THE ORIGINAL MAGAZINE FOR MODEL ENGINEERS

Vol. 226 No. 4659 • 26 February - 11 March 2021

MODEL ENGINEER

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

Boring Tool Holder

Backgear Repair

Brienz Rothorn Bahn

FOCAS Conrod

mytimemedia ENGINEERING GROUP
59
£4.20
9 770026 732216

MODEL ENGINEER

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

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

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

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

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

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

MARKETING & SUBSCRIPTIONS
Subscription Manager:
Beth Ashby

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

mytimemedia
print & digital media publishers

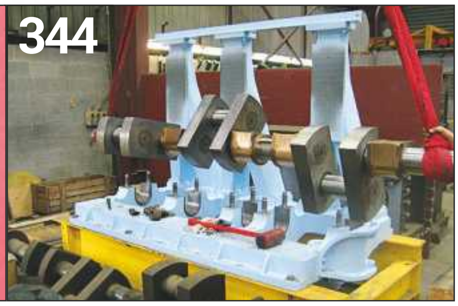
Model Engineer, ISSN 0026 - 7325 (USPS 24828) is published fortnightly by MyTime Media Ltd, Suite 25S, Eden House, Enterprise Way, Edenbridge, Kent, TN8 6HF, UK. The US annual subscription price is 136USD. Airfreight and mailing in the USA by agent named World Container Inc, 150-15, 183rd Street, Jamaica,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

http://www.facebook.com/modelengineersworkshop

http://twitter.com/modelengineers

recycle
When you have finished with this magazine please recycle it.

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



ISSUE IN THIS ISSUE IN THIS ISSUE IN THIS ISSUE

IN THIS ISSUE

IN THIS ISSUE IN THIS

Vol. 226 No. 4659 26 February - 11 March 2021

ON THE COVER...

Barry Lain created this 'cyclecar', from the 1910-1920's period, popular before 'proper' mass produced cars were made by manufacturers like Ford and Morris (photograph – John Child).

MODEL ENGINEER SUBSCRIPTION ORDER FORM

DIRECT DEBIT SUBSCRIPTIONS (uk only)

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

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

YOUR DETAILS must be completed

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

Address ....

....

Postcode .... Country ....

Tel .... Mobile ....

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

I WOULD LIKE TO SEND A GIFT TO:

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

Address ....

....

Postcode .... Country ....

INSTRUCTIONS TO YOUR BANK/BUILDING SOCIETY

Originator's reference 422562 — DIRECT Debit

Name of bank..

Address of bank ....

....

.... Postcode ....

Account holder ....

Signature .... Date ....

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

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

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

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

CARD PAYMENTS & OVERSEAS

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

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

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

PAYMENT DETAILS

☐ Postal Order/Cheque ☐ Visa/MasterCard ☐ Maestro

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

Cardholder's name..

Card no: (Maestro)

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ ☐☐☐

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

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

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

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

CODE ME2021

HURRY OFFER CLOSES 31st DECEMBER 2021

PRINT + DIGITAL SUBSCRIPTION

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

PRINT SUBSCRIPTION

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

SUBSCRIBE TODAY

SMOKE RINGS

MARTIN EVANS
Editor

DIANE CARNEY
Assistant Editor

YVETTE GREEN
Designer

Welcome Spring

As I write this, snow is still on the ground and the usual dawn chorus is rather muted. As you read this, though, temperatures should be getting much more spring-like and our long, locked down winter should be coming to a close. Having to endure both the winter and a lengthy lockdown at the same time has been a test of endurance for many of us and it must be a relief that at least part of that rather grim combination is on the way out. With the spring comes optimism and, with the very successful roll-out of the vaccines that we now have, an end, or at least an easing, of the current lockdown is within sight. I had my 'jab' a few days ago and I imagine a large proportion of you have had yours too. They are very tangible signs that we are beginning to make our way out of this crisis.

Drawing Errors

It is well known that many of the drawings we rely on to make our models contain errors. Some designers are worse than others and I understand that my illustrious predecessor and namesake was notorious for it! His models are also some of the most popular. This has been a hard problem to tackle as ownership of the drawings is rather diffuse and many suppliers of drawings have little incentive to update them. It is very good news then that John Roberts, of the Pimlico Light Railway, has offered to undertake the compilation of an 'errors database', beginning with Martin Evans's 'Simplex' design. We hope to make this database available in due course on the *Model Engineer* website. Please see John's letter in Postbag, page 332, and do give him whatever help you can.

Insurance

Dave Moore, chairman of the Brandon club, writes (see Postbag, page 332) to point out that, with far fewer days of public running in clubs this year, there must have been a sizeable drop in public liability claims. This surely represents a bit of a windfall for our insurers so it is perhaps reasonable to suppose that they might share some of this with their customers in the form of a discount on this year's premiums. It seems a little tough that clubs have had to pay, effectively, for insurance that they cannot make use of. Now, of course, I don't know how much of the claims paid out is for public liability but it's worth asking the question, isn't it?

In Memoriam

It is with regret that we report the death, on the 25th January, of Peter Langridge, stalwart and latterly honorary member of the Guildford Model Engineering Society. Peter's passion for small steam locomotives led him to create the LittleLEC competition back in 2007. We hope to be able to include a fuller obituary next time.

Mystery Object

Last time's mystery object is no longer a mystery. Mark Piper writes to say:

'I think it may be a gunsmith's choke gauge.

'Over 30 years ago I used to do a little clay pigeon and rough shooting using a 12 bore shotgun and on one occasion when I was in a gun shop purchasing some cartridges, another customer was selling a side by side double barrel shotgun to the proprietor who asked the seller what choke the barrels were. The seller was unable to answer the question, saying that he had purchased the gun second had some years ago and due to inexperience at the time had not asked such technical questions. The proprietor produced a tapered plug gauge which looked similar to the one shown in your article and by inserting it into the ends of the barrel was able to ascertain the choke of each barrel.

'The bore of a shotgun barrel is not necessarily a concentric cylinder throughout its entire length. At the muzzle, the barrel may be flared or constricted slightly to different degrees thus affecting the shot pattern upon discharge. A barrel with no flare will produce the most concentrated shot pattern and this is referred to as 'Full Choke'. Differing degrees of choke are referred to as ¼, ½, ¾ choke and produce wider shot patterns (I'm sure a gunsmith could explain things much better). For example: a double barrelled gun may have one barrel at full choke, the first shot, and the second at say ½ choke. Thus, if you miss a moving target with the first barrel, you get a wider shot pattern with the second and hopefully hit your target.'

It strikes me that this could be very useful for deterring burglars – if you miss him the first time, you still have quite a good chance with the second barrel while he's running away. This is not legal advice.

Mark's conclusion was backed up by Ian Jones, Tony Bray and Jerry Brough. My thanks to all four gentlemen.

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

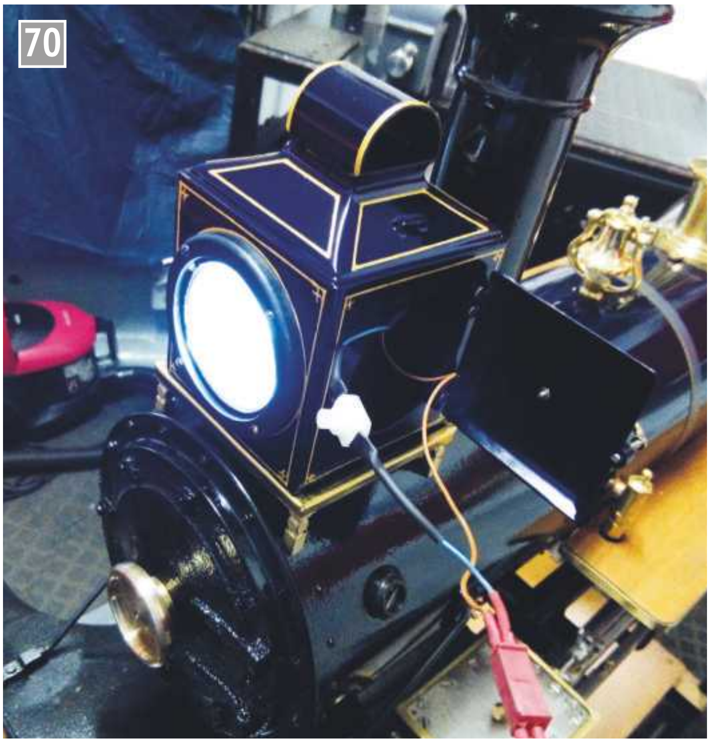
Old girl all dressed up posing for the camera.

PART 11 - THE LAMP, THE PILOT AND THE HANDRAILS

WAHYA A 5 Inch American Type Locomotive

Luker builds an American 4-4-0.

Continued from p.213
M.E. 4657, 15 January 2021



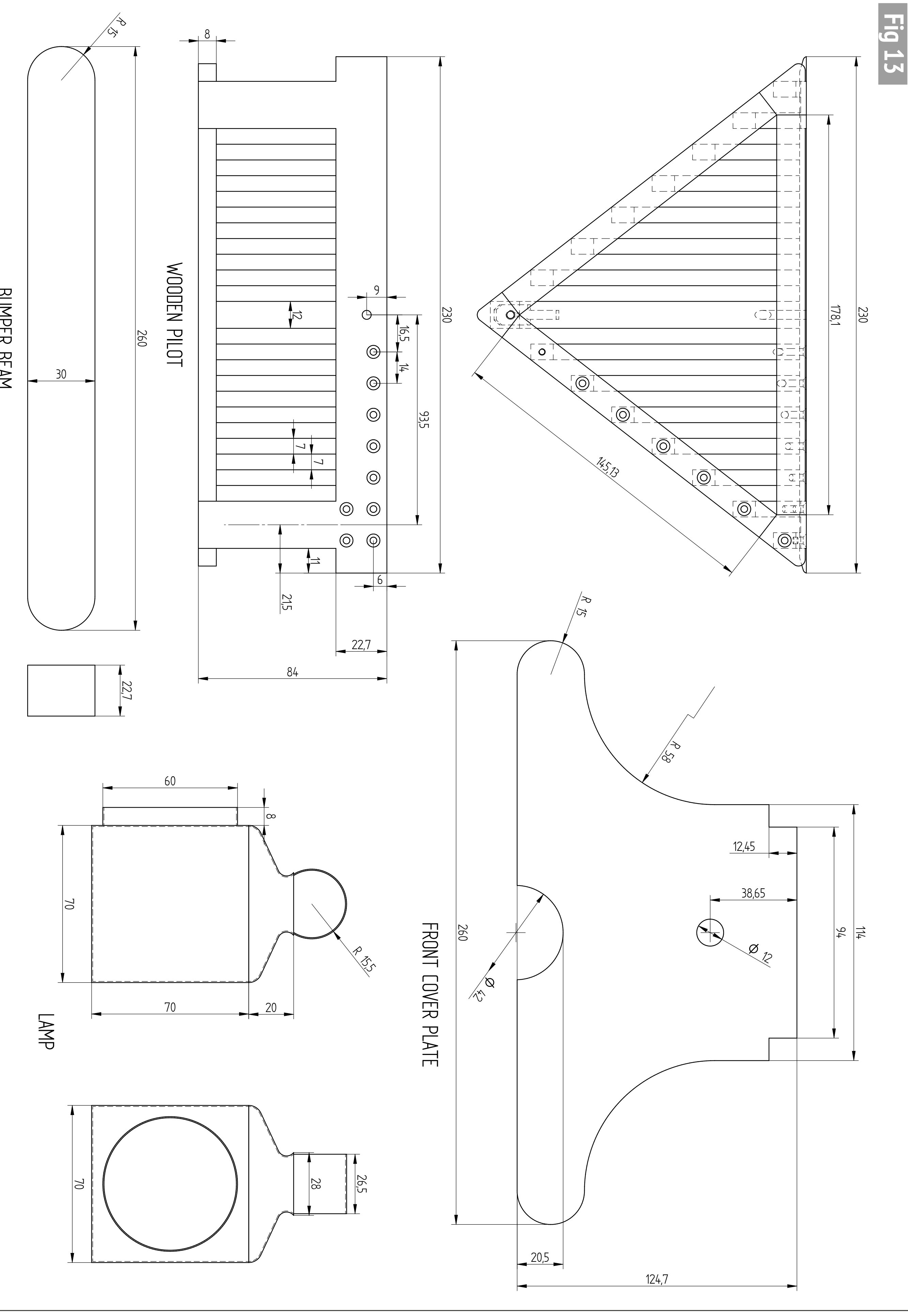
The front lamp.

The lamp

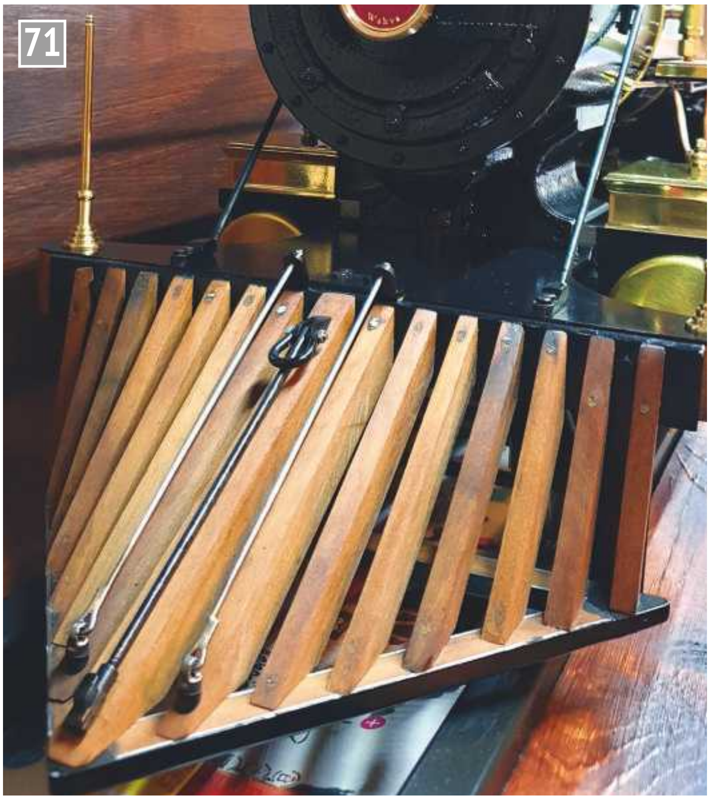
The front lamp on the American type locomotive was an ostentatious expression of pride in the railway line, with all sorts of charms fitted to the front end. Mine has a little wolf charm I found in a bead shop that could be modified to fit on the side. That, combined with some gold paint lining, gave the bold look the locomotive deserved.

The lamp itself (**photo 70** and **fig 13)** is a folding and soldering exercise and this is one of those circumstances in which cutting a little cardboard and making a dummy lamp with some masking tape is worthwhile. My specific lamp was made with the cladding I got from my house geyser when it burst (0.5mm

Fig 13



Lamp and front end.



The wooden pilot.

Machining the handrail stanchions.

Regulator dome cover.

galvanised plate). This solders just fine, is easy to cut with tin snips and is cheap (or, in my case, free). The reflector at the front is from an old down light that had a curved glass lens. This was fitted with a 6V super bright LED and a battery pack with a switch is neatly tucked behind the reflector for night running. The lip on the down light is clamped by a ring with a shoulder and four M2 rounded screws hold the lot in place.

I've been scarce with the detailed dimensions because it does depend a little on what reflector is available, with most builders probably using reflectors from old torches. The overall dimensions are, however, close to scale, with my specific lamp having a cut-out on the side with a door covering the hole.

The pilot

The pilot (**photo 71** and fig 13) for these types of locomotives needs to be as light as possible; you don't want too much weight at the front end removing adhesion from the coupled wheels. This limits the choice of materials to something lighter such as aluminium or wood. I made mine from wood like the full scale locomotives, but I didn't have the heart to paint over the natural wood, which I thought looked rather nice.

First the triangular bottom frame was built using ½ inch square tubing cut in half. Wood is fitted into the inside of the tubing and, with countersunk wood screws, held in place from the bottom. The back of the pilot is made from 3mm steel plate and is bolted to the bottom triangle forming the main frame for the pilot. After that, each individual section of wood is cut with the aid of cardboard templates and fitted to the back and bottom of the frame using wood screws. Where the wood screws protrude they can be neatly filed and any holes filled with some cold wood glue and saw dust mixed together to form a filling paste.

The bumper beam fits into the front frame angle and is clamped with through bolts between the outermost pilot beams. A 1mm cover plate then finished off the front end nicely.

The handrails

The handrail stanchions (**fig 14**) are a little tricky to machine and require a number of forming tools. When machining something like this, which will require repetitive operations for a number of components, I normally zero the feed dial gauge on the first final cut operation, with all subsequent operations marked on the dial with a marker. Okay, so a little more information is needed: first you plunge with a round nose cutter to the thick section of the taper; this is your first zero point. Then advance the taper slide to the end of the taper. Pull back everything to zero and change the forming tool to the small round and plunge until the round is the correct size. Mark the position on the dial. Change to the second rounding former and repeat for the ball of the stanchion, again marking the end position on the dial gauge. The part can now be completed (**photo 72**) and all the stop positions for the next couple of components have been marked, making the job go much faster. The same applies to the X-direction.

A drilling jig is made from some scrap 12mm square bar, by drilling a 6mm hole roughly 24mm deep, for drilling the cross holes. The stanchion needs to protrude a little from the jig for clamping in the vice to fix it in place for drilling. The cross hole can then be drilled 22mm from the vice through the jig and first stanchion (dead centre of the 6mm hole), with all other components drilled using the same set-up and the hole in the jig as a guide.

The regulator dome cover

The regulator dome cover (**photo 73** and fig 14) is machined in a similar fashion to the chimney with the help of

»

the cast on spigot. The base is then machined to the cladding diameter using a fly cutter. The two hold-down holes at the top are drilled and, with final fitment, the regulator flange is spotted through these holes, drilled and tapped for two neat looking studs to keep it connected to the boiler (and not in someone's pocket if the locomotive is not watched on a steam day). The original dome covers also only had the two hold-down studs with nuts; I assume the builders thought that the cover didn't need much more.

The sandbox

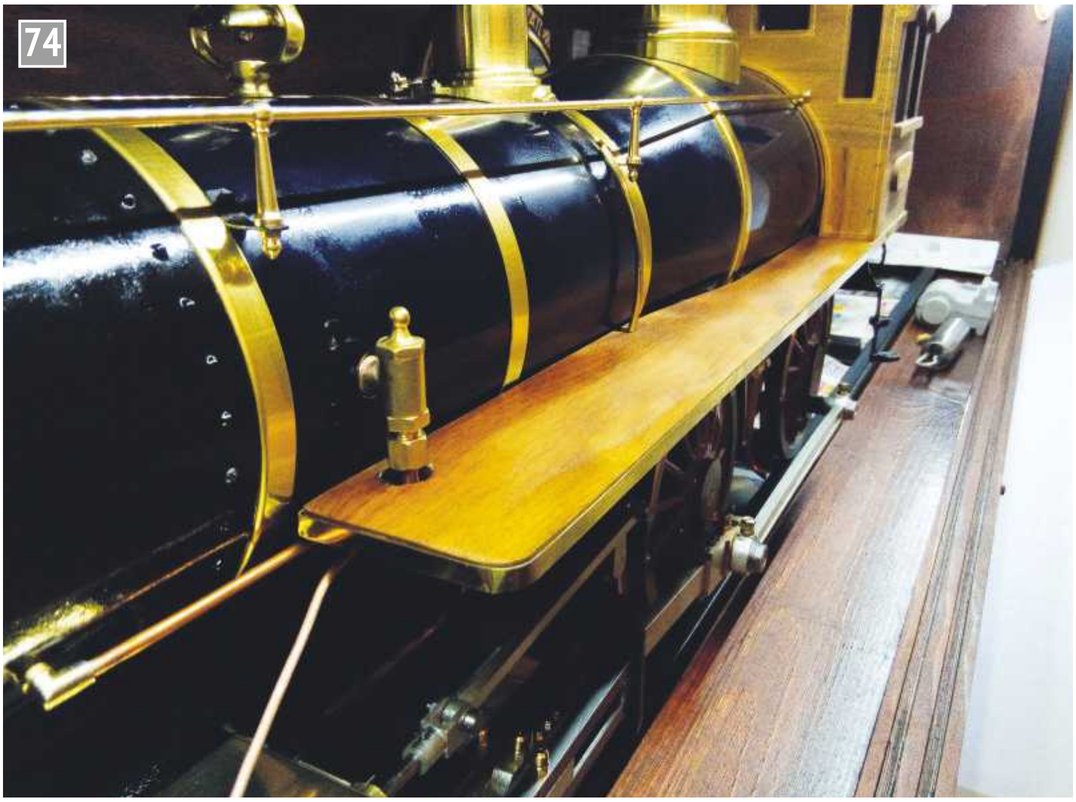
The sandbox casting required very little machining, with only the 3mm hold-down drilled with the casting pushed onto a mandrel. The base didn't need any machining as the sandbox rests on a boiler strap in any case.

The bell

The bell was made entirely from sand castings, with only the little fastening shafts and holes drilled and machined. The clapper is made by drilling a steel ball and soldering a link to the top of a piece of welding rod, held in place by the ornamental nut at the top.

The running boards

The running boards (**photo 74**) rest on the house brackets that are bolted to the side of the frames using the same bolts that screw into the drawbar. It is pointless giving detailed drawings of the running boards because it is highly unlikely they can be cut to drawing and fitted to the side of the boiler properly. These running boards are made using 2mm plate with the wooden running boards fitted to the plate using small wood screws from underneath. A decorative brass strip was soldered to the side of the plate protecting the wood around the periphery, just like the large scale locomotives. To get the correct fitment, cardboard templates are cut to match the boiler, with special care required at the taper section.



74

Running boards.

I didn't actually have any 2mm brass plate, which would have been perfect to solder the decorative brass strip to, so I had to use 2mm mild steel plate that was tin plated using my little DIY tin plating set-up, and the brass was soldered to that. If the builder doesn't want to go through the effort of soldering, the brass strip can be made wider and folded to form an angle. The fastening screws can then be hidden underneath the running boards.

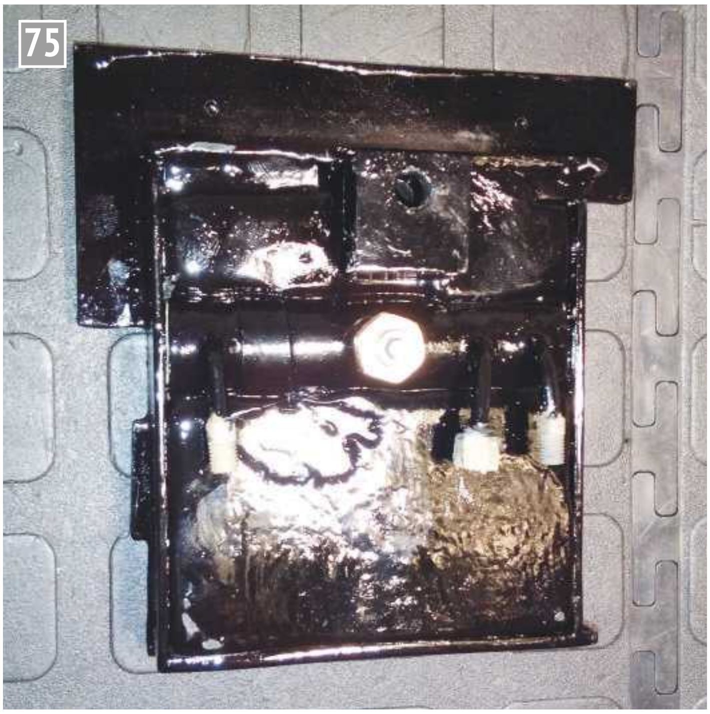
The running boards are bolted with 2mm angle sections in three places on the cylindrical section of the boiler with M2 screws rounded to look like rivets; see the GA for the scale positions.

Footplate

The footplate (fig 14) is of a very sturdy construction because the coupling bar needs to be fixed directly to it. The bottom is boxed with a simple displacement lubricator hidden here (**photo 75**). The area around the lubricator is filled with lead to improve weight distribution and to help with condensation in the oil tank to improve oil displacement. The lubricator itself is incredibly simple with a steam inlet line (from the dummy displacement lubricator) and two outlet lines to the cylinders. The outlet lines need to be at the top of the tank, and that's it! I used some 22mm copper plumbing tubing capped on both sides. Then, of course, you need a filling point at the top and I put mine through the floorboards, and a drain for the water at the bottom, all of which need to seal properly.

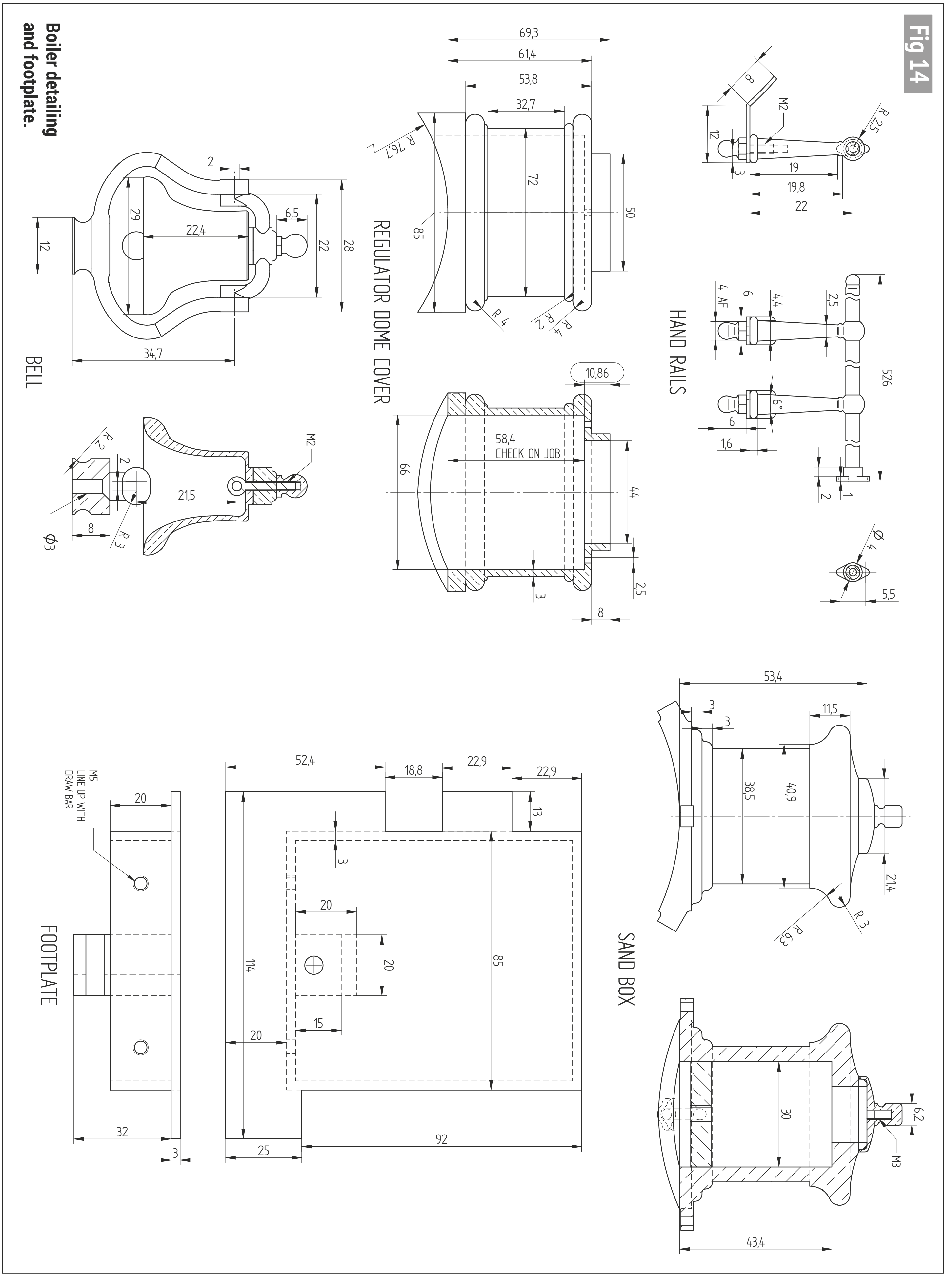
The drain cock levers

The drain cock levers on the cylinder side (**photo 76** and **fig 15**) were an interesting system to design. I wanted the levers to look like the

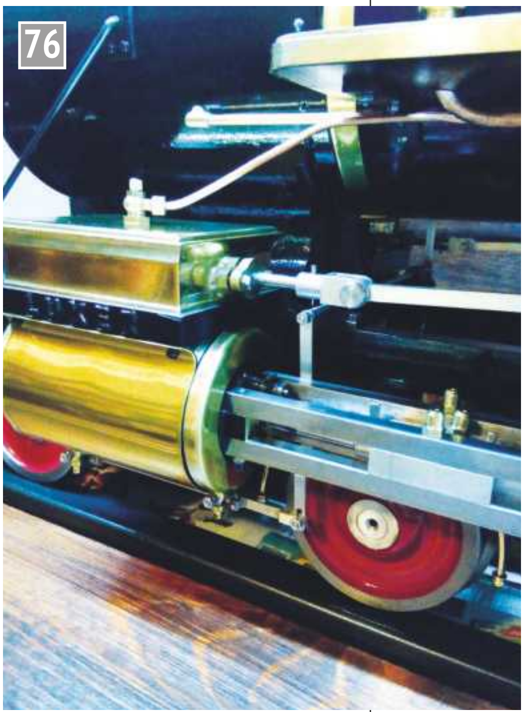


75

Underside of footplate with displacement lubricator.



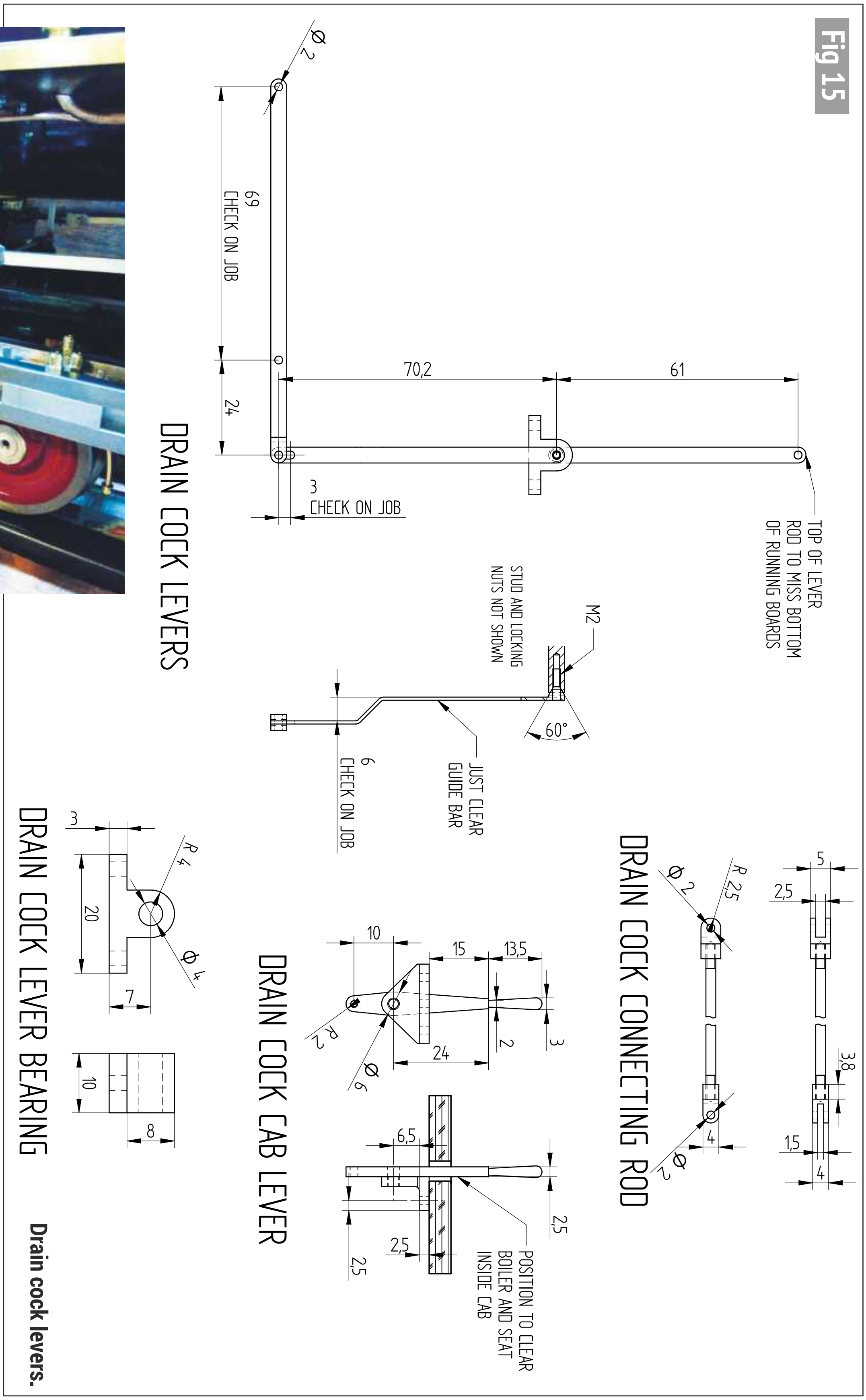
Boiler detailing and footplate.



Drain cock levers.

large scale but it needed to work on the track. In the end I used a taper or wedge locking system that worked really well. I suggest using an M2 stud with two locking nuts and then if you over torque the nuts the stud can be replaced without scrapping the main shaft. This shaft needs to rotate freely in the bearing blocks mounted at the top of the frames.

The clearance between the guide bars and wheels was very limited so the plate used couldn't be excessively thick. The same high tensile strapping I used for the leaf springs made excellent leavers; it's thin, stiff and the holes and slots can be machined with the proper feeds and speeds and, of course, a little cutting fluid. I have given dimensions in the drawings but these are really just a guide; by the time you need to fit these levers there would be considerable 'tolerance stack up' on all the various assemblies. The main dimension to double check is the distance between the drain cock taper spindles, adjusting the bottom lever accordingly. The drain cocks need to be aligned based on the lever arms by placing a straight edge on the inside of these levers and checking that it touches on the flats of both levers and doesn't rest on an edge.



Drain cock levers.

The position of the lever in the cab needs to be checked on the job. The push-pull rod needs to clear the side of the boiler and the lever inside the cab needs to be slightly to the left of the driver's seat. The handle at the top of the drain cock lever is made and soldered the same way as the reversing lever. The rod is made from 2.4mm TIG welding rod with the coupling at the ends machined from square bar stock.

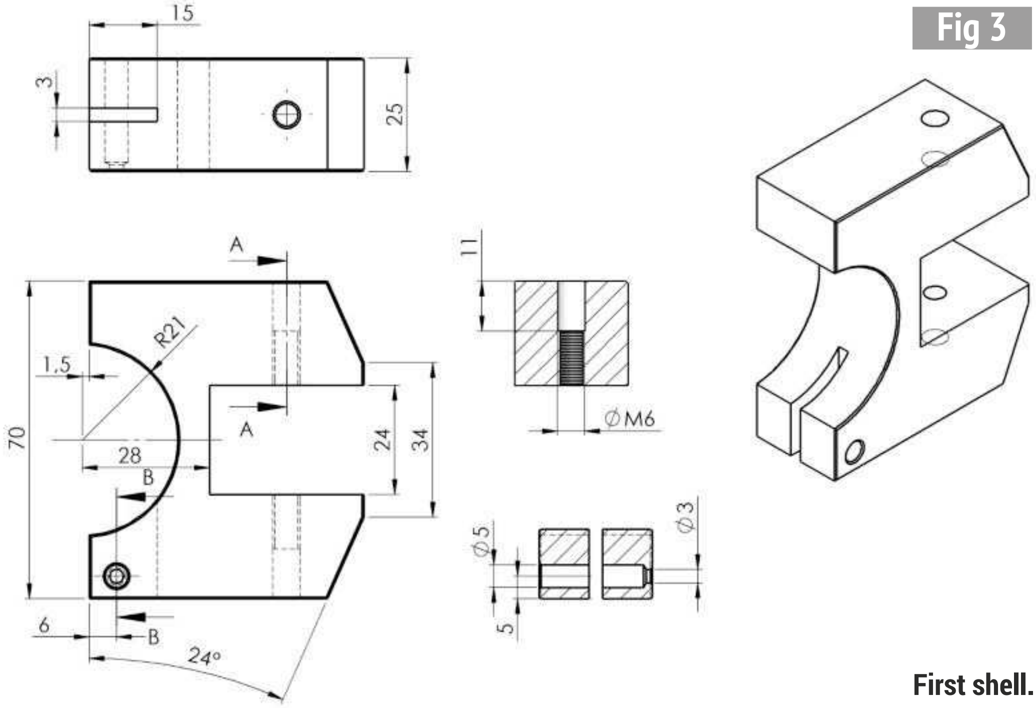
●To be continued.

A Convenient Laser Centre Finder PART 2

Jacques Maurel demonstrates a simply made but very effective laser centre finder.

Continued from p.269
M.E. 4658, 29 January 2021

Fig 3



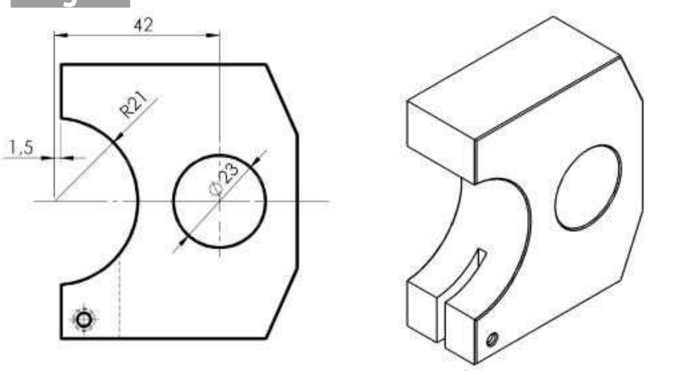
First shell.

Making

The shells (1** and **2)
(**figs 3** and **4**)
These are made from a single piece of 25mm thick PVC slab (any other plastic will do the job). First mill the block down to 124x70mm and complete all the machining less the strap groove. Saw it into two halves, machine the sawn surfaces to have a 3mm play between the shells and finish the strap groove.

Laser holder (3) (**fig 5**)
The main bore was drilled with a 13.5mm drill, but the resulting 0.3 mm play with the pointer body was too big, so I inserted a 0.1 mm shim (¾ of the circle) that took the play and gave some drag to keep the lighting button in position. The shim was prevented from moving by a notch made in the bore of part **3** (**photo 8**).

Fig 4



Second shell.

8

Locating the shim in the laser pointer bore.

Laser cap (8) **(fig 6)**
The thread was: external diameter 12.3mm, pitch 0.75mm.

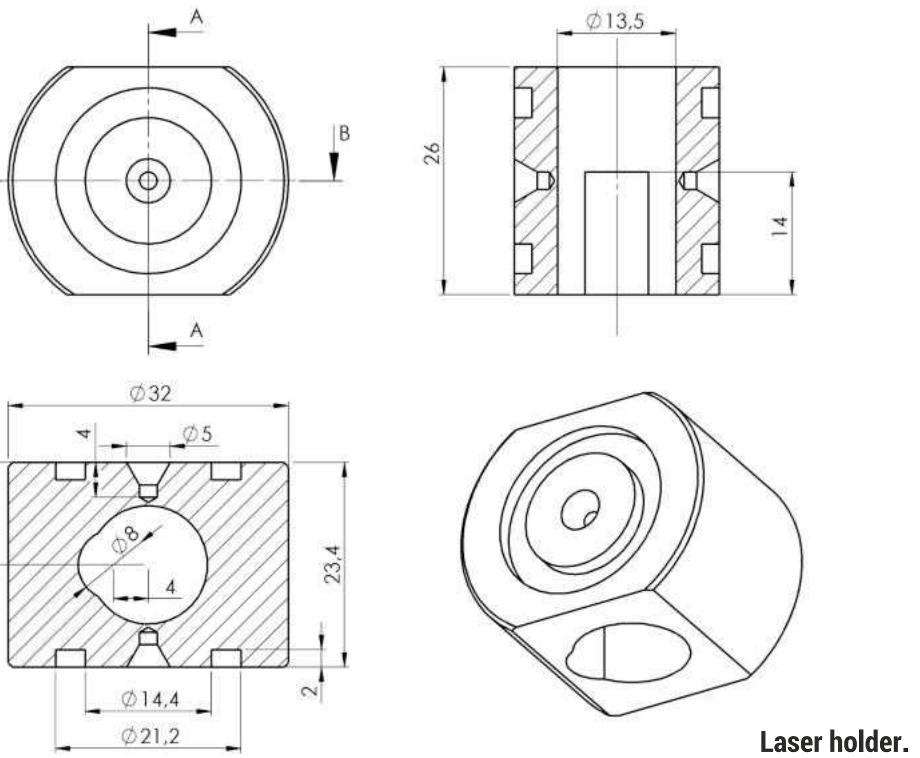
Lighting ring (4) **(fig 7)**
An 'O' ring rebate is shown on the drawing, to fit an 'O' ring as a brake, but this was redundant because of the shim stock already mentioned.

Screws (14)
These have a 60 degree cone turned on the end.

Instant latch
These are easy to find in DIY stores.

Tang plug
A plug can replace the chuck, into which is stuck a 10mm diameter tang, with epoxy glue.

Fig 5



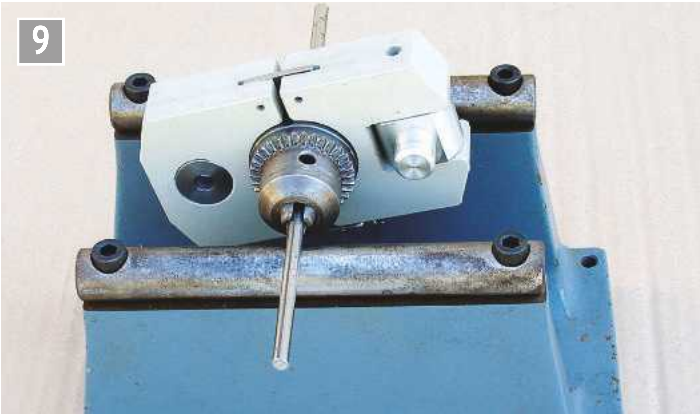
Laser holder.

Balancing

The instant latch is more or less balanced by the strap and pin's weight.

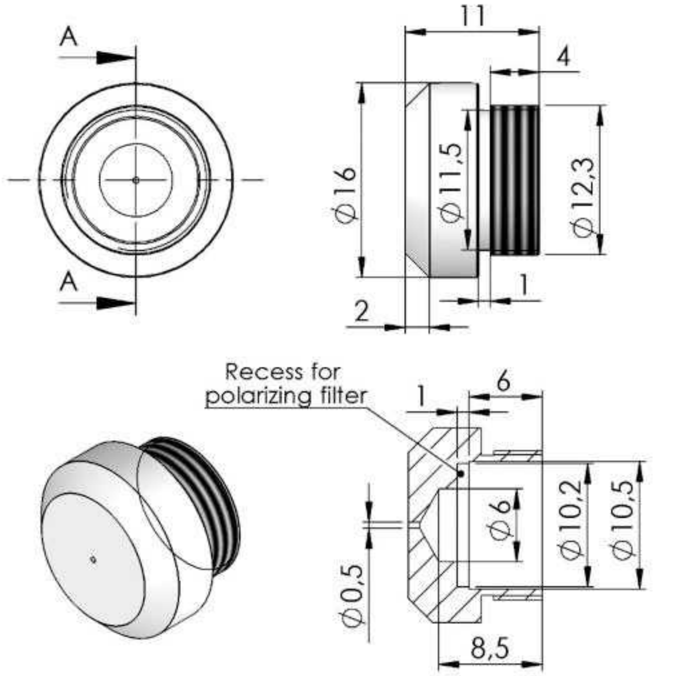
The center of gravity of the sub assembly (**3, 4, 5, 6, 7, 8, 9, 13, 14**) is near the axis of the screws (**14**). The balancing weight (**11**) is a slight press fit (0.05mm) into part **2**.
I used the grinding wheel balancing jig for my grinder (**photo 9**) to balance the centre finder. This is a 'U' shaped casting on which are set two parallel round bars that are well leveled. The whole attachment including the chuck alone has a 6mm diameter silver steel rod clamped into it. Any unbalance will make the whole thing rotate so that the center of gravity is in the lowest position. To get satisfactory balancing, 8.5mm diameter holes of increasing depth are drilled symmetrically on either side of the balancing weight.

9



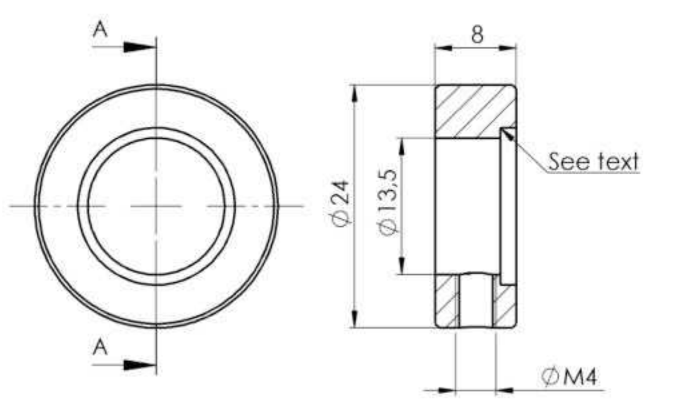
Balancing the centre finder.

Fig 6

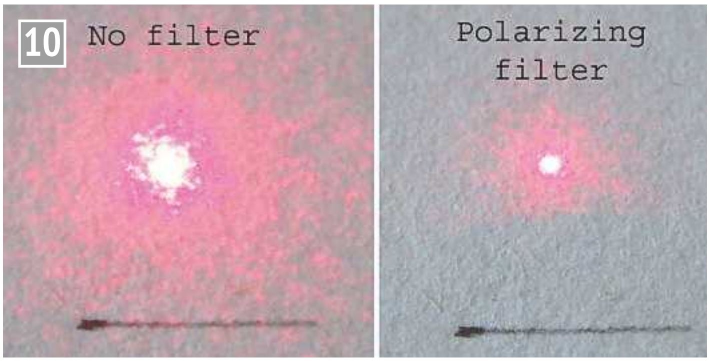


Laser cap.

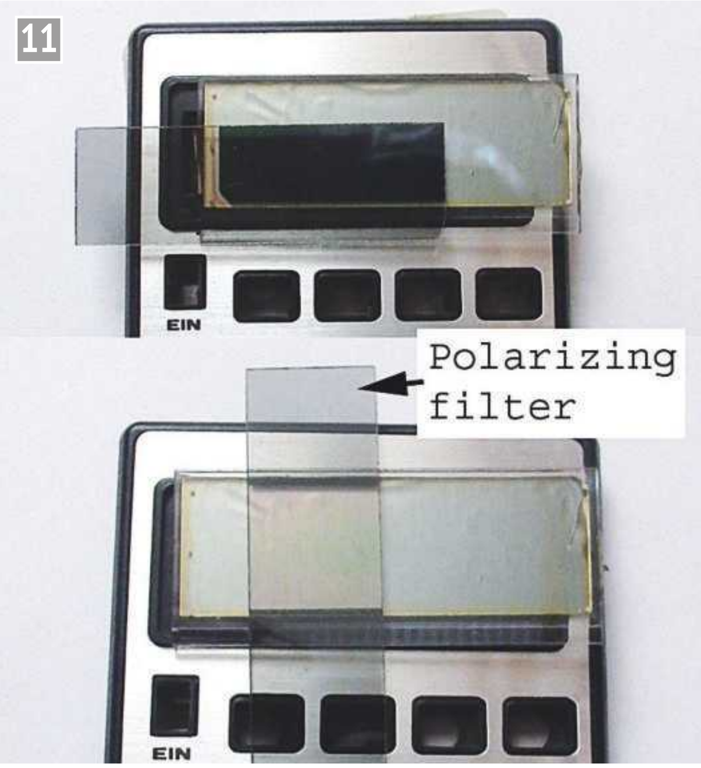
Fig 7



Lighting ring.



The effect of the polarizing filter.

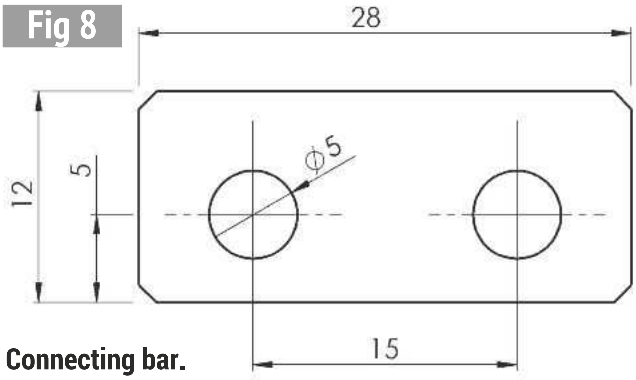


The filter was scavenged from an old calculator.

A last improvement

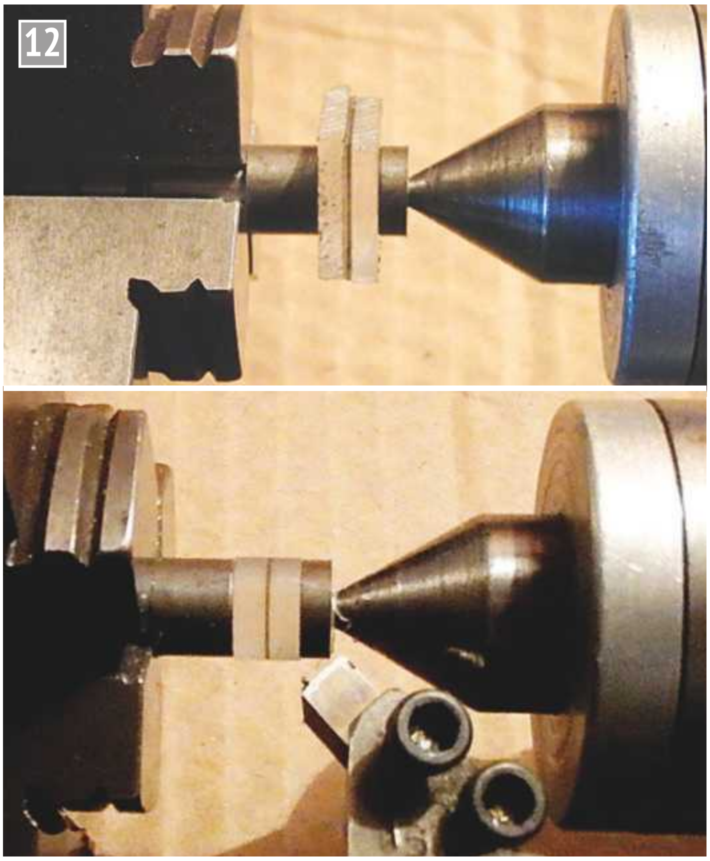
As the laser spot was quite sparkling, I've found (on the internet) that it was possible to solve this by using a polarizing filter (**photo 10**). Fortunately these filters are very commonly used for LCDs (liquid crystal displays) and I used one from an old calculator (**photo 11**). The lower part of the photograph shows the light passing through the filter, and the higher part of the photo shows the filter blocking the light when rotated through 90 degrees (go to Wikipedia for a whole explanation).

Fig 8



Connecting bar.

Part	No. off	Name	Material	Remarks
1	1	Laser shell	PVC	
2	1	Weight shell	PVC	
3	1	Laser holder	2017	
4	1	Lighting ring	2017	
5	1	Laser pointer		
6	1	Screw Hc M4-5	8-8	
7	1	Spacer	2017	
8	1	Laser cap	2017	
9	1	Lighting button		
10	1	Linking strap	FCMS	3mm thick
11	1	Balancing weight	FCMS	Dia. 23mm; 25mm long
12	2	Pin axle	Silver steel	Dia. 5mm; 22mm long
13	2	'O' ring		Internal dia. = 15.1mm, thickness = 2.7mm
14	2	Screw Hc M6-10	8-8	

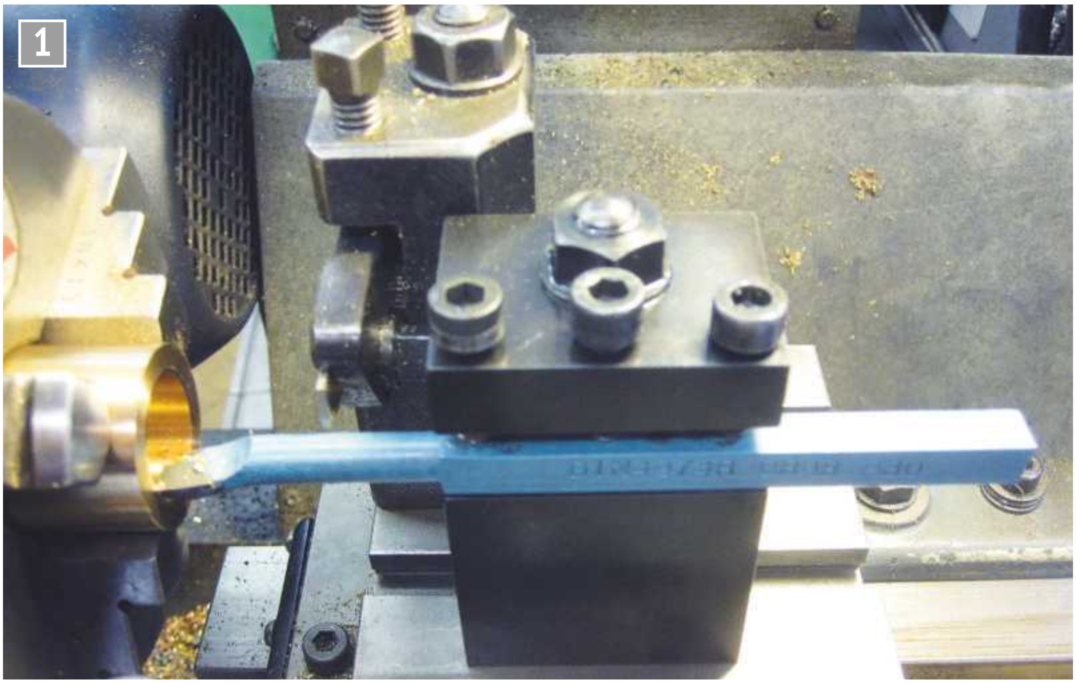


Machining the polarising filter to a disc.

The filter strip was 50 x 16 x 0.6 mm thick. A 16 mm square was sawn and set between two acrylic plates for turning, the whole held between two pressure pads, to get a 10.25 mm diameter disc for a slight press fit in the laser cap (**photo 12**).

Be careful as the filter must be set in the right angular position. To achieve this, draw a black spot with a felt pen on the outside part of the filter, turn the filter under the laser beam (the laser cap **8** completely screwed onto its body) and draw a black spot on the cap at the best position (low sparkling) in front of the filter spot. Dismantle the cap and press fit the filter in the best position with a soft 10mm diameter plastic stick.

ME



Boring tool holder.

Boring Attachment For a Myford Lathe

Bob Bramson introduces a simple but very useful boring tool holder.

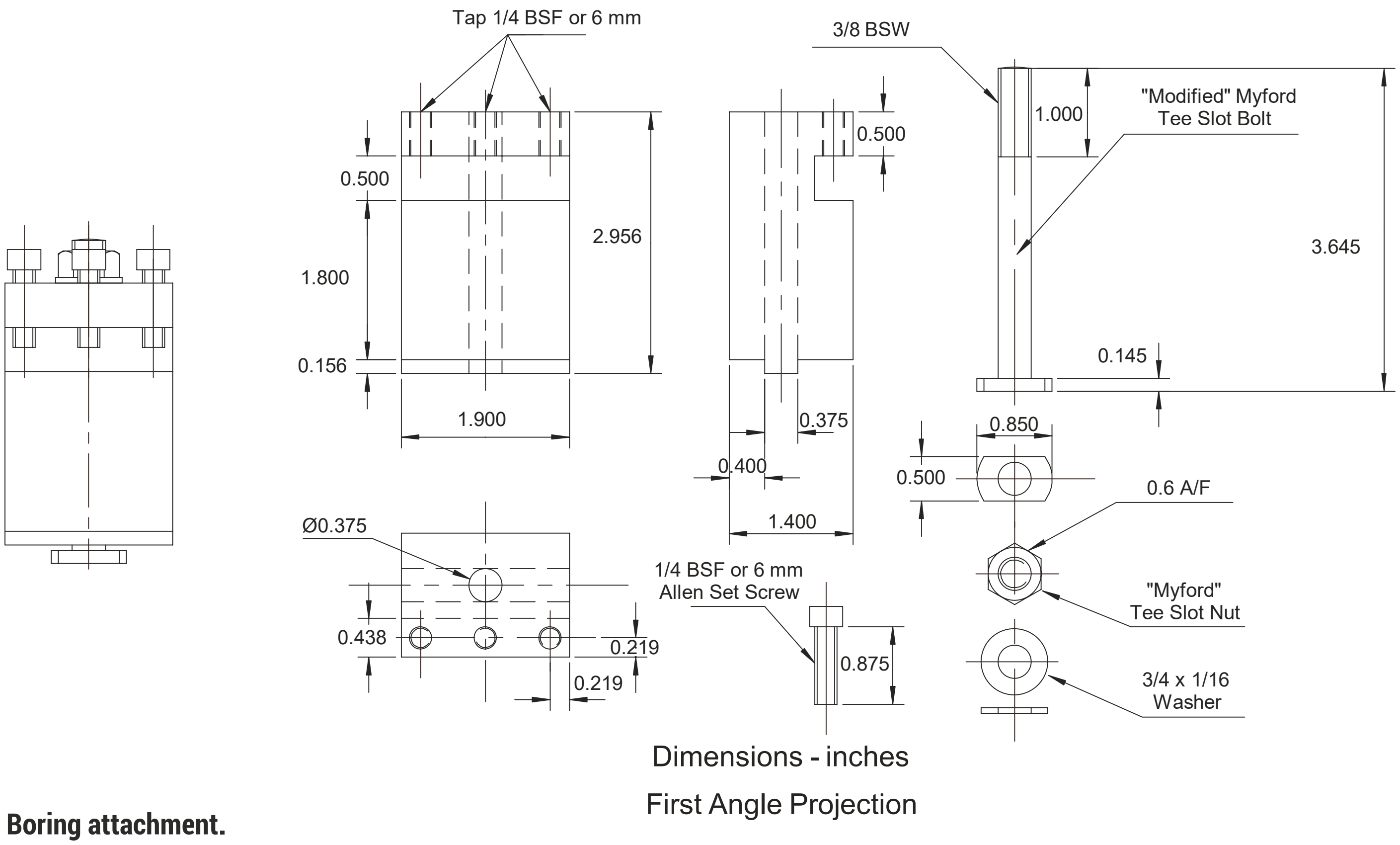
My 21st birthday present from myself to myself was a standard Myford Super Seven lathe. I had saved up for this during my seagoing apprenticeship and managed to include a three jaw and four jaw chuck plus a few other accessories as part of the deal, including the Myford four tool turret. The tool shop in Willesden from which I purchased it has long since disappeared but the Myford, 53 years on, is still performing sterling service despite the soft bed and I use it for all the relatively delicate items, leaving my Harrison M250 for the heavier parts. The versatility of the Myford is a credit to the company that introduced it and many of these machines grace the workshops of model engineers throughout the world.

As it happens, I use the four tool turret rather than a Dickson type tool holder. This is purely my preference and no criticism of the quick change tool holding devices which are very popular, as it is easy to set the tools to centre height and, given sufficient tool holders, a good variety of tooling can be selected at will. The drawback in my opinion is that it is very slow when changing tools as you really should clean the slides each time to prevent debris from damaging the locating surfaces, with the possibility of introducing undesirable side effects on the work.

Sometimes, it is amazing how a simple operation, in this case using a boring bar, becomes a bit of a drudge. Relying on drilled holes preparatory to reaming is unlikely to yield good results and larger bores that cannot be drilled necessitate the boring bar treatment. With quick change tooling it is easy to select a pre-set bar and get on with the job. Since I seldom need to employ more than four tools, the turret provides a very quick means of producing most items.

However, for years I have become vexed when having to remove at least two tools from the turret, replace with a boring bar and set up to centre height before attacking a bore. I resorted to placing a boring head in the tailstock and using that to size a hole but it cannot produce truly parallel bores and sometimes it physically fouled other items on the machine. When using the Harrison with a bolted-on tee slotted plate fitted to the

Fig 1



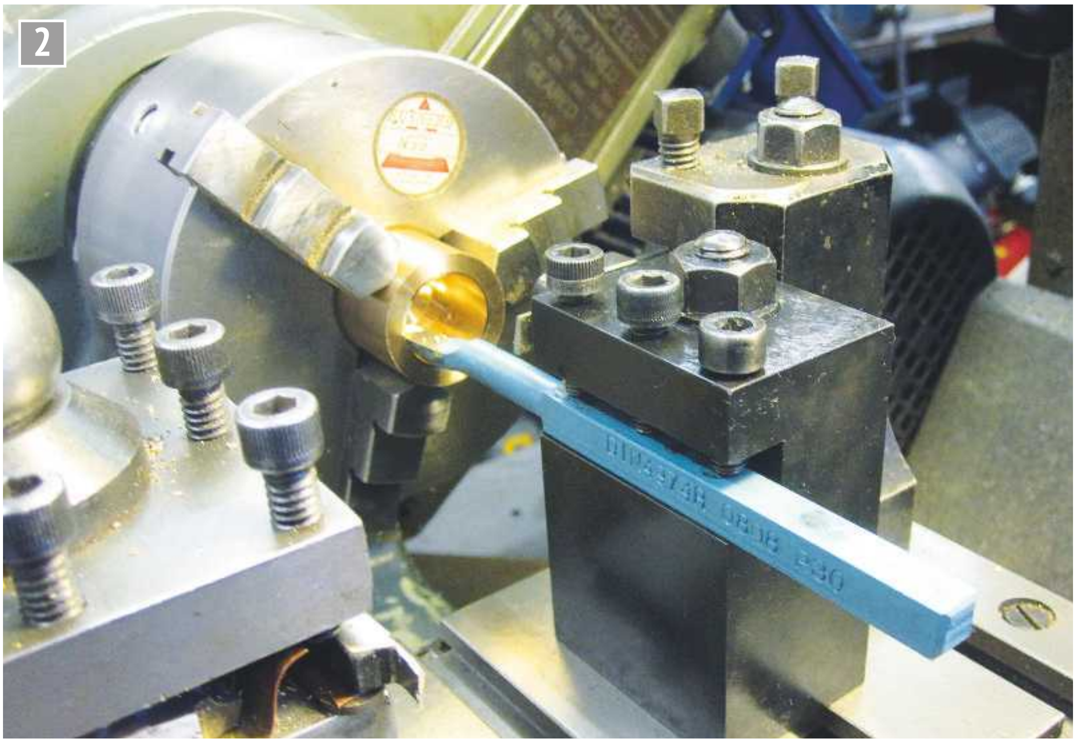
Boring attachment.

rear of the cross slide, I had mounted the quick change tool post which came with the machine and serves both as a parting tool holder and for supporting boring bars. It works very well.

I can't explain why it took so long for the penny to drop and decide that a similar facility could easily be applied to the Myford. I sat down and sketched a simple attachment which was designed such that it was easy to fix and remove and would also clear the parting off tool which resides most of the time at the rear of the cross slide (**photos 1** and **2**).

I selected an offcut of cast SG iron which was almost the right size and set about machining it to the dimensions shown on the drawing (**fig 1**). If you make one, you can either turn the main bolt from bar stock or cut off the surplus from a Myford tee slot bolt of suitable length. The tool clamping screws can be either ¼ BSF or 6mm, it matters not.

2



Another view of the tool holder.

The locating tongue should be a nice slide fit (0.375 inch) in the tee slot such that it prevents any tendency to twist. Care must be taken to ensure that the centre line of the clamping bolt is exactly in the centre of the tongue. The design will fit both the ML7 and the Super 7 and the whole job only took me three hours to make. It is so easy to deploy that it surely must become an essential for any Myford user.

ME

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

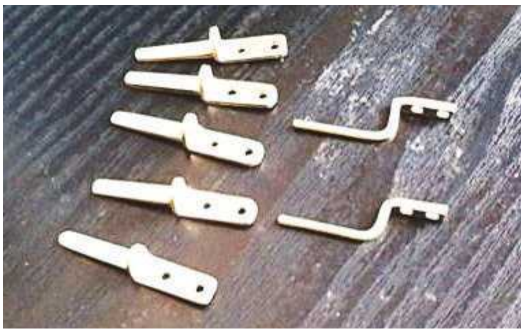
Continued from p.257
M.E. 4658, 12 February 2021

Painting by Diane Carney.

Flying Scotsman in 5 Inch Gauge

PART 5 - LAMP IRONS, STEPS AND BEADING

With these pieces joined I could then finish filing to match the photos that I had.



Here are the finished lamp irons, five of one type for the rear and two of another for the front. Don [Young] said to fix these with $\frac{3}{64}$ inch rivets; the photos show that they are in fact welded in place. I chose to follow Chris Vine's advice from his great book, How (Not) to Paint a Locomotive *where he suggests to have these items detachable to aid in the painting process later. I therefore drilled to accept 8BA hex head bolts.*

Lamp irons

First I cut some suitable brass to length and then bent it 90 degrees, followed by a lot of filing to shape. This gave me the bottom part of the lamp iron. Next, I silver soldered a suitable piece of brass as shown in the photo, far left.

Rear lamp irons fixed in place. Currently these are held by steel hex head bolts but since these go through to the water tank I shall change these for stainless at a later date, along with any others that do the same.

Steps

Here is the former for the step plate made from an oak off-cut, held in the vice squarely trapping the step material to the front jaw. It was a simple job of using a dolly one side at a time to beat to shape.

With the basic shape formed this step was then silver soldered to a rectangular piece of brass for the support bracket.

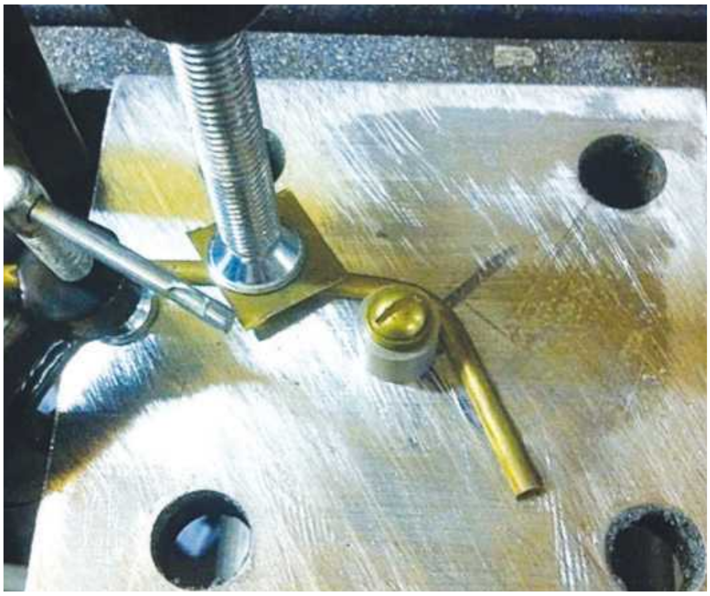
Once cooled the steps were then filed to shape as shown here, this took a good few hours. I'll probably do a little more to finish them when I go over everything before painting.

Steps fitted with 8BA hex heads, like the lamp irons.

Beading

The beading is an interesting subject. I have seen a number of different ways of doing this from other builders. In this case I have used some of those ideas and also my own but at the end of the day, there's many ways to skin a cat. I did ask myself whether perhaps I should have chosen the streamlined tender which has no beading. (Only kidding … it's a fair bit of work but makes all the difference to the look of the tender.)

The method that I have used - drilling/screwing the beading to the panel to hold it in place for soldering - I have since seen used on the new build of the Gresley P2, although in this case, of course, the beading was welded.



The piece in the picture is the beading for the front panel having been annealed prior to bending. Here you see it in a jig - an idea borrowed from another model engineer. I used a scrap piece of alloy; I then turned up the piece of alloy to the correct diameter and drilled for clearance to accept a 2BA bolt, the plate having already been drilled and tapped to accept it. A paper template was taken from the tender rear panel (same as the front but easier to draw around) and the pattern was drawn on the alloy plate for both the left and right hand sides. The beading was then bent to shape and held by a clamp with a positioning mark lined up with the turned collar for the next, tighter curve. The beading was then gently tapped using a hammer and piece of wood until it matched the drawn profile. The important part here is to ensure that the beading remains flat, i.e. no twist (it's actually much easier than it looks).

The beading, having now been shaped for the left hand side, was held in place via clamps and holes were drilled into the beading which were then tapped for small brass small screws. That was the original plan but I ended up just using the clamps for this section. The sides, though, were held as planned. Having completed the shaping of the left hand side I then marked the right while the beading was held in place and then put the beading back into the jig, but this time using the right hand profile for shaping.

>>

Next up was the rear of the coal bunker panel, similar to the front, and followed by the rear panel itself. Both now have the beading soldered in place.

Here we have the tender with its beading permanently fitted.

I then tackled the two internal strips and here we see the left hand side. This took a little more thought as it not only curves around the side profile but also follows the curve inwards. If I remember correctly, my procedure here was to do the top two curves first, form the inward curve and then the final curve downwards. The last job was to cut the beading to length.

It was then time to tackle the long pieces of side beading. This started with the front curves for which I needed to turn up another collar for the tighter curve involved too.

The first two curves for the side beading were formed using suitably radiused collars and then switched to a larger collar to form the larger curve which takes the beading down the length of the tender. The beading was left overlength and trimmed once fitted to the side sheet and blended to match the rear panel beading. Only the curved areas were annealed for this piece. It's a very long tender and you need to get this piece as straight as possible.

With the front of the side beading shaped it was clamped at the front edge of the side sheet, having already been drilled to accept 14BA brass screws. While held in place the first three holes were drilled so the front edge could be held tightly so that I could calculate/form the final top bend around the side sheet's front curve (the length of this piece was calculated before hand). It was then a simple task to drill the remaining holes around the other curves and down the side. This piece was then removed and the internal piece was held in place with clamps so that its holes could also be drilled. Once this was done both pieces were positioned and held tight via the 14BA bolts which now go through both the tender side and the two pieces of beading. It was then a simple task of sweating in place.

Once sweated in place the screws were cut and if required a little more solder was applied around them to fill any indentation.

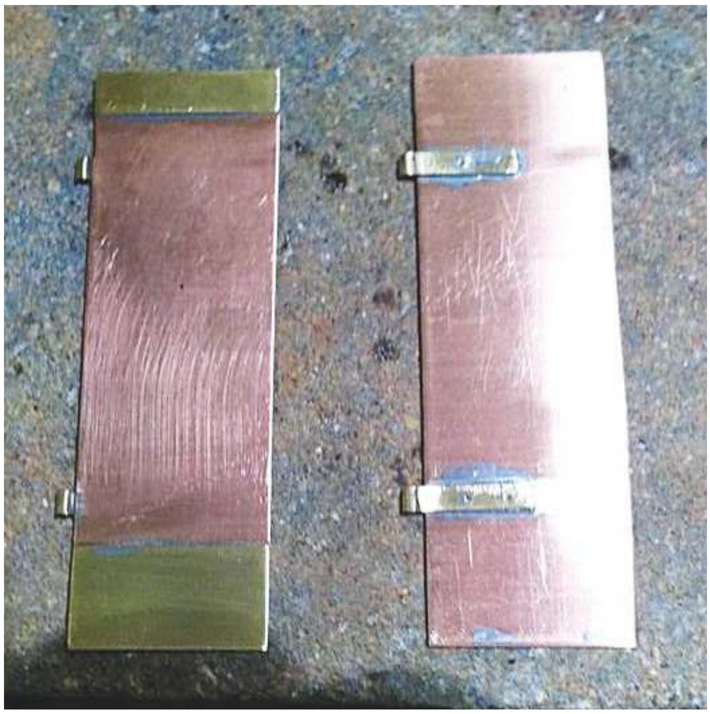
Well, according to the drawings that was it for the body. I had a few more bits I wanted to do though. The upper door clasp – and I now had a better understanding of how it operated - was one of them.

Tender doors

Next on the list (it's a very long, exhaustive list) was to do the doors for the tender, in this case the doors that connect to the cab doors when the locomotive is in service. These are not covered in Don's drawings and thus I did a little research and scaled off photos to get the dimensions required.

These doors, as fitted to a Gresley Pacific, are a little different from most other types used. Most have single doors, the majority attached to the cab and perhaps in some cases, to the tender. For Gresley we have doors attached to both which then interlock!

I first cut a piece of 12 inch wide copper to the correct door height, marked out the reinforcing strips, tinned that area and then sweated on suitable pieces of brass strip. This gave me a piece big enough for the tender doors and also the locomotive doors at a later date. Before cutting the doors to size I soldered on the hinges. I cheated a little here as in my old model boats box I had some brass rudder hinges from a ship model. These happened to be the correct width with small holes just like the prototype. I put a



The two completed doors, showing both inside and outside views.

We can see here that both doors are tested in place. I later gave the affected area a good clean and ensured that the doors hung correctly.

suitable piece of brass rod to represent the pin (that will be fixed to the tender side) and squeezed the hinge together. This was then clamped to the door and sweated on. Once in place the two brass rods were removed.

The pins where done as pairs, one piece of brass bar cut over-length with the brass rods (used earlier to space the door hinges) silver soldered on each end. These where then soldered on taking care not to let heat get to the locker doors. Once happy with the position and fixed, the over-length tabs used to hold the pins at the correct distance were cut off and filed to finish. I then reversed the jig to hold the pins for the other side where the process was repeated.

Primer

The next step was to get a little paint onto the parts made to date. As far as the body was concerned this just involved primer and a little satin black. The chassis was painted and lined but this was a little later.

First, all the bits and pieces had to be taken off, then the body had to be thoroughly cleaned. After that I gave it the first coat of etch primer, then some filling, more primer and then a light sanding. I then masked up and gave the underside and coal bunker area a base coat of satin black. That was it as far as painting the body was concerned. I will do the various top coats once the locomotive is ready for painting to ensure there's no colour variation between them. I'll be using Precision enamels. The chassis, however, was painted fully as soon as it was ready and the same went for the wheels. I will cover the chassis painting in a future article.

Before any painting took place I tested the tank for any leaks; there was a couple but nothing much. I was faced with a decision here; did I risk heating the body up and swirling some soft solder around in the hope that it sealed the small leaks or did I take a more modern approach? To be honest, the jury was out on this one, with views from both camps. I decided to play safe and use a resin designed for sealing fuel tanks etc.. This tender has long, thin brass side sheets and a slight buckle due to misplaced heat would not be a good thing, even if all the prototypes are/were so buckled! On a model this would stand out like a sore thumb. After receiving some advice on this, the product Petseal was chosen. I had not used this product myself before but once it arrived and I read the instructions, it was basically just Resin A with a hardener and perhaps a little more flexibility - something which I have worked with many times before during my years in film/TV visual effects.

Using this Petseal as recommended went without any problems and worked as planned.

The product was applied in what we in film work call a 'slush mould' process, that is you pour a small quantity in (amount worked out before hand) and slush it around until it covers all of the inside and keep twisting/turning the mould around until the resin has cured, this takes a little time and when said mould is, in fact, a large, heavy, brass tender body, it was very heavy work! The next morning I did a water test and I'm happy to report no leaks except where it's supposed to at the water gauge outlet as shown in the photo. Next I spent some time cleaning out the various holes that had been taped over for the sealing process and then put the various bits and pieces back on, once painted. This was for safety more than anything else - to stop me losing anything!

●To be continued.

At this stage there was still a lot more work to be done, both in what's shown on the drawings but also in extra detail added by myself.

A Myford Back Gear Repair

Noel Shelley and **Chris Robinson** combine forces to repair a broken Myford backgear.

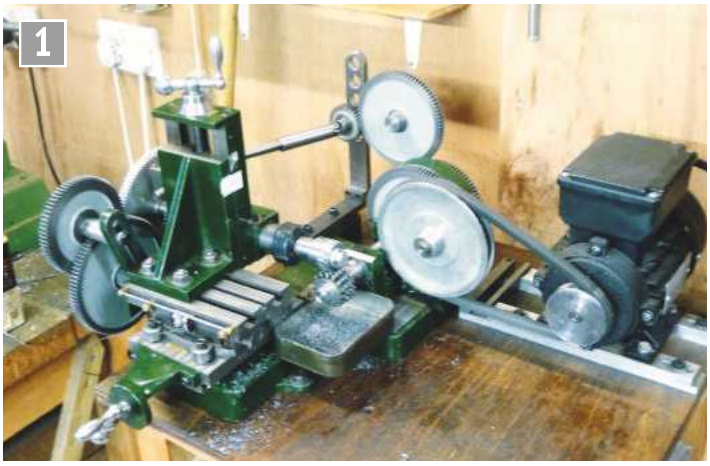
Having over a period of time bought two second hand Myford Super 7s I found they both had the same fault - the 17 tooth back gear wheel had broken teeth, one of them with four teeth missing. The back gear is a two wheel cluster of 17 and 53 teeth made in cast iron. Why were they damaged? I had owned an almost new Super 7 for over 10 years before I discovered it had a spindle lock (no laughing in the cheap seats, please) and up until that point I had locked the spindle by engaging the back gear - I had been lucky, many it would seem were not so!

There were two options for solving this problem; either buy a new cluster or attempt a repair. I chose the latter route and searched for a 17 tooth 16DP gear wheel from suppliers. Even numbers were available but not 17! The plan had been to machine away the damaged teeth leaving a stub onto which the new gear could be fixed, press fit or Loctited. Plan A out of the window !!!

Plan B was to make a special 17T gear with a stub then remove the old gear and bore the 53T to mount the new stub. **Figure 1** shows the dimensions for the 'special' gear. NOTE - it is a 16DP not a 20DP as the change wheels are.

To remove the back gear cluster one has to first remove the spindle. This is easy on the ML7 but a little more trouble on the Super 7, as one has to undo the rear bearings, but either way take the opportunity to replace the drive belt - ML7 is A23/A620 and S7 A29.5/A780. To remove the back gear shaft, first remove the 'E' clip on the end of the shaft.

1



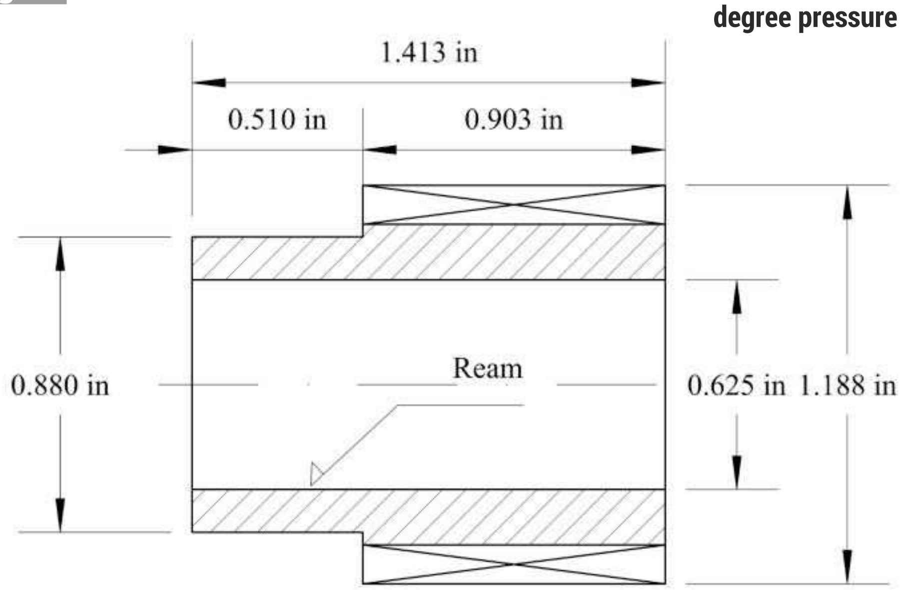
Jacobs gear hobbing machine.

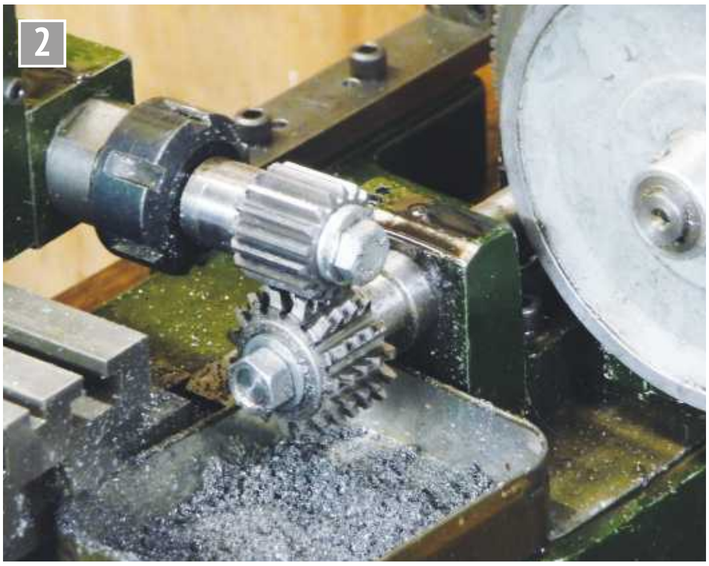
On the edge of the operating lever are two grub screws that must be loosened, then with care the lever can be removed. The operating lever detent locates in two holes. The upper one has a slotted screw hidden inside - this must be removed, then the cluster shaft will slide out. At this point the project became a joint effort as Chris Robinson, who owns a Jacobs gear hobbing machine, made the special gear as shown in fig 1. Details of this machine, which is still available as a set of castings, and a step by step description of cutting a spur gear can be found in **ref 1**. The gear was cut using a commercial hob, 16DP, 20 degrees pressure angle, made by the Swiss company Mikron. We did not have definite information regarding the pressure angle of the gear but since it has 17 teeth cut on a standard PCD it is a very good bet that it is 20 degrees pressure angle, not 14½ degrees. This is because the lowest number of teeth avoiding undercut with a standard PCD is 17 for a 20 degree pressure angle gear, and 32 for a 14½ degree pressure angle gear.

The machine was set up with a primary drive giving a 60 fpm cutting speed (**photo 1**). The index ratio was set using an 80T gear on the hob shaft and

Fig 1

Myford pinion 17T, 16DP, 20 degree pressure angle.





Cutting the new pinion.

New pinion compared with the old, broken one.

a 34T gear on the 40:1 worm gear drive so index ratio = 1:40 x 34/80 = 1:17. Feed was set at 0.004 inch per revolution of the gear being cut and the top slide was set at the lead angle of the hob, 2 degrees 33'. The total depth of cut is 0.1406 inch. Unusually for a precision company like Mikron, they have engraved the depth of cut, h0 as 0.406 inch in error. As the rigidity of the machine normally limits the largest pitch that can be cut in steel to 20DP, this gear was made in four cuts, these being 0.046, 0.083, 0.114 and 0.1406 inch. **Photograph 2** is a close up of the hobbing process. Note that these cuts are not a linear progression. Due to the 'vee' being cut these are 33%, 59%, 81% and 100% giving equal metal removal on each pass.

Truing up the cluster on the faceplate.

Boring out for the new pinion.

Photograph 3 shows the damaged cluster and the special gear. **Photograph 4** illustrates how the cluster was mounted on a face plate. The vital thing was to get the cluster dead true to its original axis. This was achieved by machining a bar to a dead fit in the centre hole and then using a DTI to move the cluster into truth. Using light cuts, to avoid the chance of the work moving on the face plate, the damaged gear was reduced to swarf. The 53T is shown in **photo 5** being bored to be a light push fit on the 17T special gear.

Before using a high strength Loctite or similar engineering adhesive to secure both parts, they MUST be well cleaned with a solvent to degrease. **Photograph 6** is the completed repair ready to fit back on the lathe.

Reinstalling the back gear cluster and shaft is a reversal of the disassembly but leave the operating lever grub screws loose for now!

Fit the new drive belt and build up the spindle, then set up the bearings as per the Myford owners' manual or search for the information on any of the relevant internet sites. The last task is to set the running clearance of the gears in relationship to the operating lever. Threading a length of string under the repaired gear cluster will enable you to hold the cluster in mesh whilst then placing the lever in the engaged position. Lightly do up one of the grub screws, unlock the back gear latch or toothed key and rotate the spindle, checking that there is very slight backlash but not an excessive amount. If there is a tight spot set the backlash at that point. Then do up both grubsrews tight.

Now, running a steel gear on a steel shaft, it is vital that lubrication is fed regularly when the back gear is being used.

ME

The repaired gear cluster.

REFERENCE

1. *Model Engineers Workshop*, No.261 Nov. 2017 pp. 9-13 and No.262 Dec. 2017 pp. 16-21

Rodney Oldfield constructs another of Bob Middleton's small but interesting engines.

Continued from p.287
M.E. 4658, 12 February 2021

The Middleton 'Monitor' Type Engine

PART 4

Piston rocker arm and vibrating arm

Using ½ inch thick aluminium plate machine one side, then mark in from the edge ⅝ inch and also ⅝ inch from the end. Centre punch and scribe a 1¼ inch circle, mark off a 2 inch centre ¼ inch down from the machined face, centre punch and scribe a ½ inch circle (**photo 43**). Mark a tangent line from one circle to the other. Repeat for the vibrating arm, only using 3½ inch centres instead. Cut out and machine the shapes, drill and ream the ½ inch hole.

Place a small piece of ½ inch diameter rod into the holes, clamp together, then drill and ream the ¼ inch holes in the appropriate centres (**photo 44**). Next, mill out the slot on the rocker arm ⅝ inch deep and ¼ inch wide on the rocker arm or the width of your crank rocker arm (**photo 45**).

43

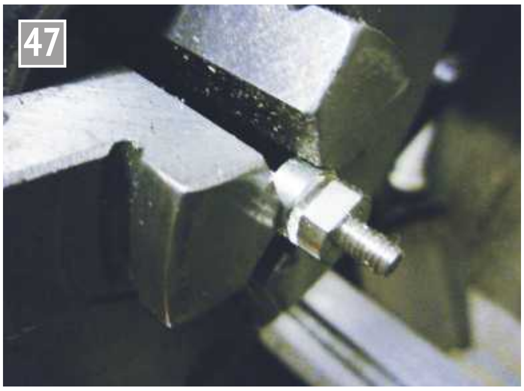
Marking out the blanks for the rocker arms.

44

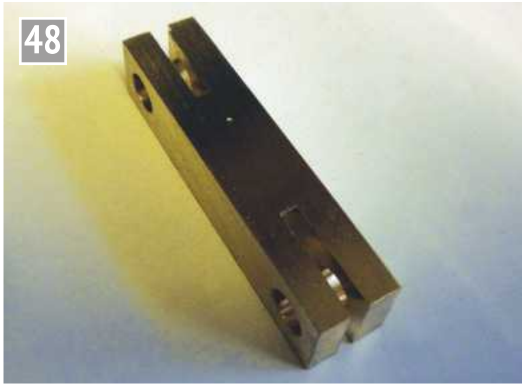
Ensuring the throw of the two arms is the same.

Finished rocker arms.

Crank rod end.



Turning a crank rod rocker end pin.



A pair of piston rod ends, back to back.

Blanks for the crank/vibrating arm connections.

Machining the boss on a crank connection.

Crank rod rocker arm

I made mine out of 6mm stainless steel because that is what I had available. It should be ¼ inch thick but use whatever you have. Cut a piece ½ x 1⅞ inch, drill and ream ¼ inch at 1¾ inch centres.

Crank rod

The only stainless steel I had for the crank rod was 6mm diameter, so I threaded this down to ¼ inch Whitworth.

Crank rod end to crank rod

Starting with ½ inch square brass 1 inch long drill and ream the ⅜ inch diameter hole ¼ inch in from one end, making sure that it is perfectly square with the flat face. Place in a four-jaw chuck and get it running true, then turn down to just under ½ inch diameter x ¼ inch long. Face off, centre drill and tap to your crank rod thread. Take out and round off the top edge (**photo 46**).

Pins for crank rod rocker arm

Using ⅜ inch diameter bar turn it down ¼ inch diameter x ½ inch long. Centre, drill 5BA clearance 1/16 inch deep (this is so that the screw will go right up to the face) then drill 5BA tapping size x ½ inch deep and tap 5BA.

Do not part off until you have a good, snug fit for the width of the rocker arms and the piston rod ends.

File two flats on it and part off ⅛ inch thick. Turn it around, slightly dome and polish, and using the same ⅜ inch bar, turn down to 5BA size and thread 5/16 inch long. File two flats on it (**photo 47**) and part off ⅛ inch thick. For a mandrel I took an old piece of brass bar, faced it off in the chuck, centred it, drilled 5BA clearance x 1/16 inch deep, then drilled and tapped it 5BA. I screwed the pin in to this using the flats to tighten the screw up, then domed the end and polished it.

Piston rod ends

I used ½ inch square brass for these. Whilst it is this square section, drill and ream the ¼ inch diameter hole then mill out the ⅛ inch slot x 9/16 inch deep (**photo 48**). Place in a four-jaw chuck, put a distance piece in the slot to prevent squeezing it and turn to ⅜ inch diameter, ¼ inch long. Centre, drill and tap it to 2BA. Make the pins as described above for the rocker arm.

Crank rod

Again, the only stainless steel I had for the crank rod was 6mm diameter so I threaded it down ¼ inch Whitworth.

The crank connection to the vibrating arm

I had a very old bit of brass bar the right size so I cleaned up the diameter and cut two pieces off at 2 inches long. Use whatever you have! Mill it down to 1 x ½ inch (**photo 49**), drill and ream the ¼ inch hole diameter and then mill out the slot. Place in a four-jaw chuck and put in a distance piece so as not to squeeze the slot, then turn the ½ inch diameter, tapering off as in the drawing. Centre, drill and tap for the crank rod using the same thread you used on the crank rod (**photo 50**).

Turn two pins down as described above for the rocker arm, only longer, and whilst it is still in the lathe screw the shaft into the rod end.

Place down on a flat surface and position roughly the crank rod end to length. Saw off the rod to a slightly longer length leaving enough for the thread. Thread down the bar and use two bits of ¼ inch diameter bar to tighten up both ends making sure that both holes are running in the same plane.

Now you can measure the ¼ inch hole centres aiming to get them to the correct length of 4 13/16 inches.

Keep threading it down and tighten it up until you get the measurements as close as you can (remember you need not get the measurements to thousands of an inch - the trick is to get both ¼ inch diameter holes as close

>>

together as possible in length). Now build the unit up and make sure that it swivels (**photos 51** and **52**).

Lining up the bearings

Now comes the good bit. Screw the cylinders onto the frame with the piston rod protruding through the front cover. Place the bearings onto the shaft with the ⅛ inch brass overhang inwards and the piston rocker arm on. Connect the rocker arm on to the piston rod – now line up the arm square with the piston. Bring up the bearing to touch the rocker arm making sure that the rocker shaft is running square with the frame and then clamp down. Just check that you can easily move the piston in the cylinder with the rocker arm – if all is good, spot through one hole only as in **photo 53**. Drill and tap. With the other bearing running square with the outrigger top plate and in the centre of plates C and D clamp down and spot through both holes and the other hole in the first bearing. Drill and tap.

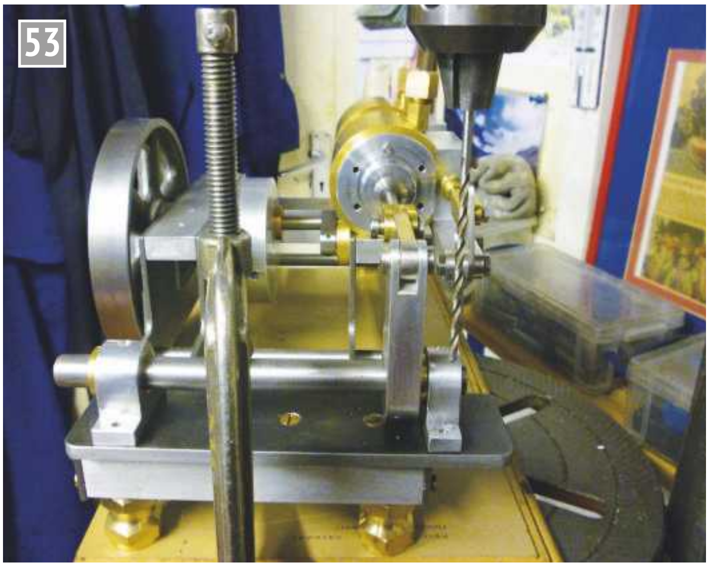
Bosses mounted on the connecting rods.

Finished connecting rods with rocker arms.

Repeat for the other side and **DO NOT FORGET TO MARK R and L or 1 and 2**. Now slip your vibrating arm onto the shaft and build up your inner flywheel with the crank rods on the crank pin. Slip them in between the plates and push the main bearing shafts through from either end. Connect up the vibrating arm, fasten the grub screws and make sure everything turns easily using the fly wheel.

When you are happy measure the distance between the vibrating arm and the bearing and then turn down the distance sleeves to length.

●To be continued.



Spotting through for the rocker shaft bearings.

NEXT ISSUE

Britannia

Norm Norton improves the draughting on his kit-built BR Standard Pacific locomotive.

We Visit Evesham Vale

John Arrowsmith goes off to the Cotswolds for a ride on the 15 inch Evesham Vale Light Railway.

Flywheel Patterns

Jim Haslam presents his own way of making casting patterns for model flywheels.

Polishing Tumbler

Luker shows how to take the elbow grease out of bringing your small parts to a high polish.

Content may be subject to change.

ON SALE 12 MARCH 2021

PART 1

Focas Connecting Rod

Peter Worden continues his occasional series describing the building of his FOCAS engine.

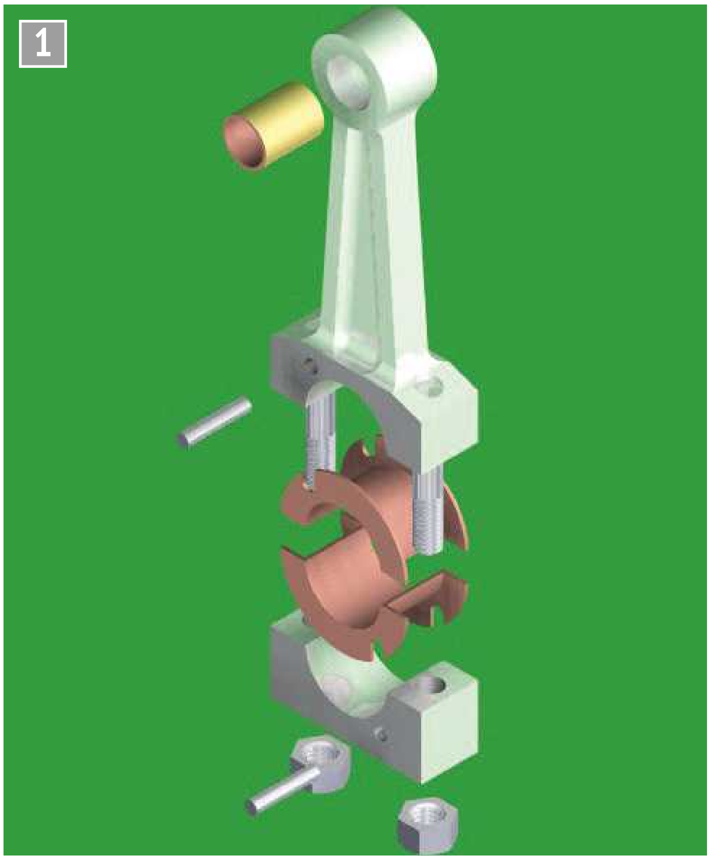
This article is number four of a series of occasional articles explaining how I went about making some of the more complicated parts of the Focas internal combustion engine I designed and describes the various stages needed to produce a connecting rod from a solid blank of aluminium.

In my time in the engineering business, working for myself for 40 years, I've often been required to make fixtures to assist in the machining of components so I decided to try and make one fixture, apart from a simple drill jig, which would enable me to machine everything on the fixture and finish up with a complete connecting rod. **Photograph 1** is a computer-generated exploded model of the connecting rod compete with big end bearing shells and small end bush.

The main drawing for the connecting rod is shown in **fig 1.**

All dimensions given in this text and the diagrams and drawings are in inches. The positioning dimensions in subsequent figures will use the centre of a rotary table as the datum for each stage and denote the centre of the cutter.

Most of the milling operations were done on a Centec 2 horizontal bench top milling machine with a vertical spindle attachment, which featured in an article in *Model Engineers Workshop* issues 276 and 277.



1

Exploded view of the complete connecting rod.

2

The drill jig.

Drill jig and fixture

The drill jig, for the clamping holes, is a simple plate with two side fences and two drill guidance holes for the clearance of 2BA holding screws as shown in **fig 2** and **photo 2**. The holes for the holding screws were made slightly larger to make it easier to load the blank on the fixture. These screws are not needed for location but merely for clamping. The big-end and small-end holes on the connecting rod are used for location.

The main fixture (**fig 3** and **photo 3**) is a 4.125 inch diameter plate 0.500 inch wide with a 1.000 inch diameter x 0.750 inch long central boss at the rear and a 0.500 inch diameter x 0.375 inch deep central hole at the front. The 1.000 inch diameter boss is used for location in the rotary table. Three pairs of 2BA holes are spaced at 120 degrees on the dimensions shown. Two 0.500 inch diameter holes to take the locating spigots are spaced at 120 degrees to line up centrally with two of the pairs of the 2BA tapped holes and 1.500 inches from the centre of the fixture. The two 0.500 inch diameter holes to take the locating spigots were bored to a limit as shown in the drawing to maintain a good press fit of the spigots.

The two fixed locating spigots are 0.500 inch diameter x 0.750 inch long. One has a diameter of 0.250 x 0.375 inch long on one end, and the other has a diameter of 0.406 x 0.375 inch long on one end. The 0.500 inch diameters of these were machined to limits as in the drawing and drilled and tapped through 2BA. The 0.250 inch diameter and the 0.406 inch diameter were turned to a limit as in the the

>>

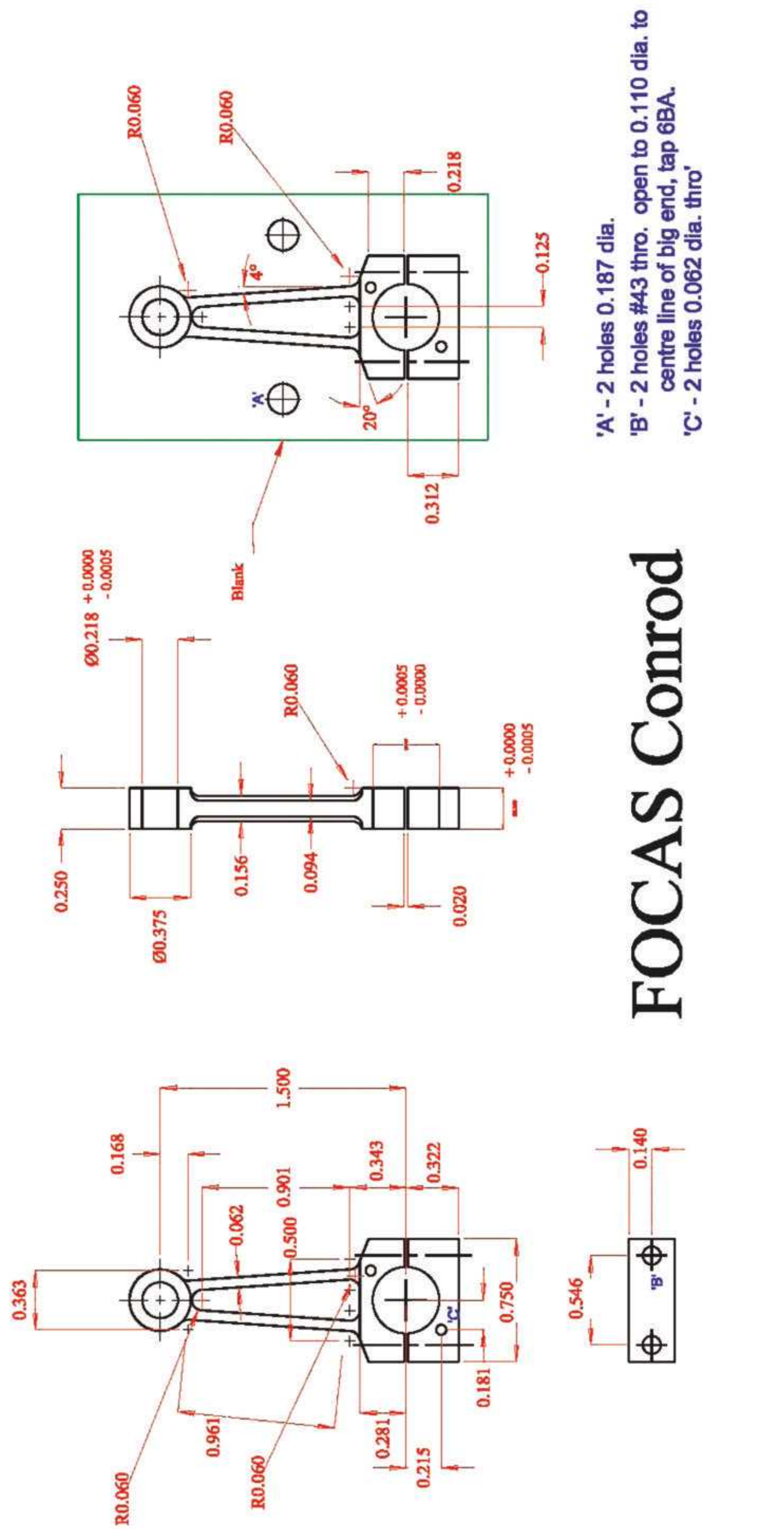


Fig 1

The connecting rod.

drawing and concentric with the outside diameter. These two spigots were then pressed into the fixture in the positions shown and secured with 2BA countersunk screws from underneath making sure they were square with the fixture and the 0.500 inch diameters were flush with the surface of the fixture, or a fraction below.

Two more removable spigots were made the same but the 0.500 inch diameter was made to have a good sliding fit in the central 0.500 inch diameter hole of the fixture for easy removal.

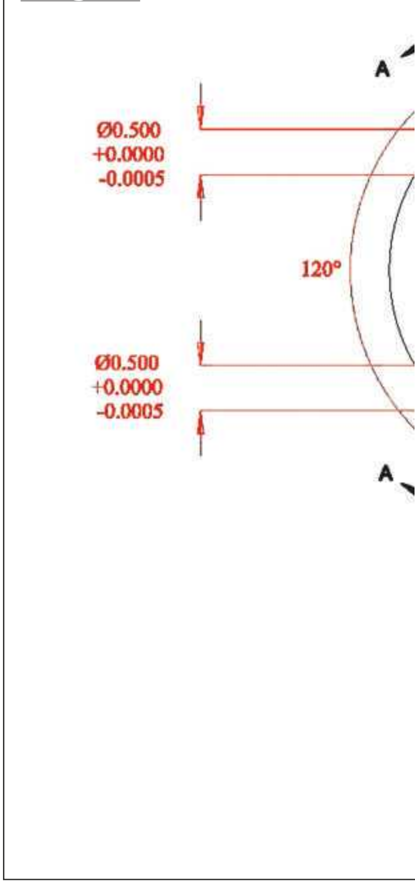
On the original drill jig and fixture, I provided six holes for clamping, as can be seen in photo 3, but I found that they were unnecessary - two holes are quite adequate.

Blanks

The blanks were made from HE30 aluminium and machined to size as shown in **fig 4** and drilled using the drill jig (**photo 4**).

●To be continued.

Fig 3



3 *The main fixture.*

4 *The blank, with fixing holes.*

Fig 2

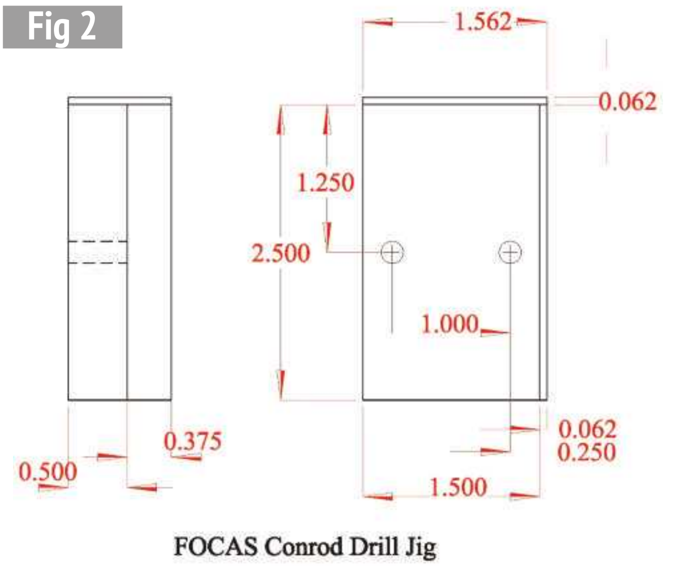
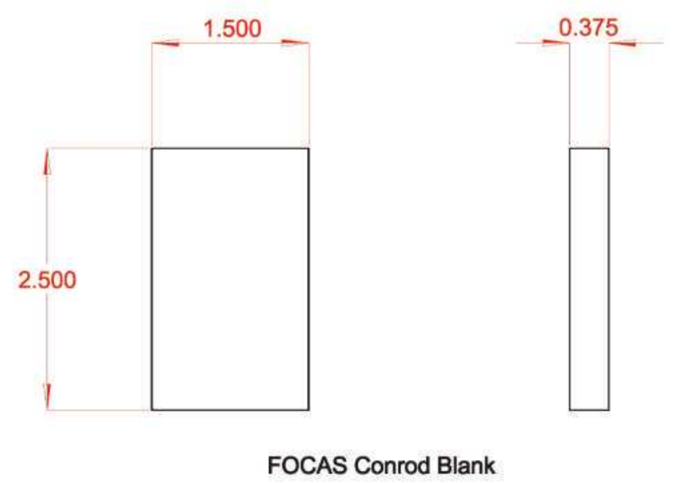
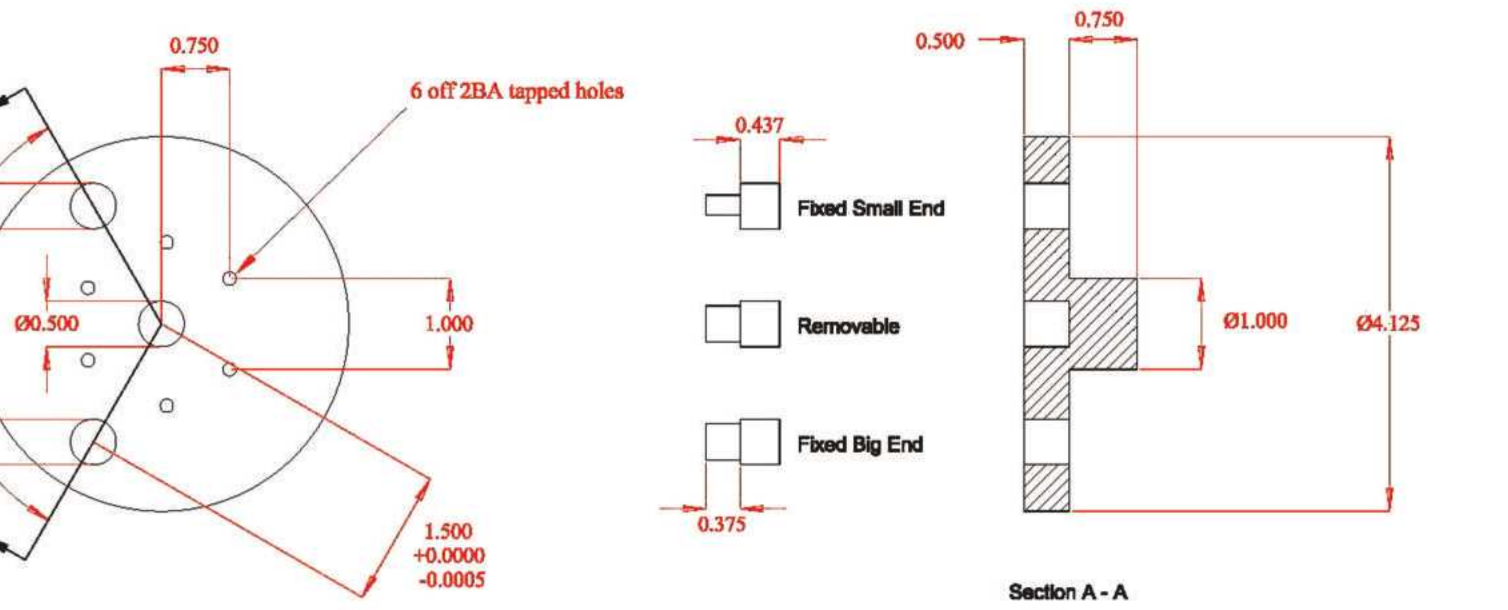


Fig 4





FOCAS Conrod Fixture

Spigot	Fixing Dia.	Limits	Locating Dia.	Limits
Fixed Small End	0.500	+0.0005 -0.0000	0.218	+0.0000 -0.0005
Fixed Big End	0.500	+0.0005 -0.0000	0.406	+0.0000 -0.0005
Removable Small End	0.500	+0.0000 -0.0005	0.218	+0.0000 -0.0005
Removable Big End	0.500	+0.0000 -0.0005	0.406	+0.0000 -0.0005

POSTBAG

Drawing Errors

Dear Martin,
There's nothing more frustrating or off-putting when you are stepping out into this hobby of ours than making up a part from published drawings, taking pride in getting it according to the drawings only to find that it doesn't fit and that the drawings are incorrect. Many a workshop has unfinished models lurking under the bench for this very reason. I have learnt over many years that this happens and with experience you find ways of looking ahead and getting around these problems.

Having complained for the umpteenth time to my wife about this her reply was "Well, do something about it! There should be a database for people to refer to". So here I am doing something and I'm beginning to understand the minefield I'm getting into.

My feeling is that there should be a catalogue held somewhere, probably the *Model Engineer* website, of known errors on drawings. Not a forum, the conversations on which often take a while to work through, as they tend to include recommendations, further ideas, better ways of doing things and so on. I feel what we need is simply a list of known errors in the drawings; so, for example anyone starting the loco 'Simplex' by Martin Evans, could go to this and know where the errors occur – before they begin. The sort of list I'm thinking about will be a statement of fact, not an opinion. There is of course the business of correcting drawings but we then start getting into the realms of copyright and modifying them at source doesn't get over the problem of drawings in a cupboard that Grandpa has given you which may be years old. I had a problem with 'Didcot' by Neville Evans, having bought a set of drawings and castings long before the original Reeves 'folded', only to find that a new revised issue had been published subsequently, correcting a lot of errors.

Taking 'Simplex', I know for a fact that there are three sources of initial information: 1) drawings 2) the magazine articles 3) the book, which goes with the design and, to take an example, the fixing of the slide bars is different in each one and the builder needs to be aware of this to decide which route to take.

I am not presumptuous enough to tackle any more than one design to start off with and I think essentially it will be more about the smaller locos, the ones that people are most likely to start with. Anyone setting out in model engineering is unlikely to begin trying to model a large four cylinder loco unless they have a considerable amount of knowledge and experience of engineering behind them.

So let's start with 'Simplex'. Three members of our club are making them at present and we have had one as a club loco for a number of years.

I am happy to have a go at this and could I ask that anyone who has made a Simplex contact me (johnpimlicohouse@gmail.com) with errors they have found and on which sheet of drawings they occur? Errors or inconsistencies only, not even your way of correcting them at this stage for as we all know with any group of 10 engineers there will 10 ways of doing that! That applies to modifications too – just ERRORS.

Let's see how that goes.

John Roberts
(Pimlico Light Railway)

Anson Engine Museum

Dear Martin,
As curator of The Anson Engine Museum in Cheshire I am currently researching The British Modelling & Electrical Company of Macclesfield who later became The British Engineering & Electrical Co., Leek. They advertised their goods in the *Model Engineer* between 1898 and 1917. There were also adverts by Goodwin, National Engineering & Electrical, Macclesfield and a very late advert, in 1926, by Alfred Rider of Leek selling the same gas engine. Over the years they must have posted out hundreds of catalogues, even reaching a 15th Edition, and some had 60 pages! I've only managed to trace one and fortunately the owner is happy to lend it to me for research. I wonder if any of your readers have a copy that they would be willing to loan or copy or whether any reader has any other information. I have managed to find a lot of information about the family behind the company but there seems to be nothing about the model business itself. No address in Macclesfield can be found and the usual places to search online such as Grace's Guide, trade directories, British newspaper archives etc. have not revealed any real detail. Of course, I am presently unable, for obvious reasons, to visit libraries and archives.

We are also planning a small power rally later this year, which will feature models made by these companies so, again, if anyone has one of their models - be it steam, gas or electrical - we would be pleased to hear from you.

I can be contacted by email at enquiry@enginemuseum.org or write to: The Anson Engine Museum, Anson Road, Poynton, Cheshire, SK12 1TD

Many thanks, Geoff Challinor

Young Engineers

Dear Martin,
I write on the morning of 5th January after the announcement of the 3rd lockdown. That news was depressing. But I also read two articles to cheer us all up. Firstly, in the December edition of the NELPG News there is an article about their Young Persons Development Group where four youngsters

Write to us

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

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

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

Responses to published letters are forwarded as appropriate.

write of their excitement about engineering.

I love the photograph of James (11) in overalls and woollen hat, hacksaw in hand. It takes me back to my own young days when my father allowed me (following instruction) to use hand tools and later his lathe. James's model of working valve gear from Lego is an inspiration to us all. Luke (17) reminds us where these young people's groups can lead. He is 'graduating' from the NELPG Junior group and has just started a four year mechanical engineering apprenticeship with Borg Warner. I wish him all the best in his education and future career.

Turning to the current *Model Engineer* there is Bethan's article covering the StayAtHome projects from the Eastleigh Young Engineers (EYE) group. It's great to read how Patrick and the Tooth Fairy came up with some suitable projects to continue to inspire the youngsters. Modern technology can come to the rescue when we cannot meet in person. May they long be inspired to create things with their hands and I look forward to seeing the results when we are next allowed to have model engineering shows.

Regards, Dave Robinson (Wiltshire)

'Minx' Loco

Dear Martin,
Reference M.E.4650 'Smoke Rings' concerning the 'Minx' loco built at Eastleigh Locomotive Works Training School.

Rest assured it is quite safe having been ensconced in Eastleigh Museum for many years, and I checked a couple of days ago, it is still there on display in its glass case as a LB&SCR C2. There are also other small exhibits in this area pertaining to Eastleigh's railway history. I started in the school in January 1960 and went into the 'Shops' at sixteen in the November. As far as I can remember said loco had not been started and in fact the plaque on the base says built from 1961-5 but before this a stationary engine was being constructed and subsequently displayed in the school entrance. Many years later when the school was declared as no longer required it disappeared, so does any person know what happened to it?

There is a slight error concerning personnel. Denis Pack, who originated from Ashford Works, was the Fitting Section Instructor, and as stated would have much involved with its construction. The main error however concerns Doug Coates who originated from Darlington Works. He was certainly not an apprentice (!), he was the 'BOSS' i.e. Chief Instructor from when the school opened in 1959 and remained so until c.1971 when Graham Taylor took over.

Yours sincerely, J. White (Eastleigh, Hants.)

PCB Etching

Dear Martin,
Mr Weare (Postbox issue 4656) makes a good point about getting PCBs made in China but readers in UK need to work out the full cost. I recently wanted five boards but it was only very slightly more expensive to get ten, $10 if I remember correctly, but then the postage was $27. Converting to UK money we're at £27.04 - cheap enough, so I paid my money. When they arrive in UK the courier contacts me, they want VAT at 20% which is another £5.40 plus £11 handling charge. I should have expected the VAT but £11 just to collect it is daylight robbery. The total was £41.44, which still wasn't too bad for ten boards, but if I only wanted one I'd have done it myself.

What we need is some enterprising chap to act as UK agent for the Chinese company, aggregate orders so that there is only one lot of postage and one handling charge, then distribute within UK. Most people won't need the very fast turnround offered.

Duncan Webster

Insurance

Dear Martin,
Over the last few days, it has been brought to our attention that our club insurance will be falling due once again. We are being asked, "As no activities have been allowed due to Coronavirus, just what was the insurance for?".

We understand the need for building and equipment cover, that should stand, but the general public third party insurance cover is definitely suspect as NO public running days have taken place, as they are NOT allowed.

Surely a reduced premium in this case should be offered. To someone who takes insurance very seriously, to pay for a £5 million third party public insurance cover, when nothing is happening and no-one Is present is somewhat one sided.

The same would apply with personal insurance for the officials within the club. Also any cover that is for events outside the club that are not allowed to take place should, we think, be offered at least a 50% discount for the duration of these special circumstances directed by the government.
I understand the insurance company offering the cover is operating as an agent for the underwriters but, surely, a small bite of the cherry is better than nothing at all.

I would be interested in what the other model engineering clubs have to say.

Best regards, Dave Moore, Chairman, Brandon & District Society of Model Engineers.

Stainless Boilers

Dear Martin,
I have been enjoying the articles by *Luker* - he covers an interesting range of engineering. Hope he continues to write.

The piece on stainless steel boilers struck a chord from many years ago. It was probably about 1966/7 when the Model Engineer Exhibition was held at Seymour Hall near Marble Arch. Kennions had a stand there and had just built a stainless steel boiler for a 3½ inch gauge 'Maisie'. I think it was flanged like a copper boiler and I presume silver soldered not welded. I have often wondered if this boiler was ever used in a model, or whether it still exists.

I do applaud the Australians with their boiler codes, it makes it so easy to design a boiler. Why our model engineering associations do not just adopt the Australian codes outright puzzles me.

Best wishes, Anthony Mount

STEN Guns

Dear Martin,
Further to the correspondence about the STEN and Sterling sub machine guns I think that what made them especially dangerous was that the firing pin was a fixed part of the breech block and, as the round was being chambered, the firing pin could contact the base of the cartridge and fire it if it was not quite fully closed. If you look at a normal rifle for instance you open the bolt and eject the fired cartridge and then close the bolt while chambering the new round, which won't fire till you squeeze the trigger. There is also a safety device built in so that you can't open the bolt until it is safe to do so, that is, when the gas pressure in the barrel has pushed the fired round out of the barrel. The same thing with the old army L1A1 self-loading rifle – again, the mechanism would not allow the breech block to open and eject the fired case. The only other weapon I know of with a fixed firing pin is of course the revolver where the cartridge case is usually rimmed and stays in place until you have fired all six rounds then you swing the cylinder out to reload with fresh rounds. In this case, as you bring the hammer back so the next unfired round lines up with the barrel and is safe to fire.

Yours sincerely, Mr. J.E. Kirby

Wenford

PART 17

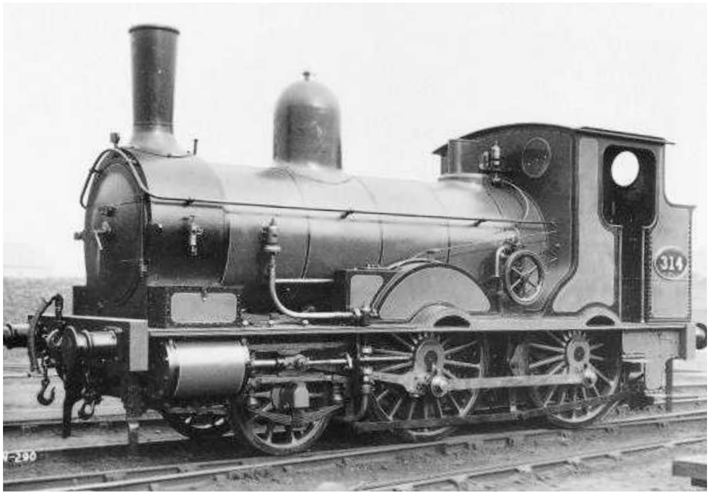
A 7¼ Inch Gauge 2-4-0 Beattie Well Tank

Hotspur catches up on the description of his Beattie well tank.

Continued from p.219
M.E. 4657, 15 January 2021

The boiler water gauges

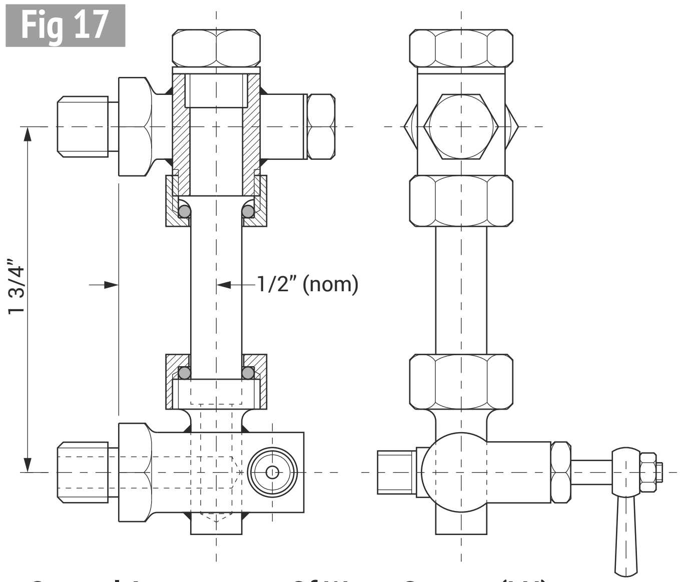
The position of the water gauge bushes on the boiler backhead was determined many years ago and, as often happens, the influence on the design of the actual fittings themselves has turned out to be very important as the space around them now is already well occupied. It was a surprise to me to also see just how adjacent is the shelf over the fire hole doors and then how the door operating handle limits how much the bottom fitting of the right hand assembly is able to protrude into the cab. So, within the constraints of the backhead layout, the two water gauges have been designed to be assembled with a good size gauge glass and be as close to the backhead itself as possible. This gives safety to their operation as the glass is less likely to be accidentally hit and broken in service.



136

The left hand pair of water gauge fitting components made from bronze and fabricated to check whether the parts could be rotated without fouling the adjacent fittings.

Fig 17



General Arrangement Of Water Gauges (LH)

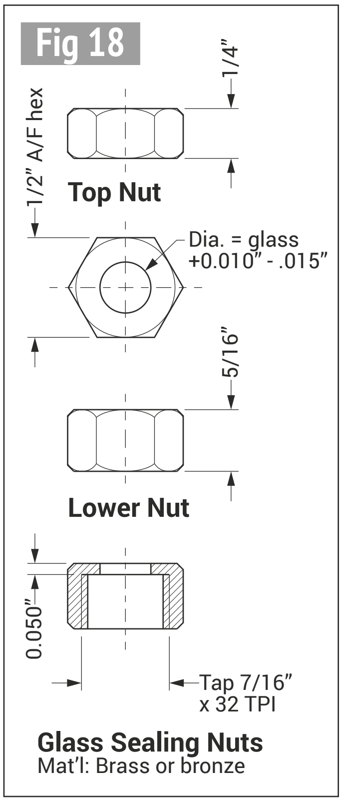
However, it has been necessary to partly dismantle other items in the immediate vicinity for both pairs of fittings to be added. The cap for the adjacent injector water return clack into the boiler needs to be loosened and the shelf removed and then both the upper lower fittings can be installed in stages, as the rotational swing of each of the two assemblies as complete units is not possible.

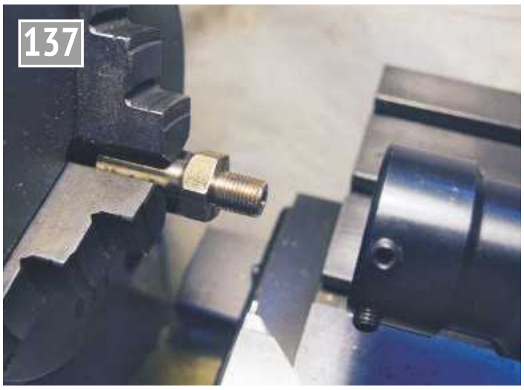
The development of the parts in this context is a process of making rough sketches, then doing a trial machining drawing before cutting metal. Taking the design process carefully, and cutting metal in stages, meant I could use bronze and silver solder the parts together when I was satisfied they would fit. **Photograph 136** shows the pair of assemblies for the left-hand gauge with the drain valve handle in the closed position.

Figure 17 shows the general arrangement drawing for the water gauges, which have a blow-down valve which is at right angles to a more normal design and the two sets of parts are handed. The drawings detail the left-hand set of parts. The assembly of the right-hand gauge is the same but the bottom fitting has to have the valve housing added from the left side and then for fitting to the boiler the valve and plug are added at the last quarter turn of the assembly as it is finally screwed into position. So, in use, the footplate crew do not have to try and work either valve in close proximity to the other pipework. I have worked on the principle that the test cock should not be capable of being unscrewed in service and some graphited yarn has been added as packing between the valve screw and the outer support gland nut. The spacing of the backhead bushes is such that there is around half an inch between the tap handles in use.

Gauge glass fittings

I began by turning the four glass seal nuts (**fig 18**) as





The starting point for the fittings is the main body made from hexagonal material, turned then reversed to add the thread for the boiler bushes and drilled for the water connection. This is the smaller upper body which is drilled right through.

This view of the assemblies shows the left hand (upper) fabrication drilled and tapped with the two blanking plugs added. These have not been detailed on the drawings as they are simple turning exercises from brass or stainless steel.

the female thread is used to ensure the threads on the main fabrications are a good fit. The close proximity of the horizontal flanged bodies to the vertical glass sections means the male threads cannot be adjusted later so it is important to get them right beforehand. I found that ½ inch A/F bronze bar was satisfactory and with nominally ¼ inch glass tube, the clearance in the nuts was made around 0.015 inch greater than the glass diameter.

The section of bar for the nuts was drilled long initially as the final short thread length was insufficient to properly start the taper tap. A 'D' bit or suitable milling cutter is also needed to ensure the bottom of the internal thread diameter is flat and square where it compresses the 'O' ring. It was also necessary to slowly and carefully grind away the very end of the plug tap to provide a full depth of thread but hopefully most experienced model engineers are aware of this. Once the final thread form has been achieved the nuts can be shortened and the top one is shorter than the lower one because the base is made deeper as it houses the shoulder for the tube.

Gauge top fittings

The main body (**fig 19**) is turned from ½ inch A/F bronze bar to be 5/16 inch diameter for no more than 25/32 inch long and a radius near the hexagon end makes it pleasing to look at. **Photograph 137** shows the first two turning operations. The hole down the centre can be drilled 5/32 inch diameter and the 3/16 inch by 40 TPI thread tapped. The bar was then cut to length and reversed in the chuck to machine the shoulder for the thread for the boiler bush and added a small undercut. I actually drilled the 5/32 inch hole from both ends so the holes would meet in the middle, which avoids any possible run-off if the drill is not sharpened correctly.

The second part for the glass fitting requires a short length of 7/16 inch diameter bronze that needs to be drilled 5/16 inch diameter centrally through the side and it is best if this is done on a length of parent bar so it can be held truly for a hole at right angles. The short length should be checked for size lengthwise each side of this hole and then threaded 7/16 inch by 32 TPI on the longer end. This thread is not accessible once the two pieces of material for the top fitting have been silver soldered together. As an aid to achieving the correct orientation of the fabrication on the boiler, the body part was screwed into place with a sealing washer and marked about 10 degrees before it achieved the final tightening position. Now, the two parts can be silver soldered together and as nearly as possible the loose piece needs to be joined at between ½ inch and 17/32 inch from the washer face. After soldering the part was checked for this nominal ½ inch dimension and the actual dimension was noted so that the lower fitting of this pair can be machined to be the same dimension for its cross-hole (but again after marking for the tightening position). The fabrication was cleaned up and mounted in the four jaw chuck to drill the through hole for the gauge glass and the top end was tapped for the sealing plug (**photo 138**).

Gauge bottom fittings

The bottom fittings (**fig 20**) are similar to the top ones and require a length of ½ inch A/F hex phosphor bronze to be turned down to ⅜ inch diameter by 15/16 inch long, less the 5/32 inch for the hexagon drive. The overall length can then be cut off and reversed to add the screwed end and partly drilled 5/32 inch for the water connection. Again, as before, the body was screwed into the boiler lower bush with a washer to mark the flange for the tightening position. Then, the vertical cross hole was drilled ¼ inch diameter at ½ inch in from the end. It is important

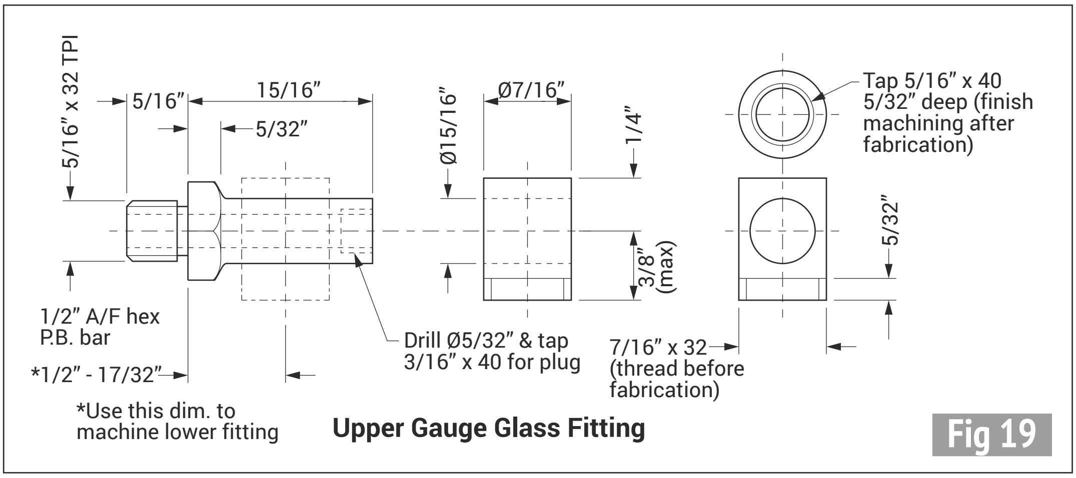
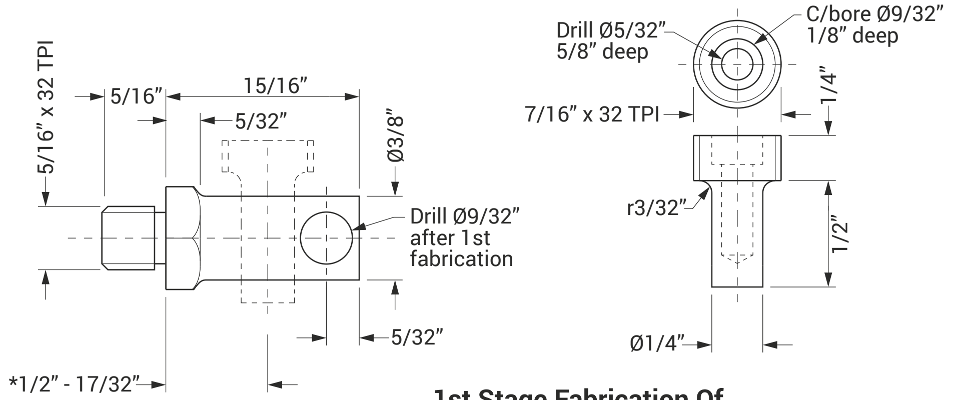


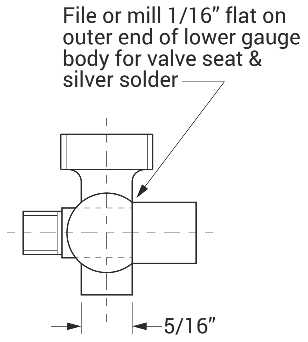
Fig 20



*Check & machine to upper fitting dim.

1st Stage Fabrication Of Lower Gauge Glass Fitting
Mat'l: Phosphor bronze

Fig 21



2nd Stage Fabrication Of Lower Gauge Glass Fitting
Mat'l: Phosphor bronze

that the distance from the washer face to the first cross hole is as near identical as possible for both parts of each gauge but it does not have to be exactly ½ inch.

At this point, I decided to fabricate the assembly in two stages and with bronze there is only minimal damage to the threads during the soldering process. The lower glass fitting was made with a further section of the 7⁄16 inch diameter bronze rod with the ¼ inch diameter machined first and the thread added concentrically before parting-off and reversing to machine the clearance recess for the base of the glass tube and centring and drilling the 5⁄32 inch hole for the lower connection to the body (**fig 21**).

Silver soldering the parts together was simple enough then the outer section of the body was filed away to create a flat and the second hole 9⁄32 inch diameter was drilled through at right angles. **Photograph 139** shows the task being done carefully so as not to damage the thread for the glass nut. This creates a seating face for the needle valve body that should be made separately (**fig 22**) as the final shape of the fabrication does not lend itself for the detailed machining to be carried out after the second silver soldering operation.

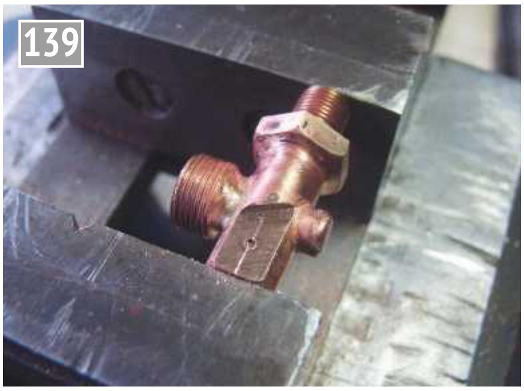
Use a length of 5⁄16 inch diameter phosphor bronze rod and machine the smaller end to thread the ¼ inch by 40 TPI section first for the pipe nut and include the 60 degree cone angle for the pipe union plus the steam outlet hole which can be drilled No. 40 by ½ inch deep. Turn the centre section to 9⁄32 inch diameter so it is a slide fit in the hole already made in the gauge body and cut the rod to length or part-off and reverse ready for the internal machining.

The details for the valve seat itself are given on the drawing and the first task is to use a 5⁄32 inch drill to a depth of 9⁄16 inch and finish the valve seat with either a 'D' bit or a suitable milling cutter to ⅝ inch depth. Then the hole can be opened out to 3⁄16 inch diameter and tapped 7⁄32 inch by 40 TPI to a depth of ½ inch.

The valve body can now be silver soldered to the gauge body. **Photograph 140** shows the result so the drillings through for the water connection and drain hole are next. The 5⁄32 inch hole through the glass support housing is done first and then the 3⁄32 inch hole for the inlet into the side of the valve chamber is completed. **Photograph 141** shows the first operation but when these holes have been completed it is a good idea to use a 5⁄32 inch end mill to take away any internal burrs by hand.

When both pairs of fittings have been made it should result in the handles for the blow down valves being in the centre of the boiler. This means they should be accessible and not restricted by the pipework for the other backhead details.

139

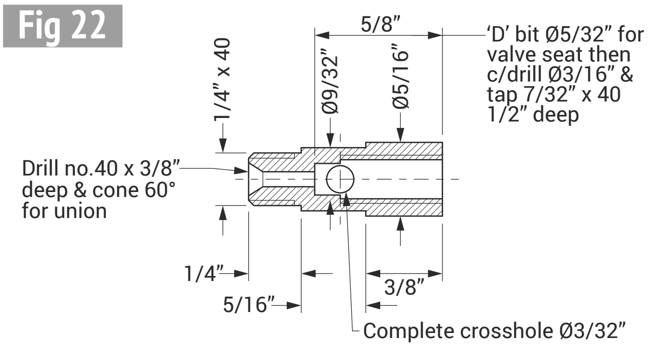


Here a flat has been filed onto one side of the main assembly and a centre added so a hole can be drilled through and it will be a contact face for silver soldering in the valve body. This feature dictates which hand the water gauge turns out to be.

140

The gauge bottom fitting has been fully assembled, silver soldered and cleaned up, the outlet pipe connection being protected with a union nut.

Fig 22



Valve Body Details
Mat'l: Phosphor bronze

Valve components

To begin the parts for the valve assembly itself, we start with the operating handle (**fig 23**) so take a length of 3/16 inch stainless rod and put a flat on each side of the end such that the rod is only 0.100 inch thick then put a full radius round the end and centre it and drill an 0.088 inch diameter hole for the creation of a square drive. This requires a fine square needle file to gradually open out the corners from both sides and I found that sighting the shape was surprisingly easy. When this operation has been done turn the rod behind the square to create a tapered length for about 7/16 inch and blend the two sections. If the lathe tool is set round at 3 degrees to the lathe axis this is quite sufficient (**photo 142**).

Next, make the spindle (**fig 24**) from a length of 7/32 inch diameter stainless steel and begin by putting an 1/8 inch length of 8BA thread on the outer end. Next, turn down the diameter to a shade over 5/32 inch diameter for ¼ inch and finally a 3/32 inch length at 1/8 inch diameter. Mark the rod to give it a reference for the return to the chuck and place the material in a small vice to form the square. If the rod is held in a small drilling vice, this will allow the rod to be turned through four 90 degree arcs whilst still held in the vice to add the flats for the handle and result is as shown in **photo 143**. The next task was to machine the rod along to thread the screwed section and turn a further length of shaft to be cut off and reversed to make the valve point itself, as shown in **photo 144**.

Lastly, **photo 145** shows more parts disassembled to illustrate the details on my drawing. Note that I have used ¼ inch diameter glass tube and the 'O' ring is reference No. 010 from the Blackgates Engineering Supplies listings (no commercial connection) and these are fine for my application.

As the water gauges are assembled with restricted access, the drain cock valve and handle for the right hand assembly are fitted to the body just before the lower body is screwed fully home and then the glass can be added from the top.

This will be all I can offer on the design for the *Wenford* model at this stage as my locomotive is in pieces being painted and this has had to be curtailed for the winter. Hopefully, I shall be able to show pictures of the assembled model and deal with any other remaining components later in the year.

Fig 23

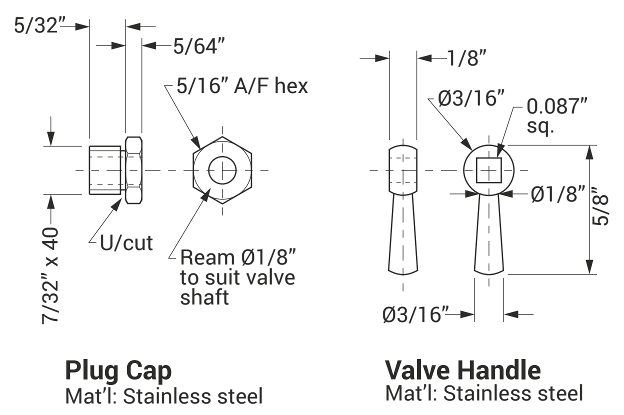
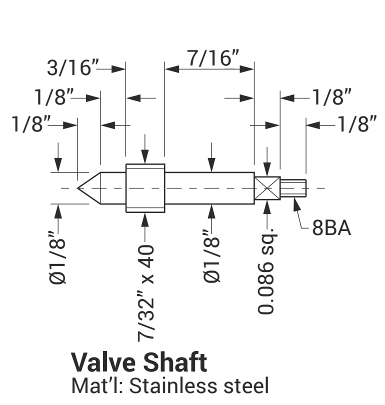


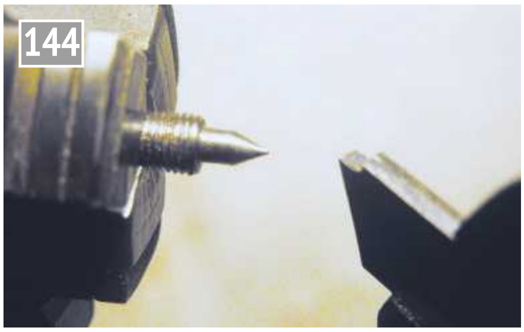
Fig 24



141 *The lower fitting is being drilled initially with a 5/32 inch drill to make the water connection through the glass fitting and then a 3/32 inch drill is used to connect into the valve body.*

142 *This picture shows a valve handle being made and the taper turning carried out ready to cut it off and put a small dome on the end.*

143 *Here the square has been carefully filed on the valve rod and the handle fitted. Ideally it should be able to be assembled at any of the 90 degree positions.*



144 *The valve rod has been machined further and cut off with sufficient length for the working end to be machined to a point of nominally 60 degrees.*

145 *Here is the disassembled set of components for the lower gauge body with the end plug included. This has not been described but the machining is straightforward and a short length of graphited yarn should be added on final assembly to be a buffer between the valve thread and the end plug as a seal.* ME

The Stationary Steam Engine

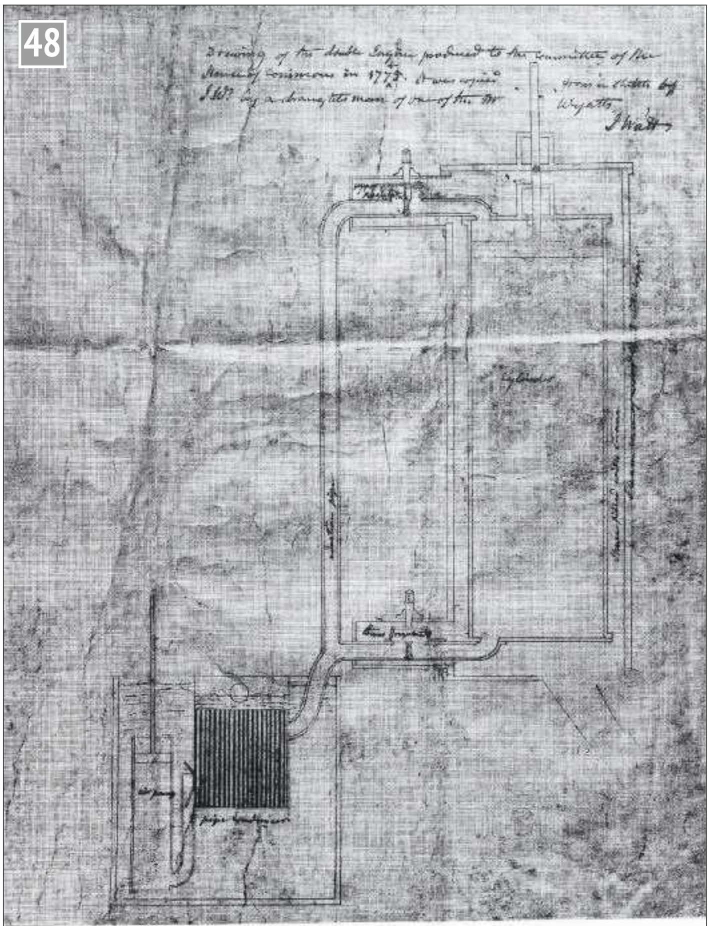
PART 18 - THE DOUBLE ACTING STEAM ENGINE

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

Continued from p.221
M.E. 4657, 29 January 2021

The events that surrounded the first attempts to produce a rotative steam engine took place entirely against a background of the single-acting engine. The Bradley Forge machine was an adaptation of the single-acting pumping engine which doubtless prompted the inclusion of the flywheel into the final drive. It may be that Watt was considering an alternative to single-acting strokes as early as 1774 (**ref 105**) using boiler pressure applied alternately to the upper and lower sides of the piston and a direct condenser connection to each end of the cylinder. This system is shown in schematic form in an undated drawing which may have been submitted to the House of Commons Committee that examined the case for extending the original patent in 1775 (**photo 48**). It is entitled:

Drawing of the double engine produced to the Committee of the House of Commons in 1774-5. It was copied from a sketch by J.W. by a draughtsman of one of the Mr. Wyatts.
(Signed) J. Watt



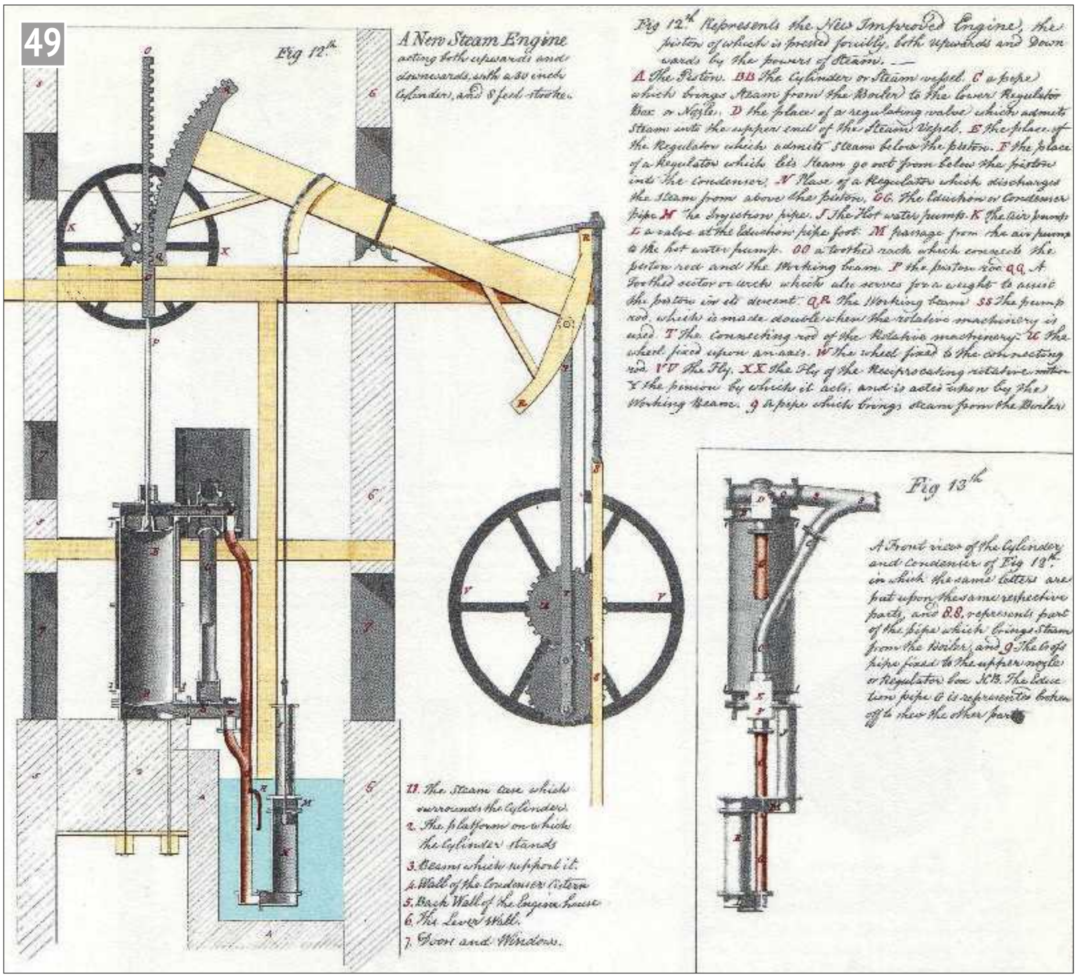
XXVI. DOUBLE-ACTING ENGINE. DRAWING LAID BEFORE PARLIAMENT, 1775
Doldowlod Papers

Early drawing of a double acting engine, possibly 1774/5.

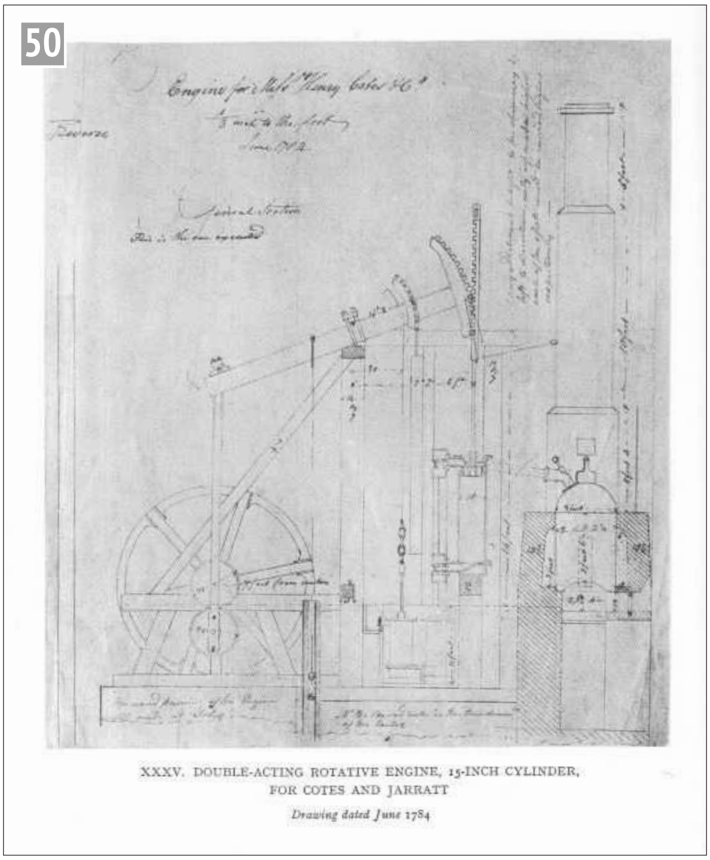
It is difficult to see how this drawing was pertinent to the proceedings of 1775 as the Committee was solely concerned with reviewing the effectiveness of the concepts contained in the original patent. The minutes of evidence as transcribed by Robinson and Musson (**ref 106**) make no reference to anything other than the separate condenser and its value. Whatever the case may be the drawing depicts an engine that is clearly early as a tubular surface condenser is shown and the valves are of the early oscillating sector plate form rather than the lifting plug, in use by 1775.

If the idea for a double acting cylinder was proposed as early as 1775, it seems to have fallen into abeyance until re-introduced in the patent sealed in July 1782. The second clause of the specification deals with applying steam pressure above and below the piston and exhausting each side directly into the condenser. This is proposed as a means of doubling the power output but the system is clearly useful for rotative engines where something was needed to replace the weight of the pumping equipment in returning the piston to the top of its stroke.

Applying steam to both sides of the piston introduced a problem in transmitting the double-acting motion to the rocking beam. The connection between the beam end and the piston in the common engine had been by an arch head attached to the end of the beam, from which hung a wrought-iron link chain connected to the piston rod. This arrangement was capable of transmitting force in one direction only; the tensile down stroke, a single chain could not deal with the powered return stroke of the piston. The return stroke required a connection that was rigid in compression but that was also capable of translating the in-line reciprocating motion of the piston rod into the arcing motion of the beam end. Watt considered several possible solutions to this problem but the most favoured was a rack and sector, included in the 1782 patent. This arrangement consisted of an extended piston rod with the upper part formed into a straight-toothed rack. The curved arch head that had previously been the rolling surface for the chain became a toothed quadrant



Watt's use of a toothed rack in a double acting engine.



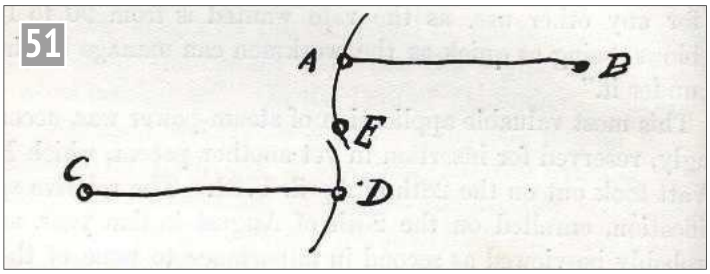
Cotes and Jarrett's engine with rack and sector but with three bar parallel motion sketched over.

which engaged with the rack. Engagement was maintained by a roller acting on the smooth surface to the rear of the rack rod (**photo 49**).

In mid-1784 an engine for driving the Hull oil mill of Messrs. Cotes and Jarratt was delivered which marked the public introduction of the double-acting engine (**photo 50**). It was a relatively small machine with a cylinder 15 inches in diameter and a stroke of 4 feet but in addition to double-acting steam it also introduced the other great hallmark of Watt's genius, the parallel motion. Although the drawing office had designed the engine with a rack piston rod and sector beam end, a pencil amendment shows the first form of the parallel motion. The Cotes and Jarrett engine was a rare instance of an engine fully erected and steam tested at Soho before delivery and it may be that it was altered from rack and sector to parallel motion before it was despatched to Hull.

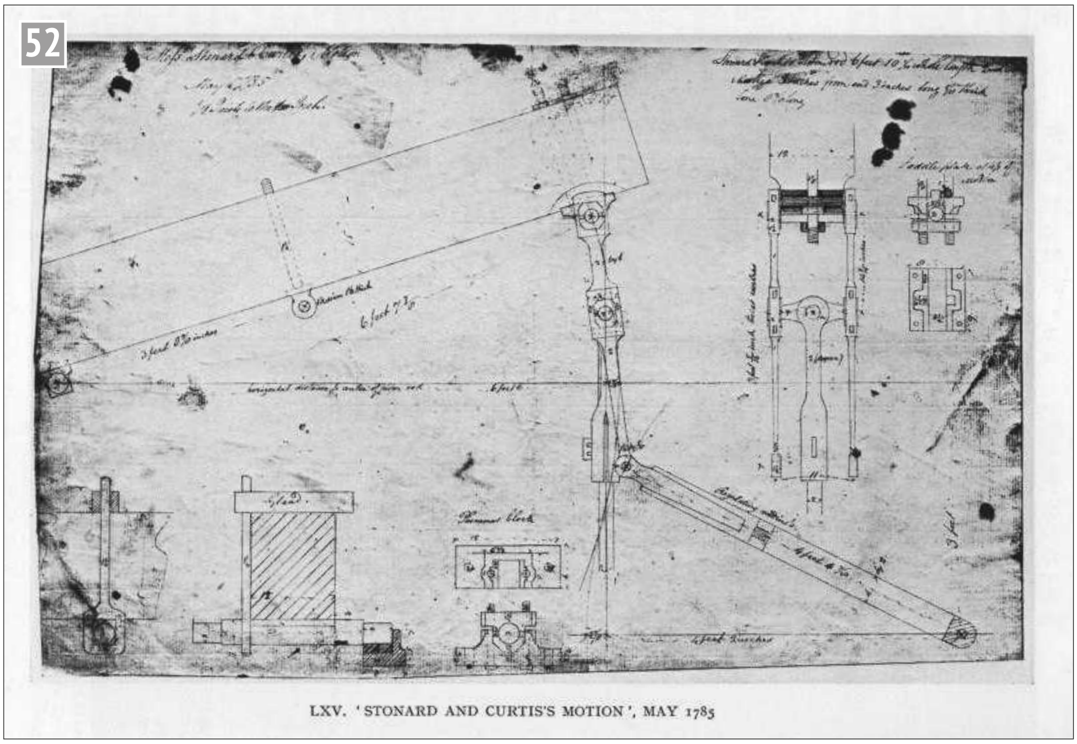
After his retirement in 1800 Watt was to say:

Though I am not over anxious after fame, yet I am more proud of the parallel motion than of any other invention I have ever made.



James Watt's sketch of the first version of the Parallel Motion (Muirhead, The Inventions of James Watt*).*

In mid-1784 an engine for driving the Hull oil mill of Messrs. Cotes and Jarratt was delivered which marked the public introduction of the double-acting engine. It was a relatively small machine with a cylinder 15 inches in diameter and a stroke of 4 feet.



Stonard and Curtis Engine with the three bar parallel motion.

He went on to describe the origin of the mechanism (**photo 51**) in the following terms:

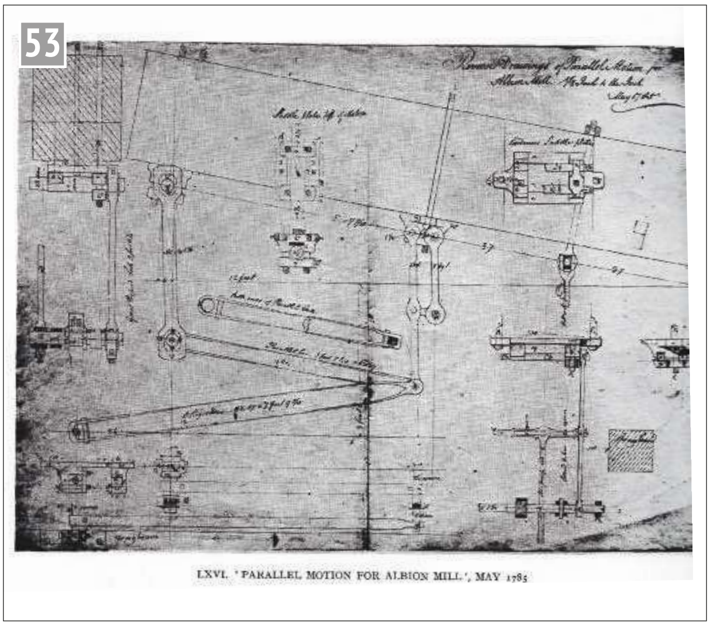
The idea originated in this manner. On finding double chains or racks and sectors very inconvenient for communicating the motion of the piston rod to the angular motion of the working beam, I set to work to try if I could not contrive some means of performing the same from motions turning upon centres. After some time it occurred to me that A-B and C-D being two equal radii revolving on the centres B and C and connected by a rod A-D moving through the arches of certain lengths, the variation from the straight line would be nearly equal and opposite. The point E would describe a line nearly straight and that if for convenience the radius C-D was only half of A-B by moving the point E nearer to the same would take place.

Watt is describing the first version of the parallel motion, subsequently known as the three link motion. In this form it consisted of a pair of drop bars attached near to the extremity of the beam and connected at the lower end to twin opposed radius rods. In Watt's sketch, either CD or AB can be taken as the half length of the main beam with C or B as the main beam gudgeon. The radius rods were secured to a pivot anchored beyond the end of the beam. The piston rod was attached to the drop link somewhat above its mid length, the ratio of the division of the drop link being adjusted to establish the ratio that Watt had proposed in the above letter.

This is the motion which has been sketched on the drawing of Cotes and Jarrett's engine. It was used again for the engine built for Stonard and Curtis in 1785. The drawing shows in greater detail how it was applied in practice (**photo 52**).

The three-bar motion had the disadvantage of lengthening the engine as the distance between the radius rod pin centres should ideally have been equal to the length between the beam's main bearing and the cylinder-end pin centre.

This would have added half of the length of the beam to the engine house length. Because of this, Watt revised the design, taking the radius rod inner pin back to the drop link which connected the air pump rod to the beam and transferring the action to the main link connected to the piston rod by the *parallel rod*. At this point the motion became a true parallelogram motion (**photo 53**).



The four-bar parallel motion.

●To be continued.

NEXT TIME

We visit the Albion mill.

REFERENCES

105. *James Watt and the Steam Engine*, H.W. Dickinson and R. Jenkins 1927, republished Encore Editions, 1981. pp. 139.

106. *James Watt and the Steam Revolution*. A documentary history by Eric Robinson and A. E. Musson Pub. Adams and Dart, 1969. pp. 16-17.

Brienz Rothorn Bahn

John Olsen visits Switzerland's only steam operated rack railway.

The Swiss are well known for their rack railways but there is only one that runs daily on steam. That one is the Brienz Rothorn Bahn (BRB) (**photo 1**). The line was built in 1892 and celebrated its 125th Anniversary in 2017. Initially, traffic was lighter than had been expected, possibly due to the opening of other railways around the same time. As with many other tourist facilities in Switzerland, the railway was closed during the First World War and did not reopen until 1931. This may have been a factor in the line never having been electrified and now leaves it unique in Switzerland in being the only rack railway routinely operated by steam and still in regular service. Some other lines do operate occasional steam services.

The line begins in the little town of Brienz, at the eastern end of the Brienzersee to the east of Interlaken. The BRB bottom station is just across the road from the main railway station and the ferry wharf, at an elevation of 566 meters (1860 feet) above sea level. The summit station is at the Rothorn Kulm, 2,244 metres (7360 feet) above sea level. The track length is 7.6 kilometres or 4.7 miles. The line is single track with three passing loops.

Locomotive No. 15 prepares to take a train up the mountain.

A little bit of calculation tells us that the average gradient is about 22% and apparently the steepest stretch is 25%. This kind of gradient is actually pretty steep just to walk up, let alone to run trains up! The line uses the Abt rack system. This uses a pair of flat racks offset by half the pitch and set side by side with the teeth facing upwards to engage with the pinion on the locomotive.

With a gradient like this, it is necessary to set the boilers of the locomotives such that they will be close to horizontal whilst on the gradient and, in fact, it seems that the entire track, including the shed, is set to match the ruling gradient (**photo 2**). This avoids little difficulties like the crown sheet becoming uncovered, as it would if a locomotive in steam was moved onto horizontal track. There are other difficulties to be overcome on a rack railway too. Points are needed at the passing loops and since these are also on the gradient, they must include the rack (**photo 3**). It appears that although the Abt system uses a double rack, this is reduced to a single rack through the points and for some short lengths within the station yard. This allows the pinion in the locomotive to pick up the other side of the rack as it crosses the carrying rail. Some Abt system railways use more elaborate systems to allow the rack to be moved across the carrying rail at the points. The »

Number 12 heads for the shed at the end of the day. Notice the shed is built on the gradient.

The moving part of the rack at a set of points.

Five trains passing at the Oberstaffel passing loop.

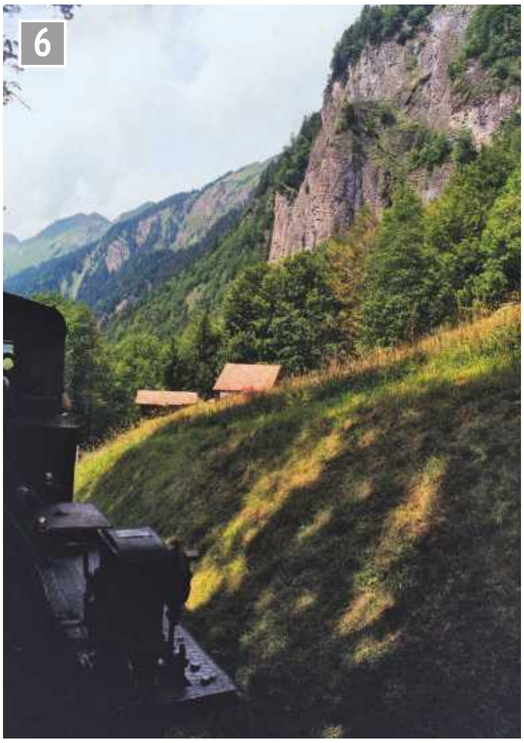
points do get quite a lot of use, as will be seen from the picture showing trains passing. There cannot be too many railways where five trains might be passing each other at once on single line working (**photo 4**).

The line also has had to overcome some quite severe civil engineering problems. Like most of the alpine lakes, the Brienzersee and its valley have been carved out by a glacier. This phenomenon leaves a valley with quite steep sides. The line climbs through the town (**photo 5**) then up the valley side towards a section of cliff (**photo 6**). Below the cliff the line turns right, partly in a curved tunnel, then follows along below the cliff for a short distance. The first passing loop is here. The line then turns to the left again and enters the first of a series of tunnels to negotiate the cliff. One of these tunnels has the novel feature of a window that gives a view out over the lake. There are altogether, depending how you count, five or six tunnels on the line, the last two sharing the same name and being Schonegg 1 and 2. Most of the tunnels are curved to some degree and all, of course, are on the gradient.

Having passed the cliff section, the line turns towards the right into the valley of the Muehlebach and reaches the second passing loop at Planalp. Our train stopped to take on water here. The line then continues up the valley, crosses the stream further up and then turns in a curved tunnel in the mountainside to head towards the third passing loop at Oberstaffel. Photograph 4 is an extreme telephoto shot, taken from the summit, of Oberstaffel showing five trains passing. After Oberstaffel the line follows around in a large loop to the left, climbing around the head of the valley. Nearing the summit ridge, it turns back on itself in the two Schonegg curved tunnels and then reaches the summit station.

The motive power on this railway is both steam and Diesel locomotives, the majority being steam. Apparently steam is used whenever possible. Some of the steam locomotives are of quite recent construction, having been built between 1992 and 1996. The Diesels were built in the 1970s and ’80s. Some of the earlier steam locomotives from the 1890s and 1930s are still in existence, although I am not sure that they are presently in active service. The rolling stock mostly has two bogies, each with two axles. As is usual with rack railways, the coaches are pushed up the hill.

Departing the yard.



Climbing towards the cliff section.

A typical train has two coaches (**photo 7**). There are of course no turning facilities.

A Seilbahn (cable car) serves the other side of the mountain and could take you down towards Sorenberg. If you are a keen hiker, there is a popular walking track ('Wanderweg' in Swiss German) towards the Brunig pass, where you can catch the train on towards Lucerne or back to Brienz. One advantage of walking in the Swiss Alps is that you can quite often use trains or cable cars to do the hard part of a walk, either up or down and just enjoy a relatively easy walk along a ridge. It does pay to remember, though, that you can be at quite a high altitude, so will find yourself shorter of breath than usual. The weather can also change quite quickly so you need to be prepared for any conditions. Even without walking any further than from the top station to the actual summit, the views are amazing. Given clear conditions you can see across the lower mountains on the other side of the lake to the high summits of the Monch and the Eiger. You can go up there on a train too, inside the Eiger, to the highest railway station in Europe at the Jungfraujoch. We once spent a week at Interlaken exploring all the various lines of the Bernese Oberland Bahn.

If you do intend to visit the area, it would also be worthwhile to cross the Grimsel Pass and go and see the Furka Pass railway. Here is a major preservation effort. The old line over the Furka pass was replaced many years ago by a tunnel, so a preservation group has taken over the original line and runs trains on it during the summer season. **Photograph 8**, taken around the year 2000, shows a train departing.

Some British readers may be nervous about the idea of driving in Switzerland, on the opposite side of the road and in mountain conditions but bear in mind that the Swiss public transport services are actually so good that you can avoid driving altogether if you choose. Timetables are generally arranged to offer good connections, with time to transfer from bus to train with ease.

Finally, for those model engineers who would appreciate a challenge, **photo 9** shows a closer view of some of the works. It will be seen that the steam engine is geared to a central jackshaft, which includes the pinions to engage with the rack. The jackshaft is coupled to the carrying wheels with connecting rods. Building a model version of this should keep you busy in the workshop for a while, not to mention the need to build a suitable rack railway to operate on.

ME

7

The Station Mistress signals the train away.

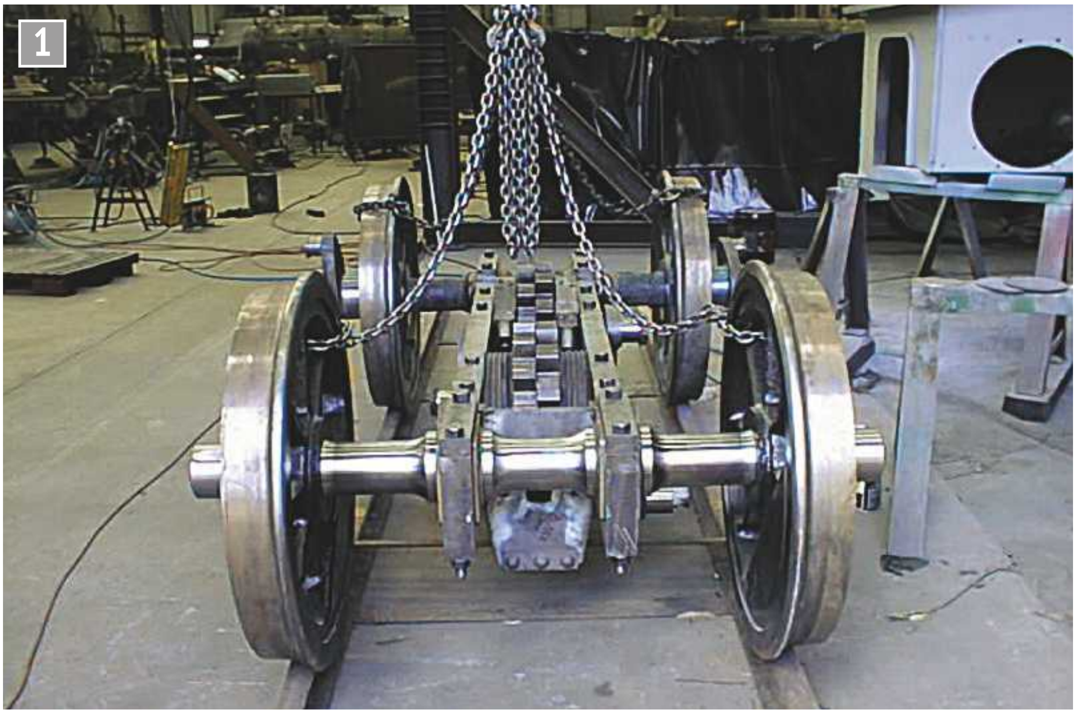
8

A locomotive of the Furka Pass Bahn tackles the gradient.

9

The complex driving mechanism.

Tony Reeve reminds us that rack railways are not confined to the Swiss mountains and North Wales.

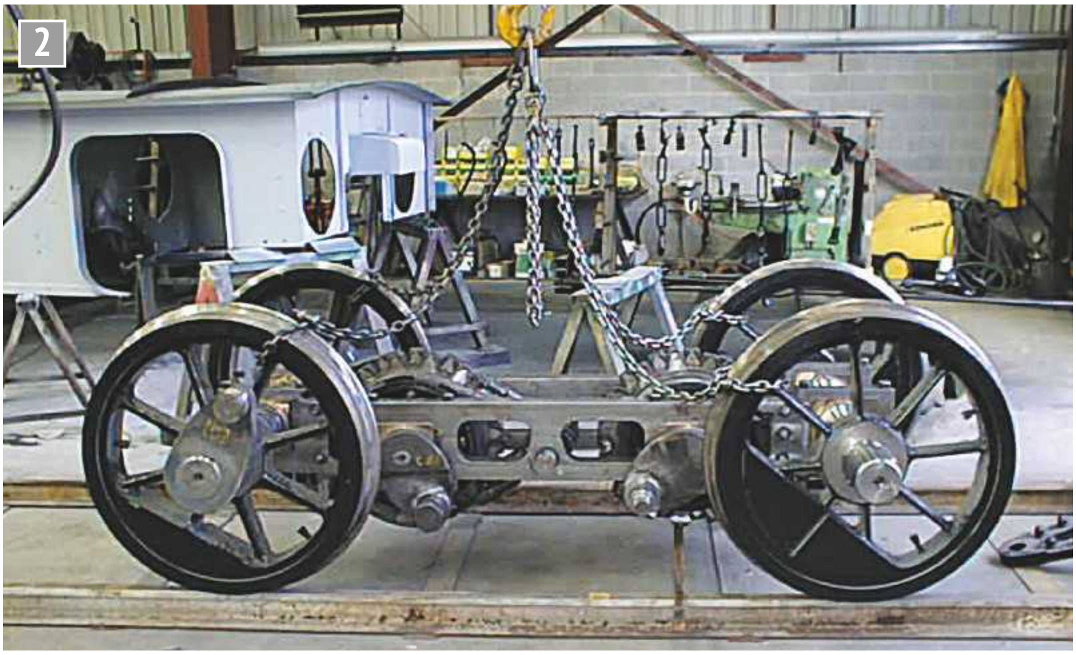


1

Adhesion drivers and Abt rack pinion assembly.

Australian Rack Railways

I've had the pleasure of travelling twice over about six years on the Brienzer Rothorn Bahn, an Abt rack railway. The first was a work trip and the second when, on holidays with my wife to her Somerset hometown of Portishead, we later travelled on for one our several visits to Switzerland. The work trip came about in 2006. The Tasmanian Government owned business enterprise (GBE) responsible to managing the state's forest were at that stage in their life building tourist attractions to entice people into the bush/forests and the wilderness. One such proposal was to build an above ground cable-car called the Maydena Hauler. It was to be about 1km long and to go to the top of a mountain about 1000 metres above sea level where excellent views of Tasmania's world renowned south west wilderness could be viewed. The company I was working for in conjunction with another local company won the contract for the track. We were to fabricate the trestles and track panels and the other company were to do the site work construction. Due to one thing and another, the cost of this project was escalating well past the original budget and it was decided that, perhaps, we should have a look overseas to see what could be done to claw back the costs and save the project. Hence the visit to Brienz and also Lucerne where we studied the Mt. Pilatus Locher system, among others. In the event, the report we wrote killed off the project even after we had



2

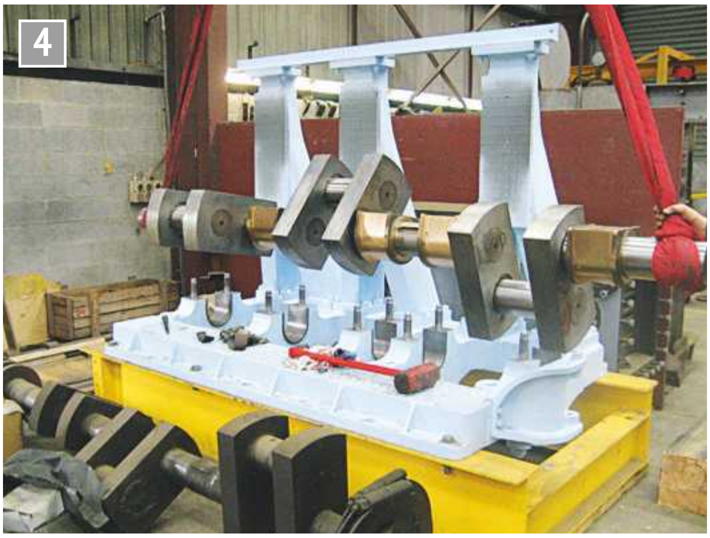
Side view.

manufactured about 20 plus six-meter track panels.

Rack railways are not new to us in Australia with at least three - all Abt systems - of which two are still working. (Abt rack systems use a vertical bar laid between the rails into which teeth are milled. Toothed wheels on the locomotive engage with these toothed bars to ensure the train doesn't slip – see **photos 1**, **2** and **3**.) One was to a mine in Queensland and is, I believe, defunct. Another, Skitube Rack Railway, began operating in the Mt. Kosciusko National Park in 1987 and is electric. The third is on Tasmania's wild and wet west coast and dates from the 1890's. This railway was built to service the Mt. Lyell copper mine at Queenstown with a port at Regatta Point on Macquarie Harbour some 34 km away. The railway had to climb from the Queen River valley at Queenstown over a hill via a 2.2 km rack section at a grade of 1:16 and drop via a 4 km rack section of 1:20 grade into the King River valley and follow the river to its entry into Macquarie Harbour. The railway closed in the early 1960's and fell into disrepair. Mt Lyell had five quite unique locomotives in that they were rack adhesion 0-4-2 tank engines with four cylinders, two for adhesion and the other two for the rack. Four of the five locomotives went into captivity. The locomotives were built by Dubs in Glasgow and No. 1 (1896) went to a museum at Zeehan (near-by), No. 2 (1898) was in the Tasmanian Transport Museum Glenorchy in Hobart but is now under going restoration by others and at the time of this article I'm unaware of its progress, No 3 (1898) was undercover on display in Queenstown, No 4 (1901) was cut up by Mt. Lyell at some stage (I don't know when) and No. 5 (1938 – North British) was on open display at Menzies Creek on the Puffing Billy line in Victoria.

In 2000 a Federal Government initiative allowed the rebuilding of this railway along with the complete restoration of two of the locomotives, No's 1 and 3. I had the extremely good fortune – because of my so-called steam knowledge - to be taken on by a Hobart local general engineering company to tender for this work, which we won (I stayed with them for the next 16 years before retiring). As for my steam knowledge, it was from all the articles I'd read in *Model Engineer* over the years - I knew reading Martin Evans or Keith Wilson was to come in useful one day. This was a dream job and to be paid for doing it… - nowadays in Australia to get a job like this one would have to live at least two lifetimes, if not three!

Rack pinion assembly.



New crankshaft being lowered into engine bed.

Our first locomotive, No. 3, took nine months to be completely rebuilt including a new boiler (designed by the Ffestiniog CME). At any one time we had up to six to eight tradesmen working on the locomotive. As the responsible mechanical engineer, I had the daily issue of problems to solve along with detail design work to bring the locomotives back to better than original condition. It was a great moment when, in January 2001, Abt No. 3 was delivered on the back of a semi-trailer to the railway, steam was raised and we watched it trundle off down the track on steam trials. No. 1 followed about nine months later and, in 2005, No. 5 was retrieved from Puffing Billy and also received the same rebuild treatment.

About 10 years ago we were approached – because of our steam expertise? – by a trust that had taken over the ownership of a 37-metre timber constructed 194 tonne passenger/cargo riverine trade vessel that had made its maiden voyage on the River Derwent in Hobart on New Years Day in 1913. Originally powered by a Plenty & Sons 500 HP triple expansion engine, this worn out engine was replaced in 1958 by a World War II left over 160 HP Vivian Diesel engine. The original steam engine was still in existence and it was this the trust wanted us to restore. A long story, but to date, as funds have become available, I've designed a new crankshaft (which we built) and the bed casting has been re-machined and the crankshaft fitted (**photo 4**). The old crankshaft was beyond economical repair - it had a central runout of over 6mm and the intermediate pressure crankpin had at sometime been welded to the crank web (1958 or earlier welding *in situ* – **photo 5**). All the main journal bearings were basically scrap bronze and were up to 3mm out of round. I might see the 'Plenty' restored and in steam in my lifetime but I'm not counting on it.

ME

Attempted welding of crankpin 1958 style.

A Boiler for *Bridget*

PART 3

Jon Edney recounts the thrills and spills of boiler making.

Continued from p.277
M.E. 4658, 12 February 2021

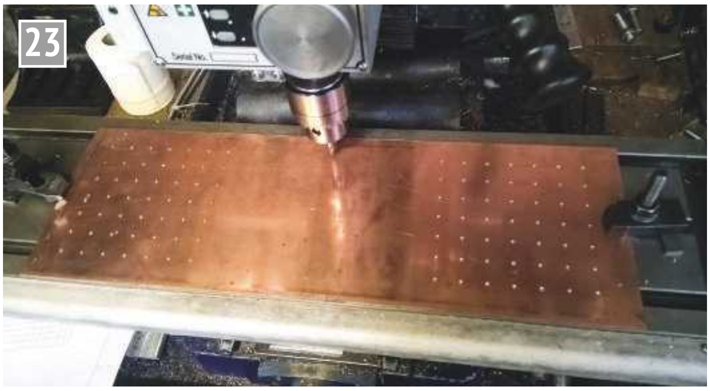
The outer firebox

The time had come to start fabricating the largest part of the boiler, the outer shell of the firebox. The top of this would be an extension of the round top of the front tube but the sides then extended vertically down to the foundation ring at the bottom of the firebox.

The starting point was a large flat sheet of 3mm copper 18 x 6½ inches. This had to be bent into a large inverted 'U' shape with the radius of the curve exactly matching the front tube at 5 inches diameter. When completed the straight parts of the shell are supported by rows of copper rivets between the outset shell and the inner firebox. Without this the pressure of the steam would inflate the boiler like a balloon. It made perfect sense to drill pilot holes for all these rivets while the sheet was still flat and also to drill location holes for the safety valves. Therefore, all these holes were drilled using the DRO on the milling machine as shown in **photo 23**.

Now time for the bending. I mentioned earlier in the article that I had made my own metal bending rollers based loosely on a plan I purchased online. I made this pretty beefy and ensured that the rollers would be wide enough to bend the final boiler cladding shell. The rollers were made from 1½ inch diameter thick wall tube and the ends from 10mm steel plate. This turned out to be sufficient for this job. Of course, I had to anneal the steel plate by heating to red hot which, once more, employed the services of the massive Sievert blow torch. The question arose of how to get the right radius of bend and how to ensure that the bend was in the middle and at right angles to the plate. I really couldn't think how to ensure this so I just launched in carefully on a trial and error basis, bending a little at a time.

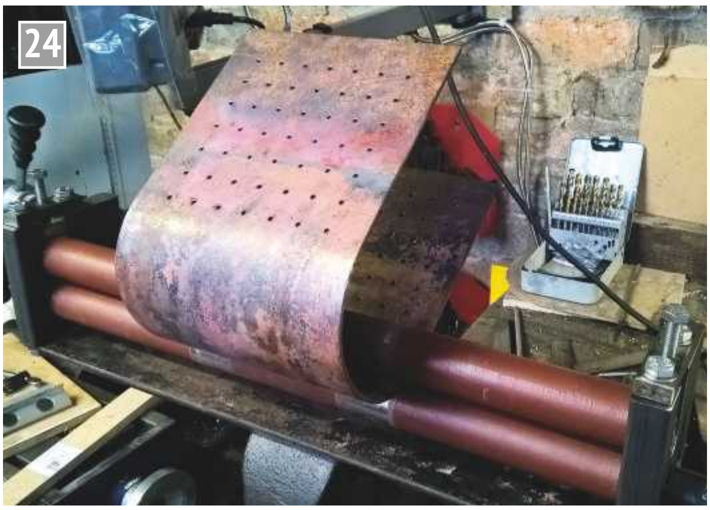
Photograph 24 shows the nearly completed bend. Notice the discoloration of the copper due to the repeated annealing. In **photo 25** we see the shell bolted (literally) to the front tube using an internal strap. You can see that the fit is very good. Of course, the use of the bolts and the strap pulls the shell, which is still soft, into perfect alignment. Eventually the bolts would be replaced with copper rivets for the soldering process and filed flat. Note the copy of *Model Engineer* pressed into good service to protect my dining room table! This photograph also shows the throat plate which has been piloted and filed to a close fit against the tube.



Drilling the outer firebox.

The inner firebox

The first soldering task I had undertaken early on was to put the firetubes into the tubeplate side of the inner firebox. As a reminder, **photo 26** shows this from the firebox side. Now I had to make the firebox wrapper which, like the outer



Forming the outer firebox wrapper.

The firebox wrapper fitted to the barrel.

Firebox tubeplate.

Forming the inner firebox wrapper.

Getting a good fit around the firebox tubeplate.

shell, started as a flat sheet of copper. In some respects, this was more difficult because it was not a gentle continuous curve but had a flat top with fairly sharp curves between the top and the sides. I had to make these bends by pressing over a round steel bar after plenty of annealing. This is seen in **photo 27** where the bending is nearing completion. Note that I am using the formed end plate as a template for the shape since, ultimately, this needs to be a close fit for soldering.

Eagle eyed readers will notice there are no pilot holes in these parts. This is not because there will be no holes, in fact they will be peppered with holes, but these are drilled through from the outside after the outer and inner parts are assembled to ensure the rivets line up. As you can imagine, it would be impossible to insert the rivets if the holes were drilled before assembly.

At this stage the firebox shell is soldered on to the tube plate but the back of the firebox is not attached yet. This operation does present a difficulty that will be apparent in **photo 28**. The problem is how to solder the plates together without melting the solder holding the tubes in place and seeing them all drop out in a catastrophic mess. This is where the oxy-propane gas torch comes in. This torch produces a very hot but small spot. It is quite capable of heating up a spot of about 10mm to red hot while the rest of the assembly is relatively cooler. You may have wondered how those clamps were going to survive and I can assure you that they would not last long in the big flame. But the approach here is to use the gas torch to heat each of the bottom corners and put a silver solder tack in place just at the corner. After that the clamps can be removed quite happily.

Once the sides are tacked, the assembly can be heated to 'nice and hot' with the big flame but not hot enough to melt the solder. Then the gas torch can be used along the joint to melt in the solder without disturbing the tubes. It sounds dodgy, and maybe it is, but it worked well and I was able to complete the joint successfully.

In fact, however, we are not yet ready to do this soldering. First, we need to make and attach the crown stays.

The crown stays

It has been mentioned that the sides of the firebox are prevented from ballooning out under pressure by the many rivet stays between the inner and out walls of the firebox. The front barrel tube is inherently strong due to its shape. The top of the firebox, though, presents a problem because there is a large gap between it and the round top of the outer shell. To prevent the top of the firebox from collapsing in, *Bridget* uses two stays that connect to the top of the shell and one supporting beam. The best way to describe these is pictorially; see **photo 29** where the stays are placed on top of the firebox before assembly. You can see that the two stays are pretty substantial and attach to the outer shell towards the middle. However, the lower ends are attached rather close to the bend for the sides and so would not seem to offer much support. The beam in the

Fitting the crown stays.

Forming the crown stays.

Firebox wrapper united with the tubeplate.

middle is intended to provide the needed support here but is not really strong enough and was the cause of trouble during testing. We will come to this later. The reason the beam is used in the middle rather than a stay is because the rod connecting the regulator handle on the back plate to the actual regulator in the steam dome runs right down the middle, just above the top of the beam. Also, there are four solid stays that run the entire length of the boiler to strengthen the top of the front and back plates. These four stays run each side of the vertical stays.

The stays are made from a flat piece of copper and are simple enough in theory but actually rather difficult in practice. I bent the pieces in a vice (**photo 30**) but it is very hard to ensure that the bends are exactly even. For example, if the angle of bend at one end is slightly different to the other, the top of the stay will not be parallel to the firebox or the other stay. Even after getting it parallel, the next problem was to ensure that it would fit closely against the inside of the outer shell so that it could be soldered. In the end I spent a lot of time adjusting and got it as good as I could. Then I riveted the pieces to the top of the firebox ready for soldering. At this soldering step, I soldered the crown stays and also completed joining of the front tube plate to the firebox sides.

At this point I have to acknowledge my wonderful wife who was prepared to man (or woman) the big torch during all the operations that required a combination of flame heating and oxy torch soldering. I would shout “heat” and she would blast away with the flame until I shouted “stop” and could apply the torch. Without her help I could not have done the job. It really takes a lot of heat and you will get some sense of this from **photo 31** which shows the assembly immediately after soldering and before pickling.

Notice that all the tubes are black and oxidised from the heat even though they were not part of the soldering operation. Notice also that the lower tubes have bent slightly due to softening – something that was easy to rectify in their annealed state.

I also want to point out that the smokebox end of the boiler is in place in photo 31 but this has not been soldered yet. It is just holding the tubes at the right spacing. I realised that soldering the front tubeplate was not going to work because the next stage would be to solder the inner and outer assemblies together and the smokebox end was a tight fit in the boiler barrel. I made a ‘fake’ end piece from a bit if aluminium (actually from the bottom of an old frying pan) as shown in **photo 32**. This took over the duty of supporting the tubes in subsequent operations.

Improvised jig for locating the tubes.

Before moving on, let’s review what has been done at this stage.

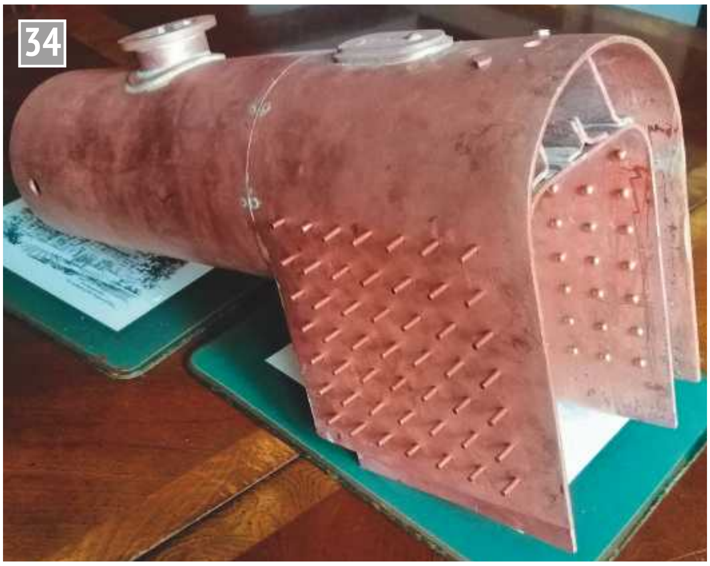
- Outer shell: although I did not describe all the steps, the two halves of the outer shell have now been soldered together along with the throatplate at the front of the outer firebox. This job is not as easy as it sounds, particularly attaching the top of the throat plate to the bottom edge of the boiler barrel which requires a reinforcing strap – but it’s done.
- Inner assembly: The tubes are soldered into the tube plate which is soldered onto the inner firebox walls and crown stays are in place. The smokebox tube plate has not yet been attached.

Joining the inner and outer assemblies

In this next section we will join the two assemblies together and start to install the stay rivets around the sides. The actual soldering operation is not complicated in principle but success is very much dependent on a good fit between the top of the crown stay and the outer shell. It’s also important to ensure that the sides are parallel and the correct gap between the inner and outer firebox is maintained (⅜ inch). As you may know, normal silver solder will not bridge gaps. It is very good at sneaking into tiny crevices but unless two surfaces are in contact or very close proximity it will not work. At this stage the joint between the inner and outer assemblies is just the top of the crown stays which, as can be seen in **photo 33**, is a little rough.

I did my best to hammer the two parts together using a long steel bar hammered just outside the boiler but, of course, this was fairly ineffective. In the end I decided to make four 6mm screws from phosphor bronze and tap holes in the top of the stay so I could draw them tightly together. The screws

Fitting the firebox into the shell.



The assembly ready for soldering.

Ready to solder the firebox stays.

At this point I have to acknowledge my wonderful wife who was prepared to man (or woman) the big torch. I would shout "heat" and she would blast away with the flame until I shouted "stop" and could apply the torch. Without her help I could not have done the job.

became soldered in and heads filed away later. The correct spacing between the sides is held by pieces of copper which will eventually form part of the foundation ring. These are held by clamps in photo 33.

Finally, I was ready to solder the parts but you can see that this is also difficult because the joints are pretty inaccessible. I placed the assembly upside down and laid strips of solder along the joins, heating until they melted and ran in. I added more with a long rod of solder as best I could. It seemed satisfactory.

Now that the two parts were fixed I could proceed to drill through all the rivet holes to form the stays for the sides of the firebox. A straightforward job, but many holes to drill considering there are 49 rivets on each side and 17 in the end. Each hole has to be drilled through and the outer side countersunk slightly. The rivets are inserted from the inside with the round head in the firebox. The part of the rivet that pokes through the hole will be soldered and cut off. The countersink is important for strength as it fills with solder during fixing.

The assembly is shown in **photo 34** where the rivets can be seen ready for soldering. Here you can see two of the phosphor bronze bolt heads on the top. The other two have been filed off to make way for the safety valve base which I machined from a bronze casting.

Before moving on, the heads of all the rivets inside the firebox are soldered while it is still accessible without the back attached. First the heads of the rivets inside are soldered in place. As usual this involved a combination of heating to nearly red heat with the big flame and then working quickly along the rows of rivet heads with the oxy torch, applying a dab of solder as each one comes to temperature. Apart from the stress of the heat and radiation this is not too hard providing you don't forget which rivets you have done and which you have not. At these temperatures, it is hard to tell by just looking at the rivet head as the flux looks a bit like solder so you have to work systematically one row at a time. In fact, I did miss one rivet in the side and had the considerable inconvenience of having to go back and reheat for a single rivet later!

Photograph 35 shows the rivets in the tube plate, which were done first.

●To be continued.

CLUB NEWS

Geoff Theasby reports on the latest news from the Clubs.

Oh yes he is! *
I've broken my duck! For years (off and on) I have been experimenting with programming memory ICs, without success. They would not 'run' or 'upload' to the device. I think I now have solved the problem, but will try other 'sketches' to prove it for good or ill. I also have it on good authority that 'Bond-It' is the stuff for mending broken ducks... The salesman told me that he was once greeted with, "Ah, hello, Mr Bond-It, I've been expecting you."

I fired up the old radio gear (valves, not transistors) for a KW Activity weekend, celebrating the foundation in 1958 of the largest amateur radio manufacturing company the UK ever had. So out with the dusty, separate transmitters and receivers, elaborate tuning up procedures and great weight. For some, placing a carry handle on them is mere lip service. When I serviced mine recently, I thought it was screwed to the bench... Not so much 'portable', as 'transportable'.

Further useless information about cars called Bolide – Bristol Cars had a Bolide in 1954, based on their 404 model, and Jeep had an eponymous concept car in 1960. This was a doorless pickup, not proceeded with.

Derek Pollard's Standard 4 (photo courtesy of Derek Pollard).

Rod Blakeman's Adams tank kit (photo courtesy of Rod Blakeman).

Meanwhile, the Bugatti version is allegedly capable of 0-300 mph in 20 seconds, but... on 110 octane fuel, and if the tyres can stand it.

In this issue: "Adlestrop, Sir!", the 'other' moors line, lockdown benefits, drinks, cyclecars and logistics.

Starting for a change with the 'dead tree' newsletters, I am spoilt for choice in this issue, with the always reliable, 100 page joy that is the *Gauge 1 Newsletter & Journal*, for winter, from the **Gauge 1 Model Railway Association**, sporting a fine front page picture of 76019, Derek Pollard's BR Standard Class 4, posing at Chris Tolhurst's line (**photo 1**). Rod Blakeman builds an Accucraft Adams 'Radial' tank kit (**photo 2**) and Richard Donovan a Western Australian 'G' class locomotive. Michael Fūg uses an old smartphone to control his battery-electric Märklin Maxi. I referred in M.E.4654 to the 2nd 15F being built by Andy Giffen

Swiss 'Crocodile' by Märklin (photo courtesy of Alan Leslie).

of Grimsby & Cleethorpes Model Engineering Society and here I find an item on his main hobby for several years, building Gauge 1 models of many of South Africa's Cape gauge (3 foot 6 inch) locomotives. David Halfpenny builds a German WWII armoured train for his well-named track *Adlestrop* (being a military train, it carried no passengers, so no one got off and no one got on…). The next item by David Viewing discussed a revival of gauge 2, a Henry Greenly proposal for 7/16 inch scale, 2 inch gauge, which had all but 'died the death'. David Leech designed and built a Class 22 on a 3D printer whilst, continuing with zoology, here is Chris Devenish's Swiss 'Crocodile' not converted to radio control (**photo 3**). Walschaerts valve gear is explained by Roger Thornber and, by way of a change, Richard Maunsell's presidential address of 1922 is reprinted as part 1 of a series on running shed experiences. Finally, John L Fox's *Railway Wagon Plans 1960 to Date*, is reviewed by Fred Roberts.
W. www.g1mra.com

Teesside Small Gauge Railway sends *Trackerjack,* November, in which editor John Palmer describes converting his 5 inch gauge Sweet Pea from raised track running to ground level. Alan Williams then describes the 'Other Moors Railway' a 7¼ inch gauge line between Whitby and Scarborough. Construction began 10 years ago and the terrain cannot be described as 'Norfolky' (Noel Coward). The layout took advantage of the contours but still has 1 in 50 and 1 in 49 banks. Motive power is a Royal Scot and a Battle of Britain Bulleid pacific plus four battery electrics.
W. www.tsgr.co.uk

Steam Whistle, December, from **Sheffield Society of Model & Experimental Engineers**, informs us of Alistair Lofthouse's trials with the 3D printing of the wasp stripes front and rear on his latest project, a Ruston 48DS. Another item is Nathan Mills's report on 'Ye Great Derailment' in Sheffield Midland station on November 11th.
W. www.sheffieldmodelengineers.com

Criterion, December, from **High Wycombe Model Engineering Club**, tells us that Hornby Railways increased sales by 30% during the lockdown and Blackgates, Polly, Warco and Steam Traction World all report increased orders during that period. A major civil engineering, electricity and plumbing project has been finished, Brian O'Connor built a Star hit & miss engine and Andrew Hopper 'pimped up' the grimy lump that powered his boat.
W. www.hwmec.co.uk

Another missive courtesy of Jon Shaw is a new club to these pages, **Maryborough Model Engineers & Live Steamers Association**, Queensland. Their *Newsletter* mentions lever engines, like the Russian OR23, or the Snowden Mountain Railway in Wales. This system reduced the need for balance weights, especially on narrow gauge locomotives. The previous issue had an item on opposed piston engines, as used on the Deltic locomotives. This item actually generated some feedback, saying the Deltics were 'high maintenance', and some Commer commercial vehicles used a Rootes TS3 engine of the opposed piston design. Editor Chris Arnold made a forge from an old Black & Decker Workmate and a few firebricks.
W. www.melsamaryborough.com

Ryedale Society of Model Engineers' December *Newsletter* opens with a report from Stuart, who tells of retubing *Hardwicke* at Carnforth in 1974. A younger, slimmer person had to enter the boiler through the dome opening and past the regulator valve to loosen the stream pipes and remove said valve for regrinding and allow access for the boiler inspector. He also tells of events at Shildon for the Cavalcade, when certain exhibits were clustered at the back of the museum yet were to be steamed the day after. They could not be lit up inside, and BR only supplied one shunting locomotive and crew. Many hands make light work, so everyone not yet tired out was coerced into pushing them outside for lighting up. Editor Bill Putman refurbished the Ivatt locomotive's tender. Strange to relate, he finds the driving position much less comfortable than he did 15 years ago…
W. www.rsme.org.uk

Bradford Model Engineering Society *Monthly Bulletin*, December, explains that John Shelton has almost finished the kitchen upgrade and suggests a celebratory drink at the Grand Opening - will it be Tetley or Taylors (tea, not beer – Geoff) I ask? Roads Vehicle News features two interesting vehicles: a 3 inch scale model of a Zettelmeyer road roller, the originals of which were made at Konz in Germany. Oddly, the boiler gauge glass is halfway along the boiler, possibly easier to see? Then, a very, very sad Leyland bus - I would have hesitated to acquire it, no matter how rare, it is so far gone. Extensive tinworm, paper thin panels, delaminating roof - and yet it will no doubt burst forth upon an unsuspecting public in 20 or 30 years' time, polished and smart. (Probably with several companions, you know what they say about buses - Geoff) Dominic Scholes made a toolpost grinder, his first being rather too big for his Hobbymat lathe. He then saw a Potts version and made his own design, inspired by the Potts. He had no plans or drawings it 'just growed'. Editor Graham Astbury, in his day job, chaired committees, many of which worked very well. He paid tribute to the BMES committee, which is the best he has ever encountered. Praise indeed!
W. www.bradfordmes.co.uk

The Gauge 3 Society *Newsletter* for winter, contains several pictures taken at John Buxton's fully signalled Little Berkeley track (**photo 4**). John says that he has been a fan of the gauge for 23 years in his 12 page article. Jim Clement bought some Horwich 'Crab' parts, which turned out to be useless and, with help from a friend in the 2½ inch Gauge Association, began one afresh. GWR 2257 was made by John Candy and has just received its brass plates (**photo 5**). Mike Williams moved into a new house four years ago and has just started his garden track, three years late! John Tomlinson found that much of his garden railway baseboards were rotten and, fortuitously, acquired some decking from his daughter who was remodelling her garden.
W. www.gauge3.org

4


Working signals at John Buxton's track (photo courtesy of Ted Sadler).

»

John Candy's 2257 (photo courtesy of John Candy).

A press release from the **Saffron Walden & District Society of Model Engineers** says they are delighted to announce the creation of The Jeff Dickinson Award, which recognises a member's project, club night presentation or newsletter article. It has been named in honour of the late Jeff Dickinson who was their newsletter editor for a number of years and who single-handedly organised many of the club nights. The first recipient is Ian Couchman for his Ransomes, Sims & Jefferies elevator. Ian showed parts for the elevator at club nights and wrote about it for the newsletter. He drew up many of the parts on a computer, made patterns using 3D printing and then cast and machined them himself. The SWDSME welcomes new members of all abilities and model engineering interests from across the Eastern Counties.

W. www.swdsme.org.uk

Halesworth & District Model Engineering Society's winter *Newsletter* opens with an Enigma coding machine from WWII. Maker Barry Lain made it and it works sufficiently well to demonstrate its design and construction. Making the rotors was quite difficult but they are the heart of the machine. There is also a computer simulation at www.101computing.net/enigma-machine-emulator if readers are keen for more. Chairman Philip Hall tells how his interest in steam was kindled. His father, whilst still at school, drew some excellent pictures, of the Titanic, a GER Claude Hamilton and a wooden railway carriage, the drawings for which he still has. He therefore asks his members to write in with their own such stories. Barry has also spent much time creating a cyclecar, of the 1910-19920s period - very lightly built vehicles, which were superseded by the mass produced 'proper' cars that Ford and Morris produced. It is ready for testing when we are allowed out again. Until then, see YouTube 'Cyclecar BAZ.L' (**photo 6**). Robert Buck made a very different model, a full size Avery Hardoll petrol pump of the1960s. The real things cost £1000s and the globes a similar amount. It makes itself useful too. It is a lamp, a cupboard and a clock for his workshop.

W. www.hdmes.co.uk

Andover & District Model Engineering Society sends the winter edition of their newsletter, *The Centre Punch*. Chairman and editor, Jon Godfrey, has deputed Trevor Jones as temporary editor whilst he deals with work problems and hopes for 'more steam' in a better 2021. The cover picture features the club's youngest member gracing the hot seat of a 7¼ inch gauge locomotive which is bigger than he is. Andover were one of the first clubs to reopen their site under the very fluid situation of lockdowns. The workshop is time-expired and is being rebuilt almost completely. The electric power board has to be repositioned, the exterior cable buried and reconnected quickly, since it also supplies the borehole pumps feeding nearby cottages. The logistics of ensuring that the right people, from two power companies, electricians, landowners and civil engineering contractors attending at the same time was very complex. Godfrey King restored a Polly locomotive bought on eBay as 'seized'. The regulator was freed off by pouring boiling water over it, but the cylinders were full of rust, probably from not properly disposing of the engine after running it. Many other vicissitudes caused by poor assembly or neglect became apparent but after rebuilding and some modifications he now has a working model and after modifying a driving trolley to take a petite pillion rider (Mrs King) it will pull them quite well. To commemorate the club's 75th anniversary, Doug Randle has written a history. It seems that Andover were the first in the UK to organise a traction engine rally, in 1954. Trevor Marks is another brave soul who lashed out the readies for a Don Young-designed 'Tug'. It was described as an 'unattractive' locomotive, although not 'of repellent aspect', as Oscar Wilde's Miss Prism was described in such an unladylike manner. Trevor redesigned the cab, which was not 'as per' the drawings, and he now has a very driveable machine. The club has a very active forum online, in which several members have posted links to 'interesting videos' of a mechanical bent. Jon Godfrey describes YouTube as an engineering wormhole and suggests these two videos of the Rode Woodland Railway, now sadly closed: www.youtube.com/watch?v=Lc9MmDChxfM and www.youtube.com/watch?v=j-TyKBPksno

W. www.admes.org.uk

And finally, how many Sellafield engineers does it take to change a light bulb?

Hundreds, one to change it and the rest to work out how to dispose of the old one safely.

*see M.E.4658.

CONTACT

geofftheasby@gmail.com

Barry's cyclecar (photo courtesy of John Child, using Barry's camera).

AMAZING SAVINGS!

6 issues for £20

Saving 42%

Saving 30%

Saving 37%

Saving 33%

Saving 33%

Saving 41%

Saving 40%

Saving 37%

Saving 33%

Saving 33%

Saving 28%

Saving 33%

SUBSCRIBE SECURELY ONLINE:

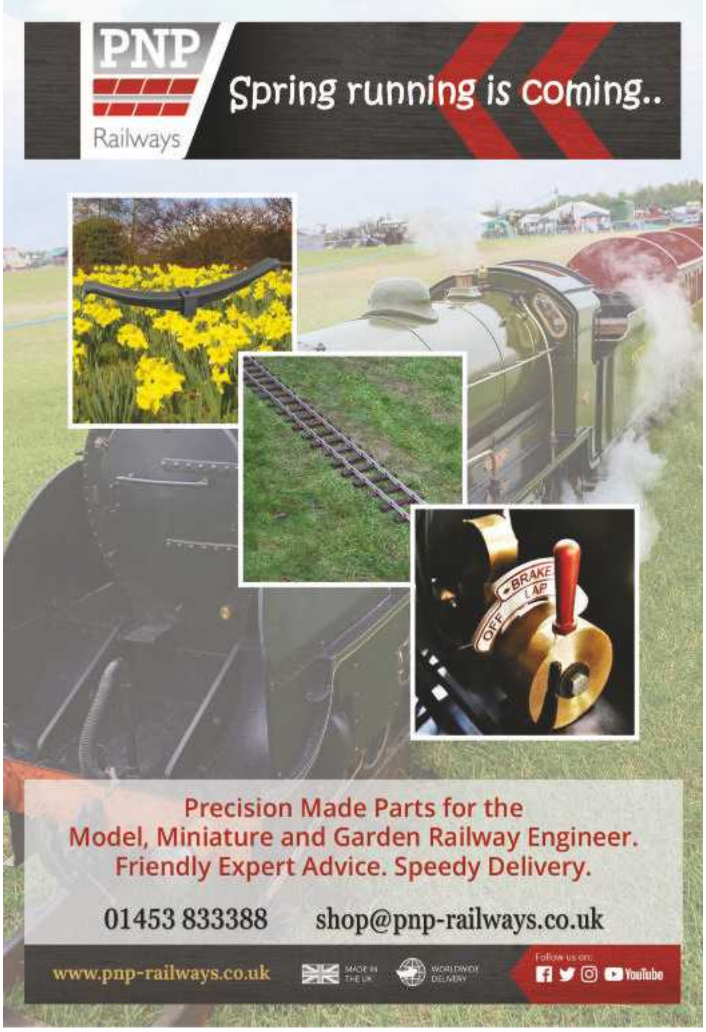
WWW.MYTIMEMEDIA.CO.UK/6FOR20

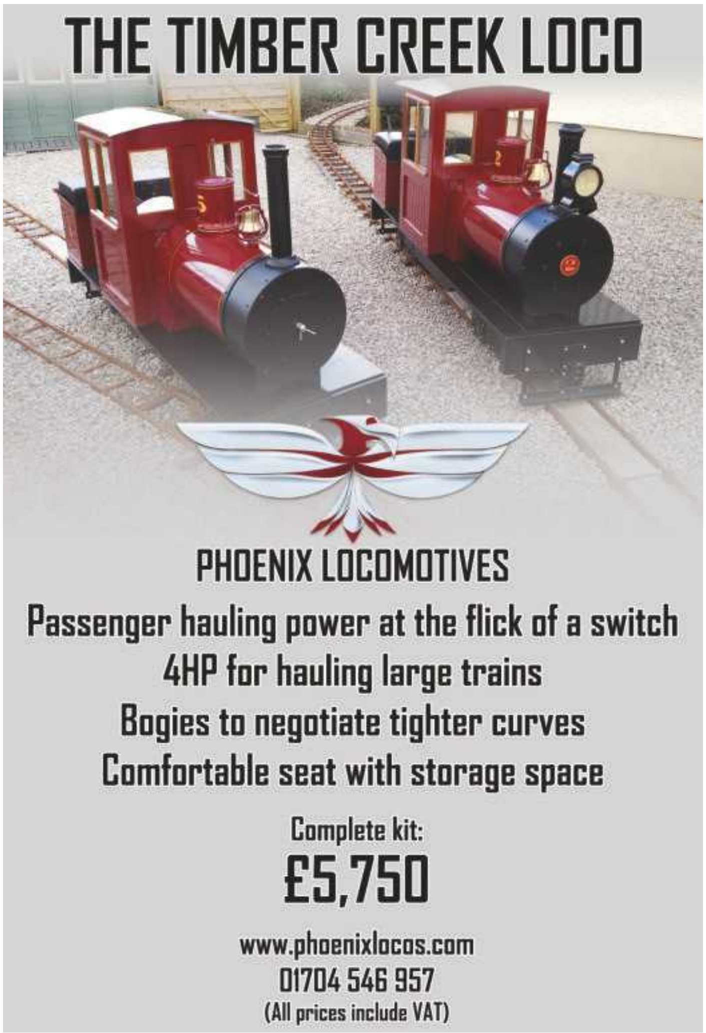
CALL 0344 243 9023** AND QUOTE 6FOR20

TERMS & CONDITIONS: Offer ends 31st December 2021. *UK print subscriptions offer only. Subscriptions will begin with the next available issue.
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@mytimemedia.com
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.

**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.


POLLY MODEL ENGINEERING LIMITED
Expanding range of In-house manufactured components
NEW! Axle pumps
Available in ¼",3/8" & ½" ram. Prices start from £45.00
NEW!
Brake Valve
For steam or vacuum
£83.00
NEW! Blowdown spanner – suitable for 5/16" & 3/8"
£6.50
BR/LMS safety valves
Safety valves
Box Spanners
BA & Metric. Available individually or in sets
Only £3 each
Tender water valves
GWR injector steam valve
GWR dummy whistles
Catalogue available £2.50 UK posted £8 international and enquire for further details or visit our website where you will find 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
www.pollymodelengineering.co.uk
Tel: 0115 9736700
email:sales@pollymodelengineering.co.uk


PNP Railways
Spring running is coming..
Precision Made Parts for the
Model, Miniature and Garden Railway Engineer.
Friendly Expert Advice. Speedy Delivery.
01453 833388
shop@pnp-railways.co.uk
www.pnp-railways.co.uk


THE TIMBER CREEK LOCO
PHOENIX LOCOMOTIVES
Passenger hauling power at the flick of a switch
4HP for hauling large trains
Bogies to negotiate tighter curves
Comfortable seat with storage space
Complete kit:
£5,750
www.phoenixlocos.com
01704 546 957
(All prices include VAT)


A.M.E 01952 879607
Abbots Model Engineering
Makers of fine 5" & 7¼" Gauge Locomotives & Rolling Stock
See Website for up to date info.
Please re-fresh your website browser.
"NEW" 5"g VULCAN 4
Bogie (4 X Motors) 24v locomotive
Ready within 4 weeks
From £2045
See website for full spec.
Choice of colours
Choice of control systems
Unit D7, Haybrook Ind Est, Halesfield 9, Telford, Tf7 4QW
Shop open Mon to Fri 9.00am to 4.00pm
Locomotives, Coaches & Trucks all on display
(See website for products & updates)
www.ametrains.co.uk


Detailing Parts in 5" & 7¼" gauges
Contact 17D :
Email: sales@17d.uk
Tel: 01629 825070 or 07780 956423
Buffer beam detail kit
7¼" g. £54.00
5" g. £37.00
BR Standard Eccentric Rod Bearing Covers
£15.40 pair 7¼ g.
BR Standard Tender Spring Mount
7¼" g. £14.50 ea
Stanier LMS/BR 4000 gal. Tender Axle Box Cover
5" g. £15.25 ea
7¼" g. £19.95 ea
Steam heat valve
7¼" g: £18.50
5" g. £14.95
Vac Hose Kit
7¼" gauge
£18.50
5" g. Timken Covers (brass) £6.95 ea.
7¼" g. (cast in stainless steel) £7.75 ea.
Silvertown Lubricators Kits
7¼" g. 12 Feed: £92.00
8 Feed: £86.00
BR Standard Smoke Box
7¼" g. Door Handles
£18.50 pair
7¼" g. 2 & 3 Feed Oil Boxes
2 Feed: £16.50 pair
3 Feed: £18.50 pair
7¼ g. BR Standard
Smokebox Door Hinges
£ 18.95 each
5" g. 8 Feed £59.00 - 12 Feed (coming soon) £ 65.00
Prices ex-works & excluding VAT
17 D
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


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
73082
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, Metheringham, 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

ModelFixings.co.uk

ALWAYS IN STOCK:
Huge range of miniature fixings, including our socket servo screws.

also the home of **ModelBearings.co.uk**

- *Taps, Dies & Drills*
- *Adhesives*
- *Engine & Miniature bearings*
- *Circlips, etc. etc.*

Tel/Fax +44 (0)115 854 8791 Email: info@modelfixings.com

www.model-engineer.co.uk

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

TAPS & DIES

Excellent Quality manufactured-supplied

British-box HQS taps dies cuts stainless
ME5(33pcs) **ME4** (30pcs) **BA3**(35pcs) has all Model Eng 32+40tpi BA, BSB, MTP etc

THE TAP & DIE CO

445 West Green Rd, London N15 3PL
Tel: 020 8888 1865 Fax: 020 8888 4613
www.tapdie.com & www.tap-die.com

BA SCREWS IN BRASS, STEEL AND STAINLESS

SOCKET SCREWS IN STEEL AND STAINLESS ● DRILLS ● RIVETS ● TAPS ● DIES ● END MILLS SLOT DRILLS etc

Phone or email
lostignition8@gmail.com
for free list

ITEMS MAIL ORDER LTD

Mayfield, Marsh Lane, Saundby
Retford, Notts. DN22 9ES

Tel/Fax 01427 848880
www.itemsmailorderascrews.com

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

Complete home Workshops Purchased

Essex/Nottinghamshire locations
Distance no object!

Tel: **Mike Bidwell**
01245 222743
m: 07801 343850
bidwells1@btconnect.com

GB BOILER SERVICES

COPPER BOILERS FOR LOCOMOTIVES AND TRACTION ENGINES etc.

MADE TO ORDER

Constructed to latest European Standards
7¼" guage and P.E.D. category 2 Specialist

No VAT — No VAT

Enquiries, Prices and Delivery to:

Telephone: **Coventry 02476 733461**
Mobile: **07817 269164** ● Email: **gb.boilers@outlook.com**

Cowells Small Machine Tool Ltd.

Cowells Small Machine Tools Ltd.
Tendring Road, Little Bentley, Colchester CO7 8SH Essex England
Tel/Fax +44 (0)1206 251 792 e-mail sales@cowells.com

www.cowells.com

Manufactures of high precision screwcutting lathes, 8mm horological 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.meccanospares.com
sales@meccanospares.com
Tel: 01299 660 097

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

BCA

Stock clearance of various used, some like new Items E.G, Collets. Vices. Angle Set Block, Measuring rods, dial collars, table handles. Rotary table top with worm. Spindle. Motor cover. 3 phase motor. Tension Bracket Body.

Tenga. Tel + 44 (0)1425 622567
E tenga.eng@homeuser.net

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 will buy your workshop so you don't have to worry about finding a new home for much loved workshop equipment and tools.

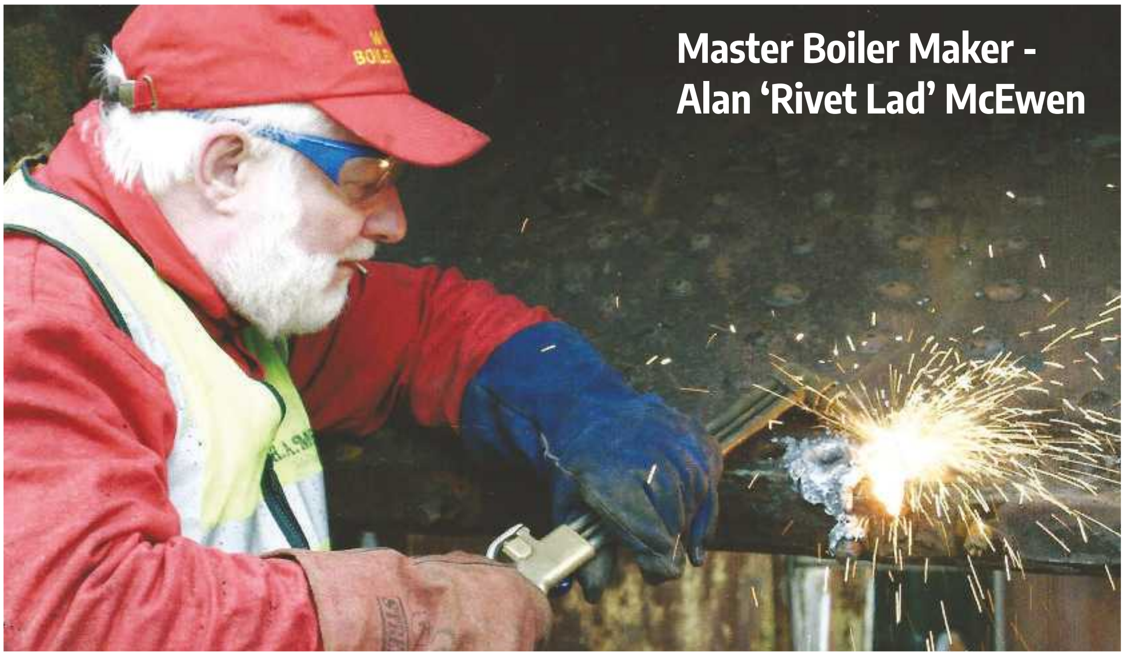
Please email photos to
andrew@webuyanyworkshop.com
Or to discuss selling your workshop, please call me on **07918 145419**

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

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

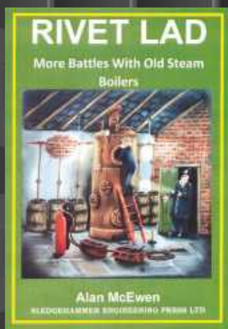
To advertise on these pages contact Angela Price at angela.price@mytimemedia.com

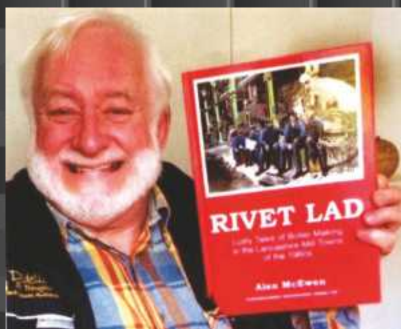
Bringing British industrial history to life



Master Boiler Maker -
Alan 'Rivet Lad' McEwen

When Master Boiler Maker and author, Alan McEwen was a young sprog, he loved banging and hammering on rusty old boilers; now that he is an old hog, he just prefers others to bang and hammer!





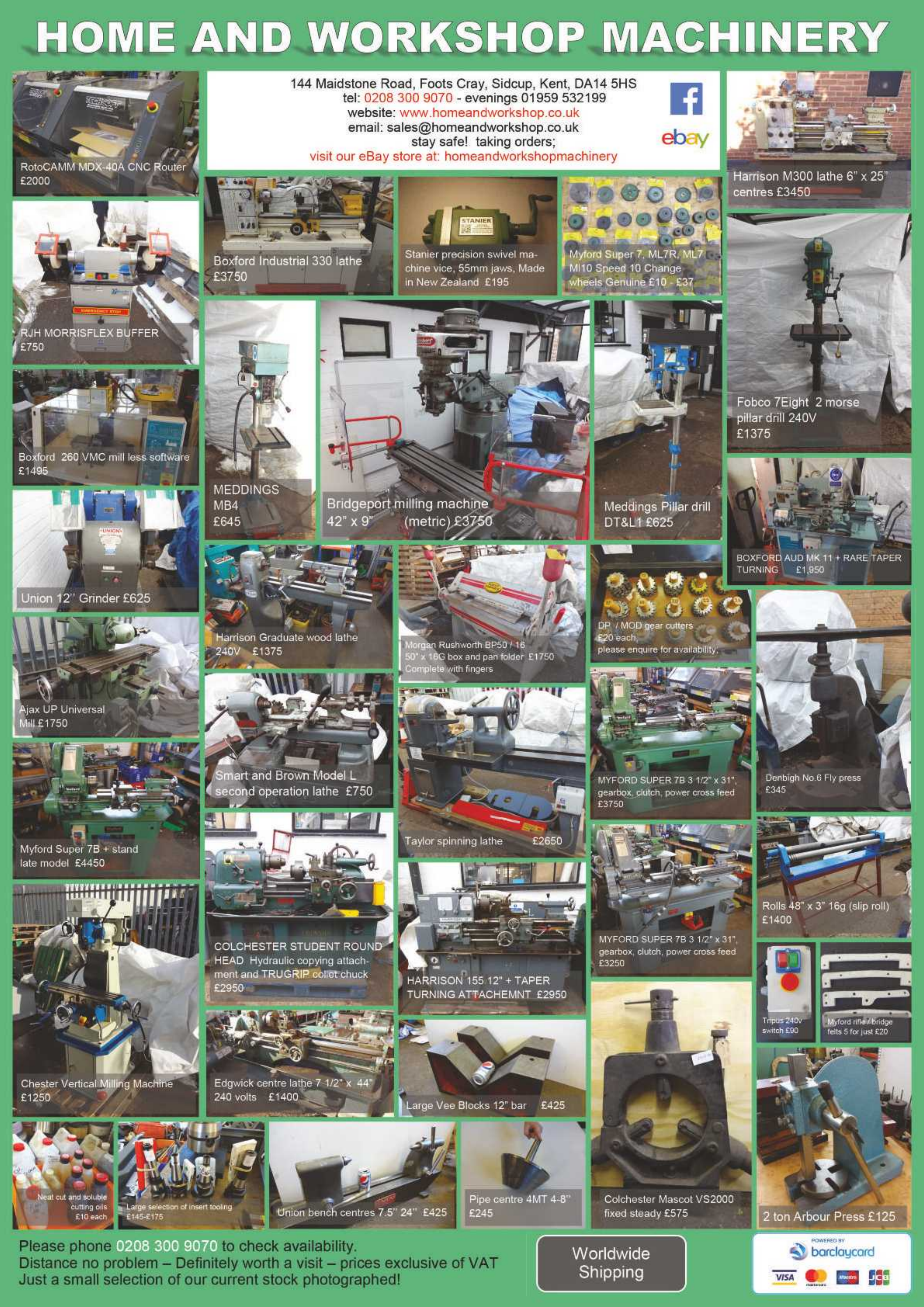
Alan McEwen's Boiler Making adventures and also 'potted histories' of several Lancashire and Yorkshire Boiler Making firms, can be read in **RIVET LAD - *Lusty Tales of Boiler Making in the Lancashire Mill Towns of the 1960s.*** The book is crammed with 'hands on' technical information of how Lancashire, Locomotive, Economic, and Cochran Vertical boilers were repaired over 50 years ago. The book's larger-than-life characters, the hard as nails, ale-supping, chain-smoking Boiler Makers: Carrot Crampthorn, Reuben 'Iron Man' Ramsbottom, Teddy Tulip, genial Irishman Paddy O'Boyle, and not least Alan himself, are, to a man, throw-backs to times gone by when British industry was the envy of the world.

Alan McEwen's first RIVET LAD book: *RIVET LAD – Lusty Tales of Boiler Making in the Lancashire Mill Towns of the Sixties* published September 2017 is now priced at £25 plus £3.00 postage and packing to UK addresses.

Alan's second RIVET LAD book: *RIVET LAD – More Battles With Old Steam Boilers* was published in September 2018. **Now priced** at £25 including postage and packing to UK addresses.

BOOK BUNDLE SPECIAL OFFER

Both RIVET LAD books can be purchased together for £40 plus £5 postage and packing to UK addresses.
To place an order please telephone 01535 637153 / 07971 906105. All our books can be ordered on our website www.sledgehammerengineeringpress.co.uk or email: lankyboilermaker@btconnect.com.
Overseas customers contact Sledgehammer by email for postage costs.
We accept payment by debit/credit card, cheques, cash and postal orders made out to SLEDGEHAMMER ENGINEERING PRESS LTD.
World From Rough Stones House, Farling Top, Cowling, North Yorkshire, BD22 0NW.



HOME AND WORKSHOP MACHINERY
144 Maidstone Road, Foots Cray, Sidcup, Kent, DA14 5HS
tel: 0208 300 9070 - evenings 01959 532199
website: www.homeandworkshop.co.uk
email: sales@homeandworkshop.co.uk
stay safe! taking orders;
visit our eBay store at: homeandworkshopmachinery
ebay
RotoCAMM MDX-40A CNC Router £2000
Harrison M300 lathe 6" x 25" centres £3450
Boxford Industrial 330 lathe £3750
Stanier precision swivel machine vice, 55mm jaws, Made in New Zealand £195
Myford Super 7, ML7R, ML7 Ml10 Speed 10 Change wheels Genuine £10 - £37
RJH MORRISFLEX BUFFER £750
Fobco 7Eight 2 morse pillar drill 240V £1375
Boxford 260 VMC mill less software £1495
MEDDINGS MB4 £645
Bridgeport milling machine 42" x 9" (metric) £3750
Meddings Pillar drill DT&L1 £625
BOXFORD AUD MK 11 + RARE TAPER TURNING £1,950
Union 12" Grinder £625
Harrison Graduate wood lathe 240V £1375
Morgan Rushworth BP50 / 16 50" x 16G box and pan folder £1750 Complete with fingers
DP / MOD gear cutters £20 each, please enquire for availability.
Ajax UP Universal Mill £1750
Smart and Brown Model L second operation lathe £750
MYFORD SUPER 7B 3 1/2" x 31", gearbox, clutch, power cross feed £3750
Denbigh No.6 Fly press £345
Myford Super 7B + stand late model £4450
Taylor spinning lathe £2650
COLCHESTER STUDENT ROUND HEAD Hydraulic copying attachment and TRUGRIP collet chuck £2950
HARRISON 155 12" + TAPER TURNING ATTACHEMNT £2950
MYFORD SUPER 7B 3 1/2" x 31", gearbox, clutch, power cross feed £3250
Rolls 48" x 3" 16g (slip roll) £1400
Tripus 240v switch £90
Myford rifle / bridge felts 5 for just £20
Chester Vertical Milling Machine £1250
Edgwick centre lathe 7 1/2" x 44" 240 volts £1400
Large Vee Blocks 12" bar £425
Neat cut and soluble cutting oils £10 each
Large selection of insert tooling £145-£175
Union bench centres 7.5" 24" £425
Pipe centre 4MT 4-8" £245
Colchester Mascot VS2000 fixed steady £575
2 ton Arbour Press £125
Please phone 0208 300 9070 to check availability.
Distance no problem – Definitely worth a visit – prices exclusive of VAT
Just a small selection of our current stock photographed!
Worldwide Shipping
POWERED BY barclaycard
VISA