TRAINING & EDUCATION SUPPLEMENT

PAGE 113

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NOVEMBER–DECEMBER 2017
ISSUE 75

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Koogan Moodliar

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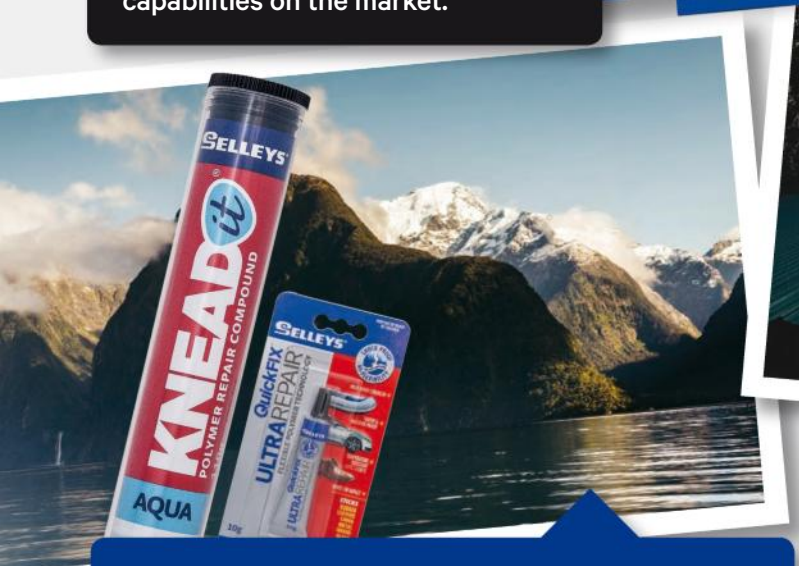

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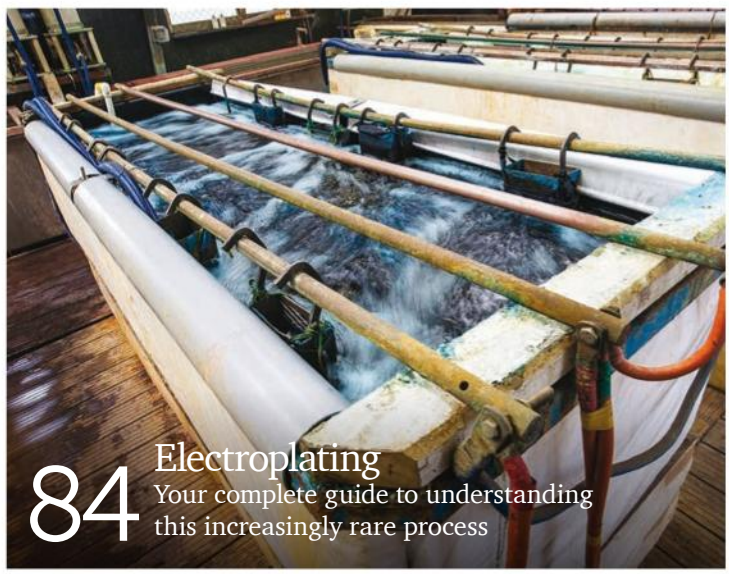

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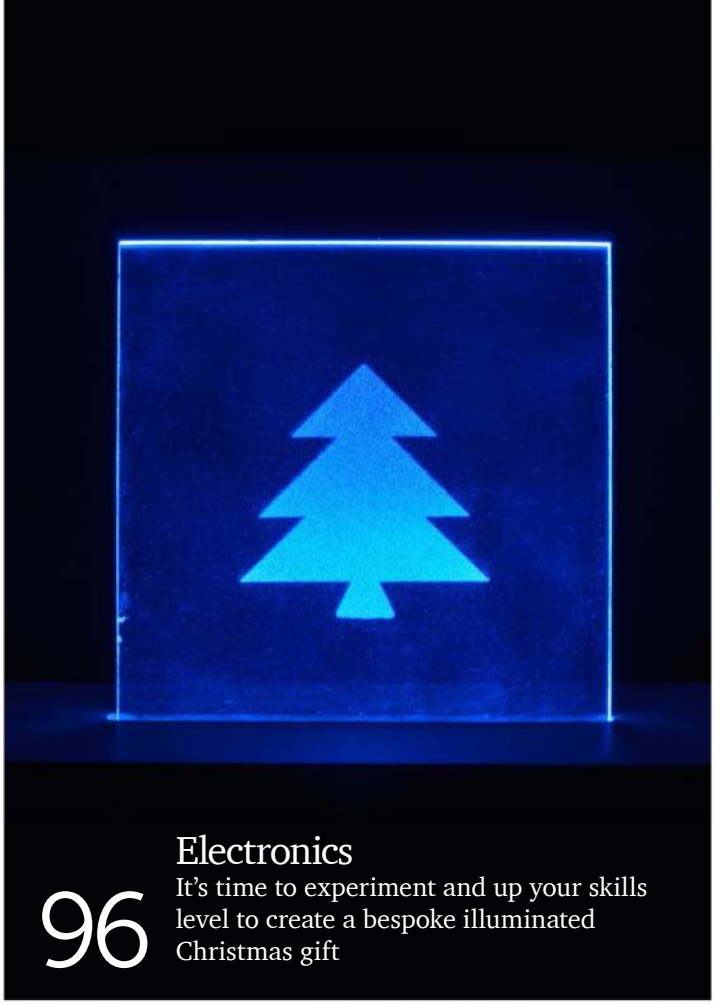

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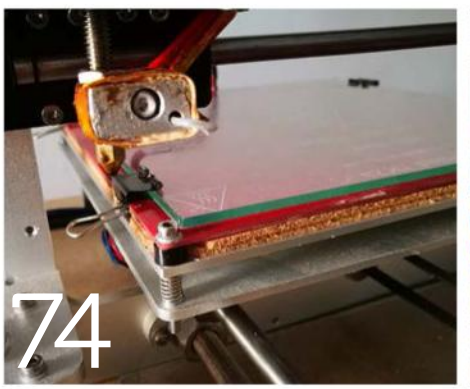

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Every issue

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The clever ones

We were a gang of four through intermediate and college, all good mates and still are some (ahem) 40-something years later.

When we all left school and went into the workforce in the ’70s (when getting a job was not hard at all) three out of us four mates went into apprenticeships. I was the only one who didn’t. Magazines were going to last forever, right?

I always admired my mates as they all signed on for three to four years of low wages, even more study (usually at night school), and some strict guidelines and rules learning their chosen trade. I didn’t have that self-discipline and no way did I want more school work. I was so keen to get that extra $8 a week in my pay packet — $8 more than my mates.

Out of those three friends, one no longer does his trade, as lithography disintegrated with progress; one has just retired but basically kept doing his trade for all his working life and just adapted to the changes in his industry; and one stepped right away from being a mechanic but has priceless skills that can see him fix issues or solve problems wherever he comes across them — and not just mechanical ones.

I have also met youngsters through my life who have also taken the apprenticeship-to-earn-a-trade route and I must say there is a definite thread running through these apprentices as well. It takes a certain type of person who can set aside the trinkets of today for the joy of a lifelong job tomorrow and I admire that.

I have never met anyone who ever regretted going to a tertiary institute to learn a trade or skill and, in fact, one of my boys is doing that right now, studying computer engineering. I believe a good approach to work and making the time to learn a skill really is to be admired and they are the clever ones among us. You get real security from a trade, a good grounding, and a terrific attitude to work, I reckon. Sure, skill sets may change over the years but adapting to change is part of life. It’s as much about that application to task and the discipline of learning that sets one in good stead.

Endeavouring to secure your future at a young age is smart and we really need to encourage that behaviour whenever we see it in our youth.

Which leads me to our special feature in this issue. We really hope you enjoy and explore our annual education supplement starting on page 113 and ensure that the young ones in the family have a good read of it — especially if they are at that stage in their life where they keep asking, “What the heck am I gonna do for a job?” Get a trade I say — be one of the clever ones.

Greg Vincent
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Submitted articles to* The Shed*:

We welcome these from readers at any time and on any subject that as a reader of the magazine interests you. There are no guarantees that we can publish all the articles we receive but we will always do our best to. Send ideas or articles to: editor@theshedmag.co.nz.

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Ian and his wife Fay are keen members of the Vintage Car Club

MR FIX-IT

A FORMER PANEL BEATER CAN TURN HIS HAND TO MOST JOBS AT HAND — FROM RESTORING CARS TO MAKING A 64-NOTE ORGAN

By Helen Frances

Photographs: Tracey Grant

Ian using the gantry to haul a heavy part upstairs

Ian Chamberlain's shed is upstairs in the second storey of his double garage in Whanganui. Ian certainly needs all the room on the ground floor to park just a few of the vintage and classic cars he has restored over the past 30-odd years. And while the styles of car evoke a walk down memory lane, the vehicles look brand-spanking new.

There's a fire-engine red Mark 1 Zephyr convertible, a more staid-looking green and black 1917 Buick, the red and brassy 1906 Reo, and its miniature lookalike. A Model T truck houses the 64-note wooden organ, drum, and xylophone combo Ian made from scratch. The instruments run on software that plays a repertoire of tinkly organ-grinder tunes and is very popular at events in Whanganui and its surrounds.

Downstairs, Ian keeps a large drill press, bench, and vice. The rest of his gear is upstairs, where we perch on two saw stools. Overhead runs a gantry for hauling heavy parts up and down, like car engines and welders — anything he can't carry up the stairs.

"The bench overlooks the driveway, so I can see who's sneaking in," Ian says laughing. "The main disadvantage to being upstairs is that I can't get a car up here, but otherwise it is quite handy. I don't get cluttered up with cars and other bits and pieces."

On a top shelf he's got a stash of old-fashioned gaslights, 1910–'20s pushbike and motorbike lamps, some of which are quite rare, and a sizeable brass car horn.

A couple of spare motors for the Model T sit in waiting under a shelf.

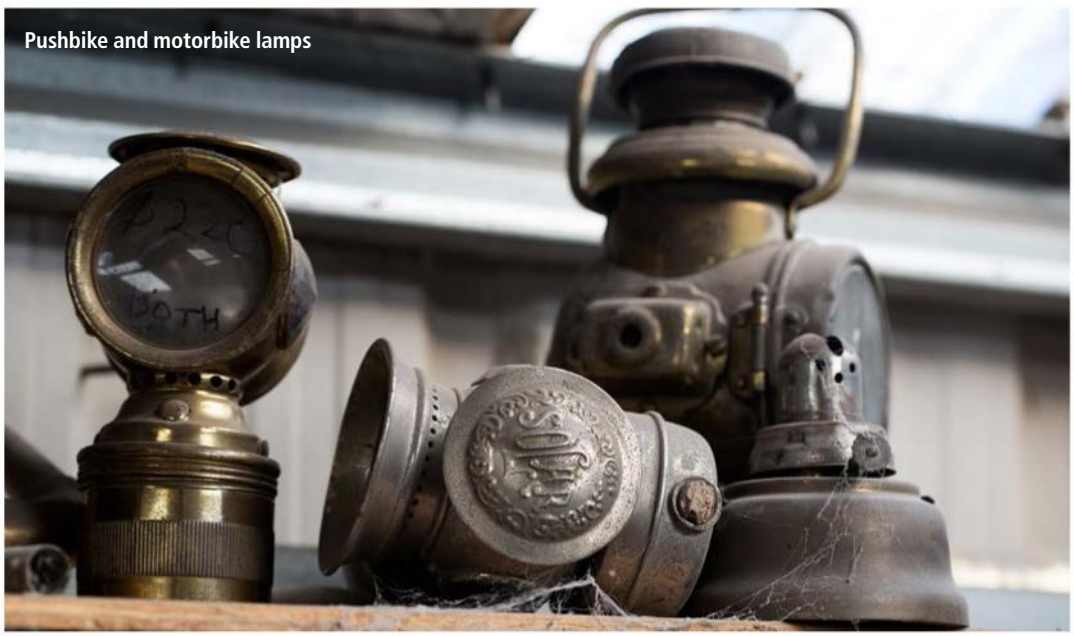
On the floor there is a metal water-blasting tray for beehive frames that he's building for a friend. The tray will help separate the wax from the water, so it won't block the drains. He's just adapting the same principles he used for a 30-foot (9m) diameter construction that he made for oil in his heavy-engineering days.

Ian's workshop

It's just a normal workshop, Ian points out. There's a general assortment of power and hand tools: a power hammer for mudguards and spare parts, a

The miniature lookalike of the 1906 Reo with the Zephyr and Model T in the background

"The main disadvantage to being upstairs is that I can't get a car up here"



Pushbike and motorbike lamps

Ian's lathe does all the jobs he needs it to

Work in progress

The 1938 Chevy Ian converted into a hearse

"A bit of horse-trading, you could call it. I'll do a job for friends and they'll give me stuff"

seven-inch (17.7cm) grinder, drills, a planer, a skill saw and disc saw, a machine for polishing paintwork, various bolts, and bits and pieces. And, unusually, an antique, manual scroll saw with a treadle.

His medium-sized lathe (600mm) "is just a cheap Chinese lathe but it does all I want it to do". He has had it since 1979. There's a big eight-inch (20cm) grinder, a scroll saw, and a small cheap drill press — "it does all I want for upstairs", a MIG welder and gas welder, and a big blue power hammer that he made. Some of this gear, such as the heavy spot welder, came from his former panel-beating business.

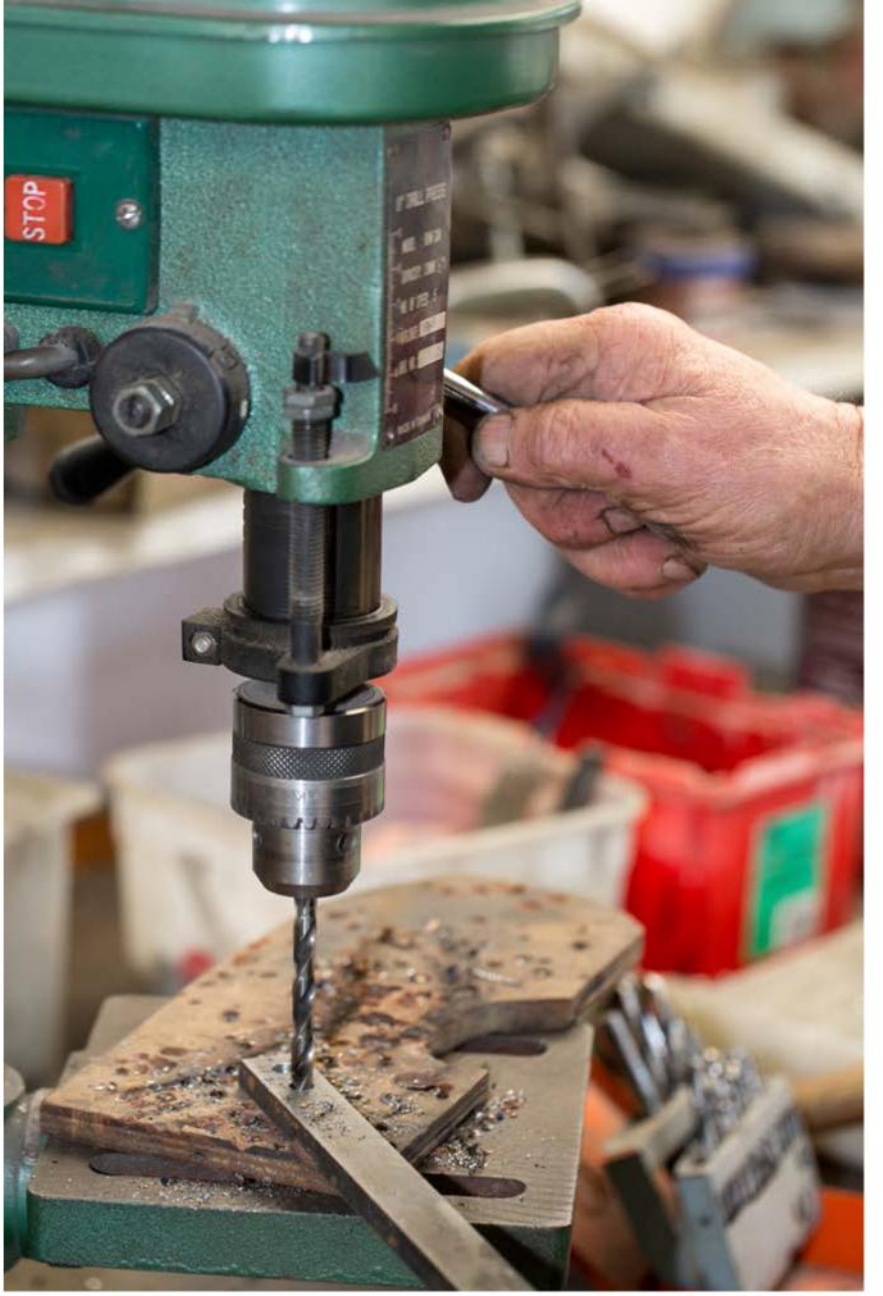
"I couldn't fit it all in here or I'd have kept it all," he says.

Ian is continually doing jobs for others "instead of watching *Coronation Street*". And they repay in kind by swapping parts or doing work for him.

"A bit of horse-trading, you could call it. I'll do a job for friends and they'll give me stuff. Last week I finished a bit of rust on a vehicle for a friend and he said, 'Oh, your woodshed looks a bit empty', so a couple of truckloads of wood came up."

The cars

Ian and his wife, Fay, are members of the Vintage Car Club of New Zealand and Ian is frequently asked to work on other people's vintage vehicles. A few months ago he completed major bodywork for a French 1902 Mathieu car, which he says is the only known car of its kind in the world. The car has since returned to its owner in Palmerston North.

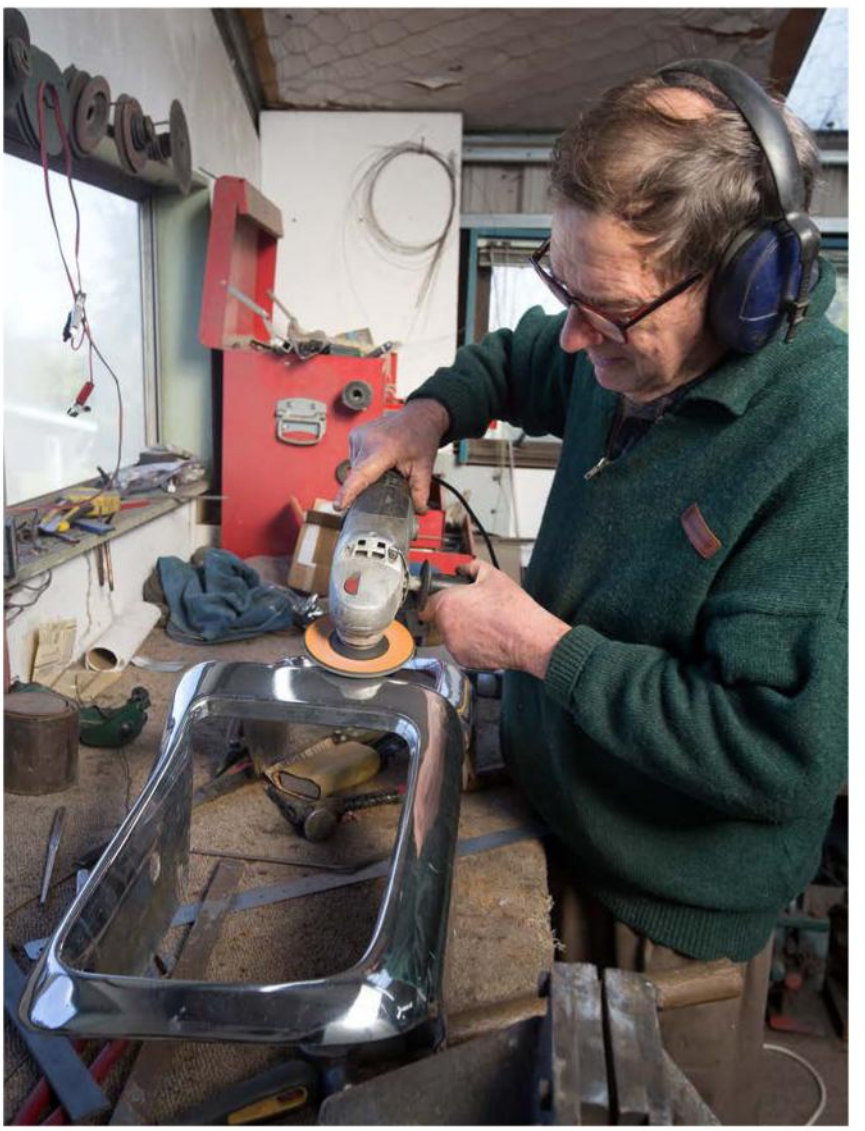


At work on the drill press

Spare parts at the ready

The Mark 1 Zephyr convertible was a bucket of rust

Buffing up



"The biggest problem with this sort of thing is that people are frightened to start because they are scared of making a mistake"

The Mathieu has a piped chassis and the car still had the original backing. As is the case with many early cars, access to the interior was through a back door, stepping over the diff.

"It was in mint condition apart from a tiny bit of borer in the back. When I was doing it, I had to leave everything as is — all the original lines and so on. I made a lot of the brass fittings, all the guards, the front panels and bonnet." A friend in Foxton made the wooden frame.

Ian makes patterns for bodywork out of cardboard or scraps of tin.

"Once you get the shape looking the same as the photo, you cut it all out. You make quite a few mistakes but you just throw it away and make it all again. The biggest problem with this sort of thing is that people are frightened to start because they are scared of making a mistake. ▸

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The organ

Ian made the organ 10 years ago and he says that it was much the same as working on a car — just making the component pieces and putting them together.

"I don't know why I made the organ. There was a parade through the town and I saw a bloke with a hand organ and I said, 'Where did you get that from?' He said to go on the internet to find how to make it but warned that 'whatever you do, don't make the 26-note organ.' So me being me, I made the 26-note organ. Everything's so close — within 1mm. But then I thought I wanted something a bit better and ended up making the 64-note organ."

The rectangular pipes, all a different length, are recycled rimu panels that Ian salvaged from a demolition job instead of using them for firewood. To tune it he made the pipes a little bit longer and adjusted them according to a four-inch water-pressure tuning gauge he made. He had 130 pipes and needed more room, which is where the upstairs sitting room came in handy.

"He's not musical, that's the strange thing, but the organ has been a real asset. We've taken it to Virginia Lake and to lots of events around Whanganui," says Fay.

The small hand-cranked organ grinder Ian made was at the time taking part in a *Mary Poppins* musical in New Plymouth.

"Sometimes the shed spills over into the house but, as Fay says, "You've got to have an understanding wife."

"The thing is to make it and if it doesn't look right, well, then it's the pattern for your next model. You don't know if it's going to look right until you make it."

The Mark 1 Zephyr convertible was "a bucket of rust" that he pulled out of a boat shed on Kawhia Harbour. Ian had done his apprenticeship on Mark 1 Zephyrs so he knew what was needed to get it back on the road.

Get it right

He acquired the 1917 Buick 25 years ago from Trevor Dickie, the senior panel beater at his work. It took him about three months to figure out how to make the awkwardly shaped guards, keeping the lines straight. But after that it was a quick job.

"I said to Trevor, 'I'm going to do them over the weekend', and he said, 'If you don't do it right I'm going to kick your backside.' Those were the good old apprenticeship days — you can't do that now.

"So I took the guard in on the Monday morning — he had his own panel-beating shop in town — chucked it on the floor and said, 'There you are, that's


REO
1906

The 1906 Reo and its mini-me

near enough.' I said it didn't take that long to make and he said, 'You bloody liar.' I've got a video of me doing it. He wouldn't let me do the other guard until I'd shown him how I did it.

"The front guard has got a crown in it and a little flash on each side so [the challenge] was trying to get that line straight. It was quite simple when I'd figured it out; totally different from how I'd been taught. I just bolted flat bars around it."

While the Buick job was underway, one of his sons announced that he was getting married in three months' time and he wanted the car for the wedding entourage, so Ian finished it a couple of days before the wedding.

To restore the Reo, Ian moved the car with all its bits and pieces into a bedroom in the sleep-out, which he built in front of the shed at their house in town. Their youngest son, who occupied the sleep-out, was on the cusp of moving out, but Ian couldn't wait.

"I got a chainsaw and cut a hole in the wall then drove the car inside. I said, 'The day you move out is the day I move in.' He went crook because he wanted to sleep in."

Ian sourced factory drawings for the Reo from a chap in California. It took him 14 months to restore. The miniature took 13 weeks to make. "It was easy. The drawings are the same size as the car."

The Reo has the original motor, which Ian brought back to life, and America was again a source for the radiator and lights. The vintage-car network is worldwide, and he saw the lights advertised in the *Horseless Carriage* magazine. ▸

Waimarie paddle steamer

The morning of the interview with *The Shed*, Ian had been working on the *Waimarie* paddle steamer boiler, crawling inside to fit the faceplate and putting bolts and new castings inside.

"Last week we pulled the paddles off to re-bush it all and see how far the engineering firm had got with it."

He has been involved with maintenance of the historic paddle steamer for the past five years.

"The skipper says, 'Ian, come here, I want you to have a look at this.' In other words he wants me to do something for him."

Last year Ian set up the cradle to get the *Waimarie* out of the river for its five-yearly survey. He had a cost-effective idea about getting it out sideways.

"They said, 'Oh you can't do it that way.' Then they came back to me and adopted my idea. They got all the experts in, which ended up costing a lot more. We had to make a slip over by Dublin Street Bridge and one bloke came up with the idea of getting two traction engines to pull it out. We laid railway lines down and it came out quite easily."

Instead of pulling it out bow first, the way it was previously set up, Ian changed the cradle so that the boat could be pulled out sideways. He called on engineering mates to lend him a workshop for a couple of months to do the work.

"I had to turn all the wheels around and reinforce it — two sets of railway lines turned sideways and two sets of bogeys for it to sit on. It took me about four weeks to change it all around."

But there were delays with floods and council permits, and the sandbank kept shifting.

"Then someone had the bright idea of making it an event. That made the permit easier to get. So we pulled it out, cleaned everything up, and it was done."

There were crowds of onlookers and the event was filmed and televised.

See this youtube clip: youtube.com/watch?v=PRPq25Iia3Q.

The 2012 rally drew big crowds to Whanganui

Ian made the bonnet and grille, the front seat, and the steering wheel. He filled the bath with hot water to shape the guards, making a jig to bend them. "Fay kept going crook because I ran the house out of hot water."

Sometimes the shed spills over into the house but, as Fay says, "You've got to have an understanding wife."

Endless adventures

The couple has had many adventures of the mechanical kind. Friends with old cars like to travel with Ian on hand and he has improvised their way out of a number of situations.

"We were all going in convoy to Dunedin. I was in the ute towing the Reo on the trailer. A Hillman broke down about 90km from Christchurch. It was raining and we couldn't get it going. The only way was towing it. When we got into Christchurch, the brakes gave out and it ran into the back of the trailer. The police passed going the other way and they were just shaking their heads. [The Hillman] bent all the grille, but we managed to pull it out. We took ages to get it going but found out the ignition had failed. We got some bits for it, then carried on."

The same car broke a kingpin on the way back. A quick weld got it back to the North Island where they sourced the special part.

As a Vintage Car Club member, Ian was one of a small committee that organized the public open day for the International Vintage Car Club Rally held in 2012 in Whanganui. Seven hundred vintage and classic cars parked at the Whanganui Racecourse.

"The racecourse was chocka, and the crowd of 35,000 people made it the biggest crowd they had ever had in Whanganui," he says.

Sheddie forever

An eternal sheddie, Ian has always had a place to do his own projects. He has lived most of his life in Whanganui and in 1943 was the only Pakeha at Koriniti School up the river. Later, his family owned a farm at Westmere.

"As soon as you learn to walk you've got to do stuff on a farm. I was driving vehicles on the farm when I was 10."

Ian and school were not a happy match, so at 15 he started a panel-beating apprenticeship earning £2 10s a week, and from that time on he came into his own. He also worked in heavy, hands-on engineering, making, among other things, a 110-ton tanker buoy and building a dredge, before setting up his own panel-beating business.

He has had the odd accident, cutting his hands twice on a grinder when he used a disc from the big grinder on a smaller machine. "It runs about three times the speed. I was taking the gearbox out of the Zephyr to fix the clutch. A piece broke out and it got away on me, so I was grounded for eight weeks."

Despite cutting tendons, Ian has regained full use of his hands. The second time it happened he injured just one hand, so he reckons there won't be a third. The hospital wasn't pleased.

Another unusual project has had an equally unusual spinoff. Ian made a hearse for a local funeral director by cutting a 1938 Chevy in half, lengthening it, making all the chassis parts and lining it up so that it looks the part. "I've been offered a free funeral," he laughs.


Ian dealing to a fender

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Get a career

By Sarah Beresford

Young students who might've been a bit bored with school and wondered what relevance it has for the transition to the big wide world of working for a living got a taste of the sort of careers that are on offer during the recent Got a Trade Week.

One student jumped on a helicopter for a ride to Clyde Dam and another was taken to look at rally cars. The trade swap helps to make things clearer in terms of how what you're learning in the classroom may be a gateway to exciting career options.

The week, organized by the Industry Training Federation (ITF) and held in August, focused on the importance of encouraging educational pathways that will provide students with a sense of purpose and direction.

The best and brightest apprentices in New Zealand were also celebrated at an awards night held as part of the week. "We held a forum earlier in the day with the 50 apprentices who had been nominated by their Industry Training Organisations [ITOs] and that was really exciting," said Josh Williams, chief executive of the ITF. "The awards had an awesome vibe and was hosted by Industry Training Minister Louise Upton. We wanted to recognize excellence in business management and leadership in young apprentices who are going through the system. It's often difficult for students to relate to people who have already 'made it' so we wanted to highlight the stories of some young people who were in the process of gaining skills. We thought [that] students would be inspired by someone who was only two or three years up the chain. It's more relatable."

This is the campaign's third year and for the first time a School of the Year award was also presented as a way of showcasing some of the ways educators could promote a range of pathways to

Graphic and web designer Myra Anderson, received the evening's top honour, Industry Trainee of the Year

The inaugural School of the Year Award was presented to Kawakawa-based Bay of Islands College

Air New Zealand customer-service agent Jahmaine Cummings-Hodge received the Maori Community Impact Award

Talented Hastings barber Peleti Oli received the Pasifika Community Impact Award

future careers other than going down the route to university.

"Seven out of 10 school-leavers don't go to uni, so it's incredibly important that students realize the options they have to upskill after leaving school," said Williams. "There's an incredibly diverse range of opportunities to gain a trade or qualification while you're working on the job earning. What could be better than a free education?"

The Got a Trade campaign website has made videos available online featuring nine Got a Trade Heroes nominated by ITOs who talk about what they do, where they are in their training, and how they got into their apprenticeships.

"There are many industries screaming out for skilled workers and both here and overseas there is a renaissance of the apprenticeship model with the acknowledgement that when workers are trained within an industry you get the skills you need," said Williams.

He explained that the perception of trades as being somehow "dumbed down" was fast disappearing: "One of the exciting things with new technology is the crossover in disciplines that is happening. There are high-tech industries which need skilled employees for very complex jobs, like training as a wind electricity technologist — it's sort of like being half an electrician and half an engineer. We really want to do some myth busting about the jobs that are available, the people who do them, and the kinds of training and skills needed."

He said the week also hoped to encourage employers to take on apprentices: "All employers remember the person who took them on and gave them a chance to work. It's a way of looking after your industry and paying it forward.

"Ultimately we just want to contextualize what ITOs have on offer and the huge range of occupational training that comes under their umbrella. There's some wonderful opportunities and we want to let students know that in the last three years of school it's not just a matter of picking subjects out of a timetable. There are some definite pathways that can lead to exciting career opportunities."

For more information, head online to gotatrade.co.nz.

How to be a solar buddy *By Mark Beckitt*

While holidaying in Queenstown I spotted an article in the local paper — *The Otago Daily Times* — about a scheme to provide LED lighting to countries where light is a real luxury (odt.co.nz/regions/queenstown/school-signs-solar-buddy-scheme).

I've seen various solutions over the years, but this Solar Buddy programme solves one of the major issues around recharging and portability, and is affordable. Kate Rowland is the local promoter and kindly arranged for me to get my hands on one, so I could see if it would suit Futureintech and the school programmes they run. While the light is the object, the opportunity for schools is learning about renewable energy, along with some basic electronic assembly. Also, assisting others and making new contacts are social interaction that has value long after the gift has been received.

Since the article appeared, Kate has managed to put a very generous programme of buy one, gift one (ebrightenergy.co.nz/product/bright-beam-solar-led-light/), and for only $25 you get two units (with one being gifted).

The assembly is simple, with no soldering, and the whole product looks well made. Perhaps the trickiest bit is getting the protective sleeve on correctly so it fits into the holes.

While the scheme is aimed at schools there is no reason why groups or businesses couldn't get together and fundraise and make a project from it.

Personally I'd be happy if both items went to those in need of them, but they would make an ideal Christmas gift. Parents or grandparents could help assemble it and then gift it — how good is that?

There are some excellent FAQs at this site: https://solarbuddy.org/faq/.

Keeping on keeping on

Hello *Shed*,

As a family we enjoy your magazine and you will find a copy of each edition at our place, right back to the first issues. The range of articles and features is still great and it's amazing all the things that happen in old New Zealand!

The reason I write is because of a parcel I recently received from my grampa which interestingly contained a toaster. A Zip toaster to be precise. However, according to an accompanying note, this toaster (which weighs basically twice as much as a new one) happens to be the exact toaster Gramps and Gran received for a wedding present 53 years ago. It has toasted bread to perfection all this time and has toasted at least 193,450 pieces of toast.

But, sad to say, it finally was beginning to fail. It would stop toasting at the correct time but failed to 'pop' the toast. So, being the electrician grandson I was sent the toaster to investigation this issue. Investigate I did.

In a modern world of electronics this old mechanical timer of a heated bimetal strip and springs and levers was quite an interesting little machine. So I fiddled, poked it with screwdrivers, tweaked it, bent it, and finally worked out its inner genius of mechanism. But my fiddling was to no avail; the old bimetal was a bit old and didn't bend as well as it needed to. The old springs were not so supple any more and I only seemed to make it worse …

So I thought about it for a while and looked at the toaster again, and then I looked on the bottom of the toaster and

there it was … it was made in Lower Hutt, New Zealand. So I knew I had to find someone who knew these old machines, with the skill and maybe the parts to make it go again … for another 53 years.

So I thought maybe I might find that person via *The Shed* magazine, a worthy publication with many readers of whom surely one knows about these old machines and has the knowledge and skill needed to bring it back to life. It's the only toaster I know of that can actually 'pop' toast properly … right on to the bench.

If *The Shed* magazine was able to forward replies to us it would be much appreciated.

Thanks,

Jason S

Can anyone help Jason and the family with their quest for perfect toast till 2070? If so, contact us here at The Shed *(editor@theshedmag.co.nz) and we will forward your correspondence on to Jason. — Editor*

Letter of the MONTH

If you work or play in an environment that puts constant stress on your equipment then look no further than the Polysteel line of flashlights. The middle size of the collection the Polysteel 400 Flashlight is waterproof with a stainless-steel core and a poly outer. Its drop and crush proof while possessing our Pure Beam Optics System with twist focus to make the light ultra-durable and ready to weather any storm.

This issue's winner is Jason S.

Letters should be emailed to editor@theshedmag.co.nz, or posted to Editor, The Shed *magazine, PO Box 46020, Herne Bay, Auckland 1147.*

Triumph Super Sevens

As an avid reader of your magazine over the years I am very interested in the articles concerning the Triumph Super Sevens owned by Noel Sims, Issue No. 73, and S & C Payne, Issue No. 74.

I am currently restoring a 1928 Triumph Super Seven Tourer (very rare) and wish to make contact with these people to exchange photographs, etc., if at all possible.

Is it possible to make contact if permitted with these people at all?

I would obliged if you can help. Thanking you in anticipation.

Regards,

Ewart Donnithorne

Our pleasure, Ewart. Both those Triumph Super Seven owners' contact info is on the way to you. I wonder how many of these Triumphs that article will bring to light. — Editor

More bush removal ideas

Hello editor,

In the September/Oct. 2017 issue, there is an article by Bob Hulme called The Right Stuff.

Could I add my experiences to the parts where Bob describes how to remove a bronze bush from a blind hole?

Yes, I have cut a slot in the bush to be removed, never used the hydraulic system, but a simple system is to tap a fine-threaded tap into the bush and keep screwing the tap in until the bush is forced out.

Stamping a label on steel (if you are right-handed), start at the end of the label and work backwards, and then you can see your spacing, etc.

Yours faithfully,

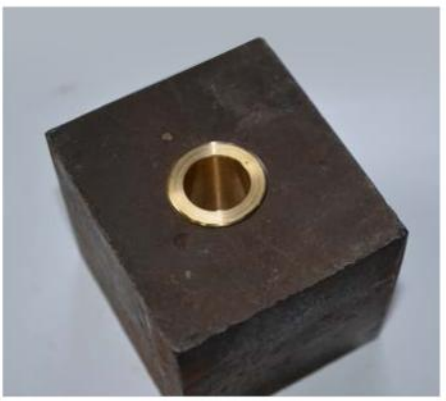
Neville Hewinson, Kamo

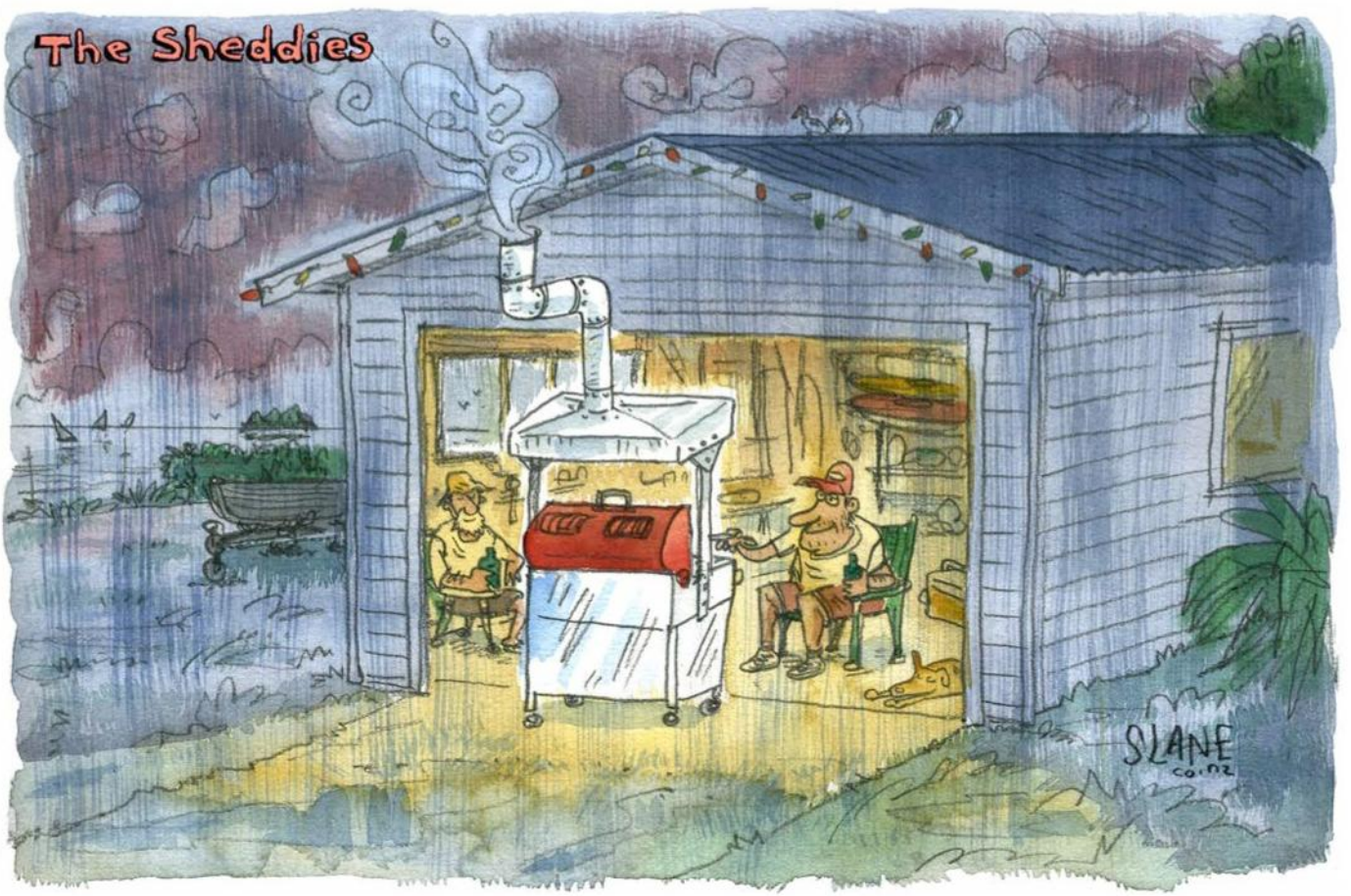
Re. Bob Hulme's The Right Stuff in Issue No. 74, I'd like to elaborate on his method of using hydraulic pressure for getting bushes out of blind holes. Oil works well as the hydraulic fluid when the bush is in a vertical hole with the open end facing up, but when the hole is horizontal it's impossible to fill it with oil, so packing the cavity with grease instead of oil is the answer. What works even better than grease is toilet paper. Yes, common old bum fodder.

Here's how it's done: tear off a few squares of paper, soak them in water, and wad them up in your hands, squeezing out the excess water. Stuff the wad into the hole in the bearing and repeat until you can't get any more in. Then, take a rod that fits the bearing bore, insert it, and whack it with a hammer. The wet toilet paper acts just like a hydraulic fluid and forces the bearing out of the hole. As the bearing comes out, add more paper to fill the volume it has vacated until it pops right out. The wadded paper makes a great gap filler, so the rod doesn't have to be a neat fit in the hole, meaning it will work as well when the bush is badly worn and it even works with ball races. An added bonus is that it's easier to clean up than oil or grease.

One final caution about using hydraulic pressure to force a bearing out, whatever the medium. Make sure the housing is robust enough to take the pressure. Blowing the back out of the housing can ruin your day, even if it does then make it easy to get the bearing out.

Allan Wylie, Christchurch





the perfect desk job

A SIMPLE BUT STYLISH DESK FOR THE HOME THAT CAN BE MADE WITH MINIMAL HAND TOOLS

By David Blackwell
Photographs: David and Val Blackwell

The desk that is the subject of this article was made for one of my grandson's and is made in a similar style to a bed that I made for him several years ago (see the article in *The Shed*, Issue No. 43, June/July 2012). Like the bed, it is made out of beech and finished with Danish oil.

While I have been able to undertake almost all of the processes in my hobby-styled workshop, I want to stress that this desk could be made at home with just a few hand tools. For example, you could ask the timber yard to dress the timber for you, all cutting could be done with a handsaw or a coping saw for the curves, and the mortises and tenons could all be done by hand. The process would take longer but you would certainly enhance your skills.

The design stage

The end mock-up from old timber

This desk, perhaps with one or two design modifications, could easily be a hall or entrance table or a lounge side table

The design process is always interesting for me and, with some initial design concepts in my head, I sit at the drawing board and draw out to scale two or three 2D versions of what I think the final product will look like.

With the simplicity of the design for the desk, the only real area for some design input was what the desk end would look like. I decided that because of the weight of the proposed top, I needed the ends to be very sturdy. The mortises and tenons in themselves add considerable strength and the cross members about two-thirds of the way up add significantly to the overall strength. I am aware that I tend to over-engineer designs but I would like to think the desk is still around 50 years from now.

Make a mock-up

After drawing the end to scale and playing around with a few different designs, I decided to mock-up an end out of old pine timber to ensure I was happy. This mock-up was just nailed together but it allowed me to further play with the position of the centre rail.

Finishing the base template

As I mentioned earlier, the desk is made from beech, which I purchased here in Christchurch from Halswell Timber. They always give me plenty of space to hunt through the racks for exactly what I am looking for. Timber is a natural product, so one or two small blemishes do not worry me too much but if I can avoid them I do. I used 50x50mm for the rails, 100x50mm for the base, and 150x40mm for the top. All the timber was rough sawn.

As this desk is likely to be replicated for another grandson, I decided to make a template out of 3mm MDF to make it easier to replicate the shape of the base. Very simple to make and it ensured there were no marking-out errors.

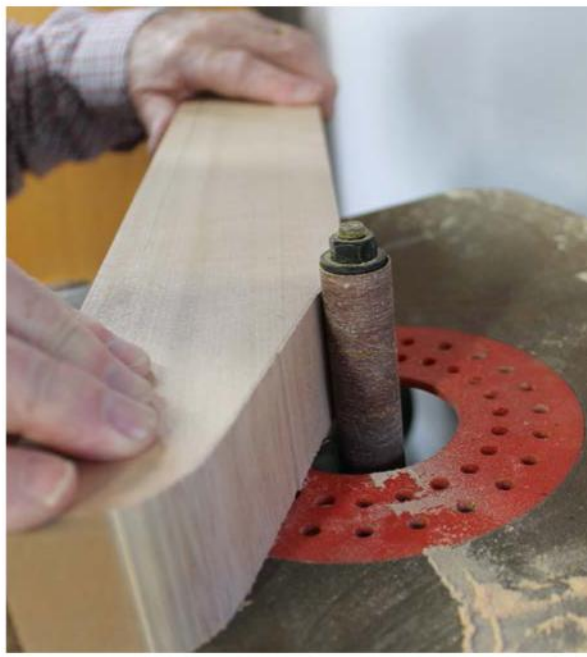
Rough-sawn timber required

These sizes allow for trimming:
150x40x1.250 — four
50x40x1.250 — one
100x50x0.65 — two
50x50x0.70 — four
50x50x0.300 — four
50x50x1.02 — two.

Also required: biscuits, threaded inserts, machine screws, thick washers, and Danish oil.

Tracing the template onto the base with a sharp pencil

Bandsawing the base curves ...



... and cleaning them up on the bobbin sander

The curves on the base were cut on my bandsaw and finished off ready for final sanding on the bobbin sander. If you do not have a bobbin sander, use a file or files and then either way you can finish with several successively finer grades of sandpaper.

The rails were made from 50x50mm rough sawn and machined to 45mm square. The exact size does not matter a lot, so a millimetre or two either way is fine, but they should all be the same. Just remember to make the base width the same as your final size for the rails. The rails were then all cut to the correct length allowing 25mm at each end for the tenons to be cut.

Woodworking high

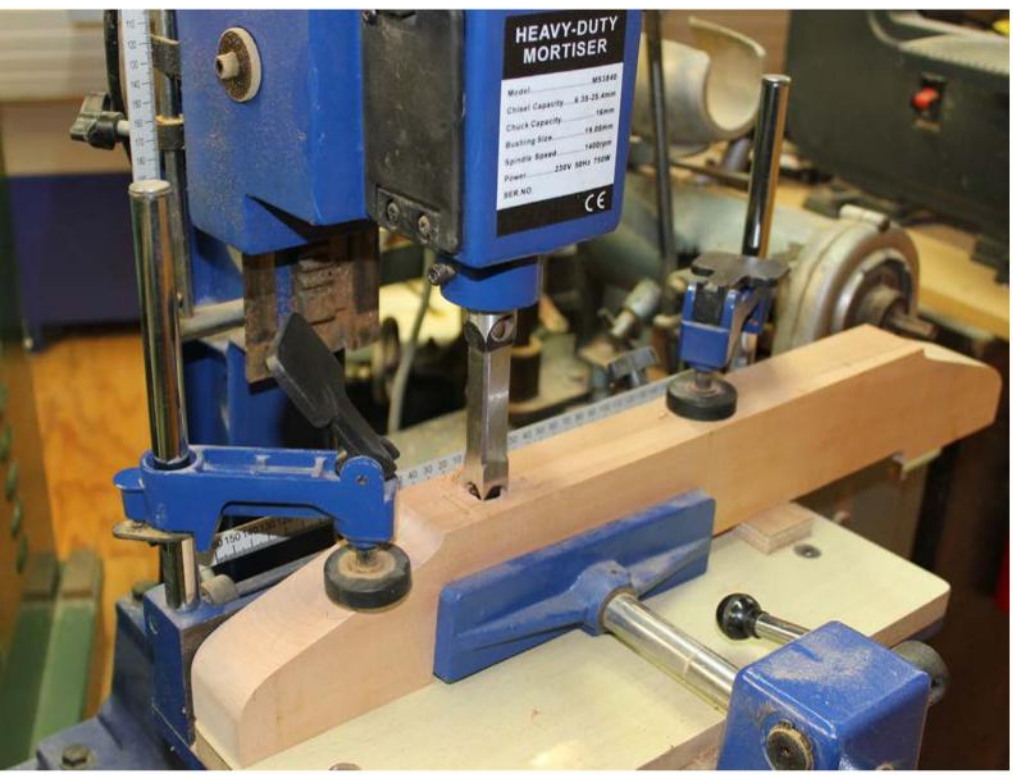
All the joints are mortise and tenon. First, I cut the mortises in the base and then in all the rails. The size I used for all the mortises and tenons was 30x20mm. I then removed the riving knife on my saw bench and cut the longer length of the tenons by gradually raising the blade until I achieved the size I required for the mortises.

I tried to achieve an almost fit from the saw and then used a file to achieve the correct fit. This, in my view, should give a good sliding fit but not so tight that it excludes the glue from the joint. Using this method on the saw bench, the tenons will be in the middle and make the final fitting much easier.

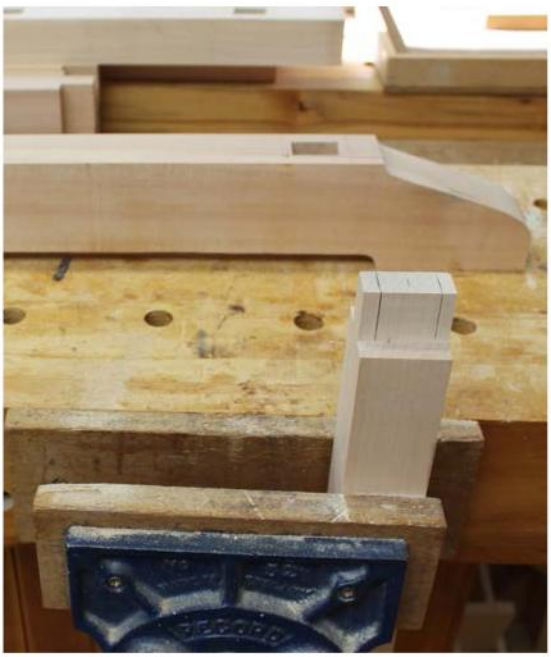
A note of warning: be aware that the riving knife and top guard are on the saw bench for safety reasons, therefore you need to be ultra careful with them removed.

I cut the ends of the tenons by hand and finished them with a file. I find this task reasonably quick, but I know many people do these on a bandsaw or bench saw. For some reason, I find making something in wood using mortise and tenon joints is the ultimate woodworking high. But they are also such strong joints.

Cutting the mortices. These can also be done easily with a drill and chisel



Cutting the tenons on the table saw



Finishing the tenons …

… and fitting them by hand

> *Timber is a natural product so one or two small blemishes do not worry me too much*

I am always concerned with the natural movements of wood as temperature changes and I allowed for the top to move a little without causing any problems. Wood moves mostly across the grain. I have held the top of the desk on with three screws along the back top rail and one either side at the front of the side rails. I elongated the holes at the front of the top side rail to allow the screw to move with any wood movement.

To cut the elongated slot, I used a 25mm Forstner drill bit to cut the recess for the screw head / washer, finishing it with a chisel. I then made the slot with a normal drill bit, drilling three holes, and tidied it up with a file. My slot is a little longer than necessary, but I made it take the file I was intending to use.

Before gluing up the frame, it is important to finish sanding all the frame rails as it is much harder when it is all glued together. The frame may need a little tickling up when it is glued but the amount of work required should be minimal.

Glue up

I suggest you assemble the ends dry just to be sure everything fits before you open the glue bottle. Every woodworker has their own favourite glue, but I always use Titebond III as I know I can rely on it. I always have a spare bottle or two in stock, as the consequences of running out part of the way through a job might not be pleasant.

I glued the ends together and then left them overnight before gluing the longer rails in place. As I glued everything in place, I continually checked that everything remained square. As I have limited space in my workshop, I often use my saw-bench table for such jobs as I know it is flat and this makes it much easier to keep things square. Presuming you have a cast-iron saw-bench table like mine, beware that should any glue spill out of a joint and end up between the saw bench and the wood, overnight the wood will get a horrible black mark. If there is any doubt, I ensure this does not happen by placing greased cooking paper between the wood and the saw-bench table.

The desk top was made using 150x40mm, and to get the total width I wanted of approximately 630mm I inserted a piece of 50mm in the centre.

Getting ready for gluing

Gluing up the desk top

Drawer or no drawer?

I did consider a small drawer at one side but decided that it would detract from the clean lines of the desk. I will later build a two- to three-drawer mobile to fit under the desk at one side.

I machined the timber as little as possible while still getting it flat and the edges square. I used my biscuit slotter to put four biscuits along each joint. The biscuit gives the joint more gluing area, thus adding to the strength of the joint. If you do not have a biscuit slotter, you might consider using dowels or even a solid tongue.

Fitting the desk top

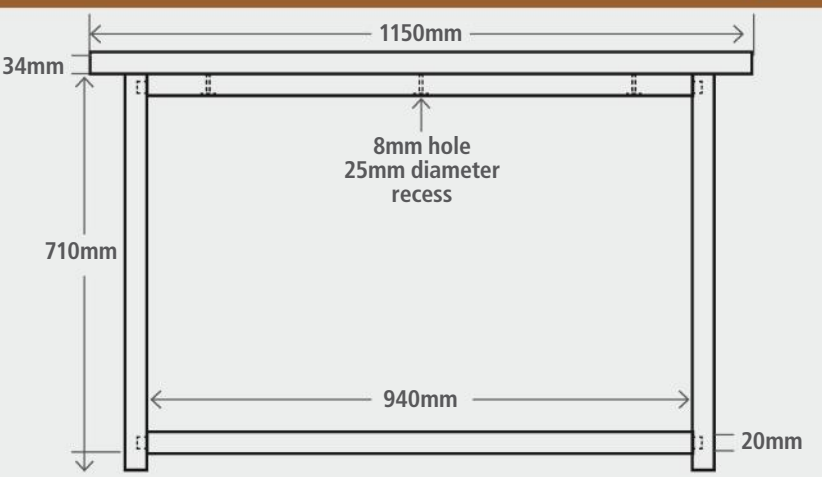
Again, like most joints, I fitted the top together dry with the biscuits to ensure everything fitted before I started gluing. I use two saw horses for a glue-up like this and have two pieces machined parallel that sit on the saw horses. I then check they are level with each other by eye and ▸

Dimensions

Measurements

Overall finished sizes:
Desk top: 1150x630x34mm
Desk overall height: 710mm
Bases: 600x85x45mm
Rails: all 45mm square

Note: there are no horizontal rails top or bottom at the front.



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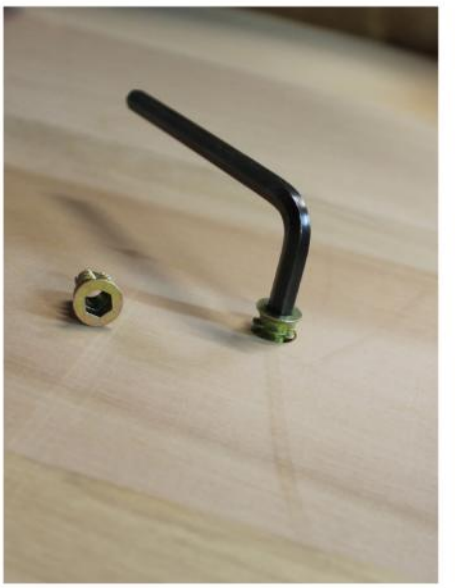
Sanding the ends and sides



Drilling for and fitting the threaded inserts

The completed desk oiled and ready for years of use

pack them where necessary. I put greased cooking paper on them to ensure the desk top would not stick to them. I put what would be the top side down and ensured the surface was as flat as possible when I applied the sash clamps.

Once the glue is dry, remove the clamps and remove any excess glue. Like most home workshops, I do not have a large sanding machine, so I asked my timber yard to run the top through their 900mm wide-speed sander. The finished size ended up just over 34mm thick. I then squared off the ends on the table saw, finishing with the desired length of 1.15m.

The surface finish from the speed sander was perfect for my requirements, and left me the four edges of the top to sand. This is a messy job that I prefer not to do but it needs to be done. I also used sandpaper on a block to remove the sharp edges all round.

For the assembly I used threaded inserts approximately 15mm long. These screwed into the table top with an Allen key after drilling a pilot hole. The ones I used had an internal thread for a 6mm machine screw. Be sure to mark the drill. I used electrical tape when drilling the pilot holes, as a hole right through the desk top could have been embarrassing.

When centring the frame onto the underside of the desk, ensure the top sits proud of the base by at least 15mm at the back, so that the top can be against the wall in a room and not held out from the wall by the thickness of the skirting board.

I finished the desk with several coats of Danish oil to match my grandson's other furniture.

This desk, perhaps with one or two design modifications, could easily be a hall or entrance table or a lounge side table.

Best of luck with your project.

What timber to use?

The desk in this article is made from beech acquired locally in Christchurch from Halswell Timber. You could use almost any timber, including recycled timber, depending on the look you want and the availability of timber in your area. The cost of the timber for this desk was about $250. Pine clears are also an option, which would be much cheaper, and would be ideal if you were considering having a painted finish.

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CARVING OUT A CAREER

DITCHING THE DAY JOB FOR A FULL-TIME ROLE AS SCULPTOR AND TEACHER IS THE BEST THING THIS SHED-LESS SHEDDIE HAS EVER DONE

By Sue Allison

Photographs: Juliet Nicholas

Shaugn Briggs' shed is a 6x3m pop-up gazebo and heavy-duty groundsheet. And that's just on a bad day. When the sun is shining, the Christchurch limestone carver works alfresco, with the sky overhead and surrounded by trees and music.

The shed-less sheddie's 'workshop' consists of a pile of portable Ryobi benches and an assortment of tools in stackable plastic tubes. When not stored in the single garage at the end of his drive, they are loaded on the trailer he tows around to various working and teaching venues.

Shaugn, who is also an accomplished painter, started his working life somewhat reluctantly as a painter and decorator. "The art thing was all I ever wanted to do but there is always that pressure to get a proper job," he says.

He was first introduced to stone carving about 15 years ago when he came across a sculpture symposium in Hagley Park. "I found a piece of Oamaru stone and started having a play," he says. Not long afterwards, he spotted some leftover blocks of the limestone at a worksite while on a job. After making a few inquiries, he was invited to help himself and headed home with a van-load of stone. "Everyone thought I'd gone mad, but I was over the moon."

Shaugn was soon spending all his

Line-up of tools includes (from top) a mallet, chisel, Stanley knife, half-round file, builders pencils, riffler file, and surform shaver.

Left: Shaugn holding a small Mount Somers stone sculpture called Oneness

spare time carving in the garden of the Saint Albans house he shares with wife, Benita. A couple of years later, with his paintings and sculptures selling well and "dead bored" with his day job, he took the big step of tossing it in to work as a full-time artist.

Time to start teaching

The next step, which hadn't been part of the plan, was to add teaching to his skill set. It came about after finishing a large commissioned sculpture, The Goddess of Flora, for the Packe Street Park and Community Garden. After the unveiling, he decided to show people the basics of stone carving using the offcuts.

"I was then encouraged to teach stone carving through night classes. I was really getting outside my comfort zone

He starts cutting out the shape with an ordinary wood saw

but decided to take on the challenge," says Shaugn, who admits to having been "petrified" the first time he stood in front of a class but now loves it. "Teaching makes you a better person. You learn to be really patient and compassionate. I've also met some fantastic people."

Thirteen years on, as well as taking adult night classes at Papanui High School, he runs school-holiday programmes, corporate and festival workshops, and classes for clubs and community groups. His most recent teaching venture has been to set up downloadable carving lessons whereby people can purchase a project containing a full set of instructions backed up by photos to help them through the process.

"Stone carving gives people a chance to be creative by using a simple medium," he says. "For some, it's their first introduction to the arts. Whatever their skill level, they can go from a basic sculpture to designing and creating some really good works of art."

Shaugn's inspiration to keep creating is sparked by a quote by motivational author, Dr Wayne Dyer: "'Don't die with your music still in you'. I just change 'music' for 'art'," he says. For Shaugn, the challenge and satisfaction of carving is in turning an inanimate block of stone into an artwork that has flow and movement. He is methodical in his approach, tackling one project at a time. "I like to do a job and get it done. I usually start about 9ish in the morning and often work till dark," he says. "I just love being out there with music playing, getting into my creative zone. I look forward to it every day." ▸

About the stone

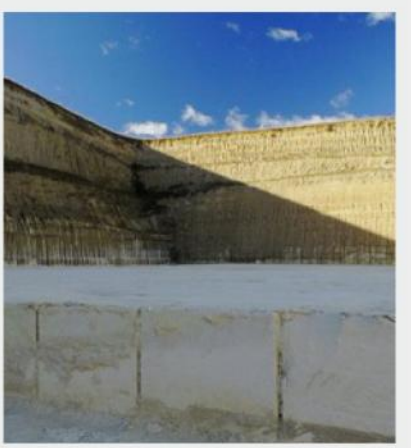
Oamaru stone, sometimes called 'whitestone', comes from a 40m thick deposit of limestone 5km inland from the North Otago township of Oamaru. The distinctive creamy-coloured stone is bryozoan limestone, which is made up predominantly of calcium carbonate (90 per cent) with trace chemicals including alumina (1.5 per cent), iron oxide (0.5 per cent), and silica (0.5 per cent).

The sedimentary rock is soft when first quarried but hardens on exposure to air. This, along with its uniform granular texture, makes it excellent for sculptural and ornamental purposes. As it is porous, it must be sealed if outside. "If it stays wet for a long time, the stone will go mushy and begin to break down," says Shaugn.

The stone has been quarried at various sites along the deposit since the 1860s, but Parkside Quarries at Weston, which opened in 1906, is the only remaining operation. It was originally sliced from the hillside using a steam-driven chainsaw mounted on rails but these days is cut with hydraulically operated 3m tungsten-tipped circular saws.

The stone has been widely used as a building material in Oamaru, but also features on prominent buildings around the country, from Dunedin's historic railway station to the Auckland Town Hall.

Mount Somers limestone, found in mid Canterbury, is denser than Oamaru stone but its treatment is the same for carving. "You use the same tools but everything takes two or three times longer," says Shaugn.



Elephant sculpture in progress ... the elephant now has solar-powered candles inside and a separate stone seat on top. (See last page).

Tools and process

You don't need specialist stone chisels and tools to carve Oamaru stone. "Anything that works with wood works with limestone," says Shaugn, who recommends starting off with a set of standard wood-carving chisels. "It's not until you choose to sculpt much harder stone like marble that you will need to buy professional masonry chisels."

Shaugn starts larger sculptures on pallets, raising them onto his portable workbench once enough has been cut away for them to be light enough to lift. He swears by adjustable Ryobi benches as the best working surface for carving stone. "[A Ryobi bench] not only allows you to work at a comfortable height, but also has the huge advantage over a fixed bench in that you can move around your sculpture and work on it from all angles without having to turn it all the time."

His adjustable bench can hold up to about 90kg and lifts and locks to a height of around 1.2m. Shaugn has drilled holes to hold his hand tools alongside the

> *You don't need specialist stone chisels and tools to carve Oamaru stone. "Anything that works with wood works with limestone," says Shaugn*

Shaugn kept the hollowed out body at least 4cm thick for strength

"We've loved this opportunity, and it's only been possible because Shaugn brings his shed to us"

Shaugn getting help from some students at West Eyreton School (clockwise from top left): Matthew Baldwin (Year 8), Suli Uhatafe (Year 6), Victoria Nicholson (Year 7), and Benjamin Harris (Year 5)

working surface, which can be enlarged or contracted by winding a pair of handles. He warns aspiring stone carvers to avoid cheaper benches that tend to be flimsy and less durable.

Workbench clamps are essential for holding the stone, thus freeing your hands and minimising the chance of cutting yourself. "Never hold your carving with one hand and try to use the blade with the other," he advises. "It's amazing how much damage it can do if it slips and cuts you." The free-standing bench has the added safety factor of making it easy to carve from all sides, letting you avoid any temptation not to work with the chisel blade facing away from you.

Shaugn first draws his design on the rectangular block of stone with a builder's pencil. For some commissions he will be given a picture to copy; for others he downloads and adapts images from the internet.

Hand tools are first choice

He uses ordinary wood saws to cut the block into the general shape. "It's a bit like sawing through a branch," says Shaugn, who then roughs out the form with a hammer and steel-tip chisels. "I don't use electrical tools much as they are too fast." Cordless battery-powered tools do have their uses, however — particularly grinders for cutting curves and spade bits for drilling holes.

Limestone dust, which is heavy so does not stay suspended in the air for long, is not harmful, except for people with respiratory conditions such as asthma. "Because I do a lot of teaching indoors, I checked with the health department ▸

School sculpture

When West Eyreton School wanted its core values set in stone, they decided that Shaugn was the man for the job.
A striking limestone sculpture is now mounted inside the school gates, its five koru depicting the school's sought-after Es: excellence empathy, example, enterprise, and effort.
Those values were reflected in the nature of the project itself, with every student at the North Canterbury primary school involved in creating the work of art.
Shaugn designed the sculpture and, once it had the school's approval, organized delivery of the massive block of Oamaru stone, which weighed over a tonne.
He spent every school day for three weeks demonstrating carving techniques to different groups of children, then letting them work on the sculpture. The older students carved with chisels, while the younger ones finished things off with rasps and sandpaper.
"It's been a great project, with the children involved along the whole journey," says principal Jillian Gallagher. They worked under his gazebo during the mid-winter project, and Shaugn also turned the school's covered walkway into a workshop for Year 7 and 8 students to carve ornamental koru and candleholders.
"We've loved this opportunity, and it's only been possible because Shaugn brings his shed to us," says Jillian. "We couldn't have taken the whole school into town over three weeks. This way, not only has every child been able to work on it but we have [also] been able to watch it evolve day by day."

It took a Hiab to deliver the block of Oamaru stone for this 2m high replica of the Lion of Chaeronea. "I've tackled some projects that have scared me and the lion was one of them," says Shaugn. "When I drove up the drive and saw the massive block I thought, what have I done?

Shaugn made the large abstract sculpture on the lawn out of cement, which is the opposite process to carving as it involves building it up. "It cost me a back operation," says Shaugn, who prefers working with stone

The finished sculpture, complete with solar candles

[Minstry of Health].” says Shaugn, who wears goggles when using power tools or heavy-duty chisels to avoid flying fragments.

The bulk of the shaping is done with hand chisels, and Shaugn recommends having a good range of sizes. He also has a variety of wooden mallets, including a well-worn one inherited from his father, who was an upholsterer.

“It’s not until the general design has been shaped out with saws and chisels that you move onto tools like files and rasps,” he says. At this point, a messy sculpture covered with chisel marks and gouges is transformed into one with smooth lines and flowing curves. Shaugn starts the refining process with a coarse file, often his 250mm (10-inch) half-round wood file. “It’s a toothy file which is great for removing excess stone and the flat side is good for general smoothing down,” he says. “It’s also good for dealing with sculptures that have a hole drilled through them or if there is a tubular space that’s tricky to get into.”

“Everyone thought I’d gone mad, but I was over the moon”

As far as rasps go, his top recommendation is the surform shaver or ‘cheese-grater’ rasp. Operated with a pulling motion, it is simple to use and its small, slightly curved blade makes it easy to access most parts of the sculpture. “Bigger rasps work well with large sculptures but can be clumsy in tight areas. This does a good job in most situations,” he says. It also has a snap-on blade that is cheap to replace.

Favourite tools

Detail and finishing touches are achieved using fine chisels and riffler files. The little riffler files, which resemble dental instruments, are among Shaugn’s favourite tools. They can be hard to find in hardware stores but can be purchased online individually or in sets.

“Riffler files are really effective for detailed work. Once you’ve tried them you’ll wonder how you managed without them,” he says. “I find them excellent when trying to replicate muscle definition or facial features, but they’re equally handy when working on larger sculptures such as an abstract where the stone is shaped into bends and twists as you’ve got a greater measure of control than with a rasp.”

Shaugn used a range of riffler files to painstakingly carve basket weave on one abstract work, then replicated the texture of flax by ‘combing’ the stone with a keyhole-saw blade. “It was incredibly difficult to make the strands look as though they flowed over and under each other,” he says.

For a very fine finish, Shaugn uses sandpaper of varying grits.

As limestone is porous, it needs to be sealed if it’s going to be displayed outside. Even if indoors, sealant is advisable so that the carving is protected and doesn’t leave powdery residue on surfaces. A waterproof masonry sealer designed for exterior dwellings is ideal, either water based or solvent based. If new to stone carving, Shaugn recommends using a water-based silicone sealer for both interior and exterior sculptures. It can be purchased in a spray can but it is cheaper to buy the concentrate and mix it yourself. “I use one part silicone to 14 parts water and use a pump spray bottle to apply it,” he says.

Shaugn’s website is full of information and YouTube clips about limestone carving: learnstonecarving.com.

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Evan Wade and his double-barrel smoker

SMOKIN'

Morphing two drums into a cold smoker

By Jude Woodside and Evan Wade
Photographs: Jude Woodside

When my friend Evan Wade said that he was going to build a smoker from two 200-litre drums, I leapt at the chance to cover it as I had been wanting to cover a Texas-style smoker build for some time. This isn't quite a traditional offset smoker like a Texas smoker — it can be used in the same way, but this is primarily a cold smoker. Evan is very partial to meat, fish, and especially smoked sausages. He had found the design on the internet and followed more or less the same process as the designer: jmillerid.com/wordpress/category/55-gallon-drum-smoker/.

The drums that he sourced had previously contained cooking oil, so they would be safe to use for food. Be aware of what your drums have previously contained, as it could influence the taste or even the safety of what you eat. Beware of drums that have held volatile liquids like petroleum products. Apart from the danger of poisoning they can also explode, especially when empty.

Evan Wade laying out the shape of the two-barrel joint

Cutting the lower barrel

Trial fit

The cut barrel

Cutting the drum

This design calls for two drums welded together in a T-shape. That requires cutting the bottom barrel so that it accepts the horizontal one. It's possible to lay out the shape involved by working the design out in CAD or by developing the shape via traditional sheet-metal development draughting.

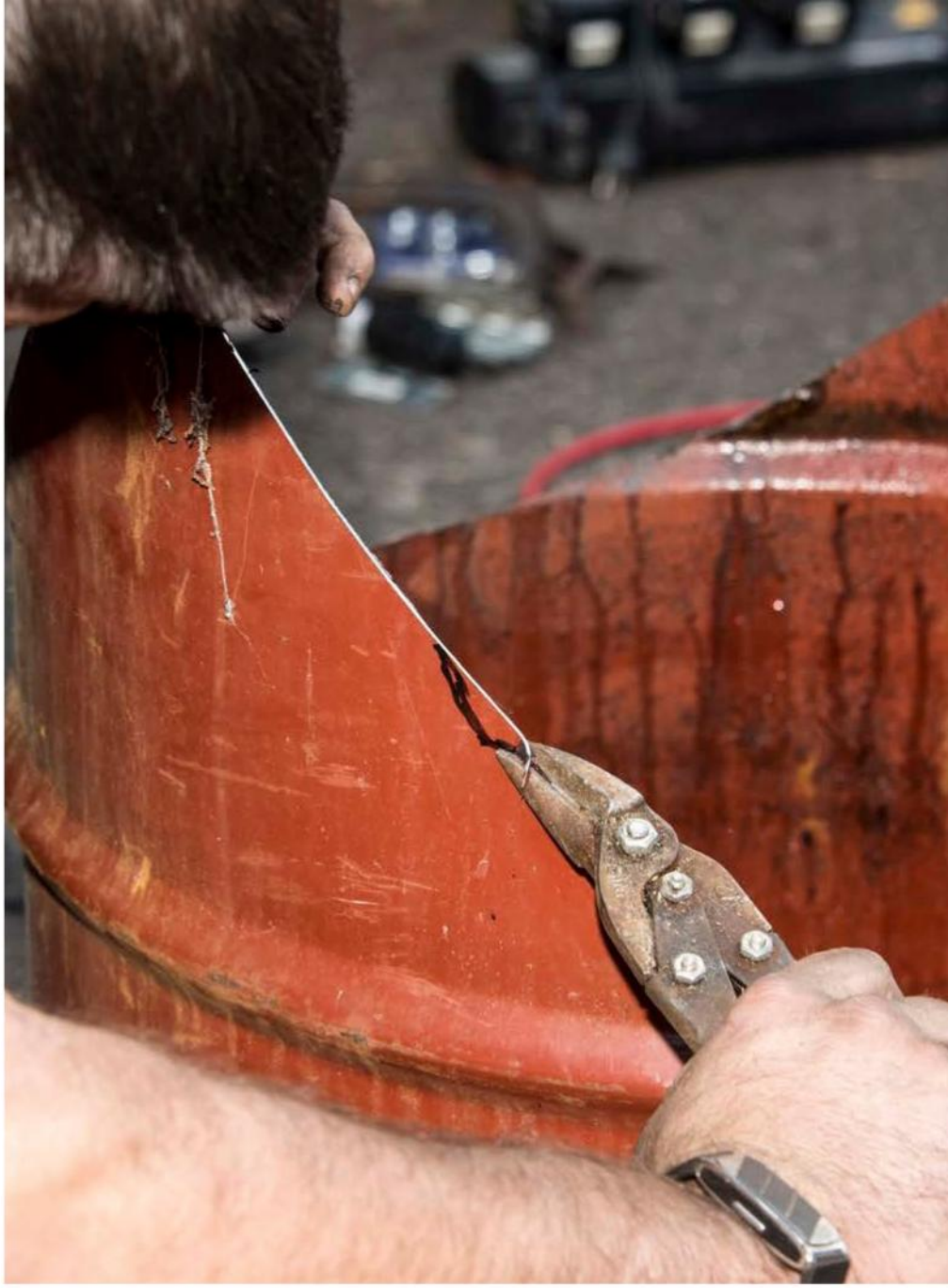
To do this (see panel on page 46) you will need to be able to print the resulting design in actual size, so you will need several sheets. You can then wrap the printout around the drum and cut to the line. Or you could just wing it as we did, using a flexible rod and knowing the four points where the curves would meet to draw a fair curve between them that approximated the shape of the developed curve.

The drum was carefully cut with a thin-blade abrasive disc but it could be cut with a jigsaw.

It is important to keep the cut as close as possible to the line or you could find large gaps that would be difficult to fill later when you weld the two together. It took some trimming and some additional work to accommodate the rolling ribs on the horizontal barrel but eventually Evan got a good fit between the two drums. The wing-it system proved quite good in the end and resulted in a good fit for the barrels with only a minor bit of filling at the end.

Nice fit

The wing-it system proved quite good in the end



Cutting relief for the roller ribs

Door

The next task was to cut a door into the main drum. To do this Evan marked out the door parameters with masking tape. This will also allow you to get a good visual on door size and make corrections easily. With the shape set, he cut along the back edge of the door with an abrasive disc. It's wise to attach the hinges prior to cutting the rest of the door. You can attach them with screws but it's a good idea to weld plates in place to hold the screws properly, or simply weld the hinge with plug welds through the screw holes.

First, clean off any paint around the area that the hinges will be welded to. These drums are usually of very thin gauge (20 gauge), or barely 1mm thick, so it's important not to crank up the MIG voltage or wire speed too high.

With synergic machines like the BOC Smootharc Elite, set the thickness to something like 1.6mm or less. The hinges are stainless and 2mm thick. Weld alternate holes at opposite ends of the hinge to spread the heat and prevent warping. It is possible to run a weld bead along the edge too, but it pays to reduce the voltage to prevent burn-through. Avoid hinges with nylon bushes as they might not respond well to the temperature.

Plug welds

Make sure that both the hinges are in line and square to the door, especially if you are welding them. With the hinges

Cutting the back of the door

Welding the hinges

in place you can proceed to cut the rest of the door. Do it carefully — you want the door to be able to close reasonably tightly.

The next stage is to reinforce the door and provide a lip for the door to close on. Welding heavy-gauge metal to thin sheet metal is often best achieved with 'plug welds' — welds made through specially punched holes in the sheet metal or the heavier gauge. Plug welding works in a similar way to spot welding, where a series of discrete spaced welds hold the piece. The final result can look very industrial chic — like rivets if you space them regularly. Punch the holes with a drill or more easily with a joggler and punch plier as used for automotive body repair.

The secret to welding thin metals with MIG is to keep the metal as cool as possible and use short bursts widely spaced to avoid distortion or burn-through. It pays to move the weld around to prevent overheating any particular region. The welds will be small enough that they will be unlikely to cause any distortion provided that you do spread the heat.

Roller

Before the 3x40mm strips could be welded in place, the strips for the sides needed to be shaped into a fair curve. ▸

Cutting the door

Bending the edge strips

Above: Plug welding the edge pieces
Left: Punching the holes for the plug welding
Below: Joggler and punch plier

That paint had to be ground off to prevent it from contaminating the food being prepared by releasing fumes or burning during the cooking process

Cold smoking

This is a cold smoker not a hot smoker. It may be possible to add a charcoal burner to the base of the upper drum or crank up the heat in the burner drum to make it a hot smoker, but it is intended as more of a cold smoker.
It's important not to get too much heat into a cold smoker. Ideally keep your smoking temperature between 20°C and 30°C. Above this can encourage the growth of harmful bacteria.
This kind of smoking doesn't cook the food — it adds flavour and can help to preserve it, but meat will need to be cooked further after being smoked in a cold smoker, or cured before smoking to remove most of its moisture. Meat and fish should be hung to develop a 'pellicle', or skin, that will absorb the smoke flavours. However, it can be used to smoke cheese, tofu, nuts, bacon, fish, and sausages. Salmon can be cured with salt and cold smoked but it can take as long as 12–24 hours.
Make sure that you only use dry hardwoods in your smoker. Don't use pine, fir, or eucalyptus, as they contain resins that can taint the food. Use only well-dried wood and no green timber. Hickory, oak, mesquite, alder, maple, and manuka are traditional woods for smoking and can be purchased commercially but pohutukawa and fruit woods like apple, cherry, and plum will work nicely too.

Cleaning the inside

To keep the doors tightly closed on both drums requires latches

The ideal means of doing this is with a roller. The roller consists of three rollers set in a triangle with the middle roller able to be screwed down. The strip of metal is passed between the two bottom rollers and the top adjustable one and after each pass the middle roller is tightened down slightly more, causing the strip to bend gradually on each pass until the desired curve is obtained.

Light-duty rollers are quite cheap although they can only roll limited gauges — in this case up to 5mm thick mild steel, which is more than enough for this job. Each strip was bent to fit and then tacked and welded in place. Evan felt that the door itself was a bit thin and required some reinforcement to prevent it either warping or twisting in use. Two more strips were cut and welded to the inside of the rolling ribs, tacked first, then a small bead was run, taking care not to burn through.

With the door set it only remained to add a handle, cut from 12mm square tube.

Cleaning

Now came the messy bit. These drums had been painted on the inside and that paint had to be ground off to prevent it from contaminating the food being prepared through releasing fumes or burning during the cooking process.

If you attempt this, make sure that you wear appropriate personal protective equipment (PPE), including a dust mask. Cover your hair (if you still have any), otherwise you will be washing it out for days.

Once the two barrels are cleaned of paint they can be tacked together. First grind off any paint in the vicinity of the join on both barrels. Place the drums in position and mark the contact for the upper one from the position of the lower drum. Keep the weld tacks spaced to prevent any distortions. Later the weld can be made complete, but in the first instance it's enough that the two drums are connected.

With both drums joined it was time to finish the layout of the top unit. First Evan tacked strips of 25mm angle iron to the sides and back to hold a series of rods or mesh from which to hang sausages or meat for smoking. The smoke and heat gets generated in the lower barrel. A series of holes needed to be drilled through the base of the upper drum

Tacking the drums

Stiffening the door

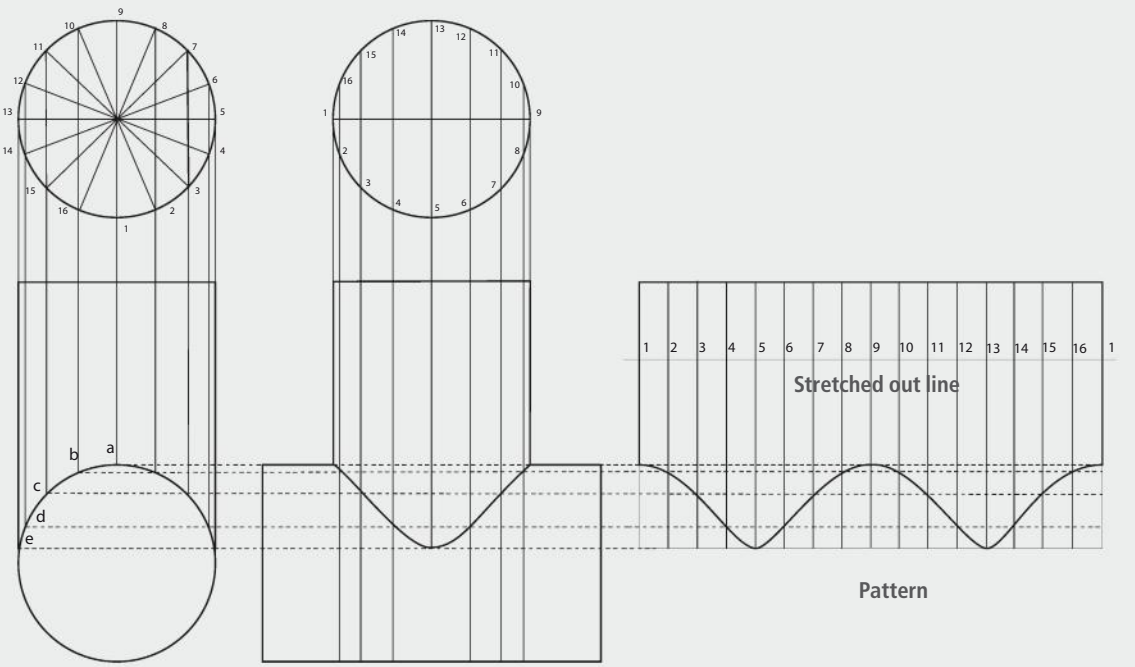
Attaching the door handle

Welding the upper shelf support

Boring the smoke holes in the top drum

Finishing welding the two drums

Sheet-metal development of a cylindrical T-joint



This description of the process of developing a T-intersection of two cylinders shows the base cylinder or drum on top purely for ease of layout. First, draw a plan view, or profile, of the base of the upright drum to scale and divide it into 16 equal parts. Draw the side elevation of the two drums together. In this example the two drums are the same size. Run lines perpendicular to the numbered segments to where they intersect with the second drum.

Alongside the side elevation, draw another profile and the front elevation alongside the first elevation. Number the segments in the new profile. Keep in mind where the side-elevation segments are placed and make sure the second profile numbers match them, given this view is the same profile but from 90 degrees. Run lines perpendicular to these segments too. Run lines laterally from the point where the lines from the side elevation intersect with the second drum through the front elevation. Draw a fair curve that connects the points where these lines intersect with the perpendicular lines from the side-elevation profile.

To describe the intersection pattern for the drum, draw a section equivalent to the circumference of the lower drum and divide the circumference into 16 equal parts. Again mark the point of intersection of the side-elevation lines and the perpendicular lines. Draw a curve that connects these points.

To make a pattern to cut the drum, lay out the circumference on a piece of paper or cardboard to actual size and scale the points up by measuring the length of the perpendicular lines to where they insect with the pattern on the scale model. Multiply this length by the scale factor and mark each on the full-size model. It's probably easiest to measure from the top edge of the drum rather than the lower edge — that way you won't need a piece the same height of the drum, just a piece the same depth as the cut. Cut out the shape and lay this on the drum you intend to cut. Mark the pattern and cut it out.

Weld in short runs

Cutting the holes in the damper

to allow the smoke to come through. These are best and most easily cut with a step drill. The holes should be cut in a diamond pattern, making sure they stay within the lower drum.

Joining the drums

Welding the two drums together with a solid bead is important to avoid air intake and smoke loss. It is also important to avoid burn-through — to ensure that, it's a good idea to cut the voltage, or, in the case of synergic machines, set the

Thickness setting for attaching the two drums

Cleaning up the welds

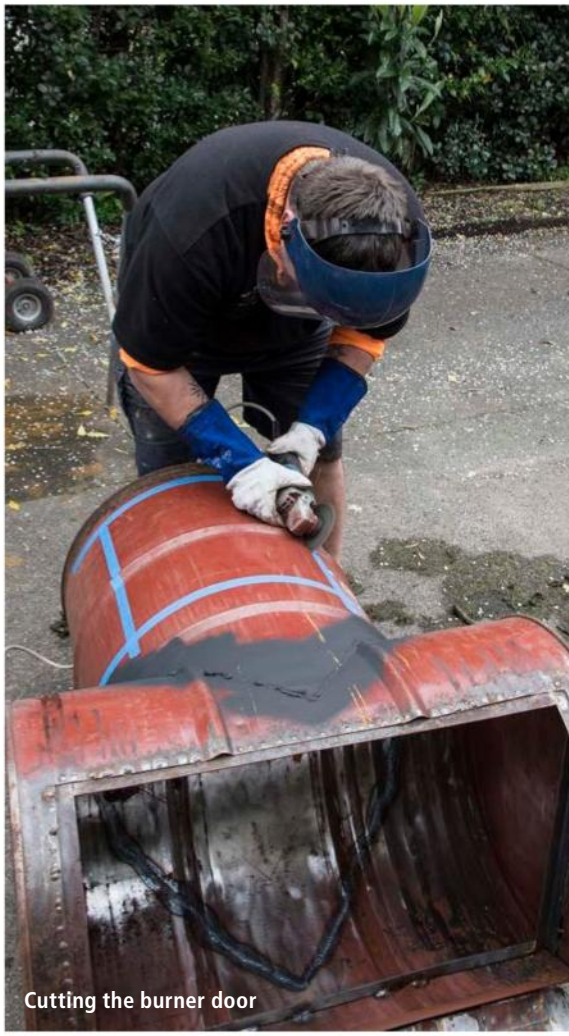
material thickness to around 1.2mm.

You will still not be able to run a long bead. It's best to work in short bursts that are well spaced and return to fill in the gaps. Where there are gaps that need filling — no matter how good your initial fitting you will likely have some — build up the gap in a series of runs, allowing the bead to cool between runs. Take some time — don't try to rush it.

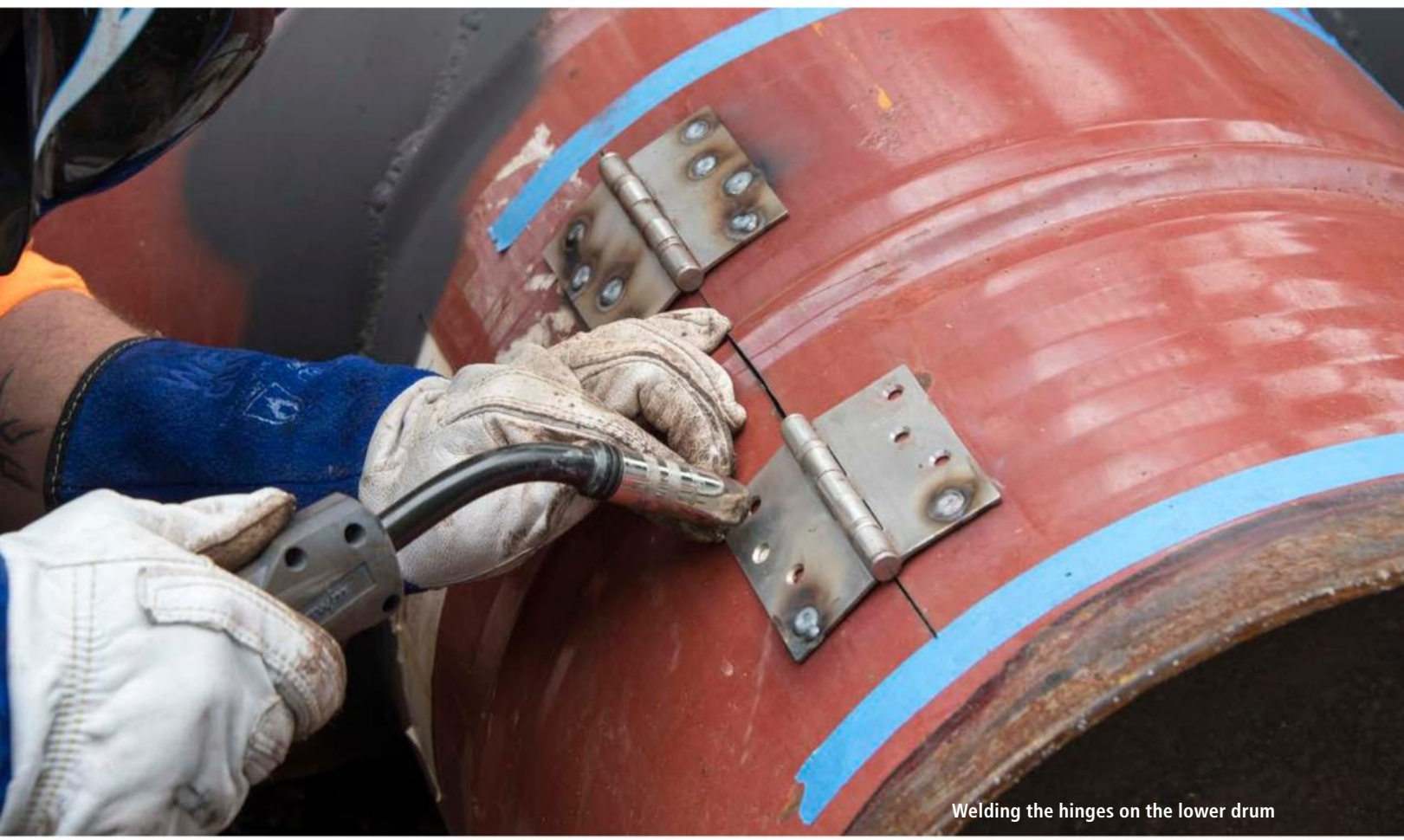
Burner

The last process is to mark and cut the door on the lower drum for the burner/smoker.

The process is the same as before. Cut the rear of the door and fit the hinges and then cut the rest of the door. Punch the holes for the plug welds and bend the curves in the steel strip to fit the curve of the drum. Holding the strip in place with



Cutting the burner door



Welding the hinges on the lower drum


Drilling the smoke release


Smoke release


Internal grills


Lighting the smoker

clamps, tack every other hole and then come back and fill the remaining holes.

To keep the doors tightly closed on both drums requires latches. The latches are attached with pop rivets and serve to keep the door tight to the steel strips at the edges retaining the smoke and the heat. The top drum took two latches and the bottom door took one.

Regulator

To regulate the airflow, the burner holes should be drilled with a small hole saw along the base of the burner and through a strip of metal that acts as a damper. The damper strip was cut from the remnant of the upright drum so it matched the curvature of the drum. The damper strip is held in place with self-tapping screws set to let it slide to control the airflow.

A handle was made from a piece of 25mm dowel. Attaching the strip in place with tape or by tightening the screws on which it slides allows the step drill to cut through the damper strip and the base of the drum, at the same time ensuring the holes line up.

Evan cut a circle of steel from the remainder of the upright drum to act as a controller for the smoke release in the top drum. The circle was bolted to the side of the top drum and holes cut with a set drill through both the circle and the drum. A handle of 25mm dowel was then attached to the controller to regulate the smoke release.

The burner for the smoker is set in a basket in the lower drum to allow it to be removed easily for cleaning. In our case we used an office wastebasket in lieu of a more permanent solution. The final step is to paint the whole thing in a high- temperature paint. Two standard barbeque grills fit in the lower part of the top drum to allow meat or fish to be laid there, and rods or mesh on the upper shelves can hold sausages for smoking.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Gregor Kregar in his studio. A polished-stainless-steel sculpture is wrapped in protective plastic film that will be removed once it is installed

THE ULTIMATE MAN CAVE

A SCULPTOR'S MASSIVE STUDIO IS A SHEDDIE'S DREAM

By Sarah Beresford
Photographs: Adam Croy

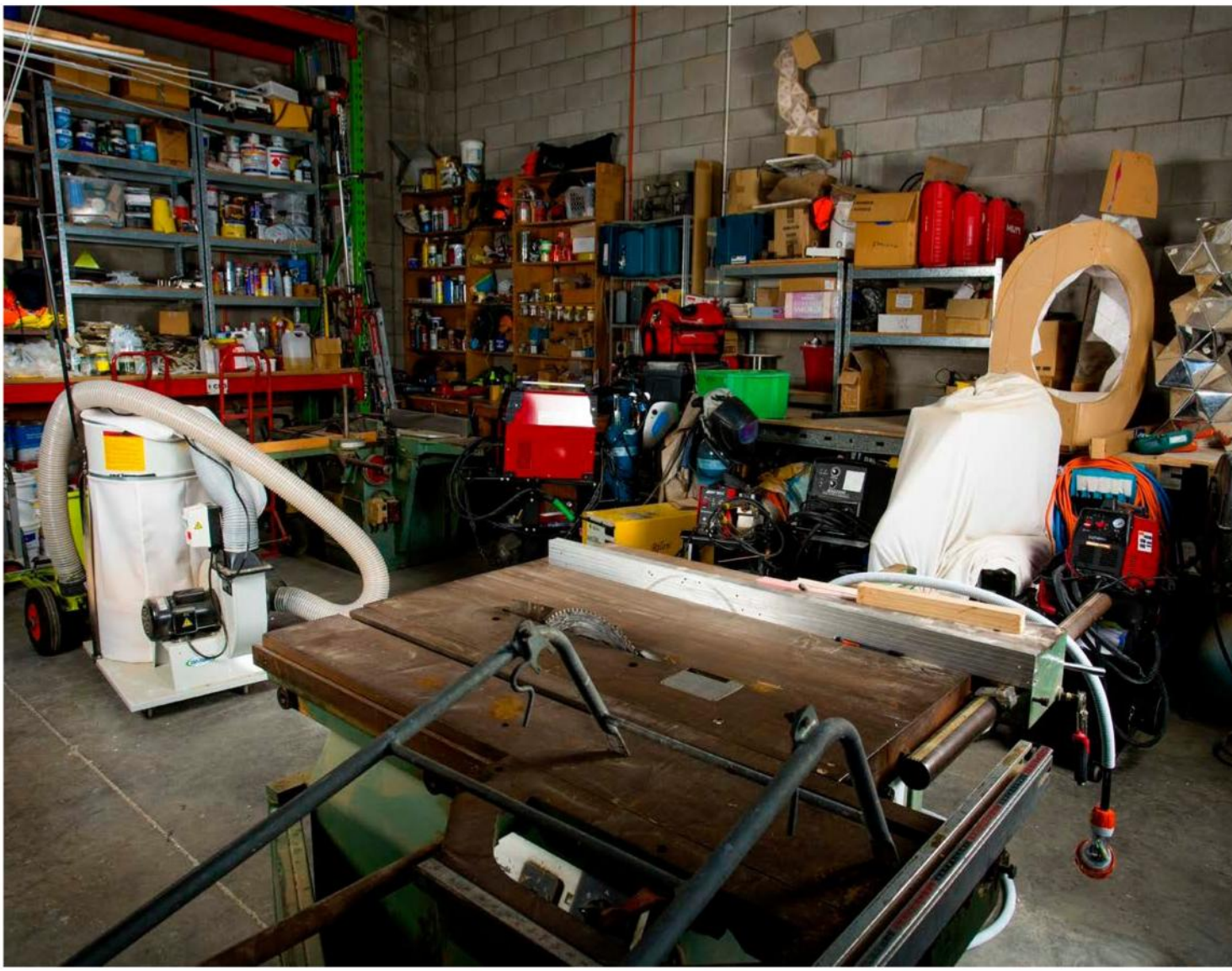
A wooden modular-shelving structure in the office showcases some of his smaller pieces

Custom-made neon

It's tempting to think of Gregor Kregar's workspace as the ultimate humongous man cave. The 410m² studio in a gritty industrial area of Auckland's New Lynn certainly has all the 'boy's toys' to make the most avid sheddie happy.

Vices, grinders, table saw, and cut-off saw? Check. MIG and TIG welders and drill press? Check. A gas-fired and two electric kilns? Check. You get the picture. This is a serious space set up to work on all manner of materials.

Gregor is a sculptor and his studio reflects the scale and diversity of his work. He is comfortable working in a range of mediums, from polished stainless steel and bronze casting to ceramics and wood. "I like doing work where the process is very hands-on and I enjoy the challenge and variety of working with a range of mediums,"



A workshop corner with the table saw and air-extraction unit

Dinosaur sculpture made from cast lead-crystal glass

he says. “The materiality of the work is connected to specific ideas and the way to best realize them. So I may be tackling a work using glass or recycled wood and then be working on a polished-stainless-steel sculpture with LED neon lights.”

Significant pieces

His sculptures often capture the essence of familiar images presented in surprising ways that challenge our normal perceptions of objects, such as his series of gnomes, sheep wearing All Blacks jerseys, and overall-clad workers varying vastly in stature. Then there are the monumental works destined for public spaces. The 6–7m stud of his shed allows him the space to work on significant pieces.

A recent commission is a case in point. In a corner of his studio is a

Gregor at work on an aluminium model

"I like doing work where the process is very hands-on"

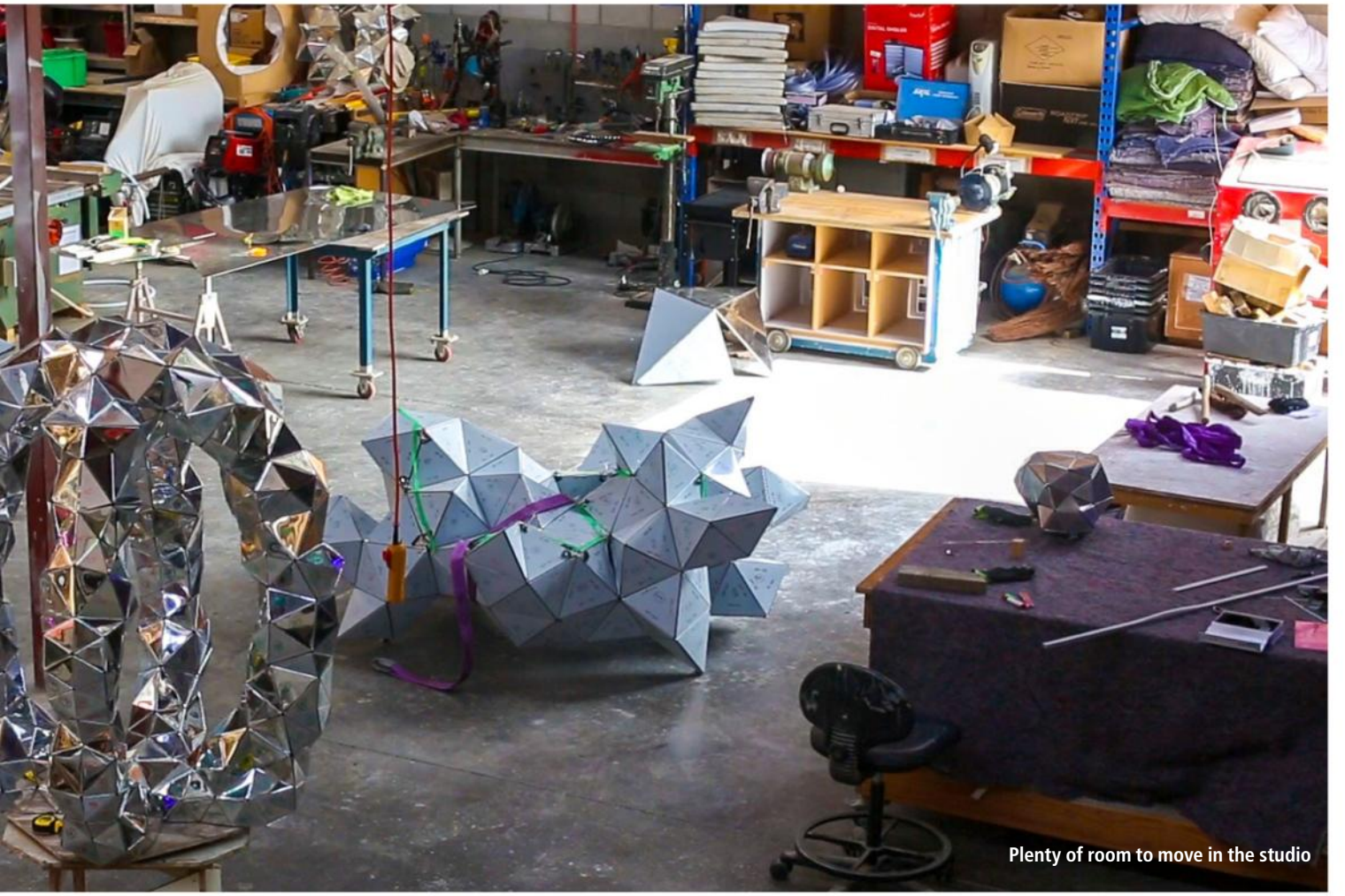
model of a polished-stainless geometric sculpture that seems like a major work in its present diminished form. But the finished piece is destined to be a whopping 6m and incorporate 200 LED RGB-controlled lights. It will be a show-stopping centrepiece for a commission from France. Gregor is heading there in December to install the work. Connecting all the lights alone is going to be a challenge. He does all this work himself.

"The wiring is incredibly complicated," he says. "You have to get the polarity right otherwise it won't work. I get my work signed off by an electrician and over the years I've gained a pretty good clue as to what I can and can't do."

Glazed-terracotta sculptures of men in overalls, part of I Disappear, a major series

The vast area of his studio allows him to skip from one medium to another without having to juggle working spaces. Two long L-shaped benches framing one corner accommodate his saws, tools, vices, and drill press. The kilns line another wall and are fronted by a large bench. Huge scaffold-like shelving towers up to the full stud height, allowing plenty of space to store materials without cribbing on the floor space.

He says that when working on his sculptures he often pushes the boundaries of what he does with certain materials: "Sculptors will often do things that others don't. There's a tendency to push the idea of what can be done and approach things differently. Sometimes

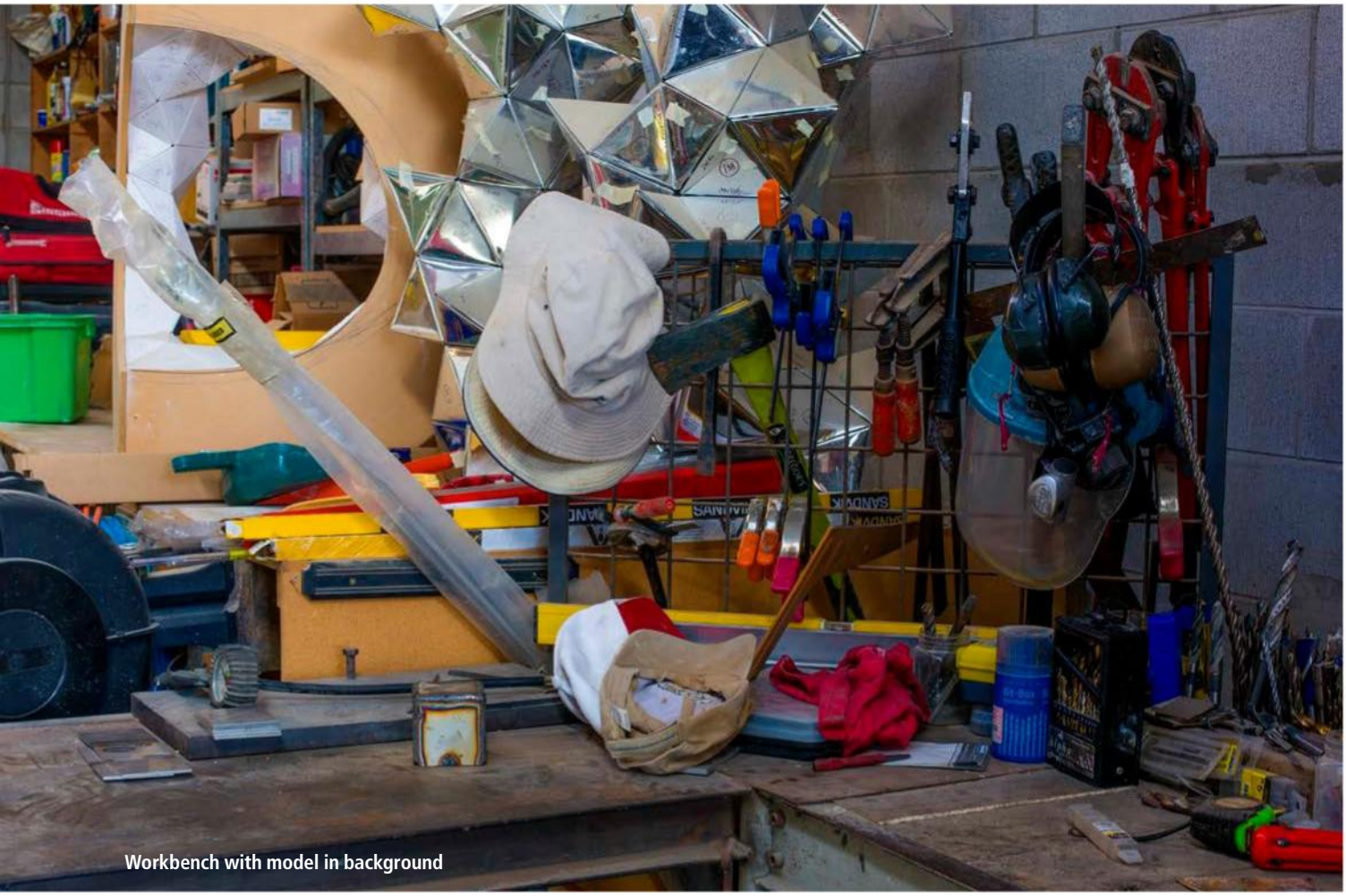


Plenty of room to move in the studio

Glass and steel sculpture, Polyhedron Dwelling

A porcelain sheep in an All Blacks jersey, from Matthew 12/12 World Cup series

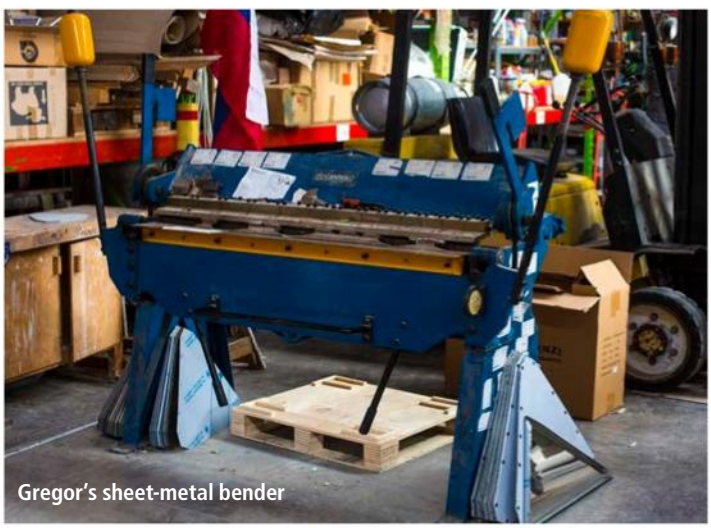
A polished-stainless-steel dinosaur, part of an upcoming exhibition, A Sound of Thunder, at Gow Langsford Gallery



Workbench with model in background

Bronze cast dinosaurs

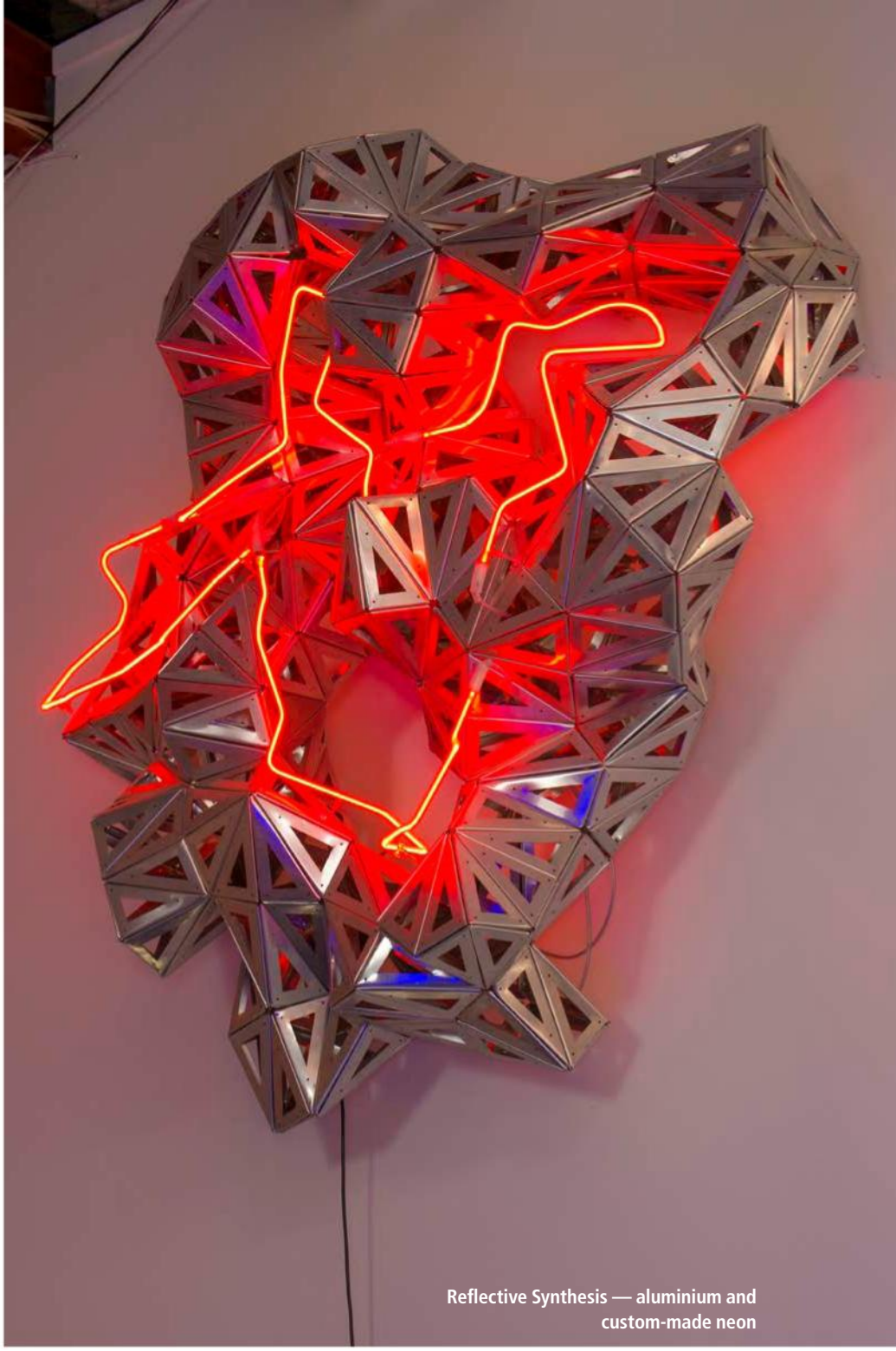
Stratus 3 Harlequin — paint and aluminium



Gregor's sheet-metal bender

Work in progress

> *"Others need to be welded, then there's all the grinding and polishing needed to achieve the highly finished look"*



Reflective Synthesis — aluminium and custom-made neon

The kilns

when you have very specific skills it can be a bit limiting in terms of how you approach material."

Working with neon

Gregor says that he has gained a lot of knowledge over the years of working with different mediums. The neon tubes that he uses in some of his sculptures are a case in point. He works on the straight tubes, 'bending' them into a variety of forms so that they seem at one with the sculpture that they are illuminating. "Pumping the neon is very skilled and complex work," he says. "You are working with argon gas at 8000V so you have to be very careful. It's best not to touch the wires at the end of each tube otherwise you'll get zapped," he says laughing.

A substantial polished-stainless-steel dinosaur standing in the studio will be part of an exhibition at Gow Langsford Gallery later this year. "There's a lot of work involved in making these sculptures," Gregor explains. "They are so highly finished that people tend to think that a machine has made them. They often don't realize the complexity and the cost

Foucault Pendulum, 2013, installation view, aluminium printing sheets, neon signs, cold cathode lights, and custom-made wooden furniture, Tauranga Art Gallery, Tauranga

involved in producing pieces. Some of my work involves processes such as lost wax casting, others need to be welded, [and] then there's all the grinding and polishing needed to achieve the highly finished look."

Gregor came to New Zealand from his native Slovenia more than 20 years ago. "I wanted to do my master of art somewhere other than Europe or America. I was interested in Maori and Pacific culture, and I also used to do a lot of windsurfing so it seemed an obvious choice," he says.

Pavilion Structure, 2013, 9x11x11m, recycled timber, Sculpture on the Gulf 2013, Waiheke Island, New Zealand

Reflective Habitat, 2013, 3.5x2x1.5m sculpture on 5.5×5.5x1m flotation device, stainless steel and steel, Brick Bay Sculpture Trail, Matakana

Scale models

Up a flight of stairs in one corner of the studio is Gregor's office-showroom, which features a selection of his smaller sculptures and his desk and computer. He does a lot of designing using 3D software when working on new projects but he says nothing can beat the real thing when showing concepts to clients. "A lot of people have difficulty visualizing things. I always make scale models because it's really helpful for the client to understand what I'm creating and it's also good for me to work through the whole process."

He likens working on large commissions to being an architect: "You have the creative process but you also have to consider making the proposal, the budget, consulting structural engineers, getting sign off from council if it's a large public work … there are a lot of factors to consider and juggle.

"At secondary school I learnt furniture making, which I really enjoyed. The whole process of thinking of a concept and working with your hands to make it is really satisfying and I guess that's still kind of what I'm doing now."

Vanish, 2008, installation view, 160 glazed stoneware figures ranging from 1.4m down to 0.4m in height, Connells Bay Sculpture Park, Waiheke Island

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An SBB RAe II on display at the Erstfeld SBB Historic Museum in June last year at the celebration of the opening of the new Gotthard Base Tunnel

Photo courtesy of Peter K. Lemmon

IT'S ALL A MATTER OF SCALE

CREATING A MODEL TRAIN HARNESSES THE SAME SKILLS AS REBUILDING A CLASSIC CAR

By Ray Cleaver

Photographs: Rob Tucker

Michael laid out a gauge-one track in his basement to get the scale right and test the mechanics

They say that variety is the spice of life. So it is in the shed. For Taranaki mechanical-design engineer Michael Wolfe this means working on projects as diverse as rebuilding a high-powered 1970 American muscle car through to intricate work creating a model of a classic Swiss 1960s train.

Michael rebuilds and maintains full-size classic cars, and in his spare time model-railway construction keeps him busy.

"The skills needed are much the same," says Michael. "It's really all a matter of scale."

His handmade creation of a replica of an iconic Swiss electric train, the RAe TEE II, is unique — probably the only one in the world. Panel construction, lathe work, welding, woodworking, and even creating parts with a 3D printer have all been part of the job. In the world of model trains, this is a big one. Each of the six cars that make up the luxury train is about 800mm long. Michael started off with some plans, photographs of full-size trains, and books, all of which he used to create initial drawings.

The 3D printer used for making model train parts. The green components were made by another 3D printer

The build

These were put onto a CAD file so that the bodies could be cut out from 0.9mm thick electro-galvanized steel — steel with a zinc coating — with a water-jet cutter. The steel was cut and folded, and then carefully spot welded with Michael's UniMIG 160 welder.

"I had it on a real low setting, as this is pretty thin steel," he says. "It's really the same as making a full-sized car body but all in miniature."

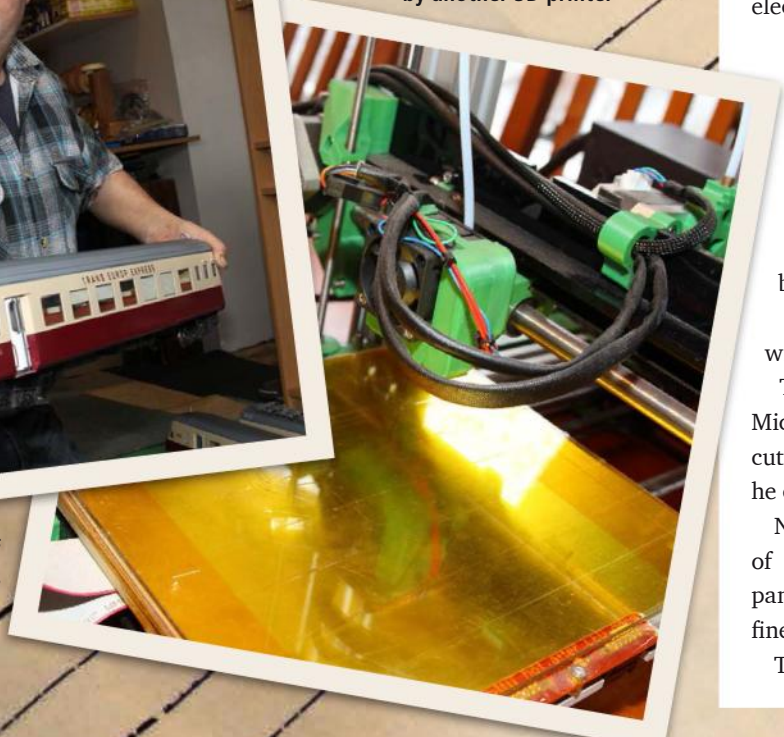
Some very careful filing and finishing with a fine putty-coat filler was next.

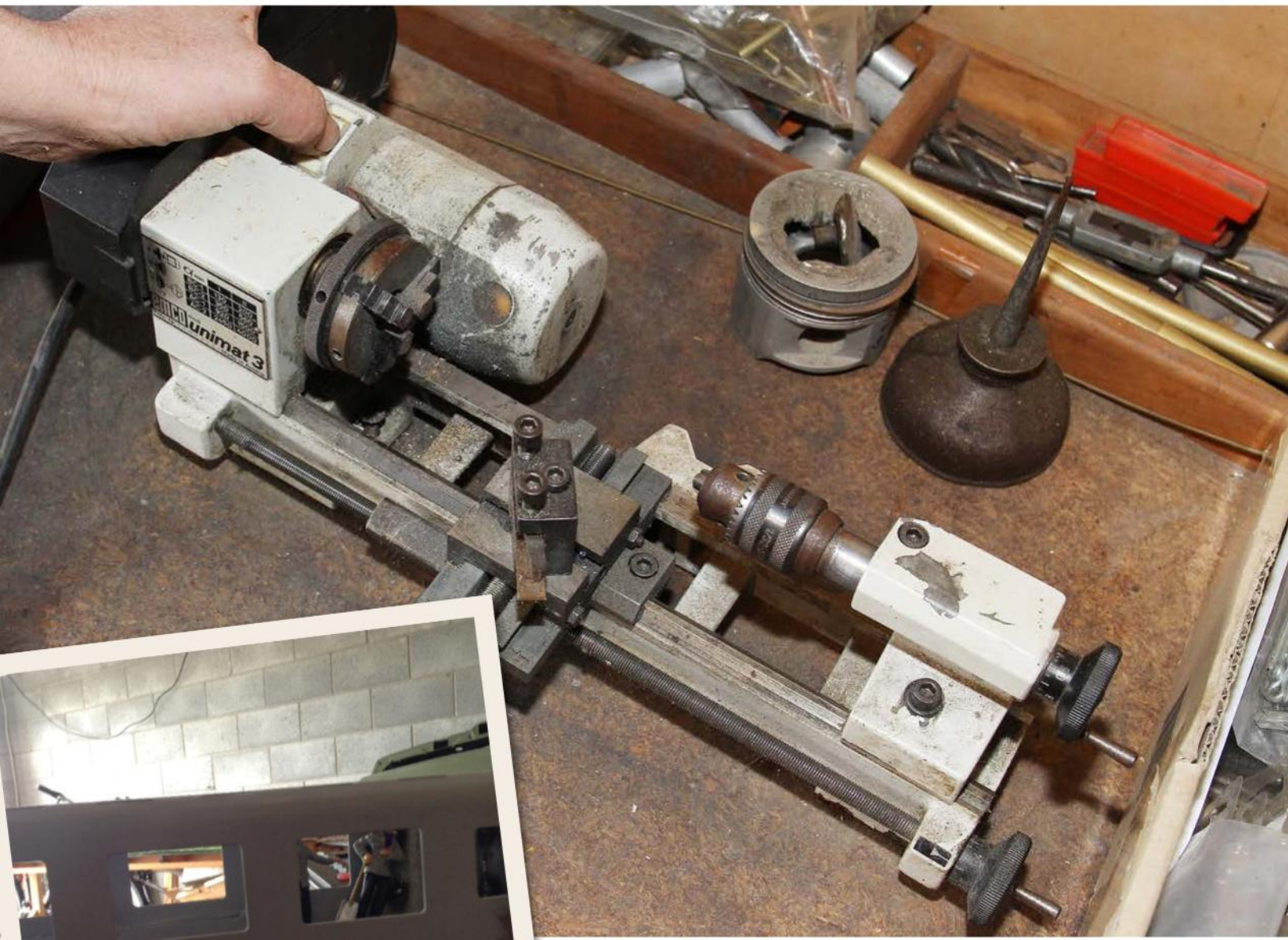
The roofs of the cars are made of wood. Michael used pine. He used the water-jet cutter to cut thin strips of aluminium that he carefully glued to each roof to make ribs.

Next up was a primer, then a top coat of automotive lacquer applied with the panel-shop spray gun and an air brush for fine details.

The metal parts for the bogies under

Michael with one of the model carriages of the Swiss train





Above: The Unimat model lathe Michael uses for miniature turning

Left: The metal frame of the train before finishing work begins

"It's really the same as making a full-sized car body"

the carriages Michael made from mild steel, and the wheel units, with tiny ball bearings, came from America.

Grant Hall of Vital Signs in New Plymouth made all the decals and signwriting using his computer. He also made little venetian blinds from white strips of film, and frames for around the windows. The window glass is made from plastic packaging.

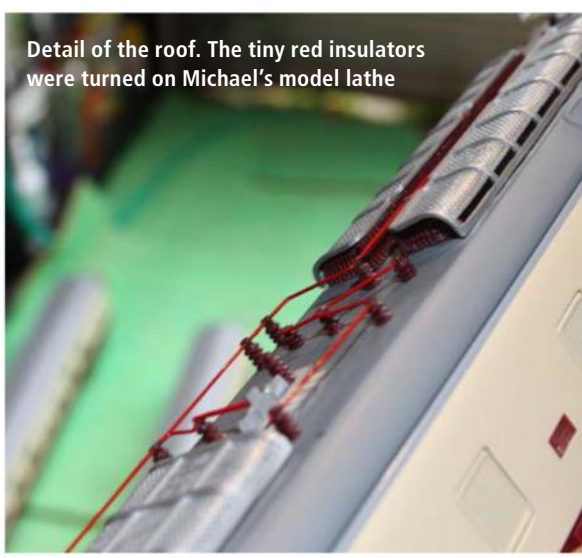
The detail is great — there are even little menus on the tables of the dining car.

Finishing plastic pieces were made on Michael's 3D printer. The figures in the train were made by Preiser of Germany, which specializes in making little people for models.

There are LED lights, front and rear, which change from red to white, depending on which direction the train is running.

The Trans-Europ-Express (TEE) was a premier train in its day, running through Switzerland and to Germany, Austria, and Italy.

The train is a gauge-one model, built on a scale of 1:32. Gauge one is one of the biggest model train sizes. It needs a very big track and Michael has built



Detail of the roof. The tiny red insulators were turned on Michael's model lathe

The 16-volt AC power unit for the train

Fitting the concertina section that joins the carriages

The plans and photos used to create the initial drawings that were put into a CAD file

six units for the train, a power car, and five carriages. The power car is in the middle of the train, which can move in either direction.

Detailed work

Time-wise, he compares creating the model train with rebuilding a classic car.

"It probably took me about 300 hours to make the train. It's very detailed work," he says.

Michael has a big metal lathe for car restoration and a miniature Unimat model lathe for turning tiny pieces for the train. He shows *The Shed* the tiny insulators on the train roof, each one a few millimetres long, that were made on the model lathe.

The power car has 16V AC motor units and a computer that drives other functions such as sound effects, including the humming of the motor, air brakes coming on, and announcements for stations.

Michael is also an auto restorer looking after a collection of classic cars owned by Bryce Barnett (see *The Shed*, February/March 2017). He has featured with a mini caravan that matches his Mini Cooper car (*The Shed*, May/June 2017) and his own ▸

An iconic machine

Swiss Federal Railways built five of the RAe TEE II railcar sets in the 1960s.

It had four different pantographs, which, in conjunction with their multi-voltage wiring, allowed the Railways to operate under seven different European railway electrical systems.

They all carried first-class passengers only as part of the TEE network. (The red and cream colour scheme is the TEE livery.)

They operated on routes from Paris, Brussels, Amsterdam, and Germany, through Switzerland and into Italy.

Once the TEE network stopped operating, in the late 1980s, they were repainted in a two-tone grey livery and reclassified as second-class Euro-City express trains (although they actually retained their first-class seating and facilities).

The two-tone-grey livery earned them the nickname 'Grey Mouse' in Switzerland.

They were retired from service in 1999. One has been preserved by SBB Historic. Restored and repainted in its original livery, it is based at Erstfeld in Switzerland and runs for historic events.

Michael and Douglas' model has the same number as the preserved railcar.

The six sections of the Swiss train

two model-railway layouts (*The Shed*, July/August 2017).

3D printer

Some of the finishing parts were made on a 3D printer. Michael's son Nickolai is the computer expert and he and Michael made up windows, vents, and covers for the bogie wheel with the printer.

The printer looks like a simple affair, with a base panel and a nozzle, both of which move independently. A spool feeds the plastic filament into the printer and it is reduced to a 0.2mm fine strand, which is squirted into the required shape.

To make one of the bogie wheel covers for the train the printer took about 15 minutes.

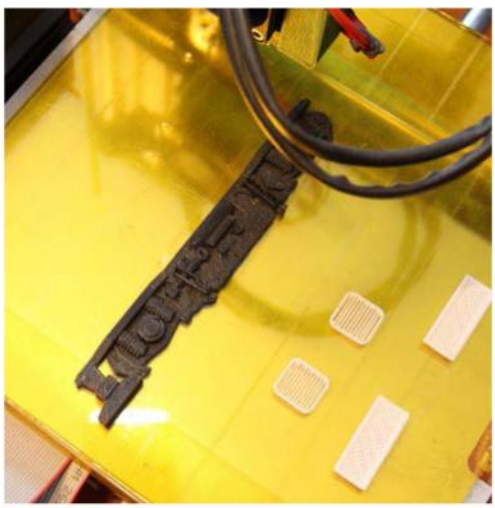
"It's a really great tool," says Michael. "If you break or need any parts, you can just make them yourself."

Scanning the plans

Michael created the model for Wellington train enthusiast Douglas Parker, who has a gauge-one layout. There are very few gauge-one tracks in New Zealand. Due to the size of the trains, these layouts take up a lot of space.

Douglas scanned in the plans for the

> *The detail is great. There's even little menus on the tables of the dining car*



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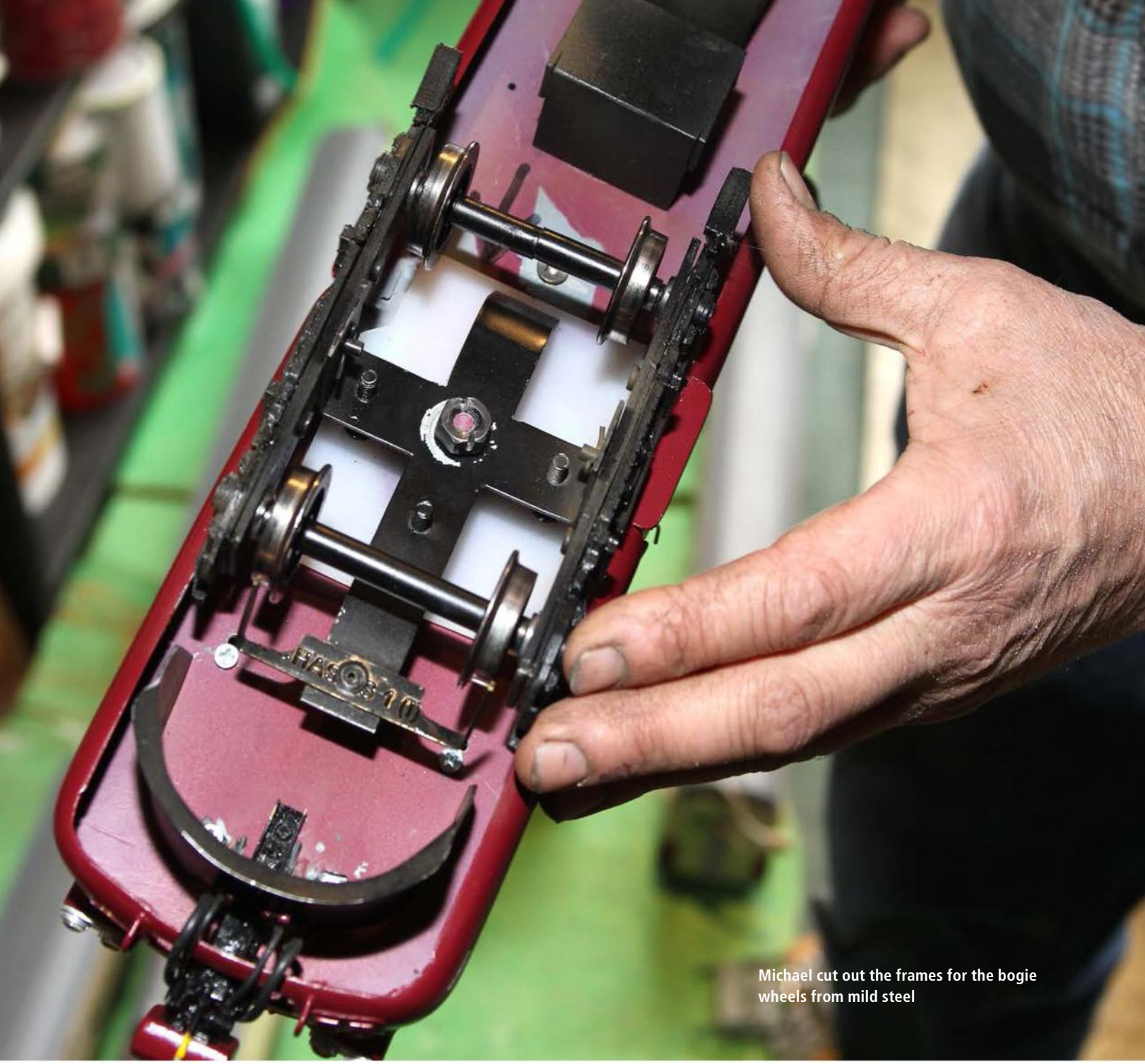


Michael cut out the frames for the bogie wheels from mild steel

▸ cars from books and scaled them up to 1:32 (gauge-one) scale in height/width, but only to around 80 per cent of that in length.

"The coaches are shorter than scale-length, so they can more easily handle the tight radius curves on my model railway," Michael explains. "The power bogies on the driving-trailer are from Aristo-Craft — their wheels were designed for the higher-profile rails of American gauge-one model railways, so a friend in the Märklin Club turned the wheel flanges down for me so that they would run OK on Märklin gauge-one track.

"The wheels for the rest of the coaches are from Bachmann, with ball bearings I purchased locally."

The decoder is a LokSound XL decoder, from the German company ESU, mounted under the power car. The decoder controls the motors in the power bogies, controls the lighting in the coaches and headlights, and plays realistic sounds through the 78mm speaker also mounted under the power car.

"To get the sounds, I downloaded the ESU sound project for the RAe TEE II from their website and uploaded it into the decoder. It contains sounds from recordings of the real rail car, matched to the operating status of the train — acceleration, track noise, and brake squeal. Horn and station announcements play when prompted by commands from the controller," he says.

See it for yourself

Michael's model of the Swiss RAe TEE II can be seen running at the upcoming RailEx 2017 model railway show, to be held at the Walter Nash Centre, Taine Street, Taita, Lower Hutt, the weekend of November 18/19 this year.

INTRODUCTION TO DIY

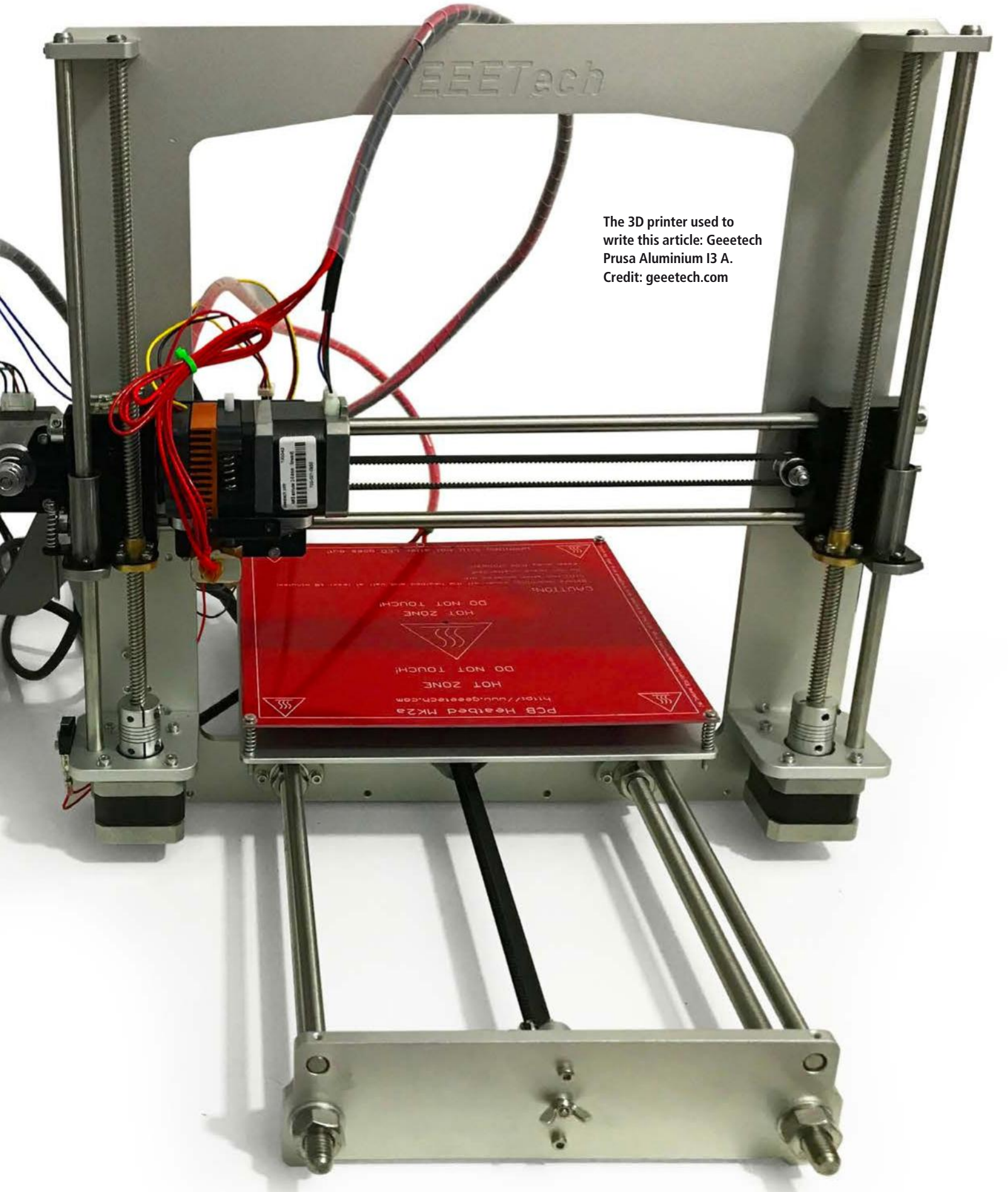
IN THE FIRST IN A NEW SERIES ON THE HOMEMADE 3D-PRINTING PROCESS WE LOOK AT EXTRUDERS AND PRINTING BEDS

By Enrico Miglino

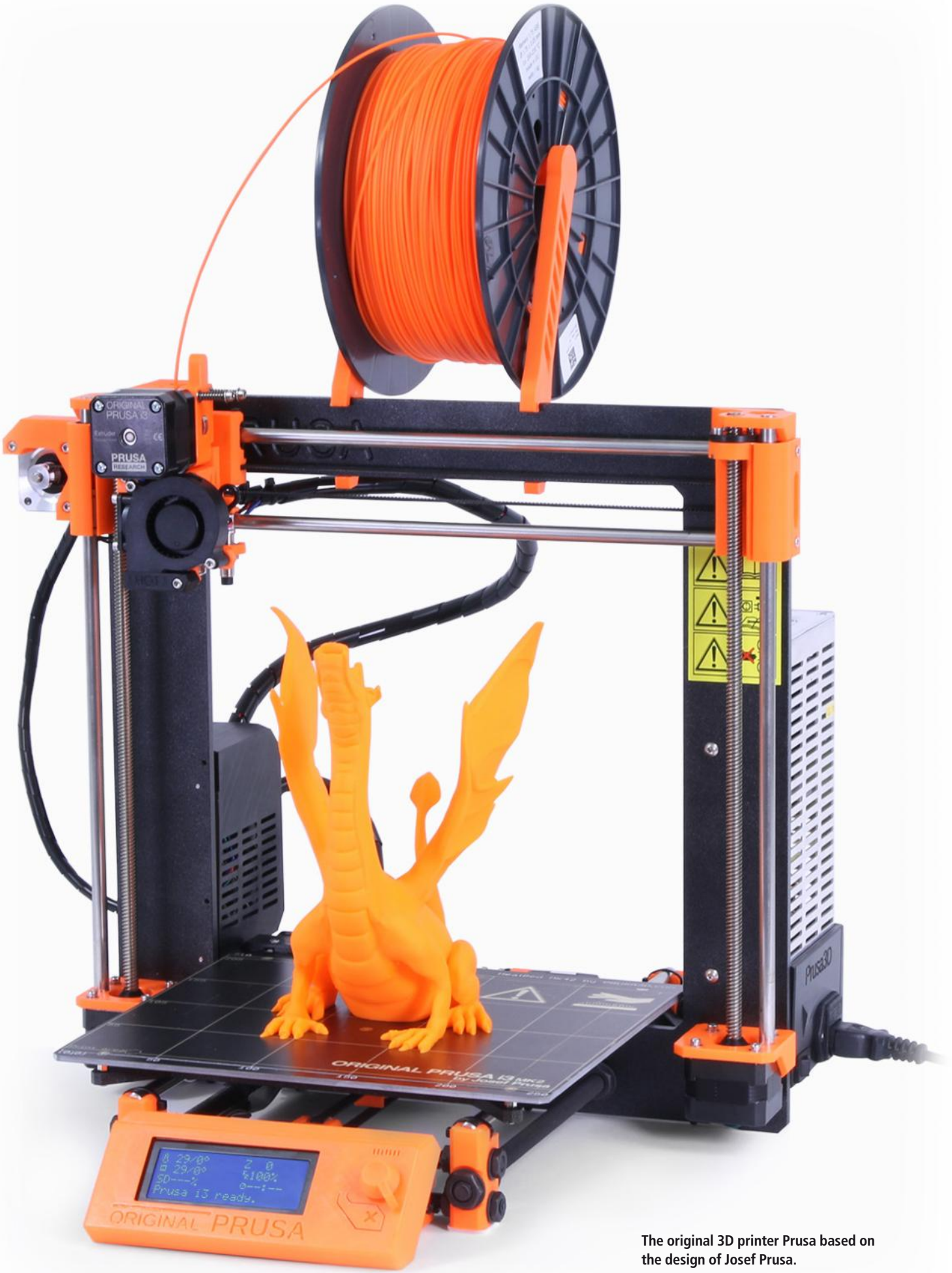
Photographs: Enrico Miglino

During the last few years, 3D printing has rapidly grown as one of the most versatile technologies to build solid objects, proving itself as one of the more efficient approaches for almost any kind of prototype — design, mechanics, modelling, medicine, prosthetic engineering, building construction, space technology, and so on ...

Historically, the idea of making solid objects from a 3D CAD, as well as the concept of slicing a model for 3D printing design, is far from new. During the early '80s, I wrote several articles about the innovative 3D-model-creation technology called 'stereolithography' by its inventor, Chuck Hall (Clinton, Colorado, 1939). A 3D-designed model was sliced into ultra-thick layers, then, using a liquid resin, it was possible to create the solid representation of the same model via an ultraviolet, laser-based solidification process. ▸



The 3D printer used to write this article: Geeetech Prusa Aluminium I3 A. Credit: geeetech.com



The original 3D printer Prusa based on the design of Josef Prusa.
Credit: prusa.com

The popular commercial 3D printer Makerbot. A lot of different versions and sizes of this printers are available and some models are also sold in assembly kit.
Credit: www.makerbot.com

Stereolithography became available at a very affordable price some 30 years later. But that was not the kind of 3D printing technology destined to become the most popular one. Here, we are focusing on the use of the 3D printers that work with filament: easier to use, cheaper, cleaner, and enjoying a low maintenance cost.

Dissecting the 3D printer

By exploring 3D printing techniques and methodology through more complex growing projects, we hope to identify those aspects and best practices that can give the opportunity to reach the optimum results for your projects. Not to worry if you have an inexpensive DIY 3D printer. There are aspects of the 3D printing job life cycle — from design to printing — that are key factors in attaining the desired results no matter how good your printer is.

The mechanics and electronics of a 3D printer are very similar to those of CNC machines. Both these technologies work with three axis motors driving a tool in a 3D space to create objects. We can think of a 3D printer as an inverse CNC milling machine. Whereas the traditional CNC machine removes material from a solid block to create the final object, the 3D printer does exactly the opposite: it adds fused material to create an object.

A great advantage of the Prusa models is they are open source; users can count on a wide community of enthusiasts, hobbyists, makers, and developers to grow their knowledge and improve the performance of their 3D printer

Most of the desktop and DIY 3D printers are derived from or based on two models: the Prusa design and the Makerbot design. The first model was created by Josef Prusa, who had already worked on the RepRap project, started in 2009. A great advantage of the Prusa models is they are open source — users can count on a wide community of enthusiasts, hobbyists, makers, and developers to grow their knowledge and improve the performance of their 3D printer. On the other hand, the Makerbot model follows a more commercial approach, with a product line oriented to those users who prefer a ready-to-print device.

Here, we will mention just two kinds of model, as the possible choices for a personal 3D printer are so wide and ever-changing that the simple listing of each model's features and variants available on the market would require a magazine of its own.

Due to its simple construction, we will focus our attention on the Prusa design and the same aspects that we will discuss at a later stage can be applied to most of the other models.

The extruder

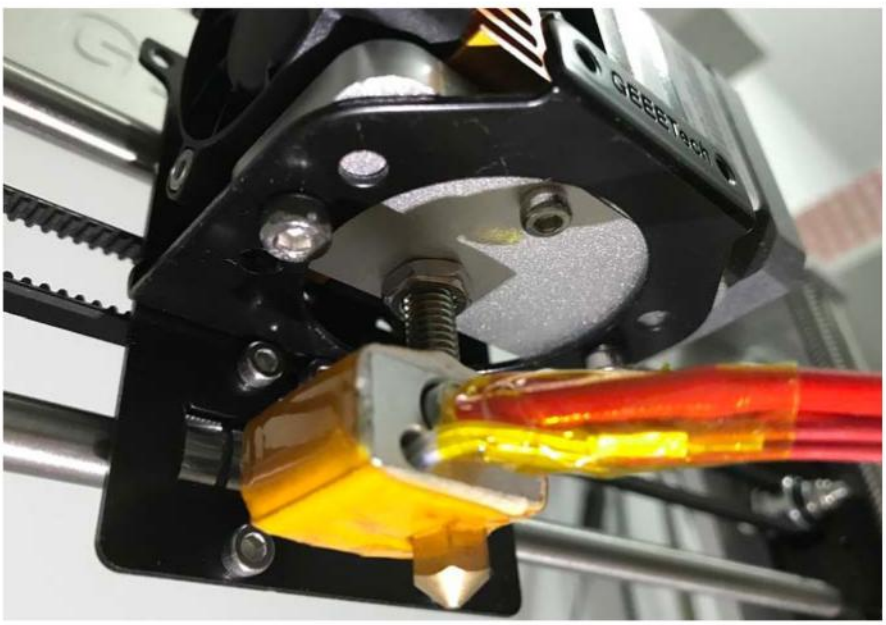
The extruder is the core of the printer. The rest of the mechanics move the

Top view of the 3D printer extruder, design reviewed by the producer. Credit: geeetech.com

extruder to distribute the filament in the right way, layer after layer, building the 3D object.

The two images on this page show the top and bottom view of a 3D printer extruder (model MK8). The filament flows inside it from the top, pulled down by a gear driven by a stepper motor. Depending on the rotation speed applied by the motor, the filament reaches the bottom side, or the hot end, at different pressures. The hot end is kept at the fusion temperature of the filament material, literally squeezing it through the nozzle. Good nozzles are bronze nuts with a thin hole. The most common nozzle diameters are 0.3, 0.4, or 0.5mm, and which you choose will depend on the kind of job you are doing and your preferences.

Bottom view of the 3D printer extruder, design reviewed by the producer. Credit: geeetech.com



A variant of the single-filament extruder is the dual extruder, which can manage two different filament feeds together.

A complete discussion on the possible extruder issues would require more space than I have here, but there are some aspects that are worth knowing before deciding which model to adopt. To avoid your getting bored due to too much theory, I will return to the extruder issues and show examples and uses in future articles.

There are cheap extruder models where the motor movement and some other parts are 3D printed themselves. One of the most important things to consider is the durability of the components. An extruder with 3D-printed mechanical parts, especially the filament drive gear, tend to wear during use, and I think this is a risky option for important components and it can affect the behaviour of the filament while printing. Full-metal extruders are more compact and need less maintenance.

If you are a beginner, it's good to use a 0.4 mm nozzle. You can change it to a smaller diameter if you need a higher horizontal resolution. The vertical resolution is determined by the minimum layer thickness and has nothing to do with the nozzle diameter as it is managed by the z-axis resolution.

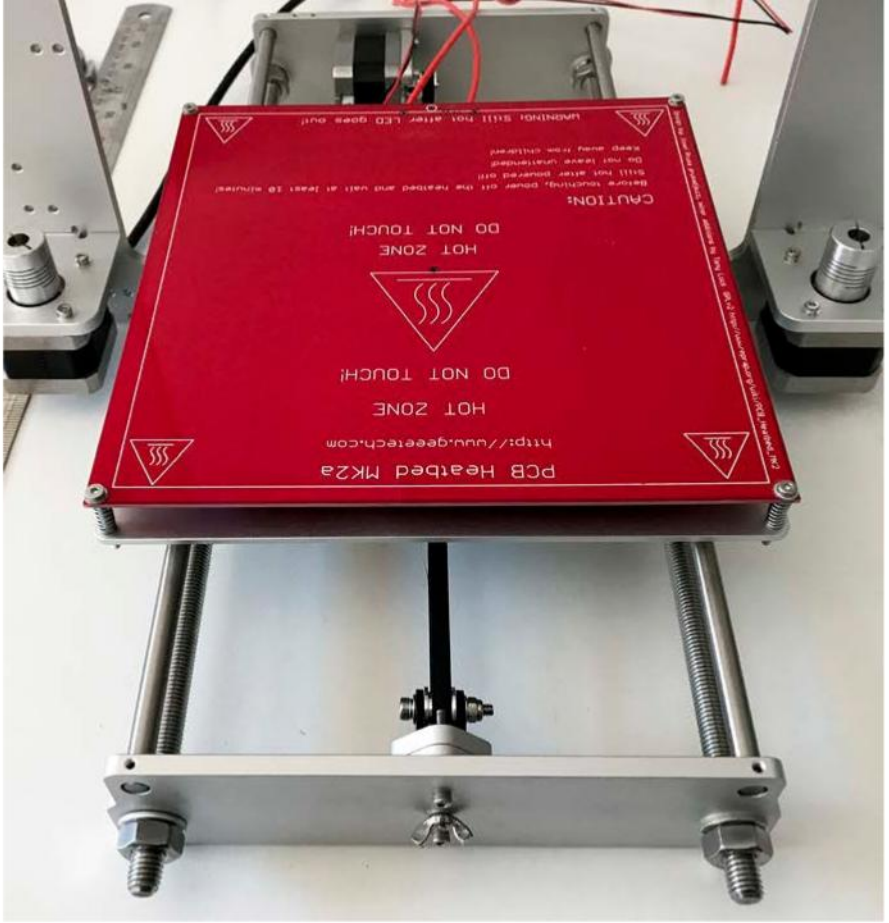
While the hot end (bottom part) of the extruder should be kept at a constant temperature for a fluid filament fusion, the top part (including the stepper motor and the filament drive gears) should be kept cold. It is important that the fan of the extruder is PWM controlled (the fan has three wires connected to the printer board controller instead of only two). The fan speed will vary depending on the distance of the extruder from the printing bed, and this is controlled by the printing software.

A dual-filament extruder maybe a trap, so please be careful! 'Dual filament' does not mean that the extruder can pull one or the other filament depending on the design; instead it means that two filament spools are involved at the same time. If you try to use a dual-filament extruder (that has a single nozzle) with a single-filament feed, it will not work. Use a dual-filament extruder only at times you choose to play with mixing colours together or if you plan to consume a lot of material.

There are 3D printers that natively host two extruders side by side. If you plan to make multi-material stuff, this is the solution, but be aware that extruders require space. Despite the printing area available in the printer, the use of two extruders on the same object reduces the printing volume due to the smaller surface. This aspect may be not relevant for you, but it may affect the maximum printing size of the object. Always ask the supplier if the two extruders can work independently controlled by the 3D printing software.

Printing bed

The 'printing bed' is the surface from where the object starts growing. There are two different printing-bed types: hot and cold.



3D printer heating bed. It is a simple thick PCB heating while printing. The print surface will be covered by 3mm glass over the 3D model being built.

The process of 3D printing is always slow. Even when using expensive professional 3D printers that are considered fast for printing relatively big objects, the time is usually calculated in hours.

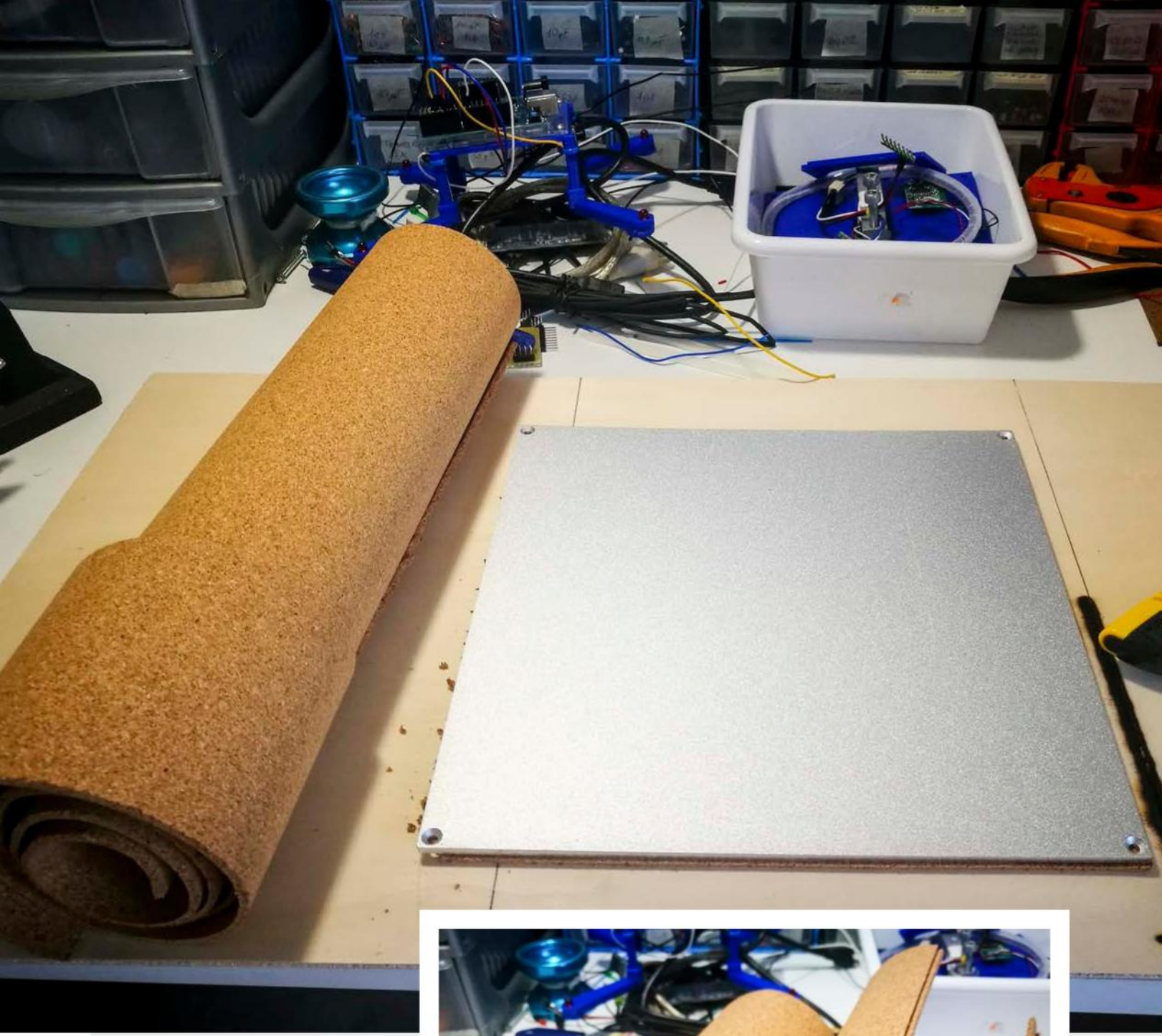
The most important aspect of the printing bed is adhesion. The building piece should remain stable for a long time in its position without detaching to avoid any deformation.

Cold printing beds are rough surfaces designed to keep the printing object in place without detaching, at least until the print job has been completed. Many of the solutions for the perfect adhesion of the printed filament to the base depend on the user's experience and their personal understanding. One of the most frequently adopted solutions is to use a special adhesive tape (not so cheap) that makes it easier to detach the finished object from the surface once the job is complete.

After trying both cold- and hot-bed methods, I would suggest adopting the hot bed solution, as I consider it easier and more flexible to manage.

The hot bed shown in the image on this page is based on the original design by Josef Prusa. It is built from a bare printed circuit board (PCB) circuit tracking a resistor that covers the entire bottom surface in order to reach the desired temperature. A thermocouple positioned roughly in the middle gives constant temperature feedback to the printer controller board. The design idea has been successfully adopted by a lot of 3D printer models, as it is cheap, simple, robust, and efficient.

The hot surface where the print material is deposed is usually a 3mm thick glass surface and suppliers often include a borosilicate glass unit in the package. When you need to replace the unit because your original has broken, you will soon discover that this kind of glass is quite expensive and seems very difficult to find other than at specialized 3D printer stores. Prices for a 200x200mm piece of borosilicate glass will vary between $30 and $50. I discovered that a common 3mm thick glass has very similar characteristics to borosilicate glass, it's just a bit more fragile. However, the price for the same size will vary between $4 and $6. I bought five of them a year ago. One got broken by accident, one is on the 3D printer hot bed, and the other three are still stored in my shed, waiting to be used. ▸



Cork sheets cut and positioned over the bottom base before packing with the heating PCB surface

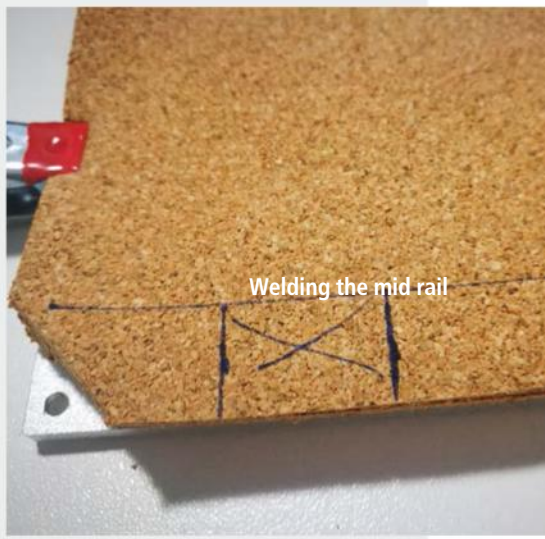
> *The design idea has been successfully adopted by a lot of 3D printer models, as it is cheap, simple, robust, and efficient*

Increasing the hot bed performance

Again, cork sheets cut and positioned over the bottom base before packing with the heating PCB surface

Cork sheets with cut areas leaving space for the clips fixing the glass over the hot bed PCB

Below: Cork sheets with cut areas leaving space for the clips fixing the glass over the hot bed PCB



Welding the mid rail

Below: Hot bed PCB bottom side. Note the thermocouple positioned around the middle of the surface

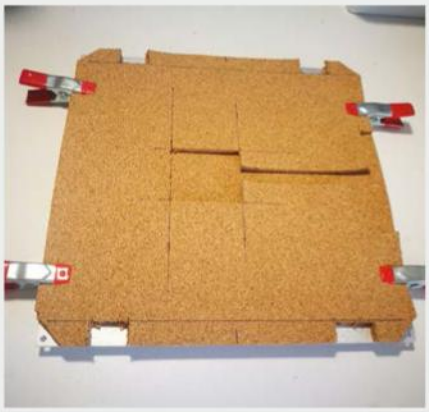
Recently, while helping a friend assemble his first 3D printer, he suggested a great solution to optimise the hot bed performance. I immediately applied it to one of my printers and it worked incredibly well.

You will need a sheet of cork, such as the type used for a wall memo board. The cork will act as protection for the hot bed bottom, reducing its natural thermal dissipation. The best thickness I suggest is 5–6mm. I used three 2mm sheets, as shown in the photos, and built the hot bed upgrade in about half an hour using these easy steps:

1. Cut the cork sheet(s) exactly the size of the heating bed.
2. Cut the four side corners to leave space for the hot bed fixing screws.
3. Measure the width of the clips used to fix the glass over the hot bed and mark on the cork the corresponding cut area.
4. Measure and mark the area of the hot bed, leaving space for the thermocouple and its wiring connection.

The completed work should look more or less like that shown in the photo. Sizes may vary depending on your hot bed dimensions and the exact position of the thermocouple. ▸

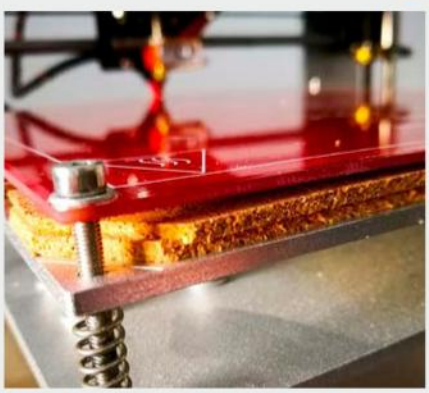
Increasing the hot bed performance (cont.)

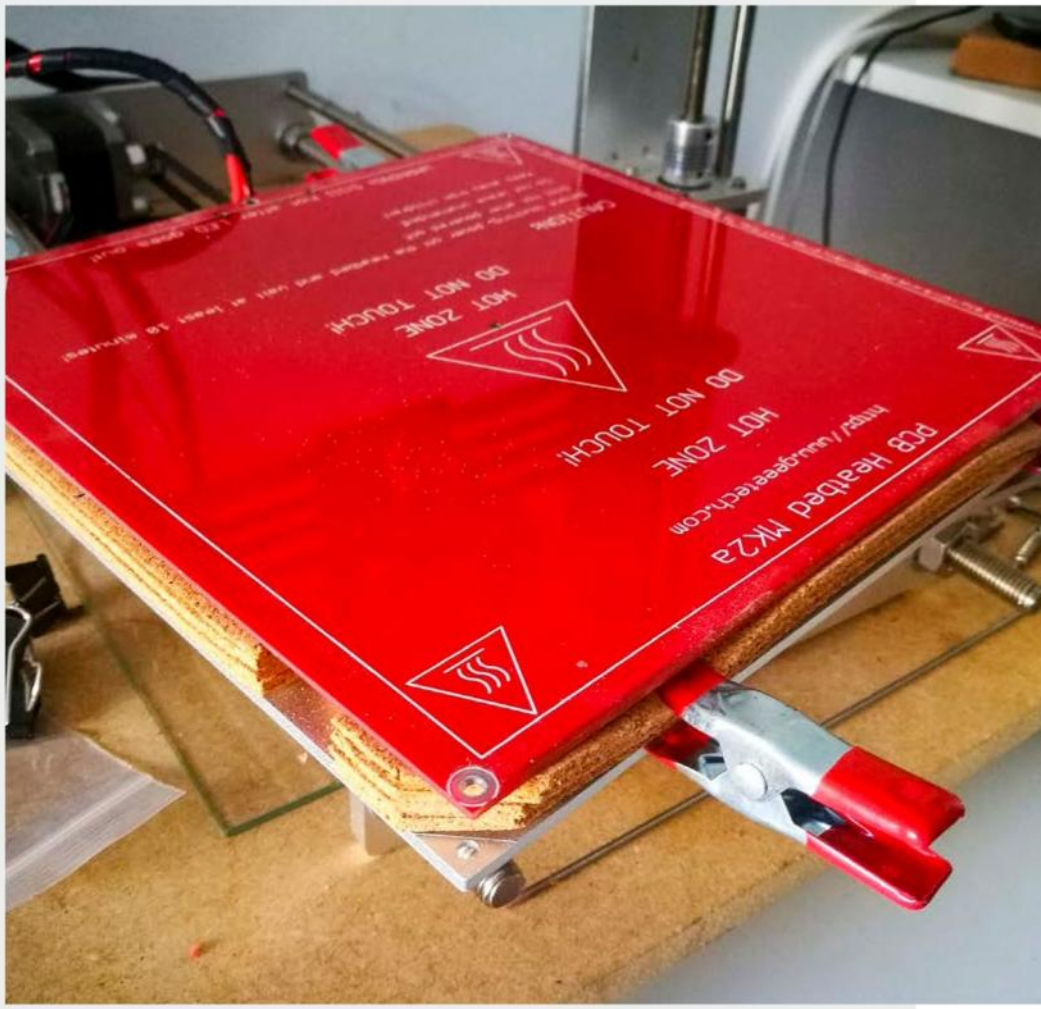


Cut a space for the thermocouple and wires in the top sheet of cork that will be in contact with the bottom side of the PCB hot bed

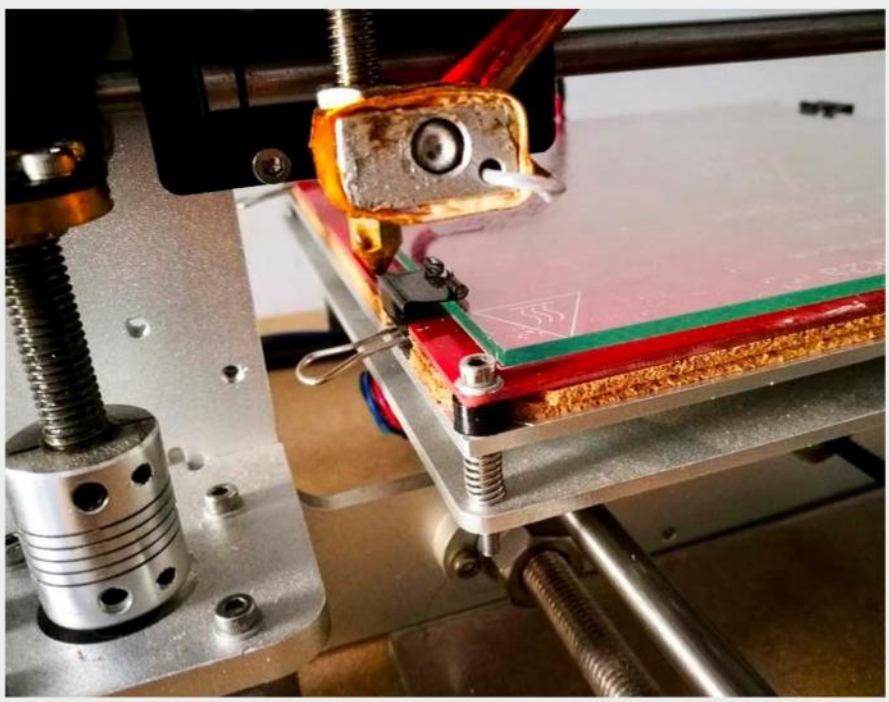
5. Assemble, inserting a 3D printer separator in each of the four screws. The height should be the same as the cork-sheet thickness. That way, you will avoid the four screws tensioning, which bends the hot bed PCB at its corners.
6. Calibrate the hot bed, adjusting it to the new height, and start printing.

With this easy modification, I have found a hot bed heating-time reduction of up to 40 per cent to reach 80°C; also the thermal stability significantly improved, thus reducing the risk of objects detaching while printing.





The final assembly of the packed hot bed PCB with the cork sheets and the base. Note the four 3D printed separators to keep the packed hot bed stable, while the screw should be used to adjust the horizontal position



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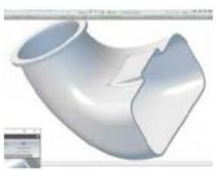

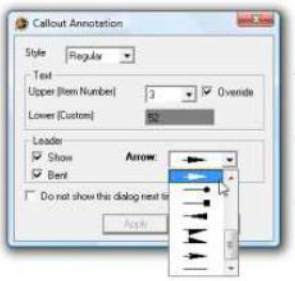

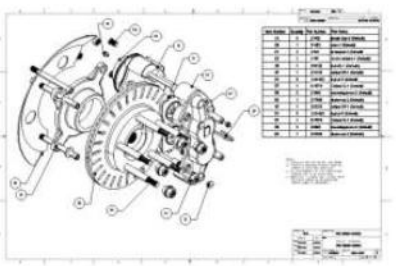

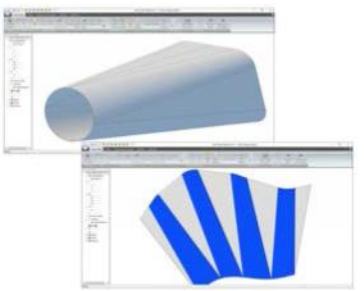

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THERE ARE NO SHORTCUTS TO THE CHROME PLATING PROCESS IF YOU WANT PREMIUM RESULTS

By Todd Wylie
Photographs: Adam Croy

It may surprise many to learn that chrome platers are getting few and far between in New Zealand, so here is a useful guide to the actual chroming process. We all know that re-chroming can take a big bite out of the budget of any car-restoration project — but do you really know how much work is required to refurbish those shiny bits?

When restoring a vintage, classic, muscle car, or hot rod, chrome plating is one aspect that often causes concern — the processes involved are not only time-consuming but can also throw up a number of hidden costs. However, once you understand exactly what's involved it's easier to see that what you're paying is well justified by the end product.

One of New Zealand's leading chrome professionals, George from Advanced Chrome Platers (ACP) in Hamilton, ran us through the process at his purpose-built facility so we could see what happens behind the scenes for ourselves.

Plating theory

'Electroplating' can be defined as the deposit of a very thin layer of metal onto a base metal to enhance or change its appearance. Unlike painting, where the new deposit is sprayed on, the chrome (and associated materials) is applied through the use of an electrical current, hence the term '*electro*plating'.

A 'plating bath' is the name for what is essentially a giant tank, many of which are used throughout the chroming process. The baths are filled with a liquid that contains the desired metal dissolved within it, which could be silver, gold, nickel, or some other metal.

The plating-bath solution serves as a conductive medium, utilizing a low-DC voltage. The metal item that is to be plated is submerged in the plating bath, and a low-voltage DC current is applied to the bath.

The electrolytic process then causes the dissolved metal ions to attach to the surface of the metal being plated. The thickness of the electroplated layer is determined by the time that the item spends in the plating bath while the current is being applied and the amount of current used.

Sometimes the shape and contour of the item can affect the thickness of the plated layer. Metal objects with sharp corners and edges will tend to have thicker plating on the outside corners and thinner plating in the recessed areas. This is due to the corners being more exposed, therefore attracting more particles.

Price of plating

The price of electroplating services is determined by numerous factors, such as the type of metal used for plating (i.e., gold, silver, chrome, etc.), the desired thickness of the plating, the base metal (i.e., steel, copper alloys, aluminium), the rough dimensions of the object to be plated, and the number of items to be plated. As an example, nickel costs around $16K per tonne — as a rough guideline, on the average ’50s US classic car, around 12kg of nickel is used.

What many forget, however, is that since the plating process does not hide or mask surface imperfections, plenty of preparation time is required to ensure a flawless finish before the plating process itself has even begun.

Most vehicles of the chrome era have more than their fair share of dents and scrapes in the trim work, and removing them is not a straightforward task. It involves plenty of skill and an even greater amount of time — which all adds to the cost involved, in the same way that panel beating and preparation add to a paint job.

Ask anyone who has had a bumper from a ’50s US cruiser chromed how much work was involved in getting the bumper straight and tidy prior to plating and you’ll soon see where a large proportion of the final cost goes. It’s amazing how many seem to forget all about the preparation time when it comes to settling the eventual bill.

It also pays to remember that as each tank used in the electroplating process has a current sent through it to activate the solution within, the monthly power bill for the plating business can be as high as $30K — another cost that most of us would never have thought of.

> *Since the plating process does not hide or mask surface imperfections, plenty of preparation time is required to ensure a flawless finish*

The process

As you’ll see over the next few pages and 19 easy to follow steps, it’s amazing how trim parts and bumpers can be repaired and returned to a flawless finish by experts with the right knowledge and skills.

1 First, the job is checked in and photographed. For this George and the team use a digital camera, and take photos of every individual piece showing not only the item itself but also any damage on the items for future reference. In the case of the 1956 Cadillac parts used to illustrate the process for this article, there were over 50 pieces all up and various processes were needed, as some parts were steel, some were cast items, and some were stainless steel.

With the job logged, all items — cast or steel — that are currently chromed, or are to be chromed, are wired up to copper wire to conduct electricity from the bars that run above the tanks to the part itself.

2 The first tank each part is submerged into is the stripping bath. This is filled with caustic soda and is kept at 75°C. The small round balls you can see on top of the tank (see next page) are there to try to keep as much heat from escaping as possible. After a few hours (depending on the amount of paint and grease on the items), the parts are removed, rinsed, and scrubbed in clean water.

3 Next, the old chrome is removed in a cold caustic bath, this time electrified to 12V with a reverse charge. The old chrome comes off the item surprisingly easily, in just 10 minutes. The old chrome and stripped metals are not recyclable. Getting rid of them is a major expense for any electroplating company, and it’s controlled by local council bylaw requirements (under trade-waste consents legislation).

Next, the item is once again rinsed in a clean water bath. This process not only

2

takes the caustic soda off the item but also stops cross-contamination of the other baths. After all, each one contains a variety of chemicals, all of which must be kept precisely at the required levels. Luckily, George is qualified at this, so doesn't need to rely on an outside physicist to make regular visits to keep the levels in check.

As you'll see later in the process, a layer of nickel sits below the chrome, both old and new. It's this layer that must be removed next. Think of it as stripping back the existing primer on a car before a paint job. If you were to plate straight over the top, you couldn't guarantee the quality or longevity of the finish.

To remove the nickel, the items are placed into a concentrated 98 per cent sulphuric acid bath for around 30 minutes. Again, a 12V reverse charge is applied, which causes the nickel to reverse-plate off the item. On removal, the item is once again rinsed.

4 Next up, any rust gets removed, and the steel item is placed in an inhibited hydrochloric acid for two hours. The trim is then again rinsed, and the acid neutralized.

These first four steps are taken regardless of whether the item is made from cast metal, as many trim pieces are, or from steel, like a bumper. If there's any damage to the items in need of repair, this is when the process changes slightly.

The monthly power bill for the plating business can be as high as $30K

5 For bumpers and solid-steel items, Advanced has a panel beater — Mike Mahoney at Trimworx — who has 30 years of hammer-and-file experience and all the tools and tricks required to straighten bent metal back to perfection.

6 As the metal on these old bumpers is so thick, it takes a great deal of skill to work it, along with plenty of heat to help soften the metal. Of course, when you bend metal one way (say up/down), its natural reaction is to shrink or stretch across too. To get it right, you must know how the metal will react.

7 Straightening the bumpers alone took around nine-and-a-half hours, but the result was bumpers as straight as they came from the factory 56 years ago. Unlike traditional panel beating, there's no hiding anything, as there can be no bog, weld lines, or imperfections that paint would hide.

8 Cast items generally don't get damaged, as they're not used in high-stress areas. However, on occasion they can be broken, as was the case for one of the front-quarter window surrounds for the Cadillac. Although welding cast parts isn't generally recommended, with the right welding rods and expertise, it can be achieved with fantastic results.

9 What does often happen to cast parts is pitting. Again, with the right knowledge and experience, this is totally fixable.

While there are a few hours' work involved in repairing items like this, it's far cheaper than sourcing a replacement, if that's even possible.

10 With repairs taken care of, the next step is the sanding (linishing) stage. Many different grits are used, starting with a coarse (60 grit) through to a fine (400 grit), with great care taken to get an even finish across the whole item, no matter how tricky it is.

Areas such as the rear side of bumpers do not go through the polishing process, just the faces, which will be chromed and visible on completion.

11 With the initial sanding sorted, it's on to another workstation, where a buffing compound is used on a polishing wheel, and the process continues. Three grades of polishing compound are used during this stage (600, 800, and 1200 grit) to achieve a mirror finish. Depending on its size, the average polishing time for a '50s bumper is between six and eight hours! The bumper is held to the machine, not the machine to the bumper — can you imagine holding up a 20kg bumper to a polishing machine for eight hours?

12 The conductive copper wires, which were removed for the polishing stage, are now refitted, as are non-conductive weights to help keep the items from moving around in the solution due to tank agitation (bubbles).

To make sure all polishing compounds have been removed, the items are once again dropped into a hot caustic bath for around 30 minutes. If any compound is still on the items it will contaminate the baths used in the next stage and cause visual imperfections in the chrome finish. The item is rinsed and thoroughly scrubbed, given a final check, and then moved to the next bath.


5

13 That next bath is a two-minute dip in a cold cyanide solution, in which the parts are electro-cleaned by having a reverse charge passed through them. Again, a fresh water rinse is performed prior to the next stage. The items must not dry out before being transferred to that next stage. If they do, blotching will occur — often the sign of a lack of care during the process. Thankfully, George and his team check the items at every stage, ensuring only the best-possible finish is supplied to the customer.

A cold bath of 10 per cent sulphuric acid is then used for two minutes to give the surface a key for the next step to etch to. This is essential to ensure that the cyanide-based alkali copper used next will adhere to the item as much as possible. Attached to the sides of the bath are baskets with blocks of pure copper (anodes). When dissolved in the solution, the particles are attracted to the positively charged item and soon a thin coat of copper covers the whole thing. The copper is less than 1µm thick and acts as a primer-sealer to key-in the next layer of plating.

The average polishing time for a '50s bumper is between six and eight hours

Again the item is rinsed, then dropped into a 10 per cent acid etch for 10 seconds, followed by a further rinse.

14 The item is next placed in a bath of blue phosphorus copper-sulphate solution, which is used to cover the surface and fill any microscopic imperfections. The bath is kept at ambient temperature and items are in it for 45 minutes. They emerge with a coating of around 30µm depth. Again, the copper (anode) is in baskets around the side of the bath and looks almost like copper ball bearings.

After yet another rinse — that's eight rinses so far, if you've lost count — the items are back into the polishing shop, where a further 15 minutes of polishing with 800- and 1200-grit compounds remove any residual defects.

15 The copper wires and weights are once more reattached after being removed for polishing due to the risk of being caught in the polishing wheels. The same soaking procedure used in the previous step is then repeated.

Rather than a water rinse, an alkali rinse is performed before the items are dropped back into the cold cyanide at 12V for two minutes, and then they are rinsed again in water. ▸


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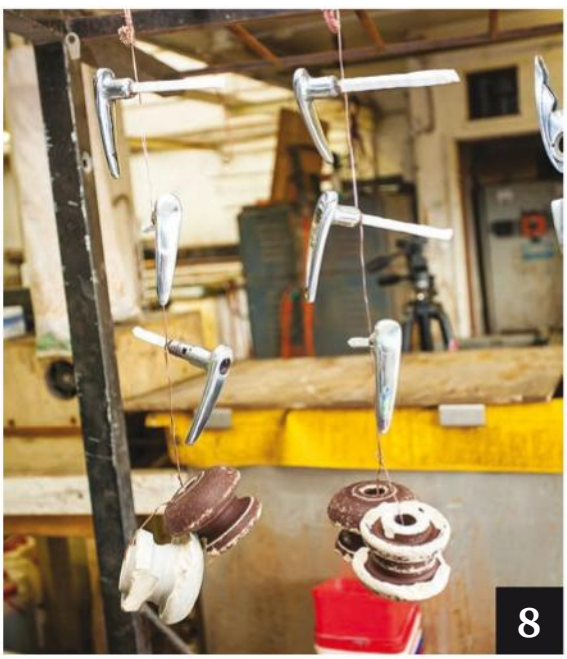
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Another two-minute dip in the acid etch and another quick rinse is all the items need before they can finally make their way to a 45-degree cyanide copper mix, in which they will sit for five minutes with 12V passing through them. During this time they'll form a smooth skin, which once again must be etched by a further two-minute dip in the acid etch, before another rinse.

16 So far, the compounds used in the process have been relatively low cost. But the nickel sulphate the items spend the next 60 minutes sitting in is notably more expensive, in fact, it's the dearest consumable of the whole procedure. After 60 minutes with a 6V current, a 45µm coating is applied to the item. This is the most important part of the whole process, as it's the nickel that gives the finished product its shine. Often the difference between cheap chrome and good chrome is the amount of time the items sit in this bath. The difference is noticeable to the naked eye by the depth of colour in the finished item.

A rinse then removes any excess residue and prepares the item for the chrome itself, which is a comparatively cheap and quick part of the whole procedure. Despite being orange the chromic acid is what gives the blue-ish look, and after just four minutes in the bath with a 12V current a 3µm coating is fixed to the item. Again the balls in the tank are there just for insulation purposes. The tank itself is tested twice daily for correct chemical levels, brightness, and condition, and is stirred throughout the day. Chrome is a heavy metal, so it tends to sink to the bottom when left for long periods.

A full refill of all the tanks would set George back around $365K, but thankfully they don't require complete replacement all that often.

17 Once the items are removed from the tank, they're given another quick rinse, and the chrome look that we all know and love appears from underneath the orange liquid. After a total of 25 stages and around seven hours, the product is nearly ready to be handed back over to the customer, but not before the dedicated quality-control officer has had a good look over it to ensure that it's perfect, and it has had a polish by hand. The items are then checked against the job sheet, packaged, and are ready to be collected.

The time taken for the process varies according to the size, shape and complexity of the item, as does the amount of voltage used in various stages. Whether the job is a 1950s bumper or a safety pin, it still has to go through all the plating processes. There are no shortcuts.

The only way to know how long each item requires is by having years of experience and practice. George himself has been in the game for 36 years, and some of his staff have been with him for almost as long, making them quite possibly part of the most knowledgeable team around.

With so many different processes and so much attention to detail required, you can only imagine the reaction when customers walk in thinking they can wait while their parts are chromed (a daily occurrence according to Anita, the manager at ACP). The reality is that the process is as involved as painting a vehicle, if not more so. And you get what you pay for. A low-cost job most likely means that steps are being missed along the way, or steps are being rushed through to cut costs.

Stainless trim repair

18 As stainless trim repair is often lumped under the umbrella of 'chroming' when vehicles are being built or restored, we thought it worth mentioning the process involved here, too. Like repairing steel bumpers, the process of fixing dented and scuffed trim is a time-consuming one, requiring a great amount of skill. Each individual dent is pressed out, and slowly the metal is massaged back into shape. The perfect example of what can be achieved is the trim on these wheel spats. While almost anything is possible, some trim isn't financially feasible to repair if it's seriously damaged — although if the parts are rare and irreplaceable, in the hands of an expert it can be done. All the stainless trim on the 1956 Cadillac took around eight hours to straighten and repair; thankfully most of it was in good condition.

19 Once repaired, the items are polished using the same techniques as in the chroming process, with finer and finer compounds used towards the end of the process. The result is an almost mirror-like finish, which is as good as (if not better than) new.

Thanks to George McLellan and the team at ACP for their help with this article. You can find out more, and view pictures and videos of the plating process, at plating.co.nz.


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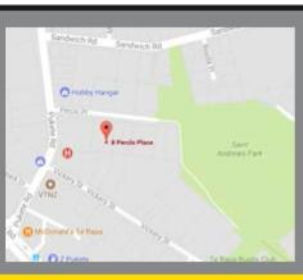

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THE RIGHT STUFF

PART TWO

MORE OF BOB'S TIPS FOR YOUR METALWORKING LATHE

By Bob Hulme

Photographs: Bob Hulme

Aluminium strips protect against chuck jaw marks

If you have followed our Metalworking Lathe 101 series in previous issues of *The Shed* you will have a grasp of the basics, so here are some helpful tips to improve your lathe experience and make those projects a bit easier to do.

Chucking

Quite often the material or item we need to hold in the chuck is delicate, either due to a fine finish that we do not want to put chuck-jaw marks on or due to it being thin walled. For jobs with a surface finish that you need to protect, it is handy to have some strips of aluminium to put between the chuck jaws and the job material. These are mostly used when holding in a four-jaw chuck, as the job will need to be 'clocked up' using a dial indicator to get it running true.

The thickness of the aluminium strips cannot be relied on to be consistent, as they squish up a bit with the tightening of the chuck jaws, so when using a three-jaw chuck the auto centring effect is not so good. If you want to use a three-jaw chuck, then instead of the aluminium strips, use an aluminium soft-drink can. Just cut the top and bottom out, slit the

cylinder and cut it to suit the size of the job you are going to hold in the chuck. Being quite thin, the aluminium layer will not adversely affect the centring with the three-jaw chuck action all that much. Three-jaw chucks do not centre material perfectly anyway and are a good approximation only.

For holding thin-walled material such as tube, you will need to turn up a mandrel or plug to snuggly fit inside it to prevent it from collapsing inwards when the chuck jaws are wound down on it. The plug does not need to be very long, just long enough for the length of the chuck jaws. If you don't use a plug then the tube will go out of shape and it will not be held well enough to prevent slipping against the jaws when you are machining. Parting off is particularly difficult with thin-walled tube (3mm or less) and a plug or mandrel is absolutely essential then. Be sure to make your parting-off cut as close to the end of the plug as possible to provide the best support for the tube.

The finish

Achieving a fine finish can be a challenge, particularly if you are working with a lathe that is a bit old and worn or if it is lightly built so that rigidity is less than desirable. Ideally, we would all be using top-of-the-line lathes built from heavy castings with high-precision slides, etc. However, budget and shed space constraints are the reality we all have to fit around, so here are some ideas on how to achieve a good finish on those jobs where it is needed.

Achieving a fine finish can be a challenge

If you are using tungsten carbide insert tooling to do the cutting then you are part of the way there. These have been developed over many years and after much research as different manufacturers strive to be ahead of each other in a competitive market. You can spend less money by using high-speed steel (HSS) tool bits and grinding them yourself, but it does take skill to get the geometry right and the edge life is less than for tungsten carbide. (I should just qualify this comment, as I do find that hand- ground HSS cutting tools are still the best for machining materials such as plastics and aluminium.) As a rule of thumb for selecting tungsten carbide inserts when turning on a lathe, select a nose radius that is larger for roughing (say 0.8mm diameter) and smaller for a better finish (say 0.4mm diameter).

Aluminium soft-drink cans are ideal for protecting the part

Correct speed

Speeds and feed rates have an impact on surface finish too. A coarse feed is best for roughing and removing material quickly and the opposite is true for achieving a fine finish. However, it's not so clear cut for speed (rpm). Too fast a speed and you will get chattering on the surface. This will also be apparent from a high-pitched, squealing noise when machining. Too slow a speed and the finish will be rough due to the material tearing instead of cutting cleanly.

It's a bit like using a rotary lawn mower. It relies on the blade spinning around fast to whack the grass fast enough to cut it rather than chew it. The grass does not have time to bend over. Clearly some experimentation is needed to find the optimum speed for the lathe you are using and the type of material you are cutting. Start off by using recommended cutting speeds from charts or reference books such as the Engineers Black Book. Use the roughing cuts to experiment so that when the last cut is to be done you will have it sussed!

Some cleaning advice

So the last cut has been taken and the finish is not too awful, but it could be better. There are ways to fix this, but be aware that the size (diameter) is going to get a little smaller as a result. One of those plastic scouring pads that are used for cleaning pots and pans can be good for running over the surface to give it a shine and take off the tops of the roughness. However, be very careful as it can grip on the spinning job and snatch your hand too. Under no circumstance use a lathe wearing gloves!

Use a scouring pad to enhance the finish

It's impossible to pull your hand out of a glove once it tries to wrap itself around a spinning job in a lathe (or a drill for that matter).

You could also use emery tape to improve the finish. The same safety precautions apply. Push from one side only and do not wrap the tape around the job. It will grab in a flash and pull your hand in too. Cleaning your lathe after using emery tape is a priority, as there will be abrasive grains dropped onto the slide surfaces that will accelerate wear if not cleaned off.

Save time

It is a myth that you can take your time when working on a project for yourself in your home workshop. At least that's what I have found. Time is always a valuable commodity no matter what you are making or fixing. There are always plenty of other things that need to be done (including time to do nothing!)

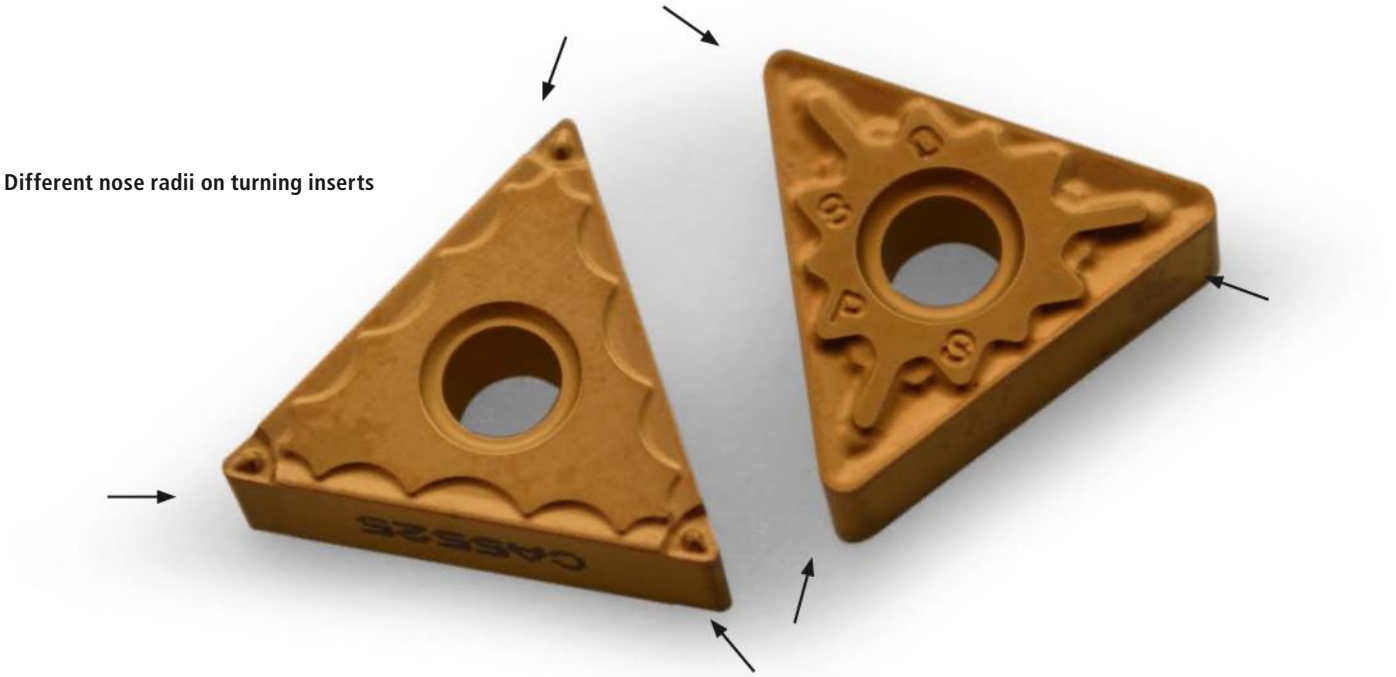
When turning a job on the lathe it's often the case that the piece of material you have available is much larger than the item you want to make, particularly when you have to work with whatever you have available at the time in your shed. So, machining away all that unwanted material needs to be done as quickly as possible.

Machining the diameter down ('turning') is always going to be faster than cutting over the end face ('facing') of a piece of material in the lathe. This is because deeper cutting depths are possible and most of the cutting is done at the largest diameter where the cutting speed (metres/minutes) is achieved. With facing, every cut has a chunk of time spent when the cutting tool is close to the centre of the end face where cutting speed is nearly zero.

Clearing the swarf

When drilling deep holes into the centre of a job, it is necessary to keep retracting the drill to clear the swarf from the hole, and the deeper the hole gets, the more frequently it needs to be cleared. Failure to do this will result in the drill jamming inside the hole due to all the swarf jamming around it.

Don't keep winding the tailstock hand wheel out to clear the drill. Instead, release the lever that clamps the tailstock to the lathe bed and slide the whole tailstock back. Once the swarf has dropped away, slide the tailstock back again, being careful not to bang the drill too hard into the end of the hole. ▸



Different nose radii on turning inserts

Time is always a valuable commodity no matter what you are making or fixing

- Feed the drill to cut the hole deeper with the tailstock hand wheel, then repeat the process until the full required depth is reached.

Know your oils

Use an appropriate cutting oil when machining, as this will improve cutting-tool life and surface finish. It takes time to stop and resharpen cutting tools or to undo and index around tungsten-carbide inserts. This can be frustrating as well as involving extra cost.

As a general-purpose cutting oil, a soluble oil type mixed with water is good, as this lubricates as well as cools effectively. Ideally, if you don't have a lathe with a pump unit for coolant/cutting oil you can buy separate units as an add-on.

The soluble type of cutting oil is especially good for materials such as stainless steel, which is not a good conductor of heat, so the area where the cutting is taking place gets very hot and the cutting tool softens and wears more quickly if not cooled. The best soluble cutting oils are a mixture of mineral and synthetic oils.

Straight (non-soluble) cutting oils are good for tapping threads, screw cutting, and there are some very good oils purely for aluminium. Brass is happy when machined dry.

A downside of soluble cutting oil is that it can stagnate and smell. This is caused by anaerobic bacteria — bacteria that grow in the absence of oxygen. The best way to combat this is to simply pump the oil/water mixture around for about half an hour each week. The splashing oxygenates it and the bacteria do not flourish. Some people install a fish aquarium aerator in the tank and this is very effective.

I hope these tips inspire you to do more with your home workshop lathe. Contact us here at The Shed if you have any aspects of lathe work you would like us to delve into or you have any questions.

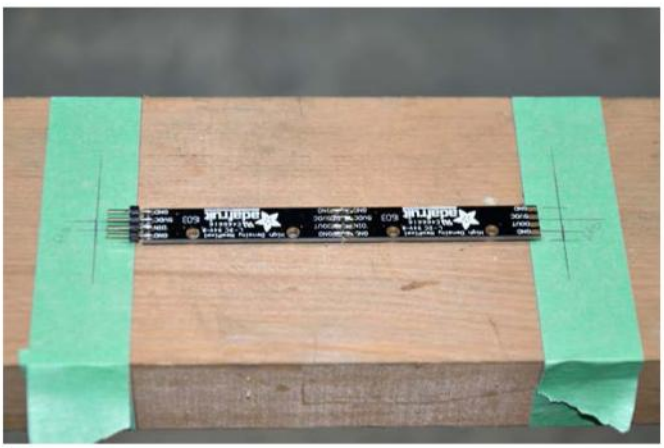
Using a mandrel inside a thin-wall tube job

SEEING THE light

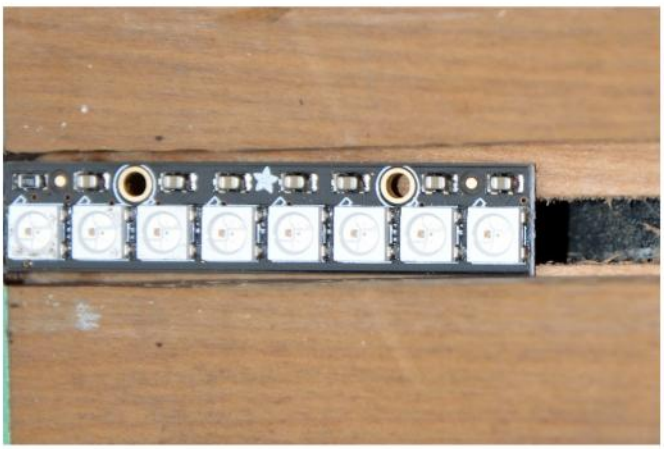
IT'S TIME TO EXPERIMENT AND UP YOUR SKILL LEVEL TO CREATE A BESPOKE ILLUMINATED CHRISTMAS GIFT

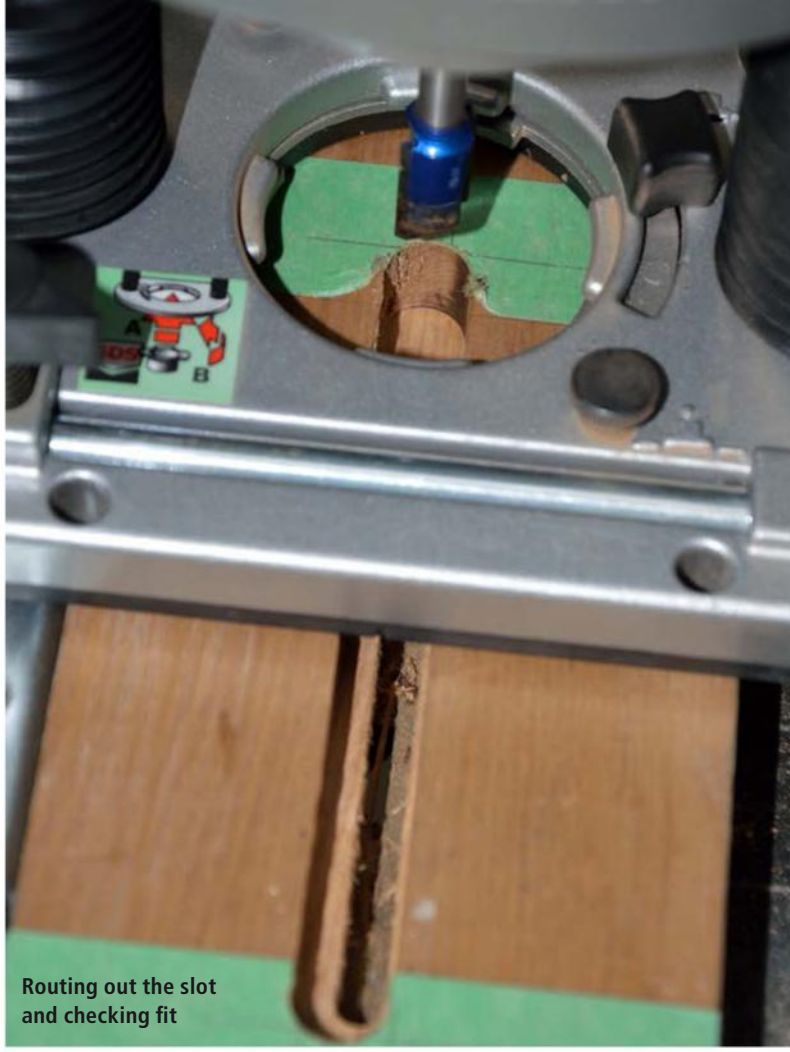
By Mark Beckett

Photographs: Mark Beckett



Marking NeoPixel slot length and position





Routing out the slot and checking fit

The basis for this article came from a visit to a night market where one of the vendors was selling small edge-lit signs. While these aren't new, the ones he had could change colour with the touch of a finger.

Luckily the designs he had were nothing worth bringing home and I did wonder about the ideal conditions (dark background and at night) required for these particular units.

Edge lighting is based on sending light into the edge of glass or acrylic where it bounces around until it escapes. You may have viewed the exit signs which hang from the roofs of buildings and are 6–8mm thick. Some restaurants and shops have a plain edge-lit panel on which they write specials or other enticing offers in bold colours.

I built a similar device when LEDs were still in their early days and not as bright as they are now. Colour-changing options were limited in those days but have become very cheap and readily available.

This article will show you several ways to make your own, and hopefully encourage some shed creativity.

> *We also need to consider that light prefers to travel in straight lines*

Limitations

Light gets lost whenever it transitions a medium (glass, acrylic, water, etc.). The medium itself will have loss, which may vary depending on the wavelength, so we have some limits on the size to consider.

We also need to consider that light prefers to travel in straight lines and, once we launch it, it tries to keep going and wants to escape the other edges.

Unless we use a laser, the light from our source will not all be at 90 degrees, and hence some of the light will bounce around between the two surfaces. This will have the effect of making the edge glow when it should be dark, so if we add more light, the contrast and the effect can be reduced.

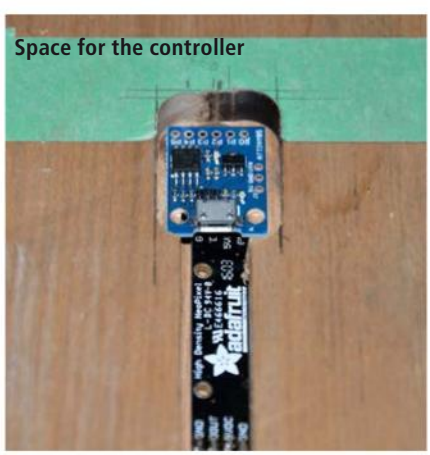
It is possible to illuminate all the edges if the size is large. This is the principle used on large LED monitors, where the backlight is on all four edges to provide an even light.

It is possible to reflect the single light source back by using reflective or white edges, but you may get a glow from the light escaping out the top and bottom surface.

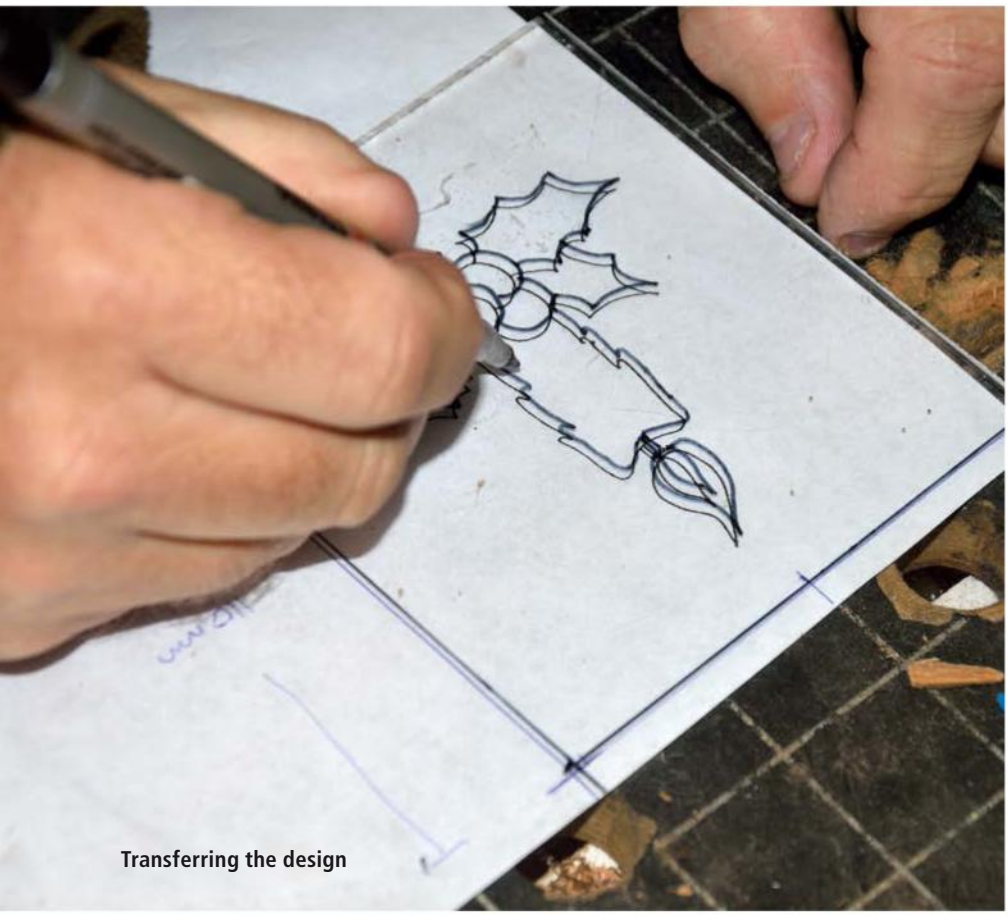
I am only going to demonstrate a single light source, but your design could use two or more.

Design

The best effect is when we interrupt the light path by etching, or digging into,



Space for the controller



Transferring the design

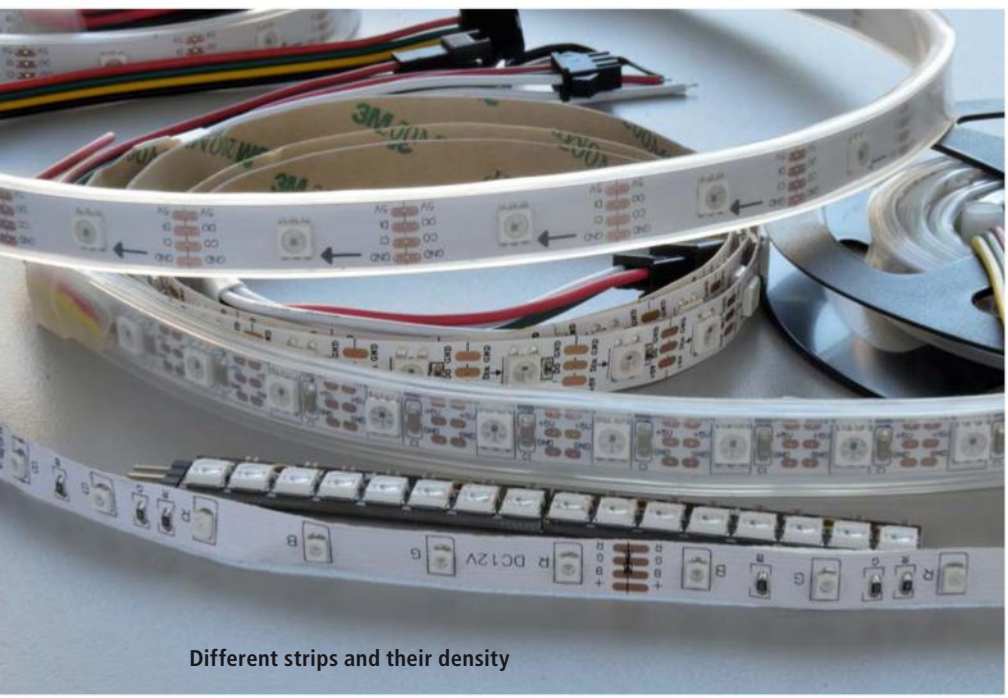
RGB strip and controller

the surface. When the light strikes this interruption, it will glow.

I have seen engraving, rotary burr, CNC routing, and sandblasting used to make a design. There are differences in each technique but rotary engraving and sandblasting are relatively cheap options that I will demonstrate.

With freehand designs, straight lines are difficult, so choose something more abstract or random and any flaws will appear to be part of the design.

The depth of the etching is hard to accurately control, which will result in a variance to the glow it provides, so once again the abstract nature will mask any issues. I have chosen a Christmas theme, and it did take a bit of searching to find something suitable without being over-complicated and difficult.



Different strips and their density

The design is etched into the rear surface, so any words would require you to flip the design.

Making the sign

It is important to keep the protective coating in place until you finish, or to provide protection from scratches.

I used some acrylic that was lying around to try the methods, and you can see nicks and marks showing up once it is illuminated. These could be polished out, but prevention is a quicker option.

Cut the piece to suit your design and light source, leaving sufficient room for it to 'breathe'.

If you are using a jigsaw, I find that a slow speed and a coarse thin wood blade works best. The friction from the acrylic tends to make it stick, so take your time and try to stop the blade from heating too much.

Smooth the edges and finish with fine sandpaper (2000 grit). To reduce the loss, I polished the edge that 'launches' the light using some automotive polishing compound, but many other products will give the mirror finish you want. Simply place a cloth on a flat surface, spread on some compound, and rub the edge along the cloth until the fine marks have gone.

Polishing the other edges will help prevent the scatter that occurs when the light strikes these imperfections. It will make the surface at the edges of the sign appear darker.

Trial-fit your sign into the base before

Using a stand for more consistency

you etch it (and then find it doesn't fit). Be sure to mark the top edge while you're there just in case.

Pattern

By now you will have worked out the size and position of your design, and you need to make it visible so you can engrave it.

I've seen videos where they taped it to the side being engraved, taped it over the clear coating and etched the other side, transferred it to the coating and used that as the pattern, so there isn't a right or wrong way.

As the photos show, the best effect is achieved when the etched surface is on the rear, so you may need to flip the design (or you'll need to use a mirror to read it correctly).

I elected to tape it on one side and etch it on the other side and, as my coating was not transparent, I had to remove it. It was hard to remove and the fact that it had been sitting around for years didn't make it easier. I resorted to pouring hot water onto both sides and letting it soak before it would come off. The glue required a solvent.

Etching the sign

Acrylic is a messy product, so doing this on the kitchen table is unlikely to be well received. The engraver or rotary tool is also likely to be noisy, and so a workshop area is probably the best place to work on this.

I purchased a Dremel 3000 for this project and I was surprised that it was bulkier than I thought and therefore a bit large for delicate work.

This was where my engraving skills are … well let's say I need some practice (a lot really). My first trial seemed fine, but as it progressed I found that I had the wrong glasses for the focal distance (excuse one), the tip wasn't the best choice (excuse two), and finally the parallax error threw me (excuse three). The example is shown only to prove that the effect works even if the skills aren't up to it.

I saw a video where they taped a light source along the edge and etched the design starting at the top and working downwards or towards the light.

I tried adding some light into the edge but found that as you turned the piece, the light was not where you needed it.

> *You really need to be careful how much material you are removing*

Fresh engraving showing the white residue

Sandblasting using a stencil

After sandblasting. Note how much media got under the stencil

With the design taped to the rear everything is white and you don't get the same depth perception, so you really need to be careful how much material you are removing.

Experimenting

I started with a reasonably small, rounded tip, but I swapped to a much smaller tip and found it much easier to control the tendency to 'bite'. I concentrated on working in one direction to ensure that I was always pulling the tip into the material. This is entirely your preference as my skills (or lack of) are clearly visible.

For the second attempt, I transferred the design to the front using a fine-tip marker pen. I used the guide to hold the engraver vertical and while it worked, it wasn't as good as I imagined and the tip kept getting a build-up that required cleaning. (I later found this to be very soft acrylic and an absolute PITA to cut with the jigsaw, which explains it.)

As the photos show, when you put the engraved side towards you, it doesn't illuminate the same as when viewed through the acrylic.

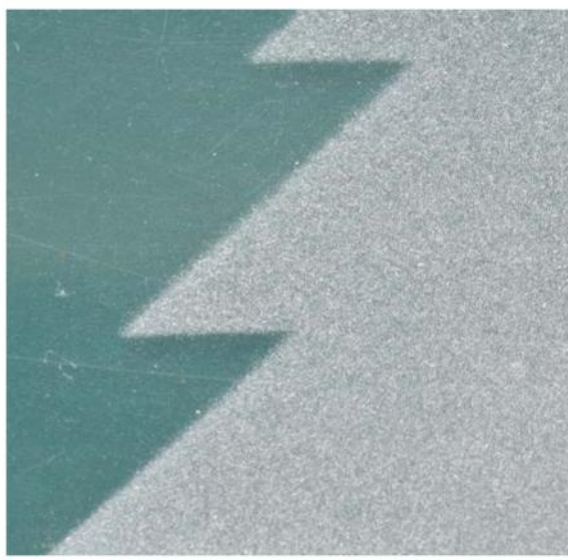
Anyone with a CNC engraver is going to have perfect signs, just like this guy does: youtube.com/watch?v=HaYUlg4ouMs.

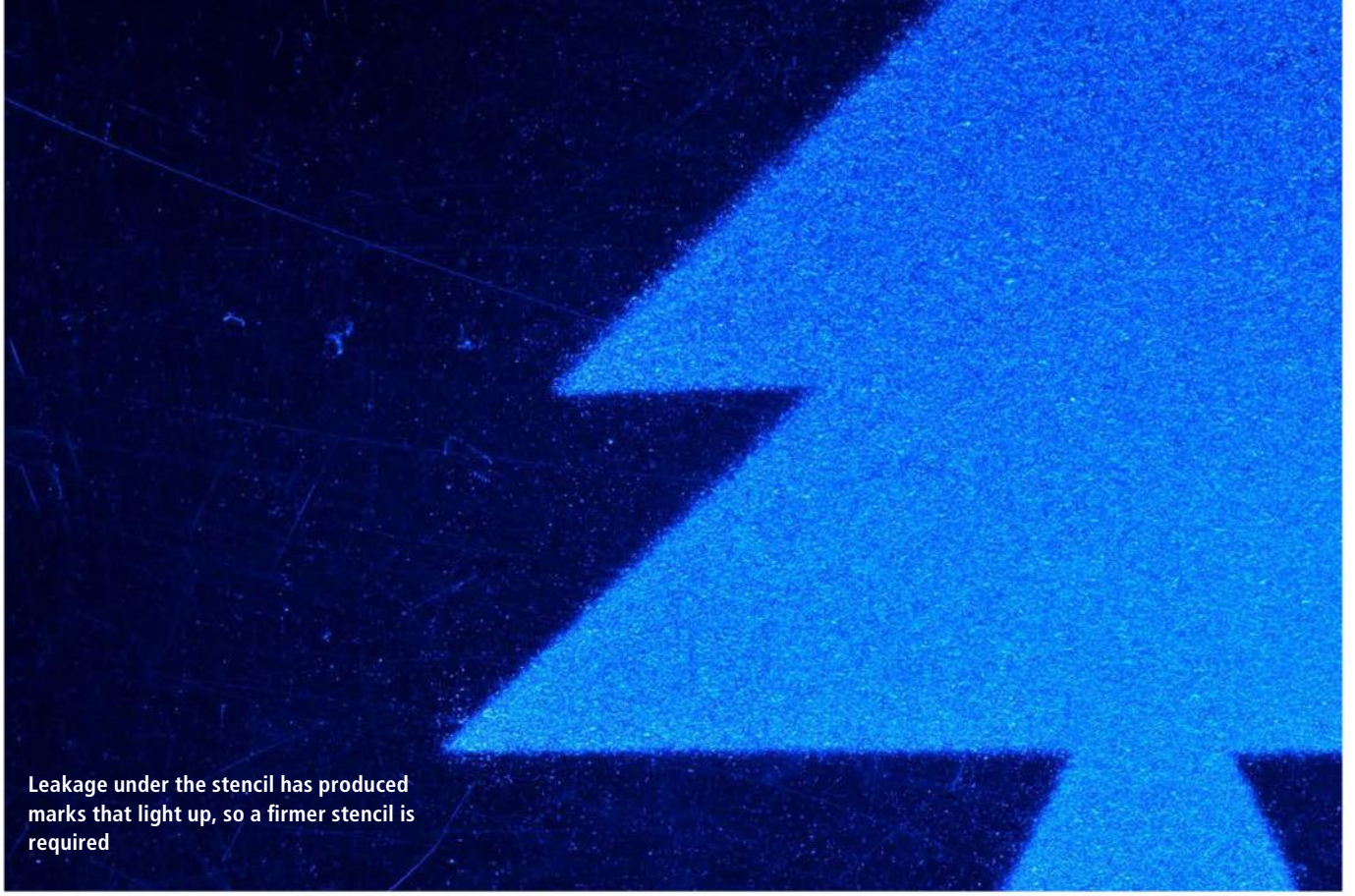
I also experimented with applying hot air to remove the white debris, and this worked well, but you need to be careful not to bubble the acrylic.

I tried sandblasting to see how effective it was. I found a packet of icing stencils for $4 at a retailer, and one of the patterns was a tree. This was carefully taped onto the sign, and three quick passes at a distance seemed enough. I was pleased that the edge definition remained and the stencil lived for another day (perhaps not for use in the kitchen though).

Stencil after one use and a wash

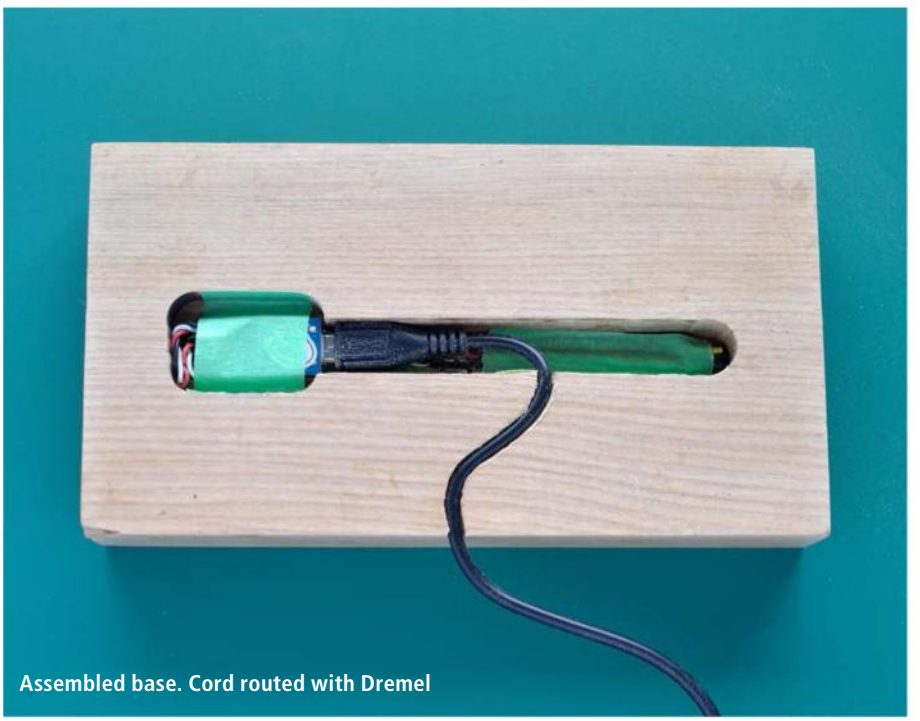
Edge definition after blasting





Leakage under the stencil has produced marks that light up, so a firmer stencil is required

> *You need to decide what strip you're going to use before deciding on the size of your sign*



Assembled base. Cord routed with Dremel

Base

As the photos show, my engraving skills are amateur, and my woodworking skills are no better, so that proves I'm an all-rounder. The acrylic needs to slot into the base and I allowed 10mm extra for this, hence the base needs to be deep enough for the LEDs, as well as the sign, and I found a piece of 30mm thick timber lying around.

I routed a 6mm slot down the middle and found that masking tape was much easier to see than a pencil line.

The NeoPixels are offset, so the slot underneath for them was adjusted to ensure the LEDs align with the acrylic. A space for the controller was cut and I left some space at each end for the Hall Effect switches.

The slot ends were squared up using a file, but you could simply round off the edge of the sign to suit.

I had a small error with the saw and chipped a corner, so this base is only to meet the deadline, and the next will include a cover on the bottom.

Once finished, the base will be cleaned up and given a coat of sealer, but you could paint it, stain it, oil it, or simply leave it unfinished.

Light source

For our signs we need the maximum number of LEDs per metre (usually 30 or 60). Ideally the sign size will match the light strip length and for the NeoPixel strips they can be cut at either 16.5mm (60 per metre) or 34mm (30 per metre).

RGB strips can only be cut every third LED, and they are sometimes separate LEDs, which means the illumination is not even.

Adafruit Industries make an eight-LED NeoPixel strip that is just less than 50mm. They are designed to be

Internals of the controller box

soldered together, giving you 16 LEDs in a 100mm strip.

The photos give you some idea of the LED density and why the NeoPixels are a good choice for small signs.

You need to decide what strip you're going to use before deciding on the size of your sign, and it always pays to have it there while you're doing the measurements.

Controller

The Asian-sourced units use an infrared (IR) remote control, so it pays to check where the IR detector is. If it isn't on a wire, you can probably de-solder and extend it.

The photo shows that the box to control the LEDs is a bit big for the base; however, the internals are quite suitable to include in the base.

My controller design is based on the parking sensor (*The Shed*, April/May 2016, Issue No. 66) and night light (*The Shed*, June/July 2016, Issue No. 67) using NeoPixels, which combine the three LEDs with a small electronic chip into a single package.

The microcontroller sends each NeoPixel the colour values and the internal chip stores and controls the LED. This approach means that each LED could be a different colour and brightness, and I used this to show a 'heartbeat' in the previous projects.

To change colour, we need to detect human interaction (often referred to as 'HMI', for human–machine interaction), and my initial approach was to use a vibration sensor. It could be hidden from view and detects whenever someone taps it.

Sadly, this turned out to be more trouble than it was worth. The sensor is a spring around a central pin that vibrates and makes contact. Unfortunately this has the effect of 'ringing' where it connects and breaks multiple times for a varying period relative to the force of the vibration. Mechanical switches do this but reasonably consistently and usually only 40mS at maximum. These took anything between 2 and 250mS to settle, and were not fit for this purpose.

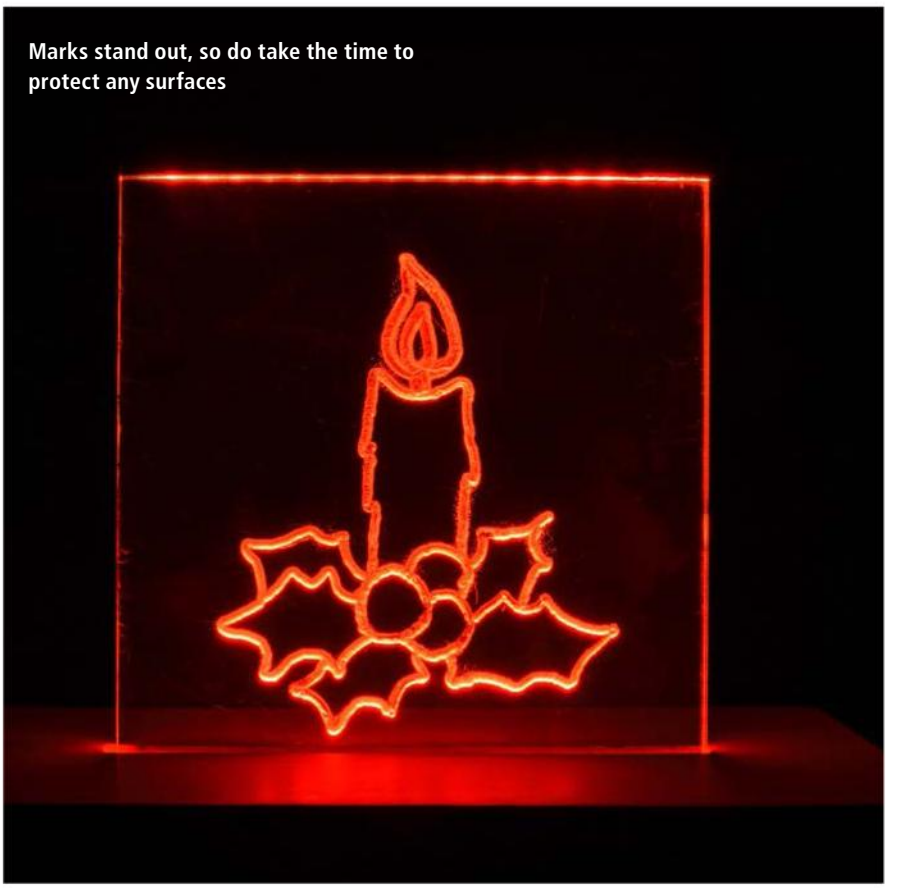
Design challenge

After quite a few days of trial, I went back to something I developed earlier.

As part of an element14 design challenge, I replaced the lamp in an illuminated beer tap with a NeoPixel ring and used two Hall Effect sensors to change the colour and brightness. You can see it here: element14.com/community/community/design-challenges/wireless-power-ii/blog/2014/08/06/the-illuminated-beer-tap.

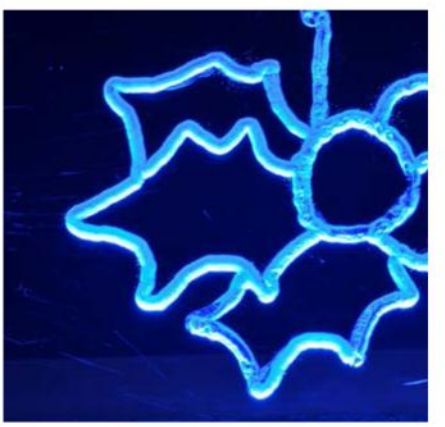
Hall Effect devices come in different

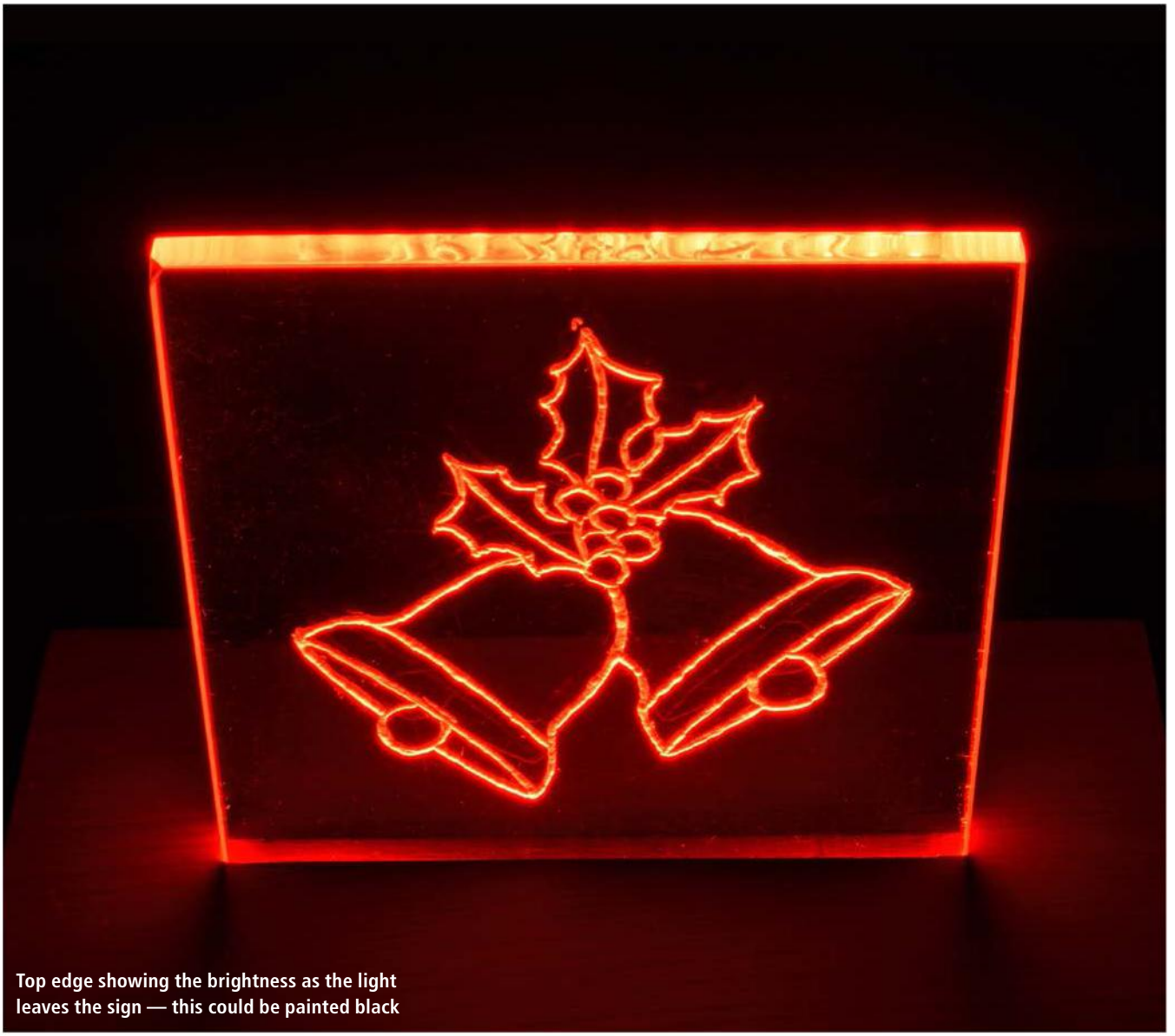
The camera highlights many more marks than the eye sees



Marks stand out, so do take the time to protect any surfaces

Below: Left side shows evenness resulting from use of the stand, but the soft acrylic did block the tip, resulting in patchy work





Top edge showing the brightness as the light leaves the sign — this could be painted black

types and the one I chose is effectively a switch that is on when the magnet is placed close. Other models latch and require the other pole to unlatch them, or will only work with the north or south pole of the magnet. With the right magnet they'll operate over a distance of 35mm, so they get hidden in the base, but you could replace them with a normal push-button.

The software detects when the switch pulls the input low and changes the brightness or colour. When the switch is released, the value is stored in the EEPROM. This means that when you repower it, your setting is recalled from memory and the sign illuminates.

The actual microcontroller only requires three I/O pins. Two for the inputs and one for the output, and once again a trusty Digispark (albeit a clone) was the best choice.

The sketch works with any Arduino-style controller but you may need a larger base, or you could extend the three wires to the LEDs out from the sign base.

Power

I elected to power this using a 5V USB charger, but your design may require something larger depending on the number of LEDs.

Each NeoPixel draws 60mA (white at full brightness), so 16 equals 960mA.

Most other strips will have a current consumption figure stated somewhere in mA per metre, and the commercial RGB strips are often 12V. If in doubt a higher capacity (mA) power supply is the side to err on.

The units I viewed were battery powered but since mine runs from 5V, a portable power bank does just fine.

Software

The sketch allows the brightness to be changed. It will ramp up and when it reaches the maximum (255) it drops to a lower value for one second then back to full bright for one second. This gives you time to remove the magnet before it starts ramping down.

The colour cycles start from green, so leaving the magnet means a continually changing sign.

Conclusion

The idea behind this article was to provide you with some ideas and stimulate experimentation. I made some interesting discoveries during my research and consumed far more time than I originally planned or wanted to.

I can see some more ideas and a small CNC router added onto a wish list.

The timing is right for you to create that bespoke Christmas gift for someone special, or to add a decoration that cannot be purchased in the stores.

Save your Back

A SIMPLE MODIFICATION REDUCES THE FRUSTRATION OF HOOKING UP TRAILERS

By Coen Smit

Photographs: Coen Smit

The finished hitch mechanism

If you are anything like me, you regularly find yourself hooking up a trailer behind the family car and, more often than not, doing it alone.

Unless you have a clear view of the trailer, or it's small enough to manhandle onto the tow ball, it can be a frustrating experience involving a mix of guesswork and getting in and out of the vehicle repeatedly until you have positioned the tow ball under the hitch. On anything but concrete, it becomes almost impossible to move a large trailer into position by relying on the jockey wheel.

When I was younger I solved the problem by using a length of pipe or wood and a good dose of brute strength to manhandle the trailer into position once I had the vehicle lined up fore and aft. However, now in my declining years, I believe that I have come up with a somewhat better idea.

The heart of the modification is a section of heavy-wall box section that slides inside another section of heavy-wall box. The inner section is in two pieces connected by a link that allows one section to move sideways and up and down relative to the other (see diagram on final page).

Tools you will need

- Angle grinder with cutting and grinding discs
- Arc welder
- Electric drill (preferably a pedestal drill) and drill bits suitable for drilling the locking pin holes, the holes for the flexible link, and for bolting the coupling to the attachment

On the front end of the inner box section is mounted the towing hitch and a short distance behind it is a locating pin, which is inserted through both box sections to hold the unit in place when towing.

Get the vehicle in position

When it comes to hooking up the trailer, back the vehicle up somewhere near the trailer coupling, remove the pin slide of the towing hitch out, and manipulate the flexible link to put the coupling onto the tow ball. At this point, lower or raise the jockey wheel so that the coupling is lined up horizontally. With one trailer wheel chocked, it is now a simple matter of reversing the vehicle until the inner box section is back in the closed position and the locating pin can be reinserted along with connecting up the trailer lights, safety chain, etc. ▸

The garden workhorse trailer before modification

Some points to remember. If your trailer is fitted with override brakes, you will need to install a snap-on hydraulic fitting that allows you to uncouple the hitch from the brake lines while you are lining up the tow hitch. Alternatively, you could incorporate a section of flexible brake line between the brake master cylinder and the trailer's steel brake lines that will allow you to extend and manoeuvre the coupling as needed.

Once you have acquired a couple of suitable pieces of box section, it's time to cut the inner one in two sections and install the link that will allow it to move in the horizontal and vertical planes. The link itself can take on one of several designs depending on what you have available. For example, a universal joint from a steering column could be adapted.

The link pictured in the photo (bottom of next page) was one I made up. The criteria for construction of the link are that it must be smaller in overall diameter than the inner box section and only allow horizontal and vertical movement. It cannot allow the front section of the slider to rotate when in the drawn-out position, as this could stop it from sliding back in (see the diagram) The link itself is only subjected to force as the unit is slid back when hooking up, so although it needs to be strong enough to withstand the force of the vehicle pushing against it, it plays no part when you are towing.

The best leeway

The length of the front section of the inner box should be adequate to install the tow hitch, leave a section to house the locating pin — which must be situated ahead of the link — as well as give you a decent range of sideways movement. The longer you make the inner back section of the slider, the less fussy you need to be when backing the car up to the trailer. Having a good length in the second part of the slider will also give you added sideways leverage if you are still a bit out of range of the tow ball.

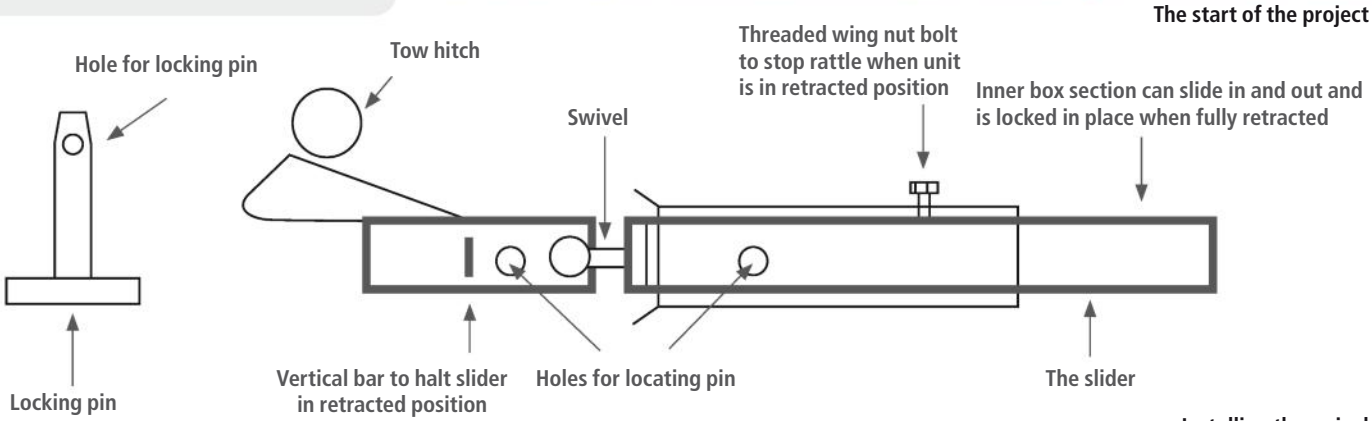
I believe that I have come up with a somewhat better idea

I leave it to you to gauge your innate backing ability as to how long to make each section. I can usually position my vehicle within 30cm or so either side of the coupling and much the same fore and aft, so I have positioned my link to give me an arc of approximately 30cm

Materials list

- Outer box section: 80mm outer-diameter (OD) square by 3mm wall thickness — 300mm long
- Inner box section: 60mm OD square by 3mm wall thickness — 750mm long
- Lockdown bolt: 15mm diameter by 30mm long
- Pin: 15mm diameter by 110mm long with crossbar 100mm long
- Top and bottom angle plates: 40mm wide by 80mm across
- Lynch pin (as used on tractor linkages)
- Square solid bar: 120x10mm (stops for the slider in the closed position)
- 120mm of 20mm inner-diameter (ID) shaft (to construct the flexible linkage)
- 180mm of 18–19mm OD round bar (to construct the flexible linkage)

The start of the project



Installing the swivel

horizontally and slightly less sideways. The rear section of the slider gives me the fore and aft leeway.

As you can see from the photos, the front of the fixed section has a small lip on the top and bottom and the front section of the slider is cut back at an angle on its sides. This helps prevent the slider from snagging the outer box section when it slides into the locked position.

A largely unintended side benefit of building a flexible hitch to your box trailer, or caravan for that matter, is that you can easily remove the hitch from the trailer and take it with you, effectively utilizing it as an anti-theft device. Anyone wanting to relieve you of your property will need to bring their own hitch and hope that its dimensions match yours!

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For more information and ordering, call in to Machinery House or visit www.machineryhouse.co.nz

WHITE OUT

From Alabaster to Sea Fog, there's no such thing as plain white. What some think of as subtle differences in tone can actually make a huge difference to the feel of a space, so get yourself acquainted with the most popular whites and neutrals for your next project — chances are that you'll need a white or neutral to help get the job done. The Resene whites and neutrals chart includes the most popular paint choices and is regularly updated to include the latest collection.

Check it out at your local Resene ColorShop or by visiting resene.co.nz.

SPINNING SPANNERS

When ratchet spanners were released, it must have felt like the best thing since sliced bread — and ever since its inception, Teng Tools has been producing the finest of examples. The latest is the 12-piece Metric Ratchet Spanner Set that includes all the popular sizes from 8-19mm. Manufactured from top-grade CR-V steel with satin finish, these bad boys are supplied in a tray for easy storage in a toolbox or workbench drawer.

Priced at $199 retail, you can pick them up on sale for $148 until January 31, 2018. Head to tengtools.co.nz/2010 to find your nearest stockist or email tengtools@tengtools.co.nz

WEAR YOUR BOOTS ON YOUR SLEEVE

Your dirty boots are allowed inside when you're wearing this Red Band T-shirt. Made from 100% combed cotton, this T-shirt is soft and strong. With a unisex fit, it's suitable for both men and women. Great for enthusiastic DIYers, or for those who just appreciate a clever design.

Priced at $24.99 and available in sizes S-3XL. Available from leading rural retailers, contact Skellerup Customer Services on 0800 475 355 or visit www.redband.co.nz

GET YOUR MIND OUT OF THE GUTTER

You can stop worrying about the cracks in your guttering and roof — Selleys Roof & Gutter Spray Seal can easily seal them with its fine mist of sealant. Covering larger areas isn't an issue, and used alongside the included mesh tape, it can seal holes up to 10mm in diameter. The spray works on usual roofing and guttering substrates, even when wet, and two hours after it's applied, it's ready for the downpour. Selleys Roof & Gutter Spray is UV and weather resistant when cured, and protects the sealed area from rust and corrosion. It is also paintable, to help keep your roof looking new.

Retail price is $19.99 — head to selleys.co.nz for more information and where to buy.

QUICK CUT

Tusk bi-metal hole saws are manufactured from eight-per-cent cobalt bi-metal for extreme toughness and long life, and feature 4/6 TPI (teeth per inch) variable pitched teeth for superior cutting action. They partner perfectly with the Tusk high-speed steel pilot drill. A full range of sizes have been carefully selected for the needs of the professional tradesman or DIY for conduit, pipe, kitchen and bathroom applications. They feature a 38mm cutting depth and are available in 14mm–152mm diameters. **Contact us now to locate your nearest stockist on (09) 414 5678 or visit www.tusktools.co.nz.**

SHED SOME LIGHT ON THE TASK

Whether you want to put it on your hard hat or simply on your head, the Coast Utility Fixed Beam HL5 headlamp is a great all-around headlamp for day-to-day use. Using Coast's Utility Beam Optics, the headlamp produces a diffused 175-lumen beam (on high) best suited for up-close work, and also features a hinged tilting head to let you adjust direction of the light beam. The beam has a distance of 56m (on high), and, weighing in at only 124g, powered by three AAA batteries, and with a runtime of up to three hours and 15 minutes, the headlamp is a real help to sheddies everywhere.

With an RRP of $49.95, the Coast HL5 Utility Fixed Beam headlamp is now available from Mitre 10, ITM, Placemakers, and other leading hardware and retail stores.

GET A GRIP

Channellock has put together the most popular tools to create the perfect gift for people who know what real work is all about.

Made in the US since 1886 by forging high-carbon steel, plumbers and engineers have enjoyed the Channellock BLUE® grip's comfort and the undercut tongue-and-groove design, which won't slip. The PermaLock® fastener eliminates nut-and-bolt failure, while the patented reinforcing edge on the channel minimizes stress breakage.

The set includes the CH420G (9.5-inch / 240mm), CH426G (6.5-inch / 165mm), and CH440G (12-inch / 300mm) straight-jaw tongue-and-groove joint pliers.

With an RRP of $120, the set is available from all good plumbing and engineering stores.

A GOOD FOUNDATION

Whether it's for your deck, retaining wall, or house, foundations aren't something you want to mess up. The Space-IT pile pad makes getting it right easy and fast. Structurally tested to handle a load of two tonnes plus on solid ground, these innovative, New Zealand–made pile pads can be relied on. They're guaranteed to save you time and effort — all you do is screw or nail the pad to the bottom of your pile or post and you're good to go. They can also be easily adapted for use with large small-end-diameter (SED) poles.

Available at most leading trade stores.
For more information, head to www.space-it.nz.

FROM HOOD TO TOE

You're probably familiar with Red Band footwear — now you can get that comfort and quality in the form of a hoodie. The Red Band Hoodie is made from premium 360gsm anti-pill pre-shrunk fabric and features a pouch pocket and full-length metal zip, and its generous fit makes it extra comfy. Black, with subtle red trim, it's a great option for keeping cosy during a hard day's work, or even for a night out.

Priced at $64.95 and available in sizes XS-3XL. Available from leading rural retailers, contact Skellerup Customer Services on 0800 475 355 or visit www.redband.co.nz

YOUR GUIDE TO

NZ'S TOP TRADE TRAINING INSTITUTES

TRAINING & EDUCATION GUIDE • 2017-2018

THE Shed

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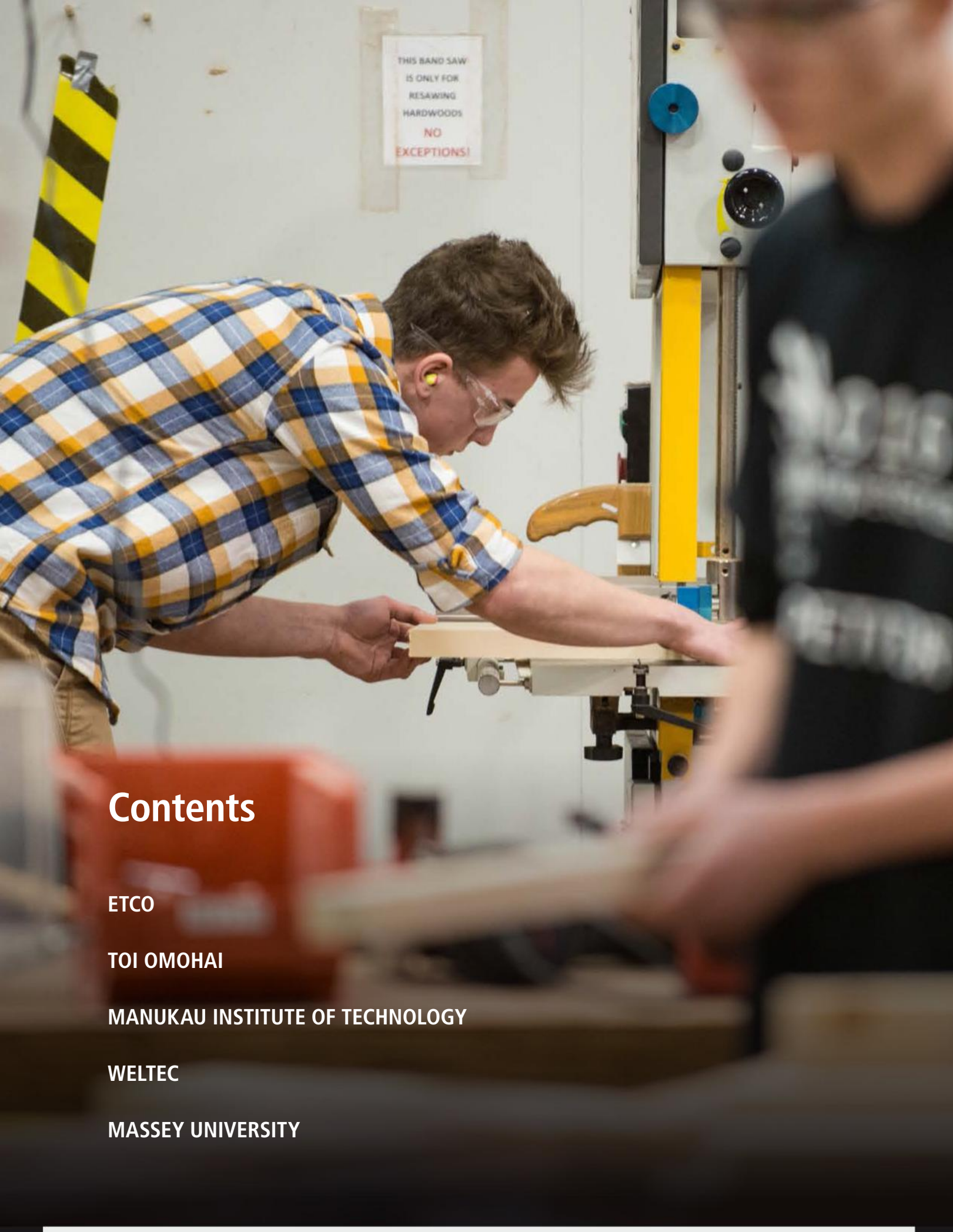


Contents

WINNIE RAWIRI-KING

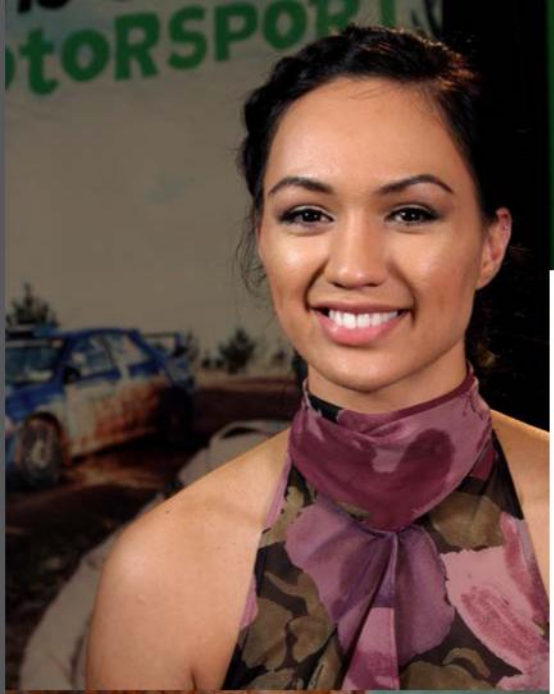
ELECTRICAL SERVICE TECHNICIAN
GOT A TRADE 2017 HERO

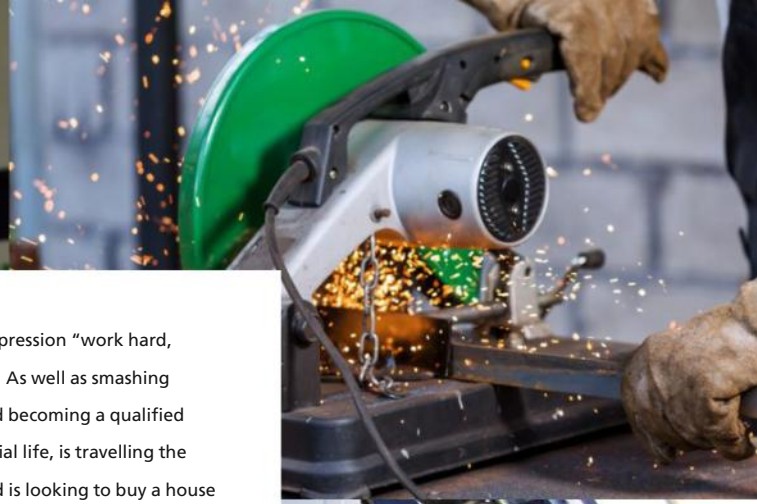
Following on from a successful 2017 Got a Trade? Got it Made! week, our Got a Trade heroes play an important role for the campaign long after the week is over. On behalf of their ITOs and their chosen industries, they shine a light on the opportunities and pathways available to young job seekers as they navigate their way through their own career decisions.

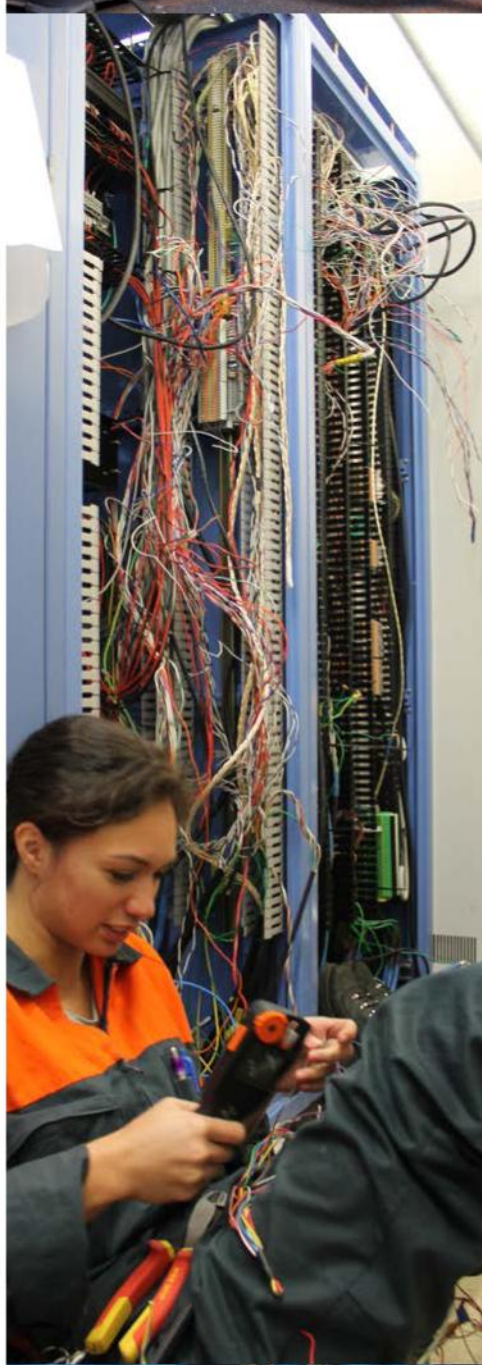
Their inspirational stories are a key part of the Got a Trade? Got it Made! campaign, real examples with real people delivering real motivation. One such example is Winnie Rawiri-King, Electrical Service Technician with Singer Electrical. Connexis, Winnie's ITO, put her forward as their 2017 hero, and she recently attended the Future Leaders Forum and the Got a Trade! Industry Training Awards in Wellington, and this is her story.

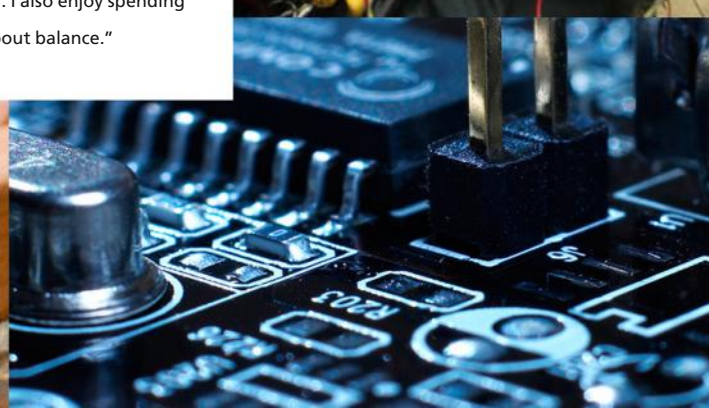
Industry Training Federation
CREATING REAL FUTURES TOGETHER

GOT A TRADE? GOT IT MADE!™









Winnie Rawiri-King takes the expression "work hard, play hard" to a whole new level! As well as smashing her electrical apprenticeship and becoming a qualified Electrician, she's got a hectic social life, is travelling the world one country at a time, and is looking to buy a house by the end of the year. And she's still only 21!

Winnie works as an Electrical Service Technician with Singer Electrical. Being a young female is relatively uncommon in the Energy Industry, but Winnie is showing the guys how it's done and has a bright future ahead of her.

Winnie is originally from the Waikato and went to Hamilton Girls high school, where she was a House Captain. "When I was at school, trades weren't even considered as an option for females," she says. "I've been back several times since I left to talk to girls in years 11 to 13 about careers in the Energy Industry. I enjoy helping to change perceptions. I'm a really girly girl, so my school friends were shocked and amazed at my career choice."

While her friends might have been surprised by her career choice, Winnie wasn't. She says, "My careers counsellor told me to figure out what drives me and what I enjoy doing – then everything else would fall into place. So I put together all of those things, and did an online quiz on the Careers New Zealand website. The top five roles that came out for me were in the Energy Industry, and the next five were in Engineering and Construction."

The combination of academic and practical learning of an apprenticeship suits Winnie's learning style. She explains, "Apprenticeships are ideal for people that want to progress a career without the requirement to take a strong academic (via university) route, as this doesn't suit everyone. Having said that, an Apprenticeship is far from the easy route, and it can be intense at times. It's important to take regular breaks from studying and to make the most of your downtime."

When she's not at work, Winnie is passionate about the outdoors. "In summer I do as many mountain walks and treks as I can, and I also play hockey for various teams, which is very social. When I feel like some alone time, I go to the gym. I also enjoy doing art, when I need a total release or don't feel like doing anything physical. I also enjoy spending time with family and friends. It's all about balance."

Etco has helped thousands of apprentices and students achieve outstanding results, comprehensive training, and employment within New Zealand's electrical industry.

"There are just so many good things about Etco"

Business owner Barry Martin explains why he's been hosting Etco apprentices since beginning back in 1991

Barry Martin, owner of Auckland-based Prolectrics, has lost count of the number of The Electrical Training Company (Etco) apprentices he's hosted — but it's more than 50, including his sons Joshua and Karl.

"There are so many good things about Etco," says Barry, who is currently hosting four apprentices, including Karl, 20. "I've been hosting apprentices since Etco began. My first was Etco apprentice number 11."

Prolectrics provides a complete electrical solution to clients in the industrial and commercial sectors. It also has a longstanding contract with the Tip Top ice-cream factory in Mount Wellington, providing electrical work on site.

"Etco is just a very well-run organisation — I don't think any trade training organisation does it better," says Barry. "A major benefit for a business is that, if needed, Etco will take an apprentice back at a week's notice.

"The training is very good and so is the pastoral care. They really keep an eye on apprentices' welfare and progress, and, if there are any problems, they do something about it. They are totally committed to apprentices completing their apprenticeships."

"An Etco apprenticeship is a tertiary education"

Electrician Joshua Martin explains why an apprenticeship through Etco provided the perfect stepping stone

Barry's son Joshua, 24, says a "few eyebrows were raised" when he told his school that he planned to do an apprenticeship — but he'd saved enough to buy his own house in Auckland at the age of 22.

"I was in the top class and the expectation is you will go to university — but an Etco apprenticeship is a tertiary education," says Joshua, who finished his apprenticeship two years ago and now works as an electrician for O-I Glass, New Zealand's only bottle and jar manufacturer.

"One of the huge benefits of the training is the broad range of experience available. I was with Prolectrics for a while but I also did other commercial and marine. That worked really well for me.

"The support from the apprentice coordinators is very good. You regularly have someone giving you guidance. My partner is doing a university degree and doesn't get that level of support from tutors.

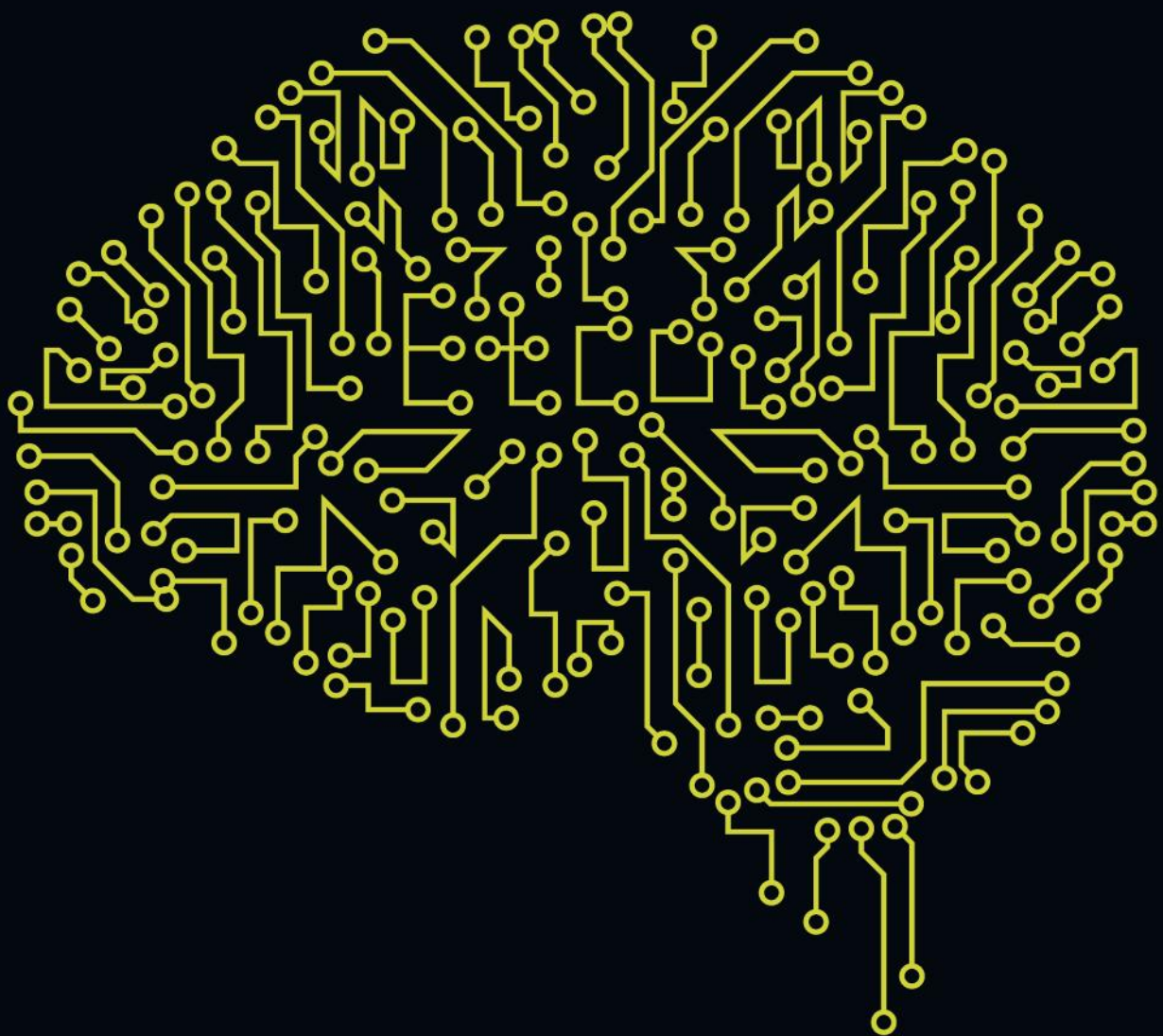
"Being paid while you learn, and [having] no student loan to pay back, was a major bonus. I'd saved my house deposit within a short time of finishing my apprenticeship. It's a well-paid, interesting career and the qualification gives you opportunities to travel — I've also spent time working in Australia and the United States."

Joshua Martin
"Former Etco apprentice

For course information
call 0800 275 3826 Mon.–Fri. or
visit etco.co.nz.

energising careers etco

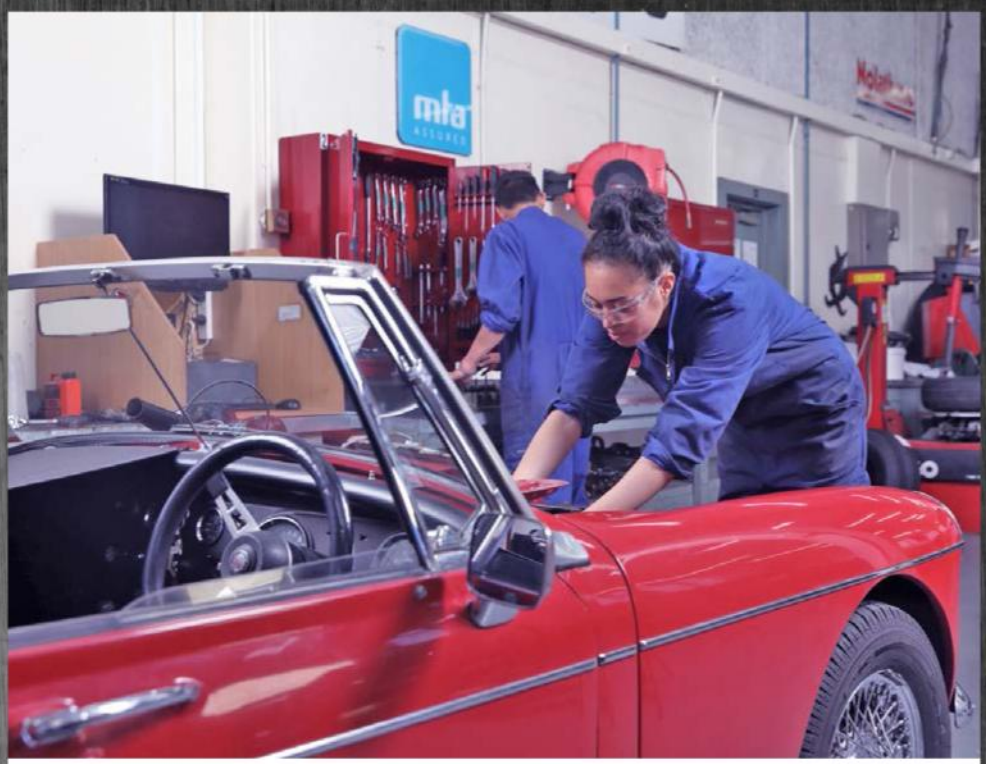
University is not the only option for smart students



Visit www.etco.co.nz to find out more about Electrical Apprenticeships, or fill out the application form and we'll call you to discuss your options.

energising careers etco

Toi Ohomai Institute of Technology is the largest tertiary provider in the Bay of Plenty and the third-largest institute of technology in New Zealand. Providing more than 150 programmes ranging from certificate to postgraduate level, they're supporting students in turning their dreams to reality.



The face of the skilled trades industry is transforming; there is more technology and innovation, better wages, rising numbers of women joining the industry, and more training offered — creating opportunities abound for the skilled tradie.

The advances in innovation and technology have completely transformed the nature of skilled trades careers, taking them to another level. The industry is so hot right now that it's screaming for more skilled tradies, making it one of New Zealand's most in-demand industries. Job opportunities are plentiful and compensation for skilled professionals promises to be especially rewarding.

Too many jobs to count — approximately 120,000 extra skilled workers across the trades are needed by 2020 — the bulk of those in building and construction. Engineering professionals, carpenters, joiners, electricians, plumbers, and construction workers are extremely sought-after, according to the Ministry of Business, Innovation and Employment's (MBIE) immediate and long-term skill shortage lists. There are some serious dollars to be made in skilled trades — the national average income for trades has risen, making it much more lucrative than the traditional 'prized' professions.

Here's a quick snapshot:

Construction workers:	Plumbers:	Carpenters:	Welders:
$49K	**$55K**	**$47,500**	**$54K**

Those who take the next step into higher level study can expect to be making some serious dollars, e.g., architects $67K and construction project managers $93,900. Experienced, self-employed plumbers can earn between $80K and $100K a year, or even more.

Building a diverse workforce: Trades are no longer seen as a man's job. Increasing numbers of women are joining the industry, creating a more diverse workforce and the industry loves it. Toi Ohomai has seen a rise in women enrolling in trades courses each year, with quantity surveying, civil engineering, welding and automotive courses being among the most popular.

Earn while you learn: Apprenticeships are a popular way to get the real-life, hands-on training you need for a trades career, and right now the industry needs people learning their trade on the job. The benefits of an apprenticeship are the 'earn while they learn' factor and being student-loan debt-free.

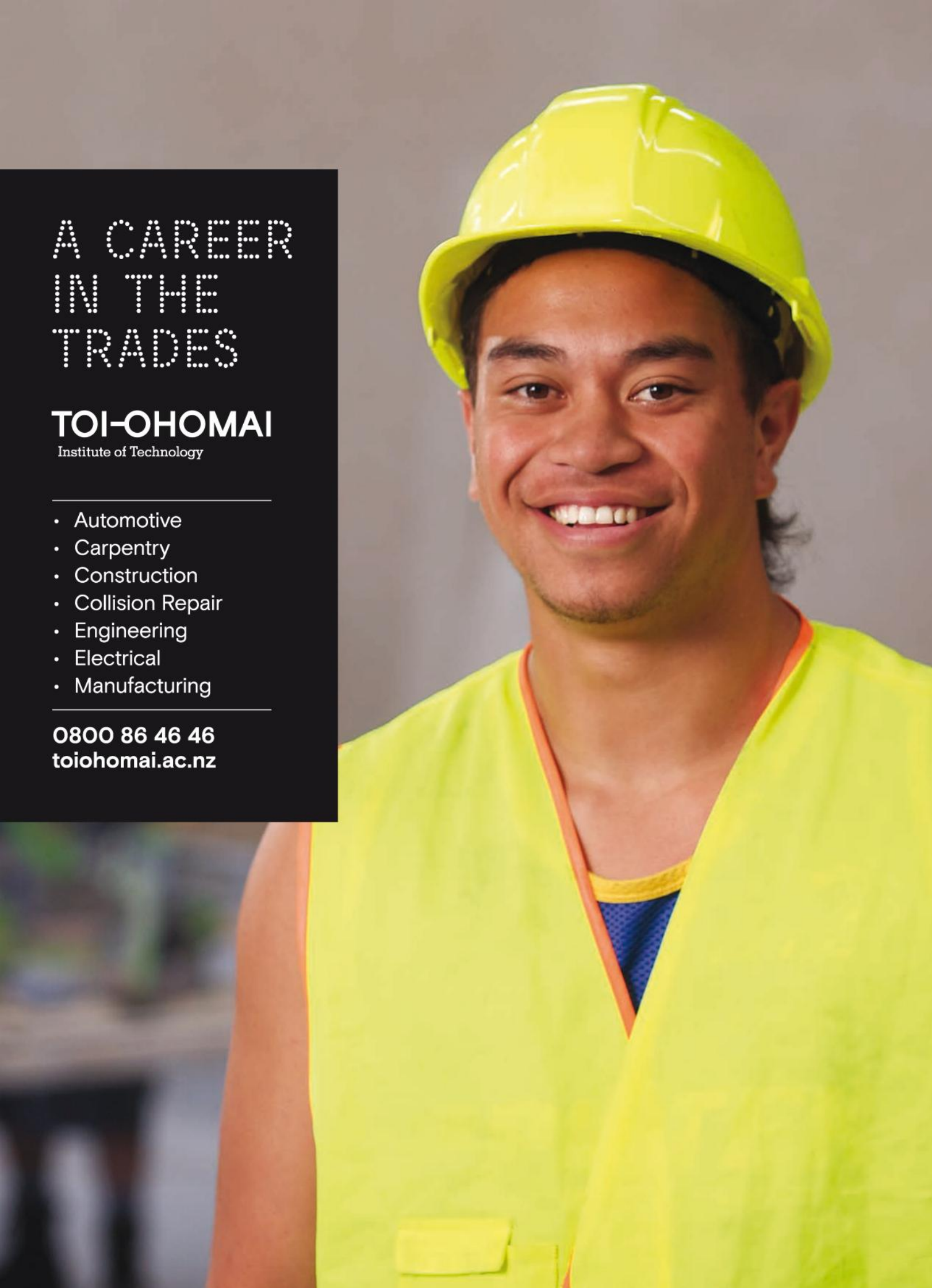
We've got what you need to start your trades career: Toi Ohomai Institute of Technology offers a variety of courses across trades vocations, from building and construction to automotive, electrical, and engineering.

"We recognize there's a skill shortage across the trades, so there is certainly a future for our graduates in this industry who are being snapped up by employers," says Brian Dillon, Head of Carpentry, Construction and Trades at Toi Ohomai. "Being successful in a trade requires hard work, creativity, and problem-solving skills and we provide our students with the skills they need to start their career in their chosen trade".

So if you are serious about a future in the skilled trades, get started with your career pathway in trades today.

To find out more, visit toiohomai.ac.nz.

TOI-OHOMAI
Institute of Technology



A CAREER IN THE TRADES

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- Carpentry
- Construction
- Collision Repair
- Engineering
- Electrical
- Manufacturing

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At Manukau Institute of Technology we've been producing quality graduates in South Auckland since 1970. Our 2016 NZQA Category 1 rating recognizes our commitment to achieving excellent results for our local communities and employers.

The Faculty of Engineering and Trades strives to work closely with employers, ITOs (Industry Training Organisations) and industry bodies. This helps to ensure we produce graduates who are apprenticeship- and work-ready with the practical skills and knowledge that industry needs.

Our seven schools cover a breadth of trades and engineering professions, including:

School of Automotive and Vehicle Technology Trades

School of Building and Civil Construction Trades

School of Electrical Trades

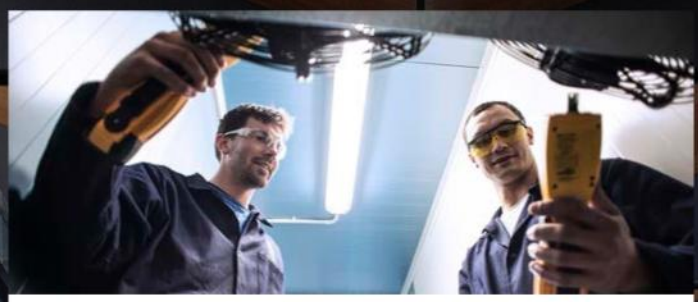
School of General Engineering Trades

School of Professional Engineering

School of Refrigeration and Air Conditioning

School of Plumbing, Gasfitting and Drainlaying

We're committed to developing partnerships with industry, and currently we have the following initiatives that help link us with our community and local industries.



POST-APPRENTICESHIP / GRADUATE DEVELOPMENT
Ongoing training such as Supervision and Main Contract Supervision are available.Delivered during the evenings to cater to the in-work learner.

GRADUATE RECRUITMENT
Access our graduates for your industry requirements
Available for Internships and cadetships you may have.
Industry training programmes in partnership with ITOs
Delivering apprentice-ready graduates.

SHORT COURSES AND CUSTOMIZED TRAINING
Professional development and licensing across a range of trades including:
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Electrical Engineering and Trades
Professional Engineering
Maintenance and Reliability Training
Plumbing, Gasfitting and Drainlaying.

PART-TIME, CASUAL OR SHORT-TERM WORK-PLACEMENT
We offer short term work placements or part-time recruitment of our students. Companies have used our students to work on specific projects they haven't been resourced to complete, or to help with business-as-usual tasks during busy periods.

INDUSTRY ADVISORY GROUPS
Be part of our industry advisory to inform what we do and how we do it. Whether you're a one-person-band, SME or large corporation, we'd like to hear from you.

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You're welcome to come and tour our faculty
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We can guide your apprentices through our National Certificate in Carpentry (Level 4) and if they already have substantial on-the-job skills our Recognition of Prior Learning programme may reduce the length of study.

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MANUKAU INSTITUTE OF TECHNOLOGY
Te Whare Takiura o Manukau

Michael Thomson, a recent graduate of WelTec's Bachelor of Engineering Technology, explains how the hands-on problem-solving-based degree ensured he was work-ready.

Michael loves working on engineering projects. He has built his own drone that goes from zero to 140kph in under a second. "I reckon I could get 160kph out of it. I just need to tinker with it," says the WelTec engineering student, who built the drone from scratch.

A few years ago, he made headlines locally and globally appearing on Three News and the front page of *The Wall Street Journal* for using his drone to muster sheep.

"It's a pretty quick way of mustering," says Michael. "I like trying new things and have always loved doing little projects like that. I built my own 3D printer, for instance. I like machines and making machines do a task."

Michael is studying engineering at WelTec — last year, he completed the New Zealand Diploma in Engineering and is now doing the Bachelor of Engineering Technology — and also works at the Whittaker's chocolate factory in Porirua.

"Lots of things I learnt went straight into what I do at work, especially programmable-logic-controller (PLC) programming and working on control systems."

In the degree, which he'll complete in two years rather than three, he's majoring in electrical engineering, learning about areas such as automation, systems, controls, and programming.

"I'm doing the degree because it opens up even more opportunities," he says.

Michael started working at Whittaker's at the beginning of the year, one day a week, and he works there full-time in the holidays.

"I do a bit of everything there. I've got lots of little projects going that keep each day interesting, plus it smells great," he says.

"It's quite good to get the industry experience while you're studying. Whittaker's has told me to put study first and I take time off for exams. I couldn't ask for a better employer."

His supervisor Herbert Aregger says Michael has a real understanding of how things work.

"We're very lucky to have him. His technical knowledge is quite amazing for a 25-year-old. He works on little projects here, does general maintenance, a bit of fabricating, bit of welding, does electrical work, and he's pretty clued up with programming, too," says Herbert.

"Whatever he learns at WelTec, he can put into practice here. One recent project was installing a new ink printer onto one of the machines to print best-before dates on the chocolate. He did the mechanical side of things and programmed the machine."

"I went to uni for two years, but I'm more of a hands-on person than a pen-and-paper person."

Michael Thomson

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WelTec
Te Whare Wānanga o te Awakairangi

Recent engineering graduate Ryan Thomas used his skills to help Emirates Team New Zealand take back the America's Cup.

"I sat in the chase boat analysing every move the Team New Zealand boat made and worked with the team to ensure they were as fast as possible."

Ryan Thomas hadn't even written a line of code before studying at Massey University, and yet in a few short years he would be helping Emirates Team New Zealand take back the America's Cup.

The team's catamaran, remarkable for its use of hydrofoiling and, of course, its unique pedal-powered system, required a considerable amount of technical tweaking from a computational perspective, which meant the inclusion of Ryan. His job was to analyse the boat on the water from a chase boat and later work with the team to make adjustments that would ensure the boat was performing at its peak.

"On a regular boat the sailors know what they want the boat to do, and when something isn't right they can make the changes to fix it themselves — there's no code or computers. Our boat was a lot more complicated than most, so my job was to help them get what they wanted out of it, within its capability and what it could actually do.

"It's really satisfying. You see a problem, you make a change, and then you see whether it works or not straight away. It was a fast-paced environment, solving problems on your feet," Ryan says.

Being part of the winning team was a great experience for the boy from Whakarongo Primary School who enjoyed mathematics and later physics at Palmerston North Boy's High School. "I was always interested in subjects that are key to engineering, but I hadn't even written a line of code before I took up engineering at Massey," says Ryan. "I literally got my first introduction in a first-year paper. That's all changing now though — I was asked to give a talk at my old primary school, and the kids told me that they were learning code already. That's so cool at such a young age."

Ryan learnt about engineering and software at Massey and extended his study, doing a master's degree that gave his CV a boost. He helped on projects including developing a machine to move hospital beds, an automated pollen-recognition system, and a robot helper for the elderly. His first job was in Hamilton, programming and automating machinery for factories. "After I had only done a few machines by myself, the company sent me to India to help a start-up that was connected to the company. It was very much sink or swim, but it was a great experience. You just get on with it and learn as you go. I was given pretty big jobs right from the get-go, and what I learnt at Massey really helped."

But how he got from the factory floor to the sailboat is a shining advertisement for social media, as Team New Zealand found Ryan through his LinkedIn profile.

"It was a little bit of luck really. My company had seen the potential in a hardware platform, that just so happened to be the same one that Team New Zealand were thinking of using. I had put it on my LinkedIn profile and they reached out to me from there. I almost didn't go, as I had other plans to travel, but I had a bit of a think and I realized that this wasn't the kind of opportunity I could say no to."

For 18 months, Ryan was part of the crew working to bring back the cup for New Zealand, pulling the long nights in the shed and early morning trips out into the water. He says, "If you like solving problems, engineering is a great career."

For more information visit massey.ac.nz/engineering

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UNIVERSITY OF NEW ZEALAND

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STUDY IN 2018
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NO BOUNDS

TRAINING & EDUCATION GUIDE 2017–2018

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Getting results

By Bob Browning
Photographs: Bob Browning

AN ADJUSTABLE ALUMINIUM FENCE PROVES TO BE AN EXCELLENT ADDITION TO A DRILL PRESS

A table with adjustable aluminium fence

Table showing added timber strip with cutout for drill press column

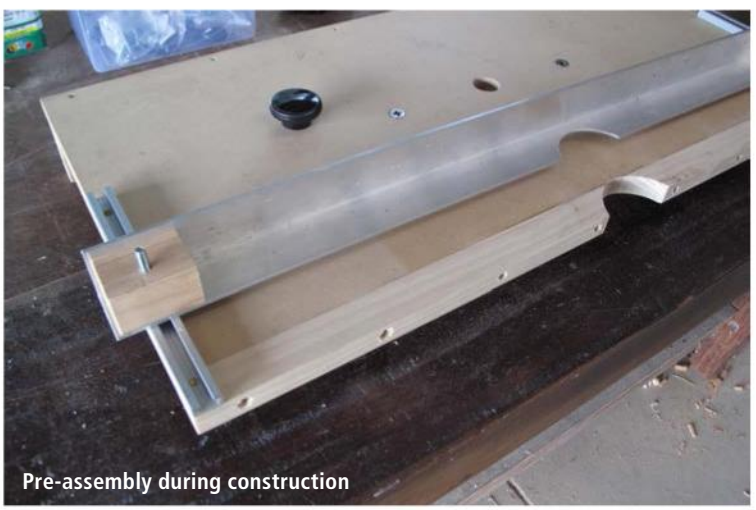
I have for some time had an auxiliary table that attaches to the steel table on my drill press. This was a piece of MDF, very basic, with no fence. An article I read in a book on jigs and fixtures led me to upgrade this table by fitting it with an adjustable fence.

The table I had was 18mm MDF. I planned to use this as a base, fit T-track to it to take the fence, and fit a piece of 10mm MDF to bring the working surface level with the top of the T-track. It appears to be standard practice to make fences for fixtures from MDF. I saw some advantages in using a metal section instead. I had a length of 40x40x3mm aluminium angle on hand and used this for the fence.

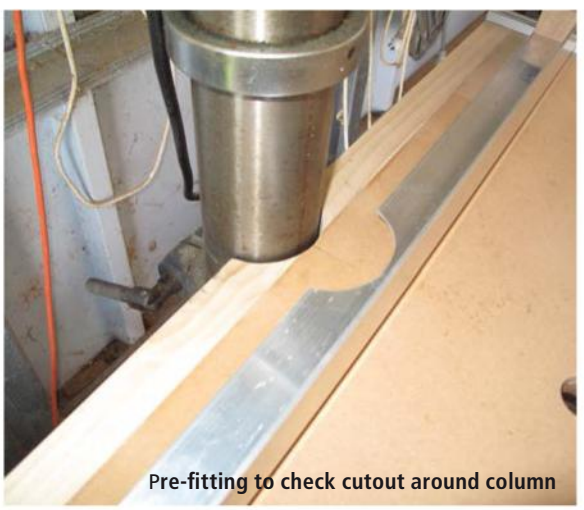
Construction

My original table stopped at the front of the drill-press column. To extend the table's depth to enable it to carry the fence right back, I dowelled and glued a piece of solid timber 30mm wide to the rear edge, then cut a scallop 30mm deep to fit around the drill-press column, leaving a clearance of 2mm so as to have some play when fitting the table to the drill press. This gave a table size of 750x375mm, which has proven to be a useful size.

I cut a length of aluminium angle 40mm longer than the table length and shaped it to fit around the column of the drill press, using my jigsaw with a metal-cutting blade. I made this cut-out 25mm deep, which left 15mm of the angle remaining at the centre. In choosing these dimensions I was trying to achieve a balance between gaining the best maximum distance from



Pre-assembly during construction



Pre-fitting to check cutout around column


Original steel table


Lugs and bolts to attach table to steel table


End assembly

the centre line of the chuck to the face of the fence while leaving sufficient material in the angle for it to be strong enough in use. I have been using the fence for several years now and it has proven to be sufficiently strong for the type of work I normally do, which is moderate diameter drilling of timber.

I then cut two pieces of T-track to length and screwed them to the top, adjacent to the outer edges of the table.

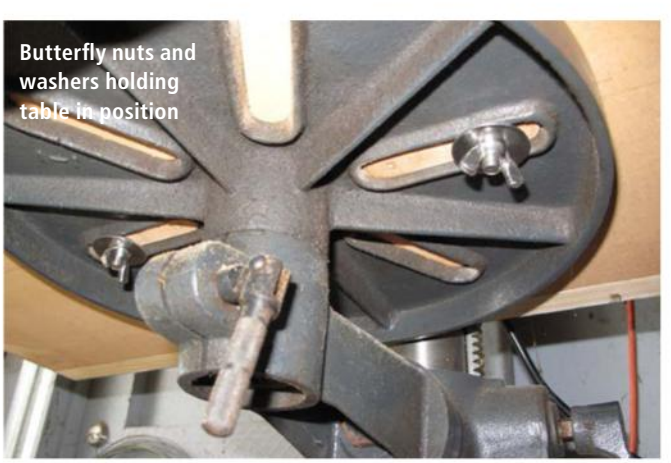
T-tracks

This position was a considered choice. The book that I read on jigs and fixtures showed all T-tracks inboard from the edge, usually 100–150mm. It seemed more logical to locate these as far as possible from the source of drilling waste — that is, the chuck — to minimise the possibility of waste accumulating in the T-tracks and jamming the fence. It did occur to me that inboard tracks were more protected from accidental damage but I thought the risk of damage small, and this has proven to be the case.

T-bolts, with extended heads, slot into the T-track and are able to slide along it. The bolts are vertical and the threaded sections pass through holes in the horizontal leg of the aluminium angle. Clamping knobs screw onto the bolts and, when tightened, clamp the fence to the top of the table, holding it in position.

It is necessary to extend the fence past the ends of the table to allow reasonable edge clearance for the holes drilled in it. I made these overhangs 20mm, which is more than required for edge clearance, but I thought these overhangs would form convenient handles to use when adjusting the fence, and they do.

The holes in the fence must be located sufficiently far back so that the front edge of the knob is behind the face of


Butterfly nuts and washers holding table in position


End detail showing washer glued to underside of fence

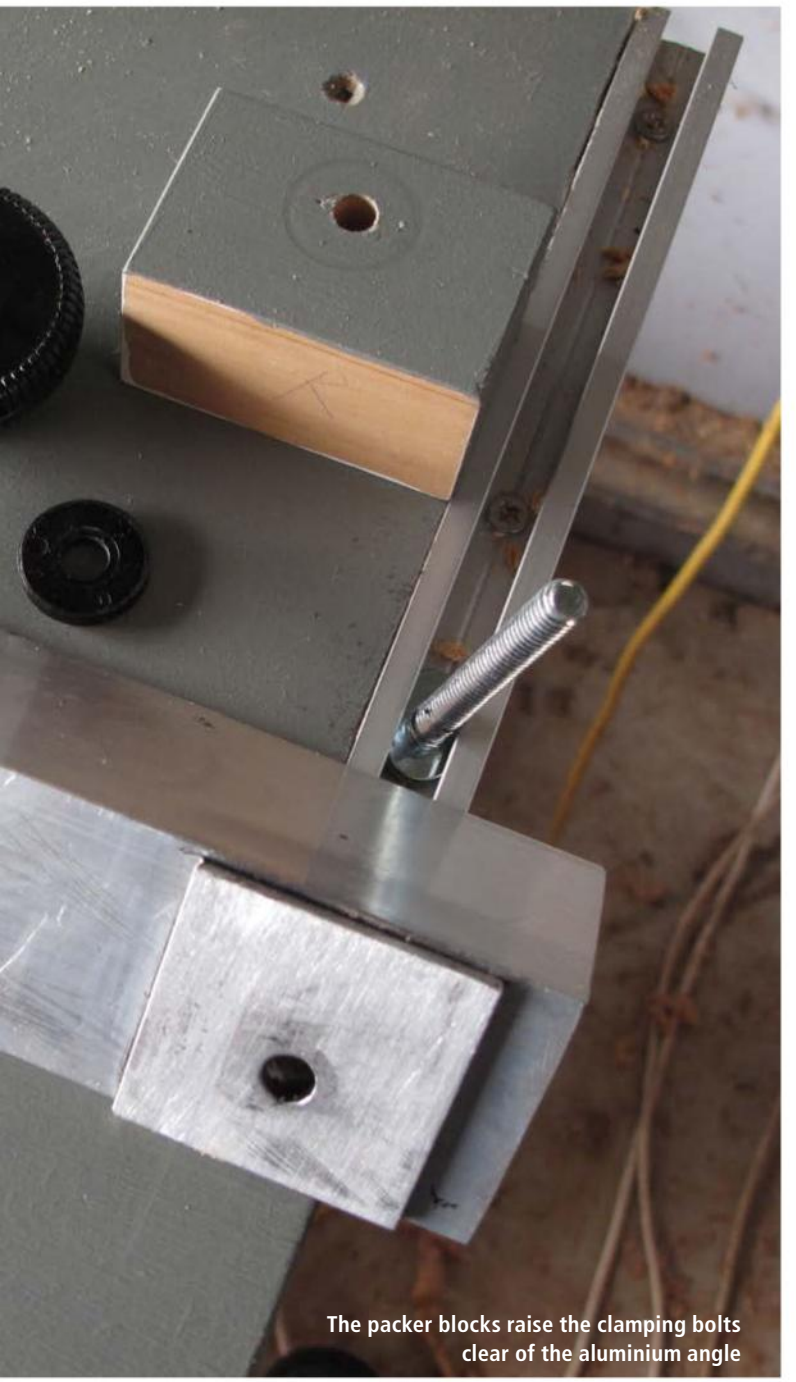
To raise the clamping knobs sufficiently clear of the aluminium angle so that fingers would not be injured when turning them, I used packer blocks of timber

the fence. I used 44mm diameter knobs and drilled the holes 24mm back from the front face of the aluminium angle, so any piece placed against the fence for drilling will be 2mm clear of the knobs.

To raise the clamping knobs sufficiently clear of the aluminium angle so that fingers would not be injured when turning them, I used packer blocks of timber, and drilled a hole through each to take the bolt that runs from the T-track to the knob. When assembling, I placed a nylon washer between the packer and the knob.

Firmly positioned

I then marked and cut the 10mm MDF to fit around the drill-press column and the T-tracks. I also drilled three holes through it. The largest of these lines up with the hole through the centre of the steel table and is the same diameter. The other two give screwdriver access to the slotted heads of the holding-down bolts, which pass through the 18mm MDF and the slots in the steel table, where lugs, and butterfly nuts with large washers, hold the auxiliary table firmly positioned on the steel table. ▸



The packer blocks raise the clamping bolts clear of the aluminium angle

Clearance between knob and workpiece

Washer to raise fence above table

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Above: chuck key holder
Below: cutout to allow handle to rotate 360 degrees

I made the lugs from 5mm MDF. They are starting to show signs of wear and tear from repeated installation onto the steel table. Using hardwood for these would be an improvement.

Before attaching the 10mm MDF, I fitted a 65x18mm stiffening rib to the underside of the 18mm MDF, 5mm back from the front edge.

I screwed the 10mm top to the 18mm MDF, painted the table to waterproof it, then assembled the fence and attached the completed table to the drill press.

When first fitted to the steel table of the drill press, the rear bottom edge of the auxiliary table obstructed the height-adjusting handle and prevented it from turning a full circle. I chiselled a stopped bevel a little wider than the handle and about 6mm deep that allowed the handle to pass and turn full circle.

A further modification was to add a bracket to the end of the table to hold the chuck key.

Waste

It is customary when fabricating a fence from MDF to make a small rebate or bevel along the bottom front edge, so that waste lying on the table will not stop the workpiece from being pushed back hard against the fence. It is not possible to do this with a light aluminium fence.

For some months I simply kept a brush handy to brush waste from the top of the table as necessary. I then had the idea of raising the fence above the table by placing a couple of fender washers (38mm diameter for a 6.35mm [1/4 inch] bolt) under each end of the fence. I have taken this a step further and glued a 38x38x3mm purpose-made aluminium washer to the underside of each end of the fence, with the bolts passing through them. The front edges of these have been kept back from the face of the fence.

The auxiliary table with adjustable fence in action

Drilling waste pushed under fence

The 3mm gap under the fence works well for the type of drilling I normally do. It is better than a rebate on an MDF fence in that waste can pass under the fence rather than bank up against it. But it is still necessary to sweep down the table from time to time.

The auxiliary table with adjustable fence is an excellent addition to the drill press. I find it significantly safer to use than the original steel table when drilling timber and worth having for that reason alone. I drill more accurately with it and it is considerably faster for repetitive drilling.

The aluminium fence on mine works well.

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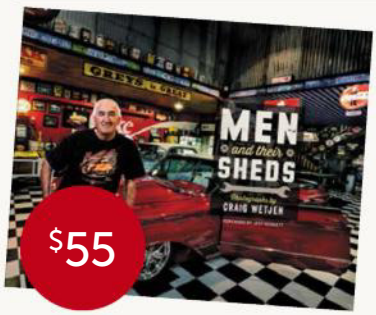

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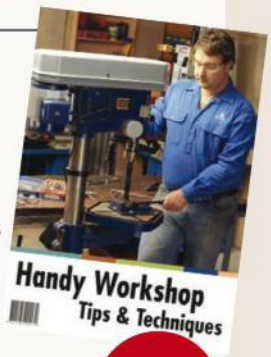

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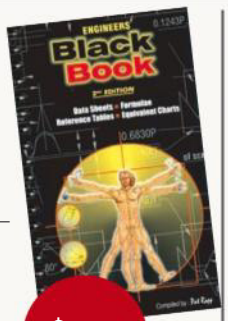

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THE RAMBLINGS OF A BUG IMPAIRED BRAIN

By Jim Hopkins

Curses! The dreaded lurgy has struck. Not exactly what spring and September are meant to bring, but it's happened anyway. For the first time in a long time, some vile little bug(ger) has invaded the chest area and mounted a major offensive down there, causing all sorts of grievous bodily harms. Dripping nose, watery eyes, coughing, sneezing, freezing, wheezing, and a very unpleasant shortage of breath. Damn scary it is and not helped, it must be said, by too many cigarettes over the years. Let that be a lesson to you, young sheddies.

But the worst malfunction of all, at least as far as delivering a *Shed* column is concerned, has happened up in the grey-matter department. If it were a clock, it would be running slow. If it were a car, it would be firing on three cylinders — at best. If it were a camera, it would be out of focus.

As it has been. Fever and fatigue have fogged its lens. And whenever the bleary brain does look for some inspiration, it tends to be irresistibly drawn to the high dramas of the election campaign and what effect all those leadership upheavals in August could finally have. Seriously, guv; who'd a thunk it? In 21 astonishing days we saw Andrew belittled, Metiria de-cycled, Dunne done and dusted, Jacinda looking like she's on the next train to Clark'sville, and Bill watching what seemed like a dead cert turn into a dead loss.

Addictive stuff for an ex–current affairs journo (who hasn't quite quit that habit, either) but of no use to you guys, who won't be reading this for another month, by which time the polls will have closed and we'll all know exactly what's happened. At that point, September's hot topic will be October's cold case and you'll be wanting a bit of shed stuff to cheer you up, brighten your day, and lighten your mood.

Which may be hard to do if you're unlucky enough to own a wool shed or a hay shed or a cow shed or an implement shed because owning any of those means that you're a farmer and that means it's all your fault. You're to blame for everything and you deserve to be taxed 'till your eyeballs bleed and that's basically what our politicians think about this country's most important, most innovative, and most underrated industry.

We're a confused and divided bunch, no question. On one hand, heartland New Zealand proudly funds a statue to acknowledge and salute the resilience and toughness of a legend like Pinetree — marvelling at the fact that he and Earle Kirton actually hitch-hiked from Te Kuiti to Auckland to play in a test. On the other hand, we've got an urban elite quite happy to kick the crap out of an industry that underpins our First World status by delivering high-quality protein and nutrition to 100 million people worldwide and generating 70 per cent of all the moolah we earn overseas.

Dismiss this as the rambling of a bug-impaired brain if you will. Perhaps the lurgy has triggered a surge of pessimism. But then you think of all those lovingly restored traction engines and tractors, which once were cutting-edge kit for an infant nation building its economic base. And you think of the tyranny of distance and how our nation's builders had to wait six months for spare parts and replacements. Practical skills were essential. So was resourcefulness, and innovation — hence the Hamilton jet and, arguably, through that tradition, world-beating designs like our America's Cup cat.

Those skills, that resourcefulness, and innovation, have all needed an incubator. And it's been there from the start. The shed is our true laboratory, factory, lifeboat, and leisure centre. Along with farming, it's shaped us, sustained us, and saved us. It would be nice to think our political class understood how that legacy is still the bedrock of our success and cared more about hands-on than hands-out. Trouble is, and blame it on the lurgy if you must, that right now I just can't see it.

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- Includes battery charger

Order Code: G090E
$285
SAVE $25.50

WDV-8
Wet & Dry Vacuum Cleaner

- 2 x 1200W = 2400W 240V motors
- Portable on wheels
- 80L stainless steel tank
- Include: brush, crevice tool, wet & dry floor nozzle

Order Code: V508
$430
SAVE $53

HGP-22
Hydraulic Gear Puller Kit

- Internal & external
- 10 tonne ram
- 22 piece set

Order Code: P011
$320
SAVE $57.20

RPCV130
Carvers Vice

- 360° rotation
- Pivoting support arm
- 4" clamp capacity
- Cast iron clamp

Order Code: R9702
$99
SAVE $39

M-16
Chisel Morticer

- 16mm chisel capacity
- 160 x 46mm adjust. table
- 120mm head stroke
- 0.37kW, 240V motor

Order Code: W347
$399
SAVE $58.70

L-612A
Belt & Disc Linisher Sander

- 150 x 1220mm belt
- 305mm dia. sanding disc
- Tilting table to belt & disc
- 1.5hp, 240V motor

Order Code: L109
$895
SAVE $59.50

WT4015MP
TIG-MMA-Plasma Multi-Function Inverter Welder

- IGBT 100KHz Inverter Technology
- Duty cycle 40°C TIG150A@30%, 82A@100% MMA150A@25%, 82A@100% Plasma40A@30%, 21A@100%
- Includes 5m plasma torch, 4m TIG torch, 3m earth lead, 3m MMA lead, Argon regulator

Order Code: W1124D
$1,050
SAVE $93.10

PROMAX 350
Auto Darken Welding Helmet

- Application: MIG, TIG, arc & grinding
- 9 ~ 13 adjustable shade
- 4 arc activation sensors
- 100 x 53mm ultra clear vision
- Switching speed 0.00003 sec

Order Code: W002
$120
SAVE $34.10

DC-3
Dust Collector

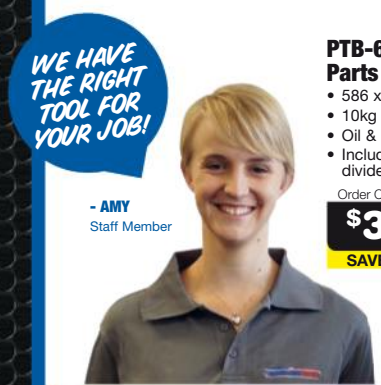
- 1200 cfm - LPHV system
- Portable on wheels
- 5 micron fine filter bag
- 1.5kW/2hp, 240V

Order Code: W394
$399
SAVE $38

DX4000
Dust Collector

- 224cfm HPLV system
- 80 litre tank
- 0.5 micron filter
- 2 x 1kW/1.3hp 240V

Order Code: R875
$860
SAVE $106



PTB-60
Parts Bin

- 586 x 222 x 937mm
- 10kg load per bin
- Oil & impact resistant
- Includes 60 bins & dividers

Order Code: T7953
$399
SAVE $72.50

SR-36
Mobile Storage Bin Rack

- 36 plastic bins
- 880 x 410 x 1705mm
- 4 x swivel wheels

Order Code: S021
$480
SAVE $60.50

Plana 3.1c
Planer & Thicknesser Combination

- 250mm planer width
- 1050mm planer table
- 250 x 180mm thicknesser
- 8m/min. thicknesser feed
- 100mm dust collector port
- 3hp, 240V (15 amp)

Order Code: W851
$1,999
SAVE $266.50

UNIQUE PROMO CODE

SHED210

ONLINE OR INSTORE!

VIEW AND PURCHASE THESE ITEMS ONLINE AT www.machineryhouse.co.nz/SHED210

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Specifications & prices are subject to change without notification. All prices include GST and valid until 31-10-17

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Nothing's tougher on timber than blazing sun and torrential rain. Intergrain UltraDeck's Hydroguard formulation protects against UV, abrasion and the extremes of weather. Visit www.intergrain.co.nz

Above image features Intergrain UltraDeck at Split Apple Resort, New Zealand.