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SMOKE RINGS

MMEX 2025

Once again, the Midlands Model Engineering Exhibition was a great success. I'd like to thank everyone involved, but particularly the speakers at our well-attended series of talks.

One particular pleasure was presenting the Stevenson Trophy to Dave Sanderson; Dave knew John well and, like me, has great memories of dropping into John's workshop to put the world to rights over a hot cuppa.

FUTURE CONTENT

I was at the show for all four days and met many readers, and I got a very strong message – one that reflected that from our recent poll. Readers want more concise practical articles in the magazine; it doesn't matter if they are tooling, techniques or models, but it's clear that people want more articles that inspire them to get into the workshop and covering a wider range of topics (John Arrowsmith's report on the show demonstrates the extraordinary breadth of our hobby, so the potential is out there!) I will do my best to include more such content. As always, I rely on getting suitable material submitted, so I'm pleased to report that many requests for the new author pack with many interesting suggestions for future articles.

Neil Wyatt
Editor

DIARY DATES

Sorry to nag, but I have had a poor response to my appeal for event dates for 2026. Please take a look at page 59, and if your club's events aren't there, remind your Events Secretary to get in touch with me!

Neil

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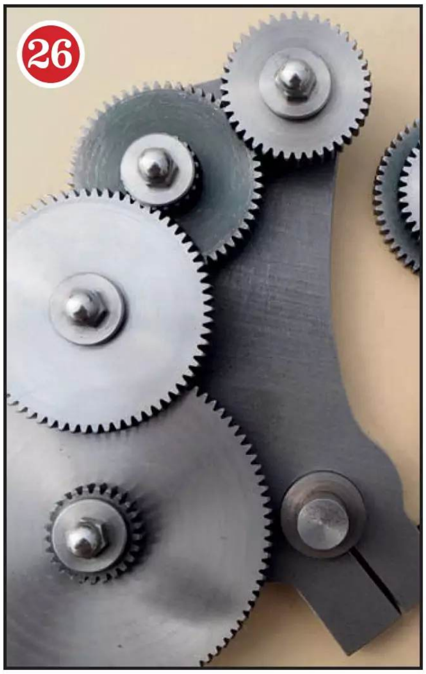

Regulars

3 Smoke Rings
The Editor canvassed the views of readers at the recent Midlands Model Engineering Exhibition.

14 Postbag
More letters from our readers around the world, including a Meccano HiFi! Send the editor your letters at meweditor@mortons.co.uk

24 Readers' Tips
Our tips winner this month shares an idea that makes releasing stuck tapers a lot easier. Send us your tip, and you could win a prize.

25 On the Wire
News from the world of model and full-size engineering, Chester announce an open week and a new giant caliper!

59 Club Diary
The essential guide to events at model engineering clubs around the UK.

77 Club News
Geoff Theasby's monthly report with news of engineering clubs across the country. Send him your news at geofftheasby@gmail.com.

80 Readers' Classifieds
It's time to bag a workshop bargain, or if you have something to sell, email us the details or use the form in this issue, to meweditor@ mortons.co.uk.

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Extra Content!

Visit the www.model-engineer.co.uk forum for extra content for this issue including:

Coventry Diehead Jig Dimension Charts

3d printable patterns for the Corliss Engine

Hot topics on the forum include:

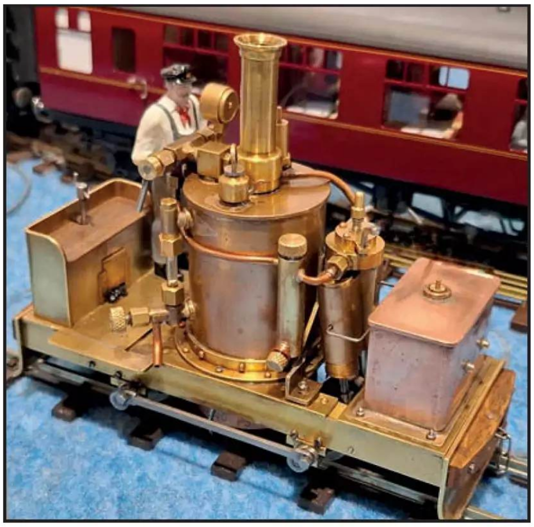
Measuring Clocks started by SillyOldDuffer - A lively discussion on assessing the reliability of clock timekeeping.

Ideas for a small marine engine started by andyp123 - Suggestions for a practical first project.

Richard B's Minnie started by Richard B - An interesting look at the gearing arrangements for this popular small traction engine.

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

On the Cover



Our cover features Phil Shrimpton's excellent model of an 1877 de Winton 0-40 locomotive at the Midlands Model Engineering Exhibition. John Arrowsmith reports on the shows competition entries from page 16.

Next Issue

In our next issue, Bruce Boldner describes his LB&SCR Terrier tank locomotive.

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Jason Ballamy uses a range of new approaches in the workshop.

PART 1

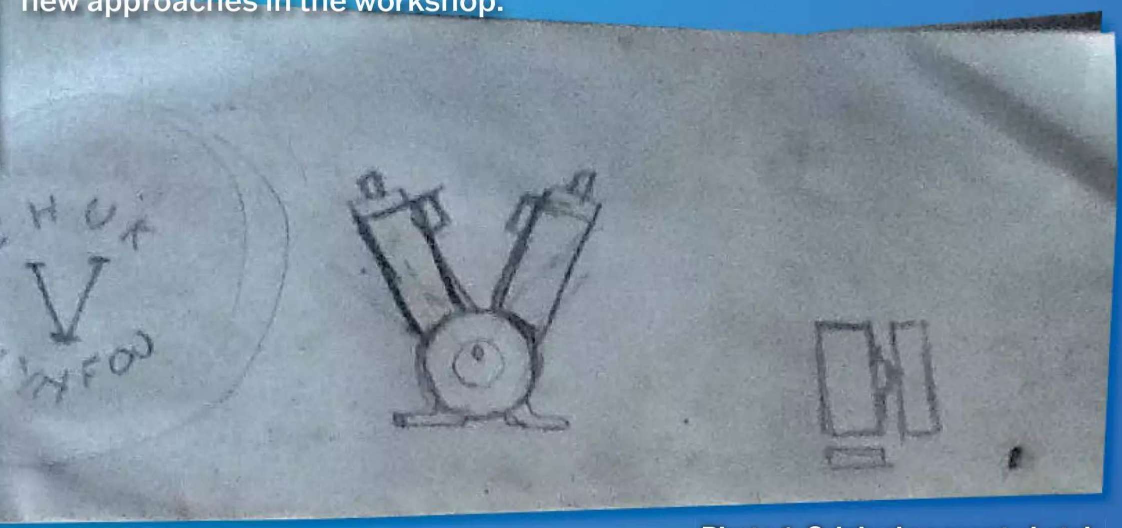


Photo 1: Original concept sketch

Embracing New Technologies - From Concept to Completion

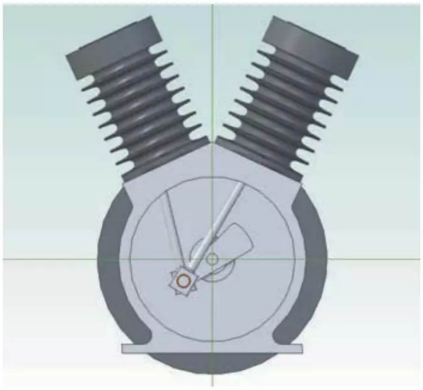


Photo 2: Preliminary Alibre CAD design

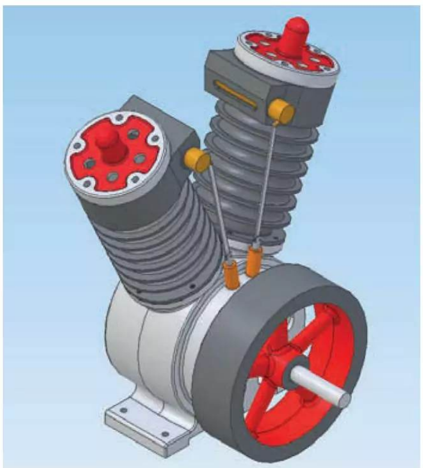


Photo 3: Final design assembly - external

Over recent years there has been much development in the way industry goes about design and manufacture with the advent of CAD, CAM, CNC, 3D Printing, etc and as these technologies become more easily available to the hobby machinist they are likely to become an everyday item particularly as the older generation are replaced by a newer one more familiar with computers and electronics.

In this pair of articles I will try to give an idea of how they can be used in the home workshop be it for model or other related hobby use. I don't intend to go into great depth but just give some practical examples of their use so there won't be any description of how to use a particular CAD package, 100s of lines of G-code or 3D printed plastic toys.

CONCEPT TO COMPLETED PART

For this example, I will cover how a basic "fag Packet" concept was taken to a completed part with the use of CAD for the design CAM and CNC to produce the patterns and finally using CNC to machine the casting. Though maybe we should start calling these "Vape packet" sketches!

DESIGN

Photograph 1 shows the initial sketch done by Graham Corry of Alyn Foundry which is the fifth version of his popular CHUK range of flame licker engines. Taking the Roman V as inspiration, he wanted to make a vee twin that utilised existing cylinder and head castings, but the new engine would need a crankcase, crankcase cover and new compact flywheel complete with five spokes. I should add that all our communication was done over the internet either by email or face book Messenger. The often-seen request for someone local to do something is now becoming a thing of the past and modern communication allows for sharing information wherever you are in the world.

I already had the old 2D hand drawn drawings in PDF format for the original CHUK engines, so the first job was to get the common parts modelled in CAD, Alibre Pro in my case. Then start arranging these to see what size the crankcase would need to be to enable the two-cylinder castings to be positioned in a fairly steeply angled Vee and not too far from the crankshaft axis. **Photograph 2** shows one view of the first 3D model with a simplified crankcase and just the major parts represented, which was emailed off to Graham for comment.

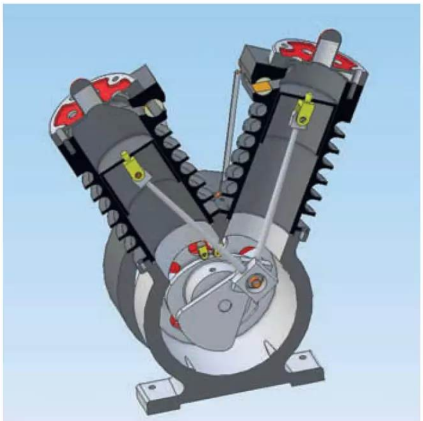


Photo 4: Final design assembly - section view

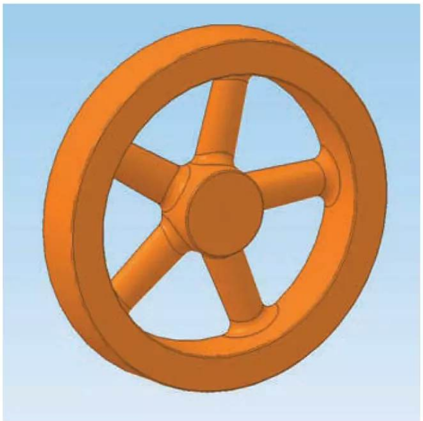


Photo 5: 3D CAD model of half flywheel pattern

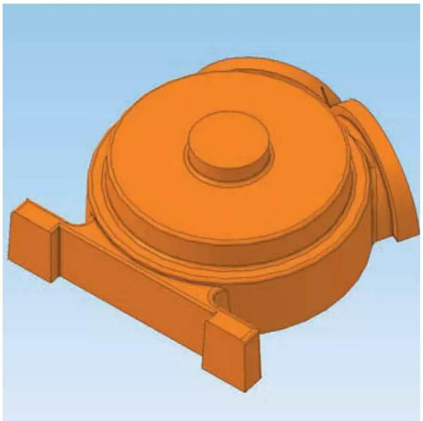


Photo 6: 3D CAD Model of half crankcase pattern

After a brief exchange, a few alterations were decided upon: The cam should be within the crankcase, the flame ports should face into the Vee, so a single burner could be used, and the flywheel should not protrude below the feet of the crankcase. With these changes dealt with, the parts could be fully detailed and put into an assembly which allowed the crankshaft to be rotated on the screen and all the other parts move accordingly so that any clashes or misalignments could be identified and corrections made as needed. **Photographs 3** and 4 show the final assembly from front and back.

PATTERNS

Although the crankcase, cover and flywheel had been designed with casting in mind, and therefore included draft angles and filleted internal and external corners they needed further CAD work to make the patterns. Copies of the part files were made so that they could be altered without mucking up the original files. The main work comprised of adding machining allowances to all surfaces that needed it, splitting the crankcase and flywheel patterns into two and finally increasing their size by a suitable percentage to allow for shrinkage of the metal as it cooled, in this case 1.5% for aluminium and 1% for the cast iron flywheel.

The crankcase had been designed in such a way that the internal cavity would be self-coring so there was no need to produce a file for a core box but that can quite easily be done in CAD. **Photographs 5** and **6** show the CAD files for one half each of the flywheel and crankcase patterns.

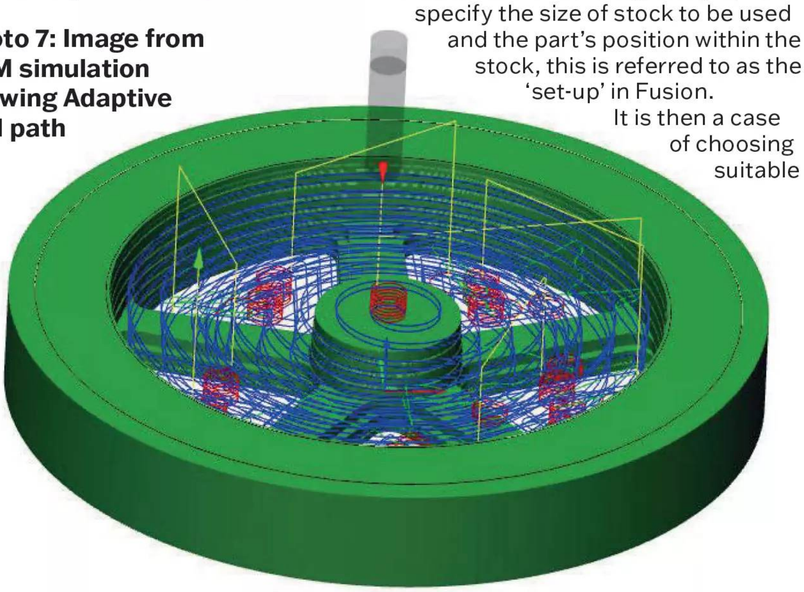
Although wood was chosen as the pattern material, the method of producing them was CNC and in order to tell the CNC what to do the Alibre files were exported in the common .STP or Step file format which could then be opened in Fusion 360 to produce the CAM (computer aided machining) files.

Once the file is open, the first task is to orientate it the right way up and specify the size of stock to be used and the part's position within the stock, this is referred to as the 'set-up' in Fusion.

It is then a case of choosing suitable machining strategies to cut the part, typically one to flatten the top of the stock, one or two to remove the bulk of the waste and then one or two more to take care of the final fine finishing passes. The cutter and its speed, feed and depth of cut needs to be specified by the user, the computer will then work out the path that each cutter needs to follow and will represent that on the screen as a series of lines which show the path the cutter will follow, in this case yellow is moving but not cutting, blue when it is cutting and red as it moves down into the material in a helical path. **Photograph 7** shows this for the roughing out of the flywheel.

It is also possible to simulate the machining on screen and watch the virtual cutters as they remove material from the stock to finally leave the 'finished part'. These simulations will also show any clashes or conflicts, for example if you only have 20mm of cutter sticking out the end of the collet chuck but have programmed the cut to be 25mm deep then it will flash up and show that the chuck will hit the work piece. It also gives the time each operation should take, percentage of metal removed and so on. Once happy that the simulation is doing what you want, the post processor can be used to produce the G-Code for your particular machine in the language it understands. This is then copied onto a USB stick that can be plugged into the CNC ready to start machining.

Photo 7: Image from CAM simulation showing Adaptive tool path



CNC PATTERN MACHINING

For stability and also due to the thin section of the parts, blanks were glued up from alternating 5mm thick layers of hardwood to form a sort of plywood rather than cutting from

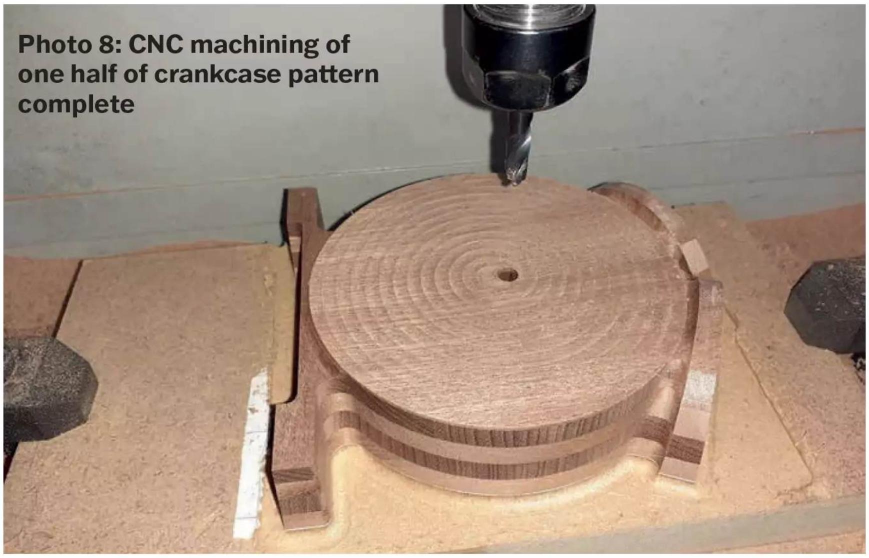


Photo 8: CNC machining of one half of crankcase pattern complete

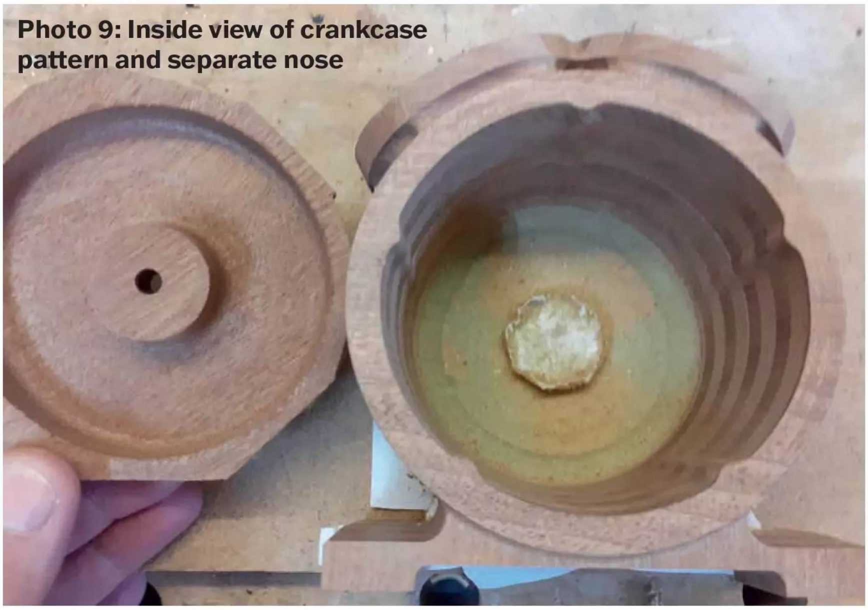


Photo 9: Inside view of crankcase pattern and separate nose

Photo 10: CNC engraved crankcase cover

a solid block. These were glued to pieces of MDF which in turn could be clamped to the mill table. Including a sheet of photo copy thickness paper within the glue joint makes it easy to separate the part once completed. It is then a case of centring up the block under the machines axis and zeroing the X and Y axes followed by loading the first cutting tool and setting its height, before loading the paths from the USB stick and pressing the start button.

As each path is completed the machine will start the next, if it also uses the same cutting tool; if not it will stop so that the next one can be loaded before it is restarted. In industry this tool changing is automated but most home users will do it manually. **Photographs 8** and **9** show parts of the crankcase pattern after machining and video 1 shows the flywheel being machined, tinyurl.com/ynv5esa7.

As the crankcase cover had some fine detail in the engraving, rather than use wood I opted for some polycarbonate sheet, this was cut and turned round in the lathe with just the lettering being done on the CNC. The engraving process can be seen in video 2, tinyurl.com/yf6zf359.

The finish straight off the CNC is very good, and only a light sanding with 360grit paper was needed to have the patterns ready to post off to the foundry. A small amount of epoxy filler was used to form internal fillets where parts of the pattern were bonded together as well as fill some holes used to insert location pegs, **photos 10** and **11**.

CASTING

This followed fairly traditional methods, with the only real change being the use of air-setting sand where a binder is mixed with the sand to hold it together rather than the old tempering of green sand with water. This is less likely to get damaged and also requires less time ramming up. **Photograph 12** shows the three castings from the CNC patterns and **photo 13**

Photo 11: Complete crankcase and flywheel patterns

includes the other parts which were cast from the older handmade patterns of the original CHUK engines.

CNC MACHINING

Although all the parts could have been completely machined on a modern 5-axis machining centre, or on manual machines for that matter, I only have a hobby size CNC mill, so the flywheel and crankcase cover were machined on the most suitable machine which was the manual lathe.

The crankcase had the housing for the crankshaft bearings and the recess for the cover manually machined, but was transferred to the CNC for the remaining milling and drilling operations. Only having a 3-axis machine (X, Y and Z, the same as a manual mill) meant that the crankcase would have to be positioned three times, once to do the feet and twice more for the two-cylinder mountings at their required angles. An MDF arbour was made to fit my rotary table, which was a snug fit into the casting's cover recess, that complete

Photo 12: Resulting castings fresh from the foundry

with a stud right through the lot was enough to hold the casting to the rotary table.

With the rotary table mounted vertically the work was rotated until the cast feet were level and the table's angle ring set to zero. The axis of the rotary table was located using an edge finder and the Y axis zeroed followed by locating the central split line of the casting and the X-axis zeroed to that. The first tool was fitted and its height set relative to the rotary tables axis set. All that remained was to switch on the fog buster air/lubricant and start the first cuts which were a roughing pass over the feet, then a final finish pass and lastly a drilling operation for the mounting holes, **photo 14**.

It was much the same for the two cylinder mounting flanges, doing one, turning the rotary table, and then doing the other. I have put together some footage of the process in video 3, tinyurl.com/5z-m55vfm. I did also decide to do a 4th setup to CNC cut some slots in the front of the crankcase so that it would be possible to see what's going on inside. **Photos 15** and **16** show the three finished castings.

Although not all home workshops will have access to the processes described above it should give an idea of what modern methods can do, and it is always possible to farm some of the work out for example if you are not proficient with CAD or don't have CNC facilities.

Next time I will cover examples of other methods that can be used where the original design already exists and other ways to obtain patterns and finished parts.

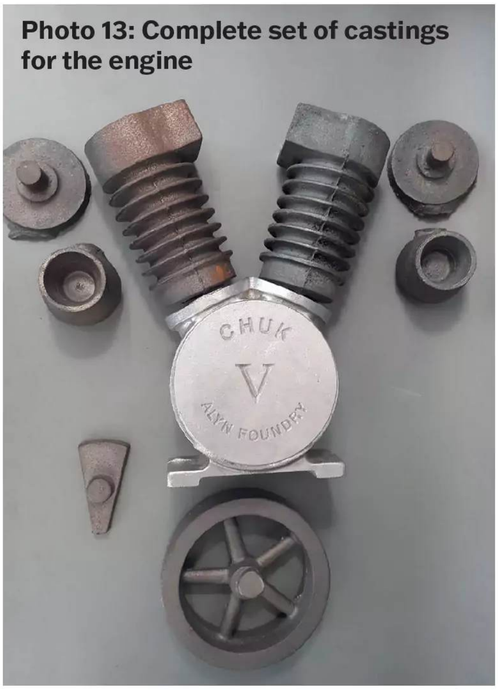


Photo 13: Complete set of castings for the engine


Photo 14: CNC milled and drilled crankcase feet

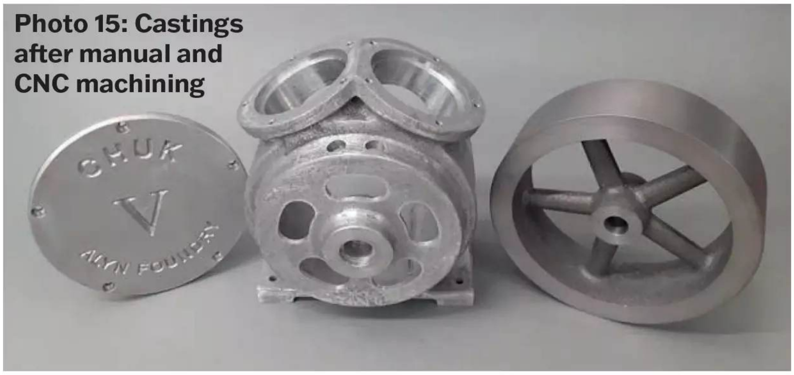


Photo 15: Castings after manual and CNC machining

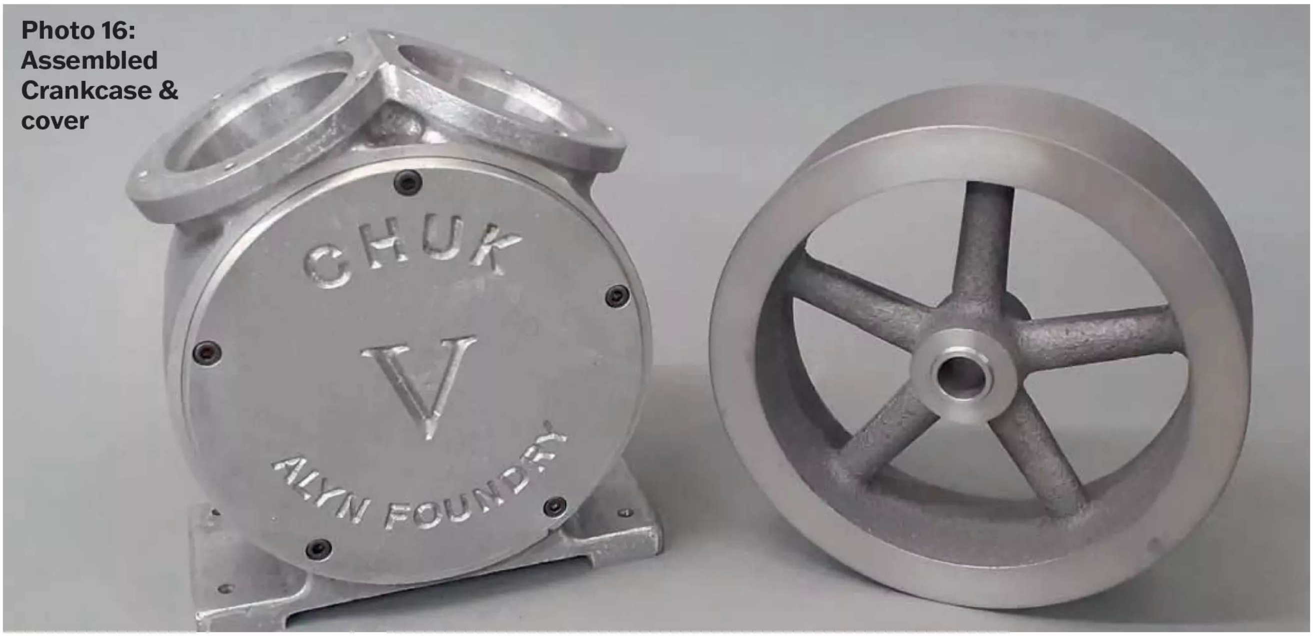


Photo 16: Assembled Crankcase & cover

POSTBAG

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

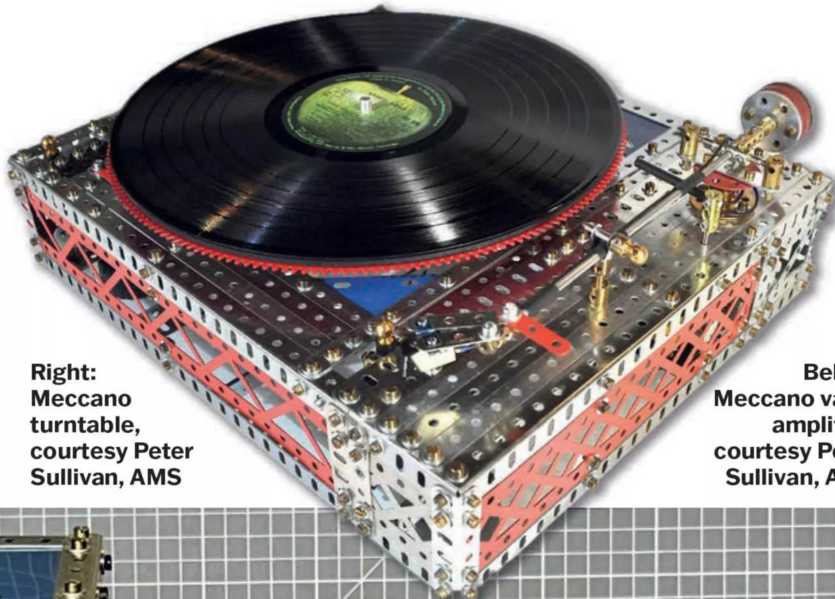
PostBag is one of the most popular sections of the magazine - readers want to hear from you! Drop us a line sharing your advice, questions or opinions. Why not send us a picture of your latest workshop creation, or that strange tool you found in a boot sale? Email your contributions to meweditor@mortons.co.uk.

PRACTICAL MECCANO

Hello Neil, some months ago (april) you published the poster of the AMS Amateure Modellbau Switzerland about their 40 year anniversary exhibition in MEW. Recently I got their Club magazine where a lot of great Meccano models were shown built by their members.

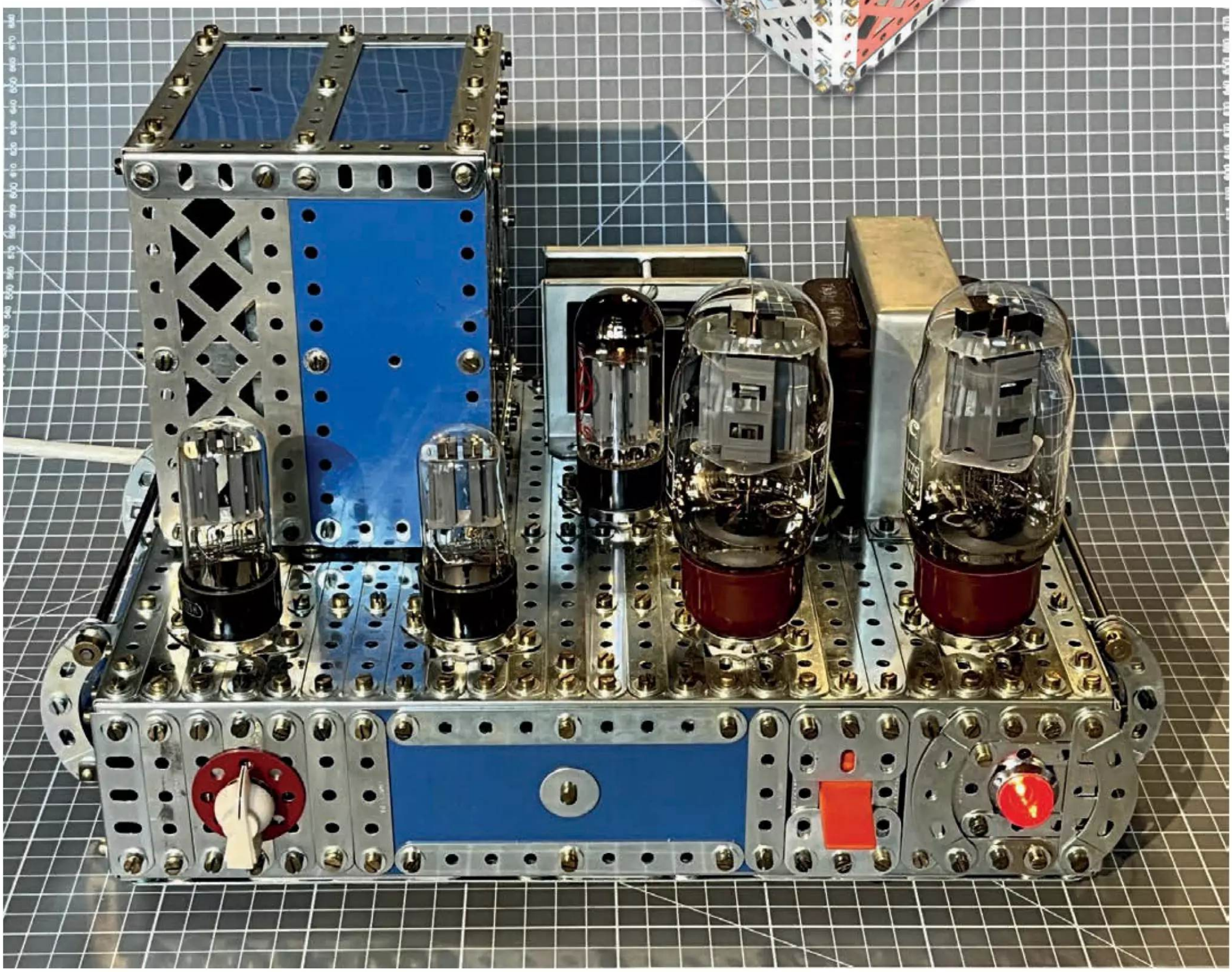
I got in contact with one of the participants, Mr. Peter Sullivan, because he showed a wonderful Tube Amplifier and Turntable built in Meccano that, according to the builder, Peter Sullivan, sounds amazing. It was published on the cover of a British HiFi magazine!

Henk de Ruiter, The Netherlands



Right: Meccano turntable, courtesy Peter Sullivan, AMS

Below: Meccano valve amplifier, courtesy Peter Sullivan, AMS



INDEX PRESENTATION

Hello Neil, I wish to congratulate you on the layout and content of the MEW magazine . Keep up the good work.
In the current issue (4770) you have included an index, I would like to comment on it . I have macular degeneration in one of my eye so the colour of items printed and also their size are important to me and others with the same problem .The index on the first page has four photos on the top bar ,which means that the content below is of a very small font size ,whereas the fourth page has no pictures on the top and the font is larger and easier to read . The blue highlighting is also a problem as it makes it hard to read. I like to print off the index in order to place in a folder in the workshop and not having to remove pages from the magazine . Could you talk to someone about the colour used to highlight or increase the front size .
John Kelleher, Dublin

Thanks for the feedback, John. We have made many changes since combining the two magazines and most readers are now happy with the format and its readability. The last issue's index pages were a particular challenge after bringing the two titles together. With our larger format meaning more content, it seems likely that next year's index will also be challenging. We will bear in mind your thoughts next time an prioritise readability, as well as a larger, clearer font, though this may mean losing the thumbnails of covers, for example - Neil

YORKSHIRE AIR MUSEUM 1

Dear Neil, regarding Geoff Theasby's 'Club News' column in November's edition and the trip to the Elvington Air Museum (which is actually the Yorkshire Air Museum). I am an aircraft restoration volunteer at the museum - I source/make and fit parts for the Halifax bomber.
The "neglected' piece of radio equipment Geoff photographed is an HRO receiver, and not at all neglected.
Ken, our electronics guru took time to explain and demonstrate it to me.
This receiver was top of the range and the preferred type used by Y Stations, who monitored foreign radio traffic before, during and after WW2.
Underneath the dial you will see two window-like vents with a handle each side of them. This is a slide-in unit which was interchangeable with others to switch to different frequency bands.
The great advantage of this particular model is that the above unit is positioned at the bottom of the case, which means that it stays cooler than those of other models. Getting too hot creates the tendency for the receiver not to be able to adhere to a particular frequency, which, as you can imagine, would be very frustrating to the operators. The blue unit atop of the receiver is a power unit used to drive it.
Most of the suspended models have been radio controlled but now have no radio gear in them. Photograph 2 - taken outside, is of a light beacon. It was originally situated at the end of the runway - just a big bulb on a stand, really.
Since we are in contact, would it be possible to also mention that we desperately need competent and reliable sheet metal workers to volunteer? - there is so much to do. A few hours over a month would be so helpful.
P. Gatenby, by email

If anyone can help the Yorkshire Air Museum with sheet metal work, please contact me on meweditor@mortons.co.uk and I will put you in touch – Neil.

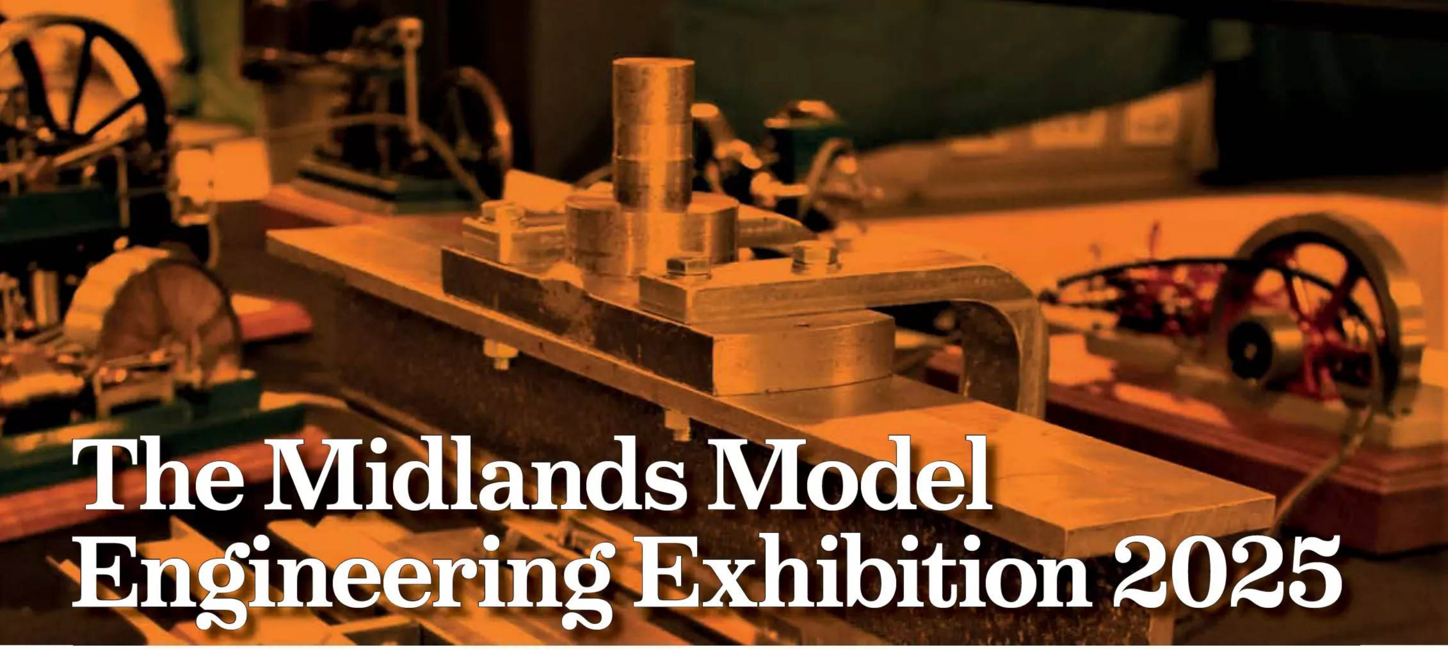
SECURING A FUTURE FOR OUR HOBBY

Dear Neil, I have been an active model engineer and have taken 'The' magazine since 1960. During this long time I have seen many changes both with the hobby and the magazine. Some good and some not so. I have over the past attended many exhibitions at various locations. In the main all well attended by both exhibitors and traders. There has been an ongoing trend to increase the admission charges to the point that I feel is becoming unreasonable and prohibiting. When one considers the costs involved in getting to the venue as well as the admission fee, I feel that it is becoming less attractive to future attendees.
I do not have any solutions to this situation, but I do have concerns as to the continued future of both the hobby and future exhibitions. I hope that a solution can be found as I would not like to see the demise of the hobby. I am now 80 years of age and have seen the many changes that have taken place. I hope that costs alone will not be the one thing that sees the hobby become extinct.
Ken Price, by email.

Thanks for your thoughts, Ken, while I agree with your concern for the future, I feel that the admission fee for recent exhibitions was reasonable. There are not many places where you can get a full day out for the price of their tickets, which were much cheaper than most classic car shows, for example – Neil.

YORKSHIRE AIR MUSEUM 2

Dear Neil, I noticed the question about "the radio shack in Elvington" in the November 2025 edition or ME&W. I assume the question relates to the black item with the graduated dial at the bottom. That is an HRO receiver made by the National Radio Company in the United States. The item bottom left is a speaker made by Yaesu in Japan in the 1970/80s. The item above the HRO is a home-made power supply. The items on the right: an RF power meter at the top and then three amateur radio transceivers from the 70's/80's/90's but difficult to identify at the printed paper resolution.
The item most likely to be of interest to ME&W readers is the HRO. Deigned in the early to mid-1930s it became a mainstay intercept receiver for the UK and US intelligence services and armed forces in WW2. Production continued for many years after the war. There are a couple of aspects of the HRO that stand out. Firstly the very precise reduction and logging scale (the large dial in the centre). This used a worm drive to turn the tuning capacitor through 180 degrees and tuning was highly reproducible. The second was the plug-in coil packs which allowed great flexibility (customisation) in the tuning ranges and eliminated the effects at high frequency of switched inductors and capacitors in more conventional designs. The dial had an index on it which was then used in conjunction with the (hand calibrated) calibration graphs front of individual coil packs.
So those intercepts, they were used for many purposes, but most famously they were used for receiving the German Enigma encoded tactical messages that were fed into Bletchley Park to be decoded.
The Radio Society of Great Britain has its National Radio Centre within the grounds of Bletchley Park, and we have a couple of examples of HRO receivers. One is nonfunctional but is available for a detailed examination of the mechanicals, and the other is in storage but can be powered up to demonstrate its operations. We of course have more modern equipment including HF, VHF and various types of satellite communications and demonstrate amateur radio to about 80,000 people a year.
Stewart Bryant, RSGB Board Chair.



The Midlands Model Engineering Exhibition 2025

In a first report from this year's MMEX, John Arrowsmith reviews the competition entries.

The Midlands Model Engineering Exhibition was created in 1977 by Chris Deith making this the forty-eighth time it has been organised and, I'm pleased to say, by the same family. The Warwickshire Event Centre was again the venue for the exhibition and the well filled display stands suggested that it was going to be another good year for Model Engineering, and highlighted the great breadth of subjects encompassed by our hobby. There were only four out of the sixteen competition classes that did not have any entries and one class stood out for the number of models entered, Class 14 for Young Engineers, but more of that later. Each class has a range of awards and prizes to acknowledge the skills of both experienced and novice model engineers.

Competition Class 1: Locomotives up to and including Gauge 1

There were no entries in this class.

Competition Class 2: Locomotives 2½" and 3½" Gauges.

Three entries graced this class and while there was no outstanding example there were some good presentations. A Third prize was awarded to Thomas Barnes for his 2½" gauge LNER A1 Peppercorn Pacific Boswell No. 60138. Well made and finished it captured the profile of the original very well, **photo 1**. The other two entries in this class although well made were not awarded certificates.

Competition Class 3: Locomotives 5" and 7¼" Gauges and above.

There were two entries in this class, a 5" gauge GER G15 live steam Tram Engine complete with dual Controls and built by Graham Monk, and a

Photo 1: A 2½" gauge LNER A 1 Peppercorn Pacific.

Photo 2: The 5" gauge GER Class G15 Steam Tram Engine.

Photo 3: Winner of Class 4 was Guy Harding's London Transport Works Van

Photo 4: A Gauge 3 Queen Victoria stock 4 wheel carriage.

5" gauge GWR Pannier Tank based on the LBSC design and owned by Paul Swingewood. The Steam Tram gained a Third prize as it presented all the external features of the original including working warning bell, **photo 2**. We hope Graham will write up this loco for ME&W, as it has many unusual features. The pannier locomotive did not receive an award.

Competition Class 4: Rolling Stock etc. any gauge

Three good entries in this class provided the judges with a challenge. The 5" gauge Metropolitan Railway Stores Van running as London Transport Workshop Van SC 630 was awarded First prize and the Burton Road Bowl Cup. Built by Guy Harding it fully deserved its accolade, **photo 3**. The Gauge 3 Queen Victoria stock four-wheel Carriage built by Michael Palmer gained the Second prize in this class, **photo 4**, and a 3½" GWR Tank Wagon built by Dave Lee gained a Third prize for a well-presented exhibit, **photo 5**.

Competition Class 5: Stationary Engines

Two excellent entries in this class had some really fine workmanship on show. The winner of the First prize was Mick Keenan with an example of a Double Compound Steam Engine, **photo 6**. A Third prize was awarded to Ian Matthews for his example of a Stothert and Pitt Beam Engine, **photo 7**, and a Very Highly Commended certificate in this class for the little Stuart 10H Steam Engine built by Anthony Brook, **photo 8**.

Competition Class 6: Steam Road Vehicles

There were no entries in this Class.

Competition Class 7: Machine Tools & Workshop Equipment.

Two useful pieces of equipment in this class where Nicholas Farr was Highly Commended for his compact Sheet Metal Folding machine, **photo 9**, a practical item we hope he will write up. A Commended certificate was made for the Small Adjustable Angle Plate entered by John Arrowsmith.


Photo 5: Dave Lee's 3½" gauge GWR Tank Wagon.

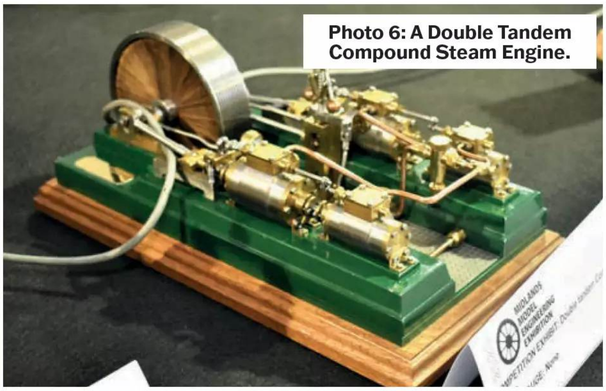


Photo 6: A Double Tandem Compound Steam Engine.

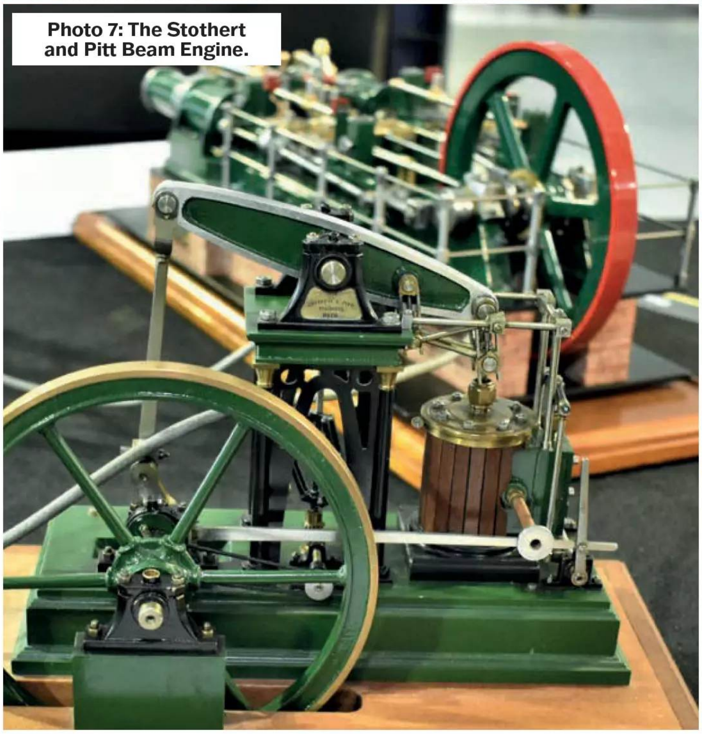


Photo 7: The Stothert and Pitt Beam Engine.

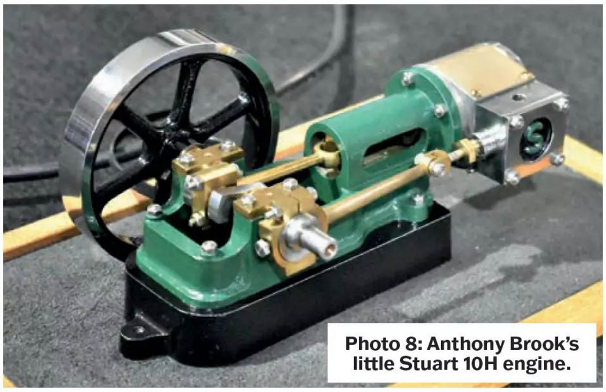


Photo 8: Anthony Brook's little Stuart 10H engine.

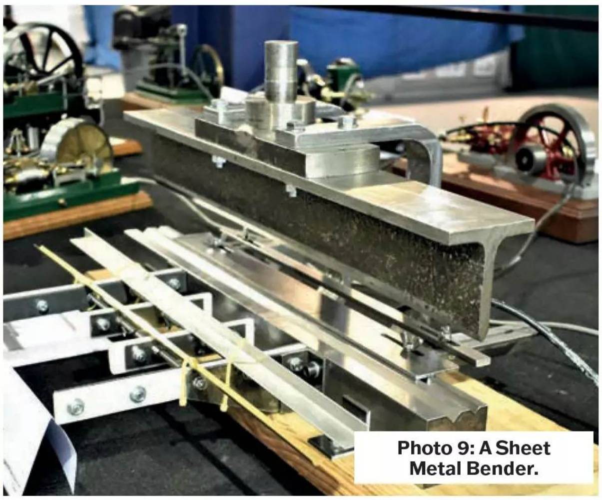


Photo 9: A Sheet Metal Bender.

Competition Class 8: Internal Combustion Engines

A single entry in this class where Anthony Brook entered an excellent example of a Little Brother Hit and Miss I/C Engine, well made and finished it well deserved its First prize and Engineering in Miniature Trophy, **photo 10**.

Competition Class 9: Horological, Scientific & Automata

Two very fine entries in this class with the fifteen-day Skeleton Clock from a design by John Parslow built by Michael Havard receiving the First prize and the Clockmaker Trophy, **photo 11**, and the Second prize was awarded to Anthony Read for his Elegant Scroll Clock to the John Wilding design, **photo 12**.

Competition Class 10: Marine Models – scale (over 50% scratch built)

First prize and the Marine Challenge Cup was awarded to Stephen Duckworth for a 1: 48th scale model of HMS Grey Fox S304 Denny Steam Gunboat of WW II, **photo 13**. The Second prize was also awarded to Stephen Duckworth for a 1:48th scale model of a Type 25 class Raumboot R-155 German Minesweeper of WWII. Both of these models were highly detailed and complete in every way.

Competition Class 11: Marine Models-kit (standard or modified)

There were two models entered in this class but only one appeared on the display and that was the 1/12 scale model of a Liverpool Class twin screw powered lifeboat. This was awarded a Second prize and was built by Chris Collett, **photo 14**.

Competition Class 12: Horse Drawn Vehicles

A good competition in this class with five excellent models to be considered. First prize and winner of the Lenham Pottery Trophy was Chris Briggs for his superb example of a Horse Drawn Police Prisoner Van, **photo 15**. In Second place was another fine model by Chris Briggs in the shape of a Horse Drawn square fronted Broughman carriage, **photo 16**. Both these entries showed off some intricate details and finishes. The third prize went to a Tip Cart made by John Tonen, **photo 17**, who also gained two Very Highly Commended awards for his Long Cart and a Glamorgan Gambo cart. All were beautifully finished and presented.

Competition Class 13: Scale Model Aircraft.

There were no entries in this class.

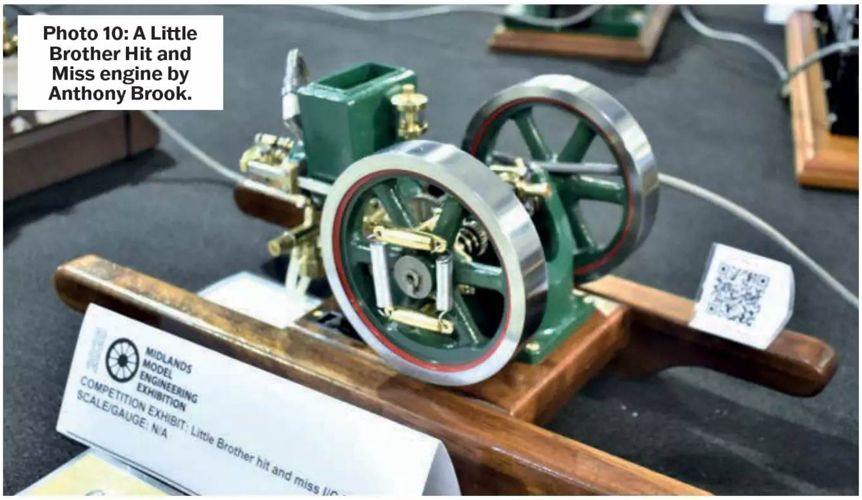


Photo 10: A Little Brother Hit and Miss engine by Anthony Brook.

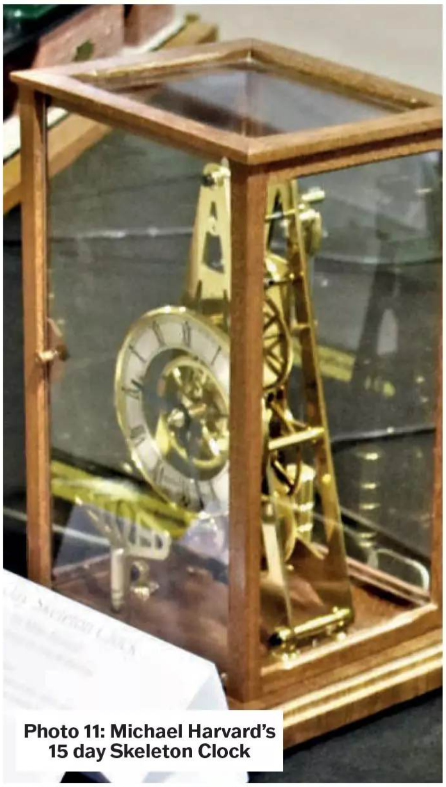


Photo 11: Michael Harvard's 15 day Skeleton Clock


Photo 12: The Elegant Scroll Clock by Andrew Read.

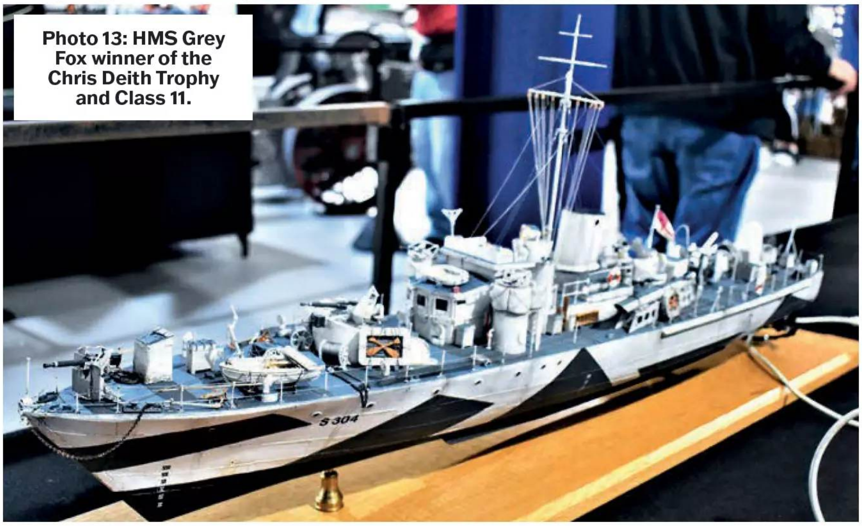


Photo 13: HMS Grey Fox winner of the Chris Deith Trophy and Class 11.

Competition Class 14: Young Engineers Award (under 20 years of age)

This was the class which received the greatest number of entries in the Exhibition, and it is hoped these young people will be encouraged to continue with their endeavours. It was an impressive display.

First prize and winner of the Stuart Models Shield was awarded to Sasha Deal for a fine example of a La Jamais Contente Electric Vehicle, **photo 18**. The Second prize went to Joseph Pritchett-Brown for a model of The Prototype Vincent HRD 1000cc Three Wheeler, **photo 19**, and Third prize was gained by Freya Hempenstall for her model of a Spacex Starship, **photo 20**. Very Highly Commended was Lyra Feldon-Thomas for her Tug Boat in wood, **photo 21**, also Very Highly Commended was Alice Dodd for her model of a Citroen 2 CV, Highly Commended was Asa Skinner for his Pleasure Boat in wood and Erin Bates was Highly Commended for her Pleasure Boat in wood. 7-year-old Caedyn Prytherch was Commended for his Plumb Bob

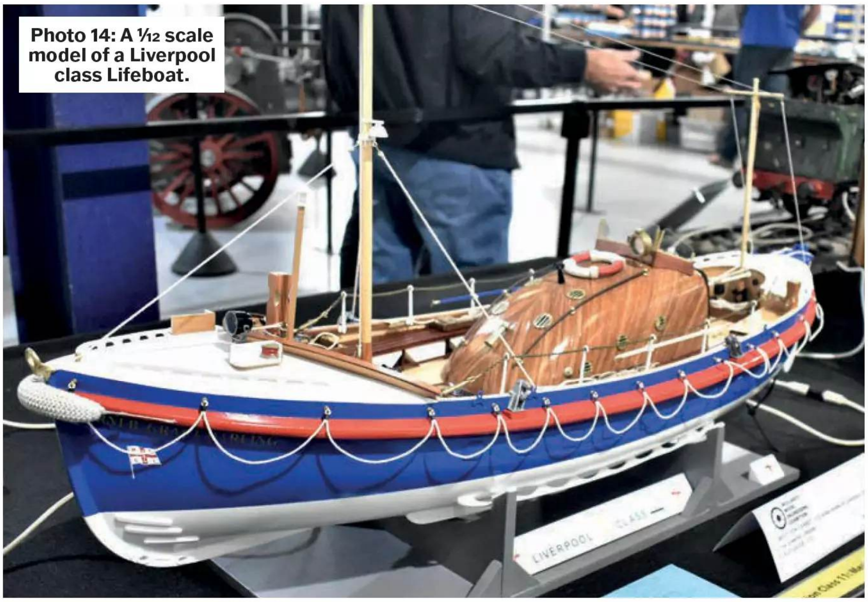


Photo 14: A 1/12 scale model of a Liverpool class Lifeboat.

Photo 15: The Police Prisoner Van.

Photo 17: John Tonen's Tip Cart.


Photo 16: A Horse Dawn square fronted Broughman carriage.

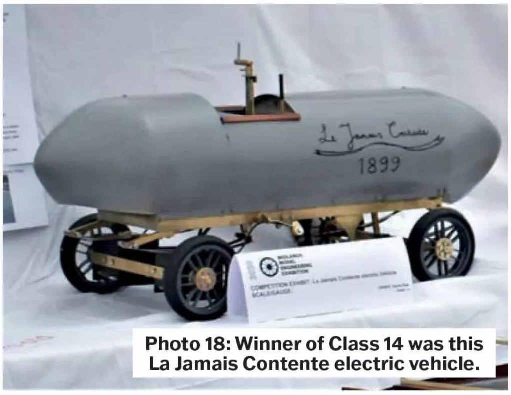


Photo 18: Winner of Class 14 was this La Jamais Contente electric vehicle.

Photo 20: The Spacex Starship


Photo 19: The Prototype Vincent 1000cc Three Wheeler.

Photo 21: A Tug Boat in wood by Lyra Feldon -Thomas

and reel, **photo 22**. Three other young engineers Zach Dodd, Dylis Wevill and Inigo Francis were also Commended for their models which made up an excellent and comprehensive display for the Young Engineers display.

Competition Class 15: Miscellaneous

This was another well supported class with a wide range of entries covering a wide range of excellent models. First prize was awarded to John Clarke for his model of a Stanhope Printing Press (c. 1830), **photo 23**. This diminutive working model attracted a great deal of attention on the SMEE stand. In Second place was a regular contributor to the exhibition Brian Swann, with another superb model of a 1911 Delage 3 litre Type X two-seater car as driven by Paul Bablot, **photo 24**. Displayed on a mirror so the underside detail could be seen and covered in road dust it was a fine model. Thomas Barnes gained the Third prize for his working Injector Test Rig, **photo 25**, no doubt a very useful piece of equipment for any club or society. A Highly Commended award was made to Graeme Ford for his model of a Scratch Built Railroad Water Tower, **photo 26**. John Clarke was Commended for his model of a Country Blacksmith working at his Forge, **photo 27**. A Fully Instrumented F1 Steering Wheel built by Angus French was also Commended as was the pair Turntable Weights made by Nicholas Farr – inspired by one of the Editor's articles!

Competition Class 16: Hot Air Engines

There were no entries in this class.

The Chris Deith Memorial Trophy

The Trophy was awarded to Stephen Duckworth for his superb example of HMS Grey Fox, see **photo 13**.

The Fosseway Steamers Trophy.

This was awarded to Chris and Ian Clipston for their 4" scale Burrell DCC "Budge" Traction Engine.

Society Shield

The winners of this year's Society Shield were the Harlington Locomotive Society, **photo 28**.

Photo 22: A Plumb Bob and Reel by 7 year old Caedyn Prytherch

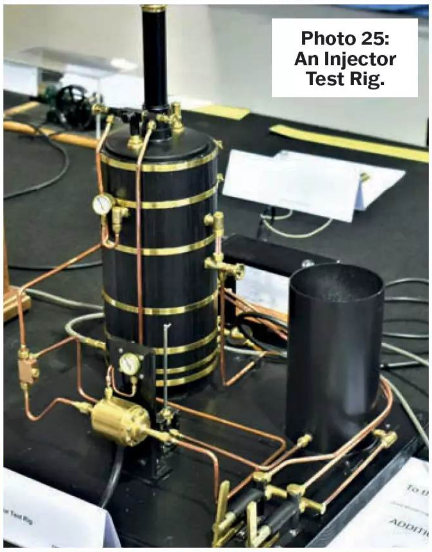


Photo 25: An Injector Test Rig.


Photo 23: The superb Stanhope Printing Press c1830

Photo 27: A Country Blacksmith at work.

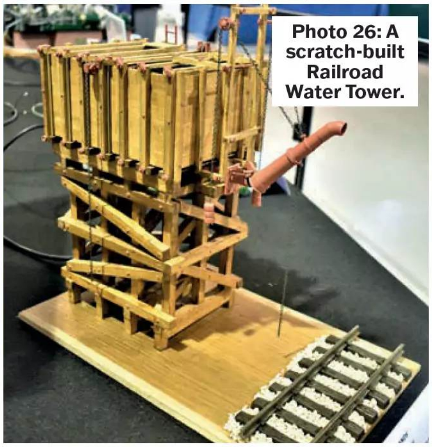


Photo 26: A scratch-built Railroad Water Tower.

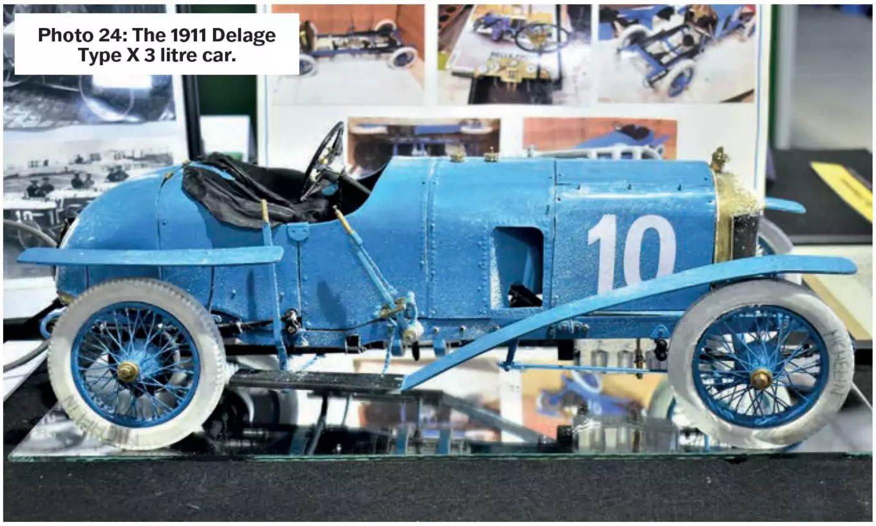


Photo 24: The 1911 Delage Type X 3 litre car.

Photo 28: Club Shield winners The Harlington Locomotive Society.

Custom 3D Printing of Challenging Materials

PCBway invited the Editor to try out their transparent resin and TPU printing services.

Two clear resin printed turrets as received.

Readers will know that I do a lot of 3D printing for myself, but one area I have found challenging is producing transparent parts. My original challenge was the turrets for a 1:16 scale British Power Boats 'whale-back' Air Sea Rescue Launch. About 100mm tall, I originally made these from plastic bottles and card; they were passable, **photo 1**, but I wanted a better result. Fused filament prints produced marginal results, best described as 'translucent' rather than transparent, and though more durable, did not look as good. When I obtained a resin 3D printer, I tried using 'glass clear' resin and this gave better results; I had to make around half a dozen or more and experiment with approaches such as not rinsing off excess resin and using a gloss lacquer. The results were usable, you could see a crewman inside (a scanned and scaled down Action Man with a Lewis gun, both filament prints). Even so it was a lot of effort for something that though neater than my scratch-built turrets, they still didn't look quite right.

When our advertiser, PCBway, invited me to try their transparent resin printing process this was an obvious choice of subject. Ordering required me to upload the STL I already had designed and choose the appropriate material. The PCBway process uses a resin called UTR-8100, which is finished with a spray of transparent lacquer to give an enhanced surface finish. Automatic checks said it was OK, but the design gets checked by a human who felt they were to thin in places, with a particular risk of damage in transit. As a result I modified the original Alibre design file so there was a minimum thickness of 1mm.

I also requested a set of window transparencies for a 1:72 model of a

Photo 1: Whaleback ASRL with 'pop-bottle' turret.

Photo 2: First attempt 3D printed Ju287 in 1:72, compare the cockpit with photo 6.

Photo 3: Well packed delivery.

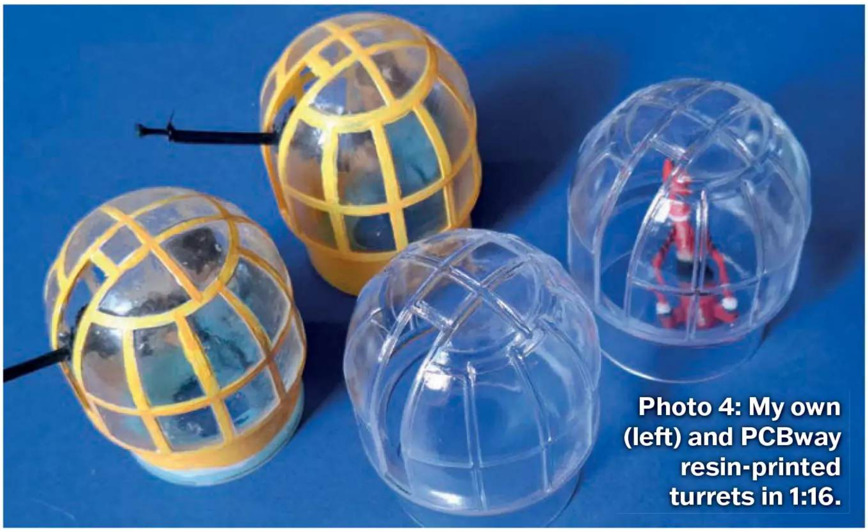


Photo 4: My own (left) and PCBway resin-printed turrets in 1:16.

Photo 5: 1:72 model with PCBway cockpit fitted.

Photo 6: A packet of five tiny domes.

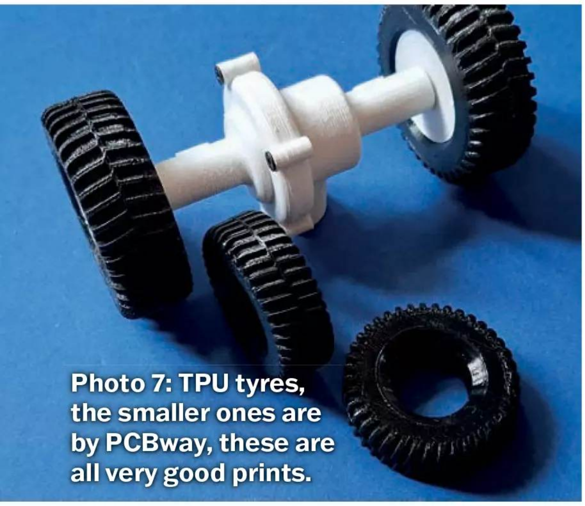


Photo 7: TPU tyres, the smaller ones are by PCBway, these are all very good prints.

Junkers 287 (I am trying to model all the early jet and rocket aircraft, and many of them are not available as kits), **photo 2**. I had already made one model (the more delicate transparent prints took several attempts), and I thought this smaller part would be another good comparison.

Again I had to increase the thickness to a minimum of 1mm. Some small (about 5mm diameter) 'domes' had to be printed as solid half-spheres (I made my own versions in this way too). They were concerned about the small size of these parts, but I said I would accept responsibility if they were too small to print successfully.

I was also asked if I had anything I could order in filament-printed TPU? I have had fair success with TPU, although some people struggle. I decided to order two tyres (I accidentally tried to order them at full size – whoops!) so I could compare them to my own prints.

The parts took a little over a week to reach me, using the air-freight option. They arrived incredibly well packed, with foam inside and outside the parts, then with extra packing inside a generously sized box, **photo 3**. I should say that the agent I dealt with clearly didn't know these were review samples, and having seen other people's results, I can say that this level of care applies to all their customers.

But what of the parts themselves? **Photo 4** shows the two turret prints compared to mine (the one on the left is the best result I have got with transparent resin). They are both clearer than mine and the surface finish has less distortion, not only can you see things inside the turret better (Thunderbird 3!), but it's possible to see things right through it. They are definitely a step up from my results.

Photograph 5 shows the PCBway cockpit glass, only 25mm in diameter, it compares favourably with my example in photo 2. PCBway were obviously concerned my tiny domes might not work, as they printed extras – I received five, **photo 6**, and they were all perfect. My conclusion is that while printing transparent parts at home can give acceptable parts, the process can be hit and miss; on the other hand all the parts from PCBway were excellent and almost as good as injection moulded examples.

Finally, the TPU tyres. Many people struggle with TPU, because the flexible filament can be challenging to feed correctly. **Photograph 7** compares two of my tyres (fitted to a printed PLA differential) to two smaller but similar examples from PCBway. I would say all four are excellent. TPU is strong and flexible, and these tyres would be functional on a scale model, its one shortcoming is the glossy finish.

The current cost of the turrets would be about £18 each, a third of that in plain white resin, the TPU tyres about £6 a piece. There is postage on top; air freight is quick but costly but there is an inexpensive surface mail option if you are patient. If you need specialist 3D printed parts to complete a model, and don't have access to a suitable printer, or just want to be sure of getting a reliable result, PCBway's service is a very appealing option.

Readers' Tips

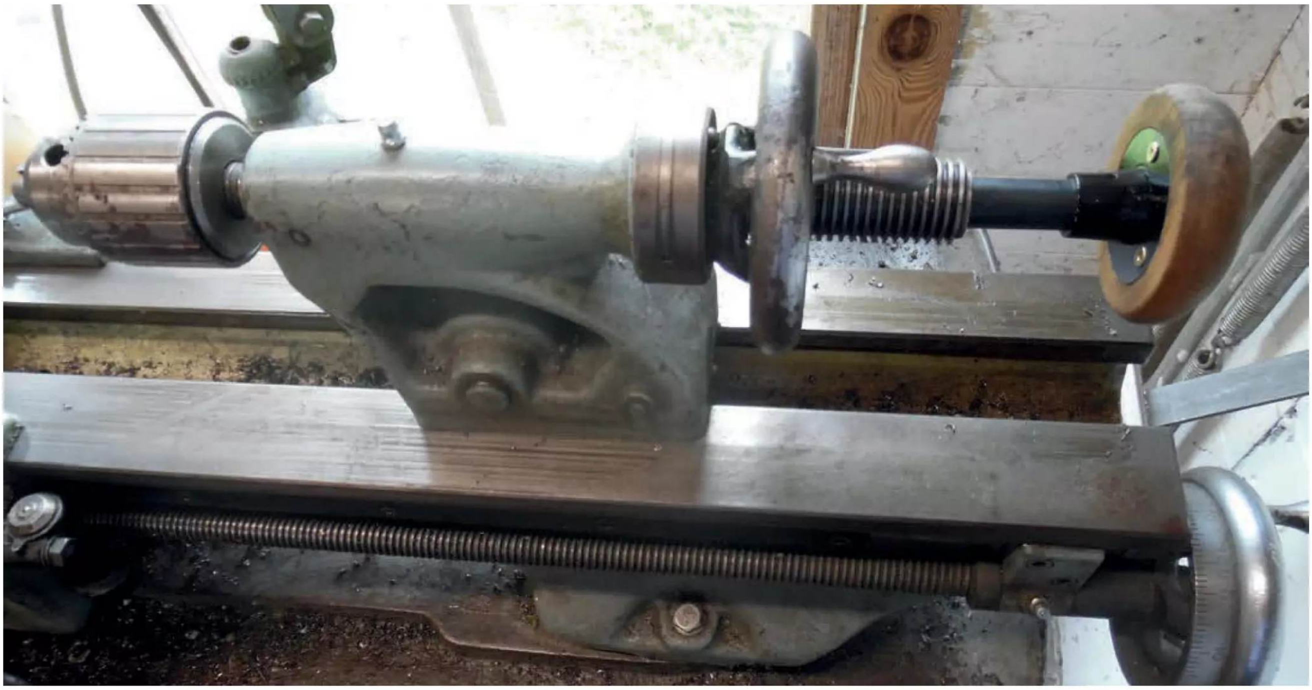
We have £30 in gift vouchers courtesy of engineering suppliers Chester Machine Tools for each month's 'Top Tip'. Email your workshop tips to **meweditor@mortons.co.uk** marking them 'Readers Tips', and you could be a winner. Try to keep your tip to no more than 400 words and a picture or drawing. Don't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

TAILSTOCK RELEASE TOOL WITH COMFORTABLE HANDLE

Our tip winner this month is John Barber who decided to make a dedicated for loosening items in the tailstock:

Rather than continue using whatever random piece of bar came to hand, I decided to make a dedicated tool for knocking centres and chucks out of the tailstock of my Myford ML7. I had a piece of 15mm silver steel in stock. It was a nice, sliding fit in the bore and heavy enough to provide some momentum. I then needed a suitable handle. A ball handle was a possibility, but probably not all that comfortable - unless it was a large one.

After looking in my box of redundant tools, I found the perfect solution: the mushroom-shaped wooden handle from a traditional carpenter's brace. This was attached to a metal adaptor by three screws, so it was just a case of turning down one end of the silver steel to suit the adaptor. In the original, the adaptor served as a bearing, but in this application, it doesn't matter at all whether the handle rotates or not, so there's no need to be too fussy about the fit. It was previously held on by a circlip, but I used a roll pin. There is a hidden recess in the wooden handle to accommodate it. I decided it was not necessary (and probably not advisable) to harden the business end of the tool, but I did chamfer it to allow for a little mushrooming.



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

On the Wire

News from the world of engineering

Chester Open Week

Chester Machine Tools are pleased to announce their forthcoming Hobby Open Week this December. Get your Christmas treats in early with their Open Week this December 8th - 12th, with plenty of great deals to be found, including free gift cards for the first 100 customers!
It's a great opportunity to see their latest range of machines in store. Visit us this December 8th - 12th, 9am - 4:30pm at Hawarden Industrial Park, Clwyd Close, Hawarden, CH5 3PZ. What Three Words: ///ever.launch.page.
For more details contact our Chester on: sales@chesterhobbystore.com or 01244 531631.

National Hamfest 2025

National Hamfest 2025, the Radio Society of Great Britain's major annual event took place on 5 and 6 September 2025 at George Stephenson Hall, in Newark, Nottinghamshire. As ever, the event brought together amateurs from far and wide to enjoy grabbing bargains, meet like-minded friends and chat with the many individuals, groups and organisations that support amateur radio.
At the event, the RSGB ran a range of practical activities and demonstrations, which we feel may be of interest to our readers. These included: construction of FM receivers; demonstrations of CubeSat simulation ground station, LoRa and Tiny Ground Station devices; discussions around 3D printing; games and activities relating to Morse Code.
Many of these activities have much wider appeal than 'traditional' amateur radio, and the RSGB hope to reach out to new audiences in 'adjacent' hobbies. For more information on the event, you can download a copy of their report, with kind permission from the RSGB at tinyurl.com/4am-56vsa, please note the first page is blank, so scroll down!

Machine DRO announce a new Giant Caliper!

MachineDRO are excited to unveil the latest addition to the M-SURE range: the MS-225 1000mm Digital Caliper. Engineered for those who demand accuracy across large measurements, this robust tool combines precision, reliability, and ease of use in one sleek package.
Like all M-SURE digital calipers, this model features a reading head equipped with a data port compatible with M-SURE's USB interface for easy PC connectivity, and the M-SURE remote digital display (accessories sold separately).
Features include Inch/Metric Conversion, On/Off, Auto Power Off, Zero Setting, Low Battery Alert, Auto Wake, Cabled Data Output, ABS/INC, Preset Value and UKAS calibration is available. Whether you're working in heavy industry, fabrication, or quality control, the MS-225 1000mm delivers dependable results, every time. The giant caliper costs £296.75 + VAT. 1000mm may be a bit beyond most of our readers' needs, but Machine DRO have a whole range of measurement solutions to suit any workshop.

Gearing Around

PART 1

Brett Meacle made some advanced modifications to his lathes to increase the range of screws he could cut and give a better choice of fine feed rates.

Photo 1: Tumbler Reverse fitted to 920 lathe headstock.

My journey into lathes started with simple projects consisting of basic turning and drilling, gaining skills shaping and sharpening HSS tool bits, learning about speeds and feeds to create a suitable finish. All the while seeing new projects and techniques appearing in *MEW* magazine and reading as many books on machining as I could find.

Jobs requiring threads started to appear, so I initially purchased taps and button dies to use in the lathe. Button dies can quickly cut a short thread but are prone to result in wonky drunken threads on longer sections, even when fitted in a tailstock tapping holder. The next subject to learn would be screw-cutting, forming threads on the lathe using the change gears. This article describes my lathe's progression into the world of cutting threads.

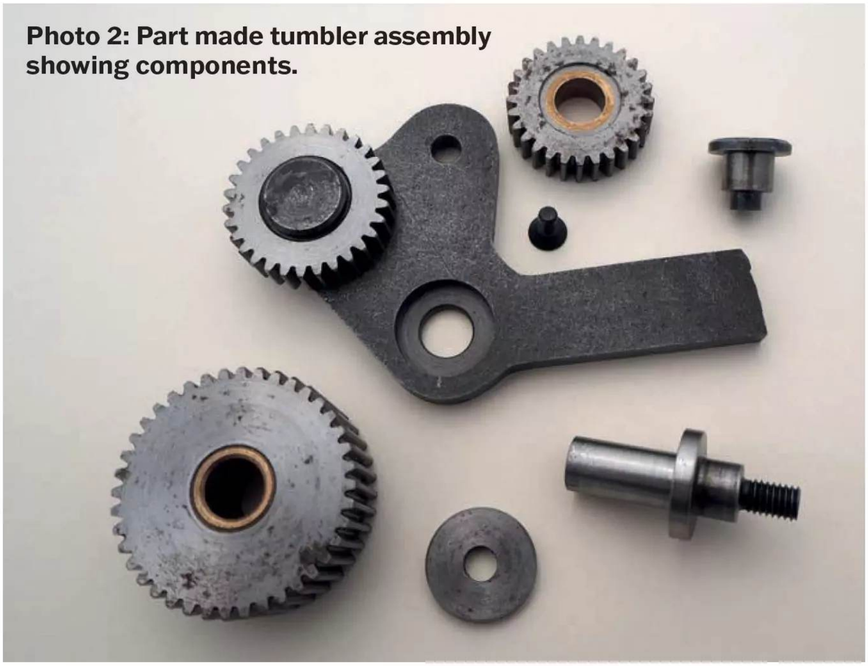


Photo 2: Part made tumbler assembly showing components.

It appears the basic setup for screwcutting on most modern hobby lathes is very limited. The number of gears supplied, along with the banjo to assemble the gear train is very restrictive. The charts on the data plates and in the manuals only show a few select thread pitches, and for a novice, calculating gear combinations for other pitches was like deciphering the hieroglyphs in King Tutankhamun's tomb.

Many lathes are fitted with quick change gearboxes; these can be an asset or hindrance depending on your views and requirement for cutting a large number of differing thread pitches. They are quick at selecting a number of pitches but are also limiting in the total number of threads able to be cut.

Change gears on the other hand can be selected to cut an almost unlimited


Photo 3: Original quadrant and studs.

number of pitches, if you have the required gears. Lots of charts and books have been written about the various gear combinations and calculations to cut almost any thread imaginable to any level of accuracy you require. As time passed, I gained experience reading the charts and setting up the gear combinations for different thread pitches.

A project then arose requiring a left-hand thread, changing from a normal RH thread to LH needs an additional idler gear inserted into the train to reverse the leadscrew direction. The original long straight gear quadrant as supplied with most new style lathes did not allow the extra gear to be fitted, or for that matter, many of the other combinations to cut normal threads.

After a learning period setting up and cutting the limited number of threads available, the original 1.5mm pitch leadscrew started to show signs of wear, and with my need for wanting more versatility, a length of 3mm pitch trapezoidal threaded rod was fitted along with making new halfnuts to match. The new leadscrew being RH instead of the original LH, prompted the decision to fit a tumbler reverse as part of the upgrade.

TUMBLER REVERSE

The basic concept of a tumbler reverse is to change the direction of the leadscrew by adding or removing an idler gear. You can also do this by adding another gear into the normal banjo setup if you have the room and additional change gear studs, but a dedicated fitting on the lathe is a more refined outcome. Changing the direction of the final gear/lead-screw compared to the input gear is a matter of changing the number of gears in the train. Idler gears change the direction of the final gear and can be any number of gears with any number of teeth, the ratio between the input and the output gears not altering. A compound gear in the train changes the direction too, but they also change the gear ratio between the input / output gears depending on the number of teeth on the two gears selected.

I have seen many designs but they all basically consisting of a plate holding two idler gears with an output gear rotating around a pivot point, and some kind of mechanism to hold the gears in one of three positions. Disengaged or engaging one or both idler gears to move the carriage either toward or away from the headstock. **Photograph 1** shows the assembly fitted to a 920 style lathe headstock.

A part made tumbler assembly is shown in **photo 2** with the components and gears, the shaped plate, the pivot cum output shaft and a couple of shafts spaced to hold and mesh the gears correctly. The pivot shaft holds the output gear and secures the tumbler plate onto the headstock. The output gear shown is a wide 40 tooth gear but can be replaced with any other XX/40T compound reduction gear. It can be set to the mid position to disengage the leadscrew or either one position for normal threads or the other for LH threads. The latching components have not been made at this point.

As a result of fitting the tumbler reverse, the distance between the first gear in the gear train and the leadscrew was reduced. The original straight gear quadrant was upgraded from being next to useless to fully useless.

The original equipment supplied with the lathe consisted of a long straight cast iron bar machined with a long t-slot and a couple of flimsy studs for mounting the gears as can be seen in **photo 3**. The setup was fine for limited basic thread cutting but not adaptable enough for anything more complicated. Many of the gear combinations could not be arranged with the straight-line method.

BANJO

A more traditional banjo was made up from steel, to allow for more varied gearing setups. **Photograph 4** shows the general layout with all the parts to mount the gears. The new studs are designed to slide but not rotate in the banjo to allow easier and more secure adjustment.

Setting up for cutting a thread is only a matter of selecting suitable gears, jointing them together on a keyed bush, mounting them on the studs, then using slip of thin paper between meshing gears to create a small amount of clearance between the gears when tightening the stud. This does involve an amount of time selecting and setting up the gears to run together. This is also repeated every time you want to screwcut a different pitch, set up for a different surfacing feed rate or swap between the two operations. I therefore decided to create a fine feed attachment to reduce the time taken when changing from a threading pitch to the fine surfacing feeds.


Photo 4: New forked banjo with components.

Photo 5: Fine feed attachment

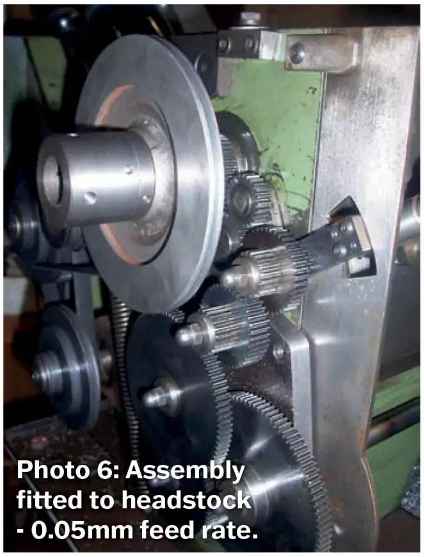


Photo 6: Assembly fitted to headstock - 0.05mm feed rate.

FINE FEED ATTACHMENT

The fine feed unit, **photo 5**, replaces the banjo when surfacing feeds are required, and swapped back to the banjo when threading jobs appear, reducing the need for constant selecting, changing and setting up gears all the time.

The attachment has dedicated gears fitted, when changing from one feed rate to another, all that is required is to replace one compound gear assembly with a different ratio set while moving the mounting stud to a new position, so the gears engage correctly.

This lathe was fitted with a 3mm Pitch RH Leadscrew and tumbler reverse setup, the plate design allowed three feed rates: 0.2mm, 0.1mm and 0.05mm. Table 1 shows the gear combinations and how the two gear changes halve the feed rate each time.

The tumbler reverse design allowed its output gear to be swapped from a wide 40 tooth one to a 20/40 Tooth combination to halve the feed rate. The other feed rate reduction was accomplished with gear 1 on the fine feed attachment, replacing that wide 40T gear with a 20/40T compound gear and moving the mounting stud to the second hole position, **photo 6**.

Apart from gear 1, all the other compound gears stay in their original positions for each feed rate. Reducing the surfacing rate to 0.2mm from a 3mm leadscrew with the chosen number of gears and limited space, resulted in some small gears attached to some large ones to get the job done. To fit all the gears into the space available, the gears were designed to overlap on three levels. Input gear 1 on the fine feed plate needed to be 3 gear widths wide to make the transition from the tumbler to the other gears on the fine feed plate.

To make it a standalone attachment, new gears were purchased and permanently fixed together. The gears were fitted with sintered bushes to run on hardened shafts, with washers, spacers and acorn nuts to finish off the job.

Because the tumbler could be selected in either position, the leadscrew direction could be set depending on any number of gear sets. It doesn't matter if up is towards the headstock on one setup but with another using a different number of gears, down may be towards the headstock. Once selected, you don't have to worry about it until you need a new setup, as you don't want to disengage the tumbler during a threading operation.

This system worked well for several years until I purchased a newer 920 lathe with a slightly longer bed and a touch more swing. I started doing all the upgrades I had fitted to lathe number 1, as it's hard to live without some of the refinements after becoming accustomed to them.

SCREWCUTTING CLUTCH UPGRADE

When upgrading the second lathe, I chose to fit my adaptation of Graham Meek's 'Screwcutting Simplified' clutch after I had discovered how easy it made cutting a thread. See *Model Engineers' Workshop* 261 to 263 for the Myford ML7 version and 304 to 306 for the EMCO Maximat Super 11.

Graham has adapted the screwcutting clutch from the Hardinge lathe to fit to Myford and numerous other lathes. His book *Projects for your Workshop, Vol 1* describes making the threading clutch as well as other useful projects. Move the handle in the direction of travel required, the carriage moves until the stop trips out the dog clutch, retract the toolbit then move the handle the opposite direction to return to the start position.

Table 1: Fine feed gearing 3mm leadscrew

Fine Feed Plate	3mm Leadscrew								
Feed Rate mm	Tumbler		Gear 1		Gear 2		Gear 3		Leadscrew
0.05			20	—	90		25	—	100
	20	—	40		45	—	75		
0.1			20	—	90		25	—	100
	40	—	40		45	—	75		
0.2			40	—	90		25	—	100
	40	—	40		45	—	75		

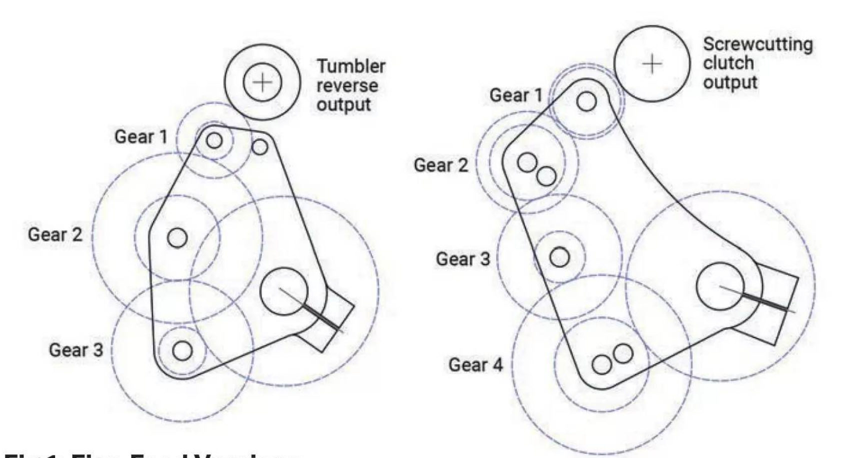


Fig 1: Fine Feed Versions

Advance the toolbit for the next cut and repeat, all at a reasonable speed, even up to a shoulder or into a blind hole without stopping the chuck, disengaging the clasp nuts or using a mandrel handle in the spindle.

The clutch is fitted to the lathe in **photo 7**, I did incorporate a tumbler style plate into the design to allow the complete assembly to be disengaged from the spindle to reduce noise and wear when doing high-speed turning or drilling. As with the first lathe, the straight gear quadrant had to be replaced with the forked style banjo to allow the gear trains to be set up correctly.

The newer 920 lathes and some others have a fine feed worm reduction drive built into the carriage apron, utilising a grooved leadscrew to make surfacing a little easier but there is still a lot of changing gear setups from your last threading exercise to a suitable surfacing feed rate.

I disabled this feature as a result of making and fitting a larger diameter leadscrew having a 3.5mm LH thread as recommended by Martin Cleeve in his *Screwcutting in the Lathe* from the *Workshop Practice Series*. A 3.5mm pitch is a more robust thread, stronger clasp nuts and has the ability to cut imperial threads with greater ease when choosing translation gearing. Most imperial threads can be cut accurately with just a 39T and 43T gear somewhere in the gear train.

Screwcutting a new leadscrew with a thread length longer than the original leadscrew travel was an interesting job.

When thinking about a fine feed attachment for the new lathe, I initially didn't think it was going to be possible. The original attachment with a 3mm leadscrew and tumbler reverse, halving the feed rate was accomplished by replacing a couple of 40 tooth double gears with 20/40T reduction gears. One being the output of the tumbler reverse and the first gear on the fine feed plate being the second. All the others were permanently assembled in their places.

My version of the screwcutting clutch did not allow its output gear to be changed because of the smaller size of 1 module gears and space constraints. The input gear on the fine feed plate, gear 1 also needed to stay in that combination because of gear meshing clearance issues, so the three feed rates had to be accomplished on the fine feed plate itself. Reducing a 3.5mm pitch down to 0.05mm looked like needing some very large gears and space was at a premium.

The operating handle on the screwcutting clutch was designed so that when moved to the left, the carriage moves towards the headstock, an adjustable stop then disengaging the dog clutch stopping the carriage. Alternatively move the handle to the right, carriage travels towards the tailstock stopping against a trip stop as well. To keep this arrangement to save confusion and delay when the fine feed attachment was fitted, the number of gears had to be selected to get the rotation of the leadscrew correct.

When screwcutting using the banjo, all threads could be cut with two pairs of gear combinations plus the leadscrew gear, so with the fine feed attachment fitted, we needed four pairs of meshing gears. The leadscrew rotates in the correct direction, and the upside of this was more compound gears in the train, allowing smaller gears to make the reduction from 3.5mm to the 0.2mm starting point, compared to the three sets on the tumbler setup lathe.

After some thinking and drawing, a solution was found, **fig. 1**. The compound gears at positions 2 and 4 would be used to change the feed rate while gears 1 and 3 would be fixed in position, along with the leadscrew gear.

Again, to make the feed plate self-contained to save time, new gears were purchased. A number of new gears were needed anyway, as to make the design work, some of them were unusual tooth numbers that were not in the standard gears supplied with the lathe, **Table 2**.

This design not being as simple as the original, required the purchase of a larger number of gears. To halve the feed rate on gear 4, a 50/95T combination needed to be changed to a 25/95T set. That would require two 95 tooth gears at a large cost if they were permanently joined together. I decided to use the standard keyed change gears in the Gear 4 position, **photo 8**. The second surfacing rate reduction was achieved by replacing a 40/54T gear with a 20/54T compound in the gear 2 position. In each case moving from one mounting hole position to the other to mesh with the fixed gears.

One advantage of this design is once the feed unit is fitted and meshed with the output gear of the clutch, all fine feed changes take place entirely on the plate, with all gear centres pre-set, just fit the new gears into position and keep working, **photo 9**.

Swapping between surfacing and

Fine Feed Plate 3.5mm Leadscrew

Feed Rate mm	Tumbler		Gear 1		Gear 2		Gear 3		Gear 4		Leadscrew
0.05			36	—	54		27	—	95		
	40	—	40		20	—	66		25	—	100
0.1			36	—	54		27	—	95		
	40	—	40		40	—	66		25	—	100
0.2			36	—	54		27	—	95		
	40	—	40		40	—	66		50	—	100

Table 2: Fine feed gearing 3.5mm leadscrew

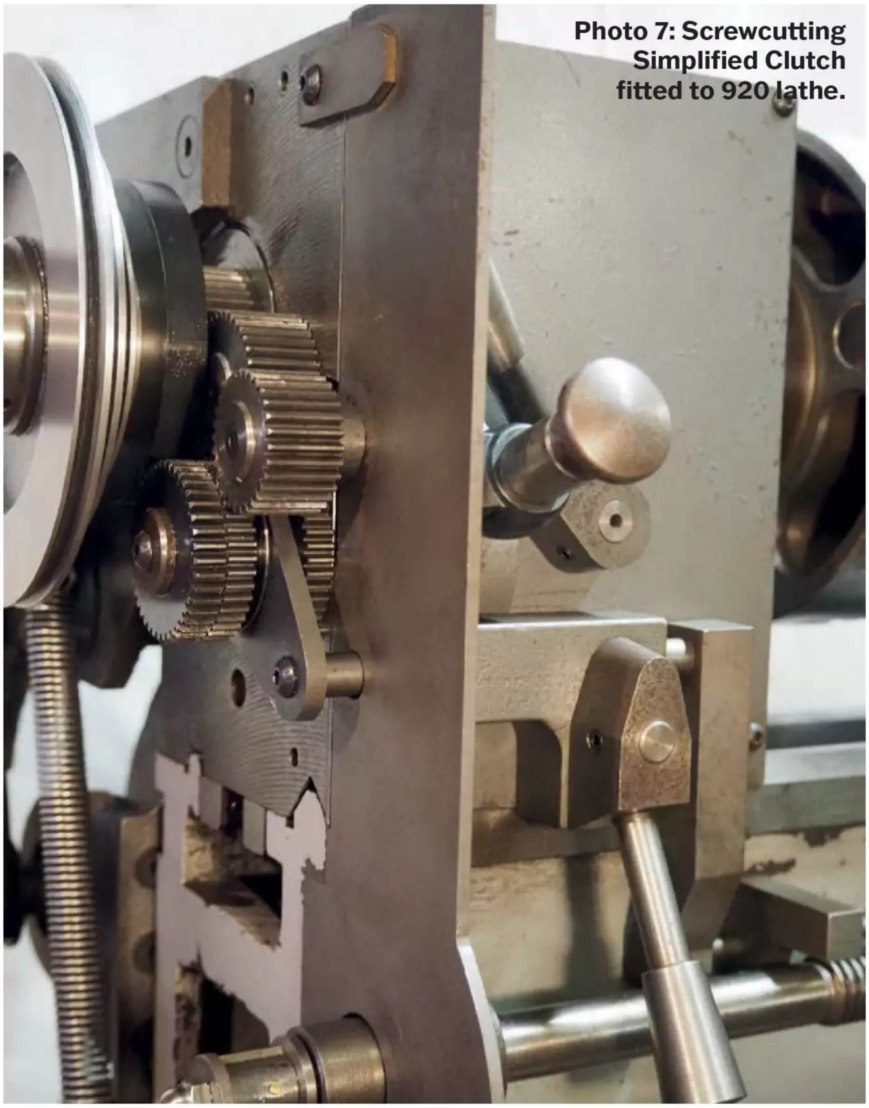


Photo 7: Screwcutting Simplified Clutch fitted to 920 lathe.

to fit, drawing out all the components using a CAD programme was a great tool, but even old school paper drawings or sketches can help you picture how any changes you make might interact with other components. This helps putting together a plan of all the things that will need making or modifying and in what order they are required.

This is not a step-by-step article on making any of these attachments but some of the techniques and design features that came about while building them will be described.

FORKED BANJO

A new forked banjo in steel or cast iron is a simple job, designed and shaped to your tastes with a bored hole to match the leadscrew boss allowing it to be clamped and adjusted into position. A couple of slots with a recess on the rear to allow the studs to slide and clamp the gears securely meshed with each other. The gears being manually adjusted using a slip of thin paper between the gears to set a running clearance before tightening in position. The actual lengths and angles between the slots will vary depending on the lathe headstock design, I played around trying different gear combinations, seeing how they fitted together to decide on the shape. An angle between 30 and 40 degrees is a good starting point to layout the arms. The bored hole can be done on the either your lathe or milling machine, with the rest of the machining done on a milling machine, cutting

threading is now just a matter of removing the leadscrew gear, loosening the attachment clamp bolt and removing the assembly from the lathe then fitting the forked banjo and setting up the gears to cut a thread.

MACHINING OPERATIONS

The progression of upgrading my lathes, started simple with purchasing and modifying standard off the shelf gears to cut a larger range of thread pitches, making a new banjo with more substantial mounting bolts, all the way up to fitting the Screwcutting clutch. All these upgrades are similar in the parts required, some gears, accurately spaced hardened shafts for the gears to run on and some means to engage and disengage the operation.

When it came to adapting and designing the modifications I wanted

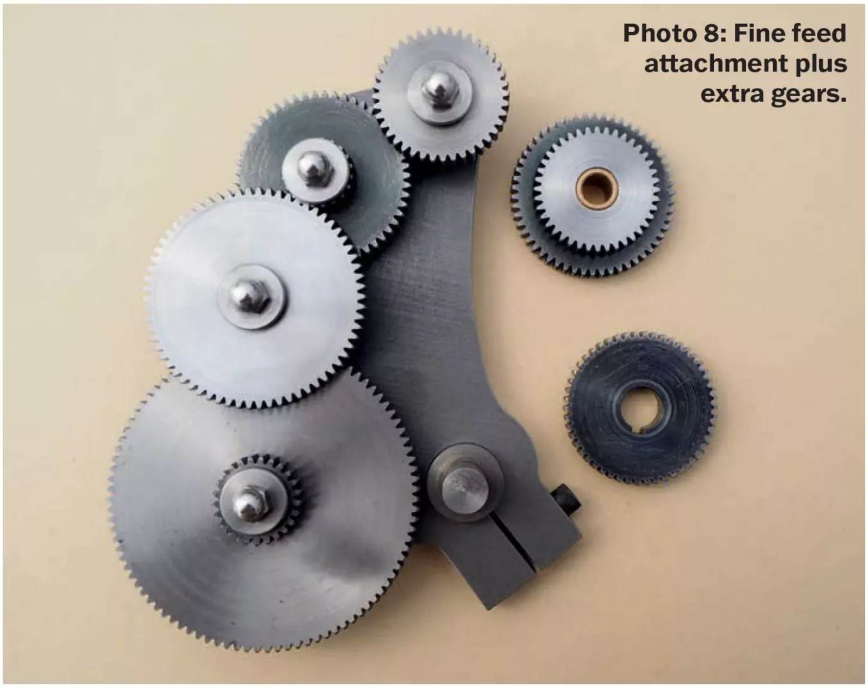


Photo 8: Fine feed attachment plus extra gears.

the through slots along with the recess at the rear. Drilling and tapping for the clamp bolt and opening up the bore with a slitting saw.

The small parts to finish off the job are simple turning, spacers, washers, hardened bushes and mounting studs.

GEARS

Gears play a large part in all the upgrades. A common gear size used on modern hobby lathes is 1 Module, 8mm thick with a 14mm bore and with a keyway of 3 or 4mm.

If you have the facilities to cut your own gears, you are ahead of the game. Some years ago, I made some patterns for a gear hobbing machine. Some castings were produced from them and are still ageing under my workbench in company with the obligatory Quorn castings, one day hopefully I will be able to cut gears too. Ready-made gears for the module/DP and pressure angle you require can be purchased. Some are available with a mounting hub that is useful for attaching a second gear onto it when making compound gears. Another option is a product called gear stock which is basically a length of material with the gear teeth machine along the length. All you need to do is machine the bore and cut off the gear to the width required. It can also be used as part of a compound gear. **Photograph 10** displays some purchased gears along with gear stock and some part machined gears in the process of being turned into compound gears for the fine feed attachment.

Any gears you purchase to make new change gears or to make any these attachments will in all probability need to be modified. The bore may need enlarging and the thickness reduced to suit the job. If the design space is tight, a recess to accommodate a washer may be needed. Some of gears need to be joined permanently together to form compound gears. Normal change gears are joined as compound gears all the time when setting up gears trains using a keyed bush. This is for ease of assembling and dismantling all the different gear combinations together.

The object of these projects is to make life easier, saving time swapping and setting up gears so for that reason new dedicated gears were purchased.

Next time I will discuss modifying gears and complete the banjo.

To Be Continued

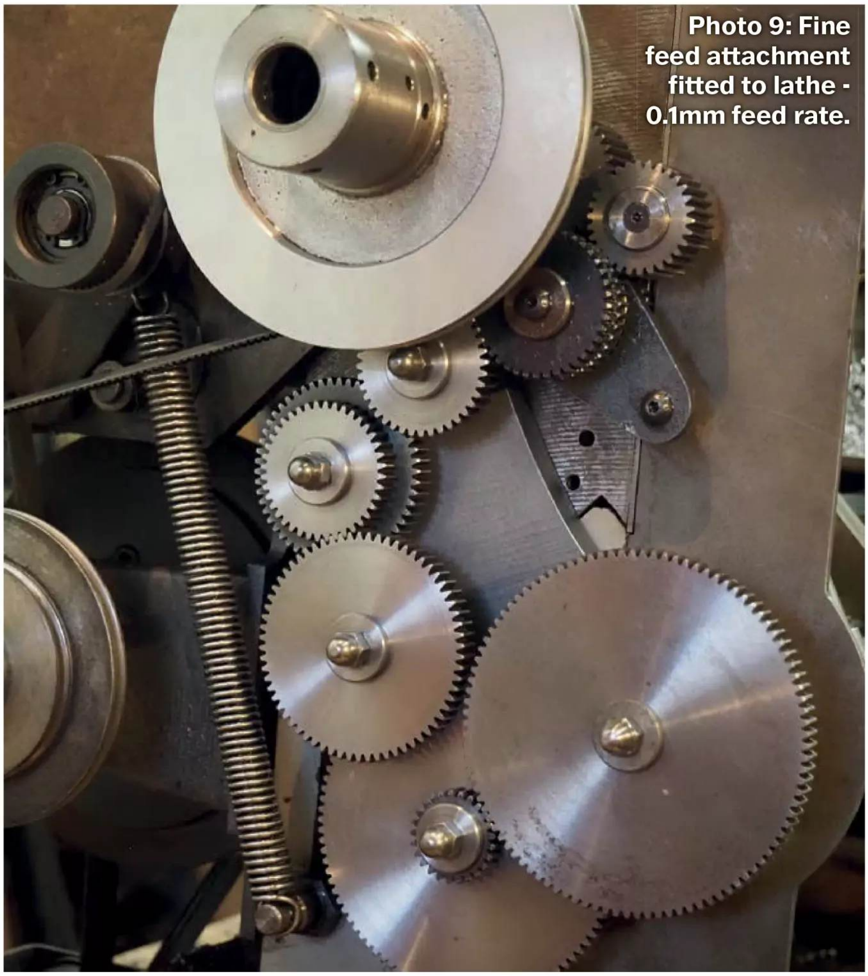


Photo 9: Fine feed attachment fitted to lathe - 0.1mm feed rate.

Photo 10: Gear stock shown with some purchased and partly completed gears.

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

PART 22

Doug Hewson returns to complete the boiler.

Photo 211: 8BA screws used to hold plate in place.

I've started so I'll finish. I decided that as I had started the boiler, I had better finish it off. Now we are into the silver soldering there are things which you need to know to make life easier. For a start, it is a great advantage if you can make a start on the backplate. I used Silverflo 24 for this little exercise to make sure that nothing moved while I was doing the rest of the silver soldering. I used low melting point silver solder for everything else and that works fine for me. I made up a steel plate with a bend in it to silver solder the studs in position for mounting the plate on it for the two lots of gauges, left and right-hand side. The right-hand one is for the boiler pressure gauge and the steam heating gauge. On the left-hand side is the steam chest pressure gauge and the vacuum gauge and once they were fitted, there was also the speedometer.

I would say that the steam chest pressure is as important as the boiler pressure as the drivers all use this as a guide to how the engine is running. I was on the Severn Valley Railway one day with Frank Cronin and all he looked at was the steam chest pressure gauge as the fireman looked after the boiler pressure. We set off from the shed and when the chest gauge showed 10lbs on the clock he slammed the regulator shut and waited. 80079 just trundled off and Frank didn't touch the regulator until he had cleared to signal ready for setting back. He then said that he would just use the steam sanders to lay a trail of sand to set back into platform 2 to collect his train. Good idea I thought. It was raining at the time, and when Frank took me down the see this trail of sand there was not a sign of any, so all we had done was to steam clean the rails. We had a job pulling out of the station at Bridgnorth!

I used 8BA bolts holding the stubs in place on the plate for silver soldering, **photo 211**. The gauge frames have the top holes on the vertical part of the boiler back plate and the lower ones are part way down the slope, so I had to make some special fixtures to hold those in place too. Same applies on the 2-6-0 too. **Photograph 212** shows the two of them ready for silver soldering. **Photograph 213** shows the completed works. I have shown the bushes for the gauge frames, **fig. 84**, the stay spacings, **fig. 85**, and the various fittings which show the tools for expanding the tubes, **fig. 86**. **Photograph 214** shows the outer shell of the boiler in

Photo 212: Fluxed up ready for silver soldering.

Photo 213: After silver soldering.

Photo 214: In the pickle bath.

the. **Photograph 215** shows the set up I used for fixing the first part of the foundation ring in place. Also worth noting are the large radii around the boiler back plate.

Now I had a bit of a disaster here because when I came to test my boiler, I could not get it to seal. First there was a dribble from one of the fire box seams so that meant warming the whole lot up again. This caused another leak somewhere else and so it went on. The leaks were in different places every time so the was nothing for it but to start again. That put me back about nine months all together. **Photograph 216** shows my new boiler which I redesigned with rod crown stays all round. Another thing which I made for my first boiler was to make a load of bullets to align the tubes into the smoke box tube plate and **photo 217** shows all the bullets in place. At long last I had a boiler which held 200psi so I left it there overnight and the following day my gauge showed about the same. I stamped the boiler 08-08-80 which I thought was very appropriate bearing in mind my loco number 80080! I could now get on with the rest of my loco and **photo 218** shows the new boiler complete with a few fittings in place.

I know that the regulator is not part of the boiler, but I am going to describe that now, **fig. 87**. I designed the regulator as per the full-size engine but the one thing I had not worked out was how to design the ports. I wasn't going to make them too large, and I didn't know how the engine would run anyway, being a completely

Photo 215: The foundation ring will fill the gap around the firebox base.

Photo 216: Rod crown stays on top of firebox.

Fig 84

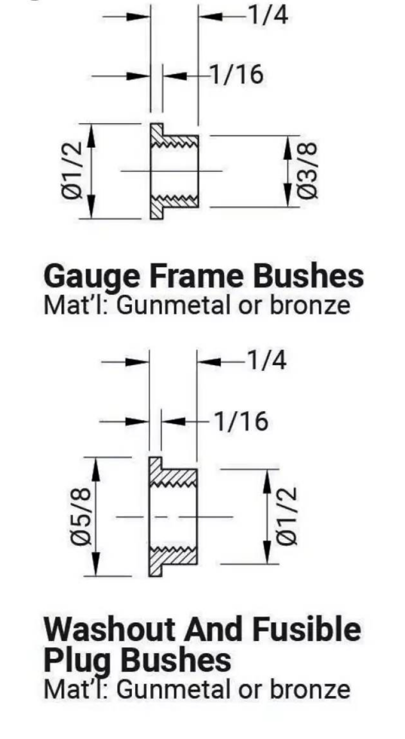


Photo 217: 'Bullets' for aligning tubes.

new design. One thing which Eddie told me was that when running 80080 it felt a bit dead and seemed to be raring to go. I had used a pilot valve of 1/16 diameter and the main valves of two 3/16 holes. He removed my regulator and opened the pilot valve up to 2mm and then made the two 3/16 holes into a slot. He took it to Gilling again to give it a run and his exclamation was "Wow". This meant that he could now shunt all of the coaching stock using just the pilot valve and then on the second valve he could put the regulator in the roof, so to speak, and control the speed by purely using the reverser. The one thing that Eddie said now was that when on a run with ten of our Mk1 coaches behind, the steam chest pressure gauge should almost match the boiler pressure gauge, but it doesn't. He suggested altering the pipes from the superheater header to the cylinders so that is what I have now done, and you will see these alterations when I get on to the description of the smokebox.

There is a casting for the regulator, and it has all the features for you to work on. **Photograph 219** shows the

Photo 218: Finished boiler with some cladding and fixings.

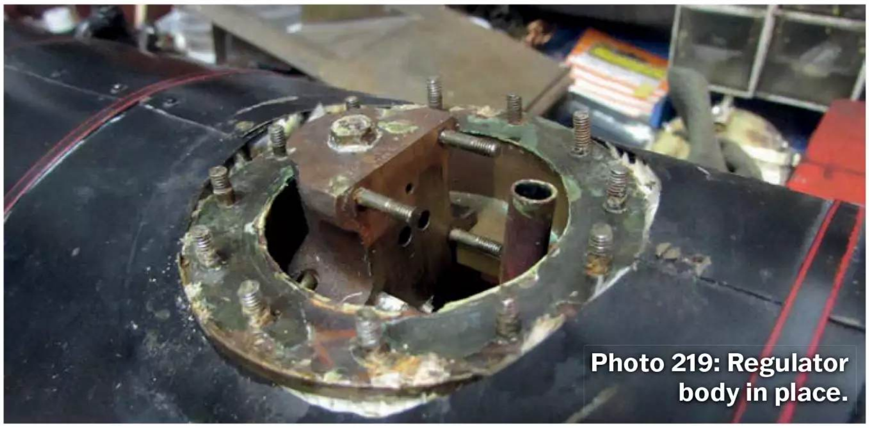


Photo 219: Regulator body in place.

Fig 85

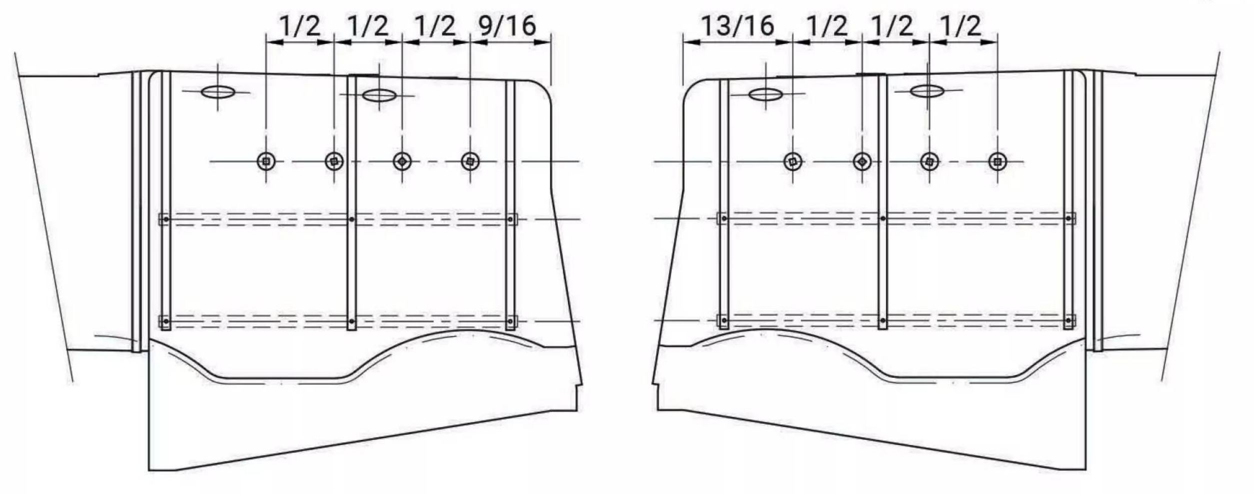


Fig 86

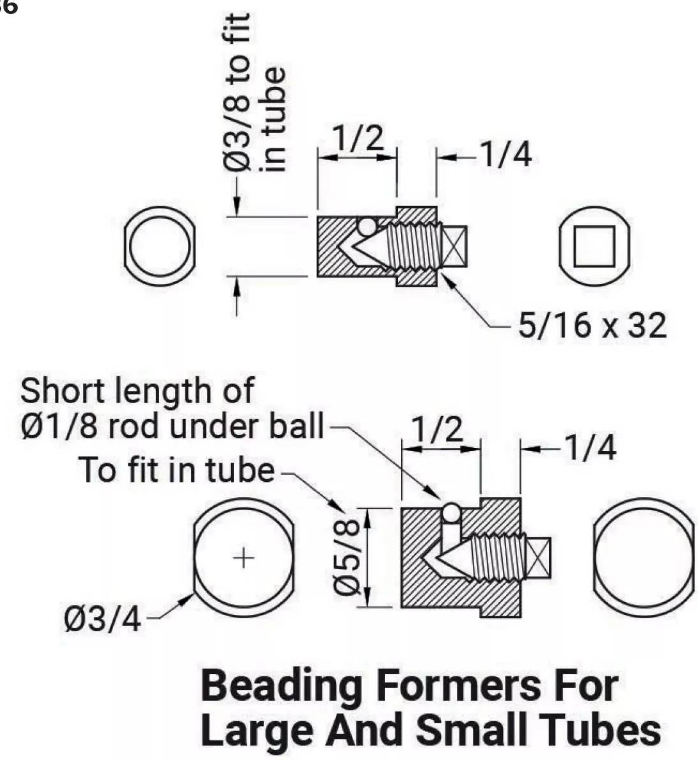



Photo 220: Regulator parts.


Photo 221: Regulator spring.

regulator in its half-stripped state and as you will see there are only two machined faces on the whole thing. There are several studs to tap holes for, and you can see the pilot valve hole and the two holes below that for the second valve. **Photograph 220** shows the actual valves and at the top you can see the pilot valve with a PTFE disc let in to the brass plate to hopefully make it seal properly. The idea is that the pilot valve moves up so that the holes meet up and then when you open the regulator fully the whole valve moves up to align with the slots in the body.

All the holes in the photos are of my old regulator, since modified. There is one more component to the regulator and that is the phosphor bronze spring which keeps the valve pressed up on to the face of the ports. This is shown in **photo 221**, and **photo 222** shows the whole lot back in place. One thing that you need to know if you are building your own boiler and that is to make sure that your dome ring needs the shelf inside so that you can screw your regulator down on to the shelf with a couple of 6BA screws.

To be continued

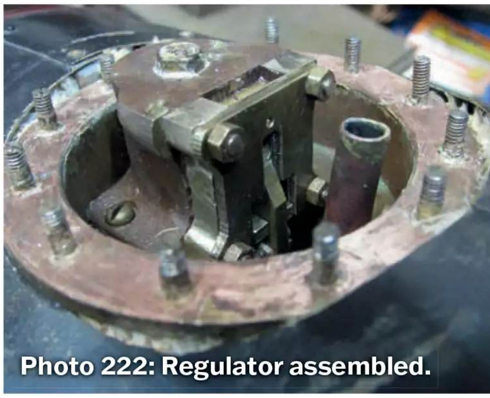
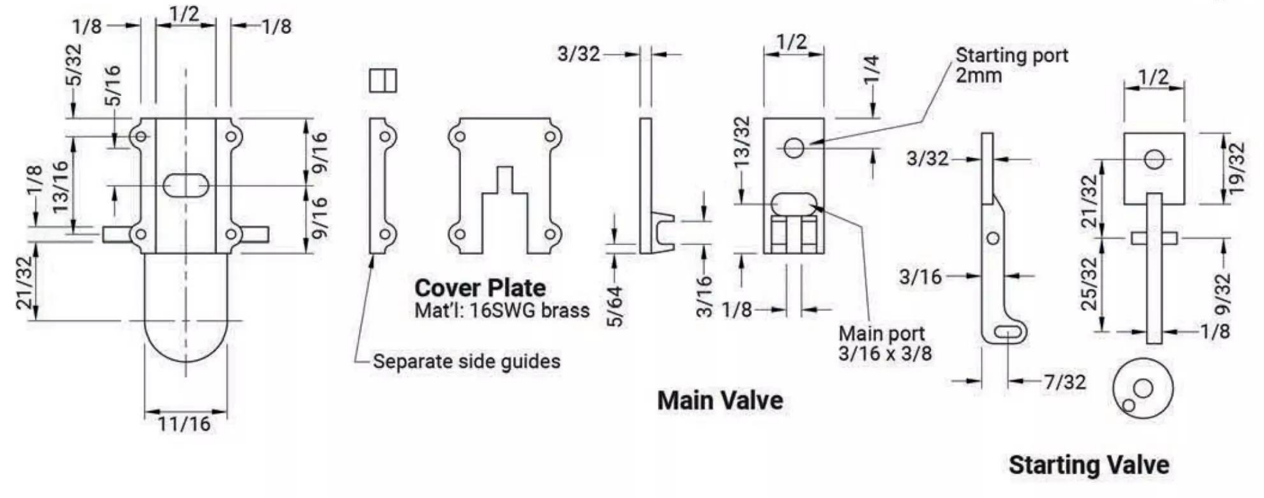


Photo 222: Regulator assembled.

Fig 87



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

REPAIR TO PUMPS

GEOMETER describes repairs and replacements for the more common types of liquid pump

IN THE various types of pumps described in the previous issue, many of the faults which arise can be corrected without difficulty.

The simple " lift " water pump, and others of similar design, may occasionally require a new bucket or cup leather fitting, to restore efficiency lost through wear of the old one. The new cup leather (obtainable in a size to suit the pump barrel) is a hard flanged disc, whose centre has to be cut out to fit the metal plunger- which work can be done either with or without a lathe.

When only a small lathe is available the cup leather being nearly as large as the chuck, the set-up can be as *A*. A piece of studding is obtained, or made, to hold in the chuck with support from the tailstock centre. On the studding, held between nuts and washers, is a piece of wood to be turned to fit into the cup leather, which is then drilled or punched, and clamped up.

Round the outside, a simple or worm-drive hose clip can be fitted if additional hold is desired. The turning tool should be a pointed type, bent if necessary. Care should be observed to check the diameter with calipers and cut out the centre cleanly.

On a medium-sized lathe with a bigger chuck of independent type, the piece of wood for mounting can be gripped firmly and turned off to take the cup leather, which can be pushed up by the tailstock centre and held by a clip on the outside.

Centring cup leather

In the absence of a lathe, the cup leather should be centred--either with a surface gauge or as, *B*, using a sharp nail at approximate centre height through a wood block, the leather being turned for cross marks to be made. A small hole is drilled at the centre position, and the cup leather mounted on a roughly rounded wood block in the vice, for the centre to be cut out with a washer cutter, C. Any necessary trimming can be done with a sharp pocket knife.

When mounted on the plunger, the cup leather should be soaked in warm water fo soften it somewhat before fitting to the pump barrel. Only a smear of oil, if any, should be applied.

A flap valve for the base of a pump barrel can be cut with the washer cutter, leaving a neck for the flap and refitting the metalweight to hold it down.

Plunger and other types

On a small plunger force pump, as used for model boiler feed., or an oscillating type for lubrication purposes, a bore which passes right through the barrel facilitates reconditioning when wear occurs. When wear is slight, a soft barrel and gland can be reamed out slightly larger by placing a narrow strip of shimstock down the side of the reamer.

Only the few thou necessary for truing will be removed, then a new plunger can be made to fit. If the barrel is steel and hardened, the bore can be trued by lapping on a piece of well fitting brass rod, using valve grinding paste. Again; a new plunger can be made to suit.

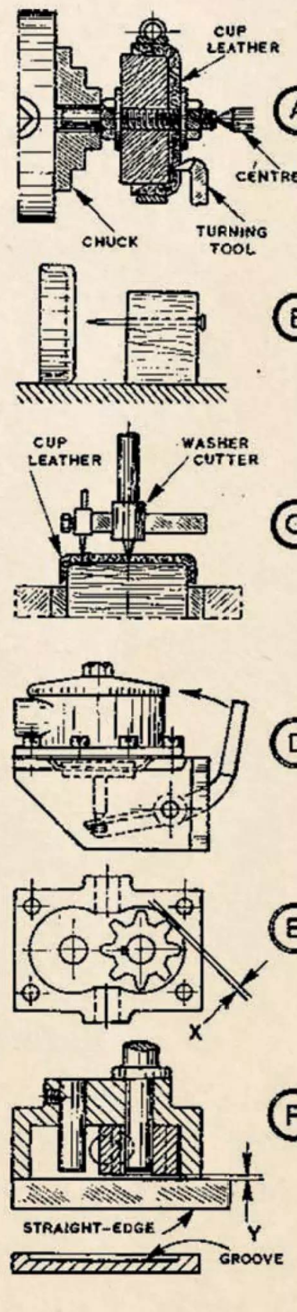
Diaphragm pump

A diaphragm pump, as used for petrol, should be marked for realignment of the body flanges before dismantling. Usually, the diaphragm has to be pressed down and turned through 90 deg., when flats on the spindle permit removal.

The spring of such a pump should not be stretched, nor replaced with a stronger one, or flooding at the carburetter may follow from the higher pressure produced. Neither should the diaphragm be sealed with jointing compound; and when assembling it is important to tighten the screws partially, stretch the diaphragm, as *D*, by operating the lever, then tighten the screws fully. If this is neglected, the diaphragm may be damaged.

Efficiency of a gear pump is reduced by leakage between the gear teeth and the body, or past the endplate. Clearance at X at *E* should not be more than about 0.006 in., and end clearance at Y at *F* not more than about 0.003 in., both tests made with feeler gauges. In addition the'endplate may be grooved.

Rectification consists of rubbing down body and endplate on a flat surface on a sheet of fine abrasive cloth, then lapping on a flat. metal surface with grinding paste.



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PART 1

Re-imagining the Antoni van Leeuwenhoek Microscope

Inspired by memories of a toy from his childhood, **Mark Noel** set about recreating a primitive microscope given for his 8th birthday.

Photo 1: My 2024 version of the Antoni van Leeuwenhoek microscope together with a range of lenses and specimen holders. The lower image shows the oval socket for specimen holders and the control knob knob for shifting it in X and Y.

Photo 2: Original Van Leeuwenhoek microscope, inventory number V7017, in the National Museum Boerhaave, Leiden. This is a medium-powered instrument with a magnification of 118. The specimen is mounted on the tip of the pin that can be moved and focussed via screws. The lower bracket hinges to traverse the specimen left-right. The rectangular body comprises two brass plates riveted together, sandwiching the lenticular lens with a viewing aperture directly below the tip of the pin. Higher-powered instruments used a ball lens. Photo credit: Tom Haartsen.

As a child I was given three presents which began a lifelong interest in science, invention and technology: these were the Philips Electronic Engineer kit, a water rocket and a tinplate replica of Antoni Van Leeuwenhoek's 17th Century microscope. I still have the Philips kit which contains all the components and instructions needed to build transistor radios, buzzers, light detectors and other gadgets. Meanwhile, the rocket provided limitless fun juggling pressures and water volumes to achieve maximum altitude. I even added a parachute! Although each of these toys was exciting, the Van Leeuwenhoek microscope stood out by revealing the wriggling micro-life present in ponds and sea water. Inspired by this memory I decided to recreate a modern version of the instrument using 3D design software and printing. Hopefully the Dutchman would have approved of my updated version shown in **photo 1**.

Antoni Van Leeuwenhoek (1632-1723) was born in Delft and worked variously as a draper, land surveyor and wine gauger. It was while running his drapers' shop that he determined to improve methods for examining the quality of thread and this led him to create a simple microscope with a spherical glass bead as the lens. This produced a very high magnification sufficient for Van Leeuwenhoek to be the first to observe bacteria, microscopic life in pond water and the structure of blood cells and muscle fibres. Such work eventually brought him fame and recognition, particularly through his correspondence with learned peers in the Royal Society. During his life he produced about 500 microscopes of which only eleven survive, the example shown in **photo 2** is displayed in the Leiden Museum.

Van Leeuwenhoek's microscopes incorporated single lenses of varying types and magnifications, of spherical and of biconvex form with non-spherical surfaces. The globular lenses were produced by flameworking the tip of a thin glass straw, while the lenticular versions were again made by flameworking or grinding. Either type was chosen to find a balance between magnification and distortion, although chromatic aberration was present in all. Nevertheless the quality

Photo 3: Gedeo Crystal Resin used in my experiments to cast miniature bi-convex lenses.

Photo 4: Polishing one of the brass casting cups with Brasso and a Cotton Bud.

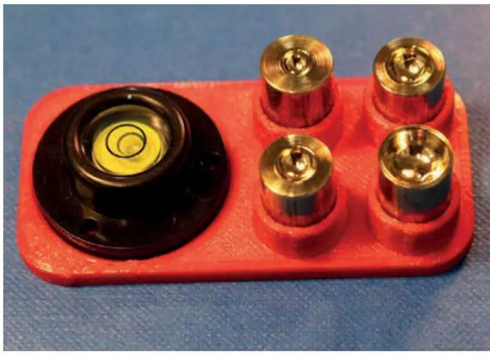

Photo 5: The four brass casting cups on a 3D printed holder with bubble level to ensure that the upper surface of the resin will cure as a meniscus without distortion.

of his lenses remained unsurpassed for more than 150 years. Van Leeuwenhoek was extremely secretive as to the methods he employed, with few clues surviving in correspondence with members of the Royal Society. One reason may be that he owed much to techniques developed by Robert Hooke, the English polymath who was making lenses and microscopes at the same time in London. Recent neutron tomographic imaging has been carried out of two surviving Van Leeuwenhoek microscopes in an effort to reveal the shapes and manufacturing methods of lenses which are partly concealed inside brass mounting plates. The results are published in a remarkable paper by Tiemen Cocquyt and others which makes fascinating reading for anyone interested in research being carried out during the Golden Age of Dutch science and technology (see References).

HOME MADE LENSES

Inspired by the work of the great Dutchman, I set about finding a way to make my own lenses. Melting glass into globules or bubbles was not an option since I don't have access to a blowtorch, and therefore some means of casting or moulding in clear plastic appeared to be the only way forward.

Gedeo Crystal Resin is a slow-setting epoxy used in modelling to create scale water features such as ponds, and which cures to create a clear plastic resembling Perspex, **photo 3**. Having previously had success in using this material, I was encouraged to try casting lenticular lenses with this resin. Four moulds were made by sinking cups into 1/2″ brass bar with ball-end cutters of 3, 4, 6 and 8mm. Each cup was then thoroughly polished to remove machining marks starting with Autosol paste and finishing with Brasso, **photo 4**. These moulds were then mounted on a plinth with a bubble level in readiness for casting, **photo 5**.

Hardener and resin were combined in the ratio 1:2 and thoroughly mixed as shown in **photo 6**, then degassed with the crude vacuum pump pictured in **photo 7**. Each mould was carefully filled drop by drop until the surface was slightly bulged, thus creating a biconvex lens shape. After curing for 48 hours in a warm room, the moulds were turned back to expose the rims of each lens which were then easily ejected, **photo 8**. Despite the care taken in mixing and degassing, the optical properties were not ideal, with streaks of differing refraction and micro-bubbles. Three of these cast lenses can be seen in the middle row of **photo 9**. It may be that use of a fresh resin (mine was 6 years old!) and with better degassing this casting method could produce decent lenses.

My second approach to making

Photo 6: Thoroughly mixing Gedeo resin with a simple hook stirrer on the drill press.

Photo 7: Crude vacuum pump used to remove bubbles from the Gedeo resin. The syringe is sealed to the cup containing the resin and the plunger retracted and held for several minutes. All the parts were found in my scrap box. Black rings on the cup were guides for combining hardener and resin volumes in the ratio 1:2.

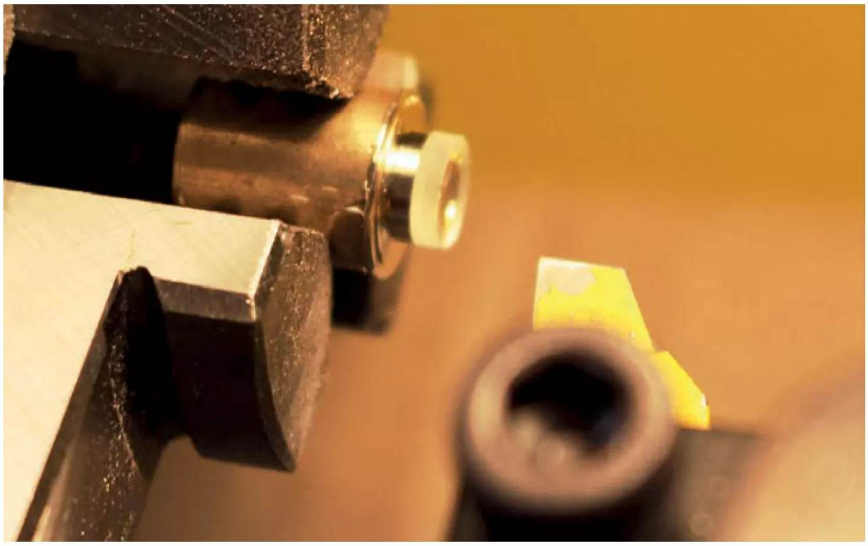

Photo 8: Once the Gedeo resin had cured each brass cup was turned back to expose the rim of the cast lens which could then easily be popped out of the mould.

Photo 9: A selection of home-made lenses. Top row: lenses cut from MES bulbs both mounted left, and broken off, right. Middle row: three cast resin lenses. Bottom: An attempt to create a lens by hot-pressing in 3mm thick Perspex.

lenses involved hot-pressing 3mm heat-softened Perspex using the tools sketched in **photo 10**. The idea is to force a convex lens-mound to be created inside the tool as seen in **photo 11**. My best result from this procedure is shown in photo 9 - a nearly bi-flat lens with negligible magnification! However, I believe that this method could be developed to produce decent lenses given precise temperature control and improved design of the press tool. It will be necessary to experiment with both cast and extruded Perspex which have differing glass transition temperatures and flow characteristics.

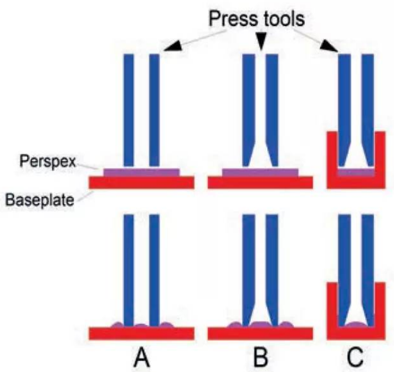

Photo 10: Three tools for making Perspex lenses by hot pressing into 3mm thick sheet: A, a simple cylindrical tool pressing onto a flat baseplate. B, a tool with conical aperture also with a flat baseplate. C, a conical tool with close-fitting cylindrical baseplate. All tools and baseplates are heated to the softening point of Perspex. Methods A and B have given poor results. Method C has yet to be tried but physics suggests that a decent biconvex lens should be formed.

Finally, I experimented with a third method for making lenses by casting Gedeo resin into hemispherical sacrificial moulds of soluble PVA, **photo 12**. Two experimental moulds were made by using ball end mills to turn pockets into porous pine dowel which was initially lined with several coats of PVA glue. Highly polished balls were then placed in the centre of each cup and PVA poured into the surrounding annulus. Once the glue had dried the balls were removed and resin poured into the cup and allowed to cure, **photo 13**, before turning back to expose the edge of each lens as shown in **photo 14**. So far so good, but after immersing the 'lenses' in warm water for several minutes both the resin and PVA had softened and turned white ruining all the effort involved. This serves as a reminder that epoxy resin is not inert but absorbs water. Also a better result might have been obtained had I printed the sacrificial mould using soluble PVA support material of the type used in 3D printing. Once again, there is scope here for others to experiment with yet another mode of lens manufacture.

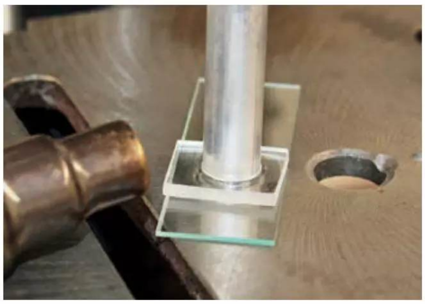

Photo 11: A tool with conical aperture being used in an attempt to press-mould a plano-convex lens in Perspex.

SALVAGED LENSES

Van Leeuwenhoek's microscopes with the highest magnification were fitted with ball lenses made by melting the tip of a glass straw into a globule which was then snapped off to release the ball. This method has been proven through neutron tomographic imaging of an instrument in the Utrecht University Museum which showed the ball having a short stalk as a relic of the process (see References).

Photo 12: Wooden dowel cups with polished balls encased in soluble PVA.

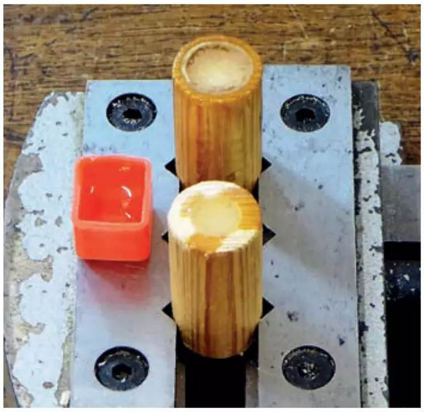

Photo 13: Once the balls had been removed the PVA cups thus formed were filled with Gedeo resin.

Photo 14: After the clear resin had cured the edges of each lens were exposed by turning back the enclosing wood dowels.

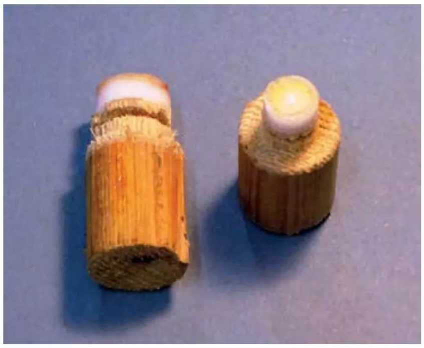

Photo 15: An unhappy result! Soaking the dowels in warm water to dissolve the soluble PVA caused the lenses to turn opaque-white before the PVA had appreciably softened.

There is no need to recreate this process since it turns out that household soap dispensers have a clear glass ball working as the valve inside the pump mechanism, **photos 16** and 17. A few moments with a bandsaw releases this ball together with a quality chromed spring and plastic spacer. Most such balls have diameters of exactly 5mm, while smaller balls I have salvaged from perfume bottles. Not mine of course!

In the next issue I shall conclude my search for lenses and give more details of the microscope.

To Be Continued

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Technique for making lenticular lenses from a bubble: J. van Zuylen, The microscopes of Antoni van Leeuwenhoek. Journal of Microscopy. 121, 309–328 (1981).

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Utrecht University Museum's description of the microscope in their collection: umu.nl/collectie-verhaal/het-van-leeuwenhoek-microscoopje/

Photo 16: Many brands of supermarket soap dispensers contain glass balls suitable for use as lenses!

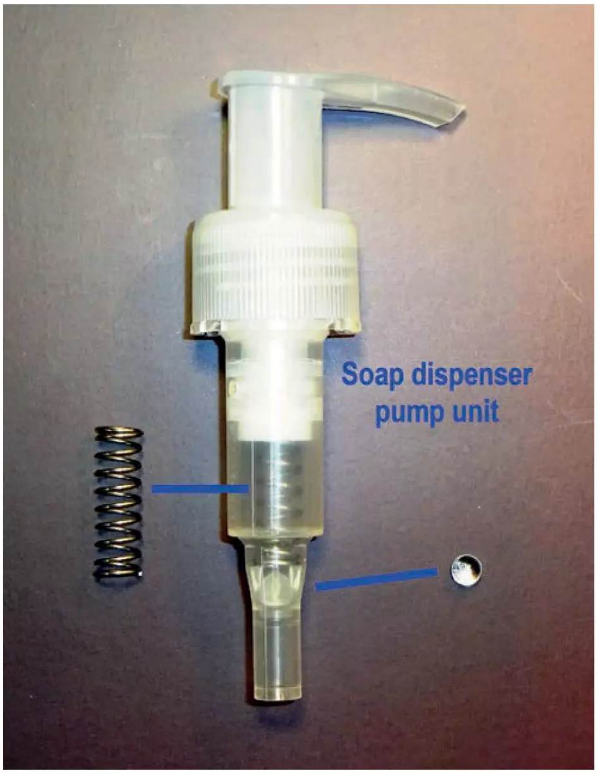


Photo 17: The pump mechanism of a disposable soap dispenser. These typically have a 5mm glass ball and a nice chrome plated spring acting as the one-way valve.

Gerald Martyn
completes fabrication of the loco's platework using laser-cut parts.

Photo 150: Tank cross beams.

PART 19

A GWR Pannier Tank in 3 ½ Inch Gauge

This third look at the platework covers the tanks and top covers. On the full size the tanks were welded assemblies, and I must say were not very neatly done, so it's easy to end up with a more presentable (but non prototypical) job than the GWR. There are fourteen laser cut parts as tabulated below plus some hand cut bits and pieces and some bits of angle needed. The side view and half-plan is **fig. 69**.

The two cross beams on top of the tanks, with their short-leg 'T' section, are an easy start that used to be rather tricky to make a good job of. Laser cutting has transformed this. The parts are fairly obvious, being the two different legs for the 'Ts', with their taper ends and tabs, the two associated flanges with tab slots, and the shorter and wider common lower flanges. Clean-up, assemble and soft solder. Clean off excess solder and tap the 10BA threads in the lower flanges, Job done, **photo 150**.

The tank outer panels are the large rectangles of 1.2mm brass and are the correct length but the width is oversize to allow for tooling differences. The best way for us to form them at home is, again, to use a wooden block and bits of angle and bar. Make the block using the tank ends as templates, and ensure the faces are parallel and square and that the dimensions are as accurate as reasonably possible, **photo 151**, shows my block and the panel sheet. My finger is pointed at a location pin. Two of these should be used to set the bottom of the tank to

Photo 151: Block for forming outer panels.

Title	M.E. Laser Part No.	Material	No. Required	Notes
Tank Outer Sheet	34726	1.2mm Brass	2	11.437" x 5.25"
Tank Inner Sheet	34727	0.9mm Brass	2	11.342" x 2.75"
Tank Rear	34728	1.2mm Brass	2	
Tank Front	34729	1.2mm Brass	2	
Tank Front Trim	34730	0.5mm Brass	2	
Front Top Cover	34731	0.7mm Brass	2	
Mid Top Cover	34732	0.7mm Brass	2	
Rear (Firebox) Cover	34733	1.5mm Brass	1	
Front Beam Web	34734	1.2mm Brass	1	
Front Beam Flange	34735	1.2mm Brass	1	
Beams Lower Flange	34736	1.2mm Brass	2	
Rear Beam Web	34737	1.2mm Brass	1	
Rear Beam Flange	34738	1.2mm Brass	1	
Footsteps	34739	1.2mm Brass	2	

width. To ensure squareness they must be exactly the same distance from the block outer face. This is done by making a simple tool out of just any bit of metal plate with one straight edge, with a hole drilled at the correct height from this edge. Clamp this to the block whilst pushed down on a surface plate, take to the drill and drill the hole through. To allow for a teeny bit of cleaning up I recommend a hole centre position which is 1 9/32" plus pin radius up from the outer face.

I'll describe the forming sequence I used. In all cases the lower inner edge must be hard against the pins. Anneal the sheet, then clamp in the vice with the block and with long pieces of angle between the jaws and the work and push it round the lower corner radius using a bar, **photo 152**. Use a hide mallet on the bar, **photo 153**, to get it down as far as reasonable. Never hit the bare sheet as this will cause an unsightly dent. Re-anneal the corner then finish tapping it down. Now use clamps across between the bottom angle and the top of the block, release the vice and rotate the work upright and re-clamp using another angle, **photo 154**. Note my mismatched ad-hoc 'set' of clamps. Remove the clamps and push the top over in two stages as before, **photo 155**. To remove any spring back just bend it by hand over a round bar of, say, ½" or 5/8" diameter, **photo 156**. Check using a square and the laser cut tank ends. Ripples along the free edges can be pushed out using finger pressure. Clean off and square-up the ends. Although the panel length was correct, I found mine had grown a bit in places, a surprising result. Mark out and trim off any excess at the top and bottom inner edges and try out on the engine (if you haven't already!) Next put the filler and pump access holes in while access is easy. Could these have been laser cut? No; too close

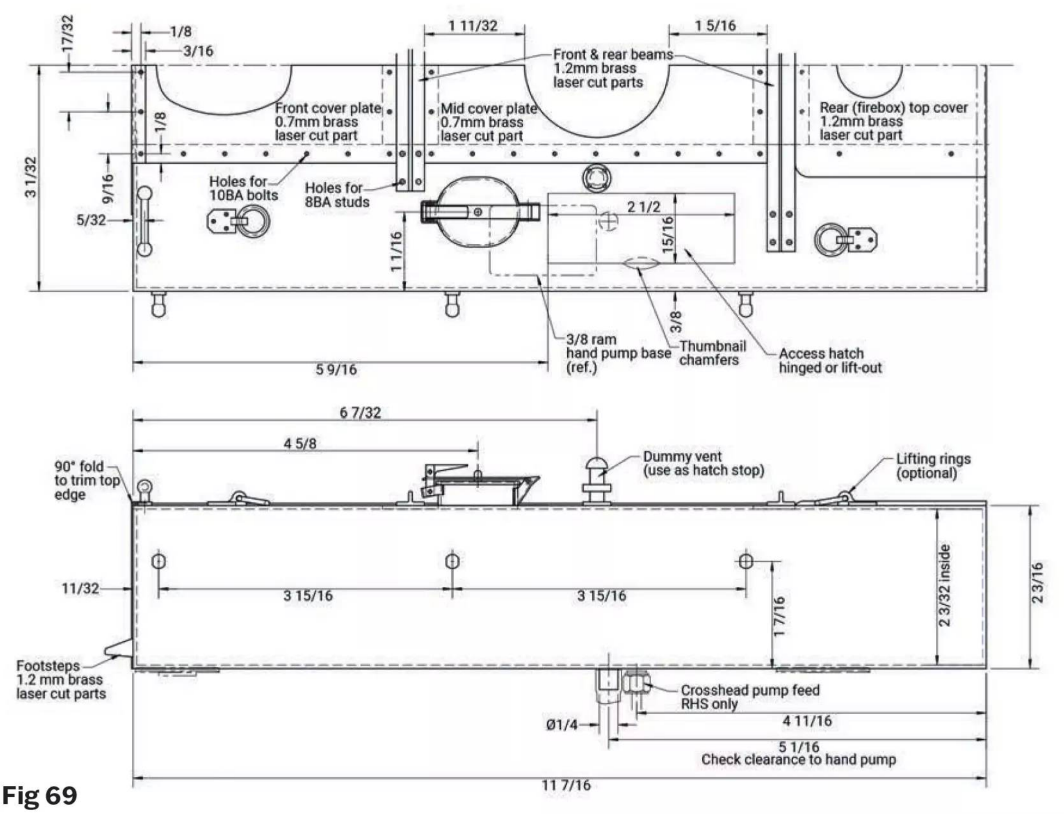
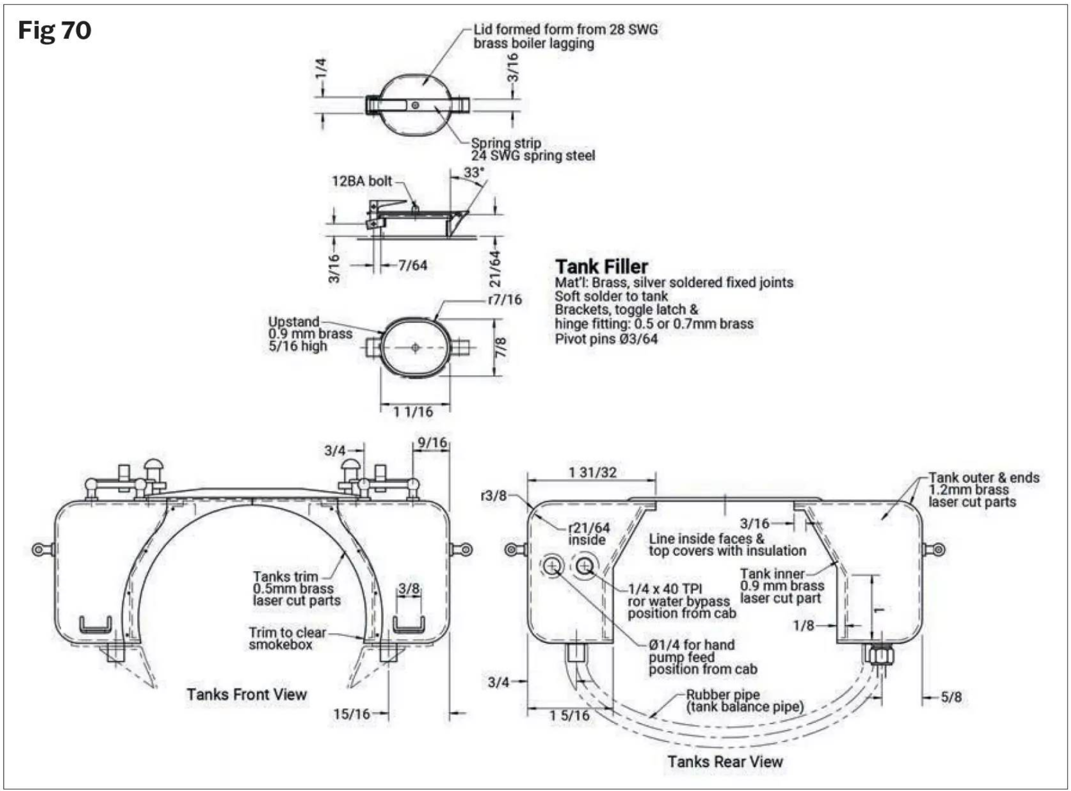


Fig 69

Fig 70



to the bends and would distort.

The tank front and rear views showing the end pieces and the front trim, together with the water filler assembly are shown at **fig. 70**. Having found that each end piece could be held in place with a toolmakers clamp or two between the inner edge and the outer wrapper I decided not to use any strengthening angles and that Cupsol solder was the stuff to use to be sure they didn't fall out when the back is put in. Using a small flame I just ran a bead of solder around the inside of the joint as far as the clamps allowed, removed the clamp and finish the rest. Cupsol was used for the footsteps, too. The back panels pushed the limits of my makeshift bending tools and direct hammering was needed to finish the job. No matter, the panels face the boiler so the dents are hidden. Those with an expensive folder may find the job easier. Start by bending the bottom flange. Then the middle bend, then the top flange. It may be found easier to cut the panel off at the top bend and use a separate 3/16" angle instead. Trim the panel to fit the outer, tack rivet in place and soft solder all round, **photo 157**. Clean-up, leak test and re-solder as necessary

Check and adjust the fit to the engine and note the need to remove metal from the lower edge to clear the smokebox. At the top the beams lower flange can be used to help set the spacing. Mark the lower fastener holes through from the supports, and drill and tap 8BA. I used studs and nuts here, though it's not prototypically correct. Studs can be sealed before fitting the tanks, and nuts onto studs are easier to fit in tight spaces than bolts into threaded holes. How? Put the nut on a bolt and transfer it to the stud by turning with a sharp point, **photo 158**. A disadvantage is that on the finished engine with the cab front trim angle fitted the tanks cannot be removed without taking the cab off first. For the top beams small head bolts are needed but these are only available in steel which would rust

Photo 152: Bending the panel.

Photo 153: A hide mallet helps avoid marking the work.

inside the tank. One size smaller steel nuts are becoming available so making hybrids with steel nuts Loctited onto brass threads will solve the corrosion problem. The threads needed are quite short and two can be made from a ½" brass screw.

The beams and covers are pre drilled tapping size for 10BA or 8BA as required. To fit the top beams then assemble them to the covers, check and adjust as necessary, **photo 159**, and use the assembly to position them on the tanks. Drill and tap the beams holes in the tanks and fix them down, then drill and tap all the holes for the covers. At the front trial fit the trim pieces and drill for 1/32" rivets. These rivets are for appearance only and cannot be closed but serve to locate the trims for soldering. Using a suitable steel rule, with a thickness a bit over 0.7mm (to allow for final painting) laid across the tanks behind the trims scribe the bend line onto them. Bend the trims to the line, drill the holes in the top to tapping size initially, then solder the trims in place. There's a fair bit of on-off-on in this job, as holes have to be opened out to clearance size in the beams and covers too. There are also lots of threads and I know I said that I'd avoid tapped holes if I could, but it's not possible here. The other thing is that I broke my rule about always buying long thread bolts for cutting to length. Here there are so many that I bought a batch of 3/16" long small head 10BAs.

Next, I bent the handrail, with the front stanchion on before bending the sharp corners at the sides, and put it into place for a picture, **photo 160**. The handrail is in one piece, and a metre of 3/32" rod is about right. The remaining work is on the bits and pieces like the tank fillers, cosmetic items like lifting rings, and the hand pump and water connections.

The pump hatch requires more hinge making but is otherwise straightforward. The tank fillers and lids are an interesting and rather fiddly job, and parts need to be made to fit each other so I've not given full dimensions. They are not really suitable for laser cutting, either, as the bending and forming would then need to be super accurate. Make the upstand from a cut strip first, and silver solder the joint. The hinge bracket and toggle latch stirrup were butt-welded onto the full-size ones, but I've shown some little flanges so that they can be tack-riveted and soldered which is a lot easier for us. They are sized to be bent over standard size bits of bar. The stirrup is easy to make. The hinge bracket is another example of bend first, mark and cut after.

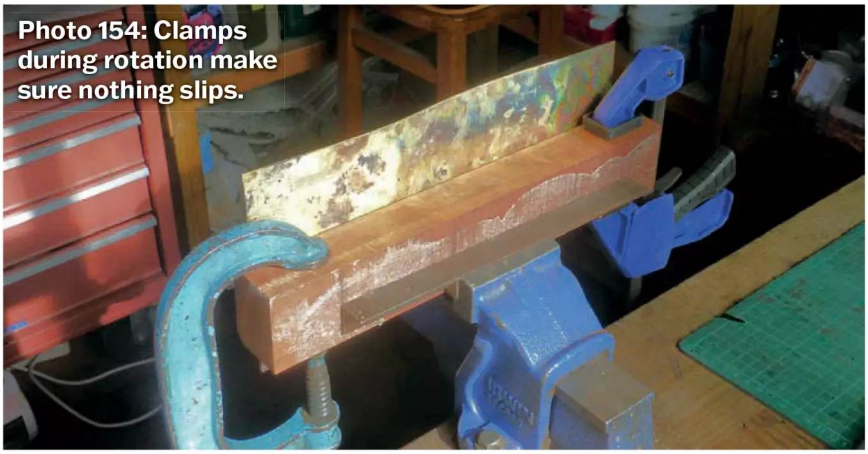


Photo 154: Clamps during rotation make sure nothing slips.


Photo 155: Making the second bend.

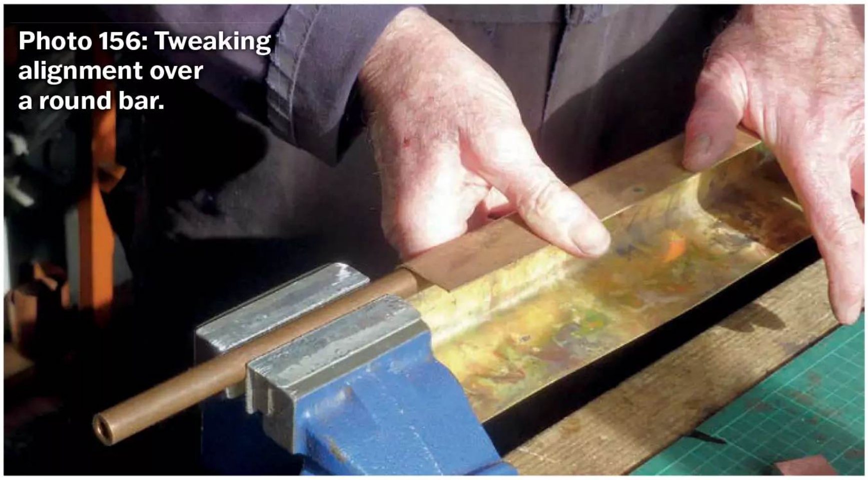


Photo 156: Tweaking alignment over a round bar.

So anneal and bend a small piece of sheet brass over a piece of 3/16" bar, then do a basic mark-out with just the channel depth and flange width (at the correct angle) and cut to the lines. The flanges can now be bent out, cut to length, and the part finished off. For drilling the rivet holes those artery forceps are useful as small part clamps, **photo 161**. I soldered these parts to the upstand using Cupsol; we have it and here is a suitable application. For soft soldering the assembly into the tank then the bottom of the hinge bracket should set the height at the rear end, and packers under the latch stirrup set the front to match. In a rush to get steaming I decided to leave the actual toggle latches and heat treating the spring bar until the painting rebuild so my 'finished' filler is as **photo 162**. Similarly, I deferred the cosmetic items

Photo 157: The basic tanks soldered shut.

Photo 158: How to coax small nuts into place with a scriber.

Photo 159: Fitting the beams.

Photo 160: The handrail fitted. It's starting to look like a real loco.

Photo 161: Take care when drilling the small holes.

Photo 162: Filler ready for a steam test.

such as the lifting rings until later, too.

Most of us, I guess, purchase a hand pump rather than make one. For this little engine one with a 5/16" ram fits nicely but its pumping capacity is a bit small. What is really needed is a 3/8" ram but it needs some modification in order to fit. I reduced the height as much as possible and trimmed the lever at an angle so that it fitted inside the tank when in its lowest position (angled forward). The bolt holes were plugged, and the base was narrowed, and the holes re-drilled and tapped 6BA to suit. When soft soldering the hole plugs the pump was upended in a tray of water to keep the body cool. The pump should be fitted with the outlet nipple under the tank filler hole. This gives enough room to fit some 1/8" pipe and just adequate access to make the connection. I note that nipples for 5/32" pipe were supplied with the pump but 1/8" pipe is perfectly adequate. No filter is required on the pump inlet. An extension arm for the pump lever may be made by tapping a drift made from a piece of pump lever size bar (3/8" x 1/8" in my case) into an annealed piece of left over 3/8" boiler pipe.

The water feed holes and pipe connections are simple stuff, and soft soldered into place, just don't forget to do them, or the two holes in the rear panel on the left tank. The tank balance pipe is simply a rubber tube which runs across under the boiler with its ends pushed onto the stub pipes. To drain the tanks just pull the rubber pipe off and store it in the bunker for next time. That completes the platework and the end is getting near, but don't permanently fix the tanks and cab just yet as being able to easily remove them makes access easier for the upcoming jobs. When finally fixing them remember to lag the inner faces of the tanks and under the top covers with as much insulation as possible. Finally, regarding the platework, I've used brass throughout. My prototype will be tested unpainted so steel would be inadvisable. I have experimented with forming the cab rear corners in a scrap of CR4 steel and it went fairly well, so could probably be used for everything apart from the tanks. If anyone would like to save money and give this a try, then no doubt Model Engineers Laser can supply the parts. Please let our editor know how you get on.

Now there are just the oil pump system, the water feed pipework and drain cocks to go. At time of writing and after becoming too focussed in the workshop I've overtaken the design task and these parts are yet to be drawn, so I must spend some time in the drawing office (spare bedroom) to complete them.

To be continued



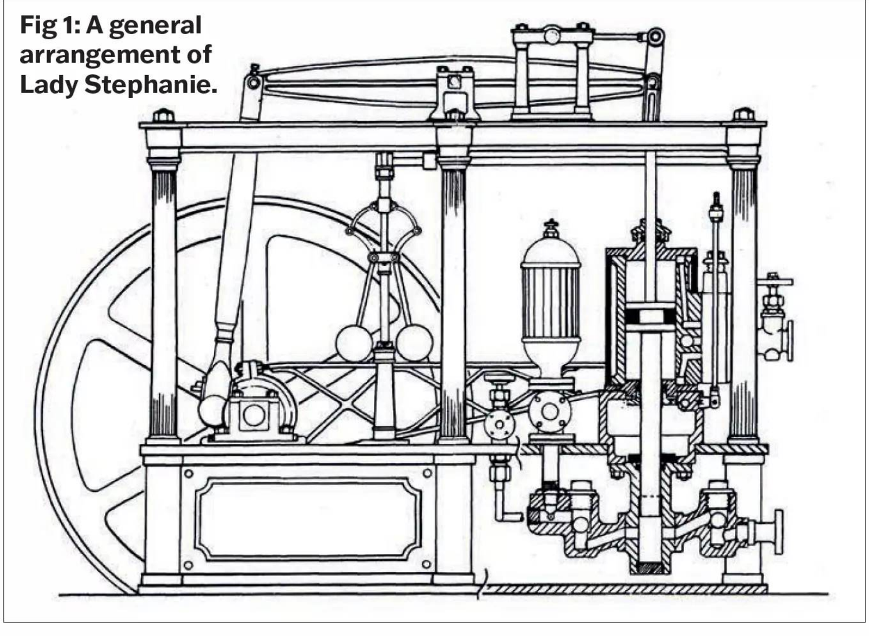
Photo 1: The setup for fluting a column.

A Workshop Challenge - Fluting Tapered Columns

Neil Wyatt recounts how he tackled a job that is a bit more complex than it appears at first sight.

An interesting question asked after Roger Foud's talk at the Midlands Model Engineering Exhibition, which involved a fair bit of CNC machining, was 'how would you go about fluting a tapered column without using CNC?' Roger gave a brief answer, but having tackled this myself in working on *Tubal Cain*'s design for the beam engine *Lady Stephanie*, I warned the questioner that there are a few unexpected things to tackle and promised to give a description of the process in *ME&W*. I freely admit that I was guided by Tubal Cain's (Tom Walshaw's) advice on the subject, **fig. 1**.

Fig 1: A general arrangement of Lady Stephanie.



The simple answer is to hold the column at an angle on the worktable of a milling machine, using a dividing head or similar, as in **fig. 2** and **photo 1**, and cut the flutes with a suitable round-nosed endmill. Incidentally this is my shop-made dividing head/rotary table, which is designed to be used, not to be pretty! This is done by using a very thin shim (I used a sheet of paper) to angle the dividing head slightly (shown in yellow in fig. 1) and a thicker shim under its headstock (shown in pale blue).

The subtleties arise from the need to get the angle right for a good appearance of the column. The first step is to prepare the column blanks, in this case six of them, and turning a suitable taper. This is best done by angling the topslide, although this limits the length that can be tapered. I worked to a slight shoulder so it was easy to stop in the right place and ensured the saddle and cross slide were not disturbed so each pillar would be identical. I made sure the holes in the top of the columns and the shoulders on top were identical (they would be threaded), as this makes getting them all in the same place relative to the dividing head's

Photo 2: A close up of the machining in progress.

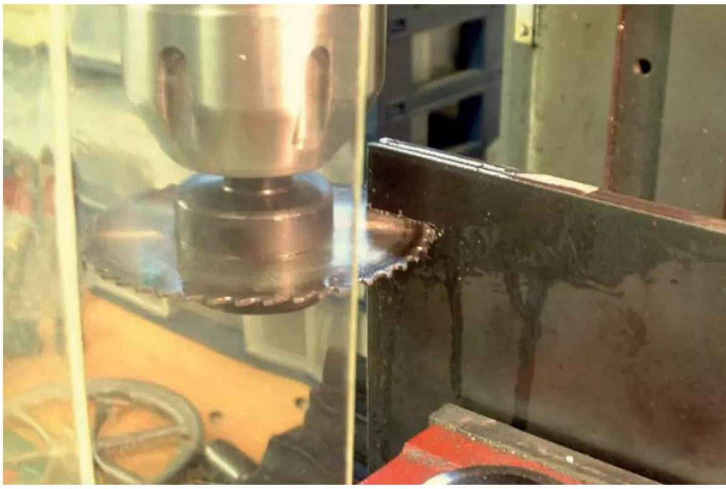


Photo 3: Using a slitting saw to cut the baseplates.

headstock easy. The angle of the column needs to be very small, around 0.5° or less, from memory, and the topslide needs to be angle by just half of this. It's worth turning a seventh 'spare' column for trial cuts.

You need to decide the number of flutes, I used twelve, which also made it very easy to divide them – five turns of the dividing head handle. Calculate their width and then choose a bull nose endmill that has a diameter slightly larger than this. This is because the flutes should not be fully semicircular, but a little shallower.

The next operation is setting up in the mill, the starting point is setting the top surface of the column horizontal. However this will mean that as the cutter moves from the base to the tip of the column the grooves will stay (roughly) the same width but as the diameter decreases, the lands between them will taper noticeably. The fluting will look much better if the narrow lands between the flutes are more or less parallel. The answer is to slightly reduce the elevation of the narrow end of the pillar so that the flutes become less shallow towards the top. There will be ways of calculating this, but trial and error worked for me, hence the suggestion of having a 'spare' column. The difference is very small, and I recall resorting to sanding down the edge of my aluminium shims to get the result I wanted. **Photograph 2** shows the cutting in progress.

You should avoid really sharp edges to the flutes as these will make painting difficult. Just run some emery paper over the columns to take off any burr and dull the corners a little. Incidentally, Tubal Cain mentioned that real pillars belly outwards slightly at the middle, he advised against trying to replicate this; I suppose anything is possible with CNC though?

Some other interesting operations in making the engine's entablature included cutting the top and bottom parts for 1/8" steel plate. I used a slitting saw to get the two pieces identical, **photo 3**, but found that this left a rather poor surface texture, **photo 4**. This was an opportunity to use 'draw filing' to tidy up the edges. Darw filling is a simple but very useful process that involved holding a file with a hand at each end and gently pulling it sideways towards you across the work. This gives a much finer, almost ground, appear-

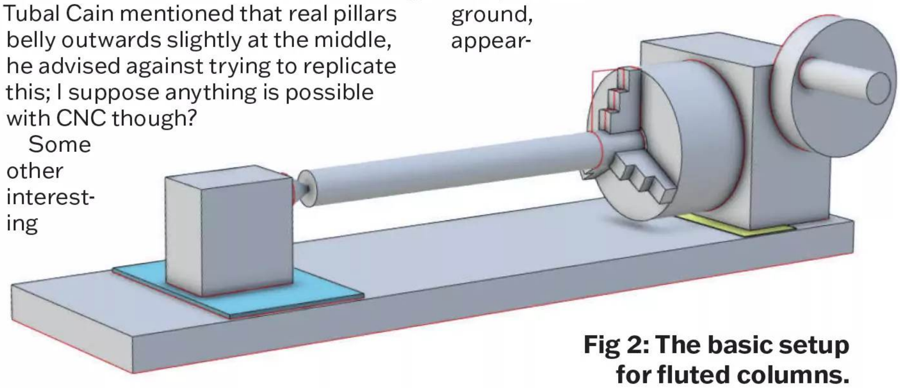


Fig 2: The basic setup for fluted columns.

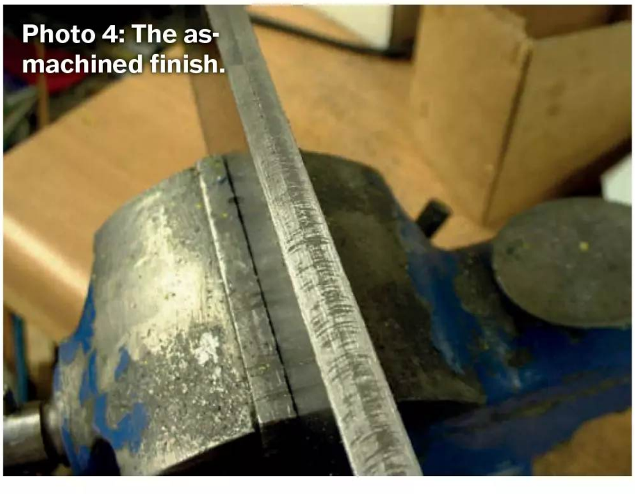


Photo 4: The as-machined finish.

Photo 5: After draw-filing.

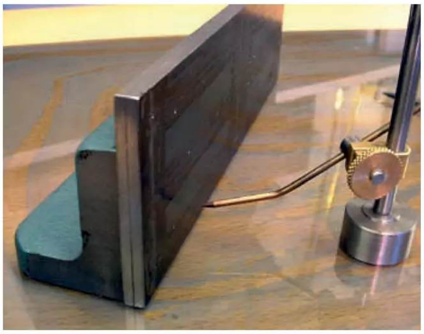


Photo 6: Marking out for the many holes.

Photo 7: Boring the cylinder aperture.

Photo 8: Milling out the 'crankshaft pit'.

ance to the finished surface, **photo 5**. I strongly recommend this approach for cleaning up cut edges, for a long edge it is much more controllable than using a linisher, as the high degree of control you have means material is removed evenly.

There are multiple holes in the upper baseplate, and this means careful marking out, **photo 6**, using layout blue and a height gauge. Back then I used a piece of float glass on a piece of chipboard worktop as a cheap surface plate, I now have a chunk of reconstituted granite worktop. I used my shop-made boring head to finish the hole for the cylinder as it was too big for my drills, **photo 7**. Rather than endless chain-drilling and filing, I milled out the 'crankshaft pit' **photo 8**.

The two baseplates are separated by six pillars, which I milled to length and rebated between the ends as a set to ensure consistency, **photo 9**. The whole entablature fo the engine is held together by rods screwed into the top and bottom of the columns, so the pillars needed an accurate centre hole, and a counterbore on top. As I didn't then have a self-centring four-jaw chuck this was a case of careful setting up with an independent four-jaw, then making sure I didn't disturb the same two jaws when placing each pillar in eth chuck in turn, **photo 10**. The pillars need brackets to support side plates, and I made these from cheap brass angle, soft-soldered in place, **photo 11**.

Unfortunately, although I have made many of the 200-odd machined parts it requires, my 'Lady Steph' has been in abeyance for nearly twenty years and has now become one of my many retirement projects. The current state of play is shown in **photo 12**, perhaps when I finish my house-built A-frame steam engine, I will move this rather fine beam engine up the priority list.

Photo 9: Machining the shorter pillars.

Photo 10: Counterboring to depth in the four-jaw.

Photo 11: Finished pillars.

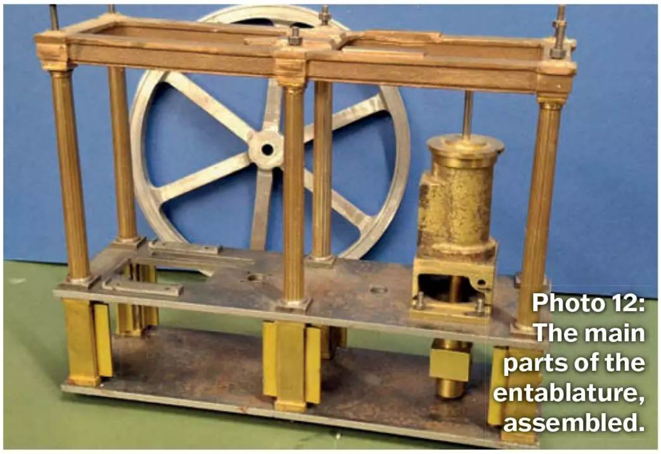
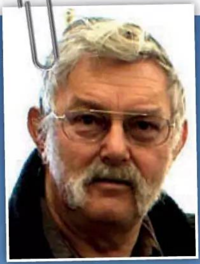


Photo 12: The main parts of the entablature, assembled.



A Coventry Die Head Sharpening Jig

Peter King gives further details for replicating a Coventry die head chaser sharpening jig

PART 2

First, a reminder the dimension tables for different sized jigs are downloadable from the *Model Engineer Forum* with the series in *Model Engineer* by David Earnshaw, which gives an excellent explanation of Coventry die heads at https://tinyurl.com/yryx6msh or use the QRcode).

The jigs, starting from the ¼" – 5/16" appear to be scaled up to the next size by very, very roughly 2:3 - maybe, this relates to accommodating the actual combined width of a stacked set of chasers along with their height that are to be sharpened in it. chasers vary in height inversely as to thread size - the smaller the thread cut the taller the chasers for that size of die-head. The ¼" chasers are not very thick and the 1" are about three times the thickness. The dimensions of the main angled slot with a small clearance to accommodate a set of chasers enables them to fit as a set into the main 'slot' and clamp in place, this sets the general size of each jig. The ¼" – 5/16" jig slot is 21/32" wide and the altered 1" jig slot is 2 3/32" (maybe it was originally circa 1 5/16" or 1 5/8"?) but the small jig is about 2/3rds the length of the 1" jig and the unit is about 2" high, against about 3" high for the 1".

For larger sizes, I guess that merely scaling up to present any larger chasers at the same angular positioning in a fabricated jig will suffice for these. However, I figure that few model engineers will be producing lots of threads larger than 1" (builders of 4" to 8" to a foot scale 'thingy's' may be so desirous). The biggest die head that was made will cut about 5 ½" dia. threads and requires a crane to move it! I wonder what size the sharpening jig was – the chasers appear to be over 1" thick in an illustration of a die-head for about 3" diameter.

I have measured everything that 'stood still long enough' in order to give the user all actual dimensions – there are an awful lot! As I got into preparing drawings from the first jig to hand – the 3/8" and ½" one, I quickly realised and noted that I had 'stepped back' in time about 114 years. The dimensions are in multiples of 1/16" and 1/32" with quite a lot in 1/64" multiples (within .001" - .003" or so). To keep one on one's toes – there are also some parts that as machined, measure in some places as millimetres (i.e. being very near a multiple 1/128") – as these appear to be the result of machining tolerances, I have tried to render these few in 1/64" multiples, where it does not cause problems – one or two were in an exact metric size for no apparent reason. The figures on the charts are therefore mostly 'as found' and clearly show machining tolerances plus or minus from exact dimensions. So if you achieve a dimension close to those on the chart you are doing well.

Angles are mostly in 'round' numbers (90°, 77°, 70°, 5° etc.) – the only half degree angles are for the part on the jig where the top face of an individual chaser is ground back. This being to restore a 'cut' after the 'throat' on re-grinding has advanced and the cutting edge is above the 'centre height'. *These are the only dimensions that are critically important.*

The above information does not mean that it was an easy job preparing the drawings, a fair proportion of my 'marking out' tools were used to ascertain angles and dimensions. If I amended a drawing but once I was lucky, I must have altered some of them ten to twenty times at least. Partly this was because I was dimensioning off machined surfaces to un-machined, variably radiused raw casting edges and sometimes onto 'as cast' faces with casting draft. I do not know what the original 'datum' was but I found that using the base plane and extrapolating angles and dimensions from there in a CAD drawing generally allowed of a steady improvement in parts correlating with each other.

From the excellence of the original design concept, a few 'thou' gained or lost in the above process will not affect the utility of the jigs – this is evidenced by the machining tolerances detected in measuring the jigs (which are

Photo 5: Close up of the clamp recess, note the rollers.

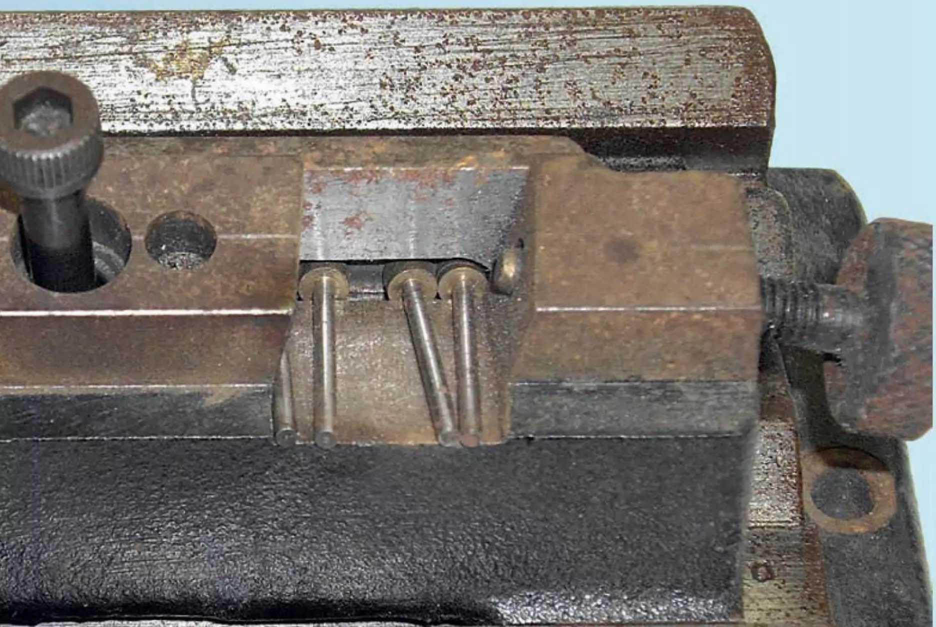
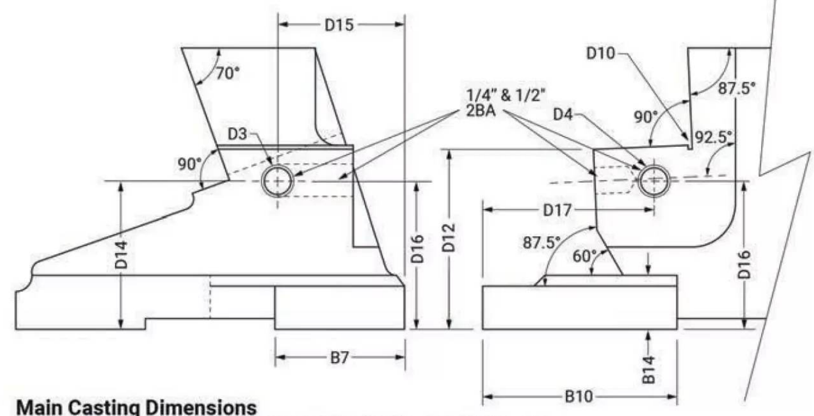


Fig 4



Main Casting Dimensions
Enlarged View Of Mounting Position For Re-grinding 2.5 Face On Chasers

somewhat variable!). The essentials *are* the sundry angles to locate the chasers – the clearance for clamping a set of chasers could easily be reduced by 1/32" for the ¼" unit and pro-rata to the about 1/8" for the 1" unit and the exact size and thread of clamp and securing screws is also unimportant providing they provide security. Any experienced Model Engineer can easily figure out what is important and what not! If anyone is really determined, all the dimensions apart from the angles could be converted to close metric ones.

The threads on the ½" jig were a puzzle. The ¼" unit has basically the same size clamping knurled nut and stud along on the left end, with the roller plate screws as the ½" unit. I have wondered whether many small components were 'bought in' from local suppliers or were suitable components already made for other machinery in the 'Herbert' factory.

Some areas, such as that for re-sharpening the 2.5° angle on individual chasers, are a mass of dimensions in a small area, so there is a 1:2 scaled up duplicate of that part drawn with dimensions irrelevant to that process removed. The 'as cast' radii on the edges of the castings are 'guestimates' – I show them variously from 1/32" to 1/8" as they are a bit variable even over an inch of a feature. Where there are apparently two different dimensions for the same feature, the difference is the amount of moulding 'draft' on the casting combined with the radii on edges – C1 and C3 are an example. The larger dimension is to a vertical from the base and the smaller from the top – or wherever. The moulding draft as can be seen from the photos is variable – minimum is about 3° to 5°.

Throughout this article 'front' means the view where all the chasers are to the right of the jig in the place for sharpening the 'throat' (all the 'a' jig photos). This is the compound angle which (on a RH jig) places the chasers leaning to the right at their tops at 77° and also down to the rear by 20° and just to make things difficult, offset by 5° horizontally to the right at the rear – all to provide the 'cutting angle' at the 'throat. Keep this in mind as whilst it will matter little if you are a few minutes of arc out, a degree or so may make a small difference to the quality of thread cut.

Despite appearances there are a number of differences between the four jigs, these are listed where small or drawn and separately dimensioned if substantial. To avoid confusion all such deviations are shown in separate drawings. The dimensions for these parts are listed separately from the similar parts of the other jigs. A 'hatched out' section of the dimensions indicates there is a separate drawing and dimensions *or* the feature does not exist on that size of jig. Where a dimension is from a machined face to an as cast face with

Photo 6: Base of the 3/8" - ½" jig with marked flats for angling the upper part of the jig.

or without draft and where a stud is immoveable, there is: - '±' to indicate best guess.

Dimensions of parts subsequently made in in my workshop to replace 'non-factory' bodges are indicated by * * against the dimensions. Any guesses as to what a dimension on a jig was before later alteration, is indicated by *** against the dimension. On the 1" jig I had to examine the angled chaser slot very carefully to detect where the original RH face was before the slot was widened – the dimension is as close as I can guess to the original – there is a very faint trace delimiting the later machining. If making a 1" jig, I suggest measuring a stack of 4 x 1.00" chasers and make the slot around 0.1875" wider.

The ¼" – 5/16" jig has at some time in its career been re-machined along its top face for some reason and will be dimensioned as I received it – but without a machined ledge along the front that does not appear to serve any purpose. The complicated clamp plate used to secure a single chaser for re-grinding the top face is on close examination a later replacement scaled or copied from another jig. It did not fit and has had the step (see dimensions H5 and H7) at the base of the angled top clamp, ground (or filed) off. The locating plate for securing the rollers is somewhat different from that of the plates on the 3/8" – ½" jig and the others. The rollers on the ¼" – 5/16" jig are also different from those of the other jigs.

The rollers on the 3/8" – ½" jig are similar to the other larger jigs except for size, but the roller locating plate is different from the larger units as it has to accommodate the spacer plate. The plates on the ¾" and 1" jigs are similar to each other but different from the smaller two jigs in both the mounting screw position and the notches for locating the rollers.

The ¾" jig has had the thumb screw for clamping a set of chasers replaced with an Allen cap screw – the dimensions in the chart are for a more likely replacement (made in my workshop).

The 1" jig has had the angled slot for the chasers widened by an unknown amount, probably for sharpening a larger set of chasers. The 1" jig has – I think – had the set-clamping thumb screw threads re-cut and a new screw made from an Allen cap screw. The roller locating plate has also been modified – as a result of the jig slot being widened to accommodate larger chasers. One of the tapped holes for mounting the plate having been eliminated, this has resulted in four threads into the jig body and five screw holes in the plate – I have detailed the likely originals. However considering that the jigs may well be 100 years old, they are in surprisingly good order.

To remind yourself about how chasers must be kept in sets and how they are positioned in the jig, see the first part of this article in *ME&W* 4770.

The aperture where the set of chasers are mounted, **photo 5**, is at compound angles: the bottom slopes down to the rear by 20° from horizontal, the sides are angled at 77° to the right at the top and 5° to the right at the back. The rear face of the aperture is formed by the plate that secures the rollers – this is at 90° to the bottom of the aperture. A 'nice' angular conundrum for the machinist – a lot of thought will be required when setting up for machining in a compound machining vice. These compound angles are to produce the correct 'throat' on a set of chasers for optimum threading on a workpiece. If when machined, the aperture is slightly too deep or wide, or a shade smaller, it does not matter! There is a generous clearance on the right taken up by the clamp screw when setting up a set of chasers.

After the chasers have been sharpened, the chasers are placed one by one into the gauge (see the articles in previous issues) and checked to see if they need the top face ground. Both the chasers and the gauge have that 2.5° angled feature. The gauge has a numbered scale and the set of chasers each have a number engraved on them that in conjunction with the gauge shows what the corrective grind is, or if it is not required on the set of chasers. At the left-hand end of the sharpening jig is a seat on which individual 'right-hand' chasers are clamped for this grinding operation. It is necessary to ascertain the 'maximum' regrind required of all or any chaser in a set of chasers and then grind *all* one by one at the same setting. Note, the chaser being one division on the gauge above its 'number' = 0.003" above optimum cutting position and 0.003" to be ground off the top rake of the 'teeth'.

The 'core' angles, around which the jigs are designed are firstly the angled face visible at the top face of the threaded end of every chaser – which is 2.5° to the horizontal rising to the left – the 'threaded' part below this is the part of a chaser that acts as a 'nut' in conjunction with the other three and follows the newly cut thread. The second angle is that of the cutting edge of the 'throat' or actively cutting section at the outer end of each chaser when mounted in a die head – this is variable depending on intended use. Mk 1 jigs catered for a single basic throat angle of about 20° without a base plate and with the two earlier angled base plates - 15° or 33°. Later jigs had means to vary that angle more widely for different metals by means of a later single base plate (see drawings) which is installed on whatever machine is being used to grind the chasers on. This base has several angled 'flats' marked with the angle in degrees that will be achieved by their use, see **photo 6** of the ½" jig. The bases are different sizes to match the particular jig used. These re-position the jig from a level plane to alter

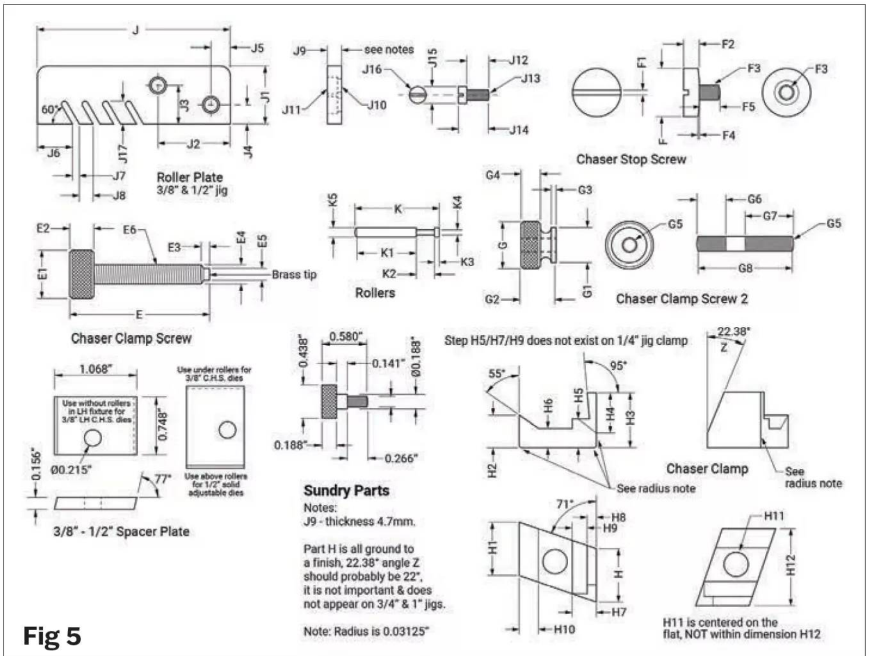
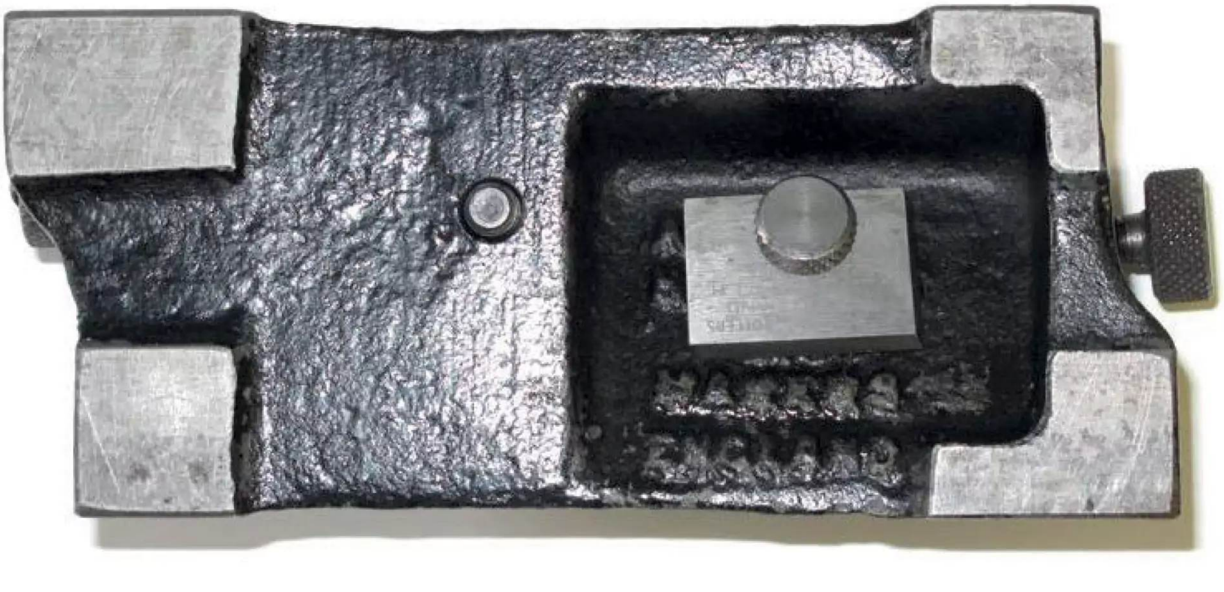


Fig 5

Photo 7: Spacer stored under the base of the 3/8" - ½" jig.



the 'basic throat angle' of the jig from 20° to 15°, 33° or 45°. The later base also allows for grinding the top rake angle from 1° negative to 7°, 12° or 25° positive for various types of die head chasers (S; AS; 4AS - 25°: M; AM - 12°: M5°; AM5° - 17°: B - 1° neg.). The later Mk 3 units are rather different and are not considered here. The jig should be bolted down to the base plate with the 'through bolt' before grinding proceeds – see further below.

Just as a matter of interest, the underside of all the original jigs has a fairly substantial recess - or two under the base plates, probably to reduce casting defects from shrinkage creating voids. This recess in the underside is used on 3/8" – ½" jigs to store a spacer to go underneath smaller and other types of chaser when sharpening them, **photo 7**.

The spacer is acid etched on one side with: "USE UNDER ROLLERS FOR 3/8" C.H.S DIES. ABOVE ROLLERS FOR ½" SOLID ADJ. DIES". On the other it is engraved: "USE WITHOUT ROLLERS IN LEFT HAND FIXT. FOR 3/8" L. H. C.H.S DIES".

None of these apply to my 'CH' die-head, but I will include the dimensions of the spacer in the drawings. It is about 1/16" shorter than the chaser aperture base, so fits easily into place, either under or over the rollers.

A left-hand fixture appears to be a mirror image in the area where the throat is sharpened, i.e. it leans to the left. I have only ever seen the illustration in the handbook! Anyone who wants one should reverse the jig stations – and I think the top face sharpening facilities are also reversed, i.e. are on the right and 2.5° *rise* to the right – which would require a 'left hand gauge' as well. This would be the inverse of that in the previous article, i.e. sloping up from the right hand. The angled baseplate is the same as that for 'right hand' chasers, as cast in to the underside for the ¼" jig: "RH and LH ¼ and 5/16 DIEHEADS", and for the ½": " 3/8 and ½ DIEHEADS RH and LH". A similar note is cast into the underside of the ¾" and 1" Baseplates.

The instructions on the use of these jigs are to be found in the very old "Coventry" handbooks and it is made clear that a 'thou' or two either way is not relevant. *This is made quite clear in the handbook text when checking a chaser in the gauge*. These jigs were designed circa 1900 - 04 for machine shop use by reasonably skilled fitters and turners, with adjustments literally done 'by eye' – particularly when using the 'gauge'. Therefore this job is not a 'very high precision job' and is well within the capabilities of the average workshop – provided due care is applied. However, I doubt that it is a job to be undertaken by a 'new-chum' - unless under supervision by a grizzled and cunning experienced model engineer.

By the end of this exercise I had a considerable admiration for Alfred Herbert and the whole concept for rapid threading with the die-heads and the clever and simple means of sharpening the chasers in the jigs. The whole concept of the die heads and sharpening jigs makes allowance for minor inaccuracies while still producing an acceptable quality end product better than that of a normal 'split die'.

The jig is mounted on the base for any other angle than a 20° throat. and mine have been modified to be bolted down at the appropriate angle. All mine have Allen cap-screws of medium antiquity. It is apparent from illustrations that there were no bolts originally used. The base plate was clamped down (three of mine have later bolt holes) and the jigs were slid along the appropriate angles under the grinding wheel. I presume that the later bolts were to avoid finger and grinding wheel interaction in use on either a surface grinder or a typical tool and cutter grinder. I have been told that this is common and may have been specified in a users' guide from the factory.

I will be using a surface grinder for the actual sharpening – others could use any of the larger tool and cutter grinders – a 'Stead' is large enough to accommodate the ¼" - 5/16" jig and would just do for the 3/8" - ½" jig, though it is a little tight and care would be required in clamping to the table, I have checked on mine. Anything bigger (3/4" or 1") will require either a surface grinder or a commercial tool and cutter grinder. The stone specified in handbook '25' is a 'Norton' 38A60-K8VG, 6" diameter x ½" x 1.25" bore, I have yet to enquire of the local agent if such an antique is still available – the 1979 Mk 3 card specifies 38A60-K5VBE 6" x ½" 1.25" bore.

The first decision that a maker will have to make is whether to make a pattern for an iron casting or to machine from a cast iron slab. The originals are all a high grade cast iron. My pick would be to make a

Photo 8: Chaser clamp plate.

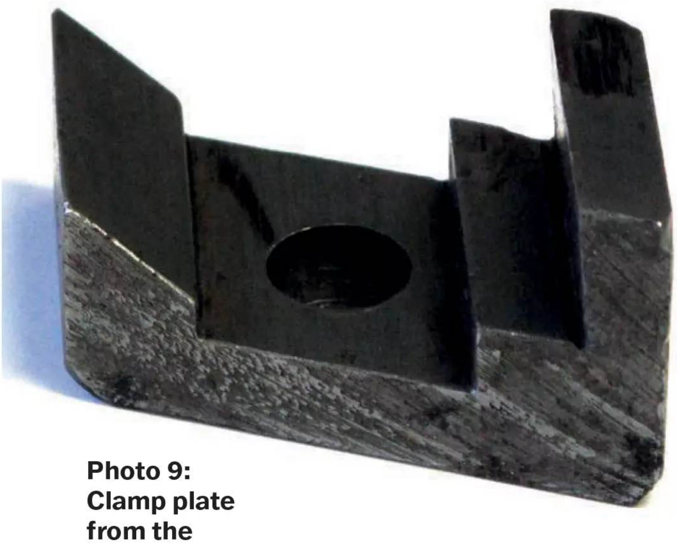


Photo 9: Clamp plate from the other side.

suitable pattern for an iron casting with reasonable 'draft' that does not include any of the apertures of the finished article apart from the base recess, a sketch of a suitable design for a pattern is in the drawings. Then give the resultant casting an accelerated ageing. The best way is to be very nice to 'The Management' and leave it in the oven for a fortnight or so of heating and cooling – with occasional 'holidays' in the freezer. This works surprisingly well at removing the stresses from an iron casting and is much, much quicker than leaving it out in the yard for a year and then trying to find it again. Any reader who has doubts about this, is advised to read a little on the subject – cast iron progressively gets stronger with a finer and finer grain and warps less and less as casting stresses work out at normal ambient (room) temperatures for a long time! Rapid cyclic heating and cooling as above accelerates the process, but it will continue, according to many authorities, for years. Do note that the 'authorities', up in ivory towers, disagree among themselves on virtually everything to do with this feature. Old machinists, however, have for a couple of centuries noted often the very coarse grain and brittleness of new cast iron and the very fine grain and toughness of old cast iron and the lack of distortion when machining old cast iron. In days past some automotive engine manufacturers put fresh iron castings out in an open yard for up to a year, however, back in the 60s others machined castings that were far too hot from the foundry to touch (I have seen the machining and the end result). The sins of automated rapid manufacture on assembly lines.

I presume that major parts for these jigs were themselves machined in jigs for ease of manufacture, maybe on dedicated machinery.

The first operation is to machine the underside of the jig to produce a flat datum from which to work. This due to the shape of the upper part of the unit will require careful setting up. The baseplate with its sundry angled faces on the top will likewise need ageing and should first have the underside machined flat.

An angled worktable will be needed for machining the sundry steps on the base plate. As it will make no real difference if the angles are out by a small part of a degree, there is no need for expensive sine tables. The upper part of the jig requires the machining of compound angles in the slot, so a compound machining vice will be required – or hours of assembling packings, cursing, checking and doing it all again. A combination of a rotary table and an angle worktable may, with careful work, suffice. A side and face angle milling cutter of suitable size will probably have to be re-sharpened so as to accommodate the 77° angle in the slot. Drilling the clearance bolt hole in the upper part for mounting on the base is easy, however drilling the matching holes for later threading in the base is less so. I figured that the only way in the home workshop to avoid a tricky drilling jig, is that after drilling the upper part, to then fit a drill guide sleeve into the hole. This should be for the tapping size of the bolt and long enough to get out afterwards. Clamp jig to base in each position and when each of the drillings is done (perhaps with an electric pistol drill?) remove the guide. Examination of **photo 6** will show the tapped holes. It is probably wise to also make a 'tap guide' and slide the tap down the larger hole to tap the base. The threads should be slightly 'large' to allow a little tolerance so that the jig will seat cleanly. Do remember that these holes in the base are all at an angle and are not easily tapped except by the above method.

The clamp screws to secure the chasers need to have a substantial knurled top and at the business ends are fitted with a rounded brass boss. The rollers (see the drawings) should be a reasonably hard steel (such as silver steel) and the plate they are located in (on the original jigs) appears to be gauge plate but not particularly hardened. The material of the clamp plate for securing a single chaser when adjusting to a gauge number by grinding appears to be hardened as all of mine are fairly hard and have clearly been ground to finished proportions on all the jigs. This clamp plate, **photos 8** and **9** is a nice conundrum to machine with all its angles.

If any Model Engineer has a query, pass the problem via the Editor and I will be happy to give an answer - if I can.

Club Diary

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

2025 DECEMBER

EVERY SUNDAY

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

Wakefield SMEE
Public running day. Contact Denis Halstead 01924 457690

NOVEMBER

9 Stafford & District MES
Steam up, County Showground, Stafford, 10:00 am. See www.sdmes.co.uk or Facebook.

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

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

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

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

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

7 Stafford & District MES
Steam up, County Showground, Stafford, 10:00 am. See www.sdmes.co.uk or Facebook.

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

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

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

29 Stafford & District MES
Steam up, County Showground, Stafford, 10:00 am. See www.sdmes.co.uk or Facebook.

2026 MARCH

EVERY SUNDAY

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

Wakefield SMEE.
Public running day. Contact Denis Halstead 01924 457690

JANUARY

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

18 Stafford & District MES
Steam up, County Showground, Stafford, 10:00 am. See www.sdmes.co.uk or Facebook.

FEBRUARY

15 Stafford & District MES
Steam up, County Showground, Stafford, 10:00 am. See www.sdmes.co.uk or Facebook.

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

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

22 Stafford & District MES
Steam up, County Showground, Stafford, 10:00 am. See www.sdmes.co.uk or Facebook.

APRIL

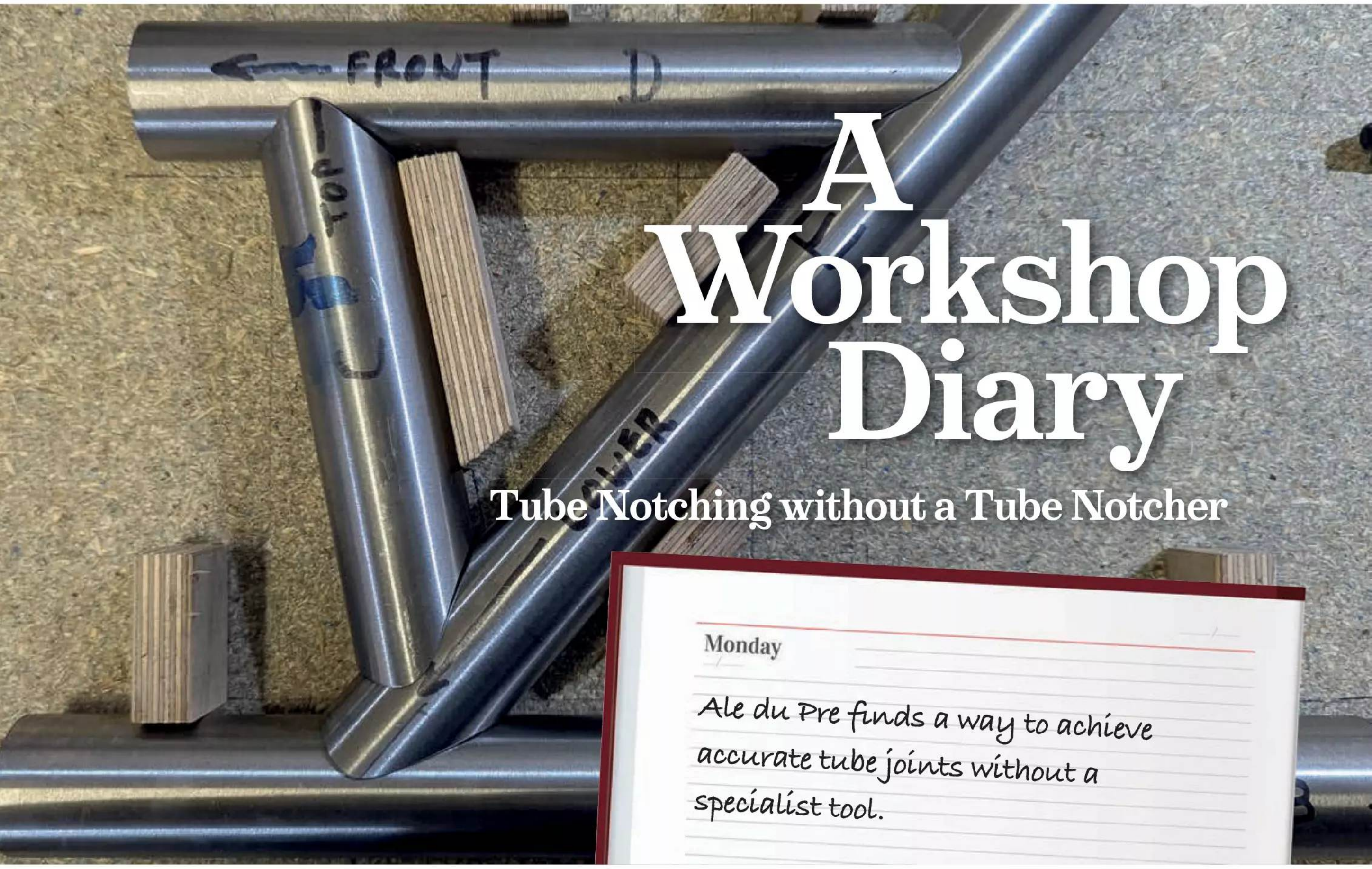
19 Stafford & District MES
Steam up, County Showground, Stafford, 10:00 am. See www.sdmes.co.uk or Facebook.

JUNE

15-14 2026 Rugby Model Engineering Society. Sweet Pea Rally To be held at Rainsbrook Valley Railway.

JULY

19 Gauge 1 North
Live steam on the Ridings track, traders and society stands North, Agriculture and Business ntre, Bakewell. Contact: secretary@gauge1north.org.uk



A Workshop Diary

Tube Notching without a Tube Notcher

Monday

Ale du Pre finds a way to achieve accurate tube joints without a specialist tool.

Use the right tool for the job is probably the best advice for anyone making things in the workshop, but I am sure I am not alone in finding that I often don't have the right tool. Buying or making a tool for a one-off job can be unattractive, so looking for a workaround is often the alternative, especially when a well-equipped workshop is available.

I had a case in point recently when I needed to notch some tubes for a project (the project being an experimental tilting trike, but that's another story).

Tube notching is the operation of shaping the end of a tube so that it sits snugly on another tube reading for joining by welding or brazing. The notch must be formed to the correct radius, is normally centred on the tube, and is cut so that the two tubes will meet at the correct angle. This can be done with hand tools but is quite laborious. The correct tool is a tube notcher, which holds the tube in the right position and uses a suitably sized hole saw to cut the notch in seconds. In my workshop activities a tube notcher would be used rarely and not justify the cost or time in making or buying one, or the precious space needed for its storage. Surely, my machine tools could be pressed into action to get the job done.

Photo 1: Thin-walled steel bike frame tubing fresh from the supplier.

USING THE MILLING MACHINE

I was using thin-walled mild steel tubing of various diameters from 16 to 35mm. With the tubing duly ordered from a bike frame supplier, **photo 1**, and a new set of hole saws waiting for action, **photo 2**, I set about notching the smaller pieces using the mill. The easiest way to do this would be to hold the tube in the vice, centre the spindle over the tube and go for it. However, things are rarely that straightforward. My vice does not open wide enough to accommodate the larger tubes and a v-block to grip them. Setting the tube to the right angle is also slightly tricky with this approach (if it's a 90° cut you are laughing, of course).

I went for the set up shown in **photo 3**. The tube was clamped to an angle plate, which was bolted square to the mill table, checking with an engineer's square against the edge of the table. Two engineer's clamps were used to securely hold the tube. The tube rests on a drilled parallel (whose parallelism is immaterial in this case) that has been bolted to the face of the angle plate at the correct angle.

A hole saw of the required

Photo 2: A set of hole saws with their arbours.

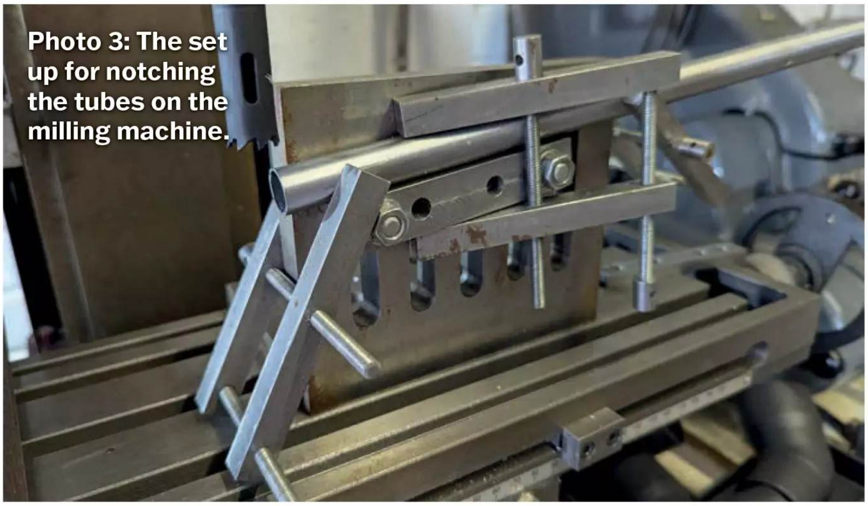


Photo 3: The set up for notching the tubes on the milling machine.

Photo 4: A 16mm hole saw being centred over a tube of the same diameter.

diameter was mounted in the mill spindle chuck and centred over the tube **photo 4**. Cutting could then proceed, at which point a further dilemma was encountered; as the tube wall thickness is only 1mm, the clamps easily distort it so they cannot be excessively tightened. On the other hand, the hole saw can easily snatch if it is feed too quickly, causing the tube to slip and rotate. I had this problem repeatedly and the only real answer was to take things slowly.

Success prevailed, with some of the initial results shown in **photo 5**. The notches were finished by hand filing to de-burr and chamfer the edges to form a v-shape at the joining surfaces ready for welding. For one tube I fine-tuned the radius of the notch with a boring head when I didn't have the right size hole saw.

USING THE LATHE

I found the mill was fine for short tubes with near 90° notches but for longer tubes with steeper notches I ran out of clearance on the mill, so I turned to the lathe in its capacity as a stand-in horizontal milling machine.

The ends of the tubes were cut at approximately the right angle using my trusty bandsaw, **photo 6**. The set up was much the same as before, this time with the angle plate bolted to the lathe cross slide. The angle was set using a protractor against the edges of the angle plate and the cross slide. The tube must be set parallel to the lathe's bed and at the lathe's centre height using shims and jacks, a frankly tricky and tedious operation, albeit essential. On the mill this is much easier as the table handwheels can be used instead. The hole saw was mounted

Photo 5: The notched tubes held on an assembly jig ready for tack welding.

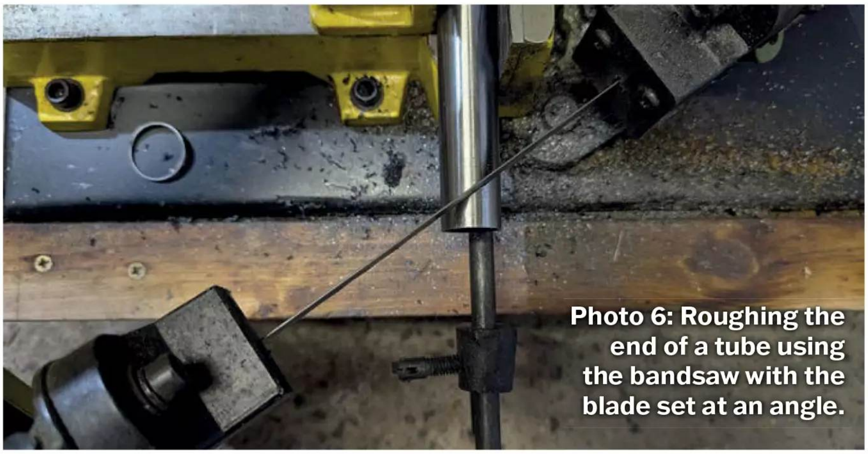


Photo 6: Roughing the end of a tube using the bandsaw with the blade set at an angle.


Photo 7: The set up for notching the tubes on the lathe.

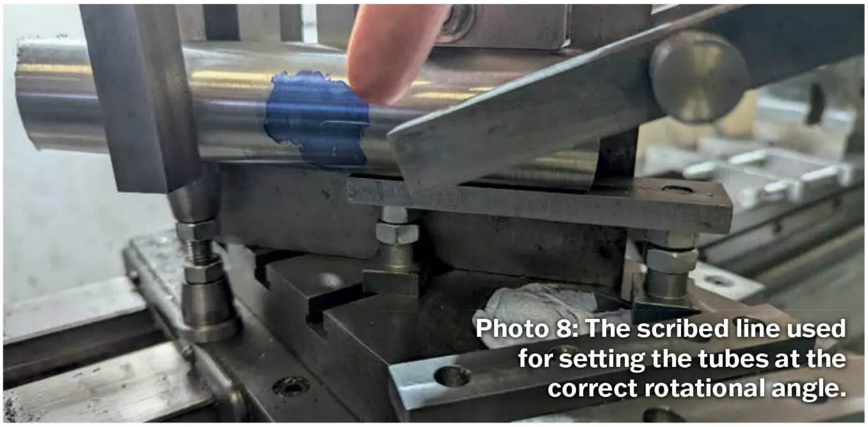


Photo 8: The scribed line used for setting the tubes at the correct rotational angle.


Photo 9: Another variant of the lathe setup.

in the three-jaw chuck. **Photograph 7** shows the idea.

A further complication arose for the tubes that needed to be notched on both ends as the notches needed to be cut in the same plane. The address this, a line was scribed on the side of the tube and the tube rotated to bring this line to the lathe's centre height using a height gauge. When the tube was flipped over for cutting the second notch, this scribed line was again set at centre height, thus ensuring the notches were aligned, **photo 8**. The notches at each end of the tube also needed to be the right distance apart so some careful marking out and measurement was needed.

Photograph 9 shows another, similar set up. Depending on the angle of the notch, the tube was set up either on the inside or outside face of the angle plate to give the necessary clearances. A bit of trial and error was needed. **Photograph 10** shows one of the finished notches after being dressed with a file.

CONCLUSION

I had a good many notches to cut for this project and eventually got the job done successfully, showing that with time and perseverance, the lathe's versatility can be exploited. By the end I was really wishing for the right tool. A tube notcher is a realistic home-build project and certainly one for the future. Next time, I will look at my welding adventures.


Photo 10: A finished notch.

LittleLEC 2025

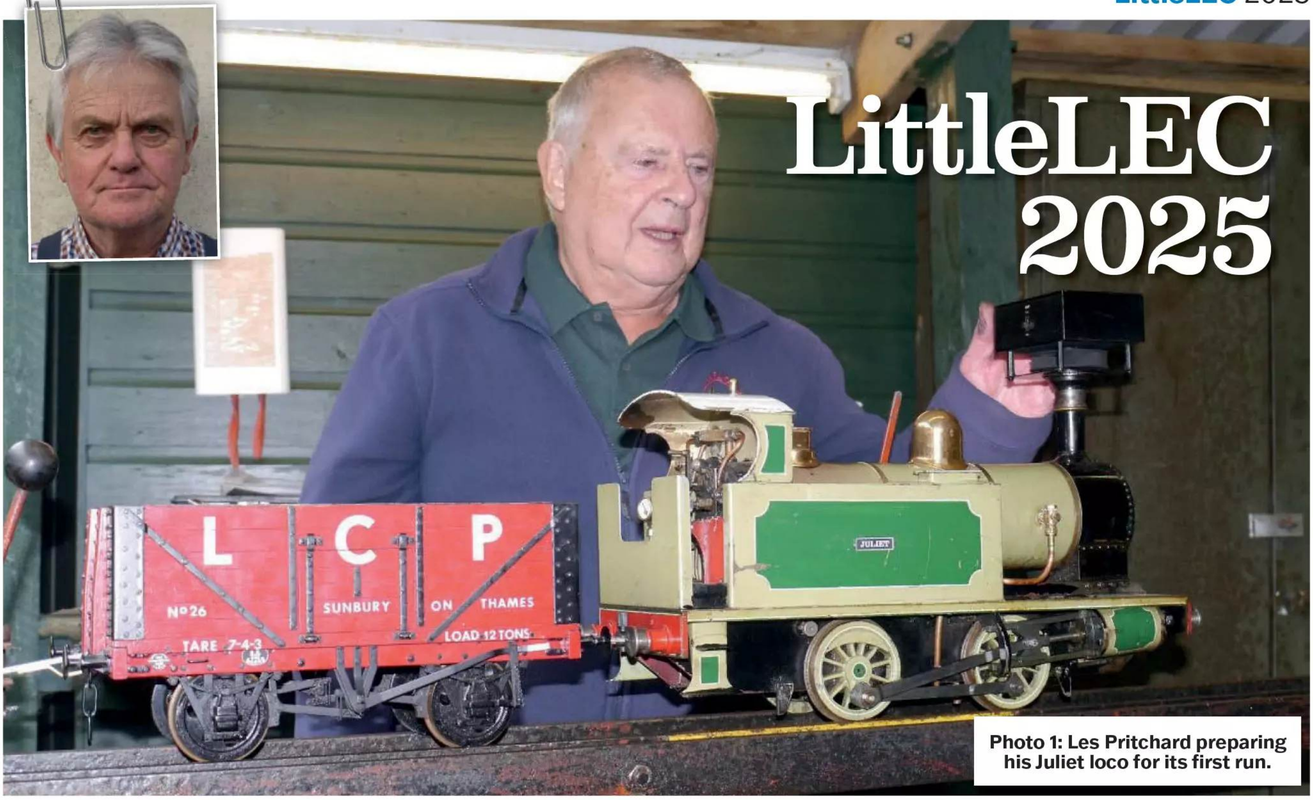


Photo 1: Les Pritchard preparing his Juliet loco for its first run.

Bill Edmondson, Tiverton & District Model Engineering Society, reports from the annual competition for smaller locomotives.

LittleLEC is the locomotive efficiency driving competition for small locomotives weighing 50lbs or under, devised by the late Peter Langridge who was a member of the Guildford Model Engineering Society as a companion to the larger IMLEC competitions. LittleLEC spotlights those small designs that were once the introduction to the hobby for many but now eclipsed by larger models capable of greater distances and speed. Locomotives are run around a track completing as many laps as possible within 20 minutes, the amount of coal used is recorded and efficiency calculated from this coupled with the weight of the engine, trailing load, track gradients and distance. The locomotive driven the most efficiently being the winner.

A new venue this year, the Tiverton & District Model Engineering Society, hosted the competition on Sunday 14th September. There were six entries, but unfortunately one had to withdraw due to illness, so five competitors made their way to Worthy Moor, the location of the club track. It is no understatement to say it is hidden away in the rolling hills of north Devon. The 925-foot-long track is deceptive; two gradients of approx 1:45 are there to challenge the unwary.

Each competitor has two runs spaced apart by about two to three hours so that the loco cools down. Here's how they got on:

Les Pritchard with his 3½" gauge Juliet to the LBSC design, **photo 1**. Completed by Les at the age of 21; he has in recent years reboilered the engine. And this locomotive won the first ever LittleLEC in 2008 – driven by Paul Tompkins. This time, Juliet was sulking; Les managed two laps but then retired. He decided not to have a second try.

Sean Pritchard (grandson to Les) with his 3½" gauge Mona to the LBSC design, **photo 2**. Originally constructed around 1970 by the late Alan Hall of Harlington MES, bequeathed to Les. The tank-side lettering ACHR stands for: Alan Charles Hall Railway. Both runs by Sean were excellent; keeping up a good speed, with safety valves often close to lifting, his only problem was the coal truck "tender" derailed a couple of times which lost him valuable time.

On his first run Sean did seven laps in 24 minutes and used 269gms of coal, achieving an efficiency of 0.197%. On his second run, a couple of hours later in the day, he did nine laps in 22 minutes, averaging 4.4mph, using 232gms of coal with an efficiency of 0.215%. His efforts brought him second place overall.

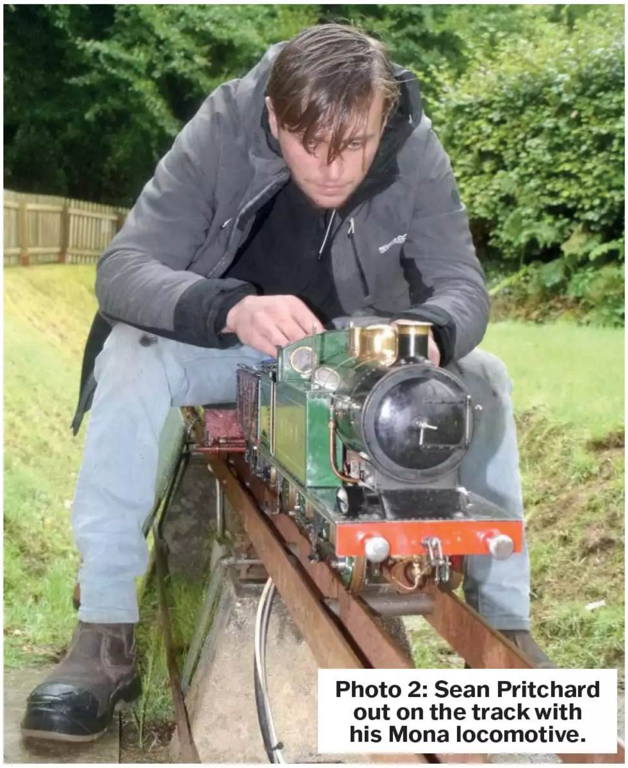


Photo 2: Sean Pritchard out on the track with his Mona locomotive.

Photo 3: Freya Powell out on her run with Dad, Will, topping up the water.

Photo 4: Will Powell with Mona.

Freya Powell aged eleven, **photo 3**. Daughter of Will, who is well known in LittleLEC circles. She drove the family 5" gauge loco which Will acquired in recent years; originally built somewhere in the Birmingham area in 1960. He reboilered it in 2016 and describes it as being in the style of LBSC and with some aspects of the Maisie design. If Freya was at all nervous at having a go, she certainly did not show it. Both her runs were full time; she chose to stop in the station when needing to add more coal and check all was well – given that every lump of coal counts, that's a plan worth emulating where drivers are prone to scatter coal all over the footplate! At the prizegiving she was well applauded for her efforts.

Freya's first run covered four laps in 19 minutes, using 289gms of coal. Efficiency was 0.050%. Her second run covered seven laps in 23 minutes, averaging 3.3mph, and she used 365gms of coal resulting in an improved efficiency of 0.070%.

Will Powell running his 3½" gauge LBSC Mona locomotive, **photo 4**. He has competed in LittleLEC many times so is well versed in how to manage his loco to best effect. Both runs were a masterclass in how to win – which indeed he did! Will also completed with this loco at this year's IMLEC at Fareham where he came 13th.

Will's first run covered twelve laps in 22 minutes, using 263gms of coal, giving an efficiency of 0.397%. Second time out – thirteen laps in 23 minutes, averaging just over 6mph, he used 275gms of coal giving him the highest efficiency figure of 0.412%.

William Musselwhite with his 3½" gauge Rob Roy to the Martin Evans design, **photo 5**. Now aged twenty, he has been a member of Swansea

Summary of the results in efficiency order

Driver	Loco	Gauge	Run No.	Laps Run	Work Done	Coal Used	Energy Released	Average Speed	Eff	Status
					ft lbs	lbs	ft lbs	mph	%	
William Powell	Mona	3½"	2	13	28171	0.606	6835821	6.1	0.412	
William Powell	Mona	3½"	1	12	26004	0.581	6544988	5.9	0.397	
Sean Pritchard	Mona	3½"	2	9	12417	0.512	5766947	4.4	0.215	
Sean Pritchard	Mona	3½"	1	7	13181	0.593	6684190	3.1	0.197	
William Musselwhite	Rob Roy	3½"	2	5	7436	0.540	6090095	2.6	0.122	
Les Pritchard	Juliet	3½"	1	3	2873	0.346	3902632	1.1	0.074	- Out of Time
William Musselwhite	Rob Roy	3½"	1	4	5942	0.741	8352131	1.6	0.071	- Out of Time
Freya Powell	Saddle Tank	5"	2	7	6341	0.805	9072999	3.3	0.070	
Freya Powell	Saddle Tank	5"	1	4	3623	0.637	7183827	2.3	0.050	

Photo 5: William Musselwhite looking very pleased with his Rob Roy loco.

SME for some years; a club that has previously hosted LittleLEC. The late Bill Roebuck was a member there. He competed several times over the years; the last being at Illshaw Heath in 2021 with this locomotive. Bill knew his life expectancy was limited so gifted this Rob Roy to William who is clearly enjoying running it. He made two successful runs; although the axle pump decided not to work, so disrupting his usual driving technique. But he coped very well with the track and came in at a creditable third.

William is now in his third year of an Engineering Physics degree at Aberystwyth University – perhaps he will be applying his studies to getting the best out of his Rob Roy! William managed to do four laps on his first run but sadly ran out of time. On his second run, William achieved five laps in 21 minutes, averaging 2.6mpg, and he used 245gms of coal giving him an efficiency of 0.122%.

In the lead up to the day, club members had kidded themselves that the dreadful weather forecast was showing signs of easing off – oh no; it came down like the proverbial stair rods. After the heatwaves of only a couple of weeks before, this made the day challenging; not least of all trying to keep cameras dry. Several members looked like they were dressed to step on a fishing trawler at Brixham. But, determined not to be put off, everyone enjoyed the day, fortified with lots of tea and cake. Tiverton MES are pleased to have put SW England on the model engineering map; one of several thriving clubs hereabouts. Here's to the next time!

Postscript from Bryan Finch, LittleLEC Co-ordinator

The coordinators of the LittleLEC (now under the stewardship of Guildford MES) wish to express their thanks to Paul Tomlinson and the team at Tiverton & District MES for hosting this year's competition, and also to all the competitors without whom there would be no competition.

Next year, LittleLEC will be hosted by the South Cheshire MES at The Peacock Railway near Nantwich, over the weekend of 20th and 21st June 2026. Details will be published early in the new year. For more details about the LittleLEC competitions, its concept, guidelines, efficiency calculations, and past runners and results, please look at the LittleLEC website www.littlelec.co.uk.

WORKSHOP TECHNIQUES 2

Forming curved brass angles

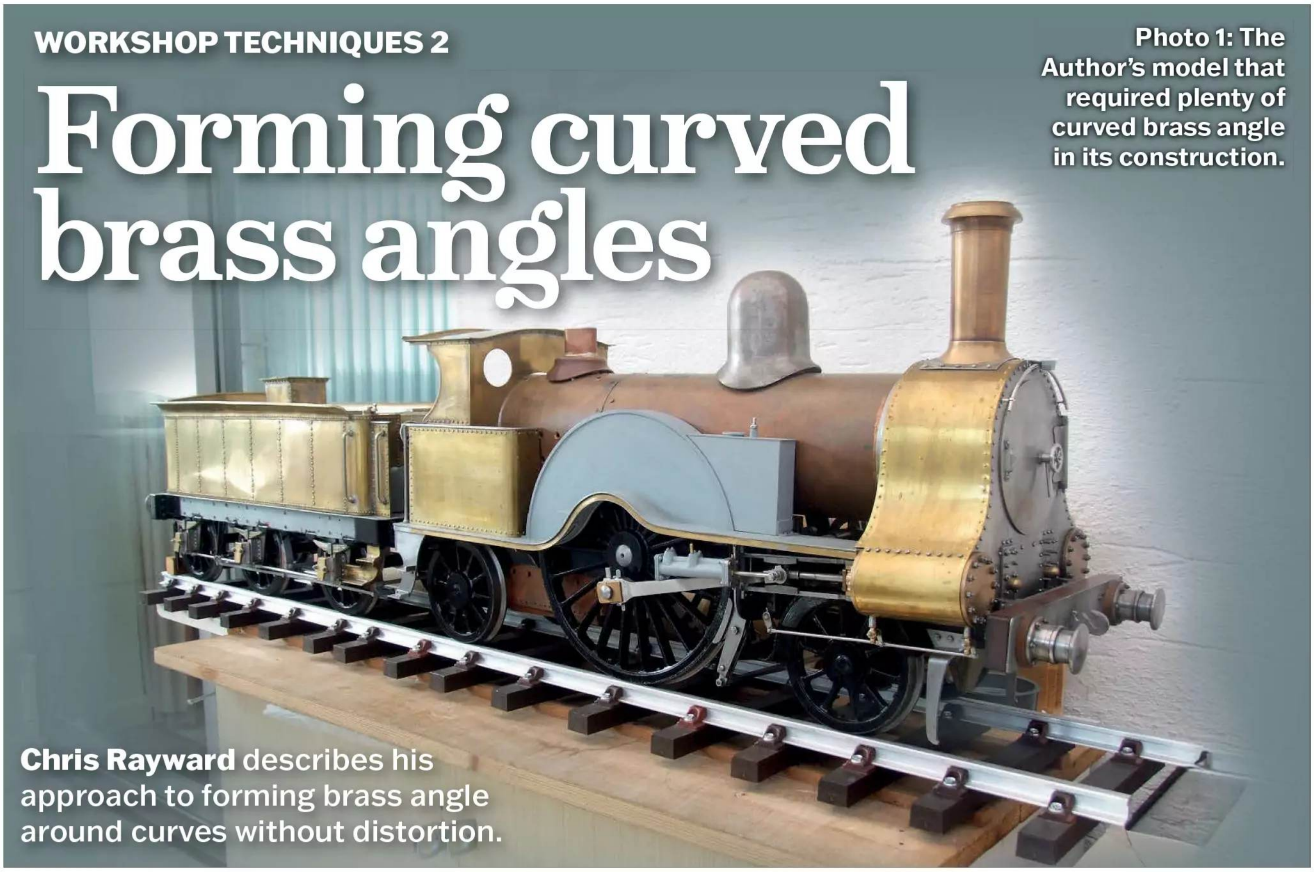


Photo 1: The Author's model that required plenty of curved brass angle in its construction.

Chris Rayward describes his approach to forming brass angle around curves without distortion.

To continue this occasional short series (see *Making Leaf Springs*, in *ME* 4747), I am going to describe how brass angle can be heated to soften it and formed into quite tight curves, say for a valance angle under a running board or platform, or for structural purposes like the corners of a tender body, water filler bodies or cab side.

The heading **photo 1** shows my L&NWR model of the *Lady of the Lake* locomotive in 5" gauge which has a number of applications of this angle forming technique. It is generally assumed that if you heat brass angle up to a dull red heat and quench it in water, this allows the material to be fashioned into a curved shape. This is only true in part for flat strip but for angle material, which is in two planes, any curvature will compress one side and stretch the other and in the extreme, it will crack or at least distort. The actual process of forming brass angle of any dimensions requires the application of heat with the gentle use of a gas flame played along the length to be formed

Photo 2: Here a section of the angle has been removed to allow the vertical section to be bent around a 3/8" radius.

Photo 3: The formed section of angle with the corner filled in with a stiffening piece of similar thickness. The panel is a cab side which has had the rest of the angles and rivets added.

Photo 4: Holding a prepared piece of plate for a tender corner so the bend can be formed after the lower row of simulated rivets has been made.

Photo 5: Plate bent down.

Photo 6: Checking squareness of the plate after riveting.

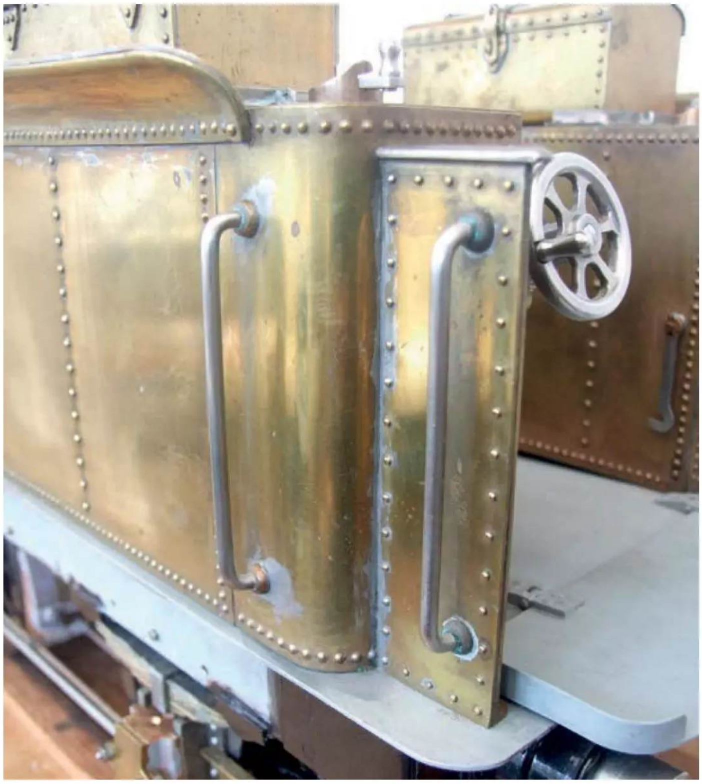


Photo 7: The front formed corner plate attached to the tender with the handrail also bent and threaded ends secured inside with a nut. The front footplate panel was also made up and attached before the assembly was added to the tender body.

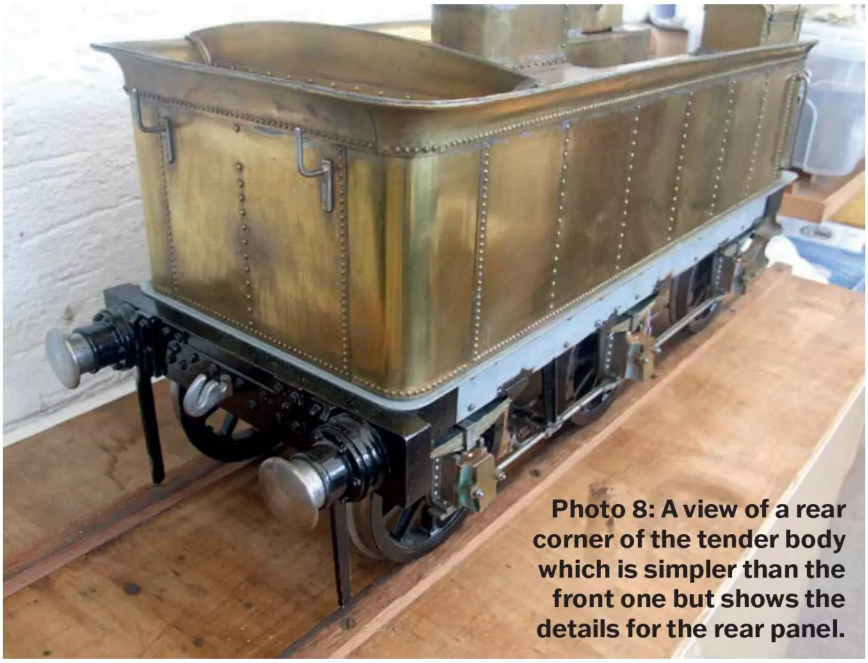


Photo 8: A view of a rear corner of the tender body which is simpler than the front one but shows the details for the rear panel.

Photo 9: The example of a water filler casing/hand pump access, with two formed angles used for the construction.

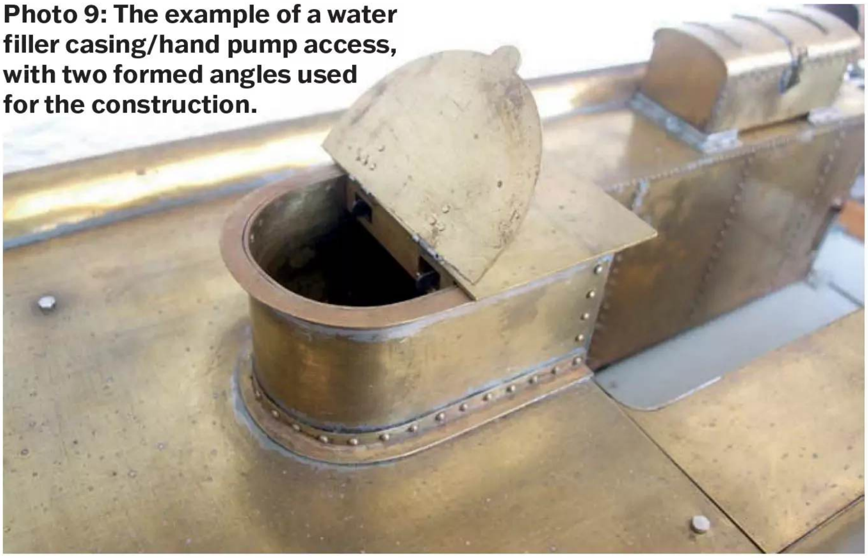


Photo 10: This picture shows the holding arrangements for the angle and the former with all the clamps and the old 'poking' file.

until the material becomes plastic enough for the opposing forces to be absorbed by the structure. It will need to be encouraged to remain flat in one plane or the other and the use of a metal template will help to gain the curvature required and keep one side flat. Some examples will be described to help explain further what is required. Ideally, builders should have a stout flat steel plate that can be held firmly in the bench vice bolted to a piece of steel angle and several sizes of clamps, either 'G' form or toolmaker's types will be required. It goes without saying that all the items involved will get too hot to touch immediately after any of the operations. A bucket of cold water nearby is useful and a lit candle for the gas torch is helpful, as it saves on matches!

APPLICATIONS.

So, let us start with a basic task to form the radius for a model locomotive cab side panel. A length of material equivalent to just 90 degrees of the circumference required for the bend has to be removed. For this example, a section just 5/8" long was cut out of the base section of a piece of 3/8" x 3/8" x 1/16" brass angle. **Photograph 2** shows the task and to form the radius, the angle should be placed on the steel plate and held steady with a clamp. Now, using a modest gas flame heat the intended corner section until it is beginning to go dull red and, using plain nosed pliers, bend the free end so it forms a curve through a right angle to achieve the radius required. With the pliers also press downwards to ensure the angle stays flat on the plate and when cool, the part can be held over a suitable stub of round bar and tapped gently with a small hammer to ensure the radius is even and to the size needed. If there is a brass base plate for the assembly being constructed and it has a radius on the corner, then the newly formed angle needs to match this arc, so this will be the final check.

The typical radius for the corners that are required can vary between 5/16" and 5/8" with the side plate work wrapping around the outside. To stiffen the bend and if necessary, to ensure the subsequent structure is water tight, cut out a small section of brass plate the same thickness as the angle section used and fit it into the area inside the arc then silver solder it in place. If the corner is to be used to secure the tank or cab side to a frame bracket

Photo 11: The formed angle has been produced and all the equipment is being left to cool off.

Photo 12: The front cab plate being used for the shape needed for the angle attaching it to the roof. The model needs two similar sections, one for the underside and one representing a rain-strip on top.

below, then making this filler plate from thicker material is an advantage. **Photograph 3** illustrates the result and shows a completed cab side that has had the rest of the support angles added plus the rivets. Readers will see that the cab side has had its handrail added and trimmed to width leaving the rounded end for the stanchion to be added later. However, this task has to be done at the outset of the cab side construction, as the 5/16" wide steel strip is silver soldered to the bent brass sheet side first! Note that the steel rail is also bent through a right angle and this is also more of a blacksmith type task.

Let us now consider a tender side panel; the plate work can be produced as described in my last article and the lower frame for the tender made up to be attached to its dedicated base plate with temporary 10 BA brass screws and nuts. As both ends of the long side plates finish with a caulking seam, they can be soft soldered in position on the base frame. The next parts to be made are the front and rear curved sections of plate that require bending to the internal radius of the tank corners. My model design specified the radius inside the corner plate as 7/16" and therefore required a 3/8" radius inside the angle. To prepare the corner plate leave it slightly over length and add the dummy rivets along its bottom edge first. The set of **photos 4, 5** and **6** show how the plate can be held between soft jaws in a bench vice, with the plate overlapping the end to protect the punched edge and the material will be soft enough to bend around a 5/8" diameter steel bar by hand. This diameter is deliberately smaller than the final result needed as the spring in the plate will mean it will not conform to the bar size. Afterwards the part can be checked on a drilling table for the position of the bend plus the squareness and accuracy of the ends. It should be possible to adjust the bend in the soft brass if required.

Photograph 7 shows the detail of the corner plate in place. It will be seen that the rearmost edge of this corner is plain and will therefore have the lap strip silver soldered to it. The other end of the bend is a closely spaced vertical row as well, as it is a 90 corner but the actual adding of this row should wait until the bending operation has been completed and the final length of the corner established. Hopefully the rows of the closely spaced seams will coincide!

The two, handed rear corners of the tender are made in a similar manner but they are probably simpler as they have plain edges for the lap strips to the side and rear against the tail panel. **Photograph 8** shows the details. The last section of the outside vertical material to be produced is the rear panel itself which is shown as a simple rectangle that has caulking seam rivet rows along the bottom and up each end to join with the curved corners. For this tender, the central vertical row of proper rivets which has a support bracket on the inside, is left without one near the top so there is space for the works number plate. Note that the very top edges of all these plates are left plain for the ultimate addition of the flared top plates when the time comes. This gap should be even all round the body and be between 5/32" and 3/16".

We can now proceed to deal with the more difficult requirement of forming small sections of brass angle. My example, **photo 9**, illustrates the tender water filler casing detail with the two curved surrounds that are made in a similar way from 3/16" section material but both flanges are left whole. The section thickness is quite small (in the order of 1mm in my case, but it depends on the material used). The forming method uses an offcut of round bar held to the work base plate and the small section angle is clamped a short way behind. Ideally, use a length of 'as purchased' material for convenience, (but keep it out of the way of your house coat or it may be bent where not required). **Photograph 10** shows the material and the 'tools' set up for the forming operation. The forming process will take longer than the simple heavier sections already described because the material needs to be really encouraged into

Photo 13: The final shape required for the angle ready to be drilled for the fine rivets, but it is best attach the angle to the roof surface first as this will ensure the shape is a close match.

Photo 14: Here several small clamps and blocks of brass are being used to ensure both the angles sit snugly to the roof. Note how the angles are facing in different directions.

the bend and significant heat has to be applied. Do not concentrate the torch in one place; waft the torch around say an inch backwards and forwards; of course, initially the heat is going into the base and clamps. **Photograph 11** shows how the brass angle has gradually conformed to the tight 13/16" radius bend. The technique here is the same that will apply to forming a valance angle to go under the running board and although the bends are not as severe, the requirement for a template and unhurried patience remains.

To add to these illustrations, most of the older style L&NWR cab roofs have an angle with a reverse bend and rain strips plus stiffening angle underneath too. On my model, the first task was to make the cab end against which to form the roof plate curvature itself, which can then be used as a gauge with the angle being formed to suit. The structural parts were formed from a length of much lighter 5/32" or 3/16" section brass angle for the underneath part and **photo 12** shows the task in progress. The main curvature is about 11" radius but the ends have a short reverse curve with a nominal 1" radius. Again, use was made of the steel plate as a working platform and the length of angle can be clamped to it while the very end is gently heated with a gas flame played 'to and fro' till the angle is warm enough to bend and the material can be tweaked with plain nosed pliers to make the initial curve. The process can then be continued around the major curve until the second small bend is required. For the whole process it is best to leave the brass angle too long and to trim it back once the final bending has been completed and fitted to the roof. **Photograph 13** shows further progress.

For my model, a second angle was made to fit underneath; note the clamping arrangements used. Several small toolmaker's clamps and small brass blocks were used during this type of assembly as a convenient way of keeping the parts in place, but be aware that all the items get hot and the task cannot be hurried. **Photograph 14** indicates the approach. When completed the row of small holes are marked out for the 1/32" snap head rivets to be added down through the roof. Lastly, **photos 15** and **16** shows two views of my cab assembly when I offered a further version of the L&NWR 0-6-2 Coal Tank known as the simpler 0-6-0 Coal Engine.

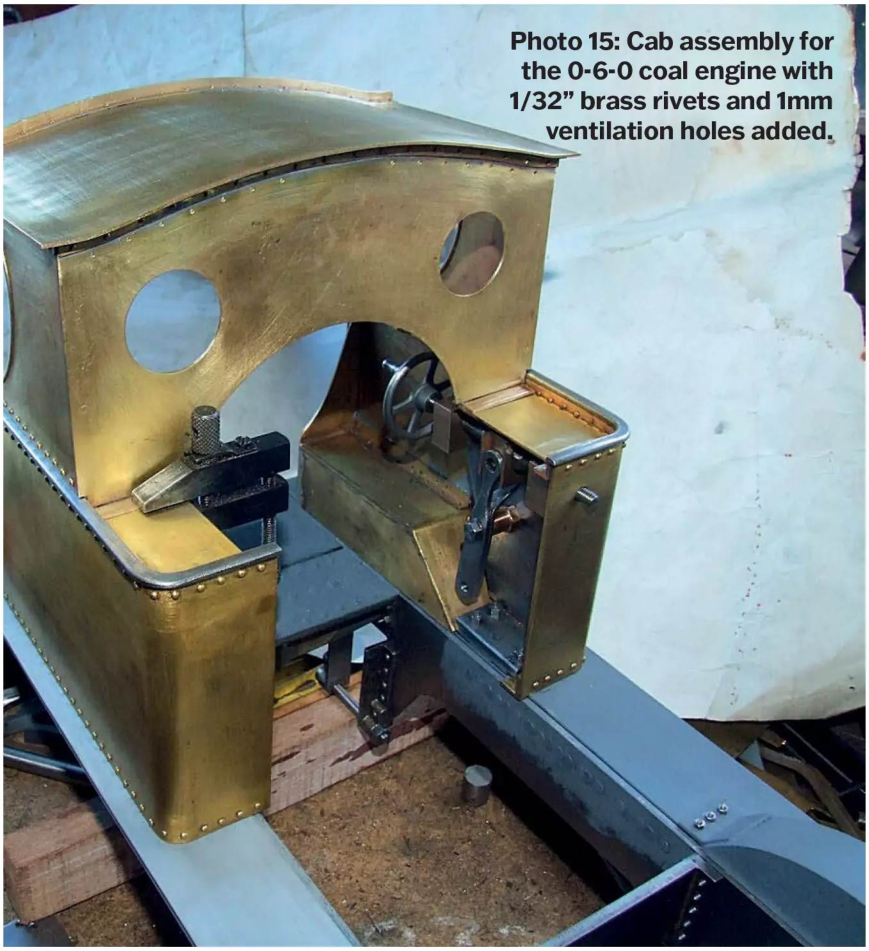


Photo 15: Cab assembly for the 0-6-0 coal engine with 1/32" brass rivets and 1mm ventilation holes added.

Photo 16: Another view of the cab.

A Tandem Compound Mill Engine

PART 22

David Thomas makes the air pump/condenser water valve and the atmospheric exhaust valve – the final working parts.

Photo 358: The groove for an O-ring seal was turned.

The body of the cooling water valve was described in the previous part, now it needs a plug and an operating handle. This and the exhaust valve are shown in **fig. 54**. It turned out that ½" free-cutting stainless-steel stock was just the right size to be a sliding fit in the D-bitted hole in the body, on assembly a very thin layer of grease was enough to seal it. The stock was set to run true in a Griptru chuck and the shaft for the handle turned and threaded on the end. At the same setting the groove for a BS012 O-ring was turned, **photo 358**, then the part moved to the dividing head on the mill to form the square for the handle, **photo 359**. The last operation on the plug before parting off was to drill the horizontal water passage using a slot drill that would not wander on the curved surface, **photo 360**. Back in the three-jaw the same slot drill was used to drill the axial water passage to complete the valve plug, **photo 361**. The little valve handle was made in two pieces, **photos 362** and **363**, and was a pleasant exercise in metal carving rather than precision engineering. The two bits were silver soldered together and the hole filed square by hand.

Figure 55 shows a section through the atmospheric exhaust valve (AEV) which is an essential fitting on a condensing engine running on steam but useless if running on air. Once again, the builder can choose to omit this or at least omit the internal bits. The function of this valve is to allow the engine to start up exhausting to atmosphere and therefore free of back-pressure until the vacuum in the condenser has been established. When that has built up the valve is closed by hand and atmospheric pressure keeps it shut. The lever swings the valve via a square shaft, and the catch serves to hold the valve open.

Photo 359: Forming the square to take the handle in the mill.

Photo 360: At the same setting the ¼" cross hole was drilled using a slot drill.

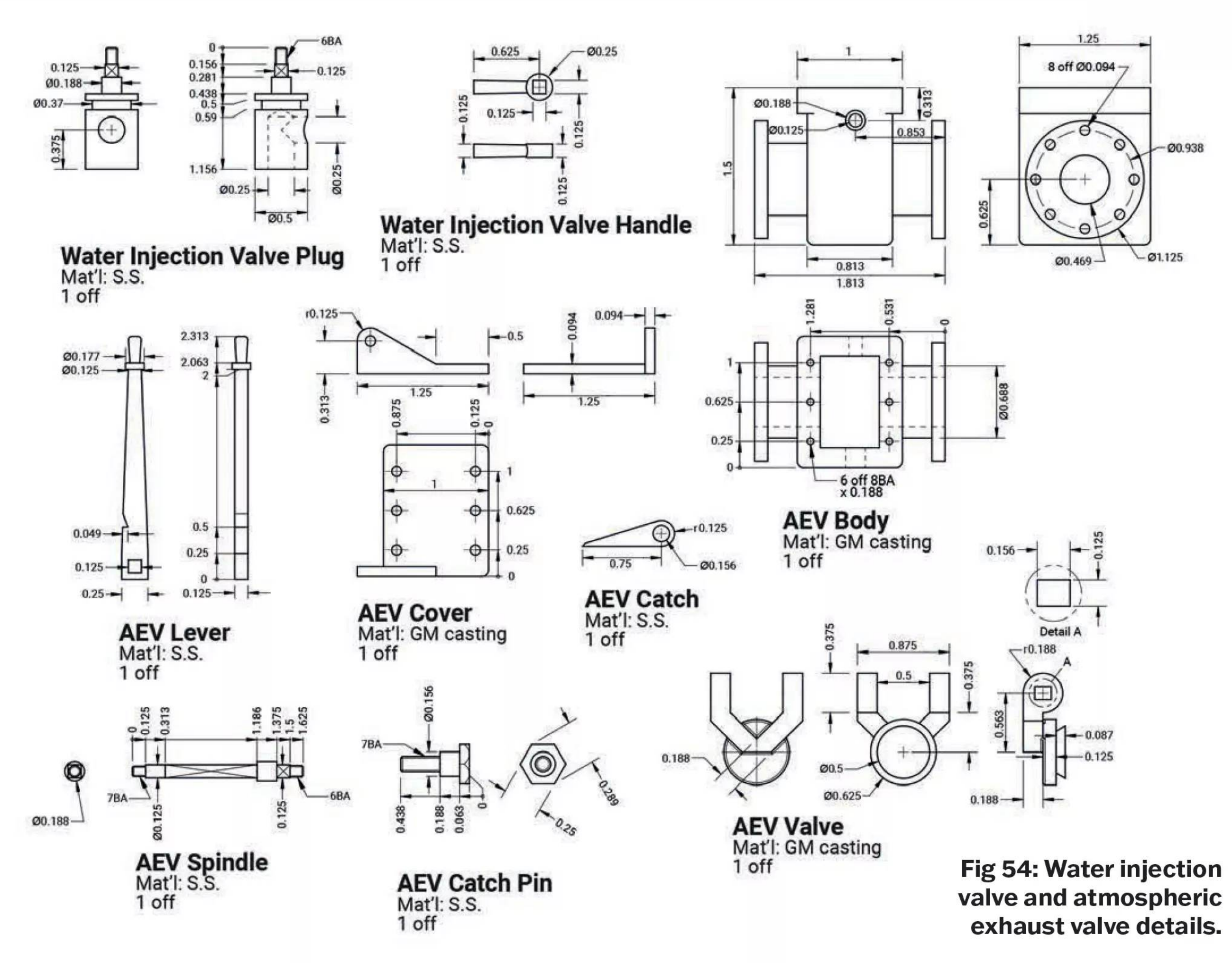


Fig 54: Water injection valve and atmospheric exhaust valve details.

The hole in the valve through which the shaft passes is rectangular to allow the valve a bit of free movement when air pressure is taking over the closing.

The casting for the body of the AEV was another rough gun metal casting with plenty of machining allowance, far too much on the internal surfaces. The exterior needed a lot of filing before it could be held securely in a four-jaw chuck to drill and ream the steam passage and turn the first flange, **photo 364**. The reamed surface made gluing the part to a mandrel easy and secure and the valve seating was turned with a small boring tool introduced along the steam passage, **photo 365**. Initially I tried using a long series endmill to smooth this surface, but the result wasn't anywhere near good enough for a valve seating. The casting was then reversed to turn the other flange and the mandrel used again to hold the piece for drilling the bolt holes in the mill. The square shaft for the valve was made on round 3/16" free cutting stainless steel stock, first turning the bearing surface on one end and threading for a nut then transferring to the dividing head on the mill to form the longer square section, **photo 366**. After cutting from the stock the square to hold the lever was milled and the end turned down and threaded (a four jaw self-centring chuck comes in very handy occasionally but isn't vital here).

Photo 361: The same slot drill was used to form the axial water passage.

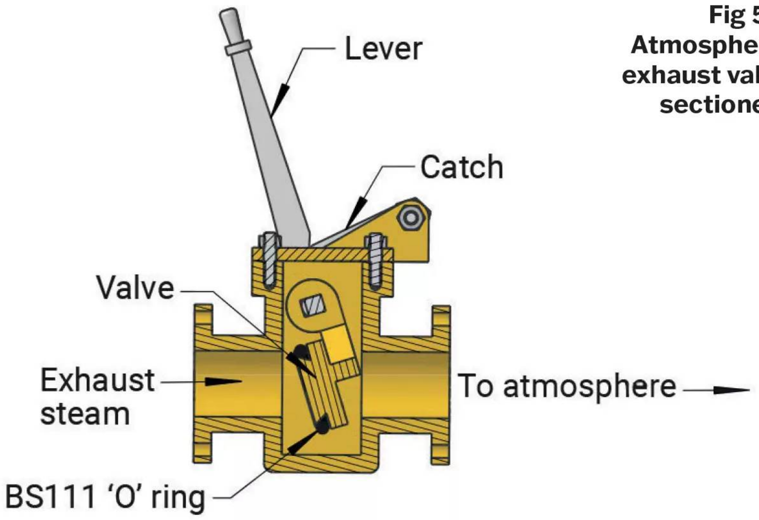


Fig 55: Atmospheric exhaust valve sectioned.

Castings weren’t available for the AEV cover or the valve so, on the assumption that the model would only ever be run on air I exported the CAD drawings to .stl files and used the 3D printer to make them in ABS. I will also provide a set of files with a 2% shrinkage allowance and 0.020” machining allowances that you could use for investment casting (these will have “_Pattern” at the end of the file name). You can download these and other STLs from tinyurl.com/4hc4kx9w. The completed AEV, this one with the plastic bits hidden by filler and paint, is shown in **photograph 367**.

We are getting close to the end now, next time I will detail the pipework and stanchions. To be continued.

Photo 363: The handle was an easy fit in the body which would allow silver solder to penetrate.

Photo 364: The AEV body set in a 4-jaw, the first flange being machined and the through hole drilled.

Photo 365: The body glued to a steel mandrel to face the valve seating.

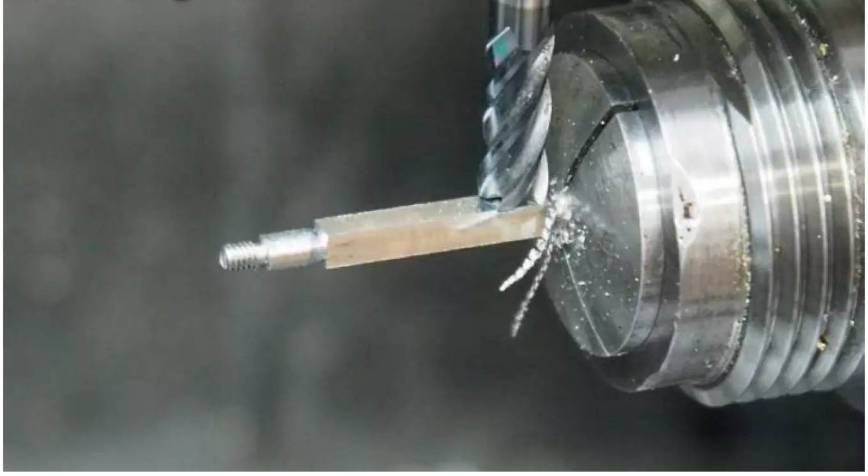


Photo 366: The AEV valve spindle being squared off with round stock held in the dividing head.

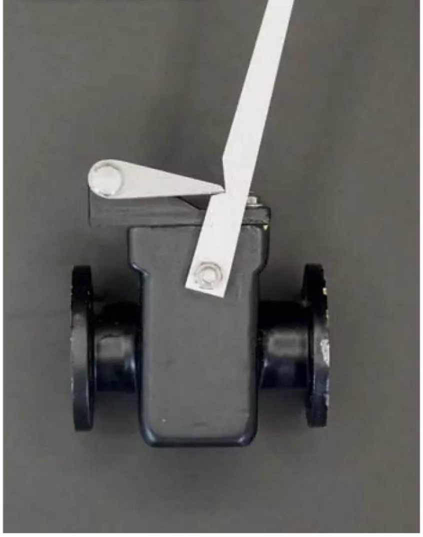


Photo 367: The assembled AEV.

Club News

Geoff Theasby reports on the latest news from the clubs.

Photo 1: 3 1⁄2 inch Garratt (Picture courtesy of Danny Hayward)

Good day all, I have a couple of items before we start, in the Sheffield Auctions, there were several live steam models, a vertical, estimated £50-120, a beam £150/250, and a horizontal, £150/250, all in brass; many penknives mostly by Stan Shaw, est. up to £700 each, and several tasty cameras, mostly Leica and Nikon, and accessories.

In Paul Tiney's article, Home Foundry Work (ME&W No 4769) he refers to Fred Camm, and 'Camm's Comics'. As Fred edited his last issue in 1959, is it not time to abandon the term? Fred did a wonderful job of guiding Practical Wireless through the post war years and it is still a major part of the electronics and Amateur Radio hobby.

In this issue, astronomy, chocaholics, Begging the question, attacked by a lathe, the Keystone Cops, Shays, the Old Controller, and a conquest.

Speaking of astronomy, has anyone been watching the increasingly hysterical videos about the supposed activities of 3I /ATLAS. The wild speculation, inaccurate claims, and clearly wrong details, plus ignorance of simple astrophysics has created a very amusing series of videos, all to be found on social media.

GMES News from Guildford Model Engineering Society, September, opens with new chair Matthew Clark reporting thieves on their site. Crows and magpies have stolen his chocolate biscuits! Andrew Giffen begins an occasional article in a new series on building a Bulleid Pacific, warts and all. W. www.gmes.org.uk

Stockholes Farm Miniature Railway had a visit from Cleethorpes and Grimsby Railway Group. As they are interested in all railways, they brought a new aspect to Stockholes Farm. Ivan says that he was pleased to see that Roger Sully's Mallard was in steam for 11 hours in the 2025 Rally, working or light engine it never missed a token, never exceeded the speed limit and the safety valves rarely sounded off. All drivers wore goggles. W. www.sfmr.org

The Link, from City of Oxford SME, gives details of the 70th anniversary weekend, and also the Dreaming Spires event at which 35 locomotives attended. Some very good pictures are printed, like this 3 1⁄2 inch gauge Garratt, brought by Danny Hayward, **photo 1**. Cover star, Danny Woodrow begins a new series of *Meet the Member*, and is featured on the cover, driving Josh Allen's Lilla. Danny spent his working life in Engineering and Robotics learning under ex-Rolls Royce engineer, Les Conway. This was where he learned about engineering, machine tools and the habits of trainee engineers, including using micrometers as clamps, leaving spanners where they shouldn't, and on one occasion rendering first aid to a young man who imperilled his marriage prospects by leaving a key in a lathe chuck.

Several photos this time include a number taken from ground level, which gives an interesting perspective. Let us hope the photographer doesn't get run over whilst composing the pictures. The popular image of a villain tying down a helpless young lady to the track is a myth, by the way. The idea was originally a 19th century creation, and was later taken up by Mack Sennet in the silent film era.

Editor, Jon Potter discusses slate wagons. The Festiniog railway is famous for its gravity train, delivering slate to Porthmadog Quay. Jon therefore made a Dandy Cart in which a horse travelled. From Porth the horse would pull the empty wagons back to the top of the line for the next load. The model equestrian occupier was taken from a rocking horse bought from a charity shop for £6. Brian Holland covers the Sweet Pea Rally at Guildford. W. www.cosme.org.uk

The *7 1⁄4 inch gauge News*, Autumn, from the 7 1⁄4 inch gauge Society, has a fine picture on the front cover, of David Carson and his 'Stafford' locomotive at the Oxford event. This publication is now edited by Tim Coles and Helen Hale, who have moved newsletters from Oxford. This is Tim's gas turbine locomotive, 18100, **photo 2**. Tim has nearly finished the model, and is aiming for another medal! Matt Rainer has been setting up a Proficiency Scheme for model engineers. There will be three classes of award, Bronze, Silver and Gold, and Helen Hale wrote up the mini gathering at Oxford. Bob Whitfield's *'The Baron'* is fitted with a spark arrestor, but opinions are divided on its aesthetic qualities.

The Little Hay Mini Gathering at Sutton Coldfield was described by Tim

Photo 2: Gas turbine locomotive 18100 by Tim Coles

Coles, and Ian Coleby writes on how to make pointwork. John Arrowsmith visited the Bentley Miniature Railway, and the Echills Wood Standard Gauge Rally, and Dave Potter builds a 'Tinkershay' a 13T Type A Shay-cum-Tinkerbelle, pointing out that the seemingly simple universal joints in the motion work were quite tricky to make. Tim appears in a video testing his turboprop engine, **photo 3**. W. www.sevenandaquarter.org

The *Gauge 1 MRA N&J*, September arrived, from the Gauge 1 Model Railway Association and immediately disappeared into cellulose hyperspace (A pile of paperwork). However it has now resurfaced and so… (Ahem!) Bob Barlow's track is on the front cover, showing his Dean Goods and its train of wagons passing Roger Markland's signal gantry. Very realistic. Editor Rod Clarke has decided to step down as editor next Spring, so a new one is required. Could you do it? Rod will Danny Hayward be a hard act to follow, but much of the content is set by a commercial company, so it isn't too onerous.

Malcolm High reports on G1 North which attracted more than 200 visitors. The group's *Moordale* was on show, after restoration from flood damage, and the *Chop-it-Up Lumber Company* diorama featured a fictitious logging company in about 1930, set on the Canada/US border. Murray Wilson made a loco tender from an old can, in such a way that the original warning on the can was retained for use on the 'phoenix' vehicle, **photo 4**. The Peacock Railway held a renaming event, organised by the South Cheshire MES in Nantwich, to change the name of their layout to *Adlestrop*, on a 95 metres long base.

Andrew Vines writes on 'pure filth', stating that although we do like to see nicely decorated tanker wagons and other rolling stock, but the reality is that most were very mucky, even the milk tankers and similar, even though the insides were clean. He has accordingly dirtied up some Slaters kit tankers to reflect reality. Murray also converted a 'Beggs' loco (c. 1900) in the foreknowledge that it was too far gone to be restored to original. Beggs locomotives were made to run exclusively anticlockwise on a circular track, so the axles are not parallel, and the LH wheels are smaller than those on the right. Eddie Castellan describes how to get your new-build loco to run properly. Julian Edwards discusses turnout construction. Electrical specialist, Ralph Bagnall-Wilde, has designed an automatic blower controlled by train speed. The 'Mason bogie' in the last issue appears again, as one was coincidentally bequeathed to a friend of Peter Thornton and they had to spend much time researching its details. Subsequently, a model was made from an Aristocraft 2-8-0 C16 in 1:24 scale. Ernie Noa built an Accucraft kit of a 13T Shay. It is pre-painted, with much detail, and the assembly instructions are very good. As an illustration of how a Shay works, it is great, says Geoff, who has a deal of enthusiasm for these odd locomotives, **photo 5**. W. www.g1mra.com

St Albans MES, October, Newsletter Chairman Mike Collins, wrote about the BIG St Albans Model Show. One of the biggest he says, attended by over 2500 visitors. Alan Elkins dressed as George Stephenson was photographed alongside a Meccano model of his "Rocket" in front of a picture of a wonderful cloudscape, which just happened to be there when the picture was taken. Another activity to reinforce the 200th anniversary celebrations, was a model rocket fired every hour – the concept of reusable rockets didn't start with Elon Musk. W. www.stalbansmes.com

Bradford MES' *Monthly Bulletin* for October begins with Martin Birch showing a couple of transparent Perspex cubes with branching pattern inside. He explained that they were made in a radiotherapy linear accelerator, which, just before it was taken out of service, was used to see what happened when one of these blocks was placed in the beam. The operation was overseen by a senior Physicist, to ensure safety, search for 'Lichtenberg figures' to see a typical result. Martin Guest had a clock with a problem base, so he 3D printed another. He also required some finials, but his attempt at printing these was unsuccessful, so he paid for a company to make them. They charged a £15 setup fee and £1 for each finial made. "Bargain!" he says. Dominic Scholes produced a small air compressor running on Li-Ion batteries, which will power a model for about 8 hours. (I would like such a device myself, I tried an aquarium air pump, without success - Geoff) Dominic says that a 3.7 volt battery will run a Stuart 10A , so I will try one. They cost about £12 from the usual

Photo 3: Tim Coles's turboprop under test

suspects. Jim Jennings showed a vintage Hamment and Morgan train speed controller, which didn't work, so he took it to a model shop in Bradford for repair, and they were so pleased to see such a nice old device, that they offered two modern ones in exchange, so they could put it in their museum, (I have a couple of these controllers, included in an auction lot, anyone want them?) In Road Vehicle News, David Jackson's brother went to a car rally and found a 1936 BSA Scout, restored after 49 years in a shed, and a 1933 BSA 10 hp saloon. David found a Daimler Conquest in Masham, having never seen one before.

On the subject of cars, I found a video on YouTube about identifying 30 cars from a rear view only. I scored 26 correct. One blanked out a badge on the boot lid, but its location told me what the car was, and in another, the radiator mascot was still in view, which made it easy. In a similar case many years ago, I was in a pub one Friday lunchtime, when a colleague produced a beer mat and said, "you reckon to know a bit about cars", and asked me what car was featured on it. I immediately said, "its a Bugatti". He was flabbergasted. I didn't tell him that those cars are instantly recog-niseable for their radiator grille. W. www.bradfordmes.uk

Halesworth & District MES, Autumn newsletter Editor, Julie Williams, comments on the front page picture where we can see two 99 year-olds, some middle aged members, and some junior members running a traction engine, in for a steam test. Very demographic! Secre-tary, Brian Sinfield reminds us that LOWMEX is in November. LOWMEX is a great show, which promises to be even better this year. Claims that this is the best show in the South East, may meet opposition from St Albans. Jon Ford invited members to his workplace (not identifed) which involved some interesting machinery, including a CNC shaper, which could probably make anything, it seemed. A novel way of making spanners was to mill out the shape from a block, then slice it longitudinally to produce several identical items. Tim Rackham, forced into the workshop when Covid struck, acquired a model Fowler road locomotive and subsequently discovered that it was originally a Showmans engine, so he decided to restore it to that standard. Kevin Rackham discussed the Great Gath-ering in Derby, with '140 vehicles from the past'. The site is huge, and there were many exhibits, including rollers, Class 59 and 66 locos, historic Land-Rovers and *MetroVick No 12*, the oldest electric loco in the UK. The four 'A' Class LNER Loco classes, *A1, A2, A3, A4* were in steam together, two Merchant Navies and 73129 *Bahamas* (with its Caprotti valve gear) and *Scots Guardsman*. Other highlights included Ruston Hornsby *Sir William McAlpine*, Westerns, Class 08s, Furness Rly No 20, and modern units too, Pendolino, HST, Eurostar, with Deltic Class 55s. I could go on, a superb exhibition. Back to reality, Tim Coles writes on Loctite 638 high strength retainer and how to use it. Lots of useful information there. W. www.hdmes.co.uk

And a poser – why does Bugatti feature twice in this Club News?

And finally, is Orion's belt a waist of space?

Photo 4: Phoenix tender (Picture courtesy of Murray Wilson)

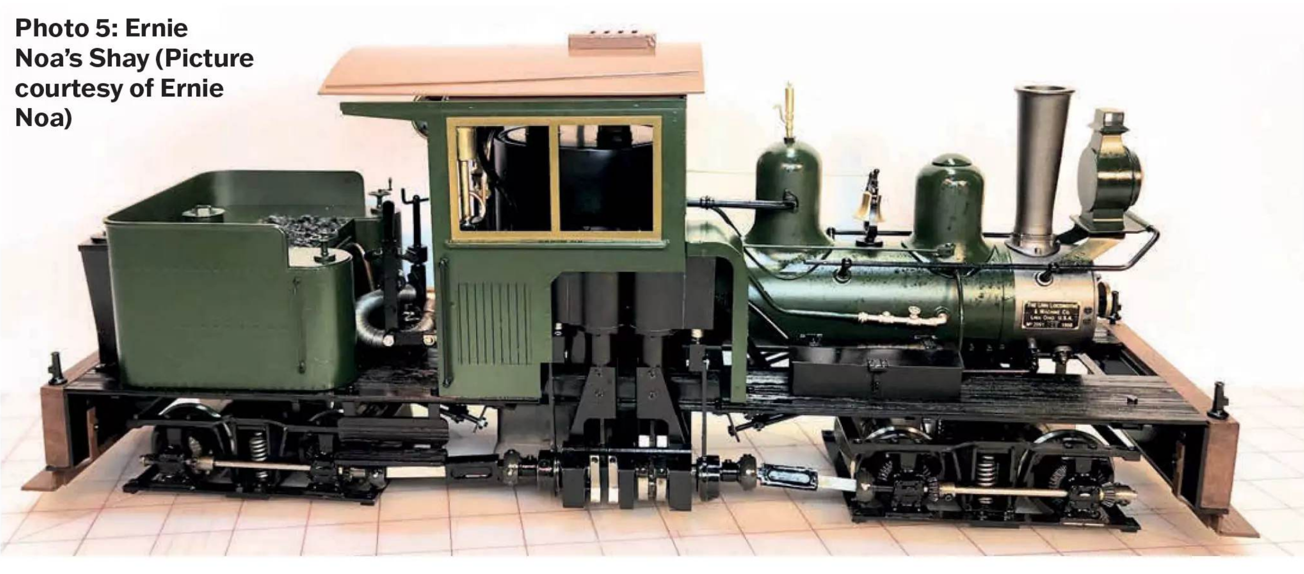


Photo 5: Ernie Noa's Shay (Picture courtesy of Ernie Noa)

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TOOLS AND MACHINERY

Dore Westbury Mk 1, miller on a stand, £250. Clark horizontal bandsaw 6" 3 speed, £95. **Tel. 01246 277357. Chesterfield.**

Workshop clear out - surplus collection of Sine Bars. 2 @ 5 inch, 1x Buck and Hickman, 1x unknown and 2 @10 inch, 1 by Grant Buhler, 1 X unknown (possibly toolroom job). All in appropriate cases and good condition. Offers invited. **Tel. 01205 290312 - Near Boston, Lincs.**

Seven bench lathes, similar Myford, ML7. Vertical bench Milling Machine (vertical) Lend lease 1/2" O bench drill Clarke 3/8 O bench drill Reyon BS10/KA band saw tooling tool maker cabinet micrometre depth mike H/speed drills machine, tool files, cutters. **Tel. 07850 881971. Basingstoke**

Warco Bench drill and milling machine very heavy combined, £250. Robroy set of castings and drawings, £150. **Tel. 07796 628908. Wolverhampton.**

Myford ML7 with gearbox on Myford stand, also Myford stand complete with Dewhust switch capco sideface grinder, 24" x 8" table. **Tel. 01743 343234. Shrewsbury.**

Dean Smith & Grace, 13" x 30" screw cutting Lathe, 1960's, 3 and 4 jaw chucks, faceplate, collet chuck and collets, steadies, 3 phase, good working order, £2000. Elliot Victoria Vertical TV2 Turret Mill 10 1/2" x 36" table 30 int spindle power feed light coolant, new 6" vice, new Clarkson autolock 'S' type 1/4" to 5/8" chuck, 3 phase, £1600. **Tel. 07798 728750. Bideford.**

Bridgeport milling machine, J head, X & Y axis Accuride DRO, 9" x 42" table, 7" riser block, R8 metric & imperial collets, drill chuck, boring head, 2MT adaptor, coolant pump, vice not included, buyer collects. £775. **Tel: 07901665688. Email: richard_moth@hotmail.com. Southampton.**

MODELS

7.25" Kerr Stuart Wren, driving truck included, copper boiler, two injectors, electric water pump in driving truck, vacuum braking system, boiler certificate: hydraulic to May 28, steam test due Oct 26. £5000. **Email: email@andrewdunn.uk. Carnforth.**

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Speedframe parts. Box of used connectors and plugs. Free. Collection only. **Email: robert8rpi@yahoo.co.uk. Near Cambridge.**

Set of castings for Robinson model hot air engine by Alyn Foundry, part-machined to good standard £150 £150. **Tel: 01962 772203. Email: nmcburney@btinternet.com. East Hampshire Nr Petersfield.**

MISCELLANEOUS

Electric motors. Name plate says, Brook 3 phase electric motor, two speed 2/1 horse power, 1425 / 2800 RPM. £60 AEI Electric Motor. Name plate says, Type 0.094, 8.75 amps,1410 RPM,240 / 440 volts, 3 Horse Power. £60 Buyer to test and collect. £60. **Tel: 01723362537. Email: g4egb@yahoo.com. Scarborough North yorkshire.**

MAGAZINES, BOOKS & PLANS

The Quorn Tool & Grinder Book by Professor D. H. Chad dock,complete set of castings, boxed Parvalux motor, 4 grinding wheels, full set of drawings. £250. **Tel. 07549997433 Nottingham.**

The EDM How To Book" By Ben Fleming. RC Starter Kit The RC starter kit includes the book and NON stuffed PCB. £35 inclusive of postage £35**. Email: johnstij@yahoo.com. Newcastle Under Lyme.**

Model Engineer magazines from July 1948 to end 2018. **Tel: 01296431371. Email: david.b.godley@btinternet.com. Aylesbury**

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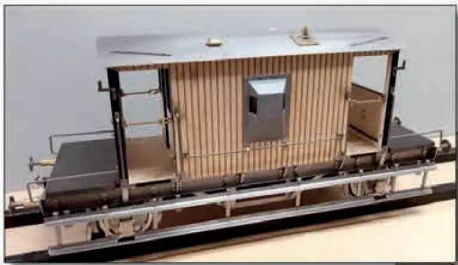
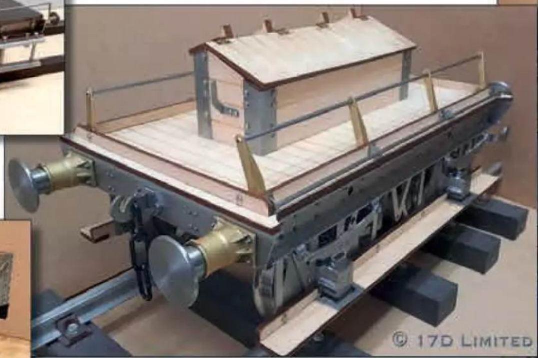


BR/LNER Brake Van

Banana Box Van



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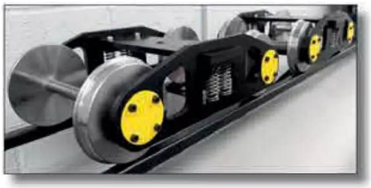

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