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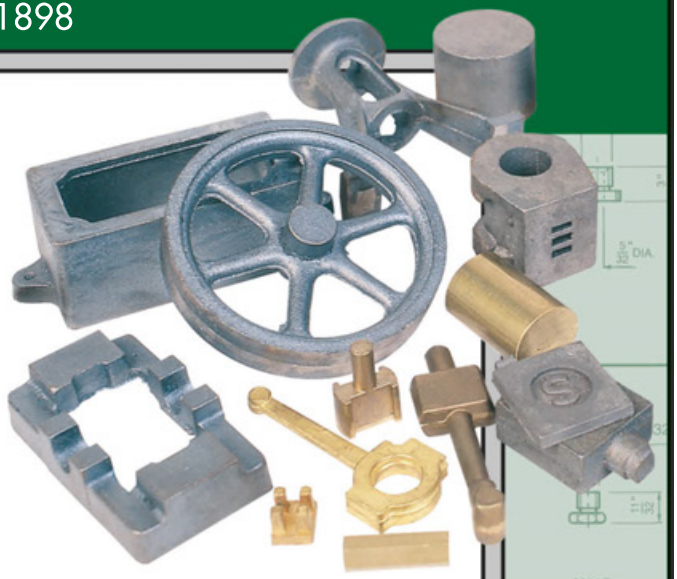

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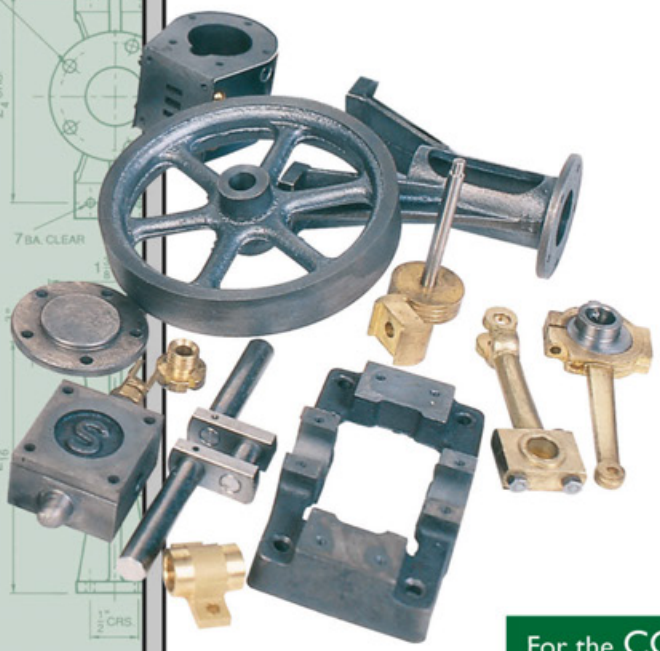

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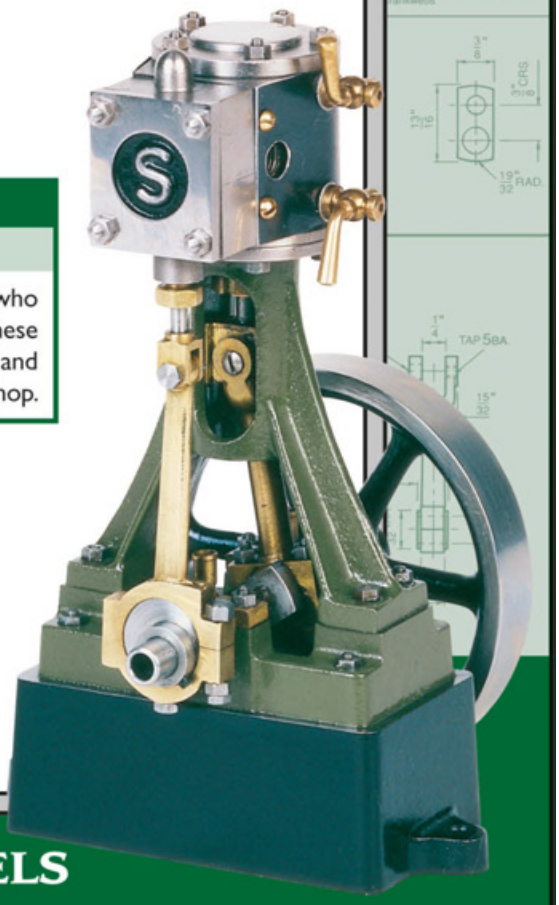

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MAY 2021 Volume 42 Number 11

ENGINEERING in Miniature

FRONT COVER

Happy in his work was this participant in the 7¼-inch Gauge Young Engineers weekend held a few years ago at the Bedford MES. In this issue we announce the launch of a new bid to increase the number of young people enthused by engineering. *Photo: Nigel Freestone*

EDITORIAL

Why it is vital to find the next-generation engineers

Welcome to the May EIM and as I write the sun is shining through the office window on a day of record temperatures for the end of March, and there is a real sense of optimism about. Across the UK the lockdown rules are easing, amid real hope that it will be permanently this time and we can go back to doing such things as enjoying our hobby in the company of like-minded friends. Events are even starting to trickle in for the club news pages – how long before we can resuurect the *Club Diary* page I wonder?

There is a real 'next-generation' feel to this issue, extending beyond a second successive cover image showing young model engineers enjoying the hobby. Three features this month are contributed by young writers – as well as Matthew Kenington continuing his beginner's oscillating engine build (and helping his dad Peter with disaster-rescuing chemistry...), Sol Johnson describes his work on the Mid-Cheshire SME's Sandiway Miniature Railway, and Sam Ridley continues to turn a part-built Winson kit into his first steam loco. Common to all three is a real enthusiasm for the hobby, discovered by actually being encouraged to try it out, and the problem is there are not enough of their fellow young people following a similar path.

Model engineering is widely described as an 'old-man's hobby' – wrongly we feel, there are many enthusiastic model engineers of all ages. But yes, it's likely that the majority of the EIM readership will have had their Covid jabs by now and some of you may wonder why there is so much fuss about getting youngsters into the hobby.

The fact is, however, that the traditional model engineering base is not going to be around for ever, and the next generation needs to be cultivated now. This is not just to ensure the hobby both survives and flurishes in future years but for wider reasons, ensuring enough people are encouraged to follow engineering careers at a time that numerous studies reveal a lack of new engineers in industry is becoming a real issue. 'Creative' and 'lifestyle' careers have never been more popular but we will never be able to exist without engineers.

Therefore we welcome the new 'Train 2 Train' initiative, described in this issue by John Arrowsmith (himself a great advocate for young engineers). Involving big players in the heritage movement, Train 2 Train aims to identify and crucially solve the issues preventing more young people getting into engineering. It deserves all our support, to safeguard our hobby's future.

Andrew Charman – Editor

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Making Muncaster's Entablature Engine

The latest construction project from EIM's resident Muncaster enthusiast is something a little more complex and also rather attractive.

BY **GEOFF WALKER** Part one of two

I would like to have made this steam engine a few years ago, but at that time I was an inexperienced model engineer and had doubts as to whether I could build it to a satisfactory standard. Some years later, I'm still a beginner but after making three oscillating engines and a simple slide-valve engine I felt sufficiently competent to take it on. The complete engine can be seen in Photo 1.

The engine is one of the short projects in Henry Muncaster's book, *Model Stationary Engines*, published in 1912. It is one of the simplest slide-valve engines in the book and is unusual in that it is inverted with the cylinder mounted on the base plate and the crankshaft overhead on an Entablature. This is an architectural term, a legacy from the Graeco-Roman era – described in its simplest form an Entablature is an upper horizontal member or platform supported by columns.

From Muncaster's brief notes he describes the engine as a type "used many years ago in the 19th century but rarely seen nowadays". Photo 2 shows the orthographic drawing from his book.

In his 1957 review of Muncaster's book Edgar T Westbury adds much more detail about the history of this form of engine. His articles, including section 7 on the Entablature engine are certainly worth reading whether you intend to make this engine or not. The articles are freely available on the internet and a basic search using the terms E.T. Westbury/Muncaster engines will lead you to them.

I am not the first and will certainly not be the last to model this engine. I have seen a few fine examples of the design, including one scaled up from the original sizes and built to an excellent standard.

I personally like the original scale and therefore the model is built to much the same imperial sizes as in the Muncaster drawings. For most of the engine it is relatively easy to convert to metric sizes, which I have done, but for various reasons explained in the text I have found it difficult to avoid some use of imperial sizes as well. When necessary I will give a metric equivalent for each imperial size.

Apologies in advance for my ▶

PHOTO 1: The completed Entablature engine – an attractive model to build.

PHOTO 2: Muncaster's original drawing published in 1912.

FIGURE 1: The general arrangement of the engine.

All photos and diagrams by the author

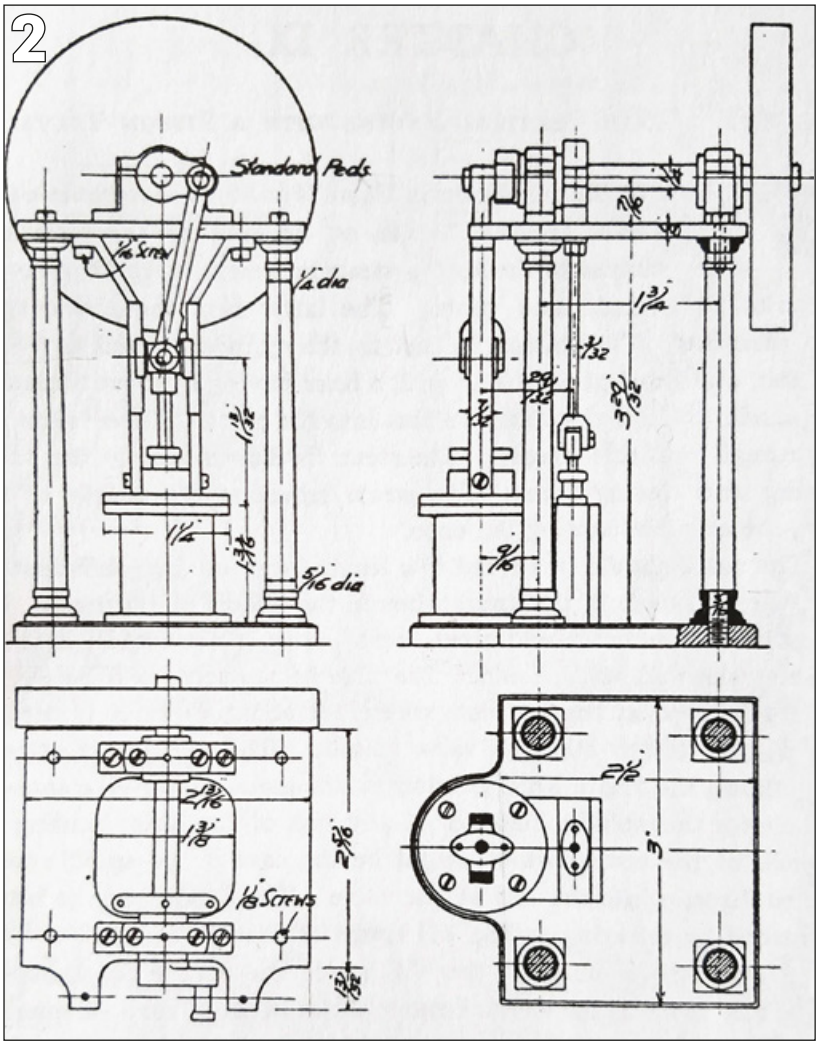


FIGURE 1
General arrangement
All drawings to approx full-size

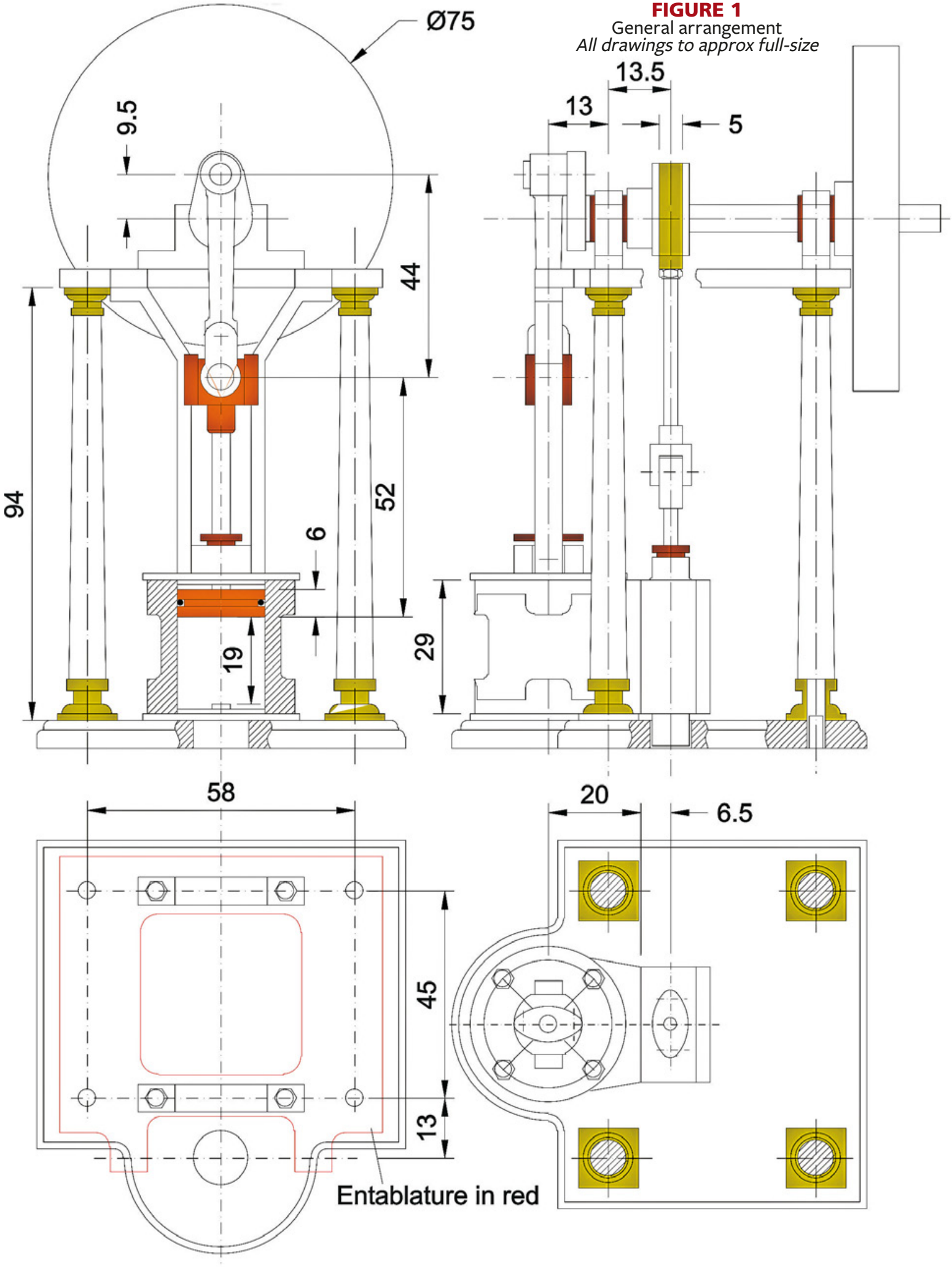
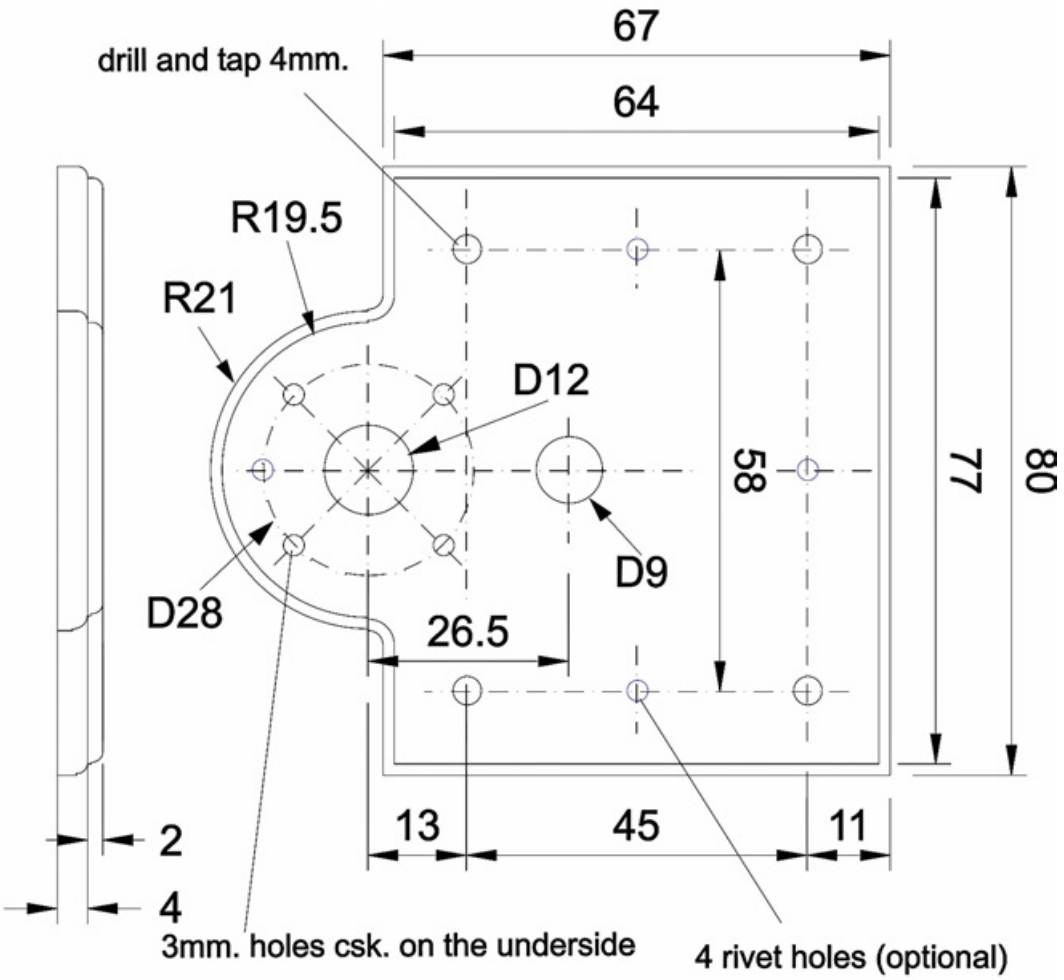
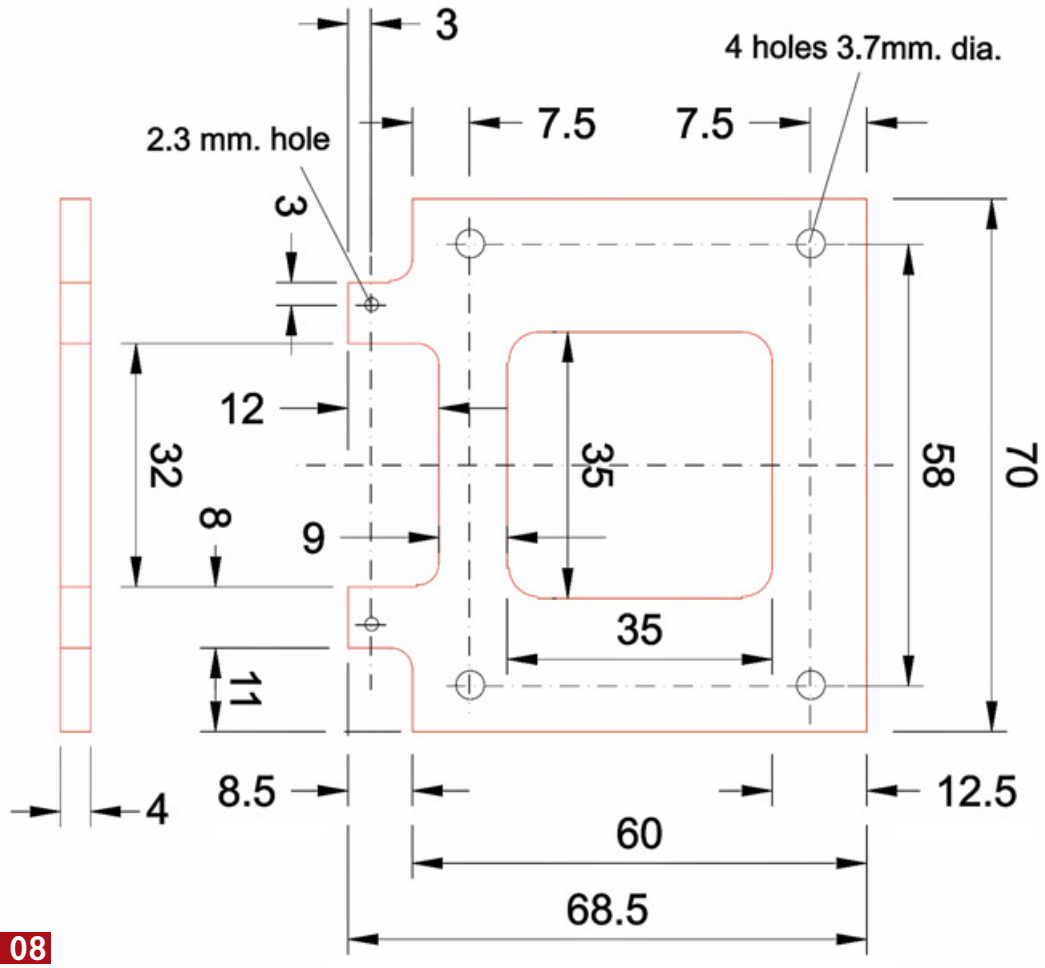


FIGURE 2
Base and entablature plates





drawing style which is broadly speaking conventional but often the convention is 'mixed'. My aim is to communicate through text, drawings, and photographs which I hope for most readers will be the case.

Equipment-wise, a lathe, milling facility, a pillar drill and a small selection of hand tools will be needed. The lathe work can be carried out on most lathes up to and around 3½-inch centre height which of course includes the mini lathes made by Cowells, Seig, Unimat, Taig and others. A small milling machine would be good for most of the milling tasks.

In this article it is not my intention to give fully detailed build instructions. My aim is an article which will be of interest, provide enough information and hopefully inspiration for any prospective builder. Any machining or construction methods are just my way of working. There are of course always alternative ways.

The materials I have used are what I feel comfortable with and at times what I have available. Alternative materials are of course acceptable such as brass for gunmetal.

The article is for all model engineers but principally for beginners – I am aware that some of the latter will have a wide range of equipment and others will not be so lucky. My workshop is modestly equipped so any guidance will be given with that in mind and where I feel it may be of real help.

In this issue, part one covers most of the fixed parts for the engine.

Stuart 10V parts

One of the things I noticed about this Muncaster engine is that the bore of ¾-inch and stroke size, also ¾-inch, are the same as on the popular 10V engine produced by Stuart Models (www.stuartmodels.com). The 10V cylinder casting is a similar size to the one in the Muncaster drawing so I decided to use one for this engine.

The Muncaster drawing gives no details about the cylinder ports, valve size or the throw of the eccentric. The 10V casting has exhaust and inlet ports cast in the port face so it would therefore make sense to use the Stuart 10V sizes for the valve and for the eccentric. A 10V valve could be made from stock material but my choice was to buy one from Stuart Models.

I also decided to buy the flywheel and a short length of brass extrusion to make the eccentric strap. The extrusion, the valve and the cylinder casting can be seen in Photo 3.

The cylinder casting is the only essential part to buy, however the valve would be desirable and particularly so as Stuart is now supplying it fully

machined and ready for use. The 3-inch flywheel could be fabricated or bought elsewhere, and the strap can be made from stock material.

For anyone deciding to make this engine I would suggest obtaining the following companion read to assist with the build and assembly. Andrew Smith's book *Building a Vertical Steam Engine*, first published in 1977 gives detailed instruction on how to build a Stuart 10V. The book therefore covers all 10V machining and of course those elements relevant to this engine. There are also instructions on how to set the 10V valve timing which will be much the same as the valve timing for this Muncaster engine.

Other books are available as are other sources where information on the 10V can be obtained including of course the internet. I will give sizes for the Stuart parts used in this engine where they differ from the Stuart dimensions. For all other sizes refer to the companion read.

Figure 1 is a general arrangement which confirms the basic layout of the engine and as can be seen is in the same format as the drawing in Photo 2. The drawing is not fully detailed but gives key sizes, which include the crank throw of 9.5mm and the stroke of 19mm. The piston is 6mm long, the bore 19mm and the milled port recesses at the ends of the cylinder are 2mm deep. Note the overall length of the cylinder which is 29mm.

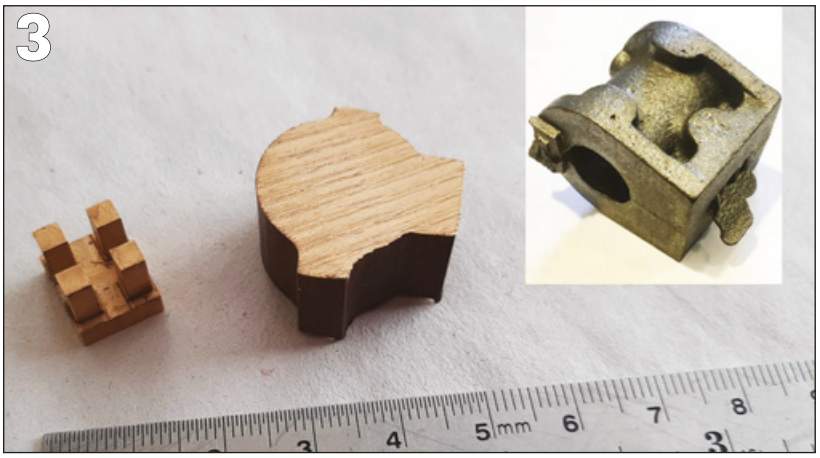
The plates

The entablature plate is shown in red to indicate the position in relation to the baseplate. I must emphasise how important it is to align these two plates accurately as shown on the drawing. Any significant misalignment will make assembly of the engine a difficult process.

In Figure 2 the baseplate and entablature plate are shown detailed with the entablature again outlined in red. The baseplate is made up using two pieces of mild steel, 2mm and 4mm thick. Mark out then cut/mill them to shape and file the radii on the upper edges. Prior to joining them together mark out each hole position on the top 2mm plate **except** for the four column holes which are positioned later by spot drilling from the entablature plate. I have shown the plates riveted together with countersunk-head rivets, however these are optional and if preferred any suitable adhesive may be used.

Prepare the entablature plate as shown including the four column holes and the two fixing holes for the crosshead guides. Clamp this plate to the base plate with toolmaker's clamps ensuring that they are accurately positioned together. The

"It is unusual in that it is inverted with the cylinder mounted on the base plate and the crankshaft overhead on an Entablature..".



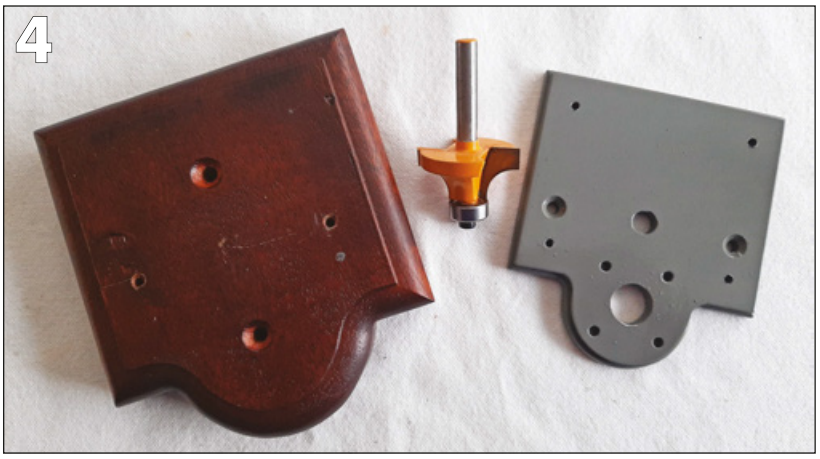
cross-over reference point is the centre of the 12mm hole. If you have X and Y centre lines marked on the entablature and base they should each be aligned carefully to ensure this position is correct.

Spot drill through the four column holes and then separate the plates. Drill each hole in the base 3.3mm diameter and then tap each one with a 4mm thread. Do take care to ensure the four holes are tapped dead square to the face.

Drill the remaining holes in the baseplate and add two countersunk holes for wood screws to attach to a wood plinth (see photos 4 and 6).

The wood plinth and baseplate can be seen in Photo 4. The router bit in the photo has a ⅜-inch (9.5mm) radius. The plinth is made from Mahogany, 20mm thick and is stained and satin varnished.

Referring to Figure 3, the initial turning operations on the columns are straightforward. One end is reduced to 4mm diameter and then threaded, while the other end is drilled with a 60-degree centre drill and then further drilled and tapped for a 4BA screw. Take care with the threading, the 4mm studs must be



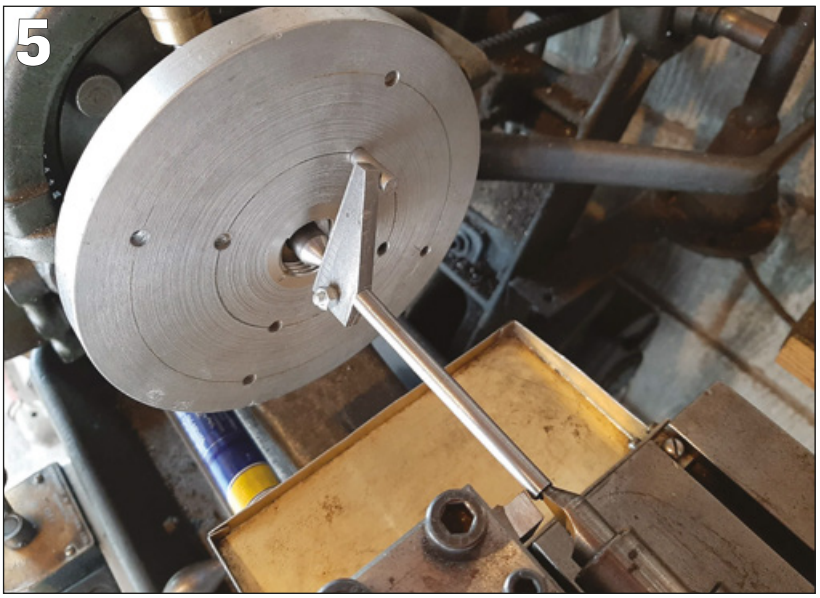


FIGURE 2: Arrangement of baseplate and entablature plate.

PHOTO 3: Stuart 10v engine parts employed in the engine.

PHOTO 4: Base parts and router bit.

PHOTO 5: Making use of a bespoke lathe carrier to turn the columns.

true to the centre line of each column.

The taper of the columns presents a problem as being quite long and slender they need to be machined between centres on the lathe. A bespoke lathe carrier may be used as shown in Photo 5 and Figure 3.

With the assembly shown held between centres, bring the lathe tool up to the side of the column and set the dial on the cross slide to zero. The dial can now be used to gauge the offset of the tailstock by 0.75mm. At this offset the taper shown in Figure 3 from 8mm diameter to 6.5mm will be generated. A knife tool is a good choice for this operation and note the half centre in the tailstock which gives additional clearance for the tool.

The brass bases and capitals can be turned from square stock or in two parts using 1.5mm thick brass plate with 10mm and 8mm round stock. The overall lengths of each, 9mm and 6mm, are important, the form and diameters less so.

A lot of the details in Figure 4 are of the cylinder and the related fixed parts. Note the length of the cylinder is 29mm, the distance from centre line to valve face is 20mm and the cylinder bore is 19mm diameter.

The valve chest is secured to the cylinder with four 6BA bolts. The holes in the valve chest and the cover plate are 3mm diameter which is a clearance size for 6BA.

The bolt holes are positioned so the bolts pass through the thinner section of the cylinder casting. Drill the holes in the chest and then clamp to the cylinder and spot-drill the hole positions on the port face. These are drilled 2.3mm and then threaded 6BA, only a taper tap will be needed.

"The taper of the columns presents a problem as being quite long and slender they need to be machined between centres on the lathe..."

FIGURE 3: The columns and capitals.

FIGURE 4: Cylinder and valve chest.

FIGURE 5: Main bearings and pedestals.

PHOTO 6: rear view of the engine showing the exhaust port.

Complete the cylinder using sizes from the Stuart drawings in Andrew Smith's book. The brass inlet pipe can be seen in Photo 1 and the small brass stub exhaust in Photo 6. The inlet is 3⁄16-inch diameter turned down for a 4mm thread screwed into the valve chest and the exhaust 9mm diameter turned down to ¼-inch x 32tpi to match the thread in the cylinder block.

Valve chest

To make the valve chest prepare a piece of cast iron, sized 40mm x 25mm x 12mm. Next cut the rectangular hole as shown on the drawing. Mark the middle of the gland ellipse boss then holding the piece in a four-jaw chuck centre this point. Drill 2mm diameter straight through the piece and then ⅛-inch and 6mm as shown.

Reverse the piece in the chuck, centre the 2mm hole and then turn the 8mm diameter boss. Turn up a small plug and Loctite in place. Remove most of the metal around the ellipse by sawing/milling and then finish by filing to shape.

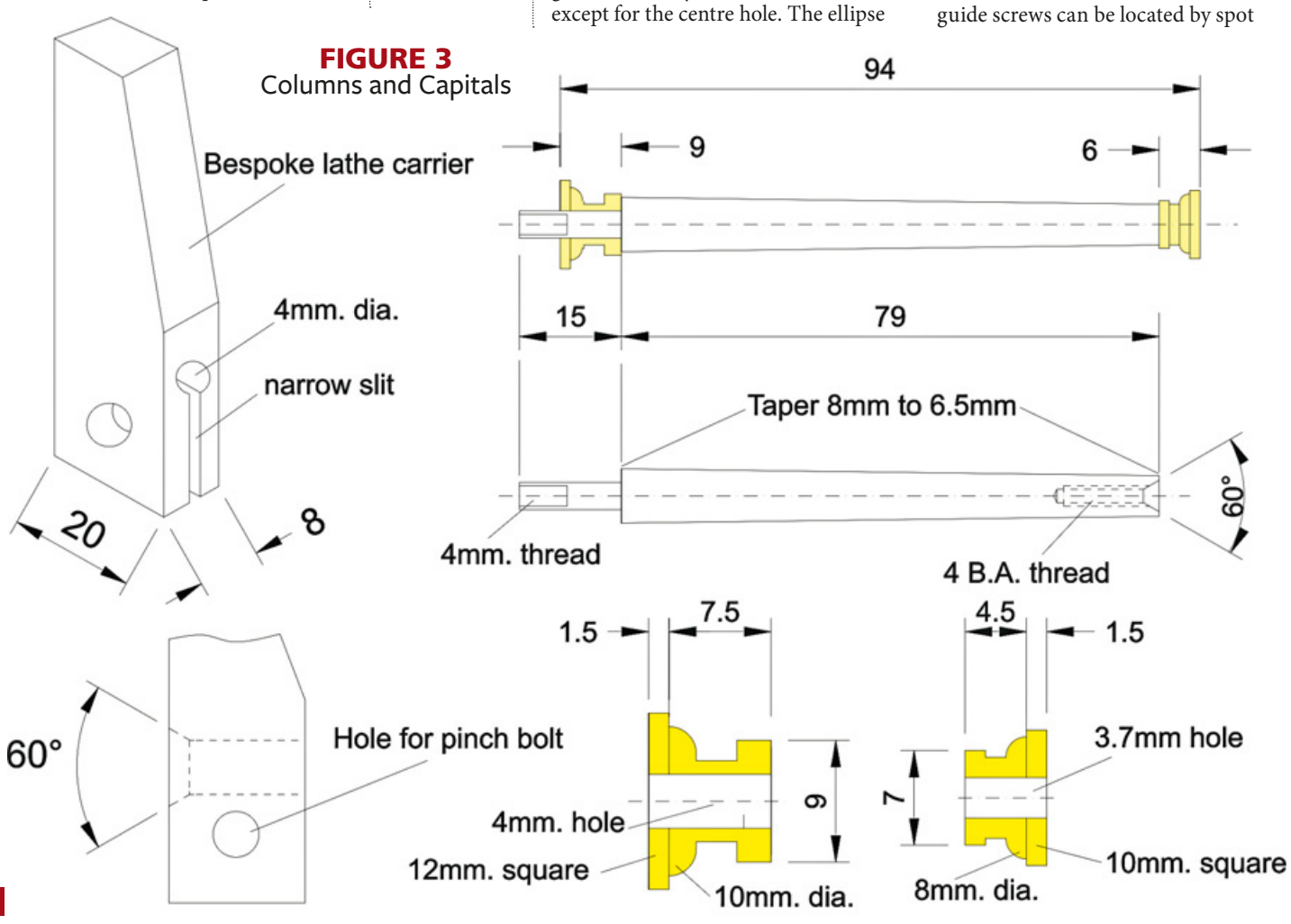
The glands are made in bronze or gunmetal. They have common sizes except for the centre hole. The ellipse can be shaped quite easily with some light milling and a final finish with needle files. The adjustment holes can be used to spot drill the position of the threaded holes in the cylinder cover and the valve chest.

The underside of each gland is internally chamfered to aid compression. Plumber's PTFE tape, rolled up then twisted and wrapped around the piston/valve rod, helps to provide a simple and effective compression seal.

The cylinder caps also have common sizes and where a size is not given it can be found on the other cap. The four fixing holes in each cap are for 6BA screws in the upper cap and 3mm countersunk head screws in the lower cap. The position of the holes means that the threaded holes in the casting pass through the thinner section of the cylinder flange. In Photo 1 you can see six screws in the upper cap, Figure 4 shows four holes which is the same as the Muncaster drawing in Photo 2.

The outside diameter of the caps is larger than the diameter of the casting to allow for an optional Stuart cylinder cladding. Take great care with the boss flats on the upper cap. Ensure they are equally spaced either side of the centre line and also when the cap is fixed to the cylinder that the flats are square to the cylinder port face. The threaded hole positions in each of the flats for the crosshead guide screws can be located by spot

FIGURE 3
Columns and Capitals



drilling through the hole in the guide.

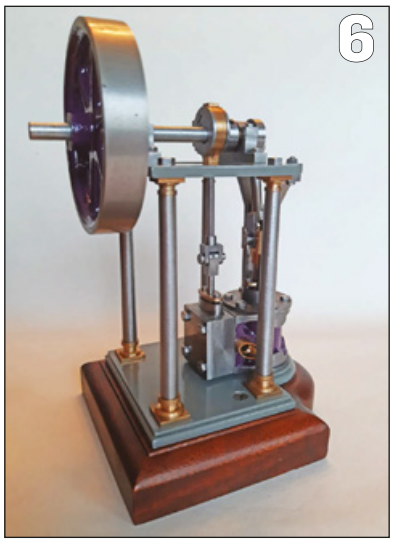
Figure 5 shows the main bearing pedestals which are made from two pieces of mild steel, one 6mm x 6mm x 36mm and one 11mm x 6mm x 36mm. I would suggest preparing the two pieces and joining them together with two 8BA screws as shown. The only important size is the height from the underside to the centre line of the 8mm bearing hole which should be the same on both pedestals. Having done that the sides can be milled to size and the radius formed on the cap. The latter can be nibbled away on the mill and finished by hand with needle files. The 3mm holes are for 6BA screws.

The main bearings can be made of gunmetal or bronze. Using a length of 10mm stock about 20mm long, hold this in a three-jaw chuck, drill and ream through 6mm, then part off the two bearings 8mm long. To turn the waist of the bearing, mount each one in turn on a shouldered stud of 6mm diameter and about 13mm long. Turn the stud to size and without removing from the lathe chuck, thread the end in situ to accept a 6mm nut and washer.

When the bearing is in place, the cap should just very lightly pinch down on the bearing to stop it rotating. Add a small amount of oil through the cap and bearing.

The pedestals are fixed to the entablature with 6 BA screws. The pedestals can be lined up with a short length of 6mm round bar and then clamped accurately in place on the entablature. Spot drill through the 3mm holes on to the entablature and then remove the pedestals and drill and tap for the 6BA screws.

That covers all the fixed components for this engine except for the crosshead guides which will be included next month. The second part of this feature will also include the drawings and text for all the moving parts, further assembly details, setting the timing, running and painting and finishing the engine. EIM



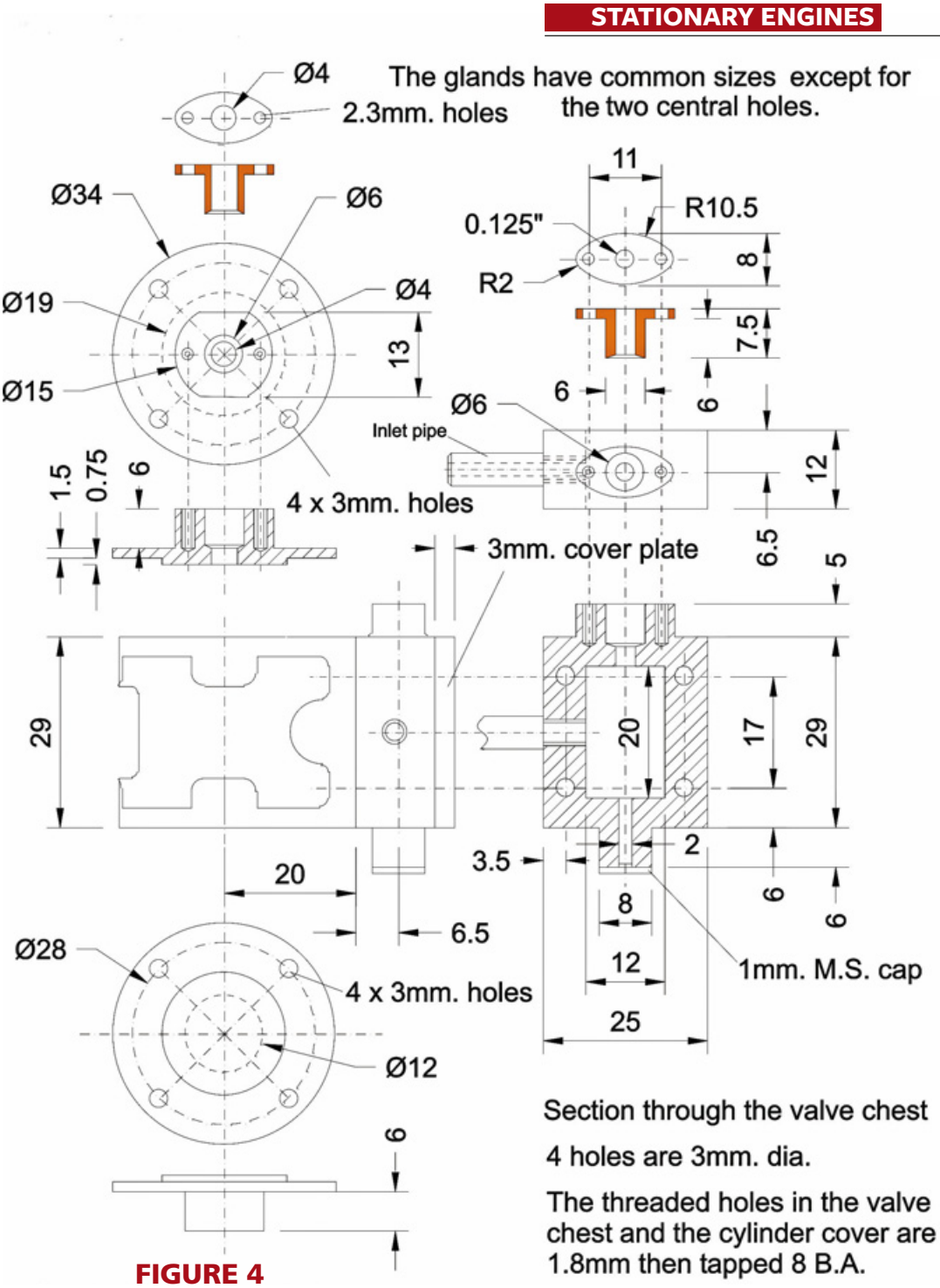


FIGURE 4
Cylinder and valve chest

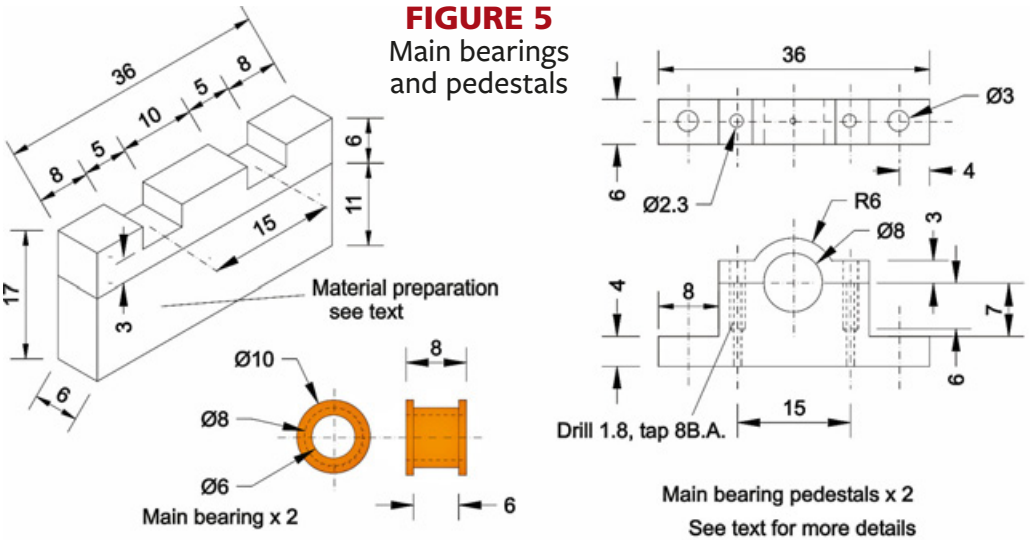


FIGURE 5
Main bearings and pedestals

Positive progress after the Pandemic

Young engineer Sol describes how the Mid-Cheshire SME not only recovered from the lockdown restrictions of 2020 but was able to extend its Sandiway Miniature Railway.

BY **SOL JOHNSON**

The Sandiway Miniature Railway is a 5-inch/7¼-inch gauge line located on the edge of Sandiway Woods next to Blakemere craft centre in Sandiway, Cheshire, and operated by the Mid-Cheshire Society of Model Engineers. The railway runs public services on most weekends every year and the start of 2020 proved no different to previous years.

The railway carried on operating passenger trains every Sunday through January with a great deal of site developments also taking place during this time. New track panels were being made and as soon as they were ready they were being laid down on the 'Southern extension'. Meanwhile in the workshops there was plenty of activity with locomotives, both steam and diesel, being worked on and various other little projects being done.

One of the activities ongoing was the process of bringing back into service the 5-inch gauge club steam loco, a Sweet Pea 0-4-0ST with a larger Kerr Stuart Wren-style saddle tank, which had not been steamed for about seven years since the railway moved site. Thankfully the loco was in a good state and only a handful of repairs were needed to put it back into steam.

These were undertaken and by mid-February the loco was ready for its steam and hydraulic test. The fire was lit and after an hour of a small fire slowly boiling the water steam was raised and the safety valves lifted, thankfully it passed the tests with flying colours.

When it came to the loco's first movement some minor issues were recorded and put down for repair. The loco has run a few times since overhaul but the Covid pandemic has prevented it being steamed as much as needed in order to run it in.

Driving test

In 2014 I began to learn how to drive, maintain and operate steam and diesel locomotives at Sandiway, but due to the club health and safety policy which states you must be 16 years old to handle the public trains I was unable to drive passenger services. But at the beginning of March 2020 I turned 16, this resulted in me being able to be assessed by the Society's health and safety officer as to whether I was ready for driving passenger trains.

The first weekend after my birthday our loco, a 7¼-inch Quarry Hunslet 'Red Damsel', was taken down to the railway and by 11:45 I had undergone my assessment and passed, resulting in the rest of the day being spent driving trains for the public.

This was a joint celebration with the Hunslet which that year had turned 30 years old since its completion in 1990, and as the picture shows some bunting was placed on the engine to celebrate.

The railway carried on running its passenger services through the first half of March until everything came to a halt when Coronavirus caused the first lockdown of 2020.

Reopening the Railway

Following its enforced closure by the

PHOTO 1: Typical scene of 2020, repated across many a cub – as another happy traveller departs after their ride, the driver gets to with sanitising all the stock.

PHOTO 2: The Club's 5-inch gauge Wren on its way to a successful steam test after seven years of slumber.

PHOTO 3: Once the test was passed, it had to be given a good run...

PHOTO 4: Celebrations for Sol (centre) and his loco, built by Jon Green (left), with at right the Mid-Cheshire Society's health and safety officer Vince Bashford.

ongoing virus the railway was left alone and with the members restricted to their homes only able to make site checks, grass and ferns were soon growing over the tracks. Finally at the end of June the rules changed to allow people to go out again in 'bubbles' – members took advantage of this and during the following weeks working parties were organised involving different groups of members, only a few on site at one time with measures in place to ensure social distancing. Members

The various tasks undertaken included major strimming of the weeds and ferns, the repainting of the original bridge and the connection of a new track extension and a large viaduct – this had recently been completed with rail on it dating from World War One!

Slowly day by day the railway came out of hibernation and the rails on the track were found again with little layers of rust resting on the top of the rail heads.

After a few weeks of preparation the first steam engine was run on the track, and before much longer several locos had all been tested and given their fresh annual boiler tickets.

After six weeks of hard work and preparation of the railway, both restoration and putting in new measures to keep the members and public Covid safe, the railway opened at the beginning of August, running for the public on Sundays between 12 noon and 4:30pm.

Public running continued during the rest of the summer and autumn months with additional days added around bank holidays and some Wednesdays during school holidays. This was later brought to a halt again by another lockdown but services resumed and trains were running up until Christmas.

After the re-opening passenger numbers surged and the railway was very busy. Due to our measures the trains ran efficiently, smoothly and managed to carry more passengers each day than we had previously. Most days during summer and autumn required two trains continuously running to keep up with the heavy demand of passengers.

Each train carried only one family at a time, running with a spacer vehicle between the locomotive driver and the passengers and then another between the passengers and the guard. This ensured all was at a safe distance.

Once their ride was finished passengers would disembark the train at the arrivals platform and exit via a different path whilst the guard would thoroughly sanitize the coaches and all touch points before the train proceeded into the departures platform of the station to pick up its next set of passengers.

PHOTO 5: It's not just about running trains! Months of inactivity resulted in some painting being needed...

PHOTO 6: A further quarry Hunslet on the roster once public trains restarted.

Photos in this feature by the author, track diagrams by Rob Neyton, Mid-Cheshire SME

Jobs and Repairs

While this running period required a lot of extra effort to be put in on the part of members, a lot of general work ▶

PHOTO 7: A new clock and sign for the station.

FIGURE 1: The Sandiway Miniature Railway, with staiton marked in orange and steaming bay in green.

FIGURE 2: The southern extension in blue includes a new viaduct.

PHOTO 8: What we've seen far too little off in recent times – a loco with a good head of steam, enjoying a run around the track.

around the line has also been done. Construction of a new steaming bay canopy was commenced, so that the drivers could keep themselves and their engines dry on wet mornings, while members were also concentrating on a new bridge for the planned northern extension. Both of these projects were completed by the time of the most recent lockdown in December 2020.

Meanwhile at the station some additions were made, with a new station clock and signage put up under the cover.

Sandiway also boasts a raised 5/3½-inch gauge track and there has been some progress with this, slight adjustments made to the track and a water supply being fed next to the track so that steam engines have a source of refill. Various jobs in the workshop have included the building of track panels for the northern extension and also some general maintenance taking place.

Work to be done includes a number of steam tests – winter repair works needed and not being able to be completed due to Covid restricitons has meant only one of our 5-inch gauge locos has been steam tested and available for running since the first lockdown.

Extending the run

A great deal of has taken place during the 2020 season, both replacing parts on the current track and making new track panels for the southern and northern extensions.

Referring to the diagrams, the first track circuit built after the Society moved to Sandiway in 2013 consisted of a basic loop with a station (coloured in orange - Figure 1). Several lines enter the shed for rolling stock and loco storage –the steaming bay, for lighting up in the morning and using as a pit to get under the locomotives easily, is marked in green.

The Southern Extension was completed in 2020 and is marked in blue on Figure 2 – the old bend marked in black alongside the extension is now redundant. The new track was used for the public running loop once we reopened in the summer.

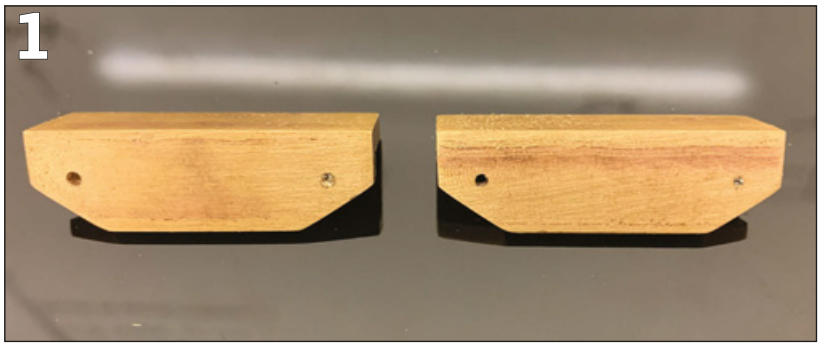
Now the Southern extension is newly finished, we have already started on the next extension, the final route of which is still being decided. We hope to make progress with this once the current restrictions end, while we are also looking forward to another busy season in 2021. EIM

■ Readers wanting to visit the Sandiway Miniature Railway in 2021 can find the latest news on opening times on the Society's Facebook page, @midcheshiresme

A Recipe for Disaster

Peter and Matthew explain how to use elementary chemistry to recover from a disaster that all model engineers will encounter – a broken tool stuck in a near-complete part.

BY **PETER AND MATTHEW KENINGTON**



We have all been there: a part which has taken hours to machine and which needs a final hole or two adding or tapping before it is complete, is always the one in which the drill/tap/reamer (or even bolt) breaks. The break is always, of course, at a point where insufficient of the broken tool protrudes to permit easy extraction and simultaneously at the point of highest visibility or maximum utility of the finished part.

Political correctness prevents us from speculating as to whose law this situation might allude. The problem can't be ignored or metaphorically brushed under the workshop matting. So, the part is scrap and a new one must be made? Well, perhaps not. If mechanics can't be employed to solve the problem, then perhaps chemistry can come to our rescue.

Playing Snap

Photo 1 shows the problem we needed to overcome: a broken 1mm centre-drill embedded in a phosphor-bronze hornblock. To our further embarrassment, this happened twice, on two different parts. We were not happy... The hornblocks had been CNC machined from bar stock and this takes a fair amount of time, and that's before thinking of the cost of the wasted phosphor bronze.

In both cases, the drill bits broke at the point where the centre drill widens, so there was a decent length (a few millimetres) of HSS material embedded in the bronze, with almost nothing sticking out above the surface of the part – certainly nothing which any tool could grasp in an attempt to extract the broken piece. I'm sure we've all had afternoons like this...

If these were pilot holes for a much larger drill (in which case, why didn't we use a much larger centre drill?!), then perhaps we could have drilled out the broken piece from the reverse side. I'm not really convinced that this would have worked well anyway, unless the size difference was substantial. This was not the case, however, and the drill used was close to the required final size (1/16-inch).

With the benefit of hindsight, we realised we did have a centre drill of the right size, and used this on subsequent pieces (we had 12 to do in total), but that didn't help with the pieces shown in Photo 1. The right-hand 'holes', in each part, are clearly blocked. Photo 2 clearly shows the broken tool pieces (bottom right-hand hole and top left-hand hole). There were (metaphorical) tears before bedtime.

Rusting – on steroids

Other than remaking the part, there are two options:

1) Wait for the (HSS) high-speed steel part to rust (the phosphor bronze won't, of course, and hence this idea should work … eventually)

2) Try and speed up the process outlined in 1.

Option 1 is obviously not a serious suggestion, but option 2 is an intriguing possibility. We're not looking to move to the seaside in the near future even though all that healthy salt-air would help speed up the rusting process, but some other form of chemical assistance might just do the job. I set my trusty young assistant, whom I like to think of as 'Beaker' (for those of you who are familiar with *The Muppet Show*...), the task of researching a suitable option and he came up with the solution, quite literally.

The chemical we need is a solution of alum in water. There are various types of alum, but only one is suitable for our needs, so it is important to source the correct one.

PHOTO 1: Oh dear...

PHOTO 2: Not one, but two, snapped drills in the holes.

Photos by the authors

"Nothing sticking out above the surface of the part which any tool could grasp in an attempt to extract the broken piece..."

Types of Alum

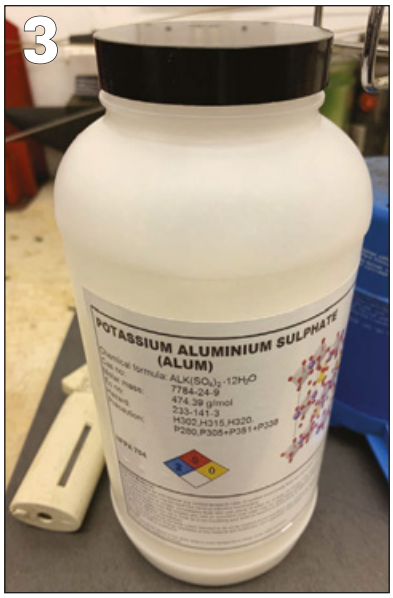
The various substances, all commonly referred to as 'alum' are:

1) Potassium Alum: Also called potash alum or tawas, its chemical name is aluminum potassium sulfate. It can be found in grocery stores and is used in pickling and some baking powders, among a host of other applications (leather tanning, water purification, the fireproofing of textiles and even aftershave!). Its chemical formula is $KAl(SO_4)_2$.

2) Soda Alum: This has the chemical formula $NaAl(SO_4)_2{\cdot}12H_2O$. It is also used in baking powder and as an acidulant in foodstuffs. Essentially the potassium in the first type of alum (above) has been replaced by sodium. The fact that both types are used as ingredients in baking powders and so are likely to be available in grocery stores, means that care must be taken in distinguishing between the two.

3) Ammonium Alum: This has the chemical formula $N_4Al(SO_4)_2{\cdot}12H_2O$. It is used in many of the same applications as potassium alum and soda alum: tanning, dyeing textiles, making textiles flame retardant, water purification and in some deodorants.

4) Chrome Alum: This has the chemical formula $KCr(SO_4)_2{\cdot}12H_2O$. It is a deep violet in colour and again finds application in leather tanning. It is also very pretty if used for crystal ▶



growing – I have fond memories of doing this as a part of my 'science' badge in scouts!

5) Selenate Alums: Selenate alums occur when selenium takes the place of sulfur in the other forms of alum, discussed above, so that a selenate, (SeO_4^{2-}), replaces the sulfate in the alum types discussed above. These types of alums are strong oxidising agents, allowing them to be used in antiseptic applications, among others.

6) Aluminium Sulfate: This compound, also called 'papermaker's alum', is not technically an alum, in the chemical sense.

It is the first of these, potassium aluminium sulphate $KAl(SO_4)_2$ also known as potassium alum, aluminium potassium sulfate and potash alum, which we require (Photo 3). Note also that 'sulphate' should now actually be spelt 'sulfate' to be strictly accurate – the old spelling ceased to be internationally recognised a few decades ago, although the new (American) spelling still jars with me. The example shown in Photo 3 was obtained from a well-known auction site (beginning with 'e' and ending in 'bay'), costing under £10 for 800 grams – probably enough to remove most of a locomotive chassis from its non-ferrous components! Smaller quantities are, of course, available.

Since it is used as a cooking and preserving ingredient, it is frequently offered as a fine white powder or as crystals (Photo 4) sold along with kitchen spices or pickling ingredients in larger grocery stores or specialist kitchen/cookware shops.

PHOTO 4: Alum crystals.

PHOTO 5: Apparatus that is required – part 1.

PHOTO 6: Remainder of apparatus required.

PHOTO 7: Carefully measuring the amount of water.

PHOTO 8: Saturated solution is formed. Note small amount of undissolved powder at bottom-centre of beaker. Stirrer also visible top left.

Is it Hazardous?

The first questions to consider with any chemical, especially one which is capable of 'dissolving' steel, are those of safety and associated handling precautions. The good news is that alum is pretty benign, in small quantities. It is classified by the US Food and Drug Administration as a "generally recognized as safe (GRAS)" substance and is even found in some foods, toothpastes and vaccines. This doesn't mean to say that you should liberally sprinkle it on your breakfast cereal, but it is unlikely to do you any harm in small doses.

The main issue is its impact upon skin, lung tissue and membranes in the respiratory system. All forms of alum can cause irritation of the skin and mucous membranes. Breathing alum can cause lung damage. Alum may also attack lung tissue. So it is best to take the following precautions:

1) Wear a mask and goggles when handling the crystals (and, indeed throughout the process)
2) Wear rubber gloves when handling the crystals, particularly if you have sensitive skin or a skin condition
3) Ideally, mix and use the alum solution outdoors and certainly in a well-ventilated space
4) Avoid breathing in the vapours from the solution (again, ensure plenty of ventilation).

The above are wise precautions, however this is not a chemical to be too scared of – just be sensible.

An Evil Brew

We need to form a solution of our alum powder in water, to create 'potassium alum', with a chemical formula: $KAl(SO_4)_2{\cdot}12H_2O$. It is this solution which will greatly accelerate the 'rusting' of our HSS (or carbon-steel) tool, but without causing any damage to its non-ferrous surrounding material. That can be virtually any non-ferrous material which we are likely to encounter in model engineering activities: copper, brass, gunmetal, phosphor bronze, most plastics, aluminium and lead.

If in doubt, a small sample of the material can be placed in the solution and the effects observed. The sample should be inert – no bubbles should form (other than those caused by the heating of the solution, as will be discussed), nor should any discolouration of the solution occur (other than that resulting from dirt adhering to the outside of the sample, of course).

Note that if you raise the solution to close to boiling point, then bubbles will naturally form on the surface of an inert part for this reason alone, as oxygen and other gasses dissolved in the water begin to be released from solution, not due to any chemical process involving the part. Once you have seen the reaction in process, you will recognise the clear difference between bubbles forming (and largely remaining) on the surface of an inert part and the constant stream of (generally smaller) bubbles flowing from a ferrous part in a manner not unlike steam from a tiny loco chimney, when the loco's blower is on. We'll discuss this in a little more detail later on.

Apparatus Required

The apparatus needed is very simple (Photo 5-6):

1) A heat-proof mat in case of accidents – we used a spare bathroom tile
2) A heat source – we used a single-burner camping stove
3) A gauze support – this may not be needed, depending upon the size of the vessel you use and the support provided by your heat source
4) A suitable (non-ferrous) container, large enough to contain the part or parts to be treated – we used a Pyrex

kitchen measuring jug
5) Some form of cover for the container – used both to minimise fumes and to contain the heat and water, to minimise evaporation losses during the process. We don't want the vessel to boil dry!
6) A non-ferrous, heat-proof, stirrer – any suitable plastic or aluminium implement will do
7) A measuring spoon – again a kitchen-sourced part was used here, but do ensure it is non-ferrous
8) Some means of gently placing in, and removing the parts from, the solution, when hot. Ideally, this means should be non-ferrous, but we didn't have anything suitable to hand and instead used some long-nosed pliers, making sure we washed and dried the parts of them which entered the solution afterwards.
9) A thermometer – we have a thermocouple-based digital thermometer, but a conventional 0–100 degrees C mercury thermometer is fine. This is, arguably, optional, since all that is required is to keep the solution hot but not boiling. The hotter the solution, the quicker the reaction. The process will, of course, still work with cold water, but would take days.

Note that the kitchen-related apparatus was dedicated to this task – we don't plan to return it to food-use afterwards! Note also that the scales shown in Photo 5 are not strictly necessary; we wanted to be able to fairly accurately measure the amount of water we used in our experiment (Matthew's chemistry master would be delighted...).

There are some simple dos and don'ts regarding the apparatus:
- Don't use a metal (stainless steel) cutlery spoon (it will rust!)
- Don't use a stainless steel pan (it will also rust) – or that nice Le Creuset pan you cook the potatoes in (cast iron will also rust, through the tiniest pin-prick hole in the enamel coating on the pan)
- Do use (Pyrex) glass, if possible
- An aluminium pan should be okay, for example something cheap from a camping shop
- Use a plastic spoon/spatula/stirrer, but make sure it will not melt when placed in hot water.

The Recipe

The ingredients and quantities we used were:
Water: 200ml (ordinary tap water is fine to use)
Alum powder: Four to five tablespoons full. Essentially, we are looking to make a saturated solution of alum in the water, when the water is hot (see below). Once no more crystals will dissolve and a small residue of crystals remains at the bottom of the heating vessel, then the solution is duly saturated (Photo 8).

The Method

If this is beginning to sound a bit like a school chemistry experiment, at least as I remember them, that is no accident. It is a simple, methodical process and, if followed carefully, yields excellent results. The main steps are:
1) Heat the water to approximately 90 degrees centigrade and add as much alum powder as the quantity of water will allow. For 200ml (Photo 7), this is around four to five tablespoons full. Stir thoroughly throughout. Photo 8 shows a small residual amount of undissolved powder, once a saturated solution has been achieved.
2) Add the part(s) to be treated, gently placing them in the solution. A good tip, which we will try next time, is to gently pre-heat the part. This will speed up the start of the reaction, as otherwise the water needs to provide this heat, which can take a while (around 10-15 minutes, in our case, although some of this probably resulted from a bubble protecting the hole/broken drill-bit – see below). The resulting arrangement is shown in Photo 9 – the gauze we used can also be seen in this photo.
3) Maintain the water temperature just below boiling point (Photo 10) – this was easier said than done with our little camping stove, as it needed to be only just alight.
4) If a bubble has formed over the end ▶

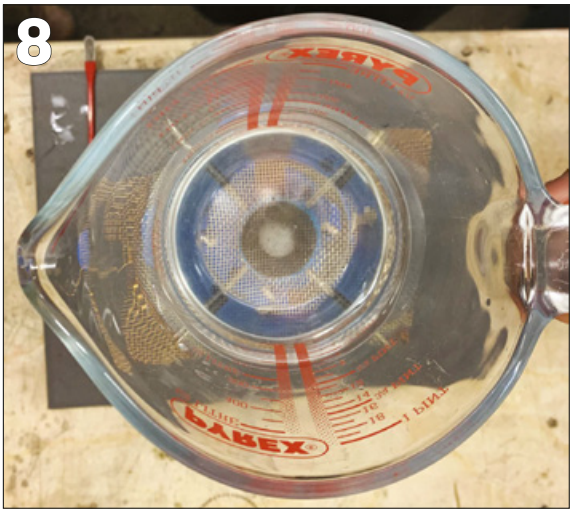
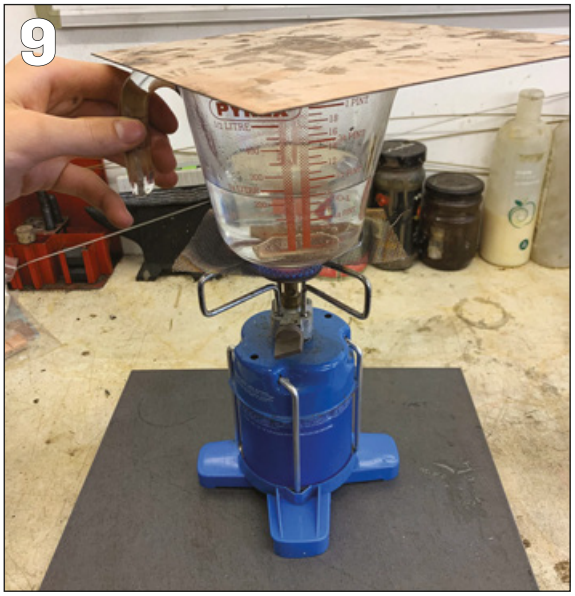
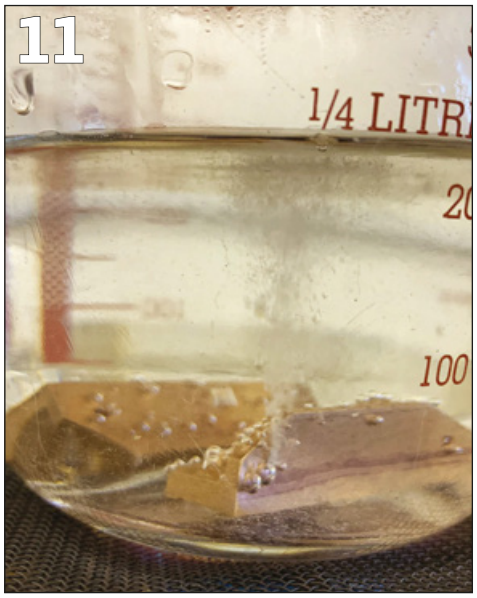
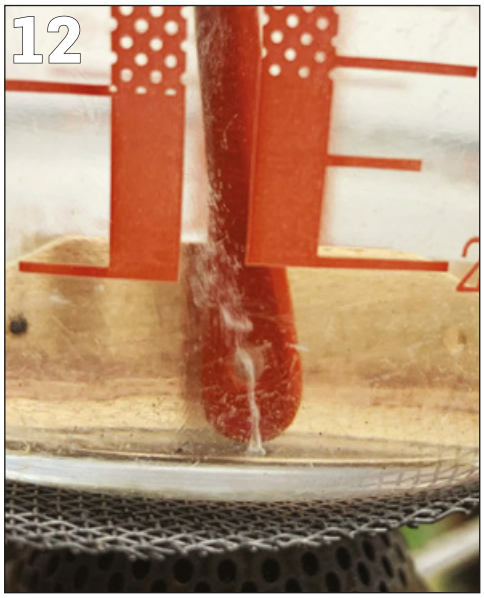


PHOTO 9: Heating the solution with parts inserted.

PHOTO 10: Thermocouple-based form of temperature measurement.







of the ferrous part, which can easily happen with very small areas, such as the 1mm diameter hole/drill-bit we were concerned with, this needs to be dislodged to allow the solution to gain access to the offending broken part.

5) As noted above, it took a little while for the reaction to get going (probably most due to that bubble), but once it did, the effect was very obvious. A stream of tiny bubbles will emanate from the ferrous part (broken tool) and rise up to the surface (Photo 11). It is quite exciting to see (Matthew was thrilled), especially when you consider how much heartache and time it is saving you.

Note the difference between the stream of tiny bubbles, emanating from the left-hand side 'hole' of the nearer of the two parts in Photo 11, and the larger, static, bubbles on the surfaces of both parts. These latter bubbles are not caused by a chemical reaction between the alum solution and the phosphor bronze and hence are not a cause for concern.

Occasionally, a small part of the tool may break off and float away in the solution, forming its own tell-tale stream of bubbles (Photo 12). This is inexplicably thrilling as well and took me back to the days of asbestos mats and Bunsen burners, and a chemistry teacher whose experiments never worked, which might explain why I was so pleased when this one did!. (*Weird, my chemistry teacher's experiments always went wrong too, especially the one that ended up on the ceiling of the lab – Ed...*)

The tiny piece in Photo 12, highlighted by our red stirrer, danced around for a while in the solution, alternately rising and then sinking – it kept us amused for hours (well, minutes, anyway – it didn't last too long before being consumed).

6) Once the stream of bubbles emanating from the part stops, the ferrous material has been completely removed (Photo 13) – the right-hand 'hole' is now shiny at the bottom and all traces of the broken tool have been eliminated by the alum solution.

The hole (in our case) can now be re-drilled. This worked perfectly (Photo 14) although doing so highlighted why the original drill bits broke. The (cast) phosphor bronze bar was very hard at the positions of the offending holes, indicating that it was probably chilled at these points during the casting/cooling process.

The whole process took about an hour and it removed a length of tool of around 2.5 – 3mm. Given the tiny surface area upon which the alum solution could act (~3mm^2), this is not too bad.

PHOTO 11: The reaction underway.

PHOTO 12: A little light entertainment from a stray part of the broken tool.

PHOTO 13: Part, with broken tool removed, before re-drilling hole.

PHOTO 14: Parts with holes re-drilled.

PHOTO 15: Hornblocks duly test-installed in one of the tender frames.

Conclusions

All good experimental write-ups should finish with 'conclusions', or so I was taught. In this case, the experiment was an unqualified success: it removed the offending drill-bit fragments completely, with minimal effort, and caused absolutely no damage whatsoever to the phosphor bronze part. What is more, it was quite fun to watch and saved us a huge amount of effort in making new parts.

We test-installed the parts, along with their brothers and sisters, in one of the frames of the tender for which they were made (Photo 15), using threaded rivets. They fit perfectly, despite their chemical assault. We now need to drill a few more holes – hopefully without needing to re-run our experiment during the process.

The parts and materials required for the technique are all inexpensive, readily-available and many will be to hand already in most workshops and domestic kitchens. I can't really think of a downside to the process, other than the fact that it won't remove a ferrous tool fragment from another ferrous part (without causing serious damage to the wanted ferrous part). It may be possible to mask the wanted ferrous part (perhaps with paint), but we haven't tried this and hope that we will never have the need to, although that is possibly a vain hope.

So, Matthew and I can add a further form of engineering to our repertoire: chemical engineering, at least if we define the process as: "using chemistry to save lots of (re-) engineering". EIM

Kenny's engine

Originally written for his club newsletter in 2004, Granville begins a short tale of model engineering trials and tribulations that many readers may well identify with...

BY **GRANVILLE ASKHAM**

It was 1946 and I could not ever remember not having a steam engine of some sort. My dad had a shed behind our little house in which, because there was no electricity down our lane, his lathe and milling machine were belt driven from a line shaft powered by a gas engine.

This engine ran on town's gas and worked on the hit-and-miss principle giving it a distinctive sound – I cannot see an engine of this type running at a steam fair without the memories coming flooding back. And what a performance when the gas meter needed another shilling, especially if Dad was in the middle of a finishing cut on an important component...

There was a vertical coal-fired steam boiler which was lifted onto an outside bench on fine Saturday afternoons where it drove a confusion of stationary engines large and small. When these 'running days' occurred, his steam pals would gather to talk steam engines, drink tea and eat mum's ginger cake.

Then one day Dad went too far. Remember, it was 1946 but the feeling of the war was still with us – rationing, shortage of materials and still no sign of the long-promised electric power line in our part of the village. What did he do? He only came home with the just-started, buffer beams on and cylinders in, chassis of a 7¼-inch gauge three-cylinder Midland Compound loco, a few wheel castings, a box of bits, a full set of blueprints and very little else.

The thing had been started pre-war in the well-equipped workshop of a nearby colliery, on the whim of the mine owner and shelved at the outbreak of war, never to be completed. It would hardly fit in the workshop but Dad had other ideas. He thought he might keep it in their bedroom adding bits to it as he completed them. Mum soon showed him the error of his ways!

A wooden staging was constructed over the gas engine and there the Compound resided. There were frequent visits from one or another of Dad's cronies to view progress and they always brought a bit of scrap which they thought might be useful. When the engine was completed, they loved to point to a particular bit and remark to whoever was listening, "Kenny made them brackets out of a bit of scrap I gev' 'im." I think it gave them a sense of co-ownership. They were always coerced into the heavy job of turning the beast round so Dad could work on t'other side. As the weight increased, props were added to stop the stage sagging – after all, we lived in a mining community.

"He thought he might keep it in their bedroom adding bits to it as he completed them. Mum soon showed him the error of his ways..."

Came the day for a trial on air. The chassis was complete, the reversing gear fitted and I remember being given the task of twiddling the lubricator mechanism to prime the oil feed lines before connection to the main steam pipes.

The monster was transported by one of Dad's steam pals to the garage in the next village. We didn't possess an air compressor nor, come to that, did our village have a garage. A posse of steam pals and assorted garage mechanics were waiting. The engine was lowered onto chocks, clear of the floor, the airline connected and the stop valve cracked open.

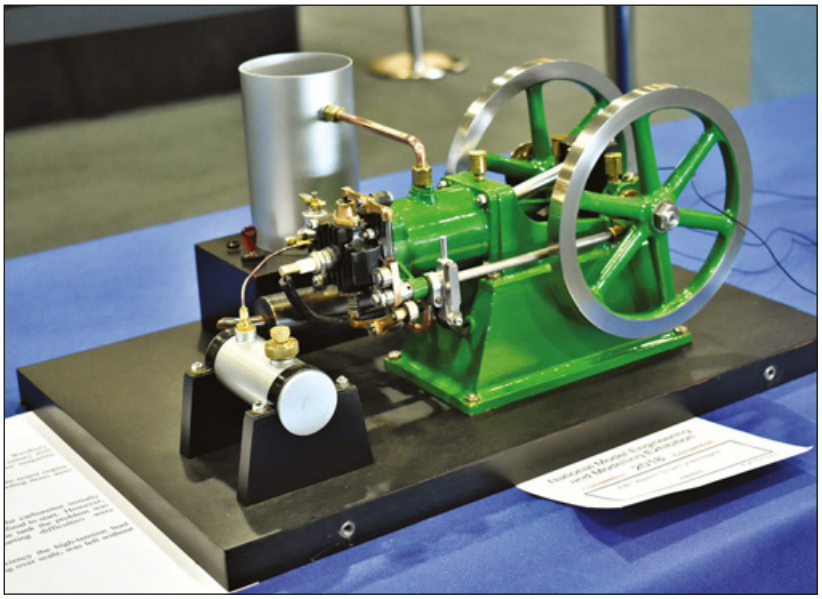
Then – NOTHING...

Fred Firth, Dad's chief steam pal, was a man of ample girth who chewed tobacco and drove one of the large steam winders at St. John's Colliery, Normanton. Such was his skill with these huge, powerful engines that legend had it he could drop the cage through the shaft at a speed in excess of 60 miles an hour and land it at the bottom without cracking the shell of a hard-boiled egg previously placed on the landing frame.

When it came to matters of steam, Fred was to be listened to. He cogitated for a while, issued his opinions with the utmost gravity and expected they would be accepted and acted upon.

In this case his verdict was that "timing were out by a fraction." The valve covers were removed to reveal the valves. The wheels were slowly turned by hand so the learned boffins and interested mechanics could view the motions. They pored over the chassis rather like seers viewing the entrails of a dead ass in Roman times. However, Fred was wrong, the timing was spot on (Dad was no slouch with steam engines either...), it had to be more basic. The monster was loaded up, taken home to its staging and subjected to much scrutiny... **EIM**

■ Will the loco run? Granville continues the story in next month's EIM...



PHOTOS: For Granville, small engines running at today's shows immediately spark memories of his formative years, and his father's novel power source. *Photos: John Arrowsmith*

A Hydraulic Copier

Tech Ed Harry describes how he set about adding some workshop equipment to ease his engineering duties at the 12¼-inch gauge Fairbourne Railway.

BY **HARRY BILLMORE**

One of the items I knew I wanted for the Fairbourne Railway's workshop as soon as possible after I started as the resident engineer was a hydraulic copier. With the line having a fleet of 24 carriages running a decent mileage over a season there will always be wheelsets to re-profiled each year.

Wheel durability is also not helped by the railway having a sharp right curve through 90 degrees over a level crossing, causing one side of a wheel set to wear much more than the other, while I also knew that this winter's needs for reprofiling would be worse than in previous years due to the line not having had an engineer to do such work during the previous season. And along with the carriage wheelsets, 'Sherpa', the line's Darjeeling-style loco currently having its 10 year overhaul, would also neede its wheel sets re-profiling.

The hydraulic copier attachment for the lathe makes turning profiles on wheels far faster and more consistent than any other method I have found so far. It is able to do this by the tool following a pattern cut out of flat sheet material, allowing complex shapes such as wheel profiles to be machined in a single pass for each side of the wheel. Because the distance from the pattern to the tool tip is controlled by a dial, by machining to the same dial position each time, you will always produce wheel that are the same diameter each time.

Plenty of choice

There are several types of copier on the market and they all basically operate in the same way. A hydraulic pump feeds a ram that operates a tool holder set at 45 degrees to the bed of the lathe. This is controlled by a finger that runs along the pattern, while a typical device also boasts a manual withdrawal feature.

Copiers regularly come up for sale on Ebay and occasionally through the machinery dealers too. I kept an eye out for one that was designed to fit the larger Colchester lathe in the railway's workshop. You can fit just about any copier onto any lathe but if you can find one designed to fit it makes the job both quicker and far simpler!

As those of you who have studied the pictures will have realised, this setup can be used to make all sorts of complex shapes very easily, along with taper turning, spherical turning (but not quite a full sphere due to the 45-degree angle of the slide) and just about any other shape you would like to make on a lathe.

Having found a suitable copier and purchased it I picked it up the works Land Rover Freelander, having to get a little creative over how I fitted in the long cast pattern holder, and headed back to Fairbourne. Once it was unloaded, and having been reminded that the hydraulic tank was full after editor Charman and I managed to spill some of the oil across the platform, I began assembling the copier onto the lathe.

I had already moved the lathe away from the wall by about a foot or so to allow for the long overhang of

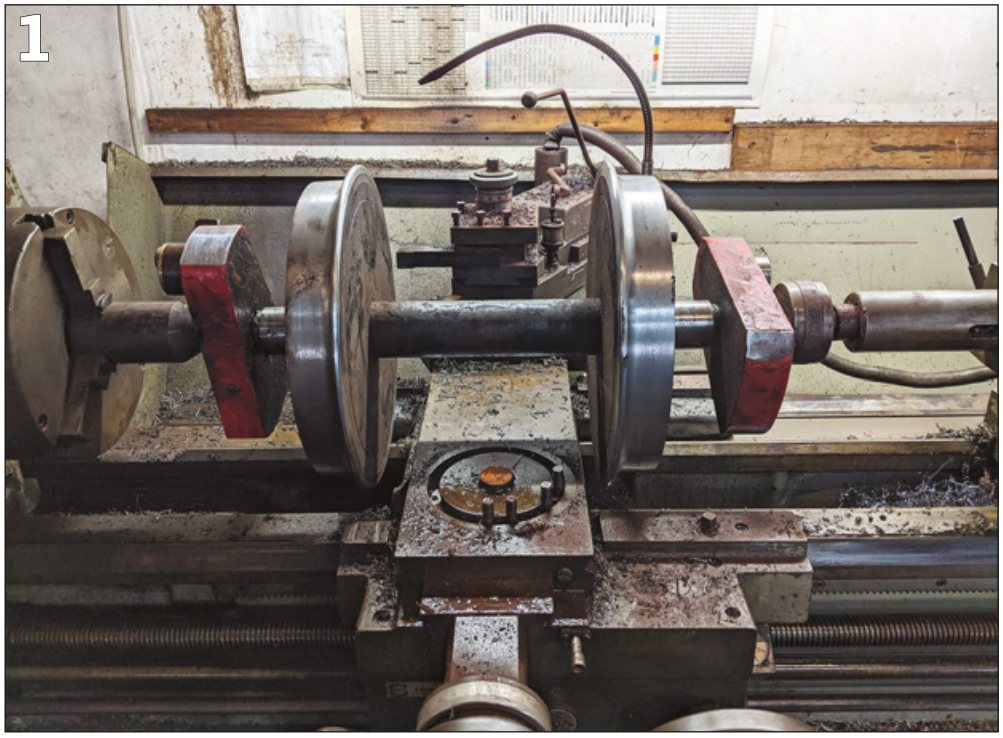


PHOTO 1: Hydraulic copier set up, having just produced a perfect profile on a wheel set from the loco 'Sherpa'.

PHOTO 2: The copier attachment in the back of the Fairbourne's Freelander. Note the rail pointing next to the front seat, this was firmly tied down before the journey started.

All photos by the author

PHOTO 3: Bolting pads for the copier on the back of the lathe bed.

PHOTO 4: The rail supports bolted to the pads.

PHOTO 5: Rail dropped in place – note how its position can be determined with respect to the bed.

PHOTO 6: Setting up the rail parallel to the bed using an indicator.

the ram assembly on the back of the cross slide. I also undid and leant back the splash guard around the back of the lathe for the same reason.

Construction

The first components to be attached to the lathe are the pattern holder support arms which bolt onto the pads on the back of the lathe bed. If your lathe doesn't have attaching points here then a bit of fabrication and drilling and tapping will provide you with what you need. It is not critical to get these perfectly flat and level, however doing so will help in setting the patterns up later on.

Once these were firmly bolted in place, I then put the pattern-holding rail onto them, this is adjustable towards or away from the bed of the lathe, it can also be tightened down at an angle from the bed.

Once the bits down the back of the bed were attached I then put on the ram and tool-holder assembly, on this version it simply slides onto the back of the cross slides on dovetails, thus allowing it to be adjusted depending on the diameter of the work piece. I have seen these attachments bolted directly to the cross slide and on specially machined brackets depending on the style of the lathe and its available fixing points.

The hydraulic pump unit was next to be fitted and that handily sat at the tailstock end of the lathe with the hoses running in armoured trunking up to the copier head. This is wired directly into the lathe's main isolator switch on the wall and fitted with its own on/off switch on top of the pump.

"If you can find one designed to fit it makes the job both quicker and far simpler..."

The next parts to go on were the pattern-holding block and its adjuster block, these were attached together with a fine-feed dial on the adjuster block and had separate clamping bolts which fixed onto a slot in the holding rail. These can be slid up and down the rail to make a coarse adjustment, then one can use the fine-feed dial to either move the pattern along to take a cut parallel with the bed, or to set up the pattern in a specific place ▶

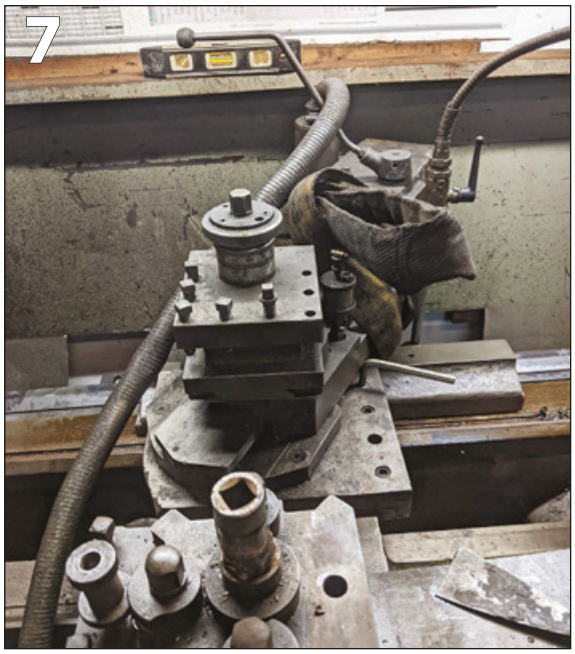


PHOTO 7: Copier head dropped onto the dovetails on the back of the cross-slide.

PHOTO 8: Main profile pattern attached to pattern-holding block – note attachment to adjuster block with screw dial on right-hand side. Also note back of the wheel position.

PHOTO 9: Further view of pattern-holding block and adjuster block, note dial adjuster to move pattern longitudinally.

with relation to the work piece.

The final piece of the puzzle was missing from the set I bought – the finger follower that operates the ram from the pattern. I made mine out of a piece from the scrap box, turned to fit into the clamp point on the valve block and the other end ground so that it would have a point facing towards the lathe bed with a perpendicular face to the chuck side and a 40-degree angled face on the tailstock side. This gives enough strength to the follower without affecting the operation of the follower.

Setting for cutting

With the follower installed it was time to prepare for the first cut – this process involves setting up the pattern-holding rail parallel to the bed, using a dial indicator dangling off the bottom of the rear of the cross slide to ensure the rail is parallel. I derived the distance of the rail from the bed by putting a wheel set into the lathe between centres and positioning the tool tip about an inch clear from the workpiece, then moving the pattern holding rail out until the pattern touched the follower.

Once this was set, the next aspect to be set up was the position of the back of the wheel I was turning to the part of the pattern I had intentionally cut to set the correct flange thickness. This is done using a steel rule across the back of the wheel, with the hydraulic pump turned on and the follower touching the pattern but the tool tip clear of the flange, and moving the carriage along the bed until the tool tip just touches the edge of the rule.

Then taking the rule and laying it along the edge of the pattern that

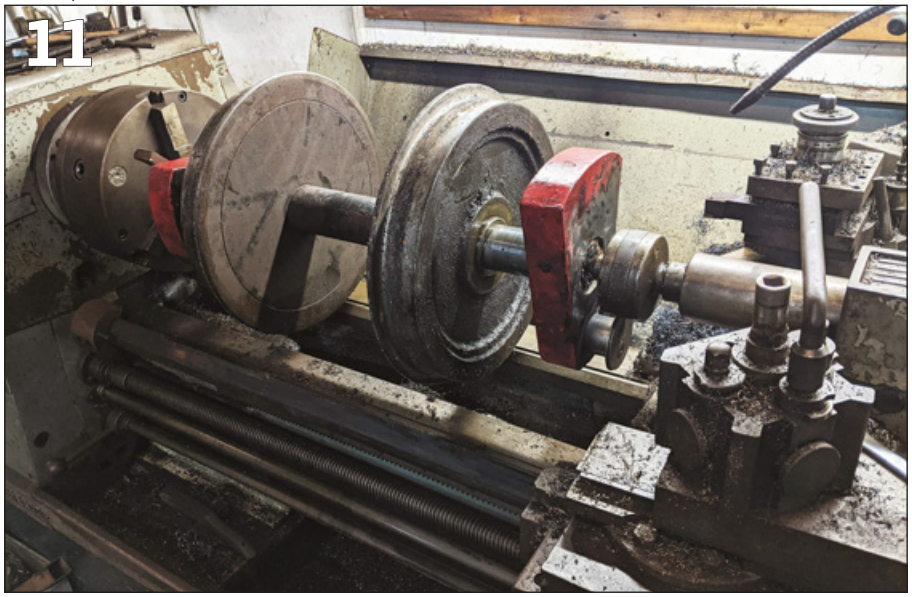


PHOTO 10: Close up showing shape of follower and pattern for machining rear of wheel flange.

PHOTO 11: Sherpa's leading wheel set in the lathe to begin setting-up process.

PHOTO 12: Setting up to machine rear of wheel profile.

PHOTO 13: To machine rear of wheel profile, follower is sat against pattern at outside diameter of flange.

PHOTO 14: At last, taking a cut from the wheel.

PHOTO 15: The finished profile, neatly matching any others that will be produced using the copier.

positions the back of the wheel, I used the fine adjuster on the adjuster block to move the pattern until the follower was just touching the edge of the rule. This was then the longitudinal position of the cut I was about to take and any adjustment from this point would be perpendicular to the bed using the dial adjuster on the top of the follower.

It was now a simple matter of moving the tool tip until it was just contacting the workpiece and then taking appropriate cuts using the power feed. The only difficulty that can arise is finding where the first contact patch will be on a worn wheel – I like to move the carriage by hand, adjusting the follower dial until it is close and then run the lathe and take cuts in thin air until it contacts. This method is slower than just touching the tool tip onto the workpiece but it carries much less danger to the tool tip and workpiece, due to the tool moving at 45 degrees from the bed. Cuts that are perpendicular to the bed will be heavier on the tool than those made parallel.

Once this is all set up, which once you are used to it, takes about two minutes, it is then simply a case of watching the lathe move up and down the bed and having the wheel set profile appear!

Once the main profile was done, I then put a small chamfer on the outside edge of the wheel using the top slide set to 45 degrees. I could have incorporated this chamfer into the pattern for the profile, but since I knew I would in future be turning wheels of several thicknesses it made more sense to do it by hand as it is not a critical part of the machining.

"It is then simply a case of watching the lathe move up and down the bed and having the wheel set profile appear..."

The next step was to turn the wheelset around in the lathe and repeat the process on the other wheel down to the same position on the dial.

Rear profile

The final operation was to move the carriage along the bed and change the pattern for the back side of the wheel profile. This is set up slightly differently as the diameter of the wheel is already set, so rather than using the rule to set the longitudinal position of the pattern, I used the piece-of-paper method to bring the tool tip just into contact with the workpiece on the outside of the flange, with the follower running and the follower touching the flange top portion of the pattern.

The machining operation was then completed by moving the pattern longitudinally towards the wheel to take cuts until the tool touched the wheel at the matching point on the pattern to take the final pass and leave me with the full correct profile.

While machining wheel sets is one of the most useful things a hydraulic copier can do, it also makes machining other complex shapes very easy, from ornamental ironwork for Victorian street lamps to press-break tooling. Some work with a hacksaw and a file can result in some very complex shapes coming off the lathe. EIM

A first model engine for first-time model engineers

Matthew's simple build for model engineering newcomers, built when he was just 12 years old, this month focuses on making the cylinder and associated components.

BY **MATTHEW KENINGTON** Part Four of a short series

The cylinder for my oscillating engine was made from square cross-section copper bar. This is possibly the worst material to make a cylinder out of (a decent hard toffee would probably have been better...) and I only used this as I was told it was phosphor bronze. How I wish it had been! By the time I realised, I had done quite a bit of work, so I decided to persevere and complete it.

First, hacksaw cut the bar to slightly in excess of the correct length then mill the bar the correct (external) dimensions (**Figure 9**). This process is similar to that described last month for machining the surface of the upright plate, but using a large end-mill rather than a fly-cutter.

Two parallel passes of a 16mm end-mill (say), with some overlap between the passes, will comfortably cover the 25.4mm sides. This will take an age (depending upon the size of bar you start with) and you will have wrinkles and grey hair by the end of it (if you had them to start with...).

To machine this square (and to the correct length – **Photo 23**) I would recommend taking an equal amount off both sides, so if if 3mm needs to be taken off, take 1.5mm off each side, or at least enough to remove all surface scratches, gouges and such like.

After you have machined the bar to the correct size and taken a moment to admire its shiny finish, centre drill, then drill, all the holes except the cylinder bore, then tap these holes to their respective threads. If you use copper, cry as you break a tap (like me) or if you are much more sensible and use bronze, smile as you put a dab of oil in the hole and tap it to perfection (**Photo 24**).

Finally, centre drill the hole for the piston with the biggest centre drill you have and slowly work your way up your drill set in, say, 3mm increments. End with it at 12mm. Then ream the hole with a 12.7mm (½-inch) reamer, taking it slowly and with plenty of oil or cutting compound (and a low rotational speed – say 150rpm or less). Finish off by smoothing all of the faces with diamond grit stones or a buffing machine.

Note that I did all of this on a mill, however it could also be undertaken on a lathe, using a four-jaw chuck to take account of the offset of the cylinder bore from the centre of the cylinder block. When reaming on a mill, a short style of reamer is required (**Photo 25**) not the longer, tapered, variety (**Photo 26**). Note that both of the reamers pictured are ½-inch, despite looking very different.

If all is well, you should end up with a finished cylinder looking like **Photo 27**. The inside of the cylinder bore should be silky-smooth and free from lines, ridges and such like – the presence of these indicates that the tool (reamer) was probably chattering when cutting, but you would have heard this during the cutting operation – altering the rotational speed and/or feed-rate should help eliminate this. I got this bit right first time and was inordinately pleased with the beautiful finish obtained (even my mentors at Hereford SME were impressed!).

"I wanted to ream the cylinder, to produce a smooth finish and, thereby, hopefully a smooth-running engine..."

Cylinder cover

The use of a cylinder cover was one of the modifications I made to the original design. In the original, the cylinder is fabricated from a single piece of metal, which is drilled to the correct bore. Unless a fairly large excess bore length is used, it is not

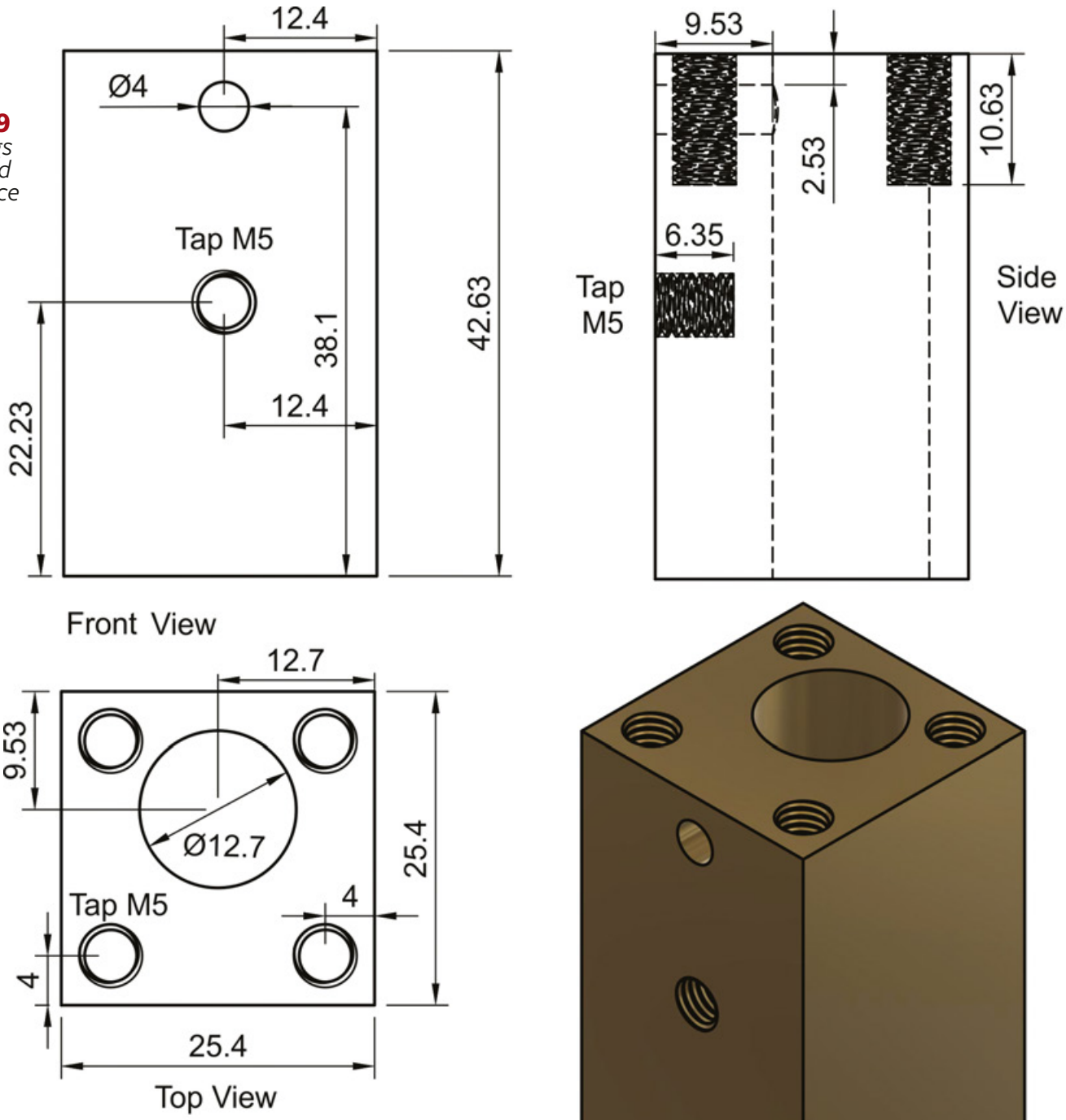


FIGURE 9
All drawings reproduced approx twice full-size

PHOTO 23: Machining the top of the cylinder to the correct dimensions.

PHOTO 24: Tapping the hole that secures the cylinder to the pivot bolt.

PHOTO 25: Short 'hand'-reamer.

PHOTO 26: Tapered reamer – good for use in a lathe, but less useful in a mill, and useless for remaing a cylinder bore...

FIGURE 9: The cylinder, reproduced twice full-size, dimensions in mm – odd sizes represent result of conversion from original imperial measurements.

All photos and diagrams by Peter and Matthew Kenington

possible to use a reamer with this arrangement, due to the small taper at the end of the reamer (the point of the drill is also an issue, but this could perhaps be alleviated by using an end-mill in place of, or in addition to, a drill bit).

I wanted to ream the cylinder, to produce a smooth finish and, thereby, hopefully a smooth-running engine. As a result, I opted to shorten the body of the cylinder and add an end-cap. This turned out to be a good move and I would certainly recommend this approach.

The material used for the end-cap was a piece of 5mm aluminium plate; a fine material for the job, giving a nice visual contrast to the copper cylinder. Again, I drew the cylinder cover in 2D CAD so our CNC milling machine could drill the holes and then engrave a letter 'M' on it (using a 1mm end mill and two passes, to arrive at a 2mm cut depth), Photo 28. This adds a little character, or looks a bit naff, depending upon your perspective – needless to say, I'm in the former camp.

The process is similar to that of the upright: first hacksaw cut the plate to approximately the correct dimensions (Figure 10), then mill the plate exactly to the required dimensions, taking great care that the bottom face is smooth and level as this will have to be a snug fit with the top of the cylinder, so no steam escapes when the engine is running.

Centre drill, then drill, the clearance holes for M4 (which are 4mm diameter, obviously). If you wanted, you could also countersink them so the bolt is a flush fit (which I did). As noted above, I CNC engraved an M on mine, but you can leave this out if you wish – I won't be offended.

Supporting role

Note the support mechanism used in Photo 28 – a single (thick) parallel located in the centre of the piece. This supports the piece whilst the engraving and subsequent drilling operations are carried out (the holes falling either side of the parallel), meaning that the clamping grip of the vice is slightly less important. It is easy for an unsupported workpiece to slip downward without adding this additional support.

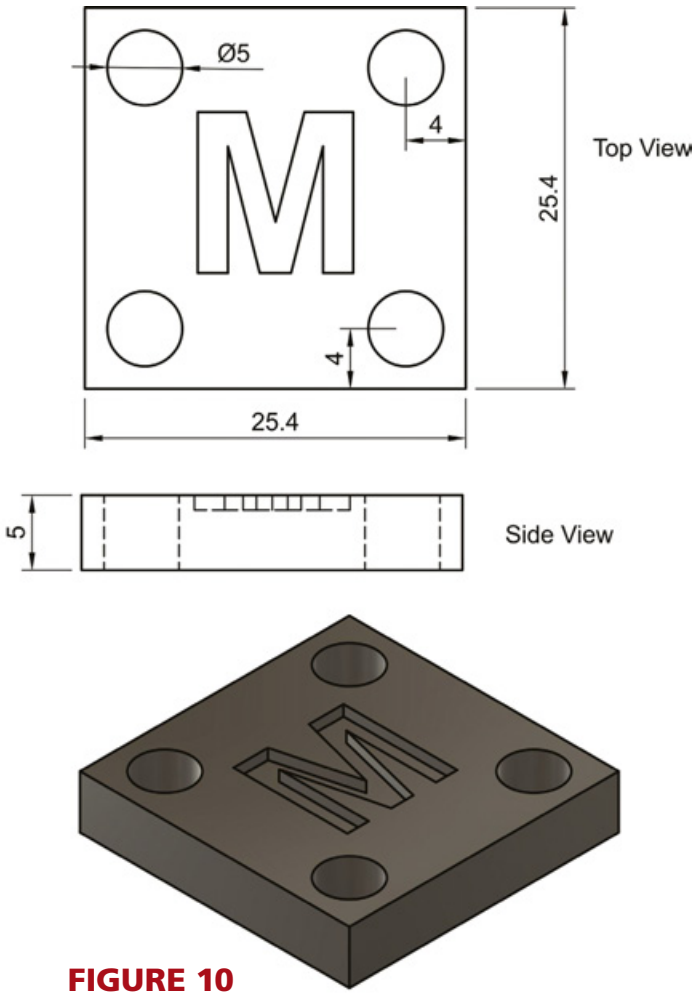


FIGURE 10

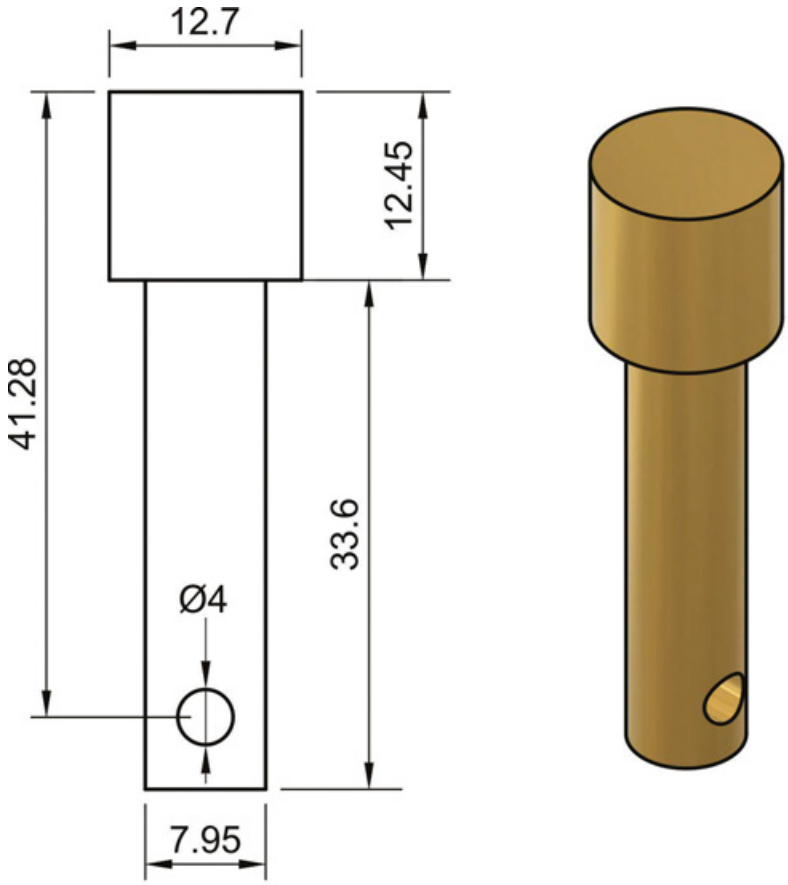


FIGURE 11

The downside of using only one parallel is that it is easy for the part to be slightly tilted – a fact which would become obvious in the engraved letter. The way around this is to set up the piece using two parallels, as described earlier in this series, then remove one and move the other to the centre. It should be possible to do this without slackening the vice jaws – the parallels should move and slide out fairly easily from underneath the workpiece.

The end result of all my efforts on the cylinder is shown in Photo 29. The inlet/outlet port and threaded pivot-bolt hole can also be seen in this photo. The circular scratches on the side of the cylinder are the result of the engine being used, to test it and 'run it in' (or 'play with it', to be a little more honest).

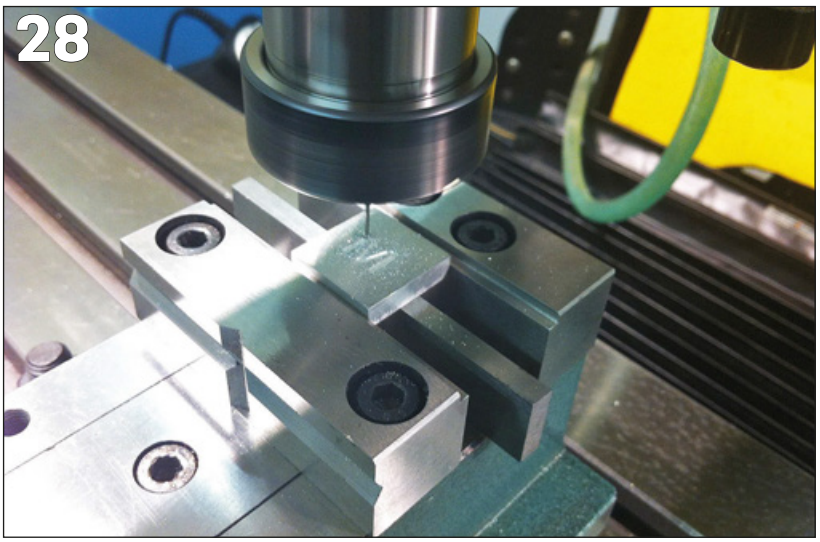
I will confess to indulging in a little bit of 'cheating' to obtain the lovely fit of the cylinder head on the cylinder body (there is no 'lip' and the whole is perfectly smooth) – again, don't tell the judges. Once the cap was installed on the cylinder body, I put both back in the mill and took a skim off the whole – the cap was fractionally larger than the body, so most material came off this. The end result was certainly worth the minimal additional effort.

Note that I didn't use a gasket between the cylinder cap and the cylinder body, preferring to try and get both sufficiently smooth to render one unnecessary (I didn't fancy the awkward job of cutting one out and trying to get it to be invisible from the outside). I now have a neat way of doing this (as regular EIM readers will know, using CNC cutting technology, see the June 2020 issue), but didn't at

FIGURE 10: Cylinder cover.

FIGURE11: The piston.

PHOTO 27: Cylinder base, showing the cylinder bore – this reamed beautifully, ending up silky-smooth.



the time of construction. But with the cylinder held stationary and compressed air supplied (to try and highlight any leaks), the seal seems to be a good one. I'm sure it won't be perfect, but it seems fine for this simple project.

The piston

We are almost finished now, but this next component is perhaps the most critical (so no pressure then...). The piston should be made from brass rod. This is the best material for the job, although it will cause wear on a cylinder made form copper (again, oh for a nice bit of phosphor bronze, but too late now...).

As before, we need to hacksaw cut or part-off the brass rod to approximately the correct length and set it up in a three-jaw chuck. Alternatively, the whole rod can be clamped in the chuck, with only the required machining length sticking out; the correct length can then be achieved by parting-off at the end, with a final facing cut used, if needed (which it often is).

Ensure, when machining, that the piston rod is facing the tailstock, thereby leaving the thickest (and hence strongest) aspect of the part attached to the remainder of the rod, for as long as possible. This will prevent the part from bending whilst being machined. The piston rod can be machined to the correct diameter with a standard left-hand lathe tool (Photo 30). All of the required dimensions are given in Figure 11.

If you have left the rod whole (in other words not cut to length) then the piston itself can be machined now and parted-off. Leave this a millimetre or two too big (in diameter), then turn the part around so the piston itself is facing the tailstock and slowly turn it down (checking each cut against the cylinder bore) until it fits.

The same procedure can be used with a cut-to-length part, the only difference being that all of the turning down will be undertaken with the piston clamped in this position (facing the tailstock). **Note:** turn down a small part of it first and if it fits carry on with the cut, if it is too small back off the cut. Don't forget to chamfer the front-edge of the piston each time, before checking the fit in the cylinder bore – it is very easy to over-cut the piston if this is not done, with only the burr being a snug fit (and this will soon wear away!).

Chamfering can be achieved with a file or emery paper depending upon how much burr is present (with the lathe rotating slowly – a few hundred rpm, say). Always take great care when doing this as chuck jaws will suffer absolutely no damage whatsoever should they come into contact with your fingers; your fingers, on the other hand, will undergo a few non-standard modifications.

Finally, mark out the hole for the crank-pin and centre punch it. Then drill it (starting with a centre-drill, as before). A quick polish with some fine emery should yield a thing of great beauty, all being well (Photo 31).

A useful test of the quality of your machining is as follows:

1) Insert the piston into the cylinder (with the cylinder end-cap fitted) and push to near the top of its stroke
2) Block (air-tight) the port hole at the top of the cylinder – a finger clamped tightly over the hole is usually adequate
3) Rotate the cylinder so that it is upright, with the piston-rod pointing downwards and clear of any surface (such that it could drop out by gravity)
4) If the piston stays put or only very slowly drops, then congratulations, you have done an excellent job!
5) If it moves a little more quickly, try lubricating the cylinder bore with some light oil (such as 3-in-One) – if it now forms a good seal, then the engine will probably work okay, so long as the piston does not rattle too much (from side-to-side) in the bore
6) If even this does not result in a good seal, you will probably need to make a new piston (or some piston rings for the existing one) – don't be too disheartened, it's all part of the learning process. It's better to make these mistakes on a simple engine like this than on that 7¼-inch gauge Britannia that you've always promised yourself.

Ring issues

Note that piston rings can be a bit of a mixed blessing on an oscillating engine due to the enforced side-to-side motion of the cylinder – this is why the piston body is so long. Multiple (at least two), hard, rings would probably be necessary, along the length of the piston body – graphited-string probably wouldn't cut it as it would still allow too much lateral movement. This is an issue almost unique to oscillating engines – most other steam engines have slide-bars to constrain lateral movement of the piston. Which is a long-winded way of saying: make a new piston!

Congratulations, you should now have a complete set of machined parts for an oscillating engine. It only took you a week/month/year (delete as appropriate). It took a good few months, in my case, but I was only able to work on it for one or two mornings a week at most. EIM

■ Next month Matthew assembles and tests his engine. The first three parts of this series were published in the February to April 2021 issues of EIM – you can download a digital back issue or order printed copies from www.world-of-railways.co.uk/store/back-issues/engineering-in-miniature or by calling 01778 392484.

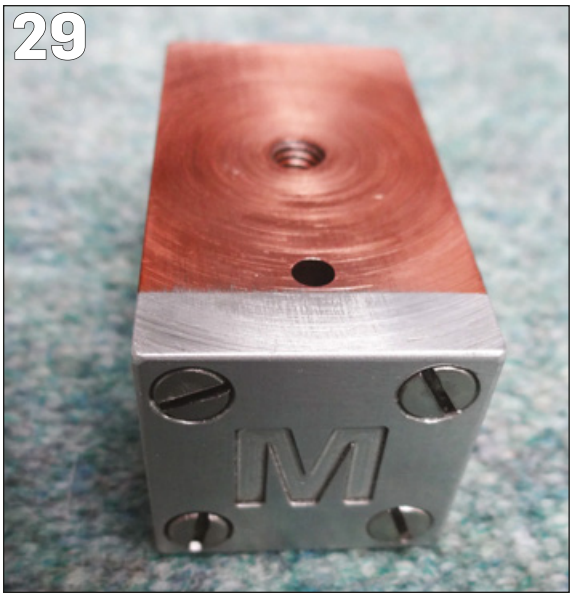


PHOTO 28: Milling machine CNC engraving the M on top of cylinder cover.

PHOTO 29: Cylinder head with cap installed.

PHOTO 30: Machining the brass rod to the correct dimensions to make the piston, on the Harrison M300 lathe at Hereford SME

PHOTO 31: Finished brass piston, machined to fit the bore of the cylinder (and not the other way around).

Rebuilding a Winson

This month 16-year-old Sussex Miniature Locomotive Society member Sam's rebuild of an unfinished kit from a defunct manufacturer heads towards a milestone first steaming.

BY **SAM RIDLEY** Part Three of a short series

With the chassis of my 5-inch gauge Winson Engineering 14XX 0-4-2 tank loco now successfully running on air again, it was time to divert our attention to the boiler and its fittings. Very helpfully, my boiler's manifold was different to the one displayed in the original pamphlet. This one had three front holes and two side holes as opposed to the two front and two side holes in the pamphlet. This was no big issue, however, as it now meant both steam fittings and the whistle valve could face the driver.

There were, however, other issues that required some attention to make the fittings, erm... fit! Extra threading was needed on the manifold to make it sit down properly on the boiler with some extra threads in the bush. Both steam fittings on the manifold needed their threads to be cut back so they would sit at the correct orientation and flat against the manifold. Working thou' by thou', this process took time.

Gauging the gap

The whistle valve needed its thread extended and a rubber (Viton) ball was used instead of the magnetic stainless ball originally supplied with the kit. The gauge glass was also in need of some adjusting, as neither fitting sat at the correct distance away from the backhead and they were also not horizontally aligned by about 1/16-inch top to bottom! Both fittings had their threads turned back so they sat the same distance off the backhead and an offset was made for the top fitting to compensate for the misaligned top bush.

The firehole doors were fitted after a small fight but required some additional stainless screws to be added. The holes were also re-drilled to remove the built in 'slop' which we assume had been added to make them fit. Finally, the blowdown valve was bored and a removable seat was added. This was sealed by O-rings on both faces and a new gland nut at the rear was made to fit over O-rings on the stainless valve spindle. A handle was silver soldered to the rear of the spindle with the gland nut captive within it.

Now with all the backhead fittings in place it was time to start fabrication on the inner dome, this was because it was missing from the original kit or perhaps never supplied. To fix this, I armed myself with a 1⅜-inch outside diameter by 13swg piece of copper tube. The first job was to face both ends to a finished length of 2½ inches and turn a ⅜-inch long x 45 thou' step at the base to fit a short length of PB102 bronze, which would house two silicone O-rings to seal against the bore of the dome bush. I then used some C4 (higher temperature) silver solder to join the two pieces together.

I added a further 2¼-inch outside diameter by 10swg thick ring of copper which was bored and silver soldered to the outside of the tube using Easi-Flo 2 (lower temperature) silver solder, at the same time as adding a crossbar to the inside, to support the regulator (**Photo 13**).

To attach it to the bush I would need to drill 12 holes all equally spaced out around the inner dome. So it was time for my first use of the dividing head on the Myford lathe, which meant I could drill the 12 holes on a 2-inch pitch circle diameter (pcd) to correspond with the 12 holes in the dome bush.

The dividing head was mounted on the vertical slide of the lathe (**Photo 14**), the head having a handle to spindle ratio of 1:60. This meant that for every five turns on the handle I could drill another one of the 12 holes into the inner dome. However, I drilled round the inner dome twice. On the first rotation I spot-drilled each hole to check they were evenly spaced before fully drilling through on the second rotation.

Finally, I turned a top plate from a ¼-inch length of 1 3/16-inch outside diameter PB102 bronze with a ½-inch x 32tpi thread through the middle and this was silver soldered to the inside of the copper tube with another use of the Easi-Flo 2.

Trial fitting ran smoothly and the inner dome proved a nice snug fit in the bush with the O-rings included, meaning we could tick off another job from our ever-growing 'to do' list.

Regulator replaced

In between times, a new and improved regulator and main steam pipe were fabricated because the original gas valve was just not up to a high-enough quality. The regulator was machined from a piece of ⅝-inch square cast gunmetal and was then bored to take a ½-inch outside diameter rotating PB102 bronze drum with a PTFE insert to keep it sealed.

"Neither fitting sat at the correct distance away from the backhead and they were also not horizontally aligned by about 1/16-inch top to bottom..."

The originally supplied regulator rod was used but it was modified to have a conventional square drive at both ends. The inlet pipe from the regulator to the wet-header banjo was increased from the supplied 5/16-inch x 16swg pipe to a larger ⅜-inch x 16swg pipe, so the bore of the pipe will feed enough steam to the cylinders. Apparently the originally supplied pipes were notorious for not passing enough steam.

The banjo fitting on the wet header was also adapted to take a silicone O-ring by way of two 1/16-inch thick PB102 bronze washers each containing a 0.070-inch O-ring which seals against the faces of the boiler bush, banjo and locking nut.

At the cab end, further silicone O-rings were used to seal the gland

and the addition of these O-rings made the initial tests much easier because disassembly and then reassembly was clean and simple.

With all the fittings now installed on the boiler, the final piece of this very elaborate jigsaw before trial fitting to the chassis was the inlet pipe to the cylinders. The clever use of more silicone O-rings meant the original brass plate used to feed air to the steam chest during testing of the chassis could be modified to accept the flat fitting at the tip of the superheater hot header.

With the boiler now able to be mounted in the chassis for the first time an air test proved to be successful because the locomotive could be driven with air fed from the boiler and through the new regulator. During the test, soapy water was used to check the engine over for any air leaks and although there were some minor leaks around the inlet pipe these were subsequently sealed. There were no major leaks anywhere else and the chassis ran well on air with a very responsive regulator! Work could now begin on piping up the boiler so steam could be raised for the first time.

Plenty of pipework

Work to connect the pipes from the boiler fittings began in early July, which was about six weeks after the initial national lockdown had been relaxed. With so much progress being made in that short space of time, there was a goal to try and get the engine into steam by the start of the summer holidays, with two more outstanding jobs to do. We needed to seal the superheater hot header to the steam chest by using more trusty silicone O-rings sandwiched inside a brass plate and also to fabricate pipes to and from the crosshead pump and injector.

The first item on that list required some adjustments to complete the process. During the air test it became apparent that the boiler was not 100 per cent level in the frames. This would require some adjusting because the error was out by about ¼-inch end-to-end.

The brass plate that houses the O-rings to seal the hot header to the steam chest needed to be thicker. The original plate was 1/16-inch thick with only a single O-ring. The newer, thicker plate would be ¼-inch thick and would house two O-rings with an insert to hold them captive. So, with the thicker block installed between the hot header and the steam chest (Photo 15), the boiler was now more or less level from front to back and work could begin on the copper pipes to connect up the crosshead pump and injector.

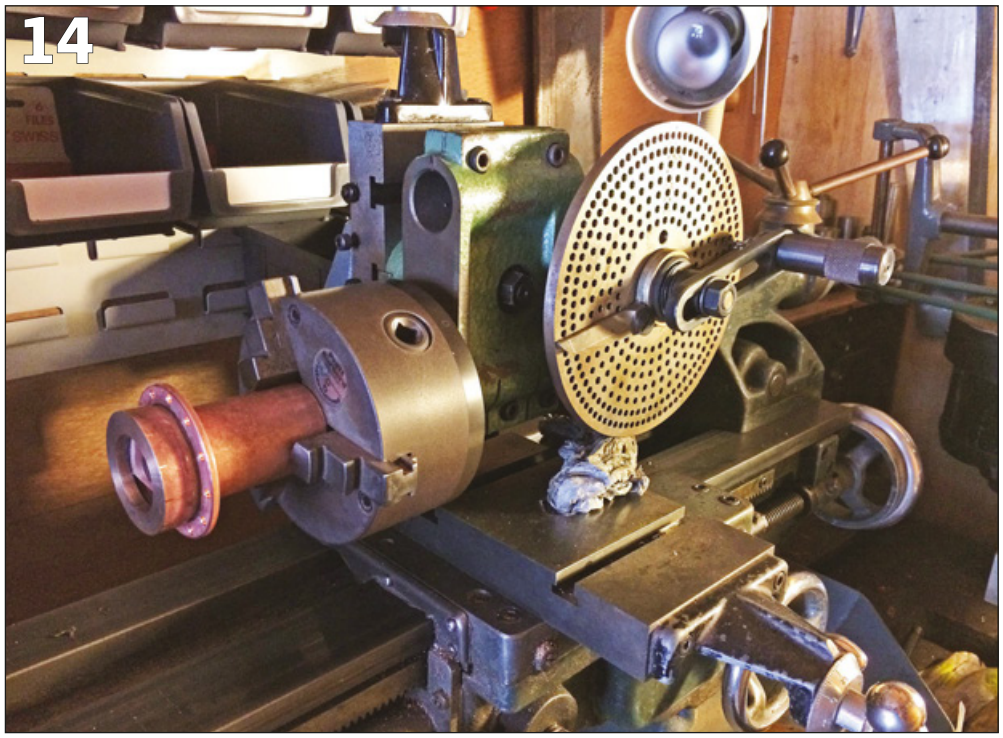
The crosshead pipes were tackled first and needed to thread their way from back to front and vice-versa. Lots of propane was used in the process to keep the pipes annealed and soft enough to bend! The annealing process was very simple with three key steps: heat the pipe until cherry red (Photo 16), quench in water (quickly!) and bend the pipe until it was too hard to work with.

This process was repeated many times with each pipe until they were all a good fit and shape to pass quality control! A bypass valve was also added in the cab between the return pipe and the backhead clack.

Next was the injector which was hung under the cab floor and just like the crosshead pipework, lots of propane was used because of the tight radii of the pipe which went from the steam valve to the injector and then to the backhead clack. If the copper became too hard, it would kink and not leave a nice curve.

To save removing a fitting each time to fill the boiler with water, the outlet from my mentor Andrew Brock's hydraulic test pump was adapted onto one of the clacks and acted as a hand pump. This also provided a backup just in case one of the other feeds did not function as it was intended.

Before D-day, or in this case 'S' for 'Steam Day', the boiler was filled with air and checked once more with soapy water to make sure every joint was as pressure tight as possible ready for the first steaming.



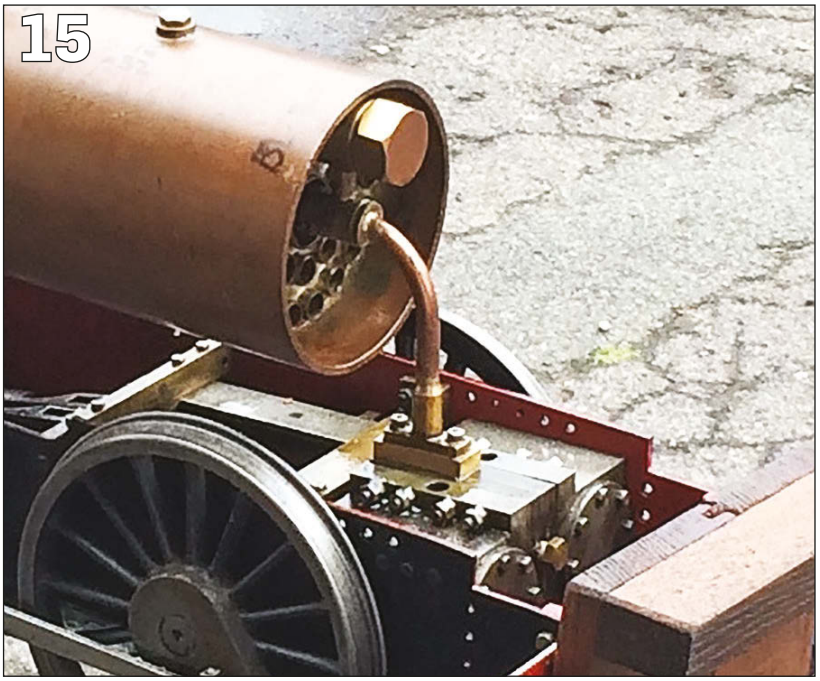


PHOTO 13: Forming a new inner dome to replace one missing from the kit.

PHOTO 14: Dividing head mounted in the lathe to drill the dome mounting holes.

PHOTO 15: Thicker block installed between the hot header and the steam chest levelled up the boiler.

All photos by the author

Successful S-day

With all of the items checked off on that 'to do' list, the date was the 24th July 2020 and 'Project 14xx' had its first ever real steam! While it was a rather unorthodox test, including a rolling road and fired by propane through a 'cyclone' burner, it worked nonetheless (Photo 17). The premier steam test was another big milestone within the progress of the project.

The steam test had ticked off many items of the 'to do' list, but it also added a few more boxes to be ticked off as well. Nonetheless it was a very successful and enjoyable day; it also attracted some public attention with walkers passing by who made some very complimentary comments!

After a great day, among the unchecked boxes added to the to-do list were two issues involving getting water into the boiler. One of these was that the crosshead pump did not maintain the water level sufficiently. There were two main causes for this problem, one was that the crosshead ram was not big enough and the other was a leak around the gland packing on the ram.

The other main water issue requiring investigating in due course was that the injector seemed to be quite temperamental when being used at lower pressures.

Another item on the list was the blow down valve. Although most valves on the loco liked to let a little steam out when closed, this one didn't want to let any out when open – typical! Finally, there was also no in-line lubrication installed on the loco yet which would be required before further testing could take place.

In all other respects, the loco performed very well for a 'first time out' and even the safety valve – over which there had been concerns – proved very accurate, lifting at almost exactly 80psi.

So, with the excitement of the first steam now behind me, it was time to crack on with the project and the main target was to get the locomotive running on track by the end of the summer holidays. EIM

■ Parts 1 and 2 of this series appeared in the March and April 2021 issues of EIM – download a digital back issue or order printed copies from www.world-of-railways.co.uk/store/back-issues/engineering-in-miniature or by calling 01778 392484.

"It also attracted some public attention with walkers passing by who made some very complimentary comments..."

PHOTO 16: Loco pipework provided Sam with plenty of practice in annealing.

PHOTO 17: Unorthodox, but a special day as steam is raised in the loco for the first time.

GWR 1400 Class Assembly Instructions/Parts lists/Exploded views

The Engineer's Emporium

Many readers may not know that for many years The Engineers Emporium has been offering a complete parts and advice service for the entire ranges of both Winson Engineering and Modelworks International, providing the continuity that was under threat when the original manufacturers of these kits folded.

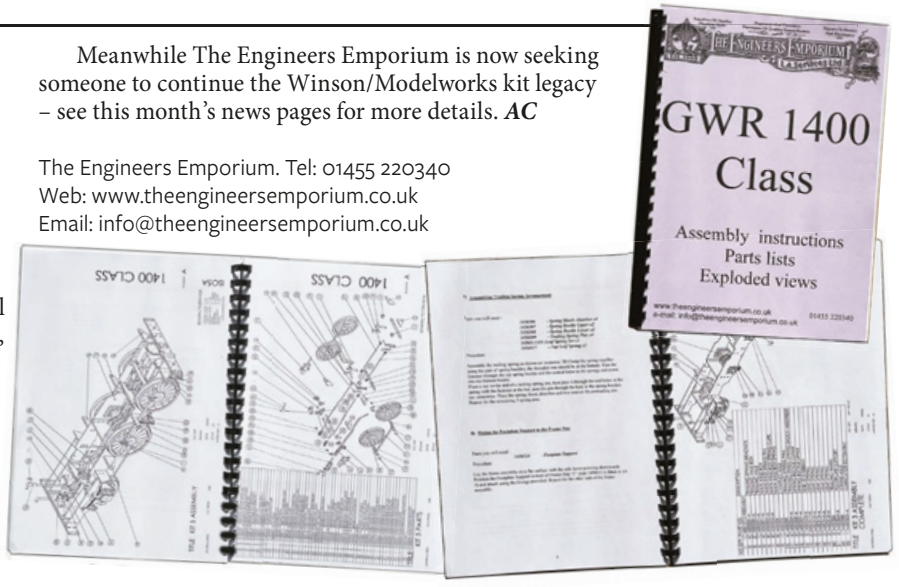
Noting Sam's efforts to rebuild his 14XX, The Engineers Emporium has sent us an example of the instruction manuals produced for each of the model ranges. These are effectively reproductions of the original step-by-step instructions that were supplied with the kits, and are very extensive.

As well as providing detailed lists of parts and describing how to assemble the models, the manual includes a host of detailed exploded drawings of each sub-assembly.

Certainly anyone who might acquire one of these kits, from Ebay for example, will find the build a lot easier referring to this manual.

Meanwhile The Engineers Emporium is now seeking someone to continue the Winson/Modelworks kit legacy – see this month's news pages for more details. ***AC***

The Engineers Emporium. Tel: 01455 220340
Web: www.theengineersemporium.co.uk
Email: info@theengineersemporium.co.uk



Indication of metric mayhem

Harry shows how picking up the right tool, and checking that it is, can save a lot of angst...

BY **HARRY BILLMORE**

"To my horror, the dial spun by three quarters of a turn and then back again..."

This is a short tale of more haste less speed... You will read elsewhere in this issue about how in my day job as engineer on the Fairbourne Railway I use a hydraulic copier to machine wheel sets. During this process I like to ensure the wheels are running true by using a dial indicator on the axle journal.

On the day in question I picked up the first indicator I came across, fitted it to a magnetic stand and set it up as normal. Turning the lathe over by hand, to my horror, the dial spun by three quarters of a turn and then back again.

Assuming that I had picked up my normal dial indicator, I then proceeded to spend an hour or so trying to find out where 0.100-inch eccentricity had come from, chasing things down such as the position of the centre in the lathe chuck, the eccentricity of the live centre in the tailstock, the position of the tailstock in relation to the lathe bed and a few other things as well.

Adjusting all of these got me down to what I believed to be 0.075-inch of eccentricity, which I was about to put down to the centres being offset in the axle, before I then noticed that the dial actually read in thousandths of a mm...

So rather than 0.100-inch eccentricity at the start I had actually had 0.003-inch eccentricity, a couple of orders of magnitude out!

There you have it, a short lesson in ensuring you know what measuring device you have picked up when trying to chase down faults! EIM

■ Have you made a mistake, silly or more complicated, that caused you frustration in the workshop? Come on, own up to it, describe it and help your fellow model engineers avoid doing the same! Send details, and pictures if possible, to the editorial address on page 3.

RIGHT: Dial indicator set up to check eccentricity on a wheel set.

FAR RIGHT: Making a close inspection of the dial reveals the error.

Photos by the author

PHOTO EXTRA

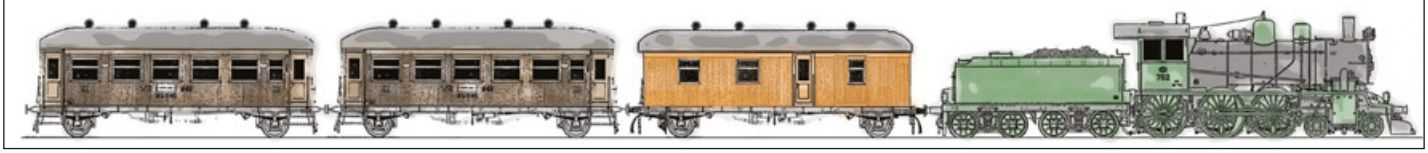
■ Another photo memory while we await the chance to start making some new ones! In a normal year we would start the month of May heading for Lincolnshire and the National Show at Doncaster. Sadly it's not happening in 2021, for a second successive year, due to Covid. Frustrating for many including our Ed, who took this picture at the 2018 show, so far his only Doncaster visit since he assumed the EIM hot seat...

Building a Ten-Wheeler

Jan-Eric concludes his 7¼-inch gauge locomotive build project with a long-awaited first steaming and some teething problems to sort out.

BY **JAN-ERIC NYSTRÖM** Part Sixteen of sixteen

FIGURE 42



Finally, after almost six years in the workshop (that admittedly included a few lulls, together maybe a couple of years), I got to the point that I could steam up the Ten-wheeler for the first time! Photo 189 shows the completed engine, as well as the carriages I had completed earlier, on the track at the Finnish Railway Museum. The total length of this 7¼-inch gauge train, as pictured, is a few centimetres short of six metres!

My inspiration for the rake of rolling stock was a couple of decades-old drawings by amateur HO-scale modellers; I had scanned, cut and pasted the clippings into a composite image showing my 'dream', Figure 42. As you can see, I didn't stray very far from the prototypes, even though I've simplified many of the technical aspects, and left out a lot of miniscule details – those that you wouldn't even notice from a couple of metres away.

Before steaming up, I had to get the engine out of the workshop... Weighing a whopping 180kg (not including the tender, another 40kg or so), I couldn't possibly lift it by myself. There was no way to get it out of the workshop by lifting, anyway, even if I could get three more people to help – the doorway would be too narrow for both the loco and the people at the same time!

So I built a motorized 'loco lift', described in the May 2020 EIM and a sketch shown in Figure 43, enabling me to lower the engine down from working height to 'rolling height', only 15cm from the floor. Thanks to the wheels under the lift, it was easy to zig-zag-navigate the engine through all the mess in my workshop, out through the door, and into the basement hallway. There, I could again adjust the height of the lift so that it matched the stairs leading to the back yard.

A piece of track propped up with a few wooden blocks helped me to roll the engine onto the specially modified trailer (see EIM April 2019). With the winch on the trailer drawbar, and with the help of the reduction gearing of the winch, I could crank the engine onto the bed with minimal effort, Photo 190. Then it was off to my own track in Hangö for the first steam test.

Again, the winch made an easy job of lowering the engine onto the track, Photo 191. A simple ramp made from rectangular tubing helped me get the loco into the right position, without derailing it. With these implements, I'm able to single-handedly move the loco from workshop to track and back without actually having to lift anything at all!

PHOTO 189: The Ten-wheeler and its stock ready for action – note propane bottle protruding through bottom of orange mail car, and red emergency gas shut-off valve in open end towards tender.

FIGURE 42: Inspirational drawing for the loco and its carriage set.

FIGURE 43: Side view of a loco lift. Red line is steel wire to electric winch at left.

All photos by the author & friends

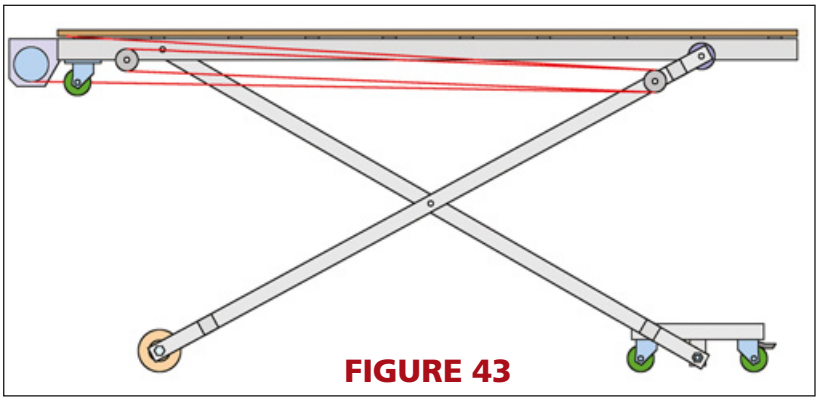


FIGURE 43

"Weighing a whopping 180kg not including the tender, another 40kg or so, I couldn't possibly lift it by myself..."

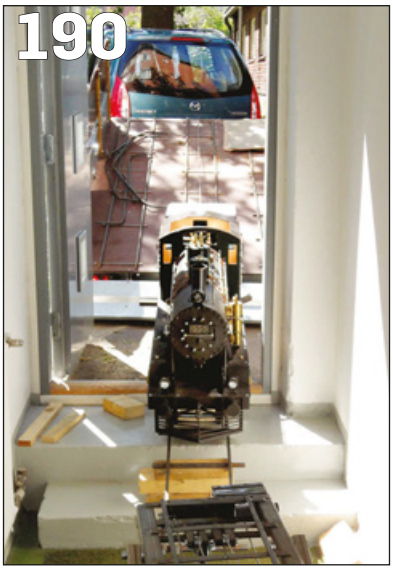


PHOTO 190: Moving the Ten-wheeler from the workshop to the trailer.

PHOTO 191: Lowering the loco onto Jan-Eric's home track.

PHOTO 192: A centrifugal fan on the chimney provides ample draft in the firebox.

PHOTO 193: Six propane burners in the firebox. Flames are all blue – a sign of complete combustion!

Steaming up

First, I had to get some draft through the fire tubes. Since this loco isn't 'self-drafting' like my two previous ones with their torch-type propane burners heating wire mesh to a bright yellow glow in large-diameter flues, I needed an artificially induced draft.

A simple home-made centrifugal fan did the job; Photo 192 shows its construction: It consists of a frame made of two rings of soft steel (bent to shape from flat stock and welded), held together by a stainless steel mesh, which also offers protection for the fan itself, a circular piece of thin brass plate, with six radial fan blades on the underside. I originally soft-soldered the blades (easy with brass), but fearing that the solder would likely melt in the heat (it hasn't, yet), I also secured them with pop-rivets.

The motor driving the fan was cannibalized from a £10 car tyre pump. Since the hot gases from the stack are blown outwards through the mesh, not upwards, the motor doesn't overheat. Without the drafting fan sucking air through the chimney, the flames will exit through the fire-door – I didn't know this until I singed the hairs off one of my hands. Poking a barbecue lighter into the firebox, the flame leapt out from the fire door! I learned my lesson at the first try – hence, I now also use gloves when lighting the fire...

I soon had a nice fire going inside the firebox. With proper draft, the burners work exactly as intended and tested (see the August 2020 issue), Photo 193. The propane pressure is ▶

adjustable with a regulator, all the way up to 1.5 bars, but the best combustion (with the least smell of unburnt gas) happens between 0.2 and 0.4 bar.

Using such a propane feed, the steam pressure rose from zero to 7 bars in about 15 minutes. The gas consumption is about 2kg per hour. The 5kg bottle, which is situated in the first carriage and connected to the loco via a pipe with quick-release couplings in the tender, does get frosty as it empties, but since propane has a boiling point a few degrees below minus 40 degrees C, I've not experienced any problems with the propane feed freezing up.

Teething problems

These were exciting moments! I checked the manual safety valve – yes, it worked as it should, and then I waited until the other safety lifted, at the intended pressure, all was okay... Pulling the throttle lever, I was awarded with some staccato puffs of steam, and the loco began to move – Photo 194.

The valve timing wasn't perfect, but I didn't expect it to be, quite yet, since the motion and the valves were only adjusted to their approximate positions in the workshop. Adjusting the valve spindle is easy; by removing the front cover of the valve cylinder (just four stainless bolts), I can use a screwdriver to change the valve position, thanks to a slot cut into the front end of the valve rod. Tightening a locking nut in the valve crosshead then prevents the rod from any further rotation.

Also, the eccentric crank on the right side of the loco refused to stay in place, despite a hefty grub screw (the left side held well). Maybe because the crank pin was too well hardened, the grub screw couldn't 'bite' into it. Some Loctite 603 and two more grub screws did the trick – after that, the crank has not moved from its intended position.

The Finnish Railways' 150-year celebration at our railway museum was only two weeks in the future, and my loco wasn't running perfectly, yet. My own track, with its six-metre radius curves was also too flimsy in a couple of places. Even though I had improved the foundation, and my old 0-6-0 ran perfectly on my layout, the new engine derailed too easily due to some skewed track portions.

PHOTO 194: The very first puffs of steam. The exhaust sound indicates that some valve adjustment will be necessary.

PHOTO 195: On the way to a better track, for more extensive testing.

PHOTO 196: A TIG welder can be an invaluable tool even in a 'field' situation!

This large engine (with a rigid wheelbase of 500mm, plus the front truck, total wheelbase 950mm, excluding the tender) can negotiate the tight curves of my home track, as I had in fact graphically ascertained in a CAD program. This is possible only because the gauge is spread by 9mm in the curves. However, having no time to fix the bad portions of my track for more testing before the celebration, I decided to take the engine to the sturdier track at the museum for more experiments and adjustments. My trailer again proved to be indispensable, all rolling stock seen loaded for the trip in Photo 195.

Trying out the engine on the museum track (more than twice as long as mine), and occasionally running it at almost 20 km/h, I did experience a few more problems. The tiny roll pin securing the lifting link to the reverse shaft sheared after a

while of running. So, I decided to weld the joint, Photo 196. Now, the shaft, the levers and their bearings are a complete unit, impossible to disassemble – but strong enough! If some part ever needs replacement, it's not an overwhelming job to rebuild the whole assembly.

Peripatetic workshop

Expecting other problems, I had brought along half my workshop, Photo 197. The TIG welder with its Argon-gas bottle was of course the most important (and heaviest) of the tools, but I had even brought my little Unimat 3 lathe – just in case. I didn't need it, so it stayed in the car.

The very tiny banjo joint for the steam line going from the backhead, through a hollow boiler stay and to the blower in the smokebox leaked a bit, so I tried to tighten it – but it started to leak even more. The 6mm internal diameter banjo's brass thread had sheared, because I had used too much force to tighten it. Incredibly, after pulling the steam line out from the smokebox end, I was able to repair the threaded end with a small propane torch and some silver solder – implements always included in the toolbox I keep with my locos. Some Teflon plumber's tape and more careful tightening fixed the problem, the banjo hasn't leaked at all after this micro-surgery.

After these adjustments, the loco ran satisfactorily, pulling a test audience of museum employees several laps around the track. Now, I was ready for the two-day celebration! Readers can watch a video of the Ten-wheeler in action during my test at; https://tinyurl.com/10wheeler

Party preparations

The Finnish Railway Museum was founded in 1898. In 1974, the museum was moved from the Helsinki railway station to its current location in Hyvinkää (Hyvinge in Swedish; Finland is officially bi-lingual), some 60km north of Helsinki. The 150-year festivities would be the largest event ever at the museum, and many volunteers were needed for the planning, setup and operation of all the different activities.

I had (of course!) volunteered offering rides to the public. Since my Ten-wheeler had not yet proved its worth, I also brought my trusty 0-6-0 engine as a backup. Anticipating many thousands of visitors, the museum needed a proper fence for the platform area of the backyard railroad, we didn't want to rely on the simple ropes used on previous run days. I volunteered again, and spent a whole day cutting up 25 x 50mm lumber into suitable lengths, and then joining them together into 2-metre fence sections.

"The valve timing wasn't perfect, but I didn't expect it to be, quite yet, since the motion and the valves were only adjusted to their approximate positions in the workshop..."

A simple jig screwed to the temporary plywood exhibition floor covering the tracks in the equipment hall (Photo 198) allowed me to assemble almost 30 metres of picket fence in just one day – the stack can be seen in Photo 199.

Each fence section has 21 vertical slats, a little over half a metre high, cut to a 45-degree angle at the top. This was easy to accomplish, since I had cut all the necessary pieces of lumber to double that length at first, using a stopper screwed into the plywood floor in order to get all pieces the same length. Then I could rotate the base of my circular saw to 45 degrees, and attach a new stopper, enabling the pieces to be cut exactly in half.

Using the jig, I loaded 41 such pieces side-by-side, and placed the 2-metre long, horizontal boards across them all. Now, I could use a rechargeable drill and screw every second slat to the long boards. When that was done, I just lifted the section from the jig, shook it lightly, and the twenty interleaving slats would just drop away... to be used for the next section! The following day, the museum staff added supports to the sections and joined them, erecting the fence around the platform. Now, everything was ready for... the big day!

On the first day of the event, I arrived at the museum well before opening time, with the 0-6-0 in my car boot. I put it onto the track, and also took my Ten-wheeler out of the storage shed where it had resided since the last test run, and pushed both locos, as well as the carriages to the fenced-in platform area.

The queues were already forming as I readied my engines for the first day of running. Steaming up the engines doesn't take long, no more than 15 minutes from cold, so I soon had the full steam pressure of 7 bars in the Ten-wheeler's boiler. Steaming ▶

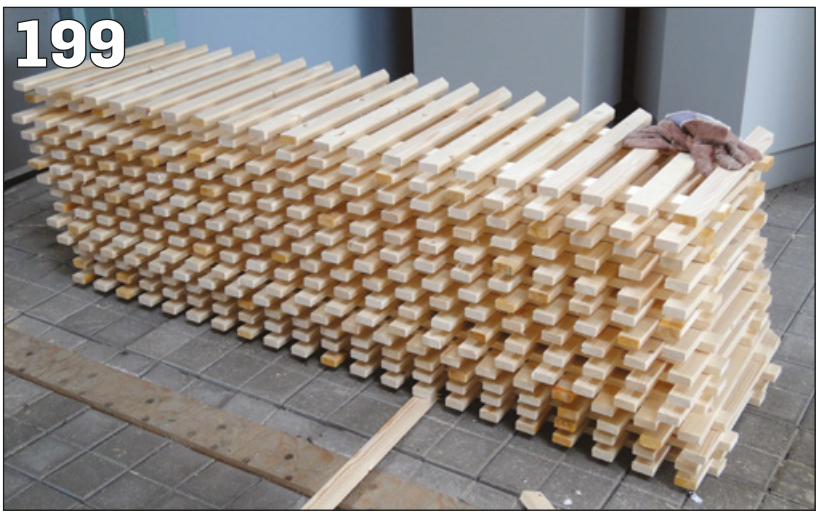


PHOTO 197: Jan-Eric's itinerant workshop spread out on the rail museum lawn.

PHOTO 198: A simple jig speeds up the building of picket fence sections.

PHOTO 199: A stack of 14 fence sections – a total of 28 metres, assembled in one day.

up was a spectacle the public enjoyed, Photo 200.

Since I ran the two steamers alternately, some 10 to 15 laps at a time, switching engine about once an hour, there was always some action behind the picket fence; filling the tender, lighting the fire, testing the safeties, even blowing down the boiler a couple of times each day.

For me, personally, one of the more interesting of the museum's displays was the presentation of the museum's Ten-wheeler #555, the 'Princess', on the turntable, Photo 201. This engine is identical to my own miniature #999, except for the shorter, three-axle tender.

Of course, the thing I enjoyed the most can be seen in Photos 202-203, running my brand-new Ten-wheeler on the museum track, for two whole days! Thanks to the superheater, hardly any exhaust steam is visible, and the exhaust beats sounded really nice after the final adjustments to the valve gear made the previous days.

All in all, more than 8,000 visitors visited the museum during the anniversary weekend, and we had some 1,600 passengers on the 7¼-inch track – split between three engines, the museum's battery diesel and my two steamers. A wonderful time for us all! EIM

PHOTO 200: The fence prevents the public from entering the platform area.

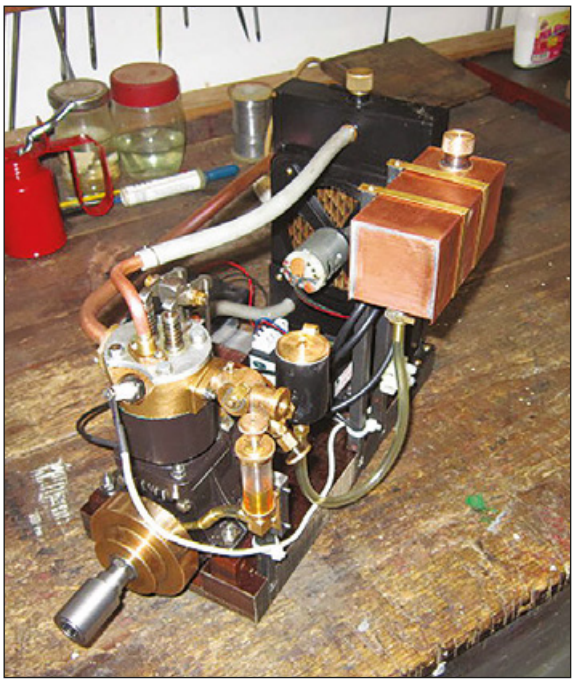
PHOTO 201: Ten-wheeler #555 rests on the museum turntable - note the loco's shorter, three-axle tender.

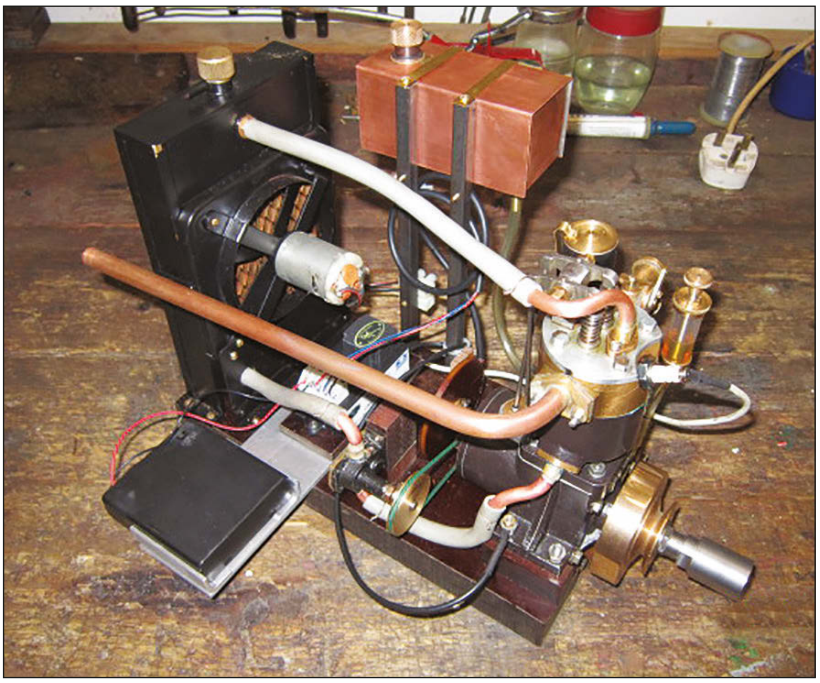
PHOTO 202-203: Running the brand-new Ten-wheeler for two whole days was exhausting, but exhilarating and it has since proven popular with visitors.

■ Previous episodes of this series have appeared as follows: Feb 2020: Introducing the Ten-Wheeler and design considerations; Mar 2020: Metal-cutting options; Apr 2020: Tab & hole – assembling components; May 2020: Frame construction; Jun 2020: Building the boiler; Jul 2020: The water pump; Aug 2020: Propane burners; Sep 2020: Casting the wheels; Oct 2020: Machining the wheels; Nov 2020: Making the tender; Dec 2020: Pumps, valves and generators; Jan 2021: The water feed; Feb 2021: The braking system; Mar 2021: Cab plates and carry cradles; April 2021: Final details.

To download digital back issues or order printed versions go to www.world-of-railways.co.uk/store/back-issues/engineering-in-miniature or order by phone on 01778 392484.

Next month Jan-Eric describes improvements made to his battery-electric loco, construction of which was recently described in EIM. And never one to rest on his laurels, he is working on a new engine which will be featured in EIM, this time on the road...





Petrol persistence pays off

Firstly may I thank you for publishing the article about my lockdown project, resurrecting my little Kiwi petrol engine in the March issue. Just to complete the story, at least for the time being, the engine test rig was completed and the engine then run on it to make the necessary adjustments.

Once warmed up the engine runs very well, ticking over nice and slow when the throttle is closed but once open running at a faster rate than I expected and never missing a beat.

I attach for interest (*above*) a couple of photos of the rig I use to run the engine. The water pump is a small gear type belt-driven from the crankshaft, the radiator fan is driven by a small 6-volt electric motor and the oiler is the one Edgar Westbury designed for this engine. Overall I am well pleased with the model.

Thank you also to Patrick Cubbon for replying (*letters, April issue*) to my enquiry seeking ideas for a small diesel-outline shunting engine to model, but for the moment the project is on hold.

I have located drawings for 1831, the LMS engine Patrick suggested, but I cannot get to view them or a shunting engine on display at Preston Rail Museum until lockdown restrictions are relaxed, so I have started building a Stanier 8F in gauge 1 just to keep my hand in! ***Stuart Rothwell***

Model engineering subject to raise or question to ask? Send your letters to the editor at 12 Maes Gwyn, Llanfair Caereinion, Powys, SY21 0BD or by email to andrew.charman@warnersgroup.co.uk

No quarter given...

I'm sure you're going to receive a host of these messages re the budget quartering jig featured in the April EIM.

This was an excellent article but one thing Julian forgot to mention was to remember to put the axle boxes on the axle before securing the second wheel! I can only assume that he must have been using proper split axle boxes and it didn't occur to him to mention it. ***David Hall***

Miniature Railways

David Henshaw

Latest in the series of inexpensive publications from Shire Books is this booklet on miniature railways by David Henshaw – as editor of *Miniature Railways* magazine he knows his subject.

To A5 format, the softback book runs to 64 pages and following an introduction and a bit of miniature railway history, it then chapter by chapter basically moves up in gauge, starting at 5-inch gauge followed by 7¼-inch, 8 to 12-inch and 12¼ to 15-inch. Each chapter boasts an overview of the gauge in question, how it came to be and then 'pen-portraits' of lines across the UK.

Included is an interesting selection of photos, well reproduced if some used rather small, while the book also features a not very exhaustive list of places to visit.

There are some oddities – some notable lines get a lot of coverage while other equally historic examples, such as the Fairbourne Railway, rate barely a mention and no photos. The Ruislip Lido Railway is described, with two pictures, in the 12¼-15-inch section despite the line being of 12-inch gauge. And there is also one of this reviewer's pet hates, an image where the bottom of the locomotive is cut off – used on the cover!

Apart from these irritations, the book is an interesting read and does serve as an inexpensive introduction to what is a very wide-ranging subject.

ISBN 9781 78442 440 4 Price £8.99
Published by Shire Publications.
Web: www.shirebooks.co.uk
Email: shire@bloomsbury.com

Where have all the youngsters gone?

John describes a new initiative tackling an issue that the hobby needs to find an answer to....

BY **JOHN ARROWSMITH**

The majority of heritage and social community groups in the UK in whatever discipline, are in the main, struggling to attract younger people into their ranks. Model engineering and heritage railways are part of this grouping and are facing the same problems.

There have been many suggestions as to why this is but nothing to date seems to provide the answer. Is it because craft skills are no longer taught in schools or technical colleges? It has been said recently that there are now more heritage railways in the UK technical colleges. If this is true then we certainly are going to struggle to maintain the craft skills nationally for which Britain was once renowned.

Train 2 Train

Recently a new group has been formed to try and address these problems for both model engineering and heritage railways. The concept of Peter Dickson, owner of the Tree Tops Miniature Railway in Buckingshire, and called Train 2 Train, this group numbers some very interesting members, including the 9½-inch gauge Downs Light Railway, Chris Vine of the *Peter's Railway* book series, and several full-size heritage railways including the Bluebell and North Yorkshire Moors lines. It is setting out to highlight the key challenges in training young people faced by many companies and organisations in both infrastructure and manufacturing.

Train 2 Train started out as a research project, leading to a book covering the opportunities offered by heritage railways to young people and the successes that resulted.

It soon became apparent, however, that the whole subject matter and its surrounding opportunities extended far beyond anything a book could cover. In fact the first challenge for Train 2 Train was to enable communication between these ventures and young engineers.

Personally I have been involved with young engineers at a well-known model engineering club for about 10 years now and supported by a good number of the senior members at the club, this venture has flourished. A

number of these youngsters, having gone through the basics of engineering at the club, have found that they enjoyed the challenges that were set, and have gone on to gain good engineering apprenticeships with local companies.

The long-term aim of Train 2 Train is to make the connection between the attraction of railways as a hobby for young people and the ultimate delivery of railway-minded young engineers and technicians to the full-size railway. Across the UK there are a diminishing number of mechanical engineers with manufacturing and maintenance backgrounds, and while technology continues to advance there are many aspects of both industry and infrastructure that are totally reliant on these core skills.

Train 2 Train is looking to grow this skill base again and it is also looking to grow the self-confidence levels amongst young people that is sadly lacking in many cases. The thought that every young person has to go to a university in order to have a fulfilled working life has its limitations. Not every youngster wants to go, but I get the feeling that schools do pressurise some youngsters to progress to university in order that the school can maintain their credibility in the league-table battle.

I have experience of this with my own grandson who had the strength of mind to resist and forge his own way in his chosen occupation. The school tried every trick in the book to get him to go to university and he refused. Now he has his own trading company and is becoming well known in his career. Some of his former school friends are leaving university and asking the one who didn't go, if he has any work for them, such has been his success.

Sign up schools

It has been suggested that liaison with schools local to heritage railways or model engineering clubs could show young people how STEM (Science, Technology, Engineering and Mathematics) subjects benefit the engineering aspects of the organisation's operations. It would be good of course, if a working relationship with a school staff member could be encouraged to enable a regular exchange of information and practical visits to be made between the organisations.

There are lots of ways to show young people how their educational needs can be enhanced by involvement in whatever way with these heritage rail or model engineering clubs. For example, the environmental aspects of the

"Train 2 Train is looking to grow the skill base and self-confidence levels amongst young people that is sadly lacking in many cases..."

operations could be another area where young people could be involved, as many of the existing sites have excellent working relationships with other environmental groups.

It is hoped that with collaboration between heritage railways, existing apprenticeship schemes and rail academies, coupled with the shining examples of effective young engagement, such as in many model engineering clubs, then this generation goal can be reached.

The photographs on these pages illustrate the sort of training now missing throughout the majority of the UK, but which is helping some model engineering clubs and heritage railways to recruit new members. It is by no means the complete answer to the overall problem of craft skills at any level in the UK, but it may help to start to address the problem.

If anyone would like to comment on these ideas and perhaps present an alternative way of hopefully achieving the goals of the group, please get in touch with me via my e mail address, pannier@hotmail.co.uk, or through letters to the editor who I'm sure will be delighted to publish comments or ideas that could help. EIM

Thanks to John Arrowsmith and others who have contributed photos for this piece.

Emporium seeks someone to continue Winson legacy

Sam Ridley's efforts to rebuild his 14XX locomotive, originally offered as a kit by Winson Engineering in the 1990s (*page 28*), have prompted The Engineer's Emporium to get in touch with EIM. While the Warwickshire supplier's stand is a familiar sight at shows each year, your editor was among those that did not realise that the firm has specialised in supporting the former Winson and Modelworks International ranges for many years.

The Engineer's Emporium first got involved in the early 1990s, buying up unsold Winson kits at the end of production runs and finishing them to sell ready-to-run. The firm was then able to buy the stock and designs after Modelworks, which had taken up the range after Winson went into receivership in 2001, also folded in 2008.

Since then spares, upgraded parts and instruction manuals (*see page 30*) have been offered for the range of kits, along with a great deal of help to enable those with part-built engines to complete them. "The kit process, like it or hate it, has had a positive impact on our hobby allowing new entrants and those less-able persons who may have never considered or have the engineering skills to build a locomotive, to join in and enjoy our hobby," the company told EIM.

While the Winson and Modelworks ranges have been the pet project of The Engineers Emporium founder and head, he now wishes to step back from some of the day-to-day running and feels the time has come to consider passing on the range to someone who could see its potential, give it more time and take it further.

"The designs are all available as electronic files, all drawn in 3D Para solid and each part is backed up with engineering drawings and build instructions," EIM was told.

"We feel there is an opportunity to release the designs, maybe as a new form of construction project especially with home CNC being very popular, as well as continuing to provide spares and upgraded parts for the kits."

Interested parties can get in touch with The Engineers Emporium at info@theengineersemporium.co.uk to discuss the opportunities available.

Winson's designs, which dominated railway magazine advertising pages in the late 1990s, still attract much interest today.

Twitter Steam Rally 2 gears up for 1st May

As revealed in the March issue the Twitter Steam Rally, which in the summer of last year provided online entertainment for many a steam enthusiast stuck indoors by Covid restrictions with no live-steam events to go to, is getting a sequel, and we now have more details of this year's event.

"We said in May 2020 that the Twitter Steam Rally was a one-off, never to be repeated event," Anthony Coulls, whose daughter Charlie came up with the concept, told EIM.

"We hoped that by 2021 the world would have changed for it not to be necessary, and we looked forward to a real rally season. In the end, it was not to be, and a second and third lockdown put many folks back into a gloomy prospect with early season rallies being cancelled.

"The online community formed with the Rally continued, and in January 2021, dozens of people saw the first half of the year written off for shows and asked if there could be a second Twitter Steam Rally. The small rally admin team had a quick chat and said yes, they would go for it. Only this time it would be on 1st May, the Bank Holiday Saturday."

Anthony added that this year's event will benefit from lessons learnt while making the first one happen. "Unlike 2020, where we flew by the seat of our pants, there is more organisation happening this year in advance – a bit like a real rally – only there will be no mud, portaloos or bins to worry about.

"We hope that thousands around the world will join in with the 8,500 in the Facebook Group already and the thousands more on Twitter itself and Instagram. There will be a full programme on the day, including live streams and the chance to showcase your own exhibit."

Rally plaques are in production and other souvenirs are being followed up, including a new mug design. Several partners are also interested in supporting aspects of the event, including the Best in Show as sponsored last year by Legacy Vehicles.

All this helps with the rally's serious side, raising money for charity, one of this year's chosen charities being Wetheriggs Animal Sanctuary in County Durham, where Charlie Coulls is a volunteer.

Other charities will be publicised as the event grows; "Last year, nearly £4000 was raised for charity, let's try for £5000 this year," Anthony added.

"Photos, videos, live streaming, all are welcome. Bring your own chips and doughnuts and we shall enjoy our wonderful hobby hopefully across the world in safety from our gardens, yards, fields and sheds!

"You don't have to have an exhibit to take part, just search on Facebook or Twitter for #TwitterSteamRally2 and see what happens and who shares what. From Mamods to Marshalls, it's all going to be there. Join us again – 1st May 2021 – the Virtual Event of the Year."

Are you a supplier launching something new that **EIM** readers will be interested in? Send details to 12 Maes Gwyn, Llanfair Caereinion, Powys, SY21 0BD or by email to andrew.charman@warnersgroup.co.uk Don't forget to include pictures!

Put it on the slate

Here is a new release that will without doubt appeal to all those model engineers working in 7¼-inch gauge who like their Welsh narrow gauge.

17D Models has produced a new kit to make an example of a typical style of slate wagon, as were used in their thousands in the quarries especially in north Wales – many have survived into preservation. This particular wagon takes a Ffestiniog example as its inspiration.

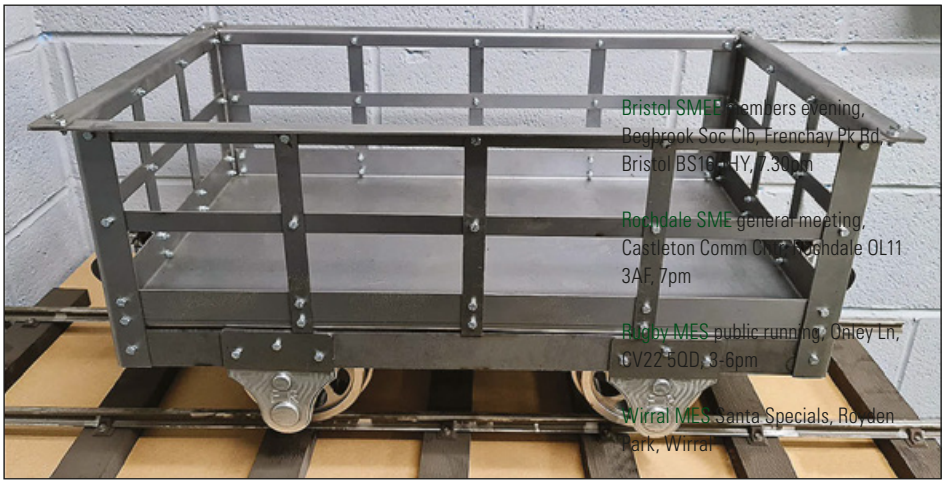
The kit comes as a complete set of bolt-together parts, with everything needed contained including laser-cut steel frame-work, machined axle boxes, and CNC machined wheels and axles with the correct type of curly spokes – such a signature feature of these vehicles.

17D tells us that assembling the wagon is a very straightforward process, but full illustrated instructions are available.

Once made up, the wagon boasts an overall length of 752mm, a width of 352mm, a body height of 243mm and height above rail head of 360mm.

The kit is available now to purchase on the 17D website, or by phone – wagons cost £499 each.

17D Miniature Railway Specialists
Tel: 01629 825070, 07780 956423
Web: www.17d-ltd.co.uk



Bristol SMEE members evening, Beaprook Soc Clb, Frenchay Pk Rd, Bristol BS16 1HY, 7.30pm

Rochdale SME general meeting, Castleton Comm Ctr, Rochdale OL11 3AF, 7pm

Rugby MES public running, Onley Ln, CV22 5QD, 3-6pm

Wirral MES Santa Specials, Royden Park, Wirral

Tiverton MES Running day, Rackenford, contact Chris Catley, 01884 798370

Maidstone MES free public rides, Mote Pk, ME15 7SU,

Grimsby & Cleethorpes SME Boxing Day public rides, Waltham Mill, DN37 0JZ, 11am-3pm

Wirral MES Boxing Day steam-up (weather permitting), Royden Park, Wirral

Bradford MES Mince Pie Steam-Up, Northcliffe Railway, BD13 3DD, 12.30pm

Covid losses force Greenwood Tools to shut up shop

We are sad to have to report that the economic fallout from the Covid-19 pandemic has claimed another much regarded model engineering supplier, with Greenwood Tools announcing that it has ceased trading.

Managing director Peter Cook posted a notice on the Greenwood Tools website, stating that he had made the decision "with great regret" after 35 successful years of trading, but that 12 months of heavy losses caused by the coronavirus pandemic had made closure of the company inevitable.

"The mainstay of the business, our account customers in the local engineering industry, have been working at much reduced capacity due to workers being furloughed or self-isolating and this has reduced our turnover by almost a third," Peter added.

"As I reached state pension age in December 2020, I have decided to retire from the industry I joined from school 50 years ago."

Peter added that he has bought the stock of the company and will be selling it off at 'closing down sale' prices.

"If there are any items you are interested in you can email me at greenwtool@aol.com or call me on 07973 165437. I will also, in the coming weeks, be listing items on eBay where my username is green-483," Peter said.

Peter concluded by thanking all his customers over the years and wishing them the very best for the future. Unfortunate news – the firm will be missed by many a model enginner.

Open season on the horizon?

The club scene is getting busier, with events planned and new locos in steam.

COMPILED BY **ANDREW CHARMAN**

Welcome to the May *Club News* pages and I sense a real air of optimism around – as the lockdown restrictions continue to ease, surely it will not be too long before club secretaries can start planning meetings and public running days?

Clear evidence of that is the start of a trickle of event notifications reaching EIM Towers. It really is no more than a trickle at present, but we are confident that the pace will begin to grow, which gives us a chance to issue a 'house notice'...

Basically if things go to plan your club will soon be sorting some new dates – for public running sessions, members meetings and such. Don't forget to send in details to us! The *Club Diary* page has not featured in our pages for more than a year now, and we miss it! As soon as enough dates start coming in, we will be restoring the page and encouraging readers to get out and meet up with their fellow model engineers.

ABOVE: This quartet of Darjeeling locos starred at a previous Rugby narrow gauge gathering, an event that hopefully will happen again this year. *Photo: Ed Parrott, Rugby ME*

BELOW: Small but delightful, Nottingham SME member Alan Gent's Gauge 1 Derby 4F. *Photos: Roger Hopkins*

Narrow-gauge gathering

It's perhaps not really surprising that the first confirmed post-pandemic event news we have received is for a gathering at the Rugby ME. The Club plans to run its popular Narrow Gauge Rally on 10th-11th July, with narrow-gauge models running on 2½-inch, 3½-inch, 5-inch and 7¼-inch gauge tracks, plus an exhibition of other scales and part-built locomotives. As the picture above shows the well-established event attracts a wide selection of runners.

"We re planning for it to happen," organiser Ed Parrott told EIM. "If the world goes pear-shaped again and we have to cancel that will be relatively easy to do, whereas trying to organise an event at short notice will be all but impossible."

The club is inviting owners of suitable locos to submit applications to run them at the event to ngevent@outlook.com. Let's hope firstly that this goes ahead and is a big success, and secondly that it's the first of many event notifications!

Meanwhile news reaches us from the AGM of the Southern Federation of Model Engineering Societies, which as is these days typical was held online using the Zoom video conferencing tool. And apparently the big news is, bye bye southern!

It seems the Federation's name does not reflect the fact that its affiliated societies are spread across the country, so the intention is to change it to the 'Federation of Model Engineering Societies.'

Of course there is also a Northern Federation and we understand the question of amalgamation of the two was mentioned. The answer we understand was that there are no plans, but it could not be ruled out in the future...

Lots of new metal

Browsing through the extensive selection of club magazines this month we can see a continuation of an established theme – clearly members have not been wasting their locked-down days, several journals featuring new locomotives being unveiled in a host of sizes.

For example the latest edition of *Kingpin*, from the Nottingham SME features member Alan Gent, happily

crouching down behind his latest creation on its first steaming, a Derby 4F 0-6-0 tender loco. But it is only when you study a second picture that you realise that this superb new model loco is rather smaller than was immediately obvious, running on the Society's 45mm Gauge 1 track.

We've often said in these pages that the smaller scales are just as important – one of the editor's interests for example is in 7/8ths scale, basically a mutant version of the much better-known 16mm scale, modelling 2ft gauge prototypes on 45mm Gauge 1 track. Smaller-scale locomotives can be just as challenging as model engineering projects and produce equally interesting models, as Alan's 4F proves.

For something significantly bigger we take another trip abroad, this time right around the globe to Australia. The latest newsletter of the **Sydney Live Steam Locomotive Society** features member James Sanders and his impressive new Australian 35-class 4-6-0 in 5-inch gauge. What is remarkable about this loco is just how long James took to build it – basically, no time at all!

Apparently the project had its beginnings in a set of wheels donated to James many years ago, but which sat around in a box until 2018 when he made a start on building the loco's front pony truck. The finished engine was first steamed late last year, which would be impressive in itself, without the fact that in the same period James has also finished building an 0-4-2 cane locomotive and built a Sydney steam tram! They don't waste their time in Sydney...

Multi-tasking...

Oh and James also had to cope with a very young daughter, apparently tapping most of the holes in the cylinder castings by hand with his daughter strapped to him in a baby carrier, simultaneously rocking her to sleep!. He said no taps were broken!

Sydney club member Warwick, who sent us the photo of James's engine, also enclosed a shot of his own 3609 locomotive having one of its first runs with a newly built and almost complete set of Pullman cars. "They were a combined effort from members Andrew Allison, James Sanders and myself," Warwick tells us. "These two had the bodies designed by Andrew, laser-cut in plywood by James and assembled by Andrew. James provided the underframes and bogies – these are a six-wheel type of timber construction sandwiched by steel plates, designed by myself but with detail 3D-printed parts such as the leaf springs and axlebox facings designed by Andrew and printed online through Shapeways."

We think they look superb – without the background you could easily take this set for the real thing, and Warwick adds there are four more carriages still under construction.

A sign of the times can be found in the new edition of *Trackerjack*, the quarterly newsletter of the **Teeside Small Gauge Railway**. Like most clubs having suffered a severe loss of funds with the lack of public running over the last year, the club has had a clear-out in order to stage a sale of surplus locomotives and equipment and raise some much-needed revenue.

There is certainly an impressive collection of items, including 5-inch gauge class 75 and 7¼-inch gauge Bridget steam locomotives, copper boilers, rolling roads and such, and at good prices. While it is a shame that clubs are forced to take such action, if the items were surplus to needs and will find better uses in new homes, there are positives to be had all round.

ABOVE: Sydney Live Steamers member James Sanders built this impressive 35-class in an equally impressive short time.

BELOW: Also in Sydney, fellow member Warwick has made great progress with a set of Pullman cars to match his 3609 loco.

Both photos: Warwick, SLSLS

Postponed presentation

The new edition of *The Bristol Model Engineer*, newsletter of the **Bristol SME**, includes the winners of the annual awards. It's good to see that these awards have still been made despite the pandemic preventing physical meetings, and while the certificates have been posted out to the winners, their trophies are being held back until they can be presented in person and their winners have their moment of glory.

This is a good decision; your editor modestly mentions that he won an award in his other career of motoring journalism a month or two ago – the ▶

trophy was posted to me and I had to record a piece to camera for an online ceremony. While I was delighted to win, it just wasn't the same!

The latest edition of the *Aylesbury Link* from the **Vale of Aylesbury ME** makes a very valid point, that anyone hoping to operate their locomotive in 2021 will need a boiler test and having not run for 18 months or more, their recollection of what is required may be a bit rusty! So the article goes on to offer a useful set of checks owners can carry out at home, to lower the risk of embarrassment when their pride and joy loco comes to be re-tested.

We particularly liked the sentiment behind point 1; "If you know there are problems with leaks or critical items not working correctly last time you used the loco, fix the problem(s) before taking the loco for the test. The pandemic won't have fixed the problem(s) for you!"

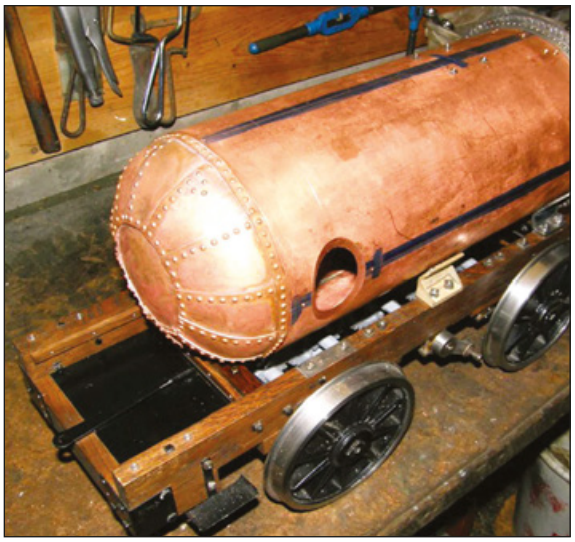
The **Chingford ME** continues to prove the resourcefulness and productivity of its members, providing enough material to maintain the fortnightly editions of the club newsletter that have been the norm since the pandemic began and stopped members meeting up on a regular basis. And the subject matter remains wide-ranging but equally interesting, one notable in a recent issue being a description on learning how to apply wood veneer onto locomotive cab panels. This is not something you generally need to do on the average British prototype, but it certainly adds the correct image if one is building a model of 'Virginia', a typical US engine. Chingford member Ralph has been doing the work, aided by veneer donated by a fellow member and normally used on clocks. The finished job is very effective...

Earliest prototype

Good to see a new issue of *Lionheart*, the newsletter of the **Old Locomotive Committee** and again pandering to another of the editor's interests, early locos. Star of this issue is without doubt an impressive 7¼-inch gauge model of the 'Puffing Billy', the world's oldest surviving steam locomotive built in 1818-14.

The model has been under construction by Harrye Frowen since 2006, using drawings obtained from Beamish Museum following the museum's completion of a full-size replica of the loco in 2004.

As the pictures on this page show, the model is excellently built, especially the distinctive 'egg-end' of the boiler which took 12 pieces to make. Harrye has an extensive website documenting the construction with a video of the loco running on air – it can be found at http://www.puffingbillylocomotive.co.uk



"Fix the problem(s) before taking the loco for the test. The pandemic won't have fixed the problem(s) for you..."

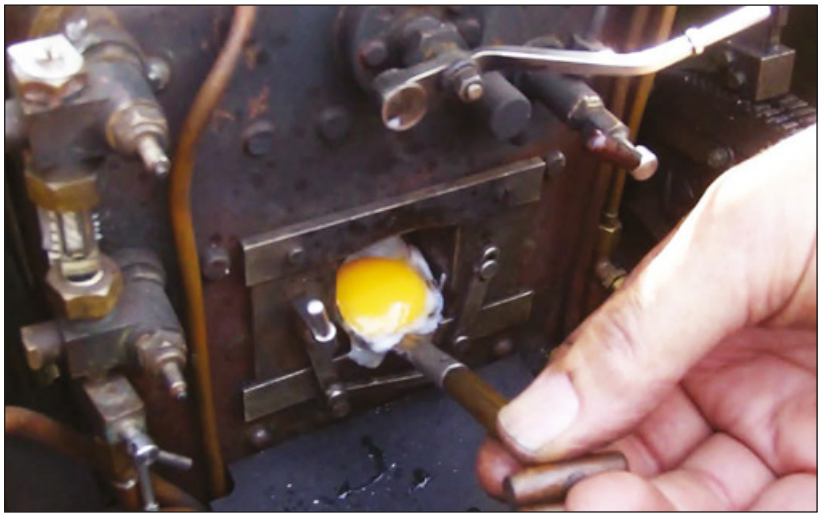
On-train catering

One final excerpt this month, from *Criterion*, the magazine of the **High Wycombe ME**, certainly made your editor smile. Being a footplateman, a fireman on the Welshpool & Llanfair Light Railway, I've more than once enjoyed that rite of passage, 'breakfast on the shovel'. In our case we usually have bacon sarnies rather than the full English (full Welsh?), but it's still delicious – if you haven't tried this kind of fry-up you really need to.

I never for a moment thought, however, that one could do the same in model engineering – step forward Bill Richardson of the High Wycombe club, who during one of the club's increasingly successful virtual members' meetings on Zoom, showed a series of pictures of the occasion in 2013 when he enjoyed a pullet's egg, fried in the firebox of his 7¼-inch gauge Dart loco. Bon appetit!

Finally another 'house notice', well it's a thank you actually, to all those club secretaries and magazine editors who take the time to send copies of their publications into **EIM**.

We have had a bumper number of issues in over the past month, and of course with limited space we can't mention every club. However every journal and newsletter is extremely useful, keeping us informed on the club scene, generating ideas for features and helping us plan future issues of **EIM** to best serve our readers. So please keep sending those magazines in! **EIM**



ABOVE: The Puffing Billy being built in 7¼-inch gauge by OLCO member Harrye Frowen is impressive, particularly the distinctive egg-ended boiler.. *Photos: OLCO*

LEFT: Cooking on a 7¼-inch gauge footplate? And why not? *Photo: Bill Richardson, High Wycombe ME*

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We've recently recommissioned the engine, steaming it for the first time in many years. In excellent condition throughout, it runs beautifully, one of the most potent-feeling steam engines we've ever run on our short test track - it feels like given half a chance it would be off like rocket! Three cylinder with Gresley-Holcroft conjugated gear, silver soldered boiler with new certification, steam brakes. **ref 9290 £59,500**

7 1/4 INCH GAUGE KERR, STUART "WREN"

A particularly attractive narrow gauge locomotive, with both preserved and new-build replicas running in preservation.

The "sun shade" canopy style cab gives easy access for driving - typical of narrow gauge models the controls are large and easy to operate.

Fitted with vacuum brake equipment, it runs well, notching up in either direction with well-defined exhaust beats. **ref 8213 £6,750**

7 1/4 INCH GAUGE "SWEET WILLIAM"

A well-built engine with tender; in good condition it steams freely and runs particularly well. Commercially built steel boiler running at 120psi with recent hydraulic and steam tests.

Backhead is nicely detailed and well laid out, with commercial steam valves, three-cock water gauges and spun brass cleading.

The engine is fitted with a four note chime whistle and vacuum brake equipment. **ref 9405 £9,750**

5 INCH GAUGE LNER B1

A well-built 5 inch gauge LNER B1 to Martin Evans' well-regarded "Springbok" design, finished in British Railways black livery.

The work of an experienced engineer, it's recently arrived with us in part exchange for a "Royal Scot".

A thoroughly sorted engine which was in regular pre-lockdown use, it steams freely and runs particularly well. Fit and finish of the motionwork and valve gear is good, machining very crisp.
ref 9414 £7,500

5 INCH GAUGE LMS 4F 0-6-0

A 5 inch gauge LMS 4F, supplied new by Maxitrak in 2011. A one-owner engine, it's come to us from a long time customer with a small private railway. Built to entertain his grand children, they have now grown whilst his knees have increasing trouble with ground level running!

The engine steams freely and runs well - there's some video of it (along with many other of the engines listed on this page) on our YouTube channel. **ref 8535 £4,950**

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A 5 inch gauge Class 08 battery electric, powered by a pair of 12 volt batteries, gear driven with three motors.

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5 INCH GAUGE BR STANDARD CLASS 4

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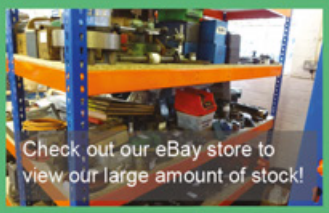
Colchester Master 1500 revs. Clutch, 6 1/2 "x36" lathe £3450


Boxford CUD MK111 lathe £1350


Check out our eBay store to view our large amount of stock!


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


Myford Super 7, ML7R, ML7 MI10 Speed 10 Change wheels Genuine £10 - £37


Fobco 7Eight 2MT pillar drill 240V £1375


Boxford 260 VMC mill less software £1495


MEDDINGS MB4 £645


Bridgeport milling machine 42" x 9" (metric) £3750


Centec 2A V/H mill quill head + height block £1950


MYFORD SUPER 7B £3250


Union 12" Grinder £625


Harrison Graduate wood lathe 240V £1375


Morgan Rushworth BP50 / 16 50" x 16G box and pan folder £1750 Complete with fingers


DP / MOD gear cutters £20 each please enquire for availability;


Denbigh No.6 Fly press £345


Ajax UP Universal Mill £1750


Smart and Brown Model L second operation lathe £750


Taylor spinning lathe £2650


MYFORD SUPER 7B 3 1/2" x 31", gearbox, clutch, power cross feed £3750


Myford Super 7B + stand late model £4450

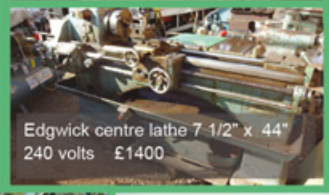

COLCHESTER STUDENT ROUND HEAD Hydraulic copying attachment and TRUGRIP collet chuck £2950


HARRISON 155 12" + TAPER TURNING ATTACHEMNT £2950


MYFORD SUPER 7B 3 1/2" x 31", gearbox, clutch, power cross feed £3250


Rolls 48" x 3" 16g (slip roll) £1400


Selection of pillar drills just arrived!


Edgwick centre lathe 7 1/2" x 44" 240 volts £1400


Large Vee Blocks 12" bar £425


Colchester Mascot VS2000 fixed steady £575


Tripus 240V switch £90


Myford rifle / bridge felts 5 for just £20


2 ton Arbour Press £125


Neat cut and soluble cutting oils £10 each


Large selection of insert tooling £145-£175


Union centres 7.5" x 24" £425


Pipe centre 4MT 4-8" £245

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

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