No. 328

MYFORD ML7 UPGRADE
– Make Resettable Index Dials for your lathe.

MODEL ENGINEERS' WORKSHOP

THE MAGAZINE FOR HOBBY ENGINEERS, MAKERS AND MODELLERS JUNE 2023 ISSUE 328 WWW.MODEL-ENGINEER.CO.UK

Harrogate Model Engineering Exhibition and Model Rail 2023
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AN LCR TESTER
Making an Electronic Component Tester from a kit.

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MAKE A RETRACTING SCREWCUTTING TOOLHOLDER.
David George automates George H. Thomas' classic design.

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Jun 23
MORTONS

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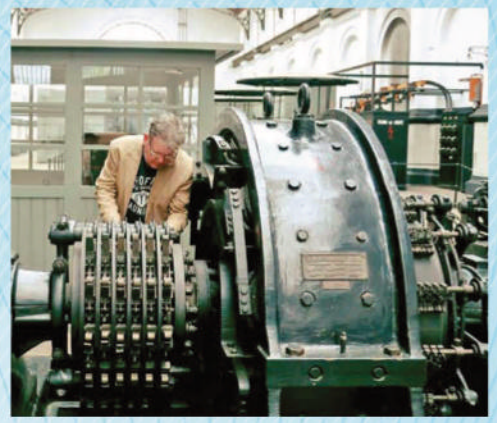

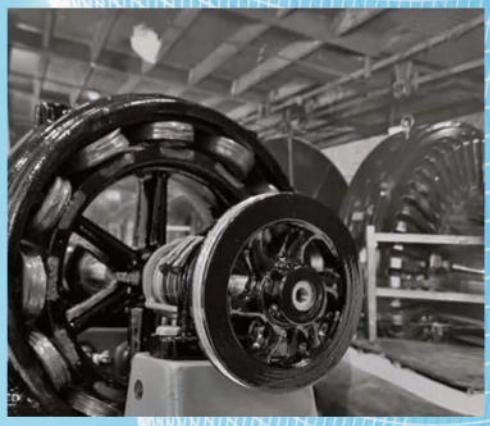

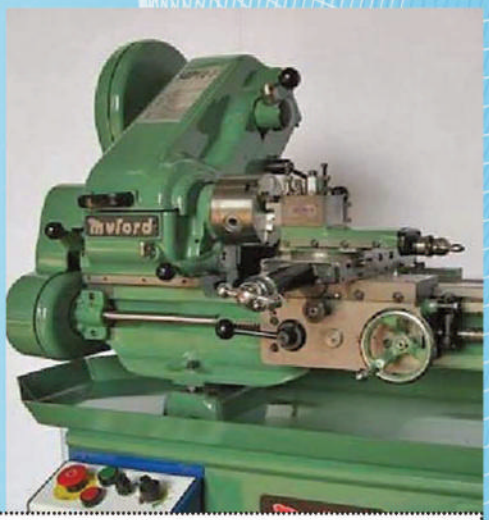

New product promotion, AV550 550W motor / inverter for the Myford Super 7. Call for details!

Managing director George Newton, originally from the British Steel industry where he worked with 20,000 HP rolling mill drives is also a skilled machinist and uses his own lathes to design and refine speed controllers especially for the Myford ML7 & Super 7

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Si (Systèm international d'unités) Newton, unit of mechanical force, Tesla, unit of magnetic field strength

MODEL ENGINEERS' WORKSHOP

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This issue was published on June 17, 2022.
The next will be on sale on July 22, 2022.

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On the Editor's Bench

3D Printing Update

I've been on a very steep learning curve with 3D resin printing since undertaking the review of a Creality printer for the last issue. I'm keeping notes and taking photos to keep track of some of the issues I have come across. The picture is a work in progress I designed in Alibre.

One thing I would like to emphasise for anyone looking at this technology is to start off by ordering a big box of nitrile gloves. Using them will help ensure you don't face any problems of sensitisation and allergies in the long term (there have been recent reports of the consequences of sensitivity to UV resins used for gel nails), but aside from this, having gloves on makes everything much more pleasant.

I've also discovered a lot about the pros and cons of using tougher, more flexible resins, making the best use of the IPA bath, creating mating parts and using the sun for curing. Expect another article with a lot more practical advice in the near future.

Plus, I'm keen to hear reader's experiences of all forms of 3D printing – letters for Scribe a Line or full articles welcome!

Collet Stopped

I'm afraid that for practical reasons we are having to hold over Bernard Tower's collet stop article for a month, It will appear in MEW 329.

King of the Workshop

I must apologise to Roy Oxley, whose article 'The King is Dead, Long Live the King' was credited to another author by mistake. Somehow the standfirst from another article was repeated; it should have read "Roy Oxley's venerable Progress Drill was nearly a century old before a cracked casting stopped play. He replaced it with a heavy duty Clarke machine, moving over several modifications and additions from the older machine."

Neil Wyatt

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Mike Pavie

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Summary Specification

Approx length 73"

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- Etched brass body with rivet detail
- GWR Pattern Safety valves
- Choice of liveries
- Painted and ready-to-run
- Reverser
- Coal-fired live steam
- 5" gauge
- 4 Cylinder
- Piston Valves
- Walschaerts valve gear
- Drain cocks
- Mechanical Lubricator
- Silver soldered copper boiler
- Multi-element Superheater

Approx Dimensions:

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- Weight: 97kg

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We will request an interim payment of £4,500 in June 2023 as the build of your model progresses, a further stage payment of £4,500 in July 2023 and a final payment of £999.00 in August/September 2023 in advance of shipping from our supplier.

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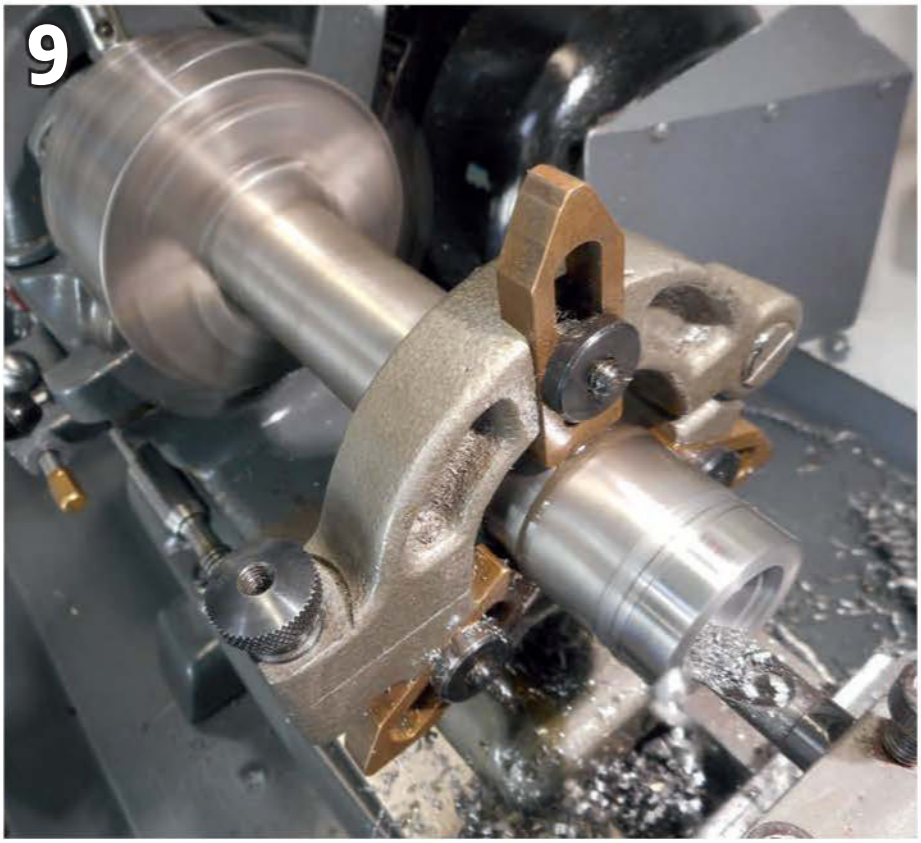

Coming up...

in our next issue

Adrian Rawson uses 3D printing to make a micrometer XY table for a measuring microscope.

Regulars

ON THE COVER

John Arrowsmith photographed this unusual Artillery Wheel Machining Centre by Peter Bramley at the Harrogate Model Engineering and Rail Exhibition. Read his full illustrated report on pages 35-40!

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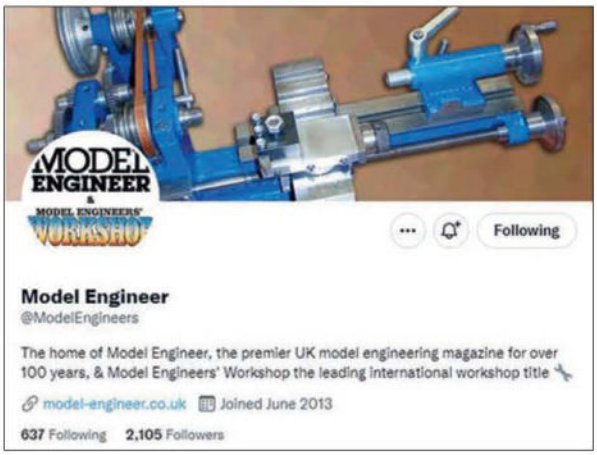

THIS MONTH'S BONUS CONTENT

Log On to The Website for Extra Content:

Visit our website to see David George's retracting toolholder in action.
www.model-engineer.co.uk/toolholder

Other hot topics on the forum include:

Sieg C6 Lathe new threading possibilities Gear ratios for cutting a wider range of threads, plus other useful discussion, by Ian Hansen.

Myford S7 with stepper on cross-slide Seeking experiences of automating the cross slide, by Matt Harrington.

Thread on BA threads A question on old and new BA Threads by Daniel Goldstein.

Alibre - A First Attempt An abundance of useful advice for those starting out with this popular 3D CAD package, by Nigel Graham 2.

Come and have a Chat!

As well as plenty of engineering and hobby related discussion, we are happy for forum members to use it to share advice and support. Come and join us – it's free to all readers!

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Manufacturer	**Cormak**
Model	**HK25L VARIO**
Condition	**New**
Max Drilling Capacity	**25mm**
Max Slot/End Milling Capacity	**16mm**
Max Face Milling	**63mm**
Spindle Taper	**MT3**
Draw Bar Thread	**12mm**
Spindle Feed	**50mm**
Head Tilt	**+/-90°**
Number of Spindle Speeds	**Variable Speed Control**
Spindle Speed Range	**50–2250 rpm**
Table Surface	**500×180 mm**
Maximum Longitudinal Table Travel	**480mm**
Maximum Transverse Table Travel	**175mm**
Maximum Vertical Travel	**380mm**
T-Slots	**3**
T-slots Dimensions	**10mm**
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Weight	**110kg**

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PRICE: £1,495.00 INC VAT

Manufacturer	**Cormak**
Model	TYTAN 500
Condition	New
Swing over bed	200mm
Swing over cross slide	140mm
Centre width	500mm
Bed width	100mm
Spindle bore	21mm
Spindle tip	MT3
Spindle speed	100-2500 rpm
Metric thread	(14) 0.3–3 mm/turn
Inch thread	(10) 10–44 Gg/1"
Tool holder	4- slots
Maximum cross support travel	55mm
Maximum transverse support travel	100mm
Maximum longitudinal support travel	376mm
Tailstock spindle travel	60mm
Tailstock quill taper	MT2
Motor power	500 W / 230V
Dimensions (without base)	900×390×340 mm
Dimensions (with base)	900×390×1160 mm
Weight	95kg

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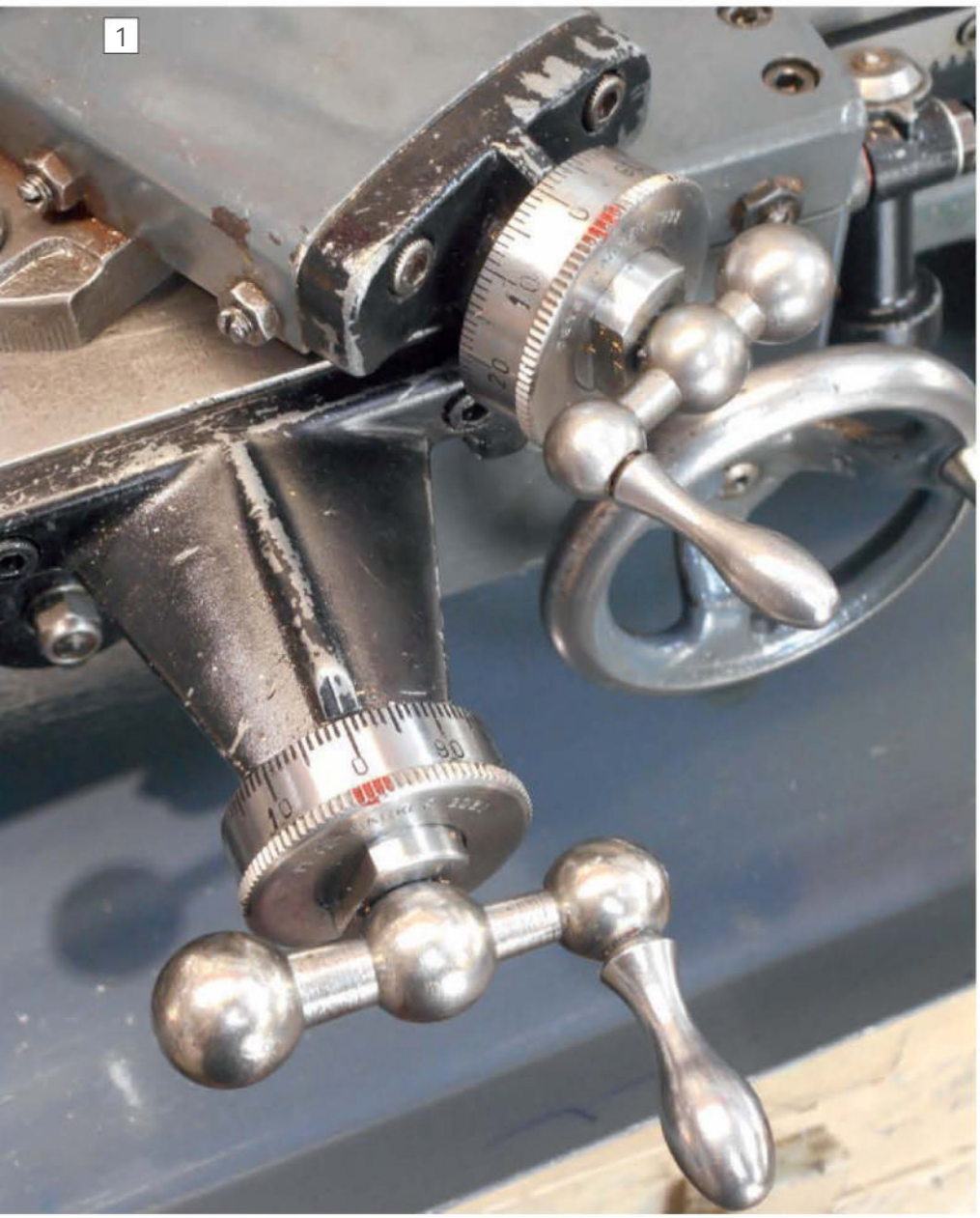
Making Your Own Resettable Lathe Dials

Pete Barker uses some innovative methods to solve a vexing shortcoming on many hobby lathes, including his Myford ML7



Resettable dials can be reset to zero or other desired number without moving the feedscrew and upsetting the tool position. And they are easier to read than the originals.

The mental gymnastics of using fixed lathe dials are a pain in the frontal cortex for the mathematically challenged like me. Trying to take, say, a 16 thou cut with a dial already set immovably on 77 thou is a special kind of purgatory. Make-do's with felt pen lines on dials and counting each thou aloud help but are no substitute for a proper resettable dial that can be turned back to zero at will. Combined with the hard-to-read standard diecast dials on my Myford ML7, this long-held gripe propelled me to make my own resettable dials with larger, easy-to-read numbers and clearer lines, **photo 1**. They are such a pleasure to use I am now kicking myself for not making them years ago. The basic design can be adapted to fit almost any lathe, vertical slide or even milling machine.

Many designs published over the years used spring loaded brass pads for friction and grub screws for retention. I hit upon a simpler design. Instead, I used a commonly available wave washer and circlip to provide the friction and retention. This makes the machining very simple. I also came up with a much-simplified method of engraving the graduation lines around the dial, using the lathe's carriage with a simply made single stop, rather than the traditional specially made and complex graduating tool with multiple stops.

Simplicity in two main parts

The drawings show the simple two-piece dial in its component form (See also photo 18 later). It consists of a hub and the dial itself. Between these is inserted

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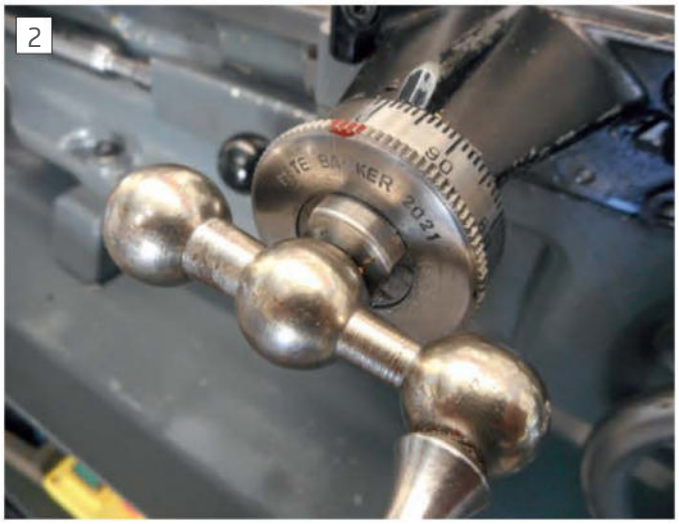
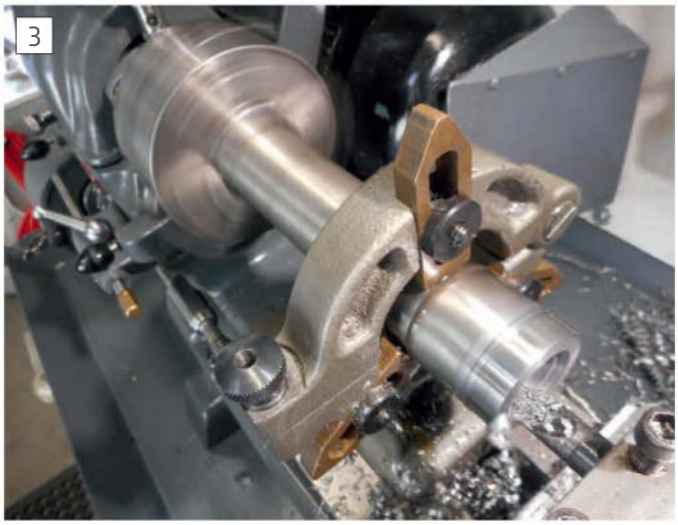


The dial is made of two main components, inner hub and outer dial, held together by a circlip at the rear.



Fixed steady allows each dial to be parted off consecutively, without wasting material to grip in the chuck, after being bored, turned and knurled.

a wave washer, a nominal 25mm inside diameter and 32mm outside diameter. I measured the wave at 0.125" wide in its unsprung state so the hub was stepped to hold it in compression by about 0.030" after some experimentation. This figure gives enough friction to hold the dial in place while allowing easy movement of the dial when resetting. Wave washers are available from bearing suppliers, used to set the preload on bearings in electric motors. They are not to be confused with spring washers or Belleville washers.

A common 32 mm internal circlip, also from a bearing supplier, holds it all together against the pressure of the wave washer. The circlip is a No. D1300-32. The wave washer is No. EPL 25. That's all there is to it, **photo 2.** Dead simple.

Turn, bore and groove the dial

The dial is a straightforward turning exercise within the scope of a beginner who has mastered the basics of turning, knurling, boring, grooving and parting, **fig. 1**. I made four of these dials at once. To save material, I set up my long bar of 1-5/8" bright mild steel using the fixed steady**, photo 3**. Each dial was turned, knurled, bored and then parted off. The .805" hole in the centre was first drilled and bored deep enough for all four dials. The larger recess bore is an odd size in Imperial to clear the OD (outside diameter) of the 32mm wave washer. Take a facing cut with the boring bar to finish to final depth of .420", **photo 4**. Polish all surfaces with emery paper so the dial will turn smoothly on the hub.

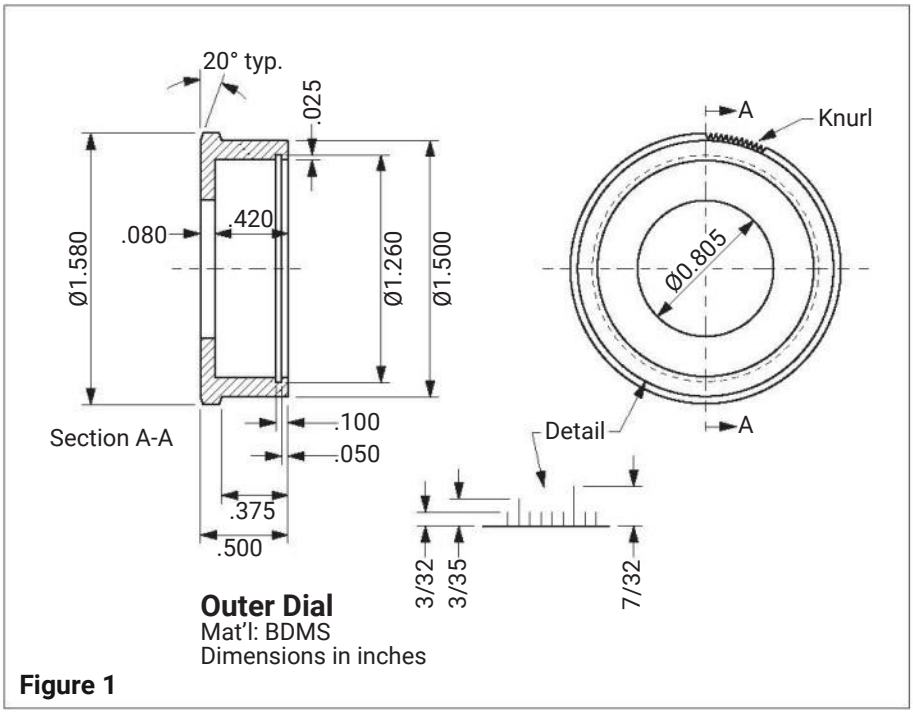


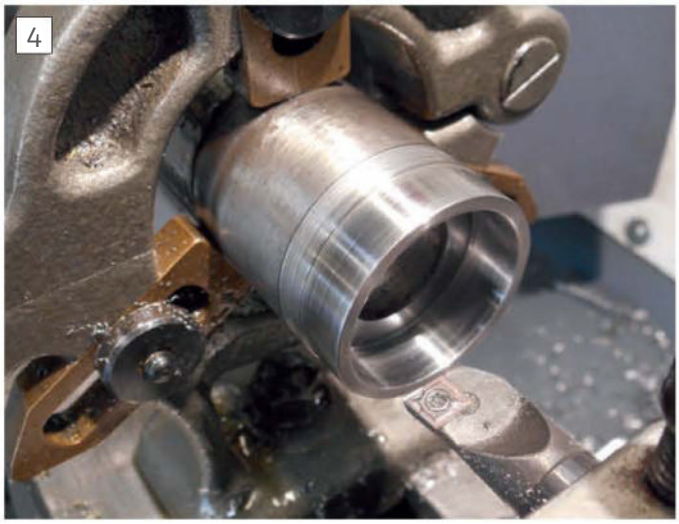
Figure 1

Add the circlip groove with a boring bar and HSS bit ground down to .050" wide, **photo 5** and deburr**.**

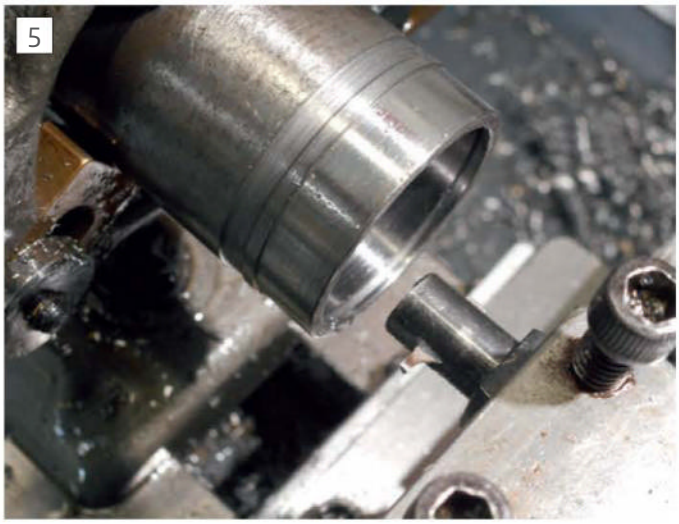
Turn the outside diameter down to .500" and knurl the remaining shoulder using a single straight knurl wheel plunged straight in. I find this works better than my two-wheeled clamp-type knurling tool on straight knurls. A straight knurl looks tidier on a dial, I always think, but diamond pattern can be used just as well. Use plenty of oil on your knurling wheels and run the lathe at slow speed, high back gear on the Myford. Final step is to part off the dial slightly oversized. Mine was then put to one side and final-faced along with the other three when they were ready.

Turn and tap the hub

The hub is also a simple turning job, with the addition of some simple milling to put two spanner flats on it afterwards, using the vertical slide in the lathe, **fig. 2**. The hub is made second so the outside diameter can be made a neat sliding fit in the bored recess in the outer dial. It is easier to size the OD of the hub exactly to match the bored recess than vice versa because of spring in the boring bar. I made mine as four sets of matched pairs.



The recess shoulder is faced to depth with the boring bar and all surfaces polished smooth with emery paper and oil.



Like the boring bar, the circlip groove tool is used with minimum overhang for rigidity.

Again, finish all working surfaces to a fine polish with emery paper and oil. The central hole should be drilled and tapped in the same setting as the rest of the hub to ensure concentricity. Use the tailstock centre to guide your tap wrench square. You can put a shallow 20-degree chamfer on the end of the hole for the ball handle to seat in if you wish, or even use a form tool to match the ball.

Do not part-off the hub just yet. We need to leave it in one piece with the parent material so it can be clamped to the vertical slide for milling the flats. If making multiple dials, make one hub on each end of a few inches of stock so it can be milled each end in one setting.

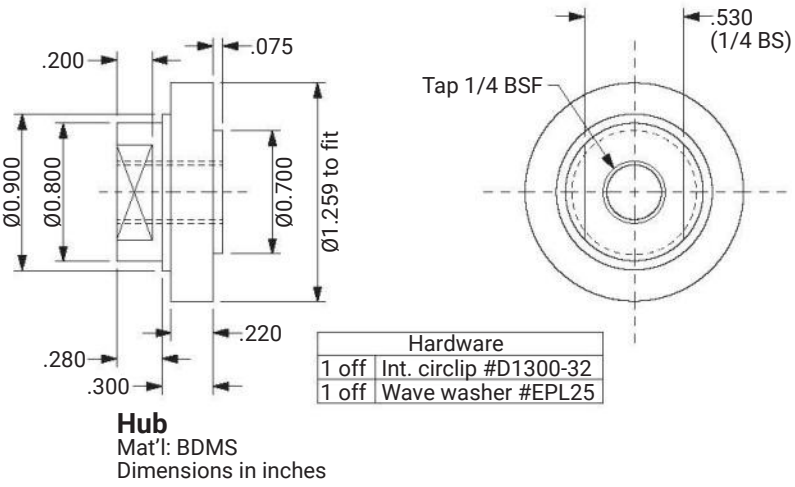


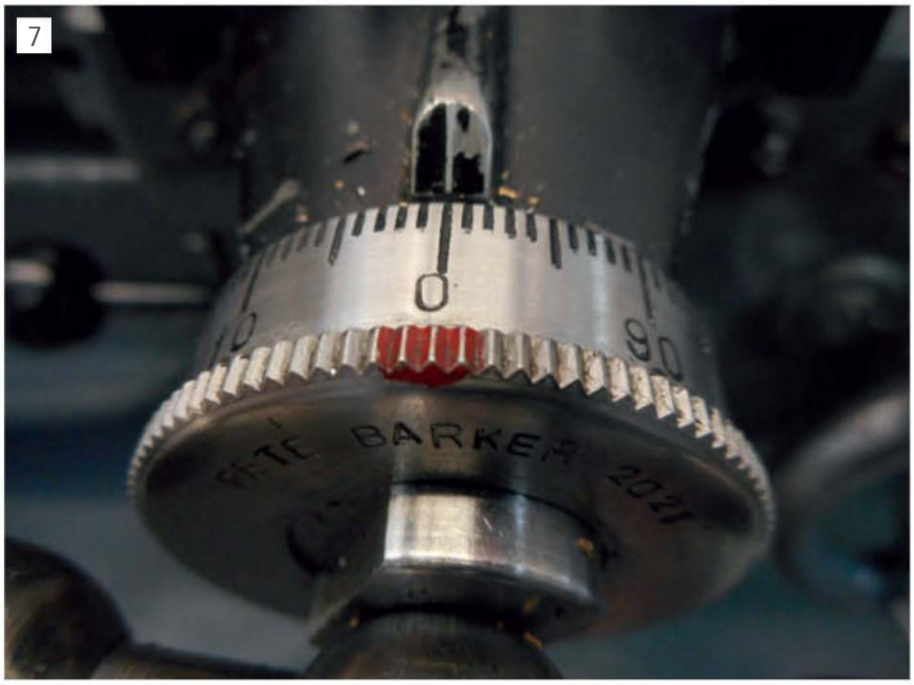
Figure 2

Mill the spanner flats

I clamped the bar with the unparted hub on the end to at T slot on the Myford's vertical milling slide. An end mill cutter was held in the three jaw chuck, a practice decried by some purists but one that has always worked for me.

After touching the OD on the end of the cutter, I moved the carriage by the requisite amount via the leadscrew handwheel and locked the carriage. After milling the first flat, I rotated the job until the first flat was vertical, as indicated by a try-square on the cross-slide. The second flat was then made. When all flats were completed, I parted the hubs off and faced them. To hold them in the chuck I made a simple round sleeve with a hacksaw cut in it, seen on the left in **photo 6**. The sleeve with a wall thickness of about 1/8" was slid over the boss with the two flats on it and clamped

The hub's holding collar is to the left of the dial's stub mandrel, securing screw and flat washer.



Graduations came out perfectly spaced, let down by cheap number stamps that don't line up consistently. But without the close-up shot, you will never notice it on the job.

The 60 – 30/50 gear train is regulated by the hacksaw blade détente unit that allows one-way movement only and provides a positive stop for precise graduating.

in the chuck. That was all the turning and milling done. Now we get to the fun part: graduating and numbering.

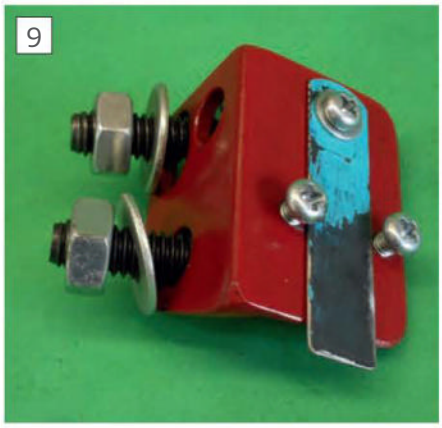
Index the graduations using change gears

Each dial needs to have 100 graduations cut on it, **photo 7**, using a pointed lathe tool laid over sideways and run along the OD to the various correct lengths for the 1s, the 5s and the 10s. To rotate the lathe chuck by 100th of a turn for each graduation was a matter of simple gearing on the change-gear quadrant, combined with a simple detent device made from a hacksaw blade, see **photo 8.** The Myford has no 100-tooth gear, so a 50-tooth gear can be used and geared to rotate twice for every one turn of the headstock spindle. I used a 60T gear on the spindle, driving a 30Tgear, with the 50T gear on the same stud. The hacksaw blade détente engages with the 50T gear. Every click is 1/100 of a turn of the spindle. Perfect.

The detent device, **photo 9,** is a simple piece of 1'' or 1 ¼'' angle with a piece of hacksaw blade held in place by small screws. The steel angle was drilled so it could be bolted to the quadrant, as detailed in **fig. 3**.

To take up backlash in the gear train from this device, I wrapped a length of cord around the chuck and ran it up over a pulley suspended above the lathe and tied a 1kg weight on the end, **photo 10**. Remember the chuck has to rotate anti-clockwise for your numbers to run in the right direction! This détente and anti-backlash set-up mean the chuck can be rotated one-handed for each graduation without having to move away from the engraving job and fiddle with the gears and détente, which can be very distracting.

Before any of the above was done, I made a small stub mandrel to mount



Detent was made from a scrap of steel angle and a ground down piece of hacksaw blade. Tension can be adjusted by the height of the two front screws limiting blade movement.

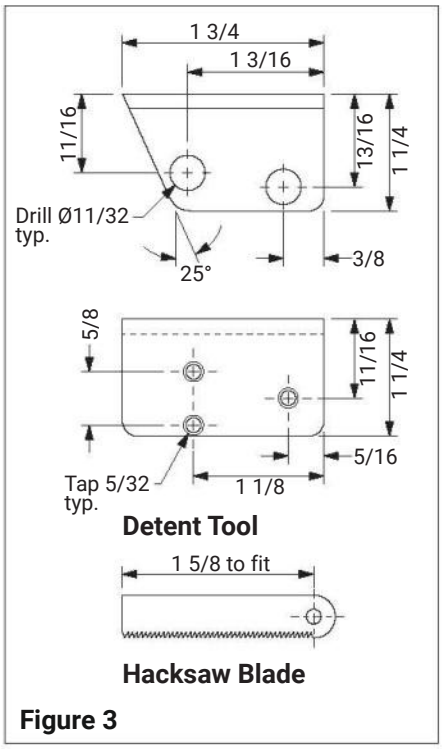


Figure 3

the dial on with the plain end to be graduated facing outwards from the chuck. This was turned in situ so it was dead true and fitted neatly into the inner hole in the dial, which was retained by a bolt and washer as seen centre and right in **photo 6**.

Cut the lines the easy way

Traditionally, model engineers have gone to great lengths to make special graduating tools that mount on the topslide and run a cutting tool along the job using a lever or gears, and have a three-position stop to make the three lengths of lines needed on a dial. Advice

The graduating set-up: Cord to eliminate backlash, carriage stop for unifom line length, V-tool mounted sideways, and the first line cut by racking carriage back and forth.

from one of the greats of yore was to use a stack of washers to keep count of how many short strokes you had made and rely on memory or observation as to whether your next line should be a medium or long variation on the short norm. A nightmare for the mathematically challenged like me to keep track of. I needed to find the lazy man's way around this unholy drama.

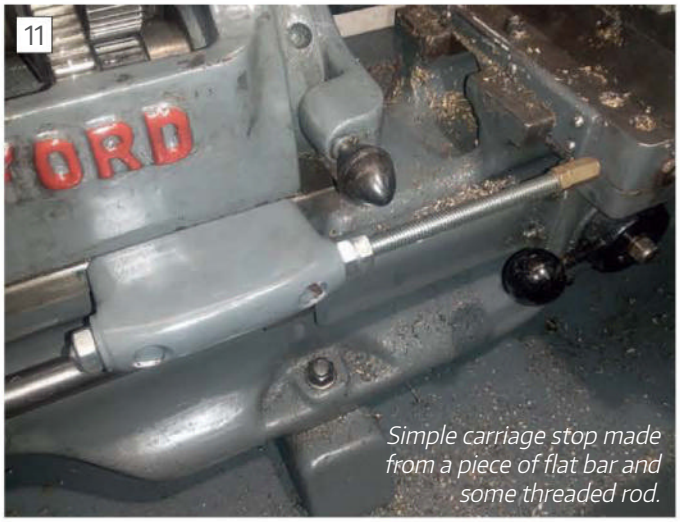
Plus, those fancy graduating tools often seem to have some slack in their sliding elements that makes achieving constant line depth another pain in the frontal cortex.

So I hatched a plot use the very stable, very precise carriage of the lathe itself to do the cutting of the lines by racking it back and forth by the handwheel. All I needed was a simple, single stop for the carriage. The stop, **photo 11,** is made from a piece of 2" x ¾" flat bar drilled and held to the bed with cap screws. I used one existing ¼" BSF tapped hole and made a second. A simpler version could use just one screw.

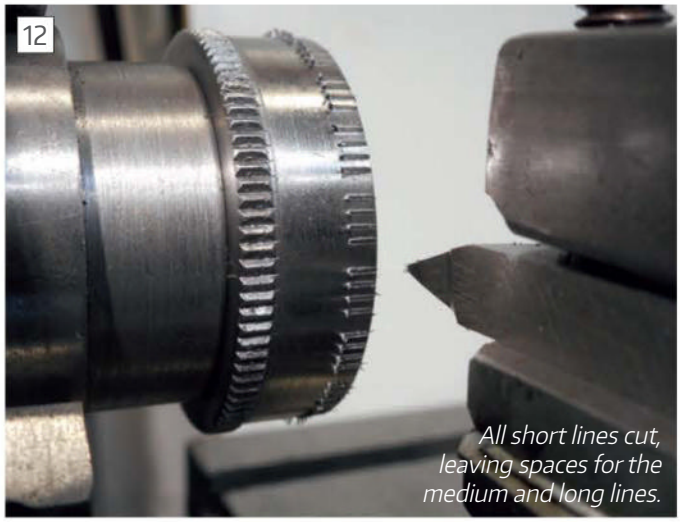
A 5/16" clearance hole drilled lengthways through the block takes a piece of threaded rod with a couple of locknuts to hold it in position. The brass hex screwed on the end softens the impact on the apron. I rounded off the block on the belt sander and later upgraded to a plain rod and cotter clamp, but neither is strictly necessary.

Simplify the varied line length dilemma

How did I graduate three different length lines with one carriage stop? Simple. I used the topslide to set the exact finishing point of each cut line. But instead of moving the setting back and forth every fifth line as I went around in the traditional manner, I set the topslide to cut a line 3/32" long and went around the full circumference of the dial, racking the carriage back and forth until it hit the stop on every click of the hacksaw blade, *except* for every fifth line, which was skipped, leaving a blank space, **photo 12**. Even I can count to five consistently,



Simple carriage stop made from a piece of flat bar and some threaded rod.



All short lines cut, leaving spaces for the medium and long lines.

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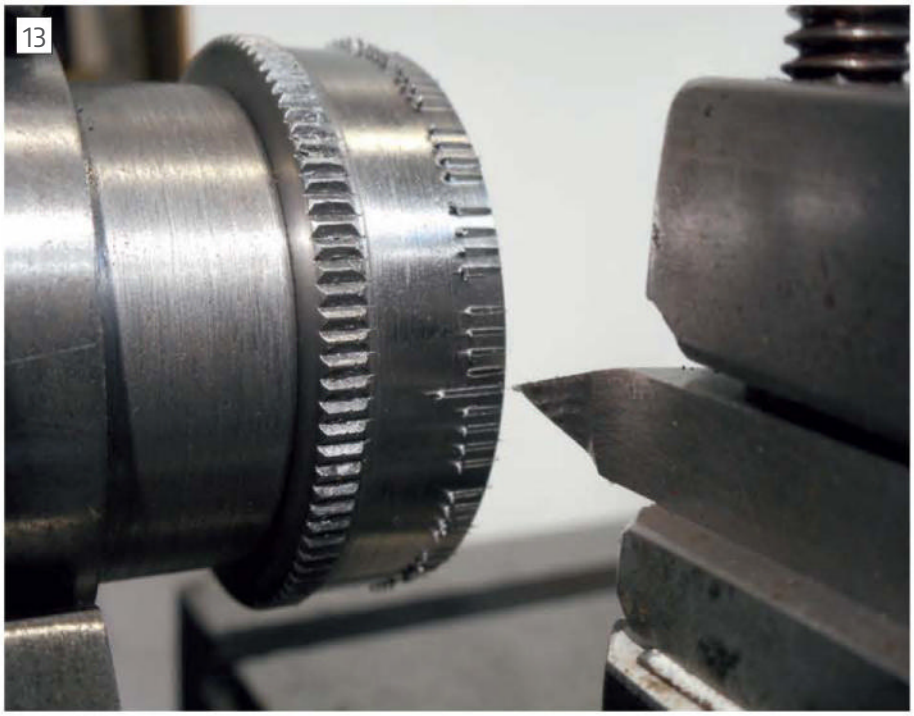
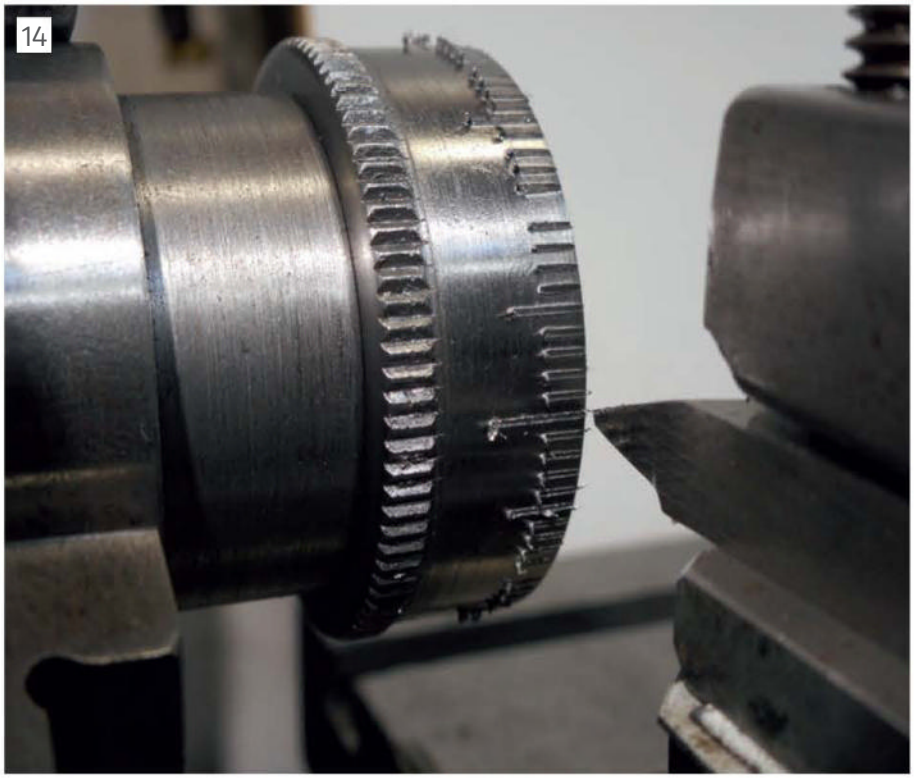


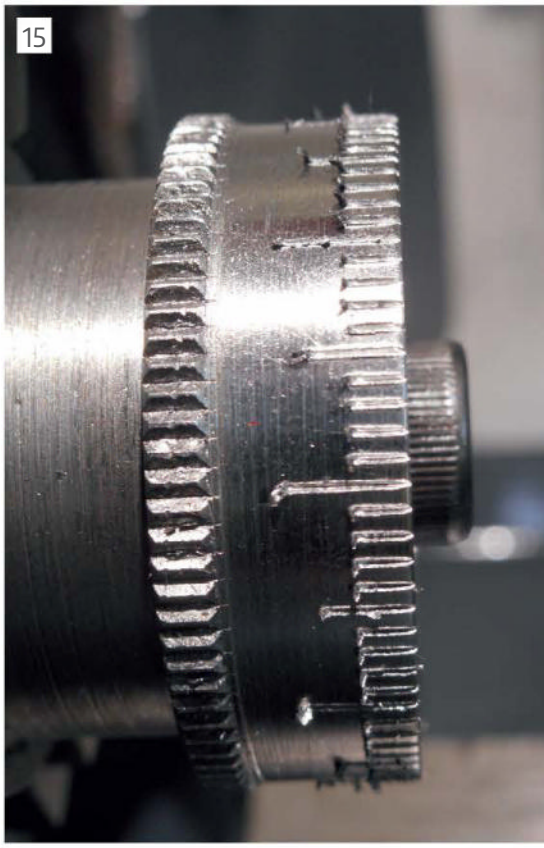
The first medium line is cut, before advancing 10 clicks to the next one.



Then the longest lines are cut in the remaining blank spaces, all 10 clicks apart.

so this worked well. I arrived back at the first blank space and advanced the topslide to cut a medium-length line 5/32" long. (It would have been handy to have a resettable dial on the topslide already!) After cutting the first medium line, **photo 13**, it was a simple matter of ten clicks and cutting another line until all ten mid-length lines were done.

Returning to the first remaining blank space, I adjusted the topslide to cut the longest line of 7/32" length. After cutting the long zero line, **photo 14**, it was 10 clicks and do another line a total of 10 times around the circle and the line-cutting job was done. It took me about seven minutes to cut the 80 short lines, then another two minutes for each

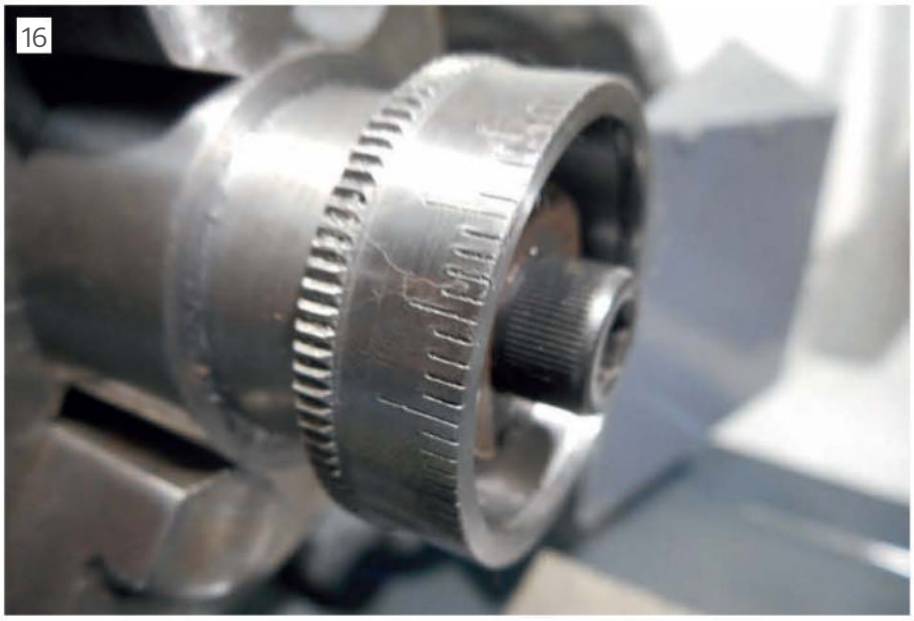


Curls of swarf are left at the end of each line after the last one is cut.

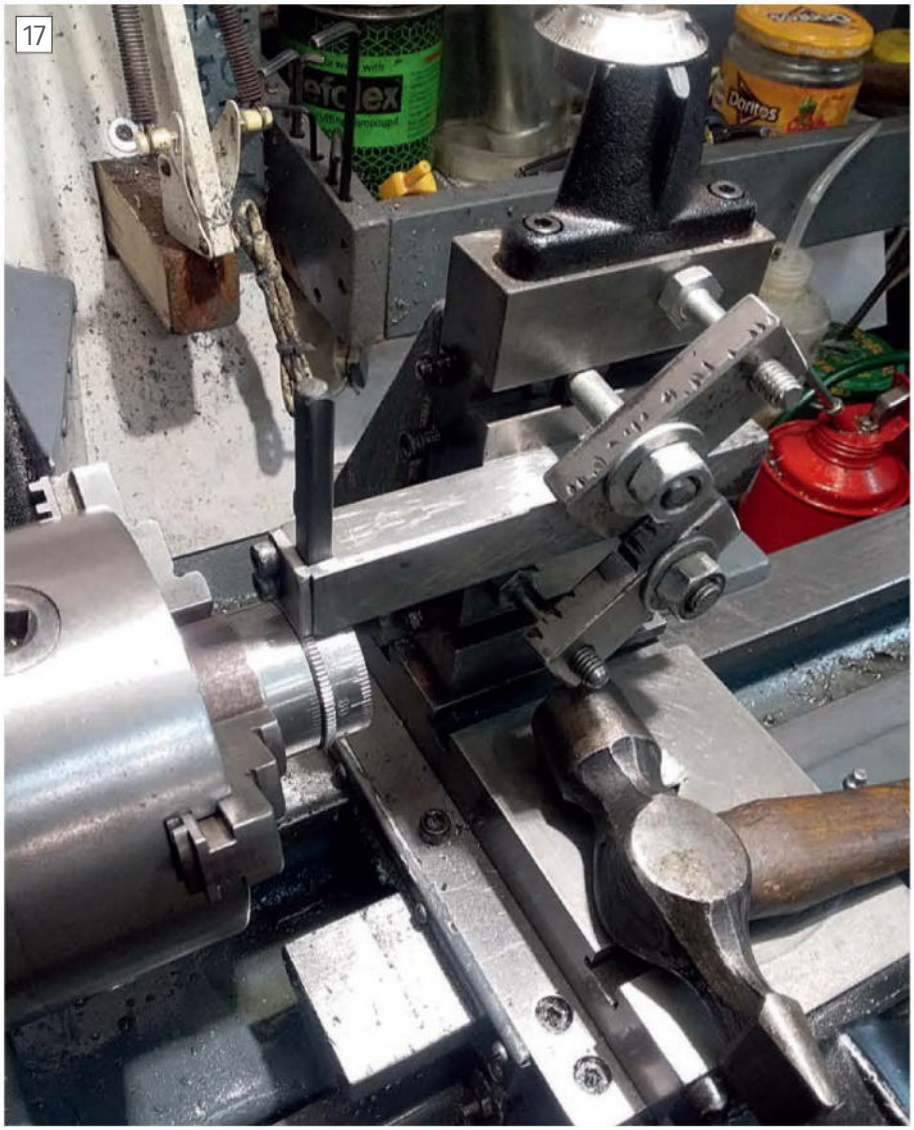
round of 10 medium and long lines. That included taking photos. It's a far simpler method than any other I have seen where each line is done consecutively regardless of its length. It has the added advantage that in the unlikely event you make a mistake, because you are starting with the shortest lines and working up, it can be corrected by making a shorter line longer.

Line-cutting tool geometry

The toolbit had a 40-degree included angle with the same sort of clearance as a lathe turning or screwcutting tool. It is being used like a shaper tool in this instance though. The very fine tip tended to chip easily so in future I will try a 60-degree tool. Depth of cut was determined by experiment using the stub mandrel as a test piece. About five thou depth seems good to me, wide enough to see easily but fine enough to allow settings of half or quarter of a thou if needed. I made two passes at the same setting as it always seemed to take a light clean-up cut on the second. A sharp cutting tool will leave a nice curl of metal at the end of each line, **photo 15**. These can be removed by using a fine flat file



Dress the raw lines down with a fine file, but not too far as the numbers must be done the same way.



Simple number stamp holder was made from square bar and clamped to the vertical slide. Detent was used to position the numbers precisely.

in the lathe, **photo 16** and then final polished with 800-grit wet-rub paper and oil.

Stamp the numbers

The hacksaw blade index détente and the stub mandrel are left in place for stamping the numbers on the dial. I made a holder for the number punches that clamps on to the lathe's vertical slide. One could be made to attach to the toolpost almost as easily. As **photo 17** shows, it is a simple piece of square bar with a slot milled in the end to fit your number punches. The end of the slot is closed off with a piece of flat steel held by two screws. I made my slot 6mm to fit my China-made 3/32" number punches. Make sure you orient the numbers the correct way up so they can be read from the knurled end of the dial, the way it will sit in use on the cross slide.

The 0 was stamped in line with the first long line. Then the chuck was rotated by nine clicks of the detent and the number 1 stamped there, one click before its line. Another 10 clicks and number 2 was stamped, and so on up to 9. The chuck was then clicked back to line up the first 0 line, then advanced a further 11 clicks so the 0 could be stamped on the 10, one click past its line. From then on it was 10 clicks each time to add the 0 to make 20 through to 90. This left a space of one click between each character, which seems about the right spacing.

Unfortunately, though, on my inexpensive number stamps, the numerals are not consistently lined up with the square shanks. So, in spite of the guide and the détente correctly positioning both job and punches, some numbers came out slightly unevenly spaced or crooked. Of course, the 0 was the worst offender. Annoying, but not really noticed when in use.

The raised metal around the stamped numbers can be filed off in the lathe. I then used a small artist's brush to fill the lines and numbers with black paint. After it dried, the excess was removed with fine emery paper, again as the dial was spun in the lathe. You could also use chemical blacking or oil blacking by heating and dropping in clean oil to the same end.

One tip discovered after the fact: If making dials for a vertical slide, put the

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The two components and two pieces of hardware assemble in the order shown.

numbers on upside-down from the way they are on the cross-slide dial. This makes them easier to read.

Put it all together

Assembly is simple, in the order shown in **photo 18**. Oil all the inside surfaces, drop the wave washer into the dial recess. Slide in the hub – spanner flats first -- press it down and insert the circlip using circlip pliers, or by getting one end in first then swearing at it until you can pop the other end in with a screwdriver.

Conclusion

With this simplified design and working methods, there is no excuse for putting up with mathematical contortions arising from fixed dials any longer. The resulting dials are also easier to read than the originals and make using the lathe a joy. No more struggling to remember where I am when screwcutting or trying to rapidly remove metal down to size or performing any other precision task. Yes, I wish I had made a set years ago. ▮

In our Next Issue

Coming up in issue 329, July 2023

On sale 16th June 2023

Contents subject to change

Brett Meacle describes how he made a number of handy Morse taper arbour accessories.

Adrian Rawson uses 3D printing to make a micrometer XY table for a measuring microscope.

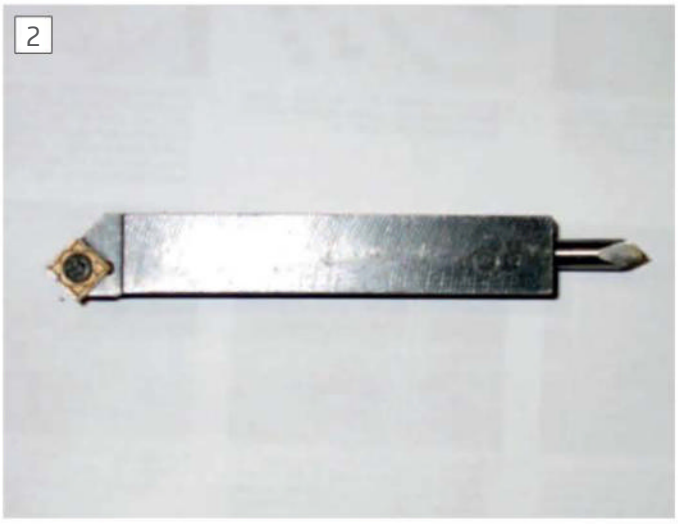
Paul Lousick uses CAD to design and build a belt grinder for his workshop.

To pre-order your copy of MEW 327 visit www.classicmagazines.co.uk or call 01507 529 529

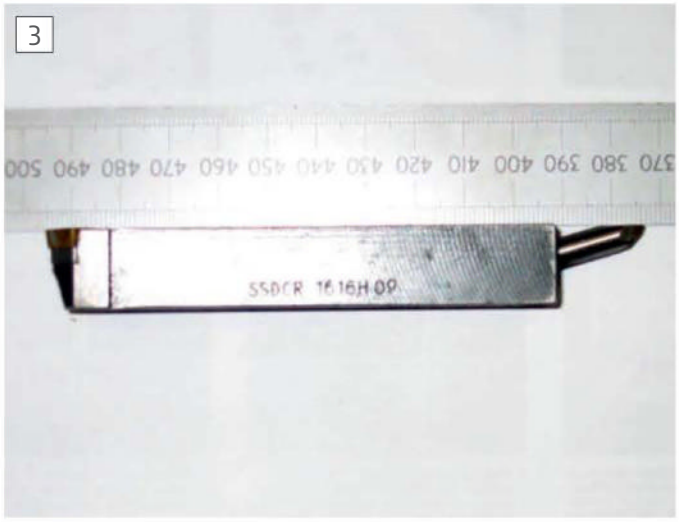
A Chamfer Tool for Small Bores

Chamfer tools are used to 'break' sharp edges using an angled cutting face. John Scott modified his standard chamfer too to make it double ended and suitable for smaller work.

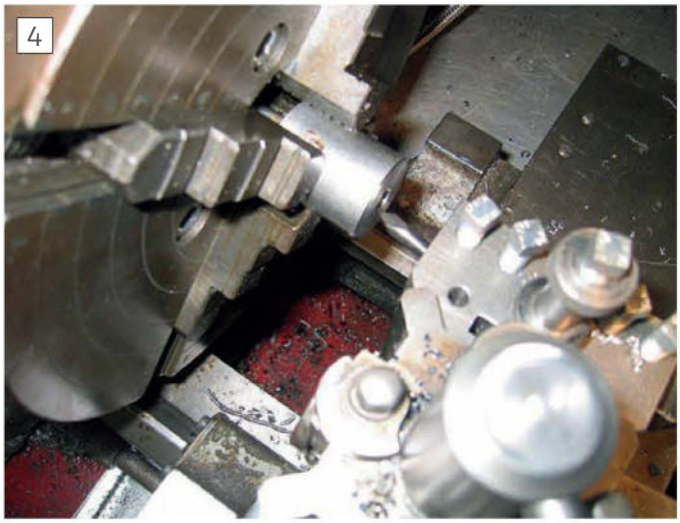
commercial chamfer tool.



HSS add on.



Matching tool height.



Tool in use.

Photograph 1 shows my everyday chamfering tool. This inserted tool can be used for turning and facing but its main use in my shop is chamfering external edges. The insert is forward of the shank However it won't chamfer bores smaller than about 80mm - there is insufficient clearance - it would rub the work with the shank and spoil it.

Photographs 2 and **3** show a broken 6mm HSS endmill (I have a supply) in the opposite end of the shank at an arbitrary 15 degrees. It's held in place with a grub screw. It can be advanced after regrinding. The top is ground to give the same tool height as the chamfer tool.

Clearance is ground to suit small bores on the side facing the machinist when the toolpost is rotated 90degrees.

This is for light duties only, but deployment is much quicker than a full toolchange so work is not interrupted.

Photograph 4 shows it breaking a bore edge so no-one cuts fingers.

An Eagle Surface Grinder

Bob Trethewey stripped down a Dronfield Eagle Surface Grinder in preparation for a full restoration.

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After purchasing this machine, a Model 3 Serial No: 3628, from an advert in the December 2021 edition of Model Engineers Workshop I brought the unit back to Dorset. The machine is heavy, when lifting the surface grinder out of my trailer I had to triple the lifting wire to even raise the unit so that the machine could be lowered onto the wheeled dolly which would allow me to manoeuvre the machine around the garage. Its weight was over 350Kg.

Photograph 1 shows the machine in its original owners outside shed where it had been standing for many years. Standing idle had resulted in the machines slideway concertina bellows drying to a point where they started to break when I tried to open them.

Photographs 2 and **3** show the original concertina bellows – these were removed from the machine and soaked in oil for a month to try to rejuvenate them. After a month of soaking they opened but this only showed that most of the individual leaves had cracks and some of these were held together with staples. It was decided at this point to order new bellows.


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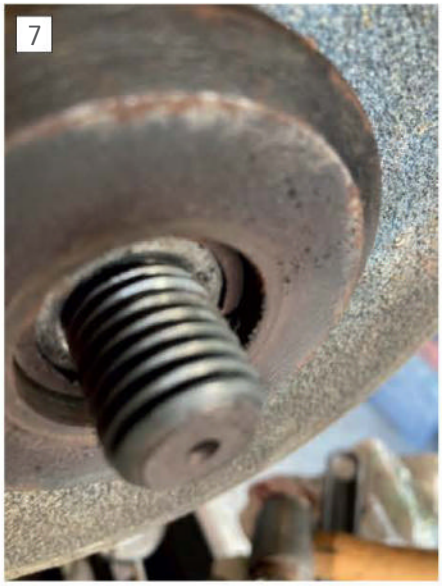
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Photographs 4 and **5** show the electrical switch starter which was removed from its bracket bolted to the side of the machines head assembly. The bolts used in the production of my series of machine were all BSW type, either hex headed, cap headed sockets, countersunk headed or button headed bolts. Several snapped off when turned to remove and needed replacement.

Removal of the spindle initially involved the removal of the head cover plate, **photo 6**, and the grinding wheel retaining nut, the nut being untightened by the insertion of a long reach Allen key through the hole in front of the electrical switch mounting bracket. This would lock the spindle allowing the spindle front nut to be untightened.

Photographs 7, 8 and **9** show the

spacers front and rear of the grinding wheel which when removed shows a spacer on the spindle coming out from the two front nose bearings mounted on the machines spindle. This allowed the wheel's back housing to be removed from the head assembly.

Photograph 10 shows the intermediate shaft gland which goes between the machines wheel back housing and the machines head assembly. The three screws removed allow the gland to slide off the spindle exposing the spindles twin front bearings as seen in **photo 11**.

The spindle will only come out of the head assembly through the front and this needs the rear drive pulley to be removed. The spindle rear housing is shown in **photos 12** and **13,** which when lifted off the back exposed the pulley and it's retaining sleeve and countersunk locking screw, **photos 14** and **15**.

When the rear spindle retaining sleeve has been removed the pulley needed to be drawn off using a three-legged puller assisted by drilling a centre cone in one


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18


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of the machine's domed headed bolts as shown in **photos 16** and **17**.

Once the pulley has been removed then the spindle can be pressed forward out through the head assembly's front gland. This exposed the retained grease trapped since the machine was last serviced see **photo 18**.

The spindle's twin bearing set comes out with the spindle. The rear single bearing is left inside the rear gland and as the spindle leaves the rear bearing a sleeve is exposed which must be picked out to avoid it dropping into the machine's column and base. **Photograph 19** shows this sleeve.

The bearing is tapped out of the gland to be cleaned and checked. Each gland of the head assembly has an aluminium spacer ring, the front gland spacer ring

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is shown in **photo 20** which retains the packed grease which is used to lubricate the bearings at each end of the spindle as well as ensure grinding dust and dirt doesn't enter the bearings.

Now that the spindle and its associated spacers and bearings have been removed the head assembly can be removed from the column. This is achieved by undoing the two BSW nuts on either side of the head assembly as seen in **photo 21**. Weight 30kg!

Next to be removed was the top moving platen or table of the manually moved cross slide. There are two stop screws in the front face of the platen identified as screwed into the holes shown in **photo 22**. Weight 35kg

Then the top platen or table is pushed off its base by moving it from right to left. The top platen or table has a set of


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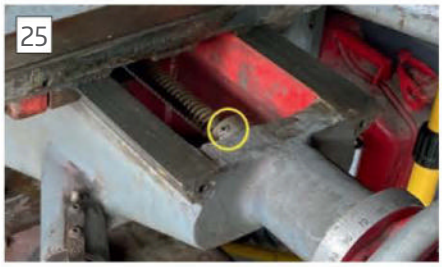
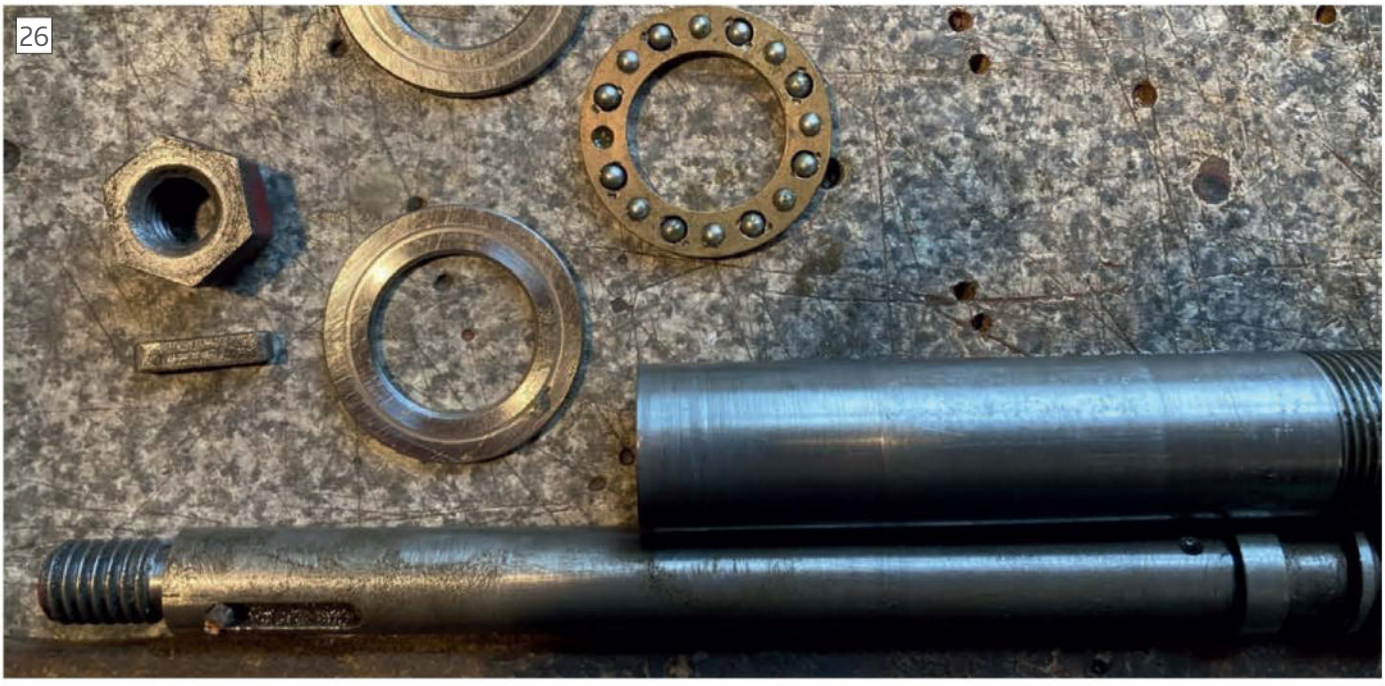


up to 6 bolts holding in place the cross slides rack shown in **photo 23**.

To remove the cross-slide base from the machines knee the bolt holding the cross-slide screw shoe has been undone, the hole for this screw is shown in **photo 24.**

The cross-slide screw is retained into the knee casting by a complex arrangement of adjusters. Initially the grub screw in the nut on the inner edge of the knee shown in **photo 25** needs to be unscrewed towards the cross-slide lower platen. When the cross-slide's handwheel has been removed the hand wheel's spacer can be removed and this will allow access to the outer thrust bearing assembly of the screw. See **photo 26.**

- To be continued



The Dandelion Salvager – Salvagers and Salvaging

We've been reading this book by Alan McEwen, Hardcover, 176 pages published by Sledgehammer Engineering Press Ltd.

This is a most unusual book. It's author, who many readers will already be familiar with as the 'Rivet Lad' of his eponymous books, has spent his life in engineering and heavy industry. As well as a passion for boiler and bridges, Alan has a fascination with salvaging and reclaiming materials. He built his own home, World from Rough Stones House, from salvaged stone, brick, timber and other materials. As well as his engineering business he also has Dandelion Stone Troughs and Architectural Antiques; hence he is the 'Dandelion Salvager'.

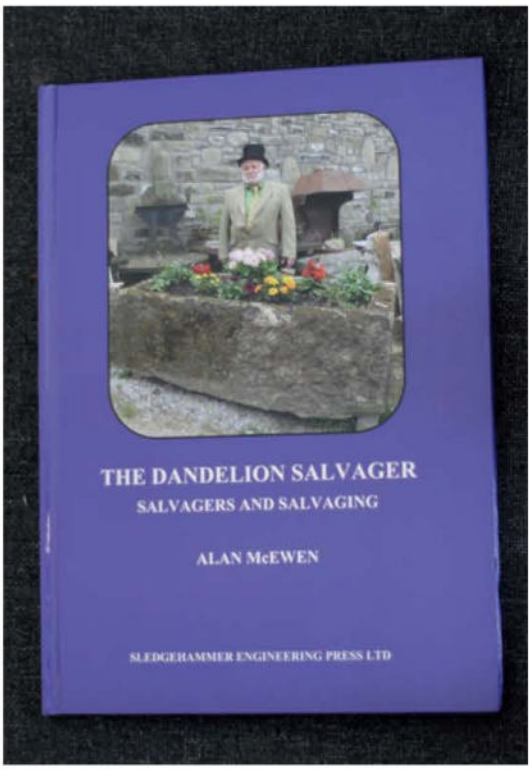
So, what does this book cover? It is a sort of near-random walk through the quirky world of salvaging, chiefly in the North of England. It's also copiously illustrated with pictures of people, places and, mostly, strange artefacts. Alan profiles the people and their businesses, from Andrew Graham on a mission to salvage Yorkshire water troughs carved from solid stone to the young William Mowbray, rescuing a near life-sized lead statue of a banal navvy. He also profiles people like Steve Parker, an artist and sculptor working in reclaimed materials, whose work includes a dolphin fashioned from plough mould boards and a pack of velociraptors made from old farm implements. This is no dry list of people and their businesses, each one is a discursive pen portrait bursting with anecdotes and random facts, as well as a sprinkling of the practical aspects that go into making use of all sorts of materials.

But as well as the people, Alan looks at the incredible variety of old and decaying artefacts that are still to be found in barns, field corners, yards and factories across the country. He clearly loves old cranes and stone crushers, and you can almost feel his distress at the loss of another boiler, cut up for scrap.

Others are stone from old gateposts and millstones to architectural finials and strange grotesque heads. Alan's love of the curious and unusual.

There are many examples of how salvage has been used creatively, a poignant example being a 'dragon tower' made of named bricks and built in memory of his friend, the late Fred Dibnah.

For anyone interested in industrial and architectural heritage, this book is a cornucopia of curious and entertaining stories and information, presented in a vivid manner that feels more like a road-trip TV series than a book. It really is a book unlike any other I have read. It's worth taking a look at this and Alan's other works.



Workshop Tales

In 1912, Welsh radio pioneer Arthur Moore picked up the wireless distress signal from the Titanic in his garden shed workshop, and it all started with Model Engineer magazine.

Arthur 'Artie' Moore was the son of a miller from Pontllanfraith in what was Monmouthshire (now Caerphilly Borough). As a child he'd lost part of a leg to the mill machinery and used a wooden prosthesis. As he grew older, he took up model engineering, building his own lathe, driven by the Gelligroes watermill. On the lathe he made a model horizontal steam engine that won a competition in our own Model Engineer magazine. The prize was a copy of 'Modern Views of Magnetism and Electricity' by Sir Oliver Lodge.

Reading the book lit a passion for wireless, and around the mill he built his own radio station with aerials, batteries and generators, a spark-gap transmitter and his first receiver based on the 'coherer' principle. Over subsequent years he improved his equipment and set up at least one other radio station. By 1911 he had already made the front page of The Daily Sketch after picking up a message about Italy declaring war on Libya.

On the night of April 14th, 1912, he was on duty at the station when he noticed a faint signal coming through on his wireless receiver. At first, Moore assumed the signal was from another ship or land-based station, but he quickly realized that it was a distress signal. The signal was weak and intermittent, but he managed to pick up enough of the message to realize that it was coming from a ship that was in trouble.

Moore immediately notified his father, who was also a wireless operator and owned the station. Together, they worked to boost the signal and get a clearer message. Over the next several hours, they listened intently as the distress signal continued to come through, becoming clearer and more urgent as time passed.

It soon became clear that the signal was coming from the RMS Titanic, which had struck an iceberg and was sinking in the Atlantic Ocean.

"CQD CQD SOS de MGY Position 41.44N 50.24W. Require immediate assistance. Come at once. We have struck an iceberg. Sinking ... We are putting the women off in the boats..."

"We are putting the passengers off in small boats" "Women and children in boats, cannot last much longer..."

The signals ended with: "Come as quickly as possible old man; our engine-room is filling up to the boilers."

The signal was received at a distance of over 3,000 miles, far more than was to have been expected with the Titanic's transmitter.

Arthur Moore's work in picking up the wireless signal from the Titanic and his subsequent role in relaying the distress signals to other ships and authorities caught the attention of the Marconi Company, which was one of the leading developers and manufacturers of wireless telegraphy equipment at the time.

The 'father of wireless' Guglielmo Marconi (no stranger to South Wales, some of his most important experiments were transmissions between Lavernock Point in Glamorgan and Flatholm Island in 1897) came to visit Moore at Gelligroes. As a result, Moore was subsequently offered a job with the Marconi Company initially as a draughtsman, but he went on to work for them in various technical roles. His work with the company allowed him to stay at the forefront of developments in wireless technology and helped him to continue his contributions to the field of wireless communication.

Moore played a key role in testing and evaluating new wireless equipment and technology, helping to improve the efficiency and reliability of wireless communication in a variety of applications.

Arthur Moore's expertise in wireless telegraphy also made him a valuable asset to the British Navy during World War I. In 1914, shortly after the outbreak of the war, Moore was co-opted by the navy to work on radio for 'Q-ships' – armed merchantmen. He went on to work with Captain H. J. Round on the development of the thermionic valve for radio.

Moore's work for the navy involved monitoring enemy communications and providing crucial intelligence to British commanders, helping them to make informed decisions about their military operations. He was also involved in the development of new wireless equipment and technology, helping to improve the navy's communication capabilities during

After the war he joined Marconi's Ship Equipment Department, and then became the manager of their Avonmouth establishment focused on marine communications. In 1932 he invented the 'echometer', an early version of sonar. He even made a petrol efficiency meter for his Alvis car.

At the age of sixty he retired, and in poor health he moved to Jamaica, but soon returned to the UK where he died in 1949 at the age of 62.

Artie Moore's role in picking up the distress signals from the Titanic and relaying them to other ships and authorities was a significant event in the history of wireless communication and helped to shape his career in the field.

A Retracting Toolholder For Screwcutting With A Twist

David George modifies a classic design by George H. Thomas for automatic operation. Full drawings commence in this issue and the balance will appear next month.

Having just received a pair of castings for the George H. Thomas screw cutting tool holder, I wondered if I could make it automatic where it would self-extract instead of having a lever to extract the tool. If you are working up to a length you need to wind out the tool at the end of the thread being cut, reverse direction or disconnect the leadscrew and traverse to start of thread. I thought that if the retract could be made automatic I can run the lathe at a faster speed which helps with cutting finish and time to cut thread. The George Thomas toolholder is shown in **photo 1**.

I decided that I would like to have a more solid slide and discarded the slide casting for a piece of cast iron which would be the same height as the body casting. I machined the casting first and it cut very well with no problems including the dovetail.

The next was to machine the slide to machine the body with a gap for the gib strip, **photo 2** and **3**. The gib strip was next as I machined it in situ with the help of a couple of dowels and toolmakers clamps, **photo 4**.

I turned it over and put a 0.005 " shim under the strip to give a little clearance on edge. I drilled the casting for the gib screws assembled and through casting into Gib strip to make dimples for grub screws with a point on end. The next operation was to machine the slide to allow the saddle to hold and allow the movement of 3/8". When cutting the clearance for the legs of the saddle I slightly cut a cut into the dovetail but it is slight and doesn't alter movement etc. the saddle was next, blocking up and then machining the clearance for the

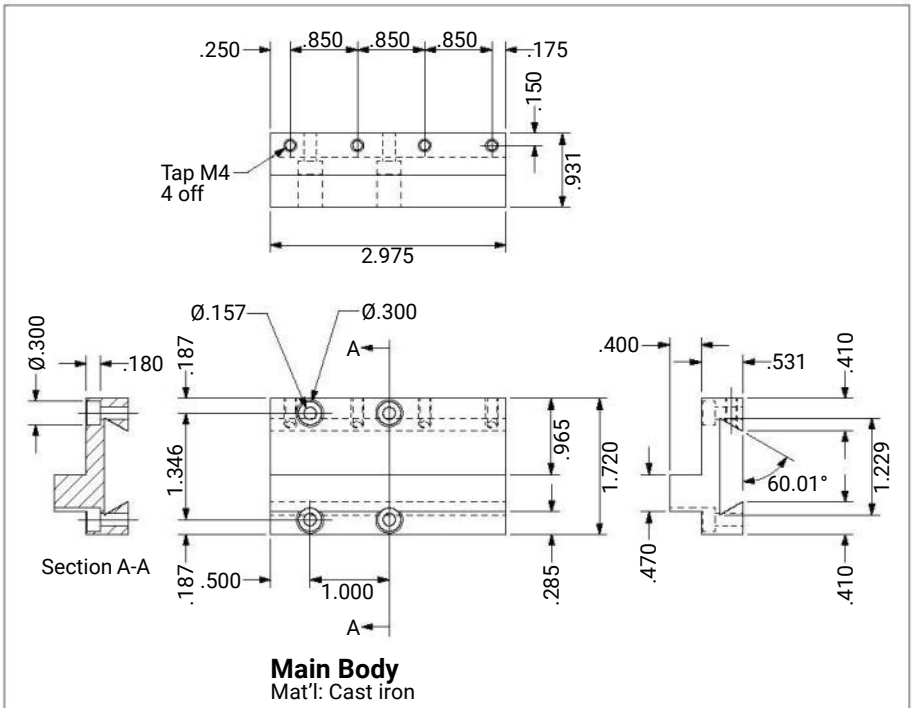
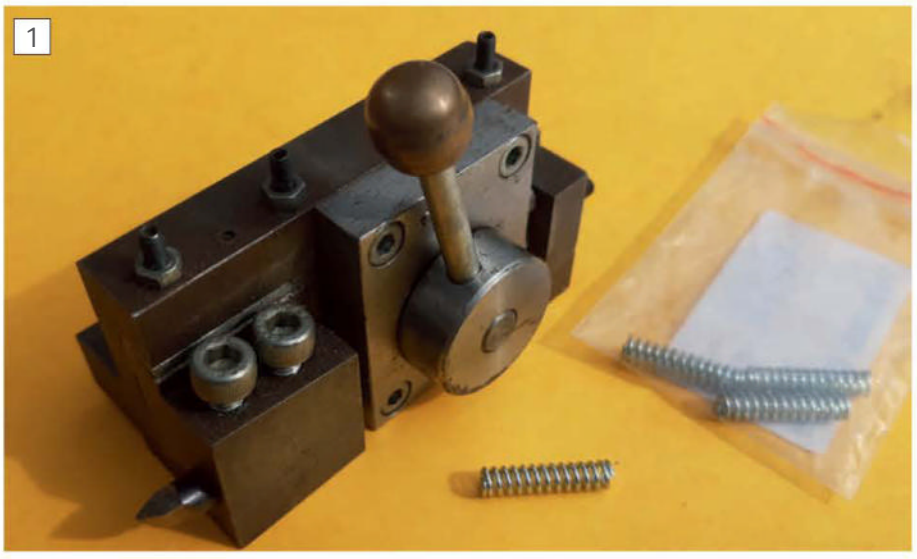


Figure 1.



George Thomas toolholder.

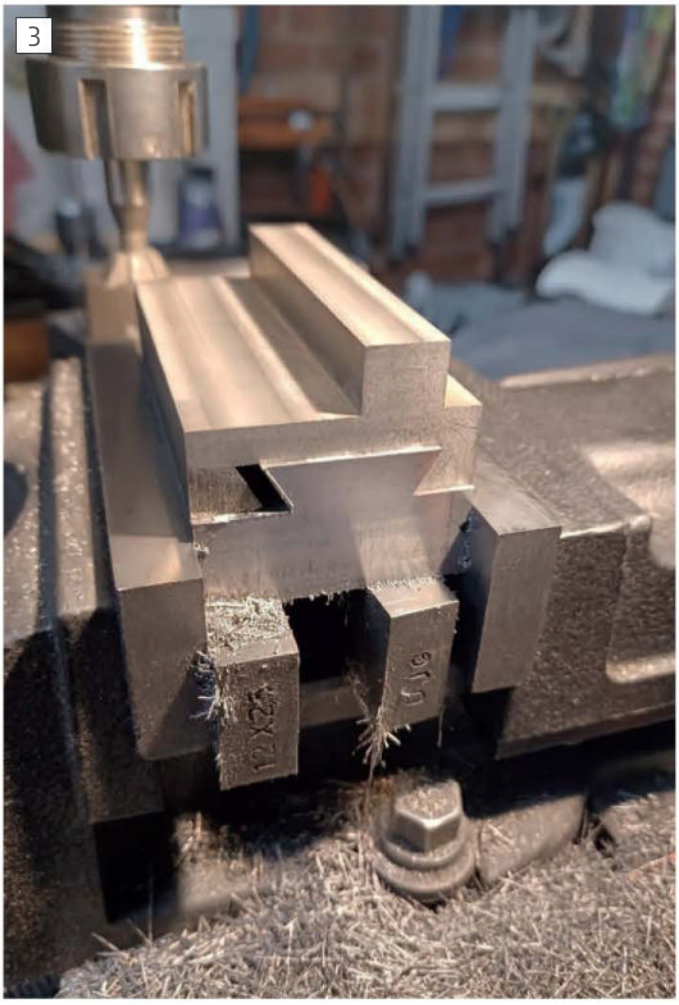
slide which leaves four legs, **photo 5**.

After drilling the body casting and the saddle casting I found that the screw just catches the edge of the dovetail which I milled slight flat to clear the screw and also as I have drilled through the screw holes in the saddle I found that it is unnecessary to drill through and have altered the drawing thus as the spring pocket cuts through the screw hole but it doesn't bother the spring on my slide.

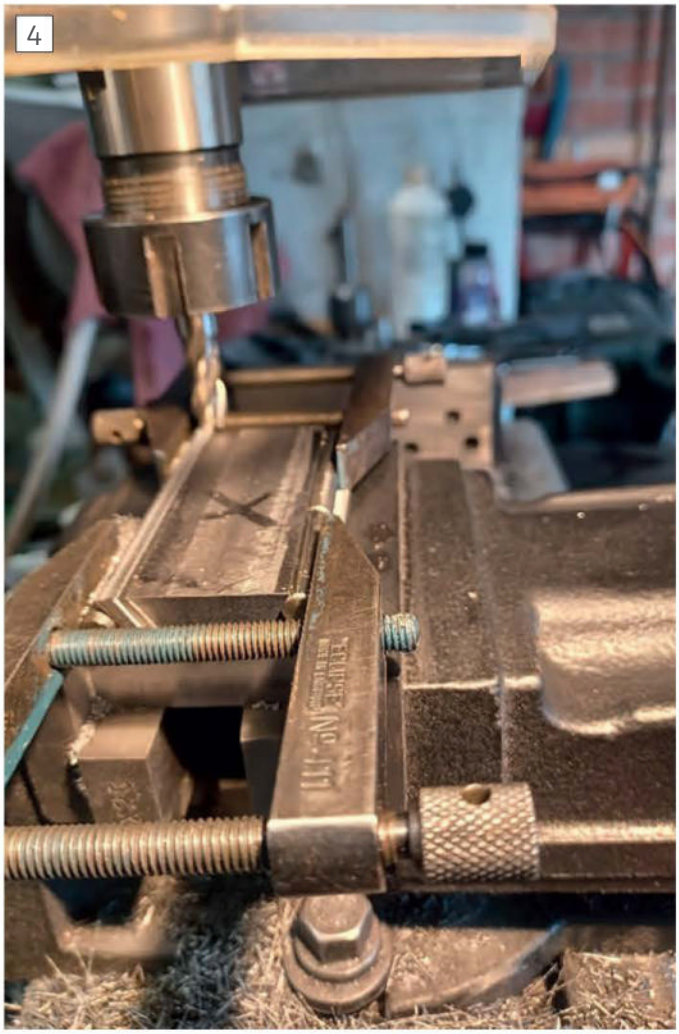
I made the latch next, from gauge plate, with a leg which is half the thickness of the ¼" plate and an end which will hold the slide till pivoted, **photo 6**.

The saddle was machined next to receive the latch which has a 3/16" for the shoulder screw and an angle to give clearance for side of latch and top of latch body.

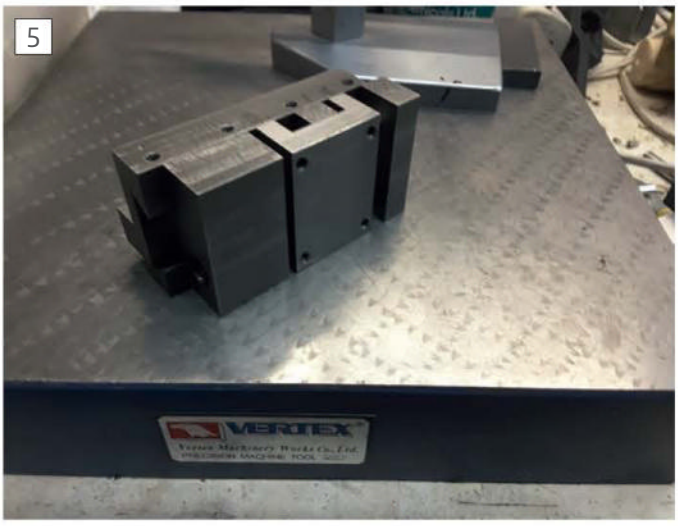
Slide in progress.



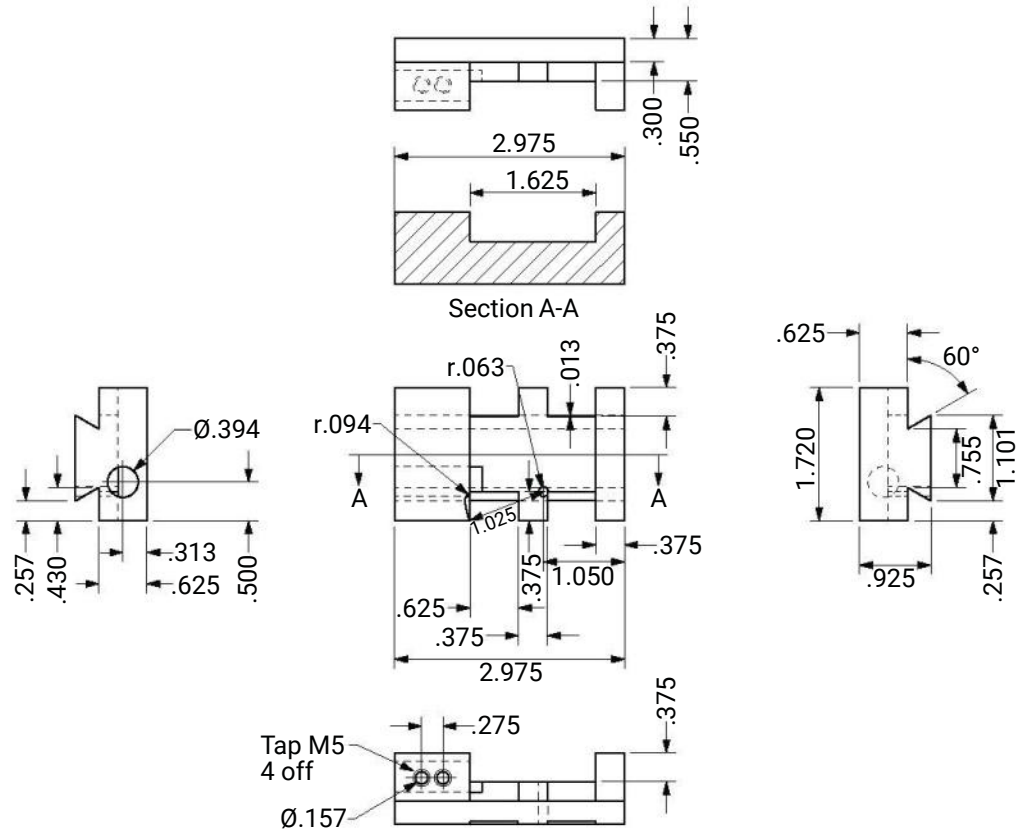
Testing dovetail.



Machining gib in situ.

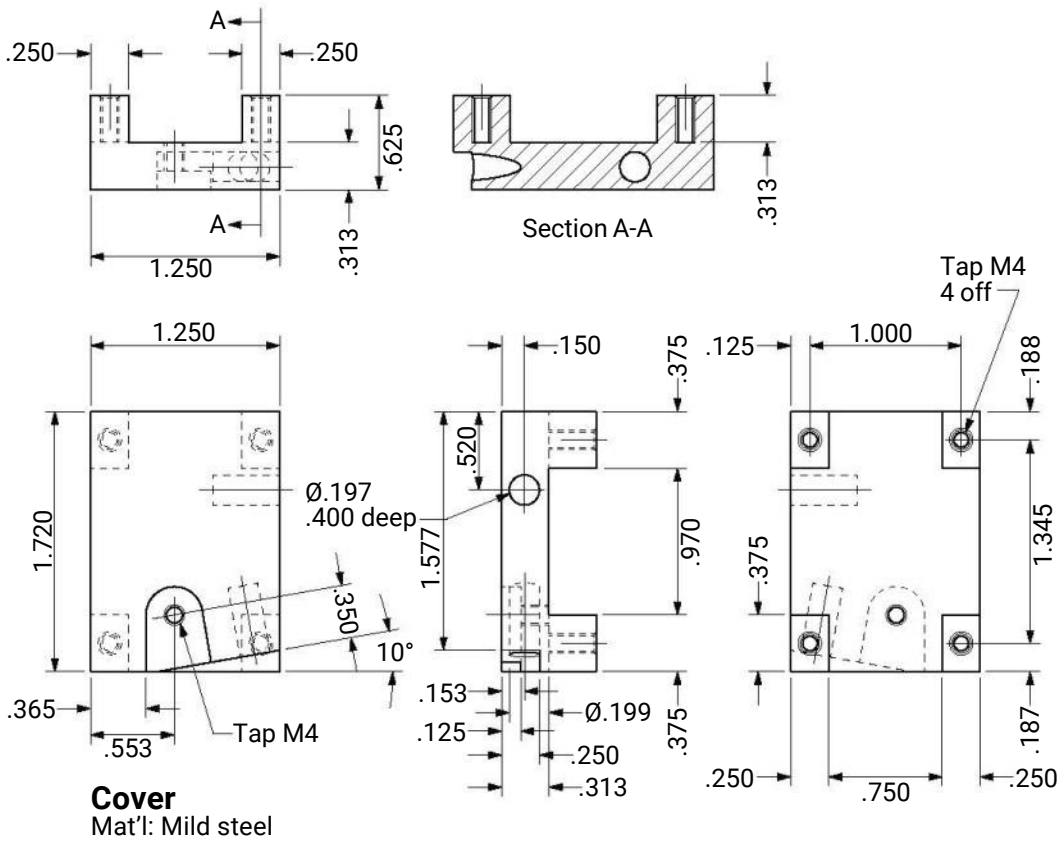


Machining clearance for the slide.



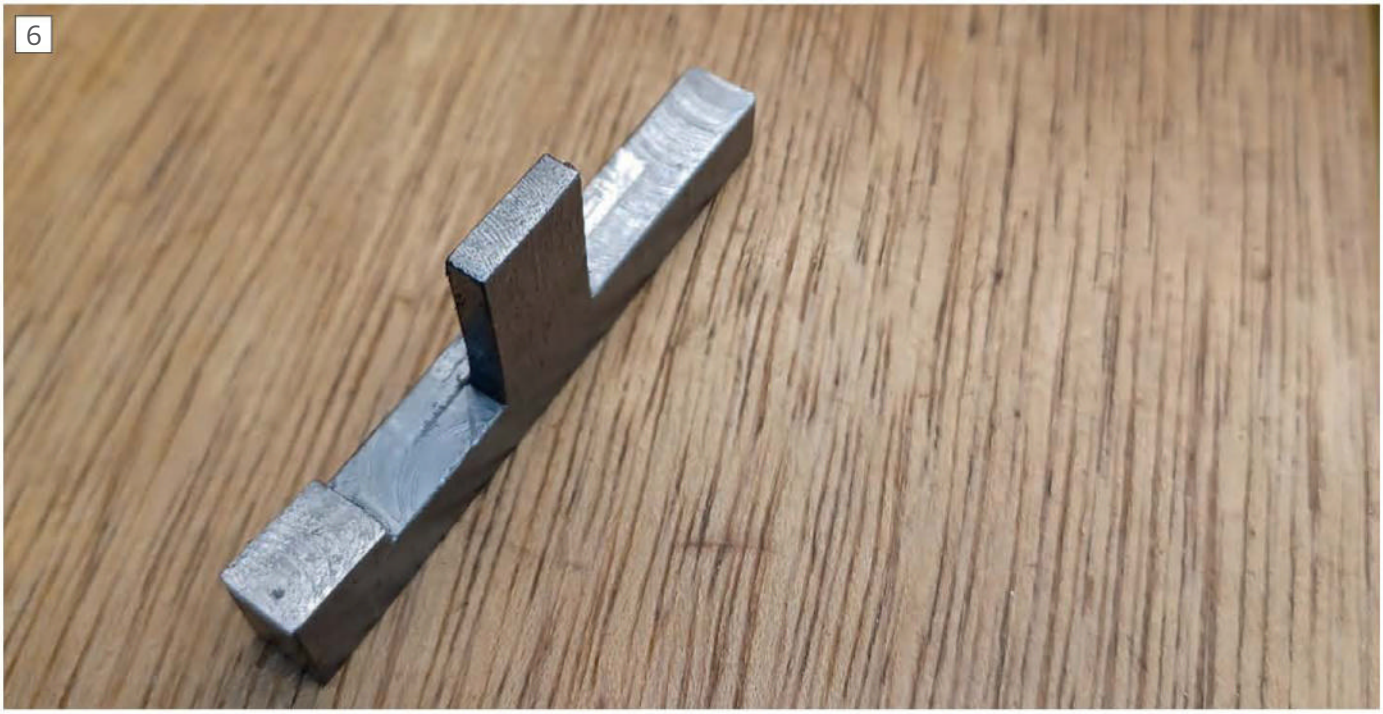
Slide
Mat'l: Cast iron

Figure 2.

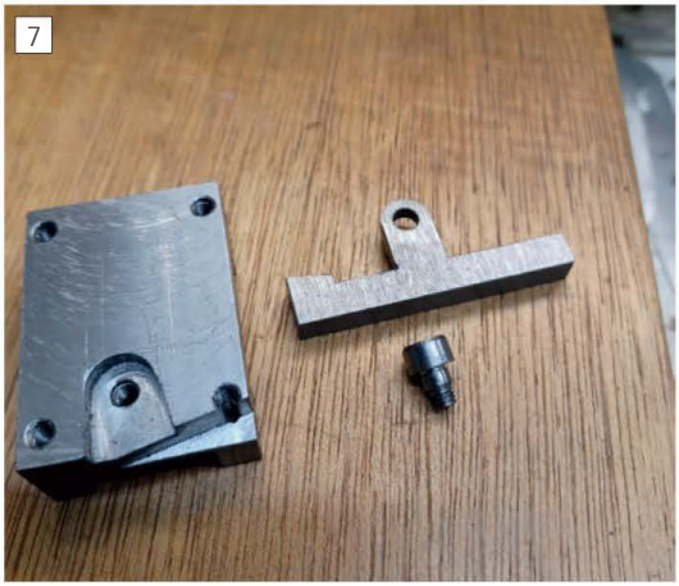


Cover
Mat'l: Mild steel

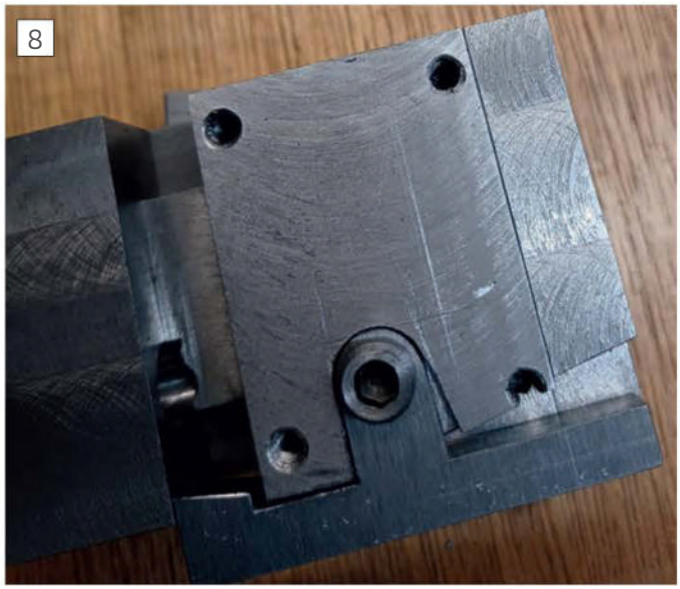
Figure 3.



Part-finished latch piece.



Latch pivot.



Completed latch.

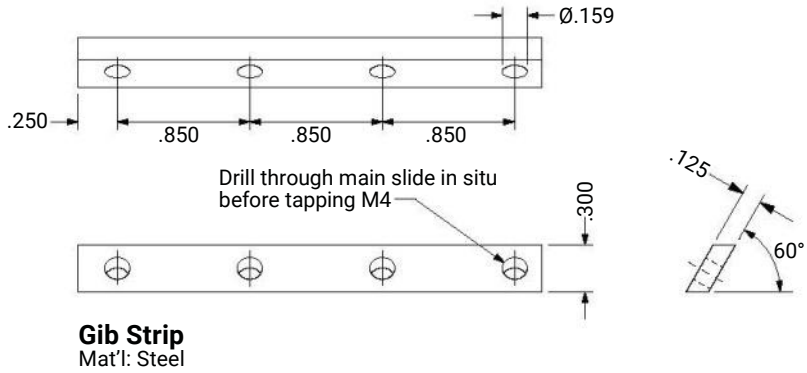


Figure 4.

The shoulder screw was cut from a 5mm cap screw. I firstly held a long screw by the 5mm diameter and skimmed the head to run true so I could hold the head, and all will run true. The next operation was to turn the thread diameter leaving a 1/8'' shoulder length for latch thickness. I made the thread length too long for now to allow thread to be cut with a die which is difficult on a short length. I then turned the middle diameter to 3/16'' to suit the pivot hole and cut of the end of the thread to length, **photo 7**.

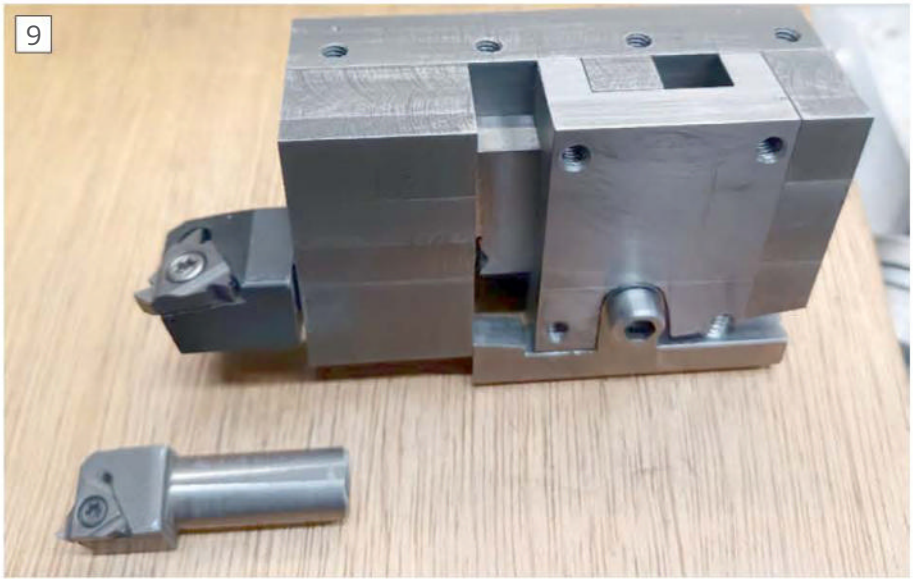
Then I drilled the two holes for the

springs one for the end to push the slide and one on the angled side to load the catch. When first assembled it worked, I thought great, but more to that later.

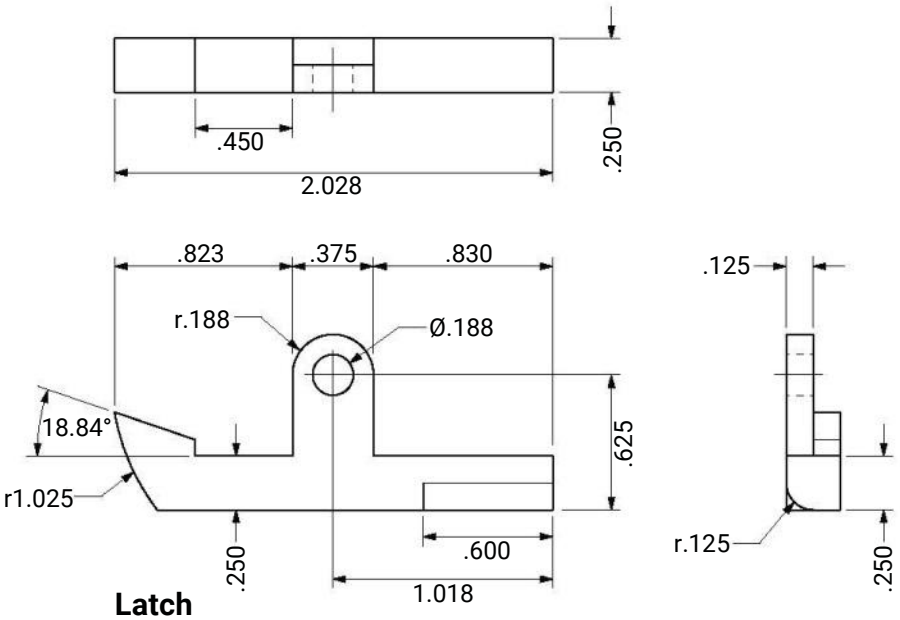
The next operation was to fit the tool holders. I was going to use indexable tool holders and as I thought it easier to drill a round hole than a square hole, I decided to turn the shanks of the two holders in a four jaw chuck with enough sticking out for a decent length. Then machined a flat on the bottom of the diameter so a couple of grub screws will hold it square and sturdy, **photos 8** and **9**.

There are videos of various stages of making the toolholder on the forum at www.model-engineer.co.uk

●To be continued.

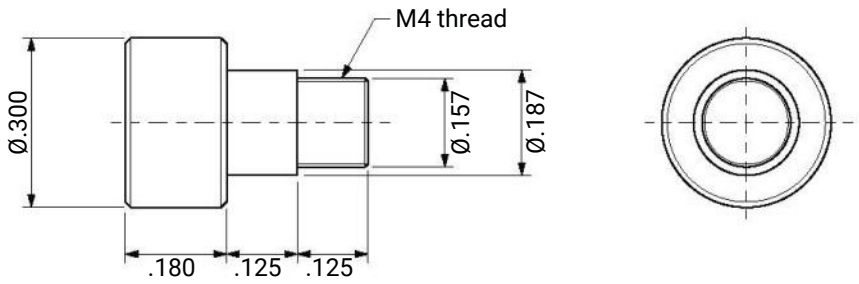


Modified toolholder.



Latch
Mat'l: Gauge plate

Figure 5.



Hold screw on shank and turn head true.
Then hold on head and turn shank to match
hole in latch and then turn thread 4mm for thread and to length

Pivot Screw
Mat'l: Make from M5 cap screw

Figure 6.

Artful Dodge #8 –

Measuring internal diameters

Essential reading for beginners and valuable to old hands, this series by the late John Smith shares some of his wealth of skill and experience from over half a century in hobby engineering.

Bore gauges.

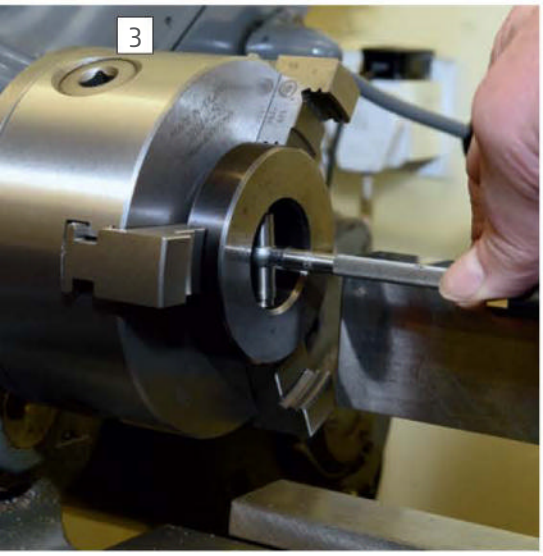
Ever since Mitutoyo produced the *Digimatic Caliper* in 1983, digital calipers have been ubiquitous in industry. I bought one of the first ones and used it for over twenty years before treating myself to a new one.

But digital measuring devices have drawbacks:

- Firstly, any device which converts an analogue measurement into a digital display has a "quantisation error". For most digital calipers, this is 0.0005" or 0.01mm, which is basically the smallest value which can be displayed. So if a caliper reads 1.9995" we would hope that the actual (analogue) measurement might be somewhere between 1.99925" and 1.99975", but the instrument gives us no clues.
- Secondly, digital numbers look so precise that we are tempted to believe that a caliper reading to the nearest 0.0005" or 0.01mm will be accurate to +/- 0.00025" or +/- 0.005mm, but in fact, the latest Mitutoyo Absolute calipers are accurate to +/- 0.001" or +/-0.02mm.

That accuracy is excellent for almost all of the measurements we take, but when measuring a bore which must be between 0.0003" and 0.0005" smaller than a shaft to be press-fitted into the bore, it's not good enough. Digital calipers are brilliant for measuring workpieces being turned or milled, but for the final measurements (as the finishing cut is approached) a good old-fashioned analogue micrometer cannot be beaten. Reading the thimble, one can estimate a size to within about +/- .00015" and the micrometer has a better "feel" than the caliper; I prefer the "feel" of a friction thimble mike to a ratchet one.

So, are internal micrometers the instruments of choice for internal diameters? I would say not. I have three lovely internal micrometer sets (all bought cheaply second-hand) which



Using a bore gauge.

can measure diameters from 1.000" to 2.000", 2.000" to 12.000", and 8.000" to 13.000" respectively, **photo 1**, but they are seldom used. Internal micrometers suffer from two problems. One can never be totally sure that:

- The mike is positioned exactly on the diameter (if it isn't, it will read low),
- The body of the mike is at 90 degrees to the walls of the bore (if it isn't, it will read high).

In industry, bores are measured using bore gauges. These have three measuring faces, eliminating the first problem. And instead of points, they have elongated measuring faces to ensure that the body of the gauge is co-axial with the bore to be measured, eliminating the second problem. They typically have an accuracy of around 0.00015" or 0.004mm. Unfortunately, a set of analogue bore gauges to measure diameters between 0.5"/12.5mm and 2.5"/65mm would cost well over £2,000; digital ones around £5,000. Perhaps they are not the solution for us.

So what is? Well it's the humble telescopic gauge, used with care and in conjunction with an analogue micrometer. A set of six gauges for bores between 5/16" and 6" can be had for as little as £30. The Starrett set which I have used for twenty years, **photo 2**, can be bought new on-line for around £180 including VAT, sets with a usable but less smooth action can be bought for much less.

If you think about the tasks of machining a bore to fit a shaft (or vice versa) - either a press fit or a clearance fit and machining a piston to fit a cylinder (or vice versa), we are not actually much bothered about absolute measurements. It's the relative measurements that matter. So if we use the same micrometer to measure both shaft and bore, any inaccuracy in the micrometer will cancel out.

When using a telescopic gauge, make sure that the body of the gauge is vertical as, if it's horizontal, the bore will be supporting the weight of the gauge and it will slip below the centre of the bore and read low.

Also, use a horizontal object in your eye-line when tightening the gauge (for example the shank of a boring tool or a parallel on the cross-slide) to ensure that the handle of the gauge is horizontal, **photo 3**. This is crucial, as a 5° angle in a 2" bore will cause an error of 0.007", a 2° angle an error of 0.001", and a 1° angle an error of 0.0003". Get it right and you will achieve the accuracy you need, and at a very affordable cost.

BEGINNERS WORKSHOP
These articles by Geometer (Ian Bradley) were written about half a century ago. While they contain much good advice, they also contain references to things that may be out of date or describe practices or materials that we would not use today either because much better ways are available of for safety reasons. These articles are offered for their historic interest and because they may inspire more modern approaches as well as reminding us how our hobby was practiced in the past.

Beginner's Workshop

CASE-HARDENING

GEOMETER explains the process and its applications

BECAUSE of its low carbon content, ranging between about 0.1 and 0.2 per cent., a mild-steel, unlike a carbon steel, will not harden merely by heating to bright red and quenching in water. The process of case-hardening, however, increases the carbon content at the surface of mild-steel and, on quenching this layer, hardens in the same way as a carbon steel, though the core of the mild-steel remains soft.

The obvious advantages of case-hardening are that parts like shafts, gears, gudgeon pins, brake rod pins, screws, etc., are rendered resistant to wear. On the other hand, it is not always realised that special cutters and small tools for aluminium, brass, copper can at a pinch be in mild-steel case-hardened-which in the larger sizes may be more conveniently and cheaply obtained than cast steel. Small blade type springs, too, if not highly stressed,. are successful in case-hardened mild-steel.

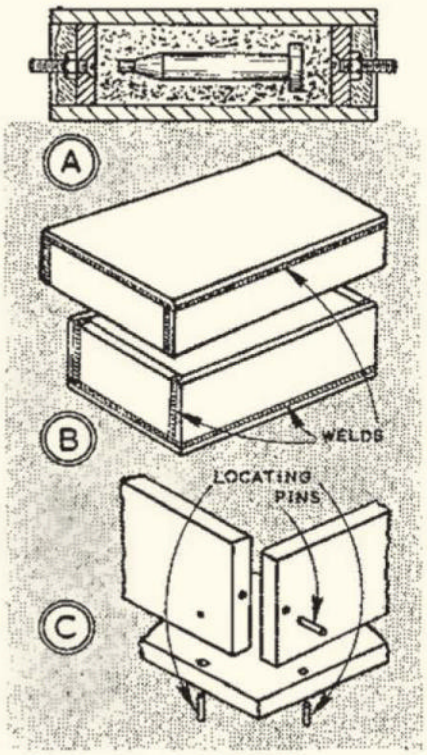
Depth of casing

The depth of hard casing depends largely on the period during which the mild-steel is at red heat and in contact with the case-hardening compound.

A simple method, yielding a casing a few thou. thick, is to heat a component red in a blowlamp flame or fire, sprinkle on the case-hardening compound or roll the component in it, reheat to bright red for about two minutes causing the compound to run over the surface and burn, then quench in water. Rubbing on a file reveals the surface is hard, though if the component is held in a vice and the file used vigorously, the casing can be cut through.

For greater depth of casing, a component must be packed in case-hardening compound in a steel box, so as not to be nearer the sides than about 1-1/2in. Maintained at red heat for four to five hours, the depth of casing is then about 3/64 in. This method is essential when the component is to be ground to size after case-hardening.

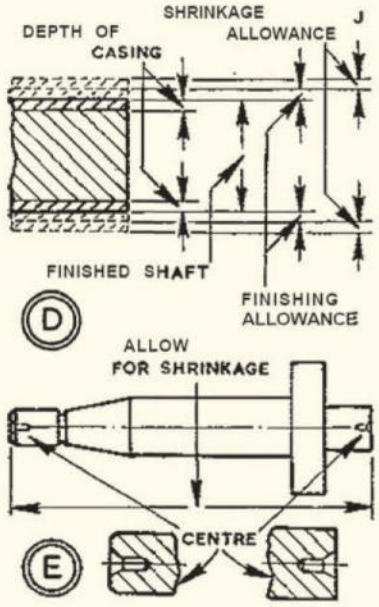
Small parts like screws, nuts, washers, and components on which distortion may be small or not important, can be case-hardened singly or in numbers by laying on a piece. of sheet iron, heating to red, covering with compound, reheatmg, then quenching the lot. A shaft or spindle, however, on which distortion can occur, should be lifted off by pliers, plunged vertically and kept moving.



For a deep casing on a special shaft, a box can be made from round mild-steel tubing with discs at the ends, sealed with fireclay, A. The case-hardening compound should be packed tightly round the shaft and the whole maintained red in the domestic fire (failing other means) for one to two hours, or longer. After cooling, the ends can be extracted, (countersunk screws shown are convenient for gripping), the shaft removed, reheated to bright red, then quenched vertically.

For flat or odd-shaped parts, a box can be in mild-steel plate, with welded corners. For a small box, thickness can be 5/32 in. or 3/16 in., or 1/4in. for fairly large ones. A flat fitted-in lid or a fit-over type, B, can be sealed with fireclay. Welding being done out, location can be as C, otherwise clamping is sufficient. Thicker than 3/16 in. plate, edges of joints should be chamfered for welding.

For hardening, parts should be polished with emery cloth, and any areas to be kept soft covered with a mixture of fireclay and pulped asbestos (sheeting or string), allowed to dry completely. After hardening, the surface is a light grey or mottled



colour, and can be repolished with emery cloth-sufficient in most cases. On a shaft where size is important, however, allowance should be made of about 0.001 in. per inch of diameter for shrinkage, and 0.004 in. to 0.008 in. for finishing by grinding-the larger dimension also taking care of slight distortion. Several thou. depth of casing should then remain, *D*.

Allowance as for diameters should be made on lengths *E* and for finishing, centre indentations can be cleaned and trued on brass or mild-steel points, using fine grinding compound.

The Harrogate Model Engineering Exhibition and Model Rail 2023

John Arrowsmith reports on the return of a much-missed model engineering exhibition.

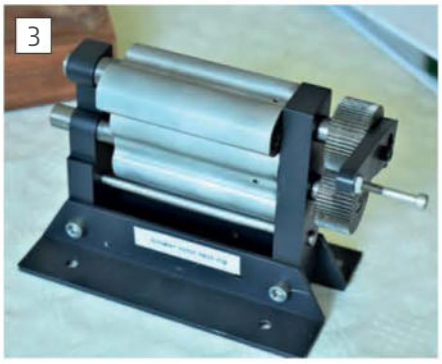
The return of an exhibition in the North of England was very welcome and a return to Harrogate in particular as it is some time that such an event had been held at The Great Yorkshire Showground. It was only a two-day event this time and combined with the model railway section the model engineering was not quite what it perhaps could have been. The exhibition had been organised by Simon Boak and was located in the two halls previously used, except that in the intervening years Hall 1 had been rebuilt into a large well lit and comfortable new exhibition space. Hall 1 held all the model railway exhibits along with some model engineering displays. The main feature of this space was the 200 ft x 50 ft "O" gauge layout built by Simon George. It was a sight to see, and one had to admire the sheer volume of work put into this massive exhibit. There were no outside activities this year simply because of the cold inclement weather.

There were no competition sections to the event either which was a little disappointing as visiting model engineers do like to discuss the merits of each entry. However, this did not affect the quality of models on show but there was very little tooling of any merit within the event as a whole. In addition there were no machine tool companies present of any kind with just a couple selling standard accessories like chucks, and small tools, plus files and cutting tools plus the usual Model Engineering establishments purveying their range of castings, material and all the traditional ME favourites.

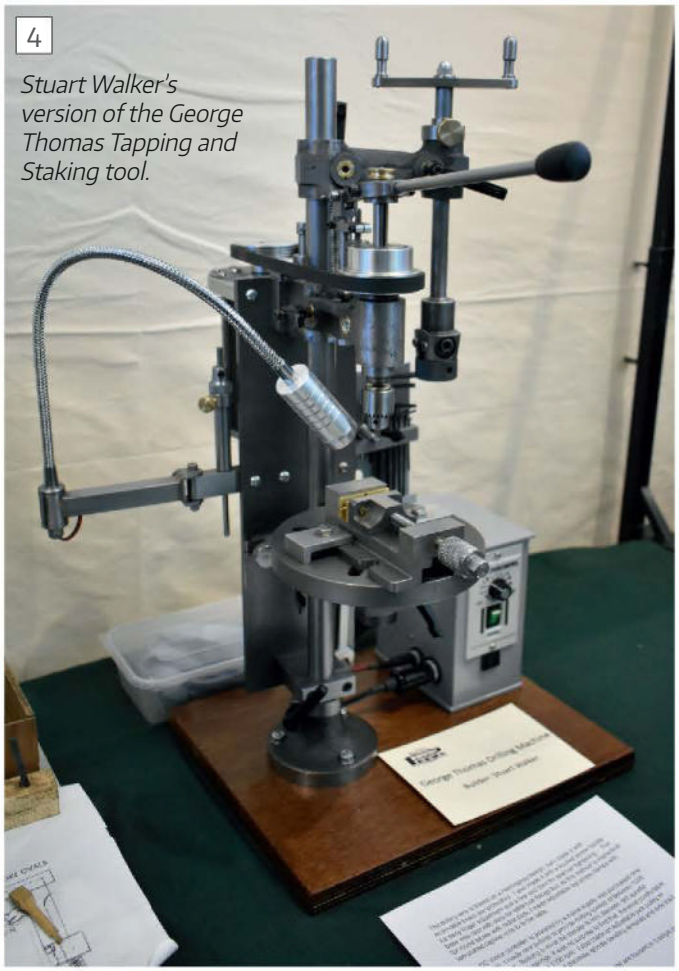
On the club stands were some superb model exhibits which I noted and will begin by looking at the one club stand which did have some very nice shop made tooling. That was the **Pickering Experimental Engineering & Model Society** (PEEMS) which I am sure all readers would have appreciated. The stand out model on this display was the 40% scale model of the Delarge 15.S.8 engine which powered the Delarge GP car to victory in the 1926 and 1927 British GP at Brooklands. It is still under construction by Mike Sayers who also had his 1/3 scale 4.5 litre Blower Bentley on show. Both of these models show exemplary workmanship and finish, **photos 1, 2** and **3.** I have included a photo of the Blower Rotor Test rig for the Bentley engine which was not at the show, but I thought it would be of interest. In addition to these fine models there were some excellent examples of small and useful workshop tools. For example the Tapping Staking and drilling machine to the original George Thomas

The Delarge 15.S.8 GP Engine under construction by Mike Sayers.

A top view of the Delarge Engine.



Blower test rig.



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Stuart Walker's version of the George Thomas Tapping and Staking tool.

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Another view of the Spiral Grooving attachment.

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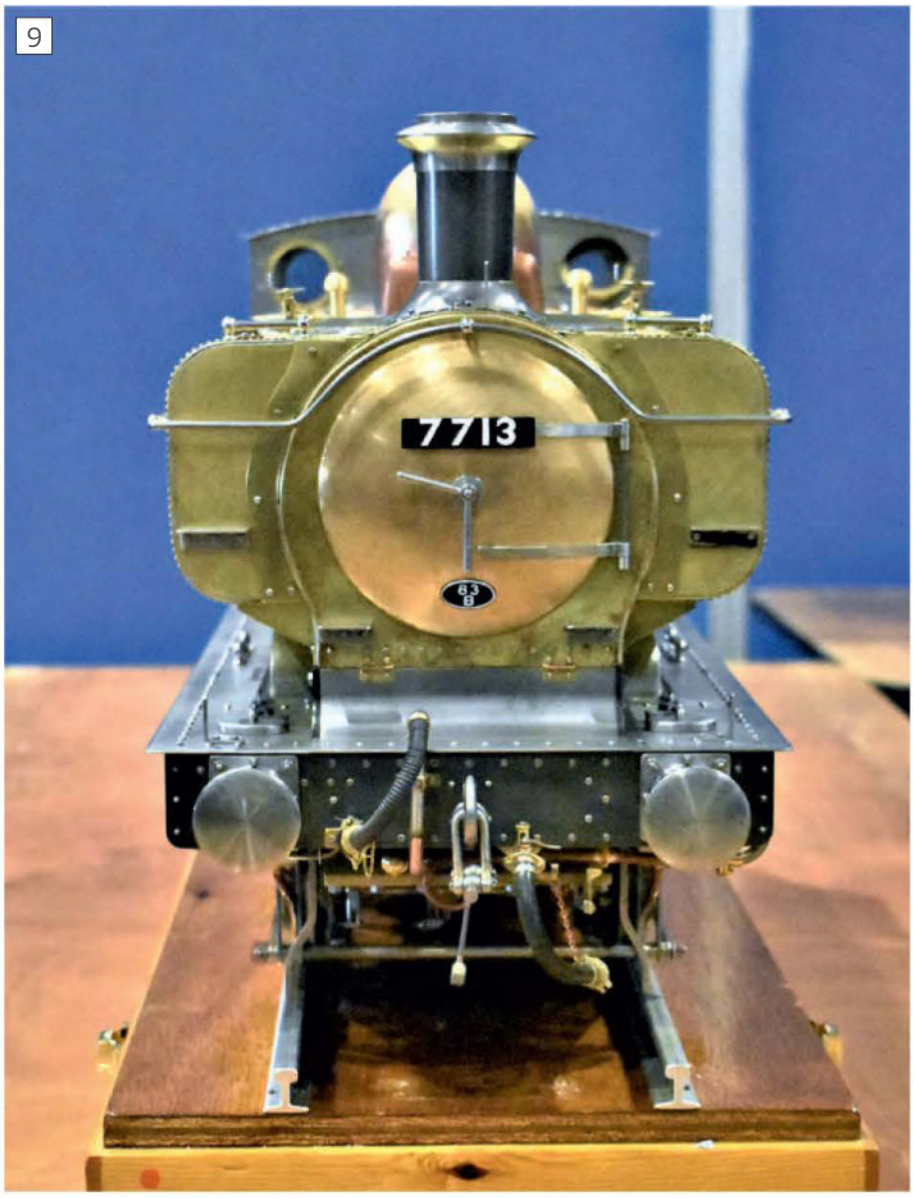
Stuart Walkers Spiral Grooving attachment.

Useful Finger Plate and clamp by Ken Shutt.

Peter Bramley's Sine Table with Fowler cylinder.



Alan Crossfield's superb GWR Pannier Tank.

design was presented by Stuart Walker who had added a high-speed DC motor and control box and various different methods of clamping both the main column and drill vice. A useful lamp had also been added, **photo 4**. In addition to his drill, Stuart also had a handy Spiral Grooving attachment, **photos 5** and **6** on show. A selection of tooling by Ken Shutt provided some good food for thought, his example of a Finger Plate and clamp was well made and fully functional, **photo 7**. Peter Bramley displayed a Sine Table with Fowler Cylinder for machining precise angles, **photo 8.**

There was a display of outstanding models which were not allocated to any particular club, but I did manage to find some information which helped. Alan Crossfield is a well known builder of particularly good locomotive models and here I found his latest creation in the shape of a GWR Pannier Tank in 5" gauge with superb workmanship and it will no doubt be a prize winner in any future exhibition, **photo 9**, Mick Keenan had a couple of excellent model stationary engines on show The Holmes Mill Clayton & Goodfellow Cross Compound Engine was a particularly fine example. With no Young Engineers section or SMEE having any input to the exhibition there were not many examples of tools at all, but a substantial set of Bending Rolls on the **Tyneside** stand caught my eye, the rolls were 2" diameter stainless steel and were fitted with a good set

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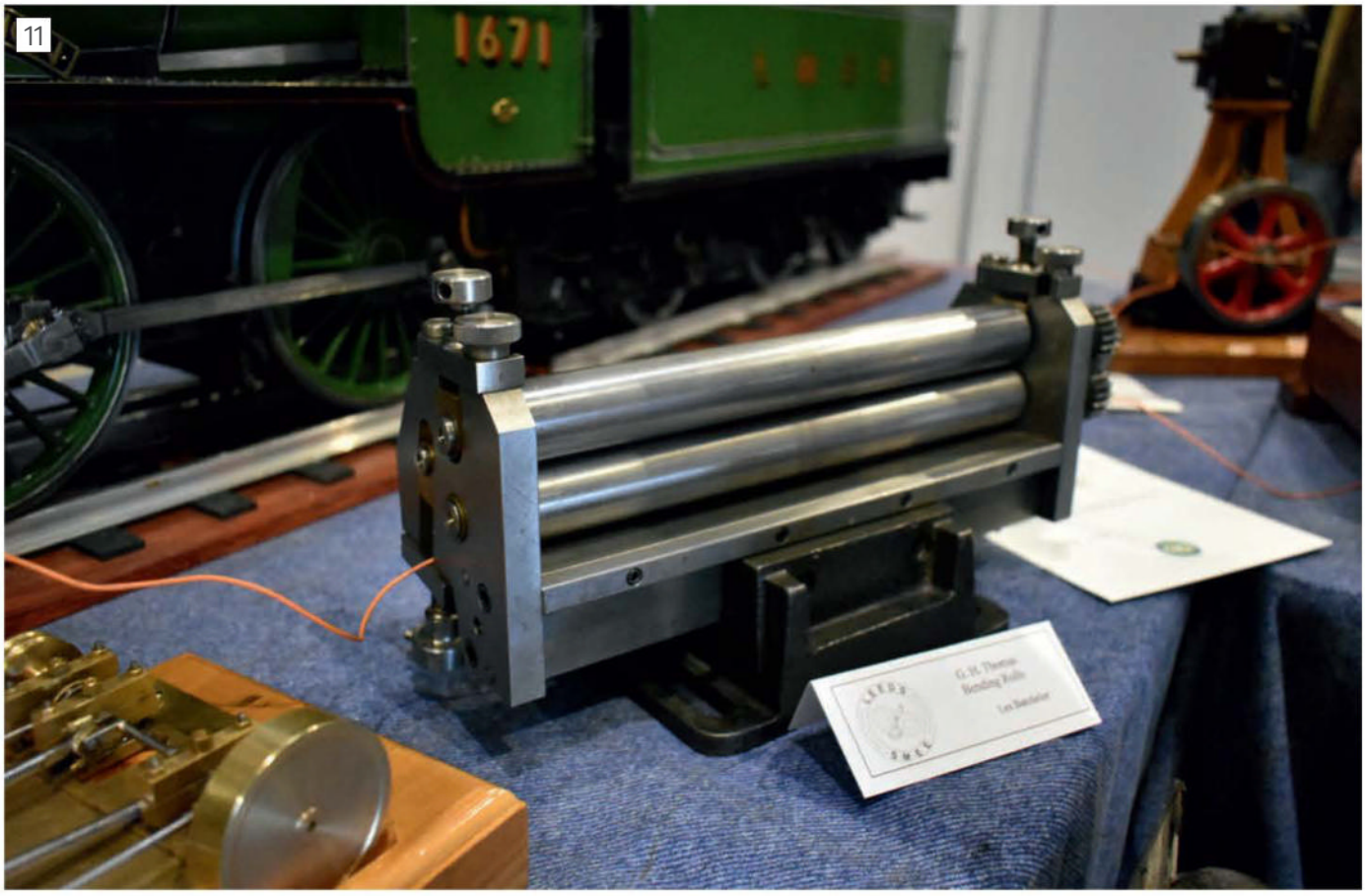
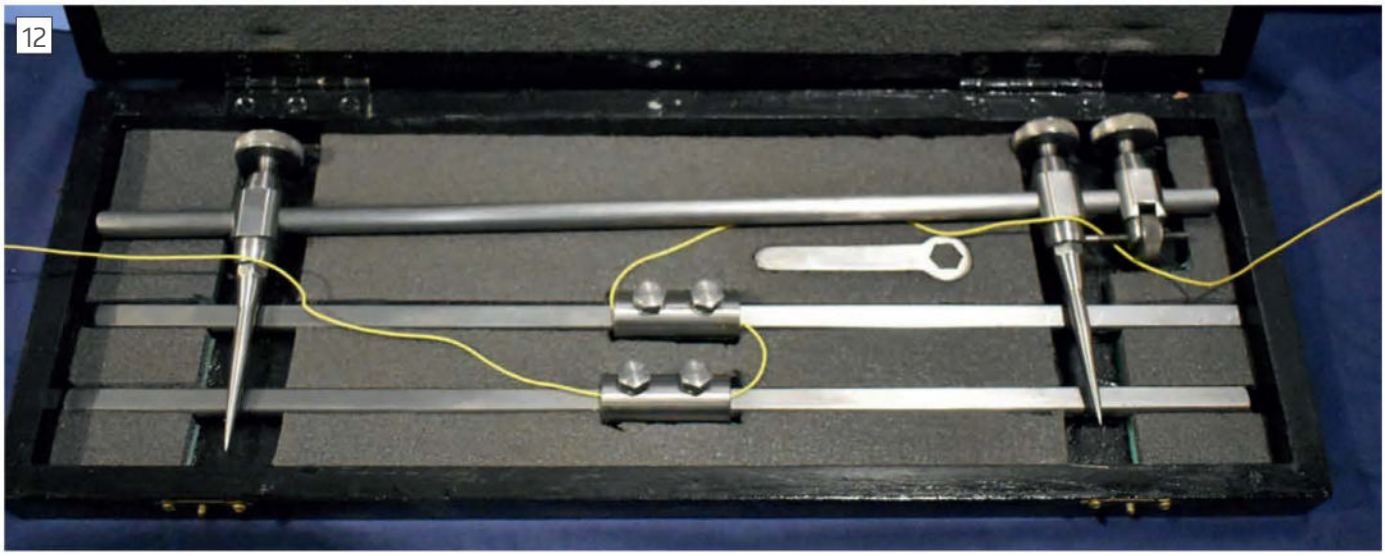
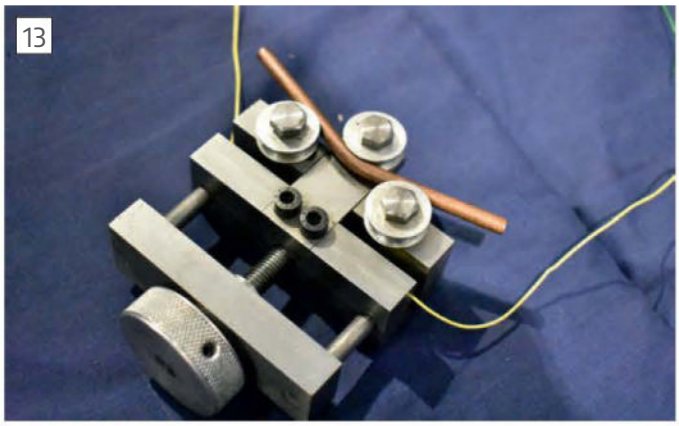
A substantial set of Bending rolls from the Tyneside Society.



This set of Bending rolls were shown on the Leeds SMEE stand.

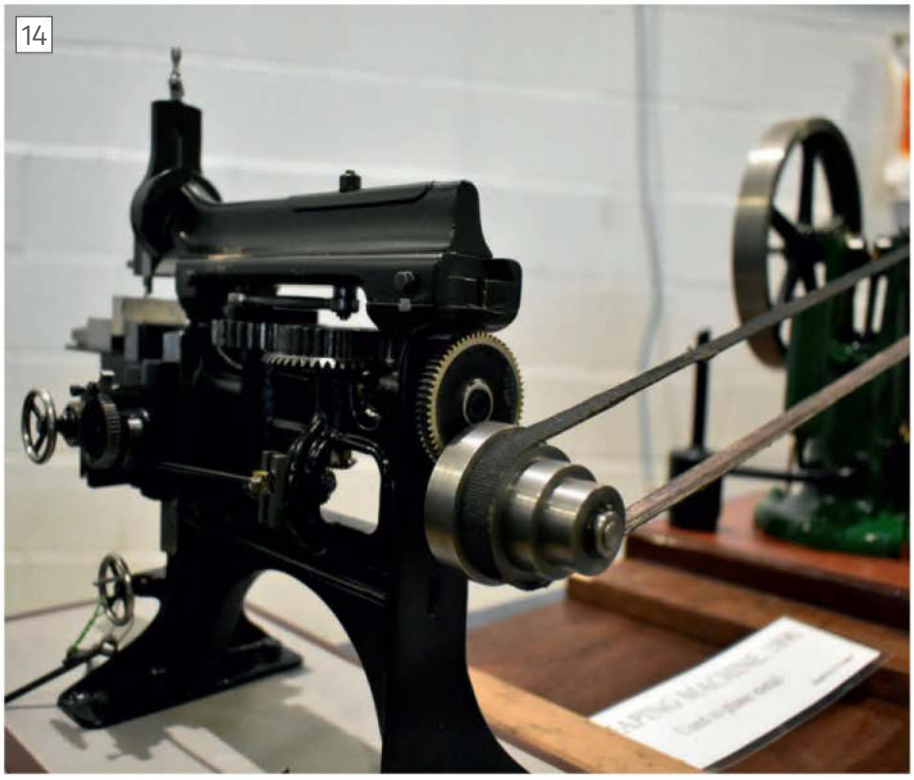


A good set of Trammels shown on the Grimsby & Cleethorpes display.



This useful Pipe Bending jig was from the Grimsby club.

Steel boiler with tell tale holes in the firebox stays.



The 1896 Shaping machine part of the Stockton & Darlington stand.

of gear wheels all mounted on a robust angle base, **photo 10**.

Another set of rolls to the G. H. Thomas design were to be found on the **Leeds SMEE** display. Both sets looked to be good useful accessories, **photo 11**. The **Grimsby & Cleethorpes MES** had some interesting instruments and tools on show with a boxed set of well-made Trammels, **photo 12,** and a nice small pipe bending jig, **photo 13.** An old machine in the form of a 1/6 size Shaping machine still looked capable of performing well, **photo 14**. On the **Stockton and Darlington MES** stand a couple of 7¼" gauge steel 9F boilers were on show with a detail that I had not seen before. The firebox stays showed excellent welds, but each stay was drilled from both ends with a small hole. This was drilled to a depth just into the water space on each side, the idea being that should a stay crack or develop a leak it would be immediately identified, **photo 15**. Apparently, it is a new idea being

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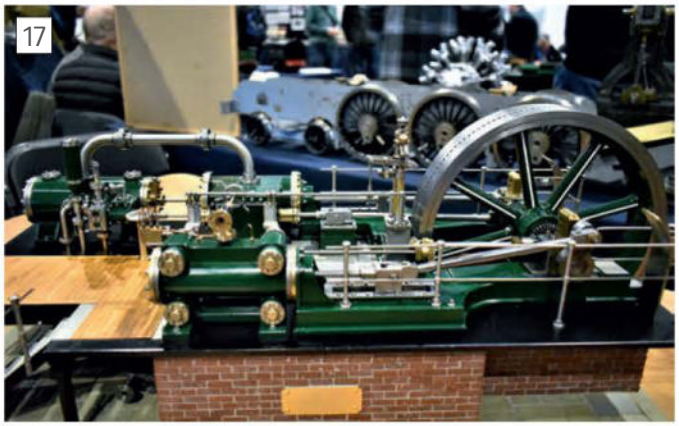
Part of the display from the City of Sunderland Society.



The Holmes Mill Clayton & Goodfellow Cross Compound engine.

Dave Bramwell's Horizontal 4 - cylinder aero engine.

introduced by a full-size boiler maker. It will be interesting to see how this idea develops. From the **City of Sunderland Society** a well filled display of some excellent stationary and aero engines, **photos 16** and **17**. Dave Bramwell from this club also had a good display of aero engines built from scratch including the spark plugs. A nice little horizontal 4-cylinder aero engine showed off Dave's excellent workmanship, **photo 18**. Overall this was a good two-day event which was enjoyed by the many visitors. It is to be hoped that a future exhibition can be held at this venue as it has all the attributes needed to promote the hobby of both model engineering and model railways, with good access from the motorways and plenty of free parking. If there is to be an exhibition in 2024 I hope there would be a competition element, along with more information on individual displays, perhaps with a boating pool and a larger space for model R/C road vehicles. If it could perhaps be considered for May then there is scope outside for the traction engine modellers to have some space to demonstrate their activities. A comprehensive exhibition guide would also be a useful addition for visitors. Having said all that, my thanks to the organisers and staff for their help and to all the members of club stands and displays, you provided a good exhibition covering all the disciplines. ▮

The Midlands Model Engineering Exhibition is Coming!

Meridienne Exhibitions can't wait to welcome you back to the Midlands Model Engineering Exhibition from Thursday 12th to Sunday 15th October 2023. They have announced that the show will celebrate 125 years of Model Engineering with the Society of Model & Experimental Engineers and Model Engineer and Model Engineers' Workshop at this year's exhibition.

SMEE will celebrate this milestone with a special stand which incorporates a collection of historic models, workshop demonstrations and promotion of its current activities.

Model Engineer and Model Engineers' Workshop will be hosting a series of talks covering a wide range of topics by some of their authors.

As always, nearly forty of the leading model engineering specialist trade suppliers, all waiting to meet you and provide everything you need for your modelling activities.

The exhibition will also showcase hundreds of fascinating models in competition and display classes and on nearly thirty club and society display stands and outside steamers.

Tickets are on sale now at www.midlandsmodelengineering.co.uk and will also be on the day of your visit from the ticket office.

Why not be part of the show and enter your work in the 32 competition and display classes? Cash prizes and trophies will be awarded to the best entries.

See www.midlandsmodelengineering.co.uk to book tickets, for full competition details or further details of the show and exhibitors present.

SMEE Update

Following the launch of The Model Engineer and Amateur Electrician magazine in January 1898, Percival Marshall received a letter from J.C.C. (Bank of England) supporting the idea of founding a model engineering society and suggesting an entrance fee of One Guinea. He wrote: *"The club itself would certainly open a fresh field for new inventions ..."* adding *"I shall be pleased to assist in any manner possible"*. Coupled with great interest from others, this led to the founding of the Society of Model & Experimental Engineers (SMEE) later in 1898 and the writer of the letter, J.C Crebbin, went on to be a key figure in the first fifty years of the Society. From its earliest days SMEE has been known for its programmes of talks, visits and training focussed on the hobby and the camaraderie of the shared interest.

This year SMEE will celebrate its 125th Anniversary and plans an increased presence at the Midlands Model Engineering Exhibition. Meridienne, organisers of the event, has kindly allocated additional space for SMEE to show some of its interesting evolution from 1898 to today with history, models, and activities. This will include J.C Crebbin's famous locomotive Cosmo Bonsor which was last shown at the National Railway Museum's recent 'Brass, Steel and Fire' Exhibition at York and later at the Science Museum in South Kensington.

On the Wire

NEWS from the World of Engineering

Rare Example Of Mediaeval Chinese Metal And Enamelware Discovered In Attic

An exceptionally rare Chinese cloisonné 'pomegranate' box and cover from the Ming period has been discovered in a dust-filled cabinet in the attic of a family home, where it had been stored and left untouched since the owner's death in 1967. This important box bearing the incised six-character marks of Xuande, the fifth Emperor of the Ming Dynasty (1426-1435), was nestled in a dusty cabinet amongst other cloisonné pieces and it was only on close inspection many years later that it was found.

During the fifteenth century metalwork in China reached new heights. Bearing the Xuande (1426-1435) reign mark, this splendidly made cloisonné box is an outstanding example of the exquisite production of the Ming imperial workshop. The box is up for auction at Drewetts in May.

The box comes from the collection of the late Major Edward Copleston Radcliffe (1898-1967), having been acquired at Sotheby's in London in 1946 and then exhibited in the National Gallery of South Africa's Chinese Exhibition in Cape Town in 1953. It is one of only four other known examples, including one in the Palace Museum, Beijing.

There is every indication that all five boxes were made in the same imperial workshop with similar designs and in uniform size (approximately 12cm diameter). Sharing the motif of auspicious fruits on their covers, namely pomegranates, persimmons, melons and grapes, they are all doubly marked with an incised Xuande six-character reign mark on the underside of the box and the interior of the cover.

Advance Notice: 2024 Midlands Garden Rail Show

Meridienne Exhibitions are pleased to confirm the 2024 Midlands Garden Rail Show will take place on Saturday 2nd & Sunday 3rd March again at the Warwickshire Event Centre. More details at **www.midlandsgardenrailshow.co.uk.**

First electric trains on Transpennine Route Upgrade in sight, as Stalybridge station reopens

The Transpennine Route Upgrade continues to build towards the future of electric rail travel in the North, as industry leaders hail the latest upgrade work at Stalybridge station.

Engineers worked around the clock over 26-days to complete their largest phase of work to date, including a full junction remodelling, installing over 2km of new track and 23 new signals, upgrading 13 crossovers and fitting new overhead line equipment for future electrification, which will improve journeys along this key route. The multi-billion-pound Transpennine Route Upgrade is set to revolutionise rail travel in the North, better connecting towns and cities through more frequent, faster trains, running on a cleaner, **greener and more reliable railway.**

New Lifecolour Sets

Airbrushes.com have announced three new Lifecolour paint sets arriving in May. There are two US Army sets, 1950-1984, which covers the Vietnam and Korean wars and uniforms 1948-80 which is for combat and fatigue clothing. Railway modellers will be glad to welcome twelve new colours in two sets covering even more of the brightly coloured locomotives seen on Italian Railways.

Clarke Boltless Shelving from Machine Mart

With over 40 models available, in a variety of sizes and colours, the range of Clarke boltless shelving combines tough steel construction with quick and easy set up for your workshop.

Only a hammer is required to assemble these boltless shelving units, allowing for quick and easy assembly. These units feature adjustable shelf heights and can be assembled as a bench or corner unit too making them suitable for any room size.

When assembled, depending on the shelving model weight capacity, shelves will hold between 100kg and 1000kg evenly distributed per shelf. The units come in a choice of colours and with an option for fibreboard, chipboard and polymer shelves. A durable powder coat finish will help protect shelves from damage.

Models in this range start from £50.39 and they can be seen at **www.machinemart.co.uk**.

A Component Tester from a Kit

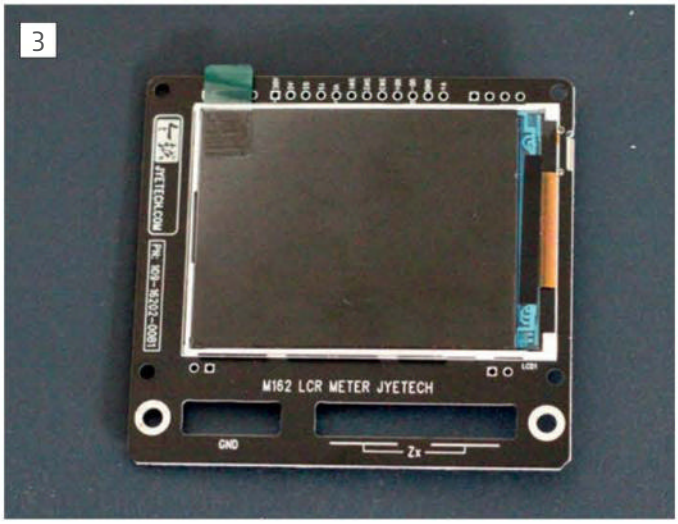
Stub Mandrel builds JYE Tech's M162 LCR Tester from a kit, with some valuable advice on approaching such projects.

The M162 from JYE Tech is an example of a new trend in affordable but well-featured small electronic test devices. These 'intelligent' gadgets are typically designed around microcontrollers and small display screens, interfacing with the 'real world' through an analogue interface.

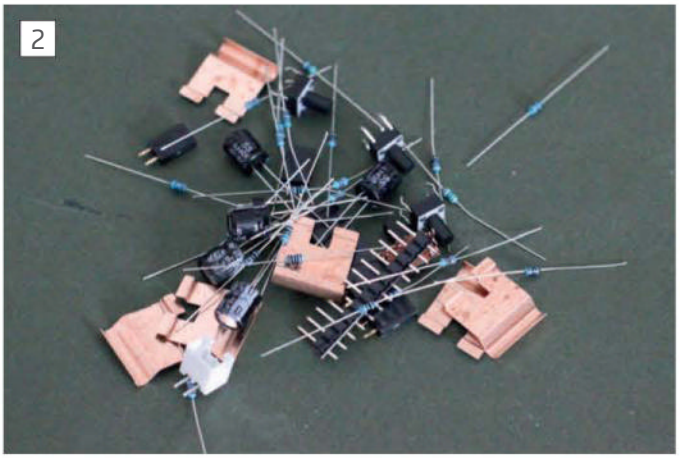
I already had a component tester, built from rather simpler kit, which determines the values of coils, capacitors and resistors (LCR) as well as testing devices like diodes and transistors and giving their basic parameters. I used it to match the gains of replacement transistors when repairing the preamp of a classic Trace Elliott amplifier. The M162, **photo 1,** is a more advanced device that tests only coils, capacitors and resistors while determining a wider range of parameters. For example, it will give the equivalent series resistance (ESR) of capacitors and inductors, an important parameter when designing loudspeaker crossovers.

Having already built a small (palm-sized) oscilloscope from a JYE kit, I knew to expect it to be well thought out. The M162 is rather larger than a pack of playing cards. All of the components were well packaged in a card box and

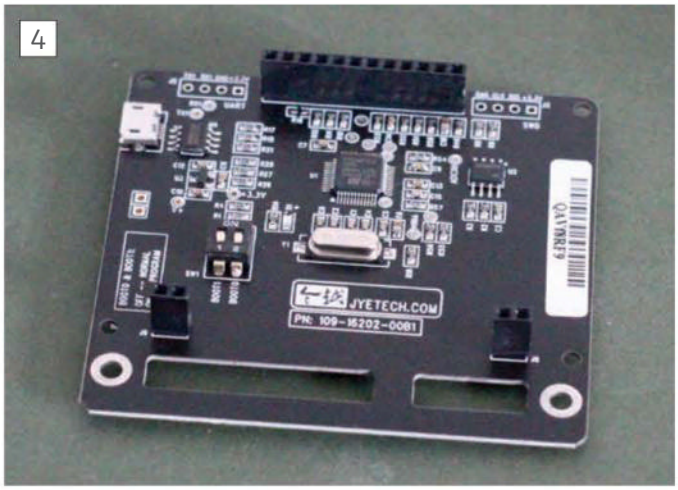
The JYE Tech M162, measuring a 1 megaohm (1MR) resistor.



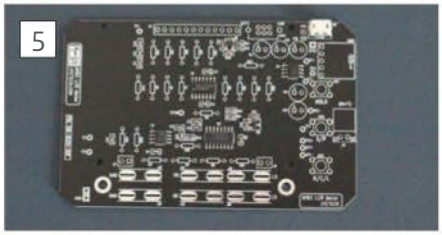
The tester includes a 2.6" full colour display.



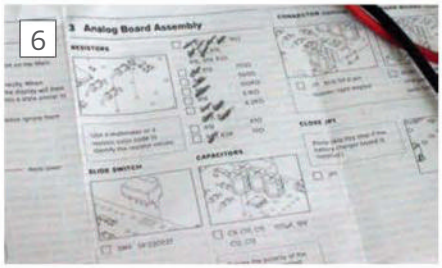
There are an assortment of components you will need to fit yourself.



Strip sockets are all you fit to the display board.



Component locations marked on the analogue board, which already has surface mount components fitted.



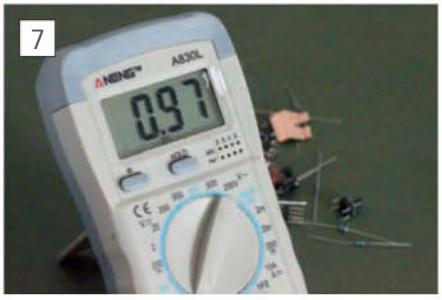
Keeping track of resistors as they are fitted is essential.

arrived undamaged**.** The parts include two partially populated circuit boards, the 'main board' with the display and the 'analogue board'. There was also a USB lead (for powering the device), parts for the enclosure, a packet of components, **photo 2**, a smaller pack with some test components, and finally A4 user guides and assembly guides.

Allow two or three hours to put together the kit. You will need a soldering iron (preferably with a fine tip and ideally temperature controlled), electronic multicore solder, wire cutters and a small crosshead screwdriver.

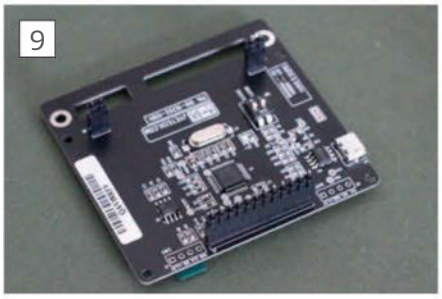
The main board only requires the fitting of three strip sockets underneath, **photos 3** and **4**. Take care to ensure these are seated neatly on the circuit boards once you have soldered the first pin and adjust if necessary. You can then solder the remaining pins and the connector should stay in the correct position.

The analogue board requires the fitting of many more components, **photo 5**. The positions are clearly marked although the small size can make it difficult to distinguish the numbers – use a magnifying glass to checkl Start by fitting the many resistors, there are over twenty, of various values, so check them off one by one so you don't lose track, **photo 6.** I found it really hard to read the colour codes on these tiny resistors, so I used a multimeter to check their values, bearing in mind that resistors



I used a multimeter to check resistor values.

These Rolson cutters have served me well.



Align the pin strips by fitting them to the strip sockets.

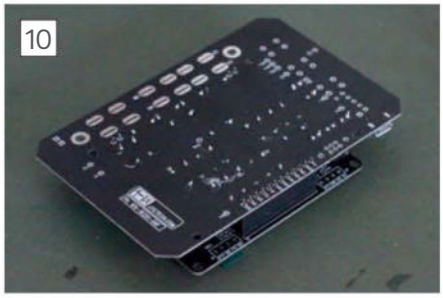
have a tolerance, so the 0.97k reading in **photo 7** shows a 1kilo-ohm resistor. Use a temperature of about 330°C for this sort of soldering, make sure you heat both the pad and the lead to make sure the solder flows neatly – you only need to solder on one side of the board. I used some neat wire cutter/strippers to trim the leads to length after soldering, **photo 8**.

I managed to forget to fit the on off switch until later (the most important part!) and jumped ahead to the capacitors. These are easier to do than the resistors as they are a bit larger and are all the same value of 100uF. They are polarised, so make sure you fit them the right way around. Strangely, capacitors have the negative terminal marked (-) but circuit boards usually have the positive terminal highlighted (+).

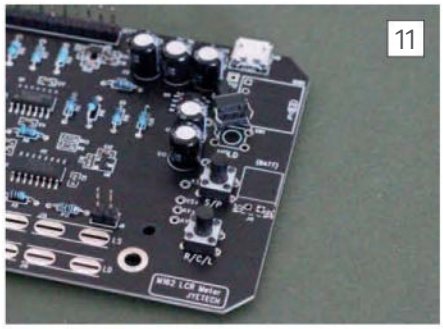
Next, fit the pin strips that mate with the strip sockets fitted on the main display board. the easy way to do this is to fit the strips to the sockets, **photo 9**, you can then place the analogue board on top and solder the pins in place knowing they will all be well aligned, **photo 10.**

Next up are the three push-button switches. Their 'legs' are spaced on a rectangle, so you should not be able to fit them the wrong way around by accident, but the legs have a fair bit of flex so you could force them in the wrong way. **Photograph 11** shows the correct orientation.

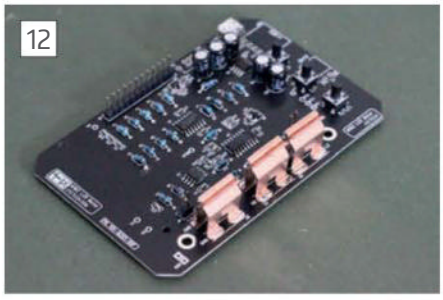
The trickiest step is fitting the beryllium copper spring contacts used for temporarily inserting components under test. These need to be accurately aligned. I started by using a relatively small amount of solder above the board to 'tack' each spring in place in turn. This allowed me to jiggle each spring into alignment with its partner in each pair by melting the solder again while gently pushing them into alignment, **photo 12**.



Pin strips soldered in place.

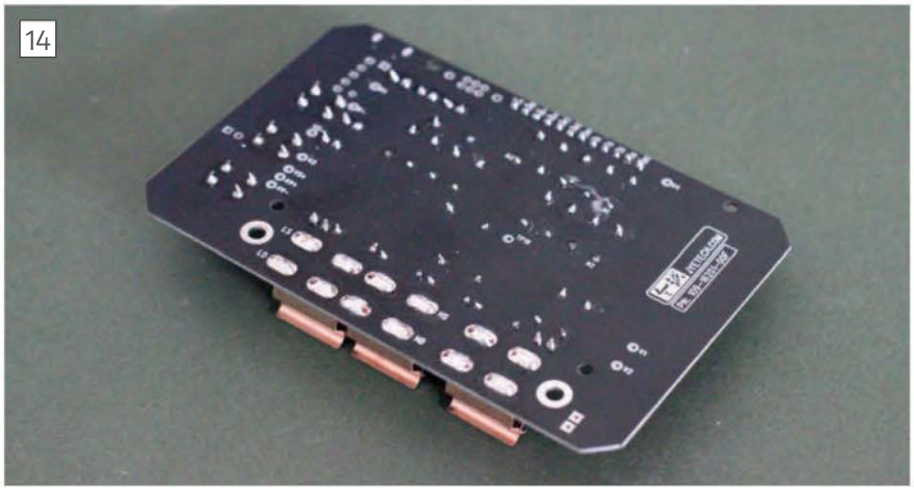


Fitting the push buttons.



Spring clips 'tacked' in place.

Controls of the variable temperature solder station.


The spring clips soldered properly in place.

I made a mental note of which 'leg' of each contact I had soldered and flipped the board onto its back and turned up the soldering iron to 150°C, the display in **photo 13** reads '149' but didn't come out very well. This increased heat allowed me to properly solder each contact to the bottom of the board, starting with the 'legs' not soldered to the top of the board so they stayed in place, **photo 14**.

To complete the soldering, I fitted the on/off switch, a redundant connector for an optional battery/charger board and used a 'blob' of solder to short a jumper 'jp1'. Hopefully **photo 15** will help you spot where it is faster than I did.

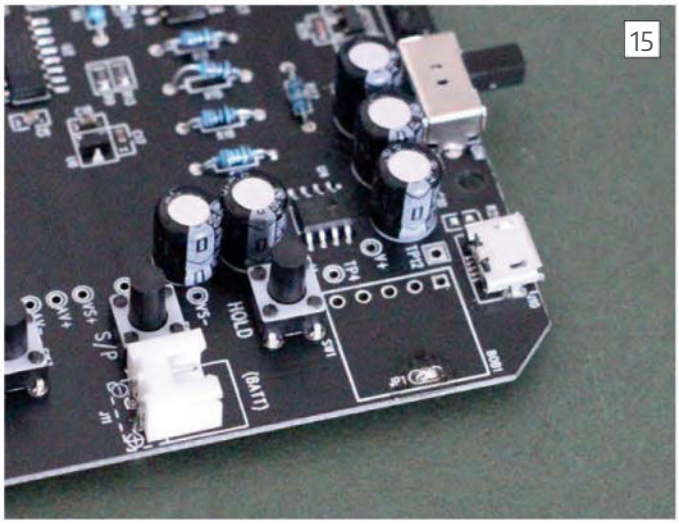
The next step is to check some test voltages around the board, just connect it up with the USB lead and go to the indicated test points with a multimeter. All my voltages were OK, if they aren't then hopefully you have only forgotten to fit a component or made a bad solder joint. If you are unlucky, you may have fitted a resistor in the wrong place – so make sure you double check resistor values and the numbers on the board.

You can now assemble the main board to the analogue board, apply power, **photo 16,** and check the functioning of the device with the test components, **photo 17**. The black USB lead is a longer one I used for convenience. Before starting, press the 'Hold' button for two seconds until the device goes through a zeroing procedure. Then fit the 'zero impedance board' and repeat but pressing the P/S button. The basic controls are hold (stops the display changing), P/S which selects parallel or series test modes (use parallel for higher impedance devices) and L/C/R which changes between the three types of components. The test component values are and the results I got were:

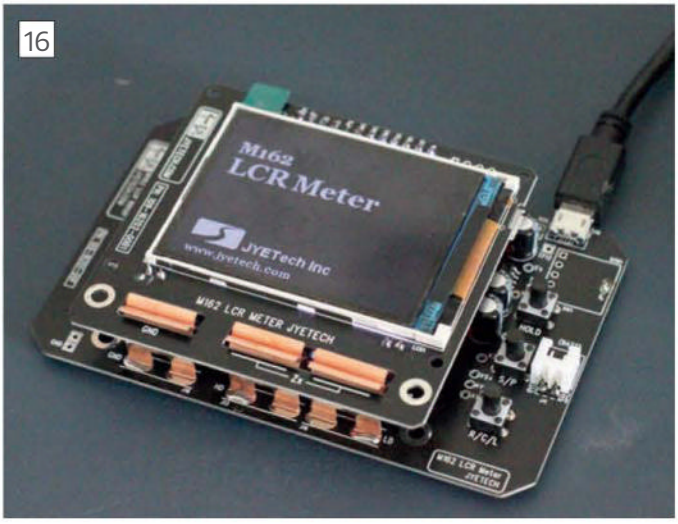
1R – 1.037R
1MR – 1.014MR
0.1uF – 0.09380uF
1mH – 0.9747mH

Photograph 18 shows the inductor under test, note that useful figures such as its ESR (4.323R) and reactance (Z, 7.496R) are shown. Note that some properties of capacitors and inductors are frequency dependent, the settings allow tests at 1KHz and 100Hz,

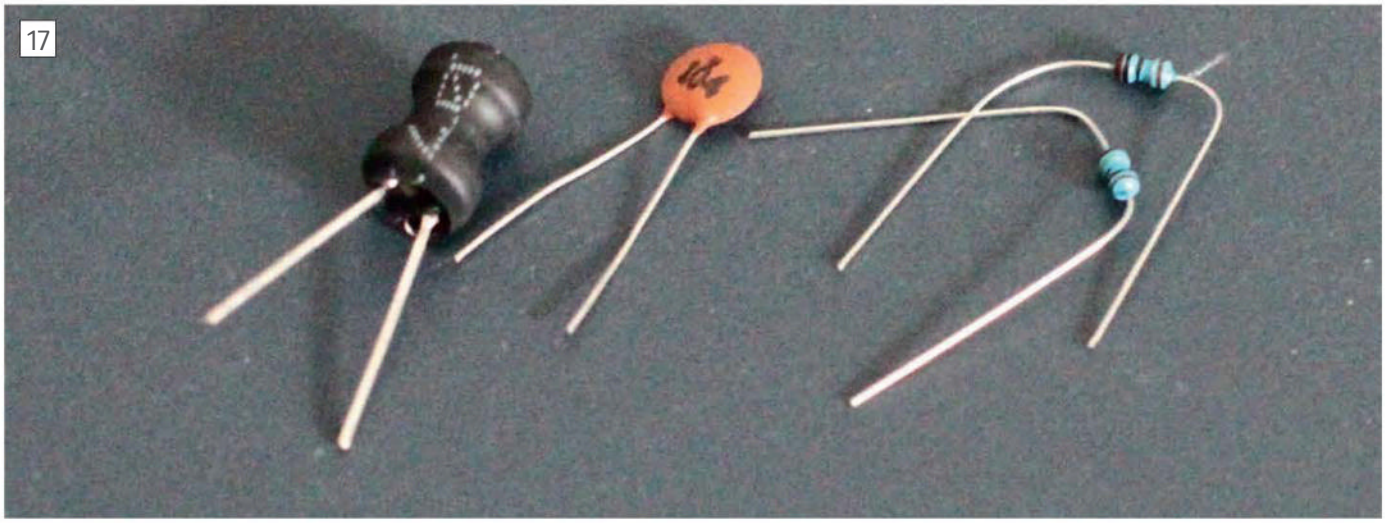
Without being sure of the actual values of the components, I can't say exactly how accurate the readings are, but they are certainly the sort of values I would expect. The zeroing procedure shows that the resistance



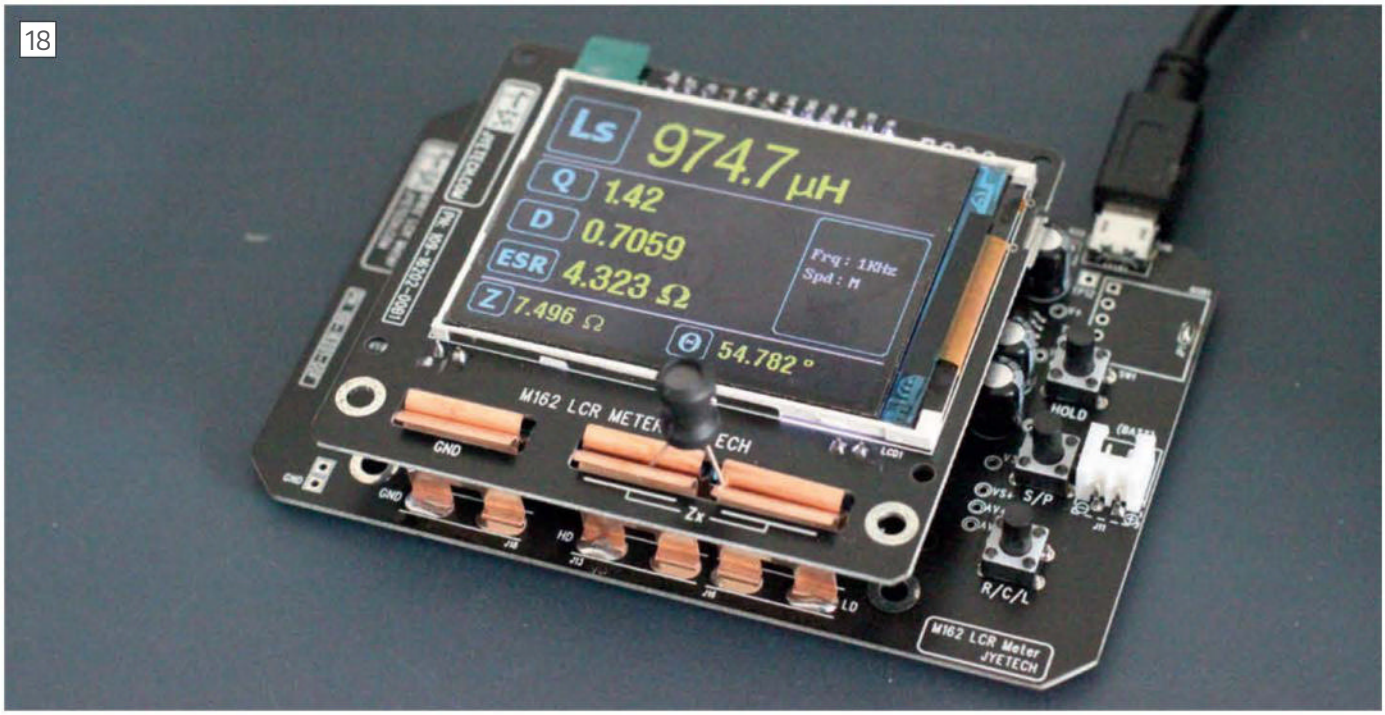
Final task, use solder to bridge the two pads of JP1.



Boot screen display on initial test.

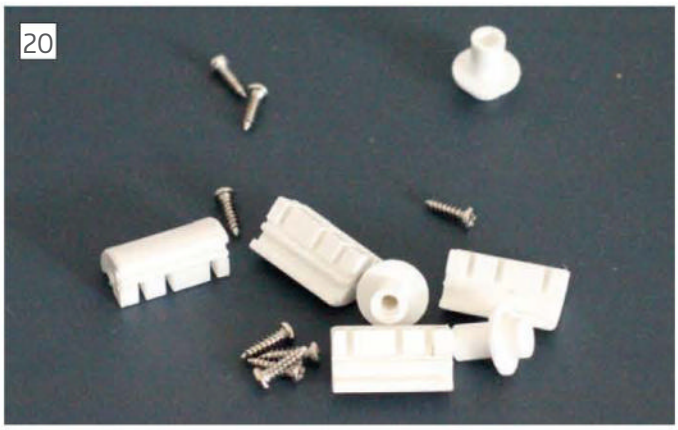


The small selection of test components.



Trial test of an inductor, the left had socket is a ground connection.

Case parts, with protective film in place.



The case fittings.

can be measured down to fractions of a milliohm, but remember precision and accuracy are different things!.

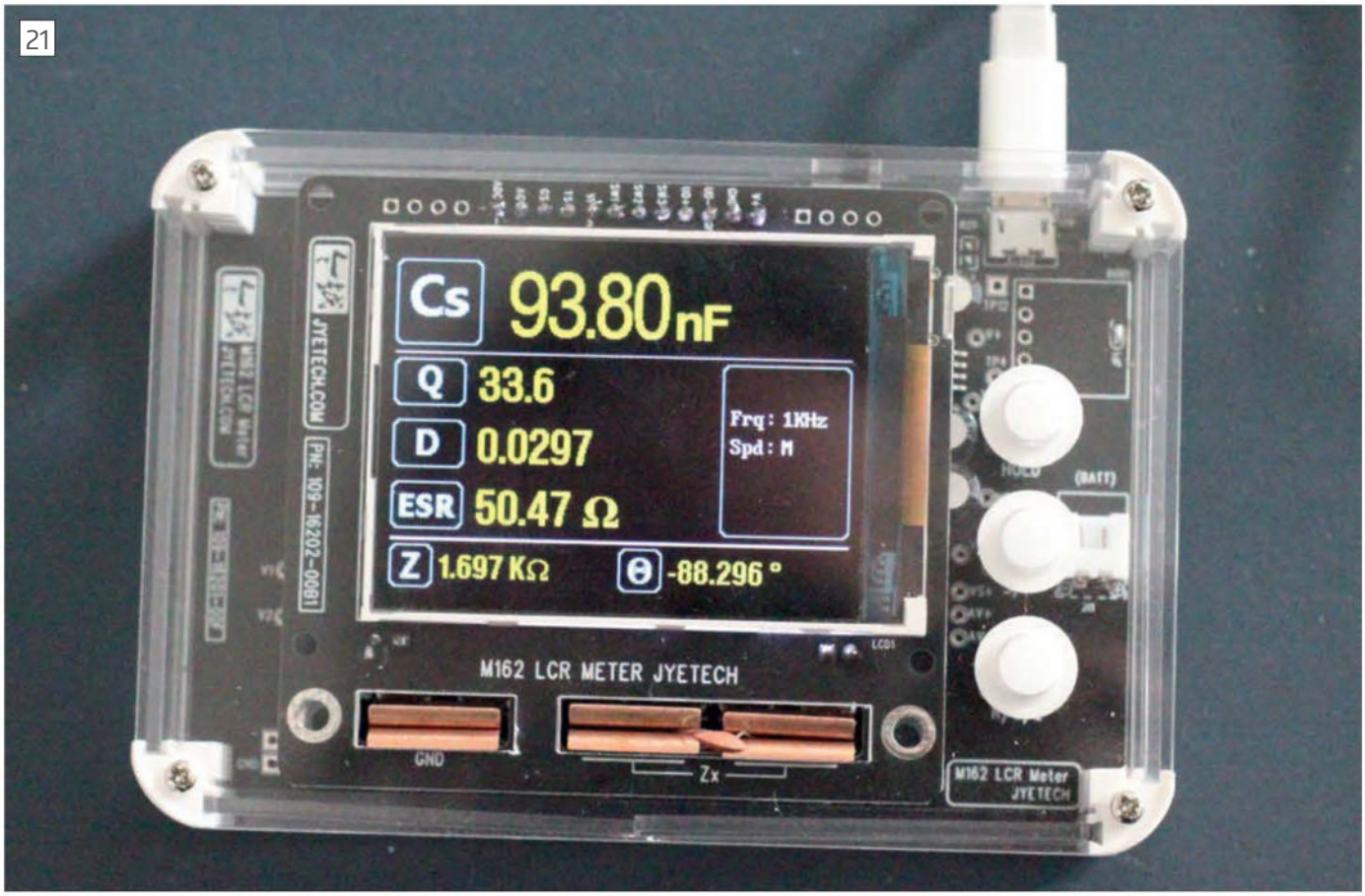
It's now time to complete the build by making up the case. This is made of clear plastic pieces, **photo 19**, held together by corner pieces, there are also caps for the buttons, **photo 20**.

I found it easiest to attach the two rear pillars (make sure they are the right way up) to the base, fit the back panel, slide in the boards, then fit the remaining pillars before adding the side and front panels, followed by the top. Also, don't forget t remove the protective film from the display. The completed device is shown in **photo 21**.

I suggest you now repeat the zeroing procedure before trying out the LCR meter on various components from your scrapbox. The micro USB connection is quite stiff and these connectors have a reputation for getting pulled off the boards; I have fitted the supplied cable now and will leave it in place.

I should note that the tester has other functions, for example you can access other data, activate a serial port (this is not fitted but the connections are on the board) and change the test frequency and speed, all through a menu accessed by holding down the RCL button. It is also possible to download and install firmware updates – this is all explained in the manual, incidentally the manual and instructions are all written in clear English, although the typeface is rather small.

All in all this project is an entertaining build that will give you a useful device that is pleasant to use and handy for anyone who dabbles in electronics in the workshop. ▮



The completed component tester, with a 0.1uF capacitor under test.

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YOUR CHANCE TO TALK TO US!

Readers! We want to hear from you! Drop us a line sharing your advice, questions or opinions. Why not send us a picture of your latest workshop creation, or that strange tool you found in a boot sale? Email your contributions to **meweditor@mortons.co.uk.**

Reading the Small Print

Dear Neil, I liked the article on ML7 oiling in the latest edition of MEW. I have thought of a double acting solenoid driven piston pump idea for a while to achieve the same result but have not found suitable hardware and am thinking of a design.

I, like many readers, I suspect, do not have good eyesight and some copy is hard to read due to size e.g. reprints. Is there an easy way round this?

Laurie Leonard, by email.

Hi Laurie, If you have a digital subscription, you can download whole issues or articles from the archive as PDFs and have your computer read them to you in Acrobat Reader:

1. Open Reader and navigate to the document page you want to have read aloud.
2. From the top-left menu, click View, then Read Out Loud.
3. You can choose to have the whole document read aloud or just the page you're on.
4. Select either Read to End of Document or Read This Page Only, respectively.

Hope that helps, Neil.

Antikythera Mechanism

Dear Neil, I thought you'd find this alternative re-construction of the Antikythera mechanism planetarium fascinating to watch. It differs markedly from the UCL conjectural re-construction.
YouTube link: https://youtu.be/mTsCx0E7YkA

Andre Rousseau, New Zealand.

Forum Beta Test

Dear Neil, if you still need testers I can offer:

- Firefox/Windows 10
- Chromium/Raspberry Pi O/S
- Chrome/Android tablet
- Safari/Iphone

Roger Woollett, by email

Thanks Roger and everyone else who has signed up as Forum Beta testers. The IT team say "Hopefully we'll have some news this week. Sorry it's been quiet, but a lot has been going on with data/content and the Beat Testing should start soon." Neil.

Writing for MEW

Dear Neil, I have taken the Model Engineer and related Model Engineers' Workshop since buying my lathe six years ago. I have been fascinated by the range of articles most of which I barely comprehend.

However, I wonder if an article based on my experience/ignorance of coming to terms with a 1947 ML7 well used lathe might be of interest to anyone in a similar situation, if so could you please forward the Authors Pack at your convenience.

Mac Timmis, by email.

Hi Mac, The perspective of relative newcomers is always useful to others! I have emailed you an author pack. Any other readers, newbies or experienced, interested in writing articles should drop me an email at the email address above.

Interesting Object

Dear Neil, a few days ago I received the latest issue of MEW and noted the content of Stub Mandrels excellent writings on the electrical gadgetry. The content rather took some of the carpet from under my feet as much of what I had written, had some very similar content and as yet not sent to you I will modify it drastically now as i feel one item (The Anderson Connectors) is worthy of more descriptive detail and information.

Thank you for the new author pack which I will deal with too asap.

Here is a photo of a 'mystery object'. Not common these days but I expect a number of folk will recognise it. I am well aware of its origins. It is known as the spinner for a Walker Log, a device used by virtually every long distance yachtsman it was towed behind the yacht on cable which rotated the input on a dial, usually mounted on a railing etc. at the stern and the revolutions enabled a reasonable estimate of the distance travelled through water, (not specifically over the "ground") to help calculate by dead reckoning the position. These days GPS has made that history. It was usual to carry a spare on board, as it was not uncommon for a shark to fancy one for a meal.

Some years ago I visited a maritime museum in Dunedin and for a few mins while looking at marine artefacts was chatting to the curator. who mentioned their identical device saying they had no idea what it was for. I was able to enlighten him !

David Dunn, by email.

Thank You Readers!

Dear Neil. I have received several scans of the article on gears I was searching for from MEW readers and through your magazine, I would like to thank them.

Ralph Thompson, by email

Laser Welding

Dear Neil, Do readers have any experience with laser welding, I noticed on Instagram a post of some sort of handheld laser welding "gun" which seems to do the trick in one strike?

Recently some articles were published in Model Engineer about soldering and I it would maybe nice to read an article about a review of soldering equipment/ tools that are available today. I don't have that much experience with soldering but maybe you know someone.

From school we used Weller, but there are soldering tools from 25 Euro's to 500 Euro's.

Henk de Ruiter, The Netherlands

Finding Articles

Dear Neil, I have hundreds of copies of MEW, all in numerical order. Does anyone know if there's an excel etc spreadsheet I can use to search for a particular article? Thanks in anticipation,

Mike Holmes, by email.

We publish indexes compiled by Barry Chamberlain every twelve issues, and David Frith kindly updates them into an Excel spreadsheet. Visit www.model-engineer.co.uk/forums/threads.asp?t=128 which is where David posts links to the latest versions of the index. Neil.

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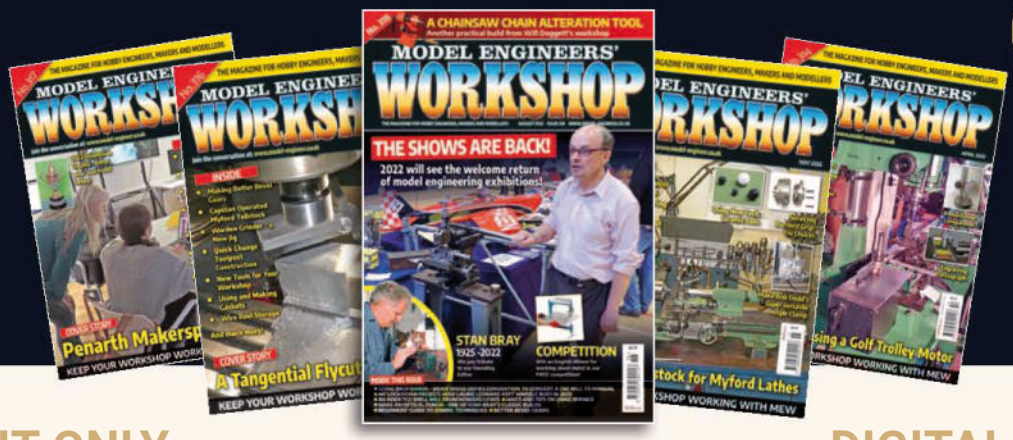

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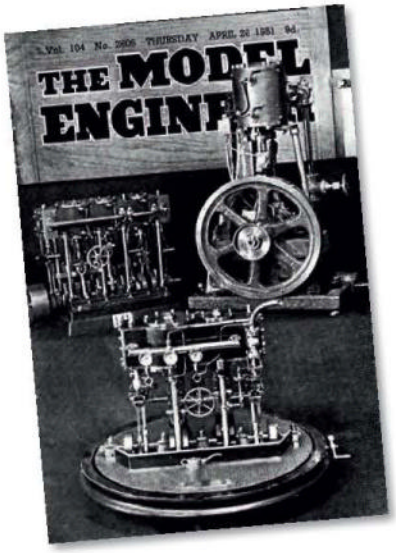
Jaw Regrinding - Pete Barker

From the Model Engineer Archive

To celebrate 125 years of Model Engineer magazine and the Society of Model and Experimental Engineers, each issue in 2023 features fascinating historic content from Model Engineer relevant to workshops, tools or techniques. These pages from Model Engineer Volume 104, No. 2605 – April 26, 1951, features some still useful advice on countersinking and a simple boring tool holder that uses an offset to achieve different settings.



Novices' Corner

Notes on Countersinking

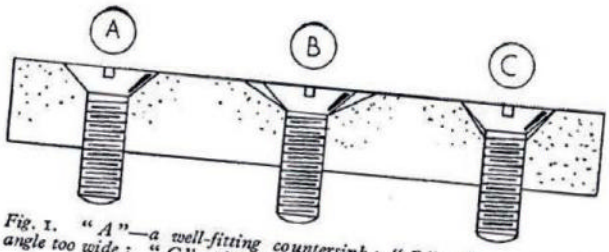


Fig. 1. "A"—a well-fitting countersink; "B"—the countersink angle too wide; "C"—the screw-head bears on the mouth of the hole

HOLES drilled in metal are, perhaps, most commonly countersunk to allow the heads of screws to lie flush with the work surface. As countersunk screws of standard pattern have the coned head formed to an included angle of 90°, the depression made by countersinking should be machined to correspond by employing a 90° countersink in order to give the appearance illustrated in Fig. 1A. Should the depression, however, be formed to a greater angle, as in Fig. 2B, an unsightly gap will be left between the edge of the screwhead and the work. It is better, therefore, to make the angle of countersinking, if anything, slightly less than a right-angle so that, as represented in Fig. 1C, a good appearance is obtained.

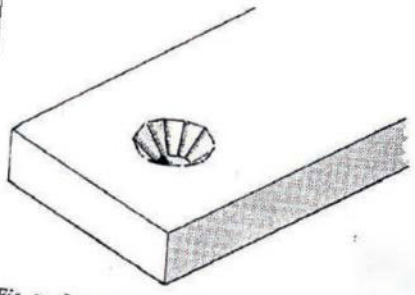


Fig. 2. Irregular countersinking caused by chatter

The chief difficulty in countersinking is to form a smooth, well-finished surface free from chatter marks, for, when the countersink is mounted in a small drilling machine and driven at moderately high speed, chatter is often hard to avoid and there may be no certainty of forming a truly coned hole; sometimes the work may even have the appearance shown in Fig. 2. However, where a robust type of drilling machine with well-fitting bearings is used, and the work is firmly secured to the machine table, the ordinary forms of commercial countersinks, shown in Fig. 3A and C, will cut cleanly if run at moderate speed. But, as a rule, conditions are less favourable; the drilling machine is of light construction and its bearings may be worn: the drilling speed is too high: and the work is held with the hand.

Nevertheless, these difficulties can largely be overcome by using a countersink of suitable form. Two examples of countersinks that have but little tendency to chatter at once come to mind, namely, the centre drill and the ordinary twist drill.

The coned end of a centre drill is formed to an angle of 60° to correspond with the coned lathe centres and so is hardly fitted for use with countersunk-head screws. A twist drill, however, has its point ground to an angle of 118° for ordinary use, but if, as illustrated in Fig. 4, this angle is reduced to 90°, an efficient countersink

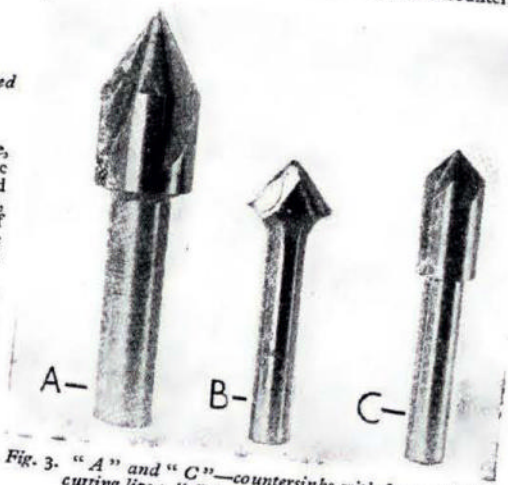


Fig. 3. "A" and "C"—countersinks with four and five cutting lips; "B"—two-lipped countersink

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will be made, although chatter and irregular machining may occur where the hole being countersunk is of large diameter and so offers but little support to the drill point.

Nevertheless, this trouble can be avoided by first drilling a pilot hole, which is then countersunk and afterwards enlarged to the full diameter required to clear the screw shank.

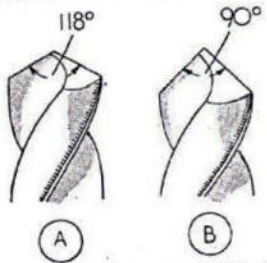


Fig. 4. "A"—standard twist drill; "B"—the drill reground as a countersink

To adapt a twist drill in this way, the point is ground free-hand on the grinding wheel, for the ordinary twist drill grinding-jig will form the point only to the standard angle. The drill lips are ground with reference to a 45° gauge or a protractor, and they must be made of equal length; at the same time, rather less than the normal amount of back-off or clearance should be given, as this will help to prevent chatter and any tendency for the drill to dig-in. In the small workshop, successful countersinking is largely dependent on giving sufficient guidance and support to the tool point by keeping the clearance angle small, so that only a thin, but regular, shaving can be taken by the cutting edge.

A Simple Countersink

The Goodell-Pratt pattern of two-lipped countersink, shown in Fig. 3B, is ground in this way and gives good results if run at slow or moderate speed and well supplied with cutting oil when machining steel. As there may be some difficulty in obtaining countersinks of this type at the present time, and as an alternative to the modified form of twist drill, the tool illustrated in Fig. 5 can easily be made in the workshop from a length of silver-steel of, say, ¾ in. diameter. This simple type of countersink is quite free from any tendency to chatter or to form an irregular hole; moreover, as shown in the illustration, it cuts a continuous, ribbon-like shaving and leaves a smooth surface on the work. In shape, the cutter resembles a D-bit, but has the cutting edge formed at an angle of 45 deg., that is to say, the round material used is cut away at the point exactly as far as the centre-line. This countersink has, of course, only one cutting edge, and the remainder of the tip acts as a guide to steady the tool when cutting; this enables holes of large diameter to be countersunk without danger of the tool grabbing or digging into the work—an action which the Americans aptly term hogging. The steel work-piece illustrated was machined with the cutter running at 200 r.p.m., and at 400 r.p.m.

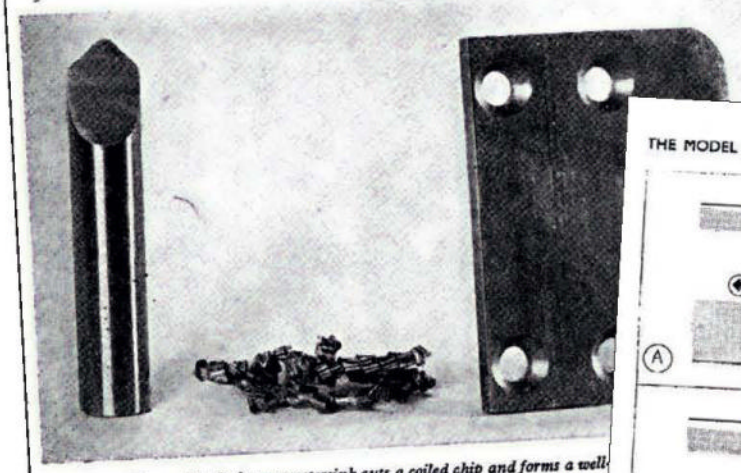


Fig. 5. The D-form countersink cuts a coiled chip and forms a well-

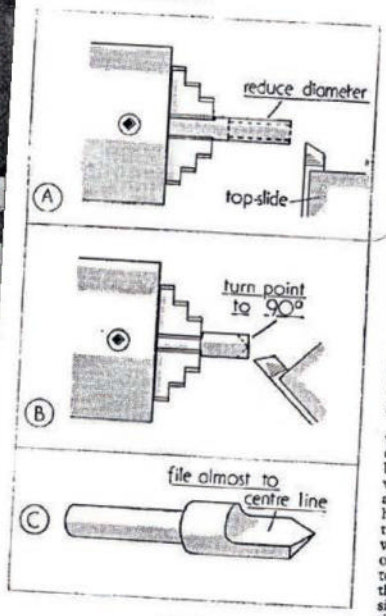


Fig. 6

the tool still cut cleanly, although the shavings did not then form continuous coils. Brass can be machined at a higher speed and a good finish obtained.

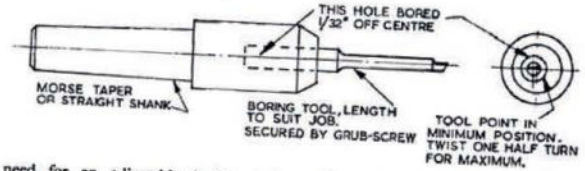
Making the Countersink

To make the countersink, a length of ¾ in. diameter carbon-steel, such as silver-steel, is used, and if the drilling machine chuck will not grip this diameter, the shank is reduced to, say, ½ in. diameter with the material set to run truly in the four-jaw chuck, Fig. 6A. The work is next reversed in the chuck, and again set to run truly, so that the tip can be turned to an included angle of 90° by setting over the lathe top-slide to an angle of 45°, Fig. 6B. There is no need to machine the tip to a sharp point, but a small, central pip should be left to act as a guide when filing down to the diameter line. After the point has been machined to a good finish, the work is gripped in the bench vice and the tip is flattened by filing to within a few thousandths of an inch of the exact centre-line. The filing should be carried for a short distance beyond the base of the coned portion, and the flat is formed with a hollow curvature at its upper end, Fig. 6C.

All burrs caused by filing are carefully removed with a fine file and oilstone slip. After the cutter has been hardened by heating it to a bright-red and plunging it vertically into cold water, the surface is cleaned with a strip of worn, abrasive cloth. The tool is then tempered by heating the end of the shank until a pale-straw tint reaches the tip, and then again quenching in water. Finally, the cutting edge is sharpened by oilstoning the flat face to bring the cutting edge to lie almost exactly on the diameter line. Although the countersink, can be resharpened in a similar manner, a tendency to chatter, when cutting, may develop once the cutting edge falls appreciably below the centre-line.

An Adjustable Boring Tool Holder

by R. L. Smith



THE need for an adjustable boring tool arose when I had some jig boring to do with the work bolted on the lathe boring table, no other means being available; but it can be used on any other job where "snout boring" is necessary.

It can be made in any size, mine being 1 in. dia. with a No. 2 Morse taper to fit the headstock.

The tool consists of two parts only: the body and holder, and the boring tool itself. In operation, the cut is increased by twisting the tool, and fairly fine adjustment is possible, half a revolution being needed to increase the cut ¼ in. Half a revolution increases the cut from minimum to maximum, of course.

The sketch is, I think, self-explanatory.

18+

WHAT IS AVAXHOME?

Making a Handrail For a Church

REMAP is a charity that uses volunteers' engineering skills to help improve the lives of people with disabilities. Gary Wooding got an unusual REMAP request one day.

The Steps.

I'm a REMAP engineer (see box). Towards the end of 2021 we received an unusual request. It was from a church—well not from the actual church, but from the Parish Church Council, or PCC. They had a problem they couldn't resolve: the church itself is very old and has two very wide steps up from the aisle to the transept, and one elderly person had stumbled and tripped when negotiating the steps; though, luckily, they hadn't been injured, the PCC was very concerned that somebody else could trip and be severely injured.

They wanted a handrail on the steps, but despite their best efforts, could find no contractor who could do it, and comply with their rather severe requirements, which were...

Its design and appearance must be sympathetic with the rest of the ancient church.

The handrail must be sturdy, rigid, and inspire confidence in its users.

- No part of the church could be altered in any way.
- No holes could be drilled into any part of the church.
- No nails or screws were allowed to be inserted into any part of the church.
- No permanent fixtures were allowed.
- The handrail would have to be removeable to allow for uninterrupted use of the steps for occasions such as weddings and funerals.
- When removed, no trace of its presence should be visible.
- Ideally, it should be moveable to the side of the steps rather than be relegated to a side room.

Their internet searches revealed that REMAP had done something similar a few years previously; could REMAP do the same for them?

The case was assigned to me, so I arranged a visit and a meeting with PCC representatives. **Photograph 1** shows the steps, which are made of wood and covered in carpet. The treads of the steps project beyond the risers a small amount and appeared to offer a suitable place for attaching clamps.

Various options were discussed, and I eventually submitted a pencil sketch of a concept for consideration by the rest of the committee; **photo 2**.

A few weeks later the PCC came back to request more detailed plans. I visited the church again, took some relevant measurements, and created a wooden

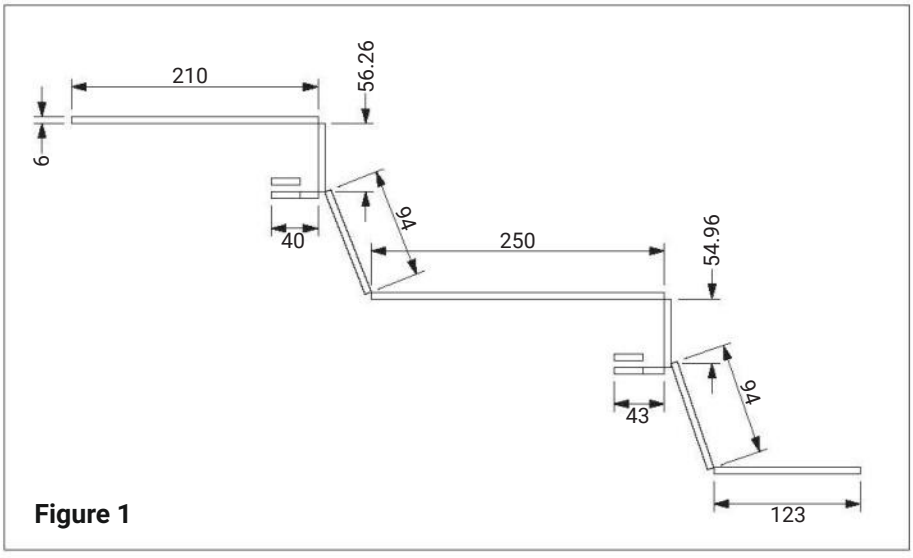
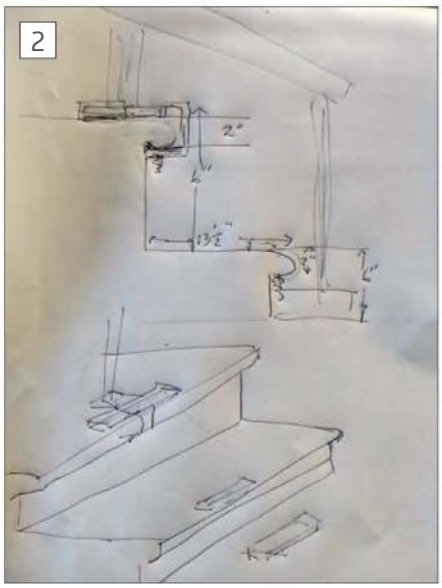


Figure 1



The sketch.

Wooden model of steps.

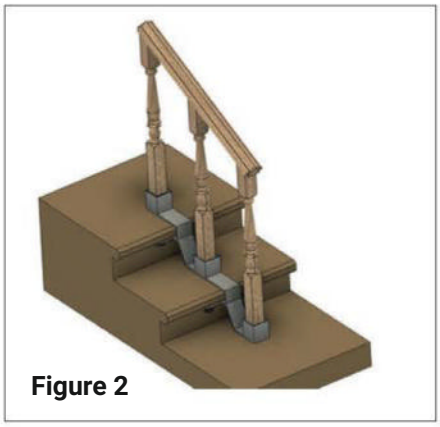


Figure 2

Figure 3

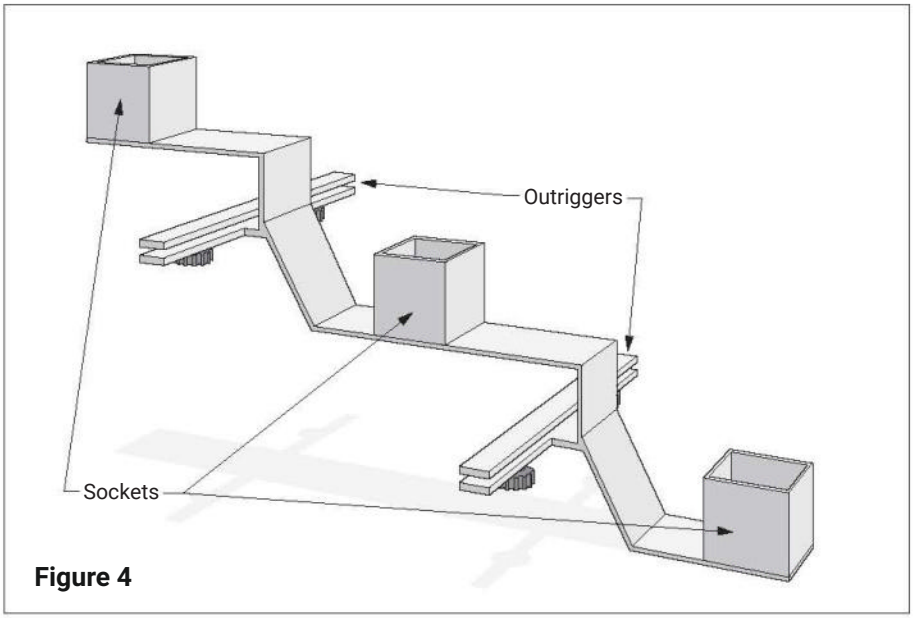
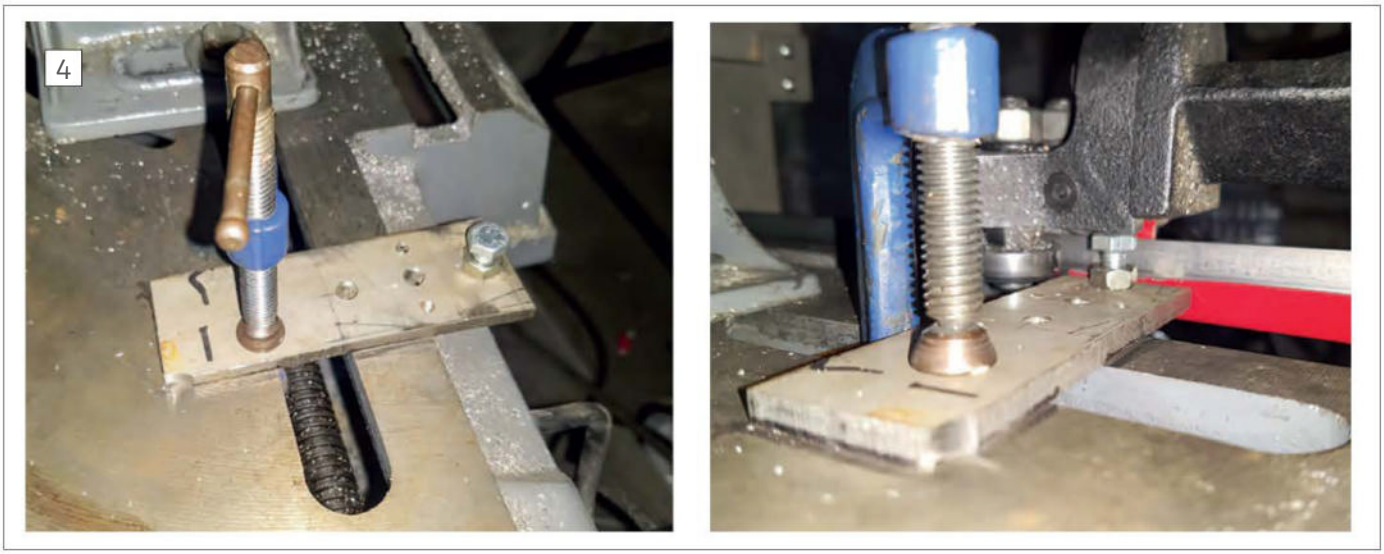


Figure 4

model of the profile of the steps, **photo 3,** and a scaled sketch of the profile of the proposed base of the handrail, **fig. 1**. From this I produced a 3D rendered drawing of the oak handrail, on the steps, supported by three oak spindles, fig. **2**. Oak was chosen to match other woodwork in the church. **Figure 3** shows the handrail without the steps. A few months later I received the go-ahead for the initial design.

The basic concept was to use a heavy steel base clamped to the noses of the two steps and resting on the floor. **Figure 4** shows a 3D sketch of the base as originally designed. The steel base was to be fabricated from three sections of 75×6 mm bar, bent to shape as shown, with the three spindles located by 70 mm square box section sockets welded to the base. I chose 75×6 mm bar to be wide enough to accommodate the bases of the spindles. Although the stepped shape of the base was clearly rigid and stable in the fore/aft direction, the 75 mm width was insufficient for adequate sideways rigidity, so hidden outriggers were incorporated under the tread noses. Each outrigger extends the sideways support to 301 mm. There are two outriggers, one for each step, each comprised of three basic parts. Two of the parts are welded to the base and project out from each side. Each contains an M8 screw that can clamp the third part against the underside of a step. The original concept was to create the base and outriggers as one single entity with the pieces welded together. But it didn't end up like that.

A major problem was: how could I bend the 75×6 mm bar with sharp corners? A friend with a heavy bending-brake looked at it and said, "No chance!" and I had no facilities for forging. Heating to red heat with an oxyacetylene torch



Bandsaw depth stop.

was also considered but was rejected as not being accurate enough. The prospect of cutting the bar into short pieces and welding them seemed attractive until I thought about the jigs required to hold them in the correct positions. It then occurred to me that if I partially cut through the bar, I could bend along the cut and fill the resulting void with weld. But how to make the cut? I made the crude but rather effective "depth stop" for my bandsaw, shown from different angles in **photo 4**. I then cut three short lengths of 25×6 mm bar and partially cut each of them using my improvised depth stop. I bent two of them to 90° and welded one up to create the three shapes shown in **photo 5**. The idea worked really well, and I kept the test pieces for measurements.

Before actually bending the pieces, I decided to revisit the church to check my measurements and was rather disappointed to find that the carpet thickness varied between the centre and sides of the steps. In fact, there was no carpet at the sides at all. This made a difference in the height of the first step, relative to the floor, of about 12 mm.

My initial thought was to bend and weld the four 90° bends and then use the wooden mock-up for positioning, accurately bending, and holding the angled sections for final welding; but the 12 mm difference in the height of the first step worried me. I consequently changed my mind: rather than have the base as one single entity, I decided to split it into three

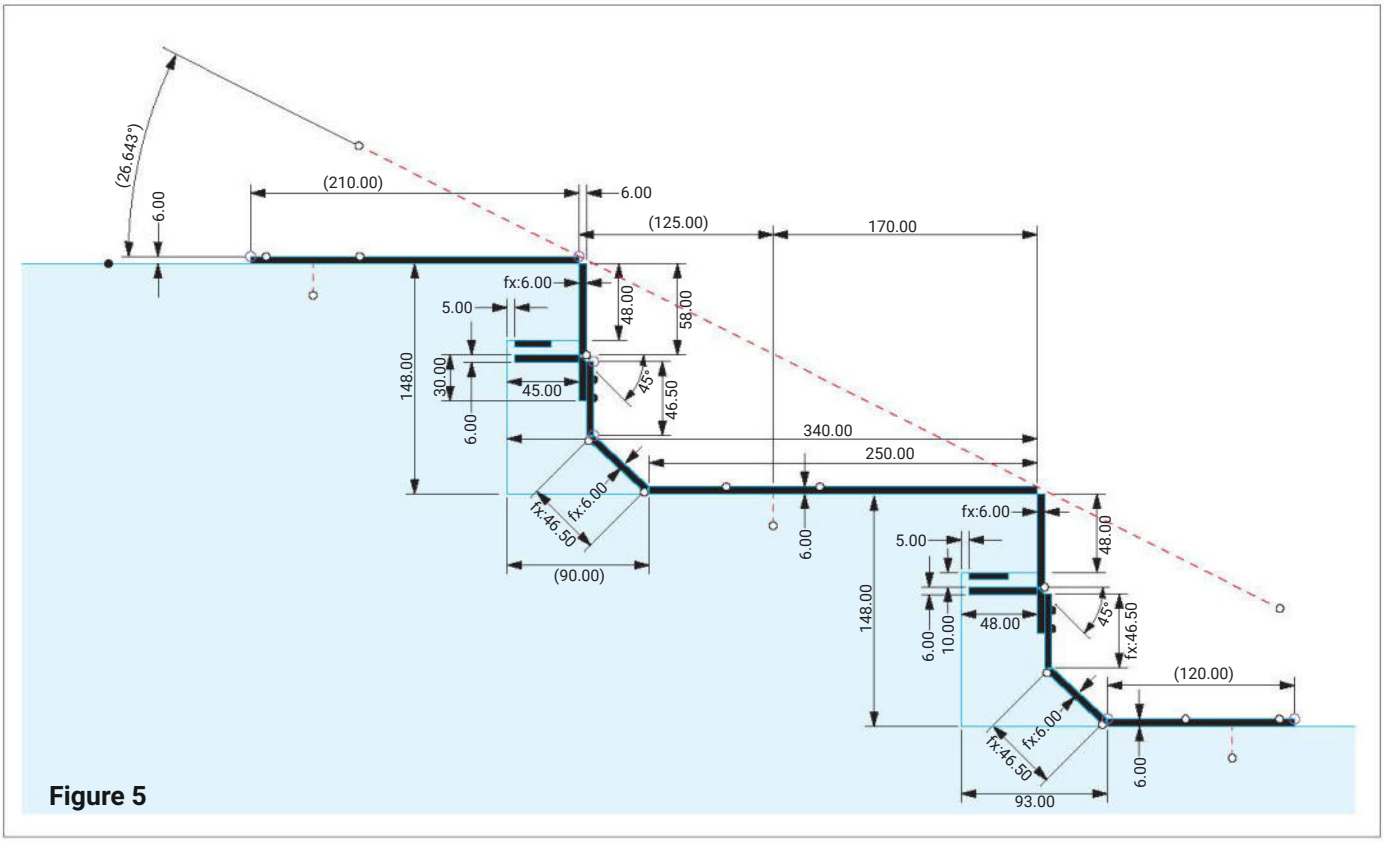


Figure 5

Bending to 90°.

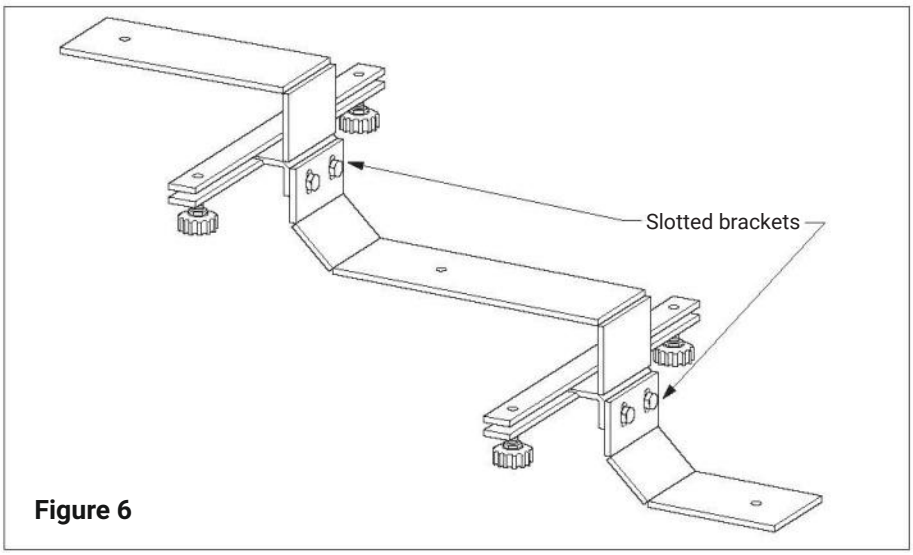


Figure 6

entities bolted together with slots to allow vertical adjustments. This change entailed dividing each 94 mm angled section into two 46.5 mm (94 mm minus the saw cut, divided by 2) angled sections as shown in **fig. 5**. It also required the addition of two short, drilled and tapped brackets, to be welded below the right-angled bends as shown in **fig. 6**.

Using the measurements from fig. 5 and those from the results of the bending test, I was then able to draw up the detailed cutting diagram for the three major base parts shown in **fig. 7**. I first cut the three major parts from the 75×6 mm bar, then carefully marked out where the bending cuts were to be made, taking into account the widths of the saw cuts. Dimensions to solid lines indicate partial cuts from the top side, and those to dashed or hidden lines are for cuts from the underside. The two 30 mm-long brackets were also cut, and the positions for the various holes were marked so that all drilling and machining could be done on flat material before it was bent and welded up. The three 6 mm holes were placed at the centres of where the three spindles would finally be placed.

The next job was to mark out and cut the six outrigger parts: four 113 mm-long pieces for welding to the base, and two 301 mm pieces for the actual clamps. I chose to use 25×6 mm bar for the outriggers; see **fig. 8**. The short bars were drilled and tapped M8 as shown, but the long bars were first drilled 7.2 mm and then counterbored 9 mm to accept the heads of M4 CS screws. The M8 screws in the short bars were used to clamp the long bars to the steps. Each M8 screw had an M4 axial hole drilled and tapped into the end and was then machined to have a 3 mm-long 7 mm shoulder that would fit into the 7.2 mm hole of the longer bars. The shoulder could push against the longer bar to provide the clamping action, and a short M4 CS screw inserted into the end of the M8 screw would ensure that the longer bar was captive. See **fig. 9**. The plastic knobs were designed with Fusion 360 and 3D printed.

The original design had three spindles made from 70 mm square oak and I had intended to attach them to the handrail by means of three metal plates recessed into the handrail. The top of each spindle was to be cut at the required angle and attached to the metal plate with two wood screws.

The plates were to be made from 1"×⅛" bar cut to length, drilled, inserted into their recesses in the handrail, and attached by means of two more woodscrews. I chose 1" bar because I had a 1" spade drill to help make the recesses in the handrail. **Figure 10** shows the drawing for the plates and handrail recesses. The ends of the plates were to be rounded off with arcs centred at the screw holes, but since I don't have a rotary table and didn't fancy a lot of filing, I rigged up a simple device to do it on my mill with a standard endmill.

I first took a suitable short scrap of bar, positioned it in the mill vice so that I could replace it in its original position later, and recorded the (*x*, *y*) coordinates. I then drilled and tapped an M4 hole as shown in the top section of **photo 6**, removed the bar from the mill and used an M4 screw through the plates, a washer, and a locknut, into the bar. The locknut was positioned to allow smooth rotation of the plates with minimum slop when the locknut was tightened onto the bar: I needed a slim 7 mm open ended spanner for that. Without the locknut, the screw would loosen when the arc was milled. The bar, with plates, was then replaced into the mill vice and the *y*-coordinate adjusted so that the milling cutter almost touched the corner of the plates when they were rotated through 45° on the M4 screw. With self-gripping pliers clamped to the end of the plates, the mill was started and the *y*-axis advanced until the cutter was just touching the corner of the plates. From this point on, plates were repeatedly rotated back in line with the *x*-axis, the *y*-axis was incremented a bit, and the plates carefully rotated to make a shallow cut as shown in the lower section of photo 6. The process was repeated until the arc was complete. This procedure is potentially rather dangerous so it is imperative that the plates are only rotated in the same direction as the cutter rotation when applying a cut, and only light cuts are made.

At this point, all the basic components were ready for assembly; see **photo 7**. I welded the four short outriggers to the appropriate base units and then bent the four right-angled bends and welded the

Rounding the plate ends.

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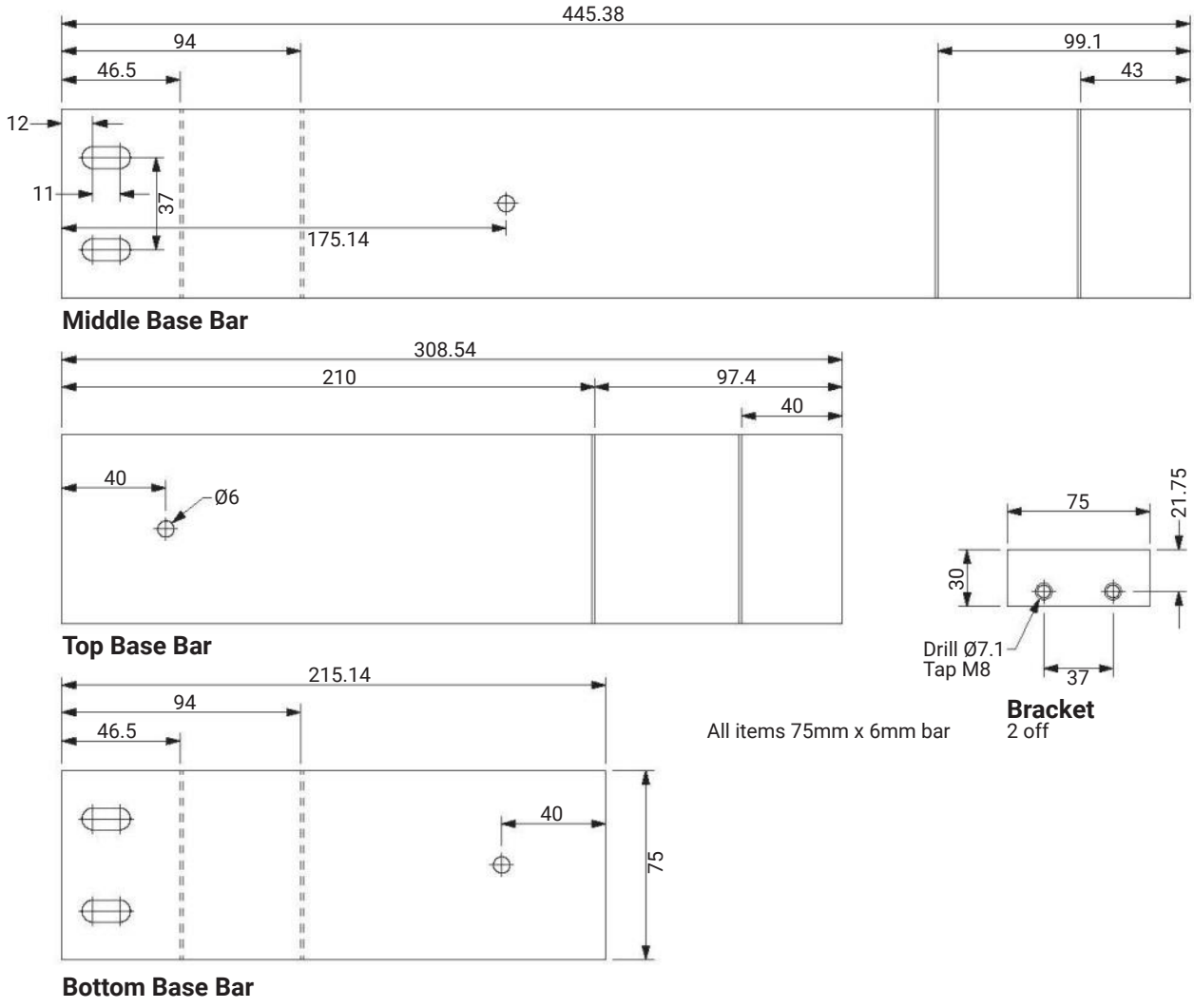


Figure 7

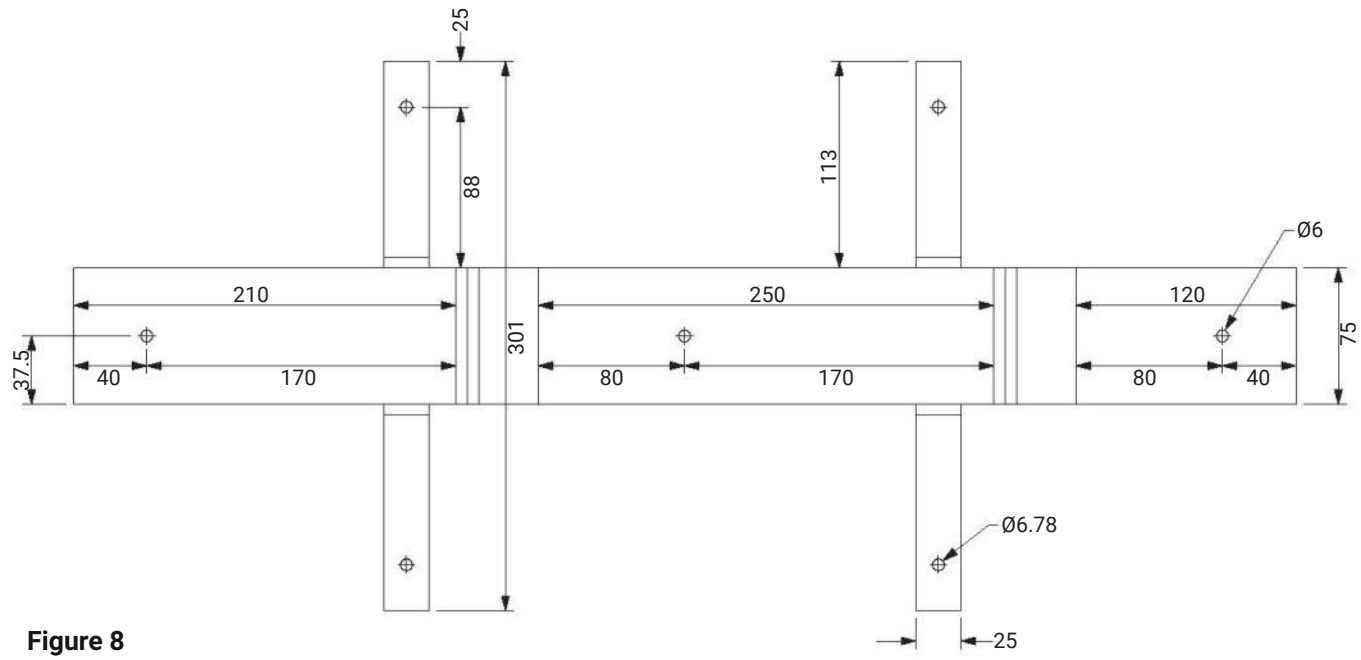


Figure 8

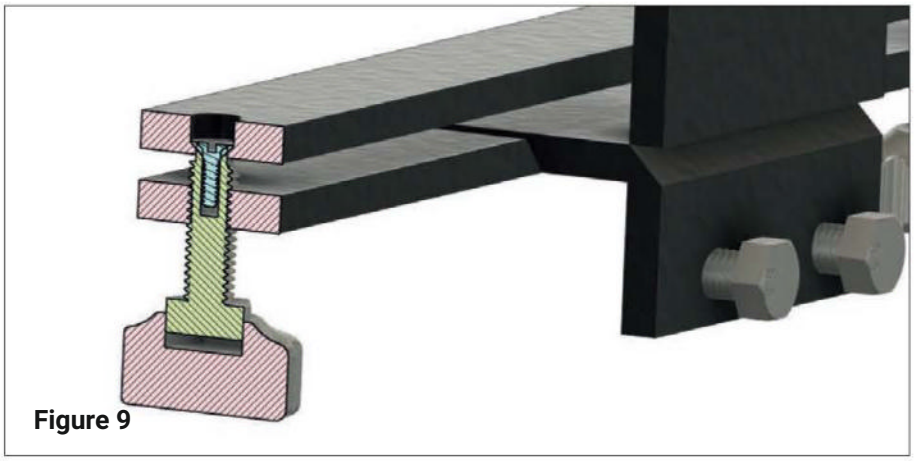


Figure 9

Basic parts ready for assembly.

voids without problems. I then prepped the edge of the two brackets and welded the first one onto the first base unit. That was my first mistake! It was meant to be in line with the first 90° bend, in other words vertical, but I had welded it in line with the top! See **photo 8**. How could I make such a stupid error? I had two choices: cut two new pieces, plus the short outriggers; or use my angle grinder to carve the bracket out and reweld it properly. I chose the latter, and re-prepped the bracket and welded it at the correct angle. Then I welded the second bracket and—I couldn't believe my eyes! I'd done it again. How could be so stupid as to make exactly the same mistake again? I was devastated! I left everything for a day or so until I could face cutting it out and rewelding, **photo 9**.

At this point the base sections were pretty much complete, but I had no handrail or spindles.

I have only a few rudimentary woodworking tools and no way to make the oak handrail and three spindles, so I started looking for a supplier. It wasn't difficult to find handrails and spindles online but, compared to the existing church furniture, they were all far too flimsy and would look quite out of place. I decided to seek quotes for bespoke items. The first quote came as a big

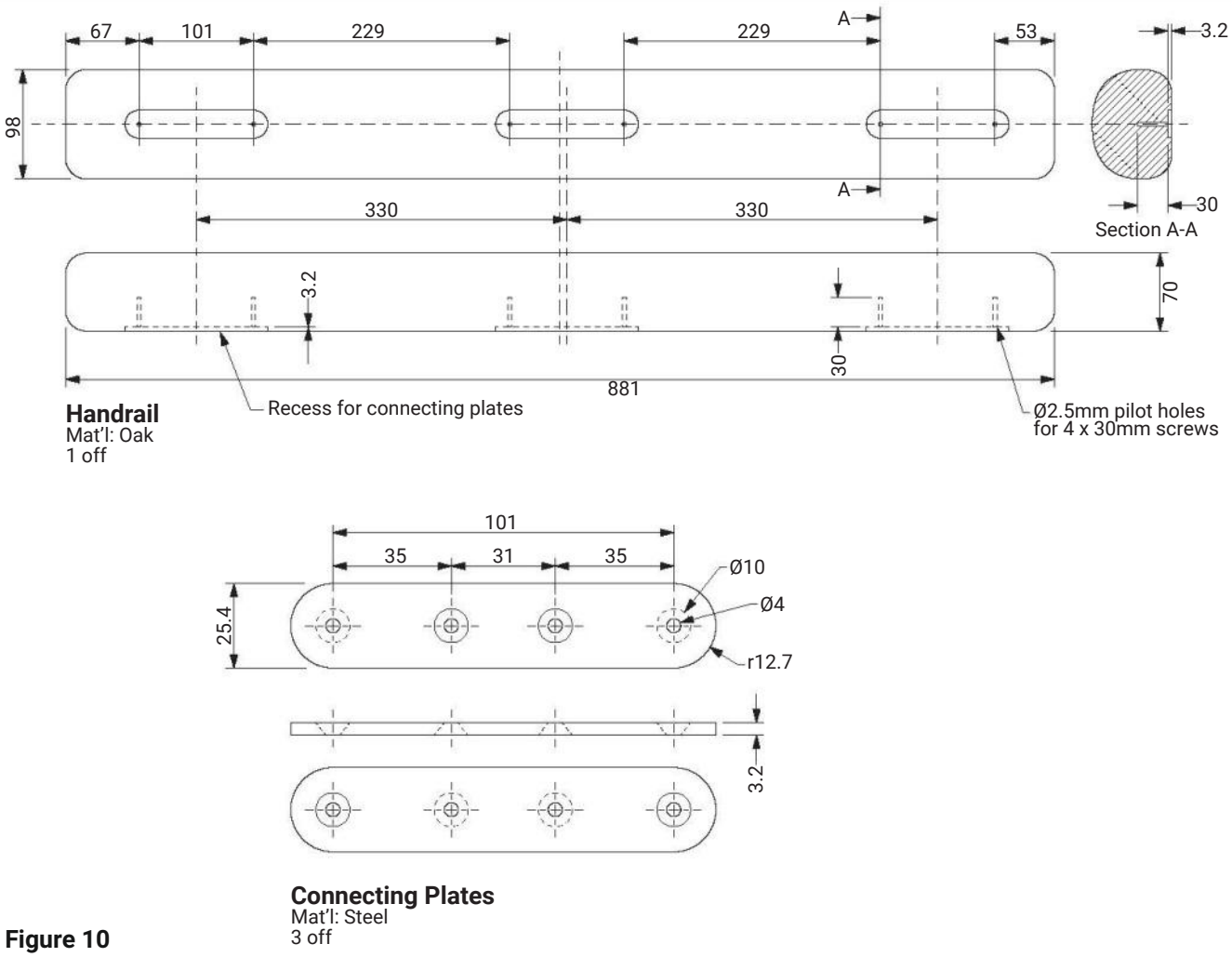


Figure 10

Bracket error.

Error corrected.

shock – it was for £800! Although the church had stated they would make a suitable donation to REMAP for the job, they baulked at the price for the oak, and REMAP couldn't afford it, so I continued the search and eventually got a quote for about £400, which was still too high. During this search I came across some spindles of various designs that appeared to be made of wrought iron, one of which seemed suitable for the church, so I prepared the updated 3D drawing as shown in **fig. 11** and presented it to the PCC, which considered it acceptable. The metal spindles were a lot cheaper than the oak ones, and reduced the price down to £260, the major expense being the handrail itself. I tried architectural salvage yards for an old handrail and eventually found one of suitable dimensions, except it had been sawn in half!

A talented friend has a comprehensive workshop and suggested we tried joining the two bits of handrail, but after a thorough examination rejected the idea. Instead, he offered a section of an old worktop made of short oak blocks joined together. We cut two slices, glued them together, and he fabricated the rather splendid handrail shown, together with the wrought iron spindles, in **photo 10**.

The recesses were made by using a 1" spade drill to cut the ends and then using a wood chisel for the centre.

The lower ends of the spindles were to be cut to fit into short metal sockets made from 70 mm square box section steel tube, and secured by means of long wood screws through holes in the base. The sockets were to be welded to the base.

In the event, instead of the oak spindles, I actually had the wrought iron spindles, and needed to attach them to the handrail and base. The new spindles were fashioned from 20×20 mm bar, straight at either end with open twisted baskets and a barley sugar twist in the middle. I had to attach them to the base. I could either weld them directly to the base or use sockets: I chose sockets. To make them I needed a short length of 25×25×2.5 mm box section tube. 3m lengths were easy to get but I had a job finding a short length at a reasonable price. When it arrived, I was surprised to find it had a wall thickness of only 2 mm and the spindles were a very sloppy fit. The supplier replaced it, but I was

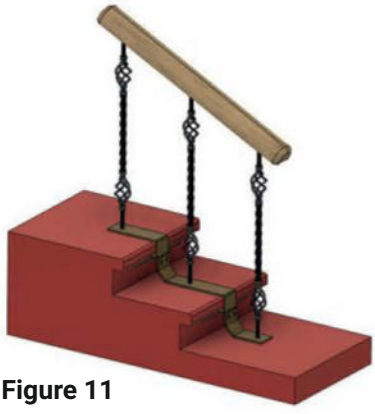


Figure 11

Handrail and spindles.

dismayed to find that the spindles were still a sloppy fit – the wall thickness was still 2 mm. It turned out that the supplier had measured across the seam and they didn't actually have any 2.5 mm stuff. After more searching, I eventually obtained some 2.5 mm stuff and cut off three 60 mm lengths. Although the sockets were to be welded to the base, I had to decide how to fix the spindles into the sockets.

For the oak spindles I had intended to cut tenons at the end of each one to make a good fit into its socket, then retain it with a long woodscrew from underneath, through the hole in the base, up into the spindle. I wasn't keen on this method for metal spindles for two reasons. First drilling and tapping a deep, accurate, axial hole into an 860 mm long metal spindle would have been very difficult, and secondly I had

REMAP is a national charity that designs, makes, or modifies equipment for disabled people, without charge: see www.remap.org.uk. It was founded more than 50 years ago and has branches (called panels) in almost every county. I'm with the Coventry & Warwickshire panel.

We are all unpaid volunteers who use our own workshops but can claim for materials and travel. We are totally reliant on donations. We get requests from individuals, their carers, Occupational Therapists (OTs), hospitals etc., but generally we are asked to help individuals.

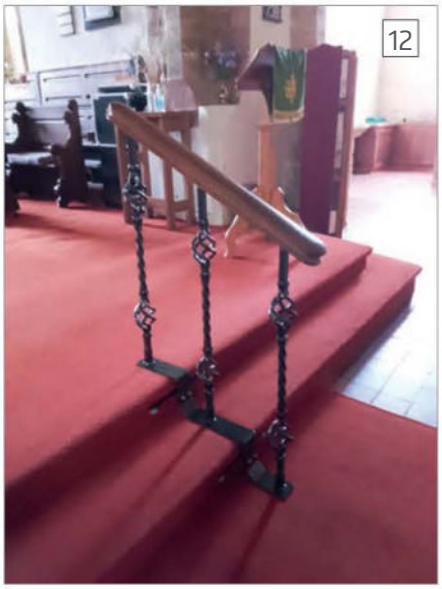
REMAP is unique in that, whereas a charity does well if more than 50p out of each £1 donated reaches the final recipient, it has been estimated that for each £1 donated to REMAP more than £20 reaches the final recipient.

Finishing the sockets.

already determined that the carpet thickness on the steps necessitated some form a vertical adjustment to the handrail height. For these reasons I decided to make the spindles a sliding fit into their sockets and retain them with a couple of grubscrews from a corner edge. Tightening the grubscrews would force a spindle into the opposite corner of its socket, thus securing it firmly by two sides and two screws from one edge.

As delivered, the spindles were 1000 mm long, so I cut 70 mm off of each end to give me six offcuts, which actually proved very useful.

The socket tubing presented two problems: the internal corners were rounded and there was an internal longitudinal seam, either of which prevented the spindles from entering. As an experiment, I cut a short 25 mm length of tube, used a small T-square to set it vertically in the milling vice, and used an endmill to carefully trim the seam away; see the top section



The handrail as installed.

of **photo 11**. I then took one of the spindle offcuts and used my small band sander to carefully remove the corners until it fitted the short tube. Encouraged by this I then cut off three 55 mm lengths of tube for the actual sockets and carefully removed the internal seam from each. My endmill wasn't long enough to do the 55 mm length in one go so the tubes had to be turned over to completely remove the seams. I then sanded the edges off of one end of each of the spindles and verified that they would fit nicely onto each of the sockets. The M5 holes for the corner diagonal grubscrews were easily positioned by supporting each socket on a small V-block as shown in the lower part of photo 11, and drilling and tapping on the mill.

The next job was to weld the sockets onto the base. I placed the 70 mm offcut with the chamfered edges vertically in the milling vice and drilled and tapped an axial M5 hole into one end. I could then use an M5 screw to accurately hold it vertically in position so that a socket could be placed over it and welded. The final job was to attach each spindle to its relevant plate for attaching to the handrail. This was not easy.

With the original concept of using oak spindles, it would have been a simple matter of sawing the tops at the correct angle, using a couple of woodscrews to fasten each metal plate to its respective spindle, and then attaching each plate to the handrail with another couple of woodscrews. I could, of course, do the same with the metal spindles, but, as mentioned earlier, the design had evolved slightly to accommodate small variations in step height, and welding the spindles to the plates would negate that. So, I decided to join the spindles to the plates with swivel joints that could accommodate slight variations in handrail slope. See **fig. 12**.

The top of each spindle was to be machined as per the figure and the three offcuts resulting from shortening the spindles were used for the handrail bracket parts. This created a problem: even if I'd had a rotary table there was no way I could rotate a 760 mm long spindle on my mill. Luckily, I have a friend with a CNC machine who was willing to do the job from my drawings, but even then, there was a 'gotcha'. The ends of the spindles weren't long enough to protrude beyond the jaws of the milling vice because of the basket decorations. They had to be held about 11 mm proud of the vice jaws to allow machining of one side, then turned over to complete the operation on the other side. There were no such problems in machining the short lengths. The short lengths were then sawn to length and welded to the plates.

After painting the metal parts, the finished handrail was delivered and successfully installed in the church, **photo 12**. The PCC was delighted with it. The total cost of manufacture finished up at about £260, around two thirds of which was travel. ▮

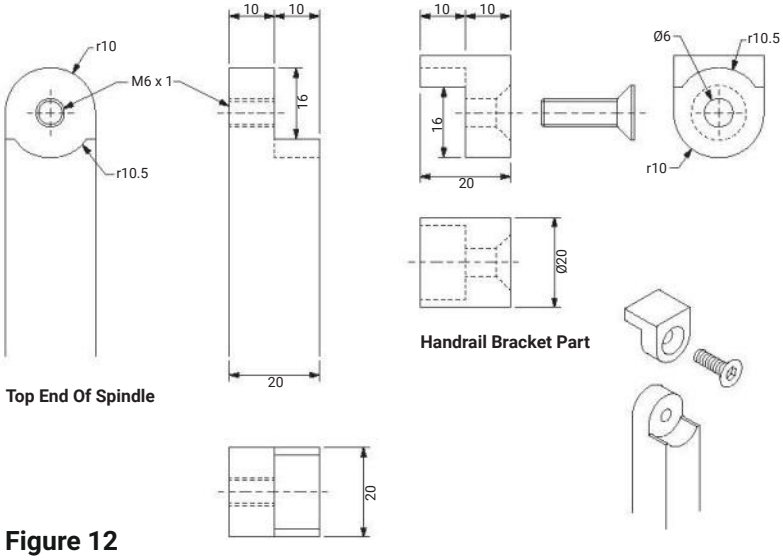


Figure 12

Readers' Tips

CHESTER MACHINE TOOLS

Cleaning Abrasive Sanding Belts

TIP OF THE MONTH WINNER!

This month's winner is Keith Beaumont who has an unexpected approach to cleaning clogged sanding belts.
If, like me, you partially use a new cartridge of silicone sealant on a job, seal it up and put it away for next time use, only to find it has gone solid when you try to use it. Do not throw it away. Use a Stanley knife to slit open the plastic cartridge and retain the solid lump of silicone rubber. This can be used to clean a clogged sanding belt very effectively. Just hold it against the belt while it is running to clean off the imbedded debris

We have £30 in gift vouchers courtesy of engineering suppliers Chester Machine Tools for each month's 'Top Tip'. Email your workshop tips to neil.wyatt@mytimemedia.com marking them 'Readers Tips', and you could be a winner. Try to keep your tip to no more than 600 words and a picture or drawing. Don't forget to include your address! Every month we'll choose a winner for the *Tip of the Month* will win **£30 in gift vouchers from Chester Machine Tools. Visit www.chesterhobbystore.com** to plan how to spend yours!

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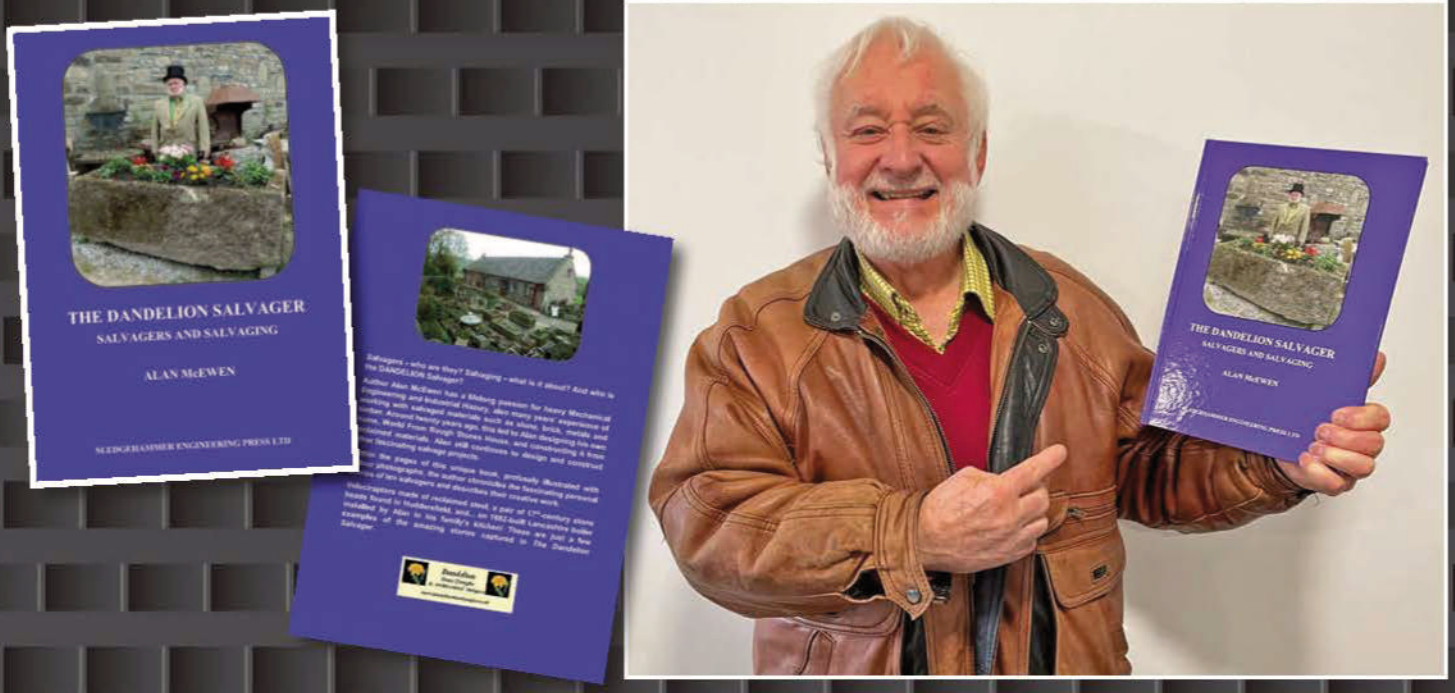

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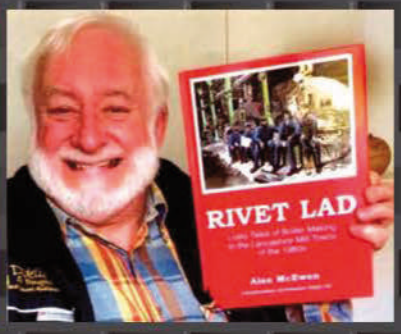

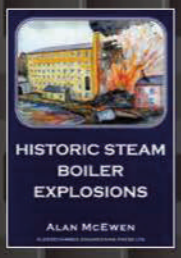

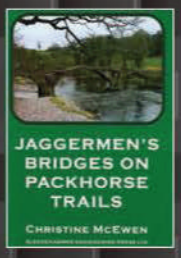

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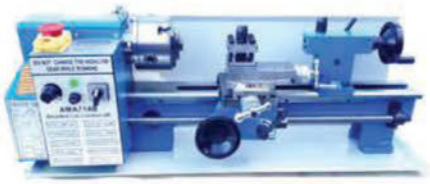

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Brushless Motor

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Spindle bore: 20mm
Number of spindle speeds: Variable
Range of spindle speeds: 100-2250mm
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Price: £694

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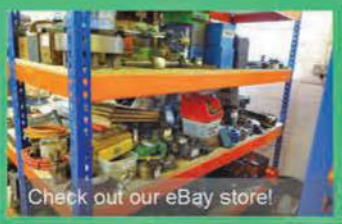
Model No: AMAVM32LV (MT3) / (R8)
Max. face milling capacity: 76mm
Table size: 840×210mm
T-slot size: 14mm
Weight: 240Kg

Price: £2,100.00
W DRO – Price: £2,537
W DRO + PF - Price: £2,948

See website for more details of these machines and many other products including a large range of accessories that we stock

HOME AND WORKSHOP MACHINERY

144 Maidstone Road, Foots Cray, Sidcup, Kent, DA14 5HS
Tel: 020 8300 9070 - evenings 01959 532199
website: www.homeandworkshop.co.uk
email: sales@homeandworkshop.co.uk
visit our eBay store! Over 7000 items available; link on website;
homeandworkshopmachinery


Check out our eBay store!


Colchester Bantam 2000 lathe (long bed) metric leadscrew, Dickson post £4950


Stanier precision vice 55mm jaw New / New Zealand £195

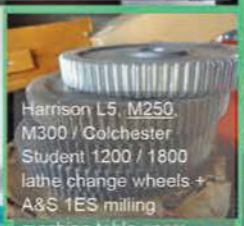

Myford SPEED 10 lathe + Transwave designed inverter, cabinet stand & tooling


Harrison M250 lathe 5" x 20" 240 VOLTS FROM NEW £5450


3 1/2" Britannia class 4-6-2 rolling chassis and castings + completed tender and part built cab, modelled on 70054 Dornoch Firth (LSBC) check out our website for more pictures £1150


X-Y 12" x 6" table £525


Myford Connoisseur Big Bore Original Myford Nottingham Long bed, Unused, inverter, 3 jaw, Dickson, stand, oils 26-3000rpm £12500.00


Harrison L5, M250, M300 / Colchester Student 1200 / 1800 lathe change wheels + A&S 1ES milling machine table gears


Startrite 24 V 10 + welder bandsaw, nice £1750


Wadkin wood lathe 6" centre height x 32" centres + 14" rear face plate on the rear end + 6 3/4" 3 jaw chuck £1150


Toggle presses from £145


Transwave 4HP & 5.5HP Rotary converter £750 / £850


Norton Deep throat No.6DB fly-press 12" throat x 9" height £950


Elliot table 12" x 4 1/4" high £500


Meddings L1 MK V drilling machine £2250


Chester Model B Super 3 in 1 lathe + inverter, DRO, 3/ 4 jaw, chucks, steadies £1000


Creuson Morrisflex 240V 8" polisher buffers £825 each


Harrison Graduate wood lathe £1450


Clarke 917 vacuum former £495


Myford 3/4HP 240V resilient mount motor configurated to match a Dewhurst reversing switch already wired + instructions £226


Trugrip collets metric £35 Imperial £30, Marico 2820 £15 each


Chester Cub 630 6" x 30" centres chucks, steadies hardly used £2950

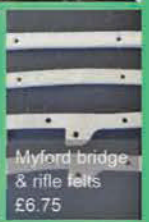

DP / MOD gear cutters £20 each please enquire Hundreds in stock!


Colchester Bantam 1600 lathe £1500


RJH Bison 10" pedestal grinder complete with light £450


HME Hearth just arrived from education 3PH / mains gas £500


Tripus 240v switch £90


Myford bridge & rifle felts £6.75


Sweeney & Blocksidge flypress 5 1/4" throat £300 FLYPRESS PUNCHES AVAILABLE


Crown Windley Brothers 6ft x 4ft cast iron surface table £1425


Smart and Brown Sabel lathe £950

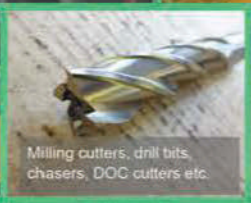

ANGLE PLATES, BOX CUBES, VICES, LATHE ACCESSORIES!


Myford gearbox unused £1000


Harrison M300 lathe £3950


Blacksmith tools and tooling in our eBay shop!


Neat cut and soluble cutting oils £10 each


Milling cutters, drill bits, chasers, DOC cutters etc.


Sedgewick 10" planer thicknesser 240V and 3PH £1150 each


Books and manuals in our eBay shop from £6.00

Please phone 0208 300 9070 to check availability.
Distance no problem – Definitely worth a visit – prices exclusive of VAT
Just a small selection of our current stock photographed!

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