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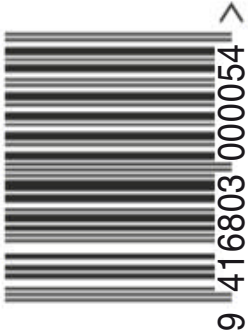
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A TRIUMPH IN THE SHED

AN ENGINEER'S WORLD RECORD CHALLENGE



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EDITOR

Greg Vincent, editor@theshedmag.co.nz

SUBEDITOR

Karen Alexander

TECHNICAL EDITOR

Jude Woodside

PROOFREADER

Odelia Schaare

DESIGN

Mark Gibson

ADVERTISING SALES

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

ADVERTISING COORDINATOR

Renae Fisher

CONTRIBUTORS

Murray Grimwood, Jude Woodside, Enrico Miglino, Bryan Livingston, Coen Smit, Nigel Young, Ian Sharpe, Geoff Burgess, Ritchie Wilson, Nathalie Brown, Brian High, Roger Curl, Bob Hulme, Dave Montgomery, Juliet Nicholas, Emil Nye

SUBSCRIBE

ONLINE: magstore.nz

PHONE: 0800 PARKSIDE (727 574)

POST: Freepost Parkside Media Subs

PO Box 46,020, Herne Bay, Auckland 1147

EMAIL: subs@parkside.co.nz

CONTACT US

**parkside
media.**

PHONE: 09 360 1480

POST: PO Box 46,020, Herne Bay, Auckland 1147

EMAIL: info@parkside.co.nz

PUBLISHER

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

BUSINESS DIRECTOR

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

GENERAL MANAGER

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

CONTENT DIRECTOR

Isobel Simmons

PRINTING AND DISTRIBUTION

Ovato

PHONE: 09 928 4200

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REASONS TO BE CHEERFUL

For many years, I felt the end of the year and the beginning of the next really was something to truly celebrate. Let's get rid of this boring old year we have now and get a new one going; next year will be so much better than this one was the belief.

Of course, the feeling that the grass is always greener was the misconception of youth. The fact was that when you got to the end of the first week in January, you suddenly realised that nothing had miraculously altered in the slightest.

We all have good and bad years but now that I have a lot of years on my score sheet, I've learned that time is not only precious but generally nothing much changes overnight — unless the proverbial hits the fan.

You won't see me wishing for this year to hurry up and end; slow and easy is the go — time goes fast enough as it is for heaven's sake.

So may I just offer these thoughts up: that we don't long for this year to end and put our troubles behind us on 1 January, like turning a light switch off, but think about how lucky we are and ... cruise. Smell the flowers.

It says a lot about Kiwis that we more often than not know what is the right thing to do and we just get on with it and do it. It's in our DNA, I reckon. This is what we have to do to make things work best for us; let's all do it and keep doing it until we have knocked the bastard off.

Hopefully, we will get a summer and holidays this year almost like every other year. There are only a handful of countries that can do this so let's be vigilant and careful with how we behave. Let's stay smart and lucky in the year ahead, because we know that on 1 January our world won't miraculously be any different.

We have so many reasons to be cheerful as the year ends, and if we think and we are careful we will have even more soon.

So, from all the team here at *The Shed*, have a wonderful summer holiday, a happy new year, and let's stay smart, team. 📖

Greg Vincent

Publishing Editor

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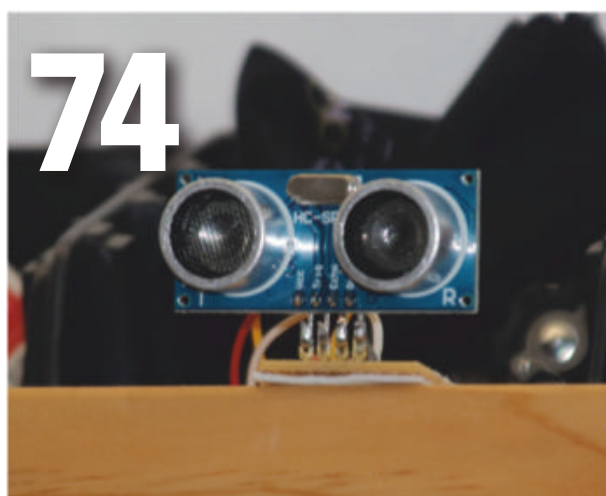
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TWIN-TRIUMPH RECORD CHALLENGER

IN A PLEASANT POINT GARAGE, ONE MAN'S PASSION FOR THE ENGINEERING OF THE PAST COEXISTS WITH HIS ENTHUSIASM FOR THE POSSIBILITIES OFFERED BY THE TECHNOLOGICAL INNOVATIONS OF THE PRESENT

By Ritchie Wilson

Photographs: Brian High and Ritchie Wilson





Packed into Gilbert Bailey's 20th custom-built frame are two Triumph 675 three-cylinder engines, a large turbo, and three computers

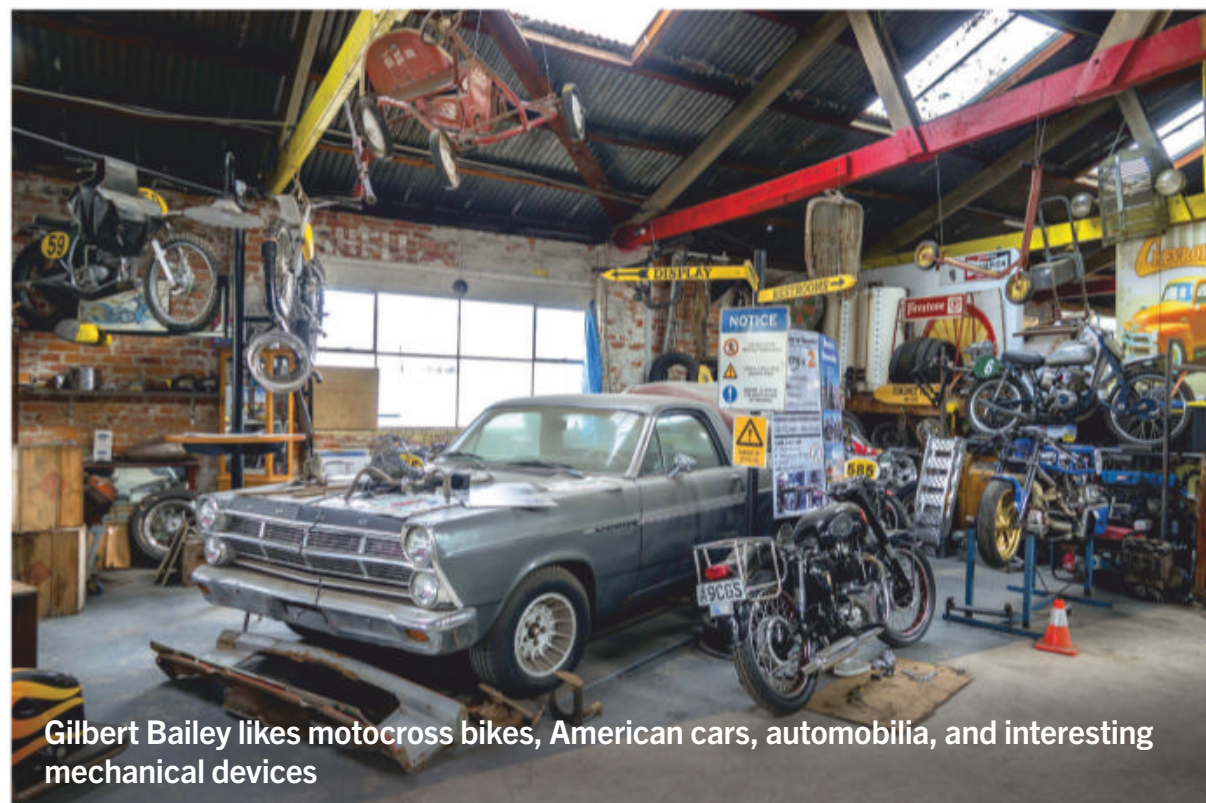
Marine engineer Gilbert Bailey was in the US for the 2015 Speed Week at Bonneville Salt Flats when he saw an advertisement online for Pleasant Point Motors, a garage inland from Timaru in New Zealand's South Island.

Gilbert was familiar with the building from his early motorcycling days as a young apprentice. Until 2001, the business had had petrol bowlers on the side of the road. If it was raining, Gilbert

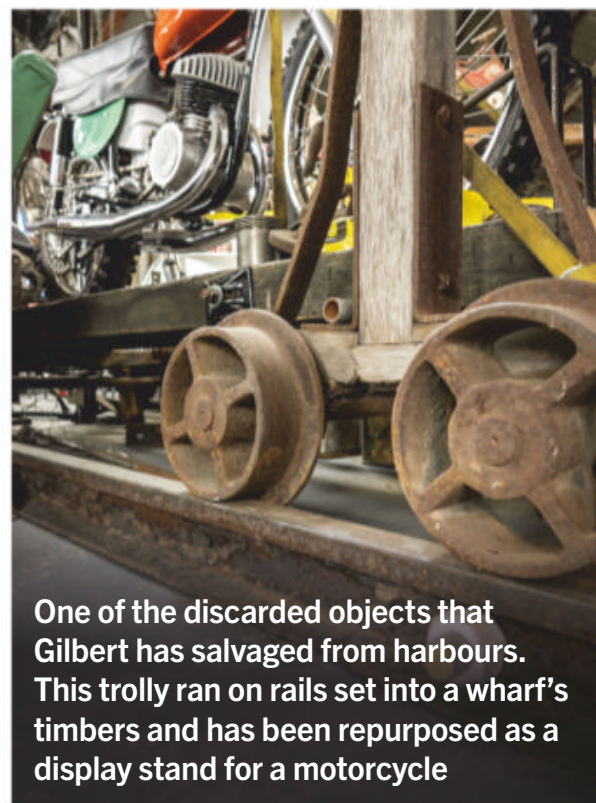
would park his bike on the footpath, under the garage veranda, to fuel up. The proprietor would see this from his office window and erupt onto the street to demand the bike be shifted.

Gilbert decided to buy the building and its contents, both as a place to live and as somewhere to store his cars and motorcycles. Unfortunately, the century-old masonry building had no steel reinforcing so didn't meet current earthquake standards. Its walls are double brick while the pillars

supporting the very long, shallow, timber trusses are triple brick. The lack of earthquake compliance meant that it wasn't possible to secure a mortgage over the building, so Gilbert had to pay cash. More recently, he has bought the vacant plot of land next to the garage. There, he plans to build a heritage-type barn, which will have a two-bedroom apartment as well as a display area for old, working machinery from the garage business and a variety of classic vehicles. ►



Gilbert Bailey likes motocross bikes, American cars, automobilia, and interesting mechanical devices



One of the discarded objects that Gilbert has salvaged from harbours. This trolley ran on rails set into a wharf's timbers and has been repurposed as a display stand for a motorcycle



Gilbert shows the skills developed over decades as he turns a component on the large TOS lathe. These Czechoslovakian machines are very well thought of. The Triumph logo is probably a later addition

50–60 per cent of his clients own older cars or hot rods

Pleasant Point Motors did a lot of motor reconditioning, so had large machine tools such as a British flat-bed lathe driven by a flat belt from overhead shafting, which is itself powered by an electric motor mounted high on the brick wall, a massive TOS Czechoslovakian lathe — interestingly labelled as a ‘Triumph’ — and a smaller Emco one.

Gilbert already owned the large Tom Senior milling machine. There is also an enormous hand-cranked press, which Gilbert plans to convert to hydraulic. However, he finds old machinery so appealing that he is increasingly reluctant to do so.

Currently, Gilbert is at the garage only two weeks out of four. The other two weeks he is employed on the construction of Napier’s new container port as a marine engineer, working on a tug that operates with the project’s dredge. After his many years at sea he is well used to the 12-hour shifts and 84-hour weeks.

Instant ‘my shed’

Pleasant Point Motors was a well-patronised working garage. However, the owners were ready to retire and put the business up for sale. Gilbert decided to keep the business going, with his partner Sharon Venmore overseeing operations when he was away for work.

Gilbert’s plan was to have a small corner in which to work on his own projects, while the garage, renamed ‘Obsolete Iron Motors’, carried on as before. It hasn’t quite worked out like that. Gilbert estimates that 50–60 per cent of his clients own older cars or hot rods. He personally spends much of his time in Pleasant Point working on motorcycles, hot rods, and custom builds.



Gilbert’s large Tom Senior milling machine

Classic car repairs

When *The Shed* visits, a number of clients' cars are being worked on: a 1929 Austin Seven Chummy, a 1935 Morris 10, a 1931 Model A Ford Fordor sedan, and a VW Bug. The 1937 Chevrolet GA Master Deluxe sedan on the hoist is having its 'knee-action' independent front suspension converted to a solid front axle. Gilbert tells us that it's possible to get oversize components from the US to repair some wear in these notoriously short-lived suspension systems, but not the very extensive wear that this knee-action has suffered over the years — the car was undrivable — so a replacement beam axle 'straight' front suspension, from the same year's GB model, is being installed.

Off to one side the unpainted alloy

tub of a replica D-Type Jaguar is being finished, after a delay of 30 years, with a V12 Toyota GZ engine from the Toyota Century limousine (1997–2016) being installed. Gilbert says this is the V12 to have, because it uses the same components as the straight-six Toyota Supra and the parts are plentiful and cheap.

The D-Type is owned by Chris Bromwich, a mechanic who stayed on when Gilbert bought the garage. It was built by Rod Tempero Motor

Body Builder in Oamaru (see *The Shed*, Issue No. 93) in about 1990 but was sold unfinished and passed through a number of hands before Chris bought it. The complicated extractors for the V12 were being formed from tube bends: short sections of curved exhaust tubing. Chris was cutting the bends to size and tacking them together with MIG welds, and Gilbert, a highly experienced welder, would finish off the numerous joins with TIG welding, which makes a neater job. ►

Off to one side the unpainted alloy tub of a replica D-Type Jaguar is being finished

The replica D-Type Jaguar of Chris Bromwich



Any collections?

On all available surfaces, in cabinets, hung from every wall, and dangling from the rafters, are old and interesting objects. Asked about his collections, Gilbert says that he has a lot of stuff but no collections as such — apart from 20 or so 26-inch-wheeled bicycles and a variety of pistons, some as big as rubbish tins. He loves motocross and also has a few motocross bikes.

Working around harbours, he comes across interesting old objects that are being thrown out, such as a long wooden trolley that ran on tracks on a wharf and a very large cast-iron maker's plate from a 1926 Stothert & Pitt crane.

Engineering apprenticeship

Gilbert's family farmed in the Pleasant Point area and he attended Timaru Boys High School as a boarder. He was motivated to pass School Certificate (now NCEA Level 1) in all five subjects — English was compulsory — because this was the requirement to secure an apprenticeship at well-known local company Wallace & Cooper.

Gilbert was officially a fitting and turning apprentice, but in fact worked in a variety of departments in the large engineering company, from fabrication to blacksmithing. He worked in several Timaru businesses after completing his trade training in 1980 before being

Local speed tracks

Oreti Beach, Southland is where New Zealand icon Burt Munro used to test his record-breaking modified Indian streamlined bikes. In 1957 he gained the New Zealand Open Beach record of 131.38mph on this beach. It is also where the equally revered Bill (later Sir William) Hamilton, of jet-boat fame, gained the Australasian Speed Record of 109.09mph in 1928 driving a 1913, 3.3-litre Sunbeam.



Working around harbours, he comes across interesting old objects that are being thrown out



Racing sidecar in the foreground, motocross bike at the back



1931 Model A Ford Fordor dwarfs a 1929 Austin Seven Chummy, although they do have similarities. Herbert Austin was a great admirer of Henry Ford



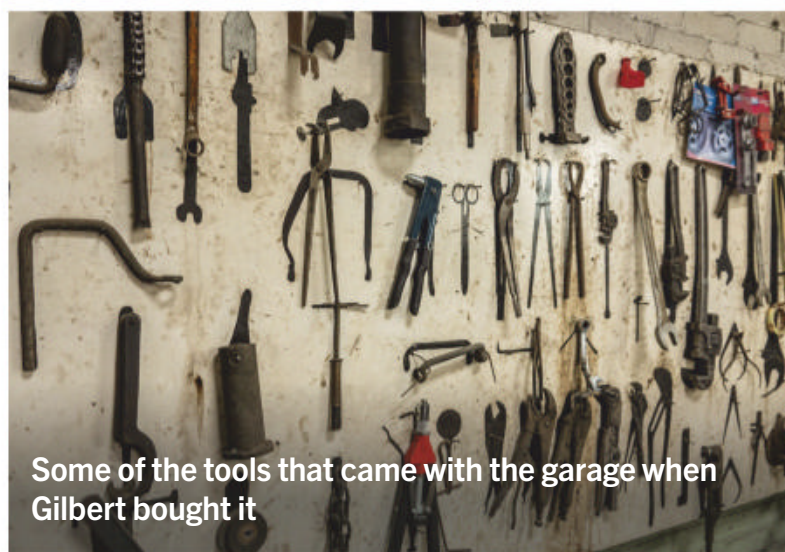
BMW boxer twin, customised with dual headlights



Not a collection, but Gilbert does have an interesting selection of pistons from small to very large



Gilbert selects a lead-screw speed from the Czechoslovakian lathe's attached chart



Some of the tools that came with the garage when Gilbert bought it



Morris Minor van, VW Variant station wagon, and Chevrolet being worked on

employed by Sanford fisheries as a marine engineer on the company's deep-sea trawlers. He spent most of the next 30 years on ships, first as a chief engineer on Sanford's large factory trawlers from 1989 to 2001, then on dredges deepening harbours around the Australian coast for two giant Dutch dredging companies. He first worked for Van Oord Dredging and then Royal Boskalis.

In between, he supervised the refitting of a new but fire-damaged 56.7m motor yacht, which had been purchased by a very well-known New Zealand business man. The engine room, for example, had been completely stripped except for the twin Cat 3512 main engines and two Cat C18 generator sets. Gilbert spent a very enjoyable 18 months ordering and fitting the super-yacht's gear. Cost wasn't a problem. He and the other engineers, — all motorcyclists — even managed to interest the owner in two-wheelers, and the boat now carries Harley-Davidsons, for shoreside excursions, as part of its basic equipment.

A love of the big jobs

Dredging is something for which Gilbert has great enthusiasm. Big jobs using big ships with big gear he finds very appealing. One job, the Gorgon Project, involved building an LNG (liquefied natural gas) terminal on Barrow Island, a Class A nature reserve about halfway up Australia's



The port of Timaru's new tug, *Hinewai*



Electricity-powered tug

Tugs

Gilbert Bailey was sent to China for the commissioning and sea trials of Timaru's new diesel-powered tug, the 24m *Hinewai*. While talking about fossil-fuelled vessels, he points out that Ports of Auckland has ordered the world's first battery-powered tug and that the Port of Antwerp is getting a 'hydro tug'.

The Belgian vessel will have a diesel-type internal-combustion engine that runs on a mixture of hydrogen gas and liquid diesel. Gilbert explains that the hydrogen gas is mixed with the air the engine takes in. The gas mixture heats up on the engine's compression stroke and, just before the top of the piston's travel, a very small amount of diesel is injected into the cylinder. The diesel burns in the hot, compressed gases and initiates the burning of the hydrogen, which provides the majority of the energy.

The combination of hydrogen with such a small amount of diesel creates very low pollution because the only product of the hydrogen burning is water vapour.

The Auckland tug's battery will last for three or four hours and then require a two-hour fast charge. It has emergency onboard diesel-powered generators. Also incorporated in the Auckland, Timaru, and new Lyttleton tugs are large diesel storage tanks, much larger than the tug would usually require. The idea, part of the national Alpine Fault Magnitude 8 earthquake response plan, is that the vessels would act as floating fuel bowzers, refuelling essential vehicles such as ambulances, in the event that normal fuel stocks were inaccessible. Apparently, after the 2016 Kaikoura earthquake, Wellington's access to diesel was restricted due to damage at the wharves. Should New Zealand's Alpine Fault, which runs along the South Island's Southern Alps, move significantly, the resulting earthquake, which is predicted to be as large as magnitude eight, could make fuel hard to come by. The tug's stocks of diesel would then be invaluable.



Model A Ford (left), Gilbert with body part (centre), and Chevrolet GA Master Deluxe being converted to a GB Master (right)

west coast. This was reportedly Australia's largest resource project, with a total cost estimated by the media as an incredible A\$55 billion.

One 'smaller' dredge on which Gilbert worked was 238m long and had two 15,000kW engines and a capacity of 37,000m³ of spoil.

An aspect of being a marine engineer is variety. The engineers are employed for the duration of a particular project, usually about 18 months, and then they are off to another ship, another job, with perhaps a completely different group of fellow crew members, certainly in another location, perhaps

in a very different part of the world.

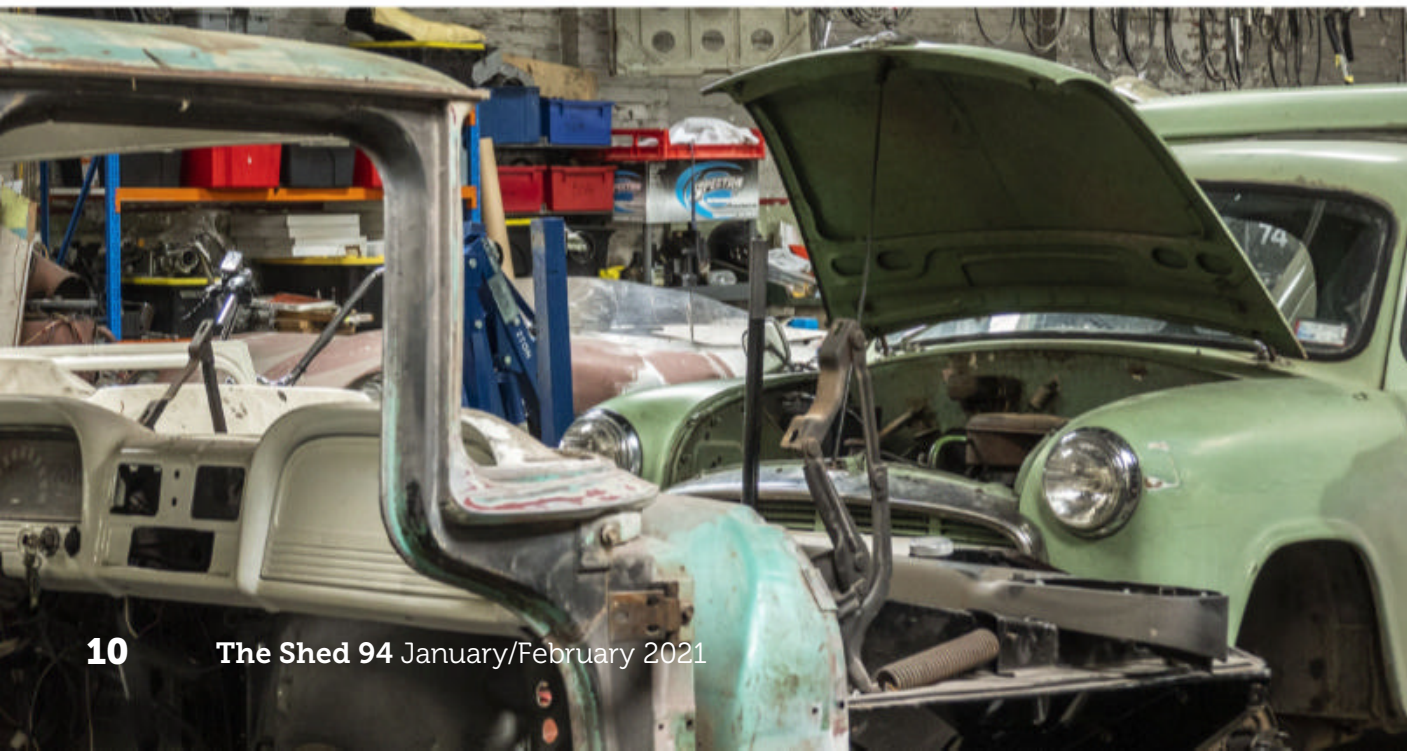
When we suggest to Gilbert that he has done very well in his profession, he replies that he knows a large number of contemporaries who have completed trade training in New Zealand and gone on, like him, to senior technical positions in many countries. He says

In the 1970s most young men in provincial towns would have been interested in motorcycles

that in his experience Kiwi experts are highly valued, especially in Australia, because of their can-do, number-eight-wire approach of getting a task done with the minimum of resources. Gilbert does concede that he has been offered great opportunities and has taken full advantage of them.

Obsolete Iron is born

In the 1970s most young men in provincial towns would have been interested in motorcycles, and Gilbert was no exception, but his employment in engineering meant that he could make and repair parts for the bikes — "helping people out". He says that, for some makes, the availability of parts is very much better today than it was when the machines were only a few years old. He started making handlebar risers and ►



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handlebars for British bikes and then custom frames for Triumphs and Harley-Davidsons. He started trading under the 'Obsolete Iron' name about 20 years ago, making and selling parts for engine and suspension swaps for hot rods and swing arms for two-wheelers, usually as part of a specific project, enjoying the challenge of problem-solving.

Hot rods have been a large part of Gilbert's life — he has a 1933 Ford coupe with a supercharged side-valve V8 — but motorcycles are his passion. He owns three BSAs, including a B50SS 585cc flat-tracker, a 1940 Harley-Davidson 1200cc flathead, a 1968 FLH, a Husqvarna, a couple of Greeves motocross bikes, a 1980s Battletruck road-racing sidecar, and a twin-engined land speed record challenger.

One turbo, two engines, three computers

You can't attempt to break a world land speed record just anywhere.

Official observers need to be present, the gradient of the surface must be less than one per cent, the wind speed can't be too great, the surface should be as smooth as possible, and it helps if there aren't fences, trees, or other obstructions nearby. Most difficult of all, official permission for a record attempt must be granted. It's easy to see the attraction of the dry-lake salt flats at Bonneville, Utah, in the US, just over the Nevada state line.

In the winter, springs flood the salt flats with brine. As temperatures

increase the brine's water evaporates, depositing sulphates and (mainly) chlorides of calcium, magnesium, potassium, and (overwhelmingly) sodium in a smooth, flat expanse.

In the summer, if there hasn't been unseasonable rain, the salt flats will be hard, level, and obstruction-free. Official and sophisticated timing gear is present, manned by the 82-year-old Southern California Timing Association (SCTA). There are a couple of drawbacks. The flats are nearly 1300m above sea level, so the air is thinner than at sea level, and the salt surface can be as slick as polished marble, so traction is poor.

The land speed challenge Triumph

Gilbert Bailey took these factors into consideration when he was designing his land speed record challenger. He was aiming to better an existing record speed of 356.425kph.

To maximise traction, he used two engines, not only to have access to

You can't attempt to break a world land speed record just anywhere



Man and machine. The exhaust is the short chrome pipe pointing towards Gilbert in the middle of the picture. The front brake will have to be removed when the bike next runs at Bonneville



A tandem, probably home-made (top left) and a Raleigh 20 commuter bicycle (top right). Signs and posters decorate the garage's walls



1937 Chevrolet Master Deluxe sedan having its front suspension replaced



Gilbert works on classic cars, hot rods, and motorcycles one fortnight, as a marine engineer on a tug the next



The new building will have a display of old-school bicycles, so Gilbert's friends have been donating examples

twice the power but to also have more weight, and hence more grip, because of increased friction between the salt and the tyres. To compensate for the thinner atmosphere, he used a large, fast-spinning turbocharger, feeding both engines, to pump in the maximum amount of air. The turbo-lag associated with large turbos isn't a concern at Bonneville because there is plenty of time to get the turbo up to high revolutions before entering the timed section of the course. The thinner, less resistive air means that the turbo spins faster than at sea level, so the turbine had to be handmade by Christchurch company Turbo Care; a stock turbine would not endure the centrifugal forces produced by the higher than normal revs. The compression of the incoming air by the turbo heats it up, causing it to expand and so reducing the mass of air delivered to the engine in any given time.

To counteract this, an intercooler is fitted between the turbo and the two engines. Intercoolers usually use the cool air from outside a vehicle to cool the air exiting the turbo or supercharger. At Bonneville in summer, cool air is rare. Gilbert's bike carries compressed carbon dioxide (CO₂) gas, which cools as it expands on leaving its storage cylinder. This cool gas is used in the air-over-air intercooler — a heat exchanger in which heat



Gilbert started work on the twin-engine Triumph immediately on return from a record attempt in Australia

The salt surface can be as slick as polished marble, so traction is poor

from the compressed air leaving the turbo is transferred to the colder CO₂. Gilbert did suggest to the Bonneville authorities that he use nitrous oxide, which has lighter storage bottles, instead of CO₂, but the proposal was rejected because of safety concerns. Some Bonneville vehicles use air-over-liquid intercoolers, in which evaporating liquid cools the air feeding the engine.

Cleverly packed frame

The two 2011 Triumph 675 Daytona engines, radiator, fuel tank, a large turbo with air filter and exhaust, intercooler and CO₂ bottle, three computers, wires, and pipes are intricately packed into the frame that Gilbert fabricated from chromoly tubing. This is loosely based on a Ducati 'trellis' frame — he thinks this is about the 20th frame he has constructed. ►



Gilbert says that he has a lot of stuff. More than even the cavernous Obsolete Iron Motors building can easily accommodate. He intends to display his several motocross bikes on a mezzanine floor in his planned building next door

Maximum speed is majorly affected by the bike’s cross-sectional area, so it was crucial that this was reduced to the absolute minimum by careful planning. The front forks are from Gilbert’s Aprilia road bike. Gilbert speaks very highly of Link Engine Management, which provided the engine management computers (ECUs). It can access and optimise the computing packages remotely — the company is in Christchurch, the bike in, say, Utah.

The 675 engine was designed for the Triumph Daytona model that was released in 2005. The 675cc, in-line three-cylinder, water-cooled engine is a fuel-injected 12-valve double-overhead camshaft (DOHC) design with a bore of 74mm and a stroke of 52.3mm. It produces 128bhp. A rev limit of 12,000rpm is specified for the 675 engine, but Gilbert was told by a Triumph technician that the unit was good for 14,000 — but not for 14,001.

The Triumph engines were chosen for their compact design — giving the desired low frontal area — good power, and availability. Gilbert says that there has not been much technical support from Triumph. “But, to be fair,” he says, “not many people build a project bike like mine; it was easier to switch to Link ECUs and start afresh.”

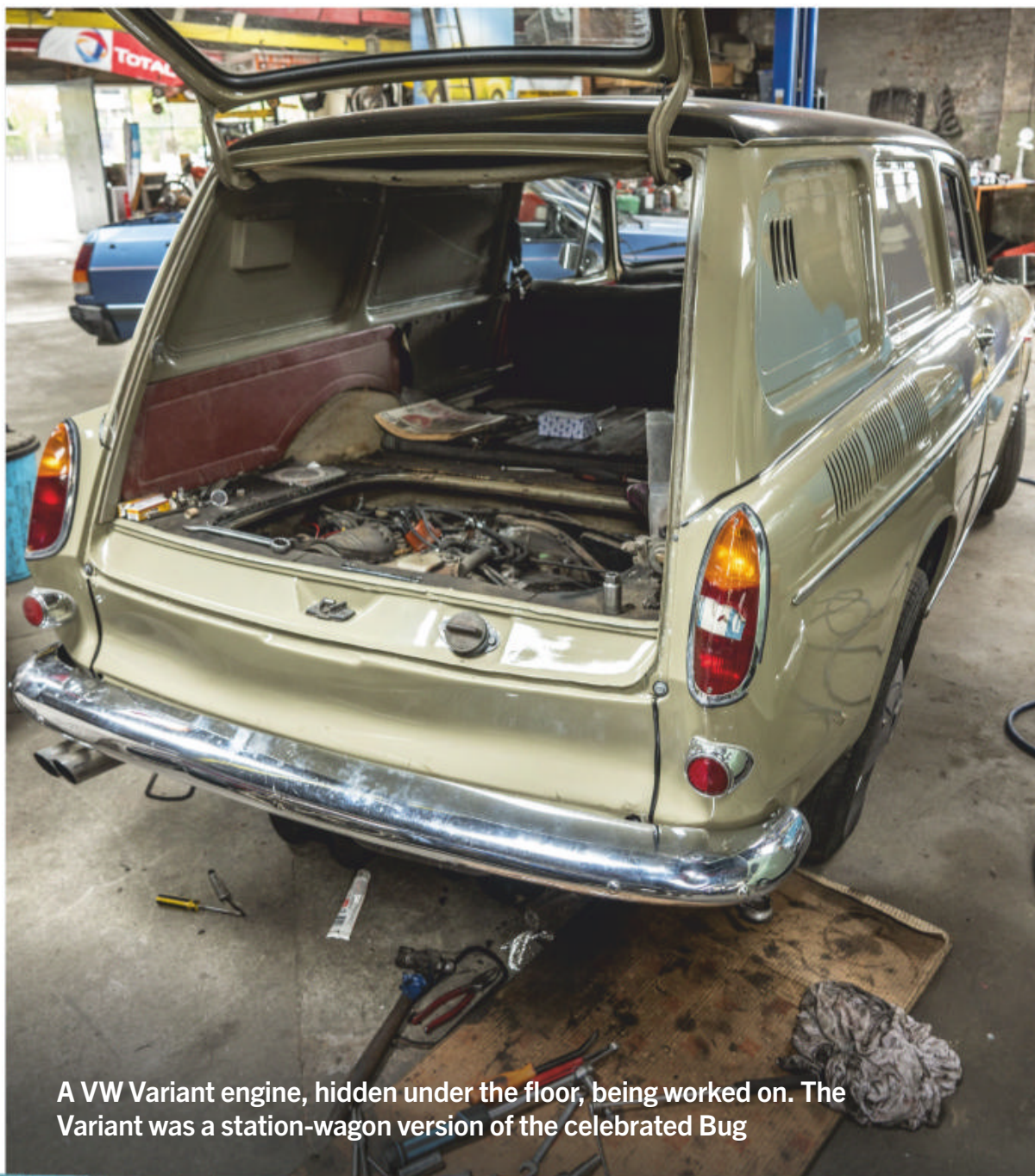
The rubber

Tyres for record attempts are especially problematic. The rapid rotation of the tyre at speeds in excess of 200mph puts great strain on the tyre’s construction.

Secret location

Christchurch’s Phil Barrett and his team constructed a three-wheeler that gained an international speed record on a road in South Canterbury. Phil was able to arrange this temporary road closure because of his links to, and good relations with, the local community. Phil told *The Shed* that, with Bonneville being inaccessible, he plans to make another attempt at a land speed record on a different road in the same general area in April 2021. Gilbert Bailey has been invited to participate.

VENUE	LOCATION	SURFACE	DISADVANTAGES	ADMINISTERED BY
Bonneville Salt Flats	Utah, US	Salt	Elevation (1291m), closed if wet	SCTA
Lake Gairdner National Park	South Australia, Australia	Salt	Extreme heat, access, lack of accommodation, closed if wet	Dry Lakes Racers Australia
Oreti Beach	Southland, NZ	Sand	Soft surface, weather	Southland Motorcycle Club
Tram Road	Canterbury, NZ	Tar-seal	Narrow road; trees, etc.; permission	
Secret location	South Canterbury, NZ	Tar-seal	Narrow road, fences, etc.	Phil Garrett



A VW Variant engine, hidden under the floor, being worked on. The Variant was a station-wagon version of the celebrated Bug

Gilbert was told by a Triumph technician that the unit was good for 14,000 — but not for 14,001

A tyre failure at high speed is too awful to contemplate. The front tyres are replaced and destroyed after each maximum speed run. Four runs will eat up \$800' worth of tyres. The rear tyre, a Goodyear Eagle car tyre, is more resilient and isn't changed so often. On the other hand, it cost \$1K.

The two Triumph engines each has a cable-operated clutch connected by an enclosed chain and is connected by an open chain to the unsprung rear wheel. Gilbert says that the drive system is quite simple: the engines are offset, the front engine's final-drive chain runs back to the rear engine's extended final-drive sprocket shaft, whose end is supported by an outrigger bearing. A second sprocket on the extended shaft takes the drive back to the small sprocket on the rear wheel.

Land speed record class

The bike is shipped to the US in a specially made box that contains the bike, parts, tyres, tools, and the essential gazebo. It can get scorchingly hot on the salt flats on a sunny day.

The bike runs in the A-BG 1350 class at Bonneville, for non-streamlined motorcycles.

'A' for special construction — not stock

'B' for blown — forced induction, turbocharged or supercharged

'G' for gasoline powered — petrol fuelled

'1350' for the 1350cc engine combustion-chamber capacity.

Engine capacity is taken very seriously and record breakers' engine capacities are routinely verified. ►

Worse things happen at sea

Gilbert wasn't completely surprised at the recent loss of the live cattle export ship *Gulf Livestock 1* in Typhoon Maysak off the coast of Japan with the loss of almost all of the ship's company, including New Zealand and Australian crew members and all of the 6000 dairy cows. He says that some combinations of ship and weather are very dangerous.

The dredges he has mainly worked on aren't designed for, and don't often make, long ocean passages. When they do, they wait for a forecast of an extended period of mild weather. Sometimes things don't go as planned. One time he was second engineer on a cutter dredge that was caught in a severe storm in the Indian Ocean. When the bad weather hit, the plan was to attempt to seek shelter in the lee of the island of Mozambique. The wind was so strong that it blew the waves flat, but there was a powerful storm-swell racking the vessel.

Dredges have a large channel in the bow that the cutter suction-head is lowered through and the violent movement caused the two sides of the channel to start to move independently. Metal bent; welds cracked; the crew became somewhat concerned. But as quickly as it appeared, the tempest gave way to calm, pleasant weather and all was well.

However, it brought home to Gilbert that if the weather is bad enough, some types of ship won't survive.

Gulf Livestock 1



The dredge currently operating at the port of Napier





Obsolete Iron Motors' shop hack, a 1959 Chevrolet Task Force Apache 31 pickup



Gilbert turns the cross-slide handle to take a fine cut on the Czechoslovakian lathe



Gilbert making an adjustment to the controls of the twin-engine Triumph. The turbocharger and air cleaner are mounted low down in front of the two engines. Note the size of the intake and exhaust pipes

Gilbert's land speed record venues

Lake Gairdner, South Australia

Gilbert first planned to go to the South Australian dry lake in 2012 as engineer for Steve and Teena Williams' big block Chev V8-powered 1934 Plymouth coupe. He also shipped his 585cc BSA single-cylinder bike to Australia, but the speed trials were cancelled due to flooding. The following year the same team returned, the salt was in great shape, and the Plymouth achieved a speed of 201mph over the timed section and set a new record. Gilbert was impressed with the efficient running of the venue. The BSA's ignition failed at the two-mile mark while travelling at 96mph.

Gilbert began building the twin-engine bike immediately on returning home.

Bonneville, Utah

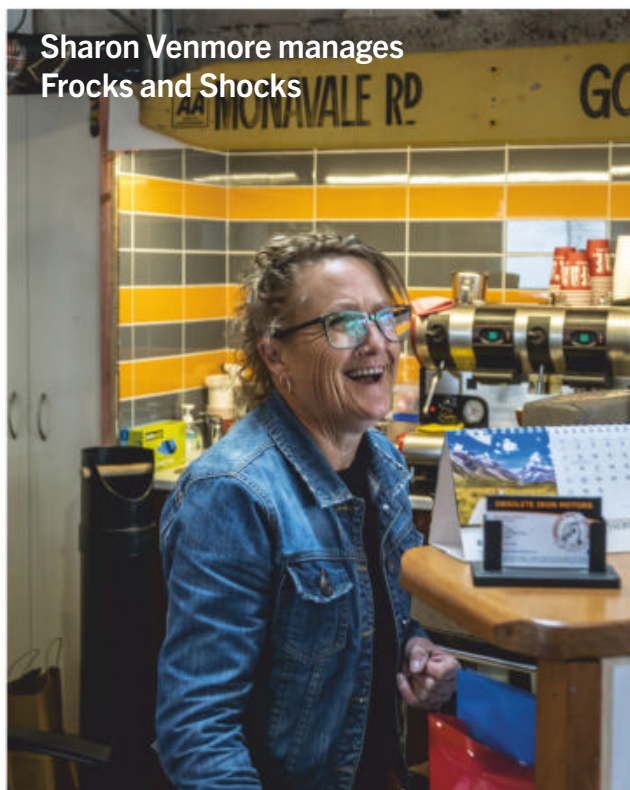
Gilbert shipped the twin-engine bike to the US in 2015. After he had received permission to import the bike from the US Environmental Protection Agency (EPA), arranged shipping, paid for a carnet — a refundable bond designed to ensure that a vehicle temporarily imported into a country, without paying any duty, actually leaves — and booked accommodation at Wendover, the nearest town, Speed Week was cancelled — again due to flooding. He did get to run the bike on the salt, participating in the Mojave Mile, which is held at the Mojave Air and Space Port.

Return to Bonneville

Gilbert planned to return to Bonneville this year, but Covid-19 thwarted his plans. Conditions were perfect apparently, and many records were set.

The SCTA has strict safety rules. For instance, motorcycles are only allowed a rear brake. Experience has shown that when things go bad at speed, the tendency is to harshly apply all available brakes. This often makes matters a lot worse. Gilbert had to ensure that the racing leathers worn for record attempts met the required standard. He gets the leathers made in Auckland and the young woman who makes them told him that she has a number of other New Zealand customers, who have the 'salt fever' and run at Bonneville. ►

Sharon Venmore manages Frocks and Shocks



Frocks and Shocks and old towns

Gilbert's partner, Sharon, not only looks after the running of Obsolete Iron Motors but also has her own store, Frocks and Shocks, which sells retro-style giftware and barista-made coffee. The town of Pleasant Point is home to about 1400 residents and is on the tourist trail between Timaru and the Mackenzie Country, the road following the old Fairlie railway branch line, which operated between 1884 and 1968.

The complete absence of overseas tourists has had an effect and the early 20th-century restrained classical revival-styled Nelligan's Railway Hotel in the main street has, apparently temporarily, closed. The brick 1928 Italianate Town Hall is closed because of earthquake concerns. The vintage railway and museum, just across the highway from Gilbert's garage, as featured in Issue No. 92 of *The Shed*, has regular steaming days and this attracts crowds of visitors. Obsolete Iron has hosted many car and bike clubs, which come to check out the vehicles and memorabilia.

Memorabilia and boxed model cars on display at Frocks and Shocks, located in the old worker's smoko room. There was no hot water when Gilbert bought the building



The eclectically decorated coffee and food area at Frocks and Shocks. The main street of Pleasant Point is just visible through the window on the right



Gilbert's entertainment area in the front of Obsolete Iron Motors. The tanks for the petrol bowlers used to be under the floor



The garage's Chevrolet pickup flanked by customer's car

The combination of innovative and retro engineering is precisely what Gilbert Bailey is about

Gilbert has been working hard to establish Obsolete Iron Motors and says that he is ready to return to Bonneville when that becomes possible, perhaps sharing a container with another New Zealand team.

Apt choice

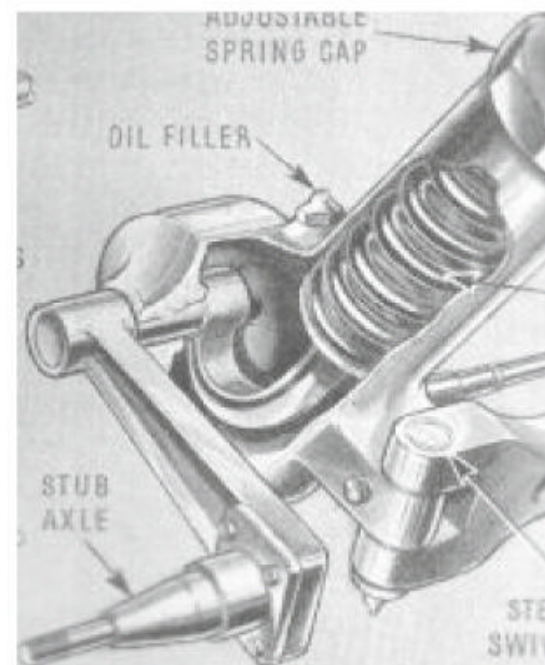
Before he bought Pleasant Point Motors, Gilbert had been looking for some time at other large, historic buildings in South Island rural towns. Pleasant Point seems the ideal choice,

with its attractive buildings and vintage railway. It is also where local farmer Richard Pearse may have been the first person in the world to fly in a heavier-than-air craft, nine months before the Wright brothers.

This mirrors Gilbert's interest in old engineering in general, and old cars and bikes in particular, and his involvement in salt flat racers with their cutting-edge technology. The combination of innovative and retro engineering is precisely what Gilbert Bailey is about. 📄



Tastefully lowered 1933 Ford five-window supercharged coupe outside Obsolete Iron Motors in Pleasant Point



Knee-action front suspension

Independent front suspension (IFS) is now fitted to all motor cars, but in the 1930s it was a rarity. Most cars had a solid axle connecting the front wheels. This could be a problem in that, if one front wheel hit a bump, the other front wheel would also be disturbed, leading to a bumpy ride and perhaps loss of control.

In 1933 André Dubonnet invented the knee-action IFS, which used trailing arms, pivoting on needle-roller bearings, restrained by springs in oil-filled cylinders, to attach the front wheels. The system was adopted by various manufacturers, including Alfa Romeo for its successful P3 Tipo B Grand Prix racers.

In the mid 1930s, America's General Motors (GM) adopted an IFS policy for its passenger cars, but apparently didn't have the production capacity to make sufficient numbers of the large coil springs that are needed for most types of IFS. The knee-action's smaller coil springs were available in large enough numbers, so the Dubonnet design was used in some of GM's Chevrolet cars between 1934 and 1938. It was also used on other GM brands, including Pontiac, Opel, and Vauxhall.

The knee-action reduced friction in the hard-working needle-roller bearings by being filled with lubricating oil. If the oil seals failed and the oil leaked away, bearing wear was rapid, as was the deterioration in handling. Repair was difficult and often short-lived.



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MOVING HEAVEN AND EARTH IN WANAKA

IN 2019, 21 YEARS AFTER THE FIRST WARBIRDS OVER WANAKA, A LOCAL TRACTOR ENTHUSIAST CREATED THE EQUIVALENT FOR HEAVY EARTHBOUND MACHINERY. NEXT EASTER'S EVENT LOOKS SET TO BE **EVEN BETTER**

By Ian Parkes



If wheels are more of your thing than wings, then 2021 is the year to go to Wanaka over Easter.

Allan Dippie, local tractor and Caterpillar collector, historic touring car racer, and now Wheels at Wanaka managing director, has claimed the alternate spot, in between the biennial Warbirds over Wanaka event, to host Wheels at Wanaka.

The first massively successful wheeled machinery event was held in 2019 and it's likely that the event currently being planned for Easter 2021 will be even bigger. It was conceived to mark the 60th anniversary of the West Otago Vintage Club but really took off when Upper Clutha contractors Kevin Capel, Robert Duncan, and Allan got involved.

As the organisers understand it, the event's formula is unique. It was partly driven by Central Otago's dry climate, which meant a lot of this old machinery has survived in good condition. However, you'd have to imagine this model would also translate well to

other parts of the world.

When Allan does something, he goes large. He only started collecting tractors a handful of years ago but he has already amassed more than 150. Last year he acquired the Caterpillar tractor and dozer collection built up by members of the Gough family, which, as Gough, Gough & Hamer, acquired the Caterpillar agency in New Zealand in 1932 and ran it until its sale to a Malaysian company last year.

Tractor nirvana

If you can drive a tractor, then get in touch with the organisers because, while Allan is a multi-talented fellow, he can only drive one tractor at a time. He needs a host of tractor-capable drivers to get behind all those wheels for parades and displays. If you are going to be fussy about what you drive, based on your allegiance to Massey Ferguson, International Harvester, or John Deere and the like, best make that known early.

Allan says if it's got wheels — or tracks (although that doesn't fit neatly in the title) — it's likely to be on show at Wheels at Wanaka. Last year more than 15,000 people attended the event at the Three Parks site. Displays are organised into the extensive car, motorcycle, and truck show; a tractor and farm machinery exhibition; the earth-moving display; and a diverse vintage fair and farmers' market with market stalls and trade exhibits. Expect the parade ring in the centre to get a heavy workout over both days.

Cars outnumber everything else but this will undoubtedly be the best place to see the tractors and trucks that shaped this country, especially during the infrastructure boom years of the 1950s to 1970s.

Owners from all over the country have shown a willingness to truck their heavy machinery to Wanaka to take part in the earth-moving displays. That also means their trucks, which are often just as interesting, can also go on



display. It's a highly efficient operation as well as highly entertaining.

Last time, some heavy machinery from Australia was also on display, including a 74-tonner — when it's empty — from an Australian coal mine. Five of them were put up for sale and three buyers from New Zealand bought one each.

"It's a bit of an icon, the biggest scraper ever made. Gotta have one," said owner Paul Clarke from Dunedin.

Shed-based shenanigans

The tractors also have to be moved out of Allan Dippie's massive purpose-built shed to provide space for around 600 guests at the event's awards ceremony, entitled the Shakedown in the Shed. If you attend, this will almost certainly be the biggest

shed-based party you have ever been to.

The shed itself was built in a modular form so it could be extended. Originally, four bays were built but six more have been added. Now that the collection has grown again it's more than possible the shed will be even bigger next time you visit.

The tractor shed will be set up with hundreds of chairs and tables, a bar, food trucks, a stage for the awards, and of course live music.

Entry for the Shakedown in the Shed awards event on Saturday, 3 April 2021 is free to exhibitors and enthusiasts but they must register first to get the appropriate wristband. The shed is at 135 Ballantyne Road, Wanaka.

Visit wheelsatwanaka.co.nz/.



WHO LET THE PIGS OUT?

A REJIGGED TALE FOR LITTLE SHEDDIES IN THE MAKING

By Ian Parkes

- *Pigs in Sheds* by Peter Millett and Shaun Yeo • ISBN: 978-1-98-853844-0
- 24 pages, full colour, paperback • RRP \$19.99 • batemanbooks.co.nz

We tend to take a proprietorial interest in anything shed related, whether we are entitled to or not, so this title grabbed our attention.

Pigs in Sheds is the latest authorial outing for storyteller Peter Millett, who has written more than 50 books over 20 years for readers aged from three to 13, including *Classic Rhymes for Kiwi Kids* and *The Anzac Biscuit Man*. Now he's retelling, in a Kiwi way, the story of the three pigs.

Fed up with being crammed in a

poky sty in Pokeno the pigs decide they want sheds of their own — definitely an authentically Kiwi impulse.

Illustrating this bacon-flavoured fable is *Otago Daily Times* cartoonist and illustrator Shaun Yeo, whose 'Crying kiwi' cartoon mourning the Christchurch mosque shootings captured attention around the world. The pair also collaborated on *The Anzac Biscuit Man*.

Millett has performed *Pigs in Sheds* to audiences for 15 years so it should make a sure-fire stocking filler for future generations of shed enthusiasts.

Win a copy of *Pigs in Sheds* by Peter Millett and Shaun Yeo

We have three copies to give away. The first three entries to tell us what Waikato town the pigs live in will win a copy. Good luck.

Send entries to editor@theshedmag.co.nz with the subject line 'Pigs in Sheds competition'.

WHAT'S HAPPENING ONLINE AT THE-SHED.NZ?

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

How to make a dead-accurate optical punch to provide you with a perfect, vertically punched mark, precisely on the spot



How to maintain your e-bike — give your electric motor an annual service to keep it in top condition



Pleasant Point Railway photo gallery — these unpublished photographs were just too good to leave sitting on our hard drive

Make this elegant table with cabriole legs — something a bit out of the ordinary to challenge your woodworking skills



SPLIT DECISIONS

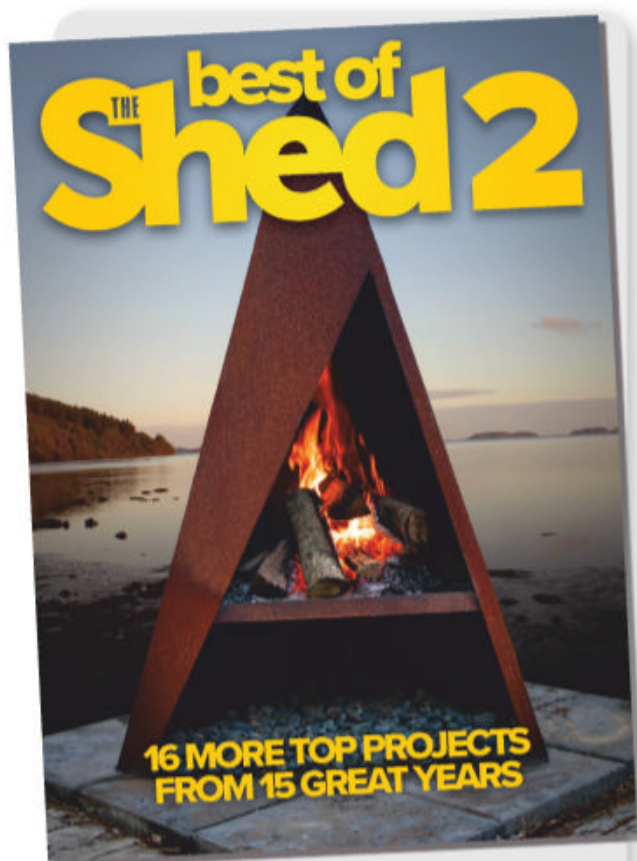
Great article on building a log splitter in your July/August 2020 mag [Issue No. 91]. I've spent many an hour on a similar splitter with few problems.

From my experience there won't be any temperature problems with the oil.

Strange things can happen with splitters, and on my splitter the hoses and operating handle were a bit too close to the action. I'd suggest that anybody building one should keep these well clear of where the wood might go. As well, I think it is important to have a safety interlock valve to ensure the operator's left hand is clear when the ram is operating.

Regards,

Bob McLellan



LETTER OF THE MONTH PRIZE

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

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

Enjoyed last edition's (*The Shed* Issue No. 91) description of building a vertical log splitter.

I hope that in his more recent modifications Bill has included a fence of some sort on the work table. That piece of wood being split in the photo on the front cover of the magazine looks like it could possibly slip under pressure and deal him a nasty blow on a part of his anatomy that would be very painful!!

Ross Farrant

Whangarei

I was reading Issue No. 93 of *The Shed* — the last article from Jude Woodside about the lathe. He mentions that he can't find an English manual for the lathe but has one in Russian.

I recently discovered the wonderful Google Translate phone app, which is free on the app store. You simply point the phone's camera at the text and it displays the English translation on the screen.

Thought this info could unlock the manual for him.

Regards,

Robin Schmid



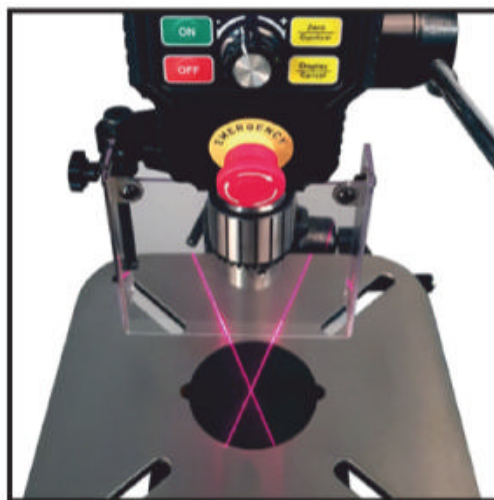
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press demonstration
as featured in
The Shed magazine
Issue 90



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MAKE A CLOCK THAT ROCKS

BUILD A CLOCK THAT EVERYONE WILL WANT TO WATCH

By Dave Montgomery

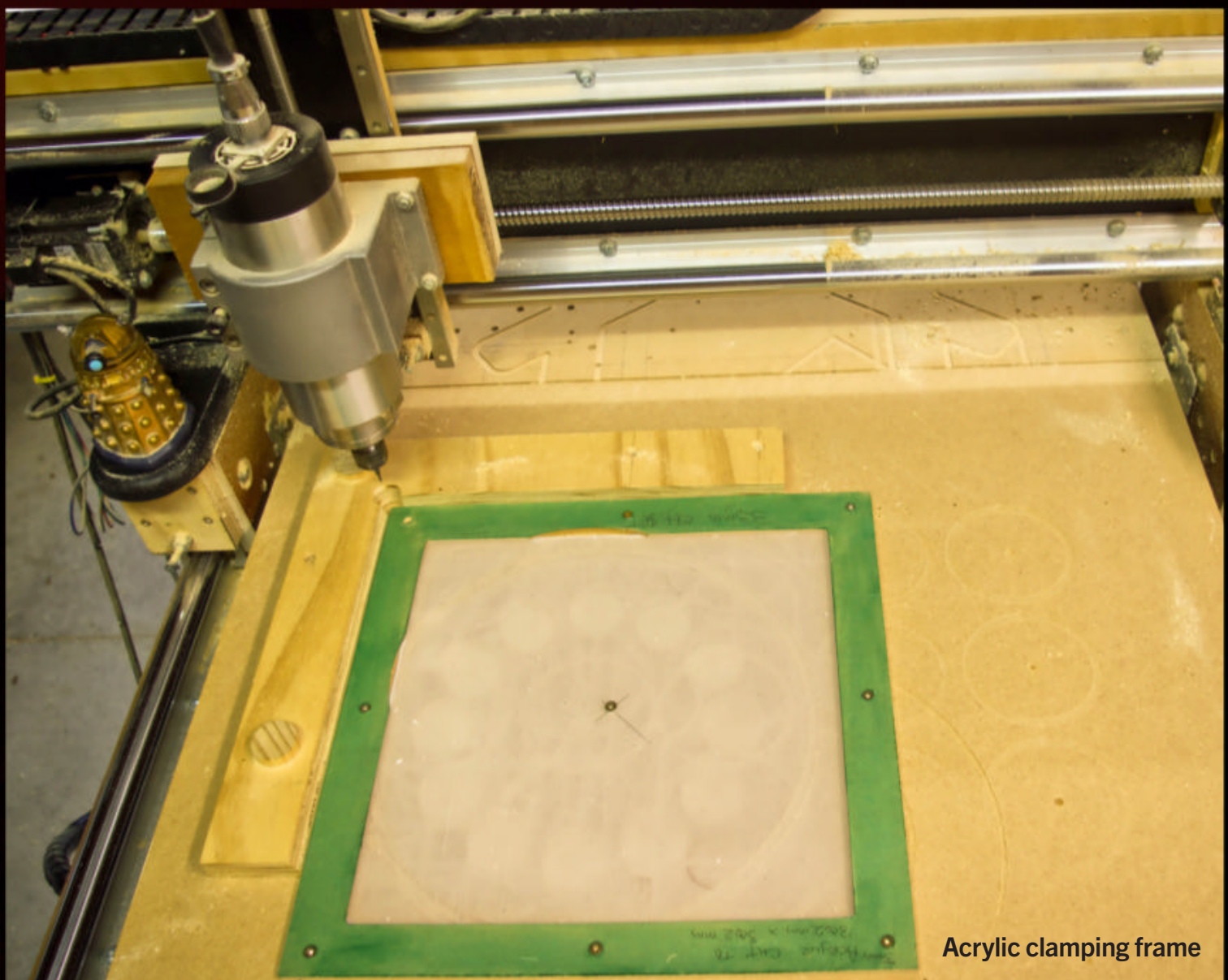
Photographs: Dave Montgomery

Edge-lit acrylic signs have been around for years. These days, most consist of a base containing the light source with a slot in the top. The bottom edge of the etched or engraved acrylic is inserted into the slot. Light then travels through the acrylic and refracts when it encounters the etched or engraved areas.

This type of sign is most effective when placed against a dark background or in a darkened room. Imagine if all the

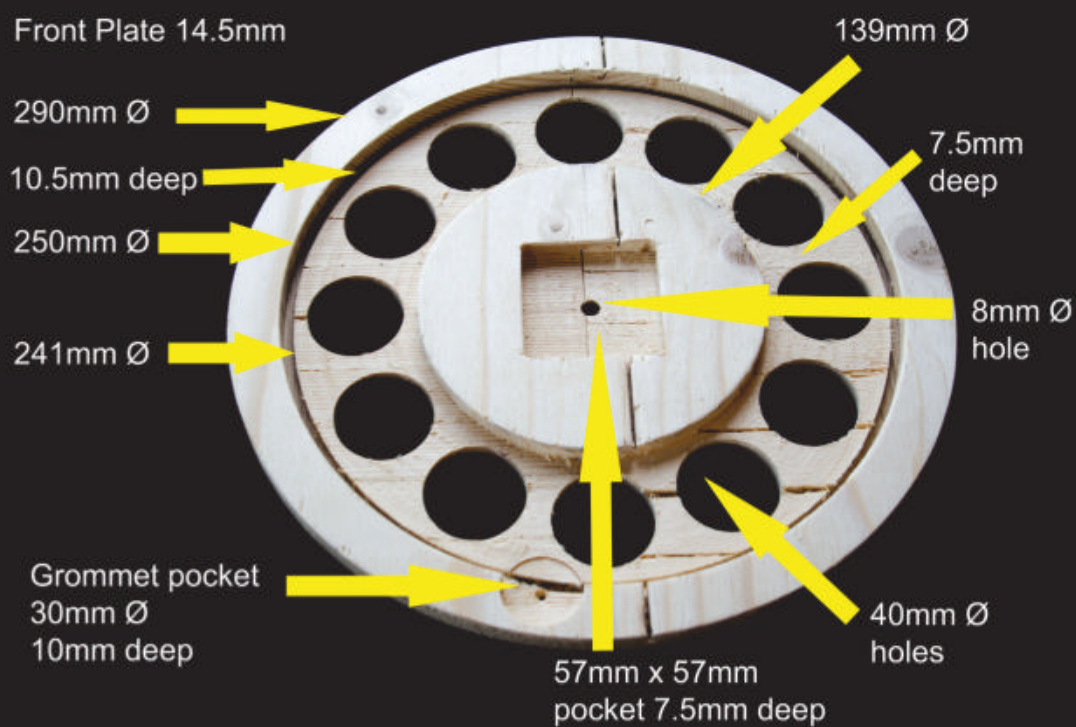
external edges were lit and the acrylic was permanently mounted against a black background.

RGB LED strips are readily available and can be purchased with controllers that vary the colour, brightness, and cross-fade effects. With the LED strip around the entire circumference of the acrylic and against a black painted background, the display is visible in the brightest of rooms. Adding a clock mechanism makes a more useful item to display. ►



Acrylic clamping frame

Left:
Shed o'Clock —
taken using long
exposure with
zoom



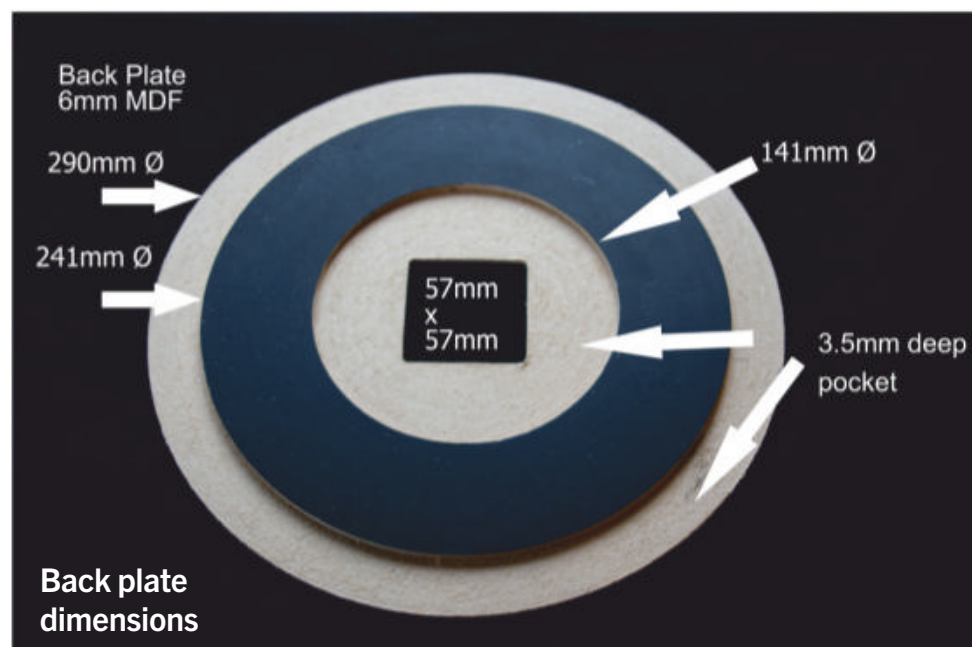
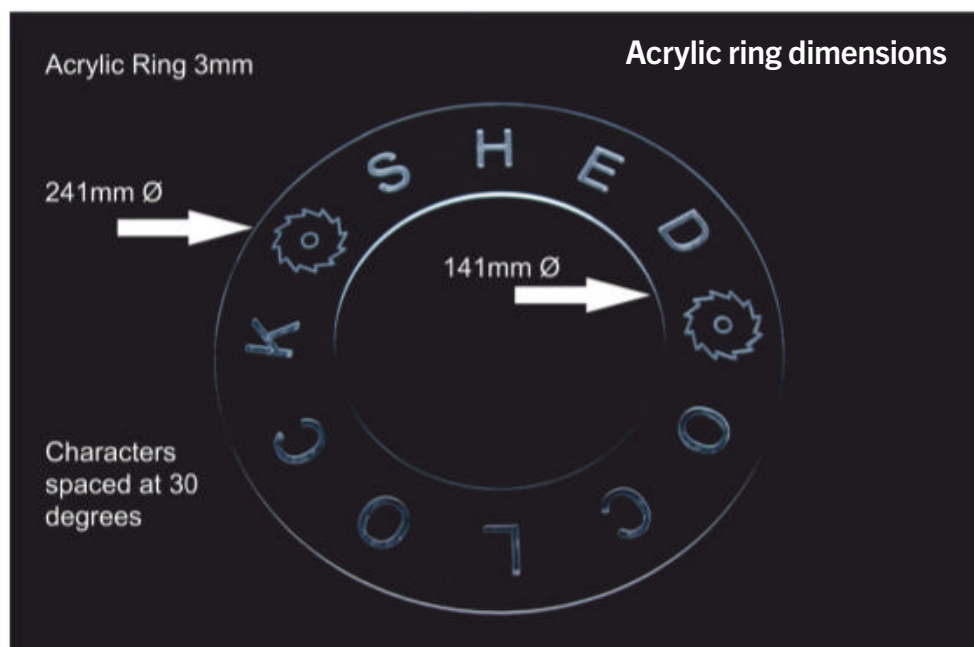
Front plate dimensions

Design considerations

I had decisions to make. I wanted to make several clocks as Christmas presents for friends and family, and decided on a budget of no more than \$30 a clock. As they were to be gifts, I wanted to customise the digits/characters for individuals. I had also invested 18 months of my time in building a CNC mill, so I needed an excuse to use it.

I already had some 14mm thick oak-lined floor panels and a sheet of 6mm MDF. I purchased a sheet of 3mm clear acrylic; a clock mechanism, complete with hands; and the LED strip with a controller. The total spend at this point was around \$23 per clock. With screws, material for a stand, blackboard paint (I used a test pot) and the AA battery of the clock mechanism still to get, I was on target with the budget.

I wanted to make several clocks as Christmas presents for friends and family, and decided on a budget of no more than \$30 a clock





Front plate milled

The key

The overall diameter of the clock was determined by the length of the clock hands, the number of flooring planks I was willing to use, and the font size I needed for the numerals/characters to be clearly formed with a 2mm end mill. The answer was a 290mm diameter clock using two floor panels and a 20mm high font.

This design can be modified to suit whatever wood you choose to use for the front and back plates. However, one of these plates must be a minimum of 12mm in thickness to accommodate

the 10mm wide LED strip.

The length of the clock mechanism shaft also comes into play. With my design, the total thickness of the clock came to 17mm. The clock shaft was only 12mm long. I milled a pocket into the front and back plates, so the clock mechanism was flush at the back while allowing the clock shaft to protrude through the front with room for the washer and locking nut.

The key design aspect is to align the centre of the acrylic edge to the lens on the LEDs. I allowed a gap of 2mm between the acrylic and the LED lens. ►

The overall diameter of the clock was determined by the length of the clock hands

After I had mangled my first sheet I made a simple clamping frame to hold down the sheet

Manufacturing the components

Dimensions for the front plate, back plate, and acrylic ring are shown on [page 26](#).

Making the acrylic ring was a bit of a challenge as it was the first time I had used this material. The 3mm acrylic sheet I used is very flexible and is prone to ride up the mill or drill bit. After I had mangled my first sheet, I made a simple clamping frame to hold down the sheet to the CNC spoil board. The

frame was made from 6mm MDF. I fixed another screw in the centre of the acrylic for good measure.

The acrylic comes with a protective film on each side. This is left on until the ring has been completely milled. Engraved numerals or characters do not have to be deep — 0.5mm works well.

Milling the front and back plates was straightforward. I painted the back plate where the acrylic sits with blackboard paint to accentuate the illuminated acrylic.



Clock back showing stand, grommet, button-head screws, and recessed mechanism



Customising

I had fun thinking up different options in place of the standard 1 to 12 numerals to make the clock more personal for the recipient. Examples are:

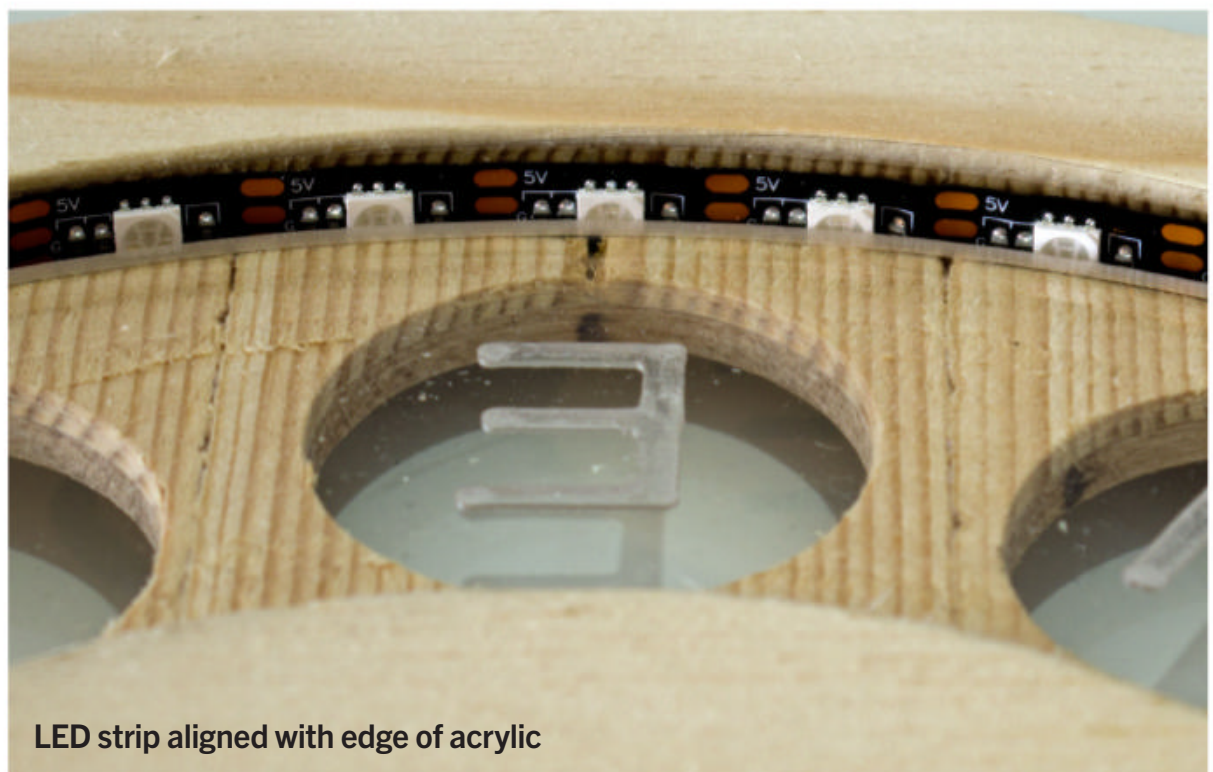
#COFFEE#TIME
EATSLEEPFISH
PINBALL#TIME
##RAVE##CAVE

You get the idea.

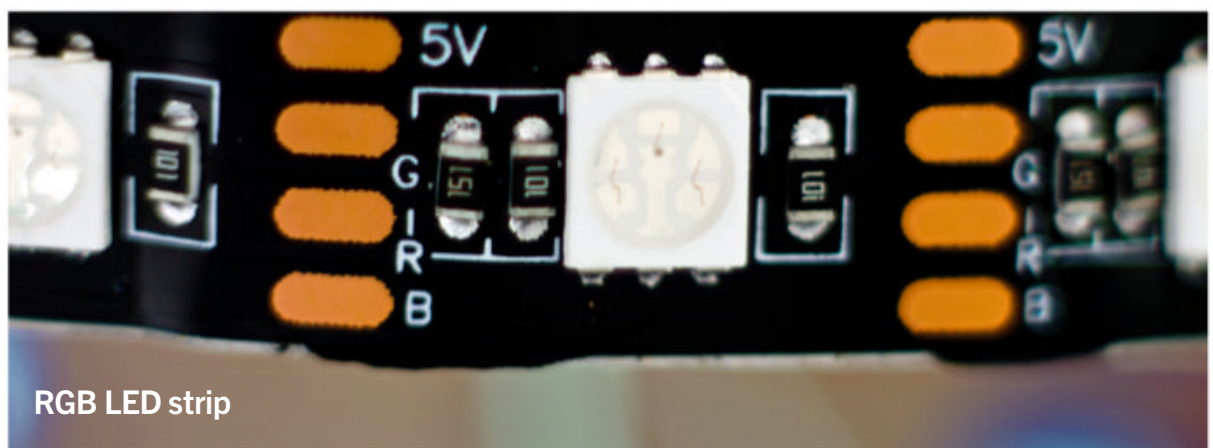
Rave cave clock

Time to make a stand

Hanging the clock on the wall was not an option for me. A dangling cable from the clock to the power source is an eyesore. To keep this clock as eye-candy, I made a stand from some 12mm ply and 20mm dowelling. This keeps the cable hidden when the clock is displayed on a flat surface.



LED strip aligned with edge of acrylic



RGB LED strip

I then hit upon the idea of using thin, flexible plastic to give the strip some stiffness

Assembly

The LED strip comes with a sticky back that is exposed when the backing paper is peeled away. I left this backing paper on for the first few clocks I made as the adhesive would not stick the grainy wood. I then hit upon the idea of using thin, flexible plastic to give the strip some stiffness. This aids in holding it in place during assembly. I got the plastic

from used product packaging and cut it to just under 10mm in width. The LED strip itself is available in 1–5m lengths. My design called for just under a metre. The excess LEDs are trimmed off and I have kept these to use on future projects.

Thread the LED strip through the hole in the back plate and mount into the front plate. Insert the acrylic ring ►



Control choice for LED strip

Controller options

Two types of controller are commonly available for the LED strip: radio frequency (RF) wireless and Bluetooth.

RF wireless controls on/off, colour, brightness, and cross-fade effects. The advantage over Bluetooth is you do not need a Bluetooth device to operate.

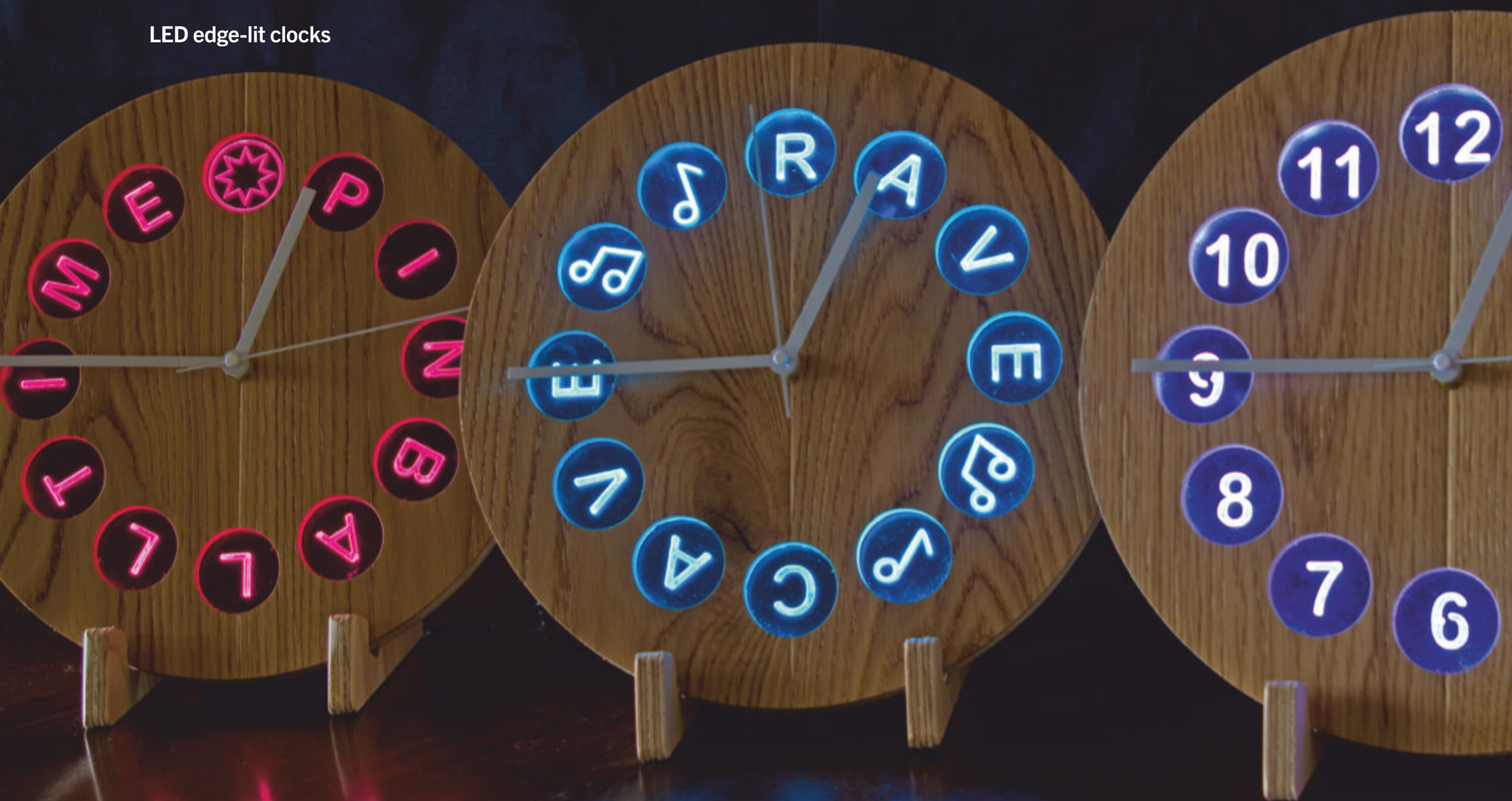
Bluetooth controls the same as RF wireless, plus it can make use of a smartphone's timer and microphone. Use the timer to set on and off time for the LEDs. Use the microphone feature to synchronise the lights on the clock to music.

right way up and align to the front plate holes. Fix the back plate on, ensuring that you don't crush the LED strip if it moves. Install the cable grommet around the feed wires and press into the back plate. Screw the back plate on. I use button-head needle-point screws, commonly used to affix signage, as the MDF is quite thin around the edge.

Insert the clock mechanism and press the clock hands on. Connect your controller to the LED and power source. Insert the battery for the clock, set the time, and you are done. 📱

Insert the battery for the clock, set the time, and you are done

LED edge-lit clocks





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A DAY FOR FIRE AND HAMMERS

THE KOWHAI FORGE

DEEP IN RURAL WAIKATO, THE ANCIENT SKILLS
OF BLACKSMITHING ARE BEING KEPT ALIVE

By Geoff Lewis

Photographs: Trefor Ward Photography





Student group
with Arja and
Rob Pinkney
— left to right:
James Marbeck,
Zac Thorp,
Vicki Dawick,
Jono Zaloumis,
Arja Pinkney,
Rob Pinkney,
Ken Shaw,
Josh Dawick,
Voyta Kucera,
Barbara
Kucerova

It was a sparkling day in the Wharepapa countryside, with views for miles around the hilltop site of the Kowhai Forge.

The Kowhai Forge is a blacksmithing school located in the tumultuous landscape between Kihikihi and Arapuni in south Waikato, where the ancient art of Vulcan himself can be seen on every side. The school is run by Arja and Rob Pinkney and provides tuition in the old, and disappearing, skills of the traditional blacksmith.

Originally from the Hokianga, Rob was apprenticed as a farrier and general smith under master tutor Malcolm Telfar and started work in the equine industry around Matamata. He was then invited to Japan, also to work in the horse industry, and spent 14 years smithing on the northern Japanese island of Hokkaido where, despite Japan's long history in steel, the art of working hot metal by hand was fading. ►

The well-equipped forge

Rob met Arja when he was asked to act as a presenter at a farrier and blacksmithing conference in Holland about 12 years ago. The couple bought a patch of scrubby hilltop from Rob's brother-in-law. An old woolshed was converted into a house and Rob's smithy was erected nearby.

The shed contains a blower-driven forge stoked with the best West Coast coal. Seven anvils are strategically positioned, along with a large gas-fired forge and a wardrobe of handmade tools and hammers essential for grasping and working the hot metal. A hefty power hammer that shakes the whole place and a quenching trough,



Back to the forge

along with equipment for grinding and polishing, round up the roll call of equipment.

Students come from all over New Zealand and even overseas. When *The Shed* visited in September, Ken Shaw and son-in-law Jono Zaloumis were over from Te Karaka near Gisborne — Ken is a farmer and loves hunting. Josh Dawick from Ngāruawāhia was busy making a courtier's sword in French style. Also taking part were Zac and James from Auckland and Vojta Kucera and partner Barb from the Czech Republic.

*The shed
contains
a blower-
driven forge
stoked with
the best
West Coast
coal*

Back to the forge





Student and Te Karaka farmer
Ken Shaw with his knife



Smithing tools



Working the blade

Knife-smithing is a skilled art and Rob's approach is to finish as much of the blade as possible by hand-forging

A variety of courses

Rob tutors a half-day taster course, at which students can make a variety of simpler items, and a full-day programme that covers knife making, the forging of a small axe, door knockers, and garden and fireplace tools.

On a steel-topped table is a display of artefacts — door handles, rings, fire pokers, corkscrews, decorative flowers — all forged in steel.

The early morning teaching session focuses on knife making, which is the most popular subject. Knives come in many styles, depending on their intended use. There are culinary, skinning, filleting, and sticking knives. Knife-smithing is a skilled art and Rob's approach is to finish as much of the blade as possible by hand-forging, with grinding kept to a minimum. Students select the style they want and work from a blank piece of 5160 spring steel between 7 and 10 inches long. A 'golden ratio' is used as a guide to ensure that the knife is properly balanced. ►



Steel blanks



Cut shapes, rivet holes drifted



Colour hardening



Grinding the shape

Making your first knife

The students start on the blade at the coal forge under the guidance of Rob or another staff member and then move to the gas forge to shape the handle. They return to the main forge to punch and drift the holes that will allow a wooden handle to be fitted later. Back to the fire again and the tip of the blade

is ‘bumped up’ — a process that lessens the potential for defects in the point.

The student then takes the work back to the main fire, where the smith holds the ‘top tool’ on the blade while a ‘guest’ thumps it with a sledgehammer to create the distal taper and set the bevel on the cutting edge.

“The blade is refined almost to the

point of a complete working knife; we’re down to less than 1mm in the edge,” Rob explains.

Following morning tea — a yummy selection of country-made goodies — the raw blade is ground, tempered, and polished. Later in the morning, work begins on the next project: making axe heads in the traditional Viking style.



Tempering in the gas forge



Choosing the wood for the handle



Stages of work in knife making

Later in the morning, work begins on the next project: making axe heads in the traditional Viking style



Working socket for handle on steel mandrel

A decent axe

Rob explained that today's commercially made axes — the sort you'd buy in the hardware store — are punched out by big industrial drop presses. Of course, early smiths didn't have this type of equipment; they made everything by hand.

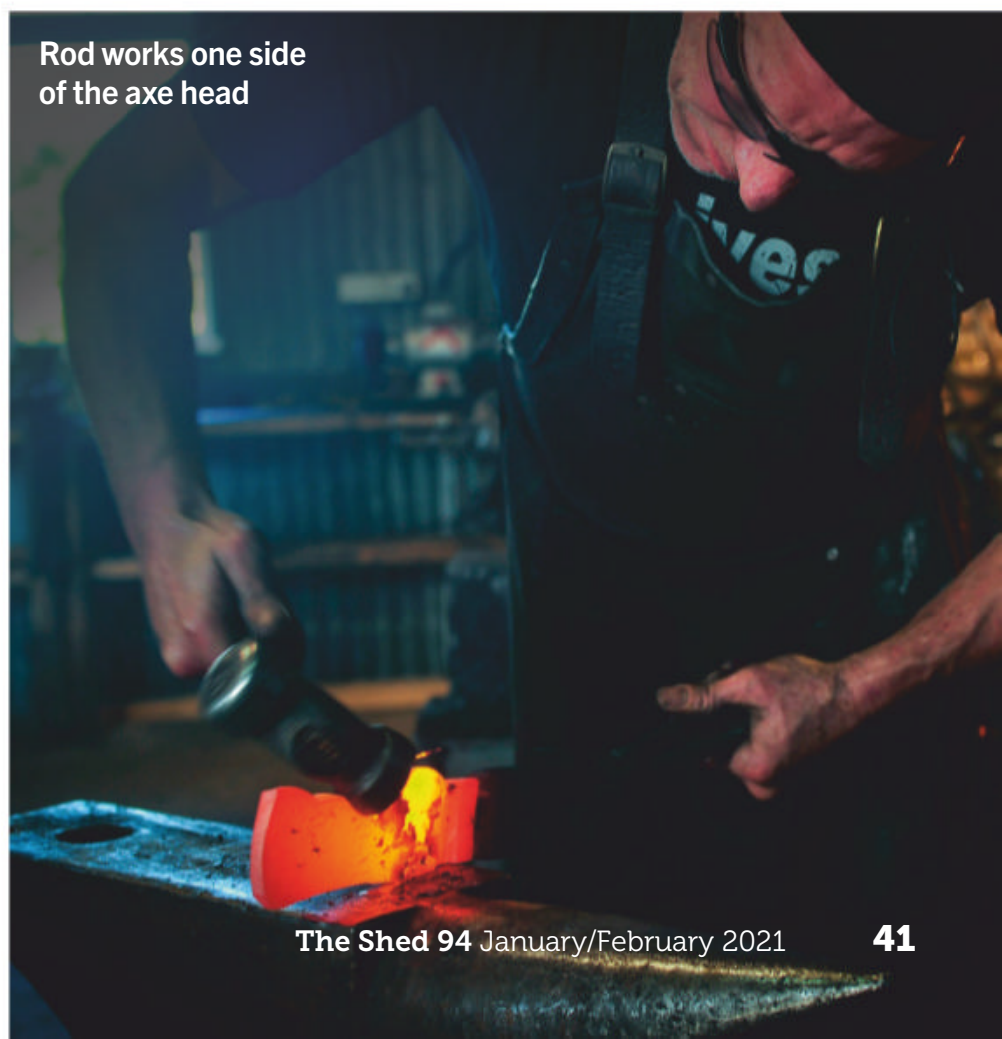
To make an axe head by the old 'folded axe' method, Rob starts with a strap of mild steel, which he heats in the coals until it is red hot. The strap is then formed into two matching halves, which are folded together. A section of spring steel is inserted between the two sides, which are then fire welded together. The glowing metal is worked by hammer around a mandrel to true the 'eye' for the wooden handle. Hardening of the edge is determined by the colour of the metal. ►



Strap steel before folding



The power hammer fire welds the sides of the axe head together



Rod works one side of the axe head



Finished product

For handles Rob uses robina, a variety of hickory, milled by Apperleys Custom Timber in Ōtorohanga and shaped by the members of the Tauranga Men's Shed.

That mystical spirit

Rob provided some of the items used in *Hobbiton* and knives, shovels, picks,



Items on the bench



Morning tea



Rob with hammer



Rob's stylish leather apron

and strongboxes used in the movie series *The Luminaries*, set on the wild West Coast of the 1860s.

There is a spirit involved in smithing, almost a mysticism, Rob believes. Written on one wall of the forge building is a Maori saying, “Kaore te kumara e korero mo tona ake reka” — “a kumara does not say how sweet he is. It's all about humility” — a good smith never brags about his work; to do so is to invite calamity.

“It takes three lifetimes to become a good smith. Every day you try to perfect the craft but you'll never become a master in one lifetime,” Rob says.

On the international front, Rob is keen to get back into the big European traditional smithing competitions, including the Biennale Europea d'Arte Fabbre, which is held in Italy, but would need some sponsorship to do so. 📦

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

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

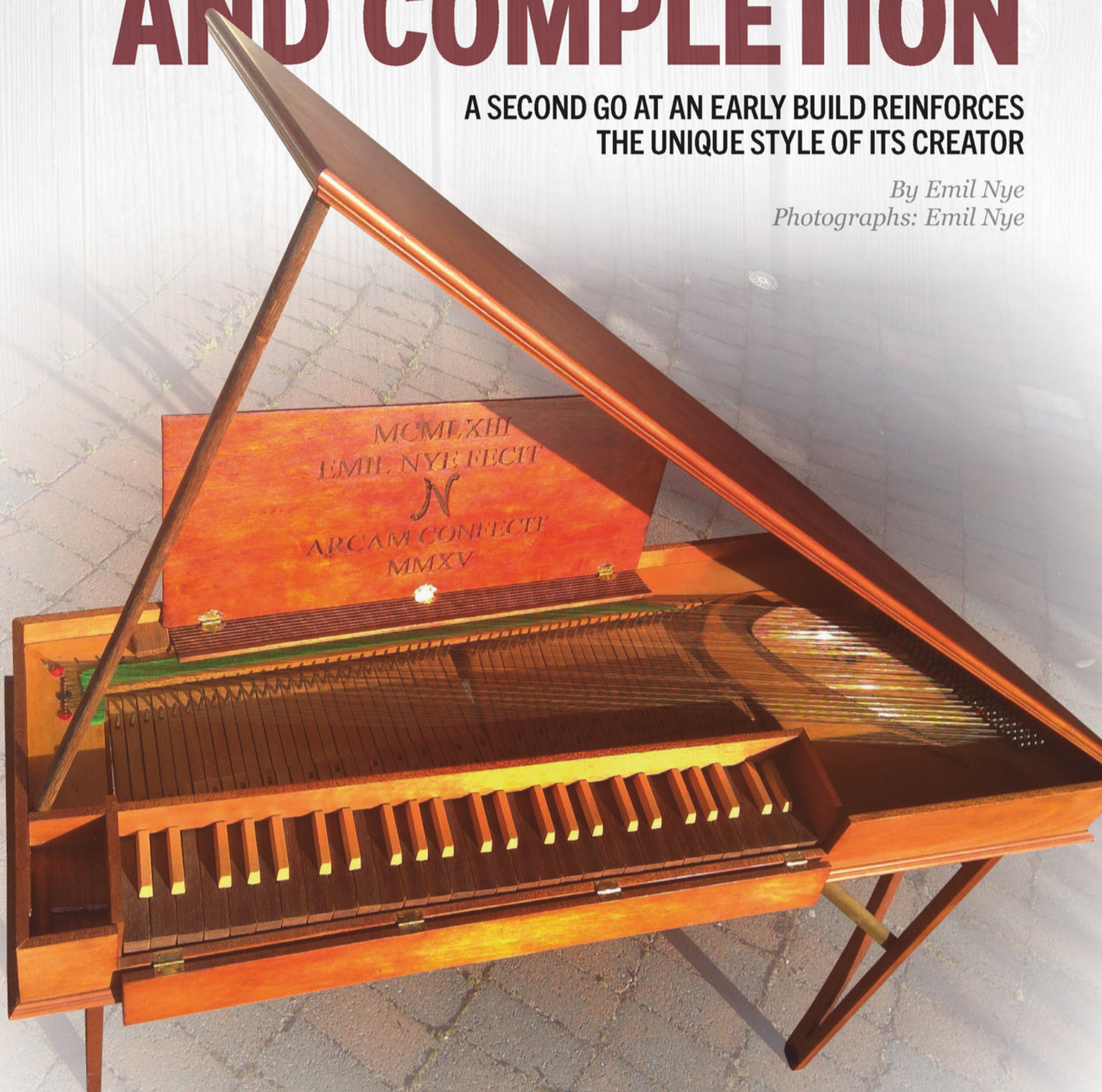
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CLAVICHORD REFURBISHMENT AND COMPLETION

A SECOND GO AT AN EARLY BUILD REINFORCES
THE UNIQUE STYLE OF ITS CREATOR

By Emil Nye
Photographs: Emil Nye



In a previous article in *The Shed* — September/October 2019, Issue 86 — I described the basic clavichord design and the historic construction of this one. **(photo 1)** It was limited at the time of the construction by ‘learning as you go’ — there was no Internet, and getting within a metre of old clavichords was forbidden! The chief disadvantage had been trying to adapt keys from an old piano “which would make a good start”. It didn’t. It made much more work and complication, rather than saving it.

The end result was quite good musically but, rather than spend much effort making a case for it, I thought it would be more worthwhile to put all I

had learned to good use, so I gave the clavichord to my more musical brother and made a second one, starting from scratch. The basics were already designed, and I could avoid most of the previous difficulties — and the overhanging soundboard.

Soon after I so generously gave the clavichord to my brother, he found in an antique shop a Broadwood ‘square piano’, which was quite easily restored and was also a very elegant piece of furniture. Then he inherited the family Steinway grand piano.

Why not do it all again?

My second clavichord was in many

It made much more work and complication, rather than saving it

ways similar to the first but, with experience, easier to make. I was pleased with the result, which incorporated a number of my unique design features from the first. **(photo 2)**

Many years later, when I was visiting my brother in Wales and he was considering moving house, he said, “What should I do with ‘clavi’?”.

“Where is it?” I said.

“It has been in my attic for 30 years,” he replied.

Poor old ‘clavi 1’ was not elegant. **(photo 1)** The frame had warped **(photo 4)** and the soundboard was coming adrift. Surprisingly, the notes still played recognisably. What would/could I do with it? ►



1. The clavichord from my previous article in Issue 86 of *The Shed*



2. My second clavichord incorporates a number of the unique design features from my first rebuild project



4. The frame had warped



4a. I glued on a thicker, stronger piece of hardwood minus curve



7. I managed to slide the soundboard out

Nostalgia struck! Here was a retirement project. On YouTube, I had since seen and heard very old clavichords with odder-shaped soundboards than mine — and I still had the materials and trim for the case.

We screwed lengths of chipboard round the frame, tacked on thin ply panels, and I brought it back as an extra ‘suitcase’. (photo 1)

Restoration begins

The plane of the frame was twisted but the main warping was beneath the keys. (photo 4) The piece I had laminated there was coming unglued — and was too thin. It came off easily. I glued on a thicker, stronger piece of hardwood, clamping it with a slightly negative curve while the glue set, almost

eliminating the curve. (photo 4a)

The next thing was to reattach the soundboard. I thought if I could lift the strings rather than taking them all off, I could slide it out, clean the area, and

refix it — but things are never so simple.

I slid a flat Bowmac bracket beneath the strings, wedged it up front and back just enough to free the strings from the bridge pins, and managed to slide the soundboard out. (photo 7) It had partly sagged, so I reglued the soundbar and added two small ones where the stress had depressed it. (photo 8) I took the opportunity of making more ‘clear air’ under the front of the soundboard by chamfering off more of the frame. (photo 9) After repairing a crack, I French polished the soundboard again — a satisfying job. (photo 10)

I slid the soundboard back beneath the strings and, in gluing it, arranged pressure all around, including the



8. I re-glued the soundbar and added two small ones

9. I made some more 'clear air' room under the front of the soundboard



edge where it was beneath the strings — another interesting exercise.

(photo 11) However, when I removed the elevating bar, the strings barely touched the bridge — oh dear!

Movement had eliminated any down-bearing pressure. Screwing the tuning pins lower involved removing each string after all. Restringing 53 pairs of strings was a bit tedious but I had no option.

Redoing the keys

The keys looked awful, with the old blocked-off balance pin holes and the rough ends where removal of the original weights near the shortened ends had left holes. **(photos 1, 12)** I filled these with half-inch dowels, reshaped the ends, and applied pre-

glued pine veneer to the top of each note. **(photo 13)** The top (played) part of each note was the original (but shortened) ivory and ebony. Like most keyboards of the early period, the black and white contrast would more usually be reversed, using lighter and darker timber, so I stripped them off. On 'clavi 2', I had replaced the top of the naturals with thin strips of teak and simply added ivory to the front of the ebony accidentals. **(photo 2)**

This time, I selected pre-glued wenge veneer for the naturals. For the accidentals, I planed down a piece of maple to half-inch thick, then put it through the table saw at a five-degree angle to give the tapered side profile — seen with ebony prototype lower right of photo 14. ►

Restringing 53 pairs of strings was a bit tedious but I had no option

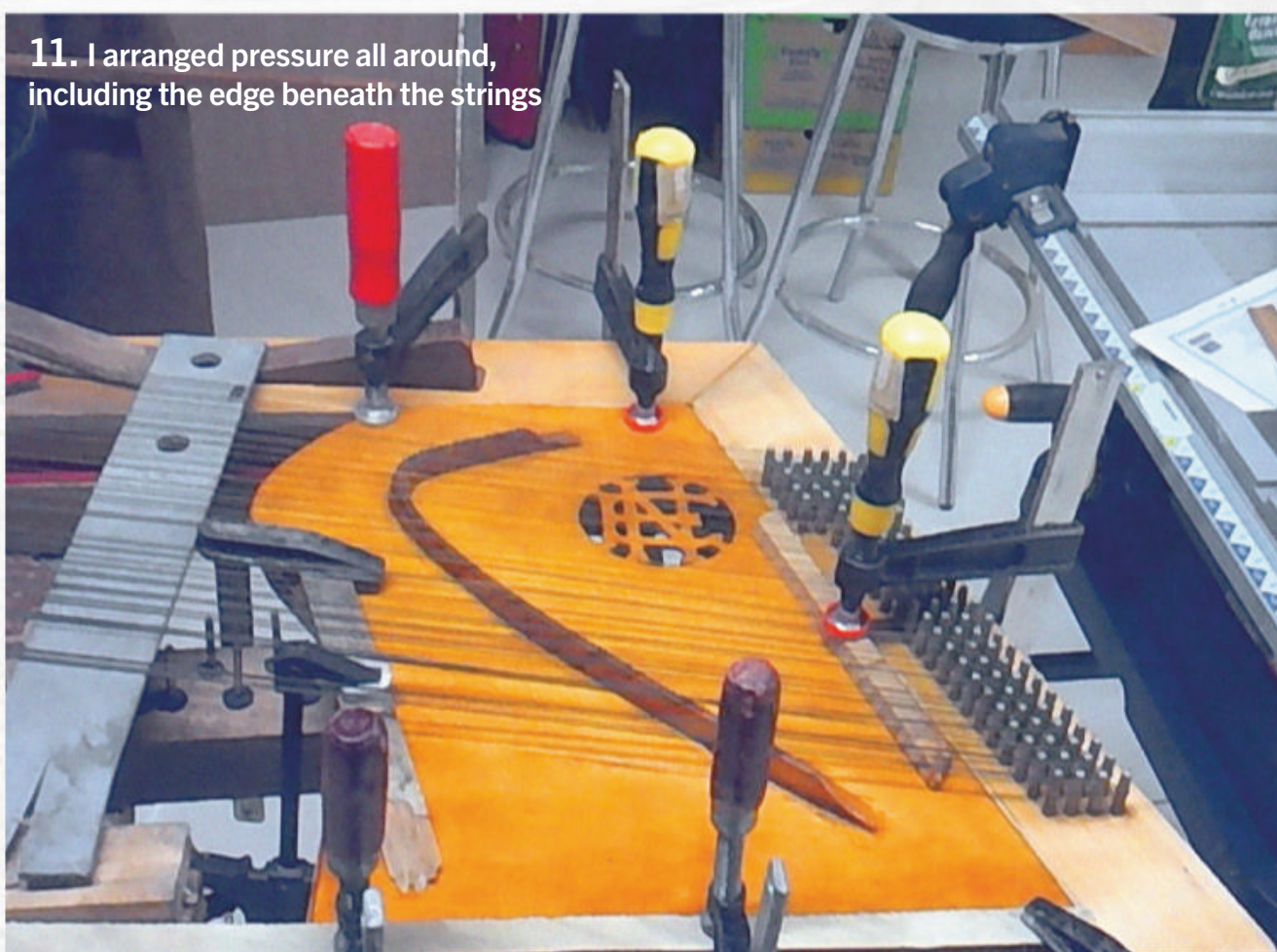
10. I enjoyed the French polishing of the soundboard again



12. The keys looked awful



11. I arranged pressure all around, including the edge beneath the strings





13. I applied pre-glued pine veneer to keys

I reversed the plank for the second side, adjusting the table saw fence to produce strips the right width; each was long enough to make three tops. I cut these off to length at a slight angle to complete the appropriate profile, fine sanding them on the linisher. For the finish on all the notes, I used fine sandpaper and boiled linseed oil. This has dried to a nice finish that is smooth to play on and easily cleaned.

Pre-purchased items

Like so many projects, the 'main' part may be hardly half the work — as those who have bought a boat to fit out will know.

I still had the mahogany ply I had chosen years ago for its appropriate grain, lengths of moulding for the edges,

and even the lock. I cut the top panel to shape slightly oversized and debated whether to hinge it at the back, like most clavichords. This can form a music rest, although it ends up a little far away so some makers hinge the length of the top. I think this spoils the look and interrupts what may be a nice panel. **(photo 15)**

I had already tapered the back, and I felt to hinge the top of the case at the right end would look more interesting, if I could still make room for the height of the music.

I hung the panel above the instrument to check. **(photos 16)** No contest — but hinging at the right end meant the top would have to be removable to give room for the key when tuning.

A length of small piano hinge, with several screws, would have been



14. Note the ebony prototype lower right

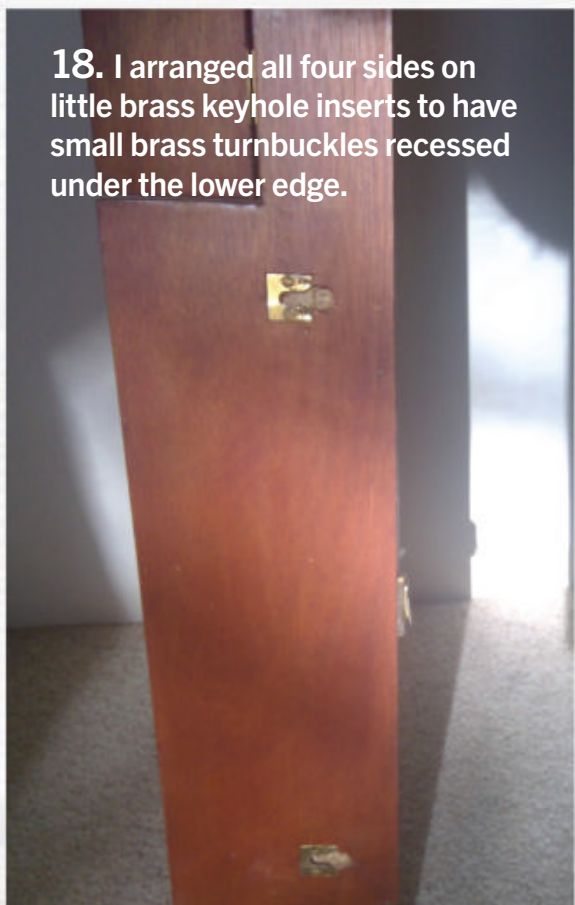


16. I felt to hinge the top of the case at the right end would look more interesting; it worked and it was

17. It made sense to make edge panels also removable for access



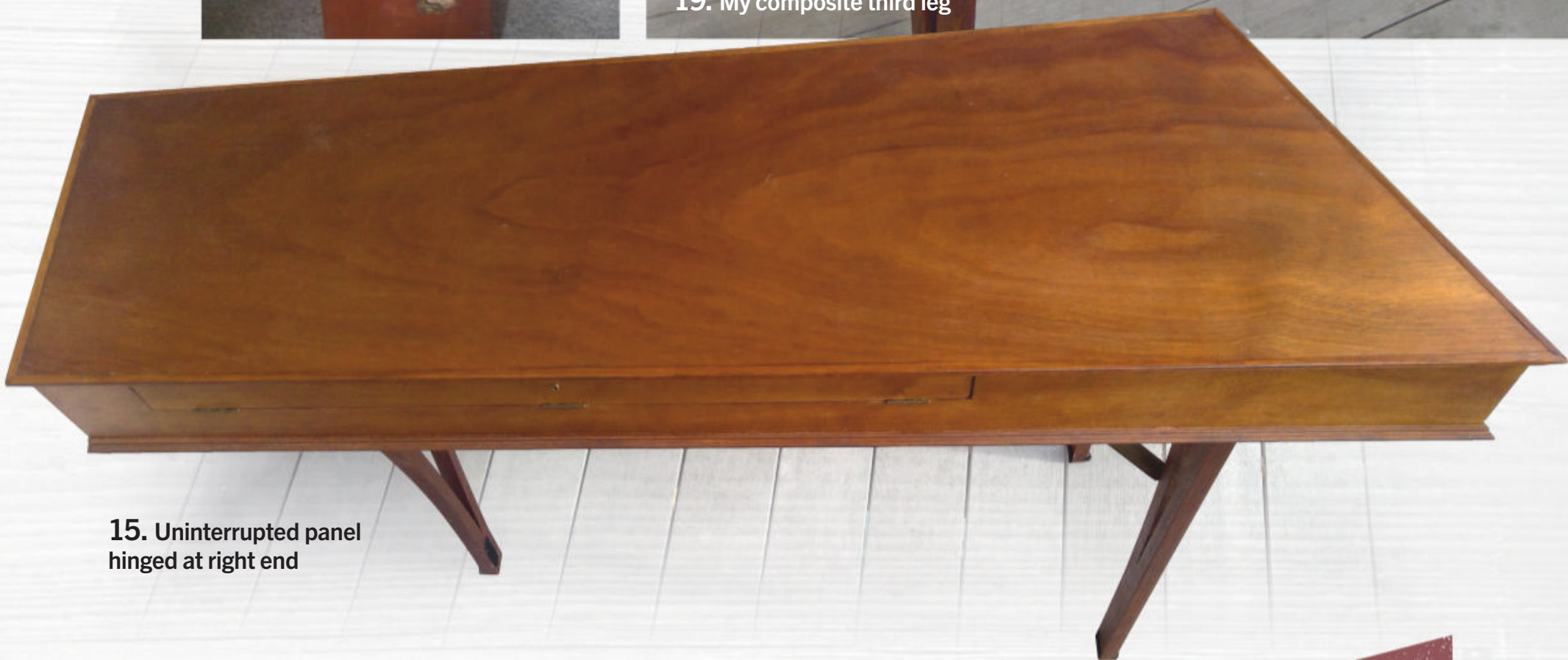
18. I arranged all four sides on little brass keyhole inserts to have small brass turnbuckles recessed under the lower edge.



19. My composite third leg



15. Uninterrupted panel hinged at right end



preferable for the thin top, but there was a slight bow in the end, which I couldn't plane out, so I used two hinges. There is some advantage in having the other edge panels also removable for access, particularly to be able to slide out the keys on the balance bar more easily (as on 'Clavi 2') if necessary. On this one, the bar dropped out below. (photos 17, 20) I therefore arranged all four sides on little brass keyhole inserts, with small brass turnbuckles recessed under the lower edge. (photos 18–20)

Standing firm

I felt the instrument should be portable but stand firmly on its own legs. On the four original screw-in legs, this was never really the case.

I had to deal with warping, as described earlier (photo 4), but what could not be corrected was some twist in the frame. This had developed early on, and to take

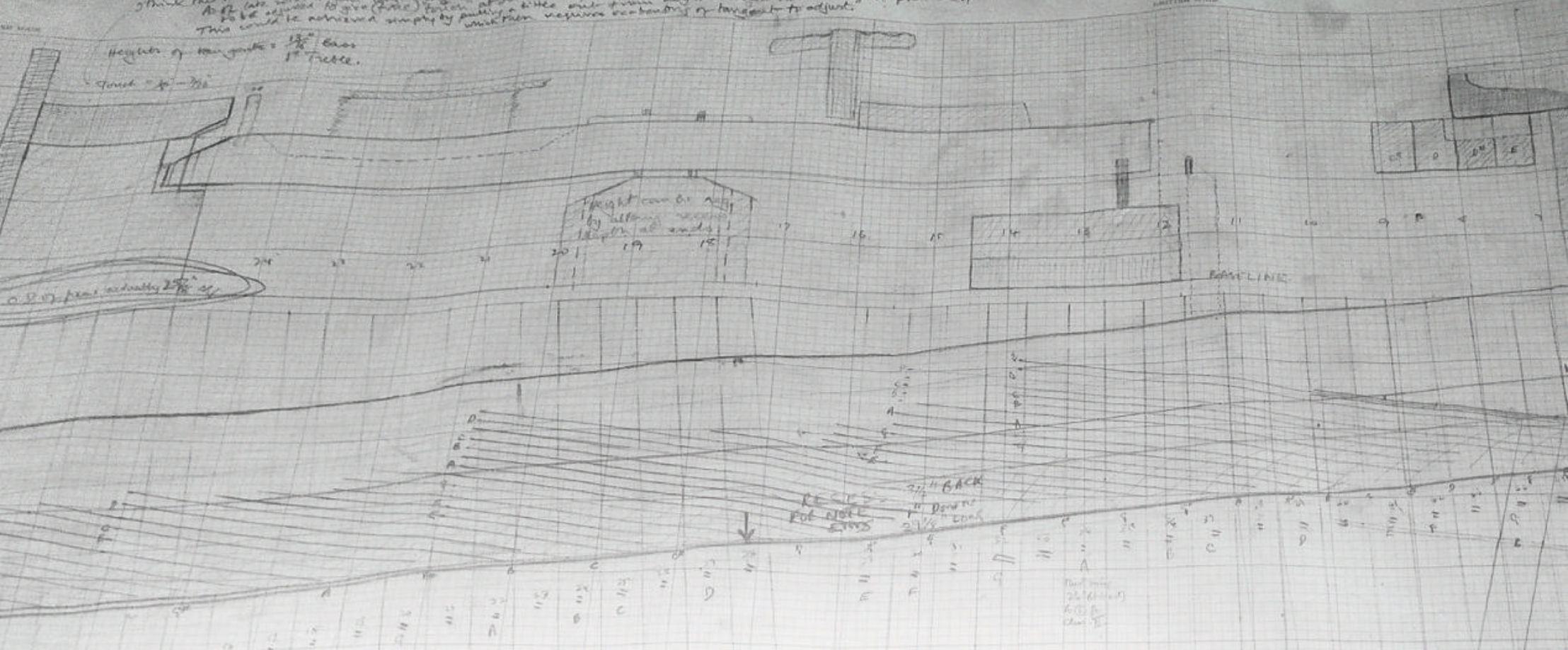
account of it I had needed to adjust the four screw-in legs, which were neither level nor perpendicular to the floor on the left, where they were quite close together.

I decided a composite single one at this end would solve the problem — particularly if it didn't draw attention by not looking upright. A table with three legs will stand firmly anywhere, even if the floor is not level or the top is warped.

I had made a wall shelf for our home's curved hall from an old bookshelf. The remainder was a long taper with a curved side, which gave me an idea for twin tapered legs on the right. I cut the centre out to form a more elegant leg.

For the second, I cut a similar curved length which I married to a straight piece; adding a solid section at the top to make a matching leg. I designed a composite third one for the left end in a style to match these, with two curved sides. (photos 19, 20) ►

The sites of the screws for the original aluminium bases for the screw-in legs can just be seen



The legs hinge firmly open. Each is held so by a brass stay, which clips over a screw on the leg. The 1-inch wide stays are only 1/16-inch thick but reasonably rigid, as I had previously angled the strip lengthwise — to make a rubbing strip for a dinghy! Unclipped, the stays fold in and clip on to another screw in the frame. All three legs fold down clear of each other for transport. **(photo 20)**

The sites of the screws for the original aluminium bases for the screw-in legs can just be seen — except on the thicker replaced part of frame below the keys.

Option of a small box

There was nowhere to store the tuning key, lock key, or other spares. The additional 2 3/4-inch by 3/4-inch beech on top of the frame was redundant on the left side beyond the end of the hitch pins. **(photo 1)** If I cut this off, I would create space that could form part of a small box.

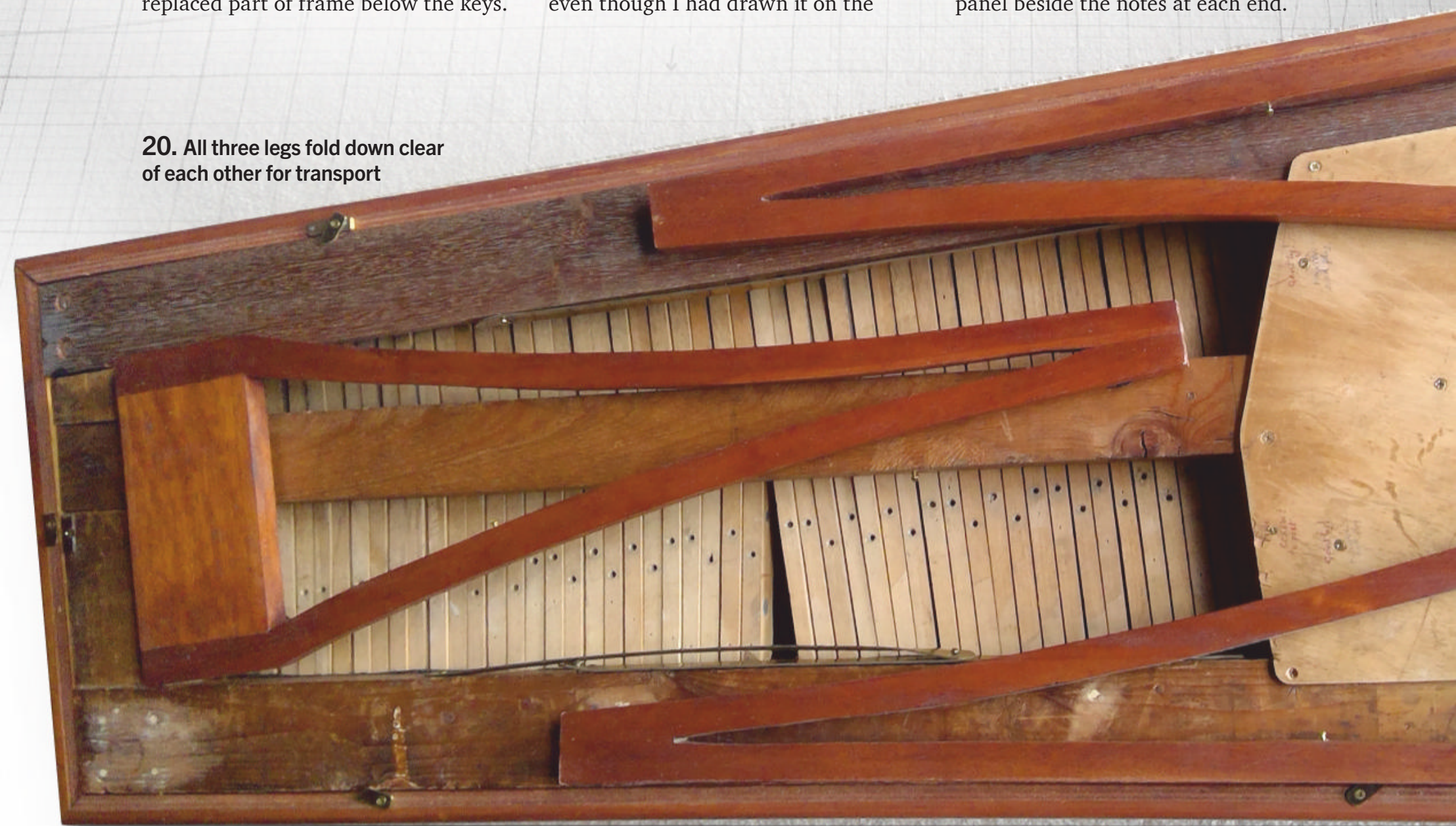
I hadn't fitted the usual name board along the back of the notes. I had thought that might provide a suitable base for a music rest but, even though I had drawn it on the

original plan, **(photo 22)** it would be difficult to make it rigid enough yet still removable to store in the closed instrument. Instead, if I made a name board and continued it across to the side frame, I could form a box.

At the right end, the name board would not clear the lowest strings and arranging support there was tricky. Beside the top and bottom notes, there was just a 3mm gap. **(photo 1)**

From my 9mm ply, I routed off all but 2.5mm, and secured a small panel beside the notes at each end.

20. All three legs fold down clear of each other for transport



22. It would be difficult to make the music rest rigid



25. The name board is supported by a small projection



23



(photos 23, 24, 25) They fit over the edge of the frame on the left and over the edge of the soundboard on the right. To support the name board at that end, I designed a fitting in sheet brass to go around the end of the panel. The name board is held between this fitting and the mitred

side, and is supported by a small projection below. (photos 25, 28)

I had to cut a slot to give clearance for the bottom two strings. On the left, the name board slides into a recess in the small panel. (photo 26)

The back of the box was thinned like the two small panels and screwed —



26. The name board slides into a recess in this small panel



28. I couldn't resist the grooves in some kwila decking; they would support music sheets



30. Inside view of open top



I felt to do the inscription in the music rest would be too time-consuming, so I had it cut by computerised water jet

inside the box — to the cut-off end of the beech overlay. The lid of the box rests on two fillets and tips up for removal by pressure just beyond them. I cut a monogram to match the one in the soundboard, removing the top layer of ply and filling the spaces with resin.

The music rest

For the music rest, I selected a piece of ply. For its base, I used an offcut of kwila decking halved in width and depth. I couldn't resist the grooves, which would support music sheets, with the wider border at the edge as a design feature. (photo 28)

I had hand-cut the rose in the soundboard and in the matching monogram in the toolbox, but I felt to do the inscription in the music rest would be too time-consuming, so I had it cut by computerized water jet. I made the music rest as large as possible and placed it centrally but so as just to fit inside when the instrument is closed. It sits nicely behind the hitch pins. A small piece on the left prevents it sliding that way. (photo 26) The top corner is angled to sit below the lid, where a fillet prevents it from sliding forward. (photo 30)

I did design a slender tapered rod to support the lid, rather like that on a grand piano, which I thought might also add elegance (photo 31), but the music rest does such a good job that the rod isn't necessary.

Very light staining gave the desired colour. The surface is finished with a light sealing coat of satin varnish and wax polish.

When tuned up, the tone — perhaps not surprisingly — is very similar to that of its successor. I could have completed it years ago, but it was very satisfying to do so now, and to develop and confirm in the two of them my own modifications and unique style of clavichord design.

The modifications in the second overcome the construction difficulties of the first, but the history of that one is interesting. As they both play well, I am not sure which I prefer! 📖

31. I designed a tapered rod to support the lid, but it wasn't required, as the music rest did such a good job





JOIN A WINNING TEAM

Why MeloYelo ebike agents are having so much success selling from home. And, how you can join our team.

The connectivity enabled by computers and mobile devices has made the reinvention of business models inevitable. Shoppers now have ways of researching what they want to buy that is far more convenient for them: The internet and social media interest groups.

So, MeloYelo asked the question: Do we need all of the overhead associated with a retail outlet in order to sell our bikes? And if not, what are the alternatives?

We chose a work-from-home/work-from-van model. We have proven the success of this model over the past 4 years and now we're ready to scale it up to meet market demands.

The MeloYelo franchisee enjoys a low buy-in fee (\$7500 + GST), pays nothing for retail premises, purchases a few demonstrator bikes, but is not required to invest in their own stock to sell. Once a customer has test-ridden a bike and wishes to place an order, the franchisee places the order

online and the product is shipped from MeloYelo's Taupo warehouse the same day or the following day.

Our training programme and online learning centre equip Franchisees with thorough knowledge about our bikes and about competitive options. Our customers recognise and appreciate this knowledge and it is a critical success factor for our MeloYelo franchisees.

MeloYelo's corporate marketing efforts – including our \$1 million marketing partnership with Stuff – drive a significant number of sales inquiries to Franchisees, who then add to their sales success by implementing local marketing programmes such as Facebook and exhibits at events. MeloYelo works with franchisees to design and implement their local marketing and to show them how to start generating referrals from their existing customers.

The MeloYelo franchise opportunity is perfect for those who already have an income, but want to supplement that income with a part-time, high-growth business of their own: One that has the potential to grow into a full-time work-from-home business within 3 years.

MeloYelo's founder is a 40-year marketing veteran who since 2011, has been heavily involved in the e-transport sector. He was founder of a non-profit association that promoted electric vehicles, and founder of the EVelocity electric vehicle programme in schools, in which teams of students design, build and compete in electric vehicles. He also founded and ran an advertising & marketing agency that employed 35 people.

MeloYelo uses the collective brains of a team of kiwi engineers and bike mechanics to specify the components of their bikes, all of which come from respected international suppliers like Samsung, Shimano, SRAM and Tektro.

The buy-in fee includes promotional materials, technical & marketing training, a web page, a Google listing, sales referrals from national marketing, and ongoing marketing & technical support.

Franchise opportunities are available in various cities & towns from Whangarei to Dunedin. McEwen says MeloYelo is looking for people with a knowledge of bikes (though not necessarily ebikes), a garage, van or vehicle and trailer to work from, and a real passion to grow a business. "If this sounds like you, we're inviting you to join our team."

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MASTERING THE LATHE: II

IN THIS PART OF THE SERIES WE COVER: TURNING AND FACING,
SPEEDS AND FEEDS, AND 'CLOCKING UP' IN A FOUR-JAW CHUCK

By Bob Hulme

Photographs: Jude Woodside

In the previous issue, we had a familiarization tour of the metal-working lathe. We identified the main elements, considered what to look for when buying a lathe, and looked at safety aspects. In this issue, the second in this series, we look closely at turning and facing, the two core uses of a lathe, and speeds and feeds.

Turning and facing

Turning refers to the process of producing a round surface and, by feeding the tool along the bed of the lathe — parallel to the axis of the spindle — a cylindrical object. Facing refers to the process of producing a flat surface by feeding the tool at right angles to the spindle axis.

It is used to make a flat true end to a cylindrical object or a square shoulder on a stepped object. Before starting the lathe and doing any turning and facing, you have to make some choices, first, what type and style of cutting tool you want to use and, second, the speed and feed rates to set.



I would suggest that the square and triangular tips are versatile enough for the home workshop

However, even when I was working at Prescott Engineering we still had applications for the HSS tool bits for the odd tricky job. It boils down to the funds, time, and patience you have available and, most importantly, your skill levels. For the purposes of this article, I will assume you have decided to use the indexable tungsten carbide tips. Prices vary from supplier to supplier and there are lower cost brands on the market. But the old adage that you get what you pay for holds true; none of us expects to get a Ferrari for the price of a Hyundai, but why buy a Ferrari if a Hyundai meets your needs?

In the illustrations, you can see how square and triangular tungsten carbide tips can be used for turning and facing. The square tip has the advantage that it can do both and is also handy for chamfering sharp corners. Unfortunately, it is not good for producing square corners and shoulders; we need the triangular tips for those. There are many other shapes of tips, but, as they all need their own special tool holder, I would suggest that the square and triangular tips are versatile enough for the home workshop. ►

Cutting tools

These days, indexable tungsten carbide (TC) tools are most commonly used, even in home workshops. While initial set-up cost may be a barrier, the convenience and reliability of TC tools are far superior in the long term to the regrindable high-speed steel (HSS) tool bits.



Bob Hulme: "Worthwhile to make your own cutting-speed table"

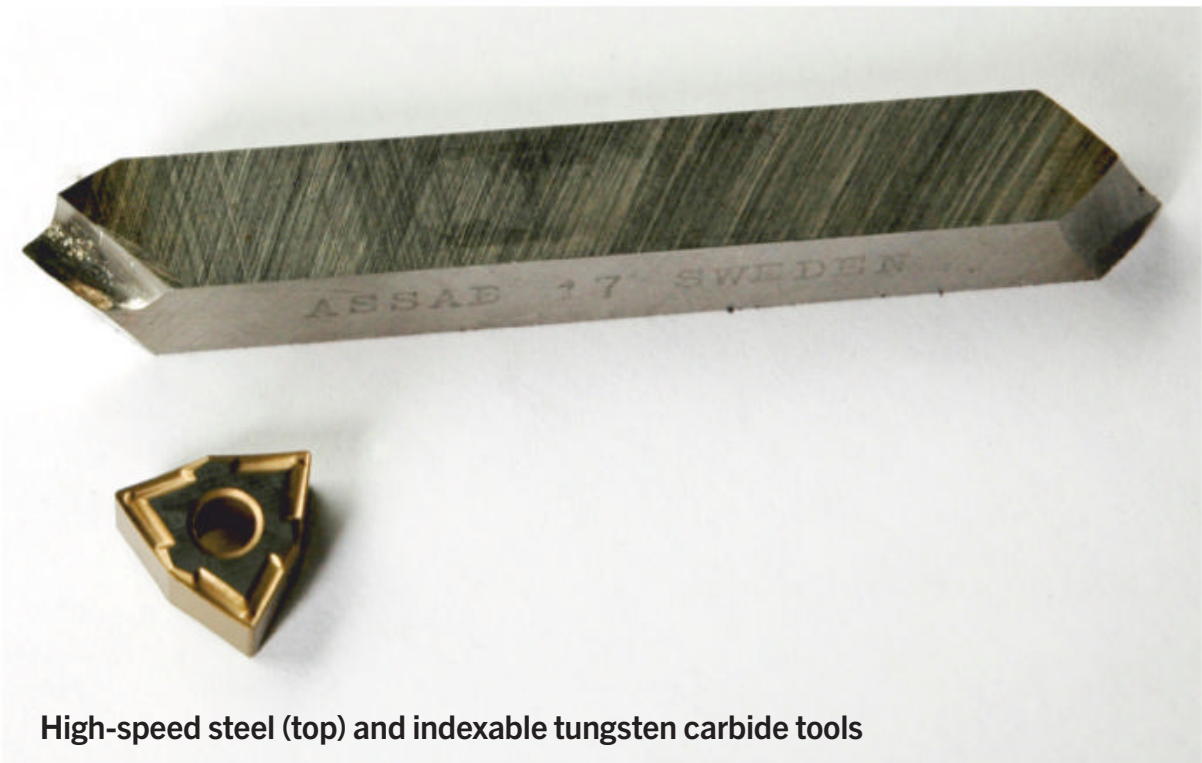
Speeds and feeds

How fast can you run your lathe? It would be great if we could do all our lathe cutting flat out. This would save a lot of time. The problem is that cutting tools would last only a short time before going blunt, and the surface finish on our project would look awful. Materials vary in ease of machining — generally, the tougher the material the slower we have to cut it. If the finish is not as good as you want, then try slowing the spindle revolutions per minute (rpm). As a guide, there are recommended ranges of cutting speeds for various materials, and we can calculate spindle rpm from those.

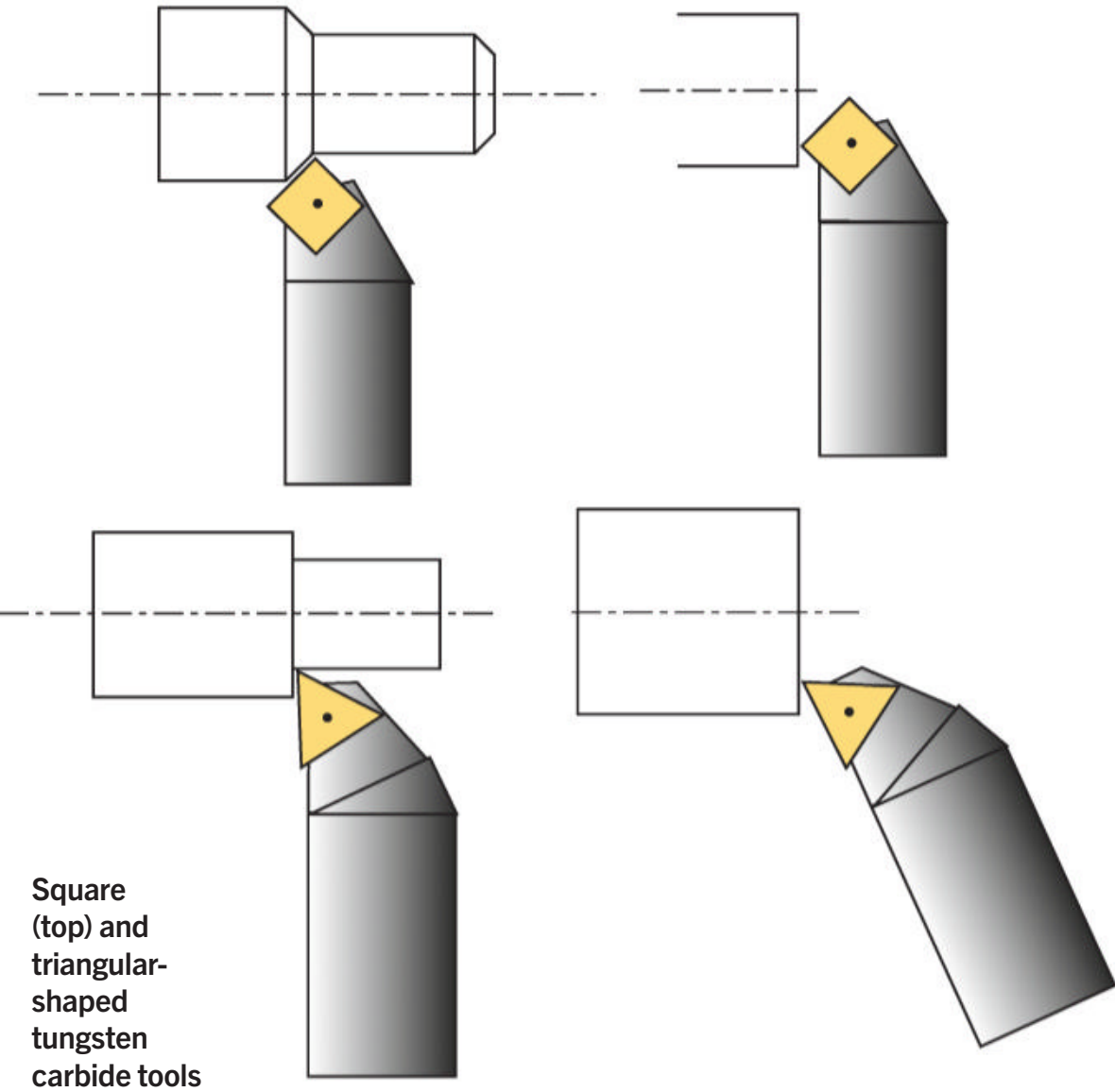
To determine the spindle rpm — which is the rpm of the chuck — it is essential to grasp the idea of cutting speed. The cutting speed is how fast the surface of the job is moving past the tip of the cutting tool, stated in metres per minute. What determines this cutting speed is the rpm of the spindle and the diameter of the job, from which we work out the circumference of the job for the formula. The formula is:

**Cutting speed = rpm of the spindle
x circumference of job at cutting
position (metres)**

This equation means that if the spindle rpm is constant, changes in cutting speed will vary with the changing circumference of the job. As the circumference of the work becomes larger, because the spindle speed is



High-speed steel (top) and indexable tungsten carbide tools



Comparison of indexable tungsten carbide cutting tools and regrindable high-speed steel

	Tungsten Carbide	High Speed Steel
Cost	Higher	Lower
Sharpening	Not necessary. Just index (or replace) when blunt	Must be ground to shape, requiring experience and skill
Life	Very hard and long-lasting. Keeps edge longer	Not as hard as tungsten carbide Needs more frequent sharpening
Shape	Available in a variety of shapes but each style needs its own holder (extra cost!)	Can be ground to the shape you want
Setting centre height	Once centre height is established can be repeated quickly and easily at tip changes	Needs to readjust every time tool is sharpened
Grades available	Various grades available to suit, specifically cast irons, ground steels, tool steel, stainless steel, aluminium etc	Two grades generally available, HSS or cobalt HSS

Cutting speeds

Material	HSS	TC
Cast iron	18–30	60–150
Mild steel	21–25	75–250
Tool steel	12–15	10–75
Brass	45–60	120–500
Bronze	12–18	120–300
Aluminium	200–300	250–2000

constant, the resulting cutting speed is greater. In other words, the speed is greater on a larger diameter job than on a smaller one because more surface area is being moved past the cutting tool in one revolution than the lesser surface area of the smaller job in the same turn of the spindle.

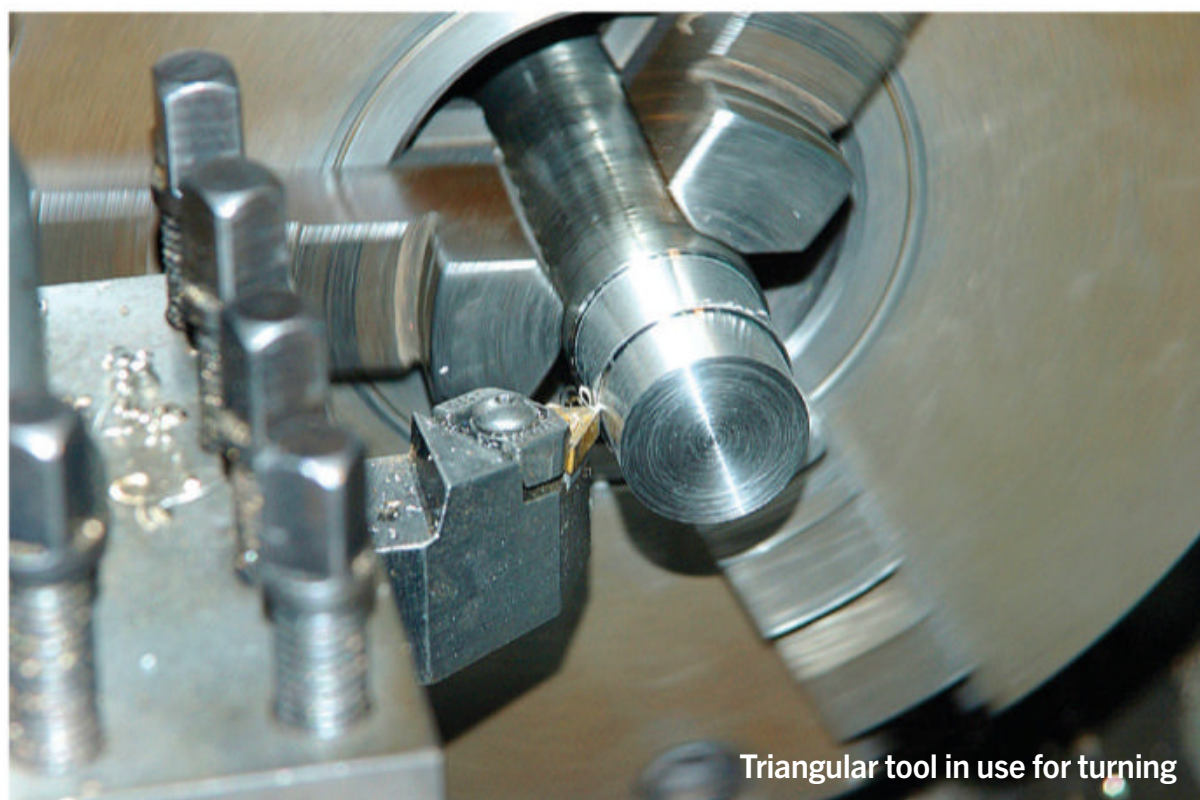
If that last sentence makes sense to you then you have got it. If not, then read the explanation again, as it is important to understand the logic. If

you set a cutting speed that is suitable for the material and you know the circumference of the job, you can find out the required spindle rpm by transposing the equation thus:

$$\text{RPM spindle} = \frac{\text{Cutting Speed}}{\text{Circumference of Job}}$$

See the side panel 'Cutting speeds' for the recommended ranges of cutting speeds (in metres per minute).

The cutting speeds are dependent upon the type of material being cut because some materials cut more easily than others



Triangular tool in use for turning

Broad range

The cutting speeds are dependent upon the type of material being cut because some materials cut more easily than others. Brass cuts easily and it is not difficult to produce a good finish on it. Personally, I'm not that keen on brass because its swarf is like very fine sharp needles, which have an annoying attraction to my fingers.

The table shows different ranges for high-speed steel and tungsten carbide cutting tools. Generally, when using tungsten carbide tips try using a faster speed first, as they tend to give better results at that end of the scale. It would be nice if we could be more exact and state one value for cutting speed for each material instead of what must seem like a broad range. The reason is that, apart from the material and cutting tool type, other factors also influence optimum speed. These include:

- * **rigidity of the lathe**
- * **power of the lathe**
- * **surface finish required**
- * **coolant used or not**
- * **depth of cut**

Experience with your own lathe will tell you where in the range you achieve the best results.

Now, to get back to our formula, we will give an example of finding the spindle rpm that has to be set for our desired cutting speed and the diameter of the job.

Take the formula:

$$\text{RPM spindle} = \frac{\text{Cutting speed}}{\text{Circumference of job}}$$

For a 30mm diameter job in mild steel using a tungsten carbide cutting tool, select a cutting speed of 150m/min or 150,000mm per minute.

$$\begin{aligned} \text{RPM spindle} &= \frac{150,000}{\text{Circumference}} \\ &= \frac{150,000}{2\pi \times 15\text{mm}} \\ &= \frac{150,000}{6.283 \times 15} \\ &= \frac{150,000}{94.25} \\ &= 1590\text{rpm} \end{aligned} \blacktriangleright$$

There we go. You have now conquered cutting speed calculations. Of course you may not be able to select this exact spindle speed on your lathe, but you will need to use the one closest to it.

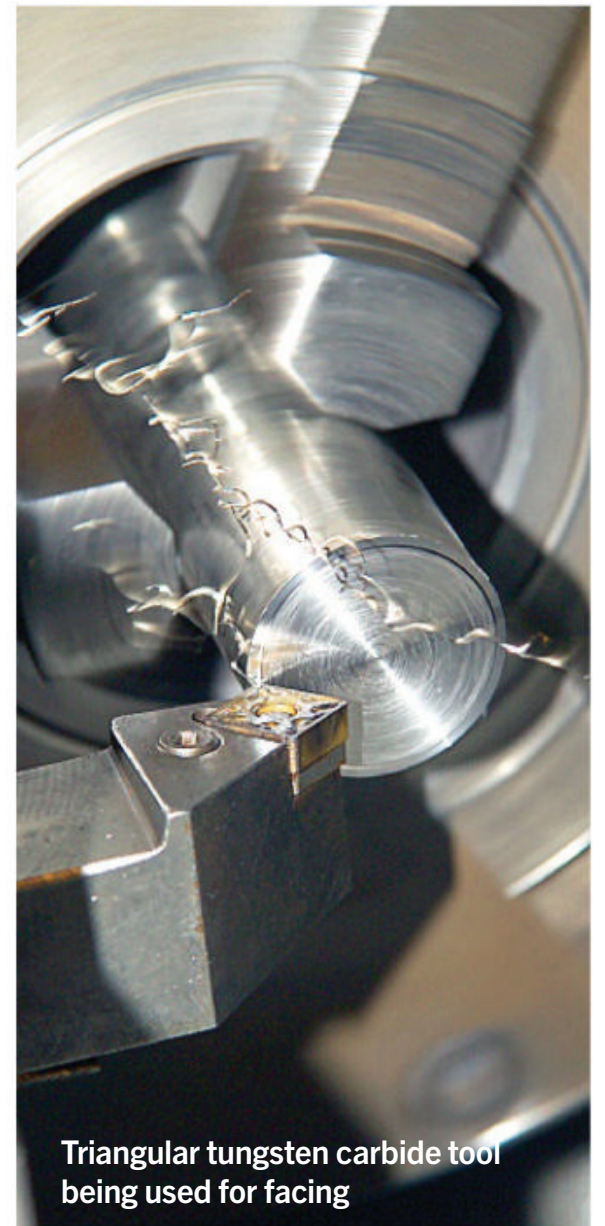
Now, as a suggestion, it could be worth your while to make your own table of rpm vs cutting speed that you can refer to instead of working through the calculations each time. The table could relate to the material you work with most, be it steel, brass, or other material. The cutting speed used could be the actual value that you find suits your lathe and the cutting tools you use.

Feed rates

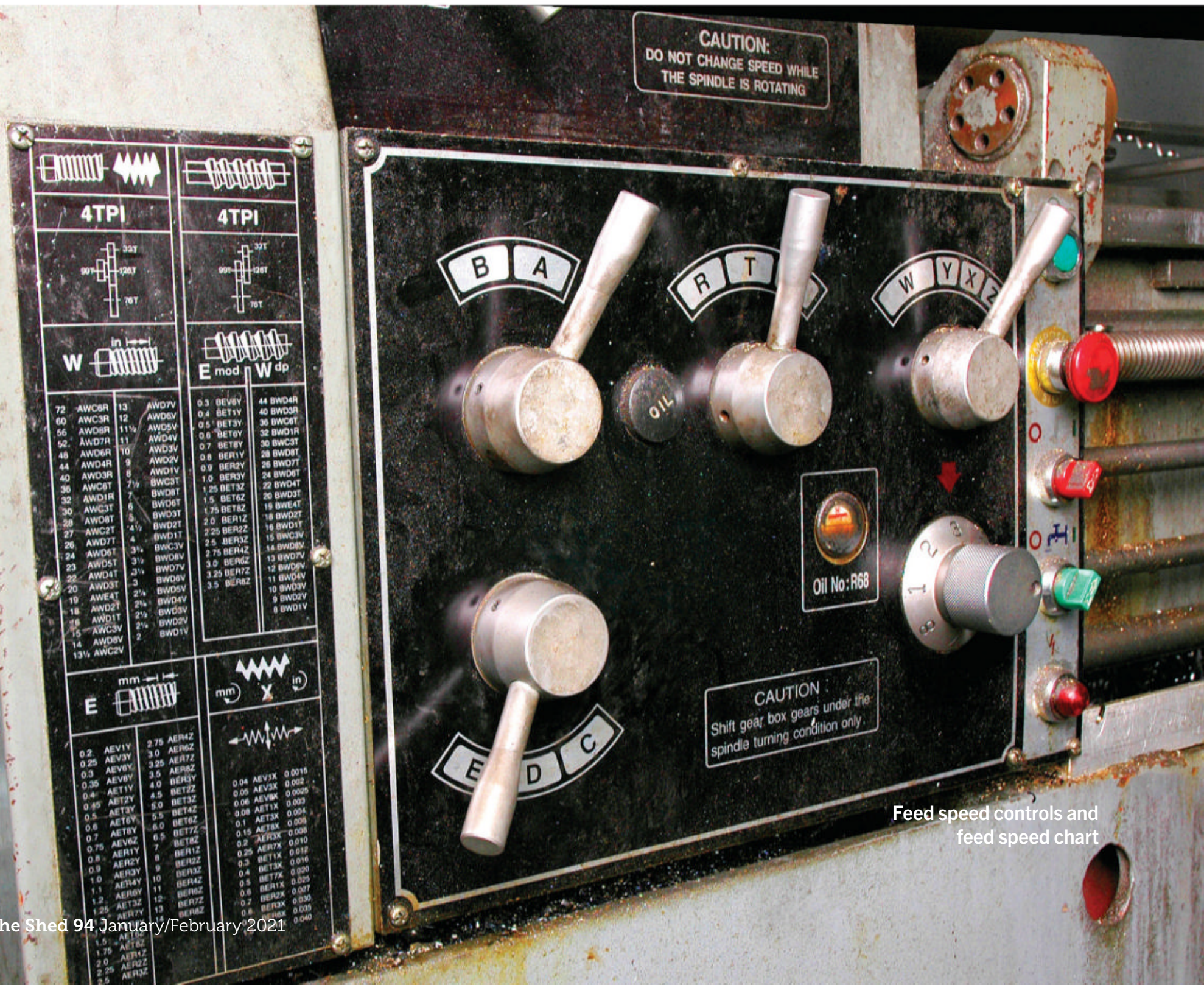
Feed rates refer to the use of the power-feed function. The feed shaft is geared to the headstock spindle, and the saddle uses it to drive the motion of the cross slide or saddle for facing or turning, respectively.

By altering the gearing, we can have either coarse or fine feed rates. The lathe will have a plate on the side of the headstock showing the feed rates according to various positions of gearbox levers. To decide what feed rate you want, first you will need to decide if this is a roughing or finishing cut. This could be a good time to talk about tungsten

Feed rate is stated in millimetres per rev. That is how far the saddle travels along the bed during one revolution of the spindle



Triangular tungsten carbide tool being used for facing



Feed speed controls and feed speed chart



Tungsten carbide triangular tip, versatile for home use

carbide tips for roughing and finishing. Tips can be purchased with different sizes of nose radius, i.e., the radius at the actual cutting point.

Larger radiuses are used for roughing cuts because they are more robust and less likely to break under heavy loads. Smaller radiuses are used for finishing cuts because the shorter length cutting surface minimizes the vibrations that create a bad finish. My preference is to use a 0.8mm radius for roughing and a 0.4mm radius for finishing. Feed rate is stated in millimetres per rev. That is how far the saddle travels along the bed during one revolution of the spindle.

As a general rule, the maximum feed rate for a tungsten carbide tool should be no greater than 80 per cent of the nose radius. To save you the trouble of calculating, the maximum feed for a 0.8 radius tungsten carbide tool is 0.64mm/rev and for a 0.4 radius is 0.32mm/rev. Again, factors such as lathe condition have some say about what feed rate suits best, and you will develop your own experience.

Another key factor is how deep your cut is. A deep cut with a coarse feed removes a bigger volume of metal from the job than a shallow depth of cut and a fine feed rate does in the same time.

This means that more power is needed to remove the larger volume of metal, so you must set these values within the limitations of your machine. Hopefully, you now have an appreciation of what sort of feeds and speeds to start off with on your lathe. Have fun determining what works best on your machine.

Centre height

If you are having trouble achieving a good finish on your job, the first thing to check is that the tip of the cutting tool is at the right height. It is absolutely vital that it is at the same centre height as the axis of the spindle. You can adjust the tool to the dead centre in the tailstock. As a further check, face the end of a bar to see if it leaves a 'pip' in the middle. This indicates that the tool is too low. You will also see from the machining lines exactly where the centre point is and can adjust the cutting tool to that.

'Clocking up'

Sometimes it is necessary to grip in the lathe a square or irregularly shaped job that does not suit the three-jaw chuck. That's when the four-jaw comes into its own. Each jaw of the four-jaw chuck can be adjusted in or out independent of the other three. This allows the chuck to hold different-shaped objects or let the workpiece be positioned off-centre.

While the three-jaw chuck is quick and easy to use and, by virtue of its design, centres the workpiece on the spindle axis, it does not do so with absolute accuracy. When it is vital that a job is running true — such as when new cutting is to be done which must be concentric with existing diameters — we need to 'clock' it up in a four-jaw chuck. The clock referred to here won't tell you the time, but will show run out very accurately and sensitively. In workshop language we call it a 'clock', but strictly speaking it is a dial test



Lever (left) and plunger dial test indicators (DTI)

indicator (DTI) and these come in two main types, plunger and lever.

Plunger types tend to be less expensive while the lever types are more versatile. They are used with a magnetic base that has adjustable arms for positioning the DTI where it is needed, just like a sky hook. When 'clocking up' a job, it is best to slip the spindle out of gear so that it can be easily rotated by hand.

Position the stylus of the DTI so that it just contacts the surface you want to have running true, then slowly turn the chuck by hand through one full rev. The needle on the dial of the DTI will move to show the highest and lowest positions around the diameter of the job. Loosen one jaw to allow the job to move towards the jaw, then tighten the jaw directly opposite to push it over.

Be careful to move the jaws only a small amount each time and to adjust only one opposing pair at a time. If you loosen jaws next to each other, the job can, of course, fall out. By



For the correct centre height, use the dead centre in the tailstock to adjust the tool

repeating this process over and over, you will eventually reach a stage at which the run-out or waver of the needle each time the chuck is rotated is extremely small. At that time, make sure all jaws are tight and recheck for run-out.

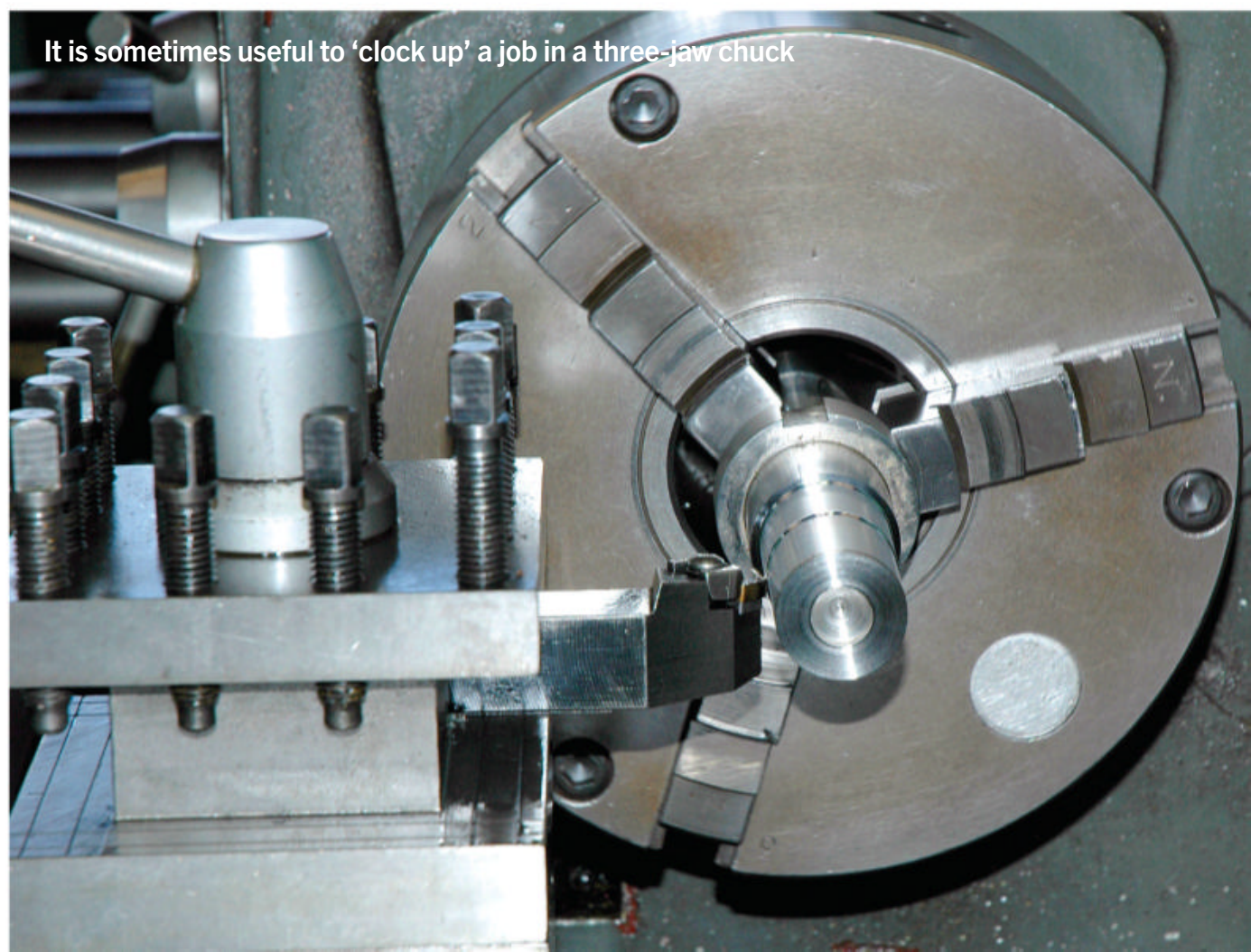
Get the DTI and its mounting base well out of the way before starting up the lathe. Being a sensitive instrument, the DTI is also a delicate one. Take care of it and it will serve you well for many years.

If you are setting up a round job in a three-jaw chuck, it is sometimes useful to 'clock' that job to see how true it is running. While you cannot adjust the jaws independently to correct any error, often a tap with a soft hammer on the 'high' side of the job will bring it closer to true. However, take the DTI out of contact before doing this as the shock from even a small tap can harm its internals. Happy 'clocking'. 📖

Being a sensitive instrument, the DTI is also a delicate one. Take care of it and it will serve you well for many years



Level DTI used to check run-out on inside of piece



It is sometimes useful to 'clock up' a job in a three-jaw chuck

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KITCHEN SINK TO FISH SMOKER

GRAHAM WHEAL HATES ANYTHING TO GO TO WASTE SO HE COMBINED HIS EXPERTISE WITH STEEL AND HIS INTEREST IN FOOD TO GIVE NEW LIFE TO A DISCARD

By Nigel Young

Photographs: Nigel Young

Graham placing the salmon steak onto the tinfoil prior to fitting the top and lighting the propane cooker

Graham showing the stainless steel patch he stitched on with a TIG welder



Graham Wheal has forgotten more about steel than you and I will ever know. His work has been compared favourably to that coming off a robotic production line, and many of the stories from his time in the industry centre on his pioneering methods, particularly with regard to working with stainless steel.

Graham is the consummate professional, and like many with that mindset he cannot see something abandoned without seeing it resuscitated, restored, and reworked, not only for what it was but for what it might be — such as turning a stainless steel kitchen sink into a fish smoker.

“I just found it and hated seeing it go to waste; as I needed a new fish smoker anyway, here was the opportunity,” he says.

“I just found it and hated seeing it go to waste; as I needed a new fish smoker anyway, here was the opportunity”

Home on the range

While Graham’s professional life has revolved around steel, his private life revolves around his family and a bach in Twizel. Founded in 1968 to house the workers on the Upper Waitaki hydroelectric scheme, Twizel was intended to be temporary and dismantled once the scheme was complete. However, when the time came there was sufficient opposition from those living in what is now

the largest town in the Mackenzie District to persuade the Ministry of Works to sell the properties off instead.

Over the years Graham and his family have enjoyed accessibility to one of the most beautiful and adventure-filled parts of the country. Combine this with a passion for cooking, and it’s not hard to see how a discarded sink becomes a fish smoker. ►



The patched sink and U-shaped stainless steel spacer tray, with the propane cooker, salmon steak and bag of manuka sawdust around them



Spreading the manuka sawdust across the bottom of the smoker prior to placing the spacer tray

“I do quite a bit of cooking at home and I like to experiment with different types of food,” Graham explains. No surprises there.

At about this point I get sidetracked as Graham raises the subject of cooking steak — one in which I also have an interest — but we digress, although I do intend to try his method next time I cook one; then there’s Graham’s interest in curing and smoking bacon ... So, has Graham made any other stainless steel cooking implements?

“Oh, some little trays to go on top of the sink like a colander to stop the peas escaping, some knives with cast handles when I was an apprentice” — and so on. This combination of steel and food has clearly been with Graham for much of his life, with experimentation and alternative methods being at the core — an attitude of curiosity that is very evident.

Making the sink a safe smoker

Part of his pioneering work was around sterilisation in hospitals and their use of pressure vessels and vacuum processes, combined with the meticulous work required to ensure high, and safe, standards. One such process involved TIG welding from just the outside of the vessel, as the inside was already sealed, with Graham developing a method to



Next, tinfoil goes over the spacer tray — its sole purpose is to keep the tray clean



Lid on smoker, smoker on cooker, and all set to go

achieve the outcome needed while still maintaining its integrity.

So, when Graham decided to make the smoker, it was about more than just process and method; it was about the application of years of experience in a highly specific and very risk-averse industry. Food preparation of any kind is not without risk, with bacterial infection, for example, being the largest shadow over badly prepared and stored processed food such as smoked salmon.

The conversion of the sink required three steps and a good understanding of both how the process works and the degree of control required to achieve the outcome Graham wanted.

For the sake of this article Graham uses a piece of salmon from his freezer. “Usually this would be freshly caught; however, I had it there so that’s what we’re using today,” he says.

Forever the pragmatist — but it doesn’t stop Graham from producing a very tasty, and surprisingly moist, salmon steak, ready for cutting and placing on crackers for the Halswell Menzshed Saturday morning smoko. It doesn’t last very long, as you can well imagine.

Pay attention to moisture

Moisture, it turns out, requires a certain amount of attention, as the fish can be too moist with the result that it overflows into the sawdust below, where it burns before sending a burnt flavour back into the salmon flesh.

“The trick is in how you use the sawdust,” says Graham, “as that’s what the design of the smoker is meant to achieve; it is that that both establishes the flavour and prevents burning.”

Graham uses a combination of salt and brown sugar: the salt helps dry the fish while the sugar helps with the flavour. There is clearly more to this than meets the eye. Here’s me thinking all he was going to do was roll the piece of salmon up like a big reefer and just light one end and drag on the other; I couldn’t quite see where the stainless steel bit fit in. Boy did I get that wrong! Keep in mind that this is salmon country, with the hydro canals hosting salmon farms, from which many escape ...

The three parts of the conversion to be addressed:

This combination of steel and food has clearly been with Graham for much of his life, with experimentation and alternative methods being at the core

1. establishing a pressure that allows for the smoke to permeate the salmon while keeping the fish safe and refreshed
 2. the separation of the salmon from the sawdust, and any negative interference from the sawdust while still maintaining an even cooking process
 3. maintaining the moisture and juices — it’s all too easy to end up with a very dry and tasteless piece of fish.
- We’ll look at each stage separately. ►

Stage one

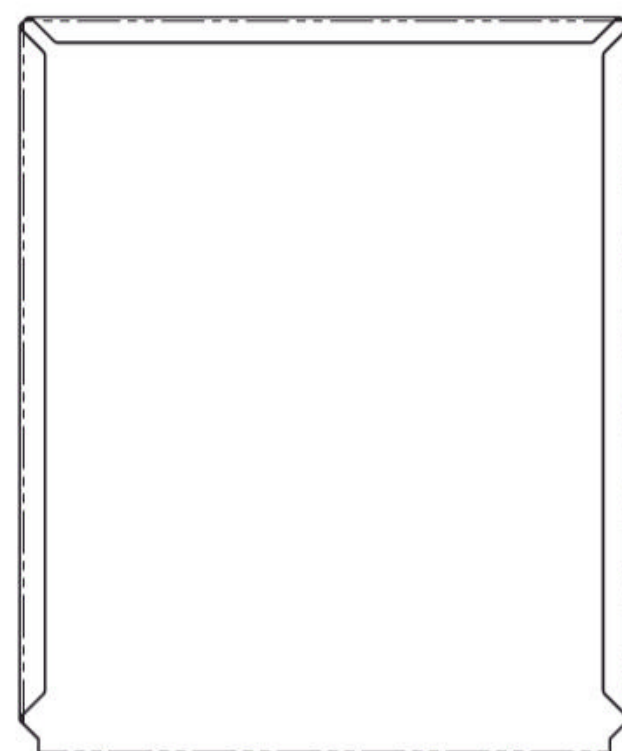
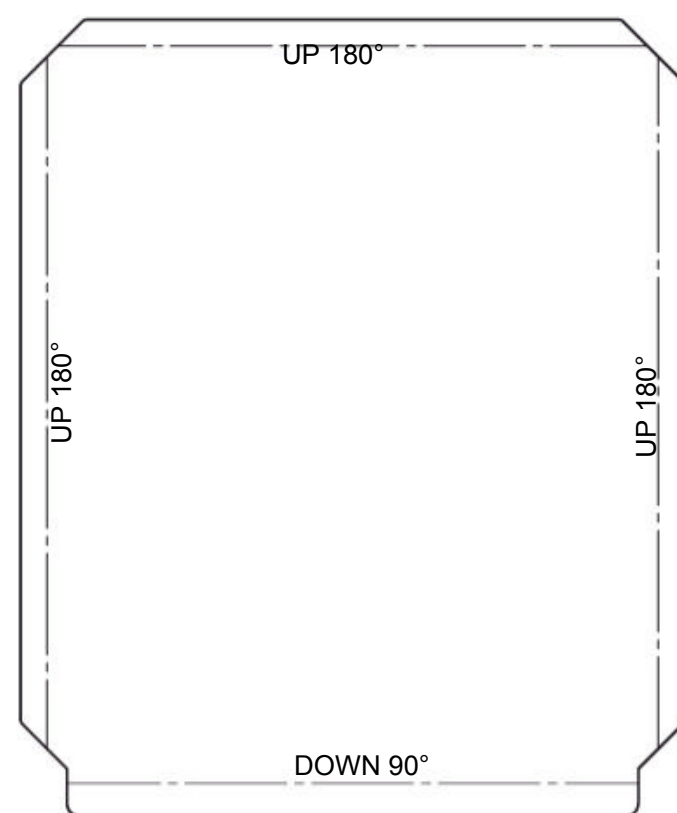
The first step was to prepare the sink to prevent any flame from the cooker acting directly on the process, which meant that the plughole at the bottom had to be sealed. Graham achieved this by stitching a 'patch' over the hole from underneath with a TIG welder. However, anything bolted in place would be just as effective. It doesn't need to be watertight, but it does need to stop the flame from the portable propane burner getting in and scorching the sawdust. Graham likes manuka sawdust, although both apple and cherry provide other flavours.

For the lid Graham used a piece of stainless steel, folding the edges to match the corresponding flange around the top of the sink.

"It's like an envelope, with three

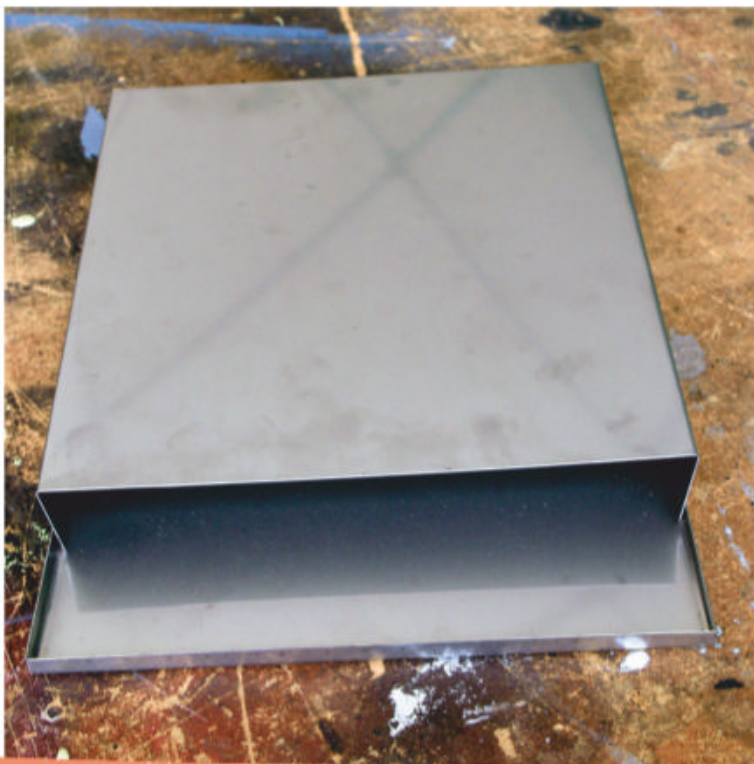
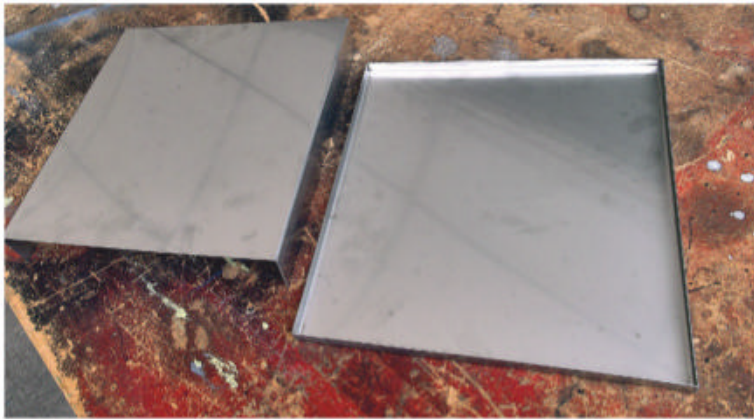
sides turned down and one pushed up so you can push it like a drawer," he says.

If the lid is too tight, it will cause an unrealistic pressure inside. By allowing the movement of smoke through, the process is refreshed and atmospheric pressure is maintained. This prevents the same smoke from becoming increasingly stale, forcing it into the fish and in turn degrading the flavour. So, by cutting back the ends of the fold to 45 degrees against the round corners of the sink, Graham has not only provided a simple method of reducing the pressure but also assisted the flavouring. Ultimately, it also gives a visual way to keep an eye on the whole process as smoke finds its way through. Simple and effective, as so many solutions often are.



Graham putting the cooking tray on top of the U-shaped spacer prior to putting on the tinfoil





The U-shaped spacer and the cooking tray inside the smoker

Simple and effective, as so many solutions often are

Stage two

At this point Graham addresses the importance of hygiene and cleanliness. While the bottom and sides would be fine, the top will turn very brown from the smoke. Any juices trapped from a previous cooking session that drip back into the current one are of concern. A thorough wash with hot soapy water and a Poli-Pad is all that is required. The whole smoker is self-contained, with the trays and sawdust kept inside and the lid kept on top — easy to put in the car and take down to those canals near Twizel.

Stage three

The salmon steak sits on a piece of tinfoil, simply to keep the stainless steel U-shaped spacer tray clean. This in turn sits on the bottom of the sink over the sawdust and acts as a diffuser, intended to prevent juices from the salmon spilling over into the sawdust and potentially causing a fire. Quite simply, burnt sawdust will produce a burnt flavour. The cooker is placed over the propane burner and the process begins.

“There is no need for the sawdust

to get burnt if it’s being done properly; it’s just a matter of taking care as you go,” mentions Graham.

In other words, it’s all about the preparation — the cornerstone of any project or event. It’s not long before wisps of smoke start appearing through the squared-off round corners, against the backdrop of a blue-sky Saturday morning in the beautiful grounds of the St John of God Hospital, where our Menzshed is situated. It really is a great foretaste of summer, the Twizel bach, and the long South Canterbury



Graham showing the salmon steak on top of the tinfoil prior to the lid being slid over and the whole thing being placed on the propane cooker

and Central Otago evenings. I think my next article needs to be based around a brewery, just to complete the picture. So, if you're working on one, please let the editor know and we'll see what can be arranged — although I do have a story about a simple but effective coffee roaster coming up.

The proof of the pudding

The whole process takes about 20 minutes — long enough for Graham to prepare some crackers — but then the moment of truth comes as he turns off the burner and opens the cooker; it was all well worth the wait. The salmon is a good colour,

flakes gently, is moist and full of flavour.

"If it had not been quite ready?" I ask Graham.

"Close it up for another five minutes and try again."

It really is that easy.

"Does it just do fish?" I ask.

"It does mussels very well. Basted with sweet chilli sauce, they are the bee's knees. I tried some chops once but they were like an old boot!"

Graham likes not only to get something right but also to be able to do it again, and again, without shortcuts or compromise. Brought up in the day of the adage 'If a job's worth doing, it's worth doing well', he's found that saying to be a good principle of work, one that has rewarded him in terms of both achievement and recognition. Even something as simple as this conversion gets the same attention to detail as the tag team welding on the huge vanes for the Manapouri power station got back in the day. Ultimately, however, it's all about enjoying this mix of professional and personal life, centred on the simplicity of family, food, and knowing that the saying 'Everything except the kitchen sink' no longer applies.

It so happens, I have a spare sink behind my house, from some recent alterations we did ... 🏠

Then the moment of truth comes as he turns off the burner and opens the cooker

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BEER CLONES

A LITTLE DETECTIVE WORK MAY ENABLE YOU SPEND SUMMER QUAFFING YOUR FAVOURITE ALE — WITH YOUR OWN NAME ON THE LABEL

*By Bryan Livingston
Photographs: Robyn Livingston*

Have you ever tried a beer and thought, *How can I make this?* Or maybe you had a favourite brew in past years that you can no longer buy. Could you reproduce or clone this brew today?

To clone your favourite beer, or make

something similar or even better, is the dream of many brewers. Sometimes we can find a recipe that someone else has created, but if you need to create your own recipe or if you want to check someone else's then there are some easy little tricks to help you.

Online recipes

A simple search on Google might locate you a recipe. If you type in the name of the commercial beer you want to make and add the word 'clone' or 'recipe' after the name you might find several recipes.



The IBU reading tells us the bitterness in the beer

The trick is to separate the good recipes from the not so good ones. If you find three recipes, print them and lie them side by side. You will see common ingredients across the recipes, so that's a good sign that those ingredients should be in your recipe. If one recipe looks quite different then it probably won't be a good clone. For example, if the recipe is for a commercial beer for a New Zealand pale ale and the hops in the recipe are Galaxy, Victoria Secret, and Pride of Ringwood then this probably won't be a good clone, as those hops are all Australian hops not New Zealand hops.

I'm not saying Australian hops aren't any good, but rather that you would not expect them in a New Zealand pale ale. New Zealand pale ales usually have New Zealand hops.

Ingredients list

Before you start building your own recipe do a little research. Look on a label of the beer you want to clone, as there could be clues to the ingredients. Some craft breweries list the hops that are used. For example, Macs Three Wolves Pale Ale lists on the label the three hops used: "Amarillo, Simcoe & Nelson Sauvin hops dominate this elaborate Pale Ale, bursting with citrus & tropical notes and a well-balanced bitterness."

So, while you don't have quantities, at least you know the hop varieties used. Other beers may list the malts, such as Pale Malt, Biscuit, Carapils, and Caramalt. Again, you won't know the quantities but you could start with the premise that 90 per cent of the grist will be Pale Malt with the balance made up of the other three malts.

Alcohol percentage

Look for the alcohol by volume (ABV) on the bottle. Under New Zealand law, breweries must list the ABV on the bottle. This is a great clue to working out how much malt you need for your recipe. As a guide, a 23-litre recipe for a five per cent ABV beer would have a grain bill of around 5kg. This will ►

To clone your favourite beer, or make something similar or even better, is the dream of many brewers



Hops listed on your bottle are a big clue for cloning a beer

differ depending on which brewing system you use, so you might need slightly more or slightly less. However, knowing the approximate total grain bill is another clue in building your clone recipe.

Similarly, for extract brewing, two cans of 1.7kg liquid malt for a 23-litre recipe will give you close to 4.5 per cent ABV. If you reduced your volumes to 20 litres then those two 1.7kg cans would give you around 5.2 per cent ABV. Knowing this, you can easily work out if you need more malt or less malt to reach the desired ABV percentage of the beer you are cloning.

Bitterness

Some beers list the bitterness, although this is less common. The industry standard is referred to as 'IBU' or 'International Bittering Units'. This is helpful when calculating what quantity of hops to add as a bittering addition as well as the total bittering from all additions in your recipe.

Looking again at Macs Three Wolves, the label states "Alcohol by volume 5.1%, 40.0 IBU".

Best guess

Sometimes there is very little information to enable you to clone a beer. Apart from the ABV there might

What you taste and smell is the start of building a clone recipe

be nothing else useful on the bottle. If you can't find any existing recipe, then you are going to have to use best guess based on your tasting experience.

Consider whether the beer has a sweet or dry finish. Are the hops aroma and flavour herbal, citrus, tropical, or spicy? What malt characters can you taste — i.e., bread, toast, chocolate, coffee, biscuit, honey, dried fruit, and so on?

What you taste and smell is the start of building a clone recipe.

Software to build your recipe

There are many software programmes that are useful when building a recipe. I use the BeerSmith software but there are many to choose from. When using these programmes it is easy to adjust hop additions to get to the desired IBU level, and adjust the malt bill to reach the desired alcohol content, just with the click of a few buttons. If you have loaded in all the ingredients, your alcohol and bitterness are close to what is on the bottle, and you have included the hop and or malt ingredients listed on the bottle label, then you should be ready for your first attempt.

Reviewing your attempt

Once you have tried your first clone recipe, if you can, review it side by side with the genuine product. How close is the clone to the original?

Check the colour — is it lighter or darker than the original?

Sweetness and bitterness — do these seem in balance?

Malt — does yours have a similar mouthfeel and length of flavour?

Hops — consider bitterness, flavour, and aroma.

Ask yourself what you need to change for future attempts — or maybe your clone is an improvement on the original! 🏠



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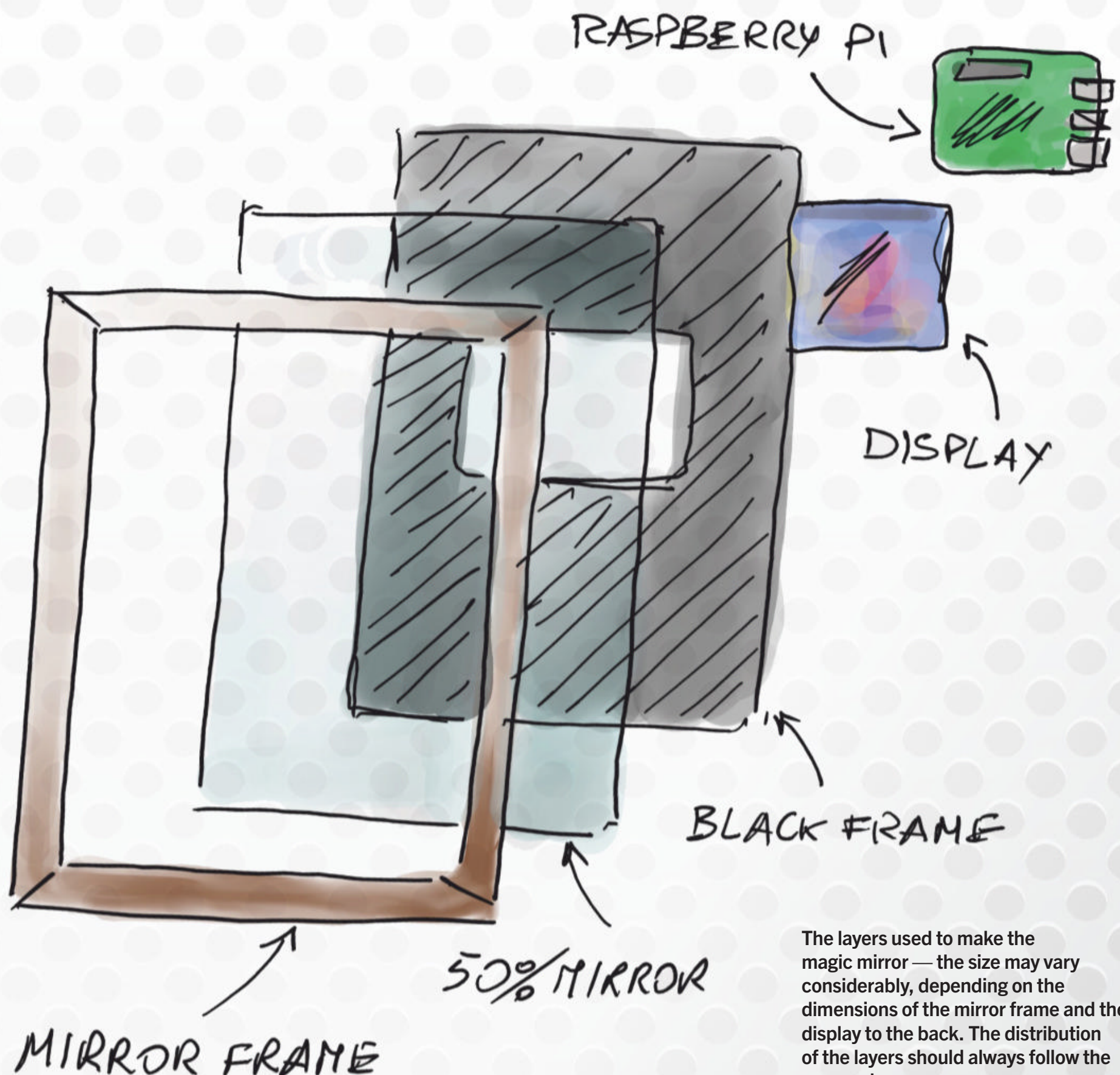
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THE SMART PEEPHOLE

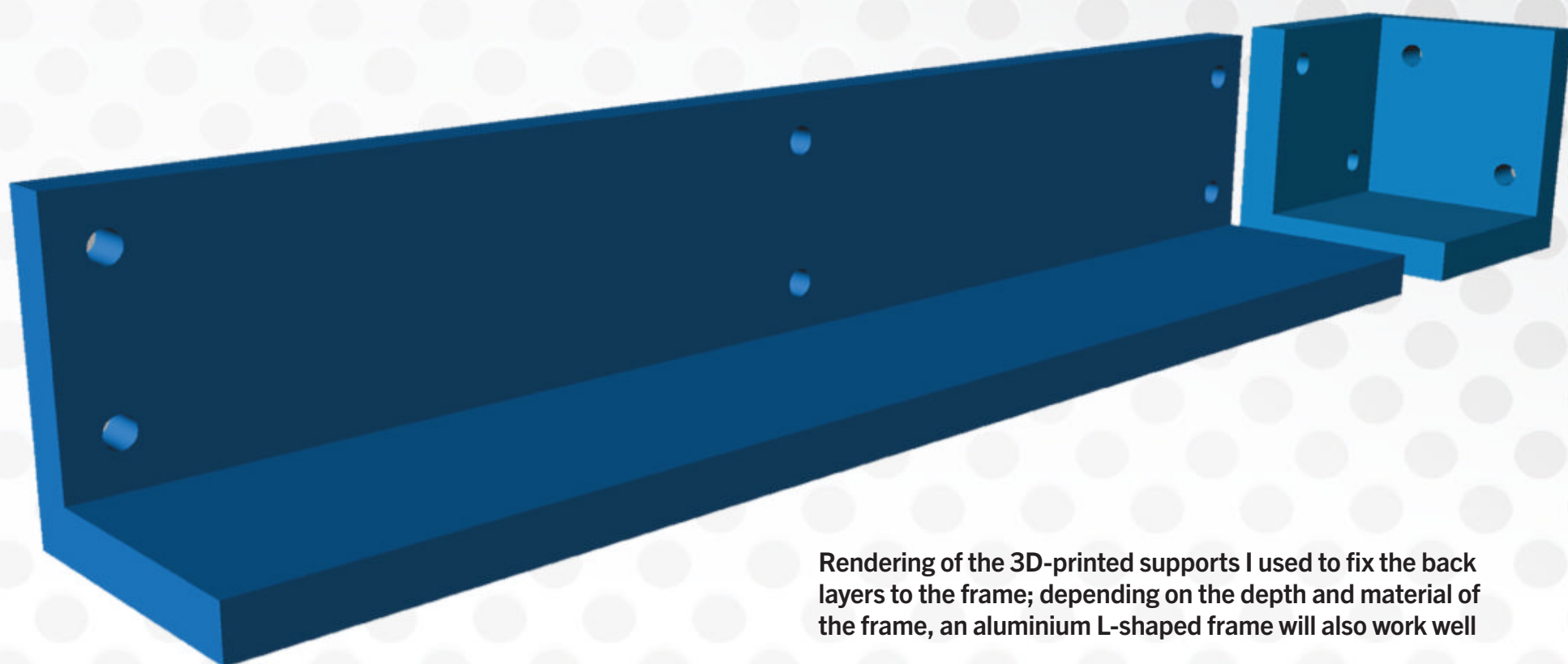
PART 1

LEARN HOW TO USE TECHNOLOGY TO MAKE YOU AND YOUR HOME FEEL MORE SECURE

By Enrico Miglino Photographs: Enrico Miglino



The layers used to make the magic mirror — the size may vary considerably, depending on the dimensions of the mirror frame and the display to the back. The distribution of the layers should always follow the same scheme



Rendering of the 3D-printed supports I used to fix the back layers to the frame; depending on the depth and material of the frame, an aluminium L-shaped frame will also work well

As stated in the first article of this series, all the projects I present should be easy to make and easy to implement in a generic home setting with as few modifications as possible. Therefore, this is also what we will try to do with this issue's project: a digital peephole.

I have already published an article in *The Shed* Issue No. 81, showing the basis of how to build a magic mirror. A magic mirror is essentially a half-reflective mirror with a black sheet on the back and a rectangular square showing a display, also with a black background. That project is also included in the new *Best of The Shed 2*, in shops now or very soon.

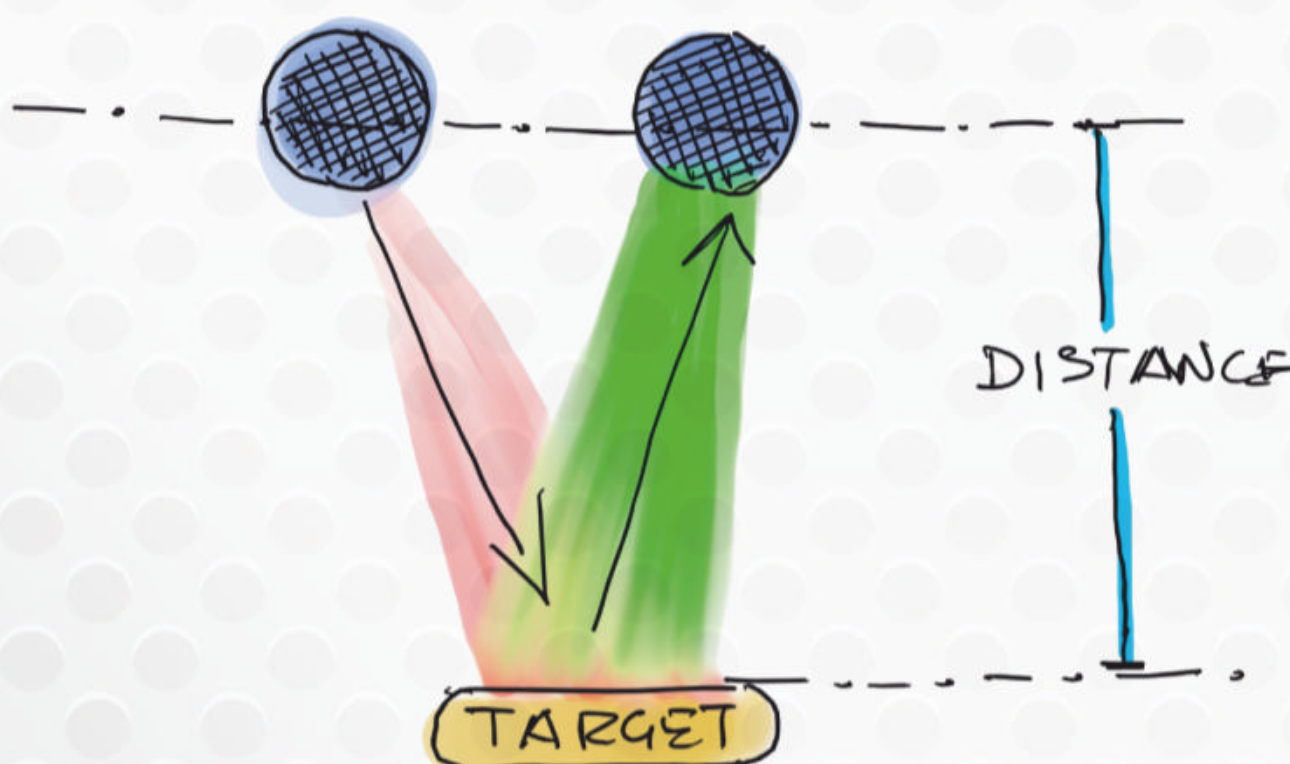
Now it is time to recall the project for a useful application as part of our smart home improvements. The idea is to make something nice, with a practical use, to hang inside the door of your home: moving the traditional peephole to the next level.

Hardware and settings

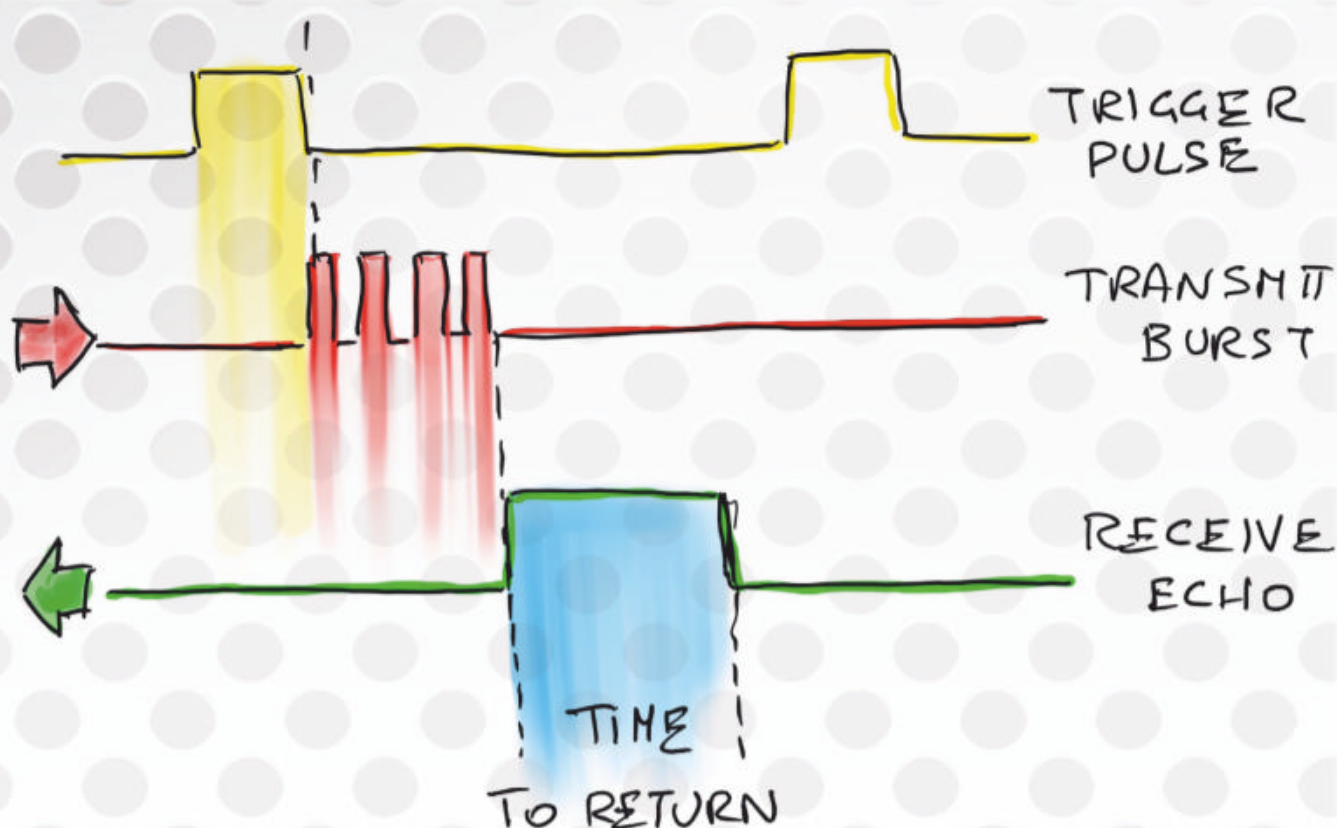
In this project, I have used a Raspberry Pi seven-inch touchscreen display but the choice depends on what kind of display you are using; it is also possible to use an old HDMI display without the plastic case. To reach the best effect it is important that the flat screen is fixed to the back of the semi-transparent mirror. ►

The idea is to make something nice, with a practical use, to hang inside the door of your home: moving the traditional peephole to the next level

The scheme illustrates the principle of the ultrasonic sensor. The sender and receiver are soldered on the board, ideally both collimated at the farthest point that can be reached by the ultrasound emitter component. The distance is measured calculating the time needed by the receiver component to detect the ultrasound burst sent by the emitter component



How a measure sequence works: every time the Raspberry Pi generates a trigger pulse of 10ms, the emitter component sends a burst at the frequency of 45kHz. When this ends, the sensor detects when the echo from the subject is received. The Raspberry Pi measures the time passed and converts it in distance units



The back frame performs two roles: it creates the black background behind the one-way mirror and it keeps the display in place

There are many kinds of 50 per cent reflective mirrors but I strongly recommend using an acrylic one because it is easier to adapt, less fragile, and cheaper than the glass support. Thanks to the proliferation of projects of this kind during the past couple of years, half-reflective acrylic mirror sheets have become easier to find. Another cheaper alternative is to buy one-way mirror film and apply it to a clean glass or acrylic sheet surface. The result is the same but you should take extra care when placing the film on the transparent support surface.

The back frame

The back frame performs two roles: it creates the black background behind the one-way mirror and it keeps the display in place.

It should be pure black and robust enough to support the weight of the display. In the project illustrated in this article, where I used the standard Raspberry Pi seven-inch LCD display, a 2–3mm thick plywood or black acrylic sheet is sufficient; the thickness of the frame depends on the weight of the display you will use.

Keep pressing the back frame to the one-way mirror with L-shaped supports fixed to the internal sides of the frame; I have printed them



I have adapted the peephole — removed from the main door of my home — to extend the capabilities of the Pi camera

adapting the design to the size of my handmade wooden frame but commercial aluminium ones will work just as well.

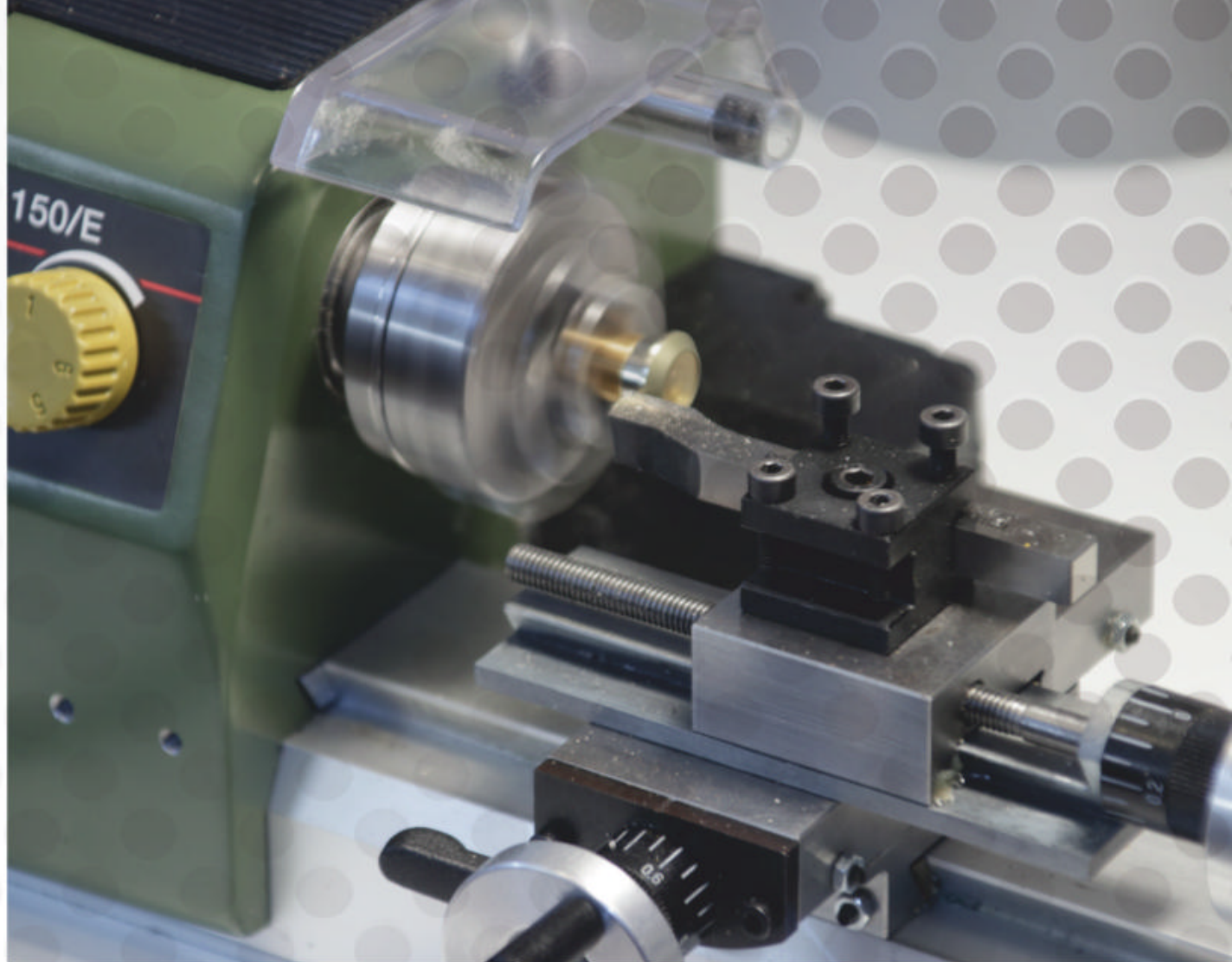
The electronic Raspberry Pi and the wires are lightweight so do not require any kind of support. You can fix them on the back-side cover of the mirror.

The peephole

To make the peephole I have fixed the Raspberry Pi camera to the back of the mirror. The connectors between the Raspberry Pi and the camera and display will determine the position of the board inside the magic mirror. I have positioned the display on the front side at about one-third of the height of the mirror and the camera at almost the same height in the middle of the back cover of the mirror. For good ventilation I have added a series of 3D-printed supports, leaving about 3cm of space between the back and the front frame of the mirror, thereby avoiding a completely closed box.

The final component I added, to make it easy to control the outside view through the peephole, is an HC-SR04 ultrasonic sensor. We have already used one in the previous smart home article in *The Shed* Issue No. 93, *Improving the Kitchen*.

In the kitchen project, the sensor was used to detect the presence of the pan on the cooking plate as well as the presence of a person in the kitchen. Here, the same sensor is used in a more sophisticated way.



The peephole mounted on the lathe; I have reduced the front diameter to make a lens extension to the Pi camera pinhole lens. I have also removed the plastic cover from the front to have a cleaner wide-angle view

The sensor

The ultrasonic sensor can also be used to measure the distance from a subject in a precise way; it consists of two main components soldered on a small board: an emitter and a receiver.

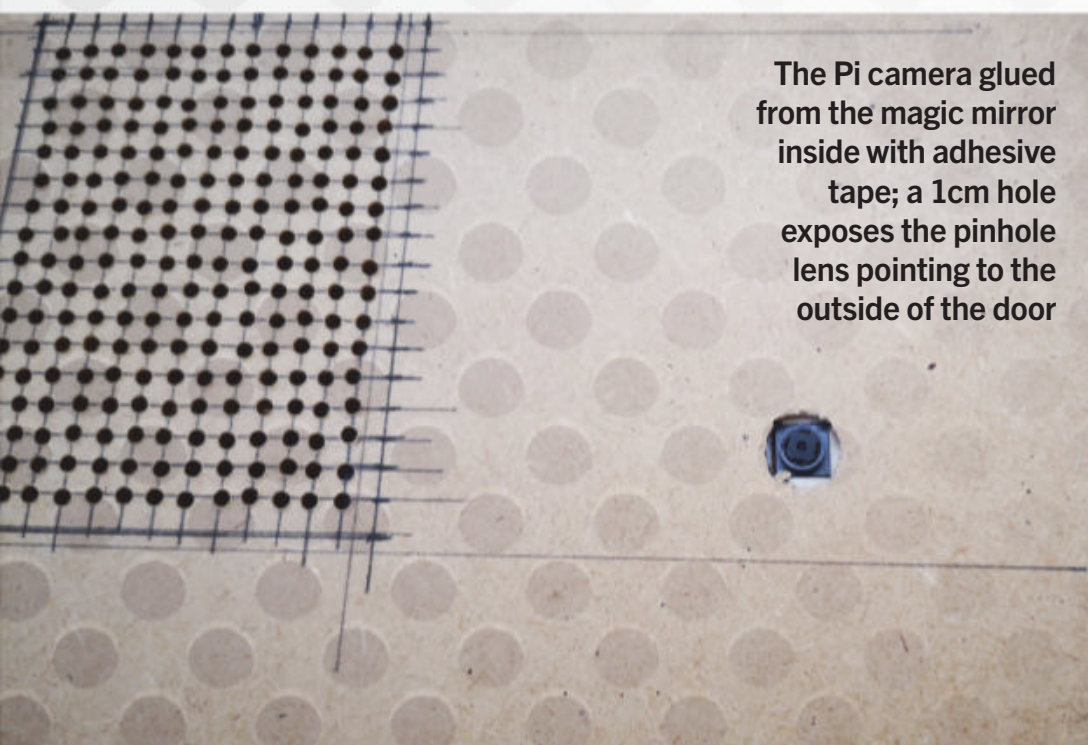
The Raspberry Pi sends a short signal of 10 milliseconds (ms) to trigger the sensor; as the sensor is activated (triggered) the emitter component sends a burst of eight pulses at a frequency of 40kHz. When the ultrasonic emission meets a subject an echo is generated and a return frequency is detected by the receiver component.

The sensor calculates the time passed between the end of the sent burst of pulses and the received signal. The distance of the subject can be calculated with this simple formula:

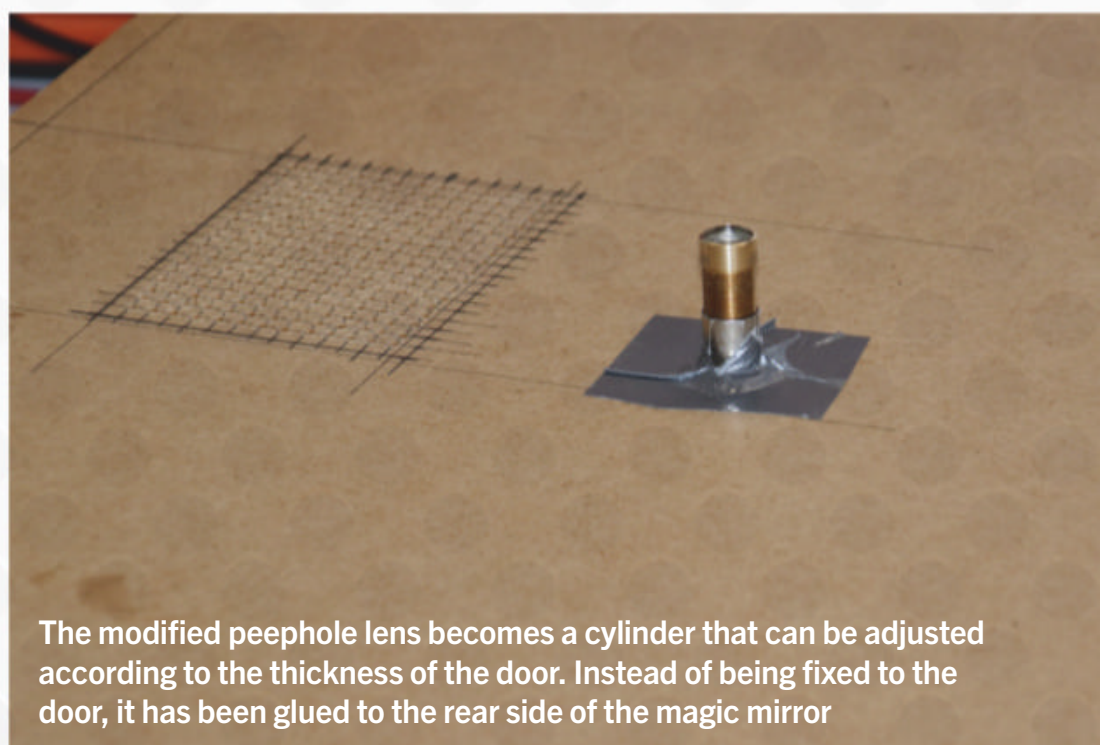
$$\text{Distance} = \text{Speed} \times \text{Time}/2$$

Knowing that the speed of the emitted ultrasound burst is 34,300 centimetres per second (cm/s) we can then calculate with good precision the distance of the subject by applying this formula:

$$\begin{aligned} \text{Distance (cm)} \\ = 17,150 \times \text{Time} \end{aligned}$$



The Pi camera glued from the magic mirror inside with adhesive tape; a 1cm hole exposes the pinhole lens pointing to the outside of the door



The modified peephole lens becomes a cylinder that can be adjusted according to the thickness of the door. Instead of being fixed to the door, it has been glued to the rear side of the magic mirror

It is possible to convert a Python script on the Raspberry Pi to a system service starting on boot

Note that we have applied the formula to half of the speed of sound because the distance calculated is half of the path of the frequency from the emitter and receiver components.

We will use the ultrasonic sensor as a switch to change the display screen when a person is encountered near the magic mirror. Being able to calculate the distance with the precision of 1cm, it is possible to fine-tune the distance that the sensor should react.

The HC-SR04 ultrasonic sensor is wired to the Raspberry Pi and positioned — in this project — on top of the frame. In fact, it can be positioned in the most convenient place for you.

The Python sensor software

I have tried to structure the software to be as modular as possible. There are three modules:

1. the magic mirror application that stays on top
2. the ultrasonic sensor that runs in the background
3. the camera image that is shown live until the person is positioned in front of the magic mirror.

Let's look at the parts in detail.

The camera show is driven by the `distance_sensor.py` Python script.

Detail of the ultrasonic sensor during the final assembly on the lab; it should be adjusted to point towards the subject that will trigger the camera view when a subject is near the mirror

```
#!/usr/bin/python3
import RPi.GPIO as GPIO
import time
import subprocess
from picamera import PiCamera
```

The programme uses the `RPi.GPIO` library to manage the Raspberry Pi GPIO data and the `picamera` library to control the camera.

Note that the first line of the Python script is:

```
#!/usr/bin/python3
```

In Linux this makes the programme run like any other Linux command, without the need to launch the script as usual with the command:

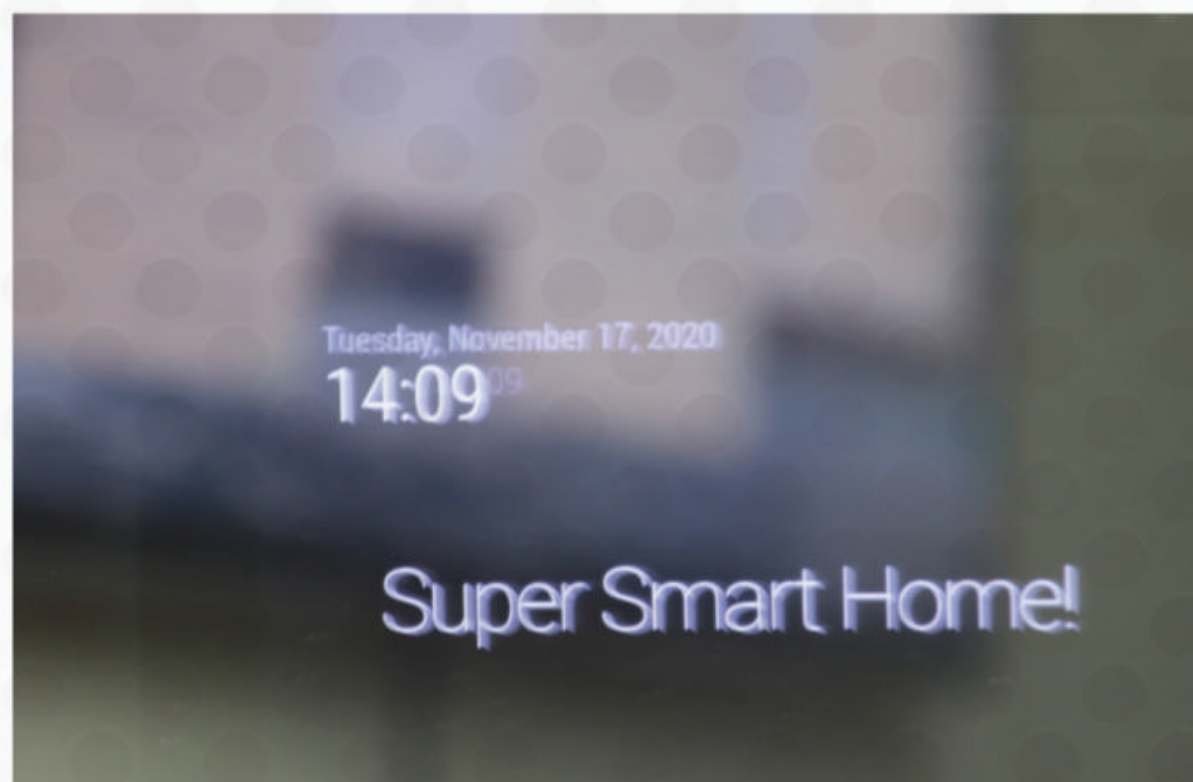
```
$>python3 distance_sensor.py
```

It is sufficient to call the programme as a command:

```
$>distance_sensor.py
```

This is a small but important difference; to make the system able to continuously check the sensor to act accordingly regardless of whether other programmes are already running the Python script should run as a service.

It is possible to convert a Python script on the Raspberry Pi to a system



A close-up of the mirror showing only the light text; the background of the screen is black. In this example, the display shows the current date and time and some text selected randomly from a list

service starting on boot. To achieve this there are some small changes and components that should be set up, well explained on the main page of the GitHub repository: github.com/alicemirror/SuperSmartHome.

What happens when the sensor detects a subject close to the magic mirror? It starts a camera live visualization, shown on top of the screen for a predefined period of time.

The `camPreview(sec)` function shown below is just an example of what can be triggered by the sensor when the desired distance is reached:

```
# Shows the camera preview for
a number of seconds
def camPreview(sec):
    camera.rotation = 180 #
Image is bottom-top
    # Show the camera preview
    camera.start_
preview(alpha=192)
    # And brightness 0
    camera.brightness = 0
    # Progressively increase the
brightness
    # to the maximum
    for i in range(0, 50):
        camera.brightness = i
        time.sleep(0.1)
    # Leave the preview visible
for the desired
    # number of seconds
    time.sleep(sec)
    camera-stop_preview()
```

Alternatively, you can start any kind of command, as well as shoot an image, play a sound or an mp3 file, and more.

Don't forget to check the last updated versions of the software mentioned in this article in the Super Smart Home GitHub repository at: github.com/alicemirror/SuperSmartHome.

MagicMirror 2 FrameworkMagicMirror

The Magic Mirror 2 FrameworkMagicMirror (github.com/MichMich/MagicMirror) is not a simple application but is an Open Source modular framework created by Michael Theuw (MicMic) and many other contributors.



The assembled smart peephole while the software was being developed and tested

It is possible to show temporised text, newsfeeds, weather reports, image galleries, and more

It is a modular system that, when installed on the Raspberry Pi, provides a number of modules, easy to configure and parameterise, to manage the display of any kind of magic mirror. It is possible to show temporised text, newsfeeds, weather reports, image galleries, and more.

The installation instructions can be found on the GitHub repository

while a complete list of the available modules, as well as detailed documentation of its features, is available on the MagicMirror 2 official site: magicmirror.builders/.

After it is installed and converted to service the Python script, I suggest you install this platform and experiment with the available modules. 📄



MAKING AN ELECTRIC WINCH MORE VERSATILE

MULTI-USE OUTWEIGHS MACHO WHEN IT COMES TO A WINCH

By Coen Smit

Photographs: Coen Smit

It would appear that electric winches and four-wheel drives are fated to be together. Serious enthusiasts of the off-road lifestyle are likely to make a winch their very next purchase after the obligatory bull bar. Even the ‘Toorak tractors’, Australia’s colloquialism for those four-wheel drives that seldom venture outside the affluent suburbs of our fair cities, are fitted with them to give them that ‘macho look’.

Pros and cons of an electric winch

There are several shortcomings with fitting an electric winch permanently to your vehicle. One is that almost every four-wheel drive spends a large proportion of its life without doing anything that calls for a winch, hence its owner is spending extra money unnecessarily lugging around a heavy device — not to mention the extra wear

and tear on the tyres and suspension of the vehicle — for no purpose.

Another is that it has been known for likely lads looking for some entertainment on a quiet evening, to play out a winch cable over the roof of the winch’s vehicle and fasten it to the tow bar, before shorting out the remote-control connection. As you can imagine this tends to detract from the look of the car in short order!

In the event of a crash, a heavy weight like a winch is another solid chunk of metal that will exacerbate the damage to the vehicles involved.

Finally, a front-mounted winch is great when all you want to do is drag yourself in that direction; it's not so great when you would rather back up once you are stuck or if any fixed point for anchoring the winch happens to be behind you! Using a front-mounted winch to pull yourself backwards requires installing roller guides under the vehicle as well as threading the cable under it, something that can be a really yucky problem when the vehicle is bogged.

You never know when you will need it

Even if you don't own a four-wheel drive but like to venture off the beaten track a bit, this small project may be just what you need, because sooner or later you will find yourself out of your vehicle's depth. Something as simple as

turning around on a narrow track can be enough to bog your car, as I found out to my cost recently.

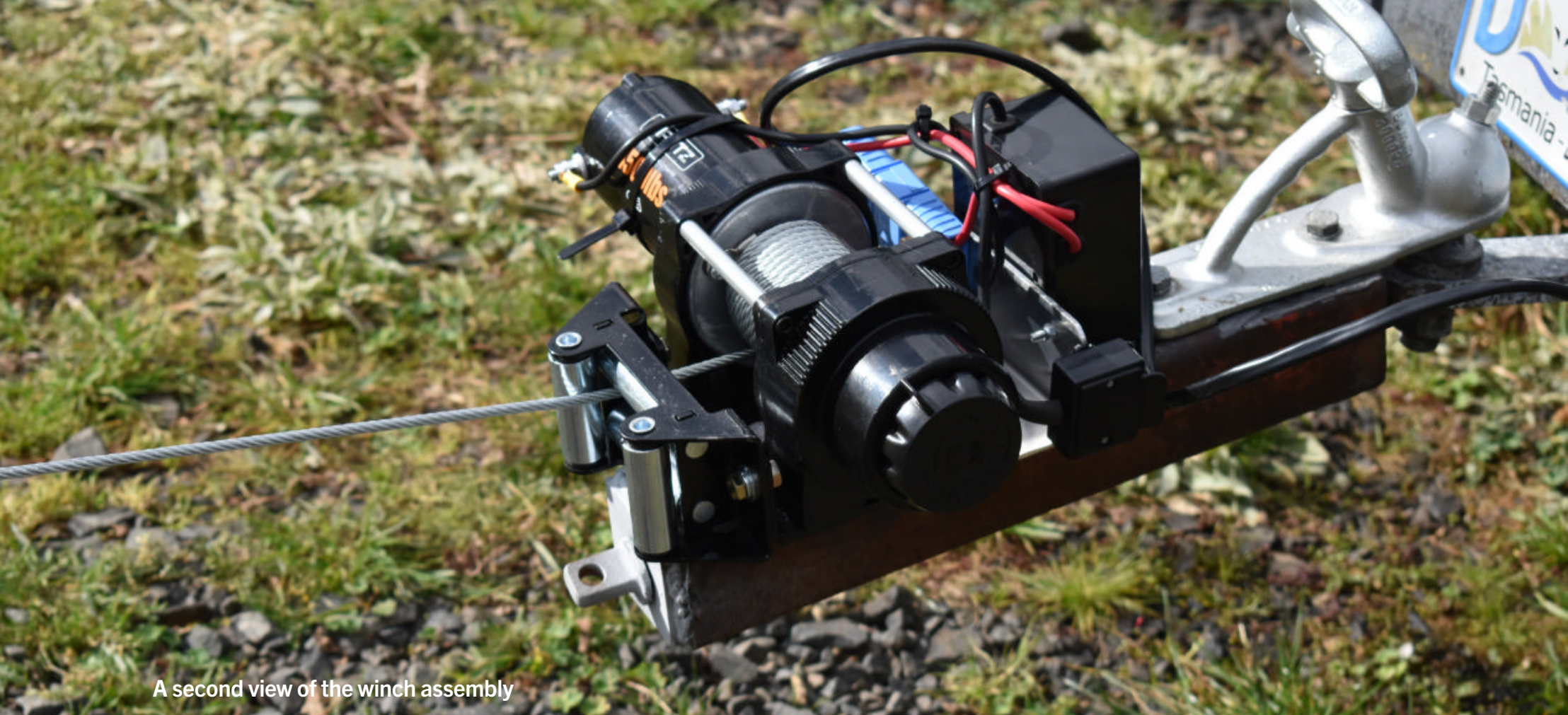
There is a way that the drawbacks of front-mounted winches can be avoided at the same time as both the winch and the vehicle are made more versatile. Instead of a permanently mounted winch, why not mount the winch on a short bar with a tow-ball fitting on one end? Yes, it does make it more cumbersome and a bit more grunt will be needed to position it when the need arises, but it suddenly becomes far more versatile.

The modification required to the vehicle is a tow-ball bracket on the bull bar, or at a strong point on the bumper bar. A tow ball on the front of any vehicle is a great asset. I have fitted them on several of the work vehicles I have owned over the years simply because they make it so much easier to manoeuvre trailers into tight spaces, and place them exactly where you want them. However, the normal car ►

Almost every four-wheel drive spends a large proportion of its life without doing anything that calls for a winch

A front-end view of the winch ready to work





A second view of the winch assembly

Having a robust ‘power point’ is also handy for running an emergency light or any other 12V appliance

owner need not mount a tow ball on the front of the vehicle to have most of the benefits of this winch system; all that is needed is a slight modification, which I will address later in this article.

Having a tow-ball fitting on the winch assembly has the additional benefit that the pull between the winch and its anchor point will always be in a straight line, virtually eliminating the possibility of chafing the synthetic rope or cable on the fairlead of the winch while maximising its pulling power. A fixed winch system must cope with these problems when the anchor point is offset from the direction the vehicle is facing.

Fitting the electric winch

You will need to run a suitable-sized positive cable from the battery to both ends of the vehicle, so that you can connect the winch to power when you deploy it. I would recommend this if you are using a really heavy winch capable of pulling three or more tonnes. For lighter duty winches, Anderson plugs are sufficient. These Anderson plugs are now capable of transmitting 50A to more than 175A, depending on the size you select. Having a robust ‘power point’ is also handy for running an emergency light or any other 12V appliance as long as you have the appropriate Anderson plug fitted to the appliance.

An alternative, if cargo room isn’t

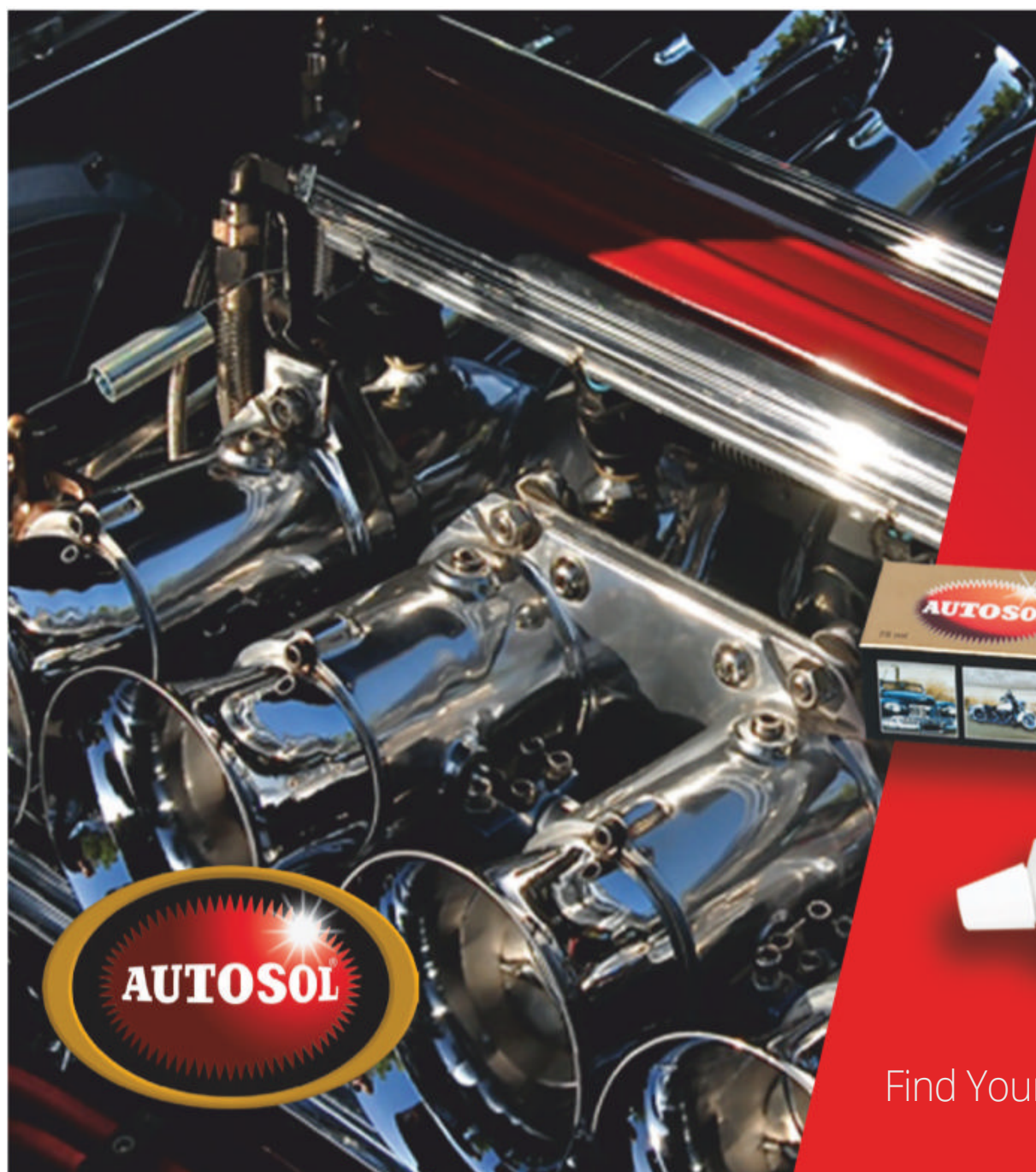
critical, is to set the winch assembly up with a dedicated extension lead (as I have shown in the diagram). Fit an Anderson plug on short leads to the vehicle battery as needed, or permanently. This set-up allows the winch to be used on any vehicle with a tow ball, making it even more versatile. For added versatility, make up a short lead with an Anderson plug on one end and a couple of solid alligator clips on the other.

The main drawback of setting up your winch as a detachable unit — apart from the physical exertion required to get it ready to do its job — is that the assembly takes up cargo space. Set against that, of course, is the advantage that your vehicle won’t be dragging it around 24/7.

An option is to consider using a smaller winch in combination with some pulleys. If you go down this route, remember the correlation between effort and distance. As a rough rule of thumb, doubling the distance halves the effort required. Even a small winch can exert considerably more pull if a sheaf pulley is used at the anchor point, and will probably suffice in most situations — unless you are determined at all costs to bog your vehicle down to the floorpan. A smaller winch takes up less cargo space and the physical effort needed to deploy it is considerably reduced, as is the financial outlay incurred in purchasing the equipment. ►



Constructing the hook attachment for the double-pull configuration



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Note the direct line pull because the winch is tow-ball mounted

A winch that can be lugged around and fixed to a post, beam, or other strong point, with a 12V battery close by, becomes useful in all sorts of ways

Although this article has focused primarily on the benefits of an electric winch that is movable in relation to vehicles, such an assembly can also be useful in moving heavy and awkward objects around your shed. A winch that can be lugged around and fixed to a post, beam, or other strong point, with a 12V battery close by, becomes useful in all sorts of ways.

Power and positioning

That brings me to the point of modifying a winch assembly for vehicles without a front tow ball.

A short section of suitably sized chain, which can be attached to that already welded to the bar, and a comparable-sized D-shackle will allow the winch to be attached to any strong point on your vehicle's subframe and back to the winch bar. If you are unsure what suitable points there are on the vehicle, consult a mechanic. However, as a general rule never tie the winch

off on steering arms and the like. The length of extra chain needed depends on the vehicle, but should be sufficient to clear the bodywork.

A light winch capable of a direct pull of around 1300kg costs as little as \$120 online. Add a sheaf pulley for \$20 and you have a winch potentially capable of exerting 2600kg of pull.

Add a second pulley and suddenly you're getting close to the four-tonne

range. The distance you can pull before you have to reconfigure your recovery efforts will obviously shrink commensurately. However, that may be a small price to pay if you're not inclined to make a habit of getting yourself continuously bogged. You can minimise the tyranny of small distance by adding a heavy-duty cargo strap, such as the ones trucks use to tie their loads down. They are incredibly strong, and a 2.5-tonne strap costs around \$50. They're lightweight, kind on anchor points such as trees, and easily adjusted for length as you pull yourself out of trouble.

If you want to go a bit more heavy-duty, companies like Kogan in Australia sell electric winches with a pulling capacity of 4500 pounds (2040kg) for around A\$200, with either steel cable or synthetic rope. I opted for one of these and blue Anderson plugs rated at 175A. Those of you who own mid-range SUVs will probably find this size of winch adequate for most situations, depending on the extent of your off-road adventuring.

Fitting tips

A note on Anderson plugs: They come in various amperage ratings and are colour coded in such a way that they cannot be accidentally connected incorrectly — i.e., grey goes only with grey, blue with blue, and so on. Therefore, if you have a caravan that charges its batteries via the vehicle alternator while travelling, with the more commonly used 50A standard grey Anderson plug, select different-coloured Anderson plugs



The basis of the portable winch



The winch baseplate and tow-ball hitch fitted



The winch, and all required accessories, in its box

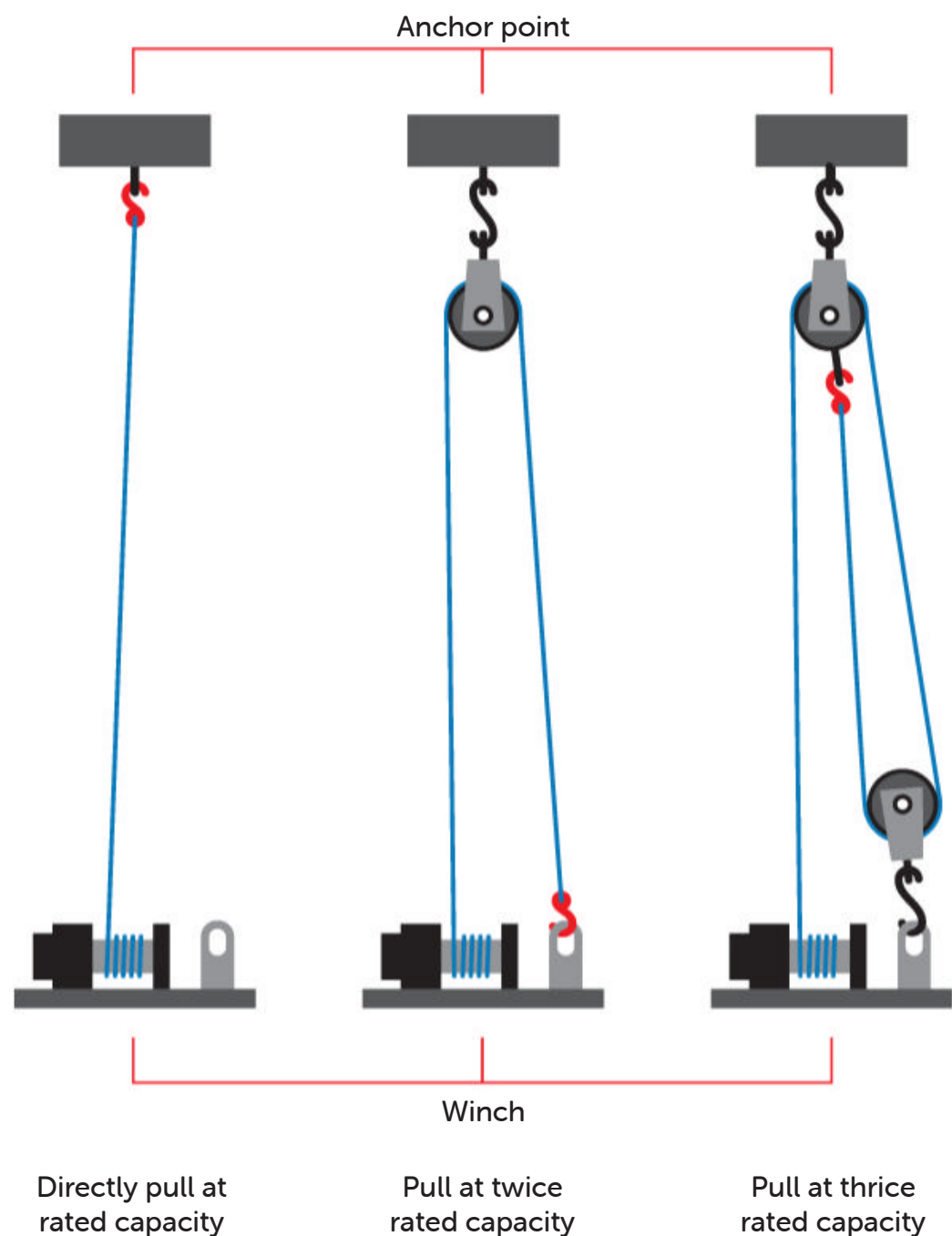
for your winch; that way you won't accidentally connect it to the thinner gauge charging circuit and melt the vehicle's wiring.

It is also advisable to leave the engine running while using the winch to minimise the chance of flattening the battery. Electric winches draw so much power under load that they will quickly drain a battery to the point at which it is incapable of restarting the engine — a situation that is not much better than being bogged in the first place. If, however, this does happen to you, sit down and enjoy the surroundings for a few hours, as a battery in good condition will gradually recover from the ordeal sufficiently for you to be able to restart the engine.

How to use

Using your portable winch is straightforward. Hook it to the tow ball, pay out the cable or rope, anchor it to a strong immovable point, and connect it to the battery's Anderson plug. It's then just a matter of starting to winch the vehicle out of its predicament. Although this is not the place for discussing winching techniques in detail, I would advise you to take a few safety precautions. ►

Using pulleys to increase winch capability



Remember that winching involves drawing together an object that doesn't want to move with an object that can't move. Two things can happen: one of the objects moves, or the equipment fails. The latter can be very hazardous, even fatal. Throw a bag, floor mat, or something similar over the cable when you start. If the cable breaks, it will whip around and cut anything in its path as it releases its pent-up energy; the material hanging on the cable will help dampen the whip. If your winch has a remote control, which most do these days, work the winch from well out of harm's reach.

Bear in mind also that the tow-ball coupling is probably rated lower than the winch cable; securing the winch assembly with the short chain, as you would a trailer, will add to the safety of the operation.

Make a habit of never standing between your stuck vehicle and the anchor point as you winch; any mishap will be in the direction of the pull.

Having said that, some of you will notice from the photos that my winch has its in/out switch located directly behind the winch — a very nasty position to be standing in if things go awry. This switch came with the winch, as did a remote control. It's my intention to use the switch only while getting the winch to take up the slack. Once it starts pulling, I will be using the remote and standing well out of the way.

The winch set up to pull at an angle to the vehicle



Remember that winching involves drawing together an object that doesn't want to move with an object that can't move

Construction

Construction was straightforward.

I used a section of 75x5mm box section, 410mm long for the base. Into it I tapped four 10.0x1.5mm threads to hold the tow-ball hitch and the winch baseplate. Between the two I screwed down a short piece of aluminium bent at 90 degrees and large enough to locate the controller box, the remote in/out switch, and a blue 175A Anderson plug. On the winch end, I welded a rotating eye to take the winch hook when doubling up the cable.

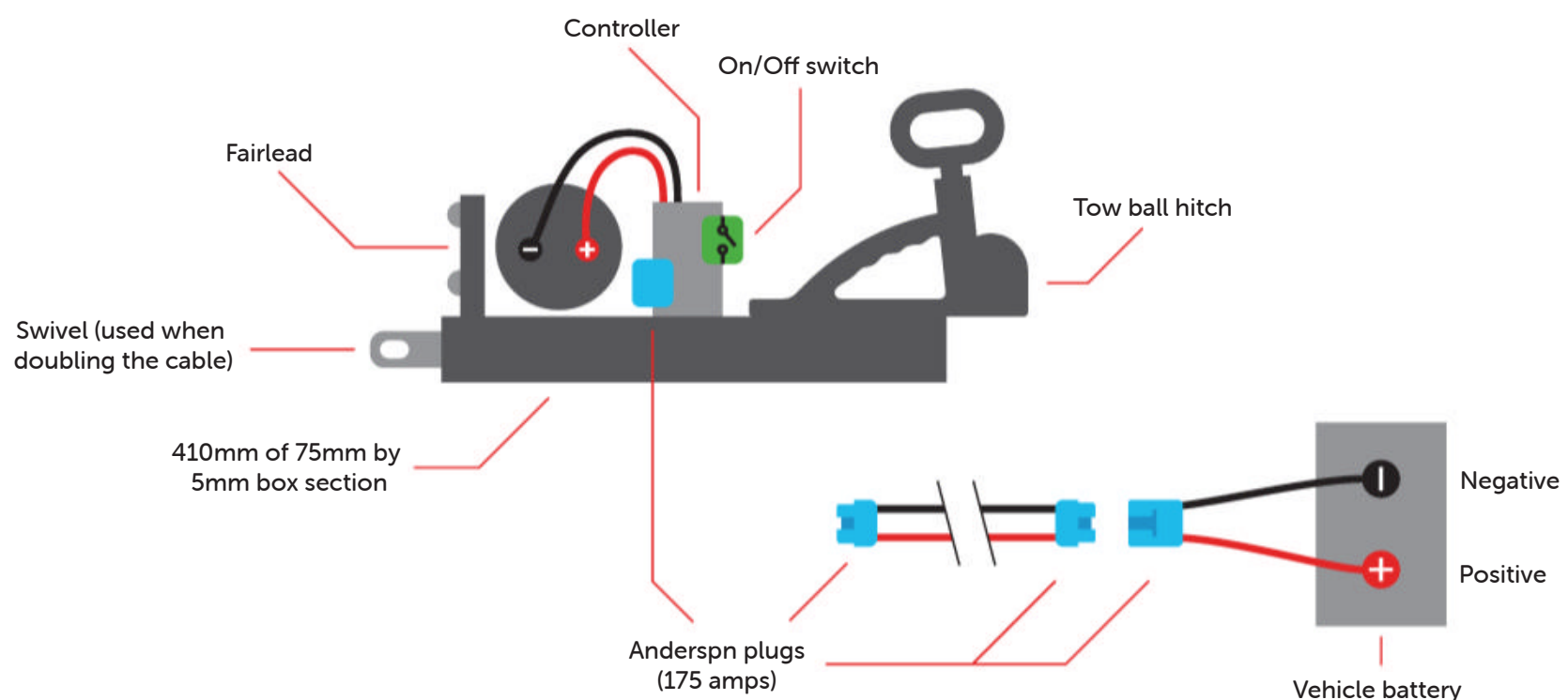
Some modification of the wiring is required, as the winch comes standard with long cables for the switch, the leads running from the controller to the winch, and the battery. I'm not a fan

of bundled wires strapped any which way, so I shortened all the cables to suit the winch configuration. I then fixed an Anderson plug to both ends of 6m of main cable running to the battery. This allows it to be rolled up separately from the winch unit rather than having to be wrapped up around it.

To finish off, I built a simple plywood box to house my winch assembly as well as the ancillary bits and pieces. This makes the whole rig ready at hand, in one convenient unit, and prevents it snagging on, or being battered by, the other camping equipment packed on top of and around it.

Of course, with this winch you will have to forgo that macho look, but I think you will find that a small price to pay in the long run. 📁

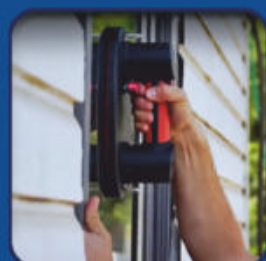
Winch assembly diagram



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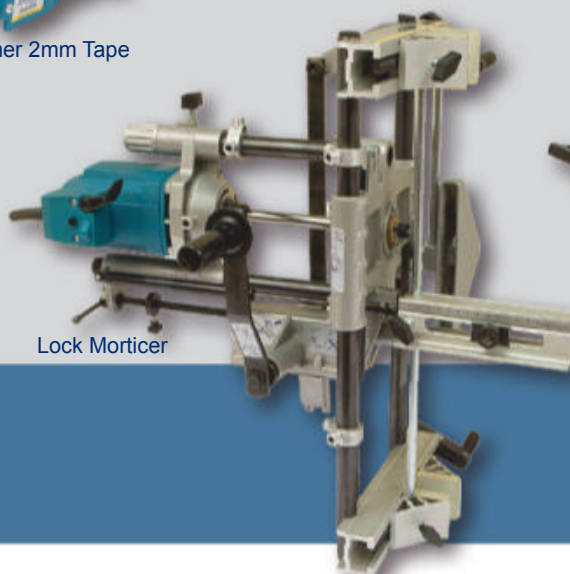
Manual Edgebander



Tilt Trimmer



Biscuit Joiner



Lock Morticer

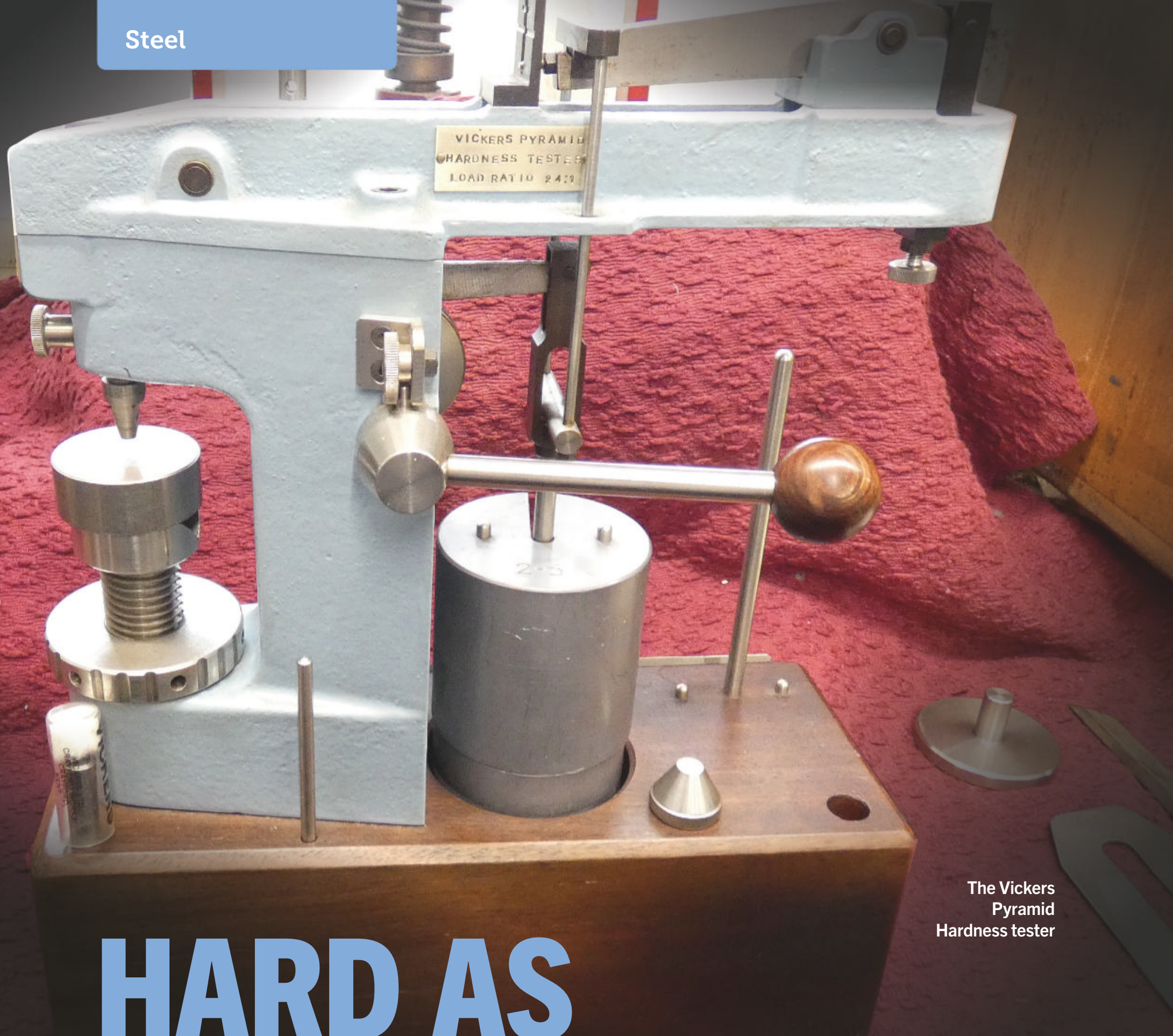


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The Vickers
Pyramid
Hardness tester

HARD AS

FOREVER SHARPENING YOUR TOOLS? MAYBE THEY ARE MADE FROM THE WRONG TYPE OF STEEL

By Ritchie Wilson

Photographs: Ritchie Wilson

A tool which keeps its sharpness — its edge — is much preferred by the sheddie to a tool which quickly becomes dull. The characteristic of tools which keep their edge is hardness.

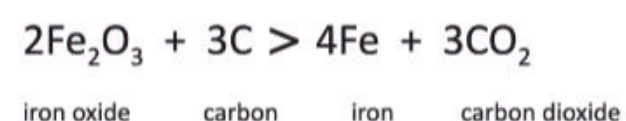
For more than 3000 years the material usually used in much of the world for cutting tools, such as knives, chisels, saws, taps, files, and so on, has been steel — iron with a pinch of carbon — but not just because it is hard.

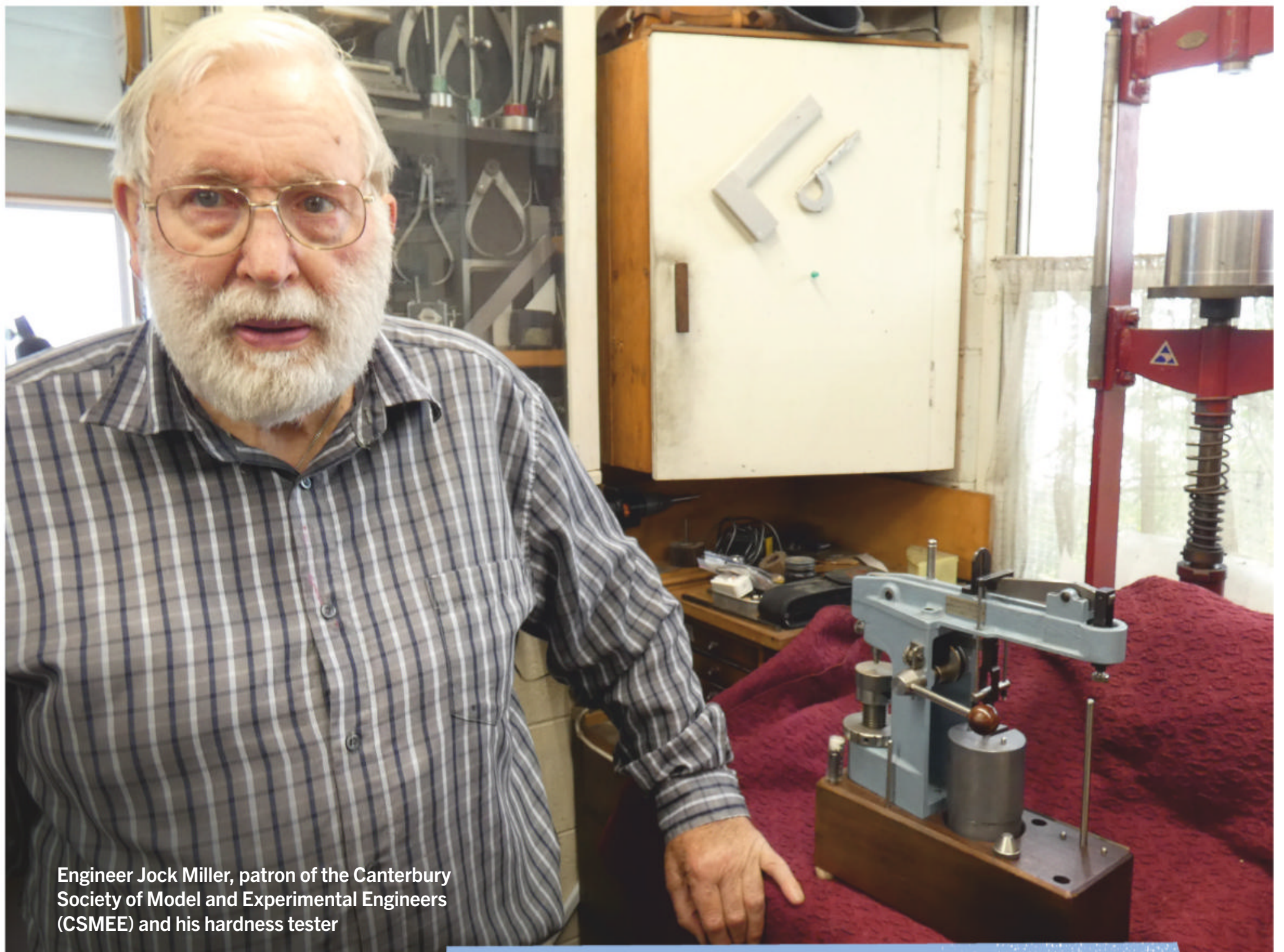
Bronze, a mixture of copper and tin,

which preceded steel as the common metal for toolmaking and weapons, is nearly as hard as steel but is also far more expensive and heavier. It is theorised that the Bronze Age in prehistory came to an end not because of the superior hardness of steel but because of the relative difficulty, especially in times of war, in simultaneously sourcing both copper and tin, which aren't usually found near each other, rather than just iron ore, which is widely distributed around the world.

Smelting steel

Iron is a reactive metal, so is nearly always found combined with other elements, principally oxygen. Iron meteorites that have recently fallen to Earth from space are the exception. The iron in iron ore is separated from the oxygen by being heated with carbon in a blast furnace:





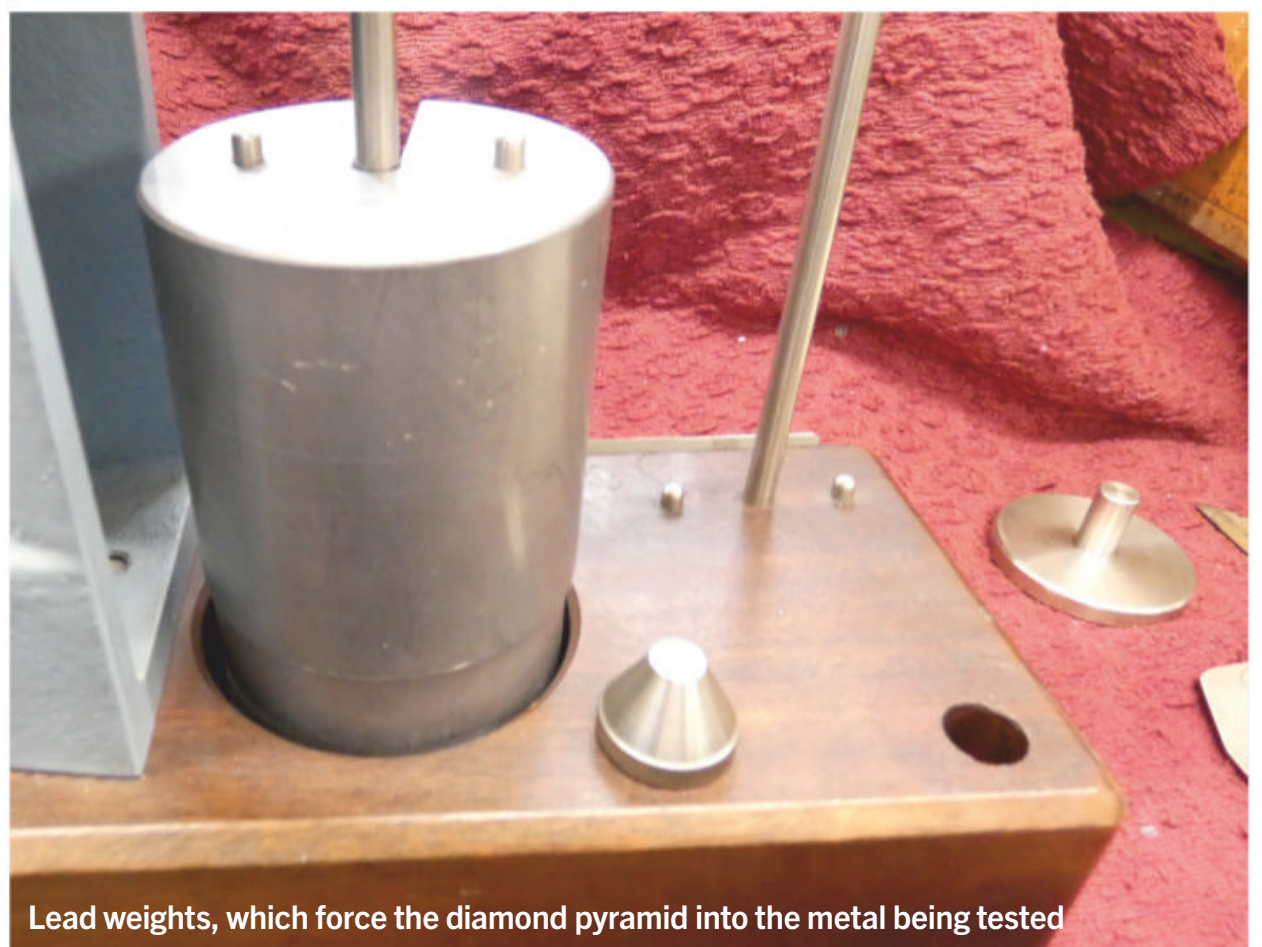
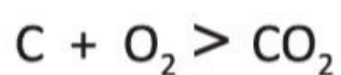
Engineer Jock Miller, patron of the Canterbury Society of Model and Experimental Engineers (CSMEE) and his hardness tester

If the iron atoms are stuck in position, the iron is hard — it will resist bending or denting

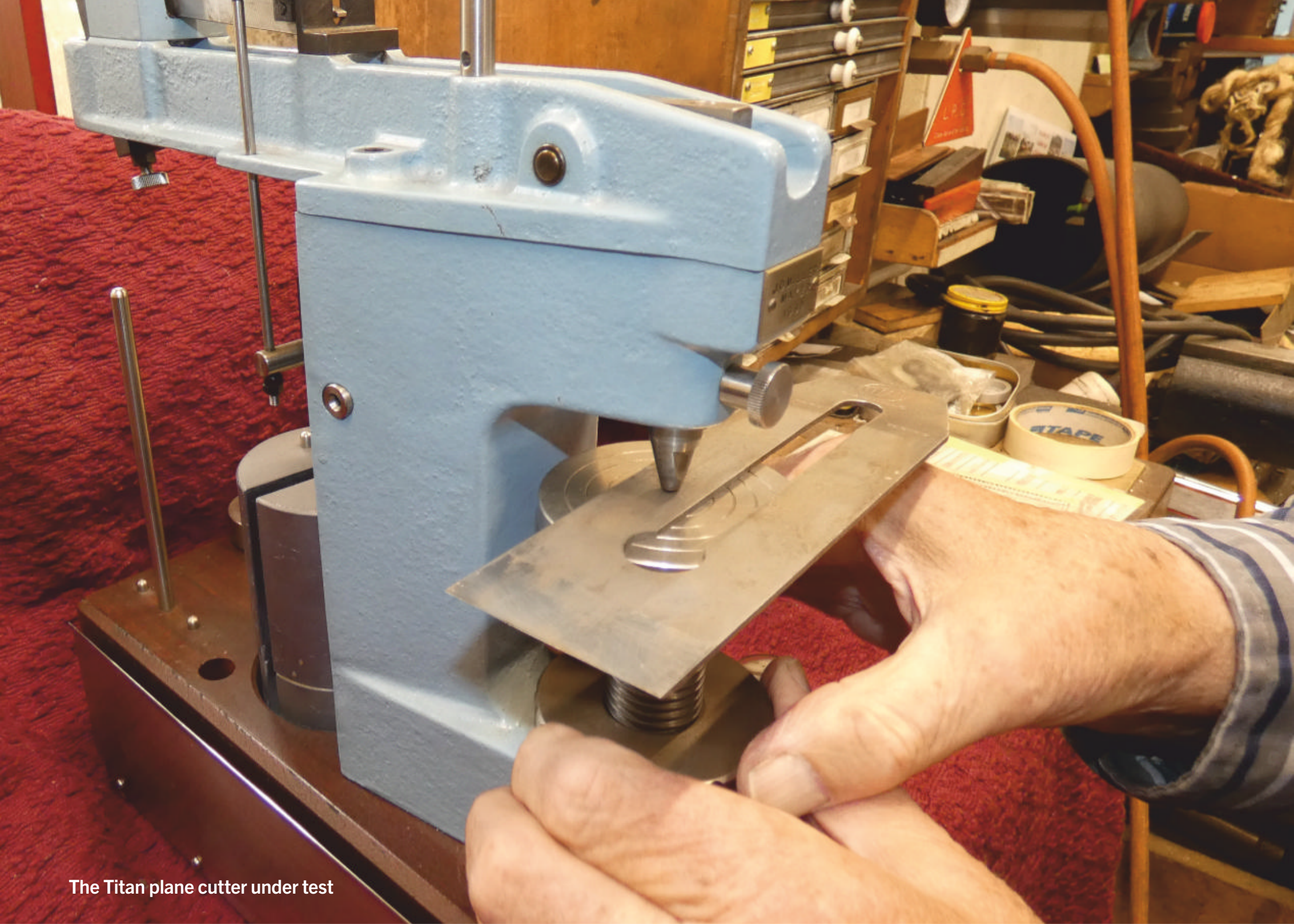
The cast iron produced in the blast furnace contains about two per cent carbon, which makes it very brittle and hard in comparison with pure iron. The carbon stops the iron atoms moving relative to one another, similar to the way clay stops the 25mm crushed stone found in top-course from moving around. If the iron atoms can move, the iron is malleable; if the iron atoms are stuck in position, the iron is hard — it will resist bending or denting.

The carbon dioxide (CO₂) made as a by-product of iron smelting is of increasing worldwide environmental concern.

Most iron used today is mild steel, which has less than 0.3 per cent carbon. The unwanted carbon is removed from cast iron to make mild steel by bubbling air through molten cast iron, turning the excess carbon into CO₂ gas, which bubbles off: ►



Lead weights, which force the diamond pyramid into the metal being tested



The Titan plane cutter under test

When tools are sharpened they may lose their hardness if they are overheated during the sharpening process



Jock Miller operating the VPHT

Tool steel and mild steel

Mild steel is perfectly fine for most uses, but, because it contains so little carbon, it can't be hardened to make files, knives, chisels, and plane cutters. Steel which can be hardened is called 'tool steel' and contains from 0.5 to 1.5 per cent carbon. When heated to a cherry-red colour and quickly cooled by immersion in water, the iron and carbon arrange themselves in a different way to form a harder substance, which can be sharpened to form a long-lasting cutting edge.

The hard steel formed is usually impracticably brittle, so is easily broken. The brittleness is reduced to more usable levels by annealing, whereby the hardened steel is heated to a specific, lower, temperature and allowed to

slowly cool in a controlled manner.

Unfortunately, the hardness is also reduced somewhat. In some situations a small section of harder steel is welded to mild steel to make a tool that doesn't break easily but that has a hard cutting edge which stays sharp for a long time.

If hardened steel is heated to a reasonably high temperature and then allowed to cool slowly, the carbon again changes and the tool steel loses its hardness. When tools are sharpened they may lose their hardness if they are overheated during the sharpening process.

Hardness testing

There are various methods of measuring the hardness of steels.

Jock Miller of Christchurch is a

Hardness Testing Table 1

Tungsten Carbide Indenter 136 deg. square base pyramid, 30 kg load.

Length of Diagonal mm	Hardness No. kg/mm ²	Depth of Impression mm
1.00	56	0.143
1.05	50	0.150
1.10	46	0.157
1.15	42	0.164
1.20	39	0.171
1.25	36	0.179
1.30	33	0.186
1.35	31	0.193
1.40	28	0.200
1.45	27	0.207
1.50	25	0.214
1.55	23	0.221
1.60	22	0.229
1.65	20	0.236
1.70	19	0.243
1.75	18	0.250
1.80	17	0.257
1.85	16	0.264
1.90	15	0.271
1.95	14.6	0.279
2.00		0.286
2.05		0.293
2.10		0.300
2.15		0.307
2.20		0.314

Hardness Testing Table 2

Tungsten Carbide Indenter 136 deg. square base pyramid, 120 kg load.

Length of Diagonal mm	Hardness No. kg/mm ²	Depth of Impression mm
0.40	1391	0.057
0.45	1099	0.064
0.50	890	0.071
0.55	736	0.079
0.60	618	0.086
0.65	527	0.093
0.70	454	0.100
0.75	396	0.107
0.80	348	0.114
0.85	308	0.121
0.90	275	0.129
0.95	247	0.136
1.00	223	0.143
1.05	202	0.150
1.10	184	0.157
1.15	168	0.164
1.20	155	0.171
1.25	142	0.179
1.30	132	0.186
1.35	122	0.193
1.40	114	0.200
1.45	106	0.207
1.50	99	0.214
1.55	93	0.221
1.60	87	0.229
1.65		0.236
1.70		0.243
1.75		0.250
1.80		0.257
1.85		0.264
1.90		0.271

2.45	37	0.350
2.50	36	0.357
2.55	34	0.364
2.60	33	0.371
2.65	32	0.379
2.70	31	0.386
2.75	29	0.393
2.80	28	0.400
2.85	27	0.407
2.90	26	0.414
2.95	26	0.421
3.00	25	0.429

Hardness Testing Table 3

5mm dia. Steel Ball Indenter, 30 kg Load.

Dia. of impression mm	Hardness No. kg/mm ²	Depth of Impression mm
1.25	24	0.08
1.30	22	0.09
1.35	20.6	0.10
1.40	19.1	0.11
1.45	17.8	0.12
1.50	16.6	0.13
1.55	15.5	0.14
1.60	14.5	0.15
1.65	13.6	0.16
1.70	12.8	0.17
1.75	12.1	0.18
1.80	11.4	0.19

Chart comparing the size of the pyramidal impression and the metal's hardness

Jock constructed the tester from plans in Britain's Model Engineers' Workshop magazine

lifelong model maker and a retired professional engineer. He uses a Vickers Pyramid Hardness tester (VPHT), which employs a pyramid-shaped diamond pressed into the sample with an adequate force to measure the sample's hardness. The deeper and wider the impression the diamond pyramid makes in the steel the less hard it is.

Jock uses a graduated microscope to measure the diameter of the impression and then reads the Vickers Hardness (HV) off a chart. Apparently the size of the impression is independent of the size of the force on the diamond above a minimum force.

Jock constructed the tester from plans in Britain's *Model Engineers' Workshop* magazine, using castings ►

Another Australian plane cutter engraved: "FALCON: A POPE PRODUCT; MADE IN AUSTRALIA — 2IN — ROCKWELL TESTED" — meaning Rockwell Hardness (HR) tested. There must have been a need for tools of reliable hardness in post-World War II Australia



The firmer chisel engraved
“TITAN AUSTRALIA”

purchased in the UK and a diamond — they occur naturally in the shape of a pyramid — that was given to him by a fellow modeller who had bought a professional VPHT that came with two. The cost of shipping the castings was similar to the purchase price.

Failure of a structure test

Jock machined the castings and the mechanical linkages himself and used it in his job as a consulting engineer. One job Jock was given when he was working for a large engineering consultancy involved investigating the

cause of the failure of a structure after it had been dismantled and moved to a new location. The contractor re-erecting the structure had lost the original nuts and bolts and had purchased new ones from a local hardware store. These failed under load.

Jock was able to show that the failed bolts were less hard than the originals and so, because there is a relationship between the hardness and the tensile strength of steel, were less strong. The conclusion was that the substitution of weaker fasteners had caused the structure's failure.



Testing the Titan firmer chisel's hardness



Titan plane cutter and chisel

The contractor re-erecting the structure had lost the original nuts and bolts and had purchased new ones from a local hardware store. These failed under load

Titan Tools

For several years after World War II, when tools were in short supply everywhere, Australian steelmaker BHP manufactured firmer chisels and plane cutters at a factory in Hobart, Tasmania, under the ‘Titan Tools’ brand. These were advertised as being individually factory tested for hardness so Jock was persuaded to use his VPHT to determine the hardness of a Titan chisel and plane cutter.

Testing for hardness

Jock placed the plane cutter under the diamond pyramid near the cutter’s edge and screwed the diamond’s holder down until a measured force was applied by the diamond. The 20kg mass was then released and, through a

lever system, the device’s full force was exerted on the diamond.

Because the cutting edge of the plane cutter was exceptionally hard the impression made by the diamond was tiny. Under the 40x magnification of the Starna brand MM4020 microscope, Jock was able to measure the diameter of the impression as 0.6mm. This gave an HV reading of 618 from the calibrated chart.

This is the hardness of heat-treated tool steel, but Jock thought it looked like high-speed steel, which is an alloy (a mixture) of iron and about 18 per cent tungsten with smaller amounts of chromium and vanadium and less than one per cent carbon. The high-speed steel cutting edge is welded to the different-looking steel, which made ►

Ancient Egyptian tools

The pyramids at Giza, built by the ancient Egyptians, are made of limestone, originally with a casing of polished marble. The builders are thought to have used copper tools. Limestone has about the same hardness as copper so this would have been possible but difficult.

There is some evidence of hearths near the pyramids where, it is suggested, the masons would have reshaped and hardened the edges of their copper chisels by heating and hammering. As the limestone would quickly blunt copper tools, this must have been a frequent operation.

The Egyptians also worked granite — a much harder material than limestone — to form statues, pillars, and the like. Abandoned, partially finished obelisks (think Cleopatra’s Needle) found in granite quarries that were in use in pharaonic times show that rows of holes were bored into the rock as a first stage in extracting large granite blocks. It is not clear how these holes were drilled.

Some copper tools may have contained significant amounts of arsenic, which occurs naturally in some copper ores. A copper alloy with 10 per cent arsenic is harder than copper but not hard enough to drill granite on its own — bronze, an alloy of copper and tin, was not used until much later. A rapidly turning copper tube with sand as an abrasive has been shown to cut into granite, but it would have been hard, very slow work.

Another possibility is that the ancient Egyptians had a method of hardening copper that we don’t know about.

A few iron objects, such as knives and jewellery, have been found in very old Egyptian tombs. The pharaoh Tutankhamen had a dagger with a gold handle and an iron blade tucked inside his mummy wrappings ready for use in the afterlife. It must have been one of his most precious possessions. Recent analysis shows that the blade contains significant amounts of nickel and cobalt — which stopped it rusting — indicating that it was made of iron sourced from an iron meteorite.



A Falcon-brand plane cutter flanked by a Titan Tools plane cutter (showing the different steel at the cutting edge) and firmer chisel. A firmer chisel has square sides

up the upper part of the plane cutter. Jock tested the upper part of the cutter and measured the diameter of the pyramidal impression at 0.9mm, giving a hardness of 275HV.

The Titan Tools plane cutter had engraved on it: “guaranteed hardness tested”, but Jock couldn’t find any evidence of this, probably because honing of the edge had obliterated the testing mark.

The chisel

The ¾-inch firmer chisel was found to be very hard, and next to the pyramid forced into the bottom of the blade by his tester Jock found a tiny circular depression. This would have been the result of the factory hardness test, which would have used a hardened steel ball forced into the chisel to give a Rockwell (HR) or Brinell (HB) hardness number.

To sharpen such hard steel, something harder, such as alumina, diamond — the hardest known substance — or silicon carbide (carborundum), is needed.

Australian Dick Lynch wrote the 320-page book *Collecting Titan Chisels*, which, despite its rather hefty price, sold out its first edition and has been reprinted. You can buy the book from the author, who can be contacted at dicklynch43@gmail.com.

Faulty heat treatment, giving the wrong hardness and insufficient strength, is a common cause of

mechanical failure. In one case the rear axle of a new Hillman Imp car broke, as did its replacement. The factory declined to pay for the repair until the owner, fortuitously a metallurgist, was able to show that the axles had escaped heat treatment and so were not up to the job.

The emphasis on the hardness of Australian chisels and plane cutters in old advertisements suggests that the local market was wary of easily blunted tools, perhaps from previous experience of tools of disappointing performance. 

These were advertised as being individually factory tested for hardness



The 50mm plane cutter “GUARANTEED HARDNESS TESTED”

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POST-COVID, MORE ‘MONEY IN THE BANK’ SEEMS A DESIRABLE FUTURE-PROOFING RESPONSE

By Murray Grimwood

Photographs: Murray Grimwood

Increasingly, as time has gone on, I’ve tried to demonstrate that a satisfying lifestyle can be had without jeopardising our grandchildren’s options. It has meant going off-grid philosophically as well as electrically.

I’ve come to see money as a bet that there will be something to buy in the future and I see too many such bets being laid. The antidote is easy: buy what you think you will need in the future, now. I value blades and bits, good tools, hose fittings, alkanthene pipe, chain-bar oil, stocks of assorted bolts, and stacks of useful extrusions more than I do the digits in our bank’s computer. Indeed, I call having that stuff ‘money in the bank’.

Simple, maintainable, maintenance-free

Our first approach hereabouts was to stay minimalist, on the basis that if you don’t have it, it won’t need maintenance or replacement. So the house is passive solar rather than active solar; the sun heats parts of it directly rather than our using pumps, fans, or compressors. Nothing to break down. However, I’m no stranger to elegant engineering — indeed, I’ve long asserted that the most elegant is that which isn’t there; that which has been eliminated by good design. So the house also uses the ‘hot air rises’ principle to direct flow and circulation, using simple flaps as ‘switches’.





A 20W panel for charging cell phones and laptops during lockdown

So, 5W of solar panel turned into 200W, then we added 300 more, and 2A of Pelton wheel nudged up nearer to its theoretical 6. Batteries — all second-hand — came and went.

Post-Covid, we decided to rationalise things; to future-proof ourselves and turn some bank-held digits into real ‘money in the bank’. A 10-year-old solar-panel array (we knew the original owners and thus its history) came home on the trailer. Good panels are



Extra LEDs hung strategically over workstations (and below)



An old-school knife switch for swapping battery banks

generally guaranteed for 20–25 years and the accepted decay rate is two per cent output loss a year, so this stack represented 2.5kW in their present state. That was far too much for us so we passed on half of them to another off-gridder and stored our half in the dark — money in the bank.

Hang on, I can use that now

Well, almost all of our half. A couple of forklift batteries from a ‘dead’ bank had done a detour on their way to the scrap merchant, ending up under my workbench. So I put one of the panels to work, via a cheapo controller — PWM (pulse width modulation) controllers are cheap, and good enough when dealing with end-of-life batteries; MPPT (maximum power point tracking; this is arguably what you want controlling a new/expensive bank).

Another bank of batteries came from a cell-phone tower via someone else’s unrealised dream. These deserved MPPT control, and got it. They became the No. 2 house-battery bank, either/or switched by an old-school knife switch. The unloading of our already lightly used backup generator was instantly noticeable.

I’m writing this using bank No. 1 via our 1500W inverter and my computer’s standard 230V charger, whereas I would have previously used the 12V charger — while keeping an eye on the sun and the battery voltage.

Resilience and capacitance

In a way it’s a frivolous energy-indulgence; in another way it represents resilience, capacitance. Whatever, we now have three separate sub-300W stand-alone systems, plus a couple of smaller solar phone-charging and battery-topper-upper circuits. Any one of the three can be asked to do the job of another; it’s a comfortable position to be in.

With some extra LEDs hung strategically over workstations we’re just that little bit more resilient. Having 12V systems, I add a twin wire and clips to dead battery — and therefore free — 12V or 14.4V cordless drills, making them my semi-portable hole makers. Clipping in the faithful DeWalt, and making an over-bench holster for it out of scrap spouting, was the icing on the cake. Bliss. ►



Primary bank: four very second-hand 215-amp-hour, 6V cells



A couple of old forklift batteries and a cheap controller now sit under my workbench



No. 2 battery bank: 201-amp-hour, 2V cells



The faithful DeWalt, holstered for action and showing the 12V feed

But wait, there's more

After all that, a friend who had gone on-grid — or is that an oxymoron? — said she wanted her windmill gone. Bolted to a long dead and rotting macrocarpa stump, echoing the nor'-west gales into her house via its catenary wire (for her, it was somewhat like living inside

Jimi Hendrix's guitar); it was time. I vaguely remembered the unit as being a cut above DIY, bigger but a few generations (pun intended) older than the current forms of domestic whirlygig. Inspection confirmed it to be a serious piece of older engineering, well thought out but perhaps noisy due to there being no washout; that is, no twisting off of the extruded blades

as their tips are neared. Some part of each blade is therefore always going to be stalled, and there are five of them chopping the air in front of each other. Result? Noise.

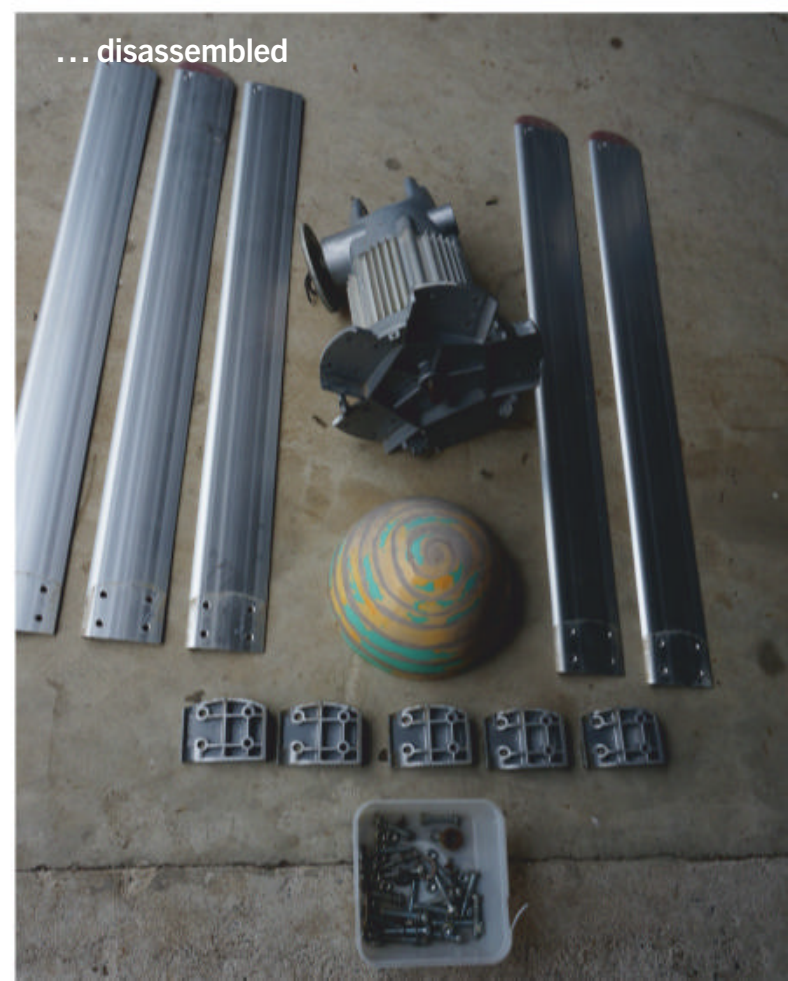
What's not to love about wind?

While I pivoted it down, disassembled it, and trailered it home, various thoughts circulated (in the windmills of my mind?). I will re-bearing it and clean it up but I suspect we won't deploy it here due to intermittency. We tried wind once before; nothing, nothing, nothing, then a gale. We'd lie there late at night as the gusts made the electronic brake howl, saying: "It's money in the bank, but if that was the neighbour's, I'd shoot it." Then nothing, nothing, nothing, again. However, I love the aesthetics and the engineering of this one and look forward to refurbishing it while learning in the process.

That includes the detective work. The only still-decipherable item on the manufacturer's label is '50Hz'. What does that mean? There are three slip-rings/brushes and three wires away; does that mean I have to go back and search for a rectifier unit? Or buy one? Oatley Electronics in Australia supplies a nice little kitset board (A\$57 last time I checked), but maybe this unit needs something bigger in the diode department? We'll see, and no doubt we'll have fun doing the seeing. 📁



Windmill gently cantilevered down and ...



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A SMALL, SMALL WORLD

THE KEY IS GETTING THE PROPORTIONS RIGHT — WHETHER YOU ARE DESIGNING A MANSION, A BRIDGE, OR FURNITURE FOR A DOLLS' HOUSE

By Nathalie Brown

Photographs: Juliet Nicholas



Perfectly proportioned, the setting on the first floor landing looks just like the real thing when viewed in close-up



Peter and Lynda have completed the first house, but, they say, there is always room for change

Peter Brocklehurst might have guessed he was starting something big when he gave his wife Lynda a copy of Queen Mary's Dolls' House by Mary Stewart-Wilson, inscribed "To Mummy at Christmas 1988 from Claire and Helen". The girls were preschoolers at the time, so they cannot be held accountable for what was to come.

The beautifully photographed book is a record of what is probably the largest and most detailed dolls' house in the world. It has inspired miniaturists and dolls' furniture-makers since 1924, when more than 1.6 million people saw it at the British Empire Exhibition. It is now on display at Windsor Castle.

Peter's interest in dolls' houses really came alive when his father, Joe, made one for granddaughters Claire and Helen in 1994 while he was visiting from the UK. Peter made several pieces of wooden furniture for it, and since then he and Lynda, with help from Claire as she grew older, have worked together building and furnishing two dolls' houses. A third is under way, and Lynda is working on a tiny fourth. ►



Peter's tiny shed — 4.2 x 2.4 — is tucked into the back of the garden



Peter at the bench saw

She has impressive skills with fabric, sewing the dolls' soft furnishings and fashioning non-wooden miniatures in her dedicated workroom, while Peter makes the wooden furniture in his shed.

New home, new shed

Peter has always had a shed. In their previous home on a 10-acre block at Irwell on the outskirts of Christchurch, he had one that suited his practice of building extensions to the family home. In retirement, he and Lynda have moved to a smaller property in Springston, Canterbury, where his little gem of a shed — 4.2 x 2.4 — was the biggest he could build without a permit, and perfect for turning out miniature furniture as well as one-off pieces for the family home.

For Peter, furniture-making is most often a winter pursuit. In the summertime, he turns to fishing, boating, and driving his vintage Riley RMB, complete with period clobber.

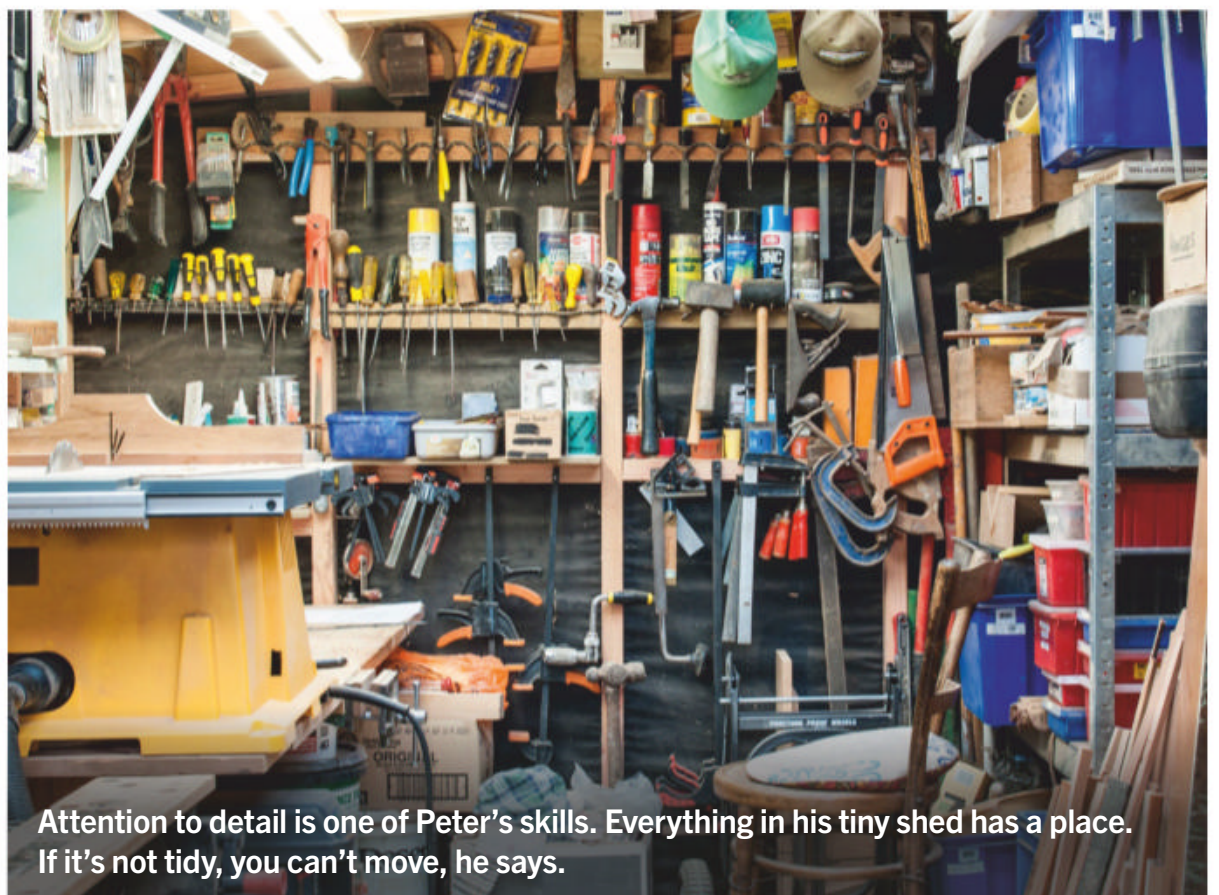
Born in Cheshire in the UK, he gained a BSc in civil and structural engineering from Leeds University

in 1970, a time of industrial unrest in the UK when there wasn't enough electricity being generated for businesses to operate full time. As a result, he could work only four days a week.

"I began looking for new opportunities and was interviewed by a New Zealander recruiting for a

consulting engineering practice in Wellington. I got the position, arrived here in 1974, and was asked to open an office in Christchurch in 1980. I met Lynda in 1981, and we've lived on the outskirts of Christchurch ever since."

Peter's professional life has always been in civil engineering, mainly in contracting. He retired at 68 in 2016. ►



Attention to detail is one of Peter's skills. Everything in his tiny shed has a place. If it's not tidy, you can't move, he says.



These pieces have yet to be incorporated into the three houses



This delicate rimu table has turned legs



A kauri dining table. See the construction process on page 112

Tips and techniques

Peter explains that getting the proportions right is the primary consideration in designing and making a dolls' house.

"It's important to make the rooms large enough to offer a good view of the back wall and the space in front of it. If the room is too narrow it's difficult to see to the back, let alone position the furniture and decorate.

"When I'm making furniture for the three main houses, I use a $\frac{1}{12}$ th scale, which is the same as Queen Mary's Doll's House. Detailed proportions are crucial for the furniture. Without the correct proportions and size, these pieces can appear very chunky: the thickness of a tabletop, the thickness of table and chair legs, the size of any wood inlays, the scale of any room ornaments, and suchlike, can make or break a piece, and therefore the room. I measure our full-size furniture at home when I'm planning a new piece and divide each measurement by 12.



Two images from Queen Mary's dolls' house — the pinnacle of its kind

"The grain of the wood on the pieces is also important. Although it will not be possible to get wood with a grain that is $\frac{1}{12}$ th the width of natural timber, I try to get as close a grained wood as possible.

"You want fine-grained wood like heart rimu and kauri. You can find small pieces at demolition timber outlets. I keep an eye out and have collected it over the years. At times people have approached me saying they have something I might be able to use. I have been known to buy second-hand chests of drawers just to get the wood. I also look for door jambs and skirting boards.

"I once used apricot wood from a branch in the garden to make a wardrobe for Claire's dolls' house, but I buy my 1mm base wood and other veneers in sheets from Acorn Models in Christchurch."

It takes two or three days to make a piece of dolls' furniture, depending on the number of glue-ups. Peter used metric measures, but the old dolls' house books are in imperial measurements. He has made much the same pieces for each of the three dolls' houses.

Peter points out that there is a distinction between miniatures and dolls' house furniture. Miniatures tend to be fine pieces for display only and children can look at them under supervision. Dolls' house furniture is designed to be played with and is more robust. The Brocklehurst houses are a fine balance of the two, whereby very careful children might play with the pieces under supervision.





In a corner of the First House kitchen, the coal range, fashioned from kauri, has been painted black. The overhead drying rack holds Lynda's hand-made laundry



Completed furniture, fittings, and accessories that have yet to find a place in one of the Brocklehurst dolls' houses

Necessity breeds skills

Peter says his skills in woodworking were passed down from his father.

"I've always had the knack. I learnt by watching and helping him. Then, when I bought my own houses, I developed the skills out of the necessity to do them up and to make the kind of furniture we wanted.

"I do woodwork as a hobbyist or enthusiastic amateur. I make one or two pieces of furniture each year for our daughters — some for the dolls' houses and some full size."

As with any household, the dolls' house decor is never finished. In all, in the two completed houses, there are 38 pieces of wooden furniture



Peter deciding what he might do next



Lynda's upholstered chair and "stuff for making other things"



Lynda at the workbench



Colour co-ordinating spools of thread makes it easy to put her hand on the perfect match for any fabric



Lynda has a room of her own — essential for any woman dedicated to sewing and craft work

made by Peter, together with wooden window frames and doors plus 10 fireplaces and two coal ranges. Peter and Lynda have bought nine pieces of furniture; Claire has made five

pieces in materials other than wood; and Lynda has made 20 pieces of soft furniture plus many, many curtains, rugs, books, flowers, and nick-nacks as well as food. ►



Peter made the dressing table, Lynda made the blue upholstered chair in the bedroom



Perfect to the most minute detail — Lynda made the little pink slippers and the box they come in

Peter's father, Joe, bought the staircase during the construction phase. The wedding photos on the wall are miniaturised family portraits



Tools

The woodwork skills needed for standard cabinetmaking also apply to making $\frac{1}{12}$ th-scale models. Take the sofa table in the sitting room of the largest dolls' house: Peter bought the striped border, the walnut veneer, and the metal handles.

"I buy timber veneers for anything less than 1.6mm simply because this is the thinnest that my standard thicknesses can do."

He then uses a bench saw, a very fine-toothed modeller's cross-cut saw, a scroll saw, or a fret saw to cut the wood for the framing of each piece. For the sheets of wood to make the drawers, where the thickness of the bottom, sides, and back is 1mm and the front 1.5mm — which scales up to adult-sized furniture — he uses wood cut with a scalpel. He says he doesn't make dovetails in the dolls' house pieces because the furniture is just too small.

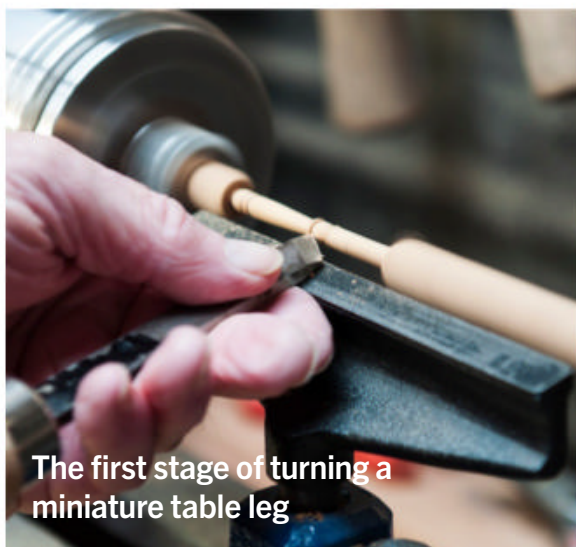
The dolls' house furniture takes PVA wood glue, the same glue Peter uses on full-sized furniture. All furniture — full size and miniature — is finished with 320-grit sandpaper, two coats of Danish oil, and beeswax polish applied with grade 0000 steel wool. Wood dyes and stains are also used for some pieces.

Peter says, "If you put too much polish on it, it looks artificial; and I don't spray with polyurethane — I think the shine looks completely wrong."

"I don't have many miniature tools. I use full-sized tools, but I've made a few adaptations for the dolls' furniture."



These are lathe tools for turning miniatures



The first stage of turning a miniature table leg



How many legs were broken while turning the miniatures?

I don't use a skill saw because it's not accurate enough. Unfortunately, there's no room in the shed for a band saw."

Peter made the saw-bench blade slot to a zero-clearance pattern to stop very fine pieces from falling into the machine. He has a router table where the router bit protrudes through the table to shape and cut profiles. He says he gets a lot of use out of it. He also has a Dremel — a miniature router to use as an engraving tool.

Other than that, Peter's tools include: a DeWalt 12-inch tabletop saw bench; a DeWalt 300mm thicknesser, with a range of 150mm to 2mm; a scroll saw to cut round corners — like a jigsaw but with a very fine blade to cut tighter corners. He has a rack of very small hand saws — modellers' saws for working with 1mm-thick wood — and any number of clamps of varying sizes, including a rack of tiny ones that are readily available through hardware stores; a wood lathe and chucks; screwdrivers, plyers, planes, and chisels; a jigsaw, electric drill, belt sander, skill saw, heat gun; a micrometre and very fine sandpaper — 120, 220, and 320 grit — glued to a sliver of wood to sand corners on the miniature pieces. Peter says many of the tools came from his father-in-law, Russ Winstanley.

A dust extractor is also a necessity. Peter uses a vacuum cleaner, and if the sawdust isn't treated, it goes on the compost heap.

Peter says the designs and patterns are often in his head, but he also finds them in books and trade publications. He has a library of magazines and books standing spine up in a drawer so that he can read the titles easily. He subscribes to Fine Woodworking magazine, and has some excellent reference books containing plans of Shaker and period furniture and information about furniture restoration and general woodworking. Many were sourced from the Ara Library's discontinued stock — one of the many

advantages of Claire's being a librarian.

Peter and Lynda are thinking about the new pieces they'd like to have in the third dolls' house. Making the pieces true to life takes patience as well as accuracy and an eye for detail — and, says Peter, you need to have a genuine interest in and enthusiasm for the pursuit. You need to take delight in the finished work when it is displayed in the dolls' house.

"Making them by hand gives me a sense of achievement. I like the aesthetic, and the fact that both the full-sized and small-scale pieces are unique. You won't find anything quite like them anywhere else."



Peter takes a break from the bench saw



Making a kauri dining table



Quite a few of the miniature pieces are modelled on their own furniture: bookcases, side tables, a plate rack — Peter used toothpicks for the uprights — Welsh dressers, wall units, tea wagon, chests of drawers, desk, fireplace, and a coal range. The fireplace and coal range are lit by 12-volt power, so they have a flickering glow.

“You need to illuminate a dolls’ house so that it looks real,” says Lynda. 🏠



The first floor landing and a partial view of the bathroom. The Brocklehursts bought the grandfather clock and the bathroom fittings — Peter made the wooden furniture while Lynda made the flower pots and flowers



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SHED STYLE

IT SEEMS GARDEN SHEDS AREN'T JUST FOR WORKING IN — TEA AND SCONES, ANYONE?

By Selina Lake

Review by Ritchie Wilson

• ISBN-13: 978-1788791823 • Published by Ryland Peters & Small
• February 2020 • Hardback • 160 pages • \$40



Shed Style is the typical coffee-table book: heavy on beautiful illustrations, many of them full page, with short descriptions and comments on the buildings shown and their decoration, and with some general advice on producing an enviable space at the bottom of the garden for relaxation.

Author Selina Lake writes for a British garden magazine and works as a stylist for photo shoots. She has had a number of books similar to *Shed Style* published.

A shed for every taste

The sheds in *Shed Style* are garden sheds, summer houses, and greenhouses rather than sheds where tools are used and stored. The idea of *Shed Style* is that these garden sheds can be repurposed to provide a retreat from home and family. The tastefully decorated outbuilding is a space where yoga, reading, or entertaining a friend or two can take place.

The few garden tools seen in this book seem more decorative than useful. The spaces are furnished with old, battered, folding iron chairs. The tables of weathered wood support jam jars holding cut flowers or flowering plants in pots. The walls may be clad in recycled weatherboards. It's all very similar to the fashionable Japanese idea of *wabi-sabi*, which translates as 'the art of the imperfect'.

Several of the garden retreats featured in Shed Style are Scandinavian and all of them have a distinctly shabby-chic ethos

A shed for staff

In the days when large houses were built on very large sections, their gardens would contain an outbuilding where the hired gardener would store his gear and have his lunch. The long garage belonging to the family of one of my school friends had a walled-off section with a bench and a toilet for the gardener. A wooden-framed greenhouse was next, and compost bins formed the end of the lengthy structure. The gardener's room would have been ideal as somewhere to furnish as a place in which to take a break.

When New Zealand Railways sold off its stock of guard's vans at \$800 a pop, as part of the 1980s restructuring of the railways, some of them ended up

as garden sheds. They would be good candidates for the sort of embellishment illustrated in this book.

Portable sheds too

One interesting section was concerned with portable garden structures such as shepherd's huts, which have distinctive curved corrugated-iron roofs and are mounted on iron wheels to allow them to be shifted from field to field. They closely resemble the New Zealand 'mill-whare', which, along with cookhouse and threshing machine, were pulled from farm to farm behind coal-fired traction engines in the late 19th and early 20th centuries, before the introduction of combine harvesters.

UK company Love Lane Caravans builds tiny houses on wheels that can be pulled from site to site; a very nice white-painted example, clad in corrugated iron with bright yellow trim and suspended on twin axles, is shown.

Several of the garden retreats featured in *Shed Style* are Scandinavian and all of them have a distinctly shabby-chic ethos, with weathered, unpainted wood and rusty iron featured in many. Cut flowers or plants are present in almost all photos, and I was struck by this aspect of the book. Could our workshops be better integrated into the gardens in which they sit? Are climbing plants on trellis attached to the shed's exterior or pot plants against sunny walls a possibility?

There probably aren't a great number of suitable garden sheds or unused Edwardian wooden-framed glasshouses in New Zealand, but if you have one *Shed Style* will show you how to make it the envy of all your friends. 📖





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THE CANDIDATE: AN ALLEGORICAL TALE

By Jude Woodside

It has been a horror year no doubt but here on the farm we have all been gripped by the ongoing political rivalry between two feisty contestants.

One is something of a traditionalist who stands for old-fashioned values concerning loyalty, tradition, and the place of women in the scheme of things. A good-looking specimen, albeit with a comb-over, he is also incurably vain and possibly a narcissist.

He is a bit bombastic, somewhat full of himself and his own importance, and likes to get on his soapbox and proclaim his talents and his achievements as long as anyone will listen — and often when they don't. He has a dedicated following who hang on his every word. He commands absolute loyalty from his followers, and indeed they shower him with almost cult-like attention. He appears to frequently take advantage of his followers for sexual favours too, or so it is rumoured.

The other combatant is somewhat quieter and concerned with the welfare of all. A strong candidate, not one to crow about his achievements but one who will brook no nonsense.

Unprovoked attacks

They have been warily circling each other for some time now, the more liberal one having to deflect frequent unprovoked attacks from the other, who often appears jealous of the attention his rival can command. The frequent altercations resulting from these attacks often end in a flurry of threats from both sides, one threatening to terminate the other, and much harrumphing and parading, usually concluding with one storming off in a huff and the other crowing in triumph.

The sad thing is they do not seem to be able to find a common ground for cooperation. Winston, the more



He appears to frequently take advantage of his followers for sexual favours too, or so it is rumoured

aggressive combatant, is often to be found urging his followers to join in unprovoked assaults on the property of his antagonist, including but not limited to home invasions. He rarely participates in these intrusions himself, preferring to stand off and later deny all involvement, yet he is clearly encouraging this antisocial behaviour.

His opponent, on the other hand, feeds all and takes care of the hygiene and general welfare of everyone without regard to their race or gender. He advocates for health care for all and a minimum feed, and has worked hard to ensure that all his subjects are housed adequately in warm, clean, and insulated surroundings. He is not without his faults, and possesses a somewhat short fuse and an intolerant attitude to the attacks made upon his person, in particular when Winston, not infrequently, resorts to violence.

Coq au vin anyone?

Despite this, Winston's fans still dote on him alone, except when his rival is

handing out goodies at daily rallies, when they have been known to desert him in a mad scramble of greed. This may, in fact, be the source of Winston's problems in that he isn't capable of offering the same inducements — tantalizing kitchen scraps and bread crusts. His rival, too, has a habit of removing the daily offerings that his followers make for Winston — small brown offerings left in straw.

Naturally, the rest of us here on the farm are concerned that the whole thing may erupt in unnecessary violence and lead to possible fatalities. The death threats are getting shriller by the day. We are hoping for peace again for Christmas; we hope they can come to terms. Although I fear Winston's rival will make good on his threat to attach his tail feathers to a hat.

Breaking news: Winston has been unseated. He was seen being dragged from his perch in the middle of the night by what passes for the law on the farm. This after a violent and unprovoked attack on an innocent bystander drew blood. He was tried and committed and will be joining us for Christmas dinner. A sad end for a glorious career: rooster to feather duster.

On the plus side, I have a new addition to my hat.

Merry Christmas and have a great new year. 🐓



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