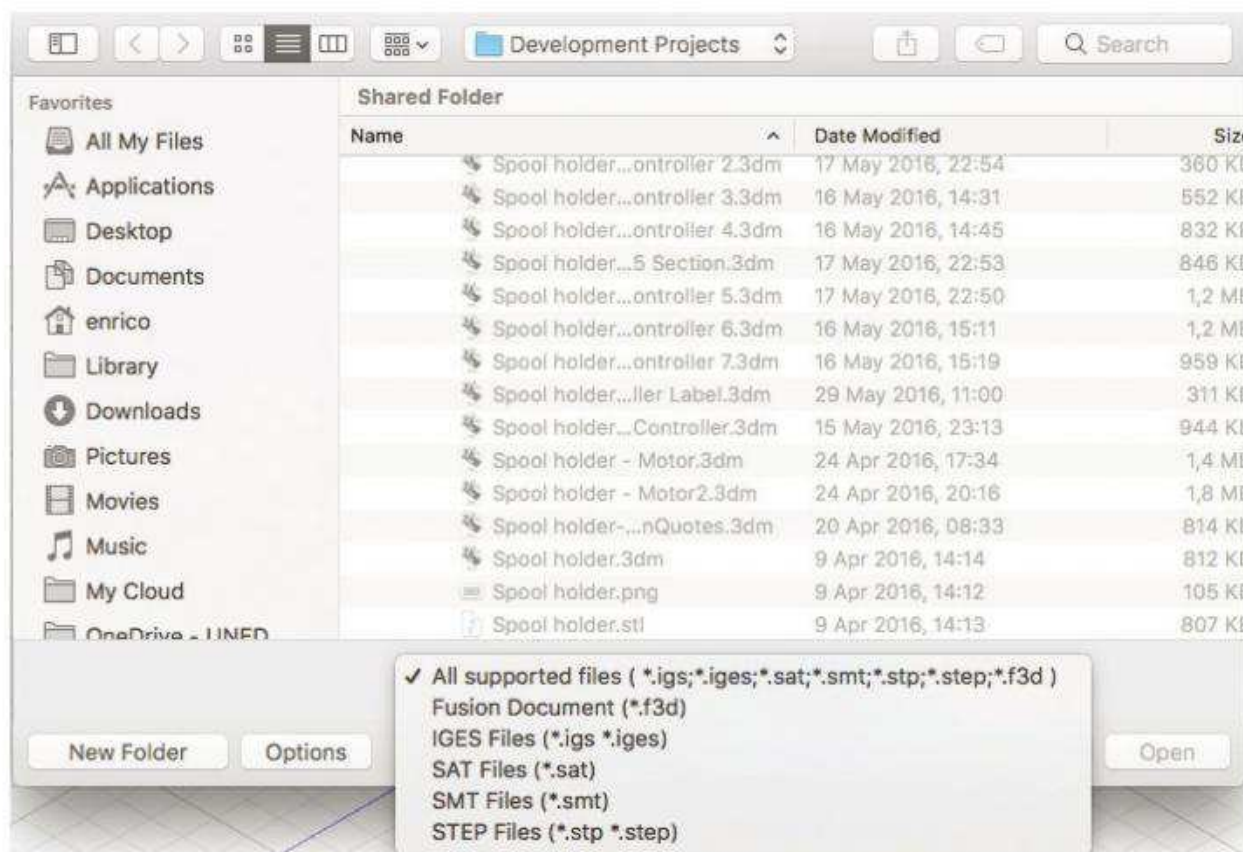
To use the programme, it is mandatory to register on the site. The registration step is essential to access the cloud features of Fusion 360



First run

The first screen shown on the first run. Note the user-settings window on the right side of the screen. One of the most useful interface features is the availability of contextual

windows that can be closed and reopened when needed, or 'rolled up', leaving only the title bar for a quick reminder of the most used features while drawing



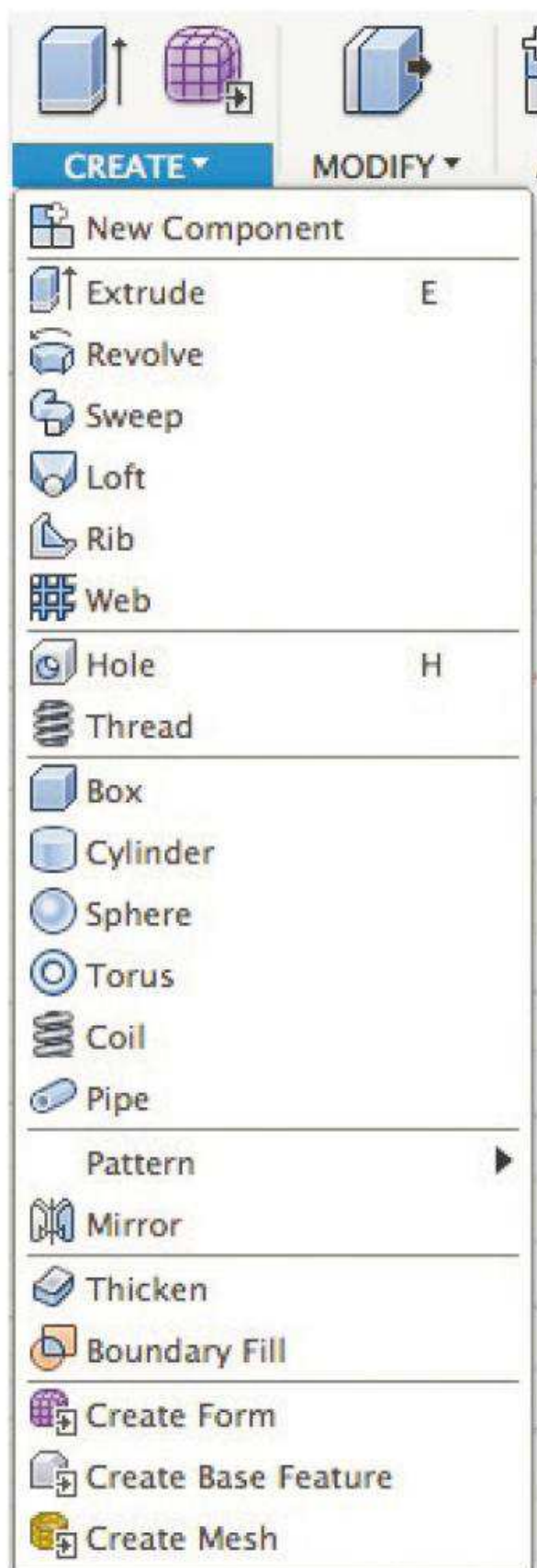
Open file

The image shows the file types naturally recognized by Fusion 360 without using the Cloud Import feature



Help tips

A valuable feature of Fusion 360 is the contextual help support. For expert designers, the feature can be disabled, but it is a valuable resource for newbies



Create

As we can expect in any CAD software, the Create menu gives access to the design primitives. With Fusion 360 it is possible to use the graphic primitives in two different modes: the traditional creation of geometric objects (box, cylinder, sphere, etc.), as well as primitive geometric deformations (extrude, revolve, loft, etc.). In addition to these common methods, is also possible create the objects as 'forms' — every primitive is shown with modifiers on the objects to immediately apply any kind of deformation to the object.

Form-based design is extremely useful when approaching 3D CAD to create objects based on freehand design. It is easier than following the traditional two-phase process

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you have access to
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and designs*

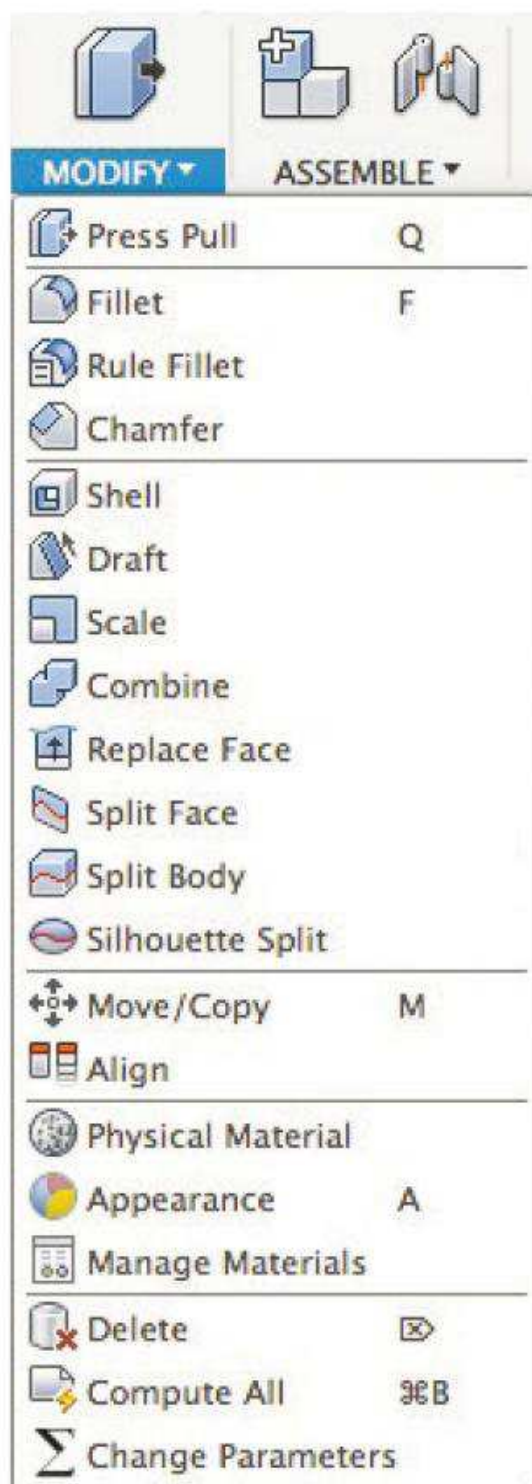
Search

The Search feature supports the retrieval of a single object in the current project. During the learning phase, adopt best practice by assigning meaningful names to the objects, especially if it is a complex structure

Browser

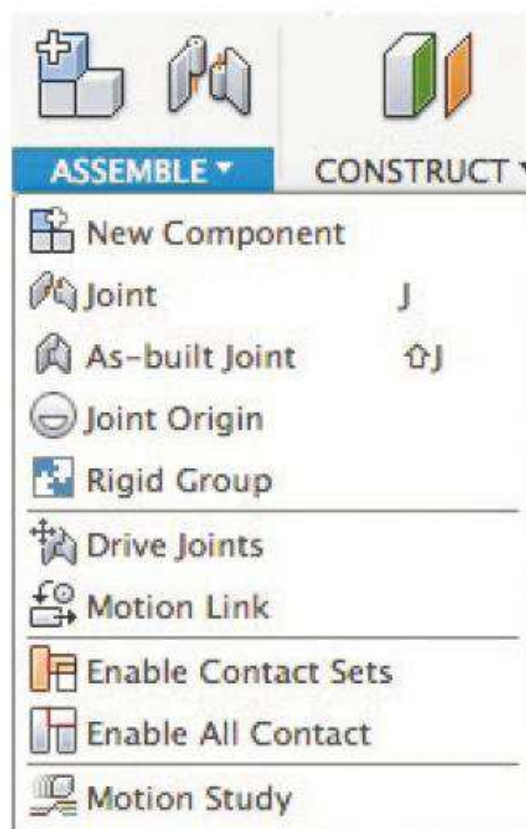
As mentioned, a Fusion 360 project is organized in documents and objects designed inside every document. The Browser menu shows the entire project tree structured as a directory view





Modify

The Modify menu exposes the functions to edit already existing objects. It includes the typical CAD modifications applied to geometric primitives, together with the model appearance and material definition

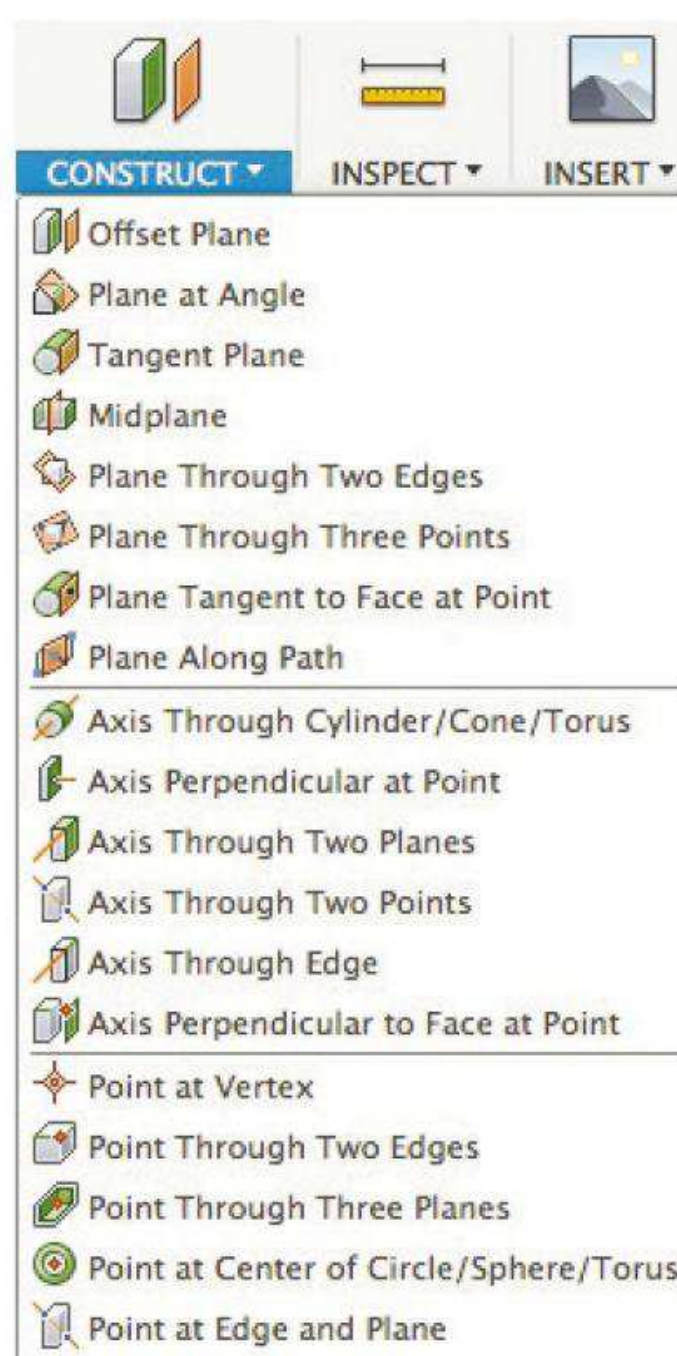


Assemble

The Assemble menu helps the user connect different objects in the same document. Assemble operates through "joints": connections between objects — rigid or mobile — depending on the motion freedom degrees decided by the user.

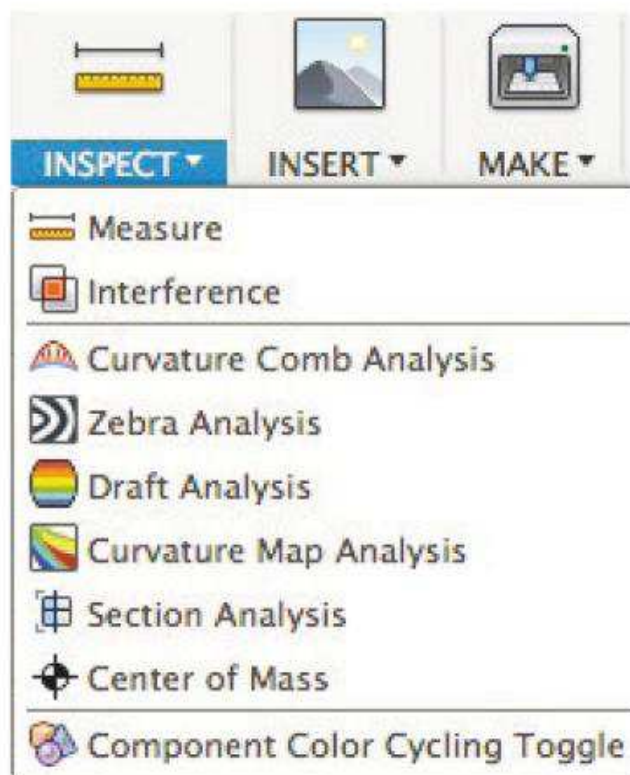
Assemble menu functions are focused to create animated structures involving the principles of kinetics. In our context, experiencing the creation of animated objects may appear less relevant, but sometimes it is interesting to simulate mobile parts to analyse the behaviour before 3D printing the components and assembling

File formats not natively recognized by the application, like 3D Rhino CAD files, can be imported as well



Construct

The geometric primitives do not always cover all that is needed to design an object. The Construct menu features a large set of geometric components frequently used to manage 3D objects, which cannot be represented in the real world, like planes, axis, and construction line. As a matter of fact, these geometric objects are important to be able to apply transformations to 3D objects, such as creating forms following a plane or along a path to design a pipe. Treat these features as a set of construction references facilitating the design process



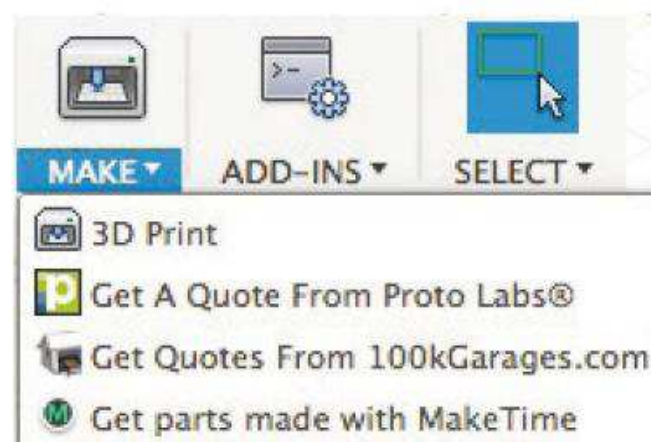
Inspect

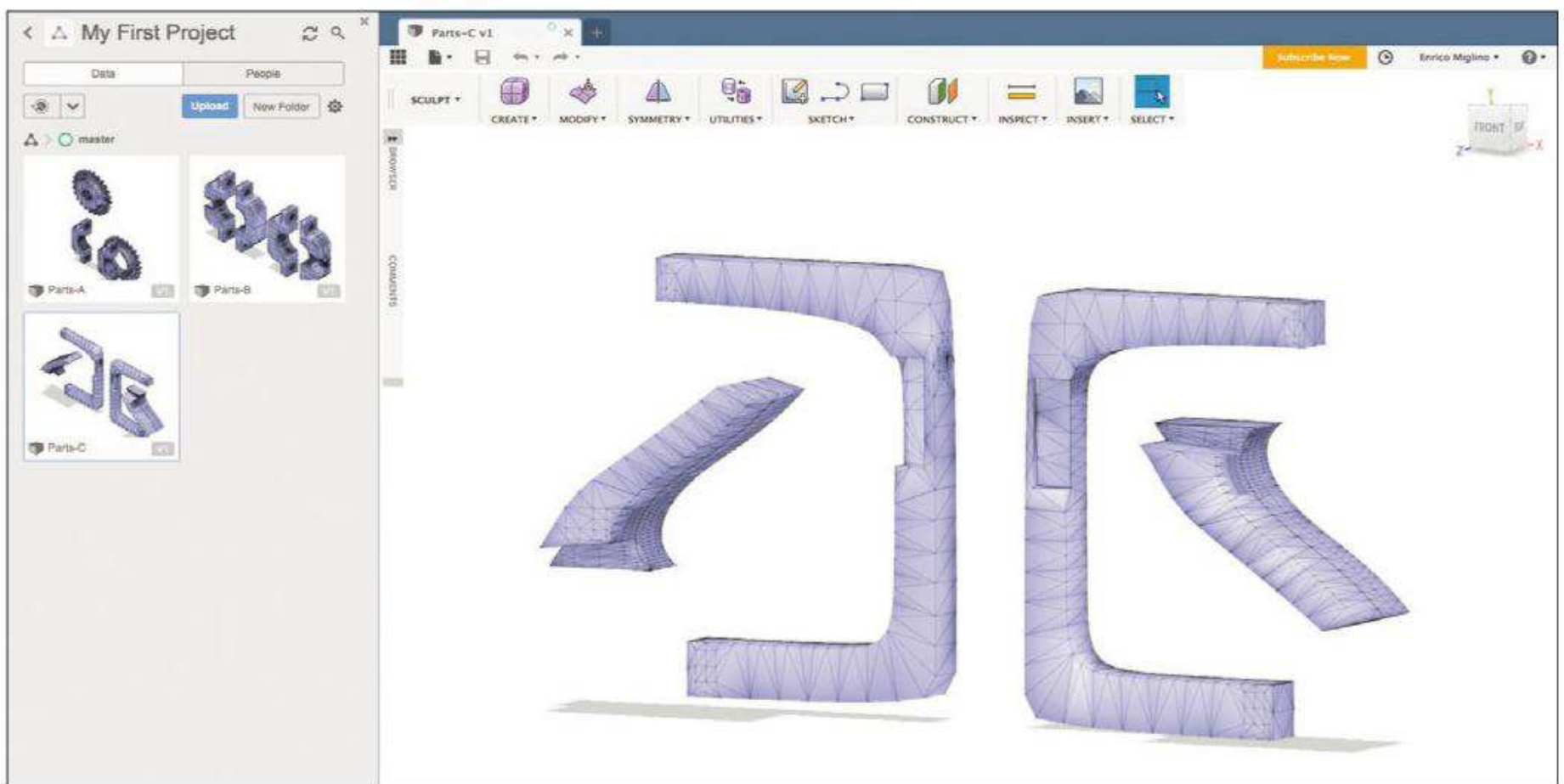
The three most important operations using Fusion 360 are creating animations, 3D printable objects, and CAM-machining objects. In all these three cases it is important to consider how objects are built inside, especially for 3D printing and CAM.

To avoid unexpected and time-consuming surprises, the Inspect menu includes the features we need to check the physical consistency of the object. It is interesting to experiment with the object analysis in the simulated 3D world of Fusion 360 before 3D printing (or machining) the design 3D model

Make

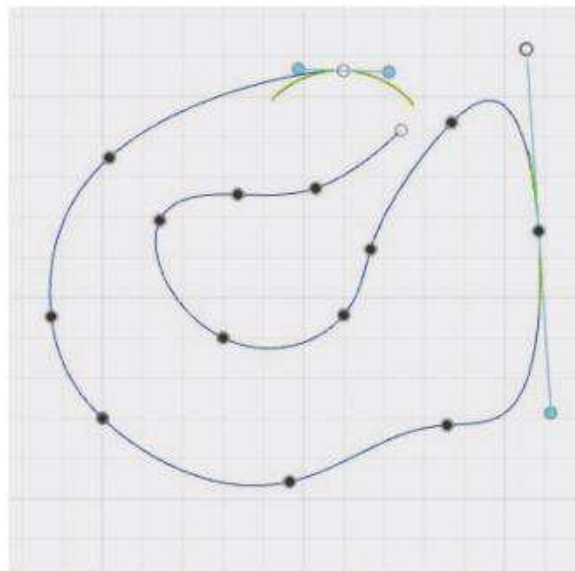
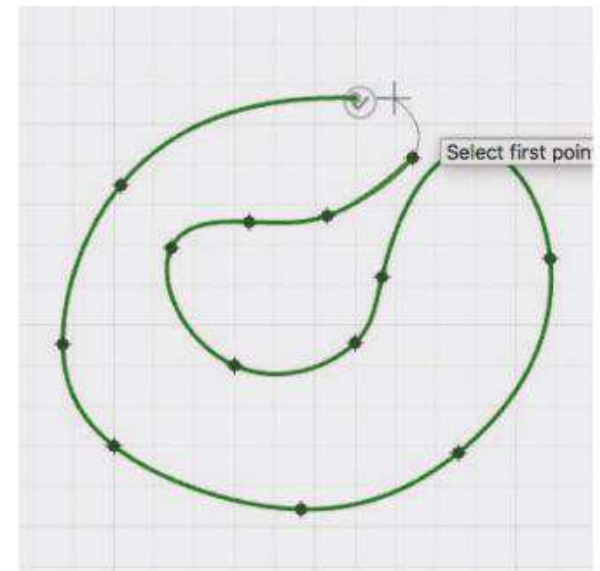
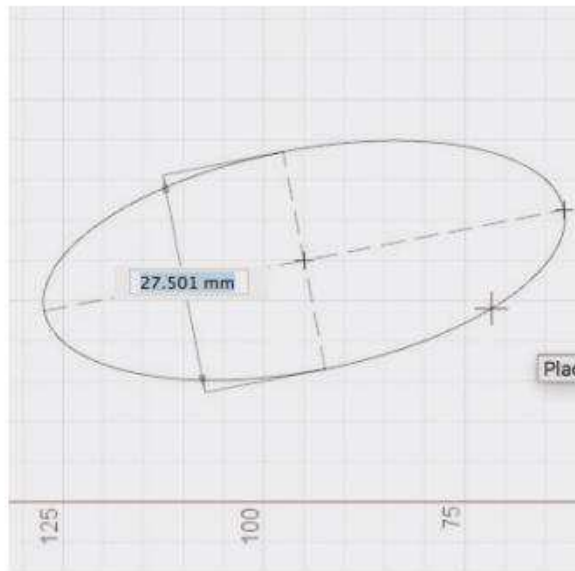
When we are ready to use the functions of the Make menu, the most complex part of our job has already been done. The Make menu sends one or more objects to the 3D printer, and exports the STL parts selected on the document ready for 3D printing. From the Make menu, it is also possible to send the STL files to online 3D printing services if we cannot print the object locally





Cloud Import

One of the biggest issues when moving from one CAD application to another is the difficulty in reusing the previous project. Quite often I have had to make several attempts before finding a way to move my previous projects to different applications. The Cloud Import feature dramatically simplifies this operation, also making it possible to manipulate and edit STL files. There are a huge number of free STL models available for online download that can accommodate projects with small changes. Using the Fusion 360 Cloud Import feature is easy — just drop the 3D model file to the conversion windows and wait for a few minutes until the model preview is visible in the imported files. The cloud models reside in the registered user's private area

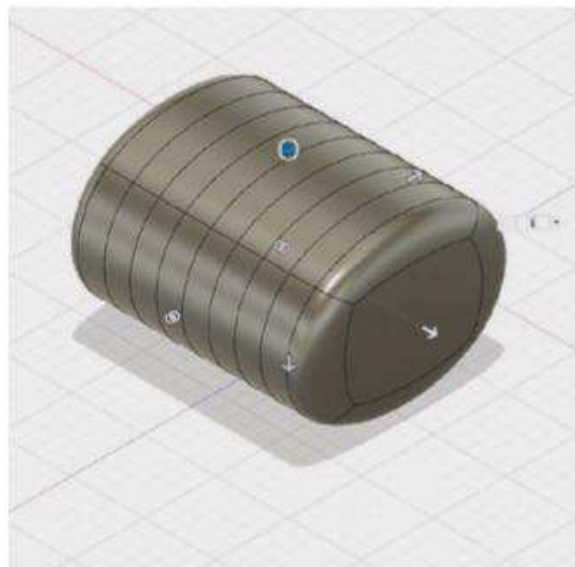
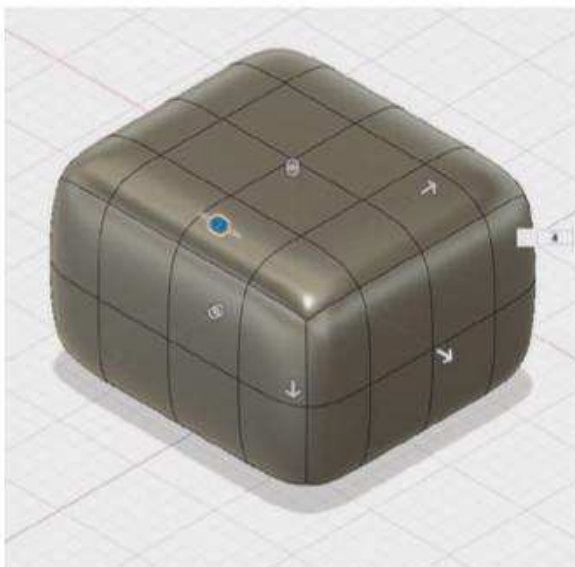


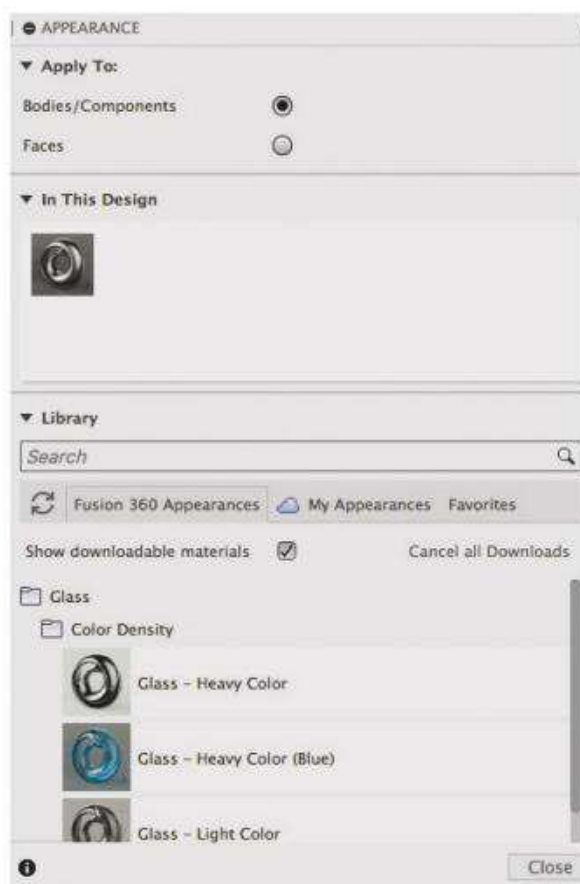
Sketch, Draw

These images show some examples of how it is possible to draw lines and paths, including freehand Bezier, as the starting point to designing 3D models. A helpful support in drawing is the automatic visualization of the quotes shown in the last segment or curve drawn ►

Form

The image sequence below shows how it is possible to completely change the shape of an object (a cube in this case) using the form modifiers on the surface of the object

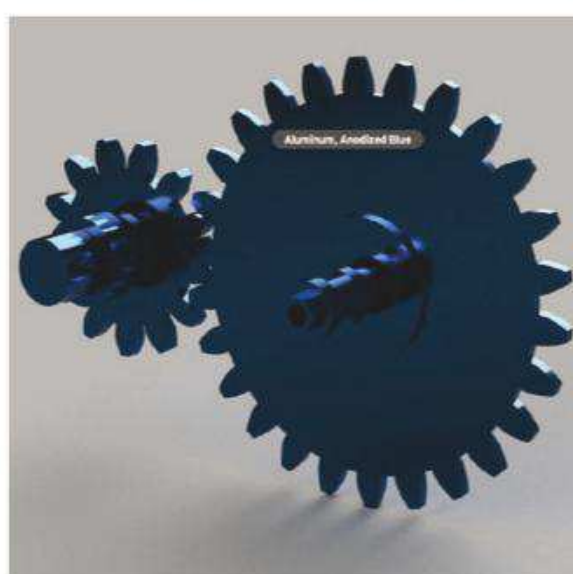




Appearance

Through the Appearance menu it is possible to assign realistic attributes to the 3D objects, such as material, lighting, reflection, and colours, and create realistic backgrounds

One of the key factors of powerful 3D CAD systems is the hardware platform you operate on

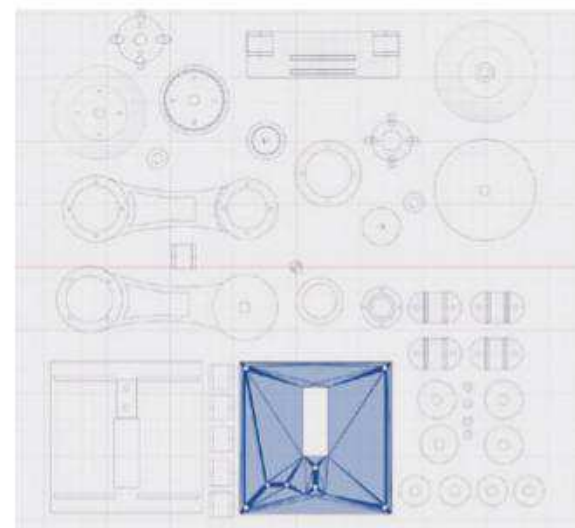
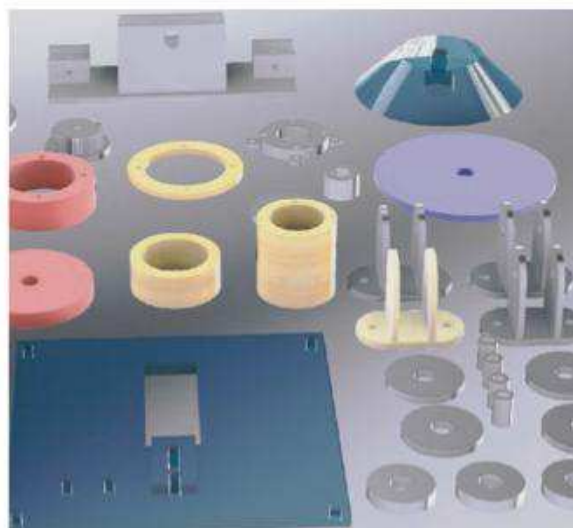
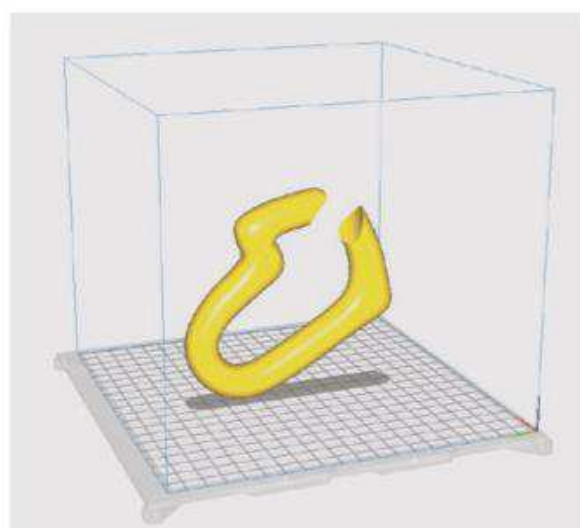
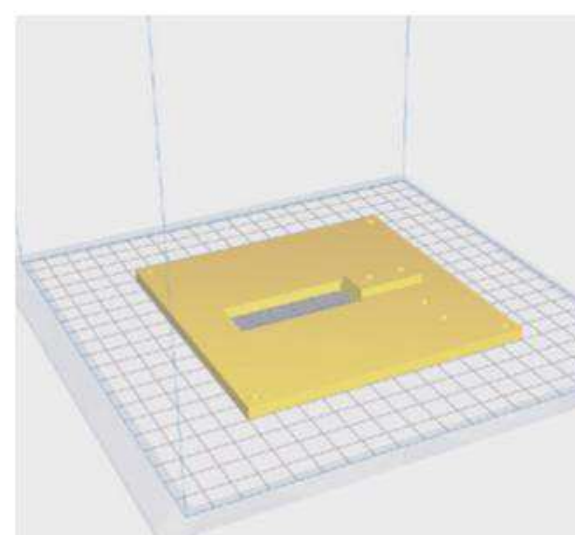
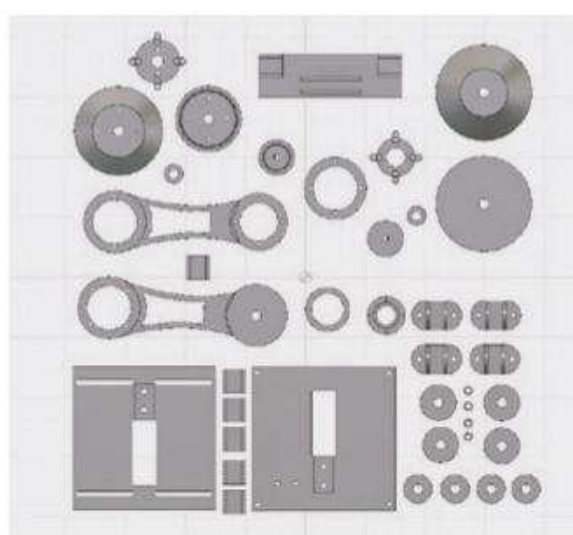


Rendering

Examples of rendering with different kinds of materials and backgrounds. The images have been captured at different stages of the rendering process. The user can decide to speed up the rendering at a lower quality or wait until the rendering is complete. The rendering process automatically restarts when the user changes the view. It is also possible to fix the quality of the rendering by default. This can be increased to maximum when the design is complete

Print

The images show the selection of some 3D objects (these have already appeared in previous issues of this 3D printing series). The objects have been converted from the 3D Rhino format using the Fusion 360 Cloud Import feature, then reorganized in a project document. Images on right have been selected from the Fusion 360 3D space, while the images below show the parts already converted to STL format and inside the simulated 3D world of the Cura 3D print application





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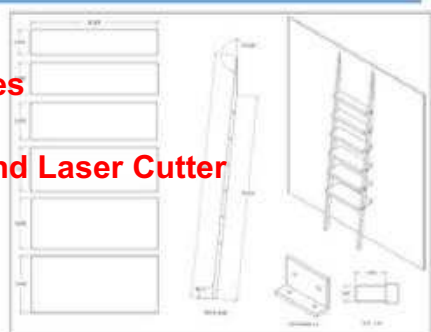
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FROM TRASH TO TREASURE

A CLUB DEVOTED TO
SAVING PAST RELICS
HAS CREATED A UNIQUE HERITAGE PARK

By Sue Allison

Photographs: Juliet Nicholas



Boat collection — clinker dinghies being repaired

The West Coast has a history as rich as it is rugged, with a past steeped in mining, logging, and dairy farming on a forest-clad strip between the mountains and the sea. Up by Hokitika airport is a sheddies' paradise, where relics from this past are being resurrected by an enthusiastic and capable band of volunteers.

"It all started back in 1981. Everything was going by train out to scrap so we formed a club to stop it," says Mort Cruickshank. The "we" he refers to were four young men — Spike Jones, Jim Staton, Mike Rooney, and Mort. They formed the Westland Farm and Vintage Machinery Club and started salvaging old machinery that had been destined for the dump. With no premises, they kept it in their backyard sheds and met sporadically to plan the future.

Four decades on and the Westland Industrial Heritage Park, spread over

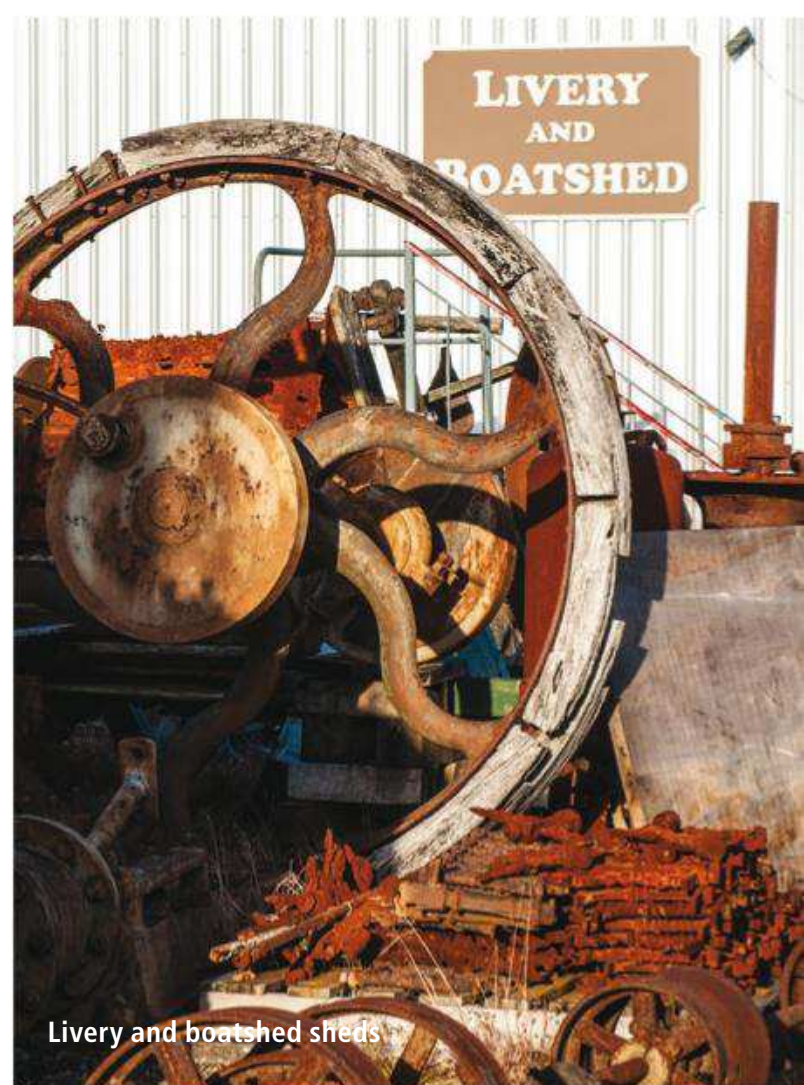
several acres up by Hokitika airport, is packed with machinery, sheds, and enthusiasts. It is a hub of community activities, has a Men's Shed on site and is increasingly a drawcard for tourists.

The inspiration behind the club

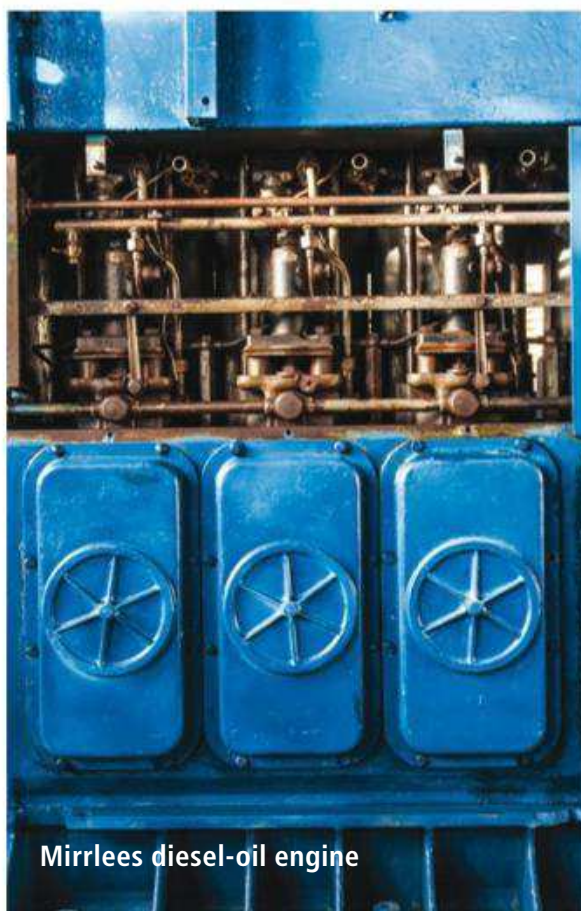
Of the original nucleus of four, three are as passionately involved as they were at the outset. Mort, a retired welder and fitter, and Mike, a former truck driver and fireman, probably spend as much time at the park as they did at their day jobs, while Jim, who works for the Department of Conservation (DOC), is a key player in setting up the on-site miniature railway through native wetlands.

"Noel Fisher, who called the first meeting, has sadly passed on. He would be blown away to see all this," says Mort.

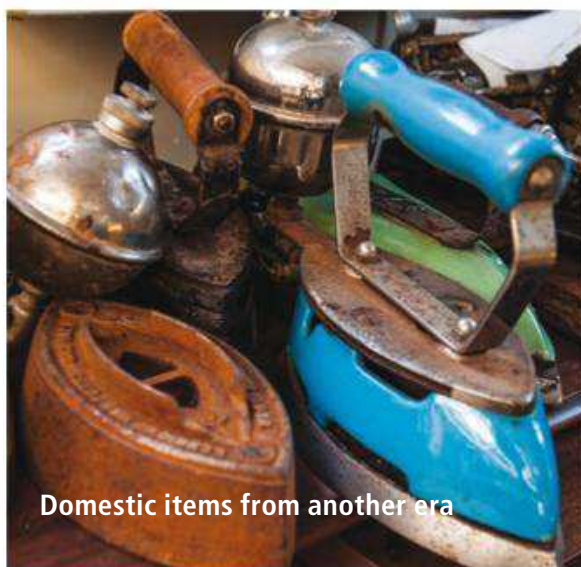
When the council-owned site came up in 1999, the vintage machinery



Livery and boatshed sheds



Mirrlees diesel-oil engine



Domestic items from another era

Oldest working machine

The oldest working machine at the park is an 1862 air-cooled Lister steam-driven milking machine that powered a single cow plant. "A farmer found it when he was having a clean-up in his cow shed that dated back to 1920s," says Mort. It will be one of the star attractions in the park's planned working milking shed, where dairying memorabilia and restored vintage machines demonstrating the three different pre-electronic mechanical pulsating systems will be displayed.



"Everything was going by train out to scrap so we formed a club to stop it"

club formed a partnership with Heritage Hokitika and leased the land from the airport authority for \$1 a year. They now have more than 40 members from a range of backgrounds.

"We have work days on Wednesdays and Saturdays but it's open every day and there are pretty much people up here all the time," says Mort, who is there five days a week.

"We all bring in our trades. There aren't many problems we can't solve between us. You have to be creative all the time here, but most of us were brought up around the 1950s and '60s when Kiwi ingenuity was at its best. When we were nine we were building crystal sets and soapbox derbies." ►



Vintage machine exhibition space showing different pieces of equipment harking back to early industrial action on the Coast



Bach steam engine

The park's 1845 Bach steam engine is believed to be the oldest surviving steam portable of its type in the world. Pre-dating traction engines, it came from Birmingham, England to Hokitika, where it was used for processing coffee beans. The boiler is butt-joined and fixed with pixie-head pointed rivets. As there are no injectors, the connecting rod is split in half so that the feed-water pump can be concentric with the main cylinder pump, running off an extension of the piston rod. Mort wants to build a replica of the engine and roasting mill using original drawings sourced from the internet.



Above: Seagull motor collection

Left: Mort, master of all he surveys

Below: Some of the very-much-used, more-contemporary machinery in the main workshop — presses, drills, mills, etc.

The spirit of the Coast

Isolation forced Coasters to develop a particularly creative No. 8-wire mentality. "If a farmer had a broken machine you couldn't just say 'I've got a bit coming from Christchurch in two days'. You had to fix it even if it was just makeshift to keep it going till the parts arrived," Mort explains.

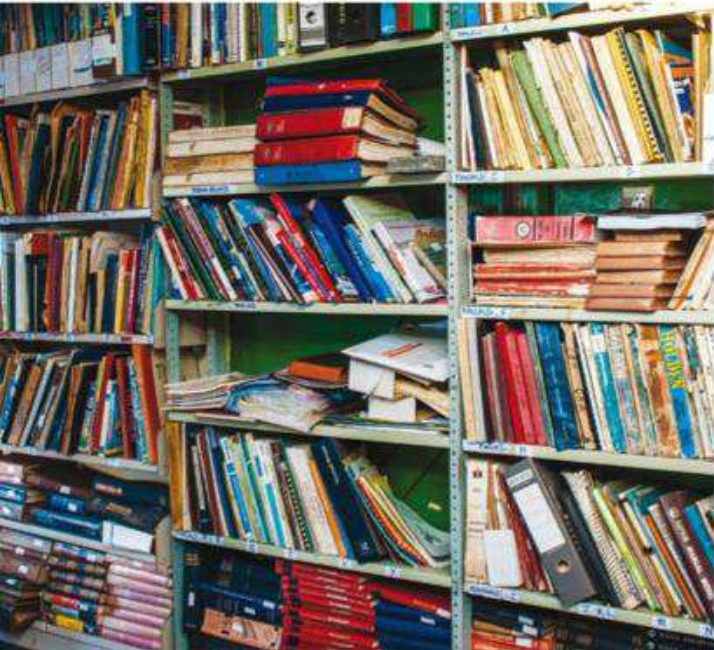
Park members, most of who are retired, bring decades of combined expertise in everything from metalwork and engineering to some rare specialist skills. Merv Johnston, the oldest member and a cooper by trade, recently restored an

early butter churn that was in pieces; club secretary Ian 'Gilby' Gilbertson, formerly cartographer for the New Zealand Forest Service and a skilled calligrapher, is masterful with the plasma cutter; Rob Daniel, borough engineer and skilled woodworker, is using traditional steaming methods to rebuild old boats. Others come to learn new skills after careers working in one area, and all come to share the camaraderie that comes with the \$30 annual membership fee. Stacked among the sheds are piles of rusty machinery, victims of time and sea air, awaiting the members' ministrations. ►





Above: The Cowan Blackstone, restored by retired engineer Gordon McMillan



Left: Donated books and manuals in the Park's library



Right: Repaired old pinball machine



Fire engines



Mike in uniform

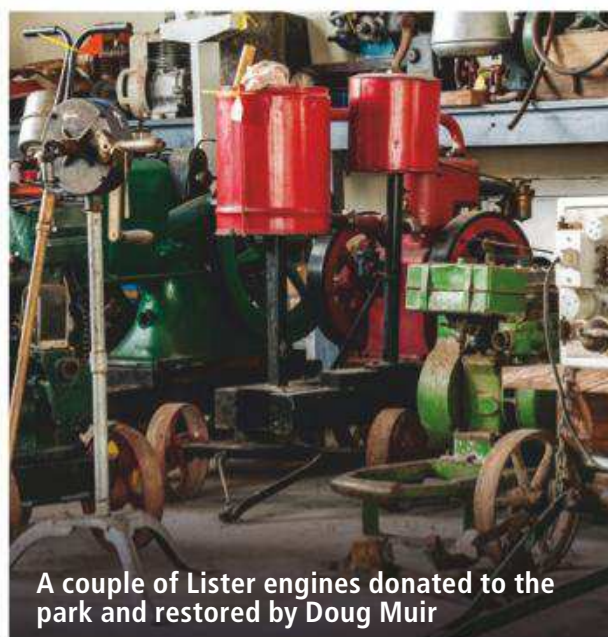
The heritage park, which has a close association with the local fire brigade, has an extensive collection of fire engines, from a 1933 Ford CV to a new arrival just decommissioned after 25 years' service. The engines are a popular part of the town's annual Christmas parade. "We get them going and paint them up. They don't have to have warrants, just be running nicely and able to

stop," says Mike Rooney, a former fireman who did time on a couple of the vehicles in the shed. Notable machines include a 'Green Goddess' fire engine from Otira that used to fight bush fires, a 1952 Ford V8 that used to serve at Reefton, and the park favourite, a Model AA Ford fire truck. "It's a real honey," says Mort. Built by the Ordinance Department at Trentham, it

served at Burnham and came over to the Coast to Seaview Hospital after the war, where it was used by the hospital fire party. "It was left derelict when the hospital closed down and we got it in a very poor state," he says. The little engine's pièce de résistance is a simple-but-effective friction-driven siren, which runs off the fan belt and is operated with a pedal by the passenger.



Merewether — 1905 classic launch being restored



A couple of Lister engines donated to the park and restored by Doug Muir



Murals painted by children who attend the park



1956 Dennis — served in Kumara

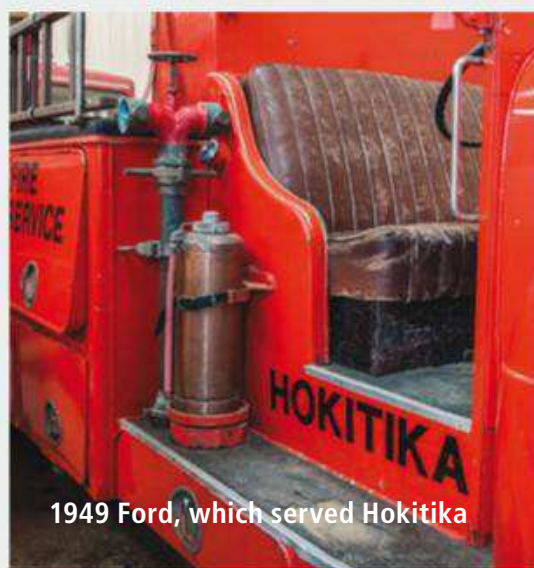


1952 that served the Reefton Fire Brigade

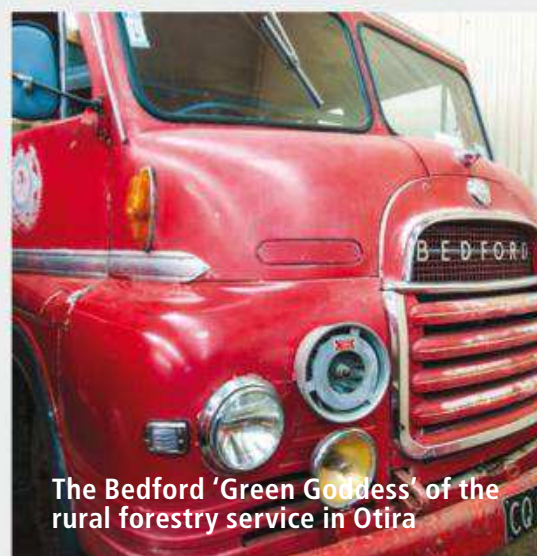


Land Rover from 1960

The club's next project is to build an eight-bay shed to display the engines and fire-fighting paraphernalia, which includes leather beaters, rakes, an antique 'jaws of life' cutter, and an ingeniously simple roof-piercing device made by the late fire chief Ray Breeze. The sharp-ended pipe has holes in the sides so that it can be punched through the tin and a hose attached, without ripping off the roof and inflaming the fire.



1949 Ford, which served Hokitika



The Bedford 'Green Goddess' of the rural forestry service in Otira

"We had a bit of a tragedy three years after we came up here when the whole workshop burned down"

► "Very rarely do we get given something which is in good working order," says Mort. But they are well-equipped to deal with most repairs.

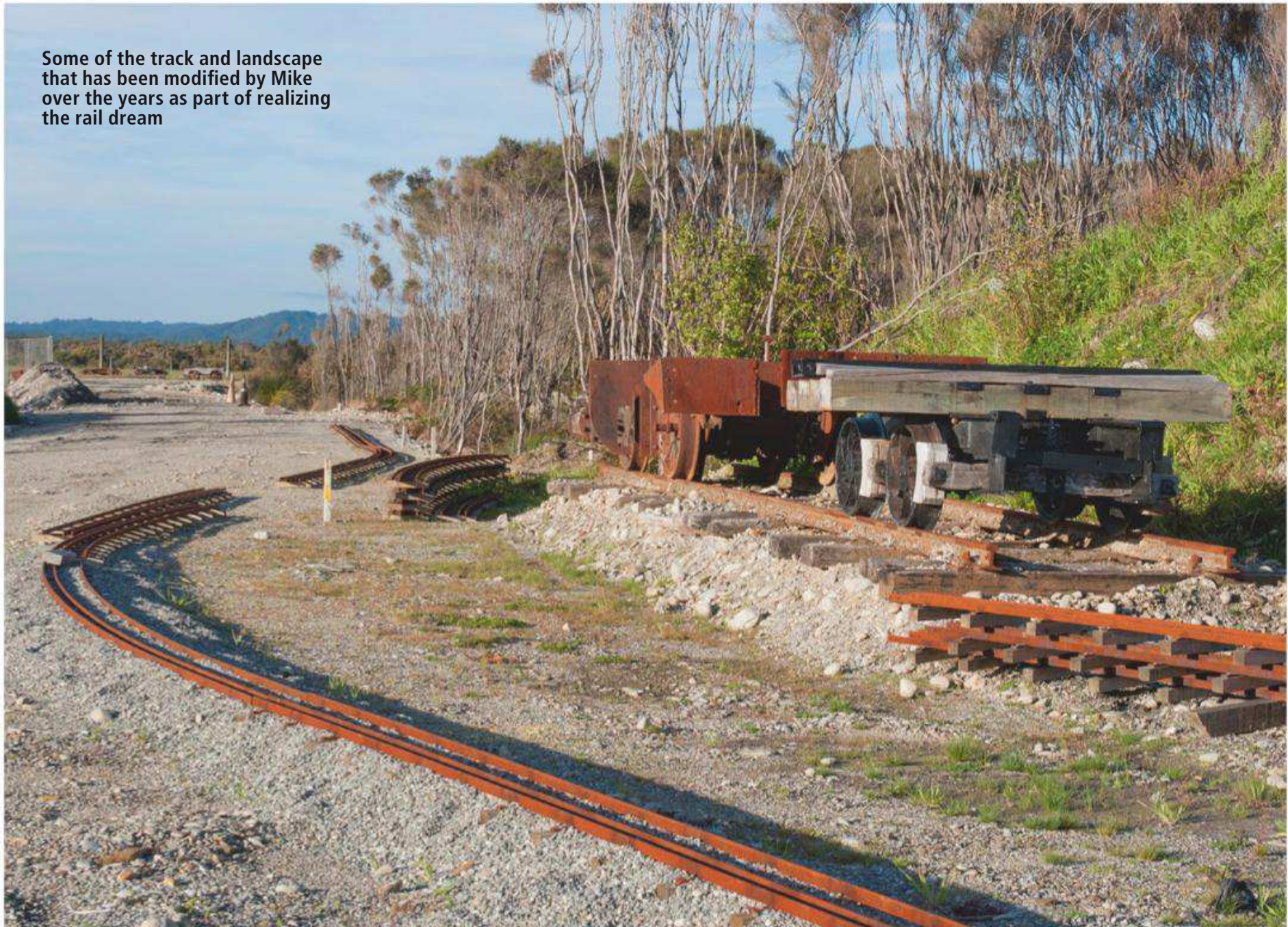
"We had a bit of a tragedy three years after we came up here when the whole workshop burned down. The only piece that survived was the concrete floor slab," he says. The silver lining was a lump-sum insurance payment, which they spent wisely on a new metal lathe, Luxcut turret milling machine (a demonstration model going cheap), and geared drill

press, as well as a 50-tonne metal press, welding machine, and plasma cutter.

"We'd had old second-hand stuff," Mort says. "Now we've probably got one of the best-equipped workshops in Hokitika." They also own three diggers, including two donated Massey Fergusons.

Raising funds

While they receive grants for some projects, funds are raised through raffles and community events as well as donations for running courses



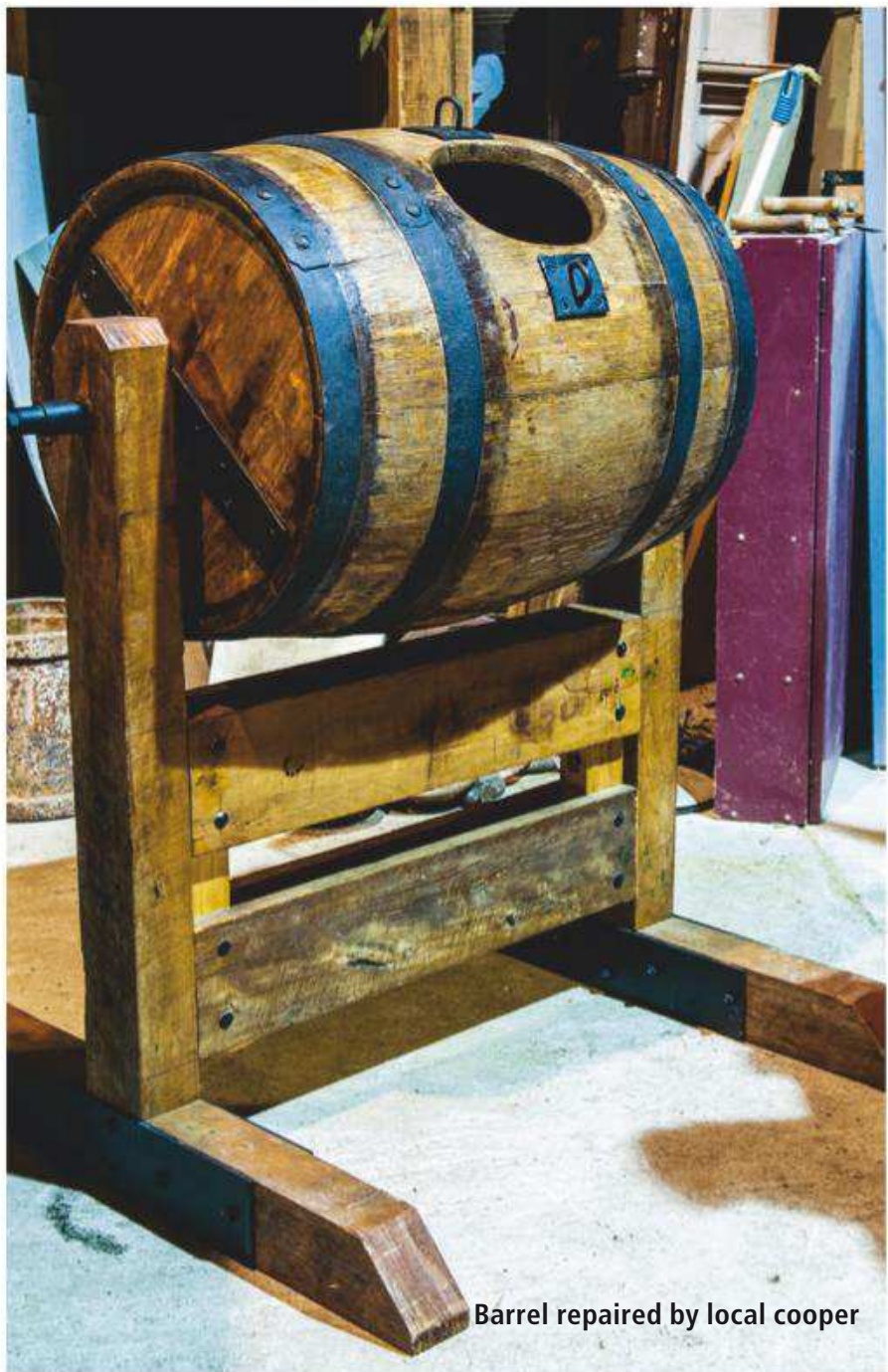
Some of the track and landscape that has been modified by Mike over the years as part of realizing the rail dream



Modified Cletrac crawler with wooden tracks added to adapt to harvesting sphagnum moss for the floristry industry



Old restored cart



Barrel repaired by local cooper

“He would be blown away to see all this”

Out-of-school teachers

Westland High School can't provide practical experience in engineering as it no longer has a metalwork teacher, so the students come to the park to get their NCEA credits. "It's a bit like a pre-apprenticeship. They get to use our machines and learn a bit of geometry and trigonometry along the way," says Mort, who has done a lot of apprentice training as well as being involved with the Boys' Brigade for more than 30 years. "They love it up here and often come up in free periods too."

Thirty students are coming to do a variety of activities over 13 weeks at the end of the year. As well as helping in the workshops, they will be involved with DOC's wetland project. The park also runs courses for REAP House, including women's welding classes. One woman who originally did the course so that she could make outdoor furniture is now helping weld railway tracks.



Mort and Jim discussing the next phase of repair of the rail engine



Machinery in the well-equipped workshop

through the Rural Education Activities Programme (REAP). They have built a memorial for the new RSA building, repaired cemetery fences, spent 250 hours doing up a derelict tractor at Okarito for DOC, and completely overhauled a 1927 shooting gallery, which they gave to the Boys' Brigade. Their annual open day, which is both a friend- and fund-raiser, also supports the Cancer Society NZ. Last year they won the regional Trustpower Community Award for their efforts to preserve the district's industrial history and improve community facilities.

Twenty-year restoration

The machine that perhaps best symbolizes the park's journey is a big twin-cylinder Ruston and Hornsby diesel engine. Gifted to the original club in 1984, it sat at the council's Kaniere depot until 1999 when it was transferred to the park for restoration.

"It was 20 years from when we took delivery of it till we first ran it," says Mort. "It would have gone to scrap if we hadn't stored it for all those years. We didn't want to put it anywhere till we knew it was at its final resting place." That final resting place was on a 20-tonne slab of ►

The miniature-gauge railway dream



The heritage park's miniature-gauge railway is the fulfilment of a dream. "It was always part of our plan since 1981 so it's been nearly four decades in the making," says Jim Staton, the project leader who also works for DOC, which has given the park a grant to plant natives and enhance the endangered mudfish's environment in the wetland area.

The railway complex will include a ticket office and station platform, as well as a concrete bay alongside so that visiting railway enthusiasts can load their own locomotives onto the track. The track comprises three rails so it can be used for both 7¼-inch- and 5½-inch-gauge trains and was designed so that all the curves are 22m radius.

Mort set up a railway workshop to

build the tracks, devising hinged jigs for welding both the curved and straight rail sections. "I had to think 10 steps ahead as you have to make allowances for the left- and right-hand curves and can't turn them end to end or the third rail doesn't line up," he says.

The lengths of steel are cut with a donated reconditioned bandsaw and welded with Mort's "brand new" 1973 welding machine, which hangs on a mobile curtain frame that came out of a picture theatre. "They used to hang the scenery on it for live shows," Mort tells us. The small crane used for loading the tracks onto the jig, turning them, and transferring the finished ones to a waiting trailer was used in a local hardware shop to move merchandise between the floors.

Mort also set up a jig for drilling the total of 6000 holes, three per stay. The track, which is fixed to treated pine sleepers, will have 200 links in its 1km circuit. It takes about 45 minutes to make one length of track from start to finish on the production line.

There will be a main engine and service engine with three wagons, each able to carry four adults, and the driver sitting in the tender. They opted for petrol-driven locomotives so the volunteer operators don't have to have steam tickets.

The engines are being rebuilt from second-hand machines, with major modifications necessary to get them up to New Zealand model-engineering specifications for carrying passengers. The previously nylon bearing blocks for the bogies have been remade using steel



from an old set of forklift prongs, then braced with steel plates to eliminate side movement. One hydraulic motor came from a machine that had been used to feed ferrets.

"A guy down at Ross was dumping it. I went and had a look and the hydraulics were exactly the same as on the other locomotive," says Mort. The motor creates pressure up to about 2500 pounds, driving all eight wheels. They adapted an alternator off a Nissan truck to create the charging system for the battery, using the vacuum system to run the brakes on the engine, which will be reshaped to look like the round-nosed DG shunters used in the last days of logging.

Some ingenious repurposing goes on to keep costs down. The railway turntable came from a car showroom, while Mort plans to build a traverser (a transfer table that shifts the rail to the side) using a mechanism off a tip truck. "For \$1200 I can build a traverser, which would normally cost around \$4K."

Mike Rooney, who is doing all the digger work for the railway, as well as landscaping the site, has dug down 5m in places and moved tonnes of soil. "I moved a whole hill. It's taken me years," he says. The tracks are set in gravel bedding from a little shingle quarry on site.

Old pieces of machinery and gold-mining gear will be displayed along the route of the railway, which they hope to have up and running within a year.

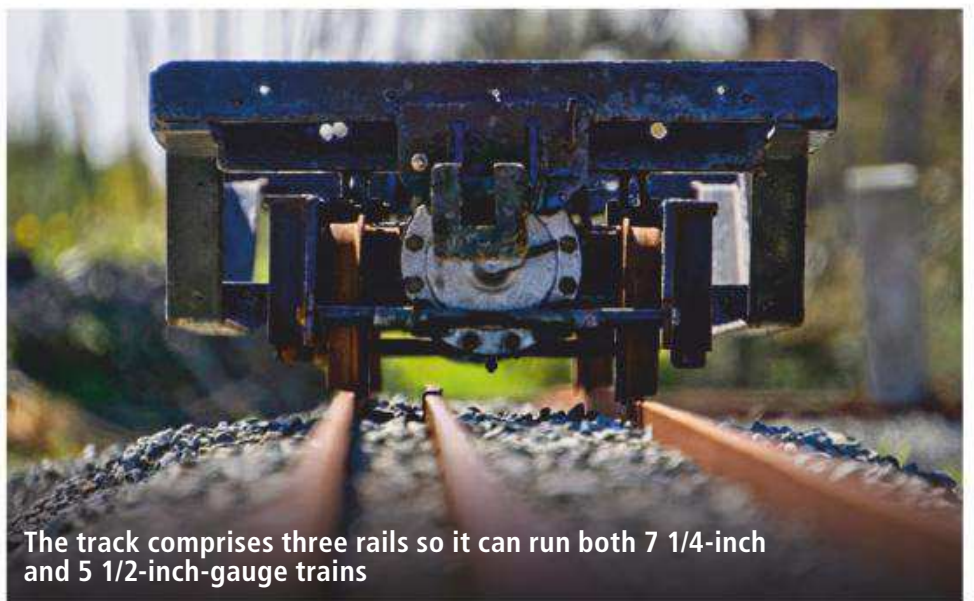


We were sad to learn of the death of Mort Cruickshank shortly before publication of this issue. Our sympathy to his family and friends.

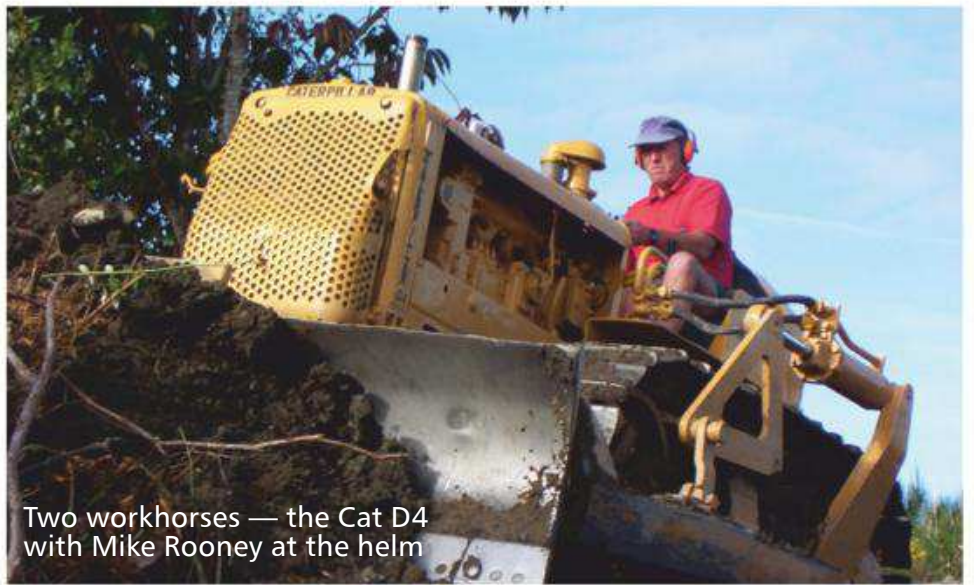
Mort was a true sheddie, whose skill, enthusiasm, and hard work have left an invaluable legacy for the West Coast community.



Old chainsaw collection



The track comprises three rails so it can run both 7 1/4-inch and 5 1/2-inch-gauge trains



Two workhorses — the Cat D4 with Mike Rooney at the helm

Ambulance



Old ambulance being worked on

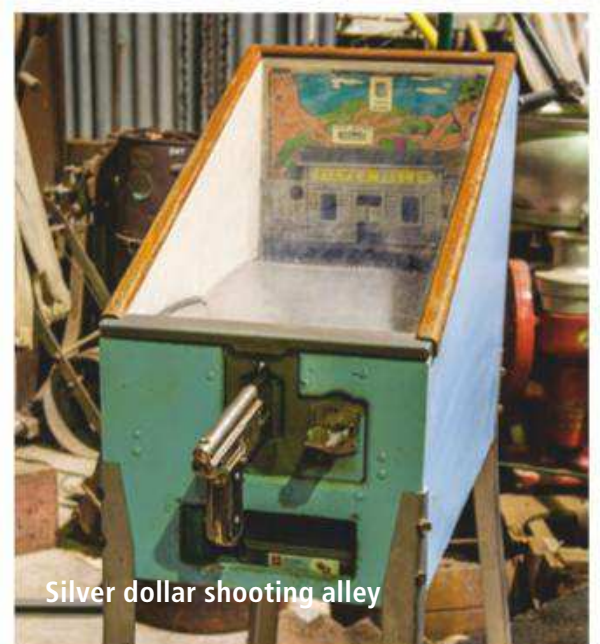
The engine of a 1914 Sunbeam Rover, which had been converted for use in a World War I ambulance, sits on a purpose-built trailer awaiting its body. "During World War I, Britain put a call out for people to donate their vehicles for ambulances," says Mort. "The gentry donated cars, including their Rolls-Royces, and also their drivers." This vehicle was bought by a local by the name of Keenan after the war. He went round showing movies, using it

as a generator to run the projector. Later the body was burnt and engine salvaged to run a sawbench for cutting firewood. The heritage shed team is hoping to rebuild it as an ambulance, having obtained full working drawings of the 1914 vehicle and had a stroke of luck in accessing handy materials: "A guy in Ashburton was doing up a Sunbeam Rover car and had heaps left over including the chassis," says Mort.

It's appropriate that 'Hokitika' means 'place of return'

► concrete. "Building the framework for it to sit on had to be precise. We had a dozen Japanese car jacks under it to fine-tune it and when we got it right, we just poured concrete over the whole lot."

For a group committed to restoring the past, it's appropriate that 'Hokitika' means 'place of return', even if the journey back to the future sometimes takes a while. 📖



Silver dollar shooting alley

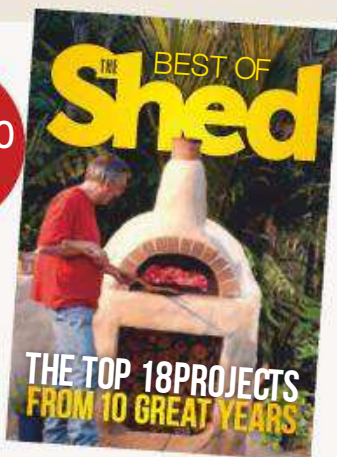
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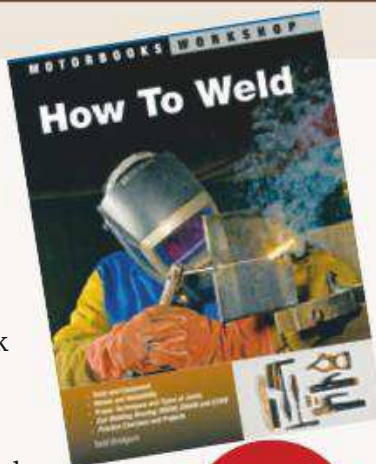
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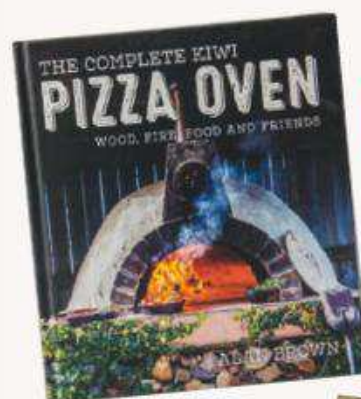
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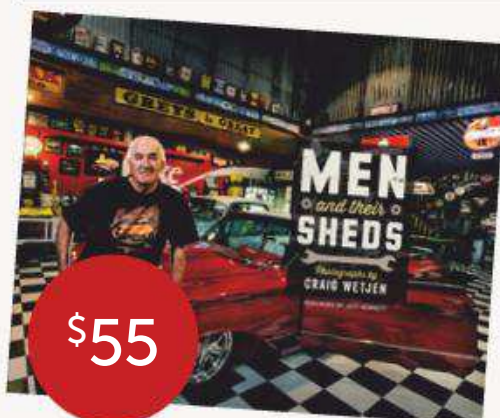
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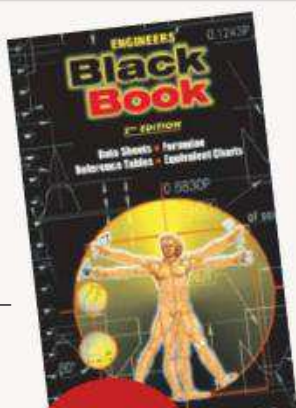
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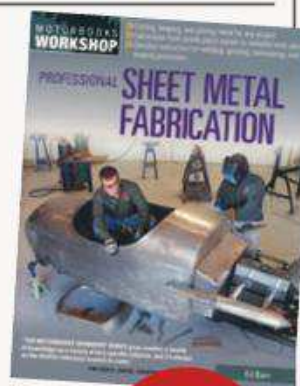
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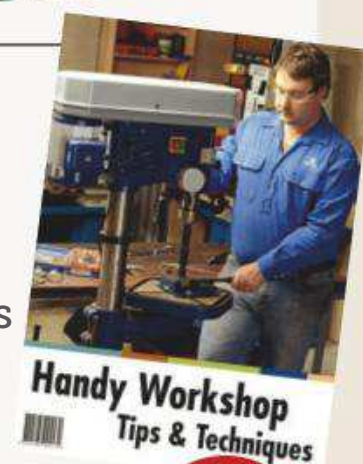
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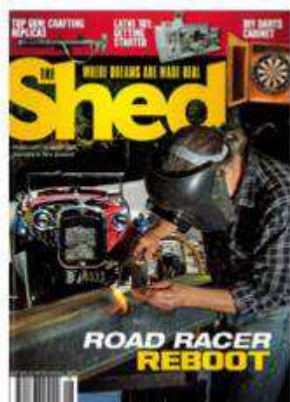
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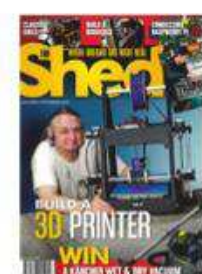
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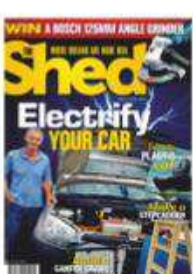
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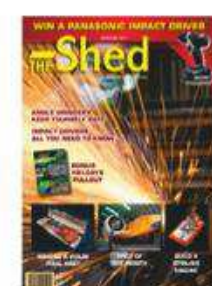
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Barbara Roper 03 352 4860 or 027 693 1278
rpb@papanui.school.nz

NEW BRIGHTON MENZ SHED

Ray Hall 03 388 7277 or 027 895 2488
secretary.nbmenzshed@gmail.com

LINWOOD MEN'S SHED

Shane Hollis 03 981 5594 or 022 062 0744
shane.linwoodresource@accd.org.nz

HALSWELL MEN'S SHED

Roger Spicer 027 229 1928
roger.s@xtra.co.nz

REDCLIFFS COMMUNITY SHED

Cameron Holdaway 03 384 4055
redcliffscommunityshed@gmail.com

ROWLEY COMMUNITY MEN'S SHED

Sven Christensen
vikings.burnettchristensen@gmail.com

FERRYMEAD BUSMENZ SHED

Ken Watson 03 355 7366
ChChBusMuseum@gmail.com

TE PUNA AUAHA LYTTTELTON

Paul Dietsche 027 536 7546
tepunaauaha@gmail.com

ROLLESTON MEN'S SHED

Stephen Rushton 021 106 0148
rollestonshed@gmail.com

MEN'S SHED OF LINCOLN SOCIETY

Myles Rea 03 3252 632
secretary.lincolnmensshed@gmail.com

AKAROA COMMUNITY MEN'S SHED

Howard Wilson 027 407 9559 or 03 304 7480
h.wilson@xtra.co.nz

ASHBURTON MEN'S SHED

Stewart Dunlop 03 3083910 or
022 133 7817
ash.menzshed@outlook.com

TIMARU MENZ SHED

Kevin Wildey 021 206 7291 or 03 6846087
kwkevlights061@gmail.com

ARROWTOWN MENZSHED INC

Russel Heckler 03 442 0204
hecklerdenise@hotmail.com

OAMARU MENZ SHED

John Walker 027 445 5265
jjms@actrix.co.nz

ALEXANDRA MEN'S SHED

Neil McArthur 03 448 9377
alexmenshed@gmail.com

NORTH DUNEDIN SHED SOCIETY INC

Paul Nelson 03 474 0060 or 021 1445 8531
madnel@vodafone.co.nz

TAIERI BLOKE'S SHED

Nick Wilson 03 742 1206
jean.nickwilson@gmail.com

MATAURA MENZSHED

Mike Whale 027 299 7218
orcas@xtra.co.nz

MENZSHED INVERCARGILL

Peter Bailey
peteolly@xtra.co.nz

WE'LL MEET AGAIN ...

By Jim Hopkins

Which will it be: a bit of Pete and Dud or an encore from the Forces' Sweetheart, now 101? Alternatively, we could combine both and bring you a hits of the wits and hits of the Blitz medley. Yes! Let's do that. All together now, 1, 2, 3 ...

Now is the time to say goodbye

Now is the time to yield a sigh (yield it, yield it)

Now is the time to wend our waaaayyyyyy ...

[Your turn, Vera]

... But I know we'll meet again some sunny day.

Indeed we will. As we should. It just won't be here, that's all. It's time for other people to use Back o' The Shed for other purposes. This dash is done. Except it wasn't a dash. More a marathon, if truth be told. Don't ask how long, although, if pressed, I'd say right from the start. I do remember meeting the mag's first editor, 'Lord' Snow at the Mystery Creek Fieldays to discuss the possible penning of ponderings and I'm fairly sure that was before the first issue came out.

Maybe it was, maybe it wasn't, but, either way, the invitation only came because HarperCollins editor Ian Watt had already asked me to write the book *Blokes and Sheds*. That was a life-changing opportunity and this column was just one of the things it brought to pass.

There were more books, TV shows, even interviews with the BBC about this strange antipodean phenomenon. Call me deluded,

but I do believe it all helped to put sheds on the map. And rightly so, say all of us. It wasn't long before higher profile chaps like James May were hailing the importance of sheds as history's great incubators of invention, and George Clark was hosting UK Shed of the Year shows for an audience of millions.

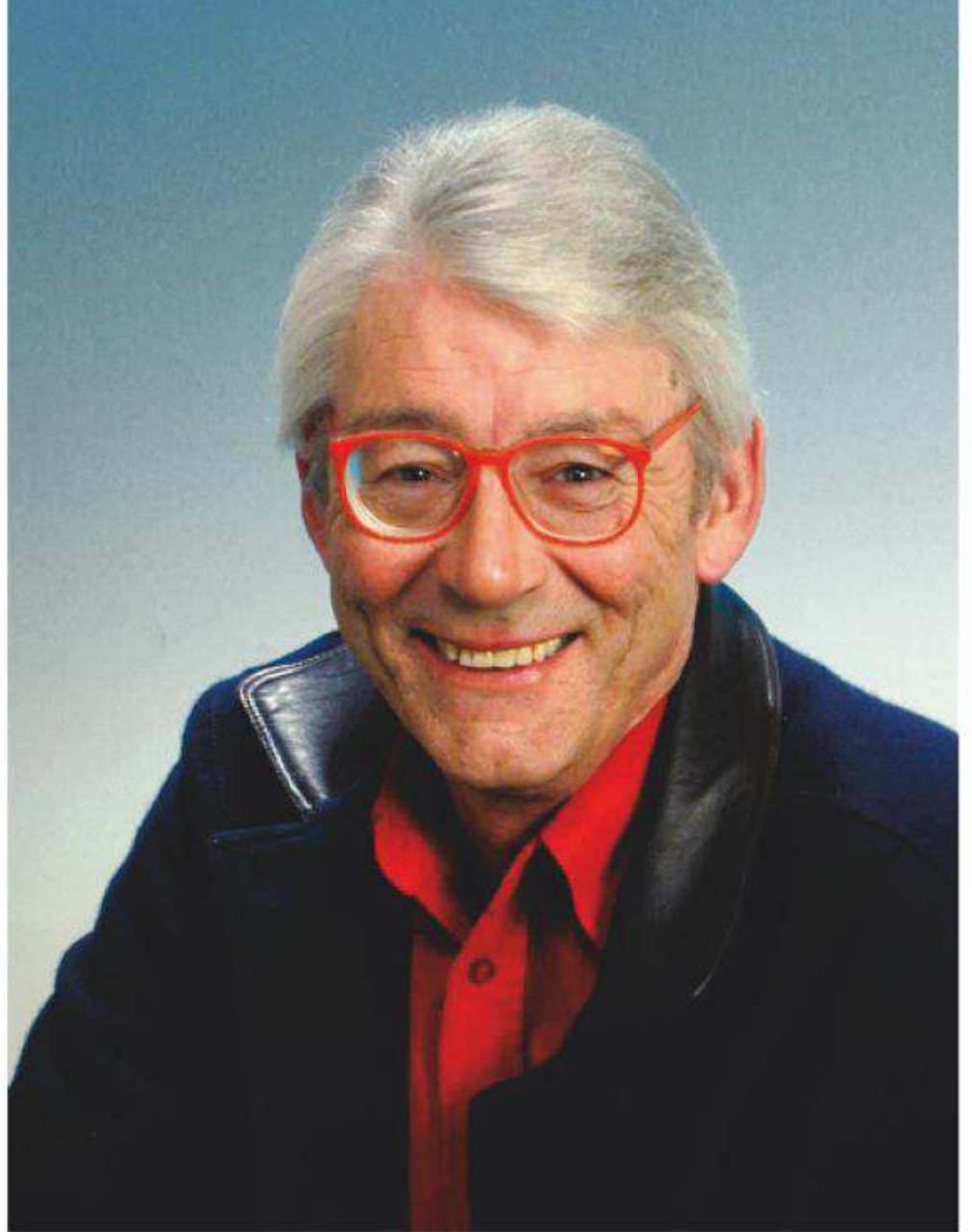
A lost opportunity, New Zillun, but cheer up, this mag survives. And thrives. And will continue to do so. As long as there are sheds where the lights burn late at night and sheddies who lose track of time and walk out into a dawn they hadn't realized had arrived. Such preoccupation is a gift — and its own reward, along with whatever else the shed yields by way of treasure.

To see so many amazing things shaped by so many diligent people in so many sheds over the years has been a joy and revelation. And an embarrassment too, because just looking at these many creations — or recreations — you know you've never had, and will never have, the skills or application to make anything so exact, inspired, or fantastic. So I've written instead. And writing is kind of making. It demands its own care and precision. A sentence can be sculpted like an E-Type fender. Perhaps not as obviously, or tangibly, but shaped nevertheless with the same attention to detail.

Anybody who makes things has their

own heroes, people whose ability to craft wonders from wood or metal, or clay or stone is simultaneously an inspiration and an intimidation. So it is with words. I've had heroes too, mainly old codgers from the age when print was king, writers like Spike Milligan's inspiration, JB Morton, who produced the brilliantly comic Beachcomber columns in the *Daily Express*, and his American counterpart SJ Perelman. Plus Hemingway (for simplicity); Tom Wolfe (of course); HL Mencken ("Every election is a sort of advance auction sale of stolen goods"); GK Chesterton; and the empress of epigrams, Dorothy Parker. They all had something funny, thoughtful, original, and provocative to say and they all cared about how they said it. They chose their words with precision and turned their sentences on a fastidious lathe. The keyboard is a workbench too, with its own skilled artisans, particularly those mentioned.

I hope they've had an influence and that their example has inspired some sentence or phrase which has taken your fancy, stirred your imagination, provoked a thought, or drawn a smile. If so, the column's done its job. Thanks for being there. Thanks for using sheds and loving sheds and knowing what they mean and why they matter. Keep the faith. Enjoy the results. And I know we'll meet again some funny way.



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