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MODEL ENGINEER & WORKSHOP

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The Falkirk Wheel

THE MECHANICS OF A MODERN ENGINEERING MASTERPIECE

Myford Lathe Lever Tailstock

AN ELEGANT DESIGN FOR A USEFUL ACCESSORY

Locomotive Stamps

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INSIDE this packed issue:

MODIFYING MYFORD COLLET CLOSERS · THE 2025 SWEET PEA RALLY · A BORING BAR WITH A PRECISION SETTING GAUGE · LASER CUT PLATEWORK · DIFFERENT TYPES OF PUMP · DRAIN COCKS FOR A 5" GAUGE STEAM ENGINE · WELLAND STEAM RALLY · CORLISS VALVE ENGINE · MAKING A COVENTRY DIE CHASER JIG.

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SMOKE RINGS

NEW AUTHOR PACK AVAILABLE

Now that the magazine has started to settle into its new format, I have revised the guidance for contributors. If you would like a copy, drop me an email at meweditor@mortons.co.uk. Looking through the articles lined up for coming issues of ME&W and weighing these against what readers would like to see, I have some excellent articles in the pipeline, but I would like to have more constructional articles and short series ready for the medium and long term.

In particular, I need more articles that focus on practical machining and making to meet the demand from readers. Whilst articles on tooling and models are welcome, so are those that focus on a single component or process. Don't be shy of offering a potential article, if you have an idea but aren't sure how to take it forward, I'm happy to offer advice, just drop me an email at meweditor@mortons.co.uk.

2026 DIARY DATES

As we near the end of 2025, the Club Diary is starting to look a bit short of events for 2026. Many readers like to plan attendance at events well in advance, especially if they require overnight stays. I realise that many clubs don't finalise events for the coming year until the Autumn, but it would be much appreciated if you could share your calendars as soon as you are able. By the time you read this, I will probably be at the Midlands Model Engineering Exhibition, I'm sure it will be as good as previous years.

Neil Wyatt
Editor

Neil

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Lever Tailstock Templates

Coventry Diehead Jig Dimension Charts

The electronic version of our Index

Hot topics on the forum include:

Best material for a collet chuck started by Grindstone Cowboy. What's a machineable but durable choice for machining a chuck body?

Mystery measuring gauge by Graeme Seed. Can you help identify this unusual find?

Piston valve steam loco 2 ½" gauge started by Chris Kaminski. Do smaller gauge locomotives need cylinder drain cocks, and if so what's the best solution? limescale or electrolytic corrosion in model boilers?

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!

On the Cover

Our cover features the remarkable Falkirk Wheel, now almost a quarter of a century old. Roger Backhouses engineer's day out starts on page 52.

Next Issue

In our next issue, Alex Dupre tackles the tricky task of accurately making bevelled tube joints.

Lever Operated Tailstock for a Myford Super Seven Lathe

David Haythornthwaite revises Pete Barker's design for the ML7 to suit Super 7 lathes.

Photo 1: The Authors' Myford Super Seven B after converting to lever feed tailstock.

I have a Myford Super Seven lathe in my workshop, and I love the lathe very much. Some projects in my workshop require me to drill work held in the head-stock chuck using drills of various sizes held in a tail-stock chuck. When doing this opera-tion, I have often found the action of controlling the tailstock movement to be tiresome.

With the normal tailstock system, the pressure on the drill is controlled by a handwheel on the tailstock which extends or contracts the tailstock barrel as the handwheel is turned. This gives very limited feel to the drilling process giving a danger of large drills jamming in the work and also creating a danger of broken drill bits when drilling fine holes. I have often looked at the lever operated tailstock attach-ment which Myford used to produce for this lathe, but they apparently no longer offer it for sale.

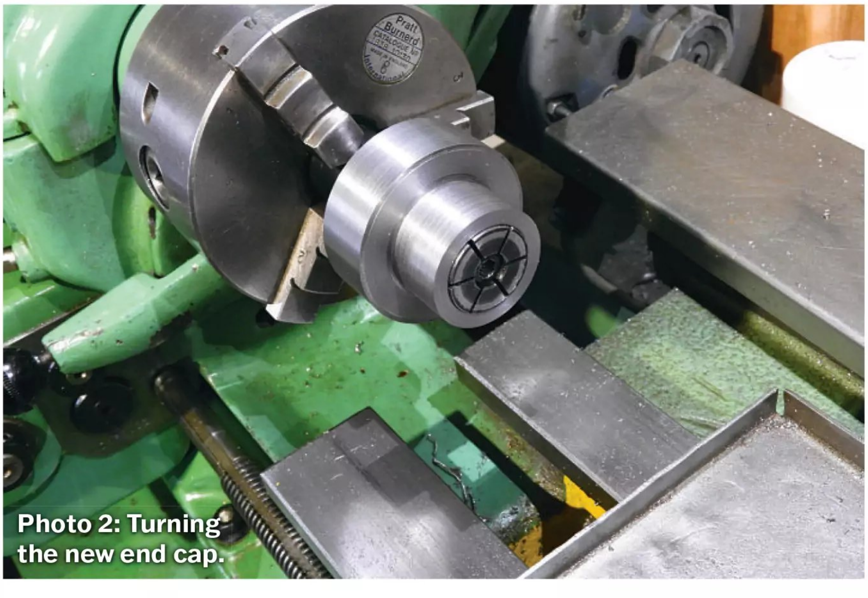


Photo 2: Turning the new end cap.

About three years ago, I started to have problems using my right (domi-nant) hand and due to the problems obtaining medical help during the Covid lock-down, I eventually was informed that I probably had broken part of my hand, and the bone had calcified. Having fairly constant pain from my hand, my thoughts once again turned to the possibility of having a lever feed on the tailstock of my lathe.

I was pleased to see that when *Model Engineers' Workshop* 323, January 2023 dropped through my letterbox not long afterwards, that Pete Barker had an excellent article on how to make a lever feed for the Myford ML7. The tailstock on the Super 7 is however significantly different to the ML7 and I set about making my own drawings for a Super 7 system, construction of which I have since completed. The main differences between the two systems are that the Super 7 requires a new, longer tailstock barrel to be made and the Super 7 also

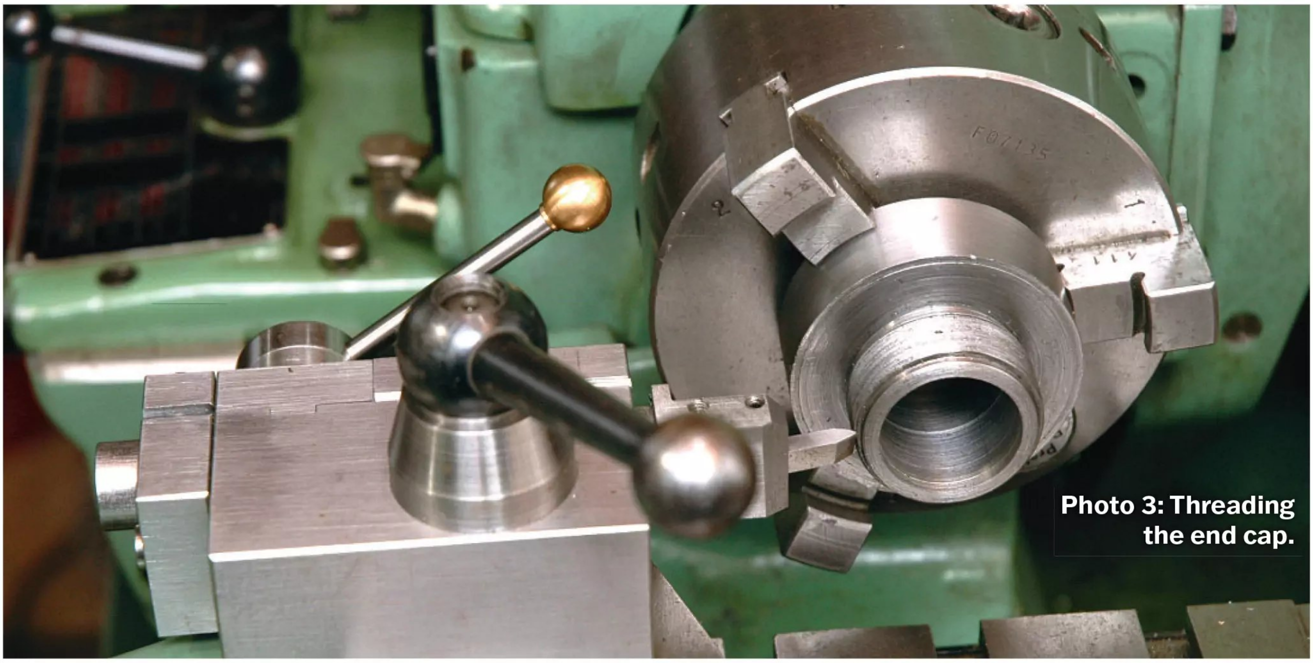


Photo 3: Threading the end cap.

needs a new tailstock screwed cap to be made to fit into the tail end of the tailstock itself. For the remainder of the construction, I mostly followed Pete Barker's construction. Full marks to Pete Barker for an excellent design. Which I followed - more or less - for my Super 7.

Construction of the lever feed, **photo 1**, was quite complicated in places if one is making it on a Super 7 as I was, with no other lathe available. I did have a milling machine available and also a rotary table, both of which were used in the construction. I made new drawings, using Serif Draw Plus **figs 1** and **2** and ensured that the original drawings printed nicely onto A4 paper keeping the drawn dimensions correct. As the figures can't be guaranteed to print at an exact size, the original of fig. 2 is downloadable from the forum at tinyurl.com/4a8kvzcz, or use the QRcode, so you can print both figures full size, this it makes construction simpler, as the shapes of the three parts can be scanned, cut out and pasted onto ¾" mild steel plate.

CONSTRUCTION OF THE NEW TAILSTOCK CAP

When making accessories for your, perhaps only, lathe, it is always difficult to organise your workflow as you are often dismantling part of your lathe that you need, in order to make the accessory. Making this item was no exception. Firstly, I would need to test the fit of the new tailstock cap into the thread of the tailstock back end. This meant removing the old tailstock quill system at a much earlier stage than I would have liked.

To dismantle the tailstock on the Super Seven, the order of procedure is to remove the handwheel by removing the Nyloc nut and washer and then tapping the handwheel off the end of the quill, using a soft hammer. There is a curved groove in the outer end of the quill with a curved key in it to mate up with a keyway in the handwheel. This key seems destined to fall out and be lost on the floor of the workshop - so do place something on the lathe bed to catch it! Behind the tailstock handwheel is a three-part thrust ball bearing (don't worry the balls are captive) and then the quill itself. There is no need to remove the actual quill at this stage.

Holding the embryonic end cap in the chuck whilst creating the thread leaves the chuck jaws in the way of the cutting tool, and I resorted to drilling and boring the centre so I could initially mount it onto a 1" mandrel. See **photos 2** and **3** for the screw cutting. Oh, how I wished that I had a lever feed for this work! Leaving the new tailstock cap in the chuck at the end of screw cutting, the new part, complete with chuck, can be carefully removed from the headstock, then reversed, and tried for fit in the tail end of the tailstock. I always seem to make things a little on the tight side and **photo 4** shows that it did not quite screw home. **Photograph 5** shows that the first jaw position had been marked on the item

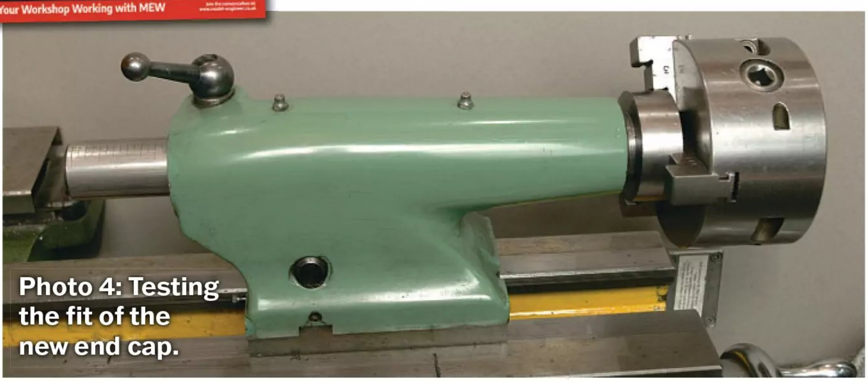


Photo 4: Testing the fit of the new end cap.

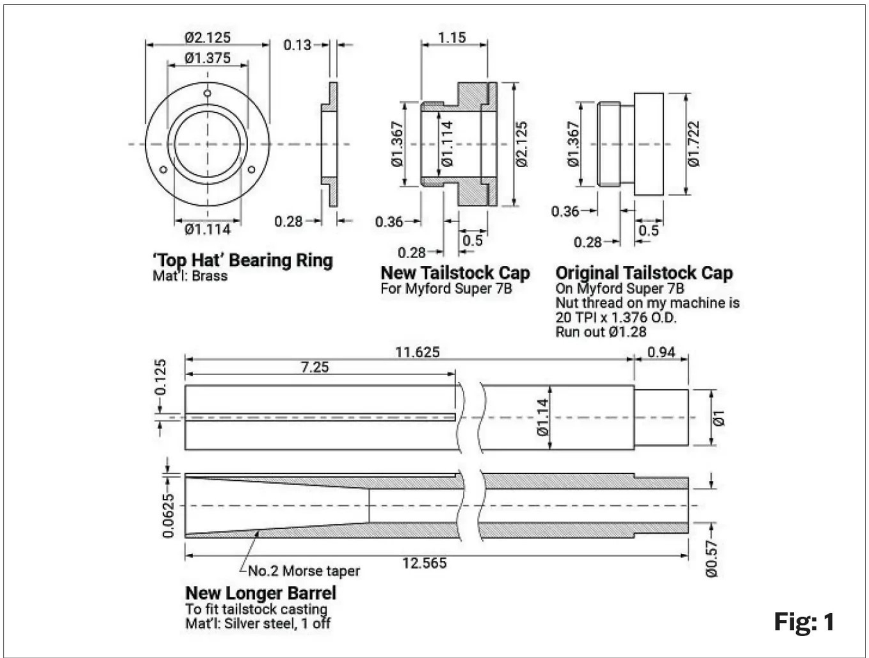


Fig: 1

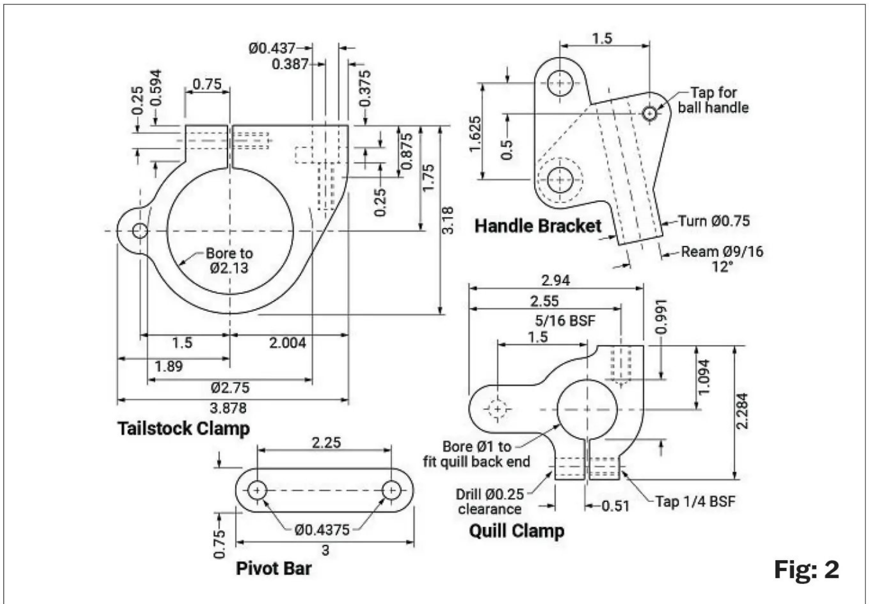


Fig: 2

just in case. Once screwed back on the headstock, the thread picked up ok and the remachined thread was retried.

In fig. 1 I have shown the dimensions of the original end cap. 1.364" O/D on the thread and 20 tpi, constructors would need to check the measurements of their lathe. My old quill measured 1.114" diameter which I doubted as it was a strange measurement. It transpired that someone on the forum owned a genuine Myford made lever operated tailstock, which he has since sold, but he kindly offered to measure it and guess what? He came back with a diameter of 1.114". I therefore bored out the new cap to be 1.114". It proved to be just slightly tight, but the size of the new quill was adjusted later by around a quarter of a thou by careful use of emery paper.

The quill needs to be of high-quality steel, and I obtained a piece of silver steel (known in North America as drill rod) 13" long and 1.125" diameter. This material is easy to turn providing you use sharp tools and is strong even in its unhardened state. I have an electric kiln which I use for hardening metals, but I considered that if I hardened it in the kiln and quenched it then it would become bent and would also probably be brittle. However, to put a central hole down the middle and a no 2. Morse taper socket at one end would probably be quite a challenge as the horizontal distance between centres of the Super 7 is only 20 inches. I decided to first drill a 9/16" hole down the centre, drilling from both ends. I set up the 13" bar as in **photo 6** and carefully centred both ends. The bar was held in the 3-jaw chuck, and I checked that the chuck end was running concentrically. Amazingly it was, so I did not have to use the four-jaw chuck. The other end of the bar was set up in the fixed steady and considerable effort was made to 'clock' it along its length and

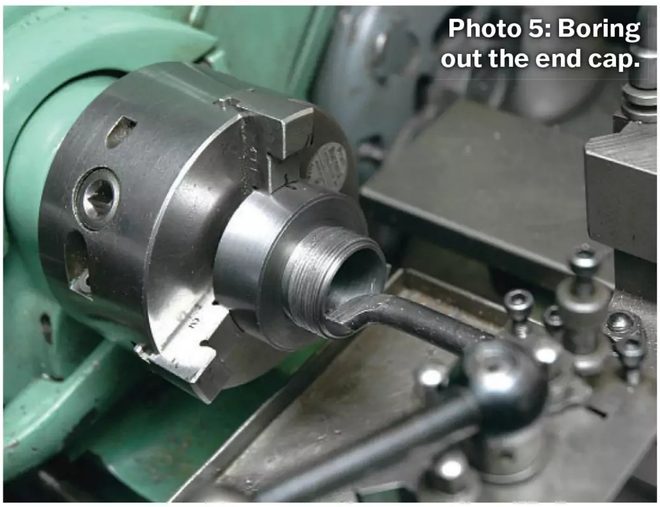


Photo 5: Boring out the end cap.

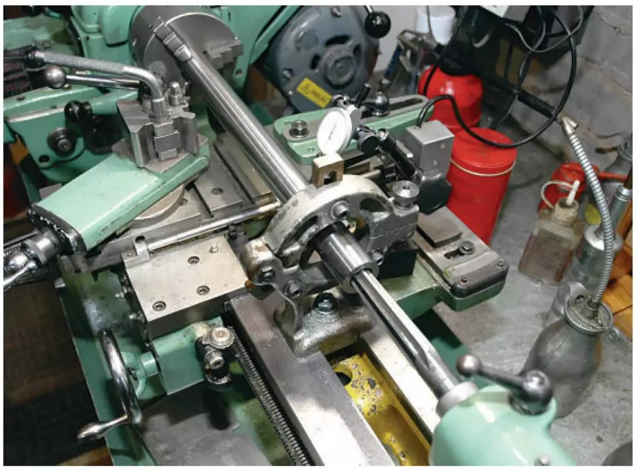


Photo 6: Reaming the M T taper socket.

Photo 7: Testing the fit of the quill parts.

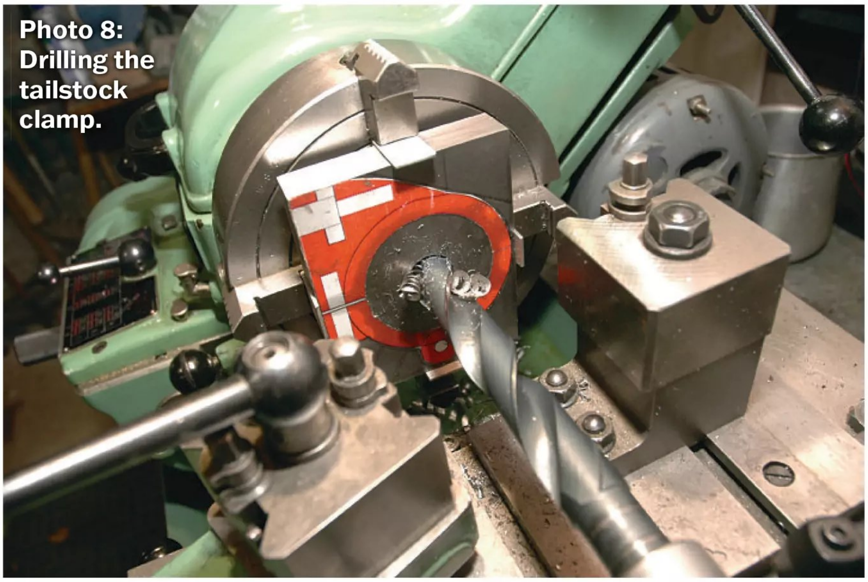


Photo 8: Drilling the tailstock clamp.

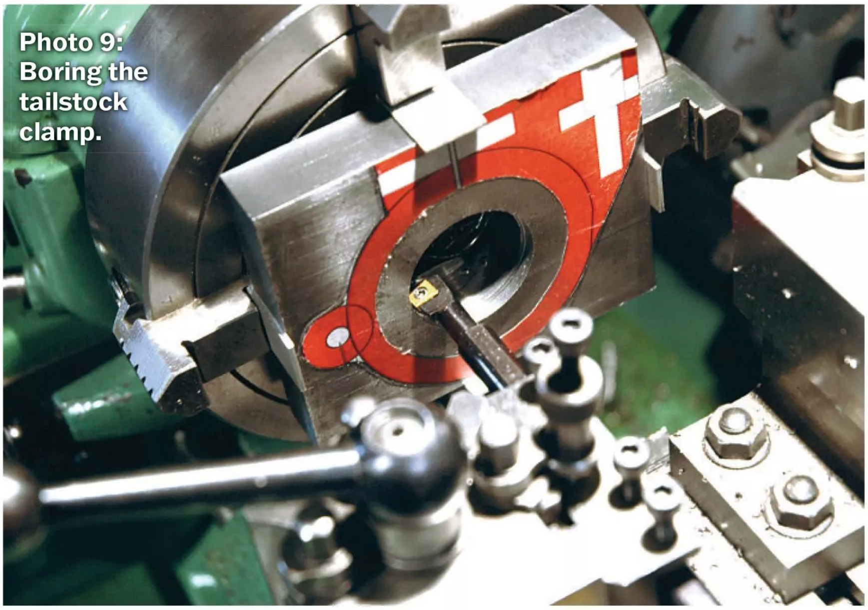


Photo 9: Boring the tailstock clamp.

ensure that it was running true. I have a fairly long 9/16" drill with a No. 2 MT shank which would just reach past the halfway point drilling down the centre and then I reversed the bar in the lathe and drilled from the other end.

I wondered whether to bore the 2MT taper socket in the quill but being short of room to use my taper turning attachment, I decided to use a 2MT reamer, held in the (original) tailstock, the stage shown in photo 6, and hope that it would cut straight - which it did. In the photo the bar had been drilled 9/16" dia. from both ends and I was just starting to ream the 2MT taper socket. I am pleased to say that the finished 2MT socket was true and, in fact, I later inserted a 2MT rotating centre into it in order to turn the outside diameter, **photo 7**. If readers who are constructing this are considering doing away with the long central hole, bear in mind that you would have no easy way to knock out tailstock chucks, tailstock rotating centres etc., so the through hole is relatively important.

I next supported the bar by two centres, drove it by a dog at the headstock end and turned it down to 1.114" diameter - which process ensured that the outside surface was concentric with the two centres. I also turned the right-hand end of the quill to 1" diameter as shown on the drawing.

The final feature that completes the quill is the groove down the outside of the quill which runs for 7 ¼" from the taper socket end of the quill. It is 0.125" wide and 0.0625" deep. Constructors should be careful to ensure that the 2MT socket finishes up at the correct end! This groove on the exterior of the quill enables it to stay aligned when sliding in and out, engaging with an existing key on the inside of the tailstock casting which stops rotation.

IMPORTANT POINTS TO NOTE

When creating the tailstock cap with the sizes on my drawing. Be careful when you relieve the thread on the cap and create a run-out. If you make the thread relief too deep, the thread will collapse, as the diameter of the quill is very close to the diameter of the thread relief, leaving very little metal available at the point of thread relief.

When turning the quill, make sure that you create accurate centres on both ends and then support the bar by these centres. Taking an initial light cut, reduce the diameter of the bar to a greater diameter than is required. Check and check again with a

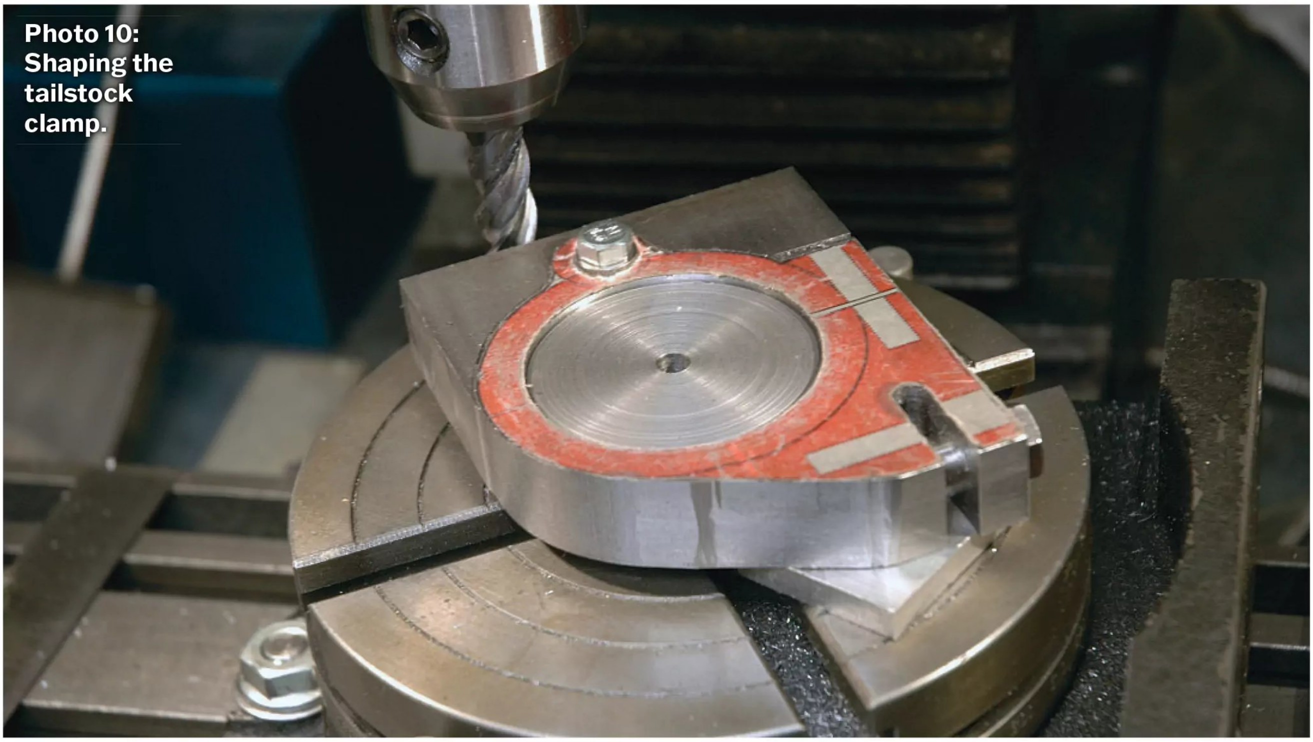


Photo 10: Shaping the tailstock clamp.

micrometer to ascertain that the bar is parallel. It must be accurately parallel if it is to eventually slide smoothly in the tailstock. If the quill is not parallel at this stage, i.e. your lathe is not turning quite parallel, then you will need to offset the tailstock to correct this and then repeat the procedure.

CONSTRUCTING THE LEVER OPERATING ACTION

One reason that I redrew the figures is that it enabled me to print out and cut out the three main parts of the mechanism and to cut these parts by sticking paper cut-outs from the drawing onto the ¾" steel plate to facilitate fabrication.

In **photo 8** you will see that I have printed out the drawing of the tailstock clamp which has a red infill for clarity. I measured a known measurement on the printout to ensure that the size tallied with the drawing and then cut out the item. A square of ¾" steel plate was cut 3.1 x 3.3" on the bandsaw and the drawing of the tailstock clamp was stuck onto that. The drawing has a centre point on it, so that was centre drilled, and the work was set up in the four-jaw chuck, using the original tailstock centre to aid holding the piece in place whilst adjusting the chuck jaws. **Photograph 9** shows the boring operation. Remember to use packing to bring the piece slightly forward, that way you ensure that you do not try to bore the 4 jaw chuck jaws or the faceplate, if you use that to hold the item.

I must apologise to readers for the fact that the drawings in figs 1 and 2 are in imperial measurements. My Myford lathe is an imperial one, so I used imperial measures on this occasion. I have worked in imperial measures throughout most of my life, but at the age of 79 years I now work almost exclusively in metric measurements. I have to say that now I have converted, I do find the metric system much easier to use. To my shame though, I often talk about "thous" when discussing fits.

In **photo 10** I have created a large plug 2 1/8" diameter which accurately fits into the centre of the bored hole in the tailstock clamp. This was fitted to a rotary table by making a mandrel to fit the centre of the rotary table. The tailstock clamp was then bolted to the


Photo 11: New tailstock / Quill parts.


Photo 12: Splitting the handle bracket.


Photo 13: Pivot Bolts for the handle bracket.

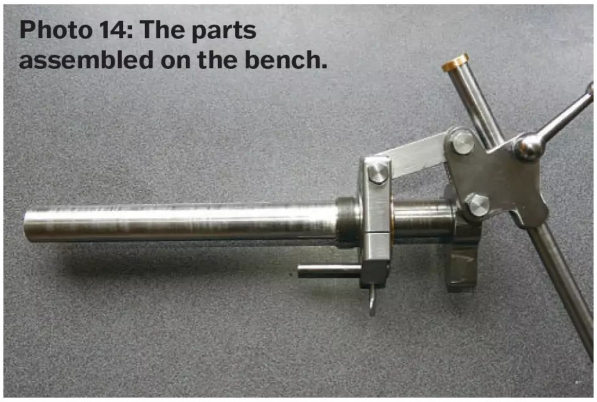


Photo 14: The parts assembled on the bench.

table with 1 bolt and aligned by means of the large plug as shown in photo 10. The rotary table was mounted onto the table of my milling machine, and the outside edges of the tailstock were milled to shape by a combination of moving the X/Y controls of the mill and rotating the rotary table. The photo illustrates the part ready for shaping the outside, then cutting the slots and holes using the stuck-on drawing to guide the machining. At this stage I also checked the nice tight fitting of the taper socket in the quill and the sliding fit of the new tailstock end cap. Please note that the end cap has been placed the wrong way round on the quill prior to taking the photograph in **photo 11**. As it simply slides off the quill, it did not matter apart from cosmetic appearance. I still had to make the brass 'top hat' shaped bearing and fit it to the end cap as shown later.

The quill clamp and the handle bracket were made by similar techniques to the making of the tailstock clamp - i.e. from ¾" steel plate and the pivot holes in the handle bracket were reamed 7/16". I chose to use a length of 9/16" silver steel for the actual handle. I used a commercial plastic knob with an 8 mm thread, at one end of the handle. At the other end, I made a captive brass cap to stop the handle from pulling out of the bracket. It is fastened to the end of the handle with a 3 mm countersunk setscrew. The drilling of the bracket (9/16") for the handle was done in a machine vice on the milling machine, being careful to get the angle correct at 12 degrees to a line drawn through the two pivot points (on the left in fig. 2).

I split the handle clamping system by mounting the handle bracket vertically on the horizontal band saw. To do this it was necessary for me to put a small vice into the band saw vice which then gripped the handle bracket with the saw blade situated so that the blade was cutting the thickness of the handle bracket exactly in the middle. The setup is shown in **photo 12**. Rather than making three bespoke setscrews to attach the handle to the two other components, I cheated somewhat. I obtained 3 - 1"x 5/16" BSF hexagon head setscrews and adapted them to make 7/16" pivots to go into the handle bracket. Placing a piece of 7/16" silver steel into the lathe, I drilled out the end with a 6.9mm drill which is tapping size for 5/16" BSF. The end of the bar was tapped and then parted off to make three short sleeves. The length of each sleeve was adjusted on the belt sander to suit the location on the handle bracket. The length of each sleeve should be such that when the setscrew is tightened up, the sleeve is captive and tight between the hexagon head of the setscrew and the part into which it is being screwed. Complicated to explain in words, but **photo 13** should illustrate the result, also see photo 16 later. Once satisfied with the result, I removed the sleeve and then refitted it with a dab of two-part epoxy on the setscrew thread to permanently hold the sleeve onto the setscrew so that it could not unscrew. I tapped the third hole in the handle bracket ¼" BSF for the lower half and opened up the top half to ¼" clearance. The size was chosen as I had a spare ball handle from a previous project (pillar tool) which had a ¼" shaft already in place. A washer on the top, underneath the ball handle makes it simple to tighten up the handle, the slot in the handle bracket is compressed and the handle is held fast. I find that I normally work with the handle clamped around the middle point which makes the whole mechanism ore compact and less in the way of the usual clutter on my lathe bench.

The pivot link was made from an offcut out of my scrap box. It is a piece of quality steel 3" x 0.75" and is ¼" thick. The piece should be a nice tight fit into the ¼" slot in the tailstock clamp. Two holes in the handle bracket are to carry pivot bolts whilst the third hole is to carry the clamp bolt and ball handle.

ASSEMBLY OF THE HANDLE ADJUSTMENT MECHANISM

At this stage I separated all the various parts and sanded the edges with a Fein Multimaster detail sander which gave the mechanism a more rounded

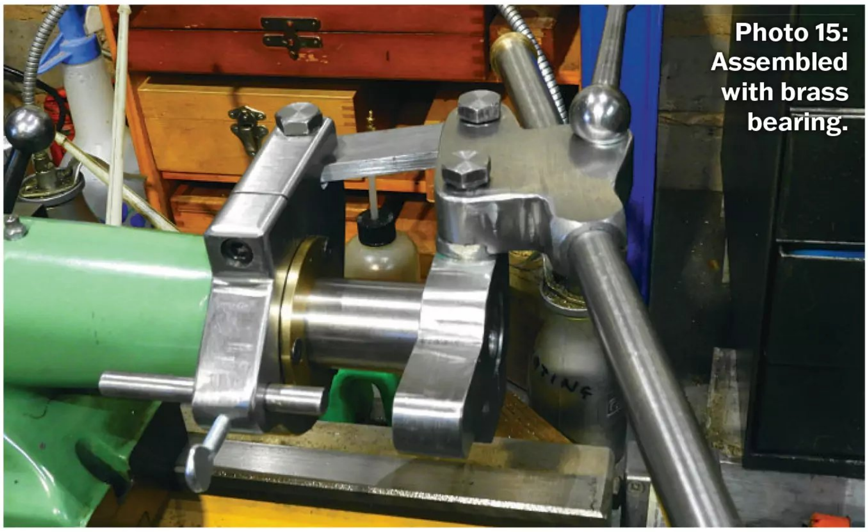


Photo 15: Assembled with brass bearing.

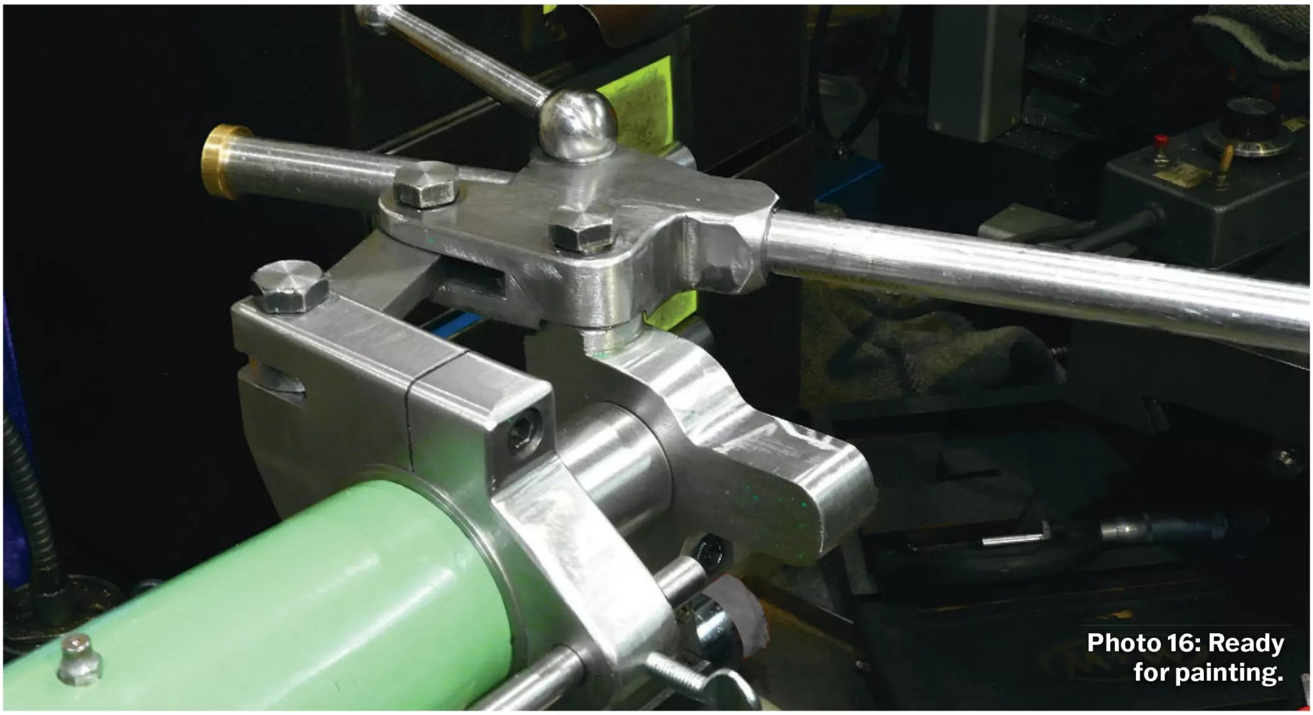


Photo 16: Ready for painting.

appearance as shown in **photo 14**. This, when painted in Myford matching enamel paint made the finished article look as though 'it grew there'.

I found the details of the lever handle mechanism difficult to completely understand from the drawing previously in MEW. I am therefore showing **photos 15, 16** and **17** to clarify how the various parts fit together. The pivot bar fits between a ¼" slot in the tailstock clamp and a ¼" slot in the handle bracket, being held by a 5/16" BSF bolt at each end with a 7/16" sleeve round each bolt as it passes through the pivot bar. A ¼" slot was milled at an angle in the handle bracket to allow the pivot bar to slide as the handle is operated. The dotted line on the drawing of the handle bracket shows the extent of the slot, which is quite a long reach for a ¼" slot drill in the milling machine.

Please note that in the handle bracket, the top (in the drawing) 7/16" hole only goes through the top part of the bracket. The lower part of this hole below the ¼" slot is drilled and tapped 5/16" BSF, so start this hole by drilling a 6.90 mm hole right through, (5/16" BSF tapping size) then reaming out to 7/16" in the top half! Studying photo 16 may help to clarify this.

The top of the quill clamp (as in the drawing) was mounted in the lathe on a small angle plate, and a boss was turned on the end to fit into a recessed circle on the underside of the handle bracket. The bolt through the handle bracket into the boss on the quill clamp carries a sleeve as in photo 13. The bolt is tight into the quill clamp, but the sleeve stops the bolt from tightening fully onto the handle bracket leaving it able to swivel.

I sprayed the sliding parts with dry PTFE lubricant, and the tailstock feels as if it glides on velvet.

Making the lever tailstock was demanding at times, but I am well pleased with a useful accessory for my lathe.

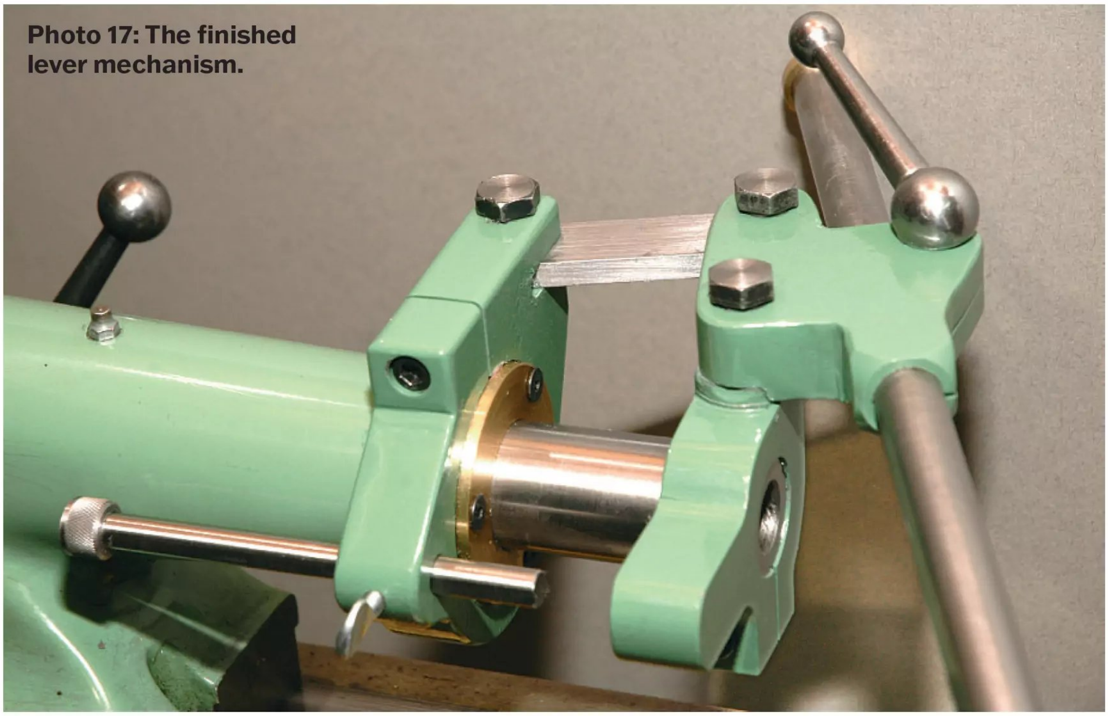


Photo 17: The finished lever mechanism.

Making Simple Taper Tooling

Simple tools can be used to make accurately tapered holes, or to open out smaller holes to an exact size. Here's a brief guide to using them and making your own.

TAPER REAMERS

Taper reamers are designed for finishing tapered holes to a standard size. Larger ones are available for machine tool tapers, **photo 1**. Depending on the amount of material to be removed the starting hole may be bored near to size (for just light finishing by the reamer); step-drilled to an approximate taper; or for small sizes and shallow tapers may be a simple straight sided hole. They should be used at relatively slow speeds with plenty of cutting fluid and regularly cleared of swarf.

Taper reamers for making valve seats and similar purposes are easily made by turning a suitable cone in silver steel, then finishing it along the lines of a d-bit. Where matching holes and tapers are needed but the exact taper is not critical, one can turn the required tapered parts, finishing by tapering a length of silver steel at the same setting. This can then be finish machined and hardened in confidence that it will produce holes a close match for the other taper parts. This approach was taken for the tool on the left of **photo 2**, a whole batch of tapered blanks were turned at the same setting.

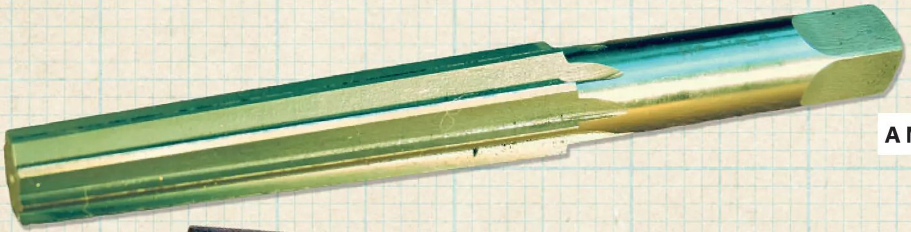
TAPER PIN REAMERS

A taper pin reamer is a slender reamer used specifically for making holes for taper pins. These metal pins (usually of hard brass or steel) have a gradual taper (often 1:48) and are used to secure a part to a round shaft. A diametric hole about the size of the small end of the pin is drilled though both parts and then shaped with a taper reamer. The pin is then hammered home and may be finished to length. Such fixings are semi-permanent and can be disassembled by driving the pin out from its small end with a pin punch.

Because for their small size and gradual taper they can be tricky to make. Rather than machining a flat along the tapered blank it is easier to clamp it in a shallow groove on a piece of wood and carefully file it away to half its depth.

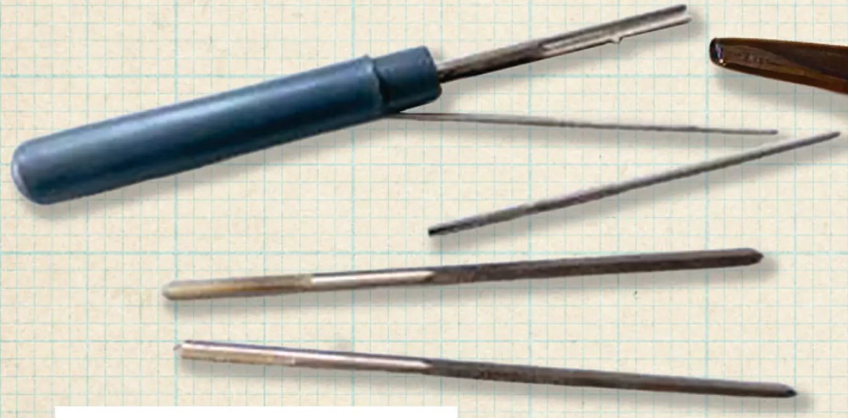
TAPER BROACHES

A taper broach, **photo 3**, is a long, edge cutting, slightly tapered, tool for enlarging holes. Unlike a reamer, which cuts accurately sized holes, a broach is usually used to slowly enlarge a hole to size. Larger broaches can be made by milling a single flute along their length. Smaller ones can be made by filing three flats around a blank, these do not cut freely and are best used in thin materials.



A Morse taper reamer.

Two shop-made taper reamers.



A set of small diameter broaches.

NASA Selects 2025 Class of Astronaut Candidates


An illustration of the Orion spacecraft. Throughout this decade, NASA will explore more of the Moon than ever before and establish a sustainable human presence under Artemis in preparation for future human missions to Mars. Credits: NASA.

NASA's 10 new astronaut candidates were introduced Monday following a competitive selection process of more than 8,000 applicants. The class now will complete nearly two years of training before becoming eligible for flight assignments supporting future science and exploration missions to low Earth orbit, the Moon, and Mars. Acting NASA Administrator Sean Duffy welcomed the 2025 astronaut candidate class during a ceremony at the agency's Johnson Space Center in Houston.

The agency's 24th astronaut class reported for duty at NASA Johnson in mid-September and immediately began their training. Their curriculum includes instruction and skills development for complex operations aboard the International Space Station, Artemis missions to the Moon, and beyond. Specifically, training includes robotics, land and water survival, geology, foreign language, space medicine and physiology, and more, while also conducting simulated spacewalks and flying high-performance jets.

After graduation, the 2025 class will join the agency's active astronaut corps. Active astronauts are conducting science research aboard the space station while preparing for the transition to commercial space stations and the next great leaps in human exploration at the Moon and Mars. The candidates' operational expertise, scientific knowledge, and technical backgrounds are essential to advancing NASA's deep space exploration goals and sustaining a long-term human presence beyond low Earth orbit.

2026 Midlands GARDEN RAIL SHOW

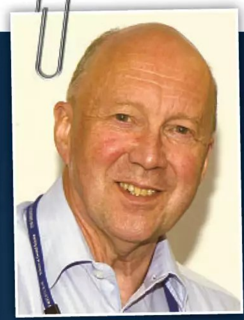
The 2026 Midlands Garden Rail Show will take place on Saturday 28th February & Sunday 1st March again at the Warwickshire Event Centre.

This event attracts nearly 2,000 enthusiasts from all over the UK and offers visitors the opportunity to see layouts in the larger gauges and scales including Gauge 1, O Gauge, G Scale and more.

Once visitors have been inspired to build their own layout, they can visit nearly forty specialist suppliers at the show who are more than happy to guide them in the right direction of the best products to purchase.

For more information see www.midlandsgardenrailshow.co.uk

Photo 343: Rough castings for the end covers, valves and a valve plate.



A Tandem Compound Mill Engine

David Thomas completes the air pump for Arnold Throp's Corliss mill engine.

PART 21

In the previous part I described the machining of the larger bits of what, on the original drawings, Arnold Throp calls the 'air pump'. However, I didn't give any explanation of the name or of its function; what follows is largely taken from pages 73 and 74 of ref. 1. Almost all compound steam engines exhaust to a partial vacuum created by condensing the steam from the low-pressure cylinder and this adds something like 12 to 14 psi to the total pressure drop across the engine. To quote Throp directly *"By far the majority of engines had jet condensers in which the steam meets a flow of cooling water sprayed in through nozzles, mixes with it to be condensed and flows away back to the source."*

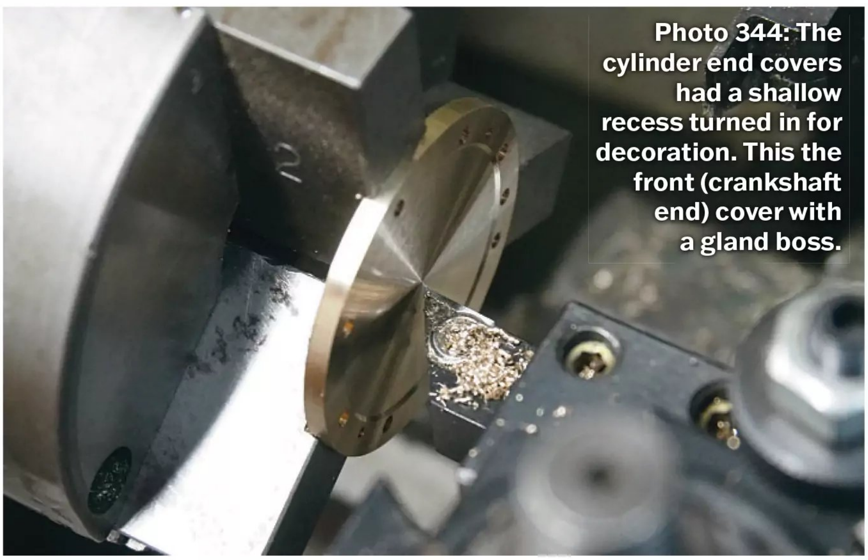


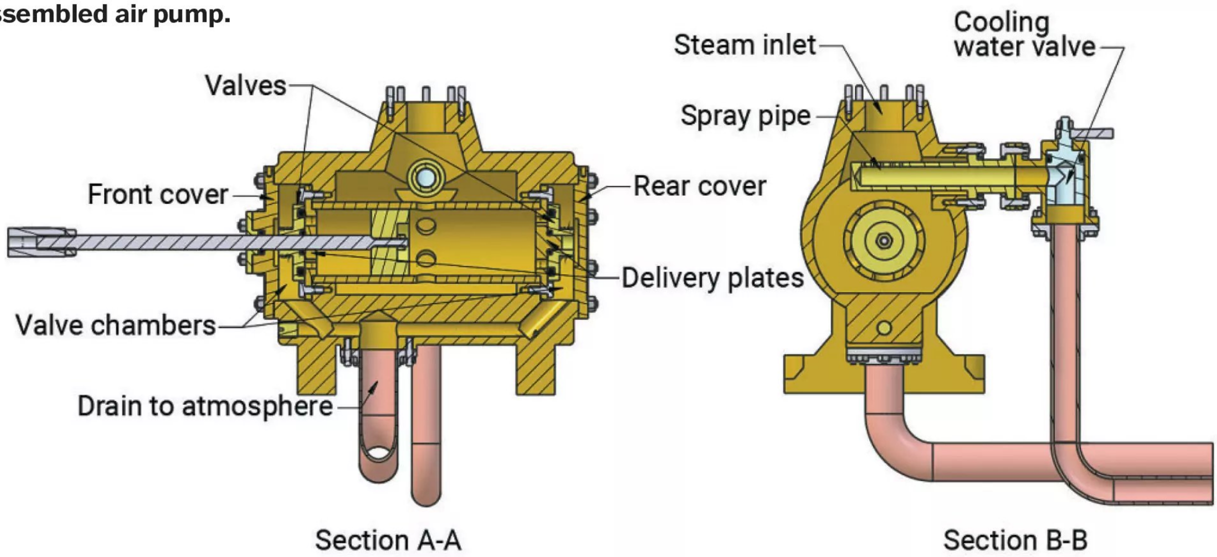
Photo 344: The cylinder end covers had a shallow recess turned in for decoration. This the front (crankshaft end) cover with a gland boss.

The condenser is either followed by, or is combined with, an air pump which is needed because *"There may also be small amounts of other gasses, especially air some of which comes with the steam from the water fed to the boilers. During the portions of the stroke of an engine when the cylinder pressure is below atmospheric, air may be drawn into the system through piston rod and valve spindle glands, drain cocks and leaking connections. If not continuously removed, these gasses will accumulate and, being non-condensable, will eventually destroy the vacuum."*

Throp describes air pumps with vertical cylinders but goes on to say *"More horizontal engines were fitted with double acting horizontal air pumps set in line with the steam cylinders and worked by an extension of the piston rod. These pumps usually had an injection water spray pipe set horizontally into the pump body casting."*

The unit he drew for the model follows that pattern exactly, **fig. 51**. The steam inlet is at the top with the spray pipe immediately below it and the jets pointing upwards into the

Fig 51: Cross-sections of the assembled air pump.



steam flow. The condensate falls to the bottom around the cylinder and is pulled into the cylinder by suction from the piston through the ring of holes around its middle. On the return stroke the condensate is expelled through the delivery plate, lifting the valve against its spring, and then falls into the drain under gravity. Now is probably the best time to point out that, if the model is only ever going to run on air all these internals are unnecessary and could be omitted! That is a choice left for the builder.

Five of the castings are shown in **photo 343** (no, I don't know where the sixth one was either), all of them were the same basic 'mushroom' shape, rough but with generous machining allowances, **fig. 52** has the drawings. The covers and delivery plates were all machined with the same sequence, first held in a four-jaw chuck by the rough rim and the chucking spigot cleaned up (no picture) then transferred to the three-jaw to turn in the external details, **photo 344**. The holes in the delivery plates were drilled while the chucking spigots were still attached and in **photo 345** the spigot is being held in a V-block hidden under the part and not by the edges. The soft jaws came in again to hold the delivery plates for de-burring and finishing of the central hole (front plate) or valve guide pin, **photo 346**. The last operation on the delivery plates was to tap the holes for two 8BA forcing screws which we can hope will not be needed but would be essential if the unit had to be disassembled, **photo 347**. The housing for the O-ring seal in the gland on the front cover was turned in before drilling and tapping the four holes for the gland screws.

The piston is a simple brass turning and the rod drawing was shown in Part 9.

The valve castings had been mangled at the foundry and were so difficult to grip safely that I discarded them and made the valves from brass bar. To machine the O-ring groove in the valve face you need a trepanning tool which can, very conveniently, be made on the end of a piece of ½" silver steel. In **photo 348** the cutting edge (0.11" wide)

Photo 345: The valve plates were full of holes...

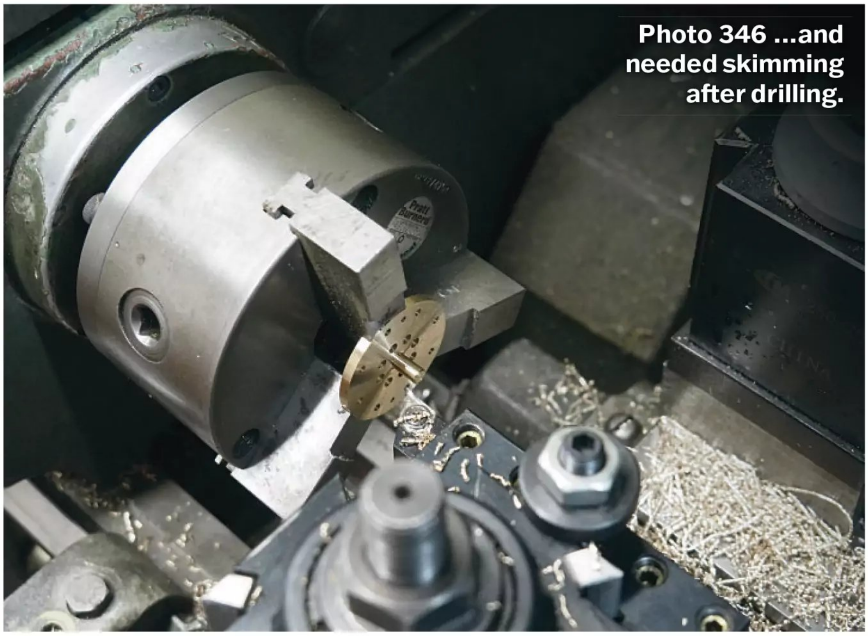
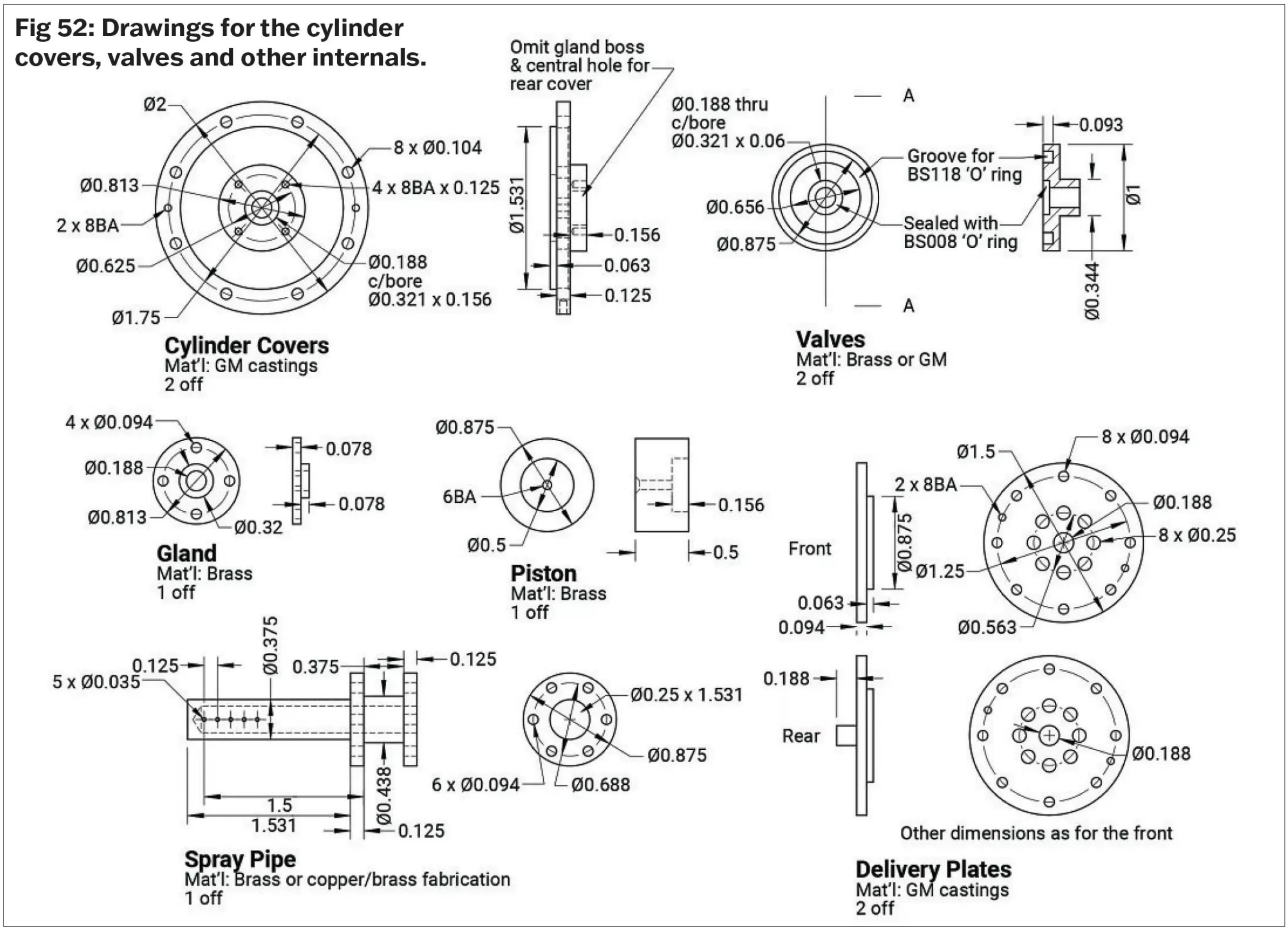


Photo 346 ...and needed skimming after drilling.

Fig 52: Drawings for the cylinder covers, valves and other internals.



is facing to the right and it is shown in use in **photo 349**. In the family group in **photo 350** the valve is at the lower right. The two springs that keep the valves seated on the delivery plates are about 3/8" in diameter and quite soft, just enough to keep the valves closed reliably.

Figure 53 has the details of the cooling water valve and the pipe flanges for that valve and the condensate outlet pipe. The valve body came as another rough gun metal casting nearly half of which was chucking spigot, and the first task was to clean this up **photo 351**. The four-jaw didn't have much grip, so the end was skimmed with very shallow cuts and carefully centre drilled. Looking at the job again now I can see that I should have made a spider to go between the chuck jaws, easily done by 3D printing. With the chucking spigot turned smooth holding the part in collets becomes easy and the lower end was faced off **photo 352** and the inside finished to a flat bottom with a D-bit. In **photo 353** the part is being held in the dividing head on the mill table to machine the flange flat and drill the water passage and screw holes. To get at the top of the valve to turn in the details there the valve body was

Photo 347: Two holes were tapped 8BA for forcing screws which I hope will never be needed.

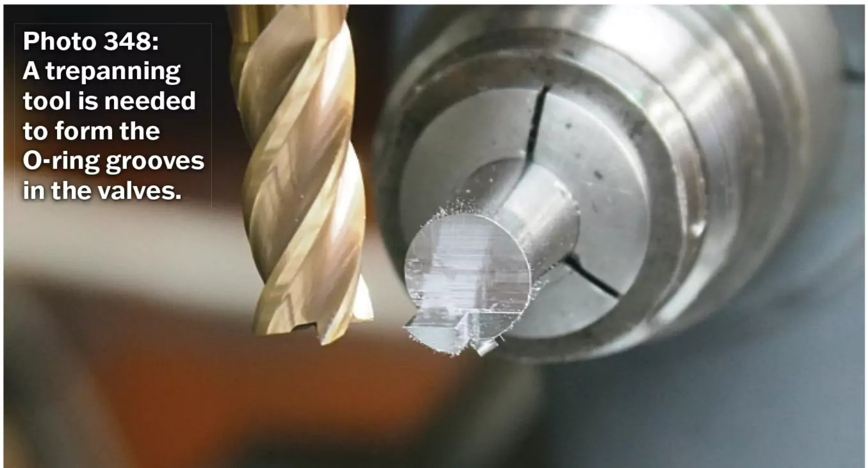


Photo 348: A trepanning tool is needed to form the O-ring grooves in the valves.

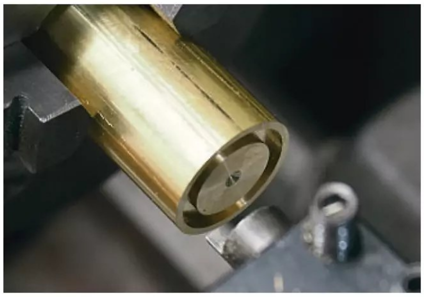


Photo 349: Rather than using the very rough and difficult-to-hold castings for the valves they were machined from brass bar.

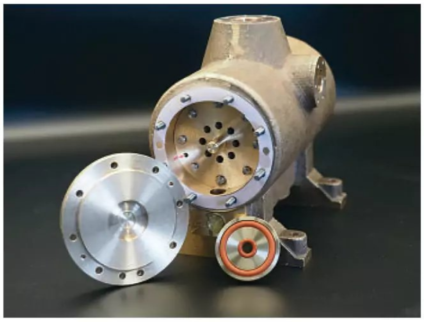


Photo 350: Rear view of the air pump/condenser with the rear delivery plate exposed along with the valve and the rear cylinder cover.

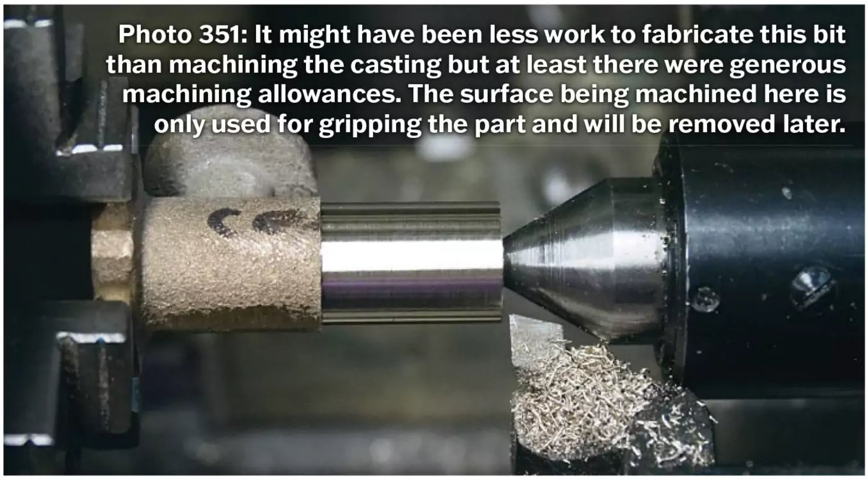


Photo 351: It might have been less work to fabricate this bit than machining the casting but at least there were generous machining allowances. The surface being machined here is only used for gripping the part and will be removed later.

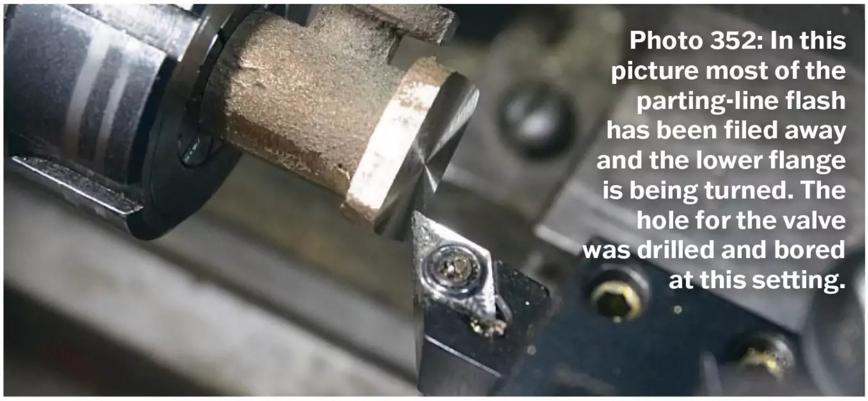


Photo 352: In this picture most of the parting-line flash has been filed away and the lower flange is being turned. The hole for the valve was drilled and bored at this setting.

Fig 53: Drawings for the cooling water valve and fittings.

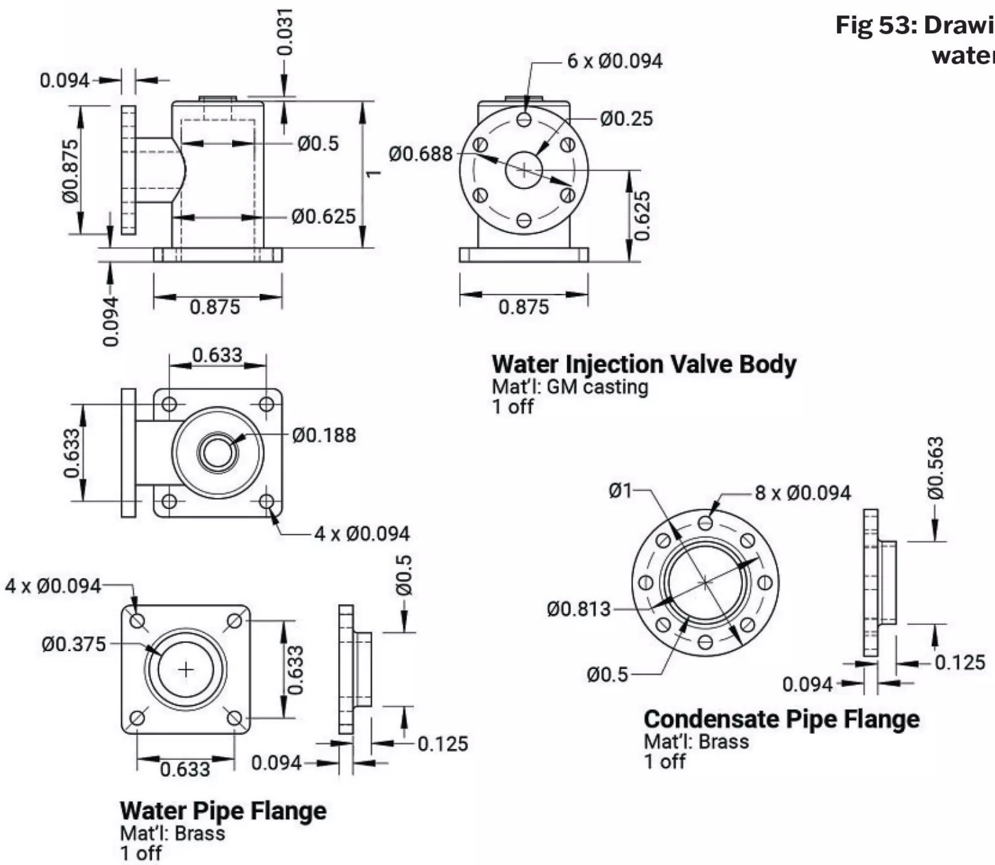


Photo 353: Now the valve body is being held in the mill for milling and drilling the mounting flange.

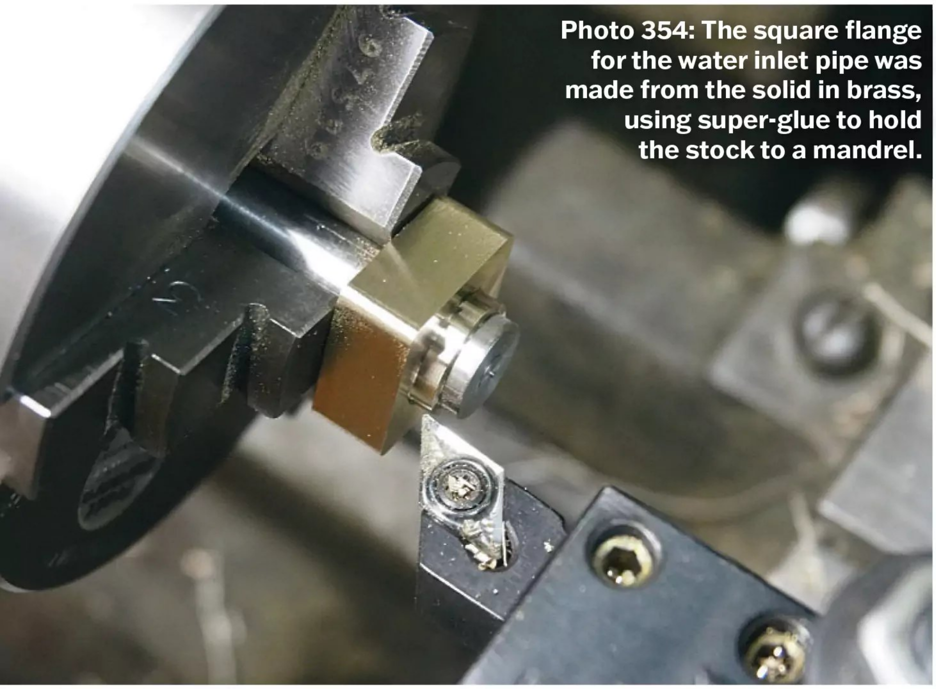


Photo 354: The square flange for the water inlet pipe was made from the solid in brass, using super-glue to hold the stock to a mandrel.

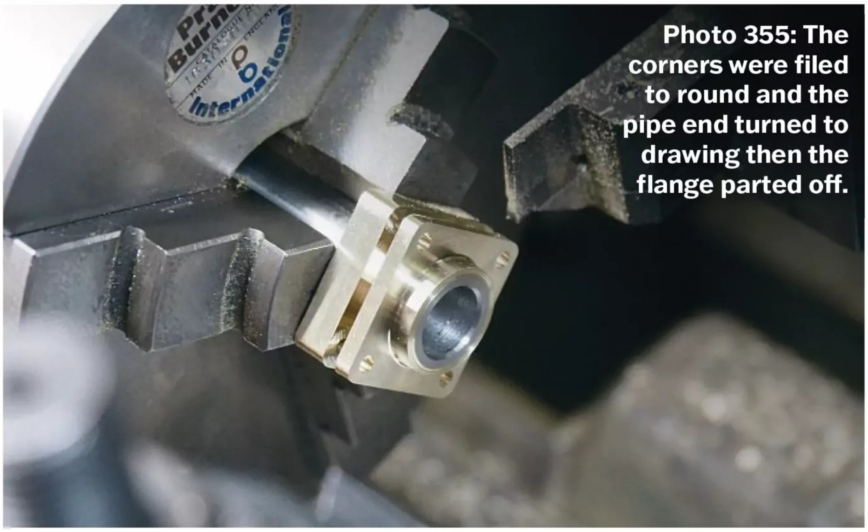


Photo 355: The corners were filed to round and the pipe end turned to drawing then the flange parted off.

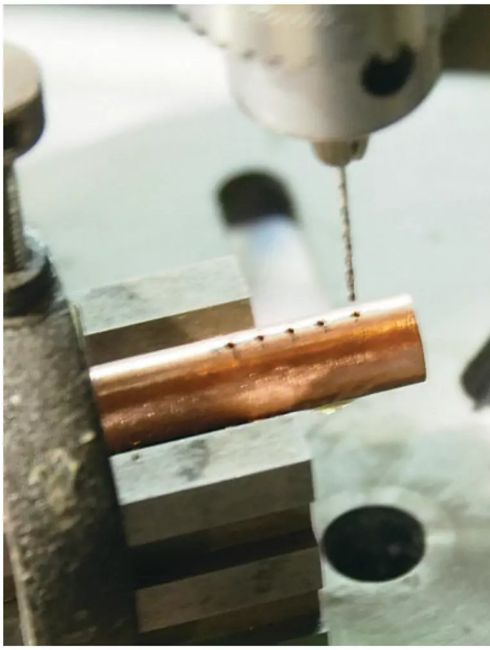


Photo 356: The spray bar is just a length of copper pipe with a brass plug soldered into the end.

Photo 357: A stub of brass bar was turned to make the two flanges for the spray bar and silver soldered to the end.

glued to a steel stub in the three-jaw chuck and this finished the machining for the body. The cooling water inlet pipe needs a square flange to match that on the valve body, and this was machined from the solid from a scrap of brass glued to the steel mandrel used for the valve, **photo 354**. The corners were rounded over by filing then the flange parted off to thickness, **photo 355**.

The cooling water spray pipe could be machined from the solid brass (a bit wasteful) or fabricated from copper pipe with the end plugged, **photo 356** and brass flanges silver soldered to the outer end, **photo 357**.

To Be Continued

Reference

1: Throp, Arnold; "The Last Years of Mill Engine Building"; Stationary Power No: 7, The Journal of the International Stationary Steam Engine Society. I.S.S.E.S 1993. ISBN 1 972986 07 2

Part of an impressive display of Showman's Engines.

Welland Steam Rally 2025

John Arrowsmith reports from the 59th Steam Rally of the Ross on Wye Steam Engine Society.

This event took place near Upton on Severn in Worcestershire over the three days of the 25 - 27 July. It is regarded as one of the best in the UK and I think that it is also one of the largest now that the Great Dorset Steam Fair is no more.

The usual display of everything steam was on show from the magnificent showman's engines down to the humble workhorses of the small steam tractors, it was all here and on show. They must use gallons of "Brasso" and other cleaning materials to keep these machines in such fine condition. Because the organising society own the land on which it is held, they are able to demonstrate other aspects of steam usage that perhaps others would find more difficult. For example they have about half a mile of standard gauge railway track installed, on which they run steam locomotives and a brake van for giving rides on the 'GWR', the Great Welland Railway. This year they had the 0-4-0 Bagnall Saddle tank *Hawarden* on loan from the Foxfield Railway in steam and performing very well. There is a comprehensive section showing how road making used to be done using steam powered tools, along with the sawing and cutting of large trees and wood sections. A full-size ploughing demonstration compliments the heavy haulage section on a considerable incline where all sorts of machines are used to move very heavy items. Steam traction engines combine with large diesel-powered trucks to demonstrate the pulling power of these large machines. The atmosphere had to be seen to be believed. They even have a demonstration of a small coal mine pithead to show visitors what that was all about.

A view of the front end of the Bagnal Saddle Tank 0-4-0 *Hawarden* operating at the show.

I always try to see how the younger generations are involved in these events and whether they embrace this culture of the UK as much as they once did. Here they were very much in evidence everywhere you looked, younger people were involved whether it was polishing, driving, fetching coal and water, acting as guides or tent stewards, they were enjoying themselves and looking at the state of some of them I think they might have been mining some coal as well! Great to see, I don't think there is a problem with recruitment for these events.

Of course it is not all about the prowess of the steam era as there are many different aspects of the show which keep the very large crowds entertained. A comprehensive craft display and a very large model section included a large earth moving demonstration by radio-controlled models. Miniature steam engines had an excellent presence with a wide variety of prototypes from 1½" scale up to half size and every size in between.

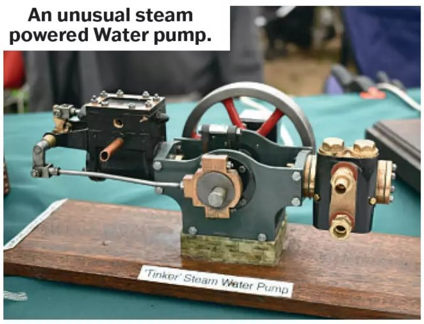
Keeling, a 1909 Burrell 8NHP Traction Engine.

It was good to talk to Rob Raynor, the miniature engine organiser, about the range of miniatures on show and there really were some exceptional examples in steam and on show. Vintage and classic cars alongside vintage tractors and motor cycles together with historic military vehicles, a wide range of operating stationary engines and of course no event of this size would be complete without the old time can-can girls and a large fun fare with a Savages' centre engine powered gallopers at the heart of things.

Put all these ingredients together with excellent warm weather and lots of moving demonstrations, fine music from an excellent brass band from the Forest of Dean, reasonably priced food and drinks and you have the ideal mix for all the family and the many connoisseurs attending to ensure a successful event. It was good to be greeted by pleasant gate staff and field stewards who were only too happy to help if directions or information was needed.

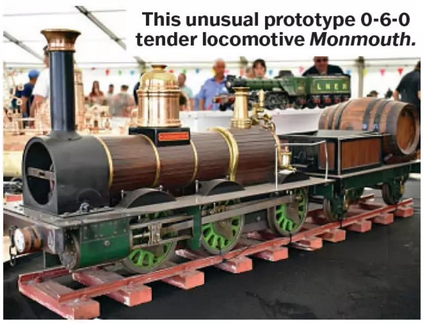
I hope my photos do justice to the show and give you a flavour of what was a great display of times past and what the future may hold. I hope you will put this show in your diaries for next year it is well worth a visit, you might need two days though such is the variety of things to see and do.

A 5" gauge example of a GWR 2-6-2 Small Prairie Tank. This is a Kingscale model.



An unusual steam powered Water pump.

A portable New Holland 1½ HP engine.



This unusual prototype 0-6-0 tender locomotive *Monmouth*.

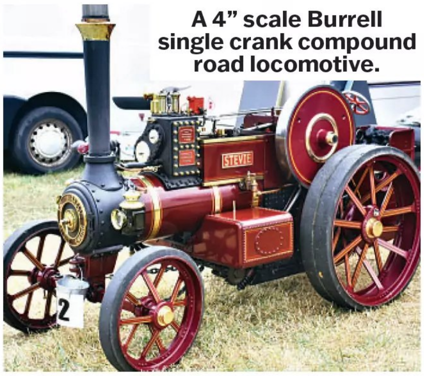
A well-made 2” scale tractor *Waterloo Boy*.

A good example of a traditional threshing machine.

This 4” scale McLaren Road Locomotive is owned by Richard Kellaway from Cornwall.

A 4.5” scale Foden Type C flatbed lorry.

A well-proportioned Victorian steam launch.



A 4” scale Burrell single crank compound road locomotive.

A large horizontal frame saw built by in France by Guilliet & Fils in the working area.

This rare Ransome Sims & Jeffries crane engine was in action in the working area.

A Coventry Die Head Sharpening Jig

Peter King shares plans and information to make a Coventry die head chaser sharpening jig.

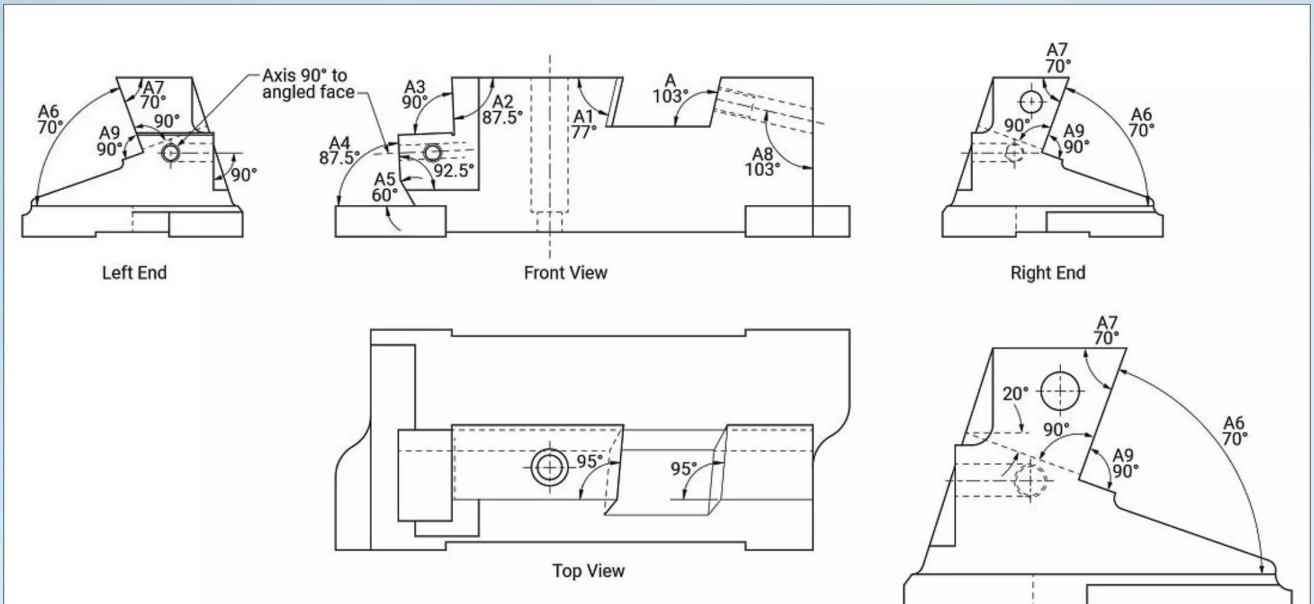
PART 1

This article is further toolmaking and leads on from that for the manufacture of a chaser gauge (ME&W issues 4768 and 4769). That gauge being for ascertaining the amount of grinding required to correctly re-sharpen a set of Coventry die head chasers. Now we come to the actual jig for doing just that.

These jigs are a combination of two arrangements, one part is to sharpen the 'throat' of a set of chasers – this is the part that does the actual cutting of a thread. The other is to reduce the height of the angled face at the point where the 'throat' runs out. When a set has been sharpened a little the cutting edge gets to be above what on a lathe is 'centre height' and ceases to cut, grinding that top face restores the 'cut' at centre height – clever eh?

The jigs are essential in order to ensure that all the chasers in a set are firstly reground to the same 'Throat Angle' (cutting angle). All the chasers in a set have on the top faces a number that matches a number on the gauge *and* the number engraved on each chaser must be all the same on all in a set. *Every handbook has the warning* not *to attempt to grind them 'freehand'. There is also a warning that they must be placed in the die head in numerical order* Clockwise *as the threading teeth are formed in a spiral when manufactured – but you can* start *anywhere.* 'Left-hand' chasers are inserted anti-clockwise by number! *The other warning is that if a chaser is broken, another from another set for the same thread that has the same number* cannot be substituted *as they are made as a set with the 'teeth' in a spiral!* The jigs are designed such that a set of four chasers (*and as above the manufacturer meant a 'SET' made as such, not a collection*) are firstly mounted in a large, angled recess on the top right of the jig to grind and re-sharpen the 'throat'. *The throat must be the same on all the chasers or threads will be peculiar! The chasers can be in any order when in the jig for the throat to be sharpened.*

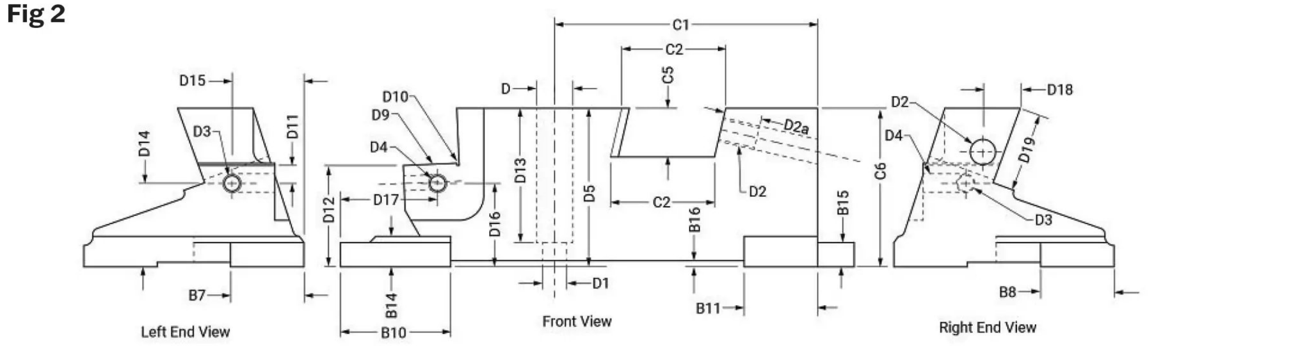
I recommend that you firstly acquire a 'Coventry' handbook from the internet – there are occasional ones for sale and free ones to down-load from the internet – your choice. Mine is 'Edition 25' which is complete, fairly antique and was free via the Internet. This handbook also has much on adapting die heads to machines other than turret lathes. There are also details of the large range of die-heads, some of which are very different to mine – which is a ½" 'CH'. The handbook will allow you to fairly

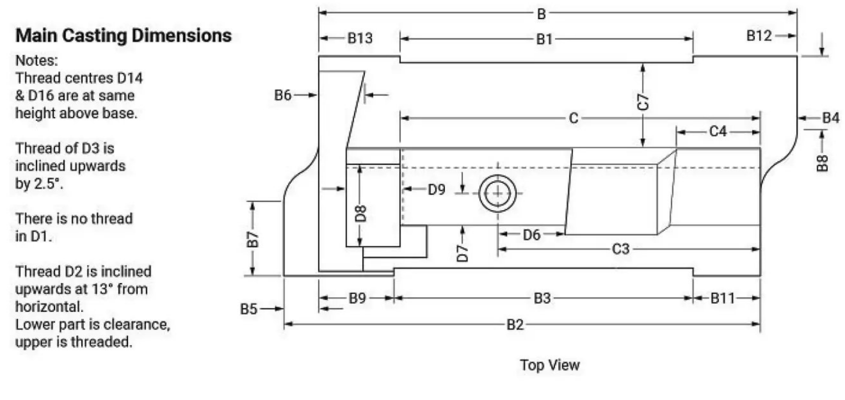


Angles, Aspects And Elevations Of Main Casting
Proportions of the features may vary between the various sizes of jig - angles of features depicted are the same in all jigs

Fig 1

Fig 2





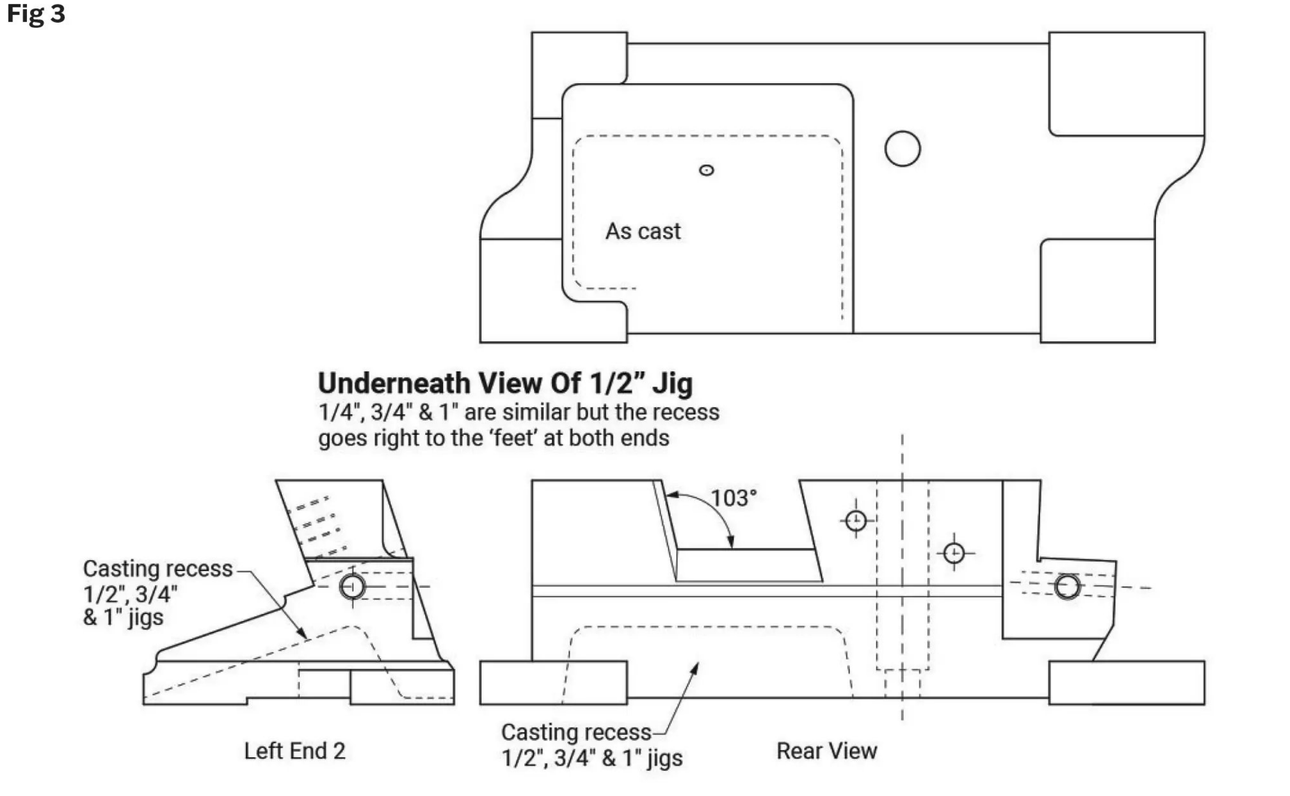
easily follow this preamble as a look at a suitable illustration will make some things much simpler and clearer than my scribbling.

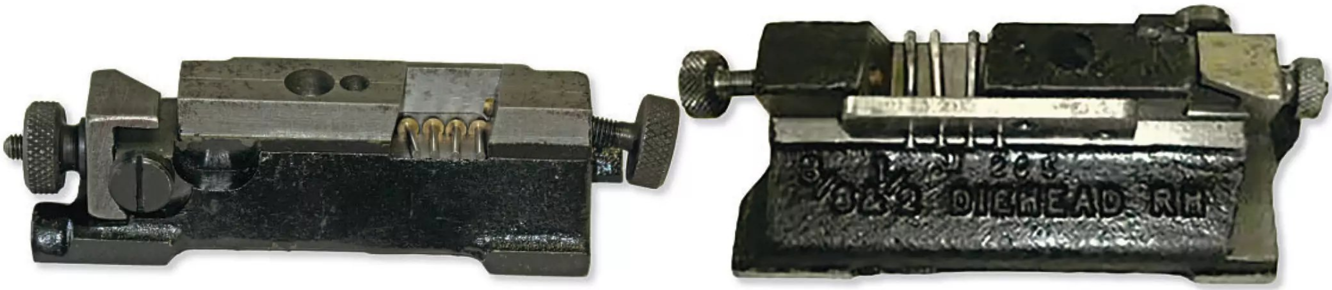
Die-head 'size' is the maximum diameter of thread it is designed to cut, and the jigs are to sharpen all chasers in the 'size' (or sizes) indicated on the body of the jig. Note that some manufacturers make fine thread chasers slightly larger in size than the jig size – i.e. 13 or 14mm to fit a ½" die head.

I refer to three different 'marks' of jig in this article because whilst all mine are one design type, I have seen an illustration of another that is similar to mine (minor differences and suspected to be earlier and maybe 'original') and one later and very different design. The drawings are for what I believe is the second design – I am happy to be corrected!

Considering the length of time I have spent in trying to find such jigs, you can take it as read that they are virtually unobtainable. One information source suggested that production stopped sometime in the 1950s or 60s. However I have a printed card giving instructions for the use of the Mk 3 unit

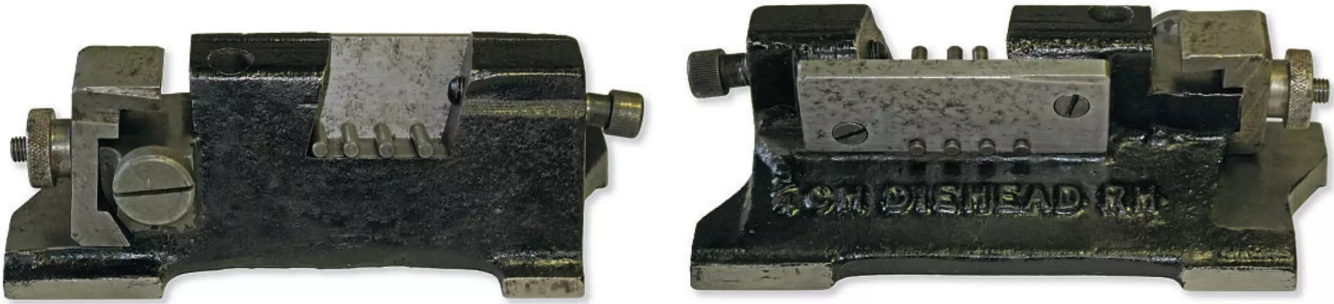
Fig 3





Photos 1 and 1a - ¼" - 5/16" jig.

Photos 2 and 2a - 3/8" - ½" jig.



Photos 3 and 3a – ¾" jig.

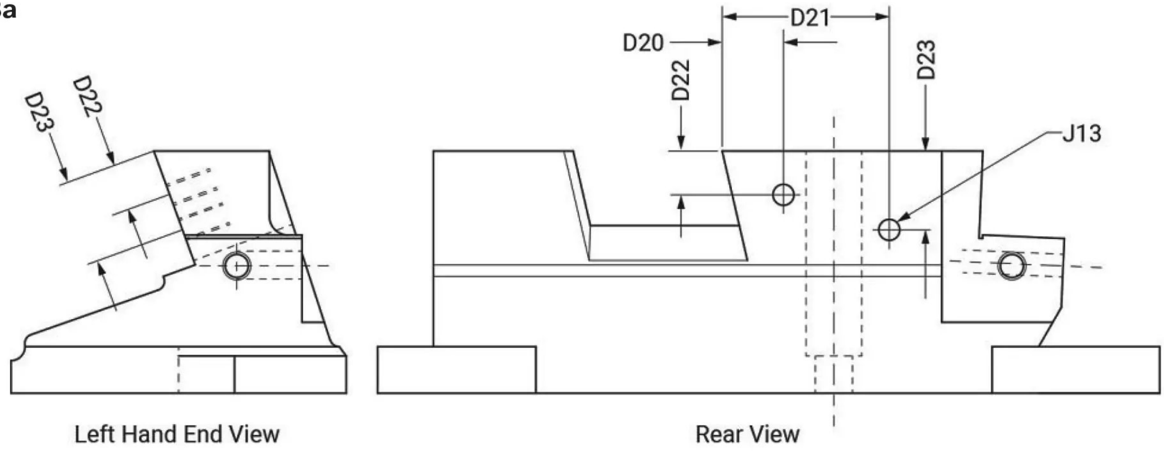
Photos 4 and 4a – 1" jig.

which came in three different forms for RH and LH chasers and for chasers for different types of die head – this is marked with "Copyright Alfred Herbert Limited, Coventry 1979" but may just be the date of printing. Perhaps production of the unit I detail ceased in the late 60s or early 70s - I do not know. If anyone wants a copy of this card for the late model jigs, I can send an email.

In 'spring' 2017 I had just bought an old Mk 2 1" Coventry sharpening jig (after years of hunting for a jig) to use as a pattern to make a ½" unit.

This was because I own a ½" C.H. die-head and there are no local firms left that will undertake re-sharpening of chasers – new chasers are no problem! I was about to start the process when fortuitously (and inevitably having bought a jig), I acquired the three smaller jig sizes down to ¼" – 5/16" and a gauge - from an advertiser on eBay. Refurbishing, minor de-rusting and repainting these four jigs and the gauge then occupied much of my time, this was however not difficult and produced fully usable jigs – they looked good too! The de-rusting was done using my new Allendale Ultrasonics' bath – the mix goes blue and then black with rust products in a very few minutes. The parts then needed to be very quickly air-blasted and sprayed with a thin oil to prevent a fresh coating of rust forming on the super-clean surfaces.

Fig 3a



Main Casting Dimensions Of 1/2" Jig
Note: The mounting screws for the roller retaining plate are in a similar position to those on the 1/4" plate but 3/4" & 1" positions are different

Even with quick work, there was a slight film of yellow forming before the oil was applied, but this film wiped off with the excess oil on a rag. A couple of the clamping studs were and still are immovable, and I may do a penetrating oil job on them sometime.

I now have jigs for ¼" - 5/16"; 3/8" - ½"; ¾" and 1", see photos 1, 2 3 and 4 (the 'a's are front view, 'b's are rear view). These are all 'right hand' jigs. I do not have any 'left hand' chasers so I do not need to make myself one, for the very, very few such threads I produce, I have taps and dies. The four jigs that I have are apparently very loosely scaled copies of each other. These jigs are all what I call the Mk 2 version, probably made circa1930. The similar, very old, Mk 1 dating from around 1904 has two separate and different angled bases to change the throat angle not one, so is limited in its utility, though the main jig unit is apparently much the same. Both the early jigs used without a base plate produce a 20° grinding angle for the throat. I call them by different marks as there are small visual differences in the otherwise similar early models, going by the handbooks. I would more than hesitate to tackle the much more advanced and rather different Mk 3, which appears to be the last in the series.

There is clearly some demand for them – going by the internet – advert illustrations often show a horrible heap of dirty, rusty bits and pieces in a grubby cardboard box – mine were somewhat better than that.

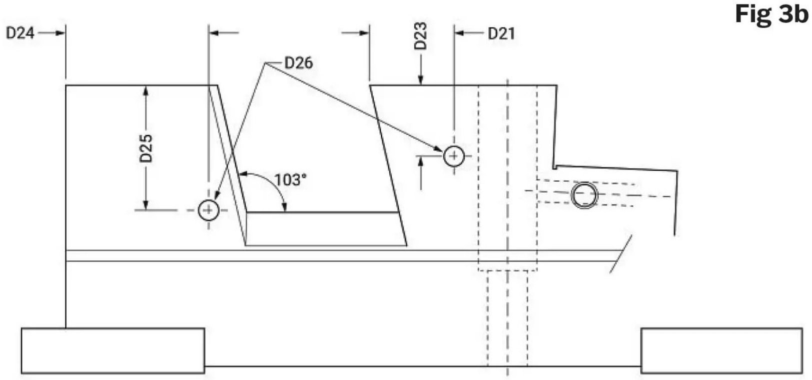
The series by David Earnshaw on making a Die Head attachment for a lathe – which by chance I was also in the throes of re-drawing to fit my lathe and about to make from directions in the "Coventry" hand-book – got me thinking. I had already submitted the previous article to the Editor on the manufacture of a chaser gauge – even less obtainable except by chance, so I then gave some thought to preparing a set of drawings to make a jig for others to use. I contacted our then Assistant Editor and we got a framework sorted out for drawings and perhaps some limited suggestions on manufacture for experienced model engineers to tackle. I have kept the suggestions to a minimum as we all work to different practices and rarely welcome 'advice'.

The routine the we decided on is:

- The drawing's dimensions are indicated as just letters (A B C D – A1 B1 C1 etc.). As the various *angles* of essential features are the same (or should be) for all the jigs, they will be shown as such both on the drawings and the chart. A chart will have four columns of dimensions, one for each size of jig with the jig size at the top of each of the four columns and the alpha-numerically titled dimensions down the left side. The idea being that the user copies what is being used and ignores or covers the columns he or she does not want. As a reminder the angles are also shown. Where a jig differs from the others an extra drawing and dimensions are provided. There are roughly 565 dimensions for the four jigs – I think!

These tables are downloadable from the *Model Engineer Forum* with the series in *Model Engineer* by David Earnshaw, which gives an excellent explanation of Coventry die heads at https://tinyurl.com/yryx6msh or use the QRcode). To Be Continued

Fig 3b



Rear View Of 3/4" Jig
1" jig has a similar bolt hole placement

Club Diary

Please send your events for Club Diary to meweditor@mortons.co.uk

2025

EVERY SUNDAY

Warrington MES
Running day. Contact : contact@wdmes.org.uk

Wakefield SMEE
Public running day. Contact Denis Halstead 01924 457690

OCTOBER

12 Cardiff MES
Public Running Day, Heath Park, 13:00-17:00.

17 Rochdale SMEE
Annual General Meeting. Castleton Community Centre, 19:00. See www.facebook.com/RochdaleModelEngineers

19 Guildford MES
Public open day, Stoke Park. Contact: Mike Sleigh, pr@gmes.org.uk or see www.gmes.org.uk

19 Tiverton & District MES
Running day at Worthy Moor Track. www.tivertonmodelengineering.org.uk/contact

21 Nottingham SMEE
Bits and Pieces Evening. nsmee.org.uk/events/

21 Rugby Model Engineering Society
Public Running, refreshments, free parking - 13.00 to 16.00 - rugbymes.co.uk.

29 Rugby Model Engineering Society
Public Running, refreshments, free parking - 13.00 to 16.00 - rugbymes.co.uk.

30 Guildford MES
Public open day, Stoke Park. Contact: Mike Sleigh, pr@gmes.org.uk or see www.gmes.org.uk

NOVEMBER

1 Bradford MES
BMES Annual Exhibition & Competition, 12.30 pm - 4:00 pm, St James' Church, Baildon, BD17 6HH. Adrian Shuttleworth, 07767 375648

1 Gauge 1 Yorkshire Group
Running day at Drax Power Station social club, 9:30 - 15:30. Contact secretary@gauge1north.org.uk

1 Tiverton & District MES
Running day at Worthy Moor Track. www.tivertonmodelengineering.org.uk/contact

16 Tiverton & District MES
Running day at Worthy Moor Track. www.tivertonmodelengineering.org.uk/contact

18 Nottingham SMEE
Peter Harris, Railway Tunnels. nsmee.org.uk/events/

21 Rochdale SMEE
Models competition night. Castleton Community Centre, 19:00. See www.facebook.com/RochdaleModelEngineers

29 Gauge 1 Yorkshire Group
Running day at Drax Power Station social club, 9:30 - 15:30. Contact secretary@gauge1north.org.uk

DECEMBER

7 Guildford MES
Public open day, Stoke Park. Contact: Mike Sleigh, pr@gmes.org.uk or see www.gmes.org.uk

14 Guildford MES
Small Model Steam Engine Group meeting, 14:00-17:00, Stoke Park. Contact: Mike Sleigh, pr@gmes.org.uk or see www.gmes.org.uk

16 Nottingham SMEE
Rob Milliken, Guild of Railway Artists. nsmee.org.uk/events/

19 Rochdale SMEE
General meeting.
Springfield Park, 17:00 onwards. See www.facebook.com/RochdaleModelEngineers

2026

JANUARY

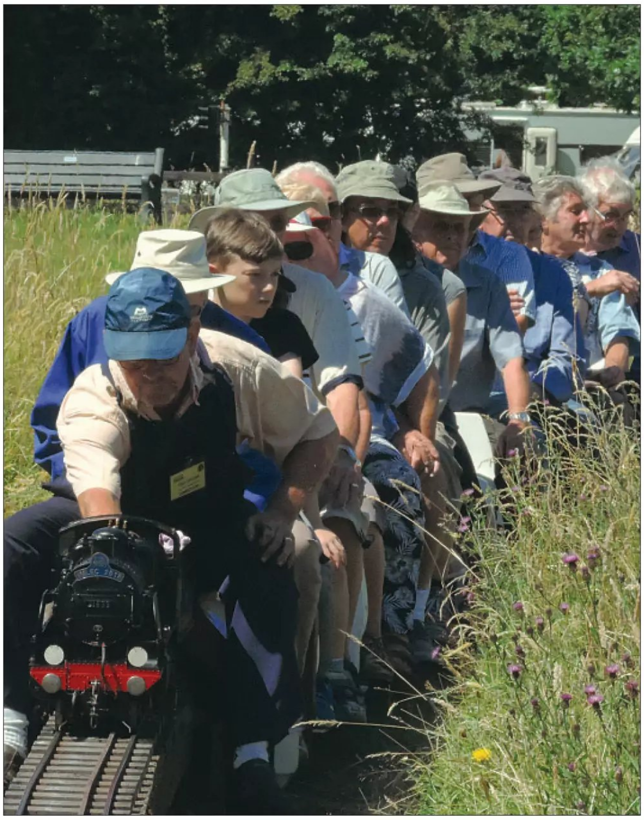
17 Gauge 1 Yorkshire Group
Running day at Drax Power Station social club, 9:30 - 15:30. Contact secretary@gauge1north.org.uk

FEBRUARY

21 Gauge 1 Yorkshire Group
Running day at Drax Power Station social club, 9:30 - 15:30. Contact secretary@gauge1north.org.uk

MARCH

21 Gauge 1 Yorkshire Group
Running day at Drax Power Station social club, 9:30 - 15:30. Contact secretary@gauge1north.org.uk



The BR Standard 2-6-0 Class 4 Tender Engine

Doug Hewson describes the making of cylinder drain cocks.

PART 21

Photo 193: Drain cocks on 4MT

Photo 194: Close up of drain cocks.

Photo 195: One of Geoff's drain cocks disassembled.

Photo 196: Casting in jig for boring.

There are three drain cocks either side of the BR Standard Engines and I am sure that other people have asked 'why?', apart from me when I was a learner. The thing was, that cylinder cocks were steam operated so everything had to be steam tight. Well, if you hadn't noticed, the centre one is much smaller than the ones at each end and this is because the centre one just acts as a steam chest drain, so all it has in there is a ball.

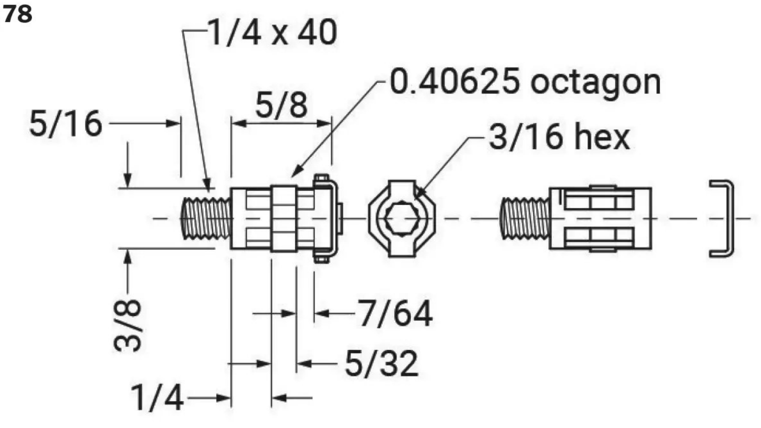
Photograph 193 shows the drain cocks on my 4MT and **photo 194** shows the set quite clearly. Machining of the lost wax castings took quite a lot of thinking about as nothing was cored out. The main thing was to bore the little cylinders out ¼ inch. In the end I decided that I needed a fixture I could hold in the 3 jaw chuck, as I started getting numerous orders from customers who wanted the cocks ready machined, unsurprisingly. I made up a piece of ¾" angle about three inches long with a piece of ½" round bar welded inside it. With a little more bar I made a U to sit inside the end of the angle. This had a hole in it to allow part of the cock to sit in it and then I welded a bridge over it with a 6BA Allen screw in the centre. This meant

Photo 197: Construction of jig.

that it was one simple movement to fit the drain cock into the fixture, bore it and then lift it out and pop another one in there without disturbing the fixture. I found that I could bore them out at about two minute intervals.

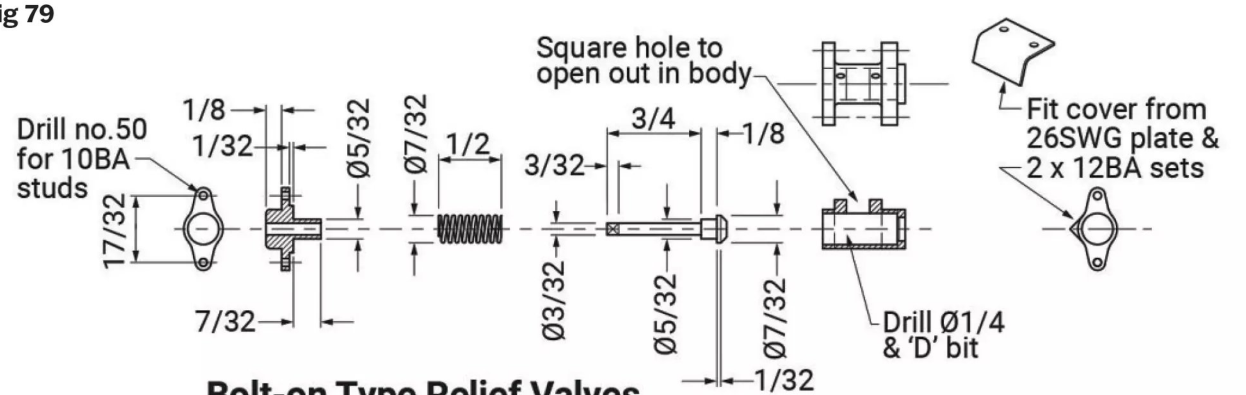
Photograph 195 shows Geoff's drain cocks machined and as you will see he has used a ball to shut off the steam. Eddie just made a point on his, 'bullet' for want of a better word, and either works very nicely. **Photographs 196** and **197** show the little fixture which I made for machining my cylinder cocks and it was so easy to use. I know it looks rather crude, but it worked, and that was what mattered to me. All it then needed was the O-ring fitting into the groove made for the job. O-rings just need a bit of sideways movement

Fig 78



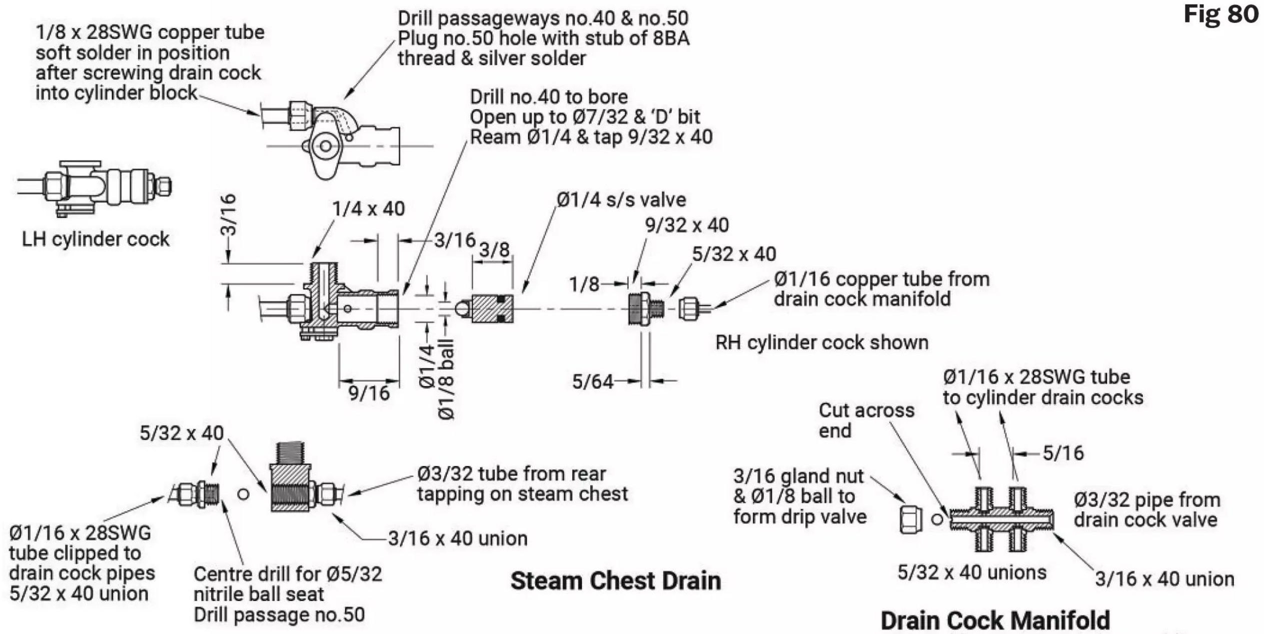
Cylinder Relief Valve

Fig 79



Bolt-on Type Relief Valves

Fig 80



Drain Cock Manifold
Situated beneath smokebox saddle
Arrange to sit level so that system drains

Steam Operated Cylinder Drain Cocks
Lost wax casting set consisting of
2 LH cocks, 2 RH cocks
2 steam chest drain valves
One operating valve

Photo 198: Replaced unions.

Photo 199: Finished actuating valve.

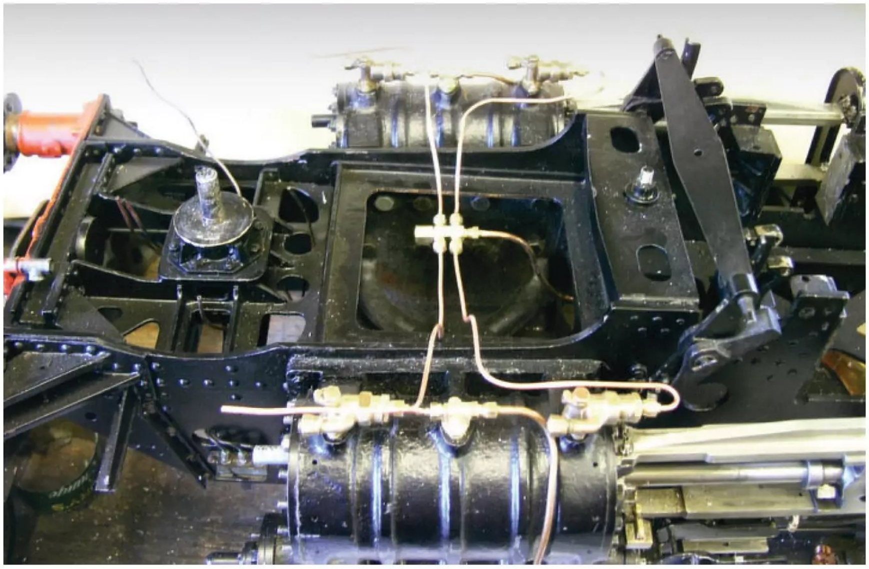


Photo 200: Pipework layout.

Photo 201: Valve on full size locomotive.

so that they can squash into the groove to form a seal. I usually test this by holding my 6 inch rule over them to make sure that the ring squashes by about 5 thou and that is plenty.

We now come on to the actuating valve. I made the pattern thinking that I was going to make it easy and could just pop a pipe into the union and that would be it. However, when it came to doing the job, I realised that I needed to use the unions properly. I then had to make some 5BA unions, chop the lost wax cast one off, and fit some proper ones on. **Photograph 198** shows the unions replaced before I silver soldered them into the body. This was so that I could use 1/16 tube to make the various connections. Someone sent me super **photo 199** to show the finished article, this is one for my 4MT design. The one for the 76000 needs a different handle. **Photograph 200** shows the fitted pipework on my 4MT but there is no difference in the layout for the 2-6-0.

Photograph 201 is the valve on 76079 and I have shown the full picture as I am sure that you will find all sorts of things you will want to copy off there. As you will see there is a different handle and a hole in the front of the cab with a rubber washer round it to seal it from draughts. There is a lever inside on the driver's side. **Photograph 202** shows the lever and, instructively, there is also a note on there to say what it is!

I have **photo 203** to show how I finished boring my valve with a D-bit and then with a special boring tool which I made to finish the bore to give a flat surface for the disc valve. I also polished the seat a little with a bit of 1200 grit wet and dry. Yes, I know, a bit of watch making but needs must. To finish off there are a few more I made earlier, **photo 204**.

We can now go on to making the cylinder relief valves. There are several types of these on the BR Standard Engines, and I have shown both types and then you can fit which you like. Our 2-6-0 has the bolt on type which is fixed to the cylinder covers with a couple of 10BA bolts. **Photo 205** shows the bolt on type of relief valve on loco 75029 and **photo 206** shows the screw in type screwed into 76017, hopefully my drawings should explain everything that you need to know.

The last part of the cylinder saga are the anti-vacuum valves (or snifting valves) and these are shown on my drawing. These valves are to prevent ash being drawn down the chimney when the engine is costing on a downhill gradient if the regulator is closed. I have provided a lost wax casting set for this and that design came from the Great

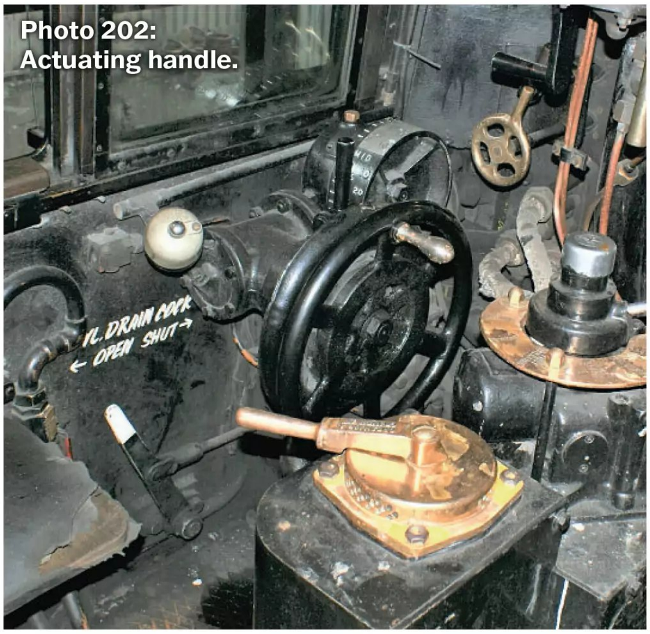
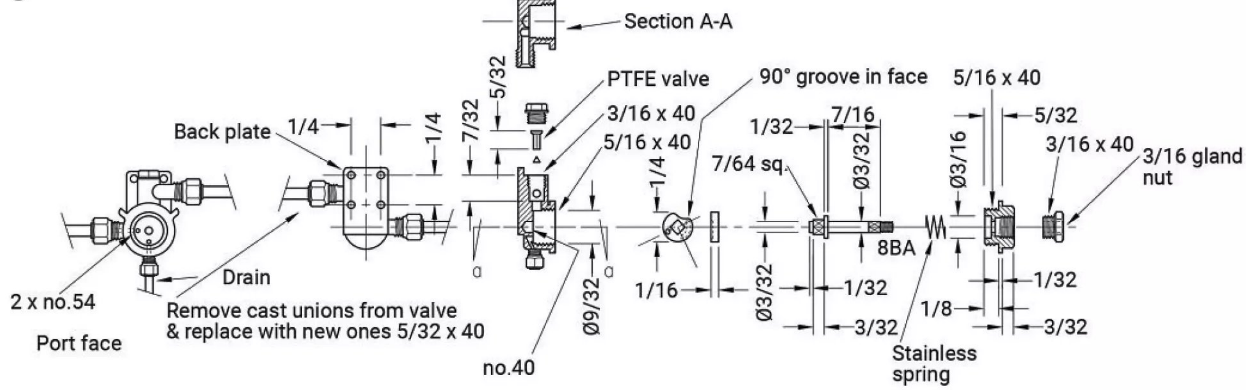


Photo 202: Actuating handle.

Photo 203: Finish boring valve with D-bit.

Photo 204: Collection of valve parts.

Fig 81



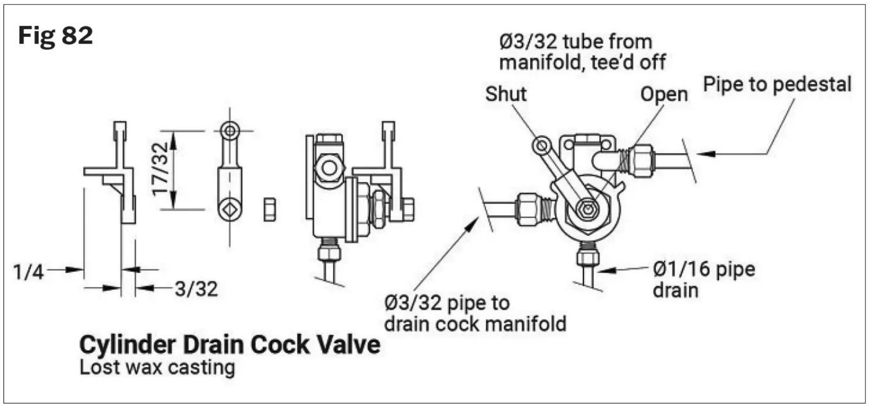


Photo 205: Bolt on relief valve on front cylinder cover.

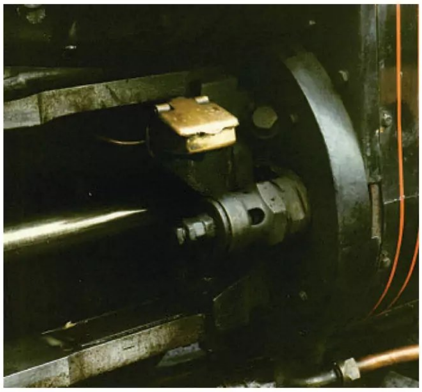


Photo 206: Screw in relief valve.

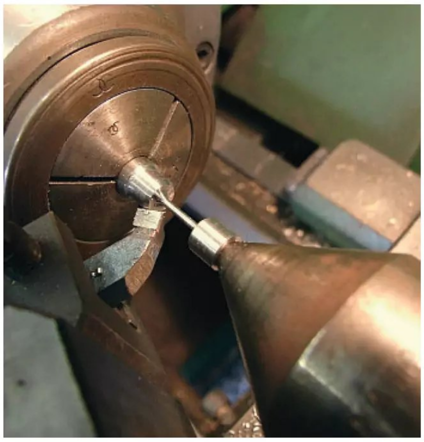
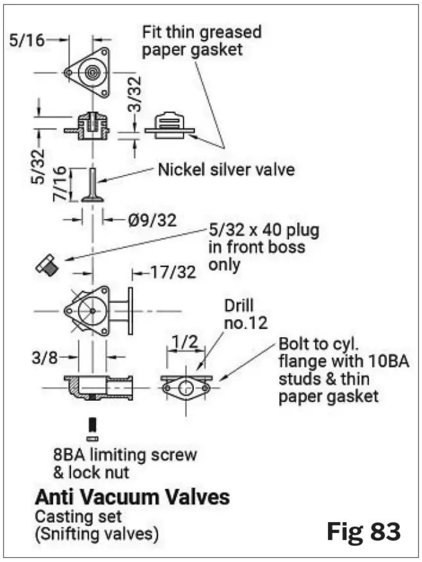


Photo 207: Forming angles seat on valve.

Photo 208: Parts of relief valve.

Photo 209: Valves on Geoff's cylinders.



Western. I have some lovely photos which were supplied by Geoff Whittaker taken when I was describing Geoff's 76069 in *Engineering in Miniature* some years ago. There are two castings for these valves, a top and a bottom but you will need to make the valves and the best material for making those is nickel silver. I bought some which I spotted on a stand at one of the exhibitions and I still have some. The castings just need facing and they need to have a light countersinking for the valve seat. **Photograph 207** shows Geoff using a tool for forming the angle on the face. **Photograph 208** shows the bits and pieces before they were assembled. **Photograph 209** shows one of the valves on my 4MT and finally **photo 210** shows a similar one on Geoff's 75069 and as it happens, this photo is identical to what your 2-6-0 should look like.

To be continued

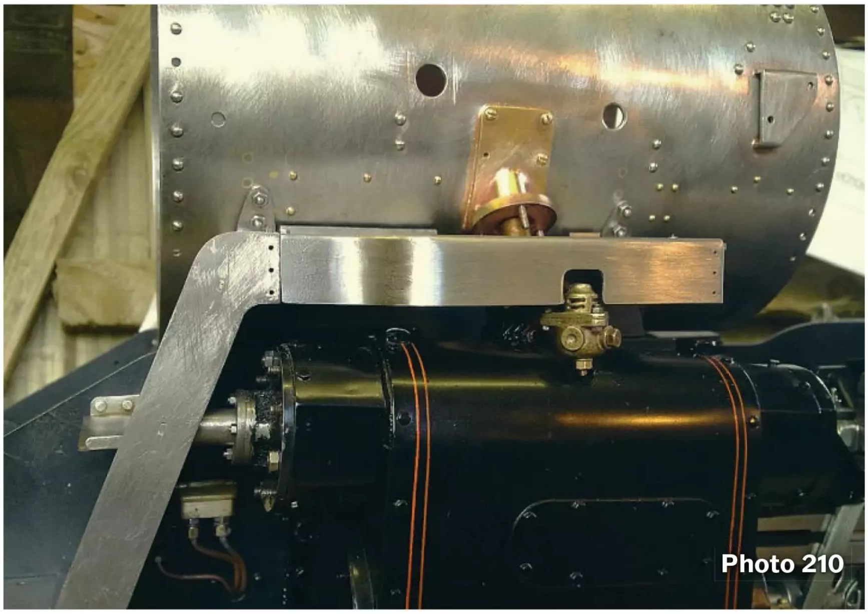


Photo 210

MODEL ENGINEER &WORKSHOP

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These articles by Geometer (Ian Bradley) were written seventy years 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 practised in the past.

Different types of pumps

Like many other mechanical devices, pumps have become largely of established design according to particular functions -a state which is likely to continue, except for detail alterations arising either from changes in layout, or from introduction of new materials. Always keeping in mind the necessity to limit complication and expense, the reason why such and such a pump is preferred, or is more practical in particular circumstances, is generally obvious when conditions are analysed.

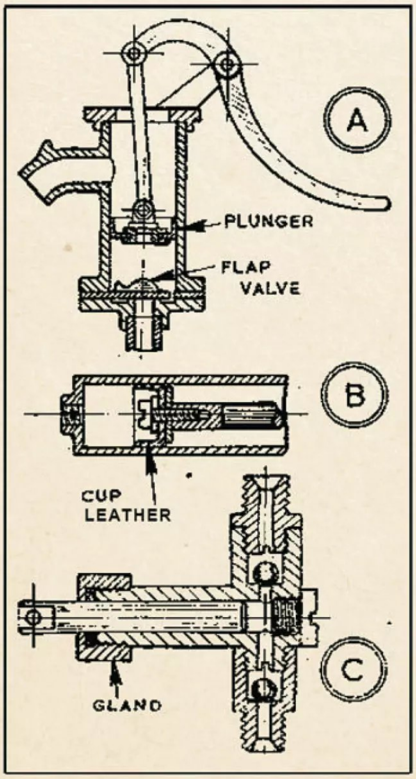
For raising a fluid like water from a shallow well, the ordinary hand-operated " lift " pump, *A*, can be employed. The rising pipe has a flange on which the body of the pump is bolted, the joint washer between them, usually of pliable leather, in-Eorporating a flap valve.

The pump plunger comprises an inverted cup leather or " bucket " and a flat-seating metal valve. Once the water has been lifted into the pump barrel the flap valve prevents back-flow, and as the plunger descends the valve in it permits water to be displaced above-and on the next stroke it is lifted and flows out of. the spout.

Limit of lift, set by atmospheric pressure and weight of water, is about 30 ft. For greater depths the pump must be down the well and the body extended upwards by a pipe. Alternatively, when the pump is a force type the plunger is mounted on a round rod which passes through a gland in the top cover, where there is generally another valve to hold the column of water above the plunger.

The ordinary cycle or motorcycle pump (and the type used on small blowlamps) also employs a cup leather plunger, ***B***. Because air is the fluid pumped it is possible to dispense with a valve on the plunger, this function being taken over by the cup leather being flexible enough to'permit air to pass on the return stroke.

An important feature then is a metal backing washer large enough to support the cup leather against pressure and prevent its forward-facing lip turning backwards-as can happen with a small washer when wear occurs. The other essential valve for such a pump is that in the tube-or the finger when this is placed over the outlet hole. A blowlamp pump has a valve in the bottom of the barrel.



Small plunger pumps

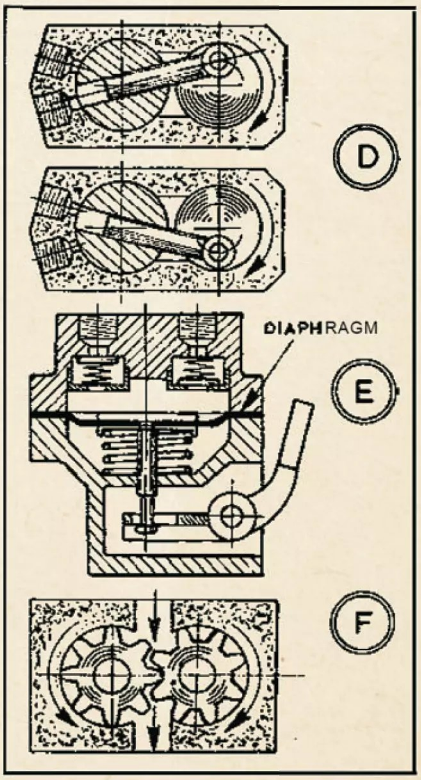
A small force pump, as may be used on a model to feed a boiler, is usually to a design resembling that at C. The plunger has a packing gland to obviate leakage and two ball valves are arranged one above the other.

For convenience in reaming or lapping the pump bore in small sizes, it can go right through the body and be blanked off by a screw-in cap. The valves should rest on flat seatings, and their lift be limited. Saw nicks across the faces above the valves prevent flow being stopped by the balls covering the holes.

When the fluid pumped is oil, and operation is slow, an oscillating type of pump can be used-oil feed on some motorcycle engines. This has the advantage of being positive in action, since ball valves could work sluggishly with oil and reduce output. Layout can be as ***D,*** with the pump body circular to oscillate in a casing, the inlet and outlet ports (bottom and top) being in the end. Here, too, the pump bore can be finished right through. By comparison with the pump at C, this one would not be so suitable for water owing to wear and leakage involved.

When wear and leakage would be insurmountable problems in an ordinary pump a diaphragm type is chosen, E-the petrol pump on cars. With this only the flexible composition diaphragm and the plastic valves are in contact with the petrol, all operating mechanism being isolated. Operated by a cam, a lever pulls the diaphragm down against a spring, which then returns it on the pumping stroke, providing a regular pressure.

Two small gears rotating in a casing, ***F,*** make a satisfactory pump for oil, particularly when submerged in it as in a car sump or motorcycle timing case. No valves are required, and intake and discharge are as shown, the oil passing in the tooth spaces round the outside of the casing. ❑



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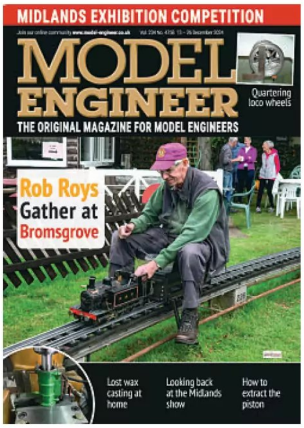

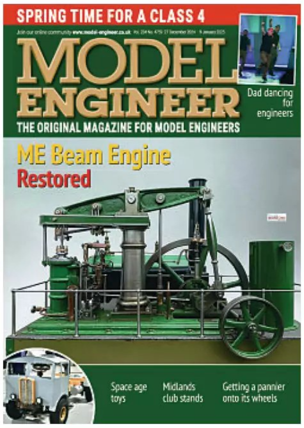

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M/C REVIEW	BALLAMY	234	4769	16	M	S	REVIEW: AMADEAL AMAB210E
MARKING	WYATT	234	4764	29	M	S	QUICK NOTES FROM THE WORKSHOP
MEASURING	SMITH / BROWN	234	4765	26	P	S	THE YIELD POINT METHOD
MEASURING	DE BARR	234	4767	42	P	S	A RESPONSE TO THE YIELD POINT METHOD
MEASURING	KING	234	4768	51	P	S	COVENTRY DIE HEAD GRINDING GAUGES 1
MEASURING	SMITH / BROWN	234	4769	25	P	S	THE YIELD POINT CONTROVERSY
MEASURING	WILLIAMS	234	4769	50	P	S	PRECISION MEASUREMENT OF SQUARENESS 1
MEASURING	KING	234	4769	70	P	S	COVENTRY DIE HEAD GRINDING GAUGES 2
MILLING	SCHIFF	234	4767	74	C	A	CUTTING A CIRCULAR SLOT IN AN UNUSUAL WAY
MILLING	JENKINS	234	4768	58	M	A	MY MILLING MACHINE AND I
MISC	ZEUSCHE	234	4762	19	C	A	CASTING POLYURETHANE TRACTION ENGINE TYRES AND STRAKES 1
MISC	WOODS / BREGAZZI	234	4762	38	C	A	HOW NOT TO BUILD A LOCOMOTIVE... FOR SOMEONE ELSE 1
MISC	JENKINS	234	4763	9	P	A	MILLING IN THE LATHE
MISC	ZEUSCHE	234	4763	27	C	A	CASTING POLYURETHANE TRACTION ENGINE TYRES AND STRAKES 2
MISC	EVANS	234	4763	33	C	A	A MINIATURE OIL CAN
MISC	WOODS / BREGAZZI	234	4763	45	C	S	HOW NOT TO BUILD A LOCOMOTIVE... FOR SOMEONE ELSE 2
MISC	DONOVAN	234	4763	47	P	A	EXTRACTING A BROKEN STUD
MISC	NOEL	234	4764	46	M	A	MY LIFE IN MINIATURE!
MISC	JOSEPH	234	4765	30	C	A	LATHE RAISING BLOCKS
MISC	STELIOU	234	4765	38	C	A	A FOLDING WORK STAND
MISC	HOWELL	234	4765	51	M	S	SPARK ARRESTERS
MISC	JEFFREY	234	4765	62	C	A	TUBE EXPANDER
MISC	BACKHOUSE	234	4765	72	M	S	BOOK REVIEW
MISC	WYATT	234	4766	16	M	S	THE BRADFORD CUP AND STEVENSON TROPHY 2025
MISC	ARROWSMITH	234	4766	56	M	S	VISIT TO THE STAFFORD & DISTRICT MODEL ENGINEERING SOCIETY
MISC	HENDRA	234	4766	60	M	S	CHEAP NASTY PLASTICS 1
MISC	WOOD	234	4767	22	P	A	ANOTHER COLLECTION OF HINTS AND TIPS FOR THE WORKSHOP
MISC	HENDRA	234	4767	67	M	S	CHEAP NASTY PLASTICS 2
MISC	BRADLEY	234	4768	34	M	S	SPOT AND FACING CUTTERS - GEOMETER

MISC	DEAN	234	4768	36	M	S	TAKING A TIGER TO THE MODEL ENGINEER EXHIBITION
MISC	BACKHOUSE	234	4768	50	M	S	BOOK REVIEW
MISC	GEARING	234	4768	63	C	A	A LOCOMOTIVE LIFTING TABLE
MISC	BRADLEY	234	4769	24	P	A	FACING AND COUNTERSINKING - GEOMETER
MISC	PURKIS	234	4769	56	M	A	THE CLAPHAM TRAIN ACCIDENT BY GREGG MORSE
OBITUARY	HALL	234	4762	46	M	S	HAROLD HALL (1933 - 2024)
POSTBAG	BROWN / SMITH	234	4767	14	P	S	YIELD POINT METHOD
READERS' TIPS	KARWOT	234	4762	50	C	Q	A VEE TAILSTOCK CLAMP
READERS' TIPS	GEORGE	234	4763	26	C	A	MACHINING GIB STRIPS
READERS' TIPS	BARBER	234	4764	20	C	A	QUICK AND EASY CLAMPING SCREW
READERS' TIPS	WORTH	234	4765	54	C	Q	A TOOL BLOCK FOR PARTING OFF
READERS' TIPS	ANDREWS	234	4766	26	C	A	BANDSAW BLADE GUIDES
READERS' TIPS	WORTH	234	4767	16	C	A	A PARTING TOOL HOLDER
READERS' TIPS	VENN (DR.)	234	4768	76	C	A	A JACOT TOOL FOR LONG WORKPIECES
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STATIONARY ENGINE	FITZGERALD	234	4762	44	M	S	THE STATIONARY STEAM ENGINE 66
STATIONARY ENGINE	THOMAS	234	4762	65	C	A	A TANDEM COMPOUND MILL ENGINE 13
STATIONARY ENGINE	FITZGERALD	234	4763	52	C	A	THE STATIONARY STEAM ENGINE 67
STATIONARY ENGINE	THOMAS	234	4763	62	C	A	A TANDEM COMPOUND MILL ENGINE 14
STATIONARY ENGINE	EVANS	234	4764	21	C	A	A LEATHER BELT-JOINING JIG FOR A THRESHING MACHINE
STATIONARY ENGINE	FITZGERALD	234	4764	58	M	S	THE STATIONARY STEAM ENGINE 68
STATIONARY ENGINE	THOMAS	234	4764	62	C	A	A TANDEM COMPOUND MILL ENGINE 15
STATIONARY ENGINE	THOMAS	234	4765	44	C	A	A TANDEM COMPOUND MILL ENGINE 16
STATIONARY ENGINE	THOMAS	234	4766	37	C	A	A TANDEM COMPOUND MILL ENGINE 17
STATIONARY ENGINE	THOMAS	234	4767	58	C	A	A TANDEM COMPOUND MILL ENGINE 18
STATIONARY ENGINE	THOMAS	234	4768	44	C	A	A TANDEM COMPOUND MILL ENGINE 19
STATIONARY ENGINE	THOMAS	234	4769	66	C	A	A TANDEM COMPOUND MILL ENGINE 20
THREADING	BRADLEY	234	4762	60	P	A	BROKEN DRILL AND TAPS - GEOMETER
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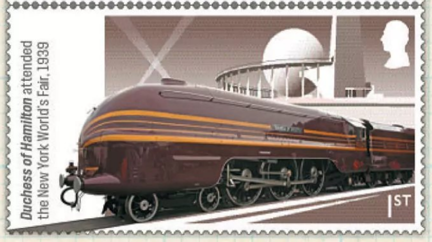
VISIT READER	BARNES	234	4763	69	M	S	A FOUR INCH GARRETT AGRICULTURAL ENGINE
VISIT TRADE	WYATT	234	4766	67	M	S	THE BRIGHTON GALLOPERS
VISIT TRADE	WYATT	234	4767	53	M	S	AN INTRODUCTION TO IMLEC
WORKSHOP	BIRD	234	4762	26	C	A	A GEAR DEPTHING TOOL
WORKSHOP	DU PRE	234	4762	62	C	A	A WORKSHOP DIARY 3
WORKSHOP	DU PRE	234	4763	65	M	S	A WORKSHOP DIARY 4
WORKSHOP	VANE	234	4765	70	M	S	NOW FOR SOMETHING COMPLETELY DIFFERENT
WORKSHOP	DU PRE	234	4767	50	M	S	A WORKSHOP DIARY 5

CREDITS

This index is compiled by David Frith.
For the latest computer searchable indexes please visit: www.model-engineer.co.uk/forums/topic/latest-mew-index/

Royal Mail Stamps to Celebrate

UK Steam Locomotives



This year Britain marks 200 years of the modern railway, and the Royal Mail has issued a striking new set of ten stamps celebrating the rich heritage of British steam locomotives and the pioneering development of the UK's railway network.

Six of the stamps will celebrate British steam locomotives and the development of UK railways. A further four, presented in a miniature sheet, mark the 200th anniversary of the opening of the Stockton and Darlington Railway, in 1825. The stamps and a range of collectible products are available to pre-order at www.royalmail.com/steamlocomotives and by telephone on 03457 641641.

The main set features six iconic locomotives that helped to shape the history of rail travel in Britain: Locomotion No. 1, Rocket, City of Truro, Mallard, Duchess of Hamilton, and Evening Star, British Rail's last steam locomotive.

The miniature sheet includes the opening of the S&DR, in 1825; Locomotion No. 1 at Darlington, circa 1890; a commemorative postcard from the S&DR centenary in 1925; and a photograph of a replica Locomotion No. 1 from 1975.

Royal Mail worked closely with the National Railway Museum and Darlington Council on the stamp issue.

The steam locomotive enabled the Industrial Revolution to advance, moving goods and people around the United Kingdom as never before. Key to its development were Richard Trevithick and the father-and-son team, George and Robert Stephenson. Trevithick was the first to have a steam locomotive pull a train, while George Stephenson designed both locomotives and the routes on which they could run.

The main line of the S&DR, opened in 1825 using the engine that came to be known as Locomotion, was powered by steam locomotives from the start. Four years later, Robert Stephenson created the prize-winning locomotive Rocket, which proved steam's worth at the Rainhill Trials for the Liverpool and Manchester Railway. Steam locomotives became key to that enterprise's financial success, prompting the rapid development of powered railways across the country.

With each passing decade, faster, heavier and more powerful locomotives were developed, including City of Truro, which was unofficially timed at 102mph (161km/h) in 1904 (the first official UK record, achieved in 1934, belongs to Flying Scotsman). This trend saw its culmination in very fast express passenger locomotives such as Mallard, as well as powerful heavy-freight engines in use on goods trains through to the 1960s, epitomised by British Railways' last completed steam locomotive, Evening Star.

Mike Crawshaw, Head of Heritage and Culture for Darlington Borough Council, said: "We are truly honoured and thrilled with these commemorative stamps that celebrate the importance of the Stockton and Darlington Railway (S&DR). They beautifully capture the spirit and significance of the S&DR and Locomotion No.1, and we're proud to see this moment celebrated in such a meaningful and lasting way."

The stamps, and a range of collectible products, are available at www.royalmail.com/steamlocomotives and by telephone on 03457 641 641. A Presentation Pack including all 10 stamps is priced at £17.90.

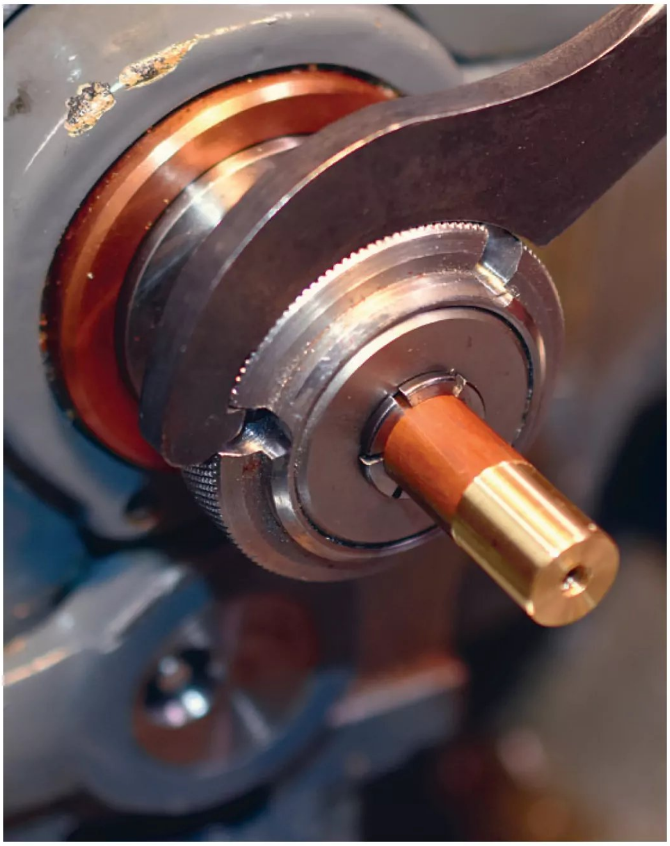
Readers' Tips

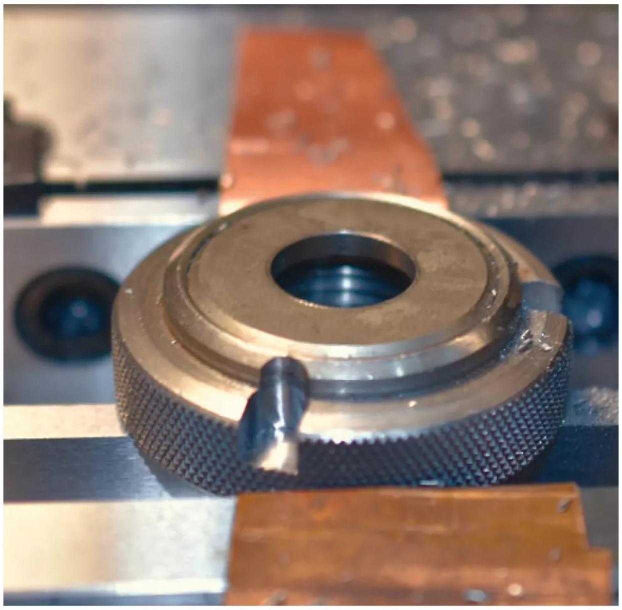
We have £30 in gift vouchers courtesy of engineering suppliers Chester Machine Tools for each month's 'Top Tip'. Email your workshop tips to **meweditor@mortons.co.uk** marking them 'Readers Tips', and you could be a winner. Try to keep your tip to no more than 400 words and a picture or drawing. Don't forget to include your address! Every month we'll choose a winner for the Tip of the Month and they will win **£30 in gift vouchers from Chester Machine Tools**. Visit **www.chesterhobbystore.com** to plan how to spend yours!

Easier Collet Closing

This tip for modifying Myford collet nose pieces comes from John Bauer, who states it appeared in *Model Engineer* many years ago, but we agree that it bears repeating (and could apply to other difficult to tighten items):

As hands age tightening the Myford collets becomes increasingly fraught. By modifying the nose piece as shown a suitable C-spanner can be applied, in this case one of 53-55 mm size. A 1/4 inch 4-flute milling cutter fed carefully and without cutting oil was used to make the recesses in 0.035 inch depth increments. The recesses need to be sized to accommodate the C-spanner to be used. In this case the end mill was brought to the outer ring in the centre of the nose piece to an eventual depth of a goodly 1/8 inch as measured at the periphery of the piece. This tip was noted in the Model Engineer about two generations ago, so it seems to be about time to resurrect it.



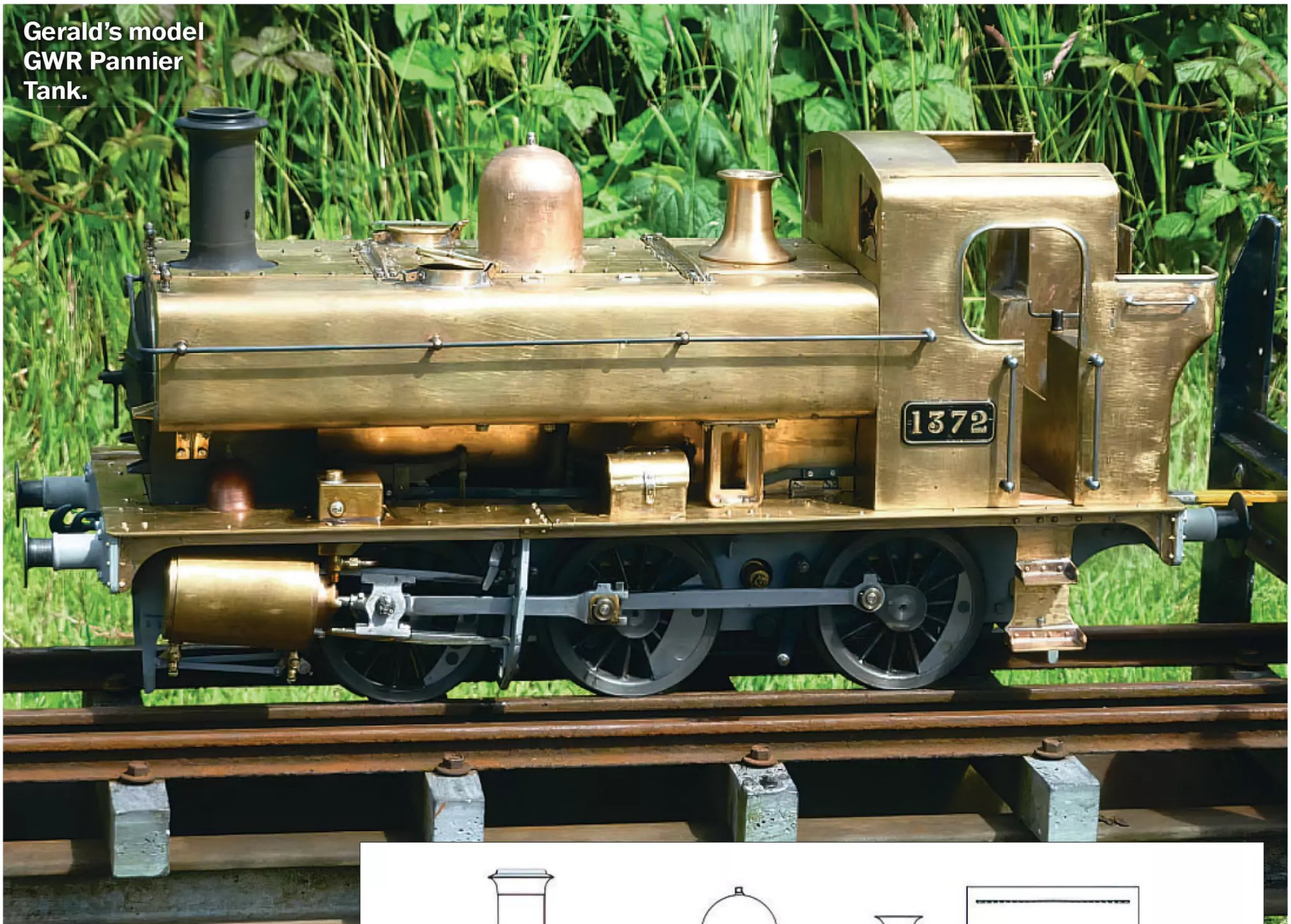


Please note that the first prize of Chester Vouchers is **only available to UK readers**. You can make multiple entries, but we reserve the right not to award repeat prizes to the same person in order to encourage new entrants. All prizes are at the discretion of the Editor.

THE BRADFORD CUP AND STEVENSON TROPHY 2025

2025 COMPETITION WINNERS

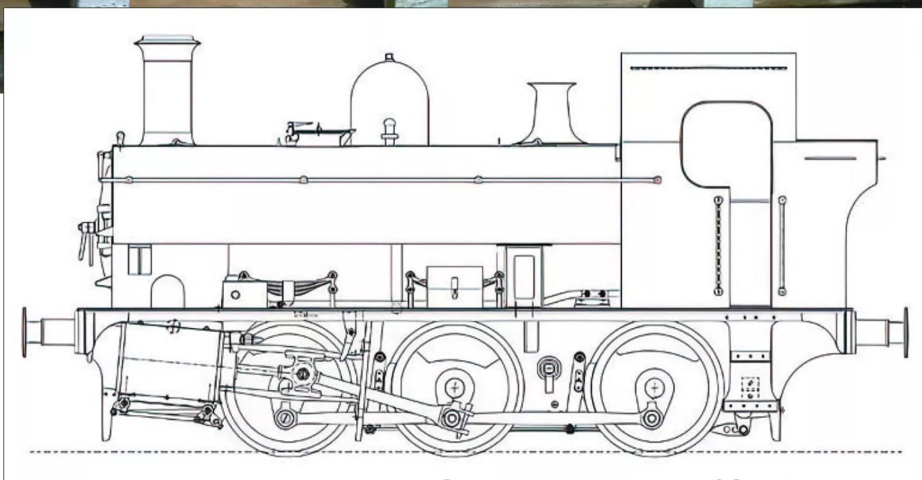
Following the online votes by Model Engineer & Workshop readers and forum members we are pleased to announce the winners in our two annual competitions. The two trophies will be at the Midlands Model Engineering Exhibition and we hope to be able to present them to the winners on Sunday Afternoon.



Gerald's model GWR Pannier Tank.

THE BRADFORD CUP

The winner of this year's Bradford Cup for the best article in Model Engineer 2024-February 2025, is Gerald Martyn, for his series A GWR Pannier Tank in 3 ½" Gauge. Congratulations to Gerald, and also to our other entrants, notable David Thomas who came second by a small margin in a surprisingly close contest all round.



General arrangement of Gerald's model.

STEVENSON TROPHY 2025

The winner of this year's Stevenson Trophy is Dave Sanderson, for his CNC mill. Again, congratulations to all the entrants, while Dave was the clear winner, all entries received plenty of support from voters.
The project has not been described in full in the magazine, but Dave has shared details on the forum. Here is Dave's full description of his winning project:

The Sanderson CNC Mill

As my projects now include shapes which are not trivial to manufacture by manual means I decided I needed a small CNC mill. The majority of intended use is for small (under ~100mm XYZ) parts.
The design is a fixed gantry carrying X and Z, with a moving table in Y. This layout is intended to allow high accelerations with good rigidity in a small footprint as needed for a machine with high speed spindles and small cutters. I already had a 24,000 rpm ER16 spindle from a previous project and decided that travels of ~150mm in XY and Z was 'about right'.
The base is a Cast Iron surface plate of the approximate correct size that I found on EBay. This was then hand scraped flat to give a good base reference surface to align the rest to and for the linear rail ways. The ball screws are 12mm x 4mm pitch.
The main structure was designed to be laser cut from plate steel of varying thicknesses. It is of a box design with tabbed construction for ease of assembly and a closed back to increase the rigidity.
It ties the 2 main columns of box section that carry the gantry rigidly to the surface plate base. The gantry itself is a large 12mm plate, which in turn is backed by a 50mm deep ribbed weldment which I surface ground flat. This carries the X axis carriage, which is made from a pair of Hemmingway surface plate castings (cheaper and lighter than lumps of Cast Iron). These were machined, scraped and aligned to carry the Z Axis and X axis linear rail cars. I opted to have the rails themselves on the Z axis 'quill' as it seemed more rigid than the other way round, as on Chinese CNCs. The 'quill' carries the spindle and lead screw and is HRS channel which is machined appropriately.
All the rails are aligned in the same manner – Linear rails are not necessarily straight and are designed to be pushed into an alignment feature on the machine. As I had only flat scraped surfaces, I did not have the required edge, so the rails are aligned using countersunk SHCS, which wedge a round bar into the rail side. By adjusting the opposing screws a powerful and controllable alignment can be created. One rail was first aligned straight (using a surface plate and indicators), then its part was aligned parallel. The C-C distance was controlled on the car mounts, such that all the ways are aligned and non-binding.
The Table is machined from a WDS Cast Iron CNC fixture plate. This came with T slots that match my main Mill and has pockets to carry the linear rail cars on the underside. The control system is housed in a steel cabinet bolted to the stand. It has power supplies for the steppers and DDCS Expert controller and switch gear and filter for the VFD drive for the spindle.

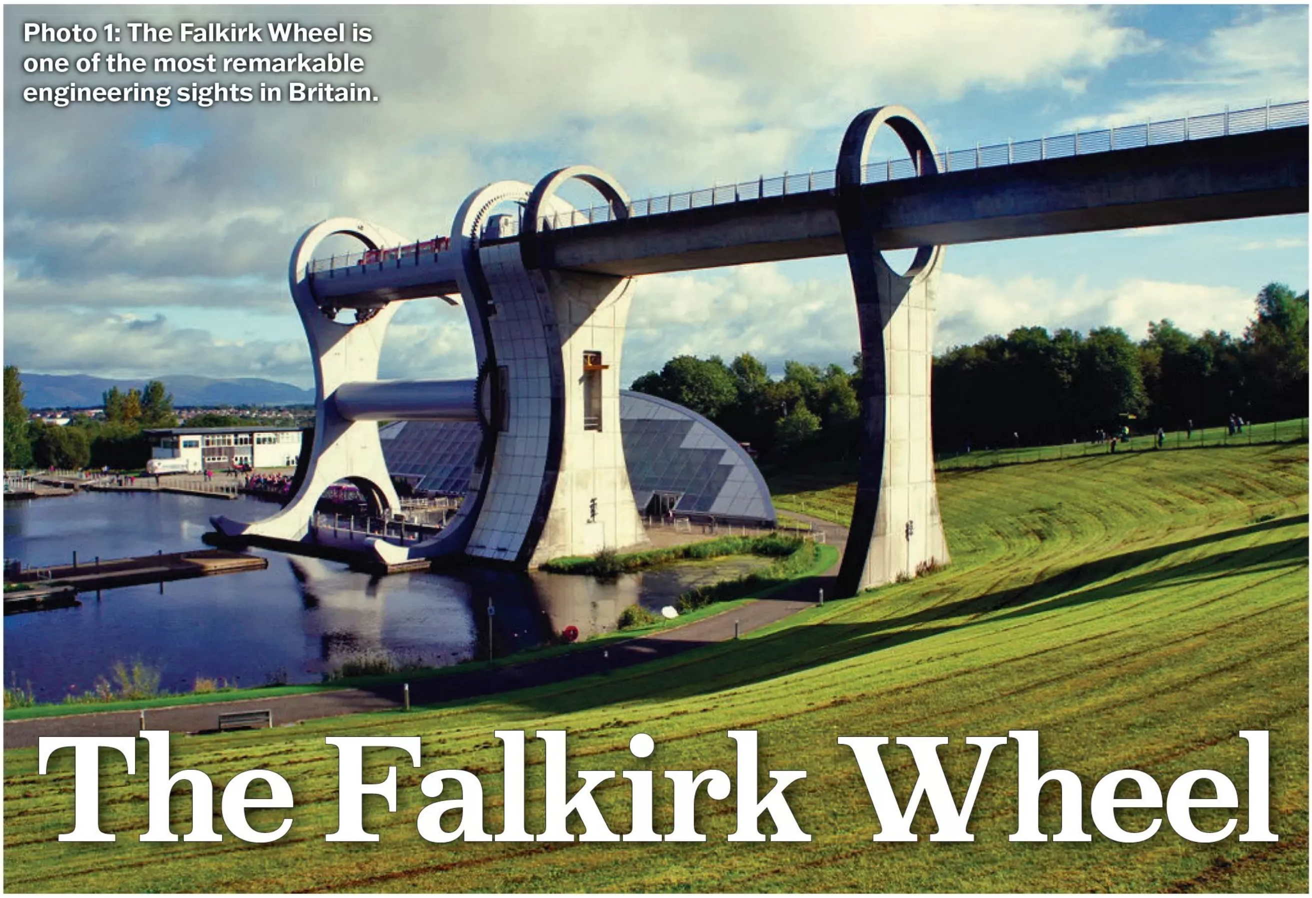


Photo 1: The Falkirk Wheel is one of the most remarkable engineering sights in Britain.

The Falkirk Wheel

Engineering as a spectacle, that's the Falkirk Wheel, a magnificent work of 21st century engineering. Unlike some tourist attractions, this deserves all its 500,000 visitors a year. Many will take a trip on this, the world's only rotating boat lift, **photo 1**.

Besides providing a link between the Union Canal and the Forth and Clyde Canal it is a remarkable work of mechanical engineering artistry attracting investment and development nearby. Although the Falkirk wheel is the most spectacular part it is just one component of a major canal restoration project, **photo 2**.

Photo 2: Falkirk Wheel is the only rotating boat lift in the world and attracts around 1/2 million visitors a year.

CANAL HISTORY

The wheel links two historic canals. Starting at Bowling on the River Clyde, the Forth and Clyde Canal has a Glasgow branch to Port Dundas and goes near Falkirk to reach Grangemouth on the Forth Estuary. All 57km were fully completed by 1790. It was the first canal in the world to link two seas, which it did via some forty locks.

By 1822, the Union Canal linked Edinburgh with Falkirk. It was a contour canal without locks, but at Camelon, near Falkirk, a flight of eleven locks linked down to the Forth and Clyde.

On the Forth and Clyde Canal smaller seagoing ships could pass along thanks to lifting bridges. Several shipyards along the route, like that at Kirkintilloch, built boats – notably the Clyde "Puffers". Up to 3 million tons of coal and stone traffic passed along the canal annually and about 200,000 passengers travelled annually by the 1830s. Water transport was safer and

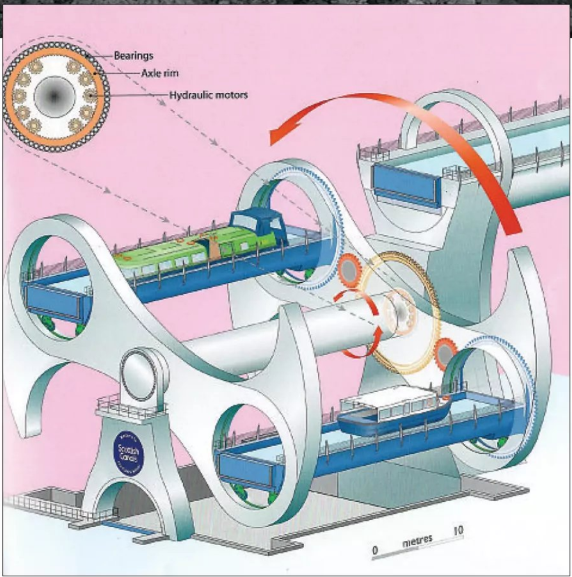


Photo 3: Diagram of wheel operations.
© Falkirk Wheel Guidebook and Scottish Canals 2023

Photo 4: A short but impressive aqueduct links the wheel to a canal tunnel; under the Antonine Wall.

more comfortable than road coaches.

During the First World War, Grangemouth dock was closed and the waterways declined. Falkirk's flight of locks was out of use by 1933, and both canals were truncated in the 1960s. Roads, motorways and pipelines were built across the canals barring through traffic, but the canals remained important for drainage.

RESTORATION

Refurbishment began in 1999. Besides repairs to locks, aqueducts and bridges a 1.7km new canal was built on Edinburgh's outskirts. Unfortunately, the flight of 11 locks in Falkirk was not restorable. The Union Canal was 35m above the Forth and Clyde. The challenge was how to provide a link?

British Waterways, now Scottish Canals, worked with the Dundee architects Nicholl Russell Studios to come up with an eye-catching and practical idea, envisaging a spectacular landmark.

A boat lift was needed and architects developed ideas, some based on the funicular railway concept, used on some continental boat lifts, and others using counterweighted arms to lift boats in water filled cradles. The design stage took five years with thoughts turning towards a rotating wheel as an open cylindrical drum, not unlike a Ferris wheel. It was feasible but clumsy in appearance, so engineers and designers looked at it again. Eventually, they realised the wheel concept was sound, but a wheel does not require a rim.

Devising the ultimate structure was a multidisciplinary effort involving a twenty strong team of engineers, architects and steel work fabricators. They considered various options and eventually settled on a rotating boat lift with two opposed arms, **photo 3**.

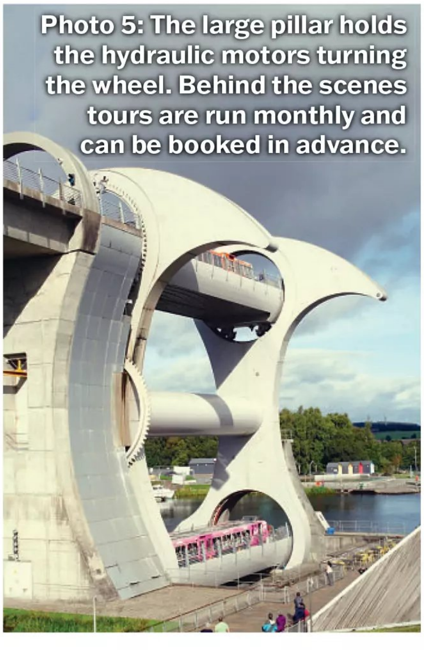


Photo 5: The large pillar holds the hydraulic motors turning the wheel. Behind the scenes tours are run monthly and can be booked in advance.

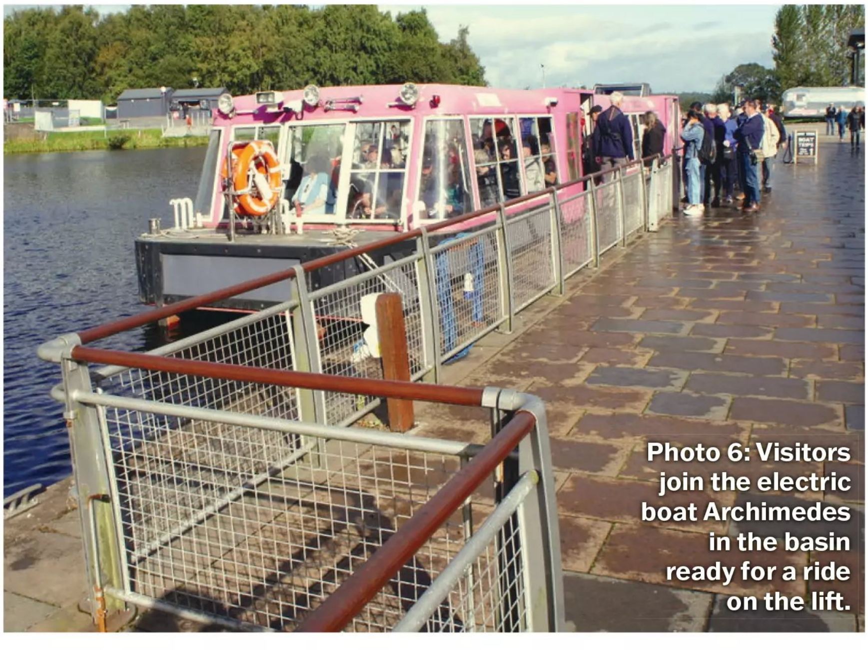


Photo 6: Visitors join the electric boat Archimedes in the basin ready for a ride on the lift.

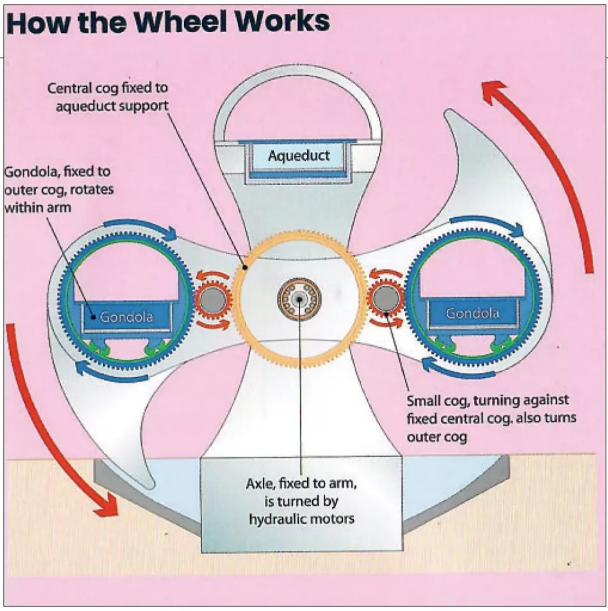


Photo 7: Diagram showing how the wheel works from the Guidebook

Photo 8: Boat enters lower gondola ready for lift

NOT ONLY THE WHEEL

Remains of the Roman Antonine Wall and Rough Castle are near the Wheel. A new canal would link from the Union Canal to the boat lift, but ancient monuments could not be disturbed. So the canal goes through a short tunnel under the wall, the first canal tunnel to be built in Britain since the 19th century, and crossing a short aqueduct to the wheel itself, **photo 4**. The area had to be excavated and remains of an old tar works cleared.

The wheel fits into a giant bowl in the hillside with a basin and lock leading to the Forth and Clyde canal. The aqueduct to the wheel is built on concrete pillars. Mechanisms for the wheel are housed in further pillars, **photo 5**.

Apart from private boat owners or renters who use the canal, the wheel offers trips on its two electric boats, *Archimedes* and *Antonine*, with a short ride through the canal tunnel, **photo 6**.

Joining one of the boats at basin level, a visitor sees the gondola gates at each end close and then the boat starts to lift. The ride is almost completely silent and takes just five minutes. The gates open, as do those on the aqueduct, and the boat sails out for the rest of the fifty-minute ride before returning to the basin.

HOW IT WORKS

The wheel works through two opposed counter-balanced arms rotating to raise or lower gondolas. Each gondola is in effect a self-contained lock with gates at each end to hold water, **photo 7**.

Visitors sometimes ask if the lift will work if there isn't a boat in a gondola. No problem. The long-ago genius of Archimedes applies. His principle shows that each boat displaces its own weight of water, so the gondola weighs the same whether the boat is in or not. The total weight of a gondola, boat and water is about 250 tons.

The rotating part has a central axle and arms. At the arm ends are rings holding the gondolas. Using linked gear wheels as the axle rotates, the gondola also moves to remain level. Below each end of the gondolas bogie wheels run round a rail inside the hole at the end of each arm.

The gear wheel round the gondola in each arm is the same diameter as the central gear wheel on the axle. So with an intermediate gear wheel linked between the axle gear wheel and the gondola gear wheel both move together ensuring gondolas stay level. Simple but it works. Although the designers had access to computer aided design, it's reassuring to know the design was still tested with a Lego model.

Gates at the end of the gondola and aqueduct are locked shut automatically as the boat is about to lift, **photo 8**. Once the gondola has reached the correct level the required gate opens along with the gate on the aqueduct so the boat can float out.

Photo 9: Gondola with boat seen from bank near the start of the lift. It is almost completely silent in operation.

Photo 10: The gondola nears the halfway point of the lift showing the gear wheels.

CONSTRUCTION

The aqueduct has concrete pillars and the mechanism is housed in another large pillar. The visually striking arches over the aqueduct are not concrete but fibreglass reflecting their non-structural function.

Designers and constructors are proud of the way water levels are computer controlled to balance, allowing a maximum of 75 mm difference in water levels between gondolas and basin or aqueduct. The gates holding the water in the gondola and the canal at the upper level are quite unlike conventional canal lock gates. Instead gates fold down into the water. When a gondola with a boat arrives at the upper level a rubber seal springs out across the bottom and sides of the 50 mm gap, ensuring a correct seal, **photo 9**.

Water is pumped to fill the gap between the two end gates on the gondola and the aqueduct and the gates lower down, allowing a boat or boats to leave the gondola. **Photographs 10, 11** and **12** show more of the sequence. A reverse sequence follows. As the gates lift the seal retracts hydraulically once the gates are vertical. The gap between is pumped dry and the seal retracted by hydraulic power, **photo 13**, shows the seals. The sequence repeats for the next boat as it arrives in a gondola.

It might be expected that arms are welded. Not so, apart from the difficulties ensuring welds are consistently good there would be the problems transporting a vast assembly to Falkirk. Nor would welded joints cope well with fatigue induced stresses that could be experienced on the wheel. Instead, the engineering contractors made the parts at their Derbyshire works and trial assembled them using bolts before transport from Butterley. Eventually 15,000 bolts were mated accurately with over 45,000 bolt holes. Overall, the wheel weighs 1,200 tons and the empty gondolas are 50 tons each, **photo 14**.

While the visitor centre has informative displays, little is said about the ten hydraulic motors rotating the axle driving the lift. They were made by Hedley Hydraulics and are remarkably economical, **photo 15**. It's claimed that balanced wheel uses just 1.5 kWh of electricity for each half turn, a tribute to a design balancing loads and to careful construction. Moreover, it uses very little water, unlike the previous locks which used up to 3,500 tons every trip through the flight.

Photo 11: The end of the wheel seen from the bank as the right-hand gondola rises up.

Photo 12: Top of the lift with the wheel vertical and the boats about to leave the gondolas at top and bottom

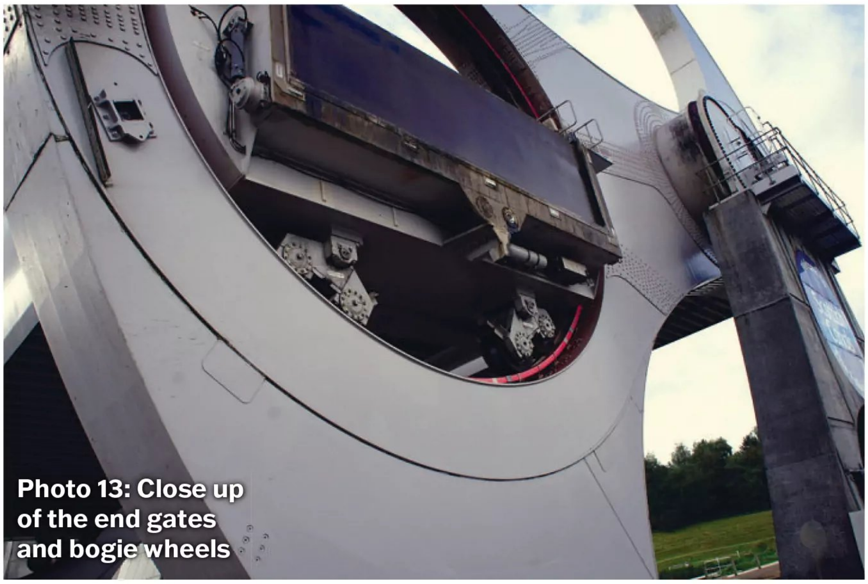


Photo 13: Close up of the end gates and bogie wheels

Photo 14: The wheel seen from the basin side.


Photo 15: Ten of these hydraulic motors operate the lift. They were made by Hedley Hydraulics. Photo taken on a 'Behind the scenes' tour. © Falkirk Wheel and Scottish Canals 2023

Photo 16: Narrow boat leaves the wheel to the basin where it may travel on the Forth and Clyde Canal.


Photo 17: This lock links the lower wheel basin with the Forth and Clyde Canal.

REGENERATION

Besides tourists served by a visitor centre the wheel helps the wider regeneration of canal corridors in central Scotland. While claims for regeneration success are common for major projects, this one appears to have delivered, **photo 16**.

Apart from the numbers employed at the wheel it's estimated that additional inward investment will attract about 16,000 jobs in total, plus encouraging development of 14,000 homes along the route, **photo 17**. The Falkirk Wheel and canal improvements have been a force for development. Similar can be said for other major engineering projects, a lesson lost on those who pressed for High Speed 2 to be abandoned.

VISITING THE WHEEL

Opening hours vary with the seasons. See website www.scottishcanals.co.uk/visit/canals. Also cafe, gift shop, children's play area and "splash zone", fishing.

Access to the wheel and visitor centre is free though there is a charge for boat trips. Some coach holidays to Scotland feature the wheel.

Bookable Behind the Wheel tours take place on the last Saturday of each month, but 2026 dates have not yet been confirmed - please check the website for details.

FINDING THE WHEEL

What3Words: ///hometown.depravity.tangible

The Falkirk Wheel, Lime Road. Falkirk FK1 4RS

Trains from Glasgow and Edinburgh to Falkirk Stations. Taxi ranks at Grahamston, Camelon and Falkirk High Stations or phone Bruce's taxis 01324 636000. No direct buses to the Wheel but McGills Buses no 7 and 8 go to Ochiltree Terrace near the Wheel. Car parking £3.50 per day.

Several firms and Scottish Canals offer canal boats for hire on both canals am interesting way to visit the wheel enjoying the waterways.

OTHER ENGINEERING ATTRACTIONS NEARBY

The Kelpies

Another eyecatcher 6km away in the Helix Eco Park, vast steel sculptures of Celtic water horse heads. The Kelpies Experience is a 90-minute guided aerial climb to the horse's mouth via cables, ladders and platforms with an abseil or quick flight descent.

Bo'ness and Kinneil Railway

Run by the Scottish Railway Preservation Society. The railway offers a 10-mile round trip along the Forth Estuary behind10-milege steam or diesel traction. Also the Museum of Scottish Railways exhibition and engineering workshop viewing gallery.

Website www.bkrailway.co.uk

Thanks to Shirley Bartynek and Rebecca Goldie (Scottish Canals) for help with this article.

Sweet Pea Rally 2025

Photo 2: Getting ready in the Steaming Bays.

Bryan Finch of Guildford MES reports on this year's gathering for owners of this popular narrow-gauge design, with photographs from Mike Sleigh, Bryan Finch and Phil Brien

The Sweet Pea Rally is an annual event for owners of *Sweet Pea* locomotives and its variants – *Sweet Violet, Sweet William, and Metre Maid*. The rally has been held up and down the country for over thirty years under the guiding hand of Phil and Jacquie Owen of Blackgates Engineering, such is the popularity of these locomotives. This year it was hosted by the Guildford Model Engineering Society at its site in Stoke Park, Guildford, Surrey, over the weekend of Friday 13 to Sunday 15 June. Some thirty locomotives were booked in along with about forty people, the gathering included seventeen *Sweet Peas* (5" gauge), five Metre Maids (5" 0-6-0), four *Sweet Williams* (7¼"), two *Sweet Violets* (3½"), and one electric Garrett version of a 5" *Sweet Pea*. It has often been said that no two Sweet Peas are alike, and that was very much in evidence over the week end. Visitors came from all directions – Nottinghamshire, Leicestershire, Essex, Wiltshire, Sussex, Dorset plus a few local folk from Hampshire and Surrey. Some engines came for one day, others were with us for the whole of the weekend.

Proceedings started on the Friday afternoon, with about nine locos running on either the raised dual gauge

Photo 1: Phil Brien's electric "Garratt".

Photo 3: Five-inch gauge Sweet Pea.

Photo 4: Another Sweet Pea.

Photo 5: Seven and a quarter inch gauge Sweet William.

3½" and 5" track or the ground level 5" and 7¼" gauge track. One of the highlights of the Friday afternoon was Phil Brien's Garrett version of a *Sweet Pea* which was battery powered, **photo 1**. The loco carried a pantograph on the cab roof, and Phil explained that many years ago some Swiss steam locomotives had been fitted with electric heating elements powered from overhead cables via pantographs to heat the boiler water.

Saturday and Sunday were much busier with around twenty locos running on each day, at times we had six or seven locos out together on the raised track, all running "line of sight". I am indebted to my fellow GMES members who so ably managed the steaming bays and the track access with so many loco owners keen to get out on the tracks. **Photograph 2** shows two Sweet Williams and a number of Sweet Peas getting ready in the Steaming Bays.

Photographs 3 and **4** show a couple of the Sweet Peas out on the raised track, while **photos 5** and **6** show how much larger the Sweet Wiliams are, running on the ground level track.

Another aspect of the Rally was that Phil and Jacquie brought along *Sweet Pea No.1* which was the original locomotive built by the model's designer Jack Buckler in the 1970s. This loco was set up as a static display along with some Jack Buckler and earlier Sweet Pea Rally memorabilia.

It was good to see that the Rally is a form of "family gathering" with many of the attendees being regular attenders and meeting up again with friends again year by year. Many of the visitors elected to stay in a local hotel rather than camp or caravan on site, "I've done with camping!", and no doubt the social interaction continued well into the Saturday evening.

All day, the GMES Kitchen kept the

Photo 6: The larger locos run on the ground level track.

Photo 7: The original Sweet Pea No.1 by Jack Buckler on display.

visitors plied with teas and coffees, cold drinks, pre-ordered sandwiches, plus snacks and ice creams all of which were appreciated.

All too soon Sunday afternoon arrived, and people were beginning to return to the steaming bays to shut down their locos and put things away, but not before the traditional closing ceremony where Phil and Jacquie presented a glass vase and a Jack Buckler Award tee-shirt to Richard Wightman for the best locomotive at the Rally, **photo 8**. Having written earlier in this report that no two Sweet Peas are the same, Richard's loco stood out from the crowd because he had used a lot of polished stainless steel on the bodywork and boiler cladding, and the loco which was a new build being finished a few weeks before the event ran very well throughout the weekend, **photo 9**.

Mention also needs to be made about Brian Holland's 13-year-old grandson, Martin, who helped prepare Brian's Metre Maid "*Fair Rosamund II*" and competently drove the locomotive around the track for quite a lot of the weekend, **photo 10**.

Inevitably, there is quite a bit of footage of the event on YouTube which gives a good flavour of it. So if you haven't taken your Sweet Pea to any of the annual rallies, please give it a thought in the future. Next year's Rally will be held at Rainsbrook Valley Railway at the Rugby Model Engineering Society. The dates are the weekend of 13 and 14 June, and details will be published in due course.

Photo 8: Jacquie and Phil Owen presenting the Jack Buckler Award to Richard Wightman.

Photo 9: Richard Wightman's award winning Sweet Pea.

Photo 10: Team Holland at work preparing Fair Rosamund II.

A Digital Boring Bar Setting Tool

Will Doggett modified a digital caliper to make a precision setting tool for boring bars.

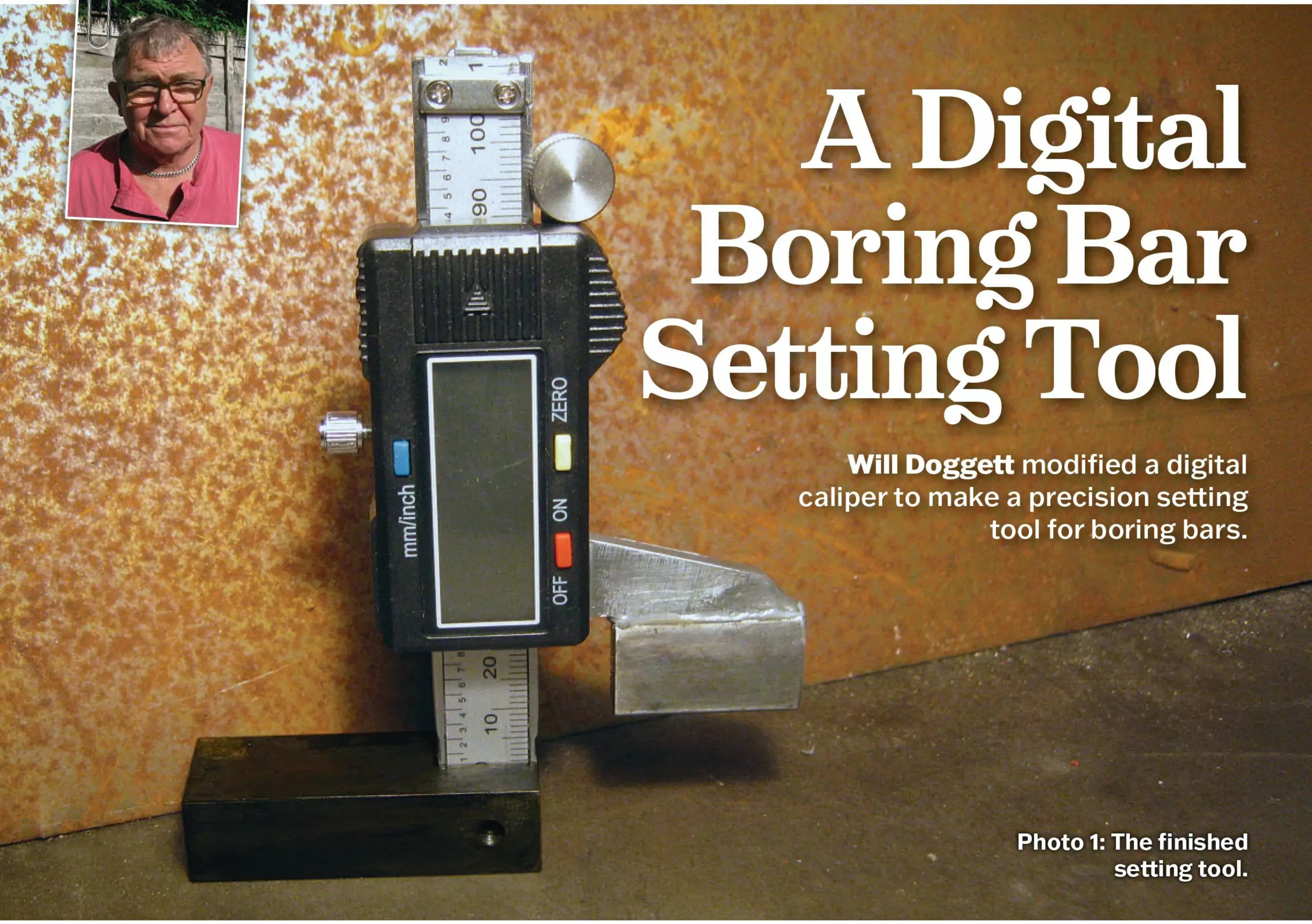


Photo 1: The finished setting tool.

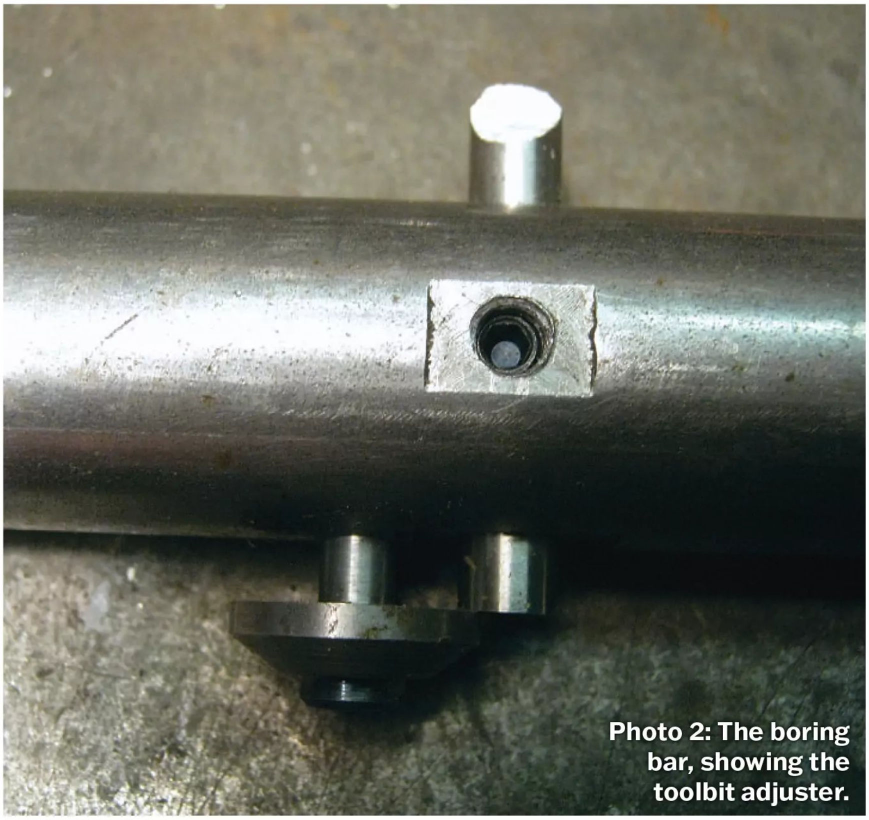


Photo 2: The boring bar, showing the toolbit adjuster.

Having made a boring bar setting tool with an imperial micrometer, I needed a metric version. I then came up with an idea to use a redundant digital calliper with some of the measuring parts removed and a base made to support it on the top of the boring bar, **photo 1**. This makes it easy to adjust the cutter height to the calliper. The boring bar and the problematic cutter is shown in **photo 2**. The redundant digital calliper is shown in **photo 3** before the modifications are made.

You will need to remove the cover sticker on the back of the read head **photo 4**, to get at the screws that hold the head to the main body. **Photograph 5** shows these screws and **photo 6** shows the measuring part dismantled.

Manufacture of the boring bar setting tool starts with cutting the parts off that are marked in photo 6. The job was done with a hacksaw, after the parts were cut off the cuts were then filed flat. The modified parts from the redundant calliper are shown in **photo 7**. After cutting and cleaning the parts are now ready for more work to be done on them. The read head

Photo 3: The redundant calliper.

Photo 4: Peel off this sticker to reveal the fixing screws.

Photo 5: Sticker removed.

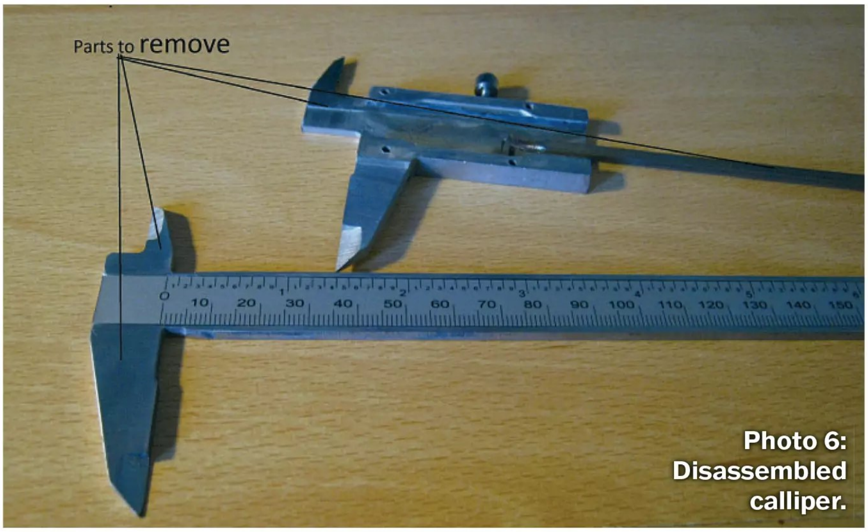


Photo 6: Disassembled calliper.

Photo 7: After removal of parts.

measuring section is not deep enough as the support section gets in the way so this is going to be extended down so that the tool can be set at the base, the section at the bottom of **photo 8** was going to be used, but it is not the correct shape. This means a new piece of material was required, a piece of 15 x 5mm steel cut to a length of 30mm and I was going to fit it to the read head by silver soldering them together.

To test the sort of temperature required I heated one of the parts that had been cut off the read head, and found that it was aluminium, as it melted. So, an alternative method is required to fix the steel part to the read head. I used a two-pack adhesive that is grey when mixed and fixed the parts together with this. The completed joint is shown in **photo 8**, before polishing. With the read head now ready for assembly, it is time to make the base. This is a piece of mild steel 15 x 20 x 55mm long. I put marking out blue on it and scribed two parallel lines and a depth line to help when cutting the slot for the rule with a slitting saw. The base is shown in **photo 9** as marked out. The base part was then put in the machine vice on the mill and cut using a 100mm diameter slot saw with a thickness just under the rule size. The process of cutting the slot is shown in **photo 10**. I used a little bit smaller cutter because I have found they cut over size, and this was the same. After the slot was cut and cleaned up, I marked out one side and drilled a 2BA tapping hole then tapped the hole for a grub screw to hold the rule part in position. This hole and screw are shown

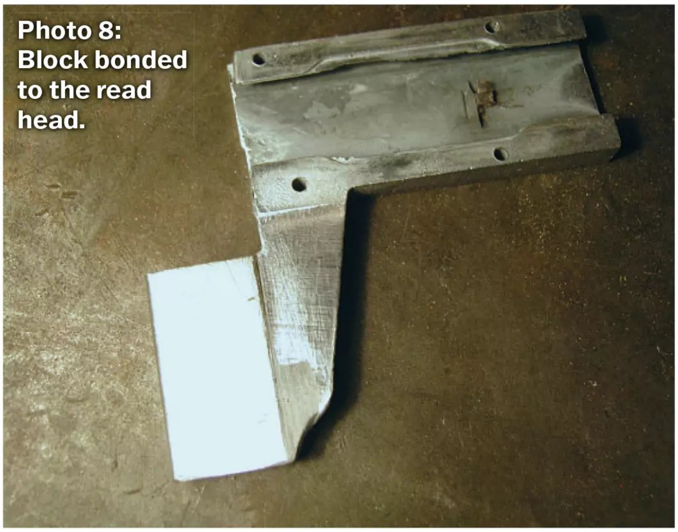


Photo 8: Block bonded to the read head.

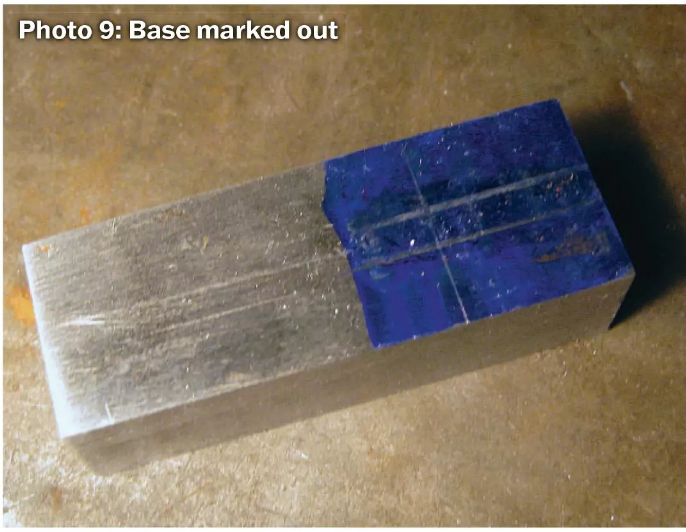


Photo 9: Base marked out

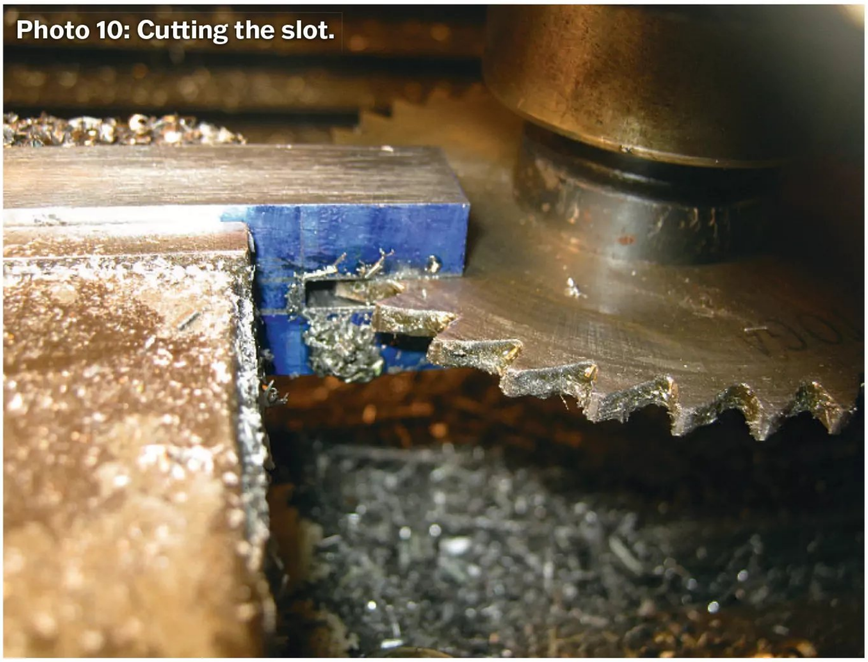


Photo 10: Cutting the slot.

in **photo 11**. After cleaning up the base, the rule was the next part to be tackled. This was from a 150mm digital callipers rule and was rather on the long side for this project, so I decided to shorten it to about the 110mm mark, **photo 12**. The now shortened rule requires two holes drilled in the end for the stops that were on the end that I cut off. The two sections are show in **photo 13** after transferring the holes. The test assembly is next; the rule was inserted in the slot, then holding it against a square I clamped the rule with the grub screw, **photo 14** shows this setting up. Now that the rule is in place the read head was fitted and assembled to the rule, **photo 15**. This photo is before the finish was applied to the base, all that is required now is the stop to be fitted that was removed from the original end. The base was blackened as in photo 1.


Photo 11: Base with grub screw.


Photo 12: Reducing the length of the rule.

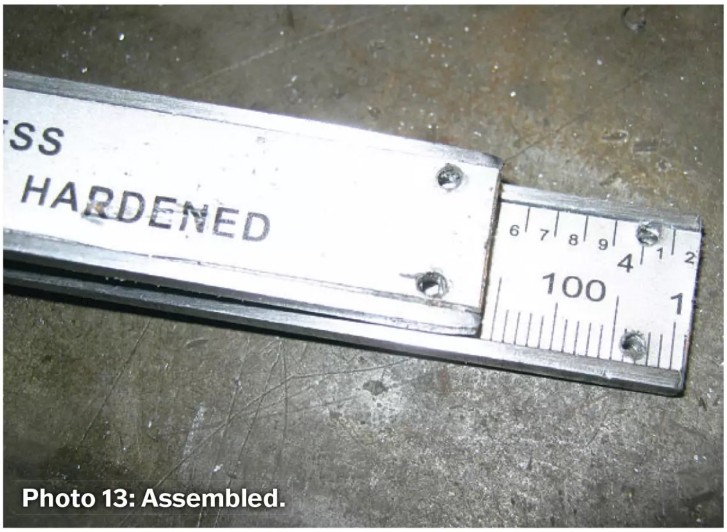


Photo 13: Assembled.

Photo 16

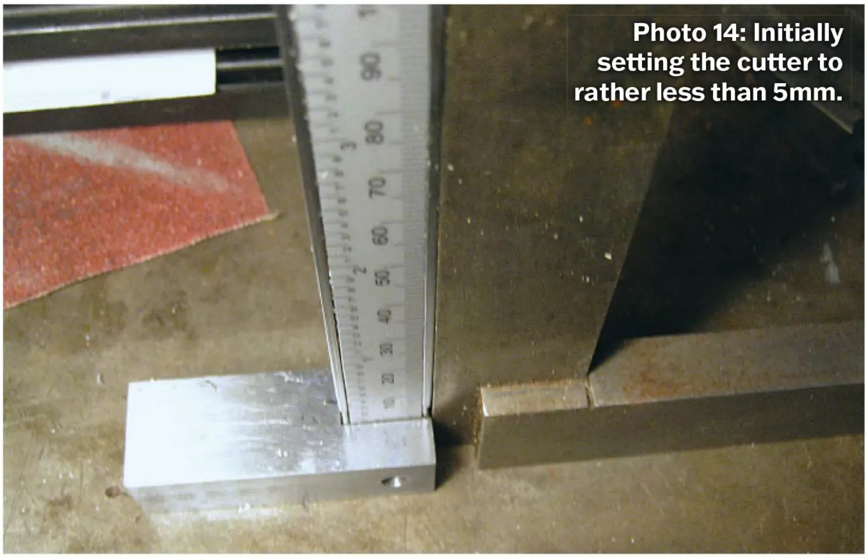


Photo 14: Initially setting the cutter to rather less than 5mm.

Photo 15

SETTING UP THE TOOL

To set the tool up the size of the through boring bar is required, the one that I have is 22mm diameter. Now the maths: divide the size of the bar by two = 11mm, this gives the centre to top of the bar, now add the half the hole size to this dimension. Say a hole of 32mm is required this needs 16mm - 11mm = 5mm protrusion that equates to 16mm from centre line of boring bar to tip of the cutter. To set the gauge up put it on a flat surface, then move the read head down and zero the head on the surface. Now set the height of the cutter on the gauge by moving the read head up to the dimension required in this case, 5mm. But as I was always told to creep up to the required size, I would initially set the tool at rather less, this gives some leeway on the size. Now lock the head with the small screw then put the tool on the bar and move the cutter up to the read head arm so that it just touches the arm then tighten the cutter on the boring bar as shown in **photo 16**. Now make a cut in the material being bored. Remove the cutter from the bored hole and check the size and use the tool to help adjust the cutter up as required to get the right size of hole.

CONCLUSION

I suppose a height gauge could be used for this purpose, but I found most of them are a bit too big and clumsy. A lot are at least 300mm in height and this makes them difficult to use when setting up the boring bar, as I found out. This was the reason for making the setting tools and this digital one has the advantage it can be switched between imperial and metric.

POSTBAG

The Editor welcomes letters for these columns, but they must be brief. Photographs are invited which illustrate points of interest raised by the writer

PostBag is one of the most popular sections of the magazine - readers 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.

COMPRESSED AIR

Dear Neil, compressed air is not to be trifled with but once I came close to doing something very foolish using it. Our local butcher had a sausage stuffing machine in which the ground meat was placed in a round clear plastic cylinder and a skirted plastic piston pushed the meat into the stuffing apparatus. The plastic piston was reasonably flexible and was driven by a metal plate which matched indentations in the piston to avoid misalignment between the two.

One day I was presented with the plastic cylinder, about 8 in inner diameter, with the piston weather-cocked inside. Attempts to extract it without damage had proven fruitless and the job was turned over to me. It seemed simple; make an adaptor for the output neck and apply a few pounds of compressed air. Then my right-shoulder gremlin reminded me of the story of how an engineer had restored a sucked-in storage tank roof using the hydraulic pressure at the bottom of a short length of vertical pipe mounted near the top of the (full) storage tank. My brain thanked Trevor Kletz (What Went Wrong? - Case Histories of Process Plant Disasters ...) and some basic arithmetic followed. Four psi could result in a force of 200lbs on the piston! The piston was finally eased out with intermittent pulses from the blowgun with the air compressor pressure regulator set as low as possible.

John Bauer, California

AI WORKSHOPS

Hi Neil, I have been playing with the amazing technology of AI-generated images using DeepAI. The attached are astonishing examples of what it can do, very much in the style of the image which you showed in MEW. This could become a new hobby in its own right!

Mark Noel, Isle of Man

ECHILLS WOOD LOCOS

Hello Neil, thank you for *Model Engineer & Workshop* issue No.4769 which arrived earlier this week. May I point out a couple of editorial slips? The photo No. 139 of the 3½" gauge tank loco shows the RH running plate not the LH one, and the Echills Wood Rally photo of double heading on page 41, the leading loco is V2 No.60809, The Snapper, The East Yorkshire Regiment, The Duke of York's Own, not a K2.

I well remember trainspotting at Doncaster In the 50s seeing these marvellous locos hauling passenger trains or fully fitted freight - Happy Days!!!

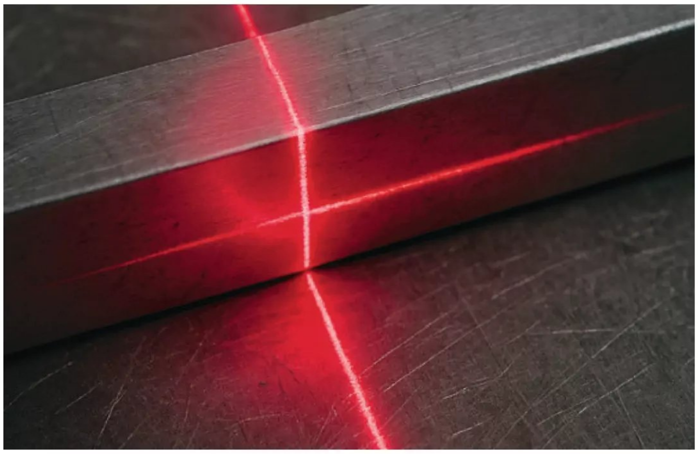
Tony Ward, by email

LASER CENTRE FINDER

Hello Neil, I was doing some sorting and came across an article in MEW around 2014 for a cross hair laser centre finder. It looks like a nice project for me but one thing then sprung to mind, what are the safety aspects from the reflected beam. The laser I have ordered is 650nm 5mw which is not that powerful but as it will be directed at shiny metal I wondered if I would need the goggles that you get with some laser levelling tools.

Bob Garrett, by email.

Hi Bob, 5mW is a class 3 laser and capable of causing eye injury. I'd suggest a class 1 laser would be fine (no risk of injury) or Class 2 which is up to 1mW and considered safe for brief accidental exposure due to the eye's blink reflex. Regardless of safety issues, I think a weaker laser should be better as it will be easy to get a better focussed spot. Given how cheap low-power laser modules are, I would get one be safe – Neil.



OBITUARY: ALLAN WRAGG

Elliott Hirst SMEE Chairman writes: We received news that Alan Wragg had passed away in the afternoon. This sad news is not a surprise. Alan had bravely fought cancer for the last 10 years and had been receiving palliative care after his discharge from hospital earlier this year.

Alan joined SMEE in 2003. A trained industrial engineer, he was already skilled. As well as making models he is remembered for his experimental work developing equipment, often working with his next-door neighbour and fellow member, Mike Kapp. He quickly became involved in the full range of SMEE activities taking on major roles in the running of the Society. In the last 15 years he was a cornerstone of the small core team that managed things through the turbulence of the 2010s. In this period, he was at various times, editor of the Journal, Membership Secretary, a major contributor to the work of the Stationary Engine Committee, cataloguing and conserving models in our collection, stand manager at Model Engineer Exhibitions, part of the training team and most importantly taking the role, twice, of Chairman. His second term coincided with Covid and exceptionally he held the post for 3 years as SMEE wrestled with the problems of closing Marshall House and making a temporary transition into an online only existence.

Outside SMEE, Alan was very active in other hobbies and activities including rifle shooting at Bisley, where he designed and made equipment for the shooting range. He will be greatly missed by his many friends at SMEE and elsewhere.

ON BOILER CONSTRUCTION

Dear Neil, I refer to Gerald Martyn's response to Simon Collier's comments on his boiler design which does not have a mechanical connection between the firebox sides and the stays apart from the head of the stay. Frankly I am amazed that it has not generated a myriad of responses akin to Bro Hyphens Twin Sisters from days of old. Gerald says that he is using a "hybrid method ... for those without access to oxy-acetylene or oxy-propane" despite the fact that other boiler joints are fully silver soldered and need at least propane equipment, and as far as I know, that no other boiler has had this stay arrangement. He is certainly out on a limb.

Simon is correct in that soft solder in boilers should have gone out with the ark. LBSC himself noted that an all silver soldered boiler is inherently safe. They can withstand being run dry and this aspect has been tested on a Gauge 1 coal fired boiler where thermodynamics theory was proven against practical tests (refer to Australian Model Engineering Issue 192, May-June 2017). Admittedly it was a small boiler, but given the conductivity of copper and the immense capacity for water to absorb energy a degree of extrapolation to a other all copper boilers would not be unreasonable and is demonstrated by the absence of catastrophic boiler disasters from low water.

However, they can exceed the temperature of soft solder and Gerald's firebox are most likely going to leak after such events, and repair in that dirty environment would be extremely difficult. Every stay is a fusible plug! Now, just so I am not misconstrued, I am not advocating running boilers dry, just that the silver soldering produces a sound and long-lasting boiler. I am not suggesting either that no one has ever suffered from low water! The series of specifications for solders are from the Australian Standard, which is from the British Standard BS 1845, now in itself superseded by an ISO standard. Keeping documents up to date with these changes is always difficult and subject to time lag, yet the evolutionary line is there if you need to trace it. Our 'foreign' standard has a British heritage!

I am also not saying the AMBSC code is perfect. People can always read a document to suit their own ends. However, contrary to other boiler procedures, the AMBSC code is an actual design. Within its scope It does not tell you how large or long your boiler should be. Nor the size of the grate or how large the dome is. However, it does relate the working pressure to the plate thickness, stay size and spacing such that builders do not have to worry about exceeding the safe stress limits. It does it all for you. You do not need to rely on previous designs. Perhaps there is some doubt that such a useful document could come from a bunch of convicts in the colonies, but there it is providing much certainty in boiler construction. All you have to do is get on board!

Warwick Allison, Mt Riverview, NSW, Australia.

For the 'soft solders' mentioned are high-temperature silver bearing alloys like Comsol: From one supplier: "Johnson Matthey Comsol™ is a high melting point (296°C) silver-tin-lead soft solder" used for "caulking Boilers and low strength applications". The ASMBC code explicitly permits the use of such alloys for purposes such as caulking boilers.- Neil

ONLINE INDEXES

David Frith's has kindly agreed to prepare the indexes for Model Engineer & Workshop which can be downloaded from the Forum at www.model-engineer.co.uk – just select Forums and then the Model Engineers' Workshop topic. Alternatively scan the adjacent QR code. If you prefer the paper indexes, don't worry, David will be producing these in the future as well.

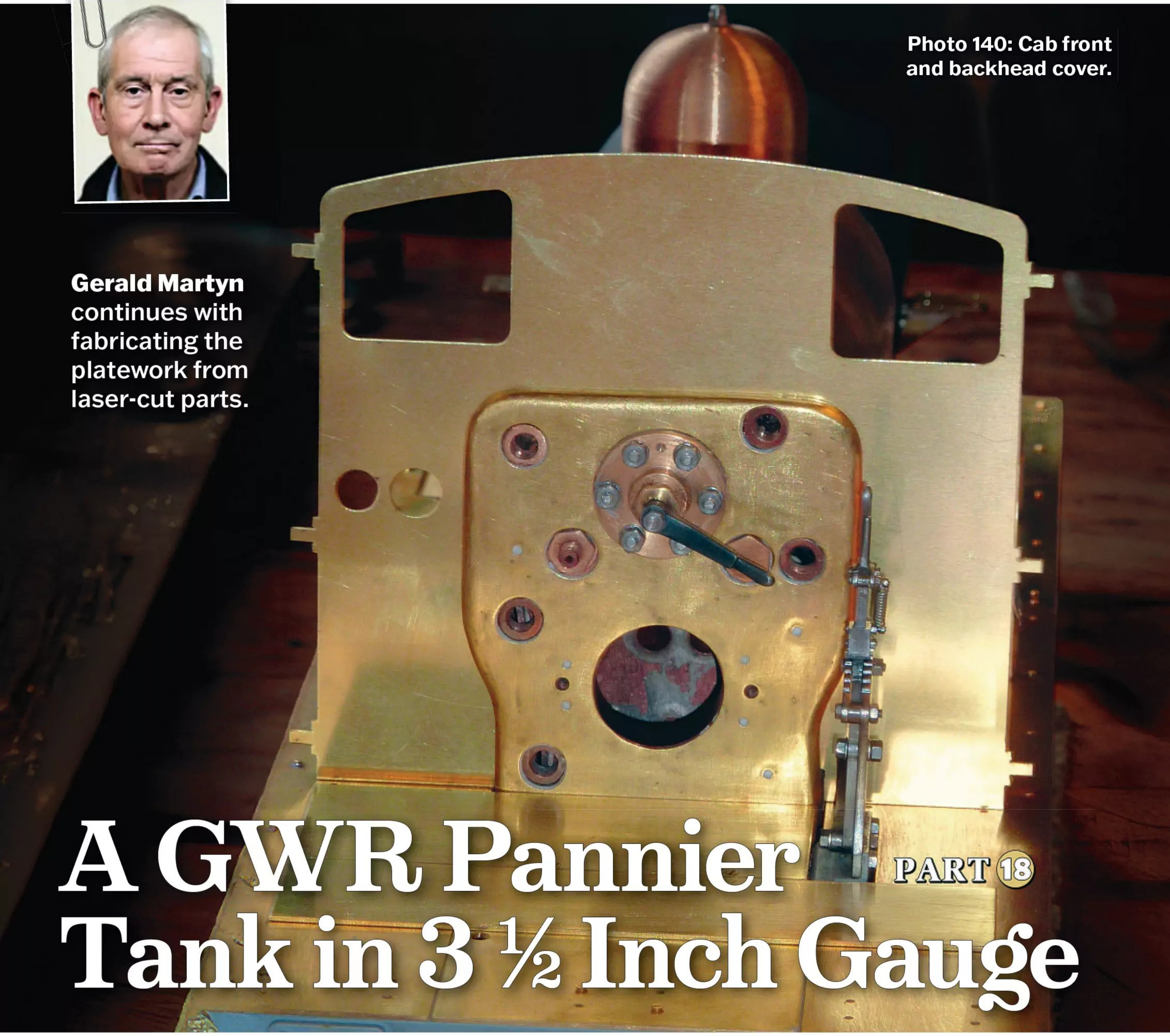


Photo 140: Cab front and backhead cover.

Gerald Martyn continues with fabricating the platework from laser-cut parts.

A GWR Pannier Tank in 3 ½ Inch Gauge

PART 18

The next stage of the platework is the cab. There are eleven laser cut parts as tabulated, plus some hand cut bits and pieces and some angle needed. On this assembly, again, twist tabs on tabs are used for holding prior to soldering.

The cab front and rear views are shown in **fig. 67**. Start with the cab front panel. This has a cutout for the boiler but will probably need some fettling to make it fit, and the cutouts for the two boiler top bushes need to be put in. When fitted it's hard to resist putting the back-head cover in place and admiring it all, **photo 140**. Fit the steam manifold, make a little cradle for it from 0.7mm or 0.9mm brass and tack rivet and soft solder it to the panel. Make and tack rivet the two attachment angles at the panel base. The windows have space for some framing, representing the glazing frame, which can be made from boiler banding strip soft soldered in place (ideally using Comsol or Cupsol). This really does improve the appearance. There should be just a slight witness of this at the front face and if the rear is filed flush, then the glazing which I plan to detail later under 'improvements' should fit.

I like my models to still look a bit 'right' whist being driven by a sixteen-times too big driver, so I access the controls via a cutout in the roof and rear panels, leaving wide side sections in place. This looks much better than when (as some do) the whole roof and rear are removed. On this engine this means that the cab rear windows need to be split which is not ideal, but the split is masked by the coal guard bars. Also, on this engine, the lower part of the bunker extends into

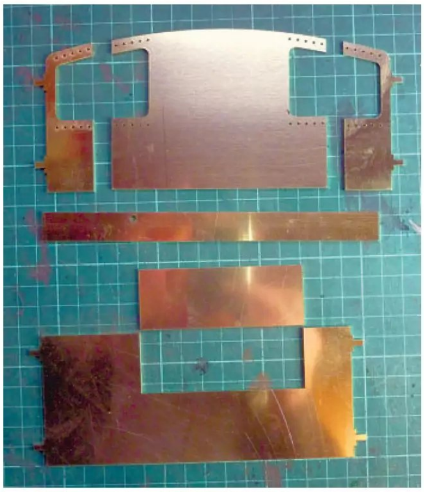


Photo 141: Cab rear and bunker front parts.

Title	M.E. Laser Part No.	Material	No. Required	Notes
Cab Front	34433	1.2mm Brass	1	
Cab Side	34434	1.2mm Brass	2	
Cab Rear Sides	34435	1.2mm Brass	2	
Cab Rear Centre	34436	1.2mm Brass	1	
Bunker Front	34437	1.2mm Brass	1	
Bunker Front, Hatch	34438	1.2mm Brass	1	3.156" x 1.171"
Bunker Rear	34439	1.2mm Brass	1	
Bunker Rear, Hatch	34440	1.2mm Brass	1	4.156" x 2.75"
Cab Shelf Strip	34441	1.2mm Brass	1	6.5" x 0.562"
Cab Roof, Front	34442	1.2mm Brass	1	5.25" x 1.437"
Cab Roof, Hatch	34443	1.2mm Brass	1	5.25" x 2.5"

the cab, leaving a full width shelf above waist height. To represent this the fixed sections of the cab rear and bunker front are made from three laser cut pieces, two pieces of the laser cut shelf strip and some 3/16" thin section angle, and the lift-out portion from two further laser cut pieces, a piece of the shelf strip and some 3/16" angle. Here is where the trimmed down DIY store angle may come in useful again. The laser cut parts are shown in **photo 141**. The shelf is the strip with one hole in it, which is for the brake standard, and this should be lined up above the hole in the bunker floor. The strip needs to be cut into three pieces to complete the job, two for the fixed and one for the lift-out parts. Tack rivet the fixed cab parts together using angle at the joints and use the tabs and slots to the two cab sides to get the positioning. Soft solder the panel joints, but not yet to the cab sides. Fit window frame strip as for the front, and ¼" angle at the bottom facing into the bunker (made from trimmed angle is neat). The cab can now be loose assembled as shown in **photo 142**.

Identify the cab rear lift-out section parts. Note that the lower, bunker, piece should be aligned to the right. As all parts are cut to nominal size these will need to be eased a bit in order to fit. Don't take too much off now as any excess may be useful when taking out small misalignments in the finished parts. Assemble with bits of angle and then soft solder, and add the window framing as before. File the edges to get a loose fit into the fixed panel.

The cab side and a half top view are shown in **fig 68**. The GWR had an annoying habit of putting curves on the corners of bunkers and, in Collet's time, at the roof line too. This must have surely been for appearance only as the metal forming and extra panels involved would have been more expensive compared to other, more sensible, railways' sharp corners. For us the best way to do the forming is to make a wooden former, anneal the metal and whack the rear corners with a hide mallet, just using a ball pein hammer where space is tight, and bend the roof section using the same block. The panel will distort when annealed, but this can be minimised by moving the flame around to heat evenly. Any distortion there is, can be eliminated when the panel is clamped tight and formed. The two cab side pieces have a strut across the cab doorway to limit distortion and in this and at the doorway top, tooling holes are provided which can be used to locate some pins in the block and these will then allow the panel to be rapidly and positively located each subsequent time.

Woodworking is something we metal-workers sometimes need to do, and I'll digress just briefly here. Where I live a men's shed was proposed, and this soon became the people's shed. As it was known that I made things I was collared to oversee workshop activities. Rather than sit around 'supervising' I started to make things for the workshop then, following the example of one member, decided to make something peculiarly Welsh, a love spoon. This, **photo 143**, was a big hit with my loved one. The reason for telling this tale is that I'd never done any ornamental carving before and so I learnt a few things, and I will share a couple. Firstly, sharp chisels and gouges make the job a whole lot easier. These are not just sharpened using a stone as I'd done in the past but honed or stropped until the cutting faces shine. Razor sharp. With sharp tools tiny shavings can be removed easily just by pushing the chisel. Mallet, begone! Woodworking suppliers will provide the necessary honing kit. Secondly, amateurs make mistakes, but unlike in the 17th Century, when Grinling Gibbons was doing his stuff, they can now be quickly, easily and nearly invisibly repaired using superglue.

The former block is made using the dimensions on the drawing and the front and rear cab pieces as templates. The length at the base should be 5 1/64" so that the front edge can align with the cab front to make positioning

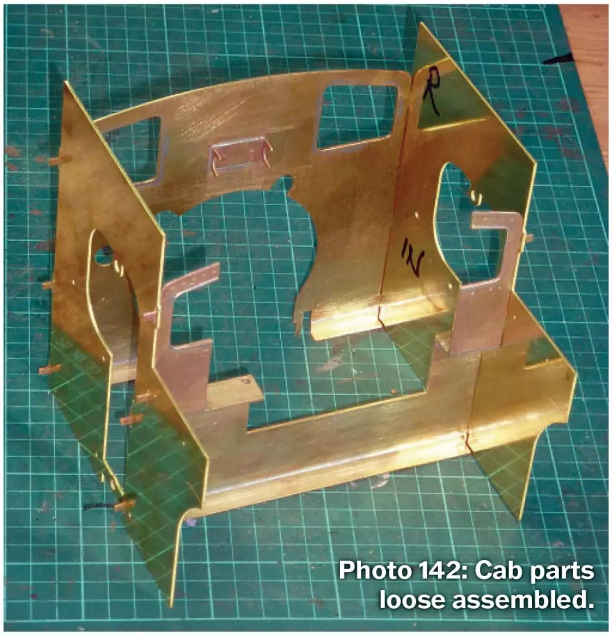
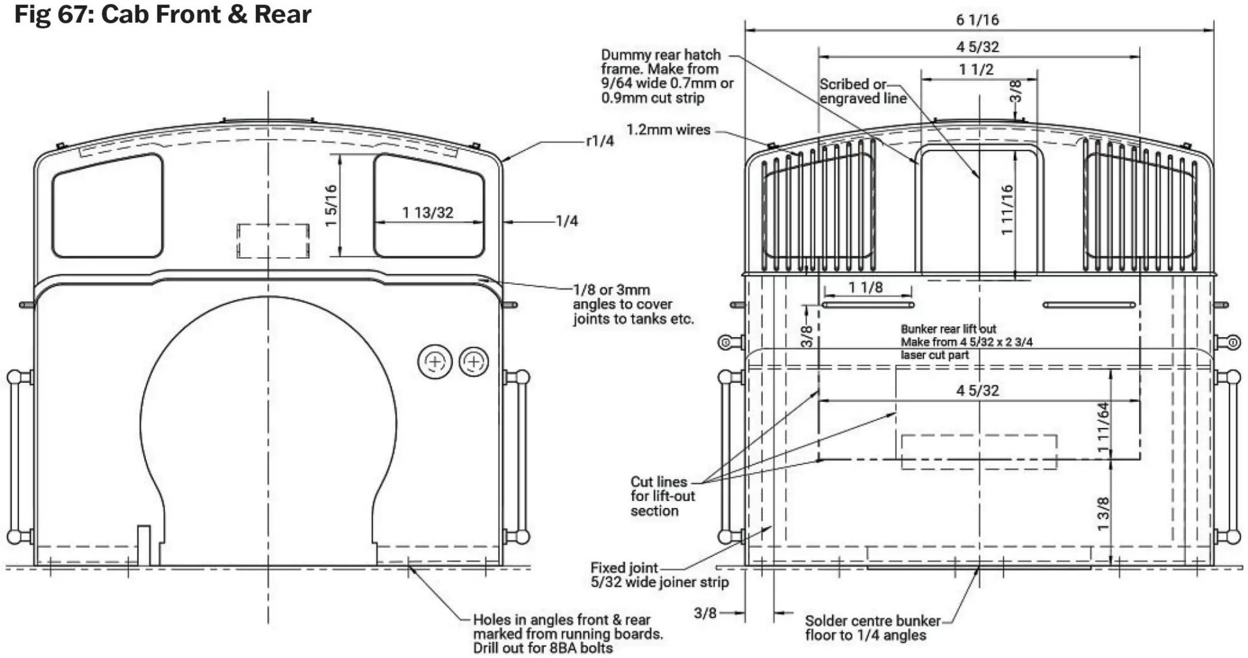


Photo 142: Cab parts loose assembled.

Fig 67: Cab Front & Rear



easy. **Photograph 144** shows a cab side with my former. The wood is mahogany salvaged from an old mantelpiece, but any hardwood will do and, I suspect, softwood too as we only use it once each side. The actual forming is much easier than you might expect. **Photograph 145** shows the panel clamped ready for forming. There is a slit to define the sharper corner where the rear curve meets the upper vertical. Whack the top section round then the bottom and the metal will overlap at the corner. One annealing did for most of the work, with another just to tidy-in. Bend the cab top corners round and check for fit to the front and rear panels and adjust if necessary. Silver solder the overlapping rear corner piece then file it to shape. Trim the rear corner's edges back to the 3/8" dimension and at the roof trim back to the edge of the rear panel side pieces.

The next job is to curve the centre roof panels and fit the front, fixed, one with its joint doublers and ledge strip to rest the lift-out on. The main panels are laser cut rectangles and are over-long so the flat bits you get at the ends when using rolls can be trimmed off. Use 3/16" angle, doubler strips etc. and tack rivets to fit the front panel. Check that the whole cab assembly is square before drilling through for the rivets as these will hold it so for soldering, **photo 146** shows the assembly ready for tack rivets and tabs twisting to hold it all together. Now squeeze the joints tight, twist the tabs, and soft solder it all together, being careful not to loosen any soldering already done.

Make and fit the rear lower angle at the bunker rear. The laser cut bunker rear panel is nominal width, has a large cutout for the lift-out panel, and is slightly over-tall to allow for forming and trimming. If the radiused corners of the bunker were trimmed to 3/8" then this panel will set them just the right distance apart. Curve the panel 'legs' to match the curve-out and sharp corner on the side panels. Tack rivet the panel in place using the lower angle and a couple of doublers. This is a fiddly job, and the doublers may need a tweak or three to get a good fit. The rivets have to be put with heads inwards (artery forceps useful) and use a long bar under the heads as a dolly when hammering them from the outside. These rivets will all be cleaned off flush so spacing and finish are whatever suits. The join itself is in the same place as on the real engine, so any small gaps or steps are prototypically correct. Tack rivet the bunker floor in place, nice and central and aligned with the bunker front panel, then soft solder all these parts. Finally, trim the rear panel to height.

For the lift out section, form it to match the bunker then cut and bend a joining piece (make from 1.2m sheet) to a channel shape so that it just slips between the bunker front and rear panels. Tack rivet it to the front and rear lift-out panels using the cab as a jig to get things right and note that the joiner should protrude about 1/8" below the panels, then trim and add the roof. Solder it all up then clean the edges to give a generous clearance sufficient to


Photo 144: Cab side with forming block.


Photo 143: My first ornamental carving, a love spoon.

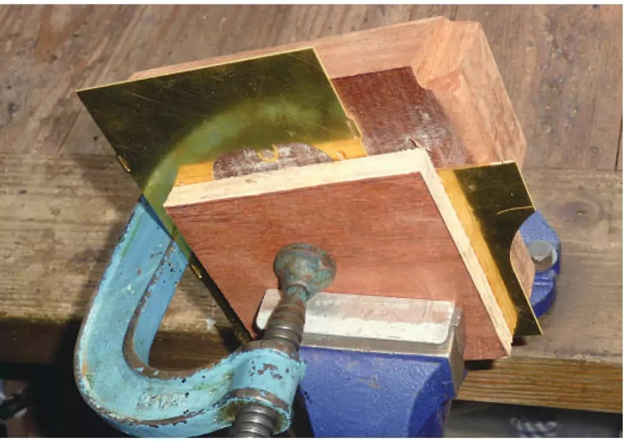


Photo 145: Cab side clamped for forming the rear corner.

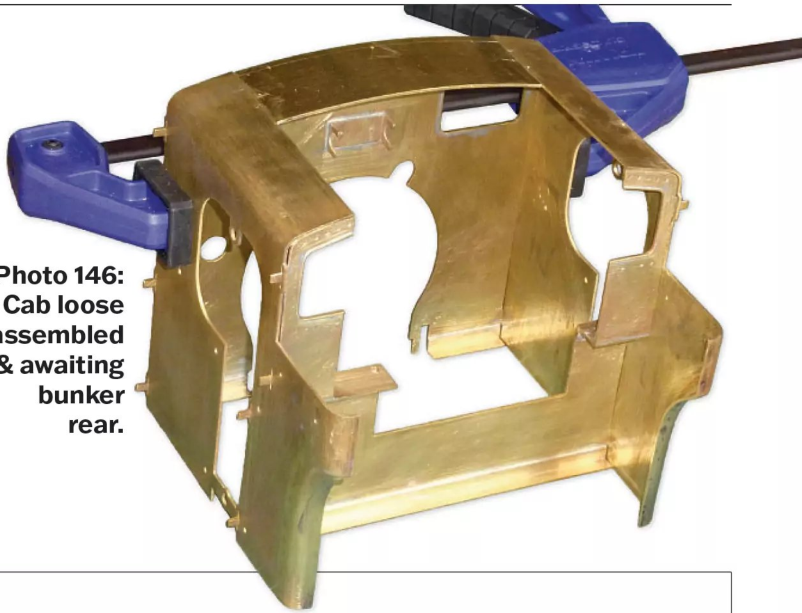
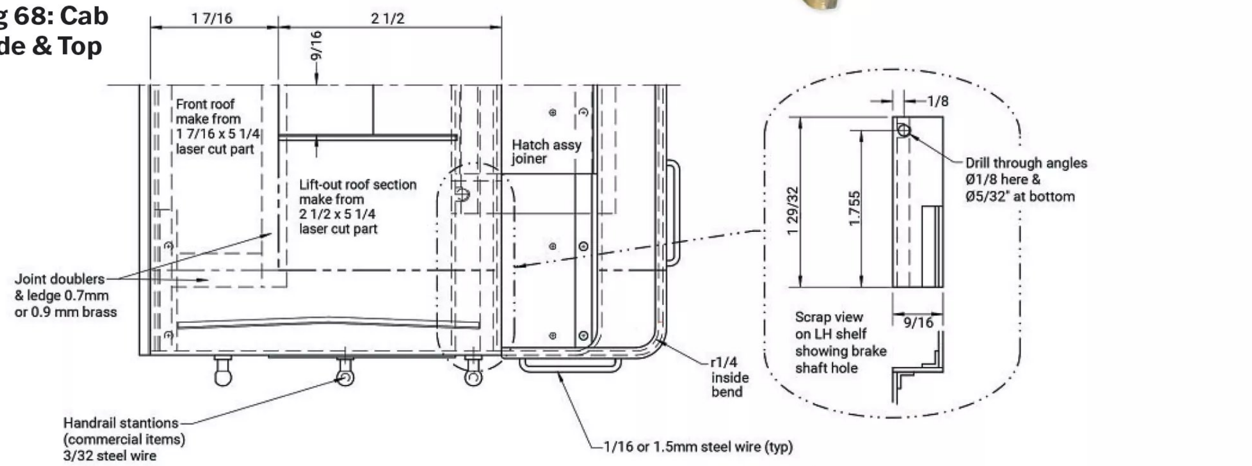
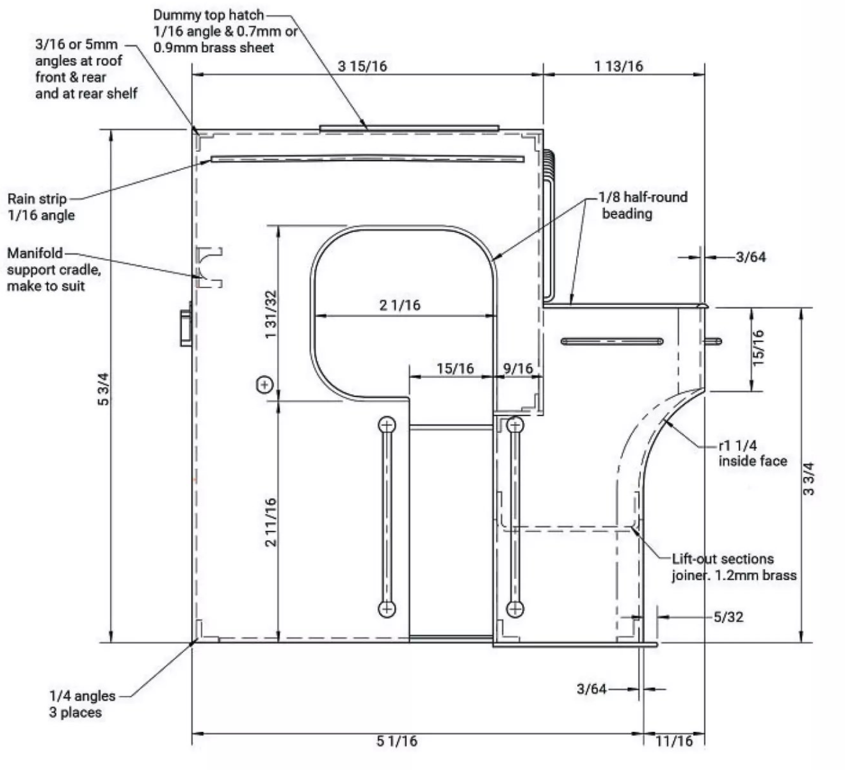


Photo 146: Cab loose assembled & awaiting bunker rear.

Fig 68: Cab Side & Top





get paint layers in. It's surprisingly easy to fit to the cab, just line up the bottom rear edge and rotate it in, where it is held by its own weight.

Now for the big clean-up, cleaning off all the joints with files and emery while there's not too much in the way. The cab at this stage, together with the lift-out, is shown in **photo 147**. The last stage is the trimmings, which are the bunker and cab door window edging, the handrails, the roof rain strips, the coal guard bars over the rear windows and, optionally, the two dummy hatches. For the edging the GWR had a special T-section extrusion which had a flange for riveting to the platework. For us there is only 'half round' brass. The cab window pieces can be bent to shape and more or less hold themselves in place, but the bunker needs 1/32" rivets as location pegs to keep them in place. It's just possible to drill edgewise into 1.2mm sheet to achieve this, if done with care. The coal guard bars can be done last and held in with Loctite or an epoxy, as it's rather risky to try with solder. Front and rear quarter views are shown in **photos 148** and 149. Eagle eyed readers may

Photo 147: Soldered and cleaned-up cab with lift-out section.

spot that the dummy roof hatch is in the wrong position, or if it is the right position then there should be a hole in the roof in front because it slides rearwards to open. I really must remember to refer to my drawings and not just go ahead with what I think is right. Lastly, mark the fixing holes in the bottom angles to match the holes in the running boards and floor and drill out for 8BA bolts. All that remains to be done now is to fit the angle which covers the joints between the tanks and boiler and the cab front, but this is optional and anyway must be left until the tanks and covers are fitted to ensure a good fit.

What's missing? Mostly rivets – as mentioned above the curved corners add complexity and the bunkers were built using several small panels all held together using lots of rivets. I'll give a layout for these under 'improvements'. It's worth noting that many of them cannot be closed because there's no access for a hammer, so they will need to be put in with Loctite anyway, so the delay is of little consequence. The other main item, already mentioned, is the window glazing. The handrail stanchions are too long but that's what came from the supplier and life's too short to make special ones. Finally, the brake handle should rotate through a curved housing in the cab rear. Without the housing then it can only be operated with the lift-out removed.

To be continued

Photo 148: Finished Cab front quarter view.

Photo 149: Finished Cab, rear quarter view.

Look out for your next issue of Model Engineer & Workshop

Number 4771 December 2025

On sale November 21 2025

Mark Noel reimagines Antoni van Leeuwenhoek's 17th Century microscope.

Jason Ballamy explains how he uses new technology to help his projects develop from concept to completion.

Alex du Pre shares his approach to tube-notching for fabrications.

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Precision Measurement of Squareness

PART 2

Mechanical engineering frequently involves measurement of angles. Warren Williams discusses using the comparator square described in our previous issue.

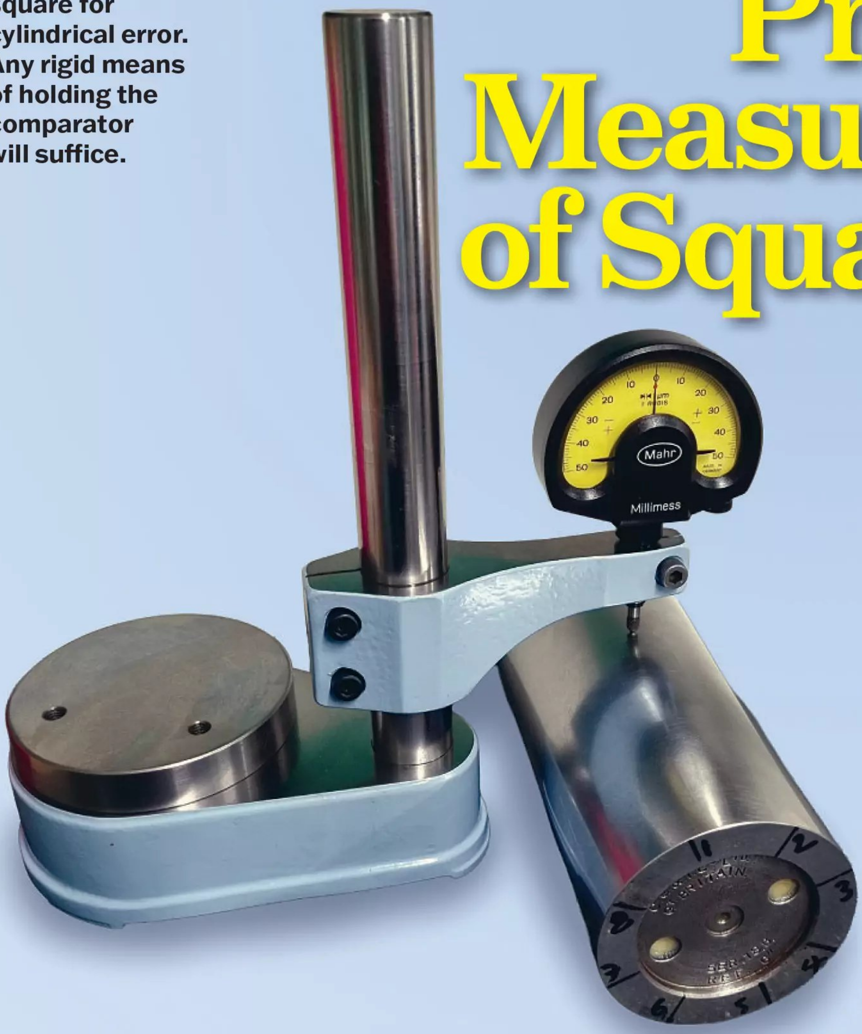


Photo 7: Surveying the square for cylindrical error. Any rigid means of holding the comparator will suffice.

Having designed and built the comparator we now come to its application. Two examples are given. Before looking at these examples some general principles of usage, for any application, are stated. The first is cleanliness. Making measurements as small as a micron or two requires everything involved in the measurement process to be scrupulously clean. This includes wiping any preservative oil from the base of the comparator, the item being measured, and the surface plate. The surface plate must be flat to within at least the level of accuracy sought. Determining surface plate flatness to a within a micron or so is likely beyond the capability of even a well-equipped home workshop. A practical mitigation to this problem is to limit movement on the surface plate of the comparator and the article being measured to as small an area as possible. The nature of the measurement process is to compensate for surface plate flatness error by incorporating that error into calibration of the comparator. A good plan is to not move the comparator at all once calibrated.

EXAMPLE 1 – CYLINDRICAL MASTER SQUARE CALIBRATION

The objective of this exercise is to calibrate the master cylindrical square shown in photo 1 (see *ME&W* 4769). The steps for doing so are as follows.

i. A suitable table to record the measurements is produced, **fig. 4**.

ii. The circumference of one end of the square is divided into approximately 45 degrees segments using a marker pen, **photo 7**.

iii. The square is surveyed for cylindrical errors, i.e., how parallel opposite sides of the cylinder are, using a suitably accurate dial test indicator (also known as a comparator) and surface plate as shown in photo 7. The square is rolled under the contact point of the indicator at each of the 45 degrees positions and the measurement recorded in the data table. This process is conducted near both ends of the square and also at approximately mid-length. The maximum difference in diameter at each of the 45 degrees positions determines how accurately squareness may be subsequently measured, using the method described above, recalling the method relies on parallelism of the sides of the measured object. More points than shown here could be surveyed should increased confidence in results be desired.

iv. After all important surfaces are again cleaned, the square is stood upright on the opposite end to which the identifying markings are applied. Marked point No. 1 is oriented towards the indicator contact point and the square is then slowly rolled about its vertical axis past the indicator contact point, **photo 8**, with the base of the square kept in constant contact with the roller situated between the square and the bottom of the comparator column. The indicator reading will increase from some initial value, reach a peak, and then recede. The peak value is recorded in the data table. The indicator does not need to be zeroed for these measurements because it is only differences in indicator readings being sought, not absolute values. The square is rotated to point No.2 and the measuring process repeated, and again, until point No. 8 measurement is completed. The indicator is then relocated to a lower height on the column to survey the same eight points at about mid-height. Finally, the eight markings are transferred to the opposite end of the square. The markings at the first end measured are carefully removed to avoid ink build-up interfering with measurements. The square is then stood on the surface plate with the first end measured, now facing down. Eight more measurements are then made as described above, and the results entered into the data table.

v. At this stage all the raw data to quantify the accuracy of the cylindrical square has been obtained and recorded in the data table, although not in convenient form. The inconvenience is to do with not having zeroed the indicator before taking measurements. It will be recalled from the description of the principle of measurement described above that zeroing is unnecessary. It is also not possible to zero the indicator at the measurement stage unless a laborious trial and error process is employed. Zeroing is easily accomplished though after all measurements have been taken and the results shown in fig. 4 have been processed accordingly. The zeroing process for the squareness values simply requires that the largest difference between diametrically opposite points is subtracted from differences between all diametrically opposite points.

From fig. 4 (data shown in the left-most situated three tables) it is seen that the maximum error in parallelism, over the height of the square, is 1 micron. This is the greatest difference in diametrically opposite pairs of measuring points, and the same deviation occurs at five different survey points. The errors are mostly variances in diameter between the end (top and bottom of cylinder) circles and the centre circle. The variances are all positive numbers, indicating the form of the square is generally that of a cylinder with some small barrel-shaped distortion. This error in parallelism reduces the accuracy of the measurement of squareness error because the method, as explained above, is founded on the assumption that opposite sides of the square are truly parallel. Quantifying parallelism error allows for its compensation when afterwards calculating squareness of the sides of the square to its ends.

In fig. 4 the centre column of tables records squareness data from measurements taken with the setup shown in photo 8, the base of the square contacts the surface plate, making it the reference surface. In fig 4 the right-most column of tables records squareness data from measurements taken with the setup similar to that shown in photo 8, but with the square now inverted, i.e., the top of the square contacting the surface plate, making it the reference surface.

Using the base of the square as the reference surface, the greatest error in squareness is -1 micron, measured at half height, and there is no discernable squareness error when measured at full height. The -1 micron squareness error suggests a waisted-centre shape rather than the generally barrel shaped cylindrical error concluded in the parallelism error measurements, however, parallelism and squareness errors are different and independent geometric parameters.

Using the top of the square as the reference surface, the greatest error in squareness is -1 micron. This same error occurs at half height and at full height. From these measurements it is concluded the square deviates from true squareness by a maximum of 1 micron over its full height, provided the square is truly cylindrical. It was ascertained however that the square deviates from true cylindricality by a maximum of 1 micron, and it has been established that that error detracts from the accuracy of squareness measurement owing to the squareness measurement principle employed. Although somewhat

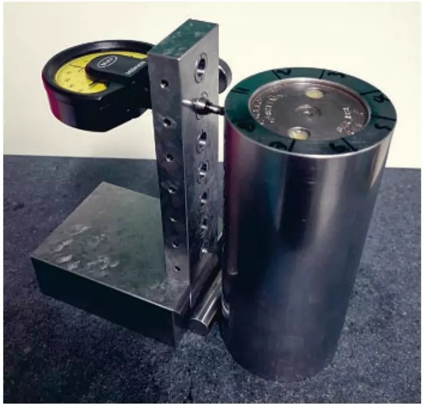


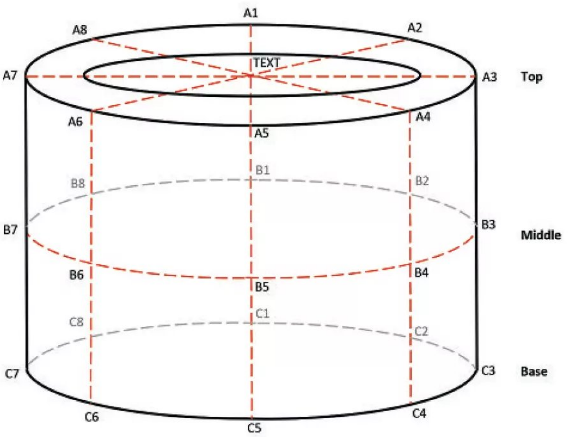
Photo 8: Surveying the cylindrical master square for errors relative to a true square.

Master Square Callibration

Dimensions in microns (micrometres) UNO

Identification: C.G & T. Co. LTD. SER 18B REF 6"
Nominal height and diameter: 5.9997" x 2.7580"
Date: 5/11/23
By: WPW

Maximum errors
Squareness to base: 1 micron
Squareness to top: 1 micron



Top Parallelism Check		
Dimension	Diameter	Dia - Min[1] Dia
A1 - A5	0	0
A2 - A6	0	0
A3 - A7	0	0
A4 - A8	0	0

Squareness Check, Base = Ref.		
Dimension	Distance	Delta
A1	0	0
A5	0	
A3	0	0
A7	0	

Squareness Check, Top = Ref.		
Dimension	Distance	Delta
A1	0	0
A5	0	
A3	0	0
A7	0	

Middle Parallelism Check		
Dimension	Diameter	Dia - Min[1] Dia
B1 - B5	1	1
B2 - B6	1	1
B3 - B7	1	1
B4 - B8	1	1

Squareness Check, Base = Ref.		
Dimension	Distance	Delta
B1	0	-1
B5	1	
B3	0	-1
B7	1	

Squareness Check, Top = Ref.		
Dimension	Distance	Delta
B1	0	-1
B5	1	
B3	1	0.5
B7	0.5	

Base Parallelism Check		
Dimension	Diameter	Dia - Min[1] Dia
C1 - C5	1	1
C2 - C6	0	0
C3 - C7	0	0
C4 - C8	0.5	0.5

Squareness Check, Base = Ref.		
Dimension	Distance	Delta
C1	0	0
C5	0	
C3	0	0
C7	0	

Squareness Check, Top = Ref.		
Dimension	Distance	Delta
C1	0	-1
C5	1	
C3	0	-1
C7	1	

Note 1 - Min Dia is min of A,B, & C values

Fig 4: Calibration record for master square, showing labelling of survey points and zeroed measurements for parallelism and squareness of sides to both ends.

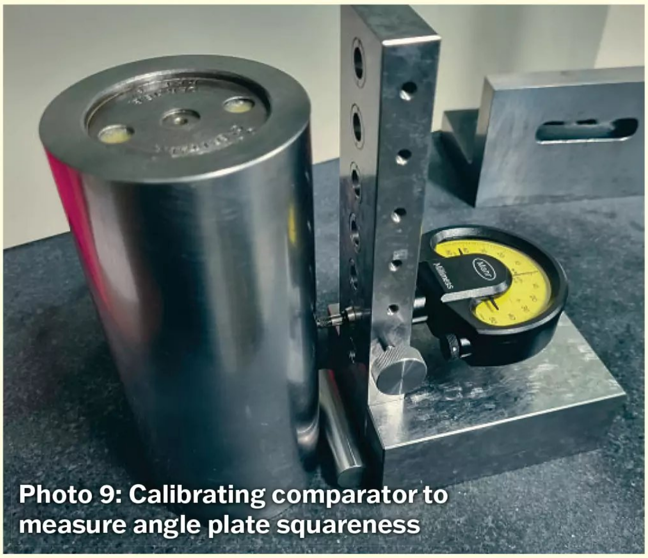


Photo 9: Calibrating comparator to measure angle plate squareness

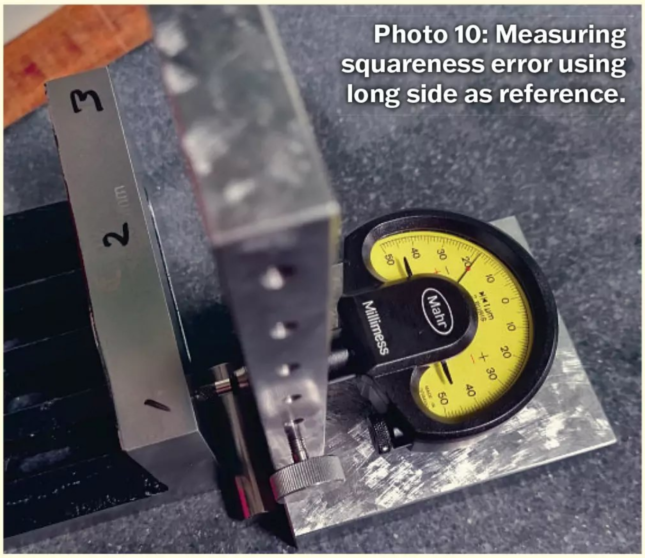


Photo 10: Measuring squareness error using long side as reference.

simplistic, a practical approach to compensating for cylindricality error is to add that error to the squareness error, resulting in an overall conclusion the cylindrical square is within 2 microns of true squareness, no matter how the square is used.

In the introduction to this article, it was stated the accuracy of a 6” BS 939 reference grade square was 0.000078”, equal to 1.98 microns, near enough to 2 microns for this exercise. The conclusion to checking the accuracy of Coventry Gauge and Tool Company serial number 18B reference grade square is that it meets the original specification, many decades after leaving the factory. In reaching this conclusion no account has been taken of measurement errors. A satisfactory repeatability check gives some confidence that source of error is small. Removal of the small surface blemishes found on the square when received has evidently had no material effect on the accuracy of the square.

The process of calibrating a cylindrical square in industry would differ from that described here. Although the same fundamental principle might be applied, there would be a more sophisticated approach to the whole exercise, especially measurement error compensation. There are alternatives to contact methods for measuring squareness, most notably, optical methods.

Measuring point	Error, microns	
	Long side (88mm) reference	Short side (75mm) reference
1	-18	-24
2	-18	-24
3	-17	-26
Ave of 1 - 3	-17.7	-24.7

Fig 5: Data recording deviation of angle plate from true square

EXAMPLE 2 – ANGLE PLATE CALIBRATION

This second example of using the comparator square concerns angle plate calibration. The item in question was supplied with information stating the angle plate is square to within 0.025mm, i.e., 25 microns.

The first step to measuring squareness of the angle plate is to carefully clean all surfaces and to check for burs. A few small burs were found. The burs were carefully stoned flat. The next step is to set up the comparator. This involves installing the indicator in the column at the correct height, which is as near as possible to the height of the side of the angle plate being measured first, and then using the master cylindrical square, now reassuringly of known accuracy, to set the comparator to read zero when square. Photograph 9 illustrates the setup with these activities having been completed. It is necessary to use a reference for squareness to measure the angle plate because the self-calibrating principle employed to check the cylindrical master square cannot be applied to the angle plate, the shape of the latter not including the necessary pair of parallel sides.

If both reference surfaces of the angle plate are perfectly flat, then only a single measurement is required to qualify squareness of an angle plate. It seems prudent however to take measurements using both long and short sides of the angle plate as references, i.e., the angle plate surface in contact with the surface plate. Squareness was measured at three points along the top edge of the angle plate for both sets of measurements. The first measurement is shown being made in **photo 10**. The needle of the indicator, lying in the negative side of the scale, indicates the surface being measured is further away from the indicator than a truly square surface would be.

In addition to taking the squareness measurements, an improvised test of surface flatness was conducted. If the reference surface of the angle plate is truly flat, then light downwards finger pressure against the surface plate, in any corner, will not move the comparator needle. This test did show some needle movement, up to about 1 micron, a rather unexpectedly good result. The equivalent flatness result when measuring the ends of the angle plate for squareness (the results of which are not reported here) were far less satisfactory, with one end rocking by up to 20 microns.

The squareness measurements for the two reference surfaces of the angle plate are shown in **fig. 5**. The data shows that the maximum error in squareness of the angle plate is -26 microns, meaning the angle between the two reference planes is slightly less than 90 degrees. Assuming a measurement confidence level of say, 1 – 2 microns, the angle plate is just on the limit of accuracy under which it was supplied.

CONCLUSION

In concluding this article, it can be said the original objective of the project, to verify the accuracy of a cylindrical master square using equipment largely made in a home workshop was achieved. The master square can now be used with confidence to calibrate the squareness of any item to reference grade accuracy.

Club News

Geoff Theasby reports on the latest news from the clubs.

I am still suffering under the misapprehension that the next magazine will be published a fortnight after the last. Then I feel something is lacking for the next two weeks and hoping to hear the sound of the letterbox. Oh, woe is me!

In this issue: radio, a 'trolley acc', the Mighty *Hood*, walking the dog, a high point, *Tapas* fugit? and a well-travelled train.

St Albans & District Model Engineering Society *Newsletter*, prints a very attractive picture of A1X 'Terrier', *Newport*, with matching coaches, a fine example of railway preservation. The Society's new containers have been moved with the help of a JCB telehandler. (A sort of crane-cum-forklift truck, M'Lud). Mike gave a talk on the BBC Microbit, programmed in Python. Don't Panic – the seemingly endless complaints by the computer that you haven't put enough/too many brackets and colons, are easier to resolve than you would think. Ian Bradley's book, Sharpening small tools is explained by Tony Ashgrove. In Curiosity Corner, ways of thinking are explained, using Google AI as a example. www.stalbansmes.com

And that's it! A week after sending off the last column, and I am up to date in the matter of CN? So, I hope lots of editors send me more copy, or readers will have to read my scurrilous gossip for three more pages…

Visiting the Wentworth Woodhouse classic car event earlier this year, we saw a couple of Fiat X-19, sports cars one of which appeared to have broken down. Very pretty cars, I think, but I presume the trouble was serious as they did not take part in the rally.

I am currently making a battery trailer so I can test run my locomotive on its own whilst I complete the driving trailer. This will enable me to walk alongside the machine around the track with a remote hand-held control box, like taking the dog for a walk. And it did! Ultimately, I was let down though. It managed 50 yards without my attention, then it derailed… I was looking forward to a machine with a good turn of speed, now that I have solved the shedding of the primary drive chain. An acceleration of 0-6 mph in 10 seconds would be good. I have identified a number of weak points in the design or construction of the machine, so I am rebuilding it better and more substantially and we'll try again.

Photo 1: Radio 'shack' at Elvington

In *Club News* 4767 I spoke of my discussion with Dr Jonathan Aylen (Correctly spelled), on the manufacture of Merlin engine crankshafts during WWII. I am pleased to say he has reached a point where he has been invited to present his findings to the Newcomen South Yorkshire meeting in January 2026. I look forward to it with interest.

My remarks in *Club News* 4768 about HMS Hood brought forth a response from Victor Croasdale, Very Interesting! He quotes Dr Ballard, *The discovery of the Bismark*; Angus Konstam, *British Battle Cruisers* 1939-45; Ernle Bradford, *The Mighty Hood*; and John Roberts, *Anatomy of the ship The battlecruiser Hood*; and not one mentions the cost of the ships' armour being a factor in her destruction.

Debs and I visited Elvington Air Museum, near York. It is much improved since my last visit many years ago. Editor permitting, a more comprehensive write up will follow. It is good to get close to these once state-of-the-art flying machines. In one small room was the radio 'shack', crammed with radio and radar artefacts, incorporating a mixture of WWII and modern equipment. Some of which worked… Deborah said it looked just like my basement setup. There was a great variety of aircraft on display from the radio-controlled models of WWI aircraft models hung from the NAAFI ceiling, to the anonymous and neglected looking artefact you see in **photo 1**. I assume the planes were radio controlled. They have visible mechanisms around the ailerons and elevators suggesting probably not control-line activated. **photo 2**. This unidentified, apparently neglected item of high tech puzzled me, photo 3. Reverse image searches found nothing substantially likely to identify it, do any readers have a suggestion?

The Victor tanker looked a massive beast, the more so because of its short-legged undercarriage. The Halifax is a fine reconstruction, these machines were rather neglected post-war, and there are few complete

Photo 2: Elvington radar beacon, or is it an rdf item?

models and no flying examples. I was most taken with the folding wings of the Blackburn Buccaneer and the Fairey Gannett. This latter having two turbine engines, contra-rotating propellors and a large radar dome. This ensemble made it look like a pregnant duck. The radar claims a direct descent from the ASV Mk 3 of WWII, and outlived the Gannet, and was subsequently fitted to the Avro Shackletons which lasted until 1991 in their role in maritime search operations. www.yorkshireairmuseum.org

Steam Whistle, August, from **Sheffield Society of Model Eand Experimental Engineers**, opens with Track Superintendent, Mick Savage beginning a series on building the Stuart 4 vertical engine. As we are a model engineering society, we should be doing some model engineering! Mick says that the recent Charity Hospital fund raising day raised £4,800. Several societies hold similar functions. “Gone are the days”, says Mick, “when ME clubs didn’t have much contact with the local community, behaving like a closed shop”. James Ardin designed and ran a driver training day for junior members. James had his first experience of driving a steam locomotive at the club track and is an occasional driver on the North Yorkshire Moors Railway. His day job is driving a tamping machine on the ‘Big Railway’. I wonder if his machine has a name? Many years ago, we enjoyed a trip to Carlisle on the Settle and Carlisle, (Albeit by DMU) after finding that there was a direct train service. On the way, we passed a tamping machine parked in the siding at Hawes Junction. I noted it was named after Thomas Telford, thereafter, known in my book as *Thomas the Tamp Engine*. Mike Peart wrote on the opening of the Stockton & Darlington Railway, 200 years ago. Derby locomotive works, run by Alstom, held an event at their factory where many locomotives, restored and modern, were on display celebrating 200 years of Railways. The event lasted three days and was entitled ‘The Greatest Gathering’. www.sheffieldmodelengineers.com

The Gauge 3 Society, *Newsletter*, Autumn, has Chairman Cliff Barker announcing that next year’s AGM and Annual Show will be at the British Motor Museum in Gaydon, Warwickshire. Ian Harper writes on the Gauge 1 North gathering at Bakewell. Jon Nazareth scratch built a horsebox, When he first saw the plans, he thought that it looked like a sugar cube. Now that he has built it, he still thinks that, and it makes him happy. Tim Gleed-Owen discusses the use of gravel boards for his garden track bed, whereas John Tuckett made a new layout based on St Pancras, and John Taylor makes a pantograph, for a class 06 diesel engine. (Spot the deliberate mistake?) www.gauge3.org.uk

Blastpipe, September, the **Hutt Valley and Maidstone Model Engineering Society** joint newsletter, begins with a photo of the business end of a Shay locomotive, but Editor, Claude Poulsen cannot remember whose it is. Claude also says that he has enlarged the newsletter in order to accommodate larger photographs. Lachlin visited Europe and reports back on the railway aspect of his trip. He shows a picture of the Stegastein viewpoint, 30 metres long and 650 metres above the fjord. You would not get me on there if you paid me. It reminds me of the visit to the Oslo Olympic ski jump tower… I dared not stand on the floor, at the top,

Photo 3: R/C models in NAAFI

with windows down to the floor, but hesitantly peered over the edge of the stair well then descended with trembling limbs. Peter Targett has designed a radar-based signalling system. It can detect three trains per unit , and is intended to allow bidirectional operation on a single line by detecting the physical presence of trains on a length of track. Most of the parts for one unit cos about NZ$50. www.hvmes.com

Bradford Model Engineering Society's *Monthly Bulletin*, September, covers the Steam Toys and Meccano Show, which took place at Leeds Industrial Museum. Brian May brought his Stirling engines, but on one of them, the flame kept going out. After some sleuthing, an open window was found to be the cause, and when this was closed the model sprang to life again. In the Meccano section, Haroun had a large display, including a Meccano model built in 1926 by a Mr Sam Bentley, of Bingley, of a Corliss tandem compound engine. It won a prize of 3 guineas and appeared in *Meccano Magazine*, July 1930. The Society took a stand at the show, and David Jackson with Road Vehicle News, visited the show in Armley, Leeds, where a double-decker model bus caught his eye, as did a working, 3-D printed, Fowler traction engine. A caption competition (photo by Bob Beach) shows a gentleman holding a large syringe in a menacing manner. Several ideas come to mind, but I am not a member and so not eligible to compete. www.bradfordmes.uk

Reading Society of Model Engineers, *The Prospectus*, September, contains an analysis of Mallard's claim to fame of 126 mph, and its detractors, together with other claims or locomotives or countries. The publication also contains a healthy sales section and a request for the ID of a pictured lathe. www.rsme.uk

Photo 4: 1935 Chevrolet at the Sheffield's Classic Car show.

York City and District Society of Model Engineers, *Newsletter*, opens with Chairman Brian Smyth writing 'musings from an old engine shed', including specific items from the club's illustrious past. Some time ago, Brian wanted to increase membership, then languishing at around 150. It had not changed materially in recent years. Clearly, he has succeeded, as membership now stands at 232. Mike Pinder asks 'what's in a name?' Referring to Sir Nigel Gresley, Mallard and other related items; Clifford Hudson pays tribute to the silent members who pay the subs but do not attend the track. They are just as welcome and the money is always useful. www.yorkmodelengineers.co.uk

Gauge 1 North in Bakewell was good, although I seem to think that there were fewer traders this year. Nothing quite caught my eye and from memory there were more traders in previous years. However, it is good to see to see working models and imaginative layouts.

This is not the image I get when I find that a car is a Chevrolet, seen at Sheffield's Classic Car Show. I'm thinking, 'Impala', tail fins and spongy suspension, **photo 4**. And now a bit of 'cultcha' from here in the north:

The shades of night were falling fast,
when through a Pennine village passed,
a youth who bore, mid snow and ice,
a banner with a strange device,
"Sheffield Model Engineers!"

The Whistle, Sept/Oct, from **British Columbia Society of Model Engineers**, suggests we look for 'Sweet New Flavour' on YouTube, it shows a 5-inch gauge 'Big Boy'. Last year, a momentous train travelled from US to Canada and Mexico, an event few thought would ever happen. Daniel Ahadzadeh writes about the tour. #2816, a 4-6-4 'Hudson' was the locomotive heading the train, and Daniel briefly covers the locomotive's history, then the tour itself. CPKC have a video of the Final Spike, well worth a look. Consulting an online map, I find it is about 500km NE of Vancouver. www.bcsme.org

WW2 aircraft engines were started electrically using a 'Trolley Acc' (Accumulator) which was a couple of batteries on a small 2 wheeled trolley. Here is a more modern version **photo 5**.

Photo 5: A somewhat more modern 'Trolley Acc'.

For those contemplating sending me news or publications, my e-mail address is geofftheasby@gmail.com. And finally, If someone were to be very familiar with a university site and the activities within, would you say he was *Campus Mentis?*

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TOOLS AND MACHINERY

Halifax 5" lathe, old but useable, it has some historic repairs, comes with 5" O three jaw chuck, drill chuck and some tooling, has power feed but no change wheel set, the motor needs wiring, £300. **Tel. 07768885343. Great Yarmouth.**

American Walker Turner 4-speed single phase ½" bench drill. V. good condition, £160. **Tel 07989 928395. Stamford.**

Unmodified Denford Novamill c/w control cabinet, spare quick change tool holder, programme disc & manuals. Fully working or suitable for upgrading. Collection only. £800. **Email: billandjane.hirst@btinternet.com. Carlisle.**

ER32 Collet chuck with Myford ML7/S7 threaded back plate. ER32 Collet chuck with Myford ML7/S7 threaded back plate. This is an ARC EUROTRADE collet chuck 100mm diam, 72mm register, 84mm PCD mounting holes. It's mounted on a ChronosTools back plate to suit Myford ML7/S7 spindle. £45 inclusive of postage or £35 without back plate. **Email: johnstij@yahoo.com. Newcastle Under Lyme.**

Kennedy Hexacut model 60 powered hacksaw in excellent working order that I would like to sell as I no longer use it. I will put some pictures up as soon as I get a chance but please contact me for further details. I am open to sensible offers and happy to post at your cost. £125. **Tel: 07714992308. Email: doug.wardle@icloud.com. County Durham.**

Harrison M300 3 phase lathe for sale. Comes with a few heavy chucks. Has had just light use as been used at secondary school only. £2200. **Tel: 07449 498650. Email: mjred93@outlook.com. West Cornwall.**

Contact probe & Edge Finder. Refurbished Job Contact Probe. LED type with 20mm dia. shank with 6mm dia. probe. (two available). Combined metric (4-16mm) & imperial (1/8-5/8in) double taper collet set with MT2 & MT3 collet chucks & C spanner. £50. £75. **Email: billandjane.hirst@btinternet.com. Carlisle.**

Myford Dividing Head. Myford Dividing Head with 2 discs +2 home made discs and instruction book. £350 or near offer. £350. **Tel: 7943939210. Near York. Email: eric.toolan2042@gmail.com**

Findlay Wilfin and sons "Electrolathe" 1940s/50s In perfect working order. £700. Tel: 07593693072. **Email: katieloustiles@gmail.com. Dalgety Bay, Fife, Scotland.**

MODELS

3 1/2" Gauge Conway n.g. locomotive. Nearly all parts made but not fitted, including boiler, platework, frames, wheels, chimney, dome, valves, photocopy of M.E. drawings and articles. Photos available. £200. Prefer Buyer collects. **Tel.07710204380. Fareham Hampshire**

5" gauge Terrier Previously run but was stripped for painting. No paperwork with boiler Chassis still air running. A really nicely made and detailed loco. Happy to post £1800. **Email: marc2citroen@yahoo.co.uk. Heathfield, East Sussex.**

PARTS AND MATERIALS

w3 ½" gauge Bantam Cock boiler materials, barrel 4 ½", flanged plates etc., plus extras, £120. **Tel 07989 928395. Stamford.**

1 1/2" Allchin traction engine, complete set of castings, gears, laser cut parts, drawings, etc. Including a brand new boiler. Total cost over £3600. The lot for £1795. Buyer collects, weight over 30kg. **Tel: 07940 830170. Email: dah@uwclub.net. Stockport.**

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