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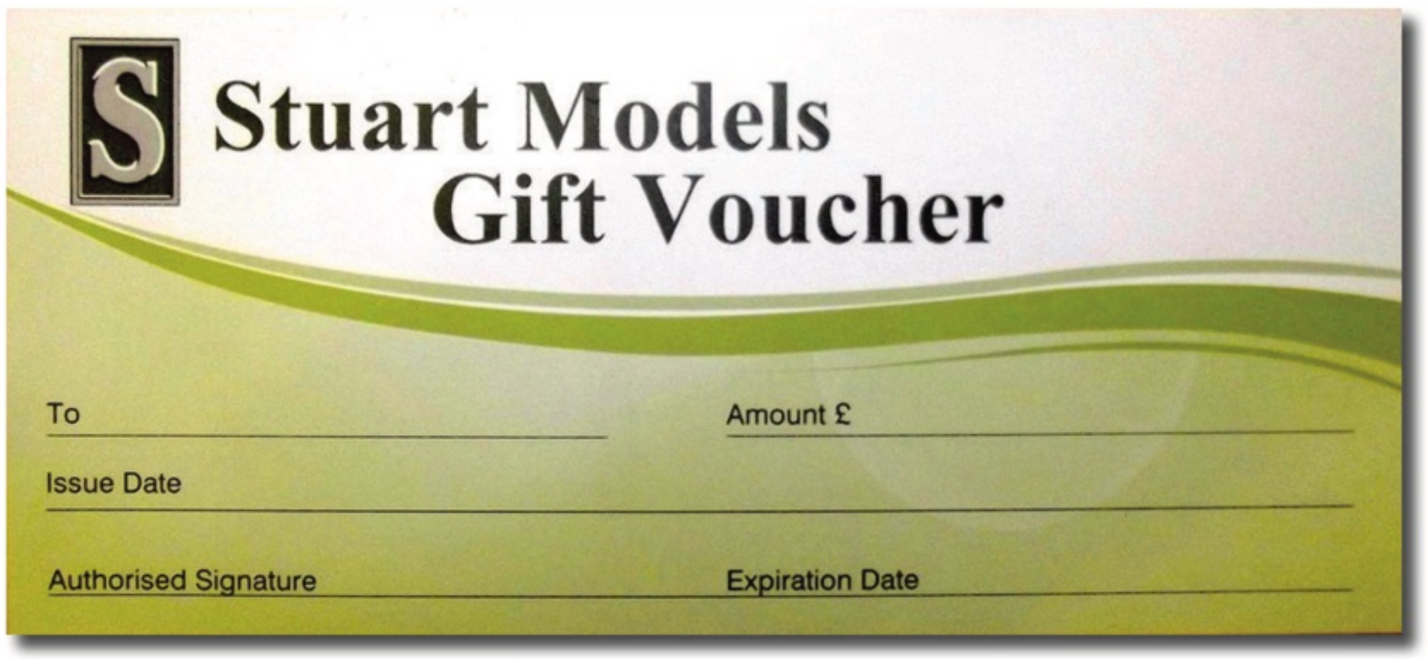

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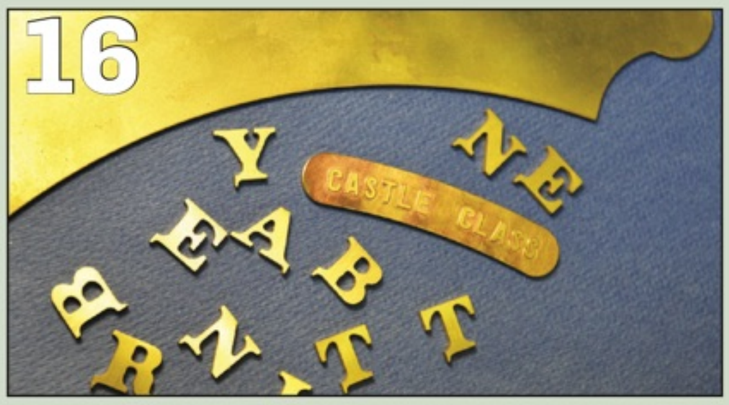

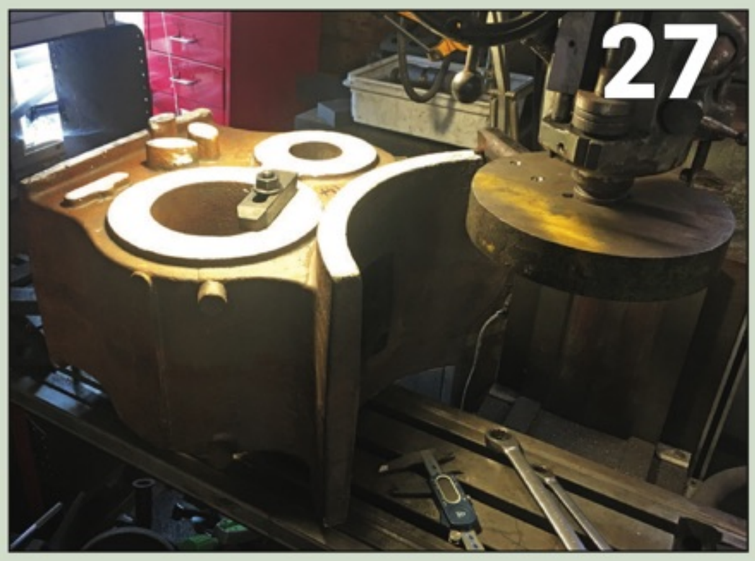

FRONT COVER

There was plenty of interesting modelling on show at the Midlands exhibition, such as this impressive front end for a 3-inch roller, made by Richard Folwell and on the Northampton Society stand. *Photo: Andrew Charman*

EDITORIAL

Smaller package but with higher quality?

Welcome to EIM and my last job on this issue before writing these words was to lay out the first part of our report on the Midlands Model Engineering Exhibition.

It was good to meet many readers at the show, and I enjoyed this year's event. I had to agree with the comment made to me more than once that the show was smaller, but to be honest that did not greatly surprise me – we knew beforehand that at least one major trade supplier had decided not to appear this year, and to be honest smaller-scale events are a symptom of our times not confined to model engineering – just a few days later I was required to attend a model railway show which had also shrunk to a degree.

What made me less concerned at the size of the Midlands show was the fact that the standard of modelling on display appeared this year to be to a particularly high quality – there was a great deal to interest and inspire, from subject matter that was certainly not 'the same old usual stuff' to the excellent standards of workmanship. I greatly enjoyed having a long look at what was contained on the packed stands, and I was particularly pleased to see yet again an increasing influence from younger engineers – a very good thing.

There are a couple of familiar elements missing from this month's edition of EIM, but don't worry, it's simply a case of ringing the changes and ensuring plenty of variety for our readers. Martin Gearing's steam plant boiler construction series, and Simon Mace's budget garden railway build will both be back in next month's issue.

I'm delighted to see some hot-air engines this month – yes our John Arrowsmith was attending the annual Stirling Engine Rally, but he spent some time talking to exhibitors and extracted fascinating details about the innovation going on in this branch of the hobby. If you are one of those doing interesting things with hot air, why not write it up?

We also in this issue build a kit! – the very Scamp petrol-electric engine your editor is driving at the top of this page. Kits have their place in EIM – not everyone has the time, or the confidence, to scratchbuild a locomotive, and anyway putting together a kit can be the first step to something much more. Certainly after driving Scamp, I was sorely tempted...

Andrew Charman – Editor

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Editor: Andrew Charman Technical Editor: Harry Billmore
Email: andrew.charman@warnersgroup.co.uk Tel: 01938 810592.
Editorial address: 12 Maes Gwyn, Llanfair Caereinion, Powys, SY21 0BD
Web: www.engineeringinminiature.co.uk
Facebook: www.facebook.com/engineeringinminiature

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Publisher: Steve Cole
Email: stevec@warnersgroup.co.uk
Design & Production: Andrew Charman
Advertising manager: Bev Machin
Tel: 01778 392055
Email: bevm@warnersgroup.co.uk
Sales executive: Allison Mould
Tel: 01778 395002
Email: allison.mould@warnersgroup.co.uk
Advertising design: Amie Carter
Email: amiec@warnersgroup.co.uk
Ad production: Pat Price
Tel: 01778 391115
Email: patp@warnersgroup.co.uk
Marketing manager: Carly Dadge
Tel: 01778 391440
Email: carlyd@warnersgroup.co.uk

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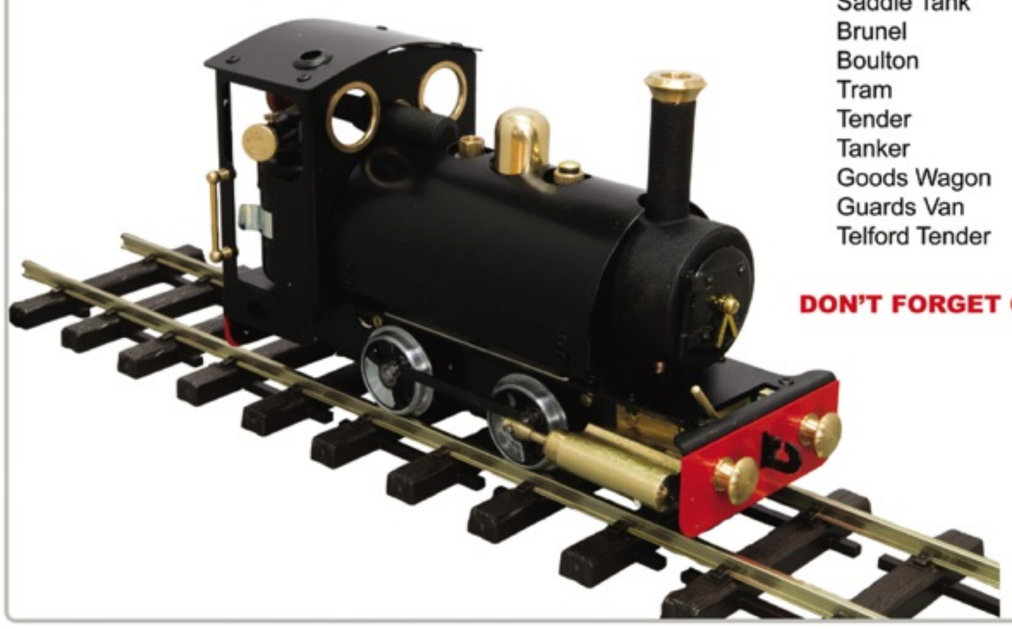

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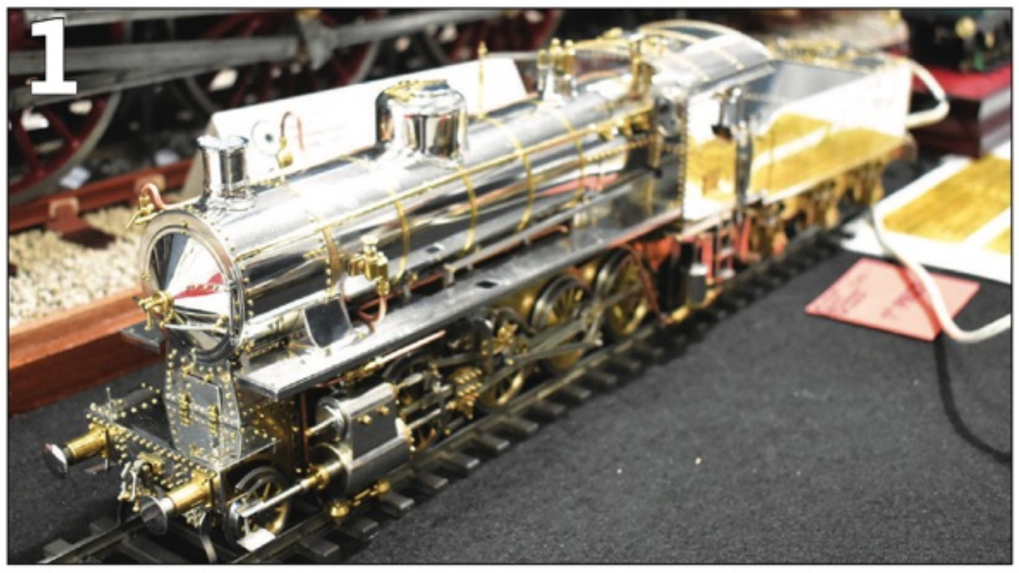
2019 Midlands Model Engineering Exhibition

Roving reporter John brings us part one of his report from the major Autumn show.

BY **JOHN ARROWSMITH**



Where does the time go? It doesn't seem like 12 months since the last Midlands show but here we were again at the Warwickshire Exhibition Centre considering the latest presentations in the model engineering world. The 42nd Midlands Model Engineering Exhibition opened on 17th October to large crowds and an excellent selection of models in most classes – better than in previous years so the organisers must be doing something right.

The entry in the Young Engineers class, larger than any other, was most encouraging and the quality of exhibits in all the categories were superb. As usual I will start by covering all the competition classes.

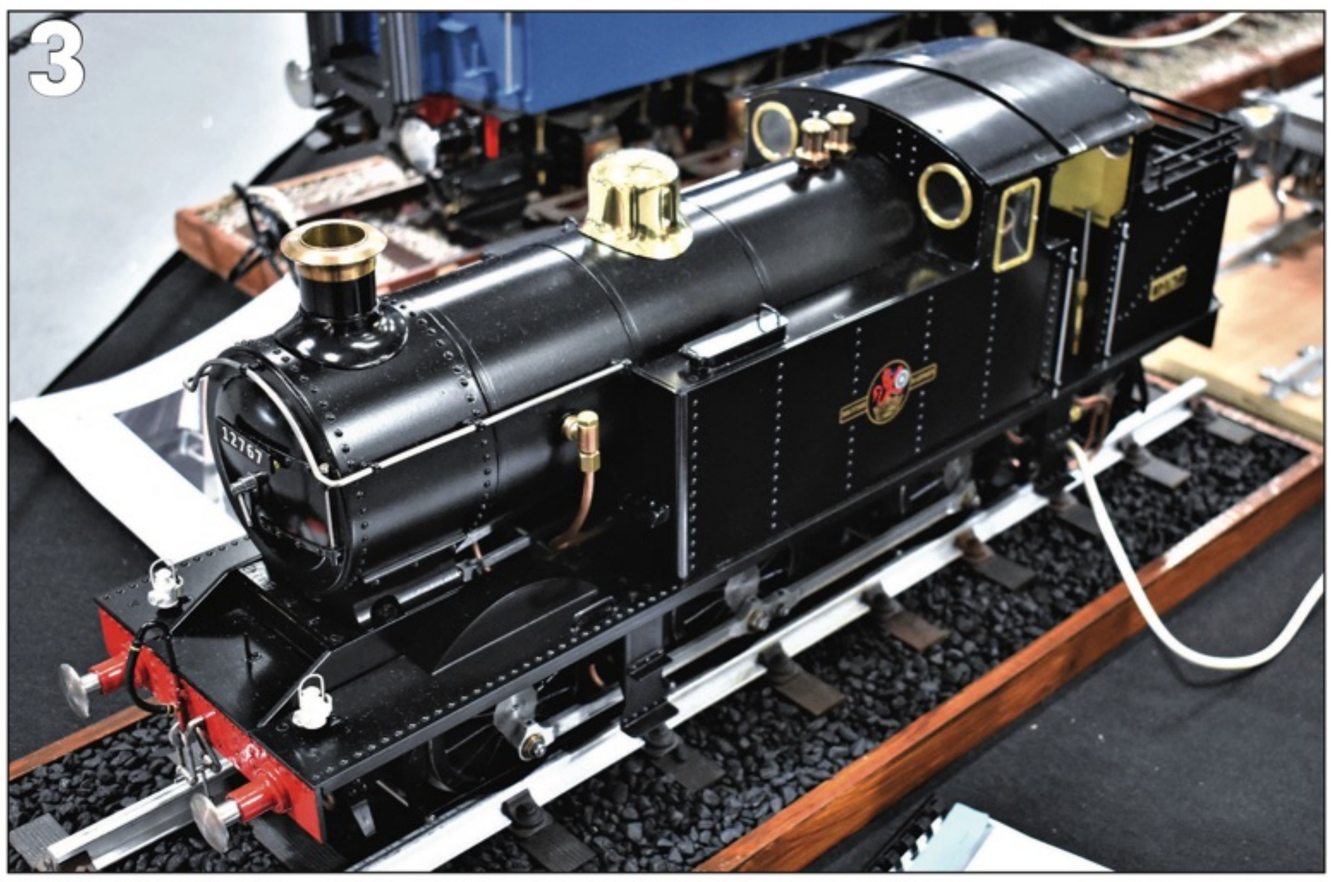


PHOTO 1: Outstanding Gauge 1 Italian Railways Consolidation loco built by Giancarlo Mastrini tookfFirst in Class 1.

PHOTO 2: Commended, David Viewing's L&NWR 4-2-0.

PHOTO 3: 'Mona' the 3½-inch gauge 0-6-0 built by Dave Lee was Very Highly Commended in Class 2....

PHOTO 4: ...as was Alasdair Milne's 7¼-inch gauge GNSR locomotive in class 3.

PHOTO 5: First in class 5, a large tandem D/A engine by Royce Limb.

PHOTO 6: Interesting 4-cylinder vacuum or flame-licker engine by Peter Wardle.

Competition Class 1: Locomotives up to and including Gauge 1

Three entries provided a good look into small-scale modelling. Our old friend Giancarlo Mastrini from Italy again took First with his Italian Consolidation 2-8-0 tender loco (**Photo 1**). Built to his usual exemplary standard it was a worthy winner.

Another regular contributor to this class is David Viewing and his L&NWR 4-2-0 loco was Commended (**Photo 2**). The third entry was a OO-gauge 0-4-0 Southern Railway class 14 shunter by David Bolton.

Competition Class 2: Locomotives 2½-inch and 3½-inch gauges

The only entry in this class was Dave Lee's 3½-inch gauge 0-6-0 locomotive to the LBSC design 'Mona' (**Photo 3**) gaining a Very Highly Commended certificate. Well made and finished it was a good example of the design.

Competition Class 3: Locomotives 5-inch - 7¼-inch gauges and above

Only one entry this year – Alasdair Milne's fine example of a GNSR 4-4-0 locomotive in 7¼-inch gauge (**Photo 4**) was Very Highly Commended.

Competition Class 4: Rolling Stock

One entry again in this class, from Dave Lee with his 5-inch gauge contractor's open coal wagon, gaining

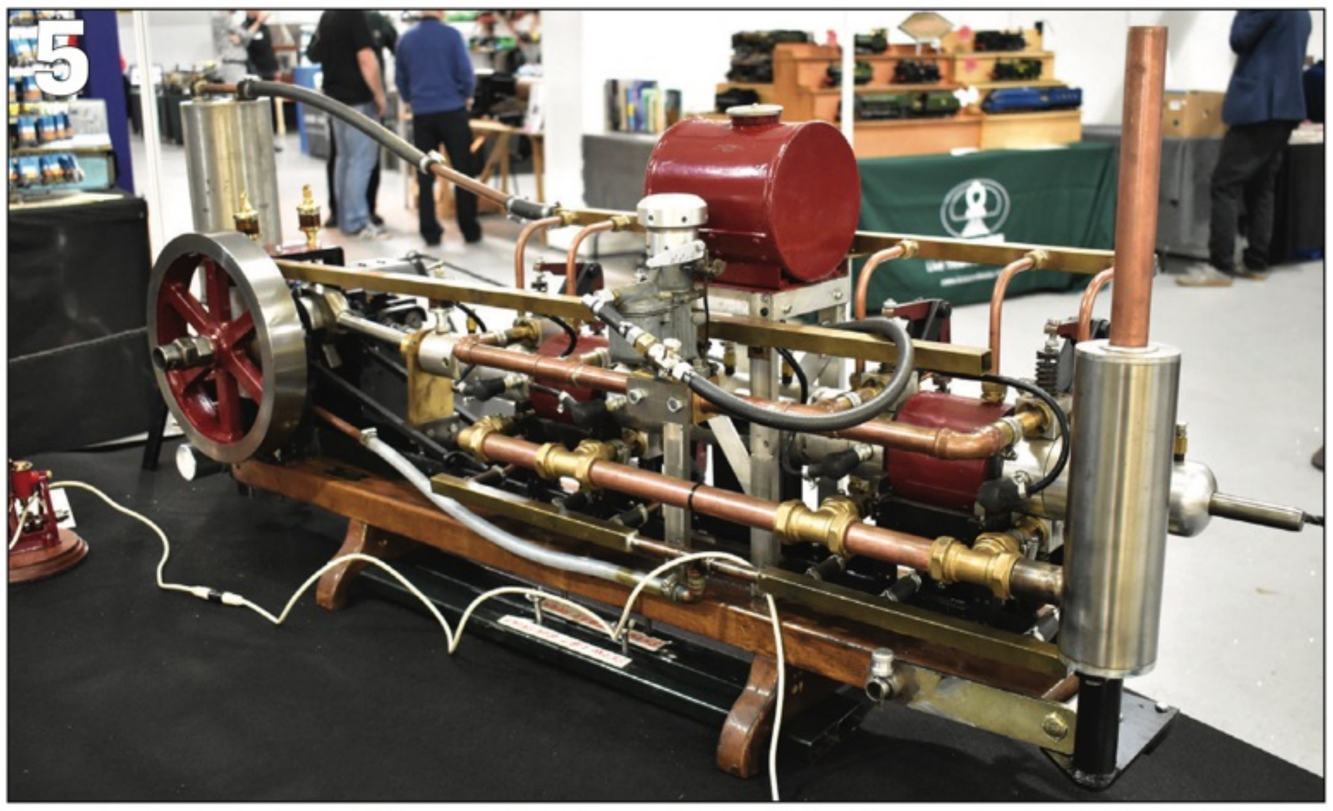


PHOTO 7: John Dickenson's superb Foden Type C steam lorry topped class 6.

PHOTO 8 Second in Class 6 Peter Lee's fine Savage 'Little Samson' tractor.

PHOTO 9: Mike Sayers' superb 4½-litre Blower Bentley engine and gearbox.

PHOTO 10: Second in class 8, a Mercedes D4F 60 hp aero engine circa 1909.

a Highly Commended certificate.

Competition Class 5: Stationary Engines

Five of the wide variety of engines in this class received an award. First prize, winning the Phoenix Precision Paints Trophy was Royce A. Limb with a tandem double-acting stationary engine (**Photo 5**). Largest in the class, it has a 2-inch stroke and 4-inch bore cylinders, giving around 900cc displacement. The fuel and air mix is handled by an ex-Austin A35 carburettor.

Second went to David Rhodes for his Duplex reversing stationary engine. He was also Very Highly Commended for his twin-cylinder A-frame stationary engine, while third prize was taken by Peter Wardle for a 4-cylinder vacuum or flame-licker engine (**Photo 6**), and John Wing was Very Highly Commended for his Trojan stationary steam engine.

Competition Class 6: Steam Road Vehicles.

Two top-quality models in this class made it a difficult choice for the judges. John Dickenson won the Staffordshire Joinery Cup with his 3-inch scale Foden C-type wagon with a van body (**Photo 7**) while Peter Lee gained second prize for his 4-inch Savage little steam tractor (**Photo 8**).

Competition Class 7: Machine tools and Workshop Equipment

Sadly there were no entries in this class despite there being some fine examples on various club stands.

Competition Class 8: Internal Combustion Engines

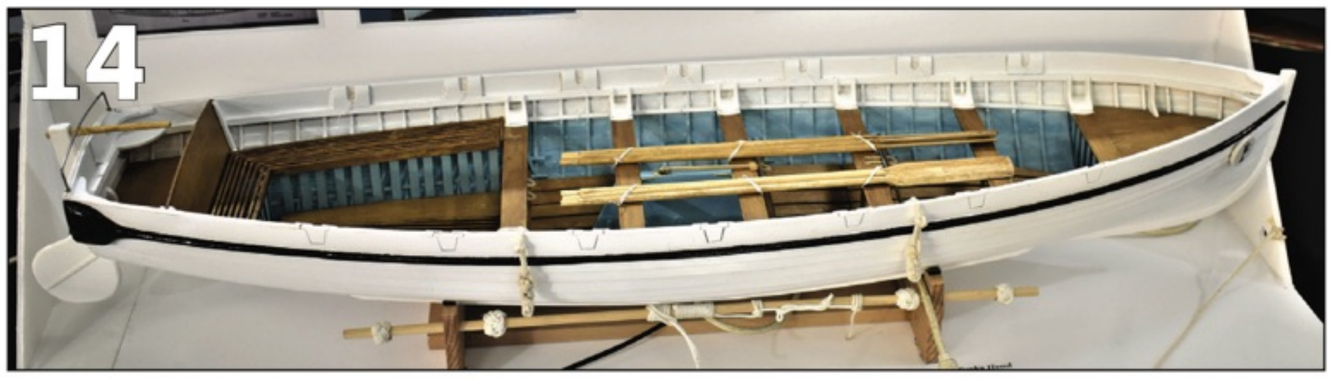
Two fine entries were greatly admired by fellow exhibitors and visitors. First Prize and winner of the Engineering in Miniature Trophy was Mike Sayers with his superb Birkin 4½-litre Blower Bentley engine and gearbox (**Photo 9**). Second went to Steve Gosling for an excellent little Mercedes D4F 60HP Aero Engine circa 1909 (**Photo 10**).

Competition Class 9: Horological, Scientific and Automata

Three excellent entries in this class provided one for each category which made for an interesting class. First

prize and winner of the Clockmaker Trophy was John Moorhouse with an exquisite example of Automata art. His small bird automata was housed in a small cello case, the cello-shaped exhibit like the musical instrument (**Photo 11**). It was in beautifully enamelled silver with 18ct gold strings, the twittering birds emerging from the back of the instrument when the bottom spike was gently depressed.

Mike Macey took second for his wooden mechanical mantle clock, skeleton style (**Photo 12**). All the gears and support work were hand-cut from suitable wood to produce an amazing piece of work. Third was taken by Nicholas Farr for a well-made basic Magnetic Compass (**Photo 13**).



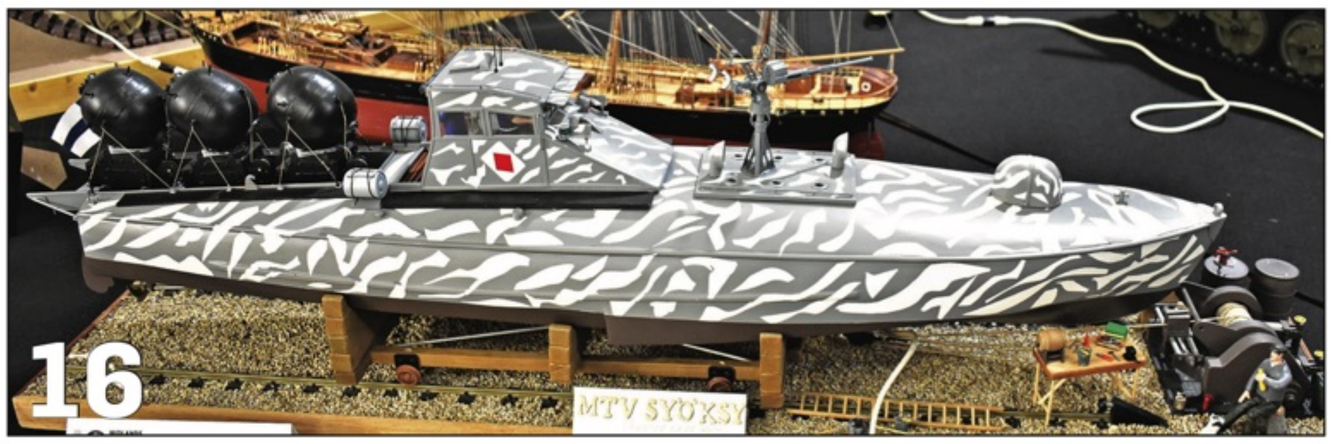


PHOTO 11: Small Bird Automata by John Moorhouse.

PHOTO 12: Mike Macey's all-wooden skeleton clock.

PHOTO 13: Basic magnetic compass by Nicholas Farr.

PHOTO 14: Roderick Milne's 1940s 32ft naval cutter.

PHOTO 15: Ray Farrow's Grimsby crab/ fishing boat was Commended.

PHOTO 16: A WWII Finnish Navy minelayer built by Michael Nicholson.

PHOTO 17: Watson class lifeboat built by Graham Farrow.

PHOTO 18: The Kent & East Sussex Railway wagonette built by Chris Biggs.

PHOTO 19: Also from Chris, this Waring & Gilling furniture van.

PHOTO 20: Monmouthshire Farm Wagon by Eric Keggans.

Competition Class 10: Marine Models - Scale (over 50 per cent scratch built)

All six entries were Commended in this class. Clive Dent provided his flat-bottom rowing skiff full-hull model, he also exhibited a little radio-control New England lobster fishing boat. Terence Orton had a nice four-masted barque-rigged steel-hulled sailing ship, while Roderick Milne showed his 32ft Naval cutter to a 1940s design (**Photo 14**). Ray Farrows' Grimsby crab/fishing boat showed some nice detail (**Photo 15**) as did the radio-control Second World War Finnish Navy minelayer built by Michael Nicholson (**Photo 16**).

Competition Class 11: Marine models – kit (standard or modified)

Just the one Commended model in this class, a Watson class lifeboat 'Lisa Jayne' by Graham Farrow (**Photo 17**).

Competition Class 12: Model horse-drawn vehicles.

Five good entries led to three prizes and two Very Highly Commended certificates. First and the Lenham Pottery Trophy went to Chris Biggs for his Kent & East Sussex Railway wagonette (**Photo 18**) . Chris also took second for his Waring & Gillow furniture van (**Photo 19**).

A Third went to Eric Keggans for his North Monmouthshire farm wagon (**Photo 20**). Very Highly Commended was Brian Young for his Kessler dump cart and Patrick Hall for his Hermaphrodite farm wagon which converts to a wheel tipper cart.

Competition Class 13: Scale Aircraft Models.

It was pleasing to have two excellent models in this class, both receiving worthy awards. First and winner of the

Variscale Cup was Nick Clark who had scratch built a ⅛th scale 1984 Westland Wessex Mk2 helicopter, complete with gas turbine engine. This well-finished model captured all the elements of the original (**Photo 21**).

In second was the ¼-scale Corsair F4U built by Anthony Hooper. This features a 250cc radial engine, 14 servos and a scale four-blade Biela propeller, its folding-wing mechanism hydraulically controlled by a specially designed motor system (**Photo 22**).

Competition Class 14: Young Engineers Award

This class once again had by far the largest entry of any in the competition section – really encouraging when you think just three or four years ago we had only two or three entries. Well done to all the young people who entered and to their clubs and mentors for continued support and guidance.

PHOTO 21: First Prize for Nick Clark's superb Westland Wessex Mk 2 Helicopter.

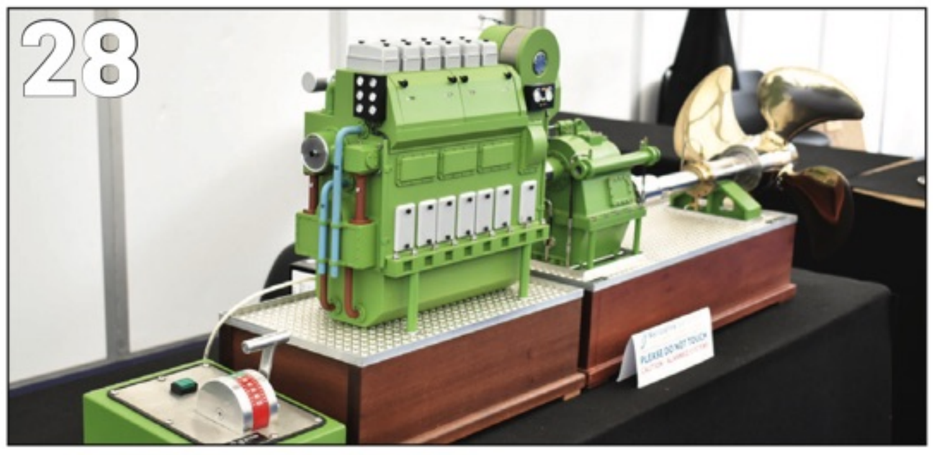
PHOTO 22: Folding-wing Corsair by Anthony Hooper.

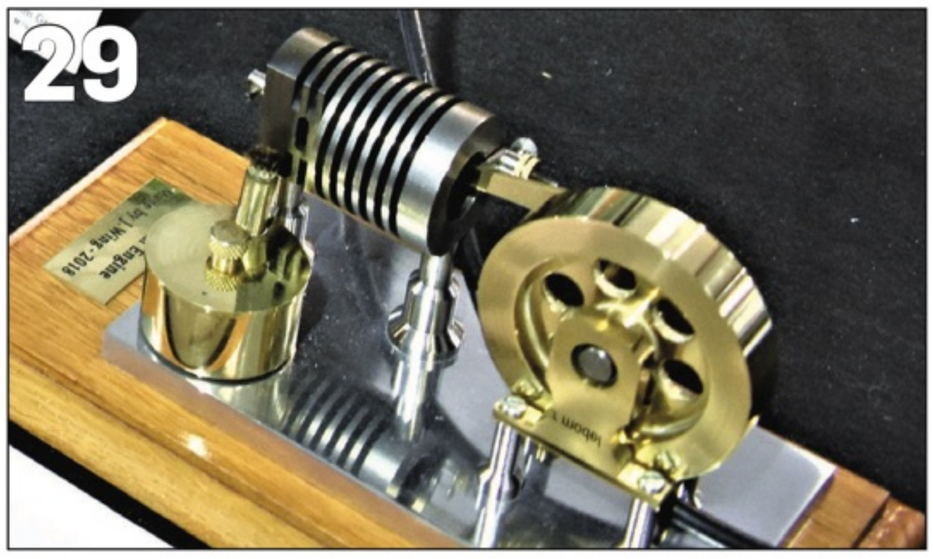
PHOTO 23, 24: 13-year old Rosemary Turner received a First prize from Exhibition Director Chris Deith for her elegant Chitty Chitty Bang Bang car.

The number and quality of models saw the judges decide that all entrants would receive acknowledgement for their efforts.

Winner of the First Prize and Stuart Models Shield was 13-year old Rosemary Turner with her very well-made Chitty Chitty Bang Bang car, fully radio controlled with some very delicate and difficult body panelling (**Photo 23, 24**).

Some seven second prizes were awarded. Luke Mason gained three of them and a Very Highly Commended certificate, Mathew Kenington also gained two Seconds while Lucas Hall and Zahra Webb gained one each. Three third prizes were presented to Archie Bell, Rubin Stannah and Ryan Philo and a Very Highly Commended ▶





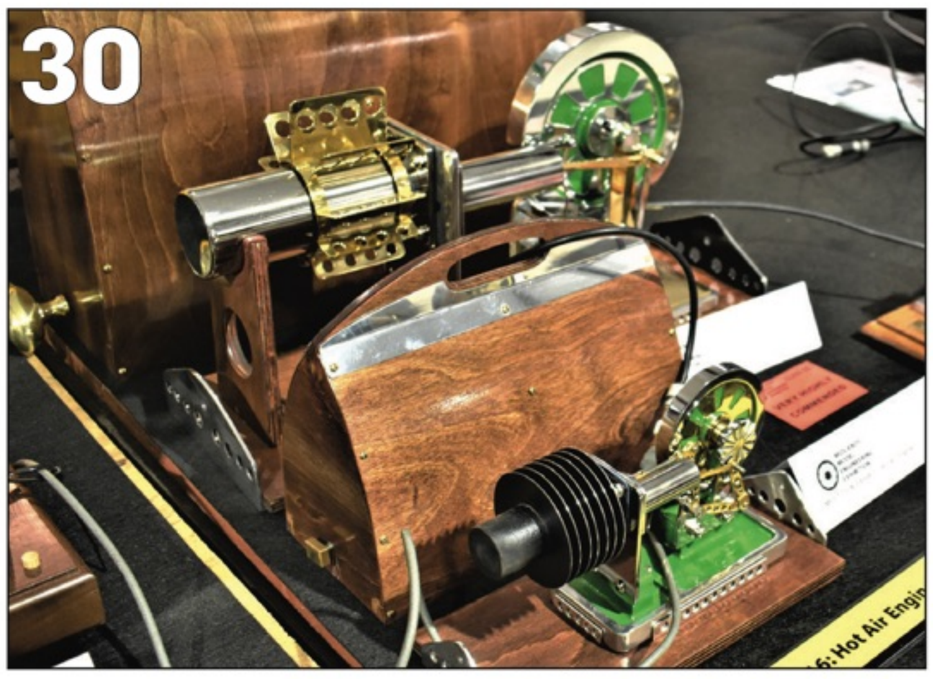


PHOTO 25: First in Class 15, Ian Bellamy's 1942 M4A3 Sherman tank. **PHOTO 26:** The smart 1912 Peugeot L76 Racing car from Brian Swann. **PHOTO 27:** Eric Keggan gained a Third with his 1942 WWII Grant tank. **PHOTO 28:** Ulstein reduction gearbox with variable pitch propeller & Bergen six-cylinder engine built by Frank McCafferty. **PHOTO 29:** This excellent Jan Ridders vacuum engine built by John Wing took first Prize in Class 16. **PHOTO 30:** A pair of hot-air engines and cases built by Malcolm Green. **PHOTO 31:** The Leonard Crane Steam Trophy was awarded to Ian Morris for his 6-inch scale Ruston Proctor SD Tractor. **PHOTO 32:** Winner of the Best Engine Management Skills Shield was Steve Lee with his 4-inch Foster 'Tracey Jayne.'

certificate went to Peter Allen. Everyone involved with the exhibition hopes that the high standard set this year will be maintained in future.

Competition Class 15 : Miscellaneous

This is one of the most difficult classes for the judges to decide with seven interesting exhibits. First Prize went to Ian Bellamy for an excellent 1942 Sherman M4A3 Tank complete with a 75mm recoiling gun. (**Photo 25**).

In second place was Brian Swann's superb little 1912 Peugeot L76 racing car, (**Photo 26**). Joint third prizes were awarded to Eric Keggans for a WWII Grant tank (**Photo 27**) which included a set of patterns for some of the components, and to Frank McCafferty for a well-made example of an Ulstein reduction gearbox with a variable-pitch propeller coupled to a Bergen 6-cylinder engine (**Photo 28**).

Very Highly Commended was Russell Taylor for his 1874 10-barrel Gatling gun on a wheeled carriage and Highly Commended certificates went to John Dickenson for an acetylene headlamp and to Martyn Shenton for his man on a bike pedalling and driving a grindstone.

Competition Class 16 : Hot-Air Engines

Three attractive entries in this section produced First Prize for the Jan Ridders vacuum engine built by John Wing (**Photo 29**). Two hot-air engines built by Malcolm Green both received Very Highly Commended certificates, both had elegant carrying cases to accompany them (**Photo 30**).

To finish off the awards, the Leonard Crane Trophy was presented this year to Ian Morris with his 6-inch scale Ruston Proctor SD tractor 'An Calliach' (**Photo 31**). The Fosseway Steamers always acknowledge one of their own for the Best Engine Management Skills and Steve Lee gained this accolade with his 4-inch scale Foster 'Tracey Jayne' (**Photo 32**.

The best society display is decided by all the entrants present and was this year presented to the Hereford Society of Model Engineers. In second place was the Melton Mowbray Society and there was a joint third place award to the Knightcote Model Boat Club and the Rugby Model Engineering Society. A lot of hard work went into all these entries.

Next month I will cover the clubs, displays and demonstrations. EIM

A Crate Idea

Peter and Matthew's novel idea for a riding truck water tank, starting with the inner tank.

BY **PETER & MATTHEW KENINGTON** – Part one of two

Matthew's most recent project at the Young Engineers' club at Hereford SME is a 5-inch gauge riding truck. The idea is that this truck will be adaptable to both ground and raised-level operation, whilst still being small and light enough to be pulled by a 3½-inch gauge 'Tich', of which he has an example for restoration. This is quite a challenge, as a Tich in 3½-inch gauge is not a powerful loco and Hereford's raised track is quite long.

As a part of this riding truck, we needed to make a water tank, in order to feed the injector on our main loco, a 5-inch gauge 'Super Simplex'. As the riding truck is based on a well-wagon style of rolling stock, the water tank will need to be carried on it somewhere, as there is no space underneath to mount a tank there.

We looked at the idea of using a standard soft-soldered brass tank, mounted on the rear section of the well-wagon, but felt that this would look a little utilitarian and not really in keeping with an item of rolling stock. We also priced up the brass tank option and it wasn't cheap, particularly given the relatively diminutive tank we had in mind. We thought there had to be a better solution and put on our (well-worn) thinking caps.

Matthew, our 3D-printing guru, suggested that we simply 3D-print a suitable size of tank and use that. I wasn't 100 per cent sure that such a tank would be strong enough, nor that it would be totally waterproof and it didn't really help with the 'utilitarian look' problem, but it did have the advantage of being cheap and simple to make (or so we thought). After all, once designed in CAD, how hard could it be to print a simple box? "Actually quite hard" was the eventual answer to that question, but we cracked it in the end (see below).

If in doubt, test it out...

Being great believers in the appliance of science, we decided to do some experiments, to check the permeability of a tank printed in the 3D staple material of PLA (Polylactic Acid) and to judge its strength. We assumed that the tank would be sufficiently far from the locomotive (and connected via a non-thermally conducting pipe) that the likelihood of it melting due to heat conduction or steam finding its way into the tank, was small. Even if such an eventuality did occur, due to a fault with the loco or injector, the worst-case scenario was that we would lose our injector supply and would need to print a new tank. Not a great disaster in the grand scheme of things (both locos have hand and axle pumps).

We set about printing a test-tank (**Photo 1**) and filled this with water. We then left it for about a week, regularly checking it for leaks – we found none, with the only water-loss being due to evaporation. We also undertook some empirical strength tests, in other words we squashed and squeezed it a bit to judge its resilience, using our carefully-calibrated fingers(!). It proved remarkably strong, even with a wall thickness of only 2mm, and easily strong enough to cope with reasonable mechanical shocks it may encounter in use (even without an outer casing) and the weight of water the full-sized tank would contain.

We concluded that we had a viable water-tank solution from a mechanical and aquatic perspective and one which met our budgetary aspirations (austerity-era pocket-money), so the final problem to solve was the aesthetic one. Firstly, however, we will discuss the printing of the full-size tank.

Grand Designs

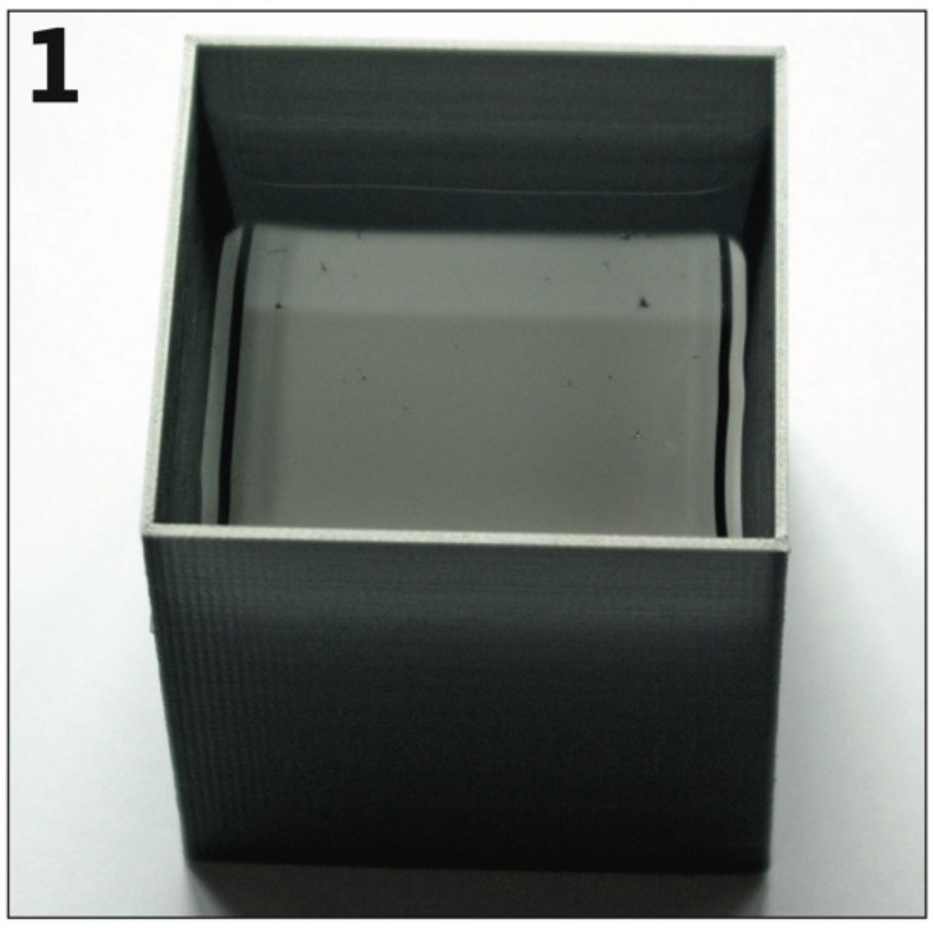
The dimensions of the riding truck water tank we made are given in **Figure 1** (for the main body of the tank) and **Figure 2** (for the lid). The tank is quite large in 3D-printing terms and stretched our Wanhao i3 Plus 3D-printer almost to its limits in two of its axes (X and Z).

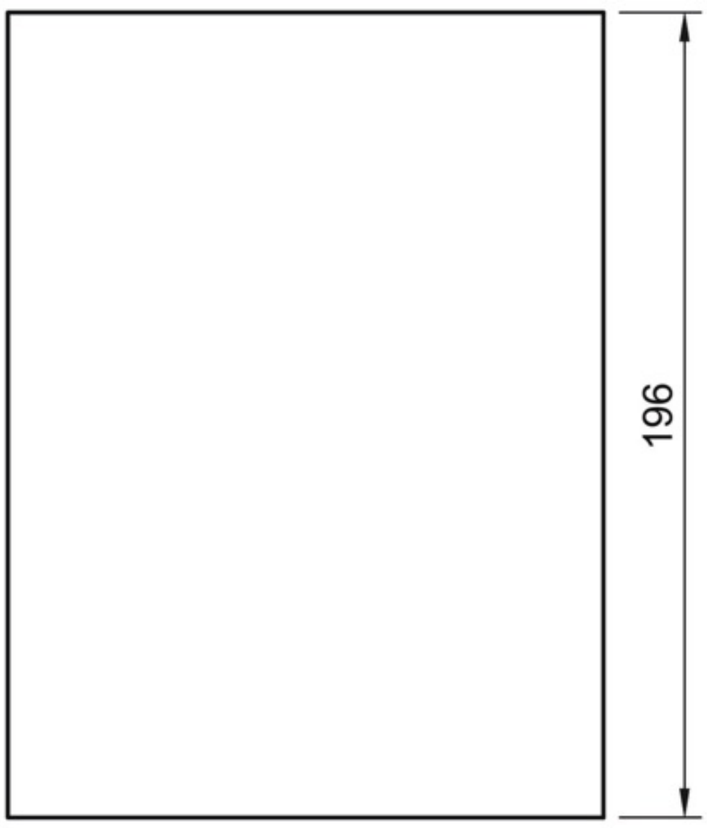
The printing parameters we used are given in **Table 1** and **Table 2** and are intended as a guide – if you have a different printer, then you may need to adapt these. **Photo 2** shows the main part of the box being printed – note the orientation of the box on the printer bed. Placing the base of the box on the bed eliminates the need for the printer to add 'support material' to the print, which can be awkward to remove later (and wastes printer filament).

A major problem we encountered with the printing process was bed adhesion – as its name suggests this is ▶

HEADING: The water-tank (on the left) in-situ on its completed riding truck – configured here for ground-level operation.

PHOTO 1: PLA test tank filled with water. Dimensions are: 50 x 50 x 50 x 2mm.





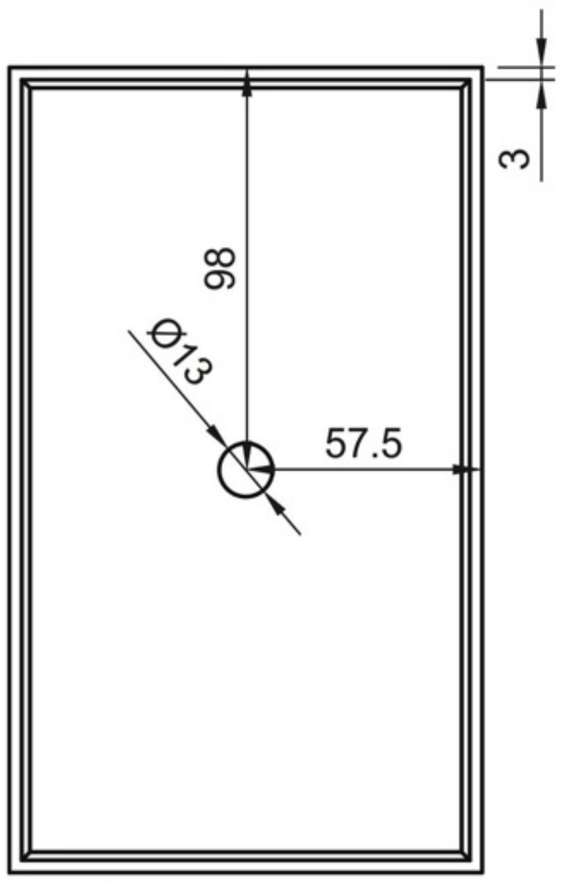


FIGURE 1 One-third full size
(For full-size enlarge 300%)

the process of persuading the printing material (PLA in this case) to stick to the print bed sufficiently well that it doesn't move during printing (a goal which is relatively easy to achieve) and doesn't warp (this is the more challenging part). Given that we are planning to encase our 3D printed tank in an aesthetically appropriate outer (discussed in Part 2), a little warping doesn't matter too much, so long as the printed box will still fit neatly in its wooden casing, but we still wanted to crack the problem.

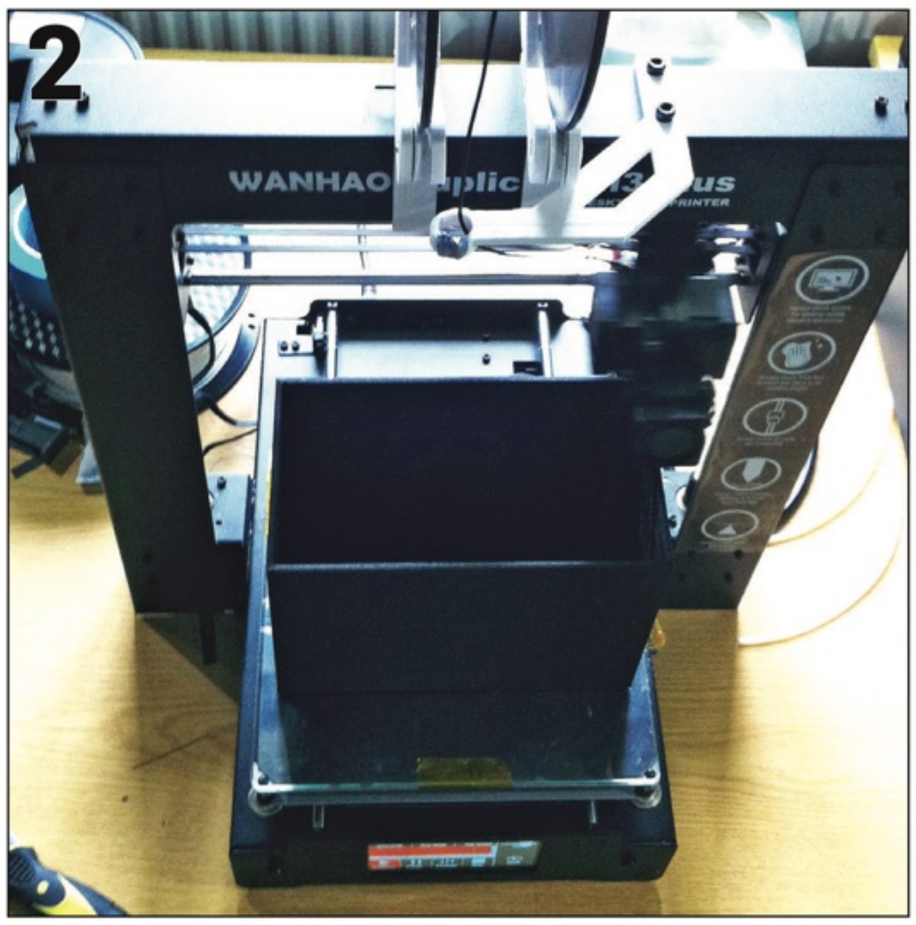
We have used a variety of mat types, coating tapes and the like, in the past, with good success for smaller printed items, however the sheer size of this box gave us a few headaches.

Our solution was to go for a glass build-plate and print directly onto this (i.e. with no tape or other covering). The primary reason why this worked was simply that it is very flat. The standard aluminium bed-plate which came with the printer is slightly warped – not a problem with smaller prints, but a huge issue with a print this large. One day it will be removed and given a little re-education on a milling machine, but that day has not yet arrived.

Glass build plates are widely available for most, if not all 3D printers, and use a special type of glass (borosilicate) to cope with the heat. One advantage of the use of a glass build plate is that the surface finish – of the printed surface which adheres to the glass – is very impressive! Photo 3 doesn't really do this justice, with Photo 4 providing a slightly better impression, although even this doesn't convey the smooth, glass-like, finish obtained. This is, of course, slightly academic, as we will be entirely encasing the 3D printed box in a wooden outer; it is, however, a useful fact to squirrel away for another day and another project when it may become important.

Note that the printing of such a large item as this takes a long time – in the region of 24 hours of continuous printing – and those of us in rural areas might want to consider the use of an uninterruptible power supply (UPS) attached to the printer; we speak from painful experience here…

Note too that printing from a memory card, rather than directly from a

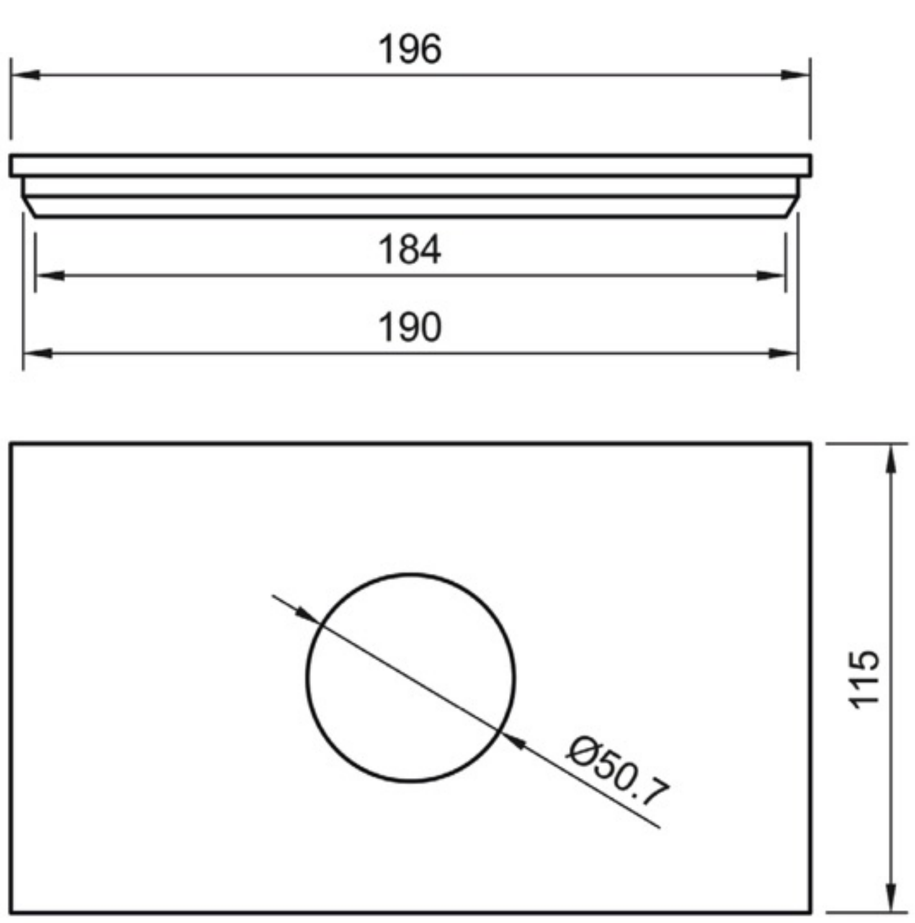


Quality		
Layer Height	0.15	mm
Initial Layer Height	0.15	mm
Line Width	0.4	mm
Wall Line Width	0.4	mm
Outer Wall Line Width	0.4	mm
Inner Wall(s) Line Width	0.4	mm
Top/Bottom Line Width	0.4	mm
Infill Line Width	0.4	mm
Shell		
Wall Thickness	3	mm
Wall Line Count	7	
Outer Wall Wipe Distance	0.2	mm
Top/Bottom Thickness	0.8	mm
Top Thickness	1.6	mm
Top Layers	11	
Bottom Thickness	1.6	mm
Bottom Layers	11	
Top/Bottom Pattern	Lines	
Bottom Pattern Initial Layer	Lines	
Top/Bottom Line Directions	[]	
Outer Wall Inset	0	mm
Outer Before Inner Walls	☐	
Alternate Extra Wall	☐	
Compensate Wall Overlaps	☑	
Compensate Outer Wall Overlaps	☑	
Compensate Inner Wall Overlaps	☑	
Fill Gaps Between Walls	Everywhere	
Horizontal Expansion	0	mm
Initial Layer Horizontal Expansion	0	mm
Z Seam Alignment	Shortest	

TABLE 1 (ABOVE): Print settings used on the Wanhao i3 Plus 3D printer – part 1

TABLE 2 (BELOW): Print settings, part 2

Infill		
Infill Density	10	%
Infill Line Distance	8.0	mm
Infill Pattern	Grid	
Infill Line Directions	[]	
Gradual Infill Steps	0	
Material		
Printing Temperature	200	°C
Build Plate Temperature	60	°C
Diameter	1.75	mm
Flow	100	%
Enable Retraction	☑	
Speed		
Print Speed	100	mm/s
Infill Speed	100	mm/s
Wall Speed	50.0	mm/s
Outer Wall Speed	50.0	mm/s
Inner Wall Speed	100.0	mm/s
Top/Bottom Speed	50.0	mm/s
Travel Speed	150	mm/s
Initial Layer Speed	50.0	mm/s



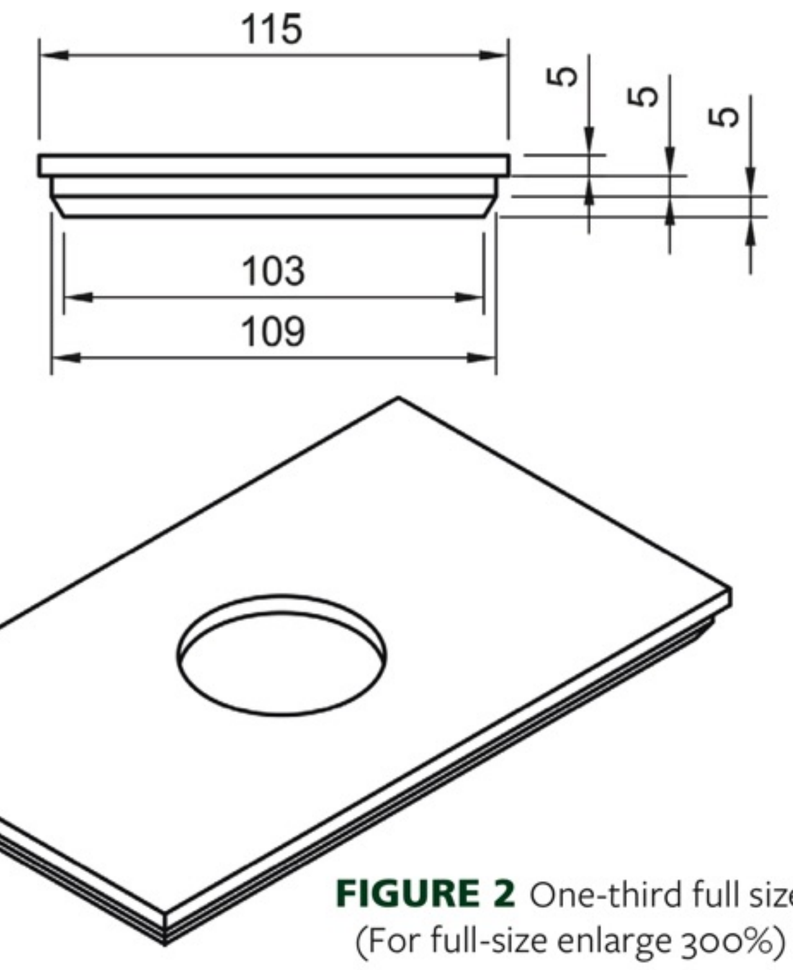


FIGURE 1: Water tank inner main box (for 3D printing) – all dimensions in mm.

FIGURE 2: Tank inner lid – all dimensions in mm.

FIGURE 2 One-third full size
(For full-size enlarge 300%)

PHOTO 2: 3D printing of tank body almost complete. Note orientation of part on bed (to avoid need to print 'support material') and use of glass build-plate. Filament is Wanhao's own-brand PLA, good quality and fairly inexpensive but not easy to get; ours came from Germany!

PHOTO 3: 3D-printed water-tank and lid. Lid designed to be tight fit and should be virtually water-tight once fitted – it will need a push to fit (bevelled rim on lid aids this). It can be removed for internal cleaning by carefully pulling (both hands) on circular aperture.

PHOTO 4: Assembled 3D printed tank.

PHOTO 5: Prefabricated mesh filter, as first supplied.

PHOTO 6: 3D-printed lid (and tank) in-situ – casing will be described in next part. Note smooth finish – this (upper) surface was in contact with glass build-plate when printed (i.e. it was inverted when printed).

PC, saves the need to keep the PC powered up and running for such a long period. Windows updates and their associated re-starts have a habit of being scheduled at just the wrong time (we avoided this one as we always print from an SD card).

Photo 3 shows the printed box and its lid, attached in Photo 4. The approximately ½-inch hole in the base is there to accommodate the hose connector, in this case a commercial ¼-inch BSP hose tail intended to connect to some flexible plastic pipe.

Filtering the water

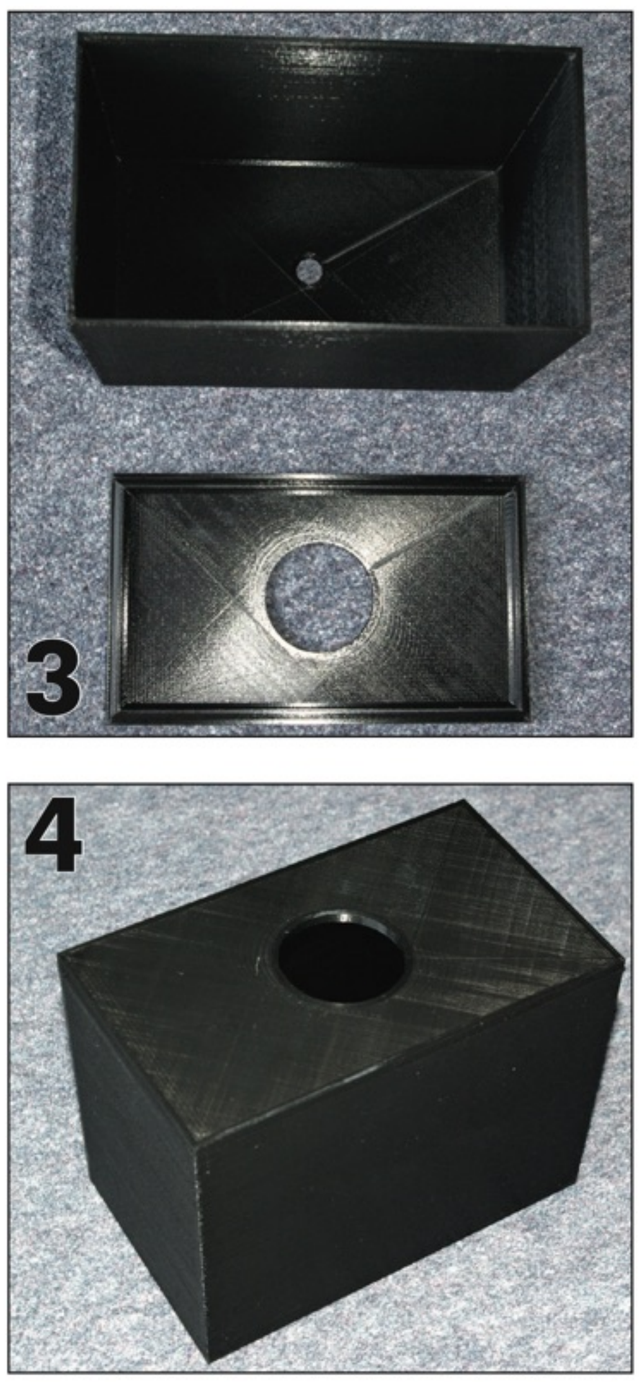
The larger hole in the lid is designed to accommodate a prefabricated mesh filter of nominally 48mm diameter (Photo 5), obtained from eBay for a few pounds (try searching for 'stainless steel lab standard test sieve').

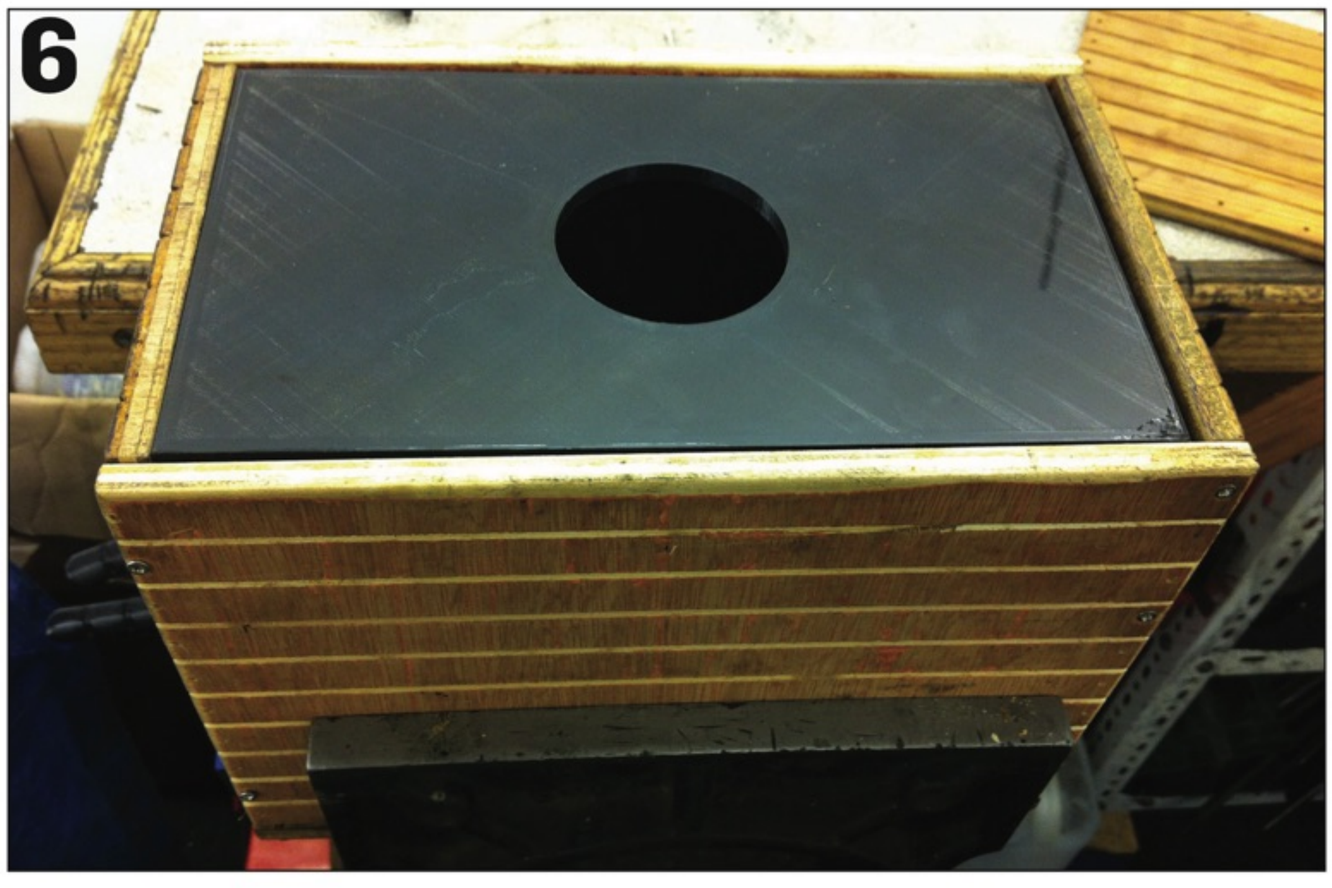
A muslin cloth filter will be added to this prior to use (the kind of cloth used to wrap around pudding basins when making suet puddings; thanks go to Mrs Kenington for sacrificing some in the cause of boiler and injector cleanliness). It is not necessary to glue this stainless steel mesh filter into the tank lid and not doing so will make it much easier to remove for cleaning (without needing to remove the entire lid – a little more painful once the wooden outer is in place).

At this point, it is probably a good idea to test the aquatic integrity of the printed box. To do this, carefully place a bung in the hole at the bottom and fill with water. It doesn't matter if the bunged hole leaks slightly – better this than using too much force and destroying the base of your printed box! Check for leaks and, if all is well, then move on to the next step.

Finally, you can attach the lid and check that it fits snugly, but not too snugly. The first time you attach and detach it, it should require a fair amount of force, with the bevels on the lid helping to centre it and force any warping of the sides to straighten. The print will have a degree of surface roughness which will depend upon the print quality obtained from the printer; this will gradually be smoothed around the lid interface once it has been fitted and removed a couple of times. This lid will remain a tight fit, however, and should be almost completely water-tight without the need for gluing or a gasket; it will only need to cope with 'sloshing' water and so doesn't need to be perfect.

The next part will describe the design of the wooden 'crate' outer (Photo 6) and assembly of the completed tank. EIM





Making GWR plates

John describes his techniques for producing that essential finishing touch to a model.

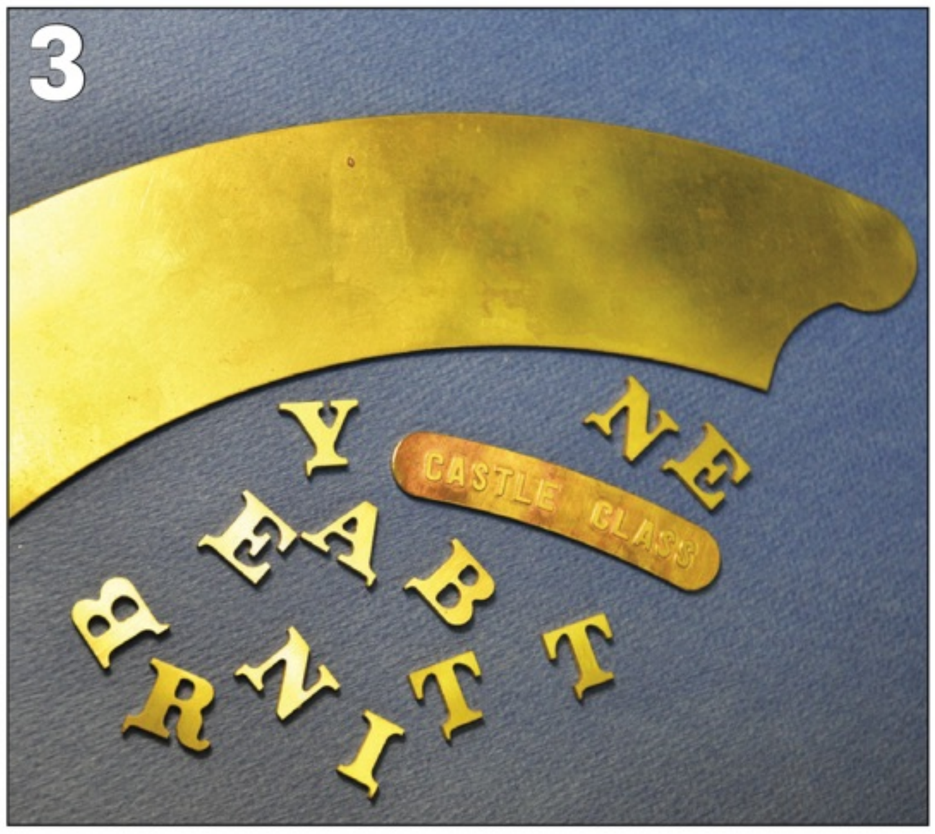
BY **JOHN SMITH**

I always seem to start these tips with a confession. This month's confession is that, whilst I have made two full-sized GWR nameplates, one using cast letters (**Photo 1**) and one using wire-eroded letters (**Photo 2**), I have never made a model nameplate. However, I can see two approaches working well.

The first approach would use a laser-cut or waterjet-cut brass back-plate with laser-cut or waterjet-cut letters (**Photo 3**) riveted on using 1/32-inch diameter copper rivets in all the right places for that authentic Swindon look. This is where my DraftSight drawing of GWR nameplate letters comes in handy.

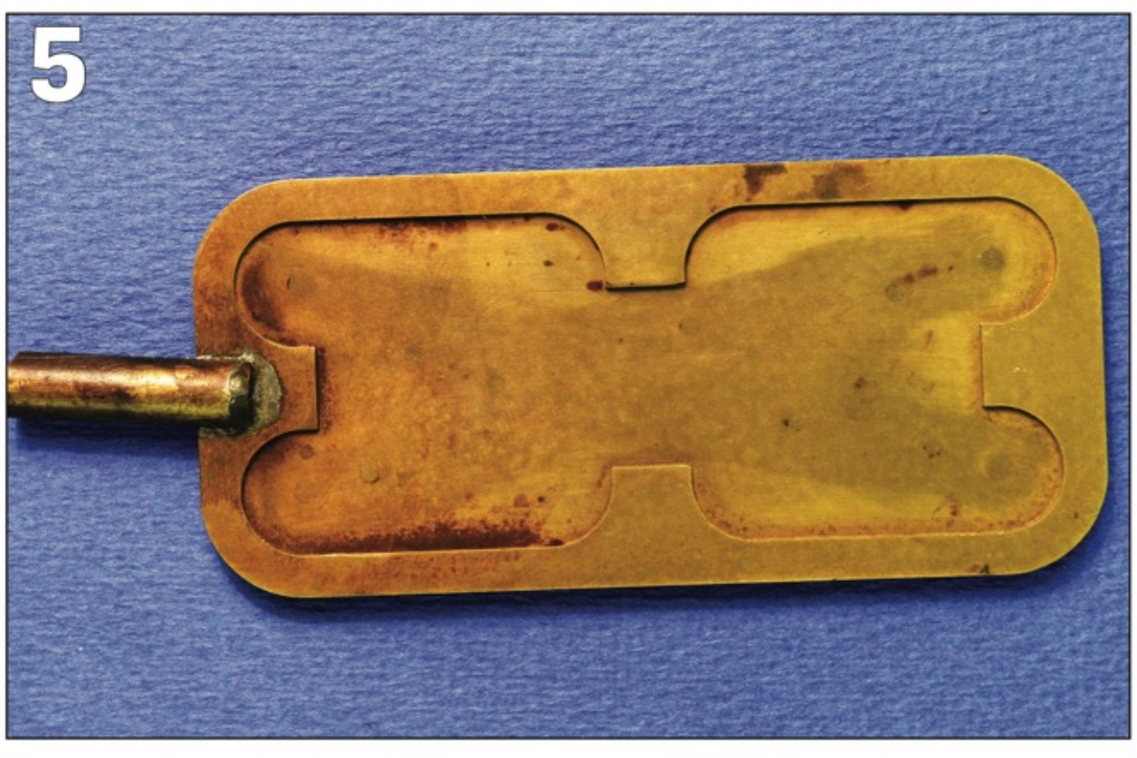
The second approach, and the one that I would use (to avoid the tricky task of making and applying the brass beading around the back-plate) would be to machine the back-plates from solid brass, using a corner-rounding cutter to machine the 'beading'. This is a job for the rotary table. Once again, I would rivet laser-cut or waterjet-cut letters to the back-plates. There are only two to make, so I would not make a lost-wax pattern, but you might choose to do so. A nameplate (or pattern) with attached letters has far more depth and authenticity than an etched plate.

All photos and drawings by the author – for details see text.



Cabside plates are another story. I have made a few of these, in 3½-inch gauge, 5-inch gauge and 7¼-inch gauge. To be precise, I have made the brass investment casting patterns for the plates. **Photos 4** and **5** show respectively the front and reverse of a pattern for a cabside for a 7¼-inch gauge Castle class loco and **Photo 6** shows some 7¼-inch gauge cabside castings. It is not strictly necessary to machine the depression in the rear of the pattern, but perhaps it helps the castings to sit flat against the side of the cab.

The pattern must be made five per cent over scale to allow for shrinkage of both the wax and the brass casting. Clearly the numbers must also be five



per cent over scale, not a problem when using a digital drawing package such as DraftSight. **Drawing 1** is a DraftSight drawing of a full-sized Great Western Railway cabside plate, including the full range of the numbers. The drawing was produced by measuring a few cabside plates and by taking tracings of the numbers, no official Swindon drawing having come to light.

The back-plate is a simple milling job but you will need to select the end mill for milling the depression on the front which will produce the correct radius at the corners. Similarly, you will need to purchase an appropriate corner-rounding cutter to achieve the correct outer profile.

The numbers can be laser-cut or waterjet-cut. I used laser-cut numbers, but some laser cutters do not like working with brass as thick as 0.048-inch or 1/16-inch as high power is needed and the high reflectance of brass sheet can damage the laser.

Reusable patterns

When I made my first pattern, my cunning plan was to make it so that it could be re-used, with different numbers. I riveted the numbers to the backplate and sent the pattern to the moulder. He produced a mould which worked well but later told me that he had found great difficulty removing the pattern from the mould due to the rubber creeping behind the numbers.

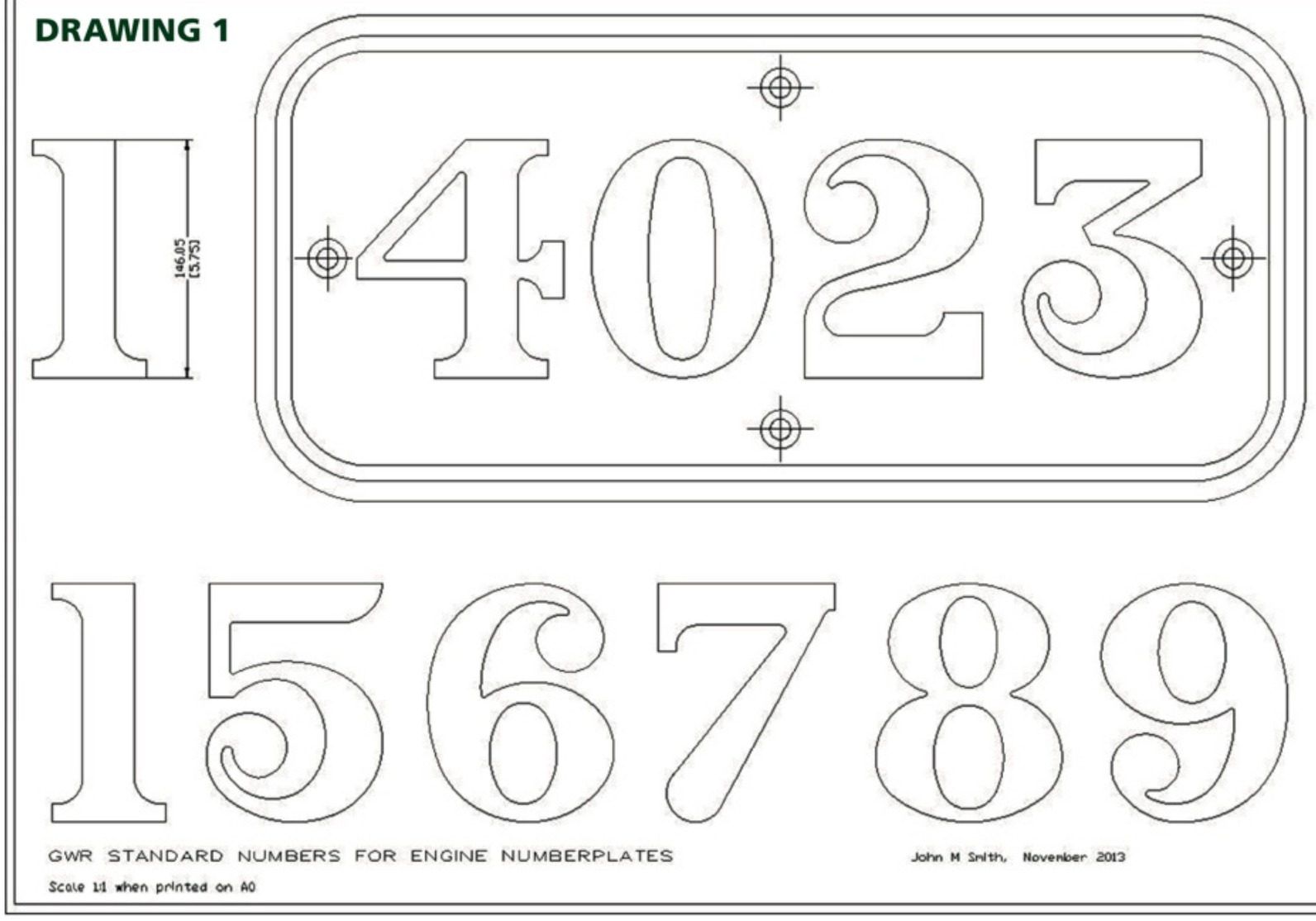
For my next pattern I used rivets and Loctite but there were still problems. So, it is better to solder the numbers to the back-plate and forget about reusability. I would personally always put a couple of rivets in each number to ensure that they don't move during soldering, and I would use silver solder rather than high melting point soft solder, which I don't find terribly easy to use. The moulder will be able to add a sprue to your pattern, but it's better if you do it (before applying Milliput fillets) as the heat of soldering can damage the fillets.

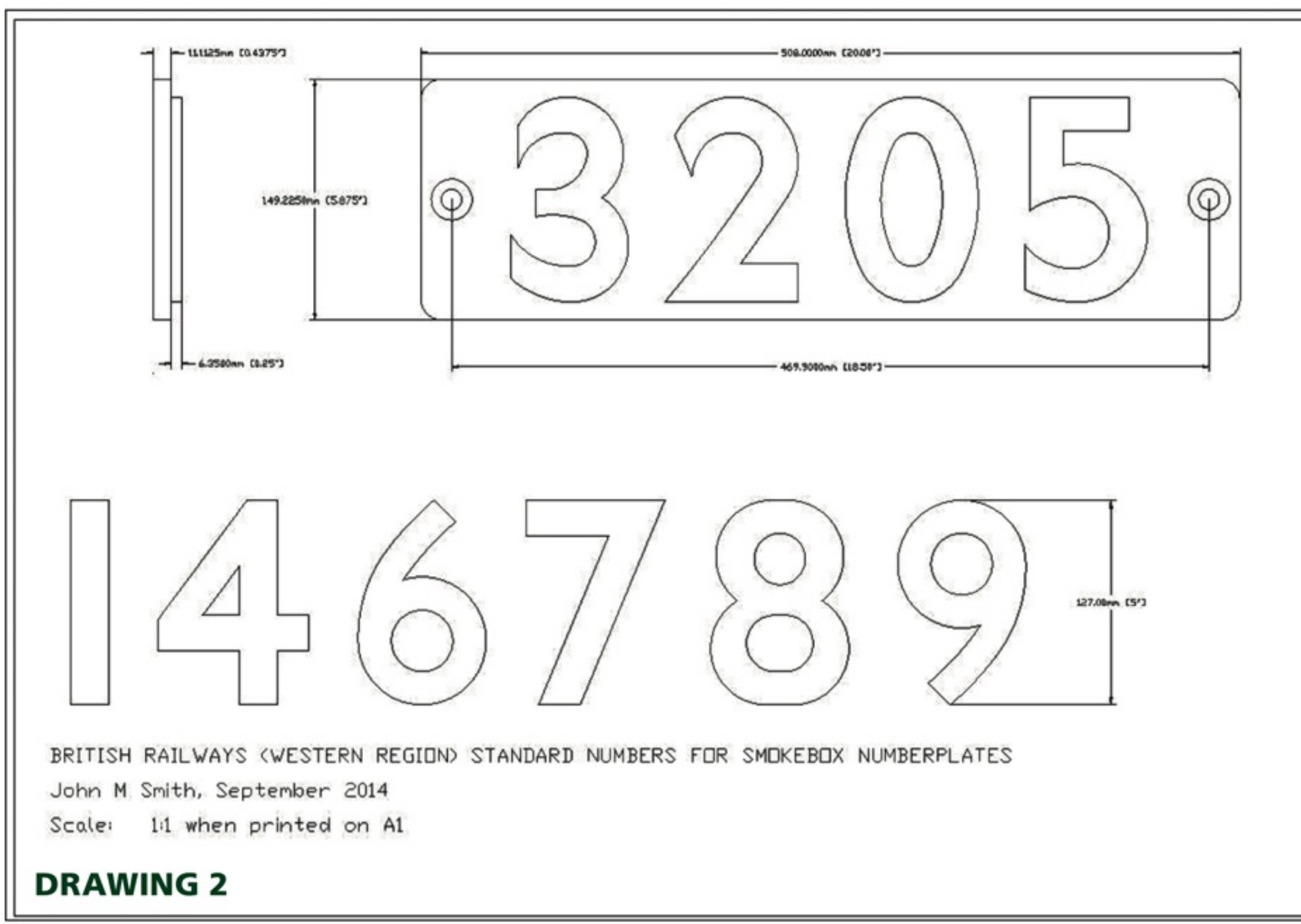
I can recommend Richard Henshaw of Priory Cast Products, Unit 14, Langston Priory Workshops, Station Road, Kingham - near Chipping Norton, Oxfordshire, OX7 6UP. Richard made most of the moulds for me and produced all of the castings. The end result is totally authentic, it being possible to purchase slotless countersunk brass screws (EKP Supplies) to attach the plates to the sides of the cab.

To complete the picture for BR-era locomotives, **Drawing 2** shows a full-sized Western Region smokebox numberplate, complete with the full range of numbers. Pete Thomas of Polly Model Engineering used this drawing to machine a smokebox numberplate using a numerically-controlled milling machine for the award-winning Collett Goods constructed by David Aitken and himself – which, I am delighted to report, carries a pair of cabsides cast from one of my patterns.

I would personally make the smokebox plate from solid brass with laser-cut or waterjet-cut numbers riveted on. There is no point making a pattern, as you only need one plate. So just make one to exact scale. If you need a copy of my drawings, just email the Editor and I'll send you the drawings you need. Finally, I should probably say that "other railway companies are available". (I'm afraid I just have the letters G R E A T W E S T E R N running through me like a stick of rock!). EIM

DRAWING 1





DRAWING 2

Scamp – minimal fun...

Not everyone has the time or inclination to build a locomotive from scratch and so a kit build can provide a lot of fun, as Dave discovered when constructing one of the most popular...

BY **DAVE BILLMORE**

Minimal is defined as genuine 12-inch to the foot narrow gauge (as opposed to a miniature of something else), in other words a tiny railway that does a real job of work, however modest, but on gauges less than Heywood's 15-inch. Likely gauges are thus 12¼-inch, 10¼-inch, 7¼-inch and similar.

The example heading this feature demosntrates the concept, my loco and wagons hard at work moving timber from a dead tree from the orchard to storage, with my son Harry, EIM's technical editor, driving.

This definition gave rise to a number of loco designs by various people. One of the most successful, with 72 built or in building at the time of writing, has been 'Scamp', designed as a kit by Colin Edmondson and available in kit-form or as complete locos from CMD Engineering (www.miniature-trains.co.uk).

Scamp is a four-wheeled petrol-electric 7¼-inch gauge locomotive with a Loncin or similar mower engine providing power and a pair of matched 800w DC motors, one used as a generator and one as a motor.

RIGHT: Harry Billmore at the controls of Dave's Scamp, working on logging trains in the garden.

BELOW: The Scamp that Dave built is finished in the form of a Lister.

BOTTOM: Other options include this traditional Scamp form with armchair...

BOTTOM RIGHT: ...while this is styled in Orenstein & Koppel form.

Photos by the author

According to the website the kit is designed as bolt together sub-assemblies, needing only basic workshop tools to build. I was greatly intrigued by the possibilities of this design, and duly ordered a kit of laser-cut parts.

My Scamp, the 14th example, was the first of the production bolted versions – previous kits had to be welded and took longer to assemble. With the laser parts come instructions and a list of items required to finish the loco, all of which which are available on eBay. The design also allows some customisation and I decided to finish my machine as a Lister Autotruck lookalike, simply because I like the prototype.

I should add at this point that the author has no connection with either the designer or manufacturer except as a very satisfied customer.

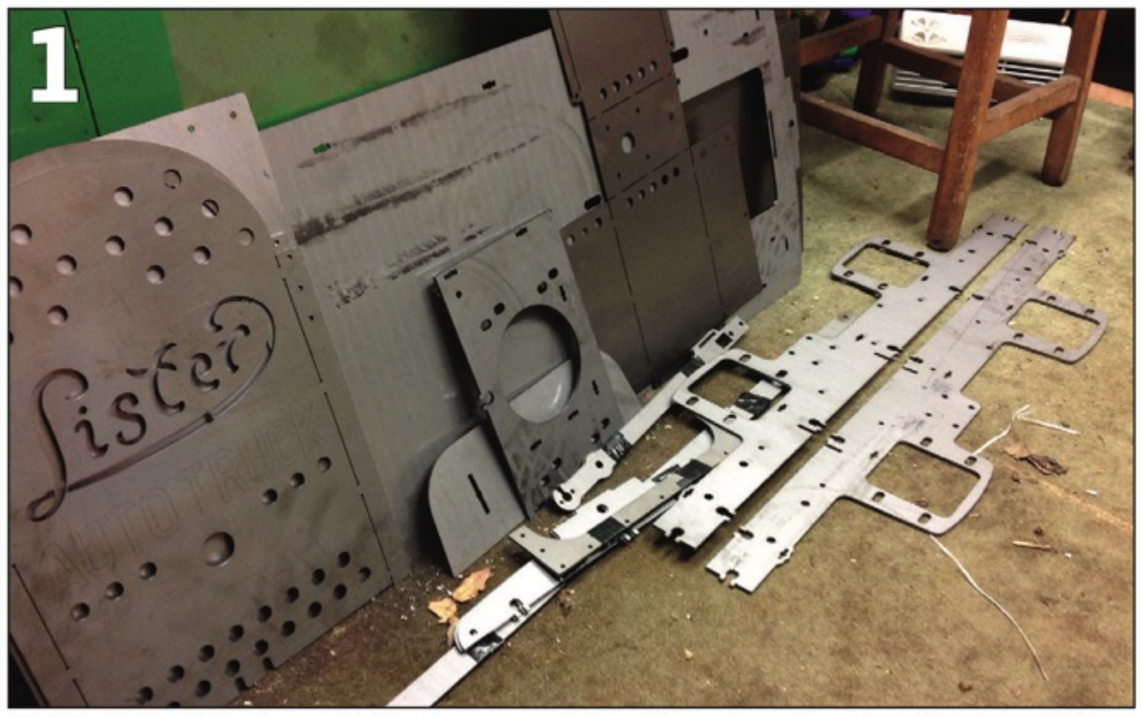


PHOTO 1: The beautifully laser-cut kit as it arrives is an inspiration. Full instructions are included.

PHOTO 2: To go with the kit, piles of eBay purchases in the workshop awaiting unpacking and assembly

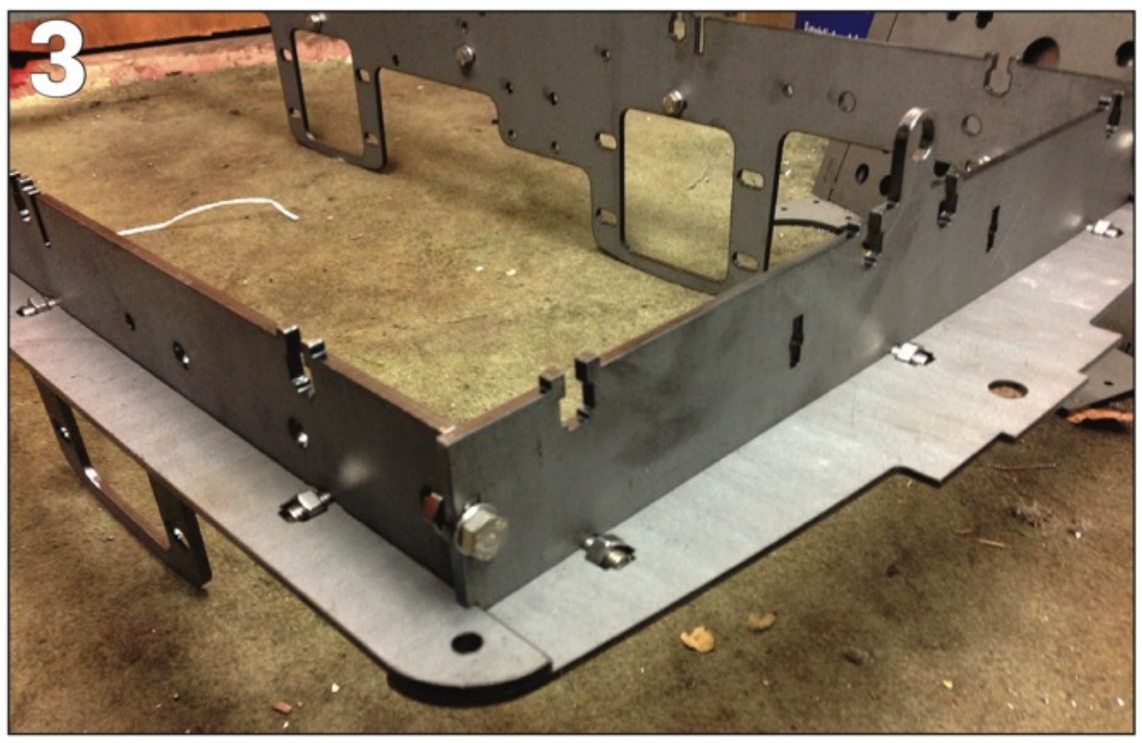


PHOTO 3: Cleverly designed bolted connections between the various laser cut components ensure that with an electric screwdriver and appropriate sockets assembly is very rapid.

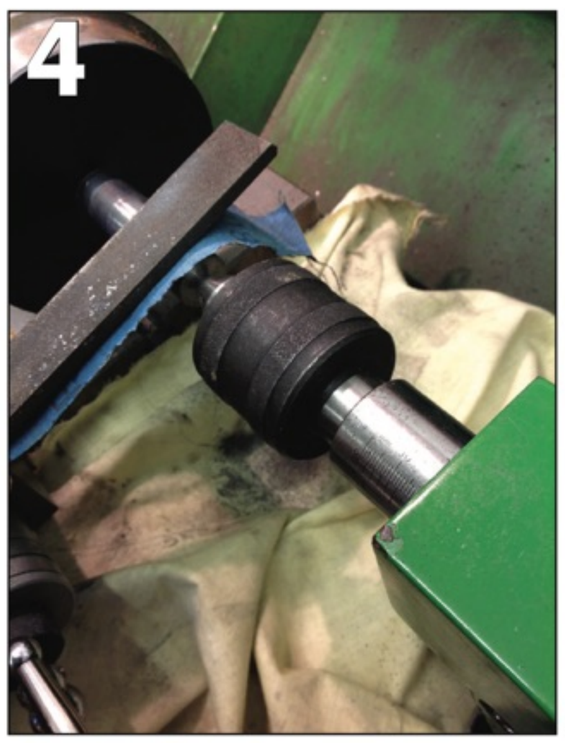


PHOTO 4: Here the axle ends are being polished up with Emery paper to persuade the bearings on.

PHOTO 5: Almost there – wheel with its axle almost fitting nice and snugly into the bearing.

PHOTO 6: Assembling Hornguides and axleboxes from the laser-cut parts, note the rubber suspension units, these have come straight from China.

PHOTO 7: It's not all screwdriver work! Here Harry is about to weld the wheels to the axles. A Jubilee clip was used to support each wheel at the correct distance from the axle end.

PHOTO 8: Turning one of the two supplied blanks to make up the drive pulley.

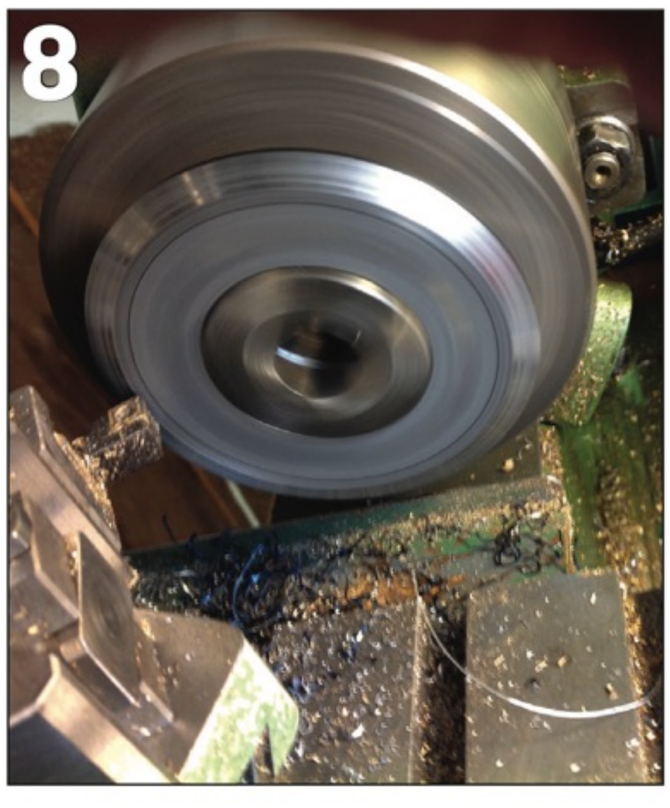


PHOTO 9: The completed drve pulley ready for fitting.

PHOTO 10: Marking-out blue on the layshaft ensures correct positions for sprockets are marked before welding. Jubilee clips hold everything in the correct place temporarily.

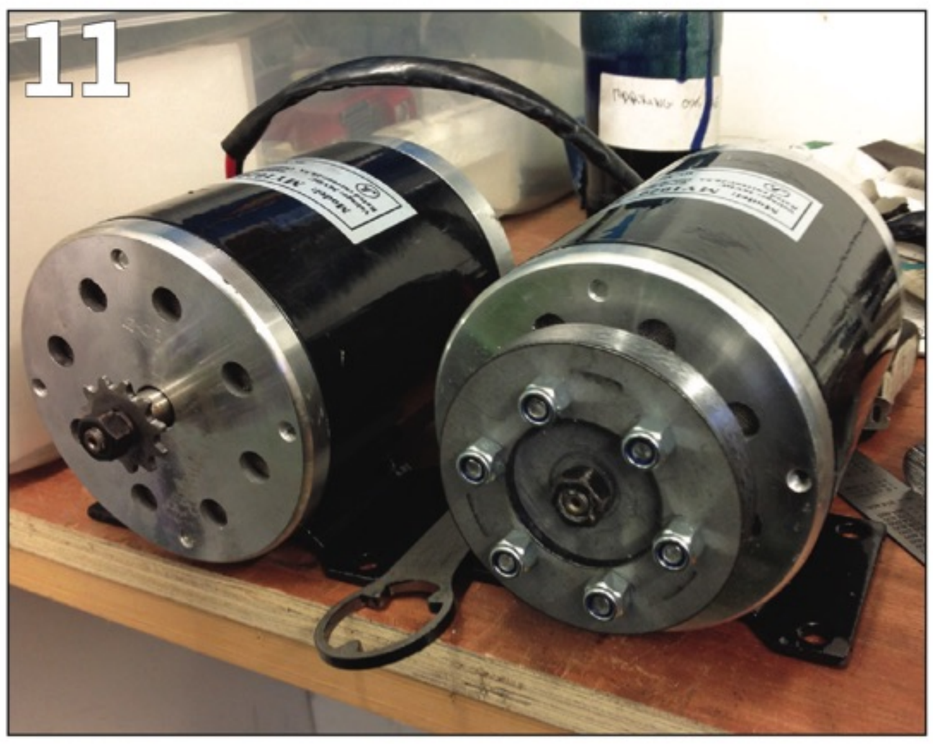


PHOTO 11: Motor at left with chain drive sprocket for layshaft, generator right, pulley attached for drive from motor. Two are identical apart from sprocket and pulley, with no danger of electrical overloading in system.

PHOTO 12: Motor/generator mount. This piece of very cleverly engineered laser cutting can be assembled completely the wrong way round if you are not paying attention, don't ask me how I know this! Luckily as it was bolted, not the the original welded version I could take it apart easily to correct the error.

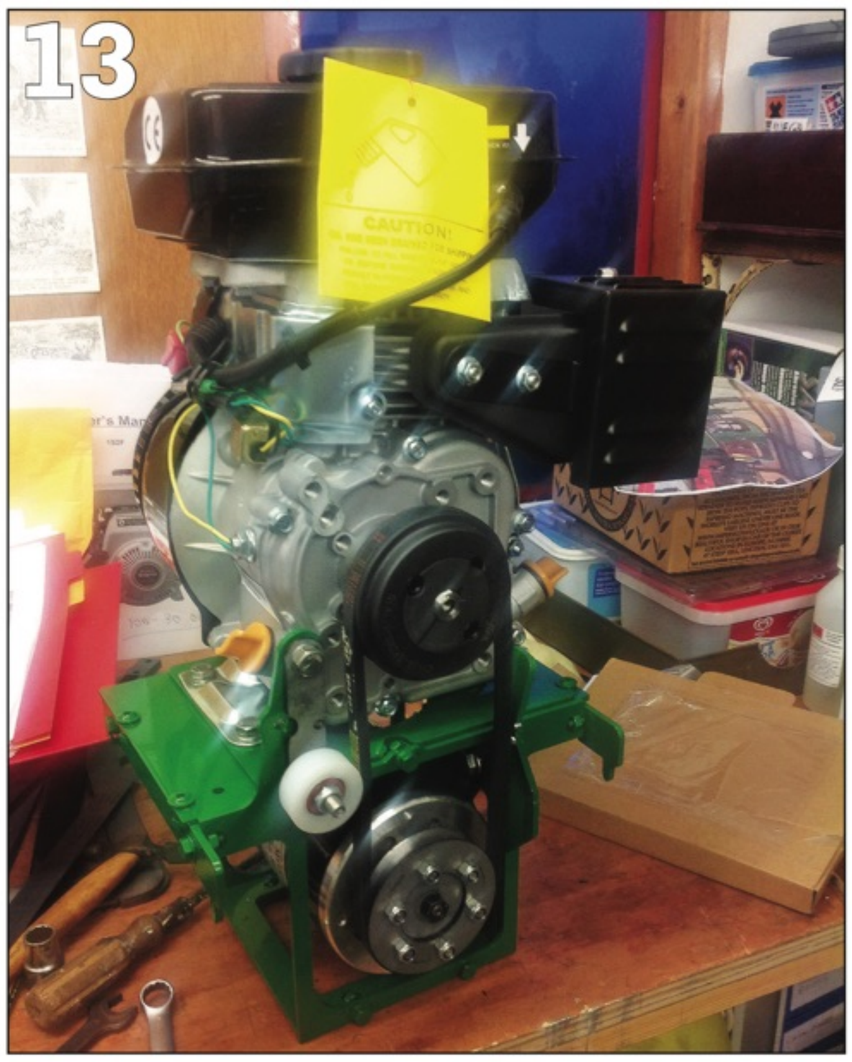


PHOTO 13: Motor and generator unit. This is designed to be simply detached from the frame. Undo one bolt, one electrical connection, and one Bowden cable end, and it is a one-person lift taking about two minutes. The bonnet and seat also come off, even more quickly.

PHOTO 14: First stage in bending up the frame for the bonnet.

PHOTO 15: Note use of wood and mole grips for a clean bend.

PHOTO 16: Completed bonnet with Lister logo.

PHOTO 17: Bending up the seat box.

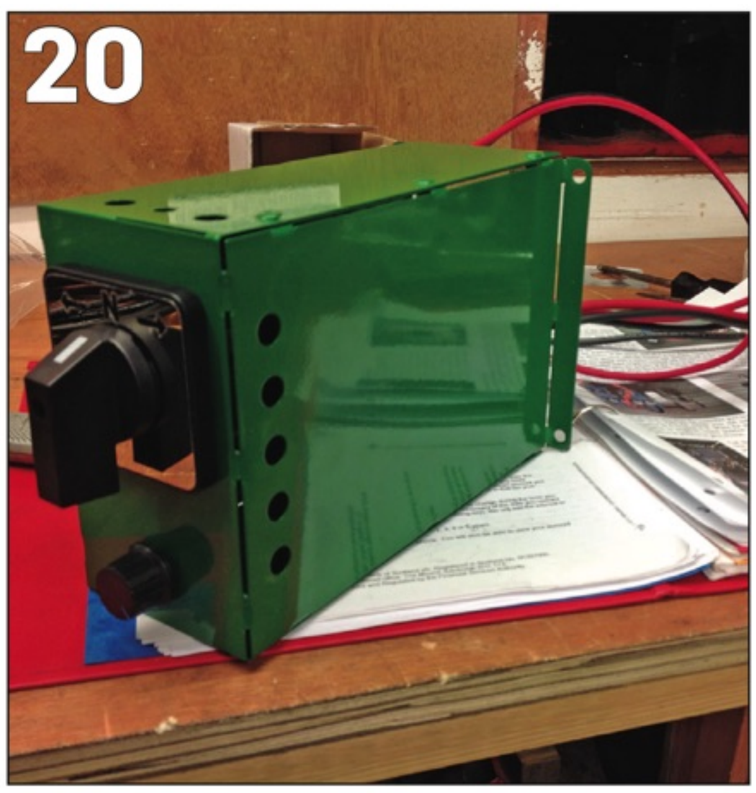


PHOTO 18: The completed seat box...

PHOTO 19: ...and the control box.

PHOTO 20: Electrics could hardly be simpler – a forward/off/reverse switch and a simple and cheap electronic speed controller with a single knob control. Only four wires to connect.

PHOTO 21: The frame ready to be loaded into the car. The square hole at the front is where the generator drops in with the motor above the frame, covered by the bonnet. The seat slots into holes in the frame to the left of the control levers. One lever engages the drive from the motor to the generator, the other is a powerful handbrake.

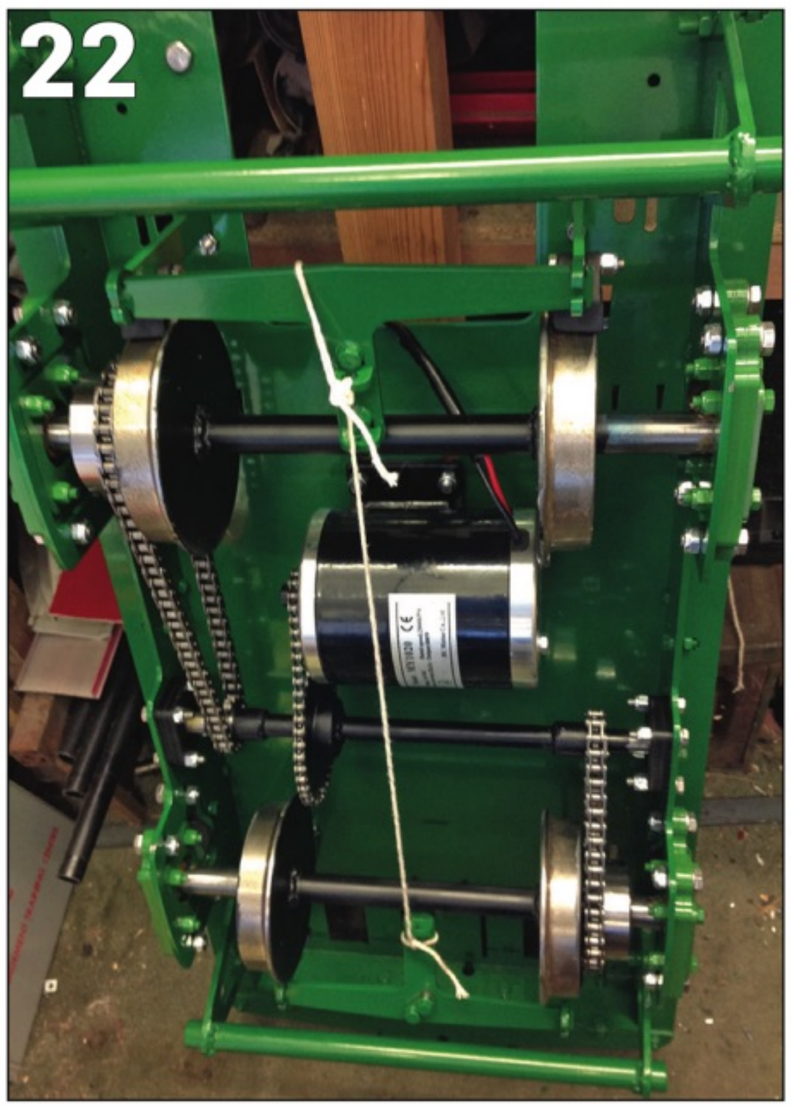
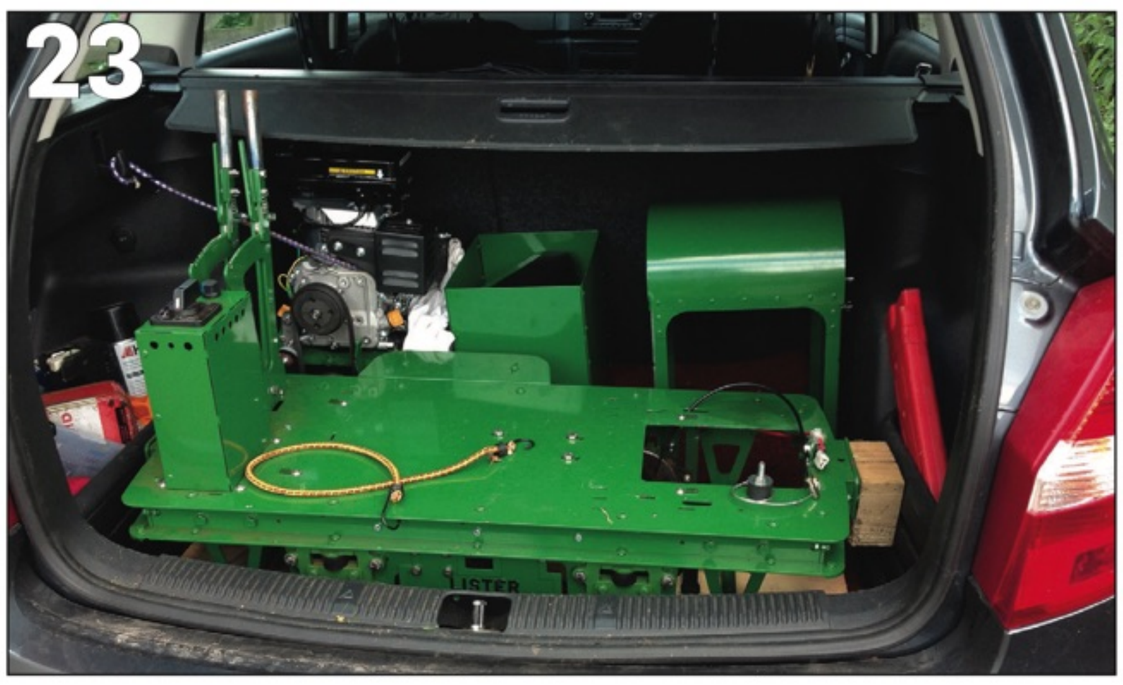


PHOTO 22: Taken during trial-fitting of axleboxes, layshaft and motor, this shot shows the underside layout. The string holds the brake stretchers from flopping about pending fitting of Bowden cables and such. Apparently bent axle is a quirk of the camera.

PHOTO 23: Once dismantled frame is a two-person lift into a normal estate car and very easy to transport, not erven needing the rear seats put down on this Skoda Fabia.

PHOTO 24: The Scamp Silly Grin appears as soon as anyone gets onto the little machines. They are fun!



NEXT MONTH: Dave builds a railway to run his Scamp on...

Examining a boiler – from the inside...

Jan-Eric adopts medical techniques to check out a locomotive boiler.

BY **JAN-ERIC NYSTRÖM**

After four summers of running my ten-wheeler, giving rides to passengers at our railway Museum for up to six hours per run day, it was high time to check how the boiler had fared. Even though I regularly blow down about every two to three hours of running, there is always a possibility of scale building up inside the boiler – and since I don't even know if the water at the museum is hard or soft, there could even be a huge build-up of scale.

The big question was of course how to get a good look inside the boiler! Well, having been active in the film industry all my working life, I've always been interested in camera technology – and recently I had found something extremely interesting while browsing eBay and other internet shops: low-cost, hobby 'borescopes'.

A borescope (known as an 'endoscope' if used for medical purposes) is either a rather complicated optical system that can relay the image from a lens, through a narrow tube (sometimes rigid, sometimes flexible) to a remote camera, or just an amazingly tiny camera at the end of a simple connecting cable. The latter type, needing no complicated relay optics, has become incredibly inexpensive – I found several vendors on eBay selling borescopes (sometime also called 'snake' cameras) for less than £10 – including shipping!

Range of types

There are several models, some are intended for connection to a computer's USB port, others are intended for tablets or smartphones. Some even include a display, and thus need no other equipment for examining the images. These, however, are quite a bit more expensive, starting at around £100 or so.

As always when shopping on eBay, it is a good idea to check the 'reputation' of the vendor. I very seldom buy from a vendor with less than 99 per cent positive feedback, and I always check the negatives, since sometimes a customer can give negative feedback due to his own lack of knowledge – not due to the vendor's fault. Thus, you should know exactly what you need!

Note that most USB-borescopes for computer use need driver software for a PC, so check that it is included. With my purchase, I got a small mini-CD disk (not useable in slot-loading disk drives), but sometimes the driver is offered only as a download. Since I use a Mac computer, I looked for a vendor offering a Mac-compatible borescope – I couldn't find too many of those, so my choice was limited, but there are scores of models for PCs only.

Some Android tablets and smartphones cannot connect to an external camera, and models that can, need a 'USB-OTG'-compatible interface and maybe even a special cable, so check your Android manual.

If a borescope is offered as iPad or iPhone compatible, it has a different plug which won't fit other brands. Thus, the easiest and safest way is probably using a laptop PC computer with appropriate driver software.

There are different camera 'heads' too – the most common are 7 or 10mm in diameter (a little over ¼-inch and ⅜-inch, respectively). I chose a model with a 5.5mm (a tad under ¼-inch) diameter camera – the smallest I could find. The quality of the image it provides is probably not as good as the slightly larger models, but the small size was more important for me – it can boldly go where no camera has gone before, i.e. into the ten-wheeler's boiler!

About three weeks after ordering and paying for the purchase via PayPal, I got the £15 Mac & PC-compatible 5.5mm borescope in my

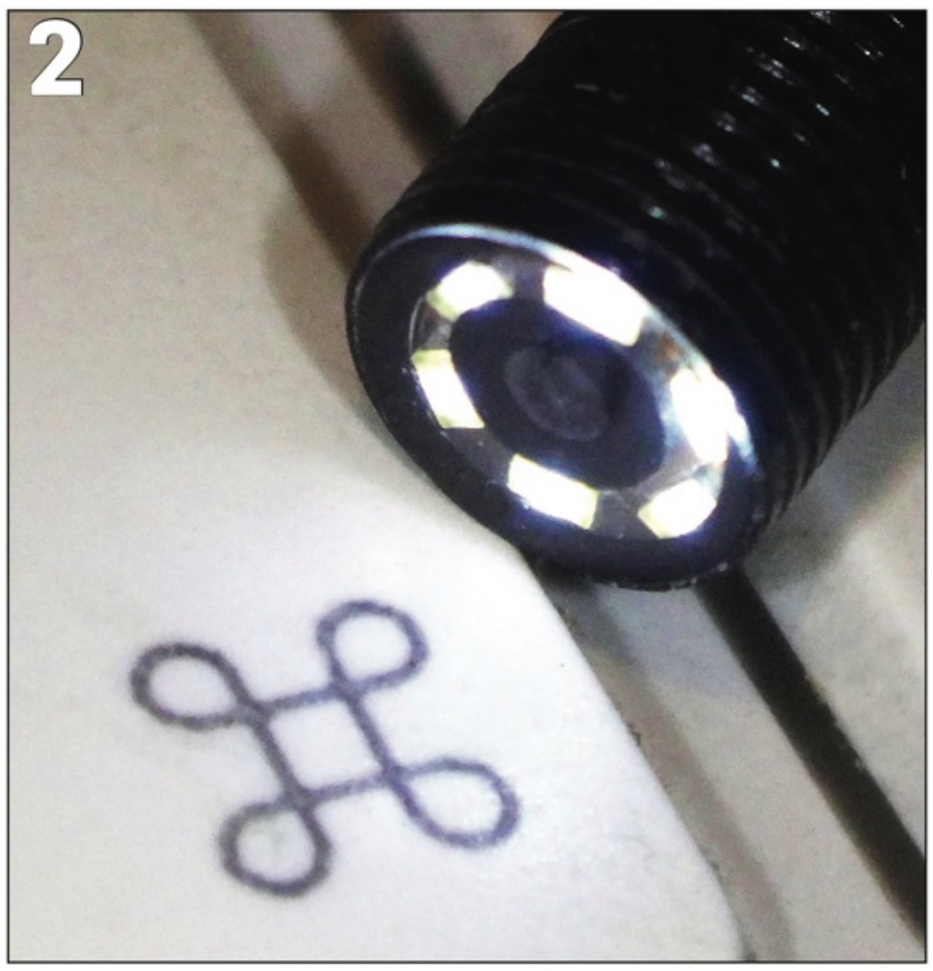


PHOTO 1: A 5.5 mm (0.22-inch) diameter borescope with a 5-metre (15ft) cable, here seen on top of a computer keyboard.

PHOTO 2: The incredibly tiny camera head contains a minuscule lens in the centre, surrounded by six LED lights with adjustable brightness.

PHOTO 3: The setup for examining the inside of a loco boiler. The borescope is inserted in the boiler's water-filling hole.

mailbox. You can see the camera end of the 5 metre (15ft) long cable placed on my laptop's keyboard in **Photo 1**.

The camera head contains an incredibly tiny lens, surrounded by six minute LED lights, (**Photo 2**). The brightness is adjustable on the USB plug at the other end of the cable. Also inside the head is the sensor chip that converts the optical image to an electronic signal fed through the cable.

In **Photo 3**, I have placed my laptop on the cab roof of the ten-wheeler, and the borescope is entering the boiler's filling hole. The cable is flexible, but the camera head is not – however, it is less than 1.5 inches long, so I was able to manoeuvre the camera head to any desired place I could reach via the boiler's filling hole by slightly bending and turning the cable. The camera is even supposed to be water-tight – but just to be safe, I chose to inspect the boiler after it had been blown down and dried...

Visual confirmation

As soon as I saw the images on the laptop screen, I was pleasantly surprised! I found no 'permanent' thick scale at all in the boiler, just some slight fluffy deposits on some of the surfaces. Whenever I found an interesting spot to grab a picture of, I took a 'screen shot' of the computer screen in order to save it for later study. Some borescopes have a button on the connector for this purpose, but this feature didn't work with my Mac, so I had to use the keyboard instead. You can also record a video movie and later choose suitable still images from it, or just watch it in motion.

I noted that for printing, the images look much better if converted to black-and-white, and then adjusted for brightness and contrast. Some camera drivers may even have these features built-in.

Let's have a look at four of the images: **Photo 4A** shows the front top edge of the inner firebox, with three of the fire tubes pointing downwards to the right. At lower left you see the dry tube passing over the firebox top. There is only a slight furry deposit on the tubes, no large amount of scale.

Photo 4B shows the firebox end of one of the solid stays between the top of the firebox and the shell – it is 8mm (5/16-inch) in diameter, which gives you an idea of how insignificant the 'fluff' on the firebox plate and the stay really is – actually, the fluff is somewhat accentuated by the contrast enhancement of the photo.

Photo 4C shows the joint of one firetube to the tube plate in the firebox – one of the hottest points in the boiler. No scale deposits! The tube diameter is 5/8-inch, so this is a real close-up, about the closest you can get and still keep the image in focus – the camera's focus is fixed, but it gives acceptable sharpness from a little under 2 inches all the way to infinity.

Photo 4D shows what I saw when feeding the borescope further down into the boiler, when the cable was passing around the entire bunch of flues – it is the longitudinal barrel seam on the bottom of the boiler. The welded seam is about ½-inch wide and 1/16-inch high. No crud or scale here, either! Blowing down your boiler regularly is obviously a good idea!

I can probably run this engine for a few more seasons before it needs a thorough washing-out – then, I might even use some coffee-percolator scale remover in the wash water to dissolve the slight fluff, and get the inside of the boiler all the way back to its pristine, original appearance.

With the extremely low cost of these modern hobby borescopes, I think every live steamer could find one useful – probably for other purposes, too! In fact, my borescope included a few handy attachments: a mirror, a hook, and a magnet – all useful, say, for finding a nut accidentally dropped deep inside some complicated machinery...

In the hopefully not too distant future, I'll tell you a lot more about the ten-wheeler, and how I built it 'from scratch'... EIM

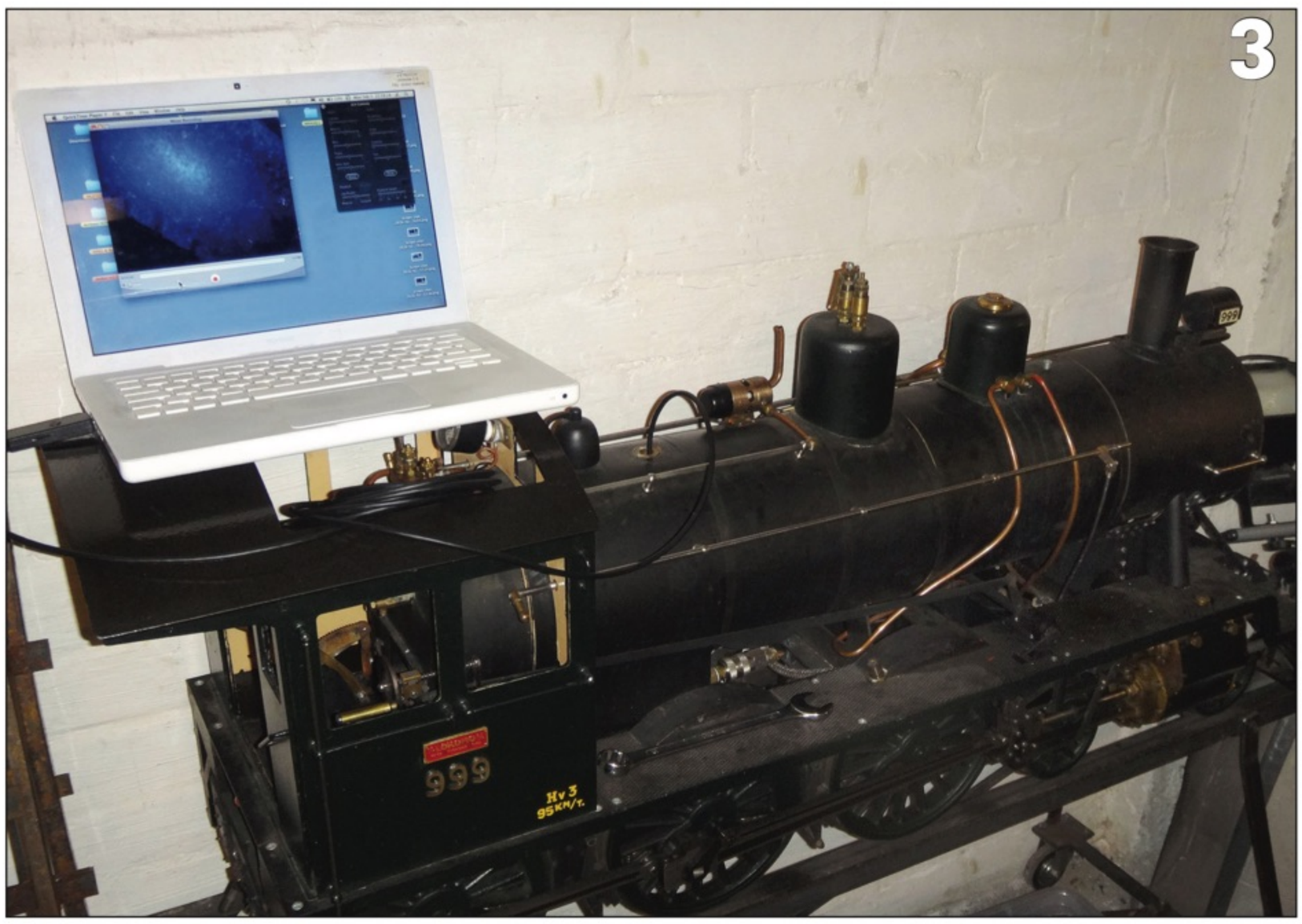
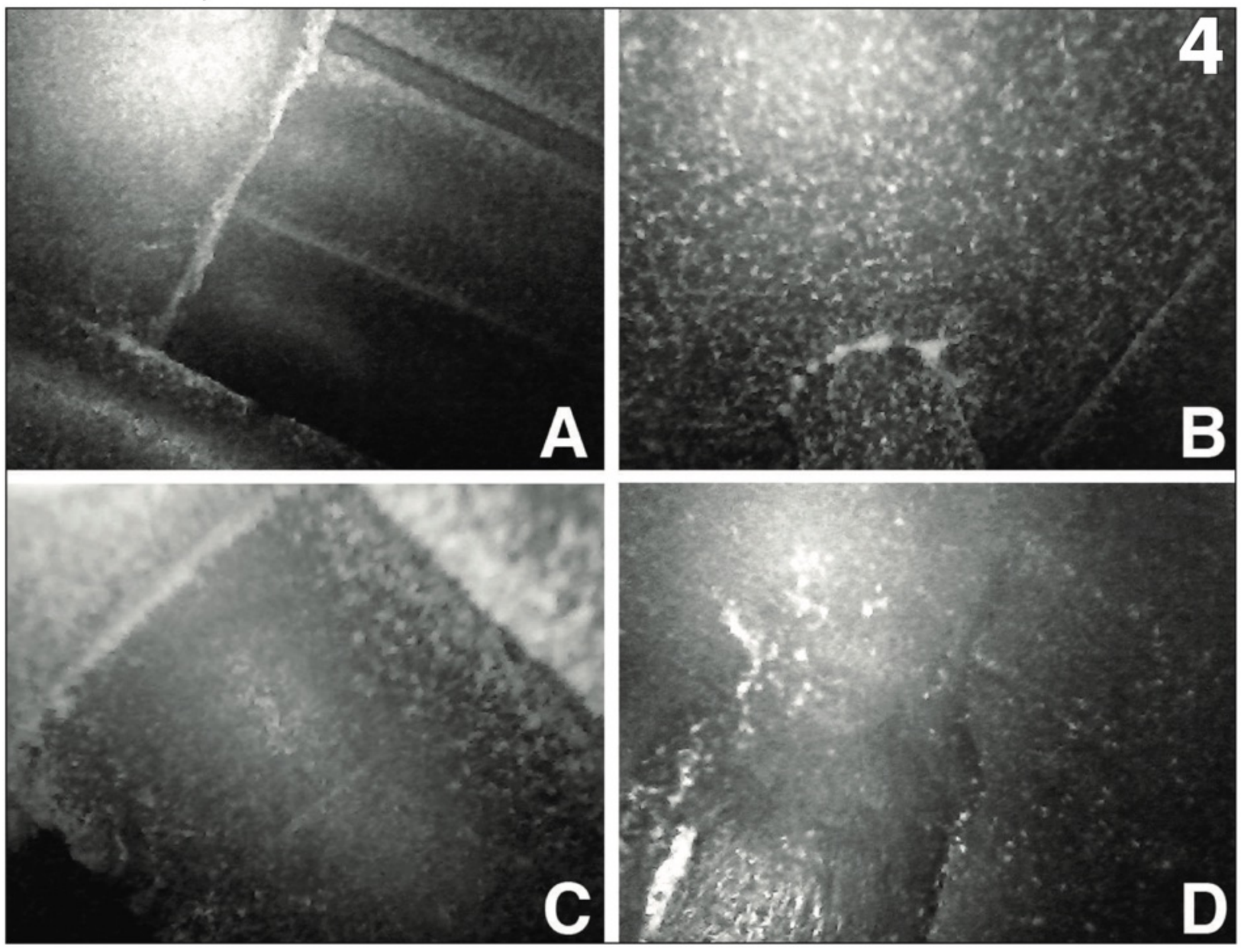


PHOTO 4: Shots from inside the four-year-old boiler. Thanks to frequent blowing down, very little scale has formed. See the text for details.

Photos by the author



Dougal – a 5-inch Barclay

A safety valve and a grate are needed before Young Sussex engineer Andrew can light a first fire in his entry-level locomotive construction project.

BY **ANDREW STRONGITHARM** – Part Nineteen of a series

I was now within spitting distance of lighting the first fire and I was still on target to achieve this by 1st January 2012. Left to do was to manufacture the by-pass valve and associated pipework for the axle pump, to design and make a safety valve and build a grate – the list was getting shorter. I should stress that this was the bare minimum required before steaming Dougal for the first time and there was still an awful lot to do after that – and that's before I applied any paint!

So that it didn't look out of place, I decided to position the by-pass valve about halfway along the left-hand running plate, which is where the water valve is located for the second injector on the real Dougal. My by-pass valve also incorporated some of the pipework and a T-fitting for the clack which was all silver soldered together.

The first attempt at the by-pass valve wasn't very successful as it was made in roughly the same way as the steam valves on the manifold but without a stuffing gland. On multiple occasions it flooded the running plate with water! I also experimented with an O-ring seal, however this gave the valve a very spongy feel.

Version two was made from a length of ⅜-inch diameter x ⅝-inch long PB102 bronze and I began by drilling a 4mm hole all the way through the material. Following this, I opened the hole out with a 7/32-inch slot drill to a depth of 9/16-inch before internally threading it ¼-inch x 40 tpi x ¼-inch deep.

Next, I began turning the stainless steel insert which I would push inside the bronze body. This was 9/16-inch long by 7/32-inch diameter, however I continued to turn down a ¼-inch length on one end to a diameter of 5/32-inch. After turning it down, I cut ⅛-inch of 4mm threads on the end ready to accept the handle once the by-pass valve had been finally assembled. Next, I turned the stainless around and drilled a ⅛-inch hole in to the other end to a depth of ¼-inch, before setting up the vertical slide on the lathe and cross drilling through to meet this hole with a ⅛-inch drill, ⅛-inch in from the bottom of the insert.

A special fitting was made to go through the running plate and this was machined from a piece of 0.324 (2BA) bronze hexagon that I turned round. This was 1-inch long in total with 5/8" turned down to ¼" diameter and the first ¼-inch of which was externally threaded ¼-inch x 40 tpi. A ⅛-inch hole was drilled in to the end of the material to a depth of roughly 15/16-inch, meaning that it stopped short of breaking through the end.

Holding the work in the vertical slide, I then inserted a 3/16-inch cross drilled hole, to a depth of ⅛-inch and 3/16-inch in from the bottom before pushing in a ⅜-inch long bronze fitting. This fitting comprised of a ¼-inch length of ¼-inch x 40 tpi threads together with a ⅛-inch long stub at one end which I turned down to a diameter of 3/16-inch to locate in the main fitting. A ⅛-inch hole was drilled the full length and a 60-degree cone was inserted to the threaded end ready to accept the olive of the axle pump return pipe. This piece was then silver soldered in to the main fitting. A ¼-inch hole was drilled through the left-hand running plate, in line with the clack on the side of the boiler and this allowed my fitting to be pushed through from underneath (**Photo 1**).

Pump pipework

As described towards the beginning of this series, I bought an axle pump for the locomotive with a 10mm ram and after fitting this to the main stretcher I adapted the T-fitting that came with it, so there was only one outlet for the water. I placed a copper washer or two over the threads of this fitting so that when screwed in, it stopped with the outlet pointing towards the front of the locomotive. This was so that the delivery pipe could come straight out of the fitting; bend round 180 degrees and rise up to the running plate to screw on to the by-pass fitting. Like lots of the other pipe runs, this one was made with custom olives that were silver soldered and machined on the pipe before I bent it.

Two further 'long distance' pipe runs were next to complete and I designed the water return pipe for the axle pump to run underneath the left-hand running plate, mirroring the injector water delivery pipe. I used an identical bracket which I made to support the opposite side and after silver soldering a 3/16-inch olive on one end, I formed quite a sharp curve on the same end ready to accept a rubber hose from my coal/water wagon behind the locomotive (**Photo 2**).

The prototype 'Dougal' is a 2ft 6in gauge Barclay 0-4-0 today resident on the Welshpool & Llanfair Light Railway in mid Wales.

Next, I ran the axle-pump water delivery pipe along the inside of the right-hand frame and made a special bracket to support this pipe which pushed over the bush in the frame for the brake pivot bar. The hole in the bracket was at least double the size of the pipe so that when I pushed the rubber hose over it, the gap was taken up by the hose.

Andrew Brock and I designed a large 'pop' safety valve for the top of the dome and I must say that we were both quite pleased with the end result. Things didn't go well to start with however, as I 'mashed' (that's a technical term by the way) the ⅜-inch diameter threads that I had initially tried to cut in the top of the inner dome. This was quickly overcome and therefore my safety valve is now screwed in with 7/16-inch x 32 tpi threads!


1

The main body of the valve was made from a ⅝-inch length of ⅝-inch brass hexagon and I began by turning down a ½-inch length of the outside until I reached a diameter of 9/16-inch. Then, using an angled turning tool I chamfered the top of the remaining hexagon to remove the sharp edges, which left the base ⅛-inch thick.

Before removing it from the lathe chuck, I bored out the centre to an internal diameter of 10.2mm and threaded the whole body 7/16-inch x 32 tpi throughout. After de-burring both ends I held the valve on the round section of the body and machined a 1/16-inch deep x 9/16-inch outside diameter counterbore to take a 7/16-inch x 9/16-inch silicone O-ring. The O-ring was designed to form a seal between the base of the safety valve and the top of the inner dome and should prevent any requirement to keep re-sealing it every time it was taken out.

The all-important internal components which screw in to the body were made in two parts. The first was the top cap which began life as a ⅜-inch length of 9/16-inch diameter round brass. I turned a ¼-inch length of this down to 7/16-inch in diameter and threaded this 7/16-inch x 32 tpi to screw in to the top of the body, before machining a ¼-inch deep x 11/32-inch diameter counterbore on the inside of the threads.

Next, I set up the dividing attachment on the lathe and drilled six 1/16-inch diameter holes in the top of the cap on a Pitch Circle Diameter of 9/32-inch. Because space was so tight, the edges of these holes were flush with the side of the internal counterbore. A further 3.3mm hole was then drilled in the centre as a guide for the ⅛-inch valve spindle and as this needs to move freely up and down when the valve lifts and sits, the hole was deliberately drilled slightly oversize.

PHOTO 1: By-pass valve fitted to the running board.

PHOTO 2: Pipework from axle pump ends in this connection, to which a hose is attached from a water wagon.

PHOTO 3: The pop-type safety valve designed for the loco by the two Andrews.

All photos by the author

"Things didn't go well to start with however, as I 'mashed' the ⅜-inch diameter threads..."

The second part to machine screws in from the bottom of the valve body and contains the valve seating and a counterbore to house the ball. Together with the spring, these are crucial to the success of the valve and must be machined very accurately to achieve a working 'pop' valve. This piece was made from a ¾-inch length of 7/16-inch diameter round brass and the first job was to thread 3/16-inch of this material 7/16-inch x 32 tpi.

Next, I began drilling out the inside with a 3/16-inch (4.8mm) drill to a critical depth of 11/16-inch as this must be a blind hole which doesn't break through the end of the material. Following on from this, and using a small boring tool, I inserted a counterbore for the ball.

I was going to use a ¼-inch non-magnetic stainless (316 grade) ball so my counterbore was carefully opened out to a diameter of 254 thou' (in other words 4 thou' bigger than the ball) and to a depth of 88 thou' (5 thou' greater than half the diameter of the ball, which also takes in to account that 42 thou' of a ¼-inch ball is inside the 3/16-inch hole).

Next, I took it out of the lathe chuck, screwed it in to a piece of ⅝-inch hexagon brass, which I used as a temporary mandrel and cut the threads on the opposite end. A further ½-inch length of 7/16-inch x 32 tpi threads were then cut, leaving a 1/16-inch of plain section in the middle which was where the O-ring would sit.

It is always advisable when using O-rings to seal components to ensure they are applied against a smooth or flat surface otherwise they won't form a reliable seal. Leaving a gap between the threads in this instance also means that when the internal fitting is screwed in to the valve body it tightens up on the end of the threads, thus meaning that both parts are locked together.

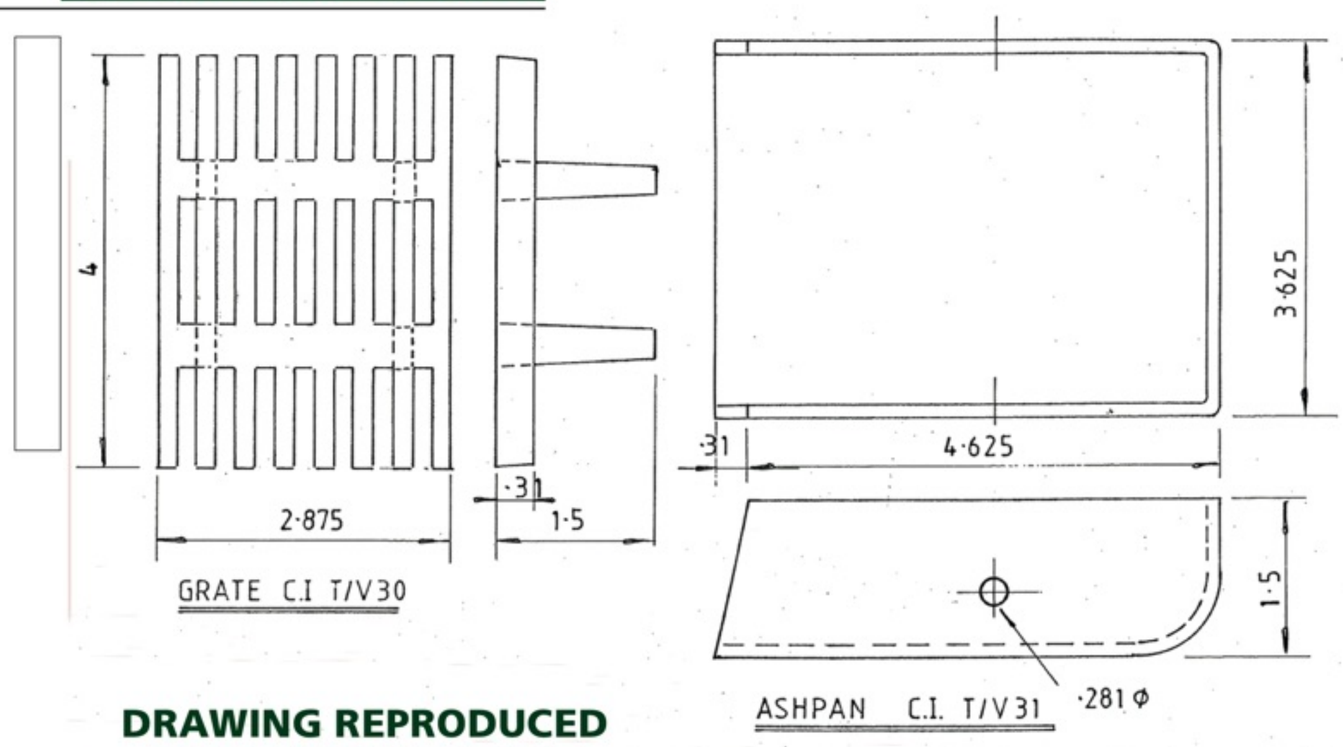
Finally, I turned ¼-inch of the end of the threads back to a diameter of ⅜-inch to form the steam inlet. I then placed the assembly in the vertical slide and, holding it on two sides of the hexagon, I drilled a ⅛-inch (3.2mm) cross hole through the steam inlet that I had just turned down, positioned ⅛-inch in from the end and central vertically. With any luck, this cross hole should break through the ⅛-inch hole which I drilled down from the top earlier, meaning that the steam enters the valve from the side, rather than directly from the bottom. It is largely considered that 'pop' safety valves function better with a side inlet hole rather than one directly underneath.

Safety valve setting

Once all of the main components had been made, I entered the testing phase in order to achieve the perfect operational range of the valve. The aim was for it to lift as close as possible to 80psi and to sit back down again with as little drop in boiler pressure as possible, although about 5psi is a good target.

In most safety valves you adjust the tension on the spring by screwing the top cap in or out accordingly, however as my top cap was designed to be screwed down tight, this wasn't possible. My only adjustment therefore was the length and strength of the spring itself so I spent a fair amount of time with an air compressor and an assortment of different springs until the valve performed just how I wanted it to. I eventually settled on a ⅛-inch internal diameter x 26swg stainless steel spring which I cut to length using an off-hand grinder.

When cutting the spring it is ▶



DRAWING REPRODUCED ONE-THIRD FULL SIZE

Enlarge 300% for full size
Dimensions in imperial

important to grind the ends as flat as possible so that they sit straight and square within the valve. I probably annoyed my neighbours with the noise of the compressor running for long periods; however it was worth it as I eventually got the valve to lift at 80psi and sit back down again at roughly 73psi. The only caveat which I should mention is that there is no guarantee the valve will perform the same with steam but at this stage my one looked hopeful! (**Photo 3**).

Making the grate

Before I was able to light a fire, the final job left on the 'to do' list was to make something to light the fire on! The grate was my own design and it was made from 10 pieces of ⅛-inch x ½-inch 316 grade stainless steel plate, which were cut to 4⅛-inch in length. The fire bars were first clamped together side-by-side for me to drill a pair of 4.1mm holes through all of them, ⅝-inch in from each end and ¼-inch in from the top.

Next, I made the 18 fire bar spacers from a length of ¼-inch round 316 grade stainless steel and after drilling a 4.1mm hole through the centre; I parted each one off 5/32-inch long. I then made two stainless-steel pins from a length of 5/32-inch (4mm) 316 grade bar and these were cut to 3⅛-inch long. I externally threaded 5/32-inch at each end of these pins 4mm before turning four ⅛-inch thick 4mm nuts out of 5/16-inch stainless hexagon.

Two side plates were made from a couple of pieces of ⅛-inch thick copper sheet which was cut to 1 3/16-inch x 3 9/32-inch in size. I drilled a further pair of 4.1mm holes, ¼-inch in from the top edge and at the same 2⅞-inch spacing as those already drilled in the fire bars. A pair of 11/32-inch holes was drilled centrally at the bottoms of the side plates, 5/16-inch in from the bottom edge.

To mount the grate beneath the firebox, I turned down the ends of a 4¼-inch (the width of the inside of the frames) length of 10mm bronze hexagon. I machined each end down to 11/32-inch in diameter x 810 thou' in length before drilling and internally threading the ends to accept ¼-inch x 40 tpi bolts. It was these bolts that I made next from a piece of 5/16-inch stainless-steel hexagon. They were ½-inch long with a ⅛-inch head although I only threaded the first ⅜-inch because the ⅛-inch nearest the head is through the locomotive's frames and therefore doesn't need to be threaded.

I could now start to assemble the grate by screwing a 4mm nut on to the end of both pins. I then pushed the first side plate over both pins followed by alternating between fire bars and spacers until I used up the last fire bar.

I fitted the mounting bar next as this acts as a spacer for the side plates. The second side plate was then added before I screwed the final pair of nuts on to the end of the pins which clamped everything together and held it all firmly in place. For added rigidity, I silver soldered the mounting bar in to the side plates before trial fitting it to the loco. The only problem is that the grate is able to pivot about the mounting bolts, but once these are done up tightly it is secured in position.

Due to its proximity to the rear axle, I chose to make an ash guard along the front of the grate to try to prevent ash from falling straight on to the axle, which won't do it a lot of good in the longer term! These were made from off-cuts of ⅛-inch copper sheet, the first piece of which was silver soldered at roughly 45 degrees to the side plates before a second ash guard was bolted to the first one and bent to form a barrier vertically downwards (**Photo 4** & **5**).

The grate was the final component required to make before the moment I had been waiting just over two years for. As mentioned earlier, I had set myself a deadline of 1st January 2012 and with the help of a bit of Christmas holiday overtime, I lit the first fire at about 6pm on 31st December! EIM

PHOTO 4, 5: Two views of the completed grate – note the ash guard to protect the loco's rear axle from corrosion.

"With the help of a bit of Christmas holiday overtime, I lit the first fire at about 6pm on 31st December"

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Next Month...

"The last thing I wanted to do now was make a mistake and potentially write-off the whole running plate..." Andrew mounts the lubricator.

Irregular shapes in a four-jaw chuck

Edward looks at a conundrum faced by most model engineers at some point.

BY **EDWARD J PARROTT**

In my day job I am a Turner, if you want round things making then I'm your man. Trouble is, customers frequently want round features putting on things that aren't round, and the only way to do that is to chuck the workpiece in a four-jaw chuck.

It's very common for model engineers to need something holding in the four-jaw as well, and the advice is always if you can only afford one chuck, buy a four-jaw independent, because you can hold any shape, whereas a three-jaw will only allow you to hold round or hexagon bar true, generally.

So you have your rectangular or just plain irregular shape, and you need to put a bored hole in, how do you set it up? Always a job comes down to how you set it up and how you hold it, and there are many ways depending on what equipment you have available.

If you have a milling machine with a Digital Read Out (DRO) or a CNC machine like me, it's relatively easy to find datum points, set out the position, and then drop in a centre drill. But what if you haven't got a mill, or the job is too big for the one you've got, or the mill is already set up and you can't break it down for this urgent job?

Digital not required

You can do this job just as easily with marking out and a centre punch. I have an optical centre punch for those really really accurate jobs, although it doesn't see much use. For what follows, a good clean centre punch in the correct place is just as good for setting up.

Having established the position and either centre punched or centre drilled, chuck the piece in the four-jaw and set it roughly running true – you can see quite easily when you pull the chuck over by hand if your mark is running out.

To get it running perfectly true takes a bit more work, here's how I do the job, as in the photo, which is the steel bars for the steam chests on one of my engines being roughed out.

I use a hard dead centre and set it in an extended morse taper socket, which is supported on a live centre in the tailstock. If you've made a centre drill with your mill it's relatively easy to clock it with a 10-thou finger clock, but if it's only a centre punch that's nigh on impossible.

"Milling machines don't actually make round holes..."

With this method, you can see I've set my 1-inch plunger clock to run on a true diameter I've turned on my socket extension. Normally I would set the clock behind the job laying flat but it didn't photograph too well, and having it on top works just as well in reality.

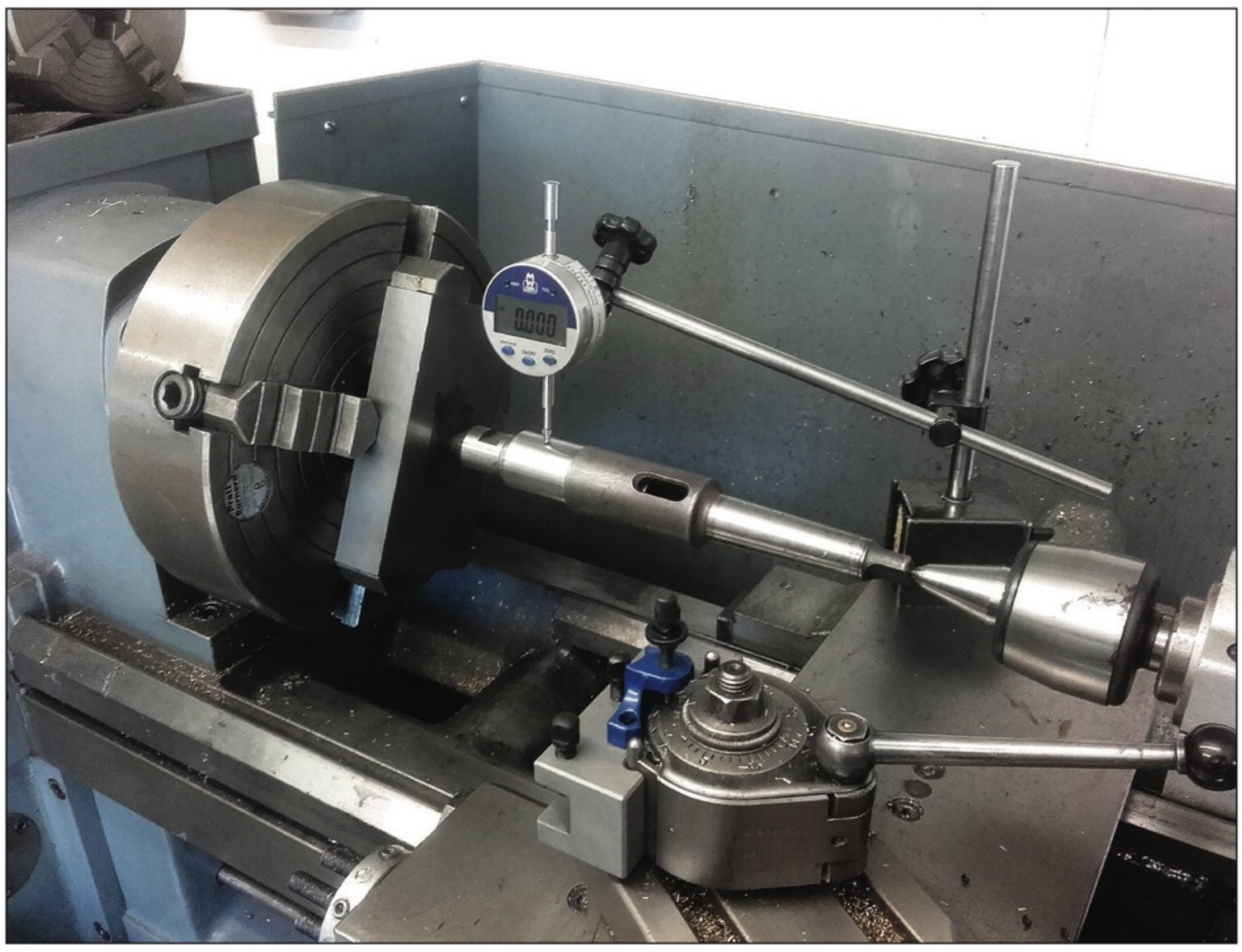
Now all you have to do is clock the job in as you would any external diameter, say the second end of axle turning. You'll notice I also use a digital plunger clock, maybe I'm lazy but I find it a doddle to take the reading on the clock and halve it when I am clocking in a job, with the ready function to reset zero at the touch of a button.

Holes that aren't round

You might well ask, if you've got a CNC mill, why don't you just use it to mill the diameter? Well the reality is that milling machines don't actually make round holes unless you have a very good spindle and a good boring head. Interpolating holes tends to result in a four-leaf clover shape which isn't always acceptable, depending on what you're doing. It might also be that the feature you want is a turned diameter – which you could do with a boring head – or it might even need screwcutting like the next piece I've got to machine. EIM

Bench Talk is our column where you the reader get the opportunity to share skills or techniques you have learnt with other model engineers – so if you've come up with a particular dodge, technique or way of doing things that fellow readers might find useful, describe it in a few words, take a suitable photo and send it in! You'll be helping the hobby, and we also pay for contributions...

Send your Bench Talk entries to andrew.charman@warnersgroup.co.uk or to the editorial address at 12 Maes Gwyn, Llanfair Caereinion, Powys, SY21 0BD



BELOW: View of Edward's four-jaw chuck setup – full details are in the text.

Tapping techniques

David looks at some interesting aspects of making those threaded holes in metal.

BY **DAVID CONEY**

Using a milling machine for accurate tapping

When I once attended an excellent SMEE (Society of Model and Experimental Engineers), milling course, I was told that after gaining experience on the mill, I would probably no longer use my drilling machine much; I would also probably use the mill for lots of things other than milling. Since buying a Sieg Super X3 mill from ArcEuroTrade (usual disclaimers) that has proved to be the case.

I was also told during the milling course that I should probably buy a machine somewhat larger than I thought I would need, given that I could accommodate such a machine in my workshop. This again has proved to be good advice; the tip I am about to write about needs quite a large distance from head to milling table.

I am in the process of building a 3½-inch gauge 'Rob Roy', and have reached the stage where I need to tap holes in the cylinder blocks, for the studs that attach the steam chests and steam chest covers to the blocks. As the studs are relatively long, the hole drilling and tapping needs to be done very accurately.

After the stud locations have been marked out on the cylinder port face, the cylinder is mounted fairly and squarely in the machine vice on the milling machine table. I did this by using a DRO (Digital Read Out), in conjunction with a probe in the chuck, and aligning the cylinder so the same reading is obtained on all four corners of the port face. No doubt there are other ways of doing this.

Next, after drilling each hole, and without moving anything in the XY direction, I exchanged the drill bit for a probe (a piece of bar about 2 inches long and 3/16-inch in diameter,with a sharp point on one end). I cranked up the head in the Z direction, to accommodate a tap held in a wrench (see the photo, note that this shows a later, simpler job in progress).

The probe's pointed end is engaged in the dimple at the top of the tap wrench, and thus keeps the tap in good alignment. By keeping light pressure on the handwheel, the tap can be turned by hand, in correct alignment at all times.

This way of tapping holes worked well for me, although there are no doubt other ways of doing it, for example using a tapping and staking machine. As with most jobs in model engineering, it pays to think first about how you are going to accomplish a particular task, considering the accuracy needed and the possible pitfalls. The work needed on model locomotive cylinders is considerable, involving a number of different tasks, so by the time you are tapping holes for studs as described above, you have invested a considerable amount of time and do not want to mess anything up.

Drilling and tapping shallow blind holes

I recently had the need to drill and tap some shallow blind holes in copper flanges on a locomotive boiler. As I did not want to mess anything up, I practised on spare bits of copper plate, and pass on here my experiences and tips for a successful result. My tips are meant for relative newcomers to the pastime of model engineering, the experienced have probably found out all this before !

The first thing to realise is that when using a taper tap in a soft material such as copper, you can easily bottom the tap without realising it, and strip the few shallow threads you have just created.

It is important to make as many threads as possible in a shallow blind hole, but I found two things that hindered this. Firstly the bottom of the hole will be tapered in profile due to the shape of the drill bit, therefore it's better to finish off the hole with a D-bit or a slot drill (milling cutter). By this means you can get as deep a hole as possible, given the thickness of the flange. **Photo 1** shows the comparison between drill bit, D-bit, and slot drill.

Secondly, even a plug tap may be conical in shape at the bottom, I would therefore grind the base off of a spare plug tap so as to get a few more threads in the blind hole.

Oh, and the other thing is to make sure that the tap enters the hole exactly vertical. You can ensure this by following the advice given in my technical tip at left; after drilling the hole, without disturbing anything in the XY direction, have the tap in a tap wrench with a probe (a short length of silver steel with a pointed end) engaged in the dimple at the top of the tap wrench. **Photo 2** shows the setup. This way everything is kept in alignment.

I hope these simple steps will help you to successfully drill and tap shallow blind holes. EIM

PHOTO 1: Comparison between drill bit, D-bit and slot drill.

PHOTO 2: Setup for ensuring that tap stays precisely vertical when cutting a screw thread.

Photos by author

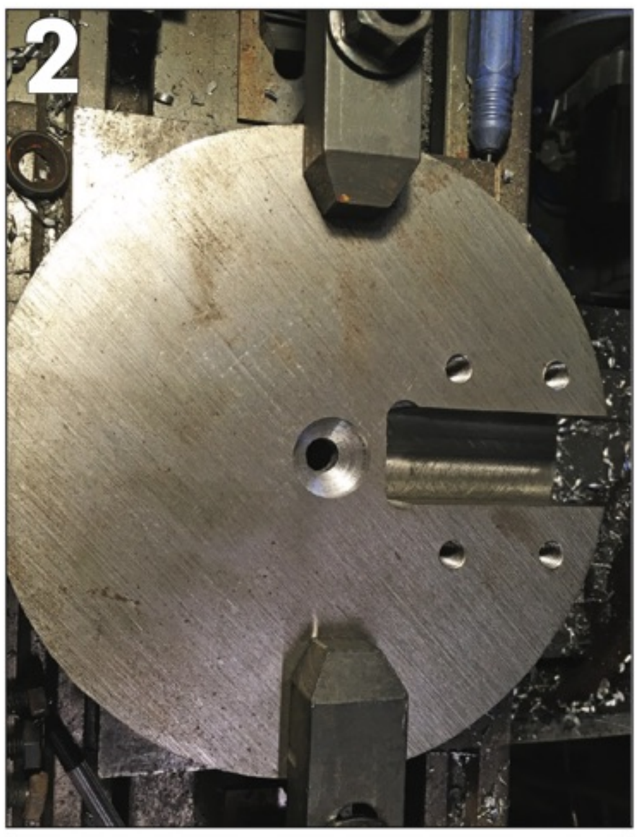
Making a large fly-cutter

Job too big for your tools? Then make up some bigger tools...

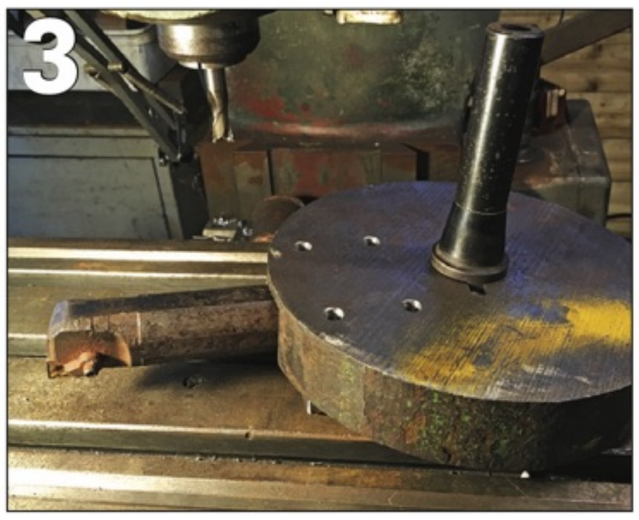
BY **ASHLEY TEMPEST**

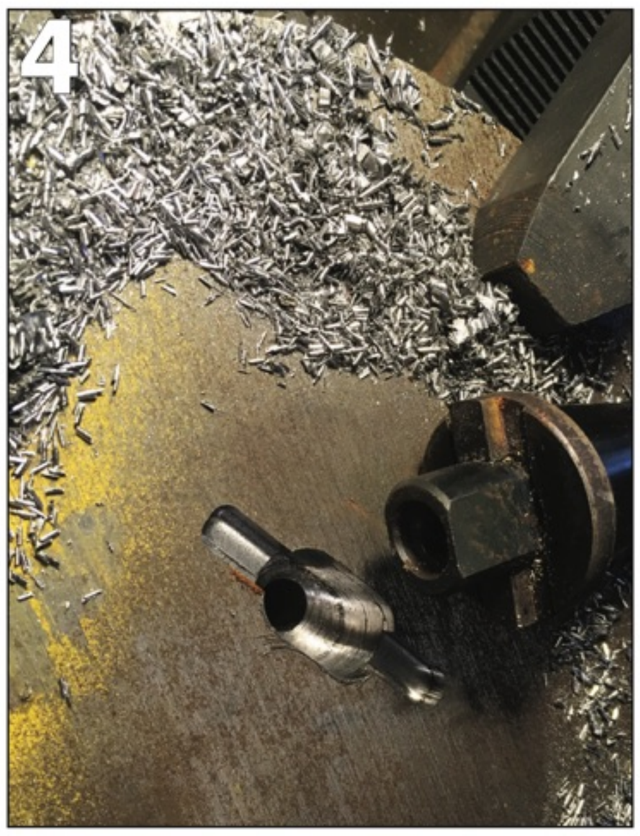
When it came to machining the cylinder block of my 6-inch scale Fowler B6 crane engine, I did not have an adjustable fly cutter that would extend to the diameter needed, I therefore had to make something to do the job. Since this was likely to be the only time I will ever need to cut a radius of this diameter I decided to make a fixed, non-indexable cutter and then use the milling machine table to bring the cutter far enough into the block to give the final size.

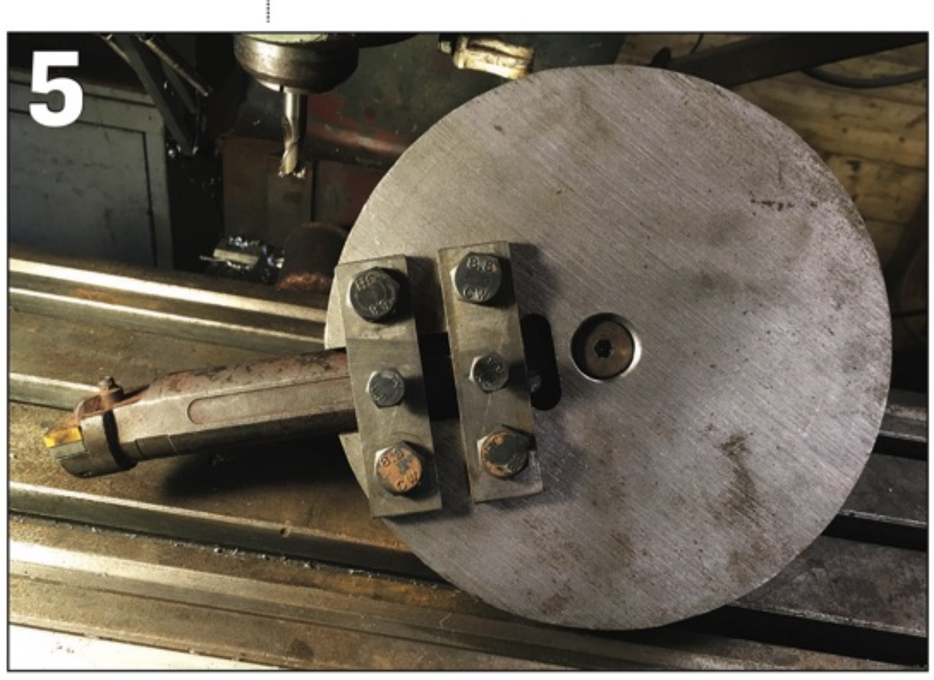
To make the cutter I bought a cut disc of steel big enough to be able to clamp a large boring bar to and thick enough to provide the correct stiffness for the boring bar. The first operation was to clamp it to a pair of parallels and drill through at 10mm (**Photo 1**) for the fixing bolt, before the slot for the boring bar was then machined out using an end mill (**Photo 2**), to 1mm deeper than the depth of the bar. This was machined slightly offset from the centreline to ensure the tip of the tool is on the centreline.



Photos by the author - descriptions in text



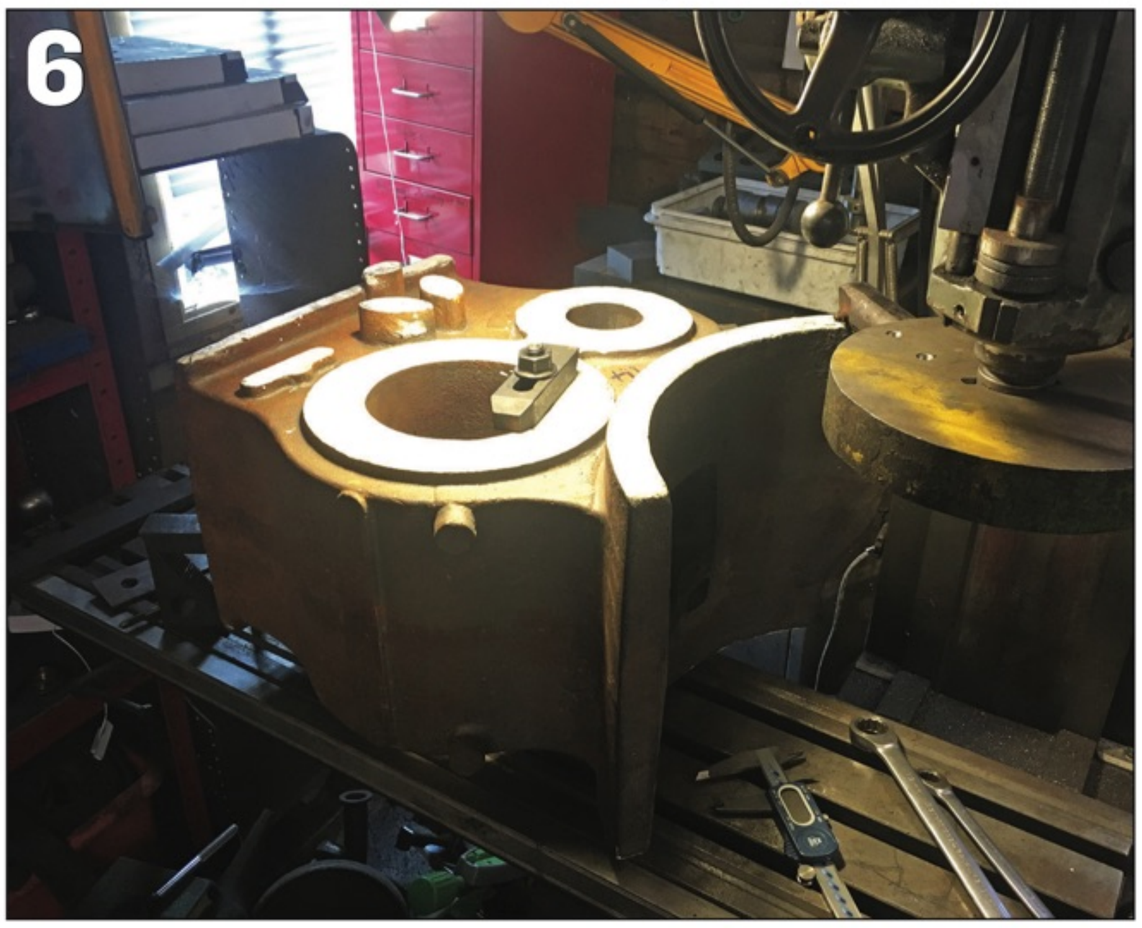


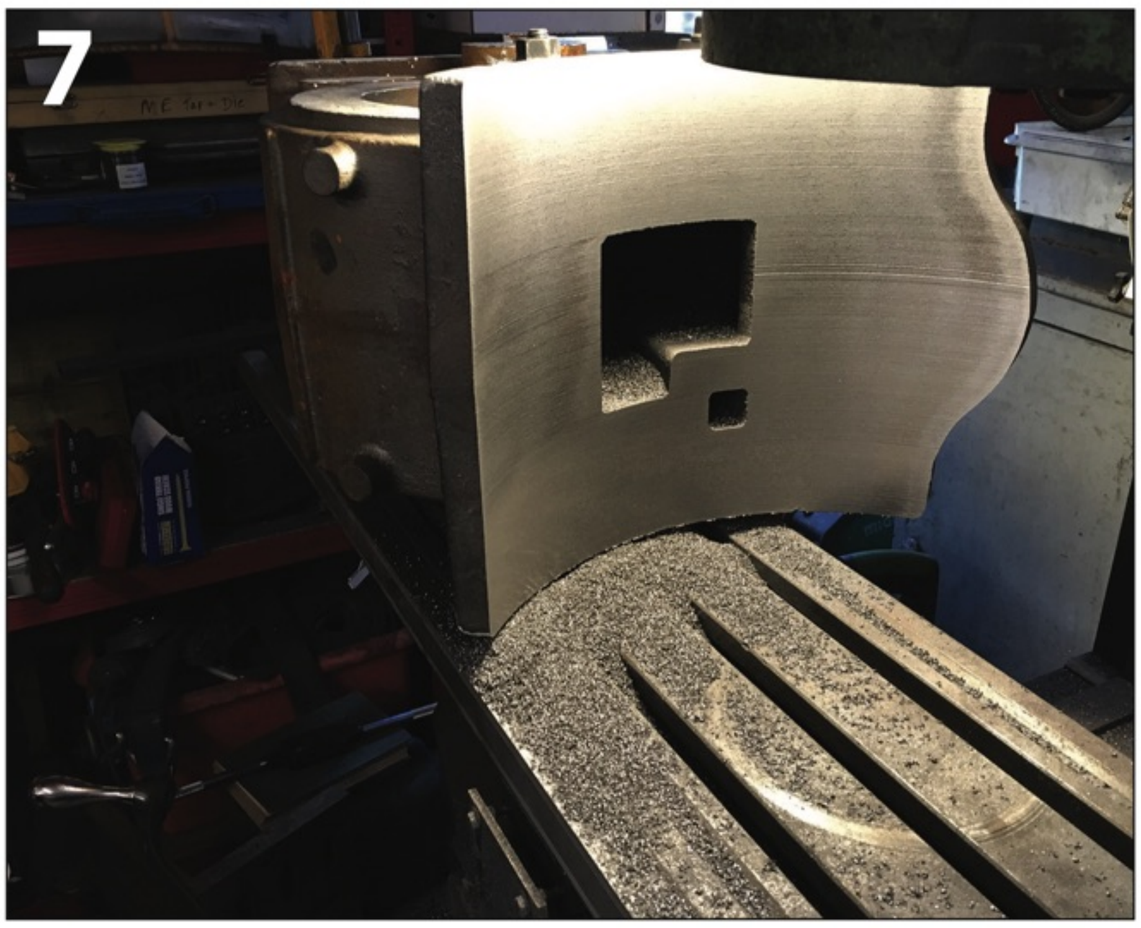


Then four holes were drilled and tapped around the slot for the holding down straps (**Photo 3**). The piece was then turned over and the slots were machined in to fit the R8 Arbour tool holder using an end mill (**Photo 4**).

The holding down straps were manufactured from two pieces of bar (**Photo 5**), cut to length, drilled clearance size for M8 on the outer holes and tapped M8 on the middle hole for the clamp bolts.

The fly cutter was assembled and the cutting diameter set before setting the block up on the mill and gradually taking cuts until the final flange thickness and diameter was achieved (**Photos 6, 7**). EIM





A Midland 115 Class 'Spinner' in 5-inch Gauge

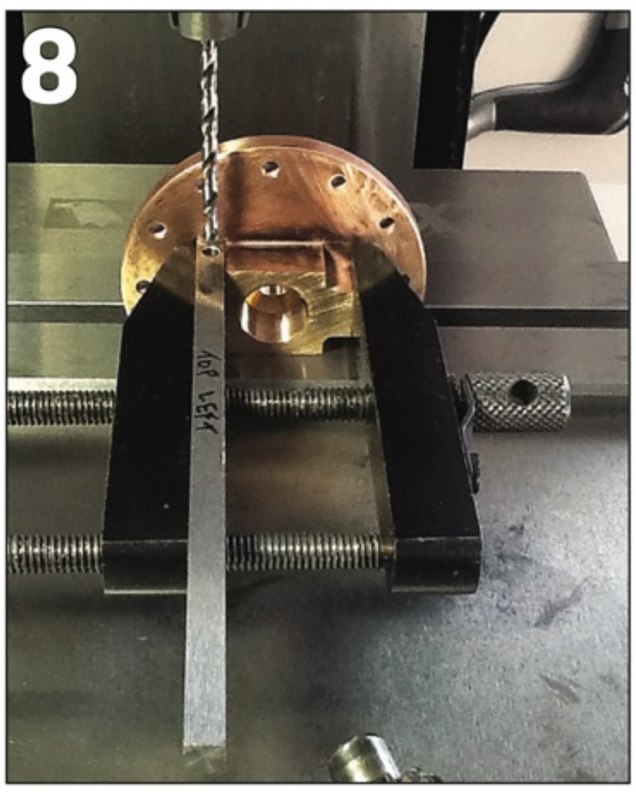
Bruce completes the chassis of his first-ever live-steam locomotive build.

BY **BRUCE BOLDNER** Part two of five

I was fortunate to obtain some lengths of 3/16-inch square silver steel bar. Silver steel usually comes in round bar these days but the square bar provided perfectly true slide bars, with no machining required.

Four blind holes for the slide bars were drilled into the projecting shelf on each cylinder rear-end cover, using the digital readout on my mill to ensure accurate spacing. I then opened the holes to open-sided cutouts (**Photo 7**).

The inner section of each drilled cutout was left round as formed by the drill – attempting to square these off would have risked a loss of alignment. Instead I rounded the inner edge of each slide bar until the remaining two right-angled sides just seated in the cutout. Then I clamped and drilled them for the retaining bolts (**Photo 8**).



As previously mentioned Martin Evans helpfully serialised the build of the final class of Spinner in *Model Engineer* in 1970 but I was not happy with his method of attempting to separately position the two valve guide sleeves into the motion plate at the correct angle.

From front to rear, the valve spindles enter the motion plate at an upward angle of 1 in 15 (4.5 degrees) whilst the slide bars above enter the motion plate at a downward angle of 1 in 13 (3.75 degrees). I adopted the excellent suggestion of a fellow club member to mill one face of an aluminium block at 4.5 degrees , then, placing the machined side face down in the mill vice, bored two holes straight through for the valve spindle sleeves.

The sleeves were pushed into the holes in the aluminium and the motion plate clamped over them. The sleeves were allowed to protrude slightly through the rear of the motion plate, to which they were then silver soldered (**Photo 9**).

The spindle guides were then reamed at 90 degrees to ensure the bores were true and parallel with each other (**Photo 10**). The finished result is shown in **Photo 11**.

The cylinder block is of course mounted at an angle of 3.75 degrees between the inner frames, matching the angle of the slide bars. Martin Evans provides good advice on positioning the cylinders. He quotes the distance that the rear of the cylinder block should be positioned from the centreline of the driving axle and suggests making a dummy driving axle with the centre turned down to ¼-inch diameter. A dummy piston connecting rod is then made up, with the axle end tapered to a point.

Due to some confusion relating to the email used to send the manuscript in, the first part of this series was wrongly attributed to Bruce's son Jeremy last month. EIM apologises for the error.

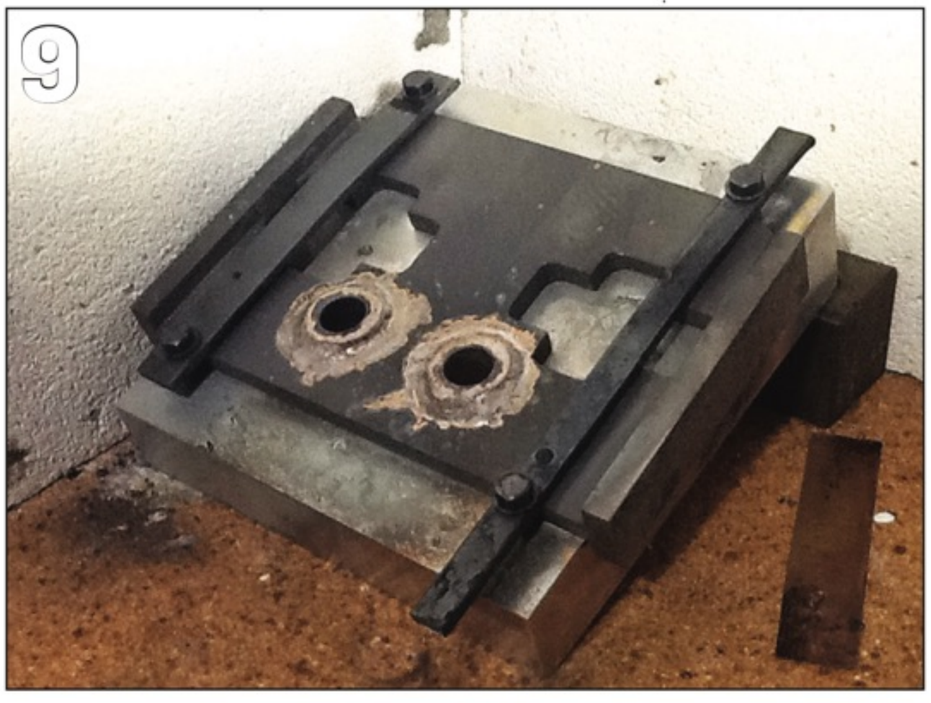
PHOTO 7: Cutouts in cylinder rear end cover for slide bars.

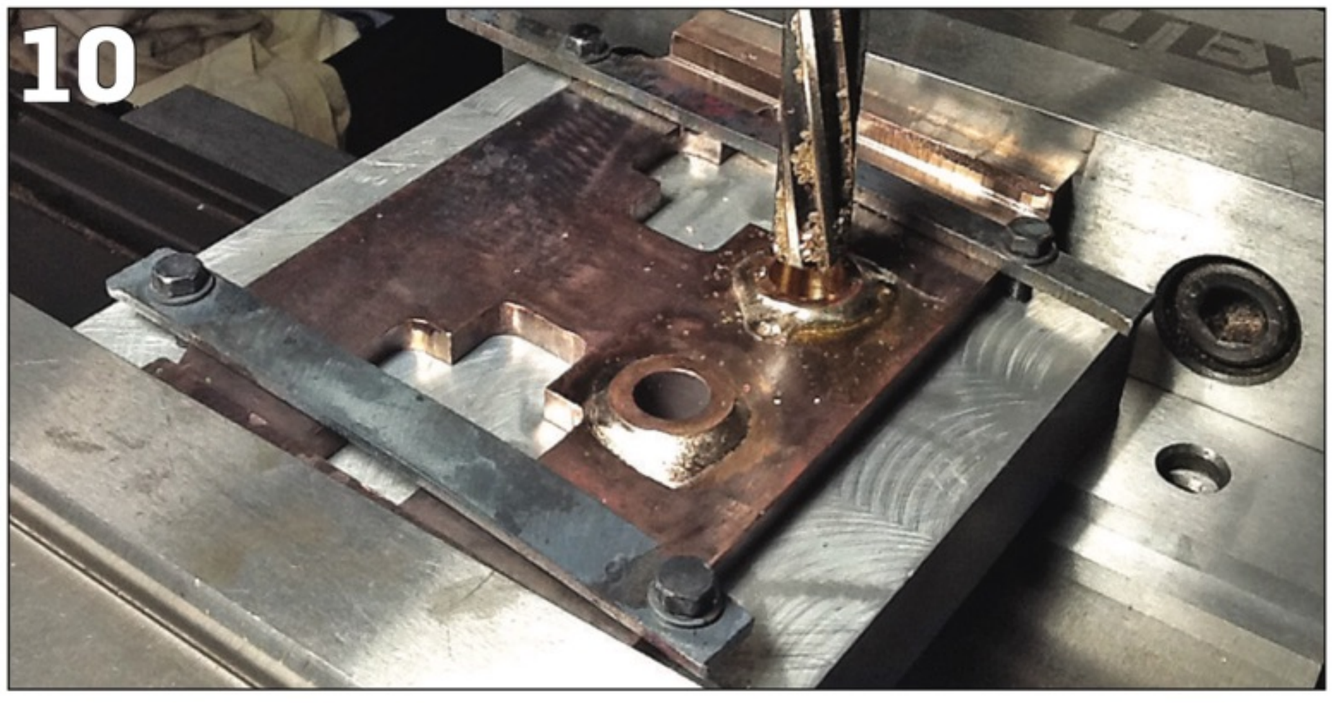
PHOTO 8: Drilling slide bars for their retaining bolts.

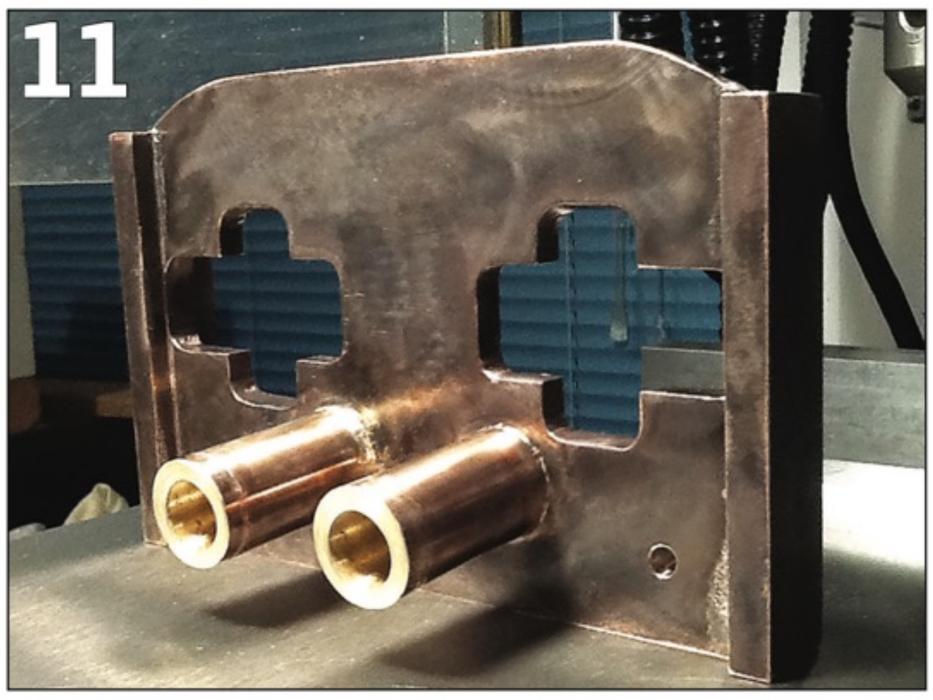
PHOTO 9: Valve spindle sleeves silver soldered to motion plate.

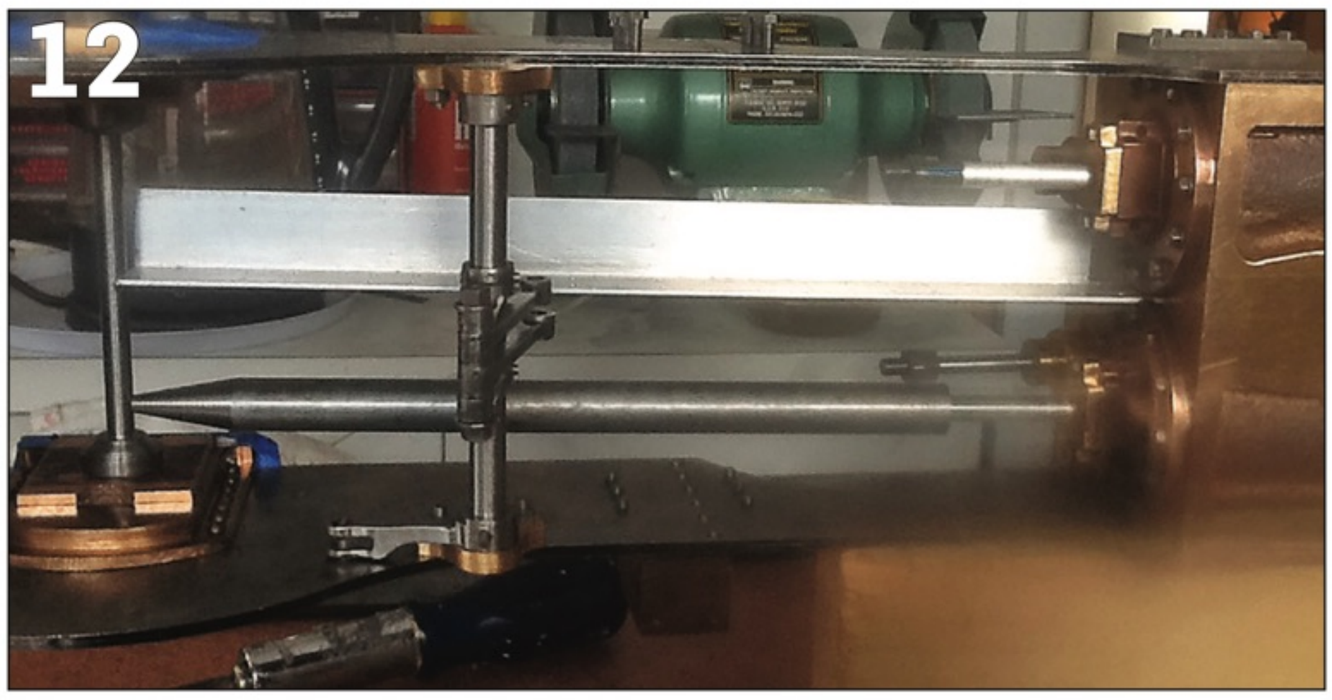
PHOTO 10: Sleeves then reamed to ensure parallel true bores.

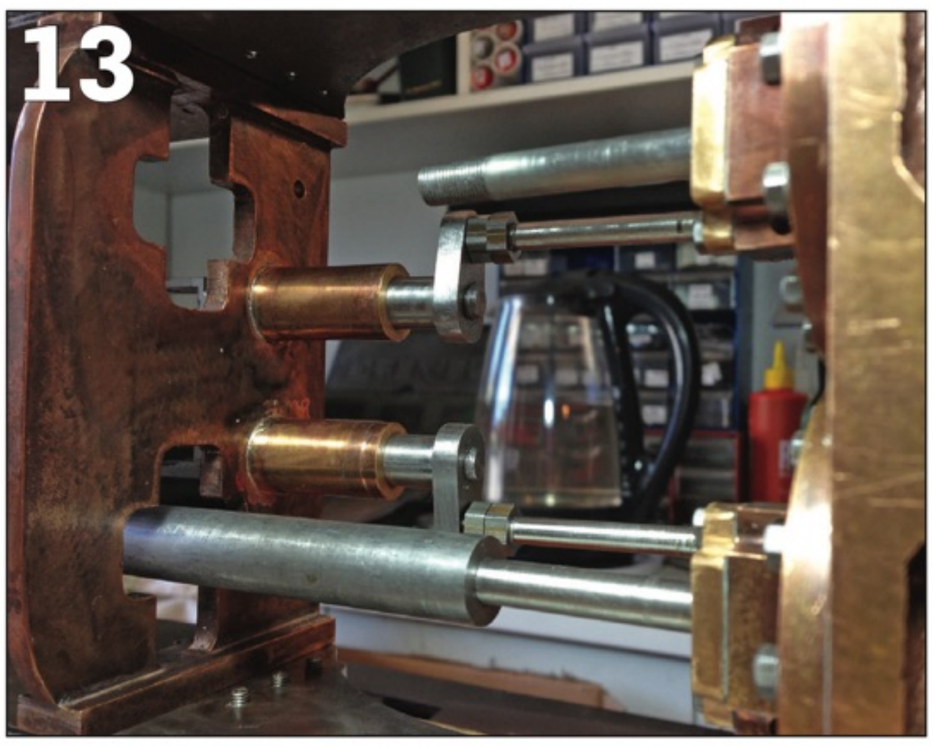
All photos by the author

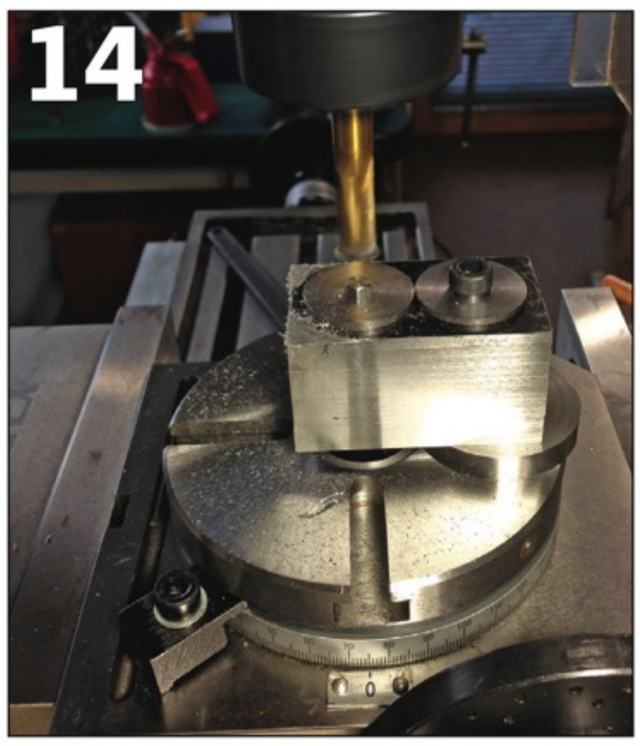












The other end is screwed to one of the piston rods in its cylinder and the cylinder block angled vertically between the frames until the pointed end of the dummy connecting rod lines up with the centreline of the axle (**Photo 12**).

The dummy connecting rod should be visually centred through its cutout in the motion plate (**Photo 13**). The small hole at the top of the motion plate (as oriented in photo 13) is for the drain cock rod.

Driving axle assembly

I decided to make up the cranked driving axle using Loctite and steel pins – one of the methods that Martin Evans suggests. It was a little tricky machining the driving axle, with its different diameters both for the eccentrics and inner and outer axle diameters, just half a thou difference

PHOTO 11: Finished plate and guides.

PHOTO 12: Dummy piston rod made to aid positioning of cylinders.

PHOTO 13: Dummy rod visually centred through cutout in motion plate.

PHOTO 14: Machining crank throws on the mill.

PHOTO 15: Cranshaft Loctited but not yet pinned.

PHOTO 16: Rubber bands hold axlebox away from wheel while Loctite sets.

PHOTO 17: Machining eccentric straps from photocoped drawings.

here and there, but my second try worked. **Photo 14** shows the crank throws being machined in the mill.

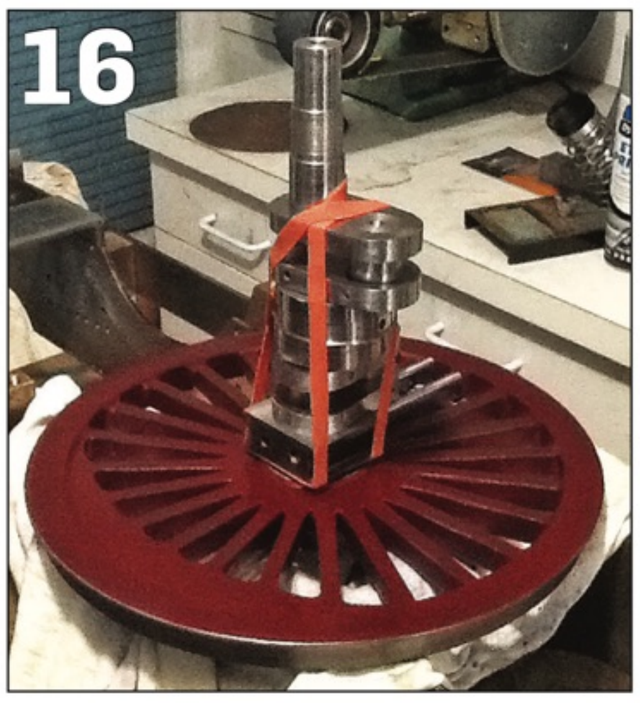
In **Photo 15** the crankshaft is Loctited but not yet pinned, with the axle not yet cut out between the crank throws and the four eccentrics trapped between them. The delicate part was preventing the Loctite from spreading from the throws to the eccentrics. I did NOT want the eccentrics immovable at this stage!

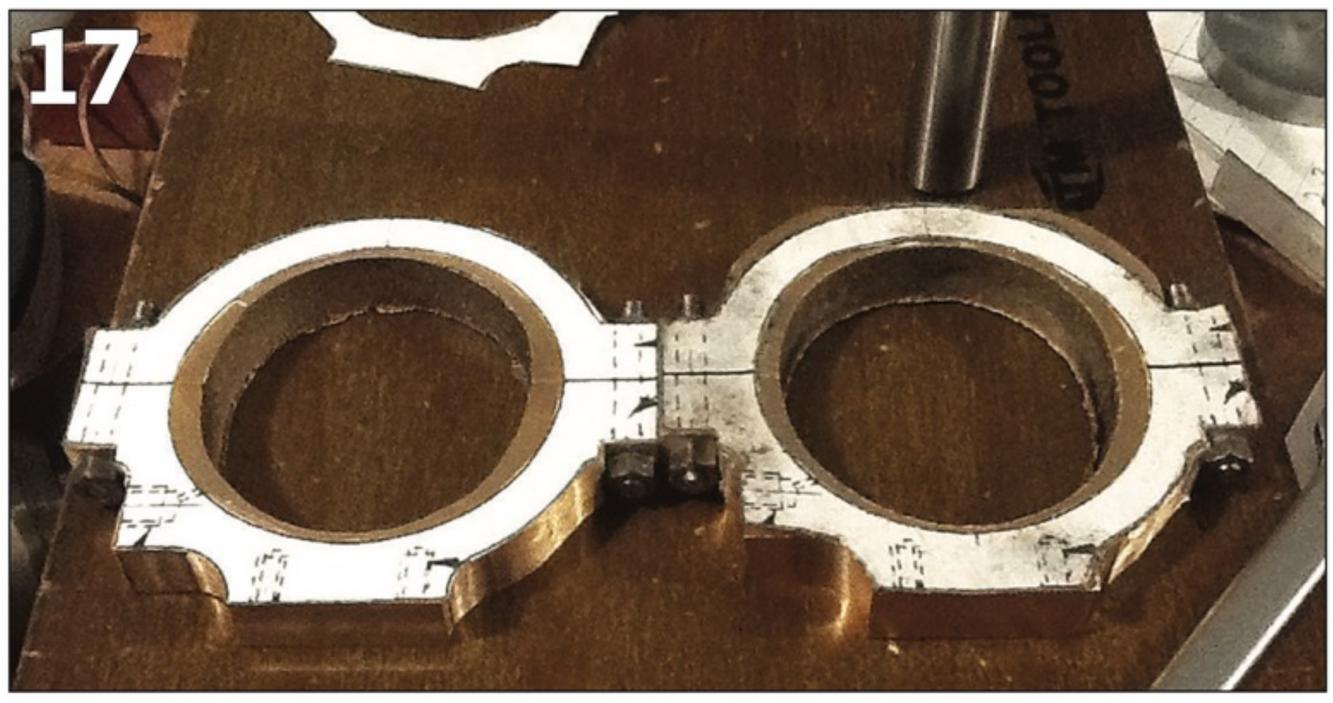
Loctiting the driving wheels to the axles was an equally delicate task, whilst keeping the adjacent axle box Loctite free. The Loctite help line suggested I spray the firm's lubricating spray on the axle section within the axle box, which would prevent any of the adhesive adhering there. I also used rubber bands to hold the axle box away from the wheel whilst the Loctite set. It worked! (**Photo 16**).

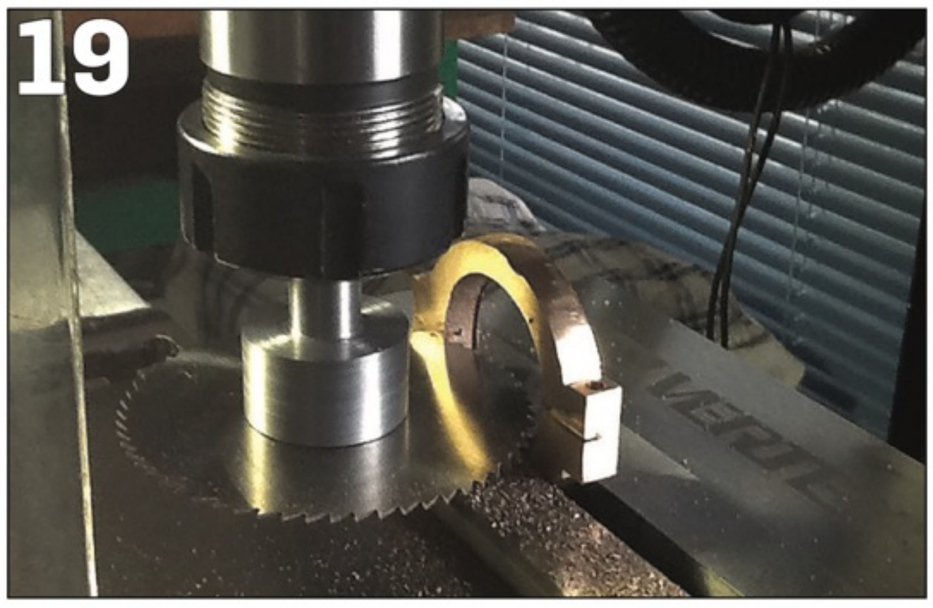
The eccentric rods were now made on a jig to ensure equal reach. To make the straps I simply photocopied the drawings from the plans, cut them out, taped them to the bronze blanks and machined and filed them to shape (**Photoa 17-20**).

Mike Boddy, another Steam Locomotive Society of Victoria member and good friend, has given me a great amount of help. He hasn't been in the model engineering game any longer than I have. But he's a lot smarter than me and that helps!

Amongst his other talents, Mike has the ability to conceptualise new parts and ideas and draw them up fully dimensioned in CAD . He drew up the connecting rods this way and ▶







we had them water cut. All that remained to be done was a little filing and linishing (**Photo 21-22**).

Crossheads and slippers were made up then tested for binding in the slide bars,before securing the latter to the motion plate (**Photos 23, 24**). Precision angle blocks were then used to determine the angles of the slide bar to motion-plate securing brackets (**Photo 25-26**), with acute angles being made for the upper bars (**Photo 27**) and the opposite obtuse angles for the lower bars (**Photo 28**).

The expansion links were water cut from gauge plate and a club member loaned me a sector plate with which to machine them. You may see the small red dot on the bottom lug holding the expansion links. This is from a laser held in the mill chuck – very handy to confirm the pivot points! (**Photo 29-30**). I also use the laser in the tail stock of the lathe when centring items in the four-jaw independent chuck.

Eccentric pinning

To return to the eccentrics, as soon as you have a running chassis and are able to time the valves and confirm that all is running smoothly on compressed air, **PIN the eccentrics!** Martin Evans specifies one 4BA grub screw as sufficient to hold each eccentric in position on the axle – **they are not sufficent!** I only managed four laps of our club track before they slipped and the Spinner came to a halt and sat there gently rocking back and forth.

I had been told by some not to pin the eccentrics before running on steam, because a locomotive which ran well on air might be very different on steam, due to the expansion properties of the latter. Others said that if it ran okay on air, pin them now! Being a nervous beginner, I erred on the side of caution and decided not to pin the eccentrics before trialing on steam.

I accept that this conflicting advice was given with the best intentions and perhaps some locomotives do behave differently from air to steam. But my Spinner showed no difference whatsoever.

When I pulled the locomotive apart to paint it , I visually set the eccentrics and valves exactly as before, **very** briefly ran it on air again with just the grub screws, then pinned them with ⅛-inch silver-steel pins into the axles with Loctite.

The Spinner is very easy to time. You just turn it upside down, remove the bogie, remove the valve chest cover and the position of the valves in relation to the ports can be seen by rotating a driving wheel.

On the two occasions that I timed the valves, I referred to figures 20-21 on page 200 of the book *Building the New Shay* by Mr Kozo Hiraoka. Yes his locomotive is a geared Shay, but its

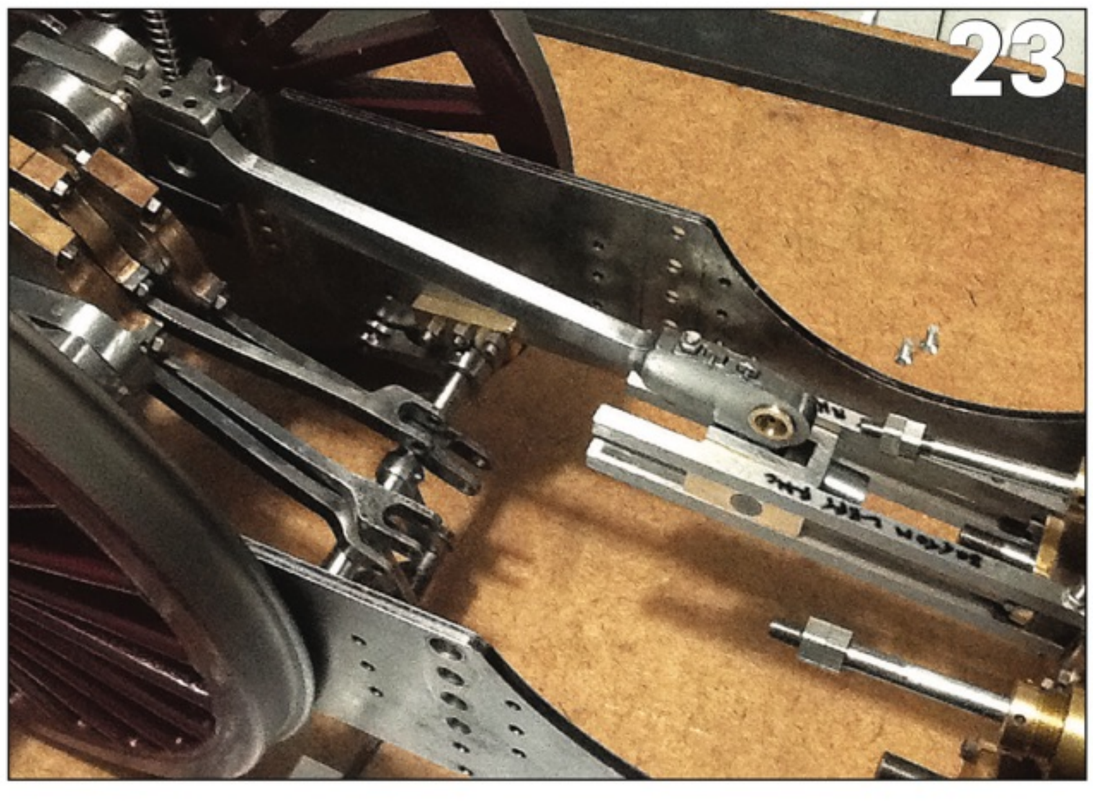
PHOTO 18-19: Stages in making the eccentric straps.

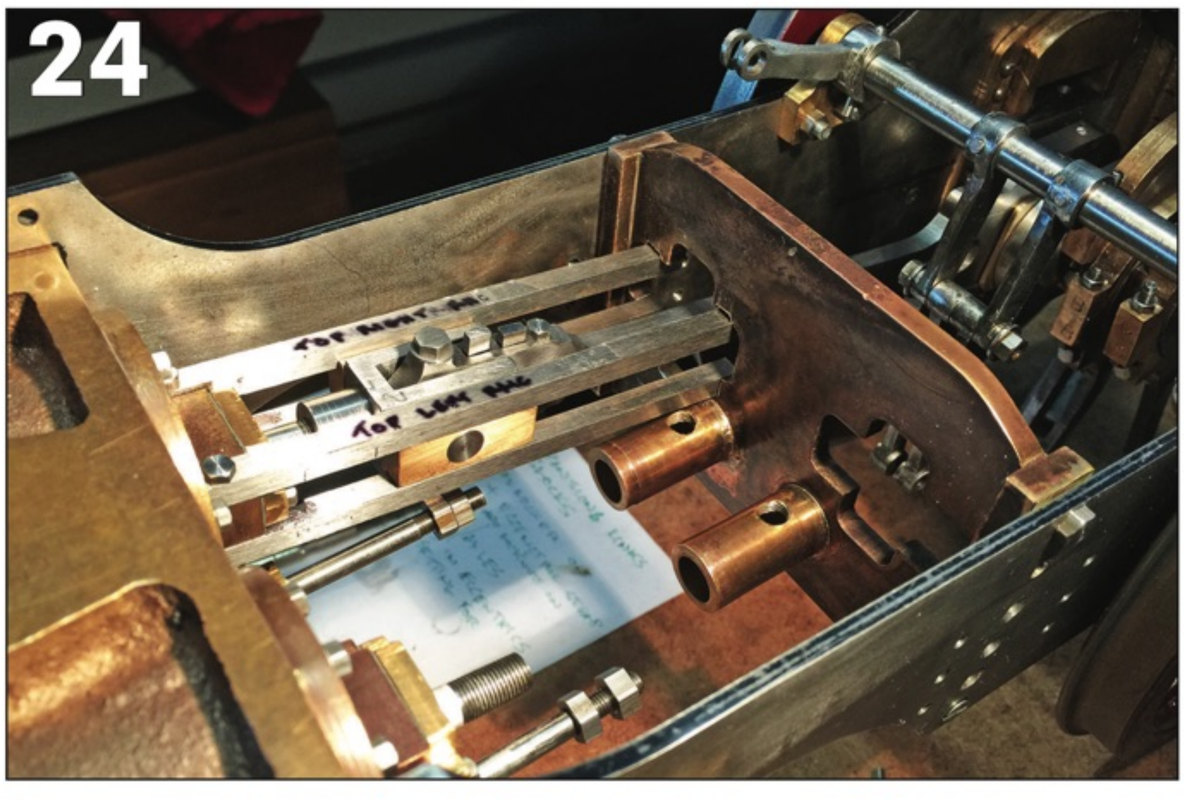
PHOTO 20: Complete and assembled set of eccentrics.

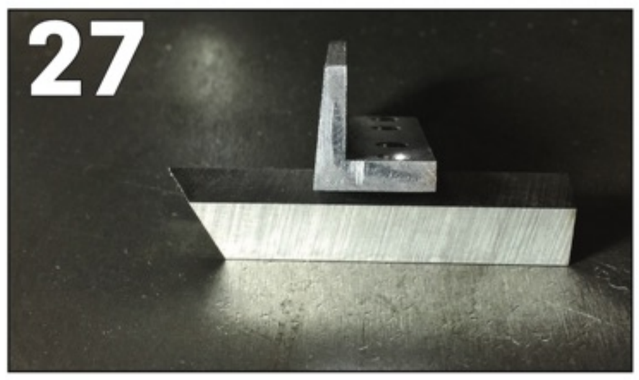
PHOTO 21-22: Connecting rods water-jet cut and filed to a finish.

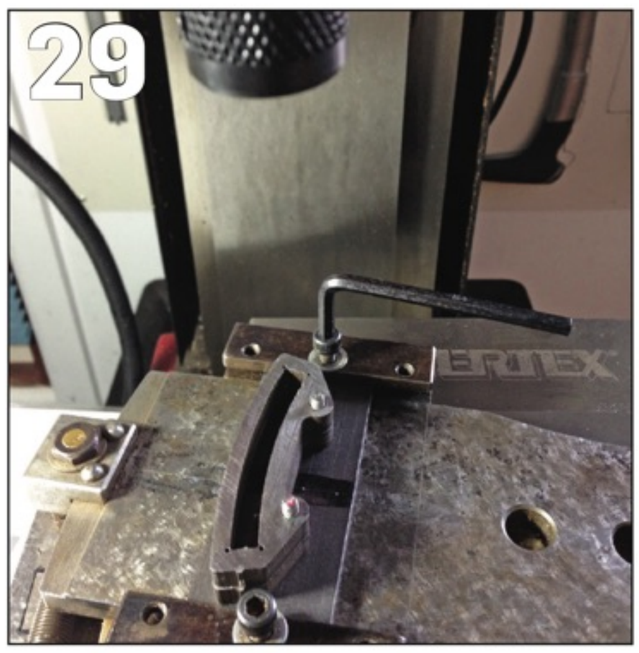
PHOTO 23: Crossheads and slippers made up and tested for binding in sldie bars...

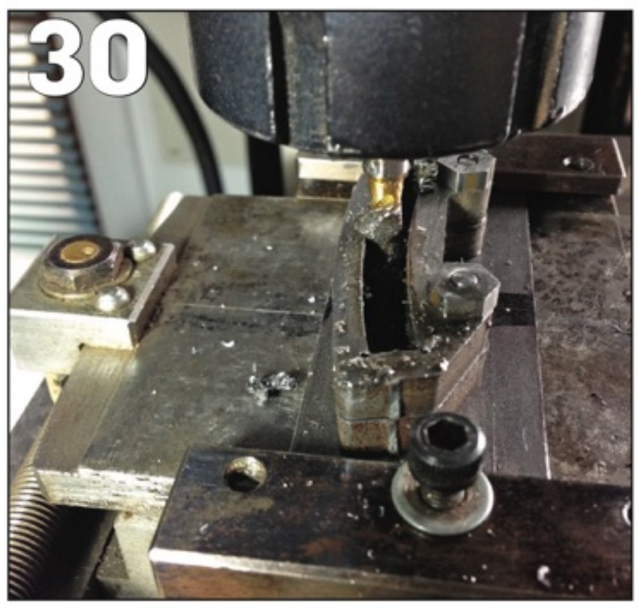
PHOTO 24: ...then secured in place.











valve gear is Stephenson Link, mounted vertically. He has written a number of books and they all feature the clearest diagrams and text on how to build model locomotives that I have ever seen. I only wish that his interest was in 5-inch gauge British locomotives rather than 3½-inch gauge American industrial engines!

Bogie springing

With regard to the bogie, Martin Evans recommends using eight Tufnol spring leaves per side. He states that the Tufnol leaves were heated to just below blistering point on an electric hot plate.After this treatment, by a fellow model engineer, it was claimed that they retained their springiness. As I did not use this method, I cannot dispute this outcome with any authority.

However, I preferred the method of another modeller and clamped a number of the Tufnol leaves to a slightly tighter radius than required (because I found that they sprang back a little after cooling) and boiled them in water for 15 minutes. I considered this method to carry less risk of destructing the Tufnol.

The other problem is that there are so many different grades of Tufnol. The strip I obtained from Reeves bore no resemblance to the dark, shiny sheet material that a member donated to our club. It was this latter that I used, as it at least retained its curve after boiling. I can only assume that this was a different grade of Tufnol.

As a result of my experiments, I have found that the Tufnol I encountered has no inherent springiness whatsoever and should only be used as a filler. Would this have been different had I used a different grade of Tufnol and baked them on a hot plate? Possibly. I'll leave that to you to decide.

With regard to my own bogie, I started out with only one spring steel leaf per side, with the remainder in Tufnol. However as construction continued and the locomotive weight increased, I ended up with five spring steel leaves, and one short Tufnol leaf per side.

Three of the steel leaves per side are full length and locate through the end buckles. There are two progressively shorter steel leaves above and one even shorter Tufnol leaf above those , topped with a small steel square inside the central buckle onto which the retaining grub screw bears.

My method of tempering spring steel leafs is as follows:

1) Bend leaf to shape
2) Heat the leaf to bright red using a propane torch
3) Immediately quench in cold oil (dirty sump oil is preferred)
4) Wipe off the oil (not essential perhaps) and place in an oven preheated to 250C for one hour
5) Allow to cool at room temperature.

My bogie holds the front of the locomotive at the correct ride height and appears not to be lifting the driving wheels off the rails, because I am very happy with the traction (no slipping) on our undulating track, although admittedly I have only hauled myself and one other adult on an additional riding truck at this stage. **Photo 31** shows the bogie in its early, predominantly Tufnol leafed stage.

NEXT TIME: Bruce focuses on the Spinner's boiler.

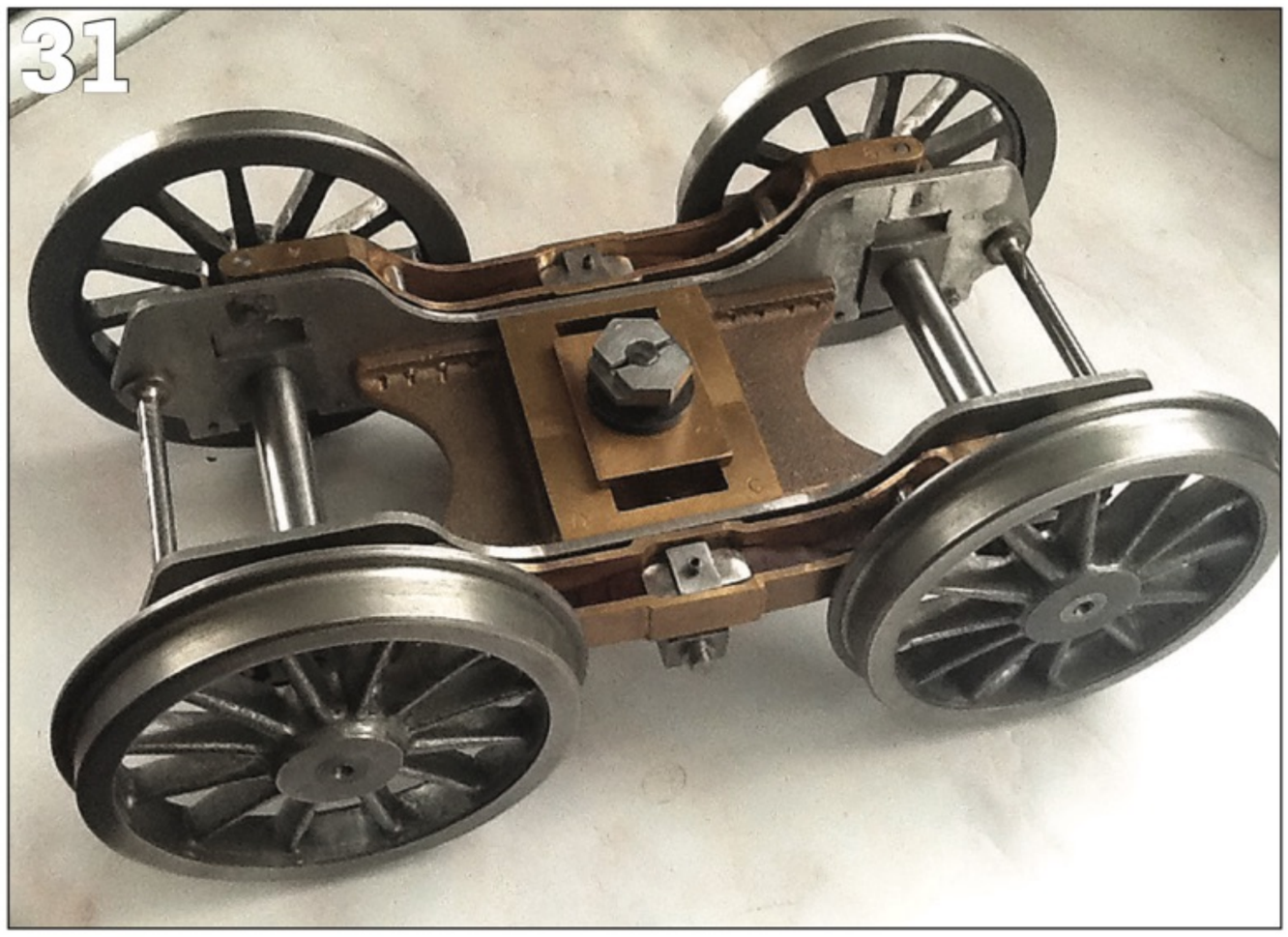


PHOTO 25-26: Angle blocks used to determine angles of slide bar to motion plate securing brackets.

PHOTO 27: Upper bars require acute angles...

PHOTO 28: ...obtuse angles for lower bars.

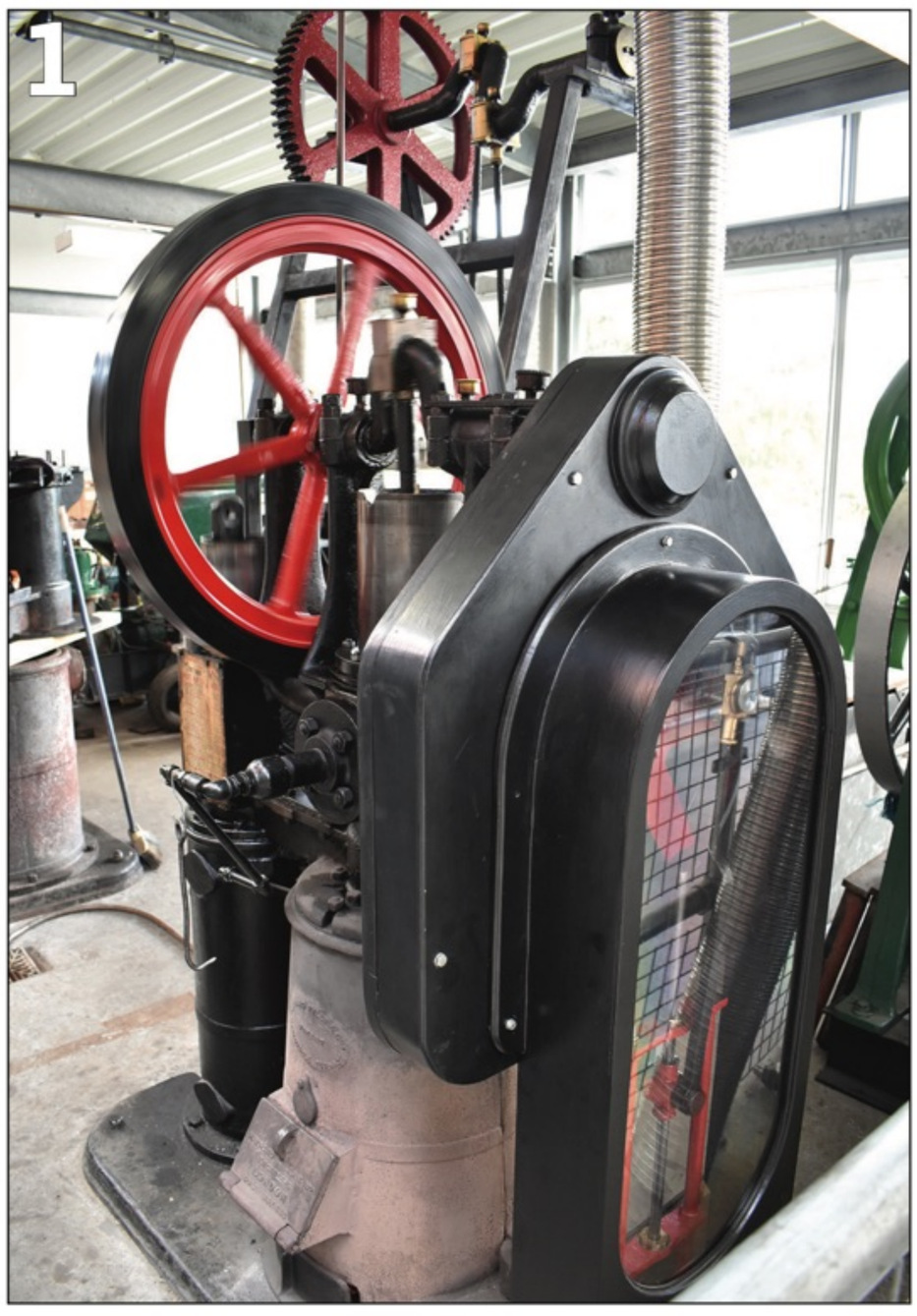
PHOTO 29-30: Laser pointer helps to confirm pivot points on expansion links.

PHOTO 31: Made-up bogie with Tufnol leaf springing.

Stirling Engine Rally 2019

John finds plenty of innovation in the annual gathering of hot-air engine exponents.

BY **JOHN ARROWSMITH**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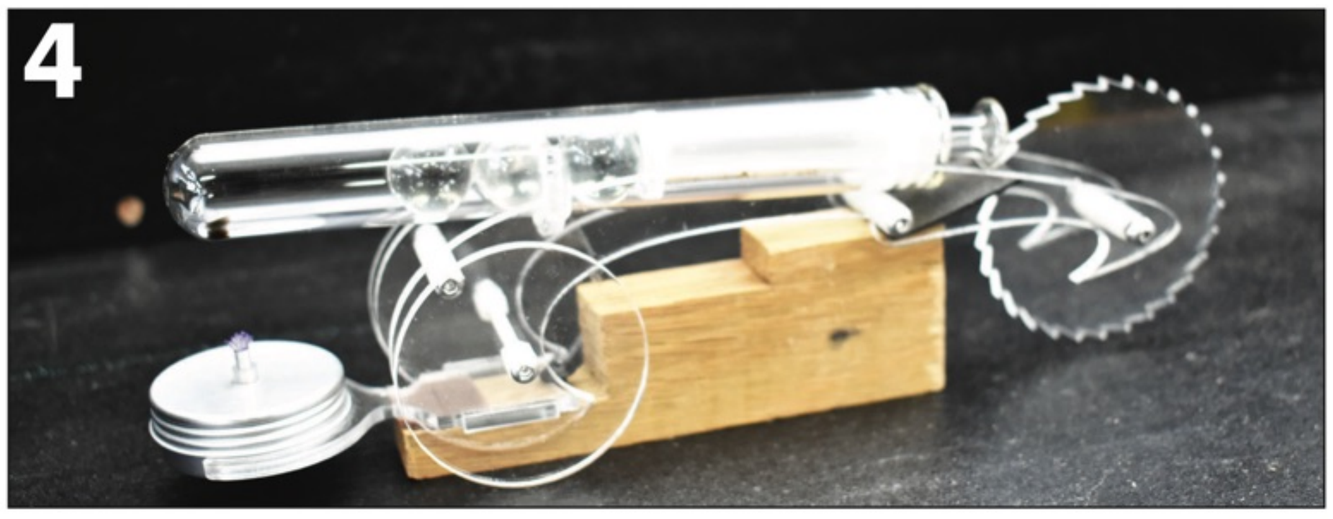
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The Herefordshire Waterworks Museum in Hereford was again the venue for the annual rally of the Stirling Engine Society on 13th October and it proved another successful event. The fully working museum has two full-size hot-air engines of its own which compliment the eclectic mix of the rally engines very well. My picture (**Photo 1**) shows the Hayward-Tyler engine circa 1890 which has a ½hp rating and was used locally to provide a water supply to a large country house.

The models on show varied from modern simple imported examples to vintage engines from the 1930s with a good range of scratchbuilt engines covering many different types in between. The museum itself also has an excellent interactive display of hot-air and Stirling engines available so that the general public can understand the basic principles and see how they operate (**Photo 2**).

Among modern examples imported from China in the well laid-out display by Brian Lowe was a scratchbuilt simple self-propelling vehicle (**Photo 3, 4**). I had a long chat with Norris Bomford, who is a very experienced builder and operator of Stirling engines and he explained many of the current innovative ideas for them which are being considered by a number of universities and surprisingly to me, by NASA.

All photos in this report by the author. Full caption details in text.

Stirling in space

The US space authority has used a Stirling engine to develop a power pack for possible use in a future Moon base. The projected output would be about 40kw of usable energy which would be equivalent to powering about eight houses on Earth. Who would have thought that a simple device invented in 1816 by a Scottish clergyman would even be considered for such a high-tech installation on the moon and possibly the planet Mars.

Norris had on show his version of a four-lever Stirling engine which he has used in a boat and which can develop enough power for two people to enjoy a leisurely river trip at about 2/3 knots (**Photo 5**). Current commercial models can generate up to 10kw which shows how the machine development has progressed.

Bob Cannon was displaying a range of models which are all totally scratch built, no commercial castings of any sort are used except for the occasional flywheel. All were nicely made and presented and were working well. One was powering a pen engraving machine built from Meccano, which was an attraction for the visiting young people (**Photo 6**).

Alongside was Andy Badman, who with his well-made Flame Gulper was

causing some amusement as at the end of each stroke the engine sounded as if it had a bad case of flatulence. The noise was caused by a diaphragm valve which reduces the pressure at the end of the stroke (**Photo 7**). I mentioned before that the museum had a working collection of these engine types, and another static display was a group of engines bequeathed by a local industrialist. These included a well-made small scale Ryder Ericsson hot-air engine (**Photo 8**).

The secretary of the Society, Julian Wood is well known all over the UK with his large collection of many types of engines. One of his new ideas was to use a tumbler gear set to provide a car with a simpler reversing method than the two-pulley system previously used. He assured me that it works well and has much more torque than the accepted conventional method.

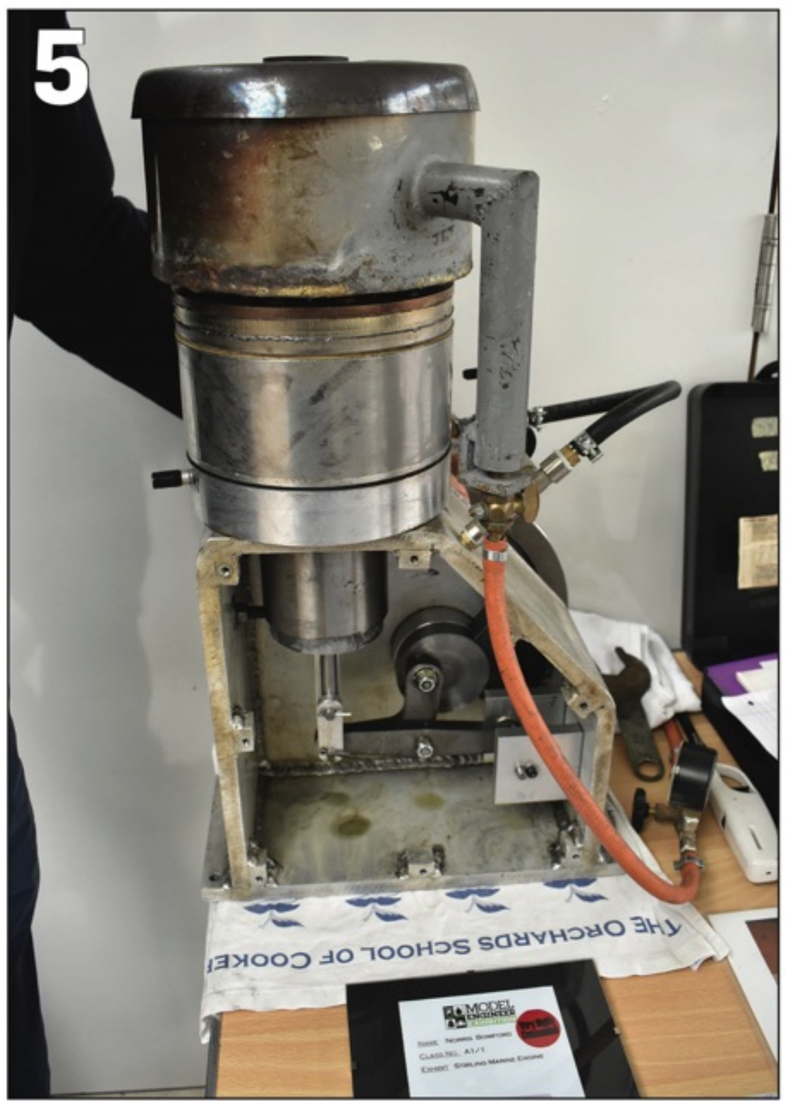
Julian also explained that the standard hot-air engine would not work without a flywheel of some description; he then proceeded to demonstrate an engine working very well without a flywheel. This is all to do with the temperature and pressure generated in the displacer, that seems to provide extra momentum and output torque on the shaft (**Photo 9**).

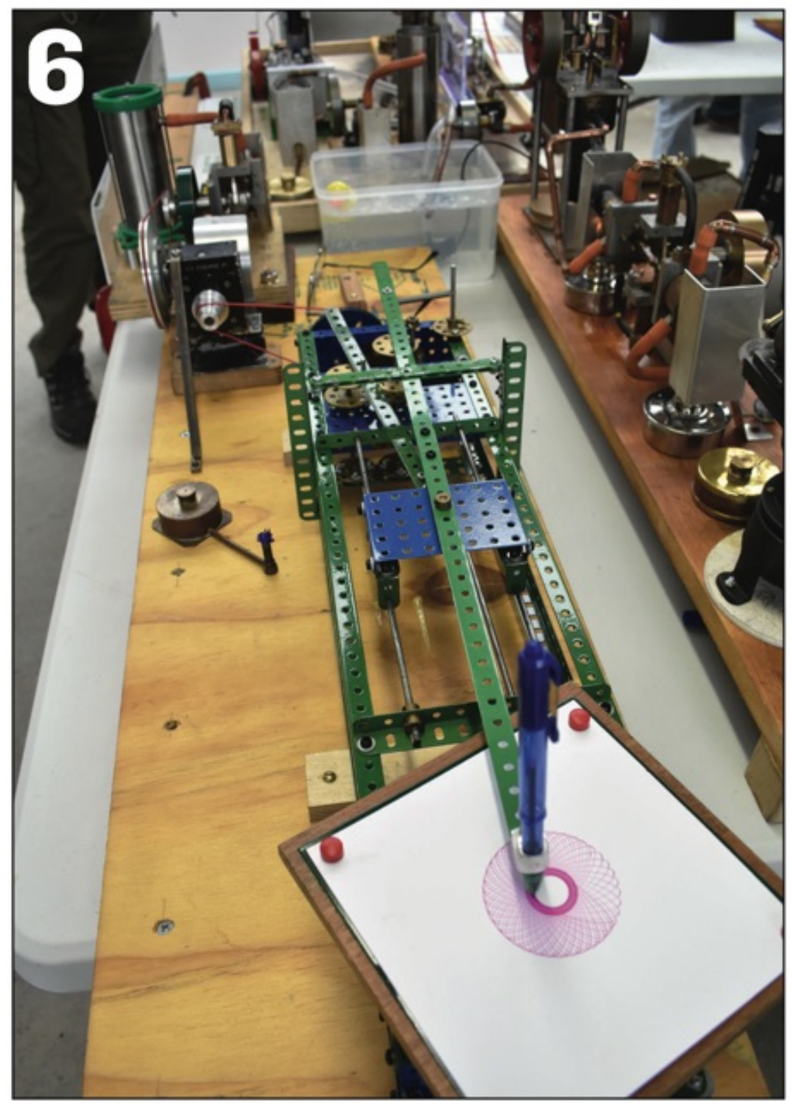
Another excellent exhibit was a fan engine, under construction by Jeff Ford. It is loosely based on the old Edwardian/Colonial fan engine and Jeff said he wanted to make it look good so he added a touch of Art Deco styling to the fan – it works very well.

He produced his own drawings for the fan and although it is a conventional design it has an offset displacer drive which makes a more compact and attractive unit. A hard anodised cylinder has not proved successful so Jeff is going to change to a cast iron one (**Photo 10**).

I hope this brief description gives you a flavour of a very interesting and friendly event which is well worth a visit if you are in the area next year. The venue is just right, the staff are informative and they make a good cup of tea and refreshments, what else do you want from an exhibition! EIM

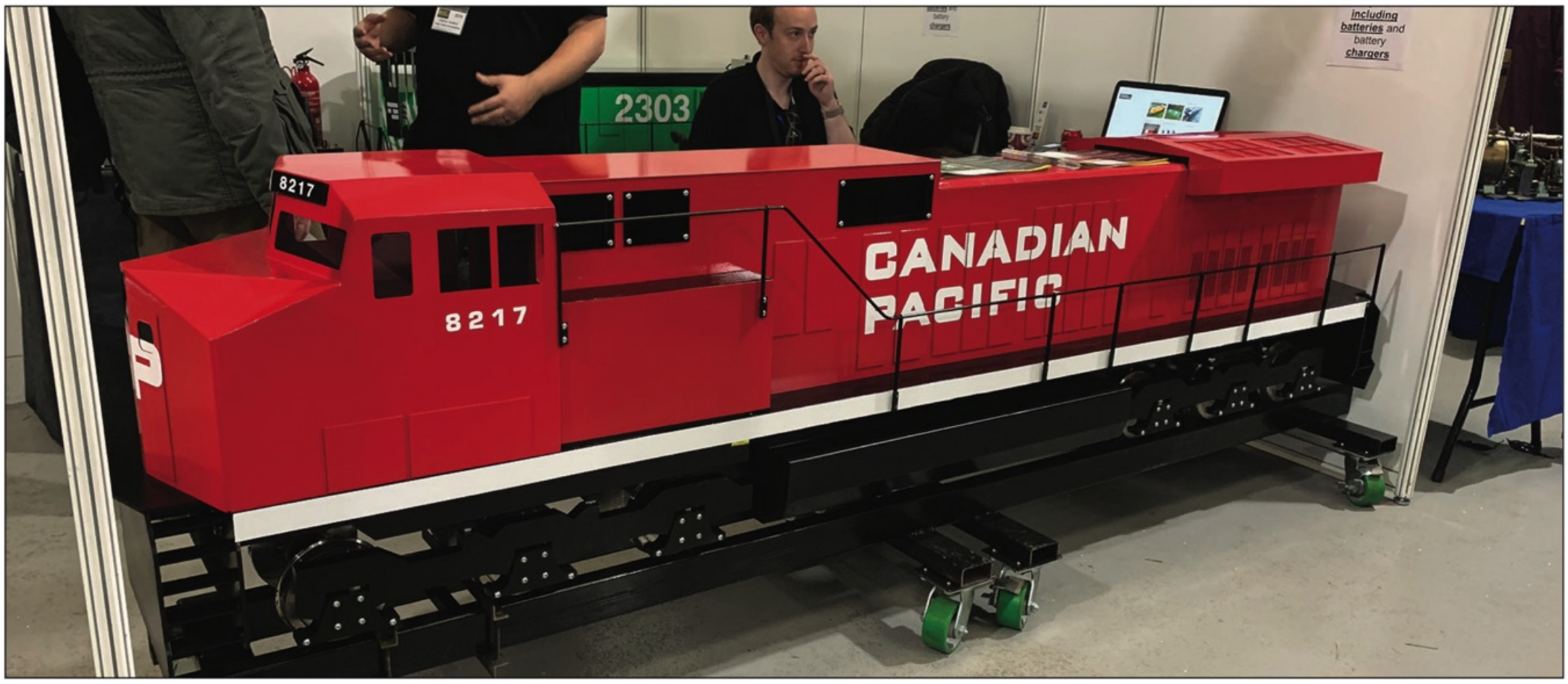
■ Herefordshire Waterworks Museum: www.waterworksmuseum.org.uk





"The well-made Flame Gulper was causing some amusement as at the end of each stroke the engine sounded as if it had a bad case of flatulence..."

Very large scale locomotives...



Definitely causing a stir at the Midlands Model Engineering Exhibition was likely the largest locomotive at the show, on the stand of the appropriately named Large Scale Locomotives Ltd.

The GE 9-44CW (Dash-9) freight locomotive is the latest release from the Port Talbot, south Wales firm, which already markets an attractive Alco S-4 switcher. Replicating the locomotives that have been the backbone of US, Canadian and Australian freight operations since the 1990s, the Dash-9 model is built to ⅛th scale – 1½-inch to the foot, and measures more than 2.9 metres long! LSL tells us that the model is designed to be ridden behind, rather than on, and is ideally suited to larger clubs where for example there is a need to haul large, heavy passenger trains.

Power comes from a single Lynch DC electric motor mounted in the body and which can be specified between 10 and 36KW, but the makers add that the loco can be built in a range of power configurations to suit any situation – for example with four 750W motors. All 12 wheels are driven, using a half-inch chain drive.

Prices for the Dash-9 start from £9,950 for a 4hp version and range up to £15,500 for a 25hp model. Locomotives are supplied finished and ready to run, between 12 and 16 weeks after ordering.

The Alco S-4 continues to be available – measuring 1.6 metres long and again designed to be ridden behind, it can be supplied in 2hp and 4hp versions at prices starting from £3,750.

Meanwhile Leighton from LSL tells us that the next offering will be of a British prototype, the Brush Bagnall 515hp diesel-electric shunter used by British Steel at Port Talbot.

Large Scale Locomotives Ltd: www.largescalelocomotives.co.uk

Show dates for the diaries

The Midlands show may be behind us but there are plenty more events to interest model engineers coming up soon, starting directly after Christmas with the Midlands extravaganza's sister show, the London Model Engineering Exhibition.

Held as ever in the evocative surroundings of Alexandra Palace, the 24th edition of the show will be held on Friday 17th to Sunday 19th January. Organisers are promising at least 45 clubs and more than 50 specialist traders at the event, plus some interesting extras – at the last show it was Steampunk, which certainly caused some comment... Details are at www.londonmodelengineering.co.uk and we will carry our usual pull-out four-page showguide next month.

And while you have those diaries out, the 2020 version of the National Model Engineering Exhibition will be staged at its traditional venue of Doncaster racecourse on 8th-10th May. Details are at www.thedoncastershow.com – see you there!

■ Polly Model Engineering showed off its most recent locomotive at the Midlands Model Engineering Exhibition. 'Molly Ann' is a 5-inch gauge 0-6-0 saddle tank, measuring a satisfying 32½ inches long and 16¾ inches high to the top of the chimney, and weighing in at 47kg. The boiler is 4½ inches in diameter, built from ⅛-inch and 3/32-inch copper, silver soldered throughout and with a working pressure of 90psi. It is fed by an axle pump, hand pump and injector and drives Stephenson's Link motion.

Like all Polly locos this engine is sold as a 12-kit package, each including fully machined parts. The first payment covers 20 per cent of the total price with the remaining 80 per cent divided into 11 equal monthly payments. This enables the buyer to spread the cost whilst progressing the build.

Polly Model Engineering: www.pollymodelengineering.co.uk

No rest at end of season...

Public running may have mostly ended for the year but the clubs are still busy...

COMPILED BY **ANDREW CHARMAN**

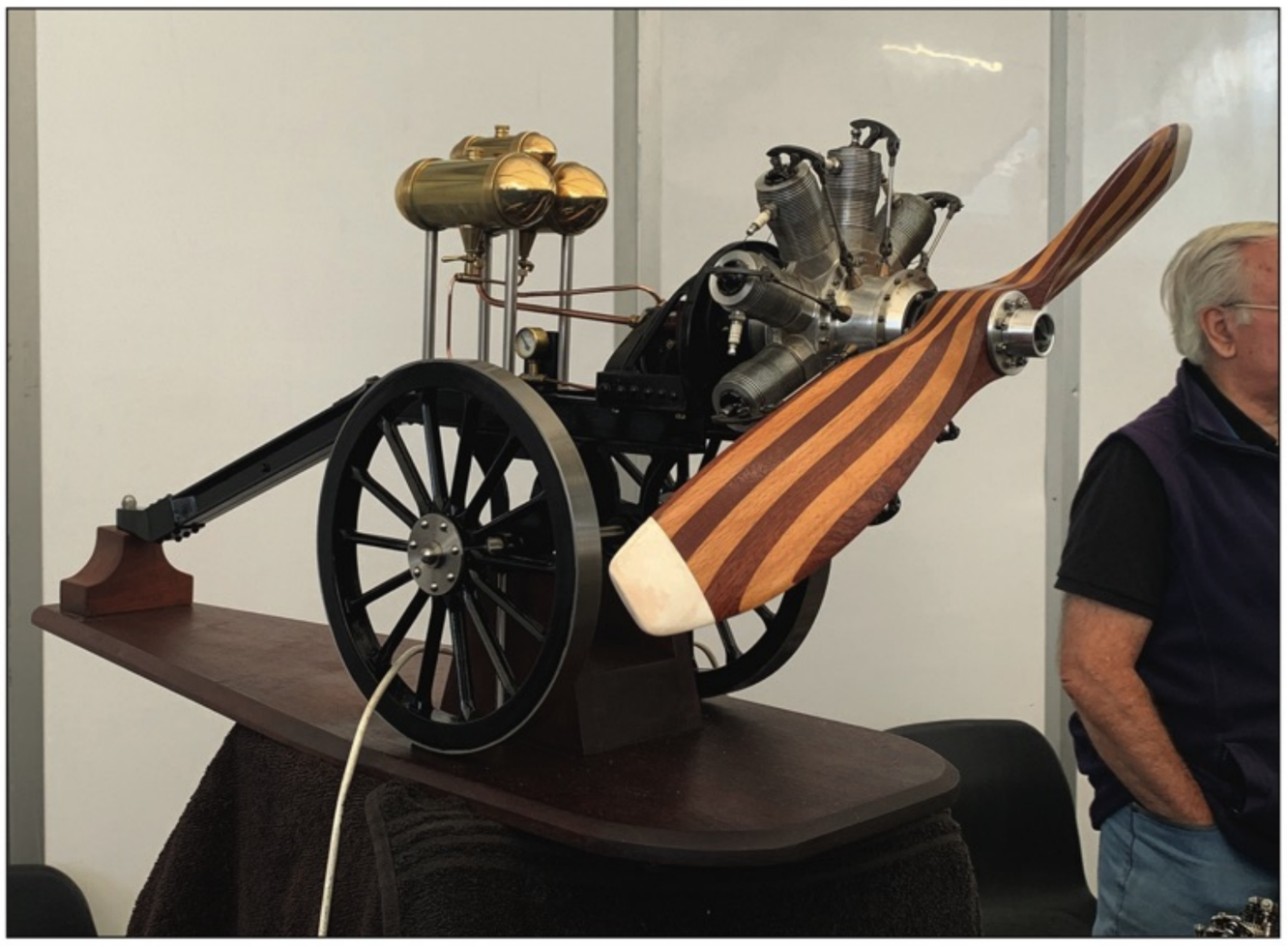
Your editor compiles this month's edition of the *Club News* having freshly returned from this year's Midlands Model Engineering Show, where of course many clubs had the best of their members' work on show. Hopefully without taking too much from John Arrowsmith's usual report on the club displays, due in next month's issue, I personally thought there was a great deal of interesting modelling to enjoy at this year's show – so long as one took a really good look at the various stands and what they contained.

I particularly thought that the subject matter was pleasantly varied, with much more to see than the usual diet of mostly rail locomotives. Even in the case of these there were some delightfully unusual prototypes on show, and they took their place amongst a host of road engines (is it me or are road engine projects generally getting bigger these days?), fascinating stationary engines and also some head-turningly different subject matter, a typical example being the aircraft engine mounted on a gun carriage on the stand of the IC Engine Builders Group.

One aspect that was common wherever one looked in the show – the quality of the modelling on display. Personally I enjoy looking at part-built models more than I do finely finished ones, both to more closely study the engineering in use and marvel at the quality – on the evidence of this display our hobby is in good hands.

THIS PAGE: Some Midlands show variety – an i/c engine mounted on a gun carriage and inspired by a picture of a full-size engine being tested by the factory. Road engine projects are definitely getting bigger – this Savage road tractor has been under construction by Chris Stubbings since 2010. At the other end of the scale this diminutive 5-inch gauge Shay, beautifully built by Melton Mowbray club member Stewart Jackson, had the Ed recalling his first-ever view of a full-size Shay in steam, in Taiwan exactly a year ago...

Photos: Andrew Charman



This time of year is of course the period of awards nights, and reading the latest edition of the **York ME** newsletter, your editor rather likes the fact that the club presents an annual 'Wallace & Gromit' award to the member adjudged to have done most for the club. The front cover shows member Eric Toolan receiving a suitably decorated award from club chairman Dave Wood – Eric earning the accolade for various tasks he carries out around the York track site, one member apparently commenting that Eric "lifts heavier weights than much younger men...".

The award took place during the club's AGM, attended by some 45 members and described as a "remarkably harmonious affair" – surely we don't generally have arguments in the model engineering world? Dave looked back on a good year overall with membership levels maintained and a lot of work on the track site, including much relaying of the ground-level line. Sounds like a club in good health, and with a bright future – members also agreed to proceed with a planning application for a new clubhouse.

Reversing skills

An interesting piece in the latest edition of *The Aylesbury* Link from the **Vale of Aylesbury ME** questions driving techniques, provocatively titled "Do you use the Reverser?". Member Dave Andrew describes how he has sometimes observed drivers on the club's track arriving at the station, desperately rushing round to fill the loco's water tanks and get water into the boiler while also struggling to revive a fire to regain pressure before setting off on another lap of the track "on a wing and prayer". He points out ▶

that more regular use of the reverser, in other words not just set at full forwards, makes for much more efficient use of steam. This resonates with your editor, a fireman on the full-sized Welshpool & Llanfair Light Railway, as space restrictions in the cabs of our two original Beyer Peacock locos mean that the reverser is unusually mounted on the fireman's side and usually operated by the fireman – under instruction from the driver of course!

Electronically leafing through the latest edition of *The Blower* from **Grimsby & Cleethorpes ME** our eyes were taken by the impressive locomotives pictured in a report from the annual **7¼-inch Gauge Society** AGM gathering, which was held at the track of the **City of Newport MES** in South Wales and attended by Grimsby member Barry Green.

Barry describes a typically friendly Welsh welcome and the clearly great deal of work involved in hosting the event carried out by Newport club members. But he also admits to some disappointments, suggesting that the advertised 35 attending locomotives was possibly generous and also noting that trade stands were few in number.

ABOVE: This month we describe the building of a Scamp petrol-electric loco and several examples of this popular kit were at the Midlands show. *Photo: Andrew Charman*

BELOW: What a beast! This Beyer Garratt 'Mount Kilimanjaro', has recently been reunited with its retubed boiler at the Rugby club. Remarkably there are hopes it could steam by Christmas... *Photo: Edward Parrott*

Next year's 7¼-inch Gauge Society AGM meeting is set for the impressive Echills Wood Railway at Kingsbury Water Park in Warwickshire between 18th-20th September – get your diaries out... As an aside the newsletter carries a couple of pictures showing some impressive triple-heading by quarry Hunslets on the Echills Wood line.

Don't fear the media

The latest edition of the **St Albans & District ME** newsletter encourages the club's members to sign up to Facebook, pointing out that the club now uses the social media platform for its members discussion forum. Now the Ed uses Facebook extensively in gaining information for both this and the other magazine he edits, *Narrow Gauge World*, but we still hear people looking on the platform as some kind of monster not to be gone near. It really isn't – there is a whole lot of interesting stuff to be discovered and you don't have to even be visible online yourself to view it.

The cover of the latest edition of *LeedsLines*, the **Leeds SME** newsletter, shows the sad sight of track materials in store after the club's enforced departure from its Eggbrough power station site, but the chairman reports that after checking dozens of potential sites to relocate to, one has been identified as suitable and efforts to "do a deal" are underway. Let's hope the New Year brings early good news for this club...

It's good to see model engineers from across the globe discussing positive ways forward. The latest edition of the **Ryedale SME** newsletter describes a visit to the club's 11th September steaming day by Craig Hill, who has his own garden railway in four acres in Australia. "We spent time discussing coal, clinker and ash residue – In Australia they have been ▶

Lowmex hosts high quality

The largest exhibition in East Anglia, Lowmex, happened on a sunny weekend in October (*writes **Julie Williams***). Organised by a sub-committee of the **Halesworth and District ME**, the show gave other local clubs, societies, individuals and trade stands the opportunity to show their engines, planes, boats and trains, in all their glory, and show just what the hobby is all about.

The models ranged from a large, in-steam 6-inch scale showman's engine trundling about outside, accompanied by other scale traction engines and steam lorries; a train givign rides on a track; fixed-line aeroplane displays, while inside the building hosted intricate models as small as thumb-sized with everything in between.

The following is a soupçon of the miniature models displayed, and choosing just a few, from so many worthy examples on display, has been very difficult.

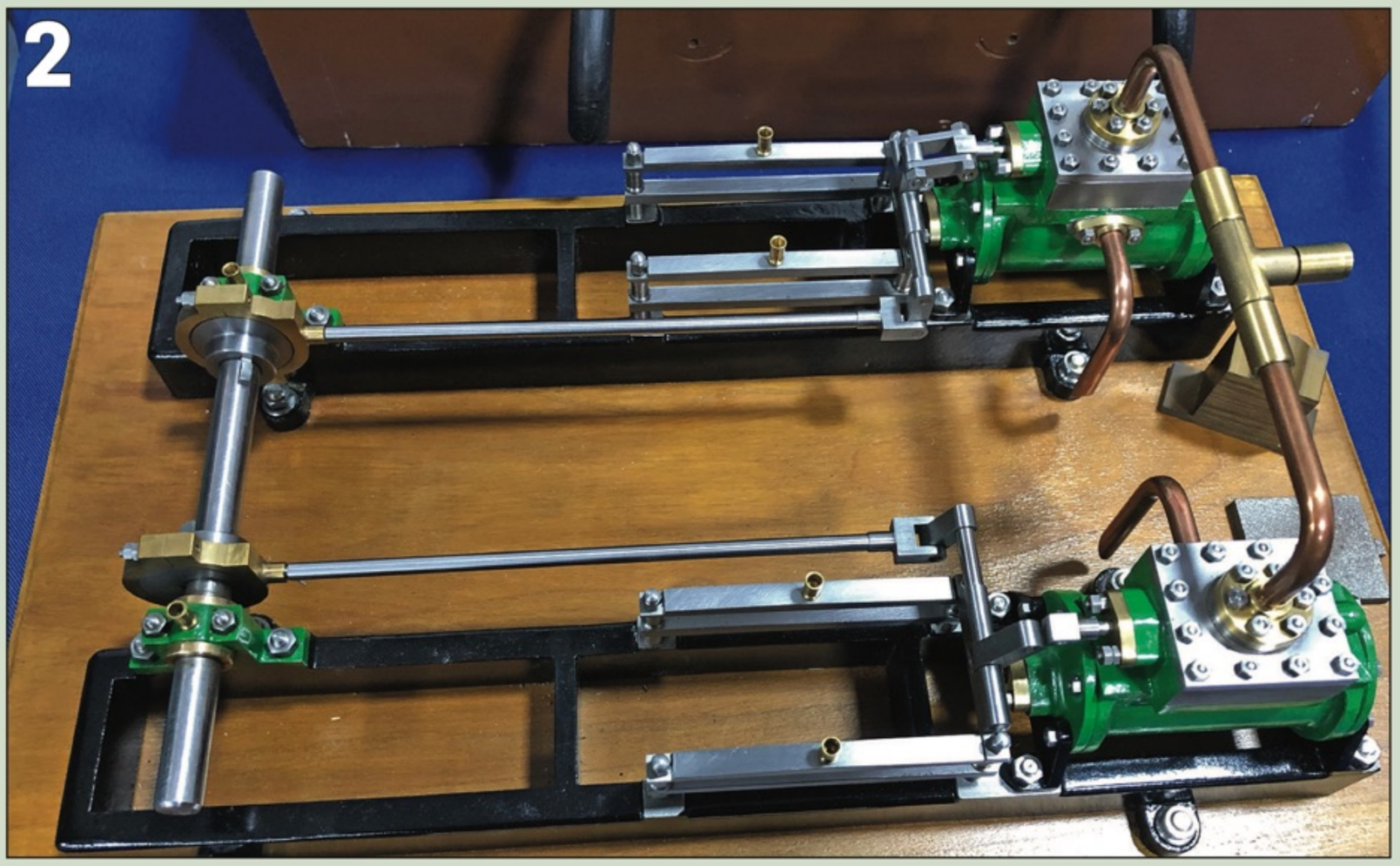
There was a 1½-inch diameter four-jaw chuck for a Peatol lathe, (**Photo 1**) designed and built by Bernie Towers. He won't be making it again as it took 93 different milling actions to produce! Bernie also displayed several more of his own unique, original equipment designed for various lathes, not just for a Peatol.

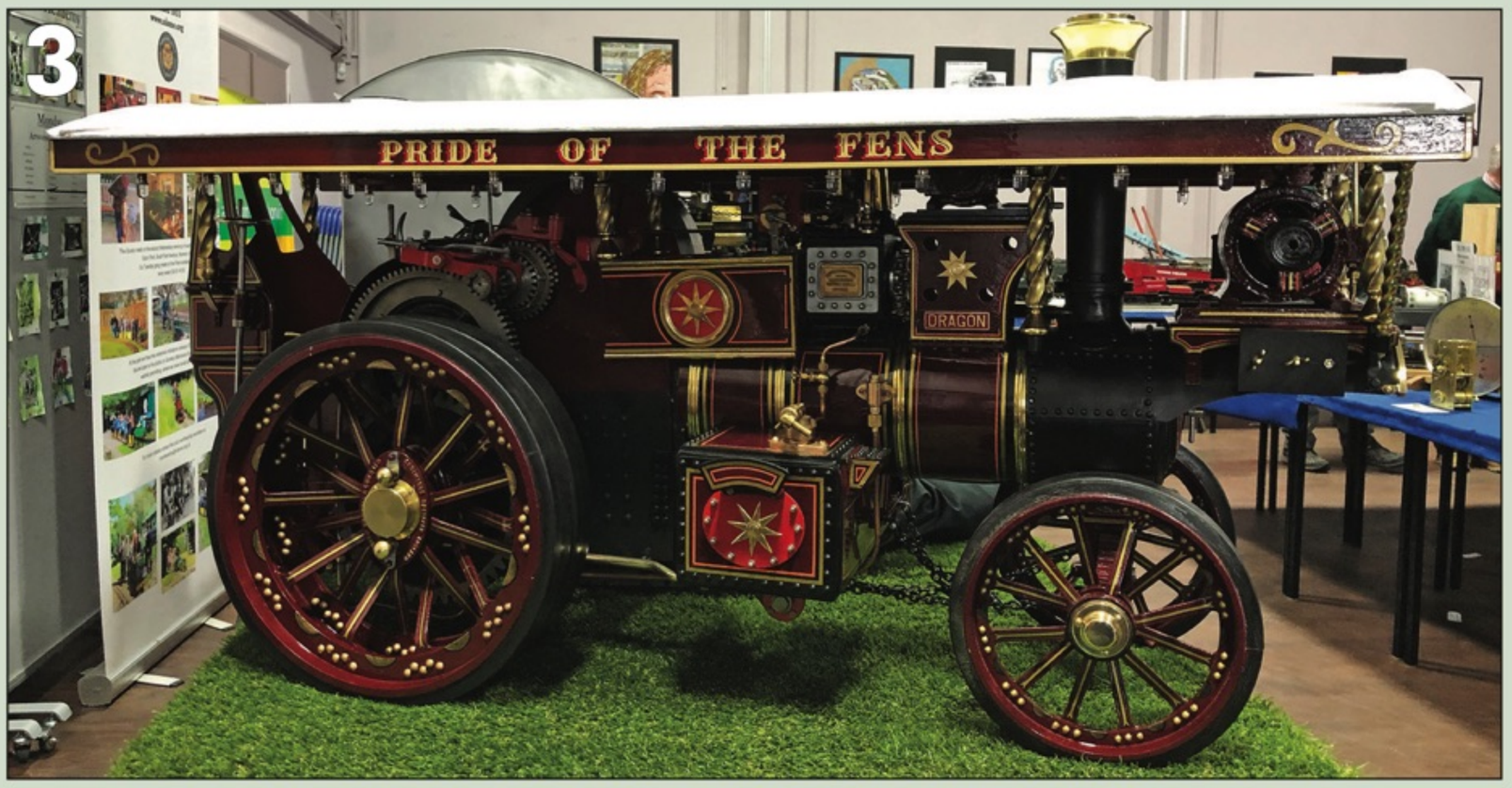
The Stuart Twin Victoria (**Photo 2**) was a modified work in progress by Roger Montgomery. He had changed the bolts and set screws for studs, changed the eccentric rods to round bars and replaced the original castings with manufactured pedestal bearings. He has still to install the eccentrics and flywheel on the crankshaft, changing them from set screws to feather keys.

Meeting a deadline

The midnight oil burned brightly for several nights before the exhibition in Nick Gratton's workshop. He aimed, and succeeded, in finishing his 2-inch scale Burrell scenic showman's locomotive 'Pride of the Fens' and Lowmex marked its debut (**Photo 3**). It took him five years to build and 18 months to paint, as each part received six coats of paint and two coats of lacquer. Nick now intends to build another engine in 4-inch scale.

There are no Gresley class A3 or A4 teak railway carriages left in the real world. Charlie Lovett, though, is



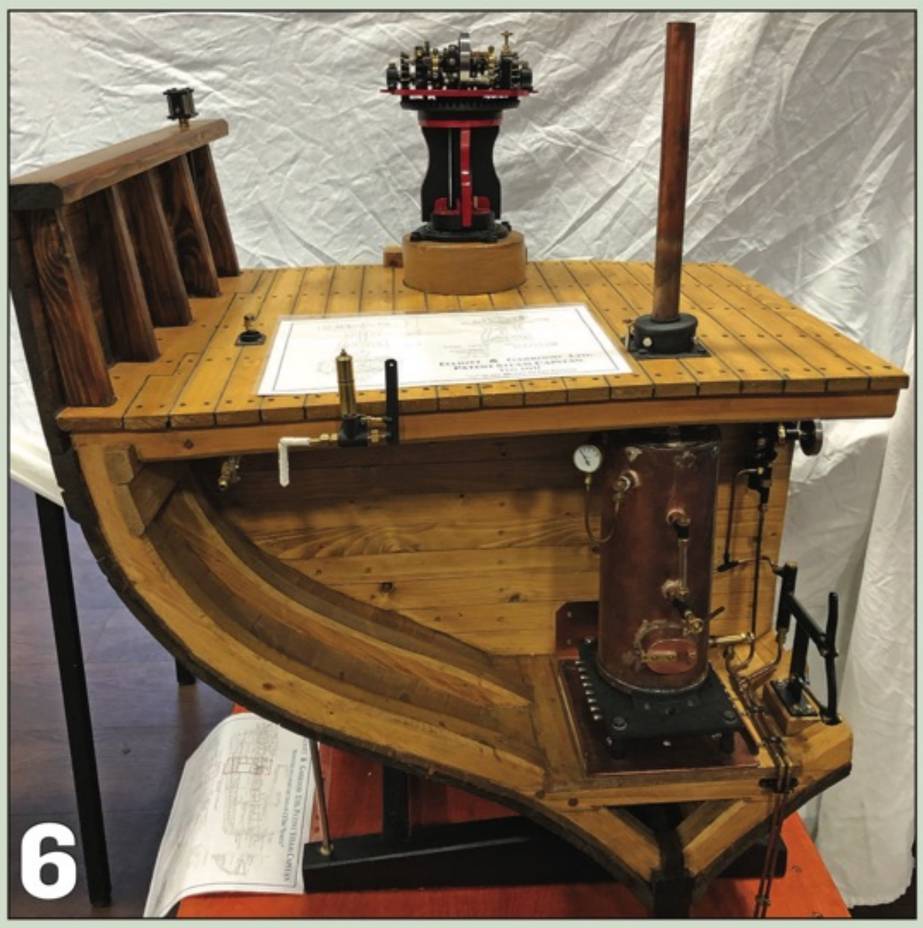


creating a 7¼-inch gauge, ⅛th scale, teak and mahogany one in miniature. (**Photo 4, 5**). Apart from the LED lamps and switches and some spring steel which he bought, everything is made from scrap, with no castings. Charlie even made eight sand moulds, one for each axlebox cover. And everything works, exactly like the real thing, except for the little toilet which can't flush.

Our final highlighted model was made by Ian Elliott, his first-ever and made from a set of schematic drawings (no plans or castings) of a Victorian steam capstan. The original was patented and manufactured in 1884 by Ian's great, great grandfather, William Elliott, of Elliott and Garrood. The steam capstan was installed onto sail trawlers and drifters and revolutionised the way that nets were hauled in, and was nicknamed 'The Fisherman's Friend' by fishermen of the day. Ian's ⅙th cross section (**Photo 6**) shows the capstan and the position of the boiler and donkey pump.

Any profit made by Lowmex is donated to a local charity, S.O.L.D. (Special Objectives for Local Disabled) and the profit made from the sale of snacks and drinks is for The Lowestoft Thursday Club, a charity which provides social activities for local adults with learning difficulties. Next year's show will be on 24th-25th October and details will be at www.lowmex.co.uk – why not come and have a look for yourself? EIM

All photos in this feature by Julie Williams – for caption details see text.



using char, which is no longer easily available," the newsletter reports.

Also demonstrating the global reach of the model engineering hobby are a couple of newcomers to the club journal selection received by the editor this month. From the **Durban SME** in South Africa comes *The Workbench*, and your editor smiled at the reference to the September running day which stated that "Fine Spring weather gives us a clue that winter is losing its grip, but it is thankfully still a long way from summer." Just as back in the UK we batten down the hatches for winter...

I must admit the chatty, slightly irreverent style of *The Workbench* appealed to this correspondent, such as the caption to a picture of some temporary ground-level track laid around an area of grass adjacent to the clubhouse that states "No I won't build it here, you can still all park your cars there and ruin the grass..."

Modern image down under

The second global newcomer is the *Willans Hill Shunter*, newsletter of the **Wagga Wagga SME** in New South Wales, Australia and being edited for the first time by Rodney Mackintosh. Star of the issue is without doubt a most unusual i/c loco, dubbed 'Ganmain Flyer' and built by its previous owner in the style of the front end of a Japanese Class 961 Shinkansen Bullet Train. Now owned by Stuart Winrow who has made some modifications, the loco is belt-driven from a 6hp petrol engine, identical to a ride-on mover. It offers forward and reverse directions and is disc braked.

The Wagga Wagga Society track appears to have some impressive civil engineering – another article in the *Shunter* details the building of a new curtain wall alongside the tunnel exit, this wall taller than most of the people building it! We look forward to hearing more from Wagga Wagga.

RIGHT: Well its' certainly different – the Bullet train loco at the Wagga Wagga club in Australia. *Photo: Wagga Wagga ME.*

BELOW: Hereford SME members David Bell and Matthew Kenington are previous winners of the award for young members organised by the Southern Federation and Polly Engineering – will members of your club be next? *Photo: John Arrowsmith*

BELOW RIGHT: Good to see one of the projects from **EIM**'s 'resident' young writer, Matthew Kenington, at the recent Midlands show, surrounded by some familiar literature... *Photo: Andrew Charman*

Finally this month, regular readers will know we at **EIM** like to promote young engineers at every opportunity, so we are very much in favour of the Southern Federation of Model Engineering Societies award for young model engineers, generously sponsored by Polly Model Engineering Ltd.

Anyone less than 24 years of age and a member of a club or society affiliated to the Southern Federation MES at the time of nomination is eligible for this annual award presented at the Southern Federation AGM held in March. The successful nominee will receive a voucher for Polly Model Engineering Ltd products together with a cash prize and an engraved glass trophy.

Application forms are available from the Federation Secretary by e-mail: petersquire@sfmes.co.uk or by telephone: 01327 342 167. The closing date for receipt of this year's completed application forms is 31st December 2019. **EIM**

NOTICE BOARD

Relaunched last month, *Notice Board* offers readers the opportunity to post free of charge private for sale or wanted ads, queries and such like. If you have something for sale, are searching for that elusive casting or drawing, or just want to alert your fellow model engineers to something of interest, simply send in details to the address on page 3 and we'll put it in! (Don't forget your contact info...)

OFFERS PLEASE: Having reached my late '80s, I have reluctantly sold my four steam locos and just run three diesel/electric locos on my miniature 5-inch gauge garden railway. I have a number of items surplus to requirements for which offers are requested – location Devizes, Wiltshire. Viewing possible.

1. New professionally welded 'Simplex' stainless steel superheater.
2. Two new 'Simplex' stainless steel fire grates (5¼ x 2¾ inches).
3. New propane gas burner (Taylor made in America) specifically for 'Simplex' – cost nearly £450.
4. Simplex and wagon drawings (used).

For details contact Nev Boulton: nev.boulton@outlook.com.

STOLEN: from Avon Dassett, Warwickshire, 8th October. 5-inch gauge Pug 0-4-0, described as very rare and not easy for the thieves to dispose of. Rebuilt in December 2018. Mechanical lubricator under front running plate. Plain black livery, no number or nameplates.

Anyone with information that might reunite this loco with its owner is urged to contact Warwickshire Constabulary, Crime-ref 23-42674-19

DECEMBER DIARY

EVERY SUNDAY
(Weather permitting)

Bournemouth SME public running, Littledown Pk, BH7 7DX, 11am-3.30pm

Canterbury SME (NZ) Public running from 1pm at Halswell Domain

Fylde SME Public running at Thornton Cleveleys from 1pm.

Kings Lynn & District SME public rides, Lynnsport Miniature Rly, 11am-3pm

North Wilts MES public rides, Coate Water Railway, Coate Water Country Park, Swindon, 11am-dusk

Southport MES Public running at Victoria Park 11.30am – 4.30pm

Urmston DME public running, Abbotsfield Pk, Flixton, Manchester M41 5DH, 11am-3.30pm

Wigan MES public rides, Haigh Woodland Pk, School Ln, Haigh, PM

Wirral MES Public running, Royden Pk, Frankby, 1-3.30pm.

EVERY WEDNESDAY
(Weather permitting)

Bournemouth SME public running, Littledown Pk, BH7 7DX, 11am-3.30pm

Kings Lynn & District SME public rides, Lynnsport Miniature Rly, 11am-3pm

1 Bristol SMEE Santa special, Ashton Court Railway, Bristol, BS8 3PX 7.30pm

1 Small Model Steam Engine Group open meeting, Guildford MES, Stoke Pk, 2-5pm

1 Wagga Wagga SME public running, Botanic Gardens, Wagga Wagga, New South Wales, Australia, 10.30am-3.45pm

1 York ME Members Running Day, North Lane, Dringhouses YO24 2JE

2 Lancaster Morecambe ME informal evening, Cinderbarrow Railway, Tarn Ln, nr Yealand Redmayne, 7.30pm

5 Leeds SME Christmas Dinner, Drax Sports & Social Club, YO8 8PJ 7pm

4 Wagga Wagga SME Engineering Meeting, Botanic Gardens, Wagga Wagga, NSW, Australia, 7.30pm

5 Cardiff MES meet, Foundry Experiences by John Styles, Heath Park

5 South Lakeland MES AGM, Pavilion, Lightburn Pk, Ulverston, 7.30pm

5 Wirral MES meeting, Mince Pies & Chat night, WI Hall, Thornton Hough, 7.30pm

6 Portsmouth MES meeting, club quiz, Community Room, Tesco, Fratton Way, Portsmouth PO4 8FD, 7.30pm

6 Rochdale SME Auction Night, Castleton Comm Cntr, OL11 3AF, 7pm

6 Vale of Aylesbury ME film evening with Frank Banfield, Community Centre, Prebendal Ave, HP21 8LF

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

7 Ickenham SME public rides, Coach & Horses pub, Ickenham, UB10 8LJ, noon-dusk

7 SMEE Competition Day, Marshall Hse, London, 2.30pm

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

7 Bedford MES Santa Specials,
8 Summerfields' Railways, High Rd. Haynes MK45 3BH, pre-booked only

8 Bradford MES Santa Specials, Northcliffe Railway, BD18 3DD, 11.15am-3.15pm

8 Guildford MES Stoke Park Railway open day, Stoke Park, Guildford GU1 1TU, 11am-3pm

8 Lincoln DSME Santa Specials. , South Scarle Lane, North Scarle, Lincs, LN6 9ER, noon-3pm

11 St Albans & District ME club night, Christchurch Ctre, High Oaks, AL3 6DJ, 7.30pm

12 TIME meeting, Pipers Inn, 70 Bath Road (A39), Ashcott, Somerset TA7 9QL, 7pm

14 Lancaster Morecambe ME Christmas Lunch, 12 noon

14 SMEE Christmas Party, Marshall Hse, London

14 Wirral MES Santa Specials, Royden
15 Park, Wirral

15 Harlington Loco Society Mince Pie run, High St, Harlington UB3 5ET, 2-5pm

15 Lincoln DSME Santa Specials, South Scarle Lane, North Scarle, Lincs, LN6 9ER, nonn-3pm

15 Rochdale SME Santa Special, Springfield Park, Bolton Road (A58), Rochdale

15 Wagga Wagga SME public running, Botanic Gardens, Wagga Wagga, NSW, Australia, 10.30am-3.45pm

18 York ME Santa Running Day, North Lane, Dringhouses YO24 2JE

16 Leeds SME Quiz Night, Drax Sports & Social Club, YO8 8PJ 7.30pm

17 Wigan MES meeting, Ince Methodist Church, Manchester Road, Ince, Wigan, WN1 3HB 7pm

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

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

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

21 Wirral MES Santa Specials, Royden
22 Park, Wirral

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

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

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

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

27 Bradford MES Mince Pie Steam-Up, Northcliffe Railway, BD18 3DD, 12.30pm

Details for inclusion in this diary must be received at the editorial office (see page 3) at least EIGHT weeks prior to publication. Please ensure that full information is given, including the full address of every event being held.

Whilst every possible care is taken in compiling this diary, we cannot accept responsibility for any errors or omissions

CLASSIFIED ADVERTISEMENTS

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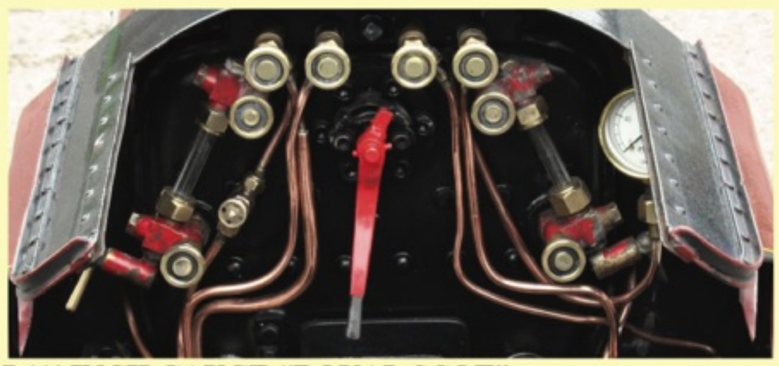
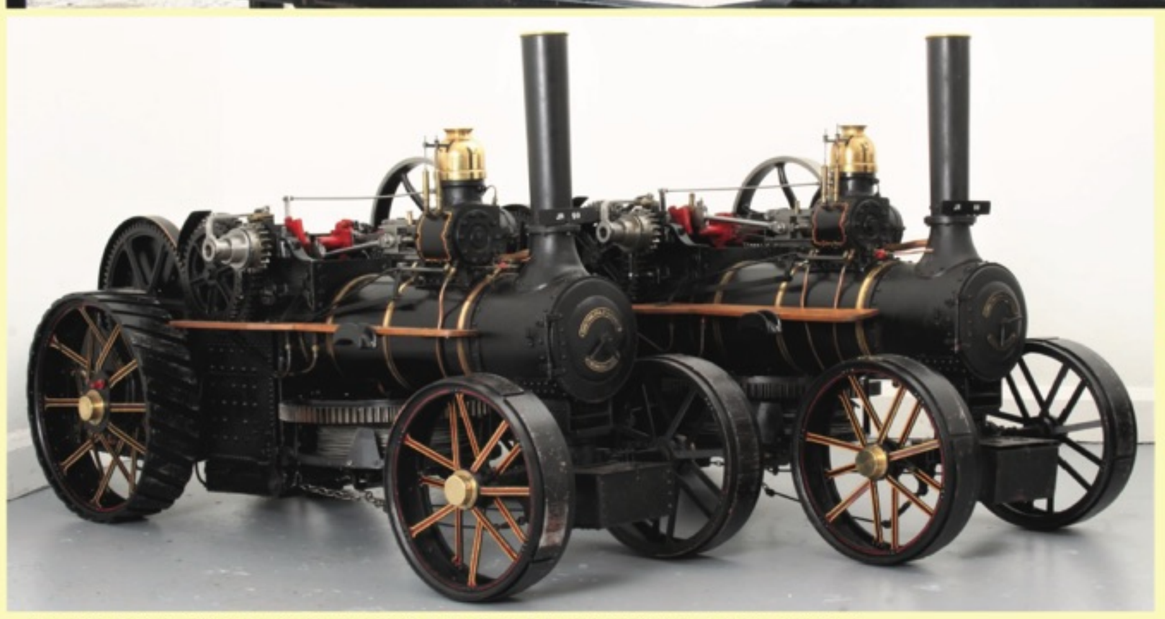


7 1/4 INCH GAUGE "ROYAL SCOT"
Built to the two cylinder Greenly/Bassett Lowke design based on Fowler's original "unrebuilt" locomotive. In 2005 a new boiler was commissioned from Swindon Boilers and fitted. Mechanically it runs well, boiler is in excellent condition.
£17,500



PAIR 2 INCH SCALE FOWLER K5 PLOUGHING ENGINES
Built as a pair, we believe in the late 90s, by a prolific local engineer responsible for a pair of compound ploughing engines and a Z7S. They appear unused in some years, both turn over freely—however, there is no documentation for either boiler. **£7,950 each**

5 INCH GAUGE CLASS 37
One of the most comprehensively equipped and nicely finished examples we've seen. It can be driven from a driving truck with hand held remote control, alternatively by radio control with driver's view of the road ahead from the forward mounted camera. **£4,650**

3 INCH SCALE ALLCHIN TRACTION ENGINE
Scaled up from the popular "Royal Chester" design, it makes a large engine in this scale. In recent use, the engine has club certification through to next year.
Just arrived.

7 1/4 INCH GAUGE GWR 11XX 0-4-0T
A well built GWR 11XX dock tank to George Gentry's "Midge" design, published in "Model Engineer" magazine in 1935. It runs well, boiler has had recent test with certification for same. Machining of motionwork and valve gear is very crisp, fit and finish good throughout. **£6,750**

LIKAMOBILE STEAM CAR
Running on heating oil, the boiler steams from cold in ten minutes. It's been in regular use and has been fitted running lights and indicators back and front. Complete with a commercially built lightweight road trailer. **£14,750**

We keep a large, constantly-changing stock of second-hand in all scales and gauges.
We are always interested in buying engines - from part-built through to exhibition-winning models.

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We are always interested in acquiring engines of the type that we sell. If you know of a steam engine for sale, in absolutely any condition, please let us know. Engines bought outright, or we are happy to take them on a commission sale basis, or pay you a finder's fee if you put us in touch with an engine which we later purchase. All engines listed are on our premises, available for inspection by appointment. Please do contact us, even if all you have is a rumour of an engine being available!

For full details, high resolution photographs and video see our website
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Taps and Dies

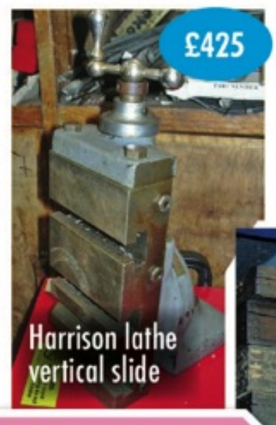

£425 Clarke 917 vacuum forming machine


£20 each Just arrived!


£1225 Startrite EF1 drill


Very nice! £1575 Myford Speed 10


£375


£425 Harrison lathe vertical slide


Aluminium!


£950 Myford capstan 5" centre lathe


£2450 Looked after! Boxford AUD MKIII long bed / imperial


£625 Micrometers Various! 0-16"/ 300mm

RJH linisher

MYFORD GENUINE PARTS
Running out fast!
Purchased from Nottingham
*Check the **web site** for full list!*


nice! £1850 Myford VMB mill


£750 rare! Atlas ratchet arbor press (USA)


£425 Worden tool grinder


Colchester Mastiff 10.5" x 60" + gap bed
Coming in!


£1250 Sedgewick TA315 12" sawbench


£4950 Myford Super 7B lathe hardened bed


Clean machine £395 Meddings LB2 bench drill


£10 Each Cora 'neat cut'

£950 Still wrapped from new! Vertex tool and cutter grinder


£625 Q & S Terrier 8" hacksaw


£950 Very nice! Startrite Bandit (10 speed for steel)


£375 Rapidor late 6" hacksaw


Myford non standard wheels £10-£49


£625 Union 12" pedestal grinder


Myford Super 7B lathe + inverter £4250


£345 original as new! Burnerd D13 8" 4 jaw chuck


Colchester steadies to fit Student, Master, Bantam 2000, Triumph, Mastiff!


nice selection Blacksmith tooling


Tipped tools + tips


£1475 Union buffer + built in extractor


£1150 Startrite 24-S-5 metal cutting/wood bandsaw (not steel)


£375 Union buffer


£845 Elliot 3A drill power feed / 3MT


£45 Each Bridgeport coolant trays

£1475 Wadkin BL150 wood lathe


£845 Clarkson tool and cutter grinder

Just arrived!

Myford gearbox, leadscrew and guard **£725**
Harrison M300 large 18" faceplate **£295**
Emco Unimat accessories Boxed!
Startrite 275 12"saw bench cuts up to 4 1/8" thick! **£1275**
123 blocks **£30 each**
R8 collets 6mm 10mm 12mm 16mm set **£40**
R8 collets ¼" 3/8" ½" 5/8" set for **£40**
Myford dividing heads; choice!
Harrison L5 L5A L6 travelling steadies **special £40 each**
Colchester student travelling steadies side and bottom mount **special £40 each**
Colchester Bantam 2000 fixed steady **£375**
Colchester Student 1800 / Master 2500, Triumph, Mastiff fixed steadies

Coming in;

Scheppach Basato 3 & Record BS300E bandsaws
3 metre bar rack £145
Record No2 & No3 bench vices £20 & £30 each **More details on Web Site**


£1750 Wadkin 12" late planer thicknesser


240V £425 RJh buffer

WD-40 £20 each

£3950 Denford Turn 270 Pro CNC

£475 Never used Baileigh 5 TON arbor press

various! Angle plates + surface plates

Special 5 for £20 Myford ML7/ Super 7 Rifle/ Bridge bed felts

£90 Tripus (German) on/off switch

£525 Union 10" pedestal grinder

£845 Tom Senior Mill

£3250 Colchester Colt 6.5" x 40" centres

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Just a small selection of our current stock photographed!

We are currently seeking late `Myford Super 7B´ & `Super 7 large bore´ model lathes!

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