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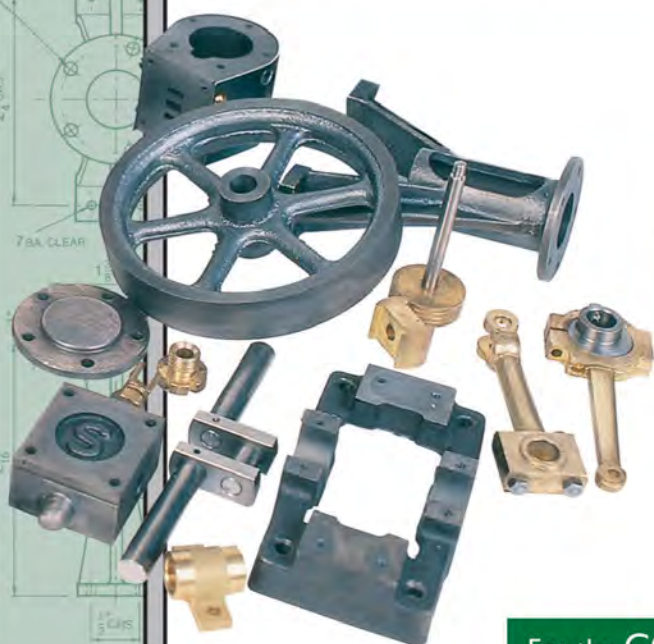
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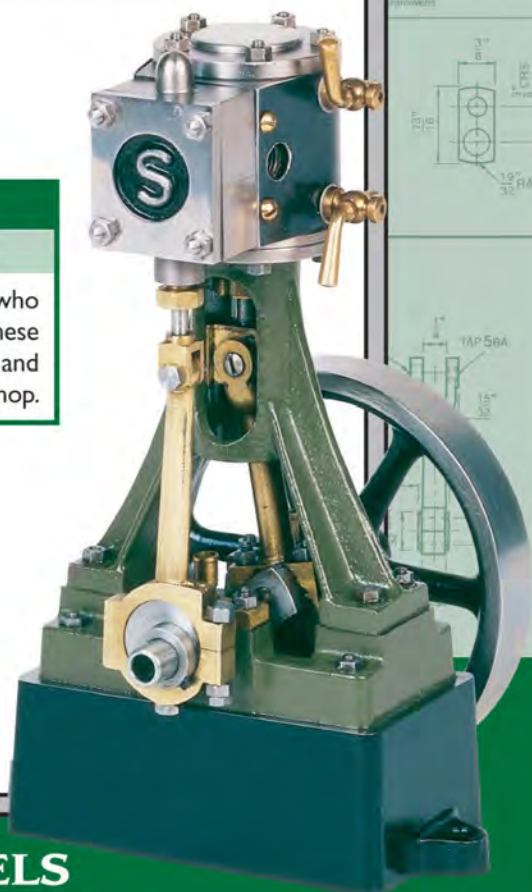
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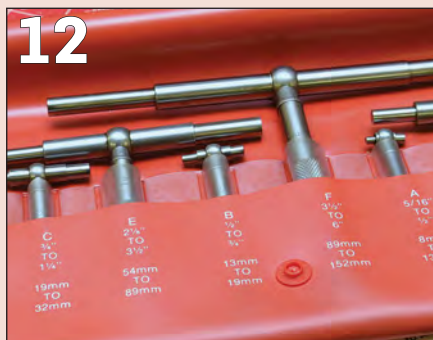
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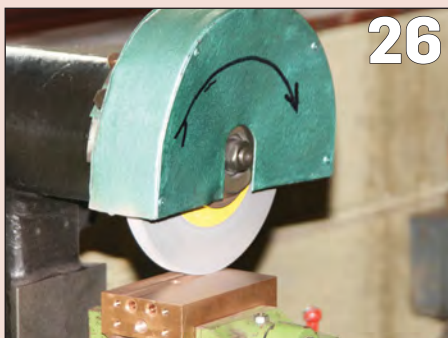
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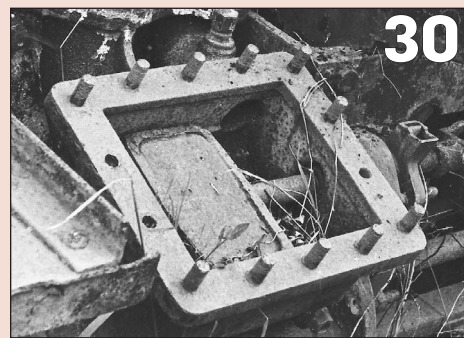
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FRONT COVER

The annual Sweet Pea Rally attracts a wide variety of motive power, none demonstrating that better than this double electric example owned by Phil Brien from Fareham. Our report of the rally starts on page 8.

Photo: John Arrowsmith

EDITORIAL

Finding tomorrow's model engineers...

Welcome to the latest edition of **EIM**. We hope this month's feature selection suits a wide sphere of interests though I admit straight away that we are a bit lacking in road steam this time. We will be making up for that next month by starting to describe a large-scale Fowler lorry with an amazing twin cylinder vertical engine – it has to be seen!

Roving reporter John Arrowsmith has been enjoying the Sweet Pea Rally this month and it was very pleasing to hear that this little locomotive remains perennially popular, Blackgates Engineering reporting that they dispatch a couple of sets of plans each week. It's not really surprising – a glance at the pictures will show just how versatile this locomotive is with different gauges, wheel arrangements, narrow and standard-gauge derivatives, stretching to the remarkable version on our cover. Your Ed really wants to hear more about that one!

Elesewhere Jan-Eric Nyström's double-acting stationary engine project comes to a conclusion. We hope several readers might be building their own versions of the engine – if you have, we want to see pictures!

I'm pleased to say that I am now regularly receiving enquiries from model engineers wanting to write up their project for the magazine and I'm confident of bringing you some excellent, interesting features in future issues. But as I've said before, we want more, so if you think you have something suitable, do get in touch!

My other editorship of **EIM**'s sister title *Narrow Gauge World* saw me invited recently to the official launch of the Ffestiniog Railway's Heritage Skills Training Programme. The FR has won £454,000 from the Heritage Lottery Fund to develop heritage skills, the HLF fearing that heritage must be made more widely appealing to ensure its future. The money will fund 20 paid trainees over a two-year period, and the skills learnt will include the mechanical engineering and woodworking skills familiar to proponents of our hobby.

Yet the FR is having difficulty filling the first 10 training places, to start in September. That's a shame – I've said before that we need to make all aspects of what we do appeal to a wider and particularly younger audience. So if you know someone to whom the training programme might appeal, point them in the FR's direction... **Andrew Charman – Editor**.



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26th Sweet Pea Rally

John went along to the latest annual gathering for this popular locomotive.

BY JOHN ARROWSMITH



The Sweet Pea family gathered this year at the Bristol Society of Model and Experimental Engineers' track at Ashton Court, Bristol to enjoy the 26th consecutive year of this very enjoyable occasion. The site, very close to Brunel's magnificent Clifton Suspension Bridge was blessed with lovely warm summer weather which made all the difference to the proceedings.

The BSMEE members had made sure their track and facilities were in tip-top condition and with David

Giles ensuring that everything was in place, the participants were able to relax and prepare their locomotives ready for running.

The steaming bays were soon very busy as lighting up proceeded apace, and first out on the track was regular attendee Dave Dick with his 5-inch gauge Sweet Pea 'Millclose'. This loco, fitted with Walschaerts motion, completed circuits of the ground level track with consummate ease. He was closely followed by Malcolm High with his example 'Adele Marie' on the raised track.

All the well known variations of this popular locomotive were on show from the small 3½in gauge Sweet Violet to the 7¼in Sweet William and this combined with a number of variations on valve gear made for an interesting weekend.

Perennially popular

Talking with Jackie Owen from Blackgates Engineering revealed that this particular range of locomotives is the most popular the firm has ever sold and even today two sets of drawings are dispatched to customers per week. This is very encouraging because many people have said that traditional model engineering is not as popular as it once was, but this locomotive seems to be bucking the trend. Jack Buckler's original engine was on display along with lots of photos and details – little did he know what a success story he had created. ▶





PHOTO 1: The busy Steaming bay on Saturday morning.

PHOTO 2: Ron Drake presents David Dean from the North West Leicester MES with the June Drake Trophy.

PHOTO 3: A proud David poses with his winning loco.

PHOTO 4: Plenty of steam from the Sweet Pea of Mike Leigh from the North London SME, as he exits the tunnel.

PHOTO 5: Linda Gearing preparing her loco for the raised track.

PHOTO 6: Sweet Pea variety 1 – ‘Monjuro’ the 5-inch gauge o-6-2 tender version of the loco fitted with Baker valve gear.

PHOTO 7: Sweet Pea variety 2 – ‘Ernie’ a 5-inch gauge o-4-2 tender variant owned by Chris Ball.

PHOTO 8: Our correspondent was (briefly) separated from his camera! John eases Phil Owens 7¼-inch gauge Sweet William out of the passing loop.

All photos by John Arrowsmith

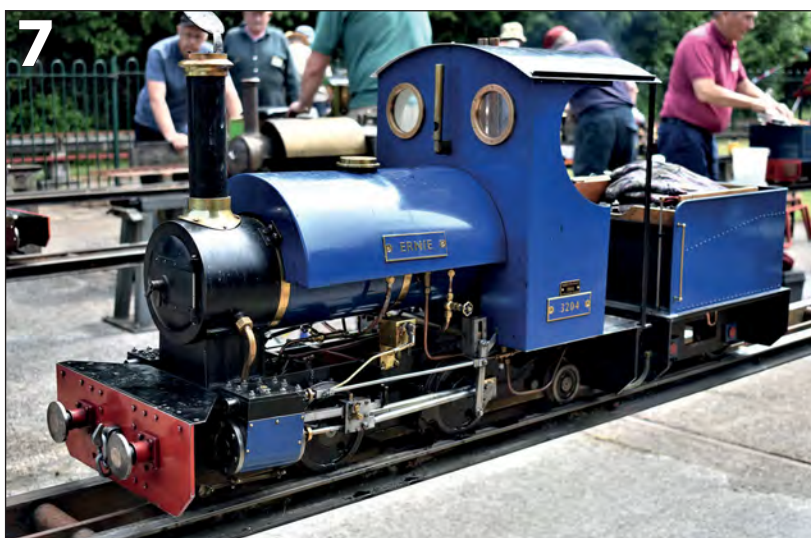




PHOTO 9: 12-year-old Matthew Kennington prepares 5-inch gauge 'King Offa' for the ground-level track

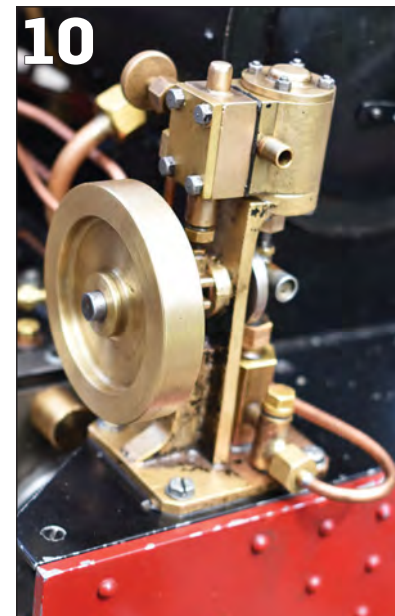


PHOTO 10: An interesting little Donkey pump on the 5-inch gauge Sweet Pea owned by Roger Andrew.

PHOTO 11: Gordon Roberts crosses the string girder bridge with his 7¼-inch gauge Sweet William.

PHOTO 12: Paul Holland from Oxford with a 5-inch gauge 'Metre Maid' takes the family for a ride.

PHOTO 13: Paul Godin from North London drifts through the station with his 5-inch gauge 'Housty'



The other regular feature of the rally is the presentation of the June Drake Trophy to a locomotive selected by Ron Drake to commemorate his wife and her commitment to the rally. The winning driver and locomotive this year was David Dean from the North West Leicester Club with his 5in gauge model 'Monjuero'. This model is based on the Metre Maid variant and is an 0-6-2 fitted with Baker valve gear and a tender. It performed very well on the track.

Finally I must offer sincere thanks to all the members of the Bristol SMEE for their hospitality and welcome combined with a superb buffet on both days, the homemade samosas were absolutely delicious, and an excellent barbecue on Saturday evening rounded off a great day. Thank you all it was most enjoyable.

Next year's Sweet Pea Rally will be held at the Chesterfield Society in Derbyshire, and the dates will be confirmed in due course. **EIM**

A Distinguished Gentleman

Mike continues to describe the design work that went into his 5-inch gauge London & North Western Railway Claughton 4-6-0 No. 650 'Lord Rathmore'.

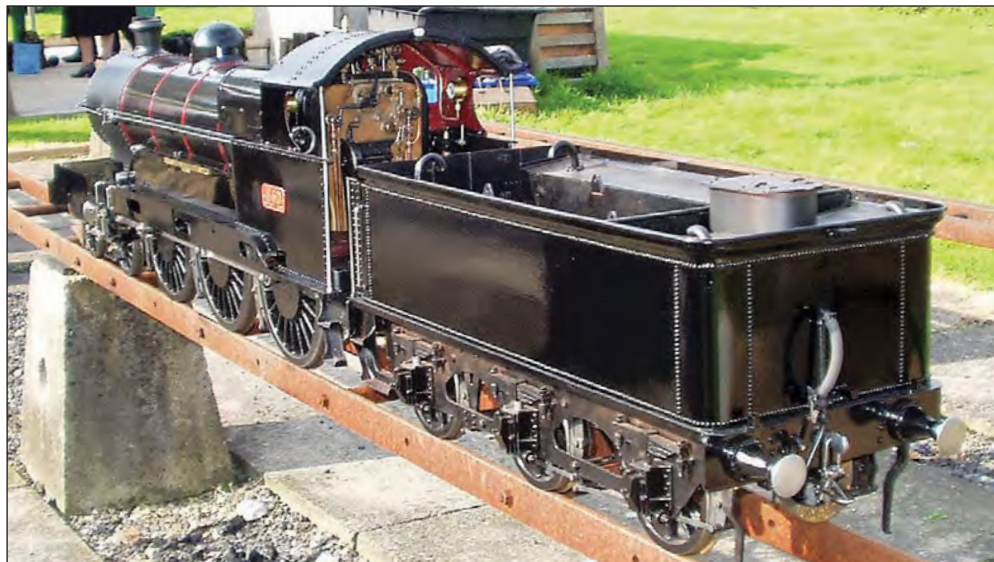
BY MIKE WHEELWRIGHT – Part Three of Five, other design matters

EDITOR'S NOTE: Mike is keen to emphasise that this is not a traditional 'blow-by-blow' account of the loco's construction but a description of what was special about the prototype and how he addressed replicating it in miniature. Included are some drawings, addressing particular areas and prepared strictly for Mike's own use and therefore not necessarily adhering to all conventions!

As always with an unpublished design the availability of suitable castings from other engines is an important matter, at least for someone whose pattern making skills are poor and who would rather avoid seeking a foundry. So before going any further I had to look at what was available, in particular my proverbial red line not to be crossed is with wheels for which castings are a 'must', but I am prepared to be flexible on details.

The coupled wheels on all the Claughtons were, to say the least, rather special: they had a large diameter centre with pockets cast in the back for carrying lead weights used in fine balancing, rather like balance weights for car tyres. These 6ft 9in diameter wheels were first used on four-cylinder Webb compounds in the 1890s and when wheel centres were recycled at Crewe they reappeared on some Precursor and George V 4-4-0s.

The green light that got me started on this model was the appearance of 'Etna' by Don Young for which castings for both types of wheel were available. Bingo! a set-and-a-half of 'big centre' castings would do me just fine. The same model was the source



ABOVE: The finished loco on show, with this shot showing the tender to the fore.

BELOW: The 'rather special' wheels required some thought...

BELOW RIGHT: The inside and outside cylinders after construction but before fitting.

All photos and drawings in this feature by Mike Wheelwright.

of castings for bogie and tender wheels plus horns, chimney and dome.

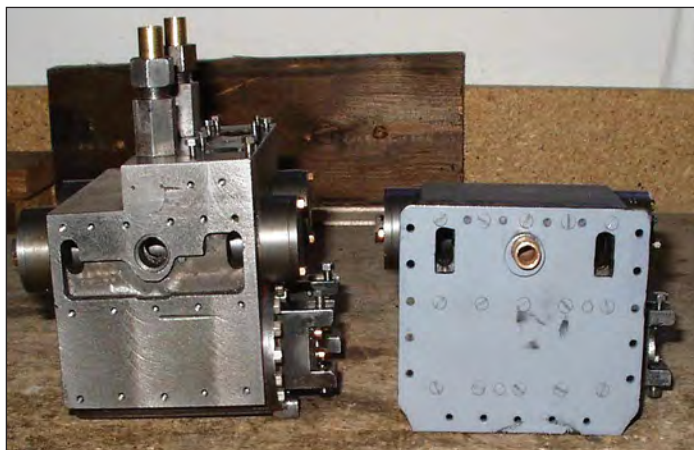
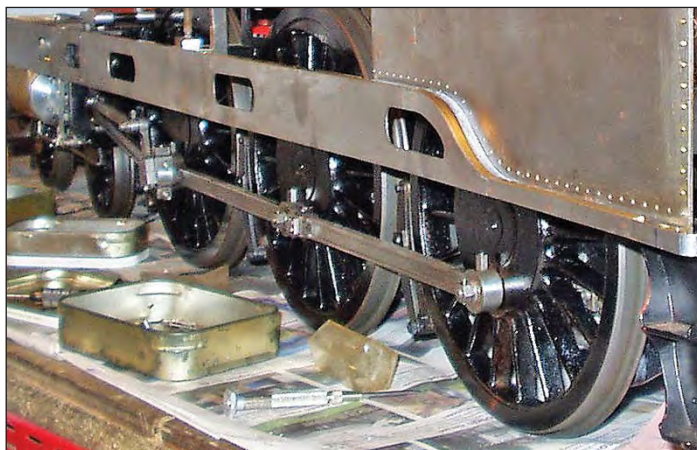
Cylinders can be made from lumps of cast iron and this was what I used for the inside block (invisible when assembled) but I thought I might save myself some messy work rounding off the lower part of the outside cylinders if I could find suitable castings.

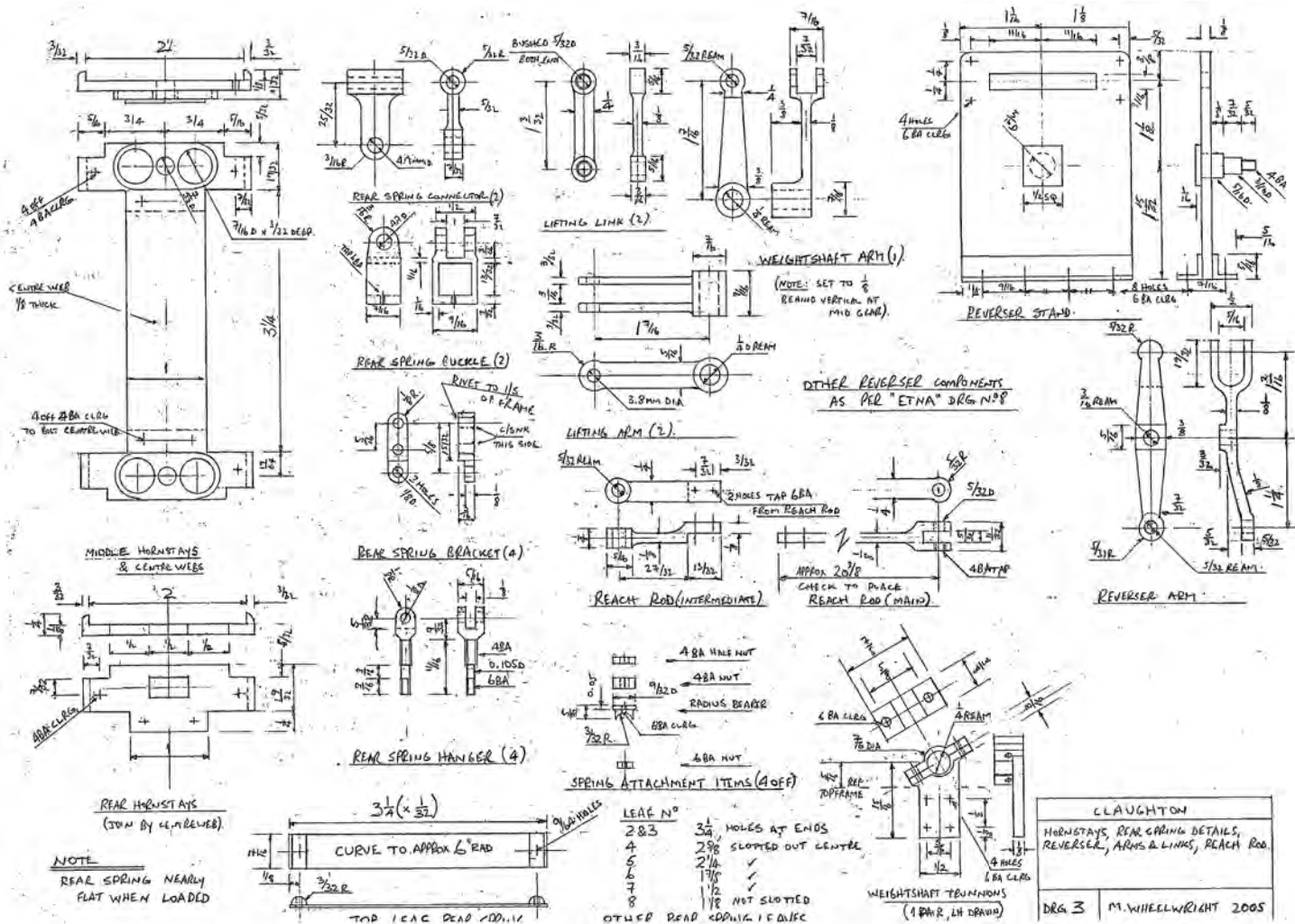
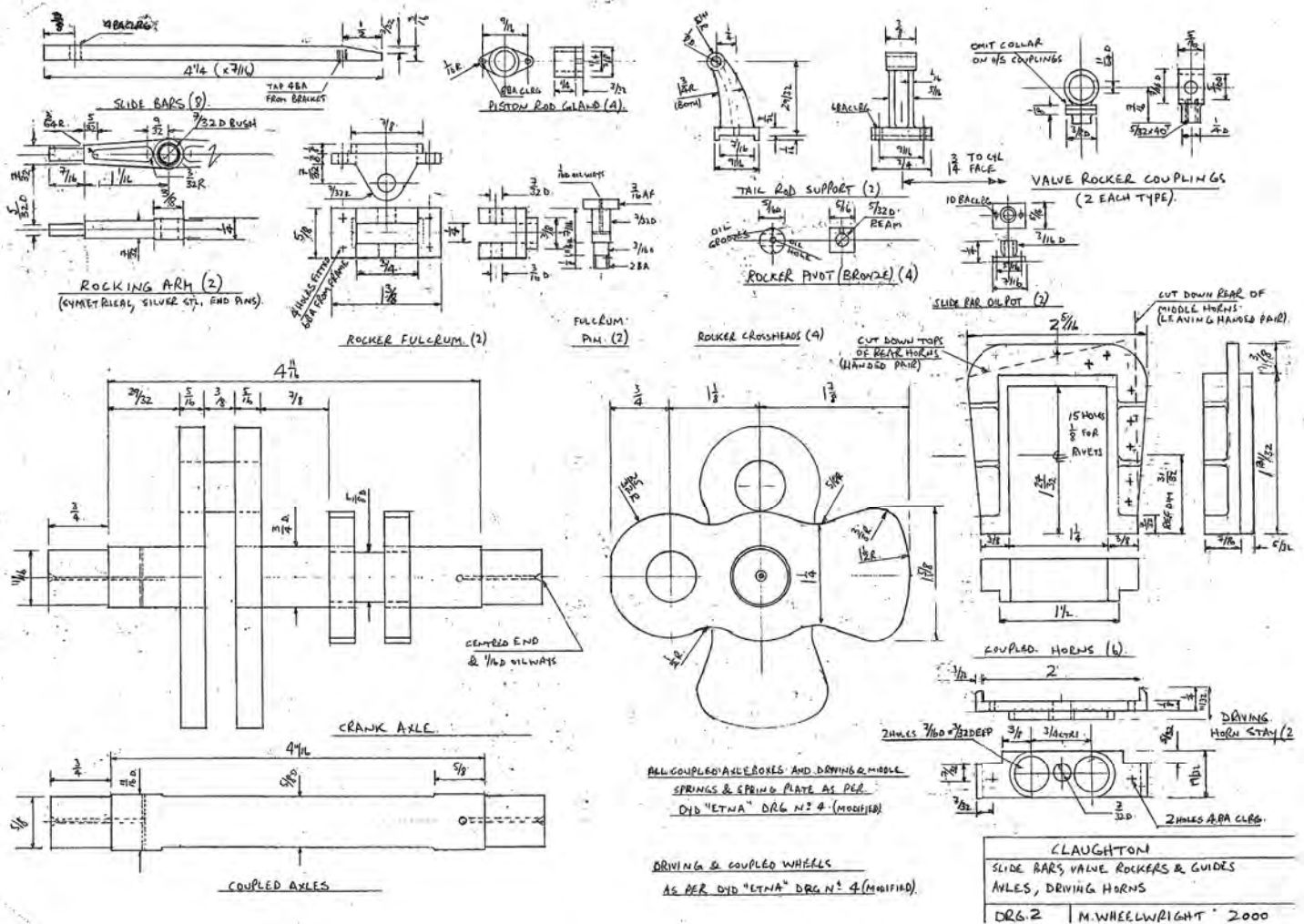
When I checked 'Enterprise', a 5-inch gauge LNER three-cylinder tank engine, the outside cylinders were just right at 1 3/8-inch diameter but I paid for my laziness. By the time I had finished them only a small part of the surface of the cylinders had not been machined away and I remember they cost me about five times the price of the chunk of cast iron that went inside. For working bits out of sight such as the main horns I searched the usual suppliers for castings of about the right size and purchased the

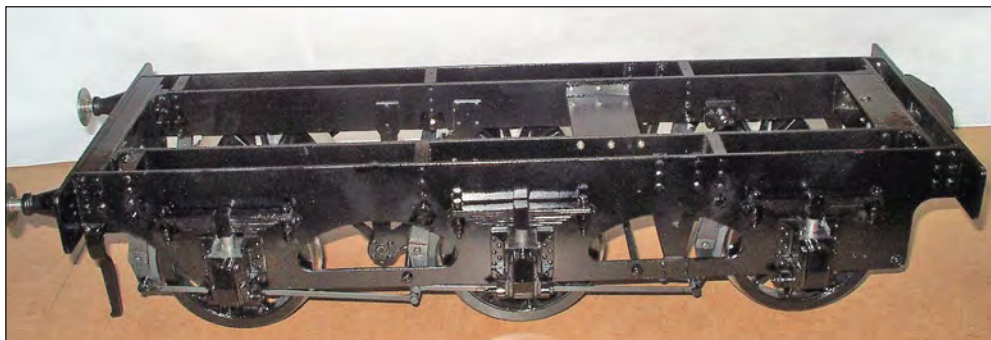
cheapest that I could adapt.

As soon as I had drawn up the design of cylinders and valve gear I felt confident enough to order castings and frame steel. Don Young's designs were being marketed by HRM but the castings were supplied by A J Reeves whose delivery times had at that time come to resemble the 100 years' war, I duly put in my order for wheels well in advance and waited, quite a while.

Disaster struck when Reeves ceased trading and went into administration. Just what I wanted to hear, I had purchased a full set of castings and materials except for coupled wheels whose only supplier was out of business and in possession of the only patterns. In haste I spoke to HRM who assured me that they were about to set out for Birmingham to retrieve their patterns with the intention of finding another supplier. I held my breath for a long time and the ▶







following year the reborn Reeves 2000 took over the DYD range and I placed another order, soon afterwards my wheels were in my workshop: phew!

The Regulator

My previous 5in-gauge engines were fitted with 'Stroudley' rotating disk regulators in their domes, they worked reasonably well but were a bit 'coarse' and were difficult to seal for a hydraulic test. My first engine, a Don Young beginners' 3½in-gauge Derby 4F, had a simple screw-down ⅜in thread regulator with none of the deficiencies mentioned and I wondered if I could make a bigger one for the Claughton.

How big? I had no idea but I did know that at 90 degrees rotation the regulator of the 4F was pretty well fully open so I calculated the area of the annulus open to steam at this position. Areas of hundredths of a square inch are a bit difficult to visualise but the circular hole of equivalent area was 0.098in diameter. How much bigger was No. 650?

As a rough guess I compared swept cylinder volumes, about 4.5 to 1. On the unproven basis of proportional volumes the new engine would need an opening equivalent to a hole of about ⅜in diameter. I found it difficult to believe a big 5in-gauge engine would get along with such a small opening, my disk regulators each had two ports of either ¼in or

⅝in diameter so some actual proof was needed as the basis of my calculation was dodgy, to say the least.

Luckily my Hunslet had an easily accessible regulator in a large dome so it became a convenient test bed. The regulator disk was replaced by another having two adjacent ⅜in holes sliding over the fixed ⅜in D port. I loaded some passengers and noted the position of the regulator handle when going nicely up 1-in-100.

Setting the handle in the same position with the dome removed revealed just one of the holes sitting over the port: yup, ⅜in diameter was right. Naturally the test disk became permanent and the engine was then easier to drive. In due course I made a screw-down regulator for No. 650 using a ½in x 6 tpi double start thread to provide an equivalent ⅜in opening when moved through the correct 60-degree arc.

The Tender

Unlike my Midland Railway Compound there was no doubt about what went behind No.650. Tenders and engines on the LNWR were not betrothed 'until scrapping did them part' – any tender of the correct size was attached to an engine coming out of overhaul and the type of tender constructed for the first batch of engines after No.2222 is well documented, even their numbers.

A drawing of a Cooke 3000-gallon

"I had purchased a full set of castings and materials except for coupled wheels whose only supplier was out of business and in possession of the only patterns..."



tender was to hand and I used it to adapt the Whale 3000-gallon tender from 'Etna'. There is little of note other than the complexity of the brake arrangements which is the usual Crewe story of minimising new work by successively modifying what already existed, the down-side of standardisation.

The original wooden-frame tenders had brakes operated from a hand wheel via a long inclined pull rod and when steam brakes were fitted to engines extra links with slots were put in so that the tender brake would be pulled on by a link from the engine, play between engine and tender permitting. Cooke decided to improve things by fitting vacuum brakes to the engine and tender so a few more bits were added to the tender rodding.

These tenders had sloping coal bunkers so the brake rod and water scoop rod pass through the water space at an oblique angle – it all makes for a nice complication. Handles were the usual five-spoke design so a bit of filing practice was called for.

Well over 1500 rivets of ⅜in dia were purchased for the platingwork, plus those that fell never to be recovered. I set them out using a jig strip drilled on the mill – the spacing is ⅛in for water-tight joints (water-tight on the prototype that is) and double or treble elsewhere.

Setting them out is quite tricky as the vertical lines have to coincide with corresponding rivets in the horizontal rows. In fact the whole dimensioning of the tender panels was done round the rivet pattern.

One unimportant curiosity is the North Western practice of fitting the fall plate to the tender so it rests on the rear of the cab floor. **EIM**

ABOVE AND ABOVE RIGHT:

Views of the tender underframe.

LEFT: The finished and finely detailed tender – some of the 1500-plus rivets visible in the platingwork.



■ The first two parts of this series appeared in the June and July 2018 issues of **EIM**. Digital copies can be downloaded or printed versions ordered from; www.world-of-railways.co.uk/engineering-in-miniature/store/back-issues/ or from 01778 392484.

Measuring internal diameters

John answers one of those “How do I do that?” issues model engineers face...

BY JOHN SMITH

Ever since Mitutoyo produced the Digimatic Caliper in 1983, digital calipers have been ubiquitous in industry. I bought one of the first ones and used it for over 20 years before treating myself to a new one. But digital measuring devices have drawbacks.

Firstly, any device that converts an analogue measurement into a digital display has a ‘quantisation error’. For most digital calipers, this is 0.0005 of an inch or 0.01mm, which is basically the smallest value which can be displayed. So if a caliper reads

1.9995in we would hope that the actual (analogue) measurement might be somewhere between 1.99925 and 1.99975, but the instrument gives us no clues.

Secondly, digital numbers look so precise that we are tempted to believe that a caliper reading to the nearest 0.0005in or 0.01mm will be accurate to +/- 0.00025in or +/- 0.005mm, but in fact, the latest Mitutoyo Absolute

“A set of analogue bore gauges would cost well over £2000; digital ones around £5000. Perhaps then these are not the solution for us...”

PHOTO 1: A selection of quality internal micrometer sets.

All photos by John Smith

calipers are accurate to +/- 0.001in or +/- 0.02mm.

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

So, are internal micrometers the instruments of choice for internal diameters? I would say not. I have three lovely internal micrometer sets (all bought cheaply secondhand) which can measure diameters from 1.000 to

2.000in, 2.000 to 12.000in, and 8.000 to 13.000in respectively (**Photo 1, below**) but they are seldom used.

Internal micrometers suffer from two problems. One can never be totally sure that:

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

In industry, bores are measured using bore gauges. These have three measuring faces, eliminating problem 1. And instead of points, they have elongated measuring faces to ensure that the body of the gauge is co-axial with the bore to be measured, eliminating problem 2. They typically have an accuracy of around 0.00015in or 0.004mm.

Unfortunately, a set of analogue bore gauges to measure diameters between 0.5in/12.5mm and 2.5in/65mm would cost well over £2000; digital ones around £5000. Perhaps then these are not the solution for us.

So what is the answer? Well it's the humble telescopic gauge,





used with care and in conjunction with an analogue micrometer. A set of six gauges for bores between $\frac{5}{16}$ in and 6in can be had for as little as £30. The Starrett set which I have used for 20 years (**Photo 2**) can be bought new online for around £180 including VAT.

If you think about the tasks of (a) machining a bore to fit a shaft (or vice versa) – either a press fit or a clearance fit, and (b) machining a piston to fit a cylinder (or vice versa), we are not actually much bothered about absolute measurements. It's the relative measurements that matter. So

if we use the same micrometer to measure both shaft and bore, any inaccuracy in the micrometer will cancel out.

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

Also, use a horizontal object in your eye-line when tightening the gauge (for example the shank of a boring tool or a parallel on the cross-slide) to ensure that the handle



PHOTO 2:

A set of six telescopic gauges can be bought for around £180.

PHOTO 3:

A horizontal object in the eye-line helps with accurate tightening of the gauge.

of the gauge is horizontal (**Photo 3**). This is crucial, as a five-degree angle in a two-inch bore will cause an error of 0.007in, a 2 deg angle an error of 0.001in, and a 1 deg angle an error of 0.0003in. Get it right and you will achieve the accuracy you need, and at a very affordable cost.

■ John's Tips for Model Engineers have appeared every month in **EIM** since March 2018. For digital or printed back numbers go to www.world-of-railways.co.uk/engineering-in-miniature/store/back-issues/ or call 01778 392484.

START HERE

This is not just steam, it's super steam...

Our concise series for novice steam engineers lifts the lid on superheating.

Not all steam technology had its origins in the 19th century and a prime example is the superheater. Rising to prominence in the early 1900s, superheating simply makes the steam 'hotter' or drier, and therefore more efficient. The technology was widely applied to 20th century railway locomotives, and even more so to steam-powered road vehicles, and also found favour in stationary steam engines.

In a superheated engine the steam taken from the boiler does not pass directly to the cylinders – instead this 'wet' or 'saturated' steam is taken on a route that involves it passing through the boiler several more times.

This process further heats the steam, both creating more thermal energy and also reducing any risk that the steam will start to condense back to water before reaching the cylinders – as we will discover later in this series water in a cylinder bore is not something to be desired...

A prime clue that a full-size loco is superheated is the existence of two sizes of tube in its boiler. Above the

nest of many normal-sized tubes will be a much smaller number of significantly larger ones, known as flues. They pass hot gases from the firebox to the smokebox just like the smaller tubes, but are sized to allow superheater elements to run in them.

These elements are simply long lengths of pipe with 180-degree bends at each end. Steam taken from the dome passes to a superheater header, normally placed in the smokebox. From here it is sent through the elements back and forth along the boiler, and is further heated as a result. Typically the elements will force the steam to loop back on itself twice at the firebox end and once at the smokebox end, so it receives four times as much heat exposure.

Too hot to handle

The issue with placing superheater elements in a flue tube is of course that they will become extremely hot as well, with the risk that they could actually melt and burn out. When the superheater is working the steam passing through the tubes will

BELOW:

This 'nest' of superheater elements has been taken out of a locomotive under overhaul. The smokebox end is closest to the camera and it can be seen how the tubes loop backwards at the firebox end.

actually have a slight cooling effect on them, which helps preserve them, but when the locomotive is not under load and therefore no steam is passing through the tubes, other measures need to be taken.

The snifting valve was primarily created to prevent a vacuum being created in the cylinder when steam cools, and its merits have been argued over for many years. But mounted on the 'wet' side of a superheater header it can be used to admit air into the elements when the loco is coasting, keeping the elements cool and preventing them burning out. **EIM**



A Double-Acting Engine

We conclude the build of Jan-Eric's small steam engine.

BY JAN-ERIC NYSTRÖM – Final Part of Four

EDITOR'S NOTE: Jan-Eric describes his small engine as a simple project, perhaps not for beginners but suited to model engineers of limited experience. In part 1, he also described how the model can also easily be scaled down to suit imperial dimensions. Details of how to obtain previous issues can be found at the end of this article.

Flywheel turning

It is a matter of taste how to make the flywheel, Part 32. It can be turned from solid, or assembled from parts, or even cast. I had a massive, almost 2kg brass flywheel 'rescued' from an old tape recorder in my scrapbox, and used that as raw material. The diameter just happened to fit my design exactly, so I just had to cut a suitable slice of it with – you guessed it, my trusty angle grinder! A model engineer who is constantly collecting interesting scrap and 'scrounging' old machinery often saves a lot of money otherwise spent on raw materials...

Turning a recess on each side of the flywheel, and drilling six holes, I produced a nice-looking design. For this, I did use a rotary table indexed every 60 degrees, but using a pair of compasses is just as good. As remembered from school geometry, dividing a circle into six parts is easy – just mark out the radius six times consecutively on the circumference, and you're done!

The hub has two threaded holes

PHOTO 1: An end mill is used to provide a start for drilling the flywheel at an angle, by tilting the mill vice

PHOTO 2: The thread is finished by hand, using a Tap-wrench.

PHOTO 3: The finished flywheel.

All photos and drawings in this feature by Jan-Eric Nyström. All constructional drawings reproduced full-size for the metric version of the engine.

for grub screws, spaced 90 degrees apart. These screws will also secure the two axle halves together, so they should be positioned one on each side of the flywheel.

In order to reach the grub screws with a screwdriver (or a hex key, depending on the screw) from outside the rim, the holes are drilled at an angle, as shown in the drawing. It is best to mill a small flat first – it is well nigh impossible to start a drill on a round, tilted surface! **Photo 1** shows the setup I used; the vice was tilted to an angle of 24 degrees, so that the shank of the mill bit just cleared the inside edge of the rim. After milling a shallow depression, I changed to a centre drill, and finally an ordinary drill.

In order to get the thread started squarely, I used the mill to get the tap a few turns into the hole, turning the spindle by hand. Then, I opened the chuck, lifted the mill spindle, removed the flywheel from the vice and used an ordinary Tap-wrench to finish the thread, **Photo 2**.

The finished flywheel is shown in **Photo 3**. Since the raw material, i.e. the old tape recorder flywheel, had too large an axle hole, you can see that I have made a bushing of steel, pressed into the flywheel. The grub screws keep the bushing securely in place in the hub.

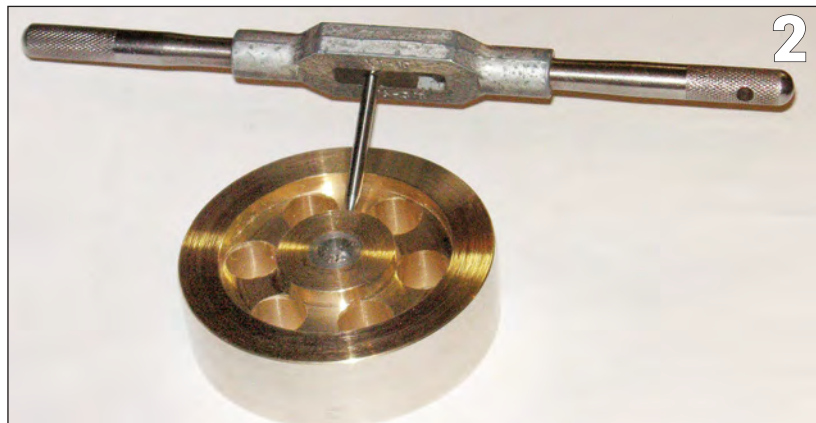
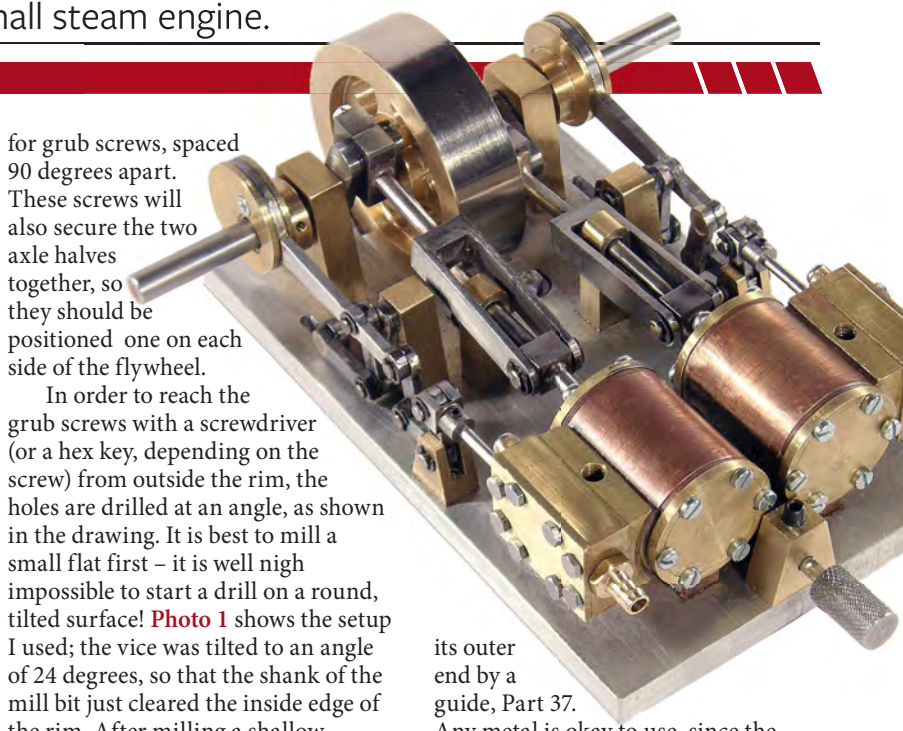
Almost there...

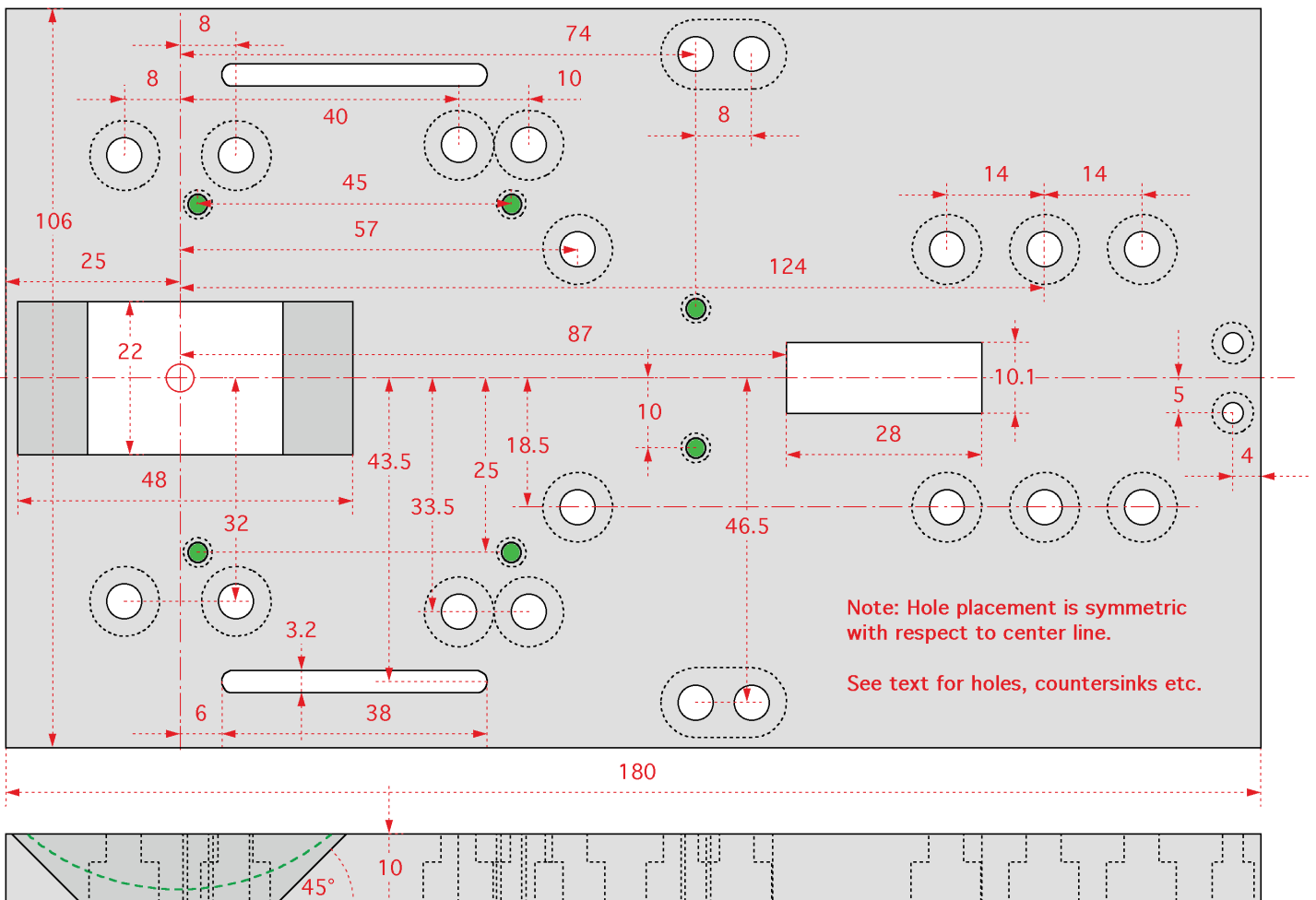
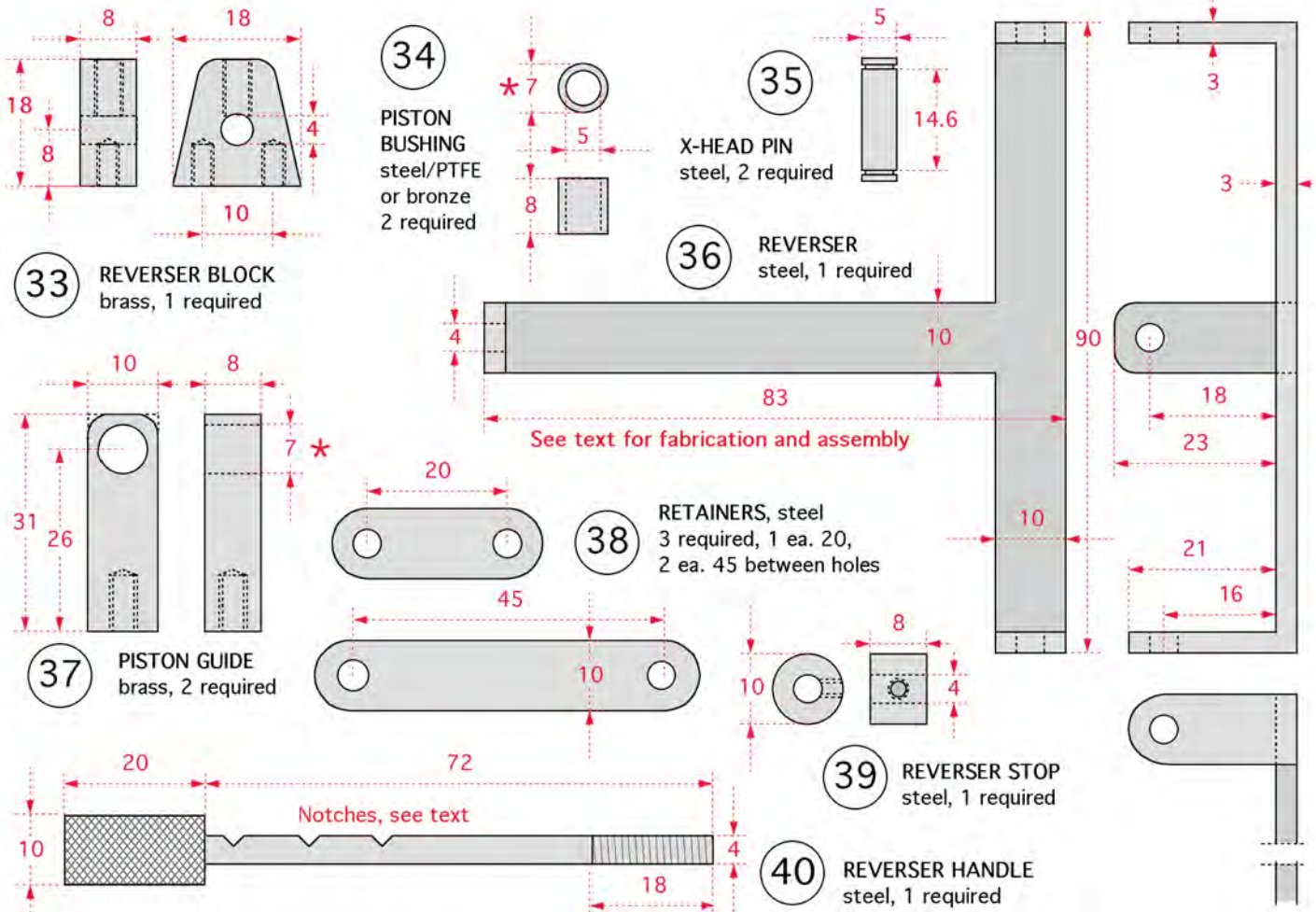
Now there are only a few more parts to be made before we can start assembling the engine. There are no usual crosshead guides in this design, instead the piston rod is supported at

its outer end by a guide, Part 37.

Any metal is okay to use, since the guide will have a bearing bushing, Part 34. The overall diameter of the bushing will determine the size of the hole in the guide. The crosshead pin, Part 35, has clip ring grooves just like all the other pins. The diameter shall suit the hole in the crosshead block on the piston rod. I used 5mm drill rod.

The reversing mechanism consists of a T-shaped reverser Part 36, a







handle, Part 40, and a stop ring to restrict the movement, Part 39. The threaded top hole in the reverser block, Part 33, is large enough to accept a spring and a small steel ball, which will engage with the notches to be filed

in the reverser rod when the valves have been set. I used a 4mm ball in a 4.2mm hole, threaded with an M5 tap.

The knob on my reverser is knurled, but it could just as well be grooved – purely a matter of taste



PHOTO 4:

Drilling a brace with the two base pieces clamped together.

PHOTO 5:

Milling a narrow slot for the reverser prong.

PHOTO 6:

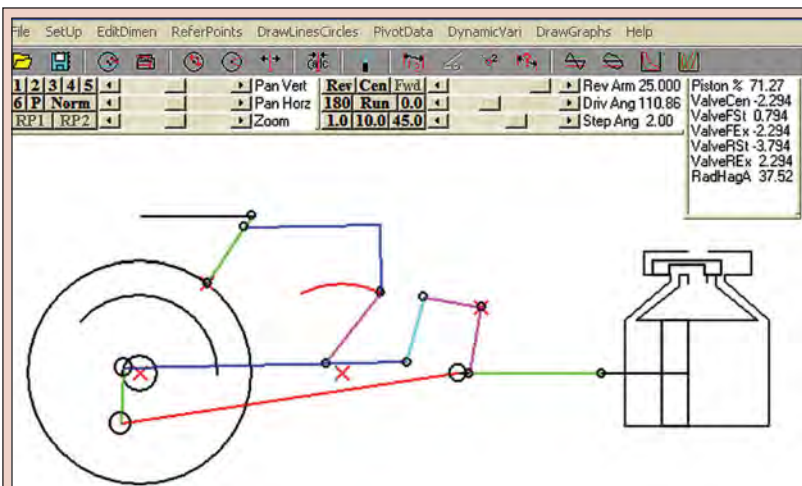
The underside of the base, with the reverser and its retainers. These parts will be hidden from view when the engine is finished. Self-adhesive rubber 'feet' can be attached to the corners of the base plate.

again. Three retainers, Part 38, keep the reverser in place. I made my reverser by 'cold forging' 10mm wide steel strips, taking care to get the width of the 'T' to the exact dimension; the prongs must fit into the narrow slits in the base plate. Since the material distorts when hammered to shape, I marked out and drilled the holes after forming the 90 degree bends – which must be sharp! The stem of the T was silver soldered in place.

In order to assemble everything, we need a base plate, Part 41. In my scrapbox (a veritable gold mine, collected over the years), I found pieces of 10 mm thick aluminum plate, leftovers from building an animation camera stand – way back in 1982! The base can be of any metal, thick enough to take the countersinks needed for the bolts. The only part that will have to be adjusted for a different base plate thickness is part 36, the reverser T. The holes in the three prongs should be at the correct height to fit the corresponding holes in the reverser block and the pins in the reach rods, i.e. 8 and 6mm above the base plate surface, respectively.

Since my scrap pieces of aluminum were not wide enough for the entire base, I made it in two parts by attaching two 53mm wide strips together with a couple of braces. In order to get them closely aligned, I first drilled the braces and the base on one side, attached the braces with screws (M4), and drilled the second side with everything clamped together, **Photo 4**. This ensured a perfect fit.

The long, narrow slits in the plate must be milled slowly and carefully, **Photo 5**. The aluminum alloy of my plates appeared a bit 'sticky', and did not give a really clean cut. A free-cutting alloy, or a brass base plate will

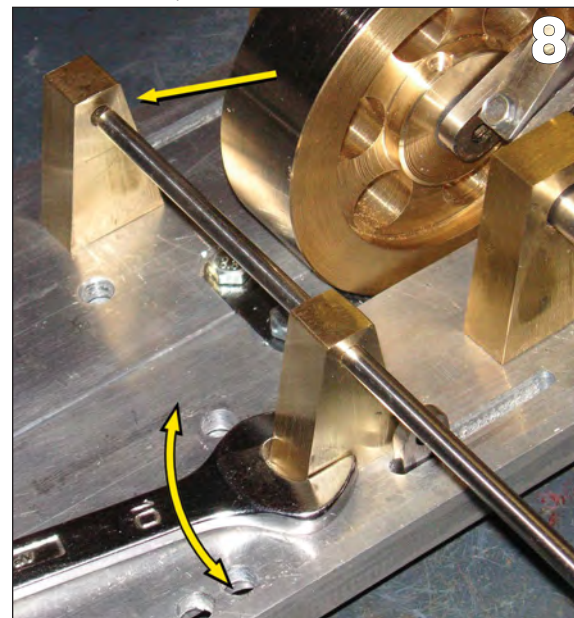
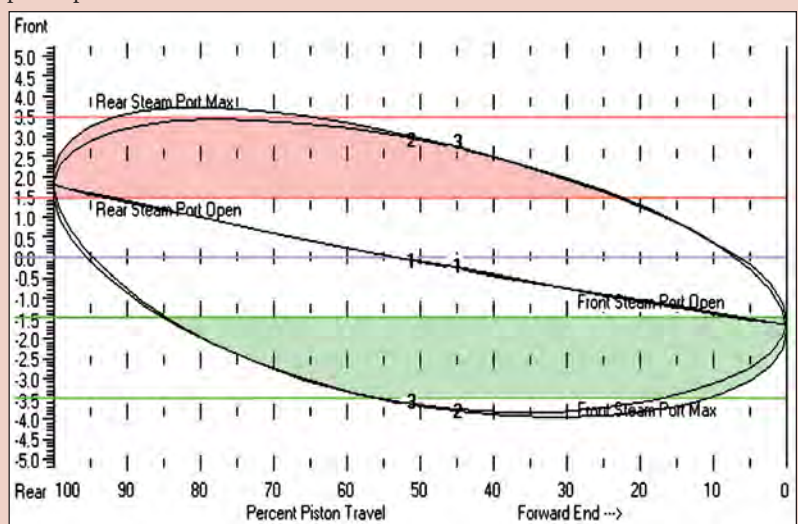


On the subject of valve gears...

I studied many different valve gears in order to find one suitable for this small engine, and finally chose a design that is related to both the Hackworth and the Southern valve gear types used on locomotives in the UK and USA, respectively.

The exact dimensions for the valve mechanism of this engine were determined with the aid of Charles Dockstader's valve gear simulator, available from many websites, including <http://www.billp.org/Dockstader/ValveGear.html>

Figure A (above) shows a still image of the software's animated display of the valve gear action, while Figure B (below) shows the port openings in relation to piston position.





not have this problem. I just used what I had available...

All the holes in the plate are countersunk for bolt heads, except the six threaded holes for the retaining straps (marked in green, M4 in the metric version). These can be drilled through, as I did, or, if you prefer not to have the holes visible on the top of the base, drilled on the bottom side of the base, deep enough to take the bolts.

The angular cut-out for the flywheel doesn't need to be just as I made it, as long as the flywheel will fit in the depression – see the dotted, green arc representing the outline of the flywheel. Note that most of the horizontal dimensions are shown in the upper half of the drawing, while the vertical dimensions are shown in the lower. Since the spacing is symmetrical with respect to the centre line, all measurements can be obtained from the drawing. The red circle is the reference point from which most distances are measured. It coincides with the midpoint of the main axle.

Photo 6 shows the underside of the base, with the reverser in place. The retaining straps and their spacers, which are slightly thicker than the reverser material, don't look pretty, but they will be hidden under the base, so I worked 'quick-and-dirty' again. Well, this design won't win any exhibition prizes anyway...

The moment of truth

If all the parts are correctly made, they should now fit together without further modifications. Since many of my parts were made by marking out by hand, and not by X-Y milling (not to mention CNC machining!), I couldn't be absolutely sure of a perfect fit. Therefore, I had drilled all holes in the base plate slightly oversize, 5.5mm for the M4 bolts I used for attaching the parts (normally, a clearance hole is just a tad larger than the bolt.) The countersinks are 10mm in diameter, made with a slot mill, so they are

flat-bottomed. This allows a slight adjustment in the position of the parts.

First, I assembled the main axle, with flywheel and main rods. Next, I attached the main axle bearing blocks (Part 15) to the base, taking care that they both were at the right distance from the plate edge. I used a precision square and vernier calipers to check the alignment, **Photo 7**. The square contacts the axle (upper right arrow), while I measure from the plate edge (left arrow) to the corner of the square (hidden behind the axle, lower right arrow). When both bearing blocks were in place, 25mm from the edge of the base, the calipers read 29mm (i.e. 25mm plus half the diameter of the 8mm axle).

Next, both radius bearings (Part 17) must be placed so that their axle holes align. I used a piece of 4mm drill rod inserted into one of the bearings as a 'pointer', **Photo 8**, and could adjust the angle with a wrench. Do not force the rod into the other bearing – it should slide in nice and easy.

The radius bearings must have their centre lines exactly 45mm from the main axle centre line, so I used the vernier calipers again, **Photo 9**. Note

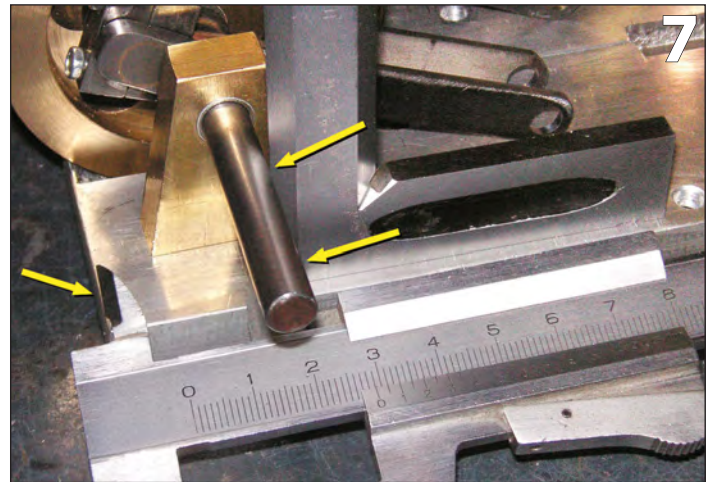


PHOTO 7: Measuring and adjusting the position of the axle bearing block.

PHOTO 8: Adjusting the link hanger bearing using a piece of drill rod as a pointer.

PHOTO 9: The distance between the parts is carefully measured and adjusted.

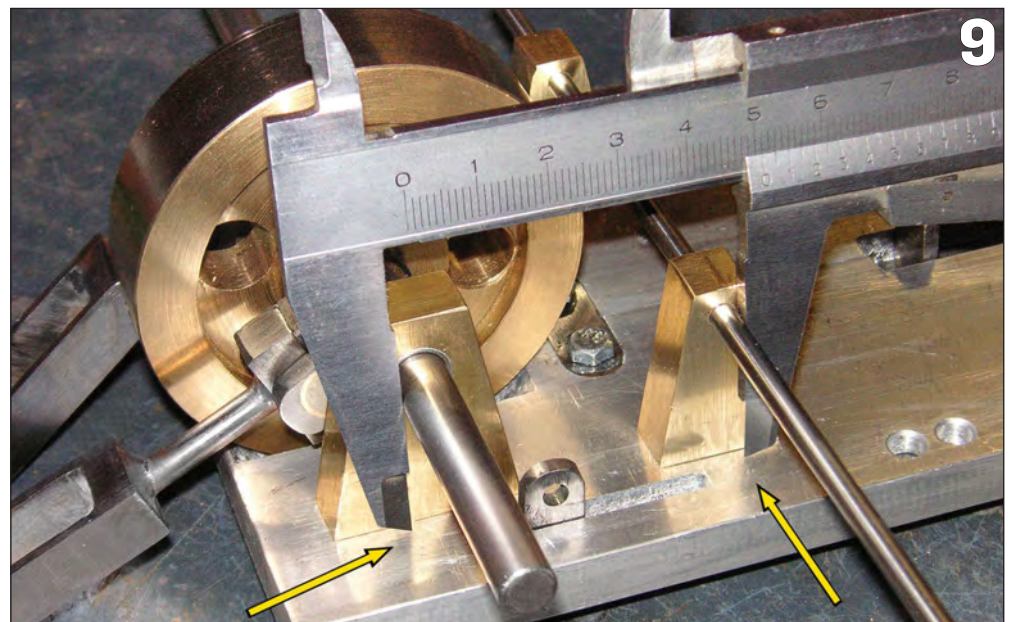
how both caliper points rest on the base plate (arrows) – this ensures the calipers are parallel to the base. The reading should be 51mm (45mm plus half of each axle of 8 and 4mm). I had tightened the bolts only slightly, so I

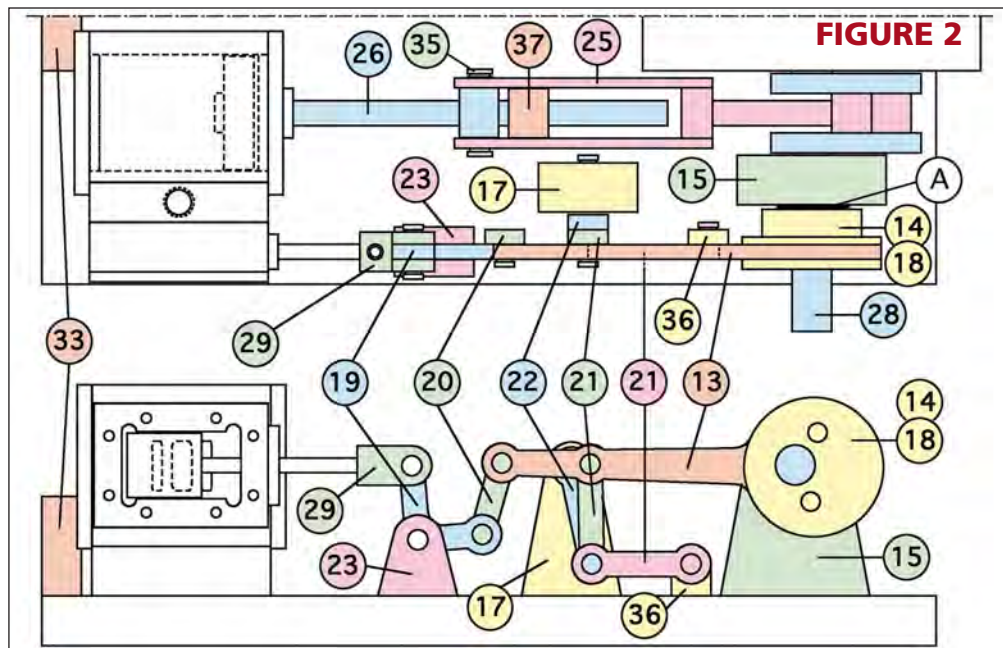
Surprise, surprise!

Since I used a split base plate for my prototype, and the axle is also split (albeit joined by the screw joint), my engine actually consists of two complete, one-cylinder engines!

The only additional parts needed in order to split it into two working engines, are another flywheel and two axle bearings, installed in the cut-out for the original flywheel, as well as individual reversers for both engines...

A single cylinder does run rather smoothly, provided it has a generously sized flywheel. Most hobby stationary engines are in fact single cylinder designs (e.g. the Stuart verticals), and may need a little nudge to start running if the piston has stopped on or very near either of the dead centres.





could make fine adjustments to the position. Afterwards, I re-checked the alignment, as in Photo 8.

Continuing the installing of the parts, the bell crank bearings are next in order. The positioning is checked in the same way as for the previous parts. The cylinders (with their pistons, valves and valve rods already installed) are attached only tentatively at this stage, leaving the bolts slightly loose. The piston guides (Part 37) are put in place on the piston rods, and the main rods are connected to the crosshead blocks with their pins (Part 35). Clip rings secure the pins in place.

Next, we need to connect all the levers in the valve gear. Use **Figure 2** as a reference. The parts here have the same numbers as in the construction drawings, and are colour-coded for clarity. Start by inserting the bell cranks (Part 19) and the link hangers (Part 22) in their bearing blocks and secure their pins with clip rings. Place the yoke (Part 20) in the bell crank so that its pins point outwards.

The reach rod and the link

(identical, both numbered as Part 21) are installed, secured with clip rings also. Here, we face some wiggling in tight spaces; the fit is very tight, and everything needs to be well squared up. For me, a few parts needed quite a bit of patience to get in place – forcing a pin into a reamed hole even slightly askew will make it stick tight! Finally, the eccentric rod (Part 13) is eased onto the axle and the two remaining free pins. Whew! An alternative would be to assemble the entire system of levers first, and then install the complete assembly.

A thrust bearing, i.e. a thin washer made of bronze or PTFE, can be inserted between the eccentric and the axle bearing block, at A. This will prevent the metal parts chafing against each other. The valve rod clevis (Part 29) will fit in place provided that the valve rod is pushed into the steam chest, and the eccentric is rotated so the bell crank tilts away from the cylinder. The clevis pin and the final clip rings are installed.

Now, we can align the cylinders;

check that neither the piston rods nor the valve rods touch the edges of the holes in the glands at any stage when the flywheel is rotated. Everything should move and rotate smoothly, without any binding.

Adjusting the valve gear

Now, we need to adjust the valve position. Let's do this one side at a time. The steam chest covers must be removed so we can see the movement of the valve. First, set the reverser to 'neutral', with the link hanger (Part 22, hidden behind part 21) perfectly vertical. Rotate the flywheel and look at the valve. It should move slightly back and forth, but only so much that each steam port opens to a small crack on both sides, **Photo 10**. At first, this probably won't happen; the valve will hardly be in the correct position by accident, but rotating the valve rod in the valve nut, and sliding the rod in its clevis will get you there!

Be careful not to move the link hanger from its vertical position during this adjustment. Not until both valves crack open equally at either end during the rotation of the flywheel, and the clevis grub screws are securely tightened, can we continue – with the steam chest covers put back in place, of course.

In order to time the valves, we need a source of compressed air (or steam). The live steam inlets in the steam chests will have to be connected to this source. Part 42 shows a simple 'hose barb' fitting suitable for a plastic or rubber tube – if you use steam, a more substantial fitting is required. You will need four unions, two for the steam inlets, two for the exhaust pipes, as well as some piping from the boiler and to the smoke stack.

A lubricator is also necessary - not so much for the pistons with their rubber or PTFE rings, but for the valves, where metal moves against metal. Gaskets, either made from oiled paper, or a silicone gasket paste,

FIGURE 2:

The positioning of the parts in the valve gear.

PHOTO 10:

Adjusting the valve stem so that the valve opens just a crack on either side.

FIGURE 3:

When the crank is vertical, the 'fat' side of the eccentric points away from the eccentric rod.

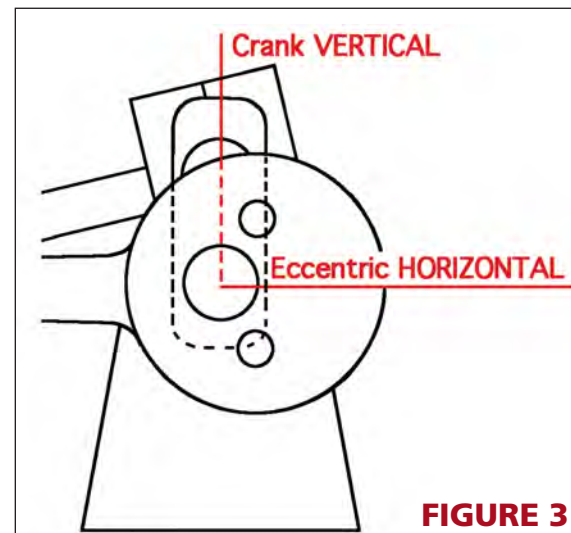
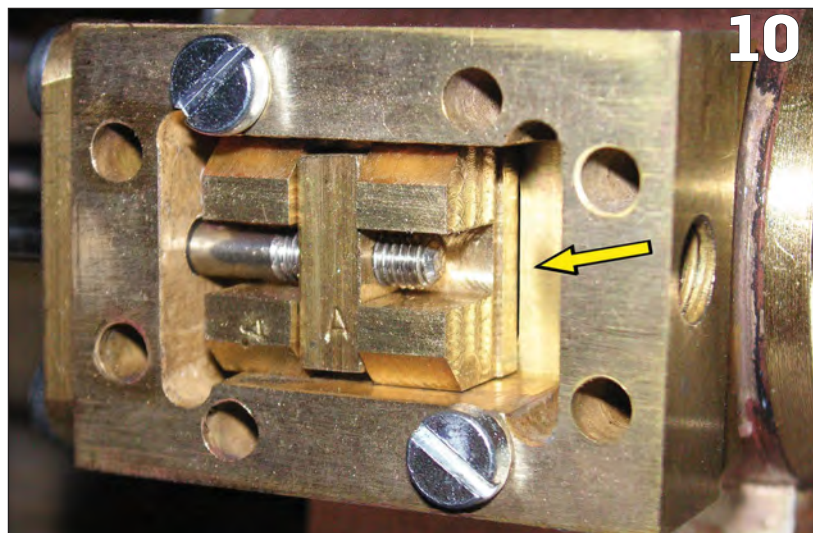
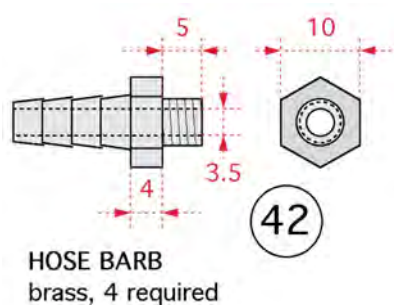


FIGURE 3



should be used in the final assembly of the steam chest and the cylinder covers. If you use gasket paste, make certain none of it gets inside the cylinder or the steam chest!

Running on air

In order to test my engine, I connected a plastic tube from an air compressor blowgun to a T-splitter, and from that, two short tubes to the steam chests. I oiled all the moving joints as well as the valves. Having set the eccentrics approximately in the right position, as shown in **Figure 3**, a quick squeeze on the trigger of the air blowgun made the engine rotate at a furious speed! However, reversing the engine to run the other way produced a staccato exhaust beat, and the engine tended to stop at low pressure.

Loosening the set screws on the eccentrics, I adjusted them slightly and tried again. Before every try with compressed air, I rotated the flywheel by hand, just to check that none of the mechanical parts would 'overshoot' and touch another. This is especially important regarding the valve, now invisible inside the steam chest – if the reverser is moved too far in either direction, the valve might contact the edge of the steam chest with disastrous consequences.

After a few tries, the engine ran well in both directions. It is theoretically possible to adjust the cut-off, however, the engine did not run well on the mid-third of the reverser's adjustment range.

Checking my design in the Dockstader software, I notice that the valve will open only very little in this region, for instance on a 35% cut-off the steam port opens only about half a millimetre! Thus, I also attribute the 'limping' in mid gear to the slight but inevitable slop in the joints and, of course, to some inaccuracy in my work – as you have seen, most parts were made with simple tools. With steam, and its expansive properties, the engine runs somewhat better on a short cut-off. Anyway, a small engine like this is almost always run at full cut-off, so I filed three notches in the reverser; one for full forward, one for

"A quick squeeze on the trigger of the air blowgun made the engine rotate at a furious speed..."

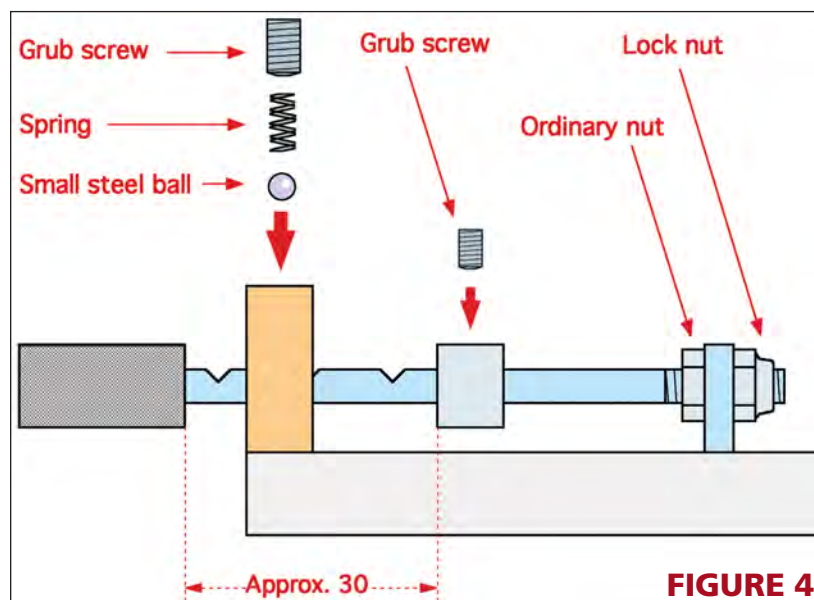


FIGURE 4

mid-position ('neutral'), and a third for full backward.

The reverser stop is a simple collar that will prevent the reverser being moved too far – check that the valve or the levers are not contacting anything where they shouldn't, and set the lock nut and the collar accordingly, see **Figure 4**. According to the design, the total reverser movement should be around 22mm, so with the 8mm thickness of the reverser block, the distance between the knob and the stop is approximately 30mm.

The speed of the engine can be regulated with the throttle – I experimented with the blowgun's trigger and could get the engine to run relatively slowly at around 60rpm, all the way up to 1,000rpm and more! With a proper load, such as the weight of a loco or steam car, or a propeller or paddle wheel on a boat, the speed will be much lower, of course.

If you are going to try running at full speed, I suggest you clamp the base plate securely in your bench vice – at high speeds, the engine vibrates a lot due to the inherent imbalance in the axle. Counterbalancing the cranks

in some form would be necessary for high-speed running – full-size, two-cylinder steam engines sometimes had their cranks set 180 degrees apart, not 90 degrees as here. This improved the balance, but the drawback was that they were not self-starting from all positions.

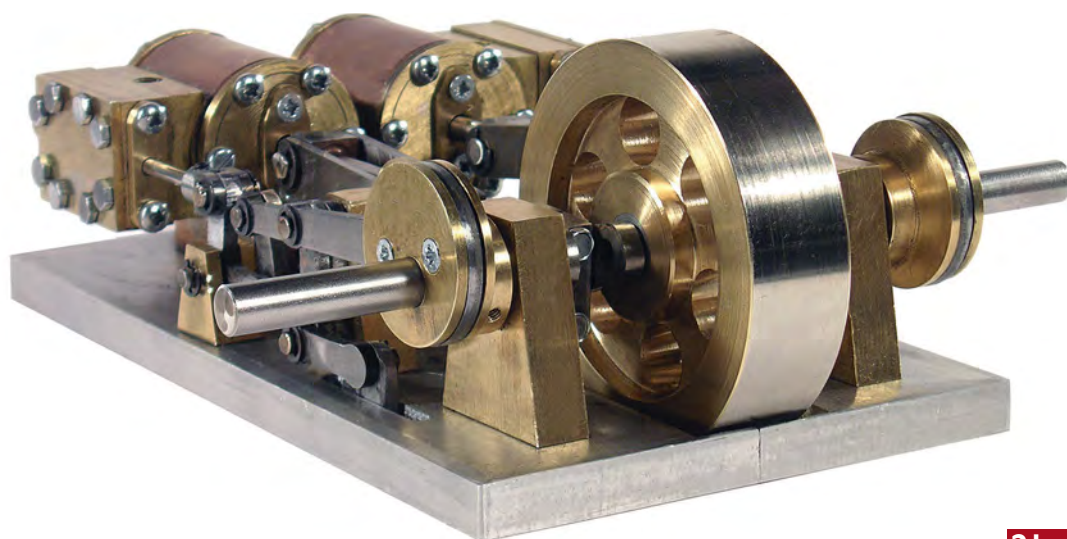
Since the reverser of this little engine moves easily, and over a short distance, it might be possible to use the engine in a radio-controlled vehicle, such as a steam roller or a boat. At least two servo channels would be necessary to control the engine; one for the throttle, and a second for the reverser – which in this case would not have a spring-loaded ball; the servo would keep it in place. How to design a radio control for shovelling coal into the firebox of such a miniature vehicle is left as an exercise for the student...

EIM

■ The first three parts of this series appeared in the May, June and July 2018 issues of **EIM**. Digital copies can be downloaded or printed versions ordered from; www.world-of-railways.co.uk/engineering-in-miniature/store/back-issues/ or from 01778 392484.

FIGURE 4: The parts providing 'click-stops' for the reverser, as well as limiting the movement.

BELOW: The completed steam engine, ready for hours of pleasure. The flywheel looks impressive from this perspective.



Space at a premium

Andrew steps into the workshops of the pioneer preserved railway to discover how the Talyllyn maintains its stock, and a planned radical solution to 19th century space issues.

BY ANDREW CHARMAN



The Talyllyn Railway's Pendre works vies with Boston Lodge on the Ffestiniog as the most revered engineering location on the UK's heritage railway scene. Pendre, after all, is the maintenance hub of the pioneer preserved railway, the setting

for much of the drama in L.T.C. Rolt's seminal document of the earliest days of preservation, *Railway Adventure*.

Yet while Boston Lodge has always been a major works and built several locomotives, when Pendre opened its doors in 1865 it was a tiny shed built

to meet the basic maintenance needs of a backwater narrow gauge railway – two steam locomotives, five four-wheeled passenger vehicles and a collection of slate wagons. When major work was needed, usually on the locomotives, they were sent away.

Since the Talyllyn Railway Preservation Society took over in 1951 Pendre has expanded beyond all recognition, acquiring two extra carriage sheds and all the equipment required by a railway trying to be as self-sufficient as possible – but always on what is a very cramped site.

As **EIM** steps off the platform of the tiny station to be shown around the sheds by engineering manager Chris Smith, it quickly becomes clear that this is not the easiest place in which to work for the seven staff and supporting volunteers. Particularly as they are now required to maintain six steam locomotives, as well as four diesels, 20 or more carriages, wagons and the engineering needs of such departments as signals & telegraph – it is all concentrated at Pendre.

Home comforts

The original building was based around a locomotive shed big enough to hold the two Fletcher Jennings engines that served the Talyllyn alone for almost 90 years, 0-4-2ST 'Talyllyn' and 0-4-0WT 'Dolgoch'. It butted end on to a cottage lived in by level crossing keeper Peter Williams, and beyond it was a workshop, with a

ABOVE: The works at Tywyn Pendre, a historic but by no means spacious site for a motive power depot... From left is the North carriage shed, the station, the running shed, original carriage shed and the entrance to the workshop.

LEFT: Chris Smith is the man in charge of making the most of his surroundings.

All photos in this feature by Andrew Charman



single track accessed from behind a wooden single-road carriage shed that was just long enough to hold the TR's five passenger vehicles.

The carriages now live in either the north or west sheds built since preservation, but locomotive stabling, and all the maintenance, basically relies on the same 1865 sheds. An extension to the running shed was made possible many years ago when the cottage was taken over and the wall knocked through – where the boundary used to be can be seen today in the running shed as the floor drops to a lower level. As a result most general loco maintenance is carried out furthest into the shed where the lower floor ensures such crucial areas as the motion fall easier to hand.

On the day we visit 1921-built Kerr Stuart 0-4-2ST 'Edward Thomas' is in this spot, two of the team finishing significant refurbishment to the loco's bottom end. A workhorse of the Tallyllyn, this loco has likely travelled in excess of 250,000 miles in preservation, and the remedial efforts have included replacing crank pins that had worn to an oval shape, reboring the wheels after discovering inaccurate quartering, new rod bearings, new axle boxes and oil trays, removing and remachining the hornguides, adding new bolts and remetaling the crosshead slippers and slide bars.

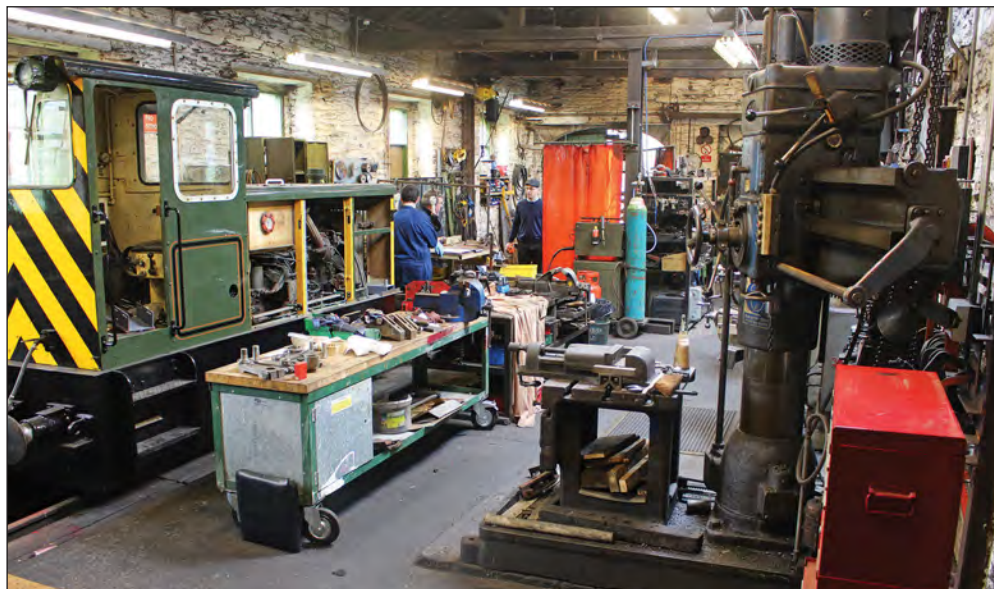
Eclectic collection

Like most heritage railways, the Tallyllyn's inventory of machine tools has been sourced from a host of sources over many years and today forms an eclectic collection, space made in the cramped surroundings for each item as it arrived.

Dotted around the workshops today are Harrison and Colchester centre lathes, a horizontal borer, two Bridgeport milling machines, radial and pillar drills, a plasma cutter, 4½-inch and 6-inch grinders and a pedestal grinder. A recently-installed three-ton overhead hoist helps move the heavy stuff around.

Clearly demonstrating the space issues faced is staff member David Christoph, using the most recently acquired, and according to him very efficient, Churchill mill to machine new hornguides for the railway's carriage bogies. The only space for this mill was virtually in the doorway of the North carriage shed – in the bright conditions of our visit this is not an issue, but Chris tells us that the mill has to be kept well oiled to stop damp getting to it and on one day over the winter it was getting snowed on...

"There is not a lot of distance between the pit used for overhauls and the wall," he adds, revealing that the



"You can go to places and get CNC-turned parts quite cheaply, so I'm not sure it's worth making the investment for yourself..."



space is not enough to make proper use of pro-lift jacks acquired for lifting carriages from their bogies. And anyone using the welding bay has to be careful as too many steps backwards will have them stepping onto the track running through the shop.

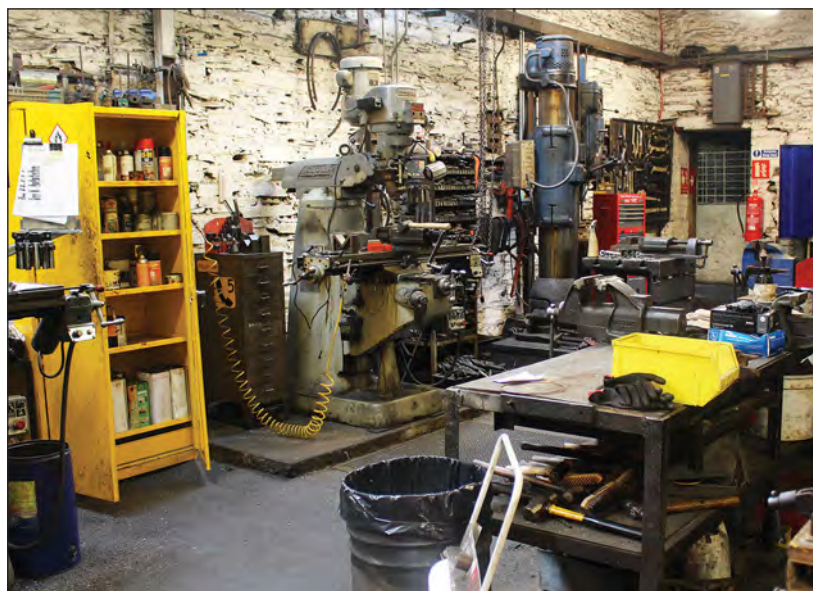
Chris is very keen that Pendre works returns to a status it has enjoyed in the past of almost full self-sufficiency. While many a Tallyllyn locomotive has received a major overhaul at Pendre, sometimes lasting several years, the most recent

ABOVE AND ABOVE RIGHT:

The workshop – with a loco in for overhaul there is not a great deal of room to move around.

RIGHT:

Turning the camera left from the show above, mills and drills compete for space against the slate walls.





to Falcon 0-4-2ST No.3 'Sir Haydn' was contracted out to the Vale of Rheidol Railway. Chris insists that the work done by the VoR was to a very high standard and No.3 is now in the best condition for many years; "but all we did was support the Rheidol with bits and drawings –we didn't do it, it's not our work."

Ensuring that such work can be effectively carried out in-house in future has involved bringing back into service machine tools that Chris discovered had not been used for some time when he took up his post in July 2017. Notable among these is a large lathe originally bought for turning tyres. A member had donated

ABOVE LEFT:

The Bridgeport mills have both recently gained DRO attachments.

ABOVE:

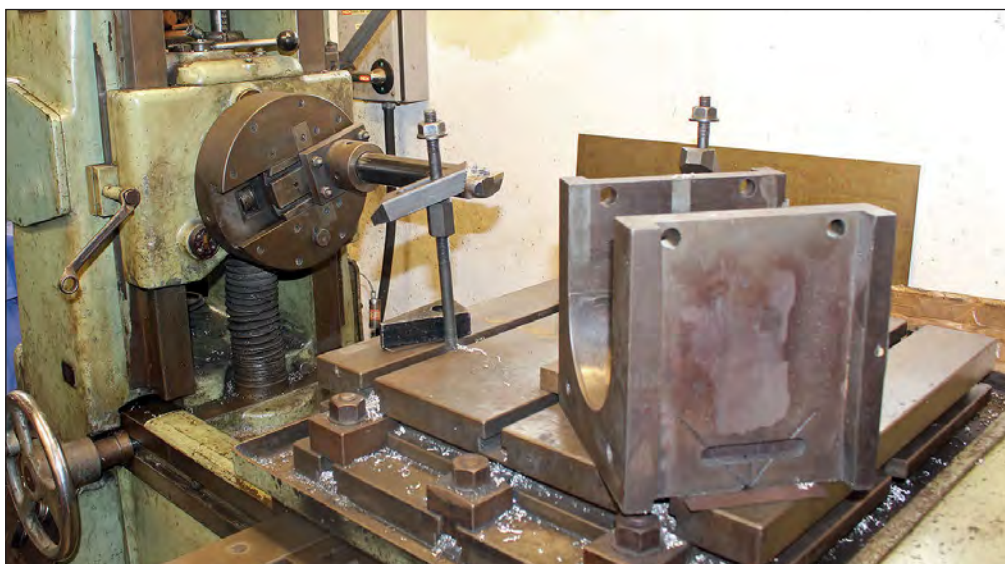
The wheel-turning lathe is now a runner.

LEFT:

The hydraulic copy turning attachment adds efficiency.

BELOW:

The horizontal borer adds the possibility of outside work.



a hydraulic copy turning attachment for it and Chris found this lying forgotten down the back of the machine. Many hours expended since in setting up the system and making it work properly have proven highly beneficial. Accurate parts production is now an easy process and Chris considers that the Tallylyn can again now offer wheel-turning services to other railways.

Boring again

Similarly a Kearns horizontal boring machine that Chris discovered had been left alone since its motor burnt out has been repaired and is again being well used; "The machine tools are probably in their best condition for some time. The two mills have had DROs added and one of them has had its head rebuilt, and we have also out a DRO attachment on the little Harrison lathe. To be honest we could do with another lathe, the Harrison gets used a lot."

Wherever one goes in the works there are further reminders of just how tight space is. Even in its extended state the running shed cannot house all the steam locomotives, especially if the far end is being used for maintenance work, so some have to be stored in the original carriage shed. And they have to be pushed outside to be lit up due to the wooden structure of the building.

In a corner of the workshop is a skip wagon currently being restored, but its presence today means there is no room for the carriage bogie forming part of an equally important programme that will upgrade these vital pieces of equipment built many years ago by the preservationists. The modified bogies will have two shock absorbers instead of one, and bored-out holes for the brake gear with bushes for the first time – when space can be found to get on with them... "You can only do one thing at a time, it all interrelates," Chris says.

Deceptively spacious

The theme persists even when our tour takes us to the West carriage shed. At first site with its white painted interior walls, and with only one of the two roads occupied by stock, this looks an unusually spacious facility, and one with some clever touches – Chris delights in lifting the boards that reveal a short in length but deep pit that allows maintenance of running gear and changing of brake blocks while standing up.

Housing the complete rake of carriages required for the line's peak train services, however, requires using the full length of the shed and opening the internal doors just shy of one end. When these doors are shut the

enclosed area serves as the works paint shop – “so we can’t paint in summer.”

On the move?

There is a potential solution at hand, however. Relocating Pendre has been talked about for decades, but may now be about to come to fruition. One of two major projects currently being considered, and detailed in the July and August editions of our sister magazine *Narrow Gauge World*, would see the heavy engineering work relocated to a new facility to be built around a mile up the line on the edge of the Pendre Enterprise park.

“We are planning an erecting shop, carriage repair shop, welding and fabricating shop, stores, and space for the track gang and its works train,” Chris says. “With a brand-new steel-framed building we will be able to decide what facilities we would like and lay out a new works accordingly.”

Pendre would then become a running shed, and the heritage aspect of the site would be focused on more than has been the case in the past. Just one lathe and mill would be retained on the existing site to provide basic maintenance facilities, with all the other tools relocating to the new facility.

A dedicated group has been formed to develop the initial plans and thoughts, with a view to having a detailed costed and engineered plan to present to the TR membership.

Chris would also target obtaining new machines, though these would very likely be, as is the current inventory, all manual units. “You can go to places and get CNC-turned parts quite cheaply, so I’m not sure it’s worth making the investment for yourself. We have members who do CNC parts for us, the fitted bolts for No. 4 for example – the jury’s still out on that one”.

For now Pendre will carry on as it has done for very many years, producing a great deal of engineering work, in highly heritage surroundings – even if they are cramped... **EIM**



ABOVE: Making hornguides on the Churchill mill, in the doorway of the carriage shed.

UPPER RIGHT: The West carriage shed may look spacious, but appearances can be deceptive.

RIGHT: That is a deep pit, if not very long...

FAR RIGHT: New electric hoist offers a 3-tonne capacity.

BELOW: Two lathes in view but Chris wants another....

BELOW RIGHT: Loco No 4. takes up valuable stabling space.



Dougal - a 5-inch Barclay

Young Sussex engineer Andrew turns his attention to making the coupling, connecting rods and smokebox saddle of his entry-level locomotive project.

BY ANDREW STRONGITHARM – Part Five of a series

The two connecting rods and both coupling rods were the next parts to be made and these were fabricated out of ground $\frac{5}{16}$ in x $\frac{3}{16}$ in gauge plate. I cut this up and machined the ends square in the Bridgeport mill so that they were the correct length before setting each one up horizontally in the mill vice to drill the holes in each end.

Once I had drilled the first hole in each bar, I used the DRO (digital read-out) to measure how far I had moved the bed of the mill before drilling the hole at the other end. This ensured that the centres between both holes were exactly to the drawings and in the case of the coupling rods, exactly the same as the centres of the axles. The centres of the axles and the coupling rods are critical to make sure the wheels rotate freely once these components are assembled. All holes were drilled $\frac{1}{16}$ in oversize to accept a bronze bush, which I fitted after the machining was finished.

Next, I had to reduce the middle of each coupling rod, which would have been for material/weight saving on the full size prototype. I made a jig out of a piece of 2in steel angle with holes drilled in one side at the same centres as those in the rods to hold the bar on during machining. One side of the angle was held in the mill vice with the bar clamped with bolts to the other side face up. I placed a couple of washers behind the bar to keep it away from the face of the angle to allow space to machine it without cutting into the angle.

When machining the bar, I left about $\frac{3}{4}$ in at each end at the original size and reduced the thickness of the middle by $\frac{1}{16}$ in. I used the side of an end mill so that the transition at the end of each reduced section had a small radius and was not square cut.

Next, it was back to the connecting rods and usefully the holes are a different size at each end. This came in handy when I needed to machine a taper along the length of each bar. I drilled two more holes into the 2in steel angle the same distance apart. This time however instead of the centres of both holes being the same distance from the edge of the angle, I made the outside edges of both holes the same distance from the edge.

I could now bolt the bar down to the angle and it was set at the correct taper. I then ran an end mill along the

The prototype 'Dougal' loco is a 2ft 6in gauge Barclay 0-4-0 built in 1946 for the Provan Gasworks in Glasgow and today resident on the Welshpool & Llanfair Light Railway in mid Wales.

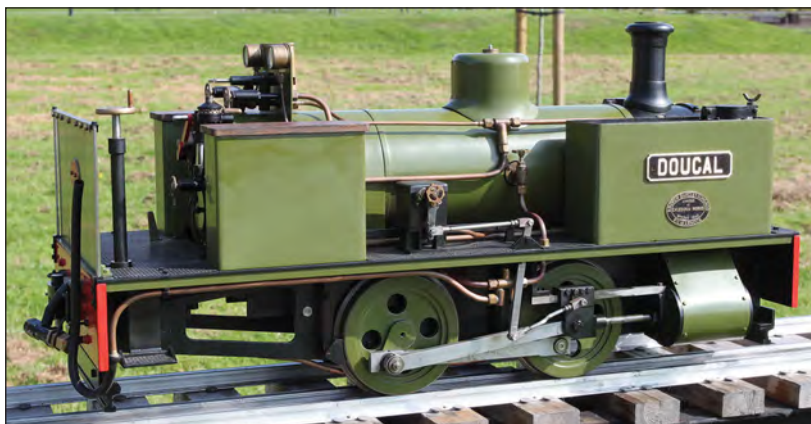
ABOVE:

Andrew's finished Dougal locomotive – this month's subject the coupling and connecting rods clearly visible.

PHOTO 1:

The wheels with their coupling rods fitted.

All photos in this feature by Andrew Strongitharm



length of each rod before turning each one over (not around) to machine the other side. This took a while to set up but the end result was very good.

The final task to complete on all four rods was to remove all the machine marks with emery paper (and elbow grease) and round both ends of the connecting rods. I was able to file away most of the excess material before finishing each end with emery paper and filing buttons. To do this I made two filing buttons out of steel, one for each of the different radii on the connecting rods.

Filing buttons are effectively a round headed bolt and a round nut for want of a better description, and this was my first use of these. To make them, you will require a piece of mild steel or silver steel bar the same radius you wish to round off.

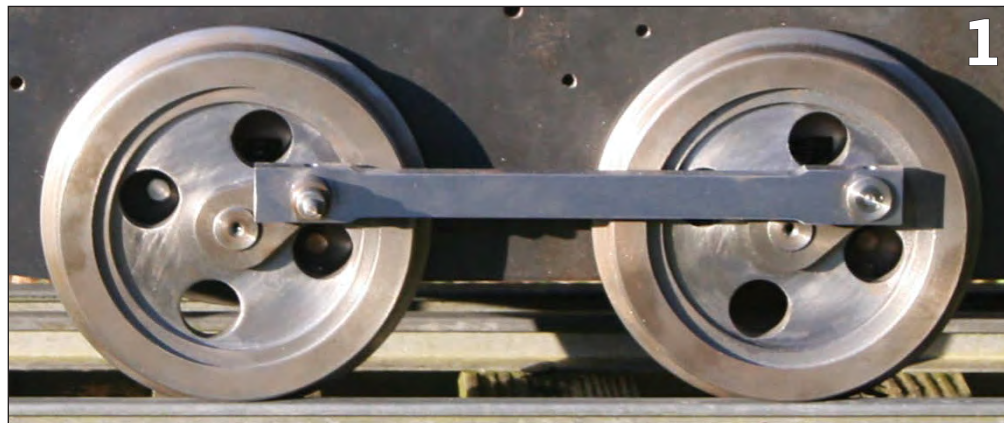
Turn a section down to the diameter of the hole through the material (assuming there is one) and by about twice the thickness of the material. Next, thread the turned down section with a suitable size BA or ME thread just under half the thickness of the material.

Now, cut the bar off so you are left

with a head approximately the same thickness as the material you wish to round off. The nut needs to be the same thickness as the head of the bolt and threaded internally likewise. Both then need to be hardened (to prevent deformation during use) by heating to a bright red and quenching in thick oil. When assembled, the nut should lock (with approximately 10 thou' sideways movement) so that the bolt is free to rotate in the hole of the material. This stops flat spots building up on the filing buttons when used. Care should also be taken to avoid rotating the filing button excessively during use and therefore potentially starting to wear the hole in the rod.

I could now turn the eight bearing bushes out of PB102 bronze to push into the holes in the rods. These bushes are inserted into the rods to prevent the crank and gudgeon pins wearing the rod away. The bush is worn away rather than the rod, as the former is more easily replaced.

For this task it was back to the Myford lathe and once again it is very important to ensure the bushes are accurate so the locomotive will turn over freely. To achieve this, the step on



the bush and the reamed bore must be completed without removing the bronze from the lathe chuck. Turning the outside diameter of each bush was straightforward enough (no more than a thou' oversize) and the coupling rod bushes were deliberately designed $\frac{1}{32}$ in thicker than the actual rod itself, as these also act as spacers to keep the rods slightly away from the wheels.

The bores of each bush were reamed to accept the crank and gudgeon pins, and this was my first experience of reaming through bronze. As per the reamed holes in the wheels, it is important to drill a pilot hole approximately 6 to 8 thou' less than the size of the reamer. Reaming holes should be done with the machine set at a very low speed, ideally less than 100rpm if possible and be sure to use plenty of cutting oil to help produce a good surface finish and to extend the life of the reamer!

Once complete, each bush was carefully pushed into the appropriate rod by means of the club's resident Jones & Shipman arbor press. Special washers and a pair of stainless steel nuts were turned to hold the connecting rods onto the crank pins. On the front axle the coupling rods are held on with two special countersunk washers and countersunk Allen head bolts as the heads need to be flush with the rod to prevent the crossheads from hitting them when the wheels are rotating. I was now in a position to fit the coupling rods and see if the wheels would turn over by hand, which I'm pleased to say they did (Photo 1).

Port and saddle block

I put the connecting rods to one side and made a start on machining the combined port and saddle block casting. Like most castings, not all faces are quite square with each other but I established which two were the best and used these to initially hold the casting in the Bridgeport mill vice. Using a fly cutter, I removed the rough cast finish from the four sides, together with the bottom face which would later have the ports machined into it. I used a fly cutter because it was able to cut the full width of the work in one pass, avoiding the marks left by a smaller end mill making several passes (Photo 2).

This casting also acts as a frame stretcher so the overall width was critical. Using the drawings as a guide and the assembled frames, I took the casting down to the correct external dimensions and checked that it was a good fit between the frames. Once this and all other faces were machined to size, I drilled the frame mounting holes into both sides by clamping the casting between the frames and using the spot drill, drill and tapping

"It is very important to ensure the bushes are accurate so the loco will turn over freely..".



method I have used previously.

All the holes were tapped 2BA, with special care being taken on the bottom two on each side which also hold the top of the cylinders on. I could now trial fit the port and saddle block in the frames, check that all the holes lined up and temporarily fit the four bolts on each side which hold it in the frames (Photo 3).

Having made sure everything was okay, I took the port and saddle block out of the locomotive in order to drill the steam ways which run through the casting. To begin, I drilled two $\frac{1}{4}$ in holes, $1\frac{5}{8}$ in deep into each side – these transfer the steam into and out of the cylinders. These have to line up with the holes already drilled in the frames and whilst I had the casting set up in the mill for this operation, I added a $\frac{3}{8}$ in diameter x 60 thou deep counter bore around these steam ways to take a 1.78mm (68 thou) section x $\frac{1}{4}$ in inside diameter silicone O-ring.

As an aside, it is always important to select the correct O-ring for the required application. Experience has taught me that silicone O-rings are best used in non-moving components where the temperature will not exceed 200 degrees centigrade. As will be described later, Viton O-rings are best suited to moving components such as pistons. Generally speaking I would avoid Nitrile O-rings which have a

tendency to harden and break up more readily than Viton when exposed to heat, oil and steam.

Steam ways

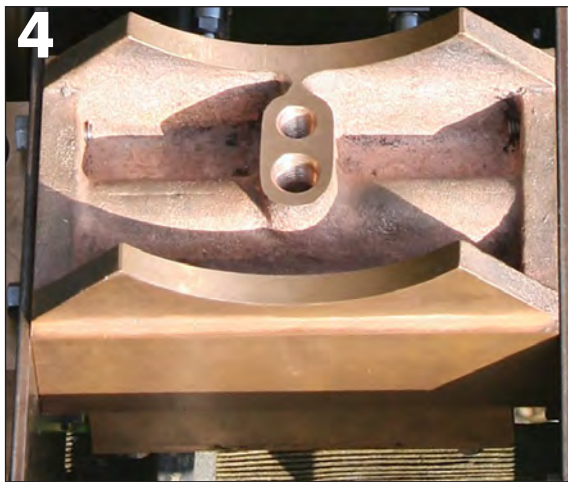
With the port and saddle block stood upright in the mill vice and following the completion of drilling the holes described above, I drilled out the main internal steam way which links the exhaust steam in the steam chest to the blast pipe. This hole is shown on the drawings as $\frac{5}{16}$ in however I increased this slightly to 8.4mm (0.332in) and it was drilled most of the way through the casting, but importantly not all the way through. As it is an internal steam way this hole needs a bung made to seal the end of it, this was threaded $\frac{3}{8}$ in x 32tpi (the reason for slightly increasing the hole). I made the bung out of brass hexagon and I machined the head off flush with the side of the port and saddle block once it had been fitted and sealed with Loctite 243.

Next, I drilled the blast pipe and main steam inlet holes into the casting, whilst holding it the correct way up in the mill. The hole for the blast pipe was drilled 8.4mm (less than on the drawings) and deep enough to break through into the internal steam way mentioned above. This was then threaded $\frac{3}{8}$ in x 32tpi to accept the blast pipe itself at a later date. The

PHOTO 2: Initial fly cutting of the port and saddle block casting.

PHOTO 3: Trial fitting of the port and saddle block, checking that all the holes line up correctly.





reason for reducing the diameter of this hole and of the thread was to ensure a suitably sized blast nozzle and blower ring could be accommodated.

The main steam inlet hole is located directly behind the blast pipe and runs the full depth of the casting, delivering steam straight from the regulator into the steam chest. This was drilled 7.1mm and threaded $\frac{5}{16}$ in x 32tpi accordingly.

I then turned my attention to the smokebox saddle, already roughly cast into the top of the port and saddle block casting. This required machining to the correct radius for the boiler to sit on and I duly set up the casting in the mill. I had to be very careful whilst setting this up as the fly cutter I would be using had to be exactly on the centre line. Too far over to one side and the boiler would sit off centre on the chassis.

With the centre line roughly calculated, I set the first cut by very gently scraping the fly cutter around the casting. I then took 5 thou cuts until the fly cutter was cutting a 2in radius. Before finishing the saddle I checked to make sure the radius was central by measuring the distance from the outside edge of the port and saddle block casting to the very top points of the saddle on each side using a pair of dial calipers (Photo 4).

PHOTO 4:

Cutting the radius on the saddle must be carried out very carefully.

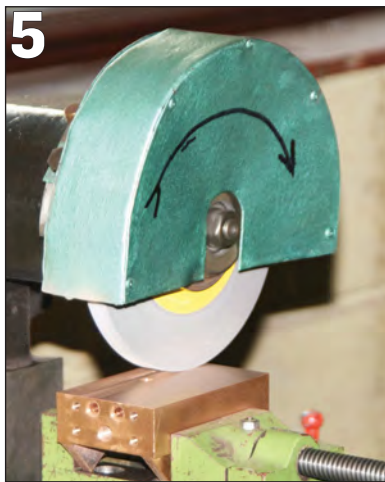
PHOTO 5:

Use of a surface grinder when cutting the ports resulted in a very smooth finish.

PHOTO 6: All the required holes drilled in the port block.

PHOTO 7:

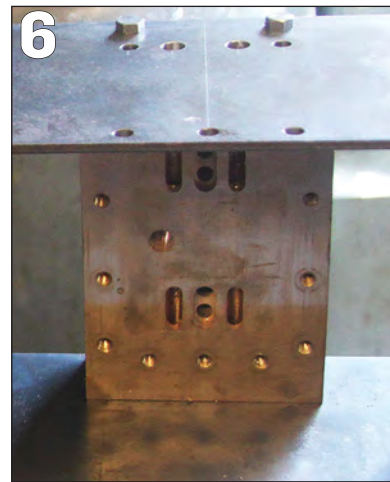
With the port and saddle block completed the boiler could be mounted on the chassis and Dougal really begin to look like a locomotive.



As an experiment before cutting the ports, I placed the casting in a vice on the bed of the club's surface grinder with the port face upwards. I then removed 2-3 thou (in two tenths of a thou increments) from the port face to see if I could obtain a smooth finish in order to give the two valves the best possible chance of sealing against it. In fact this left a very smooth finish and removed any burs or imperfections on that face which could score and potentially damage the valves. A fellow club member who once owned the surface grinder suggested this method and they also advised me which grinding wheel was the best to use for gunmetal. This process was therefore repeated upon completion of machining the ports (Photo 5).

Port machining

The next task to complete on the port and saddle block was one that I had been putting off – machining the ports. These are located on the underside of the casting, where the steam chest bolts on. The ports consist of two groups of three slots, four for admitting steam into the cylinders and two for allowing exhaust steam to escape up the chimney. I used a $\frac{3}{16}$ in slot drill to cut the four inlet ports and a $\frac{1}{4}$ in slot drill to cut the two exhaust ports. The



DRO on the Bridgeport milling machine was invaluable for this task because the position of the ports on the casting is absolutely critical.

Having calculated the dimensions I was working to, I gradually cut each port making sure that I did not over travel during each pass. It is very important not to get distracted during this task as it is very repetitive and you can easily wind the bed of the mill too far. It is also worth bearing in mind that a serious mistake at this point could potentially mean remaking the entire port and saddle block.

On the inlet steam ports, I continued machining down until the cutter broke through into the steam ways which I had drilled out earlier. When machining the exhaust ports however, I only machined down to a depth of $\frac{3}{16}$ in and then drilled two $\frac{1}{4}$ in holes next to each other in both ports as the steam way for the exhaust steam was further down within the casting (Photo 6).

Once all six ports were machined, holes had to be drilled around the outside edge of the port face in order to attach the steam chest casting to the port and saddle block. With the port and saddle block held upside down in the mill vice, I was able to accurately move between and drill each hole using the DRO.

After I had drilled a hole, I removed the drill from the drill chuck and put a 4mm tap in its place. Then, holding the handle of the quill feed in one hand and gradually pulling it downwards, I carefully held the chuck with the other hand and wound the tap into the holes three or four turns. This was to ensure that the threads in each hole started straight before I finished threading them by hand with the tap held in a tap wrench. There are 14 holes arranged in a rectangle and all were de-burred with a countersink before I finished off the port face by lightly surface grinding it again.

Since the smokebox saddle was now fitted in position and before moving onto machining the steam



chest and steam chest cover, I decided to make arrangements for mounting the boiler onto the frames. The drawings show angle brackets fitted on the firebox stays on the boiler which then rest on the top of the frames. I however chose not to fit them when building the boiler as I did not want to put any additional unnecessary stress on it. Instead I planned to fit a support directly underneath the rear section of foundation ring and I initially used the boiler as a guide to establish exactly where this would be located. I cut a piece of $\frac{1}{4}$ in steel square the same width as the inside of the frames and TIG welded it so that the bottom edge of the bar was level with the top of the cut out beneath the cab floor.

This bar had the unintentional bonus of acting as an additional frame stretcher and also doubled as a useful carrying handle when picking up and moving the increasingly heavy frames around! It also allowed me to rest the boiler on the frames for the first time and gave me a good impression of what the finished locomotive would look like (Photo 7). **EIM**



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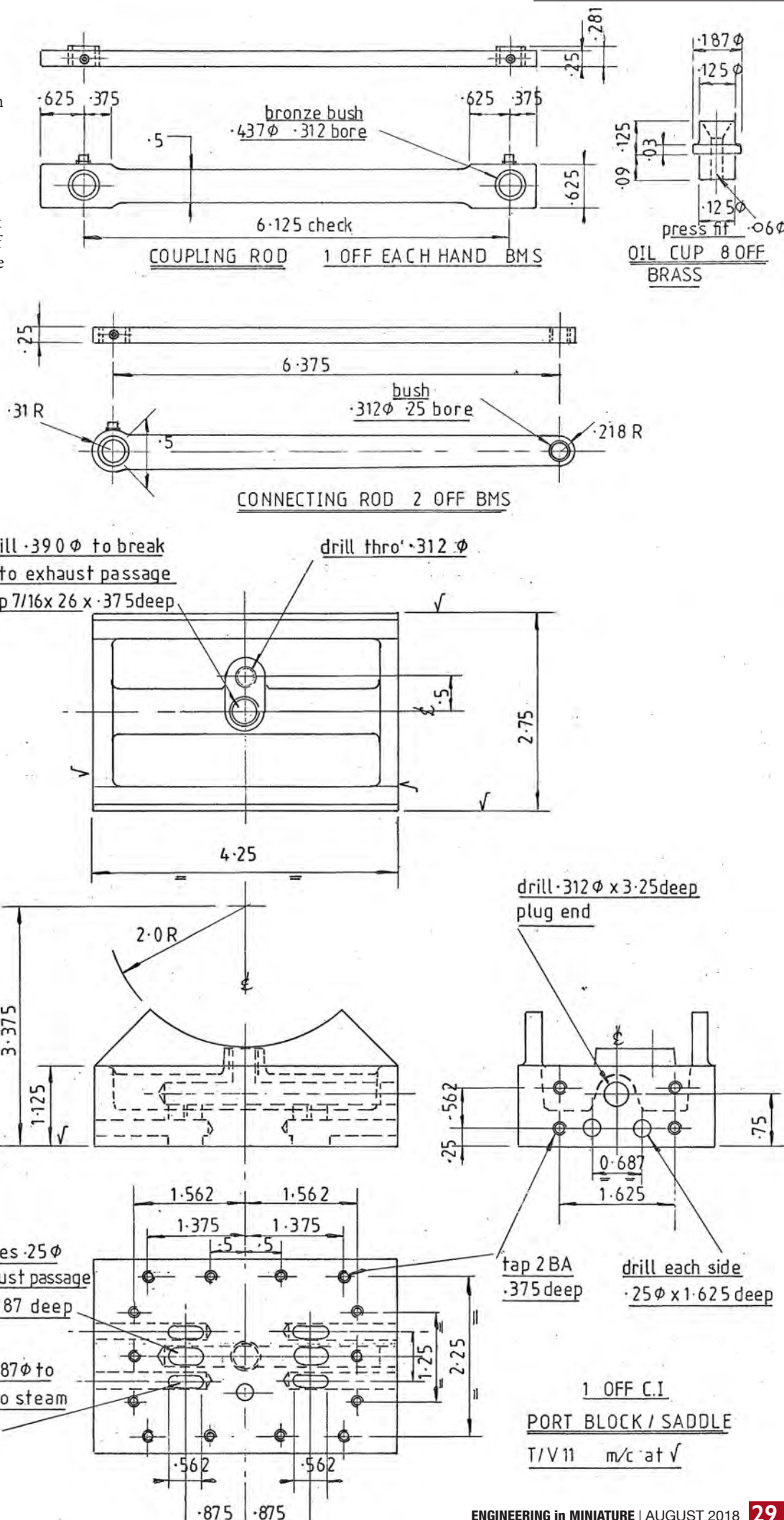
Previous Episodes...

Introducing Dougal April 2018
Building the boiler May 2018
Frames, xleboxes June 2018
Wheels, eccentrics July 2018

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Next Month...

"The gunmetal was in the form of a wash out plug from a full-size BR standard loco..." Andrew makes up the steam chest and its valves.



Walschaerts motion – but it's very easy...

Bernard continues his in-depth study into a propulsion system core to many locomotives by looking at the importance of lap in the valves...

BY BERNARD FARGETTE – Part Two of a series

We begin this month by looking at the advantages of steam expansion. With the plain slide valve seen so far, steam is admitted during all of the piston stroke, resulting in a significant consumption of steam.

To save steam, it is enough to admit the steam to the cylinder only during the first part of the piston stroke, so that it can expand afterwards.

In **Figure 9**, the theoretical pressure/volume diagram (indicator diagram) makes it possible to quantify this saving.

Physics tells us that the work done by a gas during displacement (dl) of a piston (S) is equal to $\text{Pressure} \times S \times dl$; thus, for a revolution of the wheel, without expansion, the work done by the steam on one side of the piston can be represented by the area of the rectangle **abcd**. On the other hand, with a cut-off at point **e**, the work provided will be represented by the area **aefcda**, with steam consumption reduced in the proportion ae/ab . The hatched surface **efcge** will therefore be

FIGURE 9:

Pressure/volume diagram (indicator diagram). Work provided by steam on one side of the piston. The shaded surface represents the work gained during the expansion of the steam after cut-off. The curve between **e** and **f** is not exactly a hyperbole (in the case of a gas following Boyle's law; $P.V=k$) as the expansion occurs without heat transfer (adiabatic).

FIGURE 10:

Slide valve with a lap (in mid position).

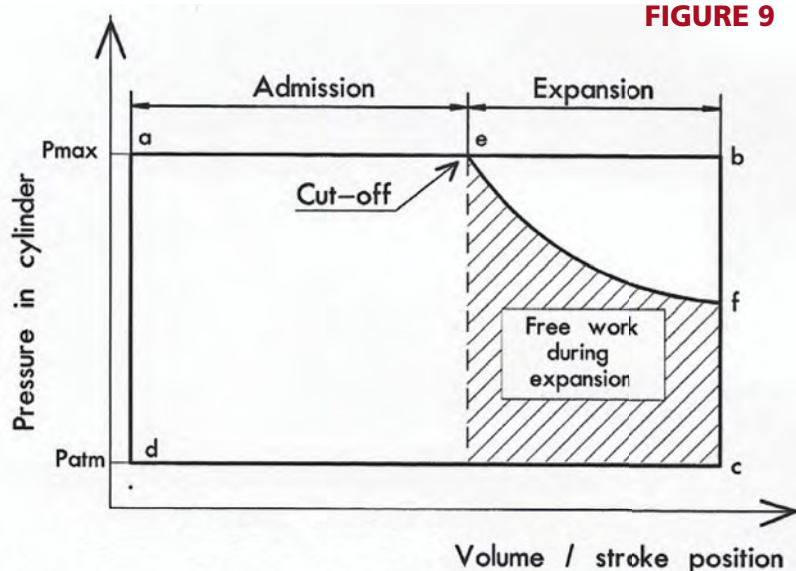


FIGURE 9

a 'free' work provided during the expansion of the steam.

A valve with lap

To reduce the time during which the steam is admitted, the slide valve is extended on each side by the same distance, called the lap (**Figure 10**).

It is now necessary to open the port when the piston is at the beginning of its travel and to close it after a certain percentage of this travel (the 'cut-off').

For this operation, it is necessary that from its mid-point, the valve has

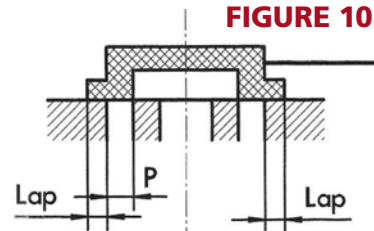
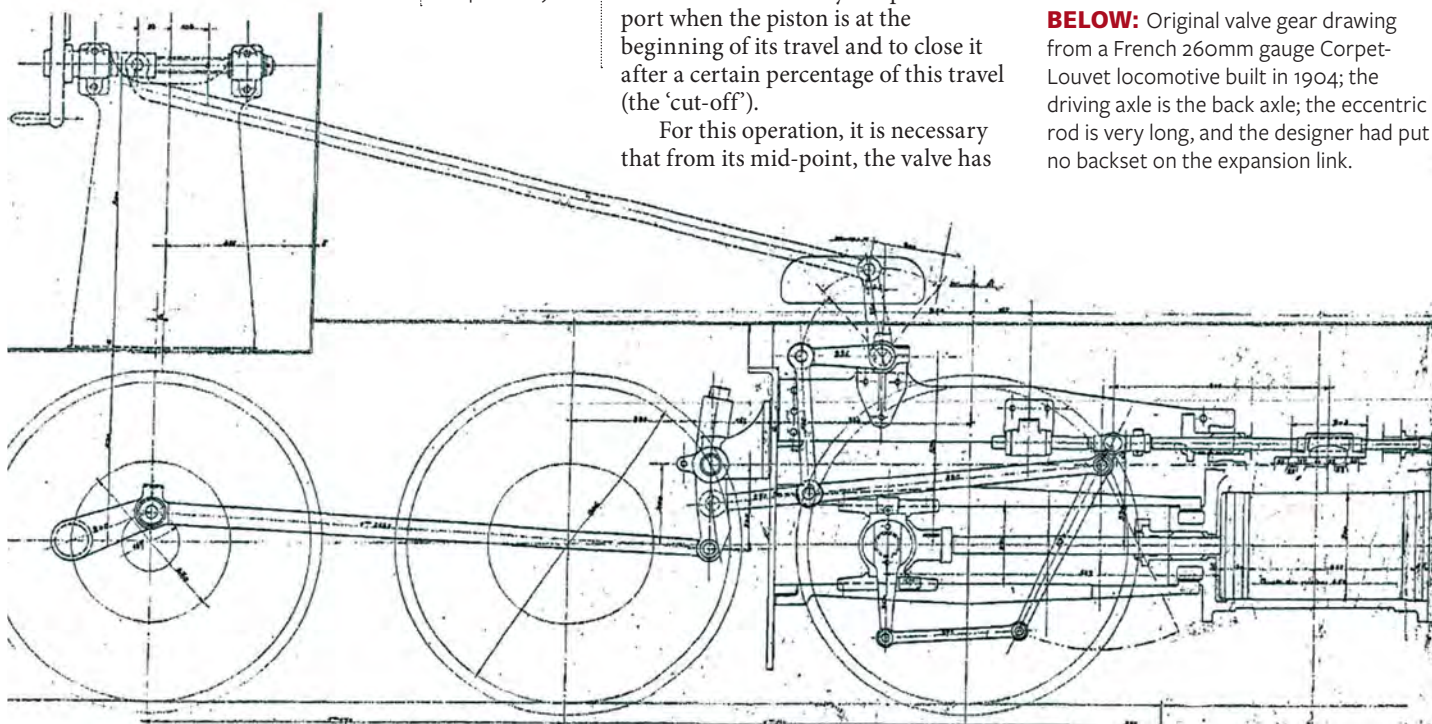


FIGURE 10

BELOW: Original valve gear drawing from a French 260mm gauge Corpet-Louvet locomotive built in 1904; the driving axle is the back axle; the eccentric rod is very long, and the designer had put no backset on the expansion link.



already travelled a distance equal to the size of the lap, to open the port just when the piston begins its stroke.

This can be done in two ways;

1) By using the eccentric and eccentric rod of Figure 3, but setting the eccentric pin at a little more than 90 degrees with an angle δ called the angle of advance, as shown in **Figure 11**. This method is applied to all valves gears with two eccentrics (Stephenson and others), allowing to obtain both a variable expansion and reverse motion.

2) From our simplified Walschaerts valve gear of Figure 6 (see part 1), if we use the angle δ as above, everything works well in full forward, but this modification prevents any proper operation if you want to bring the die block nearer to the mid position ('linking up'), and it is worse if you want to go in reverse. We must find something else.

The idea Egide Walschaerts had was to add to the motion coming from the expansion link (therefore shifted by 90 degrees) a component derived from the crosshead, and thus in phase (or in opposition of phase) with the movement of the piston.

The role of the combination lever (also called the oscillating lever, which has an oscillation movement when in operation) is to combine these two motions. **Figure 12** shows the proportions of this combination lever so that the port begins to open just when the piston is at its back dead centre, about to start its travel in the cylinder.

It is easy to show that the two arms of this lever must be in the ratio between the lap and half piston stroke, hence the formula:

$$\frac{BT}{BP} = \frac{2 \times \text{lap}}{\text{piston stroke}}$$

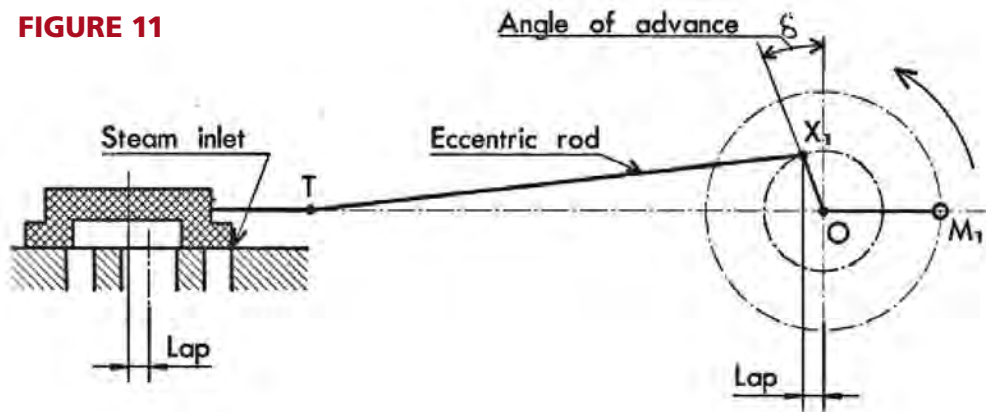
This generally leads to a relatively low **BT** distance at top joint, therefore the two pins **B** and **T** are close to each other, which can sometimes pose problems of technical realization.

Valve events

Regarding a diagram of the Walschaerts' valve gear with lap, in the elliptical diagram (**Figure 13**), we must add to the displacement **D1** coming from the expansion link, an additional displacement **D2** proportional to the stroke of the piston from its midpoint, i.e. the height of the point taken on the segment to the horizontal axis of abscissae: the initial ellipse is slightly deformed and it is clear that the admission is cut off after a certain proportion of the piston stroke, then giving way to expansion of steam.

The different phases for the forward and backward strokes of the piston can be easily followed by

FIGURE 11



referring to the diagram at Figure 13;

For forward piston stroke:

bc: admission of steam (inlet)

cd: expansion of the steam

de: anticipated exhaust (early release)

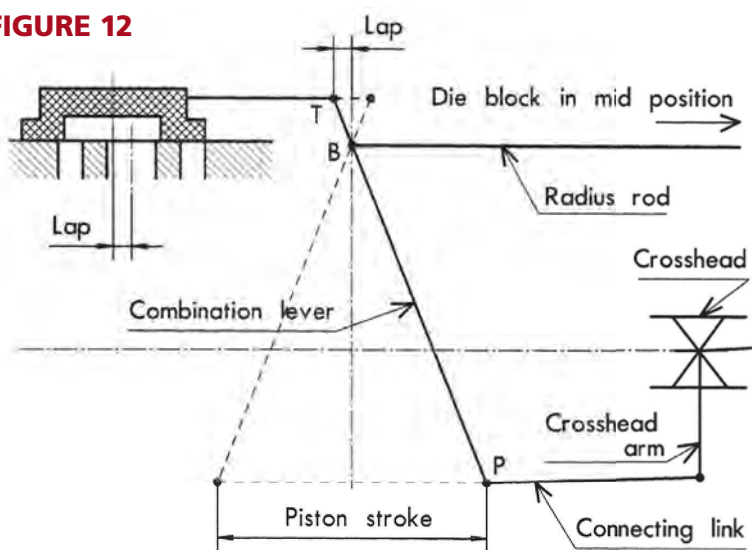
For return piston stroke:

ef: exhaust

fb: compression of remaining steam

Thus, two phases – early release of the exhaust and compression of the

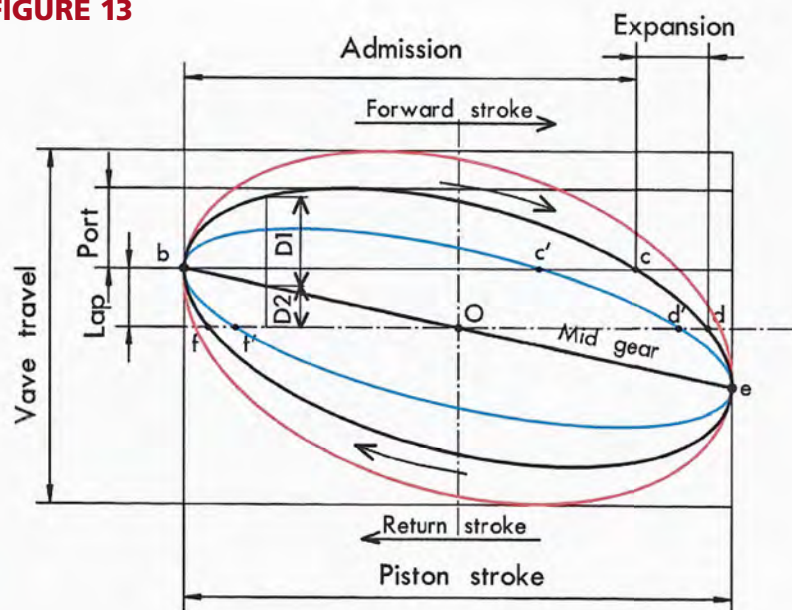
FIGURE 12

**FIGURE 11:**

Control of a valve with lap at the inlet.

The angle of advance δ allows the steam to be admitted at the start of the piston travel (crank pin in M1, rear dead centre). Due to the angularity of the eccentric rod, the opening of the ports will be different on each side of the valve.

FIGURE 13

**FIGURE 12:**

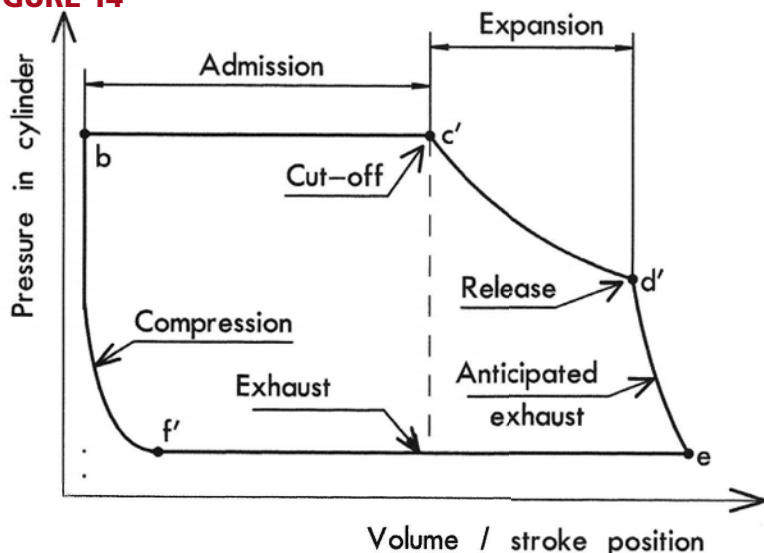
Combination lever for a slide valve. Sketch to determine the dimensions of the combination lever with the die block or expansion link in mid gear.

FIGURE 13:

An elliptical diagram of the Walschaerts valve gear with lap.

- Half valve travel = Port + Lap
- Half valve travel > Port + Lap
- Half valve travel < Port + Lap

FIGURE 14



remaining steam – were involuntarily added in the cycle.

Due to the points **b** and **e** of the ellipse remaining fixed (because they only depend on the dimensions of the combination lever), one can, by decreasing the amplitude of the motion given by the expansion link, reduce the admission **bc'**, and thus reduce the steam consumption by increasing the period of expansion **c'd'** (linking up).

These points **b**, **c'**, **d'**, **e** and **f'** can be reported on a pressure/volume diagram – see **Figure 14** – more realistically than the simple diagram of **Figure 9**.

It is noted that as a result of the early exhaust and compression phases, the theoretical work provided by the steam is slightly reduced, but without great consequences in practice, some even finding advantages in the 'fluidity' of the movements of the steam and cushioning the piston at the end of the stroke in the compression phase.

If, however, one wants to increase

the expansion period, one cannot prevent the compression period also increasing, and this in an undesirable manner. Engineers have therefore sought to be able to choose these periods independently of each other; it is the object of improvements to the conventional slide valve, such as the 'Meyer expansion valve' with two valves, or even the abandonment of the slide valve for poppet valves, tapped valves, or cams.

Lead and exhaust lap

A word about the lead; for high-speed engines, it is required that the port is already slightly open at the beginning of the stroke of the piston, so that the steam has time to fill the dead spaces of the cylinder before acting upon the piston, this is called anticipated admission. In the Walschaerts valve gear, it suffices that the half amplitude of the motion in phase with the piston is slightly greater than the lap, so that at the beginning of the stroke of the piston, the port is open by this difference, called the lead,

FIGURE 15

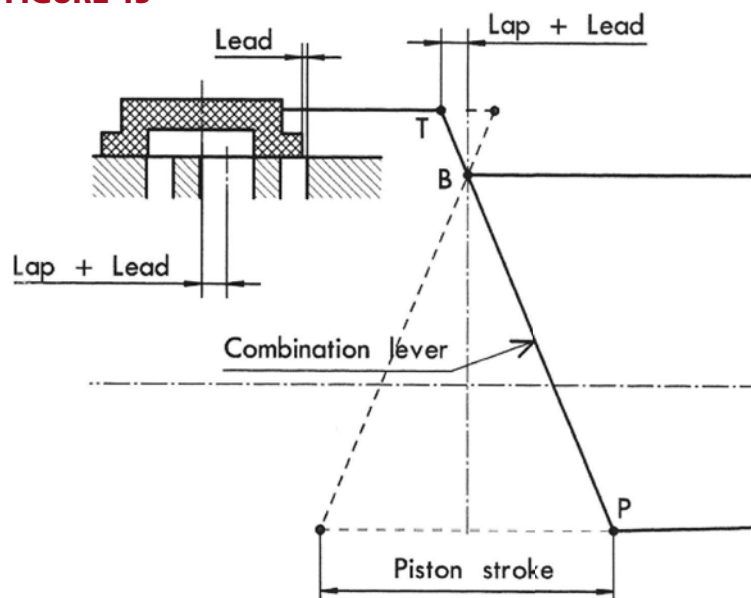
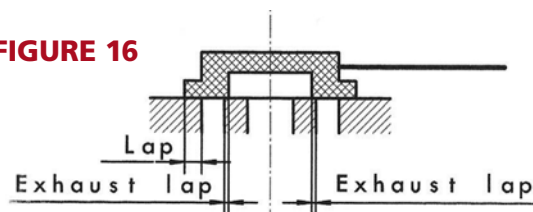


FIGURE 16



which therefore represents a further advance of the position of the valve, see **Figure 15**.

Relative to its mid position, the valve will therefore have moved by a value **lap + lead**.

The correct formula for calculating the dimensions of the combination lever, with lap and lead, then becomes:

$$\frac{BT}{BP} = \frac{2(\text{lap} + \text{lead})}{C}$$

In the Walschaerts valve gear, the lead is therefore fixed by the construction and does not depend on the position of the die block in the expansion link (linking up), so it is a fixed lead valve gear.

Generally, one takes for the lead a value approximately equal to one tenth of the lap. For engines with cylinder diameters of less than 40mm, the lead is generally neglected.

However, if one wants to add, in this case, a small lead, one way to do so is to calculate the valve gear without lead, and at the last moment machine the two ends of the valve of the lead value; thus, at the forward dead centre or back dead centre, one of the admission ports will be open by this lead (the cut-off will have been modified slightly, because effective lap will be decreased by the lead).

Moreover, some advocate adding a small lap on the edges of the exhaust, as on the valve of **Figure 16**. It is therefore an exhaust lap in addition to the steam lap (for inlet) seen until then.

■ The first feature in this series appeared in the June 2018 edition of **EIM**. Digital copies of previous issues can be downloaded or printed versions ordered from www.world-of-railways.co.uk/engineering-in-miniature/store/back-issues/ or by telephoning 01778 392484. Bernard will continue his study in a forthcoming issue. **EIM** technical editor Harry Billmore contributed to the English translation of this feature.

FIGURE 14:

Pressure/volume diagram for cycle **b**, **c'**, **d'**, **e**, **f'**, **b** (see **Figure 13**).

FIGURE 15:

Slide valve with lap and lead.

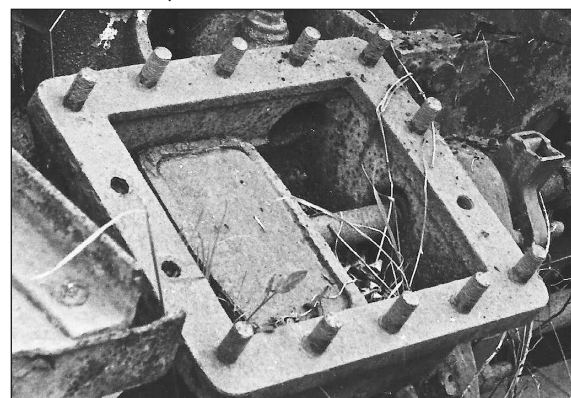
FIGURE 16:

A slide valve with lap ('steam lap') and with exhaust lap.

BELOW:

Photographed in a scrap yard, the steamchest cover of this metric 0-6-0 locomotive has been removed to reveal the valve and its chest.

All diagrams and photos in this feature by Bernard Fargette.



25th National Model Engineering Exhibition

John concludes his coverage of the national show held at Doncaster Racecourse on 11th-13th May, focusing on the club stands.

BY JOHN ARROWSMITH – Part Two of Two

There was such a variety of models on show that it is difficult to know what to leave out so I hope I can give a flavour of the overall exhibition. Like all good shows the model engineering clubs who take part provide the real substance and variety and again this year was no exception, there were some splendid examples of first-class model making on show.

As visitors walked through the door they were met by a large display by the 5in Ground Level Main Line Association (GL5), showing off some excellent rolling stock and locomotives. Dave Alexander's Bullied Q1 and its rake of wagons provided a great introduction to the show.

A highlight across the hall was the superb A4 locomotive on the 7¼in Gauge Society display. Currently under construction, this will be a tremendous model when completed.

A line of stands well-filled by the Southport MEC, Chesterfield & District MES and the Scunthorpe SME attracted a great deal of attention because of the quantity and quality of the models on display. I wish that I could show them all but space does not allow, so I hope the selection on these pages gives you an idea of what was on show.

The area which included the clubs mentioned above also housed the fine Gauge 1 layout staffed by members of G1MRA. They ran the railway with a wide variety of model locomotives, the majority of which were steam powered. A varied set of rolling stock



PHOTO 1:

Dave Alexander's excellent Bullied Q1 0-6-0.

PHOTO 2: A4 project on the 7¼" Gauge Society display.

PHOTO 3: The comprehensive display by the Southport MEC

PHOTO 4:

This superb 5in gauge LNER P2 2-8-2 was part of the Chesterfield & District MES display.

gave visitors a taste of the railways of yesterday which was all very nostalgic.

Having visited all these displays I moved onto the Bradford MES stand, which provided a very comprehensive selection of models ranging from locomotives, clocks, stationary

engines tools and workshop equipment right down to a working model of a set of canal lock gates in approximately OO railway scale, complete with a continuous flow of water. This little display created a great deal of interest.





PHOTO 5: Part of the well filled Bradford MES display.

PHOTO 6: Impressive detail on Geoff Dumbleton's 7¼in gauge Britannia tender - we love the padlock...

PHOTO 7: A very smart 7¼in gauge riding car on the York City display

PHOTO 8: This working example of Newcombe's Atmospheric Engine was built by Richard Gibbon

PHOTO 9: Part of the parade of the Doncaster Steamers.



Over on the Grimsby & Cleethorpes MES stand the 7¼in gauge Britannia tender under construction by G. Dumbleton was showing some excellent workmanship and progress from last year. Meanwhile Greg Marsden from the club was busy all weekend demonstrating his fine Stockport Tram layout.

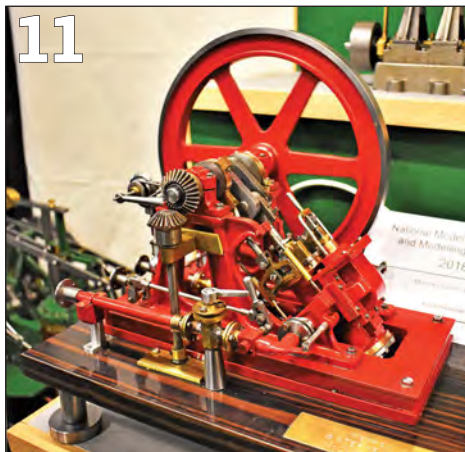
On the York City & District SME stand a 1/5th scale working model in steam of a Newcomen atmospheric engine built by Richard Gibbon was a real crowd puller when in action. I also liked the 7¼in gauge riding car in the shape of a BR container vehicle built by D. Foster.

Outside, the Doncaster Steamers provided plenty of action for visitors. With a large hard area on which to drive they put their engines through their paces. There was a wide range of sizes in action from the diminutive 2in scale Clayton steam wagon of Dan Newton to the 6in scale Foden steam wagon of Charlie Foster. All looked good in the fine weather and made a grand sight when they were lined up for photographs.

Back in the hall the Pickering Experimental Engineering & Model Society provided another large display of members' work including the superb 1/3rd scale Blower Bentley by Mike Sayers. This was surrounded by such a vast array of models I could write a report about this stand alone. I will add a photo of Brian Stephenson's fine example of a McOnie diagonal engine as an example.

The Sweet Pea Locomotive Group had a fine display of this popular locomotive in all the gauges including one I have not seen before. This was a 45mm gauge example which was under construction, but I would expect this new addition to the fleet to be a very popular model.

Next to this group the Tyneside SMEE displayed a good selection of models including a magnificent 5in gauge GWR King class 4-6-0 by Brian Nicholson. The adjacent Leeds SMEE provided a selection of 14 different



locos as part of their display including a 7¼in gauge LMS Black 5 which displayed excellent workmanship.

Elsewhere there were a number of demonstrations of model making and equipment maintenance. Derek Brown was busy on the SMEE stand using a Quorn cutter grinder to demonstrate the fine art of four-facet drill sharpening.

The OO Live Steam Club had a repair desk on which members were showing how these small steam models could be serviced.

Yet more was to be found on the upper floor where the Gas Turbine Builders Association had both a fine display of their work and a demonstration of how these high-precision machines operate. Also here the Stirling Engine Society provided a good display of these varied and increasingly popular machines.

The very fine models on the Guild of Model Wheelwrights stand showed off some of the wonderful methods of transport in years gone by. In comparison the Northumberland RCVC included many modern versions of large-scale trucks commonly seen on today's roads.

A completely different modelling group are the model flying clubs and the Doncaster MFC provided a great

range of both old and modern prototypes while outside helicopter models and smaller fixed-wing aircraft were put through their paces to entertain aficionados.

As usual there was good support from the model boat clubs who displayed a colourful selection of both complicated and simpler marine craft. The Kirklees MBC for example included both civilian craft alongside military craft which was a good mix. The boating pool also gave visitors an opportunity to see how some of these craft performed on the water.

I will conclude my notes by thanking everyone concerned with the organisation and presentations. I am sorry if I have not given you a mention but as always space is at a premium. However, all your efforts were very much appreciated by both the visitors and organisers.

There is one final photo to show, concerning the 25th anniversary of the exhibition. Organisers Lou and Gavin Rex arranged for a celebratory cake to be cut during the show and a happy group was involved in that little ceremony. We hope to see everyone again next year. **EIM**

■ Part 1 of this report appeared in last month's issue.

PHOTO 10: Another superb model under construction by Mike Sayers was this 1/3rd scale Blower Bentley engine.

PHOTO 11: An unusual McOnie Diagonal Engine built by Brian Stephenson.

PHOTO 12: Derek Brown hard at work demonstrating the art of 4 Facet drill sharpening.

PHOTO 13: High precision examples on the Gas Turbine Builders Association stand.

PHOTO 14: A wide range of beautifully made scale wagons on the Guild of Model Wheelwrights display.

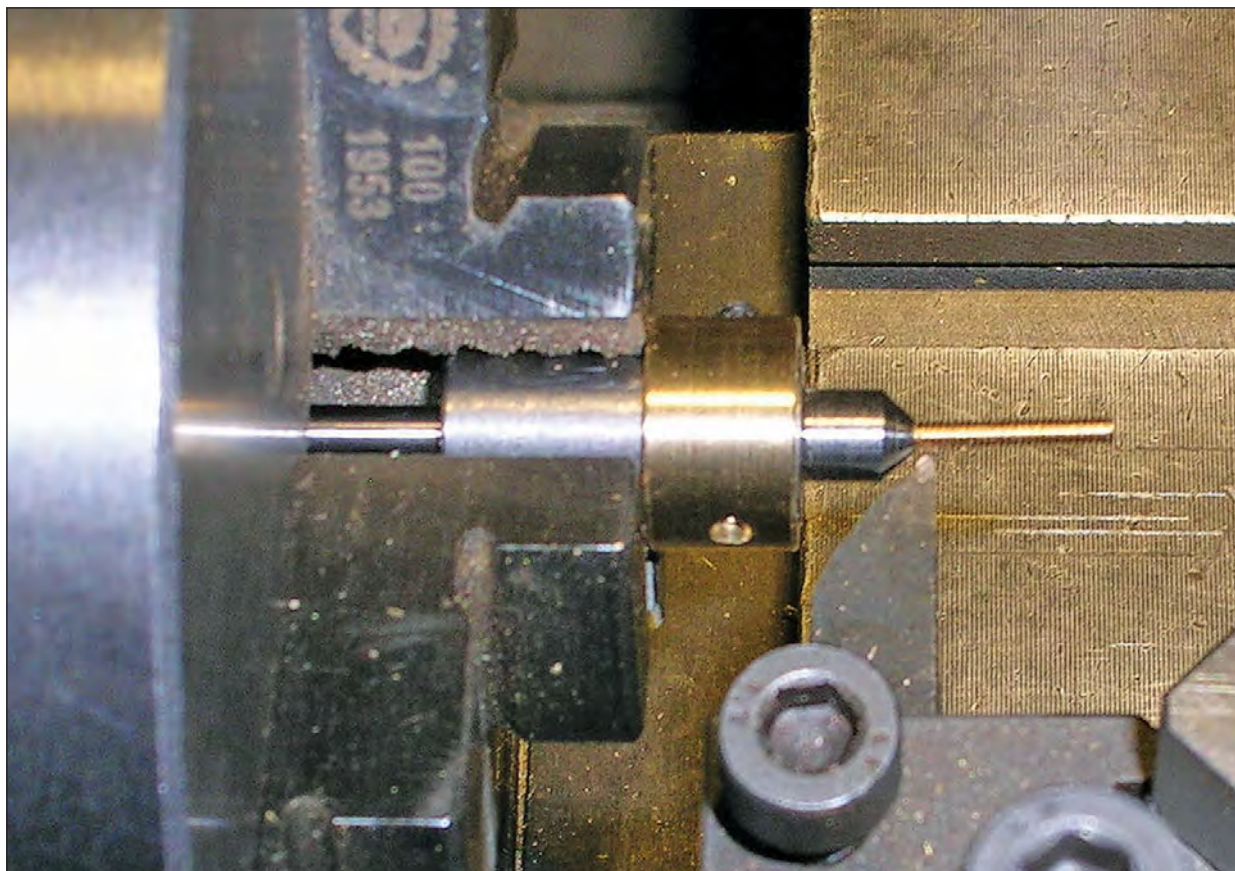
PHOTO 15: Cutting the 25th Anniversary cake are Gavin Rex, Lou Rex, Julia Towle, Mike Chrisp and Rob Senior. Julia and Rob were representing the Racecourse management.



Shortening small screws

Experimentation produces an effective method to solve Alan's problem.

BY ALAN REID



LEFT: Alan's tool for screw-shortening in use in the lathe.

PHOTO 1: First attempt employing a screwdriver with a collar to hold the screw in place.

PHOTO 2: Mk2 version which allows mounting in the lathe.

PHOTO 3: Modification which proves very useful when shortening several screws at a time.

PHOTO 4: The basic components of the screw-shortening tool.

PHOTO 5: Finished results, quality screws each time, just a little shorter.

From time to time, whilst model engineering, I have needed to shorten one or more screws because I did not have the required length of screw available. Turning the screw in the lathe chuck is my preferred way as it is easy to put a chamfer on the end of the screw thus making it easy to engage the nut or tapped hole.

Other methods I have used to shorten a screw normally involve using a hacksaw followed by a file to clean up the sawn end. In this case I always run a steel nut up to the screw

head before cutting so that after I have tidied the new screw end the nut can be removed. This cleans up the thread end which is often damaged by the hacksaw and file.

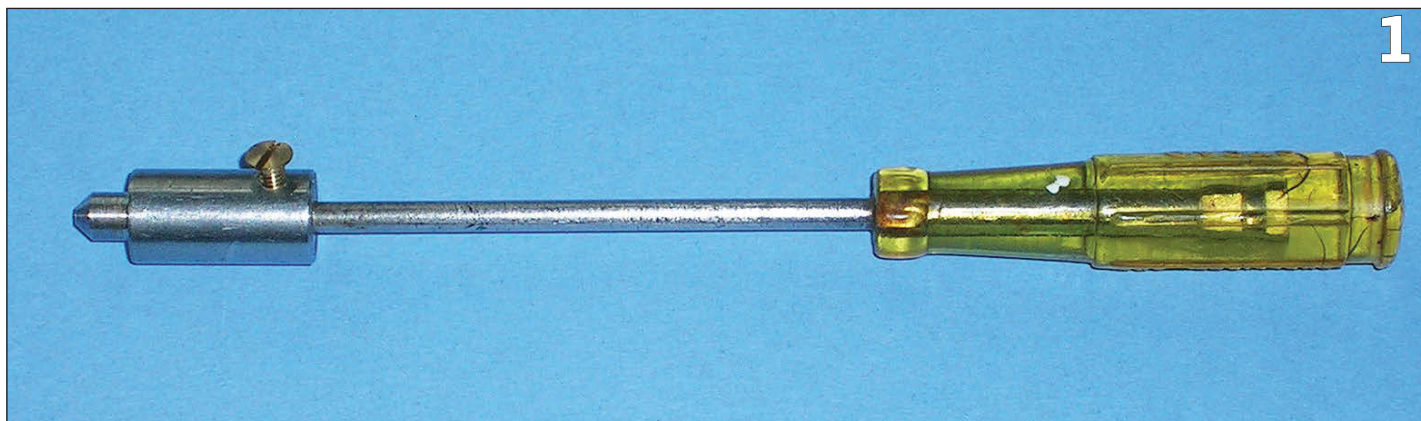
Recently I found that none of my usual ways were convenient because I needed to shorten 10BA countersunk brass screws to an overall length of about $\frac{1}{8}$ inch. These screws were needed to connect the flat top to the body of the injectors that a colleague and I make (featured in the April 2017 issue of **EIM**).

I found I could shorten these

screws to the required length and clean the ends square but they proved difficult to start in the threaded injector body because they had no chamfer on the end. None of my usual methods could be used to make the chamfer because of the small size of the screw. I therefore needed some means of holding the screw in order to chamfer the end.

Version 1

Using material from my scrap box, namely a short length of $\frac{3}{8}$ in diameter mild steel bar held in the



lathe, I drilled a $\frac{1}{8}$ in dia. central hole from one end to nearly the other end. Reversing the bar in the lathe I drilled and tapped 10BA through into the first drilling.

I could now insert a 10BA countersunk brass screw into the body, as far as it would go, so that it projected out of the tapped end. A 6BA screw was inserted into the side of the body so that a screwdriver, still engaged with the screw head, could be locked in position. This is necessary as the next stage is to cut the projecting part of the screw which would unscrew in the body when the cut is applied if the screwdriver is not holding it.

The length of the screw could then be measured after removal. After some trial and error the body was cut back to enable the overall length of screw to be finished to the desired length. The final stage of the body preparation was to chamfer the end, using the same tool which would be used to cut and shape the thread ends, thereby providing access to the screw.

This enabled screws to be cut and shaped but was somewhat rough and ready; but it did show that the method was sound. **Photo 1** shows this first trial.

Making improvements

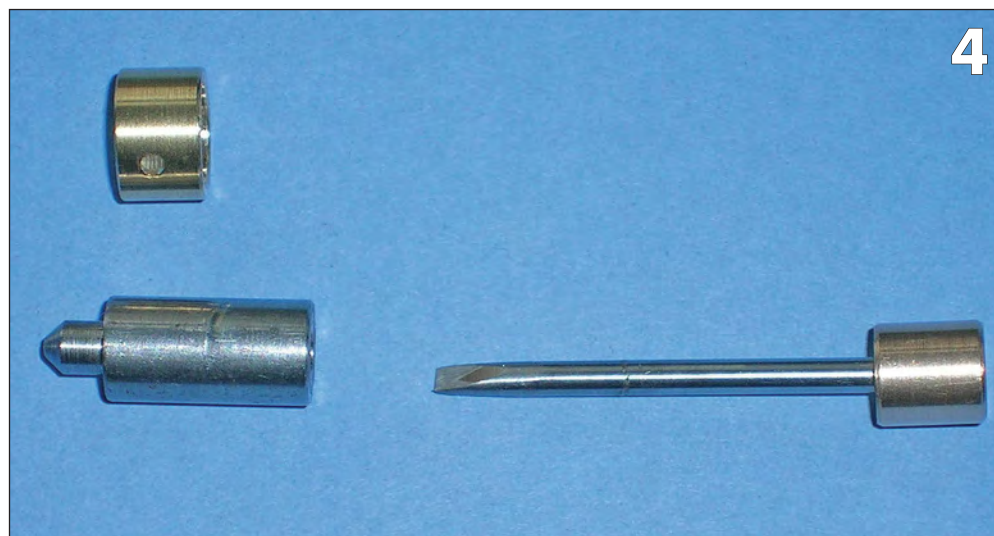
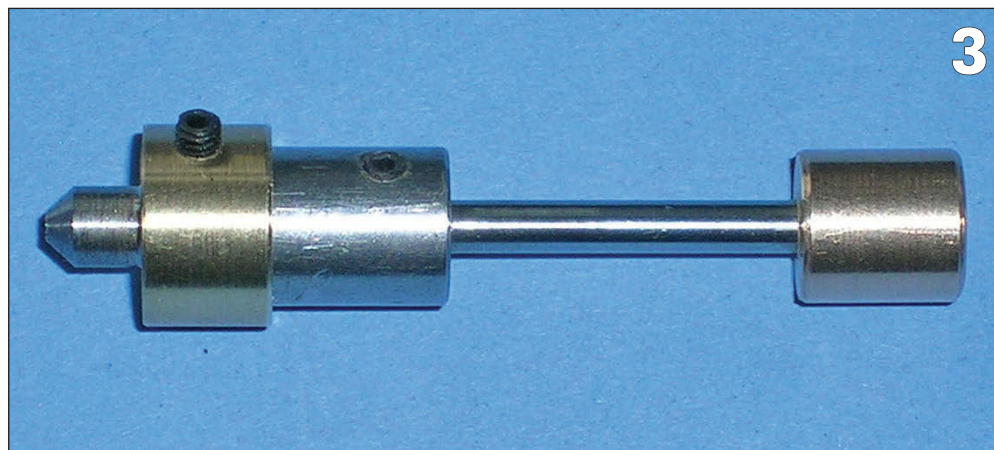
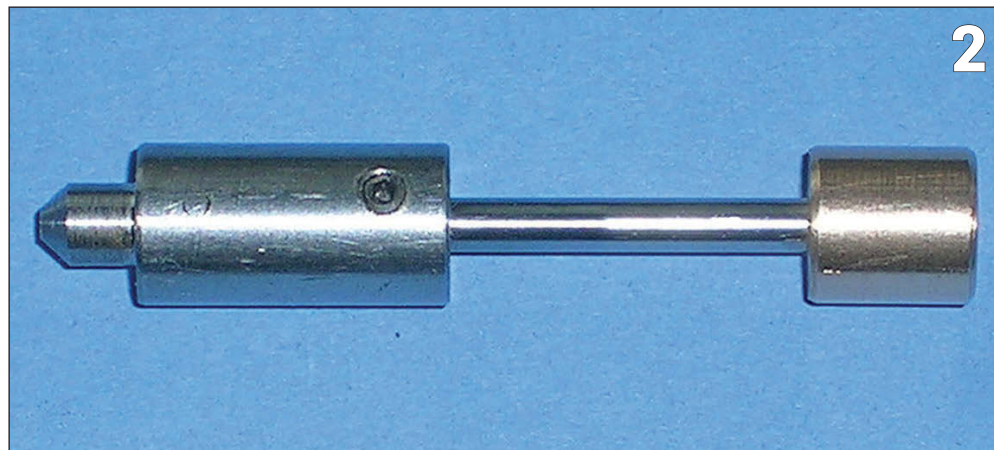
The next stage was to replace the screwdriver with a simple one made from $\frac{1}{8}$ in dia. silver steel sharpened at one end with the other end press-fitted into a short length of $\frac{3}{8}$ in dia. brass rod. The clamping screw was replaced with a 6BA grub screw. This second version is shown in **Photo 2**.

I used this for a while until I realised a location ring fitted to the main body would allow the device to be replaced in the lathe chuck in the same place as last time. This enables the lathe saddle and top slide to be set once thereby enabling repetition of screw shortening without problem; only the cross slide moves when shortening a batch of screws. **Photo 3** shows this final version.

In operation I normally advance the cross slide to cut the protruding screw halfway through then snip off the unwanted thread. A touch with a smooth file cleans up the snipped end then the screw can be removed. Any remaining burring of the thread is cleaned up as the screw is removed from the body.

Photo 4 shows the main components of the device with the results shown in **Photo 5**. The heading photo shows the device in use in the lathe.

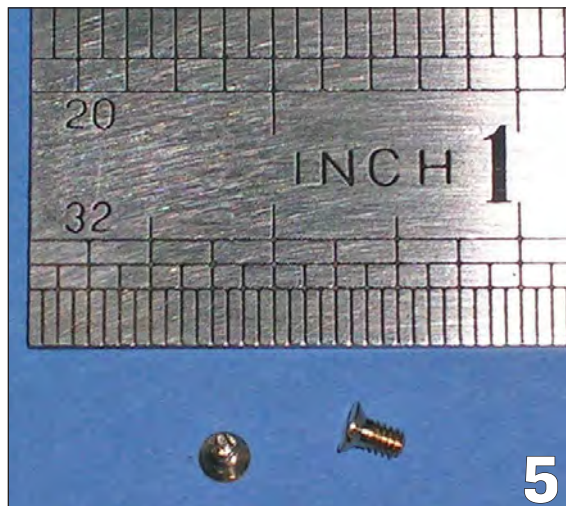
In conclusion, this simple device has done exactly what I want, in other words to produce tiny screws



which can be started with very little effort into their tapped holes.

Are there further modifications to be made? Well if I were to remake this device I would machine the body from larger diameter material and incorporate the location ring as an integral part of the body. **EIM**

■ Editor's note. Short features such as this, showing how problems arose in the workshop and were solved often through ingenious methods, are core to **EIM** and we want to see more of them! If you've come up with a neat solution to a model engineering issue, why not share it with your fellow readers in these pages?



Drawing skills, alive and kicking...

Drawing skills

In reply to Mr Hollander and editor Andrew Charman's comments in the June 18 **EIM** regarding the existence of drawing skills. Here's my two pennies worth, (both pre and post-decimalisation I should add).

I was taught from the mid-1960s in a UK state secondary school, Engineering Drawing using traditional equipment, and gained a GCE for my efforts practising the drawing of crane hooks and steam engine big-end bearing assemblies along with developments and loci.

My drawing skills were further enhanced through my apprenticeship as an Engine Fitter/Machinist practising on various parts and assemblies of steam/electric water pumps along with the pulley assemblies on crane hooks (!) and parts related to large engines, both reciprocating steam and internal combustion, as this was a component of the City and Guilds qualification.

Throughout my working life both in the UK, Spain and Australia those drawing skills I learnt have proved essential. In the late 1980s when in Australia, which seemed to have embraced the personal computer far more readily than here in the UK, I felt to remain employable I should have to 'Have a Go' at learning CAD, and accepted an offer on a PC package combined with a CAD program called Drafix which I found frustrating to use to say the least. It was like learning another language – doing basic things that ordinarily took seconds, involved what seem to be several different commands and a lot more time.

However I did manage to produce basic drawings and on my return to the UK was able to influence the school I was employed at to use the industry-standard PC computer format rather than the accepted more limited and more expensive BBC system – which initially enabled us to use a later version of Drafix.

Sometime later, back in industry, I tried Turbo CAD but it didn't 'click'. Then I was given the opportunity to use V14 AutoCAD which resulted on being sent on a 2D City and Guilds course. A year of night school, spent with a fantastic tutor, got me to a point where switching on a computer was the first action of choice when wanting to draw anything that had to be printed.

Around 2005, having been interested in converting a mill to CNC and realising I needed STL files created by 3D CAD, I attended another year's course and despite completing the syllabus couldn't produce drawings



LEFT: The discussions over what the man who designed this locomotive called himself continues apace in our columns!

worth a light, (the year might have had a better outcome with the original tutor) so I reluctantly had to accept I'd reached my limit of comprehension and to use the CNC by writing the code for the work as I needed.

My son who studied Product Design at secondary school used an educational version of Solid Works and could 'fly' the program. But I confess he confused the hell out of me when drawing out an item by starting with a circle, then extruding it to produce a hole, followed by giving the outside thickness to make a cylinder! When he studied the subject 3D printing wasn't really in existence for which this kind of mind set would have made sense. With my background – I logically think of drilling a hole in a piece of metal – it made for some interesting exchanges of views!

Times have changed, some things have improved. I have a few moments ago just made two replacement idler pulleys on a conventional imperial machine, from my sketch drawn using metric dimensions. I used a calculator to do the conversions when required and measured with the digital calipers, both these items I'm at ease with and can use productively – but I never forget that the sketch was produced using the skills learnt over 50 years ago. The same skills but transferred into the media of CAD are how I offer my ideas to those with similar interests – so they are definitely not gone.

The hobby magazines that I have experience of in the UK, USA and Australia will accept drawings in any format, from sketches to 3D screenshots provided the information is able to be understood for the item to be made – never forget that drawing is still an international/universal language, and just like English, it's spoken with many versions of accent, some are music – others a discord!

Personally the only thing I lament is the infrequent use of sectioned drawings of assembly views. In my view they contain the most relevant information in the smallest area, and enable a clear understanding of how a thing is put/held together – meaning that you can fathom out how to take it

apart with the minimum of damage! To me, coloured 3-D prints or exploded views do not come close.

Martin Gearing

Designer names

I am known as a stickler for detail, particularly with regard to steam locomotives, a real rivet counter but with the best of intentions in making sure that history is passed on accurately to those of us who were not fortunate enough to have lived in the days of steam.

Now we are going beyond the realm of engineering as Mr Simmonds' letter (**EIM** July 2018) would have us believe that the surname of the CME of the LNWR in the years 1909-20 was 'Bowen-Cooke' – it is often written this way and even the great O S Nock uses this in some early books but then settles for a mixture of just Cooke and Bowen Cooke (without hyphen).

The paperwork of the railway usually shows Mr. B C without a hyphen as does his own book of 1894. Communications of congratulations from fellow managers on his appointment to the senior position used the form "Dear Cooke". By the 1890s he occupied the fairly important position of Running Superintendent of the Southern Division and I believe that he began to use his last Christian name as if it were part of a double-barrelled surname. There is no doubt at all that he was born C J B Cooke, son of Charles John Rashleigh Cooke, Rector of the Parish of Orton Longueville from 1857.

Now, back to engineering matters, as much as I admire the Claughtons there is no doubt that they suffered from many problems, many of them from details and design features that had been Crewe standards for years, adequate in their day but well past their sell-by date in 1913. Cooke, a 'running man', was content to outline what he wanted and let the drawing office continue undisturbed, by then Churchward had pushed and pulled the design team at Swindon into the new century.

Mike Wheelwright

Opinions or information to share? A point to make? **Engineering in Miniature** welcomes letters on all model engineering subjects. Send your letters to the editor at the address on page 3.

Not that Leeds firm...

Locomotive Builders of Leeds, E.B. Wilson & Manning Wardle

by Mark Smithers

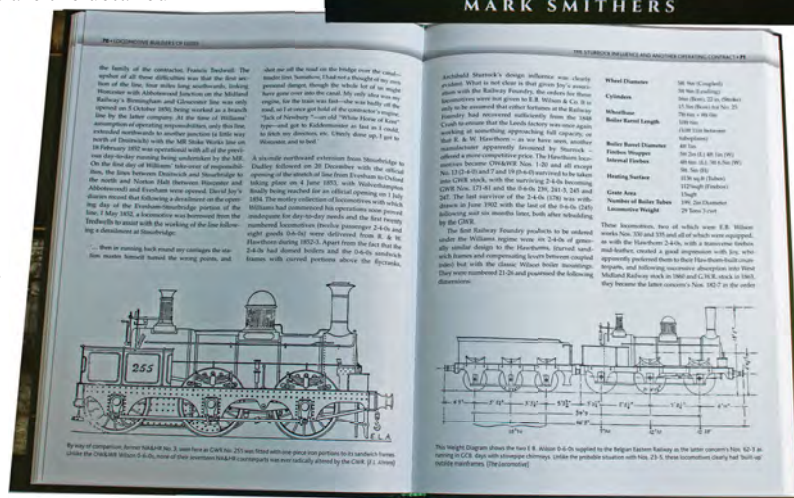
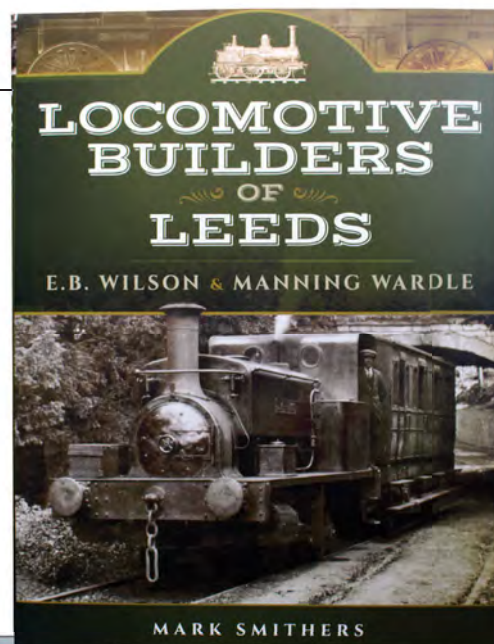
This is one title where one has to take good note of the subhead! By far the best known locomotive manufacturer originating from Leeds is of course the Hunslet Engine Co, but this is not a book about Hunslet. What is far less well known is that the two companies that most epitomised the formative years of locomotive manufacturing in Leeds, and a period of consolidation that resulted, were E.B. Wilson and Manning Wardle – this is their story.

Author Mark Smithers will be well known to readers of *EIM* as we have published many of his in-depth articles previously both in these pages and those of our sister title *Narrow Gauge World*. The level of detailed research that is a hallmark of Mark's work is very evident here, as he traces the story of the two companies. E.B. Wilson was of course responsible for many notable early designs, possible most famously the 'Jenny Lind' series, while Manning Wardle became renowned for its contractor's locomotives.

What will no doubt be of most interest to *EIM* readers are the detailed descriptions of individual locomotive classes, including vital measurements and a host of general arrangement drawings. They help, make this book an excellent reference manual and without doubt will provide plenty of inspiration for future models.

The only minor disappointment for your short-axe biased editor is a focus on Manning Wardle's standard classes, and as a result no coverage of the narrow gauge designs, including of course the renowned 2-6-2T's produced for the Lynton & Barnstaple Railway. But this is a minor quibble – this is a detailed book of very high quality in both text and illustrations, and will prove an enjoyable read for many. **AC**

ISBN 978-1-47382-563-5 Published by Pen & Sword Transport
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Price £30.00



Statfold Barn Railway Guide, Book and Stock List

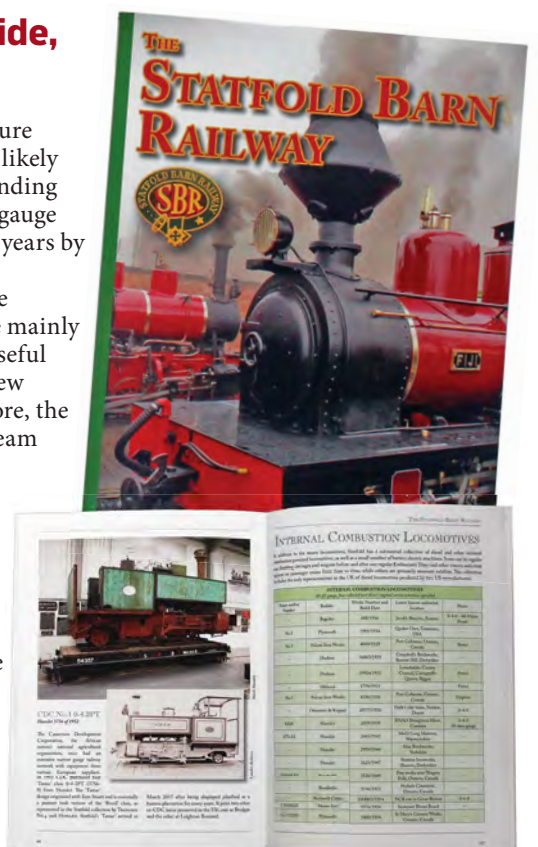
Anyone who attended the Giant Miniature Weekend at Statfold Barn in May will likely enjoy this new guidebook to the ever expanding Staffordshire collection of mainly narrow gauge locomotives, built up over the past several years by Graham Lee.

The book provides an introduction to the collection and describes the now extensive mainly 2ft gauge railway at Statfold, including a useful map of the line. While also covering the new museum and events venue at the Grain Store, the major part of the book is devoted to the steam locomotives in the collection.

Each loco is given a page to itself, headed by a quality colour picture, while the internal combustion fleet and the more eclectic items such as the Galloping Goose railcar and rail-mounted Land Rover are not forgotten.

This is an inexpensive buy, an informative souvenir of a visit to Statfold and a useful information source. **AC**

Published by the Statfold Narrow Gauge Trust. Available at Statfold open days and soon from the merchandise section of the website, www.statfoldbarnrailway.co.uk



Eco-friendly gloves launch

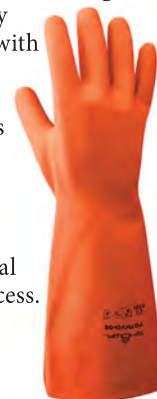
Concern about plastic pollution is now gaining overdue worldwide attention and while we don't use a great deal of plastic in the model engineering workshop, anything we can do to improve matters will be a big help.

So in the *EIM* office we took notice of a press release from Japanese firm SHOWA, which is now marketing chemical-resistant single-use hand protector gloves that are biodegradable.

The gloves are said to be impermeable, protecting against oils, hydrocarbons, grease, chemicals and abrasions. They measure 305mm long and are chlorinated for easy putting on and taking off, with a rolled cuff to prevent dirt getting in.

SHOWA adds that fears that the gloves might start to degrade while in use are unfounded, as their 'Eco Boost Technology' needs the biological material in landfill to begin the process.

More details are on the SHOWA website at www.SHOWAGroup.eu



Shows, memories and contests

News of the return of a show for the northern enthusiasts and lots of fun and games on the club scene this month...

Compiled by **ANDREW CHARMAN**

We start this month's Club News round-up with a letter to the office from Bob Hayter, Organising Group Chairman for the **Manchester Model Engineering Exhibition**, or MMEX.

The event was first organised in 2016 and designed to fill a perceived gap in northern shows. "We were overwhelmed by its popularity especially for an event run entirely on a voluntary basis," Bob says. MMEX is sponsored by NAME, the Northern Association of Model Engineers and is a non commercial undertaking run by model engineers for model engineers.

The next biennial running of the show is scheduled for 23rd and 24th February 2019. Preparations are just beginning and Bob is hoping to attract some people to help out with the organisation; "We are also unusual in being an organising group, no committee here! We communicate online and by phone so

don't actually meet until it is necessary to liaise with the venue at Queen Elizabeth Hall Oldham."

Bob adds that the duties he is seeking assistance with will not be onerous but will mean being at the exhibition (for free of course!) from setup on the Friday to pull down on the Sunday.

Anyone interested can contact Bob on Hayterbob@googlemail.com and further details of the show will be on www.mmex.co.uk. Definitely in the editor's diary, Manchester is an easy day trip from **EIM** Towers!

Finale recalled

Much sooner is another interesting event taking place this month. The **Rugby MES** have become quite adept at running special-themed weekends at their track in Onley Lane, and on 11th-12th August the theme will be British Railways locomotives.

There is a very good reason for holding the event on this particular



ABOVE: Those living towards the north will no doubt welcome the return of a show in Manchester.

BELOW: A month of a lot of work at Rugby, both in building a raised-level extension and tending to the current track and its surroundings. Photos: Edward Parrott/RMES

weekend – the '15 Guinea Special' was the last official steam passenger working run by British Railways before steam was withdrawn from the UK network, and that ran on 11th August 1968, exactly 50 years prior to the Rugby event.

So if your collection includes any of the BR standards, why not join in the fun? The club has 2½in, 3½in, 5in and 7¼in tracks available and will also be mounting an exhibition of static and part-built locomotives. For more details of the weekend email BRailEvent@outlook.com

It's been a busy time recently at Rugby as correspondent Edward Parrott details in his latest newsletter. An extension to the raised track is well underway after a method for 'planting' the concrete posts was established and members are now aiming to get at least six posts, with attendant timbers, installed per work session.

Meanwhile the central ground-level track is being routed through the main station which will both extend the routes available to drivers and provide somewhere to hold trains in busy periods.

The recent bout of very sunny weather saw the club enjoy a successful public running day in

May, though still not quite to the record number of tickets sold in October 2017, that saw 1627 purchased for a one-day event – impressive numbers...

Proficiency training

The latest magazine from the 7¼" Gauge Society gives full details of the welcome Proficiency Award Scheme that the Society is launching. Sponsored for at least the next three years by EIM, the scheme intends to train people in all aspects of running 7¼-inch gauge miniature railways, while of course also promoting the society and model engineering best practice generally.

While following on from a previous training programme, the new Proficiency Awards have been revised to make greater use of the website (www.sevenandaquarter.org) in order to deliver a larger range of training courses.

The scheme is divided into three levels, Bronze, Silver and Gold. The first two remain similar to their past forms, providing a basic introduction to the world of 7¼in through PDF booklets downloadable from the website, and training that will be carried out at club level.

The Gold Award is more intensive, covering in detail the planning, building, maintaining and running of a 7¼in railway. This will consist of three parts, each split into five or six modules, and heavily biased to practical training. There will also be distinct steam and non-steam versions. Certificates and badges will be awarded to students who complete each level of the proficiency awards.

Much more information is on the Society's website, including the downloadable booklets for the bronze and silver elements.

Alfa warning

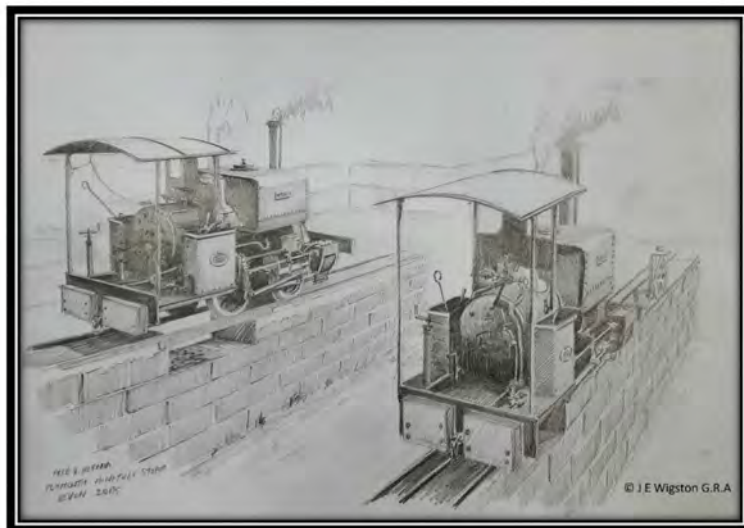
We had a laugh in the office at the efforts of the **West Riding Small Locomotive Society** newsletter editor to encourage members to submit more articles, by threatening to publish more fascinating information on Alfa Romeo cars if they didn't! Two members were duly spurred into action. Your editor knows from his 'other job' as a motoring journalist just how evangelical particularly some Alfa Romeo owners can be!

The West Riding club newsletter reveals a boost in members recently, with some joining from the **Barnsley MES**, following the closure of their small multi-gauge track in the grounds of the 15-inch gauge Kirkles Light Railway.

Highlight of much winter work at West Riding's track has been a new

ABOVE RIGHT: A superb drawing of the Plymouth Miniature Steam locos on the cover of the latest newsletter.

BELOW: The Ed found plenty of miniature interest in all sizes at the Ffestiniog Railway's 'Hunslet 125' Gala in June. The Fairbourne Railway's 12¼in gauge 'Beddgelert' actually went to the town of its name on the Sunday, as a load on a Welsh Highland Railway freight train!



Goodwin Park News Summer 2018

roof on the steaming bay shelter, which according to the club chairman Bob Lumb has "transformed its appearance."

Plymouth Miniature Steam's core public running locomotives on its half-mile long track are a pair of Kerr Stuart 'Wrens', and on the front cover of the latest newsletter both are depicted in a fine pencil sketch produced by railway artist John Wigston when he visited the line on 6th May. Chairman Ian Jefferson describes the picture as "fantastic" and he hopes that arrangements can

be made to make copies of it available to members.

Many years' effort is taking a toll on the two Wrens and thoughts are again turning to the building of a third. Ian reports that most of the materials required have now been obtained, what is now needed is the effort to turn them into a locomotive. Members are being invited to take on various components, and we will follow this project with interest.

The **Bradford MES** newsletter reports on the club's novel annual rubber and electrically powered loco ►





competition. There were two entries in the former class, each competitor allowed three attempts to record the fastest time over 100 feet and the furthest distance travelled.

While John Coppin's entry, built for last year's contest, triumphed with a 9.0-second time and $1\frac{3}{4}$ laps of the 440ft-long track, equally impressive was the entry from Roger Jordan, looking like a cross between a Gresley A4 and a land speed record car! His efforts were foiled by the rubber band snapping while being wound for the third attempt, so he could not improve on his 12 seconds to 100ft and $1\frac{5}{8}$ laps travelled.

The electric side of the contest saw four entries attempting to be fastest over two laps of the track, and

included an impressive and rather compact Meccano-based loco from newcomer Nicholas Wright running on the $3\frac{1}{2}$ in rather than 5in track.

Winner, however, was Derek Round, with a new version of an entry from 2017, now reduced to half its previous length and with the addition of race-car style 'wings' to hopefully increase downforce on the corners and prevent it flying off the rails – these electric models can be fast... Derek's fastest time over the two laps was a mere 33.2 seconds.

Browsing the various club newsletters and magazines the overall theme seems to be great variation in weather! It's gone from washed-out days due to torrential rain in the early May bank holiday,

ABOVE:

The Bradford MES rubber and electrical powered contest day produced some weird and wonderful creations. This is Roger Jordan's rubber-band propelled entry.

BELOW LEFT:

Nicholas Wright built an electric locomotive using mostly Meccano.

BOTTOM

LEFT: Electric winner, by Derek Round. The wings are functional!

BOTTOM:

Another from Hunslet 125, used because the editor liked it! If you think this space should be filled with pictures from your club, send some in!

to sweltering temperatures and welcome large crowds of people wanting to ride miniature trains at the end of the month.

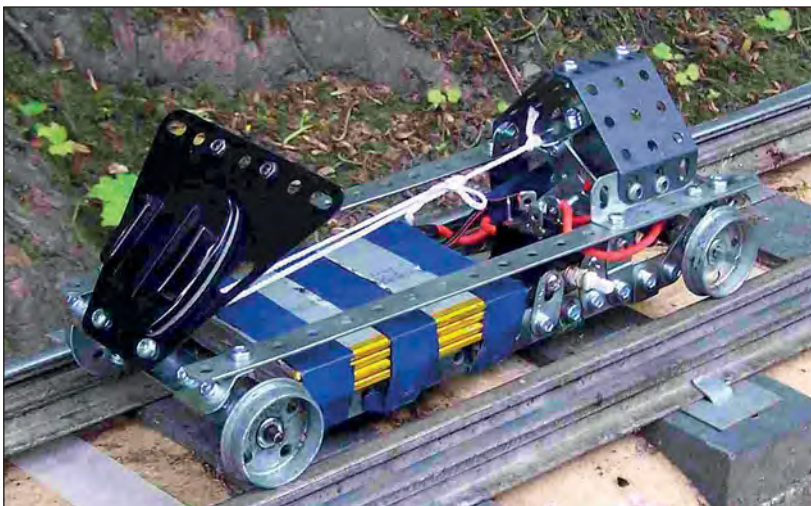
As these words are written the sun and cloudless skies seem established, the ground tinder-dry and the forecast suggesting no rain in the next fortnight, and after a small lineside fire at the weekend the Ed's local 'big' railway, the Welshpool & Llanfair, has been forced to join the growing number running diesel-only services for the time being.

All of which is a prudent warning for all of us running outside to check that we have effective spark arrestors in place – even a small cinder can cause a big blaze...

We were saddened to read in the latest edition of 'Lionsheart', the **Old Locomotive Committee** (OLCO) newsletter, of the passing of founder member David Neish, who died on 5th April. Described as a very active member of OLCO since its inauguration in June 1984, David served as chairman between 1992 and 1997 and his 5-inch gauge model of the loco that led to the formation of the club, the Liverpool & Manchester Railway's 'Lion', won the group's Lionsmeet trophy six times, and was awarded the prestigious Curly Bowl in 2012.

The group are currently looking forward to their 2018 Lionsmeet, which will be at the Hereford SME site at Broomy Hill, from 10am on Saturday 28th July. Anyone with an interest in railways of the first half of the 19th century is welcome to attend the event and it is hoped there will be operating models of Lion and other similar prototypes on the raised track of $3\frac{1}{2}$ in and 5in gauges and on the ground-level track of 5in and $7\frac{1}{4}$ in gauges.

There are hopes too of having part-built models and other items of interest on static display in the clubhouse. for more information, check out the OLCO website at www.lionlocomotive.org.uk/ **EIM**



AUGUST DIARY

EVERY SATURDAY

(Weather permitting)

Burnley & Pendle MRS public rides, Thompson Pk Rly, Burnley, 12-4pm

South Lakeland MES Public running, Lightburn Park, pm.

Sussex MLS, public running, Beech Hurst, Haywards Heath, 2-5pm

EVERY SUNDAY

(Weather permitting)

Bournemouth SME Public running in Littledown Park 11am – 3.30pm.

Bradford MES public running, Northcliff Woods, Shipley, 1.30-4pm

Burnley & Pendle MRS public rides, Thompson Pk Rly, Burnley, 12-4pm

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

Chingford ME public running, Ridgeway Park, E4 6XU, 2-5.30pm

Fylde SME Public running at Thornton Cleveleys from 1pm.

Grimsby & Cleethorpes MES public rides, Waltham Mill, DN37 0JZ, 12-4pm

Harrow & Wembley SME public rides, Roxbourne Park, Eastcote, 2.30-5pm

Kings Lynn & District SME, Lynnsport Miniature Railway, 11am-4pm

Kinver MES Public running, 2 – 4pm.

Lancaster Morecambe ME public running, Cinderbarrow Railway, Tarn Ln, nr Yealand Redmayne, from 10am

Portsmouth MES Public running, Bransbury Park, 2pm-5pm

Rochdale SME Public running in Springfield Park from 12 noon.

Ryedale SME public running, Village Hall, Pottergate, north Yorks

Sale Area MES Public running in Walton Park from 12 noon.

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

Sussex MLS, public running, Beech Hurst, Haywards Heath, 2-5pm

Urmston MES Public running in Abbotsfield Pk 10am – 4pm

Vale of Aylesbury MES Public rides, Quainton Rly Centre, from 12 noon.

West Huntspill MES public running, Memorial playing fields, 2-4.30pm

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

EVERY WEDNESDAY

(Weather permitting)

Frimley Lodge MR public running, Frimley Lodge Pk, GU16 6HT, 11-4pm

Grimsby & Cleethorpes MES public rides, Waltham Windmill, DN37 0JZ, noon-4pm

Kings Lynn & District SME, Lynnsport Miniature Railway, 11am-4pm

Vale of Aylesbury MES Public running at Quainton Rly Cntr from 12 noon.

1 Bradford MES Steam-up at Northcliff track, 7.30pm.

1 Chingford DMEC Members Locos, Ridgeway Park, 7pm

3 Portsmouth MES Members completed projects, Bransbury Park, 6.30pm

4 Tiverton MES Steam Up, Worthy Moor from 11am.

5 Bristol SME public running, Ashton Court, BS8 3PX

5 Frimley Lodge MR Public running 11am–5pm, Sturt Rd GU16 6HT.

5 G1MRA at Birmingham SME, Ilshaw Hth Rd, B94 6DN, from 10am

5 Pietermaritzburg MES (NZ), Public running, Pietermaritzburg 3201

5 Plymouth Miniature Steam public running, Pendeen Crescent, PL6 6RE

5 Tyneside SMEE Public Running, Exhibition Park, Newcastle upon Tyne, 11am-3pm

8 Chingford DMEC Chingfest Preparation, Ridgeway Park, 7pm

8 Frimley Lodge MR Public running, Teddy Bear Special 11am–4pm, Sturt Rd GU16 6HT.

8 St Albans DMES Club night, rare footage from the Ether, Tony Mason, Christchurch Cntr, AL3 6DJ, 7.30pm

10 Tiverton MES meeting, Old Heathcoat School Community Centre, 7.30pm

11 Leeds SME Open Days, Eggborough

12 Power Station, DN14 0UZ

11 Rugby MES British Railways wknd,

12 Onley Lane, 10am-5pm

12 Bracknell RS Public Running, Jocks Lane, RG12 2BH, 2-4.30pm

12 Cardiff MES Steam Up and Family Day, Heath Park, 1pm-5pm

12 St Albans DMES Barbecue, Puffing Field, WD4 9DA, from noon

12 Welling DME public running, next to Falconwood rail station, 2-5pm.

15 Chingford DMEC H20 Transportation, Ridgeway Park, 7pm

15 Stockholes Fm Miniature Rly mini loco trials, Belton, Doncaster DN9 1PH

17 Bristol SMEE Exhibition. Thornbury Leisure Centre.

19 Frimley & Ascot LC club run, Frimley Lodge Pk, GU16 6HT, 10-4pm

19 Plymouth Miniature Steam public running, Pendeen Crescent, PL6 6RE

19 Rugby MES public running, Onley Lane, 2pm-5pm

19 Tiverton MES Steam Up, Worthy Moor from 11am.

20 Pietermaritzburg MES (NZ), Meeting, Pietermaritzburg 3201

21 Grimsby & Cleethorpes MES monthly meeting, Waltham Windmill, 7.30pm

22 Chingford DMEC BBQ, Ridgeway Park, 7pm

25 GL5 Association Main Line Rally, Ryedale SME, Yorks

25 Grimsby & Cleethorpes MES Gala, Waltham Windmill, DN37 0JZ

26 Pimlico Light Railway Public Running, Helmdon, Northants, 3-5pm

26 Welling DME public running, next to Falconwood rail station, 2-5pm.

26 Bristol SME public running, Ashton Court, BS8 3PX

26 Cardiff MES Open Day, Heath Park, 1pm-5pm

27 Bracknell RS Public Running, Jocks Lane, RG12 2BH, 2-4.30pm

27 Burnley & Pendle MRS public rides, Thompson Pk Rly, Burnley, 12-4pm

27 Chingford ME public running, Ridgeway Park, Chingford E4 6XU, 2-5.30pm

27 Frimley Lodge MR Public running 11am–4pm, Sturt Rd GU16 6HT.

27 Stockholes Fm Miniature Rly Open Day, Belton, Doncaster DN9 1PH

29 Chingford DMEC Everything Runs, Ridgeway Park, 7pm

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.

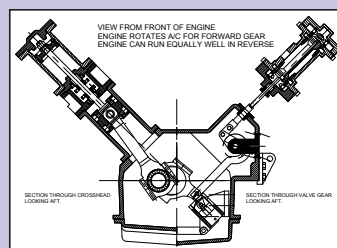
Whilst every possible care is taken in compiling this diary, we cannot accept responsibility for any errors or omissions

Coming next month in...

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Making clock pivots



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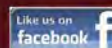
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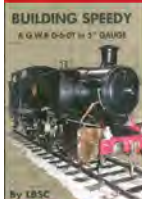


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