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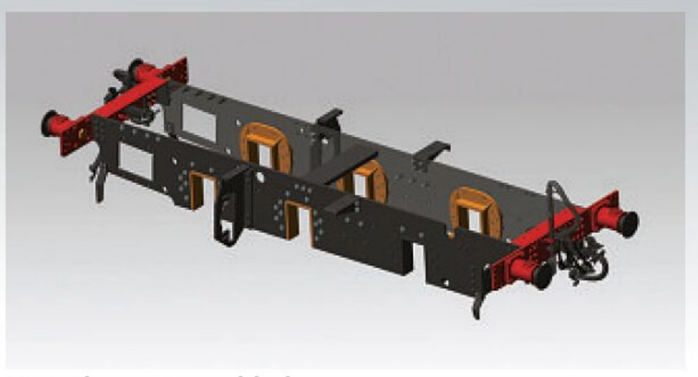

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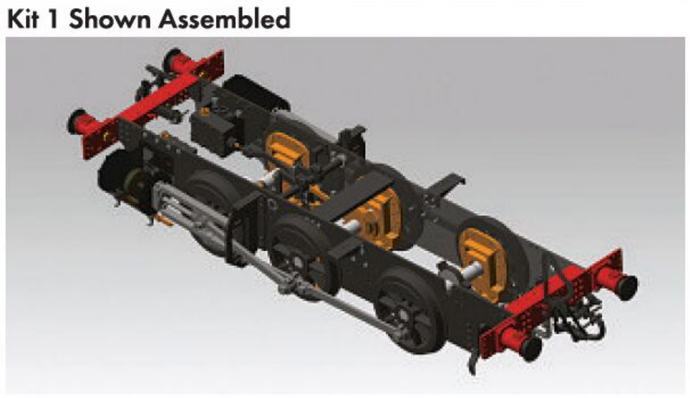

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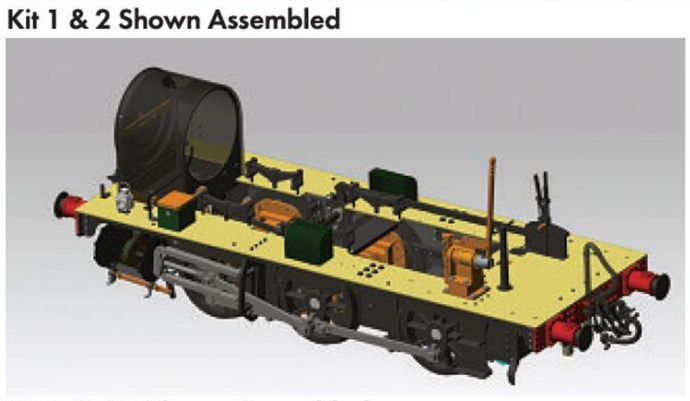

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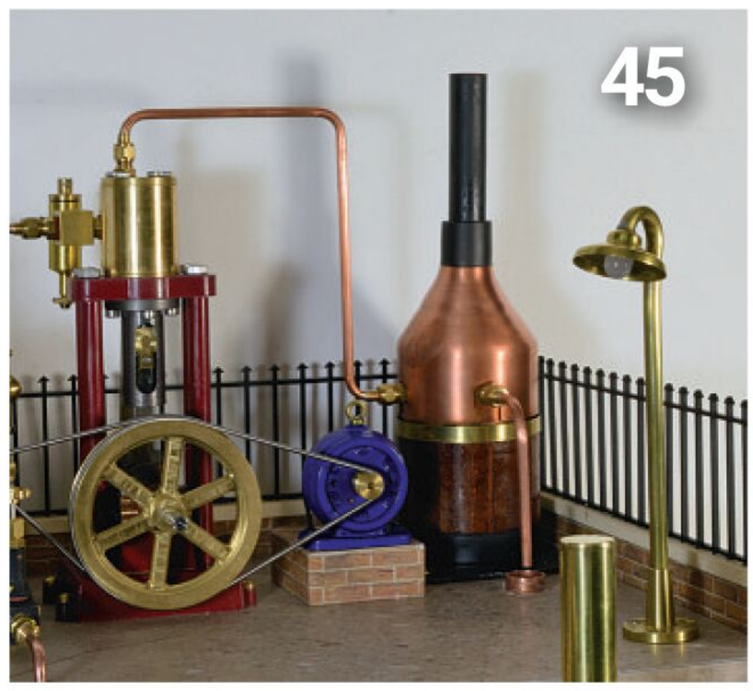

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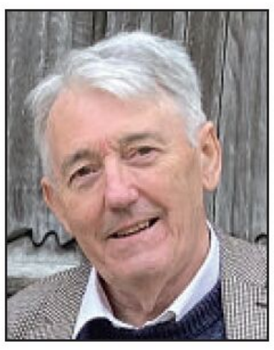

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Merry Christmas

All of us here at *Model Engineer* would like to wish all our readers a very merry Christmas.

You might think this a little premature, given that there are a couple of weeks still to go but our next issue doesn't appear until after Christmas Day so this is our last chance to wish you the best of the season.

As it is, you're probably still writing your Christmas cards, dusting off and putting up last year's festive baubles (if you're a bauble household – I'm not) and wondering what to get Uncle Fred for Christmas.

Every year, I resolve to get Christmas under control in good time but I never do. I bought my Christmas cards weeks ago (and the stamps – before the price went up!) but they remain unwritten. Every year, they get dealt with at the last minute and every year I promise myself that I will write them early next year. I never do and I know very well it will be just the same this year. Then there's the desperate trawling of the Amazon website, trying to find appropriate presents for random relatives. And of course, there is the provisioning for Christmas itself. Where can we find a turkey that won't go green before Christmas finally arrives? How many pounds of sprouts will we need (none, of course, but we never learn)? How do you roast potatoes without case hardening them? Yorkshire puddings (no)? Sausages wrapped in bacon (oh yes)? It all gets a bit desperate, doesn't it?

So why do we do it? I blame Prince Albert, with his Teutonic Christmas trees, cards, candles and baubles – the architect of our modern Christmas. Then there's turkeys, presents, crackers and Christmas puddings (no doubt inspired by his wife). It's all very jolly, isn't it? Yes, it is, and that's the point of it. It's an opportunity to spend quality time with family and friends, enjoy their company and brighten up the darkest days of winter. Turkey and stuffing or beans on toast? It doesn't really matter, does it? It's what is round the table, not what's on it, that is the real magic of Christmas. I hope you have a good one.

Sweet Pea Rally

It's time to start thinking about next year's events and Bryan Finch, secretary of the Guildford Model Engineering Society, writes with the following.

'The Sweet Pea Rally is an annual event for owners of Sweet Pea locomotives and its variants – Sweet Violet, Sweet William, and Metre Maid. The Rally has been held up and down the country for over 30 years, such is the popularity of these locomotives. In 2025 it will be hosted by the Guildford Model Engineering Society at its site in Stoke Park, Guildford, Surrey, over the weekend of Saturday 14th and Sunday 15th June.

'GMES would like to take the opportunity of inviting applications to take part in this event and we will also welcome interested folk to come along to watch. We anticipate starting the Rally on the Saturday morning, and we'll have the final runs early on Sunday afternoon giving time for those travelling long distances to be homeward bound at a sensible time.

'The Sweet Pea Rally will be run on the Society's dual gauged 3½/5 inch raised track which is 1405ft long, where curves are typically 60ft to 70ft in radius with a short length of 50ft radius, and the dual gauged 5/7¼ inch ground level which is about 990ft long with a minimum radius of 68ft. The raised track incorporates anti-tip rails.

'For friends and relatives who might wish to spend a few moments of the weekend away from the Rally, Guildford has many tourist attractions – historic buildings, the castle grounds and its gardens, the 'cobbled' High Street (actually, they're setts), a good range of shops, cafes and restaurants, riverside walks, and the 20th Century brick-built cathedral on Stag Hill. The town centre is about 20 minutes walk away, or there are bus stops for both directions just outside the GMES site. There are also ornamental gardens and an open air lido at the other end of Stoke Park.

'There are a good number of hotels and guest houses in the Guildford area, and we hope to be able to offer a limited number of camping spaces on the adjacent Challengers Field for the weekend, on a first come first served basis.

'For further information and an entry form, please contact GMES via sweetpea2025@gmes.org.uk '

Malcolm High takes Adele Marie *round the Fareham track at the 2022 Sweet Pea rally.*

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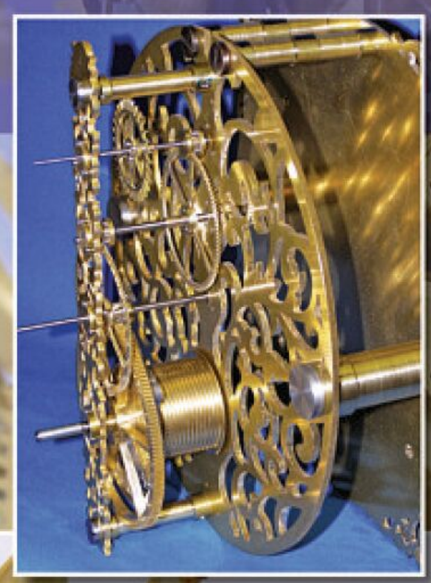

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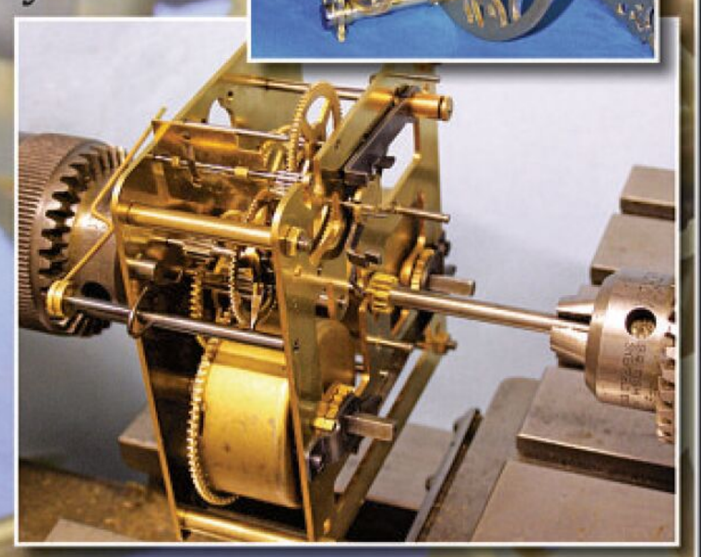

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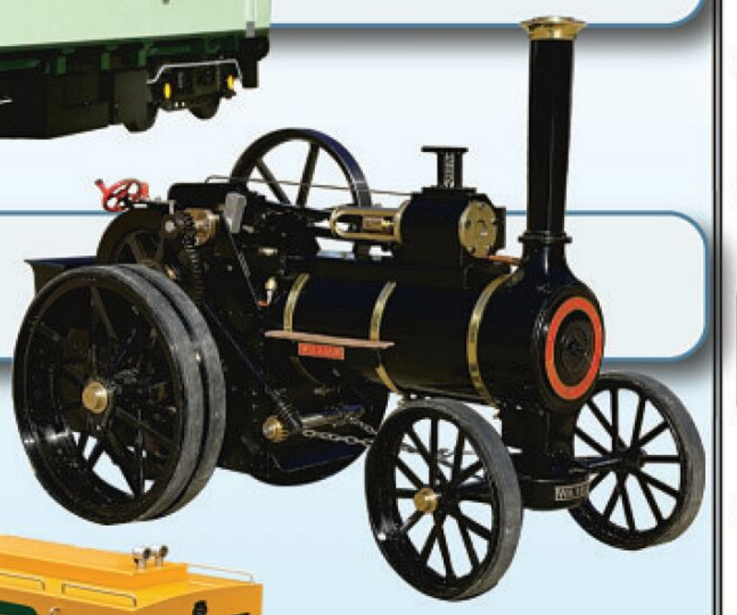

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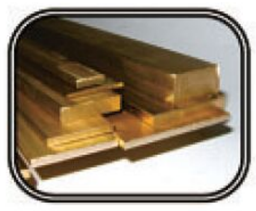

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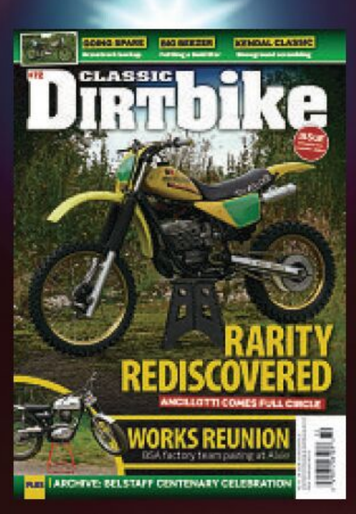

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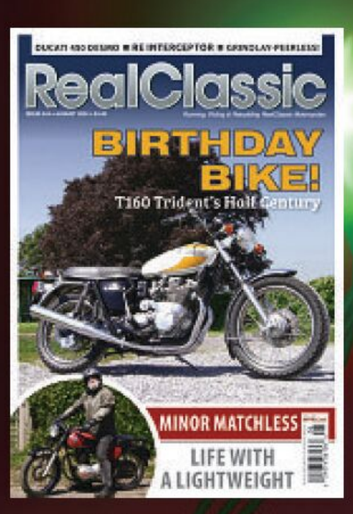

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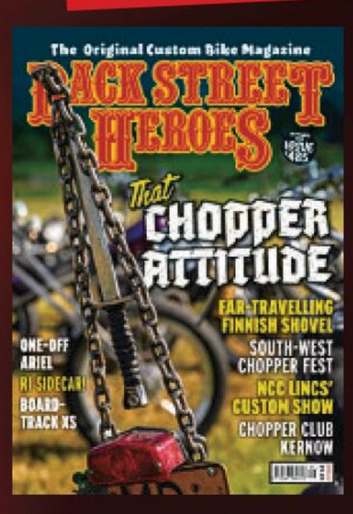

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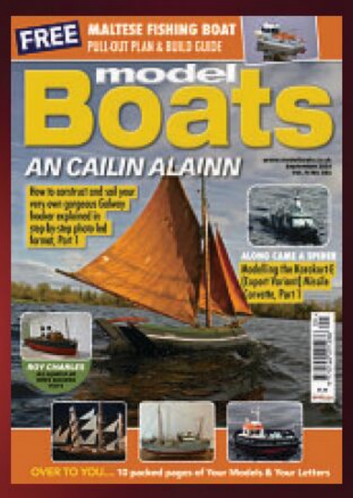

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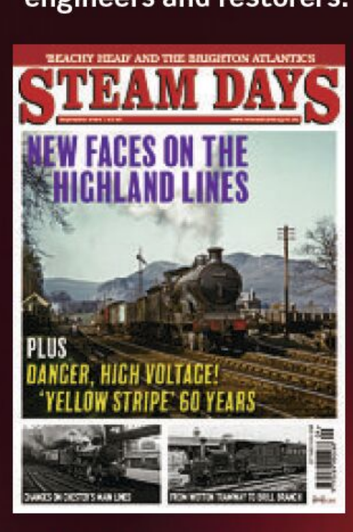

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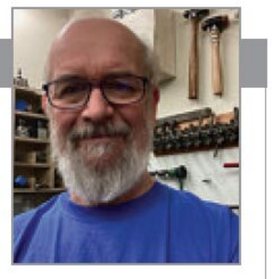
The Midlands Exhibition



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

SMEE

In October SMEE were delighted to be able to contribute to the success of this year's Midlands Model Engineering Exhibition. After last year's celebration of the Society's 125th birthday, which was very much a retrospective, we went a little Pythonesque and did something completely different. Although we did have a few favourites from our 'historic collection' the focus was very much on those starting out in the hobby or hopefully thinking of doing so.

Consequently we populated the stand with a much larger range of demonstrations and a greater offering of current work (**photo 1**). To add a dynamic feel we had a range of engines running on compressed air and with all the rods and flywheels in motion hopefully achieved plenty to look at.

For the demonstrators Myford Ltd kindly supplied a couple of lathes to run alongside our small Sieg mill supplied by the Marshall House workshop. There was plenty going on with Ralph Thompson's team of Terry Mendham, Jonathan Tickner and John Florentin making parts for the small Elmer engine, chosen for its simplicity as something that could, with a bit of application, be made in a weekend or even in a day at the show mob handed (**photo 2**). This last target turned out to be a little ambitious - not because of the workload but because all the machinists were interrupted frequently by visitors asking questions. Whilst this was a very welcome problem to have we did decide that we do need to double up on staff in the future maybe with someone fending questions in front and explaining all the machining going on in the background. As the important thing was talking to people though we didn't mind at all.

At the other end of the stand Alan Hopwood showed his comprehensive collection of George Thomas Tooling, something I was very impressed by. I'm quite a fan of George Thomas and have made a lot of his kit but I think Alan may have made a clean sweep of all of GHT's designs which made for a splendid spectacle when all

A view of the SMEE stand at the Midlands Model Engineering Exhibition.

The mob get stuck in to the Elmer engine.

Peter Wardropper's County of Dorset *and* Harringay *chassis.*

laid out. Alan spent all four days carrying out machining operations on the second Myford and talking about the GHT tooling. Parting off with Jenny Bond's wonderfully narrow parting tools started a minor sales rush and Jenny sold out of all she had brought with her. Alan's demonstration of ball turning drew quite a crowd and at one time there was even a Eureka backing off tool in operation which has to be quite a rare sight. Ralph Thompson added spice to all this at the other end with his demonstrations of carbide tip brazing and drill sharpening and Neil Wyatt who brought along his resin printer turned out engineering parts throughout the show (**photo 4**).

On the long show table in the centre of the stand was Peter Wardropper's superb *County of Dorset*, a 3½ inch GWR 4-6-0 based on a LBSC design, and his part built *Harringay*, a 5 inch GNR 0-4-4 tank, both of which attracted a lot of attention and demonstrated what can be achieved with experience. I understand Peter started building engines when he was 14 and is now a little older. In contrast Peter Mconachie showed what can be achieved by relative beginners with his triple expansion engine which is actually only his second build - so well done him.

Models working on air included the glorious Owen Bird beam engine including scale engineman, carefully restored by Mitch Barnes, which produced very pleasing chuff-chuff noises. The C.H. Tidy wall engine intrigued people and *Theseus* performed beautifully with the three different sized engines purring away contentedly. Alistair Milne provided his nicely built steam hammer from Hemingway castings which I have to say I loved for its controllability and it delighted the audience whenever it was operated. It was just like the real thing and it was unusual enough to attract a lot of attention as soon as people saw it in action. Allen Berman's 'Polly' was well liked especially as it was the only engine inside the show actually producing steam and enabled us to talk to people about training, which we are committed to reactivate next year.

The experimental 'E' in SMEE was nicely represented by Bob Reeve and Jonathan Tickner. Jonathan had converted a worm and wheel gearbox acquired at a rummage sale into an optical direct dividing head by the neat addition of a rear plate with a graduated scale and a USB microscope and laptop screen. He also showed that an alternative version could be achieved with an old iPhone with a 'fiducial' tape arrow stuck to the screen. Shows you what you can achieve with what you have lying about and it got him Second Prize in class. Bob's contribution was his stepper driven rotary table controlled by either Mach3 or Arduino and his test bed for his electronically driven gear hobber set up for his Sieg 3 CNC mill. Despite being somewhat noisy it was a good demonstration of how the software development process is aided by knocking up a test bed to run all the components of the eventual full system. Being able to drive the rotary encoder with a simple DC motor to simulate the Sieg's spindle made the process much more controllable as well as allowing development to take place in the house rather than out in the workshop. (We have been following Bob's progress on this project with interest in the SMEE digital group.) Ralph Thompson's 6 cylinder wobbler attracted interest and a Highly Commended and in my opinion was novel enough to be 'experimental'. The judge described it as 'sweet'.

Current work included three very nice Hemingway Kits projects from Nick Jones, a relatively new member, in the form of a two part vice for the milling table, a rotary broach and the ever-useful finger plate. A couple of Myford items were provided by me, namely a George Thomas indexing toolpost on a modified top slide with improved micrometer dial and Graham Meek's modification of George Thomas' Myford cross slide micrometer with slide lock and vernier which, with the loosening of a single cap head screw, allows the cross slide the freedom required to use the taper turning attachment without disassembling the end bracket. With Alan Hopwood and his display and demonstration of George Thomas tooling old GHT had a good outing.

All this made a very good basis for chatting to the visitors to the stand and we did seem popular. At some points in the day I think I counted as many as eight different conversations going on at once so interaction was high and we came away with a long list of new contacts to follow up.

It was really nice finding out what people are doing in their own workshops, answering questions and chatting about the items on display. I met a young nine year old lad who had learned how to draw engine parts on the computer at home and get them to fit together. He was interested to see the 3D printer so maybe he will start to bring some of his drawings to life in future years. So here is to next year and hopefully to see many more of you on the stand.

So a Merry Christmas from all at SMEE.

ME

Neil Wyatt (left) magics up another part from his resin printer.

A BR Standard Class 4 Tender Engine

PART 9

Doug Hewson describes a 5 inch gauge version of the BR Standard 2-6-0 tender engine.

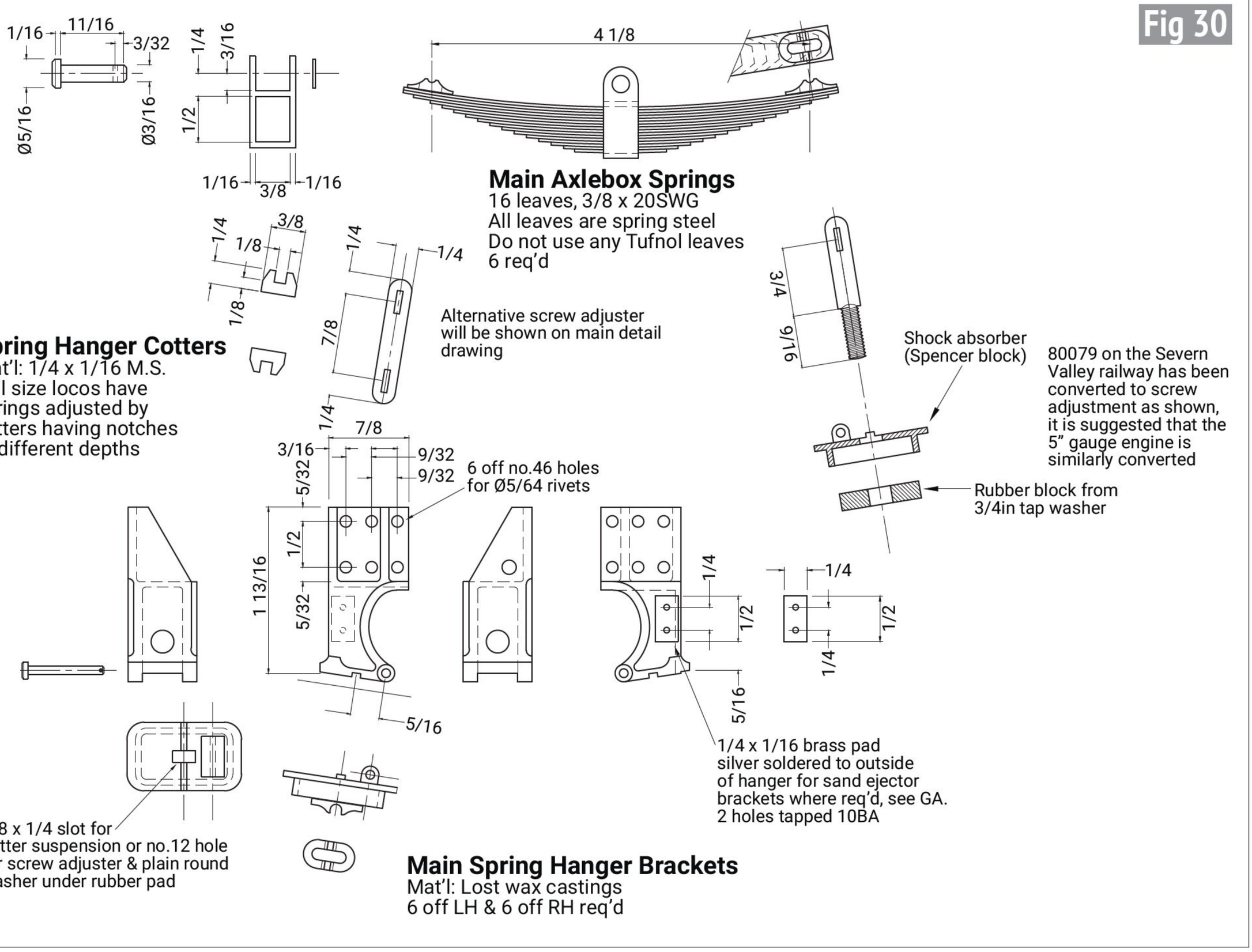
Continued fromp.743
M.E.4757 November 29

Horn blocks

We will make a start on the horn blocks first of all (now that I have remembered to put them on the drawing!. Words fail me.) These are all the same as on my 4MT but as you are unlikely to have read about them in the past, I will detail them here and now.

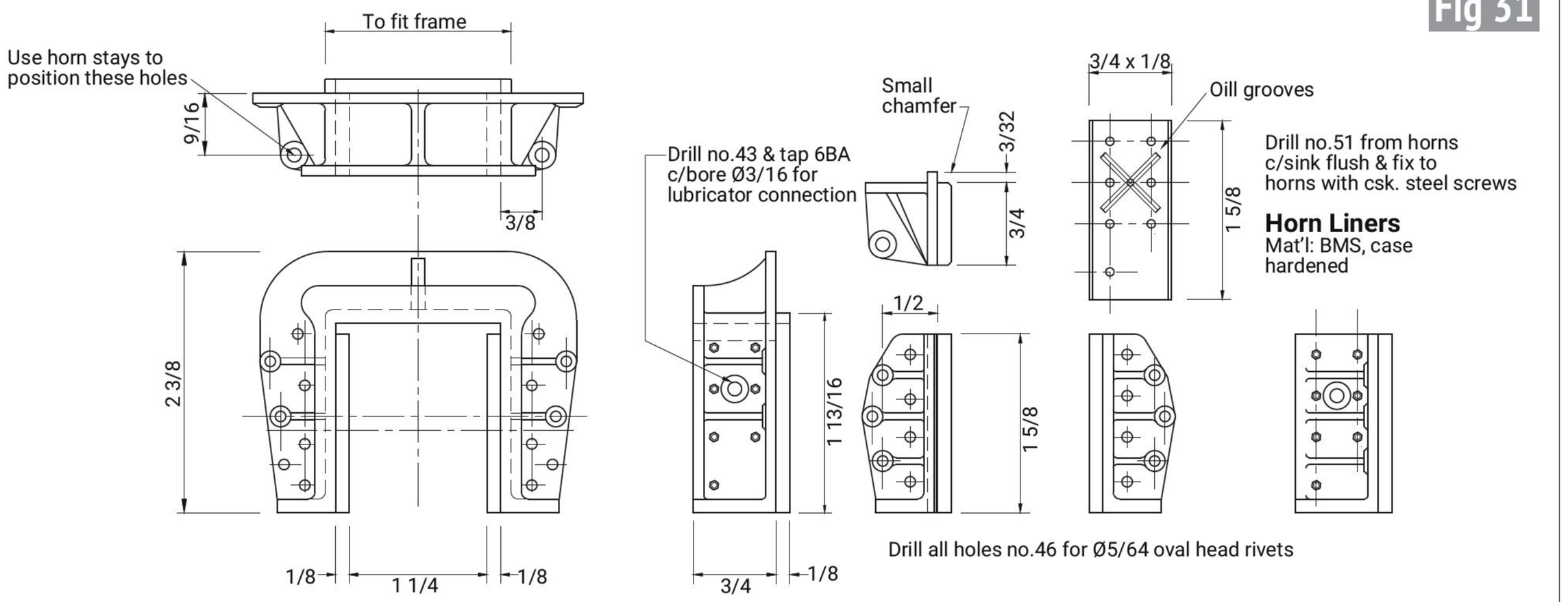
Before we can start any assembly of the frames proper, we need the horn blocks and spring hanger brackets as these need to be bolted or riveted to the frames first (**figs 30** to **32**). The main horns are another one of those jobs which I was told couldn't be done as they are double flanged. Since then, I have had lost wax cast ones made. I know of very few people who have a milling machine large enough to lay the whole locomotive frames on the bed to machine the jaws of the horn blocks, so I prefer to do it at this stage. The leading and trailing horns are separate cheeks but cast in pairs, but these can be dealt with more simply in the machine vice. The rivet holes can now be marked and drilled and also the holes for the liner bolts and lubricator connection. The liners are just 1⅝ inch lengths of ¾ x ⅛ inch BMS bar clamped to the horns and drilled through, and each one marked with a hard stamp to identify it. To cut the oil grooves I used my vertical slide and held a pointed lathe tool in the four-jaw chuck. I

Fig 30



Suspension.

Fig 31

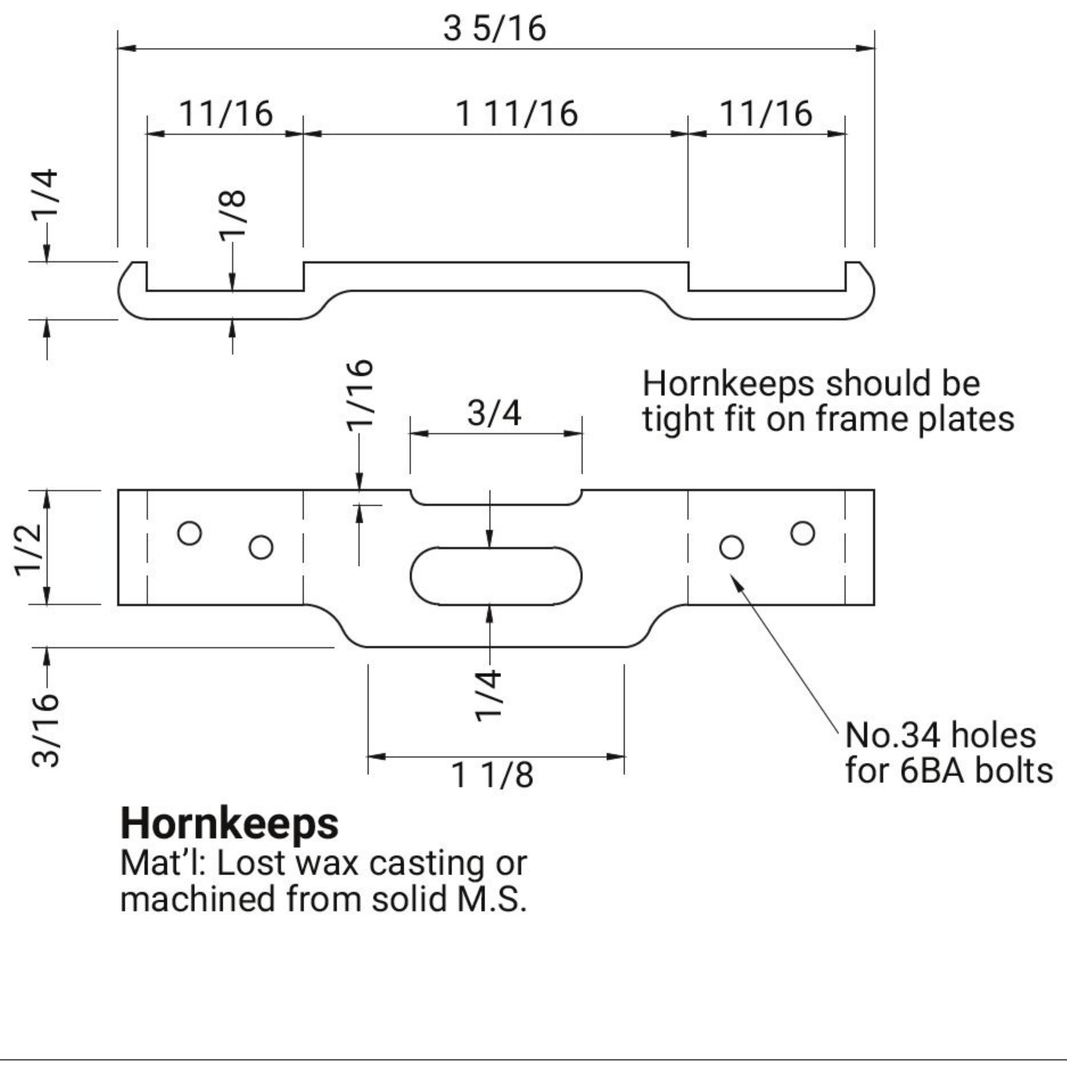


Driving Horns
Mat'l: Cast iron or steel

Leading And Trailing Horns
Mat'l: Cast iron or steel

Horn blocks.

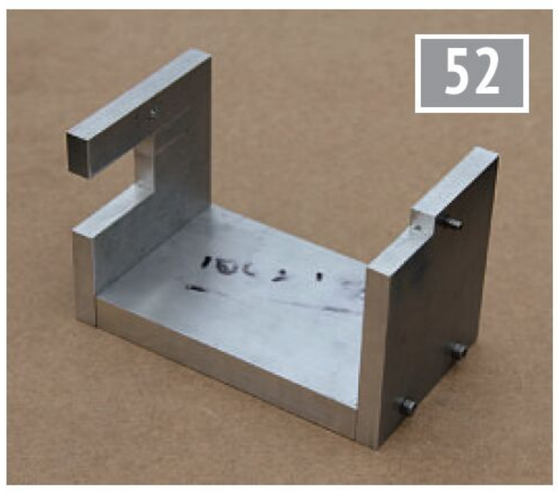
Fig 32

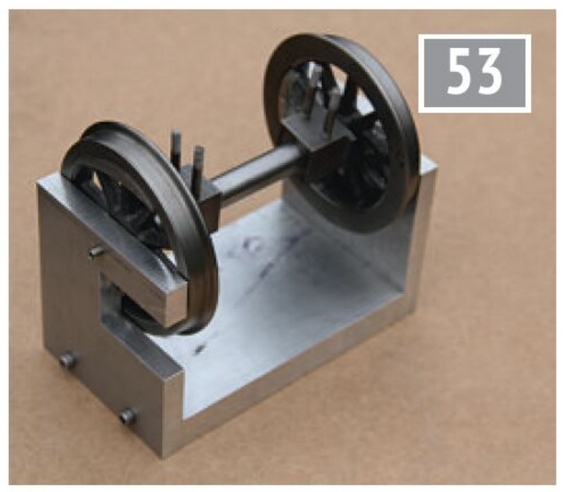


Hornkeeps
Mat'l: Lost wax casting or machined from solid M.S.

Horn keep.

Ron Head's quartering jig for his BR Standard 4MT.



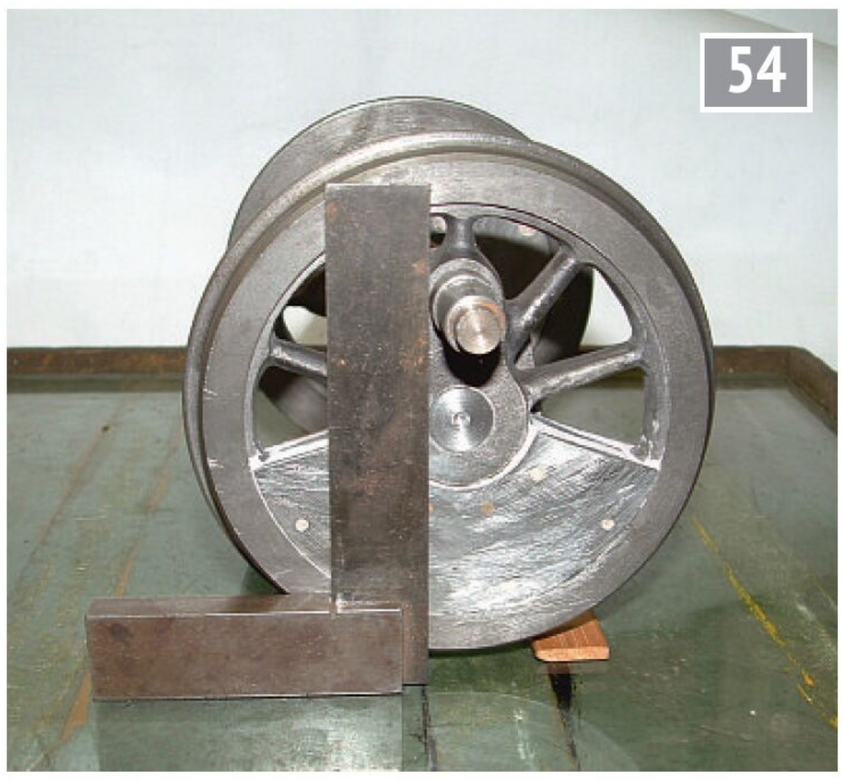


Simple quartering jig.

locked the chuck with the back gear so that the tool point was horizontal and set the vertical slide to 45 degrees. With the horn liner in the machine vice, I then just dragged it across the tool point with the cross slide screw whilst winding the lead screw handwheel to give a cut of about 5 thou' at a time. The grooves only need to be about 20 thou' deep anyway. Once all complete, case harden the faces.

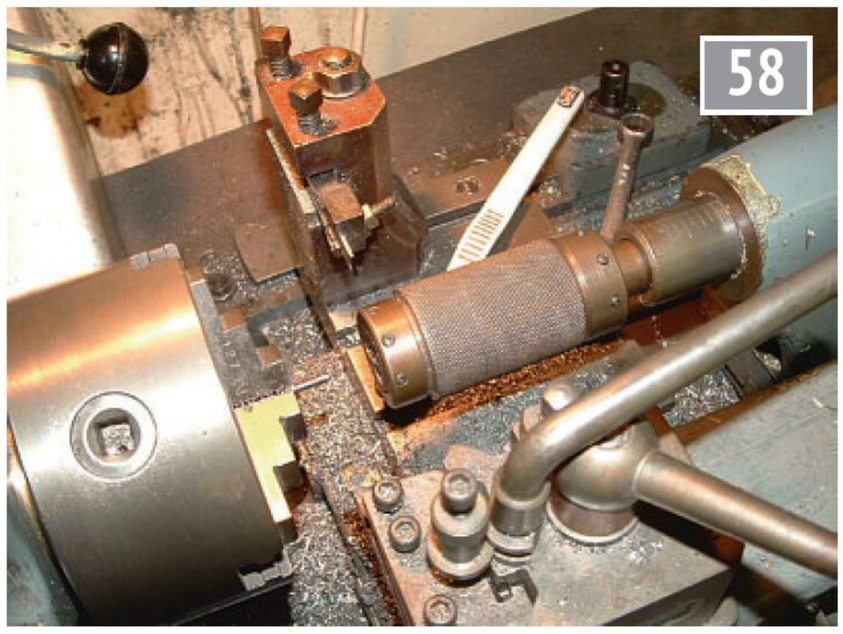
Quartering the wheels

The wheels must be quartered as that is how a steam locomotive works and gives it four beats to the bar, or puffs! **Photograph 51** shows a very sophisticated rig for quartering the wheels on a 4MT 80134 being built by Ron Head. I also have photographs of another more simple rig which consists of three pieces of aluminium plates screwed together with bits cut out of it, on one end to rest the axle with the crank pin at bottom dead centre, and at the other end it has another shelf on which the axle rests with the crank pin level across. The two **photos 52** and **53** show this perfectly. This was made for a Y4. The first crank pin needs pressing in fully home, but the second one needs a bit of a lead so that it will stay put when you fit it into the wheel. Once quartered you can then press it home to a good tight fit. For my part, I used a height gauge and a try ≫



Using a try square for wheel quartering.

Alternatively, an angle plate may be used.

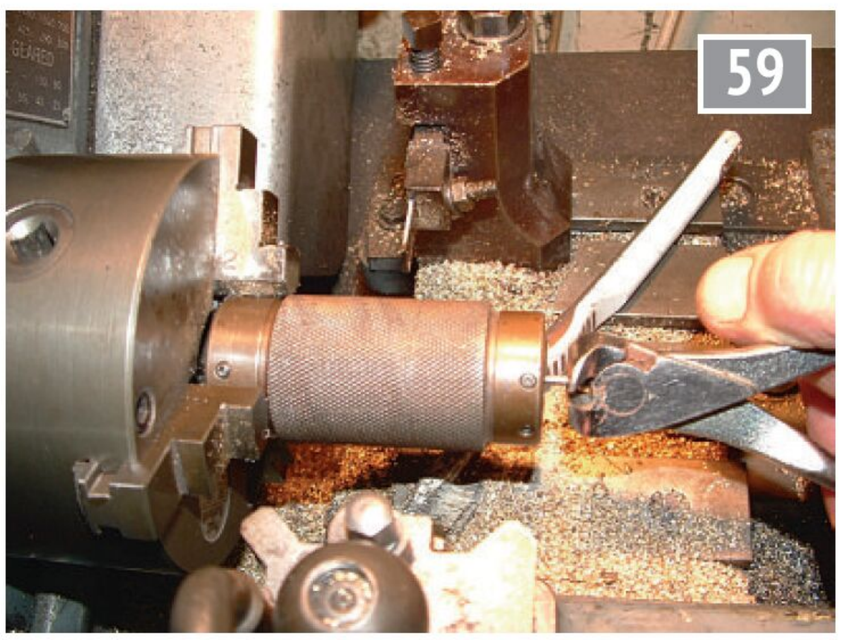


First attempt at threading the rivets.

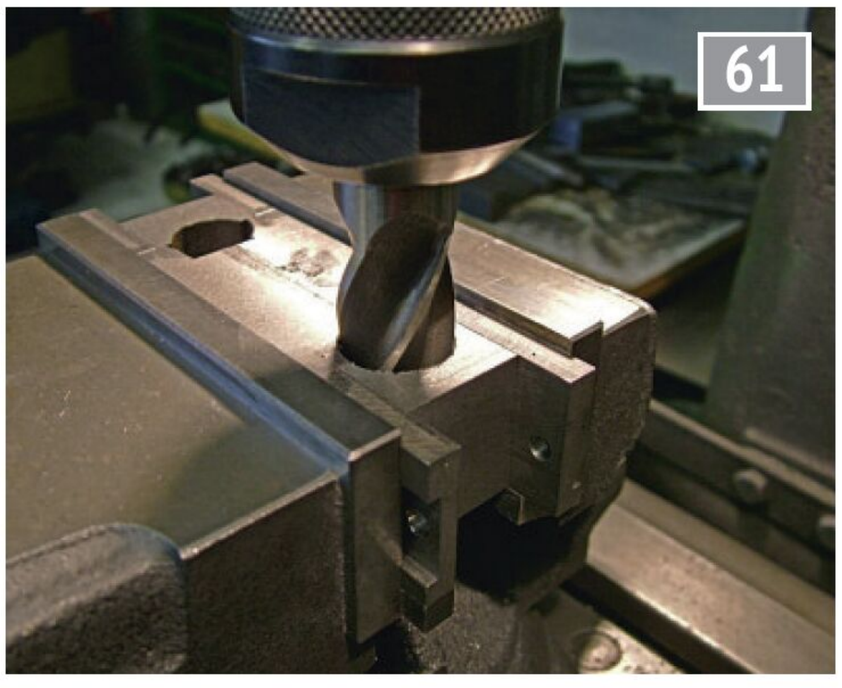
Threaded rivets.

The crankpin height can be checked using a height gauge.

Horn fixing bolts.



Improved rivet threading method.



Reaming axle boxes.

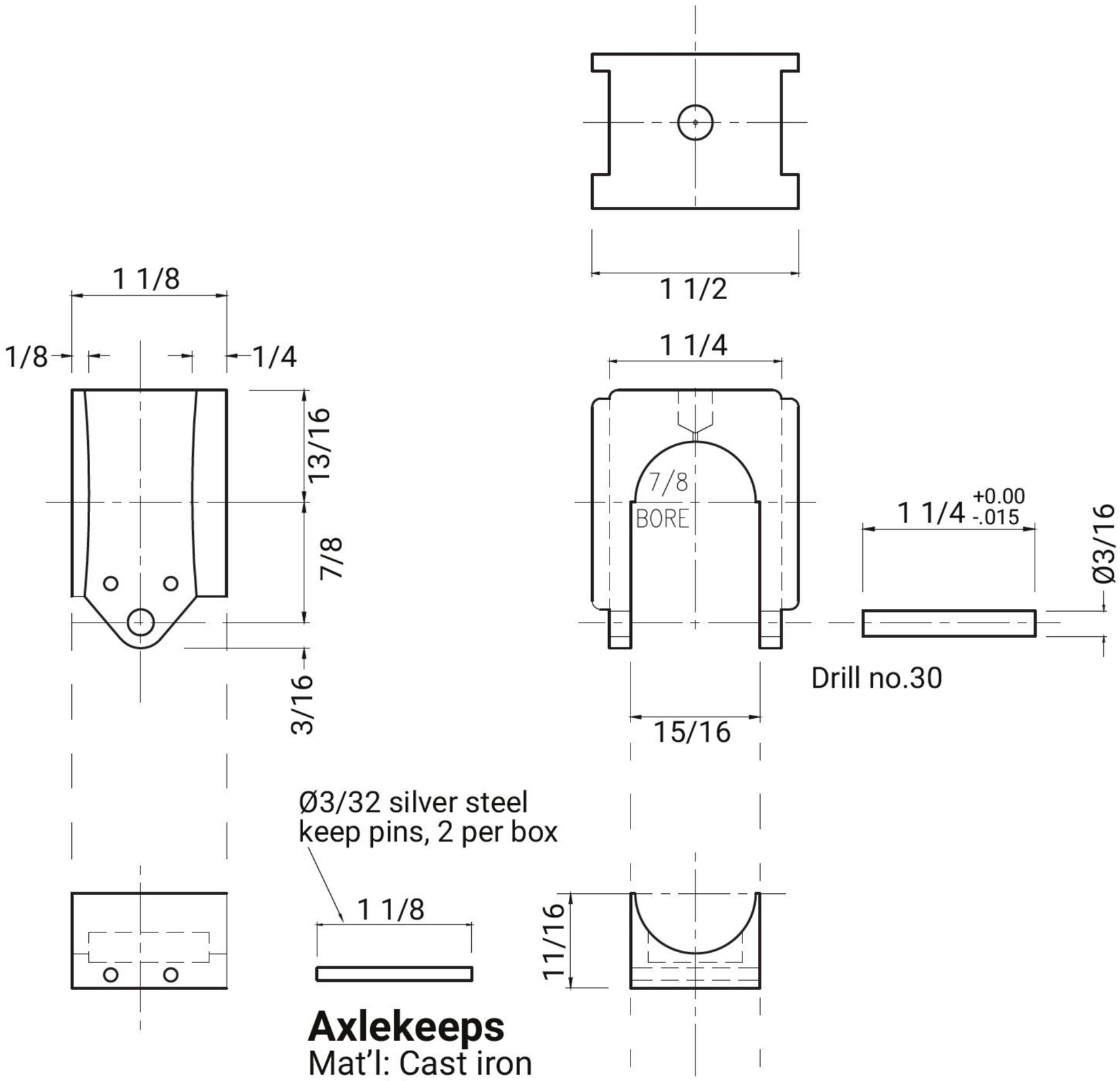
square and a slide on bush the same size as the axle end. The rest was done by sight. Make sure that your try square touches the bush (**photo 54**) and aligns with the axle end. Now have a look at the other side and check this with your height gauge and hopefully it will look like **photo 55**. You could also use an angle plate for this job as I have shown in **photo 56**.

Axle boxes

We can now deal with the horns and axle boxes. First of all, you will need to take a skim off the horn cheeks making sure that they remain dead on the axle centres, otherwise you might be in trouble! The horns are fixed with 7BA bolts which would be 'fitted bolts'. **Photograph 57** shows the horn block bolts. For a small locomotive I would say that there is no need to make them 'fitted' as long as you drill the holes with a No. 41 drill for the bolts and you may have to pop a reamer through the holes. I am still using my 3/32 inch reamer which I made to LBSC's instructions. When I was building my 'Tich' in 1957, he just said to use a 2 inch piece of 3/32 inch silver steel filed to an angle of about 60 degrees, polish it then harden and temper it. I made all my horn block bolts for my engines out of 3/32 inch rivets. One thing that I didn't do was to turn the heads down to a fine cone shape, a bit like a very shallow Chinese hat. This will also mean countersinking the holes a little and if you put the rivets through a similar hole in a piece of ¼ inch plate or similar and whack it over the head with a 1½ lb hammer you should find it forms itself into a countersunk bolt, and then you can form the Chinese hat.

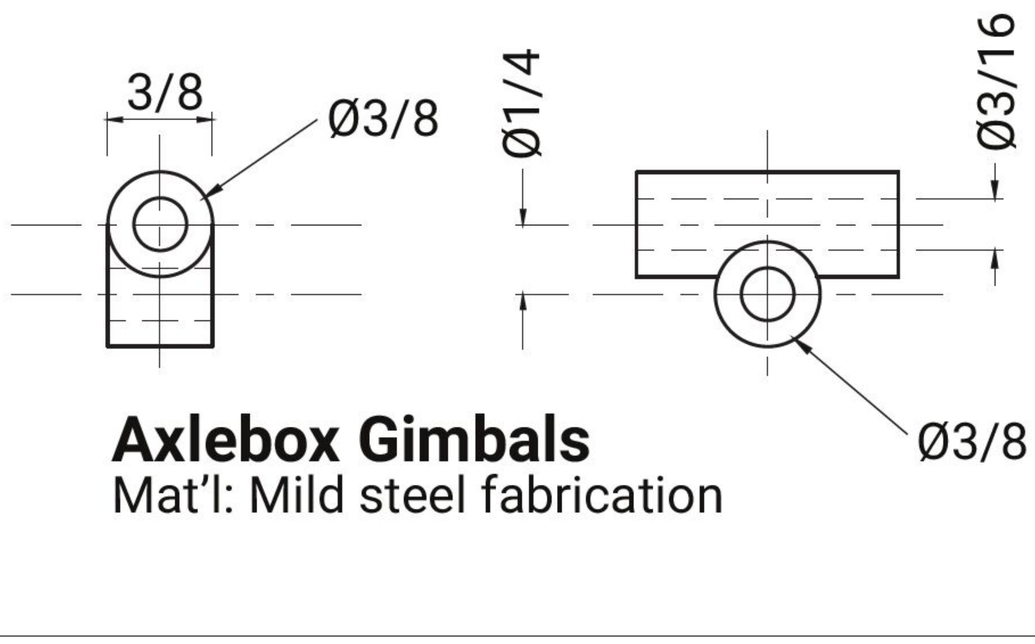
I then started by using a tailstock die holder to thread the rivets 7BA (**photo 58**), but that was taking far too long, so I held the die holder in the three-jaw chuck and held the embryo bolt in a pair of end cutters and pushed the bolt into the die and did the job in less than half the time

Fig 33

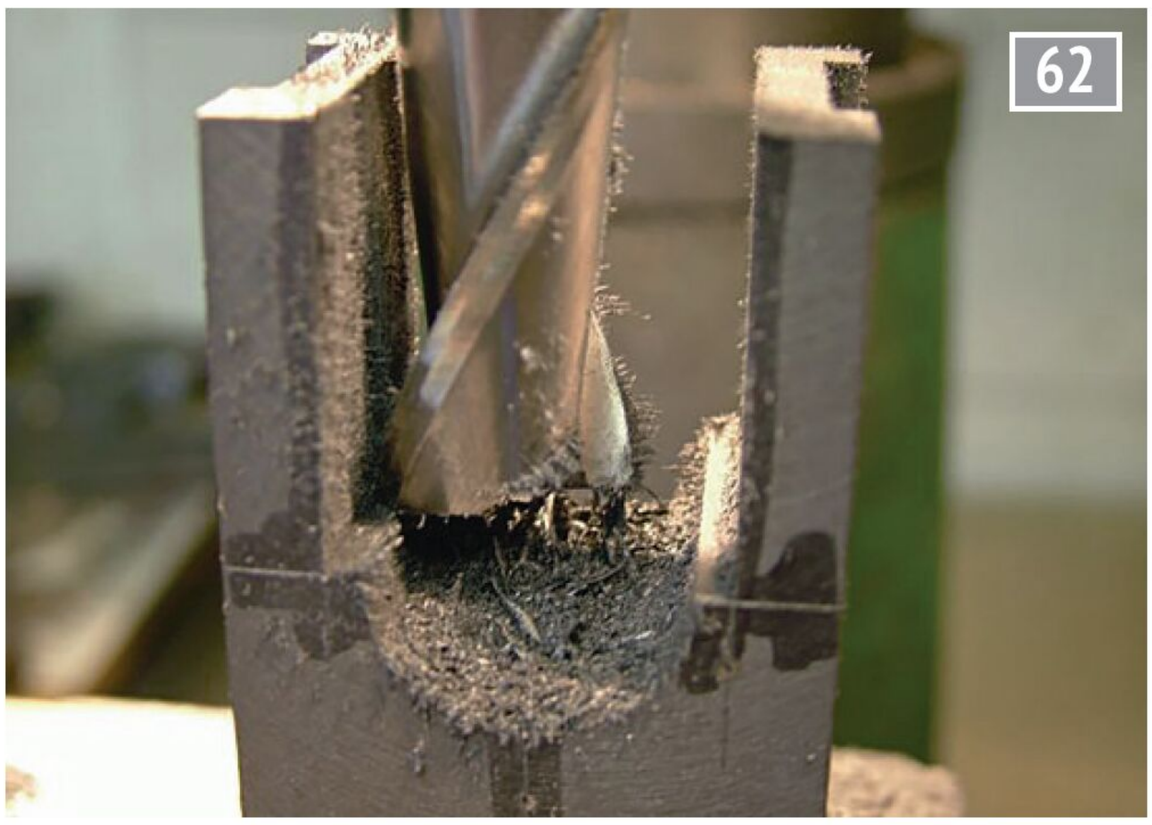


Axle boxes.

Fig 34



Axle box gimbals.



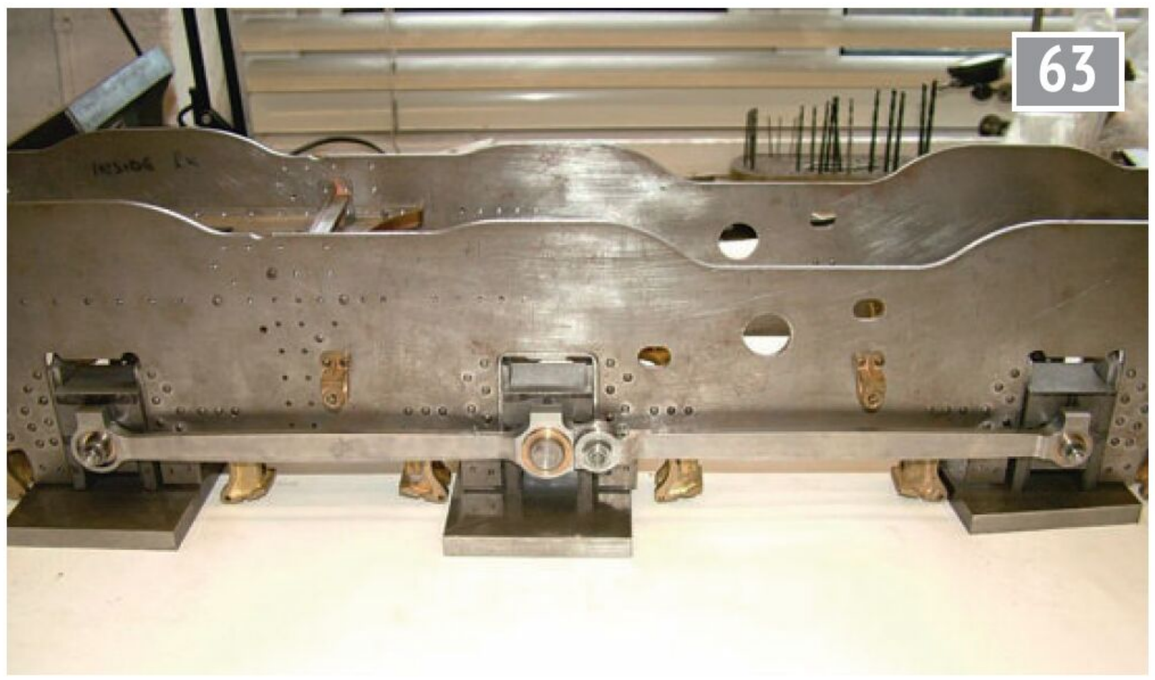
62

Creating the pocket for the axle box keep.

(**photos 59** and **60**). I think the job took certainly less than a couple of hours.

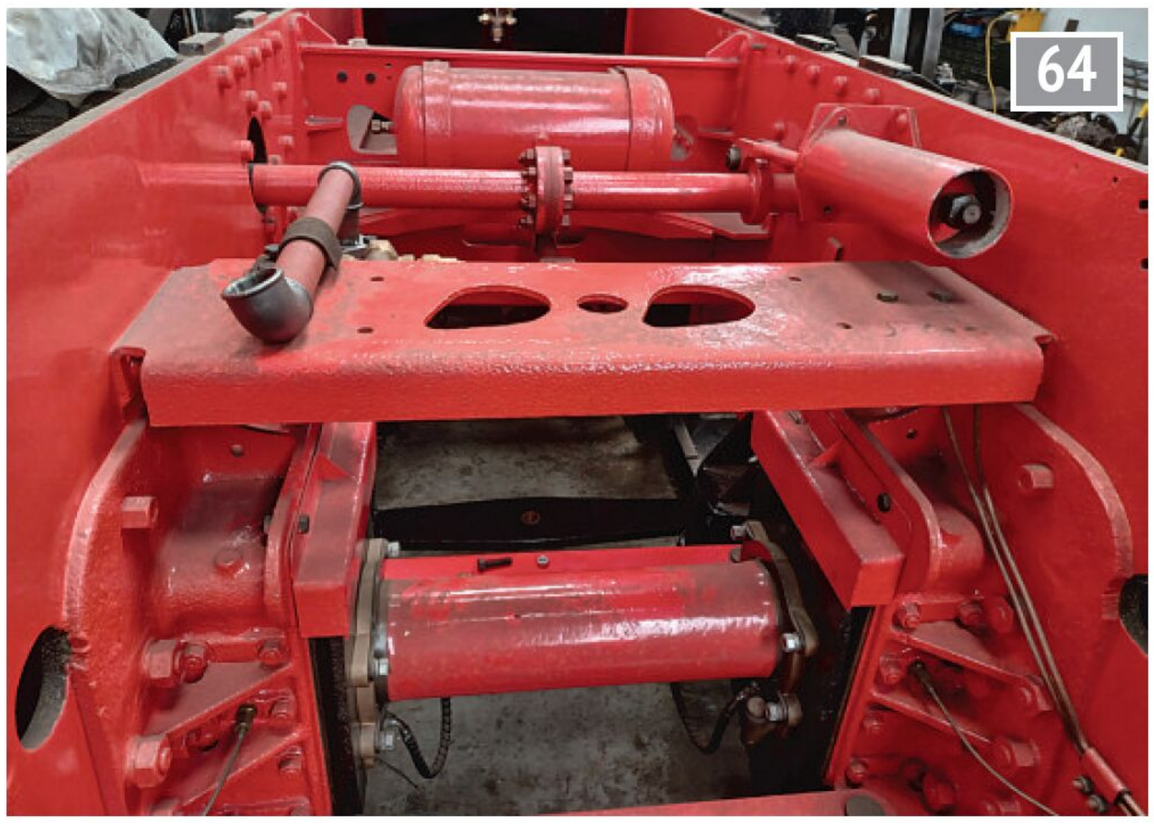
The axle boxes (**figs 33** and **34**) come in a stick of pairs and you will need to machine the outsides first, all round, as a stick. Saw them into single boxes and then you can shape the rest of them up. Mark out the centre lines on each box and then you can bore and ream them.

The insides now need machining and I have used some of Geoff Whittaker's photographs in this case. The first (**photo 61**) shows Geoff reaming the axle boxes for his BR Std 4-6-0, and this was ≫



Rods fitted to a BR Std 4-6-0.

followed by **photo 62** which shows him machining out the pocket for the axle box keep *cum* oil box. This will need an oil pad in it to lubricate the axles. This also needs an oil feed to it, which comes from the right hand lubricator via a siphon to the 1/16 inch pipe. The pipe to the underkeep needs a short piece of flexy pipe to connect it to the lubricator pipe. It would also be very nice if you could also add the dust shields which fit on the top of the horns.



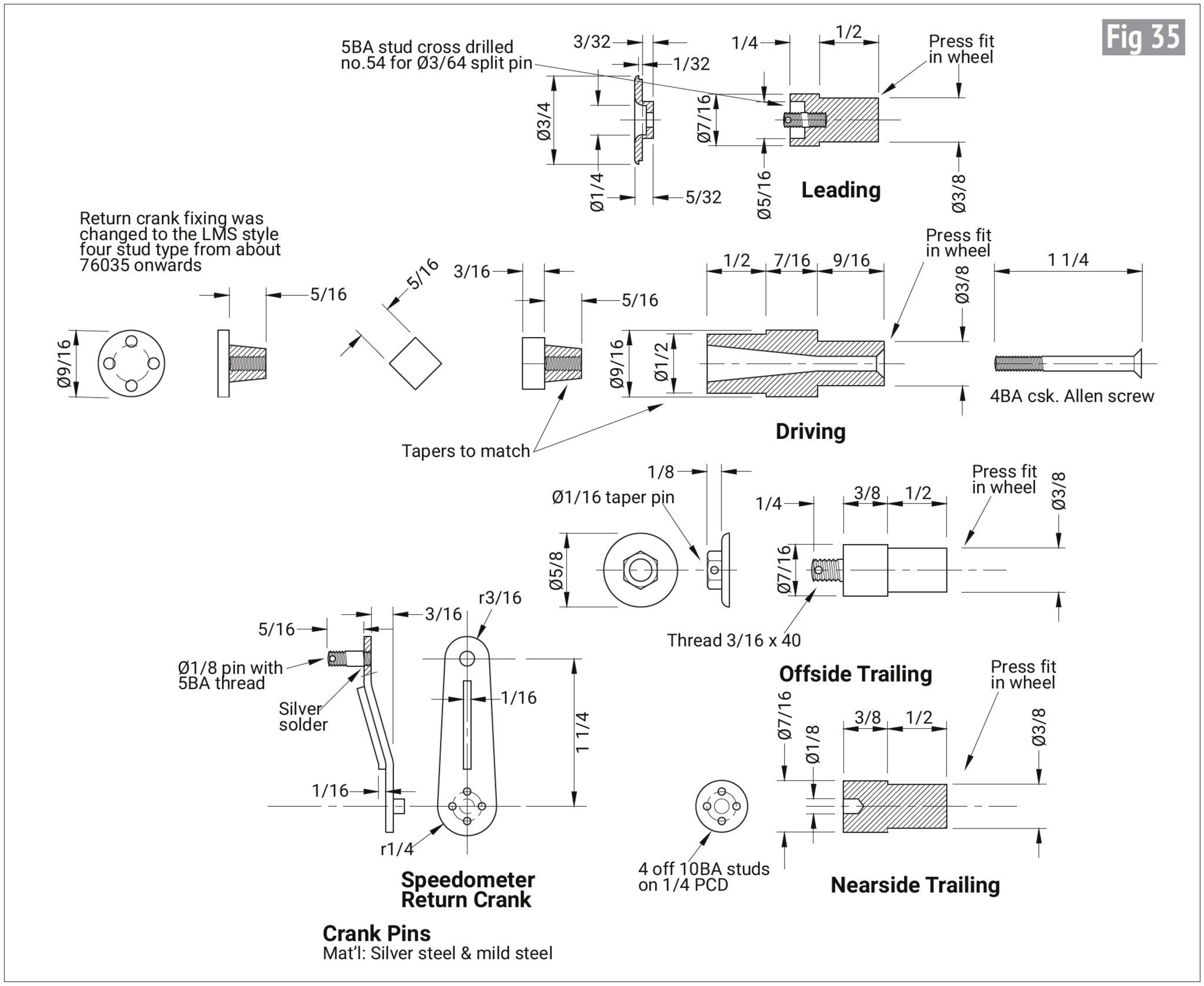
Dust shield over the driving horns.

Photograph 63 shows the rods fitted to Geoff's engine. I have just added **photo 64** in there to show you the dust shield on one of the driving horns.

I've also include a drawing for the crank pins so you can finish your wheels off (**fig 35**).

●To be continued.

Fig 35



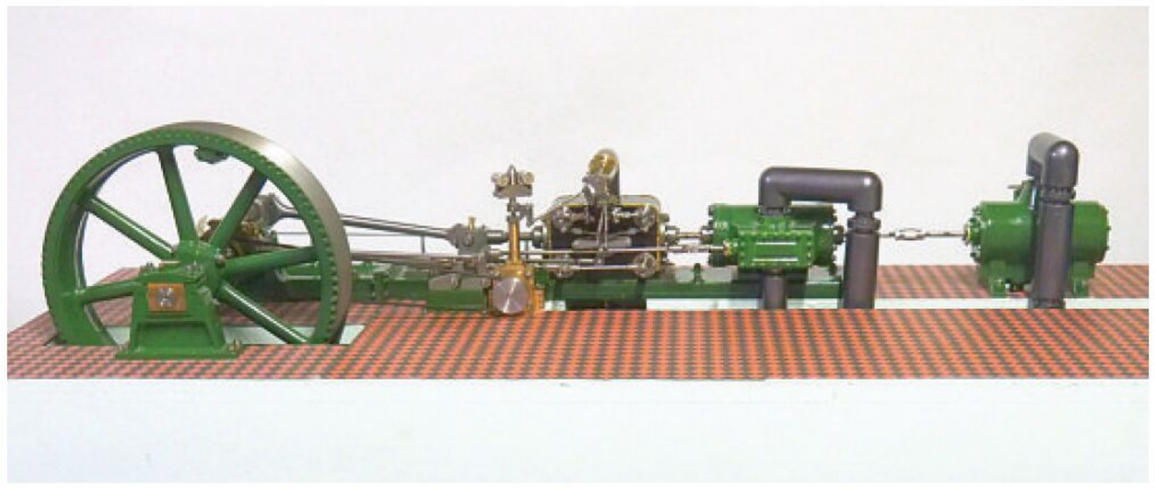
Crank pins.

A Tandem Compound Mill Engine

PART 9

David Thomas builds Arnold Throp's model of a Corliss mill engine.

Continued fromp.773
M.E.4757 November 29



As with the crankshaft in Part 2 (M.E.4751, September 6th) my metal hoard produced a piece of scrap for the connecting rod (**fig 25**) that was just the right size and made from an unknown type of steel that proved difficult to machine. It would be a much better idea to buy in either 1 x ½ inch flat BMS or 1 inch round FCMS. If I was making another version of the model and, given a mill with power feed, I'd probably use the round bar despite having to turn most of it into swarf. **Photograph 147** shows the odd bit of bar on the mill table located by low-profile clamps and two square pegs that were filed to a close fit in the table slots. In **photo 148** is the rather pretty swarf whose colour shows that I was driving the carbide tooling at about the right rate and whose shape indicates that the material was probably some sort of stainless steel. The original drawings show the ends of the rod curved in two planes but I settled for just the one (**photo 149**). The sacrificial plate on the rotary table allows for really firm clamping and location with a pin in a central hole. After aligning the pin with

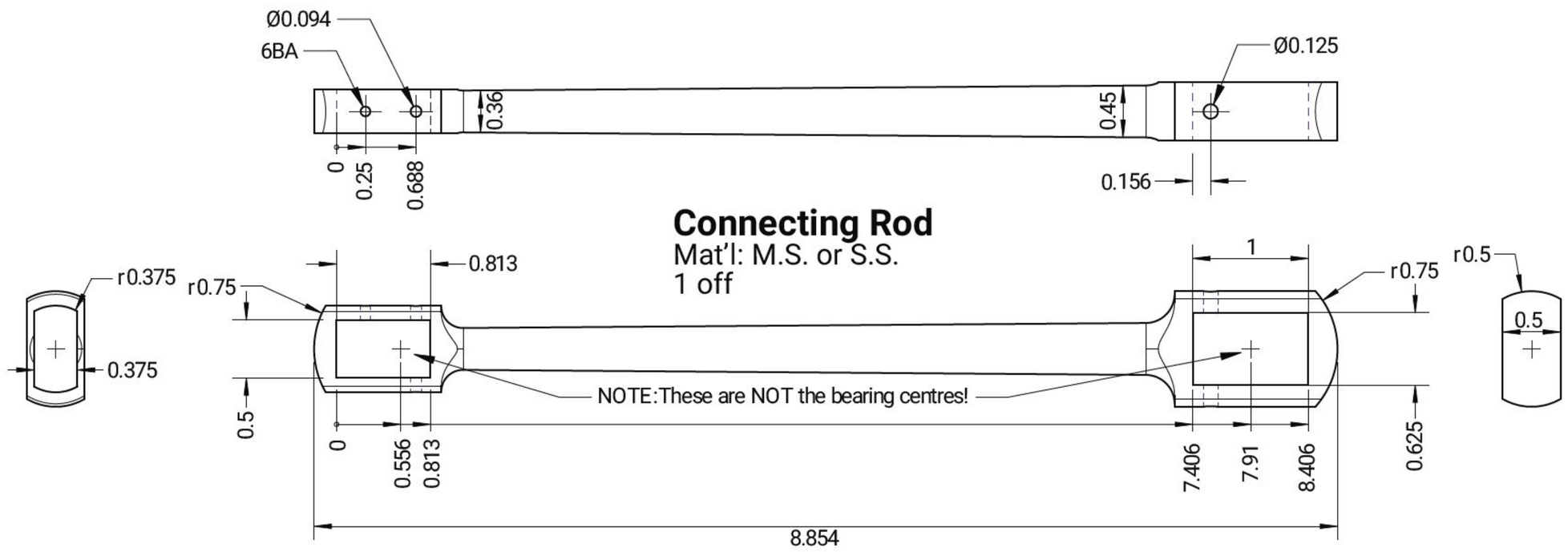
The chips that came off were pretty to look at but the machining was noisy.

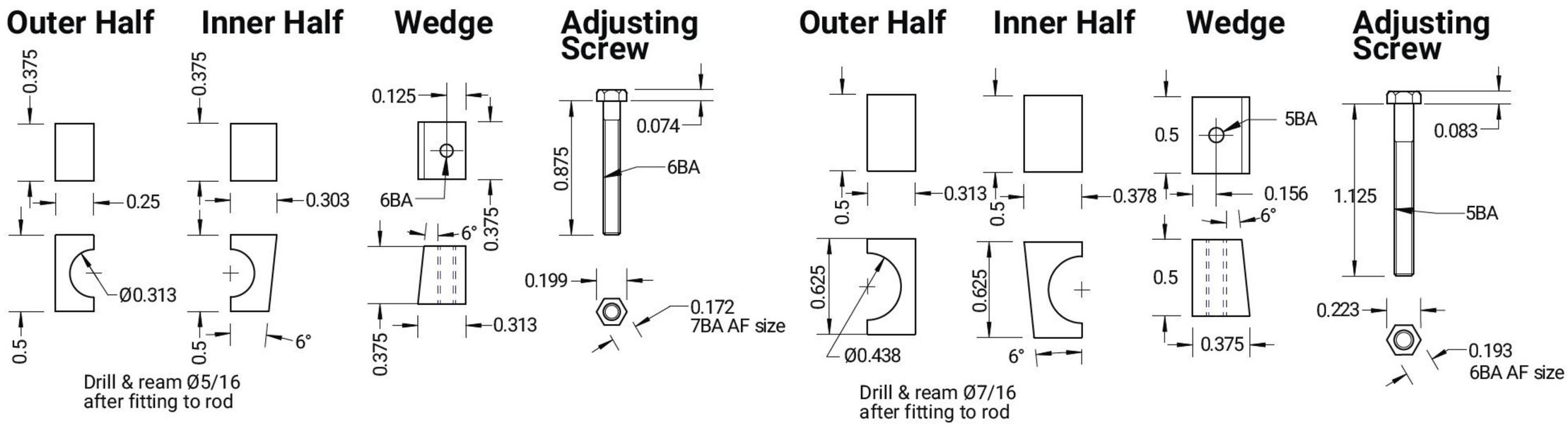
Starting to carve the connecting rod from a piece of 'unknownium'.

Rounding over the ends of the connecting rod. The centres put in for turning the shaft will have to be re-drilled.

≫

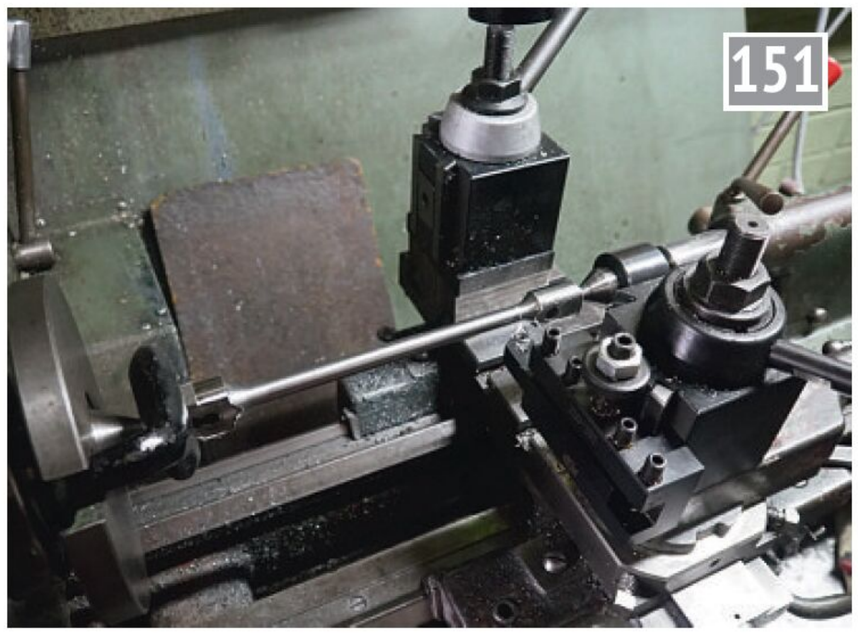
Fig 25





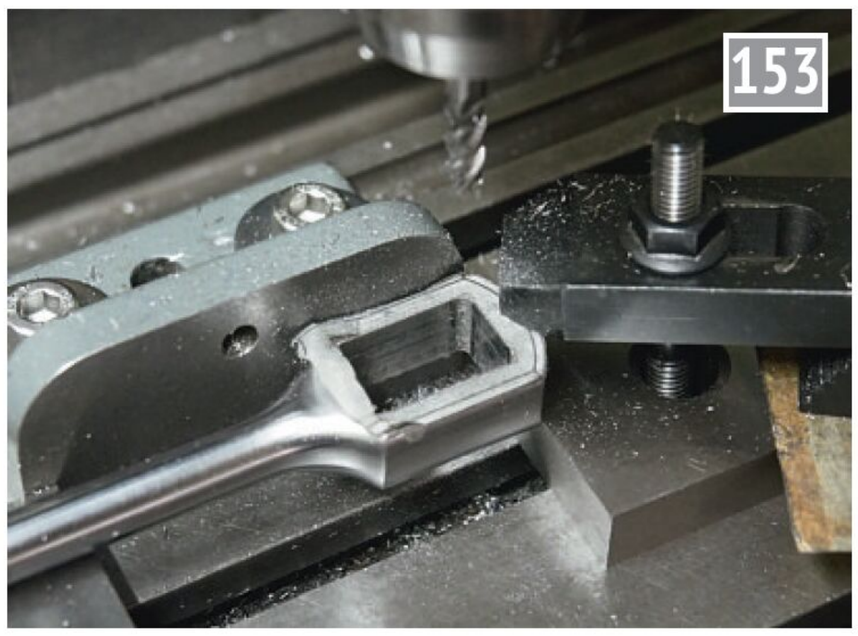
Connecting rod and bearing parts.

Drilling the centres.



The set-up for turning the shaft of the rod and for rounding the outsides of the ends. This almost turned to disaster when the metal work hardened.

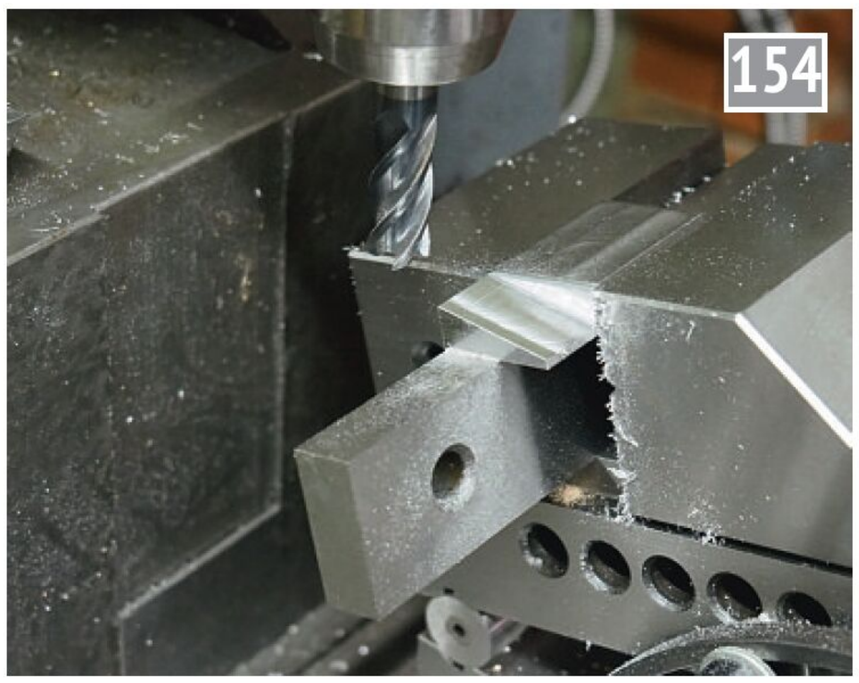
The spaces for the bearings were chain drilled…



… and then cleaned out with endmills.

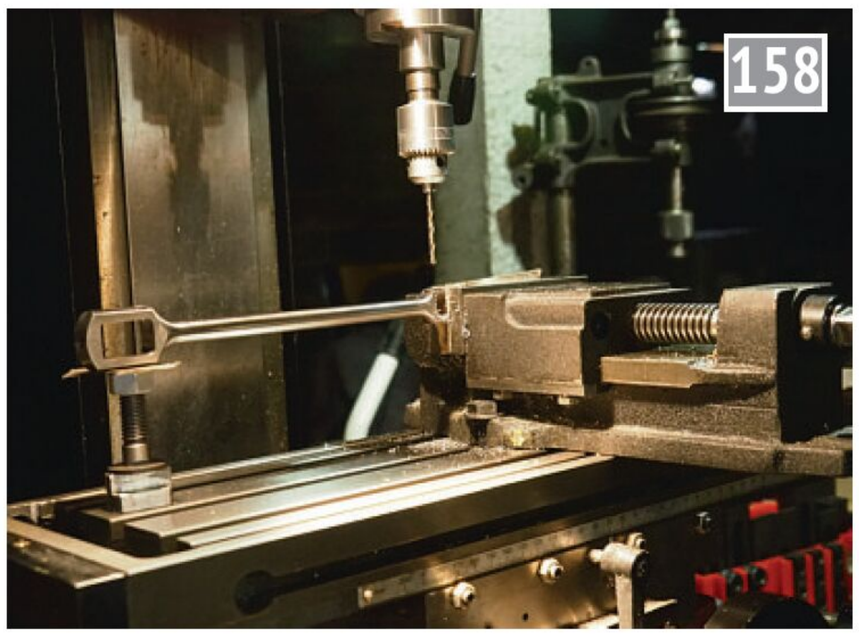
the mill axis and zeroing the DRO (or dials) producing the curved end is straightforward; having made the stepper motor drive for the RT I felt obliged to use it but turning a handle works just as well.

I had thought ahead and drilled the centres that are needed for turning the central part of the rod when the piece was a rectangular bar. What I'd forgotten was that some metal might be removed from the ends when they were rounded over and the centres ended up too shallow to be useful. When the bar was rectangular it easily went into a four-jaw chuck and, after roughing-out the shape, it was harder to hold. **Photograph 150** shows the universal mill in an unusual configuration but one that solved the problem. The central part of the rod was then turned to its tapered shape using the centres but not without drama as the 'unknownium' decided to bite back and work hardened in places. At first, I thought that

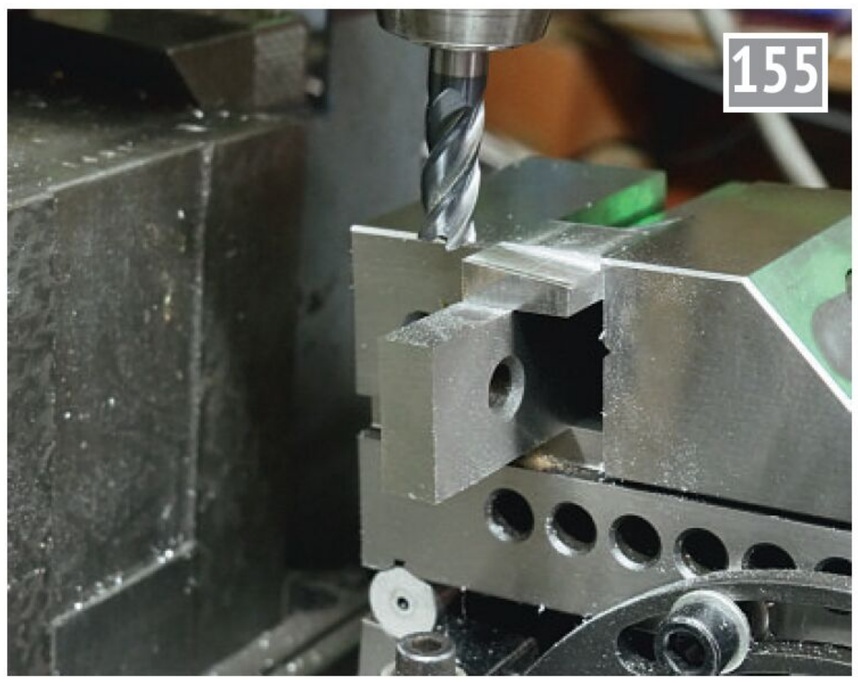


Accurate and matching angled surfaces are essential for the faces of the wedges and bearing brasses; a sine vice makes this easy. However, 90 – 84 degrees does not equal 16 degrees!

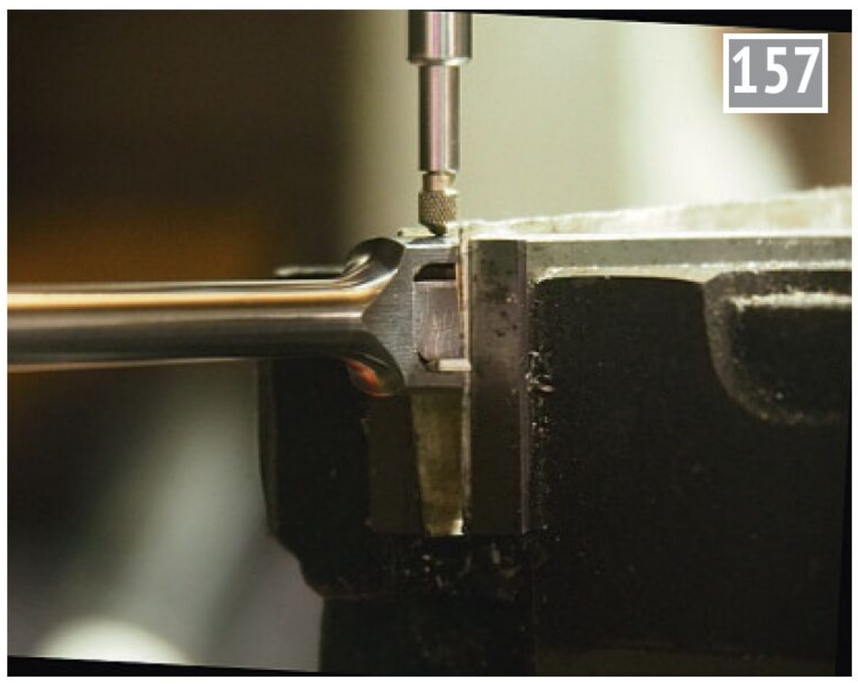
With the sine vice set up correctly machining the rest of the bearing parts was easy.



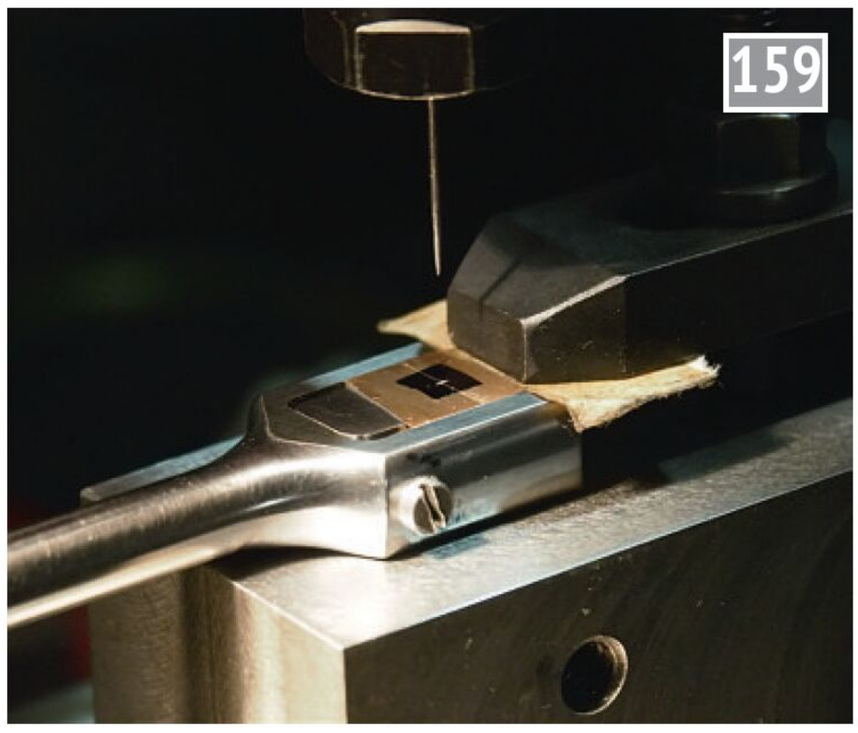
The set-up for drilling. The colour is a bit off because the drill/mill is under the house and lighting is difficult.



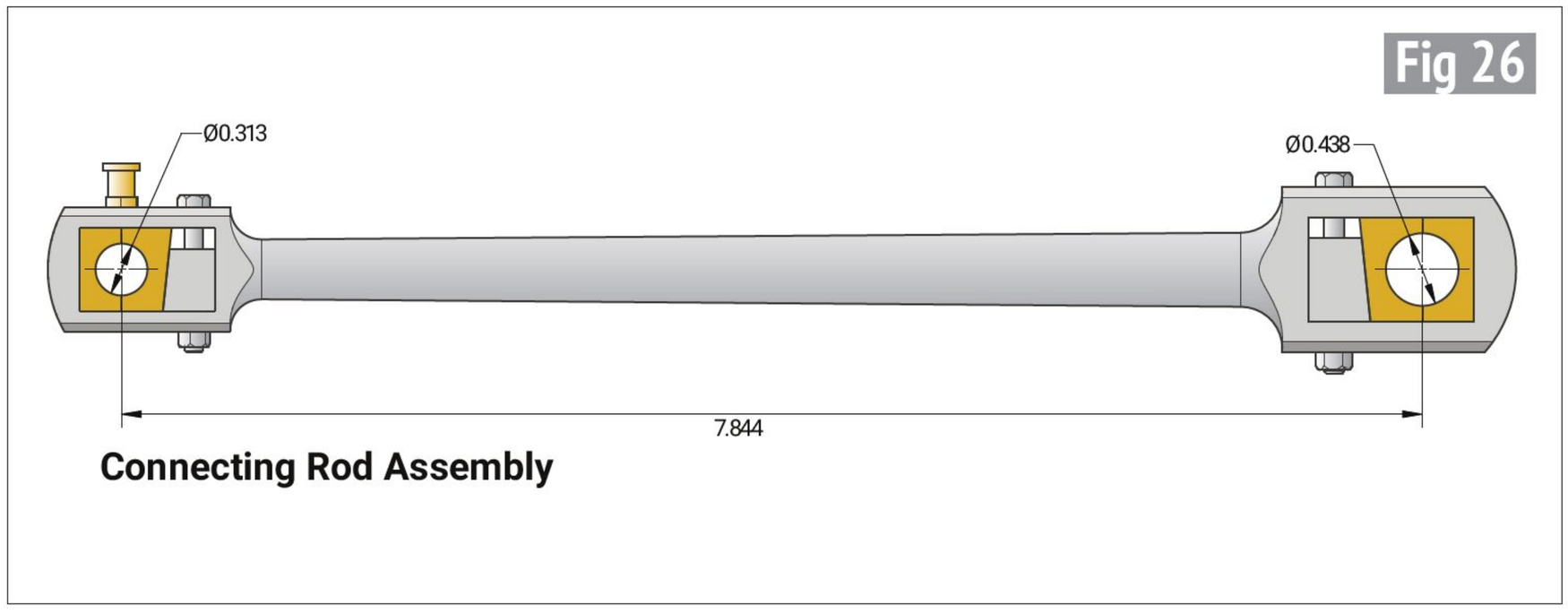
Machining a bearing wedge to the correct 6 degree angle.



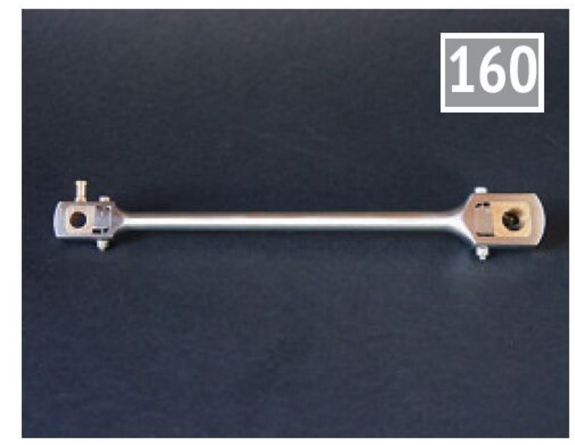
Finding the top of the curved end prior to drilling for a bearing clamp bolt.



With a temporary clamp screw in place a needle was used to pick up the split line of the bearing for drilling and reaming.



Connecting rod assembly drawing, compare with photo 160.



After polishing to a satin finish the rod with the bearings in place looked like this. Note the centre pops that will help with keeping matching bits together.

the piece was scrap and it was time to start again but, with nothing to lose, I took a big cut and, perhaps luckily, got under the hard bits and achieved a decent finish (**photo151**).

The holes for the bearing brasses were roughed out by chain drilling (**photo 152**) and brought to size with an end mill (**photo 153**). Leaving these corners rounded from the tool means filing the bearing parts to match but I found that was easier to do neatly than to file the internal corners square. Make your own choice for this.

Photograph 154 shows how easy it is to machine an angled surface to a very precise but incorrect angle using a sine vice - setting up 90 degrees minus 84 degrees as 16 degrees rather than 6 degrees and not noticing until a couple of cuts have been taken involves a serious brain fade! **Photograph 155** shows what it should have looked like and after getting the set-up correct the rest of the bearing parts all turned out really well (**photo 156**). The wedges were left undrilled until the parts could be assembled and wedged together in their final homes. The X3 drill/mill doesn't have a DRO so I used a dial gauge to find the centreline for the clamping screw holes (**photos 157** and **158**). With those holes drilled and tapped the bearings were assembled with temporary screws and the bearing centre located with a needle and some magnification for aging eyes (**photo 159**). **Figure 26** shows the 3D model as drawn and **photo 160** the actual, less perfect, result. The oiler can be just a 6BA plug or have a through hole and the ≫

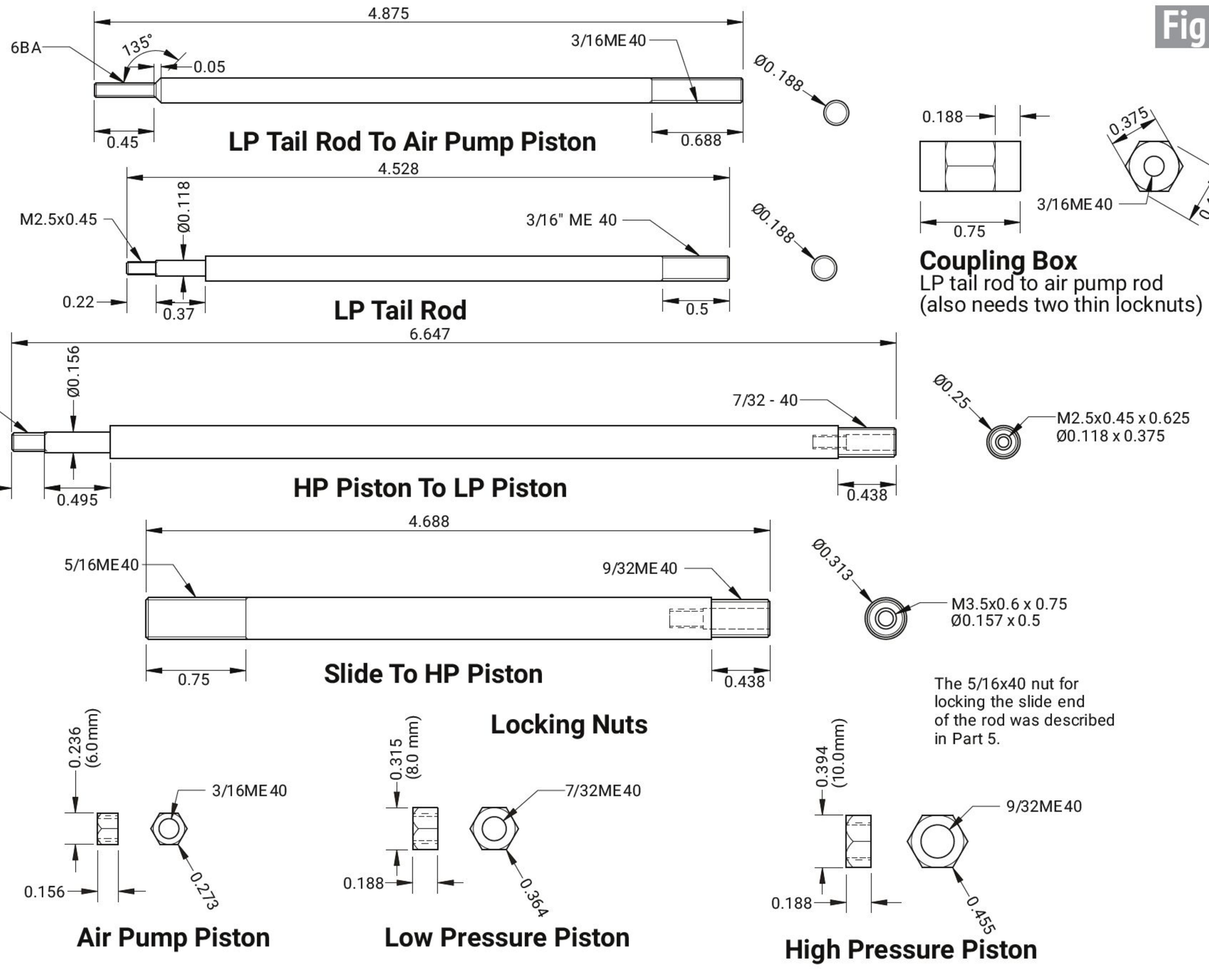
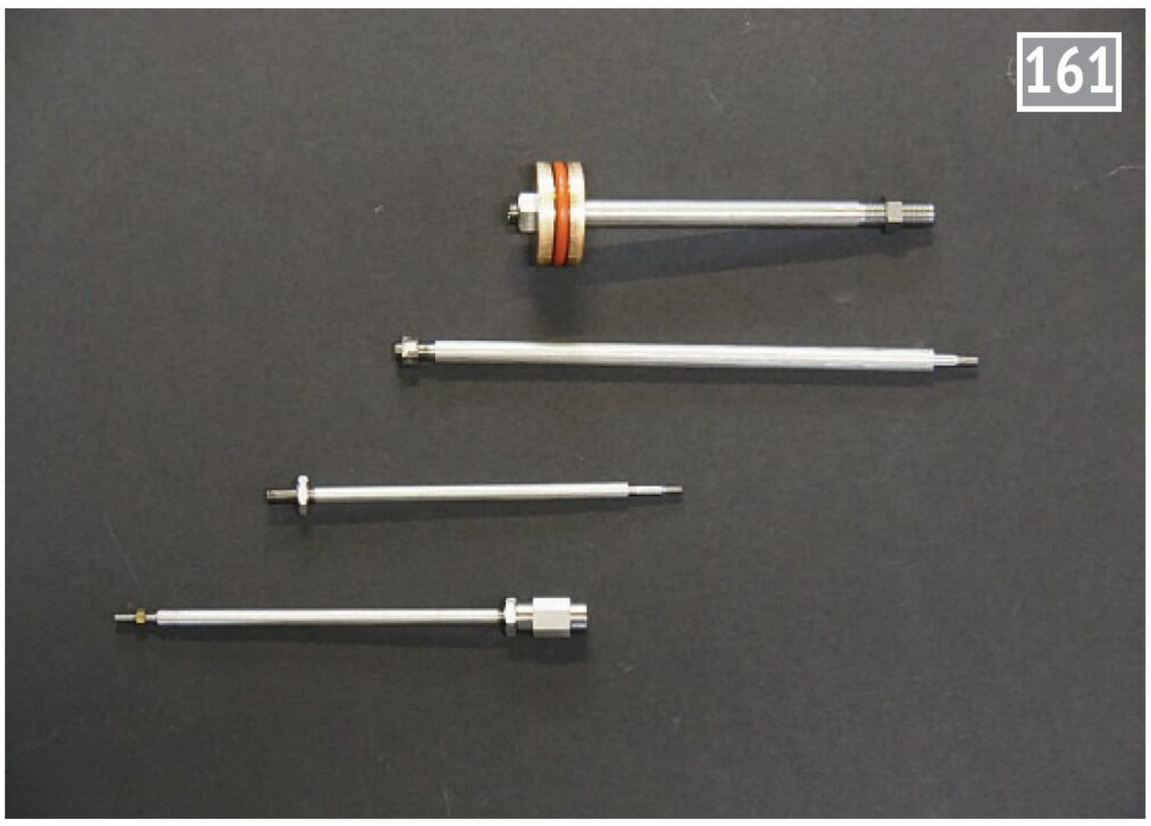
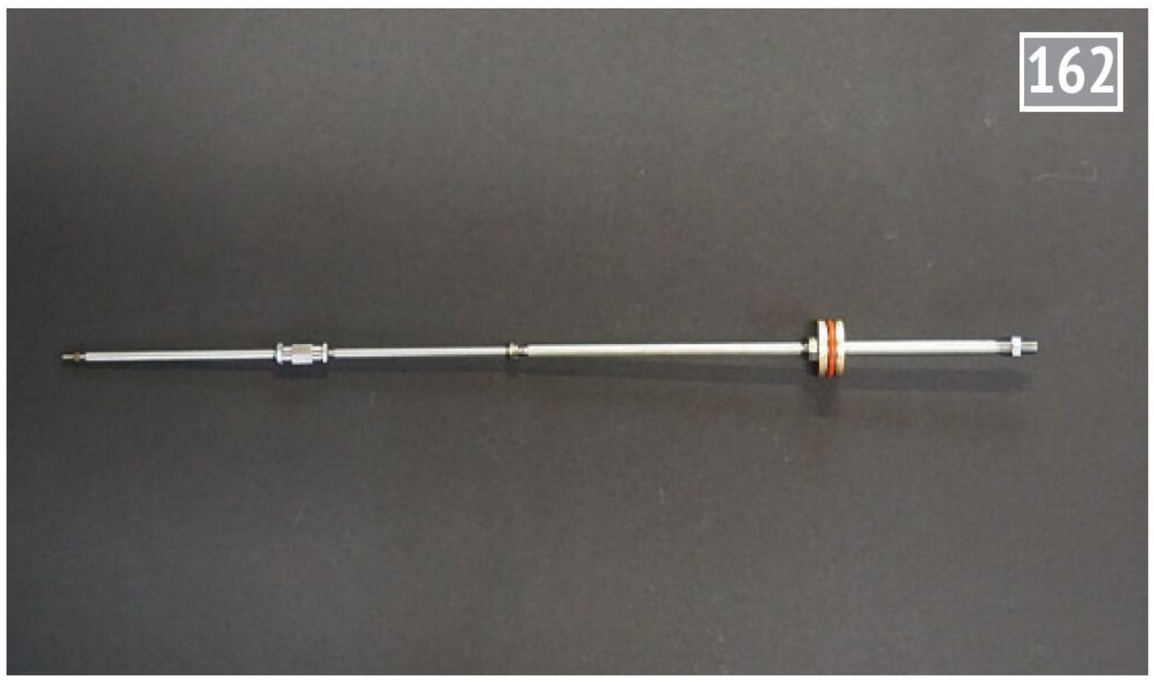


Fig 27

Sectional piston rod.



The original drawings show the piston rod as a single, very long and fragile, part. I chose to make it in sections and this worked out well.



The final product, complete with the HP piston, the various locknuts and the coupler for the rod to the air pump.

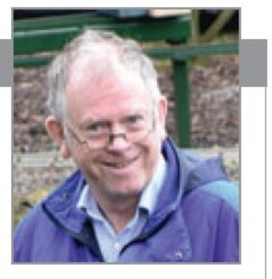
clamping screws need to be made in-house.

Having the piston rod (**fig 27**) to hand will be very useful for setting up the HP cylinder which will be the next bit to tackle so now is the time to make it. The original drawings show this as a very long and flimsy single piece. Even using a fixed steady for intermediate support, I didn't fancy my chances of getting a good finish. Apart from that the part is probably going to be sticking out of the back of the HP cylinder for a long time and be very vulnerable. Given those potential problems I chose to try making each of the four sections separately and screwing them together (**photo 161**). There is a risk with this, in that tolerances will accumulate and a kinked rod result, but everything worked out well first time. I've been avoiding giving much advice on fits and finish but the joints here need close attention to concentricity, squareness of the shoulders and fit. Finding appropriate sizes for each of the pairs of threads resulted in the mix of BA and metric sizes - obviously builders can make their own choices here. **Photograph 162** shows the final result with the HP piston in place because this was the stage reached before I remembered to take the picture.

●To be continued.

Rob Roy Rally 2024

A successful day of failures!



Rex Hanman reports from this year's eventful gathering of the Rob Roy clan.

With the Andover track due for extensive renovations, the 2024 rally was once again held at the lovely Bromsgrove society's well maintained club site. It was a successful day despite a few engine failures as the day unfolded.

As is tradition, it was a beautiful September day. In a decade of rallies there has never been a wet one. The author arrived around mid-morning and was not in the least surprised to see Paul Wootton storming round the track (**photo 1**) as though he was still going since last year, and looking as though he would never stop. Sadly, his run did come to an end later when the locomotive developed a stiffness. Early diagnosis suggested the water pump. The engine was declared as 'failed'. No doubt a trip to the works will sort things out and Paul will be back next year.

Paul Wootton.

The author was not the only Andover member attending this year. Fellow club member Peter Brown also visited with his as yet unpainted engine (**photo 2**).

The Andover visitors get steam up.

Phil Hale poses with his Simplex chassis.

A beautifully painted example.

Ian Horsfield taking Paul Wootton's engine for a spin.

Normally a great little runner, Pete's locomotive refused to go forward once on the track. A pin had disappeared from the valve gear. Reversing round the track was not an option so, like Paul's, Peter's engine was also declared as 'failed'.

Following a previous year's embarrassing problems with a blocked blower pipe, the author took no chances this time. With brand new boiler test certificates and a thorough trial and examination just days before the event, all was set for a great run. Problems appeared on the first lap when the axle pump seemed as though it wasn't working. (Yes, axle pump. This is perhaps the only Rob Roy with an axle pump rather than the usual crosshead pump!) Having returned to the steaming bays, the locomotive was raised above the rails and the regulator was opened, only to reveal a perfectly operating pump. A number of subsequent laps showed no further problems.

Bill Kite shows how easily Rob Roys can be transported.

With visitors coming from far and wide, it was a record turnout of locomotives this year, more than a dozen and several halves. It's always good to see more examples being built.

Phil Hale is building a Rob Roy and a Simplex. It was noticeable how similar his Simplex chassis is to that of a Rob Roy, very much a big brother (**photo 3**).

Last year I rudely commented on the rather shabby appearance of Paul's engine. By contrast, some of the finest paintwork was evident this year, with several outstanding looking locomotives on show (**photo 4**).

This year it was good to see host club member and rally organiser, Ian Horsfield actually take to the track, even though he didn't use his own fine locomotive (**photo 5**)!

One of the beauties of Rob Roys is that they are very portable, even with a sore finger (**photo 6**)!

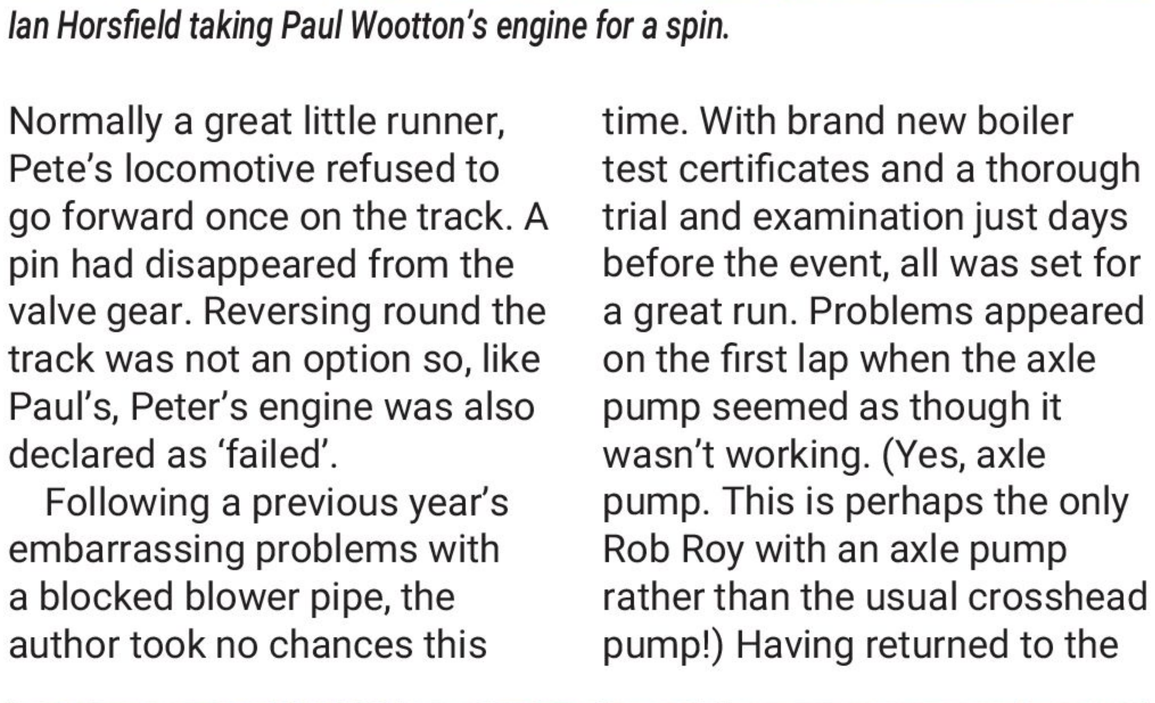
Sadly, Alan Harris had passed away since last year. Diane brought along her husband's first build, a blue Rob Roy now called Lucy. Diane often visits the Bromsgrove club and will be bringing Lucy to future rallies.

With Paul Wootton's engine sulking in its box, there was the traditional line up of engines and their owners (**photo 7**). It wasn't just locomotives on display - a fine array of stationary engines was provided by Bill Kite (**photo 8**).

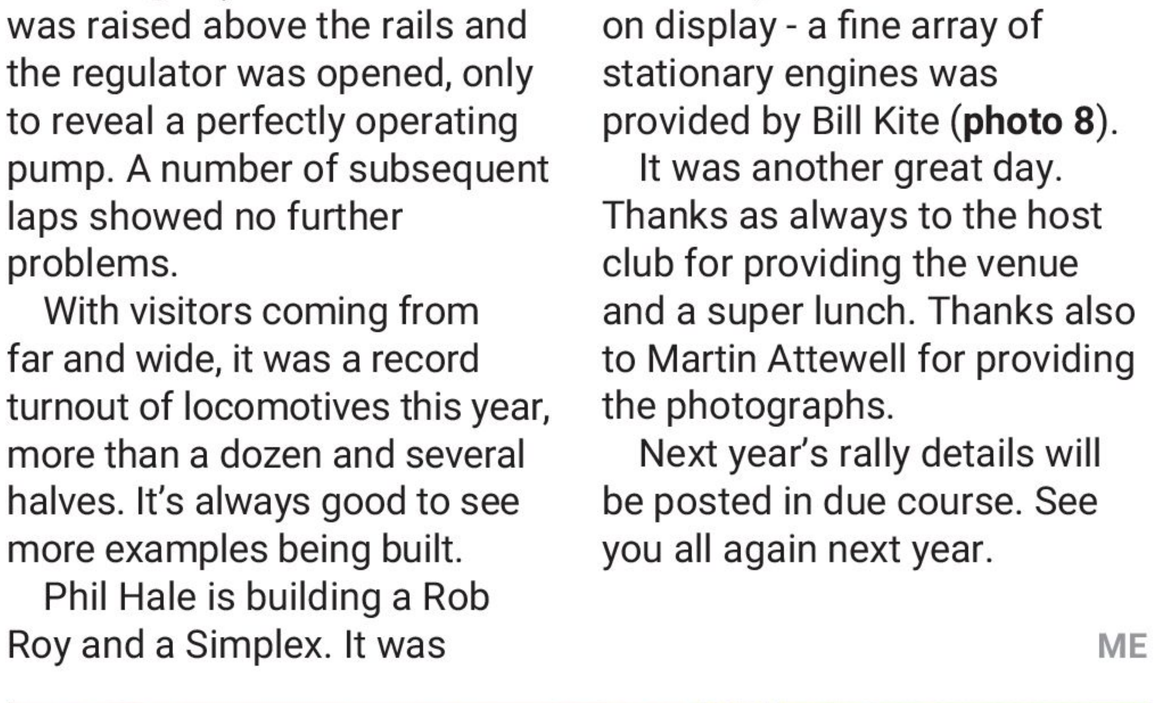
It was another great day. Thanks as always to the host club for providing the venue and a super lunch. Thanks also to Martin Attewell for providing the photographs.

Next year's rally details will be posted in due course. See you all again next year.

ME



The proud owners.



Just some of the lovely stationary engines on show.

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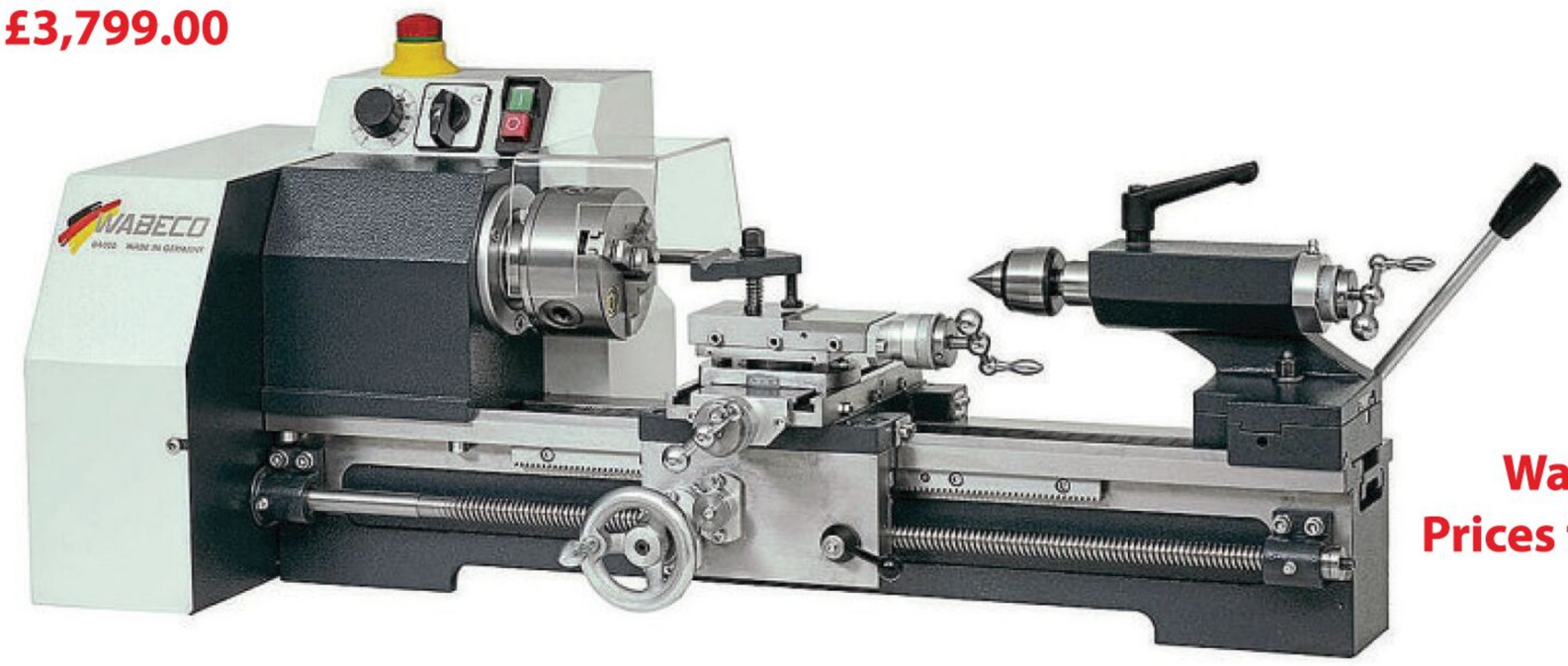

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Part 26: Merrily We Roll Along

Steve Goodbody takes a random walk through model engineering.

Continued from p.767
M.E.4757 November 29

Hello once again, joyful Reader, and if my assumptions are correct then this edition of *Butterside Down* should find you in the midst of your Christmas festivities (or Hanukkah or Kwanzaa, as your case may be). If so, then let me begin by wishing you a very happy and peaceful celebratory season; I sincerely hope that you and your family are in the very best of health as the year enters its wind-down phase.

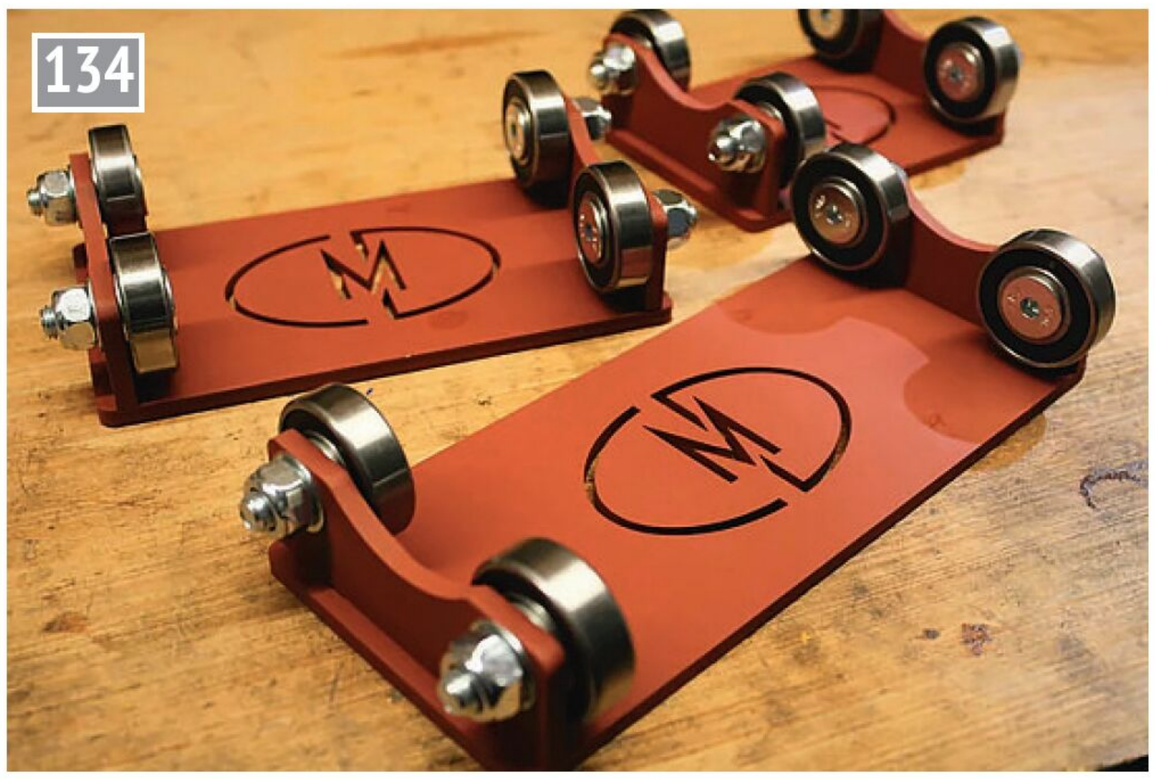
Over the course of this series and its predecessor, I made several references to an *adaptionated* item of equipment in my workshop - a hydraulic lift cart which I use to load my hefty 7¼ inch narrow gauge locomotive *Jennifer Ann,* a 3 inch scale Alice class Hunslet built over a 35 year period to the Reeves *Elidir* design (more or less) - into a transportation trailer whenever a road-trip beckons (ME 4748, 26 July 2024, for example). However, while trailer loading is indeed one of its important uses, this was not the cart's original *raison d'être,* for it was (and still is) primarily intended as the basis for a rolling road: an extremely useful device when testing and trouble-shooting a railway locomotive.

So, without further ado and especially if today is Christmas Day, a glass of sherry (or something equally rewarding) lies near to your hand and you have a few minutes to spare before the traditional fowl is wrested from the oven and disassembled into its component parts, please put your feet up while we determine if a rolling road, cart-mounted or otherwise, might be a suitable project for *your* workshop once you have the opportunity to rest and recuperate from this enforced period of rest and recuperation.

Go cart

There's no two ways about it: railway locomotives are heavy. Very heavy. While we all know this, and have likely sustained a few bruises over the years as indisputable proof, the fact remains that it is often tempting, when our pride-and-joy is located at point A and its presence is desired at point B, to spit on our palms, grab the buffer-beams, take a deep breath and, with an almighty heave, hope that all goes to plan. After all, what's the worst that can happen? Well, aside from the real possibility of a slipped disc, several strained muscles, a few trapped fingers and a foot full of broken toes, there is the far more serious worry to consider: we may damage our beloved model, heaven forbid. Yes, we all know that it isn't worth the risk, yet we're all guilty of taking the chance regardless, aren't we?

The author's lathe on the hydraulic lift-cart, ready to be lowered and rolled to his new workshop. The teacup is an incidental feature.



Off-the-shelf roller frames. With this design, each driving wheel sits between a pair of rollers, the locomotive being lifted on and off each time (reproduced with kind permission: Miniature Railway Workshop, Ltd.*)*

To the author, having been as guilty as the next person of cutting such corners over the years, in hindsight I strongly attest that the benefits of a hydraulic lifting cart are legion and, these days, with such a device close to hand in the workshop, gone are the days of the bulging eyes and beetroot-red visage of the really-too-heavy manual lift. It makes life a lot easier, believe you me.

As one example of its usefulness, when presented with the task of moving my workshop to its new shed-based location, and using my Edwardian lathe as a case-in-point, it was a simple matter of raising the cart's hydraulic table to the same height as the lathe's wooden stand, sliding the elderly ironmongery gently across, strapping everything down for added security and wheeling the lowered ensemble to its new home while whistling a happy tune all the way (**photo 133**). Simply put, without the lifting cart my workshop relocation would have been a hefty, tiring and no-doubt risky exercise. With the cart, it was a single-handed doddle.

Weightlifting

But I digress … where was I? Oh yes, railway locomotives are heavy - that was it. Knowing this, and with *Jennifer Ann* nearing completion, her steam-tests imminent and Covid-19 still raging around the globe, I began to research options that would allow her wheels to chuffety-chuff without the engine itself moving an inch, thereby enabling a close-up inspection of the whirring motion for the faults, flaws and things-to-be-fixed which are the usual hallmarks of a brand new steam engine.

I quickly rejected the most obvious option - blocking her up with her wheels dangling in mid-air, even though this was the very method I had used when air-testing her far lighter pre-boiler chassis many years prior. However, nowadays, to raise her decent fraction-of-a-tonne bulk into the air would require a hefty mechanical means, a far from straightforward proposition, and the mid-air supporting blocks would surely scratch her newly completed paintwork no matter where they were placed. Furthermore, with her axleboxes necessarily packed to running height for the test, there would be the attendant risk of damage should any of that packing come loose while she was running. No, in my view a more creative solution was needed.

How do others do it, I wondered? Searching the internet, I soon discovered the numerous steam-test videos published by our hobby's second-hand traders to advertise their wares, most of which depicted a rolling road consisting of a series of individual roller-frames (for want of a better word)

In 1985, Laurie Maunder poses with his newly acquired 5 inch narrow-gauge Sweet Pea, *the latter sitting on the then-teenage author's first rolling road which was adjustable for 3½, 5 and 7¼ inch gauge locomotives of variable axle-spacing.*

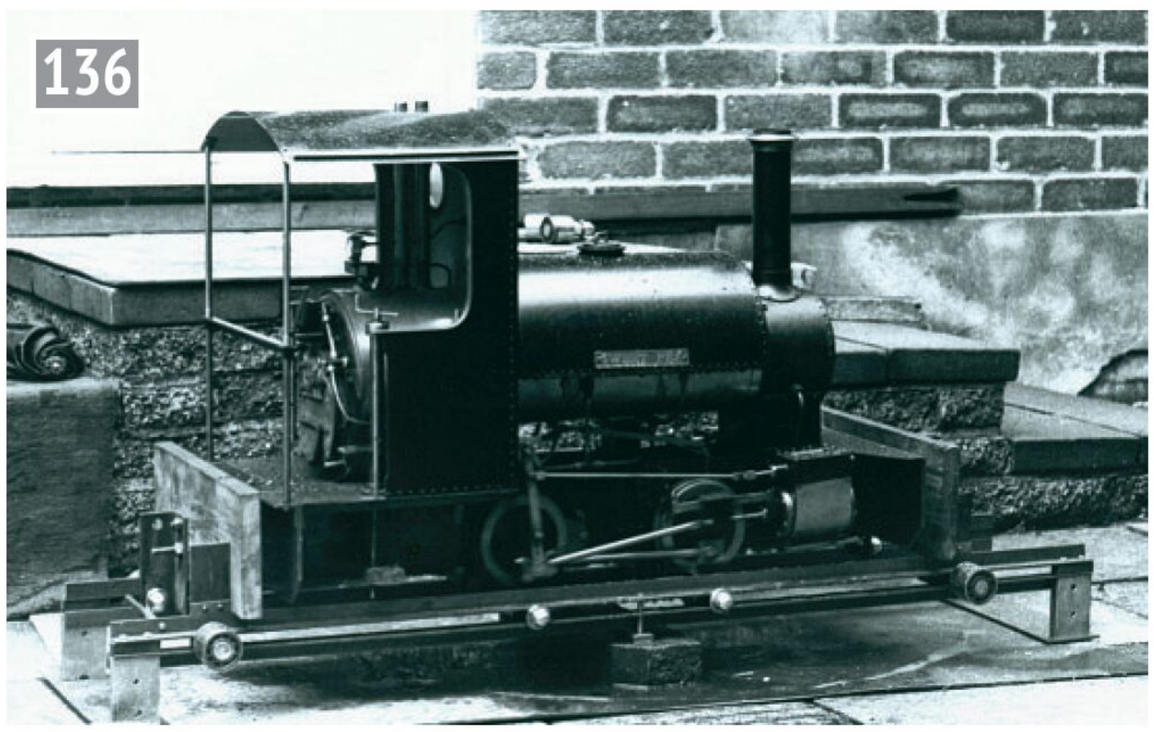
supporting the locomotive's driving wheels, with each frame's four rollers carrying one wheelset apiece and two of those rollers straddling each wheel. In fact, **photo 134**, included here with the usual disclaimer, depicts one such device.

Now, I could certainly see the advantages of this concept in principle; for a given gauge its simplicity and flexibility would enable almost any locomotive, regardless of axle spacing, to be accommodated using the same equipment. My mind drifted back, however, to a rolling road I had cobbled together as a teenager in Crowborough many decades prior, designed to be adjustable for both gauge and axle spacing and incorporating a set of chrome-plated rollers recovered from one of the earliest artificial heart machines (would you believe?). As I thought back, I remembered the one significant disadvantage to this basic design, namely, the locomotive had to be hand-lifted on and off those rollers each time it was used (**photos 135** and **136**). This fundamental downside had severely limited the usefulness of that original rolling road in the 1980s, making it a single-handed proposition only for the smaller and lighter engines: in fact, two people were required to safely handle anything much larger or heavier than my own Rob Roy, I recalled. In 2020, therefore, with the Covid pandemic in full swing and a heavy and unwieldy quarter full-size quarry Hunslet ready for testing, I knew that a lift-on/ lift-off device was not a practical proposition for me, unless I created a mechanical means to lift her into the air which was not something I wished to attempt.

Setting boundaries

Having decided that I would not lift my completed locomotive *en masse* onto a rolling road, it soon dawned on me that I had thereby limited myself to just one practical option: *Jennifer Ann* must be *rolled* onto the rolling road's rollers, if you follow my drift.

Of course, and as is the way of things, this first decision



The running locomotive, each wheel spinning a roller salvaged from an early artificial-heart machine, with four spare rollers holding the front and rear crossbeams in place and two more lying on the step behind. Although adjustable, and with ten such rollers available, the lift-on/lift-off design meant that Sweet Pea *was the largest engine to use this contraption.*

The ro/ro rolling road mounted on the hydraulic cart. The wider-spaced square tubes nearest the camera are not fundamental to the basic design.

soon begat another critical question: how to enable *Jennifer Ann's* wheels to safely transition from rails to rollers?

I had already concluded that, while my adjustable 1980s rolling-road positioned each driving wheel atop a single roller, I much preferred the commercial roller-frame's principle whereby two rollers straddle each driving wheel and nestle it in place. However, by adopting the two-rollers-per-wheel approach, this of course meant that due to the bottom of each driving wheel then lying *below* the top of its accompanying rollers, to get the wheels into their between-roller gaps suggested the rollers must either: (a) somehow rise from beneath the pre-positioned engine and jack her wheels clear of the rails, (b) be positioned *above* rail height, the engine being pulled over the top of each roller to reach its final destination or (c) be arranged with their tops *at* rail height, such that the engine would pass smoothly over the leading rollers before dropping into the gap, her wheels terminating at a level slightly *below* rail height. Of these three possible solutions I decided that I liked option (c) the best, it being easier to achieve than option (a) and likely putting less strain on the engine during the transition than option (b).

With this second verdict in the bag, so to speak, one final overarching decision was needed before the design work could begin: should the rolling road be made adjustable - capable of accommodating locomotives of different wheel arrangements and variable axle spacings - or be a bespoke device tailored to *Jennifer Ann* alone? Perhaps unsurprisingly, given that my locomotive had taken thirty-five years to complete, and I foresaw real difficulties in incorporating adjustability into a roll-on/roll-off rolling road, the answer to this last key question was straightforward: this version would be kept as simple as possible and be custom-tailored for *Jennifer Ann* alone. If another locomotive came along in the future, I'd either modify this rolling road or build another to suit.

The author selected 1 inch diameter cam followers (type: CR-1-XB) for his rolling road's rollers. Not the cheapest, but very sturdy.

And so, with the boundaries determined and a few ideas rattling around my cranium in search of an outlet, all that remained was to grab pencil and paper, begin sketching and hope that a workable solution would eventually emerge on the page before me.

A ro/ro rolling road

I do enjoy a good metaphor, have you noticed? Selecting a few more ripe examples from my metaphor tombola, all mixed up for good measure, let me state that, while I am generally someone who likes to hold his cards tightly to his chest until the stage is set for a big reveal, for a change I think we should take the bull by the horns and examine the completed ro/ro rolling road to see where we're heading. Yes, there it is in **photo 137** and, if you look carefully and ignore the two wider-set square tubes nearest the camera which aren't fundamental to the design and whose purpose I'll explain shortly, you'll see that it essentially consists of two steel tubes, each 1½ inches square and 1/8 inch wall thickness, firmly screwed to three wooden sleepers which are, in turn, bolted to the lifting cart's platform to keep things in place. Everything is held together with screws, each of the open holes providing access to a screw head. It really isn't very complicated, is it?

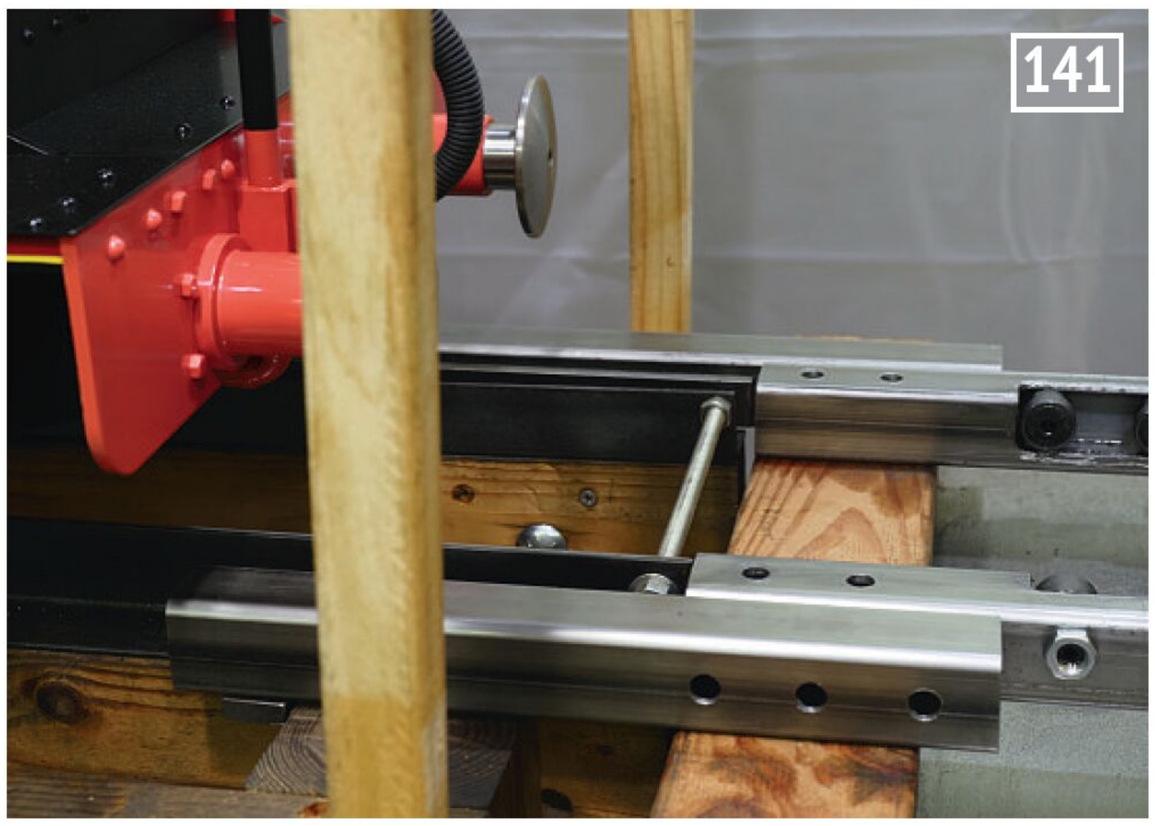
For the rollers, I decided that the one-inch diameter cam followers depicted in **photo 138** would be a prudent investment. While not the cheapest, their 3,000 lb (1360kg) radial load rating suggested they would be fully capable of withstanding the momentary magnification of *Jennifer Ann's* weight each time she drops into the between-roller gap to be suddenly arrested by the deceleration demon. Never forget the deceleration demon, wary Reader, for it is always ready to pounce.

Each roller sits in a rectangular opening and is screwed and lock-nutted to the rear face of its square steel tube.

Just visible thick-walled spacers enclose each roller's shaft, ensuring they are positioned correctly for Jennifer Ann's gauge.

In **photo 139** you'll see that each pair of rollers sits within a rectangular cut-out in the square tube rails, is screwed into a tapped hole in the tube's outermost edge and is also lock-nutted on the outside for security. Furthermore, each roller's shaft sits within a thick-walled cylindrical spacer, its length ensuring that the roller's front face lies flush with the inner edge of the square tube and is correctly distanced for the locomotive's gauge (**photo 140**). Again, nothing too complicated.

As a parenthetical aside, however, while producing those rectangular cut-outs will be a doddle for the milling-machine owners among our readership, for your less well-equipped



The wider-spaced tubes align and lock the rolling road (on the right) with Jennifer Ann's *construction stand (on the left) when she is moved betwixt the two.*

7¼ inch narrow-gauge locomotive Jennifer Ann *sits upon her rolling road. The ensemble will be lowered for use.*

author, each of these features represented a lengthy exercise in chain-drilling, hacksawing, chiselling and filing so please forgive their decidedly agricultural appearance!

And finally, as promised, those two wider-spaced tubes at one end connect the rolling road to *Jennifer Ann's* wooden construction stand for loading and off-loading, ensuring that both stand and cart are correctly positioned and securely held-together for the necessary manoeuvres (**photo 141**).

Keeping things simple

Now, before I go any further, let me explain that, because my rolling-road's dimensions are specifically tailored to suit *Jennifer Ann's* unique wheelbase, I believe there is little point in providing detailed drawings of this contraption. Put simply, unless you, patient Reader, are dealing with a 3-inch scale *Elidir* of your own, such drawings would be rather pointless for all concerned.

Fortunately, I think that it's fair to say that the design of this rolling road is sufficiently simple, and its key features plain enough to behold, that the salient details can be conveyed in writing, supported by suitably captioned pictures, to the extent that they may be copied and customised to suit the gauge and details of your own locomotive, should you desire. But we won't know for certain unless we try, so let's give it a go and see what happens. Please don't hesitate to ask questions through *Postbag* if something isn't clear; I'll endeavour to provide further explanations if and where needed.

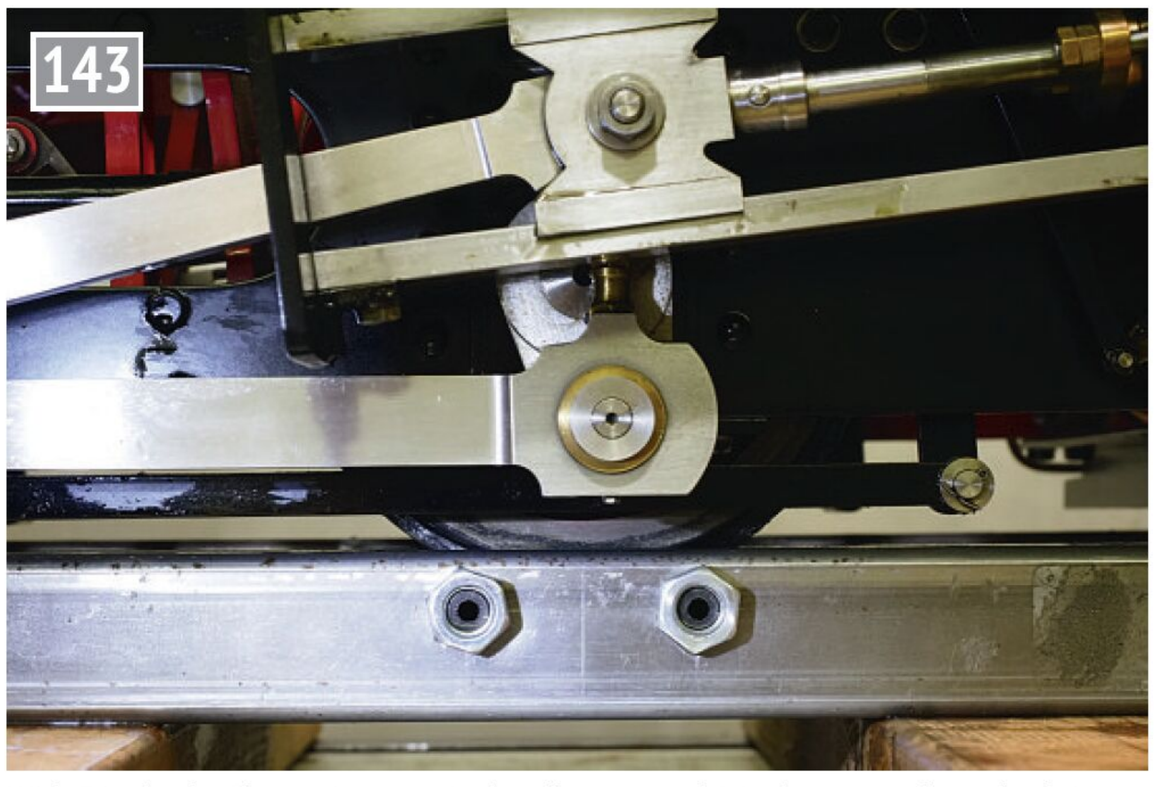
"Now, wait a minute," I hear you cry in exasperation, "even though my engine's details are different to yours, isn't the distance between the rollers important, as it determines how far the engine's wheels will drop below the rails?"

Of course, you are wholly correct, perceptive Reader, and the drop does indeed depend upon roller spacing, wheel diameter and roller diameter, but, fortunately, our recent reacquaintance with Pythagoras helps us deal with these variables and, if you glance briefly at the Addendum to this episode, you will discover both a diagram and a formula derived from Mr. P's theorem which will produce the needful dimensions. However, if the sight of all that mathematics is spoiling your Christmas dinner appetite, then let me be the first to admit that a quick to-scale sketch or two, created with pencil, paper, ruler and a pair of compasses, will provide you with a workable answer almost as quickly as plugging the numbers into this formula, although it really doesn't take long to put the formula into a simple spreadsheet to make life easier. Regardless, I certainly wouldn't blame you for following the non-algebraic route should you prefer and, even if you do use the formula, double-checking your sums with a quick to-scale drawing is still a worthwhile exercise before cutting any metal, in the author's opinion.

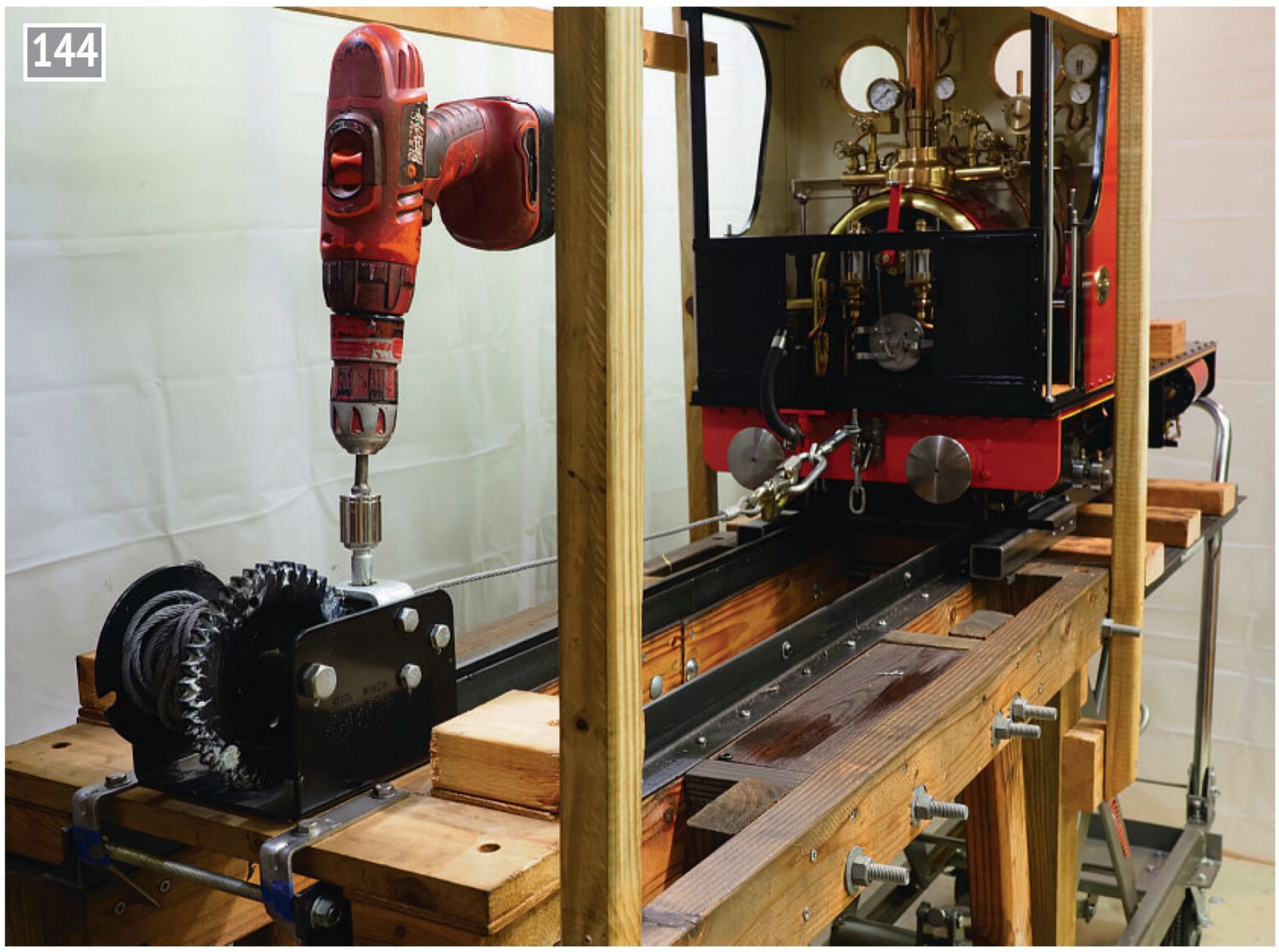
Rolling to a stop

Well, I'm sure your turkey is now ready for carving so let's wrap up this episode by taking a quick look at *Jennifer Ann* on her rolling road and run the numbers for a real-world example (**photo 142**).

With her five-inch diameter wheels (2 1/2 inch radius) running on 1 inch diameter rollers (1/2 inch radius), I determined that a drop amounting to somewhere between one-eighth and three-sixteenths of an inch - roughly 3 to 5mm - sounded about right. Plugging those figures into the aforementioned formula, I concluded that rollers spaced somewhere between 1.7 inch and 2.1 inches were needed and, after checking the results with a to-scale drawing to be sure, settled upon a spacing of exactly 2 inches to make life easy (**photo 143**). And cutting to the chase, that 'almost-three-sixteenths-of-an-inch' drop works very well for *Jennifer*

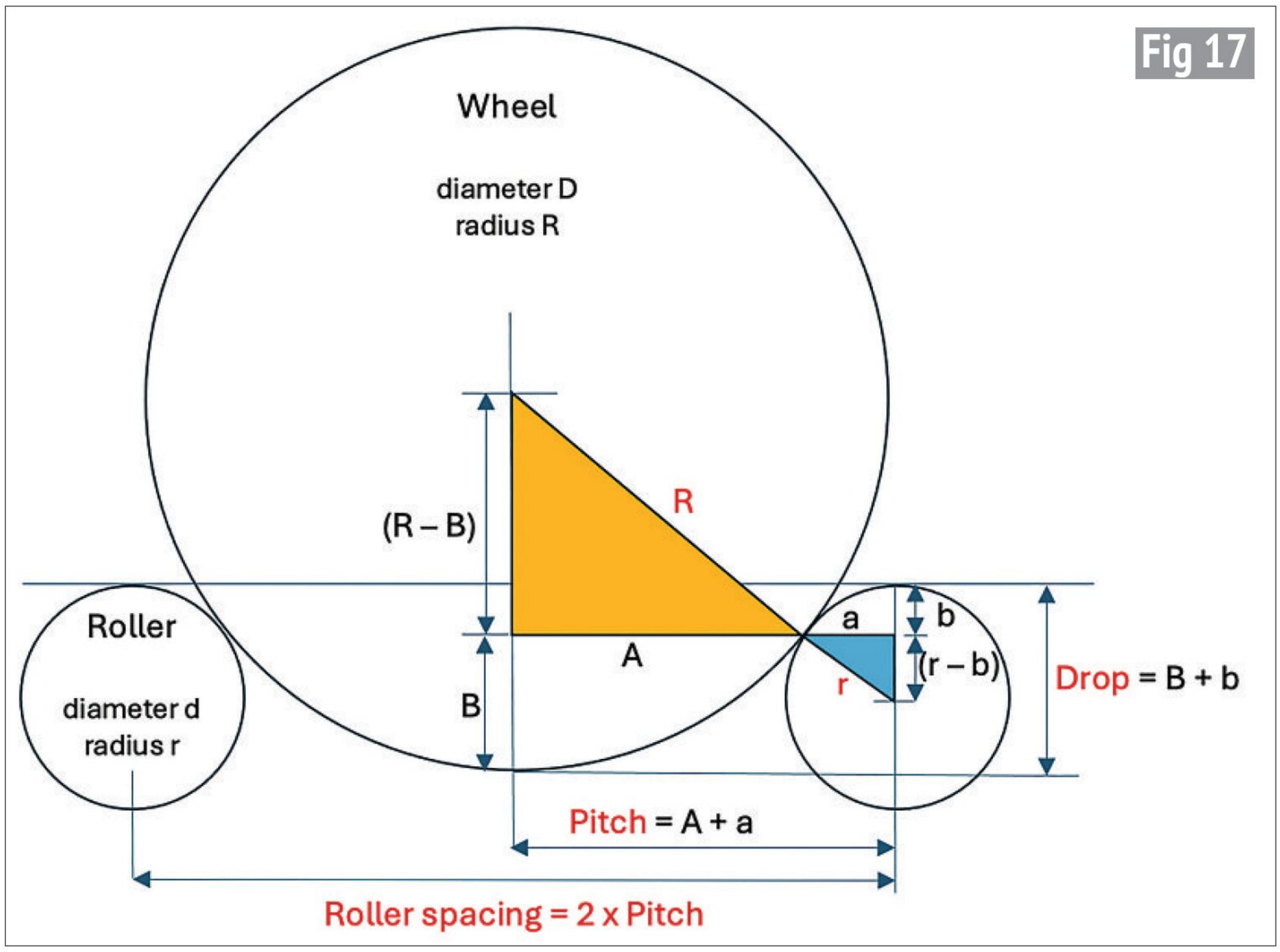


With 5 inch wheels running on 1 inch rollers spaced 2 inches apart, her wheel rims sit nearly 3/16 inch below rail height. Bigger wheels will likely need a bigger drop for security, however.



A drill-powered winch pulls Jennifer Ann *out of the between-roller gaps and returns her to the construction cart in a matter of moments.*

Ann in practice, keeping her firmly in place when she is running yet allowing her to be winched out of the hollow without difficulty thereafter (**photo 144**). However, were I dealing with an engine with bigger wheels, I'd target a correspondingly larger drop to be on the safe side and thereby prevent a 'too easy' climb out if something were to go wrong. Regardless, I always attach *Jennifer Ann's* front and rear couplings to the lifting cart when I am moving her around or she herself is in motion on the rolling road, and strongly recommend that you positively restrain your engine too, for one can never be too careful.



Calculating the pitch, given the drop.

So, there we are! Happy holidays dear Reader, as my fellow Americans are wont to say, and I wish you a very enjoyable remainder of the year. Now, off you go and enjoy your dinner before it gets cold - you certainly deserve it.

Postscript

Since it's the season of giving, I think it only right that I present you, fortunate Reader, with my all-time favourite Christmas-cracker joke for your dinnertime pleasure:

Q. What do you call someone who is no longer enthusiastic about agricultural machinery?

A. An extractor fan.

Please pass my hat, I'll be leaving now.

Addendum

Let's consider **fig 17**. First, we note that the centres of the wheel and the roller can be joined by a straight line, which passes through the contact point of the wheel with the roller and forms a common hypotenuse for the two similar triangles of sides R, A and (R-B) and sides r, a and (r-b).

Using Pythagoras's theorem we can write:

$Pitch^2 = (R + r)^2 - ((R - B) + (r - b))^2$

Rearranging, we get:

$Pitch^2 = (R + r)^2 - ((R + r) - (B + b))^2$

As (B + b) is the drop, we can write:

$Pitch^2 = (R + r)^2 - ((R + r) - Drop)^2$

We can rewrite this as:

$Pitch^2 = (R + r)^2 - ((R + r) - (Drop \times (R + r) / (R + r)))^2$

Extracting the common term and taking the square root we get:

$Pitch = (R + r) \times \sqrt{(1 - (1 - Drop / (R + r))^2)}$

which calculates the wheel to roller pitch needed for a desired wheel drop, based upon the wheel's radius R and the roller's radius r.

●To be continued.

Unseizing a Beam Engine PART 5

SMEE's **Mitch Barnes** gets to grips with an ME Beam Engine steam plant, which had become seized up at some point in its past.

Continued from p.757
M.E.4757 November 29

SMEE

This series is a transcript of a talk given to the Engine Builder's Group at the Society of Model and Experimental Engineers (SMEE) in May 2024.

The next step would be, at last, to see if the piston could be pushed out. I'd be having the cylinder inverted for this because there was less distance to push the piston as it was close to the top of its stroke when it seized up. I decided to make a tool for this, in the form of a steel rod to act as a sort of punch. I had no idea what could happen if I was to push it downwards; it might get permanently stuck. Too risky and totally unnecessary. My steel rod would have to be long enough to clear the cylinder and then some. I decided to turn a stub on its end to locate into the recess in the bottom of the piston where the locking nut had been. This would help keep things under control. Making sure that the push rod was centrally located would therefore apply even pressure to the piston, so wouldn't push it out at a potentially cylinder-cracking jaunty angle and it would stop the whole assembly moving about. Due to its length and the need for that locating stub I selected a length of 20mm steel rod for the job (**photo 22**). This was the maximum diameter I could get into a collet on my milling machine and being close to the bore diameter of 1 inch, would spread the load a bit and keep the assembly stable while pushing. I might just try a few taps with a hammer though to loosen the piston, just in case...

Conscious that too hard a thump on the piston might break the cylinder casting (disaster!), I tried gentle taps with various hammers but nothing was budging. I also didn't like the idea of doing this with the cylinder inevitably moving about. Okay, then, a pillar drill or mill quill can exert far more force than a weed like me wielding a hammer, so I set it up under the mill and put the pushing rod in a collet and brought the quill down. I was really careful to make sure that the distance that the vice jaws were apart was as close as possible to the cylinder bore, thus giving maximum area of the cylinder flange resting on the top of the jaws to hopefully resist cracking the cylinder ≫

This 20mm rod should do the trick. The stub would locate in the nut recess on the underside of the piston and keep everything central and hopefully under control when pressure is applied.

Set up and ready to go. Showtime! The vice jaws are apart only juuuust *wider than the bore diameter to minimise load on the casting and the stub on the push rod is locked in the piston preventing the cylinder casting moving out of place as the quill comes down.*

It's like giving birth... it's coming... That push rod was only just long enough!

flange (**photo 23**). That stub on the push rod was essential for this; with vertical forces involved, there was no danger of the whole assembly flying across the workshop because the more force that was applied, the more rigidly the set-up was held in position.

I pulled hard enough on the quill handle to lift my feet off the floor. Nothing. Hanging there, I realised that, unsurprisingly (because I am so thin that when I turn sideways people think I've left the room), not enough force was being applied. Resistance is useless...

Gulp. Another tack was required.

Okay then, bring the quill fully up, lock it and raise the table against it instead (**photo 24**). But don't break my precious mill!

Winding the table up exerted a force of many hundreds of pounds and even with the benefit of all that internal gearing in the mill's raising mechanism, was still really hard work. I half-expected either a sudden but not entirely surprising *twang* from me or a cracking noise from the cylinder, but while the table slowly moved up, there was no popping sound either from the cylinder or from me. Winding the table up was so slow and controlled that I could see the piston coming out and it did so without any fuss, just going *plink* when it hit the floor of the vice (**photo 25**).

Success! Great, now then, what have we got?

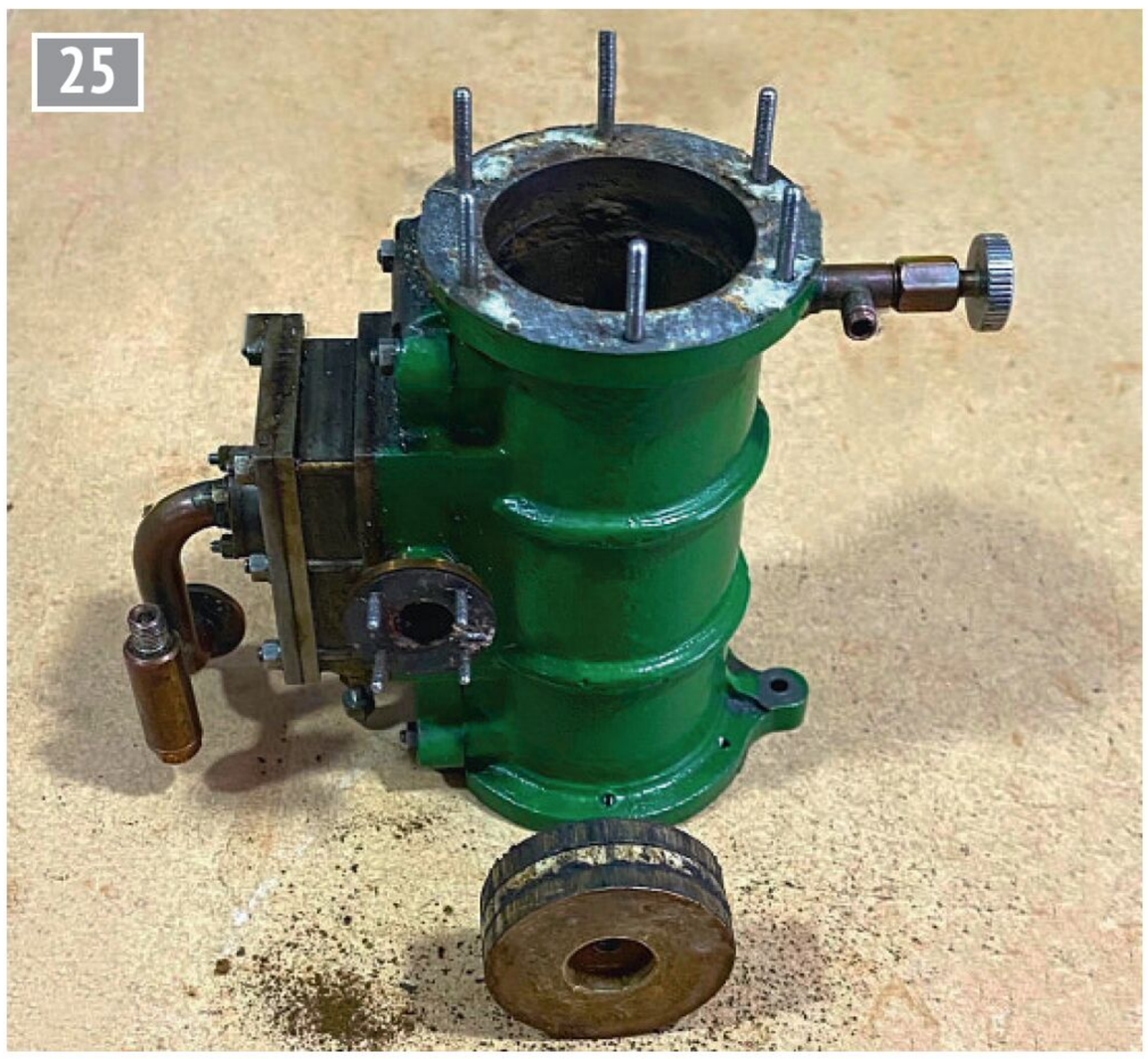
Having been in one piece for so long, everything was now in their proper number of pieces. The scrape marks on the piston's circumference were testament to the force required to get it out. Now I could start cleaning up the bore. This took ages, with scraping out the worst of the rust, then finally a bit of honing.

The original piston ring was a white rubber nitrile jobbie and some of it had been left in the bore so I think it had deteriorated somewhat. I've never been a huge fan of these so I decided to revert to the old graphited yarn method.

Before starting reassembly, I reworked the piston, cleaning it up ready for use, a quick job in the lathe as I tickled off the edge of the piston to smooth it out again (**photo 26**). The depth of cut was barely 0.04mm and the graphite yarn would take up the difference. Once completed, I put it together and popped it back in its resealable bag with the locknut loosely fitted as, of course, the cylinder cover needed to be sorted out too and would need to be threaded onto the rod when it all gets reassembled.

There had been some machining marks on the cylinder cover so I very carefully removed those in the lathe and added a teeny bit of decorative detail around the raised central rib.

●To be continued.



The piston is out! Note the corrosion still in the cylinder's bore and the rough state of the piston circumference. The assembly is still inverted at this point.

The piston rod assembly ready for work again.

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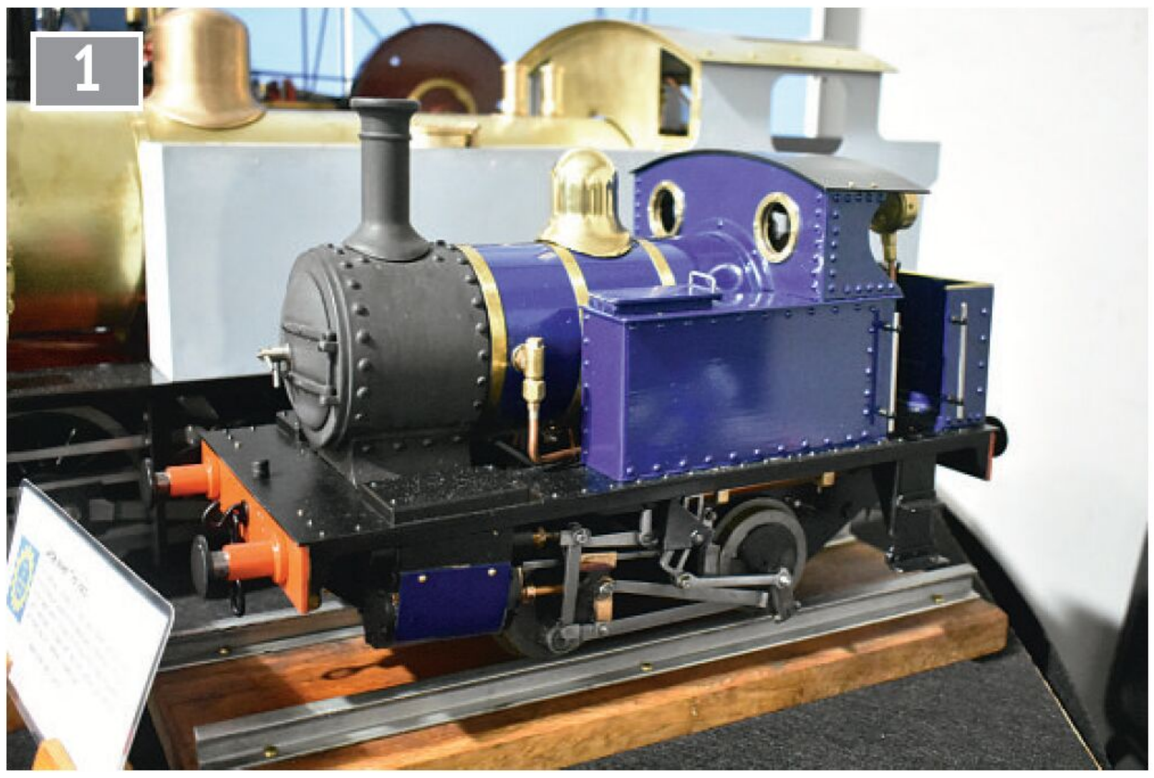
Midlands Model Engineering Exhibition – Competition

John Arrowsmith reports on the competition results from the Midlands show.

The Midlands Model Engineering Exhibition competition classes this year were excellent with some very fine models and workmanship on show. Only two classes received no entries at all: Class 1 - Locomotives up to and including Gauge 1, and Class 8 - Internal Combustion Engines. I am surprised that there were no entries for Class 1 as I know that many clubs have very active garden railway layouts that include Gauge 1 track, but we rarely see this branch of model engineering at this show. Perhaps next year will be an improvement; we all hope so. The Internal Combustion Engines usually have a couple of good entries or more but this was one of the barren years. The Chief Judge, David Moore remarked on the quality of models on show and on how many fine examples were presented. He thanked all the entrants for their hard work and efforts to attend the exhibition as, without them there would be no exhibition.



Very Highly Commended in Class 2 was Simon Dawson's Tich locomotive in 3 ½ inch gauge.

Highly Commended in Class 2 was this 2½ inch gauge LSWR T3 Class 4-4-0 locomotive built by Nick Baines.

Class 2: Locomotives – 2½ and 3½ inch gauges

Just two prizes were awarded in this class. Both models were good examples of their type and both were well finished. Very Highly Commended was the 3½ inch gauge Tich locomotive, built and entered by Simon Dawson (**photo 1**). Highly Commended was the 2½ inch gauge LSWR T3 Class 4-4-0 No. 563 built by Nick Baines (**photo 2**).

Class 3: Locomotives – 5 and 7¼ inch gauges and above

Again, just two prizes in this class, each being distinctive and very well made examples showing some excellent workmanship on both. First prize winner, and winner of the Reeves Challenge Cup, was Jon Swindlehurst for his 7¼ inch gauge model of the 1838 0-4-2 locomotive *Lion* (**photo 3**). This engine displayed some exemplary workmanship, particularly on the brass firebox cover and the copper chimney cap and was a worthy winner.

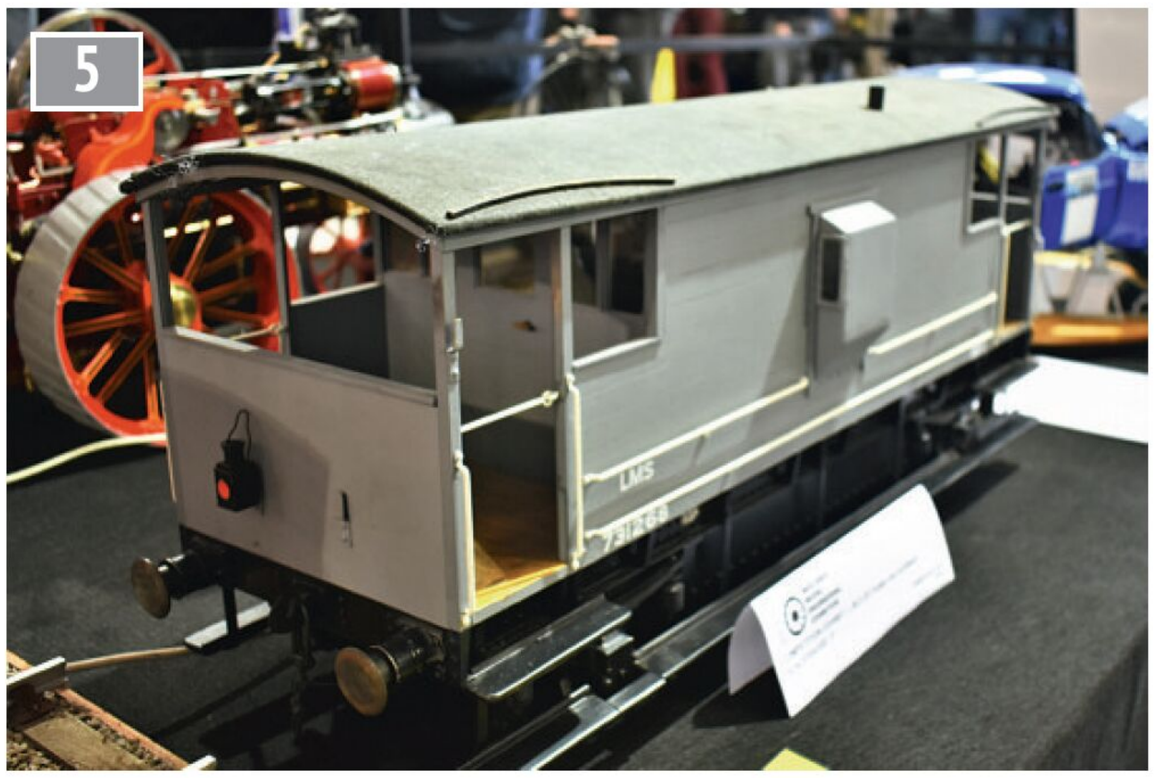
The Second prize was awarded to Terence Woodward for a beautifully presented model of a 5 inch gauge NBR K Class (LNER D34) 4-4-0 to the Don Young design. The original was built in March 1919 and finally scrapped under BR in April 1959.

First Prize in Class 3 went to Jon Swindlehurst for his 7¼ inch gauge 0-4-2 locomotive, Lion.

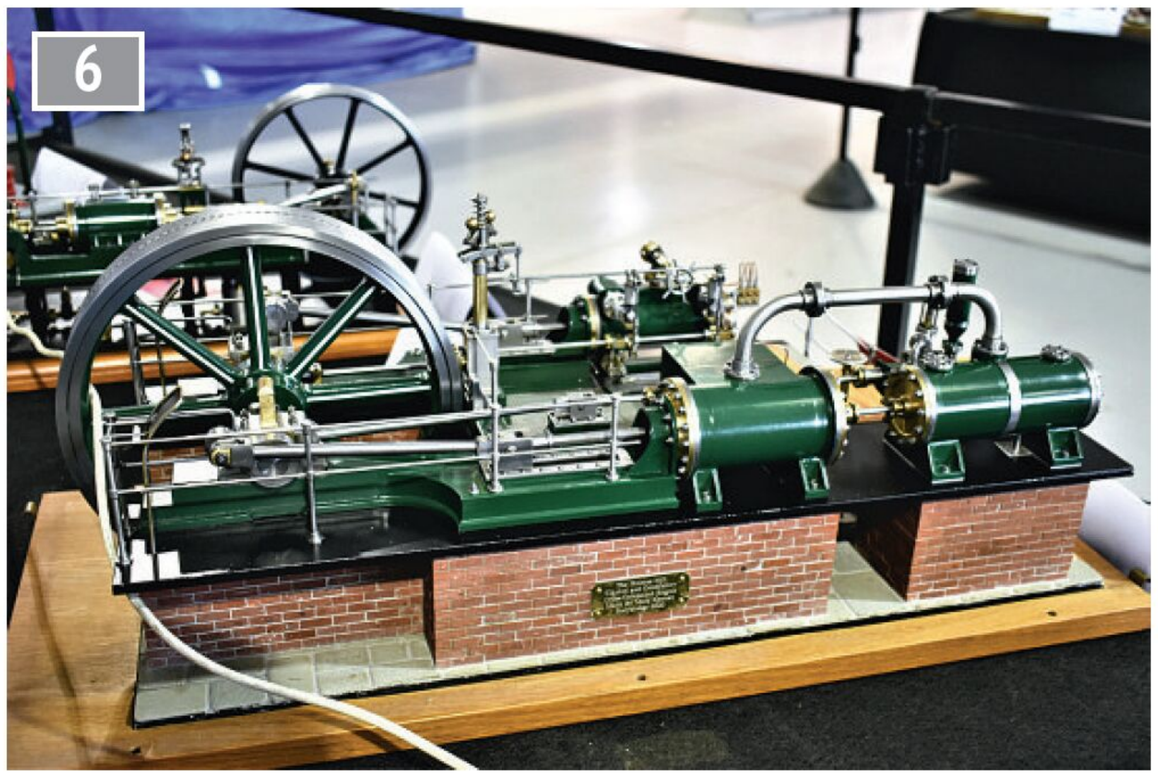
Class 4: Rolling stock etc. any gauge

Two different examples of brake vans featured in this class with firstly a Metropolitan ≫

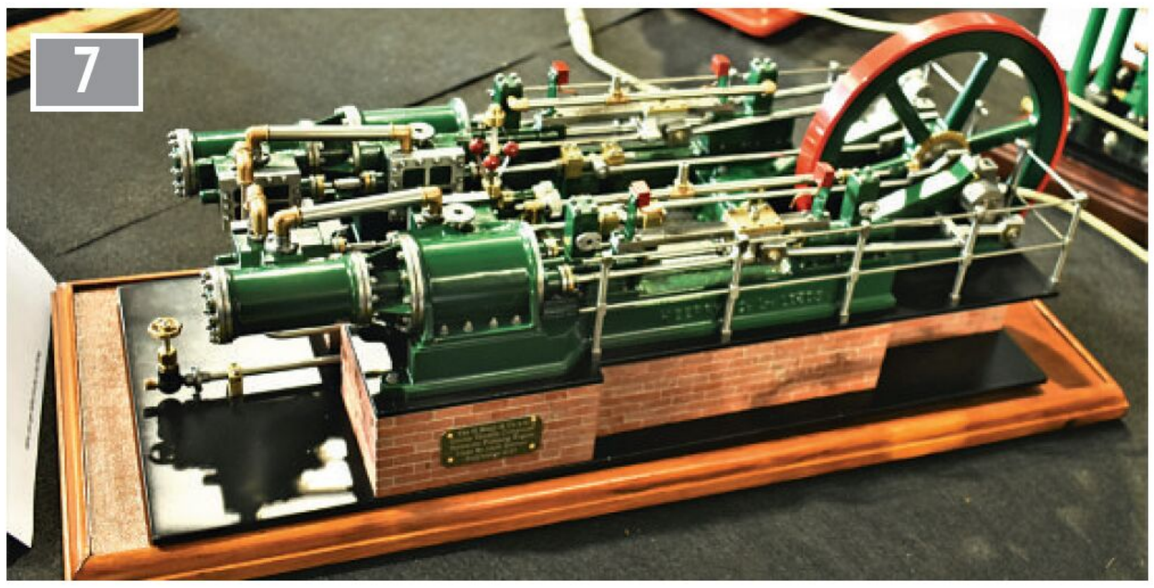
The winner of Class 4, Guy Harding's Metropolitan Railway 14 ton ballast brake van.



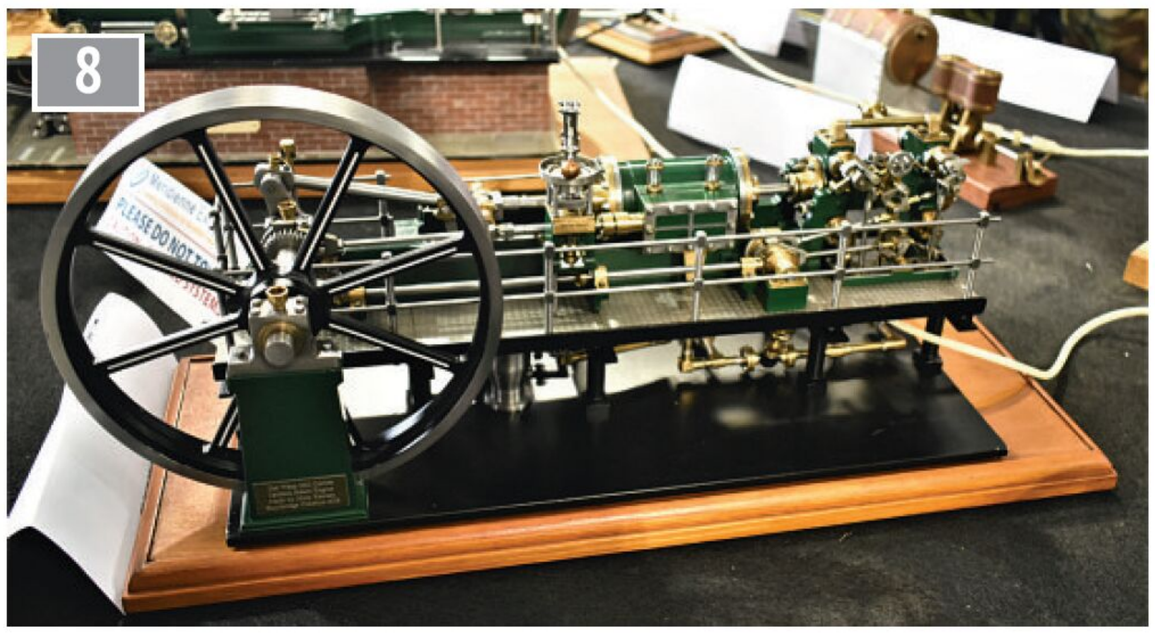
David Calvert was Very Highly Commended for his LMS 20T Brake Van (unfitted).



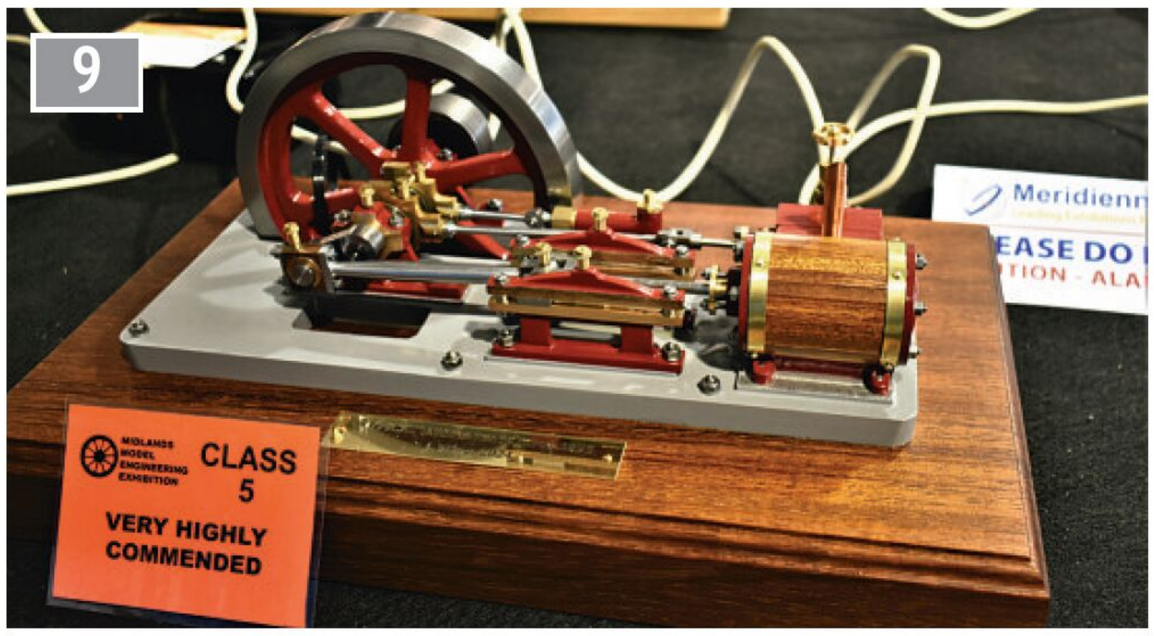
Winner of Class 5 was Mick Keenan's model of the Clayton & Goodfellow cross compound engine.



The H. Berry & Co. Ltd. double tandem compound hydraulic pumping engine, built by Mick Keenan.



The Wasp Mill Corliss tandem steam engine, built by Mick Keenan.



John Wing's mill engine was Very Highly Commended in Class 5.

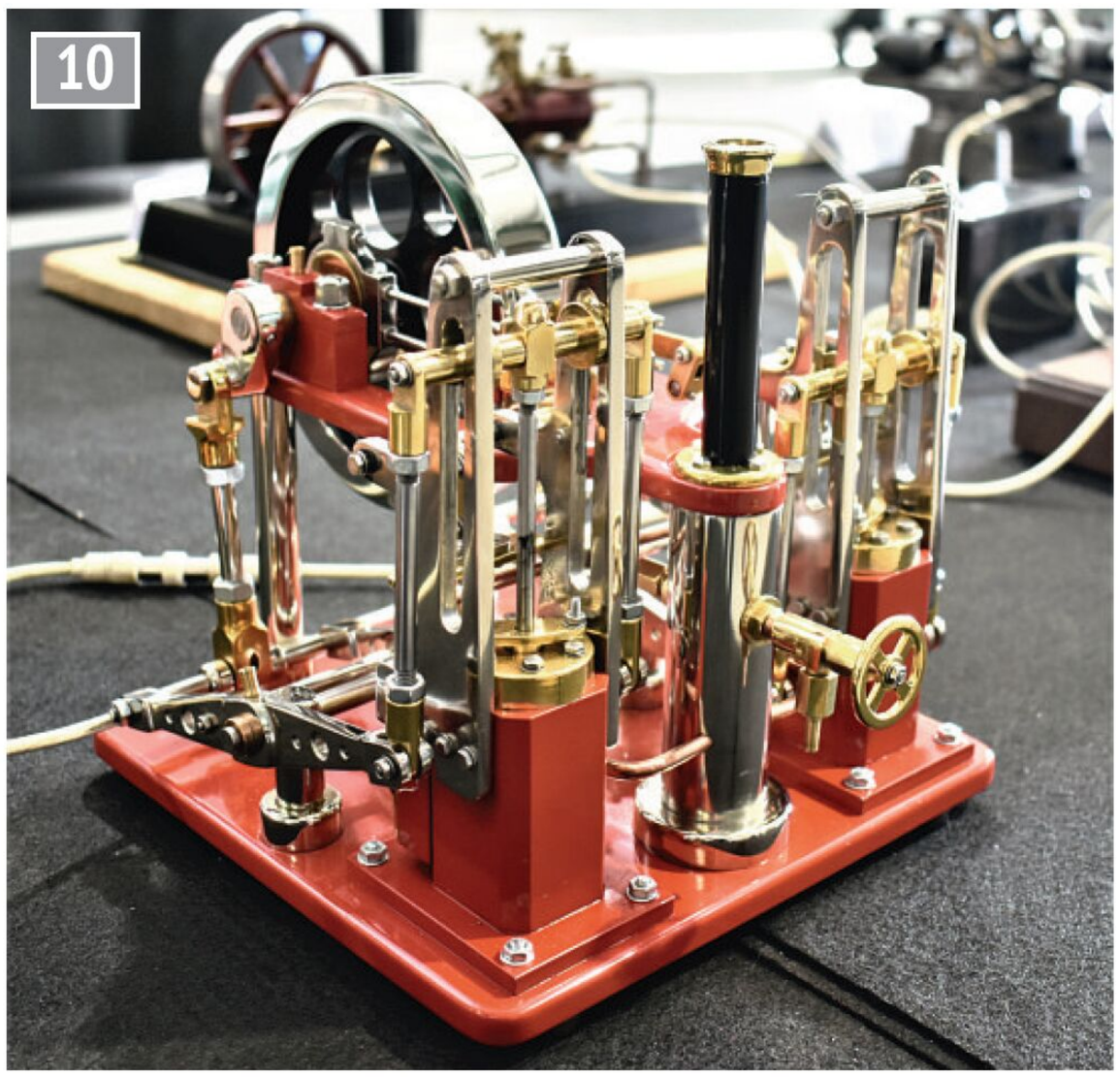
Railway 14 ton ballast van built in 5 inch gauge by Guy Harding who won First Prize and the Burton Rose Bowl Cup (**photo 4**). Beautifully finished with some excellent fittings, it can also be used as a riding truck by replacing the scale roof with a more comfortable cover. Second place went to David Calvert who was Very Highly Commended for his version of an unfitted LMS 20T brake van. Again, some excellent detail including inside fittings (**photo 5**).

Class 5: Stationary engines

In this class the judges were presented with five super models - and a severe headache, thanks to the quality of each of the models entered. Three were presented by Mick Keenan and such was the standard of all three that the judges found it very difficult to place them. Eventually, The Holmes Mill Clayton and Goodfellow cross compound steam engine in ¾ inch (one-sixteenth) scale was awarded First Prize and the Precision Paints Trophy for an outstanding example of the model engineer's skill (**photo 6**). There were no castings of any kind used in its construction and all the individual fittings and pins, for example, were made by the builder. The little barring holes round the periphery of the flywheel were a fine illustration of Mick's expertise.

Second prize was also awarded to Mick Keenan for another superb engine, this time in 1 inch scale and in the shape of an H. Berry & Co. Ltd. double tandem compound hydraulic pumping engine (**photo 7**). The photo shows the engine as it is today but during Mick's initial conversation with the owner of the engine, whom he had asked for permission to measure it up, Mick learned that it would be given on condition he also made a model for himself so he set to and made two models of this engine!

Third prize in this class also went to Mick Keenan for his ¾ inch scale example of the Wasp Mill Corliss tandem steam engine (**photo 8**).



The two cylinder double sided beam engine built by John Wakeling was Highly Commended in Class 5.

The sole entry in Class 6 was Neil Madden's 4 inch scale Burrell which was Commended.

First Prize in Class 7 was won by Wally Sykes for his scratch built tool and cutter grinder.

The optical dividing head built by John Tickner was awarded the Second Prize in Class 7

Two more model engineers were also presented with awards in this category. For a 'typical mill engine circa 1895' (**photo 9**), John Wing was presented with a Very Highly Commended certificate and finally, last but by no means least, John Wakeling was rewarded with a Highly Commended certificate for his fine example of a two cylinder double sided beam engine (**photo 10**).

Class 6: Steam road vehicles (static)

There was just the one entry in this class where Neil Madden was Commended for his 4 inch scale Burrell traction engine built from a Modelworks kit (**photo 11**).

Class 7: Machine tools & workshop equipment

There were three excellent entries in this class, with three very diverse pieces of equipment.

First Prize winner and also winner of the TEE Publishing Cup was Walter Sykes for a scratch built tool and cutter grinder based on the Quorn design (**photo 12**). The only details not made by the builder were the electric motor and the chuck and collets. Second Prize was awarded to Jonathon Tickner for his optical dividing head based around an existing worm drive gearbox and a microscope (**photo 13**). This ingenious piece of equipment should provide a very accurate way of dividing. Commended in this class was Nick Jones for his quick lock vice stop; a novel design utilising a cam locking mechanism.

Class 8: Internal combustion engines

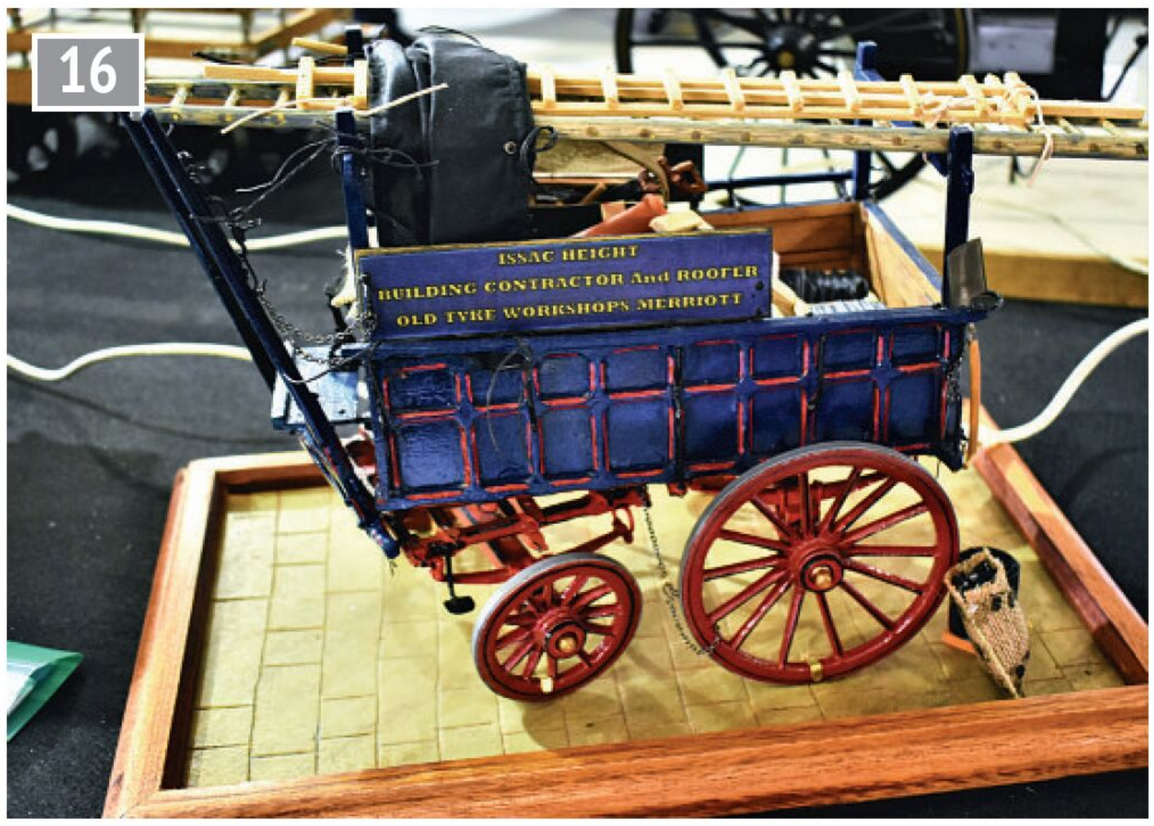
As mentioned above, there were unfortunately no entries in this class. There were however some excellent examples elsewhere in the exhibition.

Class 9: Horological, scientific and automata

Two excellent prize winners in this class, with Michael Havard ≫

First Prize in Class 9 went to the skeleton clock built by Michael Havard.

The 1:8 scale model of a Galway Hooker sailing boat built by Tony Judd was Commended in Class 10.



A Victorian horse drawn builder's van built by Chris Briggs.

Winner of Class 13 was this 1:8.5 scale model of a Westland Whirlwind helicopter built by Glen Davis.

taking the First Prize and The Clockmakers Trophy with his beautifully made skeleton clock (**photo 14**). Sharp, precise components which carried a superb finish made it a worthy winner. The Third Prize was awarded to Richard Thomas for his example of a desk/table top perpetual calendar. Nicely finished and mounted, it is a very attractive and useful accessory.

Class 10: Marine models – scale (over 50% scratch built)

A Commended certificate was the only award made in this class and it went to Tony Judd who entered a large radio controlled model in 1:8 scale of a Galway Hooker sailing boat of circa 1890 (**photo 15**). This model represents an old Galway Bay 'Bad Mor' C19 Trading and Fishing boat built in 1892.

Class 11: Marine models – kit (standard or modified)

There were no awards made in this class.

Class 12: Model horse drawn vehicles.

Three excellent models graced this class with the First Prize winner and winner of the Lenham Pottery Trophy being Eric W. H. Keggans for his superb model in one-sixth scale of a Hansom cab. Beautifully made with the correct opening lap doors controlled by the 'cabbie' from his position on the rear.

The Second Prize was awarded to Chris Briggs for his fine example of a Brooke Bond Tea wagon built in 1 inch scale; it really looked the part. Chris Briggs was also awarded Third Prize for another finely built builder's wagon in 1 inch scale. The model was full of interest with tools and ladders prominently displayed (**photo 16**).

Class 13: Scale model aircraft

First Prize and winner of the Variscale Cup was Glen Davies with another superb model of a R/C 1: 8.5 scale model of a Westland Whirlwind HAS Mk 7 Helicopter (**photo 17**). Highly detailed and with lots of fittings, it again really looked the part.

Class 14: Young engineers award (under 20 years of age)

Another fine set of entries here with eight models in competition and a wide range of models to consider.

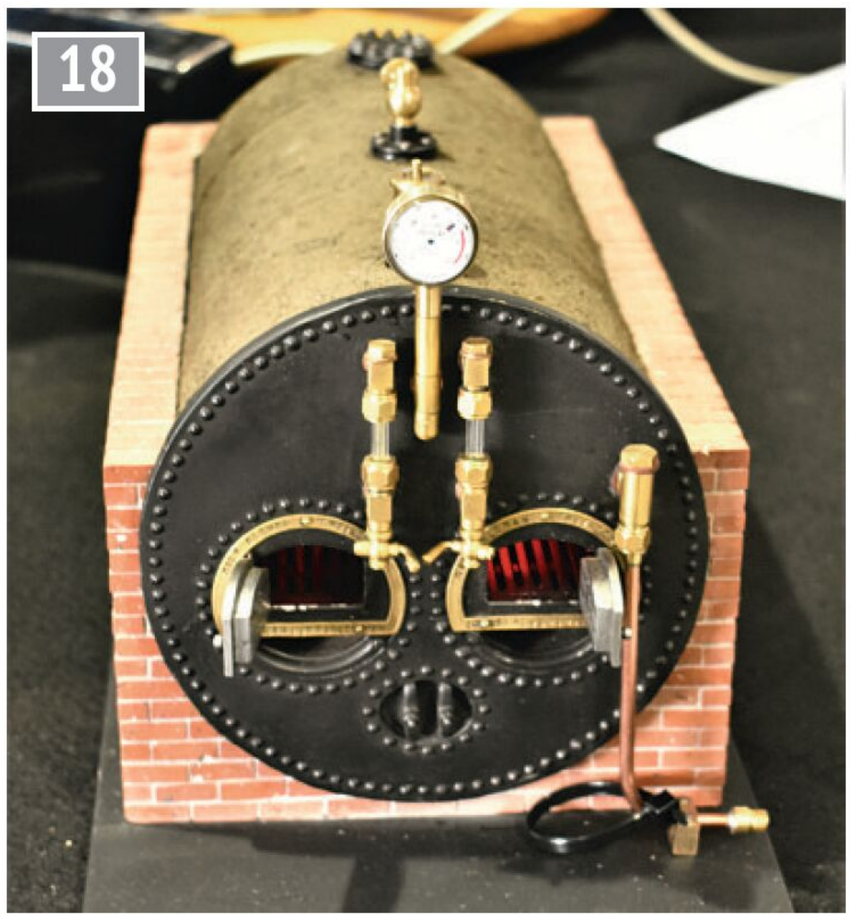
The young people who have submitted their entries must all be congratulated for their efforts and it is to be hoped that the encouragement they have received from their respective clubs will give them the confidence to continue and progress and hopefully submit new models to be considered next year.

First Prize winner and winner of the Stuart Models Shield was 12 year old Thomas-Henry Pugh Bodman for his scratch-built simple oscillating engine. No castings have been used in its construction. Everything has been made from whatever material was available to him in the club workshop. The base finish was his own idea and it certainly catches the eye.

The remaining prizes and certificates were all awarded to members of the Eastleigh Young Engineers Club and their presentation was a wholly excellent display of the work these young people have produced. The Second Prize was awarded to 9 year old Sacha Deal for a scratch built R/C jeep with machine gun. Third Prize went to another 9 year old, Freya Hempenstall for her R/C crane lorry. There were no less than five Highly Commended certificates presented to Asher Cooling, Alice Dodd, Zach Dodd, Joseph Prichett-Brown and last but not least, Jonty Spry. It was interesting and a joy to note how many young ladies were involved with this class; hopefully they will all progress, become more involved with model engineering clubs in their area and continue to produce interesting models.

Class 15: Miscellaneous

There was a very eclectic mix of entries in this class which made for some interesting judging. The winner of the First Prize was Brain Swann for his wonderful little 1911 Fiat S76 (Beast of Turin) record breaking car. The original had a four cylinder, 28 litre engine developing 290 HP capable of 132.2 mph. This little



The Lancashire Boiler by Mick Keenan won Second Prize in Class 15.

The Penny Farthing bicycle built by John Wakeling was Very Highly Commended in Class 15.

beauty looked as if it had just finished the race. The excellent display was accompanied by numerous photos and information about the car and its construction.

A Second prize was awarded to Mick Keenan for his excellent example of a traditional Lancashire boiler (**photo 18**).

Awarded a Third Prize was a very nice 1½ inch scale Fowler water cart built by Dennis Lambe.

A Very Highly Commended certificate went to John Wakeling for his delightful Penny Farthing Bicycle (**photo 19**) in 1:6 scale. The very thought of fixing all those fine spokes would fill me with a lot of trepidation!

Ralph Thompson received a Highly Commended certificate for his very unusual six cylinder oscillating steam engine built in a triangular configuration which looked to be a very neat piece of work (**photo 20**).

Finally Angus French, a previous Young Engineer class winner, received a Commended certificate for his fully instrumented replica Formula 1 steering wheel.

Class 16: Hot air engines

There were no awards made in this class.

There were four additional awards made during the show, of which the Chris Deith Memorial Trophy, presented in memory of the founder of the Exhibition, was the principal one. It is awarded to the 'Best Model in Show' in Classes 1-16. This year the trophy was won by Mick Keenan for his Clayton and Goodfellow cross compound steam engine.

The Society Shield is also a cherished accolade for all those clubs and societies who give so much of their time in making the effort to attend the exhibition. A ballot is conducted by all the visiting clubs and societies - the show organisers play no part in this award. This year it went to the Hereford Society of Model Engineers who had provided a very comprehensive selection of models and equipment including examples by their very active Young Engineers section. In second place was the Harlington Locomotive Society who had a comprehensive display, inside and out, of a typical steam locomotive running shed. In third place was the Coventry Model Engineering Society with, again, a fine array and an excellent mix of models and equipment. All of these clubs put on outstanding displays of their members' work.

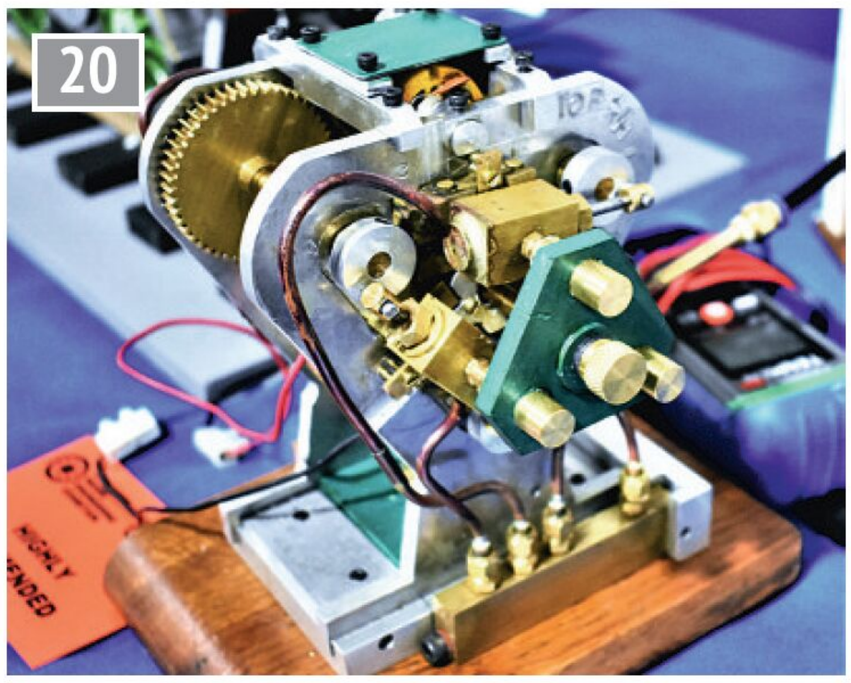
The Fosseway Steamers always entertain and add an extra dimension to the exhibition with their engines in steam and very mobile outside. The line-up always includes some elements of traditional traction engine work. Annually, a judge selected by the organisers considers what the group offers and then selects one of the participants for a special award. This year it went to Davinder Singh Mathara for his splendid half-size Little Samson traction engine (**photo 21**). In addition to this award, the Steamers themselves select one of their number for the Best Engine Management during the exhibition. This year the recipients were Steve and Chris Weaver with their 3 inch scale Marshall traction engine working with a 3 inch scale Clayton threshing drum.

As another model engineering event at the Warwickshire Event Centre comes to a close we reflect on what a fine competition it was this year, with some keenly contested exhibits in a number of classes. My thanks, and those of the organisers, to all of you who attended and made this a great event. I do hope you were happy with the results and inspired also to continue your model engineering endeavours, because, as is often said, without you there would be no show at all.

Finally, one request was made in a conversation with Dave Moore, the Chief Judge: when presenting your model into competition, please consider adding a little more information about your entry. Explain something of the process of achieving such quality. This would not only help the judges enormously but, perhaps more importantly, be of immense interest to the visitors to help them understand a little about your model and it construction.

Let us hope that 2025 will be an even better year with some more great models and presentations to admire.

ME



Ralph Thompson was Highly Commended for his unusual six cylinder oscillating engine in a Triangular configuration

Winner of the Fosseway Steamers Prize was Davinder Singh Mathara.

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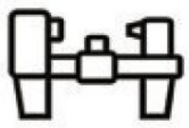

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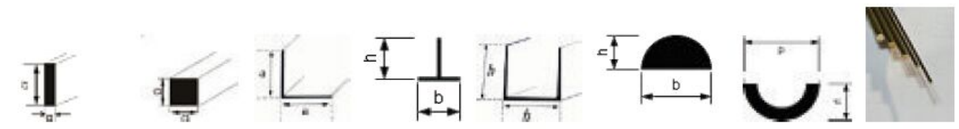

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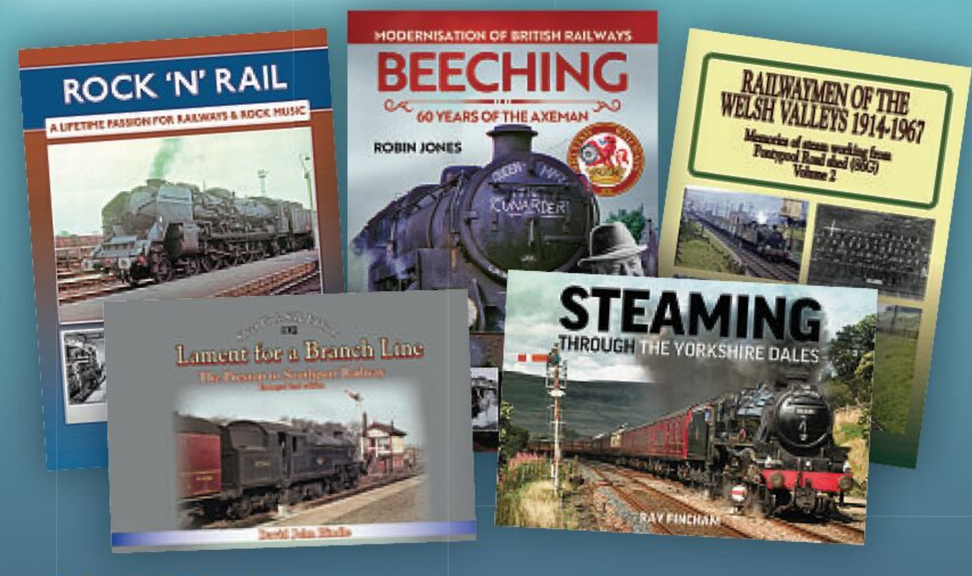

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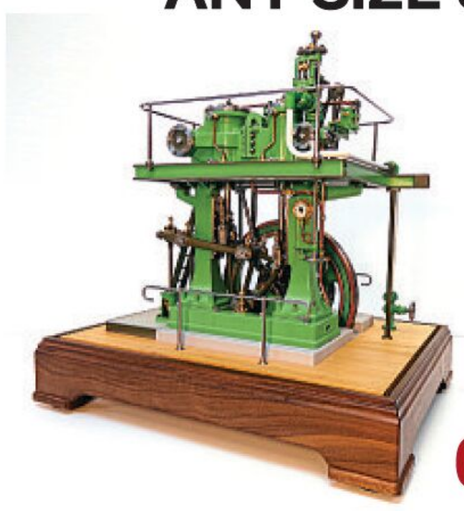

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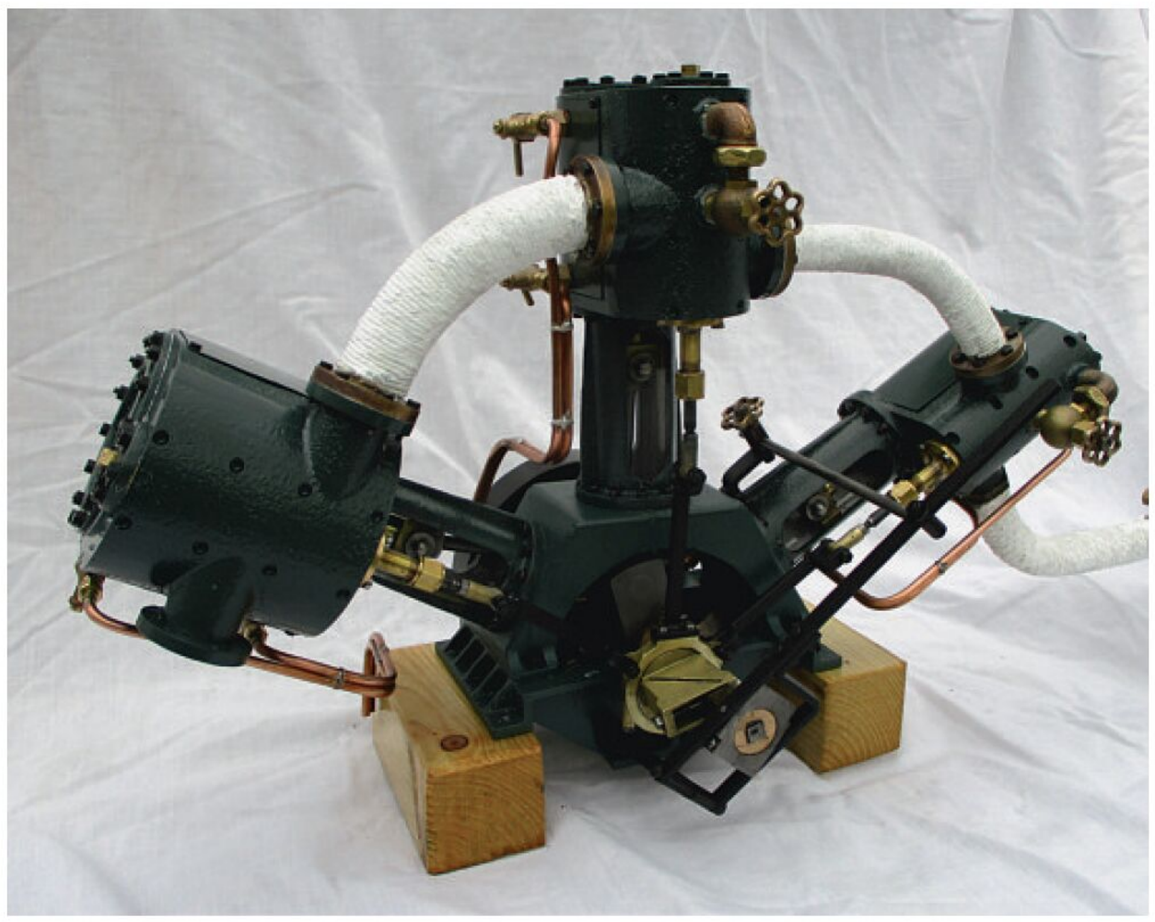
A Radial Marine Steam Engine PART 3

Ian Couchman builds a rather unusual ‘quasi radial’ triple expansion engine.

Continued from p.747
M.E.4757 November 29



Crossheads and piston rods

Now I need something to connect the connecting rods to - step forward the crossheads.

The bosses on the tops of the crossheads are machined first, then the rod holes drilled and tapped for the piston rods. They are then held by the boss in a collet and the outside faces turned true to size. Finally the little end holes are drilled and reamed.

The piston rods are a simple turning exercise, resulting in the collection of parts shown in **photo 35**.

All we need now are the little end pins. These have an oil hole drilled from the thread end, with a matching hole where the connecting rod bush sits. The end of the hole at the thread end is tapped and filled with an 8BA screw cut off flush. The prototype had oil cups on the exposed ends but I considered this a bit too fussy at this scale, so I just have holes to pump the oil in. And here we are with the last bits below the cylinders (**photo 36**), at least until I discover the bits I’ve forgotten...

The motion(for want of a better term...)

This is mostly made from castings. It was here that I discovered a potential problem with 3D printed lost plastic patterns: they leak. Let me explain.

First, let’s run through the lost plastic investment process as I use it. We start by making the patterns, either from wax or, as in this case, 3D printed Polycast. These patterns are fixed to a wax sprue mounted in a rubber base (**photo 37**, centre). A perforated flask is then fitted over the patterns (photo 37, left), then the holes are sealed with tape (photo 37, right).

Now we mix the investment (basically a form of Plaster of Paris). I use an old food mixer, which mixes in a lot of air. This is a problem, as air in the mixture will form bubbles on the surface of the castings, especially in cavities, so we want to remove as much as possible. We start by standing the mixing bowl in a vacuum chamber (**photo 38**) for a few minutes. We next pour the mixture into the flask, pouring down the side (**photo 39**), allowing the mixture to flow up

A set of three piston rods.

Little end pins.

Lost wax casting – patterns attached to a wax sprue.

Lost wax casting – vacuuming out the air from the investment.

Lost wax casting – pouring the invetment over the patterns.

Lost wax casting – further evacuation of air.

around the patterns, hopefully carrying any bubbles with it. The flask is now put back in the vacuum chamber (**photo 40**, before fitting the cover) for a few more minutes to get out as much air as possible.

It's at this point that the problem of leaky patterns arises. If a pattern leaks, air is drawn out and, when the vacuum is released, investment is drawn into the pattern. The result will be a cavity in the casting which, according to Sod's law, will only be revealed during the last machining operation...

Continuing with the operation, the flask is then removed from the vacuum chamber and allowed to set, after which the rubber bases and tape are removed, revealing the pouring funnel formed by the base (**photo 41**).

Now the flasks are put in the burn-out oven (**photo 42**). Here, the temperature is raised at 230 degrees Centigrade/hour to 230 degrees. It's held there for three hours, then raised again at 150 degrees/hour to 730 degrees (the hotter the better, but the investment begins to break down above 730) and held for four hours. This completely burns out any traces of the patterns, leaving a clean mould. It is then reduced at 150 degrees/hour to the pouring temperature (600 degrees in this case). As the metal is not poured into a cold mould, a lower metal temperature can be used than would be used in sand casting.

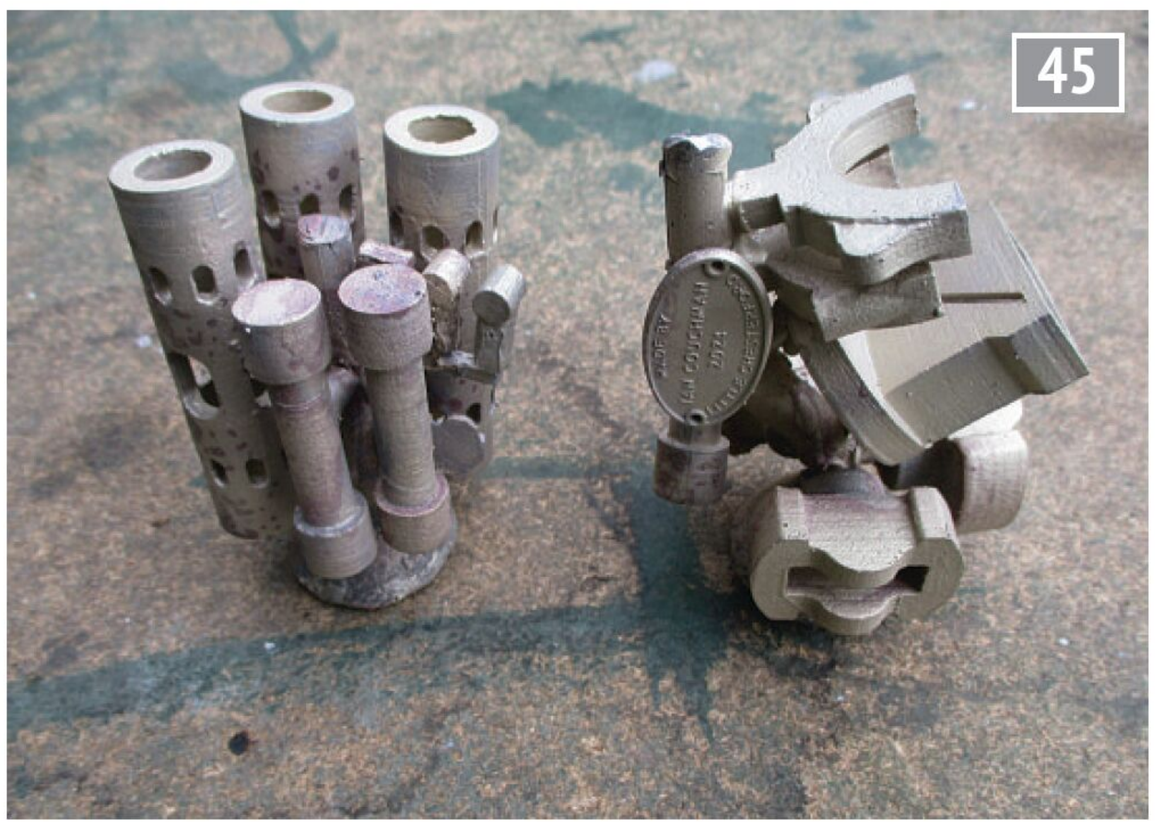
Now the exciting bit! The flask is removed from the oven and placed on the vacuum table

Lost wax casting – the investment is allowed to set.

Lost wax casting – burning out the patterns from the invstment.

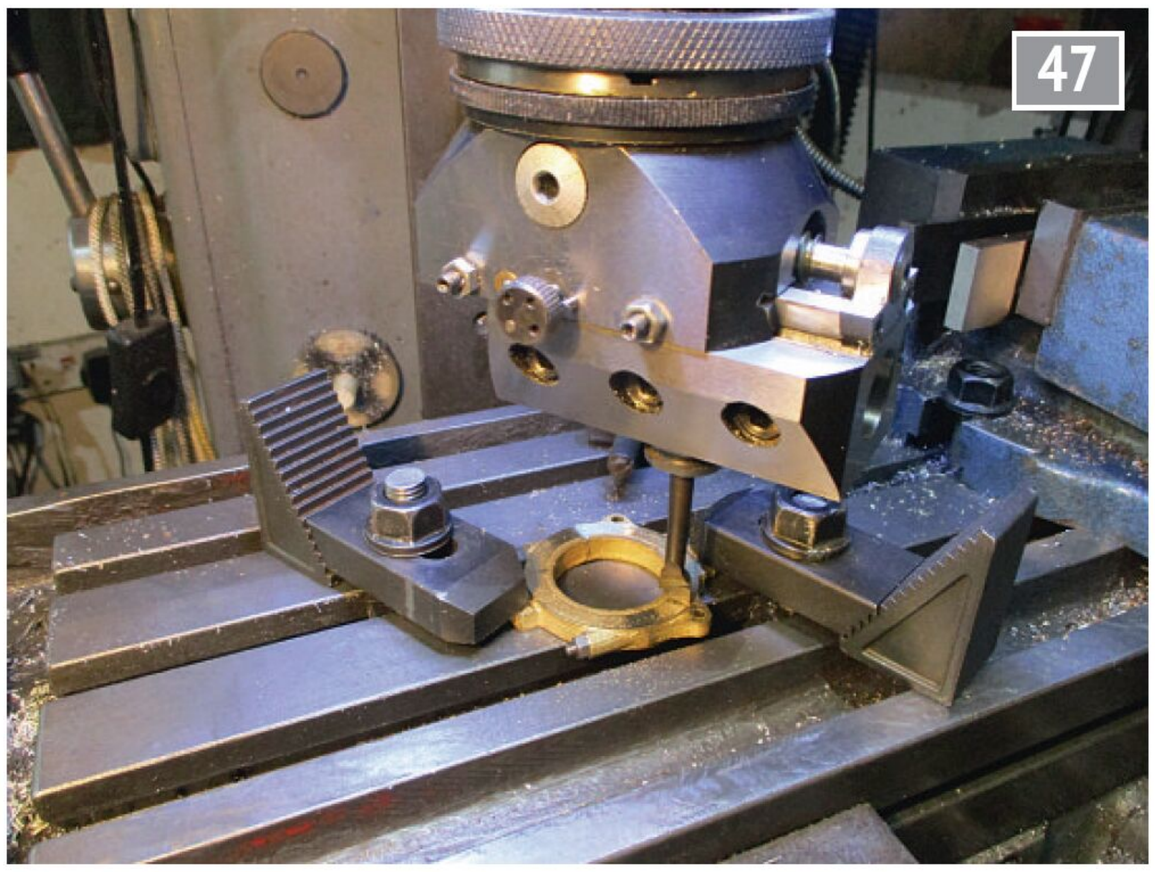
Lost wax casting – the flask on the vacuum table ready for pouring.

Lost wax casting – pouring the metal.



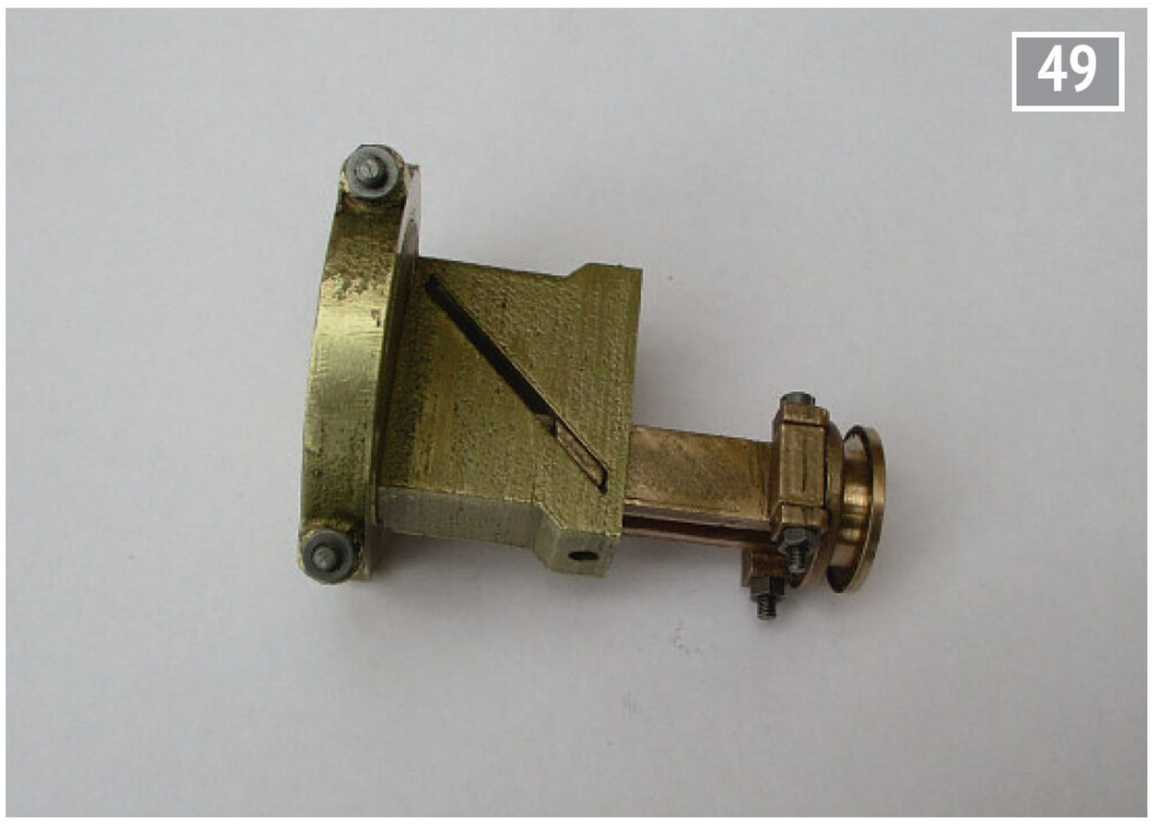
Lost wax casting – the casts, freed from the investment.

Lost wax casting – the casts, separated from the sprue.

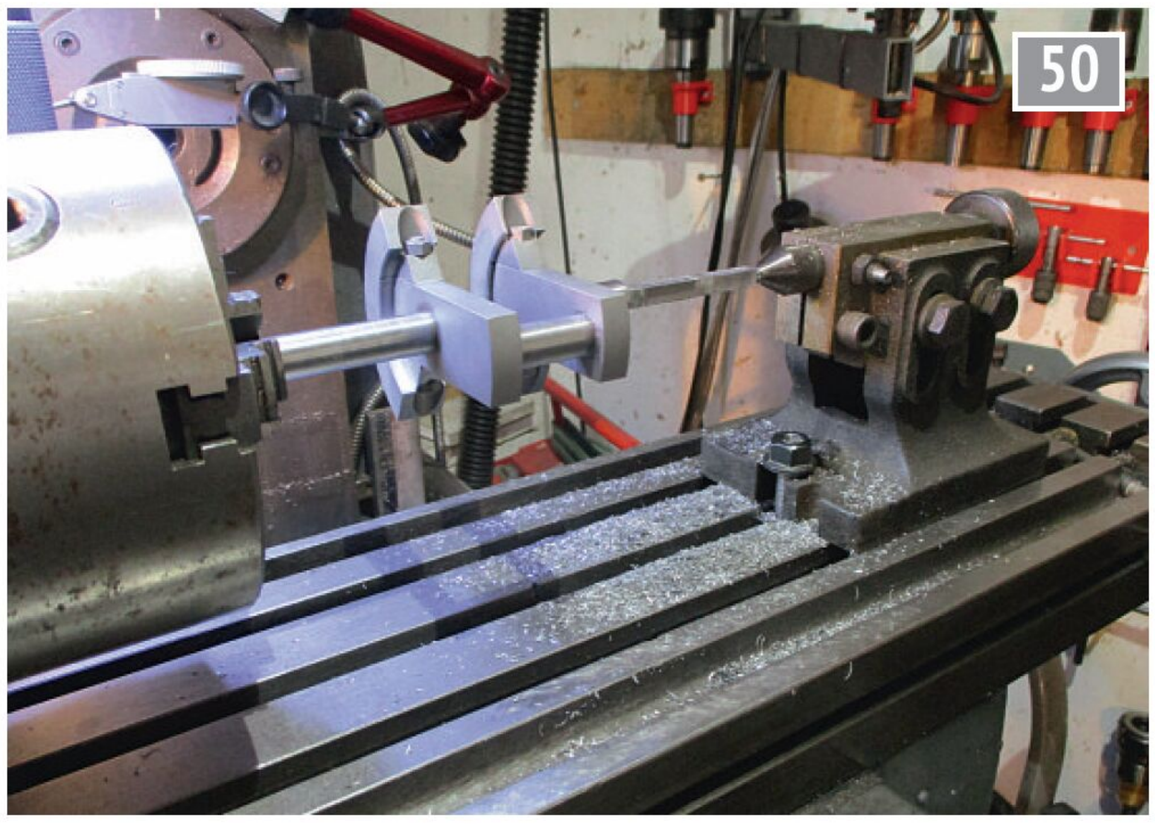


Boring and facing the eccentric straps on the mill.

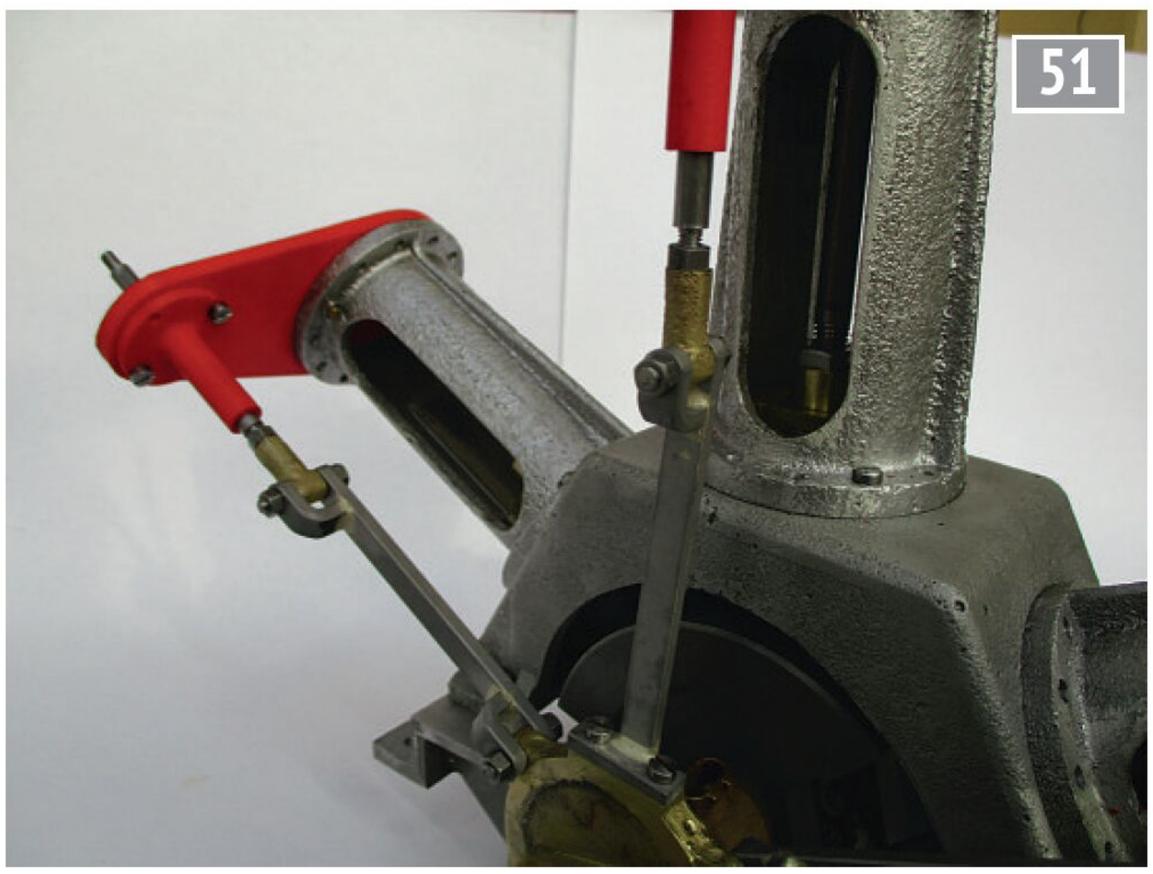
A set of parts for the eccentric.



The assembled eccentric.



Milling the square on the crankshaft.



Fitting the eccentric rods.

Making the eccentric rods.

(**photo 43**), where a silicone rubber seal seals the flange on the flask, allowing a vacuum to form around the underside of the flask. Then the metal is poured (**photo 44**) and the flask set to one side to cool.

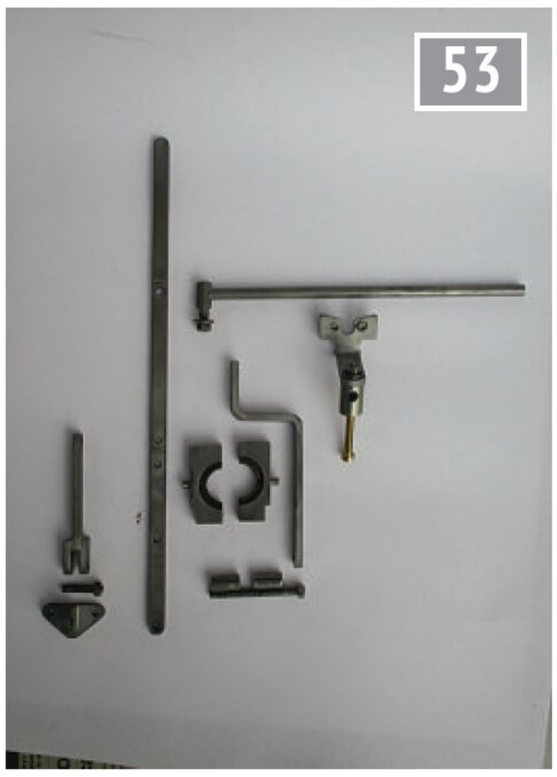
You may have wondered why the flask has holes in the side which have to be covered by tape. Well, the investment, after burn-out, is slightly porous. This allows the vacuum to draw out any air trapped in the mould, ensuring that the cavities will be completely filled. The further the air has to travel through the investment, the slower the air will be removed. By having holes in the side, you minimise the distance. This also explains why the burn-out must be complete, as any remaining wax/plastic will block the pores.

When the flask has cooled to the point that the glow from the metal is only just visible in subdued light, the flask is quenched in water, where much of the investment will disintegrate. Removing the remaining investment can be a chore. I find the best way is to soak the mass in water for a couple of hours, then use a common or garden pressure washer. Finally, the last traces can be removed (after drying) by bead blasting (**photo 45**). All we have to do now is cut the castings from the sprue (**photo 46**).

The trickiest part to machine was the eccentric strap. It's too flimsy to hold in a chuck in the lathe, so I added a couple of bosses to the castings to hold it. After machining the faces and drilling the holes, the two parts were bolted together and clamped to the mill table, using the holding lugs on the castings (**photo 47**). The face was cleaned up and the first side bored, after which it was turned over and the second side bored. The holding lugs were then cut off. Here's the collection of bits (**photo 48**) and the assembly ready for the crank shaft (**photo 49**).

The last operation was to mill the square on the crankshaft, on which the eccentric assembly will run (**photo 50**). Since this square controls the timing, it must be square to a line between the crankshaft and the crankpin.

Working out from the eccentric, we have the eccentric rods, seen here in **photo 51**. These are made from flat section steel, silver soldered together (**photo 52**). These seem a little crude, but are reasonably close to the prototype. The eccentric rods connect to the valve rods via a small casting (as in **photo 53**). The thread and nut allow adjustment of the valve bobbins. The red bits are 3D printed parts allowing the assembly and testing of the valve operation (I keep thinking that it's so simple, I must have missed something...).



A set of parts for the valve gear.

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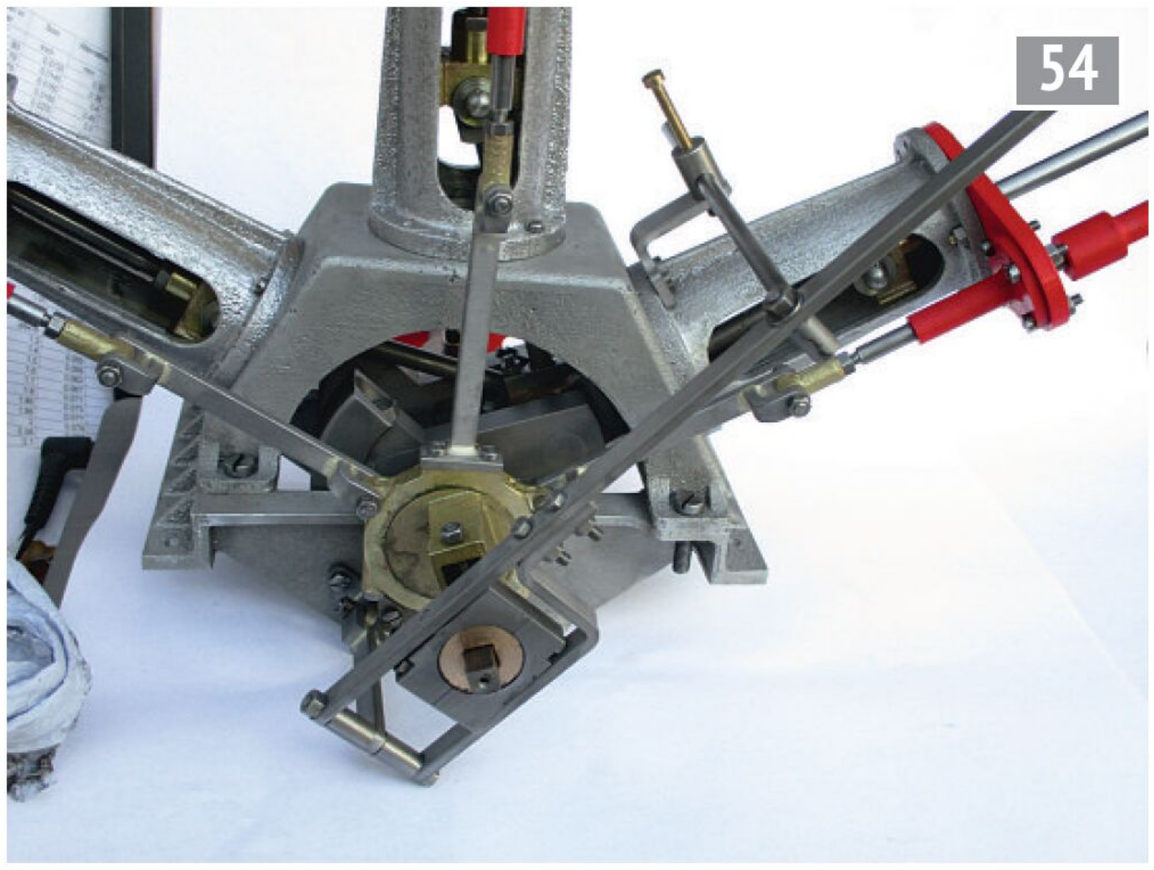


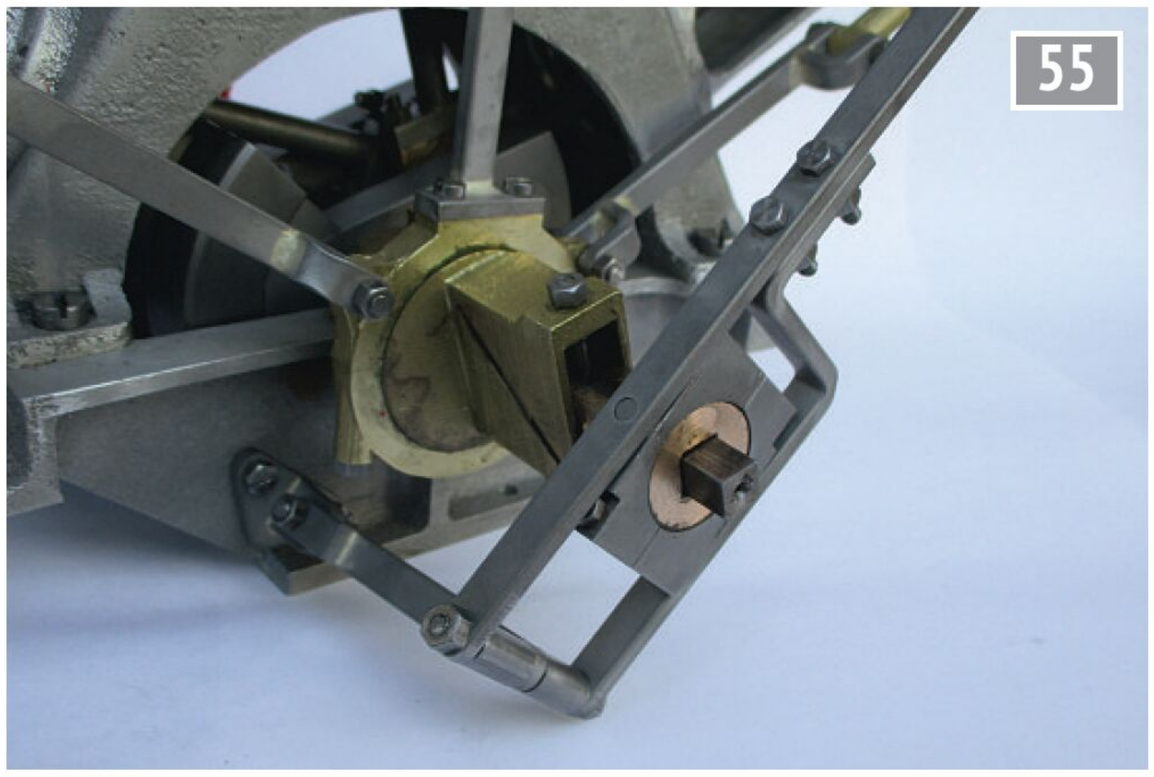
The valve control linkage.

A cast iron valve liner.

Valve rod guides and gland nuts.

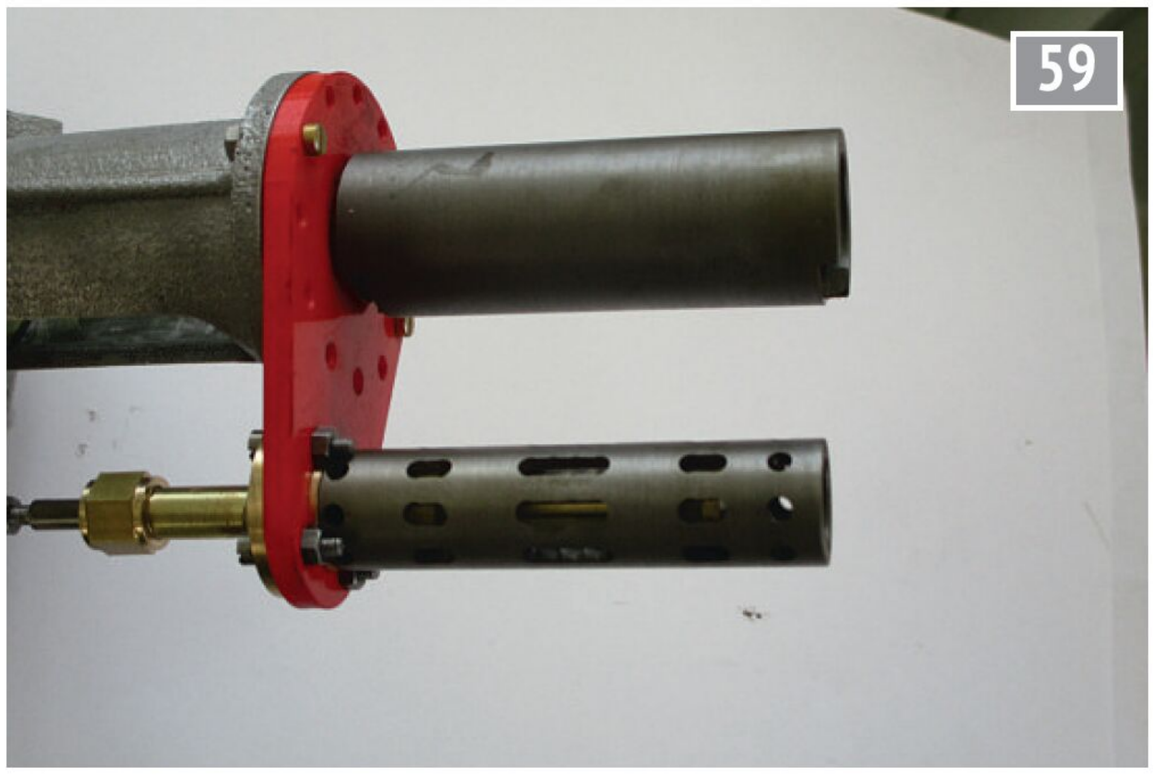
Finally, for this section, we have the valve control linkage in position, shown in **photos 54** and **55**. The control lever pivots on the triangular bracket on the lower left corner. It locates on pins either side of the yoke which runs on the end of the eccentric assembly. Moving the lever in and out shifts the eccentric from side to side, with fully in being full gear clockwise, fully out is full gear anticlockwise and neutral at the mid point, with points in between giving various degrees of expansive running. The rod towards the upper part of the control lever allows the control lever to be clamped at the required position.

The prototype in the video has the control lever mounted vertically, with a pivot on the central web of the base (if you look at the video, you can see the clamp rod hitting the crosshead...), but I have a drawing of another Ward radial engine which uses the layout I've used, with the triangular pivot bracket and the lever at about 45 degrees.



A closer view of the valve control.

Piston valve.



Piston valve assembly.

Valves

I originally intended to use lost plastic gunmetal castings for the valve pistons and liners but it struck me that there'd be a good chance of galvanic corrosion between the liner and the aluminium casting, so plan B involves a cast iron liner with ports milled in (**photo 56**). The piston stays as gunmetal, with cast iron piston rings (**photo 57**).

The last part of the valve assembly is the valve rod guide with gland nuts (**photo 58**). In **photo 59** you can see the original 3D printed guides replaced by the new brass guides (with a sneak preview of the cylinder liner!).

A final check of the valve operation (I still think it's too simple to work...) and time to move on to the pistons.

●To be continued.

Another Steam Plant PART 4

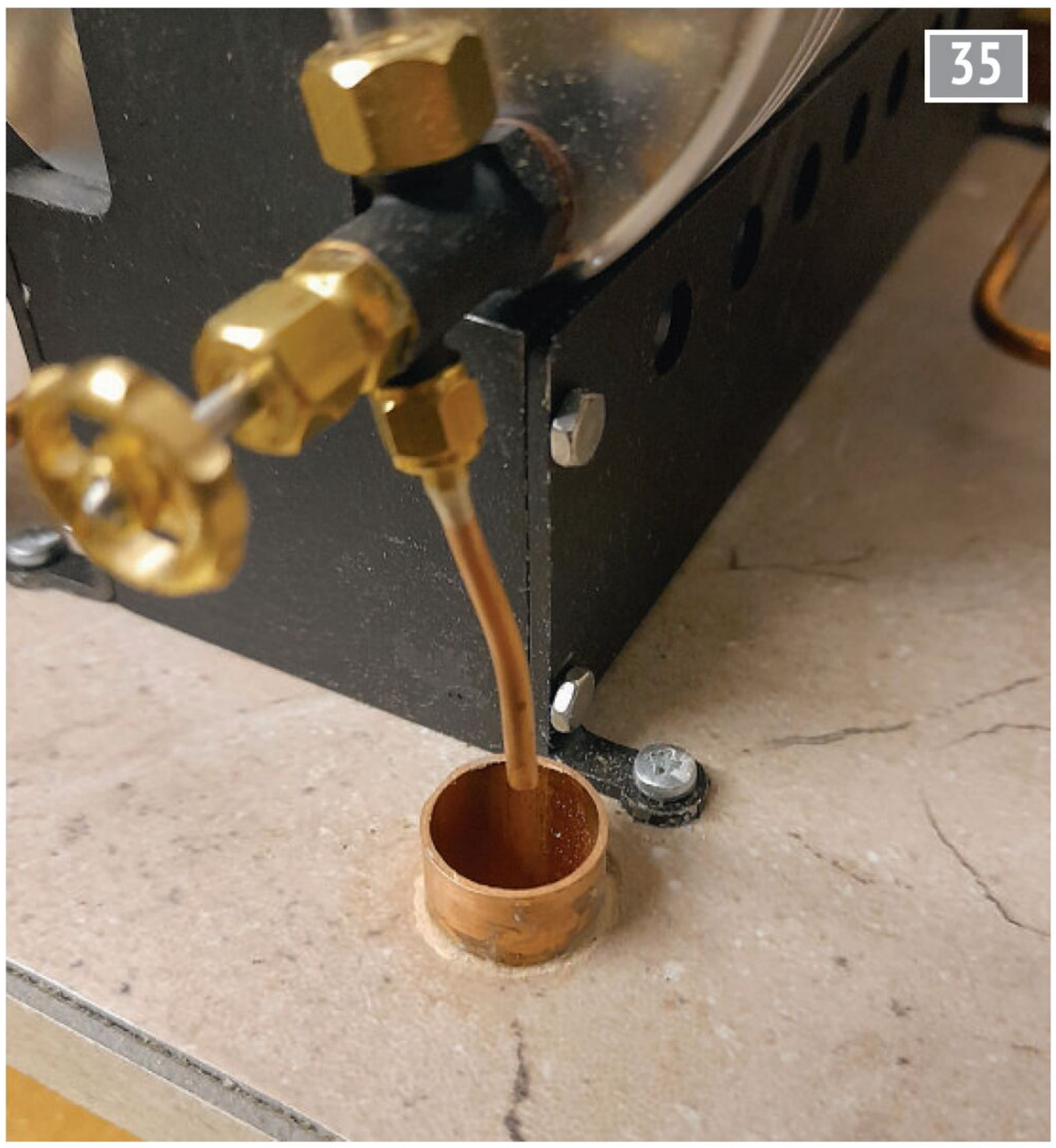
Ian Beilby builds another steam plant, this time with an electrically 'fired' boiler.

Continued from p.776
M.E.4757 November 29

In the previous part of this article on the assembly of a model steam plant with an electric boiler, all the components that were assembled and tested on the dummy board were dismantled and re-assembled on the part-finished base shown in **photo 34.**

You can see the surface of the base board has been covered in a vinyl tile which should be easy to clean and stop any water from soaking into the base. The dynamo can be seen fixed in place to the right of the engine fly wheel and a 12 volt led lamp has also been included. The drains for the boiler blow down valve and condenser have been fitted as shown in **photos 35** and **36.**

The electric boiler plug and lead (photo 34) will eventually be plugged into the voltage regulator when fitted in place.



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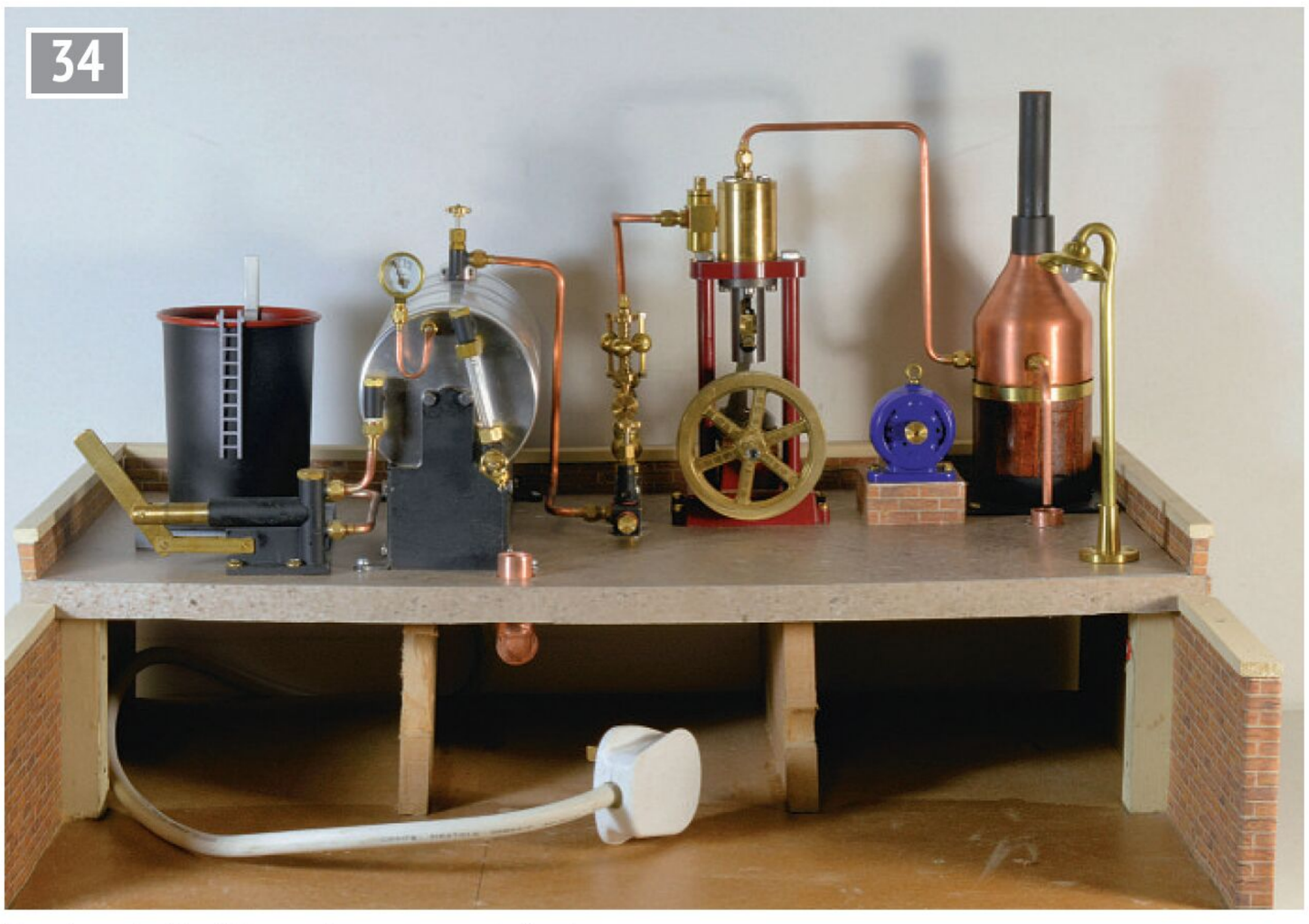
Boiler blow down drain.



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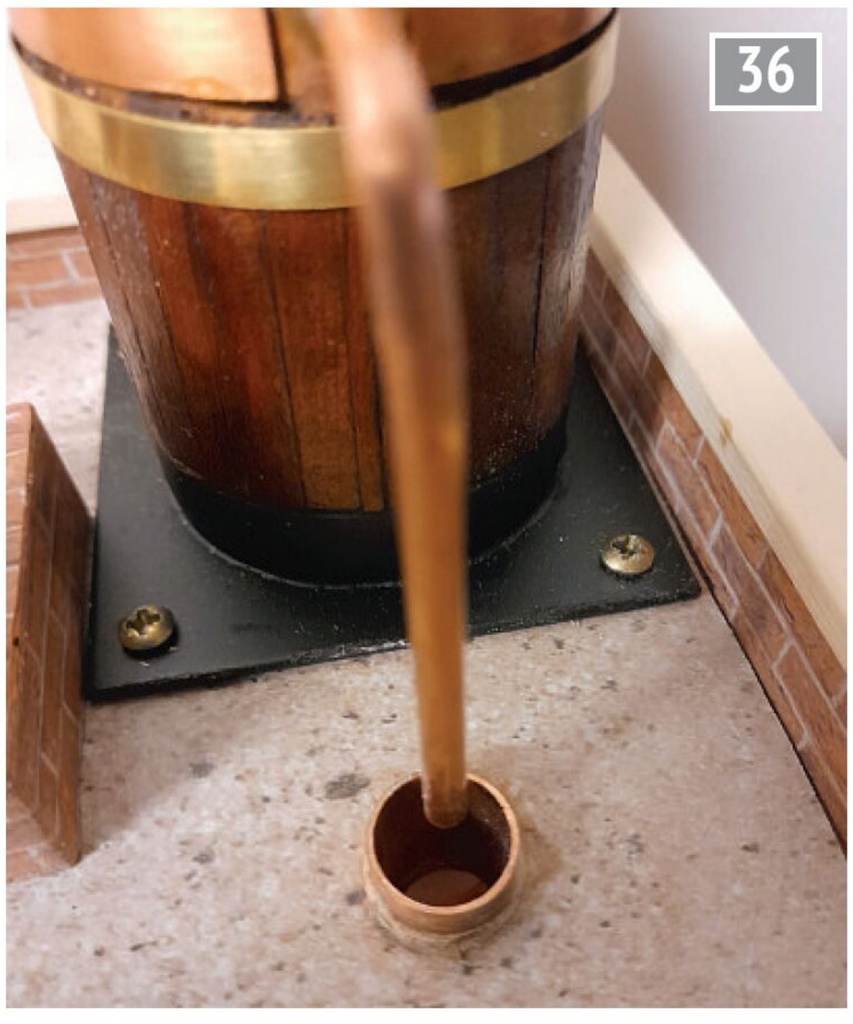
Baseboard with all the major components in place.



36

Condenser drain.

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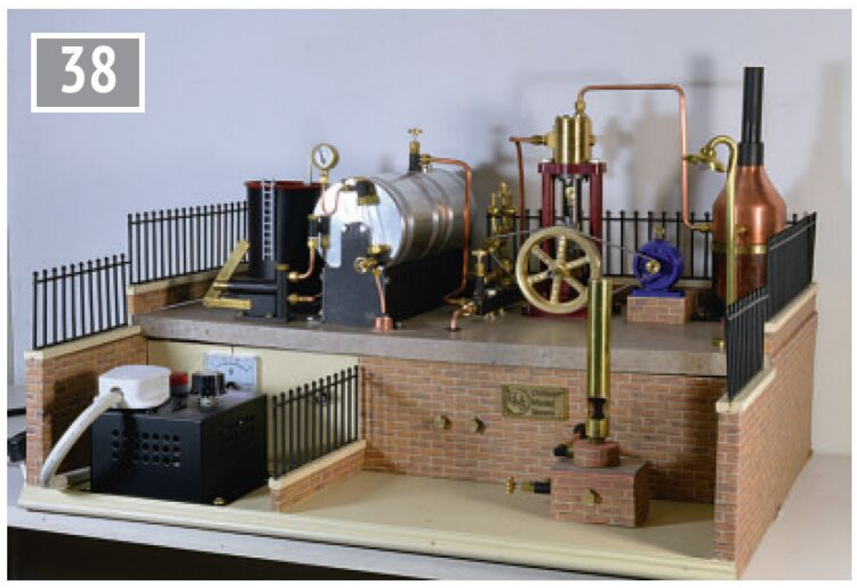
Pulleys for the governor and dynamo.

The whistle and (to the left) a couple of steam outlets.



The complete steam plant.

Boiler control and dynamo voltmeter.

The electrically heated boiler.

The engine and condenser.

The governor (left) and the dynamo.

The condenser with its lid off.

In **photo 37** you can see the two small pulleys for the governor and dynamo have both been lined up parallel to the two groves on the fly wheel. This configuration should allow the engine to drive the accessories one at a time or both together. The addition of a governor and dynamo are interesting from an engineering and educational perspective. Both items show how steam power can be controlled and put to a good practical use. I am sure teachers, engineers and physicists would all find that there are a number of experiments and calculations possible, regarding the efficiency of the boiler, the power consumption and also monitoring the effectiveness or otherwise of the accessories!

In **photo 38** you can see the finished plant. You will also notice I have included a steam whistle which has been connected to the steam turret adjacent to the boiler. Often regarded as a novelty and wasteful of steam, they are, however, a traditional accessory associated with a steam engine and make for another interesting feature.

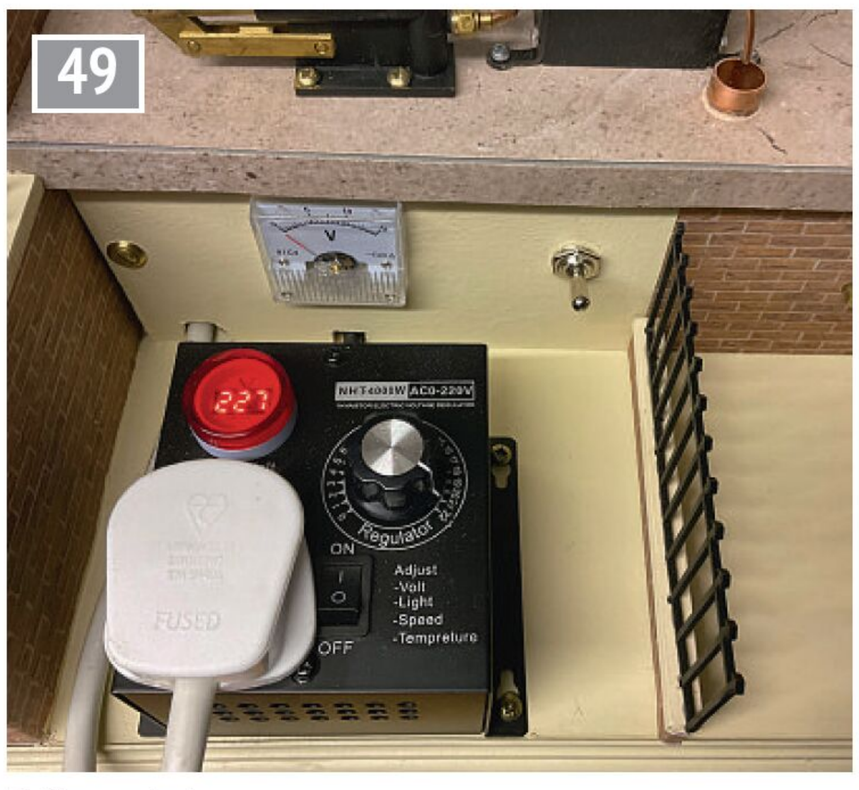
The lower section of the base unit is shown in **photos 39** and **40.** You can see the voltage regulator that I have also included, along with an analogue DC voltmeter, provided to see the electrical output of the dynamo with the engine running at different speeds. A switch for the lamp is also included. I mentioned previously in the article that I also wanted to provide some means of connecting other steam driven accessories or perhaps another small engine

Boiler filling accesories.

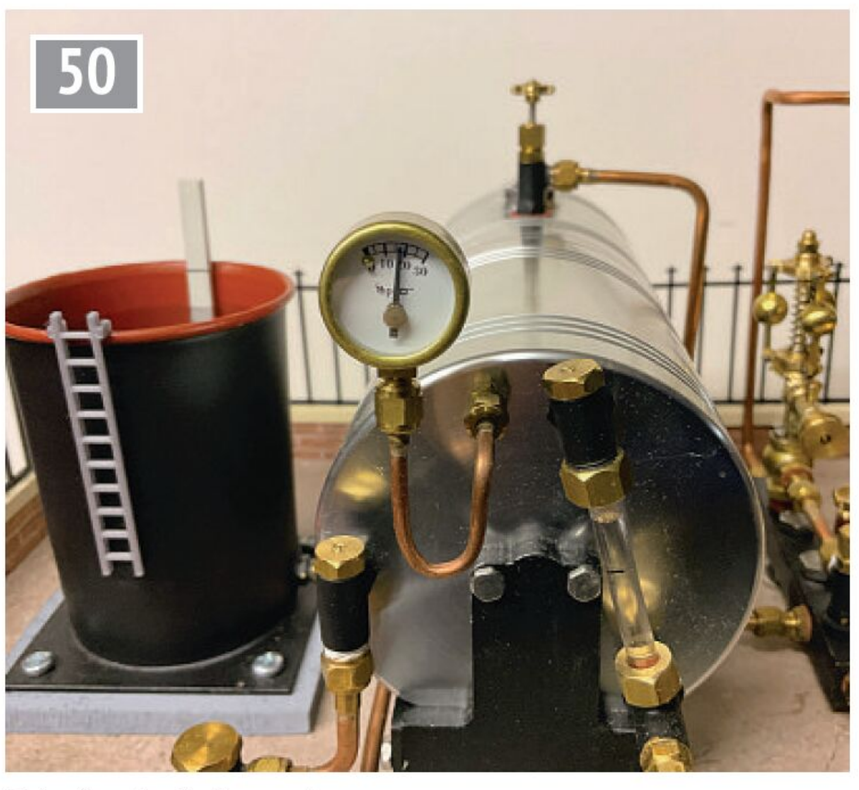
Water gauge showing a full boiler.

The auxiliary water tank.

The lubricator.



Boiler control.



Bringing the boiler up to pressure.

in the future. With this in mind I have provided two blank steam outlets on the front board.

Different aspects of the plant before firing the boiler are shown in **photos 41** to **44.** In photo 44 you can see the condenser with the funnel cover and chimney removed. Although the condenser is emptied of wastewater whilst running the plant, the cover should be removed, and the condenser thoroughly cleaned at the end of each running period.

The boiler should be filled with approx. 400ml of distilled water which is more than sufficient to cover the element in the boiler. The boiler filler plug is situated in the back of the boiler but it is not as easy to fill as it would be with a filler plug mounted on the top of the boiler. I found that using a small funnel and flexible pipe (**photo 45**) helped to make it much easier to fill the boiler in a controlled manner. Whilst filling the boiler, the water gauge should be checked and when the boiler is nearly full the gauge should read as shown in **photo 46.** In **photo 47** you can see the auxiliary water tank which should also be filled, ready for topping up the boiler whilst running. The steam oiler should be filled with steam oil (which is different from normal lubricating oil) and the bearings of the engine and moving parts lubricated with a lighter engine oil (**photo 48**). The voltage regulator can then be switched on at full power as can be seen in **photo 49.**

The boiler should be found to raise steam in around ten minutes. A close eye should be kept on the boiler pressure gauge which should start to blow-off at around 20psi (**photo 50**). When up to full working steam pressure the boiler and turret valves should then be opened and the engine should be found to start running. At this stage the voltage regulator can be adjusted and the voltage lowered. With the engine left running, the performance of both the boiler and engine can then be monitored. I initially ran ≫

The engine running under steam.

Electricity under generation.

the engine for quite a while on its own before attaching the driving belts to the fly wheel and accessories.

In **photo 51** you can see the steam governor being driven by the belt from the flywheel. Normally this design of governor would be fitted directly to the steam inlet port of the engine, however with a vertical engine this is not possible. The engine flywheel which drives the governor is positioned too far away. Attaching the governor to a separate steam turret provides a practical solution.

In operation, the faster the engine runs the farther the fly-balls spin out and in doing so reduces the amount of steam allowed to pass through the governor valve into the engine. When an extra load is placed on the flywheel, the fly-balls of the governor can be seen to visually respond. As the engine and flywheel slows, the fly-balls drop and in turn the governor allows more steam to pass through the governor valve into the engine, speeding up the engine and flywheel. The governor is very well made and I found it is possible to make slight adjustments to it, enabling it to maintain a regular set speed. The bearings and gears of the governor should also be lubricated before and whilst being run.

Employing bevelled gears, the governor is rather noisy in operation. However, a centrifugal governor is a most interesting and ingenious invention and well worth demonstrating on a steam plant. It is most satisfying to see the operation of the governor when placing and removing even a small load on the fly wheel.

With the dynamo connected to the flywheel as shown in **photos 52** and **53**, any adjustment to the speed of the engine is immediately recorded by the voltmeter. The voltmeter could be regarded as a rev-counter or speedometer would be on a car! A comparison between the engine just turning over or running at a reasonably high speed produces a voltage range from 1 to 15 volts.

Finally both accessories were connected to the flywheel as shown in **photo 54.**

As you would expect, with two accessories in use, increasing the load did not only slow the engine, but the boiler required more water and a higher temperature to drive both accessories at once.

When running the plant and operating both accessories at once there is a lot happening, and a constant eye has to be kept on the boiler water level and steam pressure. I was, however, very impressed with the performance of both the engine and boiler.

The boiler is more than capable of powering a single cylinder engine under light load, or possibly a twin cylinder engine on its own, however anything requiring more steam power would, I feel, require a larger boiler and therefore a larger and perhaps less portable board would be necessary.

The plant's adaptability and ease of access means the engine and accessories can easily be changed or modified without the need for another boiler and drastic changes being made to the board.

The electric boiler is very convenient to operate and easy to use; you can raise steam in less than ten minutes. Once steam has been raised, the voltage controller can then be turned down, depending on how much steam is required to drive the engine/accessories. The boiler must not be used if the water level drops below approximately one third i.e. 150ml of water, otherwise the boiler will be damaged. For this reason I would strongly recommend that an ancillary boiler water feed tank and boiler water gauge are essential accessories with an electric boiler. The ease with which the boiler can be fired can lead to longer continuous running periods, which, if overlooked, could lead to the boiler running dry. *This is to be avoided at all costs.*

The only drawback I find is that owing to the boiler's construction and internal design, the boiler is difficult, if not impossible, to fully empty after running. The boiler is, however, easy to remove from its steel support base and I would recommend after running it for a couple of months, the boiler be removed, dismantled and cleaned.

This has been yet another most interesting and rewarding project, none of which is beyond the scope of the average enthusiast with a minimum of tools and equipment. The wiring of the electric boiler, though straightforward, is perhaps the only task that I would advise and recommend should be performed - or at least checked - by a qualified electrician.

As with my previous article on the steam plant that I built last year, this article is aimed at the beginner without either the time, skills, experience or equipment to make an entire steam plant from scratch.

Hopefully these two articles will further encourage others like me to enter the world of the model steam enthusiast. Buying a suitable boiler and constructing a steam engine from a kit is a wonderful way to start on what is a rewarding and highly educational project, both mentally and practically.

The design, budget, size, features, time and finish of the plant are left in your hands and entirely up to you.

ME

An output of 12V is observed on the voltmeter.

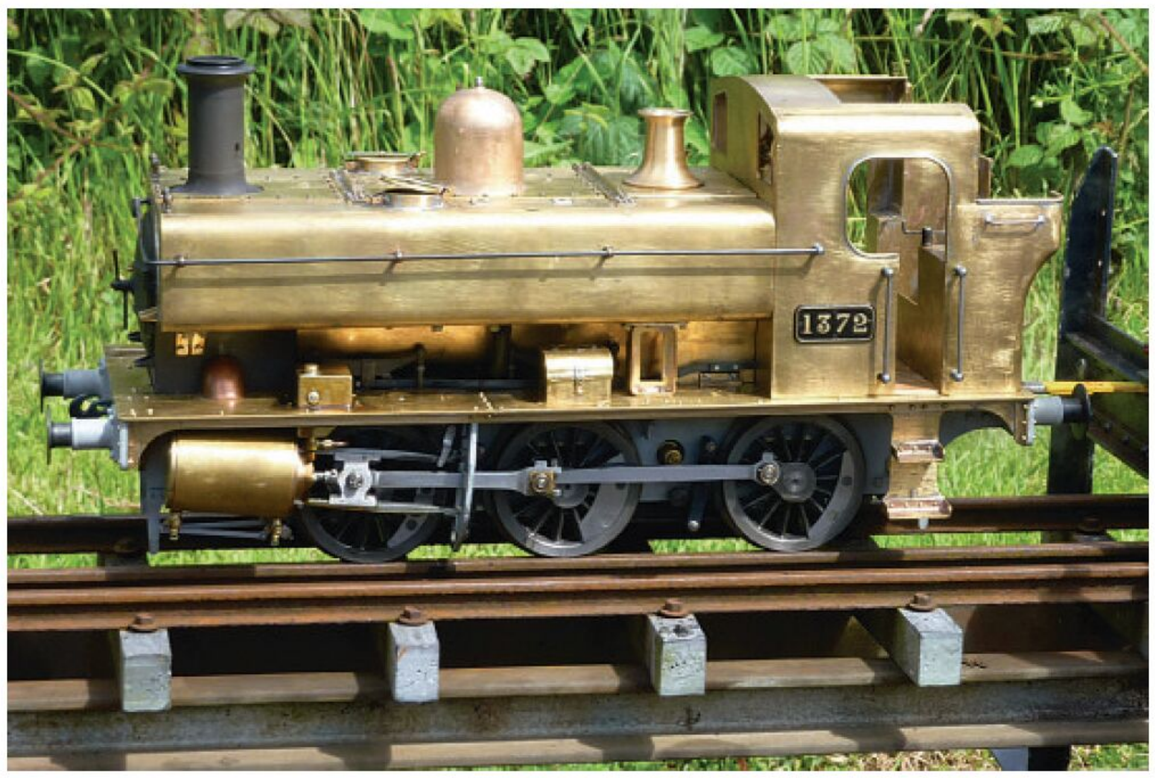
The governor and dynamo share the flywheel.

A GWR Pannier Tank in 3½ Inch Gauge

PART 7 – WHEELS AND THINGS

Gerald Martyn decides to build a locomotive that he can lift.

Continued from p.755
M.E.4757 November 29



Time to start on the bits that allow the engine to move, and make some swarf! This will be a long-ish process as the assembly should not be attempted until all parts are available. This is because we need to make the parts fit to each other and the connecting rods will be used to position the axlebox holes at the correct distance apart. This sort of gathering of parts followed by a great leap-forward assembly happens a few times and can be a bit frustrating, but is the best way to do things. The wheels are made from Rob Roy castings, which do a pretty good job except for the number of spokes. Perhaps, if this design proves popular, our suppliers could come up with something better, but I'm happy to make do for now.

Rob Roy wheels have cast-in balance weights, an often non-prototypical nuisance that I abhor. Apart from anything else they inhibit the proper machining of a simulated wheel to tyre step, and they are also the wrong shape for 1372 (and Rob Roy too, so far as I can see!). To get around these problems the weights are machined back when the wheel-tyre step is put in and representative laser-cut facing plates are fixed over them. This makes for a much more realistic wheel than retaining the cast-in weight - and for very little extra effort.

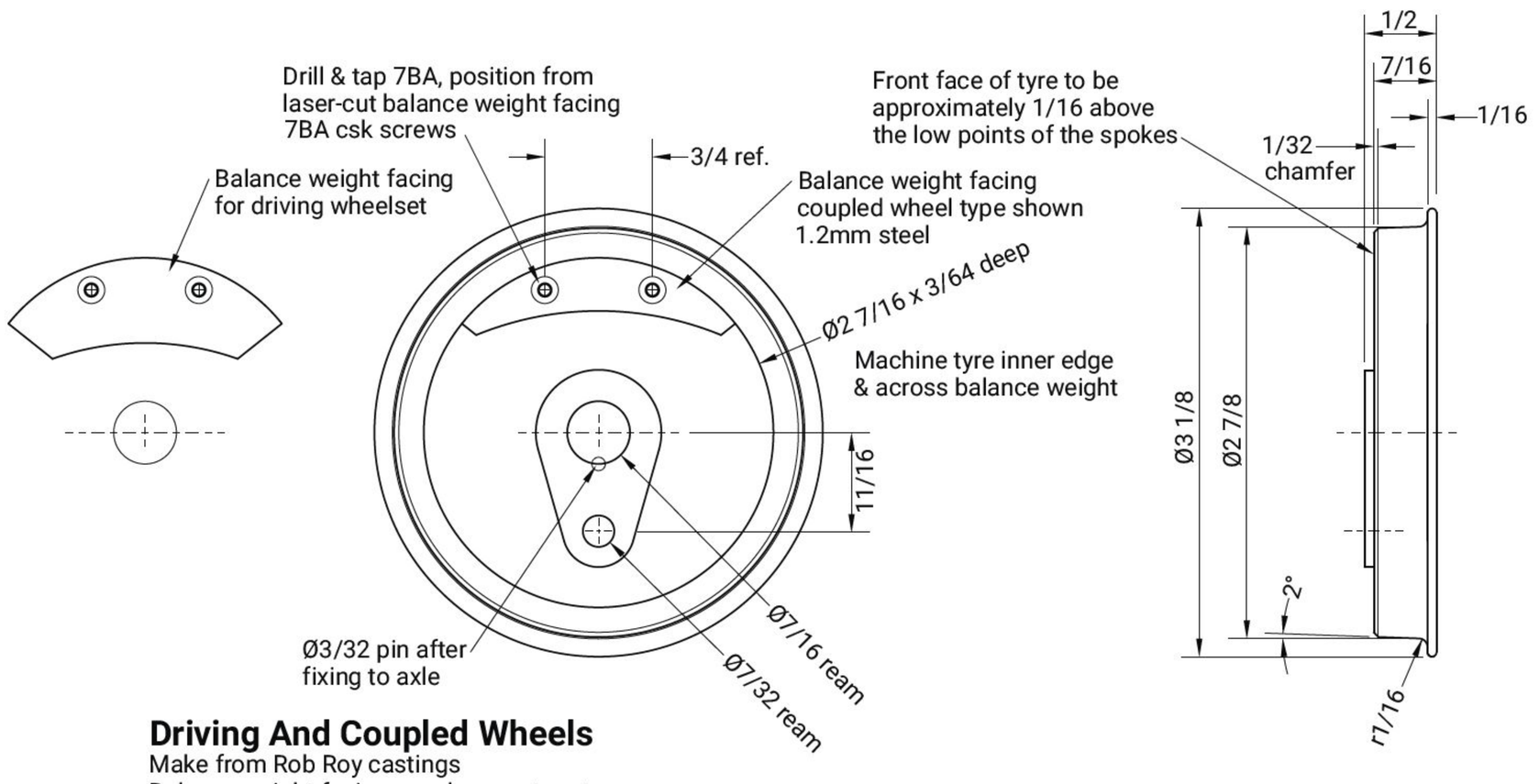
At this stage, then, it's time to order Rob Roy wheels and the ground mild steel for the axles, and some steel for the eccentrics, crank pins and collars, and Rob Roy axlebox castings. To make a decent set the laser cut parts list includes, ahead of immediate need, the coupling and connecting rods, and is tabulated in **table 2**.

Table 2

Title	M.E. Laser Part No.	Material	No. Required
Coupled Wheels Balance Weight	26270	1.2mm Mild Steel	4
Driving Wheel Balance Weight	26263	1.2mm Mild Steel	2
Axlebox Keep	26264	2mm Mild Steel	6
Axlebox Keep Packer	36981	2mm Mild Steel	6
Connecting Rod	26265	6mm Mild Steel	2
Bearing Sideplates	26260	0.5mm Brass	4
Rear Coupling Rod	26261	6mm Mild Steel	2
Front Coupling Rod	26262	6mm Mild Steel	2

Laser cut parts for wheels etc.

Fig 13

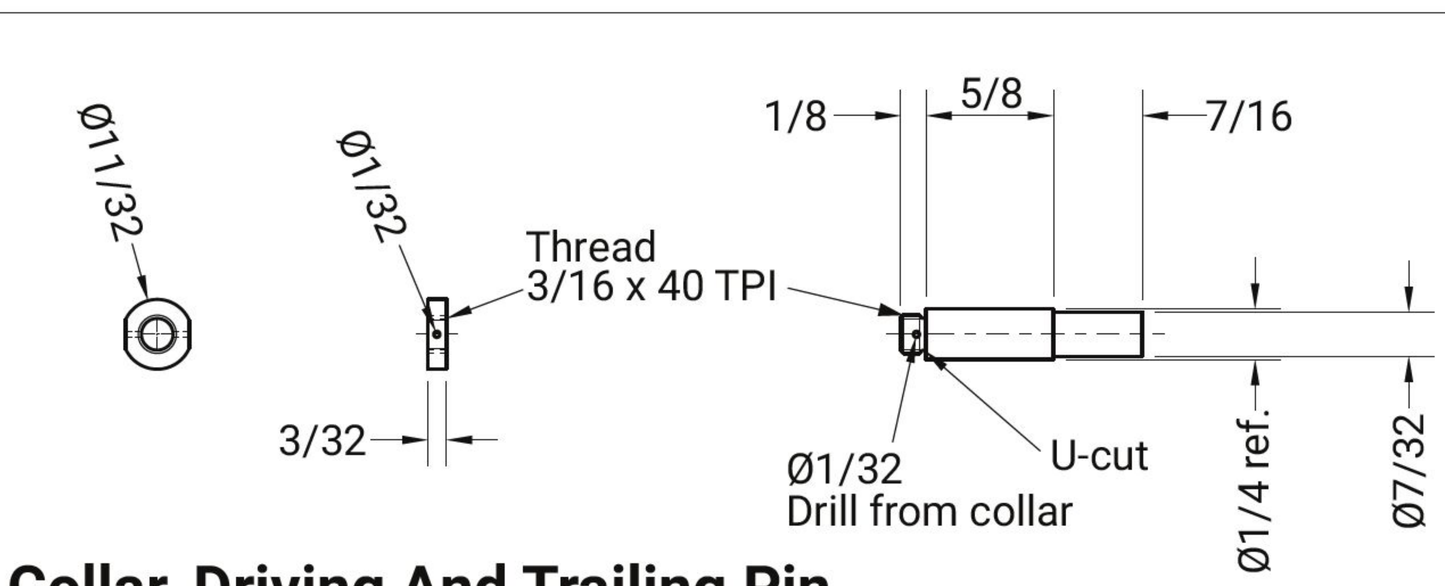


Driving And Coupled Wheels
Make from Rob Roy castings
Balance weight facings are laser cut parts

Wheels.

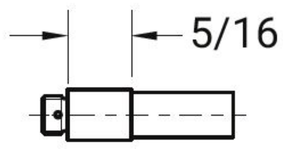
Figure 13 shows the wheel drawing. I find turning cast iron is gently satisfying but rather dirty. At fastest back-gear speed (about 150 RPM) there is a nice smooth hissing sound and the chips don't fly too far. The hazards of chilled iron hard skins, too, have largely been eliminated by tungsten carbide tooling. I've found the easiest way to turn wheels is to grip them by the flange in the four-jaw chuck with just enough protruding to allow the whole front of the wheel to be finished (**photo 29**). This may look precarious but I've done a lot of wheels this way and only resorted to other methods when the wheel is too large for the chuck. I will add, though, that I do the chuck up good and tight and take small cuts (0.2mm or less deep normally). Done this way everything that

Fig 14

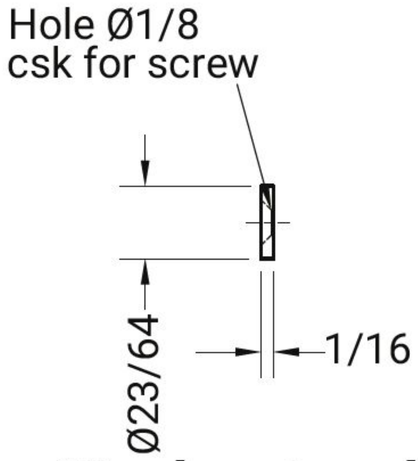


Collar, Driving And Trailing Pin
Mat'l:Mild steel
4 req'd

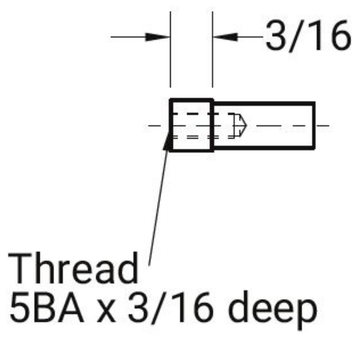
Driving Crank-Pin
Mat'l: Ø1/4" silver steel
2 req'd



Trailing Crank-Pin
Differences to driving crank pin
2 req'd

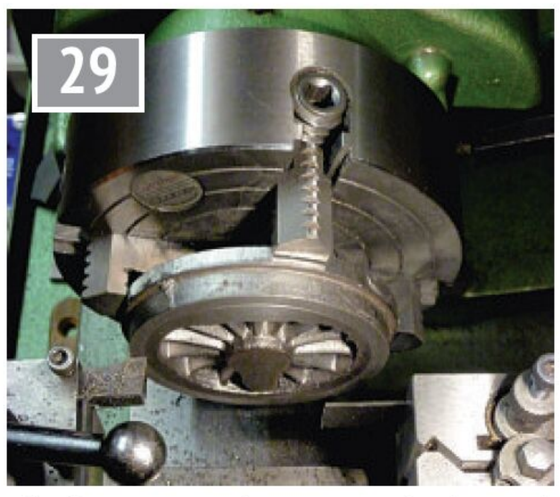


Washer, Leading Crank-Pin
Mat'l: Mild steel
2 req'd

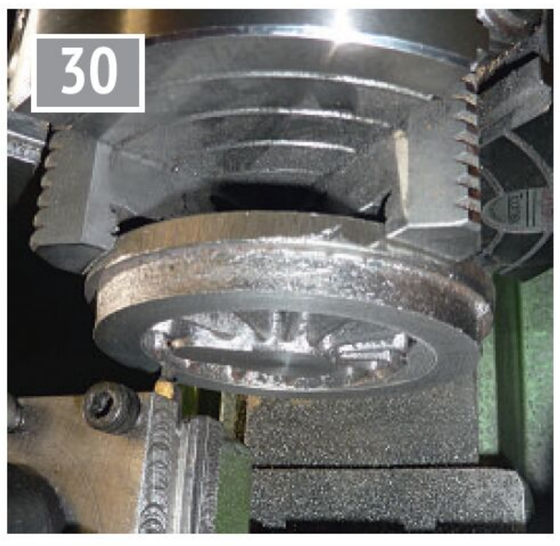


Leading Crank-Pin
Differences to driving crank pin
2 req'd

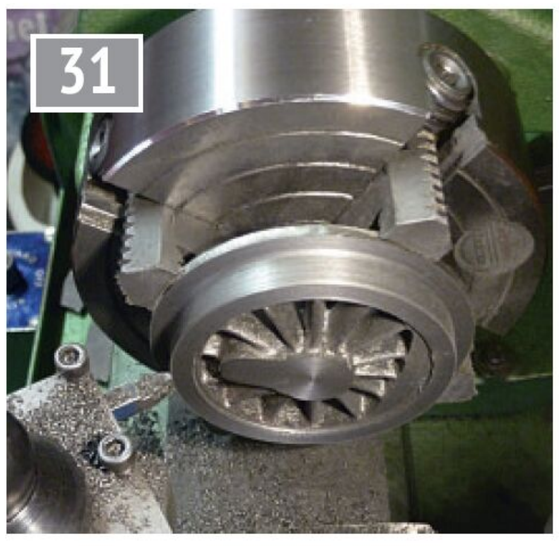
Crank pins.



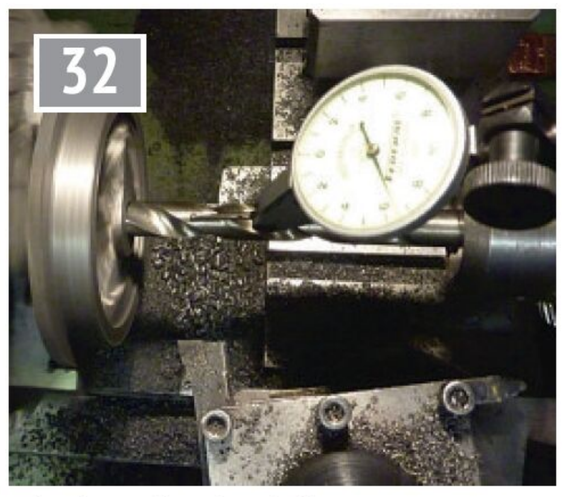
The first cut is taken across the front of the wheel.



Taking a cut on the inner edge.



Turning the tyre and flange.



Checking that the drill continues to run true.

matters - the axle hole, the tread and the flange - can be made true and concentric. If you feel this is unsafe then just resort to the methods in the Rob Roy build book or otherwise previously written.

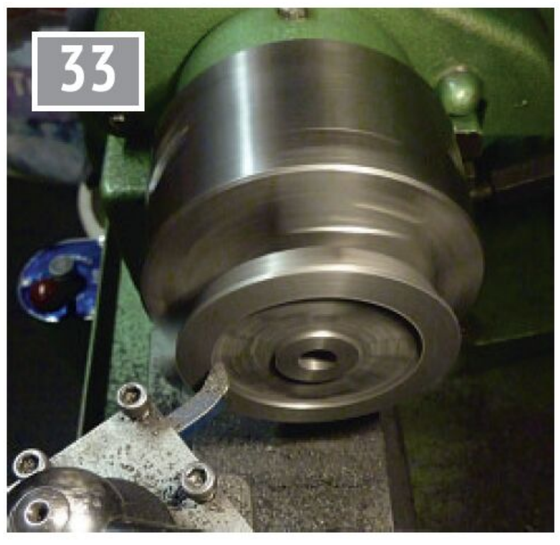
For my method, set the wheel in the four-jaw chuck against some suitable thickness packers to run flat and true by eye using the inner edge of the rim as a reference. The packers MUST be removed before starting the lathe, no matter how tight they may seem to be. The outward face of the rim should be turned such that when the tyre inner edge is put in at 3/64 inch depth it will just clip into the blend radius of the spoke. For the inner edge I use my HSS universal tiny undercutting tool that I originally made to cut undercuts and small radii, which has just enough clearance to do this semi-boring job too (**photo 30**). Whatever tool is used, it needs to be narrow to minimise cutting forces during what, because of the balance weights, will involve some intermittent full width plunging cuts. Cut across the weight to the same depth as far as can be done without clipping the crankpin boss, finally finishing the weight by taking short cuts, pulling the chuck round by hand. Cut back the boss to height, turn the tyre and flange face (**photo 31**) and cut the little chamfer on the tyre corner. Tip; before starting set the top slide to 2 degrees and wind firmly to its forward stop. Now turn the tyre rim back to the flange using the saddle handwheel and when enough has been done to accurately measure and set the tyre width and with the tool at the rim, tighten the saddle clamp. Wind the tool out using the cross and top slide and now cutting down to the tyre diameter can be done without any danger of going too far into the flange. When putting the hole in, there are sometimes problems with voids and hard spots which can push the drill off centre. It's good practice to check using a dial gauge against the drill with the lathe running (**photo 32**). The hole can be trued up if necessary, using a small boring tool, before reaming to final size. To finish the wheel, then grip by the tread in the three-jaw chuck with the wheel against the jaws (**photo 33**) and machine to thickness, clean up behind the spokes and get the flange to diameter. If filing the flange radius (carefully!) then it may be necessary to move the wheel out a bit and here a little bit of wobble will not make much difference. Finally, the gaps between the spokes will probably need cleaning up with a needle file or a mini-drill grinding bit.

Swarf? After all six I managed to catch 800g of swarf for 1300g of finished wheels. Some swarf got away!

The crankpin holes come next and it's most important that they are all at the same radius from the centre. The best way to do this is with a little jig with a short spigot to fit in the wheel centre and a hole to locate a pilot drill at the right radius. For just six wheels it doesn't need any special treatment or hardening and **photo 34** shows mine, which has a couple of extra holes from previous use. I specify a reamed hole in the wheel but if the slightly unusual size is a financial or logistical challenge then just use a drill and make the pins to fit if the hole happens to be over or under size.

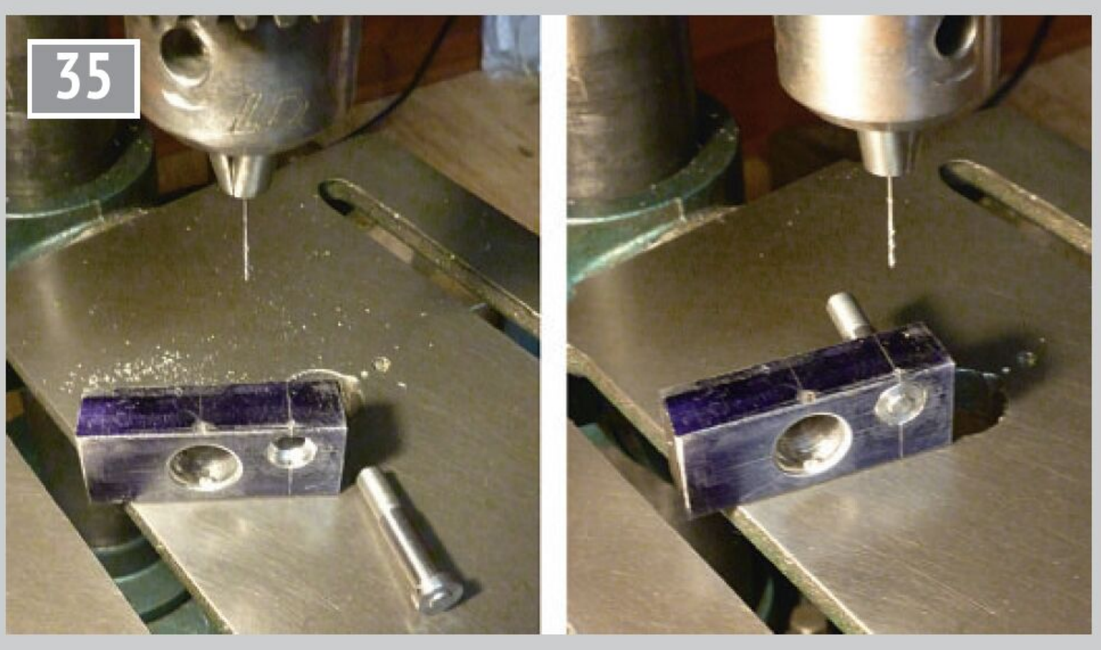
The last job is to fit the balance weight facings, which come as laser-cut parts. Use a filler to hide the screw heads after assembly.

The crankpins (**fig 14**) are similar to Rob Roy and are straightforward lathe-work on 1/4 inch diameter silver steel, with mild steel collars. The accurate 1/4 inch polished diameter forms the bearing surface so try not to damage it. Concentricity between this diameter and the 7/32 inch spigot is important and the three-jaw chuck is unlikely to be good enough. Use collets or the four-jaw chuck to get the bar running true. Pins can be made as a press fit into the wheels, or use a high strength Loctite such as 603. Before fixing, though, turn the four retaining collars for the driving and rear coupled wheels from mild steel, screw them on and drill the retaining pin holes through. Cross drilling is one of those things that needs a bit of tooling to make a decent job of it. I use any handy scrap bit of rectangular steel, with two holes intersecting at right angles; one to locate the collar and crankpin and the other to guide the drill. **Photograph 35** is a composite shot showing the tool and pin separate (left) and ready for drilling (right). This is another piece of steel



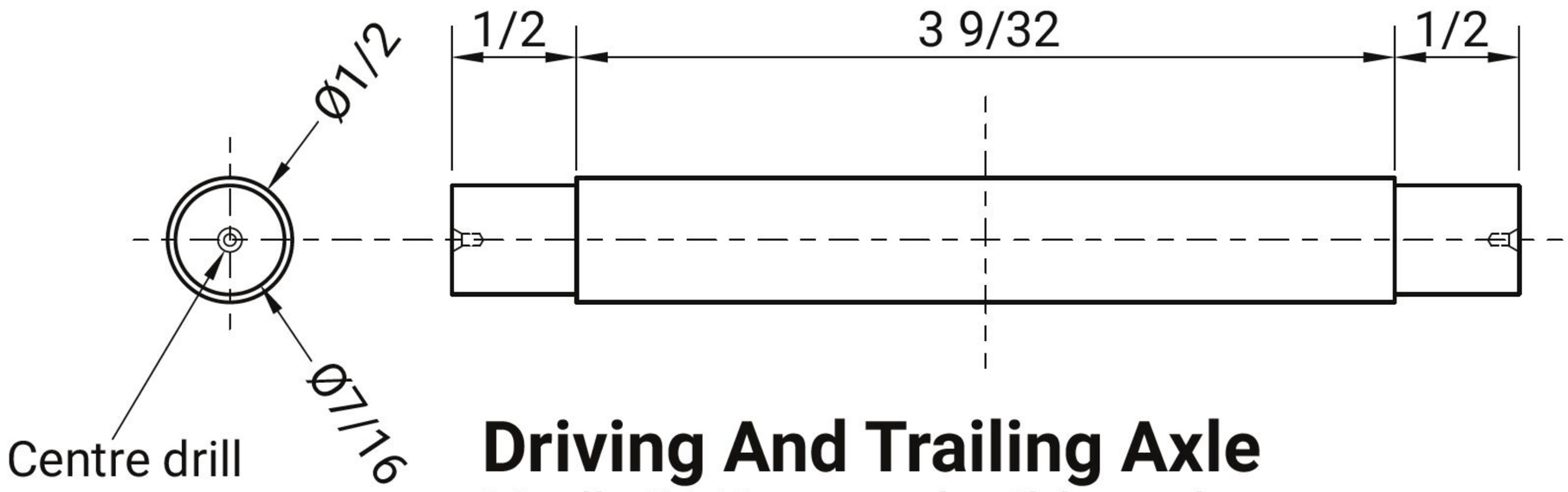
Finishing the wheel with a cut across the back.

Using a jig to locate the crank pin hole.

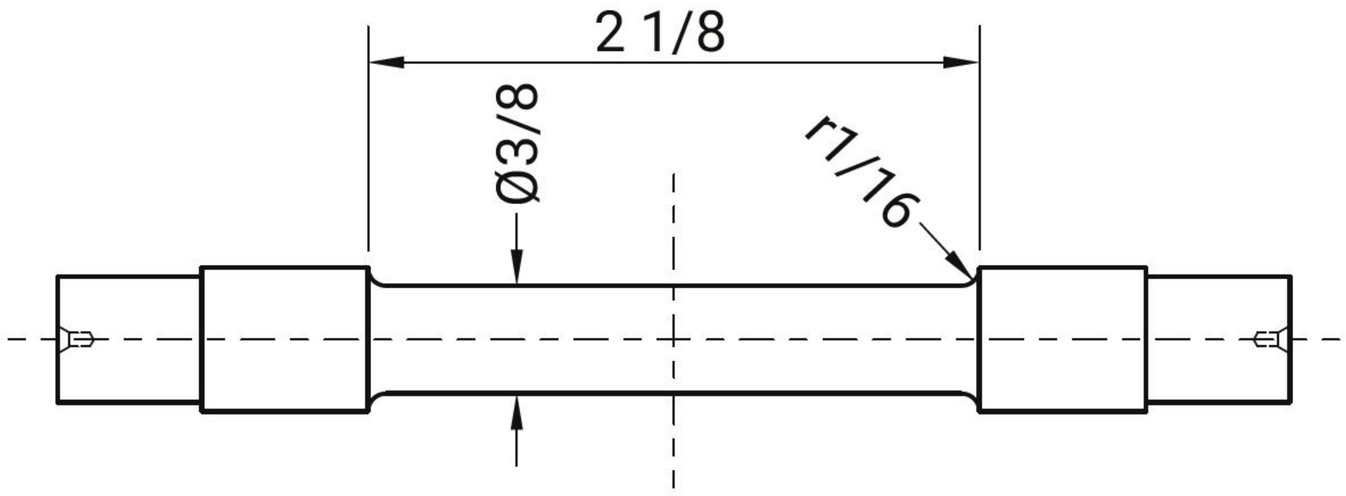


Cross drilling jig for the crank pin collars.

Fig 15



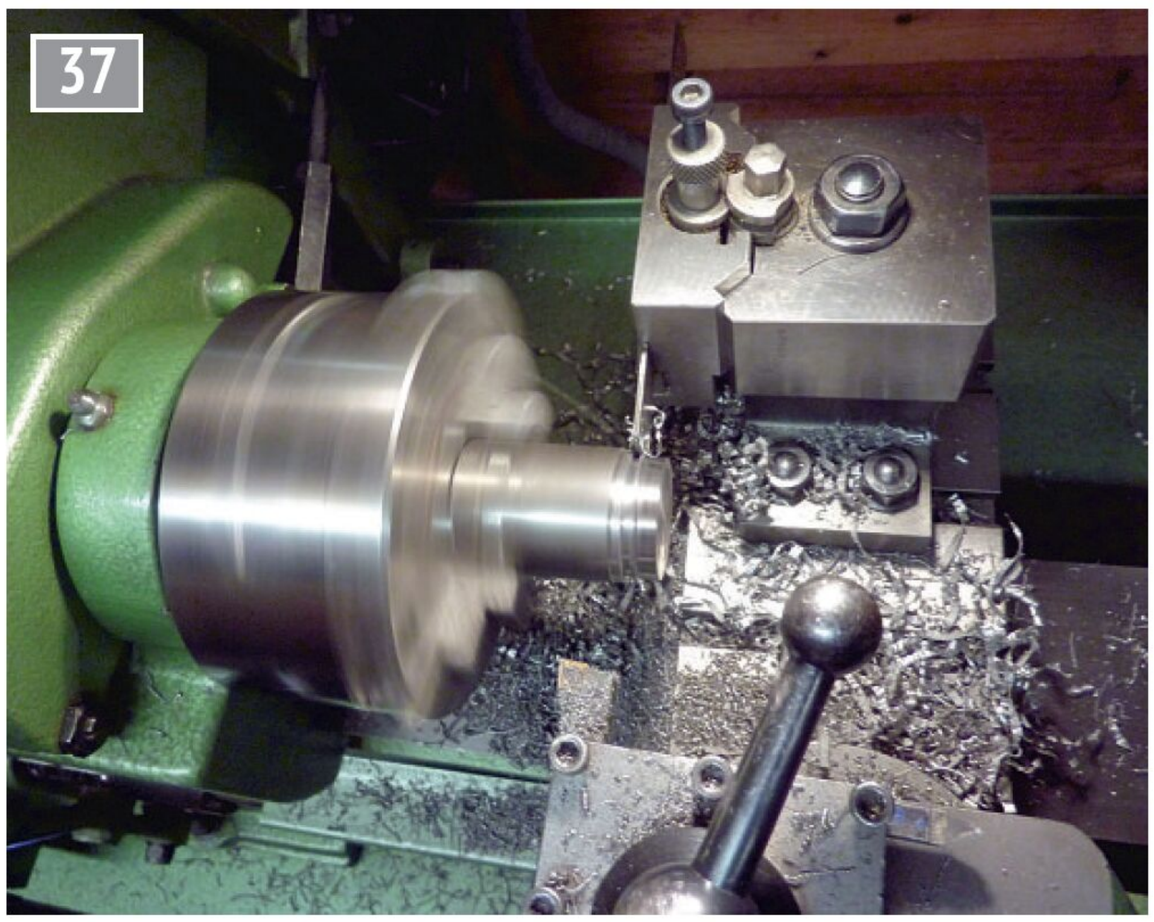
Driving And Trailing Axle
Mat'l: Ø1/2 ground mild steel



Leading Axle
Differences

Axles.

A set of six finished wheels.

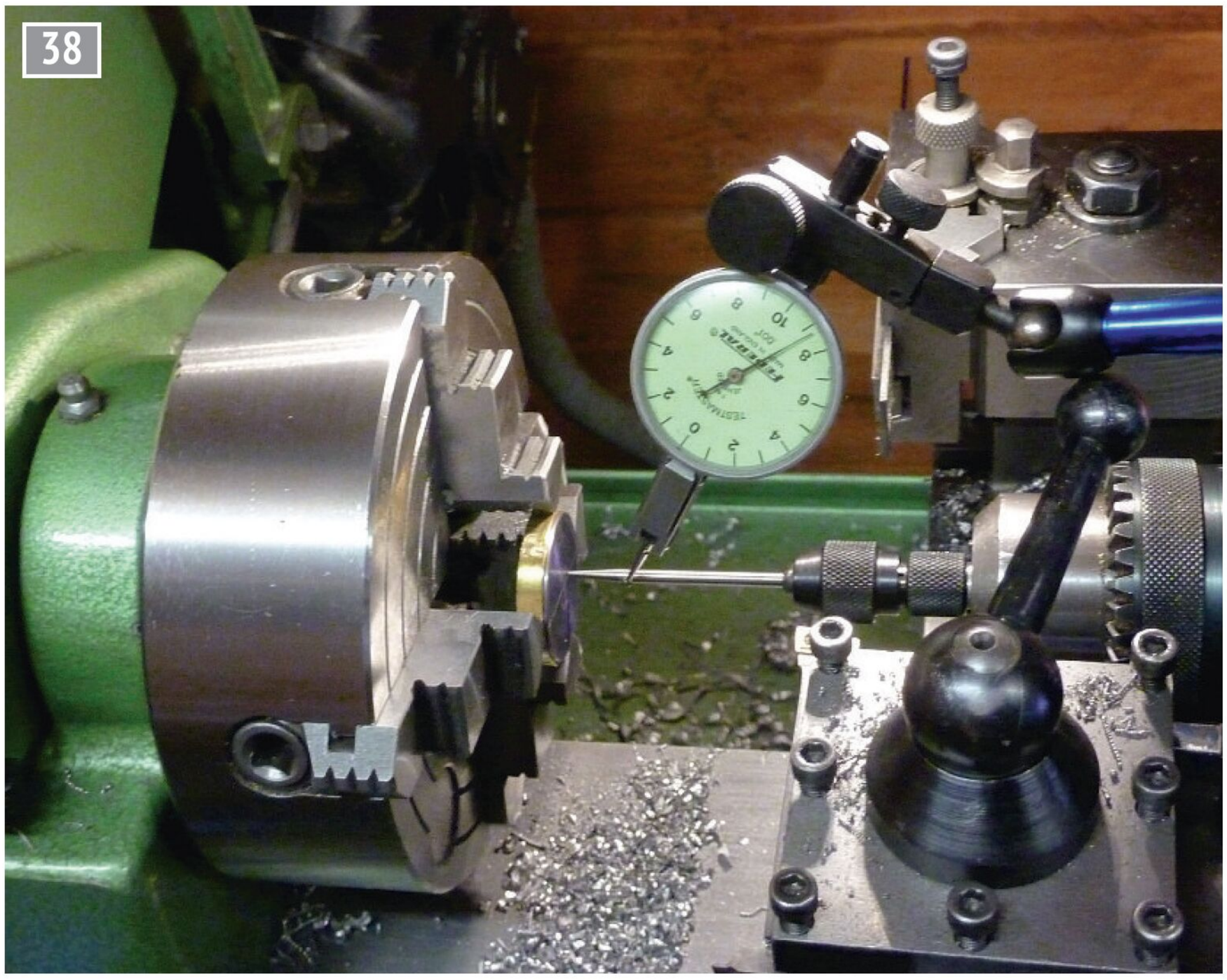


Parting off the first eccentric.

with prior history. The little hole will start in the right place but may well wander a bit so it's best to keep each collar and pin as a set. The locking pins need to align radially when the crankpins are assembled to the wheels, but with not too much accuracy if photographs of the originals can be believed. Finally, file the two little flats on the collar diameter. The retaining pins are parallel and retained (again) with Loctite on final assembly. Broken drill shanks are a handy source for these, but split pins are best during build to ensure security but easy removal. If all this looks too challenging then just retain the collars with Loctite (Threadlock 243, say) on final assembly, as will have to be the case anyway for the front coupled wheels where a countersink screw is needed.

The finished wheels are shown in **photo 36**. Mistakes I made …? One axle hole is too large, due to drill wobble so the axle will be made to suit, and one wheel flange is 0.03 inch undersize (oops!) so will be used on the rear axle.

Axles (**fig 15**) are made from accurately ground mild steel (or silver steel could be used) and, of course, the ground

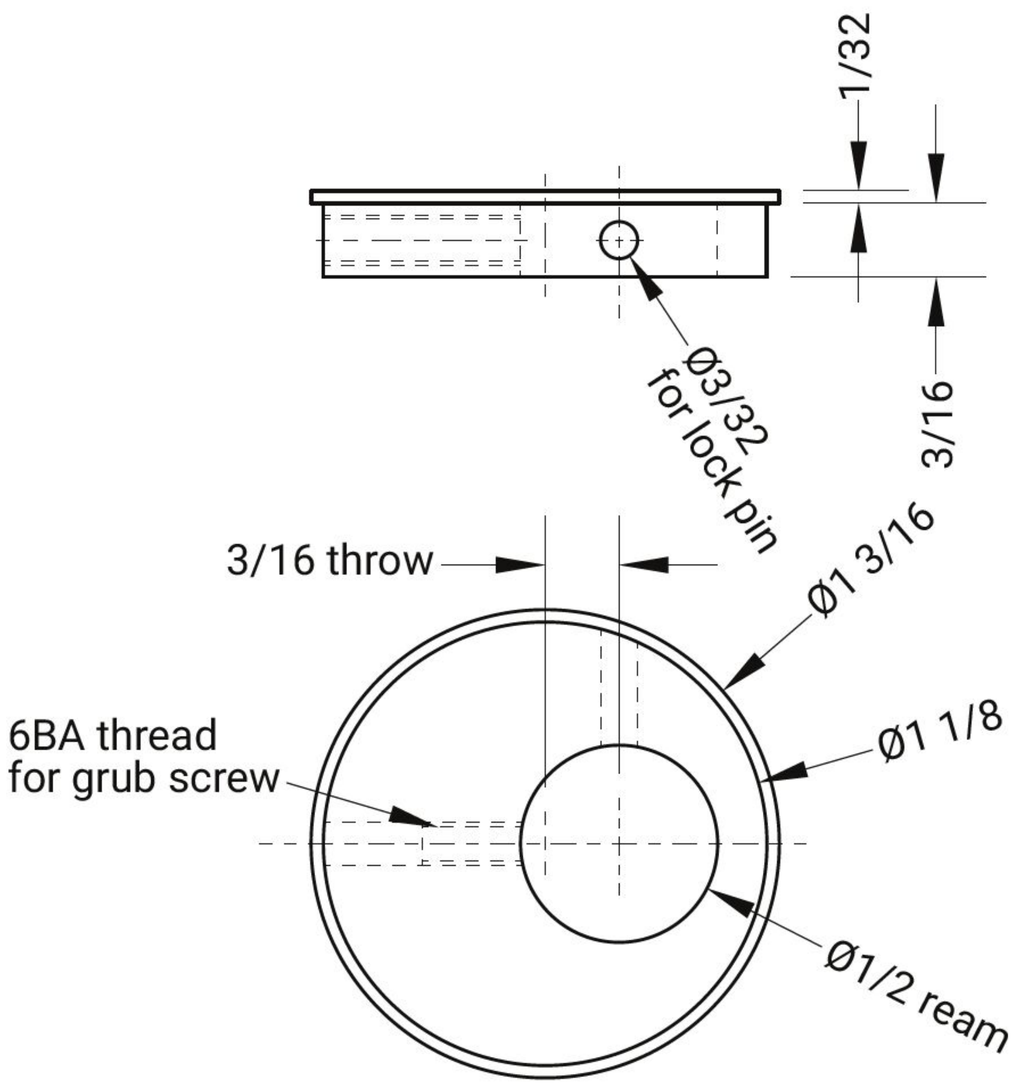


Picking up the off-set axle hole.

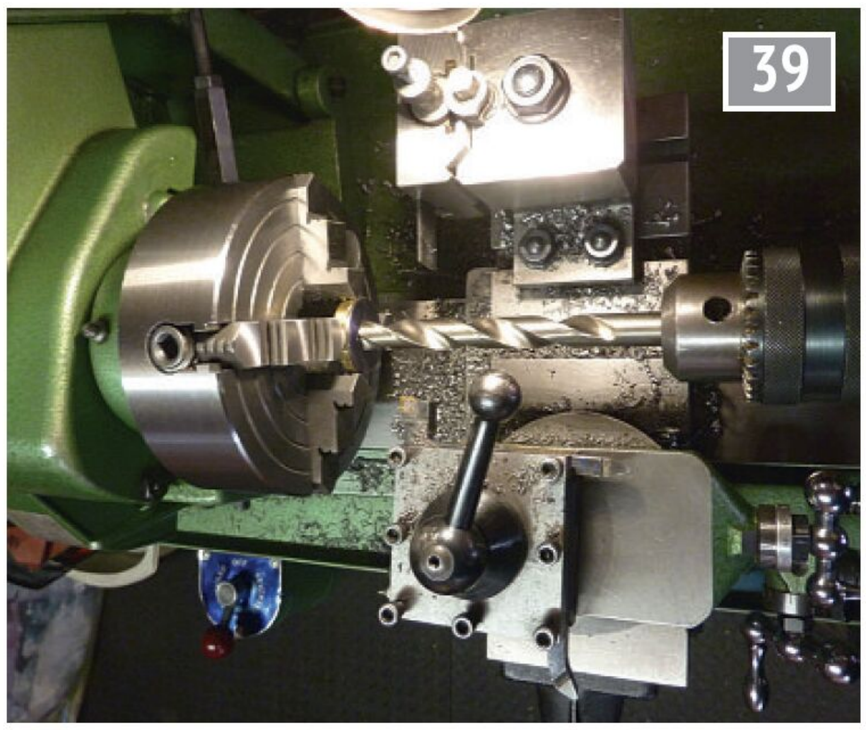
diameter forms the bearing surface. Turning the reduced diameter for the wheel centre is a straightforward job but the wheel needs to be concentric to the journal diameter so, again, use a collet or the four-jaw chuck to get the axle to run true. The diameter should be turned to a close clearance for fitting with Loctite, or a slight interference for press fitting. For Loctite it is recommended to turn a portion between the ends of the stub a little smaller, say 0.002 inch, to provide more space for the adhesive, leaving a portion at each end full diameter to provide accurate location. I find that if I slobber enough Loctite on both parts then a good joint will be made either way. The front axle has a reduced diameter between the bearing journals to allow clearance for the valve gear. This, along with a rather bent shape valve radius rod, gives sufficient clearance. This is prototypically correct, and I have found on a number of occasions that when faced with some sort of clash of parts an examination of the original drawing will show that the problem occurred on the full-size locomotive and was solved by the railway drawing office; so no need to make it up yourself.

Eccentrics (**fig 16**) are, again, straightforward turning, though there is a rather deep cut required when parting off. Leave the eccentric a little bit thick as parting off often leaves a poor finish and this can be corrected by gripping by the bearing diameter and facing off with a light cut. My first one went fine (**photo 37**) but then I ran into problems parting off and had to resort to using the hacksaw, followed by a more extensive clean-up as above. I will add that I slacken the drive belt a bit when parting so that in the event of a problem the drive will slip and no damage to the lathe occurs. Parting is always a worrying job and although a rear parting tool helps a lot, it can still go wrong. After the event I discovered that the chuck had loosened on the spindle, just a little, and a quick check with it re-tightened proved this had been the cause of the problem. Too late. There are various ways of putting the off-set axle hole in. I mark the position as accurately as I can, then centre pop it. With the bearing diameter protected by a (rolled sheet) brass ring I mount it in the four-jaw chuck, get the exposed face running flat and use a centre finder and dial gauge to get the pop on the lathe axis (**photo 38**). For many years, by the way, ≫

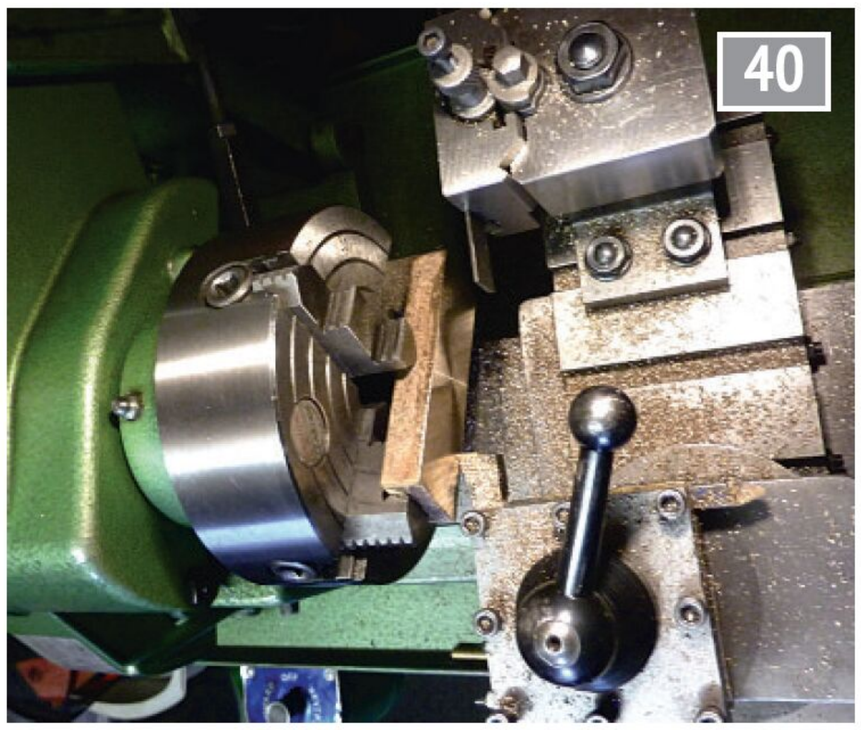
Fig 16



Eccentric sheave.



Drilling and reaming the axle hole.



Making a start on the axle boxes.

Drilling the holes for the axles.

I used a sharpened piece of piano wire as a centre finder, until I came across a proper set going *cheep-cheep* on a tool stall at our local country fair. With everything re-checked then it's a simple job to drill and ream the hole in the usual way (**photo 39**).

The axleboxes (**fig 17**) are normally made from cast sticks of gunmetal; two sticks of three 'boxes worth is normal and are much as Rob Roy except there is an oil well drilled in the top. There is a fair bit of work required to get the castings down to a 1 x 1/2 inch size with squared ends ready for cutting to length and I can't help wondering if making them from a mild steel 1 x 1/2 inch section and fitting bronze bushes would be a quicker route. Maybe 1 x 1/2 inch brass, which is available if you hunt around, would give adequate life, too. Whatever, the methods of machining the sticks to size have been described before, either in the four-jaw chuck on the lathe (**photo 40**) or on the mill (**photo 41**). The lathe method seems to be quicker but it's more difficult to get a reasonably accurate result. The grooves to fit the frame horns have to be done by milling. Getting better than a thou or two of equal width between the bearing faces over the three and a bit inches length is a tall order on a small machine, so after the individual 'boxes have been cut off and cleaned-up then correct any errors by light filing when fitting to the horns.

Axlebox keeps (fig 17) are available as laser cut parts, including the packers to rivet on top to help get the boxes to the right ride height

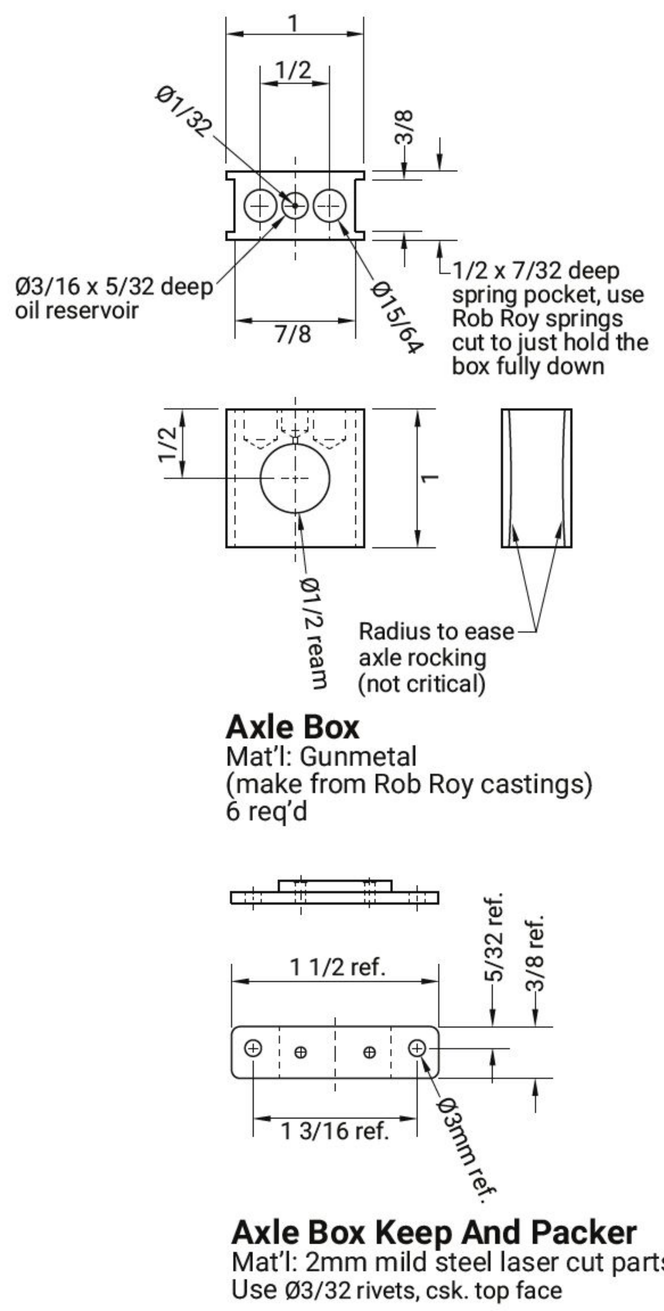
Now is the time to clean up the horns and fit the boxes, before drilling for the axles and springs etc. Do the horns one at a time, touching the one opposite just to guide the file (**photo 42**). This ensures crosswise flatness. Try to take equal amounts off either side of the horn and keep trying the box and easing any tightness until it slides freely the full height of the slot.

To digress a bit - you may have heard say that it's best to use a new file for brass, and keep it for that purpose, and if once used on steel it will not cut brass nearly as well. This is true. If you've both new and old to hand then use the new to remove metal quickly and the old to cut more gently and provide a smooth finish. Using the old file to finish will mean no extra polishing up should be needed. If you've only old files then the job just takes a bit longer, that's all.

As each one is completed then stamp the horn, box and keep with a unique number so they can always be kept together. If things go a bit wrong then don't panic. A bit of slackness is no bad thing and many an old hand will tell you that engines made to high precision don't go very well (though it's hard to confirm the truth of this). With all the 'boxes fitted, then now is the time to move on to the coupling and connecting rods.

●To be continued.

Fig 17



Axle box.

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CLUB NEWS

Geoff Theasby reports on the latest news from the clubs.

Returning from the Leeds outing, I was on the railway station platform waiting to board the train to Sheffield and a female train guard got out the folding ramp which enabled me to embark with ease, still riding on my electric buggy. At our destination out came the ramp again. It is a very simple yet practical answer to those with restricted mobility.

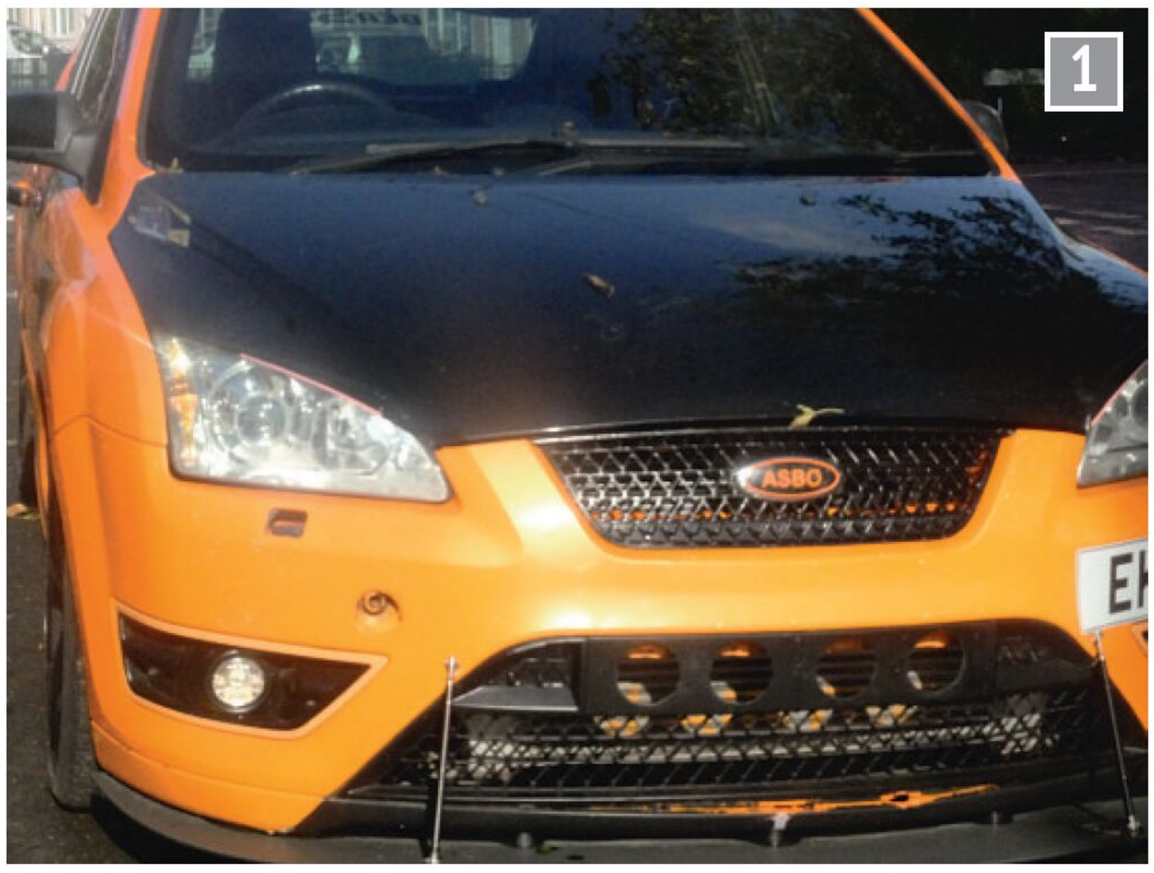
It also begs the question, why are railway carriages so different in height from the platform? Modern trams can do it, leaving a gap of about 10mm and the same height. So anyway, the guard in question will henceforth be known as *The Lady with the Ramp*.

In this issue; a rose by any other name, auctions, what's in a word, fuel tablets, George Cayley, an ASBO (look at the radiator badge in **photo 1**) and finally, a linkage and a spanner.

My wife recently pointed out that I still wear the *Hengist* wrist band, which I acquired on a visit to the locomotive being built in Chapeltown. I told her it was to remind me of my name. "But your name's not *Hengist!* "I didn't say it was," I said, " It's to remind me…".

Sheffield auctions had some interesting lots recently: two 3 1/2 inch gauge live steam locomotive models, a 3 1/2 inch gauge BR Britannia and a GWR King plus Mamod, Wilesco, the usual Hornby 00-gauge, several 0-gauge brass kit built locomotives and a box of model making tools, a pedal car and Meccano.

Worthing and District Society of Model Engineers, *Newsletter*, winter informs us that a possibly serious incident occurred when a youngster tried to leave the train on to the line whilst stationary. It transpires that he did not know the meaning of the words 'Do not alight here'. Whilst we greybeards know what it means, the younger generations may not, as 'alight' is not a word in every day use. Is this the case on your track? A thoughtful idea from an anonymous source points out



ASBO.

Electric train (photo courtesy of Reuben Fletcher).

that £1000 invested in Delta Airlines 12 months ago it would now be worth £49. Similarly, £1000 shares in Northern Rock three years ago, you would have nothing. However, if you bought £1000 of beer a year ago and taken the aluminium cans to a scrapyard, you would get back £54. Should you drink heavily and recycle? President, Andrew Breese realises that many of the younger generation can not recognise a lump of coal, or how a nuclear power station works. Then, Neil Furze writes on 'springs and things'.
W. www.worthingmodelengineers.co.uk

The 'Gowrie' **Locomotive Trust** sends *Gowrie*, named after the Hunslet single Fairlie of 1908, in which we learn that half the required funding is already in place. *Gowrie's* cab and side tanks are to incorporate several hundred dummy rivets, created by a welder. The axleboxes and guides have been fitted. One photograph shows a large hammer prominently placed on the bench alongside. A visit was arrange to Claymills Pumping Station, Burton on Trent, which has over 30 steam engines of all kinds. The site also incudes the shortest standard gauge railway in the UK. This consists of a stationary engine rope-hauling a wagon bringing coal to the boilers. The power bogies are imminent, but the 300 fasteners required have to be to the pre-war standard, ¾ BSW, at £1.90 each, that's £600...
W. www.gowrielocomotivetrusst.com

The Stephenson Link, autumn, from **Chesterfield & District Model Engineers,** were entertained by the running of a 5 inch gauge model of *Gowrie*

at the Hady track, giving a taste of what is to come. Bob Bramson writes on making locomotive leaf springs, concentrating on the tempering of the grade CS70 steel used. Vaughan Ayres has sadly died. His railway life began, as did many others, at the end of a railway station platform. He was energetic, talkative and told jokes so he was always going to fit in. Amongst the many photographs is one which is a little out of the ordinary; an electric train on the garden gauge. It is an EMU Gauge 1 of the MSJA by Pat Honey (**photo 2**). Adrian Lloyd visited Papplewick and decided to resurrect an electric boat, to run it on the cooling lake. *Sea Commander* is a four foot long cabin cruiser and when first used, her speed was quite pedestrian (I can't see why, she has four feet…). This has now been upgraded and is the bee's knees, as it incorporates a Lipo battery giving 22 volts. Still not quite enough, so a water-cooled speed controller and a racing propellor were fitted. Now you are talking! Finally a motor bike, seen at Papplewick. The engine was 600 cc from a fire pump, made as a Steam Punk bike which shared the event with, amongst others, the Tea Duels - brass polishing, snail racing, lots of black and purple clothing and acetylene lamps.

W. www.cdmes.co.uk

B&DSME News, from **Bournmouth & District Society of Model Engineers** sadly reports that Dick Ganderton has died, says Ron Bartram. Unfortunately he had not learned of his election to President at the AGM just a few days before. Ron has had his zero hours contract as editor renewed and here are the results. The Parklands Railway in East Anglia has closed and the track lifted. This is a good reason for you, Dear Readers, to contribute to your local clubs in order to prevent this happening to yours. The LBSC new-build locomotive *Beachy Head* has now been completed and is in traffic.

W. www.littledownrailway.org.uk

Graeme Quayle sends the latest **Model Experimental Engineers Auckland,** *Newsletter*. The Pointons have been attending to the steam tug, *William C Dalby* of late and so have been less conspicuous. Local byelaws forbid producing smoke when in harbour and the difficulty of obtaining smokeless fuel at a reasonable cost is worrying. Mike Jack is to resume work on his Black 5. When he began it, 40 years ago, he used it to get a job by discussing the finer points of its construction. Ray Brown is building a Fowler ploughing engine in 3 inch scale; it is 1200mm long. Ray claims that solid fuel tablets are no longer available but recently I revealed that I could get solid fuel tablets for camping stoves from Amazon, so there should be no difficulties there. They have been used to run my vertical boiler and beam engine. I have written about them before, but I can not currently find the record.

York City and District Society of Model Engineers newsletter reports a momentous occasion in that the AGM had record attendance and editor, Roger Backhouse wasn't there! On a point of information, Scarborough is not 'noted for fresh air and fun' - that was Blackpool in *Albert and the Lion.* A doctor, Wm. Harland, a contemporary of Sir George Cayley, was also of an inventive turn of mind, building a steam carriage in collaboration with Sir George and patenting it in 1827, before going on to help found the famous shipbuilding company in Belfast. Yes, that one! (There is no point in naming it as it's famous, right?) Paul Howard visited the Bure Valley Railway and Cliff Almond wrote on the Guinness Railway, whilst Mike Pinder describes the Great Eastern Railway B12.

W. www.yorkmodelengineers.co.uk

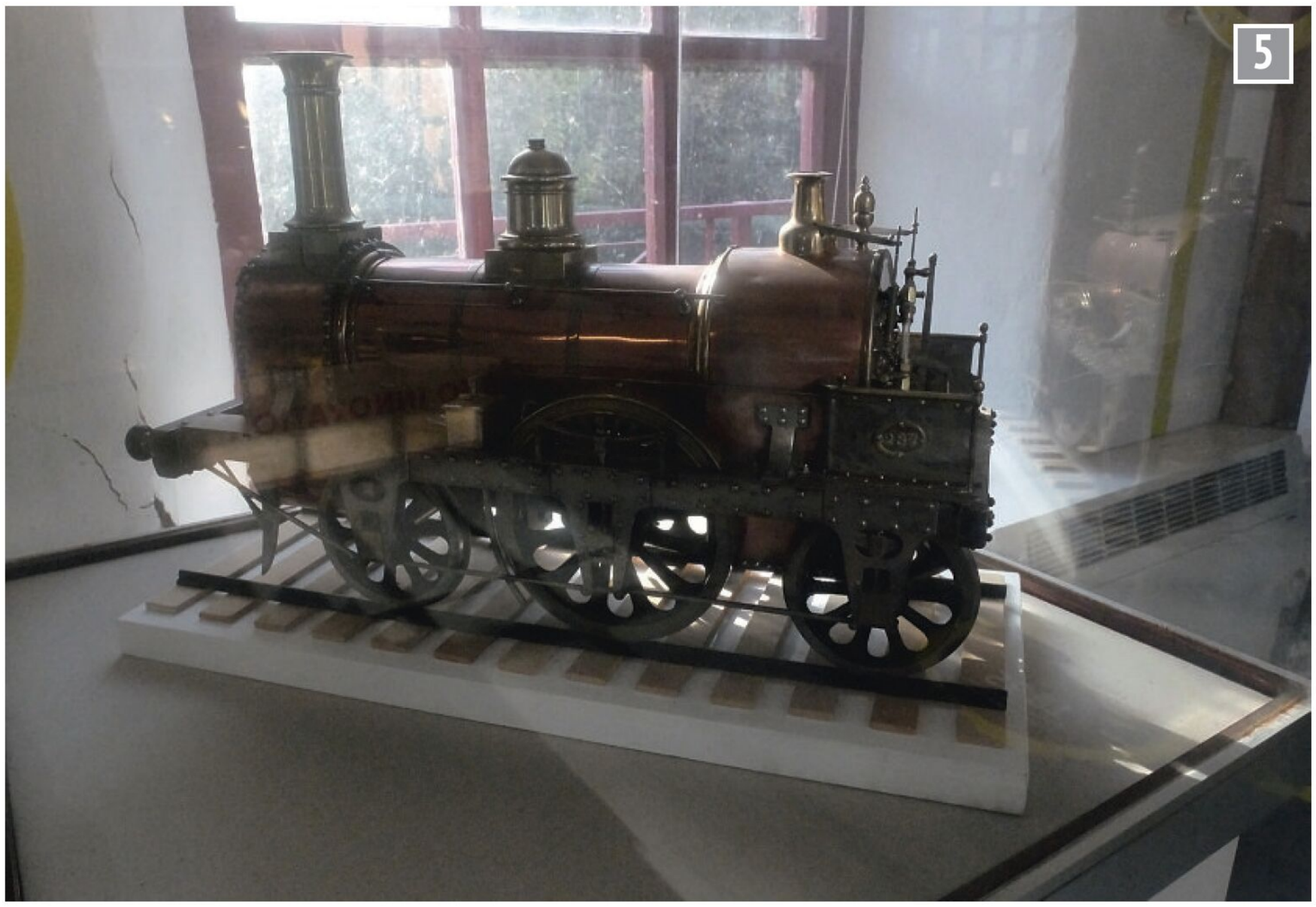
The Amesbury Link, from **Vale of Amesbury Model Engineers Society,** autumn, includes Bob Jones, on the upgrading of the signalling system. The 20-odd relay boxes around the track are not waterproof and the relays inside are beginning to corrode. They are being replaced before trouble begins. The Chairman's Cup was awarded to Neil Moddern for his BR standard tank, 80075, which is very accurately detailed and took him 10 years to build. The Secretary's Cup went to David Vesey for his twin cylinder rotary valve engine. The Ladies Bowl went to Rebbecca Howard for her miniature patio and garden. Ross Catley, in part two of his battery electric trains series, concludes that battery operated local trains are commercially viable but not so long distance, which should be fed from overhead wires. Robin Howard explains why a locomotive was named *Shredded Wheat*. It was built in 1933 for the Nabisco factory in Welwyn Garden City. The makers, Fowler, made a locomotive consisting of a steam engine chassis fitted with a diesel engine. This lasted for 20 years before being declared worn out and a replacement McLaren modular engine was found in an old boat. These engines could be enlarged by adding more cylinders. The restored locomotive won an HRA award in 2021.

W. www.vames.co.uk

Again, the last four pictures are all of a type, taken in Leeds Industrial Museum, so I have grouped them together. The Mensa annual gathering which I attended was offering a trip to Leeds Industrial Museum. I have not been for many years so I booked it. In this museum is a locally-made *Scootacar* Mk 1, which was built by a subsidiary of the Hunslet Engine Co. and designed by Henry Brown, who also designed the unrelated *Rodley*. The *Scootacar* was fibreglass and the *Rodley* was steel (**photo 3**). This model beam engine (**photo 4**) was built by B J Szlumper in 1959, No. 6282. A 2-2-2 locomotive Jenny Lind-type, No. 6270 of 1847, ≫

Leeds Industrial Museum had this Scootacar *on show.*

Beam engine LIM.



Jenny Lind type locomotive by E. B. Wilson, I think. I had difficulty in tracing the details of this model.

Cinema projector.

is modelled but I could find no details as the museum website is verse sparse. The locomotive design was very popular and widely copied as well as the 200 which were produced by its designer, E. B. Wilson (**photo 5**). As well as being the home of moving pictures (Louis le Prince), the city also became the home of cinema projectors (Gaumont Kalee) made in Leeds. This is one from the 1950s (**photo 6**).

Bradford Model Engineers' Society *Monthly Bulletin*, November, opens with Richard Pulleyn discussing his signalling days and how *serenditpity* seems to have been his constant companion. The Visitors Weekend attracted people from Keighley, Spenborough and York. (Richard III: *"A horse, a horse, my kingdom for an Iron Horse …"*) Stuart Mann set up an amateur radio station and spoke to other groups around the country running similar events, known as 'Railways on the Air'. David Jackson co-opted his sister to take some photographs for Road Vehicle News when she visited the Sidmouth Show and found a fine collection of 1/8 scale farm machinery. The Bradford Cup was awarded to Ron Fitzgerald of the Society for his still-running series in *Model Engineer*, dealing with the stationary steam engine. Another member, Martin Birch and his trams were featured in the October *Newsletter of the Friends of the Railway Studies* collection.
W. www.bradfordmes.uk

Leeds Lines, November from **Leeds SMEE** begins with an item on 'speeding up the changing of lathe chuck jaws'. This involves getting or making a short, square-section bar to fit in the cordless drill at one end and matching the lathe key sockets on the other. This will enable you to wind the chuck jaws in and out at speed (if the battery has not gone flat…). Steve Russell made a Gauge 1 boiler. Colin found, on last year's visit, that one of his granddaughters was discovered to be in the driving seat of the Deltic and moving off. This year he was hanging onto the controller a bit harder. A member of the Morgan car club brought a steam launch but the boiler could not be tested as there was no matching fitting available. The 'Grey Fergie' in the car display had a large box on the back (using the 3-point linkage, I hope, and a famous spanner - Geoff) which was thought to be for tools but instead held a picnic basket! The jumble sale tent is Judith's. She says it can be erected in about 20 minutes if on her own and more like half an hour if she has 'helpers'. A cautionary tale by Alan MacDonald concerns a member who habitually wore a white boiler suit for driving his locomotives. However, one day his locomotive parted company with the driving trailer and set off to explore the facilities on its own. Dragging said white-suited gent along the track and leaving four black, parallel lines down the front of his immaculate white overalls. A number of similar events were recalled - H&S would have had a fit! Shades of Gerard Hoffnung … The same gent, returning from the pub one night, managed to invert his Bond three-wheeler, which he had only just bought. (It was quite possible to roll them even when you are sober.)
W. www.leedsmodelengineers.co.uk

And finally: If life gives you melons, you are doubly dyslexic.

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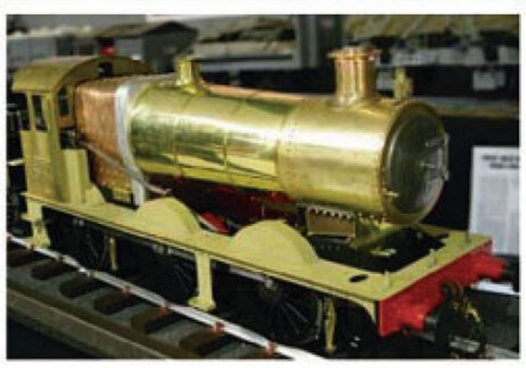

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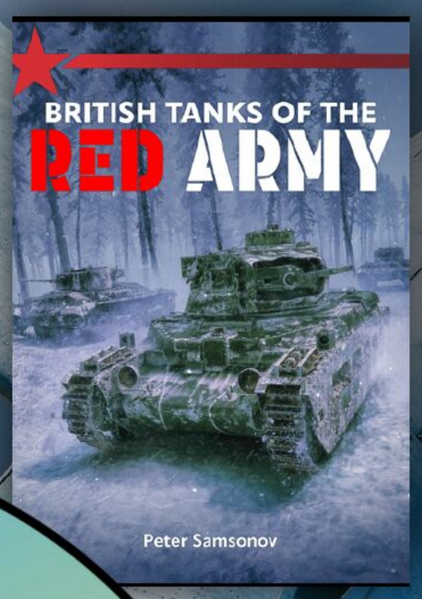

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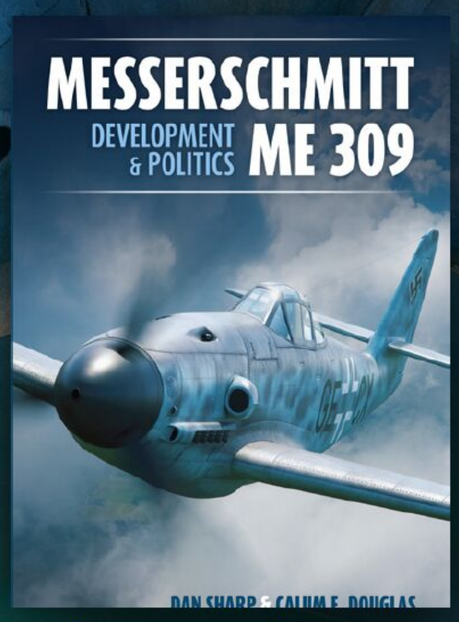

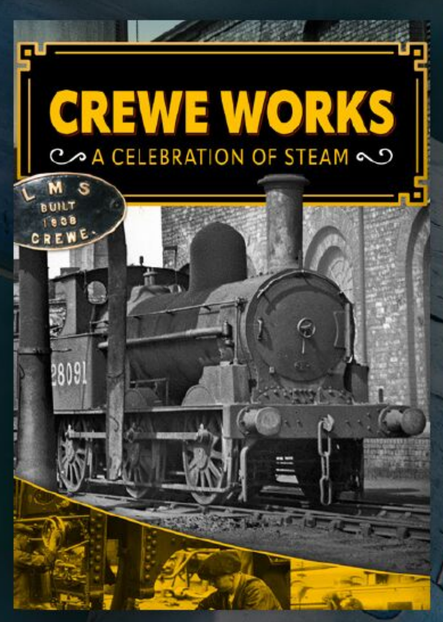

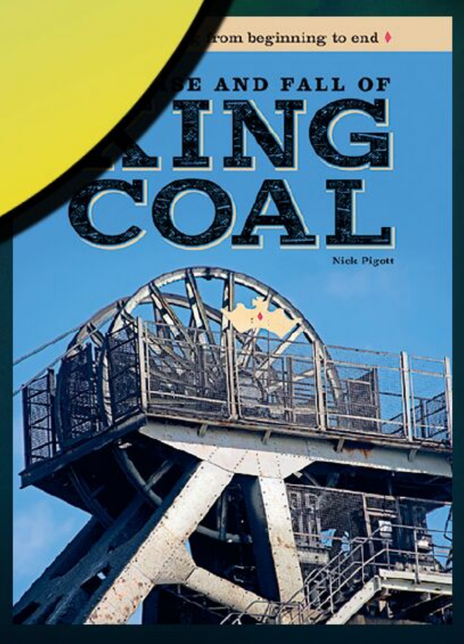

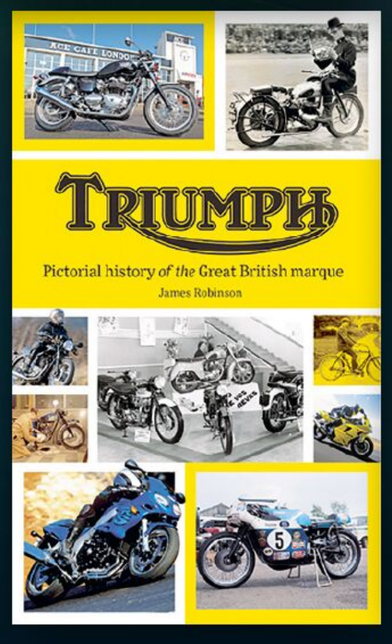

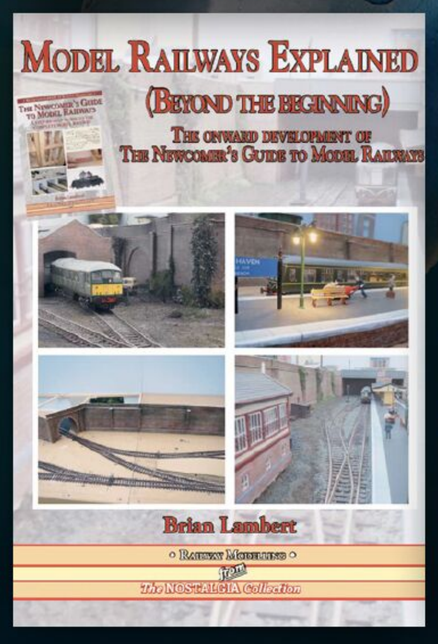

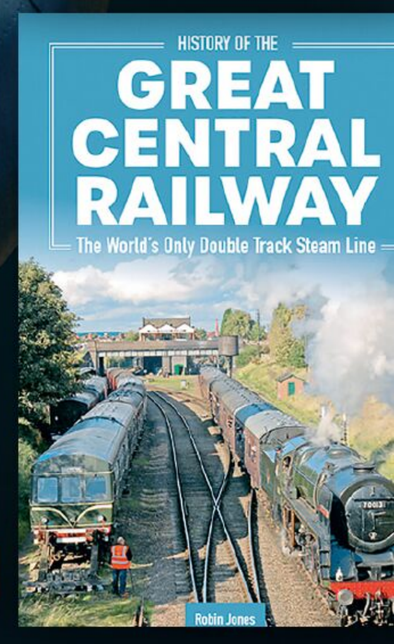

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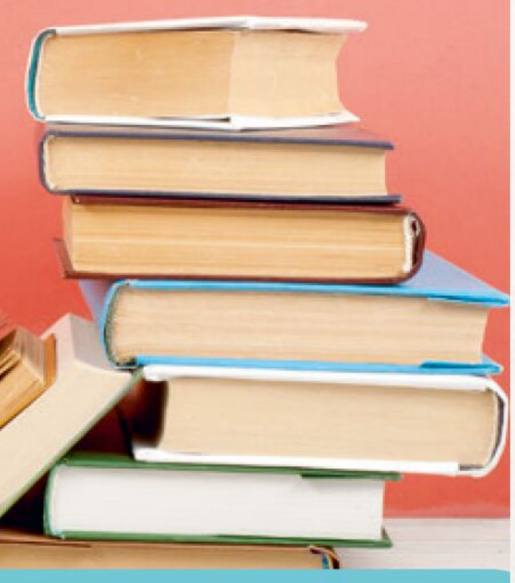

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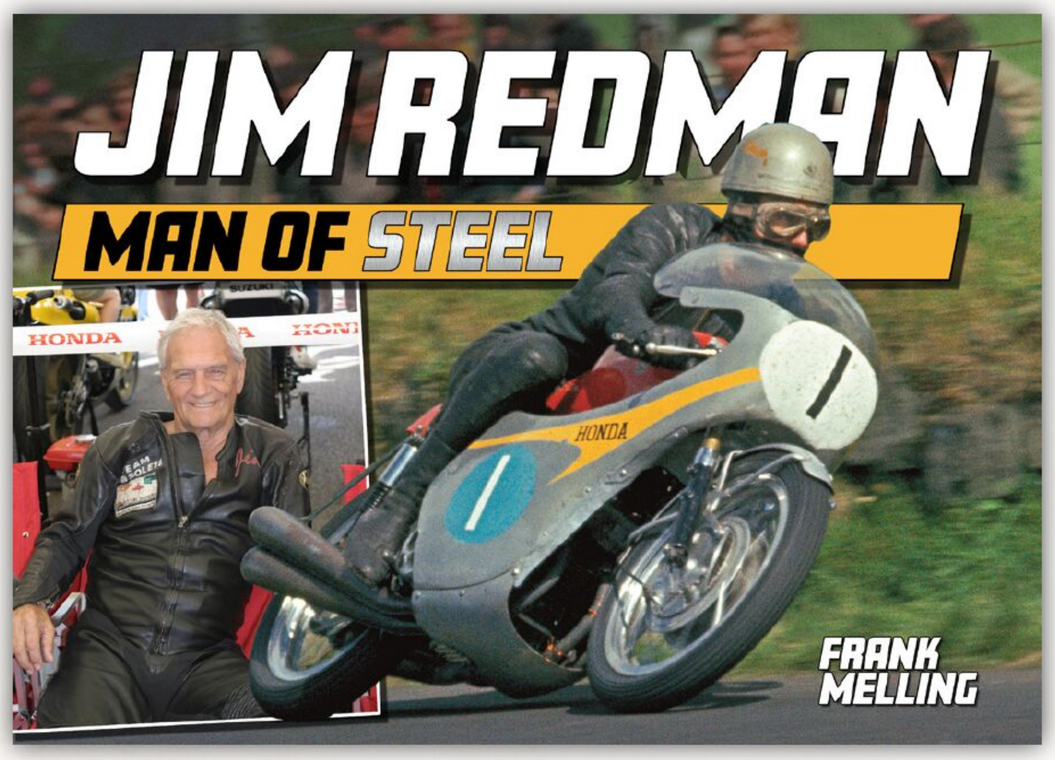

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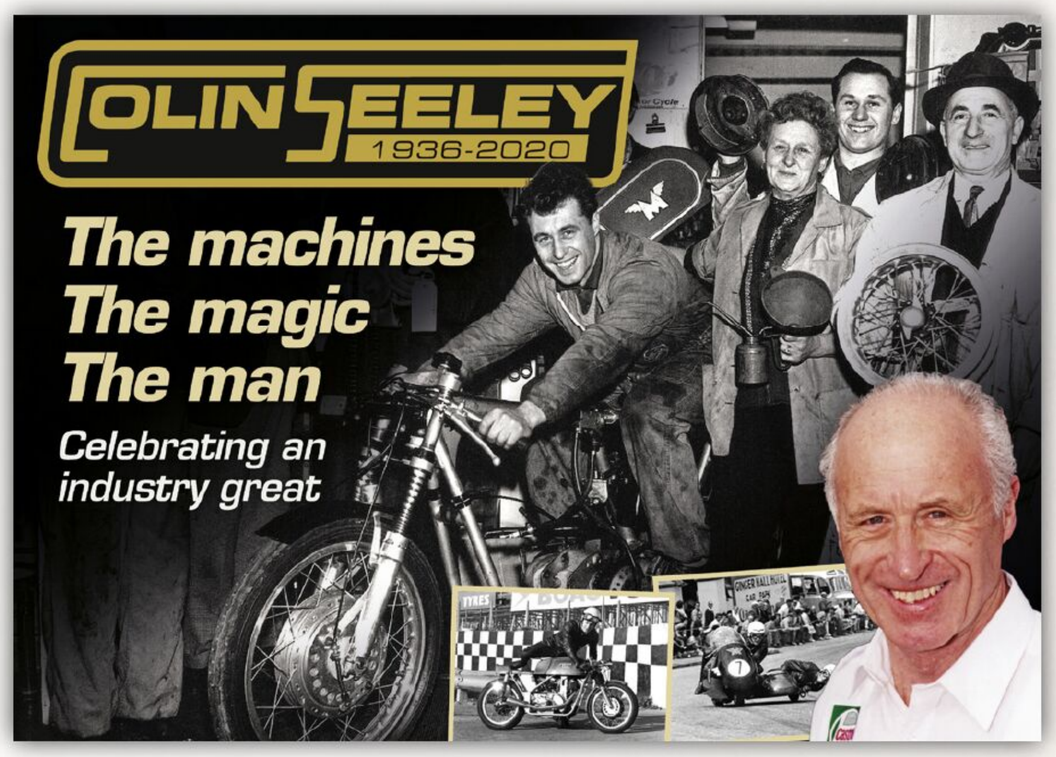

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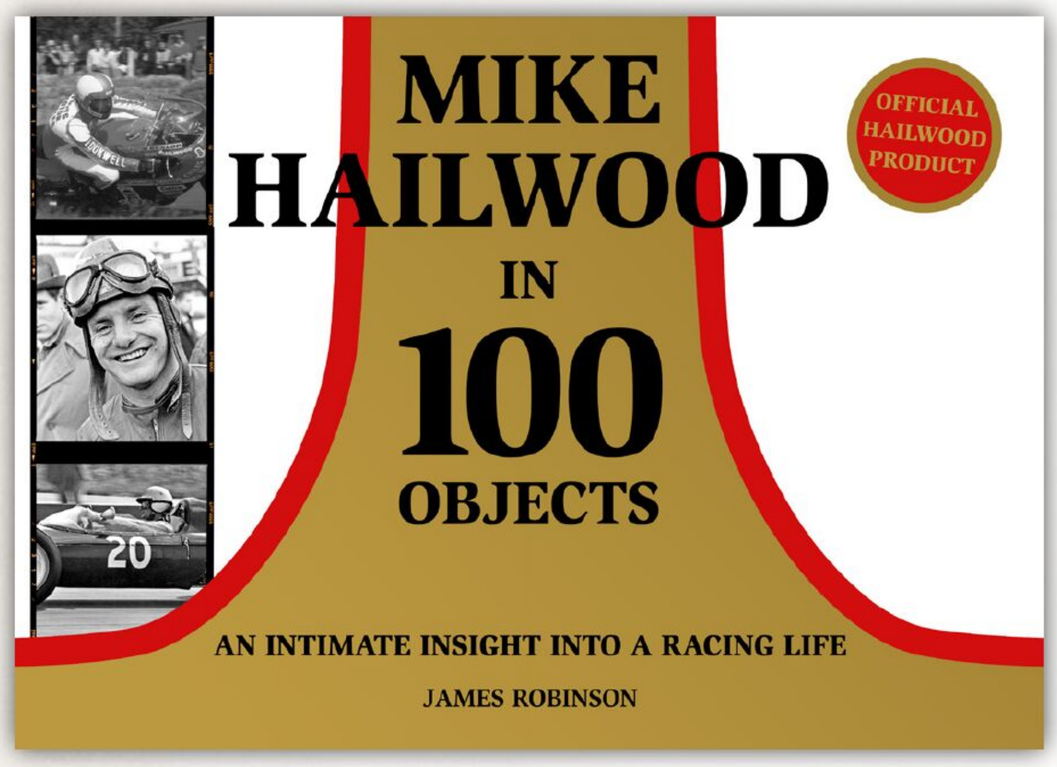

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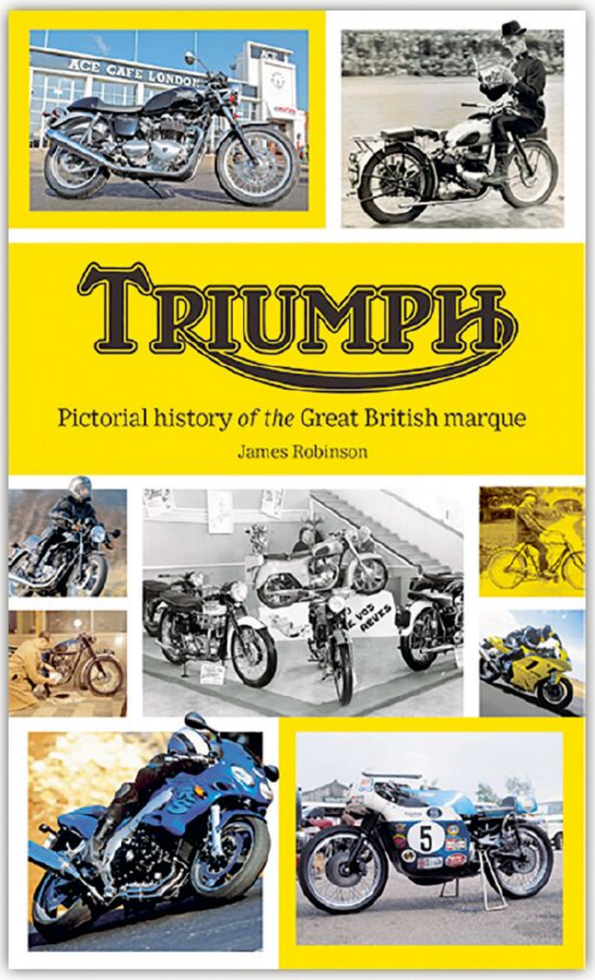

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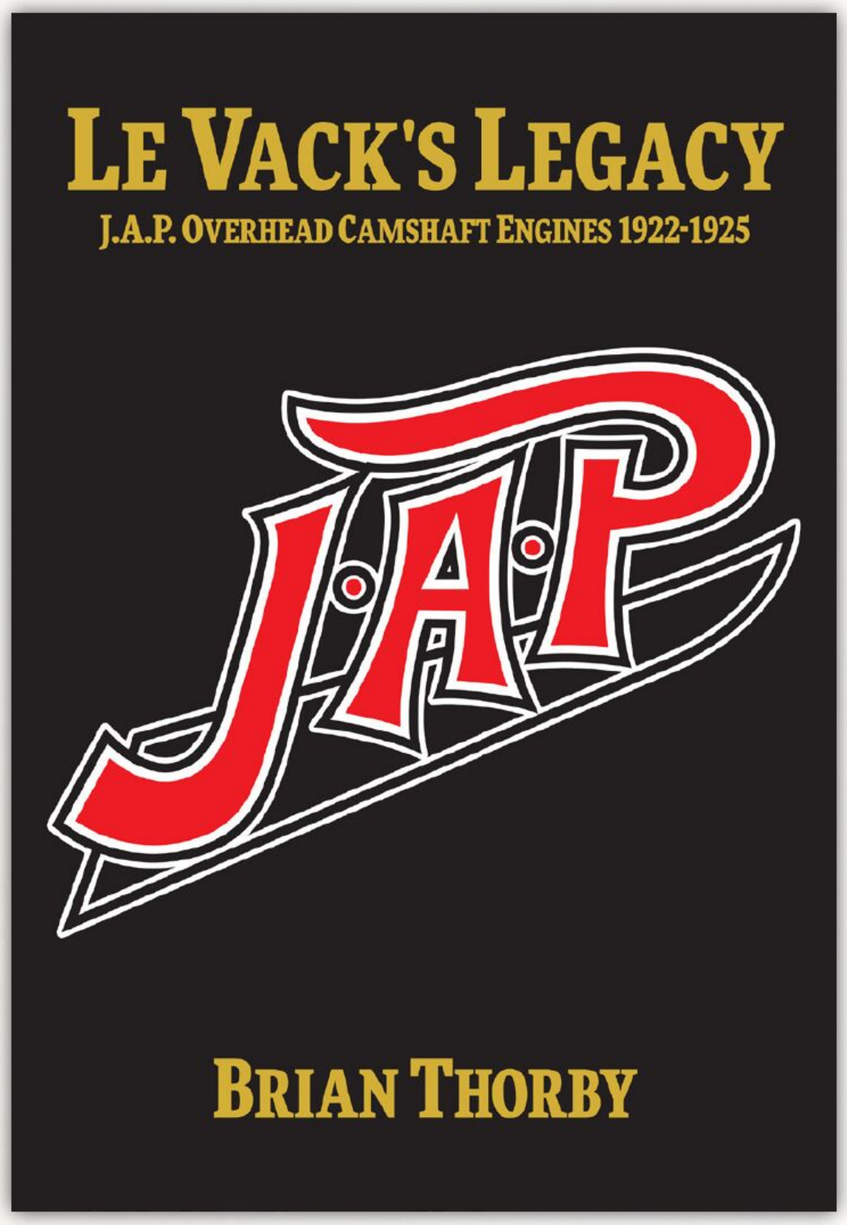

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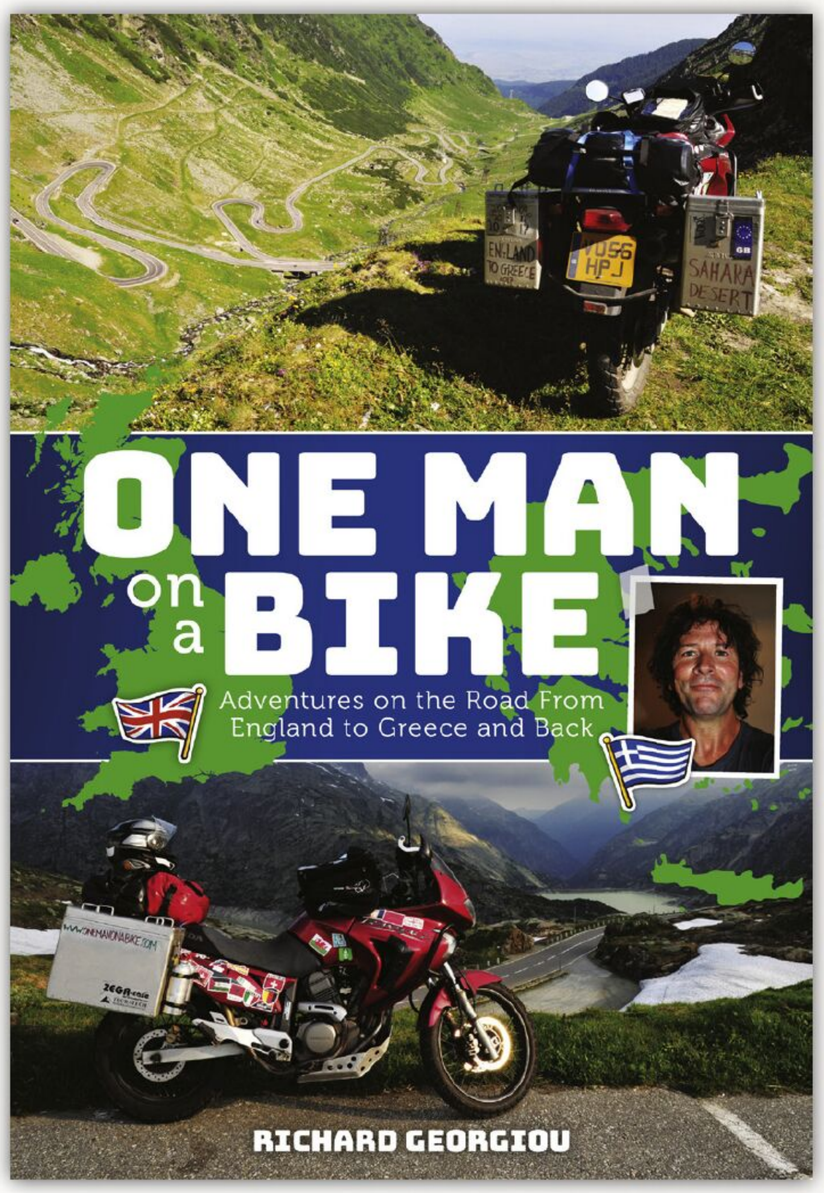

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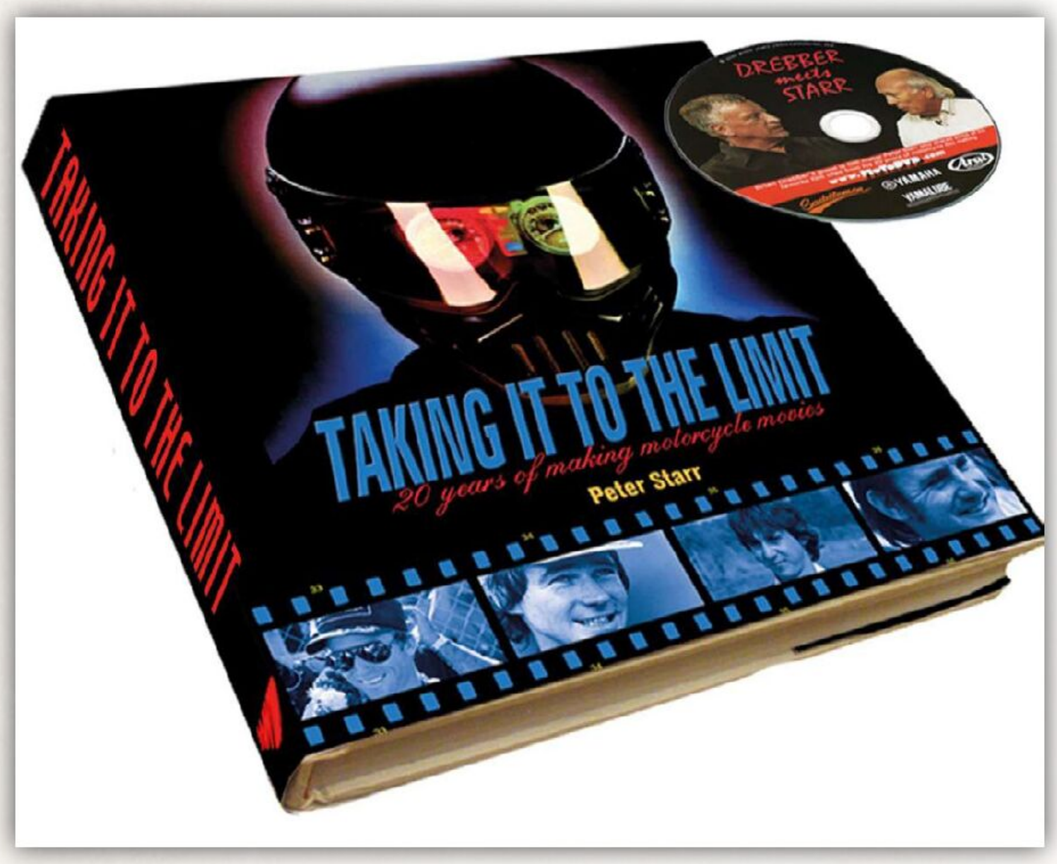

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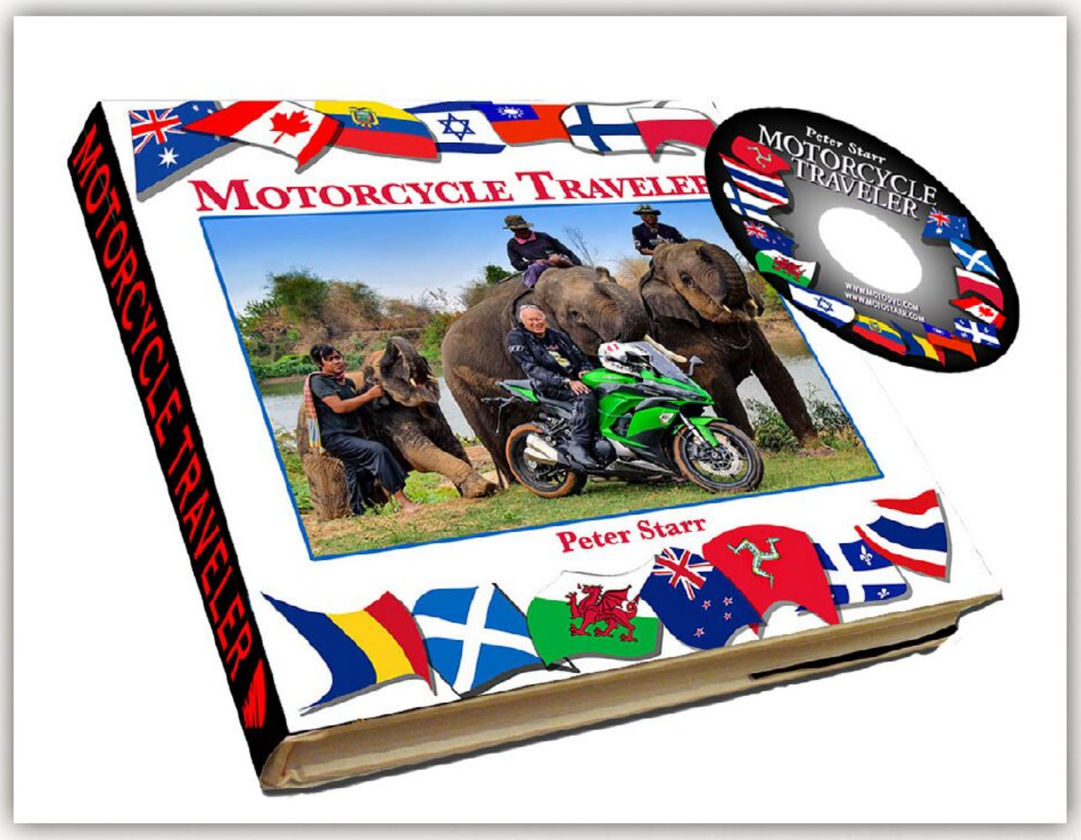

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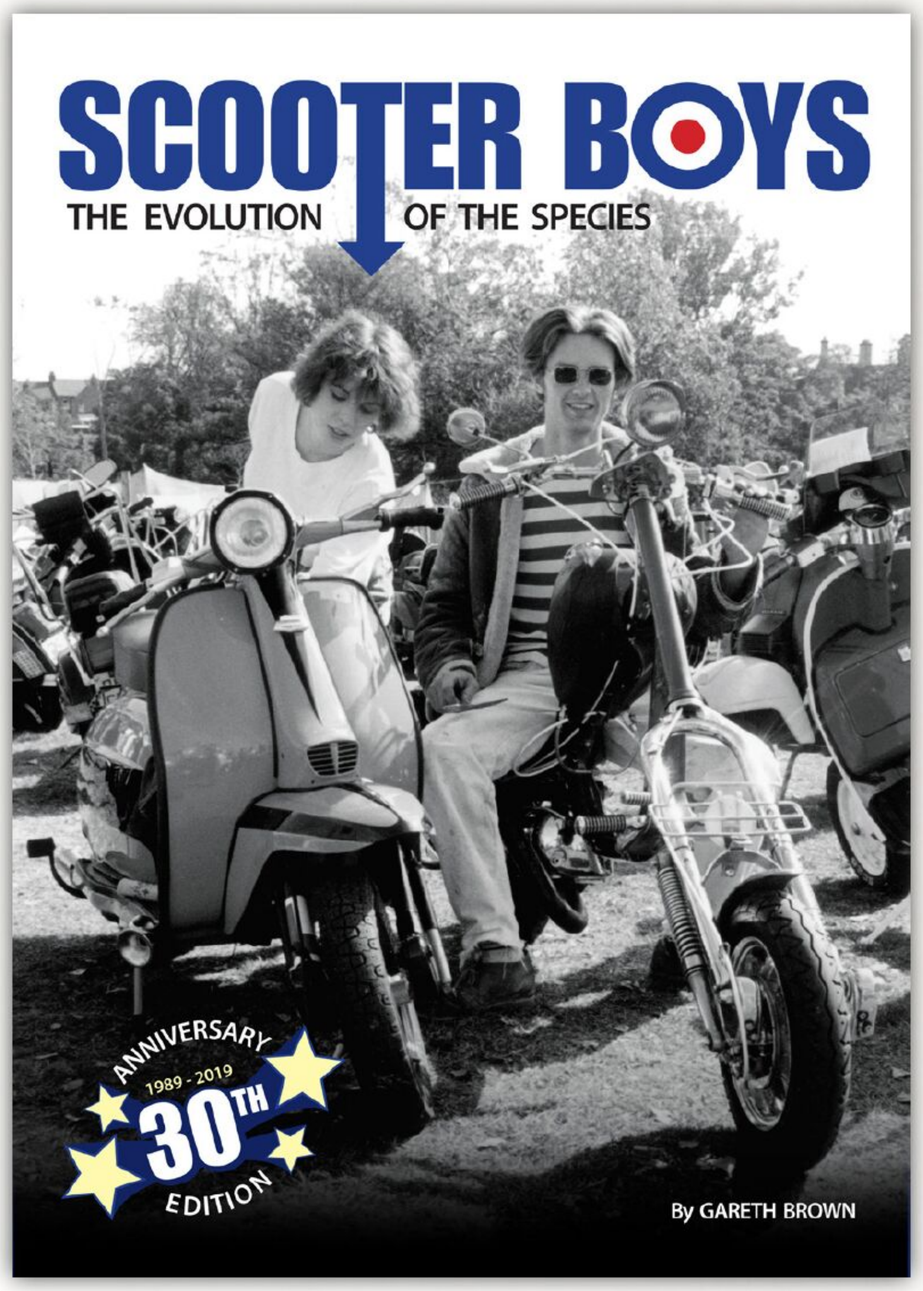

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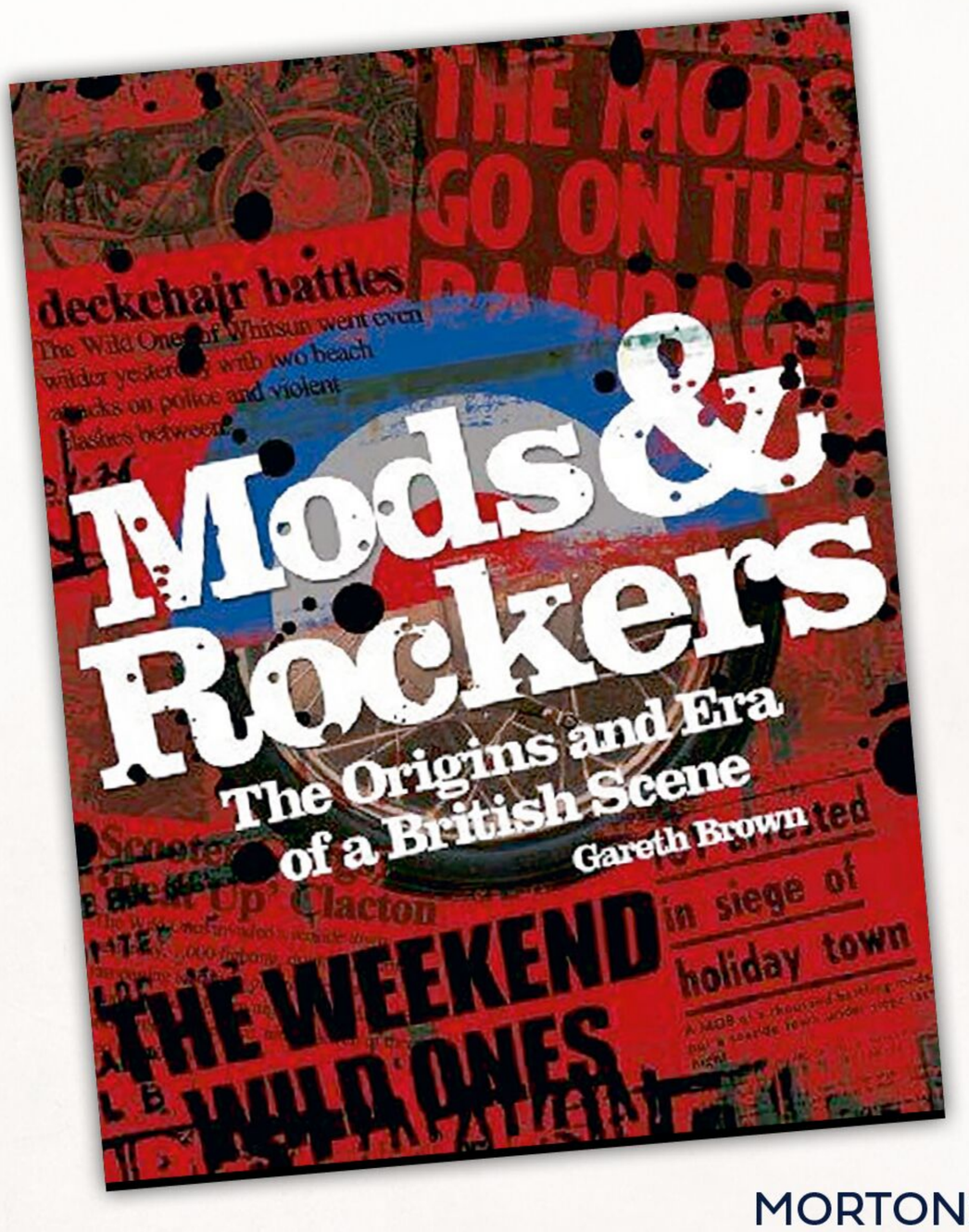

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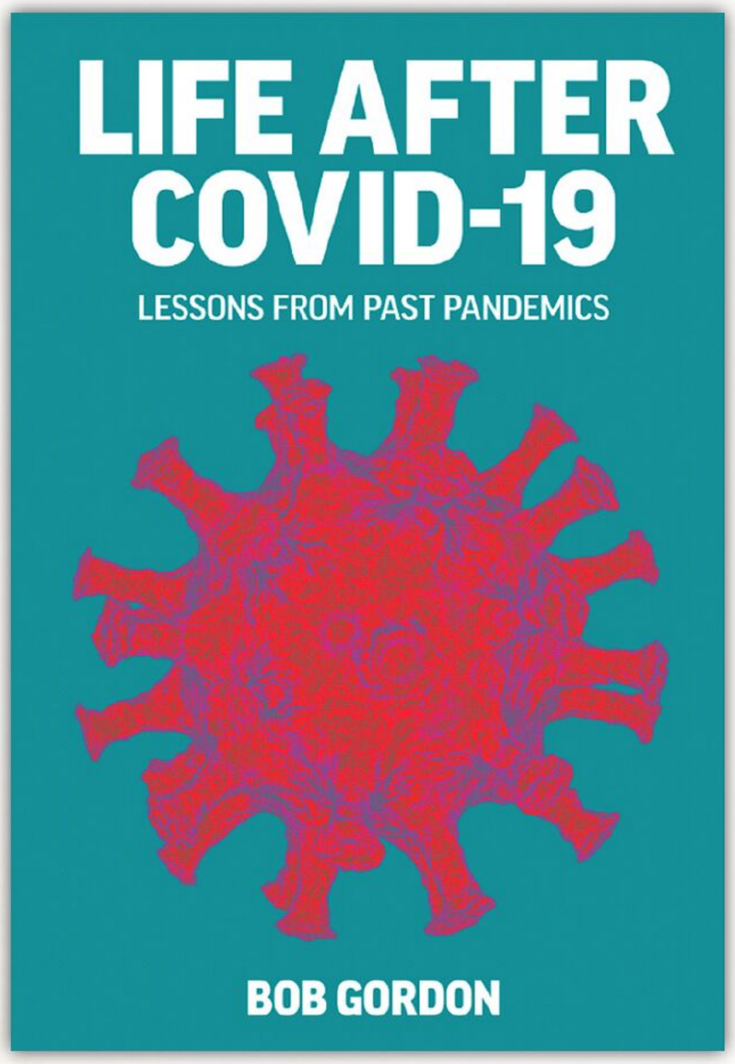

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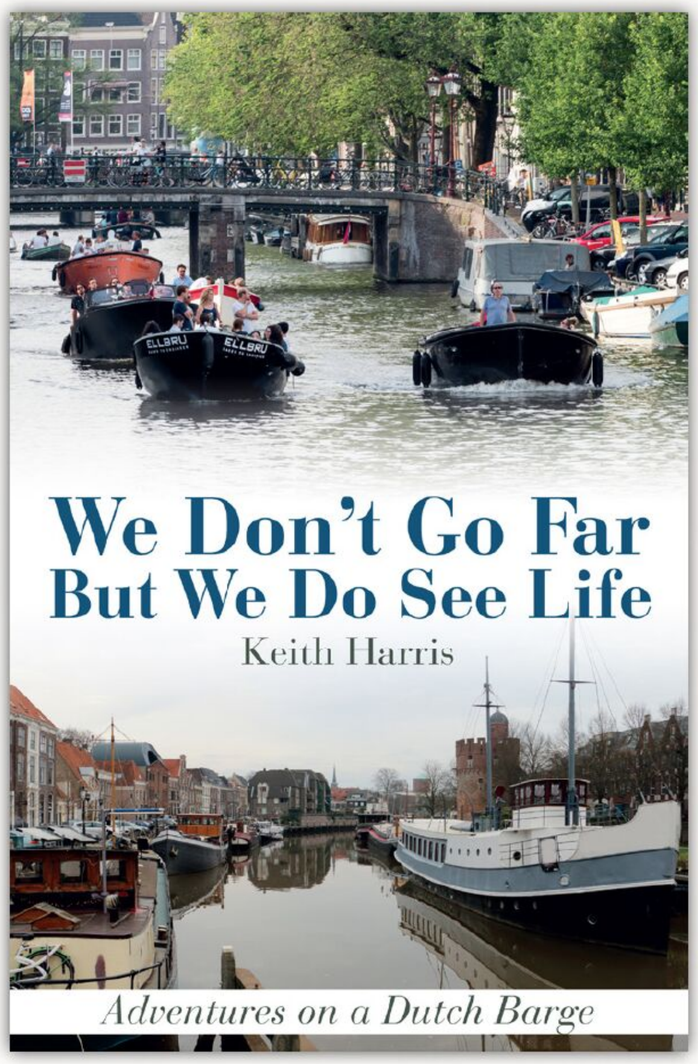

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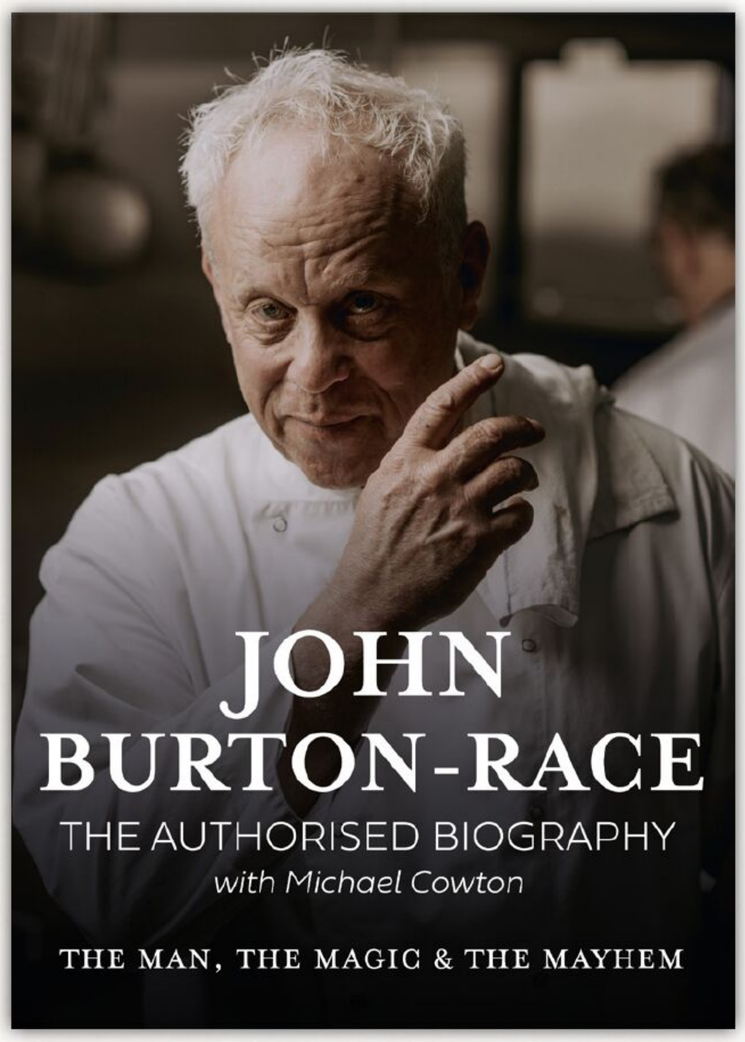

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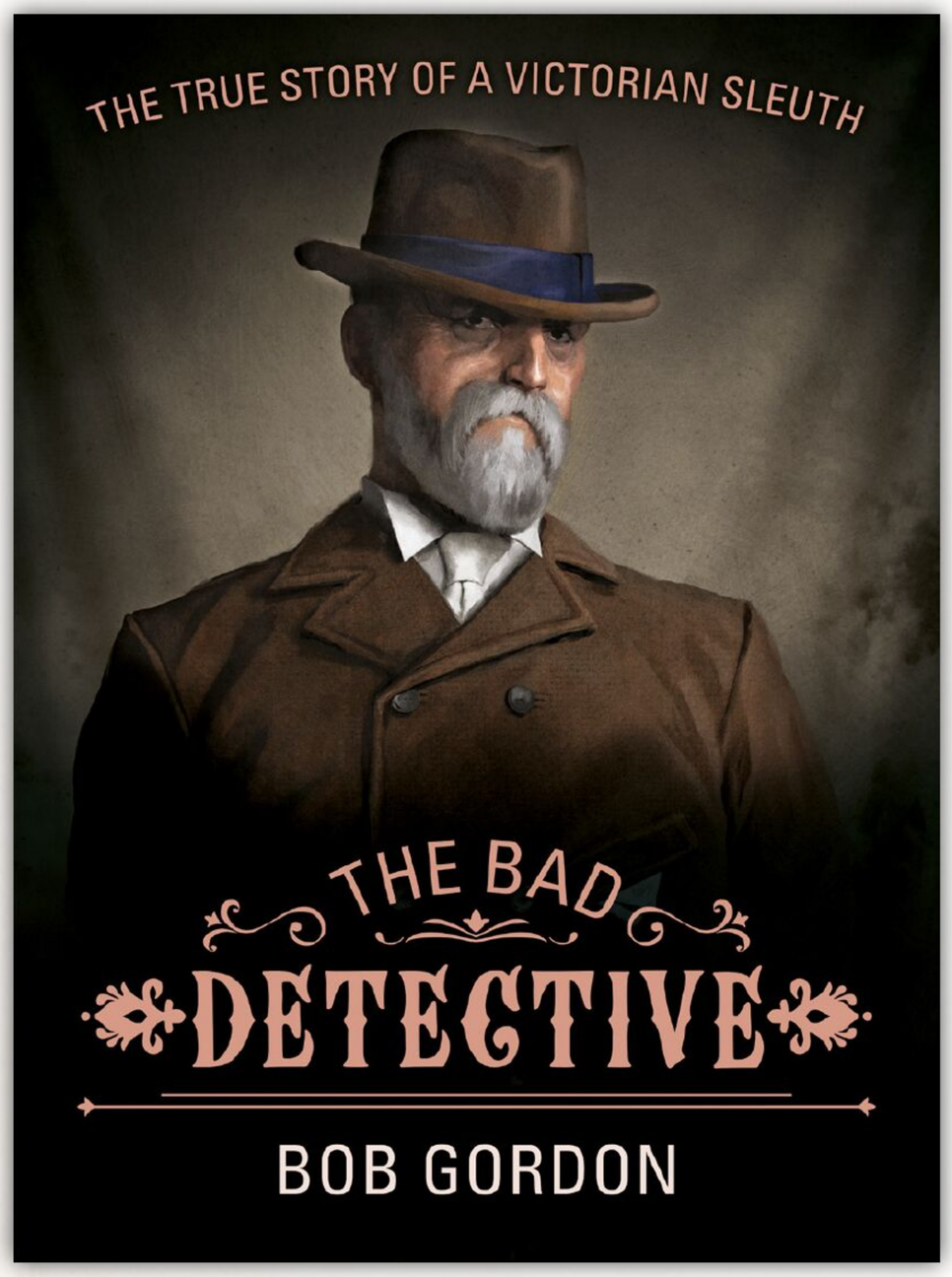

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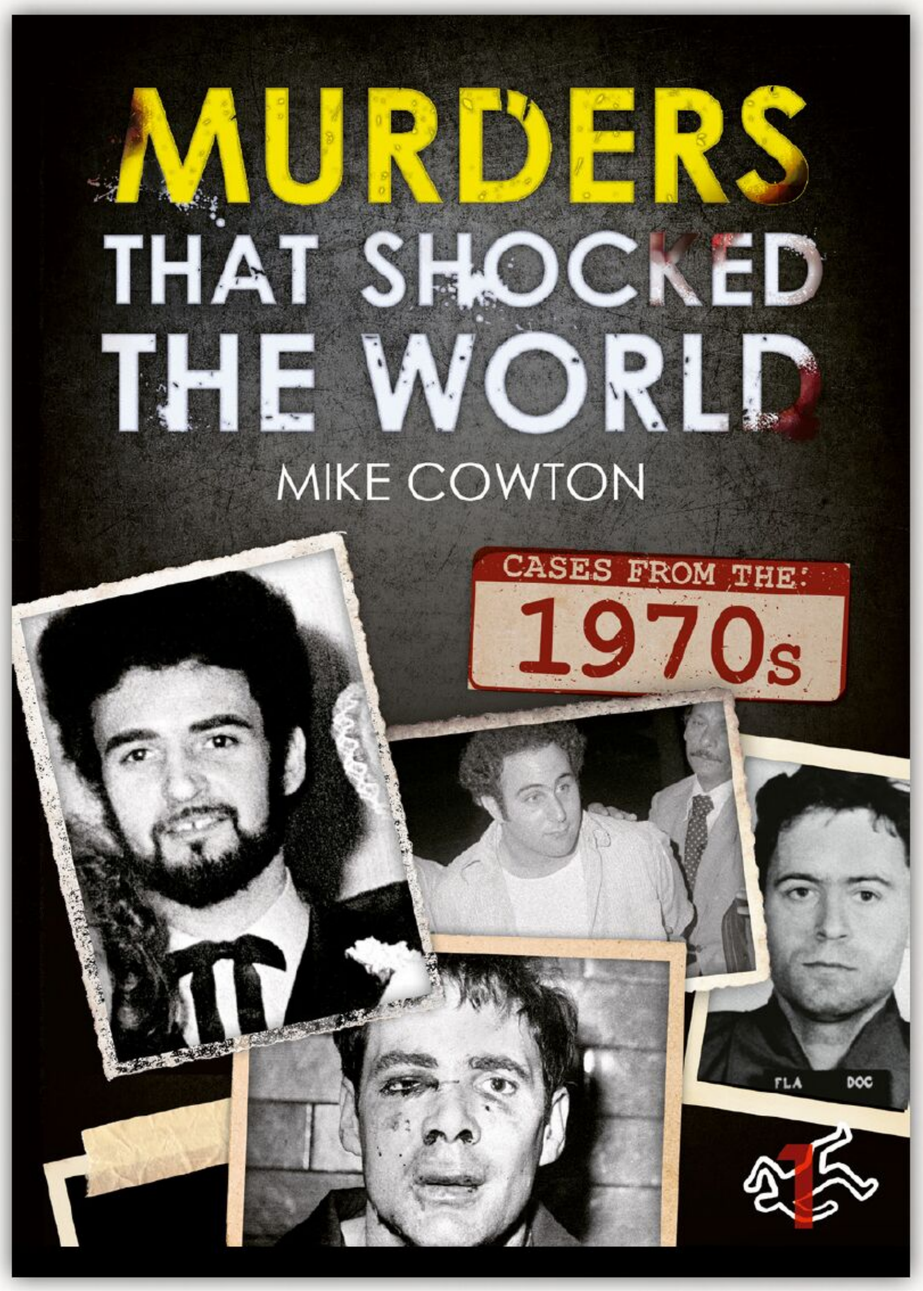

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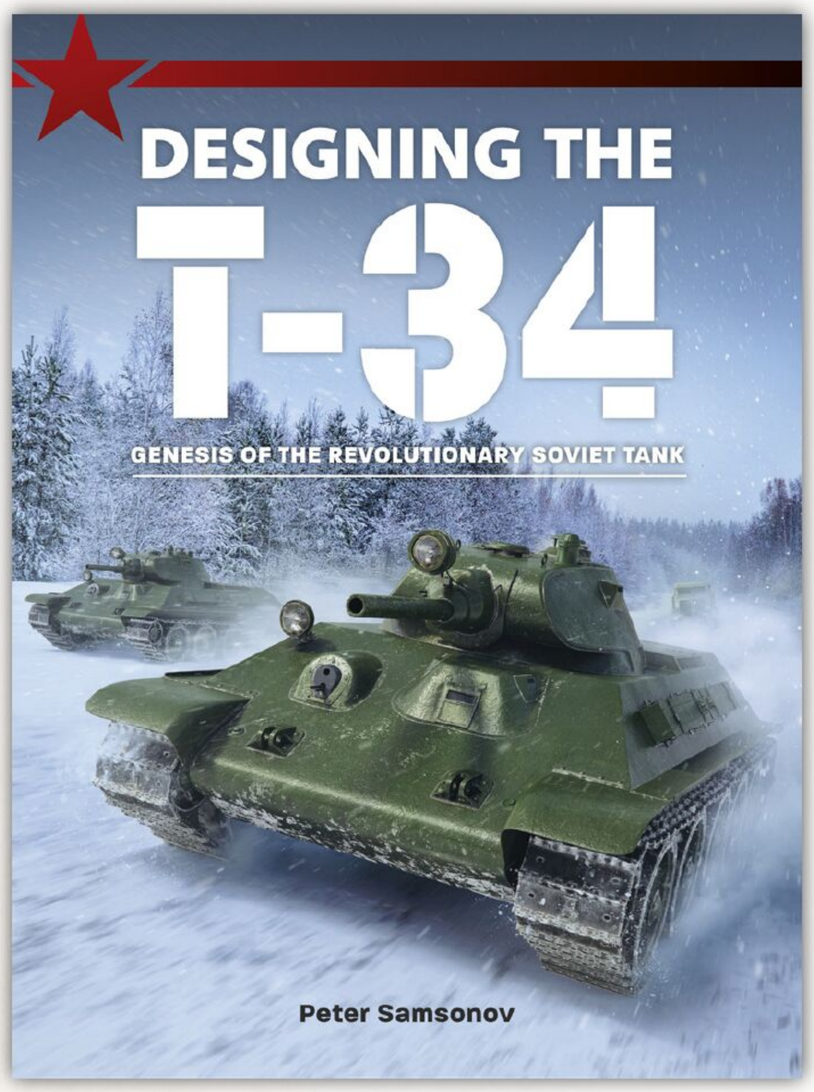

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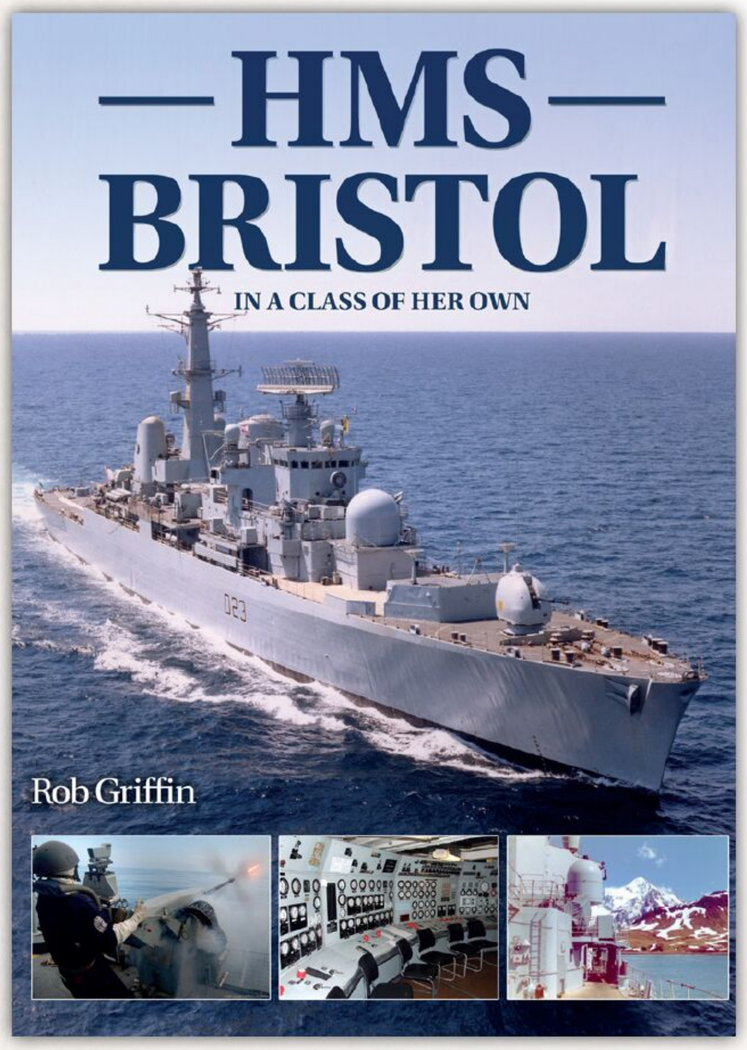

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The first encounter between British armour and the Red Army was not on friendly terms – with the British sending surplus tanks to reinforce the pro-monarchy White Army in the Russian Civil War. When the Reds won, war trophy Mark V heavy tanks as well as medium Mk.A Whippets and Mk.B Hornets entered service with the RKKA. As the political landscape changed during the 1920s, the Red Army assessed British designs available for export and a licensed copy of the Vickers Mk.E entered production in 1931 as the T-26.

During the early days of the German invasion of the Soviet Union, armour losses were huge and the Red Army once again looked abroad to acquire new fighting vehicles. A large-scale programme of military aid to the USSR began in August 1941, with the US and Britain offering help under separate terms – though not for free. A deal was struck and Convoy PQ-1 with the first 20 British tanks for the Red Army left for Arkhangelsk on September 29, 1941. These tanks arrived in time to take place in the Battle of Moscow and as shipments continued, British armoured vehicles would remain in service with the Red Army until the conclusion of the Second World War nearly four years later.

A wide range of British vehicles served under the Red flag during the war – ranging from Matildas and Valentines to Churchills and even Tetrarch light tanks.

In British Tanks of the Red Army, tank expert Peter Samsonov presents a history of British tanks in the Soviet Union and provides a detailed account of their use on the battlefield, including what the Red Army tankers thought of them.

Locomotive No 32 Tamerline became the first steam locomotive to be completed at Crewe Works on 10 March 1843. One hundred and fifteen years later BR 9F No 92250 became the 7,331st steam locomotive to be built at the Cheshire works, when completed in December 1958. This publication is a tribute to the thousands of people employed there during the steam locomotive building era.

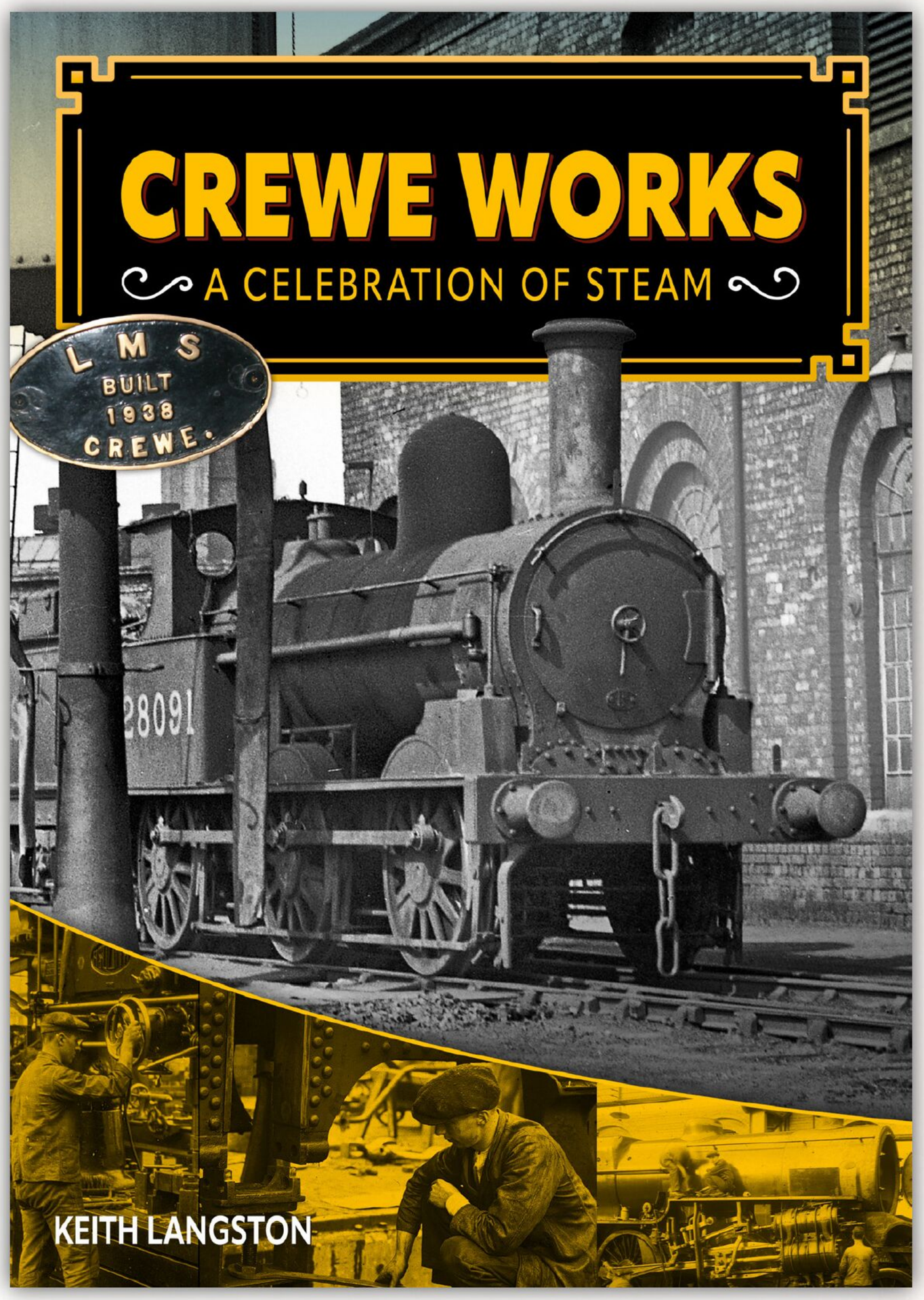
In 1913 The Railway Magazine proudly described Crewe as "the most famous railway works in the world". Indeed, railways throughout the world benefited from adopting 'best Crewe practice'. Many who worked at Crewe in its heyday, first under the London & North Western Railway and later the London Midland & Scottish Railway, held the firm belief that the works was the 'beating heart' of the Cheshire town.

Back in those days you would be hard put to find a local family without some kind of connection to that vast engineering enterprise. In earlier times the works not only provided the steadily growing town with employment, but furthermore supplied the town with both gas and domestic water. For example, the consumption of the gas produced at the works in the 1940s was assessed as 30% to the works, 20% to Rolls-Royce and 50% to the town. Those statistics are a great example of the many close ties that existed between the works and the town.

After the post-war Trasport Act, steam locomotive construction and maintenance continued under the newly created company British Railways. From 1948 under Nationalisation in addition to locomotive building, BR Crewe Works was responsible for the maintenance of some 2,779 steam locomotives. However, even as the Standard Locomotive building programme got underway plans for a future railway system without steam traction were being drawn up.

The timeline of this publication highlights those steam locomotive classes which were listed as being built by Crewe Works (in any time period) but importantly included in the BR January 1948 stock list. It also includes BR Standard class locomotives built at Crewe post 1951. Steam traction did return to the works, albeit in only a token manner during the occasion of the September 2005 Great Gathering.

Crewe Works – A Celebration of Steam by Keith Langston is not intended to be a source of detailed steam engineering practices, but is a comprehensively illustrated record of steam locomotive building and maintenance at Crewe Works. Fortunately, important engineering work was still carried out at Crewe Works in 2023. Given the reduced size of the works, and reduction in numbers employed, it would not be unfair to say that the once 'beating heart' of the town is at least a 'discernible pulse'.



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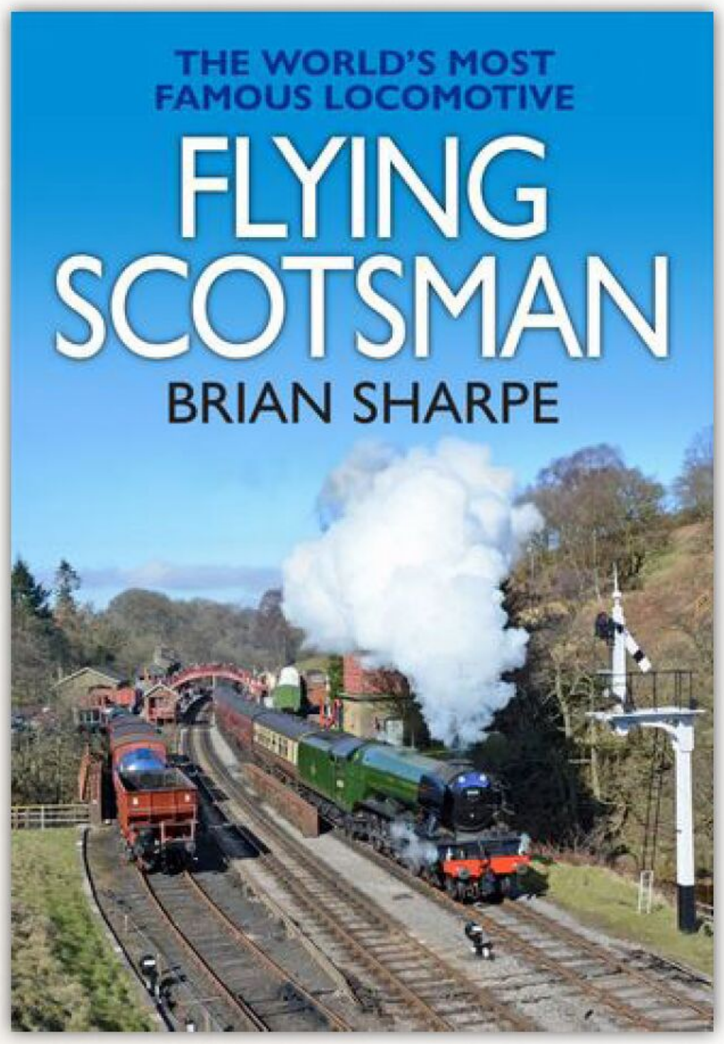

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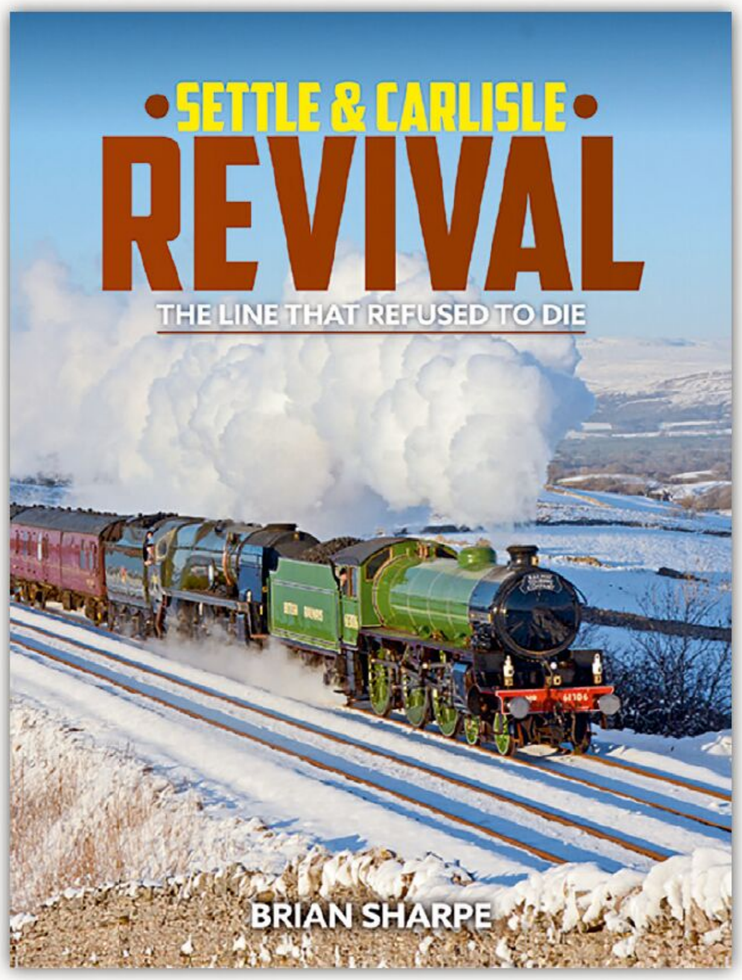

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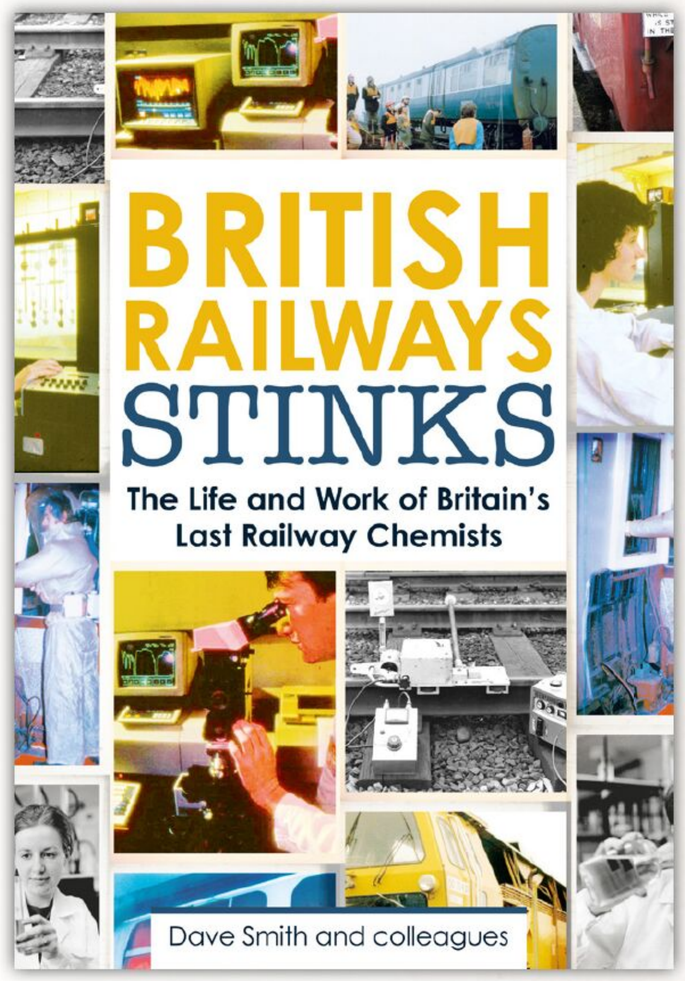

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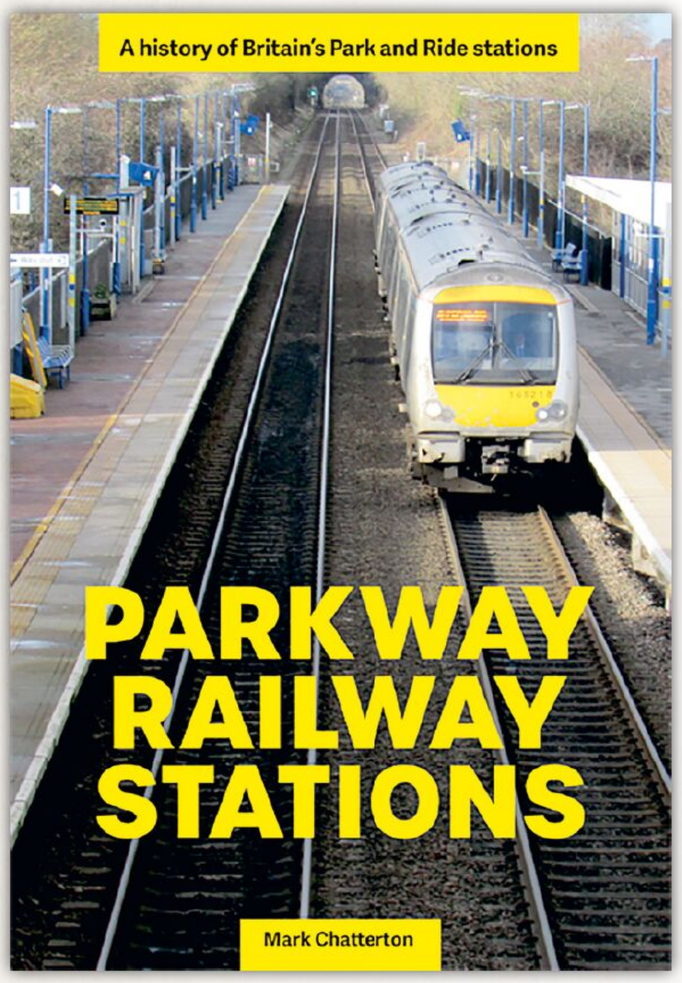

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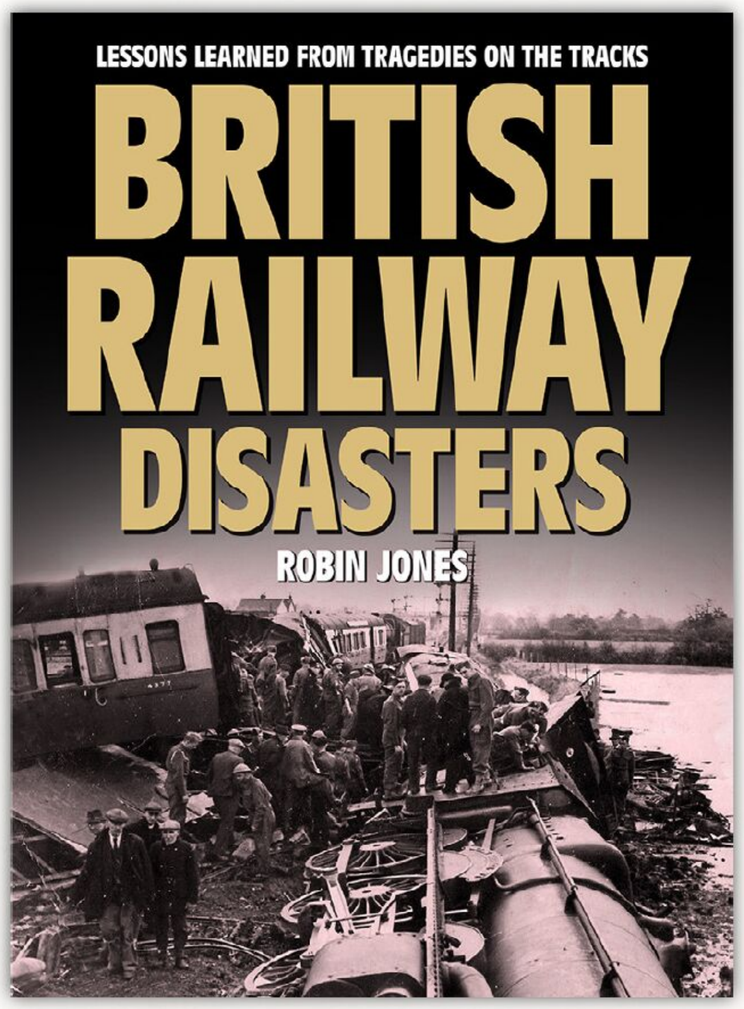

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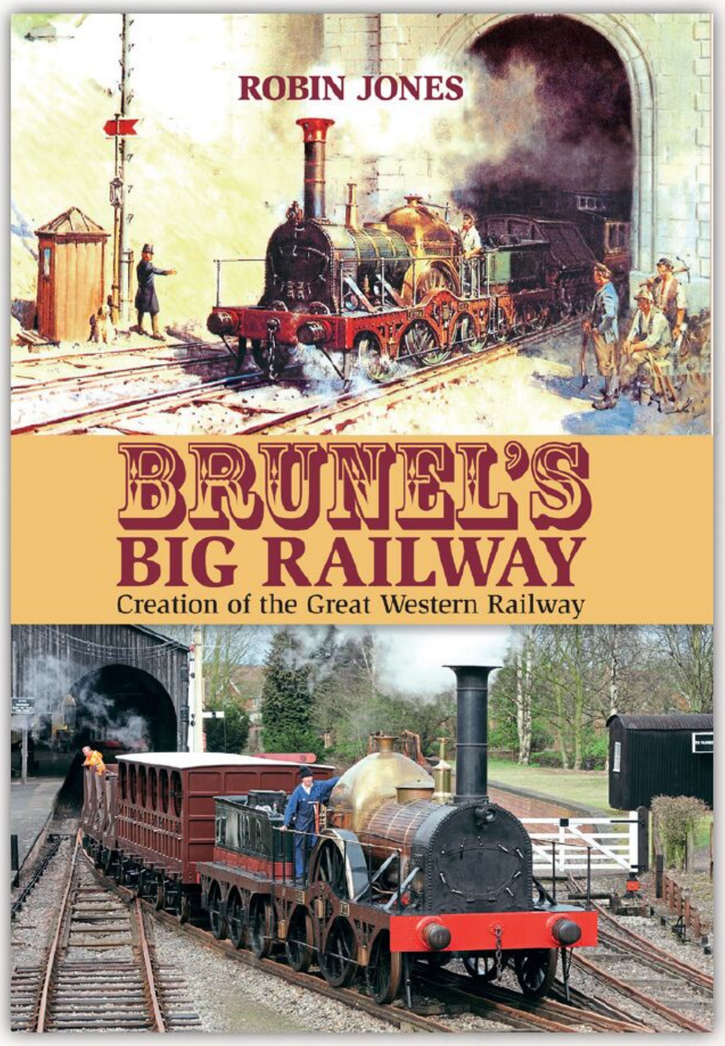

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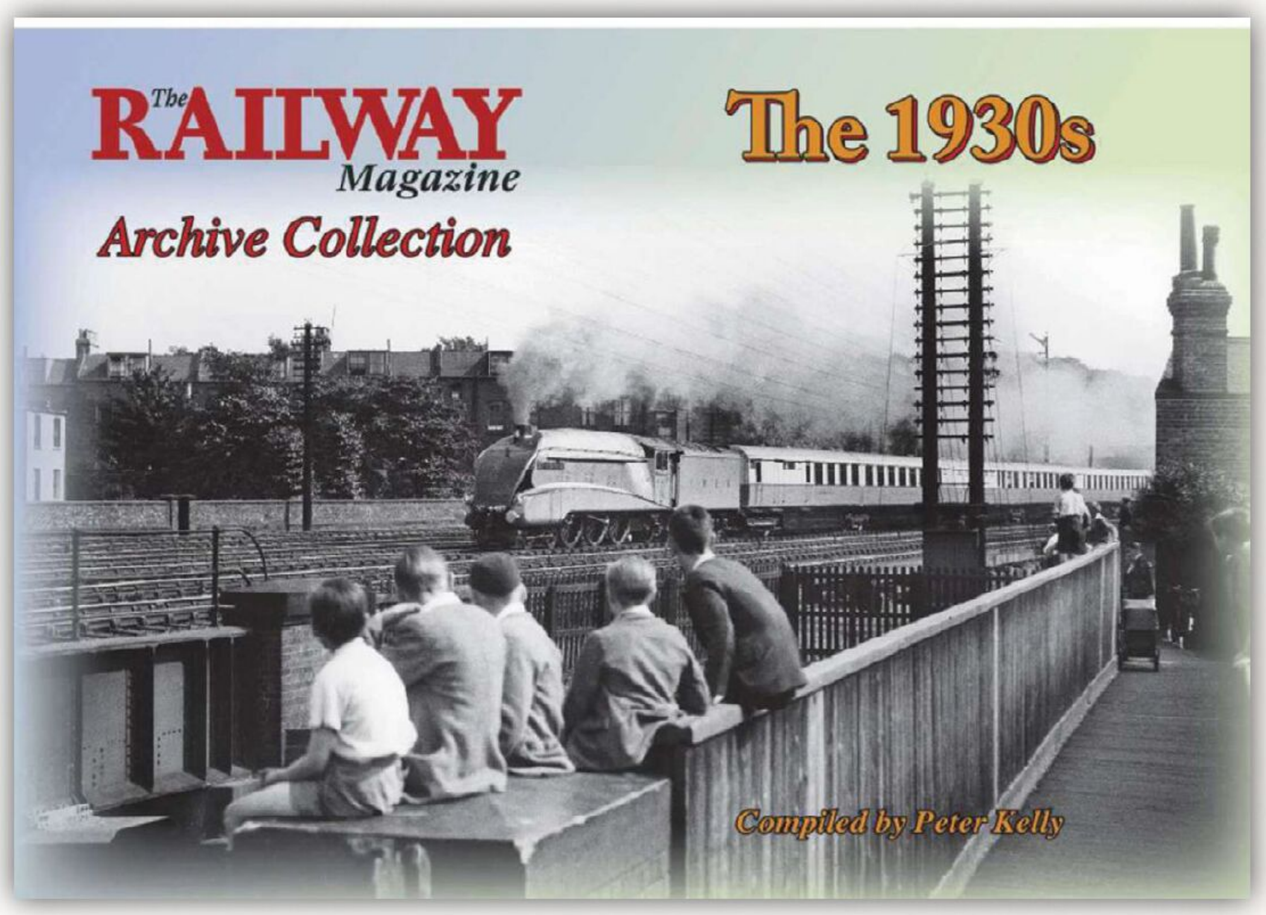

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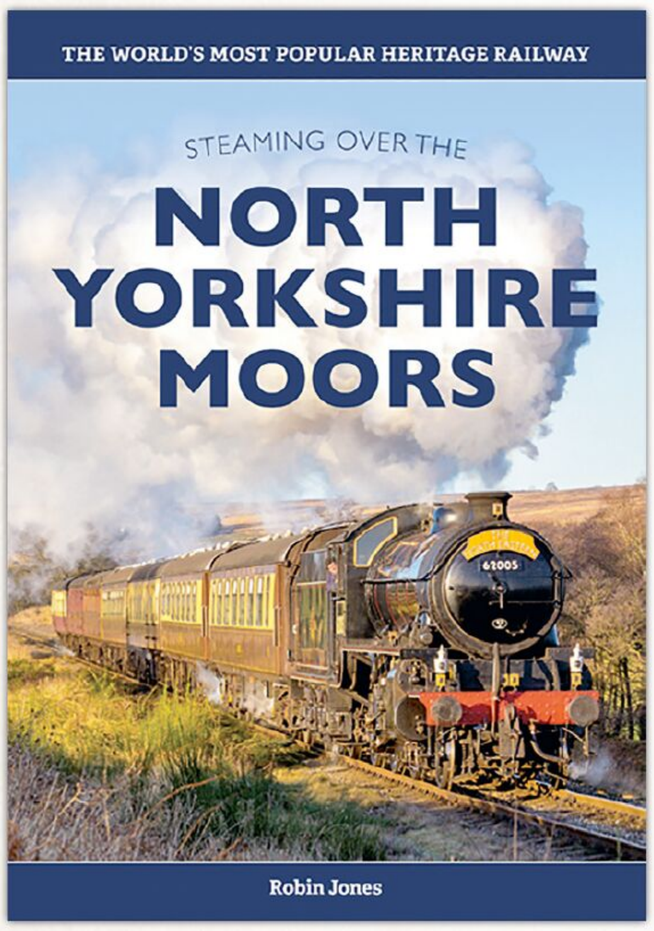

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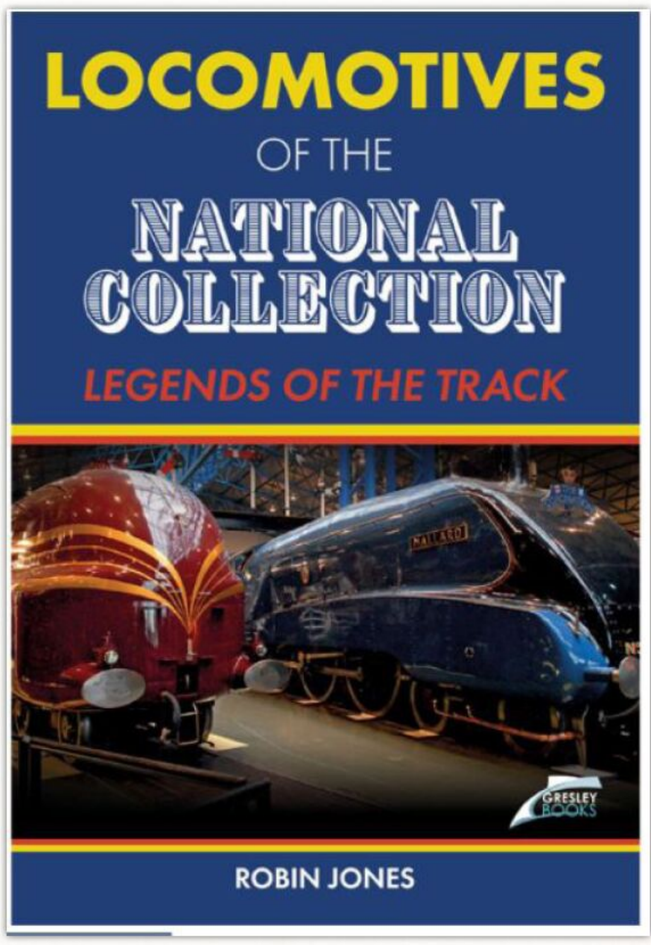

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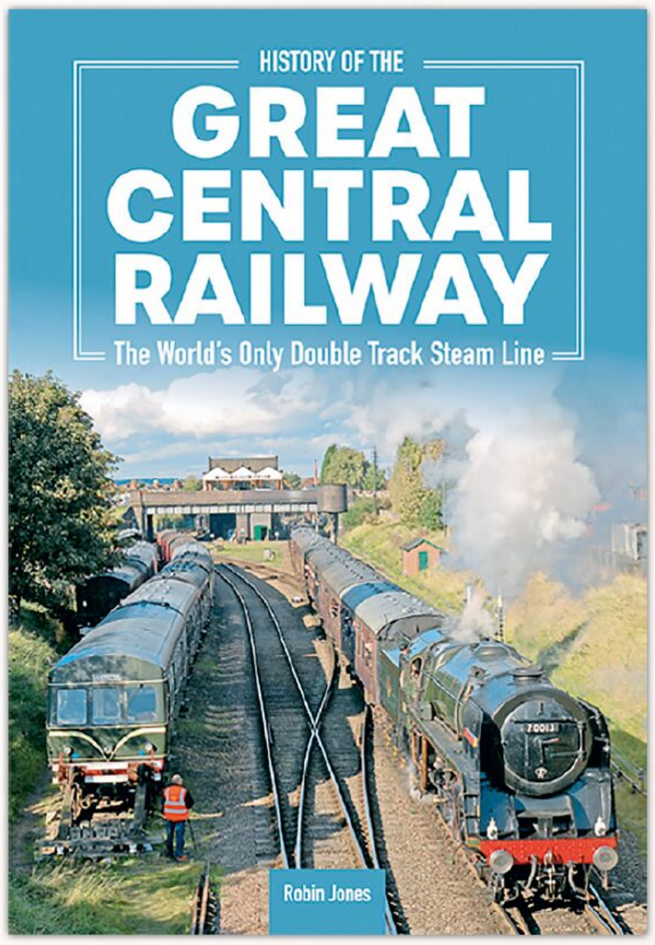

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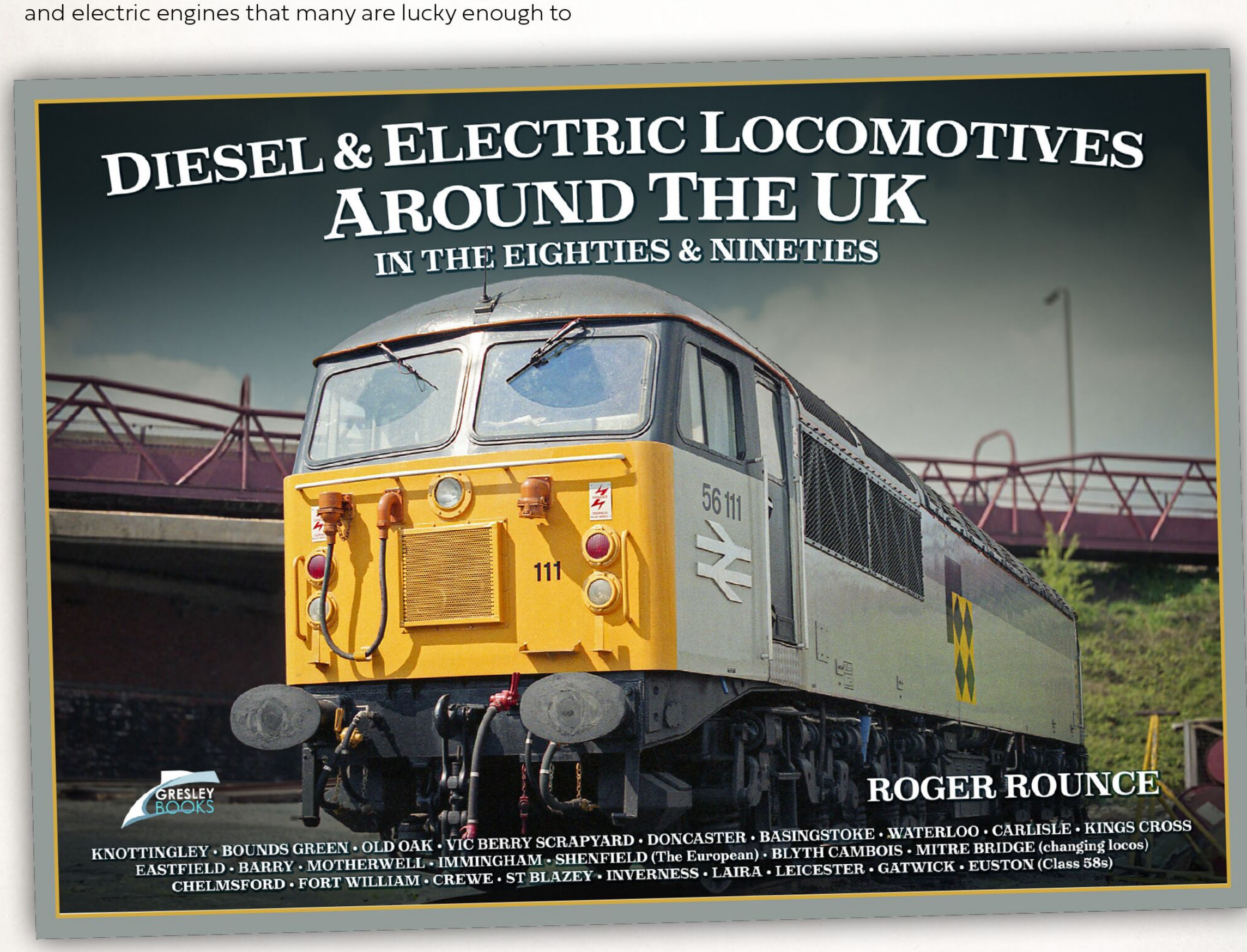

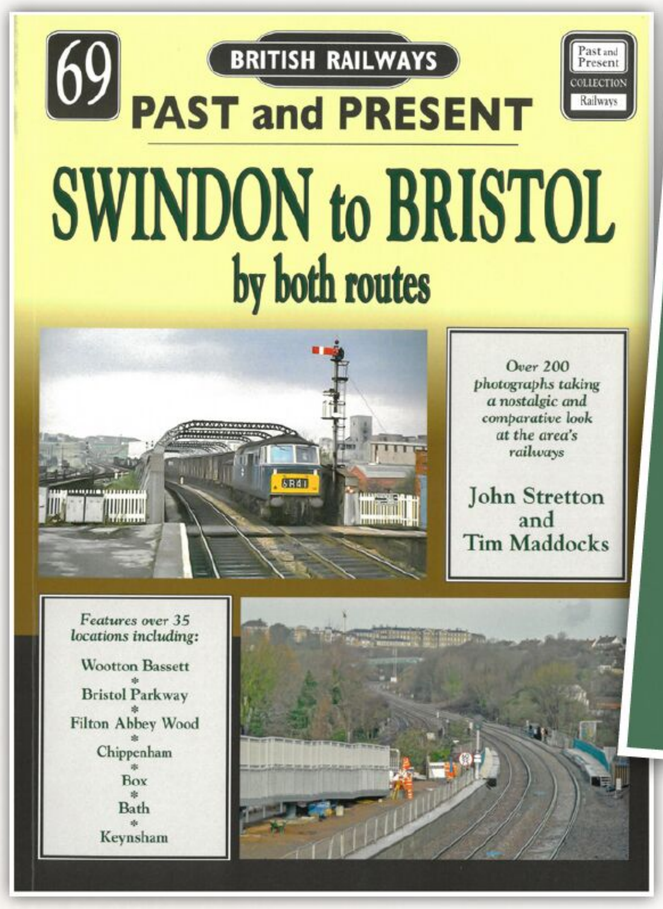

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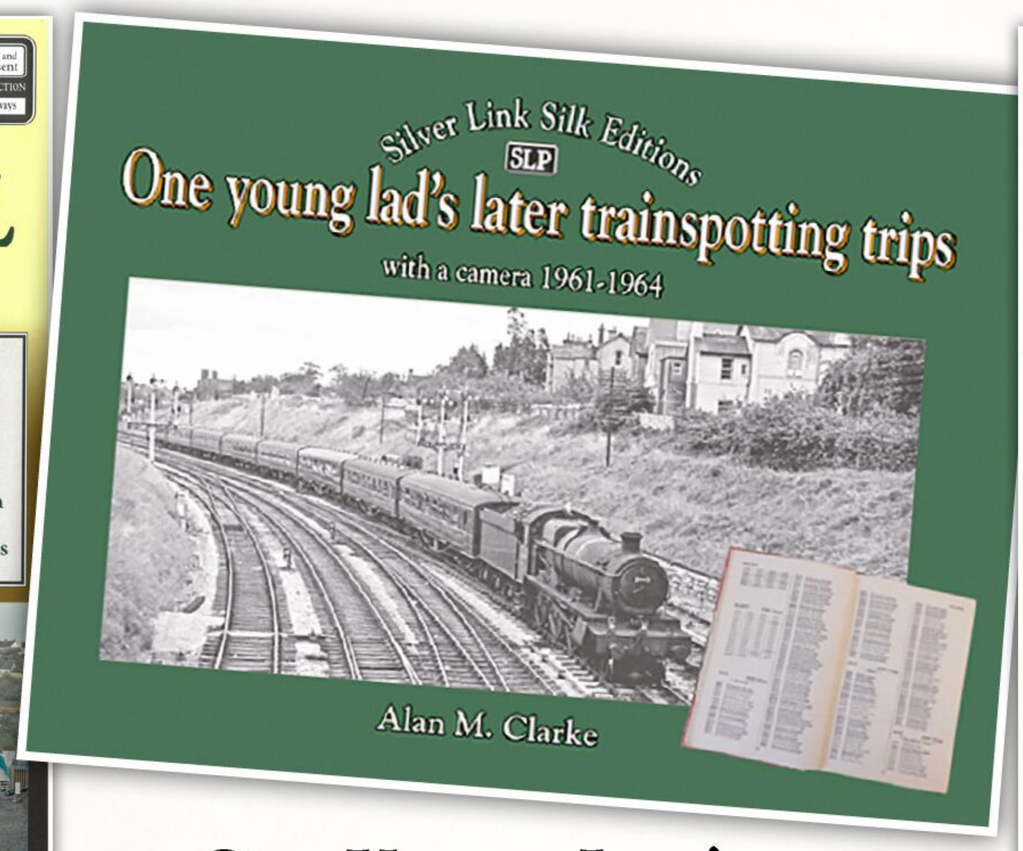

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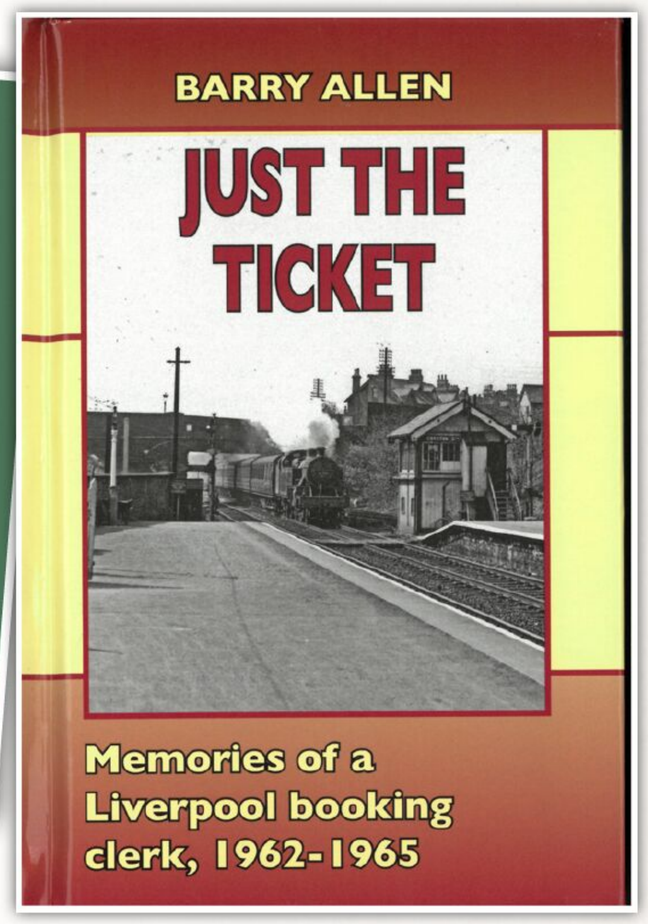

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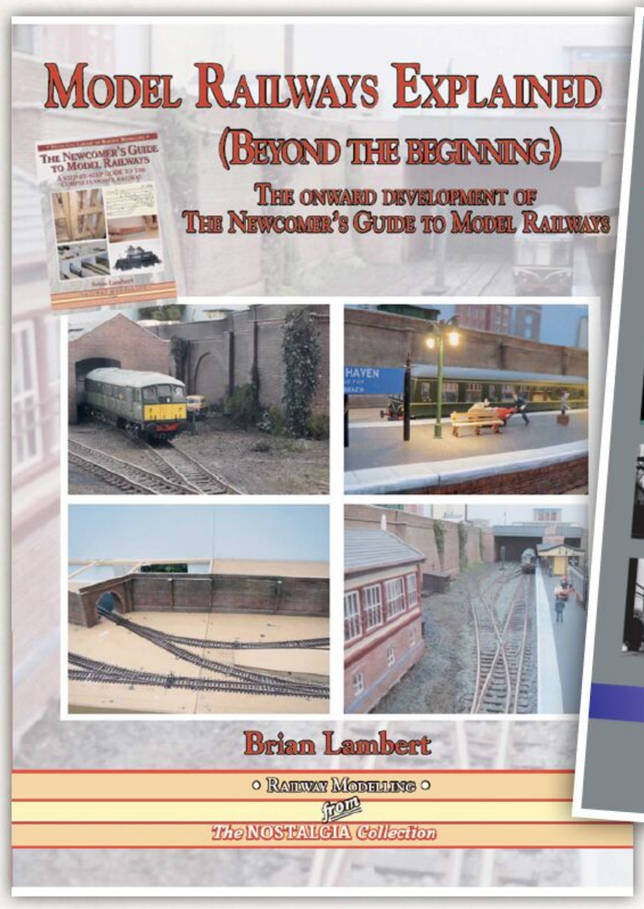

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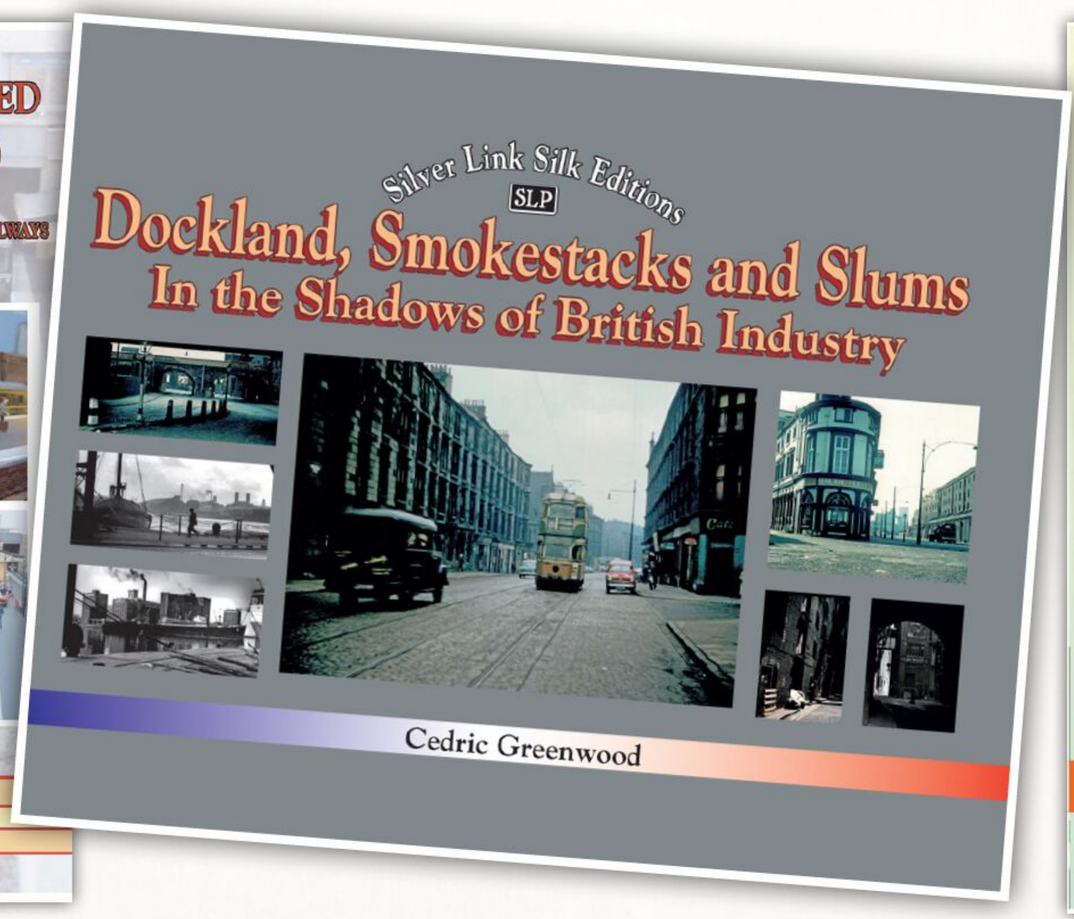

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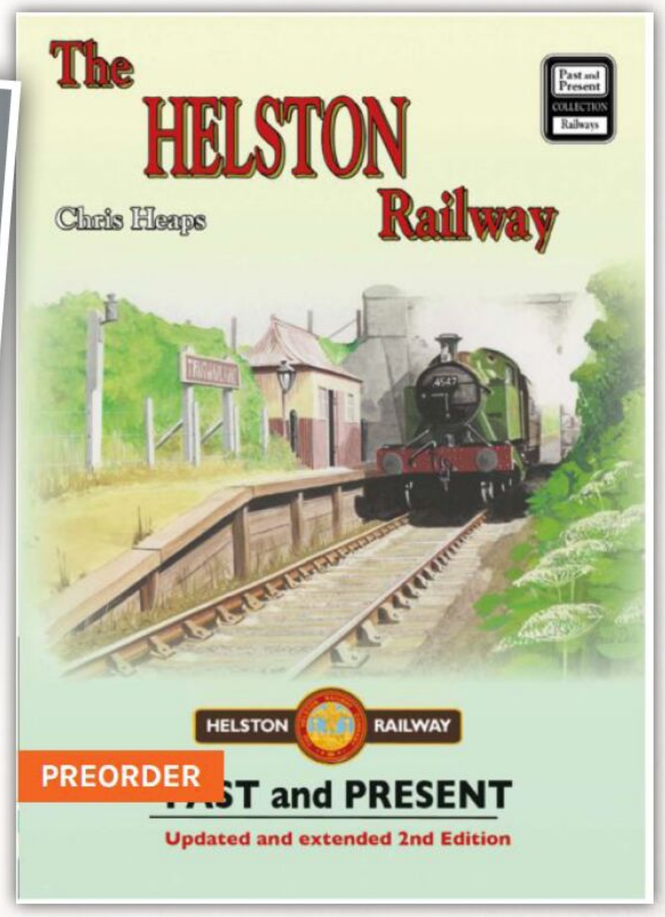

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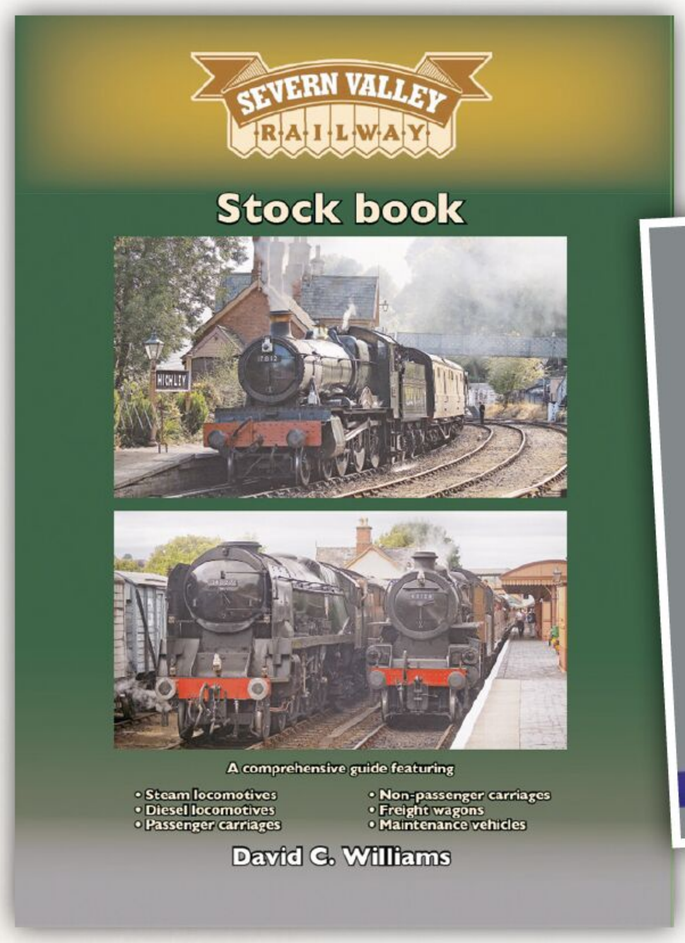

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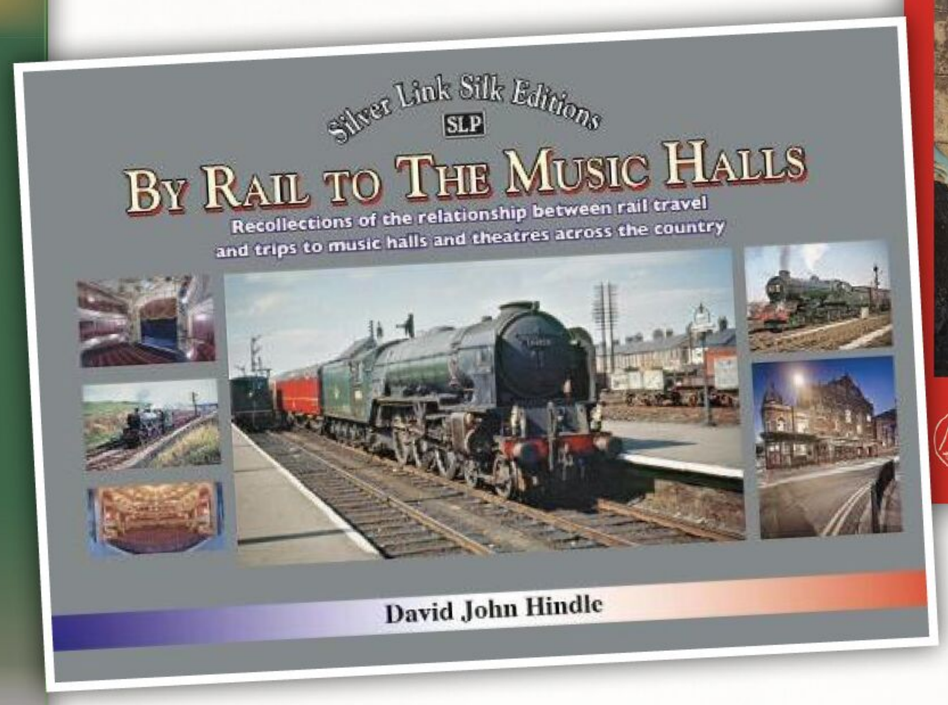

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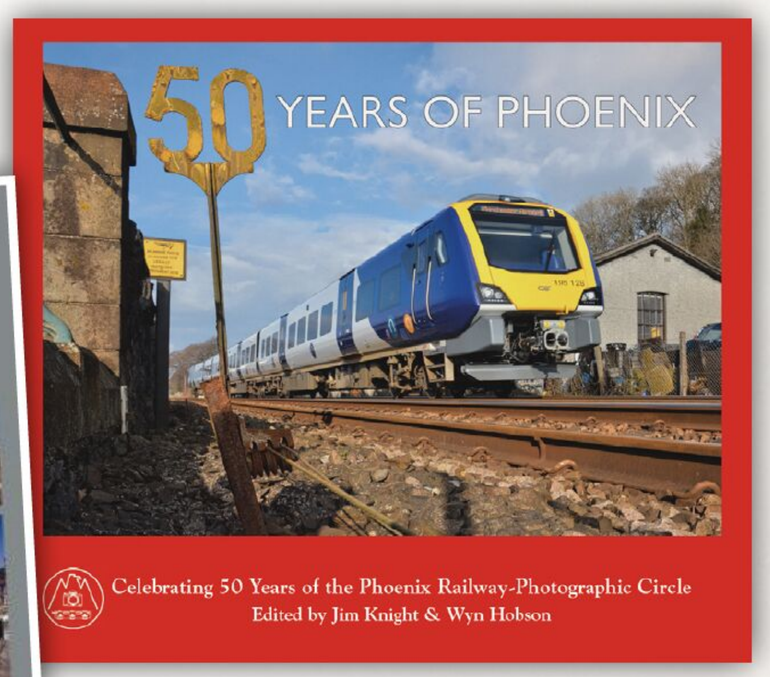

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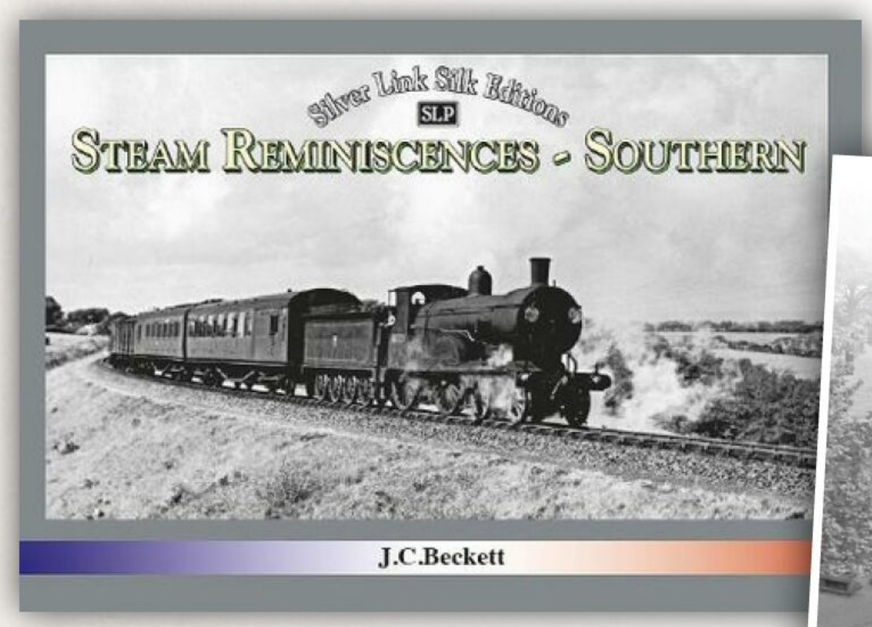

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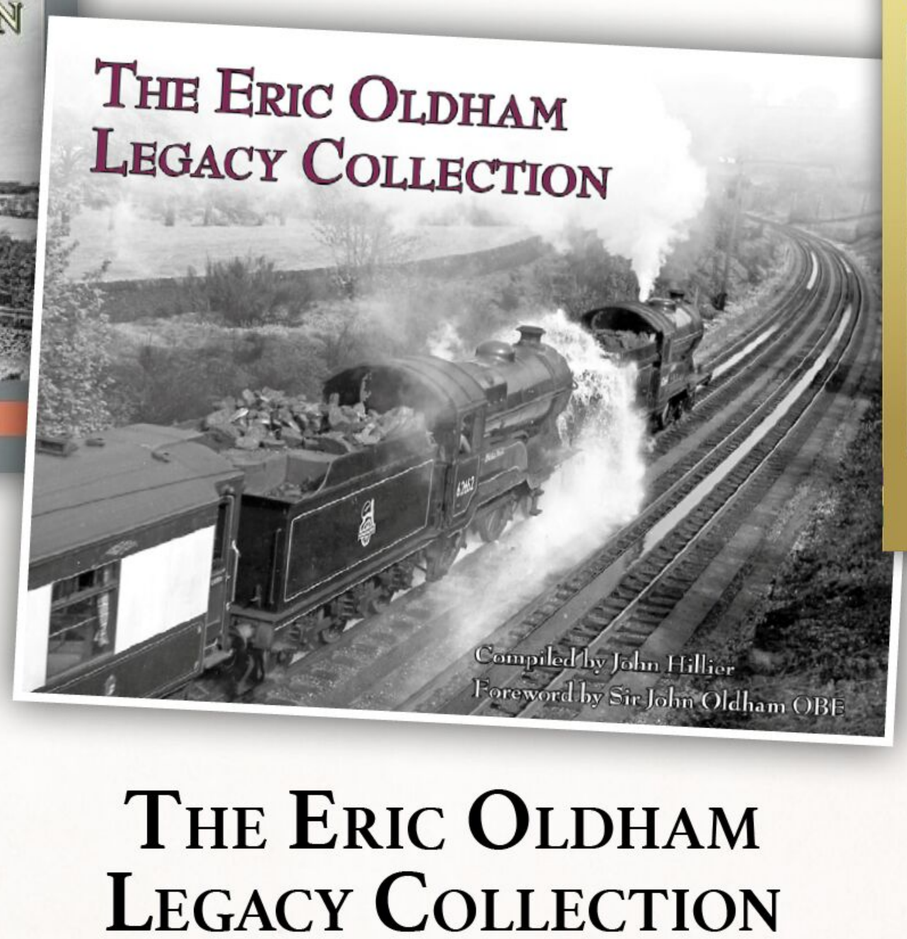

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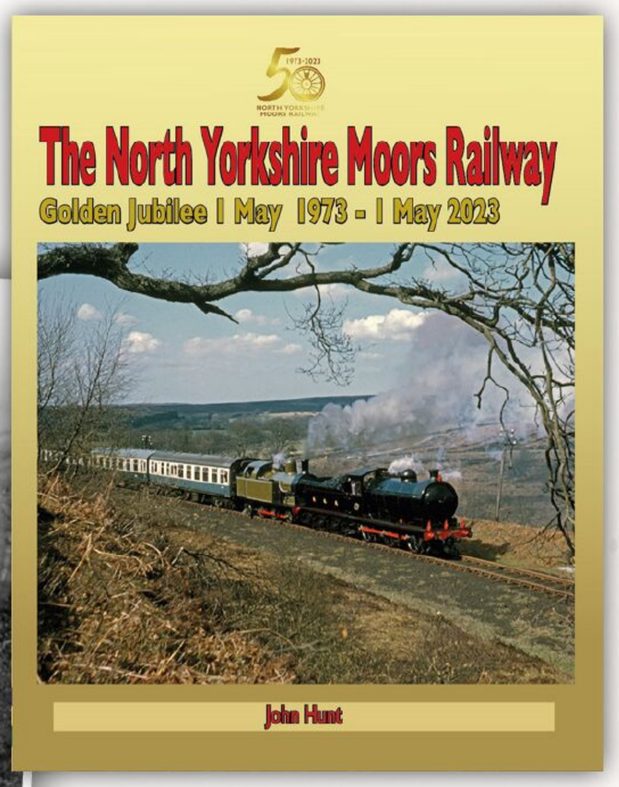

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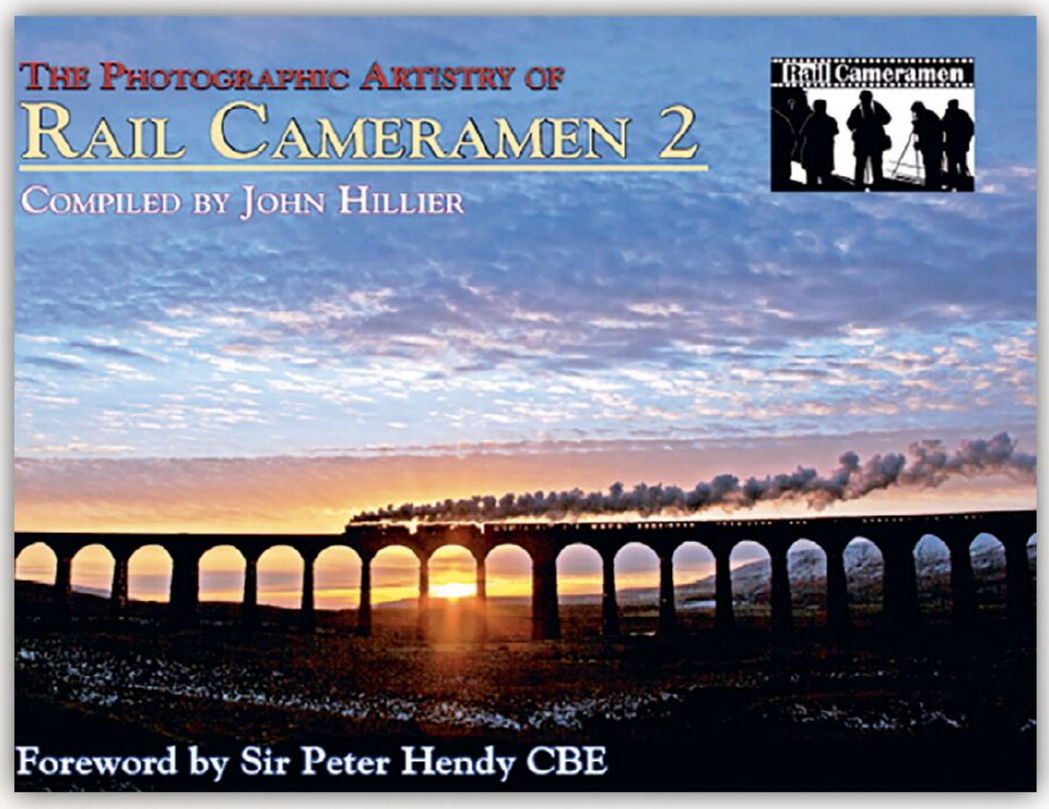

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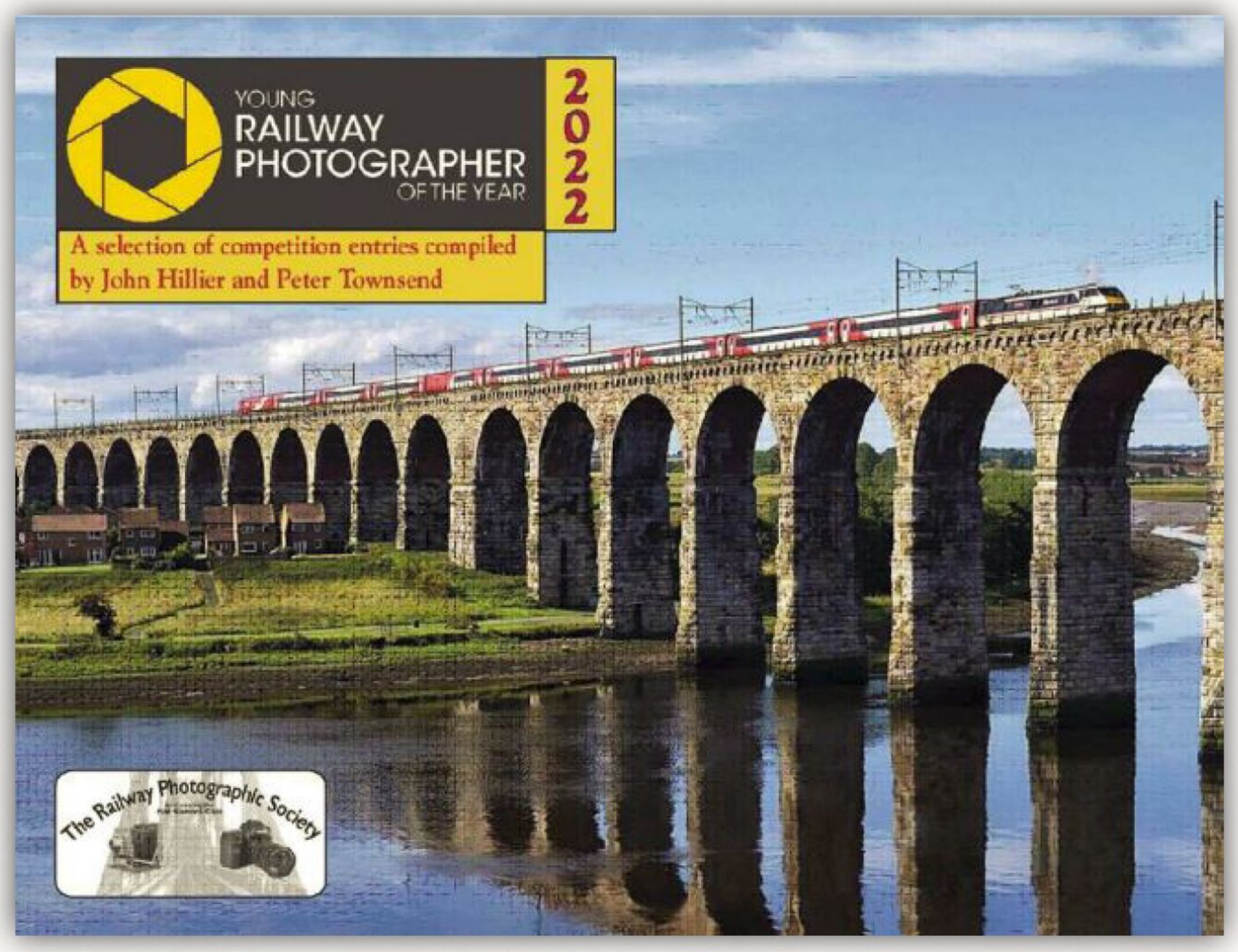

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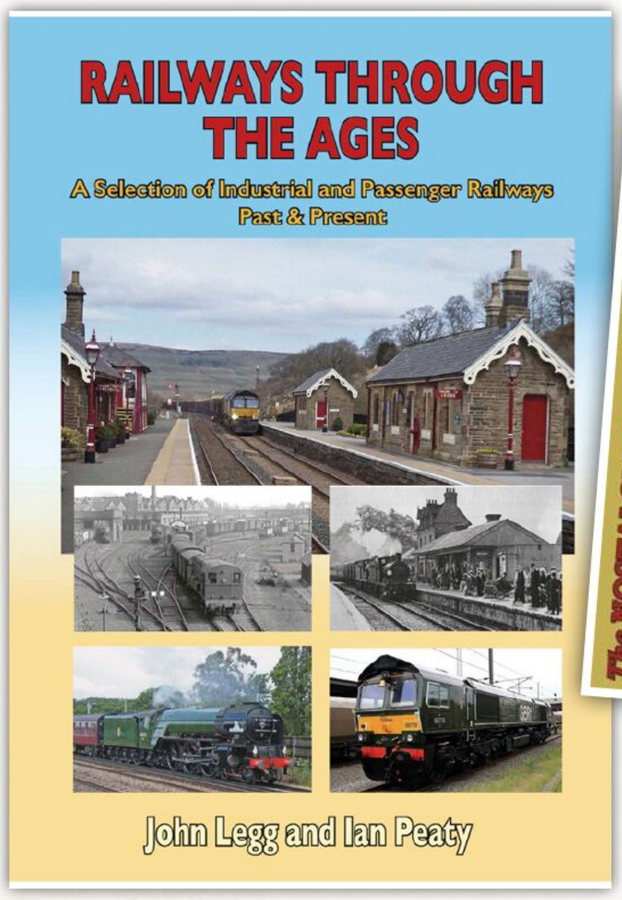

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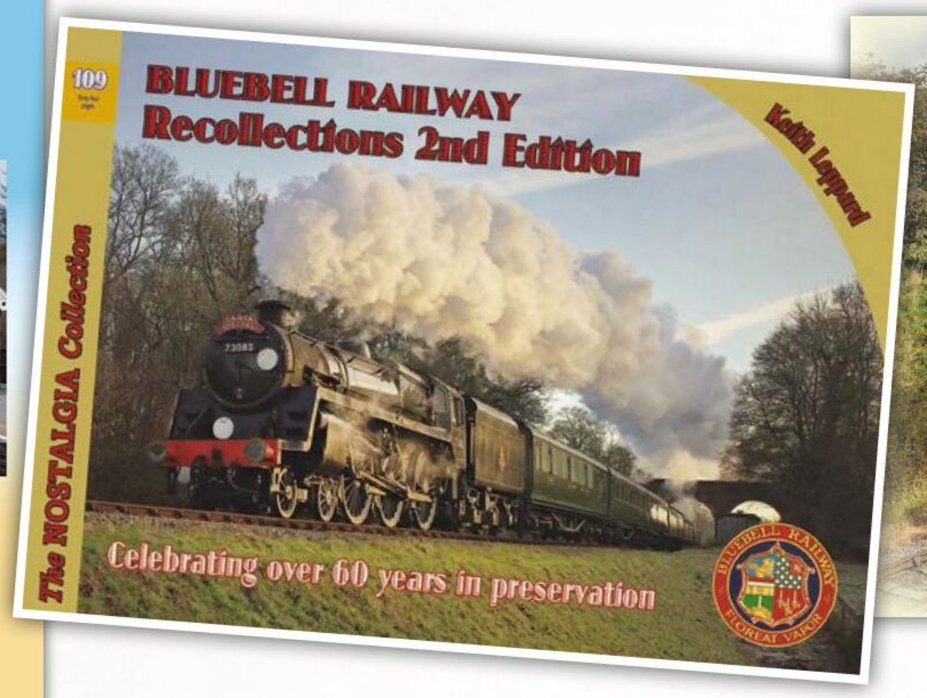

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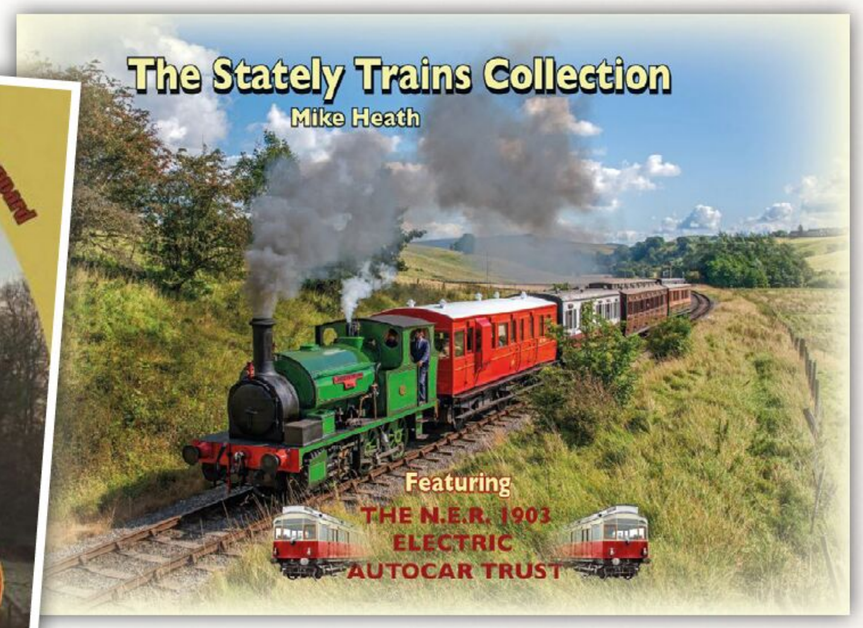

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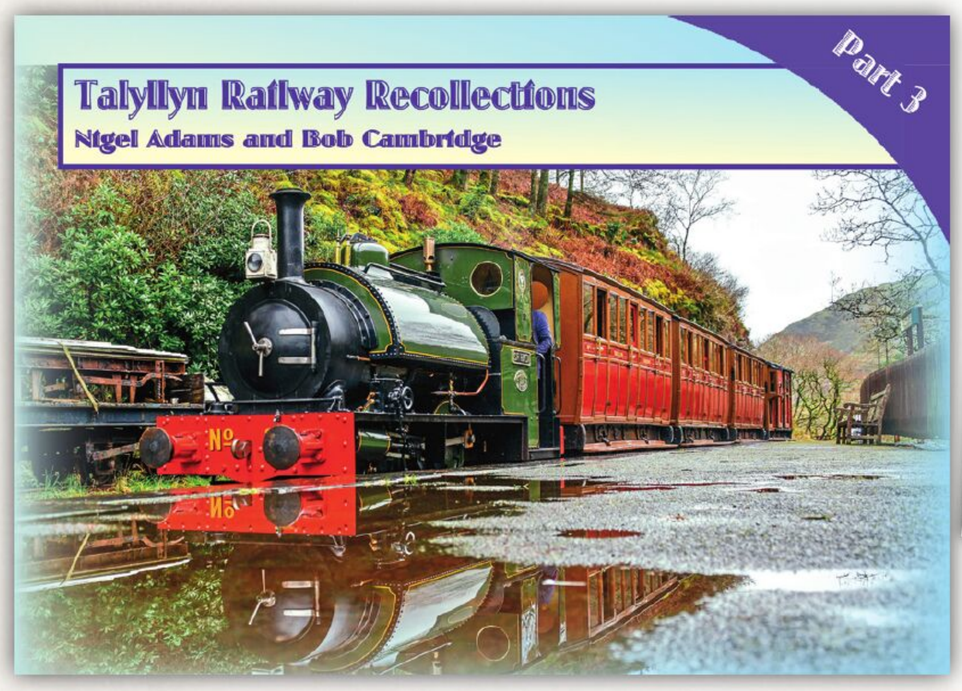

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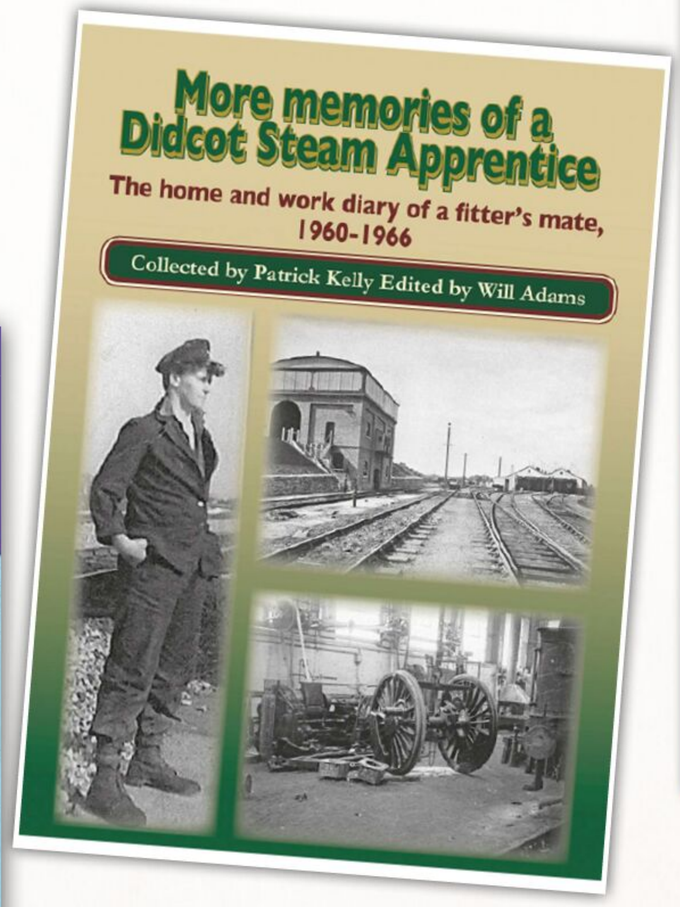

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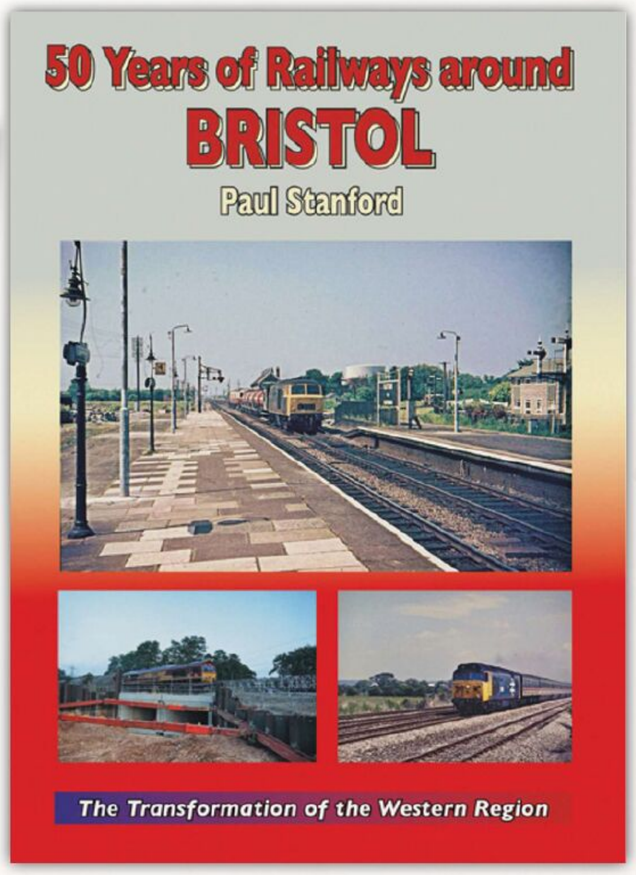

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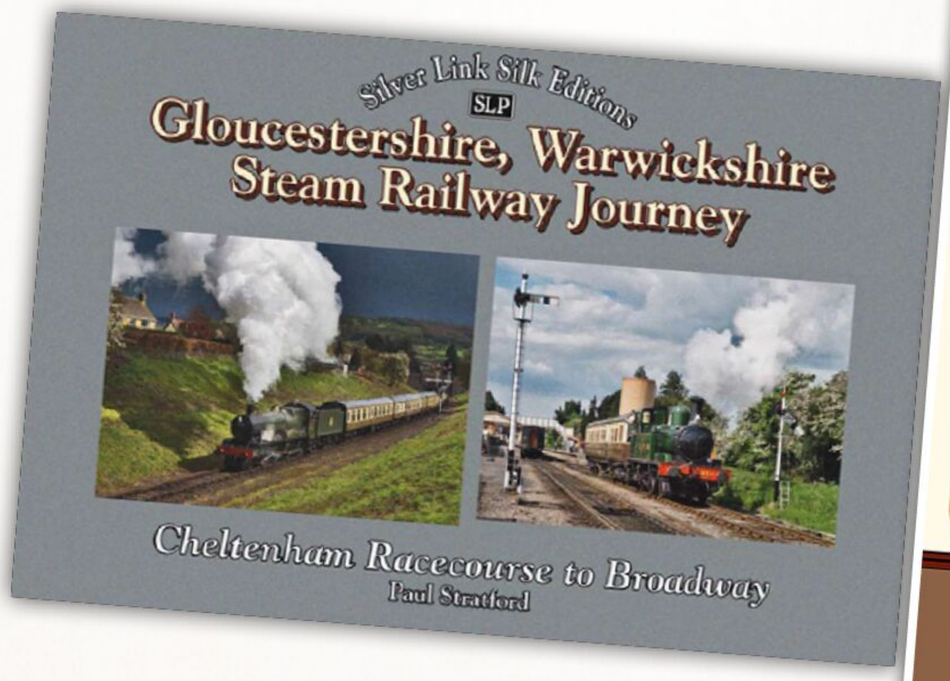

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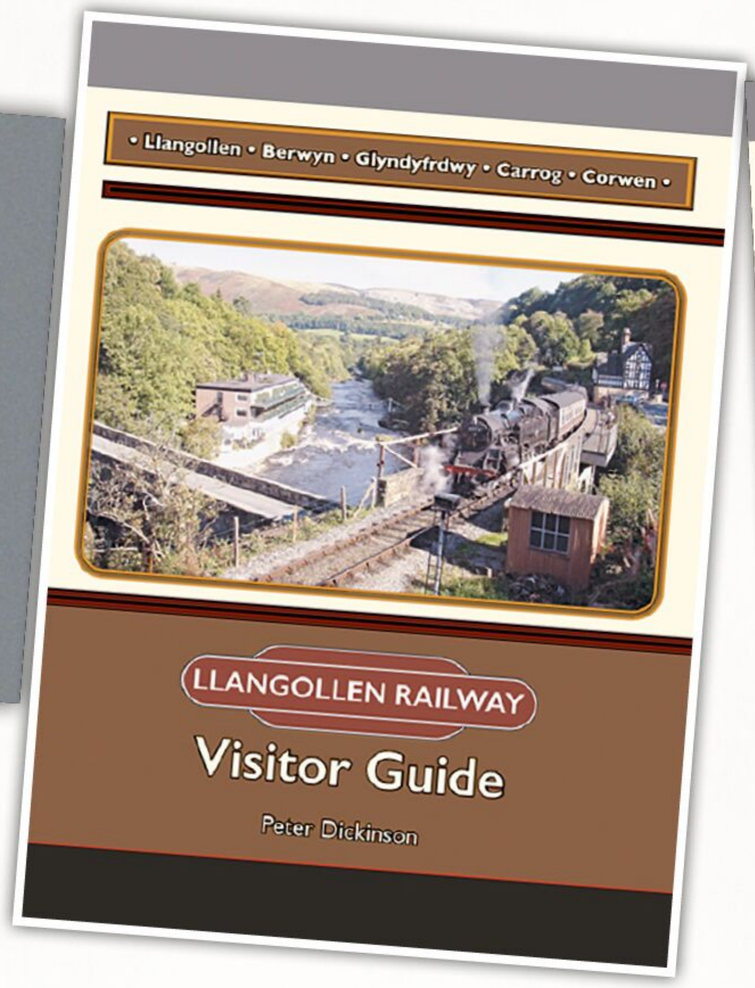

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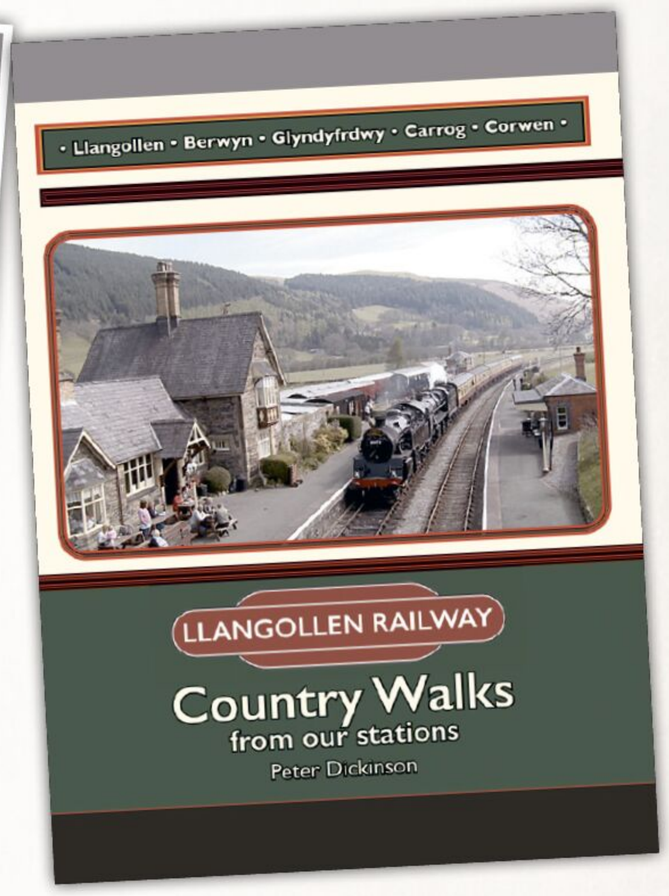

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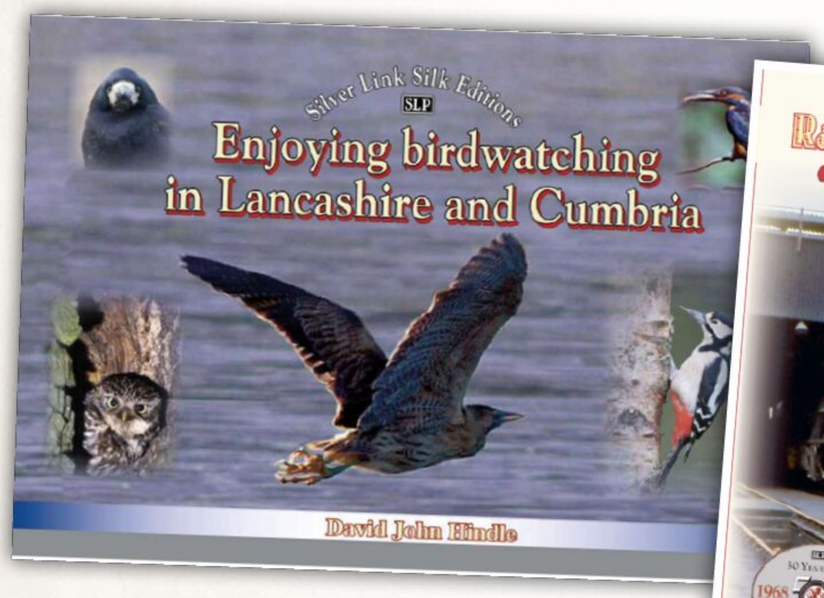

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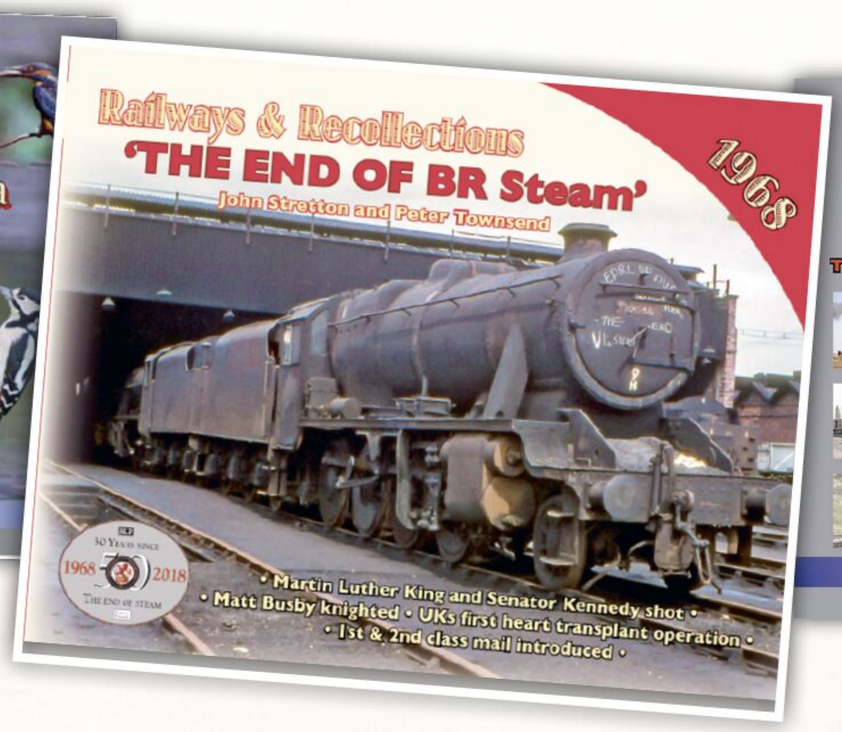

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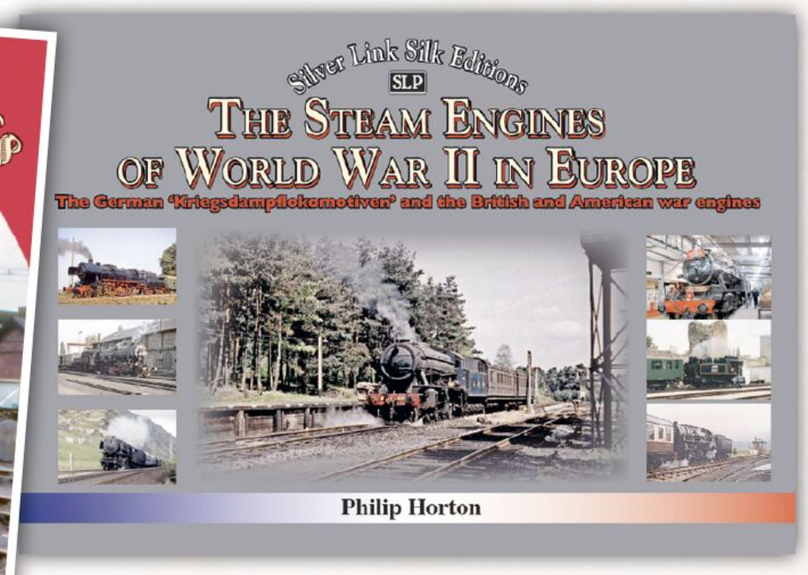

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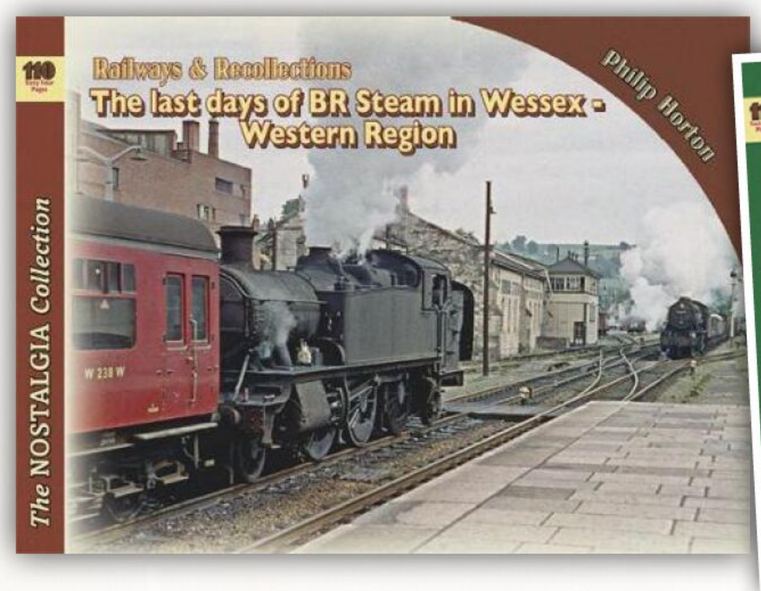

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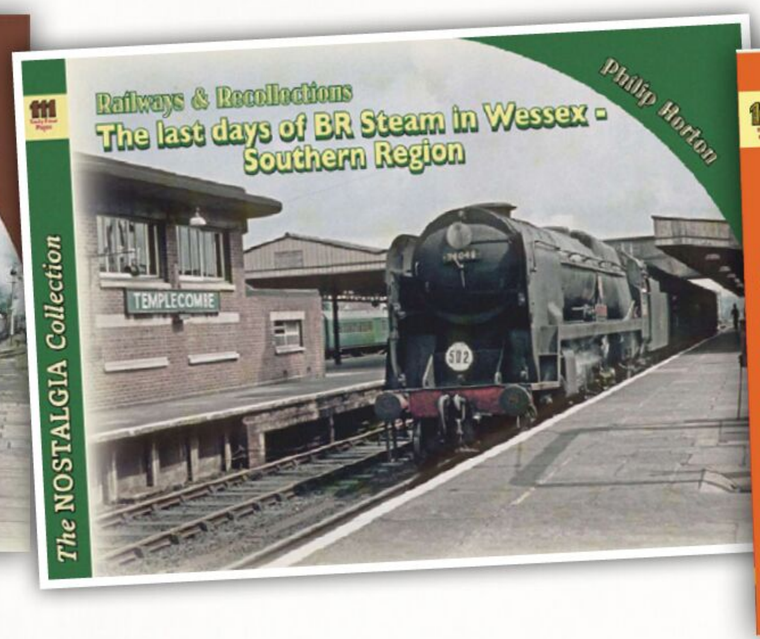

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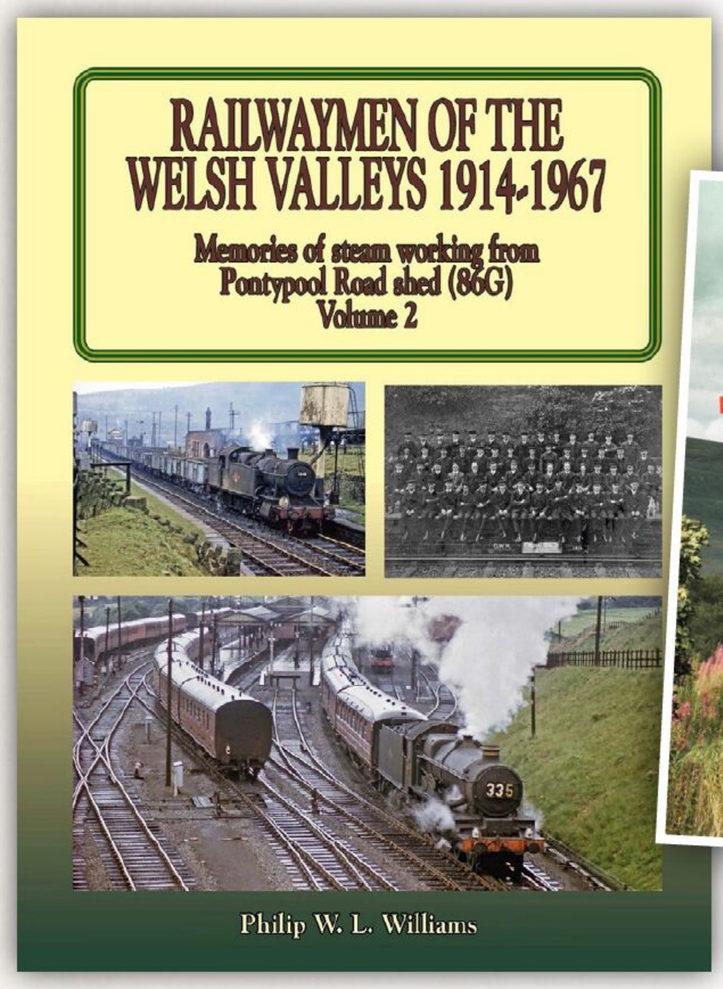

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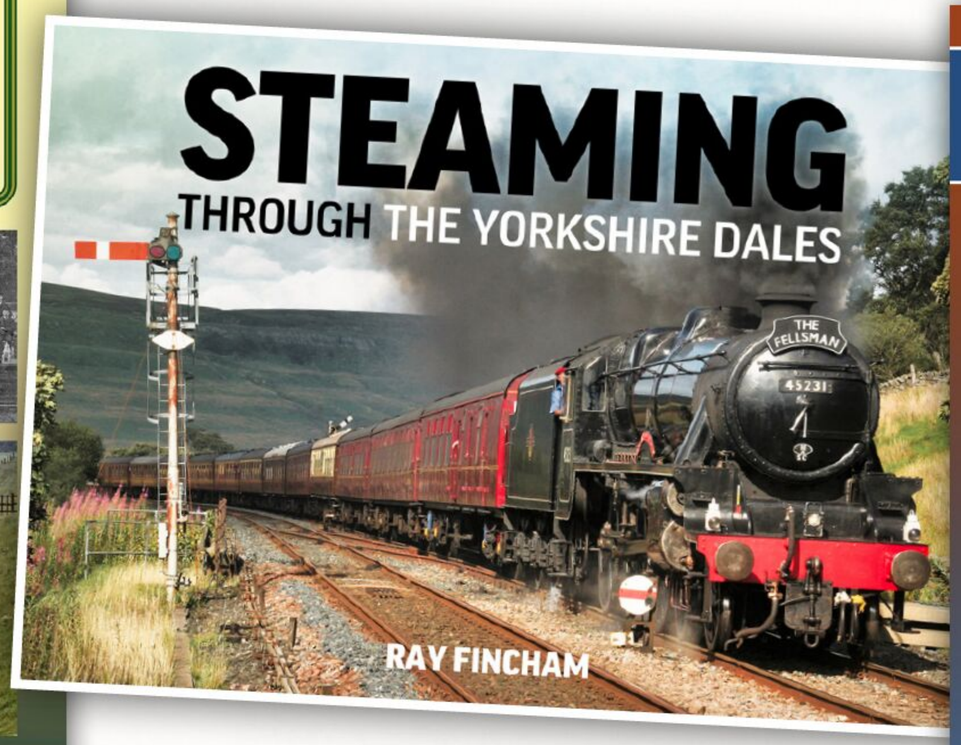

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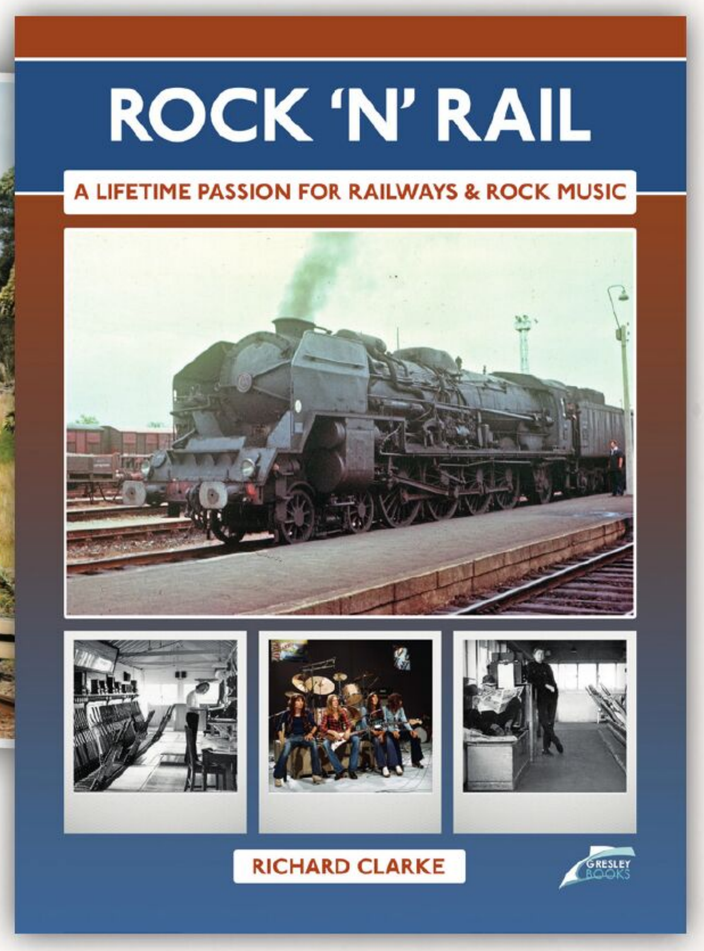

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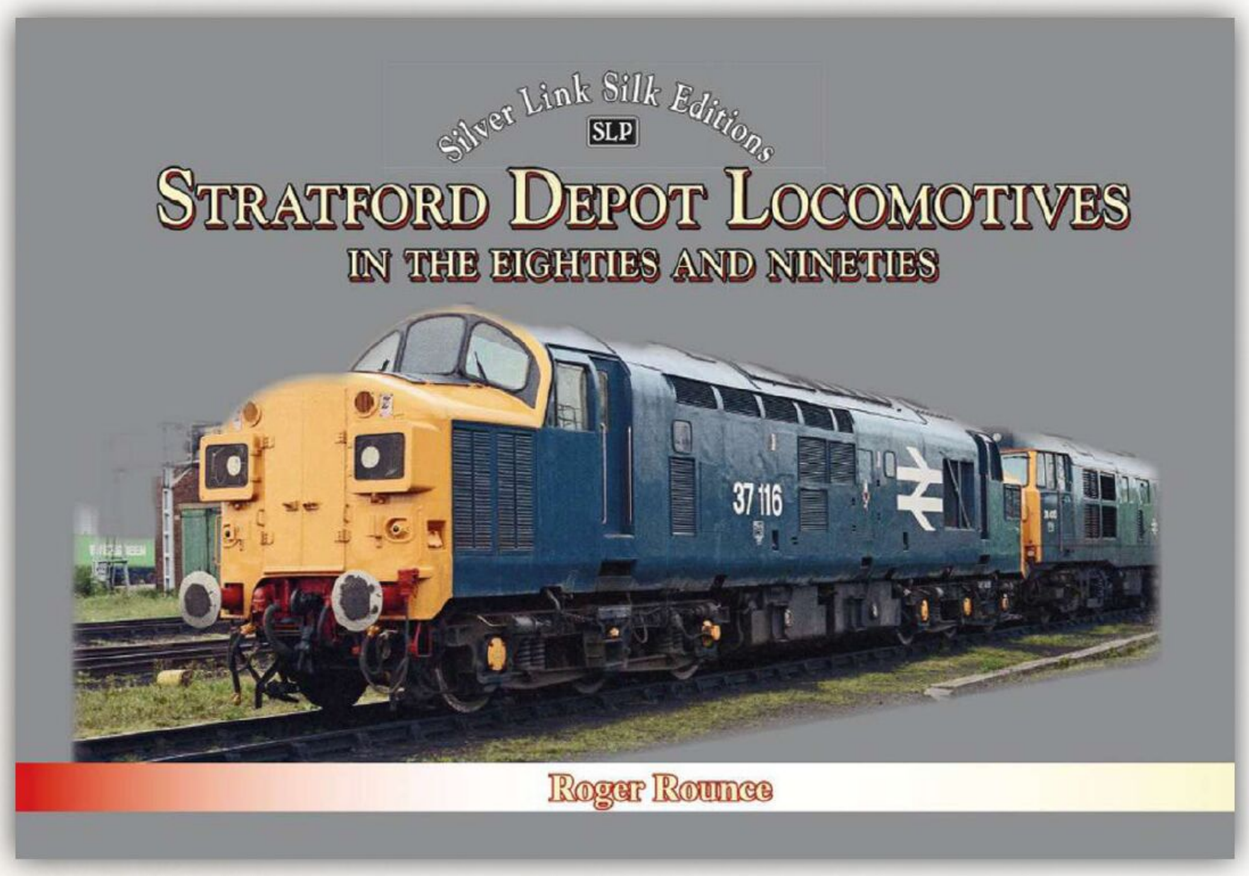

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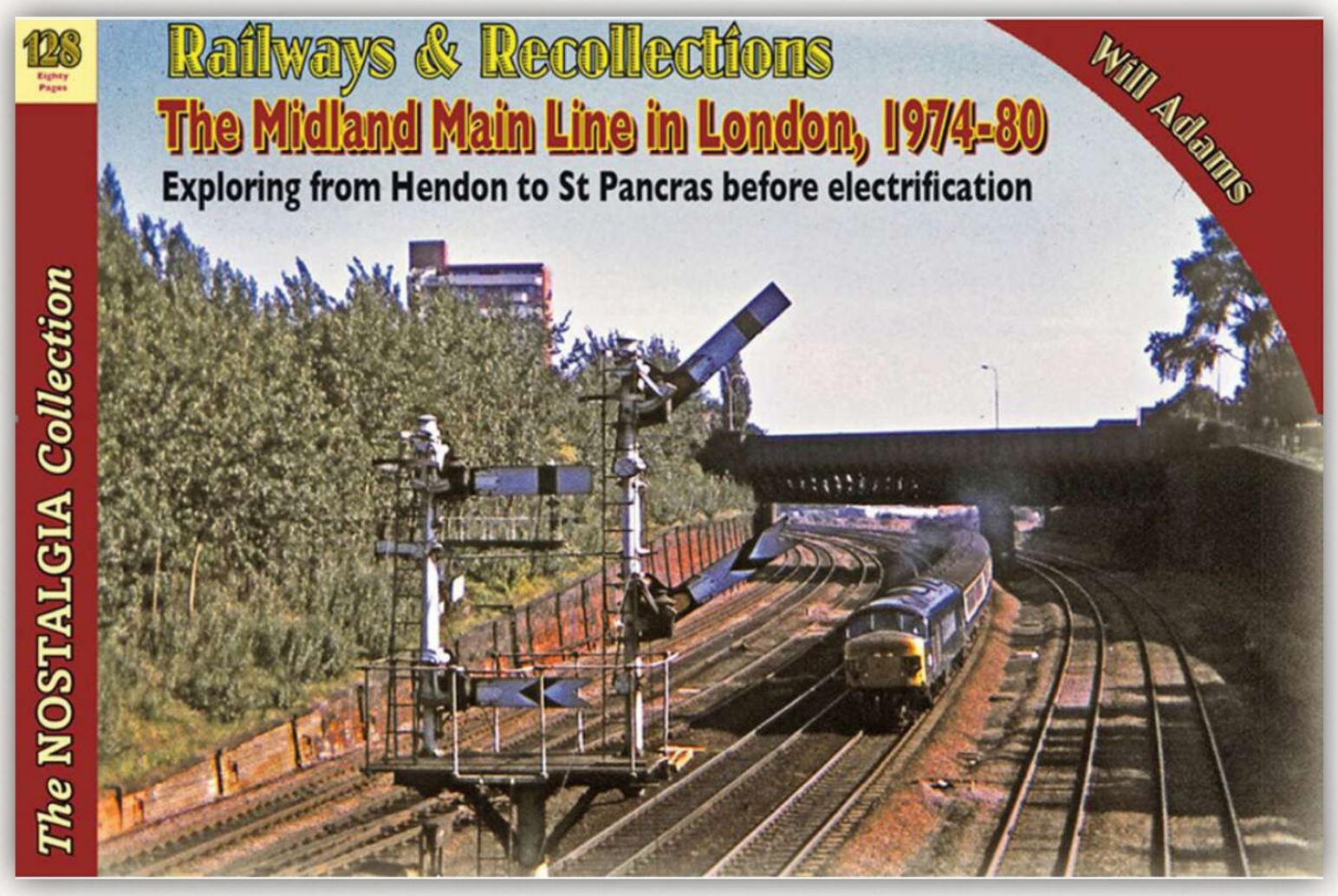

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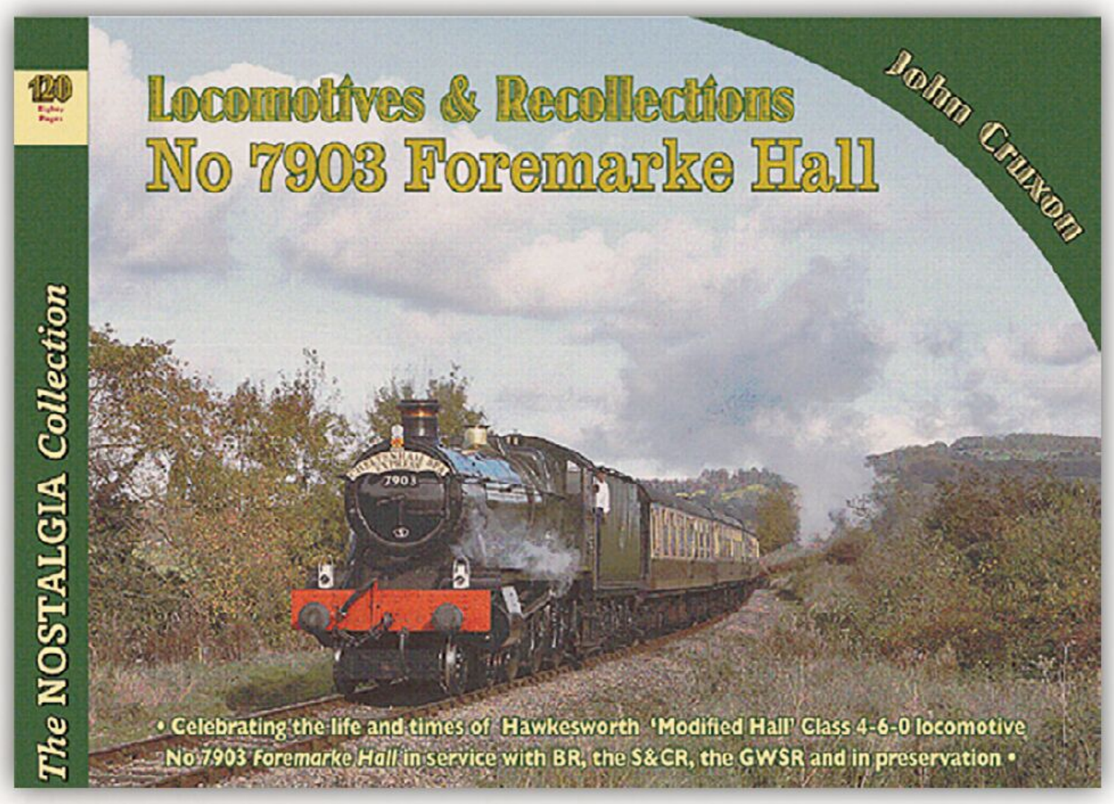

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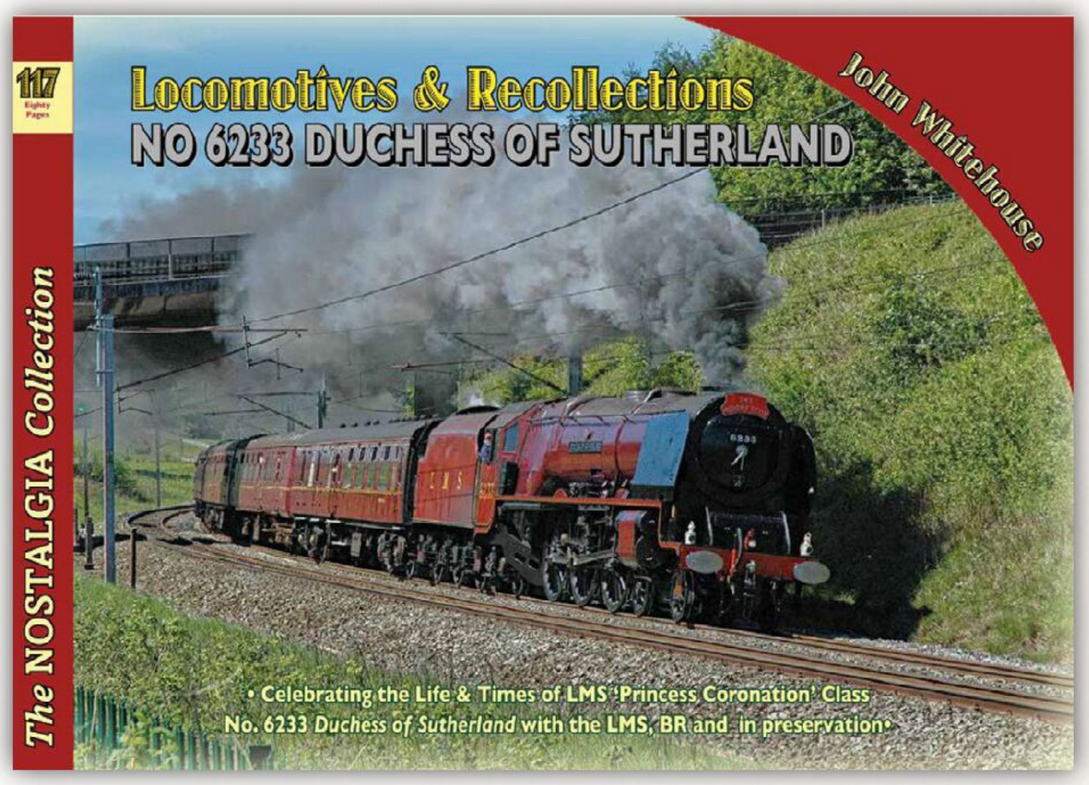

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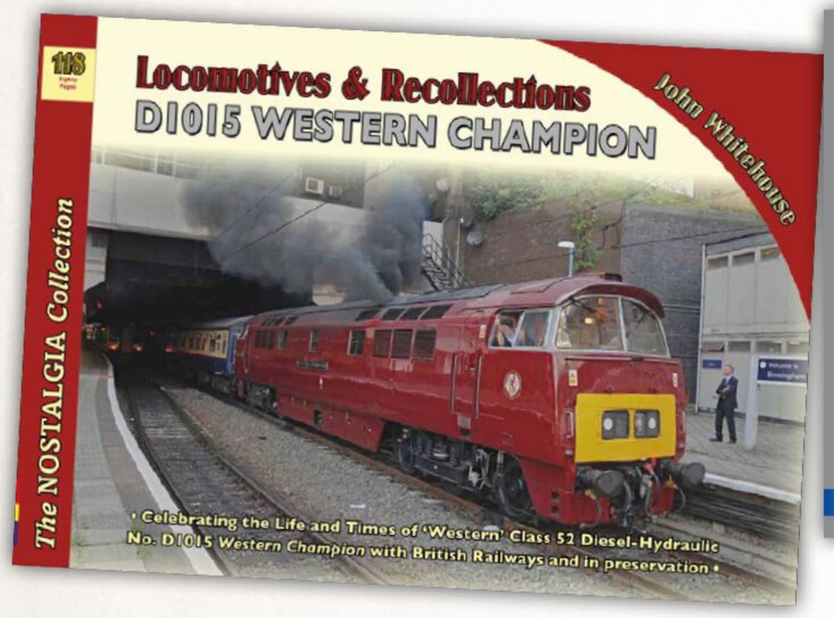

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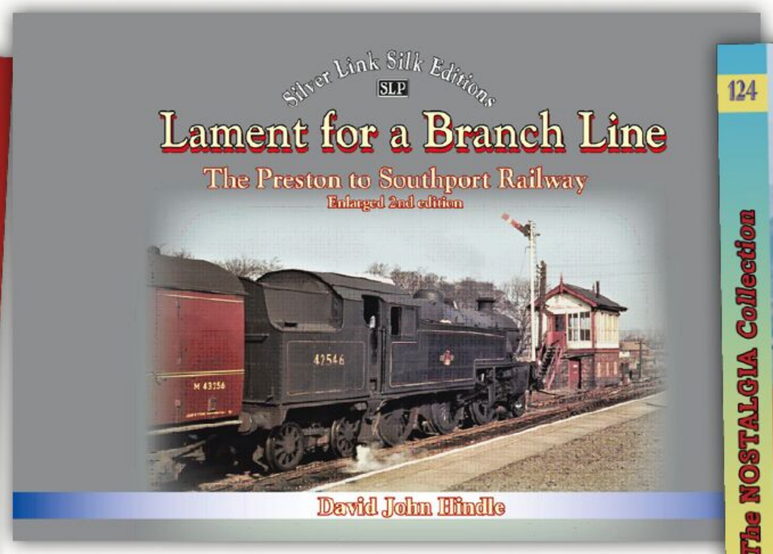

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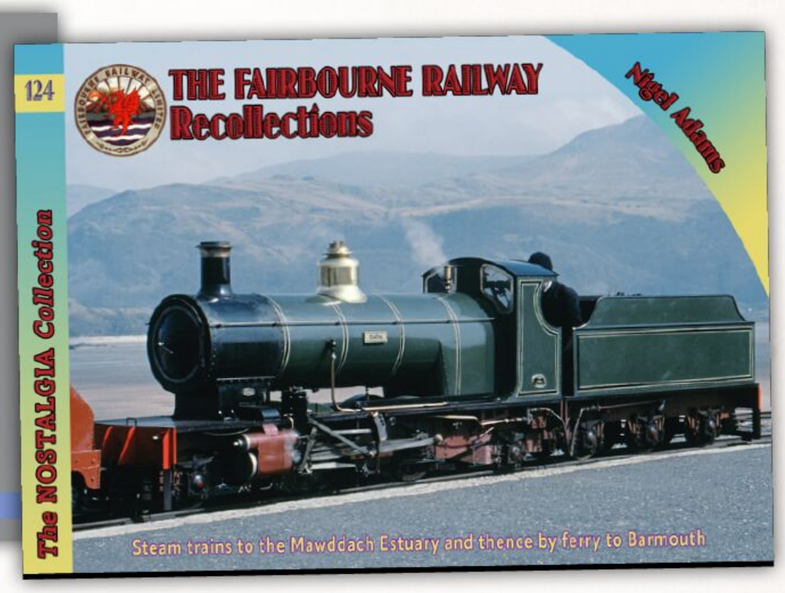

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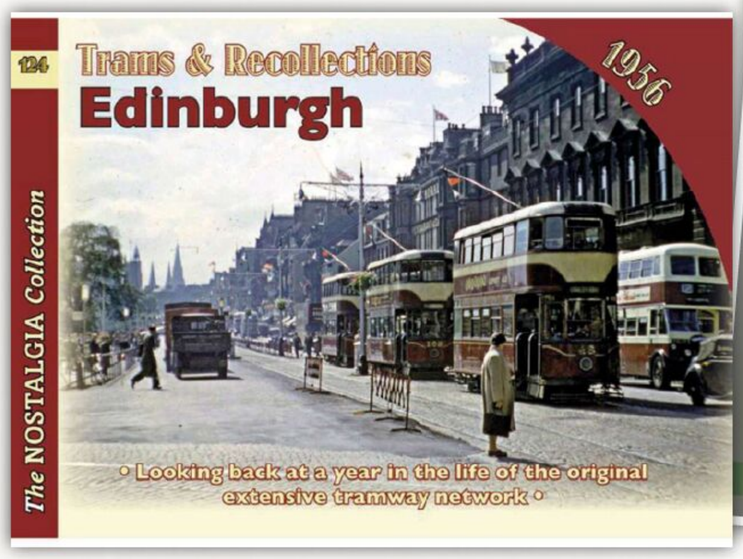

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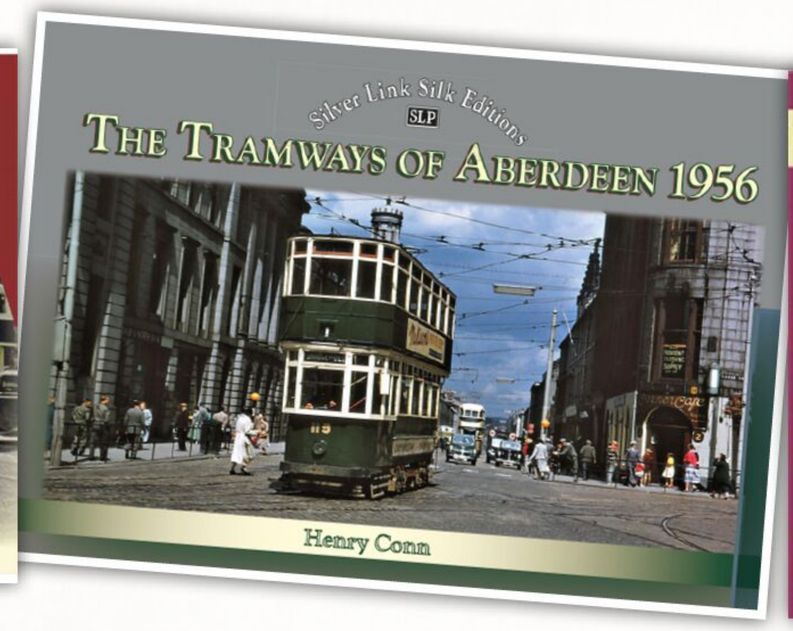

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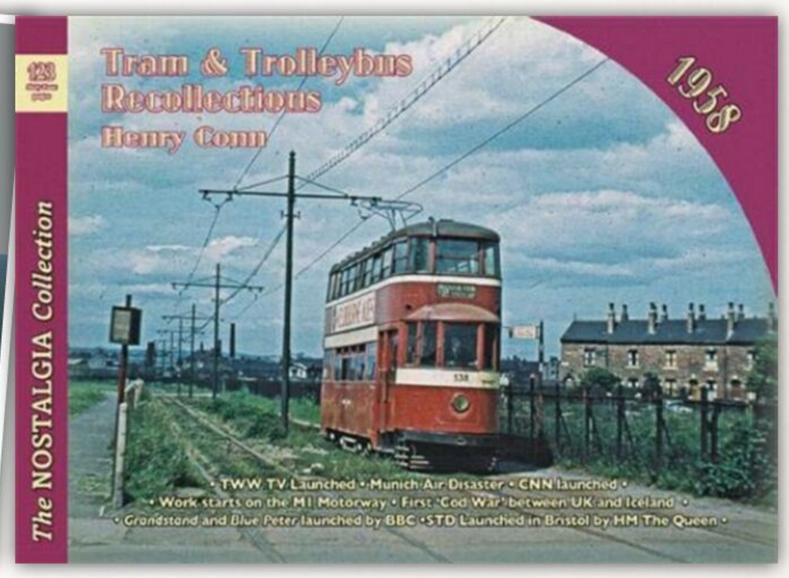

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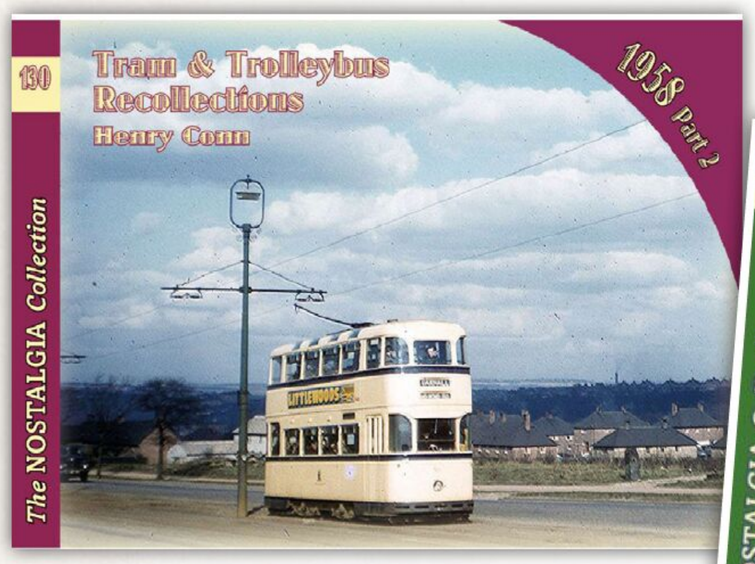

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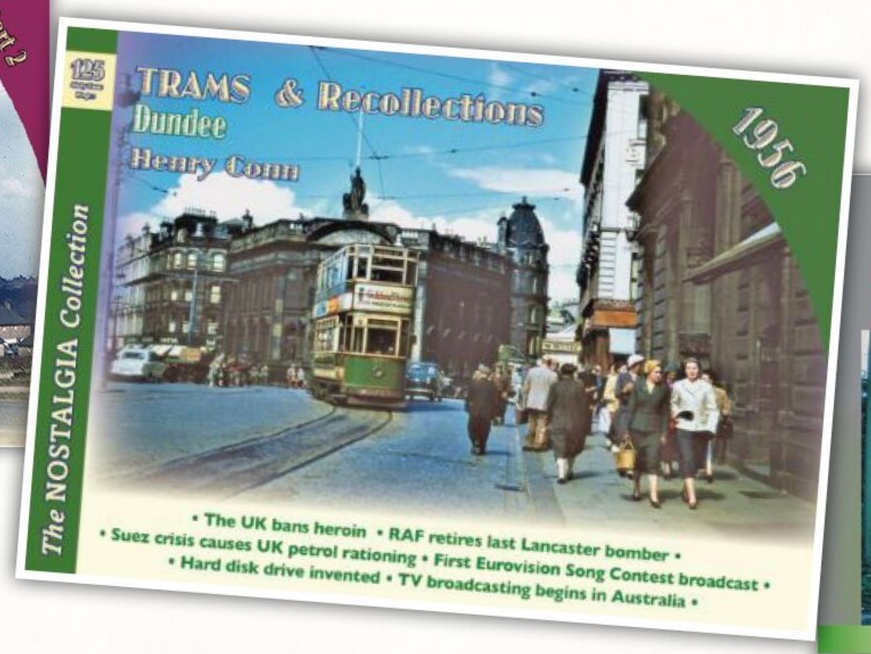

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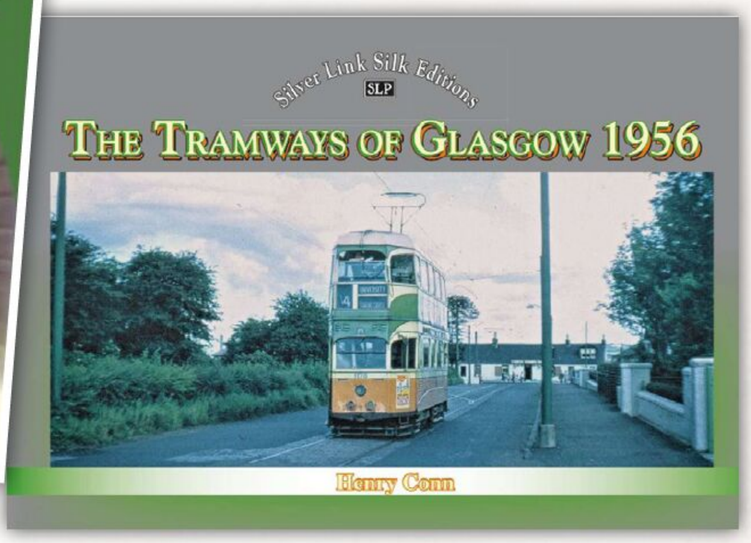

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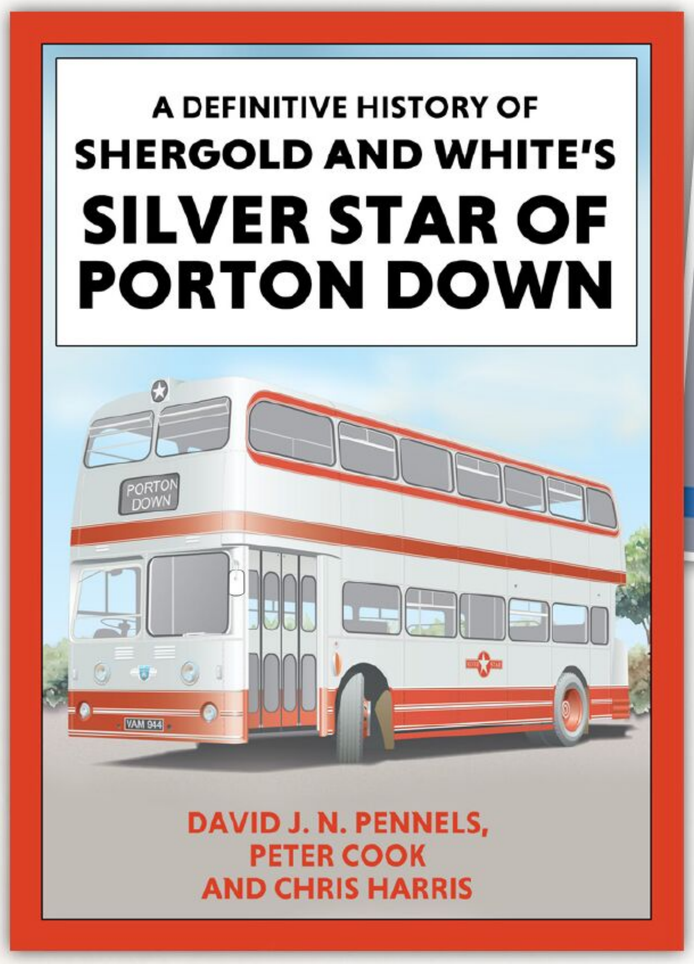

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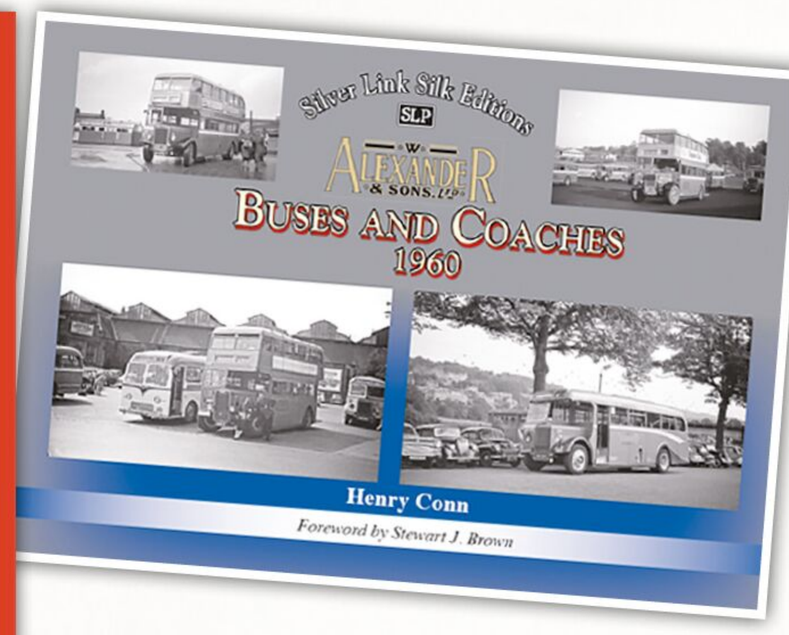

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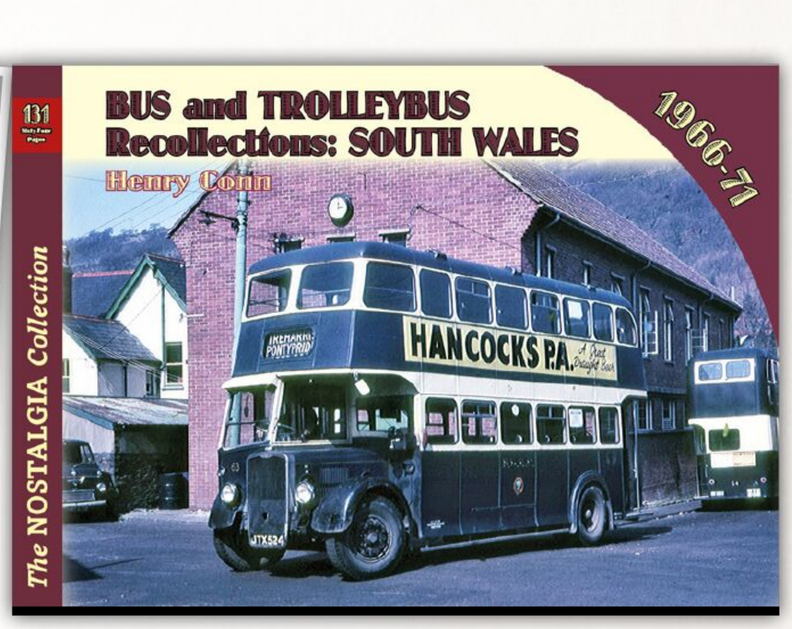

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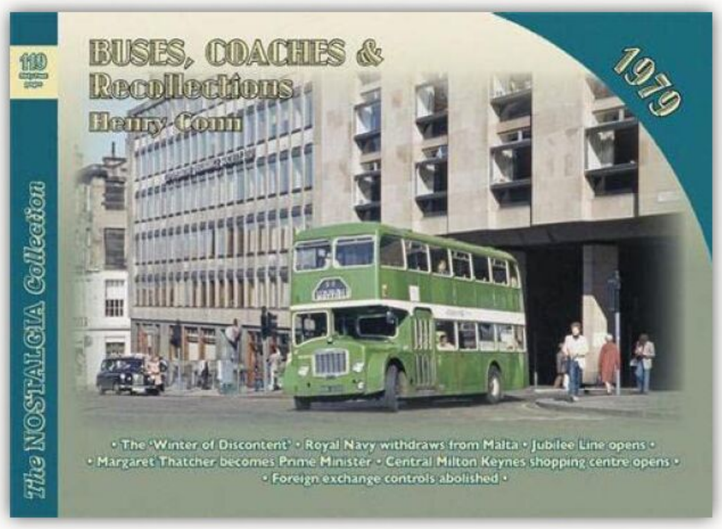

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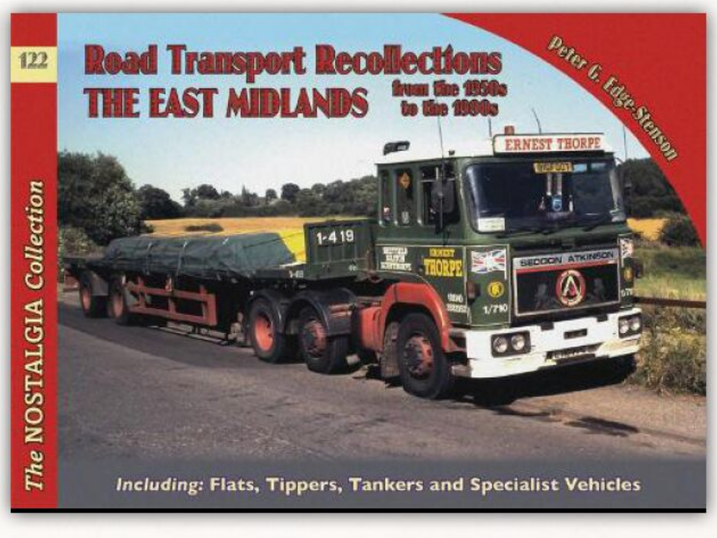

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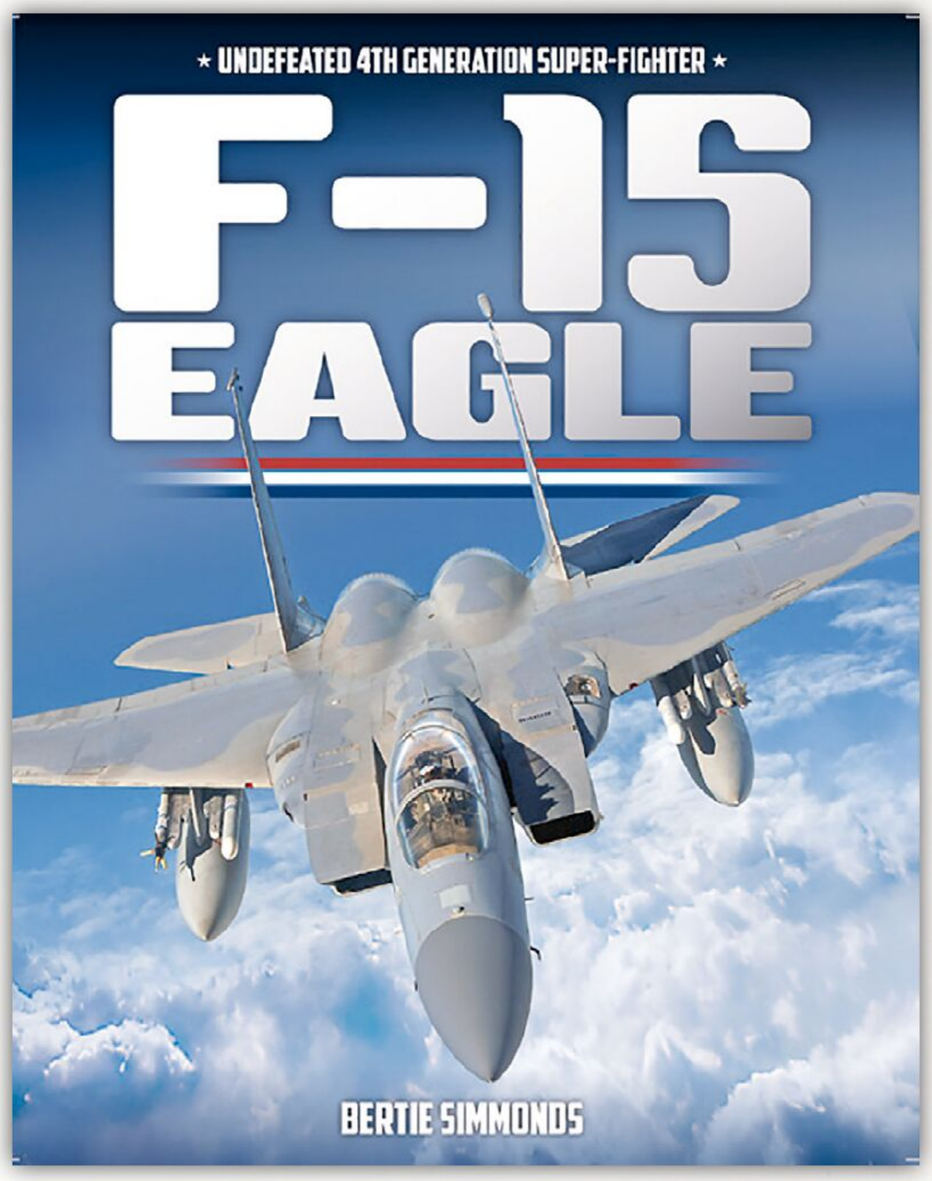

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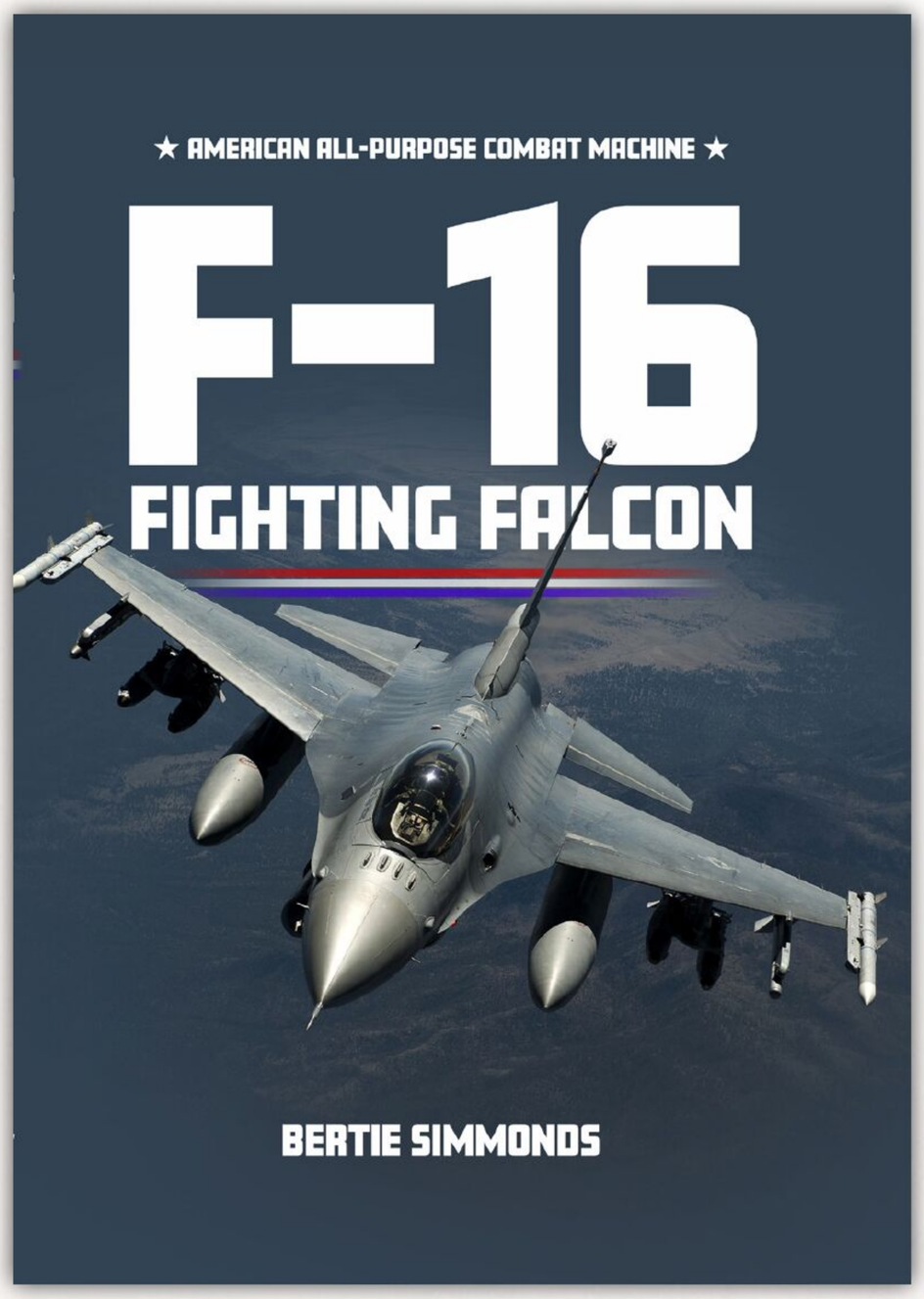

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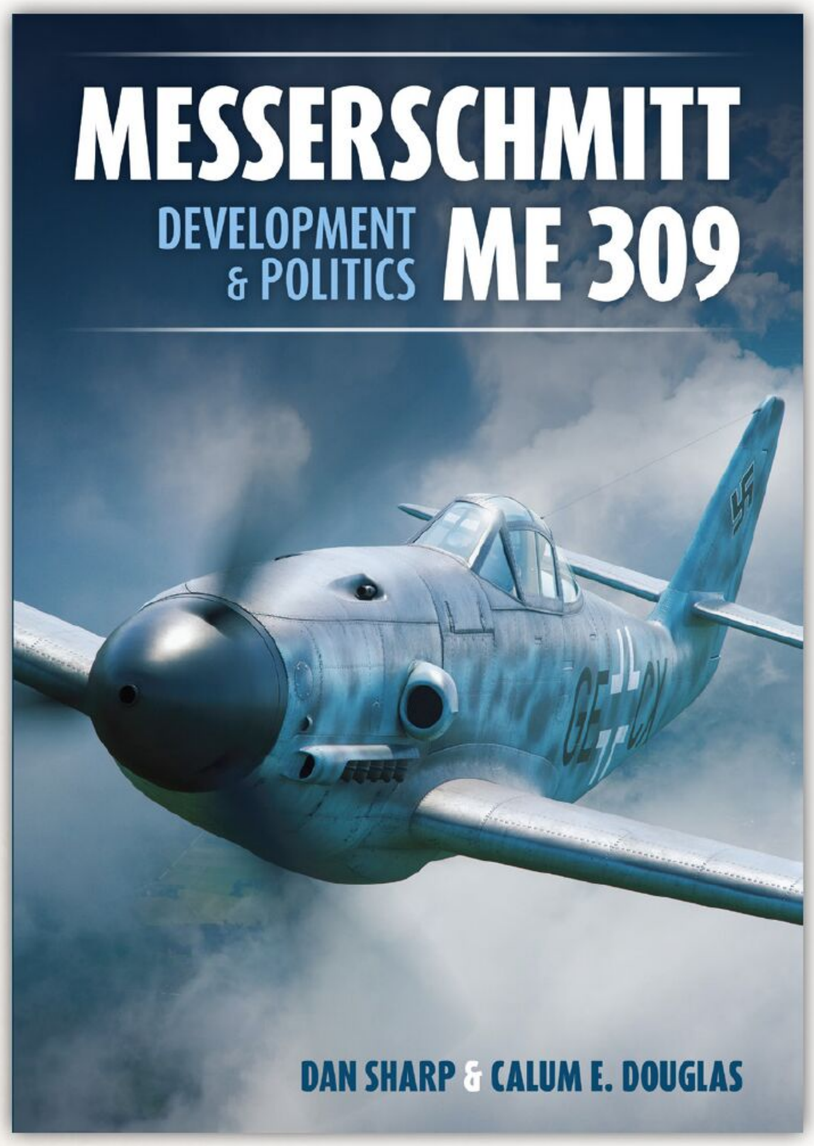

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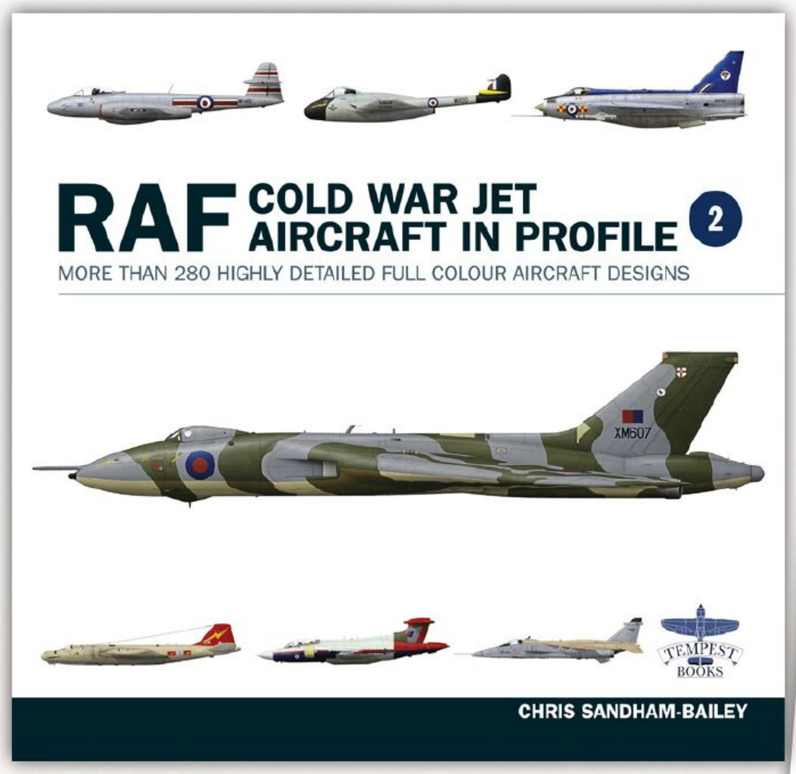

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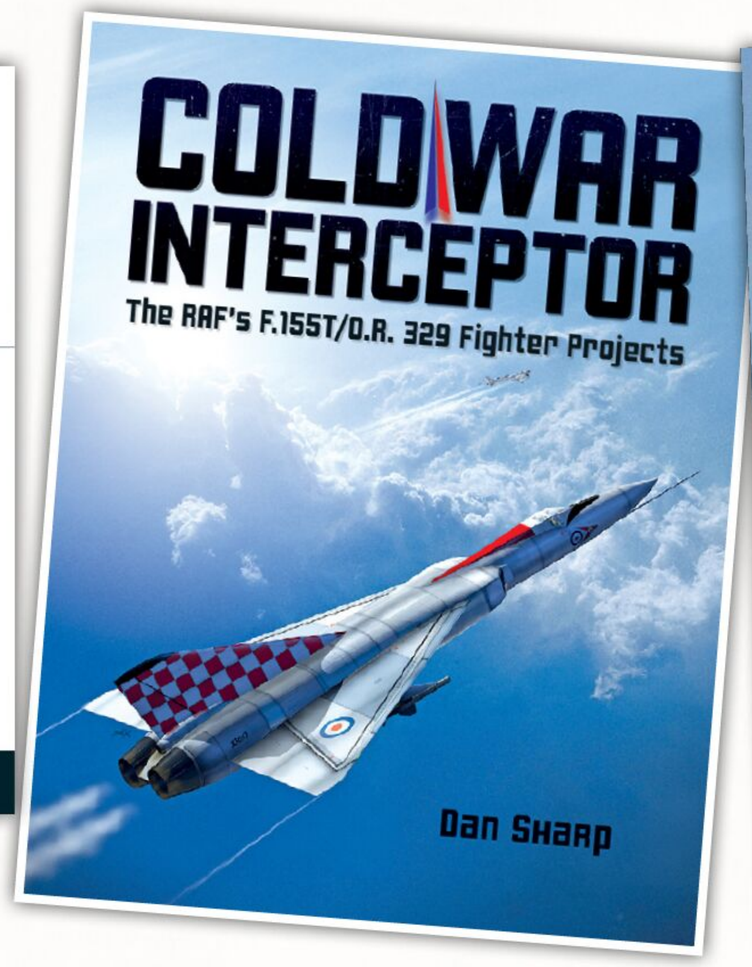

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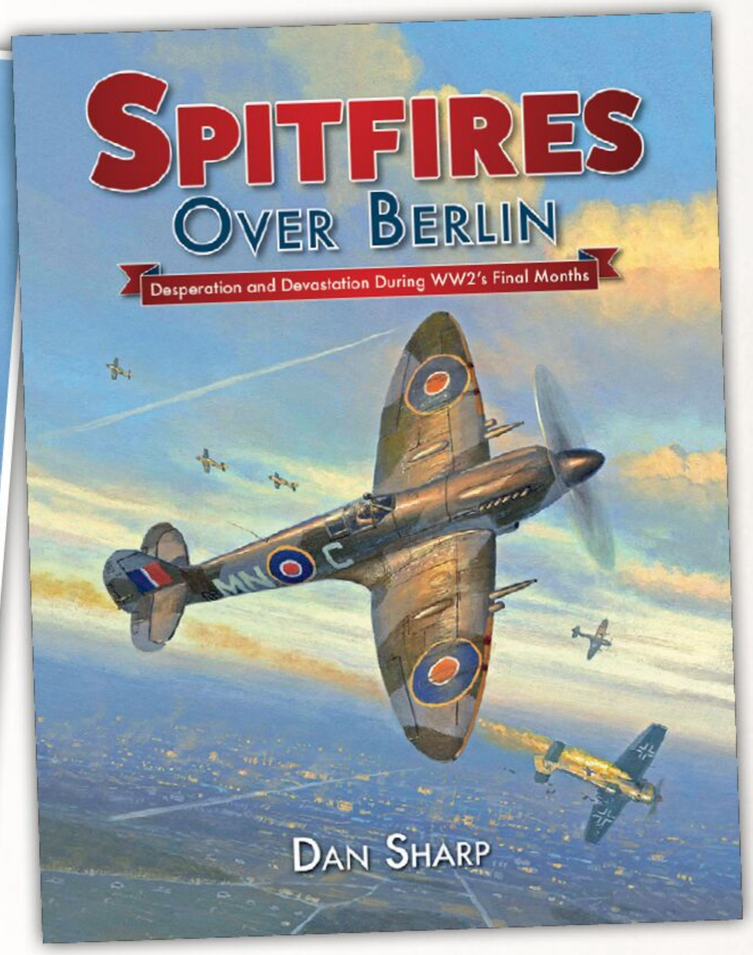

Spitfires Over Berlin

DAN SHARP

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The Battle of Britain Memorial Flight (BBMF) is a standing reminder of the heroism and sacrifice of countless British and Commonwealth aircrew who flew and fought during the Second World War.
Formed at RAF Biggin Hill on July 11, 1957, as the Historic Aircraft Flight, today the BBMF's incredible collection of aircraft includes six Spitfires, two Hurricanes, one of only two airworthy Avro Lancaster bombers in the world, a Douglas C-47 Dakota and two de Havilland Chipmunks.
The Flight's Second World War aircraft have survived against the odds to exist in flying condition today and this book charts each of their careers over the last seven decades or more. Author and illustrator Chris Sandham-Bailey has meticulously reproduced every known paint scheme worn by each of the aircraft – as well as gathering together an unrivalled collection of photographs to show how the appearance of the aircraft has changed. Never before have all of the BBMF aircraft liveries from the war's end to the present day been catalogued and illustrated in one publication. This book is a must for anyone with an interest in the BBMF aircraft and their histories.

Battle of Britain Memorial Flight in Profile

CHRIS SANDHAM-BAILEY

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Messerschmitt Me 262: Development and Politics

DAN SHARP

AVAILABLE NOW Softback **£30.00**

ISBN: 9781911658276

The first jet fighter to enter service and see combat anywhere in the world, the Messerschmitt Me 262 was a deadly technological marvel – yet it was also difficult to produce, dangerously unreliable and extremely vulnerable during takeoff and landing. Despite these flaws, its graceful swept wings, aggressive shark-like profile and undoubted combat abilities made it a legend. The aircraft underwent rapid development during its short front line career and numerous unusual variants were designed and produced. German Secret Projects: Messerschmitt Me 262 Versions examines unusual production models alongside one-offs and drawing board projects. More than 30 designs are detailed, including the Me 262 A-1a/U1-5, Me 262 A-1b, Me 262 A-2a/U1-2, Me 262 B-1a, Me 262 B-1a/U1, Me 262 B-2a, Me 262 C-1a-3a, Me 262 D-1, Me 262 E-1 and E-2, Me 262 HG I-III, Me 262 W, Me 262 Mistel, P 1099A-B, P 1100, Me 262 Interzeptor I-III, Aufklärer I-II and Schnellbomber I-III.

Messerschmitt Me 328 Development & Politics

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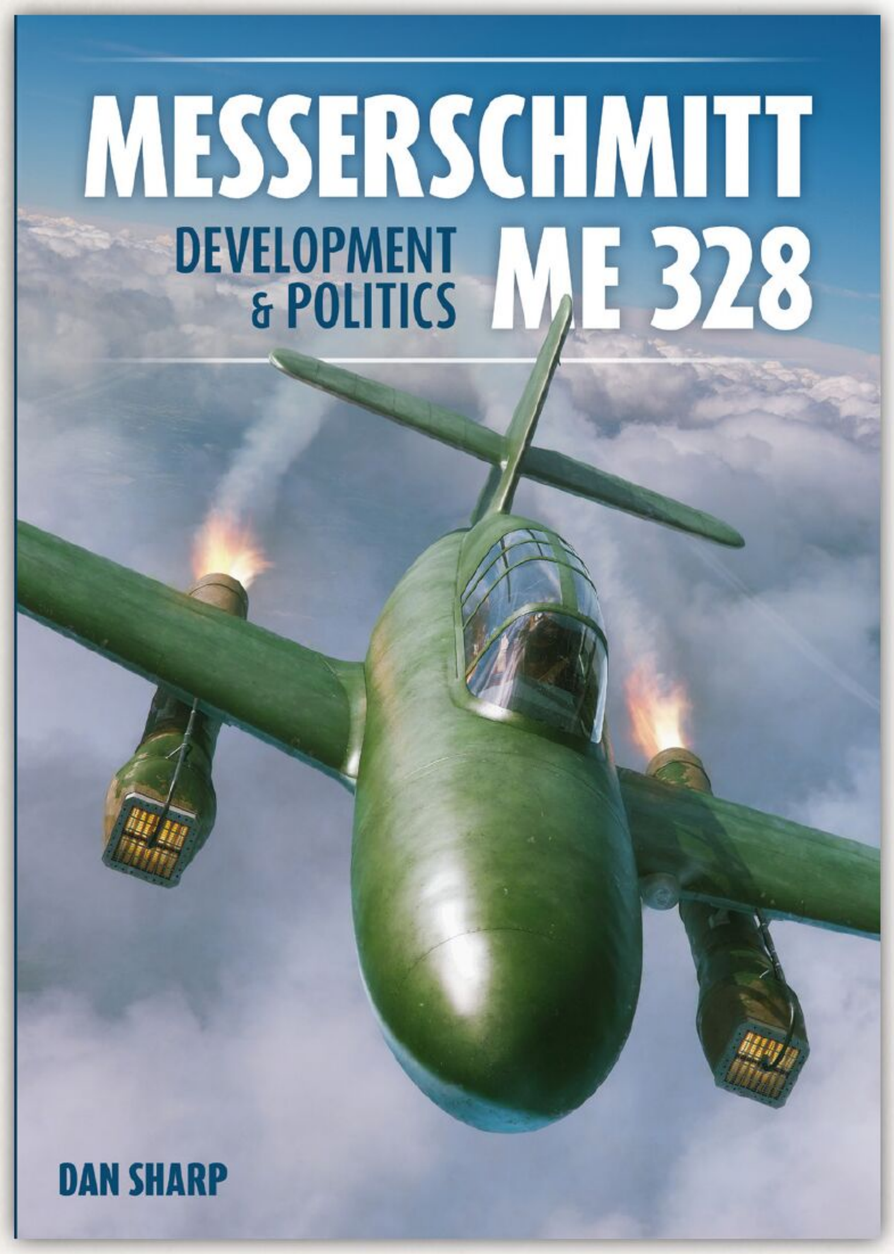
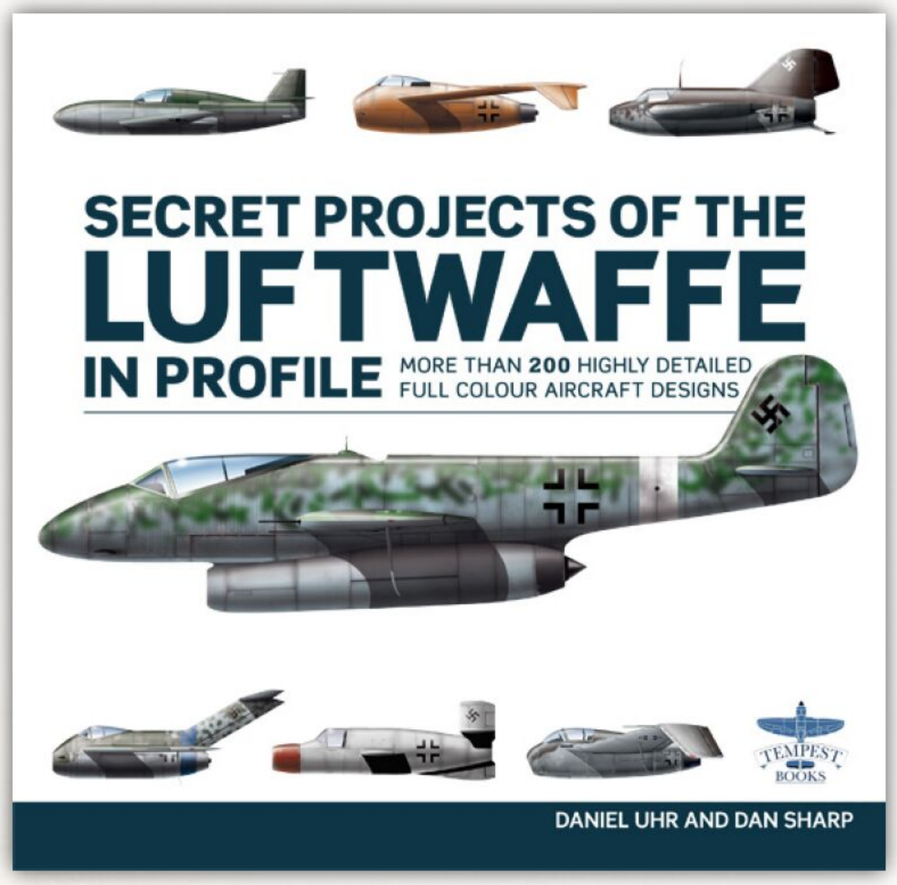


Conceived as a multirole combat aircraft based on promising early data from pulsejet tests, the Me 328 was arguably Messerschmitt's most controversial wartime project. Early projects imagined the compact machine as a fighter, a bomber, a reconnaissance platform or even a parasite aircraft – detaching from large bombers in mid-air to conduct operations before returning to the mothership. Enthusiasm was high, prototypes were built and extensively flight tested, with and without pulsejets, but it soon became clear that the airframe, the pulsejets and even the operational procedures mapped out for the Me 328 were proving far more troublesome than anticipated.

The type was cancelled – but then revived with a darker purpose: as a suicide bomber. Famous test pilot Hanna Reitsch and her cadre of fanatics chose the Me 328 as their vehicle for 'self-sacrifice' missions, where idealistic young pilots, plied with drugs to remove their inhibitions, would fly the aircraft, laden with bombs, directly into high-value Allied targets such as warships, bridges or command posts.

In Secret Projects of the Luftwaffe: Messerschmitt Me 328, German WW2 aircraft development specialist Dan Sharp presents the first ever book dedicated to the type and explores its history and purpose as far as surviving documentation allows.



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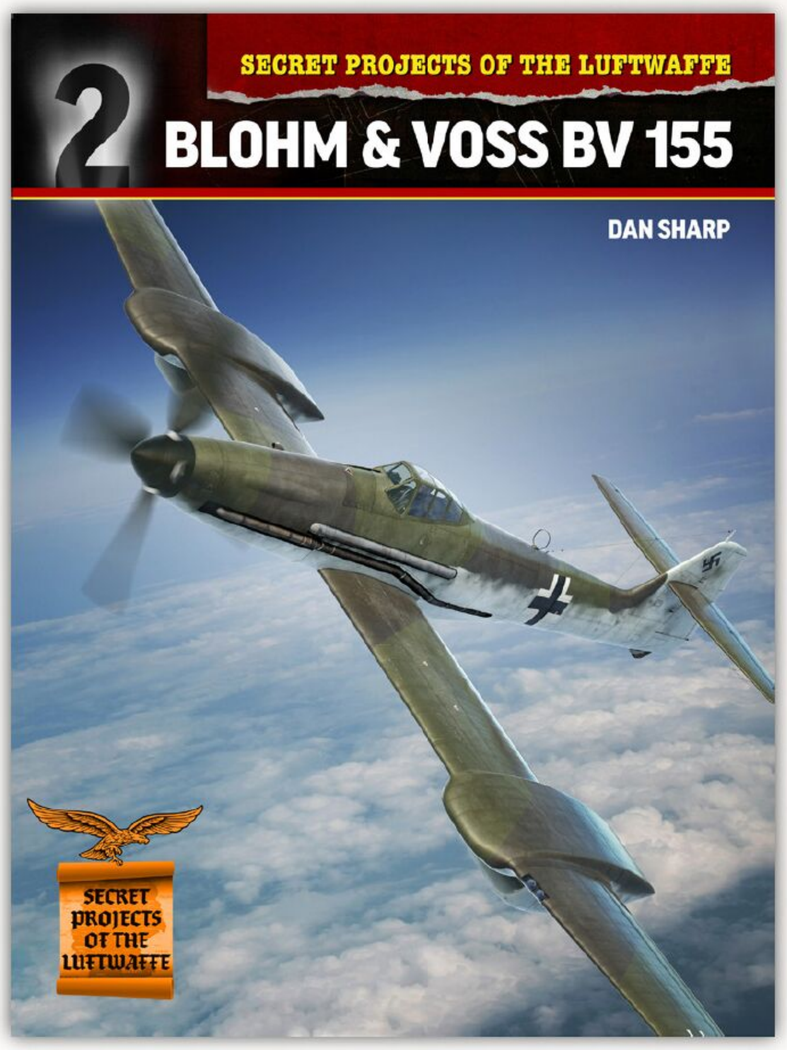

Secret Projects of the Luftwaffe: Blohm & Voss BV 155

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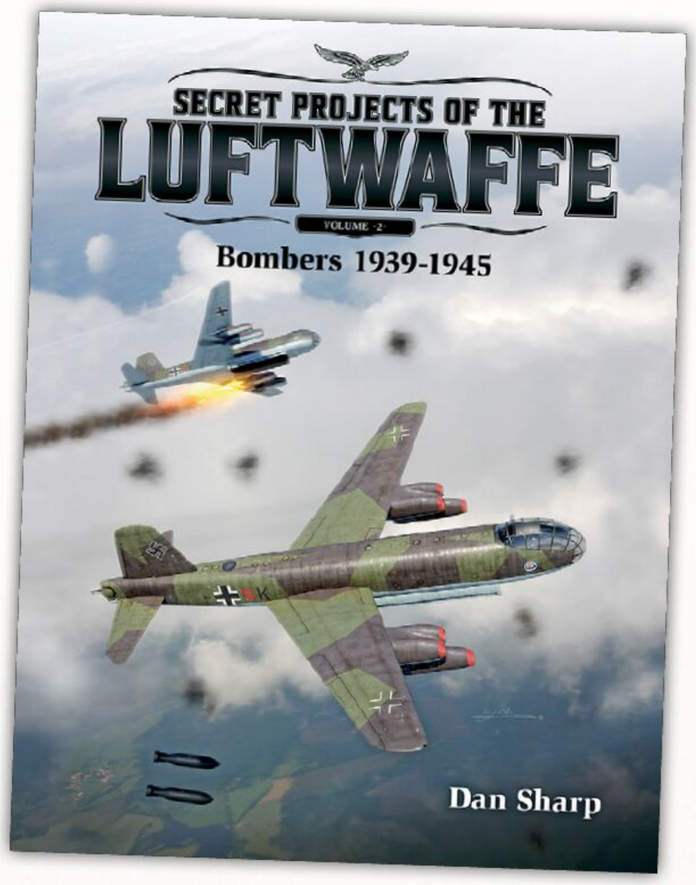

Secret Projects of the Luftwaffe - Vol 2 - Bombers 1939 -1945

DAN SHARP

On sale: SEPTEMBER 20, 2024

Softback **£39.99**

ISBN: 9781911658092

Secret Projects of the Luftwaffe: The Fastest Bomber

DAN SHARP

On sale: SEPTEMBER 20, 2024

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HOTOL: Britain's Spaceplane

DAN SHARP

On sale: SEPTEMBER 27, 2024

Softback **£40.00**

ISBN: 9781911704294

The start of Space Shuttle operations in 1981 marked a new era in spaceflight – with the five orbiters launching numerous satellites, interplanetary probes and the Hubble Space Telescope. But Shuttle was only partially reusable, its external fuel tank being expendable and its solid rocket boosters having to be recovered from the ocean and refurbished. Putting a satellite into orbit using a rocket was even more wasteful – with boosters such as Ariane being one-shot only. The costs were astronomical.

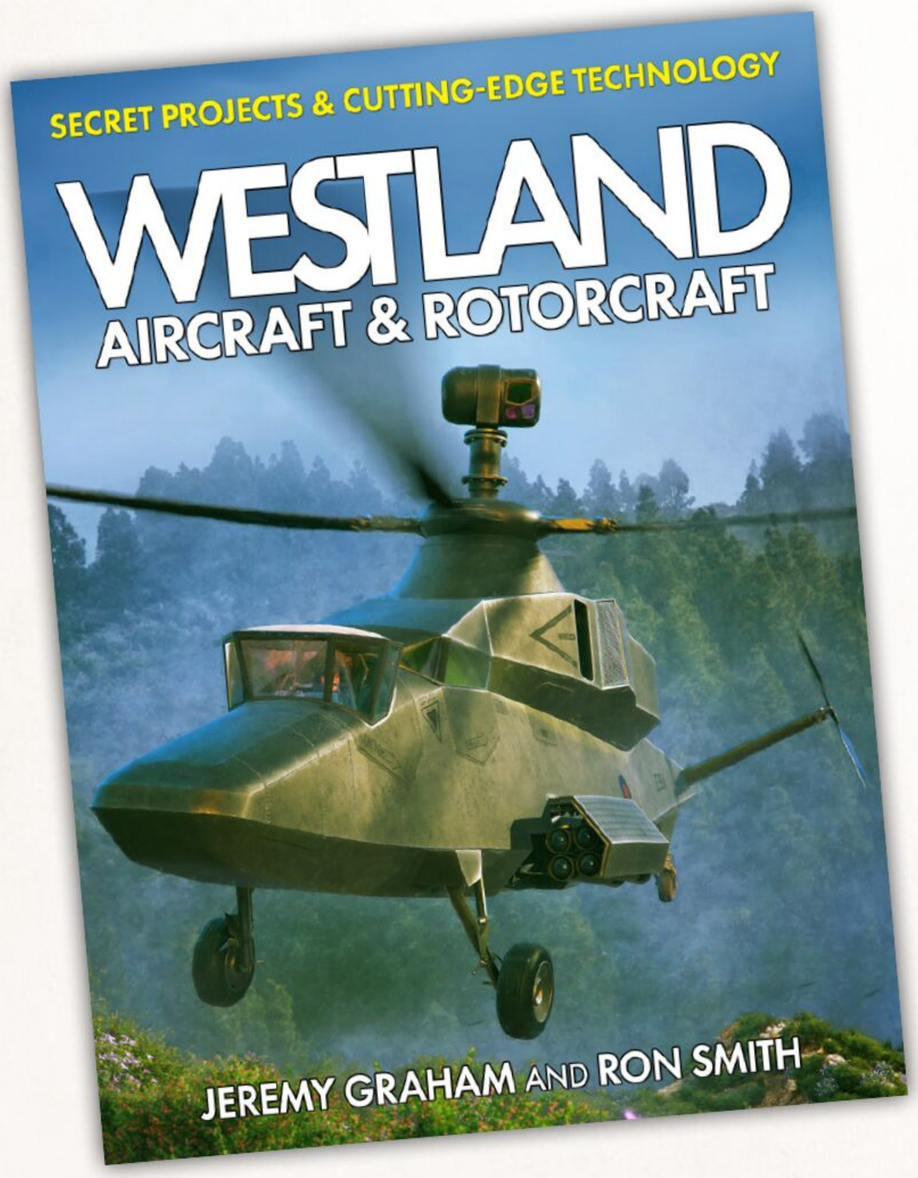
So when rocket scientist Alan Bond and aerospace engineer Bob Parkinson attended a British Interplanetary Society lecture on the proposed non-reusable Ariane 5 rocket in 1982, they began to discuss possible alternatives and concluded that the best solution was... an aerospaceplane.

The concept was deceptively simple – a vehicle able to take off from a conventional runway using airbreathing engines, switch to pure rocket propulsion at high altitude, fly up into space, complete its mission, then fly back down and land. Bond and Parkinson believed it could be done and HOTOL – HOrizontal Take-Off and Landing – was born.

By 1983 both British Aerospace and Rolls-Royce were backing the project. A broadcast on ITN's New at Ten in 1984 made HOTOL famous overnight, with the whole nation now aware of its existence. The Government agreed to match-fund the companies' financial commitment in 1985 and the work ramped up into high gear, with some of Britain's best engineers engaged in making this remarkable vehicle a reality.

Two years later, Minister of State of Trade and Industry Kenneth Clarke withdrew funding – signalling the beginning of the end of HOTOL, though there were attempts to revive it as an air-launched vehicle atop an Antonov An-225 as Interim HOTOL.

HOTOL: Britain's Spaceplane by Dan Sharp covers the full story of HOTOL's development in detail from beginning to end, drawing on the BAE Systems archive, the personal archives of the project's creators and extensive interviews with those involved. It includes new artwork plus hundreds of contemporary diagrams and illustrations, ranging from full colour brochures and publicity material – both used and unused – to previously unseen diagrams and schematics of HOTOL's numerous configurations.



Westland Aircraft & Rotorcraft: Secret Projects & Cutting-Edge Technology

DR RON SMITH AND JEREMY GRAHAM

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ISBN: 9781911658955

Half Century, Baby! - Fifty Years of the Grumman F-14 Tomcat

DAVID PARSONS, MADS BANGSO

AVAILABLE NOW Softback **£40.00**

ISBN: 9781911658924

Half Century, Baby! marks the 50th anniversary of the first two Grumman F-14A fleet squadrons (VF-1 and VF-2) receiving their first Tomcats during the summer of 1973. This lavishly illustrated volume tells the story of the aircraft from the beginning to its sunset of service with the US Navy in 2006; the longest operational career of any Naval Fighter to date. Preeminent Tomcat historian and former Tomcat RIO Dave Parsons explains the history of the F-14 decade by decade through the words of the aircrew who flew it. Artist Mads Bangsø brings his superlative illustration talents to the forefront with more than 120 F-14 profiles as well as highly accurate fully rendered recreations historical events featuring the Tomcat, highlighting the interesting markings of the aircraft (including helmets) as well as other aircraft associated with the Tomcat Community. The book features pertinent colour photography throughout, interwoven with the illustrations to complement the text.

Half Century Baby Volume II

DAVID PARSONS, MADS BANGSO.

On sale: SEPTEMBER 12, 2024

Softback **£40.00**

ISBN: 9781911704232

Bomber Command Gardening Operations - The Invisible Campaign 1940-1945

JANE GULLIFORD LOWES

On sale: OCTOBER 18, 2024

Softback **£19.99** ISBN: 9781911704287

Aerial mining by RAF Bomber Command was a vital part of the Allied war effort – claiming far more tonnage of Axis shipping destroyed than direct attack by either Coastal or Bomber Command itself. Minelaying operations commenced in April 1940 and expanded dramatically as the war progressed, yet today this vital campaign and its wide-ranging achievements against Axis merchant vessels, Kriegsmarine ships and U-boats are virtually unknown. Invisible Campaigns, based on Air Ministry and Admiralty archival material, together with squadron records, veteran accounts and logbooks as well as contemporary publications and press releases, provides the most detailed account of Bomber Command's minelaying operations and their effects ever written.

Historian Jane Gulliford Lowes looks at the aims of the campaign and how it was implemented, together with the measure of its success and how it compared against the mining operations implemented by the Luftwaffe and Kriegsmarine. The role of Arthur 'Bomber' Harris in overseeing minelaying operations is assessed and the experiences of the men who delivered the campaign, particularly the hazards they faced, are explored.

Invisible Campaigns sheds new light on a little-discussed but important and ultimately highly successful aspect of Bomber Command and is a must-read for anyone interested the RAF's in wartime bombing operations.

The Battle of Britain Memorial Flight in Photos

LISA HARDING

AVAILABLE NOW Softback **£39.99**

ISBN: 9781911704249

This collection of more than 150 high-quality images offers a unique perspective on the historic aircraft and hard-working personnel of the unique Battle of Britain Memorial Flight based at RAF Coningsby in Lincolnshire.

Photographer Lisa Harding has spent many years photographing the flight and now presents some of her finest work – chronicling winter maintenance, when the aircraft undergo extensive checks and repairs if required; out-of-season practice displays and some spectacular 'hot starts'. Ground crew can be seen performing their duties both indoors and out while pilot training provides views rarely seen by the public.

A collection of notable displays showcases memorable moments from the past decade, including the gathering of three Lancaster bombers at East Kirkby, the last two airworthy Lancasters flying together down the Derwent Valley, the RAF100 Buckingham Palace flypast and the Dambusters 80th anniversary.

The images are presented with commentary from the author, providing both background and technical details on how the shots were taken.

The Battle of Britain Memorial Flight in Photos offers a wealth of previously unseen views of the flight in incredible colour, detail and clarity – a must for any warbird enthusiast.

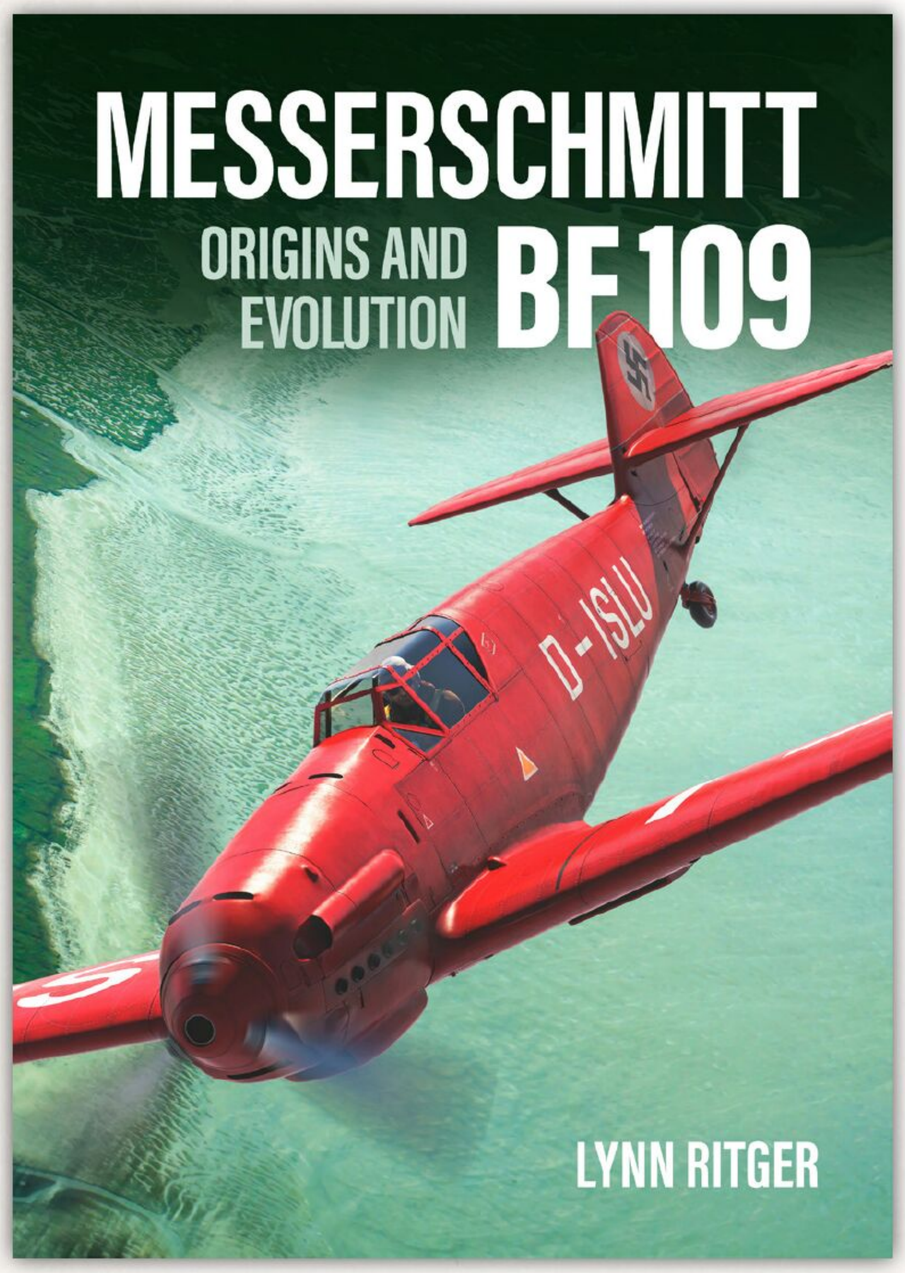
Messerschmitt Bf 109 Origins and Evolution

LYNN RITGER

On sale: SEPTEMBER 30, 2024

Softback **£39.99**

ISBN: 9781911704034



The most produced fighter aircraft in history, and arguably the single most important German aircraft of the Second World War, the Messerschmitt Bf 109 was unquestionably the most advanced fighter in the world when it first flew in May 1935. The scale of the development and production effort by Messerschmitt and its subcontractors over the next ten years to fulfil the operational needs of the Luftwaffe resulted in a seemingly endless variety of modifications to every aspect of the aircraft, from engines and weapons down to radios and tailwheels. Political gamesmanship and often heated discussions between Luftwaffe leaders and Messerschmitt company representatives, striving to keep their most successful product relevant in the face of ever-increasing Allied threats, also had a role to play in the developmental history of the Bf 109.

In Messerschmitt Bf 109 – Origins and Evolution, historian Lynn Ritger examines in detail the development of the Bf 109 family across its entire lifespan, from the first flight of the Bf 109 V1 to the last operational flight of a Spanish Hispano Ha 1112 M in 1965. Drawing upon original documentation from archival sources, including RLM meeting minutes and planning documents, intelligence reports, production records, factory handbooks, and front-line unit reports, Ritger traces the technical history of the Bf 109, illustrating prototype and service variant development, production batch differences, internal and external equipment and ordnance fitment, factory specific equipment and finish details, postwar variants developed in Czechoslovakia and Spain, and unrealised design proposals.

Fleet Air Arm Legends: Supermarine Seafire

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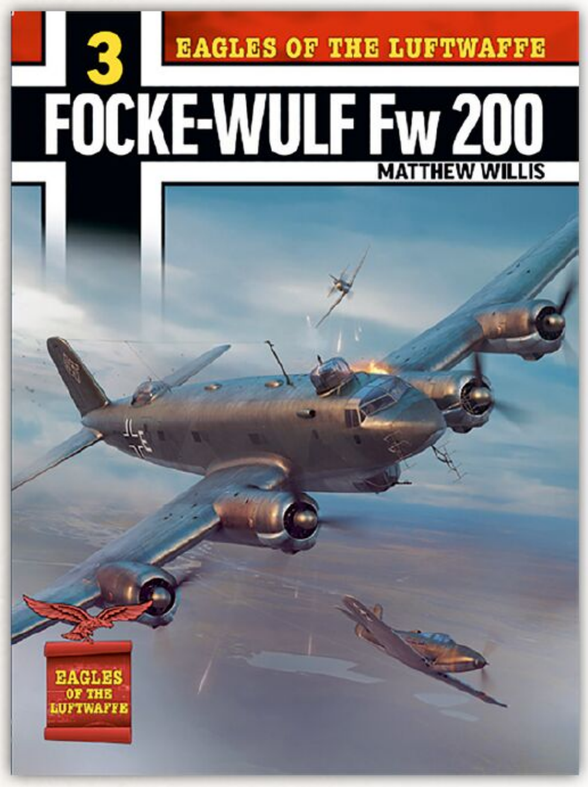

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Eagles of the Luftwaffe: DFS 230

NEIL PAGE

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Snooperbase Waddington

MICHAEL HILEY

On sale: AUGUST 23, 2024
Softback **£16.99**
ISBN: 9781911704218

The air base at Waddington has been home to the RAF's most valuable surveillance, intelligence-gathering, communications and electronic warfare assets for more than three decades.

During the 1990s, Boeing E-3D Sentry AWACS and Hawker Siddeley Nimrod R1 signals intelligence platforms became familiar sights in the skies over Lincolnshire as ISTAR (Intelligence Surveillance Target Acquisition and Reconnaissance) assets were brought together at RAF Waddington.

The Raytheon Sentinel R1 followed and more recently the base has become home to the RAF fleet of Beechcraft Shadow R1s, Boeing RC-135W Rivet Joints and General Atomics MQ-9 Reapers – as well as the Red Arrows aerobatic team and units experimenting with future drone technology.

Most recently, the base has received its first General Atomics Protector RG Mk 1s to take up the roles performed by the now 15-year-old Reaper fleet.

In Snooperbase Waddington, author and photographer Michael Hiley chronicle's the history of the RAF's ISTAR hub – including the aircraft flown, their known equipment and their operational use as far as the Official Secrets Act will allow.

Ronny Barr Profiles - British Two Seaters of the Great War

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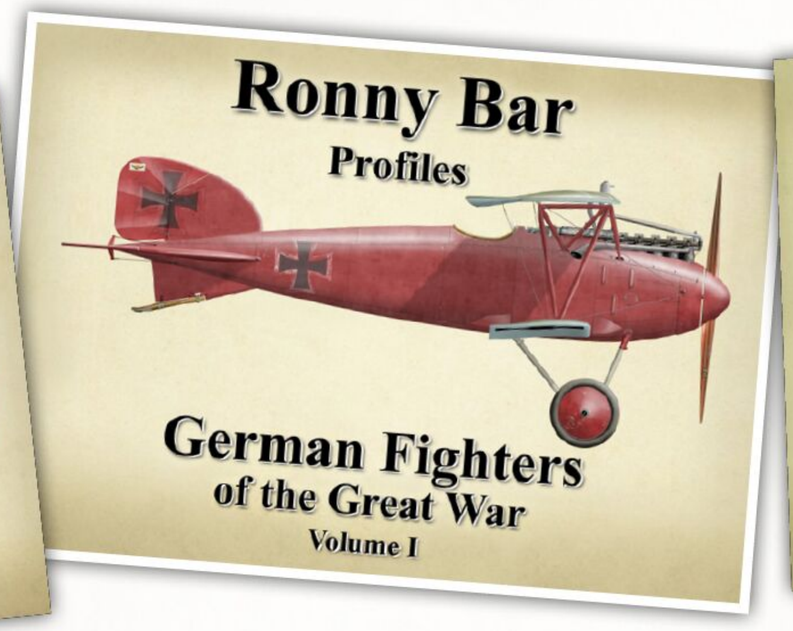

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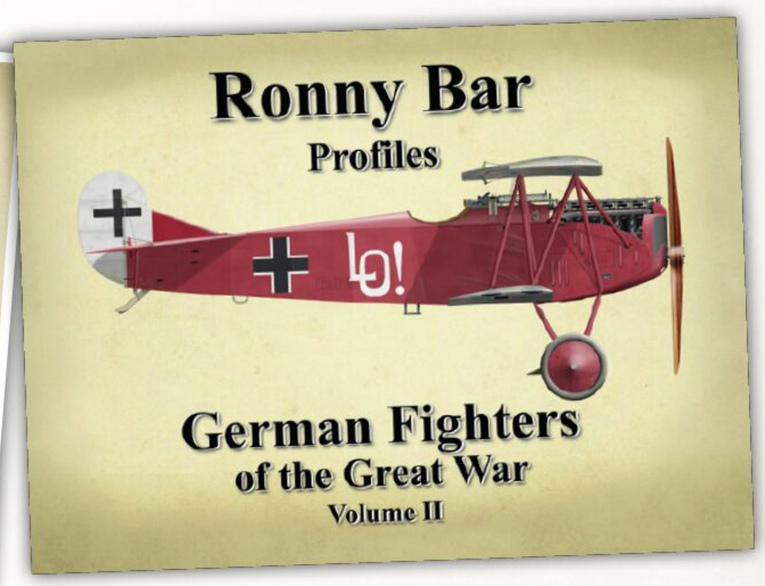

Ronny Bar Profiles - German Fighters of the Great War Vol 2

RONNY BAR

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Supermarine's iconic Spitfire needs little introduction – its graceful lines and remarkable combat record during the Second World War speak for themselves. Rolls-Royce Merlin-powered Spitfire Mk Is fought their way through the Battle of Britain during the summer and autumn of 1940 with the Mk II, incorporating a more powerful Merlin, being introduced in the meantime.

As the war progressed, the Spitfire underwent an intensive programme of upgrades and enhancements as well as modifications to expand its capabilities. Unarmed Merlin-powered photo reconnaissance Spitfires flew hazardous missions over occupied Europe and Germany, while the Seafire, a navalised Spitfire, was operated from Royal Navy carriers in the Far East. In Europe, the Mk Is and IIs gave way to the Mk V and then the world-beating Mk IX before the last major Merlin-powered Spitfire, the Mk XVI, was introduced. While some later marks of Spitfire would receive Rolls-Royce Griffon engines, it is undoubtedly the Merlin variants that bore the brunt of the action and which are the most fondly remembered today.

In Ronny Bar Profiles – Spitfire The Merlin Variants, renowned profile artist Ronny Bar presents an exciting and colourful selection of more than 350 highly detailed artworks, most created specifically for this book, showcasing the full range of Rolls-Royce Merlin-powered variants from the original Type 300 prototype, K5054, to the late-war Seafires. Aircraft of RAF aces including Robert Stanford Tuck, Alan Deere, 'Sailor' Malan and Douglas Bader are included as well as colour schemes worn by Spitfires in service with Allied forces around the world. Bar's love of Spitfires clearly shines through in his incredible attention to historical accuracy throughout this fascinating and illuminating collection.

Ronny Bar Profiles - Spitfire the Merlin Variants

RONNY BAR

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Boeing B-47 Stratojet and B-52 Stratofortress: Origins and Evolution

SCOTT LOWTHER

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Mikoyan-Gurevich MiG-31 Foxhound

SERGIO SANTANA

On sale: AUGUST 30, 2024

Hardback **£25.00**

ISBN: 9781911704140

With a top speed approaching Mach 3 and equipped with both powerful sensors and air-to-air weaponry, the two-seater MiG-31 interceptor has proven to be one of the Cold War's most formidable survivors – finally coming into its own during the Ukraine War. Development began in 1975 with a design based on that of the MiG-25 Foxbat and progressed to the point where, although it bore a superficial similarly to its forebear, it was largely a new aircraft. The MiG-31, NATO reporting name Foxhound, entered service in 1981 and more than 500 were built.

Several dozen examples remain in service today with both the Russian and Kazakh air forces – and throughout 2022 and 2023 Foxhounds using R-37M long-range AAMs operated virtually unopposed against Ukrainian fighters, which lacked the speed, range, altitude and firepower to engage them. MiG-31s have also provided a valuable platform from which to launch Kh-47M2 Kinzhal hypersonic missiles against Ukraine while remaining within Russian airspace.

Author Sergio Santana details the aircraft's early development, its long operational history and its most recent operations in this all-new look at one of the world's deadliest combat aircraft.

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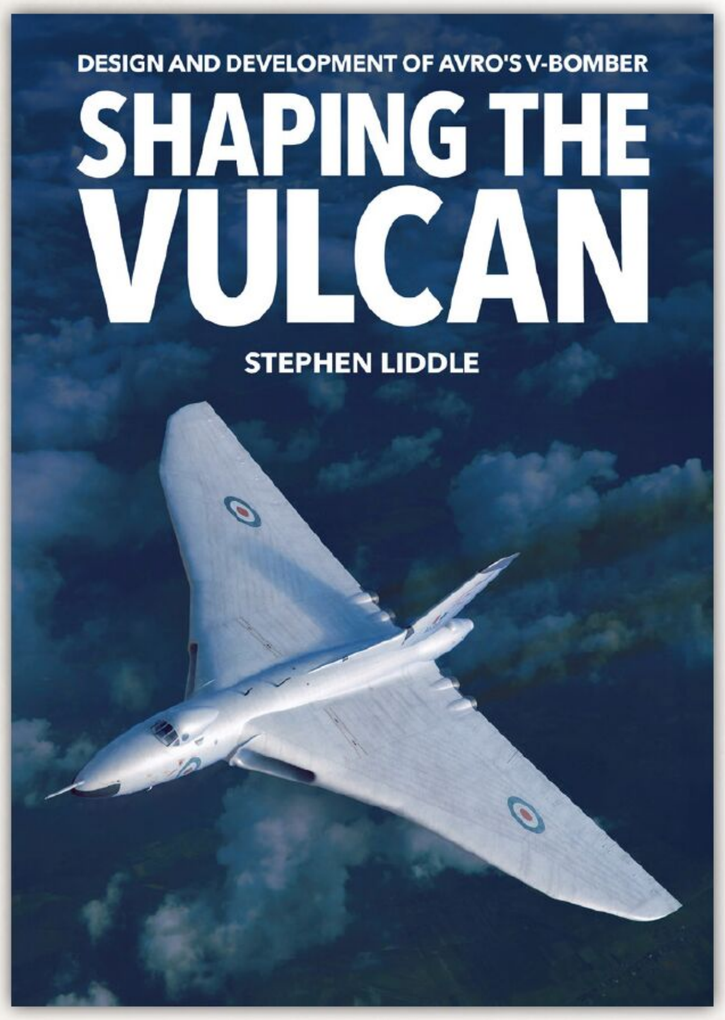


Shaping the Vulcan

STEPHEN LIDDLE

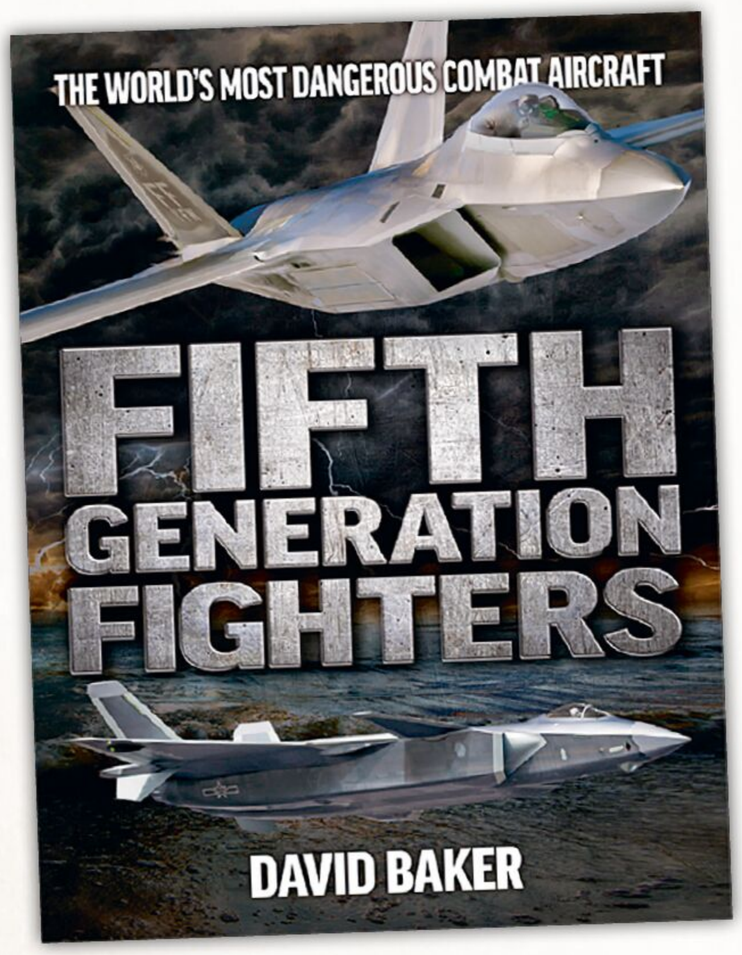
On sale: AUGUST 30, 2024 Hardback **£35.00**

ISBN: 9781911704072

The Avro Vulcan is one of the most striking aircraft ever made – its enormous wing stretching back from an improbably thick leading edge marked by cavernous wing root engine intakes. Perhaps even more incredible, its first flight was made just over ten years after the introduction of the piston-engined Lancaster during the Second World War. Within a decade, technology had taken a giant leap from straight-winged slow-moving conventional bombers to this vast delta designed to carry a nuclear payload.

But what led to such a radical configuration and what was the technology that enabled such an ambitious design? What possessed Avro to offer the Air Ministry such a futuristic aircraft and what prompted the Ministry to approve its development and entry into service?

Formula 1 racing team aerodynamicist and Vulcan to the Sky trustee Stephen Liddle presents a full history of the Vulcan's development and assesses the technological and engineering breakthroughs which underpinned the construction of this unparalleled aircraft.



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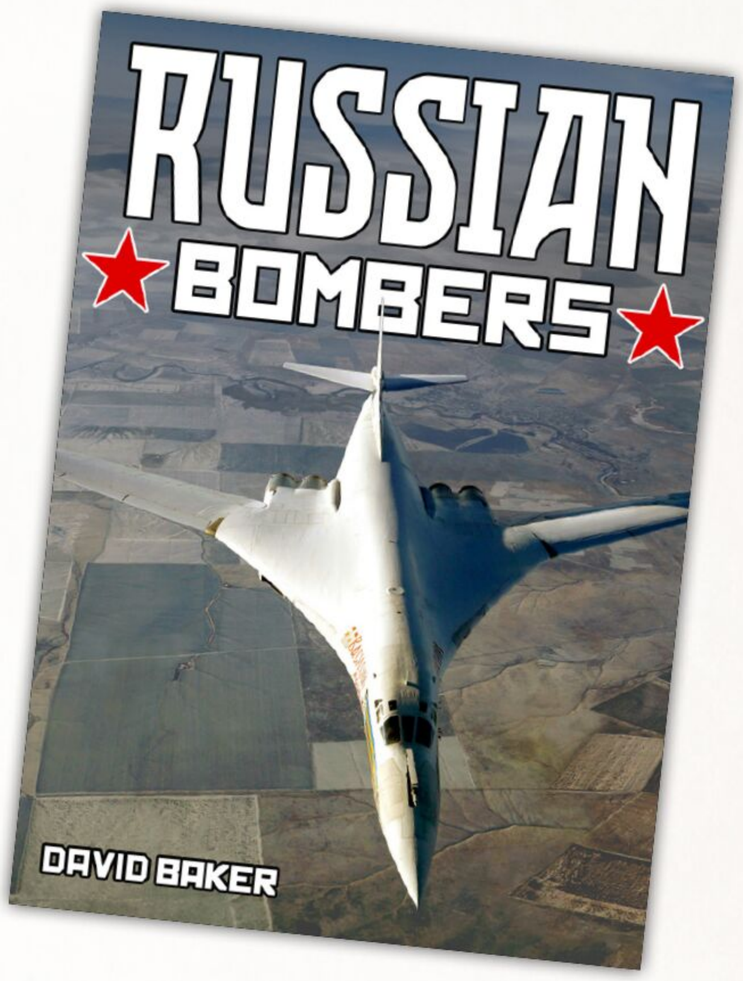

Russian Bombers

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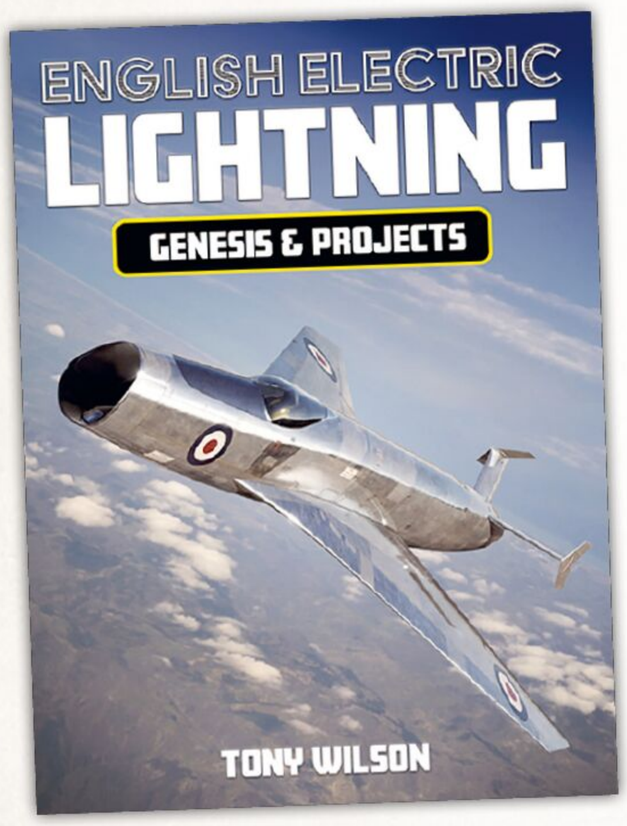

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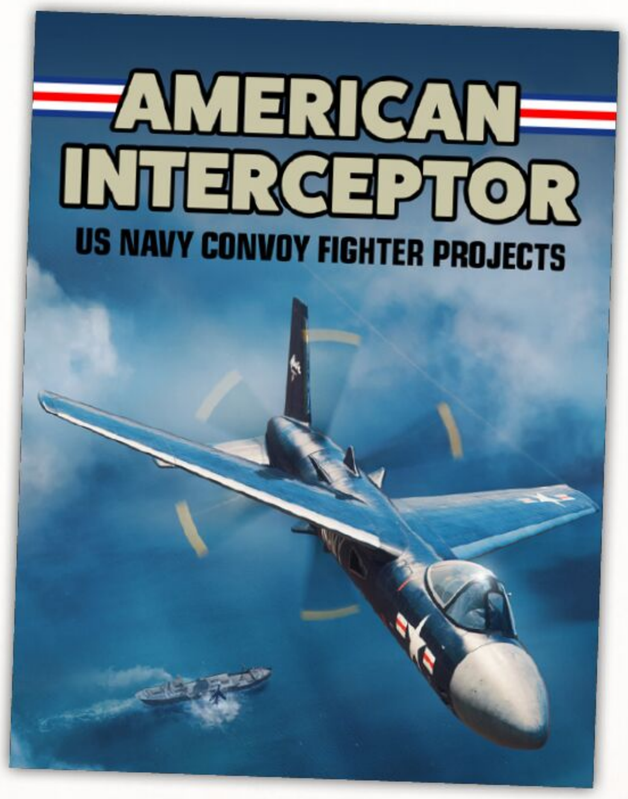

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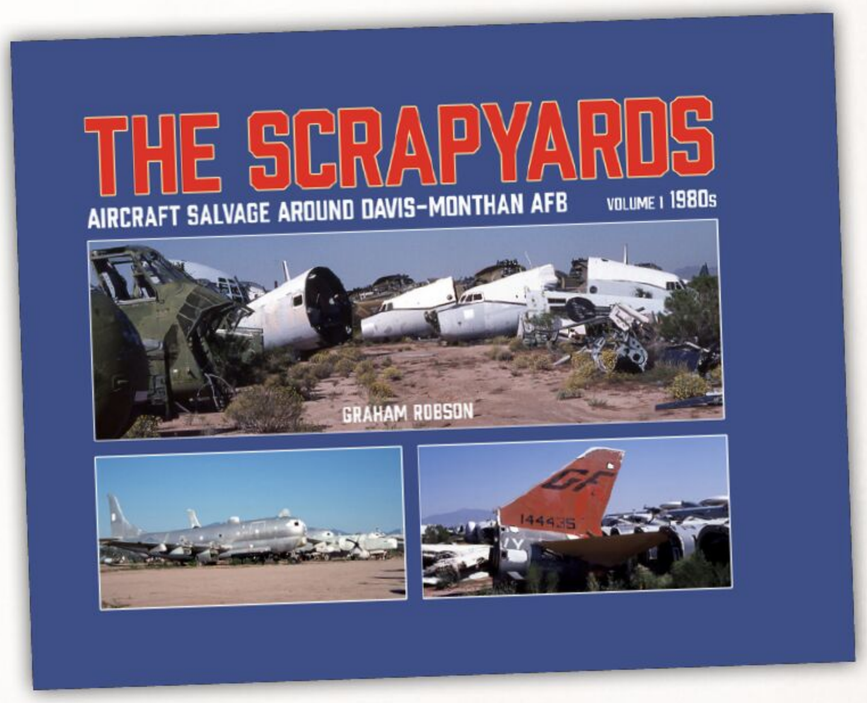

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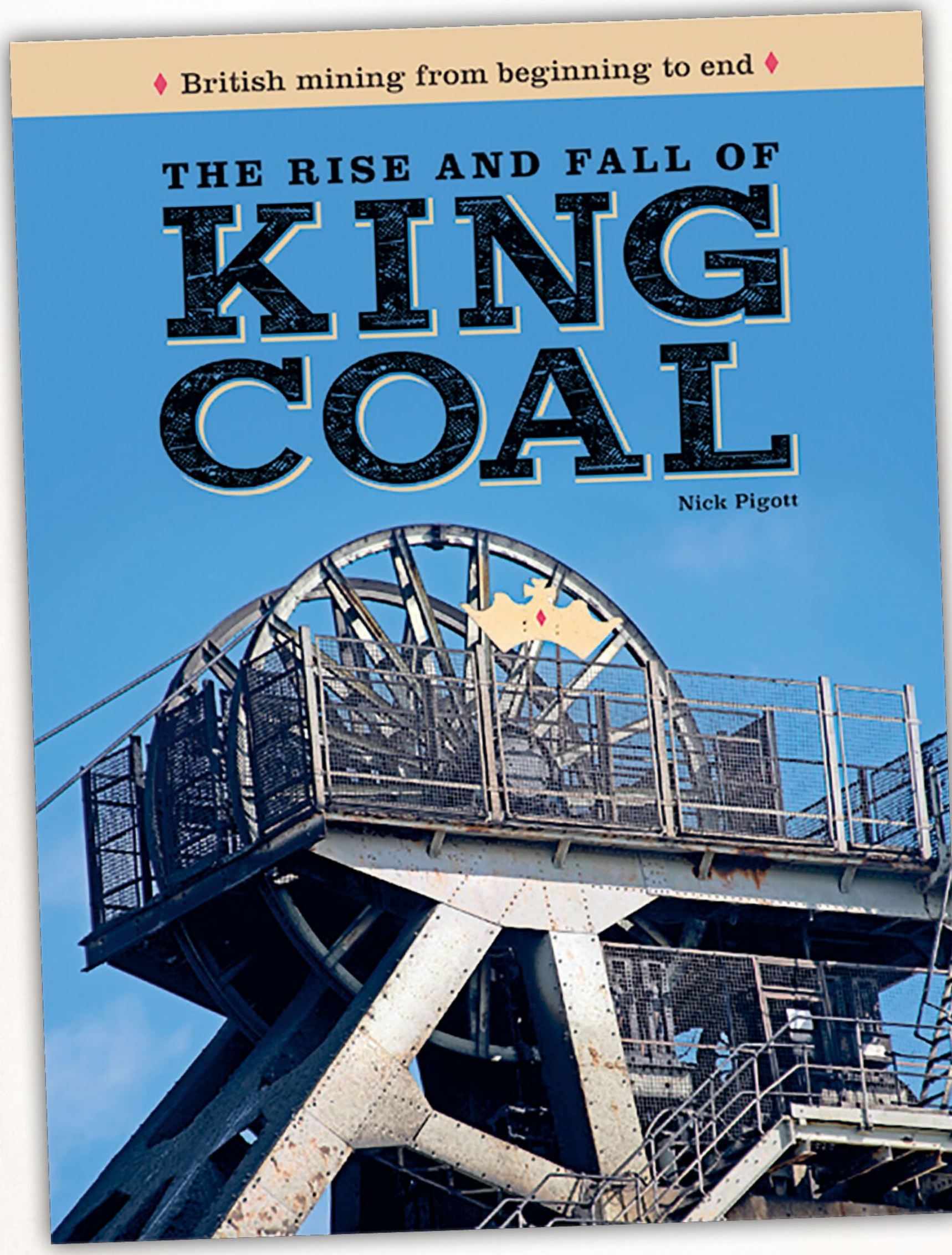

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