

THE ORIGINAL MAGAZINE FOR MODEL ENGINEERS

Vol. 225 No. 4644 • 31 July - 13 August 2020

MODEL ENGINEER

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

**Boiler
Cleaving**

**'Postie'
Lawson**

**We Visit
Hereford**

COVER FEATURE

Musgrave Engine

mytime media ENGINEERING GROUP



£4.20

BERWYN STEAM FABRICATIONS



**High Quality welding and fabrication of Steam Boilers
7¼ gauge upwards | 4 inch traction engines to fullsize
Narrow gauge steam Locomotives**

Our workshop facilities offer:

Full CNC milling and Manual Turning/Milling, Slotting, Fabrications
in a wide range of materials. Restorations & rebuilds, including new builds.

6 inch Devonshire Agricultural and Road Locomotive boilers and fully
machined components including Cylinder Blocks,
wheel hub assemblies. Part built or fully built models to your requirements.

Currently building:

- 6 inch Devonshire Agricultural and Road locomotive

- 7¼ Romulus Boilers • 4½ Burrell Plaistow Boilers

- New range of quality Bronze steam fittings for the larger model.

Please call or email Chris Pickard to discuss your requirements...

01691 860750 • sales@powysteelfabrications.co.uk

www.berwynboilers.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

© MyTimeMedia Ltd. 2020

All rights reserved ISSN 0026-7325

The Publisher's written consent must be obtained before any part of this publication may be reproduced in any form whatsoever, including photocopies, and information retrieval systems. All reasonable care is taken in the preparation of the magazine contents, but the publishers cannot be held legally responsible for errors in the contents of this magazine or for any loss however arising from such errors, including loss resulting from negligence of our staff. Reliance placed upon the contents of this magazine is at reader's own risk.

Model Engineer, ISSN 0026-7325, is published fortnightly by MyTimeMedia Ltd, Suite 25S, Eden House, Enterprise Way, Edenbridge, Kent, TN8 6HF, UK. The US annual subscription price is 132USD. Airfreight and mailing in the USA by agent named WN Shipping USA, 156-15, 146th Avenue, 2nd Floor, Jamaica, NY 11434, USA. Periodicals postage paid at Brooklyn, NY 11256. US Postmaster: Send address changes to Model Engineer, WN Shipping USA, 156-15, 146th Avenue, 2nd Floor, Jamaica, NY 11434, USA. Subscription records are maintained at DSB.net Ltd, 3 Queensbridge, The Lakes, Northampton, NN4 5DT. Air Business Ltd is acting as our mailing agent.

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

<http://twitter.com/modelengineers>



When you have finished with this magazine please recycle it.

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



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

Vol. 225 No. 4644 31 July - 13 August 2020

188 SMOKE RINGS

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

189 PARK STREET MILL ENGINE

Diane Carney introduces the mill engine modelled by Helmut Heitzinger.

190 MUSGRAVE NON-DEAD CENTRE COMPOUND STEAM ENGINE

Helmut Heitzinger builds a model of an unusual steam engine.

193 ENGINEERING'S LOCAL HEROES: 'POSTIE' LAWSON

Roger Backhouse takes a trip to Aberdeen to see the 'Craigievar Express'.

196 TEMPERING AND GEAR CUTTERS

Martin Gearing provides a step-by-step guide to making involute gear cutters.

201 MODEL ENGINEER VISITS THE HERFORD SME

John Arrowsmith visits his own club.

204 SMALL LOCOMOTIVE BOILER FEED PUMP

Malcolm High takes the work out of filling a locomotive boiler.

206 MODEL STEAM LOCOMOTIVE BOILER CLEADING

Tim Coles 'clothes' a pair of 5 inch gauge LMS 'Jinty' locomotives.

209 GWR 'COUNTY' LOCOMOTIVE

Robert Hobbs builds a 2½ inch gauge model of GWR 4-4-0 *County of Devon*.

211 CONFESSIONS OF A MODEL MAKER

John Moorhouse explains how you can maximise the chances of carrying out a successful project.

214 SIDING LOCKOUT DEVICE

Paul Tanner devises a scheme for preventing unwanted intrusions onto the running line.

215 A NEW GWR PANNIER

Doug Hewson embarks on a mission to improve LBSC's half century old GWR Pannier Tank design.

218 MURDOCK VERTICAL OSCILLATING ENGINE

Geoff Spedding builds this engine from castings supplied by the Myers Engine Works.

222 THE BARCLAY WELL TANKS OF THE GREAT WAR

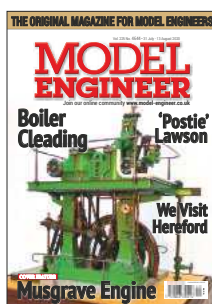
Terence Holland looks at the role played by the Barclay tanks during the Great War.

226 GARRETT 4CD TRACTOR

Chris Gunn steams up his 6 inch Garrett tractor for the first time.

230 CLUB NEWS

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



ON THE COVER...

Helmut Heitzinger's model of the Musgrave non-dead centre compound mill engine (photo: Helmut Heitzinger).



Supplied fully machined, assembly requires hand tools only – no riveting, soldering or other complex processes. Kit includes boiler CE 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.

Enquire for ready to run models. Worldwide export experience.

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

Tel: +44 115 9736700

5^g g. Timken Covers £6.00 ea.

7¼" gauge Screw Link
Couplings - £89.50 ea

Romulus
Wheels
£68.00 ea



7¼" Narrowgauge
Profile
Curly Spoke
£39.50 ea



5 1/4"
on tread

Silvertown Lubricators Kits

7¼" g. 12 Feed: £92.00
8 Feed: £86.00



5" g. 8 Feed £59.00 - 12 Feed (coming soon) £ 65.00



7¼" g. 2 & 3 Feed Oil Boxes
2 Feed: £16.50 pair
3 Feed: £18.50 pair



5" g. Plain Disc
Wheels - £9.75 ea



7 1/4" g. Plain Disc Wheels
£14.85 ea

7 1/4" Narrowgauge 6" Dia.
£22.85 ea.



A large range of buffers from
around £45 / set



Prices ex-works & excluding VAT



MINIATURE RAILWAY SPECIALISTS
LOCOMOTIVES, ROLLING STOCK, COMPONENTS
CNC MACHINING SERVICES

www.17d-ltd.co.uk

17D Limited, Units 12 & 13 Via Gellia Mill, Bonsall, Matlock, Derbyshire, DE4 2AJ

MAXITRAK.COM

40 YEARS
EXPERIENCE

The best of model rail and road.

Tel: 01580 893030 Email: info@maxitrak.com

5"
CLASS 20
FROM £1,900



7 1/4" **GALLOPING GOOSE**
READY TO RUN £3,895



5"
PLANET
FROM £995

Finance Available
T's&C's apply

PROMPT MAIL ORDER

TEL: 01580 890066

MAIDSTONE-ENGINEERING.COM

30 years experience providing fittings, fixings, brass, bronze, copper and steel
Browse our website or visit us at 10-11 Larkstore Park, Staplehurst, Kent, TN12 0QY



MODEL MAKING METALS

1/32in. to 12in. dia. bright steel, stainless steel, bronze, spring steel, brass, aluminium, silver steel, steel tubes, bolts, nuts & screws, tap dies + drills, white metal casting alloys.

Fine materials, chain, plastic.

Lathe milling machines and equipment, new and secondhand.

Mail order nationwide and worldwide callers

Mon.-Fri. 9 - 5pm. *All cards welcome.*

Send now for a **FREE** catalogue or phone

Milton Keynes Metals, Dept. ME,
Ridge Hill Farm, Little Horwood Road, Nash,
Milton Keynes MK17 0EH.

Tel: (01296) 713631 Fax: (01296) 713032

www.mkmetals.co.uk

email: sales@mkmetals.co.uk

CLOCK CONSTRUCTION & REPAIR

Books by:

John Wilding MBE
FBHI, E. J. Tyler,
John G. Wright, Eric
Woof, John Tyler
and others.

**SPRINGS
BEARINGS
FRAMES
DIALS etc.**

**FREE
Catalogue**

Telephone: +44 (0) 1420 487747

www.ritetimepublishing.com



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



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 ME4644P on the back

Cardholder's name

Card no: (Maestro)

Valid from Expiry date Maestro issue no.

Signature Date

TERMS & CONDITIONS: Offer ends 14th August 2020. 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 ME4644P

**HURRY
OFFER
CLOSES**
14th AUGUST
2020


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

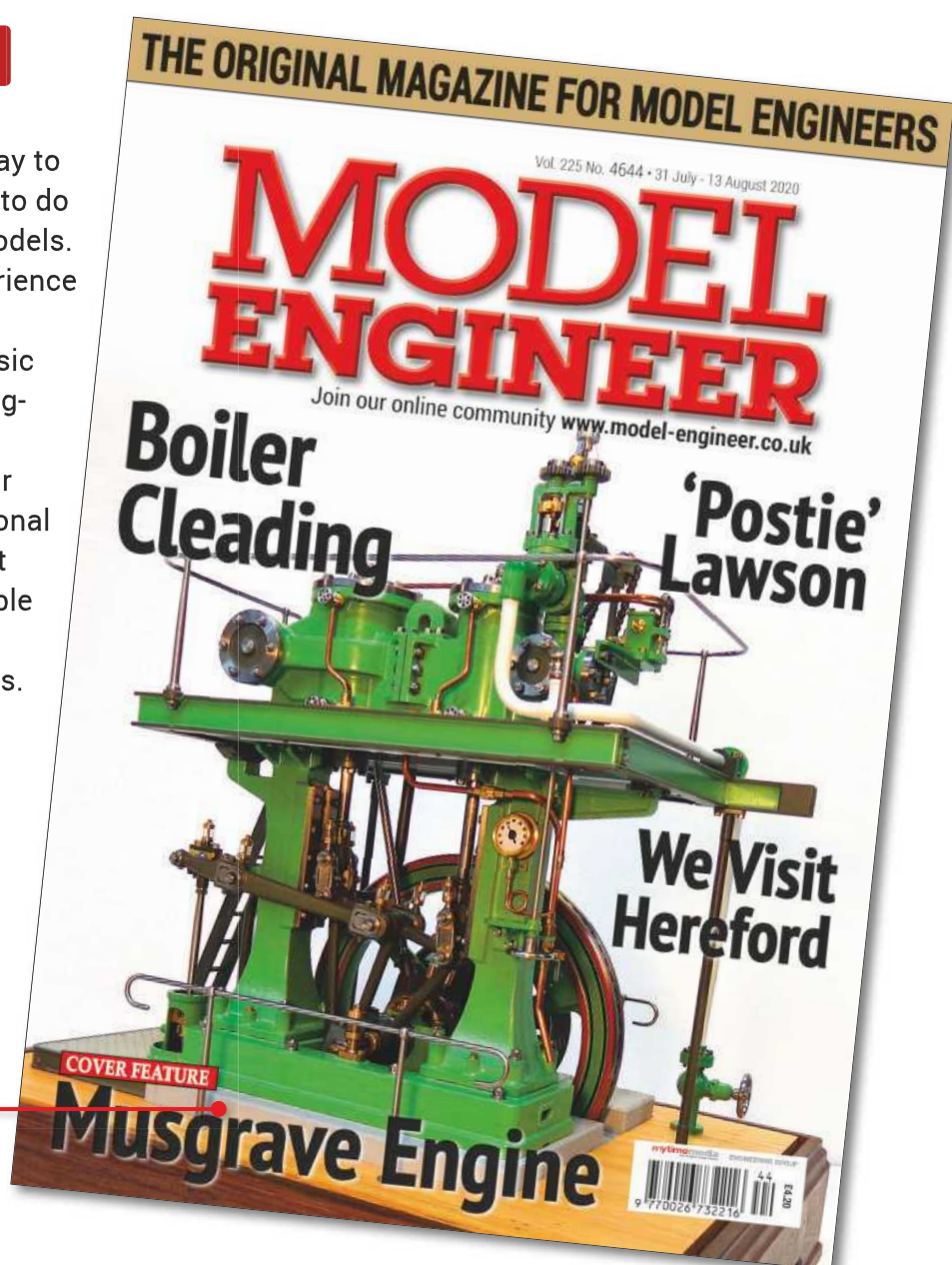
MODEL ENGINEER

SUBSCRIBE TO MODEL ENGINEER TODAY AND SAVE!

SAVE up to 41%**

Model Engineer is a great way to stay informed of everything to do with working mechanical models. With over 100 years of experience to draw on, Model Engineer covers everything from classic steam locomotives to cutting-edge modern developments in scale engineering. Regular content includes constructional articles, features on the best techniques and tools available and profiles of full-size modelling subject prototypes. Model Engineer magazine publishes 26 great issues a year.

**So subscribe today,
make great savings
and never miss
an issue!**



DIGITAL
SUBSCRIPTIONS
AVAILABLE ONLINE!

SUBSCRIBE SECURELY ONLINE

 <https://me.secureorder.co.uk/MODE/ME4644P>

CALL OUR ORDER LINE

 0344 243 9023

Quote ref: ME4644P

Lines open Mon-Fri 8am – 8pm GMT & Saturday 9.30am – 3.30pm GMT

Calls are charged at the same rate as standard UK landlines and are included as part of any inclusive or free minutes allowances. There are no additional charges with this number. Overseas calls will cost more.



MARTIN EVANS
Editor



DIANE CARNEY
Assistant Editor



YVETTE GREEN
Designer

Green Shoots

As life gradually returns to normal there is further good news for model engineers.

Many museums are now reopening their doors to visitors making proper engineers' days out a possibility again. These include the National Railway Museum (4th August), the Science Museum (19th August), the Natural History Museum (5th August), 'Locomotion' at Shildon (28th July) and the Victoria and Albert museum (6th August). All of these museums require you to book in advance and it's worth having a look at their websites. Entry to all of these museums is free of charge so they offer amazing value for money!

Many preserved steam railways are also reopening, including the Severn Valley (1st August), the Bluebell Railway (7th August) and the North Yorkshire Moors Railway (1st August). Other preserved railways are available... Do go for a wonderful day out on these railways – they need your money and you need a change of scenery! Again, it is probably best to check their websites to see if you are required to book in advance – in most cases that will be necessary.

I hope that our clubs will soon be able to reopen for steam-ups and will before long be welcoming visitors again to their sites. My own club has not had a meeting since the beginning of March and I look forward to the time – soon – when we will be able to resume. All these things help to re-establish the familiar rhythm of life and restore a sense of normality.

Greenly Royal Scot

Several readers have contacted me with information about Greenly's *Royal Scot* models, which come in various gauges from '0' to 7½ inches and possibly beyond. A number of interesting facts have been revealed, which I was not aware of:

Unusual Injector

Reader John Townsend has written to me as follows:

'In conversation recently I was reminded that some years ago I worked on a 7¼ inch gauge locomotive which had a type of injector which I have not come across before or since. It seemed to me to be a particularly simple injector to build and maintain and appeared during the short time that I had access to it seemed to perform well. Unfortunately, the locomotive went away to have some work carried out on it and the injector was removed and replaced by a more conventional one.

'Luckily, I had taken some photographs whilst the injector was in my care (attached) and I would be very interested to know if any other readers can identify the manufacturer (if it was commercial, as I suspect) or supply any further information about its construction, dimensions etc. Note that a significant feature of the design is the provision of two flat disc non return valves and ease of dismantling.

'Continuing the theme of injectors, I have sometimes pondered if these would work if submerged under water as there could be occasions when this could be useful. For example, an injector could be 'hidden' in a side tank in a scale locomotive where the original did not have injectors or had ones of a pattern that would not work on a very small scale.

'Presumably such an injector would need mounting against the wall of the tank so that the steam feed was kept as hot as possible. It would not be possible to see the overflow which would be in the tank although this could be taken out to a visible position. The body of the injector would be kept cold by the surrounding water (assuming the tank was not heated by an adjacent boiler). Am I missing something about the theory of operation which would make this impossible? Has anybody tried it?'

Does anyone recognise this injector or have any opinions about how it might work when submerged?



- * Maxitrak (www.maxitrak.com) sell copies of drawings from the Henry Greenly archive.
- * The Bassett-Lowke society has a Greenly archive (info@bassett-lowke.co.uk).
- * Drawings of Greenly's 3½ inch gauge Royal Scot are available from Kennions (www.glrkennions.co.uk).

I have also received offers of copies of drawings in various gauges. Many thanks to everyone who has kindly supplied information and offers of help.

Lockdown Showcase

Many thanks to all of you who have sent in photographs of your lockdown projects. These will appear in our next issue's *Lockdown Showcase*.

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

Park Street Mill Engine

Diane Carney provides the background to the engine that features in the following article by Helmut Heitzinger.



The prototype upon which Helmut's model is based abides within the Northern Mill Engine Society's collection at Bolton Steam Museum. It was the first engine the fledgling Society acquired back in 1966 and remains one of their most treasured possessions due to its uniqueness.

Supplied new to Barlow Brook Mill, Park Street - latterly Park Street Mill - Radcliffe (between Bolton and Bury), to the firm of Adam and James Hoyle Ltd. in 1893, the engine powered about 100 looms and the mill produced 'fancy shirtings, skirtings, checks, gingham, handkerchiefs, &c.'. The company is believed to have started in the 1850s in Irwell Street, Radcliffe, moving to Barlow Brook Mill in about 1870. The business was largely concerned with warping, weaving, bleaching and dyeing and finishing.

The layout of the engine goes back to a design by Flemming & Fergusson, marine engineers of Glasgow and was intended as a solution to the problem of getting plenty of power into a very confined space, which was not an uncommon scenario in either a ship's engine room or within smaller textile mills of East Lancashire. John Musgrave Ltd. of Bolton built stationary engines to this design - some up to to about 1500 ihp and some of them quadruple expansion - under licence from about 1892 and it's thought they produced about seventy such in total. It is essentially a two cylinder inverted vertical compound engine but with only one crank. The pistons are connected to the crank via a triangular connecting rod and pivoting links. The result is that there is no position of the crank at which the engine will not start, hence 'non-dead centre



engine', and this is the term by which they were known. Advantages of this layout, in addition to its compactness and ability to start in any position, included reduction in wear of the 'crosshead' guides as the connecting rods move in a truly vertical path.

The example at Bolton Steam Museum has cylinder bores of 10.5 and 16.5 inches with a stroke of 21 inches. The throw of the crank, however, is only 18 inches, thanks to the ingenious design. The engine ran at a fairly high speed of 120 rpm, enabled by the compact and robust design. Musgraves usually employed Corliss valves, with their own patent trip gear controlled by the governor, but in the case of this particular engine, which was relatively small and designed to run at only 100 psi with little variation in load, it was supplied with a less expensive 'throttling' governor and semi-rotary valves. It is thought that the Pickering governor it now carries may not be a Musgraves-made original.

As mentioned above, the engine is probably the most significant in the Northern Mill Engine Society's collection as not only is it the only surviving mill engine of this type but it was also the engine that started it all inasmuch as it was the first engine that the NMES's founder, David Arnfield, purchased. Park Street Mill had closed in about 1963 and in 1966 the young David, himself just a teenager at the time, hadn't the money to purchase the engine, a means of transporting it, nor a place to put it but he had a passion for mill engines and was determined to preserve this rare example. He managed to borrow the money, and a lorry, and found some temporary storage premises at Rochdale. With the help of two or three fellow members of the newly formed Society it was moved, piece by piece, through a narrow engine room doorway, over a makeshift ramp across Barlow Brook and onto the borrowed lorry. Thus began the largest collection of textile mill engines ...

ME

Musgrave Non-Dead Centre Compound Steam Engine

PART 1



The Musgrave engine in the Bolton steam museum.

Helmut Heitzinger constructs a model from photographs of a mill engine of an unusual type.



I am a relative newcomer to the hobby of model engineering. During the last few months of my working life I acquired a small lathe and a mill/drilling machine. Having been in manufacturing all my career, as a toolmaker building tooling for the automotive and aircraft sectors and also in custom precision-machining, building model steam engines seemed to be the ideal way to start retirement.

My first projects were of rather simple designs but I soon moved on to more involved undertakings. Then, a few years ago, I came across a construction article published in the USA which featured the making of a Musgrave non-dead centre, two cylinder steam engine. That model was based on a model on display in the Science Museum in London. It is not, however, a compound engine and is a very simplified version of the original engine.

At that time I was building a 4¾ inch gauge locomotive. On approaching its completion I came across another published construction article of the same Musgrave engine, also based on the same model in the museum in London. This time the article was published in a German model engineering

magazine which was given to me on a visit to Austria. This model was featured not too long ago in the *Model Engineer*. At about that time I purchased a copy of the special issue 'bookazine' published by the *Model Engineer*; '300 Years of the Steam Engine'. In it there is a photograph of a Musgrave non-dead centre engine on display in Bolton Steam Museum and it was upon this that I based the design of my model.

It is a two cylinder, inverted vertical compound engine with semi rotary valves. The high pressure cylinder bore is 10½ inches, the low pressure 16½ inches, with a stroke of 21 inches. The two pistons are connected to a crank via pivot links to a triangular connecting rod. The throw of the cranks is 18 inches.

As Diane Carney's short article explains, the engine was built in 1893, under licence, by Musgraves in Bolton. These engines were built in various versions up to 1500 horsepower depending upon their intended use. The engine in the museum in Bolton was used in the textile industry (photo 1). Following a conversation with a fellow model engineer I obtained a number of pictures which

he took during a visit to the Bolton Steam Museum whilst visiting the UK so I decided to have a go at it.

Questions immediately came up on how to obtain technical information about the engine as I was unable to find anything useful here in Ontario. This engine located in the Bolton Steam Museum is a two cylinder compound engine. As I have little or no experience in steam, the internal steam passages are something of a mystery to me. I contacted Neil Carney from the Northern Mill Engine Society and Neil provided me with more photographs from different angles so that I could stitch them together and get a more accurate idea of its internal workings as well as establish a proper scale for the model I was planning to build. At that time my decision was to use a scale of one inch to the foot. I was given a helpful sketch with the actual dimensions of the cylinder diameters, throw of the crank and special geometry of the yoke.

Armed with the pictures, the sketch and sizes of the original cylinder, I started some layout work by converting the supplied sizes into the scale for my model. There exists a computer program that will

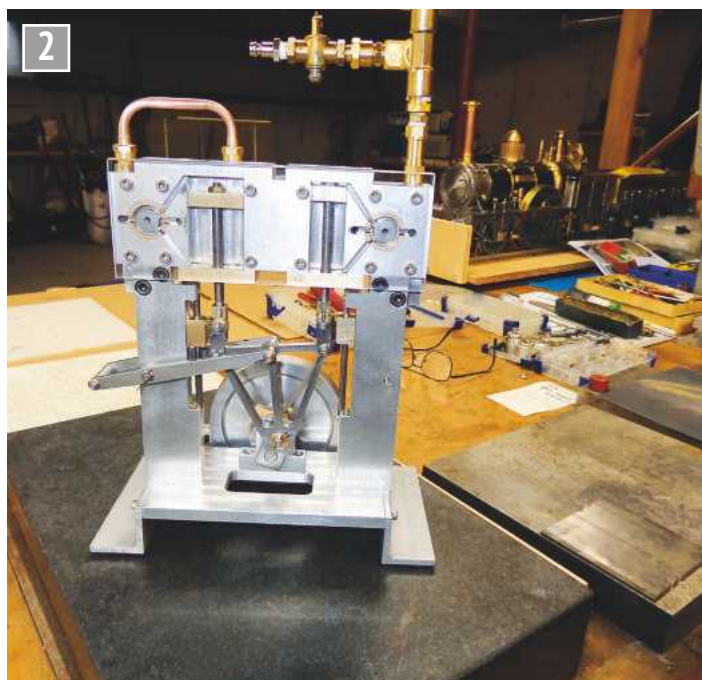
generate a 3D data file from a photograph; I have seen a presentation of it but this is way over my head. Perhaps in my next life ...

Design and building of a concept model

Before I proceed any further with this article I would like to clarify that in writing about this project there was never the intention to give a step by step description on how to build this model. It is a description of how I became involved, the processes I followed and how, consequently, I wanted to share my experience of building a model of this magnificent engine.

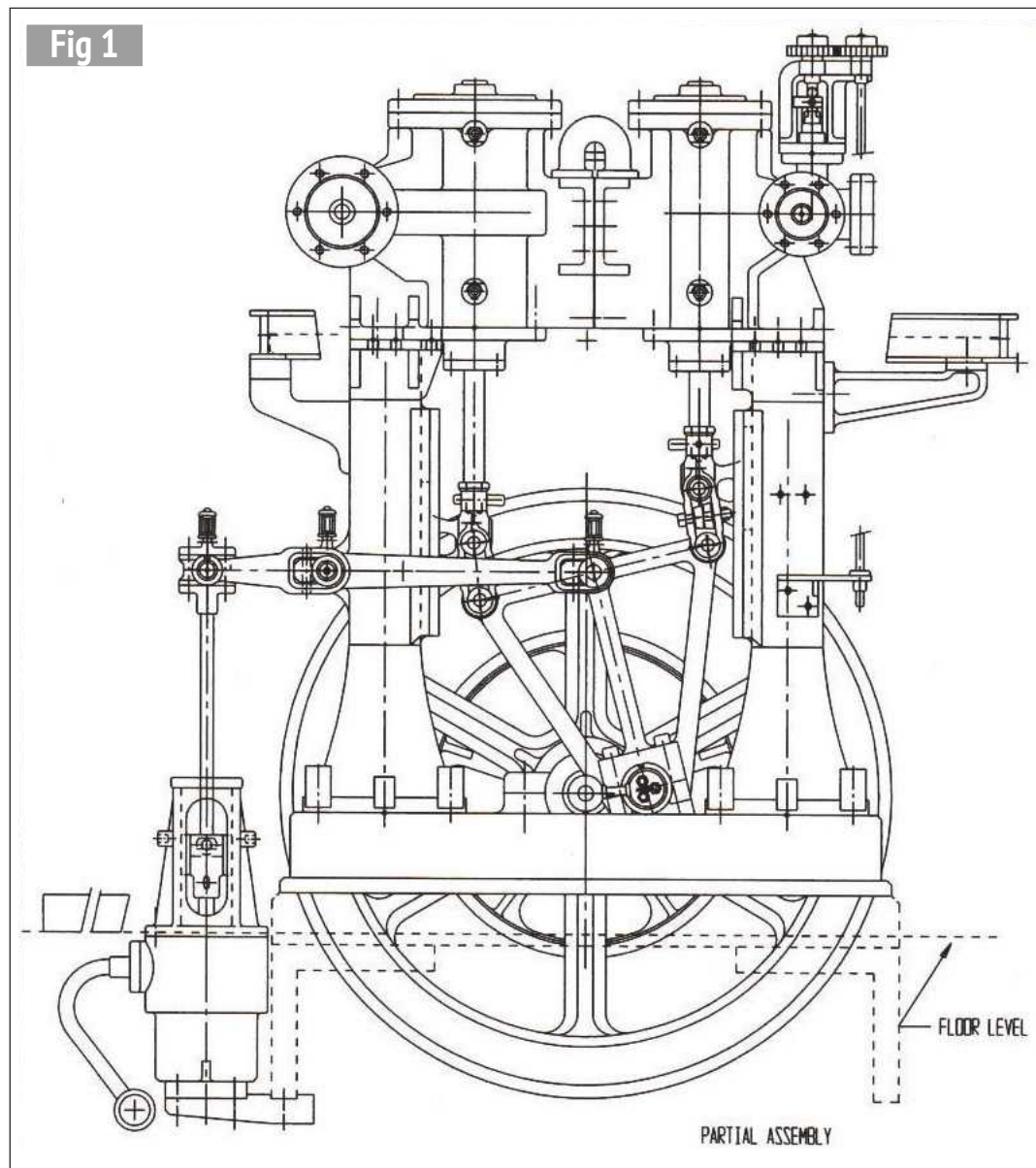
It soon became clear to me that to go ahead and start scratch building to an

untested model design might well lead to potential disasters that may prove costly to correct. I was not planning to use castings - there were none on the market anyway - so the next step was to design and build a concept model out of aluminum using the already calculated sizes for all the motion. The rotary valve motion, piston travel as well as the geometry of the yoke could be verified before cutting expensive material. It is worth noting that the throw of the crank is different from that of the piston travel. To make things more interesting there is also a slight difference in piston travel between HP cylinder and LP cylinder due to the pivoting motion of the pivot arm, links and the yoke.



The concept model built to check the operation of the engine.

Fig 1



A word about my method of making drawings. I am using a low-end, professional design software called CADKEY19. I have not upgraded it since 2003 so it is not up to date. It has full solid modelling capability which, to my regret, I never bothered to learn properly. I use it only for 2D drafting, utilising only some of its features. (I have no intention of producing proper drawings as that would probably turn out to be a project of its own.) I also want to mention the use of a digital readout on my milling machine. I do not have a drill press in my workshop so all my drilling is done on the mill. I never use the dials on the hand wheels as I rely on the DRO for everything ... and I mean everything. What a fabulous tool!

Now, back to the concept model. My original intention was to build the concept model out of wood but decided eventually to build it in aluminum with square pistons and short rotary valves open to the front. It would then be easy to see what was happening and make the required adjustments. After about two weeks the model was finished and I was ready to start checking out all the

movements of the rotary valves and piston travels (photo 2).

After adjusting everything to the calculated settings I installed a clear plastic plate to seal in the pistons and valves. I could not resist adding an air supply to it to see what would happen. To my complete surprise the thing started to run without even giving it a little tap! Now I was convinced it was safe to proceed with the design of the actual model, not having a lot of reworking to deal with. The design for the real model would therefore use the same sizes for all valves, cylinders, pistons and most moving parts.

Design and construction of the model

I established a general layout envelope around the already (hopefully) correct moving components. I scaled the photographs to come up with dimensions for the cylinder bodies, support columns and

all the other items in that part of the cylinder assembly. The photographs showing the cylinder casting geometry from all sides provided enough information as to what the internal steam passages may look like which, in a compound engine, are quite a bit different from a non-compound two cylinder engine. The issue about the receiver will have to be left to a later stage. All the rest of the items, such as the platform around the top, oil pump, required plumbing, steam regulator and of course the Pickering governor will have to take a back seat for now. **Figure 1** describes the engine but, for clarity some components are omitted.

Machining of the base plate including front main bearing block

I used aluminum here as there is no soldering required. All holes have been drilled in position using the DRO; the same applies to milling

out the pocket which will accommodate the crank movement. Two quarter inch diameter dowel holes were drilled and reamed from the bottom ½ inch deep. The same locating holes are used for locating the base to the 'concrete' foundation. The prototype shows eight raised bosses for the bolts that would hold the engine base down to the foundation. In this case the bosses are actually plugs pressed into the base which protrude about ⅛ inch to look like a casting. The main bearing support bracket is set in a pocket. On either side of the base there is a boss containing a slot. I have no idea of its purpose. Since the prototype has it, I pressed in a rectangular plug which included the slot. There are also four one eighth inch diameter reamed dowel holes which will be used to temporarily locate the two upright columns during assembly (fig 2).

At this stage I think I would like to explain how I prefer to work with my drawings. Since they are only for my own use I dispensed with all the 'proper' embellishment. After establishing the final geometry of a component, I only add dimensions to the drawing that are required for the next machining set-up. This way things don't get over crowded with dimensions that are unnecessary for this particular set-up. That, of course, would never do in a real manufacturing environment but it works for me. I would also like to point out that I seldom use layout blue and scribe lines only when it saves me trouble down the road. This eliminates the time-consuming clean-up afterwards.

●To be continued

NEXT TIME

I shall machine the high pressure and low pressure support columns.

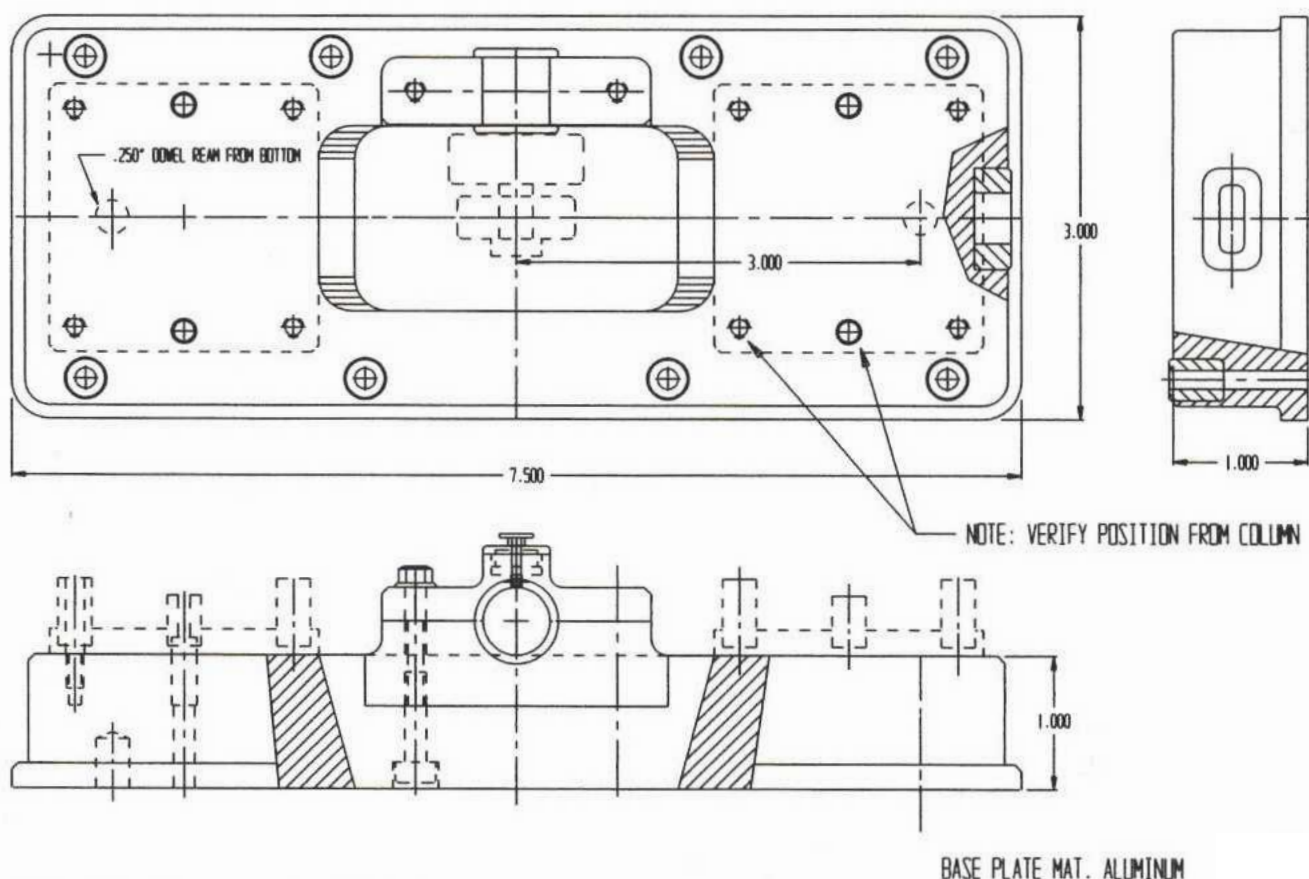


Fig 2



A picture of 'Postie' from the Aberdeen Evening Press 1897. The paper justly described him as 'a man of invention and industry'.

Side view of the Craigievar Express in Grampian Transport Museum.

Engineering's Local Heroes 'Postie' Lawson

Roger Backhouse tells the story of Andrew 'Postie' Lawson and his Craigievar Express.



Many pioneering 19th Century engineers came from well-off families. Some self taught engineers, however, came from more humble origins and managed remarkable achievements. One such was Andrew Lawson of Craigievar, Alford, Aberdeenshire.

The remarkable steam carriage he created, nicknamed the 'Craigievar Express' gained him local fame (photo 1). His daily work as a postman - hence the nickname 'Postie' - afforded him little time for hobbies but he managed to acquire skills and read widely (photo 2).

Andrew Lawson was born in 1854 near Craigievar and remained close to his birthplace. He is reputed to have made a bicycle, probably a boneshaker type, when he was just ten years old.

After school he trained as a carpenter but at the age of 18 he took up his father's career as a postman. The job offered secure employment and duties included collecting mail from Whitehouse Station on the Alford branch, and delivering between there and Craigievar. For this extensive round the Post Office made a small allowance towards use of a horse. He used his carpentry skills to make two carts for summer and winter post carrying.

When he married Mary MacPherson he built a cottage on the site of an old school, employing a mason to build walls whilst he did the carpentry. Stone and timber came from the hillside above the cottage so he devised a rail-less, self acting incline system linking two carts with a rope going round a pulley

on the hill above, so that the loaded cart descending pulled up the empty wagon. There is no mention of braking so perhaps there was none.

With the Burn of Gorse (or Corse) running near his cottage, 'Postie' created a water wheel driven system, turning a lathe and sawmill in his workshop. Later, he used this to power a dynamo, generating some of the earliest hydroelectric power in Aberdeenshire.

'Postie' delivered newspapers and magazines on his rounds. Sometimes engineering publications were passed back to him once read so, by this means, he learned of recent developments. He also subscribed to the *English Engineer* and *Exchange and Mart* from where he obtained parts from advertisers in those pages. Another important

hobby and source of income was photography. He built his own studio and produced portraits and postcards of the local area, also giving lantern slide shows locally. Later, he tried filmmaking.

He began making his best-known machine in 1895. The Craigievar Express, as it was nicknamed, was a remarkable work of home engineering (**photo 3**). With this invention he became a pioneer of the 'horseless carriage' as Scotland's first 'car', a Panhard, did not run until December 1895 in Kelso. Andrew Lawson's machine, however, was steam powered. There was no motor car in the Alford area until summer 1896 though some steam engines would have been used for farm and perhaps forestry work.

His design was a three wheeler with a triangular pine frame. He added an oak subframe to carry the boiler and engine. The wooden front wheel was basically an enlarged wheelbarrow type (indeed, another one of his sidelines was making wooden barrows for local people). A local blacksmith fitted iron rims to the wheels and may have also made the conical smokebox and ash pan.

Most equipment was second-hand with gears probably obtained from a machine tool drive.

Thanks to his regular reading of *Exchange and Mart* he obtained a vertical boiler without any fittings from England (**photo 4**). The single cylinder engine came from an Aberdeen sawmill (**photos 5 and 6**).

Although his wife regarded the carriage as a waste of time and money, his son James showed keen interest. Whilst at school in Aberdeen, James monitored the work of a local company making boiler parts including the water gauge, safety valve and pressure gauge.

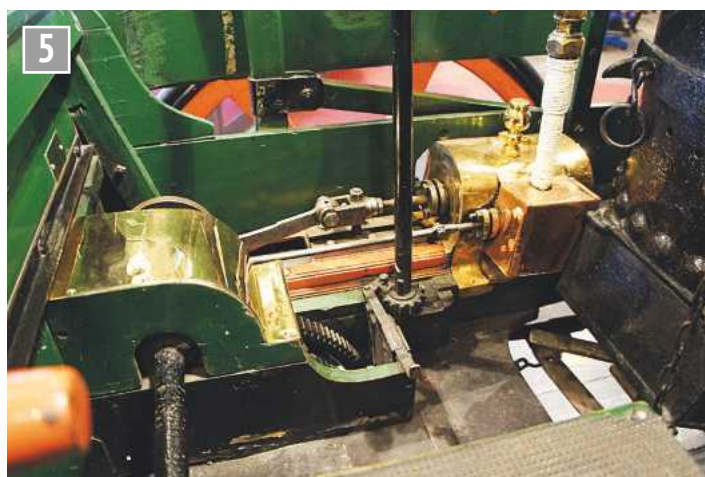
Steering was by means of a small tiller, with linkage to the front wheel, offering little leverage (**photo 7**).



Pine and oak frame for the Express.



The boiler came from England thanks to an advert in Exchange and Mart. Fittings were made in Aberdeen.



This single cylinder engine came from a sawmill. The vehicle was unusual in having a differential gear on the rear axle, under the brass cover.



Single cylinder and valve chest with slide bars.

Unfortunately the machine was not self steering so it was difficult to control. There was, however, only one recorded accident when the machine lost control and tipped over, breaking off the safety valve. Thankfully no-one was hurt.

The suspension worked on the rear wheels only and it must have been a bumpy ride. One unusual and advanced feature for the time was the differential gear on the rear axle (**photo 8**). There was a flywheel brake and also a horse carriage type brake operating on rear wheel rims (**photo 9**).



A vertical pillar with a short-handled lever is the steering gear linked to the front wheel; the machine must have been difficult to control.



View underneath showing the differential.

It is interesting to see how Lawson's carriage related to other early road vehicles. Frederick Bremer's car was the first built in Britain and ran in 1894 at Walthamstow but it received little publicity. Perhaps this was because the maker had breached Benz patents and did not want this known. Bremer's car looks more like a later motor vehicle than Lawson's steam carriage. (The Bremer car is now in Vestry House Museum in Walthamstow. See also *Model Engineer* Vol 197, No. 4277, 7 - 20 July 2006) (photo 10).

The first run was on 26 June 1897 from Lawson's home near Craigievar Castle to

Whitehouse Station. Later he wrote to the magazine, *English Mechanic and World of Science* to say that the carriage was good at hill climbing but had trouble keeping a constant steam supply. Not surprising given the small boiler. He used his carriage intermittently, complaining about the price of coal. It would have been unsuitable on his usual delivery rounds, especially on unmade tracks.

However 'Postie' demonstrated the vehicle at Alford and district events achieving local fame. He retired from the Post Office in 1914 and died aged 84 in 1938 earning obituaries in several Scottish newspapers.

After his death the Craigievar Express was sold to an Aberdeen man but



Rear wheel with a simple rim brake to the left. Solid rubber tyres replaced iron in the 1960s restoration.

later repurchased by his son James Lawson to ensure its survival. It was then preserved by Lord Sempill at Craigievar Castle and was steamed on several occasions such as, for example, at Aberdeen's 1953 Coronation parade.

After Lord Sempill's death in 1965 it was passed to Mr. M. A. Smith of Surrey, a writer and transport historian. He gave it a complete overhaul, re-tubing the boiler and also replacing iron tires with solid rubber. It also gained a suitably historic registration plate. The vehicle completed the London to Brighton run in 1971, the oldest coal-fired vehicle to finish.

The Express is now a centre piece in the Grampian Transport Museum in Alford where it is occasionally run (photo 11).

The museum has many other notable vehicles, including the oldest surviving Sentinel steam waggon, built in 1914, and a Cruden Bay Hotel Tramcar plus other regularly changing exhibitions.

ME

ACKNOWLEDGEMENTS

Much of the material in this article comes from the excellent museum publication, *The Craigievar Express: the story of Andrew 'Postie' Lawson. A remarkable pioneer.* Grampian Transport Museum. 2010, 35pp £3.

I'd like to thank Peter Donaldson and Mark Jeffery for their valued help with this article.

THE MUSEUM

At the time of writing the museum is closed due to Covid 19 restrictions but it is hoped to reopen by Autumn or earlier, Government permitting. The museum collection is well worth visiting. It featured in *Model Engineer* Vol 219, Nos. 4565 and 4566, 21 July - 4th August 2017.

Grampian Transport Museum
Alford, Aberdeenshire
AB33 8AE

W. www.gtm.org.uk
Tel. 01975 562292

The Bremer car featured in *Model Engineer* Vol 97, No. 4277, 17 August 2006.



The first car built in Britain, Frederick Bremer's i/c engine car of 1894, now in the Vestry House Museum, Walthamstow. Bremer wears the bowler hat. Reproduced by permission Vestry House Museum, London Borough of Waltham Forest.



Front view of the Express in the Grampian Transport Museum.

Tempering and Gear Cutters

Martin Gearing discusses the use of his button cutters for making involute gears.



Continued from p.161
M.E. 4643. 17 July 2020

There are four stages in making a four-tooth continuous relieved involute gear cutter using the button formed profile method, as follows.

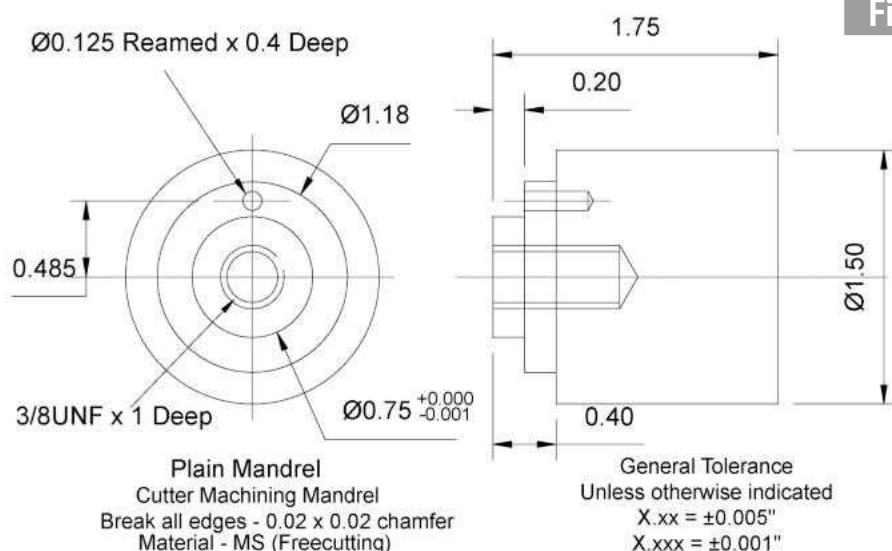
Making the two mandrels

Machine plain cutter mandrel (fig 2)

Material: Free cutting MS 1.5 inches diameter x 1.75 inches. Set blank to run true in the four-jaw chuck with 0.70 inch protruding (photo 9). Face off, centre drill, drill 0.332 inch diameter x 1 inch deep and tap $\frac{3}{8}$ inch x 24 tpi.



Truing up the plain cutter mandrel blank.



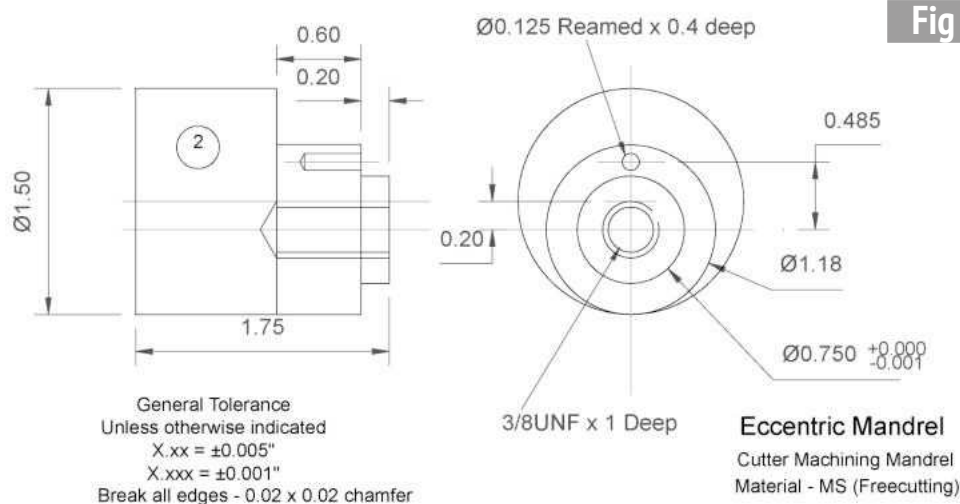
Machine 1.18 inches diameter x 0.40 inch. Machine 0.750 inch diameter x 0.20 inch (note tolerances). Break all sharp edges. Transfer to mill. Clamp work with axis vertical. Centre spindle to 0.750 inch diameter. Move 0.485 inch on X-axis and clamp table. Drill and ream 0.125 inch diameter x 0.40 inch deep.

Machine eccentric cutter profiling mandrel (fig 3)

Material: Free cutting MS 1.5 inches diameter x 1.75 inches. Set blank eccentric in the four-jaw chuck to give a DTI total run-out reading of 0.400 inch with 0.75 inch protruding. Face off, centre drill, drill 0.332 inch diameter x 1 inch deep and tap $\frac{3}{8}$ inch x 24 tpi. Machine 1.18 inches x 0.60 inch. Machine 0.750 inch diameter x 0.20 inch (note tolerance). Break all sharp edges (photo 10).



Initial machining on the eccentric cutter blank.



Transfer to mill. Clamp work with axis vertical, and with the orientation shown on the drawing.

Centre spindle to 0.750 inch diameter. Move 0.485 inch on X-axis and clamp table.

Drill and ream 0.125 inch diameter x 0.40 inch deep.

Machine two 0.125 inch diameter dowel pins (fig 4)
Material: Drill rod/silver steel 0.125 inch diameter x 0.65 inch.

Hold the pin in a collet or the three-jaw chuck, face off and chamfer.

Turn around, skim face, remove, measure, replace in the chuck, bring to 0.60 inch long and chamfer.

Repeat for the second pin.

Making the button forming tool

Note that the following example is the manufacture of the buttons and holder required to produce a 20 tooth 14½ degree pressure angle 16 DP gear for use as an additional lathe change wheel.

This would require a No 6-16 DP -14½ degree PA cutter (range 17 – 20 teeth).

From table 1 (part 1, M.E.4643, 17th July) we get:

Pin diameter = 4.256

Pin centre distance = 5.574

Infeed = 2.470

Width of cutter = 4.000

These figures have to be divided by 16 (the DP) giving the following figures to work to:

Pin diameter = 0.266 inch

Pin centre distance = 0.348 inch

Infeed = 0.154 inch

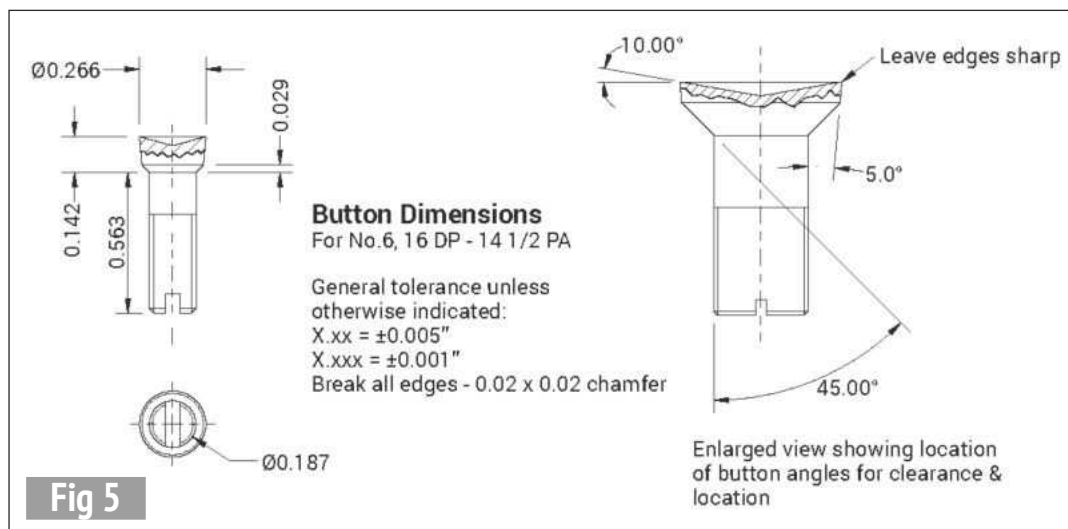
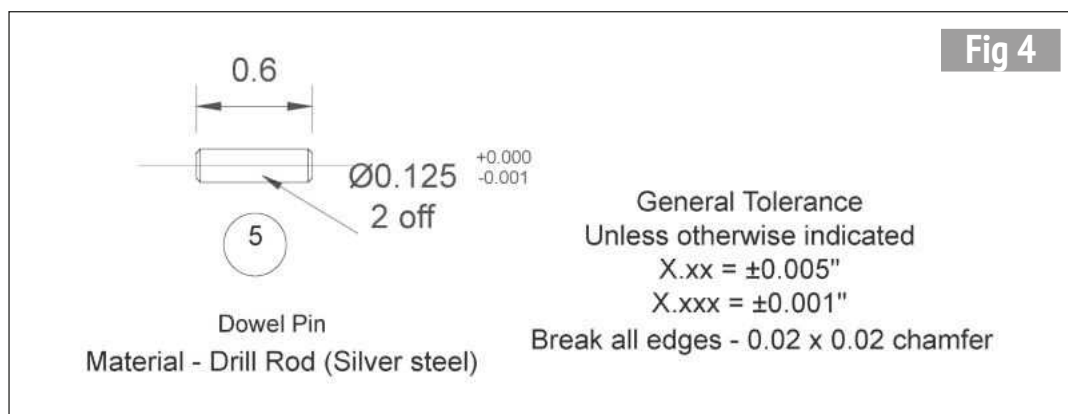
Width of cutter = 0.250 inch

Please refer to fig 1 (part 1, M.E.4643, 17th July) for terminology.

Machine a pair of button blanks (fig 5)

Material: Drill rod/silver steel. Turn the shank diameter and 45 degree seat and thread (either 8 – 32, 8 – 36 or M.E. ¾ inch x 32).

Note this should be the largest size that can be accommodated whilst retaining a meaningful 45 degree taper seat.



Parting off a button blank.

Turn the specified button head outside dimension 0.050 inch oversize. Part off 0.100 inch over length (photo 11). Mark ID on each button at the thread end.

Produce button tool holder to suit tool post on lathe (fig 6)

Material: MS bar, 0.75 x 0.375 inch.

Drill, ream and countersink two 0.125 inch diameter holes at the locations shown.

Drill ¼ inch at location shown

then remove waste and any sharp edges. Mark button ID at each location (photo 12).

Install buttons in holder
See photo 13.

'Top' buttons
Level up button holder and face across the top of the buttons until both surfaces are level (photo 14).

Buttons installed in the holder.



A completed button tool holder.





14 'Topping' the buttons.

Profile clearance angles on buttons (fig 5)

Hold the button in a collet or set true in a four-jaw chuck (photo 15).

Turn the outside dimension to the specified diameter. Coat the end face with a coloured marker.

Set the compound slide to produce the 10 degree top rake angle on the end face and machine the end face taking small cuts until the coloured marking on the end face JUST disappears (photo 16). Cover the surface of the diameter with the coloured marker.

Then with the compound slide set over to produce the 5 degree side clearance angle, take small cuts working from back face until the coloured surface JUST disappears (photo 17).



15 Setting the button to run true.



17 Forming the clearance angle on the button.

Fig 6

Button Holder Dimensions

Buttons & Holder
For No.6, 16 DP - 14 1/2 PA

General tolerance unless otherwise indicated:

X.xx = ± 0.005 "

X.xxx = ± 0.001 "

Break all edges - 0.02 x 0.02 chamfer

Harden and temper the buttons

Refer to the first part of this article. Then install the tempered buttons in the holder (photo 18).

Making and forming the cutter

Produce the initial cutter blank (fig 7)

Material: 2 inch diameter drill rod/silver steel or ground flat stock/gauge plate. Bring the blank to the calculated thickness of 0.250 inch ± 0.001 inch. Take care to get both faces parallel.

Drill and ream/bore a 0.750 inch hole in the centre. Note the tolerances if boring. Mount the cutter blank on the plain blank machining mandrel (fig 2) and turn 1.890 inches outside diameter.

Using the indexing unit drill and ream the four dowel holes at 90 degree intervals 0.485 inch away from the centre of the 0.750 inch mounting hole. See the blank at the left in photo 19.



16 Forming the top rake angle on the button.



18 Buttons installed in the holder.

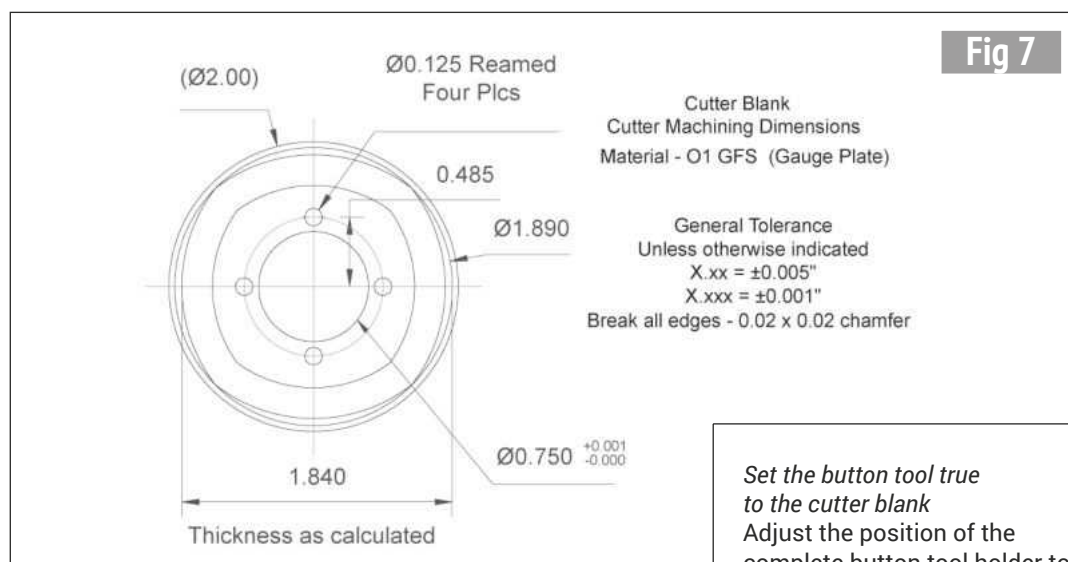
Mount the cutter blank on the eccentric profiling mandrel (fig 3)

Turn the first 1.840 inch eccentric diameter shown on the drawing. This is measured over the **lowest point** of the eccentric surface and the **back plain turned diameter**. Either set a stop on the cross slide (photo 20) or zero the cross slide dial.

Index the blank 90 degrees and repeat, cutting the remaining three eccentric diameters to the stop or dial zero. See the finished blank at the right in photo 19 and photo 21.



19 Cutter blank (left) and profiled cutter (right).



Set the button tool true to the axis of the lathe
I used the tailstock quill as

a reference, interposing a piece of tool steel to enable a sensitive 'feel' (photo 22).

Set the button tool true to the cutter blank
Adjust the position of the complete button tool holder to locate equally on either side of the cutter blank. Lock the saddle and zero the cross slide dial (photo 23).



Stop set on the cross slide.



Profiling a cutter.



Truing the button tool in the toolpost.



Adjustment of the button tool position.



Machining the profile.



A finished cutter blank.

Machine the profile to dimension at four locations

Using a slow speed and cutting lubricant, machine the profile to the specified infeed depth (table 1, photo 24). When profiling using larger diameter buttons it may be necessary to 'joggle/nibble' the tool a couple of thou side to side using the compound slide as the depth increases, to reduce the cutting loads but remember that the final stage on the infeed must be true to the centre of the cutter blank (photo 25).

Mount the cutter blank on the plain blank machining mandrel (fig 2)

Mount in the indexing head and set true in the horizontal plane.

Set the 'high' points on the cutter blank (fig 8)

Turn the mandrel and cutter blank in the chuck so that the peak between the two profiles, both top and bottom, lines up with the blade of a square placed on the machine table. Tighten the chuck (photo 26).

Gash out at four equal points around the cutter

Position an end mill to cut 0.290 inch deep from the 'peak' of the profile and on the Y-axis set it to the right of the 'peak' (photo 27).

Machine through the blank, on the X-axis, in four places, at every 90 degrees.

Move the Y-axis by the diameter of the cutter used, to bring it to the left side of the 'peak' on the blank. Index the mandrel anticlockwise 45 degrees and machine through the blank in four places at every 90 degrees.



Lining up the high points on the cutter blank. ➤

If necessary, clean out the gash by making a further cut midway between those completed. Remove all burrs (**photo 28**).

Harden and temper the cutter
Refer to the first part of this article.

Stone the cutting faces
Stone the flat cutting face to produce an even 'grey' surface. Do not touch the machined profile (**photo 29**).

Cutting the gear

Calculate the depth of cut
The whole depth of cut is 2.25 divided by the DP. As the example is 16DP this is 2.25 divided by 16, resulting in a depth of cut of 0.141 inch.

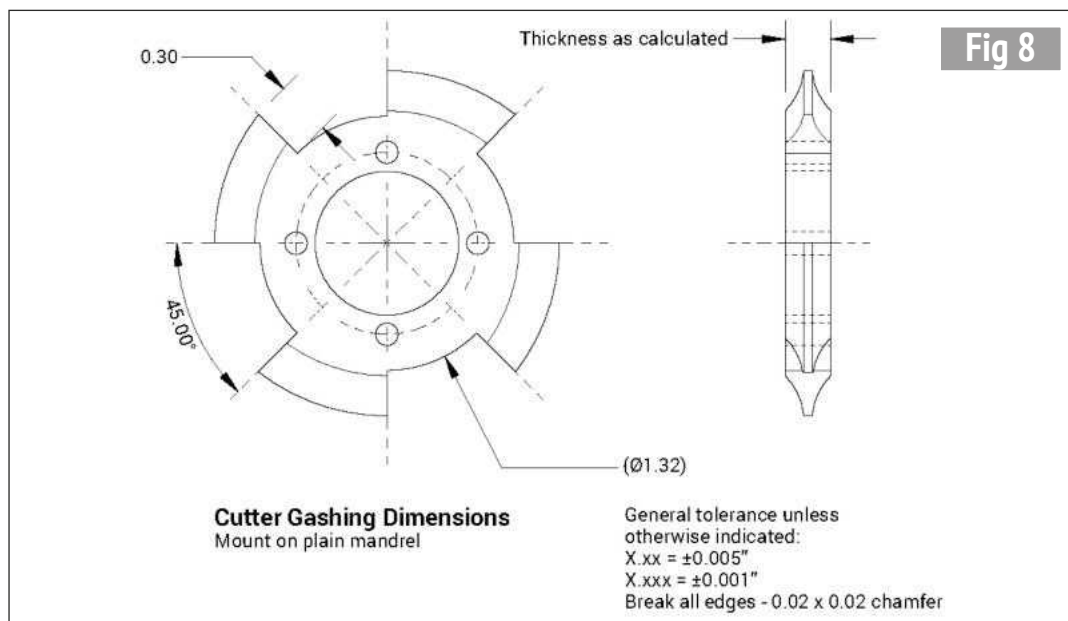
Cut the gear, after mounting the cutter on the mill mandrel
Suggested speed is 70 RPM for steel/cast iron (**photo 30**). If you arrive at this point and have indexed correctly, you will find all the teeth will fit around the blank. If you can run the cutter through the first tooth cut after completing a full rotation and find that **NO SWARF** is produced you will experience one of the greatest feelings of pleasure/RELIEF to be found in a workshop (by old and new alike)!

The cutter illustrated has cut six gears made from a 2 inch diameter high tensile stud and, as can be seen, shows no sign of wear (**photo 31**).

Did you notice?

The eagle eyed amongst you may have noticed that the buttons and holder in the preceding pictures are of different proportions to those dimensioned and used to produce the example. This is simply because to show the detail as clearly as possible of what in reality are very small items, I simply used the largest buttons and holder I had available in an effort to get clearer pictures.

The gear and cutter shown in photos 29, 30 and 31 are however of the same size as the example being 20T – 16 DP – 14½ degree pressure angle.



Gashing out the profiled cutter blank.



Cleaning out the gash.



A finished cutter.



Cutting the gear.



The cutter and the gear.

The difference between the sizes of assembled button holder used for the example and that used for the illustrations may be seen on the right and left of **photo 32**. **The underlying principle is the same regardless of the size being made and is governed by the dimensions calculated from the values extracted from the chosen tables.**

Realistic times

Assuming you have the plain and eccentric mandrels to hand, and excluding the hardening and tempering

time - which if following my previous article, is mostly done whilst you're in bed - you could reasonably expect to achieve the following:

- Locate all the sizes required to produce a working sketch.
- This would allow you to make two buttons, one holder, one cutter blank (which like the mandrels is always the same size).
- Finally, profiling and gashing a cutter in around 6 hours for the first one; any following that would be around 4 hours.

That's been my experience and I'm not a particularly quick worker, spending a fair bit of my time picking up things I've dropped or looking for spanners I've just put down!

●To be continued.



A pair of button holders.



Not much of the station can be seen in the flood.



Hereford's splendid club house was spared the ravages of the flood.

Model Engineer visits the Hereford SME

John Arrowsmith takes us on a conducted tour of his own club.



This was my first visit since the nationwide lockdown began and as it is my own club I thought it would be a useful contribution to *Model Engineer* as the restrictions begin to be slowly removed.

The Hereford Society is a well-established club, having been formed in January 1962 with six members, two of whom are still active, myself being one of them, and a third original member now living in Canada. The current membership is now

approaching a healthy 130. The winter of 2019/20 was not kind to the club with four major flooding events seriously affecting both the fabric and the operation of the railway (**photos 1 and 2**). The purpose of my visit was to see how the members are coping with the after-effects of such a prolonged wet season which has been further affected, like all model engineering clubs, by the coronavirus pandemic.

2019 had been a good year for the Society with lots of public events being

well patronised and a good working program for members; sometimes the club is fortunate to have nearly 40 members attend on their Tuesday working day which means the clubhouse is nearly full at lunchtimes and plenty of work does get done despite all the chatter and banter. For the time being all this has had to be put to one side while clear up operations are in progress (**photo 3**) and then when the social distancing measures came along, they affected that as well. My visit on the normal Tuesday work day showed what has been going on and I wanted to see the prospects for 2020.

Before the virus struck, work was progressing at a pace repairing all the damaged rolling stock and locomotives caused by the flooding as well as all the infrastructure that had been damaged. Those of you who are familiar with Broomy Hill will know that the main workshop is behind the carriage shed on an elevated floor about 4 feet above the rail head (**photo 4**). Well, for the first time in 26 years this



Chairman Wally Sykes repairing one of the flood damaged fence panels.



The view inside the carriage shed showing the main workshop floor level which was also flooded.

workshop was flooded as well (photo 5). From existing flood records this was the first time since 1795 that the river had been at this height. You can imagine the site after this much water had been flowing over the area and the damage and debris left behind. Not a pleasant sight I can tell you.

However, by coincidence during the early part of 2019 the local water authority had laid a new drainage pipe down the road adjacent to the site and had conveniently added a couple of additional blanked off connections in the large manhole adjacent to our main gate. Following the first flood on Hallowe'en, which completely damaged most of the rolling stock and locomotives etc., Chairman Wally Sykes decided that to get rid of the water more efficiently than waiting for natural drainage, a new land drain should be connected

up across the site and into the new manhole. A survey of the land showed that it was possible to get a decent gradient on the pipe, so it was decided to go ahead and try and get this pipe installed before the next flood.

Working in very soggy, wet ground some members looked like the navies of old as the pipe laying went on. As the site is part of, and adjacent to an SSSI, permission had to be sought from the Environment Agency to do this work and I have to say they could not have been more helpful. Permission was granted within two days of applying so the work could progress without any bureaucratic problems



The Bridgeport mill surrounded with water.



The land end of the new cross site drainage pipe needs another connection chamber.

holding things up. The job was completed in another two days although the installation at the site end has yet to be finished (photo 6). It proved its worth a few weeks later when the next flood arrived. With a receding river the site was almost

out any task they felt needed doing as long as they obeyed the instructions. For example, sitting on the ride on mower to cut the grass (photo 7) was allowed as long as there was a second person on hand to cover the health and safety aspects. This has worked very well resulting in the ground areas looking quite smart.

Other small groups of two have been attending to the damaged boating pool which had one complete side collapse during the inundation. The virus problem resulted in the Sweet Pea rally being cancelled for June along with all the usual public running days and Young Engineers Saturdays. However, it is not all bad news: because of the lockdown and the inability to operate public running days our local authority have presented the club with a compensation payment of £10,000 to cover the losses

drained the day after. Two more floods quickly followed and again the pipe proved its worth. Then the coronavirus hit and a new set of problems affecting the workload started up. To try and arrange some sort of work program the committee decided that the site could open on its normal work day with strict social distancing measures being clearly advertised around the site. Two people could carry

From existing flood records this was the first time since 1795 that the river had been at this height.



Like all clubs the grass needs constant attention - here secretary, Trevor Carter has the mower duty.



The new club locomotive is a Romulus variant.



The Young Engineers training room also provides space for the new club locomotive.



Part of the OO gauge 'Ledbury' layout under construction with the 30 arch viaduct on show.

for the year, which has helped with the cost of repairs, and put a smile on the face of the treasurer.

Unlike many clubs, Hereford has a thriving Young Engineers section with six or eight young people together with their mums or dads regularly turning up on Saturdays to carry on with their current projects. Among the projects under construction at the moment is a 7¼ inch gauge Irish Railbus, a freelance 7¼ inch 0-4-0 electric locomotive, a self designed hot air engine, plus some gauge 1 rolling stock. On top of that the group have won a couple of National Awards. Harrie Wills is the Northern Association Junior Engineer and Matthew Kenington is the Southern Federation Young Engineer of the year as well. All this of course augers well for the club's future as all these young people have got their families involved which means

that the age profile of the club has improved tremendously.

The seniors in the club are busy with a new 7¼ inch gauge *Romulus* which is making steady progress (photos 8 and 9). If it hadn't been for the floods and then the virus problems it could well have been in steam this year. It may still do so but there are quite a few jobs yet to be completed. Then of course the OO gauge layout of the local station at Ledbury is also making good progress, with the well known 30 arch Ledbury Viaduct in prominent view (photo 10). The interesting point about the building of the original viaduct in 1859 is that it is all brick built with the bricks being made on site from the clay dug out for the foundations. How about that for a 'carbon neutral' building site in the Victorian era?

The main running track has been cleaned and points

oiled along with reballasting as required so if and when the lockdown is removed sometime soon then the club will be almost ready to resume operations (photo 11). A comprehensive meetings program had been organised for the winter and spring months but again these have been postponed. The club are

now hoping that later in the summer a short operating season can be arranged before everything has to be shut down again for the next flood season starting in November. Everyone at the club is looking forward to welcoming visitors again in 2021 when hopefully it will be operating to its capacity.

ME



Hope springs eternal as the hanging baskets add some colour to the site.

Small Locomotive Boiler Feed Pump

Malcolm High describes his electric feed pump for a gauge 1 locomotive boiler.



Water pump box and container.



Pump and battery mounted in the box.

Sometimes projects lead you in a very different way to the one intended - this is one of those. The requirement was to fill a gauge 1 boiler whilst it was in steam at 60 psi. Normally this is done with a garden hand spray adapted for the purpose. Personally, I found this awkward and slow. I decided to acquire a suitable electric pump to do the job. These are available on the internet for a modest sum; they are designed for use in large caravans. Working on 12 volts they will deliver 6 litres per minute at 130 psi. More than enough for my small boiler's needs.

The box I made is shown in **photo 1**; it is made of steel and TIG welded. I had it laser cut with all the relevant holes

made for me. The container is a car windscreen washer fluid bottle from a large supermarket, which has a capacity of 2.5 litres. It was cheaper to buy this than an empty container.

To connect to the tank and the ENOTS connector I originally turned some brass fittings. However, I had great difficulty in getting these to seal so eventually bought some commercial barbed connectors; one straight and one at ninety degrees. These were tapped out M6 to take the filter and connector. For the connecting tube I used 8mm inside diameter silicone. This is more expensive than PVC but gives a far better seal. Building the unit posed few problems and on its first test

worked very well, filling the boiler in just a few seconds.

I didn't want to carry a 12 volt gel battery with me so looked for a smaller unit. I have used LiPo batteries for some time in model aircraft and boats. This would be the obvious way to go but with Lithium Ion batteries being so popular in hand held tools I decided to investigate that route instead. This type of battery is available from a number of suppliers on the internet and they all look the same. Charging is by a simple mains plug-in adaptor that we are all used to seeing. The battery pack had a capacity of 6800 mAh and would easily fit in the space I had. It would run the pump for nearly an hour, which was much more than I

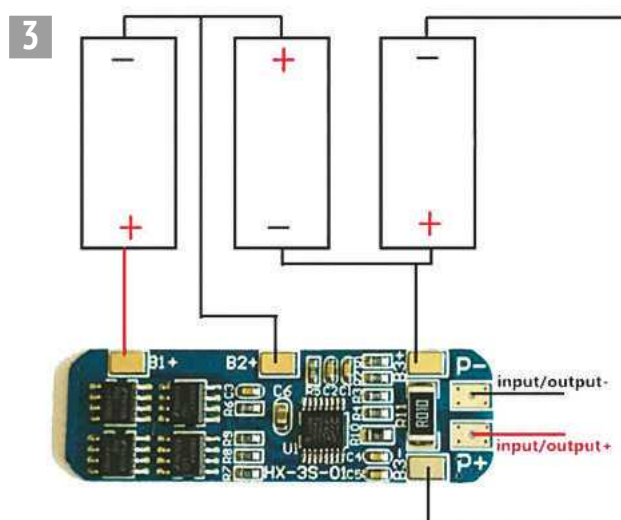
Parts available from Malcolm at www.modelengineerslaser.co.uk

needed. I sent for a couple and we were away, or so I thought. The final box with the pump and battery installed is shown in **photo 2**.

At the Manchester show in 2018 I was asked if the pump would be suitable for filling a 5 inch gauge boiler. The enquirer went to a number of tracks and every one had different facilities for filling and supplying power. With the pump he would be totally independent of the facilities and also have the possibility of filling the boiler when in steam if both injectors failed. I had seen the same pumps mounted in a tender at the Chesterfield club and the driver used these to fill his boiler, so I thought yes, I do not see why not. What I had not taken into consideration was the battery being used for a number of minutes instead of just a few seconds.

In my innocence I had assumed that Lithium Ion batteries would supply almost any current you required, as do LiPo batteries. With LiPo batteries the maximum current is a multiple of the capacity, so a 2000 mAh battery at 50°C would supply a current of up to 100 amps - not for long but it would do it. After a lot of investigating I found that the batteries I had were limited to one amp continuous and two amps in surges. This was not identified on the web site.

The Lithium Ion battery pack has an electronic board inside that protects the batteries from overcharging and over discharge. The maximum voltage per cell is 4.2 volts and they should not be taken below 2.7 volts. It was the electronic board that had stopped working, not the batteries. You have to use batteries rated for the current required and marry them up to a suitable protection board. I found some 10 amp rated cells and a 3S 10 amp board. 3S denotes there are three cells in series. The wiring diagram is a simple affair (**photo 3**). Basically, there are connections across each battery back to the board. There is only one set of power



wires; these do for both the charging and discharge of the cells. I suspect the monitoring wires only take an amp or so at the most but to be safe I used the same wire as I did for the power connections. During charging the board monitors the voltage across each cell; when it reaches 4.2 volts the charge is reduced so as to protect it.

With the cells made into a pack and the board connected it was time to test the unit and of course there were no volts at the output wires. One of the cells must have been flat. After connecting it to a charger (12.4 Volts) the pack worked well. I 3D printed a box for the cells and mounted them in the pump box. The charging point is a 2.1mm 2 amp connector which can also be used as a power source for a blower fan, which I now turned my attention to.

The blower unit is shown in **photo 4**. It is a centrifugal fan. The housing expands towards the outlet and the latter has a small evase to convert some of the air speed into static pressure. The blades are backward facing - a forward facing bladed rotor would require more blades and hence more work! The rotor is a simple slot and tab construction, the tabs being bent over to hold the unit together. The central boss is tack welded in place. The body of the blower is another tab and slot TIG welded construction. Then we come to the motor.



Blower speed control.

I had a small, fairly powerful, or so it seemed, twelve volt motor in my 'will be useful one day' box and it has proved to be up to the mark. When I looked for these on the internet I could not find another but there are a number of brushed can motors available. In the end I settled on a 550 but there are a number of variants even on that. No load speed seems to start at around 4,000 rpm going up to 20,000 rpm. Apparently, it depends on the number of turns on the armature. The fewer turns the faster the motor and the higher the current. A mid-range 13,000 rpm motor takes around five amps and produces an excellent draught, possibly too much, so I sourced a suitable speed control which will actually handle up to twenty amps. I 3D printed a suitable box as shown in **photo 5**.

At the same time there was a need for a new blower for *Hady Belle*, the Chesterfield club



The small blower unit.

Lithium ion battery protection circuit.



Large blower on Hady Belle.

engine. This has had a major overhaul and is now doing regular passenger hauling. I scaled up the fan I had already designed and found a ball raced motor with an 8mm diameter shaft. I have probably used too many blades - five or six seem to be the optimum and I have ten. The fan draws well and takes just under two amps (**photo 6**). Twenty four volt versions of the motor are available; these double the 3,000 rpm of the current motor.

I have not included drawings of the parts in the article but if anyone is interested in building any of the above I can supply drawings or laser cut parts.

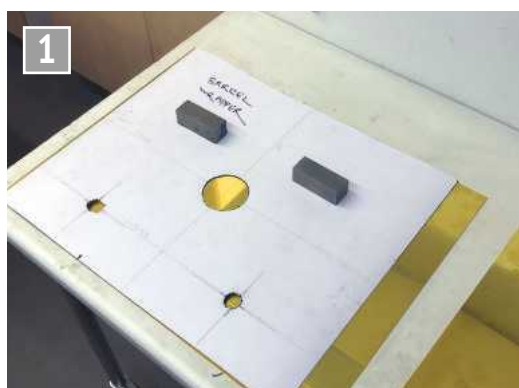
I found the project to be very interesting. When I started on the blowers I looked for some guidance on the internet but did not find what I needed. Subsequently I have and the dimensions I chose do not seem to be too far out but it would be interesting to redesign it using the correct formulae.

ME

Model Steam Locomotive Boiler Cleading

PART 1

Tim Coles clads the boiler for his 7¼ inch gauge 'Jinty' tank locomotive.



Marking out the template.



Cutting out the insulating material.

My copy of The Shorter Oxford English Dictionary (actually, two hefty tomes) defines the word 'cleading' as 'a protective cover, casing or lagging', which seems to describe the insulation and sheeting on steam locomotive boilers quite well. Approaching the completion of a pair of 7¼ inch gauge 'Jinty' 0-6-0 tanks, I was recently faced with the job of fitting the two with their boiler cleading. The Belpaire fireboxes of the original locomotives made for an interesting challenge and, bearing in mind that these are practical working scale models, here's how I went about it.

The boiler barrel on the Jinty is simply a parallel tube, which makes the cleading relatively simple. The first job was the manufacture of a cardboard template, to fit snugly between the front of the firebox and the back of the smokebox and to roll round the barrel with say ½ inch of overlap at the join. Locating the position of the hole for the dome was simple; it's on the centreline and you can easily measure the distance back from the smokebox and cut the required hole to fit neatly over the dome bush. Getting the position of the holes for the two feed clack valves on the side of the boiler was less simple, but no great accuracy is needed at this stage. The cardboard I used was 1.3mm, or about 50 thou thick and this rolled nicely around the barrel. A new blade in my Stanley knife helped cut the template to overall size and to nibble out the holes for the dome and clacks. I held the cardboard in place on the barrel with a couple of cable ties and then 'adjusted' the position of the holes for the clacks, the dome hole happily being right first time. The clack holes were now ragged, over size and a bit off centre, so I marked

the card with vertical and horizontal lines to indicate the true centres (**photo 1**).

I obtained 3mm thick glass-fibre insulation material from Polly Engineering (usual disclaimer) although, on reflection, 6mm thick might have been better, because the boilers do now look a bit skinny. Anyway, the thinner material was easily cut to match the cardboard template, using a craft knife and a steel straight-edge (**photo 2**). The dome hole was cut using the knife, but for the clack holes I made up a simple warding cutter which, given just a quick twist, produced neat holes in the insulation material. The glass fibre was then rolled around the boiler barrel and held in place first with cable ties and then more permanently with sticky tape. In this case I liberated some autoclave tape from work, because it is made specifically to stand high temperatures (**photo 3**). I next put the cardboard template in place over the insulation and not surprisingly, the clack holes were now in a slightly different position. I re-marked the vertical and horizontal lines on the template to indicate where the holes would be on the brass cleading sheet.



A trial fit of the glass fibre.



Filing out the hole for the dome.

A fellow member of my local M.E. club always rolls his cleading sheets (for 7¼ inch gauge models) from 2mm thick steel, which is great because it resists damage from dropped spanners and is also thick enough to tap in handrail stations directly. However, this means feeding the rolled sheet on from the front of the bare boiler. In my case the smokeboxes were fitted and all of the associated plumbing had been completed, indeed one of the models had been steamed and run round the club track. I really didn't want to pull all of the pipework apart and take off the smokeboxes. I therefore opted to use conventional half-hard brass sheet, 0.50mm thick, which could be rolled to a cylinder, but still could be sprung over the boiler barrel from on top. This brass sheet I also obtained from Polly Engineering, who cut it accurately to my dimensions and shipped it to me taped down on a piece of plywood, to keep it flat. I laid the cardboard template over the sheet of brass and was pleased to find the overall dimensions matched up okay. I marked the dome hole and clack holes on the brass sheet, using the vertical and horizontal lines marked on the template to arrive at the correct centres for the clacks. I drilled a ¼ inch pilot hole and then a new cone cutter made light of boring the sheet out to a diameter to



Enlarging the holes for the clacks.

match the clack bushes on the boiler. The hole for the dome was a different matter, the sheet being too big to fit onto my half-inch bench drill, so I had to use the time-honoured method of chain-drilling with a hand drill and then filing, all of which is good for the soul... A sheet this big won't fit in a vice either and so I cut a hole in the bit of plywood the brass came with and filed vertically over this hole. Thankfully, 0.50mm brass files away quite quickly (photo 4).



Rolling the cleading.

I don't have any bending rolls, but club member, Andrew Binning, generously allowed me to use his industrial-sized rolls, which easily made a neat job of turning the flat sheet into a lovely round cylinder (photo 5). I did agonise about cutting the holes in the brass sheet before rolling, because the rolled cylinder would need to be sprung open to drop down over the barrel and it could bend horribly either side of the dome hole. In the event, this was not a problem



Mass production of the little bits of angle for the ends of the bands.



Using a jig to drill the holes in the angles.

and the sheet showed no sign of kinking along the top centre line, either side of the dome hole. My personal 'smugometer' went off the scale when I found the clack holes lined up pretty well with the bushes on the barrel. Even so, on the second model, I decided to cut the clack holes under size before rolling, so that I could correct finally if required. As it happened, the holes did not need moving and I then had to enlarge them with the sheet now rolled

(photo 6). I held the rolled cleading sheet firmly in place over the boiler insulation with cable ties, carefully arranging an overlap of about $\frac{1}{4}$ inch at the edges, along the bottom of the boiler barrel.

The next job was to make up the four boiler bands which finally hold the cleading sheet in place on the boiler. I used $\frac{3}{8}$ inch wide brass strip, about 30 thou thick, again supplied by Polly. Some folks just bend up the end of the bands for fixing, but I made little angle pieces to pull the ends of the bands together. These were made from $\frac{1}{4} \times \frac{1}{4} \times \frac{1}{16}$ inch brass angle. Since 16 were needed for the two models, I went into mass production. Each angle was sliced off in the lathe, using a fine-tooth saw on an arbour in the chuck and with the material clamped in the tool holder. The DRO I fitted some years ago on the lathe saddle made chopping off identical lengths a doddle



Using the same jig to put the corresponding holes in the bands.

(photo 7). I schemed up a simple jig to drill two rivet holes in each angle and the same jig served to drill the ends of the bands (photos 8 and 9). The angles were then rivetted onto the bands with $\frac{1}{16}$ inch copper rivets, gently hammering down the cut rivet end into a small

countersink in the back of the band (photo 10). A bit of care is needed to get the length of the bands right, so that they just about pull together when the cleading sheet is firmly pulled down onto the insulation material. With the four boiler bands in place on each locomotive, I was ready



Attaching the angles to the bands.

to tackle the dreaded Belpaire firebox.

● To be continued.

NEXT TIME

Yes – the dreaded Belpaire firebox!

ISSUE NEXT ISSUE NEXT ISSUE NEXT ISSUE NEXT IS
E NEXT ISSUE NEXT ISSUE NEXT ISSUE

● Lockdown Showcase

Our readers show us what they have been up to during the recent lockdown.

● Black Five Regulator

Richard Williams takes a short cut in making a Stroudley-type regulator for his 'Black 5'.

● Slot Cars

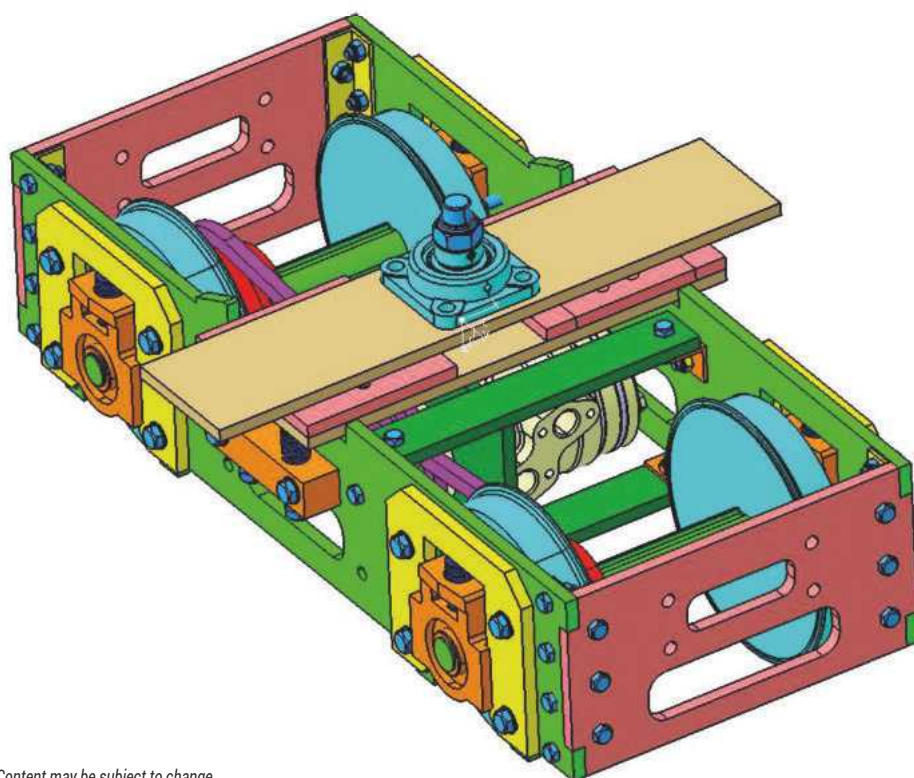
Henk-Jan de Ruiter takes another look at the slot car scene.

● Wenford

Hotspur produces the safety valve bonnet for his 5 inch gauge well tank Wenford.

● Queen's Messenger

Martin Robinson builds a $7\frac{1}{4}$ inch gauge Diesel hydraulic locomotive designed principally for club passenger hauling duties.



Content may be subject to change.

ON SALE 14 AUGUST 2020

1



City of Stoke on Trent.

GWR County Locomotive PART 1

Robert Hobbs builds a 2½ inch gauge model of a GWR 4-4-0 County Class locomotive.



My journey through building model yachts, then on to stationary steam engines before attempting locomotives for display has been stimulated by an interest in steam which started when at secondary school with the model engineering club and of course train spotting in the 1950's. More recently the aspect of the locomotive wheel arrangements of the various classifications has attracted my attention.

My initial build was a Mogul 2-6-0 based on the *Princess Marina*, followed by a 'Jubilee' tank 2-6-4, then a *Rob Roy* dock tank 0-6-0. After this I really became ambitious and started, and finished, a *Hielan Lassie* /Great Northern Pacific 4-6-2 – however, this was far too large for

my study so she was sold. These four locomotives were built in three and a half inch gauge. Still in pursuit of a Pacific, a two and a half inch Bonds O' Euston Road LMS 'Coronation' was sourced and built from new castings and now graces my study (**photo 1**). Incidentally, this build was featured in *Model Engineer* between October 2018 and March 2019. Looking for a winter project, a GWR 'Bulldog' was my first choice. However, a chassis for a 'County' was found, with a set of drawings, and purchased on eBay.

Building locomotives for display (not intended to steam) allows freedom in the detail finish and enables the recycling of many discarded or unfinished projects that would normally be left to rust and decay, let alone give hours of pleasure to the recycler or the ultimate owner. This GWR 'County' chassis had the initial 4-4-0 wheel pattern, thus extending my association with differing wheel configurations. This class was nicknamed 'Churchward's Rough Riders' the front end being too powerful for the short wheel base, combined with the six foot eight and a half

inch driving wheels. Later 'Counties' were built with the 4-6-0 wheel layout and formed the basis for the much later and much admired GWR 'Halls', 'Castles' and 'Kings'. Being an optimist and looking into the future there are many locomotive options remaining before a Beyer Peacock Garratt is smuggled into the workshop and tackled.

My locomotives are built for display and starting with an abandoned project provides castings and sometimes fittings at a significantly lower cost than new. When purchasing part-built work, from known or unknown persons, it is well worth remembering there are many reasons for the unfinished project, which are not immediately apparent or easily rectified, especially if, in future, live steam running is your intention. So be aware! When the 'County' locomotive chassis was stripped down it was evident that it had been dropped on the front-end right side distorting the frame extension, the buffer beam, the front of the leading bogie and breaking the buffer head. The chassis as arrived before starting work is shown in **photo 2**.

2



The initial state of the County of Devon's chassis.

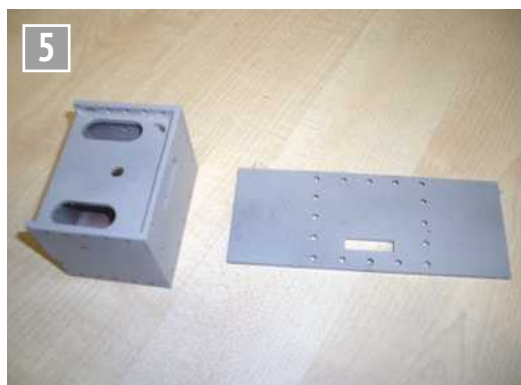


The restored main frames.

Initially the distorted items were straightened in the vice using an adjustable spanner to apply the corrective pressure. These disassembled components were then thoroughly cleaned off with Nitromors and neutralised with methylated spirits before cleaning up, checking for size against the drawings and priming to protect from rust.

Photograph 3 shows the main frames, **photo 4** the stretchers, **photo 5** the rear drag box assembly with the rear buffer beam and **photo 6** the front buffer beam after the initial painting with etch primer. The bogie was finished with a blackened satin finish. This was my first encounter with this metal treatment and will be worthy of further investigation for later projects. **Photograph 7** shows the top of the bogie assembly after cleaning.

The main wheel assemblies on the axles were carefully cleaned and are shown in **photo 8** and it can be seen from the photographs that there was very little to do to the main drive train. The coupling and connecting rods cleaned up nicely and are shown in **photo 9**. The two cylinder assemblies were tackled next and on stripping there were a few holes with broken taps in place, which are not a problem for me as this locomotive will be for display only and is not required to be steam safe. The piston/spool valves were missing and the valve chamber in one cylinder block was unfinished but in place. However, on closer inspection the steam transfer ports had been wrongly drilled and the



Rear drag box and buffer beam.

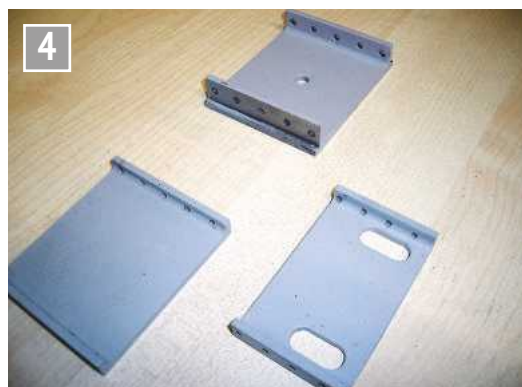


Front bogie after cleaning.



The side rods.

cylinder casting had been lined with a thin wall brass tube. The front and rear covers for the piston and the valves together with the cylinder blocks were cleaned up and put to one



Stretchers.



Front buffer beam.



The two main wheel sets.



The cylinders and covers after cleaning up.

side. **Photograph 10** shows these components ready for rectification. This is a good jumping off point for this first section.

●To be continued.

NEXT TIME

We will start part two of the series with some sheet metal work on the tender.

Confessions of a Model Maker

Maximising the Chances of Success in a Making Project

John Moorhouse looks at the factors which lead to the successful planning and execution of a project.



Continued from p.83
M.E. 4642, 3 July 2020

Parts 1 and 2 considered the challenges in preparing an achievable design and how the workshop environment could influence progress.

This final part considers various strategies to maximise our chances of success.

Rewards

We all need a regular boost to maintain both our confidence and original enthusiasm. This can come in a variety of ways. For me it comes from having made visible progress, which is a clear step towards completion. It may be different for you. Whatever it is, give yourself a personal return on your effort at each step or stage. Splitting the project into a series of separate achievable goals helps me a lot. I set a distinct reachable target. Sometimes it comes from carrying out work on shorter and easier to achieve items. This helps considerably in providing a fresh impetus to make a start on a challenging part of the main project. Sometimes the reward I give myself is a brief



After various attempts at engine turning on a shape spun on the lathe, it was clear that this requires both accurate centring and truing with good rigidity and this can only be provided with a truing chuck. The only solution was to make one (see George Daniels, Watchmaking, p.375).

deliberate break; time to do one of those small projects which I dearly wanted to do but forbade myself to avoid a loss of continuity, or an item of planned maintenance.

Part of my objectives in making and researching is to support the various groups to which I belong (AHS, BHI, MBSGB). It is for this reason that I take a full photographic record of each step. These records are invaluable. I build up a PowerPoint presentation file as the work progresses. This allows the easy preparation of talks to the groups and articles for their respective journals. These outlets provide a forum for explaining design and progress. This helps to clarify my own thoughts as well as often drawing out helpful feedback from the listeners. I also find the photographic records helpful when I compare the record of my work with other pieces which I have handled. It helps me to judge the quantity of my progress, the standard of my work and provides constructive and positive feedback. For me, success is a journey not just a destination.

When my current project reached an advanced stage I spent over half of a day with a friend who is also making a major piece. We each showed our work. We discussed design and making processes including past and current problems. The outcome was a completely fresh view on certain aspects of each of the projects. It was time well spent and we also recharged our batteries of enthusiasm.

Problems

Many projects fail or come close to collapse when a serious setback arises. This can be for a whole variety of reasons, some of which may be outside of your control. Examples are a casting which reveals a flaw, poor finish, a departure from tolerances such as a part or assembly which has to be completely remade in order to be fit for purpose. This going over of old ground can be very hard to live with. Making a component for a second time is a trial; making it for the third or fourth time is much worse. I often make paper templates for the shape of a component to help decide upon dimensions,



Pattern cutting on the rose engine required considerable practice on spun surfaces of gilding metal before any degree of competence was attained. New skills demand patience and often require advice from those more experienced. Modifications to conventional practice may also be required. Two identical eggs in silver were finally cut to maximise the chance of a fully successful end product.

shape and making procedure. After a failure, the bigger the area of work which has to be redone, the greater is the let down. It is a waste of effort and, if the problem is of your own making, it also represents a loss of self esteem. My approach is to try and use each failure as a learning exercise and to remind myself that the remade component will be of a much better standard than the first attempt.

The assembly stage is a very satisfying part of a project, when we see the work coming together to match our initial dream. It is also the stage in the work when a malfunction, or deficiencies in components or assemblies, are most likely to come to light. It can provide a great lift or severe depression. Questions arise such as 'is modification required to enable it to fit or does it have to be completely remade?' Sometimes it is sensible to try to divide a



Trial samples of transparent enamels to assess their suitability together on the patterned silver surfaces.

project into sub-assemblies that can be completed and tested before being incorporated into the bigger project. In this way problems can be resolved before they have an effect on other parts of the project further down the line. Making temporary 'trials' of critical components or assemblies can prevent a serious misfortune and allow the final items to be made more quickly.

An experienced maker knows the critical areas where a snag is likely to arise and where to take particular care. I take reasonable steps to avoid failure, especially if a fiasco with an operation will be fatal for the component. I work on the assumption that if I walk too close to the edge too often, in due course I will fall over. A common reaction is to apportion blame to suppliers, their materials, equipment or even domestic interference. It is temporary but can become ingrained. It should be avoided. We must always try to avoid situations which make us feel incompetent and lose confidence in our own ability. In any project there will always be difficulties. Part of the challenge and the prize of success is overcoming all the problems and setbacks.

Support

I suspect that many makers are initially lone workers. They have not made such a piece before. They are not sure they can achieve a satisfactory result. They do not wish to expose their possible personal shortcomings to the world until they have successfully made something. The danger of this approach is that they are less likely to seek assistance from someone when a problem arises or their steps to rectify it have gone beyond the point of recovery.

An alternative approach for makers is to be unguarded from the start about the project. Bring it out into the open with your contacts at each stage. Get feedback and discuss

current and potential problems before they arise. Share a part of the ownership of the project with someone else. The process can then become much more rewarding with less likelihood of a major setback. Confidence in approaching a process is often an advantage in achieving a good outcome. Our journals occasionally report a making project of a batch or a single item by a group of makers. This is clearly an excellent way to harness the various necessary skills and use machine set-ups and jigs etc. to maximum efficiency. Enthusiasm is maintained by the group involvement and without any doubt, 'two heads are better than one'.

Entry for competitions, exhibitions, or a waiting customer can provide a timetable for the outcome of a project, thereby providing a driving sense of commitment and adding impetus and resolve. They also provide the chance of an accolade such as being exhibited or awarded a prize. Exhibitions provide another route to problem solving, to see other similar finished items. Someone else has solved the problem and therefore you should also be able to solve it. The maker is sometimes standing by his exhibit waiting to gather the passing praise and to solve your problem! Another is to discuss the problems with a friend or co-worker, someone who is in a similar position. Join a branch or other local group!! At a recent exhibition where the BHI had a stall it was clear that quite a number



In this assembly/display stand the removable legs could be screwed into the top or below for easy working on any part of the complex mechanism; important where considerable trial and error of mating parts is required.

It is good to remember that the more time we spend on one project, the less time we have for the next!

of the visitors were makers seeking advice on some aspect of their project.

It is interesting to find that those members of clock clubs, groups and branches present at meetings are usually those who attend regularly. They have found, like myself, there are considerable benefits in attending. This is where we get information, ideas, access to private collections, as well as encouragement and problem solving which the lone worker misses. Good advice can come from unexpected sources. At a college where I attend as a leisure student it was from the store keeper, now sadly retired. When issuing tools or materials he dispensed helpful tips on health and safety, material properties, processes, use of equipment and more. The students were provided with a whole wealth of useful information and it was easy to accept, coming from a friendly and helpful source.

Completion and finishing

Before a project is finally assembled it will have to have its visible and other important surfaces finished to an appropriate type and standard of finish. It is an important aspect since we are all aware that our work will probably be judged on its quality of finish. Any maker has their personal set of standards, drawn from their training, if any, and from seeing other items of finished work. I have watched some of my fellow (amateur) silversmiths at the School of Jewellery spend many hours polishing their finished piece removing apparently invisible blemishes to create the deep mirror finish which shows the work at its best. They are unable to call it finished because they cannot live with themselves if it does not meet the very high standards that

they consider themselves capable of. The outcome can be a sense of dissatisfaction with the finished product. It is good to remember that the more time we spend on one project, the less time we have for the next!

Polishing of movement plates is an important area. If the maker has adequate experience or training to finish items with crisp corners and a high polish with a scratchless finish then they will be able to achieve this in practice. However, if not, and a maker attempts to achieve them for the first time on part of their project, they are likely to be only partly successful. Worse, once the corners are rounded it is hard to restore them back to their original crispness. Seeing a finished component with a poor standard of finish can be very disheartening after the considerable effort to reach this final stage. Achieving a good finish is about having a sound understanding of polishing techniques and being aware of the need to integrate it into the whole of the making project. It is not just something to tackle after the making and testing is complete. In particular, there is clearly no point in carrying out unnecessary finishing work on components until it is clear that they are fully fit for purpose, although in some aspects, such as escapements and sprung star wheel jumpers, the correct action is best judged when acting faces of such items are correctly polished.

One solution to shortcut a protracted finishing process is to take the plunge and pay a professional to do the final polishing stage, as is often done with silverware. It has the added benefit of then not being a let down on our personal standards and accepted as the best commercial result



The project in its full regalia. I am still taking trial steps to maximise the sound of the birds' whistle; a challenge in this type of housing!

possible. In this way we are able to accept that it is as good as can be realistically achieved. However, this route can have disadvantages where a professional's standards and objectives are different from ours. Those crisp edges you have strived so hard to maintain in the piece may well be rounded by a polisher who does not see them as important or desirable. Paying a professional is not an easy route for makers to go down; we choose to make things because we are unwilling or unable to pay for professional services. We like the challenge of setting a goal which we wish to achieve by our own talents.

An important part of the finished piece is sometimes a stand to display it. It can also be an essential aid to help hold the piece either way up for trial assembly of components. A bonus is that

holding the movement, or whatever the piece may be, in a display stand gives it an air of importance which I find quite rewarding and motivating. It is an extra step nearer to that ultimate goal.

Conclusions

The personal challenges which arise in achieving a making project are present for us all. There are a variety of routes to sustain interest and enthusiasm to bring it to a successful conclusion. I believe the best overall strategy is to fully understand the design, develop the necessary skills, establish a good working environment, harness the expertise of contacts, provide personal rewards of various kinds at each stage, plan ahead and steer as far away from failure as practicable.

ME

Siding Lockout Device

Paul Tanner describes a simple device for preventing stray vehicles causing a hazard.



The device, when deployed, prevents incursion of unwanted vehicles.



The device is simply laid flat when not required.

Here is an easy-to-use, self-designed, built, installed and tested siding lock-out device, for safe operation of your model engineering layouts of 5 inch and 7¼ inch gauge.

I come from a railway background (27 years) and have been retired for two years. Prior to railway employment, I was an electrical-mechanical engineer (24 years) in the Royal Air Force. I have habitually always looked beyond the main scheme of things and have come up with numerous ideas and inventions in my past.

This item is just one of them, which has come about by looking at safety of operation of small gauge layouts, either open to the public or on general operating member days.

The concept is simple - block a siding from wagons or locomotives straying onto the main running lines and becoming a problem and/or accident. This may be caused by an item of rolling stock left on air or vacuum brake alone and either system bleeding off, resulting in a 'runaway scenario'.

The device is made up of two 10mm heavy metal plates suitably hinged as pictured (photo 1) onto a robust treated hardwood sleeper, designed to fit in the 100mm (4 inch) sleeper spacing on plain line. The device is active when the plates are folded up and held in their almost upright position by their sheer weight and design. The facing edges of the plates are fitted with rubber bump-stops, for minimizing damage to the device itself and rolling stock items.

When the siding becomes free for movements of rolling stock, the plates are simply laid down flat by hand, therefore unblocking the rail path (photo 2). The plates are, by design, made to lie down flat onto the adjacent sleeper ends. This is primarily to protect them from being a potential trip-hazard to staff walking in and around the yard. The plates are also stowed flat, to remain clear of any dual-gauge fouling points.

All the main fixing bolts are of stainless steel, with 'captive nuts' on the underside of the sleeper-bearer for ease of maintenance, and indeed for

removal from the track at any time, for track ballast work, or for re-siting. Installation of the device to the track took around 15 minutes, because of my pretesting of the device at home on a piece of dual gauge test track.

The chevrons on the plates either side are there to make them highly visible to operating staff and to alert their presence on the ground (trip hazard) etc. The chosen colour combination is synonymous with general warning signs and hazards, as a railway standard.

The ease of use is particularly beneficial for people of all age groups, provided they are aware of the simple functions employed, with no awkward padlock etc, to make it functional and safe to operate.

The cost to procure all the necessary parts - wood and metal and fittings - is around £60 per installation. This is a small price to pay for safety, on any small gauge railway, and simpler than an interlocked catch point.

ME

A New GWR Pannier PART 21

Doug Hewson decides that LBSC's well-known GWR pannier tank design needs a make-over.



Continued from p.77
M.E.4642, 3 July 2020

We will now get on with the superheaters for the engine. I have copied, more or less, what LBSC did on his *Pansy* but I have used our own design as there are fancy return bends to make on ours and they should be available from The Steam Workshop or G & S Supplies. Each of our elements is made from one continuous length of $\frac{5}{32}$ inch x 24swg of stainless steel tube and it is so easy to bend it couldn't be easier. We carried out quite a few experiments with tube of various thicknesses and we found that the 24swg would bend back on itself without much kinking. What bit you do get can very easily be removed by a little squeeze sideways in the vice. The diameter of the tubes is no problem either as a friend of mine, Ballan Baker, entered his K1 in IMLEC and it only had three superheaters in his boiler, but he still won with it!

I was also running on our railway at an open day one day, where, very unusually, we were giving rides to the local kids, and Malc said to me "Here, Doug, take this engine and give it a run". I said to Malc, "Well you could



A handful of superheaters.

at least top the tender up with coal for me," as there was barely a couple of hands full of coal left in the bottom of the tender. Malc said to me, "Oh you'll be okay with that." Anyway, I took a turn at driving. Now, I knew that Graham had fitted our new superheaters in the *Maid of Kent* the previous week so I thought it would be a good trial anyway. I drove the engine for at least an hour if not a bit more and was carrying about eight kids at the time (and some parents) and I was amazed that I only had to use the injector once and came back with almost the same amount of coal. In fact, I only had to fire the engine once! So, there you are. I have had some of our

superheaters in my Y4 for at least twenty years now and they are still as good as new.

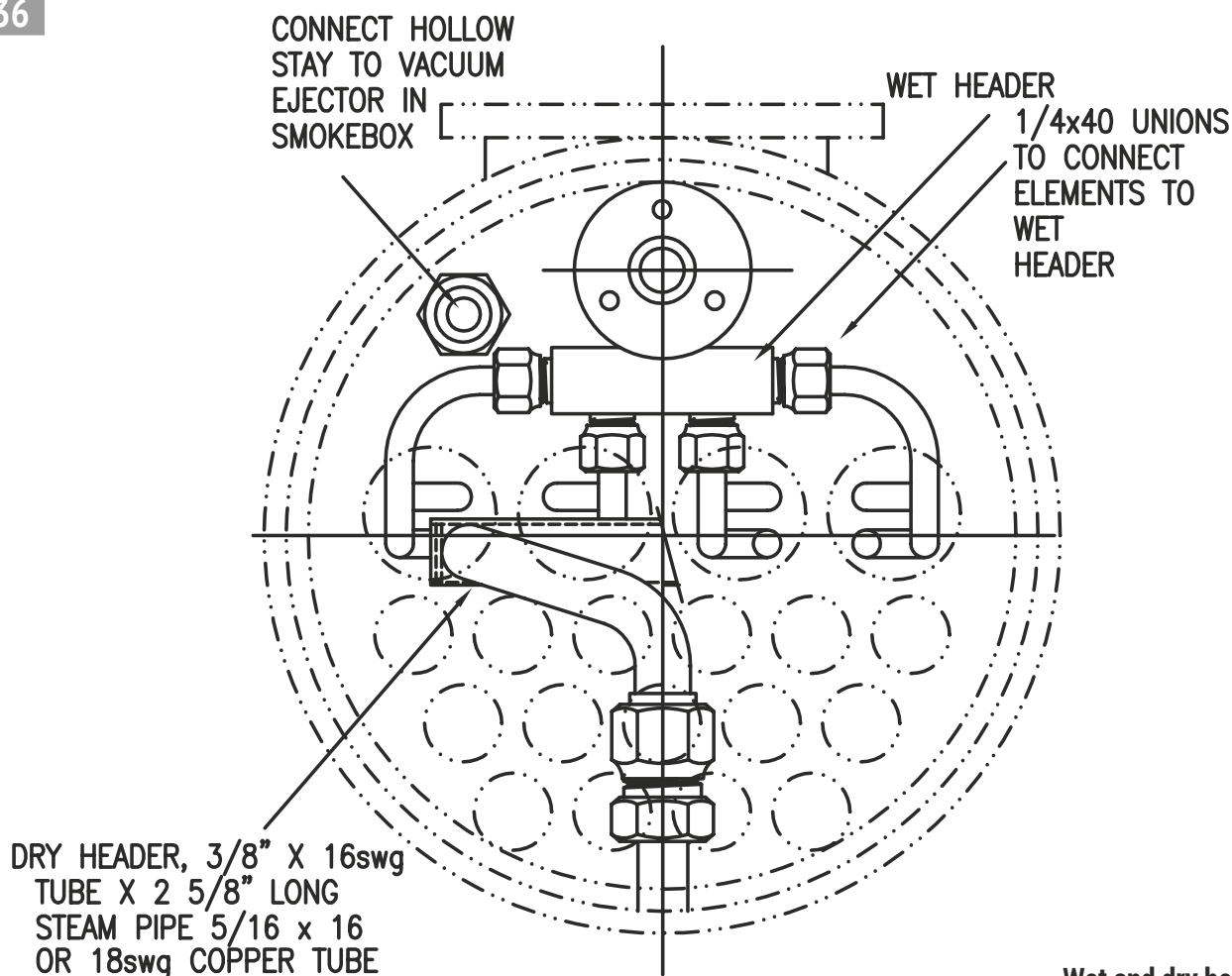
We always send the superheaters out ready bent so we will need to know the dimensions of your boiler, although we already know what is needed for a pannier tank as we have made lot of these for that engine. The only thing that you will need to do is bend the tails upwards to go into the wet header.

Photograph 165 shows the superheater tubes with bends in them and that is how they usually arrive. It is not a real task to put the final bends in them but what you will need to do is make a very close-fitting former out of a piece of brass or nylon bar, either will do. You need to turn a couple of grooves in it so that a piece of $\frac{5}{32}$ inch bore pipe just goes into the depth of the rod. If you make the grooves $\frac{1}{2}$ inch apart then you can bend them both together with thumb pressure as I did mine (**photo 166**). Once bent you might just have to nip them up in the vice so that they come back to round again. The superheaters are sufficiently thin that there is ample room to get down the side of the elements with a flue brush and these too are only $\frac{3}{4}$ inch flues. Some people seem to have this phobia against superheaters but I certainly wouldn't build a locomotive without them so don't believe what you hear!



Pipe bending former.

Fig 36



Wet and dry headers.



Bending the pipes is a simple job.

Photograph 167 shows one of the tubes being bent just with thumb pressure to show how easy it is. I have also shown my elements with union nuts on them and these are so that you can draw them out one at a time in case you need to change one of them.

To silver solder the elements you can use SilverFlo 55 (also known as 455) but I would recommend Tenacity No. 5 flux (HT5) as it lasts longer. **Photograph 168** shows my Y4 with its new superheaters ready to be connected up. I used some old tube to make



Installation of superheaters in the Y4.

these which I obtained from good old Whistons before they went under and the 1m lengths were not long enough, hence my extension pieces made of copper tube.

We now buy it all new from a 'needle' works and, as Wilson says in Dads' Army, "They don't

like it up 'em". I don't think I would like a needle this size up me either!

● To be continued.

NEXT TIME

We sort out the regulator and the regulator handle.

Why not try 6 issues for £1?



**PRINTED, DIGITAL
or BOTH!**

- Get your first 6 issues for £1 (saving £24.20)
- No obligation to continue
- Pay just £2.35 for every future issue (saving 44%) if you carry on**
- Delivered conveniently to your door
- Significant savings on **DIGITAL** only and **BUNDLE** options available

If you have enjoyed this issue of **Model Engineer**, why not claim the next **6 issues for just £1**? Model Engineer offers comprehensive knowledge and advice on various engineering subjects from an array of contributors, ranging from historical articles to the latest show reports.

3 SIMPLE WAYS TO ORDER BY PHONE

0344 243 9023

ONLINE

[me.secureorder.co.uk/MODE/
SUMMER20](http://me.secureorder.co.uk/MODE/SUMMER20)

POST

**Complete this form and
return to:**

Model Engineer Subscriptions,
MyTimeMedia Ltd,
3 Queensbridge,
The Lakes, Northampton,
NN4 7BF

GET 6 ISSUES OF MODEL ENGINEER FOR £1

☒ Yes, I would like to subscribe to Model Engineer with 6 issues for £1 (UK only)

I understand that if I am not 100% satisfied, I can cancel my subscription before the third issue and pay no more than the £1 already debited. Otherwise my subscription will automatically continue at the low rate selected below.

YOUR DETAILS (MUST BE COMPLETED)

Mr/Mrs/Miss/MS..... Initial Surname

Address

..... Postcode

Country..... Tel

Email

INSTRUCTIONS TO YOUR BANK/BUILDING SOCIETY (please select option)

☐ **PRINT ONLY:** £1 for 6 issues followed by £15.25 every 3 months

Originator's reference 422562

☐ **DIGITAL ONLY:** £1 for 6 issues followed by £12.10 every 3 months

☐ **BUNDLE (DIGITAL & PRINT):** £1 for 6 issues followed by £18.25 every 3 months

Name of bank.....

Address of bank

..... Postcode

Account holder.....

Signature..... Date

Sort Code

Account Number

Reference Number (official use only)

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.



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

TERMS & CONDITIONS: Offer ends 10/09/2020. 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@modelengineer.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

www.mytimemedia.co.uk/privacy-policy

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

CODE: SUMMER20

*Calls are charged at the same rate as standard UK landlines and are included as part of any inclusive or free minute allowances. No additional charges with this number. Overseas calls will cost more.

**Future savings based on the current annual shop price.

Murdock Vertical Oscillating Engine PART 3

Geoff Spedding builds the Murdock oscillating engine from the Myers Engine Works.



Continued from p.109
M.E. 4642, 3 July 2020

Casting sets are available from:
Myers Engine Works
10200 Waterville/
Neapolis road
Waterville Ohio 43566 USA
+44(1)419-376-3206
www.myersengines.com

Piston assembly, piston, piston rod end, piston rod (Parts 12, 15, 17) and piston rod packing gland

The piston was machined from a length of 1 ¼ inch diameter round brass bar. It was machined to the required diameter, the oil grooves cut and drilled to take the piston rod. After checking it fitted the cylinder bore, the brass bar was removed from the lathe and the piston sawn off the bar. The piston was then machined to the correct length.

The piston rod end was machined from a length of ½ x 1 inch brass bar. This was centred in the lathe's four jaw chuck, drilled with a centre drill and steadied with a revolving tailstock centre. The required profile for holding the piston rod was made to the drawing specifications. The drawings



The complete piston assembly.

Rounding the sides of the piston rod.



Machining the valve block between centres.



Finishing the bolt end profile.

show a square piston rod; on mine I rounded the sides (**photo 32**). After rounding the sides, the overall length was marked with a parting tool and the top chamfered. The rod end was not parted off at this time as I drilled and it 2BA to hold the piston rod. It was then cut off the bar machined to length. The crank pin hole was marked and a ¼ inch hole drilled on the milling machine. At the same time a ⅛ inch oil lubrication hole was drilled in the top of the piston rod end.

The piston rod was made from a length of ¼ inch diameter stainless steel 5.25 inches long. Both ends were turned down, as shown in the drawings, and threaded 2BA. The drawings specify the use of a ⅜ inch nipple for use as the packing gland. I machined both

the nipple and nut from a length of $\frac{1}{2}$ inch hexagonal brass. The threads on either end were cut $\frac{3}{8}$ inch x 32ME. The complete piston assembly is shown in **photo 33**.

Valve block (Part 10)

Like the cylinder this part has two axes that have to be machined at 90 degrees to each other. Measurements indicated good concentricity on both the steam port axis and the steam inlet and outlet flanges. The centres were marked on all the four ends and centre drilled. I started off machining the steam inlet and outlet flanges first. Both flanges were held on centres and the chuck used as a driver. This allowed the outer flange to be turned to the finished diameter of 1.10 inch diameter. Through use of a small diameter centre in the revolving tailstock the face was partially finished. The part was then reversed and the other end machine (**photo 34**).

Next, the steam port axis was machined the same way, the bolt holding end being done first. Note: a boring bar was used to finish the bolt end profile to prevent interference with steam flanges (**photo 35**). Again, reversing the casting, the steam port end was machined and the $\frac{1}{4}$ inch diameter bolt fastening hole drilled through the casting. The drawings indicate drilling the $\frac{5}{16}$ inch diameter steam ports to a depth of 1.75 inch in the inlet and outlet flanges of the valve block. However, on checking the measurements on my casting it was determined a depth of 1.3 inch was required for these passage ways. So before drilling, check your casting to determine your hole depths. To drill these passage ways the flange was held in the three jaw chuck with the other end being held in a fixed steady (**photo 36**). To drill and mill the steam ports - back to the rotary table. After centring and aligning the valve block on the rotary table, the table was offset 0.38 inch to drill the $\frac{7}{32}$ inch diameter steam port



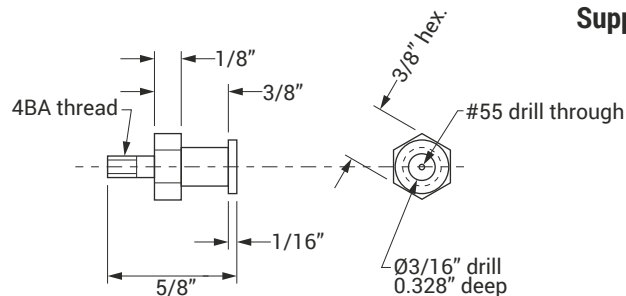
Drilling the passageways with the help of a fixed steady.



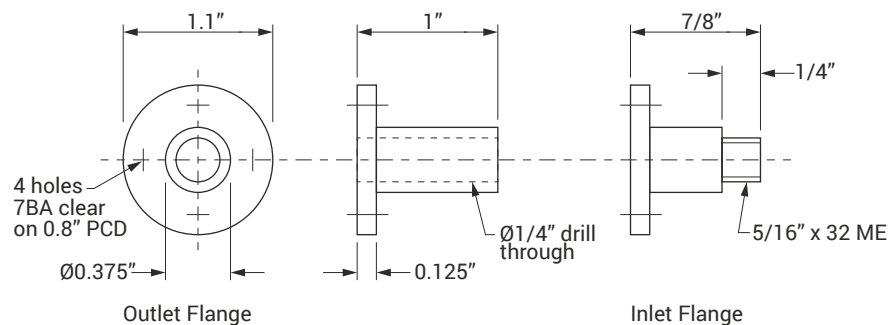
Milling the steam ports on a rotary table.

Fig 2

Supplementary parts.



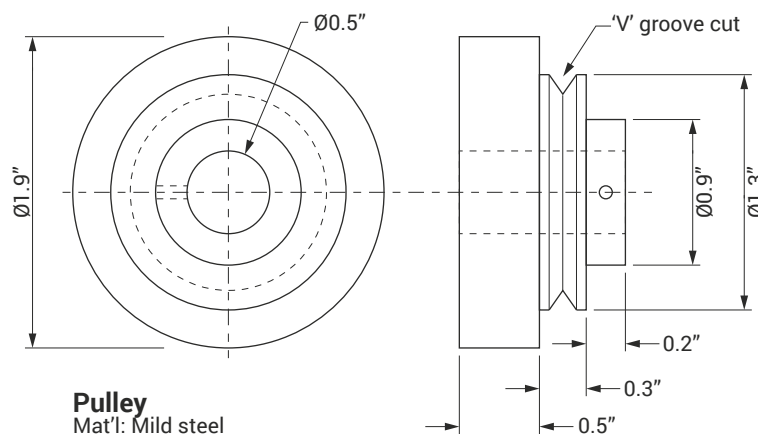
Part #19 Oil Cup
Mat'l: Brass, 4 off



Outlet Flange

Inlet Flange

Parts #22 Inlet And Outlet Flanges
Mat'l: Brass, 2 off each



Pulley
Mat'l: Mild steel

holes to intersect the flange holes. Then, at this off-set, the ports were cut. The drawings give a port width of 0.17 ($\frac{1}{64}$ inch). Not having a slotting

mill this diameter I used a $\frac{3}{16}$ inch slot drill to cut the 158 degree arc for the ports (**photo 37**). The valve block base was not machined to finished

height at this time. This, along with tapping $\frac{1}{4}$ inch x 20 UNC fastening thread was left to the final assembling so the correct height could be determined.

Flywheel (Part 1)

I tried a different approach to machining this flywheel. Measurements indicated the centre boss to have good symmetry so the centre was marked and drilled to the ½ inch crankshaft diameter. The wheel was then mounted on a ½ inch arbour supported by the revolving tail stock centre (photo 38). This allowed the centre boss to be finished along with the rim sides. Then finally the flywheel was finished to its diameter. To hold the wheel on the crankshaft a 3-48 UNC thread was tapped in the wheel boss for a grub screw. (This thread was chosen as I have a supply of these to hand.)

Oil cups (Part 19)

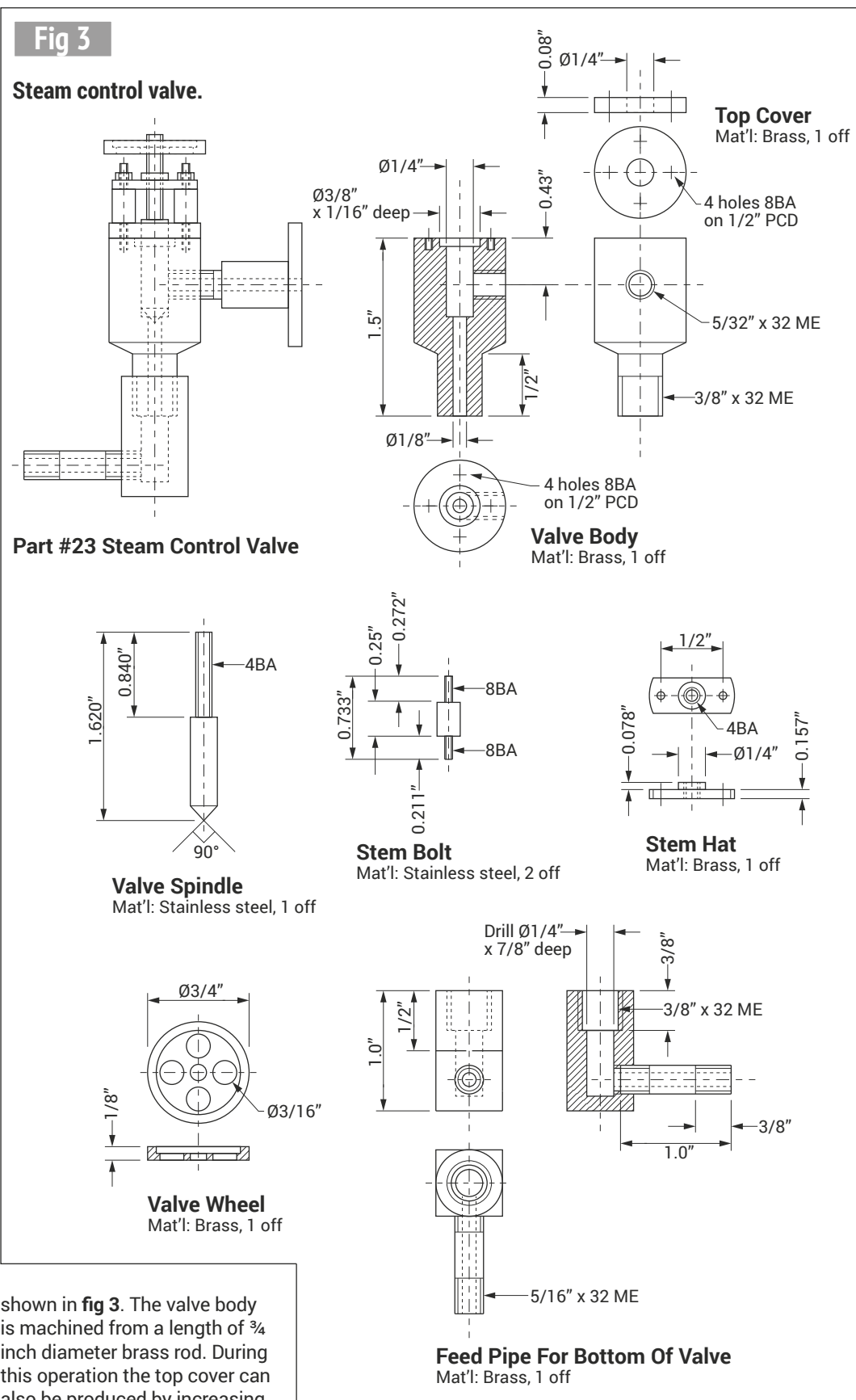
The oil cups were made from ⅜ inch diameter hexagonal brass rod to the dimensions shown in fig 2. A total of four were required.

Inlet and exhaust flanges (Parts 22)

The drawings show the steam inlet and outlet flanges tapped with a ⅜ inch NTP thread to take the steam pipes. For mine I decided to attach components through use of flanges so four 7BA threads were tapped in the flanges at 0.80 inch centres. Matching flanges were made from 1 ¼ inch diameter brass to the dimensions in fig 2. They were machined to match the diameter of the flanges on the valve block along with the four 7BA clearance holes. Then the ⅜ inch pipes were silver soldered to the flanges, one to hold the steam control valve and the other for the exhaust steam.

Steam control valve (Part 23)

I have added a control valve to regulate air and control speed. For this I have copied, with some modifications, Stewart Hart's valve design used for his Vertical Mill Engine published in *M.E.* Vol 215, No. 4511, 26 June – 9 July 2015. For this application I have increased the valve size to the dimensions



shown in fig 3. The valve body is machined from a length of ¾ inch diameter brass rod. During this operation the top cover can also be produced by increasing the length of the valve body. This allows the 8BA top cover fastening holes to be drilled in one operation on the milling machine. The valve body can then be transferred back to the lathe to part off the top cover

allowing the valve body to be finished to the required length. With the rotary table set up on the milling machine it is a good time to turn the valve wheel and then drill the four central holes.

Drilling and tapping the ⅜ x 32 ME thread in correct orientation in the body for the outlet is the next operation. The stem hat was machined from a small piece of ¼ inch x

$\frac{1}{8}$ inch brass bar. After marking out and drilling and tapping the central 4BA thread and the two 8BA clearance hold down holes, it was mounted on a mandrel and machined to correct diameter and thickness profile as in fig 3.

The valve spindle was made from $\frac{1}{4}$ inch diameter stainless steel as in fig 3, the spindle being threaded 4BA. The L-shaped feed pipe for the bottom of the valve was made from a piece of $\frac{1}{2}$ inch square brass bar, 1.0 inch long. The top $\frac{1}{2}$ inch section was turned to a $\frac{1}{2}$ inch diameter, then a $\frac{1}{4}$ inch hole drilled to a depth of $\frac{7}{8}$ inch, followed by drilling and tapping a $\frac{3}{8}$ x 32ME thread for attachment to the valve body. The bottom section was tapped $\frac{5}{16}$ inch x 32ME thread to hold the $\frac{5}{16}$ inch inlet line. This was then silver soldered to obtain a solid connection. The length of this inlet connection line is not critical so it can be left to the individual's preferences. The completed valve is shown in **photo 39**.

Driving pulley (Part 24)

In real life this engine would have been used to drive machinery, so a drive wheel has been added. This would most likely have been with a flat belt. A driving pulley for a flat belt incorporating a V-pulley drive has been added. The dimensions of this pulley are given in fig 2. There is nothing magical in these dimensions, I just happened to have a piece of 2 inch diameter mild steel to hand so created the one as illustrated. A section of 2 inch diameter mild steel was chucked and skimmed down to 1.9 inch



Turning the flywheel.

diameter then turned down to the dimensions in the drawing, with a $\frac{1}{8}$ inch deep groove cut using a threading tool. It was then removed and cut from the bar, re-chucked and finished to the desired width and bored $\frac{1}{2}$ inch to fit the crankshaft. The final operation was to drill and tap the 3-48 UNC grub screw holding hole.

Valve block cover (Part 9)

This covers and hides the cylinder rotational screw and is made from a length of 1 inch diameter aluminum rod and was one of the last parts to be made after assembling the engine. No dimensions are given on the drawings but it is a simple turning job to make it to the finished diameter of the valve block and drill to accommodate the holding screw and spring. Again, a 3-48 set screw was used to hold it in place. Equivalent BA or metric could be used depending what one has available.

Engine base supports (Part 20)

The base is not high enough for the cylinder to rotate properly so some engine base supports are required to raise the base to give

additional height. These are made from two lengths of $\frac{1}{2}$ x 1.0 inch aluminum bar. These were cut to length, two holes drilled in each to match the base holes and tapped 4BA. Four long holding studs were made to secure the base to the supports. The thread type is not critical - metric or UNC can be substituted.

Assembly and completion

Now comes the moment of truth - will everything fit together? The bearings, along with the crankshaft, had been fitted to the top of the pillars which in turn were affixed to the base. Time to assemble the cylinder in the bearings and attach the piston rod. The Pivot Dowel (part 21) which is a $\frac{1}{2}$ inch length of $\frac{1}{4}$ inch diameter mild steel was fitted into the cylinder and the cylinder bearing placed into the aluminum bearing block. With the bearings fastened to the base an engineer's square was held against the port end of the cylinder to make sure it was at 90 degrees to the base. This alignment is essential to obtain good contact and seal between the cylinder and valve block. Mine ended up being square (**photo 40**) but if yours isn't, some sanding or filing may be required on one or the other bearing to obtain the correct alignment. Once the cylinder is aligned correctly, the height from the top of the cylinder port end to the base can be determined. Then, the base of the valve block can be machined to the matching height. With the valve block at the required height the two can be joined together by a $\frac{1}{4}$ inch x 20 UNC screw. I had a



The steam control valve.

$2\frac{1}{4}$ inch round headed screw handy which I used along with a spring to maintain some tension on the mating faces. Now that the two parts were connected, the position of the valve block retaining bolt hole was determined on the base. The valve block was removed and the hole for the $\frac{1}{4}$ inch x 20 holding bolt was drilled. On assembly I applied a little grease on the mating cylinder and valve block surfaces.

With the cylinder and valve block reconnected the piston rod was connected to the piston rod end. A little adjustment was required on the rod length to obtain the correct length to ensure everything turned smoothly. The control valve was fitted and the engine hooked up to the compressed air line for the moment of truth. With 50 psi air pressure it ticked over nicely with the valve controlling flow and speed.

After a successful test trial, the engine was dismantled for painting. As with many people, painting is not one of my favourite tasks. After degreasing the parts, the body of the engine was sprayed with a green (a John Deer green) paint that I had in the workshop and the fly wheel painted red. On completion of painting the engine was reassembled, gaskets fitted to the cylinder and the engine fitted on a base board. Mine is fitted on a simple wooden baseboard as I just happened to have a piece of light oak wood in the workshop. The edges were chamfered with a router, stained, and finished off with a coat of Urethane varnish.



Checking the squareness of the port face.

The Barclay Well Tanks of the Great War PART 64

Terence Holland describes and constructs two appealing, century old locomotives.

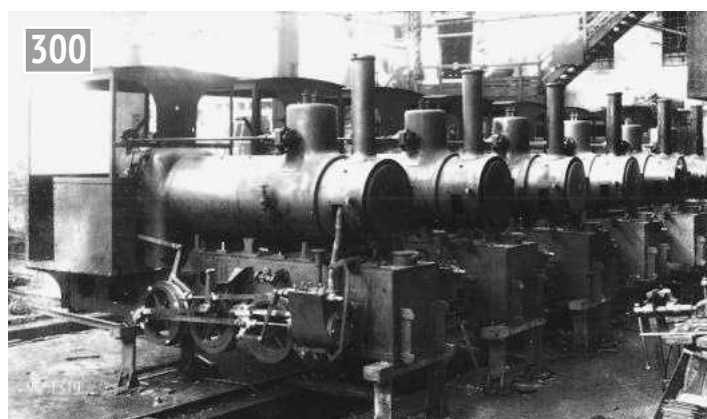


Continued from p.105
M.E. 4642, 3 July 2020

This constructional series addresses Andrew Barclay 0-4-0 and 0-6-0 narrow gauge locomotives supplied for use in the First World War. Built without the use of castings, the 0-4-0 design is described as two versions; as-built for the British Admiralty in 1918 and as rebuilt and currently running on the Tallylyn Railway as their locomotive No.6, *Douglas*. The 0-6-0 engines described were built in 1917 and operated on 60 centimetre gauge track at the Western Front in France. These were small, spartan machines of which only 25 were supplied and none have survived into preservation.

An introduction to the 'War Horses'

For the Barclay 0-6-0WT locomotives built for the WDLR I should perhaps reiterate that many of the 'bolt-on' bits are identical to the Light Class 'E' 0-4-0WTs.



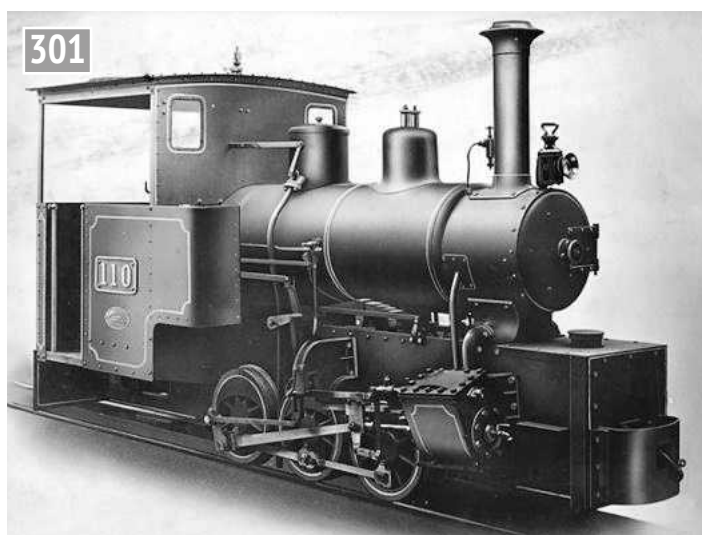
Six well tanks under construction. (Author's Collection.)

These Barclay, six-wheeled well tank engines, of which only 25 were built, were involved in operation at the front during the later Flanders campaigns around the Ypres Salient in 1917. The well tank design gives them a low centre of gravity and, therefore, greater stability on roughly laid track. **Photograph 300** shows a batch of part-built 'war horses' tied up in their stable at Kilmarnock and 'rarin' to go'. According to Davies (**ref 65**) the Barclay engines were unusual beasts indeed, with very few photographs of them in action and very little detail

recorded about their use on the Western Front. They were ordered in 1916 when various contractors were unable to keep up with demand.

The design was based on Andrew Barclay's Class F well tank – with minor modifications to suit WDLR specifications, which were the same as those for the 'Hudson' 0-6-0WT locomotives.

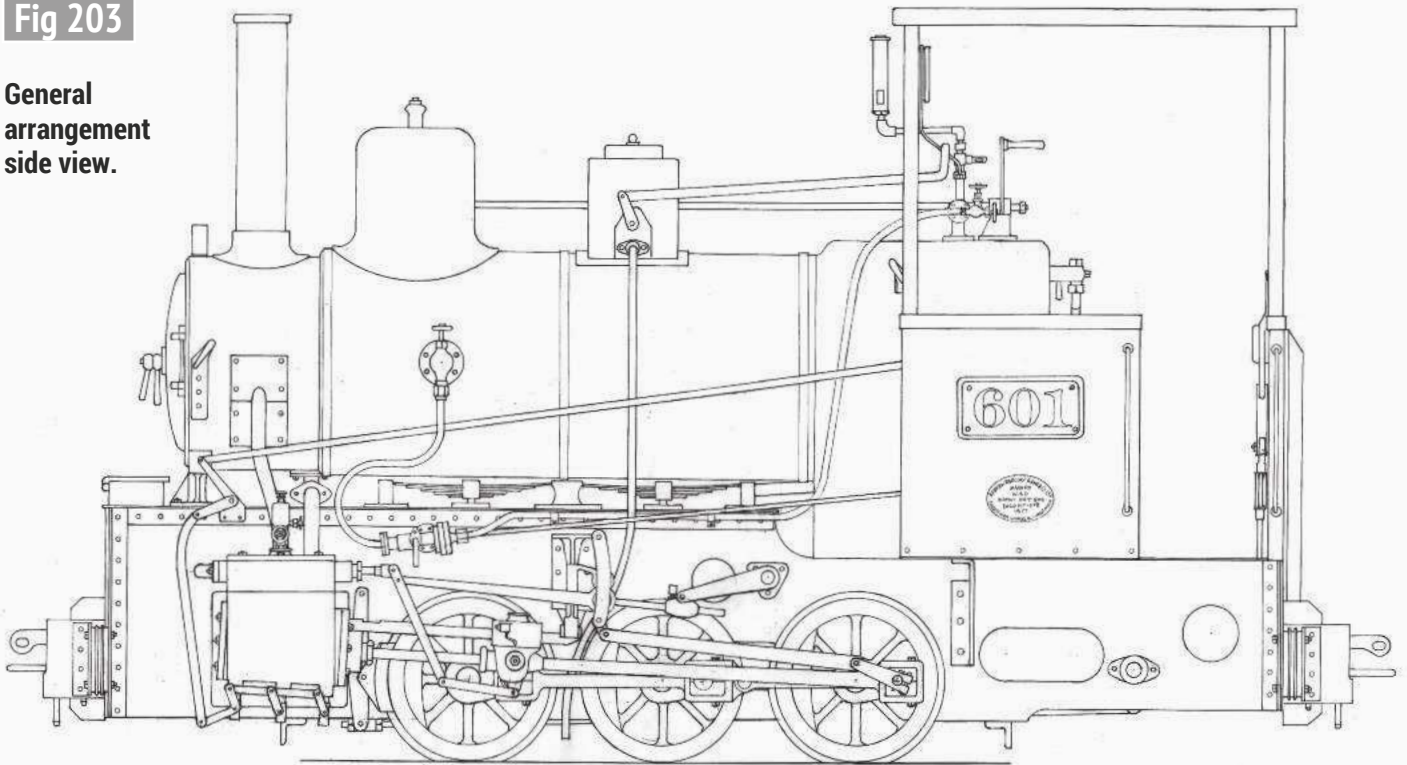
The 'Hudson' engines were supplied throughout the war by the railway contractor R. Hudson Ltd. of Gildersome Foundry in Yorkshire. They were the first steam locomotives used on the British light railways on the Western Front and some 60 engines were provided. Built under contract by Hudswell Clarke, they were fitted with Hudson maker's plates and always referred to as the 'Hudsons' or the 'pugs'. As narrow gauge engines go they were unusual, with their cylinders stuck out at a funny angle, no doubt to provide clearance for the steam and exhaust pipes. They were very similar to the Barclay engines but did not have a Belpaire firebox and, of course, had those weird cylinders. They did, however, have a



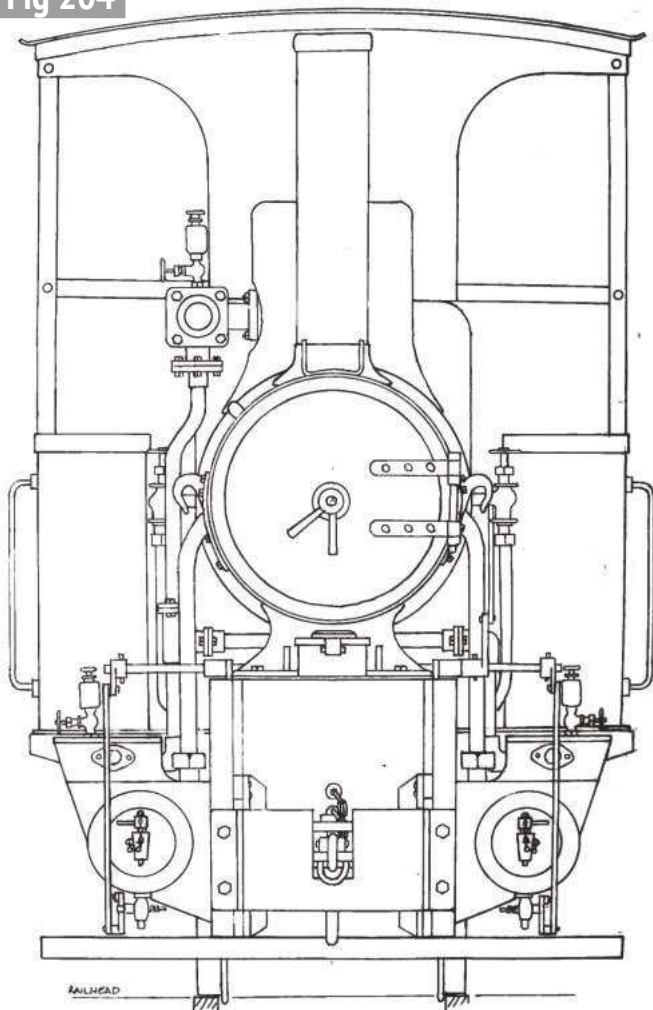
Hudson 0-6-0 as shown in their catalogue. (Author's Collection.)

Fig 203

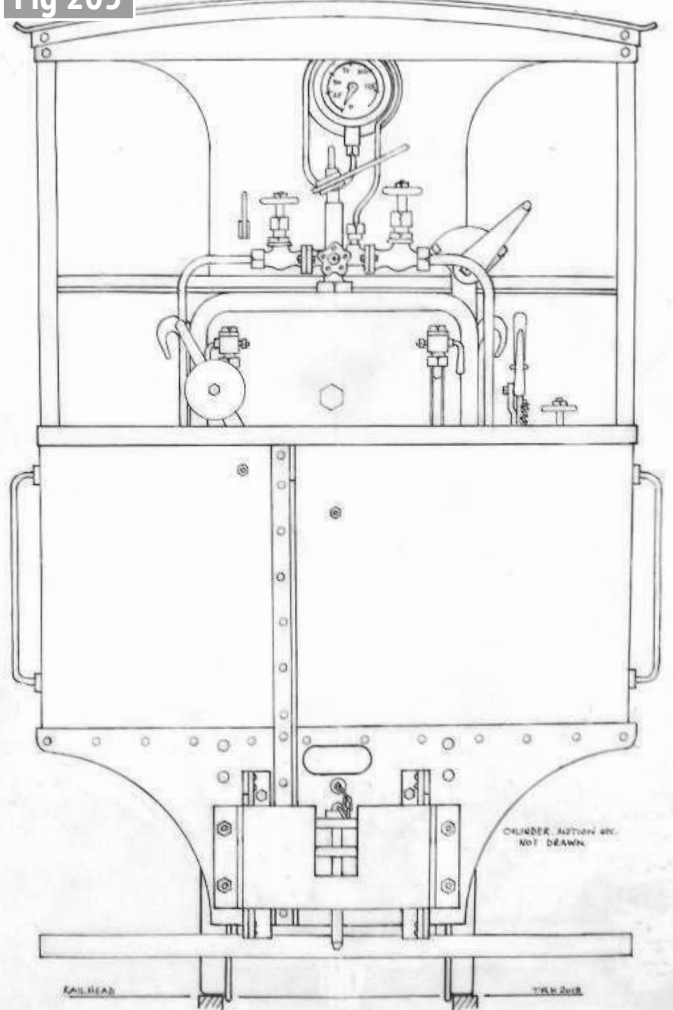
General
arrangement
side view.

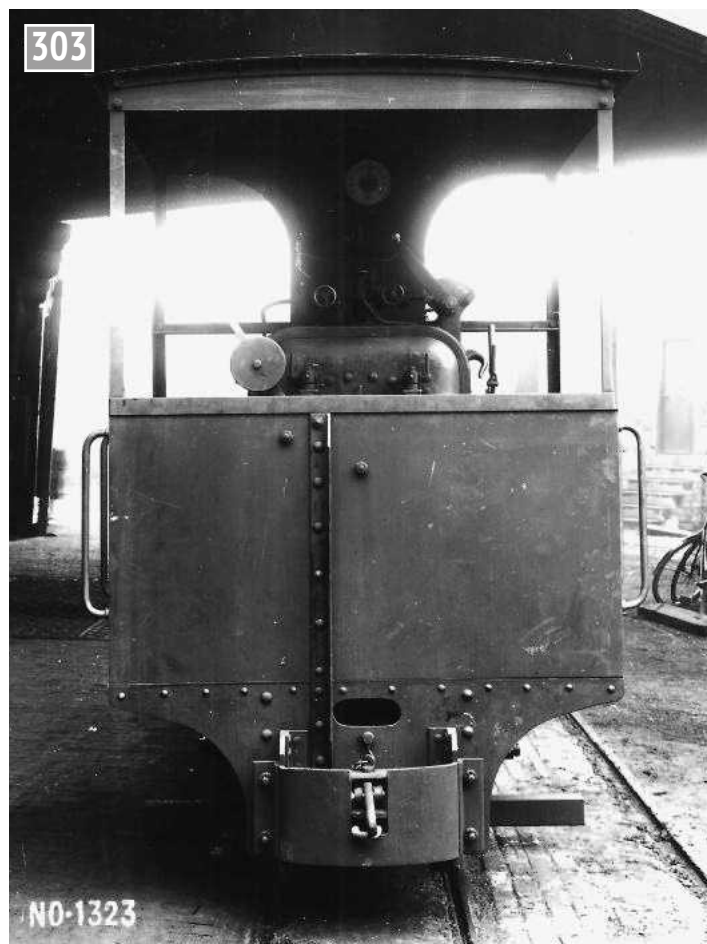
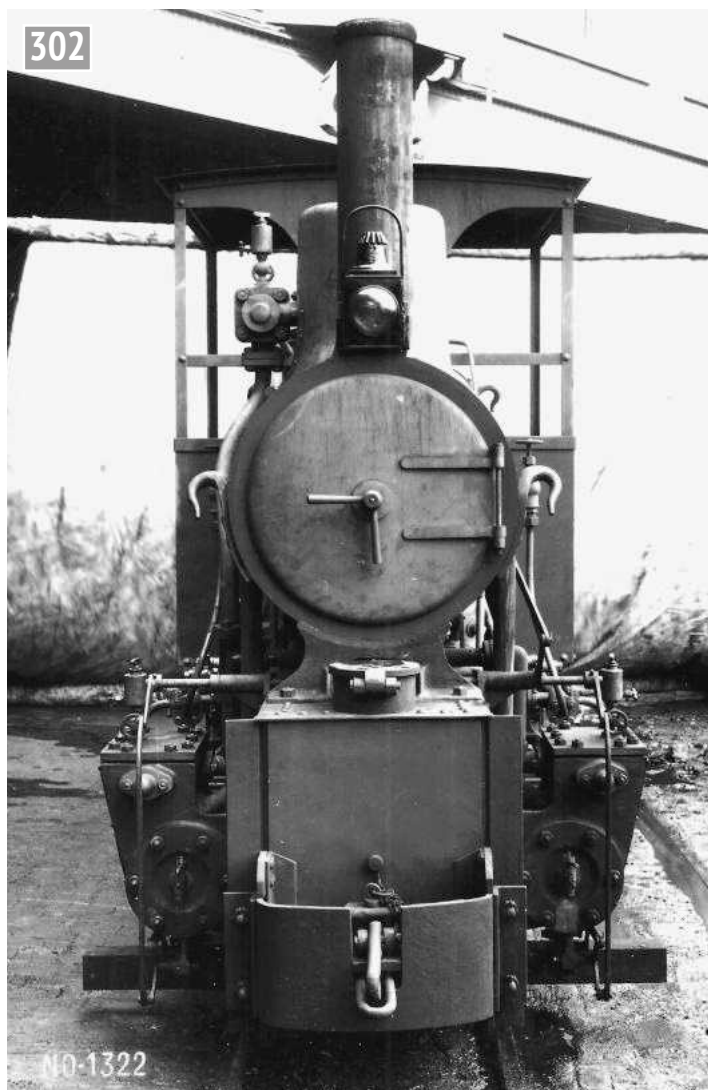
**Fig 204**

General arrangement front view.

**Fig 205**

General arrangement rear view.





Rear view. (Author's Collection.)

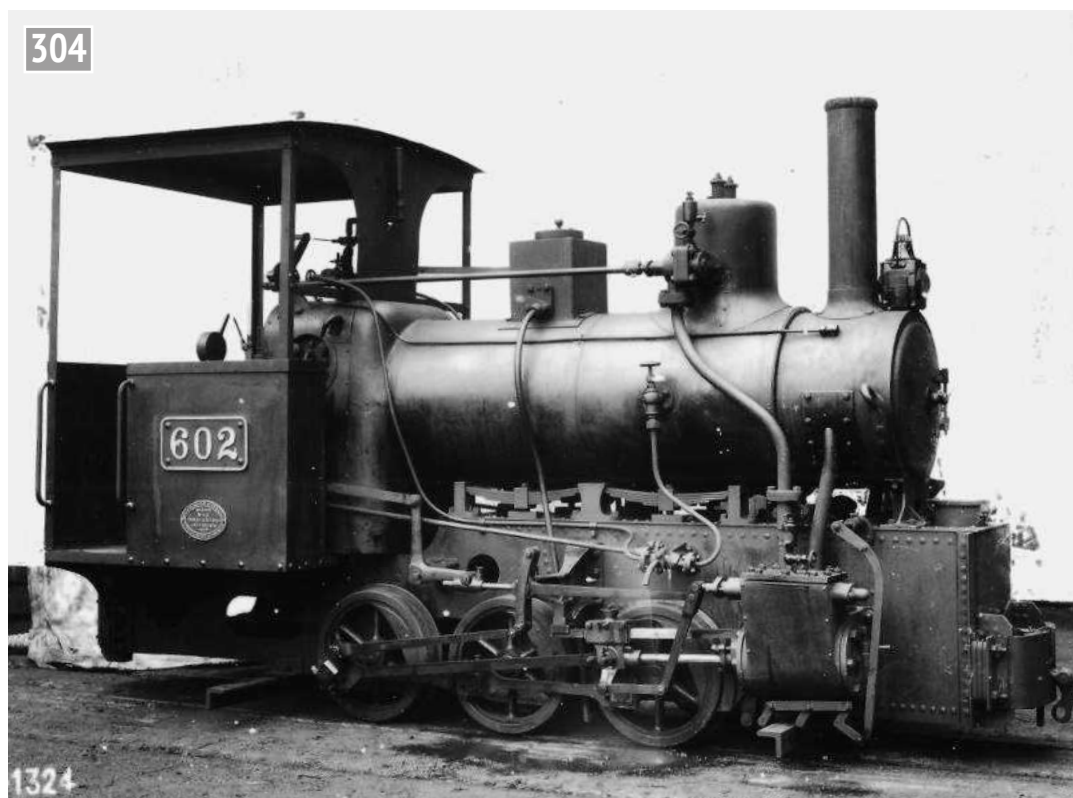
Front view of a Barclay 'War Horse'.
(Author's Collection.)

proper spectacle plate which the Barclay engines lacked. **Photograph 301** is a stylized view of the 0-6-0 from the Hudson Catalogue.

Side, front and rear drawings of the 5 inch gauge Barclay engine are presented as **figs 203, 204 and 205**. **Photographs 302 and 303** show front and rear views of the engine.

Photograph 304 shows WDLR locomotive number 602 undergoing a steam test in the works at Kilmarnock. The background has been tidied up, but the photo shows a lot of useful detail. Sadly, a similar view of the left hand side of the engine doesn't seem to exist.

Photograph 305 shows a set of scale plates made recently and gives an idea of the care that went into making the cast plates carried by these engines. The scale plates are in brass but the originals were cast in iron (**ref 66**). For such



WDLR engine in Caledonia Works. (Author's Collection.)



WDLR numberplates and maker's plates.

utility engines it's a surprise that the numbers weren't simply painted on.

After the war at least two were repatriated (ref 67) and worked for Surrey County Council on the construction of the Guildford and Caterham bypass in 1929 – although what happened to them between 1918 and 1929 seems to be unrecorded; likewise their fate after the bypass was completed in 1934.

Down Memory Way

I have tenuous connections with the year 1917 (well it was a long time ago!), with Barclay well tank locomotives and with the Alco 2-6-2 that, for me, link things together somewhat.

Firstly, my father was born in 1917 whilst the Flanders campaign was raging in Belgium. His father served in Egypt as a sergeant in the Machine Gun Corps and I once had a photo of him (sadly lost), in uniform and sitting on a camel in front of the pyramids. It would seem he was most likely part of the Sinai and Palestine campaign which was fought from 1915 to the end of the war.

Secondly, whilst volunteering on the Tallyllyn railway, I've fired and occasionally driven both *Douglas* and *Tom Rolt* (Barclay 1431 and ex BnM No.1) and acted as brakesman on *Bord na Mona No.2*, when Clifton Flewitt kindly pulled the locomotive out from its shed with the diesel so I could photograph it (ref 68).

And finally, I was honoured to have a footplate trip on the 2-6-2 ALCO *Mountaineer* on the Ffestiniog Railway in 1984, with

the late 'Dick' Hardy of *Steam in the Blood* fame as fireman and photographer. The engine was driven by Paul Ingham. *Mountaineer* started life as Cooke Locomotive Works No. 57156 of 1916; its WDLR number was 1265.

Photograph 306 gives an indication that, surprisingly, the 'Alcos' were quite big engines; I remember that the piston-like clearances through the Garnedd and new Moelwyn tunnels were pretty scary. The photograph was taken at Porthmadog in June 1984 on my day off as a TR fireman.

Up a siding

As a matter of interest I've just found this composite photo (spot the join) on the pile of CDs I have in stock, which rarely get accessed. (I'm sure its discovery is a familiar story to most of you in this era of digital photography!) The picture (**photo 307**) shows what I called my 'train set' and was taken in the late 1990s. The Barclay appears in its first manifestation as *Douglas* with the TR's No.4 *Edward Thomas* sitting behind, which is, surprisingly, a modified *Simplex*. Also in the picture is the 'Corris' van and a selection of functional rolling stock inspired by the design of the WDLR wagons.

Some years ago, 'er-indoors was talking to someone at work in the NHS who was making a big thing about his 00 gauge railway layout. She got a bit cheesed off when he started on about his *Flying Scotsman* and eventually she said "my husband's got a model railway"



2-6-2 ALCO Mountaineer on the Ffestiniog. (R.H.N.Hardy)

and he said "oh right - Hornby or Fleishmann"? To which she replied "no it's custom-built, narrow gauge and runs around my garden"! But she's not that *au fait* with engineering matters any more than her close friend Linda who needed a new iron recently, so I said to her 'why not get a steam iron Linda' to which she replied 'No thanks, I'd rather have a nice modern one'!

Thinking back I believe the reason for my desire to have a layout around the garden (**photo 307**) resulted from a desperate need as a child for a train set. I was born during the final years of the Second World War, and a very limited amount of toys were available from the 1940s equivalent of 'Toys 'R Us'. But my maternal grandfather, who had trained as a cabinet maker before joining the Marines, made me loads of useful items that were not available in the shops; for example a carpenter's bench complete with vice, saw, hammer etc. and a go-cart.

When I was about eight or nine my parents bought me a Hornby-Dublo train set for Christmas with an 0-6-0 tank engine. After about two weeks, when my father and his

friends tired of playing with it, I managed to operate it myself! A big problem, however, was that it kept blowing fuses and, ultimately, even though dad developed a repair method by soldering in thin bits of copper wire, the fuses ran out. And so things stayed until dad, fed up with my lack of interest, sold it to the man who ran the local sweet shop. Needless to say I stopped buying sweets from him and used the other confectioner in town!

● To be continued.

REFERENCES

65. W.J.K. Davies: *Light Railways of the First World War*. David and Charles, 1967.
66. Keith Taylorson: *Narrow Gauge at War*. Plateway Press, 1987.
67. Martin Fuller: *Tallyllyn and Corris Steam Locomotives Volume 1*. Pre-preservation and Manufacturers. Sara Eade Publishing, 2014.
68. Terence Holland. *Stradbally Woodland Express Railway and the Bord na Mona Well Tanks*. *Model Engineer* Issues 4451, 4452, 4453. March to April 2013.



A nice little train set.

Garrett 4CD Tractor

in 6 inch scale

PART 72

Chris Gunn carries out a steam test on the completed engine.



Continued from p.93
M.E. 4642, 3 July 2020

This article has been written to guide the builder through the construction of the 6 inch scale Garrett 4CD tractor designed by Chris d'Alquen. The writer has previously built a 4 inch scale Garrett and a 6 inch scale Foden wagon so has the benefit of considerable experience in larger scale modelling. Most machining can be done in the average home workshop but the supplier from whom the castings and drawings are currently available is able to provide a machining service for the largest items if required.

After a good check all around to make sure every hole in the boiler had something in it, and it was sealed, I began to prepare for my first steaming on the 18th of June 2015. I started off by filling the belly tank and as the tank filled I found I had one or two drips from around some of the screws, and I had a suspicion I had not tightened all the screws when I had finally positioned the tank, so that was the first job to go on my to do list.

The tender bypass was opened and the water began to flow from one to the other, using the water level going down as confirmation of that. Eventually the water flowed out of the bottom tender drain, and then the top tender drain - so far so good. In the meantime, I had been filling the boiler using a funnel attached to the water filler. The water duly rose up the water gauges so all was seemingly fine there.

Drawings, castings and machining services are available from A. N. Engineering: Email: a.nutting@hotmail.co.uk



It was time to light up, so I fitted an extension chimney made from a 2m length of 125 mm round ducting I had delivered to my door. This was slightly smaller than the bore of the chimney top, and slid down inside a few inches, so I made an aluminium ring to centralise the ducting in the chimney. The fire was started with a load of dry sticks and a firelighter, and away it went. I was pleased with how easy it was to fire as the fire-hole door swings open and is large, whereas the 4 inch Garrett has smaller sliding doors which seem to stick when cold and the runners fill up with coal dust and ash.

When the chimney was getting warm, I added some coal and the fire continued to draw very well - maybe scale plays a part here by improving the drafting. I added a little

more coal and had another reality check as I realised how much coal was needed to fill the firebox. It did not take much more than 30 minutes to get a bit of movement on the pressure gauge needle. I took it up to 30psi at this stage and had a number of steam leaks; some I dealt with there and then but others would need dealing with when it was cold and they were added to my 'to do' list.

I was very happy that I could get it to tick over nicely at this low pressure but the main problem I had was that the pump was not working so I could not really carry on safely. I dropped the fire and let it cool down. As this is a bigger engine, it took a lot longer to cool down than its baby brother. I set to, working through my list, and amongst other things made a new

rake and shovel, sorted out a leaking gauge glass, and fitted 'O' rings to all the taper cocks which were all leaking, I had forgotten to fit these on final assembly. There were various other leaks as well and these were dealt with. I had to tighten all the screws holding the belly tank to its supports - all were loose as I had forgotten to tighten them.

The main thing I spent time on was the pump. I had deviated from the drawing of the pump and made valves with PTFE seals bearing down on a flat face, which work well on my small engine but seemed not to work on this, although it was hard to tell. When I had a close look, I decided that there was not a lot of space around the valve to let the water pass, as this pump does take a big gulp every time. I decided I would try it with some $\frac{7}{16}$ inch stainless balls instead, so ordered a few up which came by first class the next day.

I was able to steam again on the 22nd and this time I took it up to 75 psi, and most of my repairs were effective but still the pump would not go. I could hear it sucking air, which I thought was coming through the gland, so I did a quick repack and still it would not go. I fiddled with the pump bypass valve and away it went. The bypass valve I had fitted (of unknown provenance) was shut when the handle was in line with the pipe and open

when across at right angles, which is opposite to normal conventions. The valve had been open all the time and I guess the pump could have worked with my original valves but as it seemed to work so well with the ball, I left it alone.

I did have some more issues which arose after the second steaming. Two leaks meant that I decided to call it a day at 75psi and let the fire die down while I let the engine run in a little. The leaks and a couple of other items were added to my 'to do' list. Most were steam leaks but I also had new water

my third steam up, and this time I took the pressure up to 160psi. In order to put this into context, the design working pressure is 225psi. I was happy with the pump which was still working fine, so the next big item that needed to be tested was the injector. It should have worked at 160, but did not, and I played about with the steam and water valves trying to get it to pick up. I was also gradually tightening the spring on the safety valves, obviously another important item that would be inspected in the steam test.

No matter what, I could not get the injector to work so I let the fire burn itself out and let the engine run in some more.

leaks from the underside of the belly tank. I removed the hand-hole covers on the belly tank, drained it down, and slathered Blackjack on the offending area. I also felt the fire was drawing too well on tick over - it was blazing away - so I removed the chimney and made a bigger diameter blast nozzle. I did try the injector at 75psi but did not expect much as it was not designed to work at this pressure. I took some video of the engine running and also one still which shows the fire on tick-over (**photo 619**).

Once again, I dealt with the items that arose and then had

No matter what, I could not get the injector to work so I let the fire burn itself out and let the engine run in some more. In the notes I took after this test I noted that I stopped the test about 1pm, and the engine was still warm to the touch at 6pm. I felt that the engine maintained steam very well and the pressure could be dropped by pumping some water in, but the effect was nowhere near as great as its little brother as there was much more heat in the boiler and fire. I would need to take care when driving it as I do not like to run the engine with the safety valves constantly blowing off. I would need to take care in only building a big fire if I was going to use it. I still felt the fire was too bright just on tickover.

I also had a problem this time with the safety valves wisping steam, so I took the spring lever off and lapped the valves in after stuffing the safety valve chimneys with rags to keep the abrasive out of the block. I made yet another blast pipe nozzle - the collection of nozzles was growing and was shown in an earlier episode.

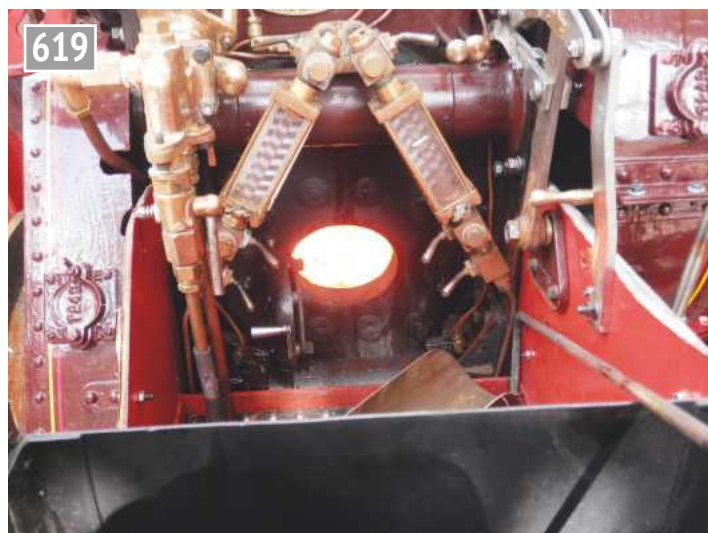
The belly tank was still leaking badly from underneath,

so I had a really close look and found that a seam had not been closed properly in the area of the tunnel which houses the steering shaft as it passes through the bottom of the tank. I mentioned earlier that, had I leak tested the tank at the time of building, I would have picked it up and could have dealt with it more easily. The Blackjack was just running through the joint instead of setting, so I applied some layers of insulating tape across the joint and then applied the Blackjack. This time the Blackjack could not run through and did set. The problem seems to be over but only time will tell.

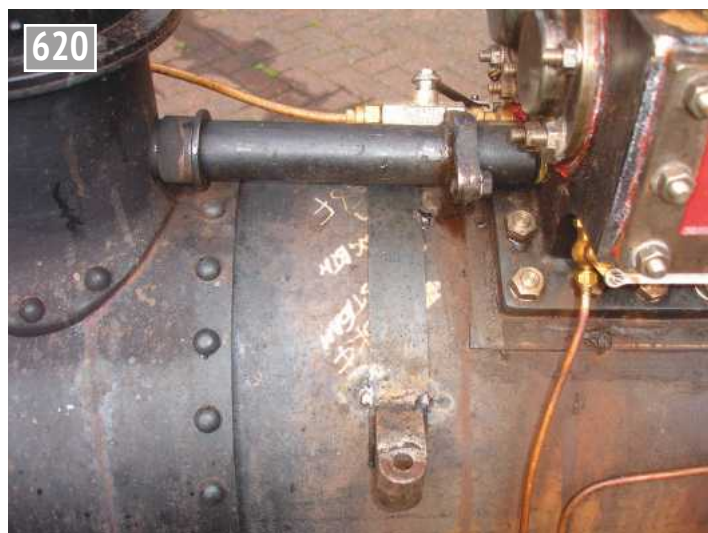
As far as the injector went, I decided to go right through it all and I felt that the fittings I had used in the water feed line could be restricting the flow, so I upped the size where I could. I checked the clack valve and opened up the fittings at that end too. I had another steam test, to no avail as far as the injector was concerned, but I did manage to reduce the wisping from the safety valves and set them a bit closer to working pressure. Once again, I let the engine run and cool down and my next bright idea was to remove the injector clack and plug the inlet. Then I steamed up again and tried the injector against just atmospheric pressure. Still I could not get a drop out of it and I deduced it had to be faulty.

I made arrangements to change it over a weekend at the Lincoln rally in August which I attended as a visitor. I must give this rally a plug. It is a good day or weekend out and if one is interested in miniature road locomotives there have been over 100 in the ring for the last few years, with a few more on display.

On the Monday after the rally, I fitted the new injector and this time I tested it in reverse order, so to speak. With the outlet open to atmosphere, when I had raised steam to about 110psi I tried it, and - yes - this time it did work, even more so at about 160psi, I felt it could



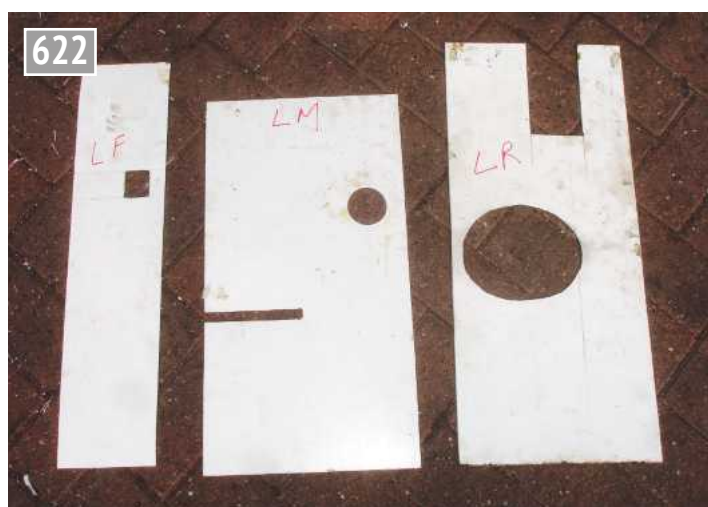
A good fire.



Canopy support.



Right-hand patterns.



Left-hand patterns.



Patterns on engine.

have punched a hole through the garage door. I had to wait a day before I could refit the injector clack and set it all up again, and when I steamed it up the injector worked perfectly from about 200psi down to 95 psi. I was now in good shape and I spent a day annoying the neighbours as I set the safety valves to blow consistently; the valves make quite a noise in a quiet urban setting. I had a couple more steam ups from cold over the course of the next few days to check and check again that everything worked as it should consistently.

I arranged a steam test, and this was duly done and passed so it was tea and chocolate biscuits all round.

I now had a chance to get it finished and to rally it before the end of the 2015 rally season. Before that though, I needed to fit and paint the

cladding to finish it off. I had a few weeks in hand, so set to. I planned to lag the boiler with some ceramic fibre blanket I had, left over from when I built the 4 inch Garrett back in 1999. I had purchased this from RS Components at the time and - yes you guessed it - 16 years later it came in handy. The blanket would be backed by some kitchen foil to reflect heat back, then I would apply the wooden lagging followed by the steel cladding.

First of all I had to decide where the boiler bands would go and, after taking advice, I used four bands, one at the smoke box end, another in front of the block, the third at the other end of the block and the last at the end of boiler barrel next to the hornplates. This made the steel cladding easier to make and fit. I also had to remember to make the cladding

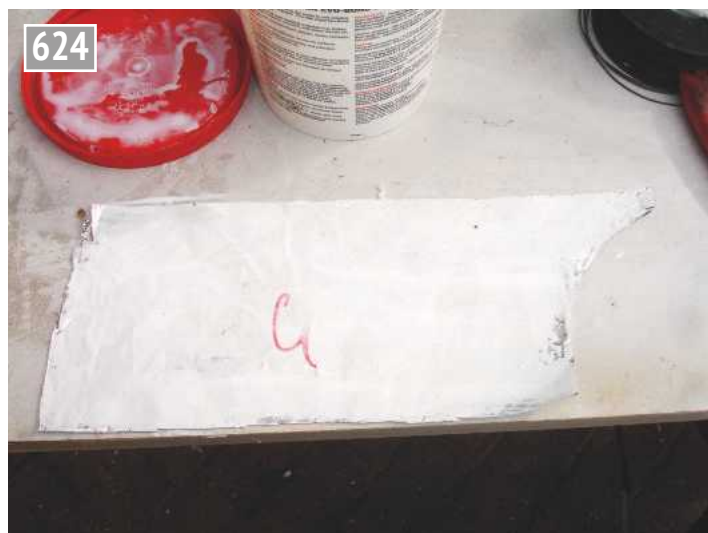
so the joint lines fell under the bands. It sounds obvious but it's worth saying. I also had made a support for the front end of the canopy and I had to work the cladding around this too. The supports, which are welded to a thin strip of steel, are shown in **photo 620**.

Once that was established then I made a start. When one has a look at the engine one can visualise that patterns can be made for the cladding, comprising three pieces each side and each would only have one hole in it. It was feasible to make the patterns with the correct size hole and with the ends left over long. There would be a join along the top of the boiler and also one underneath. It did not appear to be possible to make the cladding in three pieces that wrap right around the boiler as these would be

almost impossible to fit with the engine as it was now, in running order.

I was chatting to a friend about this and he suggested I used plasticard sheet for the patterns, the type used for making miniature buildings on model railway layouts. He had some available so I collected that and this was much easier to work with than card. I could mark it out and cut it with a box cutter. I basically started with the width needed then marked out and cut the hole and or slots, leaving the length oversize. **Photographs 621** and **622** show the first stage of preparing the patterns.

Once they were made, I then tested them on the engine, by wrapping them round and holding them with some soft iron wire from my greenhouse, normally used for plant ties. This is shown in **photo 623**.



Lagging section.

I also had to remember to make the cladding so the joint lines fell under the bands. It sounds obvious but it's worth saying.

I trimmed the patterns closer to the finished length. I could calculate this up to a point, as I knew the total thickness of the cladding would be $\frac{1}{2}$ inch. How did I know this you may ask? This was dictated by the front boiler band, which is not flat but has a radius on the front face to lift the flat section this distance from the boiler barrel, as the finished clad boiler is bigger in diameter than the smoke box barrel diameter. I had ordered this from A N Engineering who have a former to make this which saved me time I did not have.

Having sorted out the patterns the next step was to add the initial lagging which was to consist of the ceramic blanket backed by the kitchen foil. My number one tip would be to pick a calm day to do this. I did it on a windy day and every time I turned my head the wind moved the materials about. When my wife's back was turned I snaffled the kitchen foil and, after half an hour juggling cut pieces of ceramic blanket and kitchen foil in what felt like a force 8 gale, I had a rethink. I had half a tub of white PVA adhesive kicking around, so I got that out and brushed it on

the foil and the blanket stuck to it, which made life much easier. Flushed with success, I then tried painting the boiler with the PVA and sticking the lagging on, and this worked too. **Photograph 624** shows a piece of lagging ready to go on.

I should mention that this ceramic blanket has many small fibres and it is sensible to wear thin gloves and a face mask when working with it. I would also recommend keeping one's clothes or overalls separate and washing them on their own to avoid any fibres making their way elsewhere, as they can be itchy.

I worked my way from the back-head to the front



Lagging part complete.



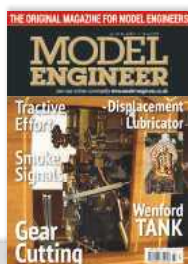
Lagging complete.

of the engine in convenient sections, and this went better than my initial expectations. I managed to lag under the belly tank by applying PVA to the inside of the lagging and pulling the sections into position with a spare piece of Plasticard. **Photograph 625** shows work in progress.

Once the lagging was done, I went over all the joints with some duct tape. I had to be careful with this as it would grab the foil and pull it off the ceramic blanket. **Photograph 626** shows the lagged engine.

● To be continued.

If you can't always find a copy of this magazine, help is at hand! Complete this form and hand in at your local store, they'll arrange for a copy of each issue to be reserved for you. Some stores may even be able to arrange for it to be delivered to your home. Just ask!



Subject to availability

Please reserve/deliver my copy of **Model Engineer** on a regular basis, starting with issue _____

Title _____ First name _____

Surname _____

Address _____

Postcode _____

Telephone number _____

If you don't want to miss an issue...



CLUB NEWS

Geoff Theasby reports on the latest news from the Clubs.



After my remarks in the previous issue, 'Follow that!', your wish is my command, 'O Bolide Master'.

There has been much activity in the workshops of the world, including here - I have a new, very small transmitter, which is menu-driven so that there are a minimum of controls on the front. I don't like this 'feature'. However, I have built a small interface so that I can program it from the computer. All hail Bill Gates and Tim Berners-Lee! Also, simultaneously with my anniversary issue we have the builders in. They tell me it's a new bathroom but I know what it really is - those soft walls are a giveaway. However, as Gloria Gaynor put it, "I will survive", to annoy you a second time... Also, search the internet for the story of Brother Jocundus.

It being Monday morning when the builders began work, I should not have been surprised when in mid-morning all my workshop power went off. (Flanders & Swann, *The Gasman Cometh*.) The plumber said he allowed a live cable to touch a water pipe. However, I checked before I restored the power - I wouldn't want to see him all black and charred, hanging from the ceiling light; he would make a mess and get in the way. So, searching around in the Stygian gloom, first to find my torch, and then replace a suspect fuse, I found it quite 'Funny by Torchlight'. I don't know what Gainsborough

Pictures would have made of it. On Tuesday it happened again! This time I was ready and had added to my solar powered emergency lighting system, placing lights in the crooks and nannies to assist me further in the preparation of this magnificent organ.

In this issue: a heresy, mooses, gas, Zoom, another lathe, a periscope?, Shack Sloths, a petardless hoist, mouldy and bent ships, and speleology. (See, like Spinal Tap, mine goes up to eleven!)

On 20 May I received an e-mail from Gerry Martyn, web organiser for **Pembrokeshire Model Engineers**. In the early hours of Tuesday 19th May their clubhouse was broken into, some items stolen, and the building set ablaze. In the words of their secretary, as first sent out to members: 'Very upsetting to see our hobby going up in smoke, literally. The building inside is totally gutted, nothing has survived, roof gone, generator, strimmers, furniture, trolleys, nothing, it's all ash on the floor. The police have spent all night there as the building is now unsafe. Fire investigators will hopefully attend the site today (there is no doubt it's arson). It would not surprise me if the building has to come down, certainly listening to the senior fire officer early this morning'. He concludes: 'There is every intention to rebuild, and I'll try and put any developments onto our website news page but under the present lockdown there

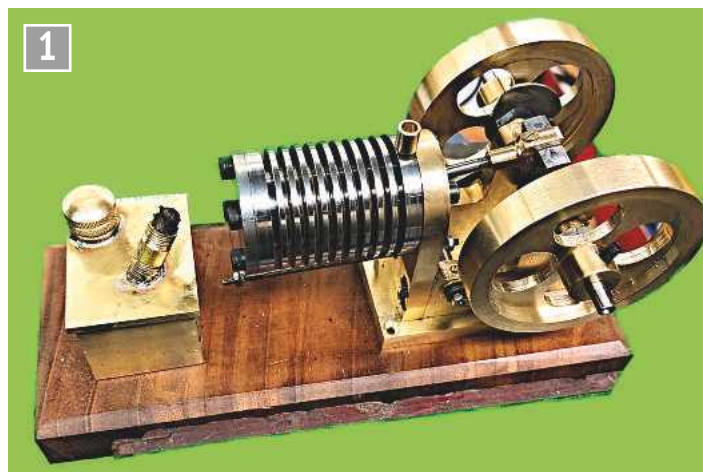
is certainly going to be some delay in getting fully on top of what needs doing'.

W. www.pembs-me.btck.co.uk

Bristol Model Engineers have produced a second lockdown special for May in which Donald Hamilton has made a very nice 'Poppin' engine (designed by a Dr. Senft in 1980) which is shown on the cover (**photo 1**). Editor, Richard Lunn, refers to committee meetings on Zoom, which he says is easy to join and use, as do many others. I beg to differ. My computer uses Linux, which may be incompatible. Several friends and acquaintances are attempting to find out why, in the meantime, I have missed several Newcomen Society, Radio Society of GB and Sheffield Wireless Society talks. Harrumph! Neil Baker was restoring a steam roller which had slept peacefully in a scrapyard for 25 years. To this end, he acquired and restored a Benson lathe (Robin Hood works, Nottingham) which also looked as though it had shared the same history. Donald Hamilton asked about cross drilling a shaft and Neil Dare mentioned a centre finder for this purpose but his then supplier seems now not to list it. (I obtained mine from Chronos Engineers - Geoff) David Ward uses a block drilled to suit the rod and drill and another way is to use a large hexagonal nut, cross drilled to suit. Norman Rogers still uses a Milnes lathe with overhead drive but it is capable of doing accurate work. Steve Smith engraved the makers name on the hubcaps of his 1 1/2 inch scale Allchin, starting with a CAD drawing. Lots of other fine projects grace this excellent, well-illustrated newsletter.

W. www.bristolmodelengineers.co.uk

Worthing & District Society of Model Engineers Newsletter, simmer [sic], opens to some music staves 'Happy Days are here again', 'It won't be long now, (yeah) yeah (yeah) yeah...', and concludes with 'Not Much Else'. (Poor girl, overlooked again!) Editor,



'Poppin' engine from Bristol MES (photo courtesy of Donald Hamilton).



Tom Scott's Sweet Pea at Grimsby & Cleethorpes (photo courtesy of Tom Scott).

Dereck Langridge, says 'If all else fails, we could always try housework'. Heresy!!! Glen Payne describes his model of Aveling & Porter, 1908 Class AM tandem roller, of which only one still exists. It was designed in 1902, specifically to work on asphalt surfaces. Glen also adds that their trademark of a rampant horse was adopted by Thomas Aveling (who lived in Kent) from the arms of the ancient Kingdom of Kent, being the steed of Odin, the Saxon King. (I shan't mention Ferrari, Volvo, etc – Geoff) Oh, go on then... <https://www.matthewsvolvosite.com> and then search for 'Prancing Moose'. John Stoton continues his entertaining series involving supercritical boilers, Russian engineers, Ohio State Penitentiary, using cash (or, trying to) in the USA, German engineers and their predilection for jokes about the people of East Friesland. Before Little

Else, David Baldwin explains what led him from a gas lamp to a 14XX locomotive kit. The KWVR's gas expert was particularly helpful. We know

our gas in Keighley. (Shades of the Goon Show, 'Foiled by President Fred'.)

W. www.worthingmodelengineers.co.uk

Grimsby & Cleethorpes Model Engineering Society sends May's *The Blower* which has an evocative picture on the front. It says to me, 'Zwei Duckstoyern dead ahead, Kapitan', but which might just be two ducks alongside a pole showing the depth of water over the lower field. Mike Gray is bored with watching the paint dry (indoors) or the grass grow (outdoors, aka cricket) and applied himself to painting his fleet of 32mm Swift Sixteen wagons. Tom Scott has a *Sweet Pea* in build. He is very pleased to be published in *Model Engineer* - fame! (photo 2). Editor, Neil Chamberlain, confesses a long held dark secret. He has taken up with an old flame. No, not the female variety, nor the male, thank you for asking. He is a radio amateur! People often think of CB (he says) but they do not compare. For a radio amateur licence there are three compulsory courses one must pass for full privileges. A physically lighter (and cleaner) activity, in which Neil was immersed during the lockdown period. If there are any couch potatoes left, or 'Shack Sloths' in the

radio amateur world (part of the Summits on the Air activity, although it requires high ground in order to participate, which is not common in Lincolnshire – Geoff) you can take a virtual tour of Swindon's STEAM museum: www.steam-museum.org.uk

W. www.gcmes.com

Graham Copley (**Ottawa Valley Live Steamers & Model Engineers**) writes to advise on the Ottawa tram system extensions, one of which ends in a field four miles short of its terminus. He mentioned his old home town of Barnsley being served in the early days only by a Midland Railway station at Cudworth ('Cuddorth') a similar distance away or, to quote an old miner, when asked why this separation of station and town, "Appen they wanted it near t' railway". Also, see some stills of 1950/60s Ottawa trams at www.youtube.com/watch?v=aR-FnxDvOmQ sent in by Stuart Gentle. The tramways closed in 1959.

W. www.x10host.com

Stamford Model Engineering Society provides us with a release from our cabin fever or, in a phrase not heard since my childhood, the 'screaming hab-dabss'. Keith Hansell has acquired a 3/4 inch scale traction engine made by David Mercer, about ten years old and never before fired (photo



Keith's traction engine in the 'paint shop', Stamford MES (photo courtesy of Keith Hansell).

3). Richard Wright decided just before Christmas that he would make a model 'something' as a change from making and mending things for others. Deciding on a vertical engine he obtained some drawings but thought it was too much like watchmaking, so he doubled the dimensions. A search of his scrap bin produced several items, of materials not suitable for full size work, but acceptable in a model. Finding a suitable picture and scaling from the nearby operator resulted in 25:1 or 'G' scale. Richard has fitted it with a DC generator, field coils above, 'old style' (photo 4).

Sydney Live Steam & Locomotive Society Newsletter, May, has Simon Collier discussing injectors, thinking previously that they were the preserve of the most able machinists only. Then he bought Derek Brown's book (TEE Publishing) and the scales fell from his eyes and bounced around on the floor. After various points, he feels able to make a 26 oz injector which would probably work. D. Lee (Robert?) made some new labels for an old NSWGR ground frame, and Geoff Hague made a sheet bending jig (or use less starch... - Geoff). James Sanders introduced 7-month-old Rosie to his workshop, with appropriate safety considerations of course. Mick Murray built a hoist, capable of moving 1.5m horizontally and lifting 100kg, driven by redundant power drill motors. The rigging of the pulley blocks was designed after studying the tower cranes near his workplace. This device worked well for some years, if imperfectly, so it was replaced by a 240 volt 100kg hoist traversing 3.3m and lifting 200mm more, with the girder, trolley and control gear from Mick. Mechanical stress levels were checked using an online calculator.

W. www.slsas.asn.au
GMES News, May, from **Guildford Model Engineering Society**, says they have been holding a series of meetings



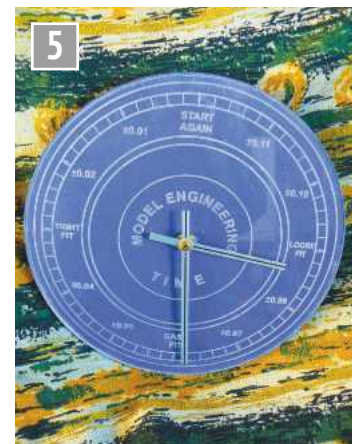
Vertical engine and generator, Stamford MES (photo courtesy of Richard Wright).

via Zoom, including 'Show and Tell'. Chairman, James Mander, says that the lockdown has provided him with plenty of workshop time, providing it doesn't last longer than about 80 years... Chris Putt is making a 1/32nd scale ketch rigged, Brixham trawler, Derek Hallowell reports that a Tesco tea strainer makes an effective spark arrester. (Cheap, too, it won't 'strain' the budget - Geoff) Roger Oates has designed a jig to help him in lining out the wheels of his *Petrolea*. Roger Curtis describes his work in a shipyard mould loft, including the production of half-mould models, usually the starboard half, probably now more often found in readers' local pubs. Roger's comments on accuracy are interesting. Engineers are said to work to '1/10th of a thou', but shipwrights worked to the nearest ship! In reality, better than a foot on the length overall was good. On top of this, the direction the ship lies whilst in build matters, for instance if it points north/south, the early morning sun could warm up the starboard

side more the port side, and the hull would subsequently bend by several inches.

W. www.gmes.org.uk

The *Monthly Bulletin*, June, from **Bradford Model Engineering Society**, begins with president, Jim Jennings, reporting that there is not much to report. However, Geoff Cowton writes of a small item he found whilst leading would-be speleologists into a cave known to have been inhabited for several millennia. It was clearly not natural, so, taking it to the museum for investigation, he was delighted to hear that it was bronze and was between three and four thousand years old! 'Happy Birthday To You...' <Ahem> Its purpose is unknown but, as Geoff says, its maker knew how to smelt metals and make bronze, to make moulds and cast items, not just into a lump but a designed artefact. Geoff has mounted it into a frame and hung it on his wall. Some years ago, Graham Astbury and friends designed and made a few *Model Engineer* clocks, with the numbers replaced by engineering terms,



BMES clock by Graham Astbury et al. (photo courtesy of John Hawkes).

and that also runs backwards! To raise funds for the club, one is being auctioned online, with a reserve of £10 (photo 5).

W. www.bradfordmes.uk

And finally, shopping deliveries during lockdown have been very useful. One company's delivery drivers have adopted a motto, *Per Ardua ad Asda* (the way to the stores).

Contact:
geofftheasby@gmail.com

FREE PRIVATE ADVERTS



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.

Classifieds and Coronavirus

For the duration of the coronavirus outbreak, it is unlikely that people will be able to collect items. Please also avoid unnecessary trips to the post office etc. Anyone selling or buying must do so on the clear understanding that despatch/delivery is likely to be delayed until it is safe to do so. If you buy or sell something for collection make sure both parties are happy to wait until after the lockdown to finalise the deal. 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

■ Warco 2B5 drilling machine mounted on a Clarke CWB57 workbench. Complete with co-ordinate table size 150mm x 470mm with Sinc DRO's on X279 & Y148. (Actual movement). 120mm drill vice included. £550 ono. **T. 07984 714487. Derby.**

Models

■ Part-built Maltese Falcon 260cc engine. Crankshaft, crankcases, cylinders completed, Honda pistons, bearings and gears supplied, also construction manual. Sale due to ill health. £500 ONO. **T. 01233 756276. Ashford, Kent.**

■ Stuart Turner Sun engine, runs lovely

and smoothly, £270.

T. 01179 324048. Bristol.

Parts and Materials

■ Stuart Turner Sun complete set of castings unstarted, still in original box with other components and drawings, £170. **T. 01179 324048. Bristol.**

■ Don't throw away your old Myford ML7 cross-slide feedscrew. Send an image to me and I might just buy it from you. State imperial or metric, jpeg please. **T. 01258 860975. Blandford.**

Magazines, Books and Plans

■ Model Engineer Volumes 90-221 (1944-2018) original issues hardbacked

bound. Advert only pages removed. In good used condition. Price £10/20 per book dependant on number of issues therein. Offers invited.

T. 01377 270120. Drifffield.

■ Model Engineer magazines - bound, binders, unbound copies, 1898 - 2018. Will sell complete or split. £1 per volume. Purchaser collects or pays post & packing or carrier charges.

T. 01929 462053. Wareham, Dorset

Wanted

■ Cowells ME lathe must be reasonably new with re-settable dials.

T. 01986 835776.

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 ☐

THE MOST VERSATILE TOOL FOR TURNING & FACING

It's easy to see why our best selling turning tool is the SCLCR. It can turn and face a bar without altering the toolpost, and the 80° nose angle gives much more strength than a 60° (triangular) insert. The NJ17 insert cuts steel, stainless, cast iron, phosphor bronze, aluminium, copper, brass etc. Please state shank size required - 8, 10 or 12mm square. Spare inserts £6.94 each for 8-10mm tools, £8.11 for 12mm.

SPECIAL OFFER PRICE £20.00

USE THE OTHER 2 CORNERS FOR ECONOMY!

Our SCRCR rough turning tool uses the same inserts as the SCLCR tools above. The good news is that it uses the other two corners! These very strong 100° corners are rigid enough for rough or intermittent turning. The insert is mounted at 75° to the lathe axis. 10mm sq section (for CCMT06 insert) and 12mm section (for CCMT09 insert).

SPECIAL OFFER PRICE £31.90

PROFILING WHEELS or SHAPING AXLES & PILLARS?

If you need to create complex shapes, our SRDCN button tool is invaluable. The 10mm square shank holds a 5mm dia cutting insert, and gives great versatility, superb strength and excellent tool life. The late Mr D Hudson of Bromsgrove SME used these tools for many years to profile the special form of tyre treads for his self-steering wheel sets with great consistency. Spare inserts just £5.87 each.

SPECIAL OFFER PRICE £34.00

TURN SMALL DIAMETERS with LIVE CENTRE IN PLACE!

The SDJCR tool uses a 55° insert, allowing access to small diameter components when using a tallstock centre. It can also profile back-angles. The NJ17 insert cuts steel, stainless, cast iron, phosphor bronze, brass, copper, aluminium etc. Shank size 8mm or 10mm square section. Spare inserts just £6.94 each.

SPECIAL OFFER PRICE £20.00

A TOP QUALITY BORING BAR FOR YOUR LATHE

Bar Dia.	Min Bore	Here's your chance to own a top quality boring bar which uses our standard CCMT06 insert. Steel shank bars can generally bore to a length of approx 5 times their diameter. Please state bar dia required - 8, 10 or 12mm. Spare inserts just £6.94 each.
8 mm	10 mm	
10 mm	12 mm	
12 mm	16 mm	

**SPECIAL OFFER PRICE £20.00 ea
or buy all 3 sizes for just £55.00!**

INTRODUCING THE GROUNDBREAKING NEW KIT-QD PARTING TOOL!

The new and innovative KIT-QD parting tool has a more secure insert location, stronger body and improved insert design compared to the original KIT-Q-CUT. It has an increased maximum reach of 23mm, giving over 1.3/4" parting capacity in solid bar. As previously, the tool fits the vast majority of ME lathes, including ML7 & ML10 machines, regardless of toolpost type. It comes complete with the key to locate and eject the tough, wear resistant insert. Cuts virtually all materials. Spare inserts just £11.07 each.

SPECIAL OFFER PRICE £69.50

EXTERNAL THREADCUTTING TOOL

These tools use the industry standard 16mm 'laydown' 3-edge inserts. With tough, tungsten carbide inserts, coated with TiAlN for wear resistance and smooth cutting, threads can be cut at very slow speeds if required. Tools are right hand as shown. 55° or 60° insert not included - order separately at £5.65. See our website for more info.

SPECIAL OFFER PRICE £36.50

INTERNAL THREADCUTTING TOOL

These tools use the industry standard 11mm 'laydown' 3-edge inserts. With tough, TiAlN coated tungsten carbide inserts, quality threads can be cut with ease. Tools are right hand as in picture. 10, 12 and 16mm diameters available. 55° or 60° insert not included - order separately at £5.65. See our website for more info.

SPECIAL OFFER PRICE £20.00

DORMER DRILL SETS AT 65% OFF LIST PRICE!

All our Dormer drill sets are on offer at 65% off list price. The Dormer A002 self-centring TiN coated drills are also available to order individually in Metric and Imperial sizes. Please see our website for details and to place your order.

TURNING, BORING & PARTING TOOLS COMPLETE WITH ONE INSERT.

Please add £3.00 for p&p, irrespective of order size or value



GREENWOOD TOOLS

Greenwood Tools Limited

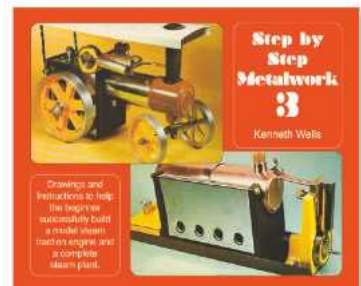
2a Middlefield Road, Bromsgrove, Worcs. B60 2PW
Phone: 01527 877576 - Email: GreenwTool@aol.com

Buy securely online: www.greenwood-tools.co.uk



**TWO GOOD PROJECTS FOR THE
BEGINNER - OR 'QUICKIES'
FOR THE GRANDCHILDREN ...
BACK IN PRINT AFTER 48 YEARS!**

Step by Step Metalwork 3 by Kenneth Wells



This brilliant reprinted book contains drawings and full building instructions for a low-pressure stationary or marine steam unit, and a simple traction engine model.

In building either model you will be instructed in working sheet metal, soldering, simple lathe work, filling, folding, taping & threading, annealing, flanging, silver soldering, pattern making, molding and much, much more.

The strength of this book lies in the quality of the instruction; Kenneth Wells was a much respected metalwork teacher and these instructions and plans were made for his older pupils to give them projects they could build over a school year. Initially only intended for use at the then Manor Court School in Portsmouth, Kenneth's instructions and designs became so well known that they were combined into book form, published in 1972 and sold widely. There are still numerous men of a certain age who treasure the Kenneth Wells designed engines they built many years ago.

Some use of workshop machinery is needed to complete these models, although a mini-lathe will cope with the machining. Alternatively, join a model engineering society with workshop facilities, or evening classes and have supervision to hand. This book can certainly start you on a wonderful hobby!

94 landscape A4 format pages, with considerable number of drawings, and B&W photographs which clarify the instruction. Spiral bound with acetate outer covers.

PRINT edition £25.40 inc. UK P&P

DIGITAL edition £ 9.95 - this may
ONLY be ordered on our website.

Barrow Farm Road Frome Somerset BA11 6PS 01373 830151

See our full range and buy online at:

www.camdenmin.co.uk

MODEL ENGINEER

BECOME PART OF
THE ONLINE
COMMUNITY FOR
MODEL ENGINEER MAGAZINE



- Get access to exclusive competitions and giveaways
- Exclusive articles and advice from professionals
- Join our forum and make your views count
- Sign up to receive our monthly newsletter
- Subscribe and get additional content including Online Archives dating back to 2001*
- Register for free today and join our friendly community!

WWW.MODEL-ENGINEER.CO.UK

* only available with digital or print + digital subscriptions

FOLLOW US



Model Engineer *Classified*



Quality, Performance, Reliability

Locos from

£1,095

Driving trucks, control systems and a whole lot more

www.phoenixlocos.com
01704 546 957



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

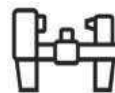
Email: david@quillstar.co.uk

webuyanyworkshop.com

Re-homing model engineers' workshops across the UK



It's never easy selling a workshop that has been carefully established over a lifetime. I can help make it easy for you to find a new home for much loved workshop equipment & tools.



Please email photos to

andrew@webuyanyworkshop.com

Or to discuss how I might be able to help, please call me on **07918 145419**

I am particularly interested in workshops with Myford 7 or 10 lathes

Don't know what it's worth?

- Good prices paid for all live steam models
Locomotives from gauge 1 to 10¼ inch
Traction engines to 6 inch scale
Part-built or broken through to exhibition quality
- A no-obligation offer and firm decision over the telephone
- Fully-insured collection nationwide
- Payment in full on collection

Speak to the experts

STATIONROADSTEAM.COM

Build, buy & sell all types and sizes of locomotives, traction & stationary engines

Call Mike or Jayne Palmer on **01526 328772**

Station Road Steam Ltd, Unit 16 Moorlands Industrial Estate, Metherringham, Lincs LN4 3HX

Open daily Monday to Friday from 8am to 6pm, visitors welcome by appointment



M-MACHINE
Unit 6 Forge Way, Cleveland Trading Estate
Darlington, Co. Durham. DL1 2PJ
Metals for Model Makers
Contact us for Copper, Brass, Aluminium,
Steel, Phosphor Bronze, etc.
PHONE & FAX 01325 381300
e-mail: sales@m-machine.co.uk
www.m-machine-metals.co.uk

Meccano Spares
New Reproduction and
Pre-owned Original
Meccano Parts.
www.meccanospare.com
sales@meccanospare.com
Tel: 01299 660 097

**To advertise here
please email
Angela Price at
angela.price@mytimemedia.com**

WESTERN STEAM
Model Engineers
Founder Member Assn of Copper Boiler Manufacturers (ME)
COPPER BOILERS
For Locomotive, Traction, Marine &
Stationary engines, to PER cat 2. All
copper construction, silver soldered
throughout using quality materials to the
standards required by the APCBM(ME),
PER, & relevant Model Engineering
Associations. CE marked and certificates
of proof test and conformity supplied.
Write or phone to Helen Verrall:
Unit 4A, Love Lane, Burnham-on-Sea
Somerset, TA8 1EY
Tel. 01273 788 007
Visit our website: www.westernsteam.co.uk

Cowells Small Machine Tool Ltd.
Cowells Small Machine Tools Ltd.
Tending Road, Little Bentley, Colchester CO7 8BH Essex England
Tel/Fax +44 (0)1206 251 792 e-mail sales@cowells.com
www.cowells.com
Manufactures of high precision screwcutting lathes,
8mm horizontal collet lathes and
milling machines, plus comprehensive accessory range.
Talk directly to the manufacturer

Meccano Spares
New Reproduction and
Pre-owned Original
Meccano Parts.
www.meccanospare.com
sales@meccanospare.com
Tel: 01299 660 097

GB BOILER SERVICES
COPPER BOILERS FOR LOCOMOTIVES AND TRACTION ENGINES etc.
MADE TO ORDER
Constructed to latest European Standards
7 1/4" gauge and P.E.D. category 2 Specialist
No VAT Enquiries, Prices and Delivery to: **No VAT**
Telephone: **Coventry 02476 733461**
Mobile: 07817 269164 • Email: gb.boilers@outlook.com

PHOENIX PRECISION
The Original and Still the best
Phoenix Precision Paints Ltd.
Orwell Court, Wickford, Essex, SS11 8YJ.
www.phoenix-paints.co.uk sales@phoenix-paints.co.uk
CARR'S
Modelling Products
www.carrs-solder.co.uk

metalcraft™
Hand powered metalforming tools
Handy for so many jobs

Punching Cutting
Riveting Bending
Rolling Scrolling
Twisting

Also suppliers of
a wide range of
steel, fixings,
clock components
& much more.

Call today for your free catalogue and if you
quote our promo code* MMENGW20, we will
send you our demonstration DVD free of charge.

J & C R Wood Ltd, Dept MMENGW20, 66 Clough Road, HULL HU5 1SR
Tel: 01482 345067 Email: info@jandrwood.co.uk
OR Visit our on-line store at
www.metal-craft.co.uk

Alec Tiranti Ltd.
Tel: 01635 587 430 enquiries@tiranti.co.uk

**Centrifugal Casting &
Mould Making Machines,
White Metal Melting Pots
Hand Casting Alloys.**

Web: www.tiranti.co.uk – we are also on Facebook and You Tube

Moulding, Modelling Tools & Materials
Pewter, White Metals, Bearing Metals, Silicone, Latex,
Polyester, Polyurethane, Fast Cast & Clear Resins.
Professional Range of Cold Cure Silicone Rubbers.

27 Warren St, London W1T 5NB & 3 Pipers Court, Thatcham RG19 4ER

To advertise on these pages contact Angela Price at angela.price@mytimemedia.com

PARKSIDE ELECTRONICS

www.parksiderailways.co.uk 01282 613646

Southfield St, Nelson, Lancs, BB9 0LD

Manufacturer and supplier of

Motor speed controllers, Motors, sprockets and chains, gears, bearings, springs, bespoke control panels, pneumatics. Bespoke electric and IC loco - complete and part - design

New range of 5" gauge bogies, chassis and locos

All chassis and locos are ready to run just add batteries

Powder coated with choice of body colours

Parvalux 150W motor on each axle

60 or 100A controller fitted as needed

Roller bearings in the axle boxes

Compression spring suspension

All can be operated from either end and be run as multiple units



Folded Bogie - £440

2x motors



Powered starter chassis £670

2x batteries - 2x motors



"Elf" £1050

2x motors

2x batteries

60A controller



"Pixie" £1350

3x motors

2x batteries

100A controller



"Imp" £1650

4x motors

4x batteries

100A controller

MODEL ENGINEER

BECOME PART OF
THE ONLINE
COMMUNITY FOR
MODEL ENGINEER MAGAZINE



- Get access to exclusive competitions and giveaways
- Exclusive articles and advice from professionals
- Join our forum and make your views count
- Sign up to receive our monthly newsletter
- Subscribe and get additional content including Online Archives dating back to 2001*
- Register for free today and join our friendly community!

WWW.MODEL-ENGINEER.CO.UK

* only available with digital or print + digital subscriptions

FOLLOW US



Tracy Tools Ltd.
Unit 1, Parkfield Units,
Barton Hill Way,
Torquay TQ2 8JG

 **Tracy Tools Ltd**

Visit our brand new website

We ship anywhere in the world

www.tracytools.com

PRODUCTS

- Taps and Dies
- Centre Drills
- Clearance Bargains
- Diestocks
- Drill sets (HSS) boxed
- Drills
- Drill set (loose) HS
- Endmills
- Lathe Tooling
- Reamers
- Slot Drills
- Specials
- Tailstock Die Holder
- Tap Wrenches
- Thread Chasers

Acme
Taps



Taper Shank Drill
HSS



Reamer



Taps
&
Dies



Tracy Tools Ltd

Tap & Die Specialist, Engineer Tool Supplies

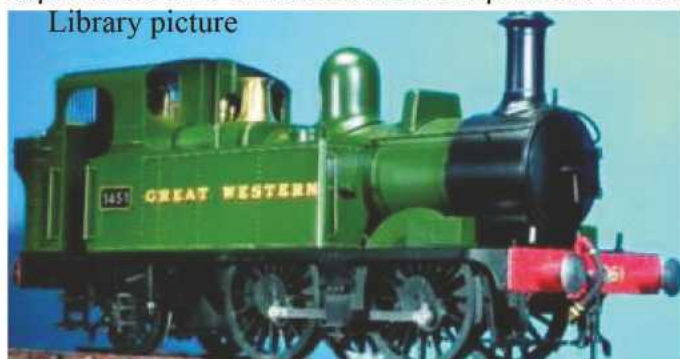
Tel: 01803 328 603

Fax: 01803 328 157

Email: info@tracytools.com

www.tracytools.com

Lock down offer we have a limited stock of pre machined parts left over from the production of Winson Engineering and Model Works. The kits could be used as a fast track way to build a model without the need to start from castings. These are new old stock recently discovered. They may require some work and fitting but many of these have been built / rebuilt and can offer a rewarding experience & fast track to a model. They were originally advertised as bolt together but engineering experience and a modest workshop would be a advantage. Help and guidance & spares available.



5" gauge LMS Dutchess locomotive 1 only unopened kit boxes 1 to 12 plus some loose parts for 2 further kits (incomplete). This includes all tender kits and the majority of a rolling chassis for the locomotive with some motion and valve gear.* This was the last model produced by Model Works before closure.

1 only, inc delivery (UK) **£2650**



Winson & Model Works spares we have a limited supply of machined spare parts for the range of locomotives manufactured by these firms. Some may be suitable for incorporation into other models please enquire.

Britannia or 9F cylinders

£175 pair limited stock

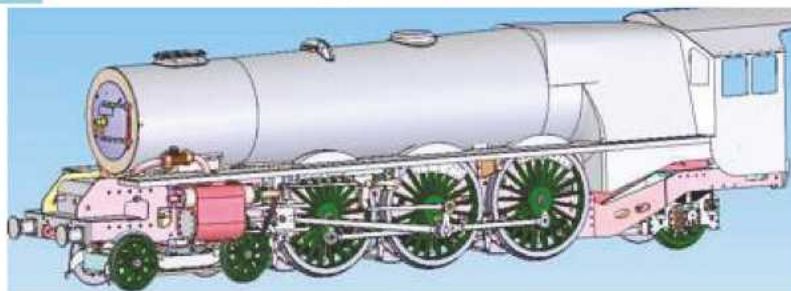


5" gauge GWR kit locomotive. The unopened boxes of kits for stages 1 to 6 will build into a rolling chassis with smoke box and motion.*

We have **2 only** special price inc UK delivery and a printed book of all instructions. each **£1750**

One as above but including tested copper boiler **£2950**

Plate work for the upper works available to special order.



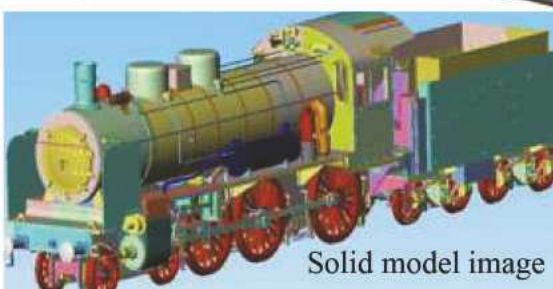
5" Gauge mineral wagon we have managed to make up 3 only sets of kit parts including chassis wheels and body for these popular wagons. There may be a few rivets and fixings missing but will produce a delightful wagon when built.*

£650 each or £1800 the 3

inc UK delivery

Printed assembly instructions and parts list

with diagrams to help with the maintenance of your model available in printed book format



Solid model image

5" Gauge Prussian P8 live steam locomotive kit.* A selection of machined prototype parts to build this locomotive. Included are 17 stages of parts** including a copper boiler to enable the design to be assembled and provide a demonstration model. This design did not reach production by its designer so presents a commercial opportunity for small batch manufacture. Included are engineering drawings (2D) and parasolid files (3D), written assembly instructions, parts lists and assembly drawings.

£ Offers

*May require rework/modification, parts / fixings may be missing, excludes engineering drawings. **List of parts available.



CHESTER MACHINE TOOLS HOBBYSTORE



EVERYTHING FOR THE HOBBY ENGINEER



0%
FINANCE AVAILABLE
IT'S QUICK & EASY
WITH
MONTHLY INSTALMENTS

Check Out Our Website for
Lathes • Drills • Mills • Disc Sanders • Bandsaws • Fabrication
Tooling & Accessories • Plus much much more in stock

www.chesterhobbystore.com