THE ORIGINAL MAGAZINE FOR MODEL ENGINEERS

Vol. 227 No. 4669 • 16 - 29 July 2021

# MODEL ENGINEER

Join our online community www.model-engineer.co.uk

COVER FEATURE

## Ballaarat

## Parklands Railway

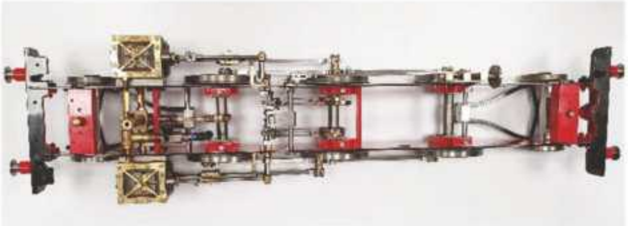
## Scotsman Frames

## Bandsaw Vice

mytimemedia ENGINEERING GROUP
69
9 770026 732223
£4.40

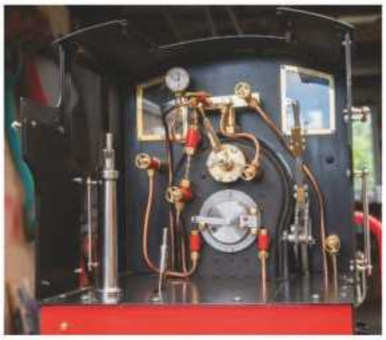
# POLLY MODEL ENGINEERING LIMITED

Find us on



## Build your new 5" gauge coal fired 'POLLY Loco' and be ready to enjoy running in the new season.

Supplied fully machined, assembly requires hand tools only – no riveting, soldering or other complex processes. Kit includes boiler CE/UK CA certified and accepted under Australian AMBSC regulations. Model can be supplied as full kit (unpainted) or a succession of kit modules.





10 other models, tank engines, tender engines, standard gauge/narrow gauge – something for everyone!
Prices from £5716 including VAT and carriage.
Build & cost optionally spread over 12 months.

Buy with confidence from an established British Manufacturer

**144 page Catalogue £2.50 UK £8 international posted (or download free!) and enquire for further details or visit our website where you will find other Polly Locos, Kits, drawings and castings for scale models and comprehensive ME Supplies.**

**Polly Model Engineering Limited**
**Atlas Mills, Birchwood Avenue,**
**Long Eaton, Nottingham,**
**NG10 3ND, United Kingdom**

**www.pollymodelengineering.co.uk**
**Tel: +44 115 9736700**

**email:sales@pollymodelengineering.co.uk**

MODEL ENGINEER

Published by **MyTimeMedia Ltd**.
Suite 25S, Eden House, Enterprise Way,
Edenbridge, Kent TN8 6HF
**www.model-engineer.co.uk**

**SUBSCRIPTIONS**
**UK** - New, Renewals & Enquiries
**Tel: 0344 243 9023**
Email: help@me.secureorder.co.uk
**USA & CANADA** - New, Renewals & Enquiries
**Tel: (001)-866-647-9191**
**REST OF WORLD** - New, Renewals & Enquiries
**Tel: +44 1604 828 748**
Email: help@me.secureorder.co.uk

**CURRENT AND BACK ISSUES**
Tel: 01795 662976
Website: www.mags-uk.com

**EDITORIAL**
**Editor:** Martin R Evans
Tel: +44 (0)7710 192953
Email: mrevans@cantab.net
**Assistant Editor:** Diane Carney
**Club News Editor:** Geoff Theasby

**PRODUCTION**
**Designer:** Yvette Green
**Illustrator:** Grahame Chambers
**Retouching Manager:** Brian Vickers
**Ad Production:** Andy Tompkins

**ADVERTISING**
**Advertising Sales Executive:** Angela Price
Email: angela.price@mytimemedia.com

**MARKETING & SUBSCRIPTIONS**
**Subscription Manager:**
Beth Ashby

**MANAGEMENT**
**Group Advertising Manager:** Rhona Bolger
Email: rhona.bolger@mytimemedia.com
**Chief Executive:** Owen Davies

mytimemedia
print & digital media publishers



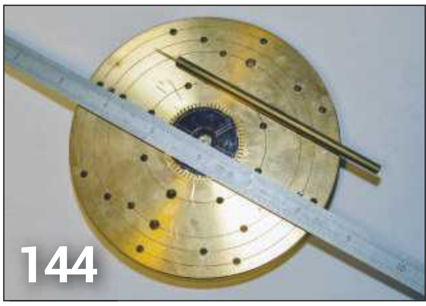


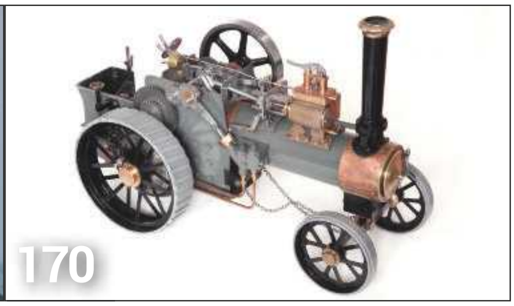
Model Engineer, ISSN 0026 - 7325 (USPS 24828) is published fortnightly by MyTime Media Ltd, Suite 25S, Eden House, Enterprise Way, Edenbridge, Kent, TN8 6HF, UK. The US annual subscription price is 136USD. Airfreight and mailing in the USA by agent named World Container Inc, 150-15, 183rd Street, Jamaica, NY 11413, USA. Periodicals postage paid at Brooklyn, NY 11256. US Postmaster: Send address changes to Model Engineer, World Container Inc, 150-15, 183rd Street, Jamaica, NY 11413, USA. Subscription records are maintained at DSB.net Ltd, 3 Queensbridge, The Lakes, Northampton, NN4 5DT, UK. Air Business Ltd is acting as our mailing agent.

http://www.facebook.com/modelengineersworkshop

http://twitter.com/
modelengineers



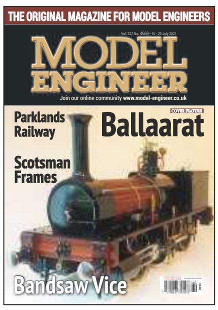


144


170

# IN THIS ISSUE


Vol. 227 No. 4669 16 - 29 July 2021




## ON THE COVER...

*Ballaarat – the construction of this locomotive is described by* **Luker**, *starting in this issue (photo:* **Luker's** *wife, the beautiful Michelle).*

SILVER CREST
models

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

# 5" GAUGE CORONATION CLASS

OVER 90% OF BATCH NOW SOLD!


£14,995.00 + p&p

## The Coronation Class

Designed by Sir William A. Stanier the first locomotives out of Crewe works were originally built as streamliners. Later some were built without streamlining.

All of the streamliners were finally re-built in un-streamlined form, and all eventually featured double chimneys. The model offered here is representative of the class as re-built. The locomotives were produced in a variety of liveries in BR days including maroon, blue and lined green.

"This is an exceptional model in so many respects. It is the largest 5" gauge locomotive we have manufactured to date and has the benefit of four cylinders to re-create that distinctive exhaust beat. It will be available in a variety of BR liveries and a wide choice of famous names to include Coronation and Duchess of Hamilton. A challenging model, but well worth the extensive development effort. As an award winning professional model maker I am delighted to have been involved in this very special project"

***Mike Pavie***

## 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**

## Summary Specification

Approx length 80"

- Stainless steel motion
- Boiler feed by axle pump, injector, hand pump
- Etched brass body with rivet detail
- 4 Safety valves
- Choice of liveries
- Painted and ready-to-run
- Coal-fired live steam
- 5" gauge
- 4 Cylinder
- Piston Valves
- Walschaerts valve gear
- Drain cocks
- Mechanical Lubricator
- Silver soldered copper boiler
- Superheater
- Reverser

Approx Dimensions:
- (L) 80"x (W) 10"x (H) 14"
- Weight: 116 kg

## The 5" Gauge Model

This magnificent model is built to a near exact scale of 1:11.3.

Although a 4 cylinder model of this size and quality can never be cheap it certainly offers tremendous value-for-money. You would be hard pushed to purchase a commercial boiler and raw castings for much less than the £12,495.00 + VAT we are asking for this model. Certainly a one-off build by a professional model maker would cost you many fold this with some medal winning examples changing hands at auction in excess of £100,000.

This model is sure to be a real head turner on the track pulling a substantial load, or when on display in your home, or office.

The model comes complete with a silver soldered copper boiler, hydraulically tested to twice working pressure. All our boilers are currently CE marked and supplied with a manufacturer's shell test certificate, and EU Declaration of Conformity. As testament to our confidence in the models we provide a full 12 months warranty on every product. **We've presently booked sufficient factory capacity for the manufacture of just 25 models.**

Order reservations will be accepted on a first come, first served basis. We are pleased to offer a choice of names and liveries.

## Delivery and Payment

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

VISA MasterCard

The order book is now open and we are happy to accept your order reservation for a deposit of just £1,995.00.

We will request an interim payment of £5,000 at the end of July as the build of your model progresses, a further stage payment of £5,000 in August and a final payment of £3,000 in September/October 2021 in advance of shipping from our supplier.

FREE BROCHURE REQUEST FORM

Please send, without obligation, my free full colour brochure for the 5" gauge Coronation Class.

Name: ____________________

Address: ____________________

____________________

____________________ Post Code: ____________

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

ME

Company registered number 7425348

# MODEL ENGINEER SUBSCRIPTION ORDER FORM

## DIRECT DEBIT SUBSCRIPTIONS (uk only)

Yes, I would like to subscribe to *Model Engineer*

❏ Print + Digital: £18.25 every quarter
❏ Print Subscription: £15.25 every quarter (saving 41%)

## YOUR DETAILS must be completed

Mr/Mrs/Miss/Ms .................. Initial ............................Surname ......................................

Address .......................................................................................................

.................................................................................................................

Postcode ........................................................ Country ..........................................

Tel ............................................................................. Mobile .......................................

Email .................................................... D.O.B ..........................................................

## I WOULD LIKE TO SEND A GIFT TO:

Mr/Mrs/Miss/Ms .................. Initial ............................Surname ......................................

Address .......................................................................................................

.................................................................................................................

Postcode ........................................................ Country ..........................................

## INSTRUCTIONS TO YOUR BANK/BUILDING SOCIETY

Originator's reference 422562 DIRECT Debit

Name of bank.................................................................................................

Address of bank ............................................................................................

.................................................................................................................

................................................................................ Postcode ............................

Account holder ..............................................................................................

Signature ......................................................................... Date .........................

Sort code ☐☐ ☐☐ ☐☐ Account number ☐☐☐☐☐☐☐☐

Instructions to your bank or building society: Please pay MyTimeMedia Ltd. Direct Debits from the account detailed in this instruction subject to the safeguards assured by the Direct Debit Guarantee. I understand that this instruction may remain with MyTimeMedia Ltd and if so, details will be passed electronically to my bank/building society.

Reference Number (official use only) ☐☐☐☐☐☐☐☐☐☐

Please note that banks and building societies may not accept Direct Debit instructions from some types of account.

## CARD PAYMENTS & OVERSEAS

Yes, I would like to subscribe to *Model Engineer, for 1 year* (26 issues) with a one-off payment

UK ONLY:
❏ Print + Digital: £77.99
❏ Print: £65.99

EUROPE & ROW:
❏ EU Print + Digital: £104.99
❏ EU Print: £92.99
❏ ROW Print + Digital: £117.00
❏ ROW Print: £105.00

## PAYMENT DETAILS

☐ Postal Order/Cheque ☐ Visa/MasterCard ☐ Maestro

Please make cheques payable to MyTimeMedia Ltd and write code ME2021 on the back

Cardholder's name.......................................................................................

Card no: (Maestro)

Valid from.............................. Expiry date.................. Maestro issue no..................

Signature.............................................................................. Date............................

TERMS & CONDITIONS: Offer ends 31st December 2021. MyTime Media collects your data so that we can fulfil your subscription. We may also, from time to time, send you details of MyTime Media offers, events and competitions but you always have a choice and can opt out by emailing us at unsubscribe@model-engineer.co.uk. Please select here if you are happy to receive such offers by email ❏ by post ❏ by phone ❏. We do not share or sell your data with/to third parties. Details you share with us will be managed as outlined in our Privacy Policy here http://www.mytimemedia.co.uk/privacy-policy. Please visit www.mytimemedia.co.uk/terms for full terms & conditions.

**POST THIS FORM TO:**
**MODEL ENGINEER SUBSCRIPTIONS, MYTIMEMEDIA LTD, 3 QUEENSBRIDGE, THE LAKES, NORTHAMPTON NN4 7BF**

CODE ME2021


## PRINT + DIGITAL SUBSCRIPTION

- 26 Issues ***delivered to your door***
- ***Great Savings*** on the shop price
- ***Download*** each new issue to your device
- A ***75% discount*** on your Digital Subscription
- Access your subscription on ***multiple devices***
- Access to the ***Online Archive*** dating back to August 2001


## PRINT SUBSCRIPTION

- 26 Issues ***delivered to your door***
- ***Great Savings*** on the shop price
- Never miss an issue

# SUBSCRIBE TODAY

# SMOKE RINGS

MARTIN EVANS
Editor

DIANE CARNEY
Assistant Editor

YVETTE GREEN
Designer

## Panamint Cinema

Panamint Cinema is a Scottish based producer of rare and classic films on DVD and Blu-ray with several featuring historic engineering. *Faces of Scotland* includes the Oscar winning film of Clyde shipbuilding *Seawards the Great Ships* and *The Big Mill*, about steel strip making at Ravenscraig, now long closed. *One Continuous Take* features wartime instructional films by Kay Mander including *How to File* and, in *Transfer of Skill*, the only known film clip of model engineer Jim Crebbin driving a model Santa Fe Mallett!

Besides this Panamint has resurrected early BBC Para Handy programmes featuring the skipper and his wily crew on Clyde Puffer *The Vital Spark.* Still the funniest. Elsewhere *A Romance of Engineering* shows ship's propeller making and fabricating steel components at Beardmore's Parkhead Forge. The wartime *Pattern of Britain* film series include snippets of narrow-gauge railways used for Fenland river bank repairs, iron ore mining and industrial trains, and even Lincolnshire potato railways.

Unfortunately, Panamint is closing down in December so buy now!

Panamint Cinema
Abercorn School House
By Newton, Broxburn
West Lothian
EH52 6PZ
www.panamint.co.uk

## Waking Up to Freedom

As you read this, our liberation from the last 15 months or so of covid captivity should come in a few days. For many of us, it has seemed like a bad dream but what kind of world will we be waking up to? Will we continue to pirouette around each other in supermarket aisles? Will the French insist on us filling in several forms in triplicate before we are allowed to bring a *saucisson Anglais* through the Channel Tunnel? Will we be getting high on the faint whiff of hand sanitiser?

Perhaps not – these covid diversions (hopefully) will soon be distant memories. What is certain though (unless Boris changes his mind) is that all the club activities that we have missed for the last year or so will resume and the various model engineering shows will run once more. We have missed one Alexandra Palace show, one Midlands show and – sadly – two Doncaster shows. The Midlands show comes up in October ($14^{\text{th}}$ – $17^{\text{th}}$) and I am assured that will take place. In fact, I have already booked my room at a nearby Bed and Breakfast ("your usual room, Mr Evans?"), so confident am I. Other key events will also be taking place – IMLEC at Maidstone and the Sweet Pea Rally at Hereford (both over the weekend of $20^{\text{th}}$-$22^{\text{nd}}$ August), LittleLEC at Birmingham ($4^{\text{th}}$ – $5^{\text{th}}$ September) and the Rob Roy Rally at Bromsgrove ($11^{\text{th}}$ September). So, there's plenty of places to visit over the summer to help chase away those covid blues.

## Foreseeing the Unforeseeable

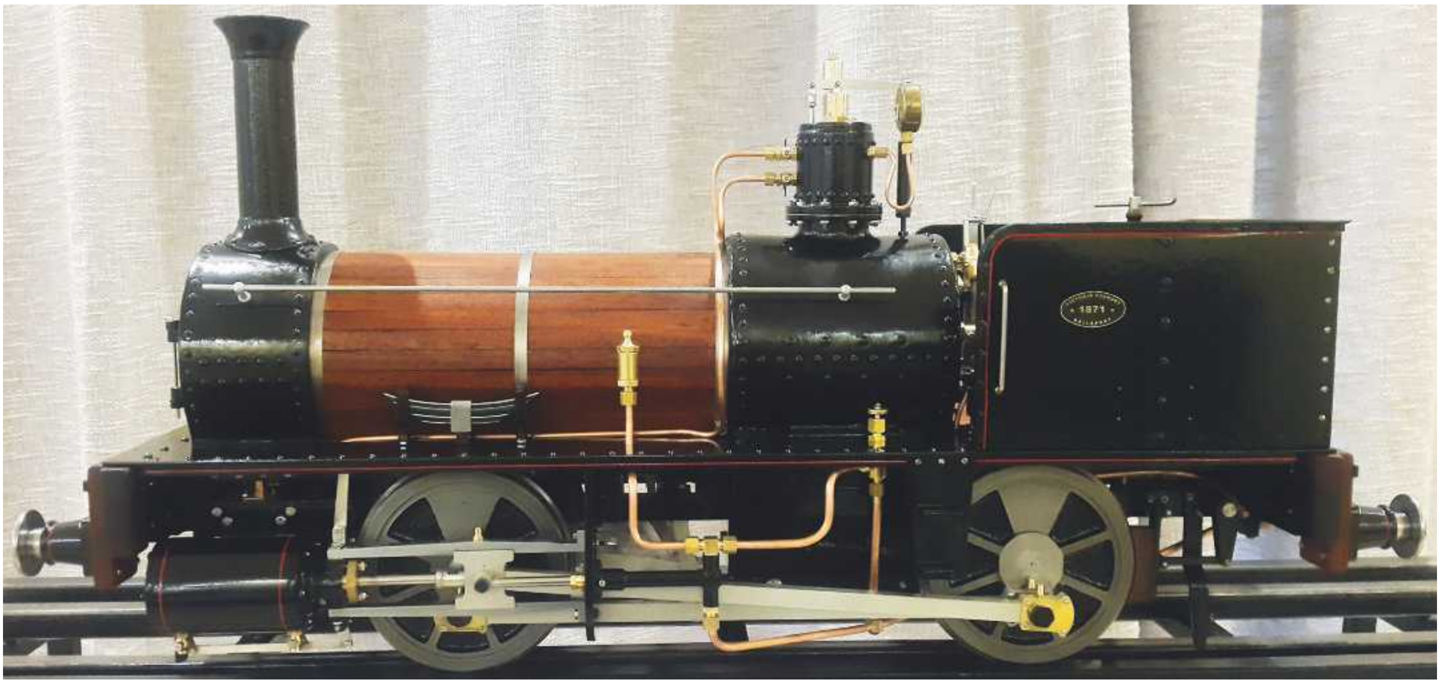
Frank Cooper, chairman of the 7¼ Inch Gauge Society, raises the following issue with sit astride coaches:

'A few weeks ago a young lad suffered severe injuries to his leg after he was able to get his foot over the end of the coach and it was crushed against the driving truck on a tight curve. 'The HSE attended and have criticised the club for 'no end boards' and will be sending them their usual fee note charged at £150 per hour plus VAT. They had originally threatened a prosecution but this has now been dropped. Your insurance will not cover such costs I am afraid. 'Make sure this won't happen if you are driving and that any risk assessment covers this possible eventuality.'

Can every possible eventuality really be covered? Sadly, there is a minority of the population who will think up ever more ingenious ways to remove themselves from the gene pool. It's the other side of the evolution coin, I suppose. The rest of us may well try to keep up with them by trying to anticipate what the next stroke of genius might be. It's a race between the urge, in some people, to discover ever more unlikely means of self-destruction and those of us who are trying to prevent them succeeding in the attempt. I used to do guard duty on the late Lord Braybrooke's railway at Saffron Walden. The tunnel on that railway has a rather narrow entrance and I would sit at the back of the train dreading the possibility of some giddy minded youngster sticking an arm, or worse, a head, out of the train at the wrong moment. Fortunately, that never happened but it seems it is just one of the virtually infinite number of possibilities for disaster that we are expected to anticipate. (I gather that very thing has happened, fairly recently, on the 1:1 scale railway.)

Why should it always be the fault of the railway? What has happened to the concept of personal responsibility? Of course, we have a duty of care but exactly how far can that duty be stretched in the face of an apparently determined effort to court disaster?

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
**mrevans@cantab.net**



# Ballaarat PART 1

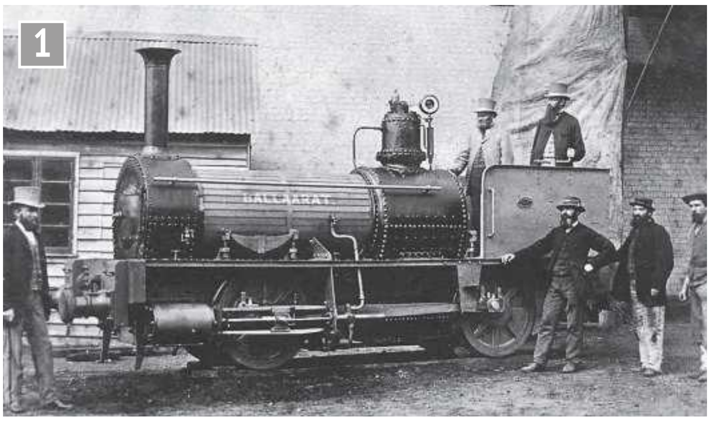
## A 5 Inch Gauge 0-4-0 Aussie Locomotive


***Luker*** describes a simple but authentic small locomotive.


### Introduction

One of the master builders here in South Africa once told me "if you're going to spend a couple of years building something, it must be of particular interest to you". Building similar locomotives, to me, isn't very appealing. The locomotives I love building are all very different, some from different continents, different designs and ideas, some more crazy than others! Most of the locomotives I've researched and built have been from a similar era (pre-1900's). This is before the ideas in locomotive building started to coalesce and this era gives a young model engineer, like me, insight into how designers thought and tackled problems well over a hundred years ago.

Having said that I would like to share with fellow modellers an interesting little locomotive I modelled and built during lockdown. The valve gear is off the front wheel and back to front when compared to the usual set-up; with the radius rod moving instead of the expansion link. Even though it's a narrow-gauge locomotive the proportions take on the more slender form typical of the standard gauge, with a beautiful, long, mahogany-clad boiler. The wheel span is also a little longer so she doesn't look like a ballerina on her tippy-toes. There is no doubt this is a working locomotive but, with the steam valves all polished and the red lining breaking the monotony of black paint, it isn't difficult to mistake her for a Cinderella all ready for the big ball. I am of course talking about the 0-4-0 *Ballaarat*, the first locomotive in Western Australia used by the Western Australian Timber Company.

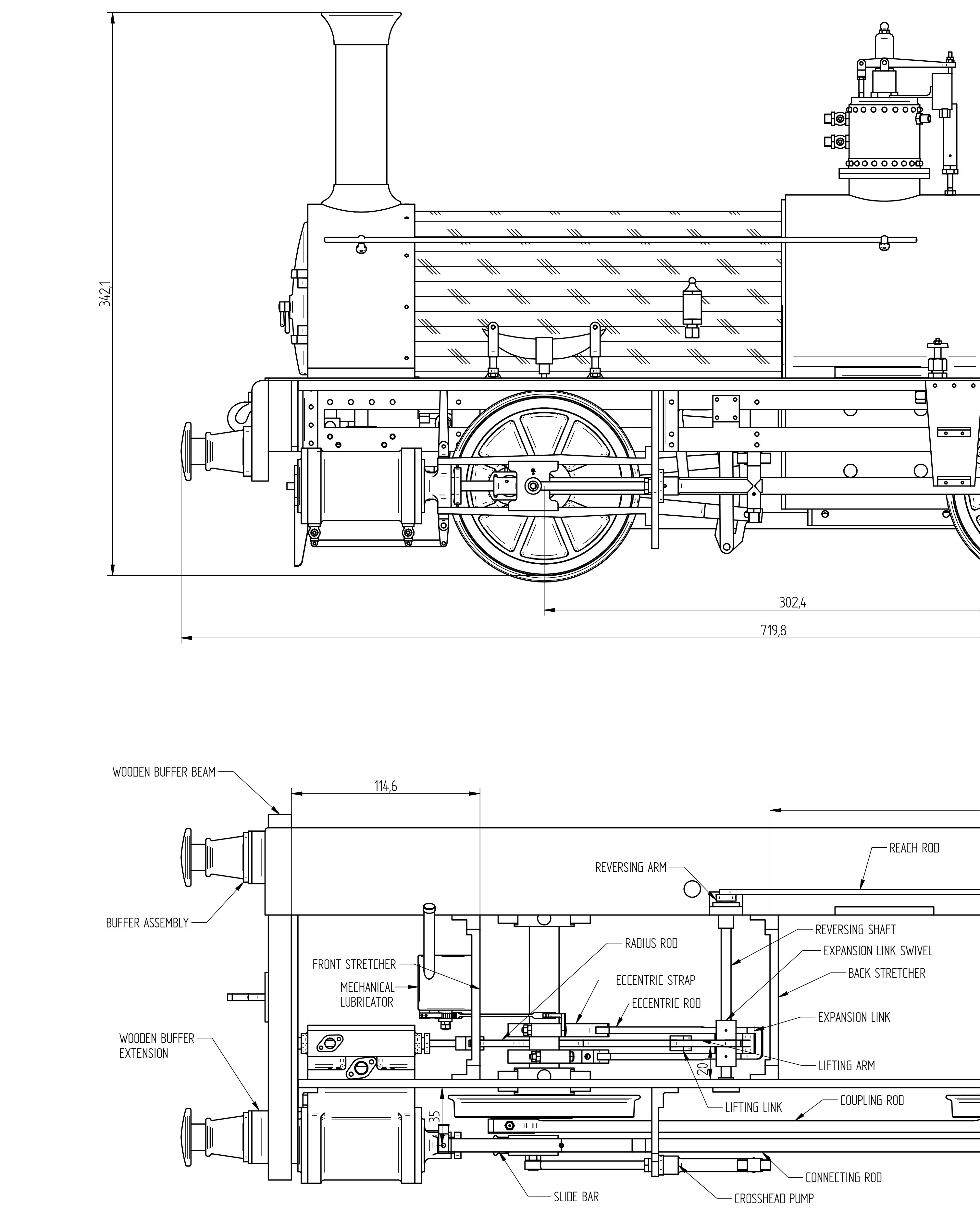



Ballaarat *in the manufacturer's yard, 1871 (photo: Rail Heritage WA).*

### Some background on *Ballaarat*

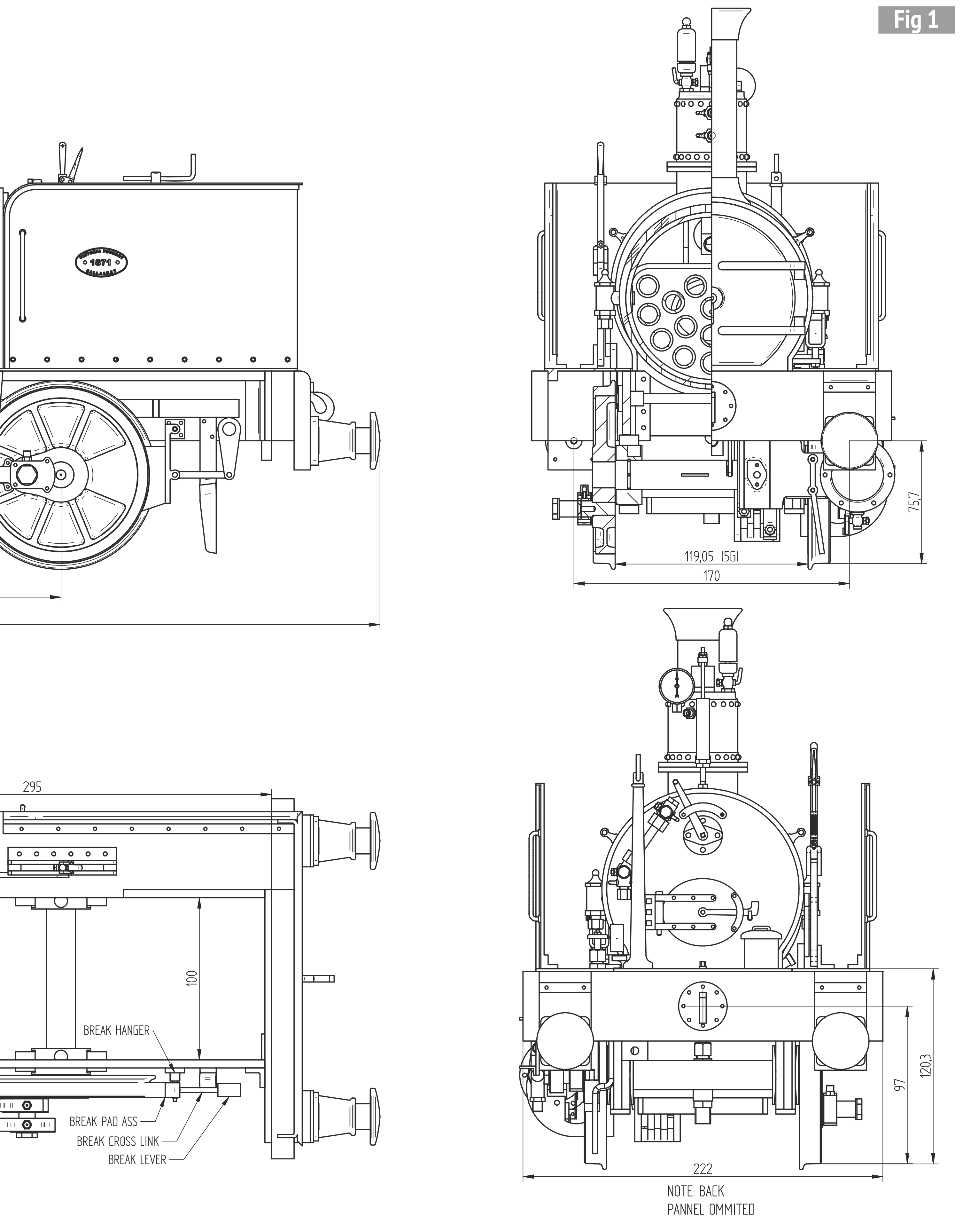
The locomotive (**photo 1**) was designed by Mr. G. Robinson of the Victoria Foundry and was shipped to Busselton but it arrived three months late, in August 1871, due to rough seas. The rail line on which *Ballaarat* was to traverse ran from the docks to Yoganup 18km inland. The line expanded over the years to 30km with a small tender being added to make the distance. *Ballaarat* saw a number of modifications during its working life but by 1888 the company was in

>>




**General arrangement.**

Fig 1


VICTORIA FOUNDRY
1871
BALLAARAT
119,05 (5G)
170
75,7
295
100
BREAK HANGER
BREAK PAD ASS
BREAK CROSS LINK
BREAK LEVER
222
97
120,3
NOTE: BACK
PANNEL OMMITED

financial trouble and most of the assets were auctioned off. From this point *Ballaarat* was moved from pillar to post by various preservation groups (and individuals) until it found its current resting place at Railway house, Busselton. This tough little locomotive survived a fire while in a shed. It was then exposed to the salt air, Bogans ravaging it of parts for souvenirs, yet it still managed to escape the scrapyard and end up in a place of honour. How can you not model a true blue like *Ballaarat*?

The technical aspects of this locomotive are what originally piqued my interest. The long wheel base gives the locomotive a slender look. The driving axle is behind the firebox and the eccentrics are on the front coupled wheel. This means the valve gear has the expansion link facing the opposite direction with the radius rod fitting between the eccentrics to the valve chest at the front of the locomotive. The proportions of the locomotive look good and it is clear the designer put some thought into the placement of the bunker tank, wheels and cylinders to get the centre of gravity exactly where needed. Having taken my model out on a number of very enjoyable steam dates I can say she behaves admirably on our rather rough track. The club members tell me she's a good looking locomotive but you never know if they are just being diplomatic; like you have to be when commenting on someone's new baby.

## The Model

A very enthusiastic young lad from our steam club wanted to build a locomotive but had no technical background. Always willing to rope young people into model engineering, I said I would help him as best I could with whatever project he was interested in. First, he would need to build a simple wobbler I designed for a machine training course I used to present. After completing the wobbler, he had the raw basics of machining and I was convinced he would stick with it and finish a more complicated build.

We decided to build *Ballaarat* together (each our own locomotive); I would do the drawings (**fig 1**) and design and give some guidance on the machining of the various components. Most of the notes I gave to him have been built into the series so it really is written for someone with limited machinery, knowledge and tooling and just starting out with model engineering. The premise for the notes was that a lathe was readily available, as well as a small drill press and the more common hand tools. The milling machine at the RSME (our steam club) would be used for the more complicated milling but where possible the lathe was used for milling. Unfortunately, a vertical slide could not be used because the apron on the lathe had no slots, so the notes were adapted to use the available lathe.

He was also particular about keeping the model a spitting image of the original locomotive and I enjoyed the challenge of that, combined with keeping everything simple and easy to make. The model could not be a long build otherwise there is a tendency to lose interest, so the minimal amount of machining was incorporated into the design. My locomotive was built during South Africa's rather extensive COVID-19 lockdown, taking in total 9 months from first casting to first steam test. The notes that were given to the young lad also became leaner in terms of descriptive detail on machining operations, simply because I got lazy and he progressed remarkably quickly in his abilities.

Some minor deviations to the original locomotive are, of course, necessary. I do think I kept to the spirit and overall dimensions rather well and I doubt the original builders would protest against some of my sneaky modifications. An injector will be added to the model; we have a funds generating steam track and sometimes you need to stop the safety valves from blowing off when in the station with the public around. The injector will be next to the frames under the running boards so it won't stick out like a sore thumb. The original crosshead pump (rather than the eccentric driven axle pump which was later fitted) is incorporated into the model. This makes the pump a feature but it is also easily accessible for maintenance.

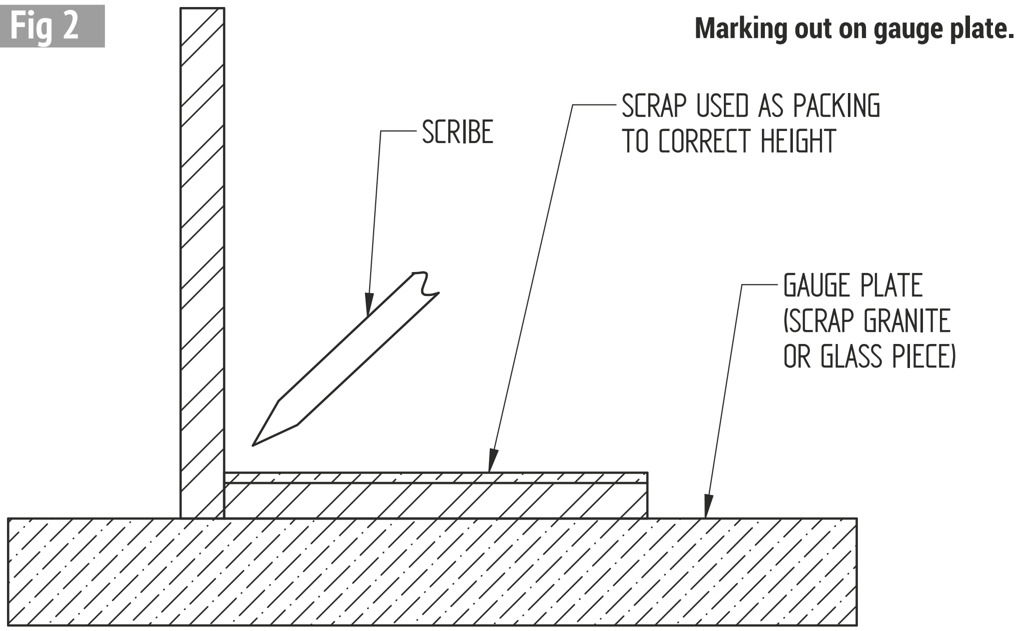
Then for a student there are always budget constraints both for tooling as well as materials. So here we have an interesting model, challenging workshop conditions and a limited budget… how can anyone resist?!

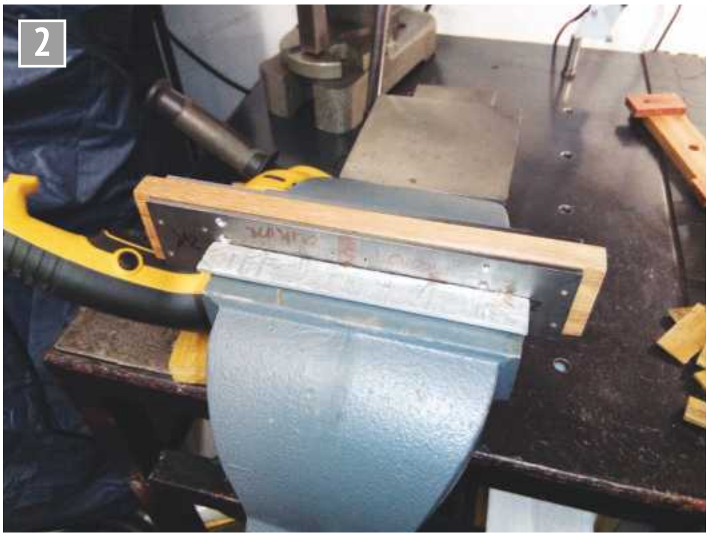
Before getting started with the technical bits here's some humble advice I gave the young man, one beginner to another. Perfection is in the eye of the beholder and I'm never happy with anything I do. I have to make a concerted effort to overcome my excessive compulsive nature. I do this by asking myself two questions: will it work and will I notice it on the assembled locomotive? If the answers are 'yes' and 'no' respectively, then I begrudgingly let it slide and move on. The alternative is spending years on a build and then being too scared to put it through its paces on the track. Besides, nobody notices that tiny little blemish in the paintwork or that one bolt that's a few microns out between the frames.

Having said that, beginners are bound to make the odd mistake; normally the corrective action does more damage that the original misdemeanour. Having fixed a few mistakes myself I'll try to give some guidance on what works best for me to fix that mistake that is too annoying to let slide.

Fig 2

**Marking out on gauge plate.**






*Drilling the wooden buffers.*


*Drilling the wooden buffers extensions.*

## The front and rear buffer beams

Because of the limited tooling, and not wanting to have a build that would take the better part of a decade to complete, the design made extensive use of laser cutting. I have found that this actually works out cheaper considering the amount of wear and tear on tooling (and the human!) and wastage in hacking out components from large sheets. All plate-work was thus laser cut with the necessary machining allowance added to the larger holes and the smaller holes engraved for easy positioning.

Generally, all holes smaller than the plate thickness will need to be drilled. This makes the front buffer beam, (the first component) a marking, punching and drilling exercise. The holes for the draw hook backing plate can be drilled using the backing plate as a drilling jig (this was laser cut) with the back ends countersunk. The countersunk is necessary to tighten the screws in service with the completed locomotive assembled.

Make a note on the buffer plate which is the top; this side is used as reference for all marking and drilling. For the buffer assembly holes, you only need to mark out one side of one plate. I drew the lines for the hole grouping on the buffer plate with a scribe by stacking pieces of scrap plate on a piece of repurposed granite I use as a gauge plate (**fig 2**). Punch the intersecting points of the scribed lines. **Punching tip**: the punch crater needs to be larger than the chisel part of the drill (the flat part between the flutes) then you know the drill won't drift.

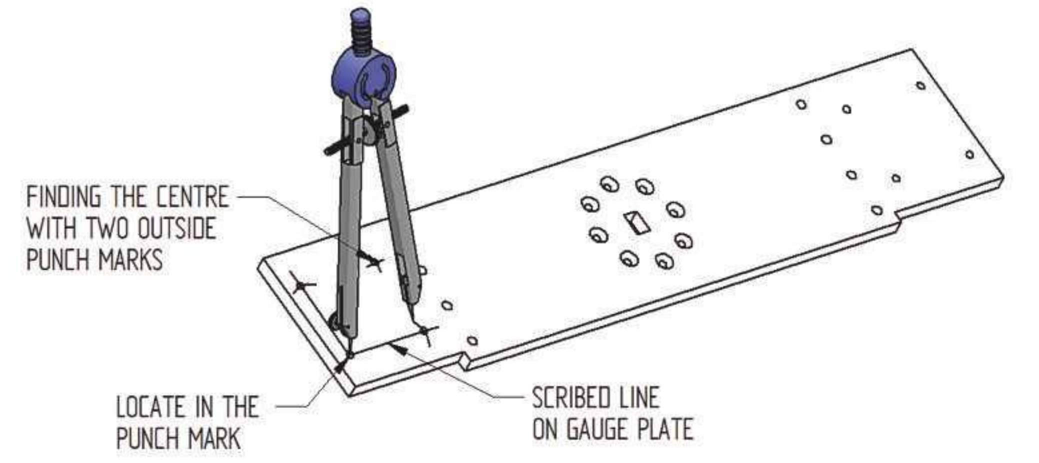
Using a pair of compasses, or an equal leg jenny, scribe an arc for the other holes using the outer punched holes to steady the one point of the compasses (**fig 3**). That's the pattern for the four holes of the buffer top and clamping plate. Drill these holes, then hold the front and back buffer plates together and match drill through the lot using the first holes as a drilling jig. Flip the two plates back to back and drill all the remaining holes through the holes you've just drilled making sure the top reference is on the same edge. The advantage of drilling like this is if you make a mistake you only do it once. All the other holes will match so it will look like it's intentional, so no worries mate!

Before assembly to the frames the holes through the wooden buffer beam and the wooden buffer extension need to be drilled through the wood using the buffer plate as a drilling jig. Each wood part should be drilled individually and not as an assembly, with the wood sandwiched between the two buffer plates. Drills tend to drift horribly in wood, so it's a good idea to drill from both sides with the holes meeting in the middle. The buffer extension piece should be aligned with the edge of the buffer plate, as shown in the picture. The wooden bits can then be cold glued (wood glue) together using broken drill bits as alignment dowels. Any holes that are a little off can be opened up through the whole assembly when the glue has dried. Cold wood glue (any brand) is one of those glues that actually lives up to the slogan 'stronger than wood' so make sure everything is aligned properly before clamping (**photos 2**, **3** and **4**).

## The stretchers and frames

The stretchers and frames can be marked out and drilled to drawing (this will appear next time). I try to draw the same way I would manufacture the components. For example, I would mark out and drill the holes as in the drawing and all matching components (like the corner angles) will be drilled using the frames as a drilling jig. Another note

**Fig 3** **Marking out using a pair of compasses.**




»

on my drawings: the boxed dimensions are critical and need to be kept as close to drawing as possible, these will start appearing in the section describing the valve gear etc.

All the angles are similar with only the bolt hole spacing changing depending on the respective position. In total there are ten similar angles so it's worthwhile to cut the lot at once. It is unlikely 12mm angles are available so a standard equal angle will have to be cut to size. If a scrap piece of 12mm square bar is used as a guide the job is quick and easy. It can either be cut using a hack saw if you want to beef up those biceps or a cutting disk in an angle grinder.

The angles are a good example of some assembly planning. All angles should be match drilled through the frames; in this way if a mistake is made you can just make a new angle instead of trying to sort out holes on a laser cut frame.

There are a number of countersunk holes on the assembly which can be incorrectly drilled in a second of distraction. I make a point of leaving notes with a permanent marker on all the plate work; for example, which holes should be countersunk and the size. You're less likely to make a mistake if it's right there where you're drilling.

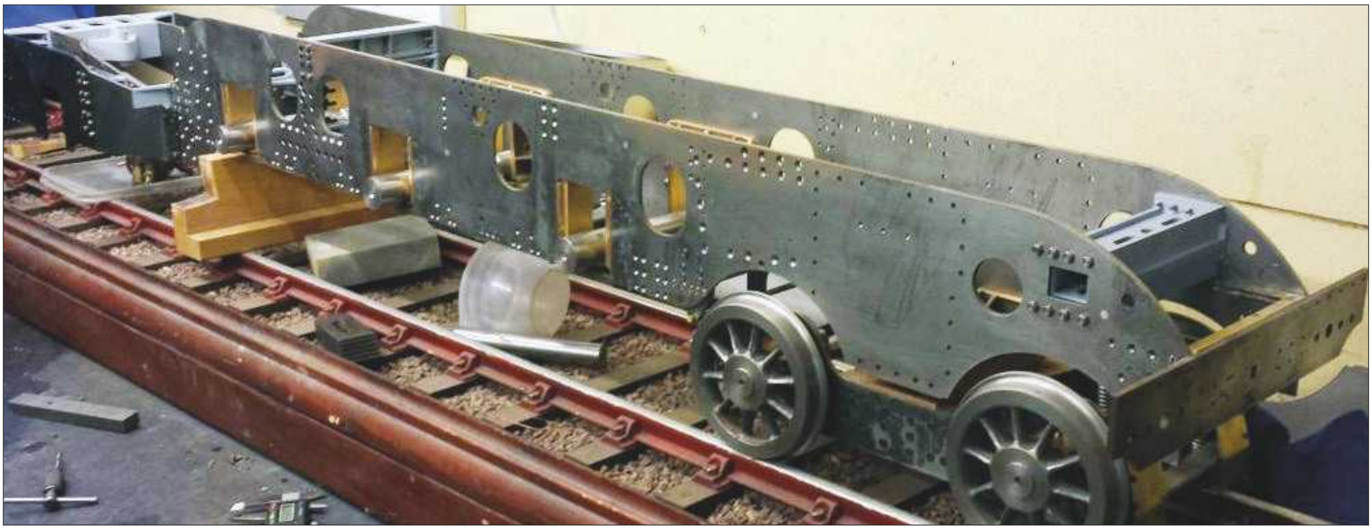
## Fixing cock-ups

If you've drilled a hole that's dodgy and you just can't live with it, no-worries, it can be corrected. If the hole is more than half the diameter out then I normally countersink both sides and rivet the hole closed. The ends are filed flush and no one's the wiser. If the hole's centre drift is less than half, the chances of drilling out the rivet when making the new hole is high. In this case I normally drill the hole to the next screw tap size. With some retaining compound screw a stub into the tapped hole and peen the edges over a little. If the plate is thick enough, putting a small countersink will do no harm. With the retaining compound set (i.e. the next day) the ends get filed flush and the hole can be re-drilled - easy peasy.

*Front buffer beams.*

●To be continued.

# NEXT ISSUE



### Flying Scotsman
Peter Seymour-Howell continues with work on the main frames of his 5 inch gauge super-detailed *Flying Scotsman* locomotive.

### Art of Painting
*Luker* expands on the black art of painting a model.

### Pugneys
John Arrowsmith drops in on the Pugneys Light Railway in Wakefield, Yorkshire.

### Dundee
Roger Backhouse spends an engineer's day out in Dundee, the city of discovery, and inspiration for arguably the worst poem ever written in the English language.

### Radial Borer
Philipp Bannick describes his home-made radial boring machine.

*Content may be subject to change.*

## ON SALE 30 JULY 2021

# Successful Silver Soldering

## Or – how to avoid disaster! PART 2

**Martin Gearing** looks at approaches to silver soldering which should result in an increase in quality and a reduction in wastage.

Continued from p.105
M.E. 4668, 2 July 2021

An alternative approach, and the motivation behind this little series of articles, is the **'Pallion'** method, which I was introduced to by a professional silversmith in 1979.

This requires that the **correct amount** of silver solder is placed on/between the surfaces to be joined **before** the work is heated. Melting the filler rod is achieved by directing the heat source **at the metal** either side of the joint and **avoiding the joint** itself. The filler rod will only melt when the surrounding metal of the joint reaches a temperature sufficient for that to occur,

After the filler rod has flowed, the joint is maintained at temperature for a few seconds to ensure **full penetration** and then allowed to **cool naturally** before submerging in pickle if further work is required.

This method ensures **complete control** over the amount of filler rod that is applied to the joint and by doing so acts as a **double check,** confirming that full penetration has occurred throughout the joint.

It also permits full attention to the application of the heat source and greatly reduces the time a joint area requires to be heated avoiding '**flux depletion**'.

Described simply, flux is necessary to exclude oxygen from contaminating the joint whilst it is being heated in an effort to enhance the flow of the filler material and allow the filler material to flow into the joint under its continued protection. Unfortunately, a flux loses its effectiveness the longer and hotter it gets. However, the correct standard fluxes available are compounds that allow a period of working if the operator is **organised** giving sufficient time to complete a reasonable amount of work before the flux ceases to be active /depleted. The Pallion method doesn't require the flux to be added after the heating process has been started if the process has been correctly prepared.

*Off to a good start, apparently.*

### Producing a silver soldered joint using the 'Pallion' method

* Again, as stated before, **cleanliness** – **no trace of any oils** – no residue from **lead soldering**.
  **Prior to heating**, pickling in 10% sulphuric or citric acid and filler material as well if old stock.
* Correct **joint preparation** to ensure that capillary attraction is able to take place. This generally requires 0.1mm (0.004 inch) separation of the surfaces to be joined using any of the methods previously mentioned in 'What is essential to silver solder with success' no 2, in part 1.
* Correct amount of filler material placed in position.
* Correct flux applied to filler material and joint and additionally any previously flowed joint areas in the vicinity.
* Selection of burner of a size that is of a suitable heat output for the mass to be heated.

### My initial failure (with knobs on!) leading to uncertainty

After looking carefully at this process as described and used by Kozo Hiraoka for all his superlative range of locomotives I was inspired, so decided to make the boiler for a 5 inch gauge 'Climax' following his instructions.

After cutting out and forming the various parts I began the process of silver soldering the sub-assemblies together and got to the second of routine mid-construction stage checks by the club boiler inspector, who had a great deal of practical experience gained in industry and personally the making of boilers for several small

*Oh dear – evidence of poor penetration on this ring.*

*This strap doesn't look too good either.*

*This throat plate joint isn't too happy.*

*It's all looking a bit ropey, frankly.*

locomotives and a small full-size steam launch.

During the examination of the sub-assemblies he complimented me on the standard of silver soldering presented. Given my respect for the standard of his work, I took it as a great compliment and an endorsement for my using the Pallion method (**photo 1**).

All was going well until the last sub-assembly was inspected when one of the eight rivets I'd used simply as location dowels, inserted but not peened over in the butt strap, was found to be loose. This was noted and I agreed to attend to it and have it checked before continuing.

But on the way home the fact of a rivet being loose after silver soldering continued to niggle - so much so that when I arrived home I found on 'vigorous' examination plus a little 'persuasion' several similar rivets could be removed. This rang loud alarm bells! The only solution, it seemed to me, was to dismantle the boiler sub-assemblies using carefully applied heat (**photos 2** to **5**).

What I found did not make me happy, mainly because I could not think why there had been so many areas devoid of sufficient filler material and signs of flux depletion within the joint, despite externally having good visible fillets.

*My initial attempt used too little silver solder.*

## After the autopsy – what went WRONG?

I looked back at the pictures taken of the preparations prior to applying heat and compared them with the pictures in Kozo's articles and found the overall views to be identical.

After several hours mulling it over a reason dawned on me.

The article images by Kozo, that I'd taken inspiration from, related to building a boiler for a 3½ inch gauge locomotive. But I had chosen a larger scale and was building the 5 inch gauge version. However, I'd slavishly cut the 'Pallions' to match **exactly the quantity and proportions** of those viewed in his article drawings, resulting in a shortage of filler materials and possible flux depletion by spending too long waiting for a visible fillet to appear. **Photograph 6** shows my prepared butt strap where the amount of filler material can be seen - this picture was taken as part of the build record.

## Figuring a workable solution out

I realised there were in fact only three distinct joint types used in the boiler construction:

During the examination of the sub-assemblies he complimented me on the standard of silver soldering presented. Given my respect for the standard of his work, I took it as a great compliment.

* A butt strap reinforcing a butt joint.
* A tube passing through a tubeplate.
* A flanged plate fitted against the inside or outside of a tube or against a sheet.

I needed to consider and calculate the quantity of filler material required for each of the three types of joints viewed in section and relate this to the cross sectional area of the filler materials available. Whatever the length, the relationship would be identical along the joint lengths for both.

This would involve nothing more taxing than basic schoolboy maths, working out the areas of rectangles, squares and circles.

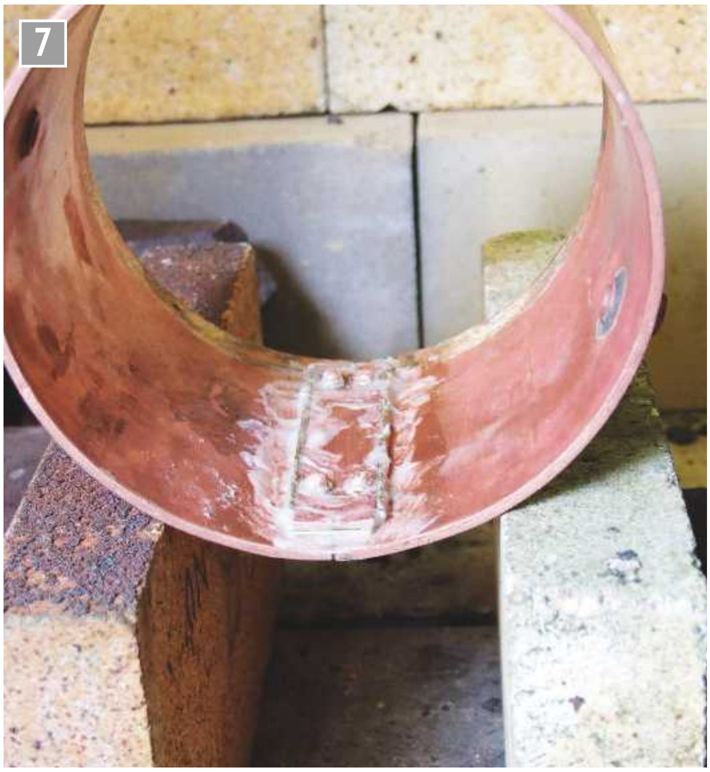
This process confirmed that my problems had been mainly caused by a shortfall in filler material. After this I sketched a section of a butt strap joint, in which I had fillets of 3mm at the butt straps edges and a gap of 0.1mm between the butt strap and wrapper with a gap of 0.1mm between the edges of the wrapper. I then calculated the amount of filler material required as shown in **fig 1**.

It can be seen the cross-sectional area of filler material required comes to 6.19mm$^2$ and this very conveniently would be satisfied by the placing of a 2mm filler rod against the perimeter of the butt strap. This can be seen in **photo 7**. This resulted in a somewhat different quantity of filler rod to be used compared to that used first time!

The design calculation for a tube having fillets of 1.5mm each side of the plate and a radial clearance of 0.1mm passing through a 3.2mm thick tubeplate give a cross-sectional area of 1.28mm$^2$, as shown in **fig 2**.

Here the volume of filler material required could be very conveniently satisfied by one 1.5mm filler rod preformed as a ring fitted around the outside of the protruding part of each firetube on one side of the tubeplate (**photo 8**).

When considering the third joint type of a flanged plate fitted against the inside or outside a tube or against a sheet I designed it with two 3mm fillets and a radial clearance of 0.1mm for the length of the flange, which in this example is 12mm, and gives the cross-sectional area




*This is more like it.*

**Fig 1**

**Calculation for a strap.**

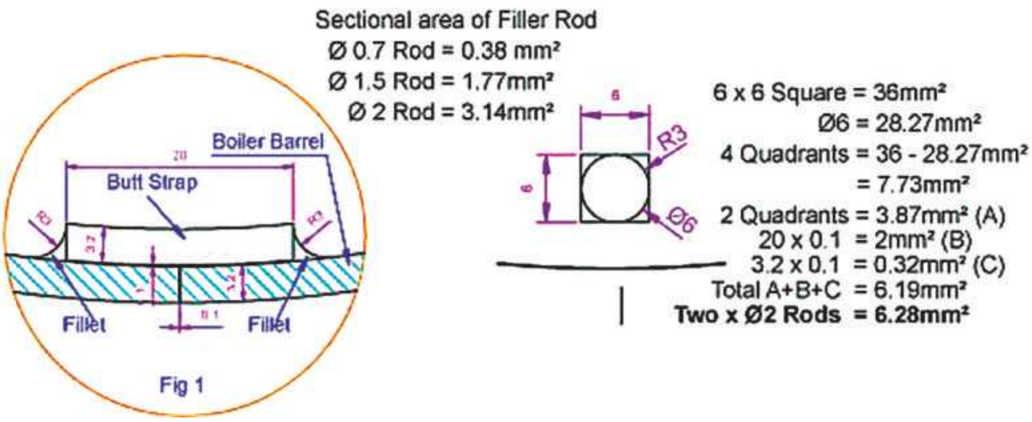
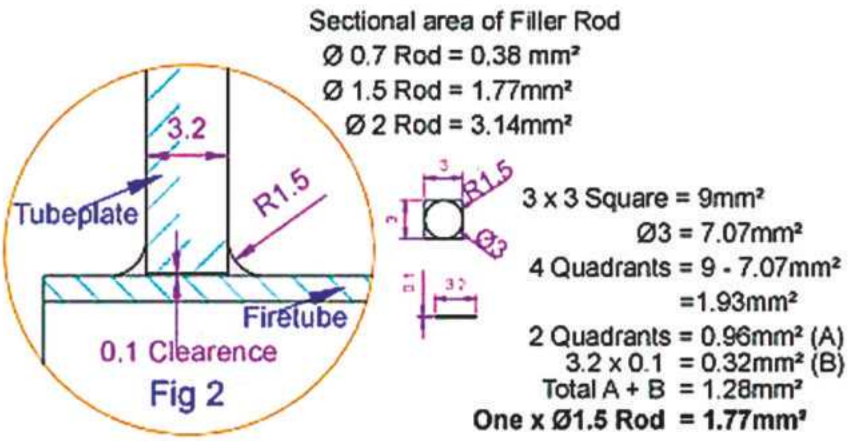
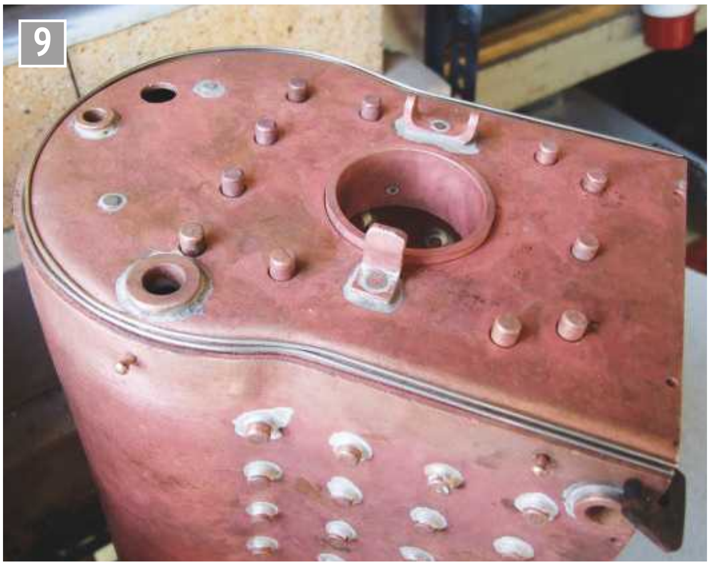



**Fig 2**




**Calculation for a tube end.**

*Preformed rings for the tube ends.*



*The backhead joint requires a surprisingly large amount of filler.*

of filler material required as 5.07mm$^2$ as shown in **fig 3**.

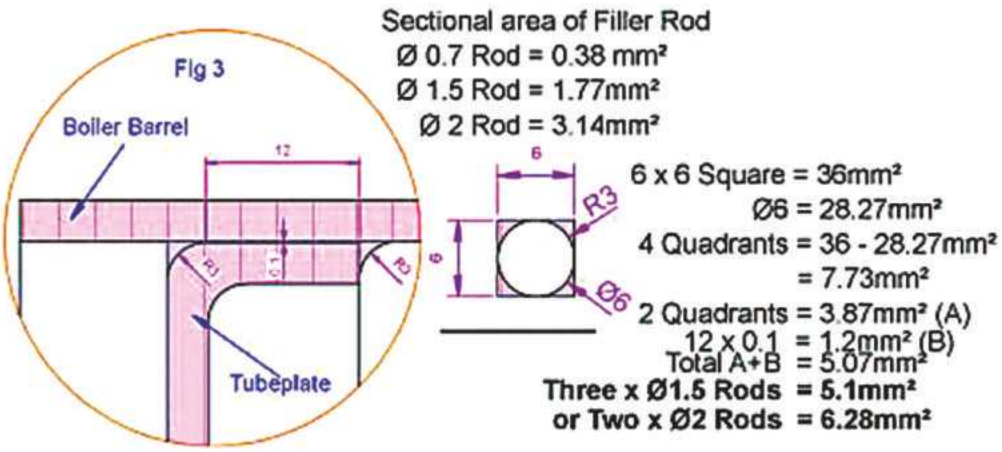
In this last example the cross-sectional area of filler material required of 5.07mm$^2$ could be satisfied either by three 1.5mm or two 2mm filler rods preformed to fit into the flanged plate outer radius. These could be made up preformed to fit and placed in the radius of the flange. The use of two 2mm filler rods was my preferred option (**photo 9**).

The amounts calculated for the three joint types would be applicable for every joint to be used in the construction of the boiler, the exception being the foundation ring that would involve a different length of the plain 0.1mm joint.

●To be continued.

**Fig 3**

**Calculation for a flanged joint.**



# Steam Turbines of the LMS Locomotive 6202

## PART 3 - CONSTRUCTION AND CONTROL

**Mike Tilby** investigates the design of the LMS turbine powered locomotive 6202.

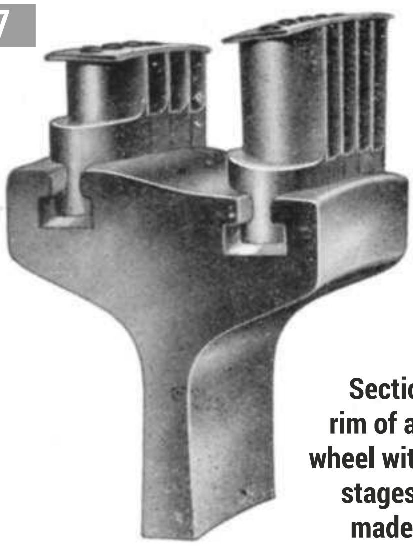
Continued from p.88
M.E. 4668, 2 July 2021


*LMS No.6202 (Turbomotive) on arrival at Euston with an express from Liverpool Lime Street in c1935 (photograph: J.N. Hall/Rail Archive Stephenson at Rail-Online.co.uk).*

### Rotor construction

The previous articles explained that the first stage of the rotor in the forward turbine of LMS 6202 was a Curtis wheel. A typical Curtis wheel as made by Metrovicks is shown in **fig 7**. Its blades were inserted into grooves machined around its circumference. This example has two rows of blades (i.e. two velocity stages).

Fig 7



**Section through the rim of a typical Curtis wheel with two velocity stages designed and made by Metrovick.**

Typical large Curtis and Rateau impulse turbines usually had a cellular structure in which each pressure stage had a rotor disc that was separated from the next by a so-called diaphragm (**fig 8**), with each disc being pressed onto the main shaft. Leakage of steam from one stage to the next via the central hole in each diaphragm was limited by the fact that the hole was relatively small in diameter and was lined with a labyrinth seal (see part 2). In contrast, the rotor of a typical early Parsons reaction turbine consisted of a hollow cylinder, generally called a drum, which was supported at each end by spoked wheels (spiders) mounted on the main shaft (**fig 9A**). Grooves to hold the blades were turned in the wall of the drum. These early turbines were relatively small in diameter and rotated at modest speeds so stresses in the drum were low. In later reaction turbines the rotors were more highly stressed and were either solid (**fig 9B**) or built up of discs pressed onto the shaft (**fig 9C**).

The rotor of the forward turbine in LMS 6202 had an unusual type of construction which had been used in turbines of all the previous turbine-powered locomotives designed by Fredrik Ljungström and Alf Lysholm. This construction had features of both drum and disc. It consisted of a central shaft with ten 'discs' but these were not mounted directly on » the shaft as in conventional turbine rotors. Instead, they each had a central bore with a diameter much greater than the diameter of the shaft (fig 3D and fig 4 in part 2). These discs had circular recesses turned in each face such they all fitted into each other to maintain concentricity. They were clamped together and fixed to the main shaft by threaded adapters that screwed onto each end of the shaft. My guess is that the discs were turned from forged billets because of the need for maximum strength in order to resist the centrifugal stresses resulting from the high rpm. These stresses would have been increased by the presence of the large central hole (**ref 23**).

The first disc from the left-hand end of the *Turbomotive* rotor did not carry any blades because it was the so-called dummy piston. (**fig 10** and fig 4 in part 2). As will be described below, the function of this was to provide an axial force to balance the force developed in the reaction blading. The periphery of the second disc carried two rows of blades and resembled the periphery of a typical Curtis wheel (compare figs 7 and 10). There is no pressure drop across the fixed blades of a Curtis velocity stage and so no seal was needed between those blades and the rotor (fig 10).

Each row of blades on this disc was surrounded by a shroud ring, visible in fig 10. All the remaining discs in *Turbomotive*'s rotor also each carried two rows of blades. This contrasts with discs of more typical reaction turbines which each carried just a single row of blades (fig 9C). Each of *Turbomotive*'s discs had a narrowed waist between the blade rings and a reduced diameter at the end. There was a labyrinth seal at each of these locations which reflects the fact that there was a pressure drop across the corresponding stationary blades. Presumably the narrow waists were provided so as to reduce the circumference and thereby minimise the extent of leakage through the seals.

As described in part 2, on the third disc, the first ring of blades was a simple impulse (Rateau) stage and the drawing shows a nozzle followed by a blade ring that was fitted with a shroud ring. the second ring of rotor blades on the third disc and blades on all subsequent discs were reaction blades and no evidence of shroud rings can be discerned in the available drawings.

## Blade attachment

Blades have to be attached very securely to the discs of turbines in order to resist high centrifugal forces. This was certainly true for the *Turbomotive* turbine which operated at relatively high speeds. Various attachment methods have been used by different manufacturers. In steam turbines these often involve a circumferential groove or a specially profiled edge to the rotor into or over which the blades fitted. The former has been used in MetroVick marine turbines, as can be seen in fig 7. An alternative is the side entry system where blades are held

Fig 8

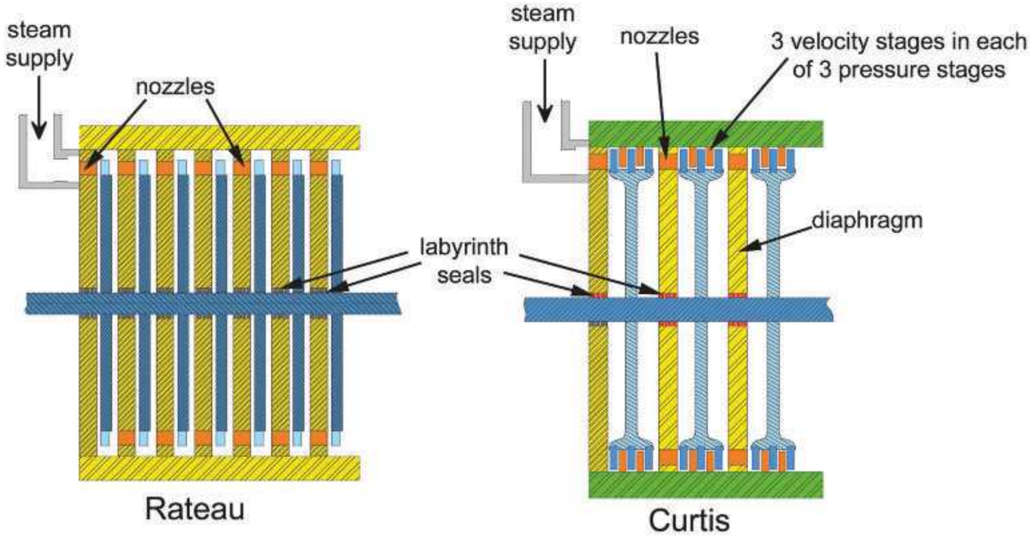
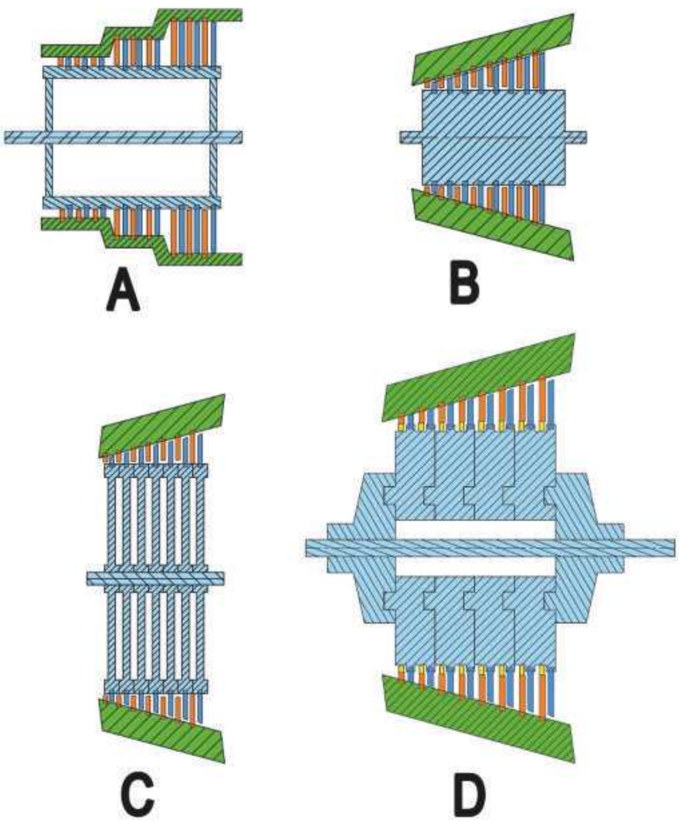



**Diagram showing constructions of typical Rateau and Curtis types of steam turbine. In these examples the Rateau turbine has seven pressure stages and the Curtis has three pressure stages, each with three velocity stages.**

Fig 9




**Diagrams showing the types of construction used for rotors of reaction-type steam turbines. A: Drum; B: Solid; C: Discs; D: Ljungström-type interlocking rings as used in LMS 6202.**

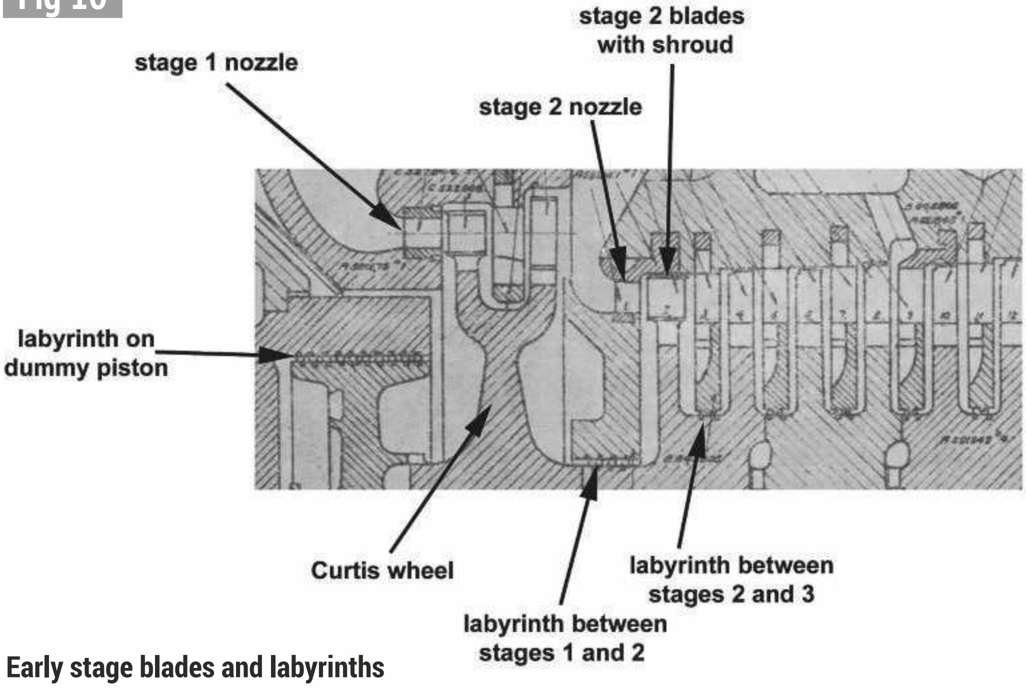
in accurately shaped slots aligned axially with the rotor. A simple version of this design was first used by De Laval in the 1880s and is still used, particularly when peripheral speeds are very high, as in gas turbines (**photo 6**). In the only available drawing of the *Turbomotive* turbine this detail is not clear but the blades may have been attached by side entry because a circumferential groove would probably have been apparent in section (fig 10) and because the rotor operated at a relatively high rpm.

## Construction of the turbine cylinder

Turbine cylinders (i.e. the casing) are usually made in two halves with a flanged joint at the centre line. Such a split construction is necessary because of the need to have rings of fixed blades alternating with the rings of blades attached to the rotor and because of the need to incorporate seals at appropriate points, as described below. The joints are usually horizontal, as was the case in the TGOJ locomotives but in *Turbomotive* the joint was inclined as can be seen in fig 3 in part 2. This would not have affected the internal working of the turbine and was presumably for convenience of connecting the external pipes and exhaust duct and/or for attaching the turbine to the locomotive.


*Side entry blading in a Bristol Proteus gas turbine.*

Fig 10




**Early stage blades and labyrinths in the forward turbine of LMS 6202 (from fig. 16 of ref 24).**

## The dummy piston and rotor end thrust

In reaction stages of a turbine, the drop in steam pressure across the rotor blades results in a significant force that tends to push the rotor towards the exhaust end. Clearly this force must be countered in some way, but a mechanical thrust bearing would waste energy through friction. Charles Parsons and colleagues developed an alternative approach that they called a dummy piston – often just referred to as a dummy. This consisted of a disc mounted on the rotor at the high-pressure end. It was exposed, on one side, to atmospheric pressure and on the other side to high pressure steam within the turbine. The difference in pressure across the dummy piston resulted in a force being exerted in the opposite direction to the force that acted axially on the rotor blades. The diameter of a dummy piston would be designed such that these forces were approximately balanced so as to leave only a small force that needed to be countered by conventional thrust bearings.

The forward turbine of LMS 6202 had a dummy (fig 10 and fig 4 in part 2) and its high-pressure side was exposed to the pressure of steam after the 1st stage nozzles. Thus, the pressure drop across this dummy was less than the inlet pressure but was still high. The dummy had a fairly large diameter which meant that the leakage area around its periphery was large. Therefore, to minimise steam wastage it was important to use a very effective seal. However, the large diameter also meant that the peripheral velocity could also be high. A good seal was achieved by using a labyrinth that consisted of a large number of fins. Ten fins were attached to the rotor alternating with another ten attached to the cylinder (fig 10). Forces acting on dummy piston and blades both vary with changes in steam pressures and so roughly balance each other under varying conditions. However, the balance is not exact and so conventional thrust bearings were also provided at each end of the rotor (see fig 4, part 2).

## Turbine back-pressure

After the last stage the steam had expanded down to a few psig. It then flowed through the exhaust passage to leave the turbine and enter the external exhaust duct (shown at C in fig 3 in part 2). It is normal practice to arrange for turbines to exhaust into a very low pressure in a condenser. In LMS 6202, the exhaust pressure of just a few psi above atmospheric pressure reduced the thermal efficiency of the turbine. However, this was necessary in order to avoid a condenser and to provide sufficient draught in the smoke-box where a double-blast pipe was used to give good performance at low back-pressure. Since the exhaust pressure was higher than is normal in turbine practice, the turbine has been described as a back-pressure turbine. Back-pressure turbines are used in industry if the exhaust steam can be profitably used for a manufacturing process or for heating.

The pressure in the exhaust of LMS 6202 was determined by the rate of steam flow into the turbine (i.e. the number of open valves). With two valves open it was 1 psi and with four open it was 3 psi. At the design stage it was a concern that if the blast-pipe nozzle had been made sufficiently large as to give a suitably low back-pressure at full power, then while the turbine was operating at reduced power there might have been insufficient draught to maintain the fire. In order to maintain a suitable blast strength under varied conditions an arrangement was installed so that the area of the blast pipe could be adjusted as the number of opened steam valves was altered. However, once experience had been gained with the locomotive it was found that there was no need to adjust the blast pipe and it could be left permanently with the smallest area (**ref 24**). Presumably the increased smoke-box vacuum at higher rates of steam flow was beneficial in increasing the rate of steam production.

## Turbine design and control of power

For a steam turbine to operate with the highest efficiency, it is necessary that the initial steam conditions, the amount by which pressure drops in each stage and the rotor speed all match the values for which the turbine design was optimised – usually the speed and power at which it is envisaged that most of its operating time will be spent. In power stations this is relatively straightforward to achieve because turbo-generators have to operate at a fixed speed in order to maintain the correct frequency of the alternating current being generated and only the power needs to be adjusted to match the load.

However, when used with fixed gearing for ship or locomotive propulsion, a turbine will need to operate at a range of speeds and powers. In designing LMS 6202 it was decided that the turbine and associated gearing should be designed to achieve maximum efficiency when the locomotive was travelling at 65 mph (ref 24). When the locomotive was travelling below or above this speed the turbine blade velocities would be sub-optimal. However, things are more complicated because, even when travelling at the optimal speed, the power required could vary greatly since it would depend on the weight of the train being hauled, the gradient and whether or not the train was accelerating.

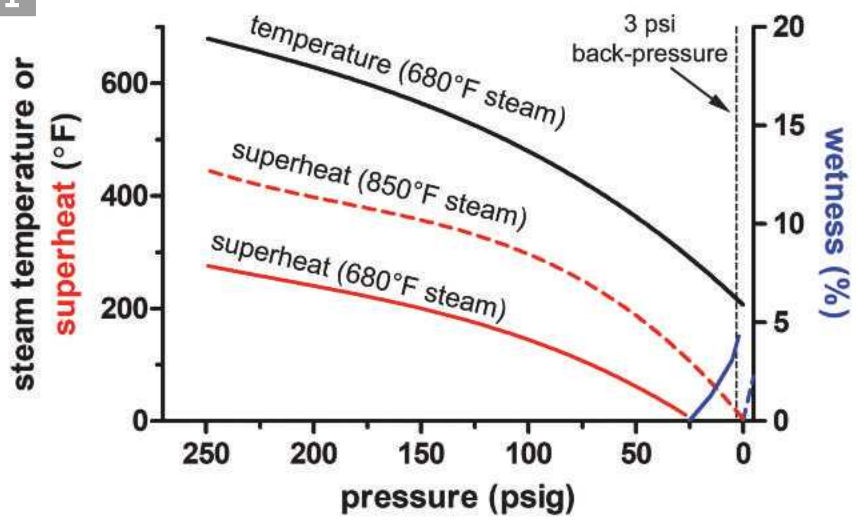
If power were controlled by a simple regulator valve then, at less than maximum power, steam would be wire-drawn in the valve and the pressure at the first stage nozzles would be low. Wire-drawing would waste energy, as it does in a reciprocating engine. However, an additional loss of efficiency would result from the low steam pressure at the nozzles since the velocity of steam leaving the 1st stage nozzles and entering the rotor blades would then be lower than the design optimum.

As described previously, control of steam entering the forward turbine was by a series of six valves which each admitted steam to a small group of nozzles. This avoided the wire-drawing and low pressure at entry to the first stage nozzles since each valve was either fully open or fully closed. However, during operation of LMS 6202 it was found that the availability of only six different power settings meant it was not always possible to match power output to what was required for maintaining the desired train speed (ref 24).

Admitting steam through nozzles covering only part of the rotor circumference is called partial-arc admission and is a major advantage of using an impulse design for the first stage of a turbine (with or without velocity compounding). Partial-arc admission is not feasible with reaction stages because a pressure drop is maintained across the rotor blades. Restricting the inlet steam to just part of the blading is not practical and, even if it were possible, each section of the rotor would experience fluctuating axial forces as it passed by the inlet region and this would cause vibration and fatigue in the rotor.

Although partial arc admission provides optimal pressures at the first stage nozzles, no variation was possible to nozzles of later stages in the turbine. Therefore, the pressure of steam in these stages would have varied depending on the number of first stage nozzles being fed with steam. Thus, there was unavoidable variation in the manner that steam entered and exited most of the blade rings. This problem was alleviated by an invention of Alf Lysholm which was the subject of a patent (**ref 25**). This patent described how to design turbines for maximum efficiency across a range of speeds and the invention was used for the turbines in LMS 6202. This topic will be discussed in more detail in the next article.

Fig 11




**Theoretical changes in steam temperature (black line), degree of superheat (solid red line) and wetness (solid blue line) during expansion for steam initially at 250 psig and 680 degrees F under ideal conditions without friction (i.e. adiabatic expansion). Dashed lines show change in superheat and wetness for steam initially at 250 psig and 850 degrees F. (Data from a Mollier chart).**

## Properties of steam and turbine design

In reciprocating engines supplied with superheated steam it is necessary to introduce oil into the steam to lubricate pistons and valves. However, if steam temperatures are too high the oil becomes degraded and causes problems. This was particularly the case in the 1930s when lubricant technology was less advanced than it is today.

In turbines, steam does not contact the surfaces that require lubrication (i.e. the rotor bearings) and so this limitation does not apply. Therefore, it was possible for the steam temperature in LMS 6202 to be significantly higher than in comparable reciprocating locomotives. This had two consequences for the performance of the locomotive. Firstly, thermodynamic principles indicate that the efficiency of a heat engine improves when the temperature range of the working fluid is increased. Secondly, in expanding down to the exhaust pressure, condensation in the steam can be avoided. This is an important consideration for steam turbines because superheated steam is dry and so contains no water droplets. In turbines, where the steam becomes wet in the low pressure stages, impact of high-velocity droplets with the rotor blades can cause severe erosion of the blades.

The working pressure for *Turbomotive* was 250 psig. Initially the steam temperature was planned to be 850 degrees F but in practice the highest attained was only about 685 degrees F (ref 24). At 250 psig water boils at 406 degrees F and therefore, at 685 degrees F, the steam was superheated by 279 degrees F. As steam expands its temperature, as well as its pressure, decreases. **Figure 11** shows the decrease in temperature and degree of superheat for steam initially at 250 psig and 685 degrees F as it expands under ideal conditions where there is no friction in the steam and no loss of thermal energy (i.e. the expansion is adiabatic).

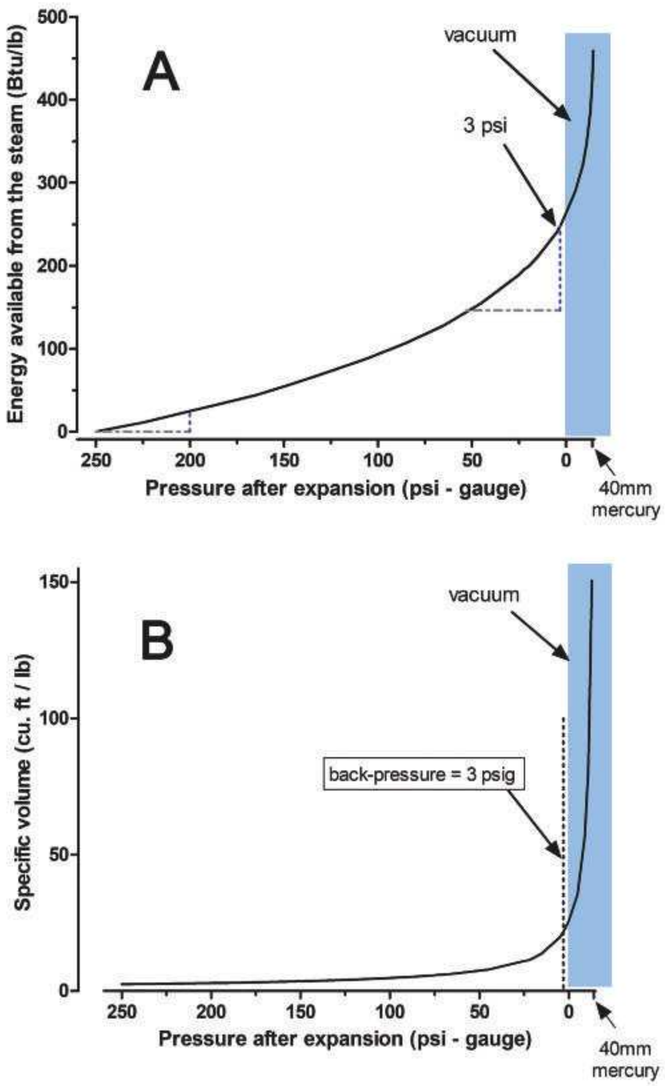
In reality there would be friction and that would act to increase the steam temperature, although that would be off-set by heat loss from the turbine. One important aspect of this for the turbines in 6202 is that the steam remained superheated almost down to the exhaust pressure. Figure 11 shows that, under the ideal conditions there would have been a small amount of condensation in the steam in the last stages. However, in reality this may not have been the case because of the re-heating effect of friction. Also shown is the absence of condensation that would have been achieved if the planned steam temperature of 850 degrees F had been attained.

**Figure 12A** shows the quantity of energy theoretically available from steam after expansion down to the indicated pressures under the same ideal circumstances as in fig 11 (i.e. adiabatic expansion). The dotted lines illustrate that, for the same drop in pressure, the energy available per pound of steam is less at higher pressures than at lower pressures. Condensers were used on several earlier steam-turbine powered locomotives because turbines are able to take advantage of the increased energy made available by the lower exhaust pressure. **Figure 12B** shows the large increase in volume per pound of steam as it expands from 250 psig/685 degrees F. Turbines, unlike reciprocating engines, can easily handle the large volumes occupied by each pound of steam at very low pressures. The other main reason for adopting condensers was to enable the re-cycling of the boiler-feed water. The absence of oil in the spent steam means that the condensed water could be re-used without any risk of damaging the boiler.

In designing the non-condensing locomotive for the TGOJ, Alf Lysholm and colleagues claimed that their design incorporated features that made it as efficient as a turbine-powered locomotive with a condenser. These features will be described in the next article.

●To be continued.

**Fig 12**




**Energy available (A) and volume occupied (B) per pound of steam initially at 250 psig / 685 degrees F as it expands under ideal conditions (adiabatically) to lower pressures. In A, the dotted lines illustrate the much greater amount of energy available when steam expands by 50 psi from 53 to 3 psi compared to expansion from 250 to 200 psi. In LMS 6202 expansion was down to 3 psig. With a condenser (as in the Argentine locomotive), expansion could be down to an absolute pressure of about 40 mm mercury (0.8 psi), as indicated by the shaded area.**

## REFERENCES

**23.** Tilby, M.J. (2018 – 2020), *Steam turbines large and miniature*, Part 6: **221** (4598) 656 – 659.

**24.** Bond, R.C. (1946), *Ten years experience with the LMS 4-6-2 non-condensing turbine locomotive No. 6202*, J. Inst. Locomotive Engineers 182 – 265.

**25.** Lysholm, A. (1930) US patent 1,777,098 (based on original Swedish patent of 1927), *Blade system of gas or steam turbines.*

# An Astronomical Bracket Clock PART 7

**Adrian Garner** makes a bracket clock showing both mean and sidereal time.

Continued from p.73
M.E. 4668, 2 July 2021

Those wishing to follow this approach of cutting all the wheels at the same setting will need to wait until the full drawings of the Moon, Solar and Sidereal work as well as the drawings of the remontoire, have been published.

## Wheels

I cut all my wheels at one set-up with a considerable saving in set up time. If you are going to do this, write, using a fine marker pen, on each wheel blank the number of teeth, the module and bore required. It minimises but does not eliminate error. (Those wishing to follow Adrian's approach of cutting all their wheels at the same setting will need to wait until the full drawings of the Moon, Solar and Sidereal work as well as the drawings of the remontoire, have been published.)

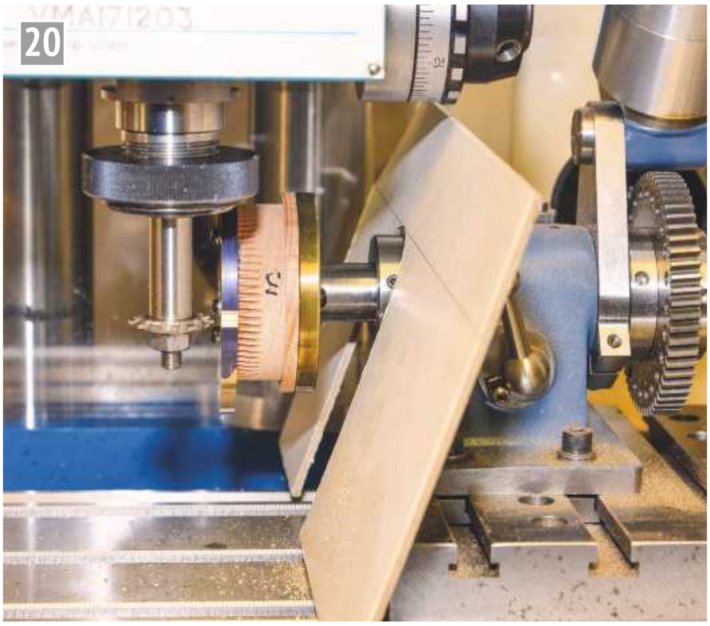
Except for the great wheel and associated ratchets, the central holes in the brass blanks were all drilled and reamed on the milling machine. Do not hold the blanks with your hand whilst drilling! Even small drills dressed for cutting brass by backing off the cutting edges can grab and make nasty cuts. In any event the hole will be unlikely to be round if the work is held by hand. Clamp the work to the table so that the drill and reamer open up into a slot on the table or place a piece of MDF between the work and the table.

The blanks need to be mounted on true running mandrels which are held in collets for turning to size (**photo 18**). Smaller blanks may be mounted either side of the larger wheels to form a sandwich for added rigidity.

The teeth were all cut in the mill after transferring the mandrels and wheels to the dividing head. The cutter had been brought to centre height using a microscope (**photo 19**). The edge of each wheel was marked with a black marker pen so that it was easy to see when full depth had been reached by cutting two adjacent trial teeth. I run my Thornton wheel cutters at 1100rpm which equates to around 250 feet/min cutting speed. Higher speeds may

*Wheel blank mounted on a true running mandrel.*

*Using a microscope to set the cutter centre height.*



*Cutting teeth on the vertical mill.*

*Cutting the 24 tooth wheel.*

be an advantage but very high rates of rotation are only needed with single point fly cutters.

After cutting there will inevitably be small curls of brass behind the tooth gaps. Laying the wheel on the bench and gently rubbing from the centre outwards with a thin piece of scrap brass will remove these without causing scratches. An old toothbrush is also useful for this exercise.

The great wheel and the 120t ratchet (fig 9, part 6) needed more support and these were each screwed to a wooden disc on a homemade face plate mounted on a ¾ inch ground steel mandrel. The wooden disc needs to be faced to ensure it is flat. Further check with a dial indicator that the face of the brass blank is really pulled up tight and not wobbling due to expansion of the wood behind each screw. If necessary, remove, countersink the screw holes and remount. After turning to size, each was centre drilled, drilled 7/32 inch, bored to about 0.365 inch and reamed ⅜ inch. They were then transferred to the vertical mill for cutting the teeth (**photo 20**).

The 32t fusée ratchet (fig 8, part 6) was made from ⅞ inch bar. After facing, drilling and reaming ⅜ inch, a slice was parted off and reversed in the chuck to face the rear using a chuck backstop to ensure it ran true. The teeth were cut whilst it was held on a mandrel. A small piece of ⅛ inch plate drilled and reamed would have been just as good!

*Parting off a pair of wheels.*

It will be seen that four of the wheels in the sidereal train have relatively low numbers of teeth (32t, 30t and 24t). Clock makers draw a line between pinions, typically gears with up to 16t, and wheels where the number is often more than 40t. For pinions it is recognised that the shape varies with the number of teeth or in clock terminology, leaves. It seems to be assumed that all wheel teeth should be the same shape whatever the number of teeth. In theory, however, the tooth shape of gears changes with the number of teeth, the variation being large for gears with few teeth (pinions) and increasingly minimal as the number of teeth increases (wheels). Hence the totally reasonable adoption of just one cutter shape for wheels with large numbers of teeth. The 24t wheels are somewhere in the middle ground. They are a long way from the shape needed for 16t pinions but when cutting these wheels with a wheel cutter it will be found that a distinct witness is left if cut to normal depth. Not to worry, increase the depth of cut until the witness vanishes. On the 24t wheels the additional cut will probably be about 0.004 inch. The same principle goes for the 32t and 30t wheels but the additional cut needed is less.

One further comment on the 24t wheel. At one stage the design required two of these wheels made from ⅞ inch bar. A 2⅜ inch long section was cut off and held in a three jaw chuck so that it could be turned to 0.500 inch for a length of about 1⅜ inches. It was then reversed and held by a ½ inch collet. The unturned section was reduced to the required diameter (0.790 inch) for the wheel teeth and the outer 0.406 inch turned to 0.250 inch diameter. It was then transferred to the mill, again held in a ½ inch collet, and the twenty-four teeth cut along the 0.790 inch section (**photo 21**). After returning to the lathe, the ⅛ inch through hole was drilled and reamed and the embryo wheels were parted as a pair from the excess 0.500 inch section. The pair was then reversed and held in a ¼ inch collet so that the shoulder could be turned at the other end. The two wheels, which had been machined back to back, were then parted off and their faces turned to length, again held in a ¼ inch collet (**photo 22**).

On reflection this was inefficient in the use of expensive brass. After the change to the current design, requiring only one such wheel, I made this by Loctiting a short section of brass onto a ¼ inch

>>

Fig 11

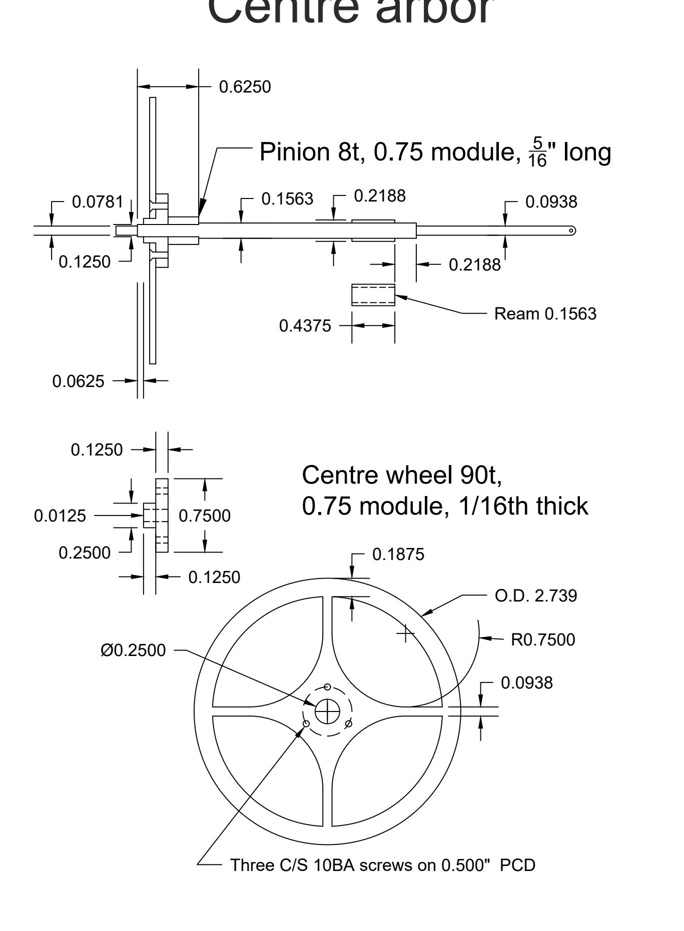
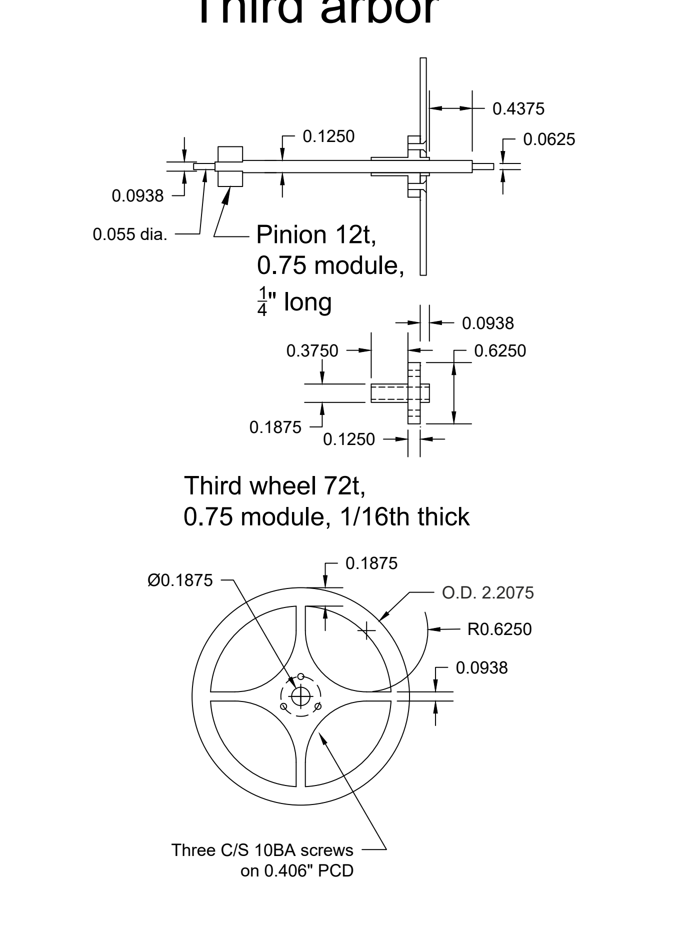



Fig 12





*A more economical way of making the 24 tooth wheel.*

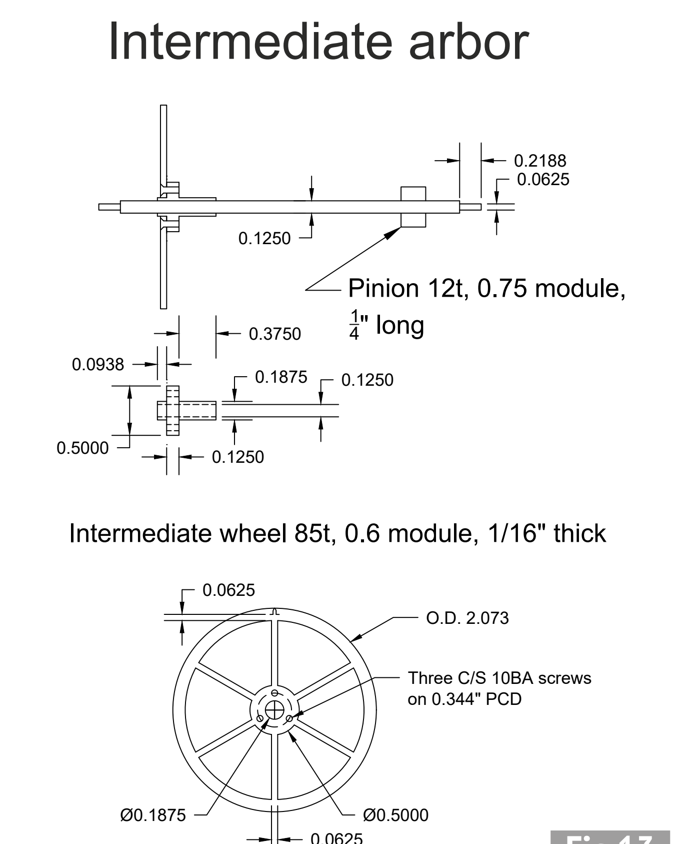
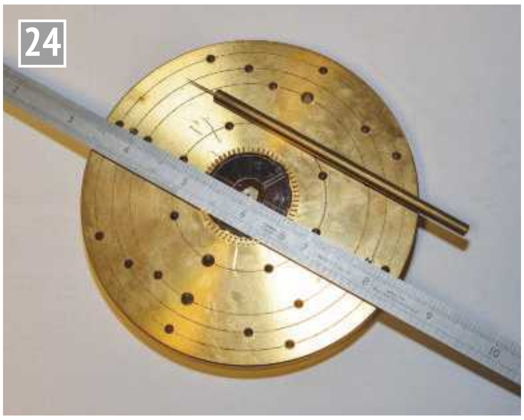



Fig 13

long shoulder turned on a ½ inch diameter length of ground mild steel. This enabled all the machining to be done with minimal wastage (**photo 23**)!

## Crossing out of wheels

The design of the crossings and which wheels are crossed out is very much personal choice. From an engineering perspective, the 'moment of inertia' of a wheel, which is a function of the mass of the wheel and the distance of that mass from the axis of rotation (centre of the arbor), is a measure of the wheel's resistance to change in the rate of rotation. This needs to be minimised in the escape wheel and those high up in the wheel train. From a practical point of view the inertia



*Marking out for piercing.*

*Using a rotary table to mill the inside of the outside circumference.*

effect is irrelevant in all the astronomical features in this clock as well as the motion work and indeed probably even the centre wheel. These wheels do accelerate and decelerate but the rates are too small to affect the clock. For this reason, the motion work on most clocks is rarely crossed out as its effect is minimal.

The above is not to say that other wheels should not be crossed out. Wheels can be crossed out for artistic design reasons. On my clock I have crossed out all wheels in the time train, the intermediate wheels leading to the sidereal drive, the two wheels in the moon train and both the ratchet and kidney wheel in the solar display train.

Whilst ornate designs of crossing have often been applied to skeleton clock wheels, in long case and bracket clocks the crossings are usually either four spokes with a joining curve sweeping back to the collet or straight/tapered spokes. The four spoke curved design is by far the most common as it is relatively easy to shape and thus commercially cheaper to produce. It was standard on most of the clocks emerging from Tompion's workshops. Straight/tapered spokes, however, produce lighter wheels and thus emerged as the standard for regulators. They take more work to produce and are thus more expensive to manufacture. In the UK six spokes was preferred. In Europe there was a tendency to have five spokes.

*Drilling the three 10BA mounting holes.*

Currently the view seems to be that all crossing should be the same shape. This was not always the case. Tompion and others took a more commercial view. In Clock No. 483 Tompion adopted curved crossings for the smaller wheels, including the deadbeat escape wheel, but six spoke tapered crossings on the large wheels, possibly to give them greater support at the circumference.

I have followed Tompion's practice and opted for four spoke curved crossings for all wheels except those visible behind the back plate. These need to be as light as possible and I have opted for six straight spokes.

The marking out and initial piercing is best done as soon as the wheels are made. I use a jig described in J.M. Wild's book (**ref 11** – **photo 24**). After removing the waste material with a piercing saw I mount the wheels on a small (4 inch diameter) rotary table and mill the inside of the outer circumference to size with an ⅛ inch end mill (**photo 25**). I also drill the holes for fitting the screws to the collets. I used to index these by rotating the rotary table but I now find it quicker to use the DRO to position the three holes as an array.

The above requires the rotary table (mine is to a design by George H. Thomas) to be centered under the mill's spindle. To do this I place a length of ¼ inch silver steel in the central hole of the rotary table with the table securing bolts loose. I then grip the silver steel in the mill chuck which moves the table and provides alignment. Re-secure the bolts.

This approach works perfectly with **light** small rotary tables used for clock work. It will NOT work on a heavy 8 inch diameter rotary table!

I usually leave the filing and polishing the inside edges of the crossings until later to ensure they do not get marked.

## THE REMONTOIRE

For good time keeping it is important that the escapement and pendulum are not affected by the complications of the displays on this clock and that the amount of power reaching the escapement for transfer to the pendulum is constant. The fusée helps with the latter whilst the remontoire provides the 'icing on the cake' by converting this spring driven clock into a weight driven clock where the weight is rewound after every three swings of the pendulum by the main spring.

As observed by those who saw the unfinished but working clock at the Midlands Model Engineering Exhibition in 2019, its motion is hypnotic. Capturing its action in words is difficult so I have made a very short video now available on YouTube at: youtu.be/gZ4wVxpkb1c

Alternatively search for 'Astronomical Clock Remontoire'.

Drawings of the parts and how to set them up will follow in later articles.

## Wheel collets

After turning the collets need to be drilled and tapped for three equally spaced 10BA screws. The easiest way I have found to do this is to mount them in a chuck under the vertical mill. I use an old Unimat rotary table with its small chuck (**photo 26**). Centring is performed as above. Again, either the table can be indexed or the DRO used to position the holes.

It will be seen from the photographs that I can mount sub-tables on my mill to allow Myford, Unimat and other suppliers' products to be used. These sub-tables were commercially available (and are still available second hand) and have been fitted with Allen cap screws to fit 'T' nuts matching the slots in my vertical mill.

●To be continued.

## REFERENCES

11. *Wheel and Pinion Cutting in Horology*, J. Malcolm Wild F.B.H.I., 2001

# FREE PRIVATE ADVERTS

MODEL ENGINEER MODEL ENGINEERS' WORKSHOP

**Did You Know?** You can now place your classified ads by email. Just send the text of your ad, maximum 35 words, to neil.wyatt@mytimemedia.com, together with your full name and address, a landline telephone number, whether it's a for sale or wanted and stating that you accept the terms and conditions for placing classified ads – see below. Please note, we do not publish full addresses to protect your security.

**Coronavirus advice is changing!**
Please follow local government advice in Wales, Ireland, Scotland or England as appropriate, especially if you are considering buying or selling items for collection. Please respect the needs of delivery drivers to protect their own safety and, if receiving a parcel take sensible precautions when handling anything packaged by someone else.

## Machines and Tools Offered

■ Myford 7 or Super 7 bed, SK57768. £25. **T. 01926 624456. Warwick**.

■ Boxford Power Feed Saddle, Tail Stock, Lead Screw. Vertex 4 inch Milling Vice, 6" Rotary Table, 8"x5" Milling Table. Reasonable Offers.
**T. 01462 434698. Hertfordshire**.

■ Refillable oxygen bottle type ALbee (size of aqualung bottle) and propane bottle, welding torch regulators some brazing rods and wire. £100 ono.
**T. 01273587046. Peacehaven**.

■ Neilson Compressor CT1619 with 50 litre tank. Clarke filter, lubricator, air drill, air chisel, die grinder, hoses £80 lot. Buyer collects.
**T. 01543 876745. Staffordshire**.

## Parts and Materials

■ Plastow 3" Burrell traction engine 50 plus castings, list price £609. will accept £350, to go in one lot. Fully machined set of gears spur and bevels, gear cut and splined list price £1178. will accept £500. Set front and rear ali wheel rims. list price £88. will accept £40. Part finished tender in brass £100. Part finished crank, splined £75. Set ali tender and boiler formers £50. Pair used hornplates £50. Photos available buyer to collect.
**T. 01902 343724. Wolverhampton**.

## Magazines, Books and Plans

■ Model Engineers' Workshop nos 1 to 140 with data sheets in mint condition, £140. Sorry cannot split. Buyer collects. Cash on collection.
**T. 01722 329919. Salisbury**.

## Wanted

■ Cowells ME lathe with accessories. Must be in perfect condition. I am too old to buy new, distance no object. **T. 01986 853776. Ipswich/Norwich**.

■ Manual for BOXFORD Model A, or info on where I can find one. Thanks. **T. 01723 892952. Filey, N. Yorkshire**.

## YOUR FREE ADVERTISEMENT (Max 36 words plus phone & town - please write clearly)

❑ WANTED ❑ FOR SALE

| | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Phone: | Date: | Town:

NO MOBILE PHONES, LAND LINES ONLY

Please use nearest well known town

Adverts will be published in Model Engineer and Model Engineers' Workshop.

The information below will not appear in the advert.

Name ..........................................................................................

Address ......................................................................................

......................................................................................................

......................................................................................................

...................................................... Postcode.........................................

Mobile ............................................... D.O.B.............................................

Email address...............................................................................

Do you subscribe to Model Engineer ❑ Model Engineers' Workshop ❑

**Please post to:**
ME/MEW FREE ADS, c/o Neil Wyatt, MyTimeMedia Ltd, Enterprise House, Enterprise Way, Edenbridge, Kent TN8 6HF
**Or email to:** neil.wyatt@mytimemedia.com

**Photocopies of this form are acceptable.**

Adverts will be placed as soon as space is available.

**Terms and Conditions:**
PLEASE NOTE: this page is for private advertisers only. Do not submit this form if you are a trade advertiser. If you wish to place a trade advert please contact David Holden on 07718 64 86 89 or email david.holden@mytimemedia.com

By supplying your email/ address/ telephone/ mobile number you agree to receive communications via email/ telephone/ post from MyTimeMedia Ltd. and other relevant 3rd parties. Please tick here if you DO NOT wish to receive communications from
MyTimeMedia Ltd: Email ❑ Phone ❑ Post ❑
or other relevant 3rd parties: Email ❑ Phone ❑ Post ❑

# Britannia Class 7 Locomotive in 5 Inch Gauge

PART 10 - LUBRICATORS, WATER GAUGES AND REGULATOR

## A Modelworks Rebuild

**Norm Norton** takes a renewed look at this popular, kit-built BR Standard Pacific.

Continued from p.769
M.E. 4666, 4 June 2021


Oliver Cromwell *on the GCR, Loughborough in 2014.*

### The project progresses

These articles have been describing stages in the rebuild of a Modelworks engine. I have previously illustrated work to replace parts that simply had to be changed because they would have had no chance of functioning correctly; these included the piston rings, valves, springs, ashpan, grate, and smokebox petticoat. The project has also included improvements solely for appearance and so far this has resulted in new boiler cleading, a cab and platforms. The most recent two articles looked at all the valves and pipework which had to be mechanically right if the locomotive is going to operate properly, but there was an equally large element of wanting to get the appearance correct.

These next three items have to be designed well for the reliable and safe working of the engine, but how the components look is a matter of personal preference.

### Lubricators

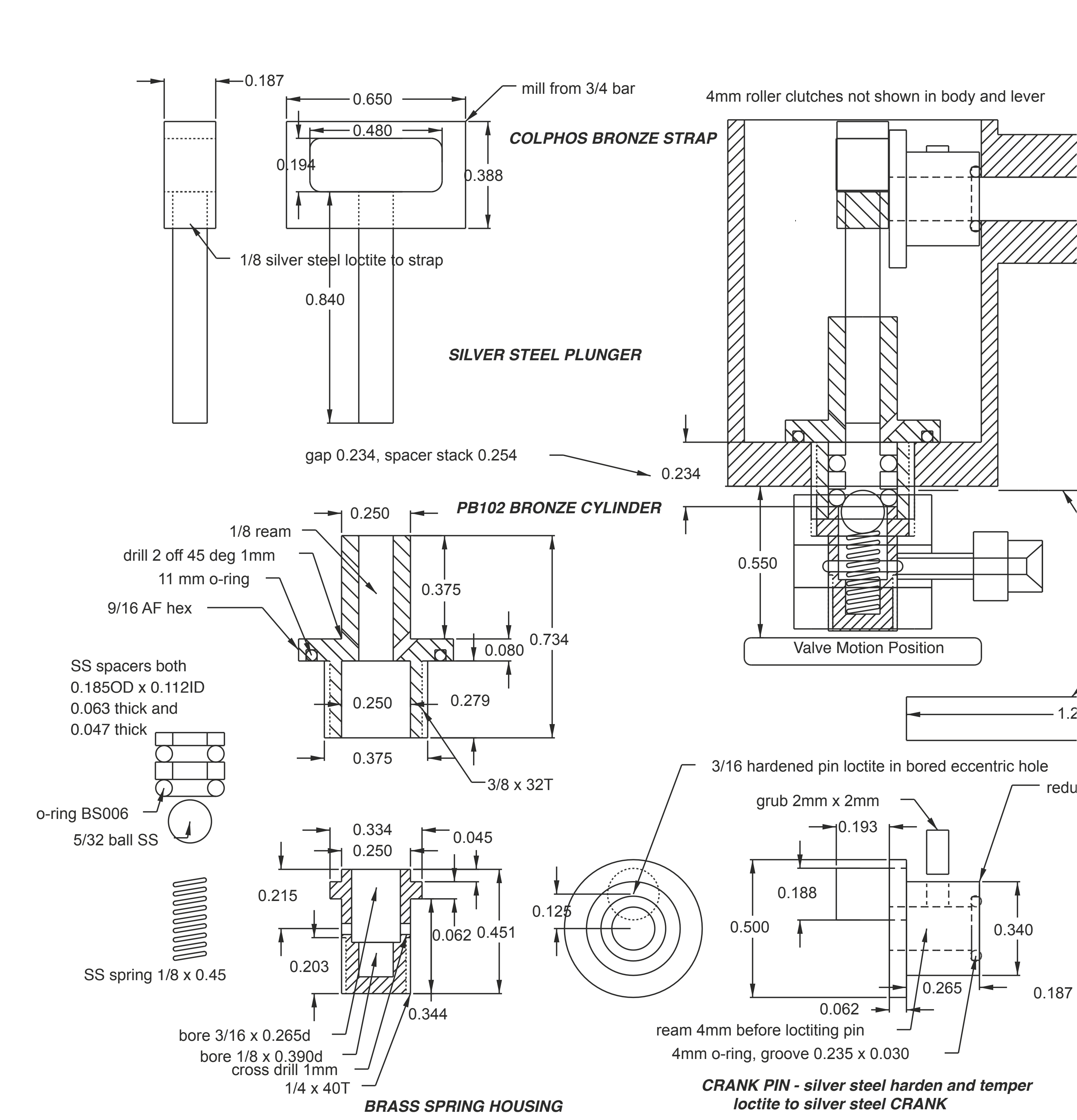
The lubricators deliver steam oil to the valves and cylinders. Pump too much and you will get an oily face and a very oily chimney; too little and you will damage the valves and pistons. The two Modelworks lubricators used what I think is a commercially available, one inch square brass body with the pump mechanism inside based upon the Ewins design principles. This has an ⅛ inch diameter piston rod rising and falling in a cylinder between two O-rings and spacers, with the piston displacing cylinder lubricating oil only as it moves down between those two O-rings.

This Jim Ewins lubricator design was produced in the 1960s but was well publicised by its enthusiastic supporter, Neville Evans in *Model Engineer* articles in 2005 (**ref 13**), 2007 (**ref 14**) and 2010 (**ref 15**). If you can only get one of these articles then the drawing from 2007 will be a start, but the writing from all three is interesting.

I will not repeat what Neville Evans has said, but only encourage you to use this design in any lubricator you build for yourself. The piston chamber is self-purging of air and the pumped volume can be set by adjusting the relative proportions of the two spacers. I find an additional in-line non-return valve helps stop steam blow back, although the plunger sealing in the O-rings should, in theory, make this unnecessary. It is always best to have a separate pump delivering oil to each cylinder and two or more pumps can be built into one oil tank.

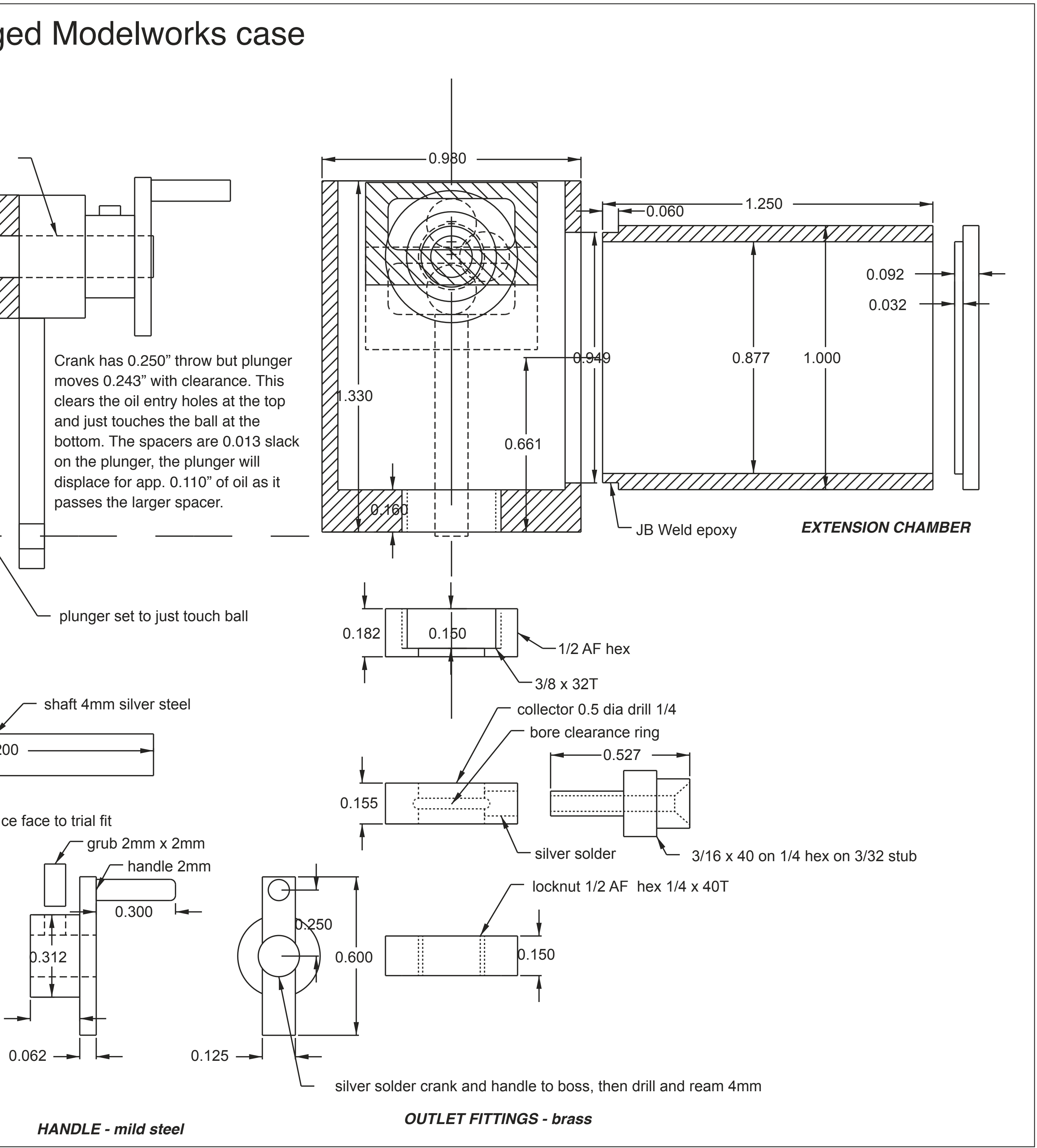
»

**Fig 11** BRITANNIA LUBRICATORS: Ewins design plunger in enlarg




Unfortunately, things were not right with the Modelworks implementation. The height of the oil tank body was such that it was mounted low on a bracket to keep the lid from protruding too far above the side platform. So low in fact that the fittings on the bottom of the lubricator were being struck by the valve motion. To resolve this, I made new brackets to raise the body and bring the input shaft to the right place in the side platform valance. I also cut down the top so that the chamber lid could sit flush on the side platform, and added a cylindrical side chamber extension to increase the oil volume (**photos 76** and **77**).

Interestingly, the Perrier design does not encounter the height problem as it uses a pump with a side outlet. However, in this design the whole piston stroke is used to deliver oil and I suspect it is far too much even with lever lengths set to minimise the rotation rate.

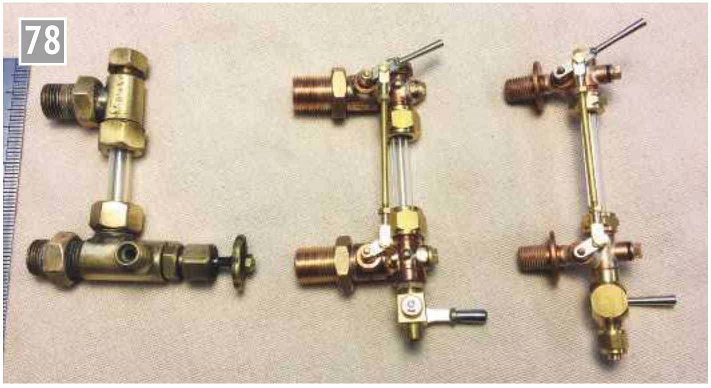



My sketch of what I produced is shown in **fig 11**. I apologise that this is not a professional drawing to recognised standards, but is more a computer scribble. It is, however, what I find helps me make parts that fit and this is exactly the drawing I used to make these two lubricators. The tricky part was getting a crank into the reduced height available. It would be best to have had the central shaft supported at both ends but reusing this oil tank, and the pressed-in roller clutch, made this difficult. Ideally, the bottom fitting nut should be an enclosed dome to seal the thread but there is no space. I will use thread sealant.

The Modelworks contrivance used a spring return under the piston rod top which bore upon a simple eccentric cam. This is a bad idea as the spring can drive the input shaft around for part of its cycle, and thus increase the oil delivered. I have used a strap, or Scotch Crank, to provide a controlled return.


*The left side lubricator; an enlarged Modelworks body with new pump mechanism according to the Ewins design.*


*Lubricator mounted under the side platform with lever and drive rod driven from a crank on the expansion link trunnion.*




*Three alternative water gauge styles: left to right - Modelworks 6mm glass; my design 5mm glass; Dave Noble production 4mm glass.*

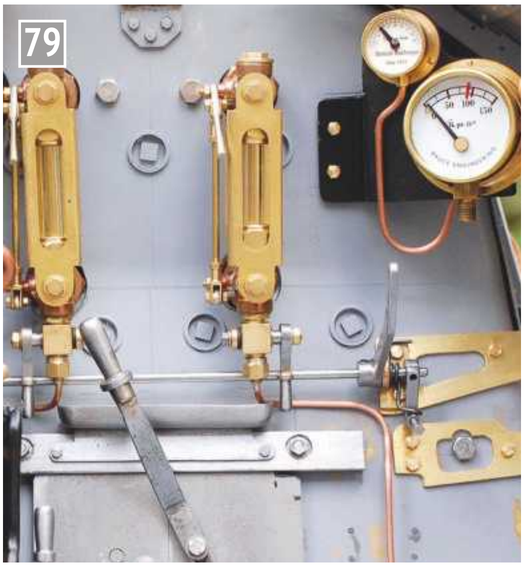
My previous use of a Ewins lubricator on a small 0-6-0 5 inch gauge locomotive has shown that an oil delivery of 0.5ml per cylinder per mile travelled is just right. I dip the oil tank with a rule before and after running and have a bicycle mileometer on the driving truck. For this bigger Britannia I wanted to achieve perhaps 1 or 2ml per cylinder per mile until it had settled down. Simple maths suggested that a 50 degree expansion link swing, a crank lever length of 0.5 inch and lubricator lever of 1.75 inch, would swing the lubricator lever 14 degrees forwards and back for each revolution of the locomotive wheels. There would be some loss of movement in the take-up of the roller clutches. (After the build was finished I made a test and found that the pump lever actually swung 12.5 degrees when the locomotive wheels were rotated, so the roller clutch movement loss is about 10%).

I had earlier found that whatever size the working spacer in a pump, it will deliver more oil than the spacer volume alone would imply. This is because the pump starts to deliver oil as soon as the O-ring seals on the piston. I found previously that a 0.063 inch spacer gave 0.02ml of oil per revolution. The Britannia 6 inch wheel size and 12.5 degree lubricator movement should give a theoretical oil delivery of 2.3ml per mile. A bit more than wanted but I decided to make it all to these dimensions and perhaps reduce the pump washer thickness after some steam trials and dip measurements of the oil tanks.

The reduced height square oil tank would have held about 9ml of oil up to the level of the input shaft. It is a good idea to keep the oil below the shaft as even with an O-ring seal you do not want to risk cylinder oil getting in the roller clutches – they will stop working. The round extension chamber adds a useful additional 9ml of volume at the same shaft height. This is a total of 18ml that will keep the engine supplied for around eight miles of running. If in future I reduce the working spacer to around 0.020 inch this should halve the oil delivery to perhaps 1.2ml per mile and double that range to sixteen miles.

## Water gauges

The Modelworks supplied water gauges would have worked well enough - they just look a bit 'heavy'. I had a pair of Dave Noble gauge




*Water gauge glasses mounted on the backhead. The glasses are twice the height of true scale from the prototype which makes the bottoms much lower and closer to the fire door top.*


*Regulator cab handle and bracket.*

glasses, planned for another locomotive, and thought I might use them on this Britannia. They are beautifully made and can be seen gracing many a prototypical model. However, the boiler bushes would need sleeves to decrease the diameter and I really preferred lock nuts and thread sealant to get the glass alignment correct. Also, the blow down valve would have interfered with the tray at the top of the fire doors. I decided, therefore, to make a new pair in phosphor bronze (PB102) - slightly larger in view of the boiler bush size - and use a 5mm glass rather than the 4mm of the Noble design. The smaller glass diameter is nearer to scale but the model Britannia gap between the top and bottom fittings is twice what the scale height of the prototype would be and with that height the gauge glasses can start to look very spindly. There is a thought that the smaller the bore of the glass the greater the meniscus effect, but I am not sure that it is any great concern. In **photo 78** I have, cheekily, added the Noble dummy shut off levers to my construction.

To complete the appearance, I cut some glass covers from 0.5mm brass sheet and bent these so that they cover three sides and a front corner (**photo 79**). It means I can fit them on with the glass tube in place.

## Regulator

The Perrier regulator valve is located in the smokebox, just as it is on the prototype. Apparently, it is not an easy task to make the Perrier valve work well and many owners have replaced it with a ball valve. This is what Winson and also Modelworks had done. Unfortunately, people seem to use commercially available ⅜ inch BSP gas valves and, in my view, the internal bore of these is too large. I have heard reports of this gas valve regulator being 'uncontrollable'. I found a company called 'Pipework Suppliers' in WF15 6PS who had a stainless steel 316 mini ball valve in ⅛ inch BSP - code DN6. It has PTFE seals with an adjustable seal pressure and once the plastic handle and fitting O-rings are removed its temperature tolerance will be very high. The internal bore is ¼ inch. This should be compared to the Perrier valve second stage which is ⅜ inch bore, but regulated with a 45 degree valve cone. When that cone is lifted 3/32 inch the free area is the same as a ¼ inch hole. I am sorry, I cannot tell you that I have tested this smaller bore valve and proved I can pull four coaches with 24 people, but a good friend has fitted one to his Britannia and he is delighted with the performance so far.

The regulator crank lever on this smokebox is now 45% longer (0.453 inch) than the Perrier design (0.312 inch) which itself is close to true scale. I have done this because I wanted to reduce the force necessary when the rods are being pushed. Even though they are 3mm stainless steel they will deflect easily, being so long, and I have seen them flex badly on some models. The driver's lever in the cab thus has an extra long top throw to suit this longer smokebox crank. This makes it a tight fit in the cab (**photo 80**). I made a stronger firebox backhead bracket to carry this new regulator handle and it just fits under the cab roof to send the actuating rod out in the correct place.

The double crank half-way along the boiler has scale levers as this does not affect the effort (**photo 81**). However, the bracket it hangs from has to be of just the right length and depth to keep the two push rods reasonably in line horizontally and vertically.

For a Perrier or Modelworks build, if you fit a ball valve in the steam line then the axis of its operation will not line up with the axis of the smokebox crank. I suspect the Winson design did line up, because the crank levers appear to be mounted higher on the smokebox. The Modelworks solution was a pair of levers similar in operation to that seen in **photo 82**, but not performing very well. I made new ones in heavier stainless steel and silver soldered the pins and arms. It needs a careful drawing to work out the correct angle for the oblong hole in the lever to drive the ball valve spindle, and the right length and position of the slot in the arm. Doug Hewson uses a pair of universal joints to connect the shafts in his design but I feel that these levers might be more robust.

The operation of the ball valve from the cab driver's lever is very nice at present. My only concern is whether the PTFE seals on the ball valve will tighten up when hot. News from my friend, however, that his works fine when in steam reassures me.

●To be continued.

81

*Alignment of the regulator rods down the boiler. The bracket height and stand-off were adjusted to get this right.*

82

*Regulator levers on the inside of the smokebox, with a pin locating in a slot to drive the crank affixed to the ball valve. All parts made from silver soldered stainless steel.*

### REFERENCES


13. *Penrhos Grange, Part 20*, Neville Evans, *Model Engineer*, Vol 194, p87, July 2005.
14. *Penrhos Grange, Part 29*, Neville Evans, *Model Engine*, Vol 199, p685, December 2007.
15. *Fair Rosamund*, Neville Evans, *Model Engineer*, Vol 205, p208, August 2010.

# Still the Secret Railway

**Brian Baker** looks back at the 40th Parklands Railway Week

A long time ago (*The Secret Railway*, Vol 184, issue 4112), I wrote about this delightful railway, tucked away in the village of Hemsby on the Norfolk coast. I described the line and explained how it had started as Don Witheridge's hobby track, on which he ran, supported by members of the Hemsby Group, and how the railway had grown and changed.

Well, that change has continued. Sadly Don snr. passed away in 2011, but the Witheridge Family wanted the railway to continue as a memorial to their father and, as he did, continue to entertain guests at the family holiday village. So the Parklands Railway Society continues in the tradition started by Don. The members run Parklands Week when fellow 7¼ inch gauge enthusiasts visit the railway during the last week in May, to run their locomotives or just visit to stand and stare.

Last year, 2020, was to have been the 40th year of this happy event, but when the 'C' word interfered, last year's event was cancelled. We have just, however, celebrated the 40th Parklands Railway Week which, I believe, is the longest running railway week of its kind anywhere, and it is already scheduled for next year. Some visitors stay on site in the holiday bungalows that the railway circles whilst others stay elsewhere in the locality and some just visit for the day. The 'Café de Parklands' looks after the inner man and woman - its bacon rolls are prize winning and devoured in large quantities during the week - and superb cakes baked by the members compete each year to out do each other in succulence. As a bonus, the ice cream man also calls regularly!

The track is just about three-quarters of a mile long, with a single line portion controlled by pneumatically operated semaphore signals, a long double track section, two bridges, a long timber viaduct, a tunnel and two three road stations - Parklands Central and Laurel Green. There are several videos of circuits of the

*Keen to encourage youngsters, Parklands Railway Society have been participants in the 7¼ Inch Gauge Society's Proficiency Scheme and here, an embarrassed Grace Clifton receives her Bronze Award Badge.*


*Resting in the loop platform, Jamie Duncan's GWR* Penrhos Grange, *No. 6868. She will shortly be off hauling big loads for the rest of the week.*

It's not all Railways at Parklands. Several members have traction engines running or in the building, but this 6 inch scale Foden, owned by Sam Pidduck, spent many evenings running around Hemsby village, usually with half a dozen tired locomotive drivers looking for food, and providing an unusual sight for the visitors in Beach Road.

railway, taken at various times, and a good one of this year's event on the 7¼ Inch Gauge Society's website.

We had thought that we would be doing well to equal the numbers that had attended this event in 2019, but we managed to beat it with 31 locomotives of all types attending. I have included photos of some of them. We seemed to have an excess of Great Western locomotives this year but one other pleasing thing for the organisers was the increase in the number of smaller locomotives attending; this greatly helped the overnight storage situation with no one allocated the tunnel!

We were again assisted by Peter Lawson and Nigel Surman in the many tasks that need to be undertaken in

*Also from Sutton, is Eric Upchurch's unusual Pet class Crewe Works shunter, which proved to be a very powerful as well as interesting locomotive. The driver's hat makes it, but I am not too sure that I fancied a ride in the front seat.*

*Even the coal was delivered by train, with the resident class 86 bringing in more supplies to keep the bunkers full.*

*Not the most practical wear for an afternoon amongst dirty steam locomotives but our ever dapper editor, Martin Evans was not giving up the chance of a few laps behind Norman Atkin's Warship.*


*LMS Pug 51207 owned by Stuart Duncan reeled off lap after lap of our track, in sharp contrast to previous years. I understand that she is now fitted with a Rosebud grate, which has clearly made a big difference to this little engine's performance.*

Tim Coles brought this LMS Jinty, No. 47406 up from Cambridge, one of a pair he has recently completed. He is about to set off with a heavy load of freight stock.


Moving off from the yard for yet another turn on pick-up goods - a job they seem to have been on all week - is Chris and Mike Jones' GWR Collet designed 0-6-0 tender locomotive, No. 2260.


Parklands Signal Engineer, David Maudsley, about to sample the delights of Penrhos Grange, a bit of a change from his regular Britannia.

John Painter patiently waits for the 'off' with 4202, with a sizable load of wagons. This is one of a number of locomotives built by Tony Newbury.

operating a railway of this size and thankfully the whole event went smoothly, with everyone enjoying a good run with a variety of rolling stock. Many passengers delighted in the excellent weather with which we had been blessed the whole week (with the exception of Friday afternoon, when a brisk shower slowed up loading).

Most visitors arrived on Saturday, unloaded straightaway and after quickly steaming up, five trains were running in the very welcome warm sunshine, but on Sunday we had a great treat when Eric Upchurch steamed his Crewe Works Pet class shunter, a model about half the size of the originals, one of which is on display in the reception area of the National Railway Museum at York. I was pleased to see how powerful


Peter King's 6 coupled wheels, Walshaerts valve gear Romulus is a regular visitor to Parklands but Peter hardly got a chance of a lap this visit, since Charlie Riches spent most of the day driving it.

*After a little maintenance, Bob Whitfield's Old Ruby C19 locomotive heads out for an afternoon's successful passenger hauling.*


*Waiting for the Driver? Well, er, no. There he is! Tim Kay is sitting on the back, radio controlling his J70 GER tram locomotive, with a load of passengers from another local 7¼ inch gauge railway.*

it was, pulling everything we put behind it with ease. Of particular excitement was the chance of a ride 'up front' which was interesting.

Sometimes, something a bit out of the ordinary happens, and GWR 6868, *Phenros Grange*, was employed to put away the empty stock the end of the day; it managed to haul 17 bogie coaches of all types, loaded with a fair number of 'shunters', up our steep Laurel Green bank with apparent ease.

On Monday we had a visit from Frank Cooper, chairman of the 7¼ Inch Gauge Society, ably assisted by Jeff Fox, who brought Society goodies and in the afternoon, our editor, Martin Evans joined us, when I volunteered him to present one of our Junior members with their Bronze Proficiency Award. Later Martin enjoyed some laps of the track behind Norman Atkin's Warship, and his grin said it all.

With several day visitors we enjoyed a constant changing display of all types of locomotive and the chat, such a feature of an event like this, was constant.

At the end of the week we were all tired, but happy in the knowledge that the 40th Anniversary Parklands Week had been a highly successful and happy time. Everyone enjoyed themselves; Don would have been pleased.

ME

*Another hooked family member is Alfie Witheridge, great grandson of railway founder, Don, about to take out his family for a run on the last day, under the close supervision of Nigel Surman, a regular visitor who spends a lot of time helping to operate the railway during the week. This locomotive,* County of Norfolk *has recently been rebuilt by a group of members and is proving very popular with the passengers.*


*Nigel's other passion is his model T Ford which he brings to Parklands every year, giving rides to all who care to ask.*

# The Stationary Steam Engine

## PART 23 - THE RISE OF COMPETITION IN STEAM ENGINE BUILDING

**Ron Fitzgerald** takes a look at the history and development of the stationary steam engine.

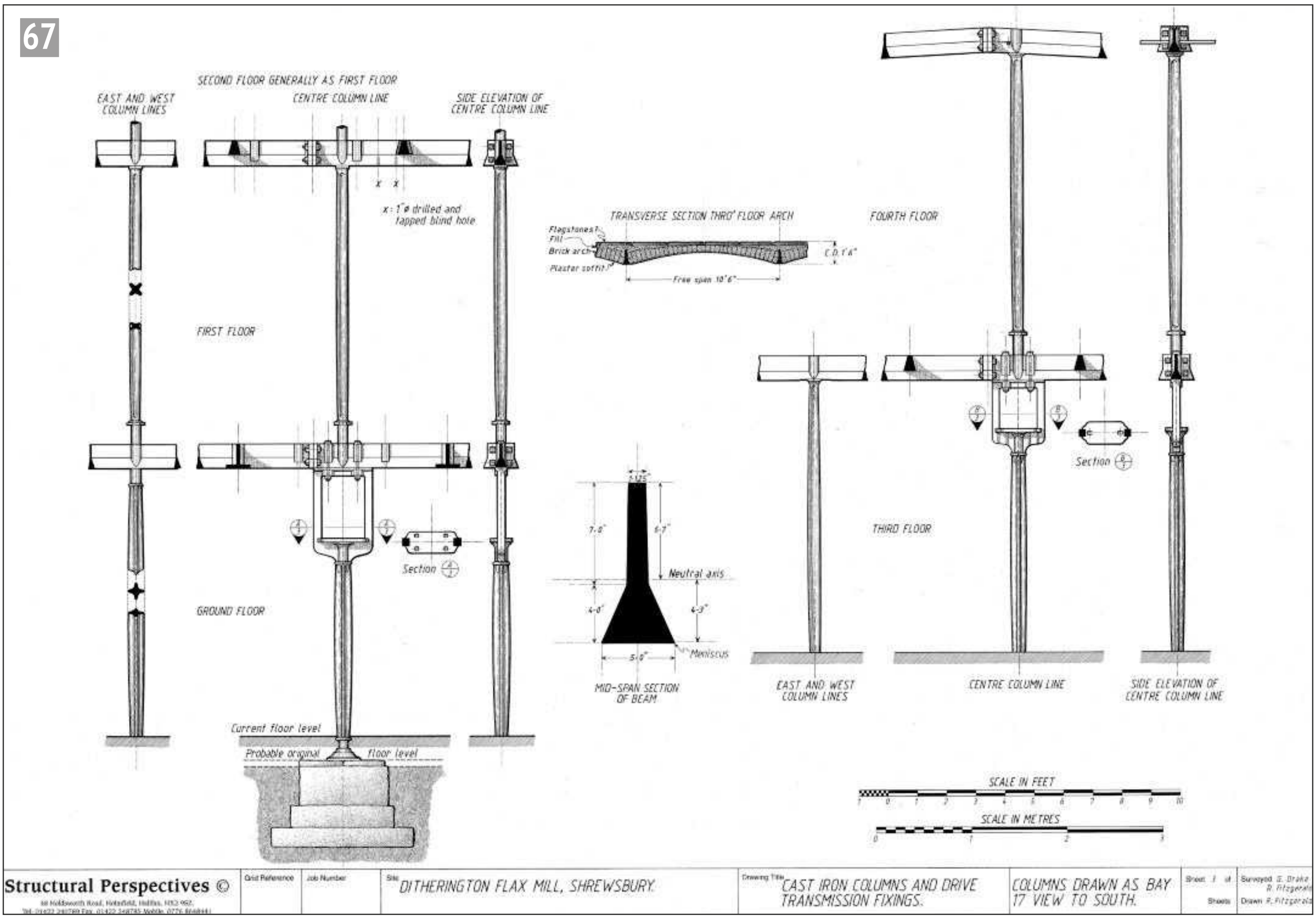
Continued from p.35
M.E. 4667, 18 June 2021

John Marshall's relationship with Boulton and Watt was quite different from that which existed between the Birmingham firm and Benjamin Gott. Gott had formed a cordial and lasting friendship with the Soho partners and their staff but Marshall's contacts were abrasive from the beginning. An early point of contention was Marshall's objection to Boulton and Watt's insistence that Soho should be party to any future resale of the machine or even, in the event of Marshall deciding to move the engine for his own purposes outside a twenty mile radius of its original location. At the same time Marshall was also disposed to exact terms which Boulton and Watt resisted. Marshall asked that any improvement in the design of their engines that Boulton and Watt might make over forthcoming years should be incorporated *gratis* in his machine or machines. A compromise was reached but other areas of dispute arose.

The most significant underlying issue was the continuing imposition of the premium and Marshall lost no opportunity to find a pretext for withholding payments. He was now paying for two engines and in early 1796 an approach was made for a third to power a new mill at Shrewsbury that Marshall intended to build with the Benyon brothers. A letter was sent to Boulton and Watt:

*… You will oblige us by advising the price of a 20 horse power Engine & what would be*

67




*The structural cast-iron of the Ditherington Flax Mill. The Cast-iron beams supported segmental brick arches which formed the ceiling and the floor above.*

*deducted from the price for each item as under being furnished by ourselves viz-Boiler, Fly Wheel, Rotative-Shaft, Connecting Link, Sun & Planet Wheels. We expect we shall want the engine about 1st Feby next …*

Dated 1 May 1796, the agreement for this engine showed that Marshall had failed to secure any concessions. Marshall and Benyon were to pay £742 to Boulton and Watt for a cylinder with valves, condenser, air pump and the valve operating gear. Marshall had to provide every other part of the machine and the building. The supervising erector, appointed by Boulton and Watt, was also to be paid directly by Marshall. The premium was exactly the same as it had been on the earlier engines. The clause that had previously offended Marshall remained. The engine should not be:

*… removed out of the kingdom of Great Britain to any place beyond the seas nor to any place more than ten miles distant from the said place of erection without the consent of the said James Watt and Matthew Boulton …*

Marshall was forced to accept Boulton and Watt terms without conceding that they were justified. As he saw the situation the engine that he had paid for was not his absolute possession but still subject to constraints regarding sale or transfer to another site. It was also irksome to know that Boulton and Watt were charging what he considered to be an excessive mark-up on the components that they supplied. Wilkinson was offering bored cylinders at Bersham for 21/- per cwt whereas Boulton and Watt were asking him to pay 30/- per cwt. He could have them cast in Leeds for 18/- per cwt. All of these factors sharpened Marshall's sense of injustice but he temporised in the knowledge that the key Boulton and Watt patents were all nearing the end of their lives. The patents for the double-acting cycle and the sun-and-planet gear had already reached their full term two months before the contract for Shrewsbury engine was agreed. The parallel motion patent would end in August 1798 and the extended master patent on the separate condenser would expire in 1800.

The prospect of the end of patent protection faced Boulton and Watt with equal force. Their position was becoming increasingly vulnerable as premium payments were their main source of income and James Watt could see the need for fundamental change. He had worked tirelessly for thirty years to perfect his engine and only his direct intervention had saved the firm from financial disaster in the first part of the seventeen-eighties. In the aftermath of this crisis he had managed to establish a more secure position and paid off his remaining private debts. As his personal circumstances improved he was inclined to look forward to a future in which he was less involved in management and free to follow other engineering and scientific interests. His fiftieth birthday, in January 1794, marked the point at which he began to withdraw in favour of his eldest son, James Watt Junior. In October of that year the firm was re-constituted as Boulton, Watt and Sons, Soho. The partners were Matthew Boulton senior, his son Matthew Robinson Boulton and James Watt with his sons James Watt junior and Gregory Watt. James Watt senior's financial share was a minor one.

The restructuring of the firm's management took place smoothly but at this point a new threat arose. The Wilkinsons, John and his half-brother William had co-existed uneasily as joint managers of the Bersham Ironworks since their father's time but William's return from a period in France in 1787 brought previously suppressed animosities to the surface. When John purchased the Brymbo estate to start a new works independently of William, a vicious quarrel ensued. As neither was prepared to compromise, the matter passed to the court. The case went to arbitration but this failed to resolve matters. In a bitter dénouement, the Bersham works was destroyed and the remains offered for sale by Court Order in November 1795. These events deprived Boulton and Watt of their main supplier of heavy castings. To add insult to injury it also transpired that John Wilkinson had been building separate condenser engines without Soho's permission. Of these events John Marshall was a not wholly disinterested observer.

Marshall's Shrewsbury engine was delivered in the aftermath of Wilkinsons' collapse and although it is not certain where engine parts were cast, they probably came from Coalbrookdale. Delivery had been promised for March 1797 but the final commissioning did not take place until 11 September. The engine was a, by now, standard Boulton and Watt machine but the Shrewsbury mill itself was a profound innovation. The devastating fire that had destroyed the 'B' Mill in Leeds so soon after it had been completed can only have been a disastrous experience for Marshall but his loss was not unique. The Albion Corn Mill conflagration was still a fresh memory and fire was proving to be the single greatest hazard for cotton and flax mills. Mounting losses drove the mill owners to make the mills more resistant to fire. The principal measure related to reducing the flammability of the mill structure. Arkwright's late partner, William Strutt took the first step at a warehouse and mill that he built in 1792 and 1793. In his buildings at Milford and Derby, Strutt substituted segmental brick arches and stone flag floors for the timber joists and floorboards that had traditionally been used to span between the main timber transverse beams, the latter of which remained the principal load bearing agent.

Marshall and Benyon's Shrewsbury mill took the next step in the direction of fire-resisting construction. Charles Bage, a fellow townsman of the Benyon brothers, suggested substituting cast-iron beams and columns in the new building for the timber that would otherwise perform this role. Relying upon existing structural theory and the limited information available from experimental investigations into the strength of cast-iron, Bage designed the world's first rational and effective long-span iron beams. For this contribution to the mill's design Bage was made a partner and the mill was subsequently known as Marshall, Benyon and Bage's Ditherington Flax Mill.

The Ditherington Mill is acknowledged to be the pioneer of all subsequent iron and steel-framed buildings. It is a sufficiently momentous watershed in civil engineering history to warrant being regarded as the first major advance in the technology of building since the medieval cathedral. Within the history of structures, it is a revolution comparable to Watt's separate condenser (**photo 67**).

The Ditherington Flax Mill still stands as a World Heritage Site and has recently undergone renovation. In the course of the building survey it became apparent that the mill was built in two stages, each comprising half of the building's present length (**ref 130**). The second half was built very shortly after or even before the first was completed and it was this enlargement that appears to have called for a second engine. This seems to be the point at which Marshall decided to circumvent Boulton and Watt. Marshall's confederate was to be Matthew Murray.

●To be continued.

## REFERENCES

**130.** Survey and Report by Structural Perspectives.

# POSTBAG

## Lubrication

Dear Martin,
I greatly enjoy Rhys Owen's writings and have tucked in to his series about lubrication. His references in the first article (ME 4665) to American and German researchers are valid but I'm a touch puzzled at his omission of British work a generation earlier. Beauchamp Tower performed a series of experiments on the oil lubrication of railway axles in the early 1880s, under the patronage of a committee set up by the IMechE in 1879 to study this commercially important area. He made the unexpected discovery that the rotating axle itself could convey oil from a pool below up into the bearing and form a pressure film that separated the shaft and bearing block with minimal friction, wholly against the conventional wisdom that oil was best poured in through a hole at the top. Shortly after his published papers about this Osborne Reynolds analysed the wedge effect and clarified the hydrodynamics. His masterful and comprehensive paper (1886) is still at the core of all convergent wedge hydrodynamic studies (and the field is vast).
**Regards, Mike Gray**

Dear Martin,
A few comments on Rhys Owen's interesting article (M.E.4665 and M.E.4666). First of all, a general comment on lubrication and how it does or doesn't work.

As a teenager I was always messing around with motorcycles; it seems the ones I bought always needed mechanical work. One particular rebuild was a Royal Enfield 700cc twin which needed new big ends and piston rings. The bid ends were plain shell bearings and I duly gave them a good squirt of oil and reassembled the motor. After a satisfactory test ride around the block I set off for Bournemouth some 20 miles distant.

On the way back, about 2 miles from home, a bit of vibration could be felt though the handlebars and a slight knocking noise could be heard. Unbeknown to me I had not removed the remains of the rubber sleeve from the quill bolt which feeds oil to the big ends via the oil way in the centre of the crankshaft. The whole journey had been made with no lubricant to the big ends other than the few ounces from the oil can!

On dismantling there were a few signs of overheating and the white metal had just started to smear, but new shells and some attention to the journals with fine emery paper was enough to save the day. Which proves that an intermittent oil feed is not the end of the world - it will stay put on the working surfaces for a long time.

I do believe that Rhys's comment that a hydrostatic lubricator will not feed oil during expansive working is not borne out in practice, as in this condition the steam chest pressure is likely to be well below boiler pressure, even on the most efficient locomotives, so there will still be a pressure differential.

The main advantage of mechanical lubrication was the fact that it was automatic and required no input from the footplate crew other than making sure the thing had oil in it. Pump settings are usually locked to make sure that footplate staff cannot interfere, whereas displacement oilers need a bit of skill from the driver/fireman to set up.

## Is It a Fake?

Dear Martin.
Noel Shelley's article entitled 'Is It a Fake?' (M.E.4665, 21st May) poses an interesting question. The reason I say this is take the almost 100 year old Gresley A1/A3 Pacific *Flying Scotsman* as an instance. When it was built in 1923 it had a 180lb boiler pressure but it was later rebuilt into A3 form with a 220lb boiler. Having had several overhauls during its life it is highly probable that the only original parts of the locomotive are the name plates. During overhauls it would have had boiler, wheel, cylinder changes and possibly also a full or half set of main frames. Also, the tender it was originally fitted with was a corridor connecting one which I understand was swapped for a non-corridor one.

Another question could be that when the team built the new (now some 15 or so years old) Peppercorn Pacific *Tornado*, although they worked as closely as was possible to the original works drawings, over half a century had elapsed since the original Peppercorn ones were built. Advances in materials and also safety requirements made changes necessary to the original design. The same could also be said for the new build of the 7th member of the Gresley P2 2-8-2 class of locomotives. Again, as far as I understand, the team are working as closely as possible to the original design but bearing in mind the problems that the original locomotives had in service and again to comply with the current regulations there would be modifications to the original design. We should also bear in mind that a lot of the materials specified are no longer available and if they were would they be considered to be suitable for today's requirements? It will be interesting to see how the team building the P2 go about solving some or all of the problems that Sir Nigel Gresley encountered when the original six P2s were put into service. (Graham Langer's articles give a good account of this – Ed.) It was said that they had problems running between Edinburgh and Aberdeen due to the curved nature of the line. Maybe if they had been used on the mainline between Kings Cross and Edinburgh they would have been a lot more successful.

Materials and manufacturing processes along with design methods have moved on greatly since the end of WW2, 75 years or so ago. I think that we are lucky in a way that so many of the former GWR, LMS, SR and LNER locomotives have been saved, if not in running order then at least held in museums. The same goes for the BR Standard locomotives. The question is, were the BR designs really needed? They were designed to have almost universal route clearance and it was the intention of Robin Riddles to have them transferred around the country replacing the older designs and going for electrification of almost the whole network, just having a few Diesel units to cover for lines not economically viable.

So, getting back to the question 'Is It a Fake?', I don't think so, as technology advances during the life of a locomotive. For example, Sir William Stanier did a lot of experimenting with different valve gears etc. for the Black 5 locomotive and these modifications were often incorporated into the design as production progressed.
**Yours sincerely, J.E. Kirby (London)**

Regarding atomisers, these are usually fitted to all feeds directed to piston valve and piston ring rubbing surfaces. Steam oil will not be atomised by being injected through a small orifice - it needs to be mixed with steam at pressure, which the atomiser does admirably.

I think Rhys has got in a twist over the LMS lubrication diagram. LMS and subsequent BR steam operated drain cocks are held shut by steam pressure, so when the driver's lever is in the closed position the steam to the drain cocks and atomisers is off, so there is no chance the locomotive can creep away with the steam from the atomiser, even if incorrectly left in gear. BR soon dispensed with regulator controlled atomisers in favour of this arrangement for the reasons he described, to allow closed regulator drifting without the risk of oil starvation.

However, Rhys's most serious error by far was to cast doubt on the lubrication of the unmodified (not 'unrebuilt' please!) Bulleid Pacifics. This advanced and very effective system of lubricating most of the valve motion and the middle big end actually resulted in excellent reliability of all the bearing surfaces that were either pressure fed by the duplex internal oil pumps or drench lubricated by the overhead oil pipes. Footplate crews had far less oiling to attend to compared to a BR standard, it was the shed staff who suffered when attention was required. The inability of the sheet metal oil bath to remain oil tight and the apertures required for the driving axle were the primary sources of leakage and were never satisfactorily solved.

Once various other design deficiencies were attended to the mechanical parts did their job, the real weaknesses were, and still are, in the levers and rockers connecting the oily part to the hot part! I'm not convinced the blame attached to the chains themselves is warranted as they operated under much better conditions than those in many industrial applications and were classed as consumables.

Bulleids still have multiple feed mechanical lubrication of cylinders and valves, so like every other locomotive in this respect.

One issue that hasn't received much comment is the excessive use of cylinder drain cocks, now used after almost every station stop on some heritage lines. I spent a long time watching steam trains in the sixties and never once saw a train pull away with the taps open, even departing from a terminus. Enginemen then were doing it for a living, so knew by experience when they needed to get rid of water. For all the spectacle of wide-open drain cocks and the guarantee that the end covers are less likely to be blown off by hydraulic locks, this is also a very effective way to wash all the oil out of the cylinder bores!

I have a particular interest in lubricators, having overhauled a few full-sized ones, both the single acting Wakefield type as illustrated in the article, which displaces on the down stroke, and the double acting Silvertown, which displaces on both strokes. I have worked out a design which incorporates four feeds in not much more space than the traditional LBSC single feed pattern and will fit between the frames of a 3½ inch gauge locomotive, based on the Wakefield pattern. I had better get the drawings tidied up now I have ventured into print on the subject. There is a bit of precision required on the pistons and cylinders but the design is simple and each feed is independently adjustable.

**Best regards, Nick Feast**

Dear Martin,

Further to Nick Feast's letter (above - and it is good to know someone read my article!) I respond below.

I am sure that instances occur where one gets away - for a while - with no, or intermittent, lubrication but, as a general rule, continuous lubrication is more desirable.

With regard to Nick's comment about expansive working, i.e. that even on the most efficient locomotives there will still be a pressure differential, the essence of my point was that without a pressure differential a hydrostatic lubricator will not deliver oil. French locomotive engineers were keen to minimise the pressure drop between the boiler and the cylinders by using large steam passages and, wherever possible, a fully-opened regulator, linking the valve gear up to give maximum use of the energy of the steam by expansive working (helped by the general use of axlebox wedges). I certainly do not think that 'a hydrostatic lubricator will not feed oil during expansive working' as, although I have seen at least one driver who seemed to view the reverser only as a means of changing the direction of the engine's travel, most drivers do 'link up' to give some degree of expansive working, whatever type of lubricator is used. But with a hydrostatic lubricator the effect of opening the regulator wide is to reduce the pressure differential, and hence the flow of oil, at the very time that a locomotive with unbalanced slide valves most needs lubrication. As Nick points out, the oil stays on the surfaces for a while - but it is not wise to depend on this for a long period.

I turn now to Nick's comment that 'steam oil will not be atomised by being injected through a small orifice - it needs to be mixed with steam at pressure, which the atomiser does admirably'. On the Morris Lubricants website a technical data sheet for their compound steam cylinder oils of types 460, 680 and 1000 states that 'In addition to cylinders, it is recommended for valve chests, slides, linkages and general lubrication by means of mechanical applicators, atomisers or oil can.' (my underlining).

As for the LMS lubrication diagram, LMS and subsequent BR steam operated drain cocks indeed seem to be shut by steam rather than opened (a more sensible arrangement). However, my point was that the interlinking of the drain cocks with the atomiser system was an excellent idea.

Now for Nick's observations about Bulleid Pacifics – and I would be interested to know at what point a modification becomes a rebuild! I don't think I cast doubt on the lubrication provided by the Bulleid Pacific oil sump but rather on the leakage. Having stood next to someone who emptied the sump of one of these locomotives into a container that was too small I may have acquired a jaundiced view of this system…

As for drain cocks, I also spent a lot of time in the early sixties watching trains, mainly at a branch line terminus with which the young Oliver Bulleid would have been very familiar. The only time the drain cocks were opened was – briefly - on departure after the engine had stood for some time. In some countries there seems to be a tendency to start with the cylinder drain cocks shut and only to open them after the locomotive wheels have made a few revolutions. So, I agree with Nick that there is no need to open the drain cocks when starting away from a station stop of short duration.

I look forward to seeing Nick's lubricator design in print.

**All the best, Rhys Owen**

## Write to us

Views and opinions expressed in letters published in *Postbag* should not be assumed to be in accordance with those of the Editor, other contributors, or MyTimeMedia Ltd. Correspondence for *Postbag* should be sent to:

**Martin Evans, The Editor,**
**Model Engineer, MyTimeMedia Ltd,**
**Suite 25S, Eden House, Enterprise Way,**
**Edenbridge, Kent, TN8 6HF**
**F. 01689 869 874**
**E. mrevans@cantab.net**

Publication is at the discretion of the Editor. The content of letters may be edited to suit the magazine style and space available.Correspondents should note that production schedules normally involve a minimum lead time of six weeks for material submitted for publication.In the interests of security, correspondents' details are not published unless specific instructions to do so are given.

Responses to published letters are forwarded as appropriate.

# Overhauling a Bandsaw Vice

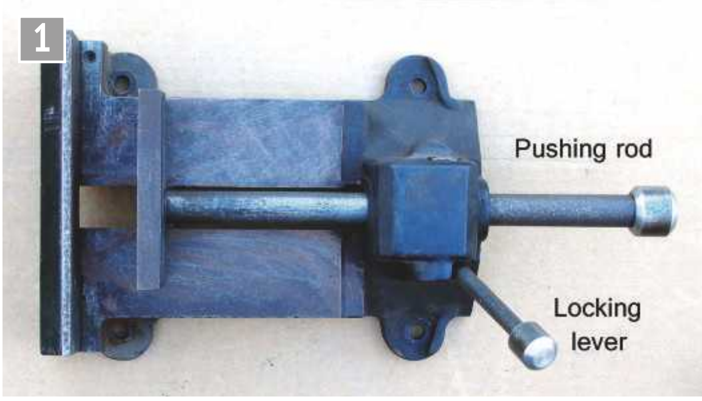
**Jacques Maurel** does a little workshop maintenance.

The bandsaw vice is of the quick acting type.

## How it works (photos 1,2 and 3)

In the unlocked situation (locking lever up, backing off eccentric **4**) the jaw can move freely. with the eccentric **4** in the back position, the spring **2** pushes the locking plate **3** until its heel stops against the head of screw **5**, relieving the pushing rod **1** and hence the jaw.

For locking, the moving jaw must be first set against the workpiece, then the locking lever is pushed down so that the eccentric **4** is moved forward towards the locking plate. As soon as the locking plate heel leaves contact with screw **5**, this plate will be 'friction locked' on the pushing rod and so the clamping force is transmitted from the eccentric to the moving jaw.




*The bandsaw vice.*

A similar mechanism is used for sealant guns (**photo 4**). A lever is used here in place of the eccentric as the force is smaller. The pushing rod is of hexagonal shape, which increases the locking action and the trigger is here to prevent any backing movement when the rod is freed by the forward locking plate (lever released). Pushing this trigger will free the rod (for loading the sealant cartridge).

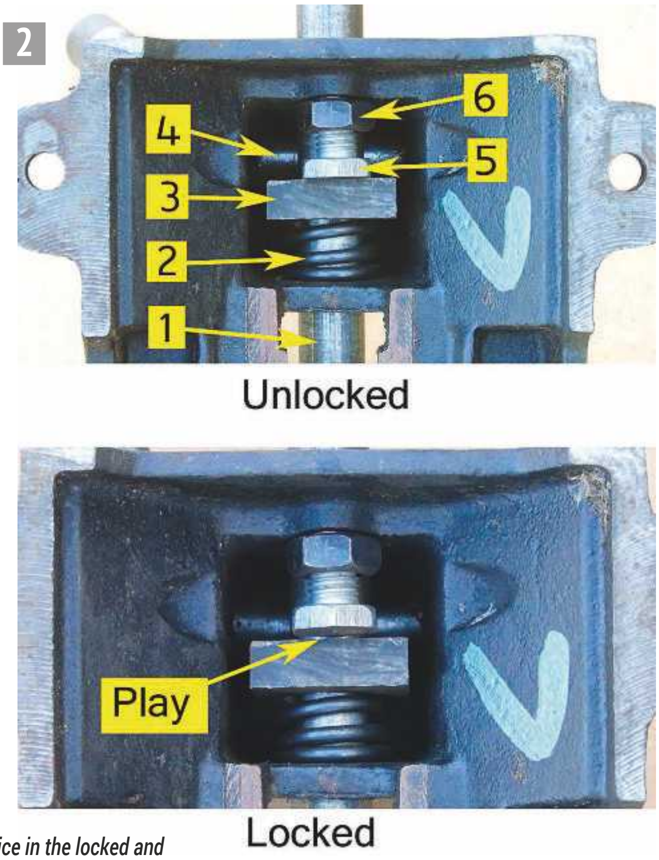
The 'single hand clamp' (**photos 5** & **6**) I've used for lifting the drill press table (described in M.E.4463) uses the same mechanism; two locking plates set side by side are used here to improve the contact area.

## The problem

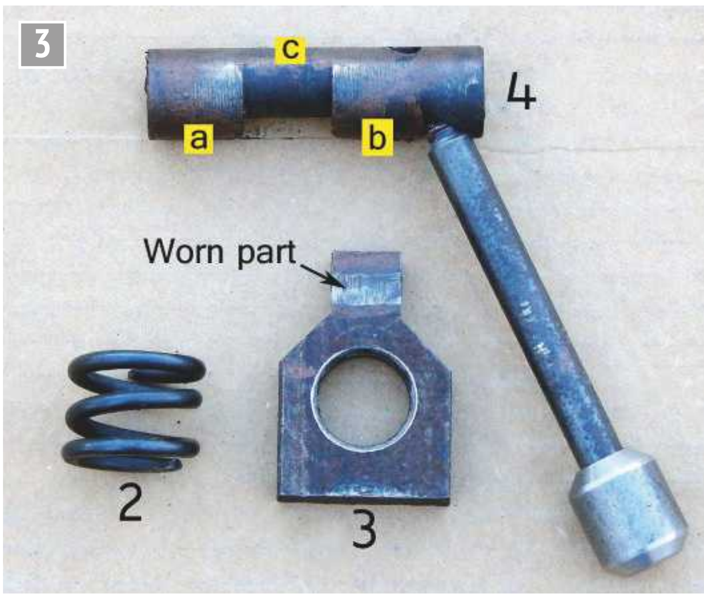
The problem found with the vice was that, as the contact between eccentric **4** and moving plate **3** was worn (see the worn area on part **3** in photo 3), too great a part of the eccentric throw was used to relieve the heel **3** from its contact with screw **5** and not enough for exerting the clamping force.

To cure the problem, the stop screw **5** must be adjusted in the following way:

* Set the locking lever high (unlocked situation).
* Free the counternut **6**.
* Move screw **5** backwards until the pushing rod **1** is locked.




*Vice in the locked and unlocked positions.*

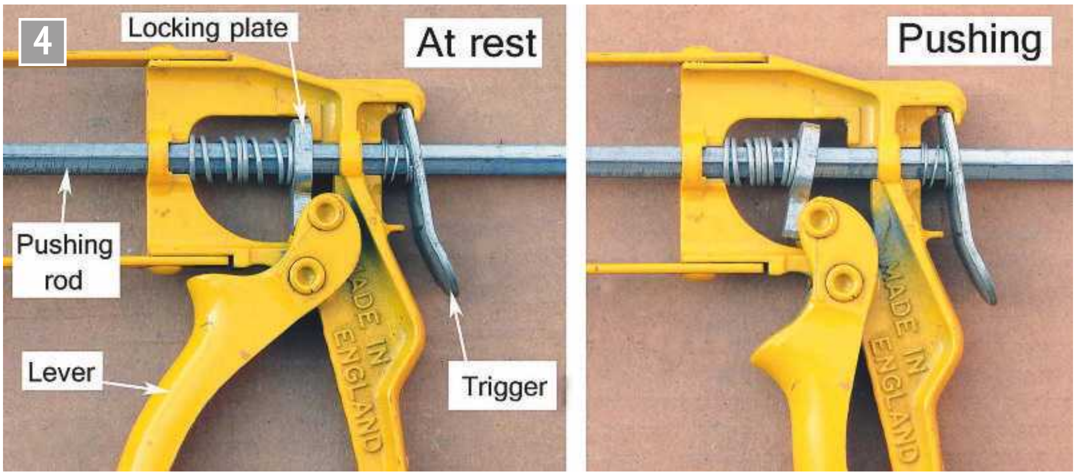



*The cause of the problem.*

* Now move screw **5** slightly forward just to free the pushing rod.
* Lock the counternut **6**. This adjustment process must be done with the vice taken out of the machine - while there is a screw driver slot at the end of screw **5**, there is no access to the counternut **6**!

## Improvements

For easy adjustment, the counternut **6** must be located outside the vice (see **photo 7**). To achieve this, the screw **5** was replaced by a longer one (M12, 48mm long) with a screw driver slot at the end (made by using two hacksaw blades set side by side in the same frame). As no M12 hex screw was available in my



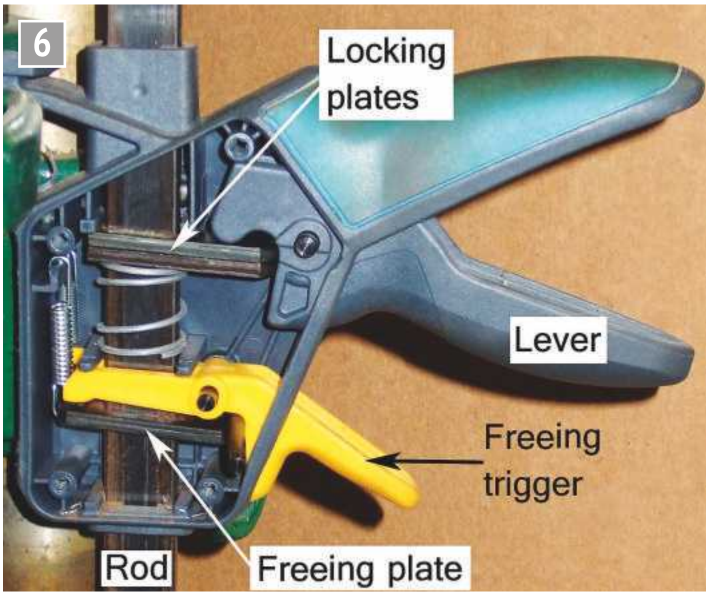

*The same mechanism is used in sealant guns.*

stock, an equivalent one was made from a piece of threaded rod and a pinned on nut. The adjustment process can now be carried out *in situ*.
The eccentric **4** is made of hardened-steel with a rough surface, so it is worth polishing the contact areas (a, b, c on **photo 3**) with emery cloth and then greasing them to diminish wear and improve efficiency.

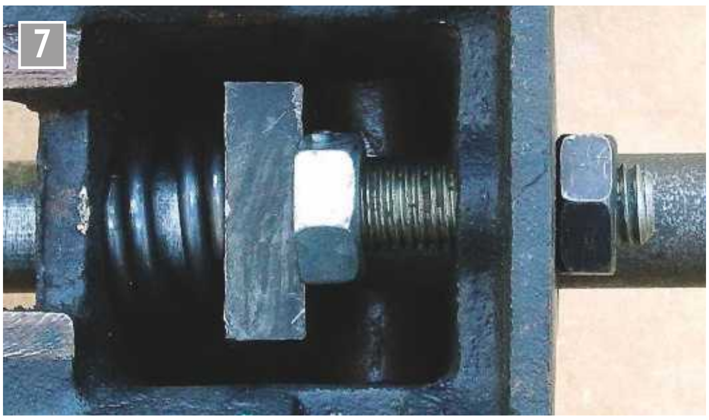
Just a small amount of grease must be put on area c (in contact with the worn part of **3**), as some grease could fall down on part **1**, but absolutely no grease should reach the contact between the pushing rod **1** and the locking plate **3** to maintain a good 'friction lock'. An experiment was made with a home-made stress gauge (see **photo 8**) - the clamping force was around 2000N (440lbf).

**ME**

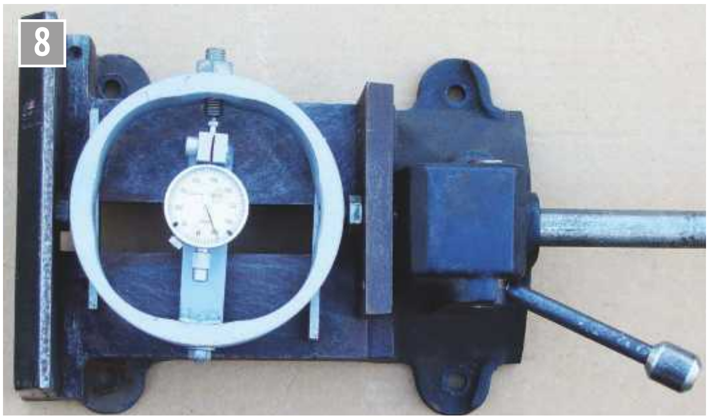

*Also used in 'single hand' clamps.*




*Internals of a 'single hand' clamp.*



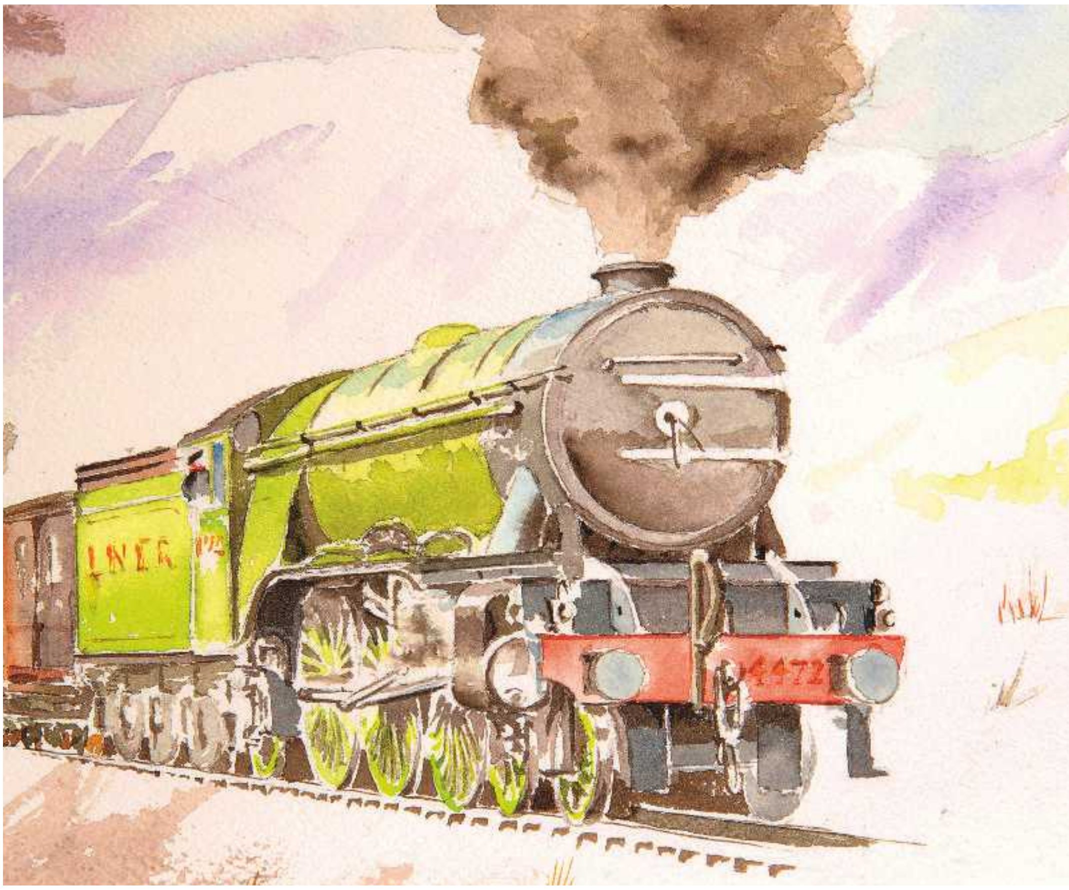

*The solution to the problem.*




*Measuring the clamping force using a home-made stress gauge.*


**Peter Seymour-Howell** builds a fine, fully detailed model of Gresley's iconic locomotive.

Continued from p.103
M.E. 4668, 2 July 2021



*Painting by Diane Carney.*

PART 14 - MAIN FRAMES

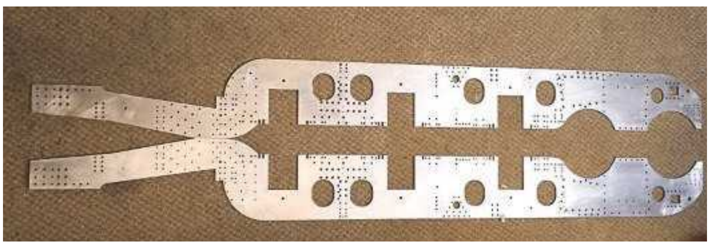
# *Flying Scotsman* in 5 Inch Gauge

## Frames

The main frames are where we begin properly on the engine itself and I have to say that Don's drawings are more or less a true scale miniature of the original prototype - they are an art-form in their own right.

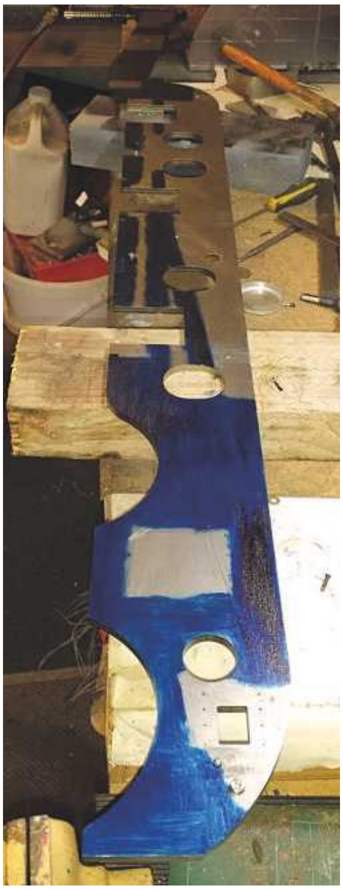
I went the laser cut route. The main frames (all 44¾ inches of them) are from Reeves2000. The bogie, doubler plates and trailing frames are all from Steve Harris of Laserframes.co.uk and I am most grateful to him for changing the trailing frames for some of my own drawing, in order to correct the position of the trailing wheels. Some of the CAD work was then drawn up for me by John Baguley and cut by Malcolm and I am very grateful to both gentlemen.

After taking a close look at the laser cut frames that I got from Malcolm at Model Engineers Laser, there were a couple of discrepancies but nothing that could not be worked around. So, to help future builders of this locomotive here is what I found. First is the position of the horn stay slots. The rear slots are in the wrong place, being too far back from the axle slots, and thus need re-cutting. The other is the weightshaft hole through the frames. The drawing has this as 5⁄16 inch but the actual hole that has been cut is ½ inch. This modification though is a good one that I'm more than happy to use - it seems to me that the idea is to continue the weightshaft bearing within the expansion link bracket into



*1. Here is a pair of laser cut frames.*

The trailing frames are one of those things that required a little care to ensure they are fitted correctly to the frames so I tackled this part first.



3. *This is how I drew the angle onto the frames. The first job was to machine a piece of brass that fitted tightly into the crank axle slot. The brass had a centre line scribed and, once fitted into the axle slot, had the datum/centre line drawn across it and then centre punched to give me the exact centre position for the axle. I then scribed a line to cross with the two previously mentioned reference points from the frame top and back from the stay. I then checked that the 1 in 8 was correct, which it was. As a last check I did a visual with all other plotted holes nearby to see if anything looked out of place. Now that I was happy with the incline I needed to plot the cylinder holes and Don had provided a reference point 90 degrees down from the centre line for marking out the cylinder bolt holes.*

2. *Having riveted the frames together I then applied a coat of engineer's blue to the areas that needed marking out. The angled line of blue is where I need to plot the angle for the cylinders, which in this case have a 7 degree incline. Don states to treat all holes as critical but this incline will be treated extra carefully to ensure the angle is spot on.*

the frames themselves as the bearing there is ½ inch. This will provide better support to the shaft (not relying just on the mounting bolts) and also act as a location guide for the bracket,

Before I could machine the horns and fit them I needed to tackle the trailing frames and stiffeners. I couldn't fit any of these until I'd fitted the horns and done the final machining to size of the slots which I'll tackle with the frames fitted together, so it was a bit of a juggling act for the next few operations.

The trailing frames are one of those things that required a little care to ensure they are fitted correctly to the frames so I tackled this part first. This was simple enough once I got my head around the fact that the holes from the leading edge of the frame are offset by ⅛ inch so first I scribed a centre line for these and then lined up the trailing frames under the main frame with the scribed line central to the holes in the main frame that they related too. The rear of the trailing frame sticks out further due to the allowance for bending to shape and also the fact that the end plates sit outside of the trailing frame but inside the main frames. What helped greatly in getting the trailing frame lined up correctly is that the rear upper face of both frames are at equal height, presumably for the cab floor to sit on, and that the lower sections also lined up.

I aligned the two parts and then clamped them together with tool maker clamps and a short length of 0.156 inch steel put in as a locating dowel. An extra measure taken was to put a piece of steel along the top edge as a visual aid to ensure nothing had moved while I drilled the seven remaining holes that made up the fixing points for the trailing frames to the main frames.

4. *Here are the two trailing frames clamped together with the 0.156 dowel pushed in to hold things true. Once I had done the same to a few of the other holes I was confident that nothing would move and drilled the rest to drawing.*

5. *I have also drilled all the holes in the stiffener plates. I played safe and first clamped one stiffener plate in its correct place on a main frame and drilled all of the holes. I then cleaned this up and accurately clamped the two stiffeners together and repeated the process for the second plate. I did it this way to reduce the risk of a drill deflecting going through two pieces of ⅛ inch steel. Once done I split the plates and lined the second one up with the other main frame to check all was good.*

6. *Bending the trailing frames. I had planned on making a couple of jigs that would fit to the frames using the various holes and for the end of the jig to be in line where the fold was needed, thus ensuring the folds were in the correct place and more importantly the same for both frames. Here we have one frame temporarily held in place to check that all was to plan. The frame fits perfectly, it's at the correct angle, sits square with the main frame with regards to height and it also ends at the correct length.*

>>

7. Here are the frames with the three spacers holding them apart at the correct separation.

8. The first stretcher made and part fitted in its correct position with just temporary bolts.

9. Following the same principle as with the frame stay I drilled one hole each side for holding the 2:1 gear stay in place. An aid in this case to ensure the stay sits where it belongs was the use of a suitably sized piece of steel that closely fitted the rectangular slot in the frames and the corresponding slots in the stay - once pushed through, trapping the stay between the frames, it wasn't going anywhere. The height was set by first scribing a line along the top edge of the stay sides to show where the bolts go through and then marking another line across it when sitting in place to give the correct position for the two holes. This tunnel is where the 2:1 arm runs through as part of the operating mechanism for the valve timing on the outside cylinders so its position is critical as Don rightly states in his words.

10. The STAR stay - this is a monster and a very prominent fixture on a number of Gresley's locomotive designs. Here is the star after soldering up. I had noted that the width was just under the required size, only by a few thou but that's enough to cause problems later on, so I packed out the two end pieces with some brass shim equally either side. I'd rather do it this way to create a small fillet in the gap created than use shims later to space the frames correctly. This gave me a fixture slightly oversize as required to be able to later machine the two side faces square.

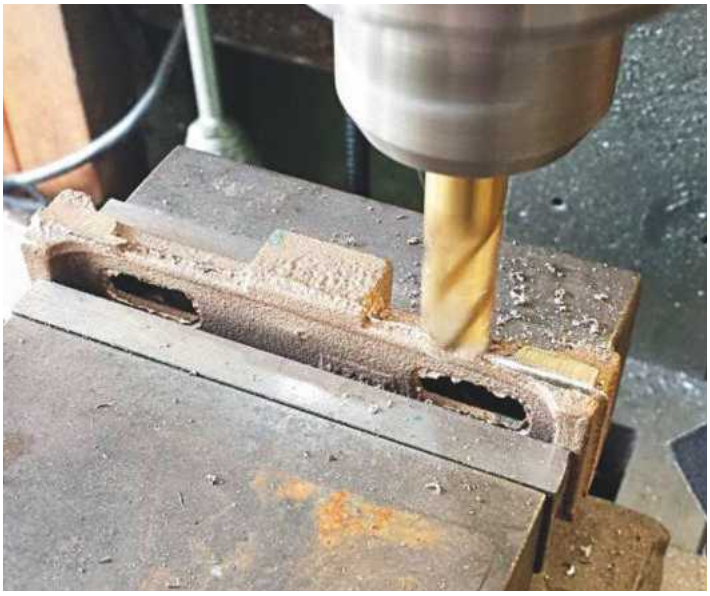
11. The picture shows how the stay was held in the chuck. I first clocked the stay to get it as true as possible, faced off and then tackled the other side. With no DRO on the lathe I took off just enough so that all of the face had been machined and then removed it from the chuck and checked the four corners and the centre for size. This showed a maximum discrepancy of 8 thou between all four corners. I noted all of the measurements, marked the stay accordingly, placed it back in the chuck, clocked it so that I had the corners sticking out by the amount they were over size to each other, held my breath and machined to size - and it worked.

12. The last job was to solder on the beading. The stay as seen here still needed a little filing and a good clean to finish. Fitting the stay to the frames followed the same procedure as with the others.

## Stays and stretchers

I turned up three spacers at 4⅛ inch length to space the frames accurately apart for fitting the stretchers as I began to fabricate and fit them. I hadn't realised until this point that the frames come in at the rear from the 4⅛ inch width to 3½ inches at the drag box - guess I missed that little bit of info.

The first stay is the simple frame stay that sits along the bottom edge of the frames below the expansion link. These parts are slot and tab construction although the bottom slot areas need machining off once they have been silver soldered together. For future builders there are two sizes for this stay so check which your locomotive had for your chosen era - as I'm building an A1 the smaller stay was required. I decided, to help ensure all stretchers fit correctly, to drill just two datum holes, one each side



*13. This is the inside motion stay and for this one a casting was supplied and used. The first job was to tidy up the stay as the casting was pretty rough. The bottom is machined flat leaving the centre angled section for later. The casting was then flipped over and machined - first the two ends close to final size, followed by machining the centre section flat. This just left the two wings which were lined up by eye, measured so both were the same and then the centre section was machined flat to join with the wings. I then machined the two end flanges to size.*

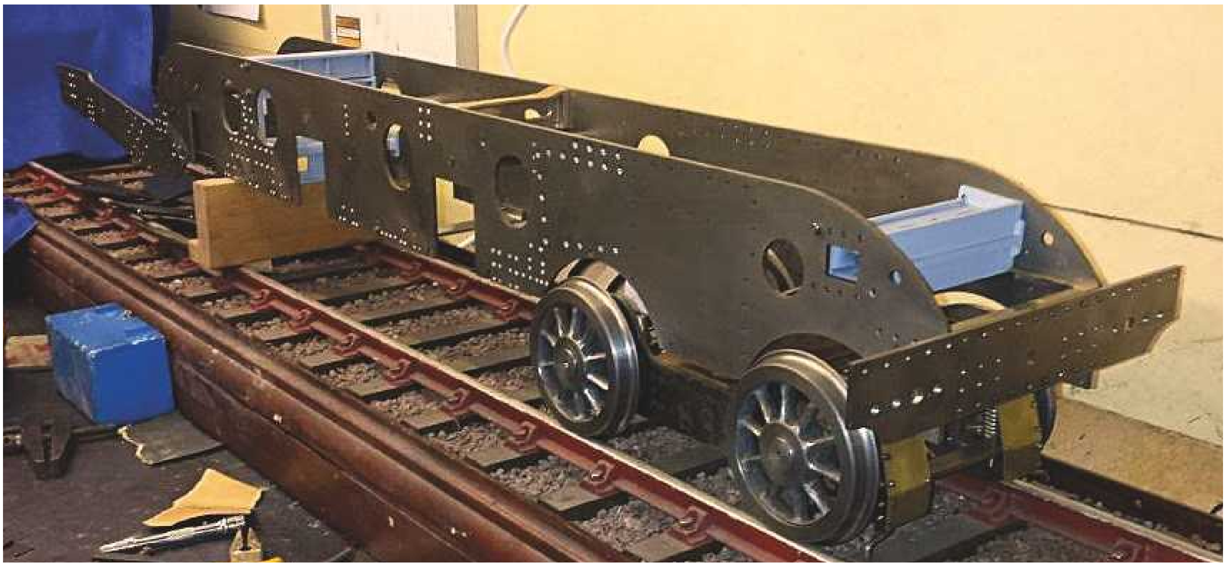

*14. Here we see the casting held in the tilting vice to have the centre cylinder slide-bar support machined at its correct angle of 7 degrees. My new digital angle finder came in handy for doing this. I also used the gauge to check the other axis to ensure all was square before machining as even though the casting was chocked up with a piece of steel to keep it square I wanted to be extra careful here as this part is very important.*

*15. This photograph shows the motion stay in place. The punch marks visible on the casting are for the centre of the slide-bar support, not the stay itself. As we look at the photo the distance from the punch mark to the right-hand frame is 2 inches and therefore the distance to the left is 2⅛ inches. The reason for this is that the middle cylinder is 'offset' and why Don calls it the 'middle' cylinder and not the 'centre' cylinder in his description.*

following the drawings for their correct positions so that each stretcher sits where it belongs. All other holes were transferred across in a mass drilling session once all stretchers had been made.

The next stretcher that I tackled (2:1 gear stay) was more involved and couldn't be fully completed until much later as the positions of its fulcrum and associated phosphor bronze bearings are critical for the proper operation of the 2:1 gear for cylinder timing. However all other parts could be made and its correct position on the frames could be determined.

● To be continued.



*16. Here are the frames so far, posing with the front bogie.*

**Noel Shelley** recalls his encounters with the Wash Monster.


*The LARC XV(15), hull no. 58.*

# LARCing About!

The second World War had shown the need for amphibious vehicles, of which the famous DUKW was the best known. This machine was a truck that floated but should not be confused with the LARC family which starts bigger, gets MUCH bigger but is also very much a boat with wheels!

The Lighter Amphibious Resupply Cargo (LARC) is a family of craft built for the US and German armies in 1967 to be able to unload stores from ocean going vessels at sea and then transport them to the beach or to an inland depot, or to get an army across inland waterways. It is NOT a landing craft!

The baby of the family is the LARC V(5), a five ton capacity machine on four large sand tyres, a fixed bow and powered by a Cummins V8 Diesel of 300hp. The hull is of aluminium of a special grade that salt water does not corrode. The control position is in the bow from which all functions of operation can be brought into play. The driver has options on two wheel, four wheel or oblique (crab) steering, two or four wheel drive and disc brakes on all four wheels. Marine steering is via a rudder with propulsion via a large propeller and a throttle to control speed. Loading and unloading was by crane or by hand. Many of these machines have been converted to offer amphibious tourist attractions around the globe.

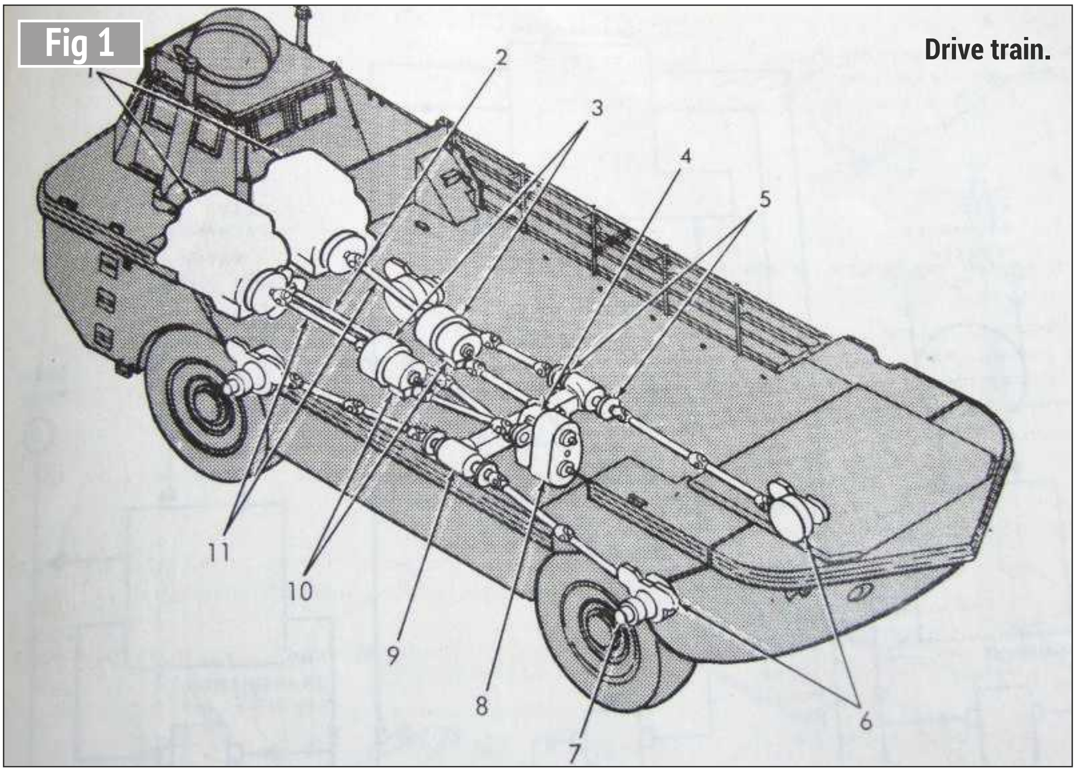
The largest of the family is the LARC LX(60). This huge four engine machine with a steel hull was, in good weather conditions, able to carry 100 tons!

The LARC XV(15) is the one in the middle. **Photograph 1** shows hull 58, one of the 15 the Germans had - only 100 were made. This machine is rated to carry 15 tons and, like the LARC V, has an aluminium hull. Its dimensions are 45 feet long, 14.5 feet wide, with four balloon sand tyres 6 feet tall to support the vehicle. The control position is at the stern and for the sake of simplicity all positions are referred to as if the machine is a ship! Two controls on the port bow operate the bow and foredeck which, in the lowered position, provide a drive-on ramp for vehicles.

In the wheelhouse are all the controls for driving the vessel. There are two steering wheels, one for marine use and another

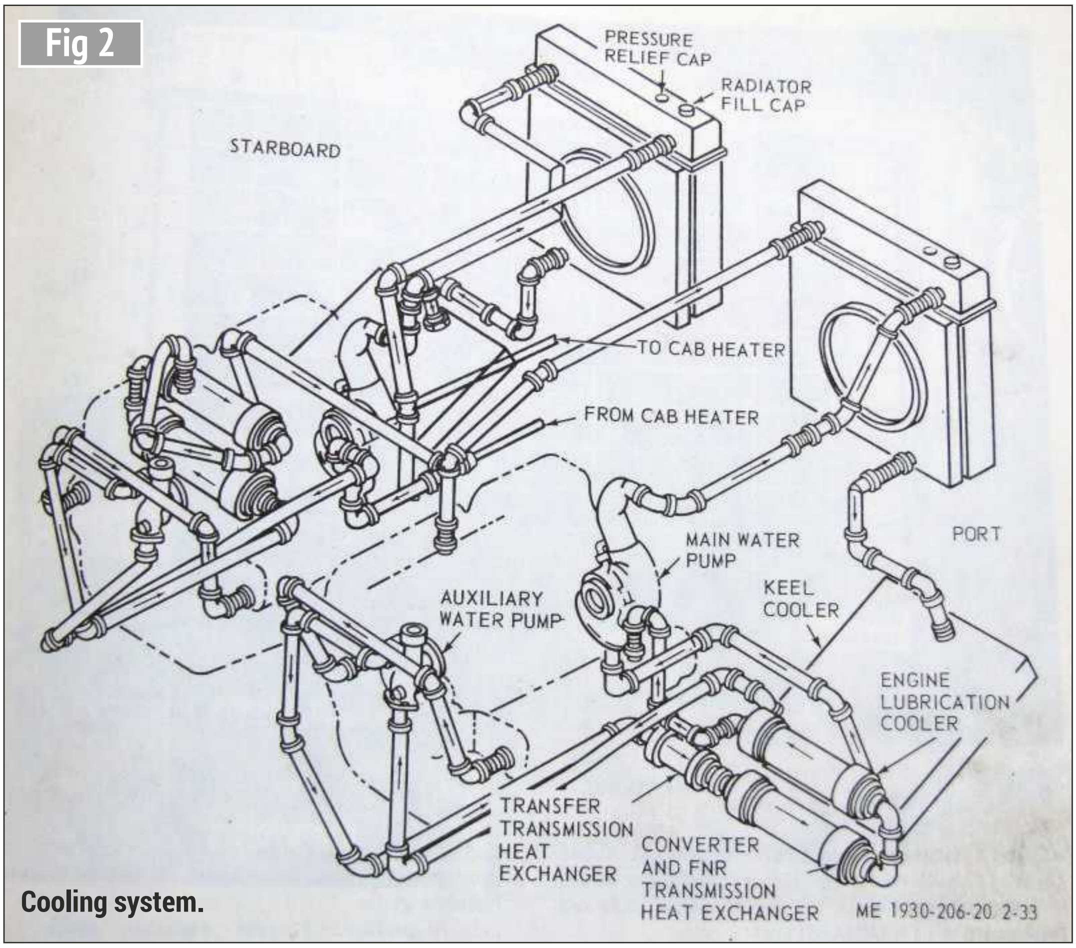

*Driver's view.*

Fig 1




Drive train.

Fig 2




Cooling system.

for use on land, two controls to operate the two forward–neutral–reverse (FNR) gear boxes, and one to operate the hi–neutral–low transfer box. There are two pedals, one for the brakes and the other for the throttle. On the starboard side of the control tower are three more levers, a hand throttle, a propeller engagement and steering selector – this gives the three choices: four wheel, two wheel, or oblique (crab) steer.

**Photograph 2** shows the driver's view. On the floor are a hand brake lever and two controls for two or four wheel drive. Power is supplied by two 13 litre V8 Diesels of 300hp. The transmission is a mass of Hardy Spicer universally jointed shafts. The drive line is as follows: engine, shaft, torque converter, FNR box, shaft, Hi-Lo transfer box, marine drive (propeller). Then, differential set, enclosed half shafts, 90 degree splitters/two or four wheel, two shafts each side to the four wheels, angle drives through the hull, Weiss joint constant velocity joints and epicyclic hub reduction to the wheels (**fig 1**).

Each FNR box has an auxiliary drive for the hydraulic pumps and gearbox oil pumps. The steering is powered by the hydraulic system, each wheel having two rams in push/pull and the bow/foredeck is raised or lowered by the same system.

The cooling is done by conventional radiators on land and heat exchangers when afloat by two systems that each hold 35 gallons. The radiator fans are electro clutch driven from the engines and when the propeller is engaged the fans stop to prevent water being drawn through (**fig 2**).

When you have familiarised yourself with the controls it's time to start the engines. Bear in mind you will be driving a 22 ton vehicle where you will be 15 feet above ground and effectively have a 40 feet bonnet! Oh, and by the way, it will do 30mph. It really is an interesting machine to drive.

If you want to see them in action, from April to October they operate off the beach at Hunstanton.

Why have I written this? In the hope that at least one reader will take up the challenge and build a model. I have worked on three of these machines for over 20 years and can provide photographs, drawings or dimensioned sketches that at ½ inch to the foot would make a very impressive radio-controlled working model. It could do things no RC boat or truck can. I can be reached via the editor in the first instance.

ME

# CLUB NEWS

**Geoff Theasby** reports on the latest news from the Clubs.

Today there is no engineering prologue
No humorous aside to bright your day,
No witty chat, no 'fancy that',
Just get on with it, they say.
And so my earnest and demanding Reader
Club News in its inimitable way...
In this issue; Fix-it TV, not a round tuit, a bender, two minnies, going walkabout, 'set the Smarties free' and apathy.

*Shoulder to Shoulder*, from **UK Men's Sheds Association**, reports that University College London has begun 6 research projects looking at combatting loneliness, isolation etc. and UKMSA has been chosen as one of them. Chris Lee writes on 'Fix-it' TV, four main programmes, only one of which does not mention filthy lucre. That is because those having items repaired or restored pay nothing for the professional services of the experts. Most of the time, none of these programmes mention saving repairable items from the tip, although this figures highly in many viewers' thoughts. My amateur radio station would not be so complex and extensive had I often bought new. Instead, most of it was acquired from radio club members, eBay, second hand from dealers etc. and many of them had to be made to work again before being incorporated into my station.

**W.** **www.menssheds.org.uk**

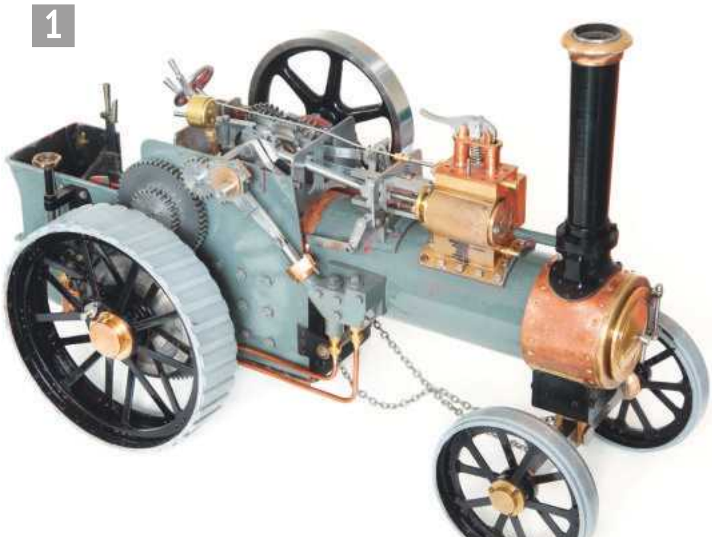
Reader, Andre Rousseau wrote to me on a different form of 3D manufacturing – using explosives! He referred me to a short video (*very* short…) (**ref 1**) and then a guy who makes explosives in his shed (**ref 2**). *Azide,* very sensitive to physical shock; don't try making model railway versions!

*The Blower,* April, from **Grimsby & Cleethorpes Model Engineering Society** has a picture of their club workshop on the cover. Never have I seen such a tidy area, with curtains even… It reminds me of an architect's house kitchen; plain, stark, unused, even for boiling a kettle. However, now that we all have entirely the wrong impression and the photographer has gone, it may revert to a more recognisable state. Chairman, Geoff Morgan has a quantity of blast furnace slag (don't ask!) and is wondering where to keep it. Answers, on a post card… Consideration is being given to the encouragement of social distancing when the site is reopened, including the thorny question of cash. (… behind the cistern, third washroom on the right). A suggestion that cash be collected in a bucket, perhaps using an 'exact fare' system, does not meet with this reader's approval. I regard the idea as a definite no-no. The public are paying for a good ride, but not to give the driver/guard/ticket collector an easy life. Of course, if the fares were set at one or two round (or Reulaeux heptagonal) coins, then there is no problem. 'New Loco Build Part 3' covers (pun!) Geoff Hoad making the body from flat aluminium panels, including the use of a sheet metal bender. Not a cheap weather-covering for robotic travellers, but a machine for accurately and neatly bending metal sheet. Andy Giffin discusses the pipework for his SAR 15F. Containing his impatience to steam it in his workshop when completed, Andy waited until all the portents were good, then submitted to and passed a steam test, followed by a swift revolution or twain of the track to celebrate.

**W.** **www.gcmes.com**

**Stamford Model Engineering Society** claims little to report this time. However, editor, Joe Dobson tells of having his Citroen TA radiator recored. The recorer had several other radiators in for the job, including a Rolls-Royce example which would run into four figures when completed. The fuel pump has now begun to play up and Joe is debating whether 'to fiddle or not to fiddle. Whether it is nobler to suffer the slings and arrows of outrageous fortune or leave the damn thing alone.' Keith Holderness built a Minnie. Here it is in all its glory. Very neat, don't you know (**photo 1**). Joe has also been building one, off and on, for some years; not an exhibition model or prize winner and he doubts it will ever run, but he has enjoyed making it. He also built a wagon, based on the type he used to play on as a child (**photo 2**). Tom Cruise has been filming Mission Impossible 7 at the NYMR, using a mocked-up locomotive bearing a resemblance to a BR Britannia, but a Class 66 provided the power. The Severn Valley Railway is host to a project involving the conversion of Class 08 635 to hydrogen power. The gas is

1



*Minnie by Keith Holderness. (Photo courtesy of Duncan Cubitt.)*


*3½ inch gauge wagon as above. (Photo courtesy of Duncan Cubitt.)*

stored in pressurised cylinders and fed to a fuel cell which generates electricity, driving the motors. The original engine has been removed but the motors are original.

**Bradford Model Engineering Society** May *Monthly Bulletin* has president, Jim Jennings telling us that he is not given prior notice of the contents of the *Bulletin* so he reads it with the same interest and surprise as everyone else. At this point editor, Graham Astbury says it comes as a surprise to him as well… Nick Percy has been reading about screw threads. In 1828 a certain manufacturer of threaded items, Mr. Clement, decided that screws should be a standard thread, rather than made to suit the job as required. One of his employees was a Mr. Whitworth, of whom you may have heard. The Fickle Finger of Fate, poor Mr. Clement, never heard of again. Unless, of course, you know different…* Three years ago, Mr. and Mrs. President were on holiday in Jutland, a sparsely occupied bit of Denmark notable for holiday cottages. Spotting an old barn with new-ish doors, enquiries revealed that within was a well-equipped workshop and a half size Bugatti in build. On learning of President Jim's interest in engineering, the occupant, an eminent naval historian and engineer, invited them to be shown round a preserved three-masted frigate, *Jylland* dating from 1860 and residing in Ebeltoft - said gentleman being officially involved with this ship. Michael Hawkridge, prompted by the trapped container ship in the Suez canal, explains how such ships are 'not just any' cargo ship, but specially designed for the task and very different from ordinary cargo ships in their construction.
**W.** www.bradfordmes.uk

**Model & Experimental Engineers, Auckland,** May *Newsletter*, begins with Michael Cryns returning with the clock mentioned in *M.E.* 4663. Comtoise clocks were made in France 'twixt 1750 and the late 1800s. They were very expensive and only the very rich could afford models like this one. Graham Bell produced a bolt from his backhoe, used to attach the cutting edge to the bucket. The ⅝ inch diameter bolt required torquing up to 200 foot pounds and is 8-8 alloy steel, core hardness 36-42 Rockwell and good for 170,000 pounds of stress.

**Chingford & District Model Engineering Club** *Newsletter* reports that chairman, Geoff and two others removed a dead tree opposite Ridgeway station, nearly removing the chairman too, but the tree did not survive the encounter. The club magazine, *Echo*, in 1953, discussed attending an event in Swindon, necessitating the arrangement of transport. This was humorously discussed, managing to insult everyone, equally. No favouritism here! The first stop was five miles away, having been 3½ hours on the journey. (I had a car like that, once … Oh, sorry, five miles from their destination… - Geoff). Junior member, Crae Smith writes on making himself useful at the club during his school's closure. Now he is back to a morning routine, rather than leaping joyously from his 'pit' 10 minutes before online lessons begin. Their next *Newsletter* informs us that the club has run test trains on recent weekends, culminating in the decision to hold Public Running Days, under social distancing rules of course, beginning on 25 April. Having run successfully for two hours, it all bodes well for a full reopening. More from the club's *Echo* in 1953 told of two visits to ships moored in Tilbury docks, involving guided tours. A problem arose, or came to a head, in November, when pressure of work, allied to lack of copy and enthusiasm by members, resulted in the failure to produce the *Echo*. Quick action by a few people saved it and an emergency issue was produced. A similar fate hovered over the evening club meetings and affected the Election of Officers with a miniscule turnout. What was wrong? Everyone consulted seemed to think that members were satisfied with the way the club was run and desired no real change.** Back to the present day; on a happier note, Ralph has been pondering the lantern for the front of his Virginia and despaired of finding a suitable solution until he encountered torches from Polymath Products whose Omnitorch is almost cuboid, is small enough, is powered by two coin cells and is fitted with magnets, such that it is almost ideal for providing the active components of the lantern (**photo 3**).
**W.** www.cdmec.co.uk

*The Newsletter,* May, from **York Model Engineers** has a picture of Clyde Puffer, VIC32 on the front. Why? Because it was built in Yorkshire, at Thorne near Doncaster, in 1943. A page of relevant information follows, giving a brief history of the ship and her current activities. A sister to VIC32, VIC27 is being restored. Model of the Month is a stone crusher by the late Brian Wardman, incorporating a rotating screen to sort the 'sheep' from the 'goats'. Editor, Roger Backhouse reviews *The Hull & Barnsley Railway, Volume 2*, by Nick Deacon. Mike Pindar features Esslingen locomotives of the T.C.F.T. (look it up… I don't understand Spanish - Geoff). Being Meyers and therefore less good with poor track, they had a distressing tendency to go walkabout, or maybe the only photographs available show them in embarrassing situations. Roger also reviewed Tim Bolton's *Ferguson*, about the man responsible for the excellent 'Grey Fergie' farm tractor. Thanks to the brilliant three-point mounting, devised by Mr. F., an astonishing range of implements were available to fit it. Paul Whattam refers to industrial 'jokes' that went wrong, beginning with the 'finger over the diesel injector on test' which resulted in an amputated finger. Other howlers mentioned were hundreds of new chain links for an automatic boiler furnace bed which proved not to fit; a reduction gear box specified as 24:1 but actually 1 rev per 24 hours; Paul himself confessing to catching himself making a 31½ tooth gear during a


*Ralph's torch-powered locomotive lantern. (Photo courtesy of Ralph Meanly.)*

>>

*Ian Welch's H&GR. (Photo courtesy of Phil Drummond.)*

morning after the night before; then a screw which resolutely failed to engage with the nut - due to it having not a continuous spiral thread but a series of grooves. All this pales into something or other when we learn that Paul's neighbour had great difficulty setting up a gas barbecue in his garden. Household Technical Consultant to the rescue. All engineers know that LPG gas bottles have a left hand thread (don't they?). Finally, the pièce de (no) résistance - Smarties are polished with beeswax in a large concrete mixer-type machine, then decanted down a moleskin-lined tube to be packed. One day the tube broke and three tons of polished chocolate beans cascaded across the highly polished parquet floor... Some were found tens of yards away! (Thinks: are Smarties the favourite sweets of members of Mensa?) The oldest signal boxes on Network Rail number four, all from 1871. One is at Poppleton near York and the rest are at Llanfair PG, Bootle and Drigg. (What about Trumpton? - Geoff)

**W.** www.yorkmodelengineers.co.uk

*Inside Motion,* May, from **Tyneside Society of Model & Experimental Engineers** has the news that yet another of Junior Engineer Sam Yeeles' photographs has been published, this time in Heritage Railway. It features 62005 at Battersby, near Whitby (perhaps Sam should be renamed, Railway Photographer/Junior Engineer? - Geoff) Dave Nesbit has completed his Princess Victoria and can be observed on YouTube (**ref 3**). Jim Scott has a Spot the Difference couple of photographs, one with a small jet of water being projected sideways from the swivelling outlet. Why? (How do you keep an engineering community, in suspense? - Please see the next issue!) (**ref 4**). Editor, Mike Maguire says that by the time it is published, there should be a cornucopia of articles, models and zillions of photographs of our lockdown activities. So, dear readers, over to you...

**W.** www.tsmee.co.uk

Our motoring correspondent, NGK Sparkright, offers more from Ian's Antipodean activities to be featured in a new, glossy magazine called *House and Garden Railway* and from the same publishers, for the more commercial reader, *What Shunter?* (**photo 4**). Readers who liked the Matra *Bagheera* photo will no doubt enjoy another, more conventional view (**photo 5**).

And finally, some gallows humour: the condemned man and the executioner are walking across the prison yard to the scaffold and it's pouring with rain. The prisoner says, *"It's a rotten day, isn't it?"* and the executioner replies, *"You can complain – I have to walk back in this!"*

* I know... Maudslay, Babbage, etc.

** I recall a club who formed a subsection for apathy sufferers. After a while, the Apathy section leader produced a newsletter and was promptly sacked for dereliction of duty (lacking sufficient apathy).


*More conventionally posed Matra* Bagheera *at Chesterfield.*

**Reference**


**1)** https://www.youtube.com/watch?v=96yhdnhPxAw

**2)** https://www.youtube.com/watch?v=-Sz4d7RQB6Y

**3)** https://www.youtube.com/watch?v=elfTlfI6NUY

**4)** https://www.youtube.com/watch?v=elfTlfI6NUY



**CONTACT**

**geofftheasby@gmail.com**

# Model Engineer *Classified*




**Complete home Workshops Purchased**
Essex/Nottinghamshire locations
*Distance no object!*
Tel: **Mike Bidwell**
**01245 222743**
m: 07801 343850
bidwells1@btconnect.com

**THINKING OF SELLING YOUR LATHE, MILL OR COMPLETE WORKSHOP?**
and want it handled in a quick professional no fuss manner?
Contact Dave Anchell, Quillstar (Nottingham)
Tel: 0115 9206123
Mob: 07779432060
Email: david@quillstar.co.uk