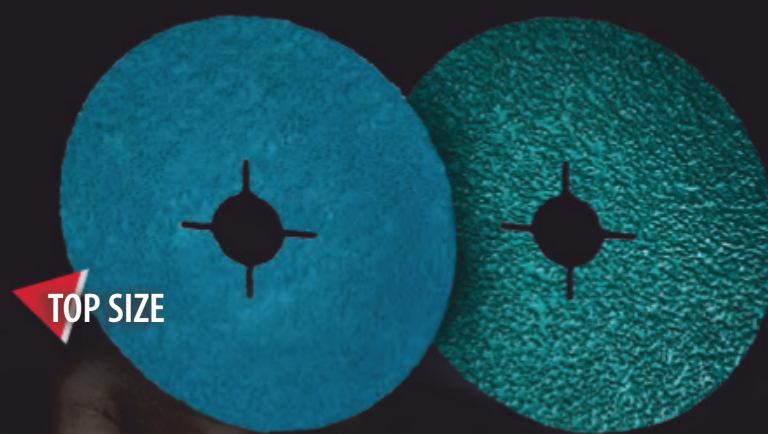


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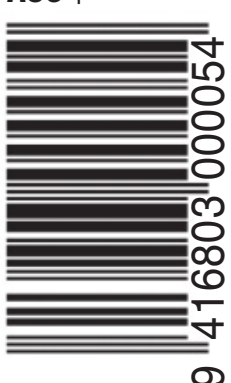
ISSUE 88

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Fishing in the moonlight

Come on, who doesn't love a tractor?

Especially a classic tractor or one with some 30 or more years of hard graft under its belt. For me, the simpler a tractor is, the more I am drawn to it. There is something honest about a machine, built well and simply, that is as tough as, and does its job day after day. It's probably the era I grew up in, but I can look at a classic tractor and easily see how it does its tasks.

"Oh yeah, that pushes that, so it drives that to spin that, and lifts that arm like that above that thing."

I have only seen contemporary tractors at Fieldays and they are just the opposite of these good old boys featured in our article on Colin Harvey on page 4.

Every bell and whistle is in and on these puppies, and to me tractors are now like spaceships. Heated cabs, wi-fi, Bluetooth, GPS, etc. Geez, Netflix is probably on board there too!

I have always thought in my declining years I would get my own tractor but I'm not so sure any more.

I am extremely fortunate to have access to a friend's bach north of Auckland and I go there as often as I am able. The house has a view of the water and the beach is very, very tidal, so the only way to launch a boat at low tide is with a tractor. One of my great joys in life currently is watching the neighbours hook up their boats to go fishing at sunset or after dark. Quite often it seems, many head out on a bright or full moon.

I enjoy watching a flurry of chugging David Browns and Massey Fergusons, et al., scurrying across the sand with

fully kitted fishing boats in tow. With their headlights on and all this activity bathed in moonlight, this really is my kind of Netflix.

And, the amazing thing is, that in a few hours they all start coming back in again and I get an encore performance!

I often wonder if they have any spare fish and if maybe I should wander down to say hi. Too obvious? I s'pose you are right.

Early summer is an especially great time for my tractor fetish. If I am lucky enough I see neighbours arrive at the beach, and some are starting up their tractors for the first time in a while, maybe six months or more. You hear their tractors eventually burst into life and then you see guys giving them a bit of a hoon around the streets to loosen up all the mechanics. I tell ya, the loud chuckles and the accompanying huge grins on these guys' faces says a lot about what a big boys' toy is for some of us.

So all going well, on a full moon or two over summer, the next episode of my favourite TV show will take place again, just off the deck in front of me.

Finally, a Merry Christmas from all of the gang here at *The Shed*. Have a great and safe summer holiday, kick back, relax, and we will see you again in the New Year.

By the way, don't forget to put up your 2020 *Shed* calendar in a spot for all to enjoy. Unfortunately, no tractors in this one; maybe next year.

Greg Vincent

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ISSN: 1177-0457

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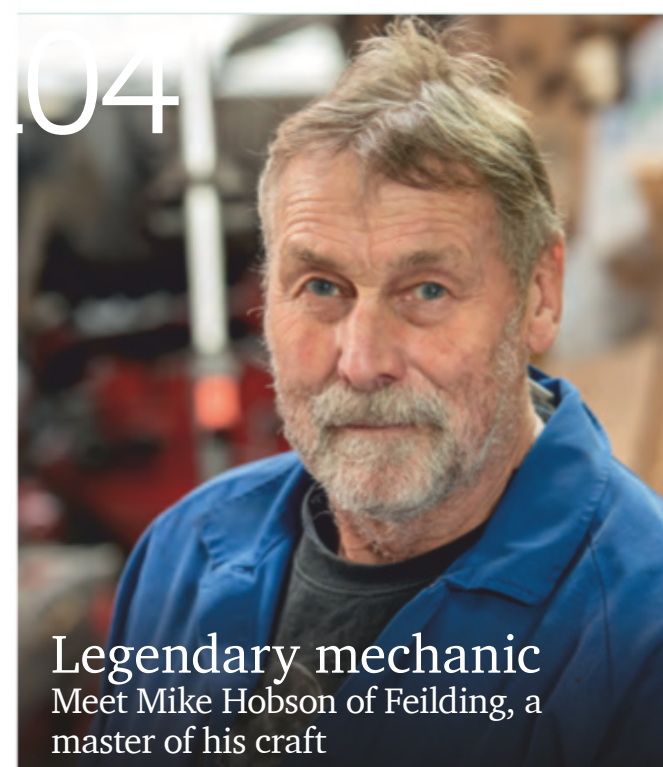
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Colin couldn't resist buying the D272, the last model in the B/D series of AC tractors, when he saw it at the Kingsman estate clearing sale at Fairlie in 2016

A TRACTOR TRADITION

A FORMER FARMER HAS SPENT SIX DECADES RESTORING HIS COLLECTION OF TRACTORS AND FARM TRUCKS

By Nathalie Brown
Photographs: Derek Golding

Sheep have always been an evil necessity and dairy cows are not much better. Just ask former sheep and dairy farmer Colin Harvey — give a man a truck or a tractor any time, he says. So when he and his wife Catherine converted their farm near Papakaio in North Otago's Waitaki Valley from sheep to dairy in the 1980s, he successfully avoided the milking shed and raised beef cattle; managed the operation, including a run-off block; and did the tractor work. And for some six decades he has been buying, restoring, and selling tractors and farm trucks.

Gathering tractors

Colin bought his first tractors in partnership with his brother, Neville, in 1964. They were a second-hand Allis-Chalmers (AC) Model B and a new Fiat 513R wheel tractor. He later bought



“I bought them
with the intention
of restoring and
selling them on”

them from the partnership, and after a few years purchased another AC B and a D270 AC wheel tractor.

All these were used as part of the normal farming operation. At this time, they were farming 6000 sheep on the irrigated farm, with water supplied from the Lower Waitaki Irrigation Scheme. They traded the Fiat 513R for a Fiat 650 and bought three more Fiat 650s over time, followed by two New Holland four-wheel-drive wheel tractors, a 95LH and 85LH.

Then, successively, Colin added an AC Model M wide-track crawler to his fleet. His father, Hector Harvey, had bought this very machine new in 1937 when he was farming at Duntroon. And on the day he bought back his father's old M wide-track, Colin went to a clearing sale and bought another AC M; this one was a narrow-track model. ►



Dashboard details of the AC D272



Power take-off (PTO) shaft on the prized D272



Above: The paint room takes up a fair portion of Colin's rear shed

Below: Not many farmers' trucks get to cart an elephant. This one did. Colin's father's venerable 1934 Chev



Restoring and selling

The AC make was part of the family history, Colin says, and for that reason he bought and restored them in preference to other makes.

"I bought them with the intention of restoring and selling them on," he says. "I like farm machines. They are more predictable than the animals.

"In the mid 1950s, Dad had upgraded to a Bedford truck and sold his 1934 Chev truck, which he'd bought second-hand in 1937, to one of his brothers-

*"I like farm machines.
They are more
predictable than
the animals"*

in-law, Ian Francis at Duntroon. After Uncle Ian died in 1995, the family offered me the truck."

Colin towed the old Chevy to where he

was then farming at Papakaio, further down the Waitaki Valley towards Oamaru.

"More recently I bought a second 1934 Chev which had belonged to Richardson's truck museum in Invercargill — they were selling surplus vintage vehicles. At the auction two gentlemen came up to me and one told me his father — a Mr Fleming, who had a transport company at Tuatapere — had bought the truck new in 1934," he says.

Colin has worked on and sold a further six tractors over the years. ►



There's even has a purpose-built smoko room in the front shed

Colin's farming life

The trucks and tractors that hold so much allure for Colin are integral to New Zealand farming, and the Harvey's farming life mirrors the history of the North Otago rural sector for the past 70-odd years.

Colin was born in 1940 and raised on the family's sheep and cropping farm near Duntroon in North Otago. He and his brother Neville bought the neighbouring property in 1964 and farmed it in conjunction with the original property. When Colin married Catherine Peart in 1967 they lived in a house on the partnership farm for three years.

"Then, later in 1967, just before the government-backed Lower Waitaki Irrigation Scheme was voted in, we bought a farm at Papakaio, at the Oamaru end of the Waitaki Valley," says Colin.

"Papakaio was a wealthy farming community of long-established families who made us welcome. We raised four children there: Anne; Karen; James; and John, who died at age 16 as a result of a motorbike accident.

"The irrigation scheme meant more grass growth and within five years of coming in, about 50 per cent of the properties changed hands," he says.

By the 1980s, although farming 4000 ewes and 2000 hoggets, it was more economical to convert to cattle fattening and dairy run-off because sheep farming was becoming marginal, and by the mid 1980s there was a significant shift from

sheep to dairy farming, which meant investing in new systems.

"We looked at deer farming to diversify," Colin recalls, "but it was hugely capital intensive and took two years before you could start to see a return, whereas with dairy farming, the income was immediate after you'd built the milking shed. In 1984/'85, the year we built the dairy shed, there were six others built in the area.

"We were still running 2000 ewes and grazing 150 bull calves and I was doing the tractor work as well, but one-third of the farm was in dairying at the time. Every three to five years we took on new share milkers and added more land to the dairy unit. We sold all the sheep until the farm was entirely dedicated to a dairy herd of 850 cows, and dairy support for stock and winter grazing.

"We always employed share milkers and liked the 50/50 system, which gives young families a very good chance of making it. In all our changes we never took a drop in production."

By 2000 and the advent of Meridian Energy's Project Aqua, 100 per cent of the property was in dairy and dairy support. Colin was enthusiastic about the proposed Project Aqua, costed at \$1.2 billion and

designed as a hydro-electric scheme consisting of 64km of canals through the valley on the lower Waitaki River.

"If New Zealand needed electricity, then hydro-generation was the most environmentally sustainable, but Project Aqua's water race system was going to disturb a lot of farms," Colin notes.

"For example, we would have lost about 100 acres [40ha], which meant dropping the dairy herd by 100 cows. Meridian were talking compensation and buying some of the farms but the amount on offer wasn't equitable."

When the option arose to sell the farm in 2003 Colin and Catherine consulted their children but none of them wanted to farm it.

"We had a lower order share-milking couple offer them the opportunity to buy the herd and become 50/50 share milkers," says Colin. "Then we went to Meridian saying we were prepared to sell on a lease-back for five years. The final agreement was for a three-year lease and the possibility of two extra years. A few months later in 2004, the scheme was cancelled.

"We got five years' lease, then had a clearing sale and left the farm."



The gearbox housing belongs to the AC M crawler tractor being reassembled in the Tees Street sheds

A bigger shed needed

Prior to retiring from farming in 2008 it took Colin a year to find a suitable building to house and restore his vehicles. He works out of two sheds in Tees Street, on the edge of Oamaru's Victorian precinct. The property had previously been used by a company called 'Timbertech' and before that by the Tempero family as a coach-building site.

The front building takes two trucks and four tractors with plenty of room for the trailer that will eventually transport them to vintage vehicle shows. The back shed houses three wheel-tractors, two crawler-tractors, plus all the tools, and there are plenty of these.

For the most part Colin uses the normal mechanic's tools: socket sets, ring and open-ended spanners, hammers and screwdrivers, pliers, electrical drills, grinders, spray-painting equipment, a hydraulic press, a bearing puller. He has recently extended the range of equipment by adding an overhead gantry and an engine lifter. When he was on the farm, he used a lathe, and also several front-end-loader tractors with forks that did the heavy lifting, but he disposed of those at the farm's clearing sale. ►



The AC D270 is the model before the D272. Colin has owned this tractor for a good 40 years



Hector Harvey, Colin's father, bought the AC Model WM new in 1937. Colin has plans to restore it



The first project Colin took on when he moved into the sheds in 2008 was fitting the front-end loader to the Fiat 650

Plan W166

Span: 12m

Length: 12m

Knee Height: 4.5/3.3m



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Top: Installing a steering clutch pack
 Left: Installing a brake drum
 Above: Installing a brake band

“
*There's little chance of
 Colin running out of
 work to do in the sheds*
 ”



A close look at the rear end of the D272



The D270 is fitted with Lucas headlights

Share milking



In the New Zealand dairy industry, 50/50 share milkers own the cows while the landowner provides the land and infrastructure. The money received for the milk (the milk cheque) is split 50/50.

Lower order share milkers most often pay for animal health while the landowner owns the cows and infrastructure and the two parties come to an agreement on the percentage of the milk cheque that each receives.



Sidetracked

He is the first to admit that his workspaces are not often neat and tidy, but he made a special effort for our photographer, saying, "Our two daughters are shocked at the state of the sheds. But our son James, who lives in England, loves to help out when he's here."

After moving into the Tees Street sheds in 2009, Colin's first project was to reconstruct a front-end loader on a Fiat 650 tractor.

"I bought the loader that had been on another tractor and had to make up a new frame to fit onto the Fiat 650 tractor. It took two or three years," he tells us.

Five years ago he started stripping one of the AC M crawlers; cleaning it, undercoating it ...

"And that job's still not finished," he says. "I got sidetracked two years ago into working on restoring a Connor Shea direct drill, which I have completed and sold as a working machine. The guy who bought it said he didn't want to use it because it looked so new. Then there have been other jobs, like making up the frame for the trailer. Before I retired, I bought the trailer at a clearing sale out Enfield way and I'm putting a frame onto it to transport vehicles to town," Colin says. ►

Plenty to do

His current project is the restoration of the AC M crawler, narrow gauge: "I've got to finish stripping it — dismantling and cleaning, then top-coating and reassembling it. Beyond that I was going to do Dad's crawler but time being what it is ... The 1934 Chev truck is a major piece of work. It needs a new cab plus general overhauling and a new engine. I'll do the cab/coach building myself but get a mechanic for the engine. We'll see how we go."

There's little chance of Colin running out of work to do in the sheds: "Two years ago, I went to a clearing sale at Kingsman Estate in Fairlie and purchased an AC D272 wheel tractor and in March last year I purchased a third Chev 1934 truck from Wellington. It's still got the original 1934 motor, which I intend to overhaul."

All this might imply that the man is an inveterate grease monkey but there's more to Colin Harvey than his obsession with buying and restoring vintage farm machines.

In 1990 he and wife Catherine took their first trip together to the US to visit friends and family. They enjoyed the experience of encountering new people and places so much that they began to take regular trips to more exotic places. "We've been away for six to 10 weeks over winter every year since 2012," he says. "We get a lot out of going to new places and getting to know different cultures. The truth is, as much as I like the restoration work, in fact it fits in around the travelling." ►



The D272 stands in the foreground while in the background stands the 1934 Chev truck bought from Richardson's truck museum in Invercargill

The elephant in the 1934 Chev



Like nearly every farmer in New Zealand, Colin's father Hector kept a diary. "He wrote only one line per day in a foolscap page dairy, hence there was not much detail," says Colin.

On 1 November 1938 Hector wrote:

Wet night, went to town [Oamaru] and got 3 drums petrol & 4 kerosene, took Sole Bros elephant to town.

The story of Dad and the elephant in the Chevy was one that Colin was fascinated by as a child. As he tells the tale:

"Dad was driving the green 1934 Chev truck with seven empty 44-gallon drums on when he was stopped by the Sole Bros circus people, somewhere between Georgetown and Peebles.

"Their truck, which was carting the

elephant, had broken down and they needed to get the elephant to Oamaru, so they asked Dad to cart it there. Dad agreed, so the seven drums were placed along one side of the deck, and then the elephant trainer climbed onto the deck. He spoke to the elephant, and up it climbed, one foot at a time, and off they went to Oamaru, with the elephant's trunk waving back and forth across the windscreen.

"That is what I can recall my Dad telling us children about that day. The 44-gallon drums of petrol would be for the truck during the upcoming harvest and car use. The 44-gallon drums of kero (power kerosene) would be fuel for the 1937 Allis-Chalmers WM crawler tractor."



This is the dashboard of Hector Harvey's 1934 Chev truck that he used to carry the circus elephant to Oamaru



Colin has finished his work on the Fiat 650, which is now about to go to a new owner



Above: the AC M is in the process of being dismantled

Below: Colin often displays his farm machinery at the North Otago Vintage Machinery Club at Clarks Mill, Maheno





The radiator on the elephant truck



The Connor Shea direct-drill coulters before molasses treatment ...



... and after molasses treatment

Tools and equipment

Having a big shed is a start when you want to restore large farm vehicles, says Colin. But being prepared to spend all the time needed to complete the project is essential. Colin estimates that it takes him about two-and-a-half years to complete each tractor restoration and this is usually spread out over five years.

His most useful tools are his collection of socket sets. He has several of these, each in a different size. The ones he gets most use out of are Whitworth, Standard American Engineers (SAE), National Course (NC), and National Fine (NF). Each has a standard size, and some refer to the thread sizes and diameter of the nut or bolt it is to be used for. The old ones are referred to in Imperial measures while others are metric, for his newer machinery.

His tool racks include a set of adjustable spanners and a set of pipe tongs: the adjustable type to grip

various types of nuts and bolts. He uses an electrically driven drilling/boring machine for drilling holes in metal, a floor jack for raising the vehicle, and an engine lifter — a small, portable crane.

When all else fails in trying to release a nut he grinds it off with an electric right-angle grinder, or the bench-mounted electric grinder when that's more appropriate.

Dealing with rust is a certainty in old machinery and this is where the gas welder comes in handy to heat the nuts before loosening them. But Colin's secret rust-removing weapon is a bucket of diluted molasses.

"I was over the moon when I discovered that system," he says. "We used to use molasses just as stock feed."

The first time he tried it, he bought the molasses from the supermarket, which made it fairly expensive. He now fills

a 10-litre bucket at the rural supplies store and finds it much cheaper.

The molasses mix that deals to rust is 10 parts water to one part molasses. Depending on the size of the machine part he's dealing with, he uses a 70-litre household storage bin, or a larger box he made very cheaply from untreated wood and lined with heavy black plastic.

"The secret is to soak it for two weeks, then water blast it, and then go over it with a wire brush attached to a right-angle grinder. It ends up bright, shining steel!"

Then there's the paint job: undercoat sprayed on, sand it down, then a topcoat with the correct vehicle spray paint.

Colin says you'll want the right colour paints for replicas and you can usually get a good steer on these by getting in touch with vintage machinery clubs.



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A safer bandsaw

KIWI CAN-DO IS A FINGER SAVIOUR

By Ritchie Wilson

Sheddies don't usually think of bandsaws as being particularly dangerous compared with table saws, or even notice the dust and noise, but in some industries where cutting speed is paramount, such as in freezing works, they have regularly caused serious injuries. Auckland bandsaw manufacturer Guardian Bandsaw's solution was to make a saw that stops within milliseconds if the operator's fingers get too close to the blade. The worker wears blue gloves and if the high-speed vision detection system sees blue near the blade, brakes are engaged, and the blade is halted, saving the person's fingers.

Kiwi made

Guardian Bandsaw is an offshoot of the privately owned KanDO Innovation, which was established 12 years ago by ex-employees of a government organization researching the manufacture mussel-opening machines.

Most parts of the stainless-steel saws are made by the company, which employs 30 workers, about a third of them women (including one of the control engineers), at its operation at the base of Mount Wellington in Auckland.

The company has sold 160 in the three years that it has been making them. CEO David Walkinshaw says that the company is increasingly focused on overseas sales, with interest being shown by American companies such as Cargill Foods, apparently the largest privately owned company in the US.

Cargill has a large presence in China and safety standards in the Chinese factories are the same as in the American ones, so safer bandsaws would be needed in both.

Keeping fingers intact

Canadian aircraft manufacturer Bombardier uses Guardian bandsaws to cut aluminium, and David Walkinshaw

has just returned from demonstrating the bandsaw to Morrison Supermarkets in Scotland. The sceptical Scots were nonplussed when shown video footage of the machine operating that demonstrated just how close their

fingers were getting to the moving blade. Morrisons bought 21 saws.

David would like his children to be able to use safe bandsaws in their school technology classes, so a woodworking bandsaw is possible in the future.



This technology could be useful for workshops as well sometime in the future



The Best Historic Blade winner



This stunning Damascus-steel blade was a prize winner too



Leif Haseltine was an award winner again at this year's show

Auckland Blade Show 2019

PLENTY TO SEE AT CUTTING-EDGE SHOW

By Brent Sandow

The second Auckland Blade Show was held on the weekend of 12–13 October at the Parnell Community Centre and it was very well attended.

There were just on 30 exhibitors from all over New Zealand, Australia, and Japan. Apart from knife displays, there were also stands selling a wide array of all knife-making materials, such as wood, steel, and leather, plus tools and dedicated knife-making belt grinders. Several makers were also offering knife-making classes.

The standard of knives displayed this year was very high, and that certainly bodes well for knife-making and collecting in New Zealand.

Door prizes were donated by Matt James, Colin Nicol, and Willie van Niekerk.

Plans are already underway for next year's show — stay tuned for details.

For any further information, contact Brent Sandow on 027 442 7046 or at knifebug44@gmail.com

To view all the knives on display at the show head to the-shed.nz and search 'Auckland Blade Show 2019'.

The Shed online



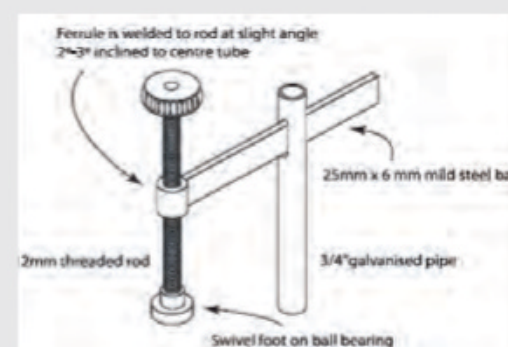
What's happening online at the-shed.nz?

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

- more than 50 photos of all the knives and knife makers at The Auckland Blade Show 2019
- make a spit barbecue from bits and pieces lying around in your shed. A great summer project



- weaving willow: get inspired by the North Otago sheddie who took up the craft of weaving with resounding success
- make a homemade bench holdfast: an easy build and a great solution when you need an extra pair of hands in your workshop.



The Shed is now on Instagram: search 'theshedmag'.



Energy feedback

I have to take issue with some points in Jude Woodside's article in the November/December issue of *The Shed*.

The first is that he claims road user charges on a car are now "\$0.72 per kilometre". This is incorrect by a factor of 10. It is \$0.072 per kilometre, or 7.2 cents, up from 6.8 cents earlier in the year.

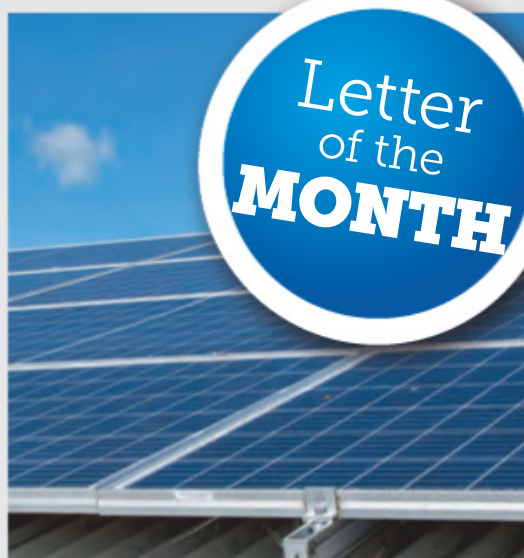
Like for like, and with the much lower price of diesel, there is generally an overall cost advantage to using diesel, but it does favour larger and heavier vehicles rather than the very economical small diesel cars.

The second is that electric cars and hybrids will not tow trailers. Many hybrids will do so — the Mitsubishi Outlander PHEV, for example, has the same rated towing capacity as its conventional version and, for pure electric vehicles, a Tesla can tow a large load. It is true, however, that the small electric cars will not do so because the regenerative braking might be damaged by the extra load.

And finally, does Jude mean 7.5kWh when he refers to the size of battery his system would need? 7.5kW is a power rating, not a storage capacity.

Regards

WR Phillips

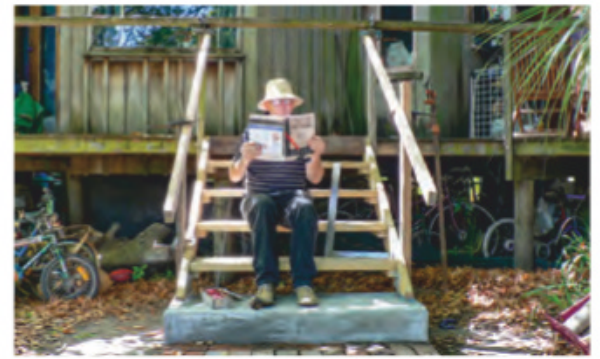


Jude Replies: *Mea culpa you are quite correct and not the only reprimand I received for that. I apologize for the gross error — it should have been 7.2c per kilometre. Never do maths when you are feeling indignant.*

I know that there are some hybrids that will tow and more are coming but when I looked at buying an Outlander some four years ago, I was told categorically that it wouldn't tow anything. Although that will change, at present, if you have a decent-sized boat you will be hard-pressed to tow it with a hybrid. I know that Toyota has some new SUV hybrids that will tow coming too.

As to the battery question I was quoted for a system capable of 7.5kWh output. I couldn't even begin to guess at the storage capacity needed for that.

A very chastened Jude Woodside



The best step size

Excellent article by Ritchie Wilson in *The Shed* Issue No. 84 on building steps. I spent half my working life making rock walls and steps in gardens, and found that for outdoor steps the simplest and best dimensions were 150mm rise and 350mm going, modified slightly by sloping the treads by 15mm, so the 150mm rise was made up of 15mm slope and 135mm rise at the next tread.

Sloping the tread prevented puddles and subsequent slime build-up, and they became self-cleaning. I found two rules for designing stair dimensions and they gave slightly different results.

The stairs in my A-framed house are 250mm rise and 150mm going.

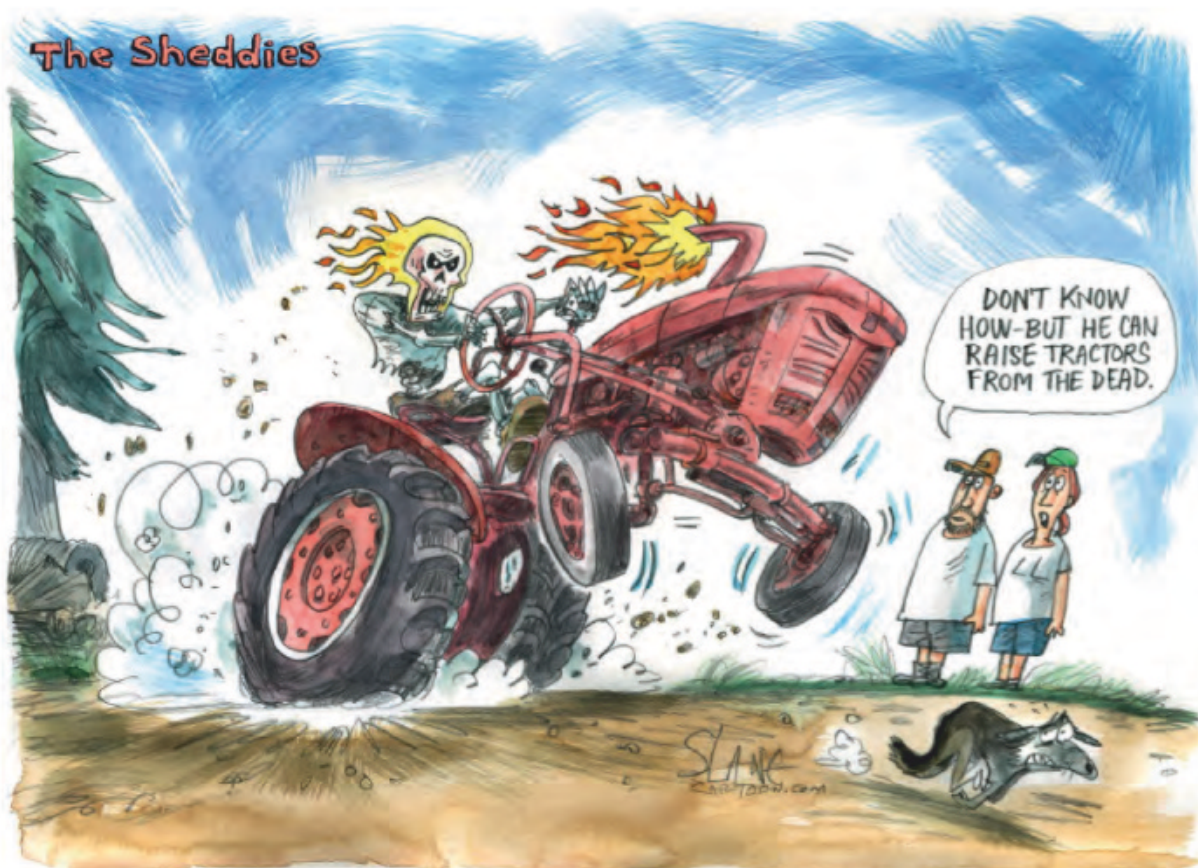
John Rogers, Warkworth



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By Nigel Young

*Photographs: Nigel Young
and Juliet Nicholas*

SAVING MONEY AND HAVING FUN TOO

WHY BUY AN EXPENSIVE HAND BASIN FOR A CAMPER WHEN YOU CAN MAKE YOUR OWN?

If necessity is the mother of invention, then high costs are her offspring. So when Des Thomson got a quote for \$900 for vacuum moulding a shower base for a camper van he was building — even though he had already made all the necessary moulds — he declined and ultimately did it himself for \$50. And that included setting up the necessary workstation from which he could make anything else that caught his eye.

The result was a shower base that was not only as good as the one he avoided paying \$900 for but also now reproducible for the equivalent of small change. And given that he is helping his local Menzshed build even more camper vans, he has saved a considerable amount of money in the long term.

That first campervan

Des's foray into campers began with the twin-pull-out conversion of a Toyota van, for which he manufactured two fibreglass telescope-like pods that extended 1.8m beyond the back door — a project which featured in Issue No. 76 of *The Shed* in January 2018.

He already had an interest in casting and had made several aluminium components for use in other projects. This meant that vacuum moulding was just a variation on a familiar theme, with the principles of one being much the same for them all. And like any such practice, the quality of the final result isn't determined by the expense or precision of the equipment; rather it is the quality and attention to detail that go into making the initial moulds, in this case a small hand basin for campers. ►





Des and the workstation



The underside of the heating unit of the vacuum-moulding workstation

Making moulds

The moulds themselves can be made from whatever scrap there is available.

Ply and MDF glued together in layers is the most suitable, due to their stability and ease of cutting and shaping them. If you have timber that is sufficiently dry, that is also suitable, especially if you are trying to reproduce a damaged timber moulding with a complex profile. The downside to working with MDF is dust, so diligence in forming and shaping includes dust control and wearing a dust mask. In the case of ply, any imperfections in the edges can be filled. For a female mould, these issues will be of little consequence, as any defects will be hidden on the underside of the component. But more about that shortly.

There are several aspects to this process: the shape to be formed, the frame that holds the material — in this case thermoplastic — in relation to

*The moulds themselves
can be made from
whatever scrap there is
available*

the mould to complete the process, the frame that holds the mould itself if it is a female mould, and the workstation and vacuum table that is central to the whole process.

Taking care will pay off

While the mould is specific to the job at hand, each of these other items can be used many times over. In the case of the mould, it can be used to make any number of components, particularly if you take care preparing it.

Any error or flaws will show up each time — a bit like copying and pasting a mistake.

The forming of the moulds is the most time-consuming task (the hand basin took about a day) while the actual vacuum-forming process itself is very quick. Like a lot of similar procedures, the quality of the work is largely determined by the quality of the preparation, however the final forming operation requires diligence and supervision: it is easy to make a minor mistake that will cause the final component to fail.

What is interesting is that failure does not automatically write off the thermoplastic being used. Put it back through the same process, and there's a good chance that the original flat form will be restored and the material made fit for reuse.

Male or female mould?

The decision as to whether a male or female mould is required depends on the nature of the project and the material used.



The holes for the vacuum on the underside of a male mould

Des used acrylonitrile butadiene styrene (ABS), a thermoplastic polymer that is commonly used to line showers. In this case he bought a piece of 2mm thick off-cut shower liner from a local plastic supplier, which he then cut down with tin snips.

Shower liner is interesting in that it consists of two layers: a very thin layer of acrylic, and a thicker backing of ABS. The ABS provides the strength and the acrylic the final glossy surface. You'll see shortly that knowing this thickness is an important part of the process. The ABS side should always be up, producing a finished surface that is glossy and free from imperfections. This is why Des chose to use a female mould, as the ABS was to be pulled down into the mould to form the final shape. ►



Des showing the basin mold in relation to the frame that will hold it during the process



The prepared holding frame with the ABS

In the case of a composting toilet he also built for the camper, he used a male mould, as the ABS was to be draped over it to form the shape as well as achieve the same level of finish.

The ABS provides the strength and the acrylic the final glossy surface

Moving to the next stage

Once the moulds are formed, any holes or imperfections can be filled with Plasti-Bond or Polyfilla, taking care to ensure that they have cured completely.

This can vary depending on temperature and humidity, so don't be in a rush to move on to the next stage, which is to seal it with whatever paint you might have at hand, in this case a water-based undercoat. The next step, once you're satisfied with the final product, is to prepare the mould for the vacuum process. In the case of a female ►



An empty ABS holding frame

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Right: Des showing his frame storage area as part of the workstation
Below: The workstation showing the female mould on the holding frame supported by the spacer

The final forming operation requires diligence and supervision



The holding frame above the hand basin



Checking the temperature with a digital laser thermometer aimed at the ABS



Des blocking out any draughts and concentrating the heat in the workstation

mould, a grid of small holes is drilled at approximately 20mm apart in both directions, with their diameter being half that of the thickness of the material being used. Any more and they become obvious in the final form, while any less and they aren't sufficiently effective.

It is through these that the process brings together the mould and the material being used. In the case of a male mould, large, well-placed holes are sufficient, as they aren't part of the final outcome.

Making the frames reusable

The frame that holds the piece of ABS in position is the next item to be made, and again the emphasis is on getting it right to ensure that it can be reused.

These frames are made from scrap 30x20mm wood, hinges and ►



Touching the underside of the ABS to see if it is soft and beginning to droop

over-centre catches to hold it together, and a self-adhesive door-draught seal to ensure the integrity of the vacuum. Des dowelled and butted the corners rather than using a mitre, which is a good indication of the forces and stresses achieved once the process begins, along with contributing to the frame's longevity.

The second frame — the one that holds the mould — is constructed next, in much the same way as the first, in this case from 18mm ply. The door draught seal adheres to this, so the accuracy of these two faces in relation to each other is very important. If the vacuum can't form, the process stops before it begins, and this is the point at which it is most likely to happen.

Des's workstation

The actual process is simple and straight-forward. After several trips to

*Des watches until the
ABS is free-formed with
no wrinkles or stresses*

the Eco Store — the Christchurch City Council's retail store for items salvaged from its land-fill depots — Des built a simple but effective vacuum press.

The vacuum-mould workstation was built on an old trolley from the long-term care hospital which the Halswell Menzshed is attached to. The completed workstation consists of two vacuum cleaners, two radiant three-bar electric heaters reorganized into a folded Zincalume chassis, independent switches for both the heaters and vacuum cleaners, a vacuum frame using PVC connectors to

make a manifold, and a basic wooden frame to hold it all together.

If you're uncertain about the electrical considerations, find someone with professional electrical knowledge who can give it the once over. In the case of this workstation, the trolley is steel, so a shorting could have severe consequences.

A point to be made here is that while both heating elements and electrical circuitry are required, there is no risk of fire or damage. The whole operation is over in a few minutes and requires total supervision and interaction. The temperature of the heating elements is typical of any radiant heater, so you would treat them the same way you would any other heater.

Creating a good vacuum

Des runs his vacuum cleaners without the filters and bags to get the best



The final form of the hand basin



A finished hand basin next to an installed one in a camper

result; he is after all only using them to create a vacuum. These are in turn connected to a vacuum table made from two sheets of 18mm MDF separated by a 20mm spacer all around, ensuring a consistent vacuum across the underside of the table.

A home-made manifold using PVC jointers connects the cleaners to the table. The use of the two cleaners doesn't increase the strength of the vacuum, only the speed at which it happens. For anyone familiar with this process, the final pressure is around seven inches of mercury (inHg) (178mmHg), as opposed to commercial systems that operate around 23–27inHg (584–686mmHg).

The top of the 600x600mm table is drilled with 5mm holes at a grid of 50mm. How much of that needs to be used depends on the size of the project, with a small one such as these hand basins allowing for much of the area to be blocked off with plastic and tape. ►



Des showing the male mould of his composting toilet next to the final product

This reduction ensures the concentration of the vacuum where it is needed.

A quick process

The temperature for the process is surprisingly low, and Des keeps an eye on it with a hand-held digital thermometer. He tests much of the process by touch before starting, while looking for consistent 'droop' across the underside of the suspended ABS. Having mounted the frame with the ABS above the positioned and sealed mould, Des watches until the ABS is free-formed with no wrinkles or stresses, at which point it is ready to be applied. It is then lowered quickly and accurately over the mould, turning on the vacuum cleaners at the same time. Speed and precision are required, as the process takes only seconds, so it might pay to practise a few times if this is your first attempt at vacuum moulding.

And that is it. The final product reflects the work and detail, so the better the preparation, the better the outcome.

What if you do get it wrong and make a mess of it? Just do it again, with the same piece of ABS. Reheat it in the frame until it flattens out, then repeat the process, making sure that you



A finished composting toilet against its mould

address the mistake you made on the first attempt.

Endless possibilities

This is a fun project for any sheddie. The cost is low, the skill level required is moderate, and the finish will be 'just like a bought one' if you've been conscientious throughout.

From here on, you can figure out how to make a range of moulds. Just don't get caught using the expensive household vacuum cleaner, or else the concepts of male and female moulds might take on a whole new meaning.

Using a vacuum as a tool

Vacuums are used extensively, and not just for manufacture.

The printing industry uses them in conjunction with a very bright Xenon bulb to create printing plates for presses, the food industry uses them to seal meat prior to export, while the automobile industry uses them to manufacture complex shapes such as front ends and bumpers. If you look around your workshop, all the tools with a formed shape will have been vacuum moulded — an indicator of the strength of vacuum-moulded items.

Closer to home, a vacuum can be used when gluing complex shapes by placing the item in a plastic bag that covers the same sort of frame described in this article. By removing all the air, the bag and vacuum provide a consistent pressure across the item while the glue sets. While vacuum moulding can certainly be used for one-offs, its primary advantage is the ability to make many items from one mould, as and when you need them. Des's hand basin is a good example of this.

An appreciation of the vacuum-moulding process can lead to a new understanding and fresh approach to solving a problem that has sat in the too-hard basket for too long. This may well be the light-bulb moment you need to finish a project, or at least make a part for a fraction of the cost. After all, it was this realization that motivated Des to explore vacuum moulding in the first place.



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The shed had to look
'right' in the landscape

SIZE MATTERS, BUT SO DO GOOD LOOKS

By Ian Parkes Photographs: Brennan Thomas

DEVELOPER PHILIP SOLOMON HONED HIS SHED DESIGN BEFORE BUILDING THE ULTIMATE SHED

Philip Solomon has years of experience putting up large sheds and his top tip is that shed aesthetics are important.

"A lot of people just focus on what they want to put in the shed until it goes up and then they say, 'Oh, I don't like that,'" he says.

Philip has installed three large sheds on different properties that he's developed so, when it came to designing and building a large shed on

his own property in Gisborne, he had already developed firm ideas about what he wanted. That included making sure it looked right in the landscape and complemented the house.

He needed to drive a truck and trailer straight in, which set the width and span at 12m. He also needed a bay for a boat on a 9m trailer, and both the boat and the truck needed high doors. He settled on 3.2m, and a stud height of 4m.

More than just a shed

Another part of the plan was to build in some accommodation, an office, a lunchroom, and a sleepover, complete with a bathroom at one end of the shed. As you can see in the pictures, that was built separately inside the shed later. Philip preserved the shed's full useable floor area by building the ceiling of the accommodation strong enough to be a mezzanine floor. He says the 4m height gives just enough headroom to use that space for storage without making the building too tall.

He chose the colours and also window and door frames to match the 355m² house that he's going to build on the same site — because shed aesthetics are important. So much so, according to Phil,



The building team: Terry O'Neill, Max O'Neill, and Shawn Smythe



Mezzanine offers storage above the accommodation unit



The shed's five-star sleepout



that in each of the three developments he's done so far with big sheds, he's built the shed first.

We ask Phil how he decided which steel shed maker he was going to go with and he says he's gone with KiwiSpan every time. KiwiSpan offers the choice of colours that tie in with

"If you are building in a high wind zone, like we are here, you need something substantial, something designed and engineered so it's not going to be a problem"

house designs. "Also they are dominant as far as strength goes," he says.

"If you are building in a high wind zone, like we are here, you need something substantial, something designed and engineered so it's not going to be a problem."

Building for strong winds

Builder Terry O'Neill of KiwiSpan Gisborne says Philip knew exactly what he wanted, so spec'ing the building was straightforward. KiwiSpan's design programme selects the correct-sized portals and framing to suit the span, height, and the wind load. Being in a high wind zone meant that the shed had to be strong to avoid flexing, which would cause issues with the Gib-lined area. The large roller doors are industrial strength and the aluminium windows are all double-glazed.

The programme allows for different roof angles to be chosen to tie in with

other buildings on-site. As the shed sits 200mm higher than the house will, Phil chose to keep the roof pitch shallow at 11 degrees, again to avoid making the shed look too big. Adding the verandah roof to the end gable, over the ranchslider door, was also a simple task.

"Phil is pretty experienced and did a good job of the site works, so that was straightforward too," Terry says.

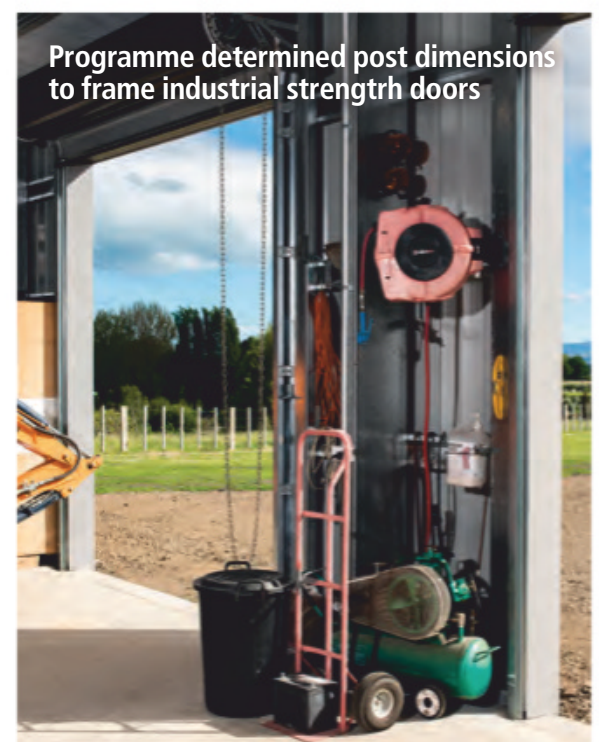
Phil says that that included capturing water from the roof from both the shed and the house and diverting it into two 30,000-litre tanks alongside the shed.

Provisioning for water was important, as the house will have a lap pool that will need to be topped up.

Phil is now keen to get on with the house build and, as in the previous properties that he's developed, having a big shed already on-site with storage space, a workshop, and plumbed-in facilities — and even a shady spot to have lunch with a view over the neighbour's vineyard — is going to make that so much easier. 📌



The verandah adds outdoor space to the shed



Programme determined post dimensions to frame industrial strength doors

Ensure you always wear protective clothing and footwear when undertaking any welding projects

Basics of welding aluminium

PART FOUR IN A SERIES ON HOW TO WELD

By Greg Holster

Photographs: Jude Woodside

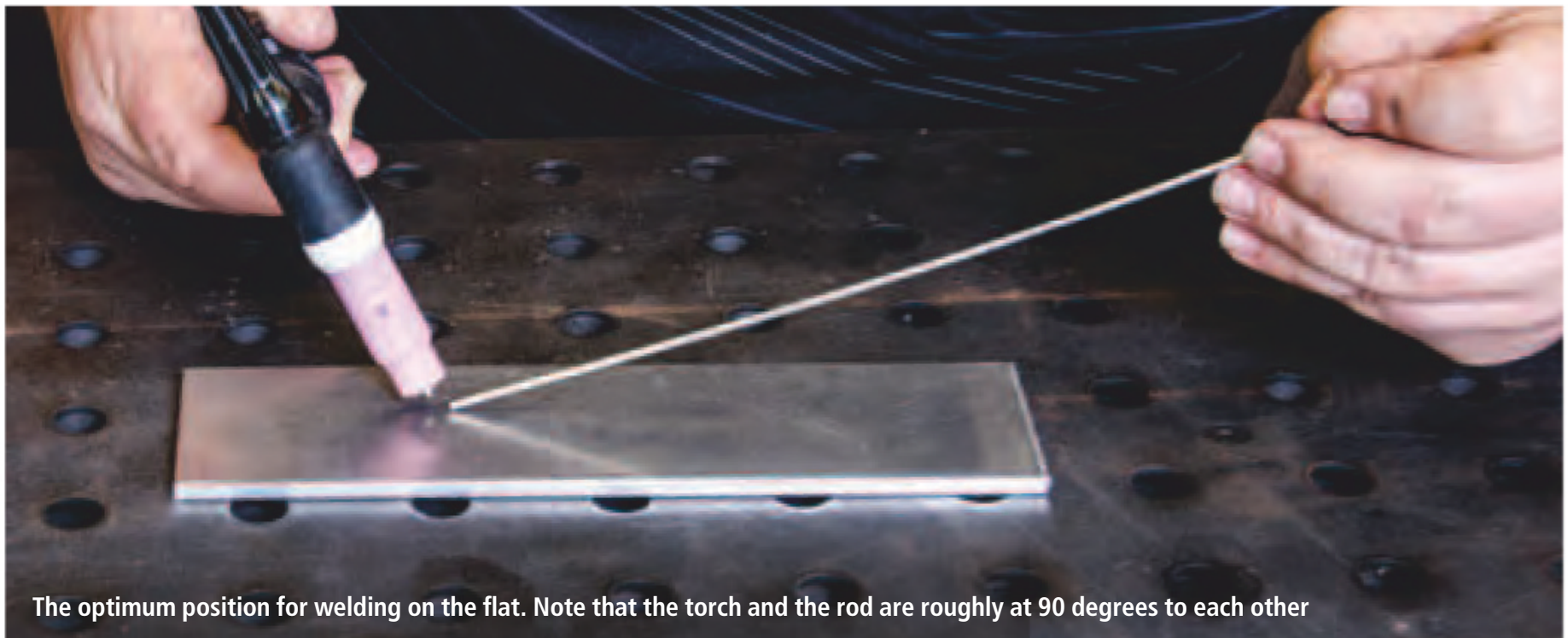
Aluminium alloys are used in so many different applications in our modern world, from motorbike frames and boats, big and small, to super yachts. The list is endless. So when it comes to building, manufacturing, and repairs, welding is often the best solution. Most aluminium alloys are weldable, but it is important to understand the special aspects

and quirks of working and welding aluminium and to figure out the best welding technique.

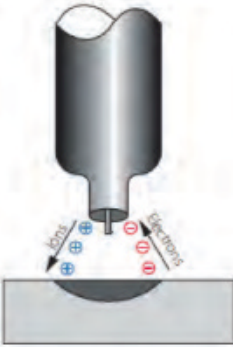
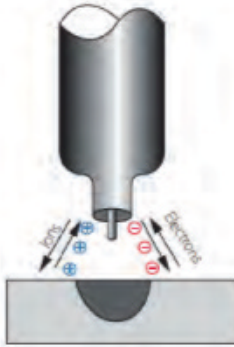
Clean it

Easily the most overlooked problem in welding aluminium is not having a clean welding preparation. So first up, cleanliness is of the utmost importance. When faced with repairs

in the shed or workshop, you will find that aluminium that is old, dirty, or with an oxidized surface will need to be cleaned. Clean it up so you get rid of any paint or oxide film on the surface. Sometimes with cast aluminium, oil and grease can embed themselves into the parent metal. Use white spirit to clean the oil off before you use an abrasive. Aluminium oxide is that



The optimum position for welding on the flat. Note that the torch and the rod are roughly at 90 degrees to each other

Current type	DC	DC	(AC balanced)
Electrode Polarity	Negative	Positive	
Effect of current and polarity on weld characteristics.			
Electron and ion flow			
Penetration characteristics			
Oxide cleaning action	No	Yes	Yes - once every half cycle
Penetration	Deep, Narrow	Shallow, Wide	Medium
Application	Most Materials except Aluminium	Not commonly used	Aluminium
Heat balance in the arc	70% at work end 30% at electrode end	30% at work end 70% at electrode end	50% at work end 50% at electrode end



The aluminium electrode is blunt compared with the steel one

The cleanliness of the aluminium surface is important; the less oxide and dirt on the surface, the less power needed

dull, matte, silvery-grey coating on the surface of all aluminium caused by contact with oxygen. This oxide melts at more than three times the temperature of the aluminium, so you can't break through the skin if it's oxidized. To remove all oxide, you need to clean it off, either by grinding or hand-sanding with an abrasive such as emery cloth.

TIG welding

TIG welding uses a non-consumable tungsten electrode surrounded by a ceramic shield that controls the flow of the protecting argon gas. Argon gas shields the molten metal from the oxygen and nitrogen in the atmosphere that would otherwise oxidize the metal and rod. The argon also acts as a carrier for the current which is the heat source. Gas flow is around eight to 10 litres per minute. The electrode tip in the TIG torch for steel or stainless steel is very pointed and made of thoriated tungsten. For aluminium welding, the TIG torch tungsten electrode should be blunt, with the corners ground off, and made of zirconiated tungsten. The tungsten electrode has a white tip for aluminium and a red tip for steel.

TIG advantages

- Weld deposits are generally smooth, with no splatter or slag coverage.
- The weld pool can be controlled and manipulated easily.
- The filler rod can be controlled separately.
- Very low fume generation.
- Improved fatigue performance.
- Extremely strong fusion welds.
- Very low hydrogen deposits.

Aluminium TIG

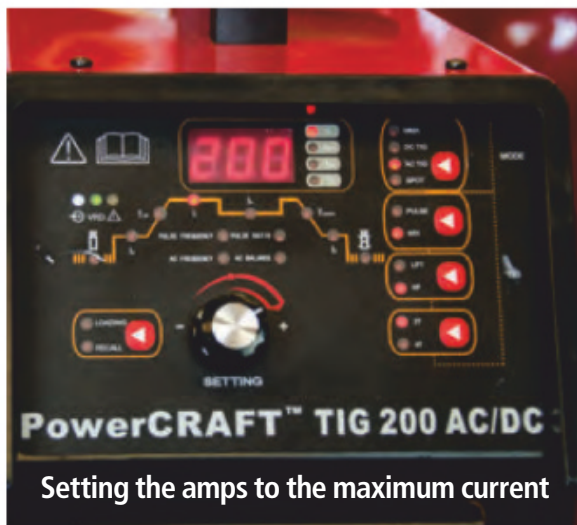
Aluminium is welded with AC power with a high-frequency signal. Aluminium TIG welding needs more power. Stainless steel needs 60–120A ►



Keeping the filler rod within the gas shield



Dipping the rod into the weld pool



Setting the amps to the maximum current



The AC balance is here set to 50 per cent

but aluminium can start at 150A for similar thicknesses, depending on the size of the machine.

This can become a problem for single-phase TIG welding machines. But for thinner sections, say up to 6mm thick, the smaller 200A machines are ideal. Technology has come a long way where single-phase AC/DC TIG machines are concerned. Preheating the job can help if there is insufficient

The less oxide and dirt on the surface, the less power is needed to burn through to create a weld pool

power. Or the Lincoln Powercraft 200 AC/DC has a Mix mode that alternates between AC and DC, creating a slightly hotter weld pool.

Spool guns



A spool gun uses the small 500g, 100mm spools. These small guns have a wire-drive motor and roller set in the gun. This means that it only has to feed wire 100mm instead of three or four metres. These guns are just the answer for repairing that small dinghy and welding light gauges of aluminium, from 1.2mm thick upwards.

I love spool guns. If you have played with aluminium MIG welding before and had feeding problems, you will know how quickly it kills the creative juices. The trusty spool gun certainly has a place in your shed. Stainless steel and bronze wires are also available.

The current setting depends on the thickness of aluminium and size of the tungsten electrode being used. If it's heavy aluminium, you may need a bigger torch and tungsten. As previously mentioned, the cleanliness of the aluminium surface is important; the less oxide and dirt on the surface, the less power is needed to burn through to create a weld pool. More heat is required because of aluminium's high conductivity.

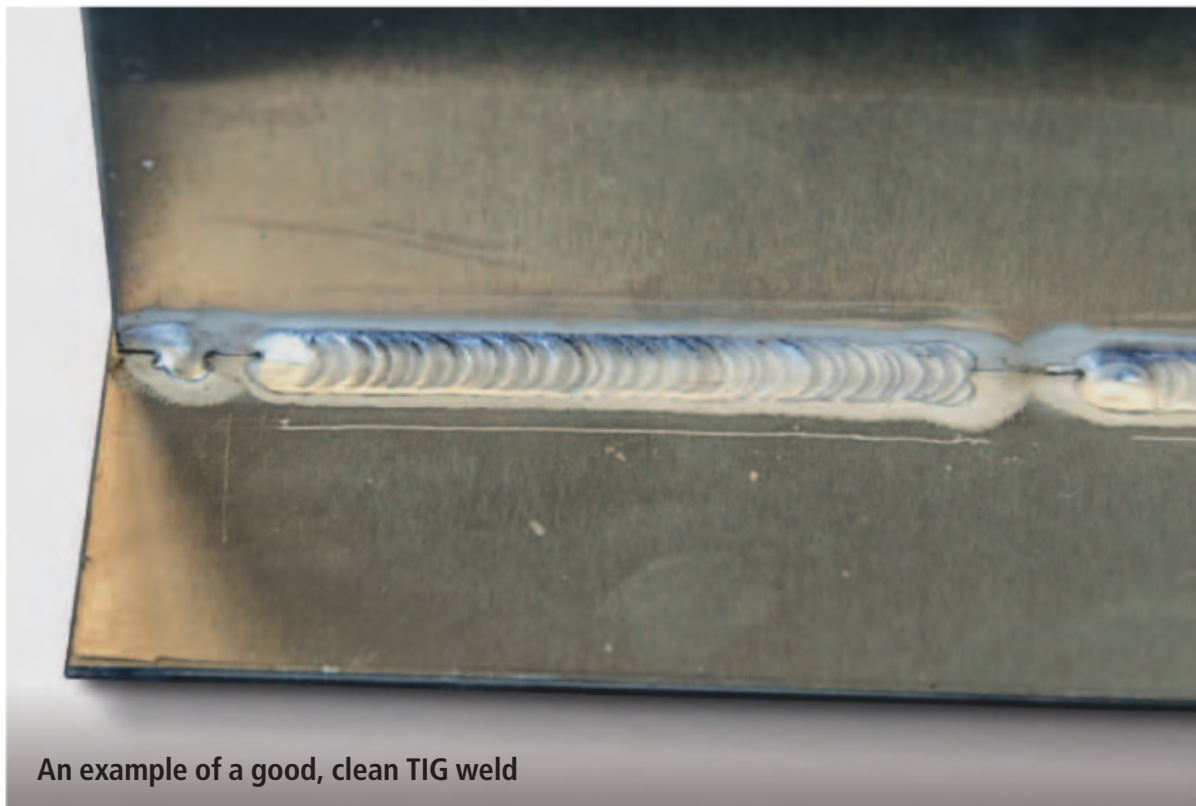
Pay attention to using the correct TIG rod thickness:

- for aluminium thicknesses from 1.0 to 4.4mm: use a 1.6mm rod
- for aluminium thicknesses from 3 to 8mm: use a 2.4mm rod.

Weld pool

When you strike an arc with TIG, do not expect to see a molten pool immediately. Be patient and let the weld pool form, because at the start everything is very cold and it's necessary to warm the work. Once the weld pool has formed you can start adding your filler rod. Adding the filler rod at just the right amount will cool and stabilize the weld you are creating. If the pool feels too cold, stop feeding. Otherwise continue dabbing the rod in and out.

It is crucial not to touch the electrode to the work, otherwise the electrode ends up with molten metal stuck to it. The welding has to stop while you



An example of a good, clean TIG weld



Examples of dirty welds — the black bits are impurities and burnt oxides

reshape the tip or weld on a piece of scrap until it is clean again.

Technique

When you are TIG welding, you need to hold the torch in one hand a little bit like a pencil, with the second finger over the top of the torch. The filler rod is held in the other hand and fed in as for gas welding. Adding filler rod takes place in front of the TIG torch as you move forward. The torch and the filler rod should be in a 90-degree configuration to each other. The torch is held about 60–70 degrees from the work and the rod held at about 20–30 degrees.

Always try to push the TIG torch, not drag it. Always add the filler metal on the leading or front edge of the weld pool. Don't be afraid to add too much; it is easy to cut back if necessary.

When starting out, most learners have issues getting their hands working independently. While the torch does move slowly, most of the action is with the TIG rod and the weld pool. Beginners usually end up moving both hands at the same time, and the tungsten dips into the weld pool too, which usually results in touching the filler metal to the tungsten. We have all done it.

So with the power off, hold the TIG torch still and concentrate on sliding the TIG rod underneath the tungsten without touching it until each hand performs its task independently. When you've mastered these movements, you're ready to strike an arc.

It's worth experimenting with the controls — you will learn a lot about your machine this way

All welding should be done in a comfortable position, so if possible rest the hand with the torch on something firm. Calculate where you will finish the weld and position your start to reach that position.

When finishing an aluminium weld, take your finger off the button, but don't pull the torch away. The protective argon post-flow keeps on going after you have stopped, so leave the torch there for five seconds to allow the weld to cool without it oxidizing immediately. This also prevents crater cracks.

Points to note

Make definite movements with the rod in and out, and don't leave the rod too close in. If the rod is close, the metal gets very hot and can vaporize as you bring the rod in again, especially if the rod is too small. Too far away and the molten end of the rod will oxidize. ►



The result of too much positive current: the end of the tungsten has formed a ball. The arc tends to be less stable and wanders

The best spot is 5–6mm outside the pool but still under the argon shield.

You should try to obtain a series of overlapping circles, like cent pieces. If you are not using enough power, you get an ugly lumpy build-up on the plate.

Keep the torch at an angle of about 60–70 degrees to the work.

If the weld is too thin, chances are you are not adding enough metal to the weld pool from the rod, or the TIG rod is too thin. Don't be afraid to put too much weld down when starting out.

Beginners usually end up moving both hands at the same time, and the tungsten dips into the weld pool too

Setting

Most TIG machines have a balance control, often confusing for a newbie. Where do you set it? What does it do? This gives you either penetration or cleaning action.

'AC' is alternating current, which alternates at 50 cycles per second (50Hz). The electrode positive side of the AC cycle is where the current flows from the work to the tungsten electrode. This half of the cycle burns off surface oxides and allows the electrode negative side of the cycle — where the arc current flows from the tungsten back to the work — to melt the base metal and fuse the aluminium, giving you penetration.

The balance control can give you more positive or negative control, meaning penetration can be preferred over cleaning.

Balance-control benefits

Effects of increasing the electrode negative:

- greater penetration can be achieved on thicker sections
- travel speed can increase
- the weld bead can be narrowed
- tungsten electrode life can be increased and balling action reduced
- a smaller diameter tungsten can be used for more precise work.



The correct angle for MIG welding aluminium is 20–30 degrees



Negative earth

Effects of increasing the electrode positive:

- greater cleaning action can be achieved to remove heavy oxides (this negative side is what breaks up aluminium oxides that DC cannot burn through)
- minimal penetration, which helps prevent burn-through on thinner aluminium alloys
- bead profile can be widened, excellent for scalloped welds on hot rods and cold-air intakes
- tungsten electrode life can be decreased and balling action increased.

The rules about setting balance control are dependent on what you need in an aluminium TIG weld. A typical error involves too much cleaning action (electrode positive), which creates heat

build-up in the tungsten. A large ball will form on the end of the tungsten.

The arc can lose stability and this makes it difficult to control the direction of the arc and the weld pool.

Too much penetration creates insufficient cleaning action, resulting in a dirty weld pool. Often your weld will have black, burnt particles set into it. These are burnt oxides and other impurities.

All machines are different, so it's worth experimenting with the controls — you will learn a lot about your machine this way.

Welding aluminium with small MIG welders

There are thousands of small MIG welding machines in sheds everywhere ►

AC/DC welding controls

CURRENT CONTROL

This adjusts the main welding current/amperes.

GAS PRE-FLOW

Pre-flow can be set so that the argon flows before the arc starts, pushing air out of the torch before welding starts; 0.2 secs is enough.

START CURRENT

A start current can be selected lower than the set welding current. Sometimes it is a percentage; sometimes it can be amps. It just depends on the brand of machine.

UP SLOPE

This adjustment is usually 0–10 seconds. The main welding current will rise from a minimum set amperage up to the main current selected in the time selected. Turn this back to zero when learning. One less thing to think about.

DOWN SLOPE

Down slope is used when you want to cool the weld pool down slowly. This avoids crater cracks and hollow finishes. Depending on the brand, this adjustment is usually 0–10 seconds. Some machines may call this 'crater fill'.

GAS POST-FLOW

Gas post-flow adjustment 1–20 seconds. This keeps the argon flowing after the welding has finished, which cools the tungsten electrode while it is still glowing. It stops oxidization and contamination. Some machines have automatic post-flow that is synced to the set current. Trying to save money by turning this timer down will only result in a dirty, oxidized tungsten electrode. A 2.4mm tungsten electrode at 150A will need about 10 seconds post-flow. A 3.2mm tungsten at 200A may be 12 seconds.

PULSE PEAK CURRENT ADJUSTMENT

This sets pulse amperage and is usually set higher than the base (main) current amperage. If the

machine calls it 'background current' then the (main) current is the (top) peak and the background current is set at the lower pulse setting. This setting can be set as a percentage of the main current or an amperage setting.

PULSE FREQUENCY ADJUSTMENT

This sets how many pulses per second, 0.5–200.0Hz. A setting of one or two pulses per second is excellent for timing when dipping the TIG rod into the weld pool. But turning the pulse rate up will give you a narrower, deeper penetrating weld bead. As you turn the pulse rate up you will lose sight of the flashes at around 30 pulses per second.

PULSE RATIO

Normally the pulse will be 50/50 per cent. This is half the time at the top and half the time at the lower pulse setting. A setting such as 30/70 per cent (that's 30 per cent of the time at the higher pulse current) is ideal for that scalloped-looking weld often seen on intercooler piping and aluminium motorbike frames.

AC BALANCE

This is your penetration or cleaning action.

Personally, I like more cleaning as it isn't hard to achieve good penetration with welding aluminium. Setting the balance to 60 per cent negative and 40 per cent positive will make the arc wider. There will be less penetration and more cleaning action.

AC FREQUENCY ADJUSTMENT

Traditional TIG welders have a fixed frequency of 50. Advanced technology allows AC frequency adjustment from 20 to 250Hz. The higher you turn up the frequency, the more the width of arc from the tungsten decreases. This allows more control of weld pool, which you will notice will also get narrower and you can increase travel speed. The 'AC' noise of the arc will increase when AC frequency is turned up. This is normal. When welding dirty/contaminated material more cleaning may need to be selected.





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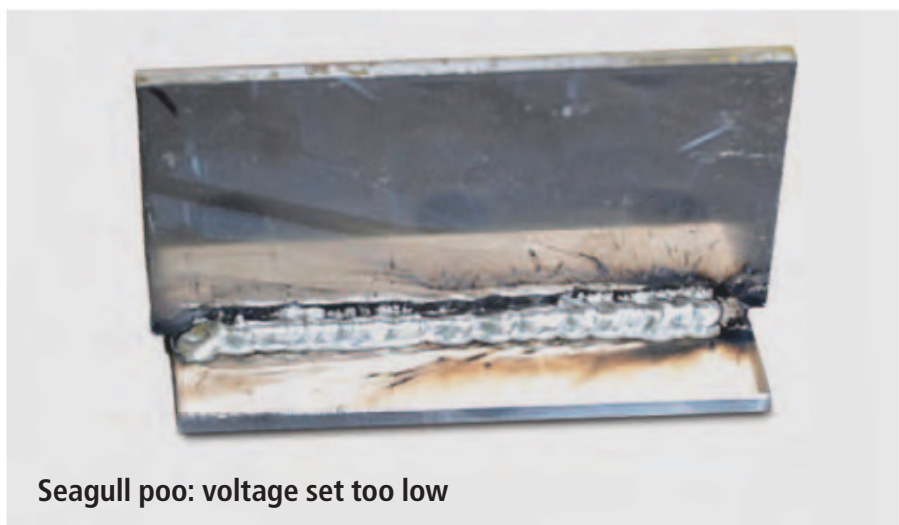
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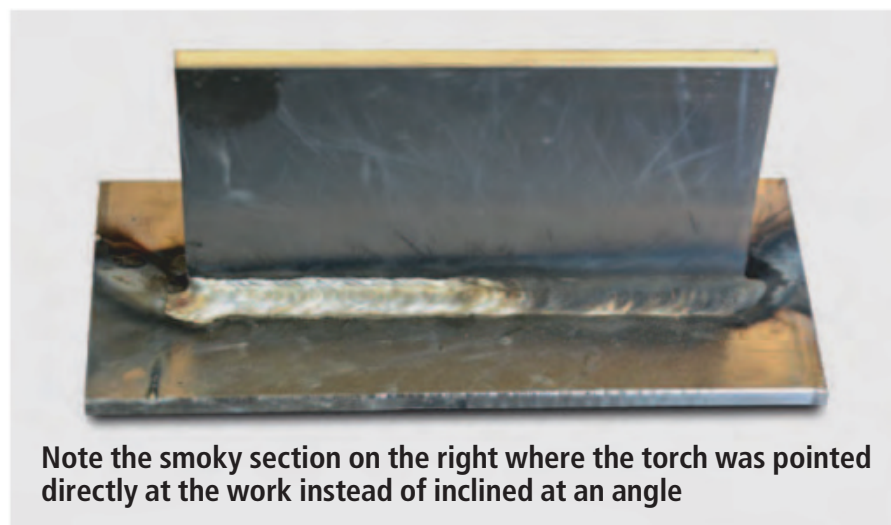


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Seagull poo: voltage set too low



Note the smoky section on the right where the torch was pointed directly at the work instead of inclined at an angle

Thickness v. power

Having to weld aluminium that is under 2mm thick can be a big ask for the inexperienced operator. The best advice I can give is:

- tune your machine to weld a little bit hotter than you normally would
- weld a bit faster than, say, if you were welding mild steel
- set up and practise on scrap of similar thickness before starting on the good stuff.

Welding aluminium more than 2mm thick shouldn't be too difficult as long as you don't expect to weld gigantic lumps of aluminium. Aluminium between 4mm and 6mm thick is about the maximum you can expect to weld successfully with your small MIG machine, again depending on the size and brand.

Common problems

1. Burn through. Moving too slowly? Speed up. Don't be afraid to move a bit faster. Your welding current may be too high and you need to find a happy medium. Again, use trial and error on scrap pieces.
2. Lack of fusion, commonly known as 'seagull poo'. Those round blobs usually mean that the voltage setting is too low for the amount of wire set on the machine. Set the amps and volts up higher and work your way down. You may be surprised how hot you need to go before a weld with good edge-wetting is produced.
3. Black or dirty welds. These can be caused by several different factors:
 - inadequate gas coverage
 - dirty parent material, with heavy aluminium oxides not cleaned off

- the wrong torch angle
- the wrong gas
- leaks in the MIG torch and hose
- holding too long an arc
- a loose nozzle
- an unstable arc from a poor earth connection
- a worn contact tip that needs changing.

Amps and volts

Ask 10 experts what the secret is for a beginner to set the amps and volts on a small MIG welding machine and you could get 10 different answers. I believe the best advice I can give is to conduct a practical test on a piece of scrap aluminium 3–4mm thick.

Set your wire speed on max and voltage on max. If the wire in the arc is stubbing and spattering, turn the wire speed down. If the arc has a hissing sound and the wire wants to burn back into the tip, turn the voltage/power setting back. You will hear when the arc is playing the right tune. From this point, both settings can be adjusted down to the required setting. You will also have a better idea of what your machine is capable of. Don't forget to write down your settings as you go. Many machines come with settings in the instruction book, so as a last resort read the instructions. The inside of the wire-feed units often has good info, depending on the brand.

Aluminium v. mild steel

When aluminium welding with a MIG welder compared

with using one for mild steel, there are some differences that should be noted:

- torch angle: use plenty of forward angle. I use about a 40- to 45-degree forward angle — too straight an angle will give a sooty weld
- speed up: keep moving about a quarter faster than for steel welding. It looks better and keeps the heat out
- stick out: use stick out of 15–20mm. The tip should be back into the nozzle by 4–6mm. If the tip is flush with the nozzle, this can give you a sooty finish.

Summary

If all else fails, try your local welding shop. Most welding agents and welding supply chains have people who can help, especially when it comes to things like tips, nozzles, and liners. Keep your torch in good clean condition. Change the parts before the problems start. Don't be afraid to experiment with power settings and material thickness. Once you get to know your machine, welding aluminium will be a breeze. 📖



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Smootharc MIG 181 tackles aluminium

The Smootharc 181 designed for light to medium industrial and maintenance jobs, offers the pulsing function needed for welding aluminium and thinner material. Get the Smootharc MIG 181 online at hoc.co.nz or from your local BOC Gas & Gear for \$988.69 incl. GST until 29 February or while stocks last. For more information and to arrange a free demonstration contact a BOC Gas & Gear or BOC sales representative. Offer price does not include delivery charges.

High time for high shine

The world-famous Autosol Metal Polish is available in an easy-to-use liquid formulation. It's perfect for cleaning and protecting all metal surfaces on cars, boats, bikes, and around the home. It removes corrosion, tarnishing, and discolouration, and it's simple to apply. Autosol Metal Polish is made with high-quality polishing ingredients that give dull surfaces a new brilliance, and the liquid formulation ensures intensive but gentle cleaning of weathered surfaces and stubborn tarnishing.

Autosol Metal Polish is available from leading automotive, hardware, and engineering stores nationwide. For more information, visit hobeca.co.nz.



Serious cordless drill

DeWalt's DCH733N-XJ drill delivers corded performance with cordless freedom over such long periods that you will forget it's battery-powered. High power demands extra safety and it's fitted with an anti-rotation system that detects a loss of tool control and instantly cuts the power. It also has a multi-function hammer action and a 'rotation stop' mode made for chiselling, plus an 'impact stop' mode for rotary-only drilling with dry diamond cores, making it an ideal tool for drilling anchors and fixing holes up to 48mm in diameter. For more information, see dewalt.co.nz.

ATB compressor special

Get the ATB piston compressor at the special price of \$1493.85 (RRP \$1608.85) at participating stockists nationwide. These cast iron piston compressors are built to deliver a lifetime of Atlas Copco performance and reliability. Powered by a 1.5kW / 2HP motor this model has a 100 litre air tank and delivers 10bar / 145psi of pressure with 190l/min / 6.7cfm free air delivery. For more information, see isl.nz.



Hafco mini wood lathe

The HafcoWoodmaster WL-14V mini wood lathe (order code W385) will suit both the seasoned pen turner or enthusiast hobbyist looking for a reliable and sturdy compact lathe. The lathe is made from cast iron for strength. Its two-step electronic variable speed motor offers low-range spindle speeds from 450rpm to 1800rpm, plus a high-speed range from 900rpm to 3850rpm. The 0.75Hp (0.55kW) motor also has a variable speed dial with a digital readout and the drive can change direction at the flick of a switch, handy for sanding and finishing. Priced at \$655.50 incl. GST. For more information call into Machineryhouse, or see machineryhouse.co.nz/W385



Mafell MT55cc plunge cut saw

The MT55cc is one of top-end German manufacturer Mafell's most successful tools. As a plunge saw the blade is contained in the saw body and is only exposed during cuts, making it safe and easy to use on Mafell's or others' track-guide systems. And its quick-set 2.5mm scoring function allows chip-free cuts on laminated materials. Mafell's philosophy is 'creating excellence' and a strong and compact motor with a cast body ensures reliability. For more information visit jacks.co.nz or mt55.mafell.de/en/.

Festool still setting the pace

Many of the standard features of today's portable circular saws originate from Festool's TS55. The latest generation of TS55s are innovating again with an ultra slimline housing providing a side clearance of only 12mm, and a guide wedge for greater safety and precision. A movable, transparent window also offers a clear view of the scribe mark. The RRP of \$1080 plus GST, valid to 31 January, includes an extraction attachment, saw blade and 1400mm guide rail. Order number 561655. For more information see hml.co.nz.



Super smart impact driver

The DTD171 brushless four-stage impact driver from Makita has multiple modes designed to deliver good-quality driving without overdoing the power. It has two 'T-modes' for fastening self-driving screws, which start fast then slow for final tightening. And it has an A-mode designed to avoid cross-threading by starting off soft and slow. It also has four impact speeds. It delivers 180Nm of max. fastening torque and features XPT technology which enhances dust and moisture protection. For more information see makita.co.nz.





Goodbye mould and mildew

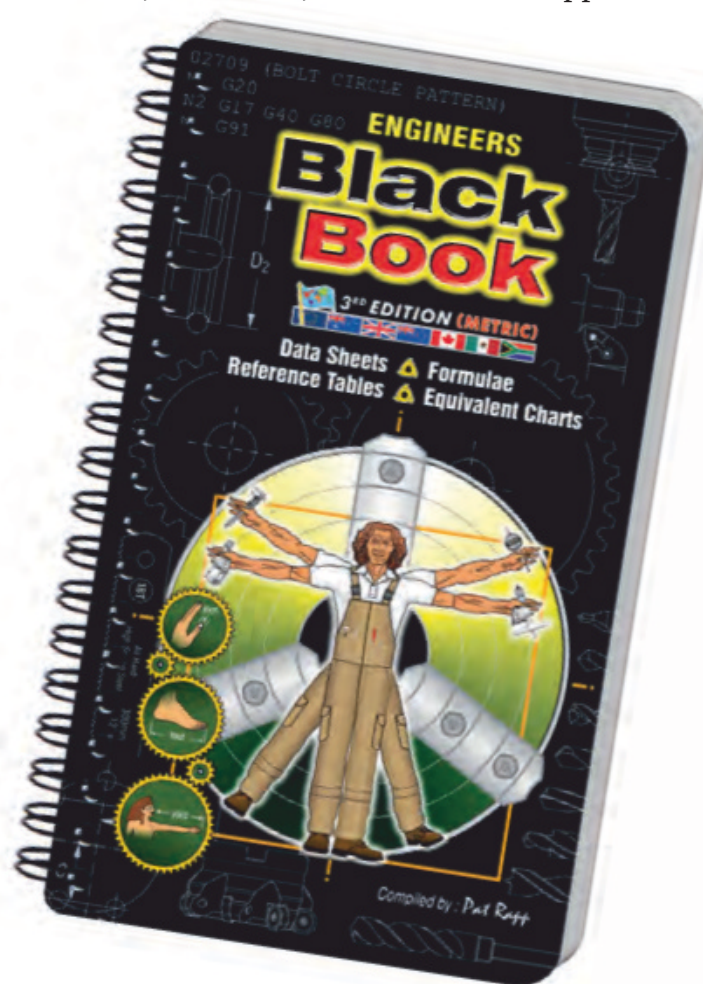
Selleys No Mould prevents mould and mildew build-up in usually damp areas of your home, like the bathroom and shower. It's an ideal solution to use when renovating your bathroom or when you're replacing old mouldy silicone. All you need to do is follow four easy steps. Remove any old silicone from the surface, spray the area with Selleys Rapid Mould Killer to make sure the area is hygienically clean, remove soap residue, rinse the surface and dry thoroughly, then apply Selleys No Mould, making sure you push the sealant into the joint. Wait for one hour and you're ready to go. You'll have a waterproof seal and mould will no longer grow.

Selleys No Mould is priced at \$19.80 and more information can be found at selleys.co.nz.

Go to the source

When you are on the job, it can be a pain to go to a computer to look up tables, or find that tip on drill angles you saw somewhere. This handy little ringbound book puts it all in your pocket. The *Engineers Black Book* is the ultimate reference book for engineers, trades people, apprentices, machine shops, tool rooms and technical colleges.

It has 234 pages of tables, standards, illustrations, grinding wheel info, conversion factors, tapers, lubricants and coolant descriptions, nuts and bolts, spur gear calculations, tungsten carbide specs, plastics specs, sharpening information, G-codes, hardening and tempering guides, formulae, geometrical construction, weights of metals, engineering drawing standards, tolerances, keys and keyways, tapping, drill sizes, speeds and feeds, equivalence charts and more. Available at all leading hardware, industrial, trade and DIY suppliers.



Keep it clean

Shop-Vac's three new L Class wet-and-dry vacuums meet WorkSafe New Zealand guidelines with the ability to trap over 99 per cent of the dust generated when connected to your power tool. The Shop-Vac Pro 20L, 40L, and 60L vacuum cleaners are the ideal cleaning tool for those tough jobs that an ordinary vacuum won't cut the mustard for. They all feature a blower port that turns your vacuum into a powerful blower, plus their wet/dry cleaning power really takes care of those tough clean-up jobs. The Shop-Vac Pros have power tool plug-in capacity for dustless drilling, sanding, and grinding, plus the auto start/stop function works with compatible power tools. These models are a bagless vacuum, but they do come with an optional collection bag, as well as a 2.4m x 32mm lock-on hose, two Posi-Lock metal wands, dual-surface nozzle, wet/dry nozzle, round brush, crevice tool, gulper nozzle, HEPA cartridge filter, and a tool adaptor.

Pricing on the Shop-Vac Pro range starts from \$320. Get more information from Fox & Gunn, the new official distributor of Shop-Vac in New Zealand, at foxgunn.co.nz.



Band like a pro

Spanish specialist tool manufacturer Virutex offers a compact and portable edge bander, the Virutex AG98R, for small jobs undertaken by both hobbyist and commercial users. Using pre-glued tape avoids mess and has a set-up time of less than one minute. The adjustable clamps allow stable and precise working even on circular and shaped pieces. The AG98R will process PVC, polyester, veneer and melamine tapes with a much greater glue-strength than iron-on tapes. For more information visit jacks.co.nz or see virutex.es/productes/?accio=producte&id=93.



Power up your socket set

Makita's WR100D 12V CXT cordless 3/8"-1/4" Ratchet Wrench takes the sweat out of socket wrenching and comes with XPT, extreme protection technology, which channels water and dust away from critical internal components. It can produce up to 47.5Nm max. fastening torque. It includes adaptors for 1/4" and 3/8" drive sockets, and if you remove the adaptors, it can tighten 13mm nuts or bolts directly. For more information see makita.co.nz.



Toggle clamps

When it comes to clamping, lever-action toggle clamps offer excellent power from a quick and easy motion and they are simple to install for ready access. Toggle clamps have a multitude of uses in engineering, metal fabrication, and woodworking.

Hi-Q Components stocks a wide range of high-quality Turkish-made Kukamet toggle clamps including horizontal and vertical actions, latching or push-pull configurations with different mounting options and even pneumatic versions.

See the Hi-Q Components website or for more information, email sales@hiq.co.nz or call 0800 800 293.



Bordo has answered your Chamfering prayers

Need to chamfer the end of some threaded rod or a rusty bolt, or a timber dowel? Bordo's new E-Z Chamfer tool is the right answer. Using a hand file or grinding disc freehand will give a rough result at best. Bordo's E-Z Chamfer will give you a perfect chamfer in seconds and, made from M2 HSS, it will work on the toughest materials, including stainless steel and grade 12.9 super hard bolts. The E-Z Chamfer has five cutting slots in the pentagon-shaped cone offering extraordinary cutting efficiency and tool life. Ask for it at your local hardware or engineering stores nationwide. For more information visit foxgunn.co.nz.

Clean your grill with a grin

30 Seconds' BBQ & Grill Cleaner works on all interior and exterior BBQ surfaces, it's specially formulated to clean up grease, animal fats, vegetable fats and general BBQ grime and dirt, so you can cook with confidence at home or on holiday. It is fragrance-free, water-soluble, biodegradable phosphate-free, non-flammable and made in New Zealand, and it comes in a recyclable one-litre trigger pack. See 30seconds.co.nz/product/bbq-grill-cleaner.



Joist the ticket

The DCD460N-XJ Flexvolt stud joist drill is ideal for electricians, plumbers or HVAC installers looking to drill large-diameter holes in joists or studs or nogs. The robust 54V brushless motor supplies corded power in a cordless tool. The mechanical clutch has two variable speed ranges. The E-Clutch system reduces speed automatically when it detects reactionary torque caused by binding up, allowing you to quickly regain control — a vital feature on a tool this powerful.

This drill features a 1/2" chuck and an adjustable bail handle and a two-position side handle. It is part of DeWalt's 'perform and protect' line, tools designed to provide one or more of greater control, dust containment, or low vibration.

For more information, see dewalt.co.nz.

Make an impact quietly

The M12 Fuel Surge 1/4" hex hydraulic impact driver (M12FQID-0) is Milwaukee Tool's quietest 12V impact driver. It delivers best-in-class sound at only 76 dB(A) in wood fastening applications. Its fluid-drive hydraulic powertrain reduces metal-on-metal contact within the tool, delivering quieter operation, smoother performance and increased durability over a standard impact driver. Mode control allows the user to choose between four different speed and torque settings to suit different applications. For more information, see milwaukee.com.



Rotex RO 90 gear-driven eccentric sander

This 400W lightweight sander delivers high-quality coarse, fine, detail sanding and polishing in just one tool. Its tool-less Fastfix sanding pad system sands up to the edge with the Festool protector and its geared eccentric motion delivers high-quality scratch-free surfaces. And it has an ergonomic grip all for RRP \$920 plus GST until 31 January. Order number 571824. For more information see hml.co.nz.



Join the dust-free revolution

Bosch has launched a range vacuums along with tool extraction guards for grinding, drilling, demolition and woodworking. The versatile wet/dry dust vacuum range includes the GAS 35 L SFC+ with a 35-litre tank. The vacuum features semi-automatic filter cleaning and the L-Boxx system on top of the vacuum adds storage for mobile use. Above L-class are the M-class filters which vent air comparable with normal 'clean' air. The GAS 35M AFC is a 35-litre tank vacuum and the GAS 55MAFC provides a 55-litre tank ideal for frequent heavy use. M class vacuums come with automatic filter cleaning allowing continuous work with sustained suction power, and they have a six-year warranty. For more information, see bosch-pt.co.nz.



Compact laminate trimmer

Milwaukee's M18 Fuel compact router (M18FTR-0) combines power, speed and accurate depth adjustments to deliver clean cuts in a variety of materials. The compact router uses a brushless motor and electronics to deliver best-in-class 31,000 RPM for clean, quality cuts in hard materials, and the equivalent of corded 1.25 horsepower trim routers.

A variable-speed dial offers speeds from 10,000 to 31,000 RPM providing control in all applications. A sturdy 100mm sub-base plate offers stability while dual-LED lights illuminate the work surface. The M18 Fuel Compact Router is compatible with a plunge base and an offset base sold separately. See milwaukeeetool.co.nz.

Different Tusks for different tasks

Tusk offers three ranges of fully ground drill bits made from different grades of high-speed steel for the best combination of strength, heat and wear resistance. M2 HSS bits are titanium nitride (TiN) coated for drilling steel, aluminium and timber and feature a 135-degree 'split point' or 'self centering' tip. M35 bits are made of 5% cobalt HSS giving them three times more life than TiN coated bits and feature a 'bullet point' tip for easy piloting and fast precise drilling on flat or curved metal surfaces without burrs or 'walking' with half the force. M42 bits are made of 8% cobalt HSS for hard material like stainless steel, giving them five times more life than TiN coated bits and feature a 135-degree 'split point' or 'self centering' tip. All drills are available in 1mm–13mm diameter. Call 09 414 5678 for nearest stockists or see tusktools.co.nz.





Ex stock car champion, Albert Gordge, is not one to put his feet up and retire gracefully



Just for the hell of it

A RETIREE MAKES A DIY FOUR-WHEEL-DRIVE MORRIS 1300 BY POPPING A MOTOR IN THE BOOT

By Ray Cleaver Photographs: Rob Tucker



Engine number two — tucked into the boot



Not much room for back-seat passengers

Turning a two-wheel-drive into a four-wheel-drive car by adding an extra motor has been a long-running but successful engineering challenge for retired New Plymouth mechanic Albert Gordge.

What made the operation more unusual was that Albert put the extra motor into the rear of a 1972 Morris 1300. The Morris 1100s and 1300s were popular cars in the '60s and '70s — front-wheel drive cars with a sideways-mounted engine, a slightly bigger version of the Mini.

Anybody who has ever put a motor into a car that's not made for it will know the headaches that can and usually do occur. How about putting a motor into the boot of a car?

We're talking two engines, two gearboxes (and two linked gear sticks!), a combined clutch booster, and a hell of a lot of synchronization

Some real know-how

Albert did the whole operation in his shed, with no hoist or pit and just many years of experience behind him.

He put the car on four 20-litre drums and lay on his garage creeper to work underneath. The operation took four-and-a-half years!

The ex-stock car champion is not one to put his feet up and retire gracefully. He wanted a challenge and no way was he going to let his age of 75 and a bit of Parkinson's disease slow him down.

Albert has always had a soft spot for the Morris and Austin 1100 cars and the idea of adding an extra engine into one first popped into his head 30 years ago.

Now he's done it.

The operation was not without its headaches. We're talking two engines, two gearboxes (and two linked gear sticks!), a combined clutch booster, and a hell of a lot of synchronization. There're two keys, two chokes, and a new shared petrol tank. ►



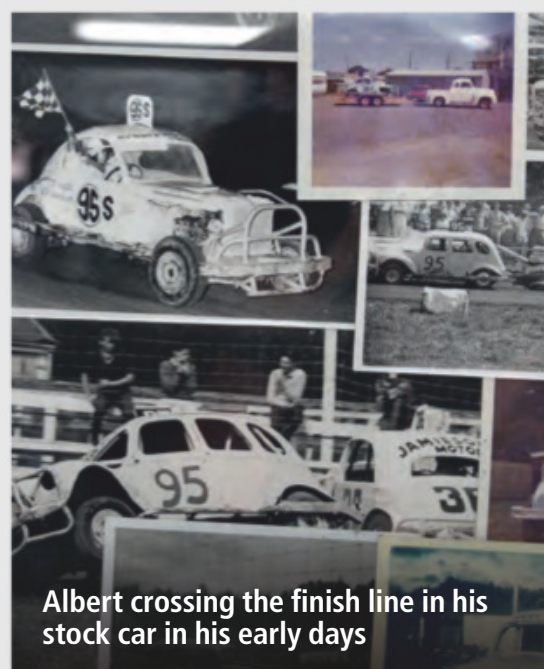
A mechanical life



Albert Gordge knows his way round cars. He began with a motor mechanic apprenticeship in the 1950s with Newton Kings in Hawera.

From 1960 he spent 10 years working for the Kiwi Dairy Company and then got into stock car building and racing.

"Stock cars was like a second apprenticeship really," he says.



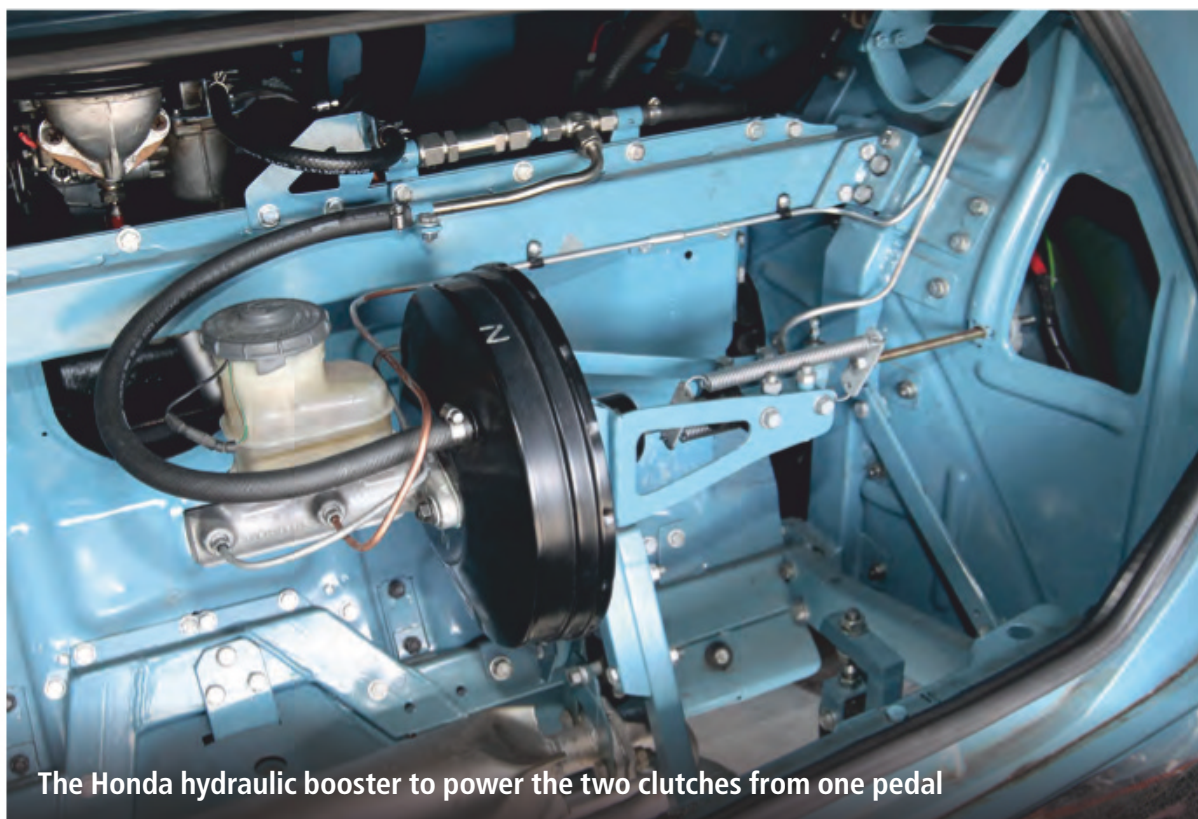
Albert crossing the finish line in his stock car in his early days

He built and raced cars all around the North Island. He'd build the chassis and attach a body. He started off with a Ford Prefect body, powered by an old Dodge flathead six-cylinder engine, and then built a stock car with a Jowett Javelin body, which he shortened and narrowed to fit. That car had a Vauxhall Cresta 3.3-litre engine and he won the New Zealand championship in it in the 1972/'73 season in Wellington.

During this time he ran his own garage in the south Taranaki rural town of Okaiawa for 22 years. He then worked on the maintenance crew at the Kapuni gas plant for 15 years before retiring.

He'd heard of people putting two engines into a Mini before, and that fired him up.

"I retired four years ago and started pissing around. I needed a project and this was it," he says.



The Honda hydraulic booster to power the two clutches from one pedal



Home-made boot hinges — solid stuff

How to begin?

He began by making a new rear sub chassis for the rear motor. This was cut from another 1300 and the car was flipped over for the operation.

“I got the front of a rear sub chassis and the rear of a front sub chassis and welded them together,” Albert explains.

“I took the firewall off the first car, put it into the rear of the second car, and joined it to the sides.

“I then cut out the boot floor and put it all together. This meant the attached sub-chassis parts were factory-made so that saved a lot of engineering reports.”

We ask him how he got the new sub chassis and running gear to line up and he shows us lugs under each side of the car used in the factory construction.

“We measured from these lugs,” he says. “There was no welding when we put the new sub chassis in. Everything has been bolted together.”

The second engine

The second engine is a 1300 GT that was also used in the Mini Cooper S.

It varies from the standard 1300 engine in that it has twin SU carbs, high-compression pistons, lighter timing gears and con rods, and bigger inlet valves.

“That front GT engine has 7hp [5kW] more than the standard 1300 engine in the rear, not that it makes a lot of difference in this machine,” Albert says.

“When the 1300 GT car came out, it was a bit different — as well as the quick motor it had racing stripes, different wheels, and twin horns.”

Albert overhauled both engines and gearboxes before starting the operation.

“It’s not cheap to run the car. With both engines going it probably gets about 15 miles per gallon (19L/100km), same as a V8,” he reckons.



Stripping down to the basics



Some of Albert’s experimental gear linkages — he got it right in the end



Albert's quick-release clip to disengage the two gear sticks



Twin-key dash



Working upside down

"Making sure the new motor and gearbox unit was in line for the wheel arches was a worry, especially with the car upside down. It worked out fine though," he says.

"People said the body won't handle the weight of two engines but all the weight of the engines are direct onto the wheels, so no problems there."

To avoid having two clutches or having

to use a lot of force pushing one pedal, Albert cunningly used a Honda brake booster assembly to operate them both at once.

He pulled out the original petrol tank to make room for the second motor and built a 10-gallon (38-litre) new one in the back seat to feed both motors.

"There's a shitload of regulations to make a petrol tank legal, but I got there," he says.

He was pleased the car could retain the floating Hydrolastic suspension that it originally came out with.

A lot of headaches

The brakes caused a few sleepless nights. The car came out with discs in the front and drums in the rear. He adapted the rear brakes, fitting Honda calipers for the handbrake. He fitted factory engine stabilizers to both

engines to stop engine movement.

His biggest headache?

"Sorting out the gear linkages was a big job — it took months. There is a tunnel running down the car for the front exhaust and I had to design and make up gear linkages to fit into the tunnel to the rear-engine gearbox. Cables wouldn't work so everything had to be made from scratch."

The first linkage Albert made after a month's effort didn't work. He shows

"You had to be more of an engineer than a mechanic. No, change that, you really had to be a magician!"

us a box of linkages he invented and made that also didn't work. Eventually he got there and invented a clever clip that enabled the two gear sticks to clip together with an instant-release clip.

A job for an engineer or a magician?

Sorting out problems often took weeks rather than hours. He said that a big lesson was not to work too far ahead but rather work on one job at a time.

"You can't buy linkages. The whole operation caused many sleepless nights working things out. You had to be more of an engineer than a mechanic. No, change that, you really had to be a magician!"

"A mate asked, 'At what stage do you think you'll regret starting this job?'"

"I thought, *Cheeky bugger*, but it was pretty early on I wondered *What have I gotten myself into?*" he says with a grin.

Everything had to be robustly made to pass roadworthy inspection by the Low Volume Vehicle Technical Association (LVVTA).

A substantial technical manual under the heading of *NZ Hobby Car Manual* (now *The New Zealand Car Construction Manual*) became Albert's Bible for the job. However the car passed muster at the testing station with flying colours. ►



Albert runs a tidy ship



Suspension

“There’s a shitload of regulations to make a petrol tank legal, but I got there”

Lots of parts, that’s for sure

Albert used three 1300 car bodies: two to cut up for parts and one as the main car. He acquired the second motor 20 years ago and has been saving parts since then. He has seven engine blocks piled up that he salvaged for parts.

A lot of the bits, especially linkages, he made himself.

His metal lathe handled a lot of the work and he has gas and stick welders, a sand blaster, and a grinder. He mainly does stick welding.

“I brought myself a TIG welder but TIG welding requires a steady hand and the onset of early Parkinson’s makes that a bit shaky,” he explains. “I stuck to the old-style arc welding with a rod for the big stuff and used oxyacetylene for the smaller jobs, including the hundreds of brackets I had to make up.”



No shortage of engine blocks and parts





Heading off for a test drive

The road test

We roar down the road, changing from front-engine drive to rear-engine drive, to both together.

The car runs really well, no vibration, and it's completely legal and certified.

"What are you going to do with it now?" we ask.

"The car is absolutely no use to me at all," says Albert. "It's just been an engineering exercise and a challenge, as well as something to keep me ticking over and stop me getting Alzheimer's."

He says long hours on the project have been well tolerated by his wife, Maxine.

"At least she knows where I am — it's been all go in the shed for a long time."

Maxine says Albert started the project to keep his brain active: "He is not computer literate, nor is he interested in computers. A lot of what he needed was possibly online, but the exercise was to use his brain, which he did.

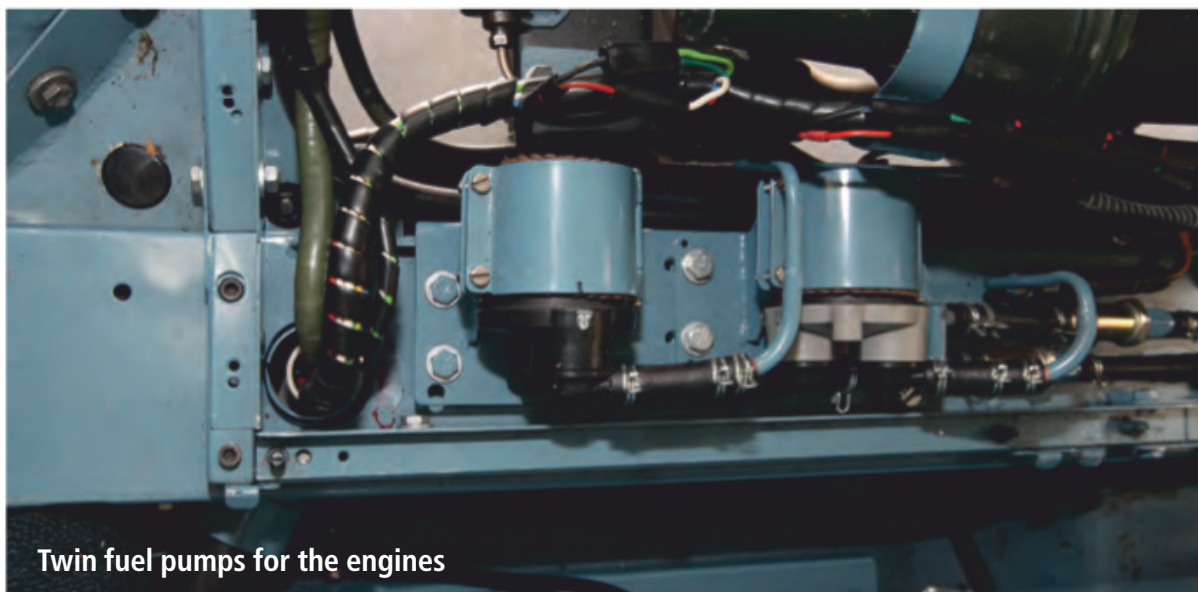
"He figured everything out himself, which shows the type of man he is. Anyone who thought he wouldn't finish the project doesn't really know Albie," she adds.

His next project is catching up on garden work around the house for Maxine.

Albert and Maxine also enjoy road trips in their restored 1930 Ford Model A.



Spares



Twin fuel pumps for the engines



One of the hundreds of box brackets Albert made by hand for the project



The evolution of craft beer in New Zealand has also meant an evolution in the way we brew

A BREWING REVOLUTION

VAST IMPROVEMENT OF HOME BREWS LEADS TO DIY CRAFT BEERS

By Bryan Livingston
Photographs: Robyn Livingston

Everyone has their reason for starting to brew their own beer. For some it's the interest of making their own version of their favourite beer. For others it's a desire to make a good beer for a fraction of the price of the beer that they buy at the local bottle shop.

Whatever the reason, many of us started brewing with a can of liquid malt and a kilogram of household sugar in a plastic barrel. While the quality of the kits and the range of different ingredients has changed over the decades, many new brewers still start out brewing the same way with a home-brew starter kit: a plastic barrel and a beer kit with some brewing sugar.

But the growth and evolution of craft beer in New Zealand has also seen an evolution in the way we brew. We have changed the type of beer we brew, the processes have evolved, and the quality of home brew has mostly improved.



We have changed the type of beer we brew, the processes have evolved, and the quality of home brew has mostly improved

From Mexican lagers to European Pilsners, New World IPAs, APAs to Dubbels and Triples, New Zealand Pilsners to Russian Imperial Stouts — whatever your taste, there is likely to be a beer kit right off the shelf to cater for your needs.

Hops have evolved

In the past hops were just added to contribute bitterness to the beer. More recently hops have been developed to contribute unique flavours and aromas. American-grown hops are imported for brewers to brew tropical flavours of mango and passionfruit for hazy New World IPAs. ►

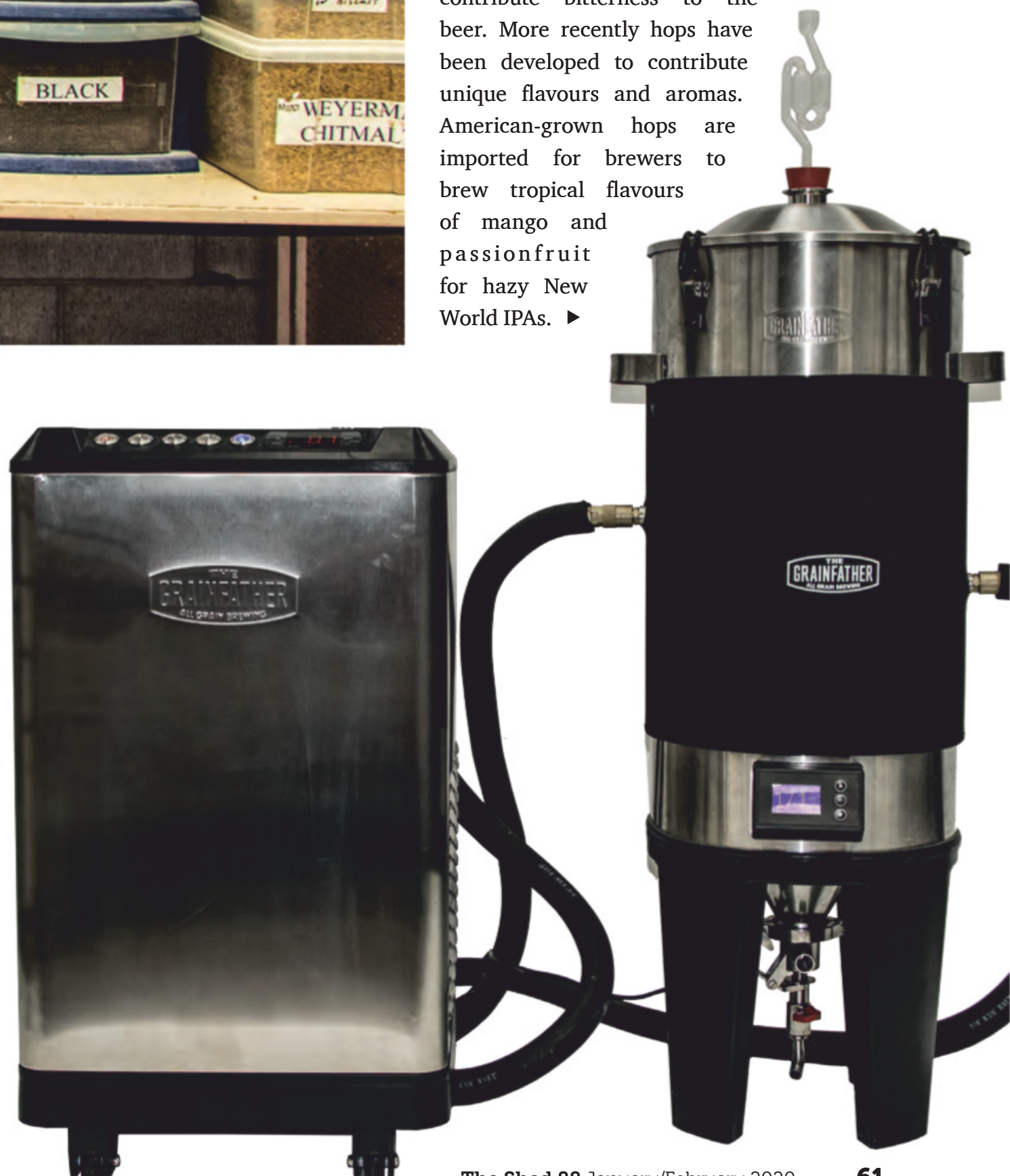
A taste for craft beer

For years what we knew as beer in New Zealand was dominated by the beers made by the two main breweries, Lion and DB.

But the arrival of craft beer has seen home brewers enjoying the taste of all malt beers, modern New World hops, and a huge range of international beer styles rarely seen in New Zealand until recently. This has changed the way we home brew. While we may have started home brewing to make cheap beer, we have evolved and now we are brewing good-quality craft beer at a reasonable price.

Ingredients have evolved

Both the range and the quality of beer kits have evolved. Many kits are designed to cater for our changing beer tastes. Draught and lager kits are now lost among the range of beer styles.





The evolution of craft beer in New Zealand has also meant an evolution in the way we brew

And our New Zealand-grown hops are unique and sought all around the world. There is no hop anywhere in the world that is like New Zealand-grown Riwaka or Nelson Sauvin. Gone are the days when the supply of hops was closely controlled by the main breweries — these great hops and others are readily available in home-brew stores.

New brewing equipment

While brewing equipment like plastic fermenters and bench cappers is still common in most brewers' homes, new stainless brewing equipment is becoming more prevalent. In some cases breweries in Kiwi man caves now look like mini commercial breweries, and in many instances that's just what they are. The internet has made information available to us all and it's now easy to work out what is needed



to build a home brewery. Blogs are full of recipes for people to clone their favourite commercial beer.

Electric all-grain brewing systems like The Grainfather and Brewzilla (formerly the Robobrew) allow home brewers to brew all-grain beers just like commercial breweries. By not using liquid malt and instead brewing with different malted grains and hops, home brewers have better flavour control of the beers that they produce. They are crafting their own beer!

Conical fermenters and temperature-controlled brewing

After the malt, hops, and yeast, the temperature that the beer ferments at is the next largest contributing factor to beer taste. Temperature-controlled brewing is an easy process that can improve your beer. At the simplest, an old fridge connected to a temperature controller and a heat belt can have you up and running with minimal effort. The temperature controller has a probe that sits in the fridge and both the fridge and a heat belt (or heat pad) are connected to the controller. The temperature set on the controller means the fermentation is held at that temperature by the controller turning the fridge and the heater belt on and off.

At the other end of the price spectrum, brewers can utilize a glycol chiller attached to their stainless conical fermenters to control temperature. Often this can also be connected to brew programmes so this can be monitored remotely on the brewer's mobile phone.

Lastly, brewers have evolved

I remember judging a large national home-brew competition more than 10 years ago when a team of us judged more than 900 beers over two days. Among the good beers were many that were infected and faulted due to a number of brewing issues, including oxidization, diacetyl, acetaldehyde, cross-contamination, dimethyl sulphide (DMS), poor yeast health, and hygiene issues.

Last year I judged a similar home-brew competition with a team of around 30 other beer judges and the quality of beers has improved dramatically. Infected beers have dropped to less than one per cent and beer faults were also significantly reduced. And the best beers were stunning!

Brewers now understand the brewing process and are always looking for feedback on how they can improve their beers. Reducing the beer's exposure to oxygen, healthy yeast-pitch rates, and ingredient selection to match the style being brewed are just some of the issues home brewers are locking into their brew processes. The result is a stunning home brew. 📁

Brewers Coop crafted NZ Pilsner

ALL-GRAIN RECIPE

- 5.5kg New Zealand pilsner
- 400g Carapils
- Grains mashed at 62°C for 60min
- 60 minutes' boil with hop additions as follows:
 - 25g Green Bullet (60min)
 - 15g Green Bullet (15min)
 - 20g Green Bullet (10min)
- 35g Riwaka dry hopped on day five for four days
- Lallemant BRY-97 ale yeast

EXTRACT RECIPE

- Black Rock Lager beer kit
- Black Rock Unhopped Blonde Malt
- Lallemant BRY-97 ale yeast
- 30g Green Bullet hops in a coffee plunger with boiling water for 15min and added before pitching yeast
- 35g Riwaka hops dry hopped on day five for four days
- Ferment at 18°C



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The lamp lighting my desk, powered by the laptop via the USB port

UPCYCLING A BRIONVEGA DESK LAMP

A '70S CLASSIC IS GIVEN A CONTEMPORARY ELECTRONIC MAKEOVER

By Enrico Miglino
Photographs:
Enrico Miglino

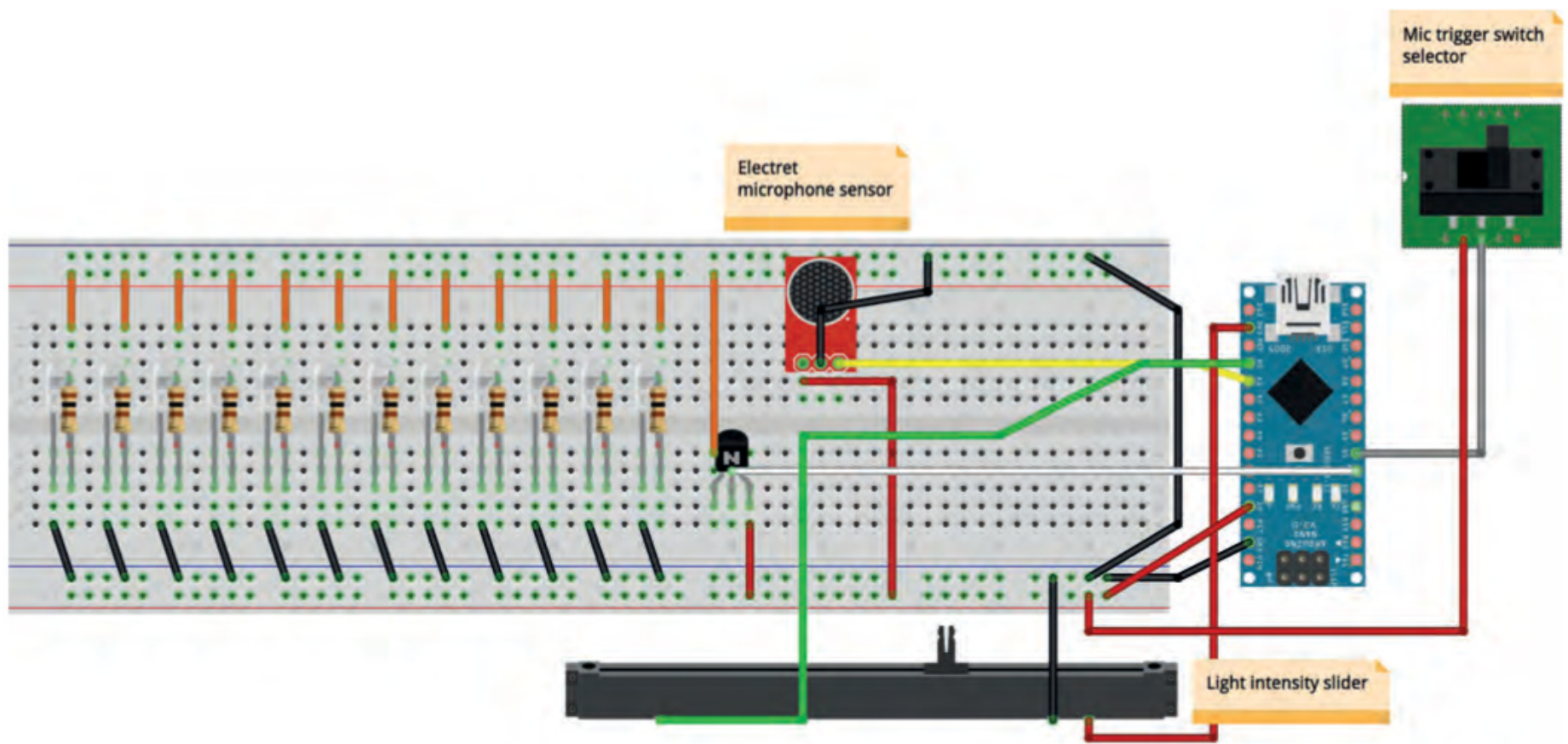
Introduction

For our second vintage appliance upcycling project in *The Shed*, I decided to work on an iconic Italian appliance from the mid '70s, a Brionvega desk lamp.

When I bought this lamp I was captivated by the design, so I decided to upcycle it, retaining the original style but trying to make it even better by updating it with contemporary technology.

The project itself is relatively easy in terms of electronic modifications, and the challenge is to achieve the upgrade with minimal changes to the original design aesthetic. This

makes the project more complex of course, but I always follow the same principles: every upcycling project needs to use the space available inside the device without adding any external parts or components, or making major changes to the design. The removal of the unused original components inside should not compromise the structure and functionality.



The original '70s vintage Italian Brionvega desk lamp

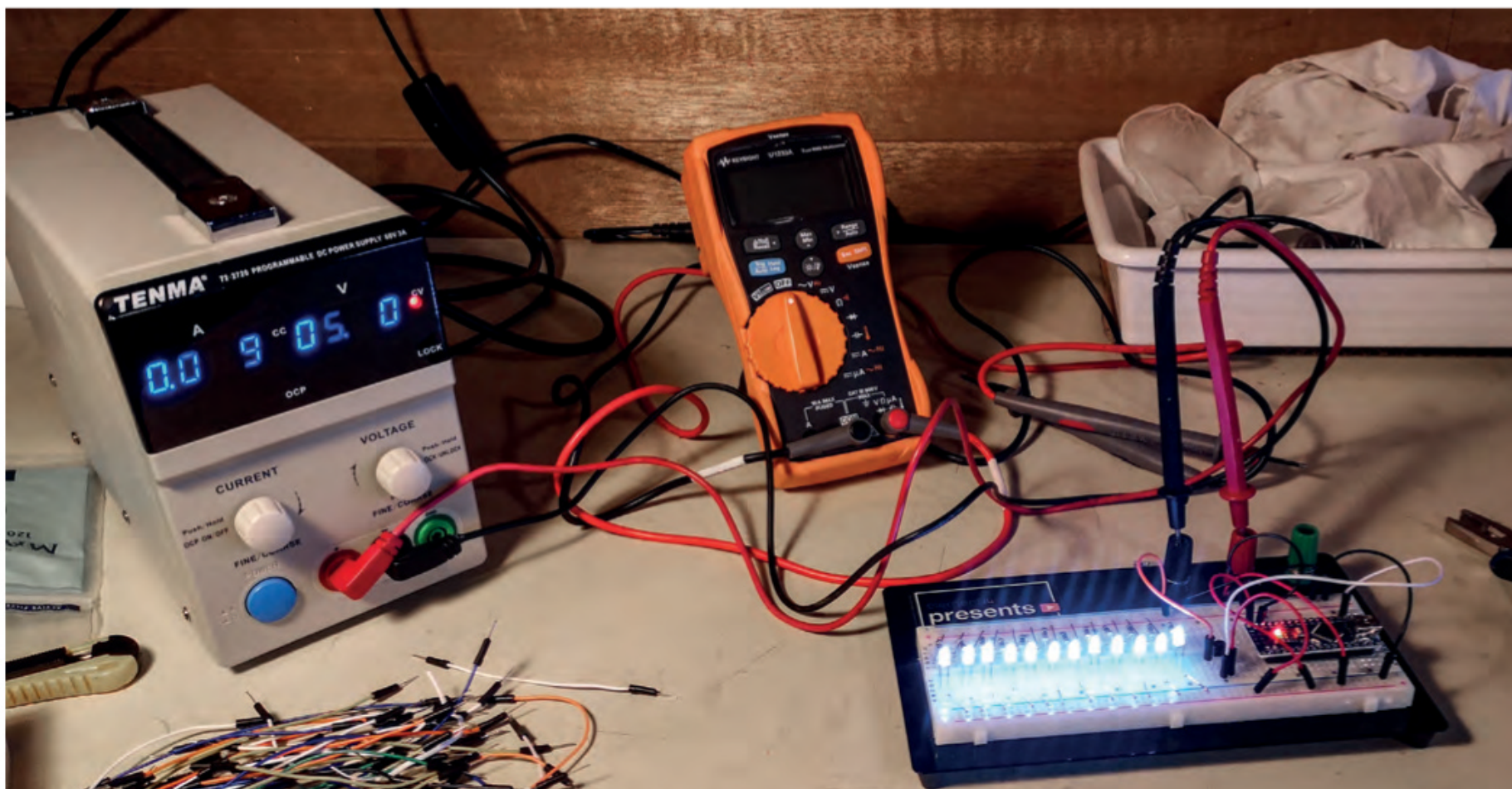
Designing and making

I decided to change the lighting features of the lamp, adding a sensing device and a linear light-intensity regulator.

Digital control of the new features can be easily achieved with an Arduino board. Due to the limited space available inside the base of the lamp, I opted for an Arduino Nano. The Nano version has the same characteristics of the traditional Arduino Uno and the same GPIO pins, but it is smaller. One of the most important aspects of this upcycling project is the dramatic reduction of the lamp's power consumption, providing better lighting and transforming the appliance from analogue to digital. ►

Detail of the base of the pole light head. Note the sliding contacts: the internal wire will be connected to the positive wire and the external wire will be connected to the ground circuit





Testing reliability

One of the biggest differences between almost any kind of electronic device made before the late '80s and one produced since then is the working voltage and power consumption, so I had to test the reliability of a set of high-efficiency, low-power LEDs to replace the original yellowish 12V lamp.

The typical low voltage reference for lamps, radios, and a lot of electronic devices of the era was 12V, but the new version of the Brionvega lamp should work at 5V. However, I also wanted to power it with a standard USB port and this meant keeping the power needed for the entire circuit under the standard 500mA.

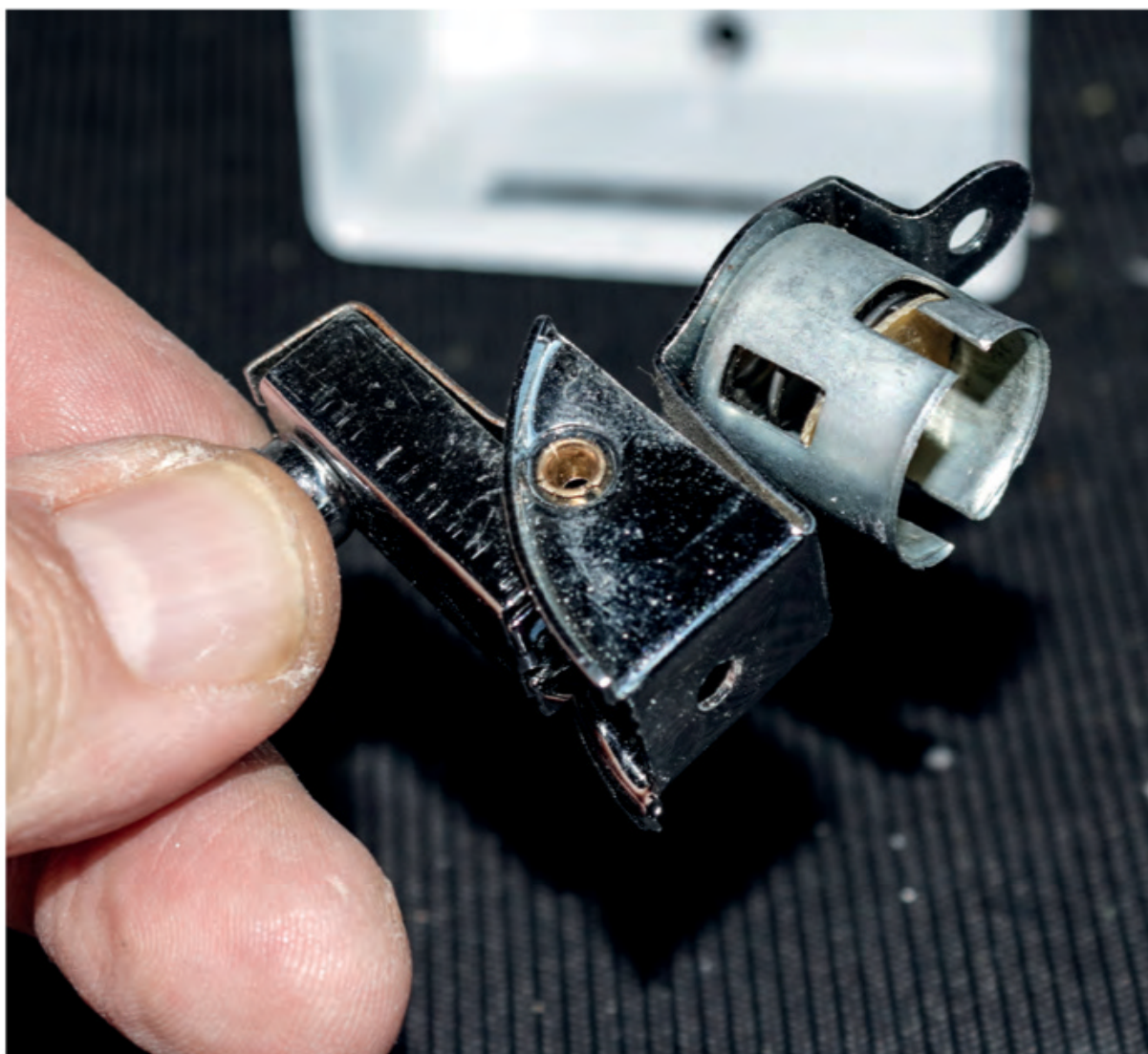
I decided to make a grid of 12 white LEDs to provide good-quality light. All the LEDs are connected in parallel to an NPN 2N2222 transistor, acting as a micro relay controlled by an Arduino pulse-width-modulation (PWM) output pin, and eventually amplify the Arduino 5V output powering the LEDs.



Above: The full working prototype created on a breadboard before assembling the lamp. The prototype breadboard was also used to write the software and test the power required by the entire circuit

Below: Disassembling the internal parts. The base of the lamp hosts a 200V AC to 12V DC transformer, as shown in the illustration details. By removing the transformer power group and fuse, the power connections to the lamp light support pole can be reused to power the LEDs





Time to open it up

After testing, I found that 104mA was sufficient for the whole circuit, with the light set at maximum power, so a standard USB connection to any device (laptop, smartphone, portable power bank, USB charger) should work well.

The first step was opening the lamp and removing the original bulb and power supply, an internal 220V AC to 12V DC transformer controlled by

an on-off switch.

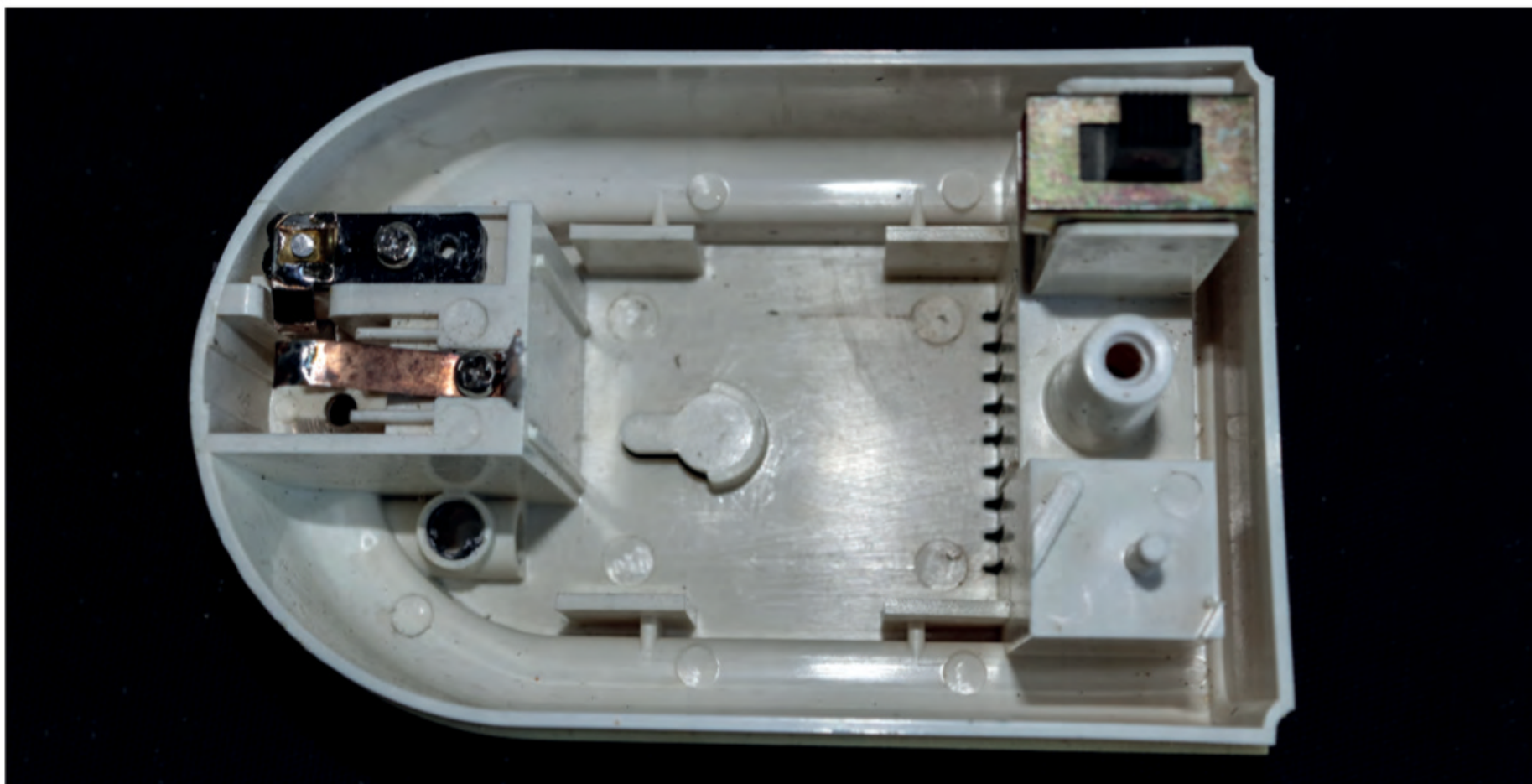
After removing the transformer, which is also the biggest component of the lamp, almost all the base box was empty for my new installation.

I made a full working prototype on a breadboard, with the associated circuit design, to test the parts of the circuit and programmed the Arduino Nano before assembling the new version of the lamp. ►



Above: The head lamp holder should also be removed. The pole top connectors are soldered to the new LED matrix power wires

Below: Removing the transformer and desoldering the low-power wires leaves all the space inside the lamp body free. The connectors to the pole light head have been restored, removing the oxide to get better contacts



Replacement parts

The second upcycling step consisted of designing and 3D printing the replacement parts: the LED grid support that should fit into the rounded rectangle of the lamp head, and the slider button that would replace the on-off switch on the lamp base.

These objects, as usual designed with Fusion 360, had to be very precise, so I decided to use the Elegoo LCD resin 3D printer instead of the PLA filament printer. The resin 3D printer provides a smaller printing volume compared with the 200x200x200mm of the filament printer, but it can reach a precision of 0.05 or less, almost a factor of 10 in the fusion filament technology I use to print bigger 3D components.

To keep an eye on the project's environmental impact, for the first time I used the brand new Elegoo washable grey resin. While this product has the same qualities as traditional resin, the 3D prints can be cleaned using water, drastically reducing the pollution problems inherent in cleaning the parts with isopropyl alcohol.

Internal components and switch

I assembled the Arduino Nano electret microphone used as a tap sensor for the light on a small breadboard printed circuit board (PCB). This, along with the slider and the extra switch, all fit inside the lamp base. I hot-glued the new assembled internal components to keep them in place.

I placed the switch selector to enable or disable the tap sensor on the outside of the bottom of the base so that it does not alter the lamp's design aesthetic.

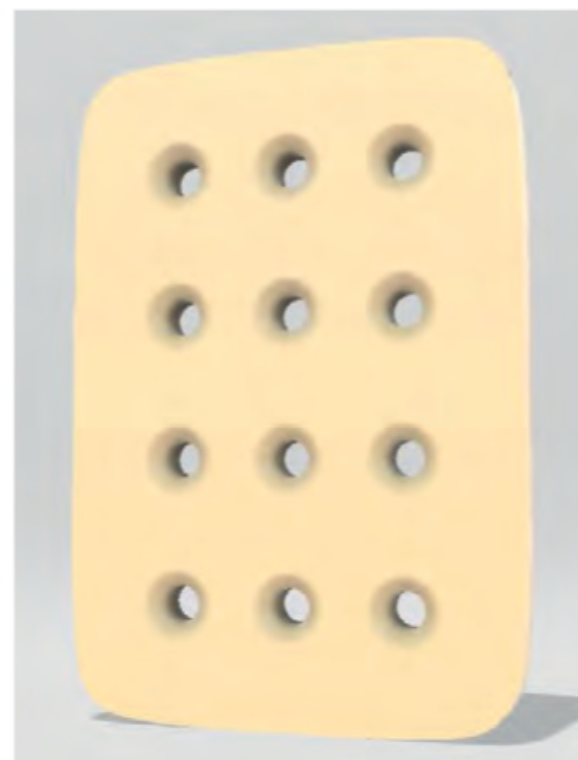
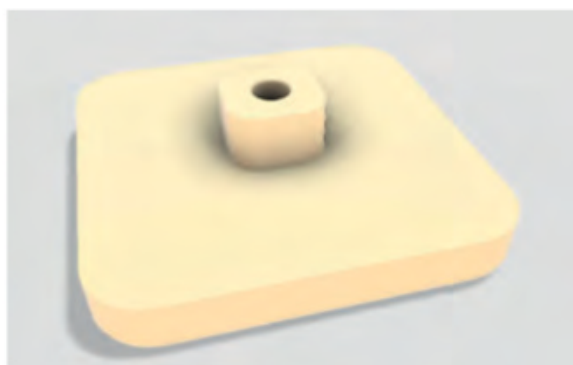
After testing and building the 3D components on a breadboard, I started to assemble the upcycled version.

Top left: A 3D-rendering of the dimmer button that replaced the original on-off switch

Top right: A 3D-rendering of the white LED support that replaces the bulb from the original lamp which keeps the 12 LEDs in place in a four-by-three matrix

Middle: I 3D-printed the STL with a high precision Elegoo 3D LCD resin printer

Right: Once the print is completed, the resin should be stabilized by exposing the printed object to a 480nm UV source lamp for about one hour. After the stabilization, the LED support is painted to reflect the light



I used the brand new Elegoo washable grey resin ... the 3D prints can be cleaned using water, drastically reducing the pollution problems inherent in cleaning the parts with isopropyl alcohol



The software: converting the analogue lamp to digital lighting

The software architecture of the sketch is quite simple to follow.

On top of the sketch I defined a series of constants to drive the behaviour of the programme and control the limits of the dimmer and the tap sensor. These values were deducted empirically and refer to this specific kind of appliance; it is not difficult to replicate the same behaviour in a different container of a different kind of lamp by just reconfiguring the values.

MIN_DIMMER and MAX_DIMMER depend on the effective potentiometer range and correspond to the analogue values read on both extremes of the slider.

The three constants OFF_LIGHT, MIN_LIGHT, and MAX_LIGHT instead

define the range of the LEDs' intensity provided by the (PWM) output pin that controls the light power transistor.

The off status should always be zero, used to power off the lamp, while the min and max values depend on the kind of LEDs used, as well as the number of LEDs connected in parallel.

The MIC_TRIGGER constant instead defines the sound level that the

electret microphone should detect to switch the light on/off.

Note that when I tested the software on the breadboard prototype the sensitivity of the microphone was higher than it was in the final assembly, when the microphone is inside the lamp base. Depending on the thickness of the container the sensibility should be configured accordingly.

```
#define MIN_DIMMER 30    ///< Minimum analog value of the potentiometer
#define MAX_DIMMER 255   ///< Maximum analog value of the potentiometer
#define OFF_LIGHT 0      ///< Light intensity off
#define LOW_LIGHT 50     ///< Light intensity min range
#define HIGH_LIGHT 255   ///< Light intensity max range
#define RESPONSIVITY 50  ///< Sensitivity of the dimmer readings in ms
//! The sample window amplitude of 50ms corresponds to a frequency of 20Hz
#define SAMPLE_FREQ 50
#define MIC_TRIGGER 400  ///< Min sampled value to trigger the light
```

The sketch source is available as usual on GitHub (github.com/alicemirror/LampUpcycling) and includes the USB to serial interface initialization in the set-up function and commands in the loop function for testing the values with the serial terminal available on the Arduino IDE. I used these to define the ranges defined in the constants described. The code of the serial interface can be deleted as it is for testing and debug purposes only and does not affect the logic of the sketch.

```
// -----
// ----- Check for the dimmer current position
// -----
// As the analog value is between 0-1023, it should be mapped to
the limits of the min/max light PWM value // Before mapping we check
if the values are outside the dimmer range
// to set the off and max intensity mode without flickering
If (dimmer <= MIN_DIMMER) {
    intensity = OFF_LIGHT;
} else if(dimmer >= MAX_DIMMER) {
    intensity = HIGH_LIGHT;
} else {
    intensity = map(dimmer, MIN_DIMMER, MAX_DIMMER, LOW_LIGHT, HIGH_
LIGHT);
}
```

The first part of the loop function — executed every cycle — checks if the light control (the slider potentiometer, or dimmer) changed its position. Using the analogue value of the dimmer, the corresponding intensity value is calculated, mapping the dimmer range to the intensity levels range. The dimmer range corresponds to the analogue values read from the analogue input A0, while the intensity levels correspond to the PWM value set to the output pin connected to the transistor.

Note that if the dimmer value is under

the lower range, the lamp intensity is set to zero (light off), while if the value is higher than the max value, the intensity is set to the max value. This solution avoids the light flickering when set to off, or to a higher intensity.

The second part is controlled by the

sensor activation switch.

```
if(digitalRead(MIC_CONTROL_PIN)
== true)
```

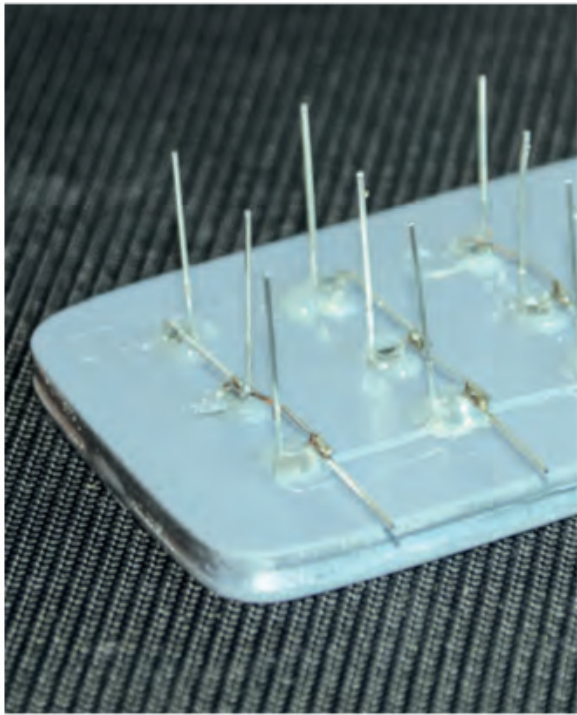
```
{ [Electret microphone tap sensor
reading] }
```

If the switch pin defined on the GPIO by the MIC_CONTROL_PIN is set to on, the updated light intensity level is applied only if the user who taps the microphone sensor has powered the lamp, otherwise the light intensity level is forced to zero (light off).

The light intensity is set every cycle with the PWM instruction:

```
analogWrite(LIGHT_PIN, intensity) ►
```

*The sketch source is
available as usual on
GitHub*



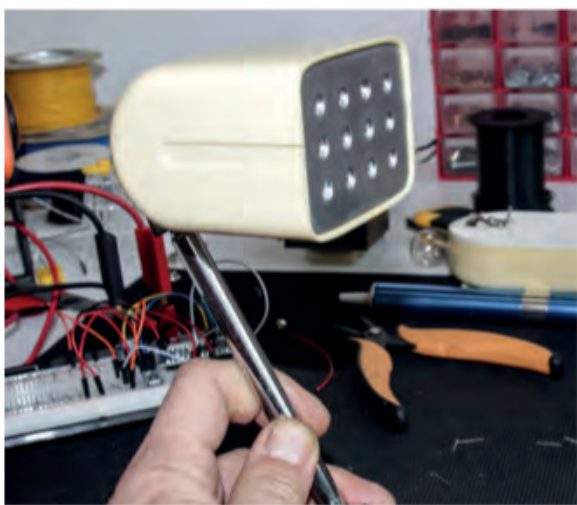
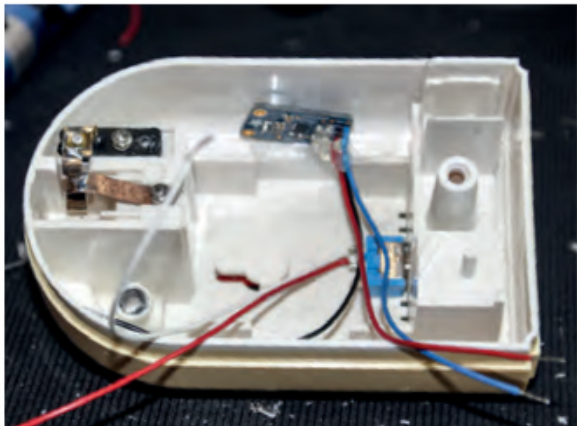
Above: The 12 LEDs are connected in parallel and powered by the Arduino 5V through a 2N2222 NPN transistor. The lamp head should only include the LEDs, while the transistor is part of the circuit on the lamp base. The LEDs were hot-glued to the support, then I soldered a grid adding the 100Ω resistors so the lights are connected together, powered by the 5V and GND wires



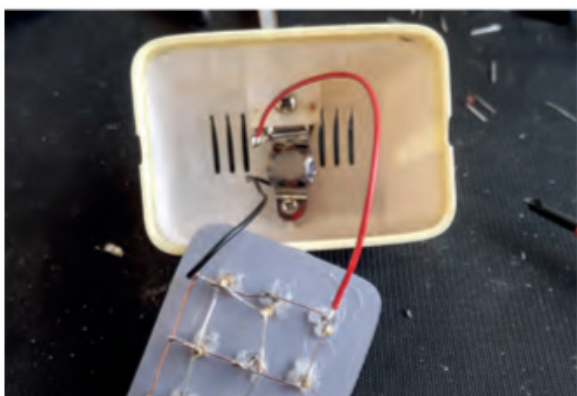
Microphone tap sensor

The only complex part of this sketch is the electret microphone tap sensor reading. Let me take a step back

to show how the software works when a tap is detected on the MIC_CONTROL_PIN GPIO input port.

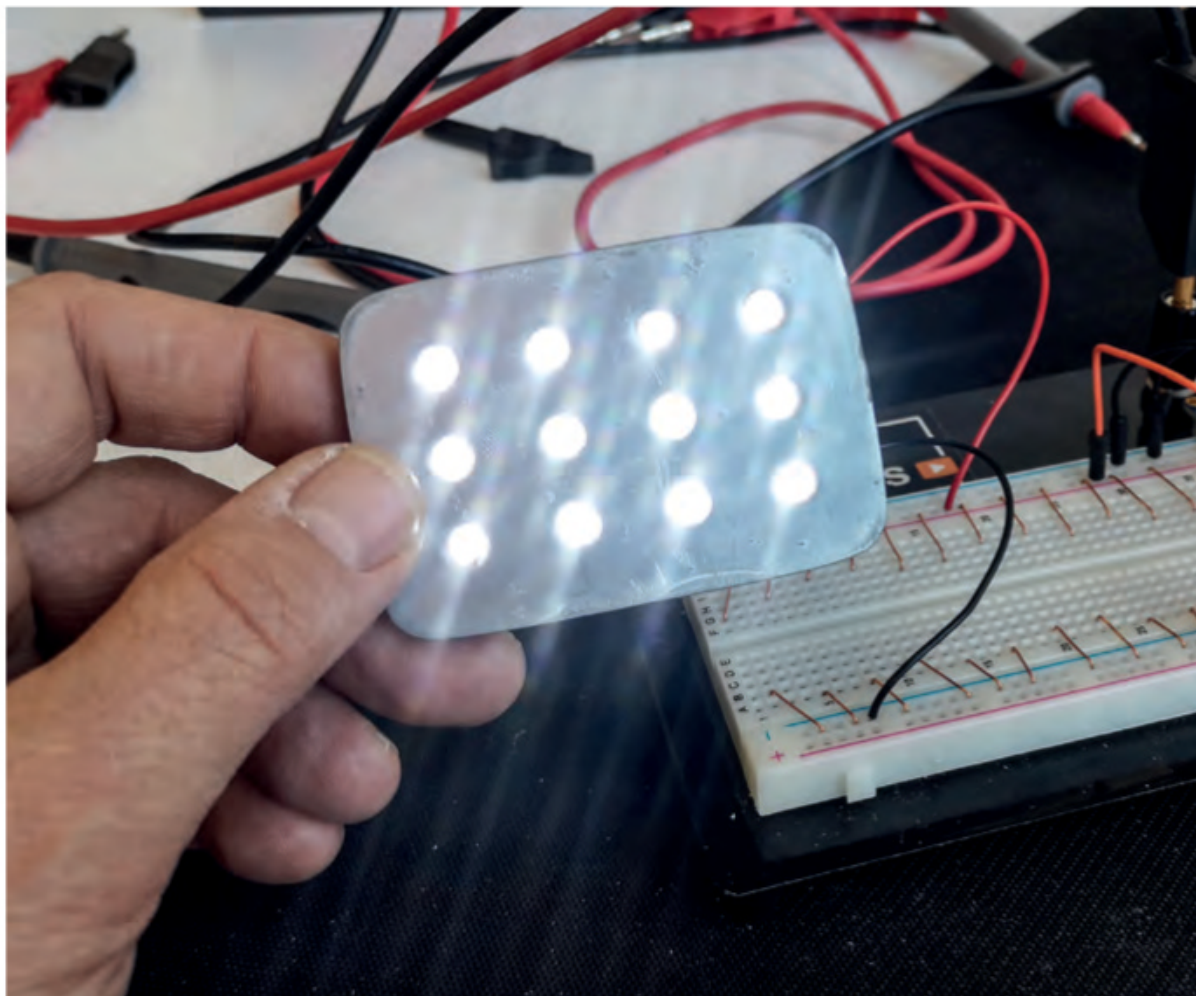


Below: The assembled LEDs were tested on the breadboard prototype, then the two power wires were soldered to the pole and the light head assembled



```
// collect data for 50mS and save the max and min values
while ( (millis() - startMillis) < sampleWindow ) {
    // Check sample
    sample = analogRead(A1);
    if (sample < MAX_SIGNAL) {
        if (sample > signalMax) {
            signalMax = sample;
        } else if (sample < signalMin) {
            signalMin = sample;
        } // Smaller than last saved min
    } // Greater than last saved max
} // while ... sample cycle

// Calculate the peak-to-peak amplitude of the last sample.
// If the amplitude reaches the trigger level, the status of the light
// is changed
peakToPeak = abs(signalMax - signalMin);
// Reset the min/max values
signalMax = 0;
signalMin = MAX_SIGNAL;
// Check if the light status should be changed
if(peakToPeak > MIC_TRIGGER)
{ // Change the light status
    if(lightStatus == true) {
        // Bypass the intensity value read from the slider
        // and force the value to off
        lightStatus = false; // Update the status of the light
        // Update the light
        analogWrite(LIGHT_PIN, 0); } else
        { lightStatus = true; // Update the status of the light }
    } // Mic sampling is triggered
    // Update the light status if the light is on. This is to accept
    // light intensity changes also when the mic sensor is active.
    if(lightStatus == true)
    { // Update the light analogWrite(LIGHT_PIN, intensity); }
```

Above: After reassembling the lamp head, the slider, electret microphone, and switch were fixed inside the base box



Circuits and software

The circuit design and the 3D-printable STL files of the project, as well as the Arduino software, are available on GitHub: <https://github.com/aliceinmirror/LampUpcycling>.

Options for lamp reactions

The electret microphone provides an amplified voltage read by the analogue input port A1 corresponding to the intensity of the detected sound frequency. To detect a 'tap' from the user, a single reading is not sufficient, so I adopted a sampling method to test the reliability of the readings.

Every loop cycle of the MIC_CONTROL_PIN detects the tap sensor, which starts a series of readings of 50ms duration. During this period, the higher and lower intensity levels are saved on the two variables, signalMin and signalMax.

At the end of the period, the absolute value of the difference is calculated: the obtained value indicates if a consistent sound variation has been detected and accordingly with the peakToPeak amplitude if the value is bigger than the MIC_TRIGGER value, the light status is inverted between on and off.

By configuring the right value of the MIC_TRIGGER, it is possible to change the sensitivity of the microphone. Consequently, the lamp can be configured so that it reacts not only to a tap on the base but also, for example, to a variation of the sound in the environment, in order to react to a particular range of frequencies. 📄



SHEDS DOWN, DOWN UNDER

Loading a shed at Bluff

A BRIEF VISIT TRIGGERS AN INVESTIGATION OF OUR SOUTHERNMOST SHEDS

By Murray Grimwood

Photographs: Murray Grimwood and expedition members

Our sub-Antarctic islands are inhospitable places — you need shelter to survive. Apart from a single-season 13th- or 14th-century Māori visit, the history of the Auckland Islands is one of sheds. It divides naturally into three parts: sheds built by and for sealers and castaways, sheds dedicated to wartime coastal surveillance, and sheds facilitating

recent conservation initiatives.

Discovered by Europeans in 1806, sealing gangs were soon being left on the islands, sometimes for long periods. Their shelters were improvisations of canvas and local materials; mostly southern rātā, grasses, and ferns.

Some gangs were forgotten, or abandoned, for years. At least those folk went ashore voluntarily and

somewhat prepared. Myriad are the tales involving neither. Typically a vessel would pile into the western side of the island group, popularly charted as being 35 miles (56km) further south. Survivors would straggle ashore wet, cold, and ill-equipped. They faced near-impenetrable low-canopy forest, peat-mud underfoot, and saturated everything.

Weather-beaten sheds on Enderby Island

“Grafton’s anchor chains parted, she struck a rocky beach, and she foundered”

The *Grafton* shipwreck

The most famous of these castaway stories is that of the *Grafton*; a 54.8x18.0 feet (16.7x5.5m), 56-ton schooner.

Written about by two of the five-strong group — *Castaway on the Auckland Isles* (Thomas Musgrave) and *Wrecked on a Reef* (FE Raynal) — and subject of a recent Radio New Zealand serialization, this is a *MacGuyver* story extraordinaire, albeit one which had some lucky breaks.

In early 1864, after a two-day gale inside Carnley Harbour, the *Grafton*’s anchor chains parted, she struck a rocky beach, and she foundered. The crew first built a shelter, then a substantial dwelling, which they called ‘Epigwaitt’ (North American Indian for ‘dwelling by the water’). Epigwaitt measured 24x16 feet (7x5m), with seven-foot (2m) walls and a 14-foot (4m) ridge. The fireplace was 6x4 feet (1.8x1.2m) and the walls one-foot (30cm) thick, consisting of 5000 bundles of thatch weighing over two tons.

Their lucky breaks included being able to access the wreck and salvage a lot of useful stuff, not to mention being alongside good running water. Inspired leadership and a fine understanding of morale, married to an amazing knowledge of chemistry, saw them storing food and firewood, besides constructing sleeping cots, a table, and a writing desk using only an axe, adze, hammer, and gimlet. When ink ran out, they substituted seal



Remains of the *Grafton*



Stella castaway hut, Enderby Island



No shortage of water here

blood. With scurvy in mind, they grated, boiled, and fermented a root to make beer. They tanned seal skins and made them into clothing. They shot, salted, and smoked waterfowl. They produced potash and thence soap. They made a chess set, ran educational classes, and raised a flagpole to alert passing ships.

Time to be rescued

After a year had passed, they decided to rescue themselves. A forge was built, including a bellows constructed from sealskin, to turn metal from the wreck into “chisels, gouges, and sundry tools” (including a saw made from sheet metal), 180 clinch bolts and 700 ►



That rare event; a sunny antipodean day



Ranui World War II base hut



nails, spikes, and sundry fittings. After a false start attempting to build a “cutter of about 10 tons” from scratch (held up by Raynal’s inability to forge an auger!) the 12-foot (3.6m) ship’s boat was lengthened, strengthened, and had its freeboard raised.

Nineteen months after the wreck, three of the five set out for Stewart Island, arriving at Port Adventure five boisterous days later.

In response to their claim to have seen smoke elsewhere on the island, a ship was sent (by the governments of NSW and Queensland) to search for castaways.

That ship left an impeccably carved inscription on what has become known as the ‘Victoria tree’, which still reads: “H.M.C.S. Victoria Norman in search of shipwrecked people Oct 13th, 1865.” The hand carving is router-perfect. They landed goats and rabbits, and also planted vegetables. Later, castaway



The Tagua base hut is beyond repair

depots would be established, some of which remain.

One 1880s photo in a Canterbury Museum collection shows what appears to be a castaway shelter being erected on the Epigwaitt hut site — it resembles the still-existing shelter erected on Enderby Island by the crew of the

Stella in 1880. To direct castaways towards the depots, wooden ‘finger-posts’ were erected at the coastal bush-edge, many of which still exist.

Many lives lost

Besides the *Invercauld* (simultaneous with the *Grafton* and possible source of



Victoria tree carving



Fifty-pound fine notice for nicking emergency supplies!



Castaway shelter



Lookout hut (and below)



Remains of the German Transit-of-Venus establishment

that observed smoke), wrecks include the *General Grant*, *Anjou*, *Dundonald*, and *Derry Castle*. Every one of them is a tale of survival and (as with the four survivors of the *General Grant* who sailed for New Zealand and were never seen again) non-survival. Forensic archaeology has added the survivor-less *Rifleman* (1833) to the list of known wrecks, and there must have been others. A punt built by the *Derry Castle* survivors exists in the Southland Museum, as does the frame of the coracle built by the *Dundonald* crew, which is in the Canterbury Museum.

Island sheds

Next come the buildings — from mansions to boat sheds — constructed by would-be settlers.

A township was attempted here, named ‘Hardwicke’ and championed by Samuel Enderby, but it only lasted from 1849 to 1852. At least two private farmers — Monkton and Fleming — tried their hands also. In all cases, the lack of sun and warmth, the persistent rain, wind, and mud, coupled with the logistics of getting to and from this piece of rock in the Southern Ocean, beat them all. Of all these abortive attempts, virtually no trace exists.

On 15 October 1874 a team of eight

German scientists arrived at Port Ross harbour to observe the Transit of Venus. The team erected their kitset buildings, including a house, a wooden shed for equipment to measure magnetic variation, and “an iron shed in which a tool to assess the tide was placed”. The brick plinths they erected to steady their instruments remain.

Defence sheds

Of more interest to New Zealanders are the two sites where structures were established for World War II surveillance — not that any ships were sighted! The only enemy vessel to visit, the *SS Erlangen* (6010 tons, 142m) did

a runner from Port Chalmers at the outbreak of war but had insufficient coal aboard. For 39 days they cut and loaded 235 tons of wood in Carnley Harbour, having to make special saws because the southern rātā was too strong for axes. The *HMS Leander* having visited but missed them, they did 35 days to Chile, partly under sail. Then, intercepted by British cruiser *HMS Newcastle*, *Erlangen*’s crew scuttled her.

The two World War II sites are at Ranui Station in Port Ross, and Tagua in Carnley Harbour, presumably named for the vessels that kept them supplied. *Ranui* is an iconic story in herself, built on a sandfly-infested beach in ►



Castaway shelter



The prefabricated hut seen being loaded on P72, being erected

Stewart Island's Port Pegasus, launched in 1936, requisitioned by the New Zealand Government in 1939. Having been many things in between (including a stint as an oyster dredger) *Ranui* lives today fully restored, in Auckland.

Keeping watch

Codenamed 'Cape Expedition', the World War II programme saw coast watchers stationed on-site, for 12 months at a time, in prefabricated huts. The bigger huts were constructed in a modular fashion, purportedly for an abandoned Antarctic project.

The modules featured a 10mm plywood exterior covered with painted fabric, a 16mm Pinex sheet as a central air-gap divider, and 8mm interior ply, all framed in Oregon pine. Transmission from lookout shed to base shed was by telegraph — No. 8 fencing wire strung

through the bush on insulators, earth-return. If you get lost in that bush today, you can still follow the No. 8 wire.

The *Ranui* buildings are in good nick and well maintained, as is the Tagua lookout. The Tagua main building is, sadly, past saving. Graham Turbott wrote of his coast-watch experiences in a book titled *Year Away*. It's an interesting read.

DOC sheds

The most recent Auckland Island constructions are Department of Conservation (DOC)-initiated, and are prelude to a proposed pest-eradication operation. There are pigs, cats, and mice (but no rats — which suggests that the cats got there first). Following their successful Million Dollar Mouse eradication effort on the Antipodes, the team is moderately confident as it tracks the range and habits of all three species.

But local conditions haven't changed from what those early castaways endured. Sheds and good logistics planning are essential; you are a long way from a hardware store, and it still pays to have MacGuyver-slash-sheddie skills in such a hostile environment. Long may we nurture them. 📁



No. 8 wire and insulator



Ranui woodshed



Ranui World War II base hut

Books on Auckland Islands

Wrecked on a Reef — FE Raynal

Castaway on the Auckland Isles — Thomas Musgrave

Year Away — Graham Turbott

In Care of the Southern Ocean — Paul Richard Dingwall, Kevin L Jones, Rachael Egerton

Far South — William Dougall

Beyond the Roaring Forties — Conon Fraser

The Auckland Islands — FB McLaren

Straight Through to London — Rowley Taylor

Island of the Lost — Joan Druett

Reference websites

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<http://ranui.co.nz/her-past/>

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THE GIFT OF HAVING FUN

MAKING A KUBB SET FOR A LASTING CHRISTMAS PRESENT THAT EVERYONE CAN ENJOY TOGETHER

By Emil Nye

Photographs: Emil Nye

What could we give the family for Christmas? Certainly not another present that they don't really want or which won't last! This is an economical story with a twist and the emphasis of the project is on function and satisfaction, certainly not high-class woodworking.

On a summer afternoon after a wedding in the UK (in Shakespeare's church), extended family were having a get together in a park by the river and playing kubb.

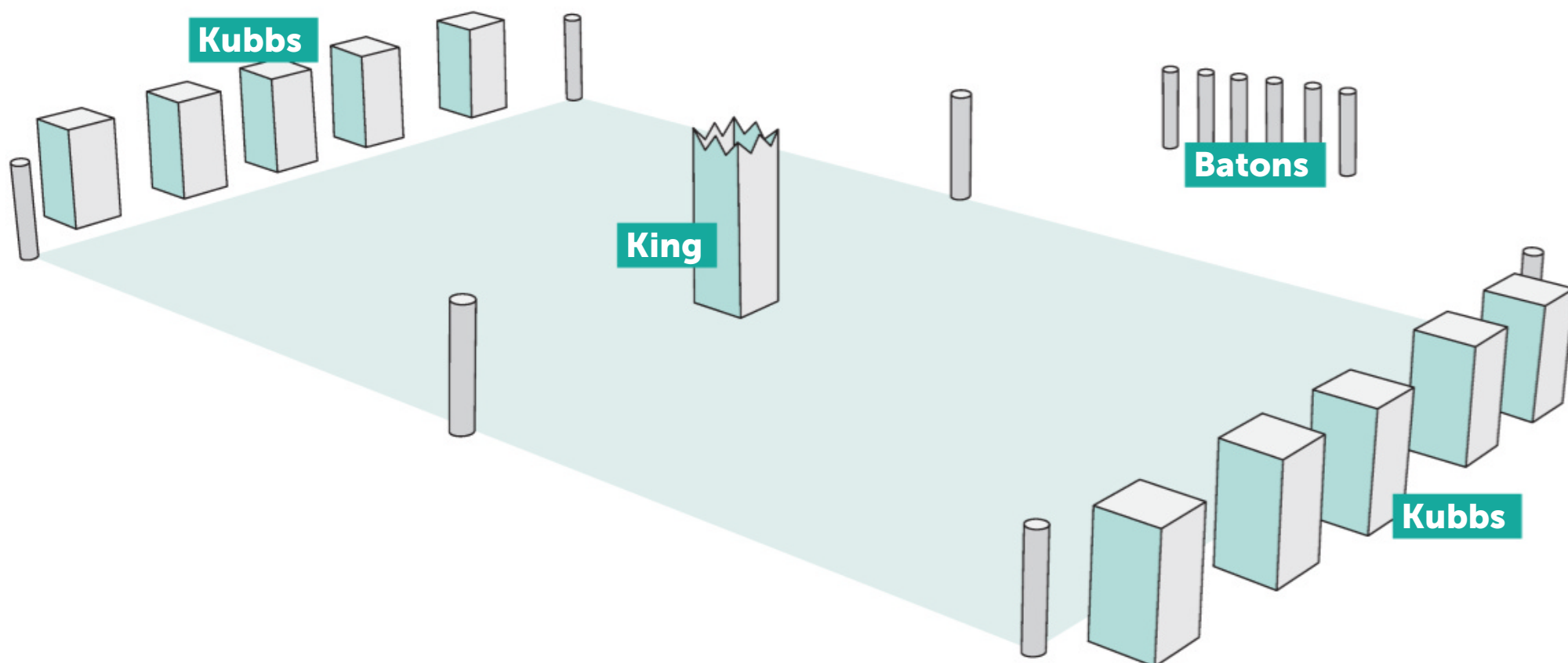
The players included a three-year-old and one aged over 90, and everyone was enjoying it. The emphasis on adjustment,

fairness, and debate added to the appeal.

I thought this would make a good little project for my workshop and everyone would be happy (Images 1 and 2).

It would also give opportunity for practising old or lost woodworking skills, and the 'can't waste' ethos that I can't avoid.





What is kubbs?

Kubb is otherwise known as ‘Viking chess’ and is an outdoor game with similarities to boules, bowls, skittles, and other games. It can be played on grass or sand, and the size of the pitch can be varied. Details are easily found online.

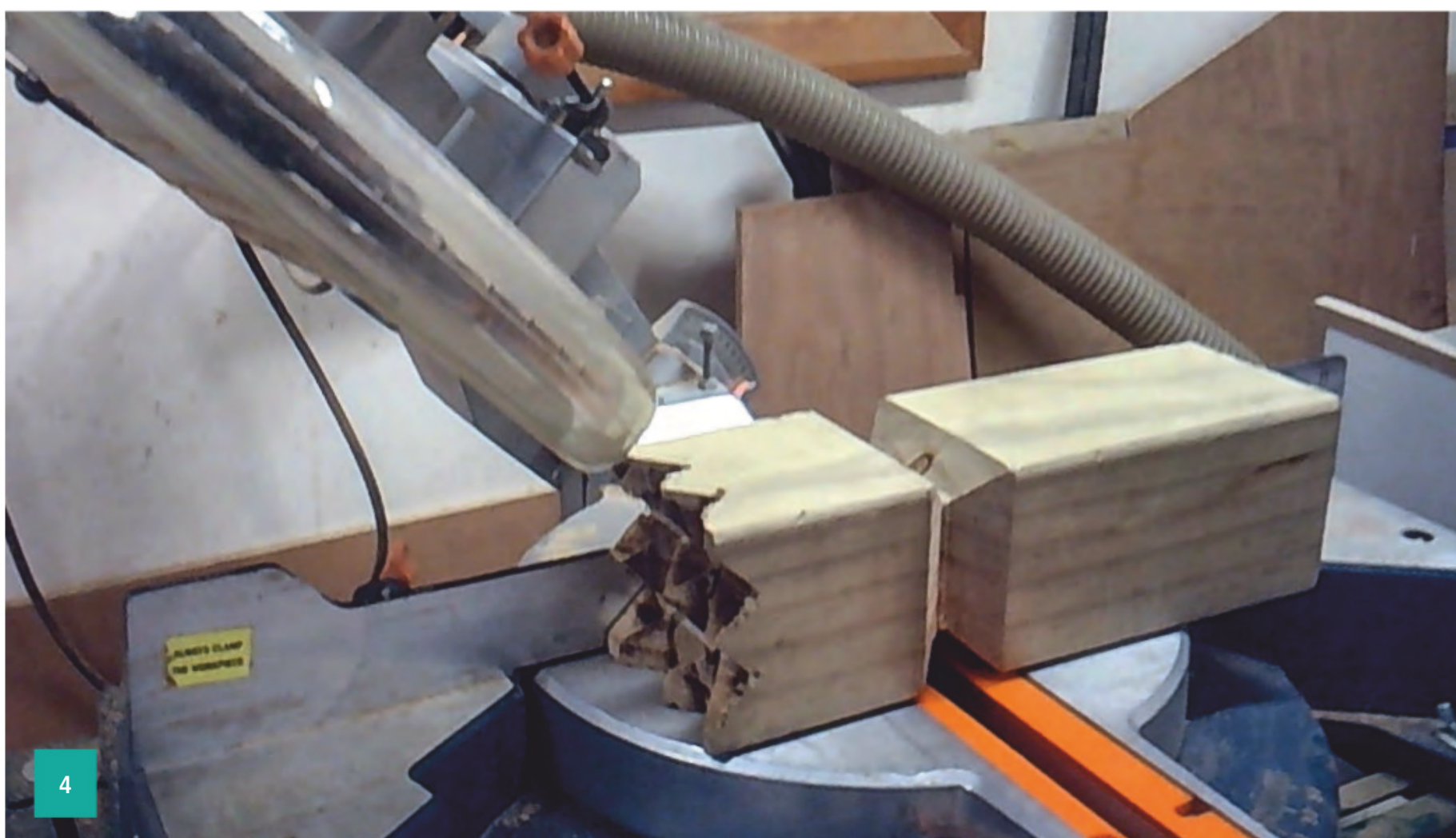
Although the players are unlikely to reach international standard, I decided to make the pieces the standard size. The official density for the wood happens to be quite close to that of our everyday pine.

Pieces consist of a king, 10 kubbs, six throwing batons, and six place markers.

- The king is 300x90x90mm.
- The 10 kubbs are 70x70x150mm.
- The six batons are 300x44mm.
- The six field markers mark the corners and centre lines; their shape is immaterial.

Other materials required are odd bits of ply, woodworking glue, and small nails. I had 18mm bronze boat nails, which were particularly suitable — they hold well and don’t rust. As they are mostly into quite narrow ply and also close to the edges, I pre-drilled all holes. I also used woodworking glue, though boat nails hold really well and the flat heads don’t pull through. ►





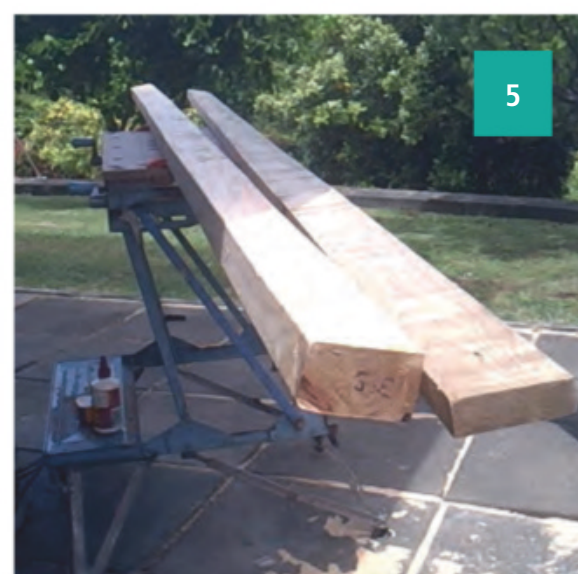
Why make just one set?

I planned to make three sets so I chose a left-over metre of 4x4 (95mm) square house post. I was fortunate to find 1800mm lengths of large dowel in a local trading store, so I bought three lengths of 45mm and two of 30mm.

Only later I remembered that many years ago I had made a croquet set for our family where I used rimu dowel for the shafts and laminated 100mm dowel for the mallet heads. The two end posts

The players included a three-year-old and one aged over 90

were larger dowel. The hoops were made of 12mm steel rod bent in a vice, sharpened, and dipped in plastic. It has lasted 30 years.





6

Taking the metre of 4x4 square house post, I planed 2.5mm off each side and cut 300mm lengths. This would make three kings. It was easy using a combination square to mark 45-degree lines (Image 3) and then on the compound mitre saw to cut a pointed crown on the top (I left small flats), and a small decorative 'waist' (Image 4).

Good use of twisted timber

The next step was making the kubbs. I had a couple of long lengths of treated 4x2 (95x45mm) that were quite warped (Image 5). Here was an opportunity to use them; by the time they were cut into lengths of just 150mm, there would be minimal twist in each piece.

I had also some oddments of 35mm decking. I decided that laminating these together would make enough for at least one of the sets. I cut them down to 75mm wide. Strips of the decking made 35mm square section, which, with a tapered end, was good for a set of marking pegs (Image 6).

I laminated together the 45mm and 35mm lengths. The result is shown in Image 7 — you can never own too many clamps. The strength of a twist in wood will be familiar to many. When I took off the clamps, it was too strong for the glue at the ends (Image 8).

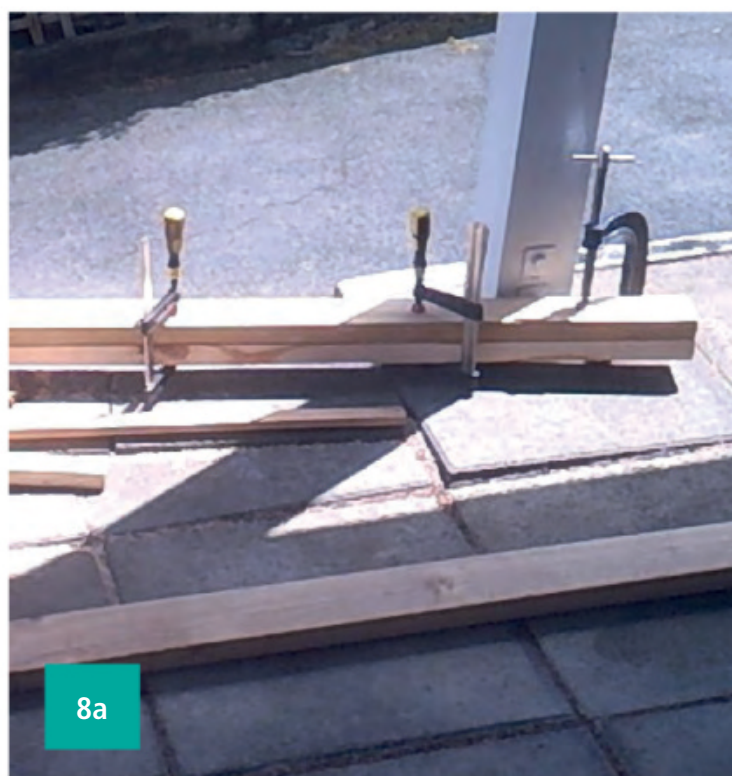
I cut off the separated ends (Image 8a). Surprisingly, even when cut into only ►



7



8



8a

Kubb rules

Kubb is a lawn game where the object is to knock over wooden blocks by throwing wooden sticks at them.

Kubb (the vowel is pronounced similar to the 'oo' in 'boob') means 'wooden block' in Gutnish, a Swedish dialect. Kubb can be quickly described as a combination of bowling, horseshoes, and chess. Today's version originated on Gotland island in the kingdom of Sweden.

A kubb game consists of

- One King
- Ten kubbs
- Six round wooden batons
- Four pegs to mark out the field plus/minus two for the halfway line



8b

Set-up

Kubb is typically played on a rectangular pitch approximately 5x8m. Although there are no official rules as to the size of the field, the dimensions can be altered for younger players or to accommodate faster games.

Typically the pitch is grass, but kubb could also be played on sand, snow, or dirt. The pitch should always be level, with no more than a three-inch (8cm) drop from one end — or one side — to the other.

Stakes are driven into the ground at the corners of the pitch. Two other markers may be used to demarcate the centre line. The narrow ends are called 'baselines'.

It is worth noting that in serious play, or in games where the players are skilled, or where there is betting involved, the use of twine or strings should not be encouraged, as the ability to reach common agreement over whether a kubb is 'in' or 'out' promotes sportsmanship and a sense of fair play, which is a trademark of this unique game.

The king is placed in the centre of the pitch, halfway between baselines. An imaginary line drawn through the king and parallel to the two baselines divides the field into two halves. The kubbs are set up across each baseline, five to a side.

150mm lengths, the twist still showed — see the stacked kubbs (Image 8b).

Fortunately, there was width and thickness to spare. Passing it through the thicknesser with a fillet under the rear corner (then turning it over to work on a true surface) worked well.

A quicksand on the finisher smoothed the faces, corners, and edges. In this set, although the homely and artisan look had its own attraction, I didn't like the asymmetrical appearance of the laminated bits, so I used the marking gauge to scribe a line to match the line of the join (Image 9). For the other sets I used matching sections (Image 10).

Cutting three sets of six throwing battens 300mm long from my 1800mm



9



10



12

lengths of dowel took only a few minutes on the drop saw. I chamfered the ends, rotating them against the finisher.

A carry box is needed

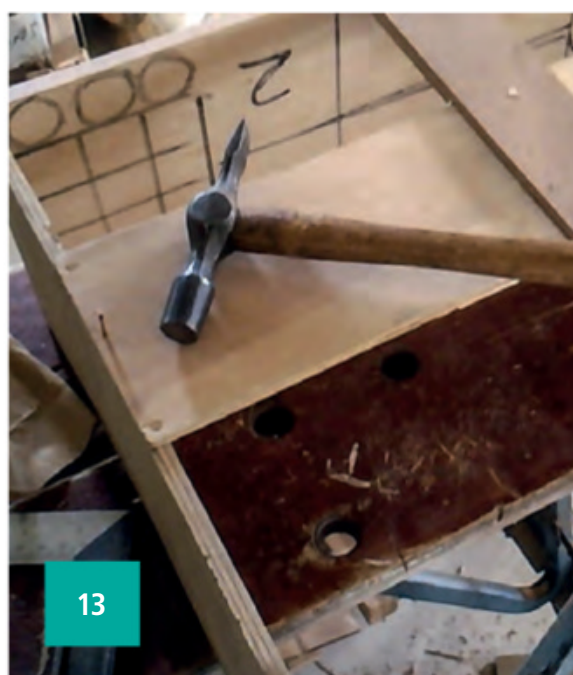
Commercial kubb sets often come lightly packaged or in a bag so the next thing was to design a carrying box that would hold them neatly, could stand in a corner, and even have things stacked on it.

I stood the pieces on the floor (Image 12). The six place markers (30mm or 35mm) would fit neatly three on each

The next thing was to design a carrying box which would hold them neatly

side of the king (Image 13). At the other end, the six throwing batons (44mm) would occupy a similar space (Image 14).

There remained the 10 kubbs. Pairs of kubbs (2x70mm) comprised a similar width. In two layers (2x150mm) they would match the king height. If I stood three pairs, with a pair on top of each outer two, the two in the centre could stand single height, which would leave



room to hold the handle (Image 15).

I had many remnants of 7mm ply. The base was 410x160mm and the ends support the paired kubbs' 160x300mm. Although, at least for the base, something thicker might be better, 7mm was OK.

Sag from the weight beyond the handle was prevented by support from the sides, particularly as this passed through recesses in the arms. The handle was made from strips of 50x10mm rimu — 10mm ply would have done but I had this odd length of rimu that looked nicer. I rounded the top, drilled a recess with a 25mm spade drill, and secured a section of broom handle with a single screw each end (Image 15). ►



Playing

There are two phases for each team's turn:

Team A throws the six sticks, from their baseline, at their opponent's lined-up kubbs (called 'baseline kubbs'). Throws must be under-handed, and the sticks must spin end over end. Throwing sticks sideways or spinning them side-to-side is not allowed. Kubbs that are successfully knocked down are then thrown by Team B onto Team A's half of the pitch and stood on end. These newly thrown kubbs are called 'field kubbs'.

Play then changes hands, and Team B throws the sticks at Team A's kubbs but must first knock down any standing field kubbs. (Field kubbs that right themselves due to the momentum of the impact are considered knocked down.)

Again, kubbs that are knocked down are thrown back over onto the opposite half of the field and then stood. In New Zealand, knocking down a baseline kubb before all field kubbs would result in the throwing team forfeiting the rest of its turn. If either team leaves field kubbs standing, the kubb closest to the king now represents that side's baseline, and throwers may step up to that line to throw at their opponent's kubbs. This rule applies to field and baseline kubbs only; fallen kubbs are thrown from the original baseline, as are attempts to knock over the king.

Play continues in this fashion until a team is able to knock down all kubbs on one side, from both the field and the baseline. If that team still has

sticks left to throw, it may make one attempt at knocking over the king (In Somerset, as a sporting gesture, right-handers will attempt this using the left hand, and vice versa). If a thrower successfully topples the king, they have won the game.

However, if at any time during the game the king is knocked down by accident — even by a newly thrown kubb — the offending team immediately loses the game.

For informal play between players of widely differing abilities, such as an adult and a child, it is permissible to shorten the width of the arena on the child's opponent's side, making it easier for the child to hit the kubbs, and it is also permissible to move the king closer to, but not behind, the child's line.



Making the case weatherproof

To support the ends of the carry case and stop the stacked kubbs falling out of the sides, I glued and pinned a 110mm strip of 3.5mm ply half way up (Images 13 and 15).

It had to be recessed (and glued) into the handle strips. My router brushes were on the blink. Using the draw saw it was easy and satisfying to form the recess using the old method of making serial cuts to the right depth, knocking out the kerf, and smoothing with a chisel (Images 16 and 17).

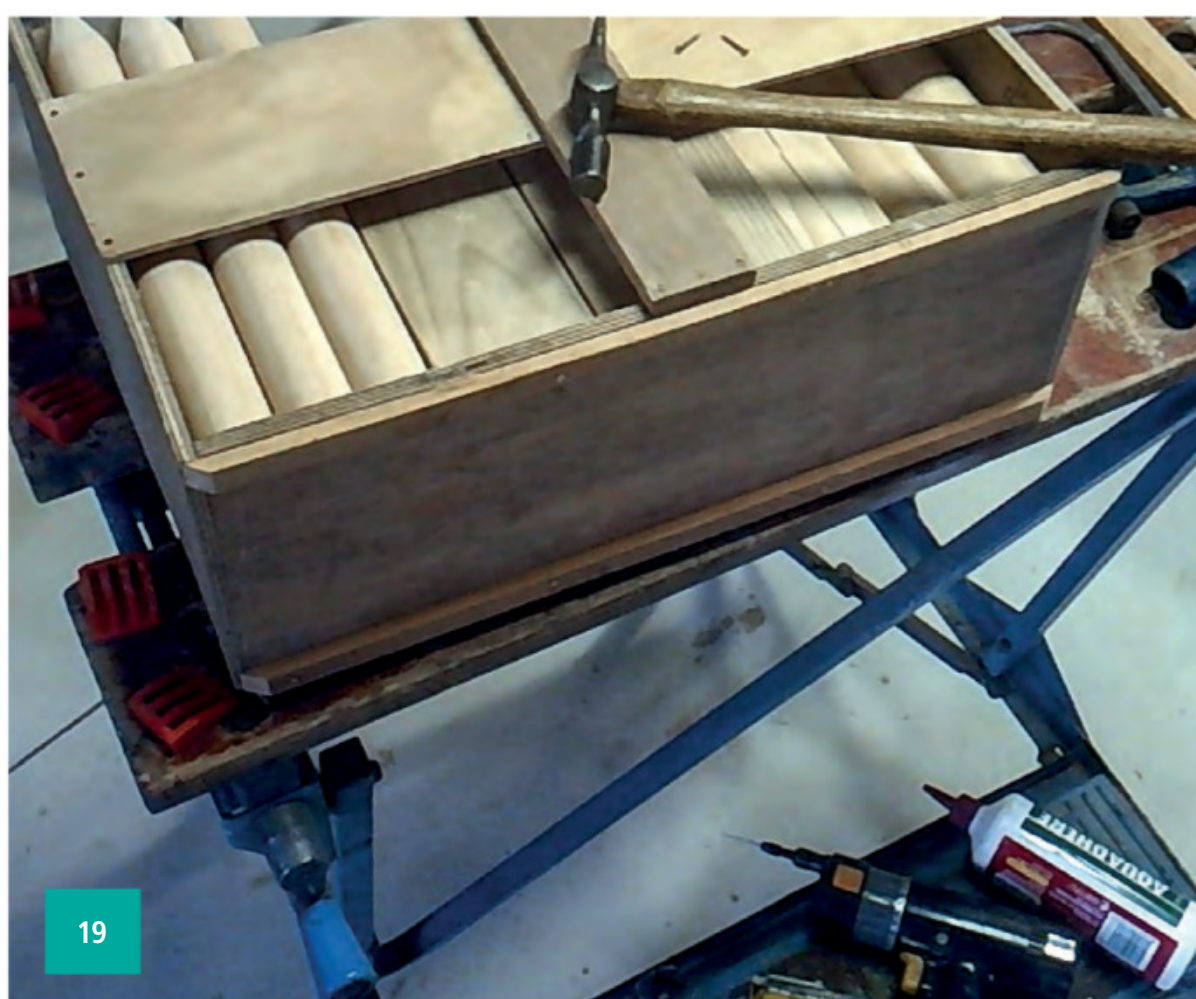
Lastly, to prevent the inner stacked kubbs sliding into the handle area, I pinned small strips of thin ply between the handle sides (Images 1, 2, and 18). The upper edge of the dowel handle could have been slightly lower, level with the top of the (doubled) kubbs and king. This would still leave room to hold it and things could stand comfortably on a completely level top.

I thought of finishing off the sets with stain and varnish. They could also have been made of more elegant, expensive hardwood, but they are treated wood, are unlikely anyway to live out in the rain, and I rather like the homely, rustic look (Image 19).

It is satisfying to have given something that all can enjoy, made (quite inexpensively) by father/grandfather

The only thing left then was to pin wood strips under each side of the base to keep it clear of damp ground. I used the 18x9mm throwaway packing strips that come with hardwood decking (Image 19). The rustproof, holdfast boat nails were particularly appropriate here.

The sets give great pleasure and the game is something that all the family and friends can play together. It is satisfying to have given something that all can enjoy, made (quite inexpensively) by father/grandfather. Simple as they are, they might even pass down to the next generation! 📦





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HERE'S THE PERFECT SUMMER PROJECT
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SHEDDIES KEEN TO SAVOUR PIZZAS COOKED
IN THEIR VERY OWN DIY OUTDOOR OVEN
By Robin Overall

The aroma of wood smoke mingled with that of garlic, toasted cheese, tomatoes, and basil ... a glass of wine and the company of good friends. What could possibly be better?

When we originally published an article on how to make your own pizza oven, *Shed* readers enthusiastically took up the challenge. Several years later I wrote an update of that feature sharing the tweaks I'd made to the design and building process to make it easier after learning a few lessons building many pizza ovens for others. I have used some alternative materials that became available but the overall shape and design of the actual oven have not changed, just the way it is put together.



Lay footings

We've had so many requests for the article that updated the original design that we decided to publish it again for all those keen pizza-loving sheddies. One recurring question we get is whether you can make the oven larger or smaller. The answer is: yes, it can be made larger, but no, it should not be made smaller. You can scale the oven up or down but the flames stay the same size. The original oven is optimal for a good, efficient flame pattern to consume all the fuel and produce minimal waste. A smaller oven would tend to choke and burn inefficiently.

A larger oven increases the number of flames, so to speak, and the fire will burn efficiently up to a point. But if it's too big you would rarely light it and that defeats the purpose of the exercise. This oven can cook food for more than 20 people easily yet still be convenient for only one without consuming vast amounts of fuel.



First two courses of blocks



Rebar in corners

Foundations

The oven rests on a foundation that has to be calculated for the weight it bears. The footings that form this are excavations in the surface soil filled with concrete. The oven weighs about two tonnes and the footprint of the blocks is approximately 1m². That equates to 2kg per cm². If the footings are extended 100mm out all around, you can double the footprint and reduce the bearing to 1kg per cm². The footings need to be only 100mm deep on average soil. If you have very friable volcanic soil, then extend the footings either down or out to reduce the load even further.

The concrete is a standard mix of 8:1 (eight parts builders' mix to one part Portland cement). The less water you use to arrive at a final mix, the stronger the concrete will be.

Once you pour the foundations and float them off, leave them for an hour or so and then lay the first course of blocks dry. Merely set them in position and then insert reinforcing rod (rebar) in the corner blocks and the end of the middle row. Make sure that the rebar is pushed well into the foundation concrete.

Support base

The support base is in the form of an 'H', a change from my original design. The H gives the oven extra support in the middle and also creates two wood storage areas. The dimensions of this base are 1400mm square.

This will allow for the oven dome, and sufficient room for the arch at the front. The blocks used for the base are standard 20 series measuring 390x190x190mm, and 190x190x190mm. Lay these dry and then backfill them with concrete. Although this is not the purist's way of

laying blocks, for our purposes it is both quicker and more accurate if your block-laying skills are not perfect.

In all, five courses of blocks are laid. Fill them with concrete and any broken rubble you have. Make sure the concrete is well rodded around the rebar. Stop the concrete filling about 50mm short of the top of the blocks, as this will enable the slab to key-in when it is poured next.

Slab

Once the block base has set, it is time to box up for the slab. Standard fence palings are good for boxing, though some timber yards sell boxing grade cheaply.

Cut two pieces of 7.5mm ply to fit in the

spaces between the blocks and prop them up from underneath with short lengths of timber. Then cut two palings to the exact length of the slab and two longer pieces to overlap the short ones to allow for nailing.

Strap the whole lot together with a tie-down winched up tightly. Cut



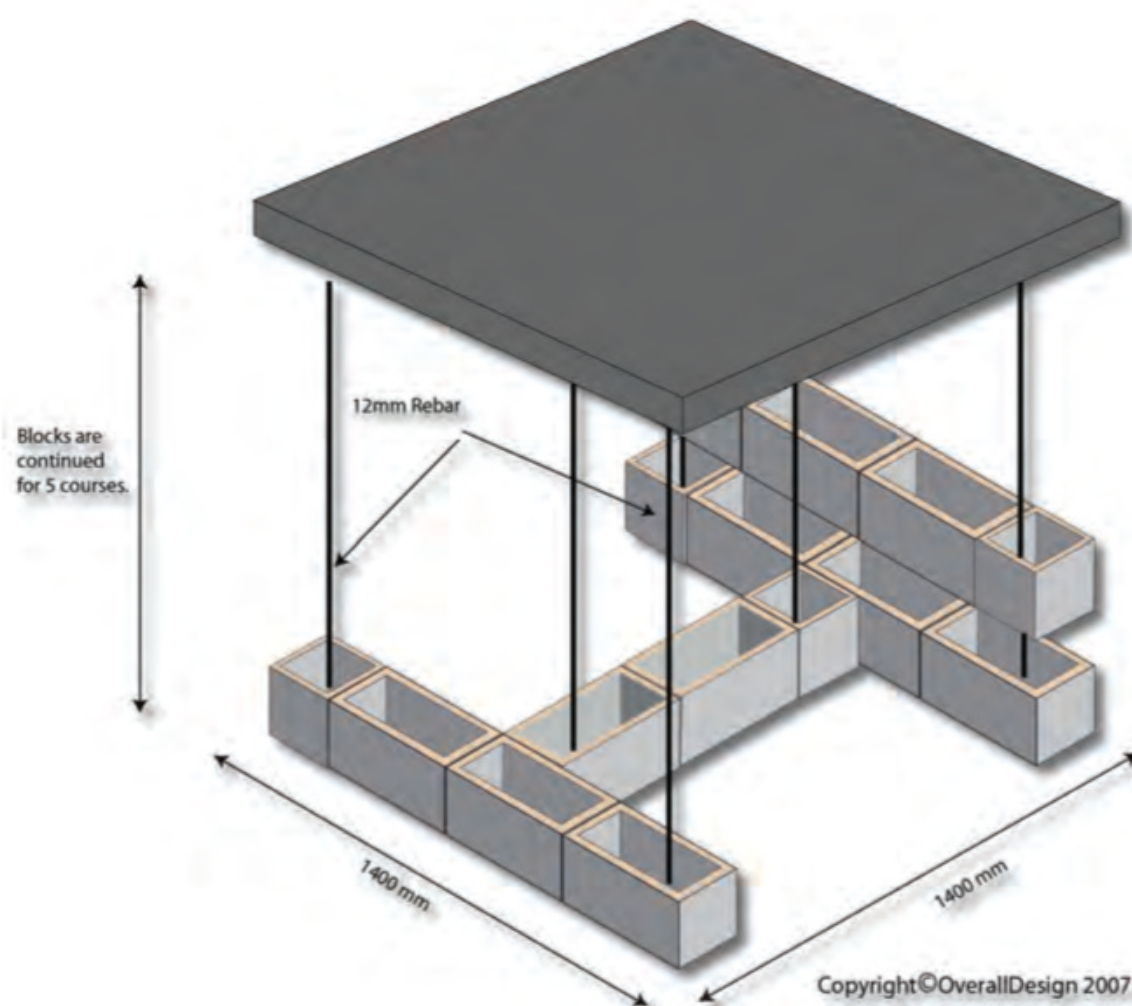
Boxing uses tie-down for the slab pour. The slab is 20mm deeper than the slab in the original article

wedges and jam them between the tie-down and paling if any bowing occurs.

Checking with a level, hammer up the boxing so that it is 100mm higher than the top blocks. This will produce a slab 20mm deeper than the one in my original build article and will add immensely to the mass, thereby improving heat retention.

Any gaps between the formwork and the blocks can be patched with a couple of layers of damp newspaper torn into strips. You simply want to stop concrete dribbling through. Pour in a mix ►

Construction uses H-shape for block base





Cutting the bricks in half. Half bricks are used throughout the dome

of concrete to a depth of 50mm and then lay in rebar/mesh/chicken wire or similar. Ensure that this remains in the bottom third. The object is to avoid exposed metal and rusting. This also overcomes the problem of concrete cracking when under stress. Concrete is very strong under compression but poor under expansion so the rebar compensates for this. Pour in the remaining 50mm depth of concrete. Trowel the whole lot off, checking for level. Cover with damp sacks until it is cured, over about two days.

Brick base

Cover the slab with kitchen foil and spread a sprinkling of sand over the



On the concrete slab, place foil, sand, whole bricks on flat faces, butted up not mortared. The bricks are held by haunching or a supporting concrete line around the edge. A spread of sand/mortar on top awaits a layer of the firebricks known as 'pizza hearth tiles'

surface (about 5mm thick). On this, lay whole bricks on their flat faces. They are not mortared; simply butted up to each other. Adjust the sand underneath each one if any discrepancy in level occurs. The bricks are held by haunching or a supporting concrete line around the edge, using a weak sand/cement mix (8:1 of sand to cement).

This combination of poured slab and

bricks is the heat sink that will maintain the cooking temperature in your oven long after the fire has gone out. On top of these bricks, we are shortly going to lay the cooking hearth using smooth, 25mm thick firebricks known as 'pizza hearth tiles'.

Dome

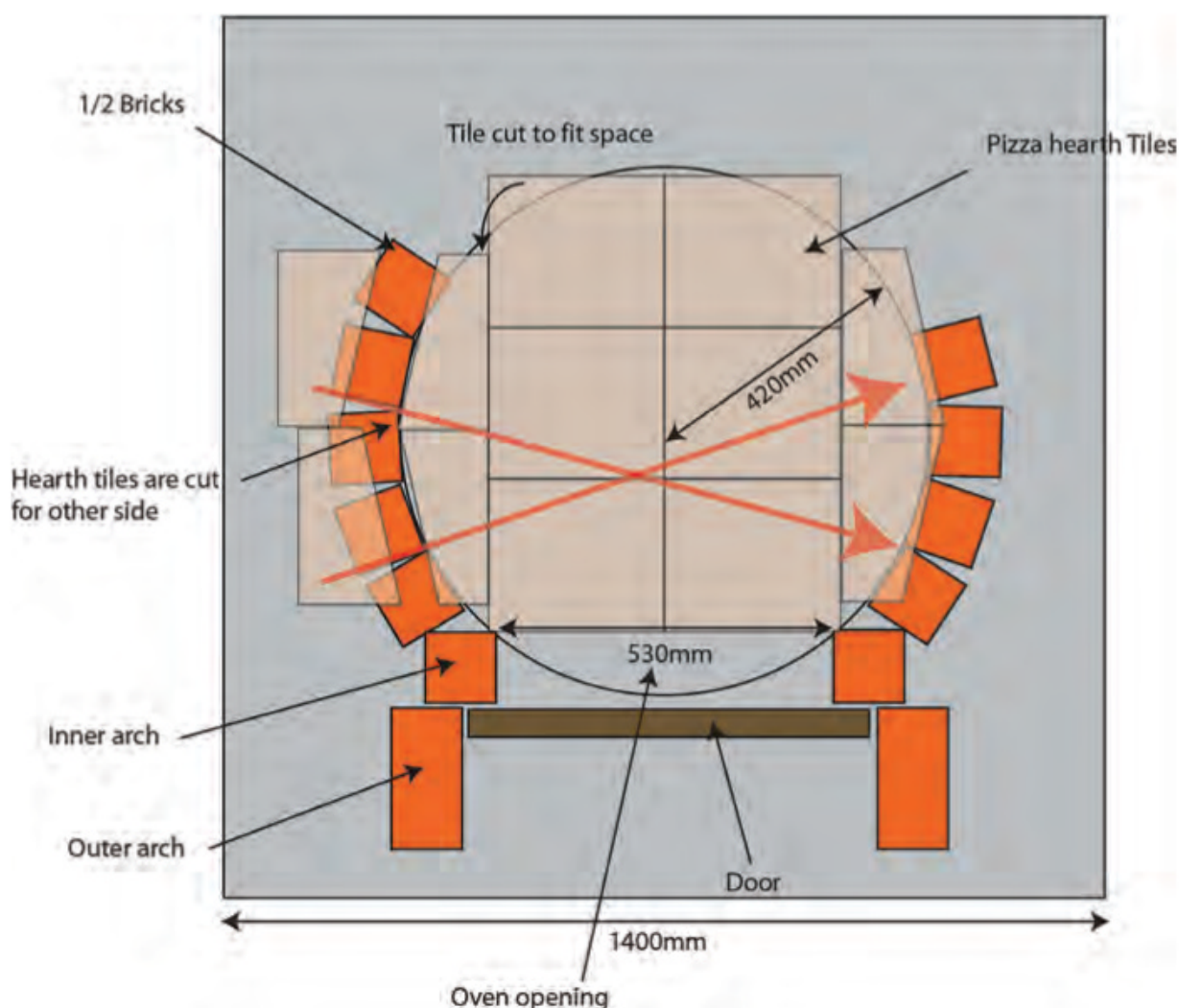
The dome is built up entirely of half bricks, which are the most manageable for this size of oven. Half bricks supply sufficient mass. The bricks are cut in half with a bolster and hammer. This is easier than you imagine — a matter of confidence more than skill or number of bricks cut, so do a few to begin with and then more as work progresses.

To find the circumference of the dome, mark the centre of the slab by drawing diagonals from corner to corner. Then chalk a circle with a radius of 420mm. The circle prescribes the inside of the oven. The first course of half bricks is laid around this circumference, which is broken with a gap of 530mm (see diagram) at the front for the door.

Lay the first course flat dry, then poke just cement/mud between the bricks once they are in place. The mud/mortar mix is around half or 50 per cent clay/subsoil with sand and cement added. Aim for a sand content of approximately 20–40 per cent and 10 per cent Portland cement.

Mix it in a wheelbarrow, as a concrete mixer will simply ball up the mass, which will go round without mixing. The sticky mud holds everything

Cooking hearth of the pizza hearth tiles sits on a bed of 10:1 sand/cement mix. Outer tiles are cut to fit the space





First courses of bricks. Note the blue plastic sheet protecting the oven floor



Mud/mortar mix



The inner arch uses two plywood semicircles as a form



The outer arch uses whole bricks on a plywood former with a 325mm radius

together while the mixture dries, unlike sand/cement strength. You will need about 100 mortar that is friable until it dries. The mud is also capable of flexing with the intermittent hot and cold cycles your oven will go through.

Door opening

The door opening is 530mm wide. The early French settlers in Montreal built domed mud ovens for baking bread and over a period worked out the ideal proportions.

Recent research has established that most ovens had a door arch that was 63 per cent of the internal dome height. This allowed for an efficient flow path for the flames to consume all the fuel and smoke. Therefore, if our oven is 840mm diameter and we build a perfect dome, our internal dome height will be 420mm, the radius of the cooking circle raised vertically. Calculate 63 per cent of this, which is 265mm. Thus, the arch is 265mm high, which is the radius of a circle with a diameter of 530mm. So our door width is 530mm. Place a brick on each side to mark this.

Inner arch

The inner door arch is built next, using as a form two plywood semicircles of 265mm radius with a block of 100mm scrap in between them.

Lay a few strips of newspaper over this form and lay half bricks, with cut edge facing inwards, in the shape of the arch, packing them with a little mud mix. Bond them together properly later. The newspaper will enable you to remove the form easily. It's a good idea to make a handle on the front piece of ply for this.

Cooking hearth

The cooking hearth is the next part to go in and this is best made using 25mm thick pizza hearth tiles that measure 280x242x25mm. You will need eight of them, and with the use of a cheap angle grinder and diamond blade they can be used to make your hearth fit snugly, as shown in the diagram.

By putting the hearth in after laying the first course of dome bricks, if you crack or damage a hearth tile you can easily remove and replace it.

They are simply laid on a thin bed (5mm) of a sand/cement mix at a 10:1 ratio. The dome holds them in place. After they are laid, they are brushed ►

Terms for various mixes

Mortar

A sand/cement mix in a ratio of 6:1, used for bonding brickwork. In oven building this consists of a sand/subsoil mix and cement in a 10:1 ratio.

Concrete

A combination of builder's mix / cement in a ratio of 8:1.

Render

For coating the pizza oven exterior, this mix is silica sand, white cement, and lime in a ratio of 6:1:1.

Plaster

For the pizza oven exterior, a mix of sand/cement in a ratio of 6:1, sometimes with fibreglass strands or coconut fibre added for strength.



Cover the exposed crown of the dome support with dampened sand



The dome in progress

with the same mix to fill in the minute gaps. It is beneficial to have a slightly loose edge for when they expand. Cover with a layer of newspaper or plastic to keep them clean.

Start the next course of bricks at the arch end and angle it slightly to create the dome. Use a quarter template of 420mm radius to guide you in this operation. Continue these courses from alternate ends until gravity begins to take over and it is impossible to keep the bricks in place.

Support

Now you have to create some form of support to hold the bricks up until they have dried. In the original article, we used a framework of lath and covered

it with sacking and sand. More recently we used a Swiss ball. A Swiss friend who built an excellent oven locally has no idea why it is so called, so any suggestions are most welcome.

On a platform of bricks and pieces of plywood (for easy removal through the door) sitting on the cooking hearth, place the ball, semi-inflate it, and leave the nozzle facing the front. Pack the gap between the ball and the bricks of the oven dome with old towels, sacking, or whatever.

Cover the exposed crown of the ball with dampened sand to create a rounded dome. When you are satisfied with the shape, carry on laying bricks, which will be supported by the sand-covered ball.

Continue until you have about a 200mm diameter hole remaining. Fill this hole with refractory concrete (see Refractories on pages 94–96). This concrete is in a dry, ready-mixed form so you simply add water. Use only enough water to dampen it (almost too dry) and ram the mix in firmly with a length of dowel or similar. If you make it sloppy, it will form a weak structure. You can bulk this out with broken brick if you like, but it is important that the mix is well tamped together for strength.

Dome

When you have rammed the dome cap, turn to the rest of the dome. Cover it



Foil over the dome



Chicken wire over the insulation layer provides a key for the render coat to adhere to. Note gap at the front for the flue



Drying out the fire with a smoke circulation test

with a layer of mud mortar about 50mm thick. Then over the arch bricks, lay another mix of refractory concrete, like a collar to key them all together.

When the dome is dry, it is time to remove the sand. Carefully locate the Swiss-ball nozzle and deflate the ball. Then wiggle out the brick and ply support and the sand mass should fall down. Remove the sand and brush out the oven.

After emptying the dome, mortar the joints on the face of the arch with a slurry made from refractory concrete sieved to reduce the number of big lumps in it. Now you can light a small fire — small being the operative word — to dry out your mass. It doesn't have to be bone-dry but simply have the majority of water removed. It also allows you to see if the proportions are correct. They are correct if the smoke is circulating within the fire and then spilling out under the arch.

Over the arch, lay a mix of refractory concrete like a collar to key the bricks together. Note the dome bulked out with broken bricks





Stainless-steel flue



The space between the chicken mesh and flue allows for expansion



Inner arch to support the door

Outer arch and flue

The outer door arch uses whole bricks and is wider than the inner arch. This allows you to fit in the door to bake or roast, by raking out the embers and closing the oven. For the outer arch, you will need to make another plywood former of 325mm radius. Build with whole bricks up on either side for five courses and then continue with half bricks, positioning the cut edge facing upwards this time. This allows for the placement of a flue transition piece, which will have to be made from stainless steel.

The flue redirects the small amount of smoke away from your face and is not an integral part of the burning process, so the size does not matter. You could get away without a flue at all if you didn't mind the odd puff of smoke in your face. A stainless-steel flue needs to convert from 250x100mm to 115mm diameter (the standard pot-belly flue) or whatever fits your available flue.

As a universal practical solution, surround the flue with small pieces of rubble held in place by chicken wire and it is ready for you to apply a base layer of render. This loose outer casing accommodates any expansion or contraction of the stainless steel.

A suitably sized field tile surrounding the stainless-steel flue will serve as a chimney pot.

Insulation

You need to insulate the oven before rendering it with its final coat. Cover the whole oven with cooking foil prior to adding the insulation. The best insulation for this type of structure is vermiculite, readily available from horticultural supply companies. It is bulky and usually comes in coarse, medium, and fine grades. Get the coarse grade. It looks and feels like puffed wheat made from polystyrene.

To cover the oven in this is a challenge and we have arrived at a true sheddie solution. Cut the legs off about 10 pairs of old pantyhose and fill these legs with the vermiculite. Tie a knot in the end and use these sausages of vermiculite to coil around your oven. You can hold them in place with short lengths of wire or sharpened chopsticks until they are covered. Now form a cage of chicken wire, pressing it firmly to the shape. This will be the key for your render.

Rendering

'Rendering' is an overcoat for your oven that needs to breathe and shed water.

Traditional lime/cement/sand render is, in my opinion, the best material for this job.

Over my many years of oven making, I have received no complaints about LOS (leaky-oven syndrome). The process involves a base layer and final topcoat layer.

Traditional plastering uses three layers: key coat, scratch coat, and final coat. But we already have a key coat in the form of the wire over our insulation, so can get away with two coats. The base layer is made up of fine or plasterer's sand and cement in a 6:1 mix. Spread it by hand onto the wire to about 40mm thick. Try to let it dry slowly by covering it with tarpaulins or plastic sheeting so that it sweats. Smooth with a damp sponge after it has dried for an hour or two.

The next day, spray the surface to dampen it and apply a finishing coat of 4:1:1 (four parts silica sand to one part white cement to one part lime paste). Lime paste is made up of builder's lime soaked in water for as long as possible — weeks is better than days. In this process, daily stirring disperses the small particles evenly so they do not burst out as little white spots in the render at a later stage. ►



The door cut to shape and terracotta tiles on the entrance sill for the finishing touch

Spread on the finishing coat with a sponge. Wear gloves, as this will play havoc with your delicate sheddie hands. I rinse my hands in a bucket of water with a cup of malt vinegar in it whenever I feel the lime getting to my skin.

If your final colour is not white, then you may get away with Portland cement instead of white cement (third of the price). Apply tile work or inlaid stones at this stage. The interior dome of the oven remains the same in all cases, but the exterior can vary according to taste.

The Door

We made our door from 50mm thick macrocarpa, cut to the shape of the inner arch with a 20mm overlap.

Pin a length of heat-seal fibreglass rope from a wood-stove retailer around the inner perimeter of the door and fill the space with vermiculite. Cut a sheet of galvanized-iron sheet to size with enough extra to bend under the

bottom edge and nail it in position with galvanized clouts. We also screwed it to the door with screws and screw cups. Our door had a wrought-iron handle but any garden shed-type handle will look good. The door was well-oiled with tung oil.

The sill

Terracotta tiles cemented at the entrance to form a sill make a nice finishing touch, as well as providing a level plane and smooth transition for the pizzas going in and out of the oven. You could use a glazed tile if you prefer. Tell your tile supplier what you want them for, as some tiles do not take the heat so well.

Firing your oven

Allow the oven to dry for a day or two before you light a real fire in it. The first firing will remove most of the remaining moisture. As an outside brick construction, your oven is bound to take up moisture, especially in the humid regions of New Zealand. If you plan to use the oven after a long spell of inactivity, use a small firing the day before to dry things out.

Light a small fire in the middle of the oven from small manuka twigs, dry cabbage-tree leaves, bracken, or any



Lime/sand/cement render finishes another oven



Lime soaked in water — weeks rather than days to prepare



In goes the pizza dough test

finely split wood. Gradually feed this with thin sticks, maintaining a hungry fire rather than one with too much fuel.

As the fire builds up, feed in more wood. Pieces under 50mm diameter are best and pine or macrocarpa make the best fuel with high calorific value, giving up their heat quicker than other woods. We are looking for quick burning rather than long, slow burning. The old ovens in the Middle Ages were, after all, fired with bundles or faggots made of furze (gorse).

Reaching an efficient temperature should take about two hours before you put the first pizza in. Push the embers to the back and sides of the oven with a 'rooker', a form of rake, and occasionally feed them with small sticks. The temperature of your oven should now be in the region of 400°C. The brickwork will absorb a lot of this heat and slowly release it back as usable cooking heat at around 200°C–280°C.

You may notice a slight smell of drying masonry in early firings. Any hairline cracks that develop under heat in the new outside covering can be repaired with the lime cement coating. I strongly advise getting an infra-red digital thermometer. These make control of the oven temperature child's play and they are reasonably cheap.

Cooking pizza

The first pizza you place in the oven is usually a test one and can cook in as little as 45 seconds. Place the pizza in the oven using a wooden peel (paddle) that has been sprinkled with semolina to act like ball bearings and enable the pizza to slide off easily. But use a stainless-steel peel to turn the pizzas around and remove them from the oven, as the wooden one would burn. Occasionally, to remove melted cheese, etc., you will need to brush the floor of the oven with a brass barbecue brush. As the temperature drops, the pizzas will take a tad longer to cook.

Well ... happy building. You will be joining the ranks of the truly converted and changing your lifestyle when you embark on this really enjoyable and achievable exercise.

Buon appetito ...



COOKING WITH YOUR OVEN

By Arno Sturny

There are different styles of pizza dough. High-grade-flour dough can stretch and capture more air bubbles but if handled too roughly result in a tough pizza. This dough gives a chewier pizza with more crunch in the crust and requires a little more water than plain-flour dough. Plain flour gives you a lighter dough for a pizza that is soft and has less rise.

The Italians use tipo 00 flour (available through specialty food stores). Other options are half high-grade and half wholemeal flour for a more wholesome pizza base, or three-quarter high-grade and quarter fine rye flour. 'Retarding', or slowing down the yeast activity, will improve the flavour of your pizza base. Make the dough early in the day and retard the divided dough pieces in the fridge. This process can be done up to 12 hours ahead. Make sure to bring them up to room temperature before using them.

Pizza dough

- 500g flour (high grade or plain)
- 2½ tsp active dried yeast (or 20g fresh yeast)
- 1 tbsp olive oil (15g, traditionally not required)
- 1½ tsp salt (10g)
- 1½ cups+ water, tepid (320–350g)

Place the flour, active dried yeast, oil, and salt dissolved in some water into a large bowl. Slowly add the remaining water into the centre of the bowl and stir by hand, or with a wooden spoon, until the mixture starts to form a ball. Tip the dough out and knead it on a floured work surface, pushing and folding the dough back on itself continuously. Adjust the consistency by adding water or flour.

Knead the dough for about 15 minutes, leaving it to rest every three minutes for about a minute. Dough develops faster with resting time. Properly mixed dough has a satiny sheen and smooth elastic texture — a small piece should stretch thinly (do it gently) without ripping too quickly. Put the dough into a lightly oiled container covered with a lightly oiled plastic sheet or cling film to prevent a skin forming. Leave it to rise in a warm place at a constant temperature (yeast ideally ferments at between 25°C and 28°C) for 1–1½ hours or until it has doubled in size.

Halfway through this time, push and fold the dough gently to 'knock it back'. This will revitalize the yeast's activity and strengthen the dough. Place back into the bowl and cover. Divide the fully risen dough into four equal portions, shape into balls, and let them rest, covered, on a lightly floured ▶

work surface for five minutes. Shape or roll out a thin, round disc, leaving the rim slightly thicker to contain the filling.

Place the pizza base onto your wooden peel, generously sprinkled with semolina or fine polenta to assist with sliding. Spread the base lightly with tomato sauce, then add your toppings. Top with thin slices of mozzarella or standard cheese. Remember not to use too much sauce and cheese, as the pizza base will not cook properly and become soggy. Italian pizzas are thin and light on toppings.

Drizzle with olive oil and bake.

Pizza tomato sauce

- 1 can tomatoes (discard the juice)
- ¼ tsp freshly ground black pepper
- ½ tsp salt
- 1 tsp oregano

Use a potato masher to get a good sauce consistency. Don't use a food processor or hand mixer, as those will break the seeds and give your sauce a bitter flavour. Do not cook the sauce if you are using a brick oven, as the hot oven will cook it perfectly. Other flavouring options

include single teaspoons of either dried basil (2 tbsp of fresh basil) garlic powder or olive oil, or 2 tbsp of red wine vinegar or lemon juice.

Wood-fired oven

You can use your wood-fired oven like a barbecue, especially when the fire is still going and temperatures are up near 450°C. With the intense heat, items such as vegetables, meat, or fish can be cooked very quickly as long as the cuts are not too large and pans or oven-proof dishes are not over-filled. You might be surprised at how moist meat can be when cooked in a pizza oven.

Vegetables

Vegetables such as red onions, mushrooms, courgettes, or asparagus, chopped, sliced, or quartered, can be marinated in olive oil, balsamic vinegar, crushed garlic, salt and pepper, and fresh garden herbs. Cook them in an oven dish, adding the onions first as they take the longest to cook. Two minutes or so later add the mushrooms, courgettes, and asparagus to the dish. The whole lot

should only take around 5–10 minutes from start to finish. Make sure you use a large enough oven dish, as you do not want to stew the vegetables.

Fish

A good marinade for fish is 100g of peanut oil; a chopped, seeded red chilli; and single teaspoons of chopped garlic, lemon juice, ground coriander, lemongrass, and a sprinkle of turmeric powder. Marinate for no longer than 20 minutes, as if left longer than this, the marinade will start to cook the fish.

Cooking

Use large, seasoned frying pans and oil lightly (thin pans, no wooden or plastic handles) and place for a minute into the oven to heat up. Place food items into the hot pan and put in the oven. Make sure to use large pans, as overfilling will stew the fish or meat. Any white fish is suitable, as is chicken breast meat (cuts with bones take too long and may end up burnt on the outside and raw inside — unhealthy), and low-fat sausages, which cook quickly.

Tips

- Make sure the oven is hot before you start cooking (you are not after stew).
- Make sure the pans are clean (if not, they are easiest to clean as they heat up).
- Lightly oil pans to help lubricate and prevent sticking (making cleaning up afterwards easier).





REFRACTORIES

A GUIDE TO FIREBRICKS AND OTHER THINGS

Article courtesy of Shinagawa Refractories Australasia NZ Ltd

It has been said that the beginnings of civilized society can be traced back to the ability to control fire. Societies able to do this became the dominant civilizations of the time and led the world out of the Stone Age into the Iron Age, and later Bronze Age, along with developing pottery and ceramics. In fact, civilized society as we know it stemmed from this control and has led, ultimately, to the sheddie being able to produce his own outdoor fireplace, pizza oven, and even the home foundry. It has even been claimed that the profession of refractory engineer is the second oldest in the world — men have always got their priorities right. Articles on pizza ovens, outdoor fireplaces, home foundries, and the like appear to have created interest and inquiries for “hot bricks”, “that casting crap”, and “fireproof wool” so it’s opportune to present a very brief summary of refractories for sheddies.

The *Collins English Dictionary* defines ‘refractory’ as: 1 (adj.) stubborn or rebellious (well, that covers most sheddies); 2. (of a material) able to withstand high temperatures without fusion or decomposition. Refractories include products from the familiar firebrick through to the tiles found

on the Nasa space shuttles — ‘flying brickyards’, as they are known by their drivers. These are possibly beyond the scope of even the most ambitious sheddie, so we will stick to the home-product range. This is the alumina-silicate family and as the name implies is manufactured from alumina-based clays and aggregates. Products in this range can be broadly divided into firebricks, refractory concretes — ‘castables’, mouldables (also called ‘plastics’); mortars; and ceramic fibre.

Firebricks

Firebricks range in alumina content from 25 per cent through to 90 per cent. Typically, the 35-per-cent alumina high-duty (HD) and the 45-per-cent alumina super-duty (SD) brick will suit most sheddie applications, with the HD being more than adequate for pizza ovens, outdoor fireplaces, fire pits, etc. The 45-per-cent SD is used for foundry applications. A full range of high alumina brick is available from Huntly if you are thinking of starting up your own steelworks. Nomenclature for bricks is generally based on the alumina content: e.g., shiral 35, shiral 45, shiral 50.

The standard size for firebricks in New Zealand is 230x115x75mm.

They are also available as splits with thicknesses of 25mm, 40mm, and 65mm.

The standard shape is called a ‘square’. They also come as a side arch with the 115mm dimension tapered from 75mm to 69mm, 63mm and 51mm, enabling the construction of an arch or a circle with a lining thickness of 115mm, or as a wedge with the taper over the length of the brick giving a lining thickness of 230mm.

The arch is frequently used and the wedge very rarely.

Refractory concretes

Refractory concretes are ‘castables’ — “that casting crap”. These are a blend of graded refractory aggregates and calcium aluminate cements and generally come in a 25kg bag. Just add water. To achieve best results use potable water — if it’s good enough for whisky, it’s good enough for refractory castable. Keep the water added to what the manufacturer specifies.

It is preferable to mix by hand in a mixing trough rather than in a conventional drum concrete mixer. With the correct amount of water added, concrete mixers tend to produce ‘ball bearings’ rather than a homogeneously mixed product.

Paddle mixers are the recommended weapon of choice. The ideal to aim for is a ‘ball in hand’ mix consistency. To test, take a handful of the mixed product, form it into a ball and chuck it up and down 150mm a couple of times. If it slumps and oozes through your fingers, it is too wet; if it breaks up, it is too dry; and if it just slumps a bit it is about right.

Ideally, castables should be vibrated into place but rodding and tamping will get you there on small jobs. A quick sweep with a wooden float gives the best finish. If you overwork with a metal float, it brings the fines to the top and tends to seal the surface, thereby making it more prone to explosive spalling on initial heat up.

Castables require slow and controlled initial firing and can explode if fired up too quickly (‘explosive spalling’ occurs when moisture trapped in concrete ►

under heat becomes converted into uncontrollable steam pressure, which eventually explodes super-heated concrete out of the structure). Ask your supplier for a heat-up schedule.

Nomenclature for castables is generally based on the maximum continuous service temperature of the product. For example, shiral 145 is a 1450-grade castable (maximum service temperature of 1450°C) and is more than adequate for most sheddie applications.

Dense castables are available up to an 1800°C rating. If you have something that hot in the shed, drink the whisky and call the fire brigade.

True sheddies might like to spend hours smashing up old firebricks with a hammer and making their own brew by adding fondu cement but the result is unlikely to be as good as the factory-made product.

Castables are also available in insulating lightweight grades for use as back-up linings as well as hot-face applications. Castables generally require anchoring to the furnace side-wall and roof. Anchors should be in a 'V' configuration made from 304/310 stainless steel, with the end no closer than 25mm from the hot face and a spacing of about 11 per square metre depending on the lining thickness. Overhead will require up to 22 anchors per square metre.

Mouldables

'Mouldables' are a mix of refractory aggregate and clay that normally come as a slab or slabs in a 25kg carton. These are used for patching or as a stand-alone hot-face lining for pit furnaces, ladles, etc. The material is hammered into place.

The higher alumina products may be available as a phosphate-bonded product, which has the advantage of setting hard at 400°C. Clay-bonded products should be fired up to 1200°C minimum before use to achieve a ceramic bond, even if the furnace operating temperature will be lower. Once the heat-up schedule has commenced, under no circumstances should it be stopped, as a mud-slip plane

can form and the hot face can sheet off.

Immediately after installation, the lining should be 'rodded' to allow steam venting to two-thirds lining thickness at 200mm centres (200mm apart in both directions). A pointed welding rod does the trick.

Refractory mortar

Refractory mortar is either heat set or air set. 'Heat-set' mortars have no binder and are a blend of clays and ball-milled aggregates relying on a ceramic bond at high temperature. This bond is comparatively weak.

'Air-set' mortars are ball-milled aggregates bonded with sodium silicate. They come ready-mixed in pails or can be available as a dry mix in bags. While having a much stronger green strength than heat-set mortars, the air-set mortar only reaches full strength after being fired to a few hundred degrees.

Fireclay is a naturally occurring clay that is ball milled and can be used as a heat-set mortar. Refractory mortar joints should only be 1–2mm thick.

Ceramic fibre

Ceramic fibre is available in blanket form in rolls, as vacuum-formed board, paper, and rope. The base material is made from alumina-silicate aggregates melted and either spun or blown to

form a blanket or loose fibre from which the derivative products are made. The products are normally available in 1260 grade or 1400 grade. These are about the most cost-effective high-temperature insulation products available.

Safety precautions are important when handling ceramic fibre. It is recommended that full-cover paper overalls be worn when installing and handling the blanket and exposed skin be given a coating of barrier cream. You should wear a P2 respirator.

Special care should be taken when handling used material and a P2 respirator is the minimum. In overhead or enclosed conditions, a full-face P3 respirator is recommended. Installation instructions will be available from the supplier.

Your suppliers are there to help as well as take your money, so ask the questions.



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Enjoy!

PART 2 **MAKING A MUSIC BOX**

SORTING OUT THE DESIGN AESTHETICS AND COMPLETING THE PROJECT

By Enrico Miglino
Photographs: Enrico Miglino

The music box assembled and ready for the first charge. On the right side is the charging key of the ratchet and the charge level indicator is on the left

We skipped an issue of the magazine with this project but here is the second and final instalment on how to make a music box. Part one was in Issue No. 86 of *The Shed*.

The design of the Arduino MP3 player in part one was the first step to confirm the feasibility of this project.

To complete the build, I temporarily

stopped working on the electronic part to concentrate on the aesthetics of the box. Following the style of this series of Micro Bit projects, I decided to use recycled cardboard to create the container. The box was metal painted with a brownish finish to simulate rugged metal.

It required a considerable amount of design and 3D printing to make

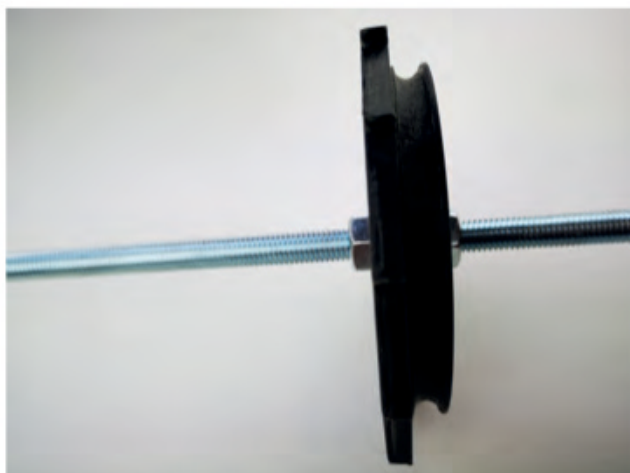
the visible parts of the music box and the spring-charger simulator. The 3D-printed parts are used to control the music box and provide several effects simulating the behaviour of an old spring-charged music box.

Charge-level simulator

A metal-painted arrow simulating the

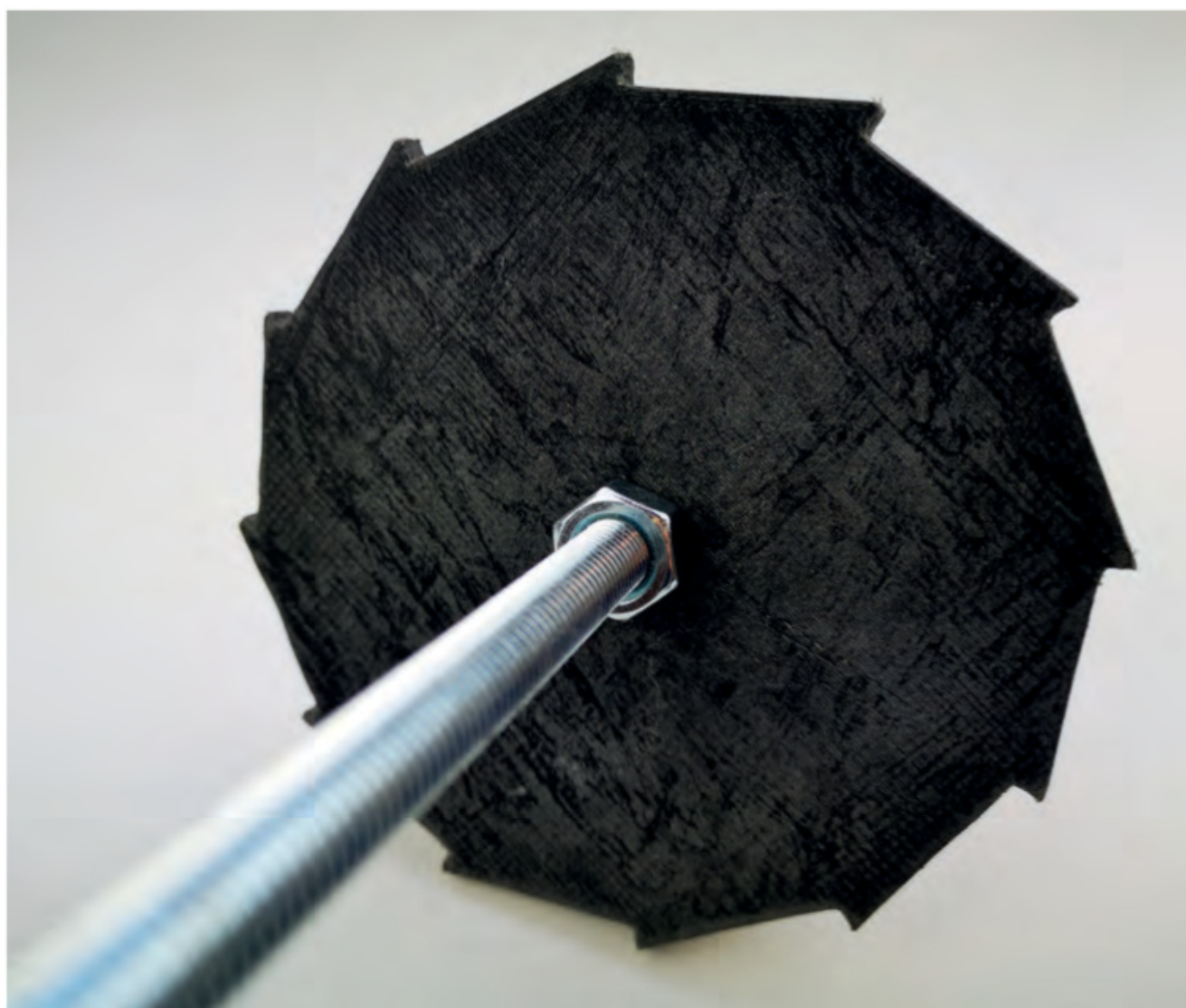


Detail of the DC motor used as a pulse generator with the 3D-printed pulley



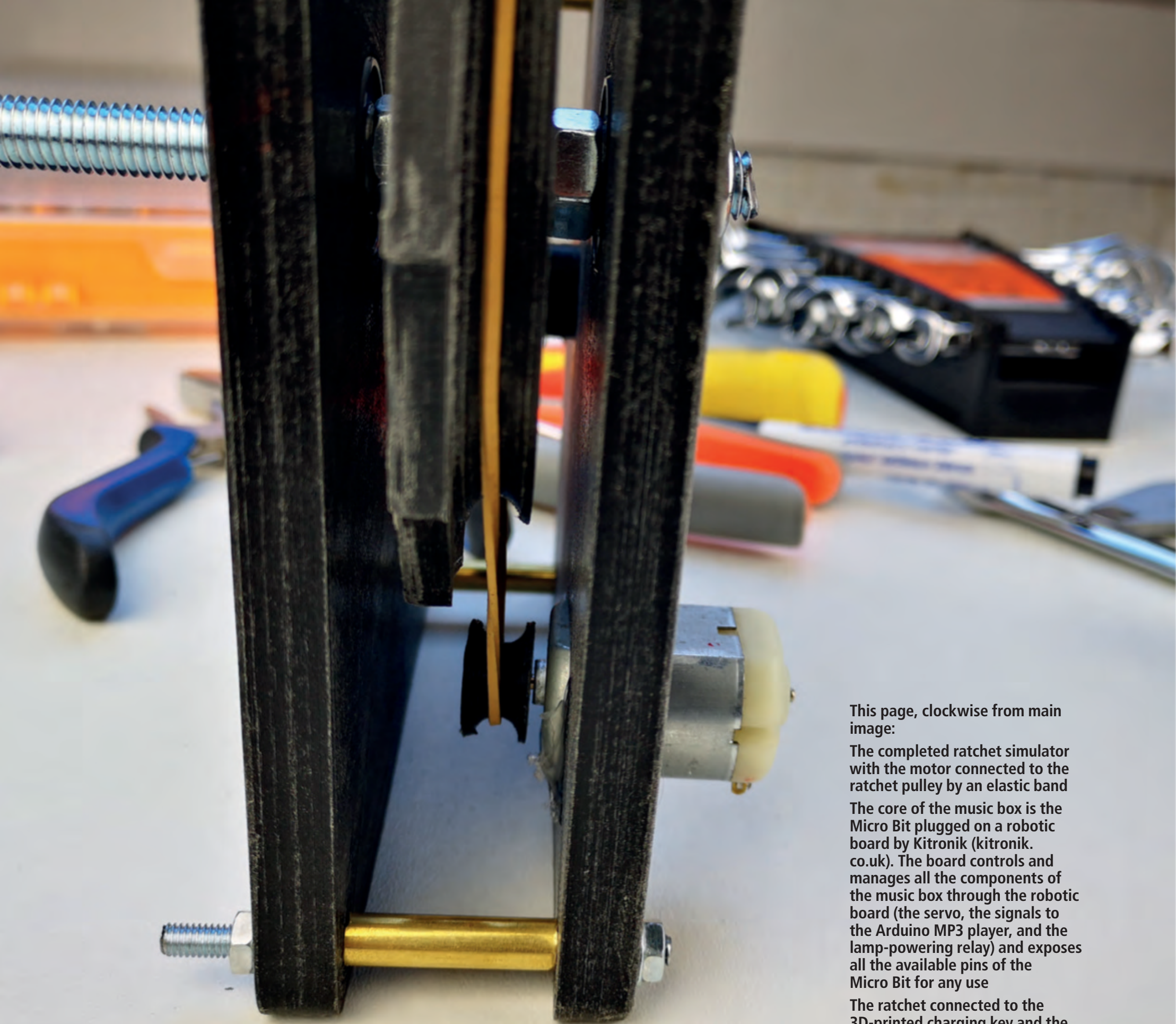
The 3D-printed ratchet with the pulley connected to the DC motor. A half rotation to the ratchet wheel is required to make the DC motor (with the small pulley) rotate fast and generate the current pulse

charge level of the spring moves at precise angle positions between zero and 90 degrees (from horizontal to vertical position). I have programmed nine positions, corresponding to the Arduino MP3 player's nine sound tracks. When a track ends, the charger moves down one position until it reaches zero. You have to recharge the ratchet simulator to restart playing. ►



Assembling the ratchet. The 3D-printed ratchet mechanism simulates a real spring-charger ratchet. The rotating components — the notch and the retain spring — are assembled between two plates



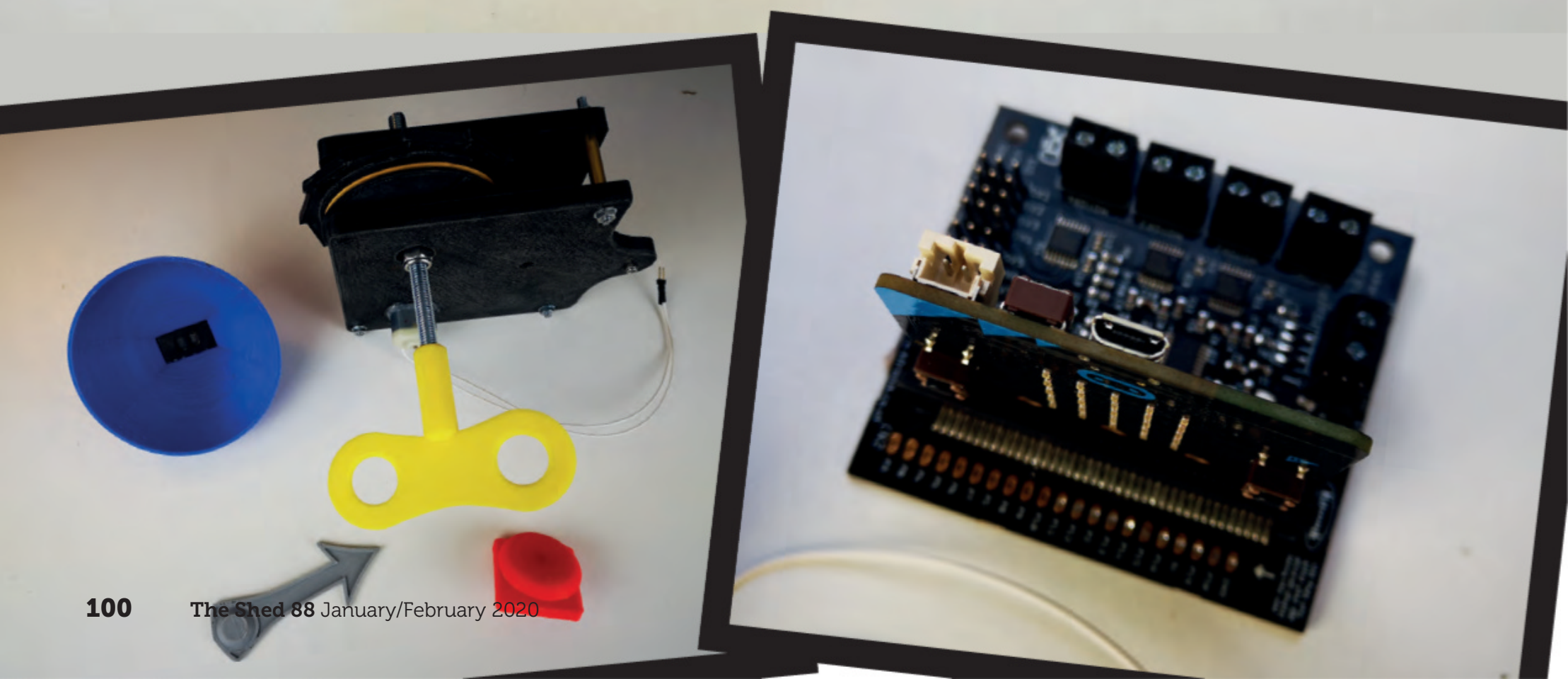


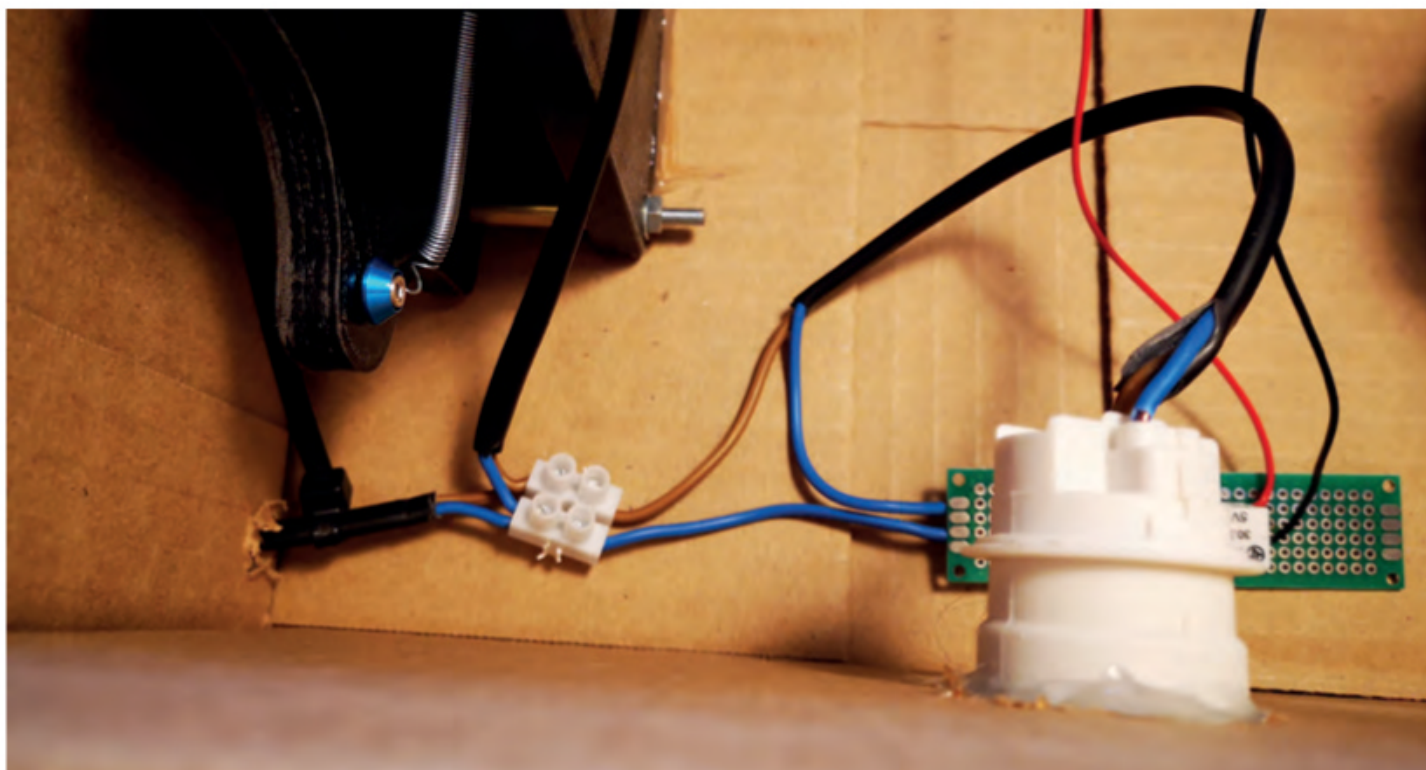
This page, clockwise from main image:

The completed ratchet simulator with the motor connected to the ratchet pulley by an elastic band

The core of the music box is the Micro Bit plugged on a robotic board by Kitronik (kitronik.co.uk). The board controls and manages all the components of the music box through the robotic board (the servo, the signals to the Arduino MP3 player, and the lamp-powering relay) and exposes all the available pins of the Micro Bit for any use

The ratchet connected to the 3D-printed charging key and the other 3D-printed components used to build the music box





Detail of the 220V glowing lamp simulating a flame. To digitally control the light, the on-off signal sent by the Micro Bit through the robotic board changes the state of a relay

Charger simulator

The charge simulator is built in two parts. The internal part simulates a spring charger — the old music boxes are fully mechanical, of course — with a 3D-printed ratchet and a notch.

Rotating the ratchet, a small brushed DC motor driven by a couple of pulleys and an elastic belt

produces a sufficient voltage pulse to be detected by the Micro Bit.

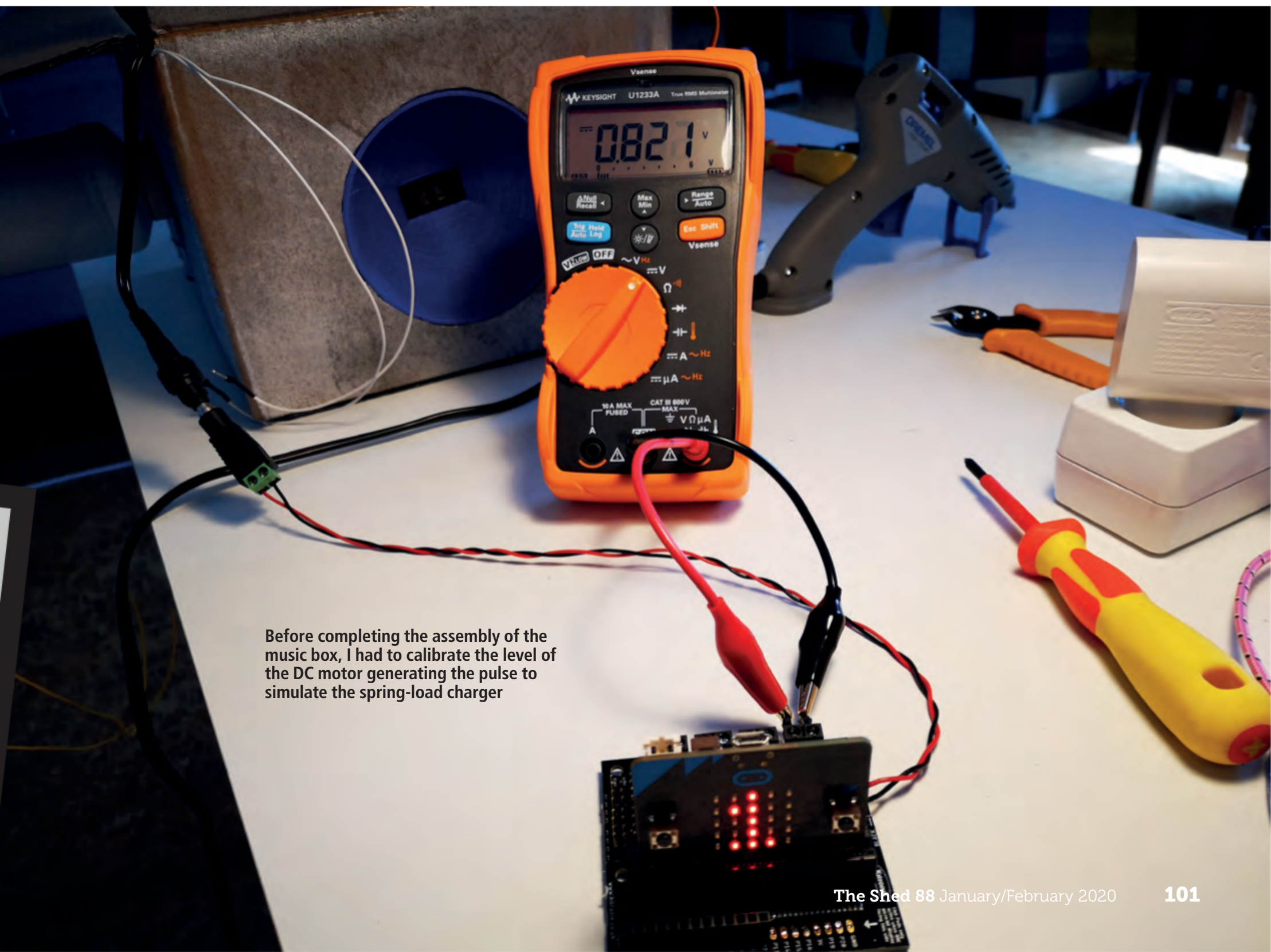
The external part is a big yellow charging key that is rotated to activate the music box.

Music-changer button

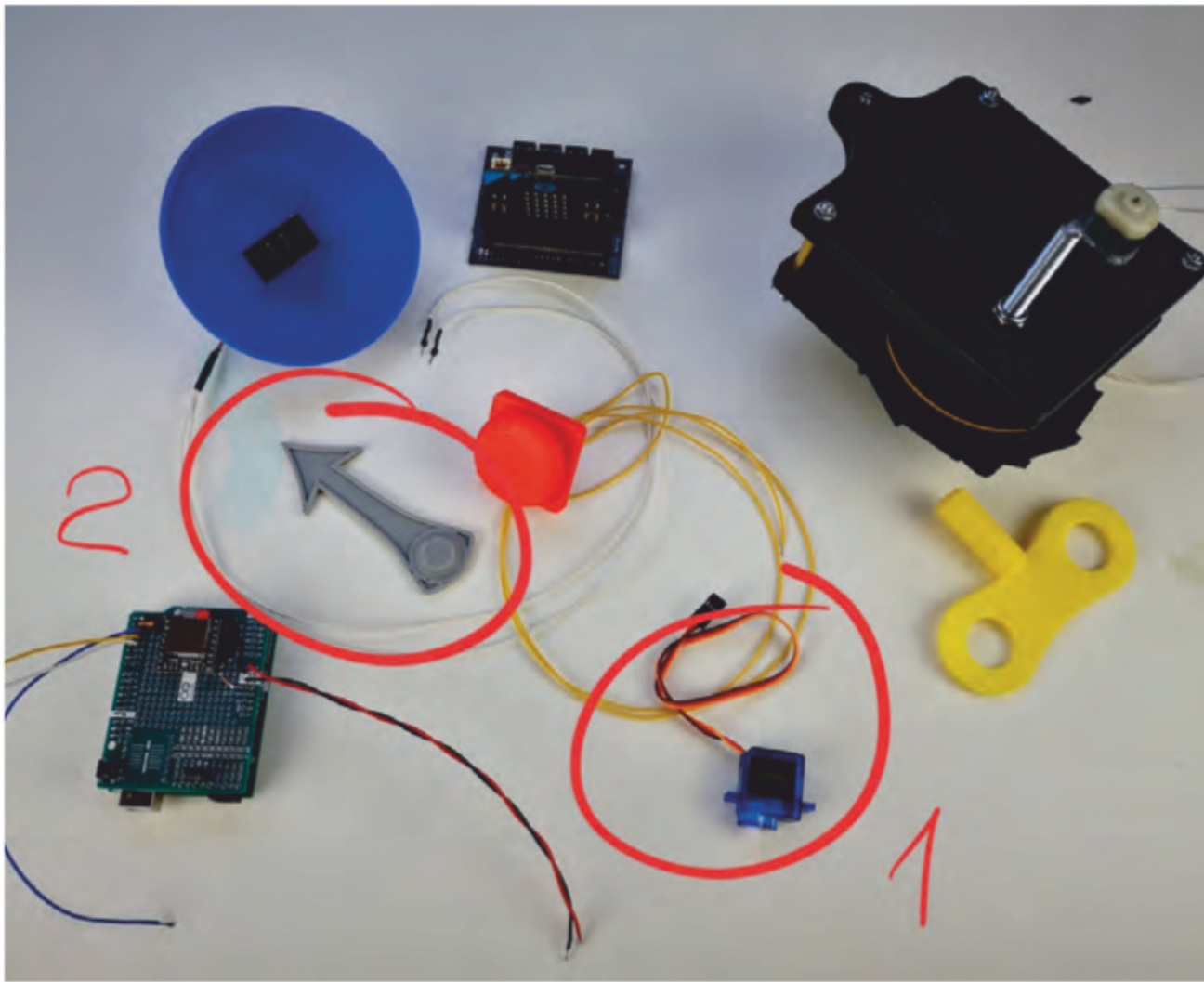
The Arduino stops when the track ends, and when the red button on top of the

box is pressed the music box starts playing the next track. The Arduino will also skip to the next track when the button is pressed.

The output of the Arduino MP3 player is sent to a smartphone-sized speaker and the sound is amplified by a 3D-printed blue cone, which is visible on one side of the music box. ►



Before completing the assembly of the music box, I had to calibrate the level of the DC motor generating the pulse to simulate the spring-load charger



The charge-level indicator is controlled by the Micro Bit through a servo, positioned at precise angles. When the nine levels of the charge are complete, the music box starts playing the first track. When the red button is pressed a new track is played. After every track is played the servo is moved down by one step until the music-box spring simulation needs a new charge

Lamp

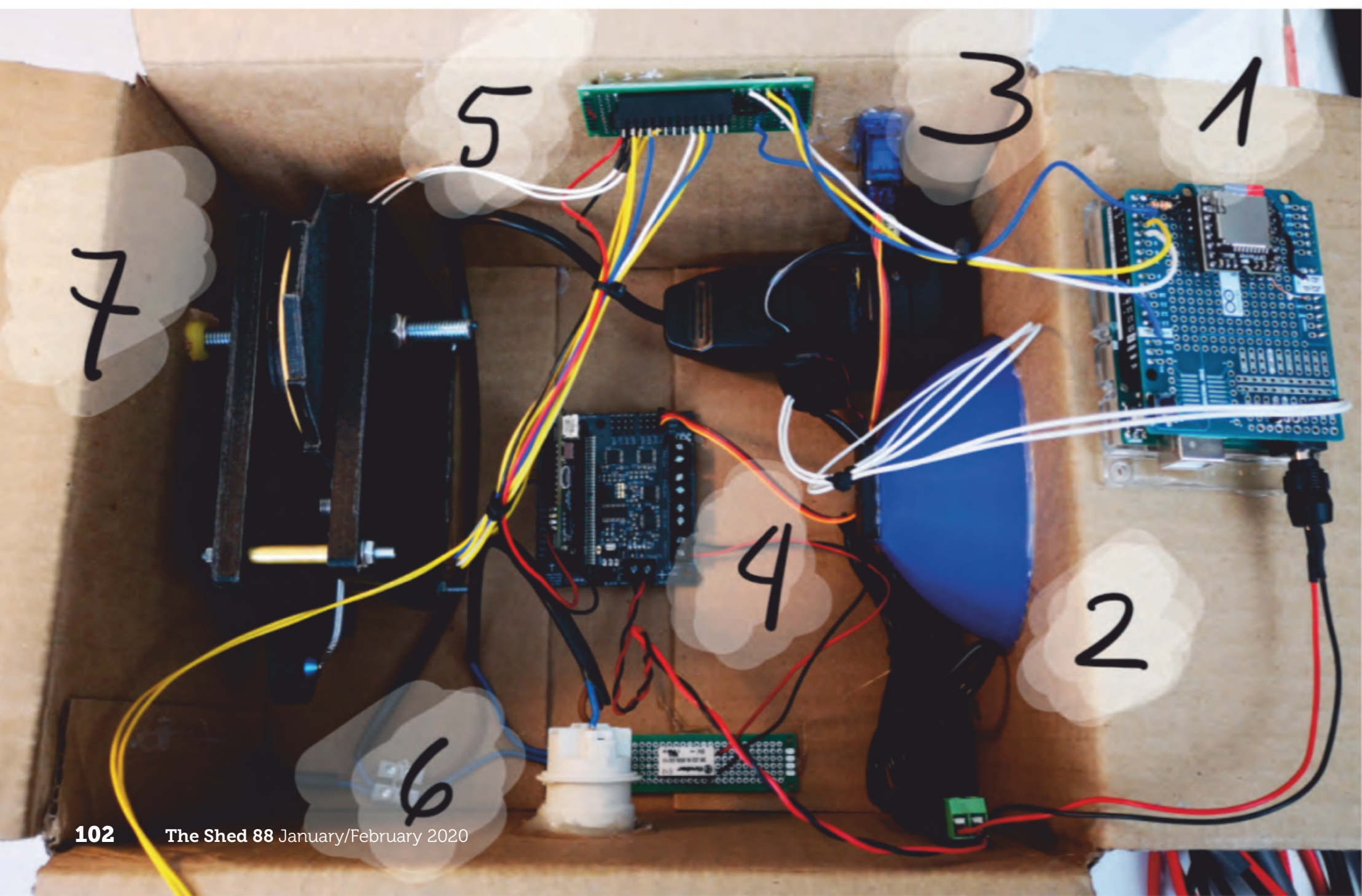
I installed a 220V lamp simulating a yellow burning flame on one side of the box. The lamp is powered when the musical box is fully charged and the charger indicator is in the top position (90 degrees). The lamp remains powered until the charge level reaches zero. The lamp power is digitally controlled by the Micro Bit through a relay because of the power difference.

I assembled all the parts inside the box with hot glue, including the 9V power supply. Then I powered up the music box and enjoyed playing it. 📺

Below: The music box before closing the container with all the components:

1. Arduino MP3 player
2. Smartphone-sized speaker with the 3D-printed blue cone to amplify the sound
3. Servo connected externally to the charger arrow of the box
4. Micro Bit plugged in the robotic Kitronik box
5. Printed circuit board (PCB) wiring the digital control signals
6. Relays and 220V lamp group
7. Ratchet module with the DC generator connected to the spring-charger simulator

It required a considerable amount of design and 3D printing



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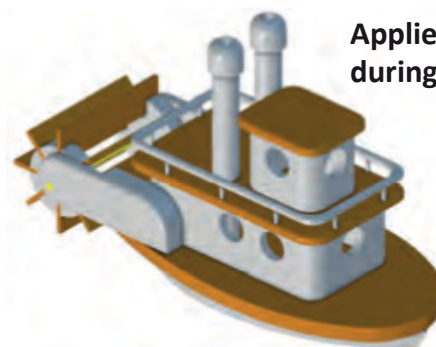
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A MASTER OF WHAT IS BECOMING A
LOST ART FINDS THERE'S STILL PLENTY OF
DEMAND FOR HIS SKILLS
BY JUDE WOODSIDE

Photographs: Jude Woodside

Mike Hobson is a bit of a legend in the lower North Island. For 32 years he has been rebuilding, regrinding, re-boring, and repowering engines for classic cars, motorbikes, and less classic makes throughout the area and beyond. His impressive shed contains everything he needs to perform any kind of precision surgery and there can't be many things he can't do or hasn't done to an engine.

Mike started his working life as a

mechanic's apprentice but soon tired of general mechanical work. When he was offered a job at the local engine reconditioner he leapt at the chance.

"I spent a year just dismantling engines before they let me near the machinery," he says.

But he soon developed his skills working the machines to the point where he decided in 1987 to go out on his own. He built a shed in his backyard and set up shop. ►



A Mini Cooper head ready to go racing

That sharemarket crash

The timing wasn't exactly ideal, coinciding with the crash of the sharemarket in New Zealand, but one man's misfortune is often another's opportunity and he was able to pick up a shed full of high-tech machinery at auctions of other failed businesses — equipment that he otherwise wouldn't have been able to afford.

That windfall has been the mainstay of his business and contributed to countless winning race cars, repowered classics, and high-performance bikes since. Being based not too far from Manfeild Park in Feilding is another advantage for a specialist in high-performance engine building.

Amid a surfeit of old engine blocks and heads, huge boxes of used valves and springs, all neatly stacked under benches and covered with a fine grey dust from the grinding and polishing processes, Mike takes us on a tour of his shed. He shows us where he cleans and bead blasts engines, before setting them up for grinding their surfaces on his rotational surface grinder, which is currently grinding its third flywheel of the day.



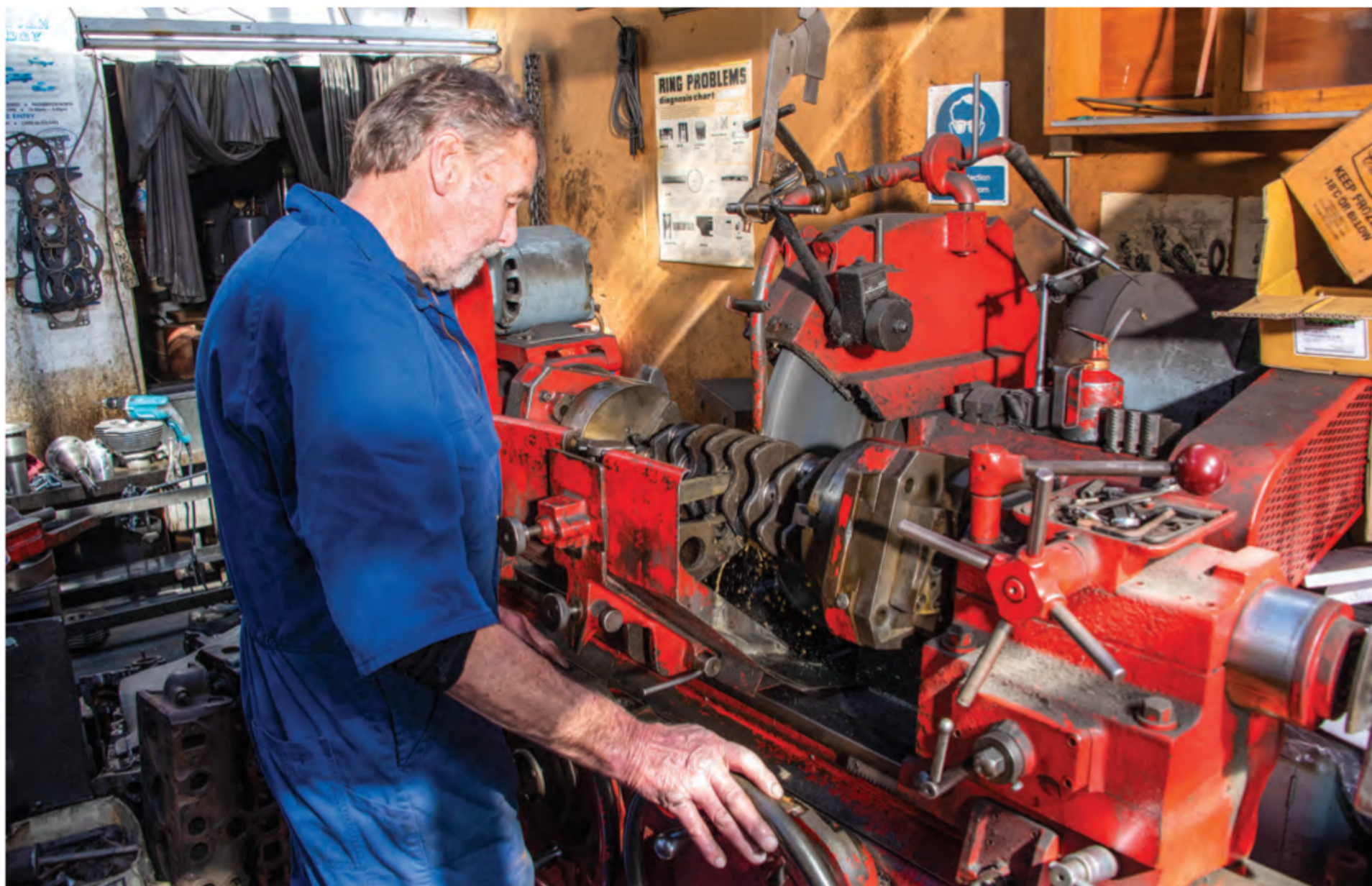
Above: Honing a con rod big end; below: Grinding journals on a crankshaft

Mike's set-up

He has a mill to rebore cylinders and another to hone them. He can grind the big end on a con rod to precise tolerances and rework the bearing shells to fit with exquisite precision. He has a lathe dedicated to grinding the journals of a crankshaft and an even bigger one for general work.

Heads are a speciality and Mike can not only lap valve seats, but he can also recut and reprofile them with a magnetic-base Mira valve re-seater. In an alcove in the

workshop he shows us his secret weapon: a machine rescued from the now-old Department of Scientific and Industrial Research (DSIR) that comprises two enormous electromagnets where he can position an engine block and apply fluorescent magnetic crack-detection fluid. The magnets energize the block and attract the fluid to cracks where it accumulates and can be seen under UV light. He also has a pressure tester for doing the same thing with alloy heads.





*There can't be many things
he can't do or hasn't done to
an engine*



Far left: Mike Hudson and his dog Diesel
Left: Re-boring a cylinder
Below: A collection of old valves

A bit of a vanishing art

His real passion is motorbikes and he owns four late-model bikes, including a late-model Royal Enfield, which are now being built in India.

Mike has found that many workshops don't like spending time grinding and honing cylinders and heads and prefer to simply replace them. He has made specific jigs for torqueing motorcycle cylinders for honing. A cylinder can go out of round without the appropriate tension, so the jigs are designed to fit several types of cylinder and provide the working torque they experience in position. It is easy to make an ellipsoid cylinder, which is of little use to anyone.

What is now second nature to Mike is a vanishing art. In the era of computer control, much of what he does is now done with a CNC machine or the part is simply discarded. It's often cheaper to simply replace an engine or a head than to machine it.

Trying to retire

That's not an option for rare classics or for high-performance race cars and bikes. Many of the motors that Mike works on come from a time when all this work was done by machines under the watchful eye of experienced technicians like him. Since he started in the engine-reconditioning business



the number of similar companies has fallen from 13 to just two in the Feilding area alone.

But Mike isn't giving up. He wants to carry on doing classic cars and the odd bike, but at his own pace.

"I love working on Jag motors. They are beautifully put together," he says.

He is presently working on a Chevrolet and has two Mini Cooper heads on his

bench, one for a friend who is racing it and the other a spare. He isn't hungry for work: "I'm retiring. I just want to work on the projects that interest me now. I don't need any more work."

He may be trying to retire, but the procession of people arriving at his workshop indicates the difficulty of doing so. It's also testament to his reputation. 



Gandalf with rack

RELEASING YOUR INNER GANDALF

THE NEED TO SHOWCASE HEAVY *LOTR* COSTUMES
PRESENTS A DESIGN CHALLENGE

By Hugh McCarroll

Photographs: Hugh McCarroll and Kathy Drysdale

My niece Kathy is a *Lord of the Rings* (LOTR) tragic. She loves the books, films, and everything associated with LOTR. She has been a fan for decades, so much so she has converted a room in her Wellington house into a fan museum, showing off all the costumes, memorabilia, and stuff that she has collected over the years. She advertises it on social media and has a regular stream of visitors, all equally in thrall to the one ring.

Among the stuff in her fan museum is a large collection of costumes, which her visitors love to put on, grasp a sword or a bow, roleplay their favourite story characters, and take selfies. The costumes are quite heavy, and she has gone through three racks that all collapsed under the weight.

I love a challenge like this. It's the fun of thinking through the design options

The challenge

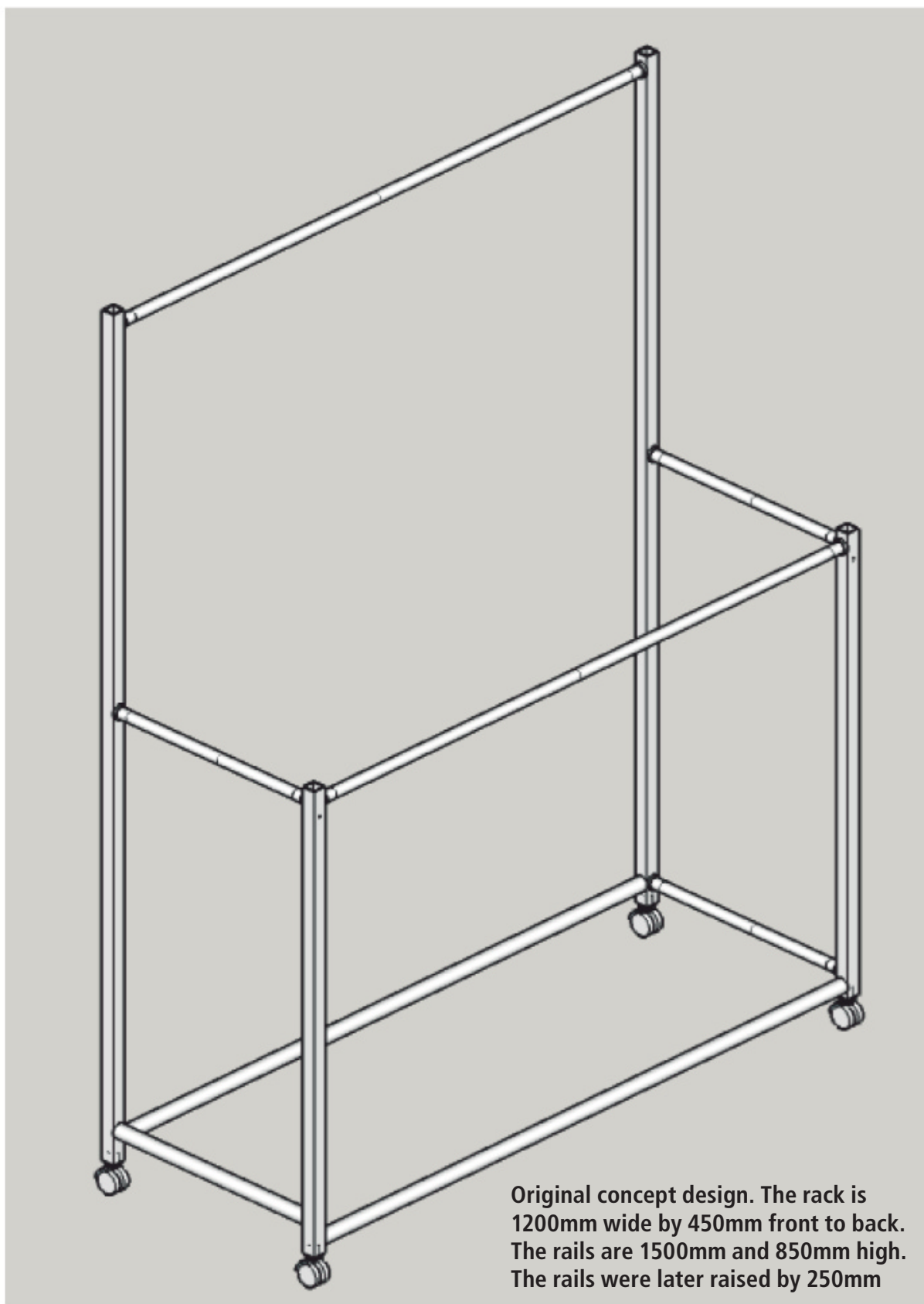
She asked if I could help — either fix the rack she currently has, or make one that wouldn't collapse. The racks you can buy are cheap but are very cheaply made. It was obvious from photos she sent that the current one was not worth fixing, so I offered to make her a new clothes rack that was structurally sound. Turned out she needed two, one for her museum and a transportable one for when she takes her costumes to fan events and film locations.

The racks each needed to have two 1m long hanging rails, one 1500mm above the ground and one 800mm, and each rail needed to carry up to 25kg. She also wanted the racks to be on wheels, so that they could be moved around easily, and if possible able to be assembled and dismantled without tools.

Not a difficult job, but making the racks easy to assemble and mobile made it an interesting challenge. The structural requirement is to transfer the weight of the clothes on the rail through a structure to the wheels and not collapse. ►



Top: Kathy with finished rack
Middle: Legolas testing his bow
Right: Finished rack in the One Room Fan Museum



Original concept design. The rack is 1200mm wide by 450mm front to back. The rails are 1500mm and 850mm high. The rails were later raised by 250mm

What I enjoy

I love a challenge like this. It's the fun of thinking through the design options, selecting and designing one, and then making it real. It'll never be commercially viable, but this is what I enjoy doing in my retirement and my time is my own.

I also like working with aluminium. There is a huge selection of extruded sections available.

Ullrich Aluminium has an extrusion plant and distribution centre where I live in Hamilton, and an extraordinary selection of profiles in its catalogue. I settled on a design using square tubes for the vertical members and round tubes for the horizontal members, the round tubes, all with screw fittings in the ends and the whole thing bolted

together. The original design has 30mm diameter hanging rails 1175mm long, set 1500mm and 850mm above the floor, and the 425mm long bracing tubes 25mm diameter, all 1.6mm wall thickness.

The verticals are 25.4mm (one-inch) square tube, 1.2mm wall thickness.

I estimated \$300 for the materials, and Kathy was happy with that

The structural integrity depends on good tight joints, and as long as the

horizontal round tubes are bolted tightly against the vertical square tubes the rack should be structurally sound and rigid.

Time to get going

I priced up the extrusions, which came to about \$200 for the two racks. Allowing for wheels and other bits and pieces, I estimated \$300 for the materials, and Kathy was happy with that.

I bought the aluminium extrusions required, plus eight 40mm diameter castoring wheels with 10mm threaded studs for mounting. They are rated at 50kg each, so there is plenty of margin.

Each rack consists of four vertical square tubes with a wheel set in the bottom end — four short 25mm diameter round tubes and two long 25mm diameter round tubes. Two long 30mm diameter tubes (the hanging rails) complete the framework.

I cut the square tubes first, one 5m length of extrusion per rack cut into two lengths 1550mm and two 850mm. Then I marked up and drilled the 6mm diameter holes for the connecting bolts.

Using 25mm diameter aluminium bar stock, I turned eight flanged plugs that would be a light press fit into the square tubes, and tapped a 10mm diameter threaded hole through each one. Using a mallet, I fitted the plugs into the ends of the square tubes and pop riveted them to secure them in place.

Plugs galore

There are a lot of plugs to make for this project. Two end plugs for each of the eight round tubes per rack — 32 plugs for the two racks.

I anticipated turning them for a sliding fit and securing them in place with pop rivets, but then realized that if I used a good interference fit for the round tubes, I wouldn't have to worry about pop rivets. I had acquired a 12-tonne benchtop press from a friend a few years ago and hadn't had cause to use it till now. It would be ideal for the short (415mm long) tubes

I turned a test plug 22.2mm diameter, 0.4mm oversize for the 21.8mm tube inside diameter (ID). I cut one short length 25mm diameter tube, set it up vertically in the press, and pressed

the end plug in. All appeared to be going well when suddenly the tube buckled under the load. First lesson in machining: secure the work.

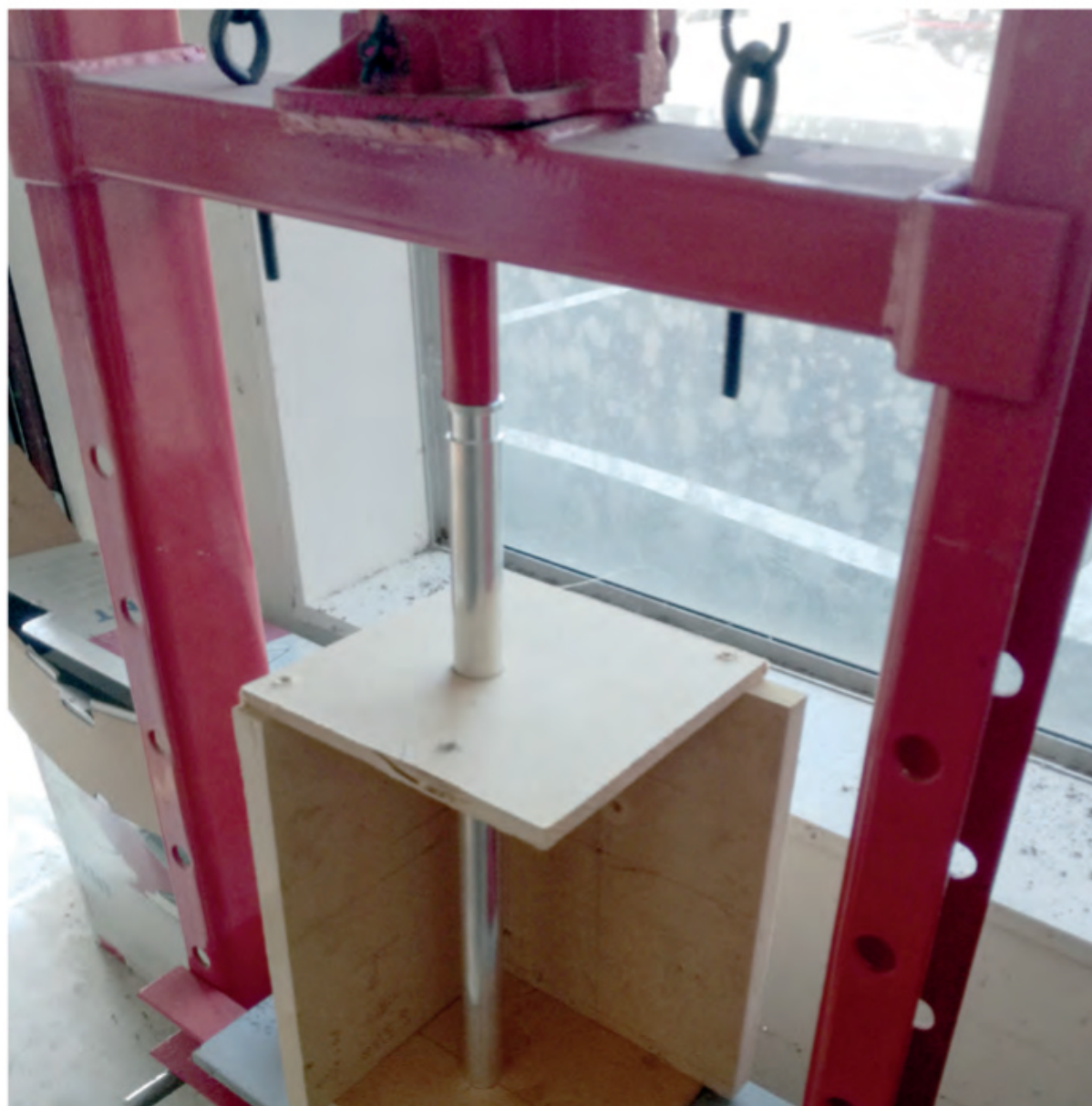
The tube needs to be supported to stay vertical, and supported to prevent buckling.

So, I made up a frame from MDF offcuts in my garage to hold the tubes vertical and supported them at the bottom and near the top end. This solved the problem and I was able to press the plug into the first tube. Then it was just a case of doing the same thing 15 more times to assemble the eight short tubes.

The results are excellent. Each plug has a 5mm flange at one end and the plug is pressed in until this touches the tube end. There is no way the plugs will come out without destroying the tube. It is an excellent DIY jointing method. The plugs need a 6mm diameter threaded hole through the centre, and using a tap was proving a chore.

I did the 16 plugs for the short tubes this way before realizing that I could use my press to press fit a 6mm nut in place instead. A 6mm hexagonal nut is an interference fit into an 11mm diameter hole. So, for the other 16 end plugs I drilled an 11mm diameter hole in the end of the plug, and pressed the nut into the hole. I'm happier to have steel on steel for the bolt and nut than steel on aluminium to bolt the pieces together.

The long tubes presented another problem. They would not fit in the press.



Support frame for short tubes in the press

I had acquired a 12-tonne benchtop press from a friend a few years ago and hadn't had cause to use it till now

End plugs with nuts pressed in placed



So, I built a temporary press: two 1800 lengths of 90x45mm timber forming the vertical frame, with cross frames top and bottom bolted to the vertical timbers with 6mm diameter through bolts. The 12t hydraulic press from the small press is removable, so I removed it and sat it on the bottom cross frame of my new press. ►

Pressing nut in end plug





Temporary press I built to press the plugs into the long tubes



First attempt at pressing end plug — one buckled tube

Buckling issue

The other problem with pressing the long tubes is buckling. The longer the tube, the greater the problem. To prevent buckling, I made five support plates from 10mm thick MDF with a 25mm diameter hole, and a 30mm diameter hole on the centre line.

These were fitted over one long length of 25mm aluminium tube and set up on the new press. Support plates were set at each end, the middle, and quarter points of the tube, and each attached to the two vertical timbers with lengths of timber cut to suit. When these were all screwed in place, the long tube was supported every 300mm, with no chance of buckling.

It did the trick and the plugs were pressed into the four 25mm diameter long tubes without difficulty. For the 30mm tubes, I repeated the process using the 30mm holes in the support plates.

All that was required then was to assemble the frames and check they were rigid and strong enough. I tested one by hanging a 25kg bag of ready-mix concrete from the rails. The rails bent slightly but could clearly have taken more load. The frame remained rigid and easy to move.

Off they go to the capital

I had ordered a knurling tool for my lathe to complete this project, but it was delayed in delivery, so after a discussion with Kathy I packed the whole lot up and sent the racks to her in Wellington, with a spanner for her to do up the bolts. I told her I'd do the knurled knobs when the tool arrived and send them separately.

Kathy assembled them immediately with the help of a friend and sent me photos of a finished rack in use. She was delighted, but I noticed that the clothes on the rack draped on the ground. "Perhaps the rails should have been higher?" I asked. She agreed — it was a bit lower than she wanted. She may have mis-measured the

Load test, 25KG no problem





Travel rack collapsed

original heights and she'd put up with them being a bit short. I suggested a modification to add about 200mm height to each of the uprights.

The square section extrusion I had used for the upright is available in the hardware stores in cut lengths, so I was able to buy two 1m lengths to make eight 250mm extension pieces, and two 1m lengths of 20x20x1.2mm angle to make 16, 80mm long doubler plates.

I planned to pop rivet two doublers inside each upright, slide the extension over the doublers, and pop rivet them to form a strong joint. Then drill new holes for the hanging rails.

Uh oh, they are not in my shed. If I had been doing this in my shed it would have been a morning's work. But the racks were now in Wellington, and neither Kathy nor her husband Pete had used a pop riveter before.

So, I cut the square tubes to the correct length, drilled the holes and pop riveted the doublers in place in the extension pieces. All Kathy and Pete had to do was fit the extension pieces into the uprights, drill the holes, and pop the rivets in place.

Perhaps the rails should have been higher?

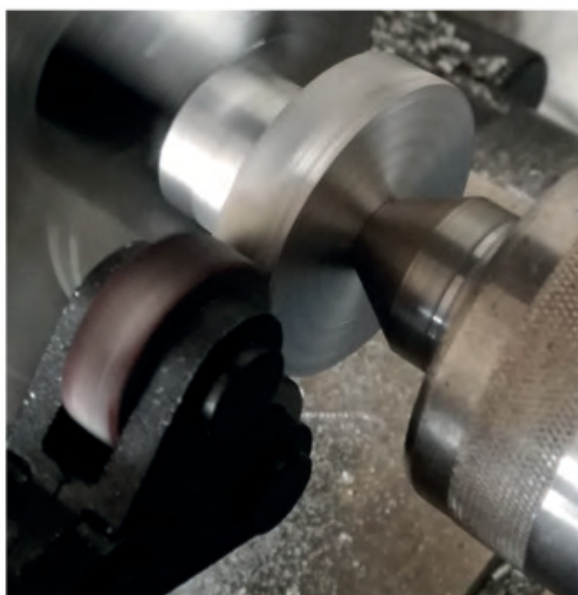
While I was thinking about the extensions, it occurred to me that the rack could have a tendency to tip backwards. It is only 450mm between front to back uprights, and the high rack has a reasonable weight hanging from it. To prevent tipping, I made four 250mm longspurs to bolt to the bottom of the tall uprights. In the event of a tip, these touch the floor and resist further tipping.

The knurling tool arrived and I was able to complete the job. ►



Above: Kathy's husband Pete installing one of the extensions

Below: Knurling a nut in the lathe. Below right: Finished knurled nut provides good grip



The longer the tube, the greater the problem

Right: Final assembly check

Below: Assembly in Wellington.

Below bottom: Castoring wheel secured in square tube



Finishing touches

For the knurled knobs I used longer 6mm diameter bolts with the heads pressed into a turned aluminium knob with a knurled hand grip to allow hand tightening sufficient to bolt the tubes tight against the uprights.

To check how big to make the knobs, I had turned one from 40mm diameter bar stock on my lathe, pressed a 6mm bolt into it, and assembled one short tube to a square tube before I sent the racks to Wellington.

The knobs are 30mm long, 25mm diameter except for 10mm at the end, which stayed 40mm diameter and had a knurled face. A 6mm diameter

hole through the knob with an 11mm diameter recess at the outside end allowed the bolt to be pressed in place.

I made 16 of these and packaged them up with the modification kit (the extension pieces, the spurs, a centre punch, a pop-rivet gun, a pack of rivets and a page of instructions) and posted these to Kathy.

Pete did the mods without difficulty and the racks are now in use. If you're in Wellington, go see them at Kathy's museum. Contact her at theoneroomfanmuseum.nz.

Release your inner hobbit and try on a costume or two — and don't forget to admire the racks. 

Anti-tipping spur to stop the rack tipping backwards



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Mahutaariki Adamu adds decorative carving to a ukulele body.

CRAFTING MUSIC ISLAND-STYLE

AN EARLY INTRO TO MAKING UKULELES BECOMES A FAMILY AFFAIR

By Sue Allison

Photographs: Priscilla Chapman

Riki Adamu used a machete to fashion his first ukulele out of a coconut shell as a 12-year-old boy growing up on a remote atoll in the northern Cook Islands.

Making do with anything he could find on Rakahanga, the resourceful

young instrument maker used birchwood sap for glue, cut nails in half with a hacksaw blade to make frets, sanded it down on raw concrete, and strung his ukarere (in Cook Islands Māori) with fishing line.

Four decades on, and the finely

crafted instruments made by Riki and now his son, Mahutaariki, grace the shelves of musical establishments such as New Zealand's Rockshop, as well as being sought after by tourists and locals alike at Rarotonga's Punanga Nui market. ►



Ready for market.



Mahutuaariki's 2-year-old daughter, Mama Rita, likes pottering in the workshop



A tropical workshop needs plenty of ventilation

A career move

A few years after making his original coconut-shell ukulele, Riki moved to New Zealand with his family. After he left school, he took up the craft in earnest and set up a business making bespoke ukuleles out of New Zealand timbers. Mahutaariki, who inherited his

father's passion or woodwork, started helping him in his workshop from the age of seven.

The family returned to the Cook Islands when Mahutaariki was in his teens, and established their business on Rarotonga. Now 25, Mahutaariki is making ukuleles in his home-based

workshop, while his sister Ripeta does the office work and their younger brother Mara, 15, helps out when he is home from school in the holidays. With the business in his children's capable hands, Riki has returned to his roots with his wife, Reea, and is building a retirement house back on Rakahanga.



The colour and grain of native timbers come to life with oil and varnish



Drilling holes for string attachments

Well tooled up

The instruments crafted in Mahutaariki's shed are a far cry from the coconut-shell prototype with the exception of the strings — it seems nothing beats 10kg fishing line.

The workshop resounds with the whirr of electric machinery and there isn't a machete in sight. The sea air takes its toll on the more sophisticated equipment. "We have to really look after the machines and oil them down regularly, especially if we are going away," says Mahutaariki, who regularly travels around the islands and comes to New Zealand for the annual Polyfest.

The double-stringed ukuleles are made using laminated local timbers such as mahogany, rosewood, teak, tou (kerosene tree or *Cordia subcordata*) and the swirling, green-grained wild hibiscus. Kwila and recycled rimu and kauri from New Zealand are also incorporated.

Behind the workshop among the palm trees is a huge trunk of mahogany and ready supply of rough-cut rosewood. When he needs more timber, Mahutaariki steps outside, fires up his chainsaw, and slices off another slab. ►

Near-finished instruments with frets marked and cedar soundboards fitted



“

Mahutaariki steps outside, fires up his chainsaw, and slices off another slab

”

The build process

The ukulele bodies are made from 50x50x380mm laminated timber blocks, glued with two-pot epoxy and clamped in a mirror-image arrangement on either side of a 900mm neck. The lamination not only creates a striking appearance but also prevents the instrument from warping.

Mahutaariki marks out the shape with a pen before cutting it with a bandsaw. The corner trimmings are used to create a decorative brace between the head and neck. “We don’t waste anything,” he says, indicating a 44-gallon drum filled with sawdust that is used to smoke fish.

The body of the ukulele is hollowed out using a router, and a circular



Shavings and sawdust are used to smoke fish

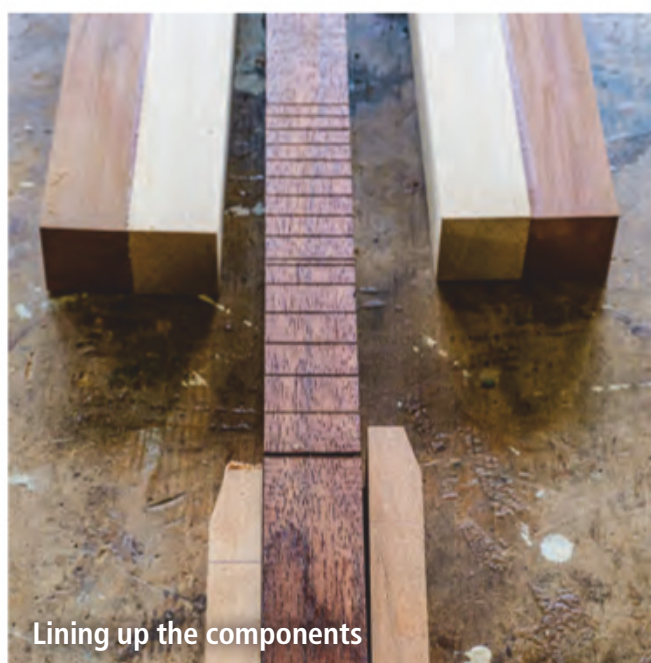


Factory line-up of laminated blocks





A dust-extraction system has been fitted to each machine, while a big fan blows sawdust out of the back of the shed



Lining up the components



Mahutaariki does a lot of the decorative carving in front of TV at night

soundboard is fitted over the cavity. Cedar is always used for the soundboard, which will only be 2mm thick after sanding, as it is strong and doesn't split. A jig sits in the router, with its wheel guiding the blade as it cuts a perfect circle. Precision is important, as the cedar disc sits snugly on a narrow lip over the hole. Once it is glued in place, a thicknesser is used to bring the soundboard flush with the body before it is finished with the belt sander.

The frets are cut on the table saw using a template. The chord markers along the frets look like inlaid wood but are actually 'bog' — body filler pressed into shallow holes made with the drill press. ►

Tahitian ukuleles

The Pasifika-style ukuleles made by the Adamu family are sometimes known as 'Tahitian ukuleles' (or 'Tahitian banjos').

Unlike other ukuleles, they do not have a hollow sound box. Instead, a cavity is bored into the solid body and covered with a thin sheet of timber (usually cedar).

They have eight strings, tuned in pairs, to give the sound more body. The two middle courses are tuned an octave higher than they would be on a normal ukulele. The instrument is strummed rapidly using fingers or a pick, producing a distinctive banjo-like sound.



Dark kwila and light kauri make for a striking contrast



Mahutaariki, who performs in a local band, strums a ukulele with a body made of distinctive wild hibiscus



Oiling the finished instrument is his favourite part



The double-necked ukulele is rosewood with wild hibiscus on the edge and kauri necks. The fret markers are aluminium

Classy finish

Mahutaariki sometimes embellishes the instruments with carvings, while others are inlaid with paua or mother of pearl. He has the inlays laser-cut to his own designs.

The completed ukulele is sprayed with three coats of clear lacquer and finished with a coat of Wattyl gloss varnish. “The best part is seeing the colours come up when it is finished,” he says. The varnished instruments are fitted with tuning screws and strung with fishing line.

Mahutaariki makes the ukuleles in batches of 20 or 30 at a time, crafting left-handed instruments to order (with

a reverse configuration so the hand can move up the neck) and adding a side fitting for electrics for those after a less traditional sound. He also makes double-necked ukuleles, which can be tuned to produce an impressive sound range.

An accomplished musician himself, Mahutaariki and his mates play in a ukulele band that performs at the local fishing club on Friday nights, island time — “We officially play from 7pm to 9pm but often go on till midnight.” It’s a free-for-all affair, with any comers joining in, and Mahutaariki’s double-necked ukulele awaiting repair to its smashed soundboard is testament to the fervour of the night. 📺



Sea themes feature in many of the surface carvings



The Adamus’ ukuleles come in a range of designs and shapes

Bookcase

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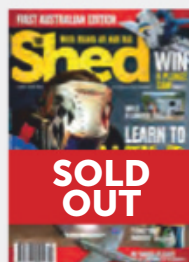
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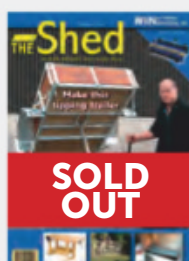
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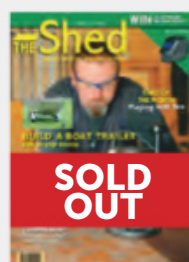
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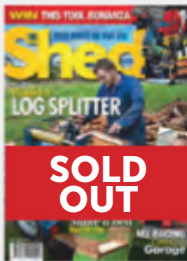
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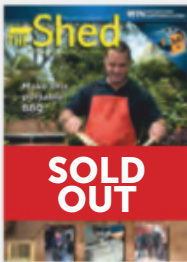
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A SHEDDIE'S CHRISTMAS

(WITH APOLOGIES TO CLEMENT CLARKE MOORE)

By Jude Woodside



*T'was the night before Xmas and all through the shed
Not a spindle was turning, the place was quite dead,
The sheddie, retired, was tucked up in bed,
While the Minister for Finance snored by his head.*

*As he slept, he was dreaming of vices he'd known
Of lathes and of grinders and powertools he'd owned.
The sheddie was frugal, he'd scrimped and he'd scraped,
In order to build up his craft to a peak.*

*But alas he was restless he groaned in his sleep.
There was one thing he needed to make it complete.
A mill, a great big one with CNC scales,
He knew just the one, he'd seen it in sales.*

*In the shed all was quite quiet there was barely a whisper.
Till the door opened, at first just a whisker.
Some chap dressed in red with a bag on his shoulder
Slipped in through the door, like a thief, only bolder.*

*His bag bulged and grew as he came through the door.
He dragged it with effort out onto the floor.
He carefully positioned to open the swag,
And dragged out a Bridgeport from deep in the bag.*

*(What magic is this? That mill weighs a tonne!
You can't simply pull one from out of your bum!)*

*He shifted it round till it stood in its finery
The moonlight shone in and made it all shinery.
The light was reflected in the DRO dials
and bounced off the table's silvery rails.*

*Our sheddie was snoring along with the wife.
So, he never noticed the dream of his life,
Was presently standing alone in the shed,
Installed and set up while he was in bed.*

*Xmas was here and it wasn't too long,
Till hordes of his relatives gathered to throng.
While the roast was a'roasting and toasts were a'toasting
and old Uncle Cecil was endlessly boasting,*

*He'd planned to slip off to the shed for respite.
Away from the noise and the "trouble and strife".
Hoping no one would notice he went out the back,
And down the short path to the front of the shack.*

*He opened the door and slipped into the shop.
He noticed that something was different and stopped,
In the middle of taking a breath, when he saw,
Lit up in a sunbeam miraculously showing,
Through the skylight above it, that left the mill glowing.*

*His eyes did a blink, and he just couldn't think,
If what he was seeing was real or imagined.
An enormous machine, all in battleship grey,
Was taking up space in the workshop that day.*

*The sheddie was stunned, he ran to caress it.
He ran his hands over the breadth of the table,
And tested the buttons and turned all the levers.
He turned on the power, the machine hummed to life,
The buttons and lights glowing green, red, and white.*

*He fitted a collet and fixed in a cutter,
Set up the start point and wound up the turret.
He fitted a vice and found some old stock,
And attached it to the table with the aid of a chock.*

*The machine started purring as he set it to run,
The chips began flying, the work had begun.
His heart it was singing as he carved out the block,
And radiused the edges and flattened the top.*

*He became so engrossed he neglected to notice,
That hordes of onlookers had gathered to see,
What had taken him off from the merry party.
They peered in the window open mouthed with surprise,
As the sheddie continued to shave off the side.*

*Then a noise made him jump and his heart gave a pump.
The door was flung open and in through the gap,
The Minister for Finance appeared at a gallop,
With her hands on her hips and a glowering look,
She marched up and hit the emergency stop.*

*The sheddie woke up with a start, in his bed,
As visions of mills still danced in his head.
But the look from his wife soon sorted him out,
"There's work to be done, they'll all be here soon
I need you to sort out the dining room."*

*The sheddie got up in a daze and he wondered,
Was it all just a dream? Could it really be actual?
He wanted to slip off to take a small peek,
In the shop, through the window, while no-one was watching,
To see if his vision really was factual.*

*I cannot confirm or deny what he saw there,
was real or imagined, nor would I be glib.
Or is the whole story a fiction, a fib?
A means to distract you, your attention to steal?
You be judge. Can dreams become real?*

THE INDUSTRY'S CHOICE!

Metal Working	Sheet Metal Fabrication	Wood Working	Workshop & Automotive	Lifting Handling	Cutting Tools	Machine Tools & Accessories	Measuring Equipment	Spare Parts
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- 150mm / 6"
- Metric, inch & fraction
- 4-way measuring
- Includes battery



LARGE CLEAR DISPLAY SCREEN

Order Code: M738

\$35

SAVE \$11

TCS-3 Tool Storage Cabinet & Seat

- 406mm seat height
- 3 x drawers with ball bearing slides
- 420 x 235mm padded seat
- 2 x magnetic side trays
- 360° swivel wheels



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\$110

SAVE \$16.50

EDBD-13 Drill Sharpener

- 3-13mm or 1/8"-1/2"
- CBN grinding wheel
- Split point
- 80W, 240V



Order Code: D070

\$89

SAVE \$23.70

WT350 Auto Darken Welding Helmet

- Application: Mig, Tig, Arc & Grinding
- Ultra clear visiontrue colour lens
- 9 ~ 13 adjustable shade
- 4 x arc sensors for reliable arc detection



Order Code: Z00894AA

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SAVE \$43

KT1214MRN05 Combination Metric Wrench Set

- 14 Piece Set
- Ring & open end wrench
- chrome vanadium alloy steel
- 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19mm



Order Code: Y409

\$105

SAVE \$21.50

PF-75 - Pedestal Fan

- Ø750mm 3 blade design
- 90° oscillate or fixed
- Head tilts 120°
- 3 x fan speeds, 280W, 240V



ADJUSTABLE HEIGHT

Order Code: F032

\$185

SAVE \$17.40

TiGer 2000S Wetstone Grinder

- German design & technology
- 200mm stone & 225mm hone wheel
- 120rpm stone speed
- Includes straight edge jig, setting gauge & honing paste
- 120W, 240V



Order Code: W859

\$215

SAVE \$26.50

LT-226 Hydraulic Lifter Trolley

- 226kg load capacity
- 710 x 440mm table
- 270-740mm table height
- 2 fixed & 2 swivel wheels with brakes



Order Code: J048

\$275

SAVE \$70

WBS-3D Steel Work Bench

- 2000 x 640 x 870mm
- 500kg load capacity
- Bearing slide drawers
- 3 Lockable drawers



HEAVY DUTY STEEL

Order Code: A380

\$495

SAVE \$57

PJ2000RS Premium High Pressure Water Blaster

- 2200PSI maximum pressure
- 6.4l/min. water volume
- 5.5hp Lifan 4 stroke engine
- 8 metre high pressure hose
- Large pneumatic tyres



Order Code: WB700

\$510

SAVE \$58.10

PD-325 Pedestal Drill

- 16mm drill capacity
- 2MT spindle
- 12 spindle speeds
- Swivel & tilt table
- 1hp, 240V motor



IDEAL FOR HOME WORKSHOP OR FARM USE

Order Code: D592

\$399

SAVE \$56.40

WL-14V Mini Wood Lathe

- 356 x 470mm turning capacity
- Electronic variable speed
- Digital readout speed display
- 12 position spindle indexing
- 0.75hp, 240V motor



Order Code: W385

\$589

SAVE \$66.50

UB-1400F - Industrial Aluminium Ute Tool Box

- 1400 x 500 x 800mm
- 3.2mm aluminium checker plate (thickest point)
- Key lockable stainless steel latches
- 5 position adjustable top shelf
- Dual gas struts on lid



Order Code: T740

\$759

SAVE \$69

KIT194MH - Tool Chest & Assorted Tools, Racing Series

- 9 drawer tool chest
- 94pc socket, driver & accessory tray
- 25pc ring & open end spanners & screwdriver tray
- 31pc plier, hex key & adjustable wrench tray
- 38pc gearless ratchet driver & bits tray
- 5pc VDE/insulated screwdriver set



Order Code: Y314

\$850

SAVE \$90

T-13S Thicknesser

- 330 x 152mm capacity
- Helical cutter head with HSS inserts
- Smooth & quieter cutting
- Anti-kick back fingers
- 2.4hp, 240V



Order Code: W815

\$799

SAVE \$155.50

AC15 Air Compressor

- 424l/min. twin cylinder
- 50 litre tank
- 125psi pressure
- 3hp, 240V motor



Order Code: C3120

\$970

SAVE \$173.10

BP-310 Wood Band Saw

- 305 x 165mm capacity
- Cast iron table tilts 45°
- 2 x blade speeds
- LED lighting
- 0.75kW / 1hp 240V



Order Code: W952

\$740

SAVE \$111

MB-210 Meat & Bone Band Saw

- Food grade stainless steel
- 185mm x 240mm capacity
- Table size 440 x 465mm
- 0.75kW/1hp, 240V
- Includes integrated safety push device



Order Code: F320

\$1,299

SAVE \$161.50

RYAN
Staff Member

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