

FORRESTER'S 'CREWE TYPE' LOCOMOTIVES

Join our online community www.model-engineer.co.uk Vol. 233 No. 4746 28 June 2024 – 11 July 2024

MODEL ENGINEER

THE ORIGINAL MAGAZINE FOR MODEL ENGINEERS



Bassett-Lowke
'Eclipse'
engine
revisited

A Stirling Single in South Africa



MORTONS



Inaugural
train on
Edinburgh's
new track

Forrester
locomotive on
the Dublin
railway

Three inch
Allchin
embarks on a
day's outing

MARKET LEADER IN LARGE
SCALE, READY-TO-RUN,
LIVE STEAM

OVER 80% OF BATCH NOW SOLD!

GWR 15xx CLASS FOR 5" GAUGE

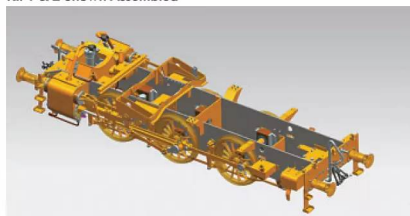
£6,495 + £195 p&p



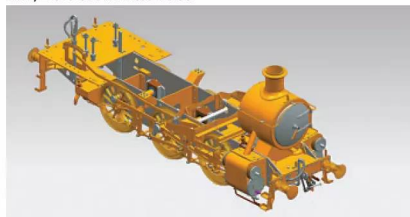
Kit 1 Shown Assembled



Kit 1 & 2 Shown Assembled



Kit 1, 2 & 3 Shown Assembled



Kit 1, 2, 3 & 4 Shown Assembled



Kit 1, 2, 3, 4 & 5 Shown Assembled



Kit 1, 2, 3, 4, 5, & 6 Shown Assembled

Request your free brochure today

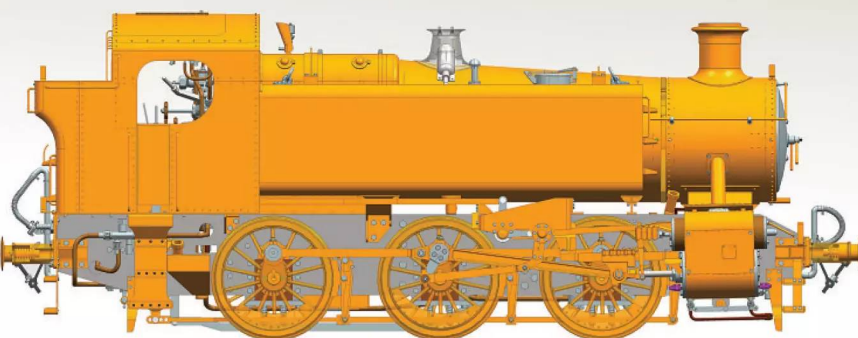
Request your free brochure today by e-mail, telephone, or by returning the coupon opposite.

Telephone: **01327 705 259**

E-mail: **info@silvercrestmodels.co.uk**

Find more information at

www.silvercrestmodels.co.uk



The GWR 15xx Class

All ten locomotives of the class were constructed in 1949 at Swindon and entered service on the Western Region of British Railways. They were employed on heavy shunting duties at London Paddington. Numbers 1501/2/9 were later sold to the National Coal Board for use in collieries. The 15xx was turned out in different liveries including lined black and NCB maroon.

The 15xx Model

We have chosen the 15xx Class as our first fully machined, bolt-together, kit model. It is a substantial tank engine with two outside cylinders and Walschaerts valve gear. You will receive the model in a single delivery with every component required to build a complete model. The kit is divided into 6 sub-kits. See illustrations here showing the build stages. It is suitable for the novice builder who will benefit from illustrated assembly instructions and an instructional video. The kit is delivered fully painted in the livery of your choice. The model is also available ready-to-run. Boilers are silver soldered and UKCA marked. All components benefit from a 5 year warranty.

Summary Specification

- 5" Gauge, coal-fired, live steam
- 2 outside cylinders
- Outside Walschaerts valve gear
- Stainless steel motion
- Silver soldered copper boiler
- Boiler feed by axle pump, injector and hand-pump
- Multi-element superheater
- Drain cocks
- Safety valve
- Etched brass body
- Choice of liveries
- Mechanical lubricator
- Reverser

Approximate Dimensions

- Length 35"
- Width 10"
- Height 14"
- Weight 51kg

**FREE
SAMPLE KIT
WORTH
£100!***

TRY BEFORE YOU BUY

Experience the 15xx build for yourself with this free kit comprising main frames, stretchers and buffer beams. It is completely free when you request the brochure. **It's yours to keep, with no obligation to buy the model.** This free kit reduces the cost of the model to £6,395 should you decide to purchase it.

Delivery and Payment

Save £195.00. Free p&p for any order received within 28 days.



The order book is now open and we are happy to accept your order reservation for a deposit of just £995.

We will request an interim payment of £2,450 in July as the manufacture progresses, a further stage payment of £2,450 in September and a final payment of £500 in November 2024 on batch completion.

Request your free brochure and free sample kit now by returning the coupon below, or by phoning 01327 705 259.



15xx model in BR Black livery

Please send, without obligation, my free brochure and free sample kit

Name: _____

Address: _____

Post Code: _____

Please send to: Silver Crest Models Limited
18 Cottesbrooke Park, Heartlands Business Park,
Daventry, Northamptonshire NN11 8YL

MEM

MODEL ENGINEER

Published by Mortons Media Group Ltd,
Media Centre, Morton Way, Horncastle, Lincs LN9 6JR
Tel: 01507 529589 Fax: 01507 371066
© 2023 Mortons Media ISSN 0026-7325
www.model-engineer.co.uk

EDITORIAL

Editor: Martin R. Evans
MEEditor@mortons.co.uk
Deputy editor: Diane Carney
Designer: Druck Media Pvt. Ltd.
Club News: Geoff Theasby
Illustrator: Grahame Chambers
Publisher: Steve O'Hara

CUSTOMER SERVICES

General Queries and Back Issues
01507 529529 Monday-Friday: 8.30am-5pm
Answerphone 24hr
help@classicmagazines.co.uk
www.classicmagazines.co.uk

ADVERTISING

GROUP HEAD OF INVESTMENT – Lifestyle & Tractor Publications | www.talk-media.uk

Mason Ponti mason@talk-media.uk
A: Talk Media, The Granary, Downs Court,
Yalding Hill, Yalding, Kent ME18 6AL
Investment Manager: Karen Davies
karen@talk-media.uk

PUBLISHING

Sales and distribution manager: Carl Smith
Marketing manager: Charlotte Park
Commercial director: Nigel Hole
Publishing director: Dan Savage

SUBSCRIPTION

Full subscription rates (but see page 66 for offer):
(12 months, 26 issues, inc post and packing) –
UK £132.60. Export rates are also available,
UK subscriptions are zero-rated for the purposes
of Value Added Tax.

Enquiries: subscriptions@mortons.co.uk

PRINT AND DISTRIBUTIONS

Printed by: William Gibbons & Son, 26 Planetary
Road, Willenhall, West Midlands, WV13 3XB
Distribution by: Seymour Distribution Limited,
2 East Poultry Avenue, London EC1A 9PT

EDITORIAL CONTRIBUTION

Accepted photographs and articles will be paid for upon publication. Items we cannot use will be returned if accompanied by a stamped addressed envelope and recorded delivery must clearly state so and enclose sufficient postage. In common with practice on other periodicals, all material is sent or returned at the contributor's own risk and neither Model Engineer, the editor, the staff nor Mortons Media Ltd can be held responsible for loss or damage, howsoever caused. The opinions expressed in Model Engineer are not necessarily those of the editor or staff. This periodical must not, without the written consent of the publishers first being given, be lent, sold, hired out or otherwise disposed of in a mutilated condition or in other unauthorised cover by way of trade or annexed to or as part of any publication or advertising, literary or pictorial manner whatsoever.

MORTONS
MEDIA GROUP LTD



<http://www.facebook.com/modelengineersworkshop>

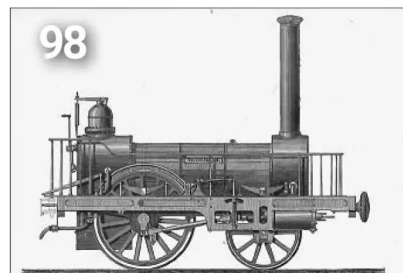


<http://twitter.com/modelengineers>



When you have finished with
this magazine please recycle it.

Paper supplied from wood grown in
forests managed in a sustainable way.



ISSUE IN THIS ISSUE IN THIS ISSUE IN THIS ISSUE IN THIS ISSUE

**SUBSCRIBE
& SAVE UP TO 49%**
See page 66 for details.

Vol. 233 No. 4746 28 June 2024 – 11 July 2024

68 SMOKE RINGS

News, views and comment on the world of model engineering.

69 INNOVATIONS IN THE LAST 100 PUBLISHED MODEL ENGINEER ARTICLES

Luker reflects on his contributions to Model Engineer.

72 A TWIN TANDEM COMPOUND STEAM ENGINE

Graeme Quayle presents an interesting design for a compound winding engine.

77 BUTTERSIDE DOWN

Steve Goodbody returns with further tales of the trials and tribulations of a model engineer's life.

82 FLYING SCOTSMAN IN 5 INCH GAUGE

Peter Seymour-Howell builds a highly detailed A3 locomotive based on Don Young's drawings.

84 HARRIS TWEED

Roger Backhouse discovers how an iconic fabric is produced..

87 SMEE NEWS

Martin Kyte reports from the Society of Model and Experimental Engineers.

90 SUPER GLUE IS SUPER

Patrick Hendra contends that superglue really does live up to its name.

94 BASSETT-LOWKE ECLIPSE REPLICA

Jason Ballamy revisits a small boat engine produced by Bassett-Lowke a century go.

98 BOXERS TO POLKAS

Ron Fitzgerald describes the work of George Forrester, originator of the 'Crewe Type' of locomotive.

103 THE BALLAD OF ALMONDELL

Andrew Newton presents the history of the Edinburgh club's new track, accompanied by song.

107 LNER B1 LOCOMOTIVE

Doug Hewson presents a true to scale five-inch gauge model of Thompson's B1.

112 CLUB NEWS

Geoff Theasby compiles the latest from model engineering clubs around the world.

115 CLUB DIARY

Future Events.



ON THE COVER...

Luker's 5 inch gauge 2-2-2 Stirling Single locomotive (photo by Mrs Luker).

This issue was published on June 28, 2024.
The next will be on sale on July 12, 2024.



www.model-engineer.co.uk



CJ18A Mini Lathe - 7x14 Machine with DRO & 4" Chuck

SPECIFICATION:

Distance between centers: 350mm
Taper of spindle bore: MT3
Spindle bore: 20mm
Spindle speed: 50-2500rpm
Weight: 43Kg

Price: £595



AMABL210D BRUSHLESS MOTOR 8x16- LARGE 38mm spindle bore

SPECIFICATION:

Distance between centers: 400mm
Taper of spindle bore: MT5
Spindle bore: 38mm
Number of spindle speeds: Variable
Range of spindle speeds: 50~2500rpm
Weight: 65Kg

Price: £1,185



AMABL250Fx750 Lathe (10x30) Variable Speed - Power Crossfeed - Brushless Motor

SPECIFICATION:

Distance between centers: 750mm
Taper of spindle bore: MT4
Spindle bore: 26mm
Number of spindle speeds: Variable
Range of spindle speeds: 50~2500rpm
Weight: 140Kg

Price: £1,904



VM25L Milling & Drilling Machine Belt drive & Brushless Motor

SPECIFICATION:

Model No: AMAVM25LV (MT3) / (R8)
Max. face milling capacity: 63mm
Table size: 700x180mm
T-slot size: 12mm
Weight: 120Kg

Price: £1,431

W DRO – Price: £1,921

W DRO + PF - Price: £2,210



XJ12-300 with BELT DRIVE and BRUSHLESS MOTOR

SPECIFICATION:

Gas Strut
Forward Reverse Function
750W BRUSHLESS Motor
Working table size: 460mm x 112mm
Gross Weight is 80Kg

Price: £725

W 3 AXIS DRO- Price: £955



VM18 Milling Machine Belt drive & Brushless Motor

SPECIFICATION:

Model No: VM18 (MT2) / (R8)
Max. face milling capacity: 50mm
Table size: 500x140mm
T-slot size: 10mm
Weight: 80Kg

Price: £1,190

W 3 AXIS DRO - Price: £1,627

See Website for more details of these machines and many other products at incredible prices!



www.amadeal.co.uk

| Call: 0208 558 4615 | Email: info@amadeal.co.uk |



AMABL290VF Bench Lathe (11x27) - power cross feed - BRUSHLESS MOTOR

SPECIFICATION:

Distance between centers: 700mm
Taper of spindle bore: MT5
Taper of tailstock quill: MT3
Motor: 1.5kw
Weight: 230Kg

Price: £2,782

W 2 Axis DRO – Price: £3,150



VM32LV Milling & Drilling Machine Belt drive & Brushless Motor

SPECIFICATION:

Model No: AMAVM32LV (MT3) / (R8)
Max. face milling capacity: 76mm
Table size: 840x210mm
T-slot size: 14mm
Weight: 240Kg

Price: £2,100

W DRO – Price: £2,537

W DRO + PF - Price: £2,948



**Clamping
Kits**



**Boring
Head
Sets**



**Parallel
Sets**



**Keyway
Broach
Sets**

Hi Spec Low Prices Why pay more?

**Prices inc VAT & Free delivery to
most mainland UK postcodes**

We Accept



MODEL ENGINEER

SUBSCRIBE AND SAVE

Enjoy 12 months for just £68



PRINT ONLY

Quarterly direct debit for **£19**

1 year direct debit for **£68**

1 year credit/debit card for **£74**

PRINT + DIGITAL

Quarterly direct debit for **£22***

1 year direct debit for **£85***

1 year credit/debit card for **£88***

DIGITAL ONLY

1 year direct debit for **£50***

1 year credit/debit card for **£54***

**Any digital subscription package includes access to the online archive.*

Great reasons to subscribe

>> Free UK delivery to your door or instant download to your digital device

>> Save money on shop prices >> Never miss an issue

>> Receive your issue before it goes on sale in the shop



classicmagazines.co.uk/MEDPS



01507 529529 and quote MEDPS

Lines are open from 8.30am-5pm weekdays GMT

Offer ends December 31, 2024. Subscriptions will start with the next available issue. Direct Debit payments will continue on the agreed plan unless you tell us otherwise. To view the privacy policy for MMG Ltd (publisher of Model Engineer), please visit www.mortons.co.uk/privacy

Please visit www.classicmagazines.co.uk/terms for full terms & conditions.



MARTIN EVANS
Editor



DIANE CARNEY
Assistant Editor



Bradford Cup

The votes are in and have been counted! Many thanks to everyone who took the trouble to vote.

I am pleased to announce that the clear winner this year is **Ron Fitzgerald** for his excellent series on the stationary steam engine. The priceless trophy will be presented to Ron in due course – watch this space!

Midlands Show and Competitions

Meridienne Exhibitions look forward to welcoming you to one of the UK's largest model engineering exhibitions, the Midlands Model Engineering Exhibition, taking place from Thursday 17th to Sunday 20th October 2024.

There will be **over 30 clubs and societies** present displaying hundreds of exhibits covering a wide range of modelling skills.

There will also be **nearly 40 of the leading model engineering specialist trade suppliers**, all waiting to meet you and provide everything you need for your modelling activities.

SMEE will be presenting some **practical workshops** again this year which will focus



on a beginner's project Elmers No 19. Over the duration of the exhibition the team plan to make multiple sets of the parts and build a number of running examples as the show progresses. This is the model in more detail: www.journeymans-workshop.uk/elmer19.php

For the more experienced model engineer there will also be demonstrations of more complex techniques as well as a range of their famous models on display and a chance to meet the members and learn about their training courses, programme of meetings and membership.

The **competition and display entries** are now open, and the entry form can also be downloaded from the show website.

At this year's exhibition, the **John Stevenson Trophy** will be awarded in association with Model Engineer's Workshop and the *Model Engineer* website. This competition is awarded for excellence in practical and useful workshop equipment. For more information on the competition and how to enter your work see www.model-engineer.co.uk.

The **Association of Helicopter Aerosports** will be at the exhibition with an indoor static display, simulator, and outdoor flying demonstrations!

The static display will cover various types and sizes of R/C helicopters and the simulator will allow visitors to have a go at flying R/C helicopters. Weather permitting the AHA will also have an outdoor flying demonstration of scale model helicopters. Models included in the flying demonstrations are a 1/8 scale MH-65 Dauphin, a 1/7 scale Bell UH-1B Iroquois (Huey) and a 1/8 scale Westland Lynx HMA Mk8.

The **lecture program** is also shaping up and the full schedule will be announced soon!

This unique exhibition is the result of a tremendous amount of effort by many hundreds of modellers and other enthusiasts. A full list of confirmed exhibitors to date is available at www.midlandsmodelengineering.co.uk as well as the competition entry form and advance tickets!



Elmers No 19



Model Engineer



Midlands Show



Martin Evans can be contacted on the mobile number or email below and would be delighted to receive your contributions, in the form of items of correspondence, comment or articles.
07710-192953
MEeditor@mortons.co.uk

Innovations in the Last 100 Published Model Engineer Articles

PART 1

Luker looks back over his recently achieved century.



Non reverti

Would you believe I have recently achieved my century for published articles in model engineering print (most of which were in *Model Engineer*)? I felt a warm fuzzy feeling when I realised I had hit this milestone, not only for the good innings, but more because I managed to keep most of the articles technical and novel.

Over the years I have received some great feedback but my last article 'demise of the model engineer' seemed to have hit a chord with some readers. The article dealt mainly with how to promote the hobby, specifically amongst the youth, but I do believe model engineering needs to evolve to cater for the next generation with a different skill set, including modern materials

and methods. Innovation is the technical evolution of mechanical systems, and as I step over the 100-ish (*sic*) article I would like to take a look back at some of my innovative ideas hidden amongst the construction series, or in-between a broader subject.

I do need to be upfront on a few things before I begin. Nothing is really new; everything has been done or tried, or is just a variation, or extrapolation of someone else's idea. With that in mind the terms innovation or novel are used very loosely! All the 'novel ideas' in this article have been used, and tested, in my builds. The ideas, to the best of my knowledge, were novel (maybe just to me) or applied in a unique way. Whether or not I was first is always debatable and, in my experience, there's always someone that claims to have already thought of an idea with very little to show for their visionary insight...

Modern techniques and calculations for balancing steam engines

The first innovation has never explicitly been published but has been lurking in the background of my live steam designs. Thermodynamic balance of live steam models has always been of particular interest to me. This is not to be mistaken for heat transfer, which is at a component level, but will affect the overall thermal performance. For example, if the heat flux into the boiler (heat transfer)

doesn't match the cylinder swept volume (thermodynamic balance) then you have an unbalanced steam engine which will either suffer from a safety valve constantly blowing off, or a fire that runs cold or burns out quicker than it should. Martin Evans, in his fine book *The Model Steam Locomotive* gave ratios for grate area to boiler tube area (heat input) and grate area to cylinder swept volume (steam usage) respectively, which seem to work well for the more modern locomotives, but fall short with the very old prototypes, which are my preferred models. I've found the ratio of grate area/design tractive effort (**ref 1**) to give a better indication of steam usage for most engines and I typically aim for a ratio of between 100 and 130 mm²/kg. This was experimentally verified with a number of club locomotives and seemed to hold true.

Once I'm happy with these ratios, everything from pipe sizing, blast nozzle heights and sizes etc. to valve travel and port sizing is 'hand calculated' in an excel spreadsheet and a solver used to optimize the design before anything is modelled or simulated (**photos 1 and 2**).

Computer aided design (CAD) and virtual dynamic model checks

When designing my models I keep an eye on the centre of gravity and try to balance the design; specifically the weight over the drive wheels



My little William, a 2-6-2T engine designed by Martin Evans. I built this locomotive very close to drawing, but found that it tended to run with a colder fire and had an uneven beat. The valve timing and grate was modified to bring it in line with my newer methods; now this little locomotive is a pleasure to drive.



The Stirling 2-2-2 was designed using the ratios in Martin Evans's book but I found the thermodynamic balance was out, causing the safety valves to constantly blow off. This locomotive was fitted with my first experimental stainless steel boiler which may have contributed. The imbalance was easy to fix by adjusting the grate and blast nozzle; this locomotive runs perfectly now.

(fig 1). This is done by adding weight to sneaky areas; a good example is the footplate water tank of Ballaarat which was filled with lead to balance the design perfectly. Most 3D models can be used to check for valve clearance and movement as well as looking for clashes in the virtual space before cutting any material.

CAD in model engineering is not new and for the most part is becoming more common. This is incredibly beneficial to the hobby allowing DFX files for laser cutting to speed up builds and make the final model much easier to assemble.

The days of calculating bending profiles are long gone, with these fancy programs



A complex cylinder casting which would normally require multiple split lines is cast by splitting the pattern; this is much easier with 3D printed patterns. Incidentally the sand is a mix of plaster sand, bentonite and flour; my home made mix that seems to work very well for copper based alloys.



The cylinder as it came out of the sand. Note how the breather holes extend for almost an inch, indicating too much superheat for this pour, but there was very little burn-on with the home made reducing sand mix.

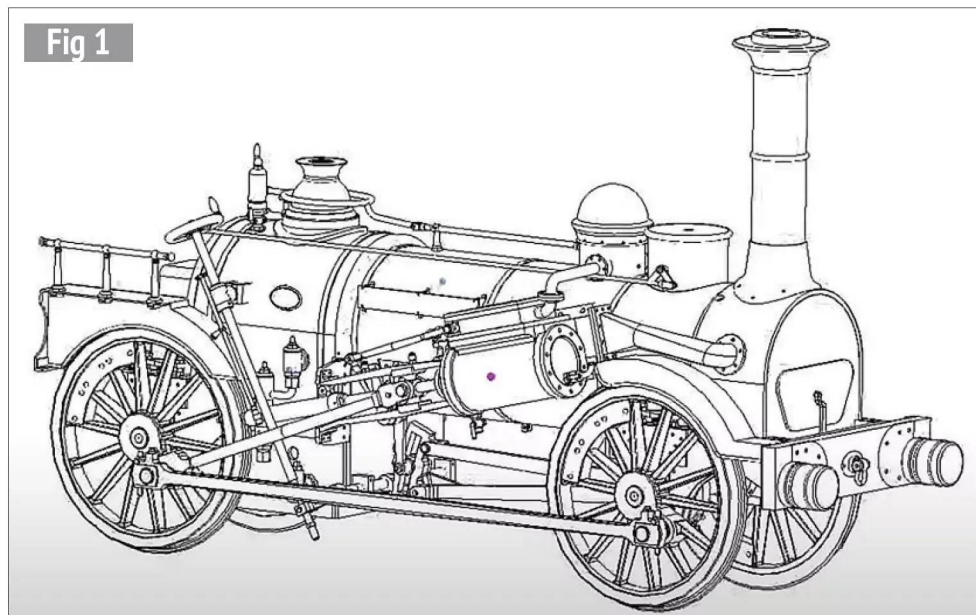
doing the job for the designer. With a click of a few buttons complex profiles can be turned into a flat pattern, a DFX exported, sent to your friendly laser cutters and in no time the flat profile is ready to be folded



A relatively simple pattern, until it needs to be made using wood. Imagine the complexity of making those ribs on the underside and blending the corners without 3D printing or CNC.

or bent to a perfect shape.

The cast component models are very useful to calculate the casting modulus to determine if there will be draw inclusions when casting. This is one of those things you try to solve before going through the effort of melting a charge and casting. These models can be scaled with a simple click of a button to take into account any shrinkage. Ingates, split lines and risers can be included with little effort making ramming easier than if this was eyeballed with a kitchen spoon.



The Fire Queen was a particularly special model. It was very close to scale and in the end the centre of gravity was almost perfectly centred between the wheels. The young engineer that designed the original prototype, no doubt, had this in mind when designing his fine locomotive!



A main wheel pattern with a ribbed rim. 3D printing is perfectly suited for all these fillets and radii.



Copper is one of the more difficult metals to cast because the chance of blow holes, due to gas pickup, is very high.

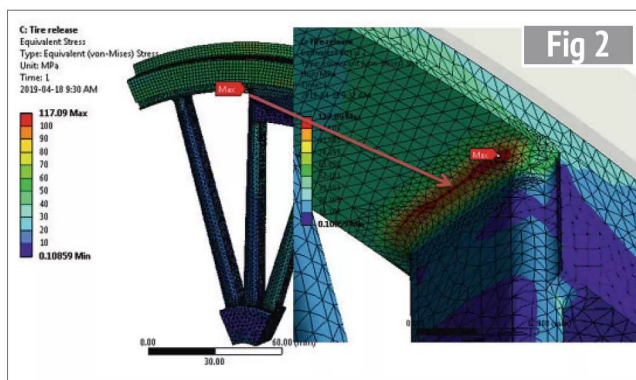
3D printing of complex patterns

Most people can visualise the symmetry split line and draft angles required for removing patterns from sand. Recently I cast a cylinder that had no convenient split line and, instead of making a multiple box mould, I solved the problem by 3D printing a complex multi-part pattern that could be removed from the sand, even though it had a negative draft (**photos 3 and 4**). 3D printing makes techniques like this (called core prints) very easy, turning a simple backyard foundry (with homemade greensand) into one capable of casting very complex shapes.

Another unique example of where 3D printing shines is where old school wheels were domed at the rim, or the disk type wheels with their complex thermal casting ribs. Blending the spoke and the rim would be incredibly difficult and time consuming if this were done by old-school wooden pattern making techniques (**photo 5**) - conversely, a 3D printer can do the job for you overnight (**photo 6 and ref 2**).

Casting methods and new alloys

Many model engineers have cast their own components over the years with incredible results. Most of the furnaces I've seen published over the years were gas fired, or coal fired in the early days. A waste-oil fired furnace is much safer



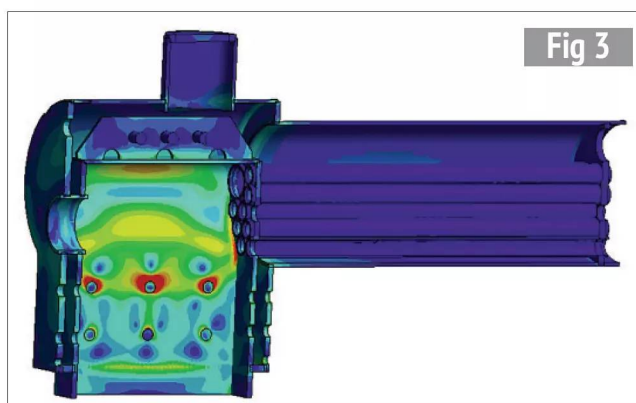
Assemblies of interest which are known to be problematic can be tested to failure, virtually, to determine if the design can handle anything a rough model engineer track can throw at it.

and is relatively inexpensive if the oil from your last car service is used as a fuel source. Design ratios for an efficient design was given in one of my first technical series and as I developed new techniques over the years that made the process more efficient, cheaper or more robust, articles were added to the proverbial casting pot. New crucible additives were developed to reduce the melt and prevent gas pickup (**photo 7**). This is practically necessary when melting fines or copper which is notorious for gas pickup. Various green sand mixes have been developed, tried and tested over the years simply because no local foundry supplier was willing to sell small quantities to a backyard enthusiast. This is the best possible outcome because it forces one to be innovative and cook up new, and inevitably, much cheaper alternatives (**ref 3**).

Because I do most of my own castings it is relatively easy to make designer alloys, and often I tweak the FeSi in cast iron, or tin in copper alloys to get the required grade for the job at hand. One novel alloy was a specially formulated grade of alumina bronze that had almost identical characteristics to gunmetal, but was free machining, and not as tough as the higher strength alumina bronzes. This alloy has effectively replaced gunmetal in my foundry due to difficulty in obtaining tin as an alloying element (and, no, melting tin solder is not financially viable) (**ref 4**).

FEA as a thermal structural design tool

FEA (Finite Element Analysis) is a fantastic tool, used by modern day designers to virtually confirm that a design is sound. When doing research on a specific prototype it's



A surface tensile stress plot to check sensitivity to crevice corrosion cracking when using stainless steel as a boiler material. This plot also debunks the misconception that a crownstay places undue stresses on the foundation ring.

always a good idea to check for known design issues and failures during service. One such example is wheel failures on the old large Victorian era wheels (**fig 2**). Some of these wheels were forge welded which didn't help with failure analysis, but once the design is done, a virtual model can be pushed to failure, and a sanity check done on the input forces to make sure the model will handle high loading without failing.

Boiler design has always been a contentious issue and I'll elaborate on that in a little more detail. FEA has been critical in checking the surface tensile stresses for all my stainless steel boiler designs. Using stainless for boilers is not a new idea, but with the aid of FEA, crevice corrosion cracking (or stress corrosion cracking) can be minimised by strengthening areas where the surface tension is problematic. FEA has also shown that previous misconceptions about loading the foundation ring when using a crownstay instead of rod stays has no basis for my specific designs and it proved that a crownstay is suitable, and in fact, beneficial when fabricating a boiler using TIG (**fig 3**).

●To be continued.

REFERENCES

- Ref 1** Design tractive effort = piston diameter² x stroke x boiler pressure / wheel diameter
- Ref 2** *Backyard Foundry Techniques: Pattern Making Using 3D Printing*. Model Engineer; vol. 226: 4662, 4663
- Ref 3** *Backyard Foundry Techniques*. 2019. Model Engineer; vol. 223: 4626, 4627 and vol. 224: 4628, 4629
- Ref 4** *DIY Model Engineering Cylinder Alloys*. 2023. Model Engineer; vol. 231: 4731

A Twin Tandem Compound Steam Engine

PART 7

Graeme Quayle presents his own design for a compound winding engine.



We'll continue with the making of the valve gear for the TTCSE model steam engine (fig 16). The valve chests and covers in this drawing have already been covered in a previous instalment, so it is the other smaller valve parts that have still to be made.

The valve spindle guides, valve spindle guide bush and the valve spindle gland nuts are all made from 8 mm (5/16 inch) brass hexagon bar and

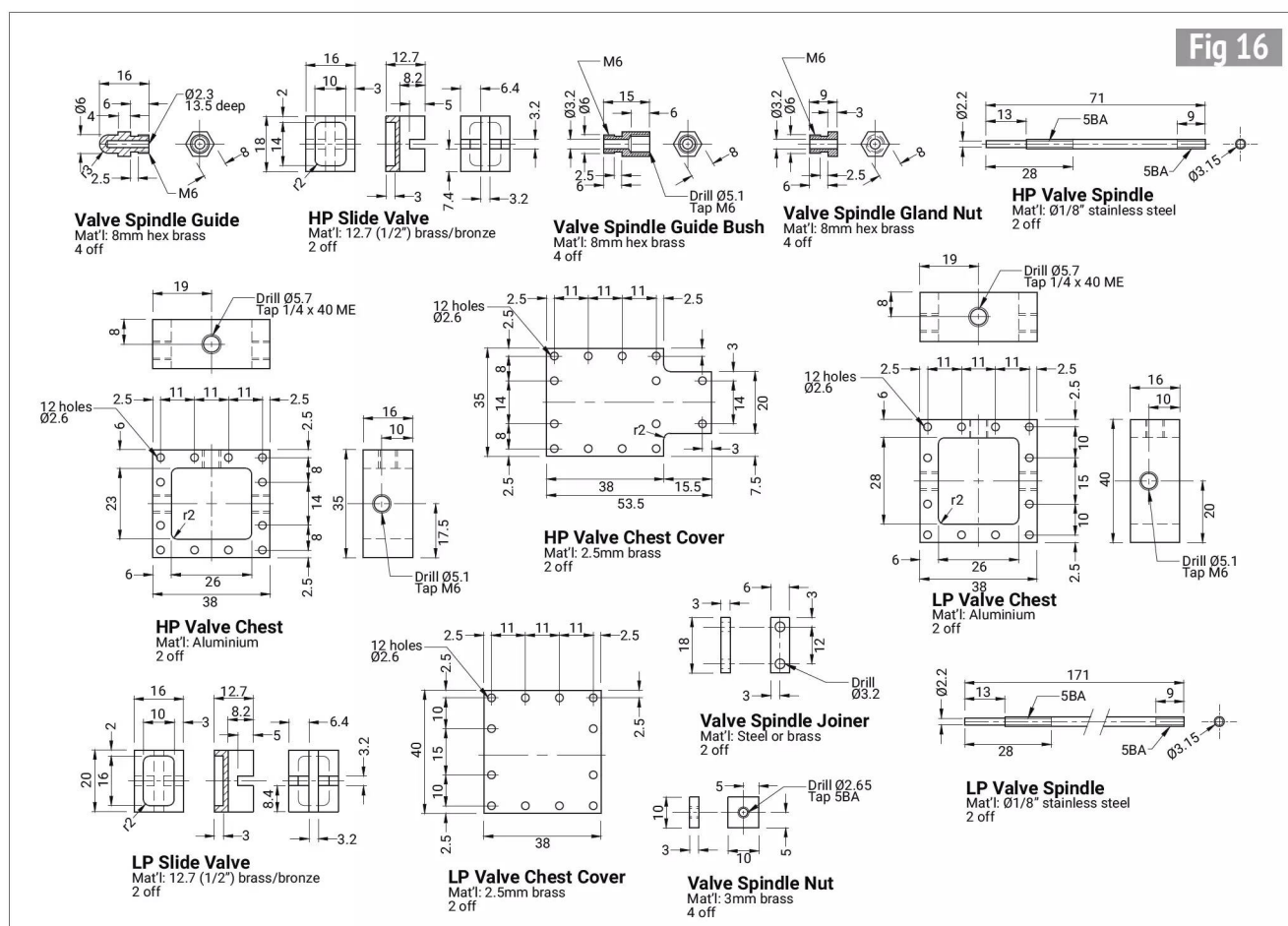
are straight forward machined parts. Do use plug taps to do the internal threading and note the recesses at the shoulders of the external threads - this is so that the parts screw hard against mating surfaces. On assembly of the spindle guides and the guide bush to the valve chests, it is good practice to bed them on 6 mm copper washers.

The HP and the LP valve spindles made from stainless steel are in a harder material

that requires a very sharp tool to machine. Otherwise, because of the small diameter, the turning of the 2.2 mm diameter portion parallel will present problems. This diameter is not critical, so do not worry if it is a little undersize. To do the 5BA threads requires a sharp button die and the thread must be parallel to the axis of the spindle. If you have not got a 5BA die but have 1/8 inch BSW the thread can be changed.

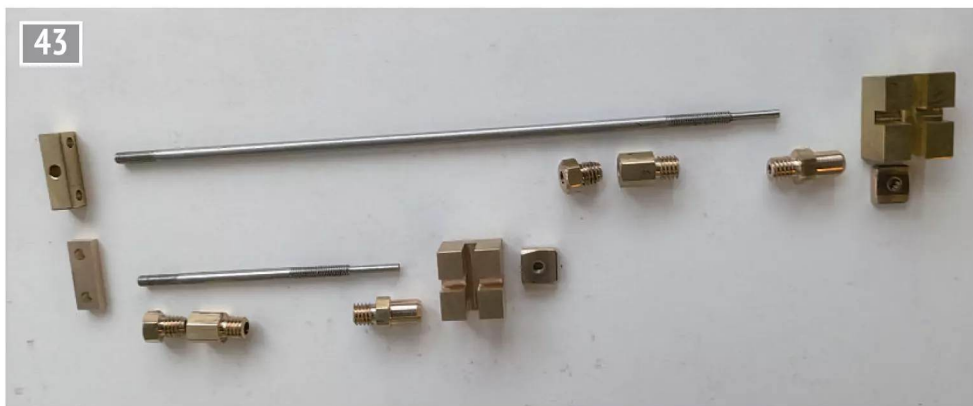
Continued from p.39
M.E.4745 June 14

Fig 16



Valve chests, covers and slide valves.

43



Slide valves and rods.

However, do remember to change the threads in the spindle nuts and the knuckle joints and all the other associated parts. Check that the valve spindles are straight as this small diameter can easily get bends in it. The valve spindles should slide freely through the spindle guides.

The valve spindle nuts have to have the threaded holes

square to the face of the nuts and the nuts must be a free fit in the slots in the slide valves. This is because the slide valve must be free to seat against the valve wear plates.

The slide valves have a rectangular recess 3 mm deep on their working faces and on the outer face two slots. The shallower one fits freely to the valve spindles and the

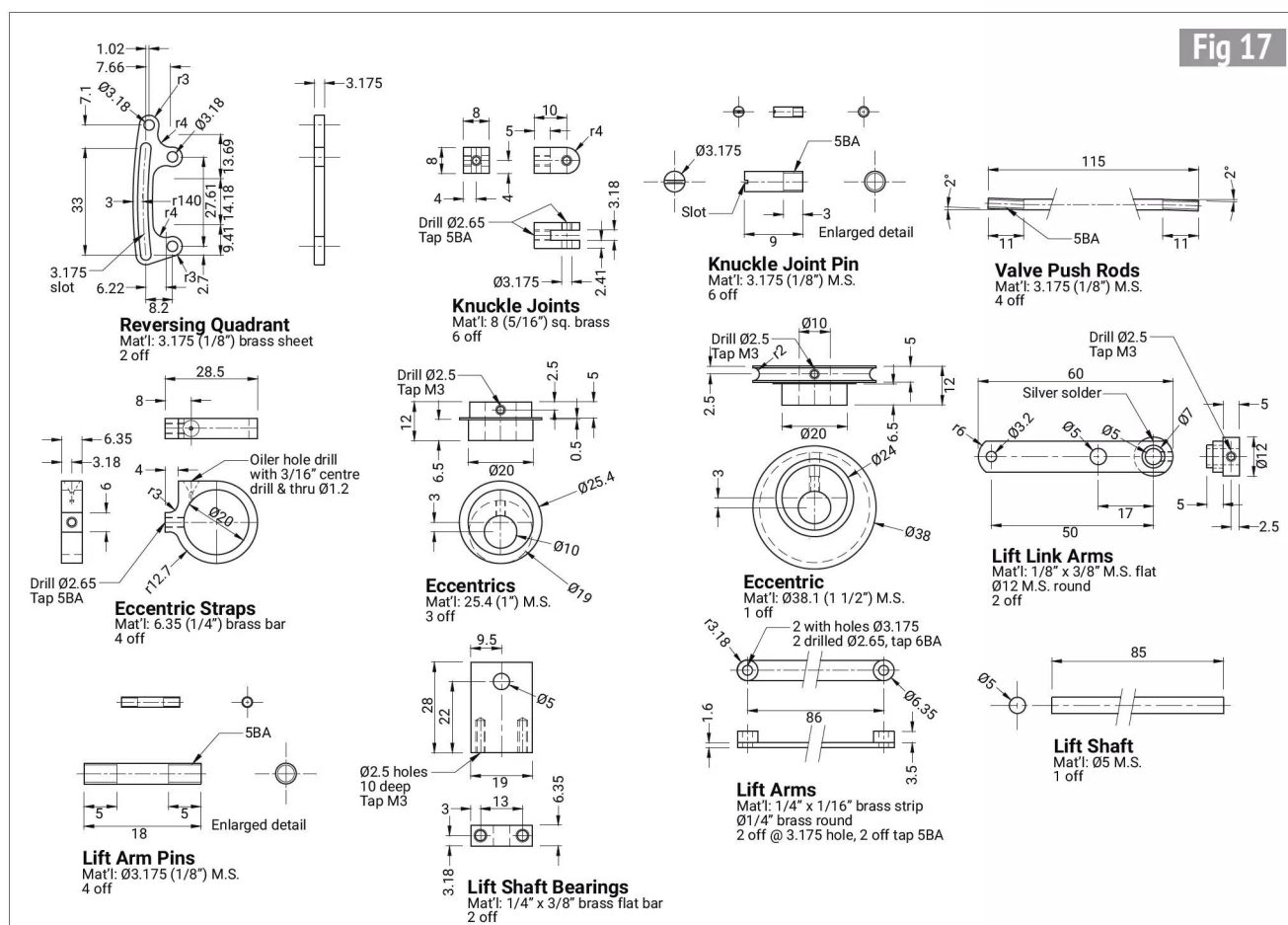
deeper one takes the square nuts, again an easy fit, but not sloppy. The valves are made from 12.7 mm (½ inch) brass or bronze flat bar or plate. The working faces must be finished flat with sharp corners - use fine sandpaper on a flat surface. The final part on this drawing is the valve spindle joiners.

Photograph 43 shows the slide valves and rods. Most of

these parts are shown in fig 16 but a couple of them will be covered next time.

Now moving onto **fig 17** and the rest of the valve parts. The reversing quadrants will need a bit of lateral thinking to be made. If you have access to a laser cutter then that is an option. They can be milled out by hand but it does require a set up to do this. The main part is a flat bar some 50 mm wide and sufficiently thick, say 10/12 mm and at least 600 mm or so long. At one end mount a close-fitting pivot bolt that clamps to your mill table and allows the flat bar to move radially but not freely - it needs to require some effort to move around. Drill and tap the bar to pick up the quadrant's three holes at the required 140 mm radius and fix the individual reversing quadrant blanks to the bar with suitable screws. Countersunk head screws are ideal. Set up a packer under the flat bar out

Fig 17



Reversing components.

44



First stage milling the quadrant slot.

towards the free end and if possible, set up a bridge plate over the top so that the flat bar can still swivel but is trapped vertically. Next, with say a 3 mm slot drill in the mill, set stops on the bed of the mill to the ends of the slots so that the cutter only cuts the 33 mm long slot. Lock the milling machine's bed. Start your machine and carefully advance the slot drill down into the work piece, while holding the end of the flat bar from moving. Slowly swivel the flat bar, by hand, to start milling the slot. Progress the milling until the slot is completed. Replace the 3 mm slot drill with a $\frac{1}{8}$ inch one and open out the slot. Do not attempt to hold the slot drills with a drill chuck, they are not ridged enough, use proper collets. Now the milling machine's bed can be repositioned to mill the outer and inner radii (photos 44, 45 and 46). The smaller radii can

45



Milling the outside radius in the quadrant.



Milling the inner radius.

be done with a spigot in the rotary table or simply formed with a finisher or hand file (**photo 47**).

The faces of the quadrants need to be burr free so hand finish them with some fine sandpaper. The slots should be a smooth finish to allow the pin to slide from end to end in the slots easily.

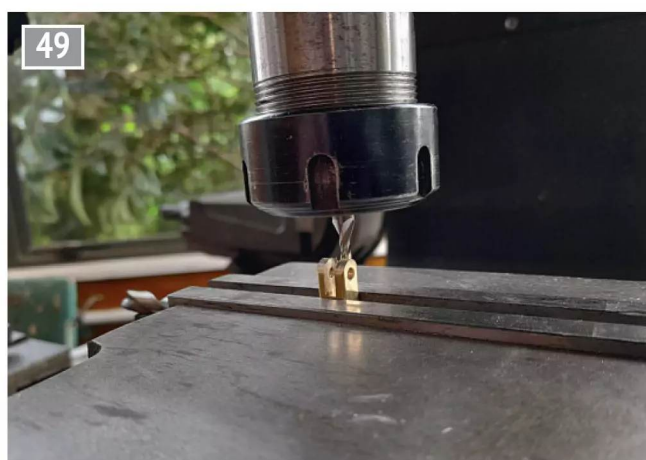
The process to make the knuckle joints can seem obvious but the way that they were done on the prototype is as follows. The pivot hole was drilled for the non-threaded side and then continued through with the tapping size drill and tapped. It pays to prepare the six to each stage. With a stub mandrel in the rotary table the end radius was done (**photo 48**). With a slot drill mill the slot (**photo 49**). Part off in the lathe, drill and tap the rod holes (**photo 50**).



Milling the pivot radius.



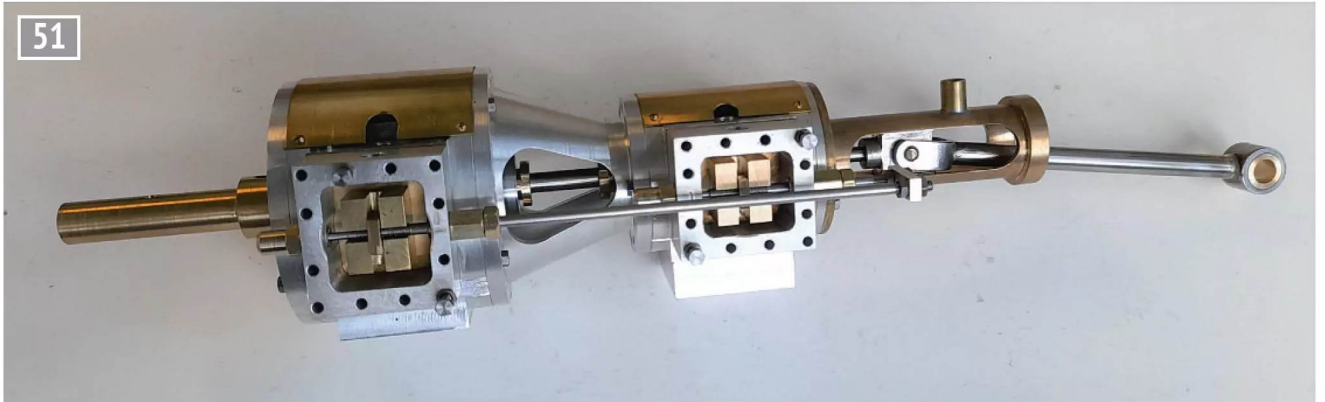
Milling the radius on a knuckle.



Slotting a knuckle.



Finished knuckles.



Assembly of slide valves.

The knuckle joint pins have just sufficient thread on them to screw into the knuckles and lock. They should not project more than 0.5 mm out at either end. Slot them with a junior hacksaw blade.

The valve push rods must be all the same length. Do not bend the ends at this stage - that will be done later.

The four eccentric straps need to be machined identically from $\frac{1}{4}$ inch brass. The prototype ones were made from $\frac{1}{4} \times 1$ inch flat bar, the 20 mm diameter holes being reamed with an adjustable hand reamer, using slow speed in the mill. They were then mounted on a stub mandrel in the rotary table and the radius was milled. The oiler and tapped hole completed these.

The three plain eccentrics were machined to fit the straps, then offset and drilled and reamed for the 10 mm hole and with a parting blade the concentric boss was machined, finally parting off to length. The eccentric with the pulley is a little different as the pulley is concentric with the bore and the eccentric boss offset.

The lift arms are made from $1/16 \times \frac{1}{4}$ inch brass strip which can be bought from model shops that stock the K & S stocks of metal. These arms have to be exactly identical centre to centre. The bars were drilled 4 mm initially and the bosses machined with spigots to fit into these holes. Note that there are pairs of arms some with 3.175 mm ($\frac{1}{8}$ inch) holes and the others drilled and tapped 5BA. The

bosses can be soldered into the arms.

The lift arm pins are threaded one end just long enough to screw into the lift arms and end up flush, the other end having two lock nuts so that the arms can still pivot. The lift shaft bearings screw underneath the top plate so the tapped holes must line up with those already in the top plate. The lift shaft must be able to slide through the lift shaft bearings and revolve. The lift link arms are grub screwed to the lift shaft parallel to one another and they pick up the lower holes in the lift arms. The arms could be out of brass not steel but they must be silver soldered together.

The final valve control parts are shown on fig 11 (M.E.4744, May 31). The reverser lifting link mounts between the link arms and is threaded for the reverser lifting screw. Both parts are self-explanatory and the arrangement on the model is shown on this drawing. The reverser handwheel screws onto the end of the lifting screw and is locked with a nut. The handwheel needs to be able to rock sideways so that the lower end of the lifting screw can just touch the sides of the 10 mm hole in the reverser column. This is to allow for the radius that the lift link arms swing through. The reverser column screws onto the top face of the base plate with 10 mm long screws from underneath.

Setting up the valve gear

The eccentric straps, valve push rods, and the knuckle joints need to be assembled so

that all four are identical, the only difference being that two will have the plain hole in the knuckle facing one way and the other two the other way. The plain holes face outward so that the slotted heads of the knuckle joint pins can be accessed. Then the push rods are slightly bent horizontally so that the knuckles can sit one above the other when the eccentric straps are sitting side by side. The knuckle ends are bent the opposite way until they match together. Mount the eccentrics to the crankshaft with the eccentric straps.

Slide valves and cylinders

The HP and the LP valve spindles are partially slid into their respective valve chests and the valve spindle nuts screwed into spindles about half way along the threaded portion of the spindles. On the HP spindle run a hexagon nut onto the 9 mm threaded end then the valve spindle joiner, locked with another nut. The LP spindle has the guide for the LP valve rod loosely put on then a nut on the 9 mm end, the valve spindle joiner, then a knuckle joint locked on. This knuckle joint connects to the slot in the quadrant but at this stage do not connect it (**photo 51**). This next step is easier to do with the cylinder assemblies not on the base plate but before taking them off mark their positions on the base plate. Slip the slide valves into the valve chests over the valve spindle nuts. Mount the valve chests to the cylinder assemblies but without their covers. Adjust

the valve spindle nuts so that both HP and LP slide valves are just opening and closing the ports in the cylinders at the same time. Make sure the ends of the valve spindles are not bottoming in the valve spindle guides and that the transfer ports can open fully. Mount the cylinder assembly back on the base plate and couple the quadrant with the outer valve push rod coupled to the upper mounting in the quadrant. The top quadrant hole couples to the lift arms. The bottom hole in the quadrant couples to the inner valve push rod. Have the quadrant in its down position for a start. In turning over the crankshaft this will move the valves and they now need to be set so that the end ports open the same amount. If they do not, adjust the valve spindle nuts until both port openings are the same. Remember both HP and LP valve spindle nuts must be adjusted together.

To set the eccentric positions, set the crank to TDC and then turn the eccentric on the crankshaft until it is ahead of the crank by about 90 degrees and the end transfer port is just opening. This means the flywheel will run towards the cylinders. With the quadrant in the up position the other eccentric should be about 180 degrees from the first eccentric, again just opening the port.

The valve chest covers can now be fitted and the guide for the LP valve rod can be fixed in place with two screws and nuts.

●To be continued.

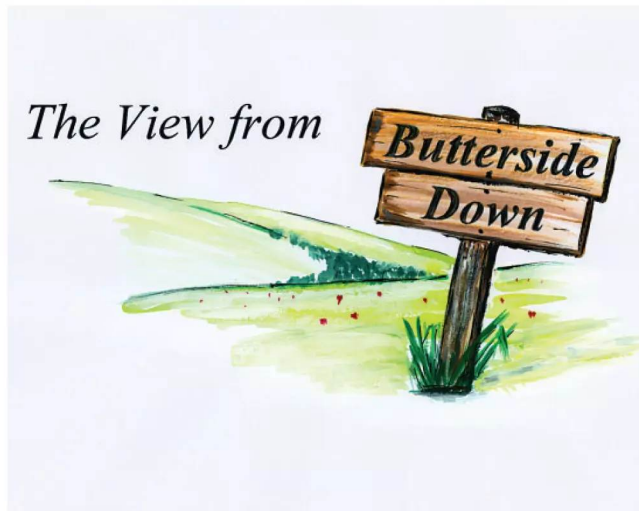
Part 14:

Hauling the Toys - Part 4

Steve Goodbody takes a random walk through model engineering.



Continued from p.46
M.E.4745 June 14



In the previous dramatic instalment, a brave and mathematically inclined cow narrowly escaped injury and a careless driver discovered the Deceleration Demon and lost his no-claims bonus in the process.

We re-join the tale as the author, trailer in hand and bit between his teeth, is deciding how to secure everything in place within.

Ermintrude is presently in hiding; I suspect we have lost her trust.

A firm anchorage

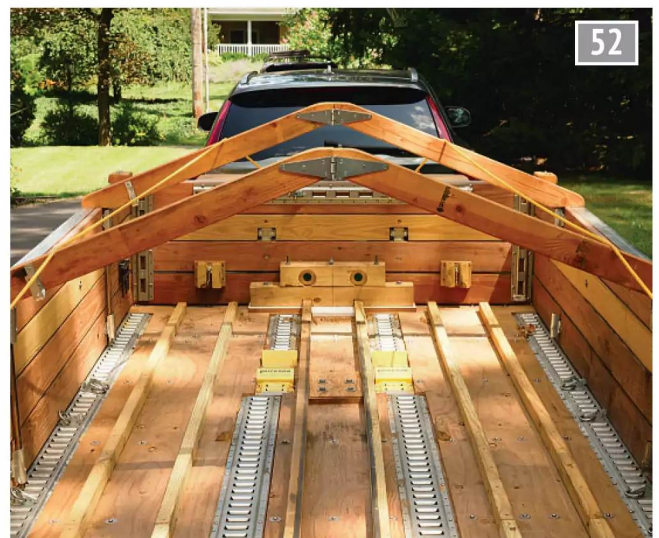
As with the weakest link in the proverbial chain, any system is only as strong as its least-strong component. When considering how to safely secure a traction engine to a transportation trailer, therefore - or anything else for that matter - it is important to ensure that each part of the whole is up to the job.

Knowing that trailers are a common sight on our roads in America, hauling everything from lawnmowers to cars to entire houses (admittedly

less common in the latter case), it seemed reasonable to conclude that a sizeable supply market must exist for trailer tie-downs and their associated accessories. To my happiness, this indeed proved to be the case and it did not take very long to find several websites devoted to the subject.

Reviewing these purveyors,

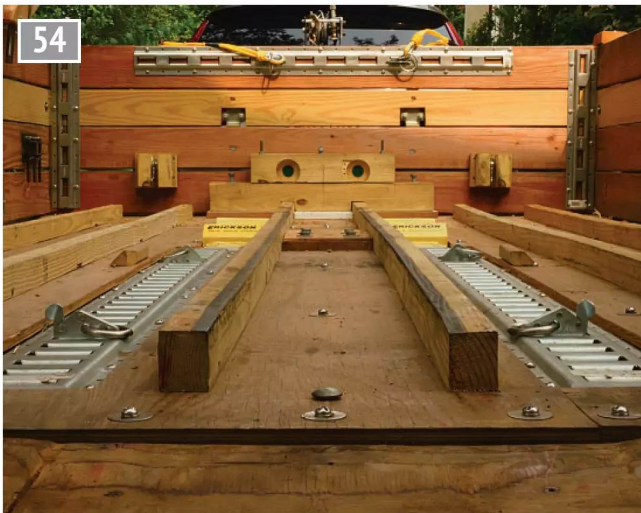
I discovered that one product range – Erickson's *E-Track* (named here and elsewhere with the usual disclaimer, although I am open to offers should the manufacturer wish to reward me for the unbidden advertising!) - appeared to be both commonly available, well-endowed with interesting attachments and eminently adaptable thanks to the clip-in/clip-out nature of those attachments with the *E-Track* mounting strips which form the foundational parts of the system (**photo 52**). Furthermore, as I reviewed the pictures, specifications and load ratings, some of the available items seemed ideally suited to my somewhat unusual application. Convinced that this might be a viable solution, I returned once again to the trailer's layout drawings and, after a bit of thought to determine the best location for the mounting strips to suit the loading plan, I assembled an order, parted with my credit



The author selected Erickson's versatile E-Track system as the basis for his trailer's payload mounts.



53
A hundred (or so) quarter-inch diameter stainless steel fasteners, all lock-nutted to be sure, secure the E-Track strips to the trailer's floor and chassis. A chain is only as strong as its weakest link, after all.



54
Half-inch exterior-grade plywood sheets are also fastened through the original floorboards to the chassis, creating a sturdy composite sandwich.

card details once again and waited for the packages to land upon the doorstep.

The following weekend, the hold-down paraphernalia having duly arrived, I set to work, plan in hand, to install the impressively sturdy mounting strips within the bed of the trailer. Realising, like the aforementioned weakest link, that these items would be useless if they were themselves not securely attached, I began the lengthy process of installing a hundred or so ¼-inch diameter stainless steel screws into the attachment holes, thence into holes painstakingly drilled all the way through the trailer's substantially-planked

wooden floor and finally, where possible, threading and lock-nutting them directly to the trailer's frame, all with shakeproof and large-diameter washers to prevent any chance of their loosening under normal use or pull out in the event of an accident. Overkill perhaps, but better to be safe than sorry (**photo 53**).

With these in place, next came sheets of half-inch exterior-grade plywood, with cut-outs to avoid the mounting strips, all similarly attached to the trailer with another hundred or so fasteners. These sheets would, I reasoned, by tying all of the floor planks together from above, create an

extremely strong composite sandwich and prevent individual planks from breaking free to release the mounting strips (and my precious cargo) even if, heaven forbid, the trailer was upended or perhaps even overturned (**photo 54**). While the theory is, I believe, sound, I sincerely hope that it is never tested in practice!

And so, with the *E-Track* mounting strips firmly attached to both the trailer's frame and the now-reinforced composite floor, the next item on the agenda loomed. How to get *Ruby Swann* into the trailer in the first place, and safely back down at the end of each journey?

Heave-ho

Now, try as I might, and I did try, it is sadly true that I do not possess the strength to push *Ruby Swann*, all three hundred or so kilograms of her dainty Allchin frame, up the ramp and into the trailer. And knowing that she is unlikely to get lighter and I am unlikely to get stronger in my dotage, it seemed prudent to install an *aide mécanique*, as our Gallic friends might say, to get her safely into and out of her conveyance.

Over the years I have used a variety of winches for a range of tasks and, broadly

speaking, they fall into two main categories – those that don't move when you stop them and walk away and those that do. And of these, and especially when working single-handedly, I strongly prefer the former category. However, as you surely know, it is largely the winch's gear ratio which determines whether it will stay put when you are checking what's going on at the other end of the cable or begin spinning wildly to deposit your previous load back at its starting point in a hurry; a winch with a high gear ratio will not move while a lower-g geared variety might. But there's a penalty to pay for a highly geared winch; it takes a heck of a lot more handle turning to move the load any distance.

Of course, one solution is to use an electric winch – a motor doing the job at the press of a button – and that was certainly an option. However, and being an awkward so-and-so, I am not a fan of electric winches; in my experience either the battery dies or the motor conks out at a critical juncture and the operator, now unable to move the precariously suspended load in either direction, finds themselves up the proverbial creek without a proverbial paddle. No, what I wanted was a nice, simple, manual,



55
The worm drive winch, its handle removed and replaced by two locked nuts.

high-ratio winch, capable of getting the traction engine up the ramp in less than two minutes, requiring little effort from yours truly in the process, and allowing me to walk away mid-pull without fear of an uncontrolled downhill descent. Oh yes, and I didn't want it consuming valuable load-bay space within the trailer.

Now before you pooh-pooh this seemingly absurd mishmash of conflicting goals, doubting Reader, let me assure you that such a thing is possible, given a little bit of lateral thinking. For if you, as I, own a modest battery-powered portable drill, then you are already nine-tenths of the way there. And if you still don't believe me, **photos 55 to 58** hopefully explain my particular solution – *vis-à-viz*: a worm-drive high ratio winch, its handle removed from the threaded driveshaft and replaced by two nuts locked together, a two-speed battery-drill to provide both fast and slow motive power and a socket spanner, mounted in the drill's chuck with the appropriate adapter, to transfer the torque from one to the other. And with these simple provisions and a nonchalant grin to the incredulous onlookers, *Ruby Swann* will steadily ascend or descend the ramp under complete control and stay where she is put in the meantime when needed. And should the drill or its battery



The winch is bolted to a substantial shelf above the towbar; readily accessible without consuming valuable payload space.

fail, although I keep a fully charged spare battery in my toolbox as a precaution, I can simply remove those nuts with a couple of spanners, return the winding handle to its intended place, spit on my palms in preparation and finish the job by hand. Fortunately, I haven't had to – yet.

And if you, like me, decide to use an open-topped trailer, then you may want to consider mounting your winch on a

sufficiently robust forward-facing shelf above the towing hitch frame where it will always be ready for use, easily accessible from both inside and outside the trailer and yet consume none of the valuable load-bay space within. For me, three years on, it has worked like a charm.

Chocks away

With a handy winch to drag the traction engine aboard,

sturdy mounting strips to hold her in place once there and a substantial plank-and-plywood composite floor to transfer the loads evenly to the trailer's frame – and hopefully prevent catastrophe in the event of a major upset *en route* – all that remained was to determine exactly how to anchor *Ruby Swann* to those mounting strips. And this, believe it or not, was the simplest part of the entire process because



The winch with portable drill in position, all ready for use.



Ruby Swann begins her drill-powered ascent into the trailer.



Erickson's ATV (All-Terrain Vehicle) wheel chocks were ideal for securing Ruby Swann's front wheels.

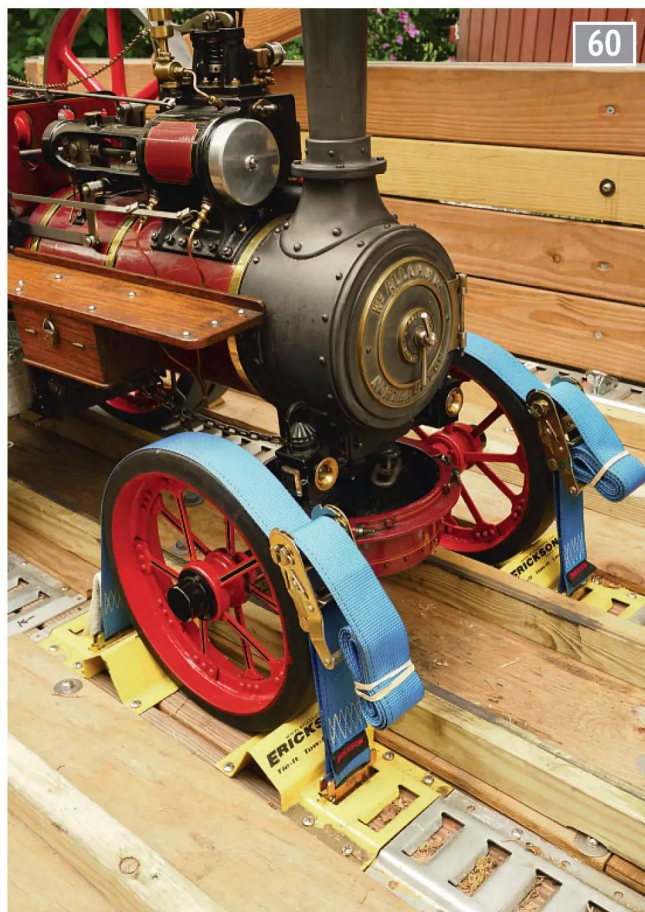
(while reiterating the usual disclaimer regarding the manufacturer) the reason I had

chosen the E-Track system in the first place really came down to a couple of gadgets depicted

in the catalogue, evidently intended for the securing of all-terrain vehicles (or ATVs,

as they are commonly known) and automobiles, yet seemingly ideal for the job of holding my weighty traction engine firmly in place.

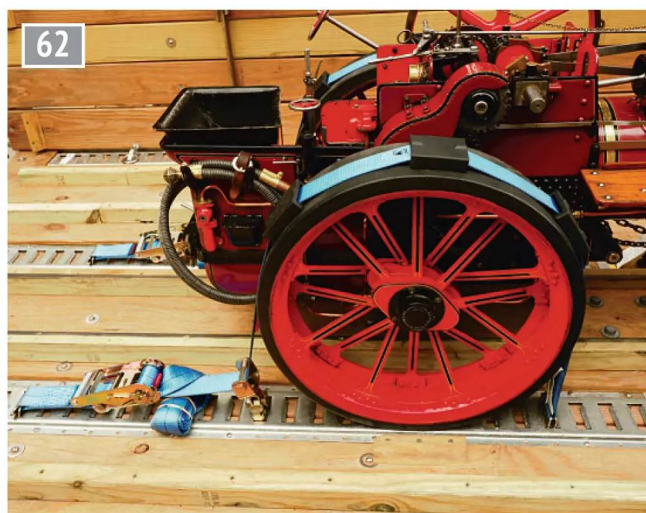
The first of these items, listed in the manufacturer's online catalogue as a 'Wheel Chock and Strap Kit' (Erickson part number 09160, should you ever wish to refer) and typically intended to secure the aforementioned ATVs, consists primarily of four cunningly designed mounting strips, a pair for each wheel and having an integrated wheel chock apiece, positioned one in front and one behind each wheel to constrain its movement. Thus, with four wheel chocks firmly bolted through the trailer's floor in the appropriate place (**photo 59**) and after rolling Ruby Swann's front wheels over the rearmost pair to nestle in the space behind the foremost two, a ratchet strap - also provided with the kit - is placed around the top of each



Her two front wheels tightly bound by the ATV kit's ratchet straps.



For the rear wheels, the Ratchet Strap with Roller Idler kit includes three rubber wheel pads having triangular protrusions on each side, ideal to locate with the groove between Ruby Swann's vulcanised tyres.



62 Another view of the rear wheel strap. The roller-idler allows the ratchet mechanism to be positioned behind the tender, with less risk of accidental paintwork damage.

front wheel and clipped to the chock-cum-mounting strip, thereby holding each wheel firmly in place once tightened (**photo 60**).

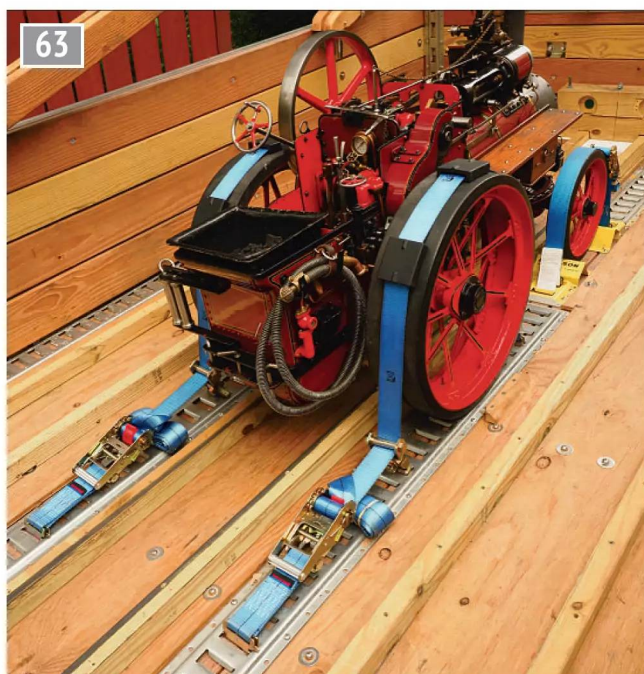
For each rear wheel, another gadget spotted in the manufacturer's line-up came into play, this time listed as their 'E Track Ratchet Strap with Roller Idler' (part number 58523, for completeness). These items, based around a longer ratchet strap and intended to help secure weighty automobiles from movement, include three moveable rubber pads affixed to the strap, each pad having triangular-shaped protrusions on both sides to engage with the car's rubber tyre treads and prevent the strap from slipping off. Furthermore, and unsurprisingly given the gadget's description, an idler roller, clipped to the mounting strip once the wheel is in place, enables the ratchet mechanism to be positioned behind - rather than underneath - the car, rendering it more accessible for tightening and loosening. For myself, with a traction engine to secure, these two innovations - the wheel pads with their protrusions and the idler roller to position the ratchet rearwards - were absolutely ideal; the former fitting neatly over *Ruby Swann*'s wheels and engaging with the circumferential groove

between each vulcanised tire (**photo 61**), and the latter allowing the ratchet to be positioned well behind the engine, preventing the risk of inadvertently scratching or damaging her tender while tightening or releasing the mechanism (**photo 62**).

In short, these two gadgets were so perfectly suited to the role of securing *Ruby Swann* to the trailer that, if I didn't know otherwise, I would assume they had been custom designed for the purpose (**photo 63**)!

Postscript to Episode 14

To satisfy our legal brethren, wherever they may be, and because the world outside our walls is an annoyingly litigious place seemingly devoid of self-responsibility and common sense, I must state that nothing in this episode, or in any other part of this series of articles for that matter, is intended to instruct, warrant or guarantee that the techniques, assemblies or components described, depicted or detailed are suitable or safe for these applications or for any other purpose. In other words, sensible Reader, when deciding how best to secure *your* toys within *your* chosen means of transportation, you are the person responsible for those decisions and their execution and you must conduct your own calculations and research before adopting or adapting



63 *Ruby Swann* all buckled in and ready for a trip. The wooden rails beneath her tender limit sideways movement in the event of a sideswipe.

anything seen or read here. The risk is, as they say, yours alone. 'Nuf said, as an erstwhile contributor to this magazine would have put it!

Now, with this disclaimer clearly stated, and although I am simply describing what I did for my specific application in my neck of the woods, I realise that some readers may find the *E-Track* system appealing and wish to investigate it (or similar products) for their own specific needs. If so, it is possible that the items may not be as readily available where you are but hopefully my descriptions and pictures may be of assistance in sourcing something similar and appropriate for your needs.

For our UK-based readership, after performing a quick search on the Internet, it appears that a limited selection of *E-Track* components is potentially available under the *DC Cargo Mall* brand and available through a popular online shopping site, presumably operated by a tribe of ancient Greek warrior-women. In that case, however, be warned that the seemingly similar *ATV Wheel Chock & Strap Kit* seems to be available only as

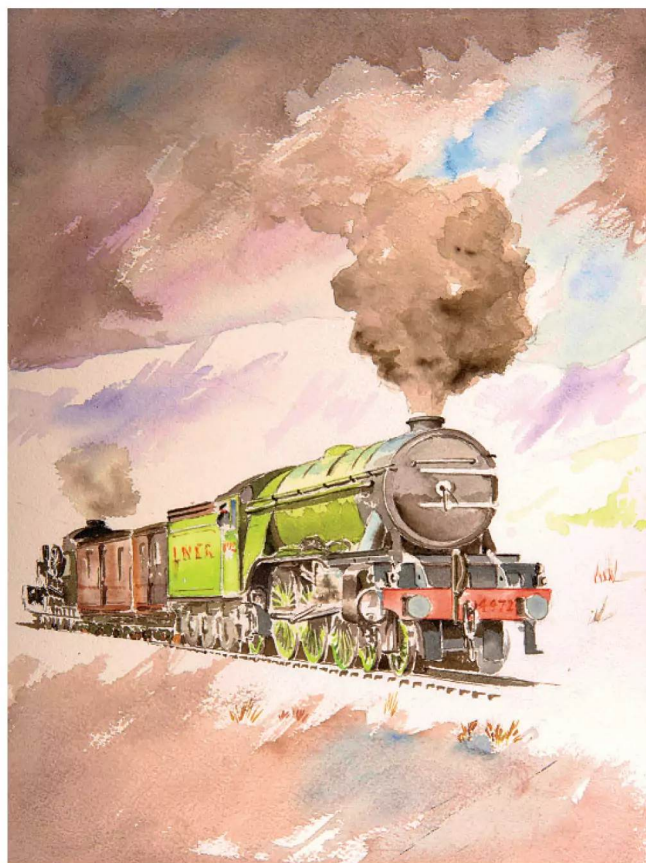
a four-wheeled version, making it twice as expensive as the two-wheeled variant available on my side of the pond. Should you decide to use these devices to secure all four of your traction engine's wheels, then please don't forget that you will need to heft all four of those wheels over the chocks simultaneously to get the engine in and out, which may prove especially difficult from a standing start when trying to remove your engine.

Finally, while I haven't included any pictures of *Ruby Swann*'s driving trailer located *in situ*, suffice to say that it is simply positioned sideways against the front wall of the trailer and secured in place by two tightened ratchet straps, each clipped to the wall-mounted *E-Track* strip at its top (just below the winch) and to one of the floor-mounted strips at its bottom.

● To be continued.

Flying Scotsman in 5 Inch Gauge

PART 60 – REVERSER STAND (CONTINUED)



The two parts for the hinged shelf.

be able to hinge up for access. On top of that the shelf sits a little lower as I'm using the pre-cut tabs as the hinge pins. This leads to one other change in that the small angled vertical plate now needs to be deeper. Yes, I could spend yet more time making these parts as in the prototype but they will be difficult to see anyway once in the cab and I do still have an awful amount of work to do to get this model completed, so I took the easier route.

The two cut parts in **photo 1** are to do with having the shelf hinged. The steel plate below adds back the strength to the side plate which will be lost with a moving shelf and the brass shape is a representation of the small angled plate that sits along the front edge of the shelf. It is, of course, deeper here due to the lower shelf position required to accomplish the hinges using the slots already cut.

The next extra was the 12 8BA hex bolts in four rows on

the inside face of the assembly (outside omitted as discussed before). As can be seen, I have taken advantage of using the base to hold the part square for this operation (**photo 2**). Here's the side with its bolts



Drilling the array of bolt holes on the inside of the assembly.

Peter Seymour-Howell

builds a fine, fully detailed model of Gresley's iconic locomotive to Don Young's drawings.



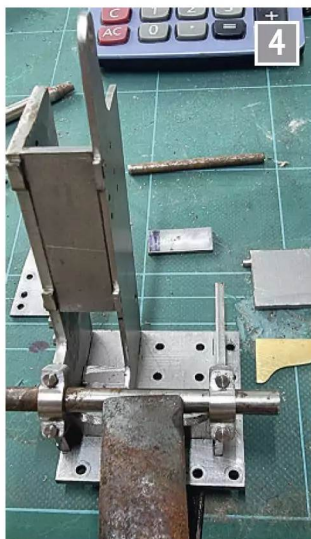
Continuing from the previous instalment I am finally getting something assembled that looks like a Gresley reverser. I'll give a few details on the extra detail items covered in this article first.

As stated in the beginning I decided to have the shelf hinged to make it easier to reach the cab floor mounting bolts, which presents a few obvious changes to the prototype. I already mentioned the omission of the 12 hex bolts to allow for the shelf to

Continued from p.672,
M.E.4743, May 17



Trial assembly of the bearing plate.



Dry test fitting.

mounted and cut flush with the back face (**photo 3**). Note the bearing plate isn't fully aligned in this photograph, which will be tightened fully once the assembly is brazed together ensuring everything sits squarely.

We are now ready to braze everything together which I plan to do in one go except the various bearing points - I'll get the bulk of the job done first so I can fine-tune the bearing positioning in a more relaxed atmosphere. **Photograph 4** shows the last dry test fitting of the various components to



Brazing the shelf and its upright.



Holding everything square for brazing.

make the reverser. There will be lots of final cleaning/fettling before this is finished.

Before brazing the main body I first tackled the shelf and its modified angled upright. These were pushed against the hearth bricks and held in place with a little help from some scrap steel (**photo 5**). All parts were checked for squareness before heating.

On to the main body. Alas, in my eagerness to get this done, I forgot to take a picture of the first stage, the second being attaching the lower bearing blocks, so I will describe both stages with just the one picture. The reverser body parts were individually coated in flux and then one by one put together. Next, I cut up suitable lengths of silver solder and placed these on the inside of the body, the plan being to protect them from direct heat as it's applied around the



Sharing the pickling bath with the cleading.



Brazing completed.



Trial fit of the cleading.

outside. I then applied yet more flux over the silver solder strips to ensure there was plenty as the heating session would be longer than normal - it took approximately ten minutes to

get the solder to flow. I used a metal clip to hold the upper section together and square (**photo 6**). After cleaning I attached the lower bearing blocks as seen in this picture although when heating it was the other way up to let gravity help. Before heating, I checked that the bearings were square by measuring the distance of the metal rod holding the bearings in place, checking both height and distance from the front edge.

This was then soaked in citric acid for cleaning. In **photo 7** you can also see one half of the backhead cleading to which I attached some steel strips to keep the two halves when joined in line.

This got us to the stage of the basic body completed except for the final filing/cleaning and painting (**photo 8**). I also have some more holes to drill/tap for auxiliaries to be mounted. I also still have the bearings to make and then align/attach to the top mounts, which I'll cover soon.

Next time I'll make a start on the working internals, plus some work on the backhead cleading. I need to do the two in tandem as the reverser indicator slide needs to be positioned correctly to the cleading. I'm still researching its operation but I think I have a fair idea of what's what. I'm always happy to hear from any of you guys who are familiar with the full-size workings. **Photograph 9** is a taster picture of the cleading, with lots to do here including shaping the top and sides to curve around the firebox. I may even try my hand at an English wheel for this, which will be a first for me.

● To be continued.

Harris Tweed

PART 1

How engineering innovations transformed an island craft

Roger Backhouse

discovers how a cloth unique to the Outer Hebrides is woven.



It is a remarkable business. A cottage industry on remote Scottish islands became internationally famous for a product extensively used by well-known designers. The story of Harris Tweed is an example of how technological innovations transformed an industry, helping it remain competitive in a world market, yet retaining home production by human effort.

Harris Tweed cloth is known in Gaelic as Clo Mhor (the 'Big Cloth'). It is claimed to be the world's only fabric governed by its own Act of Parliament (the 1993 Harris Tweed Act builds on earlier legislation) and is the only fabric produced in commercial quantities by truly traditional methods. By law it can only be woven within weavers' homes on the islands of the Outer Hebrides, notably Lewis, Harris, Uist and Barra (photo 1).

Thanks to Kenny Neil MacIennan of Breiscleite, I saw how a Harris Tweed weaver



'From the land comes the cloth'. Looking out from Kenny Neil MacIennan's weaving shed on the island of Lewis.



Kenny MacIennan with his rapier loom. He has been a weaver all his life and describes the loom as 'like a large knitting machine'. Many colours now used are much brighter than the original natural dyes used by islanders.



Pirn winder once used to wind thread on to pirns used in shuttles. Pirn winding was once Kenny MacIennan's job after school. His mother was also a weaver.

produces cloth (photo 2). He has many years' experience. His mother was also a weaver and one of his jobs after school was winding thread on to pirns used in her shuttles (photo 3). Although Kenny kept

his mother's cast iron loom he now weaves on a Bonas Griffith rapier loom, the first time I have seen one operating. These machines have transformed Harris Tweed production.



Genuine Harris Tweed is inspected and if found satisfactory is stamped with the Orb trademark. Hebridean shops sell a remarkable range of Harris Tweed goods.



Harris Tweed jacket made for Ray Craig who worked at the Benbecula rocket range. Seen at Kildonan Museum, South Uist.



Spinning wheel as traditionally used to prepare yarn for weaving seen at Taigh Chailean B & B at Laxay, Isle of Lewis. It was given as a birthday present but not used.

History

Many distinctive patterns have been developed over the centuries, each one unique but unmistakably Harris Tweed. Historically the cloth was made locally, usually for a family's own needs, using wool from the hardy blackface sheep. Crofters used local materials like peat soot for tan dye or crotal, a type of lichen, to give a reddish brown colour needing no mordant to 'fix' the dye. Sometimes dyes like indigo or logwood would be bought in.

Significantly, wool for Harris Tweed is dyed before blending and then spinning, allowing many colours to be blended into the yarn, creating a cloth of considerable depth and complexity.

Harris Tweed is also a rare Scottish example of a largely beneficial aristocratic intervention. The Outer Hebrides and much of the Highlands suffered massive clearances in the late 18th and 19th Centuries. Landowners drove tenants off their inland crofts, forcing them to emigrate or move to the coast where they scraped a living. Emigration is a theme in all the small museums across the Hebrides; it created the depopulated, if scenic, landscapes of Lewis, Harris and Uist.

Following the potato famine of the 1840s many islanders

were reduced to destitution. Catherine Murray, Countess of Dunmore, inherited the Amhuinnsuide Estate on Harris and in 1846 had Harris Tweed made into jackets for the estate staff. She promoted the cloth to her friends in 'high society'. The Harris Tweed Association was set up in 1909 to regulate and promote the industry and registered the Orb Certification Mark in 1910 with the first stamping then in 1911 (photo 4).

Activities like deerstalking and grouse shooting became popular among the Victorian *nouveau riche* who wanted to dress the part. Tweed became fashionable outdoor attire and consequently, instead of producing clothing solely for their own use, families were able to weave cloth for sale, thereby supplementing otherwise meagre incomes from crofting or fishing.

Harris Tweed became recognised leisure wear. Patrick Grant of Savile Row tailors, Norton and Sons describes Harris Tweed as 'the greatest cloth of all' and it remains popular worldwide. Like many 1950s teachers, my father had Harris Tweed jackets that wore well (remember the rustle of elbow patches?) and schools like Cheltenham College insisted on tweed jackets for their students leisure wear (photo 5).

Traditional Tweed making

Everything was once processed in or near to local homes. Marion Campbell, BEM was one of the finest traditional Harris Tweed weavers and one of the last to carry out almost all the processing involved, having only the carding done at a local mill. She picked the wool, washed and spun the threads on a hand spinning wheel (photo 6) and dyed the wool using natural dyes that she gathered herself (photo 7).

Crofter-weavers used a narrow loom with the shuttle (sometimes a sheep shinbone) pushed through the warp threads by hand to create the weft. Later, larger wooden looms were introduced enabling weaving of wider

cloth. They had flying shuttles containing a pirn with the thread and weaving became faster. After weaving, the cloth was 'waulked' - a process involving hand washing and beating the fleece on a waulking board which was often an old door - to thicken the cloth, which also made it slightly narrower. This fulling process also 'felted' cloth. Waulking was a communal activity, usually done by women who gathered together to treat the cloth, often singing at the same time. The Tweed was then sold to dealers.

Essential parts of a loom

Modern looms retain most of the features of the earliest looms. The basic principle is



Marion Campbell's pattern book showing some colours and patterns that could be achieved by a skilled weaver using a wooden loom and natural materials (seen at Drinishader 'Clo Mhor' Exhibition).



Each warp thread is passed through an eyelet in the heddle (heald or board). Boards are lifted alternately to form the shed. By using several boards, patterns can be created.



The aluminium strips are the tops of boards. Earlier versions were made of wood. As demonstrated by Kenny MacLennan on his Bonas-Griffith loom, they move up and down to create the shed for the rapier. The light underneath helps show any imperfections in the weave.

that warp threads (originally stronger than weft threads) pass from the weaver's beam behind the loom, are threaded through eyes in the healds or heddles (known as boards in the Hebrides) to the beam at the front (photo 8).

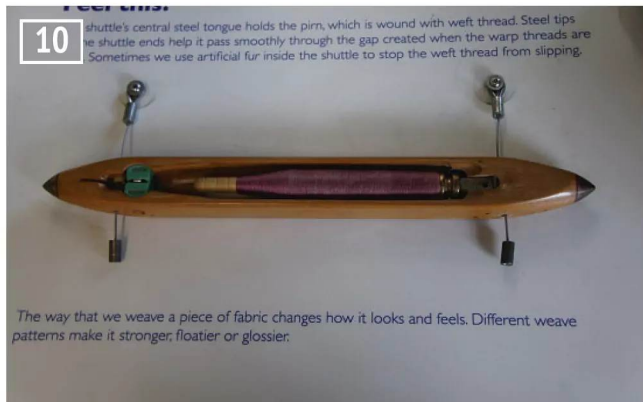
These boards (heddles) are lifted alternately to form a 'shed' or gap so that a shuttle, with the weft thread, can pass through. Once the shuttle has passed through, the position of the boards reverses; one goes up and the other down, creating a new shed for the shuttle to pass through on the reverse movement. By using several boards different patterns can be created (photo 9).

One key innovation was the flying shuttle, invented by John Kay in England in the 1770s.

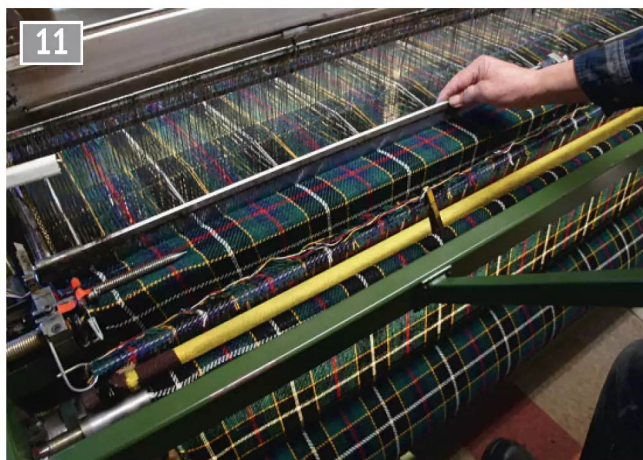
It holds a pirn of thread inside the shuttle that unravels as it passes through the shed. The flying shuttle could be flicked across making weaving faster (photo 10).

To compress the woven cloth, a slotted metal beater or sley (slinn in Gaelic) is used to beat up the woven threads (photo 11).

In the 19th Century, larger wooden looms came into use. These used treadles to lift the healds. Using these looms weavers produced wider bolts of cloth which were easier to market. Several are preserved, notably in the excellent Kildonan Museum on South Uist. Some were exported to Ireland and may still be in use for weaving Donegal Tweed (photo 12).



Flying shuttle - this was used for cottons but similar shuttles were used for Harris Tweed.



Beater (or sley) moves behind the just woven fabric to compress it. Demonstrated on his rapier loom by Kenny MacLennan. The tops of the boards are just behind Kenny's hand. Finished cloth is on the beam near the floor.

Using the loom

When using a wooden hand loom, both hands and feet are used simultaneously. Using both feet the weaver presses down two of the treadles to lift the heddles and make the shed. Then the weaver pulls a cord to throw the shuttle carrying the weft across the loom. Using his or her left hand, the weaver then swings the beater forward and back to beat up the weft thread tightly into the woven cloth.

To make a pattern, boards are lifted in different orders. For example lifting boards in a sequence 1 2 3 4 3 4 1 2 will create a small herringbone or diamond pattern. The page from Marion Campbell's pattern book shows the variety of designs that could be achieved on a wooden loom.



Wooden loom displayed at the excellent Kildonan Museum, South Uist. The wooden lath springs the flying shuttle across the loom. Tops of the boards are visible.

●To be continued.

SMEE News

Amberley Museum Visit

Martin Kyte has the latest from the Society of Model and Experimental Engineers.



Best described as a living museum of industrial and social history the museum is housed in an old chalk pit which makes for a very pleasant and spacious site. From the 1840s to the 1960s chalk was quarried and burnt in the kilns at Amberley to make lime for mortar, decorating and agricultural uses. After the final closure of the site as a business, a group of architects, surveyors, planners and museum professionals felt there was a need for a centre in the south-east, where industrial and social history could be conserved and interpreted in an active working environment. After small beginnings, in 1979, the museum grew to become the major open-air museum it is today.

For many of you the 'outings season' will be well under way and likewise SMEE began its program of visits with a day at the Amberley Museum near Arundel in West Sussex. We do like to spread ourselves around the regions to give all our members a chance to join with us in turn.

We arrived on a glorious sunny morning and very soon realised that there was far more to see than could be possibly accomplished in a day. The museum exhibits fall into four main categories of Transport, Industry, Communications and Craft with a side helping of nature trails and the promotion of lesser known and under-recognised pioneers in engineering and technology. It would be impossible for me to describe in detail everything we saw, so I will just try to showcase a few things that I found worthy of note and attempt to give a general flavour of the site in the hope that this will whet your appetite for a visit, should you get the chance.

The museum staff were very helpful and as they knew we were coming arranged for the running of a number of their stationary engines as well as being on hand to explain and showcase many of the exhibits. Our first treat was the running of a sizeable Tangye gas engine. This engine was designed to be run on producer gas from the attendant producer gas plant with the main fuel being anthracite. Due to the poor quality of the fuel the power output of the engine was only 20hp despite its large size. The engine had been employed in a brickyard in Staplehurst, Kent and I understand its main advantage was the relatively small amount of time required to prepare the engine for running and the variety of fuel that could be employed. Unfortunately I failed to get a photograph of the whole engine except for the drive for the lubricator (**photo 1**) which resulted in much discussion



SMEE



Amberley Museum



Tools and Trades History Society



Lubricator drive on the Tangye gas engine.



A rather crowded machine shop.



Thomas Long printing press.



A typical 3 triode receiver from 1927.



A variety of thermionic valves.



A nice set of measuring instruments.

about how one would machine such a thing.

Close to the engine shed sat the machine shop (**photo 2**) housing a variety of flat belt driven machinery much of which would have been seen in machine shops between the wars and indeed some of the smaller lathes in the workshops of model engineers from days past.

Next to the machine shop was the printmaking exhibition and I suppose the primary exhibit would be the Columbian (Eagle Press). Designed by George Clymer of Philadelphia and first marketed in 1813 the press was not a great success in the States due to its weight with the settlers moving into new territories preferring the lighter wooden press. Clymer moved production to England in 1817 and with the large type bed and platen able to print large sheets with one pull the press became very popular. Demand was such that it was allowed to be manufactured under licence around the country and across Europe. The example shown in **photo 3** was built by Thomas Long in Edinburgh in the mid 1850's.

As an electronics engineer I was very taken with the radio and television exhibition. A

large building was absolutely crammed with the artefacts of radio and TV from the very early days up to I would say the late 70's. I could not fail to appreciate how widespread interest in constructing radio sets at home once was and in particular the amount of support in terms of component suppliers and design publications that existed. A typical home built 3 triode valve receiver from 1927 is shown in **photo 4** along with some of the available components with a selection of valves shown in **photo 5**.

Opposite the Worshipful Company of Plumbers sits the building run by the Tools and Trades History Society whose website hosts a series of photographs of the collection at Amberley (see the weblink below). A very helpful member of the museum staff was kind enough to show me a chest of measuring tools he had collected over the years many of which were either Brown and Sharp or Moore and Wright from the interwar years and were of superlative quality (**photo 6**). I thought the measuring gear was quite



A 1/16th scale tool box.



Robey oil engine.

a treat but then he pulled out a tiny tool box he had made complete with a full set of typical tools all in 1/16 scale (**photo 7**). The attention to detail was astonishing. He had the colour on the Gilbow snips spot on and all the proportions for the hammers and wrenches were just right. The tap wrench and die stock were fitted out with 12BA threading gear and he had made an operational hacksaw blade from a section of clock suspension spring with ground teeth. Everything worked down to the wheel braces and files excepting of course the hammers (you can't scale mass obviously).

After lunch in the Limeburners Café, Nigel Stanley, who is a SMEE member and a volunteer at the museum, arranged for some of the stationary engines to be started, the star of the show being the large Robey oil engine (**photo 8**). This horizontal single cylinder engine No. 4523 built in 1929 originally stood in the Harwood Road Council Depot at Littlehampton and was used to pump the town's sewage up from the sewers into the sea. A practice such as this would have been commonplace at one time but one that would horrify the modern mind. The engine is a compressed air start and drives its own compressor so killing the engine before the air receivers have been recharged is definitely on the 'not to do' list. This took a couple of goes, including some assistance from the expert standing on the

spoke of the flywheel to get the engine turning over before the compressed air was applied. Cooling is by water jacket and external tank with the engine producing around 35hp, typical of the slow rotating horizontal engines of its day.

Many of us enjoyed the high-voltage demonstration which proved both entertaining and educational, taking us back in history to the time when only the phenomenon of static electricity was known. Demonstrations of the Wimshurst machine and other static devices were followed by displays from the early days of electricity generation and battery development. This area of the museum also has a large range of items that the older members of the party remembered from childhood. Early washing machines, vacuum cleaners, refrigerators, radios and synchronised clocks provided a fascinating journey for older members!

Photograph 9 shows the rather splendid Mather and Platt 375kVA 3 phase electrical generator driven by a 500hp Bellis and Morcom steam engine. For demonstration purposes this engine can be run at 12 rpm producing 3 phases at 1.6Hz to give a very clear understanding of the phase relationship.

Late afternoon refreshments in the café gave time to share what people had seen and the general consensus was that 'we must come again'. We had a chance to see old friends, make new ones,



Three phase electrical generator.

discover curiosities and revive memories and ultimately inspired us to go home and get out in the workshop. All in all the day was a resounding success, as evidenced by the happy faces in **photo 10**.

As a 'newsy' footnote, SMEE occasionally grants honorary membership to people who have made a significant contribution to the Society or to model engineering. Two such people have been recently been recognised in this way, Dr Russell Walshaw and D.A.G. Brown, a face many of you would have seen at shows, demonstrating six facet drill sharpening on the

Quorn amongst other things. Advancing age has meant Derek ceasing his model making activities but thanks to the kindness of Alan Hopwood is able to attend meetings of the York Society which he enjoys immensely.

Further details of the Amberley Museum and the Tools and Trades History Society can be found at: www.amberleymuseum.co.uk www.taths.org.uk

As usual details of SMEE including membership can be found on our website at www.sm-ee.co.uk

ME



Super Glue is Super

Patrick Hendra, from Eastleigh Young Engineers, describes the use and limitations of cyanoacrylate adhesives.



My colleagues at the Eastleigh and District Model Boat Club are completely sold on superglue. It is, for them, THE adhesive. It is reasonably strong, sets rapidly, adheres to almost anything they use and is almost perfectly impervious to water. The combination of properties is almost unique and ideal for boat-building.

My Young Engineers again use the stuff with considerable enthusiasm but from their point of view the possibility of achieving something during a one-hour workshop session is crucial. Superglue is vastly superior to any competitor - furniture glue or epoxy adhesives are just too slow to satisfy a youngster. However, it is not legal for young people to purchase superglue in the UK.

We use superglue in the workshop for a very different set of reasons and it is about these methods that I would like to tell you.

What is superglue?

The chemical name is polycyanoacrylate. For those who can remember a little chemistry, the structure of the diethyl variant is shown in **fig1**.

This adhesive, so widely used today, was developed in



The glue and accelerator are widely available as a pack.

1947 and was first used for temporarily closing wounds in the Vietnam War. It took until 1971 before it emerged as a commercial adhesive. The monomer polymerises very rapidly to produce the structure in **fig1** when catalysed by water. As a consequence, it polymerizes and hence sticks to skin very rapidly. This is why children cannot buy it in the UK.

Superglue does not stick very well to polished surfaces and some plastics. It is also brittle and fails under impact. See the end of this piece.

The adhesive is easy to debond—acetone, nail varnish remover or methyl ethyl ketone thinner work well.

Today, it is cheap and is available on eBay or Amazon for as little as £4.50 for a 50g plastic dispenser. An accelerator is widely available and as we shall see this can be very useful. Glue plus a spray can of accelerator costs about £12. See **photo 1** for one of several examples.

It is said that superglue tends to 'go off' and solidify over time and should be stored in the fridge! We, here at the Young Engineers, have only seen this problem once over a decade and we don't have a fridge in the workshop.

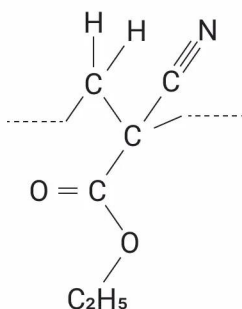
Superglue in the mechanical workshop

It is not my place to try to teach old dogs new tricks but the examples below might be helpful.

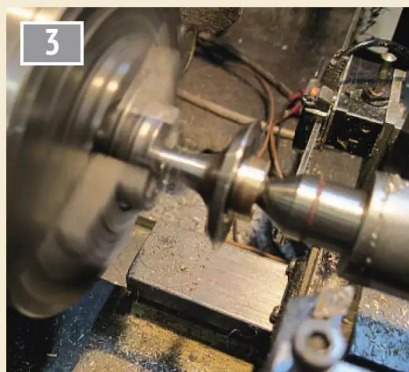
One of my interests, alongside running the Eastleigh Young Engineers Club, is the resurrection of rusty ancient motorbikes.

My son recently asked me to sort out an incomplete 1938 250cc MOV Velocette - beautiful little square engine way ahead of its time. One of several problems I encountered was that the exhaust valve was badly pitted and I was unable to source a replacement. The solution is obvious - pop it on the Myford and reface it. I tried but could not prevent the valve stem from flexing, resulting in a chattered surface to the valve face. The solution was to turn up a piece of scrap brass and superglue it to the head, centre it and then turn the valve between centres producing a new seating surface. Normally, one uses superglue sparingly so that the film of polymer is thin. This is not possible in this case so multiple applications were made using accelerator between each application.

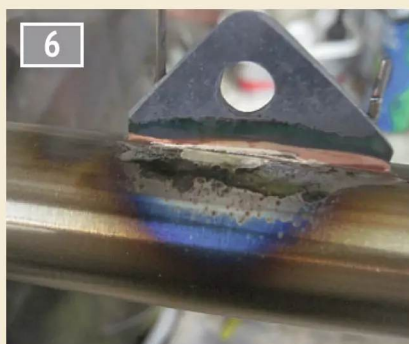
Fig 1



Molecular structure of poly diethyl cyanoacrylate.



Using superglue to attach a centre for facing a valve.



Holding a bracket in place for brazing using superglue. Note – the hanger is on the underside of the pipe.

Removing the glue is obvious - burn it off.

Superglue is not very strong but by dolloping the workpiece rather more than is elegant, it worked.

In **photos 2, 3 and 4** you can see the valve and its renovation.

A totally different example - holding during drilling

My current motorbike project is to resurrect a 1924 Royal Enfield from the dead. The heap of rust I started with was incomplete and, since no spares were available I had to make half the bike including an exhaust pipe. The pipe hangs below the off side foot board and a hanger is ideally silver soldered beneath the pipe.

Materials: stainless steel. The problem is a familiar one - to hold the hanger precisely on the top of the pipe as it is brazed. Of course, I asked a Young Engineer to do the honest thing and hold it whilst I did the brazing. It seems the young these days are averse to

the smell of burning flesh so I had to be a little more creative.

The obvious procedure is to pin the hanger onto the pipe and away we go but how to align and hold the triangular hanger as the pin holes are drilled.

Perfectly possible using clamps but very messy - and then there is superglue.

The hanger was drilled 1.5mm, carefully aligned atop the exhaust pipe and then glued into place. The holes were drilled down into the pipe. The glue is not strong, so the trick was to use a very long series drill in the electric drill.

You can see the sequence in **photos 5, 6 and 7**. Note that the hanger is **BELOW** the exhaust pipe on the bike.

Assembling and retaining

Sorry it's another motorbike example. Here the problem was that no brake shoes were available but a set of the correct radius and width could be sourced. To make them useful, the open mouth end, which could not be used, had

to be machined flat and a hard brass pad had to be screwed onto the surface. Logically, this could have been achieved by defining the hole centres, drilling and tapping and then making the appropriate pad. Far easier would be to make the pad and simply hold the pad on the shoe, drill through and tap the retaining screw

holes - but how to hold the pads in the correct position?

Answer - superglue. Again I offer a set of photographs to explain in **photos 8 to 11**.

A problem for a Young Engineer

The young lad is making a WW1 tank and he has made the two panels on each side



The shoes don't match the back plate.



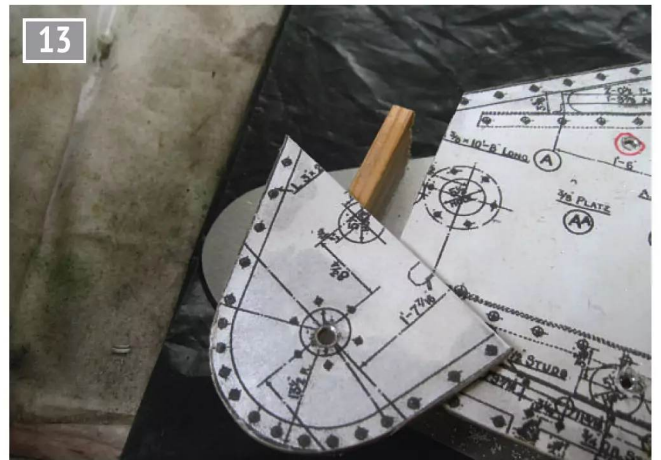
Reversed shoes with a new pin.



Cutting the plates on the bandsaw.



Drilling and fitting pressure pads.



The removed pieces.



Finished - the cam is at the top.

of the tank over which runs the track. On these machines, the track goes over a driven sprocket at the rear, up above the body of the tank over a tensioner sprocket and back to the ground. Having shaped the pair of panels, the movable tensioning section has to be sawn off accurately. As you can see, the panels were separated by wooden blocks (I'm not sure why!) and after careful alignment the cut was made on the band saw - I did the sawing for obvious safety reasons! See **photos 12** and **13**.

And a final one. Young (and old) Engineers don't like fiddling with clamps. Here is a good example of how to avoid them. The pictures explain themselves. The Young Engineer is building a self-designed F1 car and he is working on the chassis pan



Gluing rather than clamping for spotting through.

and the front suspension. See **photos 14 and 15.**

Superglue is brittle

Superglue is a really simple and rapid solution to lots of holding and retaining problems which I hope you will think of for yourselves but the trick is to remove the glue after it has done its job. The glue is very brittle so a tap with a small hammer breaks the bond easily through a shear failure and instantly. Fragments can either be abraded away or methyl ethyl ketone will rapidly soften the fragments so that the surfaces can be cleaned. Once you get over the idea that sticking assemblies together before drilling is NAFF - poor engineering practice! - you will soon use up that first 50ml bottle.

In **table 1** I note the performance of joints made and tested, not very scientifically made as I write this piece. The glued surfaces were faced dry and reasonably flat. One piece was lightly sprayed with the accelerator, the other smeared with superglue. The joints were made using only manual pressure and left under no pressure for about 20 minutes and then broken.

You will note that the well-known statement that superglue sticks anything to anything is total rubbish. Any self-respecting chemist will know that it does not

join to *nonpolar surfaces* e.g. polyethylene, polypropylene or PTFE (teflon). If you want to prevent the glue from sticking to a flat surface, an often encountered situation, use polythene bag material cut from soft (waxy) bags. Don't use clingfilm.

A safety note

I use the glue in my work with Young Engineers and we are VERY careful. We respect its properties.

Because the polymerisation reaction is catalysed by water you can easily stick skin to skin very rapidly. Moisture in and on your skin sets the stuff off in seconds. ALWAYS USE SAFETY GLASSES and don't touch your faces if superglue is around. If you use the glue on cotton, the polymerisation reaction is very fast and since the process is exothermic it gets hot. Very rarely, it might just burn you. Finally, if you abrade superglue on a sanding machine you will notice a smell not unlike almonds from the dust. Try not to breathe it in.

If you get the glue on your fingers:

- A Wash your hands immediately.
- B Don't bother A&E.
- C Be patient - it will wear off. Promise.

ME

Table 1

Material	General Strength	Bending Strength	Brittle or Not
Cast Iron	Good	Very good	Brittle but OK
Aluminium**	Reasonable	Good	Reasonably OK
Mild Steel***	Reasonable	Good	Broke easily - OK
Stainless Steel	Fine	Fine	About right - OK
Hard Brass	Excellent	Excellent	Very tough!
GRP Nylon*	Fine	Reasonable	Breaks too easily
Delrin Acetal	Suspect	Bad	Hopeless

Performance of superglue with various materials.

* Glass filled nylon 6

** Machine grade half hard

*** Free cutting mild

Bassett-Lowke Eclipse Replica

PART 1

Jason Ballamy builds

a small boat engine inspired by a Bassett-Lowke design.



Running the Eclipse engine

Those that follow what I get up to on the forum will have seen the build threads for my recreations of the Stuart Simplex and Gamages small steam engines as well as a brief description of this engine which is a replica based on the Eclipse that was produced by Bassett-Lowke around the late 1920s to early 1930s. These engines were typically used for pond boats which were very popular at the time. Typically the models were set off from one side of the boating pond and whichever got to the other side first won!

The original

Bassett-Lowke's catalogue at the time describes the engine, which was supplied 'ready to run' and tested, as a High Speed Marine Engine suitable for boats of good lines up to about 3 feet long. They list suitable boilers which include their Streamlinia steam plant and give some details including the following.

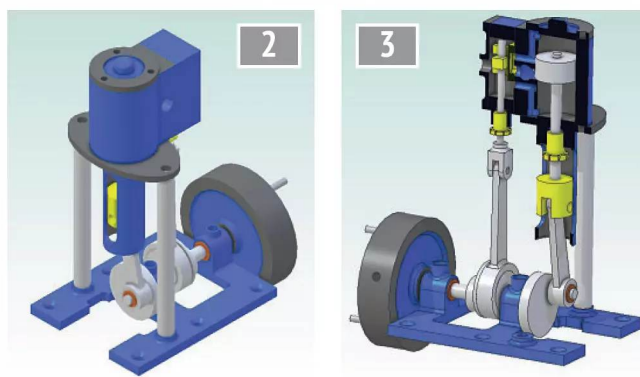
Bore and Stroke 7/16 x 7/16 inch
Height to top of cylinder 3½ inches
Base 2 x 1¾ inch
Weight 13oz
Working Pressure 20-75 psi

As with my other build articles, there will be a topic on the Model Engineer Forum with some additional photos and other information. If you do decide to make this engine and have any queries, please feel free to ask there.

Before commencing the build description can I suggest you have a look at this video of the completed engine to give an idea of what the finished engine



Original catalogue illustration and description.



3D CAD General Arrangement.

3D CAD section through engine.

looks and runs like. <https://youtu.be/o31fz7ykhb0?si=FsaKvad6jpnJzvFm>

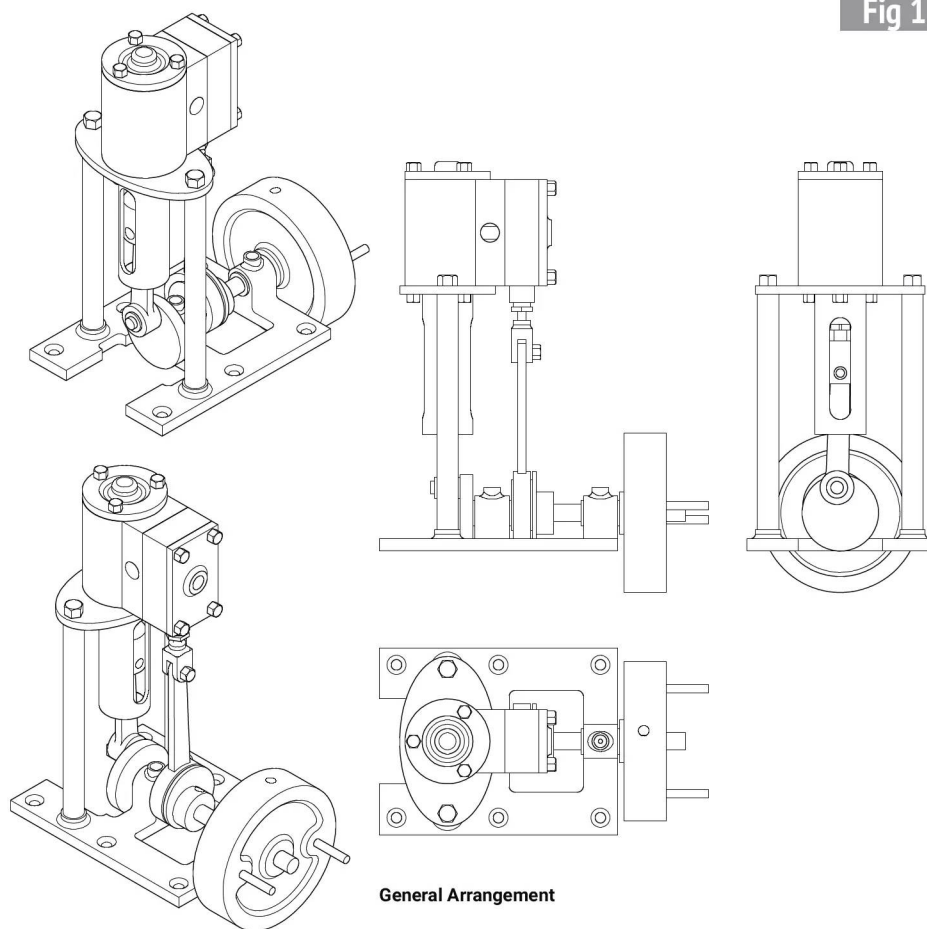
The model

There was also an illustration of the engine (photo 1) which, combined with these basic sizes, was all that I had to go on when designing my rendition. Like most of my other home-designed engines it was done using Alibre and all dimensions and materials are metric. I kept it at approximately the same overall size but did increase the bore and stroke slightly to 12

x 12mm and substituted what would have been castings with a mix of fabrication and cutting from solid.

I did use silver solder to assemble the sole plate fabrication but if you are not able to use that method then JB Weld would do to stick things together as there are additional screws to hold the bearing blocks and the column bosses are in compression so unlikely to go anywhere. Photographs 2 and 3 show the general arrangement and a section through the engine.

Fig 1



General Arrangement

Original catalogue illustration and description.

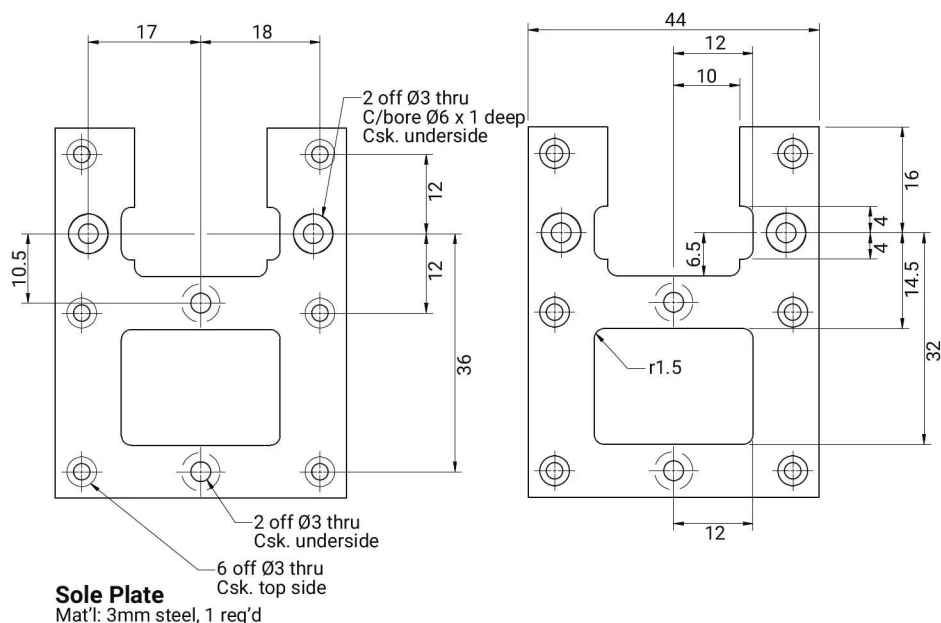


Fig 2

Sole plate.

Sole plate

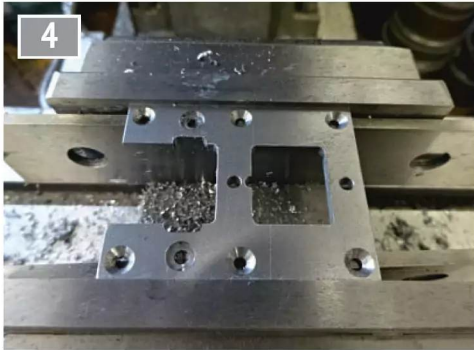
Start by milling a piece of 3mm flat bar or plate to the required overall size then hold in the vice and locate the central axis in the Y direction and cylinder centreline in Z and zero your DRO or hand wheels as this is the point used as the datum to lay out the features. Since fitting a DRO I seldom do any traditional marking out, instead I just use the DRO to position holes and edges.

Begin with drilling the holes, countersink the six for mounting screws and use a three-flute milling cutter to counter bore for the bosses that will go below the columns. Next, mill the two cut-outs using a 3mm diameter cutter. I tend to rough out 0.2 to 0.3mm away from the line then finish off with a full depth cut to the final offsets (**photo 4**). Last job is countersinking the two bearing holes on the underside.

The two bearing pillars are made from 8mm square brass or bronze. If you don't want to buy a length then just mill the end of some 12mm or ½ inch round material to a suitable square section. As the crankshaft hole is drilled and reamed after fabrication it is not possible to use filing buttons to round over the ends at this stage so they can be done by eye or, as I did, by mounting a small vice to one side of the rotary table and setting the square bar central to the R/T's axis and milling the end to the half round profile (**photo 5**).

Once shaped, saw the pillars off from the bar and hold in the four-jaw or a square collet to face the end and drill and tap the M3 hole. Don't go too deep as the crankshaft holes may wander if the drill runs into the threaded holes. Reverse the parts and use an end cutting milling cutter to form the counterbore for the oil boss.

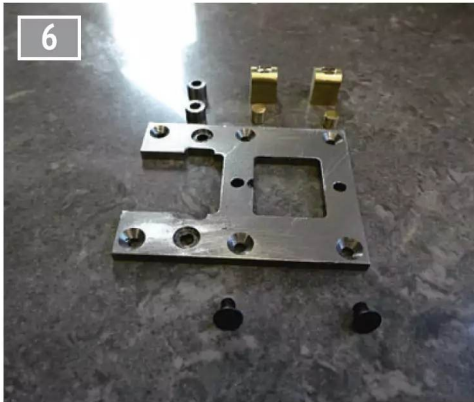
The two bosses that fit below the columns are simple pieces of rod that are drilled 3mm and then parted off. Leave over length at this stage. The brass oiler bosses are even simpler short pieces of brass rod, again over length (**photo 6**). I used



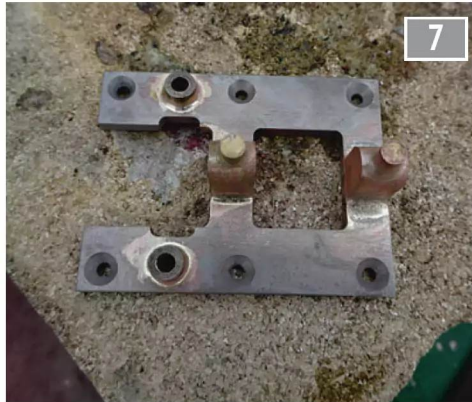
Sole plate milled, drilled, countersunk and counterbored.



Rounding the tops of the bearing blocks.



Sole plate components ready to be silver soldered.



Sole plate after soldering and a pickle.

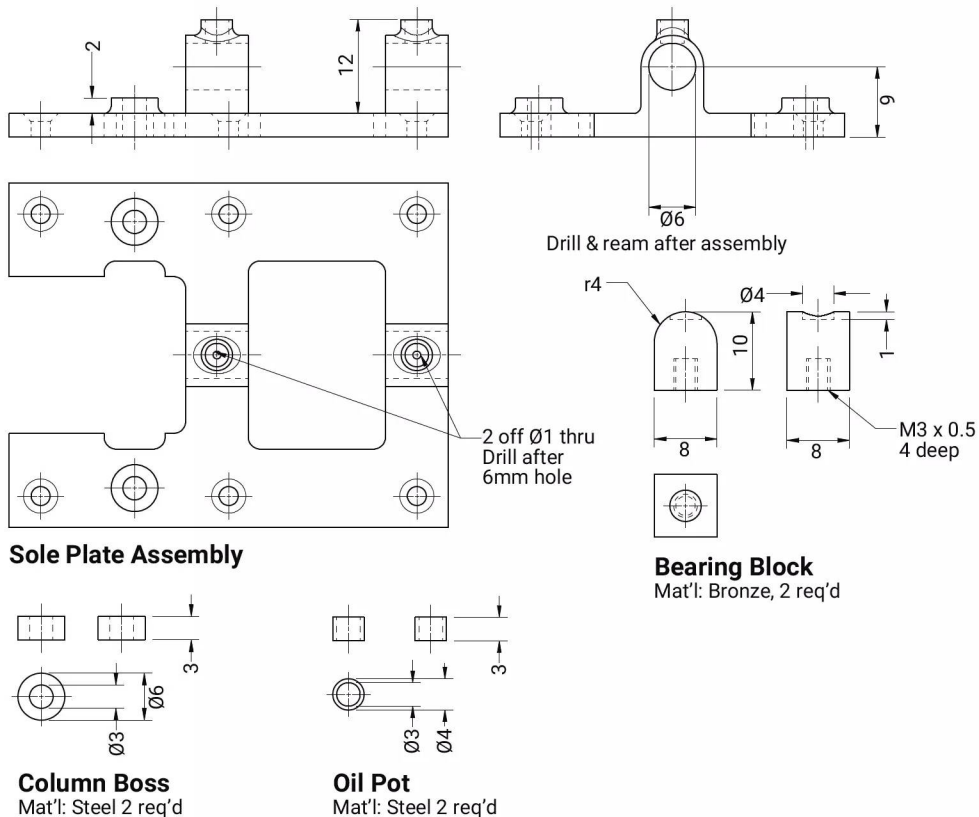
silver solder to assemble all the parts but they could also be done using JB Weld which is a strong and reasonably heat proof epoxy adhesive that is thick enough to form a small fillet to give that cast look (photo 7).

After a clean up, mill the four bosses down to the correct height and then set the soleplate on end and locate the centre of the crankshaft hole, which can be spot drilled followed by 5.8mm and finally reamed 6mm (photo 8). After this the oil holes and their counterbores can be drilled which completes the sole plate (photo 9).

Main bearings

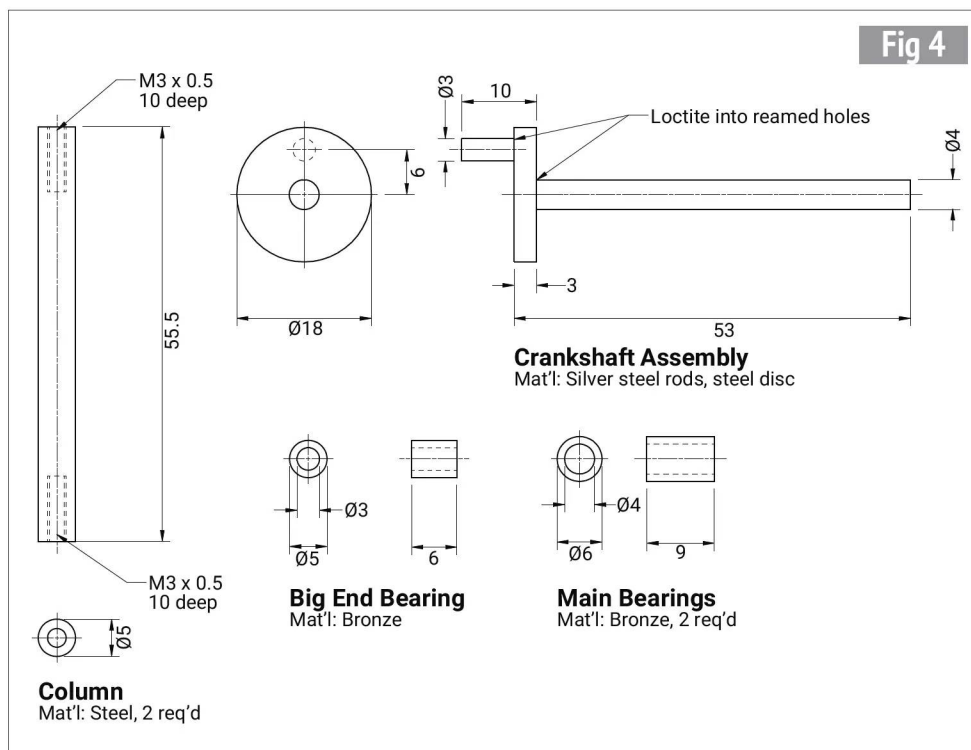
Turn the outside diameter to a good fit in the pillars using them to gauge the size as you get close. Then spot, drill 3.8mm and ream 4mm before parting off to length. The bearings can be set into the pillars using Loctite with the aid of a piece of your crankshaft

Fig 3



Sole plate assembly.

Fig 4



material slipped into the holes to help line them up. Just be careful not to Loctite the shaft into the bearings! Once set, remove the shaft and continue the oil holes in the pillars through the top of the bearings.

Crankshaft

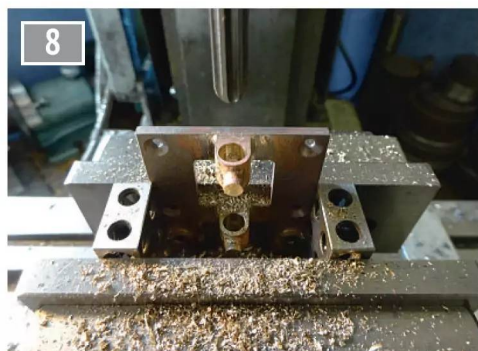
Start by facing and turning some 20mm bar down to 18mm; saw off and face the sawn edge leaving the part a bit over thickness. Spot, drill 3.8mm and ream 4mm. Clean this and your crankshaft material and Loctite the disc onto one end of the rod. Once set, hold by the rod - preferably in a collet or a reasonably true chuck - and face right across the end to bring disc and shaft flush and the disc to the required finished 3mm thickness (**photo 10**).

Holding in the mill vice by the shaft, locate the centre and then off-set to drill and ream the crank pin hole. A short length of 3mm silver steel can be faced off to length and Loctited into the disc (**photo 11**).

Columns

These are fairly straightforward items; the 5mm diameter rod just needs facing to length but do pay attention to getting the two columns as close as possible the same length. The ends are then just spotted, drilled 2.5mm and tapped M3.

●To be continued.



Reaming the main bearings.



Drilling the oil holes.



Facing crank disc to final thickness.



Drilling for crank pin location.

Boxers to Polkas

The Story of George Forrester's Locomotives PART 1

Ron Fitzgerald explores the history of George Forrester, a little known but influential locomotive engineer.

The recent publication of Jim Clark's articles on his excellent model of the LNWR locomotive *Cornwall* in the *Model Engineer* coincided with some research that I have been doing in a related area. *Cornwall*, in spite of its somewhat idiosyncratic origins, was part of a general class of LNWR locomotives known as the *Crewe Type*, characterised by its system of frame construction and the use of outside cylinders. Like the Holy Roman Empire, which was neither Holy, Roman, nor an Empire, the *Crewe Type* did not originate at Crewe Works and the alternative names that

have been bestowed upon it are equally suspect. In fact, the design is owed to a now almost forgotten Liverpool locomotive builder, George Forrester of the Vauxhall Foundry. The few Forrester locomotives that were built exerted a disproportionate influence on locomotive development and it may be that our readers might find this story of interest.

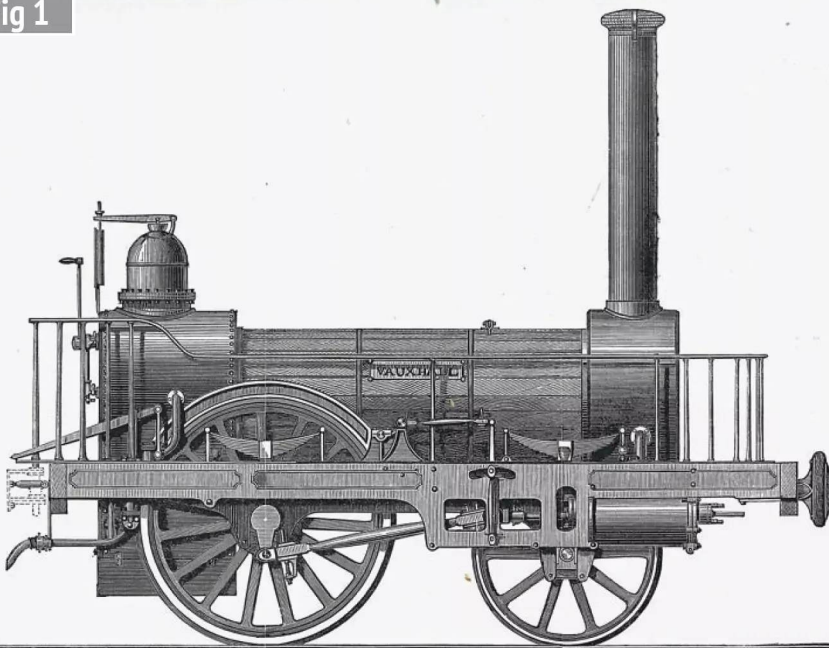
George Forrester, born in 1780 or 1781, was a Scottish engineer who started an engineering concern in an eighteenth-century cotton mill at Vauxhall Road, Liverpool, around 1827. Amongst other products, the Vauxhall Foundry

built steam engines and sugar machinery for export to the West Indies but later became notable for marine engines. They first attempted to enter the market for railway locomotives in 1831 with an unsuccessful bid against a tender issued by the Liverpool and Manchester Railway. Subsequently the *Planet* type 0-4-0 locomotive, L&MR No. 25, *Milo*, built by Stephenson's in 1832, was sent to the Vauxhall Foundry for repair but it was decided that the work involved was not justified and Forrester was instructed to scrap the machine. The *Swiftsure*, which the L&MR subsequently ordered from Forrester, was intended to replace *Milo* (**note 1**). Alexander Allan (**note 2**), who was working for Forrester's at this period, confirmed that this was the first locomotive to be constructed by Forrester's Vauxhall Foundry. Allan was sent to the L&MR to carry out trials with the *Swiftsure* and spent several months on the line in the first part of 1834. In the late summer of that year he went to Ireland where he put three more machines into service with the Dublin and Kingstown Railway. They were named *Kingstown*, *Dublin* and *Vauxhall* (**fig 1**). Writing to *The Engineer* in February 1883 (**note 3**), Allan says that:

...These engines were of the same size and design as the *Swiftsure*...

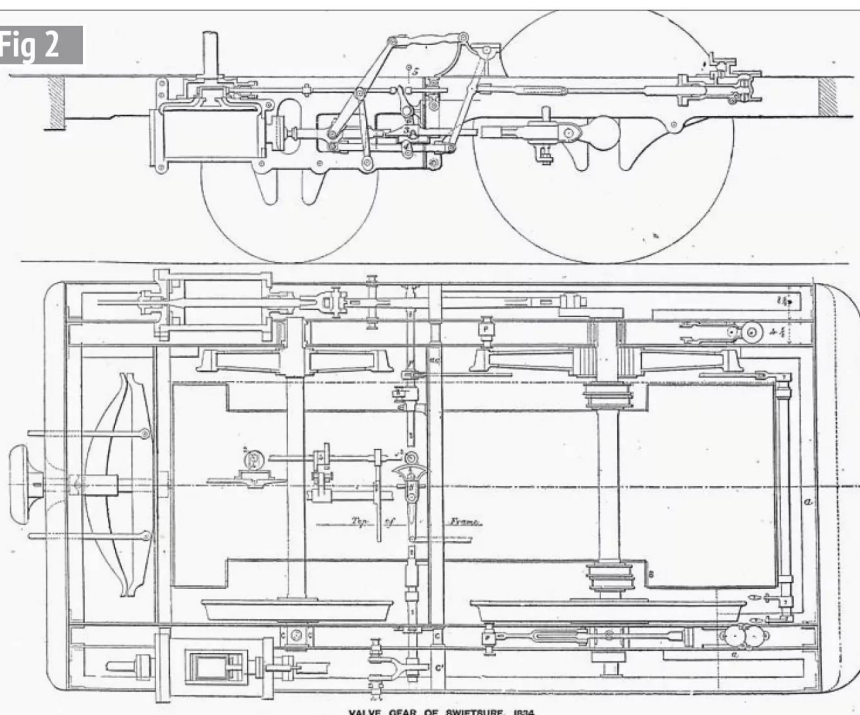
Swiftsure established the characteristic Forrester lineaments. The basis for the design was Robert

Fig 1



George Forrester's 2-2-0 Vauxhall, built for the Dublin and Kingstown Railway. According to Alexander Allan, similar to Liverpool and Manchester Railway locomotive *Swiftsure*.

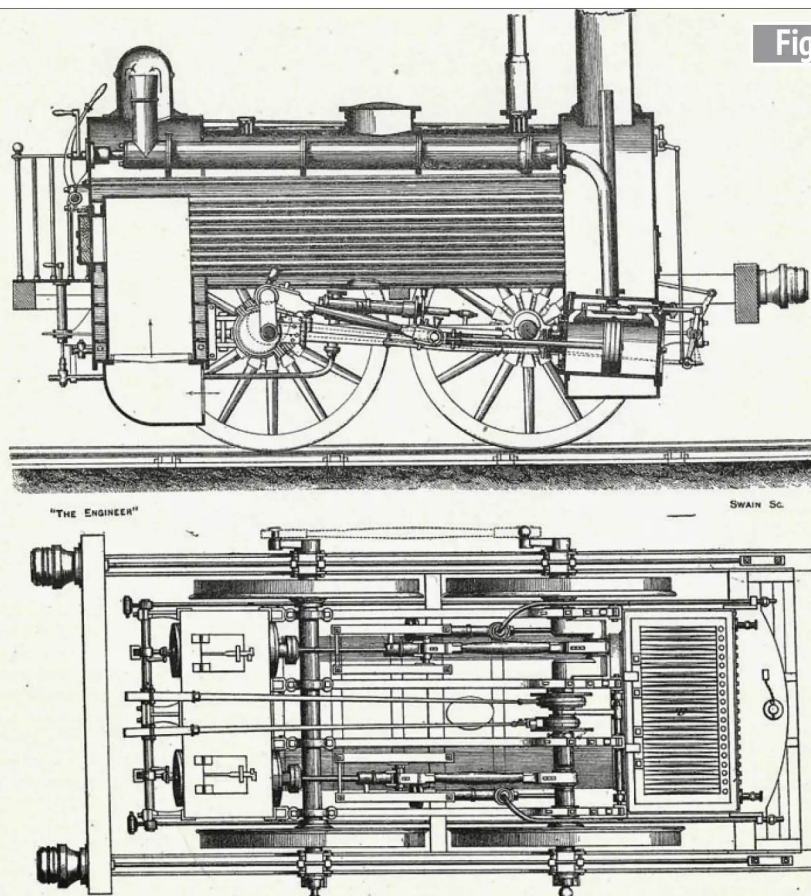
Fig 2



VALVE GEAR OF SWIFTSURE, 1834

Liverpool and Manchester Railway locomotive Swiftsure, 1834. Top: parallel motion and gab eccentric rod driving valve spindle through rocker arm above. Lower: frames, valve gear with reversing quadrant and small eccentrics for lifting gab out of gear.

Fig 3



"THE ENGINEER"

SWAIN SC.

Liverpool and Manchester Railway locomotive Samson of 1831.

Stephenson and Company's *Planet* but whilst the *Swiftsure* adopted *Planet*'s 2-2-0 wheel arrangement and driving wheels 5 feet in diameter the leading wheels were six inches larger at 3 feet 6 inches diameter. The cylinders were also enlarged to 11 inches bore by 18 inches stroke compared to the usual *Planet* size of 11 inches by 16 inches. In the arrangement of the cylinders however, Forrester departed radically from the Stephenson model. The *Planet* had cylinders between the frames, placed beneath the smokebox but in the *Swiftsure*, Forrester relocated the cylinders outside the frames, on the horizontal centreline of the driving axle, coupled to flycranks attached to the over-hanging ends of the axle. Placing the cylinders outside the frames avoided the use of a crankshaft, both then and thereafter a notoriously problematical component. The *Swiftsure* was the first recognisably modern application of horizontal, outside cylinders to a railway locomotive.

Comparison of *Swiftsure*'s frame plan (fig 2) with that of the final development of *Planet* class, the 0-4-0 *Samson* (fig 3) shows how, in transposing the cylinders and the motion to the outside of the frames, Forrester secured benefits beyond the elimination of the crankshaft. The *Planet* class had cylinders incorporated into the base of the smokebox. Four parallel forged wrought-iron bars spanned between the rear of the smokebox and the throatplate of the firebox. Unsprung bearings in each of these frame bars provided additional support for the crank axle and assisted in preventing crank flexure. The drawbar pull of the train passed from the tender to the engine through a forged bar coupling that was secured by a U-bracket attached directly to the rear of the firebox. In consequence the haulage forces had to pass through the firebox to the intermediate frame bars and the crankshaft bearings. The external

sandwich frames carried the weight of the engine only.

In dispensing with the crankshaft in the *Swiftsure*, Forrester (**note 4**) removed the need for intermediate frame bars between the smokebox and the firebox. On each side, the frame assembly of *Swiftsure* consisted of three parallel plates, the two inner wrought iron plates providing the axle bearings whilst the cylinders were bolted to the front end of the middle and outer plates (**note 5**). All of the plates were continuous from the wrought-iron buffer plate at the front of the locomotive to a drawplate at the rear. The drawplate was a channel section with horizontal flanges and enclosing a wooden buffer beam, the flanges of the channel having provision for a link-and-pin inserted through the eye of the drawbar extending from the tender (**note 6**). The path of the haulage forces passed from the rear beam to the inner pair of frames and the axle boxes whilst the forces of the cylinders were conveyed through the outer and middle frame plates to the draw beam. As a result the loading was confined exclusively to the frames and the boiler was relieved of the destructive stresses that were imposed by the *Planet* design.

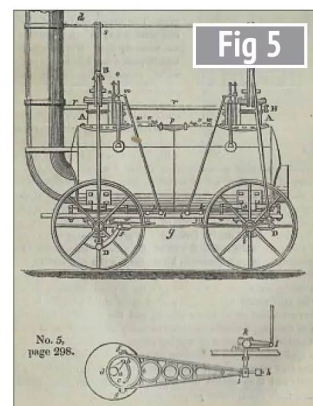
Forrester chose not to use the built-up Stephenson type wheel that the *Planet* class had used. Instead he incorporated his own novelty. In 1831 he had taken out patent for *An Arrangement of Wheels for Carriages and Machinery* (**note 7**) and a related system was used for his railway locomotive wheels. The ends of the driving axle had a large boss to which the wheels were bolted and the driving wheel nave had a clearance diameter hole in the centre which allowed the wheels to pass over the axle ends without the need to remove the cranks (**note 8**). This enabled the wheels to be taken off separately for tread turning as contemporary lathes were only capable of dealing with a single wheel at a time (**note 9**). Forrester also adopted an alternative to the crosshead and slide bars favoured by Stephenson, instead using a vibrating pillar form of parallel motion adapted from stationary engine practice. The pillar was external to the outer frameplate and communicated with the radius arm by way of the segmental slot in the plate. A further innovative detail was the extension of the piston rod through a stuffing box in the front cylinder cover (**note 10**). This lengthened rod running in the stuffing box bearing provided support for

the piston on the supposition that it prevented undue wear caused by the weight of the unsupported piston bearing on the lower part of the cylinder.

The valve gear used on the *Swiftsure* and the three Irish locomotives was a development of the *Planet* gear but improved by Forrester. To place Forrester's work into context it may be useful to briefly outline the evolution of the locomotive valve gear up to this time.

The application of the eccentric to reciprocate the steam valve marks the beginning of the generically distinctive locomotive valve gear. The first locomotive valve gear that incorporated an eccentric was Matthew Murray's Middleton Railway rack locomotive of 1812 although the form was initially his patent box eccentric and wiper arm cam. The cam was mounted on the locomotive's axle and by striking the inner edges of the box eccentric drove rods which actuated plug cocks on the side of the cylinders which controlled the admission (**note 11**). The eccentric was not responsible for reversing the locomotive. Murray employed a sector plate with a lever operated dog clutch which was used to position the plug cock for reverse or forward motion (**fig 4** and **note 12**).

At some point around 1816, George Stephenson's acolyte, Nicholas Wood, converted the eccentric which Stephenson had used on one of his later Killingworth locomotives to a slip eccentric (**note 13**) enabling it to run the machinery in reverse (**fig 5**). The eccentric revolved freely on the axle and an arm fixed rigidly to a collar on the axle had a pin at its opposite end which engaged in segmental slot cut into the eccentric sheave. The pin, rotating with the axle reached the limit of the slot and caused the eccentric to rotate. Forward or reverse motion of the locomotive depended upon which end of the slot the pin was in contact with. The first stroke of the

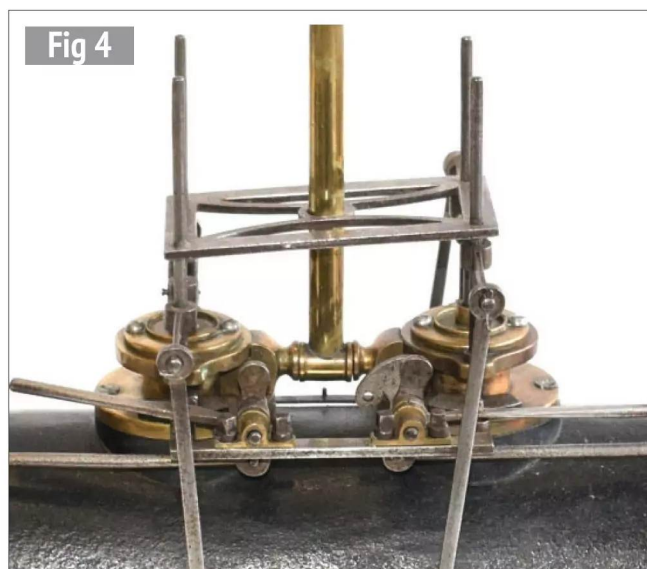


Nicholas Wood's slip eccentric valve gear applied to a Killingworth locomotive.

piston in the opposite direction required the driver to disengage the eccentric drive and, with another lever, to move the valve manually before the eccentric drive could be re-engaged for automatic operation.

By the time that Robert Stephenson's *Rocket* was built, Wood's basic idea had been elaborated into a coupled pair of eccentrics sliding laterally on the driving axle (**fig 6** and **note 14**). Each eccentric carried a back plate with slot which engaged with a dog clutch spigot on either the left-hand or right-hand side according to the direction of motion required. The dog clutch was secured to the driving axle and rotated with it. The eccentric rods were hinged at the eccentric ends to allow the eccentric assembly to move laterally and at the opposite end the rods drove drop cranks on a pair of rocking shafts, one shaft rotating within the other. At the outer end, a crank was attached to each shaft and by a pair of linking shafts and a second rocking shaft drove the slide valves. The linking shafts had handles by means of which they could be raised and lowered into and out of engagement with pins on the levers which operated the valve spindle rocking shaft. When disengaged these levers could be manually operated to move the slide valves.

The valve gear layout used on the *Rocket* was essentially that used on the *Planet* class locomotives but, as will be seen from the drawings of



Sector plate and dog clutch on a contemporary model of the Middleton Railway locomotive. Model in the collection of the Leeds Industrial Museum.

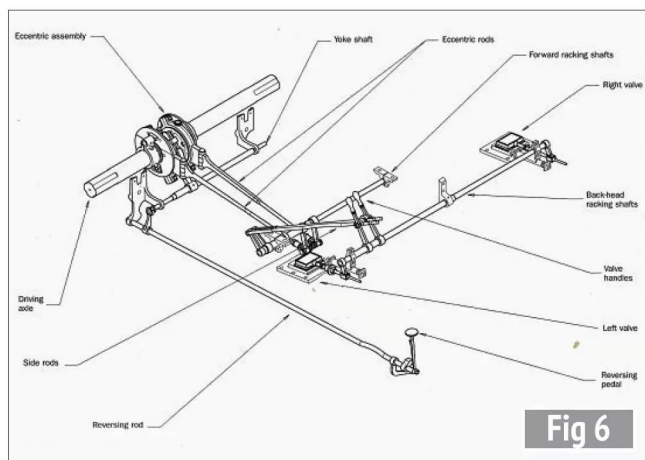


Fig 6

The Rocket's valve gear. The Engineering and History of the Rocket, a survey report. Michael R. Bailey and John P. Glithero. Drawing by John Glithero.

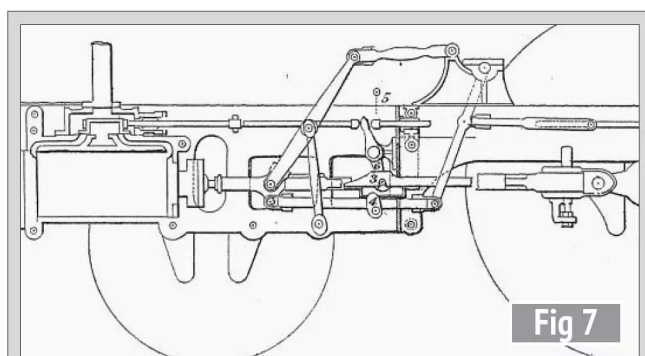


Fig 7

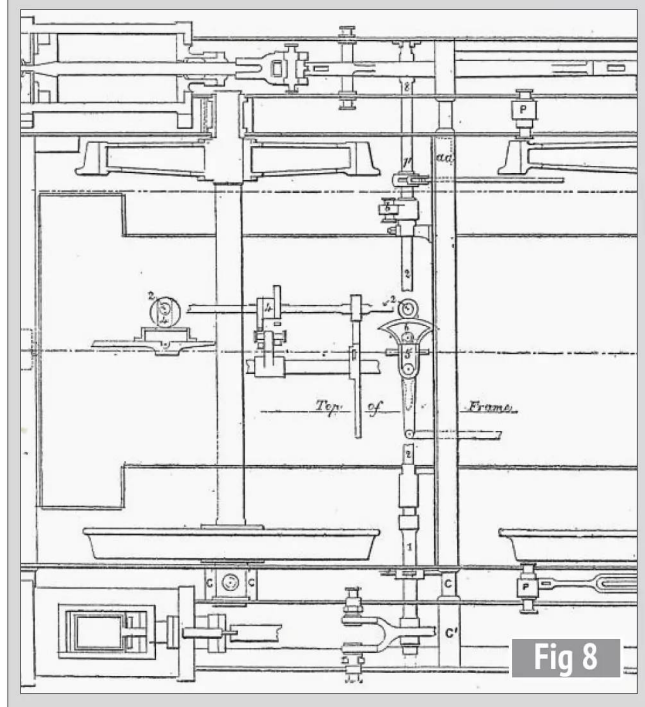


Fig 8

The Swiftsure's valve gear.

Samson (fig 3), because the cylinders were now at the front of the locomotive, under the smokebox, rather than adjacent

to the driver as they were in the *Rocket*, it was necessary to introduce a system of long links and levers to carry the

motion from the eccentrics to the front end of the cylinders. Reversing the locomotive involved manipulating four handles and a foot pedal. The drive was firstly disengaged by lifting the drop hook gab levers free of the drive pins on the manual control handles. The two manual control handles were then moved to alter the position of each of the slide valves for the required direction. The steam regulator was opened and as the engine started to move, drop hook gab levers were re-engaged. At the same time the foot pedal was depressed to slide the eccentric assembly laterally to the left or right until the dog clutch spigots meshed with the appropriate slot in the eccentric back plate. If the gear survived this sequence of operations without being wrecked the valve action became automatic.

In the circumstances it is not difficult to understand why there should be a desire to simplify the control mechanism. Forrester's *Swiftsure* made a significant step in this direction. The locomotives had valve chests on top of the cylinders but, unlike the *Planet* arrangement where the valve spindles operated the slide valves from the front of the cylinders via rocker arms, Forrester passed the valve spindle through a stuffing box in the rear of the valve chest, eliminating the long whippy transfer rods and the rocking levers that Stephenson had used. Where previously a single floating slip eccentric per cylinder had been used, Forrester substituted two eccentrics for each cylinder, placed side-by-side and fixed to the axle. One eccentric was set for forward motion and the other for reverse. The reciprocating action of the eccentrics was conveyed to the eccentric rod which terminated in inverted U-shaped drop hooks (item 3, fig 7). The hooks engaged a pin at the bottom end of a pendulum lever on a rocking shaft. Also mounted on the rocking shaft there was another, vertical

lever that ended in a tappet working in a slot in the valve spindle. As each valve train from one eccentric was uniquely responsible for a single direction of travel it was simply necessary to disengage the first valve train and engage the second to reverse the locomotive. This was done by a geared quadrant connected by a rod to a lever on the footplate. Movement of the quadrant through its arc revolved a pinion on a second shaft above the rocking shaft (items 2 and 5, fig 7). The upper shaft carried a pair of cams (item 4, fig 7 and fig 8) that acted upon a frame enclosing the slot of the gab drop hook. Rotating the cam raised or lowered the U-shaped drop hook into or out of engagement. The valve spindle had an extension rod carried back to the footplate and when the cams had both eccentric rod drop hooks disengaged the driver could traverse the slide valve by hand prior to engaging one or the other gab drop hooks. Long levers and short eccentric rods gave the necessary angle for the lead of the valve. The slide valves had about ½ inch lap.

Forrester's arrangement eliminated the multiple starting handles which were in constant motion on the footplate in the *Planet*, a source of danger to the engine men, and it also reduced the incidence of rough starting and shunting of engines in stations. Daniel Kinnear Clark's authoritative *Railway Machinery* states that the four eccentric valve gear was owed to Hawthorn's of Newcastle in 1837 but due to a confusion referred to below, he was unaware of Forrester's earlier work.

According to Baxter (note 15) *Swiftsure* entered service on the L&MR in October 1834 (note 16). Two years later *Swiftsure* was used for experiments in coal burning instead of the then universal coke. The firebox was damaged and the regular use of coal in locomotives was deferred for another thirty years. Further change came

in 1838 when the Forrester's valve gear was removed and replaced with the patent gear of John Melling, the locomotive superintendent of the L&MR (**note 17**). The locomotive was withdrawn and scrapped in 1842, a good average lifespan for what was a non-standard machine on the L&MR.

The first of *Swiftsure*'s sister locomotives, the Dublin and Kingstown Railway, *Vauxhall*, underwent trials on the Liverpool and Manchester Railway in July 1834 and was then dispatched to Ireland together with the Sharp Roberts locomotive *Hiberia* (**note 18**). *Vauxhall* hauled a special train on the 4th

October between Martello Tower and Booterstown and on the 9th of the same month both locomotives ran the full length of the line. The arrival of *Kingstown* and *Dublin* allowed regular working to commence in January 1835.

Experience in service showed time-wasting delays in turning the locomotives on the 10 foot diameter turntables which were too short to accommodate engine and tender when coupled (**note 19**). This gave rise to a suggestion, apparently on the part of the railway, that the tender be dispensed with and the locomotive should carry its own coal and water. The modification involved

fitting three water tanks between the frames in the free space that resulted from the absence of any crankshaft or running gear (**note 20**). A plate was cantilevered out behind the firebox backplate for a distance of 4 feet and this carried a coke box (**note 21**).

The success of the railway rapidly exceeded the capacity of the existing rolling stock, a situation that was made worse in late March when *Dublin* and *Kingstown* collided with the result that new tenders were required. Allan maintained that three more locomotives were ordered from Forrester's in 1835 although in this number he was almost certainly

mistaken. Murray, in his book *Ireland's First Railway* says that only two locomotives were added to the stock, the *Comet* and the *Victoria*. They were built as well tank engines and also differed from the earlier machines in that they had conventional slide bars with crossheads. The parallel motion does not seem to have been used by Forrester's thereafter.

● To be continued.

FOOTNOTES

- Note 1** *Locomotives of the Liverpool and Manchester Railway*. A. Dawson. Pub. Pen and Sword 2021. P. 64. A second *Milo* was built in 1836 by Charles Tayleur's Vulcan Foundry. This was a 2-2-2 and numbered 36 in the L&MR running lists. *British Locomotive Catalogue 1825-1923*. Vol. 2B, L. N. W. R and its constituent companies. B. Baxter.
- Note 2** Alexander Allan was one the first generation of locomotive engineers. Born 1809 he was apprenticed to a millwright named Gibb of Lochside near Montrose. In 1832 he joined Robert Stephenson and Co., Newcastle and in 1834 moved to the Forrester's Vauxhall Foundry. *Alexander Allan*. F. C. Hambleton. *The Locomotive Magazine*. February 15th 1941, p. 31.
- Note 3** *The Engineer*, February 23rd 1883, p. 150.
- Note 4** Allan is quite clear in stating that George Forrester was personally responsible for the design of *Swiftsure*. *The Engineer*, March 2nd 1883, p. 160.
- Note 5** The outer plate seems to have been made of cast-iron. See description of the frame construction in *The Engineer*, March 2nd 1883, p. 160. The detailing of the outer frame as shown in the illustration that appeared in *The Engineer* February 23rd 1883 p. 146, supports this interpretation.
- Note 6** The combined buffer and drawgear shown in the illustration at the front end of *Vauxhall* was unique to the Dublin and Kingstown locomotives. It was the patent of Thomas Flemming Bergin, one of the directors of the D&KR.
- Note 7** Patent 3158, 5th September 1831,
- Note 8** Allan's account in *The Engineer*, March 2nd 1883, p. 160.
- Note 9** Joseph Beattie whilst he was with LSWR introduced the double lathe that allowed both wheels to be turned simultaneously whilst still mounted on the axle.
- Note 10** Latterly referred to as a tailrod.
- Note 11** George Stephenson's locomotives appear to have been the first to use the slide valve for, as has been noted above, despite it being Murray's invention the Middleton locomotives continued to use older plug cock inherited from Trevithick.
- Note 12** A forthcoming article in my *Stationary Engine Series* in the *Model Engineer* will discuss the Middleton Locomotive more fully.
- Note 13** The engine built by John Robertson for Henry Bell's steamship *Comet* in 1811 used a slip eccentric but with raised quadrant stops rather than a pin and slot.
- Note 14** For discussion of an intermediate form of this valve gear see *Loco Profile 25. Locomotion*. Brian Reed. Profile Publications. Pp. 14 and 15.
- Note 15** *British Locomotive Catalogue 1825-1923*. London and North Western Railway and its constituent companies. Bertram Baxter edited David Baxter. Pub. Moorland 1978.
- Note 16** Op. cit., *Locomotives of the Liverpool and Manchester Railway*, p. 150, Anthony Dawson ,states that the *Swiftsure* was ordered in November 1834 but then goes on to say that Marc Sequin illustrated the parallel motion on the locomotive in June 1834. In view of Allan's account it is likely that Dawson's date of ordering seems to be a mistake for November 1833. Dawson's subsequent account of the trials of the Dublin & Kingstown locomotive as the first Forrester locomotive on the Liverpool and Manchester Railway is also in conflict with Allan's account.
- Note 17** Op. cit., *Locomotives of the Liverpool and Manchester Railway*. Anthony Dawson. P. 92.
- Note 18** *Ireland's First Railway*. Kevin Murray. Pub. Irish Railway Records Society 1981.
- Note 19** This was not unique to the D&KR. Several early railways including the London and Birmingham had to detach the tenders to turn their locomotives.
- Note 20** *The Engineer* February 23rd 1883. P. 150.
- Note 21** *The Engineer* March 2nd 1883. P. 160.

The Ballad of Almondell

Andrew Newton

explains how Edinburgh's new track is more than just a track.



The Ballad of Almondell

When I compiled a song and video with Rob Griffith, a gifted folk singer and fellow member of the Edinburgh Society of Model Engineers (ESME), I didn't realise that it would lead to a request from the editor of *Model Engineer* to write an article. The song, accompanied by a series of photographs, was our way of recognising and documenting 10 years of hard work by the ESME members and their families, to create the Almondell Model Engineering Centre, near Broxburn on the outskirts of Edinburgh.

Fifteen years ago, ESME was like many other model engineering clubs; we had a few acres of land which we 'leased' on a private country estate where we had set up a small track. We had moved there in 1976, initially just for a few years, on a 'handshake arrangement'. Forty years later we were still there!

One of the conditions that we had agreed with the original owner (another fellow member and model engineer) was that we would keep quiet about our occupation and we could only invite the public to ride our trains when the 'big house' had its open days on Sundays in May each year. Over time we had become a slightly insular group in our own world. The only interaction we had with the public was when we took the portable track out to gala days and events at the railway museum at Bo'ness.

In 2008 a new generation of the family at the big house suggested that maybe it was time for us to find a new home. That did seem perfectly fair as we had stayed a little bit longer than expected. Our

club committee set about looking for a piece of ground anywhere within 20 miles of Edinburgh but, despite visiting over 150 locations over a five-year period, it took until 2013 before a derelict woodland was found, almost on our doorstep. Fortunately, our current hosts allowed us a further three years before we eventually moved out.

At 11½ acres the new site was a lot bigger than we originally intended to buy but it was in the right place and was affordable. The woodland had been left unmanaged for many years (**photo 1**). Trees lay where they had fallen and the undergrowth was so thick that you could hardly walk into the site. With a leap of faith, without planning permission and no clear view of what lay beneath the dead wood, the club used funds that had built up over the years, with many additional donations and loans from members' pockets, to go ahead and purchase the site.

It was around this time that our long-term stalwart chairman handed the reins to a new man. The new chairman, with strong project management skills, took on the task of setting us up for the challenge ahead. Our forward-thinking committee had already updated our constitution, formed us into a company and registered us as a charity. This attention to our governance was to prove highly beneficial in the following years and a 'National Lottery Awards for All' grant helped to fund a planning application, cover the legal fees and do some of the required surveys. Members, their families and friends, chipped in with skills and knowledge to keep bills down. We conducted surveys for trees, bats, newts, frogs, developed a woodland management plan, obtained a felling licence, risk assessed our work and basically tried to cover every type of



We had to start somewhere!



Members were trained to use chainsaws and measure 3m lengths.



Survey team.



Model engineers in their new habitat.



Instead of taps and dies, wives bought tractors and diggers for their husband's birthdays.

objection that anyone might raise (**photo 2**). Our planning permission came through, albeit with a proviso that we could only open to the public for four events per year and that hooting of whistles should be restricted!

So there we were, a group of middle aged and older men, many of us still at work five days a week, and we had 11½ acres of derelict woodland to sort out. It is at this point

that we should first remind ourselves that we were here as model engineers and this was only a hobby!

With some professional training and a few chain saws we began the work of cutting our way in to the woodland, discovering as we went where the hollows and bumps were (**photo 3**). A former chairman and retired civil engineer surveyed the site as we progressed and slowly a

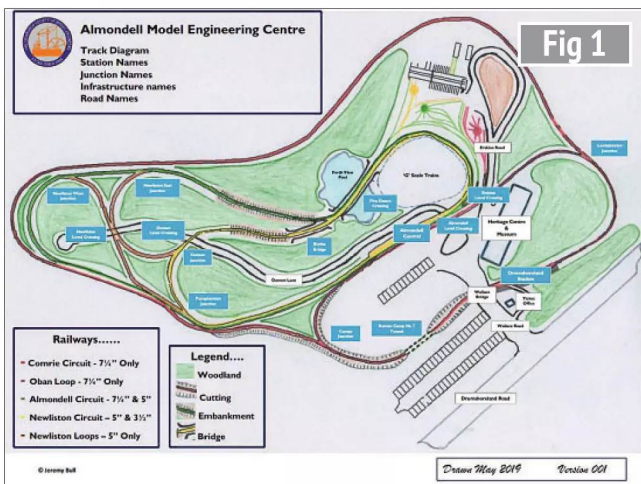
CAD plan of a track evolved. We had lots of space to play with and we began to realise, particularly as members' professional skills began to materialise, that we had an opportunity to do something very different here (**fig 1**).

A vision began to form. Rather than simply creating a track for our own use, as a model engineering organisation with a long history, we had an opportunity, maybe even an obligation, to lay down some roots and establish a 'Model Engineering Centre'; a place where we could protect the heritage of model engineering, encourage creative and traditional skills, invite the local community and likeminded groups to get involved with model engineering and use our space and to provide a home and permanent legacy for the Edinburgh Society of Model Engineers (ESME).

Work progressed in the woods with members, friends

and family all helping (**photo 4**), while others with commercial skills started to work on funding. We had a lot going for us. We were a charitable organisation, improving derelict land in an area of economic deprivation. We were encouraging skills and training in young people, providing physical activity and improving mental health in males over 50, creating a leisure facility, building capacity in a third sector organisation and connecting a previously reclusive group to the wider community. We were willing to embrace outside groups and actively work with schools and disadvantaged people. We ticked a lot of boxes.

We had virtually no money, but with a brass neck, passion and a total confidence in our ability to deliver projects, we sought and won support from local contractors, sponsors and funders. A member introduced a local plant hire



Map of Almondell.



One of our first public running events.



ICF construction was like building with lego.

operator to our hobby and activities, and soon big diggers and dumpers were loaned to us for some of the heavier work (**photo 5**). Many local building supply companies and traders donated materials and discounted supplies.

For three years we worked in mud, through snow and rain every Thursday and Saturday (and whenever we could) with no toilet and only a small builders' portacabin to shield us from the elements. We didn't mind - we were having fun and working together for a common cause. With the challenge that we had taken on, many of the older members wondered if they would ever see the day that the trains would run.

We cut down trees and manually moved over 300

tons of logs which were sold for biomass. Every load that went out gave us money to pay for materials and substantial amounts of shale waste were brought in for bottoming track beds and to create embankments.

Slowly the site opened up and we completed a 7½ inch gauge circuit with a platform and passing loop, running under a bridge and through a tunnel, and the first trains started to run (**photo 6**).

The site had no utilities so we approached the site manager working on a local housing building scheme. We explained our vision and, as part of their community engagement, they installed and connected us to the mains water supply, saving us £10,000. We then

discovered that the local electricity operator did not have way leaves for their power lines over the edge of our land, leading to an agreement to have a £13,500 transformer installation at no cost to us.

In 2017, after an approach by one of our members, we were mentioned on a BBC Radio Scotland broadcast at 6.30 am on a Sunday morning. The next morning a man from West Lothian Council phoned to ask how they could help us. How often does that happen? We went to see them and laid out what we had in mind and said we needed £250,000 to put up a 380 square metre 'Heritage building' with workshops, large communal area for meetings, talks and exhibitions, toilets, kitchen, mess room and library. In commercial terms this was

less than half the money that would normally be required, but apart from the main structure we planned to do much of the work ourselves.

We seemed to hit the sweet spot in terms of timing as they were in possession of an amount of European funding that needed spending and they were able to offer us a substantial part of the amount we needed. Having obtained one major supporter, others came on board, closing the gap to £55,000 which members covered through further donations and personal loans.

With a local architect (a member's brother-in-law who, of course, gave his services free of charge), we planned our building to be as environmentally friendly and accessible as possible. Having a hobby that is based on the consumption of fossil fuels is no excuse to ignore the effects of climate change. Using borrowed equipment our members dug and laid the foundations, installed an environmentally friendly sewage treatment plant and rainwater harvesting system, and prepared the site for construction by builders. The walls were constructed with ICF blocks (foam blocks with a mesh, into the centre of which liquid concrete is poured) to give fully insulated walls (**photo 7**). Double glazed windows were fitted, the roof space insulated, underfloor heating and an air source heat pump were installed, all paid for by funders (**photo 8**). With many capable volunteers including skilled electricians



The building taking shape.



Our Heritage Building.



The main station area.

in our group, we then fitted out the interior ourselves, complete with PIR activated LED lighting and single and three phase supplies. This has now been complemented by an 80% Scottish Government funded 15kWh solar panel and battery installation making us, surely, one of the first 'net zero' model engineering sites! At exactly the right time for us we were then offered, again through a member, high quality furnishings and equipment from a major company which was moving premises (photo 9).

In late 2022 we held our first open day for members of the public. These days are purely about giving back to the community, allowing families to enjoy train rides and raising money to allow us to make further developments (photo 10).

This year we will open our model engineering workshop

which will give those members who don't have any facilities at home the opportunity to use machines to which they otherwise would not have access.

Despite building over 6,000 feet of 7¼ inch, 3,500 feet of 5 inch and 1300 feet of 3½ inch gauge track (photos 11 and 12), we still have a long way to go. We have yet to build proper steaming bays, engine sheds, rolling stock storage, boating pond, G scale track, picnic areas and further loops and stations. However, we have realised that we have had so much fun building the site that we never want to finish building new things. We have attracted many new members who wouldn't normally have thought of themselves as a model engineering enthusiast. With over 100 members now we are starting to get back to practising the actual hobby!



Points were built outside on tables.



Bridges and embankments.

So, can you come and run your trains? Well sadly, no, not just yet. We have the most basic rudimentary unloading system and we don't yet have the facility to allow visiting groups to come. In years to come we hope to host such events but we are not going to put ourselves under pressure and say when!

Can you come and visit? Absolutely. Yes! We are very happy to have casual visitors drop in on us on a Thursday or a Saturday and we would love to show you around and have a chat. Please don't visit on a public running day unless you have children, or you want to stand back. To be honest, on

those days we are inundated with families and we would rather have time to chat to you if you could possibly visit at another time.

If you are a model engineer, or even just an enthusiast, that lives within travelling distance of Edinburgh and you want to join us then there are a lot of exciting activities to get involved in so do get in touch.

And what's all this about a song? Well, you will need to look on our website www.edinburgh-sme.org.uk and look at the 'Ballad of Almondell' tab and run the video. Then you will see what we are talking about.

ME

LNER B1 Locomotive

PART 48 – PAINTING AND LINING

Doug Hewson

presents an authentic 5 inch gauge version of Thompson's B1 locomotive.



Continued from p.23,
M.E.4745, June 14

Quite often get embroiled in detailed discussions about the merits or otherwise of painting locomotives either during or after completion. Two things spring to mind here; one is that if I didn't paint things as I made them, they would be covered in red rust within hours even though my workshop is heated and, secondly, I couldn't bear the thought of having to strip the complete locomotive down to paint it and then have to rebuild it when I could be running it. For these two reasons I am definitely in the 'paint as you go' camp. I have been in workshops where there are almost complete locomotives looking immaculate and not a dab of paint or a spot of rust on them.

I have heard numerous people say that they could never line a locomotive. Well, when I started I couldn't either but didn't want to be beaten by it. However, I did start by lining 4mm and 7mm locomotives so having come up the scales I have to say that I found lining a 5 inch gauge locomotive relatively easy. One often sees very nicely built locomotives at exhibitions lined with transfers or, worse still, vinyl. Transfers can be an easy option provided that one takes great care in getting the corners of the various bits to line up properly. However, I do think that a mediocre hand lining job still looks better than a mediocre transfer job as it not only has a more real appearance, but it also shows that someone has 'had a go'.

I really would encourage you to have a go, as I can assure you that it is nothing like as difficult as it might look and, like many things, it just requires a little care and patience. I was recently lining a Britannia tender and having gone round

two sides without a hitch I couldn't for the life of me get the third side to go right but it was just a question of wiping the line off with a soft rag moistened with white spirit and doing it again, and again, until finally, after the third attempt it looked right. From then on, the next corner and closing line went perfectly.

I know a workman should not blame his tools but good ones certainly help. At a very young age my uncle told me that there is no such thing as a cheap tool and throughout my life I have never bought cheap anything, especially tools. I was brought up as a draughtsman and was taught to use a lining pen and have stuck with it ever since. I bought a good quality tech drawing set when I was an apprentice draughtsman at United Steel Structural Company in Scunthorpe. On my first day as an apprentice our tutor showed us a lining pen and how to sharpen it to produce a fine line. This was done on a fine oil stone with the pen held vertically and it was stroked backwards and forwards along the stone rotating as one went to produce a nice curve on the end. The important thing was to ensure that the two legs of the nib were dead equal

lengths and this is the secret to fine lines. The two sides of the nib were rounded off to a razor edge but on no account was any grinding done on the insides of the nibs save for removing burrs. The insides had to be perfectly flat. We were then tested on our skills by drawing as many lines as possible on a piece of drawing linen in the space of one inch without any ink running from one line to the next. George would then get out his magnifying glass and count the lines using a needle to see who had won. I still use that pen and it has one half of the nib which swivels for ease of cleaning. The pivot pin has a knurled nut with graduations on it and the swivelling blade has a register on it to align it exactly with the other.

Below is a list of useful things to assist with the painting and lining (**photo 353**).

- Aerosols
- Grey primer and satin black
- Car body filler
- No. 7 and 9 sable brushes
- Draughtsman's plastic curve template or Plasticard templates made for the job
- Phoenix Paints Red, Cream and Grey BR lining
- Short length of 3/32 inch welding rod (for stirring paint)



Kit required for painting and lining.

Draughtsman's pen with swivel nib

Soft rag dampened with white spirit

Aerosol cap with clean thinners in it

Long and short straight edge with several dabs of Blu-Tack on the back

Shiny postcard or similar as a test piece

Wood blocks of various sizes

A couple of pieces of clean kitchen roll

Now, the paint nowadays is pretty useless unless you go to the right shops! You need to go to a proper paint supplier. They have 'lining paint' which sign writers use as they do not want to be going over everything two or three times and the tins seem to be twice the weight of that water based stuff. The other alternative is to buy 'Heritage Paints'. If the shop keeper asks any questions, tell him that your house is grade two listed! It is not much dearer than water based stuff and it has to be made with all of the ingredients that the proper

stuff has in it. It lasts several years. The first 5 inch gauge engine I lined was one of the Britannias we built.

After painting the chassis, I painted my wheels by hand with gloss black enamel. The No. 7 sable brush was used for this. The buffer beams and buffer guides were done using lining paint in gloss buffer beam red. I have read about dipping the wheel castings before machining but this is a pretty pointless exercise as the whole wheel wants painting, tyres and all, otherwise it will not look like a proper working locomotive. Apart from a few locomotives prepared specially for photographs or exhibitions the wheels were black. To my mind there is nothing which gives a loco a more authentic working look than black wheels, and nothing more, than polished rims and axle ends that give a locomotive a 'model engineers' look. Even the green B1s had a black strip around the outside. Also, lots of polished copper pipework also gives locomotives the 'model

engineers' look about it. Too much polished pipe looks a bit toy-like to me.

Anyway, everything else on the chassis is just plain satin or gloss black, the choice is yours. After the first coat of primer this was rubbed down. My locomotive was finished off with wet and dry paper, ending up with 1200 grit. It took several goes to achieve an acceptable finish before any more paint was applied. Anyway, I am going to describe how I lined my 4MT (photo 354).

Before any serious painting was attempted, I gave the workshop a good tidy up and clean down then went around with the vacuum cleaner at least a couple of hours before any paint was applied. The bench in the nice warm second workshop was covered in newspaper. The aerosol was just passed by to and fro about a foot away to give a nice even coating. These were then left to dry for a day or so. This time it was rubbed down with 800 grit wet and dry and it is quite

amazing what small blemishes can be picked up with the fingertips through the paper. At least two or more coats of primer were applied before starting with the black.

Whilst waiting for the tanks to dry I made a start on the next part, which in my case was the bunker, side platforms and cylinder covers. The rear of the bunker did take quite a lot of getting into some kind of order as it had distorted rather badly in the making through using too thin a plate. I spent three weekends fettling the back plate and was beginning to despair when it suddenly began to look right.

Once happy that the primer was a good finish, I then carefully applied about four or five coats of black, again rubbing down with wet and dry between well hardened coats. This time the wet and dry was 1200 grit. When all was satisfactory, I could then make a start on the lining.

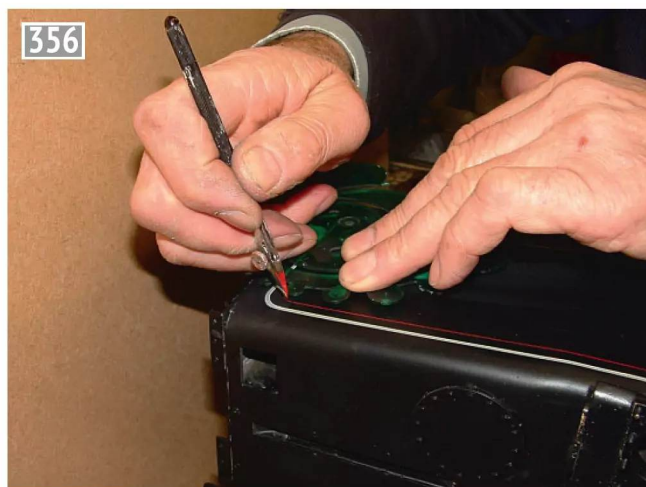
On the lined black locomotives, the lining was LNWR red, cream and grey, and



A painted and lined 4MT locomotive.



Lining up to add the grey line at the bottom of the tank.



Adding the red line.

to my mind looks very smart on a black locomotive. None of the 2-6-4 tank locomotives was ever painted green despite what you may have seen on the NYMR! Whenever I am doing lining, I always begin with the outer line and work inwards and being right-handed I always work left to right or clockwise around the tenders etc. The curves around the corners of cabs and tenders etc. are all done to set radii according to the 1949 Standard Liveries Manual. The outer line is $\frac{5}{16}$ inch wide grey and 5 inches from the edge of the plating. This is edged with a $\frac{1}{8}$ inch wide cream line on the inside. The outer corners are 4 inch radius. The radius of the inner red line is $1\frac{1}{8}$ inches and it is $1\frac{1}{8}$ inches in from the inner cream line. This means that you can actually make

some Plasticard templates to those radii ($\frac{5}{16}$ and $3\frac{1}{16}$ inch respectively) and use them for most corners. If you are using a template with a bevelled edge, make sure that the bevel is on the underside. The Blu-Tack should be stuck on the bevelled side about $\frac{1}{8}$ inch back from the edge and pressed down so that the template is about $\frac{1}{8}$ inch from the surface to be lined. You need to work at a bench of convenient height - I made mine the same height as the kitchen work tops - and you need a good light in front of you so that there is no shadow cast on the work by either the templates or yourself.

Photograph 355 shows the set up I used for the grey line along the lower edge of the tank. The red line was done probably a week later once the grey line had hardened

off. At this stage (**photo 356**) I had already added the cream line and the inner red line just completed the job nicely.

I begin with the grey line at one corner using either a plastic radius template or a draughtsman's circle template. First a couple of faint lines are drawn on with a soft pencil $7/16$ inch from the edge to meet at the corner. If you use Phoenix lining paint it is generally just right for consistency straight from the tin. However, if it will not run then just add a drop or two of white spirit. If you get to the stage where it blobs off the end of the pen then you have gone too far. If this happens leave the tin open and go off and do something else for a while until some of the white spirit evaporates - or buy a new tin! It is surprising how quickly it does evaporate with the lid left off as I usually have to keep adding a few drops every half hour or so.

To begin the lining, I charge the bow pen by dipping the $3/32$ inch welding rod into the tin (stirring it before each pen refill), lifting the rod out and allowing any surplus paint to drop back into the tin. When it is down to dropping one blob off at a time, I then allow one of the blobs to drop into the pen. One blob will go quite a long way but sometimes two are required. No more than two are required otherwise the paint will flood out of the nib and probably drop onto your paintwork. Try the pen with your straight edge on your shiny postcard. Another good test piece is a large biscuit tin lid as they generally have a nice paint finish (but not one with embossed lettering!). Put a little piece of Blu-Tack on the back of your chosen radius template and rest it on the corner. Hold your pen over one pencil line and hover there to see if it will drop dead on the line when lowered. Now try it over the other line at right angles to see if it will end up in the right place when you have gone round the curve. Adjust your template accordingly and once all looks well take the

plunge, put your pen on the line and start moving round the curve immediately.

As you go round the curve twist your pen between your fingers through 90 degrees to follow the curve so that your pen ends up in line with the second pencil line around the corner. Of course, what I have described above takes less than a second so it may sound a bit long winded, but it isn't. Lift your pen off the line as soon as you have completed 90 degrees, stand back and admire the work. Now, for the grey line, I usually draw two lines to achieve the correct width and then fill the middle in with a third line by angling the pen slightly against the template otherwise the pen should be held as near vertical as possible. If you try to paint the line to the desired width in one go by opening the pen up there is a danger of the paint blobbing out of the end of the nib if it is the correct consistency for lining.

Having got round the corner I now wipe the nib with a piece of kitchen roll and put it to one side whilst I set up the straight edge for the first straight line. Draw the pencil lines for the other corners if you haven't already done so and lay your straight edge in place. Recharge the pen and again hover over each end of the straight edge to make sure that the pen will join to the end of the curve properly and end up in the right place at the other end. You should be able to paint the straight line whilst the curve is still wet so that it blends in. When you are approaching the end of the straight, stop about $\frac{1}{2}$ inch short of where the curve will start. Clean and recharge your pen again and do the next curve, then with your straight edge you can complete the little gap blending both ends in nicely. Stand back and pat oneself on back. Continue round like this and you will suddenly realise that it does not take very long at all. It takes me about five minutes to do one complete line round a Britannia tender if all goes well. The secret is to clean the pen and



Guide strip for lining the cylinder covers.

recharge it after each section of line. When you get a little more confident you will find that you can do several sections of line at one filling, but you have to be quick and at the first sign of trouble stop and clean the pen and start again.

Continue with the grey line on all the other bits and pieces, and by the time you have finished the first piece will probably be dry enough to start on the cream line. For the cream line the paint needs to be slightly thinner to get the narrower line. On full size the line is only $\frac{1}{8}$ inch wide so in our size it should be 11 thou' wide so only a witness really. However, it is very noticeable if it is missing, and the lining will look completely wrong. The cream line can be done by using the same template as the grey just by angling the pen slightly but follow the same rules as before. If any problems occur on the way round just wipe the line off with a soft rag dampened with white spirit and start again. This is why we only do one line at a time so that if a mistake is made the latest line can be just wiped off without affecting the previous one. The red line requires a template with a smaller radius except for the upward sweeping curve just in front of the cab window where the red line is on the outside of the curve and similarly on the lower edge of the tank.

Once I had completed the

grey line on the tanks, I bolted them onto the locomotive and was then able to use them to align the grey line along the bottom and top of the bunker. I used the Blu-Tack straight edge and drew a faint line on the bunker with the soft pencil again using the grey lines on the tank as a guide. One difficulty with these tanks curving under at the bottom and similarly with the BR Standard tenders is knowing where exactly to place the lower grey line. On the tank locomotives this resolved itself by looking at photographs and realising that the grey line at the front end had to align with that on the front platform. This



Using the guide strip to add the red lines.

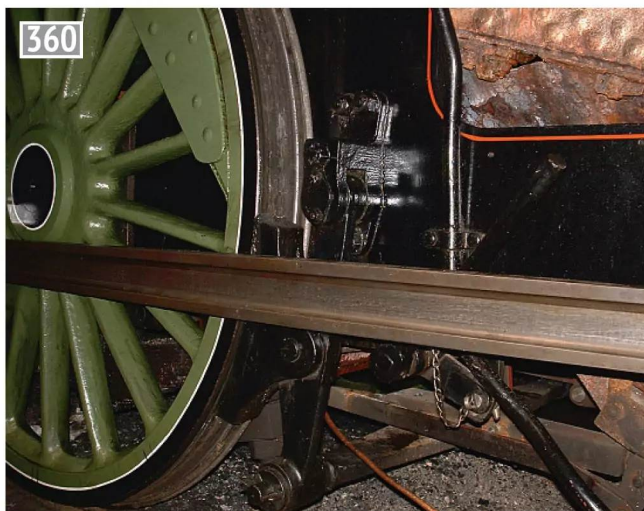
distance was repeated on the two other levels on the bottom of the tanks. Incidentally, the grey line on the cab side should be a scale 4 inches below the lower edge of the window openings and this then aligns with the one on the bunker. The red line along the front platform should be about mid-height of the valance. The cylinder covers have a double red line down front and rear edges and again the outer line is just inboard of the fixing studs and the space between this and the inner line which is about $\frac{5}{32}$ inch.

For the cylinder covers I made a guide from a strip of steel and glued it on with

Blu-Tack so that the pen could just be run along the edge (photos 357 and 358). All four lines were done in about two minutes with one filling of the pen. As for the boiler bands, Phoenix Paints do provide lining strips and they are easy to use as they do not require any joints. The bands for the green locomotives are in one piece so I have used these on Britannias with some success. However, the boiler bands need to be slightly over-scale width as the transfers are slightly over. I couldn't get them to sit on a scale width band without one or other orange lines falling off the edge. The boiler bands are 2 inches wide which scales



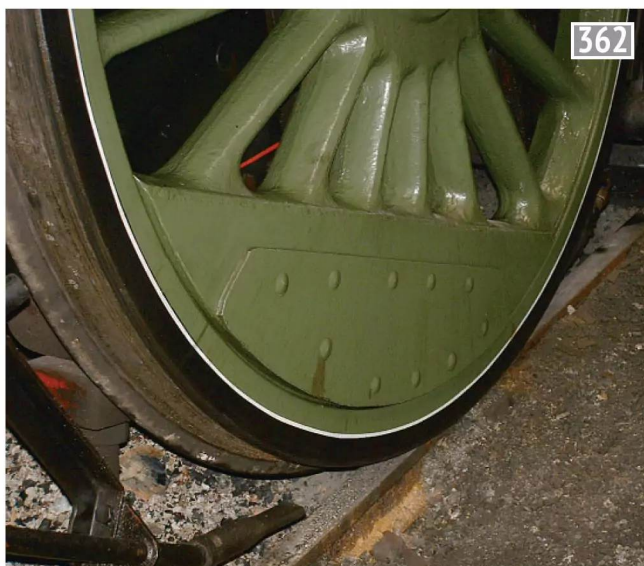
Lining finished on the 4MT.



Lined wheel on B1 1306 (photo: John Thompson).



Tight radius at the corner of the cab on 1306 (photo: John Thompson).



Another view of the lining and balance weight on 1306 (photo: John Thompson).

at 0.177 inch and the transfers are slightly over 0.2 inch wide.

One of the beauties of the tank locomotives is that apart from the front band there is only about a third of the bands visible so that is all you need to line. I clamped my bands to a nice straight piece of 2 x 1 inch timber so that I could again use my finger as a guide and run along one edge. I lined one edge at a time and let it dry before attempting the other side. It also helps if one holds the band down with a finger whilst running the pen along with the other hand. Again, Phoenix Paints do supply red boiler band lining though it is in separate lines. I painted my bands as I was not confident

that I could get the two transfer lines parallel.

For the numbering I chose to use Phoenix Paints transfers again as they are the only ones I know with the correct black outline to the figures. You may not think that this matters on a black locomotive but I can assure you it is very noticeable, especially by its absence. They are also available as separate figures so you can just order the ones that you require rather than buying a whole sheet and throwing away 80% of it. In any event, on my locomotive there are lots of 0s and 8s. They also provide the class numbers to go above the running number. Having said that some of the early locomotives had the '4'

under the cab windows and not on the bunker, others later in life had '4MT' above the running number. The transfers are very easy to apply if you just follow the instructions and it does help if you snip round the figures as closely as possible with a pair of nail scissors. This enables you to space them out correctly. Just make sure that when you get them placed correctly you dab them with a soft tissue to squeeze out all the air from beneath otherwise they will appear opaque when varnished over.

Once the lining and transfers were complete, Malcolm Gregory kindly varnished all the relevant bits and pieces for me and once again we used the semi gloss varnish from Phoenix. This gives quite a nice glossy finish without looking as though it has just left a car showroom. As I didn't want it to look quite brand new, I then went round with a small brush and painted around the insides of all the washout plug cups and mudhole doors with a tinge of Humbrol 'rust'. I also used a fibreglass stick to rub a little bit of the paint off the step treads and the cab handrails so that it just looks as if it has been in service for a few weeks. I also treated the screw couplings with my 'Blackit' kit.

Other finished touches include a set of number plates from Diane Carney and the set includes bunker capacity plate, works plates and shed plate

to your choice. As I described some time ago, I made my own front number plate by cutting out the figures from 16swg brass plate with a piercing saw and silver soldering them onto a back plate so that they have the slightly more convincing depth of a cast iron number plate. I painted the figures on mine with a No. 2 sable haired brush. Another finishing touch which I haven't got on mine yet is the tank water level indicator from Bill Hall. I did describe this some time ago on completion of the tanks. **Photograph 359** shows my 4MT once the lining was all finished.

I have also included some of John Thompson's photos of '1306' which is the green B1 as preserved, to show some of the detail. **Photograph 360** shows one of the wheels with half the tyre painted green and the other half painted black separated by a ¼ inch white line and similarly the axle end. **Photograph 361** shows the lower edge of the cab side showing the small radius in the bottom corner. **Photograph 362** is another view of the driving wheel showing the lining and it also shows the additional balance weight.

Anyway, I hope you have enjoyed the series and, next, I am going on to design a completely new locomotive. This will be another BR Standard engine.

ME

Geoff Theasby reports on the latest news from the clubs.



Please note - this column was written before any of us had heard the terrible news of the Spitfire crash near RAF Coningsby on 25th May.

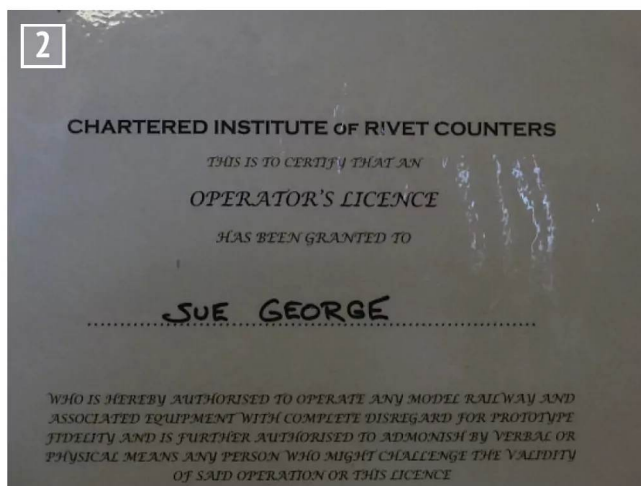
Whilst engaged in vitally important constructional work in the garage, I dropped a weight on my foot. It hurt! I carried on, consoled by the fact that I could still wiggle my toes and walk about. Later that day I had a look at it and found it was very swollen, red and blue all over, and worthy of some paracetamol. The NHS website suggests that I am correct in believing that it is not broken. I will print a picture of it, unless I receive more newsletters and photographs. An ultimatum, not to say blackmail!

In this issue, Galileo? A Hamfest, a 'Challenger', another challenge, vacuum brakes and a bonus photograph.

The Sheffield Model Railway Society, in conjunction with **Neepsend Model Railway Society**, had their annual exhibition in the nearby suburb of Grenoside and I gained a few photographs. Otherwise I would have been in my basement radio bench-cum-test area-cum-writing and research desk. You may think I am so secluded down here but I have the spiders to keep me company. I found one abseiling down my spectacles yesterday. I have called him (him?) Boris Plastikmak. The show was its usual interesting self, not the new and boxed '00' and other gauges, but the many and well made dioramas down to Z gauge. Whilst we were down among the 'Z' men, I bought some very detailed maps of Sheffield and its railway system circa 1935, each with thumbnails of significant variations of the layout over the years, including the route of the M1. This is sure to keep me enthralled for hours. As is also the case, I found a sort of anomaly, nothing to do with the show at all, but a young lady with a real, live Bearded Dragon on her shoulder (see Wikipedia). I suppose I just have the knack*. This reminded me of a joke: A man walks into a bar with a newt on his shoulder. The barman said, 'What's that?' and was told,



Sheffield Model Railway Exhibition diorama.



A fine certificate at the Model Railway Show.

'This is Tiny'. 'Why do you call him that?' 'Because he is my newt'.

At the Sheffield Model Railway exhibition was this unusual diorama, including an electricity substation. Deborah has described these edifices as 'Electric' Henges (**photo 1**). Also spotted on another layout was this certificate, on which I shall offer no comment... (**photo 2**).

Shoulder to Shoulder, April, from **UK Mens Sheds Association**, starts with a picture of a movable shed. What was that Galileo Galilei said? It is surely no accident that the strategic placing of a tin bath and, just behind it, a chimney, leads me to see a steam locomotive in my mind's eye. Or is it just me? (Probably, says Deborah. But he's harmless really...) With the assistance of Men in Sheds

Cymru, Seimon and Stephen Paigh Jones have turned a trailer into a mobile art gallery. **W.** www.menssheds.org.uk

Steam Lines, May-June, from **Northern Districts Model Engineering Society**, put on a pub run (to the Henley Brook) for the first time. Seven traction engines took part plus a few on static display. The colourful engines and the perfect weather meant that everyone had a good day. This was then followed by a dancing display by the local Ukrainian community. This was even more colourful. Ron Collins writes on the lack of fixed dimensions for cones, nuts and nipples. A major supplier has now ceased production and Ron has drawn up a chart and tables as a standard for NDMES which is now fixed to the workshop wall. Editor Jim Clark says, 'the

Guinness World Record for the longest distance covered by a coal-fired miniature steam locomotive in a 24 hour period was broken by Andries Keyser at the Pietermaritzburg Model Engineering Society's track in South Africa. Working with a team of nine friends he set a new record of 205 miles (330km) – beating the previous world record set in the UK in 1994 of 167 miles. The locomotive used was his 7¼ inch gauge Lawley'.

W. www.ndmes.org.au

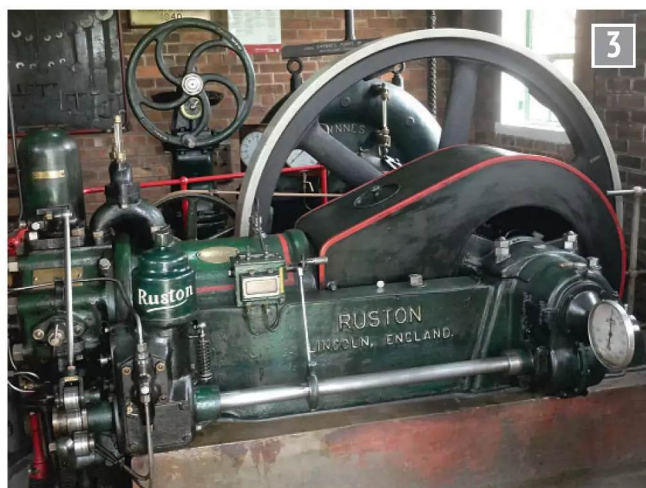
Our trip to the amateur radio 'Hamfest' was spread over an entire weekend, as it is a couple of hours by car and Debs gets tired on a long drive. We found an attractive hotel in Coningsby and woke to an absolutely silent, sunny morning (with the exception of a cuckoo). Of course, this is the time of the Dawn Chorus, although it

is usually over by the time we awake, I mean, all those macho birds warning their rivals to 'keep clear, or else I'll give you what for! This territory is mine', whilst, in the next tree over, a suitor is proclaiming, 'Oh yeah, you and whose air force?' To me, brought up on the Yorkshire Dales, the sight of billiard-table-flat land as far as the eye can see is quite a novelty. We visited Thorpe Camp, built in WWII to provide common services for RAF Coningsby, Woodall Spa and Scampton - the BofB flight is kept at Woodall Spa. We next visited Dogdyke Pumping Station, which still retains its Ruston 7XHR oil engine, dating from 1940 and kept in working order (photo 3). Prior to that machine, a steam pump was employed and is also retained at Dogdyke in working order fed by a Lancashire boiler

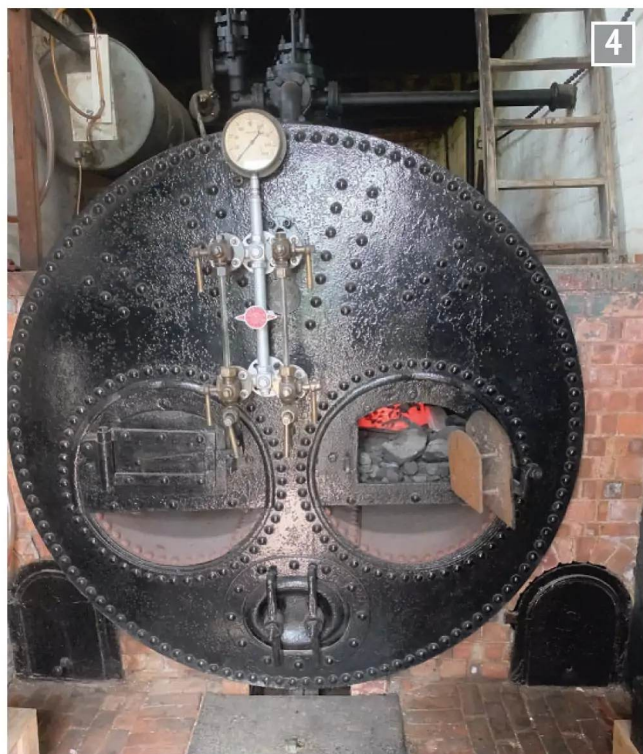
(photo 4). After a good lunch we visited Tattersall Castle, brick built in 1500 - quite a spectacular sight in all that flat land. Hearing the snarl of a powerful aircraft engine, I spotted what I think was a North American Aviation Mustang (Rolls-Royce Merlin engine) practising 'circuits and bumps', as it used to be known (landing, take off, landing etc.). The sound of a Merlin engine is poetry to engineers. Leaving the steam pump, we encountered a classic car rally, with some unusual exhibits,

This Citroen (photo 5) looks like a TA, but it isn't. Ventilation doors on bonnet, seems bigger, bonnet louvres in some. My usual checks drew a blank but eventually it was found to be a 1950 TA 11B or BN. This stepside pick-up has been 'lowered' but needs a repaint (photo 6).

The Whistle, May-June, from **British Columbia Society of Model Engineers**, opens the new year with a picture of the Mayor of Burnaby opening the club site for the first public running of the year....



Ruston oil engine at Dogdyke.



Lancashire boiler, Dogdyke.



1950 Citroen TA 11B at Tattersall Castle.



Stepside pickup.



Chris Holland's 'Challenger' at BCSME.

The Mayor and councillors, plus the Burnaby firefighters, were on hand for the first running to help and encourage people to enjoy the day. The Society has already beaten its previous record for one day ride tickets and had the largest opening day ever! Editor Brian Ruebottom is full of praise for outgoing editor, Paul Ohannesian, and secretary, Joe Holman, for all their help in getting settled into the job, as well as Brian's immediate superior in the Society hierarchy, Marie Rogers, communications director. Proceeds from the event are to be donated to the Burnaby Firefighters charity. A new locomotive graced the BCSME tracks at Easter - Chris

Hollands has just finished his 7½ inch gauge 4-6-6-4 'Challenger' locomotive of the Union Pacific. It took him 18,000 hours to make and build and weighs two tonnes (photo 7). The Sea to Sky Model Train and Hobby Show was held at the British Columbia Railway Museum in Squamish. Some 20 BCSME members were present, in a variety of guises, just visiting, manning a display, acting as stewards etc. A ride on the 1950s Woss Logging Railway speeder was a little light relief, followed by a trip on the Canadian National, *Little Obie*, which instructs children on railway safety matters. A photographic competition for members under 25 years old is announced. Editor Brian R

asks re. John Woods, about whom he wishes to research. Mr Woods was an avid reader of *Model Engineer*, and he is mentioned in ME 2441 of 1948 in the BCSME library. There may be more references as the club records are incomplete. The locomotive in the picture, with ex-editor, Paul Ohannesian, was built in 1935 and donated to the society by Paul who repainted it to the appearance shown. It is to one inch scale, maintained in good order, and coal fired. The tender originally claimed to be of the 'Coquihalla, Hope, Western', (no, me neither) (photo 8).

W. www.bcsme.org

One day recently, I chanced upon a headline in digital media about a couple who bought a house in Derbyshire and discovered a large miniature railway in the overgrown garden. Instead of regarding it as an obstacle to be cleared away, she began to take an interest and started researching. Now, during a conversation with my fellow radio amateurs on't wireless, I thought that should her husband take up amateur radio, they could combine forces and tune the track as a low level aerial. (Known as a 'Beverage' aerial - very long and low down, named after its inventor, Harold H. Aerial.)

Ottawa Valley Live Steamers and Model Engineers sends comprehensive (17 page) safety guides to its members and other assistants on their public running days, the first of which is May 18th.

W. www.ovlsme.com.

I have, somewhere in the recesses of my workshop, in my cabinet of curiosities, a titanium bolt, which emerged from the Concorde program, via an engineering supplier in Skipton. This bolt, which is coated with molybdenum disulphide because titanium squeaks when tightened, is also drilled for a safety wire to prevent it becoming detached in service. For some reason, it is not drilled across the flats of the hexagon head but across the corners of the hexagon. The question is, is it drilled before the head is formed and the excess milled away, or is it drilled *in situ*, so to speak, despite the expected difficulties in drilling into a slant surface. A quick check of Amazon guides me towards a predrilled jig in which the component is held, before drilling the hole, possibly forming a small flat first then centre punch to locate the drill? Is it possibly milled rather than drilled? See this: www.machinemart.co.uk/p/gunson-imperial-safety-wire-nut-and-bolt-jig-k/

Steamview, April, from **Sydney Live Steam and Locomotive Society**, welcomed John, a visitor from Derby in the English Midlands, for their last summer public running day of the year. Ross Bishop writes on machining wheels from solid and this is followed by Mick Murray on vacuum brake testing in SLSLS, including the making of a self-contained portable test rig.

W. www.slsls.asn.au

And finally, Roger Backhouse asks: 'Can tectonic plates go in the dishwasher?' 'I don't know, but they're ideal for a continental breakfast.'

* 'My Pogona' That's yer actual Latin, don't you know?



Mystery locomotive at BCSME with ex-editor Paul Ohannesian.

Club Diary

27 June 2024 – 1 September 2024

June

27 Sutton MEC

Afternoon run from 13:00.
Contact: Paul Harding,
0208 254 9749

30 Cardiff MES

Open Day at Heath Park,
Cardiff. Contact : secretary@
cardiffmes.co.uk

30 Westland and Yeovil MES

Running the track at Yeovil
Junction – Pirate Day. Contact :
Michael Callaghan,
01935 473003

July

3 Bradford MES

Meeting: Steerage Trophy
Competition, 19:30, Wibsey.
Contact: Russ Coppin,
07815 048999.

4 Sutton MEC

Bits and Pieces evening 20:00.
Contact: Paul Harding,
0208 254 9749

4 Westland and Yeovil MES

Thursday running afternoon
and evening followed by fish
and chips. Contact : Michael
Callaghan, 01935 473003

5 Rochdale SMEE

Members projects/Bits
and Pieces. Castleton
Community Centre, 19:00.
See [www.facebook.com/
RochdaleModelEngineers](http://www.facebook.com/RochdaleModelEngineers)

6 Bromsgrove SME

Modern Traction Open Day
– all gauges are welcomed
– 5, 3½, 2½, Gauge 1 and
16mm. Contact: Doug Collins,
01527 874666. See [www.
bromsgrovesme.co.uk](http://www.bromsgrovesme.co.uk)

6/7 Bournemouth and District MES

Gala Weekend at Littledown
Park, Bournemouth. Contact:
bdsme.secretary@gmail.com

6/7 Guildford MES

Gala, 10:00-17:00.
See www.gmes.org.uk

6 Sutton MEC

Coulsden Fete. Contact: Paul
Harding, 0208 254 9749

7 Bradford MES

Rae Day Gala, Northcliff.
Contact: Russ Coppin,
07815 048999.

7 Plymouth Miniature Steam

Public running, 14:00-16:30,
Pendean Crescent, Plymouth,
PL6 6RE, Contact: Rob
Hitchcock, 01822 852479

14 Sutton MEC

Track Day from 13:00. Contact:
Paul Harding, 0208 254 9749

14 Westland and Yeovil MES

Running the track at Yeovil
Junction – Steam Train Day
and Turntable Day. Contact :
Michael Callaghan,
01935 473003

19 Rochdale SMEE

Models Running Night – 17:00
onwards. Springfield Park.
See [www.facebook.com/
RochdaleModelEngineers](http://www.facebook.com/RochdaleModelEngineers)

19-21 Southport MEC

International Model Locomotive
Efficiency Competition. See
[southportmodelengineering.
club](http://southportmodelengineering.club)

20/21 West Riding Small Locomotive Society

Open weekend at Wakefield.
Contact: wrslsec@gmail.com or
07890 532224

21 Bradford MES

Public Running Day. Members
from 11:30, public from
13:30 to 16:00 whatever the
weather, Northcliff. Contact:
Russ Coppin, 07815 048999.

21 Cardiff MES

Open Day at Heath Park,
Cardiff. Contact : secretary@
cardiffmes.co.uk

21 Guildford MES

Open day, 14:00-17:00. See
www.gmes.org.uk

21 Plymouth Miniature Steam

Public running, 14:00-16:30,
Pendean Crescent, Plymouth,
PL6 6RE, Contact: Rob
Hitchcock, 01822 852479

25 Sutton MEC

Afternoon run from 13:00.
Contact: Paul Harding,
0208 254 9749

27 Cardiff MES

Steam up and family day at
Heath Park, Cardiff. Contact :
secretary@cardiffmes.co.uk

27 Westland and Yeovil MES

Track running day 11 :00.
Contact : Michael Callaghan,
01935 473003

30 Westland and Yeovil MES

Running the track at Yeovil
Junction – Diesel Day. Contact :
Michael Callaghan,
01935 473003

August

1 Cardiff MES

Members' projects. Contact :
secretary@cardiffmes.co.uk

1 Sutton MEC

Bits and Pieces evening 20:00.
Contact: Paul Harding,
0208 254 9749

2 Rochdale SMEE

General Meeting. Castleton
Community Centre, 19:00.
See [www.facebook.com/
RochdaleModelEngineers](http://www.facebook.com/RochdaleModelEngineers)

4 Guildford MES

Small Model Steam Engine
Group, 14:00-17:00.
See www.gmes.org.uk

6 Westland and Yeovil MES

Running the track at Yeovil
Junction – Diesel Day.
Contact : Michael Callaghan,
01935 473003

7 Bradford MES

Meeting: Evening running
& Social, 19:30, Northcliff.
Contact Russ Coppin,
07815 048999.

8 Guildford MES

Open day, 10:00-13:00.
See www.gmes.org.uk

8 Westland and Yeovil MES

Thursday running afternoon
and evening followed by fish
and chips. Contact : Michael
Callaghan, 01935 473003

10 Canterbury and District MES

Open day for visiting clubs.
Contact : secretary@cdmes.
org.uk

11 Sutton MEC

Track Day from 13:00. Contact:
Paul Harding, 0208 254 9749

11 Westland and Yeovil MES

Running the track at Yeovil
Junction – Steam Train Day and
Steam Punk. Contact : Michael
Callaghan, 01935 473003

13 Westland and Yeovil MES

Running the track at Yeovil
Junction – Diesel Day. Contact :
Michael Callaghan,
01935 473003

16 Rochdale SMEE

Quiz. Castleton Community

Centre, 19:00. See

[www.facebook.com/
RochdaleModelEngineers](http://www.facebook.com/RochdaleModelEngineers)

17 Maidstone MES

Open Day at Mote Park.
Contact : secretary@
maidstonemes.co.uk

17 Westland and Yeovil MES

Public running day. Contact :
Michael Callaghan,
01935 473003

18 Bradford MES

Public Running Day. Members
from 11:30, public from 13:30
to 16:00, whatever the weather,
Northcliff. Contact: Russ
Coppin, 07815 048999.

18 Cardiff MES

Steam up and family day at
Heath Park, Cardiff. Contact :
secretary@cardiffmes.co.uk

18 Guildford MES

Open day, 14:00-17:00. See
www.gmes.org.uk

20 Westland and Yeovil MES

Running the track at Yeovil
Junction – Diesel Day. Contact :
Michael Callaghan,
01935 473003

22 Sutton MEC

Afternoon run from 13:00.
Contact: Paul Harding,
0208 254 9749

25 Westland and Yeovil MES

Running the track at Yeovil
Junction – Steam Train Day.
Contact : Michael Callaghan,
01935 473003

25-26 Cardiff MES

Open Day at Heath Park,
Cardiff. Contact : secretary@
cardiffmes.co.uk

27 Westland and Yeovil MES

Running the track at Yeovil
Junction – Diesel Day. Contact :
Michael Callaghan,
01935 473003

29 Guildford MES

Open day, 10:00-13:00. See
www.gmes.org.uk

31 Westland and Yeovil MES

Track running day 11 :00.
Contact : Michael Callaghan,
01935 473003

September

1 Cheltenham SME

LBSC Memorial Bowl. Contact:
csme@cheltsme.org.uk

Model Engineer Classified



J A Alcock & Son Courses

Craft Your Own Mechanical Clock Movement

Introduction to Practical Clock Servicing

For more information including additional courses run by J A Alcock & Son please see our website
Tel: 01909 488 866 Web: www.sortyourclock.co.uk
All courses taught by a Fellow of the British Horological Institute

Find us on   @sortyourclock  THE HARLEY FOUNDATION

webuyananyworkshop.com

Re-homing model engineers' workshops across the UK



It's never easy selling a workshop that has been carefully established over a lifetime. I will buy your workshop so you don't have to worry about finding a new home for much loved workshop equipment and tools.



Please email photos to **andrew@webuyananyworkshop.com**
Or to discuss selling your workshop, please call me on **07918 145419**

All equipment considered: Myford, Warco, Chester, classic British brands etc
Polly steam locomotives also purchased, especially those needing a bit of 'TLC'

HORLEY MINIATURE LOCOMOTIVES

7 1/4" Drawings and Castings Dock tank BR STD Class 2 2-6-0 BR STD Class 2 2-6-2T BR STD Class 4 2-6-4T BR STD Class 5 4-6-0 BR STD Class 7 4-6-2 BR STD Class 9 2-10-0 L.M.S Coronation Class 8 4-6-2 (Duchess)	5" Castings Only Ashford, Stratford, Waverley. 7 1/4" Castings Only Dart, Roedeer, Green Queen
---	---

HORLEY MINIATURE LOCOMOTIVES LLP
Phone: 01293 535959 Email: hml95@btinternet.com
www.horleyminiaturelocomotives.com

Complete home Workshops Purchased

Essex/Nottinghamshire locations

Distance no object!

Tel: **Mike Bidwell**

01245 222743

m: **07801 343850**

bidwells1@btconnect.com

MODEL ENGINEER

To advertise please contact

Karen 01732 442144

karen@talk-media.uk

Talk Media in association with 

www.model-engineer.co.uk



BRITISH HOROLOGICAL INSTITUTE


Training Clock and Watch Makers
Since 1858



LEARN HOW TO DESIGN, MAKE AND MAINTAIN TIMEPIECES

Horology combines engineering, metal and wood working, tool-making skills, technology and traditional techniques to produce working timepieces.

At the BHI we've been training clock- and watch-makers for over 160 years and have a range of short (on site) and Distance Learning Courses for all levels.

From beginner to expert you can train with our professional tutors to learn new skills or work towards an internationally recognised qualification to set you on a horological career path.

The skills you learn also apply to an expansive range of engineering professions, including model making and automata.

UK associate membership is only £160 a year.

Your membership also includes a print copy of *The Horological Journal* every month and access to all 160+ years of the *Journal* online...

as well as access to the BHI forum, events and more!

Join today

01636 817603

membership@bhi.co.uk



bhi.co.uk



www.model-engineer.co.uk



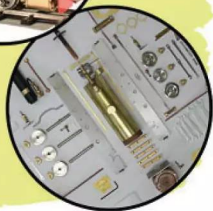
A World of Locomotion

Live steam and battery powered 16mm:1ft scale models of narrow gauge prototypes, ready to run and handbuilt in the UK.

Entry level live steam locos and live steam kits with full assembly instructions.

We have you covered!

Roundhouse Engineering Co Ltd
In Steam Since 1982
Doncaster, South Yorkshire, UK
01302 328035 | mail@roundhouse-eng.com
www.roundhouse-eng.com



STEAMWAYS ENGINEERING LIMITED

LIVE STEAM LOCOMOTIVES

FROM 0 GAUGE TO 10 1/4" GAUGE



Steamways Engineering Limited builds working live steam locomotives from Gauge '0' to 10 1/4", Traction Engines up to 4" scale and stationary steam and launch engines – all to a high standard,

We also complete unfinished projects, finish paint and hand-line them.

The renovation and repair of steam models is sympathetically undertaken.

To assist you complete your own projects, we manufacture individual parts to order including supplying a range of fully certificated and EC PV Regulations compliant silver-soldered copper boilers up to and including 5 inch gauge.

Visit our Website

www.steamwaysengineering.co.uk

email us on **info@steamwaysengineering.co.uk**

or telephone us on **01507 206040** with your requirements for a no-obligation quote or discussion.

Steamways Engineering Limited

Dovecote House, Main Road, Maltby le Marsh, Alford, Lincs. LN13 0JP

Call: 01507 206040

THE SUMMER SALE!

CAMDEN MINIATURE STEAM SERVICES RODE FROME BA11 6NZ

40%+ off Retail Price!

The fire burns much better • Koopmans £20.90

The book in print on steam locomotive exhaust development! Covers all exhaust systems from Trevithick in 1804 up to Porta and Wardale in 2004. Each is described and then analysed in detail for their good and bad points; now it is possible to follow the development of exhaust systems for steam locomotives chronologically. If you are working on steam locomotives, full-size, miniature or model, there is all the data here you need to design a good, effective front end. 488 pages, full of drawings, diagrams, data and formulae. Paperback. (Original price - £30.90 inc UK P & P)



Stirling Engine Projects Volume 1 • £14.10

James Rizzo's last book, concentrating on 'Bell-Crank' mechanisms, which are amongst the simplest to make for Stirling engines. They are described in detail and then there are six Projects (including full drawings) which you can make yourself. 128 paperback pages, numerous photographs. (Original price - £20.45 inc UK P & P)



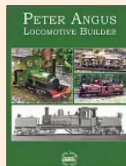
Model Steam Locomotives • Greenly • 1954 £15.10

This reprints the eighth edition of Henry Greenly's famous book on building model steam locomotives in sizes ranging from Gauge 1 to 15 inch gauge. Was Greenly the best of the writers whose designs appeared in print? Opinions vary, but we believe he was in the top-rank for clarity both in ideas and clarity of writing. Buy this and see what you think! 322 page illustrated paperback. Full of B&V drawings and photographs. (Original price - £21.90 inc UK P & P)



Peter Angus - Locomotive Builder • £26.70

If you would like to build a live steam narrow gauge engine in 16mm scale and want ideas, suggestions, hints, tips and the story of the prototypes, look no further than this book from Peter Angus, who has built 100s of such models. A pleasure to read and with 217 A4 size pages crammed with photos, drawings and illustrations, the bulk in colour, it is very good. (Original price - 39.45 inc UK P & P)



Building the Maltese Falcon • Shelley £7.28

Fancy a BIG model IC engine? The "Maltese Falcon" powered a 15 foot wingspan Taylorcraft! This isn't a beginners engine, but it can be built by any reasonably experienced model engineer. The book doesn't contain full building instructions - rather you get the full drawing set of 11 sheets, reduced in size to fit A3 format, and 36 A4 pages of notes, hints and tips on building the engine, plus numerous photos of parts and set-ups for making them. Wirebound (77% discount on original price!)



Mixed Gauges - VERY SPECIAL PRICE - 69% off! • Snell • £22.70

The late John Snell's wonderful story of his life with steam, and his travels worldwide, told in 256 pages, 386 photos in full colour and 48 in b&w. Countries covered include the U.K., Wales (the start of the preservation), New Zealand, Australia, Scandinavia, France, Spain and Portugal, Java and Thailand, Germany, the U.S.A., Switzerland, Austria and Italy, Yugoslavia, Bulgaria, Rumania and Czechoslovakia, Columbia, Ecuador and Peru, and South Africa. John was a superb writer and photographer as this book evidences - Hardbound. Hugely enjoyable!



Prices shown INCLUDE U.K. Post & Packing:

Buy two or more items and **SAVE ON POSTAGE** - this is automatically calculated if you order online, as is Overseas postage.

GOOD READING and INFORMATION at UNBEATABLE PRICES!

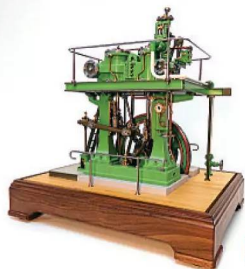
Buy online at: **www.camdenmin.co.uk**

or phone 01373 310285 to order



ALL LIVE STEAM ENGINES WANTED

ANY SIZE & CONDITION INCLUDING PART BUILTS



Stationary Engines inc. Stuart Turner, Bing etc
Traction Engines and Locos in all sizes.
Especially wanted 4" and 4½" gauge Traction Engines.

Any Locos from gauge 1 to 7¼".

Also any Electric models locos, buses etc

Will collect personally. Distance no object.

Call Kevin on 01507 606772 or 07717 753200



MODEL ENGINEER
THE ORIGINAL MAGAZINE FOR MODEL ENGINEERS

Adam Heslop's
LANEILLI SPRING RALLY

SCAN ME...

GUARANTEE YOUR COPY
PRE-ORDER YOUR NEXT ISSUE

3 GREAT REASONS

- Delivered straight to your door
- Free postage and packaging
- Buy direct from the publisher

Pre-order today: www.classicmagazines.co.uk/issue/preorder

Radio Controlled Aircraft, Boat and Model Engineering Plans & Parts

sarik hobbies

The World's Biggest Selection*

www.sarikhobbies.com

* World's biggest selection of printed RC Model Plans & Short Kits.

Plans
Laser Cut Wood Packs
Hulls
Materials
Short Kits
Tools
& much more

MAXITRAK.COM
The best of model rail and road.
Tel: 01580 893030 Email: info@maxitrak.com

5" E.M Baldwin Painted Kit or Ready to Run

5" Austerity

1 1/2" Allchin
Available in three liveries
Gas/propane fired
Length: 627mm
Width: 266mm
Height: 429mm
Rear Wheel dia 228mm

10-11 Larkstore Park, Lodge Road, Staplehurst, Kent, TN12 0QY

MAIDSTONE ENGINEERING SUPPLIES
01580 890066
MAIDSTONE-ENGINEERING.COM
info@maidstone-engineering.com

One stop model engineering shop

Leading suppliers of fittings, fixings, brass, copper, bronze, steel, plastics, taps, dies, drills, machine tools, BA nuts and bolts

Browse our website or visit us at
10-11 Larkstore Park, Lodge Road, Staplehurst, Kent, TN12 0QY

Copper TIG Welded Boilers

Newton Tesla (Electric Drives) Ltd have been trading since 1987 supplying high power variable speed drives and electric motors to industry up to 500KW so you can be confident in buying from a well established and competent variable speed drive specialist.



*New product promotion, AV550 550W motor / inverter
for the Myford Super 7. Call for details!*

Managing director George Newton, originally from the British Steel industry where he worked with 20,000 HP rolling mill drives is also a skilled machinist and uses his own lathes to design and refine speed controllers especially for the Myford ML7 & Super 7

For the Myford ML7, George and his team produce the AV400, a complete 'Plug & go' solution including a new variable speed motor that meets the original Myford motor specification, has the correct 5/8ths shaft diameter and is a direct fit

The 'AV' range is extended with the AV550 & AV750 for the Super 7 lathe giving a choice of 3/4HP & 1HP motor power

Full Torque is available from motor speed 90 - 1,750 RPM

Advanced Vector control for maximum machining performance

Prewired and programmed ready to go

The AV400/550/750 speed controllers have an impressive 10 year warranty for the inverter and 3 years for the motor (Terms and conditions apply)

Over 5,000 units supplied to Myford owners

Speed control solutions also available for other lathes including Bofford, Southbend, Colchester, Raglan etc call or email for details

Technical support available by telephone and email 7 days a week



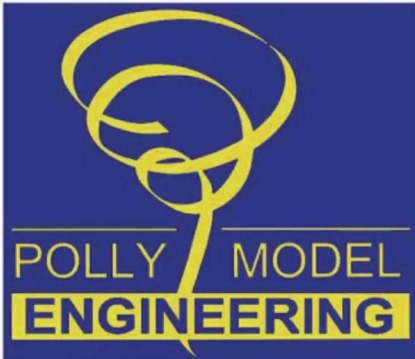
Newton Tesla (Electric Drives) Ltd.
Warrington Business Park, Long Lane, Warrington
Cheshire WA2 8TX, Tel: 01925 444773

Email: info@newton-tesla.com

Visit <https://www.newton-tesla.com> for more information.

Follow us on Facebook: www.facebook.com/NewtonTeslaLtd





POLLY MODEL ENGINEERING

*For all your Model
Engineering Requirements*



Extensive range of parts:
pressure gauges, injectors,
steam valves, superheaters,
lubricators, oil cans,
transfers, spanners,
taps and dies, draincocks
nuts and bolts etc.

Stationary Engines and Locos

**- Orders welcome via
Website**

Telephone or Email!



Polly Model Engineering
Unit 203 Via Gellia Mills,
Bonsall, Derbyshire,
DE4 2AJ, United Kingdom

www.polly-me.co.uk

Tel: +44 (0)115 9736700

Find us on 

sales@polly-me.co.uk