VALVE GEAR DESIGN FOR THE CLAUGHTON • MAKE A SPARK ARRESTOR

THE MAGAZINE FOR MODEL ENGINEERS

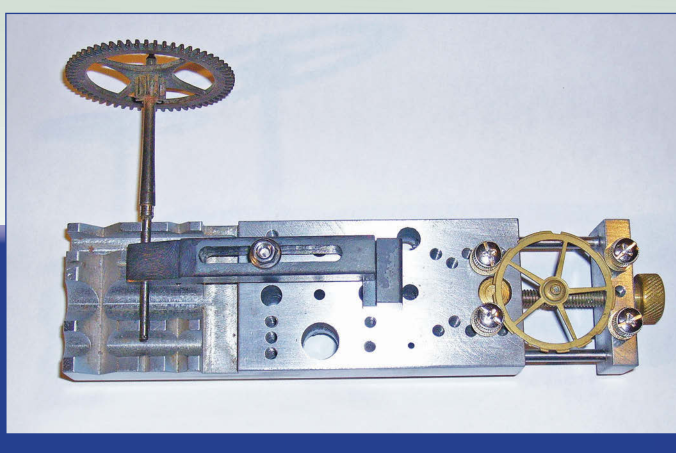
ENGINEERING in Miniature

JULY 2018 | £3.99

BUILDING A VERTICAL BOILER FOR A SHAY

Doncaster Show

Modelling excellence on display in Yorkshire

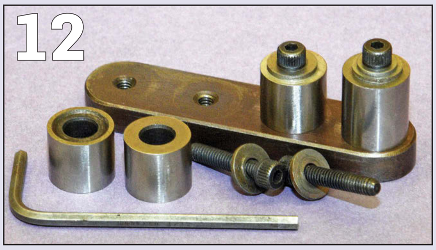


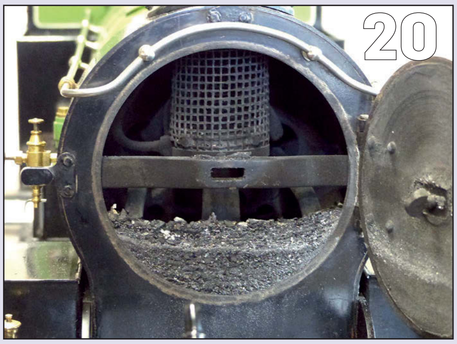
A VERSATILE BLOCK & VICE FOR TINY PARTS

CONTENTS

THE MAGAZINE FOR MODEL ENGINEERS
ENGINEERING in Miniature

JULY 2018 Volume 40 Number 01





FRONT COVER

A fascinating Burrell Boydell Traction Engine was just one of many fine models on show at the Doncaster Exhibition in May – a full report is in this issue. *Photo: John Arrowsmith*

EDITORIAL

Nice to meet you at the National...

Welcome to this month's **EIM**, and I must start by thanking all the readers and contributors I met last month on my first-ever visit to the National Model Engineering Exhibition in Doncaster.

I came away from the event with two overriding memories – firstly what a superb show it is, and secondly what a nice lot of readers we have! Many of you appeared eager to meet me, to talk about the magazine, and to offer your views and comments. And I'm delighted to say the comments were overwhelmingly positive. I've been pretty pleased with the direction I've been taking **EIM** in since I settled into the editor's chair a mere five issues ago, but it is very gratifying to hear the readers tell you that they support what you are doing – so thanks again.

Of course I'm still learning things – you never stop doing that – and one of the aspects I've learnt I am not at all good at is accurately predicting what will be appearing in forthcoming issues! Suffice to say you won't find anything about the engineering prowess at Statfold Barn in this issue, I'm still trying to tie that one down, but in the next one you will find an inside look at the work that goes on in the Victorian-built workshops of our pioneer heritage line, the Talyllyn Railway – I know that will appear because I've already been there!

I'm equally delighted to say that we are getting a steadily increasing flow of good, proper model engineering articles which makes my job harder trying to get everything I want in, in! We've added four more editorial pages this month but it's still a juggling act. Don't think for a moment, however, that I won't welcome YOUR feature – I want my job to be even harder, so please keep those features coming, we do pay for what we publish you know...

There was one aspect of the show scene I found hard to understand at Doncaster, and it's something I see at other events too – perhaps readers would like to write in and give me their thoughts. It's this – at each of these shows a tour of the various club and society displays always reveals a feast of excellent model engineering, widely varying in subject, typically of excellent quality. Yet at every show I also hear that the competition classes, many of which produce nice trophies and cash prizes, struggle with only a handful of entries. Why is that?

Anyway, that's more than enough from me – enjoy your **EIM**.

Andrew Charman – Editor

The August issue of **Engineering in Miniature** publishes on 19th July.

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

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

Published monthly by Warners Group Publications Plc,
The Maltings, West Street, Bourne, Lincolnshire PE10 9PH. .

Articles: The Editor is pleased to consider contributions for publication in Engineering in Miniature. Please contact us to discuss your work.

Engineering in Miniature – ISSN 0955 7644

Dream Steam

Ex- display items now for sale. Check our End of Line

Garden Railways

PayPal VISA JCB Maestro MasterCard

Visit Our Aylesford Show Room!

Open Monday-Friday 10am-4:30pm & 1st Saturday of the month 11am-4pm

Request your FREE Catalogue today!

Collect Loyalty Points Online

01622 793 700

www.dream-steam.com

Locomotives | Rolling Stock | Track | Accessories | Upgrades | Fixing kits & Washers | Chuffers | G Scale Figures | Curve Setters

BRAND OF THE MONTH: PECO

32mm (SM32) Track

Flexi Track - 12 Pack	SL600x12	£110.00
Flexi Track - 4 Pack	SL600x4	£38.00
Flexi Track - Single	SL600x1	£10.00
Setrack Curve - 6 Pack	ST605x6	£44.00
Setrack Curve - Single	ST605x1	£6.90
Setrack 38 Radius Curve - Single	ST607	£6.90
Setrack 38 Radius Curve - Six Pack	ST607x6	£44.00
Right Hand Point	SLE695	£45.00
Left Hand Point	SLE696	£45.00
Y Point	SLE697	£45.00
Small Radius Right Hand Turnout	SLE691	£45.00
Small Radius Left Hand Turnout	SLE692	£45.00
Wagon Turntable and Crossing	SL627	£20.00
Rail Joiners - 24 Pack	SL810	£3.50

45mm (G45) Track

Flexi Track - Six Pack	SL900x6	£79.00
Flexi Track - Single	SL900x1	£15.00
Setrack Curve - Six Pack	ST905x6	£40.00
Setrack Curve - Single	ST905x1	£8.00
Setrack Straight - Six Pack	ST902x6	£40.00
Setrack Straight - Single	ST902x1	£8.00
Right Hand Point	SL995	£54.00
Left Hand Point	SL996	£54.00
Point Motor Mounting Plate	PL8	£3.60
Metal Rail Joiners - 18 Pack	SL910	£6.00
Insulating Rail Joiners - 12 Pack	SL911	£3.10
Dual Rail Joiners - 6 Pack	SL912	£6.00

Set-a-Curve

Available in 32mm and 45mm with a wide range of Radii

£15

*In stock as of 11/04/18, please note these loco's may no longer be available, check stocks online or call. Please note basic range takes 4 weeks from inital order and other locomotives are in batches. Batch dates will be in product description. Locomotives in stock will state instant dispatch available.

Dream Steam Works manufacturers a range of upgrades and enhancements for old Mamod,MSS, IP Jane &PPS Janet locos.

Upgrade Cylinders	DSUPCYL	£72.00
Ceramic Gas Burner Set	DSUPGBS	£90.00
Three Wick Meths Burner	DSUP3WMB	£45.00
Dead Leg Lubricator	DSUPDLDL	£29.00
Steam Regulator Kit	DSUPSRK	£35.00
Small Brass Chimney Cowl	DSENSMCWL	£4.00
Brass Cab Hand Rails	DSENCH	£4.20
Brass Side Tank Hand Rails	DSENSTHR	£5.20
Brass Smoke Box Hand Rails	DSENSBXHR	£3.10
Cylinder Covers	DSENCYCV	£12.00
Brass Sand Boxes	DSENSBX	£12.50
Brass Tank Tops	DSENWTT	£9.40
Lubricating Oil	SWLUB30	£3.00
Meths Burner Wick	DSWWK6	£1.90
Curve Tipped Syringe	DSWCTS	£2.10
460 Steam Oil 500ml	DSW460SO500	£5.50
220 Steam oil 500ml	DSW220SO500	£5.50
Solid Fuel Tablets	980001	£3.50
Water Filler Bottle	DSWWFB	£4.00
Meths Filler Bottle	DSWMFB	£3.00

BACHMANN

V Dump Car (Oxide Red)	92504	£46.00
G' Flat Wagon with Logs	98470	£79.00
"LS" Skeleton Log Car	98490	£79.00
"LS" Jackson Sharp Passenger Cars Coach	89399	£87.00
"LS" Speeder Orange	96253	£90.00
"LS" Speeder PRR	96251	£90.00
"LS" Speeder Santa Fe	96252	£90.00
16mm Scale Fireman and Driver	16-703	£19.95
16mm Scale Sitting Man and Woman	16-704	£19.95
16mm Scale Standing Man and Woman	16-705	£19.95
G Scale Grazing Cows	22-199	£24.95
G Scale Horses Standing and Grazing	22-201	£24.95

ROUNDHOUSE

In Stock Now*

Millie	Black, 32mm	£650
Millie	Victorian Maroon, 32mm	£650
Sammie	32mm & 45mm	£650
Bertie	Blue, 32mm	£650
Bertie	Yellow ,32mm	£650
Bertie	Maroon , 32mm	£650
Bertie	Deep Brunswick Green, 32mm	£650
Bertie	Maroon , 45mm	£650
Bulldog	Victorian Maroon, chevrons	£634

On Order

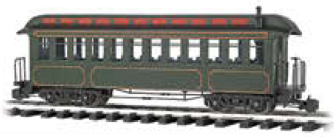
Bulldog	Due June 2018
Little John	Due Sept 2018
Bulldog	Due Oct 2018
Lady Anne	Due Nov 2018
Katie	Due Jan 2019
Russell	Due Jan 2019
Lilla	Due Feb 2019
Billy	Due March 2019

Many Home Builder parts and kits available to order online!*

Set-a-Curve

Available in 32mm and 45mm with a wide range of Radii

£15

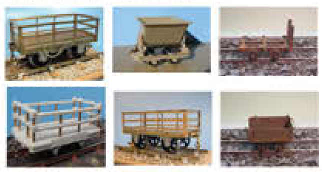


BACHMANN

Percy and the Troublesome Trucks Set	90069	£390.00
Thomas with Annie & Clarabel Set	90068	£390.00
Thomas' Christmas Delivery	90087	£410.00
Toby the Tram	91405	£250.00
Thomas the Tank Engine	91401	£225.00
James the Red Engine	91403	£230.00
Annie Coach	97001	£80.00
Clarabel Coach	97002	£80.00
Emily's Coach	97003	£58.00
Emily's Brake Coach	97004	£58.00
Troublesome Truck1	98001	£59.50
Troublesome Truck 2	98001	£59.50
Ice Cream Wagon	98015	£56.00
Tidmouth Milk Tank	98005	£39.00
S.C Ruffey	98010	£70.00
Explosives Box Van	98017	£56.00
Open Wagon Blue	98012	£56.00
Open Wagon Red	98013	£56.00
Sodor Fruit & Vegetable Co. Box Van	98016	£56.00
Sodor Fuel Tank	98004	£56.00

SLATERS

Festiniog Railway Ashbury First Class 4-Wheel Carriage Kit	16C01	£73.50
Festiniog Railway Third Class Ashbury 4-Wheel Carriage Kit	16C02	£73.50
Dinorwic Slate Wagon Kit	16W01	£20.00
Festiniog Railway 2 Ton Braked Slate Wagon Kit	16W03	£26.60
Festiniog Railway 2 Ton Unbraked Slate Wagon Kit	16W04	£25.40
War Department Light Railways K Class Skip Wagon Kit	16W06	£20.00
Dinorwic Quarry Slab Wagon Kit	16W08	£25.50
Dinorwic Quarry "rubbish" Wagon Kit	16W09	£25.50
Slaster's Mek-Pak	0502	£5.00
Slaster's Mek-Pak Brush	0505	£3.70



MSS

Side Tank Locomotive (32mm/45mm)	909003	£200.00
Saddle Tank Locomotive (32mm/45mm)	909013	£230.00
Side Tank Locomotive Kit (32mm/45mm)	909011	£190.00
Maroon Tender (32mm/45mm)	911403	£53.00
Green Tender (32mm/45mm)	911405	£53.00
Black Tender (32mm/45mm)	911401-BL	£53.00
Blue Tender (32mm/45mm)	911402-BL	£53.00
Maroon Passenger Coach (32mm/45mm)	911201	£53.00
Blue Passenger Coch (32mm/45mm)	911201BL	£53.00
Log Wagon (32mm/45mm)	911501	£53.00
Goods Van (32mm/45mm)	911101	£53.00
Guards Van (32mm/45mm)	911001	£53.00
Coal Wagon Grey (32mm/45mm)	911505	£53.00
Coal Wagon Unpainted (32mm/45mm)	911505-1	£53.00
Pair of Flat Bed Wagons (32mm/45mm)	911301	£57.00
Straight Track	910003	£34.00
Curved Track	910005	£34.00
Left Hand Point	910001	£24.40
Right Hand Point	910002	£24.40

WE HOLD A FULL RANGE OF MSS SPARES AND UPGRADES FOR OLD MAMOD & MSS LOCOS

MAMOD

Telford	MTELG0	£452.00
MKIII	MK3 From	£336.00
Saddle Tank	MST From	£336.00
Brunel	MBrunelOG	£440.00
Brunel Goods Set	BGS-CC-N	£520.00
Tender	MTDR	£39.00
Tanker	MTNK	£39.00
Goods Wagon	MGWN	£44.00
Guards Van	MGVAN	£50.00
Telford Tender	MTDR-T	£45.00

SUMMERLANDS CHUFFER

These highly developed and precision engineered chuff pipes that can bring the real sound of a working steam loco

A wide range always in stock!

Specials can be ordered on request

£25

inc. P&P

BACHMANN EUROPE Plc | DREAM STEAM DSW WORKS | Mamod | MSS | ROUNDHOUSE | SUMMERLANDS CHUFFER | PECO

facebook twitter

Dream Steam Ltd, Ground Floor Suite, Vanguard House,Mills Road, Aylesford, Kent, ME20 7NA

Call us: 01622 793 700 or send an email to sales@dream-steam.com

www.dream-steam.com | sales@dream-steam.com | @dreamsteamworks | facebook.com/dreamsteamworks

25th National Model Engineering Exhibition

John reports on an excellent selection of models and displays presented at the national show held at Doncaster Racecourse on 11th-13th May

BY **JOHN ARROWSMITH**

This prestigious exhibition opened its doors on Friday 11th May and celebrated 25 years of presenting a wide-ranged exhibition covering every discipline within the model engineering world. The range of models and skills on show still manages to provide a classic environment of many hours in the workshop combined with the delicacy of fine art to show to the wider world, the craftsmanship that still exists in the UK today despite the best efforts of bureaucracy to change things.

Quality over quantity

Once again though the number of entrants into the competition classes was disappointing but what was included provided some excellent quality model engineering. There were six good entries in Section 39 for Locomotives. Visitors were able to compare the range of scales which are used to build these engines and note the difference in size that results between standard gauge and narrow gauge examples. All the popular model engineering gauges were represented in this class which was also a pleasing aspect of the competition.

There was plenty of work for the judges to do which resulted in the 5in gauge 9F 2-10-0 locomotive built by A. West being awarded a First certificate as well as the Myford Shield for the Best Locomotive in addition to the

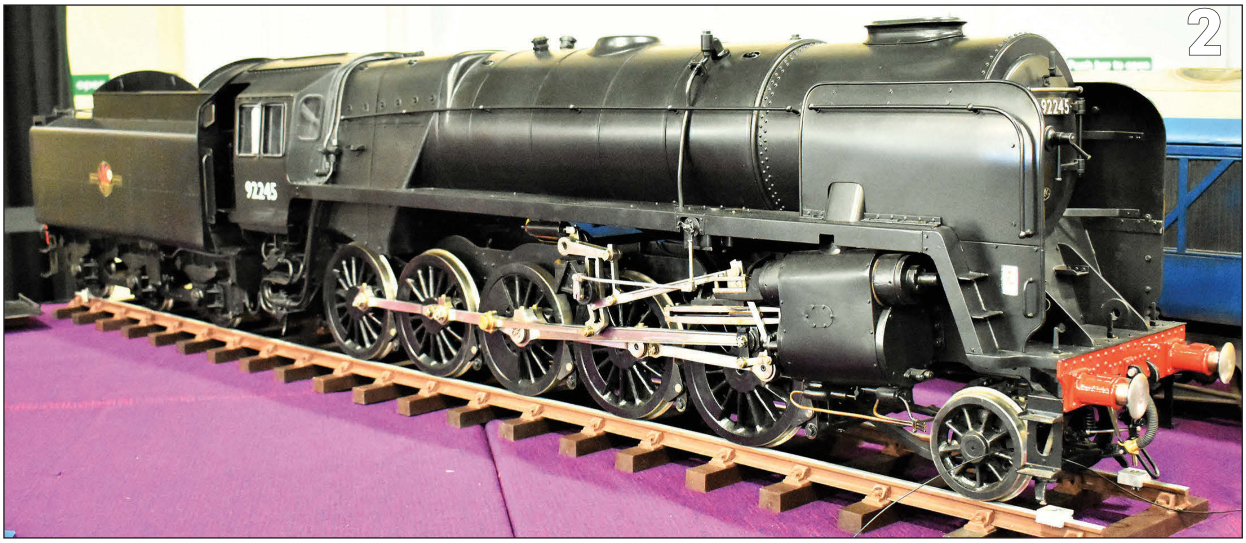


PHOTO 1: Completed axle – note rounded web ends.

PHOTO 2: Test assembly of entire unit to ensure everything moves freely.

PHOTO 3: Gauge 1 Franco Crosti 9F built by S. Johnson running on the G1 MRA layout.

Barry Jordan Trophy for the Best in Show. This was a superb piece of work which captured the essence of these imposing machines. Fine motion work was complimented with an excellent overall finish.

Four Second certificates were presented to a wide range of locomotives. Another 9F, his example in Gauge 1 scale had been built by S. Johnson to depict the Franco Crosti version of the engine. A 3½in gauge Talyllyn Railway 'Tom Rolt' 0-4-2 was entered by N. Bennett along with a set of patterns and tools to show how the various components were constructed.

Rare and vertical

A well-made example of a rare LNER B2 prototype in 2½in Gauge by T. Barnes also boasted an excellent finish and really looked the part. And last but not least in this second certificate group was the 7¼in gauge example of an 0-4-0 vertical-boilered locomotive 'Markham', displayed on the Chesterfield Society stand.

The final loco acknowledged in this class was the 5in gauge Class 37 diesel 'Loch Eil Outward Bound' presented by M. Lock. This engine was also awarded the Precision Paints Award for the best-finished model. ▶

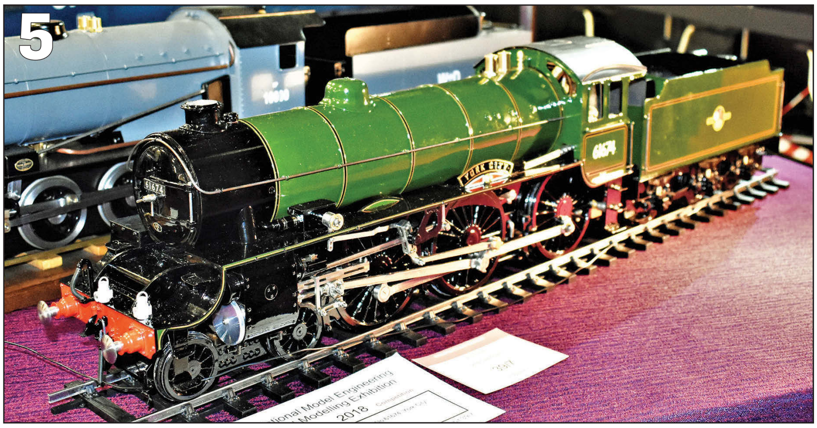
PHOTO 4: 3½in gauge Talyllyn Railway 'Tom Rolt' 0-4-2T built by N. Bennett.

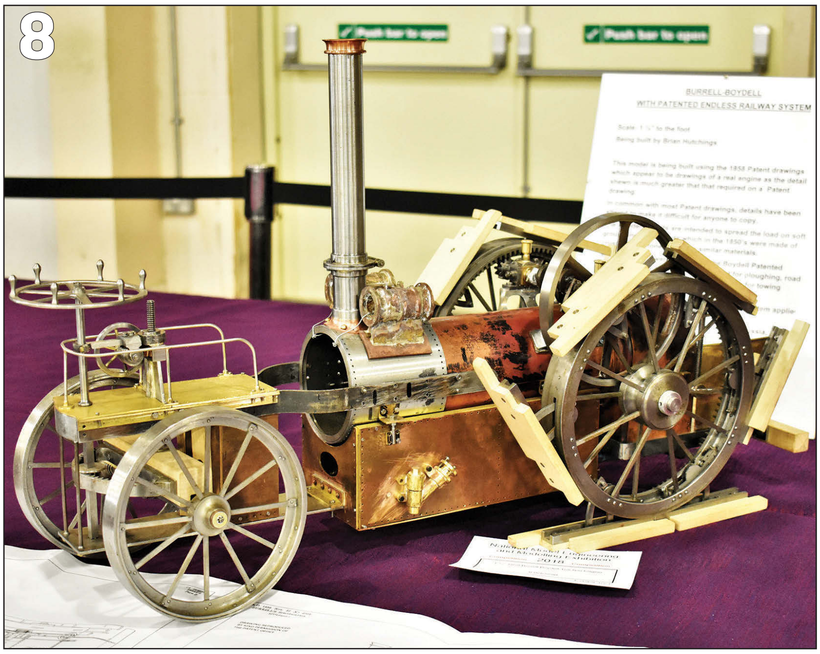
PHOTO 5: A 2½in gauge LNER B2 built by T. Barnes gained a Second certificate.

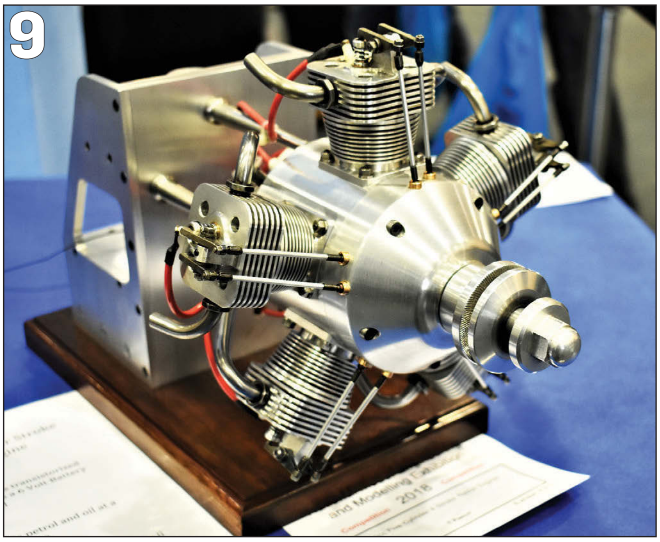
PHOTO 6: Declared the best finished model was this 5" gauge Class 37 by M. Lock.

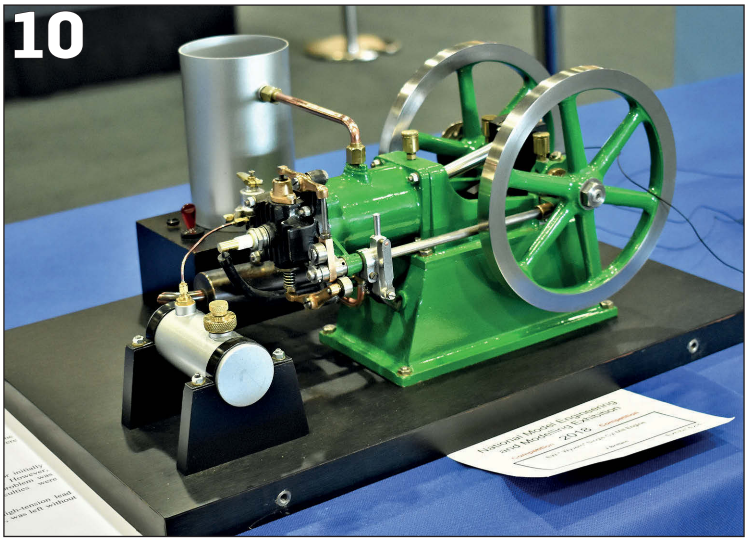
PHOTO 7: An unusual Vertical boilered 0-4-0 loco 'Markham', by D. Penny

PHOTO 8: An interesting Burrell Boydell Traction Engine in 1½" scale built by Brian Hutchings.









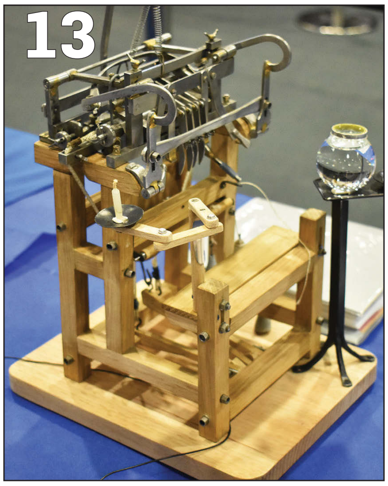


PHOTO 9: Tom Pasco's five-cylinder radial Engine took a First.

PHOTO 10: J. Brittain's EW Wyvern mill engine took a Third certificate.

PHOTO 11: The 1/10 scale Ulstien G/Box with six- cylinder Bergen engine by F. McCafferty.

PHOTO 12: John Clarke's replica of a shoemaker's sewing machine.

PHOTO 13: John also built this framework knitting machine...

PHOTO 14: ...and this First-winning Newsham fire engine.

PHOTO 15: The little Stuart Lathe by D. George.

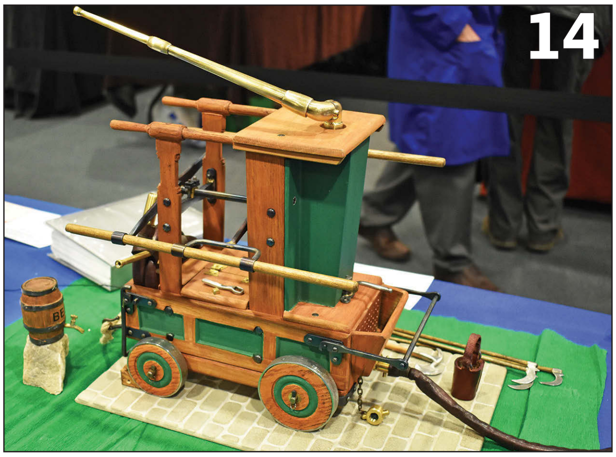
The next competition class was Section 40 for Road Vehicles, and unfortunately only one entrant was present, our cover star, a 1½in scale Burrell Boydell Traction Engine. Still under construction by Brian Hutchings it was nevertheless a very interesting model to consider. Displayed alongside was the 1/16th scale open-top Preston Tram presented by Julia Stephenson.

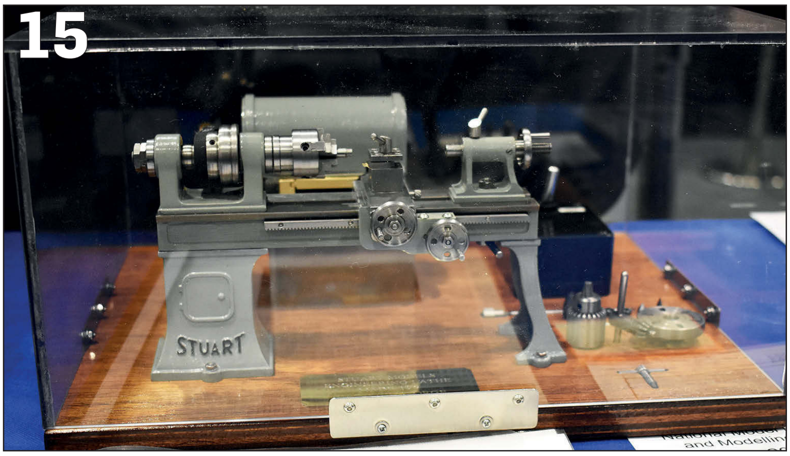
Three quality entries competed in Section 42 for Stationary Engines. A First certificate and the Warco Trophy for Best Stationary Engine went to the 50cc five cylinder four-stroke radial engine built by Tom Pasco. As usual with Tom's work this engine was superbly constructed with excellent detail and finish.

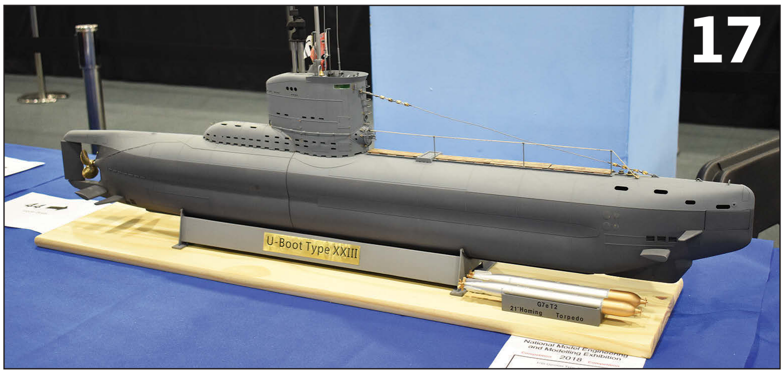
The EW 'Wyvern' single-cylinder mill engine by J. Brittain gained a Third certificate and the 1/10th scale Ulstien G/Box with six-cylinder Bergen engine built by F. McCafferty was Commended.

Model variety

Section 43 is the Miscellaneous class which covers many different disciplines. Two First certificates were awarded here, to John Clarke for his excellent little Newsham fire engine (based on an original of circa 1721) and to M. Whittingham for a







collection of hand-made miniature knives. John Clarke also secured a Second and Third certificate for his models of a framework knitting machine and a leather sewing machine. Both machines were full of character and fine detail.

A Very Highly Commended certificate was awarded to D. George for his lovely little Stuart Lathe. An Hour Strike Twin Fusee Skelton Clock built by K Taylor-Nobbs gained a Commended certificate.

Dried up?

Only one example appeared in Class 44 for model boats and this gained C. Behan a Third Certificate for his 1/35th scale German Type-23 U Boat. The lack of numbers in this class was disappointing as there were some superb examples of model ship and boat building elsewhere on the club stands.

The final competition class, Section 45 for Model Wheelwrights saw prolific builder Brian Young once again take the honours with a Third certificate for a 1/12th scale example of a Yorkshire plough and another Third certificate for a model of Queen Victoria's bathing machine, also in 1/12th scale. This model was also awarded the Guild of Model Wheelwrights Trophy for Best Model.

There were just two more awards to be made, one for the Best Club Stand and the Raymond McMahon Trophy for the Best Road Vehicle in Steam. The Best Club Stand was judged to be the display by the Durham RC Model Club which had a comprehensive selection of models and manoeuvres to entertain the visitors. Outside, the Doncaster Steamers were performing all weekend and the winner of the Raymond McMahon trophy was Alan Phillips with his 4½in Burrell 'Auld George'. EIM

COMING NEXT MONTH – CLUB STANDS AND FURTHER DISPLAYS

PHOTO 16: Brian Young's prize winning 1/12th scale. Queen Victoria's Bathing Machine.

PHOTO 17: A Third winner was this 1/35th scale German Type U Boat by C. Behan.

PHOTO 18: This Yorkshire plough gained a Third for Brian Young.

PHOTO 19: Taking the N.A.M.E Shield for best club stand, Durham RC Model Club.

PHOTO 20: Best in Steam award winner, Alan Phillips' 4½in Burrell 'Auld George'.

Boring on the button

John Smith's latest best-practice techniques call for the use of toolmakers' buttons...

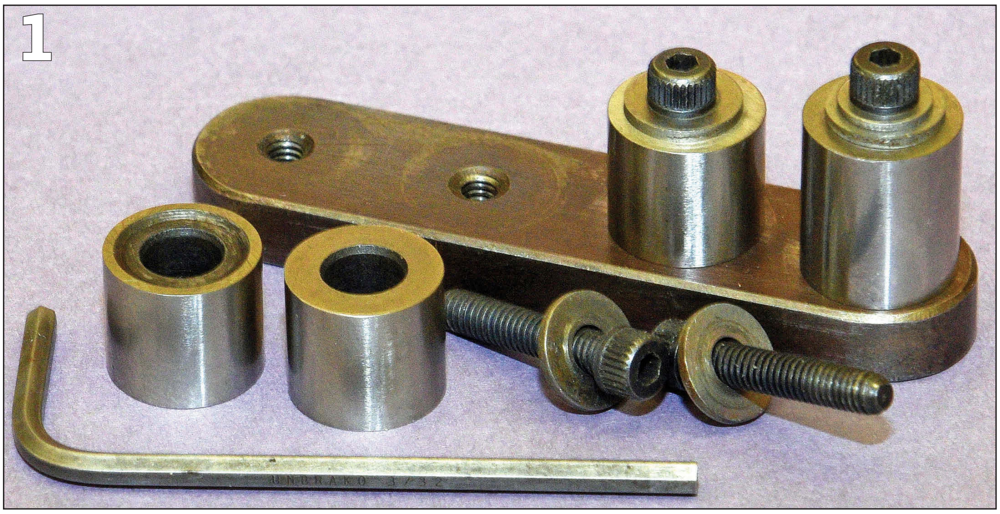
BY **JOHN SMITH**

I first learned how to use the cunning devices that are toolmakers' buttons while spending three months in a machine shop during a sandwich degree course. It was in the days before digital readouts (DROs) were common. If high-accuracy hole-positioning was required, the only alternatives were a jig-boring machine or the use of toolmakers' buttons. Imperial button sets can be found in sizes of 0.3-inch, 0.4in and 0.5in. I believe that metric button sets were also made.

Photo 1 shows my set of 0.5in D buttons. Buttons are finely ground and polished, with the diameter being accurate to 0.0001in or better. Having said that, it is pretty easy to make a usable set oneself from silver steel. The dished end goes against the workpiece. The central hole is substantially larger than the outside diameter of the screw so that the button can be 'set' accurately, even when the threaded hole in the workpiece is only approximately located.

Needless to say, now that almost all commercial machine-shop work is undertaken using numerically-controlled machines, toolmakers' buttons are seldom used in industry. This means that they can be picked up cheaply online on eBay. This is very convenient for us, as toolmakers' buttons still have a role to play in the model engineer's workshop.

Such sets are very useful for positioning holes in axleboxes and coupling rods to ensure that the wheels of a loco can rotate freely without 'tight spots'. If you don't have a milling machine (ideally with a DRO) they are also useful for ensuring that the valve rod bearing holes at both ends of a valve chest are precisely co-axial.

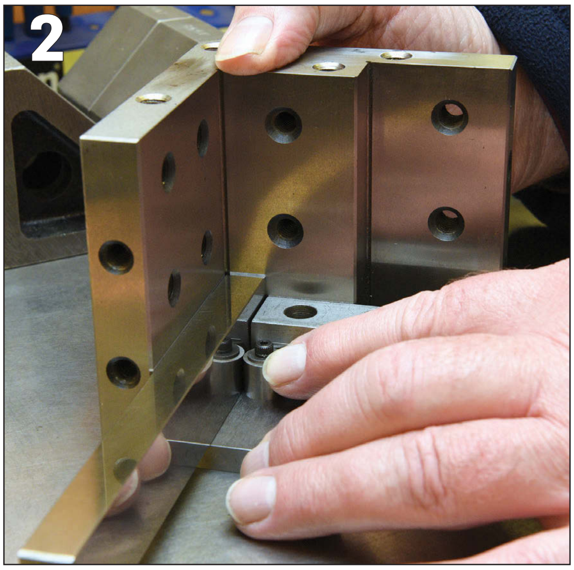


How to use buttons

Let's assume that a precisely-located and reamed hole has to be positioned 0.750in from the top edge of a rectangular workpiece and 1.000in from one side of the workpiece. The first task would be to mark the position of the hole with a height gauge, the second to use a centre punch to mark the precise point where horizontal and vertical scribed lines cross, the third to drill a tapping-sized hole to suit the thread of the screws (4BA in my case), and the fourth to tap the hole.

To 'set' a 0.500in D button relative to the top and one side edge of the workpiece, we need two pieces of steel or brass packing of precisely 0.5000in and 0.7500in thickness respectively. I happen to have a pair of inspection-grade parallels which are precisely 0.5000in thick. The 0.7500in thickness can be obtained using an offcut of ¾in thick bar and a shim. I used a 0.004in shim for this purpose, that size giving a precise measurement of 0.7500in when measured with the piece of ¾in bar using my very best micrometer.

The button can be set using an accurate angle-plate or large parallel sitting on a surface plate. Alternatively, an angle-plate which is truly-ground all over or a large V-block can be used. The button is set by pressing the workpiece against the angle-plate surfaces, pressing the button against the two pieces of packing and tightening the screw. You will see from Photo 2 that two hands are insufficient for this task – you will



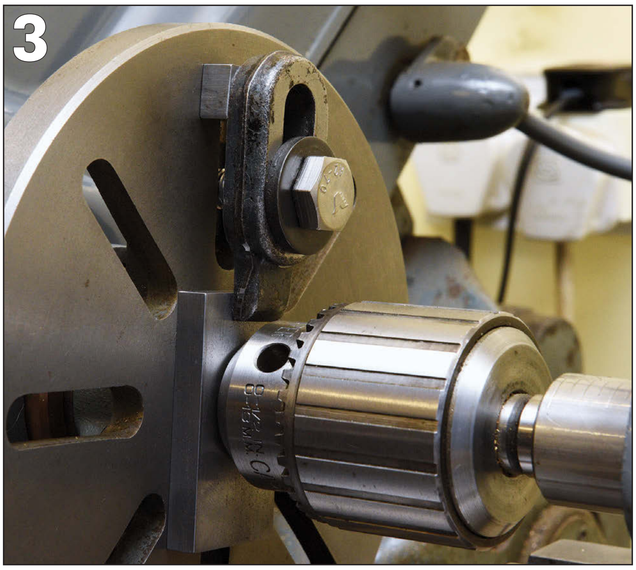


PHOTO 1: A typical set of half-inch toolmakers' buttons.

PHOTO 2: Setting up a workpiece using buttons and an angle plate – many hands required!

PHOTO 3: A drill chuck in the tailstock loosely grips the button as the workpiece is lightly clamped to the faceplate.

PHOTO 4: A dial gauge is employed to adjust until the button runs true.

All photos: John Smith

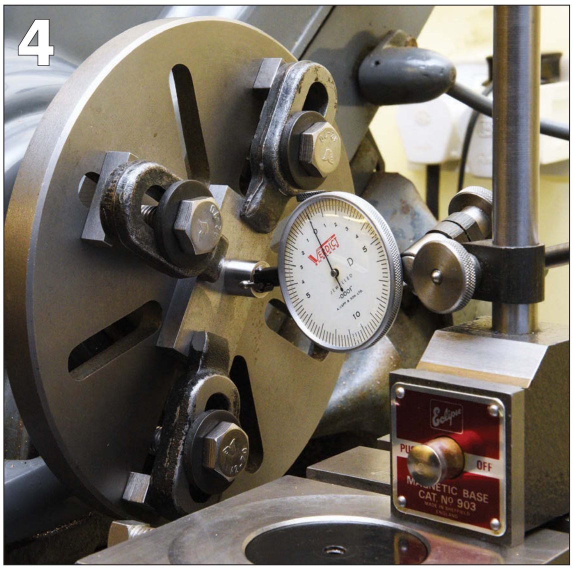
need the services of an assistant to actually tighten the screw.

With the button set, the workpiece is transferred to lathe or mill and a dial gauge used to position the workpiece such that the button is co-axial with the axis of the machine spindle. For this type of work I would use the lathe, clamping the workpiece to a face-plate.

A drill chuck, mounted in the tailstock, is used to grip the button loosely while the workpiece is lightly clamped (Photo 3). A dial gauge is then set up and the position of the workpiece adjusted (by tapping it with a piece of wood) until the button is running true – pulling the lathe belt by hand. (Photo 4). The clamps are then fully-tightened and the position checked one more time. A lever-type dial gauge works well for this job.

The hole can now be drilled and reamed or, better, drilled and bored and reamed. As a drill may wander a little when drilling out a threaded hole (especially if the threaded hole is not coaxial with the drill), I usually drill the threads away using a suitably-sized slot drill mounted in the tailstock drill chuck. The bore can then be drilled, bored and reamed with a machine reamer (often called a 'chucking reamer').

To address the specific challenge of ensuring that coupling rod bores are spaced identically to the bores of the axlebox, make a jig from mild steel with two, three or four reamed 0.5in holes (depending on how many coupled wheels there are on your locomotive) at the required spacings. Machine the horn slots in the axleboxes, fit the keeps and drill and tap holes for buttons. Set the first button accurately as described above. Then place the axleboxes in their horns and set the remaining buttons using the jig. Similarly, make the coupling rod (complete with its hinged joints), set the position of the leading bore using a button and then set the position of the remaining bores using the jig. Job done! EIM



NEXT MONTH – MEASURING INTERNAL DIAMETERS

START HERE

Of smoke and steam...

Our beginners series concludes a study of the boiler, by looking at the smokebox.

If you've followed this series over the past couple of months you will know we have looked at the boiler and the firebox, and the final important element of this part of the locomotive is, affixed to the front of the boiler barrel, the smokebox.

Steam that has done its work in the cylinders passes through the smokebox and then out through the chimney (not the funnel – these are fitted to ships...) by means of a nozzle known as the blastpipe. In the process it provides a pull drawing the hot gases through the boiler from where they too exhaust through the chimney, while any ash generated settles on the floor of the box.

The smokebox has a large door in its front, usually dished for strength. Most are side-hinged with a rod passing through the centre, the rod boasting a flat end and known as a dart – when turned through 90 degrees using one of two outside handles, the dart catches on a securing bar inside the door. The second, threaded lever tightens the door to maintain the vacuum necessary to draw the gases through the boiler tubes.

There are other methods to secure the door, a popular version being a ring of 'dog-catches' around the edge, much favoured on European and US-style locomotives for example.

The loco crew open the door to inspect the smokebox interior and the boiler tubeplate, and to clean out the ash that collects on the floor from the gases. Boiler tube cleaning, using a very long rod with a brush on the end, is also carried out from the smokebox end of the loco.

Most smokebox interiors are dominated by the spark arrestor, a large grille, sometimes flat, sometimes box-shaped and designed to catch hot particles and prevent lineside fires. It surrounds the blastpipe, which is specially designed to make the most efficient pull on the fire.

There have been many designs of blastpipe over the years, the theories behind which would fill a book on their own. One of the best known and most modern is the Lempor exhaust, developed by Argentinian Livio Dante Porta in 1952 and designed to create a vacuum in one cylinder as the other ejects its used steam, thus requiring less pressure to drive the piston – we'll take a look at how cylinders work in a coming issue.

Attached to the blastpipe will be a blower pipe. The fireman uses the blower to stimulate his fire, directing a jet of steam up the blastpipe and increasing the pull of hot gases through the boiler. EIM

RIGHT: Typical UK-design side-hinged smokebox door.

BELOW: Inside, from the front one can see the dart and its securing bar, the spark arrestor, blastpipe and boiler tubeplate and the ends of the tubes.

Dougal - a 5-inch Barclay

Having built the frames young Sussex engineer Andrew begins construction of the wheels on his entry-level locomotive project, and discovers a problem...

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

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.

Continuing with construction of the chassis, the next job was to turn the three eccentrics – two to drive the valve rods and one to drive the axle pump. These were also made out of steel and had the hole for the axle drilled off-centre to produce the desired eccentric rotation as per the drawings.

For this task it was back to the trusty Myford lathe and my first experience of an independent four-jaw chuck – until now I had only used self-centring chucks. Setting each eccentric took a few minutes but this was time well spent as each turned out perfectly. A steel peg was pressed into one side of both valve eccentrics and this would be used to drive them round the axle.

In order to drive the eccentrics, two stop collars were made, which would be fitted adjacent to both valve eccentrics on the axle. These were two ¼in steel discs with a ½in hole through the middle to take the axle. I then milled away half the diameter to leave a ⅛in thickness and the resulting step would push against the pegs in the eccentrics to drive the valves.

The position of the stop collars on the axle is critical as these determine the point at which the valves start to move in the steam chest and ultimately affect the timing of steam admission into the cylinders. The cross hole, which was necessary to pin them to the axle was drilled prior to fitting them however the crucial hole into the axle couldn't be drilled until the valves, steam chest and cylinders had been machined and fitted.

The first castings to machine for the project were the four wheels. I initially cleaned up the back face of each one in order to hold it square in the lathe chuck jaws and then cleaned up the front face likewise. Next, I bored out the wheels to a very accurate ½in using a boring bar to ensure a very good fit on the axles. It was at this point that I noticed that the boss wasn't central with the hole for the axle (I will return to this problem later).

I then turned a mandrel for each bored wheel to mount on in order to turn the remaining diameters. The mandrel was a simple 1in diameter steel bar turned down to ½in x 5 thou less than the overall thickness of the faced wheels. A step was then turned to ⅜in diameter and threaded ⅜in x 16tpi Whitworth for a nut to lock each wheel in place whilst machining. Manufacturing the mandrel took a couple of hours but made the process of turning the wheels far quicker.

The remaining diameters were then turned on each wheel including a 2 degree taper on the tread, correct ³⁄₃₂in root radius and flange taper. These dimensions were produced using a tipped form tool and are essential to ensure the locomotive will pull a good load. Flat treads with little or no root radius are not correct and will considerably reduce adhesion.

Using a flat file, I removed any burs that could potentially damage the track and I rounded off the flanges to leave a smooth radius.

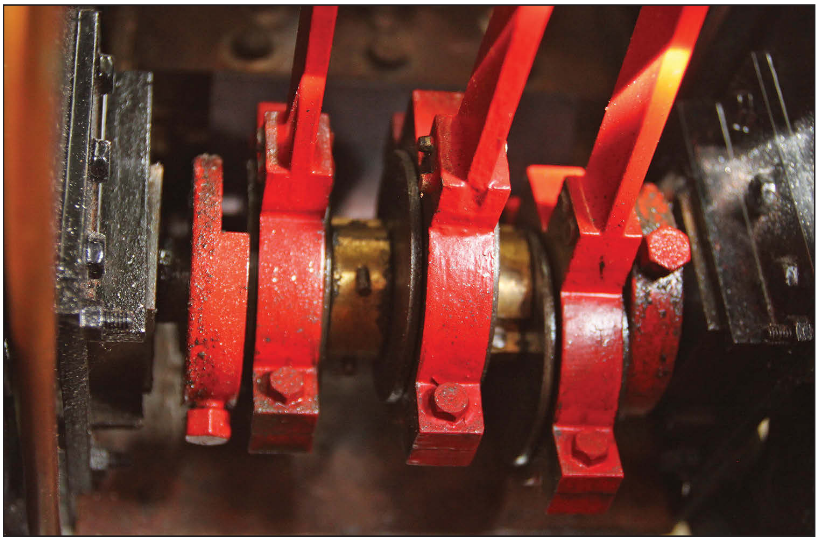
Correcting an error

As mentioned earlier, the entire wheel boss was cast 80 thou over to one side. Every wheel was the same and since it was very noticeable I made the decision to machine the edge of each boss using a rotary table attachment on the milling machine. Again, this was another new piece of equipment and as such took a short while to learn.

Each wheel in turn was mounted in a three-jaw chuck which in turn was centred on the rotary table. Once set, and using a ³⁄₁₆in end mill, I very carefully machined the periphery of each boss to centralise about the bored axle hole. This did take a long time to set up and even longer to machine however the end result was worth it.

As a result of this additional machining, the inside face of each wheel required all the machine marks removing with emery paper, which in itself took a couple of hours.

The wheels on Dougal don't have any spokes but they do have four holes located around the central boss. These holes had to be opened out to ¹¹⁄₁₆in as unfortunately the castings wouldn't clean up with a ⅝in cutter. This



ABOVE LEFT: Andrew's finished Dougal locomotive – this month's build focuses on the wheels.

LEFT: A view under the frame reveals the three eccentrics made this month, with their collars.

operation was also performed whilst the wheels were set up on the rotary table, ensuring that each hole was exactly 90 degrees from each other.

Now with the rotary table locked and centred about the axle bore, I moved the table of the mill over to drill and ream the hole for the crank pin. It is advisable to machine the crank pins after reaming the hole in the wheel to ensure a firm press fit. The crank pins were made from 5⁄16”in silver steel and in a similar way to the axles with a groove to take the Loctite 648 retainer. I made the crank pins a good tight fit in the wheels and for extra security I carefully drilled and fitted a grub screw half into the pin and half into the back of the wheel casting to lock it in place.

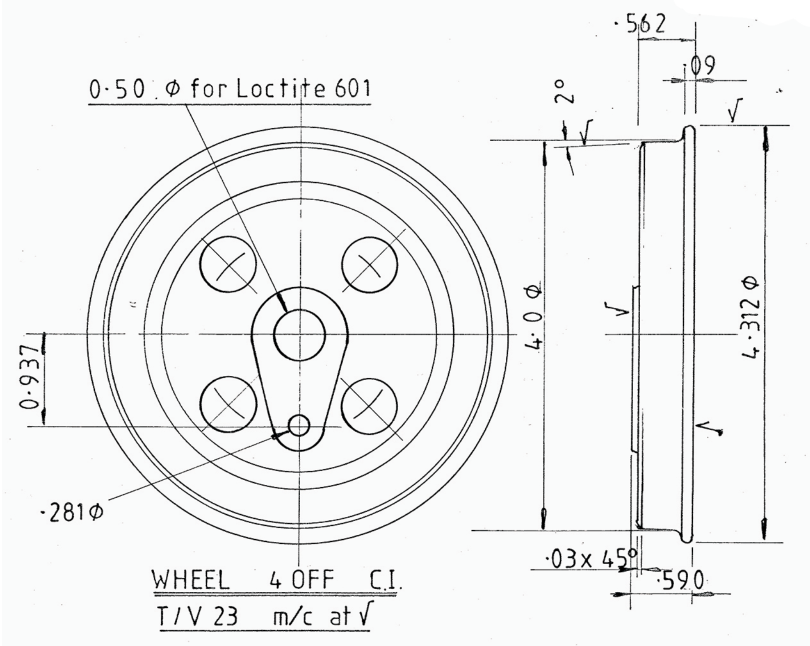
The art of quartering

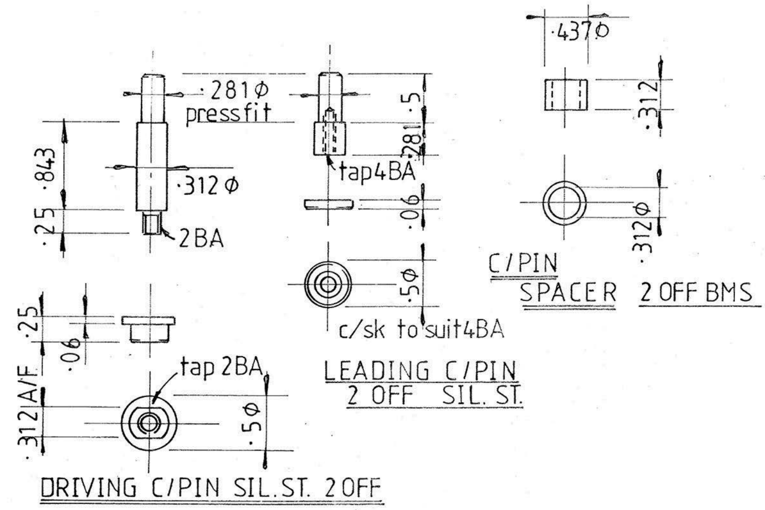
With the wheels, axle boxes and axles finished it was time to assemble them all together and quarter the wheels – ensuring that one wheel is attached to each axle at precisely 90 degrees from the other wheel on the same axle. In the case of Dougal the left-hand-side wheel should be at the front of the stroke at the same time as the right-hand-side wheel is at the bottom of the stroke.

One at a time, both axles were held in the lathe chuck and after applying the groove with Loctite 648 retainer, I pushed the right-hand-side leading wheel on and held it in place with a flat-ended attachment in the tailstock and against the jaws of a three-jaw chuck. I then left this set up overnight to allow the Loctite to cure before repeating this process for the right-hand-side trailing wheel.

Now for the tricky bit! The second wheel of each axle had to be fixed perfectly in position as even one degree out could mean the locomotive not turning over smoothly. Again, using the Myford lathe I held each axle between fixed centres, with the already attached wheel at the headstock end of the lathe. I rotated this wheel so that the crank pin was

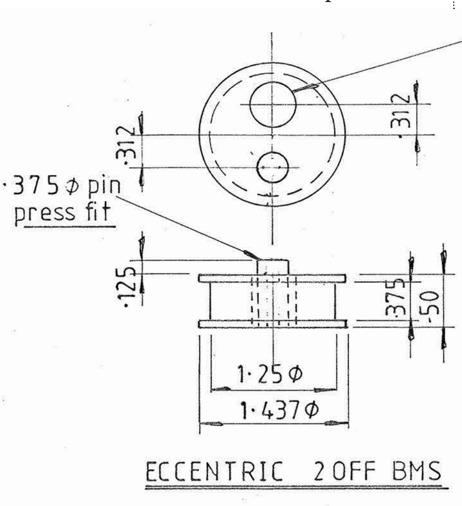
“It was at this point that I noticed that the boss wasn’t central with the hole for the axle...”

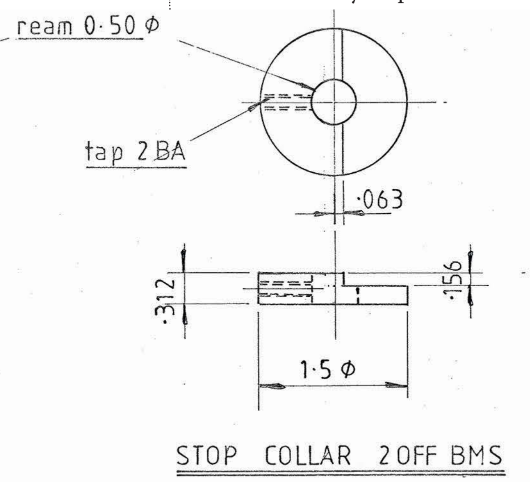


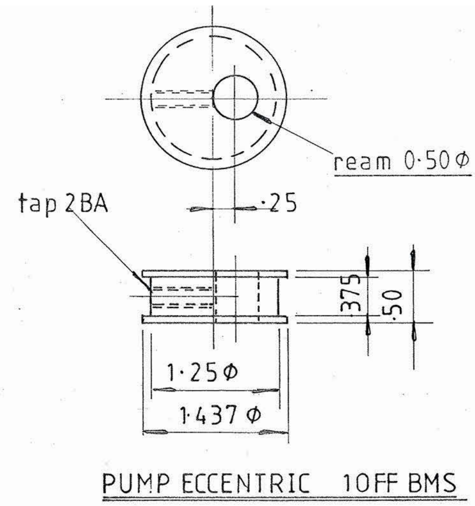


roughly pointing downwards and then using a depth micrometer off the front edge of the lathe bed and a fixed back stop behind the crank pin I set this so it was exactly at right angles to the top edge of the lathe bed.

Knowing that a Myford ML7 lathe has a centre height of 3.5 inches I was then able to calculate the distance that a piece of 3⁄8in square tool steel held in one of my Tripan tool holders should be set above the top of the lathe bed so the second crank pin is exactly 90 degrees to the first one. With this in place I was then able to apply Loctite 648 retainer to the groove on the unfixed end of the axle and carefully holding the fixed crank pin against the aforementioned back stop and the unfixed crank pin against the top of the tool steel my wheels were now quartered.







It's worth emphasising again at this point that the quartering operation is tricky and must be accurate. If possible it is easier to complete this task with two people rather than one and once the Loctite has been applied and the second wheel pushed on it is advisable to physically hold this set up for at least five minutes to ensure the Loctite has started to cure. Ideally, the wheels need to be a firm press fit on to the axles so the above method can be achieved by hand. If they are too tight you will not be able to push them on by hand and if they are too loose the wheels are highly likely to wobble and the Loctite retainer may not cure properly.

A lesson that stuck

When I was quartering my wheels, I did learn one very important lesson. About two hours after applying the Loctite to one of the wheels, I realised I hadn't put the axleboxes on the axle first and so a frantic 15 minutes or so was spent undoing everything that I had just done. Luckily, since I was using fairly old Loctite, it hadn't completely gone off, so I was able to reset the axle, making sure the axleboxes were now in place and reapplying the Loctited wheel in the correct position.

As another small digression, it is a useful lesson to learn that older (even out-of-date) Loctite takes longer to set than new Loctite. When undertaking certain delicate tasks such as wheel quartering it is highly desirable to use older Loctite to ensure maximum working time before this adhesive starts to cure. The full curing time is also slightly longer but overall strength is not compromised.

The completed wheel sets were placed in the hornblocks together with the springs and rotated as freely as can be expected for a new locomotive. I now had a basic rolling chassis, which I was able to test by pushing round part of my club's track.

When the wheels were rotating quickly, however, I noticed that they were not perfectly true, which I believe was a result of two things which I would do differently if I built the locomotive again. The first was that the wheels were turned individually and not between centres in the lathe once they had been finally assembled on the axles.

Secondly, the ends of the axles were not turned down for the wheel to push on against a shoulder. As the wobble was very slight, I decided not to worry about correcting it and the wheels still have it today.

It is important to note that if you wish to manufacture stepped axles you should consider boring the wheels to ⅜in rather than ½in. I would not advise using ⅝in axle material because this also requires the enlargement of the bores through the axle boxes and eccentrics. EIM

"When undertaking certain delicate tasks such as wheel quartering it is highly desirable to use older Loctite to ensure maximum working time..."

ABOVE LEFT: The finished wheels – after some careful work to correct bosses cast off-centre...

BELOW: A complete rolling chassis – providing major encouragement to press on...

Drawings in this series reproduced with kind permission of A J Reeves. Drawings, castings and material for this build project are available from A J Reeves.

Tel: 01827 830894

E-mail: Sales@ajreeves.com

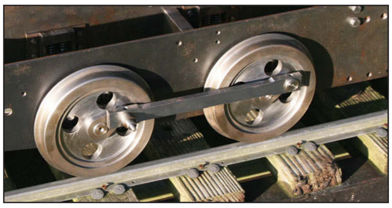
Web: www.ajreeves.com

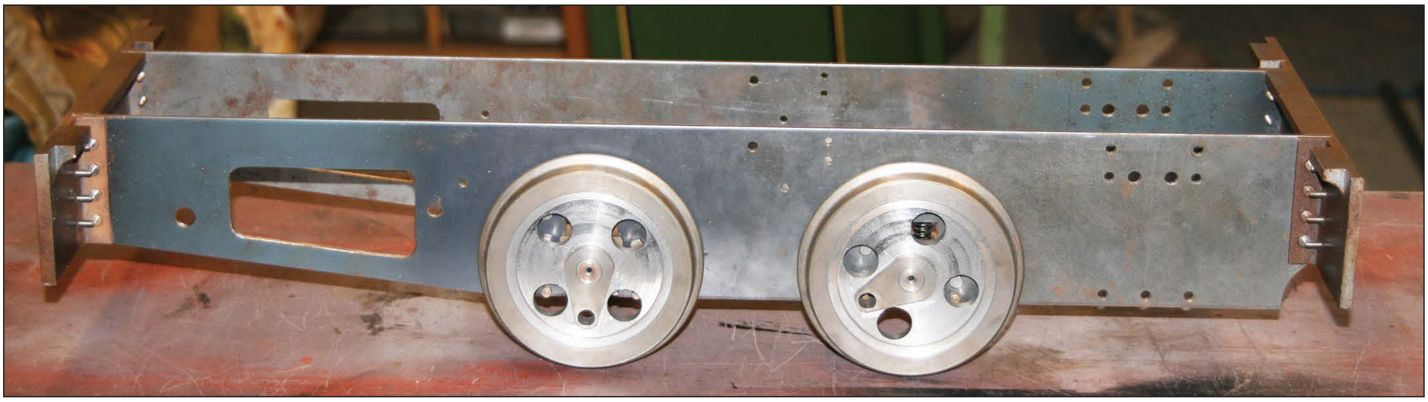
Previous Episodes...

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.

Coming Next Month...

"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 ..." – Andrew focuses on the motion...

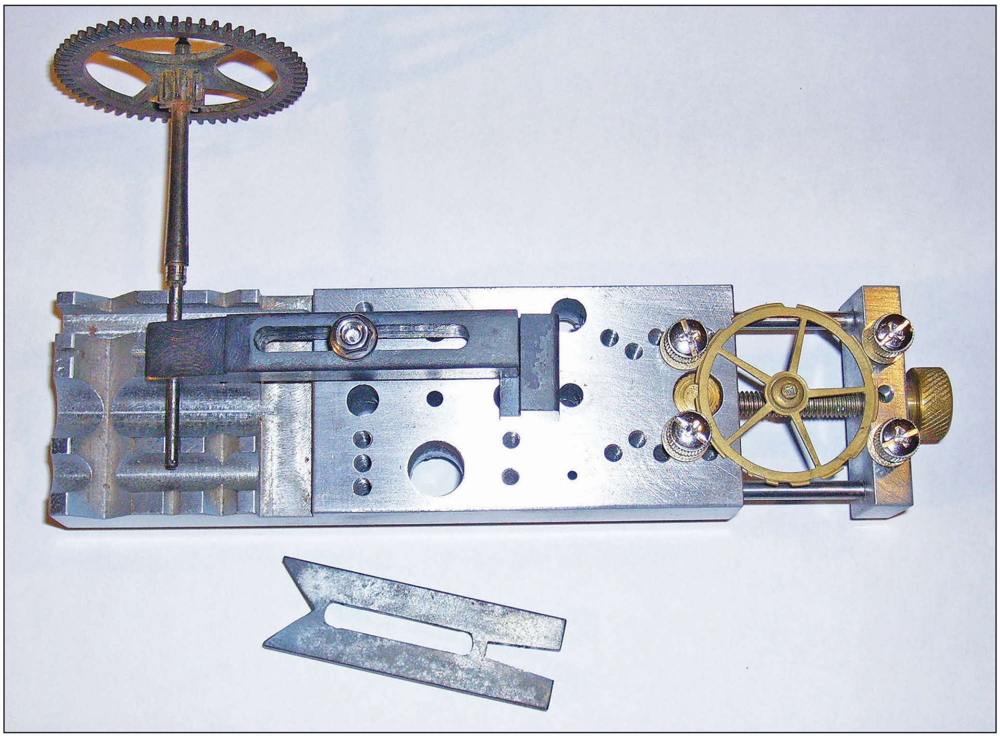




Multi-holding block and vice

Clock maker Mark describes a tool that could find widespread use in the workshop.

BY **MARK BROCKLEY**



Working on small delicate parts can sometimes be difficult. Holding a fragile part rigid to prevent damaging it when drilling or broaching is essential, as well as supporting thin shafts or materials to prevent bending while drilling, filling, cutting, polishing along with many other tasks performed in the workshop.

I have two tools I think came from a workshop clearance many years ago that have been indispensable at times. They are pictured in Photo 1, the steel V block with multiple Vs has held small round stock rigid, but at times using a toolmakers' clamp to hold work in place restricts the block from being used on the bench. It has to be clamped in a vice resulting in the work being at an uncomfortable height.

The round tool in aluminium is a pin vice that has been home made and is useful when working on hand collets and the like. It is useful to hold jobs when polishing and filing as well as drilling. A variety of brass pins in different diameters make it very universal for varying sized jobs.

Two tools in one

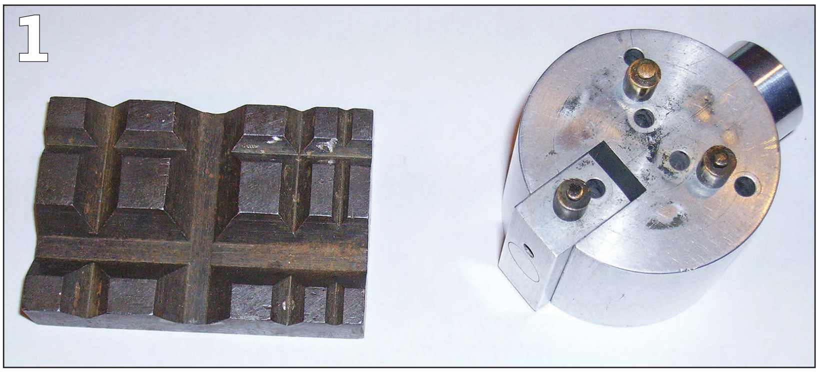
This pin vice is a favourite tool in the watch and jewellery trade and has its uses in clock making and model engineering. but its round shape makes it difficult to fix rigidly to the drill table or to hold in the bench vice. This led me into designing the tool in the heading photo, a multi holding block that also incorporates a pin vice.

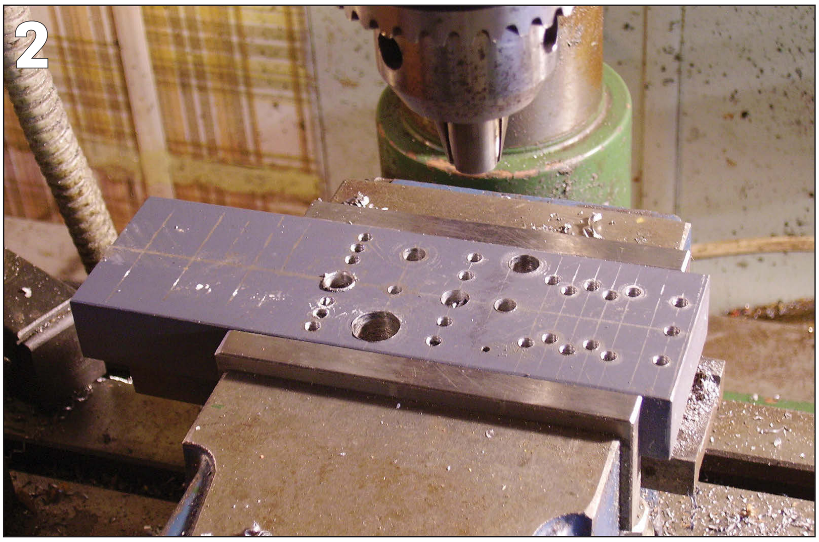
Included along the full length of the base is a milled slot the same size as the slots in my milling machine table. A strip of steel that is a snug fit into the table slots is then bolted to the base enabling instant squareness to the machine table. A variety of clamps can be made and added to when required to really make it suitable for any job.

I started with an offcut of 50mm x 20mm black flat bar around 156mm long. I skimmed first one edge then the other with a fly cutter, then skimmed the base and face of the block along with each end. After cleaning the block up and removing any sharp edges by drawing a file along them I used spray undercoat to coat the face and edges.

Once the paint had dried I used my height gauge to mark out all the holes and centres of the V slots as shown in Figure 1 and 2. I then carefully centre punched each hole and proceeded to drill and tap all the M4 clamping points as in Photo 2.

I removed the burs left from drilling before placing a parallel in the milling vice then clamping the block



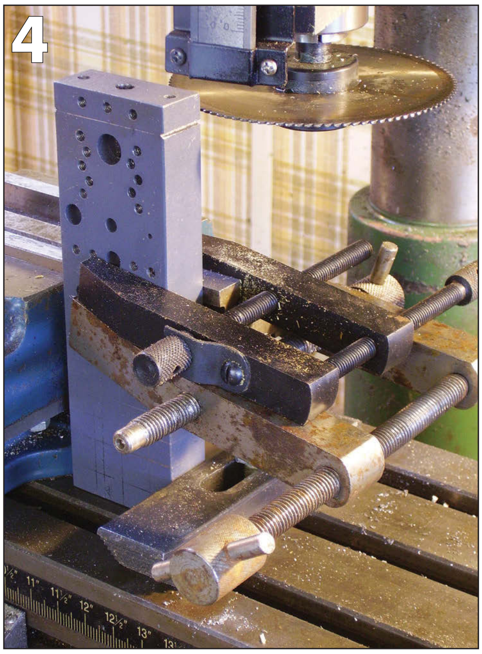


HEADING: The completed holding block, demonstrating its versatile multiple uses.

PHOTO 1: Two staple tools in Mark's workshop, but both with limitations hat led him to think outside the box.

PHOTO 2: Many clamping points means the drilling of many holes...

All photos and diagrams in this feature by Mark Brockley



to it making sure it was square, allowing the vice guides and thread holes to be drilled as in Photo 3. My mistake, however, was clamping the block to the wrong side of the parallel so when I came to start cutting the vice jaw off I had to re-clamp it. I also used a machine clamp this time – this can be seen in Photo 4 fixed to the table to prevent the block moving while marking all four sides with a slitting saw. I only cut approximately 3mm depth all round as a guide before I cut through with a hacksaw.

I went back to the milling machine and after setting up in the vice I milled the freshly cut end to a finished total length of 143mm. A 12mm slot drill was used to machine the 2mm deep slot for the alignment strip, Photo 5.

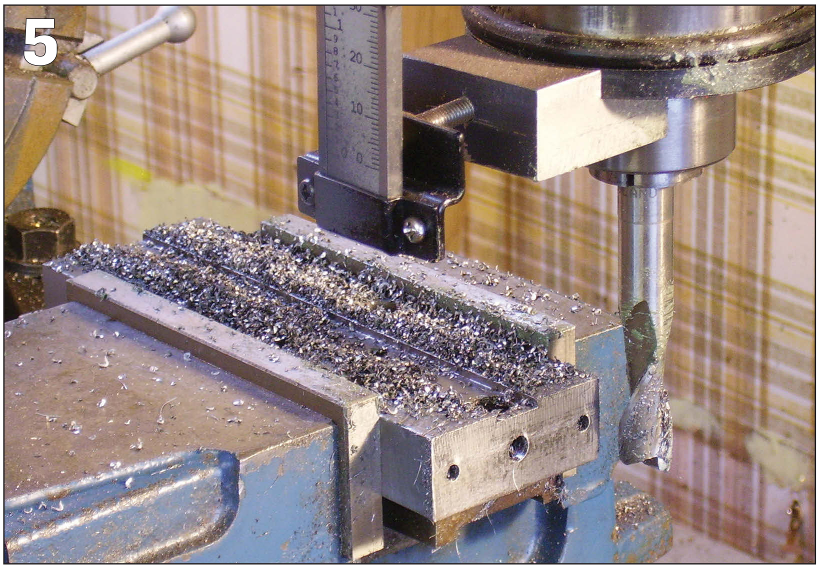


PHOTO 3: Parallel was clamped on wrong side...

PHOTO 4: So for cutting the block had to be re-clamped. Slitting saw marks sides.

PHOTO 5: Machining aligning slot.

PHOTO 6: Setup for V-slot machining.

PHOTO 7: Spot-drilling clamping holes.

PHOTO 8: Cleaning up moving jaw with a fly-cutter.

PHOTO 9: Making brass stepped washers.

Next I turned the block over and milled the 11 x 6mm deep slot in the end of the V block section. With a 6mm slot drill the end slot was machined to a depth of 8mm. Next the half rounds were machined with appropriate ball-nose cutters to a depth of half the cutter's diameter.

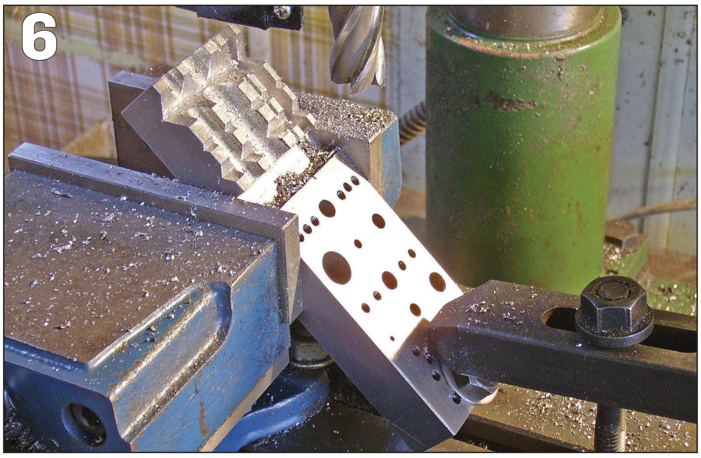
Slot machining

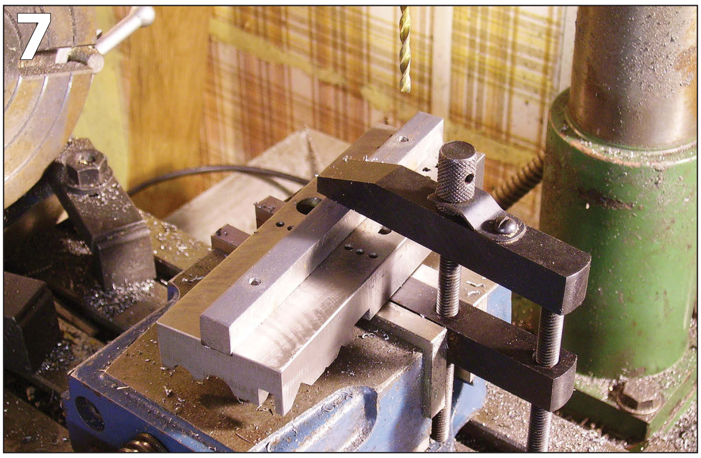
Photo 6 shows my setup for machining the V slots across the face of the block. I used a 45 degree square to set the angle in the vice, making sure the edge was firmly on the machine table. I then put a bolt through the vice nut hole and tightened a nut on the bolt to provide somewhere to place a clamp, giving extra rigidity while machining.

A piece of 12 x 12mm square black iron shown in Figure 2 was machined to length and then carefully skimmed until it was a tight fit in to the underside of the block and the machine table. After marking out and drilling the outer two holes M4 clearance I clamped it to the block and spotted through, Photo 7. I then countersunk the holes in the aligning strip and secured it to the block with countersunk screws to spot through the four clearance holes required. These were drilled through and any burrs left removed.

The next step was to clean up the moving jaw with a fly cutter, Photo 8. After cleaning up the jaw I pushed two 4mm dowels into it. These can be made up from silver steel but I have an assorted box of dowels on the shelf so used two at a length of 40mm. If they are not a good press fit a drop of Super Glue can be used before pushing them home.

Figure 3 gives the details of the dowels used along with the nut, thread and hand wheel/handle. The nut is a simple brass turning, made a good press fit into the block then drilled through while in situ before tapping M5. A length of M5 stud can be used for the thread – after cutting to length it was gently held in the lathe chuck to be cleaned up square with a file. I





All diagrams reproduced approx half full-size

made a brass hand wheel/handle with a light knurl then fixed it to the thread with a drop of Super Glue.

The jaw pins are M4 thumb screws – the large head helps hold a variety of items from thin sheet in the shoulder at the bottom to medium-sized bar. Another alternative is to use brass stepped washers as seen being made in Photo 9. I ground my own profile cutter to make decorative washers some time ago. I then used the rear tool post and parting tool on my Myford lathe to cut a square shoulder before parting the washers off. The thumb screws can be used or if preferred an ordinary cap head bolt to hold the washers to the jaws.

Threaded security

Traditionally this type of vice uses well-fitting pins that are easily slipped into the holes rather than threaded but I chose to use bolts. This then makes it possible to machine soft jaws from plastic or, aluminium and steel steel jaws could also be made with a V-grove machined into them to hold bar.

I have included in Figure 3 the clamps I have made so far for work holding but these can be made when required for a particular job as it arises. A stepped block can be made up from a short end of 12 x 12 square bar to help when clamping larger-sized items. I used a piece of M4 threaded rod and a flanged nut to hold my clamps but a bolt and washer will do just as well.

The scope is endless to make add-ons for this tool, making it indispensable in any workshop. Returning to the heading photo shows two uses for the block and pin vice. Clamped to one of the Vs is the centre wheel from a long-case clock so that a new hole for the minute hand retaining pin can be drilled. The pin vice is holding a delicate French count wheel so that the damaged square hole can be cleaned up before re fitting to the clock.

All I need to do when time allows is to make a wooden box to store all the parts along with the block itself to prevent parts going missing. EIM

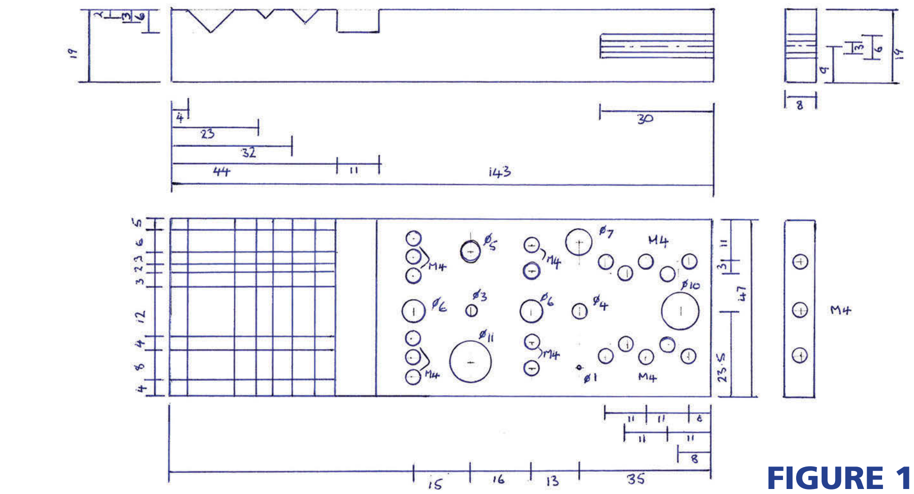


FIGURE 1

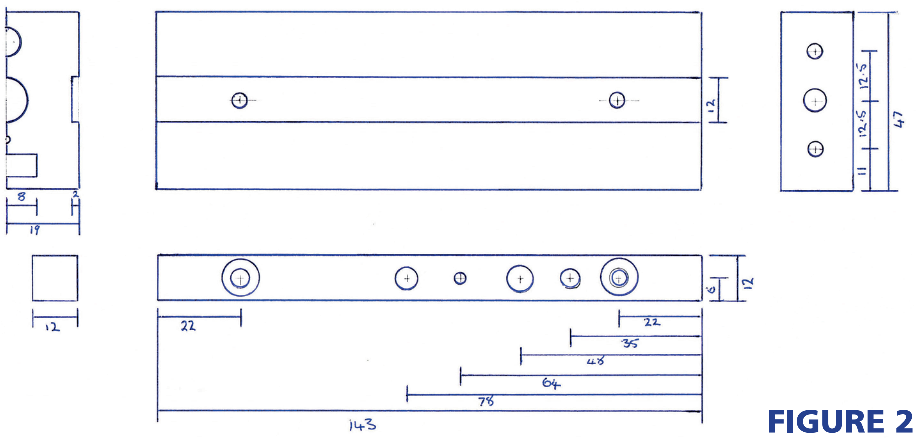


FIGURE 2

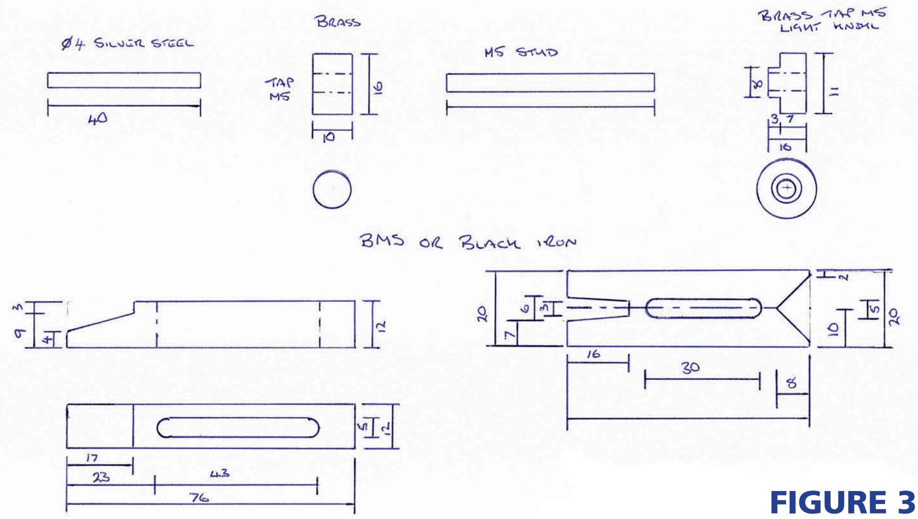
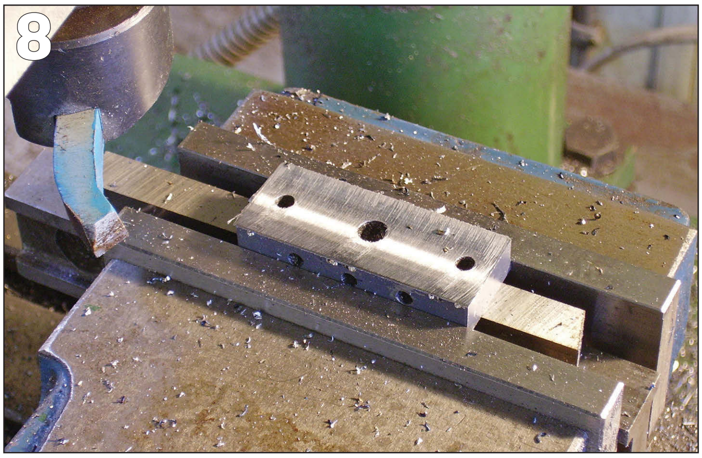
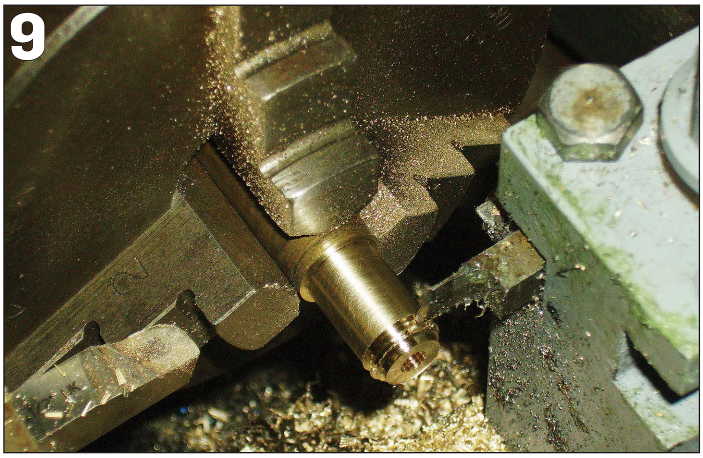


FIGURE 3



8



9

Water tube boiler for a CliShay

Mike's 7¼in gauge logging locomotive project requires a somewhat unusual boiler...

BY **MIKE TATTUM**

1

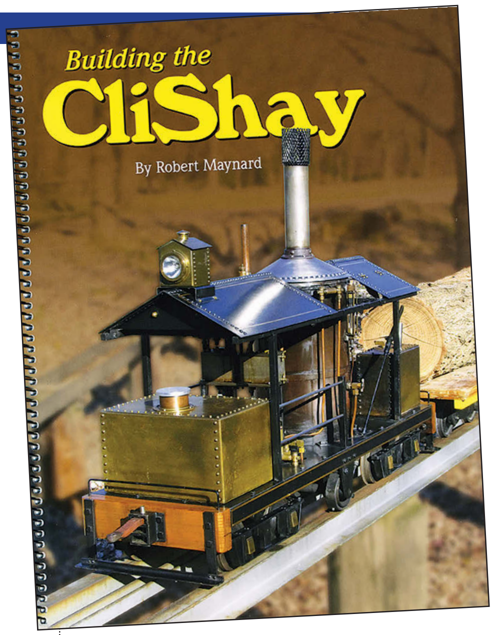


PHOTO 1: The completed water-tube boiler. – a very unusual item.

PHOTO 2: Drilling the main drum. All holes were centre drilled first and the cycle repeated with further drilling, finishing with a 15mm end mill.

All photos by Mike Tattum. Photo of CliShay book cover courtesy Camden Miniature Steam

I am building a Water Tube Boiler (Photo 1) for my CliShay locomotive, which is to Robert (Bob) Maynard's design. Bob, an American, loosely based his design on the logging locomotives built by Climax and Shay in the 1880s – hence the name 'CliShay'. Being an American design the gauge is actually 7½ inches so some adjustments are necessary for the engine to run on British 7¼in track.

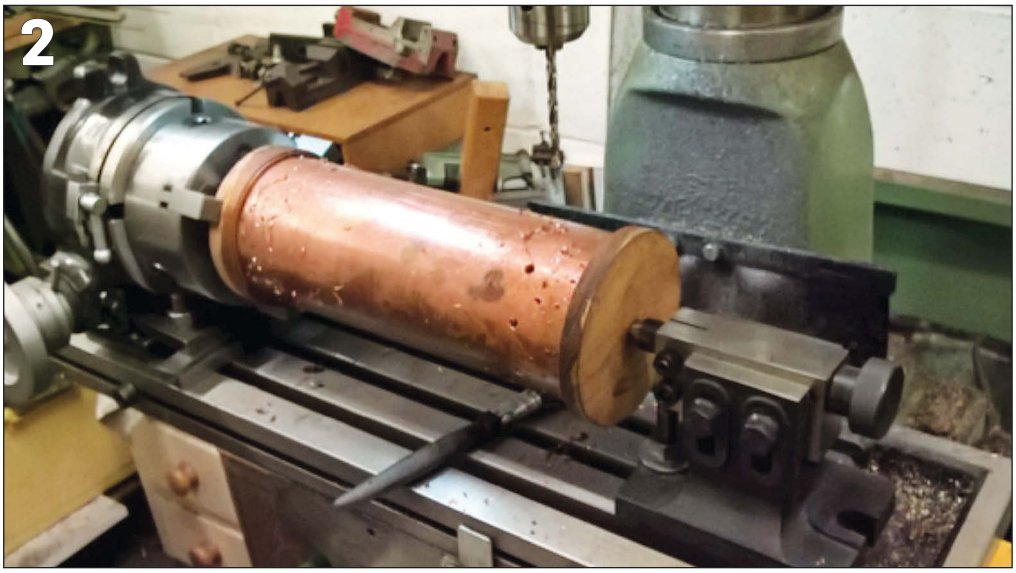
Designed as a simple beginner's engine the CliShay was featured as a series of articles in *Live Steam* magazine in the late 1970s and subsequently published in book form, *Building the CliShay* in 2012. The book is still available in the UK from Camden Miniature Steam (usual disclaimer) and an Internet search will reveal numerous posts and opinions on the locomotive.

The CliShay features a vertical water-tube boiler with power provided by a non-reversing vertical twin-cylinder steam engine, and runs on two four-wheel trucks (bogies). Power is transmitted by gear/chain drive with forward, neutral and reverse settings plus drive to all four axles. If you would like to see one running try putting 'CliShay' into YouTube.

Unlike a fire-tube boiler, where the insulation is wrapped around the outer shell of the boiler itself, the CliShay's water-tube boiler is suspended inside an insulated barrel with a firebox at its base and chimney on top. Being a vertical boiler there is sufficient natural draft to light the boiler without an auxiliary blower.

The design uses standard American copper tube and fittings,

2



none of which are commonly available in the UK, additionally the American way of describing tube differs in that US 4in pipe (which forms the main drum of the boiler) refers to the bore, making 4in diameter 10swg copper tube actually 4¼in outside diameter whereas in the UK 4in tube refers to the outside diameter, making the bore 3¾in diameter; I had to take this into account when building the boiler so as to maintain its overall size.

Whilst not interchangeable standard 15mm copper tube is a good substitute for American ½in domestic plumbing copper tube (used to make the water tubes, 20 in all). Bob's design calls for "½ Type L or M copper tube," and after some time spent searching the Internet I found that 'Type M' is essentially the same as our standard 'Yorkex' 15mm copper tube which has a wall thickness of 0.7mm as against Type M's 0.028 inches, and that Type L has a 0.040-inch wall thickness just about the same as a UK-produced tube with a 1mm wall thickness which goes under the trade name of 'Kuterlon'.

I tried local plumber's merchants for Kuterlon without success – none of those I approached had ever heard of it, the eventual reason appeared to be that Kuterlon is a specialist tube typically used on an industrial scale for underfloor heating. Further Internet searches eventually came up with Mytub Ltd of Whitley Bay (disclaimer), and the company was prepared to sell me one 5.8-metre length at a reasonable price.

As you can see from photo 1 the water tubes are not formed by bending but by soldering an assembly of elbows, tees and bushes, all of which were easily sourced or made. The design actually called for "standard copper street ell(s)" which translates as 'street elbows', or elbows with a tail that replicates 15mm tube and facilitates the fitting of a male part on one side of the elbow and a female on the other. By the time I had worked all this out I had already got the elbows so I decided to use what I had.

A lot of cutting

Having gathered the materials I needed the next stage was cutting and forming the various parts. I started with the main drum, 10in of 4in diameter 10 swg copper tube, which was plugged with wood and set up in the lathe for skimming the ends. The job was then transferred to my mill/drill (Photo 2), using a rotary table on its side with a centre to support the free end of the tube so that each hole could be indexed.

There are 20 water tubes in all so I had 40 15mm holes to cut, 20 at each end of the tube in two staggered rows of 10. In his book Bob describes drilling the holes in a pillar drill with ordinary drills. Copper can be difficult to drill and is inclined to snatch with potentially disastrous results. There are ways of grinding drills for cutting copper but rather than experiment with these I opted for finishing each hole using a nice new 15mm end-mill.

To start with each hole was centre drilled followed by opening out with a ¼in and then a ⅜in drill and finally the 15mm end-mill. White spirit was used as a cutting fluid and worked well with each hole being a snug fit to a piece of 15mm tube. This was a laborious task, 160 cutting operations in all, but I was not prepared to risk the rather expensive main drum. To speed things up and reduce on tool changes the drilling was done by indexing and coordinates so all the centre holes were drilled first followed by drilling and finish end-milling.

Bob recommends partially assembling the water tubes and then soldering the rest of the boiler in one go with the aid of helpers. By doing it this way the final count of joints to solder is reduced from 147 to about 77. This may not be a problem for experienced builders but was still too much for me, especially as many of the joints are hard to get at (see photo 1). After some thought I decided to solder the boiler in three stages. Firstly I would solder the 20 water tube sub-assemblies, stage 2 would be soldering the water tubes to the main drum, and finally soldering the end caps and associated parts.

The big advantage of stage 2 is that the water tubes can be soldered from the inside of the main drum rather than the outside which is very congested and would result in the flame playing directly on the elbows and tees for some time. Soldering from the inside largely avoids this problem and allows for a clear view of each tube and its soldered joint, so if a joint does not look right it can be fairly easily corrected.

Because the main drum had been coordinate-drilled the drum could be used as a jig to align each of the 20 water tubes; 10 long and 10 short. The short water tubes comprised a main tube, two short tubes and two elbows making four joints in all. The long water tubes comprise five plain as for the short tubes and five 'specials' which have tees and bushes.

Test fitting

All the water-tube assemblies were first cut and dry-assembled to check for fit – and to avoid confusion. Work then started on making the joints but firstly a test piece was made up to show that the silver solder (55 per cent silver) would flow into the normal gap made by the copper fittings, (Photo 3) and it did easily.

The minimum gap advised for 55 per cent silver solder is 0.002 inch which was ideal for soldering the tubes and fittings but not for 'gap' filling which meant that I had to be careful with the fit of other parts of the boiler.

PHOTO 3: Sectioned test piece. Silver solder was fed from the outside and can be seen as white line at the inner end of the bush. The actual tube joint lies between the two arrows and again the silver solder can be clearly seen..

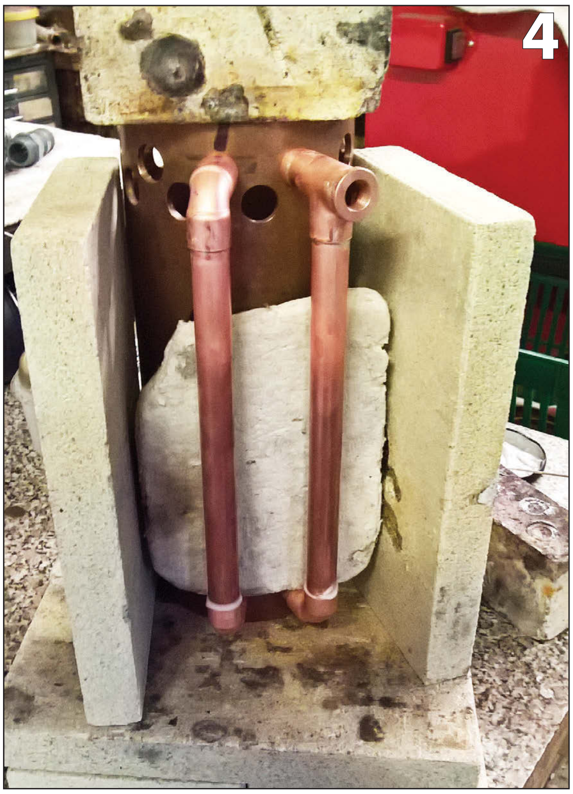


PHOTO 4: Tube assemblies prepared for soldering up.

With all 40 water tubes soldered except for one joint, that between the long tube and the elbow, it was time to use the main drum as a jig. The first tube assemblies were fluxed and assembled on the main drum (**Photo 4**). The short tubes fitted nicely into the end-milled 15mm holes so no other support was needed. Insulation was placed around the joint and using a Sievert 3941 nozzle soldering began. The joint was brought up to heat and touched with the solder which flashed around the joint and disappeared inside exactly as advertised.

I should say at this point that Bob used 15 feet of $^{1}/_{16}$in diameter silver solder in making his boiler, I bought five metres (ouch!) of 1.6mm silver solder and used all but 18 inches; most joints took around 8mm of solder.

"The last 20 tubes were soldered as readily as the first and I staggered off for a much-needed mug of tea..."

The assembly was allowed to cool and removed from the jig – this required a firm pull because, or so I thought, of the difference in expansion between the main drum and the thinner water tube. The joint was sound so I pushed on and over the next two days soldered the rest and that is when I hit the first snag.

One of the long water tubes carries the water gauge and a blow-down valve at its base. It is made up of three tees, four pieces of tube and three bushes and is the most complex water tube of all (see photo 1). Whilst the final joint was being soldered the adjacent bush moved so the assembly was removed from the jig, placed so that each bush was face-down on a refractory brick and reheated with the expectation that with the solder molten a gentle push (with a brass rod) would get the bush back into place, and it did.

The assembly was cleaned up and an attempt made to check it against the jig and the assembly had shrunk by nearly ⅛th of an inch. Why? The answer seemed to lie with the way the final joint was made. In all others the tubes are pushed fully into the elbow or tee, but with the final joints allowance was made for adjustment so when the joints were made the tube did not reach fully to end of the joint. On being reheated to reseat the bush it seems that somehow capillary action 'sucked' the tube to the bottom of the joint reducing the overall length of the water tube – this may in part explain why all assemblies required a firm pull to remove.

Learning from an issue

The assembly was scrapped and replaced by a new one. To avoid any further problems each joint that had a bush fitted was secured by punching with a round-nosed punch effectively

PHOTO 5: Ready to solder the water tubes to the main drum. Note the 1-inch thick ceramic blanket wired in place and the whole assembly set on ceramic blocks.

PHOTO 6: End cap assembled with mahogany formers, ready for flanging.

PHOTO 7: Final assembly of the boiler ready for soldering the top end cap, steam take-off bush and stays in place.

pinning each bush in place so it could not move if the solder was remelted.

Next up was stage 2, soldering the water tubes to the main drum (Photo 5). This turned out to be fairly straightforward. All parts were fluxed and assembled, each water tube requiring a light tap with a soft mallet to get it in place and making the assembly self-jigging.

A 25mm thick ceramic blanket was secured around the assembly and then it was out into the garden to do the soldering. Using a Sievert 2942 nozzle the assembly was easily brought up to temperature despite it being a frosty day. The only problem was that the sun had come out making the joints difficult to see – I won't make that mistake again. I quickly worked around the assembly using about 8mm of solder on each joint which flashed through nicely. The ceramic blanket was so effective that I was able to turn the assembly over with my bare hands – I did check first!

Marathon effort

The last 20 tubes were soldered as readily as the first and I staggered off for a much-needed mug of tea. Once cooled the assembly was cleaned and checked with all of the joints passing a visual inspection.

The last stage included making and fitting the 3mm thick copper end caps. The former and backing disc for making the end caps were made from mahogany (Photo 6), they were screwed together with the disc for flanging trapped in the middle, the pattern of holes matching those for the longitudinal stays. Screwing the former and backing plate together ensured that the end cap did not move during forming.

The copper was fully annealed and the assembly secured in the vice. Flanging, with an 8oz hammer, started with gentle taps working round the flange of the end cap and as soon as resistance from the copper was felt the hammer was moved on until the first pass around the cap was complete. The embryo end cap was then re-annealed and flanging continued.

Each cap was annealed several times before the flanging process was completed. The end caps were then trimmed to length and carefully fitted by filing to their respective end of the main drum. The caps were made a light push-fit to ensure the sliver solder had space to flow. The recommended soldering gap is 0.002in so the end caps needed pinning to ensure that they did not move when being soldered.

With each cap correctly positioned three $^{1}/_{16}$in holes were drilled equi-spaced around the rim of the main barrel – these were to take $^{1}/_{16}$in copper rivets on final assembly. To ensure that the rivets would not fall out each one was lightly squeezed in the vice so that they would fit snugly into their respective holes.

Final assembly of the boiler comprised of cleaning the main drum where the soldering was to be carried out, fluxing all of the joints and then fitting the end caps. Each of the six rivets was fluxed and gently hammered into place leaving a slight gap between the rivet head and the main drum. With my little 1oz hammer I went around each rim carefully tapping it into closer contact with the respective end cap.

I had previously noted where there was a bit of a gap when dry-fitting the end caps and this final adjustment with plenty of flux in the gap would ensure the silver solder could do its job without having to be a gap filler too, something it really is not suited to doing. The four ¼in copper stays were lightly squeezed at one end, fluxed and threaded into place.

A longer stay

To help with finding the corresponding hole in the end cap at the far end of the main drum each stay was made an inch or so longer than necessary and given a tapered point. This worked well with the excess being cut off after soldering. Finally the steam take-off bush was fluxed and fitted into the top end cap, the ceramic blanket refitted (Photo 7) and the final soldering commenced.

Again I used the Sievert 2942 nozzle – this soon had the assembly up to temperature, the silver solder flowed nicely especially in the joint between the end caps and the main barrel, each of which took over six inches of silver solder, and as I discovered after cooling and cleaning had flowed neatly under the heads of the $^{1}/_{16}$in copper rivets. Whilst the stays and the steam bush were touched with the silver solder rod the rivets were not. I fully expected the solder to flow down into the joint between the end caps and main drum and seal the flattened rivets which it did (Photo 8).

With all soldering done, the four stays trimmed to length, the boiler cleaned up and all joints passing visual inspection it was time to see if the boiler could take the test pressure of 200psi (Photo 9). The boiler was prepared and pressure gently raised past 40psi... 50psi…60psi and silence, no leaks, no creaks. Finally 200psi was reached and held for 30 minutes. This was longer than necessary but I had to be sure. This was followed a week later with a formal test by the Hereford SME boiler inspector who expressed himself completely satisfied with the inspection and test.

The next stage is to make the insulated jacket for the boiler, followed by the firebox, chimney and boiler fittings. EIM

EDITOR'S NOTE: A fascinating project – we look forward to further CliShay updates from Mike in future editions of EIM.

"The only problem was that the sun had come out making the joints difficult to see…"

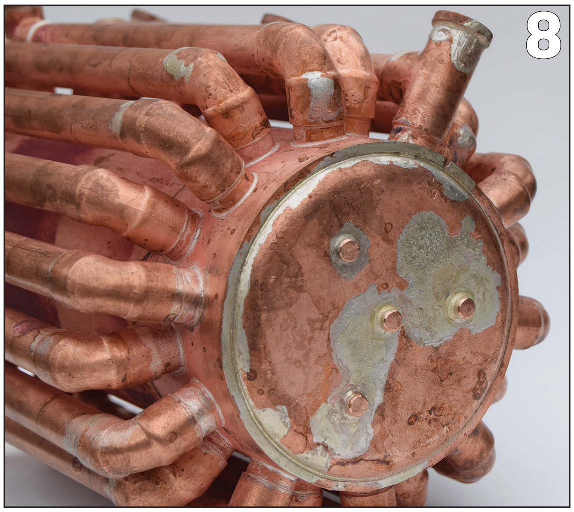


PHOTO 8: The bottom of the boiler showing how the silver solder has flowed around the various joints.

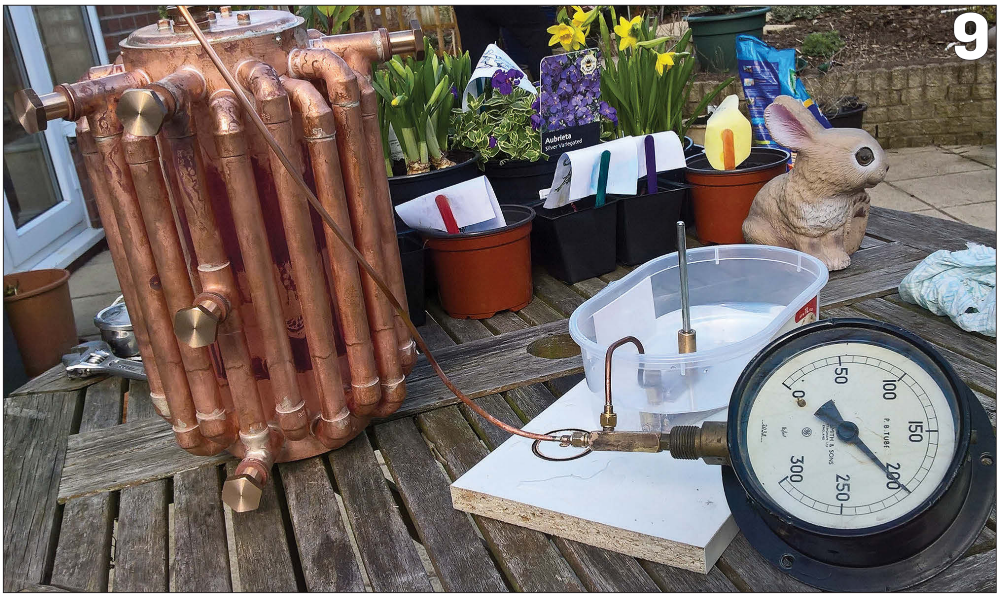


PHOTO 9: Pressure testing the boiler prior to the formal test at Mike's local club the Hereford SME.

Making a spark arrestor

Ron describes a useful and in many ways essential upgrade to a locomotive

BY **RON HEAD**

I recently acquired a secondhand locomotive which, despite being in basically good running order, had clearly come from a club where spark arrestors, safety chains, and even red lines on pressure gauges, were unheard of! The latter two items were quickly attended to, but making a spark arrestor to fit the loco took several attempts before a satisfactory solution was arrived at.

Spark arrestors are frowned upon in some circles, with claims that they clog up and affect the steaming of the locomotive. I think this indicates the use of too fine a mesh. We are not trying to stop every particle from coming out of the chimney, and fine ash is generally not too much of a problem. What we are trying to stop are the large glowing embers of coal, which can cause burn injuries to bare flesh, or damage to clothing.

Before spark arrestors were made compulsory at our Cutteslowe Park Miniature Railway operated by the City of Oxford Society of Model Engineers, we did indeed incur some burns injuries, mainly to children, but there was also a lady who was none too pleased when a burning lump of coal went down the neck of her dress! In today's litigious society, it's important not to have accidents which are entirely preventable.

A spark arrestor can be constructed in one of four forms:
1) Mesh baffle plates mounted across the tube nest.
2) Something sitting on top of the chimney, containing a mesh.
3) A narrow roll of mesh, inserted down the chimney to enclose the blast orifice and blower jets.
4) A wide cone or cylinder of mesh, inserted through the smokebox door and enclosing both the blastpipe and the petticoat.

Now each model engineer will have their own preference, but for my money type 1 is too difficult to fit, and can cause the tubes to block, as the ash is retained against the tubeplate. Type 2 looks ugly, obstructs the exhaust flow, and collects oil. Type 3 has only a small 'free' area, and being within the petticoat, can disrupt the exhaust flow. Which leaves type 4 as the only realistic solution for me.

Before I describe my own spark arrestor, let me say that I've seen some very elaborately made devices on model locomotives and I'm full of admiration for these. The one I'm about to describe is cheap and cheerful by comparison, but it's quick and easy to make and will do the job.

Size matters

The selection of mesh size is critical. I've seen spark arrestors made from very fine mesh, like you would find in a tea strainer, and these will indeed block up in no time. At the other end of the scale, a spark arrestor that is too coarse might as well not be there.

A search on the Internet found a company called Inoxia (www.inoxia.co.uk), that can supply stainless steel mesh in various pitches and sheet sizes. From experience with another engine, I considered ⅛in pitch to be just right for 5-inch gauge, and I bought a 300mm x 300mm sheet of '8 mesh' as it is called, for just under ten pounds.

My initial thought was to make the spark arrestor as a truncated cone, with the narrow end enclosing the blastpipe and the wide end enclosing the petticoat, and I went so far as to draw out a development of the shape and cut one out of card.

"The one I'm about to describe is cheap and cheerful, but it's quick and easy to make and will do the job..."

LEFT: The arrangement of the spark arrestor in Ron's locomotive – full details of its construction are in the text..

However, the mesh is woven and not welded, and I realised that any attempt to cut it into anything other than a rectangular shape would cause it to fall apart at the edges. The body would have to be cylindrical.

To support the mesh cylinder, I drew up a base ring, slightly larger in diameter than the petticoat. This would sit on the blastpipe, clear of the blower jets, and would have a ledge to support the mesh. I then turned it from a suitable offcut of brass bar, cut a notch in the side to accommodate the blower pipe, and fitted an 8BA screw to secure it to the blastpipe. A further card model of the mesh was made, and fixed to the base ring with tape.

Now on some engines it should be perfectly feasible to offer the complete arrestor up around the petticoat, lifting it over the blastpipe before dropping it down into position, but not on mine! The petticoat is high up in the smokebox, and the card ring hit the curved inside of the smokebox before the base ring would clear the blastpipe.

Back to the drawing board as they say, and I searched for fresh ideas. The base ring would have to go in first, and the mesh would have to be made in two halves, but how to join them together? It was beginning to look complicated.

Spring-loaded

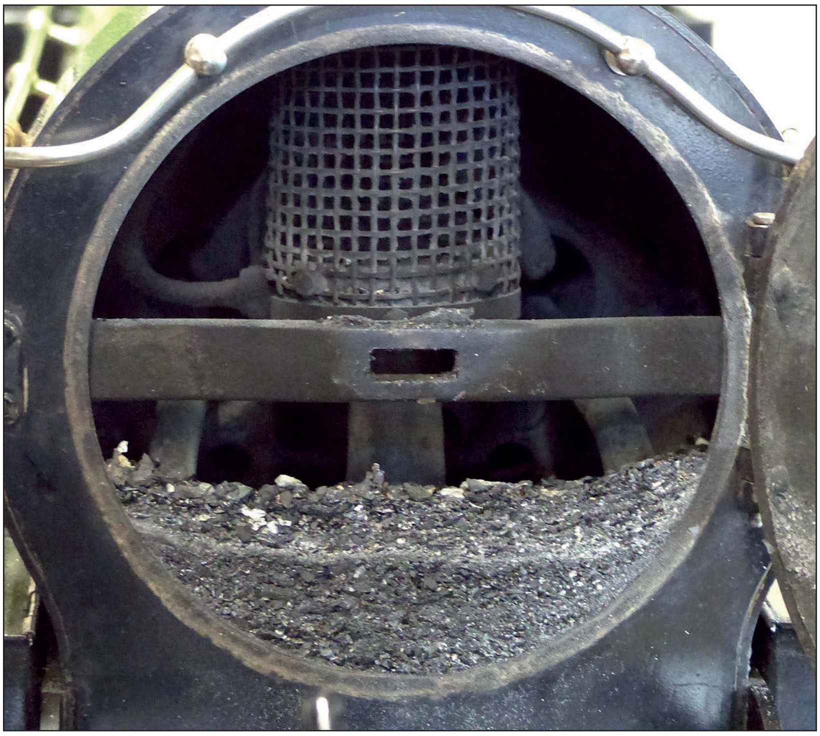
I then realised that as the mesh is quite springy, it should be possible to make it in one piece and spring it into place over the petticoat and base ring. The mesh was therefore cut and rolled into a cylinder, with an overlap of about ¼in.

This worked well, so I drilled two more holes in the base ring, one each side of the centre, and tapped them 8BA. After springing the mesh into place, two 8BA screws were inserted through the mesh to keep it in place.

Just as I was congratulating myself on a job well done, I suddenly discovered that I couldn't shut the smokebox door! The smokebox on this particular engine is very short, and the end of the dart was fouling the base ring. However, all was not lost, and to overcome this unexpected snag, I cranked the crossbar forward and made a shorter dart. All of this can be seen in the first photograph.

In service, I've had no trouble with clogging of the mesh, despite driving the engine fairly hard at times. After about two hours running with passengers, there will be a heap of cinders in the bottom of the smokebox, and an oily deposit around the blast nozzle, which has attracted a certain amount of soot. The second photo shows that despite the heavy accumulation, the mesh is entirely unclogged. After vacuum cleaning the smokebox, the mesh and base ring are easily removed, and only need a quick scrub with white spirit and an old toothbrush. EIM

"Just as I congratulated myself on a job well done, I suddenly discovered that I couldn't shut the smokebox door..."



ABOVE RIGHT: The scene at the end of a clearly busy run, with a nice pile of ash at the base of the box.

The Editor adds... Spark arrestors are important in model engines and essential in full-size ones to avoid setting the countryside alight, as the photo below clearly demonstrates! The lack of them can also have less serious but annoying consequences – I remember attending a members basically beer special on my local line a couple of days after Christmas, wearing the new fleece my daughter had given me as a present. Suffice to say that the loco crew thought it was a good idea to leave the spark arrestor off and when said daughter saw the nice little holes burned in my new apparel – I was not exactly in her good books...

RIGHT: This photo, taken by James Waite for our sister magazine *Narrow Gauge World*, clearly illustrates what escapes when no arrestor is fitted! The Avonside 0-4-2T was pictured on the Paton's County Railway, a heritage line in South Africa

A Distinguished Gentleman

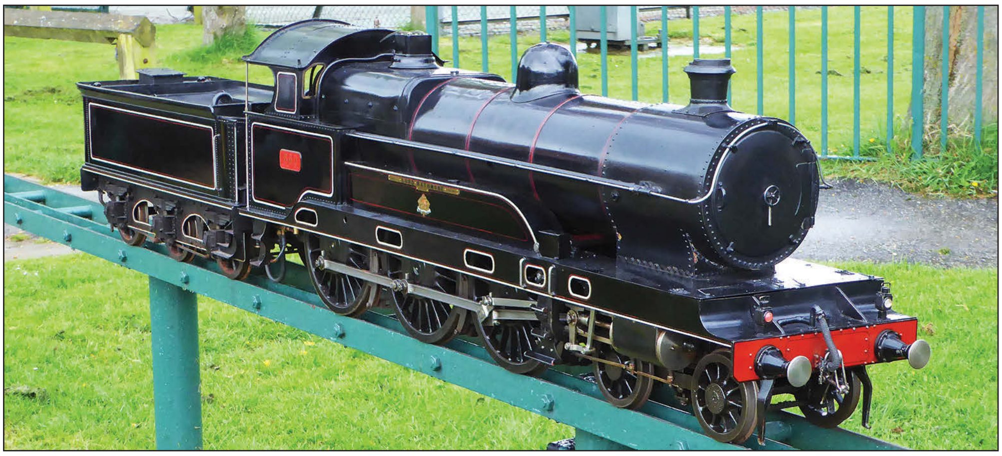
Mike describes the design considerations that went into his 5-inch gauge London & North Western Railway Claughton 4-6-0 No. 650 'Lord Rathmore'.

BY **MIKE WHEELWRIGHT –** Part Two of Five, Design considerations

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!

Being a North Western enthusiast and a member of the LNWR Society I was reasonably well acquainted with the prototype and I had a fair bit of information in my library including works on LNWR engines by Nock and Tuplin with plenty of photos from Talbot's illustrated book of LNWR Locomotives. Nock's book, *LNWR Locomotives of C.J. Bowen Cooke* was useful as it contains nice clear photos and a general arrangement-type drawing reproduced from *The Engineer*. As usual the main source of information was a copy of a Claughton general arrangement from the archive at the National Railway Museum.

Knowing the degree of standardisation at Crewe I also purchased a set of Don Young 'Etna' drawings so I could copy ancillaries such as buffers, chimney and fittings directly, or with slight modification. With this to hand I set to with a large sheet of paper on the drawing board laying out a feasibility draft for a $1\frac{1}{16}$th scale model. This was an elevation showing frames, wheel centres, wheels, centrelines of motion, cylinder outlines with valve centres, boiler and smokebox outlines with odd bits of detail such as the location of the expansion link so I could have a look at fitting in the valve gear. A section at the cylinders showed how the width would work out (always a problem in miniature) but things went together well and it turned out only ¼in oversize. I could see that the critical areas were the arrangement of the four cylinders with their valves and a valve gear layout that would give reasonable events when fitted into the reduced space created by the front axle drive. With this latter I had a feeling that Jackson and his team at Crewe had gone through a similar experience 90 years earlier which might explain the short valve travel.



ABOVE: The finished Claughton – *photo by David Baldwin.*

BELOW: Mike designed his own cylinders rather than copy the complex versions of the prototype.

FACING PAGE: Detail drawings of the cylinders and their piston valves.

All photos and drawings in this feature by Mike Wheelwright unless stated

The space above the trailing axle for accommodating the grate and ashpan was a bit restricted but this is not unusual for a big wheel 4-6-0.

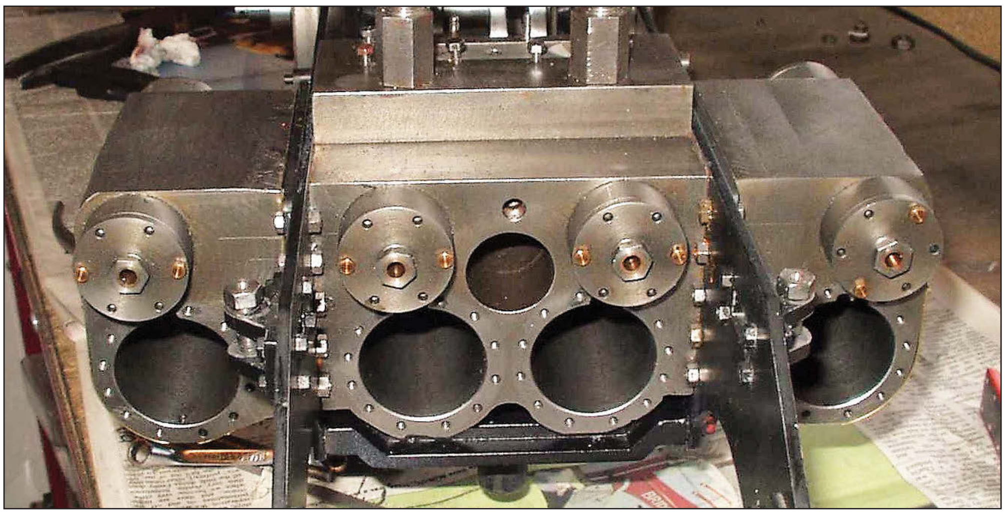
The Cylinders

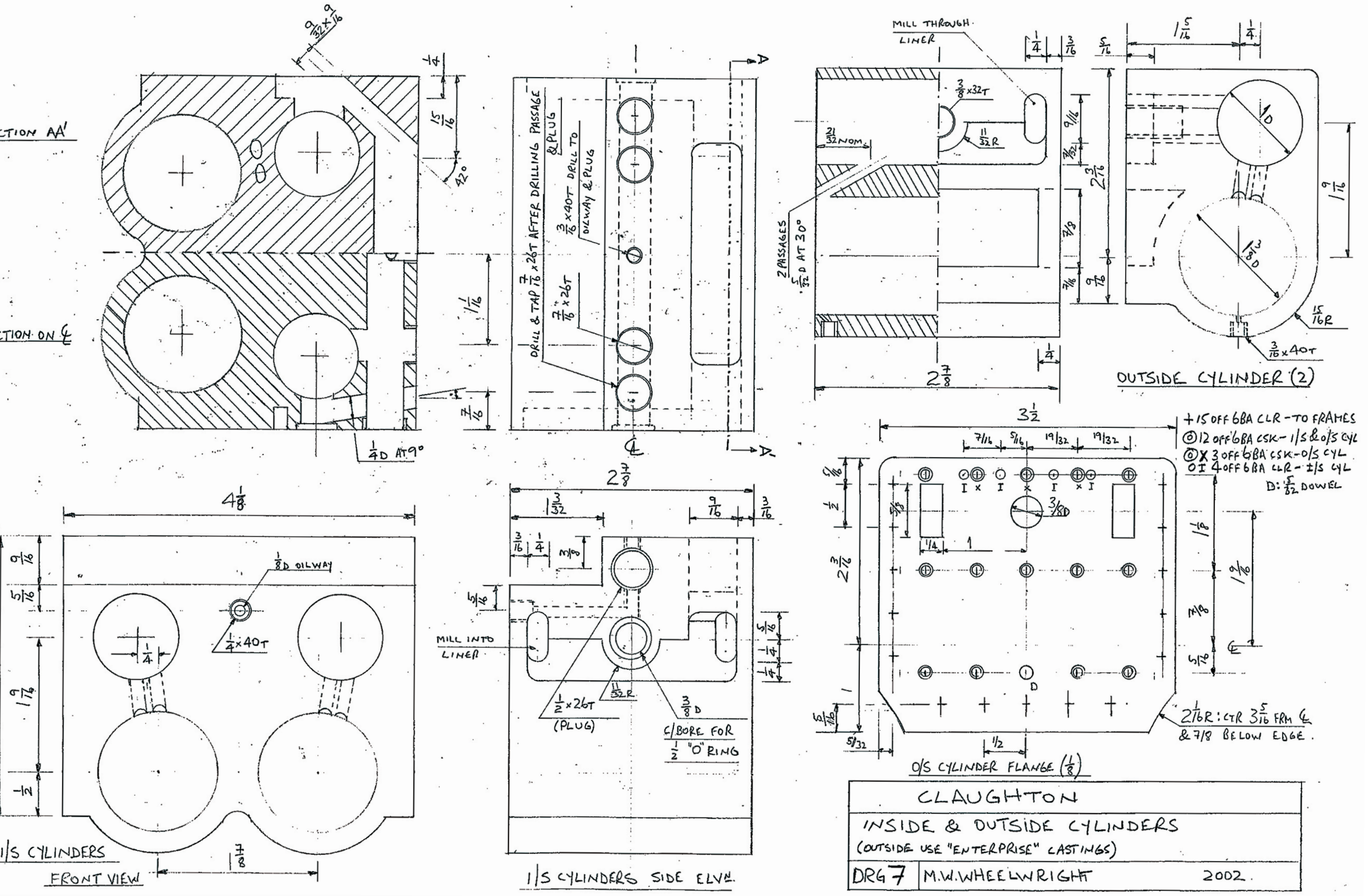
I spent quite some time working out a suitable design for the cylinders as under no circumstances would I attempt to copy the prototypical arrangement. Two contemporary English four-cylinder 4-6-0s (the GWR Star, L&Y Dreadnought) had their inside and outside cylinders staggered and attached to the frames conventionally but the LNWR experience with the Webb four-cylinder compounds, in which all cylinders were in line, prevailed and it was no surprise to see this reappear on the Claughtons.

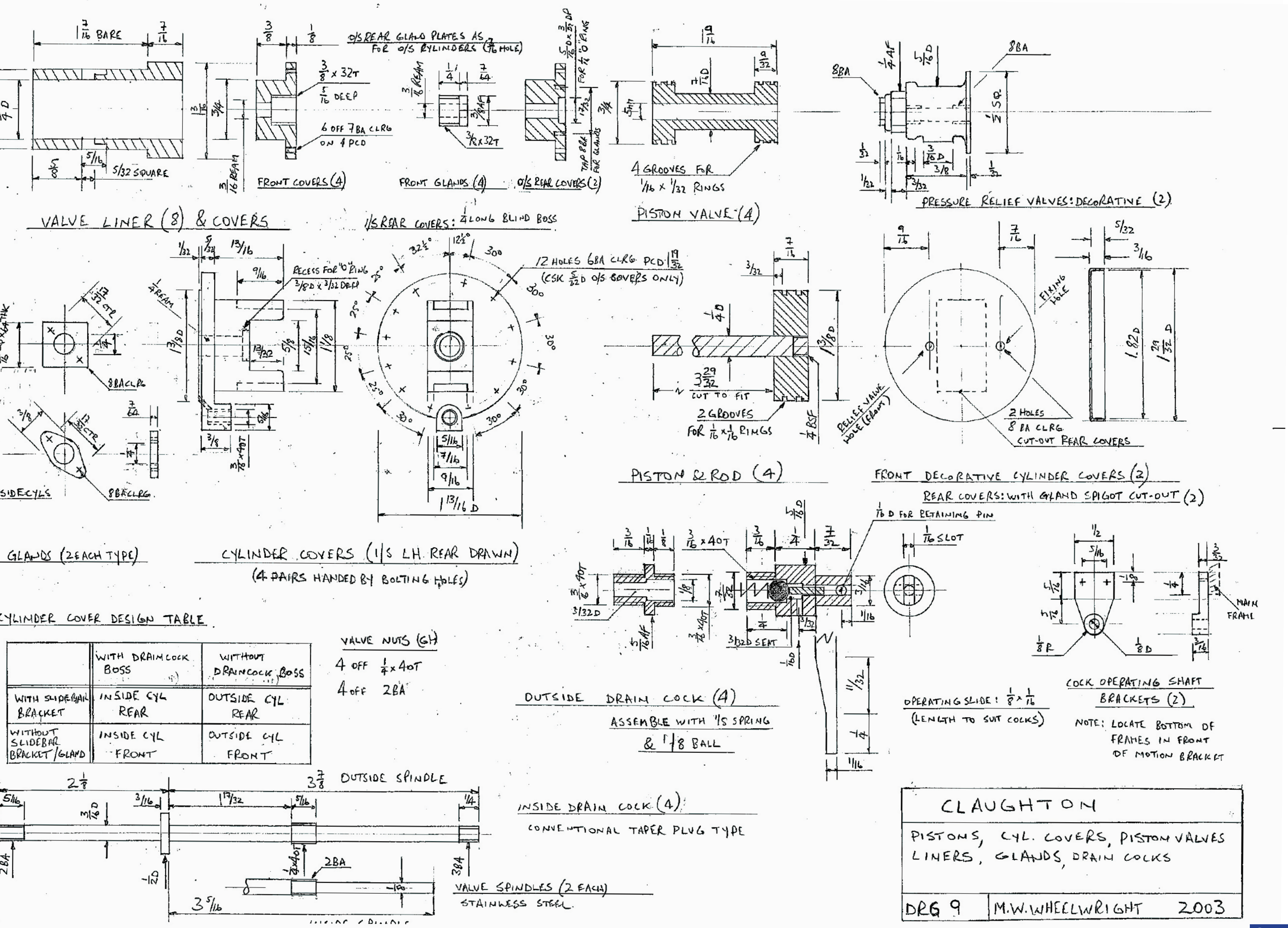
Each cylinder casting consisted of one outside cylinder and the adjacent inside one, plus valve chests, straddling the frame and two such blocks were bolted together on the engine centreline. Unlike American two-cylinder practice there was no cast-in smokebox saddle and as the assembly did not rest on bar frames each casting had a slot between the inside and outside cylinders extending up from below so that the block could be slipped over the plate frame, of reduced depth at that point, and bolted to it.

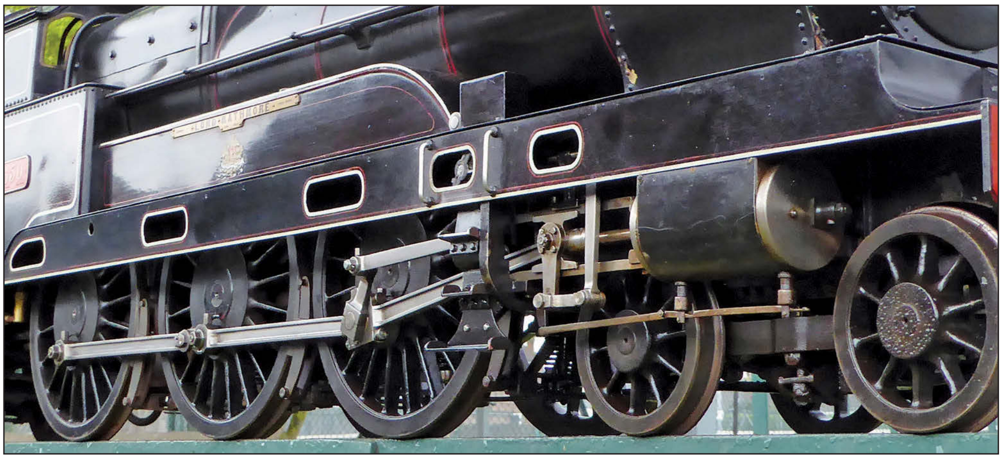
The steam and exhaust passages were cast into the cylinders so there were no pipes or holes in the frames, although passages were rather contorted. This was rejected out of hand as too difficult for making patterns and castings as well as for assembly. I resorted to attaching an inside cylinder block to the frames in the normal way, but using countersunk-head screws and locating dowels, followed up by mounting the outside cylinders on the other side bolted through their flanges as usual.

The through-frame passages were dealt with using short steam pipes ▶




CLAUGHTON
INSIDE & OUTSIDE CYLINDERS
(OUTSIDE USE "ENTERPRISE" CASTINGS)
DRG 7
M.W.WHEELWRIGHT
2002
OUTSIDE CYLINDER (2)
O/S CYLINDER FLANGE (1/8)
I/S CYLINDERS FRONT VIEW
I/S CYLINDERS SIDE ELVN.
SECTION AA'
SECTION ON ℄
MILL THROUGH LINER
MILL INTO LINER
2 PASSAGES 5/32 D AT 30°
1/8 D OILWAY
C/BORE FOR 1/2 "O" RING


CLAUGHTON
PISTONS, CYL. COVERS, PISTON VALVES
LINERS, GLANDS, DRAIN COCKS
DRG 9
M.W.WHEELWRIGHT
2003
VALVE LINER (8) & COVERS
FRONT COVERS (4)
FRONT GLANDS (4)
O/S REAR COVERS (2)
I/S REAR COVERS: 1/4 LONG BLIND BOSS
PISTON VALVE (4)
PRESSURE RELIEF VALVES: DECORATIVE (2)
GLANDS (2 EACH TYPE)
CYLINDER COVERS (I/S LH REAR DRAWN)
(4 PAIRS HANDED BY BOLTING HOLES)
PISTON & ROD (4)
FRONT DECORATIVE CYLINDER COVERS (2)
REAR COVERS: WITH GLAND SPIGOT CUT-OUT (2)
CYLINDER COVER DESIGN TABLE
WITH DRAINCOCK BOSS
WITHOUT DRAINCOCK BOSS
WITH SLIDEBAR BRACKET
INSIDE CYL REAR
OUTSIDE CYL REAR
WITHOUT SLIDEBAR BRACKET/GLAND
INSIDE CYL FRONT
OUTSIDE CYL FRONT
VALVE NUTS (GH)
4 OFF 1/4 x 40T
4 OFF 2BA
OUTSIDE DRAIN COCK (4)
ASSEMBLE WITH 1/S SPRING & 1/8 BALL
INSIDE DRAIN COCK (4)
CONVENTIONAL TAPER PLUG TYPE
OPERATING SLIDE: 1/8 x 1/16
(LENGTH TO SUIT COCKS)
COCK OPERATING SHAFT BRACKETS (2)
NOTE: LOCATE BOTTOM OF FRAMES IN FRONT OF MOTION BRACKET
OUTSIDE SPINDLE
VALVE SPINDLES (2 EACH)
STAINLESS STEEL



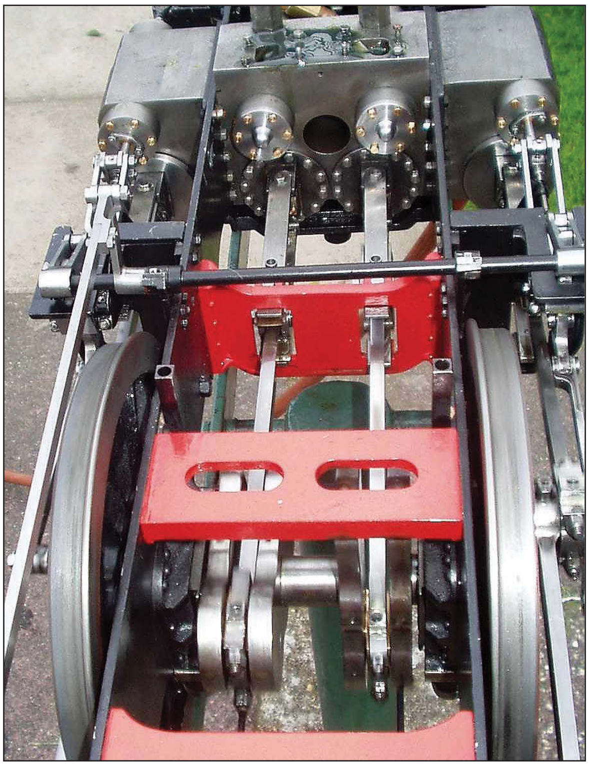
projecting from the back of the outside cylinders passing through the frames into matching holes in the inside block and sealed by O-rings compressed on assembly of the outside cylinder. Various holes in the frames at steam chest level allow exhaust steam from the cavity in the outside block to pass to another one inside, as this is at low pressure liquid gasket is sufficient to make things steam tight, and all exhausts merge there before passing to the blast pipe.

At first I entertained doubts about the passageways to the outside cylinders, especially for the exhaust, but they were dispelled once I had 'Lord Rathmore' in steam: maybe things could be improved but they seem to work fine.

Cylinder sizing is close to scale at 1⅜"in x 2¼in with ¾in diameter piston valves – the pistons carry two cast iron rings as does each valve head. Ports are $^3/_{16}$in wide and valve heads at $^5/_{16}$in provide ⅛in lap, I regard these dimensions as normal for a medium size five-inch gauge engine and in this case they are particularly favourable as the cylinders are small. With this lap a long valve travel is required: $^9/_{16}$in full gear travel gives a maximum steam opening of $^5/_{32}$in and exhaust opens fully even when notched up considerably.

ABOVE: Close up of the outside cylinder and motion. *Photo by Dave Baldwin.*

BELOW: Before the boiler was fitted, showing the arrangement between the frames.



The valve gear

Let me own up right away, I have a mathematical background and valve gears are just linkages so I don't draw out multiple alternatives but just calculate valve movements. On the other hand I still find it easier if I can actually see the thing itself so I laid out drafts of my preferred arrangement on the drawing board at x2 scale and cross checked by calculation. Since then I have tackled designs for other engines and I have run up a few Excel spreadsheets to crunch the numbers for me.

Even if the valve movements are satisfactory I draw up the entire linkage at different rotational points and show adjacent parts to check for fouls, particularly in extreme positions. A fellow modeller ran into difficulties when constructing a five-inch gauge locomotive despite making all the valve gear components accurately to published drawings. The valve events tabulated by the designer looked quite nice but in the flesh, so-to-speak, things collided and the wheels would not go round.

The particular challenge I faced came from my desire for a model with better valve events than the prototype: luckily I had 90 years of hindsight to help me. The changes I wanted to incorporate arose from my overscale lap and consequent longer full gear valve travel plus my liking for big leads, 0.030in is considerably overscale for the Claughton.

I know many modellers cannot understand why I would want so much lead but to avoid turning this article into a treatise on the effects of lead I will just say that it provides bigger port openings at any particular cut-off which is very useful for pulling hard when well notched up. Just have a look at the performance of LMS three-cylinder engines when their leads were increased to $^5/_{16}$in (28 thou scale).

The lap + lead of 0.155in was easily obtained by adjusting the proportions of the combination lever, this is about 50 per cent more than scale and it made a useful contribution to the valve travel but the rest of the extra movement had to come from the die block. The options are simple: either more swing of the expansion link or a longer link, but they leave very little room for manoeuvre.

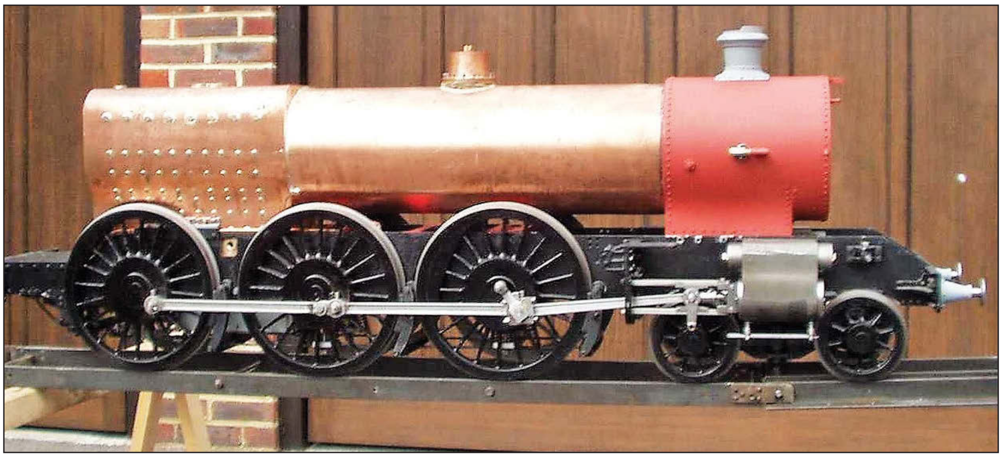
The prototype has a swing of just over 20 degrees each side and a bit more was acceptable but anything much greater would be detrimental to events with a lot of die slip and possible locking up towards maximum swing. I was pushed into elongating the expansion link which brings additional complications on this engine where it is located behind platework with the upper part enclosed in a box-like cover above the framing.

I compromised by using a cocktail of changes: a few degrees more swing, increasing the length of the link, setting the link trunnions slightly lower so as to reduce the projection above the plate. Mounting the link lower down is almost unnoticeable (says I) and the bigger cover is not too exaggerated.

In the end I got my desired lap and lead with full gear cut-off at 75 per cent, a bit early so setting back to get away is occasionally needed. The good news is that even at a cut-off of 35 per cent the ports open to steam by 0.050in and almost fully to exhaust, so the reverser wheel gets plenty of use.

The return crank on Walschaerts motion always needs careful design: I wanted mine to look like the real thing as well as having positive location. All my valve gears are assembled without provision for subsequent adjustment and angular relationships are fixed, usually by fitted pins, but of course the return crank has to be removed if the motion needs to be taken down and keeping the timing was essential. The Claughton return crank fits on to the crankpin like a split big end tightened by studs, I just added a non-prototypical $^1/_{16}$in roll pin across the diameter. The crank arm is put on and located by the roll pin before tightening up the cap with the studs, the driving force is taken by the clamp, not the pin.

One item that caused me a bit of consternation was the union link that drives the bottom of the combination lever, for which I had only an elevation. Usual practice is for forked ends embracing the combination lever but from the three-quarter front views



ABOVE: A Don Young design provided a suitable donor boiler, slightly modified to suit the loco.

in photos that I possessed it appeared suspiciously like an arrangement with the 'Y' on the lower end of the combination lever.

Salvation came in the unlikely form of the official photographs of the visit of the King and Queen to Crewe Works in 1913. I believe this was a first ever royal visit to industry and quite appropriate as the works was the largest in the Empire. In amongst the flags, bunting and photographs was a neatly laid out decorative arrangement composed of valve gear components with combination levers used to form a surround: the bottom bosses were clearly visible, and were plain as usual.

The inside valve rockers are horizontal levers ahead of the cylinders driven by extensions of the outside valve spindles and connected back to the inside spindles. The prototype was provided with hinged covers that lift up to expose the rockers so lubrication is easy but I was less than enthusiastic about the rockers themselves as they are to an antiquated design used by Webb on his four-cylinder compounds.

Rocking levers frequently appear on multi-cylinder engines but there is usually a swinging link to transfer the valve spindle's linear motion to the arc described by the rocker. Not so here, it is all very cheap and cheerful with the out-of-line movement of the arc being taken up by bronze blocks sliding on pegs at the end of the rocker. I was concerned about this in $\frac{1}{12}$ scale and managed to draw in short swing links. Luckily before I started manufacture I saw the Claughton model built several years ago by Nigel Thompson, designer of 'Wessie', and noted that he had faithfully copied the original rockers, and driving slide valves to boot. Seeing is believing, I made miniatures of the real thing and not surprisingly they have given no trouble.

The Boiler

The boiler was quite simple, the prototype is a straightforward parallel type with a 'square' Belpaire firebox and vertical throatplate and doorplate (the LMS term for what modellers call the backhead). It didn´t take long to find a donor design with the correct 5½in diameter and Belpaire firebox to adapt to my requirements: Don Young´s 'Pom-Pom' was ideal, on my model the barrel was made a bit longer as was the firebox but the cross section remained unaltered, the only staying needing modifying were extra rows of firebox stays at the same pitch.

The unobstructed internal cross-sectional area of tubes and flues is known as Free Gas Area, the FGA of the prototype was a bit low at 13.6 per cent of grate area a consequence of the smaller diameter boiler that was imposed on the design, so a fierce draught was needed to maintain steam. I had a go at improving things – the tubes are 16½in long and by fitting in 21 of ½in overall diamater (OD) and two flues of 1in OD it was possible to get the FGA up to 16½ per cent. This is a notable improvement and totally satisfactory so the blast nozzle could be opened up and the boiler still just replaces the steam that is used thereby keeping the needle close to the red line.

The depth of the firebox was adjusted to fit on to the 4-6-0 chassis, deep at the front rising up towards the rear to pass over the trailing axle. The first Claughtons had GWR-style grates, level at the back and sloping at the front, but the later ones simply sloped down, No. 650 carried the early style but I preferred to fire an even slope so that is what the model has. The depth below the firedoor is shallow but in practice heaping coal at that point does the trick, after which it shuffles down steadily to the front pretty well looking after itself.

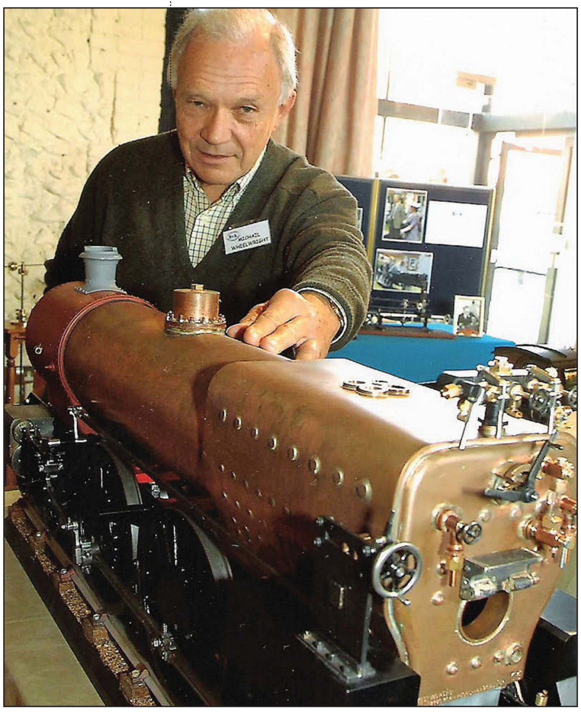
The matter of the trailing axle was dealt with by putting a big hump into the floor of the ashpan and fitting shields over the horns to give some small protection from ash. The pan itself cannot be removed with the boiler in place but the floor at the front hinges down and the grate rests on a bar at the back while supported by legs at the front so it can be removed through the trapdoor opening.

To get the grate past the brake rods the full-size run was altered slightly by moving the pull rods further out. A small flap is provided behind the hump to drop the ash at the back and there are nice big air holes at each end. It sounds complicated but is not difficult to use, most of the embers are taken out through the door and within 10 minutes things are cool enough to touch and open the trapdoor. A standard commercial stainless grate is used and renewal is necessary every few years due to the ash accumulation over the hump eating into the bars.

The LNWR used a standard Ramsbottom-pair type safety valve on all of its engines until pop valves began to creep in just before the grouping. This valve was first used with engines of about 15ft square grate area and continued in use right up to the Princes (50 per cent larger) and even on the first Claughton. Just a single valve was a bit optimistic considering the size of the boiler and sure enough No.2222 returned to the works, shortly to emerge with two safety valves side by side enclosed in a sheet steel surround. This remained standard for the class until the gradual adoption of pop valves. I decided to fit four individual safety valves of the usual 5in gauge type, sized to fit in the enclosure and decorated with dummy easing levers. With four of them it is impossible to get anywhere near the 10 per cent excess pressure allowed in a steam test. EIM

NEXT MONTH – FURTHER DESIGN MATTERS

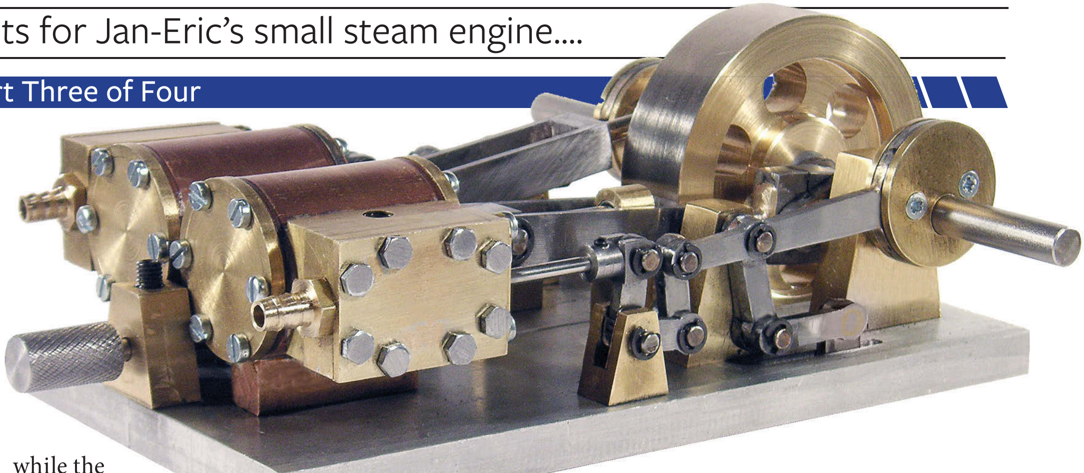
BELOW: Mike with the part-built Claughton at the Worthing & District SME show, details of the boiler evident in this shot.



A Double-Acting Engine

Making motion components for Jan-Eric's small steam engine....

BY **JAN-ERIC NYSTRÖM** – Part Three 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.

Continuing the fabrication of the parts for the engine, we come to the small levers of the valve gear. These are made from steel plate or flat steel strip. Because I had the stock available, I made them from 3mm thick material, which is more than enough to stand the forces involved. You can make the levers more graceful if you wish, even with bosses at the ends – but I chose the quick-and-dirty approach for my prototype.

The bell crank, Part 19, has an angle of 90 degrees, and the holes are reamed to exact size in order to accept the pins attached to the other levers. The pins in the metric version have a diameter of 4mm, while ⅛in is a suitable dimension for the 'converted', 20 per cent reduced version in imperial measures (see Table 1 in the first part of the series). The distance between the holes in the crank and all the levers should be kept within tight tolerances, since any error here will greatly affect the valve motion. Using the X-Y feed on the mill table enabled me to get good precision, first using a centre drill, then an ordinary drill slightly smaller than the final diameter, and finally a reamer.

After this, I used an angle grinder to roughly cut out the bell crank from the larger piece of plate. I used a couple of drill shanks to position the workpiece in the milling vice while milling the outline, as seen in Photo 1. It is important to remove all burrs from the part before clamping it in the vice, otherwise it might move during milling and be destroyed – at the same time destroying the mill bit…

Parts 20 to 22 have silver soldered pins with grooves for clip rings ('E-rings'), or alternatively, tapped holes for small retaining screws. See the enlarged detail in Figure 1. I chose clip rings instead of screws, even though the latter may look better – but all those small, tapped holes are much more demanding to make! In addition, the screws would have to be secured with a locking compound, while the clip rings will stay in place by themselves.

The grooves on the pins should be turned to the width and depth determined by the clip rings. Photo 2 shows the lathe tool bit I prepared for cutting the grooves; the end of a square 6mm HSS bit was ground to a tiny, only 0.5mm wide point using a thin disk on an angle grinder – and a steady hand! (Of course, you can also use a bench grinder, but the stone has to be in good condition; no round corners…) Note the side rake; the tool is widest at its point. This will make a nice, clean groove in the pin. Nevertheless, you should clean up the almost invisible, tiny burr left by the tool – otherwise, the pin won't fit in, or if forced, will ruin the finish of the reamed hole.

The holes in all the levers should be reamed to the exact dimension. A deep countersink is made to the hole on the opposite side of the pin, in order to allow enough silver solder in the joint – see Figure 1. The tight fit between pin and reamed hole won't let the silver penetrate all the way through – also preventing solder from fouling the bearing surface of the pin.

Soldering the pins

The pins are left overlength on the side to be soldered – the excess will be cut away later. Before silver soldering the pins to the levers, I prepared spacers of suitable thickness. These spacers should be drilled with oversize holes for the pins, and blackened with soot in a candle flame as a precaution – silver solder won't flow and adhere to a sooty surface! Photo 3 shows how I prepared a link for soldering, with the

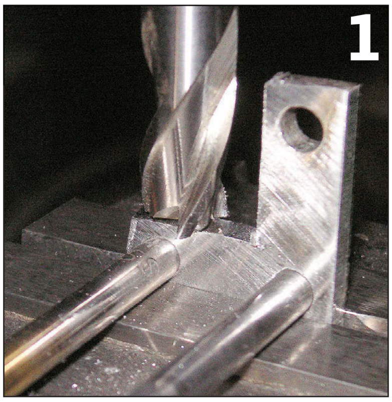


PHOTO 1: Drill shanks help with positioning for machining bell crank outline.

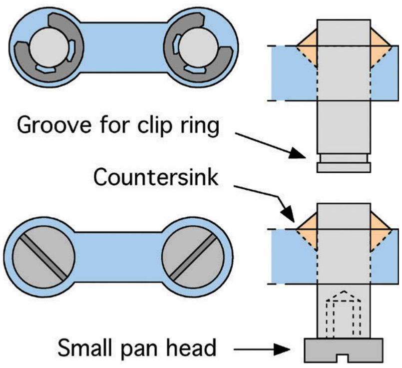
FIGURE 1: Detail of clip-ring grooves – see text.

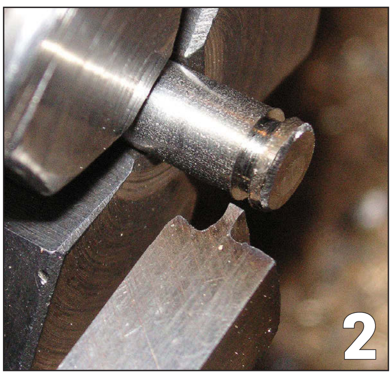
PHOTO 2: Lathe tool bit prepared for cutting grooves in pins.

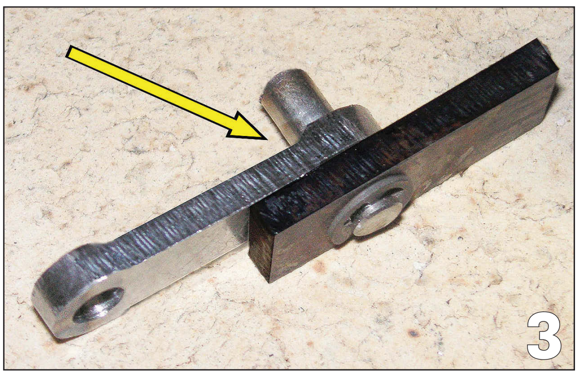
PHOTO 3: Link prepared for soldering.

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

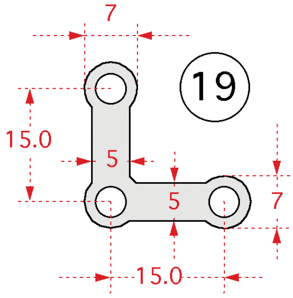
FIGURE 1





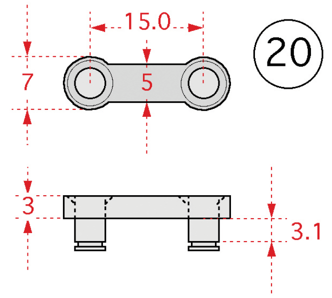


19



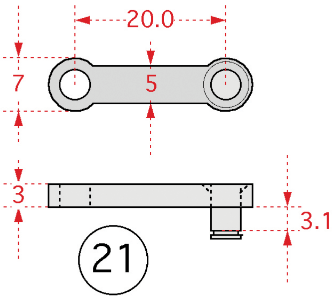
BELL CRANK, steel
3 thick, 2 required

20



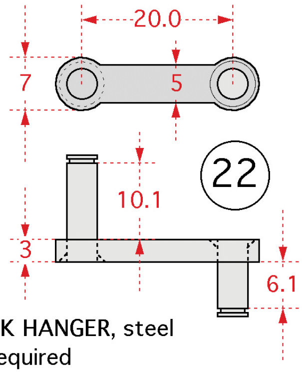
YOKE, steel, 2 required
See text for all pins and holes

21



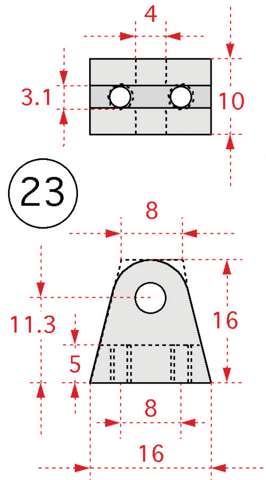
LINK & REACH ROD
steel, 4 required

22



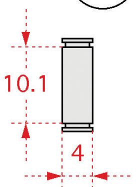
LINK HANGER, steel
2 required

23



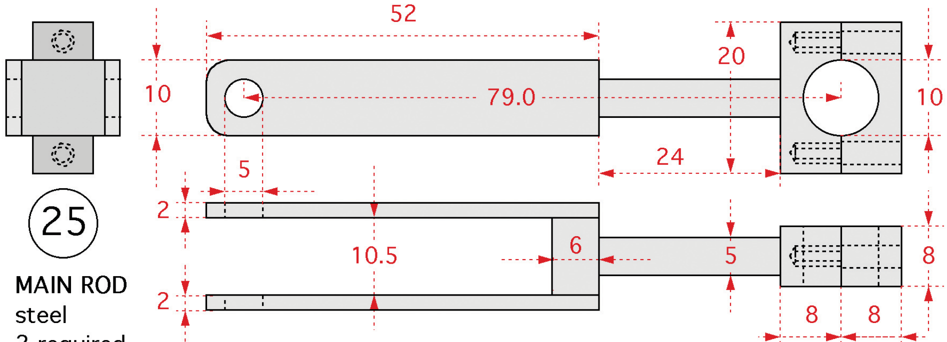
CRANK BEARING
2 required

24



PIN, steel
2 required

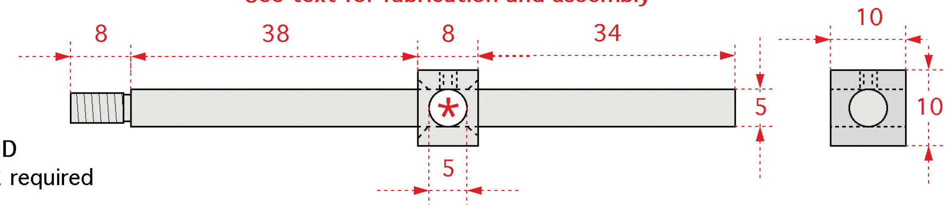
25



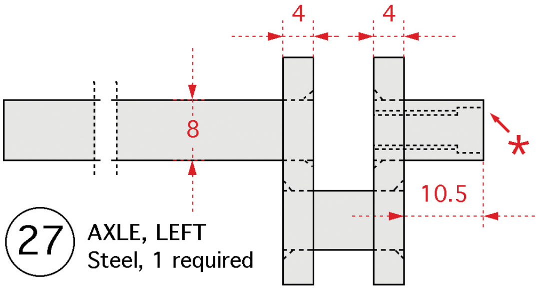
MAIN ROD
steel
2 required

See text for fabrication and assembly

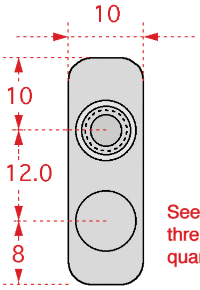
26

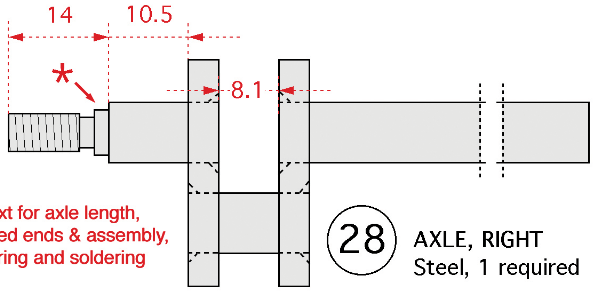


PISTON ROD
stainless, 2 required



27 AXLE, LEFT
Steel, 1 required

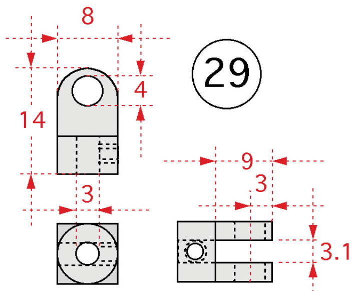




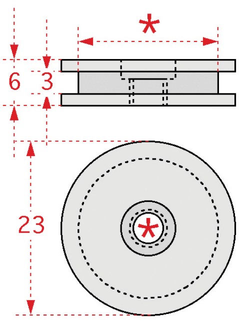
See text for axle length, threaded ends & assembly, quartering and soldering

28 AXLE, RIGHT
Steel, 1 required

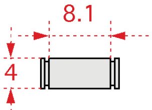
29



VALVE ROD CLEVIS
steel, 2 required

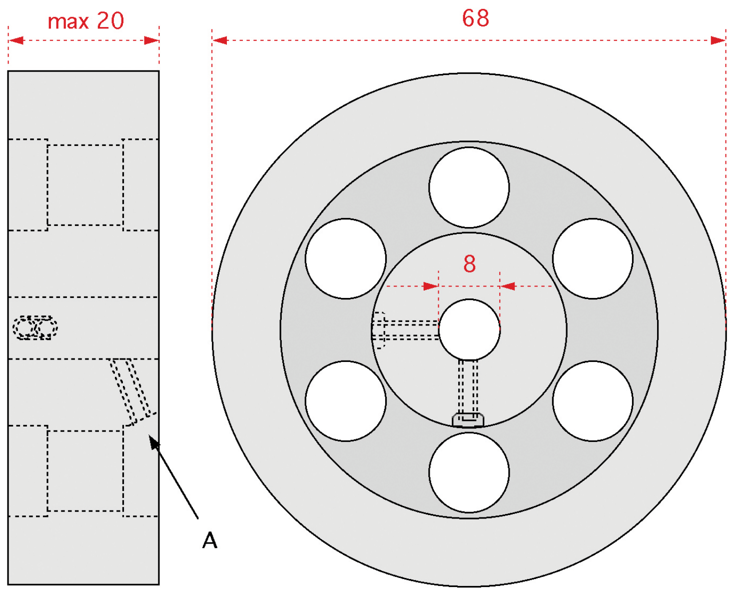


31 PISTON
brass, 2 required



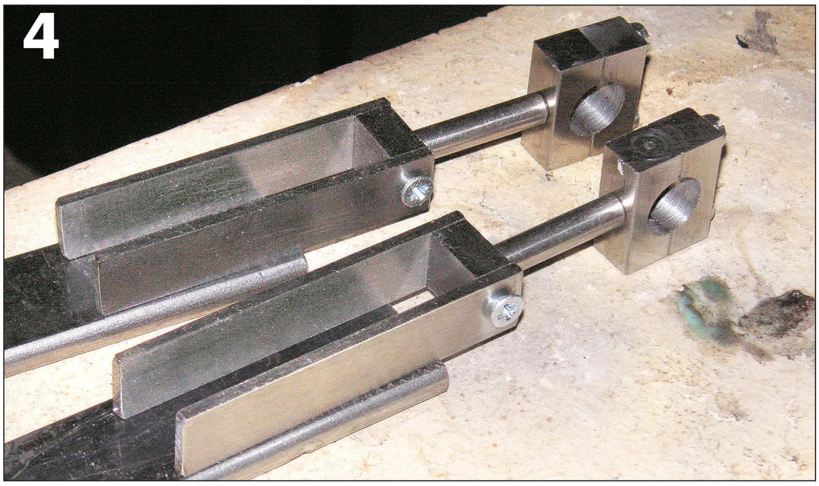
30

CLEVIS PIN
steel, 2 required



32 FLYWHEEL
1 required

See text for
rim, spokes and hub



pin inserted and kept in the right position by the spacer and a clip ring (which should be discarded after soldering, since the heat will soften the clip and make it useless).

The solder is applied only to the countersunk side, at the arrow point. A sufficient amount of solder is necessary in order to fill the countersink and provide a slight fillet, see Figure 1 again. However, care must be taken not to use too much solder, which would otherwise flow all over, even onto the spacer. Molten flux and silver solder have an eerie tendency to creep!

After the part had cooled and been pickled, I used a thin cutting disk (only 1mm, with a diameter of 125mm) in an angle grinder to cut off the excess length of the pin. A Dremel-type tool can also be used, but since there are many pins, you will use up many of its tiny cutting disks… The soldered end of the pin should be ground down all the way to the surface of the lever. This is why that deep countersink is necessary!

The bell crank bearing block, Part 23, has a reamed hole for a loose pin, Part 24. The block can be made of brass or steel, it is forked with either a slitting saw or a slot or end mill, and it has two threaded holes for fastening to the base plate. The thread can be anything that fits – I used M4. The pin has grooves for clip rings at both ends. The distance between the grooves should be slightly larger than the thickness of the bearing block.

Many small parts

The main rods, Part 25, can be made by assembling and soldering several, less complicated pieces together. I happened to have some pieces of 8x8 and 10x6mm key stock available, as well as a strip of 'gauge plate' (flat ground stock of silver-steel type), measuring 2x10mm. Ordinary cold-rolled steel is also suitable for these parts. Together with a piece of 5mm round steel, I fabricated the assembly as shown in the drawing.

There is really only one critical dimension that needs to be closely adhered to, that is the distance between the crosshead and crankpin holes. The thickness of the crankpin end and the inner dimension of the 'fork' must fit the rest of the design, so any significant changes here will also affect other parts. Most other dimensions can be determined by the raw material available.

The crankpin end of the rod is prepared for a split bushing, either steel/PTFE or bronze, similar to the other bushings, Part 16, described in the previous instalment, but with a length suitable for the main rod. The large hole in the rod end should be punch-marked, drilled and reamed with the two parts tightly clamped together in a vice. The round steel mid-section can be threaded at both ends, and corresponding holes in the other parts tapped to fit.

"The spacers are blackened with soot from a candle flame as a precaution – silver solder won't flow and adhere to a sooty surface..."

For silver soldering, the fork parts should be attached with small screws, as shown in Photo 4. This will keep the whole assembly together during silver soldering. Note that I have put a piece of steel under the fork, so that both ends of the rod rest firmly on a support when heated – thermal expansion might otherwise loosen the screwed joints, and the assembly would sag without this support. The screws keeping the fork together will be removed (or filed off if they are stuck) after soldering.

After pickling and cleaning the part, the holes in the forked end of the main rod are drilled and reamed for the piston rod crosshead pin (5mm in my prototype). A spacer of a similar steel type should be inserted and clamped between the fork arms during drilling, or the drill might wander, causing a skewed seat for the crosshead pin.

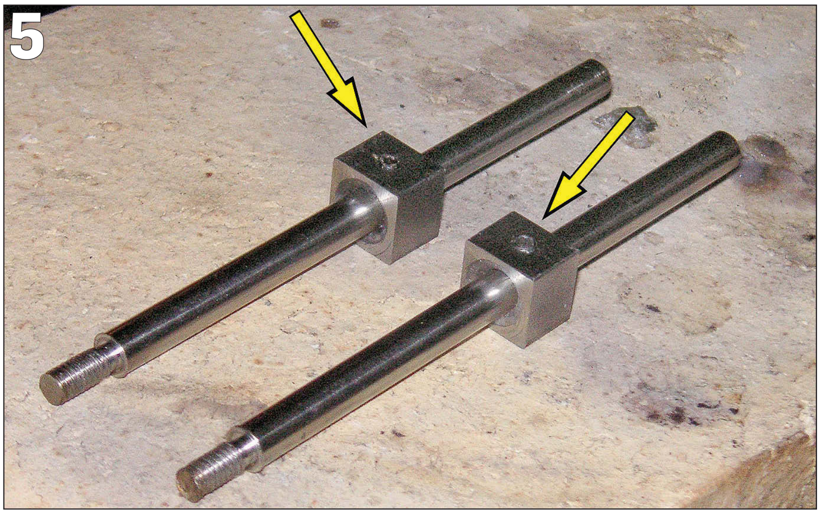
Part 26, the piston rod, is made from 5 mm stainless stock. A suitable inch alternative can be chosen, provided that the piston and the O-ring glands in the cylinder covers are modified accordingly. The threaded end (M4 in the metric version) will accept the piston, described later.

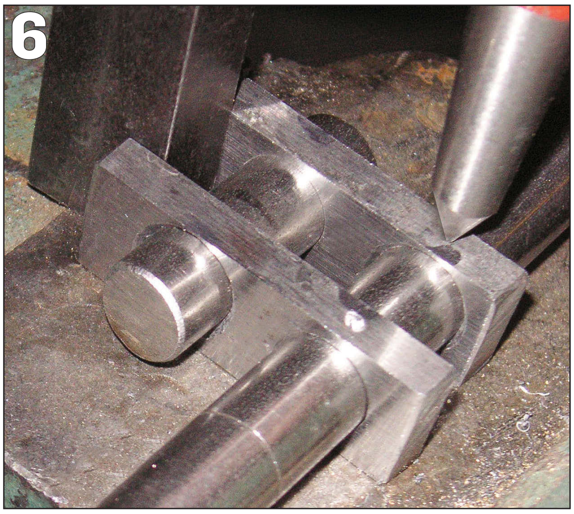
The crosshead block is an integral part of the piston rod, and is made from a piece of square key stock or cold rolled steel, silver soldered to the rod. Each block is drilled and reamed to fit the rod, and small grub screws keep the blocks in place during soldering, see the arrows in Photo 5. Here, too, the blocks are deeply countersunk on both sides in order to retain enough silver solder. Take care not to spread solder over the surface of

PHOTO 4: Small screws used to join parts of fork in readiness for silver soldering.

PHOTO 5: Arrows show grub screws that secure the crosshead blocks in place for soldering.

PHOTO 6: Punch marks help ensure correct location of components before soldering the assembly.





the rods! The cross hole in the block will be drilled after soldering. Note that key stock, as well as some grades of stainless steel, harden easily if cooled too quickly, so don't drop the parts in water after soldering – let the assemblies slowly cool by themselves.

Crank axle fabrication

Now, another moderately complicated task, the main axle. It consists of two halves, Parts 27 and 28, which screw together by a threaded joint. The reason for this is twofold; first, the flywheel can be positioned between the cranks, and second – well, I'll leave that as a surprise for later… The length of the axle can be chosen at will, taking into consideration for what purpose the engine is built.

In order to fabricate the two half-axle assemblies, I first cut and turned the round steel, 8mm diameter (for the 'reduced' inch version, 8 units of 1/32in, i.e. ¼in). The drawing shows how to prepare the threaded ends; a step on the right axle fits exactly in a recess in the left axle. This will make the two parts properly concentric and straight when joined, even if there is some slight inaccuracy in the threads – which is almost inevitable, even when a tailstock die holder is used.

Next, the short pieces that will form the crank pins are cut from the same stock as the axle. I left the pins a bit over-length, since they will be cut to dimension after soldering. Then, the four pieces that form the web of the cranks were cut from gauge plate (cold-rolled steel is also suitable). They were drilled and reamed, two and two clamped together, so that the holes are exactly at the same distance. This is important – if there's an error, the crank pin will not be parallel to the axle! Deep countersinks were made for the silver soldering, just as for the pins of all the small levers, earlier.

Silver soldering again...

In order to prepare everything for silver soldering, the parts of course need to be assembled; the webs are put on the axle, and the crank pins inserted into the webs. Now, how to secure everything in place? I did this with deep punch marks! (I believe I mentioned that I have used some 'quick-and-dirty' methods…). Photo 6 shows the procedure: A spacer (a tad wider than the big end of the main rod) is placed between the webs, the parts are carefully positioned on the axle, and a generous whack with the hammer on the centre punch puts a deep dent in the thinnest part of the web so that it stays in place on the axle, but can still be adjusted with some slight force, if necessary.

Note that at this stage, the two cranks should be 'quartered', i.e. set at 90 degrees apart, as exactly as possible. It is also important that the two axle halves are firmly screwed together, so that this angle will not change later. Check that the position of the parts relative to the joint line in the axle is according to the drawing. Photo 7 shows the result – now, everything is firmly in place for soldering.

When applying the silver solder, take care not to spread solder onto the surfaces of the pins and axle – remember that the solder should be applied on the outside of the pins, but on the inside at the axle. These parts, as well as any surplus solder, will be removed later.

After pickling, it is time to clean up; first, the excess of the crank pins is cut off on both sides, with a hacksaw – or a carefully applied angle grinder, as is my wont…

While the axle is still intact, it is a good idea to clean up the outside of the webs on the lathe. Photo 8 shows this operation. Note the yellowish ring of silver solder – this is where the web was deeply countersunk in order to get some surface for the solder to adhere to. Not until everything else was

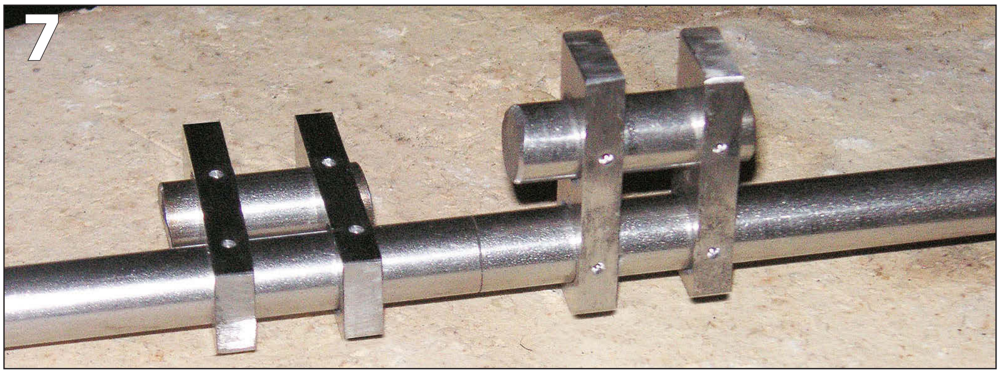


PHOTO 7: All mounted up for soldering.

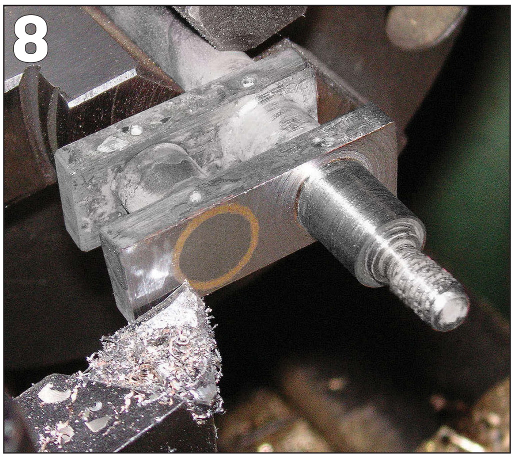


PHOTO 8: Cleaning the webs on a lathe.

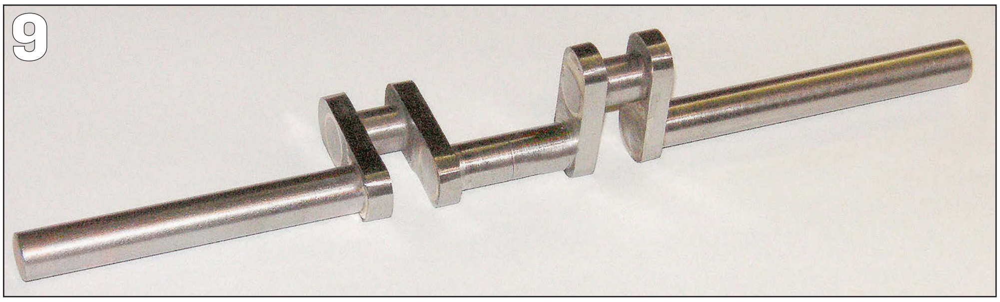


PHOTO 9: Completed axle – note rounded web ends.

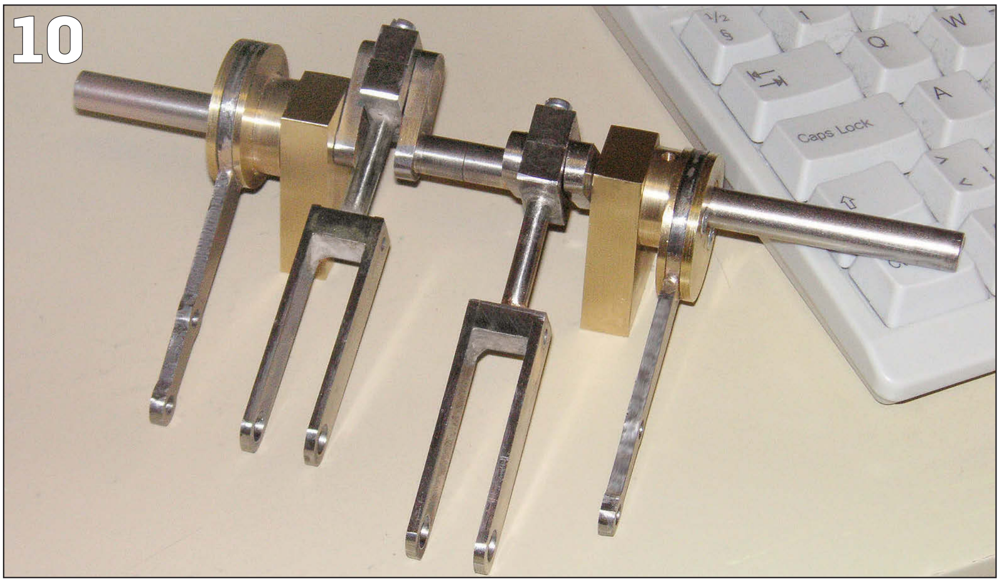


PHOTO 10: Test assembly of entire unit to ensure everything moves freely.

cleaned up did I cut away the part of the axle between the webs.

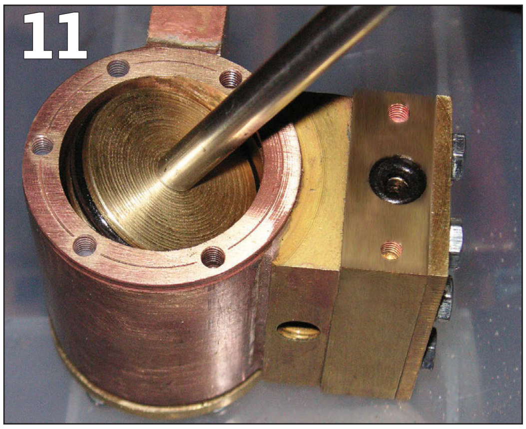
The completed axle assembly is seen in Photo 9. I have now also rounded the web ends to a nice contour on a belt sander. Alternatively, the webs could have been formed to the final shape before soldering. A test assembly of the axle, the main rods with their split bushings, as well as the eccentrics is shown in Photo 10 – at this stage, I performed a check that the rods and eccentrics fit well and rotated smoothly.

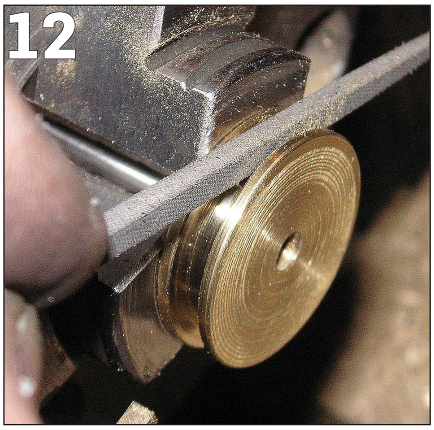
And more parts...

The valve rod clevis and its pin, Parts 29 and 30, are next. The pin is made just like the pin for the bell crank, note only the different length. The clevis is made from 8mm square stock (¼in in the imperial version). It has one end forked with a slot mill or slit saw, the other drilled and turned on the lathe. Use the four-jaw chuck to centre the work piece for turning the outside as well as drilling and reaming the hole for the valve rod. There is a grub screw to attach the clevis to the rod – I used the M3 size.

Next, the piston, Part 31. There is a groove for an O-ring in the piston – no dimensions are given, they depend on the ring used. I followed the instructions found in a catalogue from my supplier of the O-rings, and turned the groove almost to the recommended depth, holding the piston in the chuck by a rod threaded at the end. Then I made a trial fit of the ring, inserting the piston obliquely into the cylinder, so as not to cut the ring on the sharp edge of the steam passage, see Photo 11.

The piston was rather tight, even when oiled, so I skimmed the bottom of the groove with a file, Photo 12 (taking care not to get my fingers hit by the chuck jaws!), then tested again and filed a bit more, until the fit was perfect; a slight resistance should be felt when the piston is pulled back and forth in the cylinder. With a groove too deep, the ring won't seal, if the groove is too shallow, energy will be lost to excessive friction.





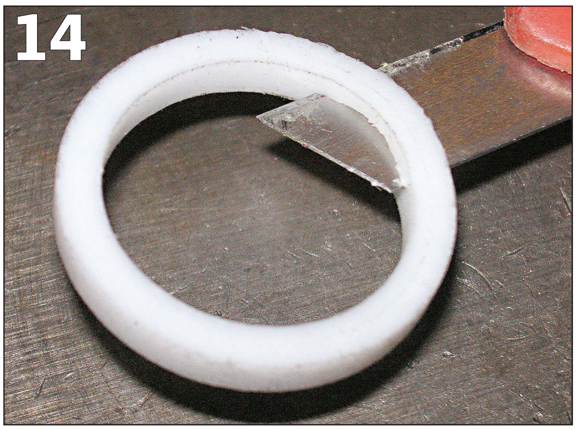


PHOTO 11: Trial fitting of piston, tilted so as not to damage ring on sharp edge of steam passage.

PHOTO 12: Skimming piston ring groove with file to alleviate tight fit.

PHOTO 13: Piston ring alternative – turning PTFE.

PHOTO 14: Slitting PTFE ring for fitting.

PHOTO 15: Completed piston with PTFE ring fitted.

Note the threaded hole (M4) and the flat-bottomed countersink on one side of the piston – this is for a partially recessed securing nut. The material of this nut should be either stainless or brass. The nut needs to protrude enough to be gripped by a spanner. The cylinder cover (Part 3) also has a recess, so the nut won't hit the cover when the engine is running.

Alternative to O-rings

I have also experimented with another type of piston ring, made of PTFE, i.e. Teflon. Having some round bar of this material, I bored a hole in it, 1.5mm larger than the bottom diameter of the piston groove. I then prepared an arbor of this diameter, for turning the outside and parting off the rings, Photo 13. The material should be a tight press fit on the arbor. The outside diameter of the PTFE was then turned to 1mm larger than the cylinder bore. I then cut the rings to a width that resulted in a tight fit in the groove, sideways.

Next, the rings must be split and cut so that they can be put into a piston groove. Using a very sharp, thin knife (the type with a snap-off blade), I first made a slit in the middle of the ring, all the way through, about as wide as the knife blade, Photo 14. I opened the ring by removing some excess material, cutting away small pieces at opposite ends of the slit, thus forming a Z-shaped cut. Then I could ease the ring over the piston and press it into the groove, Photo 15. The ring should not touch the bottom of the groove even when compressed to the size of the bore. It will seal on the sides only.

If necessary, the outer diameter of the ring can be turned down slightly if it is too tight a fit in the cylinder bore. This is done with the ring mounted on the piston, and the piston on a threaded arbor held in the chuck. This ring is very similar in shape to the cast iron rings used in full-size steam cylinders. The slit and the cut-outs will allow the ring to expand when heated; PTFE has a very large thermal expansion coefficient.

One advantage over other types of rings is that this modern plastic material is self-lubricating. I have used PTFE piston valves on one of my 1.5-inch scale locomotives, and have yet to replace a single one, even after four summers of running! **EIM**

■ Parts one and two of this series appeared in the May and June 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 by telephoning 01778 392484.

COMING NEXT MONTH – FINISHING AND RUNNING...

The man behind the locomotive...

Building the Claughton

May I say it`s great to see something in the magazine about these beautiful engines (**EIM** June). We`ll overlook the fact that the model is in the scale of 1:11.3! They were one of the most elegant classes of the time, G.J.C. notwithstanding!

The various criticisms of the locomotives are all very well with the wisdom of hindsight but it must be remembered that they appeared in 1913 which means that the design work was carried out in an age when there was no free flow of information as we have nowadays, and C J Bowen-Cooke did a brilliant job given the information he had available to him.

There is just one glaring error in the feature, however, which grates horribly, in that C J Bowen-Cooke was just that, not C J B Cooke, Bowen being the first part of his double barrelled surname, not another christian name, please correct it in any future articles.

By the way, I myself am building a Claughton in 7¼in gauge.

Tony Simmonds

***Andrew C** replies:* Many thanks for your comments Tony, featuring the Claughton certainly seems to have struck a chord with several readers.

Writing names correctly is the constant nightmare for any editor on any magazine! Best of luck with the Claughton build, we hope you will share some pictures with **EIM** readers when it is complete...

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.

Water gauge glasses

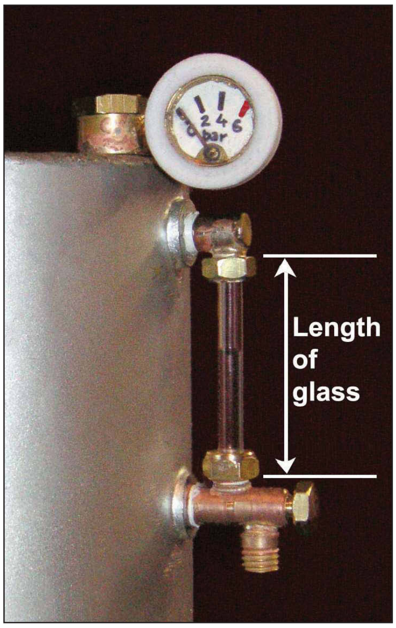
Jan-Eric Nyström's article in the April 2018 about building a small boiler **EIM**, talks about a boiler water gauge glass.

What I would like to know is how he gets the glass into the gauge when the top and bottom fittings are in the boiler. Is that possible?

Geoff Golding

***Jan-Eric** replies:* It is indeed possible, with a twist – literally! If you look closely at photo 29 (reproduced here), you'll notice that there is enough space in the lower fitting to push the glass far enough down so that it will clear the top nut. Then, the bottom fitting can be twisted just enough so that you can exchange the glass.

The new glass is again pushed all the way down. After turning the fitting back to its original position, and pushing up the glass and tightening the nuts, you're done!



There are of course several turns of plumber's Teflon tape wound around both ends of the glass to prevent glass-to-metal contact, which might (let's say would) cause the glass to crack. The tape also ensures that the glass stays in place.

Tape is also used in the threads of the fittings, and it allows making the slight twist without causing a leak.

Empire builders...

The North British Locomotive Co Ltd

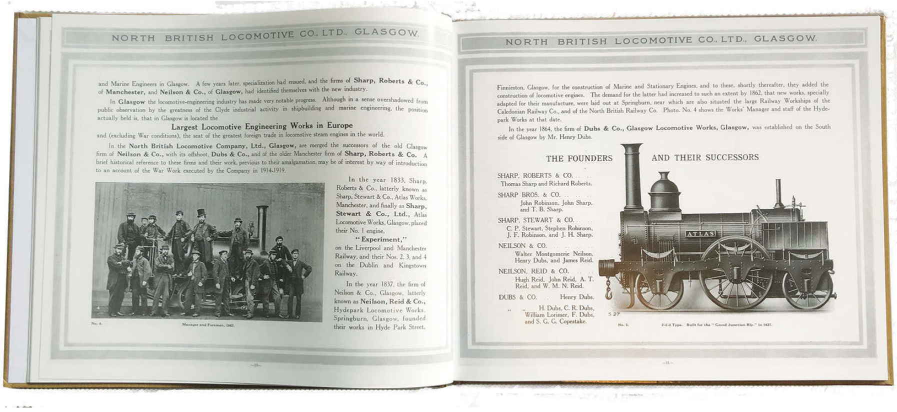
Moseley Railway Trust reprint

It is often said that the best books are the old ones, and luckily there are organisations such as the Moseley Railway Trust around to reprint classic titles and make them available to a whole new audience.

This book is a very good example – subtitled 'The Manufacture of Locomotives and other Munitions of War during the period 1914-19' the reprint focuses on how the North British Locomotive Company diversified to meet the demands place don engineering firms across the UK by the First World War.

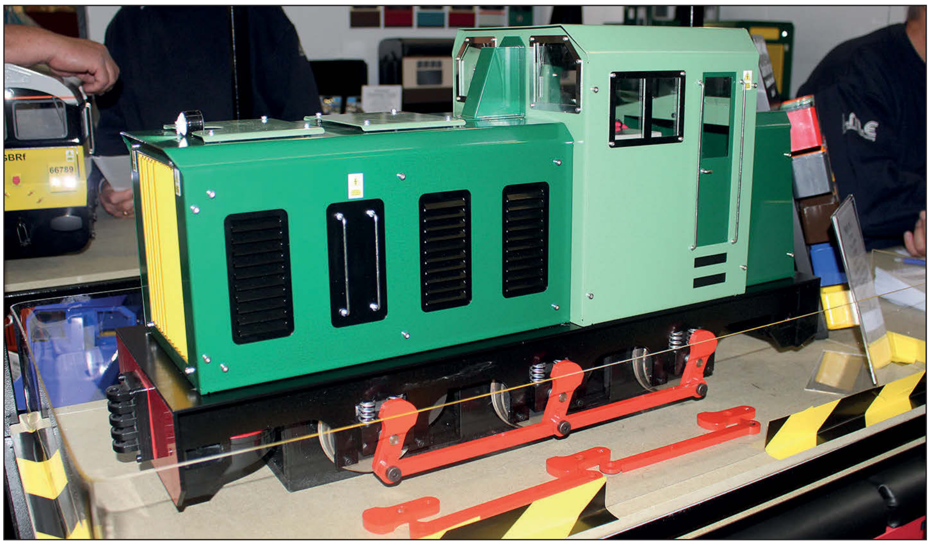
It is a lavish publication, the reprint faithfully reproducing the glossy pages and large plate photographs that were once typical of such books. NBR's output of locomotives are extensively detailed, with general arrangement photos and technical specifications but the book also covers a very wide range of material that left the company's Glasgow works, from tanks to munitions to hospital equipment.

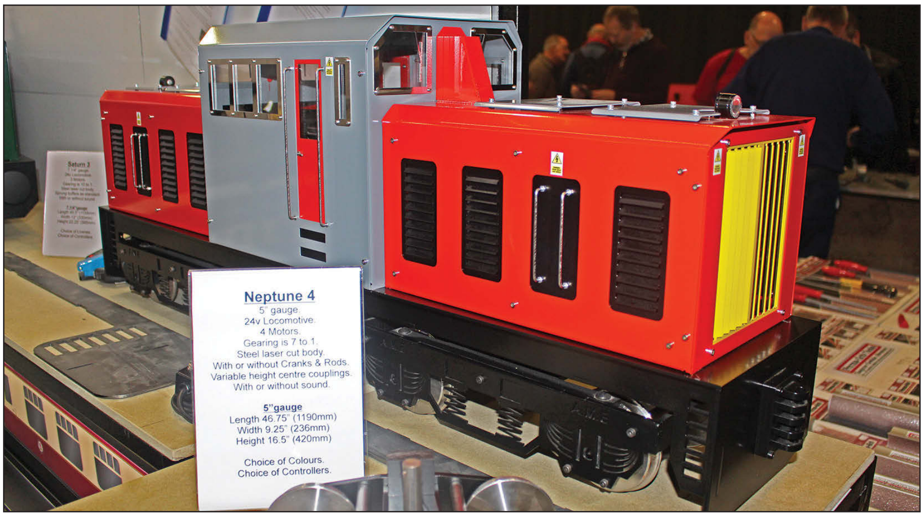
This is the kind of book to be left on the coffee table of any engineer's home, where it can be picked up, leafed through and enjoyed. And of course all profits from its sale are ploughed straight into the work of the Moseley Railway Trust preserving industrial narrow gauge railway history, which is continuing to progress at the Apedale site in Staffordshire. ***AC***



ISBN 978-0-9576789-4-1 Published by Moseley Railway Trust. Available from Trust shop at Apedale Valley Railway, Staffordshire and through various booksellers Web: www.mrt.org.uk Price £22.95

Neptune is Abbot's new load hauler





Touring the trade stands at the recent National show in Doncaster unearthed some interesting new releases for the model engineering and miniature railway market, none more so than two new five-inch gauge locomotives from Abbots Model Engineering (A.M.E.).

The Neptune 3 and Neptune 4 are two versions of a locomotive designed to both be a powerful hauler and compact enough to be easily transported. The Neptune 3 is a typical 0-6-0 diesel and employs three motors, while the double-ended Neptune 4 runs on bogies and is powered by four motors – Peter Griggs from Abbots tells us that both versions are capable of hauling between 10 and 14 persons plus the driver on a club track. At 830mm and 1190mm long respectively they will also fit in the back of even a small car – the loco is designed to break down into body, chassis and in the case of the 4 bogies, allowing easy single-person loading.

The two combine a CNC laser-cut, welded and powder-coated black steel chassis on which sits a laser-cut steel body, which can be supplied painted or unpainted. Axleboxes are independently sprung, while the motor sets are fully assembled and supplied with a handset control system.

Other notable features of the loco include LED headlamps, stainless steel window frames, glazing using plastic sheet, and the availability of sound and a two-tone horn.

The locos can be supplied as unpainted kits, painted kits or ready-to-run – Peter adds that the kits do not require workshop facilities with the 'awkward components' being ready assembled.

The Neptune 3 costs 1395 as an unpainted kit, £1495 painted or £1945 ready to run. Equivalent prices for the Neptune 4 are £1895, £1995 and £2445. Currently delivery times are around four weeks.

A wide range of accessories are also available, for example sets of outside cranks and rods.

Abbots Model Engineering
Tel: 01952 879607
Web: www.ametrains.co.uk

A real head turner...

Also attracting a lot of interest among Doncaster visitors was the Turnado freehand metal turning system from the splendidly named Eccentric Engineering.

Eccentric describes itself as a manufacturer of "Innovative workshop tooling and weird stuff" and promises that the Turnado will make it possible to produce curves never previously thought possible on a standard metalworking lathe. These include internal and external hemispheres, spheres from 2mm to 50mm diameter, Toroids (doughnut shapes), Ovoids (egg shapes) and Ellipsoids.

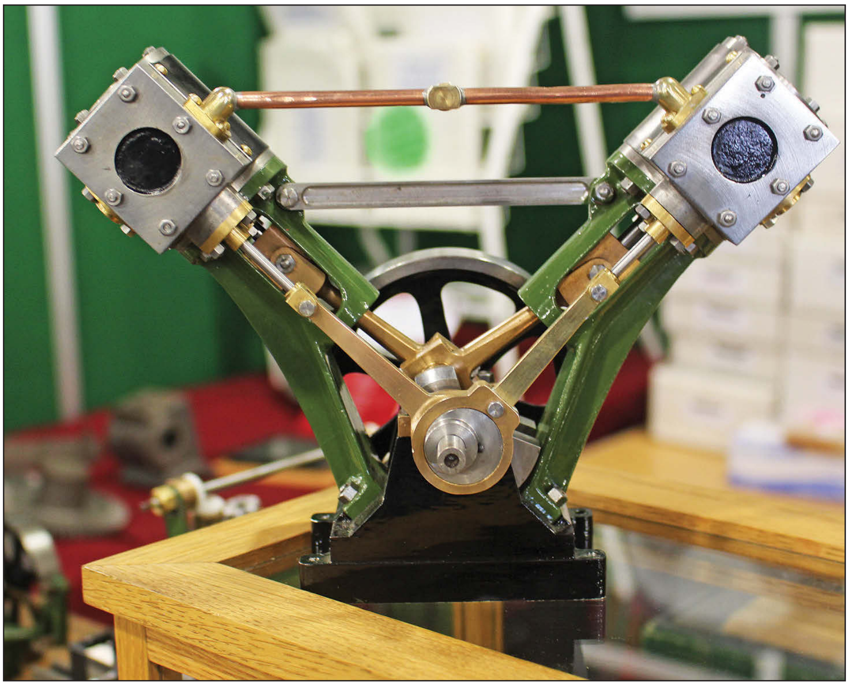
Accessories available further widen the capabilities of the system, turning radii up to five inches possible with the Large Radius Shoe, or up to any size using a Tracer Arm.

More details of the system can be found on the Eccentric website or the company's Facebook page.

Eccentric Engineering

Tel (UK distributor): 01524 751 731
Web: www.eccentricengineering.com.au/

Stuart's twin

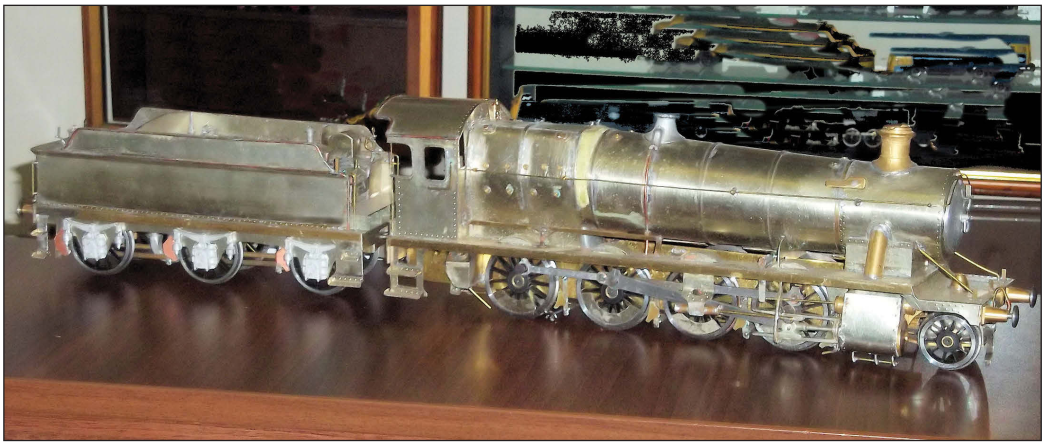


So many model engineers have cut their workshop teeth building the products of Stuart Models over the years, so a new release from this long-established firm is definitely good news.

The Stuart Twin 7V is a 90-degree V-twin which can be used as a launch engine or as a stationary engine. As can be seen from the picture at right the 90-degree twin design produces a delightfully balanced, fine model. The finished engine stands 6¼in high with a 3½in flywheel, and its two cylinders have a one-inch bore and stroke.

Like all Stuart kits it can be purchased either as a full set of castings in cast iron and gunmetal together with all the materials, fixings and drawings required, or as a fully machined kit with only screwdrivers, spanners, some filing and painting needed to assemble. The casting kit is £390 plus VAT, the machined version £1,475 plus VAT.

Stuart Models
Tel: 01308 456859 Web: www.stuartmodels.com



■ Pictured at right is one of two new Gauge 1 electric models from Classic Loco, a GWR 3800x 2-8-0 freight engine, but more interesting news is that the firm also now offers a Gauge 3 (2½in) Southern T9 4-4-0, fitted with Slaters wheels and a G3 can motor.

Both these and a G1 GWR 4-4-0 Duke are available in basic metal or primer finish up to fully painted and lined versions, prices ranging from £1450 to £2000 for the hand-finished versions.

Classic of Cleethorpes
Tel: 01472 291934
Web: www.classicloco.co.uk

Enter your model in the Midlands show...

We may have only just enjoyed the Doncaster national show but plans are well advanced for the major event of the Autumn, the Midlands Model Engineering Exhibition. Organised by Meridienne Exhibitions the show will be held this year between 18th-21st October at its usual home of the Warwickshire Event Centre.

Organisers are encouraging modellers to enter their work in the show's classes. There are 32 classes, 16 competition and 16 display – they include Locomotives, Rolling Stock, Stationary and Internal Combustion Engines. Models still under construction will be eligible for the display classes.

Entry to the classes is free, every entrant receives a commemorative plaque and exhibitor's certificate, while winners will receive trophies and cash prizes. Entry forms can be requested by calling 01926 614101 or downloaded from the show website.

As ever upwards of 1,000 superb models are expected on display – more than 30 engineering clubs and associations have already booked to be a part of the event, supported by around 50 specialist suppliers to the hobby.

Outside, the popular 5-inch gauge outdoor track operated by the Coventry Society of Model Engineers and the Polly Owners Group will return along with the Fosse Way Steamers with a wide selection of road steam.

More details, including advance ticket booking, is at www.midlandsmodelengineering.co.uk or on 01926 614101. Of course EIM will carry its usual full preview to the event including a show guide, and extensive reports afterwards. Hopefully we'll see you there!

■ Those working in the smaller scale of Gauge 3 (2½in gauge) will be interested to hear that Woodbury Models is planning to upscale from its current G1 freight stock to offer a range in the larger size.

We are told that currently 15 wagons and brake vans are in development incorporating prototypes from the Midland Railway, Lancashire and Yorkshire, North Eastern, Great Eastern and Great Western Railways.

First examples are expected to be available around the middle of the year and details will be available on the firm's website

Woodbury Models Tel: 01384 893515 (Evenings 6-9pm, wknds)
Web: www.woodburymodels.co.uk

Good and bad news...

The clubs are now busy, many well into their public running season, while some are facing new and unexpected challenges....

Compiled by **ANDREW CHARMAN**

ABOVE: Loco 'Hampton' during the first members running at the Rugby MES.

Unfortunately this month's Club roundup starts with some less positive news. The **Welling and District MES** are looking for a new site, having occupied their present location behind Eltham electricity substation at Falconwood for some 41 years.

The club tells us that they are being obliged to move as National Grid will require the site at the end of this year to sink a deep shaft in order to bore tunnels to carry cables underground to other substations.

The Society is in negotiations with two local councils in efforts to find a new site. If you want to take a ride on the 3½in or 5in raised track opportunities are decreasing – the remaining Sunday public days will be on 1st 15th and 29th July, 12th and 26th August, 9th and 23rd September and the very last day on 7th October when members of other Ssocieties and Gauge One members will be hosted.

This will be a major upheaval for the Welling group – the current track is impressive, 1,268 feet long, electronically signalled and featuring a full anti-tip rail, level crossing, footbridges, a mini-viaduct, signal box and tunnel. Let's hope they can find a suitable new home soon.

Very convenient

Better news comes in the newsletter of the **Worthing & District SME**, on the subject of some very basic needs – loos! Last year the Sussex coast club launched a fundraising campaign for a new toilet block at its site in Field Place, and local company ETI (Electronic Temperature Instruments) offered to donate £500. An informal cheque presentation was arranged at the club, at which ETI's representative revealed that the donation was being doubled to £1000, not surprisingly to the delight of club members.

Elsewhere in the Worthing newsletter editor Dereck Langridge reveals that by far the most effective means of spreading publicity for public running days has proven to be Facebook. This is interesting but not surprising to your Editor – I still smile inwardly when people tell me they don't do social media because of all the horrors that lay in wait on such platforms – in fact so long as you are sensible nothing bad will afflict you, and you will open up a vast world of information – model engineering, full-size railways, lots of fascinating stuff, and some superb photos...

Social media publicity, and some seriously good weather, helped Worthing enjoy what was described as its busiest-ever public running day on 13th May. A major extra boost came from the grandfather of a child enjoying a birthday party in the pavilion next door to the track, who bought 100 train tickets for guests!

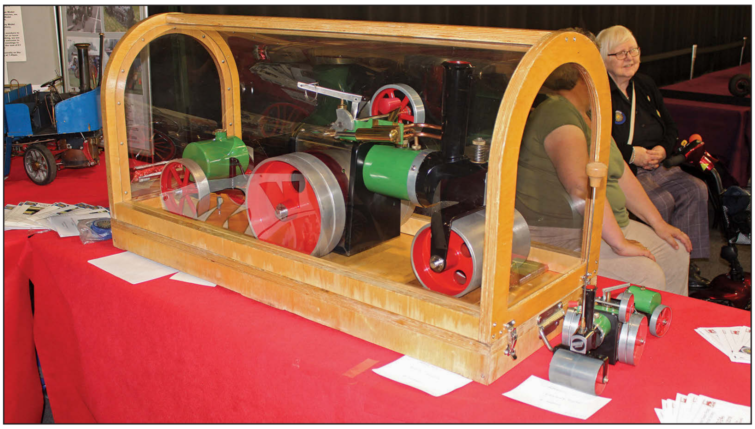
There were queues outside the club's ticket office all afternoon, only just cleared by closing time, and toting up the figures afterwards revealed more than 750 paying passengers had been carried and each loco had completed 25 circuits, equivalent to around six miles.

It's been a busy time recently at the **Rugby MES** – April began with a members' running day which also saw pre-season boiler tests – apparently the testers were kept very busy! The club's testers have also attended a seminar on the new boiler test code, which we reported on back in March.

Meanwhile at the track many new faces were welcomed to the pre-season ▶

BELOW LEFT: Newly rebuilt APT in action during the first public running day at Rugby.

BELOW: Rugby members are enjoying upgraded signals and points.



guards training session – good to see so many taking the time to ensure the hobby is presented to the public in as professional a manner as is possible.

Beating the weather

Our Rugby correspondent Edward Parrott tells us that the club's new motorised points and indicators have been brought into operation and so far all is going well. The first public running day was touch-and-go after weeks of rain left the car parking field waterlogged, but with some careful re-routing for visitors the day was able to go ahead. Unfortunately we understand several clubs had to cancel running days due to the weather.

With summer around the corner the open days and Galas are coming thick and fast but some groups are already looking towards 2019. At the Guildford MES it has been announced that a Garden Railway Show will be held at their Stoke Park site on 8th-9th June 2019.

The GMES believes the new event will fulfil the need for a garden railway show in southeast England – the Merstham Model Steam Show, held a few miles north of Gatwick Airport each May, was a staple event on the smaller-scale live steam scene until its demise a few years ago when its school site became unavailable.

GMES adds that the new show will be unique amongst such events because as well as offering the usual fare of visiting layouts and trade stands alongside the resident 16mm scale garden line, also on offer will be miniature steam train rides on the Society's 3½ and 5in gauge raised track, and the 7¼in gauge ground-level track.

This will be the first time that GMES has organized an event specifically aimed at the garden railway scene, but the Society has more than 50 years experience of holding the annual two-day model engineering events at its site – this year's Gala will be on 7th-8th July.

The GMES Garden Railway Group has been running the outdoor 16mm narrow gauge layout on site for more than 25 years, making extensive improvements to the layout over that time, and also operates a portable 32mm/45mm gauge layout which has attended many shows around the country in recent years.

An outdoor Gauge 1 layout has relatively recently been added to the facilities on site at Guildford and is being steadily developed.

GMES tells us that it is hoped that the new Guildford Garden Railway Show will become an annual feature helping to promote and support the Garden Railway movement. Invitations to traders and potential exhibitors will go out in January 2019.

Rather sooner will be the annual Open Weekend of the Tyneside SME, held at its track in Exhibition Park near the centre of Newcastle. The society offers 3½in and 5in raised lines, along with a 5 and 7¼in ground level line, the latter fully signalled with points. A hydraulic traverser is also available which makes unloading of locomotives a much easier process.

Anyone interested in getting involved can find more details on the website, www.tsmee.co.uk, or on the Society's Facebook page.

And finally – just as we close for press a copy of *Vectimod*, the quarterly newsletter of the Isle of Wight MES, arrives in the post. The front-cover picture is fascinating, a steam lawnmower! Built by Steve Schlemmer in 2011 and recently brought to the island, it uses the steam plant of a Maxitrak machined kit for the 7¼in gauge vertical-boilered Welsh quarry loco 'Chaloner.' It even has full Stephenson reversing gear! See – even the most boring chores like mowing the lawn can be made more fun if you think outside the box... EIM

ABOVE LEFT: EIM Ed Andrew Charman took this picture of the road steam action at the Doncaster show. We'd rather have used a picture from a club here – but we don't get enough! (Hint hint...)

ABOVE: One of the Ed's favourite models at Doncaster – a 'mutant Mamod' displayed on the Model Steam Road Vehicle Society stand.

JULY 2018 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 running, 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.

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

1 GL5 Association Rally, Lincoln

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

1 Plymouth Miniature Steam public running, Pendeen Crescent.PL6 6RE

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

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

2 Lancaster Morecambe ME members evening running, Cinderbarrow Railway, from 5pm

4 Bradford MES Steerage Competition, Wibsey Park, 7.30pm.

4 Chingford DMEC Members Locos, Ridgeway Park, 7pm

6 Portsmouth MES Driver instruction, Bransbury Park, 6.30pm

7 Lancaster & Morecambe ME Open Day, Cinderbarrow Rly (see Every Sunday), 9.30am-4.30pm.

7 SMEE Talk, 3D Printing in the Engineering Workshop, Neil Wyatt, Marshall House, London SE24, 2.30pm. Pre-book only at chairman@sm-ee.co.uk

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

7-8 Guildford MES Gala, Stoke Pk Railway, GU1 1TU, 2-5pm

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

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

8 Chichester ME Public Running, Blackberry Lane, PO19 7FS. 1-5pm

8 Leeds SME public running, Eggborough, 10am-4.30pm

8 Worthing SME Public Running, Field Pce, The Boulevard, BN13 1NP

11 Chingford DMEC Juniors Night, Ridgeway Park, 7pm

12 Cardiff MES Members Projects, Heath Park

12 Worthing SME Meeting, Field Pce, The Boulevard, BN13 1NP

13 Tiverton MES meeting, Old Heathcoat School Comm Cntr, 7.30pm

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

15 Bristol SME Club Day, Ashton Court, BS8 3PX

15 Plymouth Miniature Steam public running, Pendeen Crescent.PL6 6RE

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

16 Pietermaritzburg MES (NZ), Meeting, Pietermaritzburg 3201

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

17 South Durham SME Open Day, Croft Rd, Hurworth, from 10am

18 Chingford DMEC Time Trial, Ridgeway Park, 7pm

20-21 Frimley Lodge MR open Weekend, Sturt Rd GU16 6HT.

21 Sydney SLS Running Day, Anthony Rd, West Ryde, NSW, Australia

21-22 Tyneside SME Open Wknd, Exhibition Pk, Newcastle, www.fsmee.co.uk

22 Bradford MES Visitors Day, Northcliff

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

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

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

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

22 Worthing SME Public Running, Field Pce, The Boulevard, BN13 1NP

25 Chingford DMEC Hornby Dublo Night, Ridgeway Park, 7pm

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

26 Worthing SME Club meeting, Field Pce, The Boulevard, BN13 1NP

27-29 GL5 Association Rally and AGM, Saracen's Head

28 Tiverton MES maintenance & improvement day, Worthy Moor.

28-29 Rugby MES Narrow Gauge Event, Onley Lane, 10am-5pm, details NGEvent@outlook.com

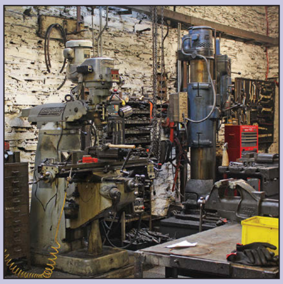
29 Welling DME public running, next to Falconwood rail station, 2-5pm.

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...

THE MAGAZINE FOR MODEL ENGINEERS
ENGINEERING in Miniature



Inside the Talyllyn Railway's Victorian workshops

Further Walschaerts study

Steaming the double-acting stationary engine

Making clock pivots

August issue on sale 19th July

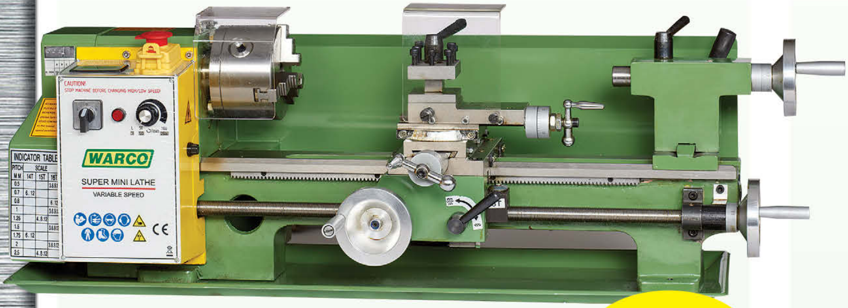
Contents correct at time of going to press but subject to change

Index to Volume 39

SUBJECT INDEX

This index covers Engineering in Miniature volume 39 nos 1 to 12, July 2017 to June 2018. For ease of use the feature is listed with its month of publication followed by the page – so for example Aug 33 means August 2017 issue, page 33. 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.

Vintage Steam Rallies



CLASSIFIED ADVERTISEMENTS

RATES: Display box: £10.50 for scc (plus VAT) (min 25mm), Classified lineage 70p per word (inc.VAT) (min 20 words)
All classified advertisements must be prepaid. ALL ADVERTISEMENTS SUBJECT TO VAT AT RATE AT TIME OF PRINT

THE MAGAZINE FOR MODEL ENGINEERS
ENGINEERING in Miniature

BACK ISSUES

Vol. 1 No. 1 (Apr 1979) to Vol. 18 No. 6 (Dec 1996) .... **£2.20 each**
Vol. 18 No. 7 (Jan 1997) to Vol. 2 No. 4 (Oct 2000) .... **£2.40 each**
Vol. 22 No. 5 (Nov 2000) to Vol. 28 No. 3 (Sep 2006) .... **£2.60 each**
Vol. 28 No. 4 (Oct 2006) to Vol. 30 No. 6 (Dec 2008) .... **£2.70 each**
Vol. 30 No. 7 (Jan 2009) to Vol. 18 No. 6 (Jun 2011) .... **£2.95 each**
Vol. 33 No. 1 (Jul 2011) to Vol. 34 No. 2 (Aug 2012) .... **£3.10 each**
Vol. 34 No. 3 (Sep 2012) to Vol. 36 No. 6 (Dec 2014) .... **£3.30 each**
Vol. 36 No. 7 (Jan 2015) to Vol. 38 No. 2 (Aug 2016) .... **£3.50 each**
Early issues may be facsimiles (Photocopies - not original)
Individual issues postage (UK) – quantity/cost 1/**£1.35** 2-3/**£1.75** 4-5/**£2.35** 6-12/**£2.95**
ANY 12 ISSUES pre-1997 for **£21.00,** 1997-2006 for **£28.00,** 2007-2012 for **£32.00**
BOUND VOLUMES (All subject to availability - no stock of Volume 1):
Volumes 2-19 inc. **£32.95** (F) each, Volumes 20, 21 & 22 **£35.95** (F) each
Volumes 23-25 inc. **£38.95** (F) each, Volumes 26-37 **£42.95** (F) each
All volumes, Unbound, Loosebound or Bound are subject to availability
UK Postage £5.95 per volume. Order over £50.00 sent free. Overseas postage please enquire.
ORDER NOW www.teepublishing.co.uk **or Call** 01926 614101
TEE Publishing, The Fosse, Fosse Way, Nr. Leamington Spa, Warks. CV31 1XN

TO ADVERTISE HERE CALL ALLISON ON 01778 395002

WANTED

Myford 7 & 10 Lathes
Small Milling Machines
Home workshops cleared for
CASH
Distance no object
Please contact John on
01205 480 666

ADVERTISERS' INDEX

MODEL ENGINEERING PRODUCTS (Bexhill)

www.model-engineering.co.uk
E: modelengineerssupplies@gmail.com
Manufacturer of 5 inch gauge diesel outline battery electric locos and accessories
PHONE: 01424 223702 MOBILE: 07704 256004
17 SEA ROAD, BEXHILL-ON-SEA
EAST SUSSEX TN40 1EE
VISA MasterCard

MACC Model Engineers Supplies LTD
0161 408 2938 www.maccmodels.co.uk

We supply a vast range of materials
Brass, Steel, S/Steel Phos Bronze
Sheet and Bar.
Copper and Brass tube upto 6" dia

We also stock a range of high quality, British made steam fittings.
BA Nuts and bolts, taps and Dies.....

Iseasteamdesigns.uk

Boiler gauge glasses
Vacuum brake fittings
Scale lubricators for 3 1/2"- 5" - 7 1/4" gauge locomotives.
2"- 4" scale traction engines fittings.
Built to order
Contact Ian: iseasteam2@gmail.com
01485 541627 / 07511 198943

LASER CUTTING

CNC Folding and Machining
Fabrication and Welding
All Locomotive & Traction Engine parts.
Your drawings, E-files, Sketches.
e: stephen@laserframes.co.uk
m: 0754 200 1823
t: 01423 734899 (answer phone)
Well Cottage, Church Hill, North Rigton, Leeds, LS17 0DF
www.laserframes.co.uk

VIEW MODELS

We trade in locomotives and traction engines in the model engineering scales. We have various models in stock for which a list is available on request. We are also interested in purchasing models and can provide a repair and restoration service for those without facilities.
Telephone 01252 520229 or e-mail: viewmodels@yahoo.co.uk

ITEMS MAIL ORDER LTD

MAYFIELD, MARSH LANE, SAUNDBY, RETFORD, NOTTS, DN22 9ES
Tel/Fax: 01427 848880
BA SCREWS IN BRASS, STEEL AND STAINLESS. SOCKET SCREWS IN STEEL AND STAINLESS. DRILLS, RIVETS, TAPS, DIES, END MILLS, SLOT DRILLS ETC
PHONE FOR FREE LIST

Meccano Spares

Reproduction & Original Meccano Parts.
www.meccanospares.com
Tel: 01299 660 097