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Vol. 233 No. 4757 29 November – 12 December 2024

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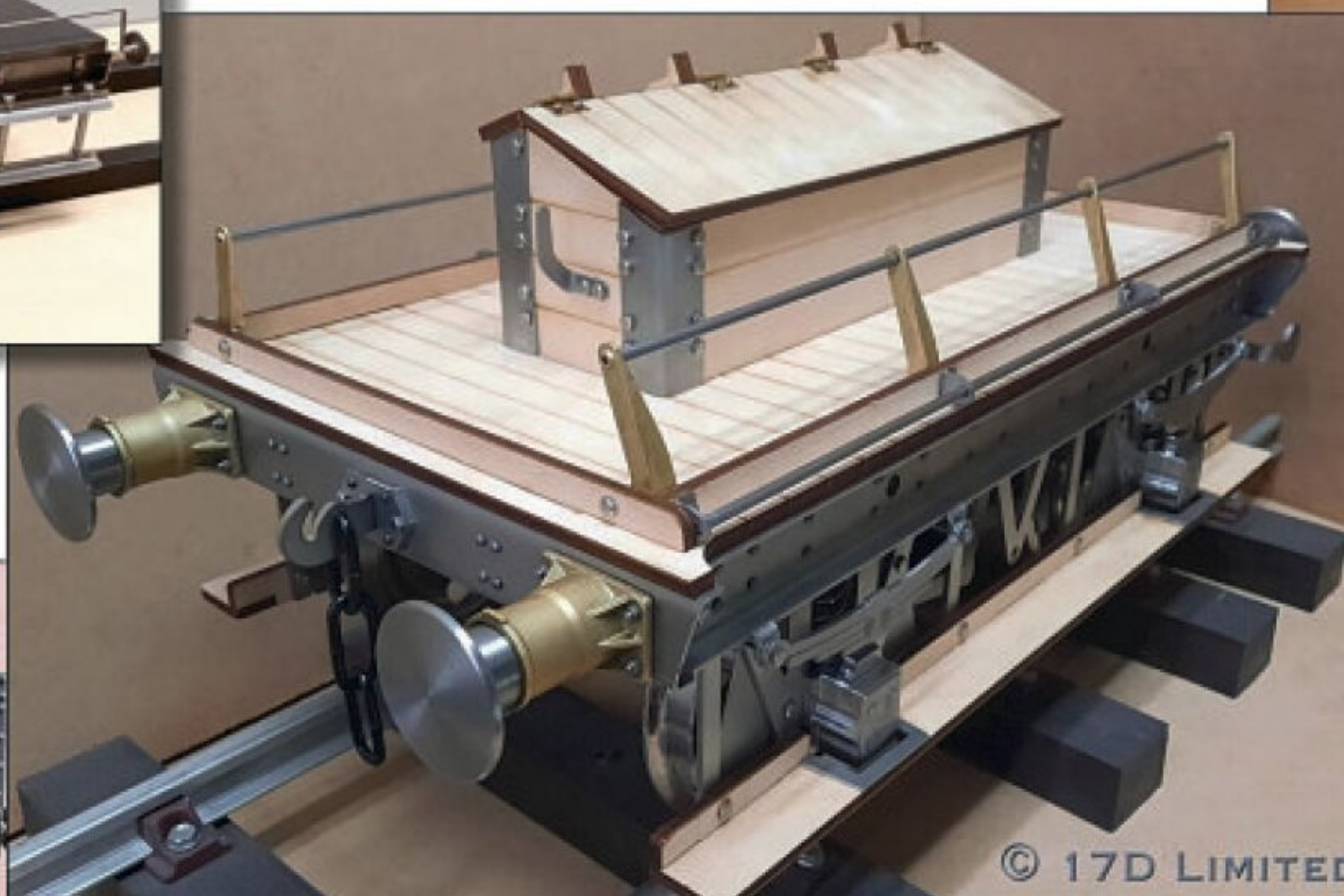
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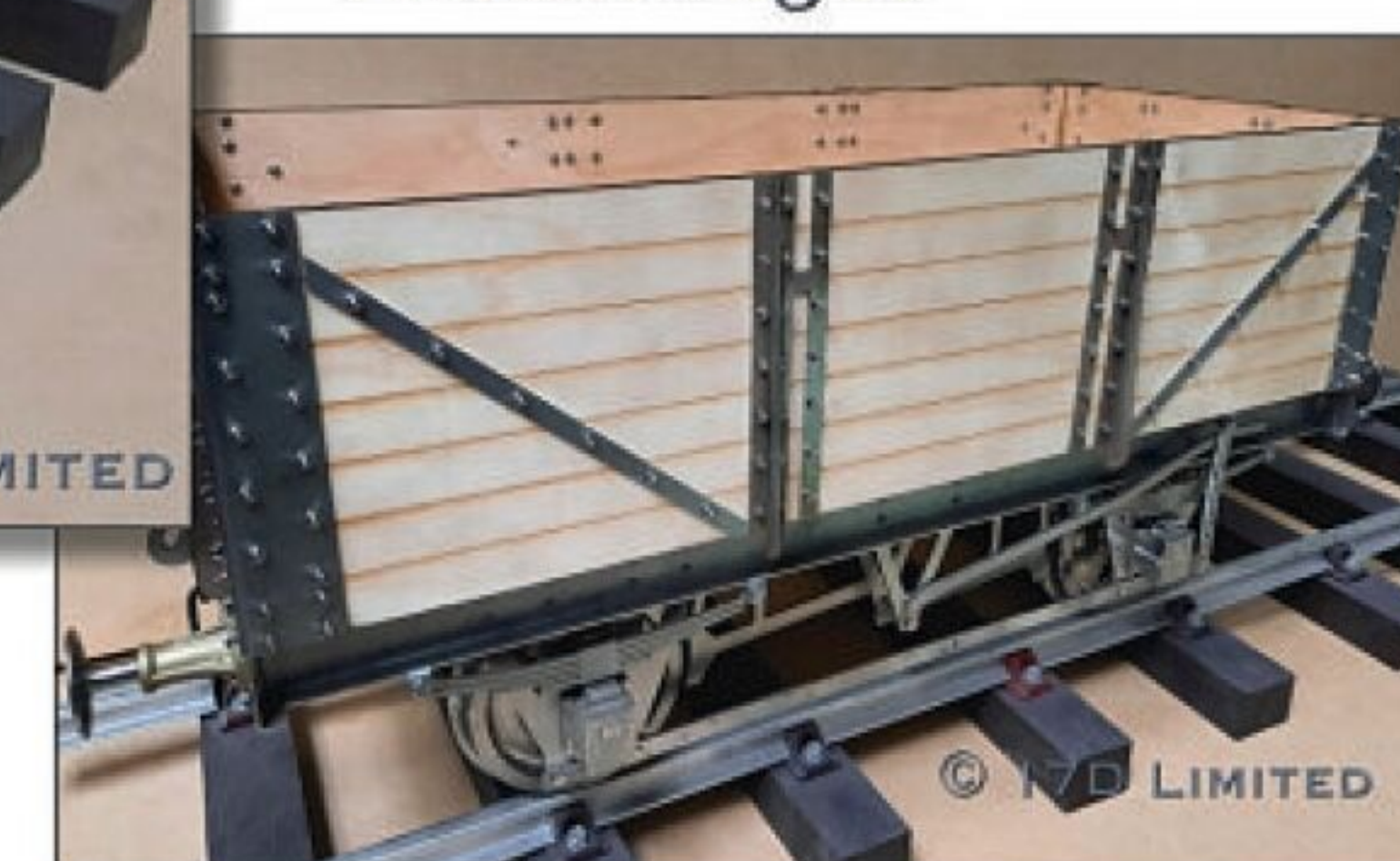


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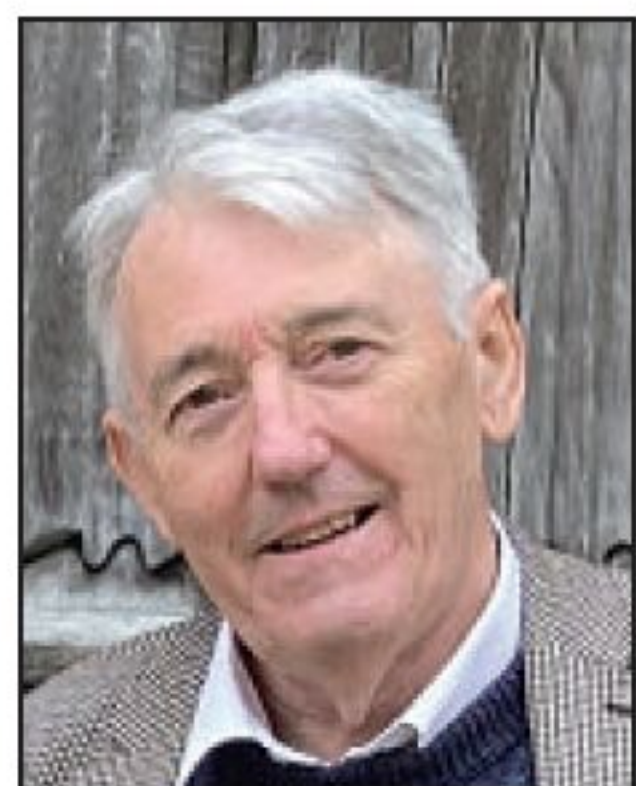
A very pretty GWR 1400 class locomotive and 'Toad' guard's van in 10¼ inch gauge seen at the Midlands show (photo: John Arrowsmith).

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SMOKE RINGS



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Clive Randlesome's Fowler showman's engine guards the entrance at LOWMEX.

LOWMEX

As usual at this time of year, I trekked across East Anglia to visit the Lowestoft model engineering exhibition (LOWMEX), held at the East Coast College in Lowestoft. This is a show that goes from strength to strength, getting bigger and better from year to year. It is organised by the Halesowen and District Model Engineering Society under the very capable leadership of Kevin Rackham. Standing sentinel at the door was Clive Randlesome's very fine 3 inch scale Fowler showman's engine (**photo 1**). Inside was the show's characteristically diverse display of models of all kinds, and work in progress. The show's only weakness is that it is located in the easternmost town in the UK, on the East Anglian coast, which makes it a long journey for anyone approaching from beyond the west of Cambridge.

While the major national shows (with the exception of the Midlands show) appear to have more or less disappeared from the calendar, a number of regional shows are becoming more prominent, this and the recent St Alban's show being prime examples.

I suspect a major reason for the loss of some of our major shows is the increasing expense of running these shows at major venues, especially in London. The regional shows run on much smaller budgets and are more likely to be profitable.

Rochdale

Bob Hayter has written to me with the following:

'At Rochdale SMEE we ran a halloween special on Sunday 28th October. All our young and junior members were present dressed ready to give our passengers scary rides, it was a good opportunity to



Rochdale's young members show off their certificates.

present certificates recognising the contribution these younger members make to the running of the club. Margaret Foster, who initiated the awards, was on hand to make the presentations (**photo 2**). The club has been fortunate to have five young and junior members this year; they have not only helped run railway operations but are active in the club publicity on social media creating and maintaining a YouTube channel to share the video that they make. The effect has been substantial - the halloween event gave over 900 rides in the 3 hours of evening operations. The rain held off until the finish but everyone got very wet packing up, bolstered by a chilli and hotpot supper.'

Old Engine

Peter Bill hopes to restore this old engine (**photo 3**), dating back to the 1930s. It would help in the restoration if the original maker and type of engine were known. Peter wonders whether any of our readers can shed light on this. I shall be pleased, of course, to pass on any ideas.



Does anyone recognise this old engine?

Cock-up Corner

Lynx-eyed readers, especially those with a keen interest in mathematics, will have spotted the incomplete sentence in Rhys Owen's article on Kinematics (M.E.4755, November 1, p.628) at the bottom of the first column. The complete sentence should read '... (i.e. the rate of increase of the vertical component relative to the increase of the horizontal component)'. My apologies for this omission.

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Midlands Model Engineering Exhibition – Highlights

John Arrowsmith offers his first impressions of the Midlands show.



Presenting the highlights of this year's exhibition is quite difficult because there were so many things worthy of mention. So let's start with the attendance this year which was excellent on all days and was complemented by increased entries in all but two of the competition classes. Add to that a completely new organisation attending, in the form of the Association of Helicopter Aerosports. They provided a new look at some excellent miniature helicopters. They call them miniatures rather than models because the way they are built is the same as their full size counterparts. The flying displays of these machines was equally outstanding, given the often blustery weather conditions outside, and here they provided something that has not been seen at the exhibition before.

On to the more conventional and traditional offerings in the show. The quality of work in some of the classes really was outstanding and showed that the skilled model engineer is still very much alive and kicking despite all the doom and gloom that surrounds us these days. Every competition class had entries except two so the organisers were very pleased with the response this year. Looking at the various sections there were some outstanding models in many classes and in particular the BR Standard Class 5 locomotive No. 73000 displayed on the 7½ Inch Gauge Society stand and owned by Andy Harvey. This was an excellent example of both the model maker's skill and the finished product (**photo 1**). The other large locomotive which caught the eye was the 10¼ inch gauge GWR 1400 0-4-2 tank locomotive and



A superb example of a BR Standard Class 5 locomotive.



The 10¼ inch gauge GWR 0-4-2 tank locomotive and Toad guard's van.



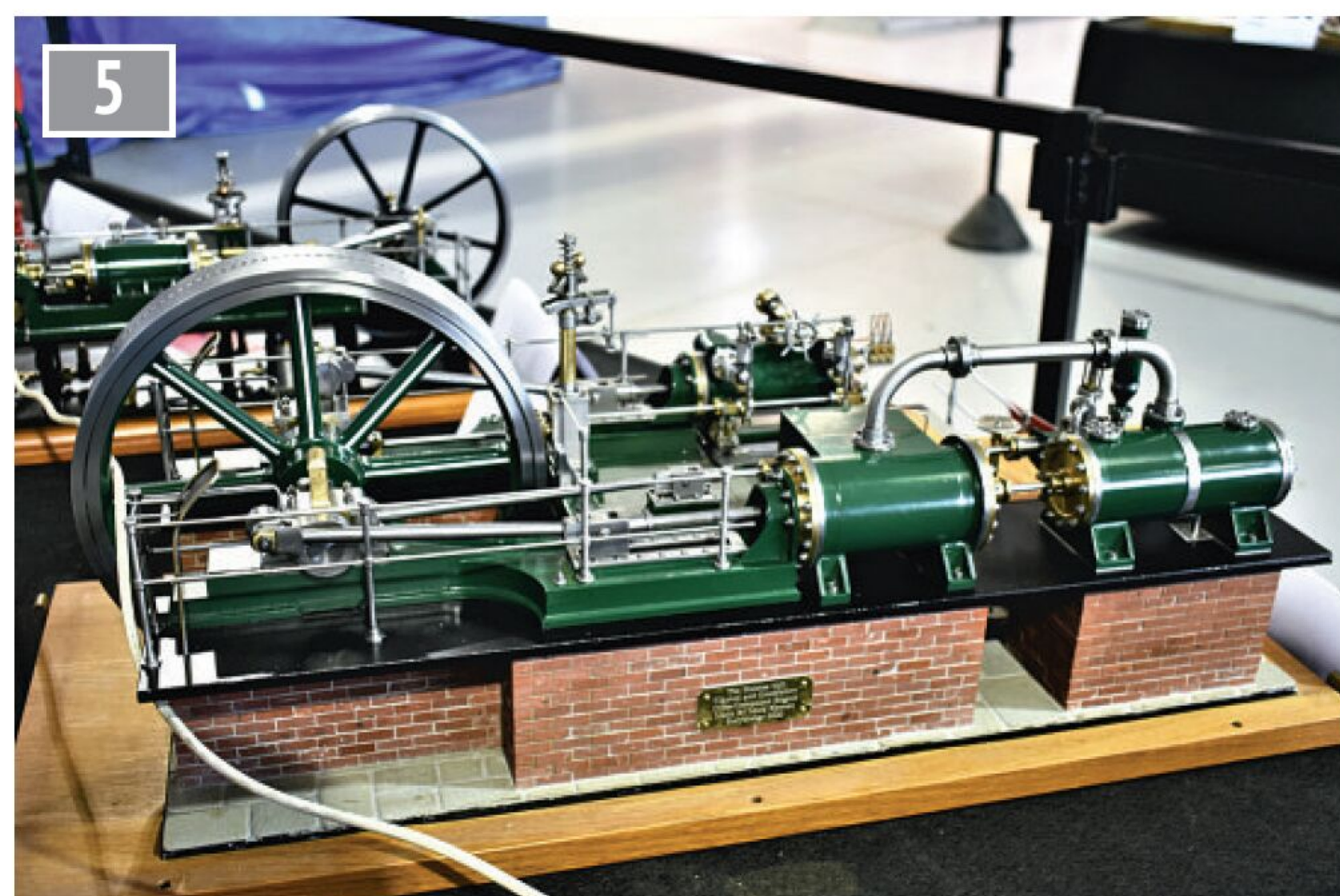
This delightful 2½ inch gauge LSWR T3 class 4-4-0 locomotive was built by Terence Woodward.

Toad guard's van featured on the 10¼ Inch Society stand. Beautifully made and finished, it was an excellent contribution

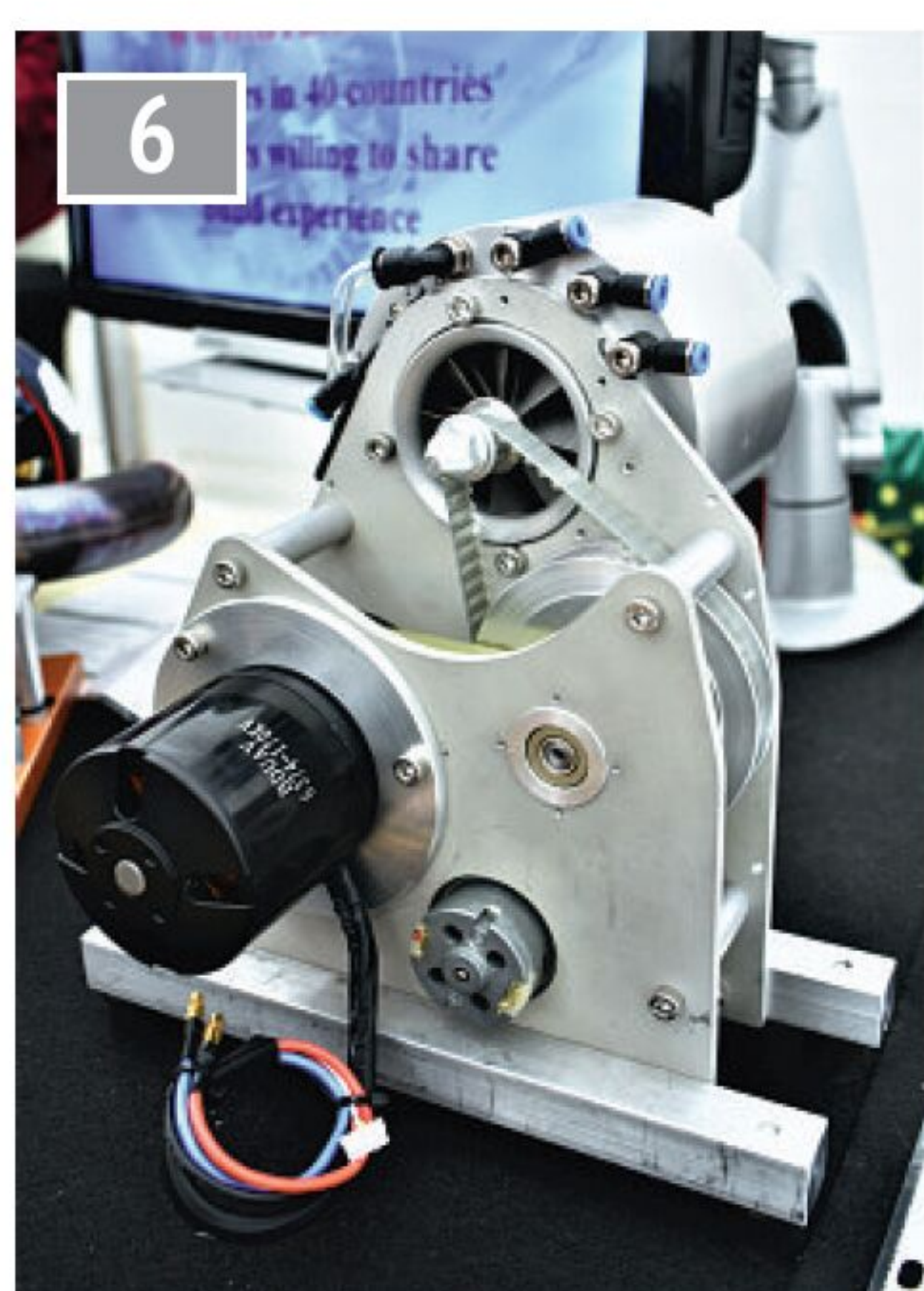
to the show (**photo 2**). In complete contrast to both these large locomotives, the little 2½ inch gauge LSWR T3



A 1/4 scale model of a Royal Navy Gazelle Westland HT2 helicopter being flown by Glen Davies.



Mick Keenan's Clayton and Goodfellow cross compound steam engine.



The 'Desktop' hydrogen demonstration unit.



The replica Formula 1 steering wheel built by Angus French.



Twelve year old Tommy Pugh-Bodman built this small oscillating engine from scrap material.



An AEC Matador lorry under construction from Kai Pugh-Bodman.

Class 4-4-0 locomotive was a delight to see (**photo 3**).

I mentioned the helicopters being a new addition to the show and the flying display was another highlight, with some amazing aerobatics being performed by the pilots (**photo 4**).

The Chris Deith Memorial Trophy for the Best in Show model in competition went to a quite outstanding model of The Holmes Mill, Clayton and Goodfellow cross-compound steam engine (**photo 5**) built by Mick Keenan. This model was completely built from scratch

with no commercial fittings, all the nuts and bolts, pins etc. being made by the builder. Again, in complete contrast to this 19th century engine, the cutting edge technology of a new 'Desktop' hydrogen (H_2) gas turbine demonstration unit displayed by the Gas Turbine

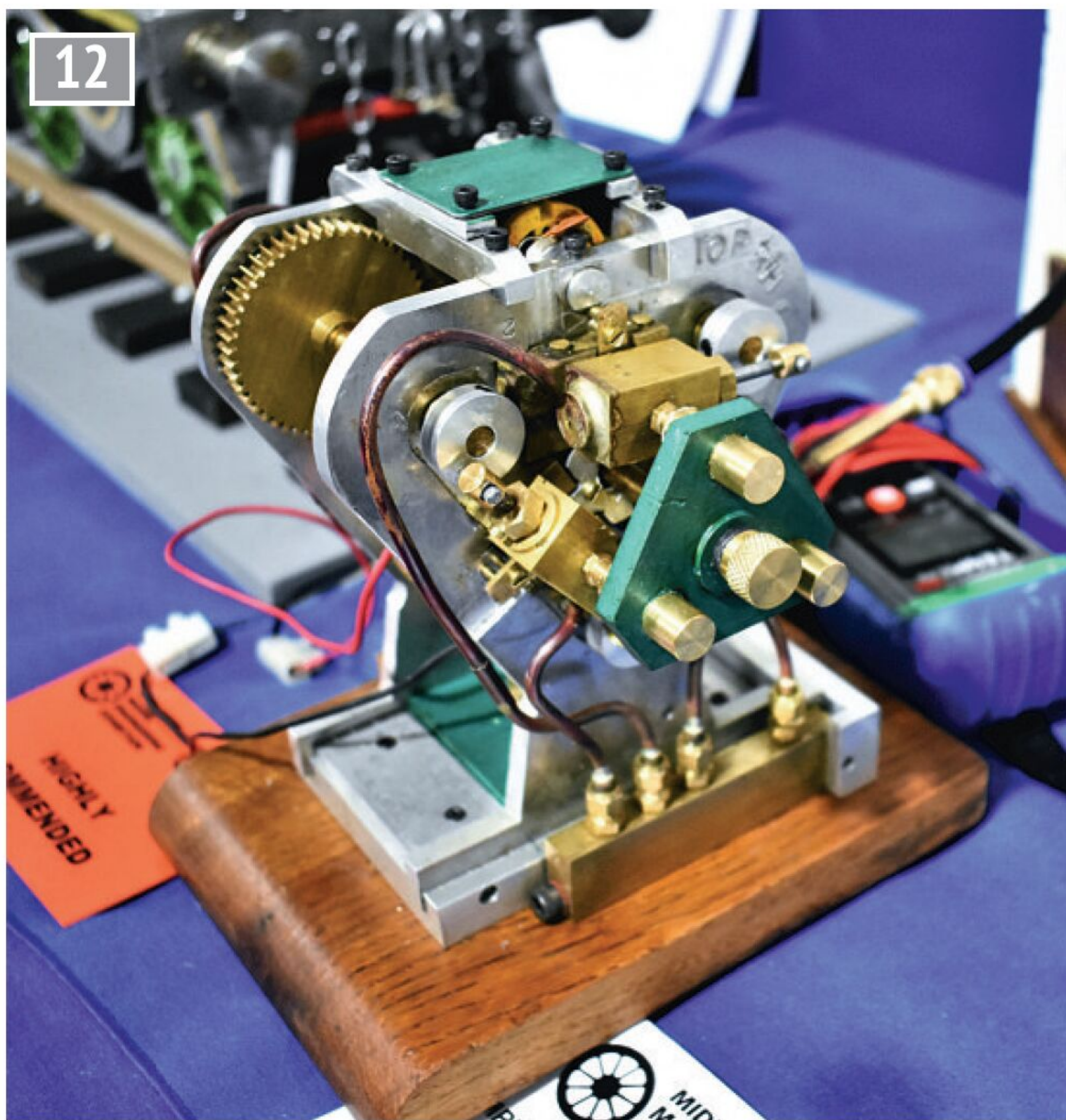
Builders Association showed how model engineering has progressed over the years (**photo 6**). This new engine operates at 90,000 rpm with the generator working at 5800 rpm and can generate 1.2 kW @18V/70A DC. Not bad for an engine which weighs just 3.1 kg and is only 11.2 mm diameter with a 66 mm diameter turbine. The exhaust is pure water vapour so it is very environmentally friendly. That is the essence of these exhibitions, which can show the exemplary workmanship of the old traditional crafts and engines right up to modern technology, which modern day young people will be working with.

The exhibition had examples of all the modern technology from 3D printing to laser cutting and these high tech machines to the old style machining techniques and fitting. Some of the work produced by young engineers was excellent - I am talking now of youngsters from 10 up to about middle twenties. The Formula 1 replica steering wheel displayed by Angus French (**photo 7**) to the little oscillating engine built by 12-year-old Tommy Pugh-Bodman (**photo 8**) and the Matador lorry under construction by Tommy's brother Kai, who is now 16 (**photo 9**), just show the versatility of today's youngsters.

Talking with some of the traders they were quite buoyant about the show, saying ➤



Plenty of interest in the SMEE display.



The 6 cylinder oscillating engines in a triangular formation.



This 3 inch scale Clayton thresher drum is being driven by a 3 inch scale Marshall traction engine.

business was good, so that is encouraging as well. A fine and very varied display by an increased number of club stands this year provided a good representation of what is happening around the UK. Lots of new builds and some

old favourites were on show and as far as I could see stand stewards were kept very busy answering questions from visitors and fellow model engineers alike.

The Society of Model and Experimental Engineers (SMEE) had a large display area this year (photo 10) with a well stocked stand, including a wide variety of models from their extensive collection as well as a workshop demonstrating different machining techniques. Members were kept very busy answering many questions from visitors. In addition to these older models some very new and up to date offerings were also on show. The optical



An optical dividing head based around an existing worm drive gear box.



A fine display of lifeboats from the Knightcote Model Boat Club.

dividing head based around an existing worm drive gear box and microscope (photo 11) was interesting as was the six cylinder oscillating steam engine built in a triangular configuration (photo 12).

In the marquee the Knightcote Model Boat Club displayed a fine selection of model lifeboats with information about each class of boat on display (photo 13). Outside, the Fosseyway Steamers had a full program of activities to keep the visitors entertained and they were lucky because, despite the rain earlier in the week, the ground conditions were relatively good. The little 3 inch scale Marshall traction engine with a 3 inch scale Clayton thresher drum coupled to it (photo 14) was

an attractive set up to watch in operation and again reminded people how the modern day farming community has progressed over the years.

That just about sums up the 2024 Midlands Model Engineering Exhibition, which combined some very old and traditional skills with up to date cutting edge technology, providing a wide and varied exhibition for everyone. I hope this very brief look at the show combined with reports next time of the competition entries and then the clubs and display features, will encourage both young and old to continue to support this fine exhibition which at the moment is the only one of this size in the UK.

ME

A BR Standard Class 4 Tender Engine

PART 8

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



Continued from p.720
M.E.4756 November 15

We will now concentrate on the wheels and axles (figs 27 to 29). These are the same on all BR Standards except that wheels on the Britannias, Clans, Class 5s and Duke of Gloucester are on roller bearings. However, some of the Britannias were on plain bearings. Now one of the things I can't fathom, is why on earth the driving wheels on the 76000s are different from the 82000s when they are the same diameter? The tank engines were built at Swindon and the tender locos were built at Doncaster, Derby and Horwich. I can't help but feel that there must have been a bit of pettiness going on here. The tender engines have sixteen spokes, and the tank

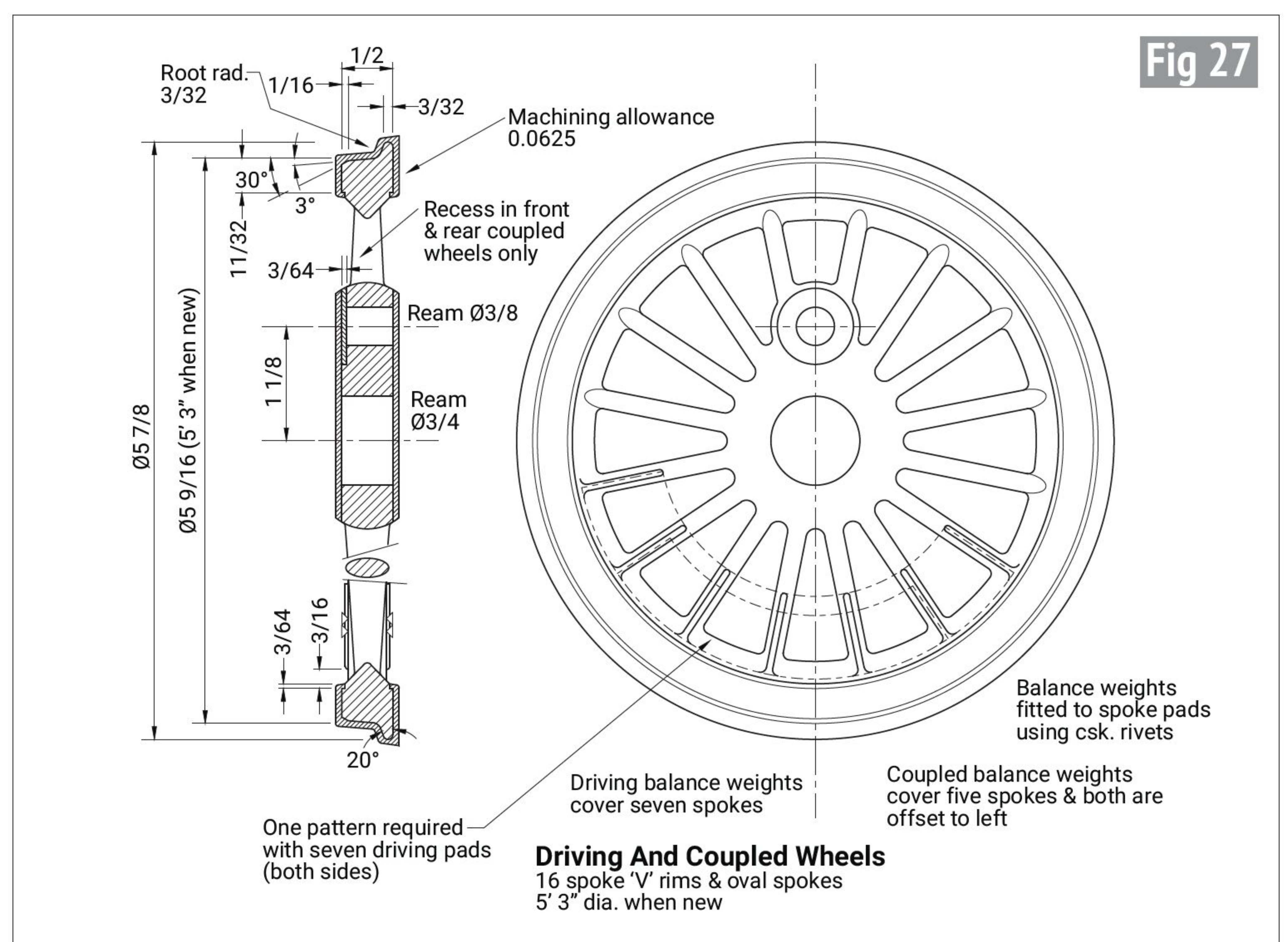
engines have seventeen just to be different. They each have the crank boss between two spokes.

We will start this time with some full size photographs of a couple of the 76000s. **Photograph 44** shows 76033 looking rather worse for wear with no front number plate. However, it still had the AWS battery box on the left-hand platform and it also has tablet catchers in the cab sides. It is coupled to a BR2 tender before it was converted to a BR2A tender. The photo was taken at Eastleigh on 12th March 1967. This next photograph (**photo 45**) is of 76064 taken at Southampton Terminus looking much better and nicely polished and it is coupled to a BR1B

tender. This was taken on 26th June 1957, which explains a lot.

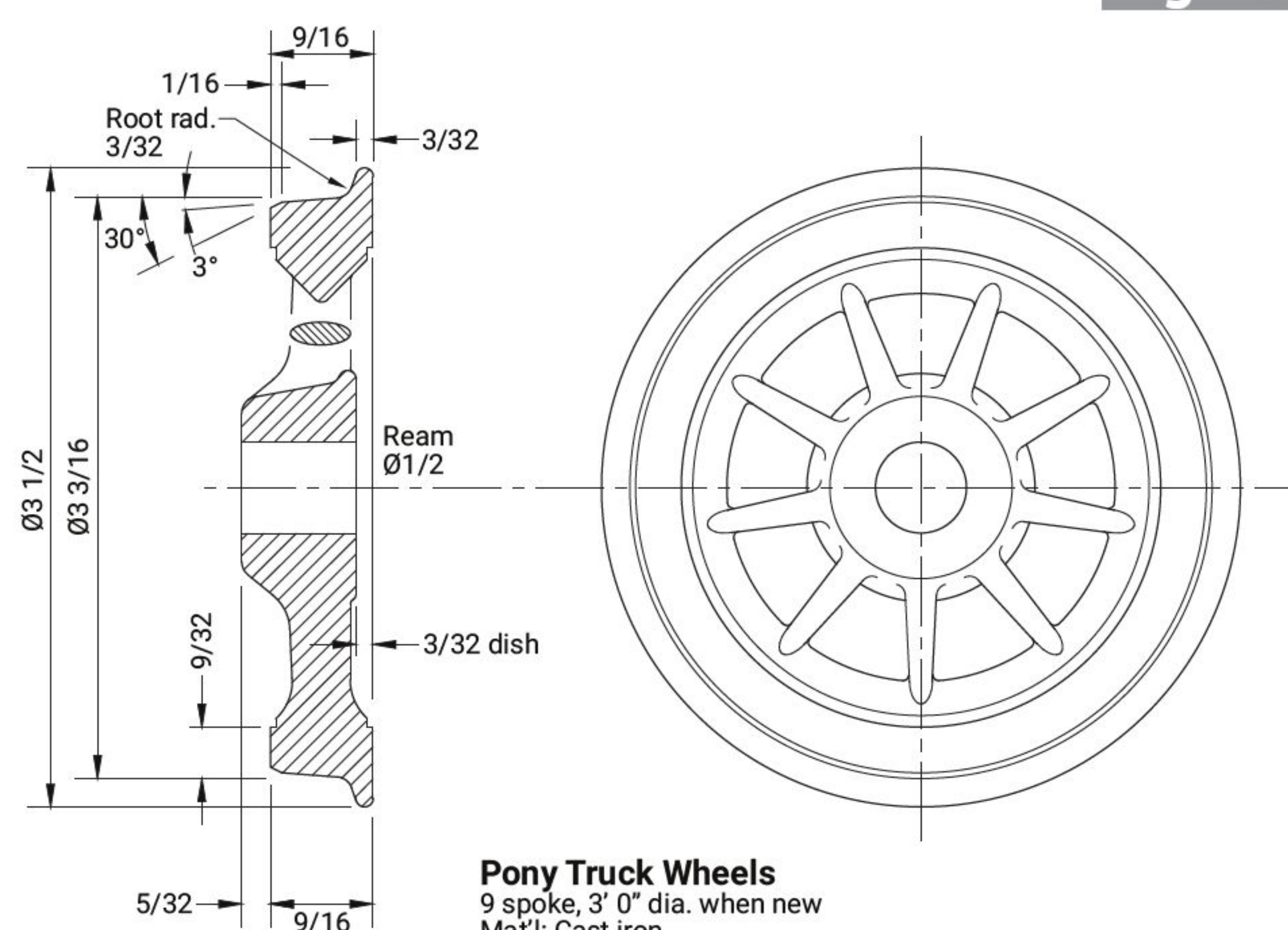
We now come to what is probably one of the most satisfying jobs in locomotive building and that is turning the wheels. Good quality cast iron is wonderful stuff to machine and I always find it a pleasure to see the rough casting go into the lathe chuck and a nicely machined face come out. There are various schools of thought on turning wheels and I know that a lot of people say that they have described this before so refer back to such and such but I do not like that as I think the series should be written as a standalone piece.

First of all, you will need the jaws of the chuck turning inside out so that the wheel



Driving and coupled wheels.

Fig 28

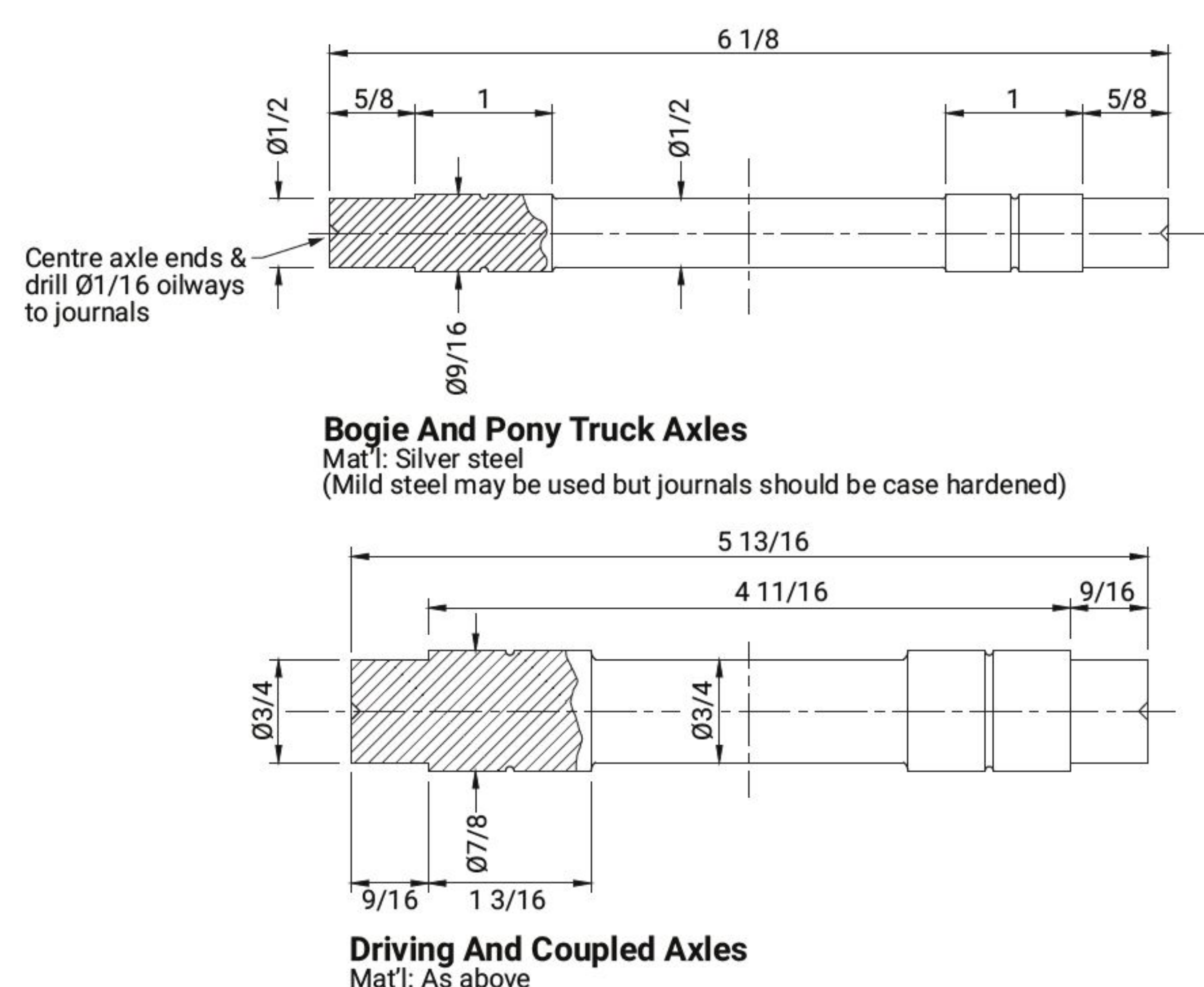


Pony truck wheels.

can be gripped by the rim but use some 3/16 inch packing pieces behind the wheel so that the wheel is just held by the tips of the jaws. There is quite often some slight discrepancy in alignment of

the spokes between the front and the rear of the wheel, so I start by gripping the flange and getting the tread to run truly as this is the side of the wheel that you see. I feed the tool across the wheel as fast

Fig 29



Axles.

as it will go without stalling the lathe as there is no point in hanging about. The other thing is that tipped tools like being fed this way. You will have to be a bit more careful when you reach the crank pin boss

and take that a little slower but continue feeding right to the centre of the wheel. You will probably need at least one more cut of 30 thou' which should leave a finishing cut of about 5 thou'. For the finishing



BR Standard Mogul 76033 (photo: The Transport Treasury).



76064 – a much better turned out Mogul (photo: Rail Online).

cut you will need quite a fine feed to achieve a nice finish on the rim.

Next, centre the wheels and drill through with something like a $\frac{1}{4}$ inch drill for a start but the drill will need the cutting edges taking off with just a touch on the grinder so that the actual cutting edge scrapes away at the cast iron rather than trying to cut under it. You need to aim at a bore into which the lead end of a $\frac{3}{4}$ inch reamer will just begin to enter and then the hole can be finished off with the reamer. These wheels will come with the balance weight pads cast in so you will have to pull the lathe round by hand. Change the tool for a flat topped knife edged tipped tool and turn the tread down to about 30 thou' over the $5\frac{7}{8}$ inches and do not bother about the taper at this stage. You should also just be

able to turn a little bit of the flange casting away but do not start catching the chuck jaws.

You can now grip the treads of the wheels and face the back in a similar manner, though in this case you will need to make a little gauge out of a scrap of 16swg plate, brass or steel - it does not really matter - which has a slot cut out of it at one end exactly $\frac{1}{2}$ inch wide and about the same depth and you can use this as a gauge for finishing the thickness of the wheel.

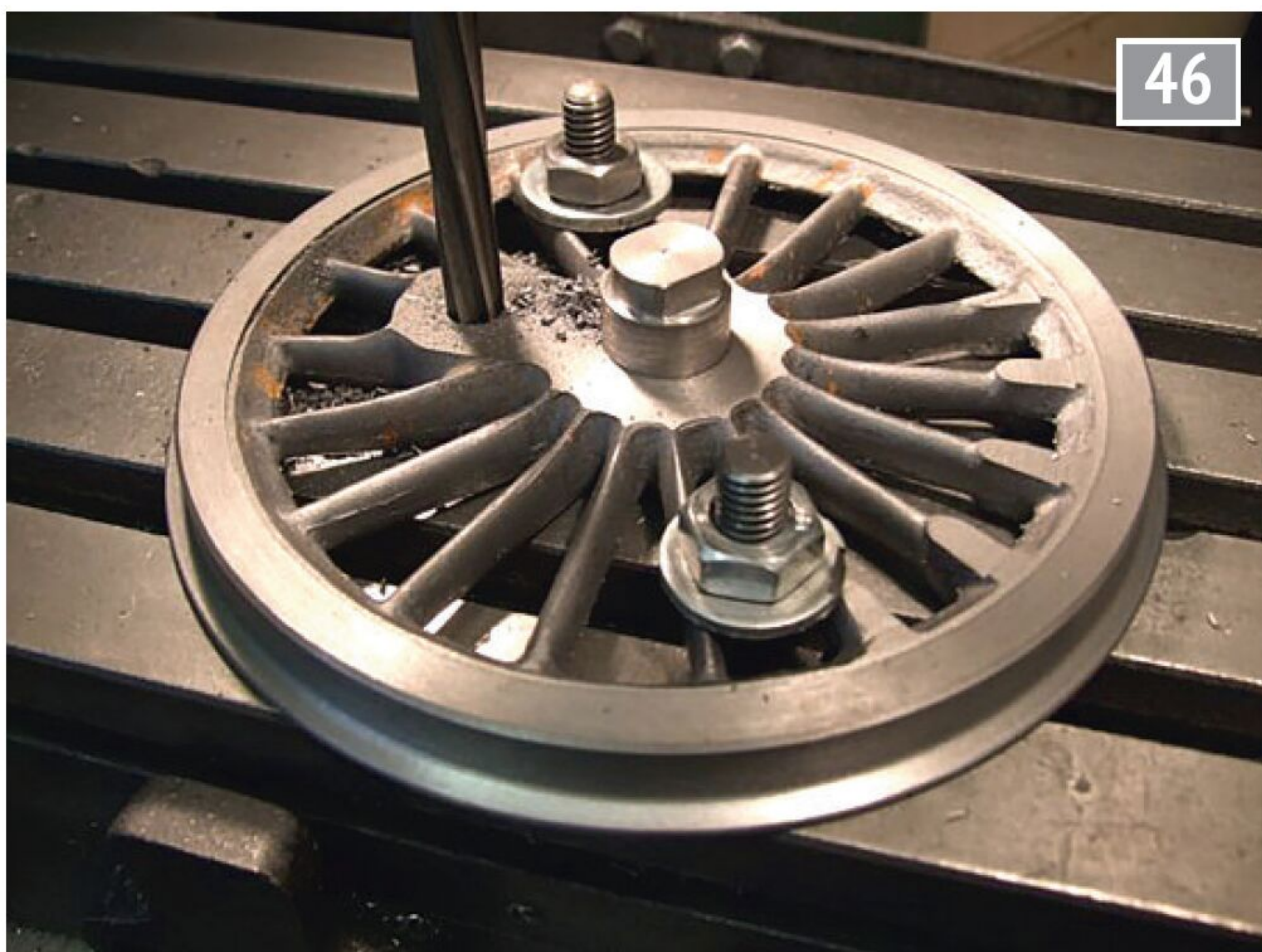
To complete the wheels, you will need to make your own face plate out of a blank disc of steel about $\frac{1}{2}$ or $\frac{3}{8}$ inch in thickness and $5\frac{3}{4}$ inches diameter with another disc of similar material approximately $3\frac{1}{2}$ inches diameter welded to the back of it. However, first of all it is advisable to make the pin that goes into the middle

of the plate on which to mount the wheel. You will need a piece of $\frac{7}{8}$ or 1 inch free cutting mild steel bar and turn down approximately $\frac{1}{2}$ inch diameter and thread it with whatever $\frac{1}{2}$ inch die that you have to hand, preferably something like $\frac{1}{2}$ inch BSF. Part off about 1 inch from the shoulder and then this can be screwed into the face plate once you are at the required stage.

Now, mount your face plate in the four-jaw chuck with the rear boss facing outwards and turn it down to a reasonable finish, though the diameter is not important, and it does not require facing, although you should aim to end up with about a $\frac{1}{8}$ inch step where you finish the turning as this will be used as a register against the chuck jaws when you turn it round. You can now turn the plate round and hold it in the

outer jaws of the three-jaw chuck marking with a pop mark at No. 1 jaw so that when you take the face plate out you can replace it in the same position. The face plate now needs facing and for this job I use a replaceable tipped tool. You can also take a cut across the outer rim just to tidy the job up and remove the burrs with a fine file. On my own face plate, I relieved the centre with a 10 thou' cut leaving a rim about $\frac{1}{2}$ inch wide so that when you tighten the wheel onto the face plate, it will grip on the flange and nowhere else.

Next, centre drill and tap the centre of the plate to your favoured $\frac{1}{2}$ inch thread and screw in your part made centre pin. This now needs to be turned down very carefully until the wheel will just slide on with no shake. The outer end of the pin can then be turned down to



Reaming the crankpin hole.

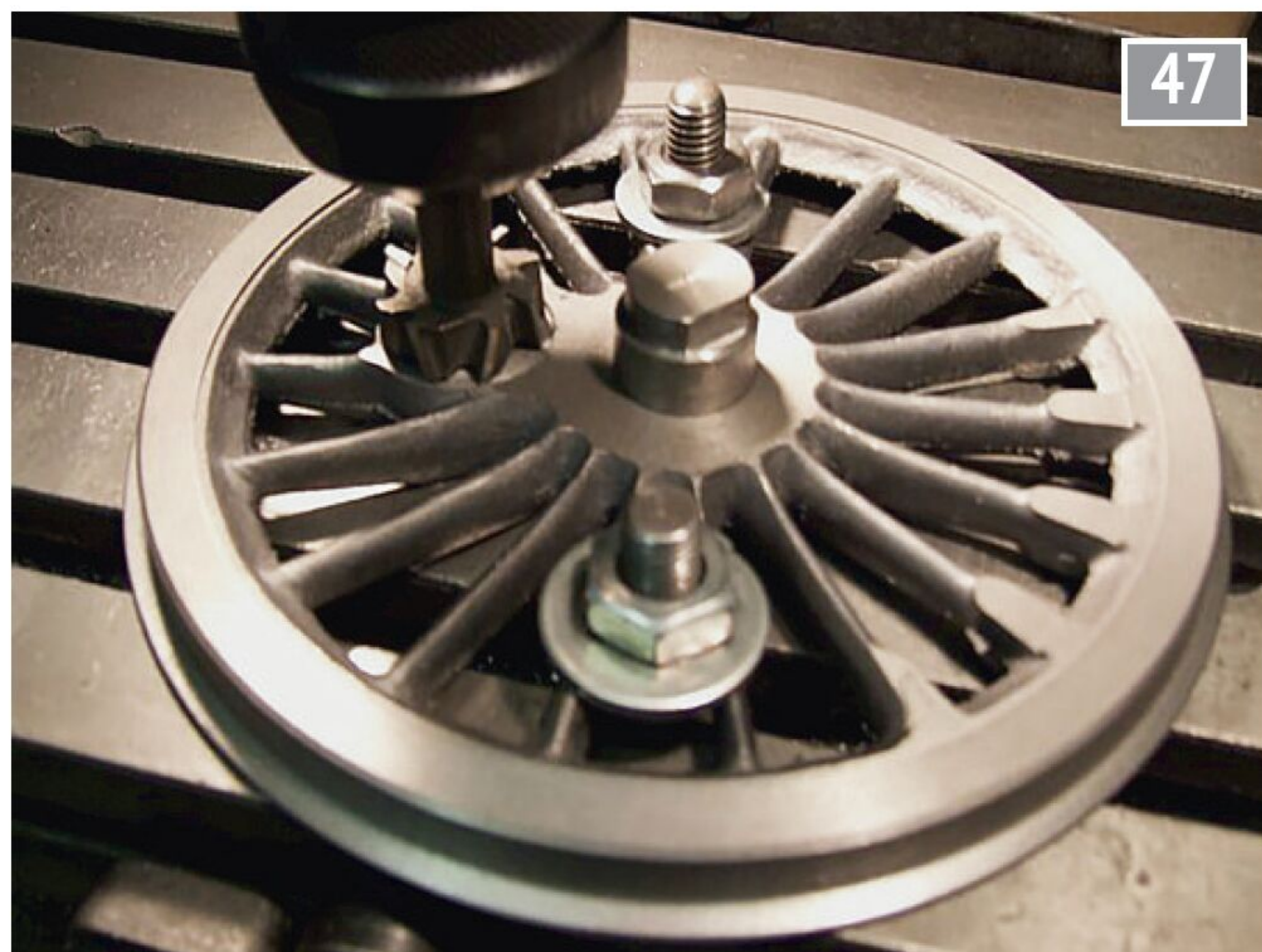
your ½ inch thread, again such that the shoulder is just slightly recessed in the wheel boss. This can then be fitted with a stout washer and nut. Before you start on the next stage, you need a piece of 16swg brass strip, 9/16 inch wide and approximately 1 inch long and on one end of it draw the wheel profile. This then makes your everlasting wheel profiling tool grinding gauge. You now need to grind the reverse profile onto the end of a piece of ¾ inch square tool steel and this again will make your everlasting wheel profiling tool and every time you sharpen it, you should use the brass gauge to check the profile. The front rake of the tool needs grinding to about 4 degrees but the top can be left flat.

You can now put the first wheel on your face plate, face outwards, and tighten the nut and washer and then turn down the flange to 5⅞ inches diameter. The remainder of the tread can now be roughed out leaving the flange thickness of just over 3/32 inch. Turn all of the wheels to this stage and then, with the last one, set the top slide over 3 degrees and lock the cross slide and saddle so that only the top slide can be moved. Now you can turn the taper on the tread with one cut. Just wind the top slide back, put the next wheel in position and do them all to the same stage.

With the last wheel still in position, you can now swap

tools to your newly made profiling tool and with the top slide still set to 3 degrees you can very carefully form the root radius and outer radius of the flange. You can apply the rear radius to the flange with a medium cut file though I like to do this with the lathe running a little faster - something like the highest back gear. The top slide can now be set over to 30 degrees and you need to go back to your normal cast iron turning tool to machine the outer chamfer onto the tread but do not be tempted to use a chamfering tool and do this in one cut as it is bound to chatter.

The final operation on the face of the wheel is to cut the groove to show the inner edge of the tyre and this can be done with a small parting tool set parallel to the lathe bed though you will need to unlock the cross slide for this operation and when you have finished one groove, set the dials on both the cross slide and the top slide to zero and turn all the others to the same setting. For these finishing operations it is as well to put your chuck key on the bench rather than keep it on the lathe so that you remember to take the wheels off using the nut on the face plate rather than undoing the chuck jaws by mistake as you do not want to disturb the face plate. The wheels also now need the tyre groove turning on the rear of the tread in the same way as just described.



Facing for the crankpin.



Balance weights with rivets filed down.

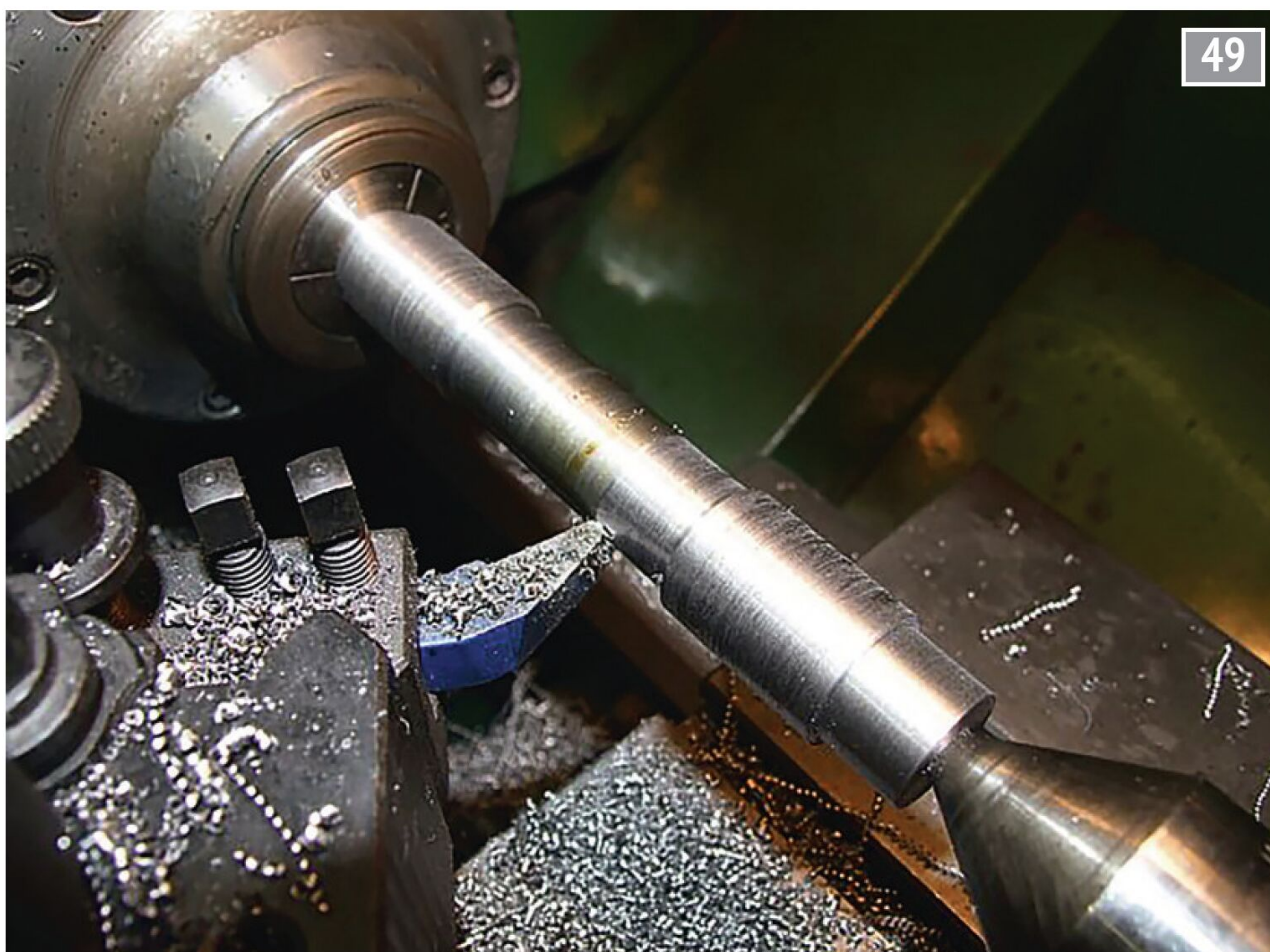
It is very important to turn all locomotive wheels to this profile particularly if you are running on a ground level railway where there is pointwork. The small chamfer on the outer edge of the tread gives a smooth run across crossing noses and the taper on the tread gives the differential action on curves. Apart from anything else it makes for a much freer running engine than if the treads are turned parallel.

Photographs 46 and 47 are Geoff Whittaker's photos showing him reaming one of his wheels on his milling machine and then machining the crank pin face. These were for his 75069. I know that Geoff drilled his crank pin holes using a different method to what I have always used and I think it is preferable to my method. He used his milling machine to do the job which I did not have at that time. As you will see from

the photographs, Geoff has mounted them eccentrically on the bed such that the chuck was centred over the crank pin hole. The holes were centred, drilled and reamed from there.

You can now turn the pony wheels and for this job I would use the three-jaw chuck with the outer chuck jaws set. The main axles on the full size engine are not the same as I have drawn them here as, on the full size engine, the wheel seat is a larger diameter than the axle journal and there is no shoulder on the axle for use in registering the back-to-back distance of the wheel sets. I have taken the liberty of altering the design slightly from the full size so that we do have a shoulder on our axles up to which the back of the wheel may be pressed.

There is no substitute for silver steel for axles as it comes with a ground finish and it is hard wearing without



Machining an axle.



Full size driving wheel – with 16 spokes.

having to do anything to it. If you can only obtain the silver steel in 13 inch lengths, then I am afraid you will require two lengths as the axles are 5

13/16 inches long. If you have a lathe big enough you may be able to part these off using a good stout parting tool and a slow speed, otherwise you will

have to resort to sawing them off at about 5 15/16 inch long just to allow for cleaning them up and centring at both ends. If you are a proud possessor

of the ordinary 3½ inch Myford, then you should be able to get the axle far enough into the chuck to be able to face the end and centre it. Once centred, it is advisable to support the end with a revolving centre in the tail stock - although to reach the wheel seat you may have to angle the top slide. This means that you will not get a direct reading on the dial, although if you set the top slide to exactly 30 degrees the dial indicator will read exactly twice the cross feed measurement. This is handy as for every thou' added on the dial, you only get ½ thou' feed. **Photograph 48** shows him fitting his balance weights both rear and front and **photo 49** shows Geoff turning his axles.

Photograph 50 shows a photograph which I took showing one of the driving wheels. As you will see it has sixteen spokes.

I much prefer a good old fashioned press fit for my wheels and, in this case, you need to turn the tip of the axle down until it will just enter the hole in the wheel by about ⅛ inch and then wind the top slide back to take out the backlash and feed it in again ½ thou' short of where you were before. The other important dimension on the axles is the 4 11/16 inches to gauge the back to back of the wheels and, if the axles are finished between centres, you will be able to measure this with a calliper gauge. The pony truck axles are a similar turning job from 9/16 inch silver steel and you will need some of the same material for making the driving wheel crank pins. I have changed my design of the axles slightly in that I have done away with the oil holes in the axle ends as all this does is to dribble oil all over the track and that causes a big headache at Gilling and at other tracks, which wouldn't surprise me at all. There is just no need for all that oil. In any event the driver should never be without a rag in his hand to wipe up any drips of stray oil.

●To be continued.

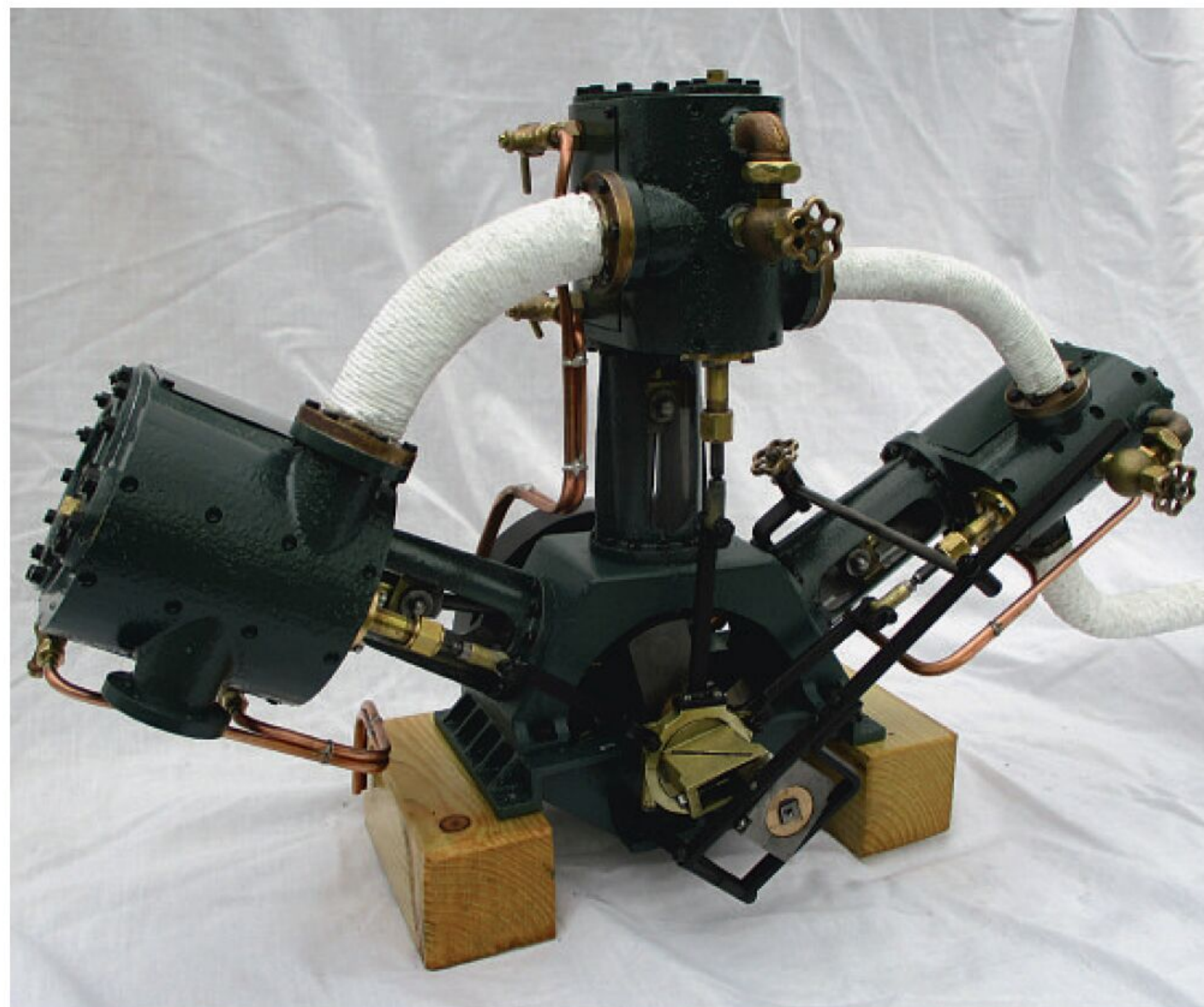
A Radial Marine Steam Engine

PART 2

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



Continued from p.679
M.E.4756 November 15



The crankshaft

This will be made from silver steel for the shaft and crank pin, mild steel for the webs and cast iron for the counterweights. The plan is to assemble it using high strength retaining compound then drill, ream and pin with taper pins. The counterweights will be bolted to the webs, as in the proto-type (with some more of that retaining compound, just in case...).

The webs were cut to length, then held together in the vice and drilled and bored to size. The square ends were milled to length, with the other ends left over-size to allow for machining.

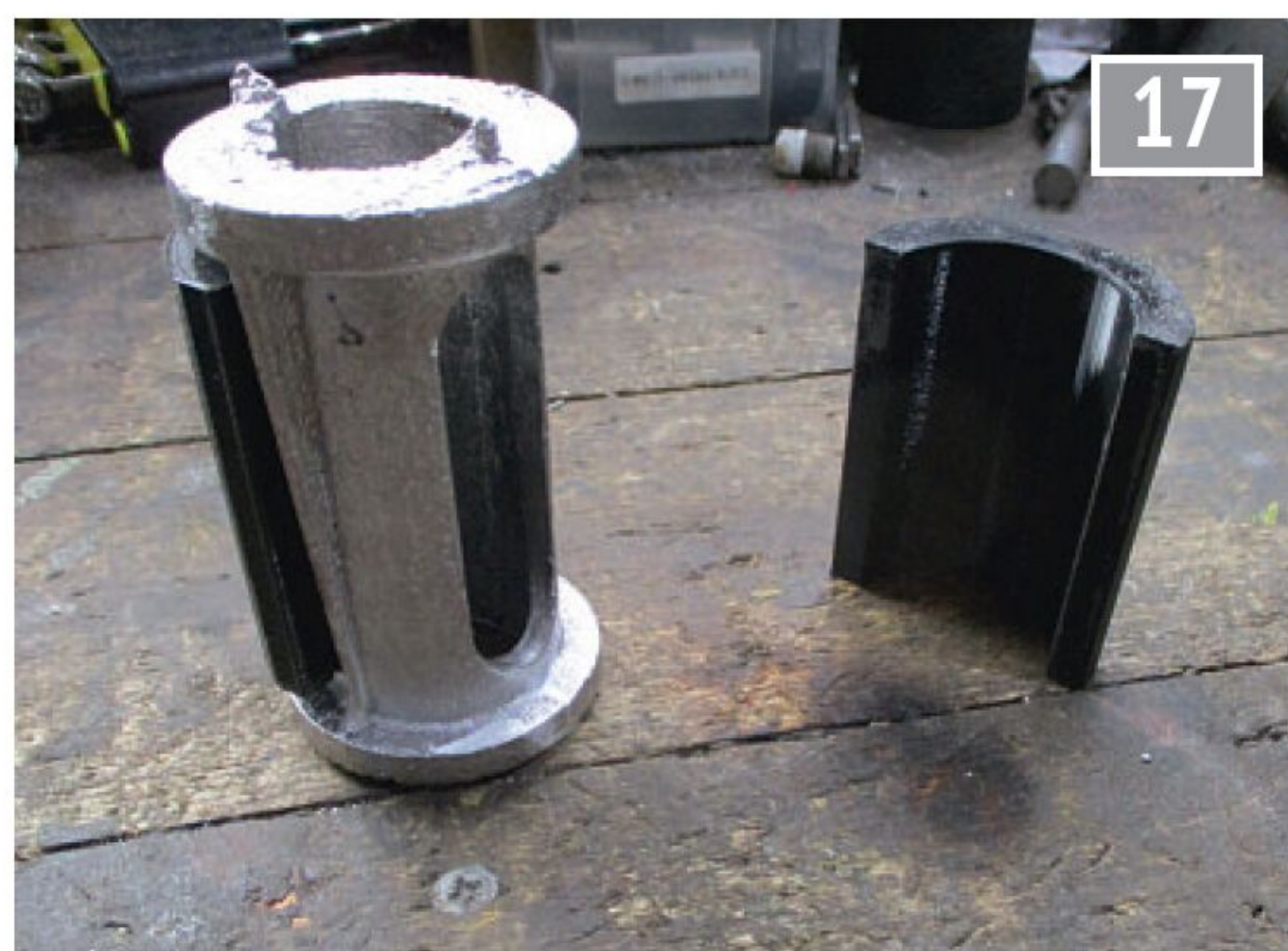
Here the shafts have been glued in place, drilled and pinned (**photo 21**). To avoid unnecessary stress on the joints, the main shaft will not be cut until the machining is finished.

On to the counterweights, currently pretending to be a short length of cast iron bar. Set up in a four-jaw chuck with as much as possible protruding from the jaws, the face of the rim and the recess are machined, and a 1 inch hole

Crosshead guides

These were tricky little beasts to hold. In the end, I made a pair of half shells to fit around the body of the guides (**photo 17**) - the 3D printer again! Luckily enough, I had a four-jaw independent chuck with a big enough bore to (just) take the guide with the shells. Once mounted and trued, it was a straightforward job to face the first end, turn the locating spigot and bore the bore (**photo 18**). They were then

turned around and mounted on an expanding arbor. The cylinder end was then faced and the second spigot turned. Moving to the mill, the guides were mounted on the rotary table fitted with the chuck holding the expanding arbor to hold the guides (**photo 19**). The 12 holes per end were drilled using the same DRO function and settings as used on the upper frame so, hopefully, they'll fit together... and they **do** fit (**photo 20**)!



Crosshead guide casting with holding shells.



Boring the crosshead guide.



Drilling the fixing holes.

bored in the centre (**photo 22**). After turning around in the chuck, the rim is machined then the inner web reduced to size - the width of the crankshaft web. The rim was left over size on width and outside diameter to allow for a final skim when the crankshaft is assembled.

More precision engineering; the blank is cut in half with an angle grinder. After mounting the remnants in the vice, a side

and face cutter, mounted on the horizontal arbor, is used to cut the slots into which the crankshaft webs will fit, making the slot a sliding fit on the webs (**photo 23**). The last operation on the counterweights before fitting is to machine the angled faces (**photo 24**).

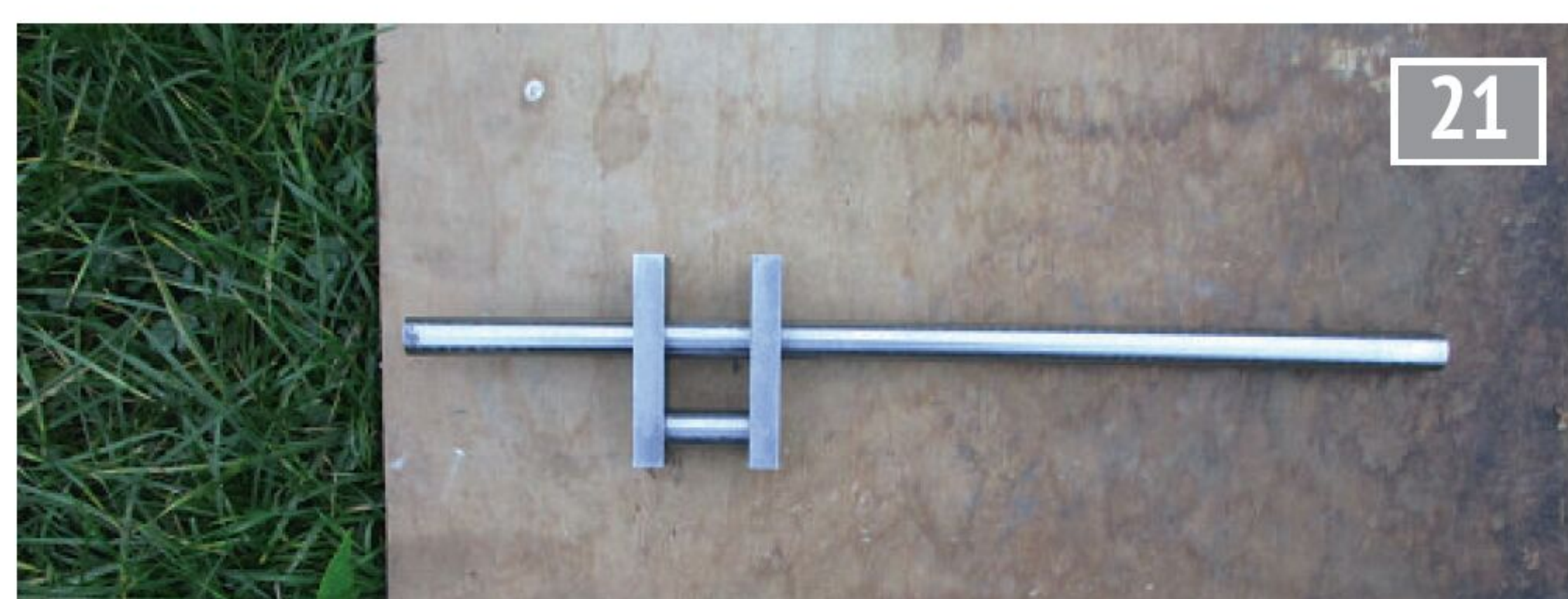
Fitting the counterweights was fun... I located the weights on the webs by clamping pieces of steel flat bar either



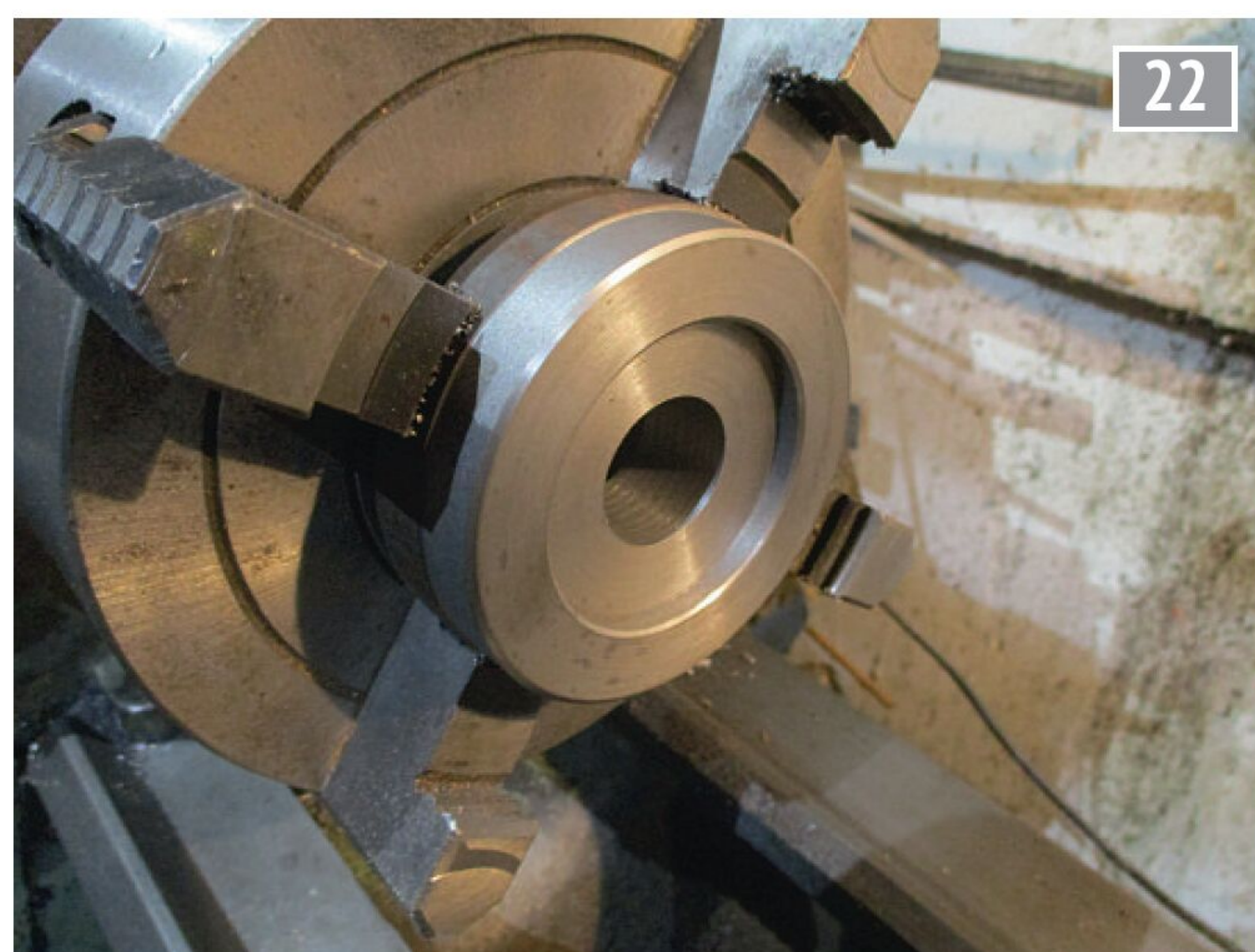
Finishing the counterweights.



A perfect fit.



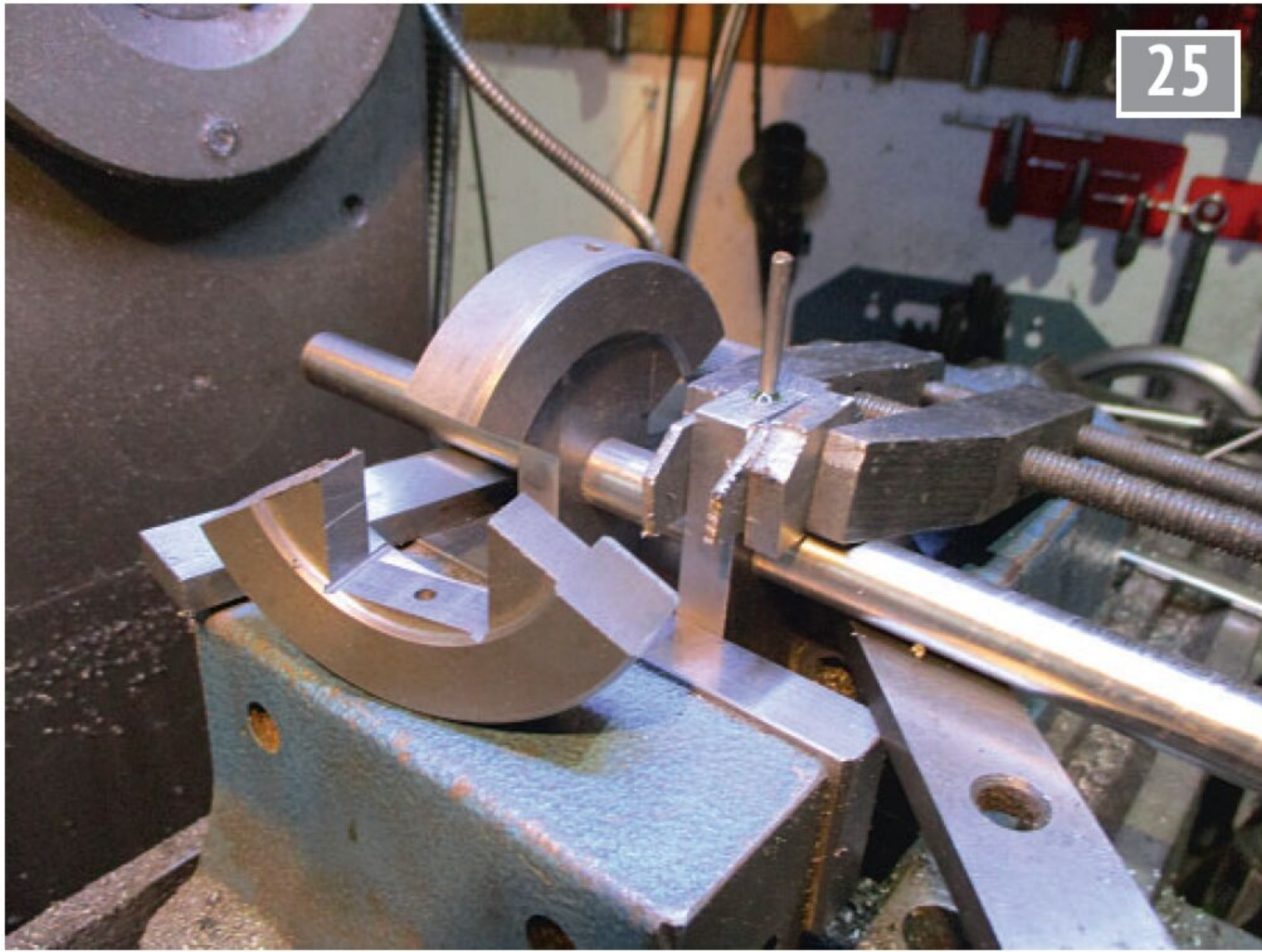
The crankshaft is glued together and pinned.



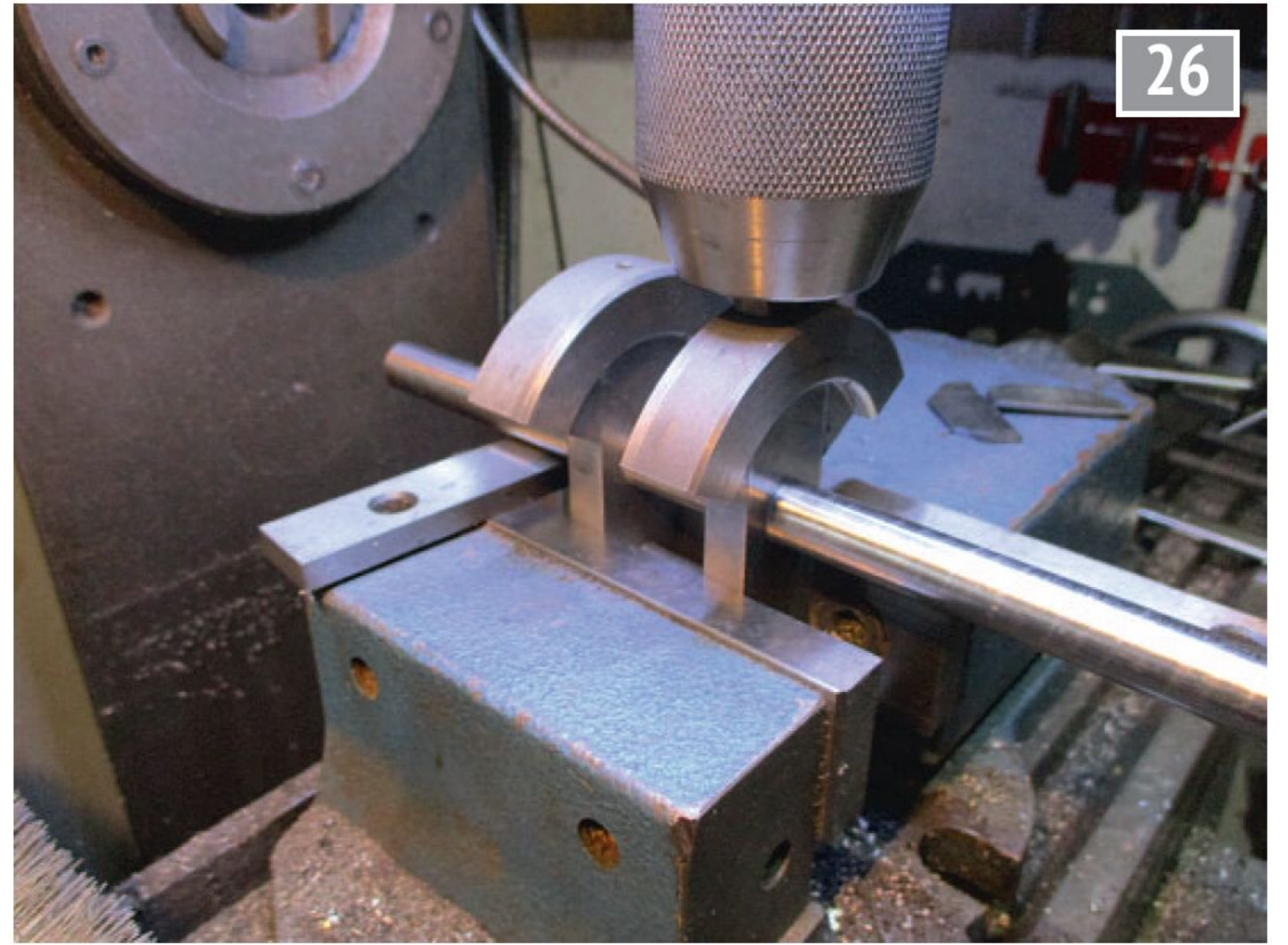
Initial machining of the counterweights.



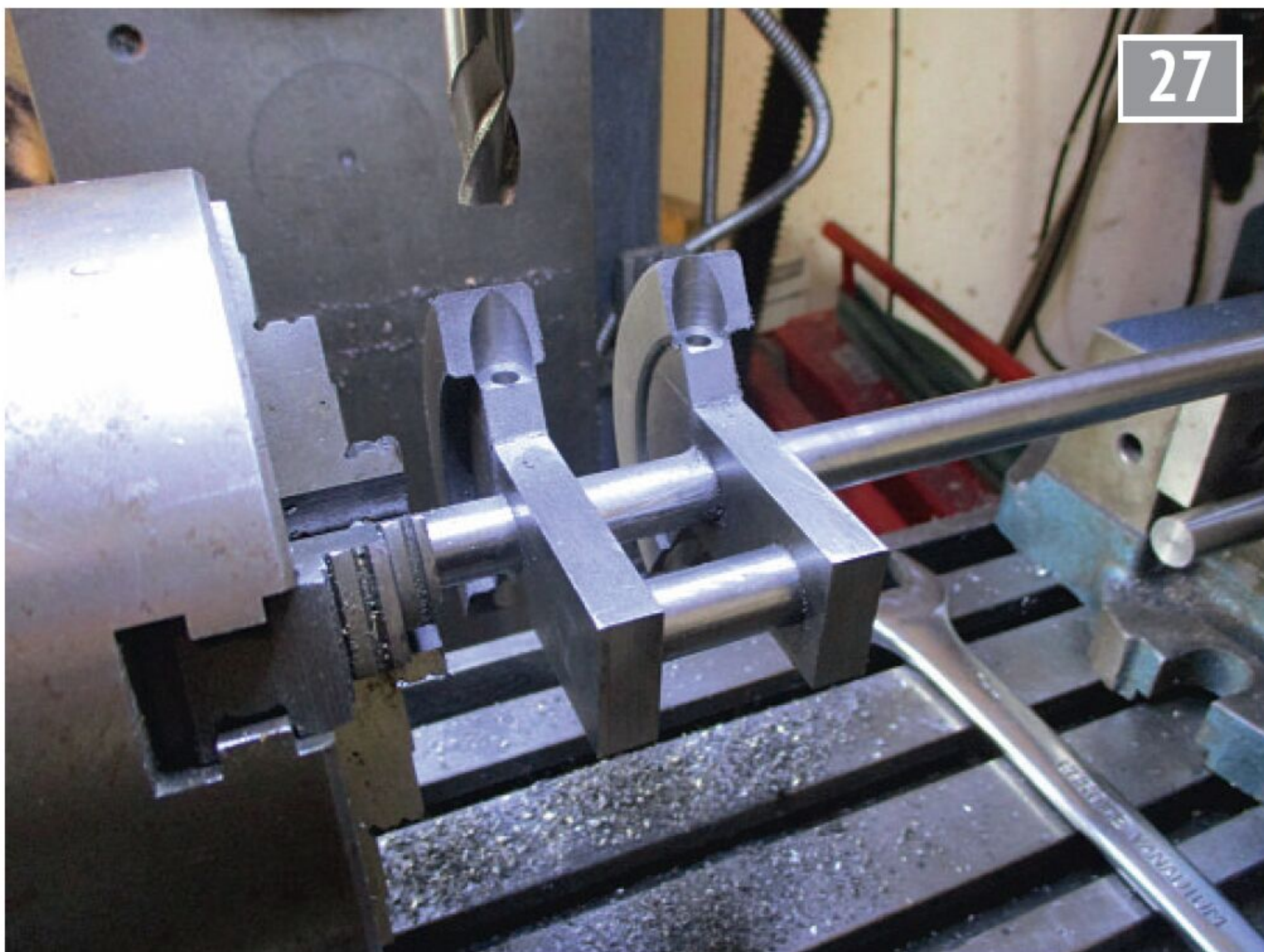
Adding the angled faces.



Fitting the counterweights to the crank webs.



Driving the counterweight into position.



Drilling the counterweight fixing holes.



The complete crankshaft.



The big ends.

side of the web, then drilled and reamed a hole through the weights and webs. Leaving the clamped locating bars in place, a short length of round steel

was glued in place (**photo 25**). Using this pin and the clamping pieces, after applying the magic retaining fluid to all faces, the weight was slid into place then



Connecting rods.

clamped in place by applying pressure with the drill chuck (**photo 26**).

Next, the holes for the bolts were counter-bored and drilled

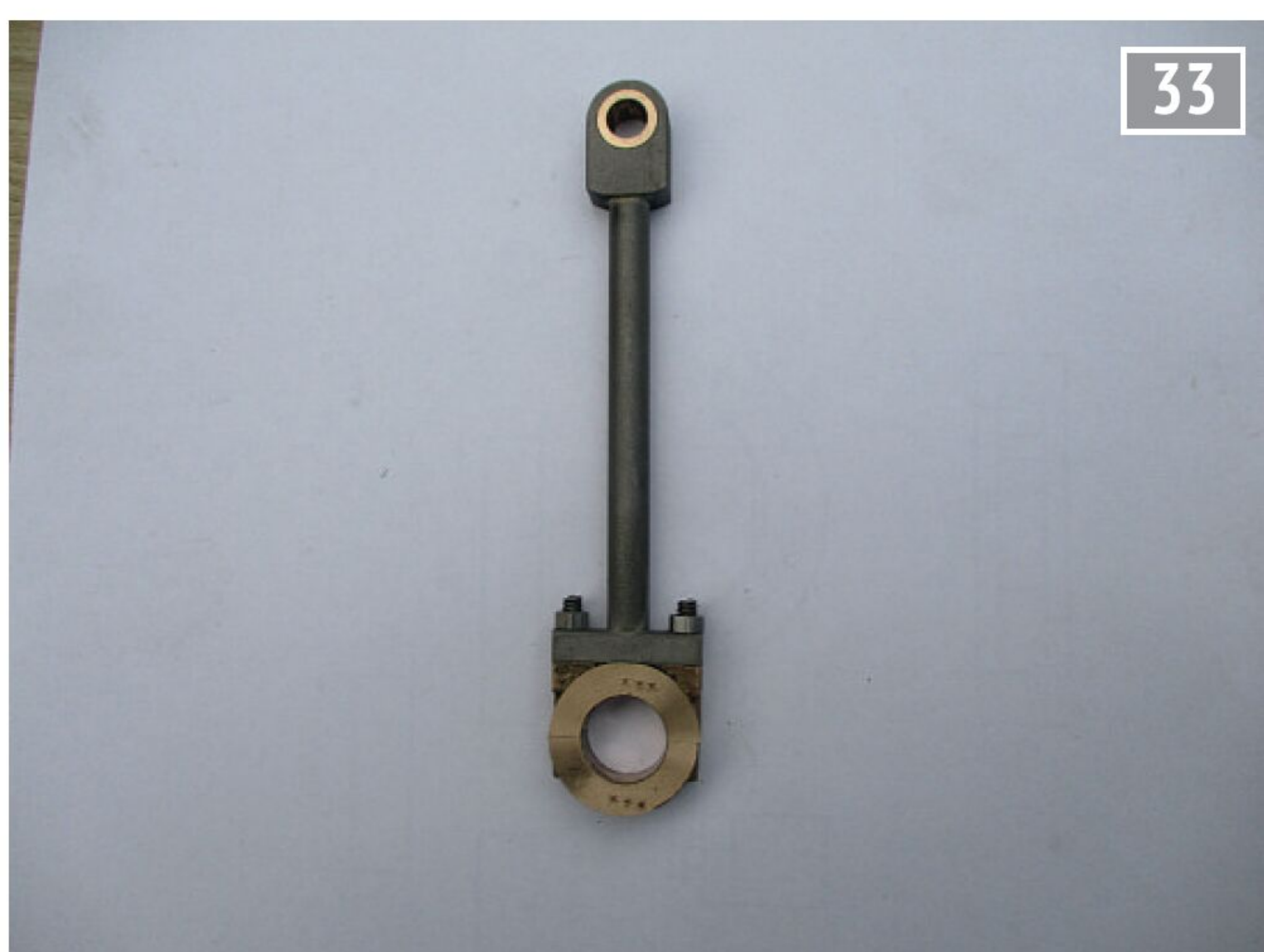
(**photo 27**). The bolts were fitted and the counterweights and web ends skimmed in the lathe. The piece of the main shaft between the webs



Silver soldering the ends to the rods.



Rods with the little end added.



Complete connecting rod with big end.

was cut out (making sure I cut the right piece...) and the cut ends cleaned up. Finally, after masking up the shafts, the assembly was sand blasted, clearing up any minor blemishes and leaving a nice matt finish (**photo 28**).

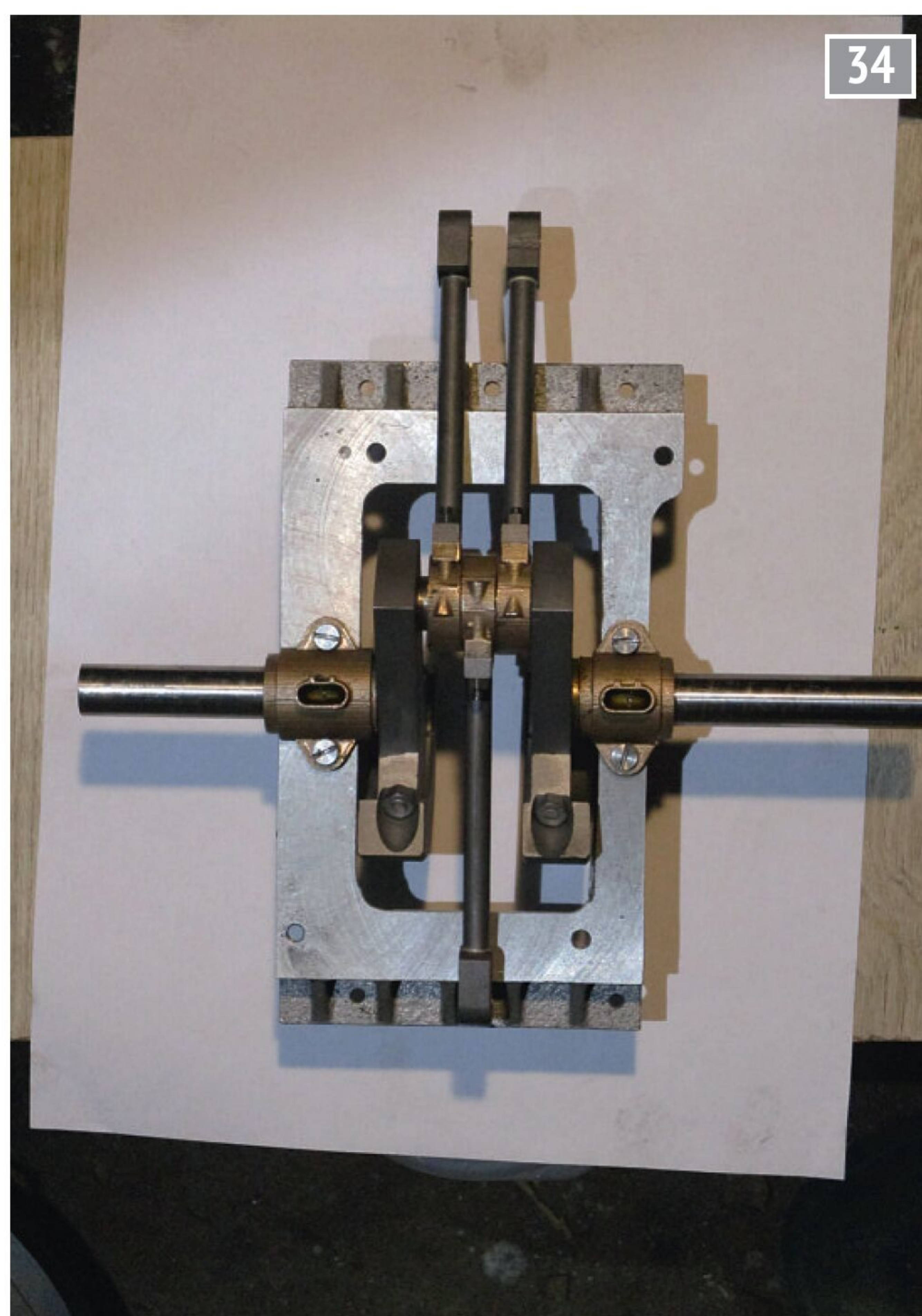
Big ends and con rods

The big ends are lost plastic castings. The faces were machined, holes drilled and tapped as appropriate (**photo 29**). Then they were mounted in a four-jaw chuck, the end faced and the hole bored to size. Finally the second face was machined, holding the piece in an expanding arbor.

I decided to fabricate the con rods. The end attached to the big end was a simple flat piece with three holes, two for fixing to the big end and the central

hole to align the rod. The little end consists of a length of flat bar with one end rounded, a hole for the bush and a hole to locate the rod. The rod has a spigot on each end for location. **Photograph 30** shows a cluster of bits waiting to become connecting rods. A couple of centre pops were made on the flat surfaces to leave a small gap to allow the solder to flow. In **photo 31** you can see the arrangement for silver soldering; the right hand rod is soldered and you can just see a short length of silver solder on the fluxed assembly in the middle.

Before assembling the little end, a centre pop was made on the side of the locating pin. The plan was to flux the parts, assembling and aligning the two ends, with the centre pop holding the assembly until it



Connecting rods added to the engine.

is soldered. The plan worked! (**photo 32**). Once again, the steel parts were sand blasted to give a nice matt finish (and, as a bonus, removing the flux residue). Just the last bush to fit and, finally, a complete connecting rod and big end (**photo 33**) and a full set on the crankshaft (**photo 34**).

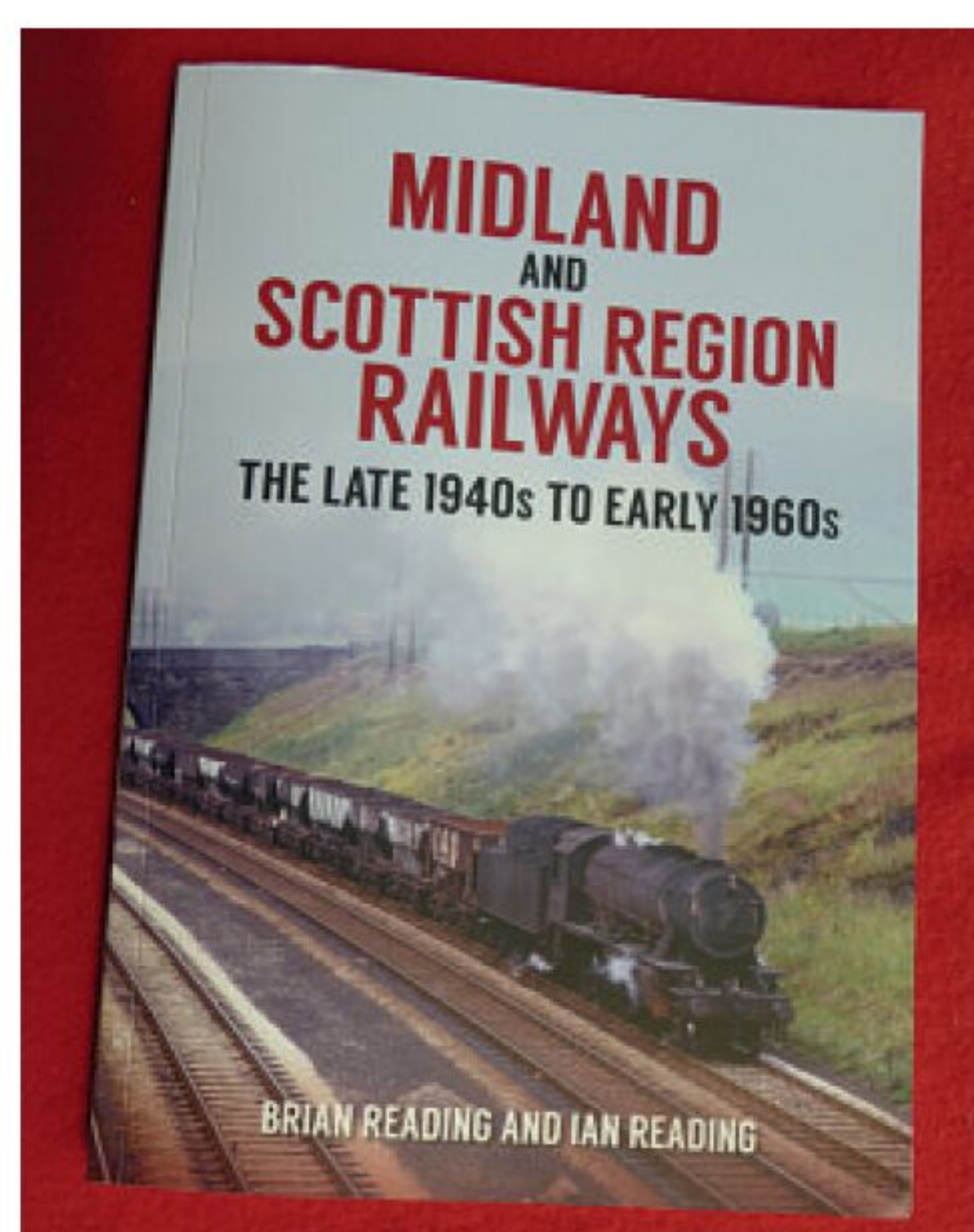
The cross heads will be lost plastic cast. Because the process takes so long (about 12 hours using the recommended cycle), I'll leave these until I have enough parts to have a run (I can do half a dozen flasks at once).

● To be continued.

Book Review

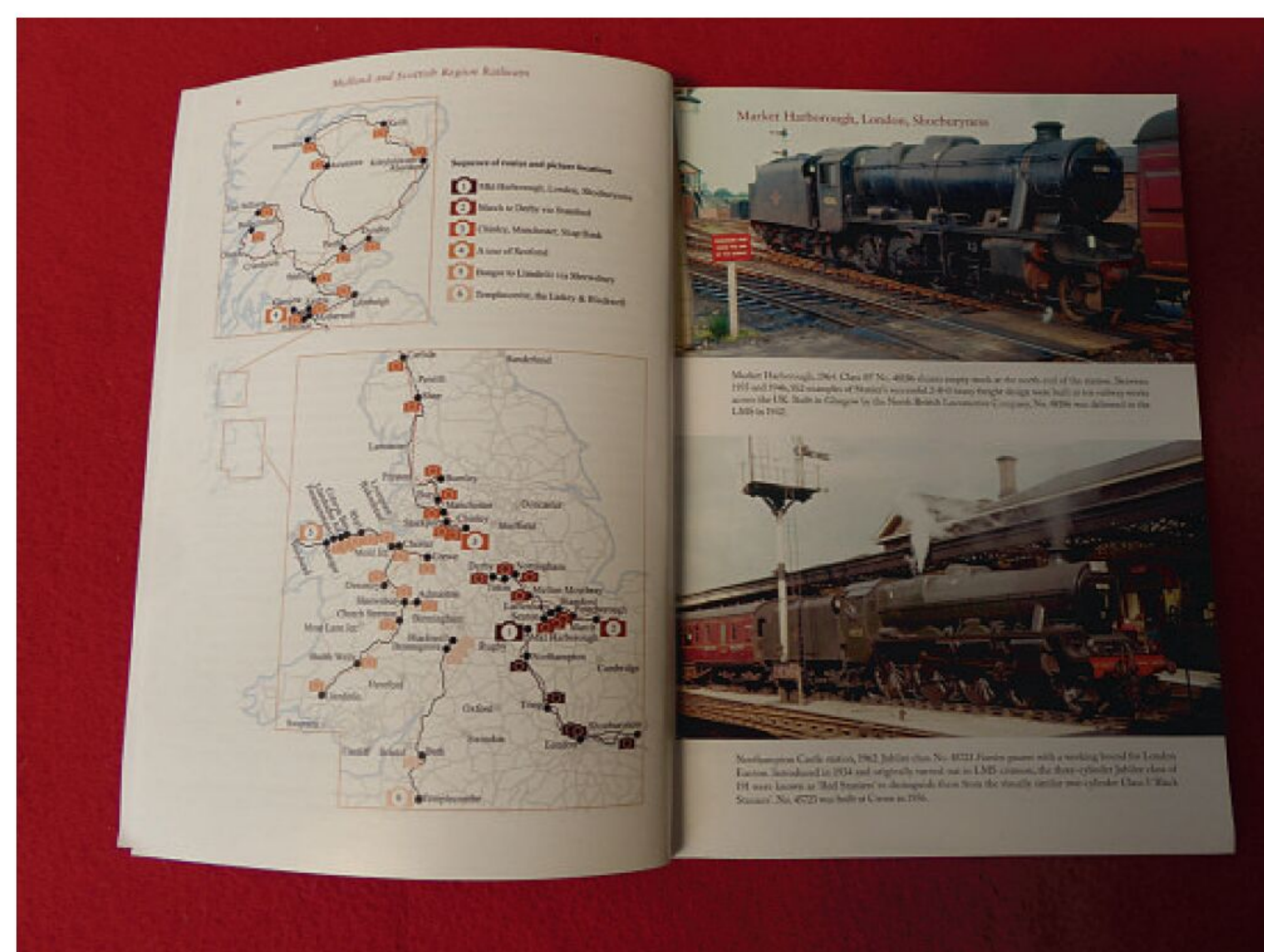
Completing the Quintet

The fifth edition of Brian Reading's photographs with computer based restoration by Ian Reading.



At last the final member of the Reading family's series of books comprising photographs taken by Brian Reading during the 1950's and 60's. This volume concentrates mainly on ex London Midland Scottish railway territory and indeed, extending from Shoburness in the east, Templecombe in the south, Holyhead in the west and Fort William and Inverness in the north, a pretty extensive area.

We start at Market Harborough, then down to Willesden Junction, where we enter the shed, and the photos show the range of locomotives in use, from Jinties, Royal Scots Jubilees and several versions of the 2-6-2 and 2-6-4 tank classes, an interesting shed tour, before moving on to Neasden shed, with a similar selection of locomotives, then a dip into Camden shed, Euston station, Devons Road shed and the Shoburness, with a photo of an immaculate 42509, a 3



cylinder Stanier 2-6-4 just back from overhaul. These were the 37 locomotives constructed for the London, Tilbury Southend Railway that I knew well.

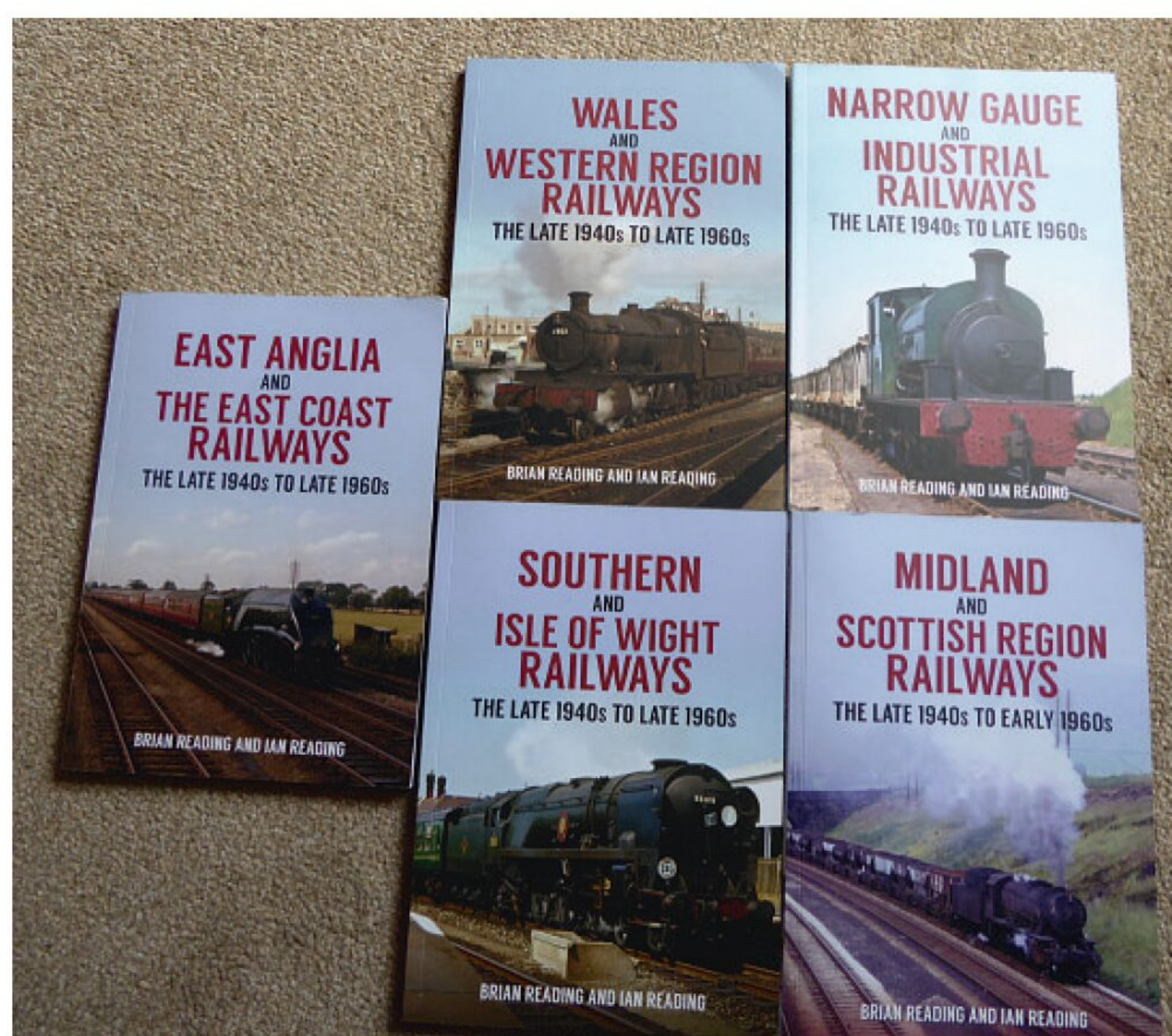
Leaving London, we spend time in March shed, regularly used by ex LMS locos, particularly on freight duties from the Midlands, before viewing 2-8-0 '8Fs' and 'Dub D' classes at Peterborough,

together with a Garratt on shed, and we are only just a third of the way through this fine volume.

Every photograph is accompanied by an interesting and informative caption, often with extra snippets of information about the class, or location. The photographs have all been carefully restored and enhanced recently and are full of detail useful to a modeller or a historian. Some are in colour and I particularly enjoyed photos of working on the Licky Incline and of Bath Green Park station.

This book, containing many useful snippets of information, illustrates the forgotten world of railways and their operation, concentrating on the LMS region, is published by Amberley Publishing of Stroud, and is available from booksellers or Amazon.

Brian Baker



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ISBN 978-1-3981-0014-5
96pp, paperback, £14.39

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5 INCH GAUGE FREELANCE PACIFIC

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5 INCH GAUGE BR 9F 2-10-0

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The engine is in new & unsteamed condition, supplied complete with manufacturer's original hydraulic certificate and documentation

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5 INCH GAUGE POLLY VI 2-6-0

A 5 inch gauge Polly VI, one of the largest locomotives in the Polly range. This one's been through the workshop for full service, hydraulic and steam tests with new certification issued.

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A venerable example of a 3 1/2 inch gauge LMS "Princess Royal" Pacific, built as a two cylinder engine and apparently - given the layers of dust and dried oil covering it from front to back when it arrived - not run in years. The combustion chamber boiler has had hydraulic and steam tests with new certification issued.

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The Stationary Steam Engine

PART 64 – BUILDERS II: Manchester, Liverpool and Newcastle

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

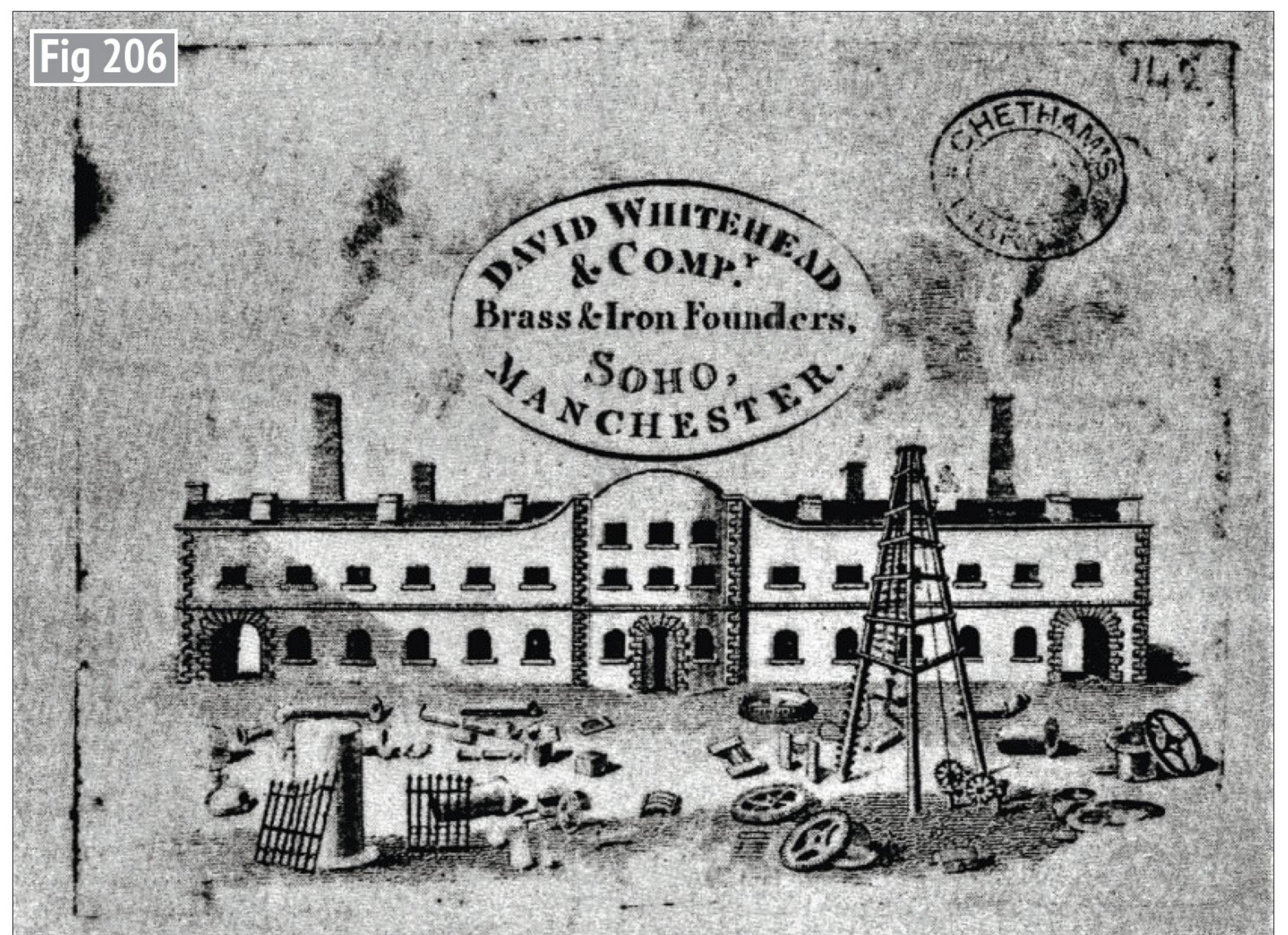
Continued from p.626,
M.E. 4755, November 1

Trevithick's policy of selecting a number of nationally dispersed firms to manufacture the patent engine was firmly established by the beginning of 1805. In the south-west of England the Hayle Foundry provided for the Cornish peninsula whilst in South Wales Samuel Homfray was the main designated builder although Neath Ironworks may also have been producing engines. Coalbrookdale and the Bridgnorth Foundry served the English Midlands but Trevithick was also developing contacts in the north. In September 1804, an unnamed

foundry at Chesterfield was building an engine as a sample - doubtless, Ebenezer Smith's Griffin Foundry. In Lancashire, Trevithick focused on Manchester where David Whitehead's Soho Foundry in Ancoats was to be his principal agent (**fig 206**).

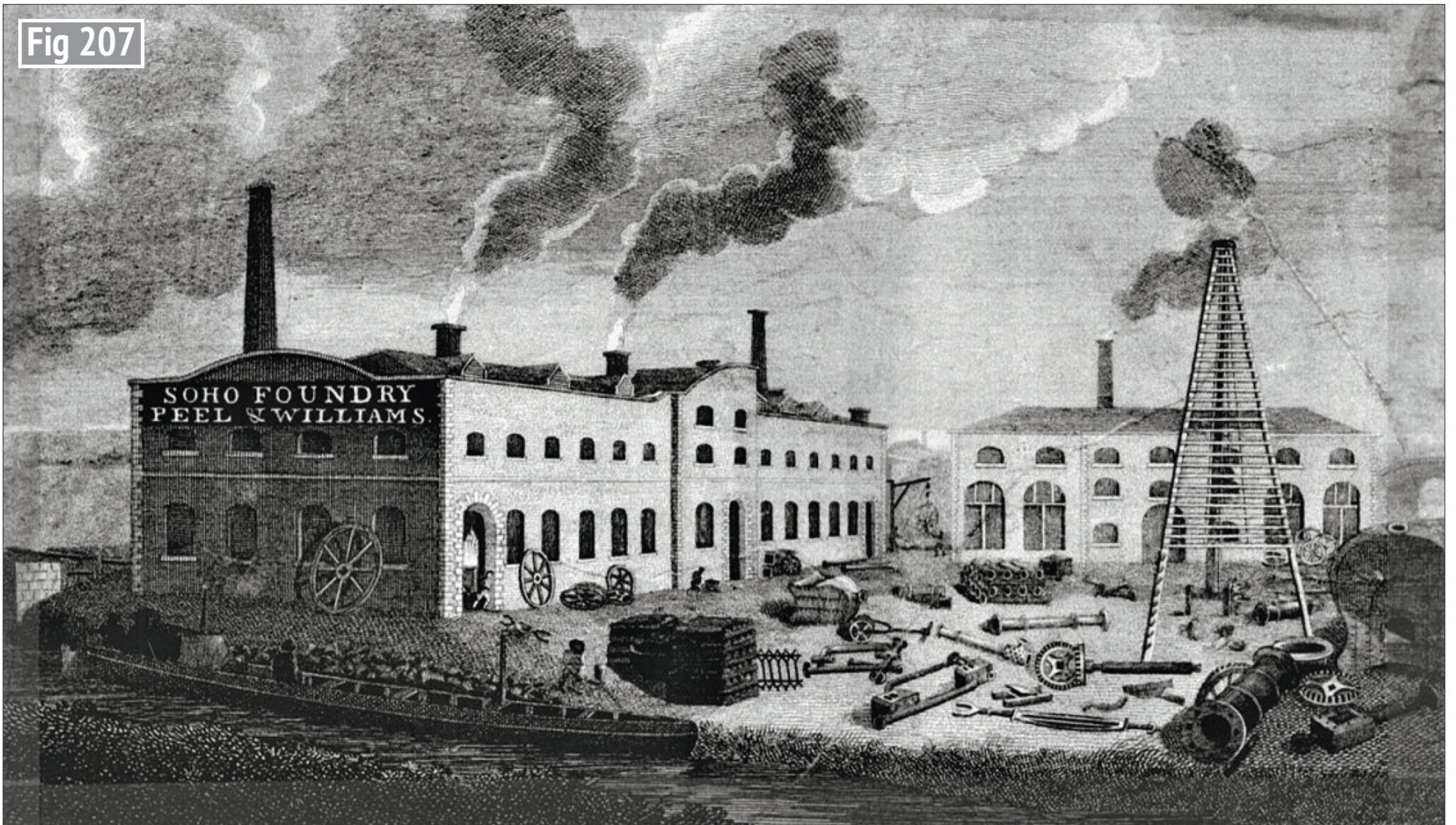
In the first decade of the nineteenth century Whitehead's Soho Foundry was one of the foremost engineering firms in Manchester. An advertisement placed in the *Manchester Mercury* following the proprietor's death in 1807 gives an idea of the character of the firm that Trevithick was dealing with:

All that capital and extensive ironfoundry called the Soho Foundry in Manchester, heretofore occupied by the late firm of David Whitehead & Co. The Foundry is 75 yards long by 25 yards wide; contains air furnaces, cupolas, stoves, cranes of extraordinary power, an excellent smithy and finisher's shop and extraordinarily well lighted pattern makers and turner's shops extending 100 yards in length. Adjoining the foundry is a most complete boring mill and turning shop replete with every apparatus on the very best principle for boring and turning every kind of heavy or small iron



Trade card for David Whitehead's Soho Foundry, Ancoats, Manchester.

Fig 207



Soho Foundry, Ancoats, Manchester at the time that it was acquired by Peel, Williams.

or brass work. The boring mill and turner's shop are worked by an excellent steam engine of 18 horses power which also works the blasts for the cupolas and there is additional power which may be applied to other purposes. There is an extensive yard with stable, cart houses, sheds and other conveniences and also six cottage houses for the accommodation of workmen belonging to the foundry. The premises have likewise belonging to them a commodious wharf on the bank of the Ashton Canal which communicated with other canals by means of which coals and metal are advantageously brought without any expense of land carriage and goods conveyed to all parts of the kingdom.

Manchester Mercury 23rd January 1810.

The relationship between Trevithick and Whitehead was established in 1804. The three-wheeled model of the high-pressure engine made in 1798 was despatched to the Soho Ironworks to act as a guide to Whitehead in manufacturing the full-sized engine but whether drawings were also

sent is unknown. Trevithick used the Soho Foundry as a base when staying in Manchester and several of his letters are addressed from this location. In September 1804 he wrote to Giddy that in Manchester two engines were completed and three more were building. This, however, is not a straight-forward case of the Soho Foundry's work. At least two and possibly three more firms were building Trevithick engines in Manchester. In the same letter Trevithick says:

... A great number are building at different foundries. Mr. Sharratt a founder in Manchester who has four in building said he would not pay the patent right; on giving him notice of a trial he agreed to pay...

This was, of course, Bateman and Sherratt whose work has been discussed in an earlier part of this series but it was also the case that Alexander Brodie, the partner in Hazledine's Bridgnorth Foundry, was suspected of building Trevithick style engines at his ironworks in Manchester, the St. George's Iron Foundry, Knot Mill, where he had been in

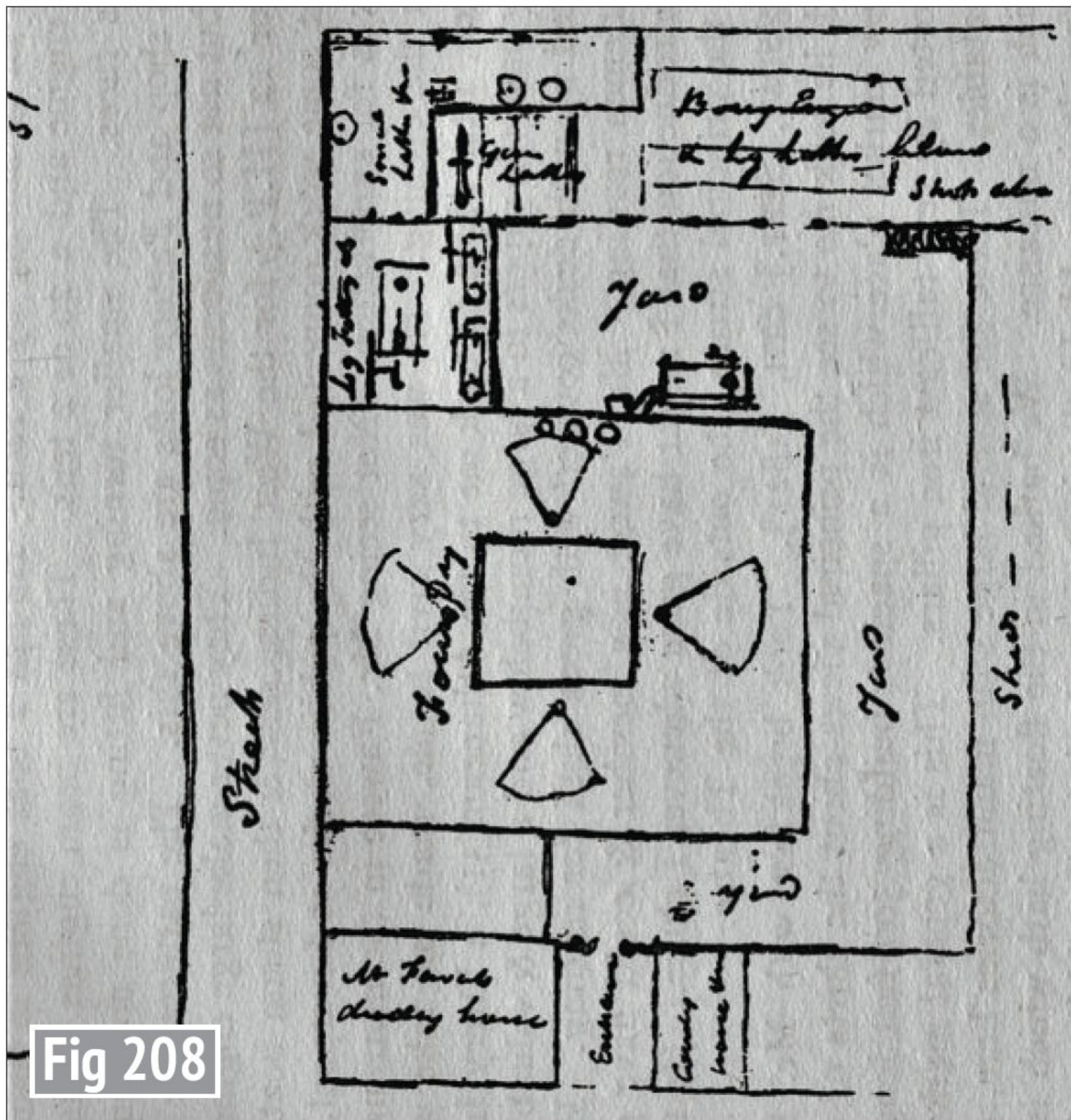
partnership with McNiven and Ormrod since 1794.

Matters were complicated further when David Whitehead died in 1807. The Soho Foundry at Ancoats was not advertised for disposal until 1810 when it was bought by Peel, Williams (**fig 207**) who had another foundry at Swan Street in the Shudehill district of Manchester, the Phoenix Foundry. Williams, born in Wales in 1772, had trained at Carron and Walker Brothers of Rotherham whilst Peel, the financial partner, was connected to the Lancashire cotton family that was to produce the statesman Robert Peel. An 1805 Manchester directory describes them as ironfounders, engine makers and roller manufacturers. They had a reputation for high-quality production, particularly gear work and they were apparently making high-pressure engines for Trevithick in 1805, before they purchased Whitehead's premises (**ref 364**).

Cultivating yet another manufacturer within thirty miles of Manchester at first sight seems excessive but, in

September 1804, Trevithick writes to Giddy saying that he was on his way to Liverpool from Coalbrookdale where a founder had made two of his engines with another nearly finished and three others begun. The founder was William Fawcett's Phoenix Foundry. Trevithick had been drawn to the firm because it had established itself in a specialised market that he was keen to enter, the West Indies sugar industry. Sugar cane pressing had been the express intention of the roller milling element in the 1802 patent and Trevithick had at one point envisaged boiling the juice in the steam boiler to reduce it whilst at the same time using the waste steam to heat the pans. He had attempted to gain access into the West Indies market but with limited success; Fawcett offered a much more viable opportunity than Trevithick could provide acting alone.

The Phoenix Foundry had begun life in 1758 as a Liverpool warehouse for the Coalbrookdale company's products. George Perry, who had worked previously at



Joshua Field's sketch plan of Fawcett Little & Co.'s Coalbrookdale Foundry in 1821.

the Shropshire ironworks, came north to manage the business and it was Perry who subsequently proposed that the premises at 17 York Street be converted into a foundry. He died in 1771 and was succeeded by his partner Joseph Rathbone, also a partner with his brother in the Coalbrookdale Company itself. Rathbone's nephew, William Fawcett, joined the firm as an apprentice in 1784, at fourteen years of age. By the time he was twenty Fawcett had risen to be manager and when Rathbone ran into financial difficulties Fawcett succeeded in rescuing the situation. In 1790 he was granted a lease upon the site by the Coalbrookdale Company which, for £2,300, was converted to an outright sale in 1794. Relations with the Coalbrookdale Company remained cordial until 1797 when Fawcett began to manufacture ordnance at which point he was 'disowned' by the Quaker ironmasters.

The Phoenix Foundry prospered as long as munitions contracts remained buoyant but by 1808 its position was deteriorating and the premises became subject to mortgage which Fawcett was unable

to redeem. In 1810 he was declared bankrupt with debts of £10,000 and three years later the foundry was sold to George and Henry Little & Co. for £18,000. Fawcett was retained as manager and the title of the firm became Fawcett, Little & Co. (fig 208). Two other Little & Co. brothers, Thomas and Isaac, were commercial brokers holding substantial interests in the West Indies and they seem to have been involved financially with the foundry before the family assumed full control. The Little & Co. interest consolidated the trade with the West Indies and thereafter the sugar trade machinery business was to remain the mainstay of the firm's output (ref 365).

Fifteen years after Trevithick began his association with Fawcett, Joshua Field visited the works and recorded a description in his diary:

Mr. Fawcett is manager at 1,000 per annum, the two Mr. Littledales manage the accounts. They do a great deal of good business: sugar pans for the West Indies Sugar Mills ... They make high-pressure engines with cast iron boilers abt. 7 feet diam. & 14 feet long with the cylinder inside. These

are for places where water is scarce. They are making one now which has the cylinder inside but A standards, a beam & the crank & fly wheel behind it. One high pressure engine of the old construction is at work blowing the furnaces. The boring engines, of which they have two, are of the common kind, the large lathe common and clumsy; the small lathes are very common. They use very much upright drilling or boring machines. They have three or four. The thing to be bored is put on a horizontal chuck and a cutter or bit brought down to it. The chuck also turns round by hand gently by which it bores straight. Their screwing tackle is like that at Horsley [?] threads very common. There are 5 or 6 gun boring lathes not used now. Over these lathes and in the Foundry as well as the fitting up shop he has cranes with the top block moving laterally so that parts of engines can be moved sideways for some distance. The foundry cranes are all so moving by a rack. The smaller turning and fitting is done upstairs. The carpenter's shop and pattern lofts are above this. The patterns are very well arranged but not so numerous as some. They never make large engines above 10 or 12 h.p. for the West Indies....most of their work is for exportation. (ref 366)

The works that Field saw must have been largely that with which Trevithick was familiar. The blowing engine for the furnace situated outside, in the foundry yard, was one of Trevithick's high-pressure engines and the plan shows another in a shed which provided power for the machine shop. This latter engine had a cylinder within the boiler but the crankshaft was carried by independent A-frame standards and a beam was used. It is also interesting to note that Fawcett Little & Co. were still building Trevithick style high-pressure engines in 1821.

As far as the north-east of England was concerned Trevithick turned to the partnership of Phineas Crowther and John Whinfield

whose foundries at Pipewellgate in Gateshead and Skinnerburn have already been discussed in connection with Crowther's own engine (ref 367). They were actively building Trevithick-style engines by the autumn of 1804 when four were at work and four more were building. Six of these were for winding coal and one for lifting water. There was one for grinding corn with an 11 inch cylinder driving two pairs of five foot stones 120 rounds per minute. Again Trevithick makes a comment that seems to imply that these engines were locally designed. He criticised the corn mill engine as having much too short a stroke at two feet six inches. This presumably would not have been the case had he undertaken the design himself. John Whinfield's contribution to locomotion using Trevithick's principles will be discussed more fully in a later episode of this series.

● To be continued.

NEXT TIME

Trevithick falls foul of faulty finances and patent piracy.

REFERENCES

- Ref 364** *The Origins of Engineering in Lancashire*, W. H. Challinor and A.E. Musson p. 453.
- Ref 365** In 1820 the Littledales sold two thirds of their shareholding to R. W. Preston and the firm was finally known as Fawcett, Preston & Co. Ironfounders and Engineers, Liverpool which survived independently until 1935.
- Ref 366** *Joshua Field's Diary of a Tour in 1821*, E. C. Smith, T.N.S. Vol XIII, 1932-33. p. 40.
- Ref 367** *Model Engineer*, 4723, 11th – 24th August 2023.

A GWR Pannier Tank in 3½ Inch Gauge

PART 6 – BUFFERS AND HOOKS

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



Continued from p.685
M.E.4756 November 15



in **fig 11**. These can be turned down from bar material but this will create a great deal of swarf and for the stocks then marking-out, shaping and drilling the backplate is a deal of work. I have therefore provided for laser cut discs for the buffer heads and laser cut backplates with the holes all drilled. These can be silver soldered (Silverflo-55 or similar) to the smaller diameter buffer shanks or stock barrels as appropriate. This is not a perfect method but it works and I've made upwards of two dozen buffer assemblies this way. In real life the buffer shank is retained in the stock by internal stops, and nothing protrudes into or through

There's a temptation to rush ahead and get the wheels rolling but if this is a first model then maybe it's best to practice some lathe

work on something just a little bit simpler (and cheaper if things go wrong) first; the buffers. The drawings for the buffers and stocks are shown

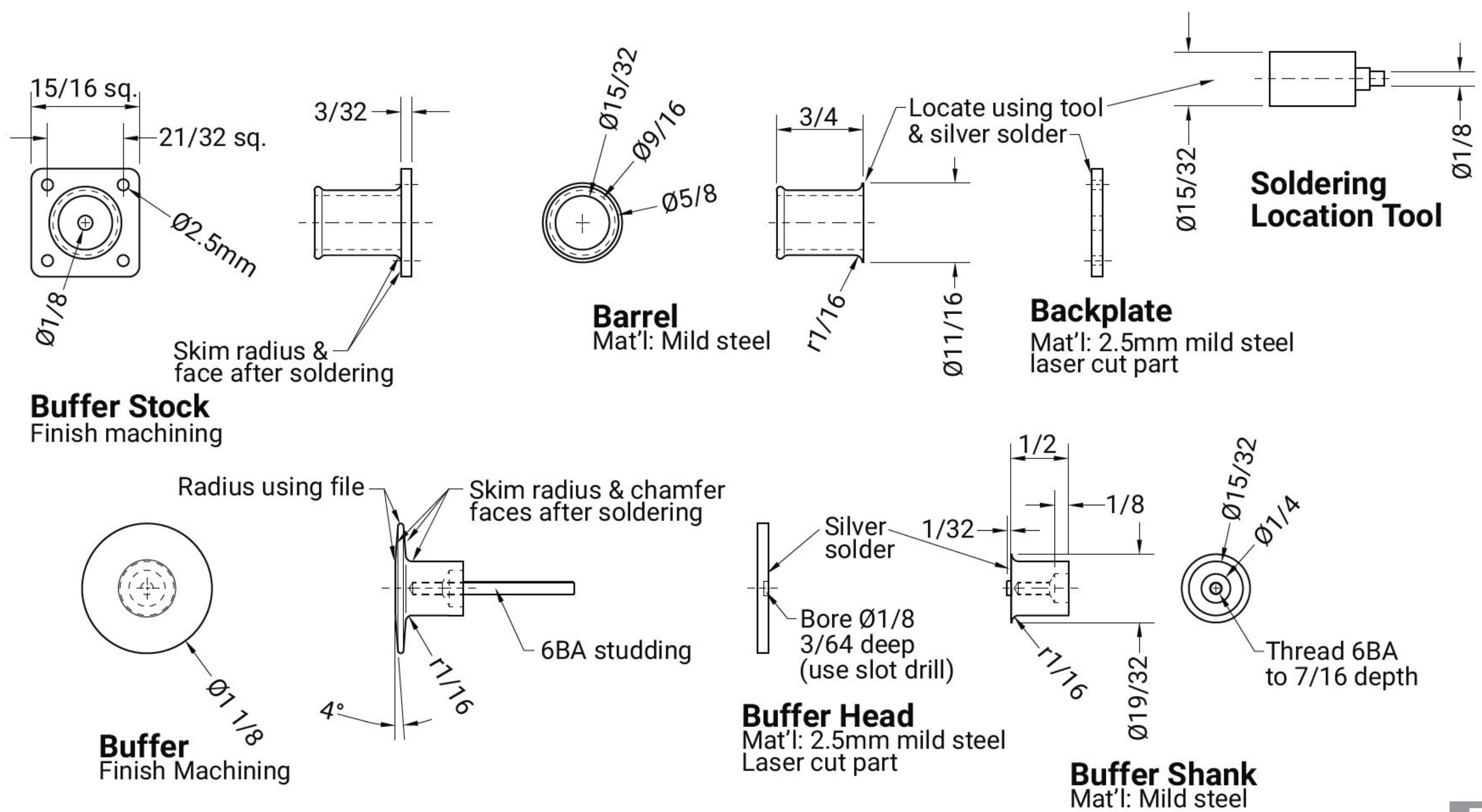
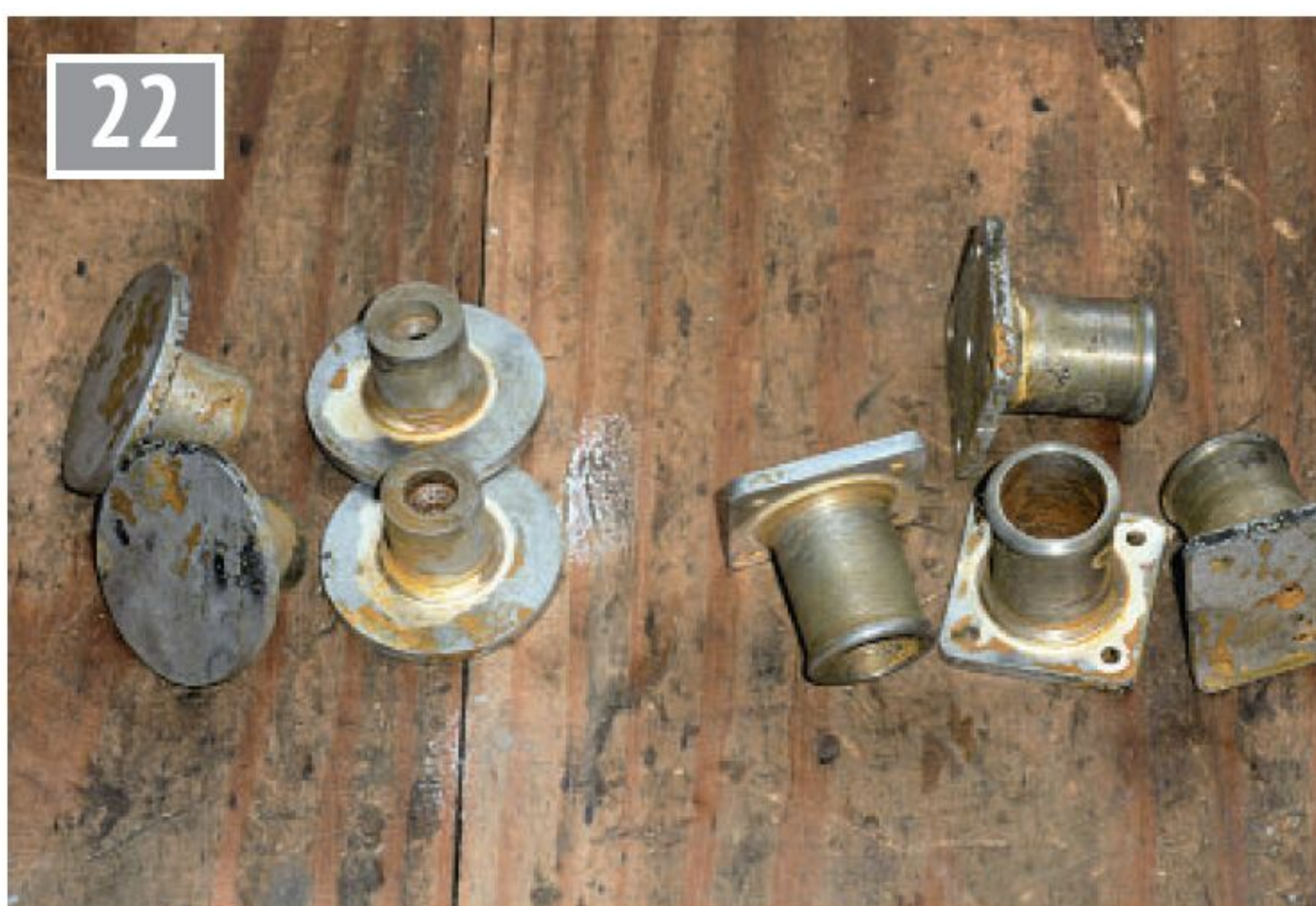


Fig 11

Buffer head and stock.



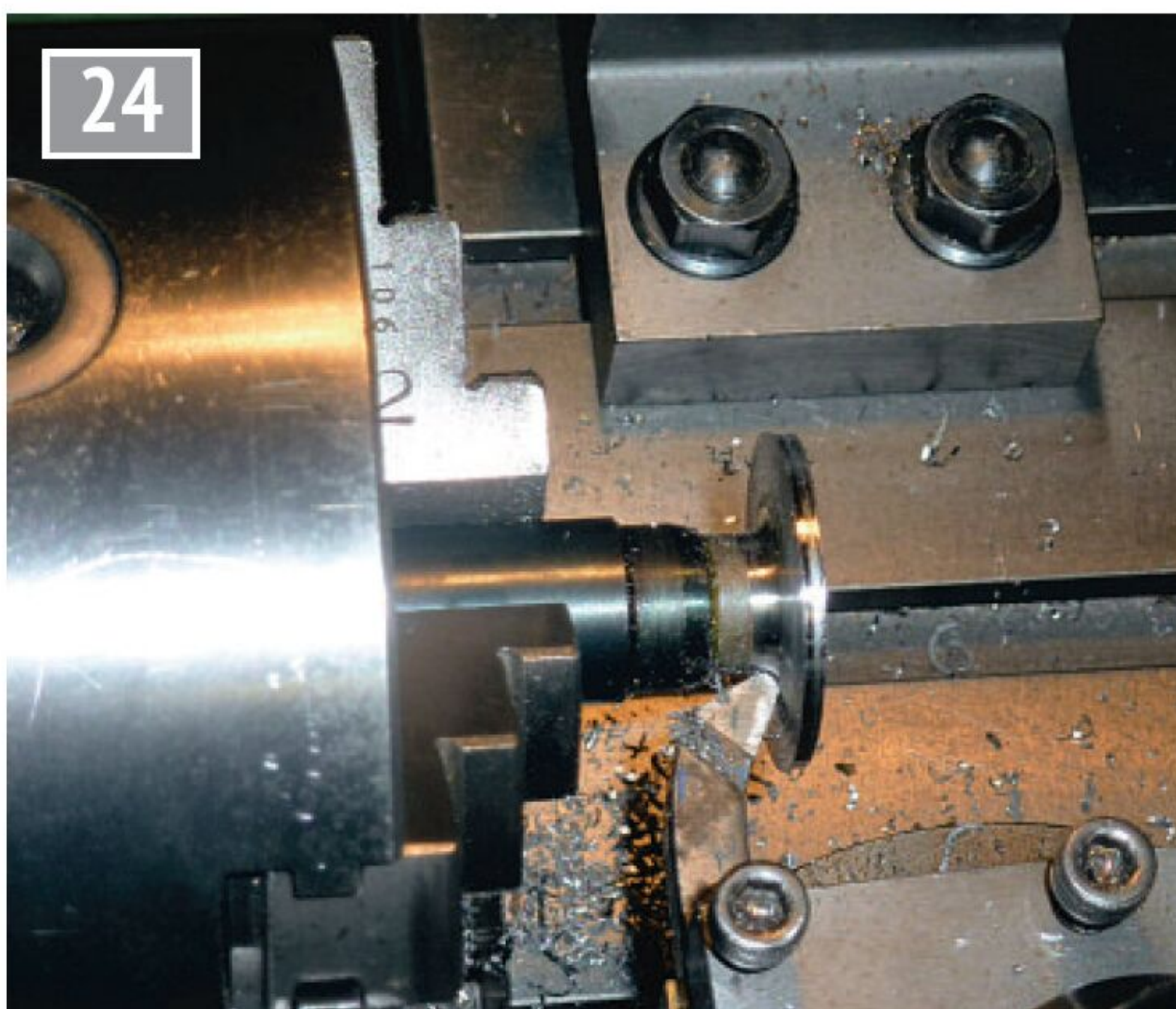
21 Silver soldering a buffer stock.



22 Buffer heads and stocks after soldering.



23 Mandrels for the buffer stock and head.



24 Turning a buffer head.

the buffer beam except the attachment bolts. It's perfectly possible to do this on a model but much simpler to follow the Rob Roy path and have a bit of threaded rod passing through the stock and buffer beam, with a nut behind to hold it all together.

The shanks are as good a place to start as any. Turn, with the rear end outwards, up to beyond the blend radius, put the hole and thread in, and part off a little long. Turn around in the chuck to finish to length, leaving the little spigot which locates the shank in the centre of the head. Then take the laser cut discs and mount each in the chuck and drill a $\frac{1}{8}$ inch diameter recess in the centre, using a slot drill, and deep enough to contain the shank spigot. Similarly, turn the stock barrels to drawing. Also needed is a little tool to centre the barrel on the backplate when soldering. This is shown too in fig 11, and it should be oxidised by heating and typing correction fluid (Tippex or similar) applied before use to discourage any stray solder from sticking. As an afterthought, there I was,

turning the first buffer shank and as I brought it down to diameter I thought 'what diameter?'. As the hole in the stock was to be drilled with a drill from a cheap set it seemed a better idea to have done that first and then make the shank to a loose sliding fit. I recommend this order unless you happen to have the right size reamer.

Barrel soldering is shown in **photo 21**. The soldered parts are shown in **photo 22**. Now the tricky bit; make a couple of mandrels, one for the buffer head and one for the stock. The head or stock can be fixed to the mandrels using soft solder or (I use) Loctite (**photo 23**). For the buffers the idea now is to blend the fillet radius to the head using a cranked round nose tool (**photo 24**) and cleaning up the whole rear face at the same time to remove any wobble. Try to remove all excess solder, just leaving a thin ring which will hardly show on the finished part. I've called for a slight angle to be turned onto the outer and inner faces, and to do this there may be rather a clash

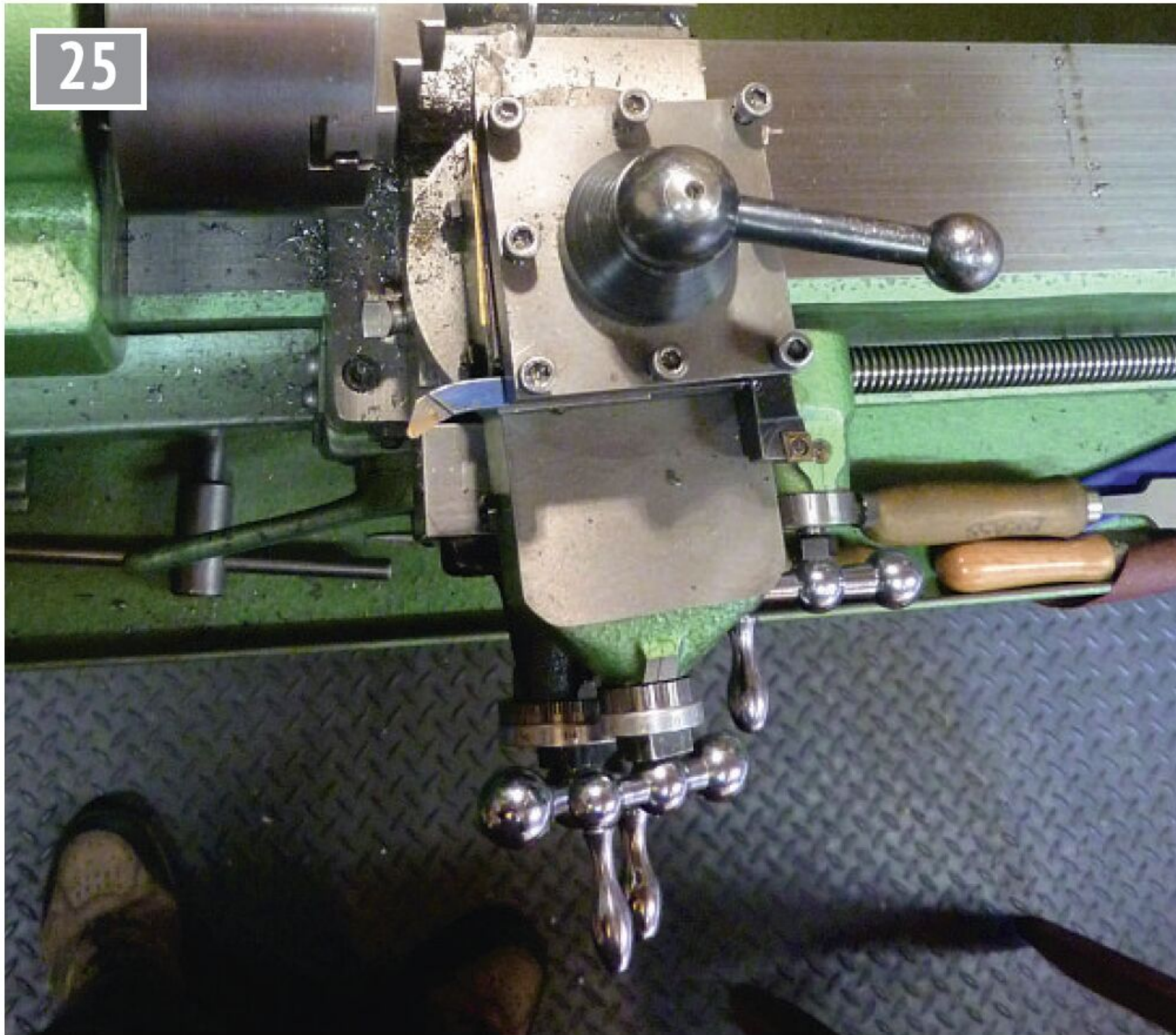
of handwheels (**photo 25**). On my Myford I can just get the required travel. Skim the front face to clean-up any wobble and put the required angle on there too, leaving a flat centre about $\frac{1}{2}$ " diameter and blend the transition from angle to flat using a file. Now this sounds a bit dodgy but if we were wood-turning or clock making then the whole job would be done with hand held tools. Some rules - use a file with a proper handle, don't wave it around, don't poke it at or put your hand into the chuck, use both hands and use the tool post to steady your grip. There's a bit spare on the laser cut head diameter, to allow for clean-up, so skim it down to $1\frac{1}{8}$ inch and round the edge, again using a file (**photo 26**). The finished shape is not wholly correct but it's simple and gives a fair representation of a buffer that's been walloped in the centre a few times by angry trucks.

To separate the parts from the mandrels heat is used. For Loctite then this must be done outdoors as the fumes it gives off are beyond unpleasant and

should not be inhaled. There's some fun to be had with the buffer heads unless you put in a vent hole; the hot air trapped behind the shank will blow the part out, with a satisfying pop. Point this makeshift cannon somewhere soft and safe and not into a corner full of spiders, or the greenhouse. The range is four or five yards and it's hard to find in long grass. Loctite retains some strength even when burnt, so use a hammer and a brass rod as a drift against the barrel edge to tap the stocks off, and do it while still hot.

To finish then clean-up with emery in the usual way and choose a finish type. The stocks should be painted with the buffer beams. Originally the heads were black but in later life were just plain dirty. For the model then black oxide is good, or for a dull metal finish try etching in citric acid overnight, which gives a nice grey surface. Either way, wipe over with mineral oil to prevent rust. The solder ring will dull over time and nobody has ever commented about it on any of mine but if the buffers are black oxide finished then it can be tipped out with paint. The springs can be anything, unless you intend to push long rakes of wagons. Little children like to push them in to see if they work, so maybe a something that's not too stiff. Let's try and keep the little ones interested as they may be the engineers of tomorrow. I used the springs sold for axle box suspension in this gauge and they work quite well.

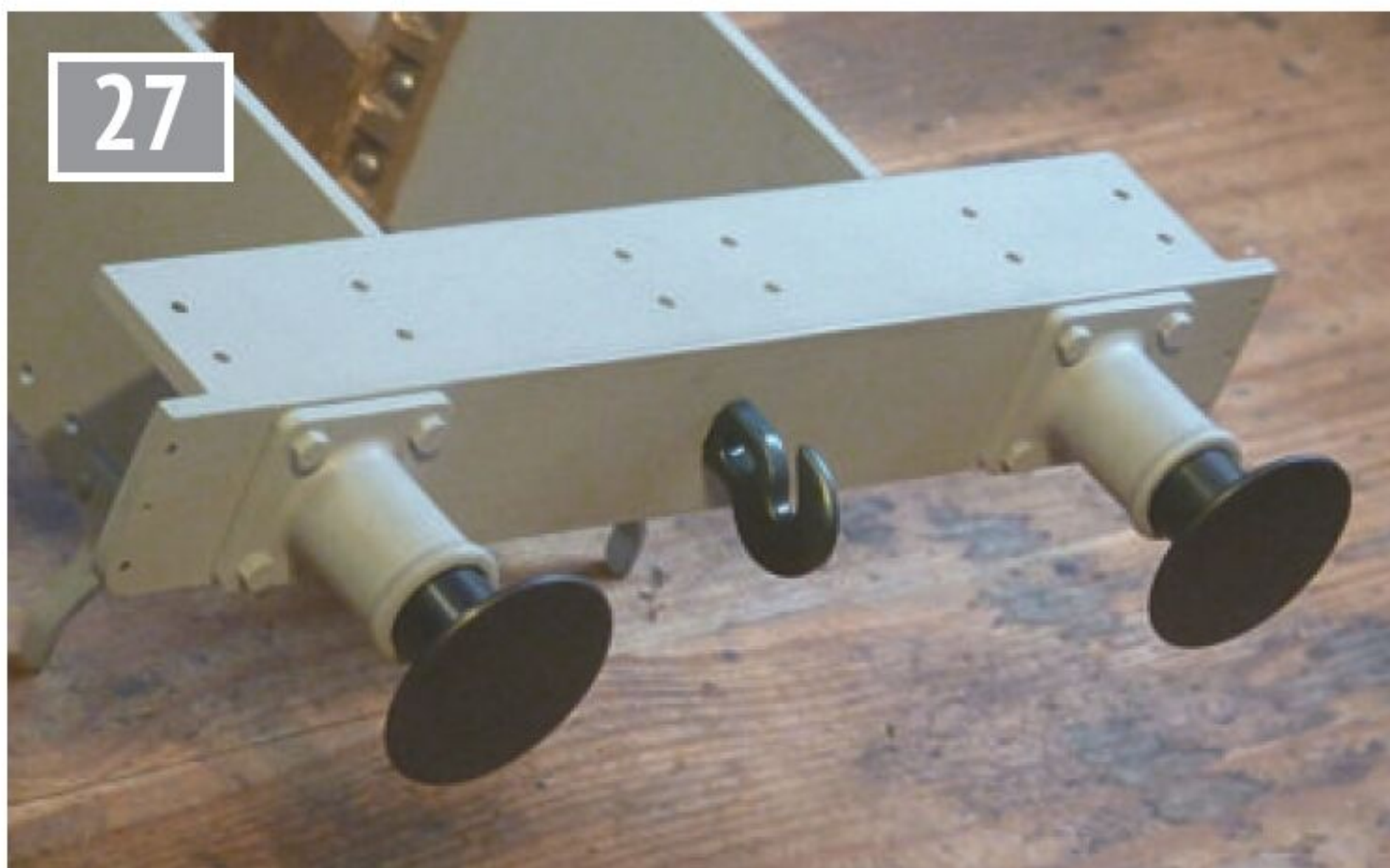
The draw hooks (**fig 12**) are available as laser cut parts, which is as well because trying to dimension them and cut them out is a nightmare. They are slightly oversize for strength, and long enough to carry an anti-shock spring on the rear one that does the work. This spring should be quite stiff, and give a 'break-out' force greater than about half the weight of the model, say 15lb or more. Taper the hook point and round all the edges with a file/emery/mini-drill. On the shank then cut it short for



A clash of handwheels.



Shaping the edge of the buffer head.



Finished buffers and hook.



Coupling with keeper.

the front hook and, if not fitting a spring at the rear and, either way, round the top and bottom edges to take the thread. Note the shank is not completely round and there's a flat along each side as the thread is

larger than the shank width. Cut the thread in the usual way, and long enough for double nuts (and Loctite) on the one doing the pulling; we don't want it to come undone! The finish, black or grey metal, should match

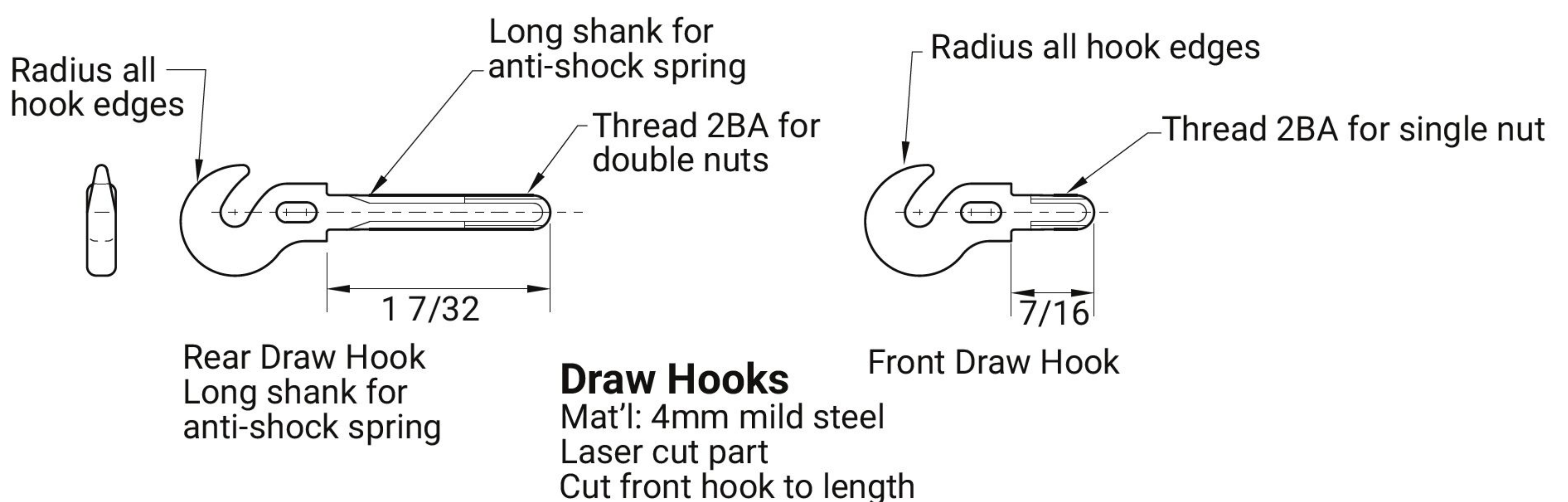
the buffer heads. The parts installed on a buffer beam are shown in **photo 27**.

Proper screw link couplings are for show, not for pulling, and can be made or, I think, bought. Use something

stronger for pulling a load. Years ago now, and just before I started this hobby, my old club banned chain couplings. This was after a breakaway on a passenger hauling day. The track was only 440ft round in those days so the engine would have soon smashed into the rear of its loaded train had not a quick-witted member thrown it off the track. I use a bar coupling with a little keeper (**photo 28**). The bar will go over the hook if held vertical but when lowered and held in the horizontal pulling position cannot come off.

●To be continued.

Fig 12



Draw hook.

Unseizing a Beam Engine

PART 4

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.722
M.E.4756 November 15

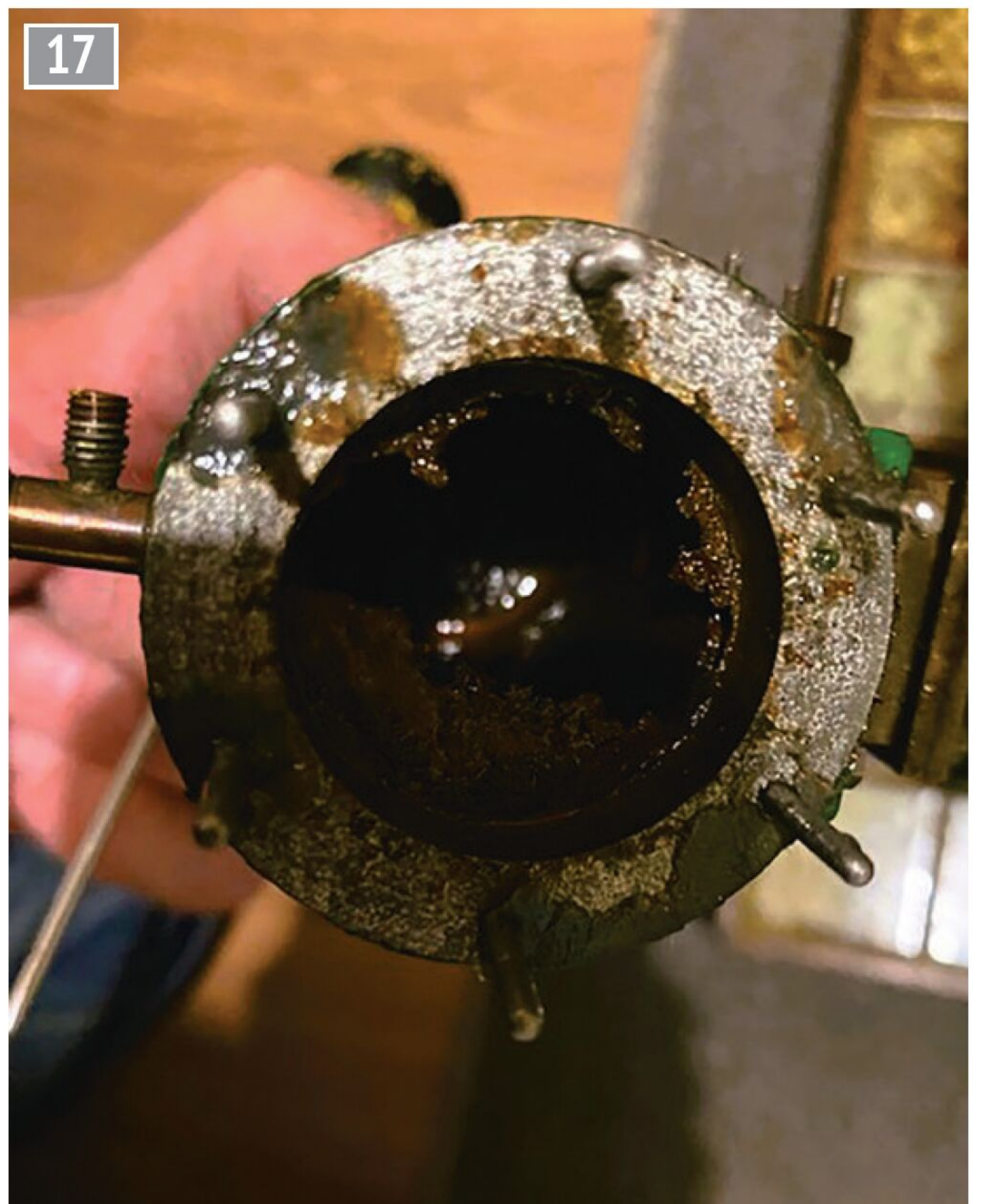


SMEE

**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.**

There are two ways of bolting the cylinder onto an ME Beam's bedplate. Brave souls try to use small headed nuts that can be accessible from above the cylinder's lower flange but most builders bolt it on from underneath using bolts or studs and nuts, which is what Mr. Evans did back in 1981. This was also common practice on full sized engines.

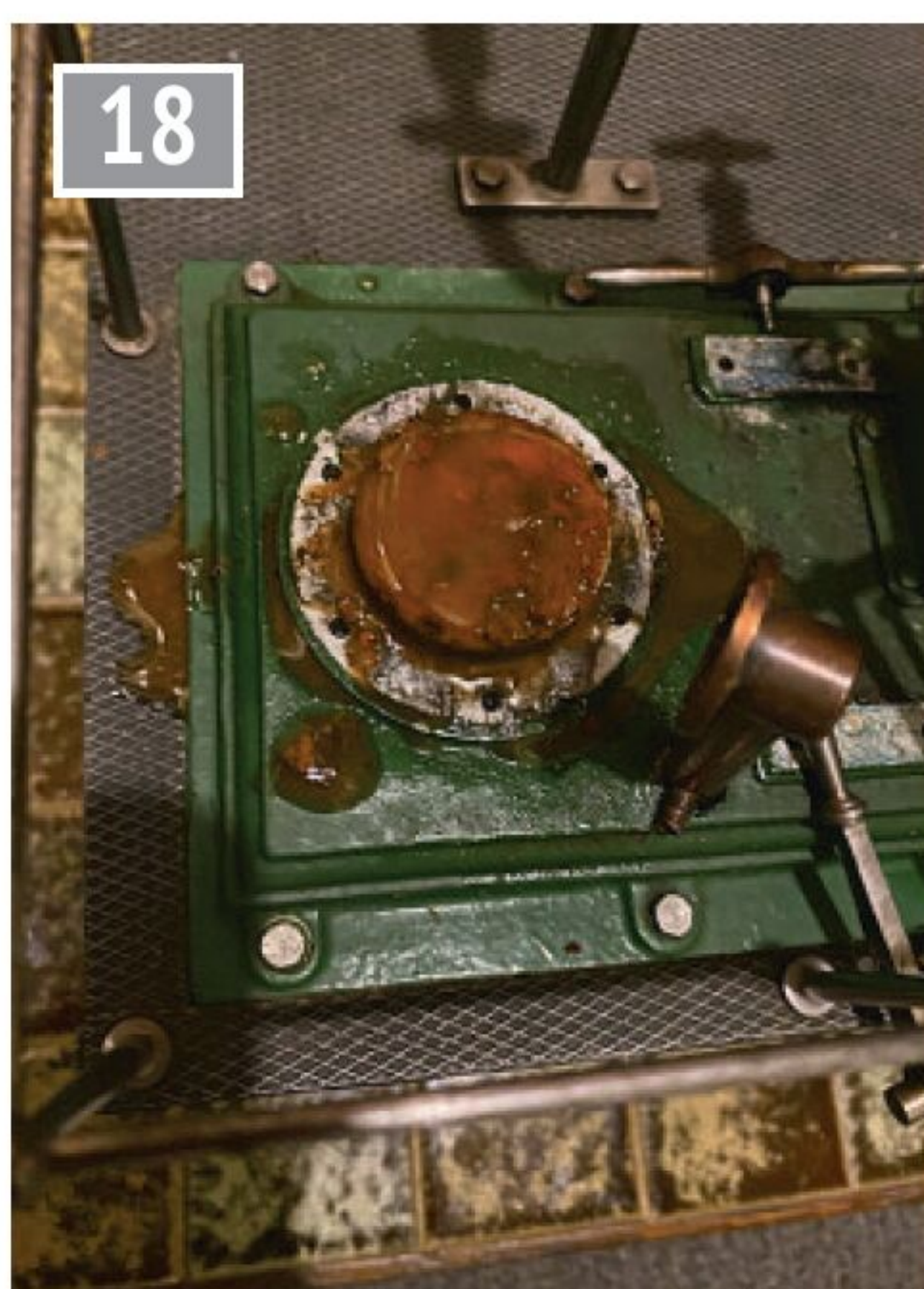
This is a heavy model to turn over in order to get to those studs, but having chosen to use studs, it would actually make reassembly easier later on. This is because I could put the cylinder into place with the studs poking through and simply pop the nuts back on – far easier than trying to hold it in place while fiddling with poking bolts up through the bedplate and to find their threaded holes in the cylinder's lower flange. Two of the studs were not terribly accessible I noticed, being partly masked by some of the woodwork but



The view from below the piston ... oh dear ... I'd need a spoon to remove that pasty rusty gunk.

actually I found that their nuts weren't terribly tight anyway. Perhaps Mr. Evans had found it tricky to do them up or maybe I was just lucky. It would have been easier if the engine had been removable from its base but I couldn't do that because of all the bedplate bolts being buried somehow within the base box, which the engine stands on. Never mind, live with it: at least the whole base unit, built of half inch birch plywood, was all square, very strong and it does the job.

I think Mr. Evans must have enjoyed engineering far more than woodwork because the quality of his engineering was waaaaay higher than the baseboard, which seems to have been built by a fully paid up and practising member of the Provisional DIY... Maybe someone else had built it and he'd taken it on, or perhaps he felt that if it wasn't going to be seen, then why bother with aesthetics or perhaps he was running out of time to get it done. Only someone



18
The location where the cylinder stood.
Still wet!

performing maintenance would ever see it, and Mr. Evans perhaps felt that by then he'd most likely be pushing up the daisies. Either way, the fine finish on the outside of the baseboard box doesn't prepare one for the sight that lies beneath! Perhaps rather than the work of Chippendale, it was more Chip and Dale, the cartoon chipmunks.

I hoped that the cylinder would be okay when it came off, after some more of that gentle tapping around its base with a Stanley knife blade to ease the gasket away. Perhaps the view from below the piston would be at least not quite as bad as the view from above the piston.

What a pity it wasn't (**photo 17**). The cylinder bore seemed to be comprised of 100% pure unadulterated corrodium. It looked as if it was packed with wet tealeaves so it must have been full of water for AGES to generate all that mess!

The next photo (**photo 18**) shows what the bedplate looked like. Some mopping up was required. Actually I'd already mopped up some of it when I snapped this. None of my predecessor's hopefully-applied oil had migrated beneath the piston but at least the cylinder was watertight!

But how did it wind up like this? I wonder whether someone operating the engine after shutdown had cycled the engine over by hand and without steam, inadvertently



19
A ray of hope - the cylinder bore wasn't a write off and there was a nut visible on the underside of the piston.

filling the cylinder with water from the boiler without opening the cylinder drain. Having filled the cylinder with water, it was able to do its rusty work undisturbed... Had Mr. Evans lost contact with the engine by this time? Or had he allowed someone to operate the engine and then they'd not drained it all off afterwards? Someone hadn't, anyway, and this was the result. After spending hundreds of hours building this lovely piece, I can't see him leaving it full of water on purpose because he'd know what that can do. Fortunately the ME's base plate is aluminium so it hadn't rusted itself to the cylinder, which would have been another nightmare to deal with.

The next stage would be to scoop out all that rusty gunk from the cylinder bore and see what I had, with a view to seeing if I could remove the piston rod. Removing that rod was essential as it'd be in the way for any future operations.

That scooping revealed that the bore wasn't quite as bad as I'd feared (**photo 19**). It was difficult to photograph but there was a nut visible on the underside of the piston. This looked like a locking nut for the piston rod. It probably didn't want to move but after scraping away all the rust I could from above and below the piston, I kept the cylinder inverted and full of penetrating oil overnight, in the hope that it might free things up. One can live in hope...



20
This could do with a bit of a tidy up later on.

The following morning, it looked as if it should be fairly easy to get that nut undone, but a slight challenge was that the piston was too far down the bore for me to put one of my box spanners in and rotate it. Blast! I could always silver solder an extension onto the box spanner but there was an alternative. I had a very long nosed pair of pliers. They *juuuuust* reached and the penetrating oil had helped because that nut came out very easily. A brass nut on a steel rod - so lucky once again as it hadn't been rusted together even if it had been pretty tight to begin with.

I could now unscrew the piston rod, undamaged. Yes!! I refitted its locking nut and put it in its own labelled resealable bag. I'd need to clean it up later. I also removed it from the cylinder cover which, on close examination, needed a bit of a tidy up on the top surface as well as the bottom (**photo 20**). It had some machining marks; I thought I could improve its finish a bit and add a personal touch so I set it aside as an assembly with its gland in place, for attention later on. Evidently L. J. Evans used a dividing head to drill those stud holes: you could place the cylinder cover in any orientation you liked on either end of the cylinder because it fitted like a glove in any of them.

To remove the piston, I'd be mounting the cylinder, inverted, over the jaws of my Abwood machine vice. This meant that



21
It's easy to remove studs without damage by running a pair of nuts tightly together - your spanner in this instance needs to be working on the lower nut.

I'd have to remove the cylinder cover studs because they'd be resting on the vice's jaws.

For those who are time served engineers, the following is second nature but for the uninitiated, there's a time tested method of taking studs out that's probably as old as threads themselves, and it involves using two nuts working against each other. I'd mentioned earlier, with the entablature that I'd had to do this trick so here goes, times six, for the cylinder cover studs (**photo 21**).

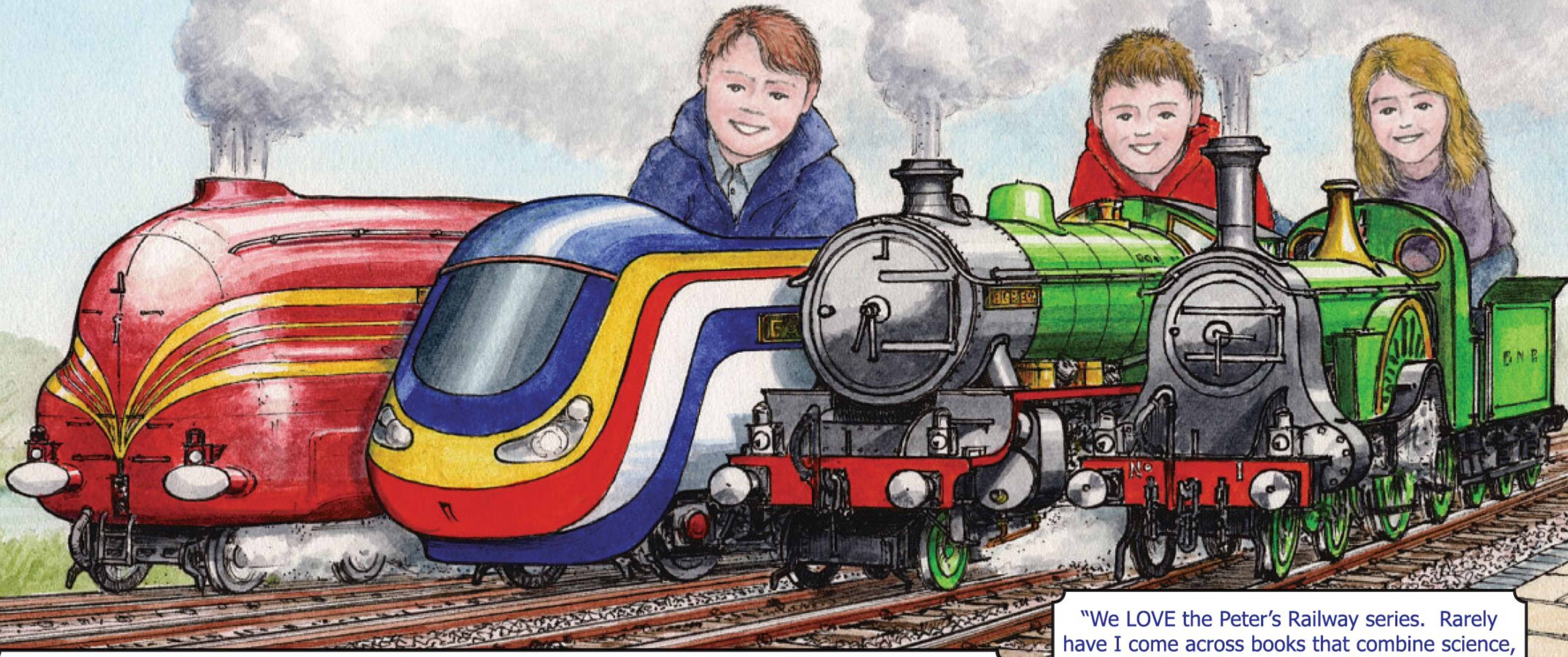
Having tightened the nuts together, use a spanner to turn the one closest to the cylinder, in this case: it takes a moment and the stud should easily come out. You can do the same thing to put the studs back in again: I didn't need to remove the lower studs.

With the upper studs out, I could easily clean off the remains of the gasket.

● To be continued.

Peter's Railway

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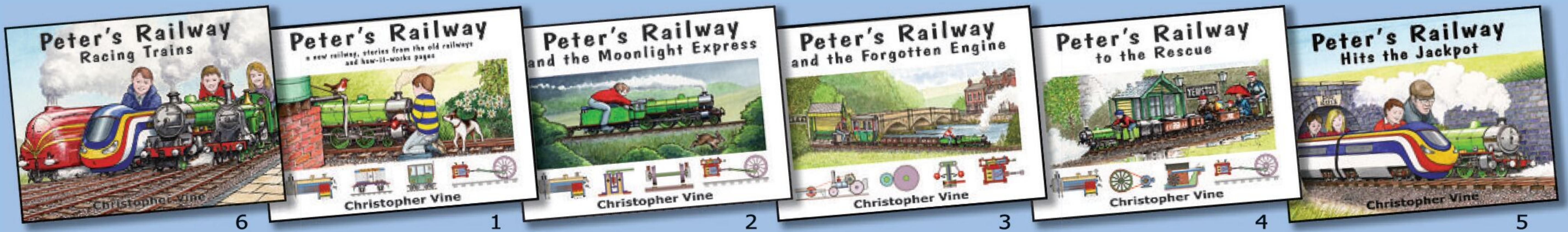


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Nelly The Copter

Dear Martin,

I wish to offer my heartfelt congratulations to Freya Hempenstall on her superb scratch-built helicopter model Nelly (M.E 4753, October 4th) and to commend her for producing such an excellently written and well-illustrated article for our enjoyment. I am sure that neither of these achievements were easy and suspect that both took more time and effort than Freya imagined when she started, but that's the nature of creativity and she should be extremely proud of both accomplishments. Very well done, Freya!

On behalf of our model engineering community, I would also like to applaud Freya's mentor Patrick - who I suspect is Patrick Hendra, whose fascinating motorcycle series is also running at present - on his expert guidance of the up-and-coming members of our group. I suspect that I am not the only one who noted Freya's nonchalant mention of bushes, grub screws and gears in her article, items of which vanishingly few youngsters are even aware (never mind familiar) and which subtly demonstrates that Patrick is giving Freya a first-rate grounding in the fundamentals of engineering. Jolly well done too, Patrick!

I very much look forward to discovering what Freya chooses as her follow-up project to Nelly and reading about the future exploits of Eastleigh's Young Engineers as a whole.

Steve Goodbody
(New Jersey, USA)

New Workshop

Dear Martin,

There are two things in Steve Goodbody's articles about his new workshop that I would like to comment upon:

1. He mentions that the heating cost over 8 months was about 1200 kWh and in the UK instead of costing around \$250,

this would be £277 at summer prices and last winter when the cost went up to about £0.33/kWh to £417 including VAT.

2. Steve has chosen to not plasterboard the ground floor ceiling to allow access to cables, etc. In the UK if there is 'living accommodation' (bedroom or living room, etc.) above then 30 minutes fire protection is needed, typically 12.5 mm plasterboard. If it is for an 'office' then I don't think this applies but if there is a bed then it must.

My own workshop is insulated but with only 50mm 'Kingspan' because that was what fitted and with plasterboard on top. The workshop is heated, just, with tubular heaters and a thermostat set to 5 degrees Centigrade which seems to keep rust at bay.

Regards

Mike Joseph
(Chipperfield)

Escapements

Hi Martin,

I've noticed quite a few clock projects in *Model Engineer* of late and I appreciate that these will appeal to that segment of the readership into things horological. Still, these builds like to play it safe by sticking to tried-and-true escapement mechanisms but I'm sure many will be intrigued to learn that there are some adventurous horologists out there who like to travel the road least followed - namely, a clock without an escapement (and no, I don't mean cheating by use of digital electronic time-keeping!). See the QR code. It's always more interesting to see the unorthodox...

I also wanted to use this letter to alert readers who own and operate one of the ubiquitous Chinese-made mini-lathes/mills powered by a DC motor. Not infrequently one hears of the motor controllers burning-out and the consequent tears and tantrums over the near impossibility of rendering a practical 'fix'. Fear not! Grab a hold of the July and August 2024 issues of *Silicon*

Chip magazine and you will find a two-part construction series for such a controller designed specifically for these motors. I hope this is of use.

Kind regards,

Andre Rousseau



Modern Methods

Dear Martin,

A couple of recent *Model Engineer* articles have been the catalyst to write this letter. The first is Luker's mini-series when he looked back on the innovations in his last 100 published model engineer articles. Its good to be open to new ideas and techniques now available to us from CAD, 3D printing and laser cutting as well as new knowledge from material sciences. Then there was the remark by Doug Hewson in part 4 of his BR Standard Class 4 (M.E.4753, October 4th) where he converts Imperial works drawings to metric when producing laser cutting drawings and can avoid problems of a cab kit cut suitable for 5 inch gauge rather than the intended 3½ inch gauge. The final catalyst was Eddie Castellan's excellent book on the Life of LBSC.

My life on the ME journey started in 1988. In my youth I had been a keen railway modeller but had to take an absence of 10+ years because of study. Reading the model railway press in the summer of 1988, I discovered that there was a world of small scale live steam. Then at a Gauge O Guild event in Langley I saw Clarrey Edwards's demonstration of true to scale 7mm to the foot live steam. I was hooked. Talking to my father (a model engineer), he remembered LBSC's series on NETTA had a 1¼ inch gauge variant. He dug

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out the relevant issues from his collection and I bought the plans. Closely following LBSC's words and music I was reasonably confident to achieve a working model.

After reading the entire set of articles, visualising the building and also reading as many articles in the Gauge O Guild Gazette related to live steam, I decided to:-

Work in mm – provide a consistent set of measurements which I can easily visualise. Working at 7mm / ft it is trivial to convert an Imperial drawing to scale size. Of course this meant converting all the dimensions on the LBSC plans. But this had the added value of really understanding the design - was a dimension critical or was it a convenient stock size.

Use Loctite. All wheels are held onto their axles by 603 and thread-lock grade used to hold the nuts onto the ends of the crankpins. This has the advantage of making quartering a doddle and avoids the need for producing close press fits.

Use 'O' rings for glands and piston rings. Eddie Cooke popularised them in 7mm live steam through his articles in the Gazette. After 25 years of steaming, in 2020 I gave my NETTA a major overhaul and observed there was minimal wear on any of the 'O' rings.

Adopt Gauge O Guild Standard wheel profile (i.e. 29mm back to back). Conveniently the Standard wheels are thinner than Coarse scale wheels as specified by LBSC so the outer edge of the wheels are the same. This means no other alteration to the design was necessary.

While the 1¼ inch version of NETTA as described in 1954/55 made to LBSC words and music worked, I was not happy with her overscale appearance. But following the Master's words and doing some more reading, I was emboldened to adapt and modify. The NETTA design is based on the NER T class but I wanted a LNER Q6 as I had remembered as a child.

Thinking hard about the cylinder block I realised I could shave off 1mm here and 0.5 mm there and have the front of the engine brought into scale width. I also replaced the Smithies water tube boiler with a G1MRA 'Project' style one and fitted an axle pump. She runs in this form today although I have recently given her a new boiler. Use other designs and adapt if they look suitable. I have subsequently built a 70% ARMIG cylinder block and incorporated a reduced axle pump/bypass valve from DEE into a 7mm/ft live steam LNER N10.

Which brings me to my final thought. LBSC and other designers including Martin Evans mark 1 have left us model engineers with a wealth of designs to build. However what practices and techniques have not just been superseded by modern technology but would be unacceptable today? Even as a novice in the early 1990s I was surprised at screwing boiler fittings into ¼ inch copper plate. What other things would be considered to be unacceptable?

BTW if you want to see what is possible in 7mm live steam, search for 'O Gauge Live Steam' on YouTube.

Regards,

*Dave Robinson
(Wiltshire)*

Tool Panel

Dear Martin,

This is a simple way for me not to lose tools amidst the clutter of the workbench.

Very easy – use spring clips, odd screws and hooks to hold the tools and use a marker pen to make an outline – it is then obvious what is missing. This idea has been used in the car maintenance trade for many, many years and was adopted by the Apollo programme after a socket spanner was found in the command module during the investigation into the fatal fire of Apollo 1. The spanner was not the cause (it is thought) but was one of a number of things that should not have happened.



The Apollo programme's engineers adopted this practice henceforth.

*Mike Joseph
(St Albans MES)*

Trevithick's Engines

Dear Martin,

Ron Fitzgerald continues to produce a most fascinating and readable account of the early development of the steam engine. But sometimes I wonder if he creates more questions than he answers? Of course that might be the great secret of writing...

In the most recent episode, part 63, Ron has a description and photos of the 'Hazeldine' engine, built to what is obviously a Trevithick design. I have not had any opportunity to examine this engine in the Science Museum, but from the description and photos it must correspond very closely with the presumed appearance of the Coalbrookdale Locomotive, except for the location of the cylinder. The boiler dimensions are virtually the same, the bolted-on boiler end with the curious manhole would make perfect sense if the manhole flange were there to mount a horizontal cylinder. But this would mean that the Hazeldine engine was built from castings to the same patterns. It seems unlikely that a horizontal

cylinder inset in the boiler above the firehole would be a standard feature, tending the fire whilst the machinery was working would be 'interesting'; and I am not aware of any other recorded Trevithick engine with a horizontal cylinder except the locomotives.

There is also the question of the 'joint' in the boiler barrel. I can quite see that it might be easier to form the barrel end containing the cylinder mounting as a separate piece, to be bolted onto a standard barrel, but I question the likelihood of an internal flanged joint. This seems like a very poor engineering design, and the people who built it were very good practical engineers. To deliberately build in a joint that was impossible to inspect, or maintain, and that if it should fail would give no warning of catastrophic failure, seems sheer madness. Whereas, to provide alternative patterns for boilers with alternative provision for different cylinders makes a good deal of sense, and if the patterns were not in perfect registration, then you get a visible seam mark in the finished casting.

I agree that the curious dishing in the barrel end could be to accommodate the tappet gear, if the crosshead had been assembled the wrong way round, which is possible; but would mean that the cylinder is also the wrong way round, and the feed water heater, and the feed pump. Or it could mean that the barrel-end pattern had been made for an earlier design which had the tappet gear on the other side, and the pattern was being reused rather than make a new one. Blessed be the name of Webb for preserving this engine! But I wish he had left a few more notes when they put it back together...

Regards,

Alan Cox (Carnforth)

Engineering's Local Heroes – Dr William Harland and Sir Edward James Harland of Scarborough

Roger Backhouse tells the story of a remarkable father and son.



One of the more unusual exhibits in a British museum is a set of dentures hand carved from hippopotamus teeth. They can be seen in Scarborough's Rotunda Museum. Even more unusual, they were carved by the man who wore them, Doctor William Harland. As the teeth move they can be considered an unusual form of mechanical engineering (photo 1)!

Besides being a successful physician who owned medicinal baths in Vernon Place, Scarborough, Dr Harland was a scientist and inventor, and knew many leading scientific minds of the time.

The Rotunda Museum (photo 2) was opened in 1829 and was one of the first purpose built museums and the first built specially to display and explain geology. The museum still does that today. The design was suggested by William Smith, (1769-1839) known as 'The Father of English geology', whose pioneering geological map of England set a remarkably high standard. The galleries were painted with a frieze created by his nephew, John Phillips, showing the Yorkshire coast with outcropping strata.

Encouraging scientific discussion

Early 19th century Britain had a number of local philosophical societies. Their interests were in natural philosophy, i.e. science in its many forms, rather than topics like ethics and theory of knowledge. They played an important part in advancing scientific understanding and inquiry,



Dentures made by Dr William Harland from Hippopotamus teeth.



Scarborough's Rotunda Museum, a distinctive design for the first purpose built geological museum.

linking together like minded gentlemen, for they were usually restricted to men of some affluence.

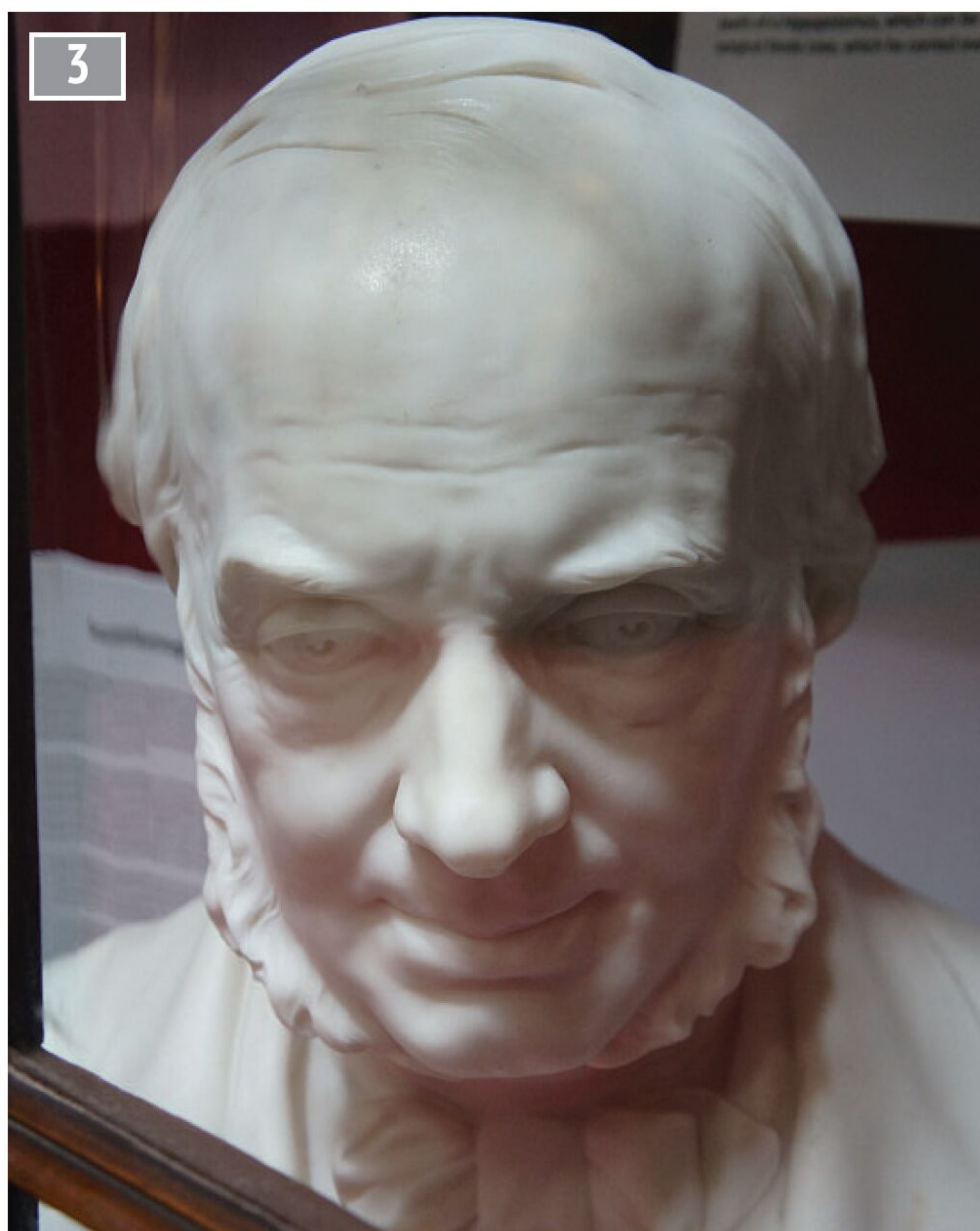
Societies like Yorkshire Philosophical Society (YPS) and the Literary and Philosophical Society of Newcastle upon Tyne still flourish. YPS is the Yorkshire arm of the British Science Association and continues to promote learning and inquiry through awards and frequent lectures on scientific, natural history and archaeological subjects.

Scarborough Philosophical Society members were interested in geology and

it was thanks to them that the Rotunda Museum was created. Sadly, the society folded around 1930 when the museum, collection and archives were taken over by Scarborough Borough Council. It remains a fascinating museum today yet retaining something of the atmosphere and layout of when it was built. It is more interesting than many modern collections where minimalism is now fashionable.

Dr Harland's engineering interests

One of the leading lights in the Philosophical Society was



Bust of Dr William Harland in the Rotunda Museum.

Dr William Harland (**photo 3**). Baker's *History of Scarborough* describes his youth as follows: 'as a boy he showed considerable mechanical talent. At that time he built a small kiln near his fathers house, where he used to burn a barrow load of lime at a time for his father's garden. He never seemed to care to play at ordinary games with his school fellows, but preferred to spend his spare time in a small workshop making many models of water mills etc.'

Although William studied medicine he retained an interest in mechanics. He is said to have patented a steam carriage in 1827 and Baker says of it: 'the most important part of the invention is now in use in many of the traction engines of today', though it is not clear exactly what this was. Unfortunately the patent has not yet come to light. The car was tried out successfully on Newborough Hill in Scarborough near the family home.

The Rotunda museum displays a well made model

of a steam carriage but unfortunately has little information about it (**photo 4**). It is highly likely William Harland made the model himself. Though it has suffered some deterioration in nearly 200 years it is clearly well made and probably represents his steam car.

Perhaps a local carriage builder made the body work which resembles that of a horse drawn carriage of the period (**photo 5**). The wheels are also well made. The model has two cylinders and a geared drive but, oddly, does not appear to have any vent for smoke or steam (**photo 6**).

Another member of Scarborough Philosophical Society and a friend of Dr Harland was Sir George Cayley who lived nearby at Brompton. Sir George was a polymath who developed the science of aeronautics but also implemented ideas on land drainage. He invented the tension (bicycle) wheel, the caterpillar track, which he called an 'endless railway', and the theatre safety curtain.



Model of steam carriage invented by Dr Harland and tried in Scarborough in 1827 (photo © Scarborough Museum and Galleries 2024).



View underneath the steam carriage model (photo © Scarborough Museum and Galleries 2024).



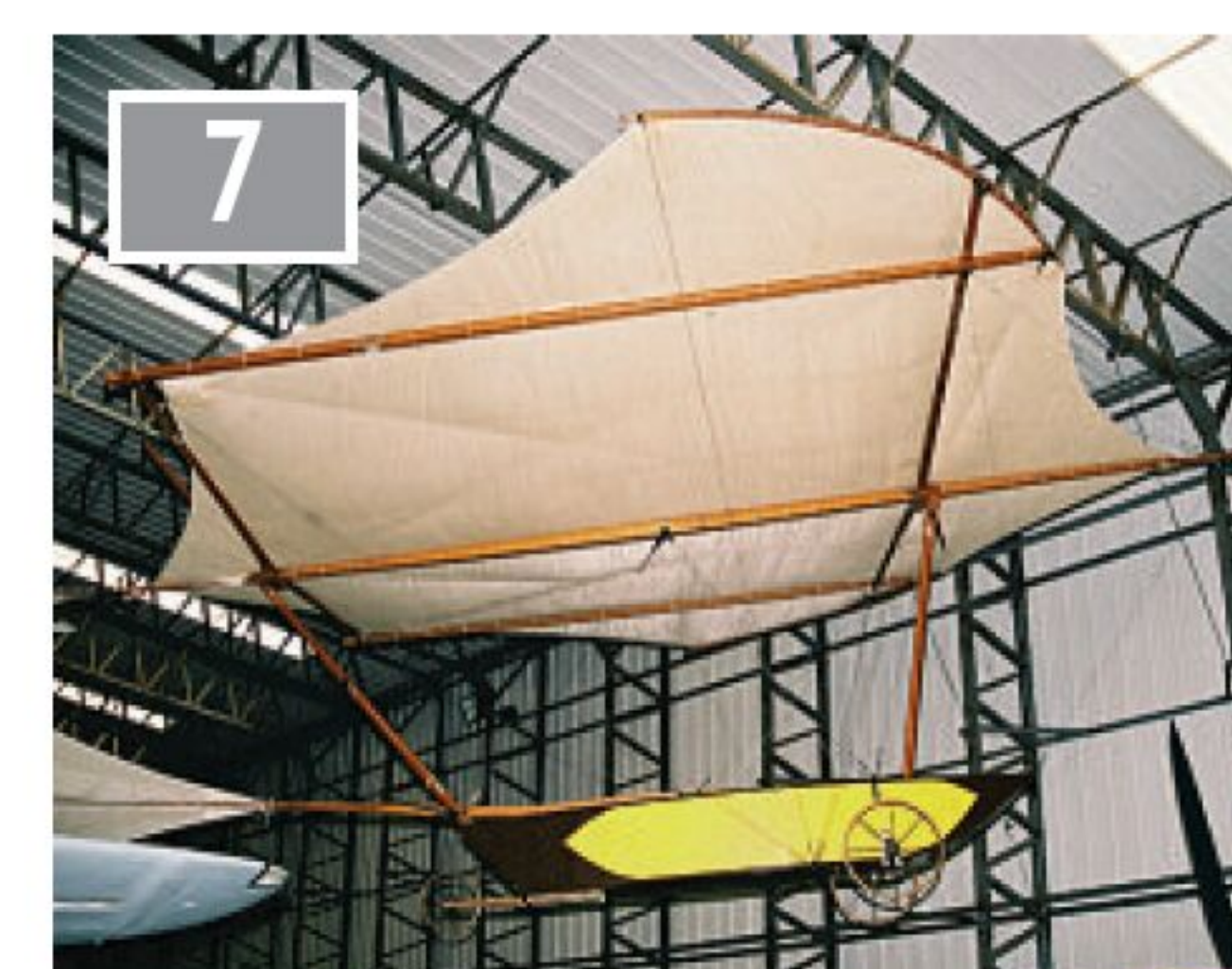
Close up of driving seat and steering wheel.

His greatest achievement was to build the world's first successful heavier than air craft, a glider which flew across nearby Brompton Dale (**photo 7** - see also *Model Engineer*, Vol 209 no. 4437 p.323 2012 Aug 24th - Engineering's Local Heroes - Sir George Cayley).

Another of Dr Harland's friends was reportedly Robert Stephenson, the great railway engineer, who was MP for Whitby, though never a prominent or particularly active MP.

Dr Harland was reportedly a man of great enthusiasms and optimism. He said 'What you have the will to do, do with all your might!', also saying 'This

is a glorious world! I should like to be here 100 years, and then there might be some chance of doing some good. But I don't think I shall get over this winter!' (After his death in 1866 his large collection of birds, birds eggs, fossils and shells went to the Rotunda Museum.)



Replica of Sir George Cayley's 'governable parachute'.

8



White Star steamship Oceanic (photo: Wikipedia Creative Commons).

Sir Edward James Harland

Dr Harland had several children of whom the most notable was Edward James Harland. He had access to his father's workshops and seems to have inherited something of his father's determination and drive. He was also encouraged by his mother who was often found 'making things'.

After a time at Scarborough Grammar School Edward was sent to Edinburgh Academy where he studied for two years. Though his father wanted him to become a lawyer the urge to be an engineer was too strong. Whether his father's friendship with Robert Stephenson was a factor or not he joined his company as an apprentice in 1845 at the age of 15. He continued to visit Scarborough where he was interested in the work of local shipbuilders.

After his apprenticeship he worked for Stephenson's as a journeyman, now paid £1 a week, and was there during the construction of the High Level Bridge. He was involved in building caissons for Keyham Dockyard, Plymouth perhaps because his familiarity with setting out curves, knowledge obtained from shipyard visits, was considered helpful.

After leaving Stephenson's he is said to have spent a remarkable two months at the Great Exhibition in 1851,

then joining Glasgow engine builders J. and G. Thomson. Appointed assistant to the head draughtsman, he took over that post when he left.

At Thomsons he gained a reputation for working on drawings more carefully than previous draughtsmen. Parts could be then made exactly to fit, speeding up construction. Then in 1853 he took over management of Thomas Toward's shipyard on the Tyne as the owner was ill. The firm specialised in tugboats. The owner spent a whole winter away allowing Edward Harland to take charge of the whole yard - valuable experience for his next post.

Belfast was then an expanding shipbuilding centre and Edward Harland moved there in 1854 to join the firm of Robert Hickson and Co. The yard was suffering financial problems due to poor management which seems to have been somewhat lackadaisical. Harland insisted on higher standards and gradually recruited a better workforce and foremen.

He was known to have a good sense of smell and could discover anyone taking an unofficial smoking break at work. One of his mannerisms was carrying an ivory rule and a piece of chalk to mark any mistakes that might be

9



Statue of Sir Edward Harland outside Belfast City Hall.

noted on one of his frequent inspections.

Always ambitious, Harland wanted to set up his own yard. However, Robert Hickson was reluctant to see him go but then sold his own holding in the yard for £5000. He soon expanded the output. Having earlier helped James Bibby buy a steamer in Glasgow J. Bibby and Son became a customer with Harland selling them three screw steamers.

Bibby's were clearly pleased with their ships and returned to Harland for more orders. Harland promoted bigger ships and suggested one of 310 feet rather than the earlier 270 feet. Others criticised this suggestion, expecting his ships to break their backs in the Atlantic but this did not happen. Bibby's placed many more orders. Several vessels were extended amidships.

Another innovation was building decks from iron instead of wood, enhancing the strength by creating what was in effect a box girder. He increased capacity by building his ships with flatter bottoms, an innovation that became known as the 'Belfast Bottom'. Harland also took out patents for improved decks and screw propellers.

Harland's personal assistant was Gustav Wolff and in 1861 Wolff became a partner, creating the firm of Harland and Wolff. The yard was one of several in Britain to take orders for blockade runners from the Confederate States. With

the defeat of the Confederate States is the mystery of whether the yard was ever paid.

Later, William Pirrie, a former yard 'gentleman apprentice', joined as a third partner. They started an engine building business in 1880, having previously bought engines from other companies.

The triumvirate developed a leading business receiving many orders from the White Star line, then one of the leading British owned trans-Atlantic shipping companies. Their first order for that line was the *Oceanic* built in 1871 and many more ships followed (**photo 8**). Harland retired to his County Leitrim home in 1889, leaving Wolff and Pirrie as yard managers.

'If you want something done, give the job to a busy man' applied to Edward Harland. He served as a Belfast harbour commissioner and in 1885 he was granted a knighthood and later that year a baronetcy. A Conservative and staunch Unionist in politics, he served as Mayor of Belfast and as MP for Belfast North from 1889 until his death in 1895. He is commemorated in Belfast by a statue outside Belfast City Hall (**photo 9**).

Harland and Wolff went on to build many fine ships and it is ironical that their most famous was the ill fated *Titanic* in 1912, hardly an advert for the firm. Unfortunately the yard later suffered from overseas competition, as did other British shipbuilders. The yard is now a shadow of its former extensive size with recent press reports suggesting the firm has gone into liquidation. However, as 'The Titanic Quarter', parts of the yard attract tourists in large numbers, something Edward Harland could never have expected to see.

Thanks to

Scarborough Maritime Heritage Centre

Gary Sullivan (Belfast City Council)

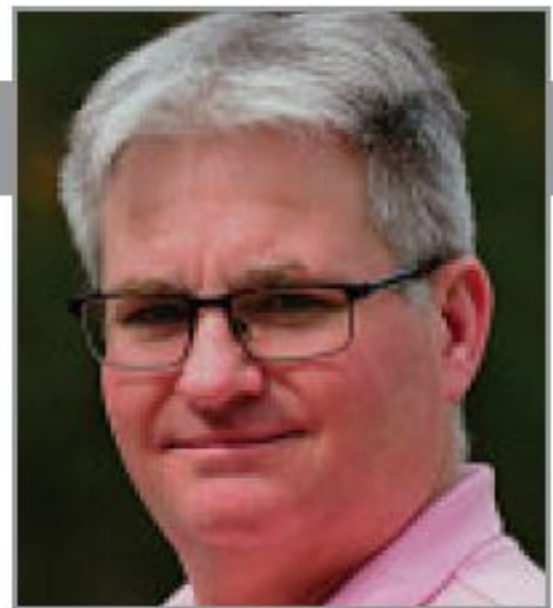
Jim Middleton (Scarborough Museums and Art Galleries)

ME

Part 25: The Unassailable Power of Reason

Steve Goodbody

takes a random walk through model engineering.



Continued from p.706
M.E.4756 November 15



Heavens above, have we really reached the quarter-century edition of *Butterside Down*? While the numbers presumably do not lie, I confess a degree of incredulity that we've attained this milestone and congratulate you, persistent Reader, on your impressive stamina if you've persevered with the series thus far. While still doubtful of your sanity, having struggled through the prior twenty-four monologues, I offer to you my sincerest thanks and suggest you take a long lie down in a quiet and darkened room - you will surely feel better for it if you do. That's alright - I'll pause while you depart for a safer haven.

Ah, wait a minute; it appears that I have unwittingly created a perfect vacuum of inattention - a situation to which I am well accustomed as the parent of two teenagers - for I see that the last remaining soul is presently leaving the figurative auditorium. Hang on a moment while I gather the departees back to the fold and see if I can't create something to banish their weariness, grab their interest (who said: *'that'll be a first'*?) and avoid the stigma of being the first author in history to prove that, like the metaphorical tree falling in its philosophical forest, the unread word has no tangible

impact upon its surrounding environment.

With today's introduction largely complete, it likely won't surprise you that the mind behind these *Butterside* missives doesn't seem to work in quite the same way as that of most people. Admittedly this is sometimes a blessing - spurious thoughts occasionally foster novel ideas - but often it is a bane, especially when those thoughts spark an unintendedly comic inner interpretation of an overtly serious statement and I struggle to keep a straight face. To illustrate this, I offer the following recent example.

Perpendicularity

"It was a catastrophe!" exclaimed Sarah, one of our friends, over a quiet Thursday-evening's drink on the Cow and Calculator's pleasant patio, concluding the story of her friend's about-to-be-cut wedding cake, collapsing under its weight, sliding off the table and falling to the banquet hall's well-polished floor. *"A real catastrophe!"* she repeated to emphasise the point, and our little group nodded and commiserated over this obviously traumatising event.

Of course, while Sarah's heartrending tale seamlessly combined two subjects close to my heart - baked

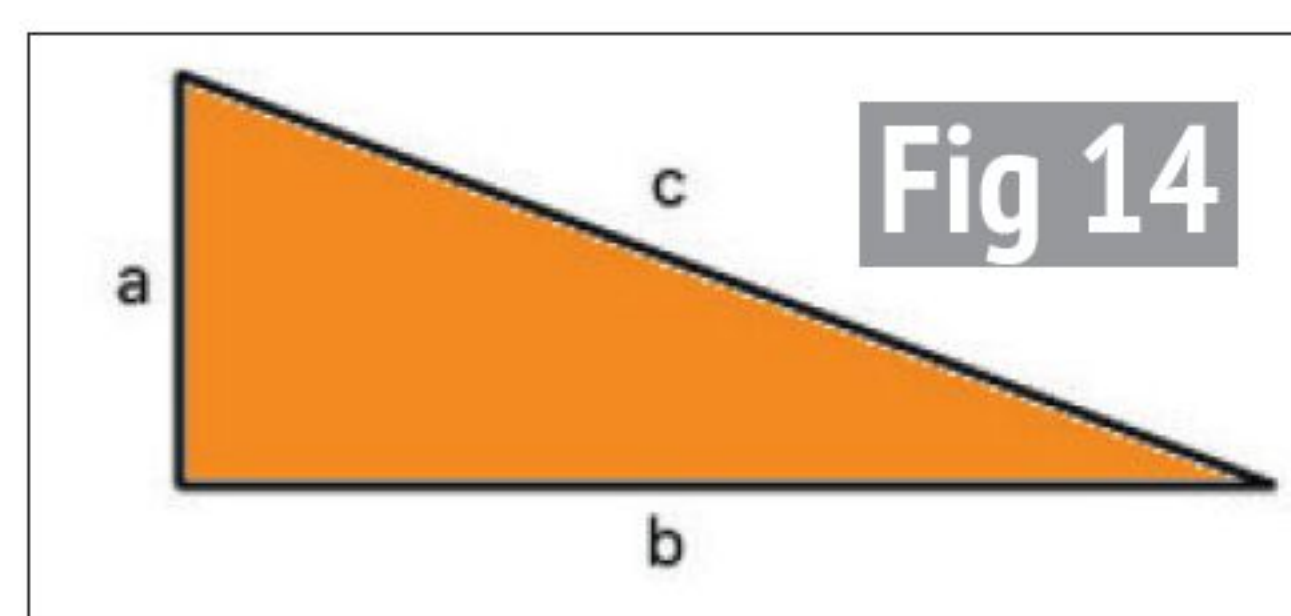
confectionary and the Deceleration Demon (which you all know about by now) - and even though the imagined *splat* of cake-meets-deck has humorous slapstick overtones when envisioned in retrospect, hers was a serious account and, in addition to the obvious impact it must have had at the time (if you'll pardon the pun), I am sure it also resulted in a great deal of clearing-up for the event host's staff who have my belated sympathy.

Despite the pathos, there was I, trying not to laugh, sitting quietly at the table, the corners of my mouth twitching, wrestling to contain the question which had immediately entered my thoughts upon Sarah's final words. Jenny, knowing me of old, recognised the signs.

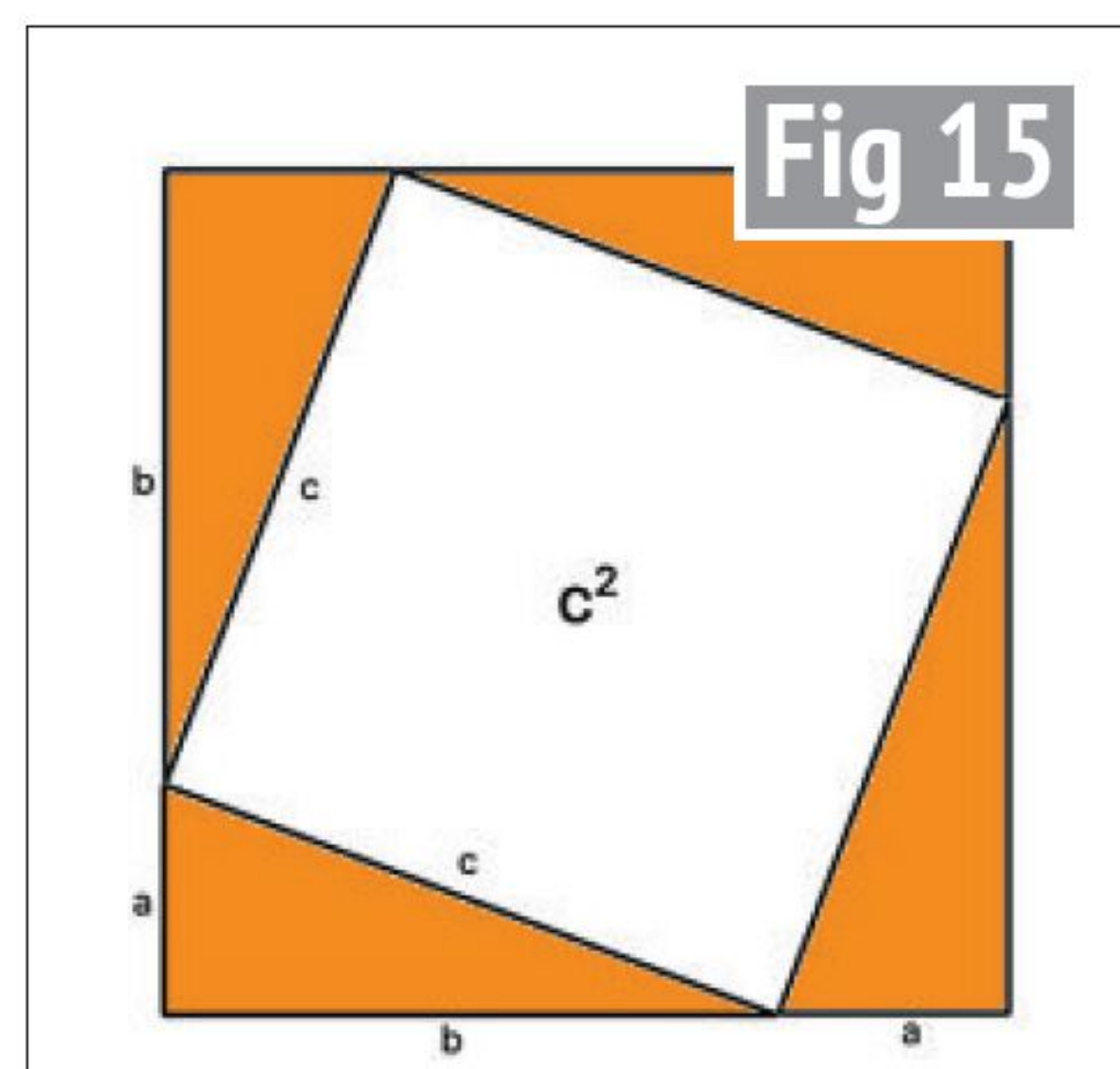
"Alright - out with it - what's on your mind?" she sighed in mock annoyance, while the others turned expectantly in my direction. Fortunately, they knew me well too.

"Sorry, I didn't want to interrupt the conversation," I replied, after taking a sip of our fine pub's latest concoction, "but I was just trying to decide: is a *catastrophe* a feline punctuation mark?" Fortunately, I am used to the groans by now and treat them as a mark of appreciation; please don't tell anyone because they think it dissuades me.

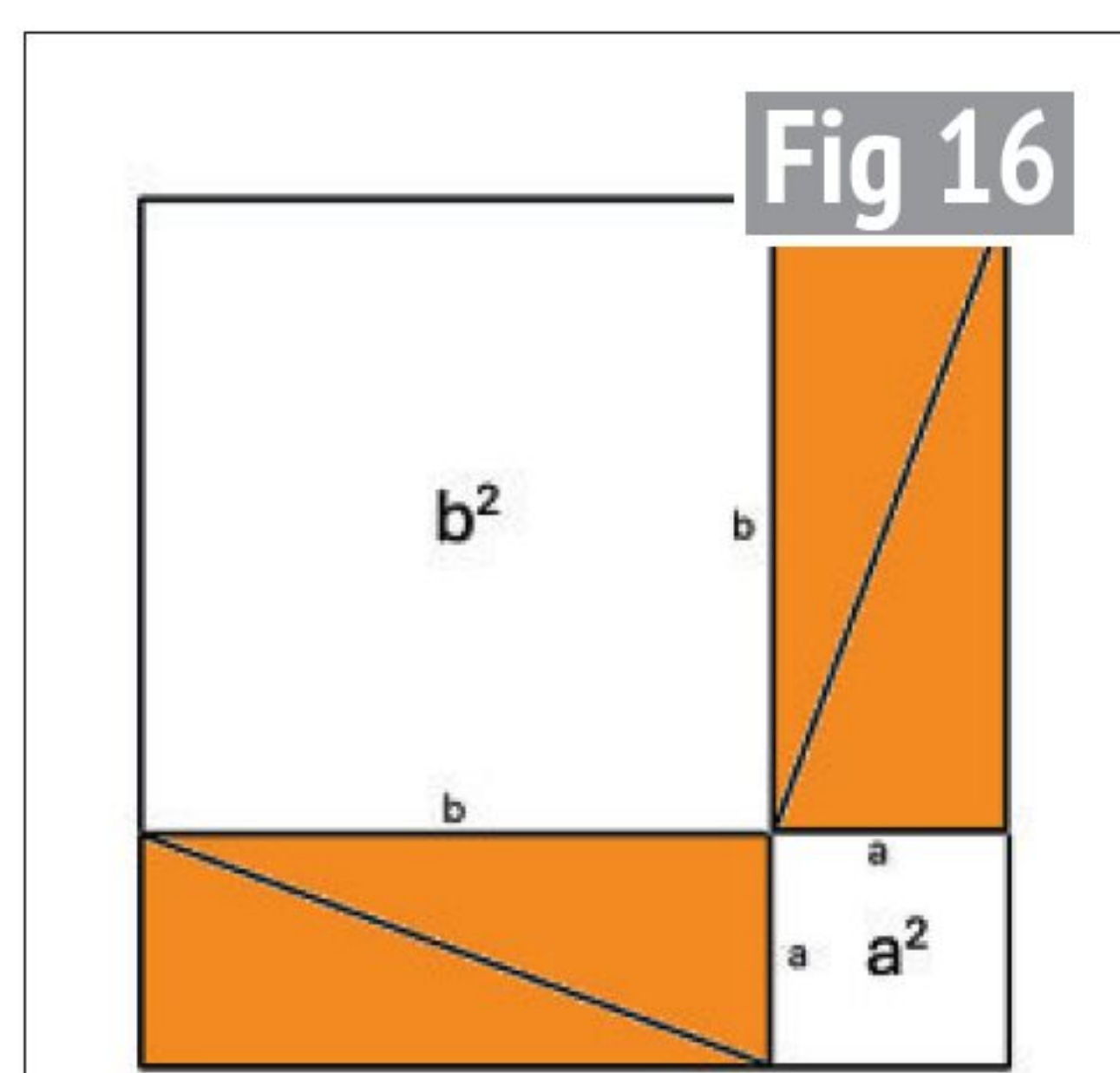
Moving swiftly onwards, the point I am desperately trying to make is this: for some reason, and on a frequent basis, ideas and thoughts enter my mind, whether triggered by an external or internal source, which lead to a flight of fancy which is wholly unrelated to, and which departs at ninety degrees from, the original context. You may pity me,



Step 1 – A randomly-drawn right-angled triangle.



Step 2 – With four identical triangles arranged with their corners touching, a tilted white square appears in the centre of the first arrangement.



Step 3 – Rearranging the triangles, and with the overall boundary unchanged, two new white squares are formed which occupy the same-sized space as the tilted square in Step 2.

concerned Reader, for medical science has no known cure.

So, what to call this disorder? These aren't *tangential* thoughts, or even *lateral* thoughts, they are something far more obtuse which should really be given their own name in readiness for the medical encyclopaedias of the future. So, why don't we call them *perpendicular* thoughts, and entitle the affliction *perpendicularity*? I like that – it seems to be an appropriate moniker – so perpendicular it is.

With this out in the open and decided, I suspect you've recollected a few perpendicularities in my writings over the past few years, haven't you? Well, at least you now know where they

come from and what to call them, even if there's nothing to be done to change the situation for the better. Sad, but true, these are the burdens which we must bear.

A hefty clout of logic

One excellent example of perpendicularity, not of my creation although I truly wish it were, coincidentally also involves an unwitting moggy, and, while you may have heard it before, I repeat and expand upon it here without apology because it is, in my opinion, an absolute masterpiece of the perpendicular artform. But enough preamble, let's get to the gist.

As you well know, world-wise Reader, there are certain fundamental laws of nature which, even though one may wish otherwise, we are powerless to change. Have you just settled into a nice relaxing bath? A natural law dictates that your phone will immediately ring. Are you taking that little-known shortcut around a notorious bottleneck? Another law demands that the road will be inexplicably closed at the final junction. And of these cast-in-stone rules, two irrefutable facts, held firmly in humanity's collective psyche since the invention of baking and the domestication of animals, stand above all others in their unwavering truthfulness: (i) a falling cat always lands on its feet, and (ii) toast always lands buttered side down. Let's call them Law 1 and Law 2 respectively, for simplicity.

Despite being undeniable truisms since time immemorial, it is only in recent years, perhaps through the rise of artificial intelligence or its balancing corollary, real stupidity, that the importance of these seemingly unrelated facts has come to light. Put simply, being creative types, were we to strap a slice of toast to the back of a cat, butter it (the toast, not the cat) and swiftly shove the toast/cat ensemble off the table to fall unhindered under the influence of gravity, a magical paradox will occur. Let's explore.

Firstly, by instinct, the cat, upside down and sensing the approaching ground, will rotate its body, corkscrew-like, pointing its feet downwards to be ready for landing and thereby satisfy Law 1. However, as this happens, the buttered side of the toast faces increasingly upwards – a clear breach of Law 2 – and the toast, its influence becoming greater as the breach worsens and the floor draws near, forces the cat's continued rotation through bottom-dead-centre until, once again, the cat's feet are pointing skywards. The buttered toast, now facing downwards, has happily fulfilled Law 2 but the cat, finding itself inexplicably upended once again, is in clear breach of Law 1. It therefore rotates its body, corkscrew-like, pointing its feet downwards.....

You get the idea.

Allowing our cat-and-buttered-toast system to settle after its initially jerky start, this innovative mechanism, driven by the unassailable power of pure logic, eventually stabilises; its conjoined components hovering in mid-air a few millimetres above the floor, rotating gently and continuously, the world's first perpetual-motion-and-antigravity-machine.

As practically minded model engineers, I am sure the myriad opportunities arising from this breakthrough invention are obvious to us all. For example: add a belt and a few gears, connect it to a generator, and a solution to the world's energy crisis is within our grasp. Alternatively, attach some bearings along the cat's major axis, support a simple platform from those bearings, bolt a handlebar atop and, *voilà*, a near-frictionless cat/toast hover-scooter is within our grasp. Yes indeed, the potential benefits and applications of this miracle machine are truly endless, and all we need are a cat, some buttered toast and a few cases of Whiskas to keep things going for the longer term. Other cat foods are available, I hasten to add.

But please don't try any of this at home, for you'll only

get into trouble and I won't be held accountable for the consequences.

It's all Greek to me...

It may come as a surprise – it certainly did to me – but the ancient Greeks, those early masters of mathematics, inventors of the Doric and Ionic columns, conquerors of Olympus and builders of the Parthenon, while developing a rudimentary system of symbols to enable mathematical discussion, did not use written formulae, did not consider zero to be a number, believed negative numbers to be absurd and thought that finding one solution to a problem was sufficient even though they likely knew that other equally valid solutions existed.

Given these startling facts, an argument could be made that the ancient Greek mathematicians, whose ranks included both Pythagoras and Euclid – names still familiar to us despite roughly 2,500 intervening years – arguably understood rather less about the fundamentals of mathematics than today's primary school children. After all, any modern five-year-old, upon carelessly dropping their ice cream and staring at their now empty hand through tear-filled eyes, has a harshly intuitive understanding of that most critical mathematical abstraction – zero. Time, of course, is crucial to determining the *why* behind this seemingly contradictory situation.

To explain further, I think it's fair to say that we take our everyday numbering system (0,1,2,3,4,5... etc) for granted. In fact, it's so commonplace that we forget that someone had to invent this scheme – the Indians in the sixth or seventh century AD, according to the Encyclopaedia Britannica's online edition – and we are likely unaware that it only achieved widespread adoption, including in Greece and the rest of Europe, as a result of its inclusion in the published works of the great Arabian mathematician Muḥammad

ibn Mūsā al-Khwārizmī's in the 9th Century AD. Yes, it's easy to overlook the fact that *our* collective numbering system is really the Hindu-Arabic system, and that it has been in common use for only a relatively short period of human history and long after the demise of the classical Greeks and their Roman counterparts.

Taking one step further, and again according to Britannica.com, it was the self-same al-Khwārizmī who introduced *algebra* – a corruption of the Arabic words *al-jabr* from the title of his seminal ninth-century work *Kitāb al-jabr wa al-muqābalah* (*The Book of Integration and Equation*) – to the world and thereby let loose the fundamental system underpinning all of modern mathematics, science and engineering. We owe a great deal to the Mr. al-Khwārizmī, do we not?

Putting these disparate facts together, an intriguing question arises. If Pythagoras, Euclid and their lesser-known (but undoubtedly important) contemporary mathematical compatriots all pre-dated both the Hindu-Arabic numbering system and algebra by more than a thousand years, and knowing that they were saddled with huge gaps in their understanding of numbers, then how on earth did they achieve, and communicate down the ages, the startling mathematical insights which have made them household names for several millennia? Well, believe it or not, a large part of the answer is contained within just one word - *Geometry* - for the Greeks were absolute masters in the relationship between proportion and shape and knew that much can be achieved through the insightful application of images.

Pythagoras by pictures

Let's face it, it's tough to think of Euclid without immediately thinking of Euclidian Geometry, isn't it? Yet, although many of us habitually pick up a pen and paper to sketch out an idea before cutting metal, or gaze with satisfaction at

the drawings which have just arrived in our mailbox to form the start of our latest endeavour, we tend to overlook the importance and benefits of pictorial visualisation and forget the inherent power of the visual image coupled with a bit of geometry.

But the ancient Greeks were absolute masters in the art and, by combining illustration with some remarkably clever perpendicular insights, they explored, dissected and communicated the intriguing world of mathematics to their peers and, in so doing, enabled the construction of architectural marvels which would go on to survive their creator's eventual demise by millennia.

And if that all seems like a stretch, let's conclude this *Butterside* episode with an example which I find particularly elegant and begins (or, more correctly, ends) with a mathematical equation we probably all know well: $a^2 + b^2 = c^2$.

This simple equation, containing only three expressions a , b and c to represent the lengths of the opposite side, adjacent side, and hypotenuse of a right-angled triangle respectively, is of course Pythagoras' famous theorem - drilled into every secondary school student as a part of their introduction to algebra - enabling us to calculate the unknown length of any side of any right-angled triangle provided we know the length of the other two sides. We all recognise it, but how many of us can prove it? Here's a hint: If you were an ancient Greek, it required only three straightforward steps and no algebra at all.

Prompted by my question, I suspect that many of you have now looked more closely at this deceptively simple equation and your minds have started to churn. Can it be expanded? Are there some trigonometrical identities which can be brought to bear? What on earth am I missing, you are perhaps asking yourself? While Wikipedia and other similar

sources tell us that there are many ways of proving the theorem algebraically, with at least 370 different algebraic and geometric proofs overall, it's not immediately obvious, is it?

Well, to put you out of your misery, let me reiterate one crucial point: Pythagoras, like the rest of the ancient Greek mathematicians, did not use algebra or formulae, and the equation as I have written it - and we all know it - would have been absolutely meaningless to poor old Pythagoras. No indeed, the principal tools of mathematical exploration to its Hellenic inventor were *geometry* and *logic* and those are the keys to how Pythagoras himself probably went about it, possibly while staring at a newly tiled floor according to various sources on the Worldwide Web.

Step 1: Draw a right-angled triangle, any right-angled triangle, just as I have done in **fig 14**. You needn't label the sides - Pythagoras presumably didn't - for it isn't necessary for his proof, but I have added the customary algebraic labels to aid in our translation.

Step 2: Make three identical copies and position the four triangles with their corners touching as shown in **fig 15**. Draw a box around the outer boundary if you wish, although it's again unnecessary.

Step 3: Reposition the four triangles as shown in **fig 16**.

Now, if we look at **fig 15**, we'll see that the tilted white shape in the middle of the four triangles is a square and, as such, its sides are all the same length - the length of the original triangle's hypotenuse (c). It is, quite literally, *the square of the hypotenuse* and its area, in algebraic terms, is of course c^2 .

Similarly, if we look at the rearrangement in **fig 16**, we see two new white squares, one being a square made from the triangle's opposite sides (a): *the square of the opposite sides*, the other being a square made from the triangle's adjacent sides (b): *the square of the adjacent sides*.

In algebraic nomenclature, their areas are a^2 and b^2 respectively.

Finally, realising that the size of the outer boundary hasn't changed at all, and knowing that, while we shifted the triangles around, we didn't add, alter or remove any in the process, we can legitimately conclude that the two white squares in Step 3 must cover exactly the same space as the tilted white square in Step 2. In other words, *the square of the hypotenuse is equal to the square of the opposite sides added to the square of the adjacent sides*. Translated back into algebraic notation, $a^2 + b^2 = c^2$.

Quod erat demonstrandum, as Pythagoras wouldn't have said.

Postscript to part 25

If you are struggling to find an algebraic proof of Pythagoras' Theorem and are cursing me from the bottom of your heart - I wouldn't blame you in either case - here's one answer based on **fig 15** to put your mind rest.

The length of each side of the boundary box is: $(a + b)$

Therefore, the total area of the boundary box is: $(a + b) \times (a + b)$.

Multiplying this out, gives us: $a^2 + b^2 + 2ab$. Let's call this Equation 1.

Now, the area of the tilted square is: c^2

And the area of each triangle is: $\frac{1}{2} \times (a \times b)$

Hence, the combined area of the four triangles is: $2 \times (a \times b)$ or $2ab$

Therefore, the total area of the boundary box is: $c^2 + 2ab$. This is our Equation 2.

Finally, because Equations 1 and 2 both represent exactly the same thing - the area of the boundary box - they must be equal.

Therefore: $a^2 + b^2 + 2ab = c^2 + 2ab$

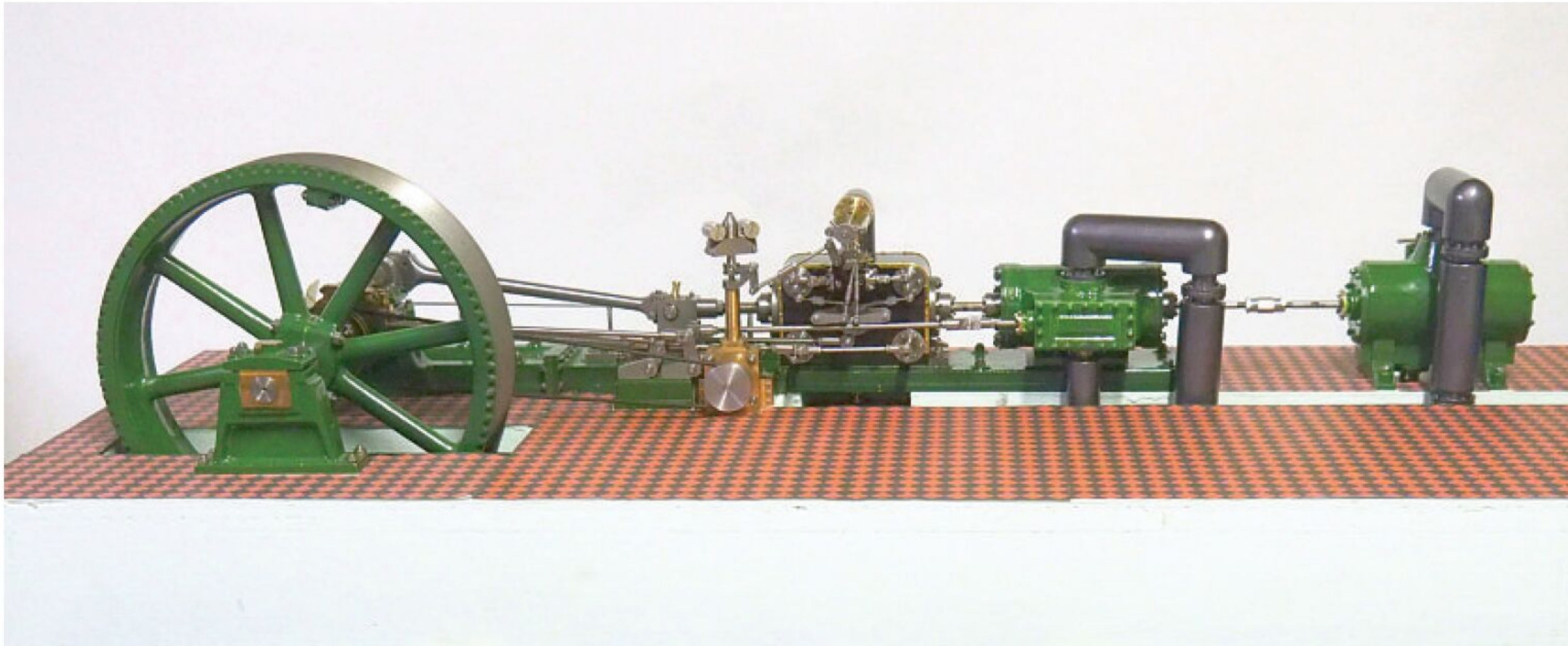
And subtracting $2ab$ from both sides gives us: $a^2 + b^2 = c^2$

Yes, I fully agree, that's more than enough maths for one day!

●To be continued.

A Tandem Compound Mill Engine

PART 8



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



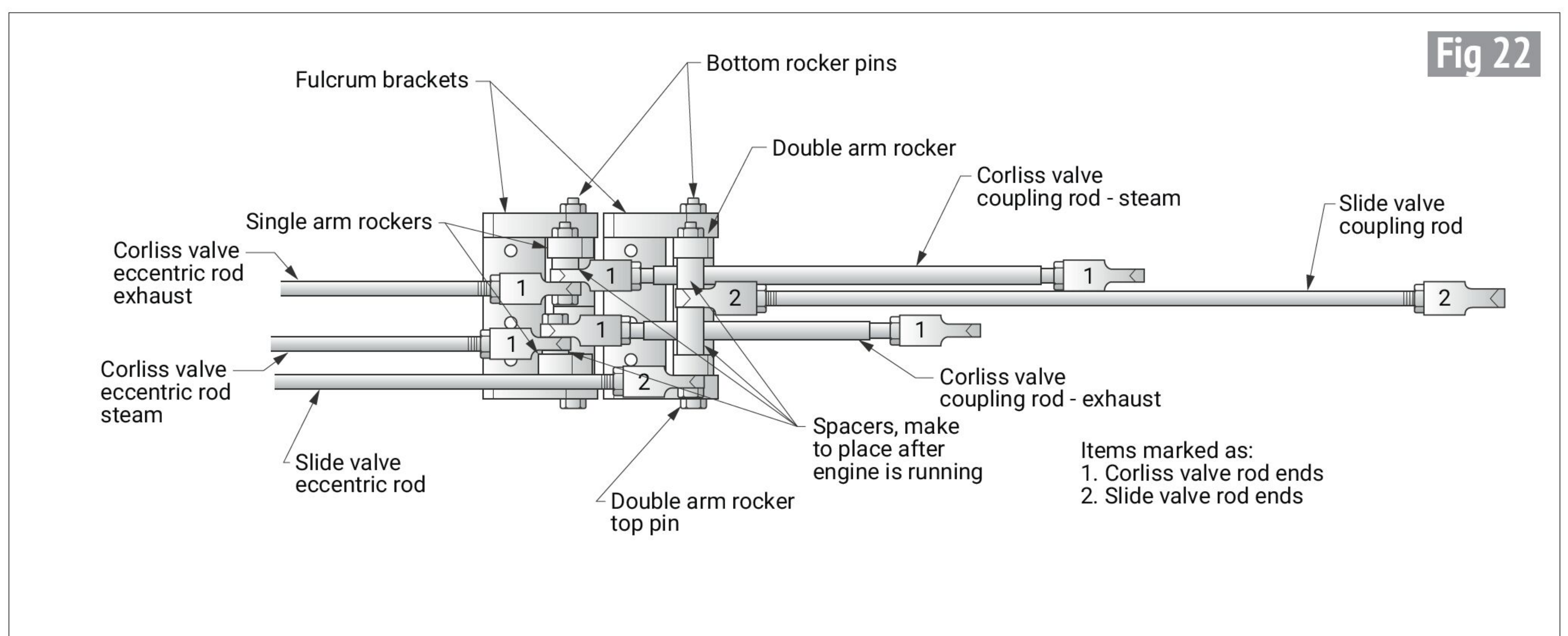
Continued from p.697
M.E.4756 November 15

The distance from the shoulder on the eccentric strap to the clevis pin in the slide valve spindle is about 38cm which is half the overall length of the model. Just for the length alone the valve coupling rods would need some intermediate support but the drive to the slide valve also has to change direction slightly in the vertical plane in order to miss parts of the HP valve gear. The fulcrum brackets and

associated rockers and pins provide this support (fig 22). In later types of engines, the eccentric rods and other bits were eliminated by having pairs of mitre gears coupling a rotating shaft to the crankshaft. This layshaft had eccentrics mounted on it close to each of the valves that they drove.

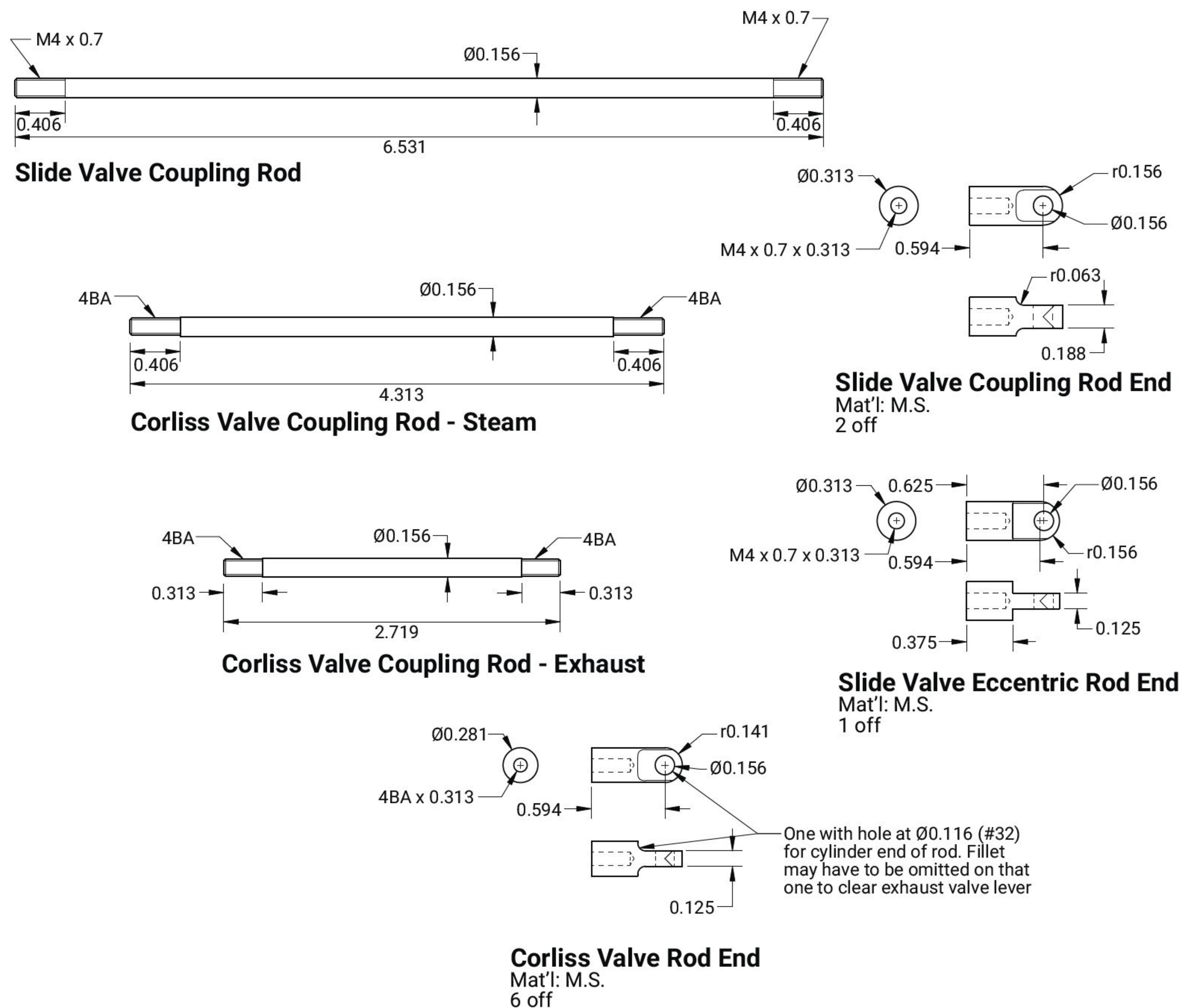
There are 26 (if I've counted correctly) rod ends or clevises (fig 23) in the whole model, all of which need a hole drilled at

right-angles to a flat surface. Direct indexing in a dividing head, or using a square collet block, will make getting things square and in the right place quite easy (photos 122 and 123). In the original drawings the outer ends of these parts were left square which would be a valid choice. I chose to round them over to improve the appearance and be more like the full-size ones I could find. Many other full-size designs had adjustable bearings which were much more complicated but in 1/16 scale those didn't look practical (photos 124 and 125). Rounding over can be done very neatly using a rotary table but this requires some significant set-up time and a bit of hand work with filing buttons is simple and something I find satisfying (photo 126). Keeping parts as long as possible for as long as possible is usually a good plan and most of the rod ends were made in pairs (photo 127) until cut apart and



A general assembly sketch.

Fig 23



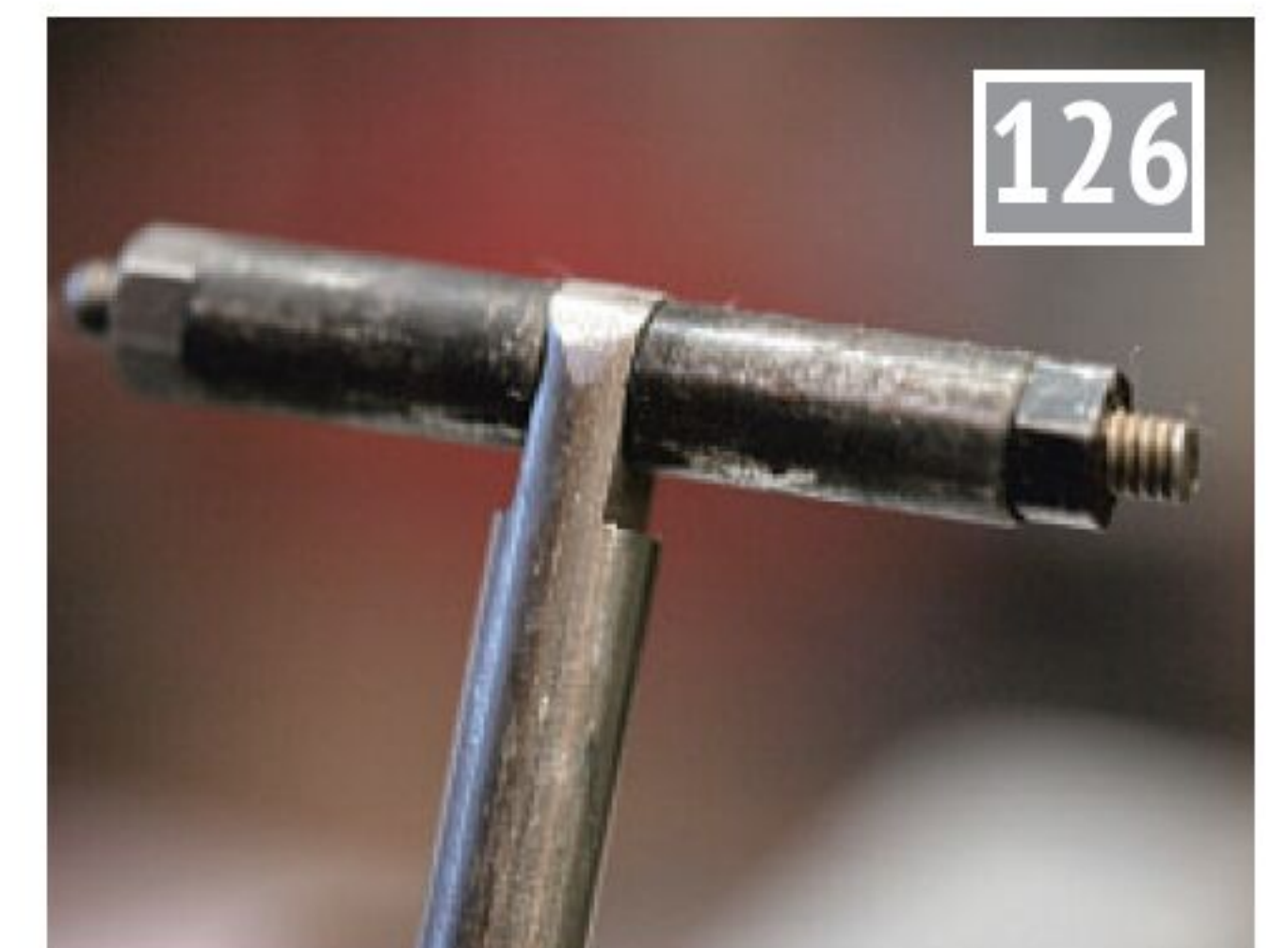
Coupling rods and rod ends.



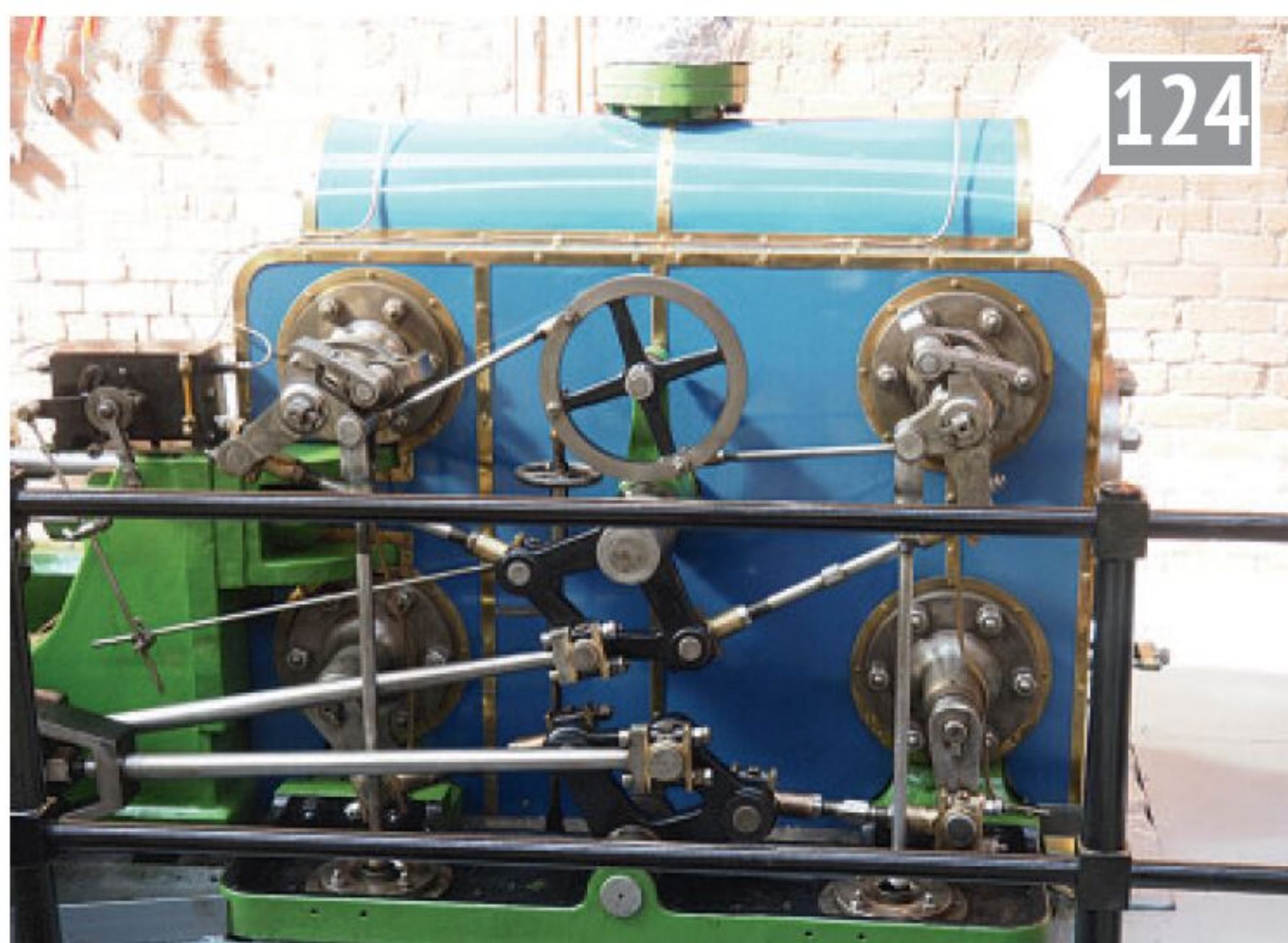
One useful way of making rod ends and clevises is to mount the stock in a dividing head (or collet block) and start by forming the flats ...



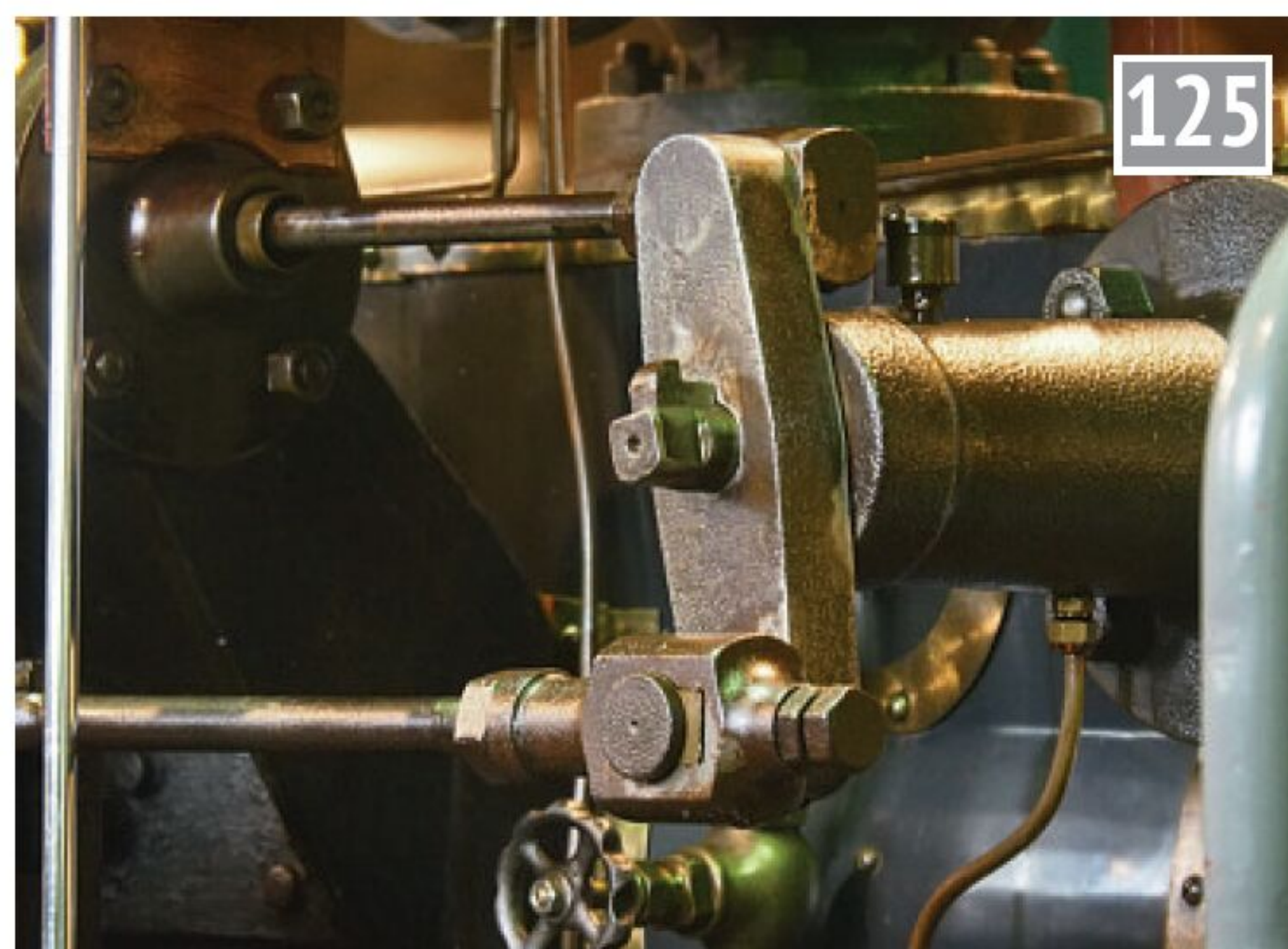
... then turning through 90 degrees to drill the pivot hole.



The end could be rounded over using the mill but filing buttons are quickly made and very quick to set up.



An alternative rod end design on show in the Bolton Steam Museum.

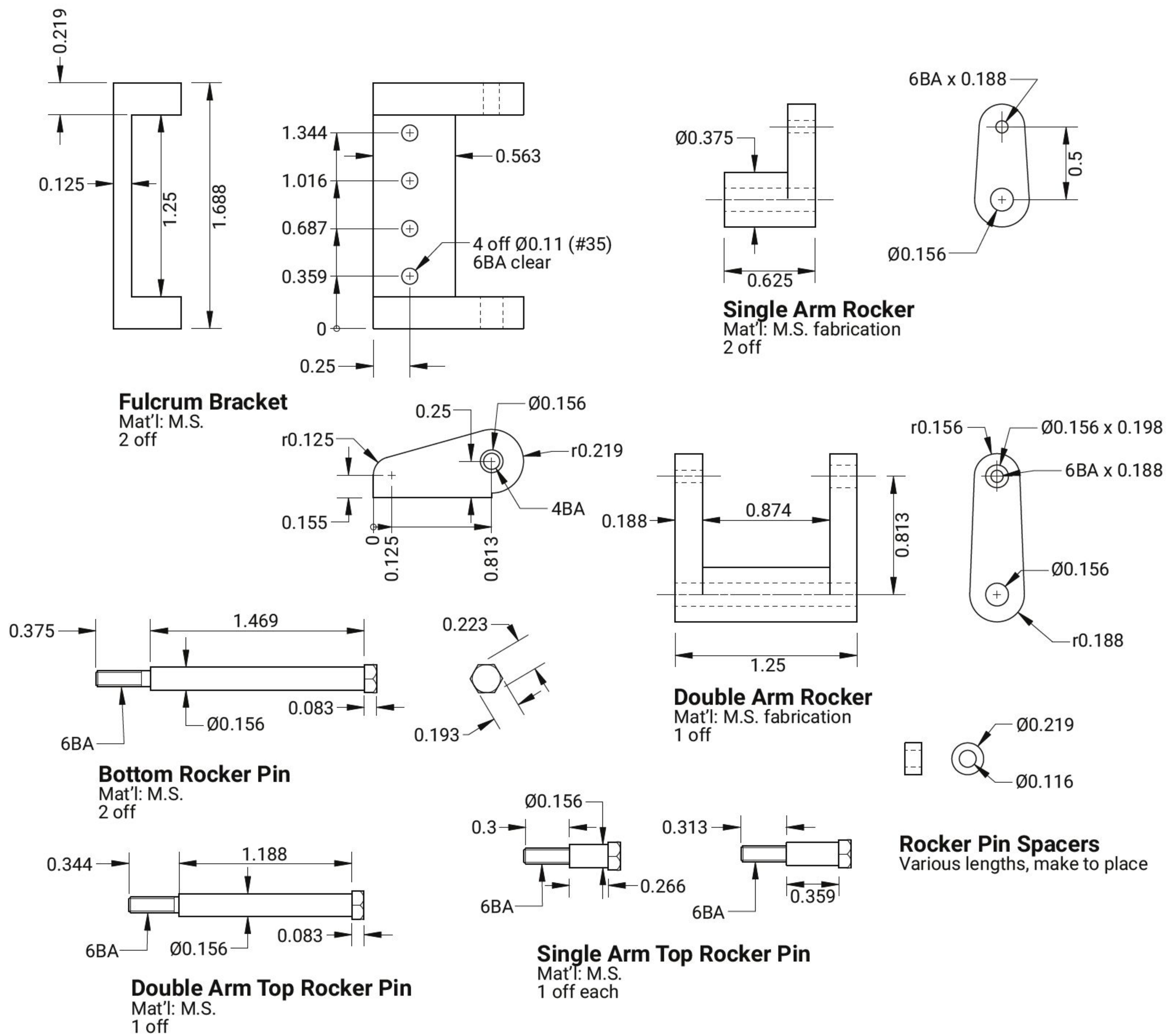


Another alternative type of rod end on an engine in the Anson Engine Museum.



Making the rods' ends in pairs is a big help when it comes to keeping hold of them. After the stage shown here, they are cut apart, machined to length and the axial holes drilled and tapped.

Fig 24



Fulcrum brackets, rockers and rocker pins.



The rods are made from stock and the ends attached. Thin locknuts of the correct appearance will need making.

drilled for the rods. All but one of the rod ends have a 1/16 inch radius fillet in the transition from the flat section to the round and the exception is the end for the slide valve eccentric rod. This fits on the outside of

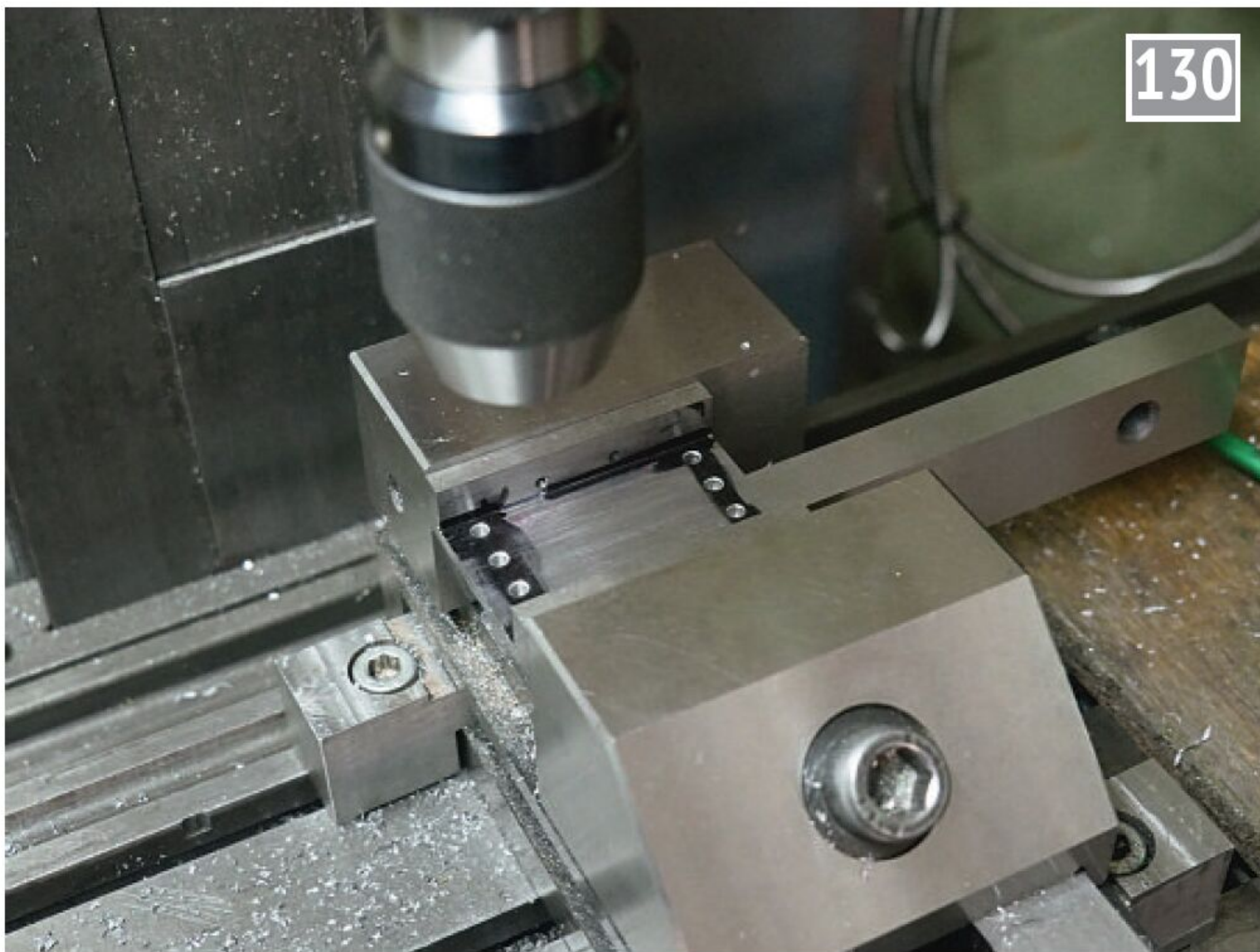
the double arm rocker (fig 22) and the fillet would interfere with the edge of the rocker. A similar modification is needed on the Corliss exhaust valve rod end that attaches to the valve lever (see the note on fig 23).



The two fulcrum brackets were carved from the solid as a pair – first the central trough.

The rods themselves are from stock material, free-cutting stainless in my case because I'm trying to avoid too much maintenance in the future (**photo 128**) but mild steel is cheaper and a bit easier

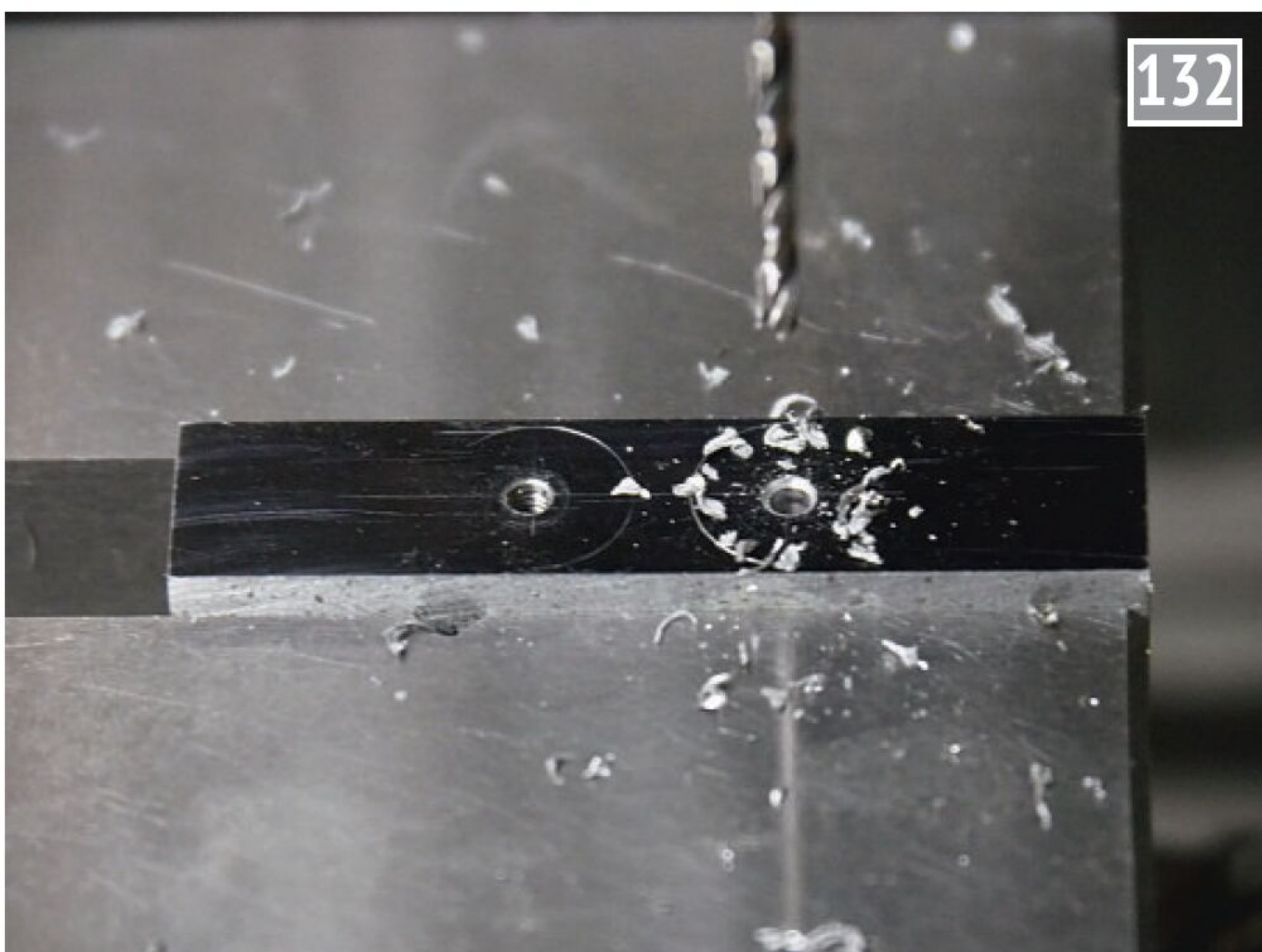
to work. The 5/32 inch rods are threaded M4 (which could be 3BA if you have the tackle) for the slide valve parts or turned down a little to take 4BA for the Corliss side; later adjustment will be a lot easier if one end



Then the various holes were drilled.



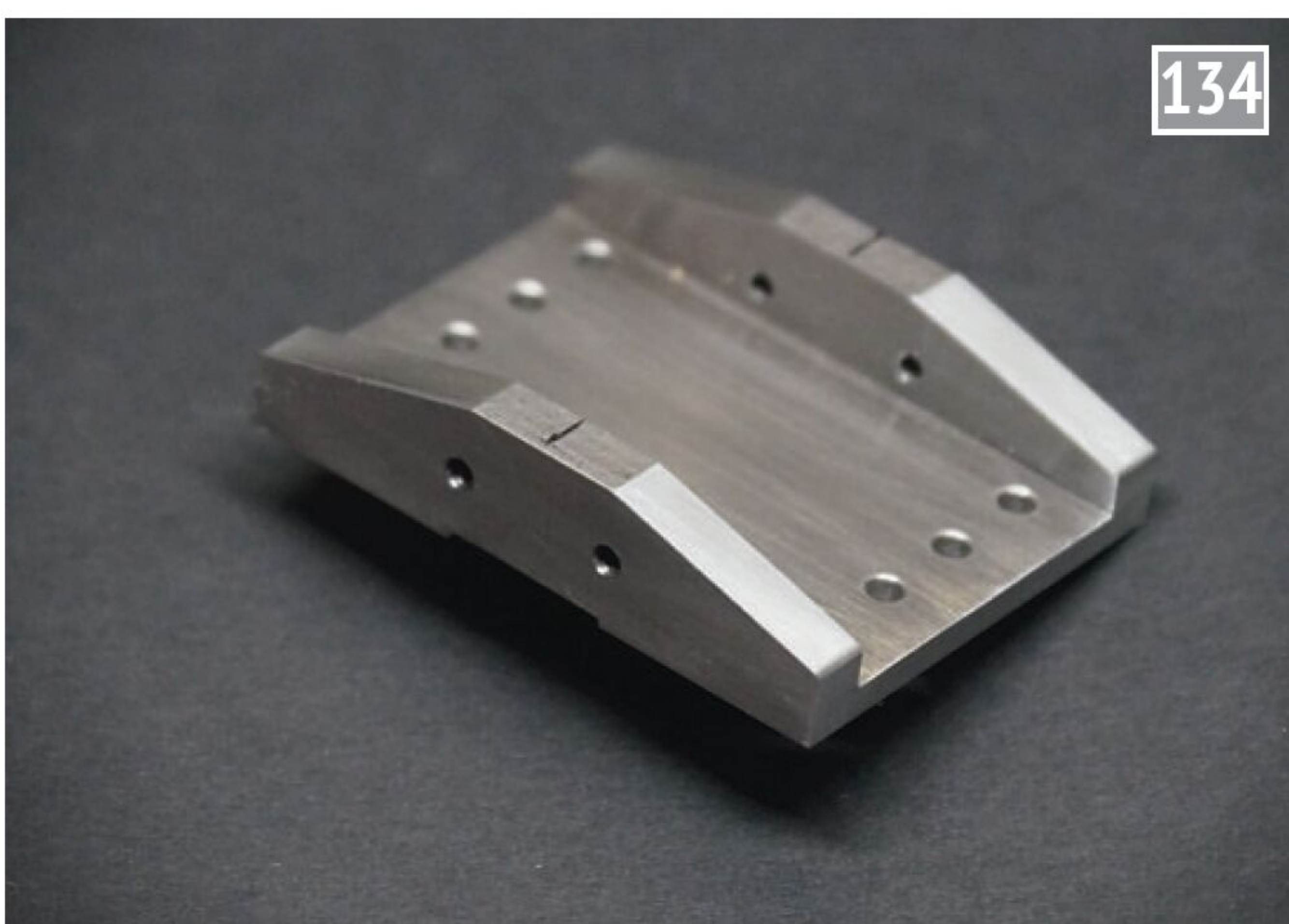
There is a small clearance step in the underside.



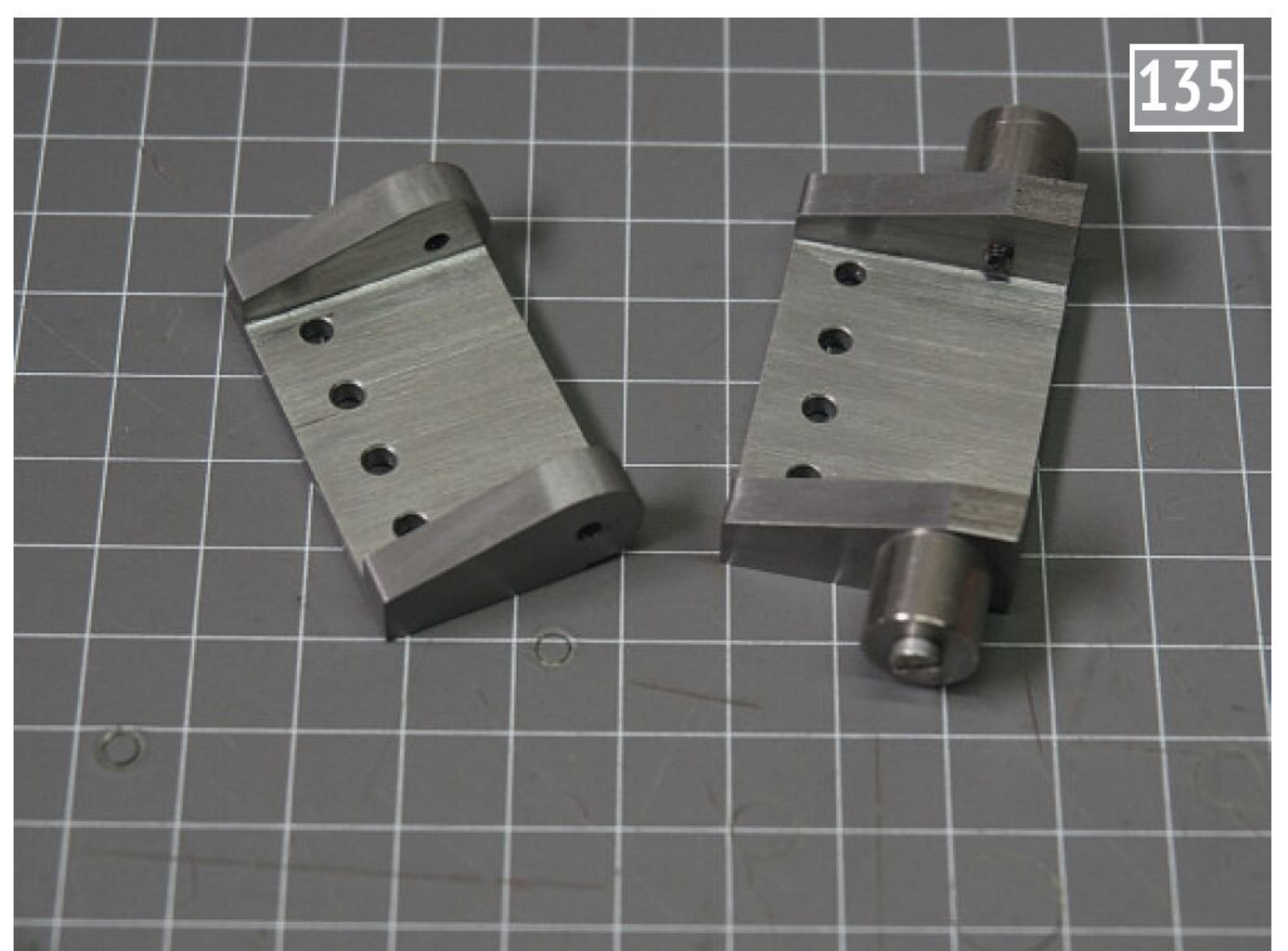
The side profile isn't critical but the pivot holes need to be the correct distance from the end.



A sine vice makes it easy to set up the slope of the sides, but the parts could be gripped in an ordinary vice just as readily.



After a bit of finishing with 600 grit 'wet-or-dry' the two pieces are ready to be separated.



Filing buttons were used again to round off the ends.

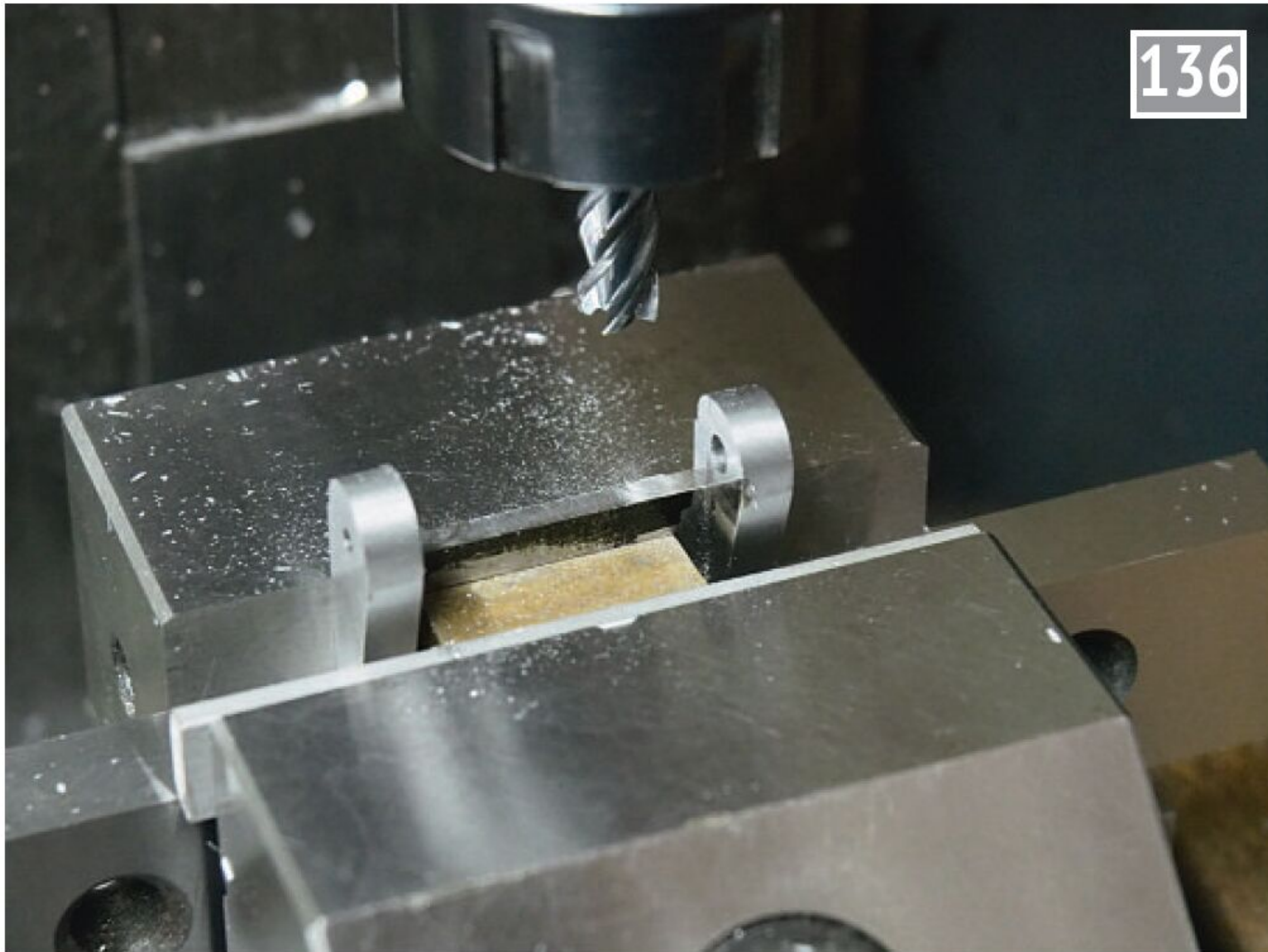
has a left-hand thread, but this isn't vital.

The fulcrum brackets (**fig 24**) would be good subjects for investment castings but

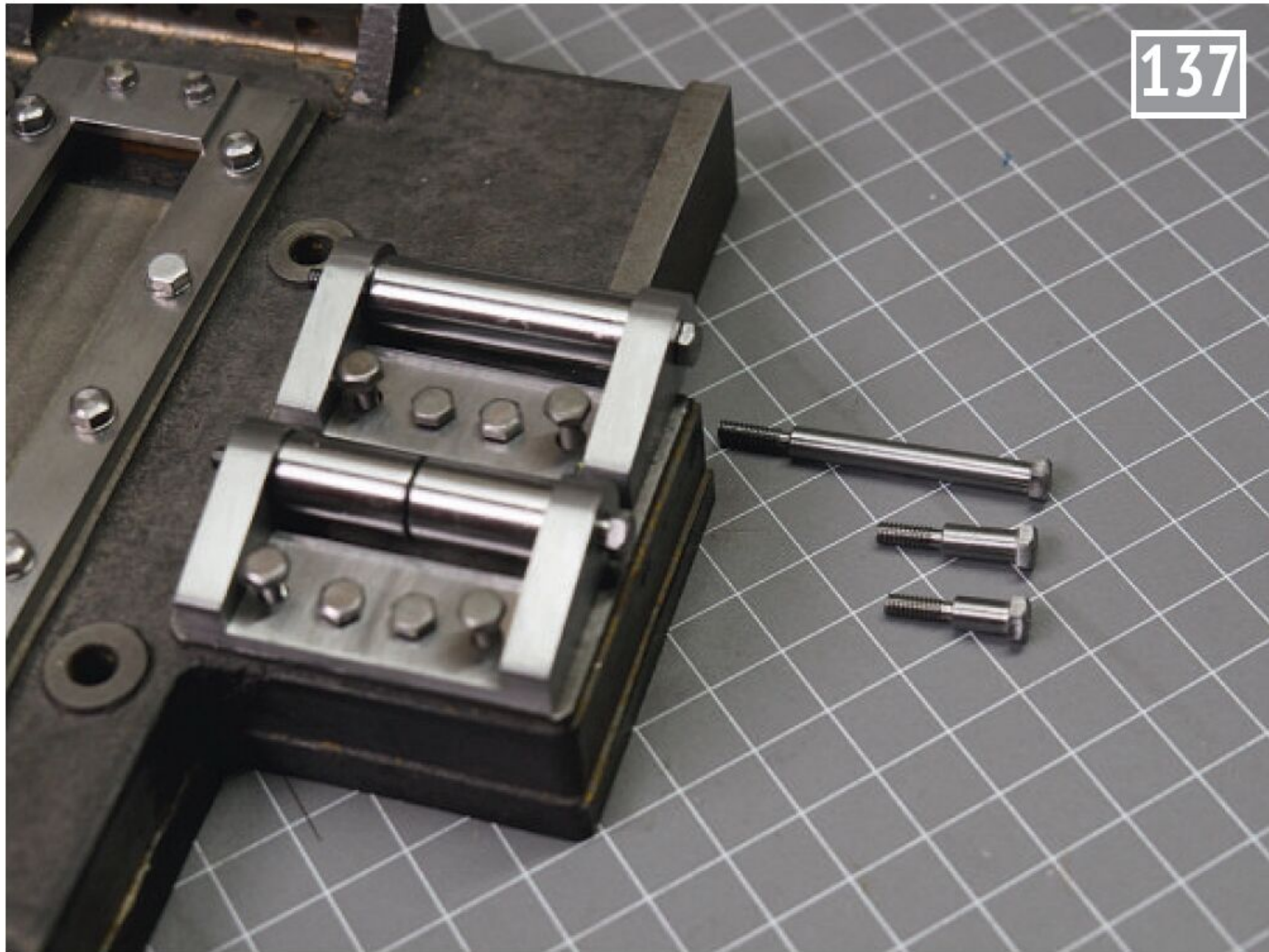
lacking these then they can be carved from the solid as a pair, starting with the central trough (**photo 129**), cleaning that up to a good finish then drilling

the holes (**photo 130**). There is a small clearance step on the underside (**photo 131**) and then the side features (**photos 132** and **133**) can be set out and

machined. This, after some cleaning up, gets us to the stage shown in **photo 134**. After cutting the two bits apart another set of filing buttons



The final operation on the brackets was to machine in the clearance between the two 'horns'.



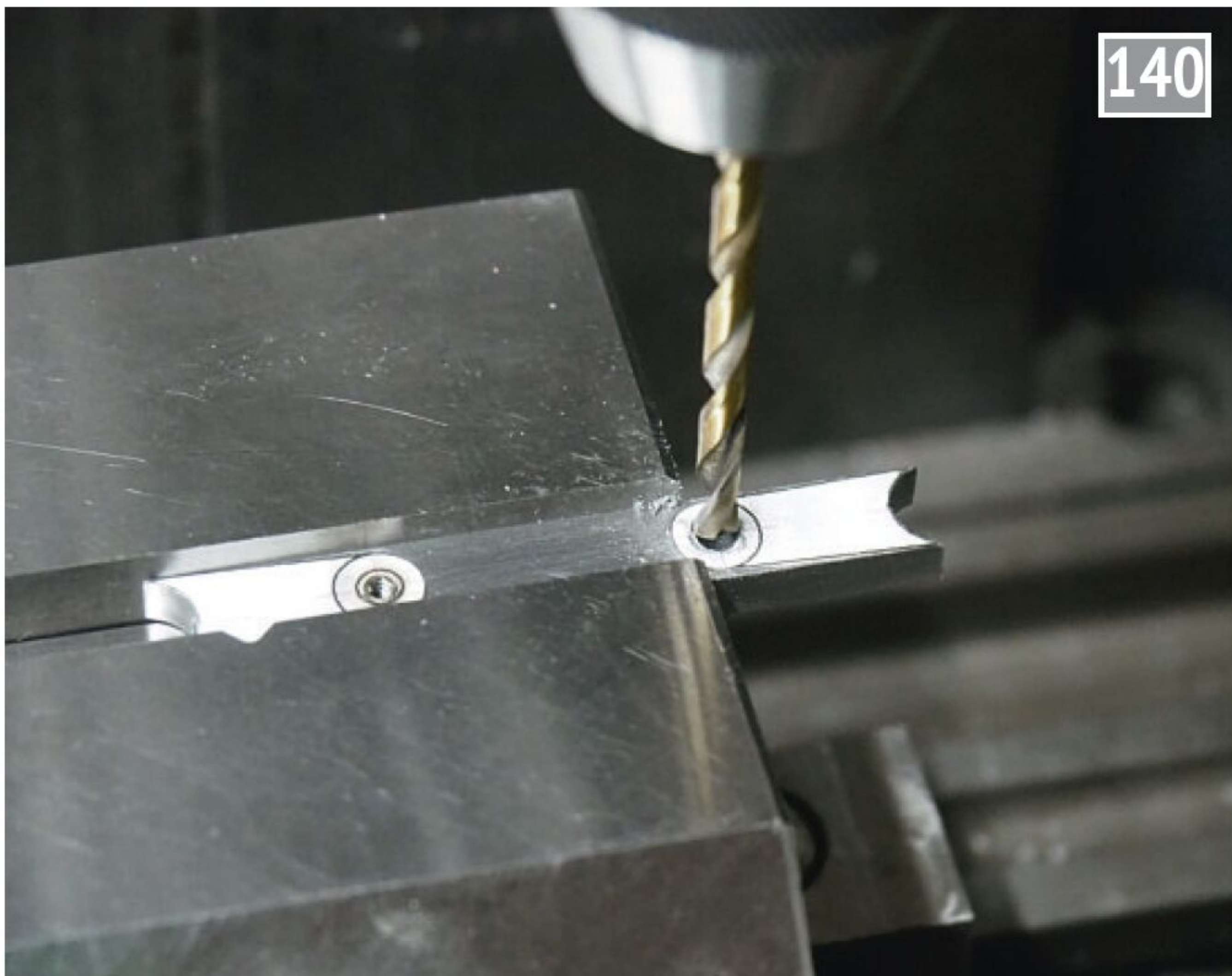
A temporary fit-up on the slide casting with some pivot pins as well.



The rockers were built up from stock round bar and flats milled to size.



Cutting the scallop in the lower end of one of a pair of uprights ...



... which were then drilled for the upper rocker pins ...



... and drilled axially for a peg to hold things together during assembly.

help to produce the rounded ends (**photo 135**). **Photograph 136** shows the final operation to remove metal from between

the 'horns' of the brackets. The final products, along with some pivot pins and other bits, are shown in **photo 137** in what will

be their final places on the slide casting. It would also be useful to have castings available for the

rockers (also on fig 24) but in their absence, fabrication seems to be the best option for making these parts. The



142

The angles of the sides don't need to be very accurate, but it will show if they aren't all the same.



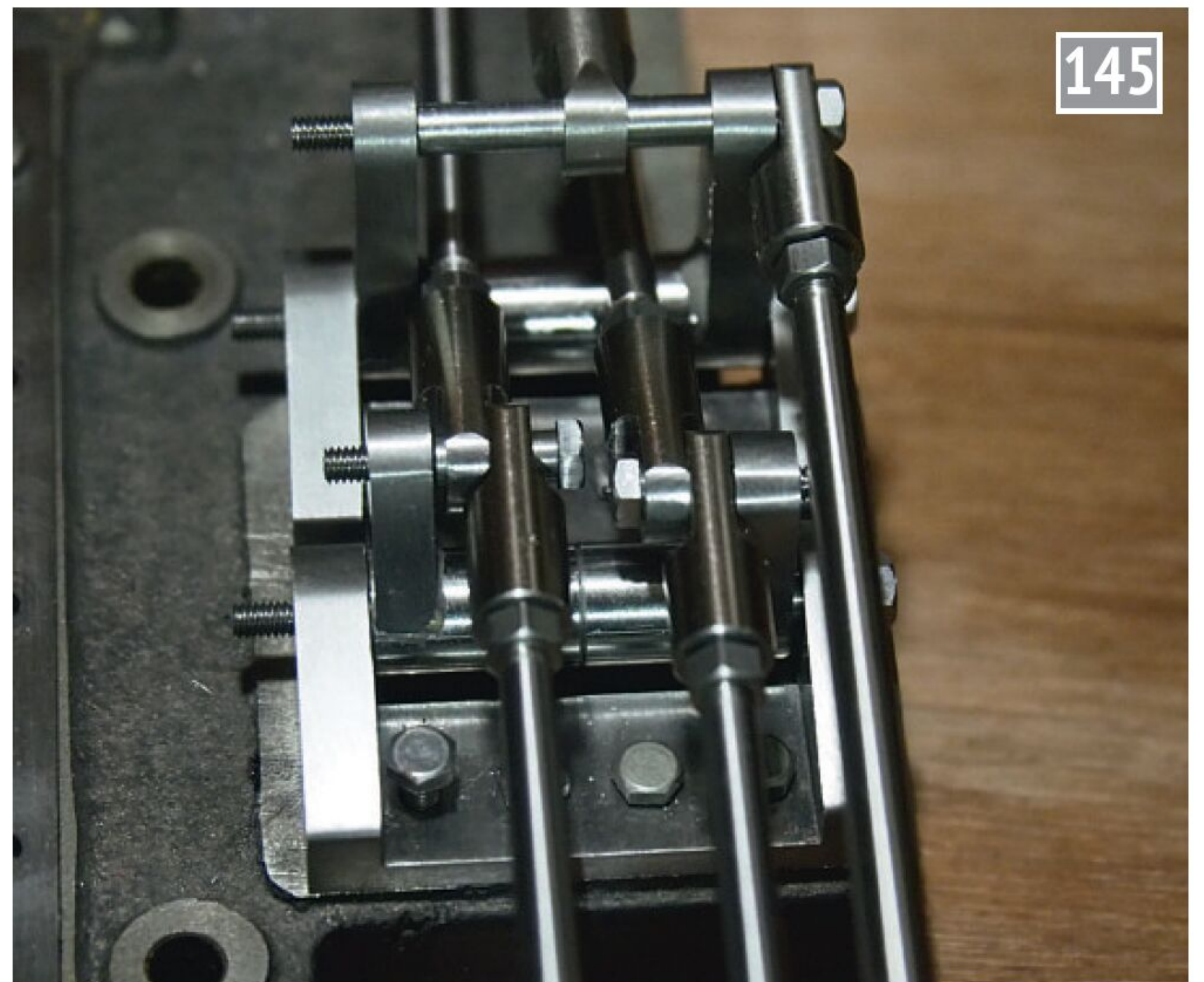
143

It was probably over-kill to tilt the mill table to machine the sides, but it did make it easy to get the angles the same.



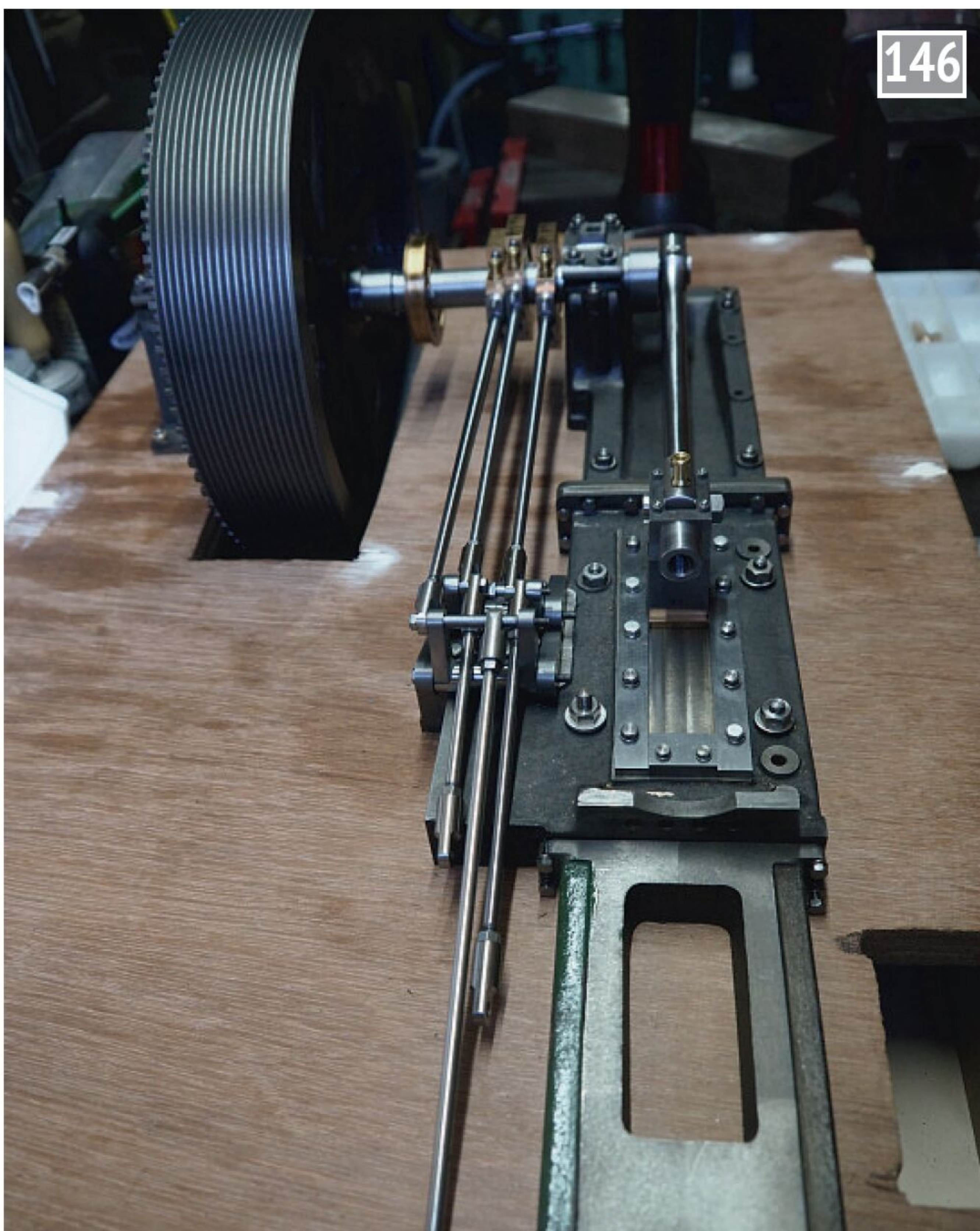
144

The parts were assembled using JB Weld.



145

Something to compare with fig 22.



146

Progress so far. This view emphasises just how elongated the engine is. It will be longer still with the LP cylinder and air pump added.

materials are stock sections (**photo 138**) (although I didn't have any 3/16 inch flat at the time and had to mill down larger stuff) which I chose to fix together with JB Weld. One joint later failed due to an inadequate layer of epoxy and had to be re-done and it's possible that silver soldering would be a more reliable option. The ends of the bars were scalloped (**photo 139**) to fit the axles and the sides marked out for the holes and angles (**photo 140**). Holes were drilled for pegs to hold the assembly together while the epoxy set and provide a bit more strength (**photo 141**). The sides were shaped in the mill (**photos 142 and 143**) and the top ends rounded off using filing buttons (again).

Photograph 144 shows the finished double arm rocker. The various rocker pivot pins were turned down from bar large enough for the hexagonal ends to be formed from the solid. In **photo 145** you can see where spacers will be needed to keep the rods in line, but these can be left until the valve gear is all together and working and the actual positions are known. This is really important for the slide valve rod as this has to be threaded through the Corliss valve gear and clearances are very tight there.

Much of what is visible in **photo 146** has already been described with the connecting rod and its bearings coming next time.

● To be continued.

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Another Steam Plant

PART 3

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

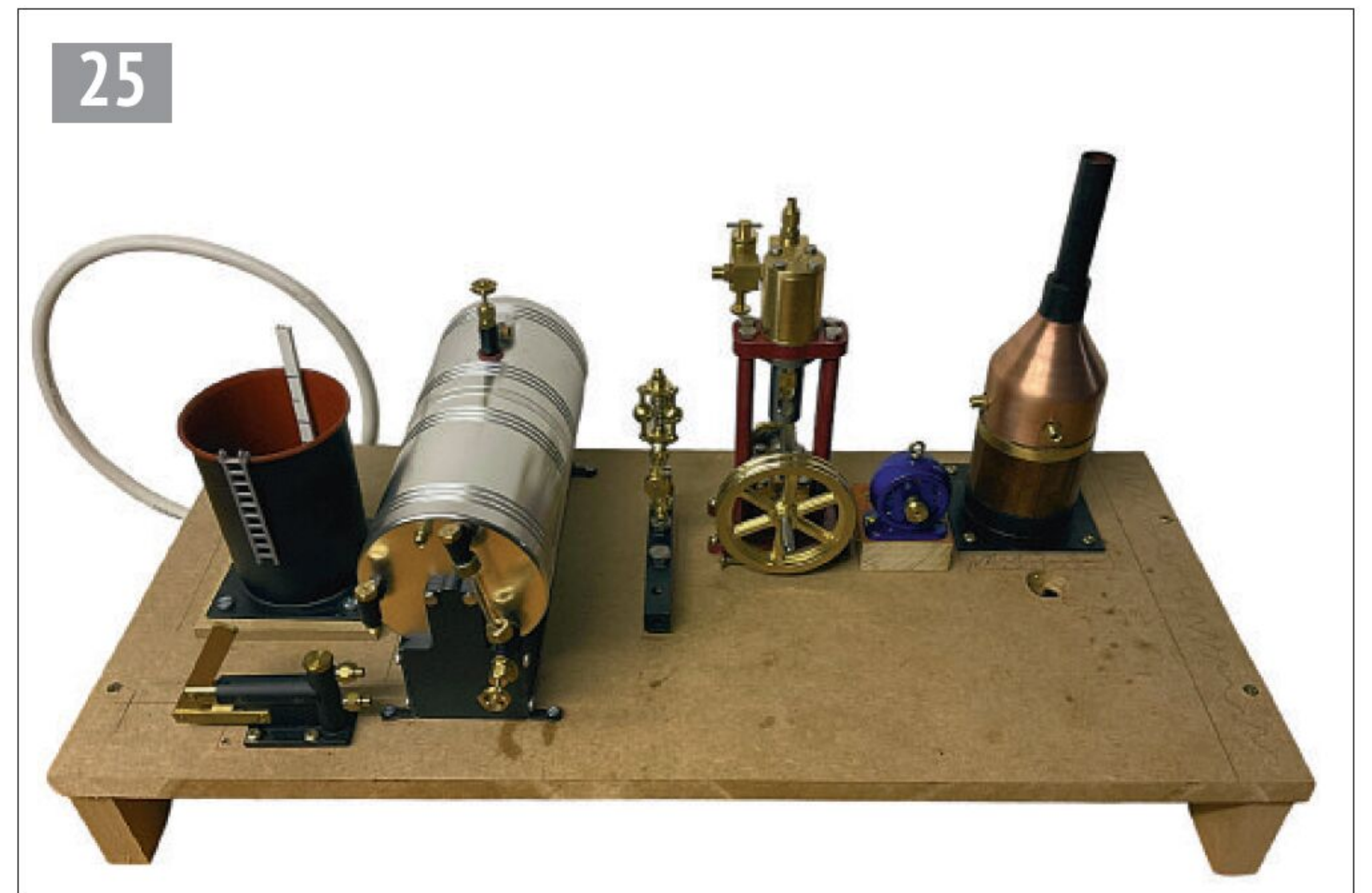


Continued from p.716
M.E.4756 November 15

Having assembled the engine and discussed some of the accessories and components I intend using on my steam plant, I am now at the stage of positioning everything on a 'dummy board' and making and connecting the necessary pipework.

The practical layout of the components confirms there is plenty of space between the parts and helps in determining the shape and bends in the pipework. The pipework should be neat and the connections should fit correctly when finally mounted on the actual board.

The dummy board was made the same size as the actual board intended for the finished plant and the boiler and water tank were the first items to be secured in place. All the components must be securely fastened to the board and at the same time be accessible and easy to remove from the board for future maintenance. The boiler and engine were fastened down with threaded nuts and bolts from underneath, which could be easily unscrewed or tightened if necessary. The correct



The layout of the steam plant.

relationship and alignment of the different components was carefully measured before clearance holes for the bolts were drilled in the top of the board. The layout is shown in **photo 25**.

At this stage some thought can be given to disposing and the emptying of the condenser and any water released by the boiler blow down valve. The waste water should be contained and directed to run underneath the surface of the board, keeping the water well clear of any of the electric

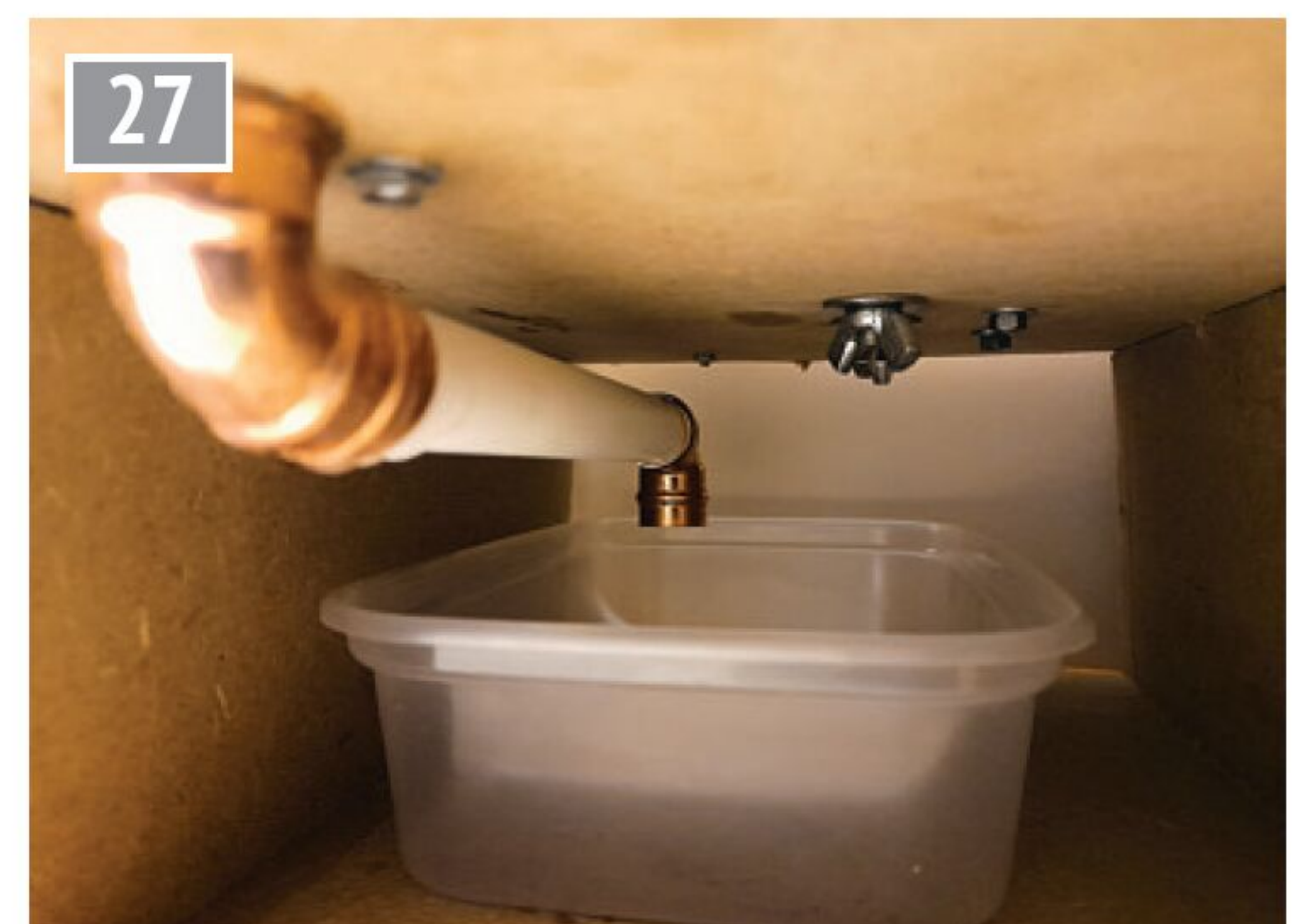
wiring or electric components. This is one of the advantages of making a raised board with space underneath, providing easy access to the nuts and bolts and also waste water containers.

Photograph 26 shows the wing nuts which secure the steam turret in place and in **photo 27** one of the pipes used to carry the waste water from the condenser.

With all the component parts, the engine and boiler fastened down, a start could then be made on bending and



Nuts securing the steam turret.



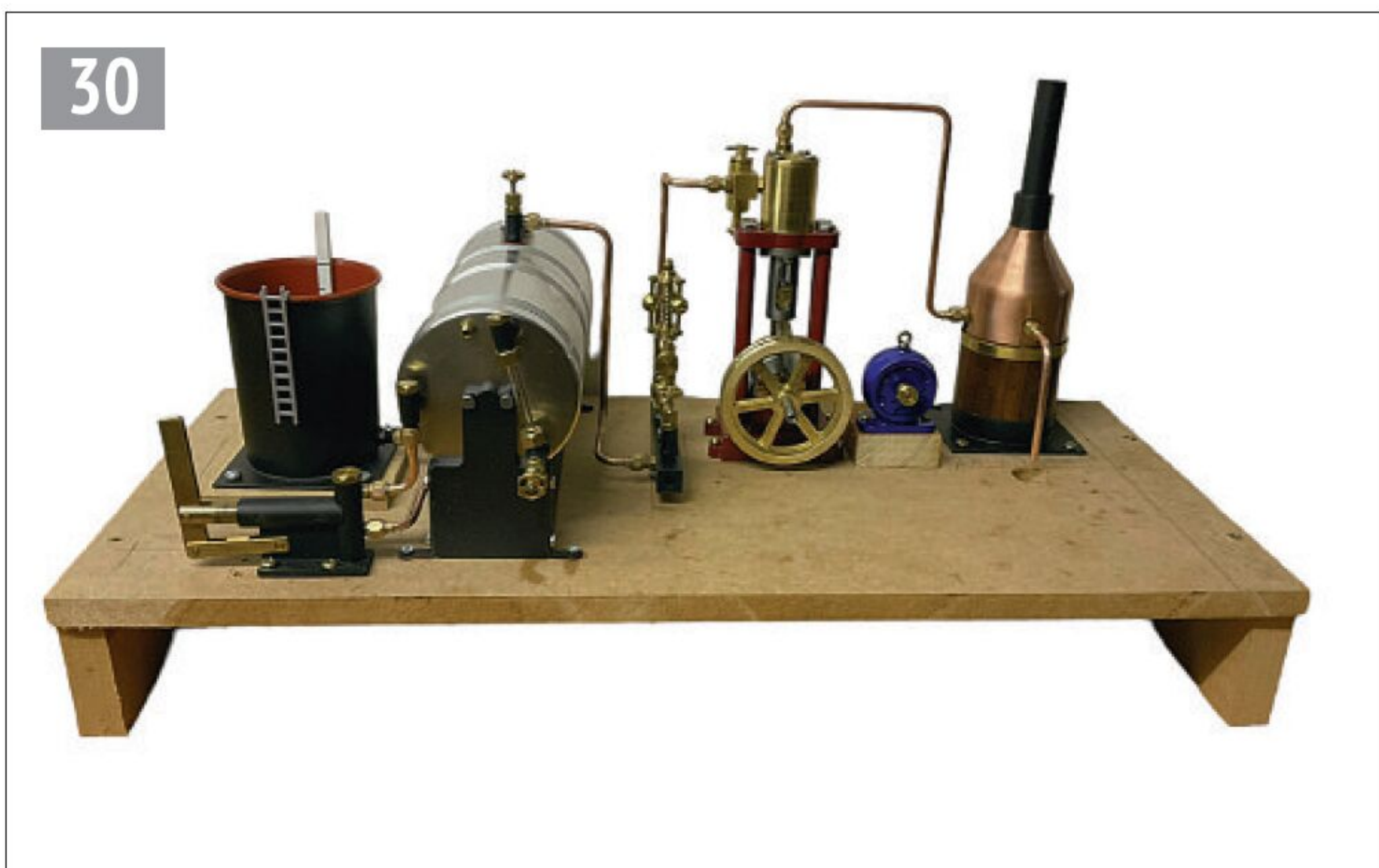
Waste water pipe from the condenser.



Pipe bender in action.



Pickling the pipework.



Pipework installed.



Adaptor for the air compressor hose.



Wooden base, with removable front.

running the pipework from one component to another. I wanted the pipe work to be visible, neat, and tidy. The distance in height between the boiler, engine, and condenser meant a number of runs of pipework with 90 degree angles would be required in order to connect everything together. I find the bending tool shown in **photo 28** most useful in this respect, enabling the pipe

lengths to be measured and the bends made accurately in the right place. The pipework was all made at the same time, the nipples were silver soldered in place and the pipework checked to make sure it all ran and fitted comfortably between the different components. After soldering, the pipework was then placed in a bath of pickling salts in order to remove any dirt and oxidation (**photo 29**).

Photograph 30 shows the plant with the pipework connected to all of the components fitted on the board. All the connections were tightened and the engine and pipework could then be tested with an air compressor for leaks.

Photograph 31 shows the steam turret with the adapter for the air compressor hose in place.

The engine bearings and all moveable parts were oiled and the plant tested and operated for a short while at 10psi.

I was very pleased with the performance of the engine at this relatively low pressure. One or two small air leaks were encountered in the pipework joints, but these were quickly tightened and rectified.

A small air compressor is most useful in this respect. Most modern small air compressors are fitted with both a regulator and pressure gauge. You can pre-set and adjust the air pressure and take your time tracing any air leaks that may be present as well as adjusting the timing and performance of the engine if necessary. Work could now start on finishing the actual board that was to house the steam plant.

The rear of the base is open, and the front of the base constructed to be removable (**photo 32**), giving easy access to the underneath of the board. The base is constructed from MDF board which is strong and stable; it keeps its shape and is easy to work with. It does not, however, stand up to water, and must be well sealed and treated before any waterproof paint or other finish is applied. The board can simply be painted, but as with my previous model of a steam plant, I like to make the plant look visually interesting as well as practical and operational.

In the next part of this article I show the finished board with the voltage regulator and wiring in place and some images of the finished plant in operation.

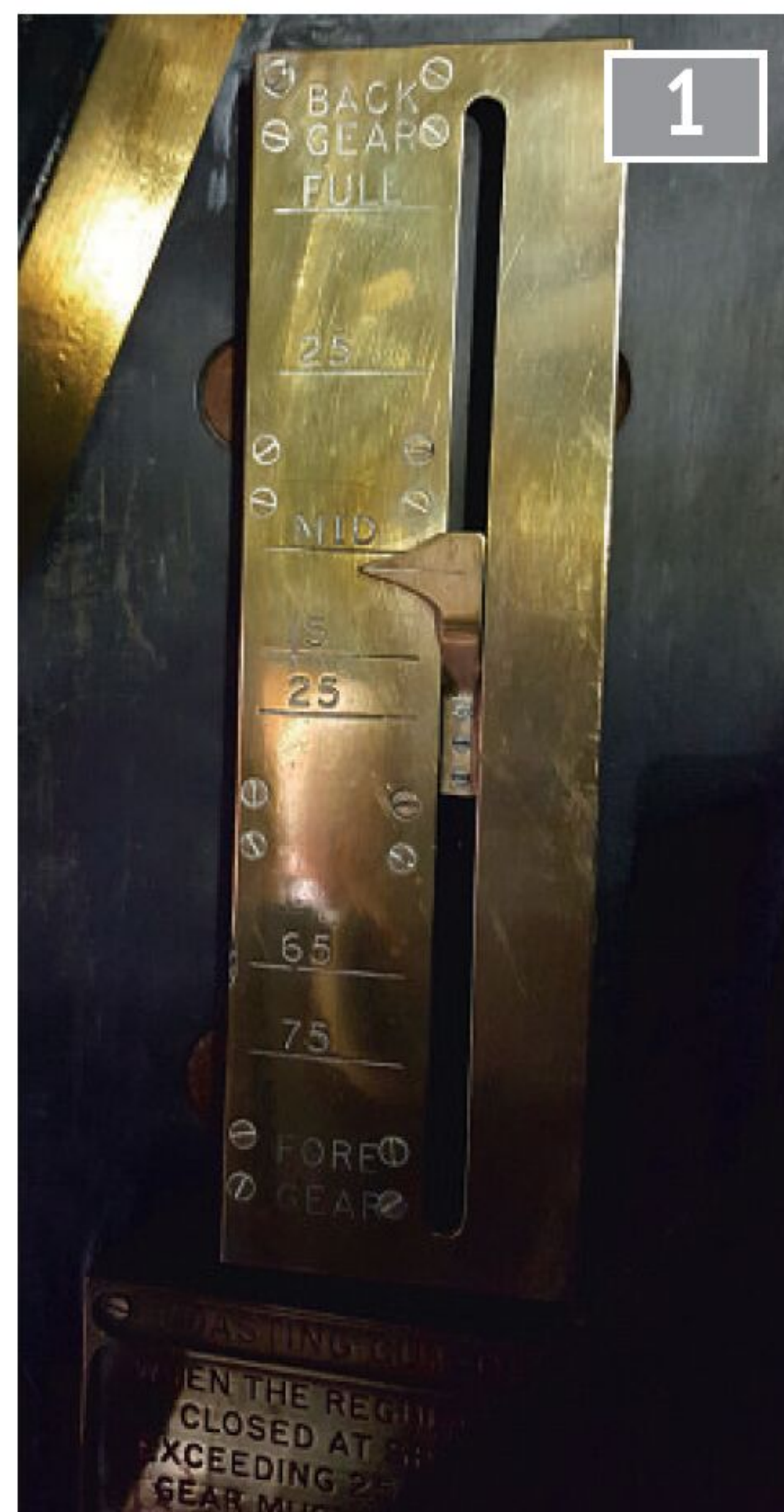
● To be continued.

Flying Scotsman in 5 Inch Gauge

PART 62 – REVERSER STAND (CONTINUED)



Painting by Diane Carney



The reverser plate gauge on Flying Scotsman.



Where the reverser plate gauge is mounted.

now before fabricating the sleeve itself. I will though make the screw as I need to work out the length of the marking strip and position of the plate.

First, some pictures to show the relative parts. **Photograph 1** shows the plate as it is today on *Flying Scotsman*. I took this picture in York in 2016, a great reference for those building a Gresley Pacific.

Technically, this is not correct for my chosen era as it shows a 75% cutoff; for my chosen late 30s, it should be 65%. As I have zero chance of finding a close-up image of the correct plate I have decided to use this later version - no one will know ... well except you lot...

One thing that I do need to change though is the mount

that the plate sits on, as seen in **photo 2** - most of what's seen in this picture was not there in her previous life. I will therefore ditch the somewhat angular back mount and follow what *Mallard* has today and what also seems to be present in an early image of Great Northern's backhead when launched. This image (**photo 3**) is what I am aiming for and for lack of a photograph from my era is probably the most likely state of *Flying Scotsman* for the late 30's. Please excuse the poor quality, it's been blown up a lot for me to be able to see the detail. This also shows the marking strip between the plate and the reverser screw. Although not very clear here we do have some great photos of *Mallard* easily available online, which show the same type and are thus a good quality reference.

Peter Seymour-Howell

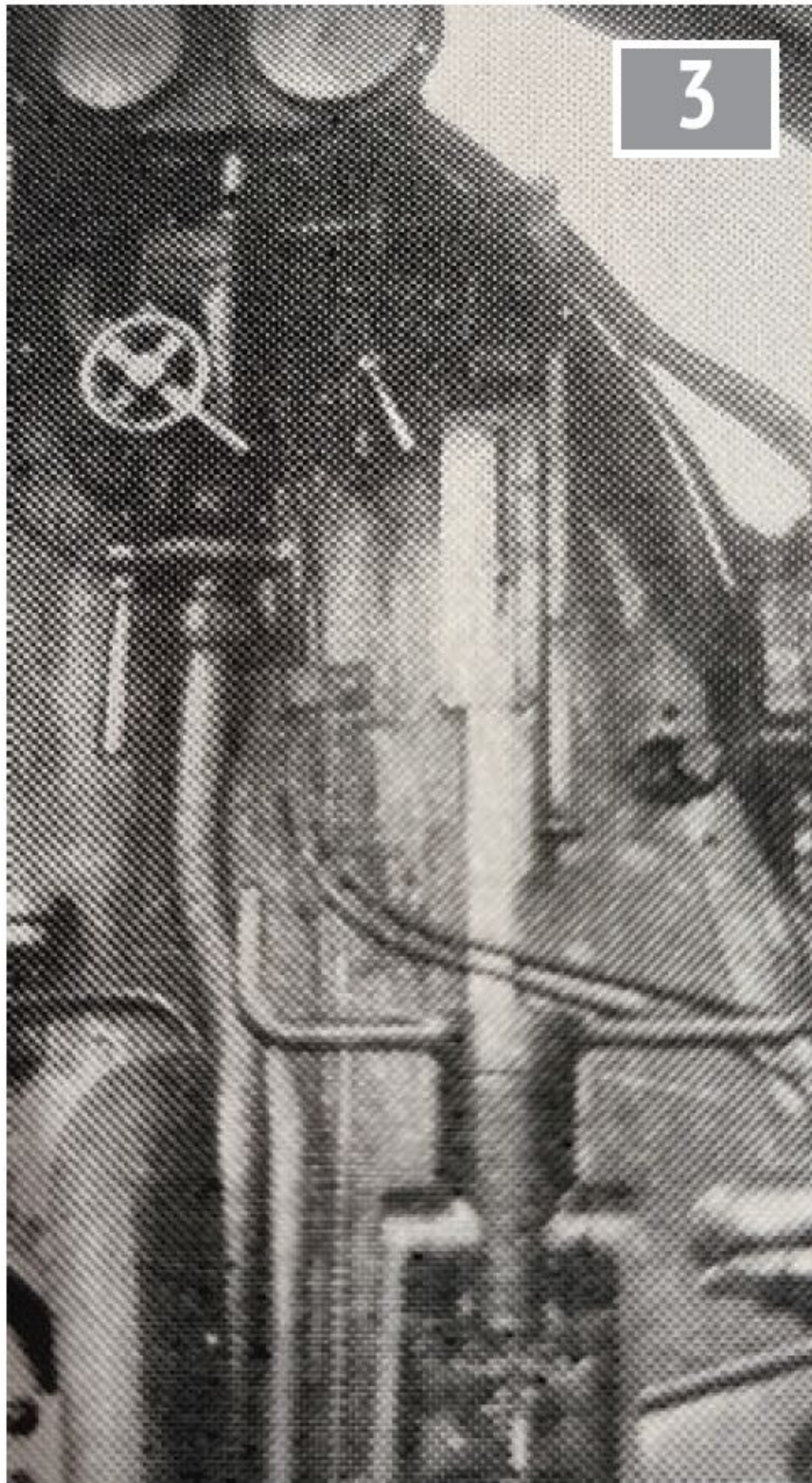
builds a fine, fully detailed model of Gresley's iconic locomotive to Don Young's drawings.



Don says 'We now come to an area where everything is interdependent'.

Actually he says this later when reaching the construction of the sleeve, thrust plate and nut. Still, the next part is also very much interdependent of other later parts. The brass dial plate gauge for example is related very much to the backhead cleading, its fitting and the position of the plate and the strip that connects the reverser shaft to the plate. I, therefore, decided to take a look at these

Continued from p.703,
M.E.4756, November 15



A view of a Great Northern backhead in the 30s.



Using square brass tube to hold the work.



Screw and shaft temporarily assembled.



A nicely etched plate.



Machining of the rear of the plate.

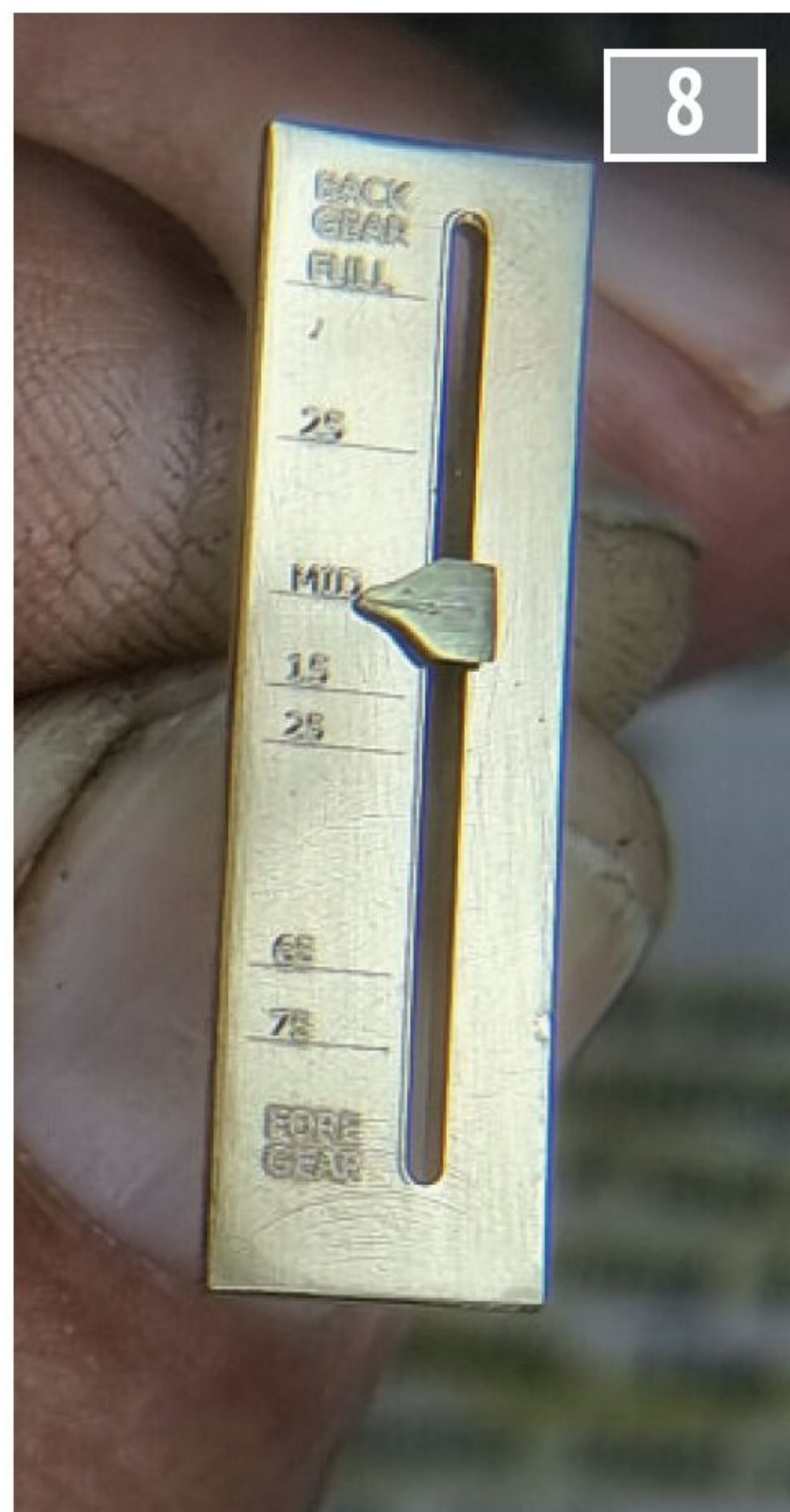
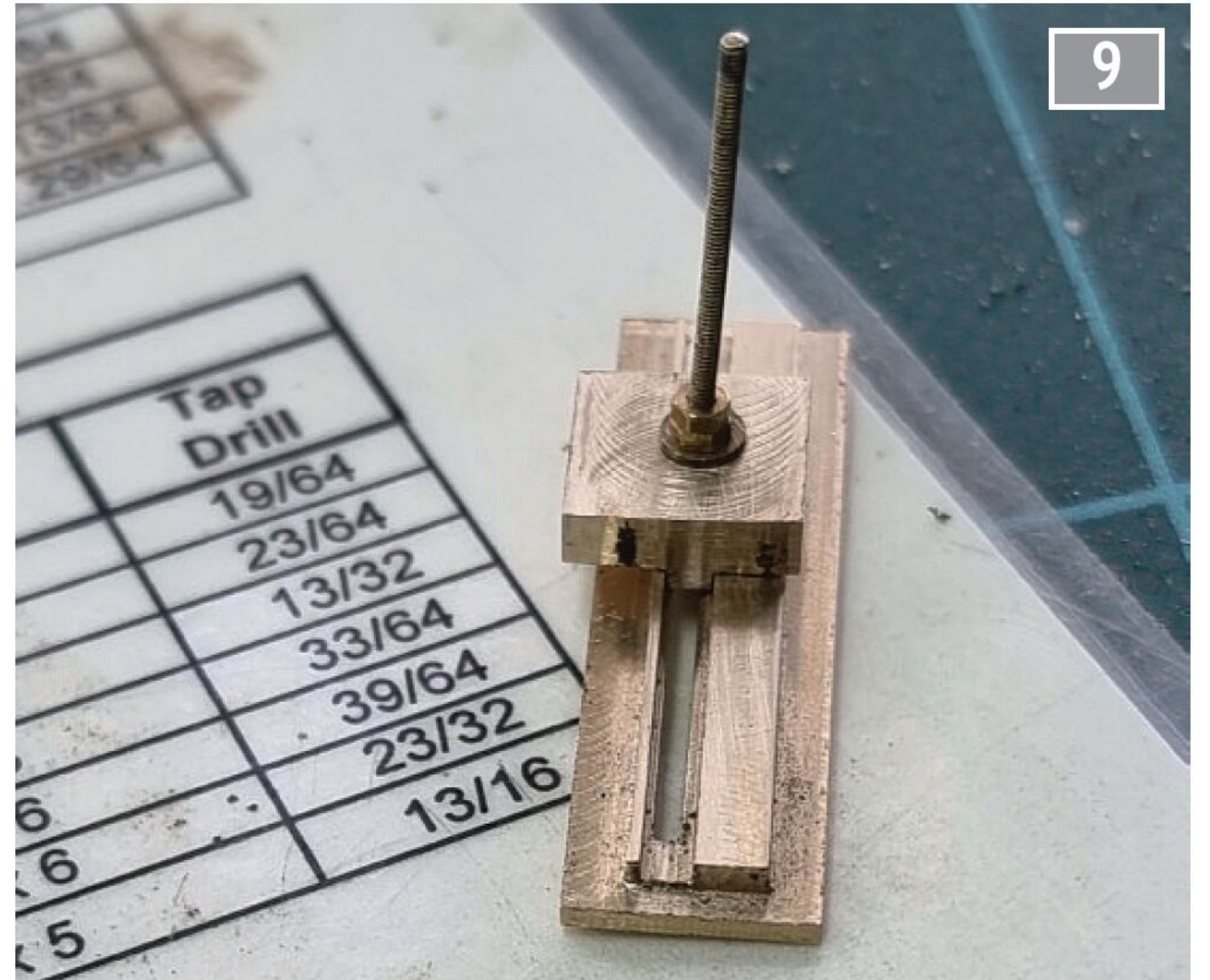


Plate with marker.



Rear view after assembly.

Okay, so on to the next part which is the screw. Don describes a simple 5/32 inch forked rod which is cross-drilled to hold the marking strip. I have chosen to replace the rod with a length of 3/16 inch square bar, silver soldered to the 5/16 inch fork and then turned down to 5/32 inch for a length of 1 1/8 inches, with a 5/32x32 Whitworth thread.

This gives me a flat surface for the marking strip to sit flat on, much stronger than a cross-drilled 5/32 inch rod which will not be easy to get at if it fails. The making of the screw is fairly straightforward and I will share a tip here as my lathe's four-jaw chuck can't close up far enough for this size bar - K&S square brass tube comes to the rescue as shown here (photo 4).

Here is a picture to show the completed screw temporarily attached to the shaft (photo 5). I have also turned up a small flanged pin to connect the two together that fits easily inside the stand - this will be cross-drilled for a small split pin.

Some years back my son James did some laser etching at his old work for my model. We've not seen these in action yet but the batch included the brass indicator plate which was scaled from the photograph shown at the beginning of this update. I can now finally make use of my son's fine work (photo 6). The size of the plate

was taken from Don's drawing and the etching was scaled from the photo, as said.

The first job was to carefully machine a 1 mm narrow slot as seen in the photograph. The next job was to machine the reverse side. First, a step was machined around the edge which will allow the plate to sit in a mount (photo 7) and then a 1/16 inch slot was also machined over the 1 mm slot for holding a plate to slide in.

A marker was then cut/shaped from a piece of brass shim and a 14BA threaded rod (cut from a 14BA screw) was silver soldered to its rear (photo 8).

Photograph 9 shows the reverse side when assembled. The back plate still needs sizing in this picture and you can get an idea from the marks I have put on the sliding pad. It also still needs to be thinned for clearance. I'll do this once I have decided on and made the mount. This is very much still a work in progress.

The last piece of the puzzle for the gauge is the various screws that can be seen in photo 1. I am still awaiting delivery of the very small 16BA brass countersunk screws ordered. Wanting to get on I will, therefore, cover this later. I will also give the plate a highly polished look, as seen with the prototype.

● To be continued.

The 2024 Usk Country Show

John Arrowsmith recalls his day at one of the oldest country shows in the country.



This large scale one day show is located just outside the town of Usk near the village of Gwernesney and has been there every year since 1844. It is now one of the biggest one day shows of its type in the UK.

The day dawned bright and sunny so when I arrived the activities of this country show were in full swing. I made my way through the showground to the area known as Steam Corner. The large marquee and the provision of both full size and smaller models had been organised by Phil Pritchard together with other members from the Newport Society of Model Engineers. Outside the marquee the Hereford Preservation Society had provided a good selection of the smaller engines that used to power farm machinery in times past.

The inside display of models was quite comprehensive with sizes ranging from a 6 inch scale Allchin traction engine to the small military dioramas. Outside, the full size Foden Type D timber tractor circa 1931 owned by Tristan Jones looked a fine sight in the bright sunshine (**photo 1**). Along with this engine John Kidley's 6 inch scale general purpose Burrell was ticking over nicely and was attracting plenty of interest (**photo 2**). A 4 inch scale Burrell double crank road



The Foden D Type tractor circa 1931.

locomotive built by Keith Morris was also attracting a great deal of attention (**photo 3**). To accompany these engines the Newport Society of Model

Engineers had their portable track and steam locomotive in operation giving rides to anyone who wanted one. They were kept quite busy for most



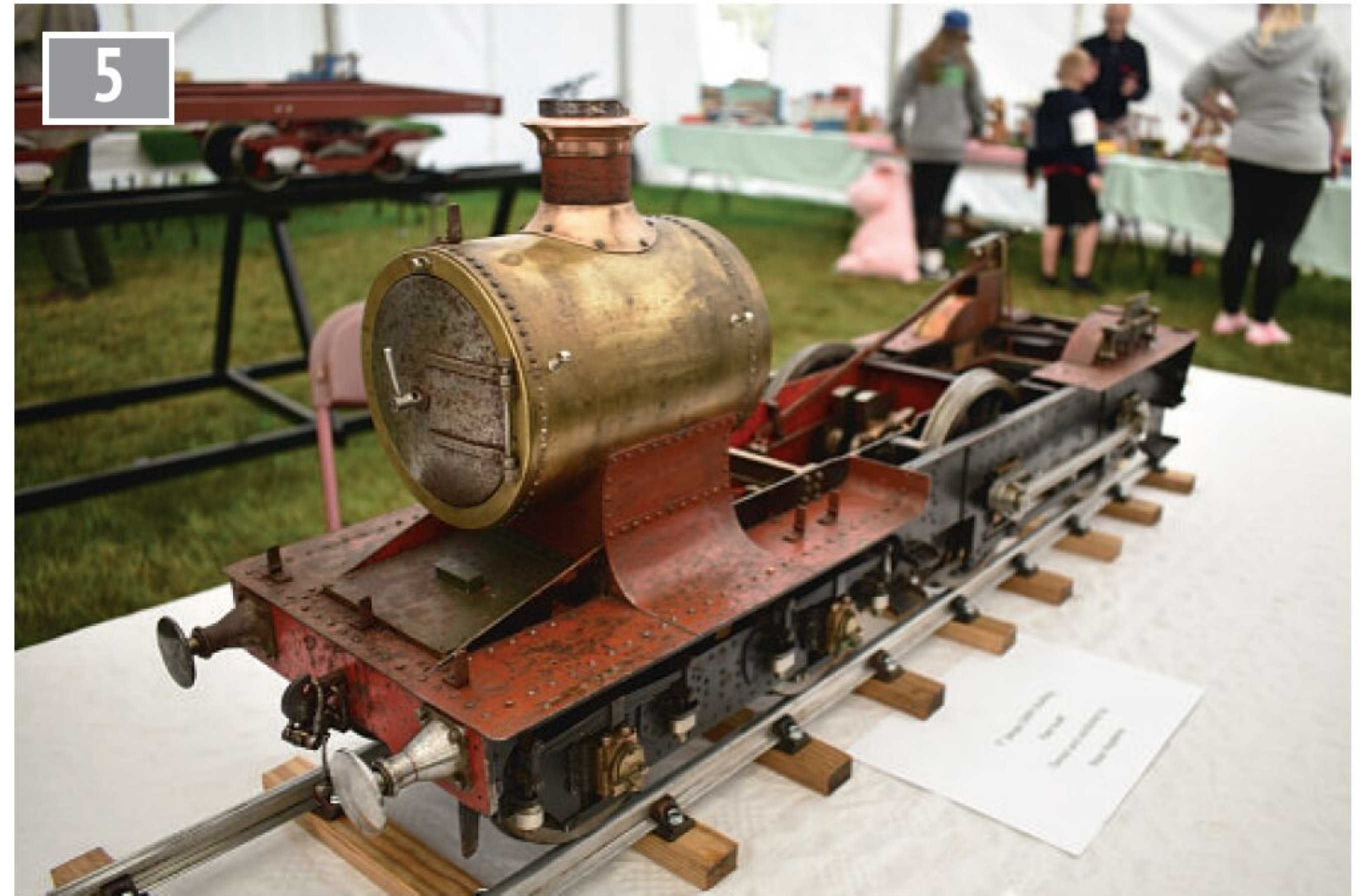
John Kidley with his 6 inch scale general purpose agricultural engine.



The 4 inch scale Burrell owned by Chris Morris in steam and getting some attention.



Tony Hall, the Newport Society chairman, at the regulator of the club's Simplex locomotive.



This 5 inch gauge example of a GWR Bulldog locomotive is owned by Ross Hopkins.



Keith Morris is presented with the John Haining trophy.



Eddie Atree's 2-6-0 Mogul chassis of a Sweet Creek American locomotive.



John Abbot is building this large American locomotive in 7 1/4 inch gauge.



A walking stick with an oscillating steam engine within the stick.

of the day (**photo 4**). A partly built GWR Bulldog class 4-4-0 to the Keith Wilson design now owned by Ross Hopkins showed off some excellent attention to detail (**photo 5**).

One of the features of the day is the presentation of the John Haining Trophy for the best traction engine on display at the show. John Haining was a regular contributor to

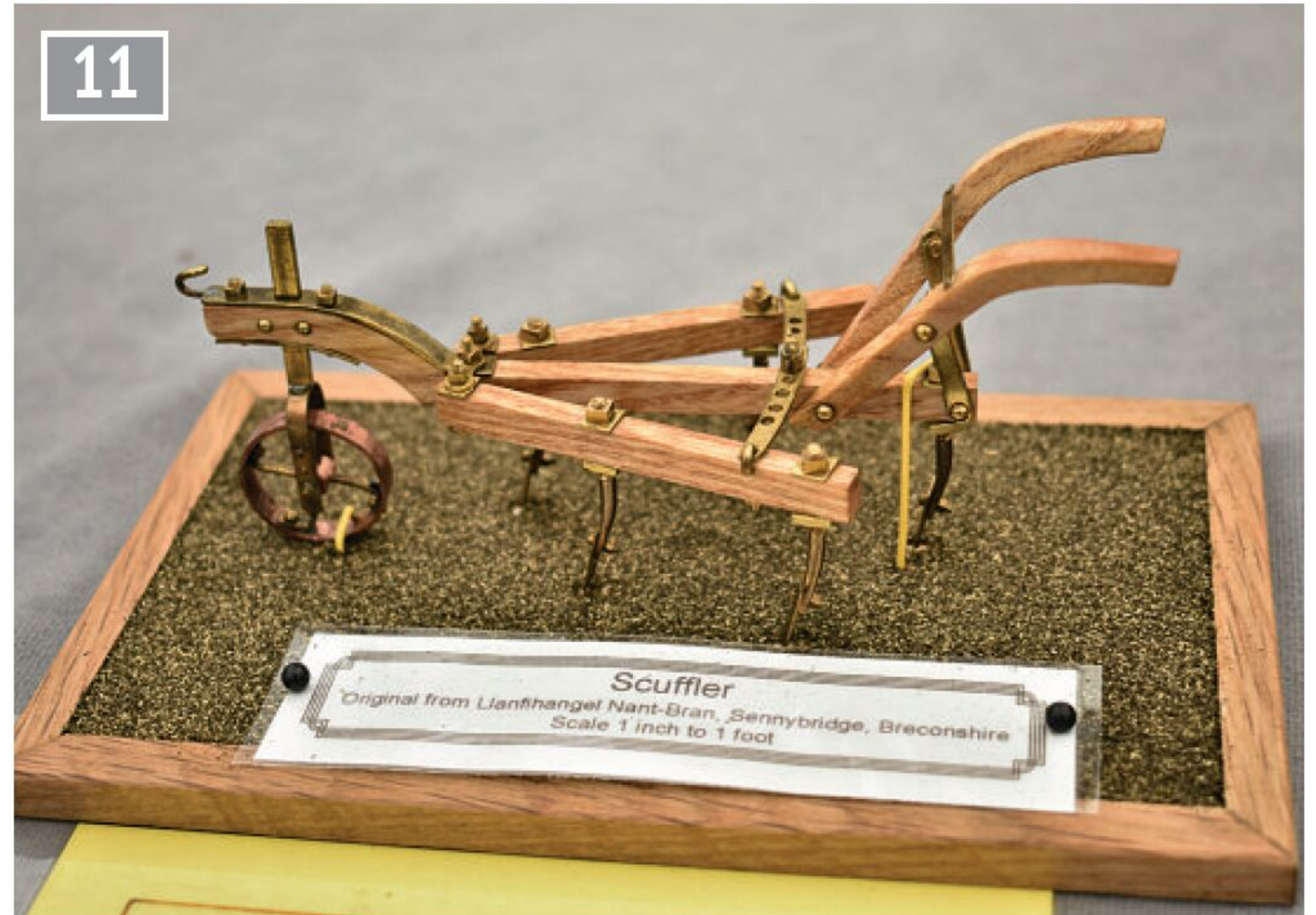
Model Engineer magazine some years ago now and his range of traction engines and associated vehicles were a well constructed range of models. John used to organise this part of the show for many years and to keep this relationship going they now present a nice little trophy to the best traction engine on show. This year it went to Keith

Morris for his excellent 6 inch scale Allchin traction engine (**photo 6**). Not quite finished, the engine shows some superb engineering skills with, for example, all the gear wheels used having been made by the builder, a worthy winner of this trophy. Another large model under construction and again showing some fine workmanship was the Sweet

Creek American narrow gauge 2-6-0 Mogul locomotive being built by Eddie Atree in 7 1/4 inch gauge. This is a large engine which when completed will need a large railway to be able to operate (**photo 7**). It has 3 inch diameter pistons with a 4 inch stroke and in working order will weigh around 700 kg. John Abbot, a member of the Newport Society, is also



A nice example of a Stuart Turner 'Victoria' Twin cylinder steam engine built by Colin Thomas.



One of John Tonen's superb farm implements was this little 'Scuffler'.



A fine collection of Mamod engines and equipment owned by James Tonen.



Julian Woods and his apprentice Danny Jones at work on the hot air engine display.



Julian Woods latest experimental engine is this hot air heat pump.

building a large 7¼ inch gauge American locomotive and here he was displaying the tender which in itself entails a great deal of work (**photo 8**). One intriguing exhibit was the walking stick with a little oscillating engine in the top. I cannot think why anyone would want an oscillating engine in a walking stick - but here it was (**photo 9**)! Colin



The display of matchstick models was by R & C Markey.

Thomas had a large display of horizontal steam engines of many different types which he has built over the years. His 'Victoria' twin cylinder engine and his small steam hammer were excellent examples of his workmanship (**photo 10**).

A real eye catching selection of models by John Tonen really told the story of the older side of farm implements.

All beautifully made from a range of different woods, John has done a tremendous amount of research into each of his models. Some he has found in all sorts of places like collapsed barns and then made detailed drawings before starting his model. In fact some of his drawings have been used to construct full size replicas of these old artefacts. Such is his attention to detail that John has made all the square nuts and bolts needed in his models because such things are not generally available from any retail outlet (**photo 11**). Alongside John's display was that of his son James who has collected a large number of Mamod models and tools, all well presented and fascinating to look at (**photo 12**). Another regular at this show is Julian Woods and his collection of hand built Stirling engines in their many guises. His assistant or apprentice is

Danny Jones who thoroughly enjoys working with Julian and is a really interested young man in everything to do with these remarkable engines (**photo 13**). Julian's latest work is the design and building of a hot air heat pump (**photo 14**). Very topical and politically correct these days, it works very well. Perhaps one of these will be the heating source for many people in the future. Who knows?? A large selection of matchstick models was another fascinating display of what must be a difficult modelling process in assembling all the matchsticks into recognisable models. Some are working of course which again cannot be that easy. I know it is not steam or model engineering as we know it but it is creative and demonstrates a high level of skill to get things right (**photo 15**). Phillip Heames was displaying some modern hot air

16



This Henrici hot air engine was built by Phillip Heames's father many years ago.

17



David Ayres with his 4 stroke I/C engine.

engines along with a model of an Henrici hot air engine built by his father many years ago (**photo 16**). David Ayres had his little four stroke I/C engine ticking over nicely for quite a long time (**photo 17**).

In complete contrast to everything else inside the

marquee the planetarium organised by the Usk Astronomical Society had a constant stream of visitors during the day and was kept very busy (**photo 18**). Finally I must mention the lovely little 2 inch scale Clayton & Shuttleworth steam lorry built

18



The Usk Astronomical Society provided a completely different experience with their planetarium.

19



This 2 inch scale Clayton & Shuttleworth Steam lorry was built by Alex Dobbs.

by Alex Dobbs which looked just right in its fine blue livery (**photo 19**).

In closing my notes on this excellent one day show I must thank Phil Pritchard and Bob Klinkert for all their help, enthusiasm and hospitality together with all the other

members from the Newport Society for organising this aspect of the Country Show. It was a real pleasure to attend and talk to the many people involved. Here's hoping it can all be repeated again in 2025.

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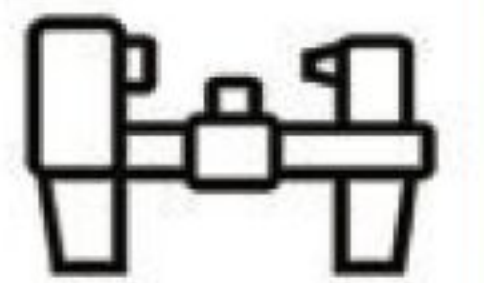
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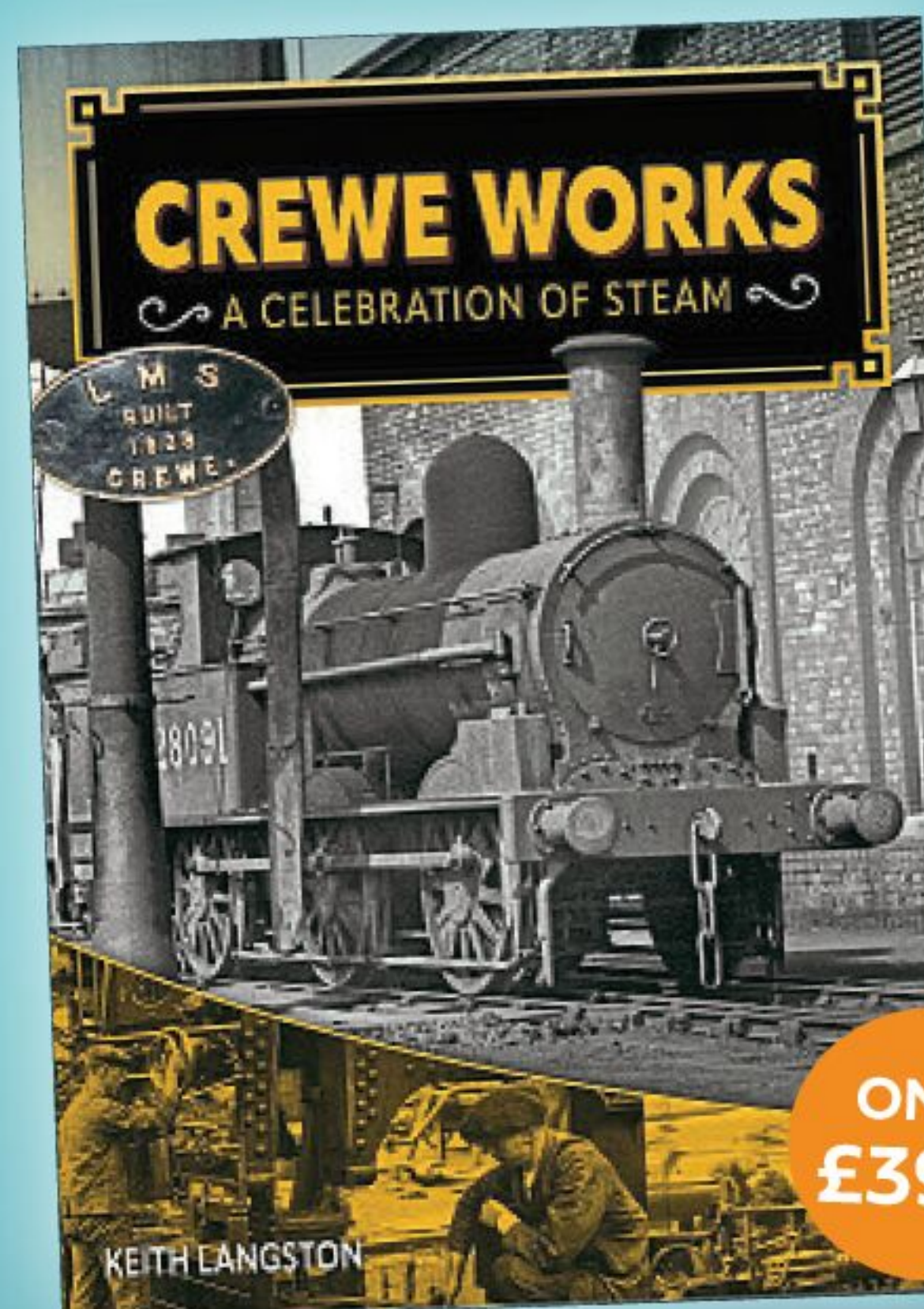


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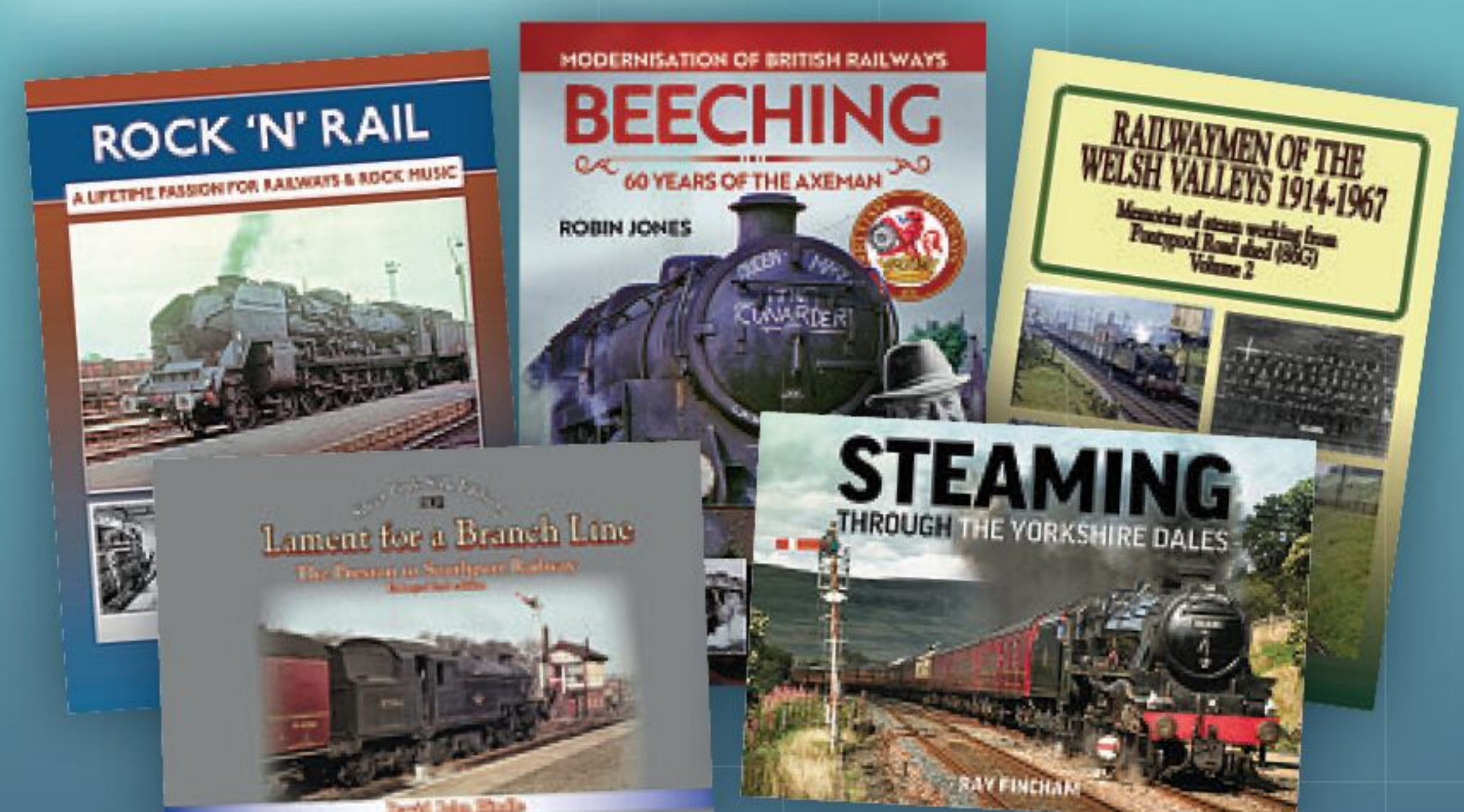
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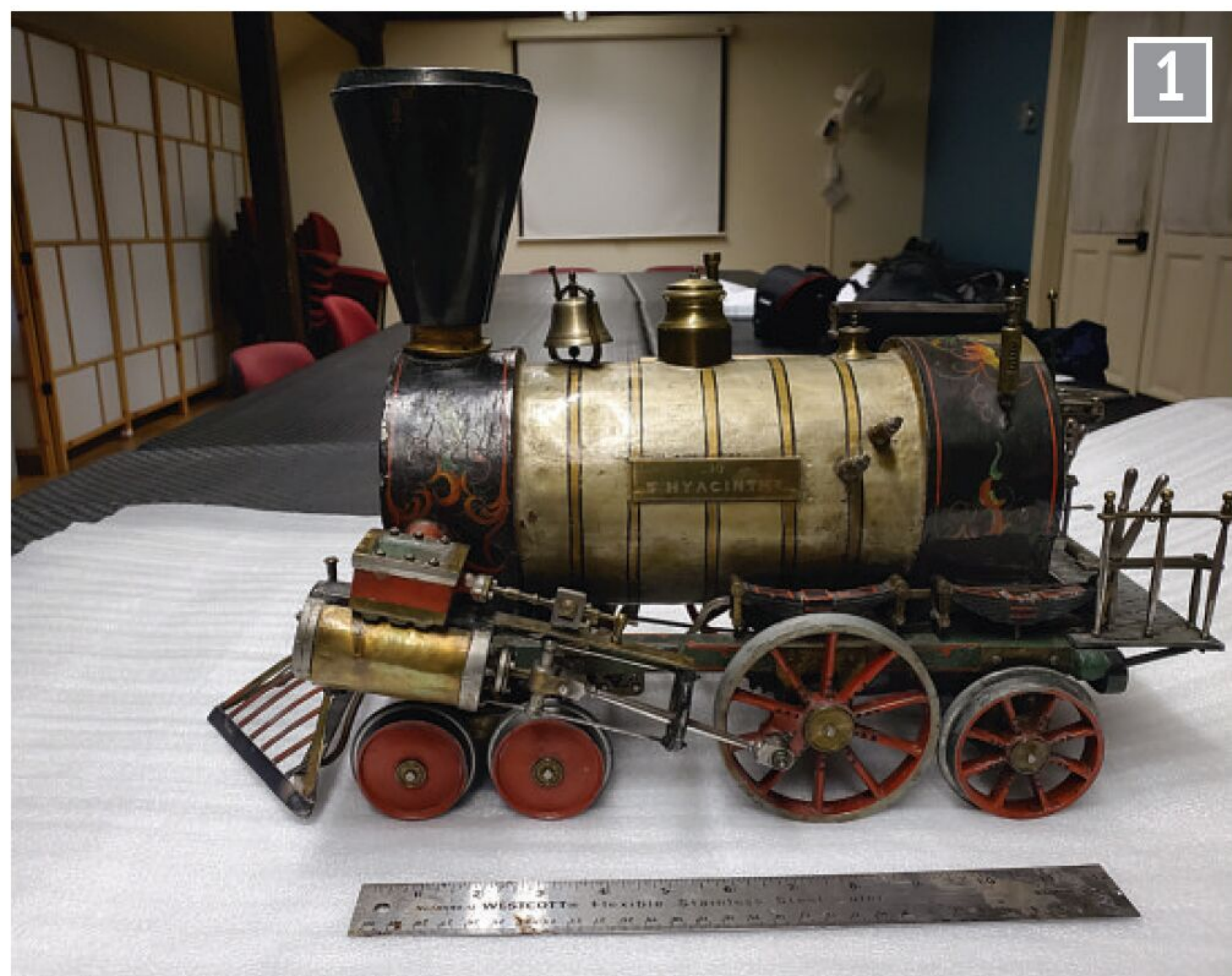


It is well known that the Apollo astronauts were chosen for their temperament as well as their motor skills.

Imagine if the three fell out on the way to the Moon. 'Open number 3 valve, Mr Armstrong'. 'Shan't'. 'You will do as you are told'. 'No'. 'That's an order.' 'Please inform Major General Collins that Major General Aldrin instructs him to open number three valve before we all die.' 'I'm not speaking to the Major General.' 'Why?' 'He knows why.' 'What have I done?' 'Are we going to the moon or not?' 'I suppose...'

In this issue: Dissent before the descent, a battery tram (if it hits anything it would become a 'battering tram'), traffic stats, send a gunboat, pre-CRB checks, minijets, under six drivers, dangerous curves and an errant grub screw.

The Gauge 1 Newsletter & Journal, September, graces my doorstep once more. This missive which regularly amounts to 96 pages, shows what can be done with willing volunteers. The subscriptions are comparable to other similar model engineers' clubs so it isn't outrageously expensive. More power to their collective elbow! Star of this issue is a model live steam locomotive in a Montréal museum, described by Rod Clarke and built by two Québec teenagers in 1850! This must make it one of the very first working models built by amateurs. Rod bought a book in Montréal, which mentioned the young builder of a model locomotive (though not Gauge 1 which hadn't been codified at the time). The gauge is 171mm, on a scale of roughly 1:10 for the Canadian 5 foot 6 inch gauge of the time. Lots of close-up pictures of the mechanism and some line drawings (**photo 1**). Then, the scene on the Ridings layout, making an ARMIG from JTT parts, an analysis of pre-grouping transfers by Tony Armstrong, 'LBSC' revisited by author, Eddie Castellan and home-brew radio control by Ralph Bagnall-Wild. John Judson commissioned an



1850 live steam model (photo courtesy of Rod Clarke).



Windmill looking up into the cap.

LNER Sentinel railcar, as his wife asked him why they had no electric vehicles. Rod came in person to see Gauge 1 North at Bakewell and was full of praise for the event. He also writes *From Whitby to Whitby* or how he came to live in Whitby, Ontario, after being brought up in Whitby, North Yorkshire. The front cover is an excellent perspective shot by Gina Ford; the foreground is a real model but the background is miles away.

W. www.g1north.org.uk

As related last time, we visited Heckington windmill, right next to the railway station. We had been invited by Jim Bailey so, after admiring the Tuxford portable, we were free to clamber about the structure except the rotating cap where the machinery is.

All the fittings are wooden and mostly original. The connections betwixt floors are by ladder or steep stairs and I barked my shins on them a couple of times. Never having been in such a building before, I found it fascinating, not least in the station entrance, a large rock breaking the surface and blocks have been built around it. I have no idea what this is, despite some time spent online. The signal box is Grade II listed and several mid-19th Century station buildings are extant (**photos 2 and 3**).

W. www.heckingtonwindmill.org.uk

On Track, October from **Richmond Hill Live Steamers** noted that the turning of the first sod at Simcoe County Museum was carried out by a small Erie steam excavator.



Windmill - the car park mystery excrescence.

Silver spade? Hah! A new book should please some people ... *50 grades of Shay*.

W. www.richmond-hill-live-steamers.tripod.com

City of Oxford SME's *The Link*, autumn, is graced by a picture of a fine Stirling Single but I can't quite read the number. It (she?) was built by the late Saville Bradbury and donated by his family. Brian Remnant is photographed on a novel form of transport - a powered slate wagon. (He should have no trouble with adhesion, Geoff.) New editor,

Jon Potter has made a fine start with his first newsletter and young Connor drove his J70 battery tram, as used on the Wisbech and Upwell Railway. He handled it very competently despite his tender years. Peter Turville's 16mm gauge *Chevallier* won the Butterley Trophy at the 16mm show earlier this year. The original was made in 1915 by Manning Wardle for Bowaters and others, then went to Whipsnade zoo. Now owned by Bill Parker, she has visited the Welshpool

& Llanfair Railway and has also been to Romania. Brian Garland, convalescing after an operation, found an absorbing job in collecting the statistics of traffic on the GL line. Details also collected were locomotive, driver, number of coaches in train, time of departure, time of arrival at the destination. This produced nine pages of A4 which were analysed and Brian concluded that some changes be recommended. Finally, one member accused him of 'spying'. To what end, I wonder.

W. www.cosme.org.uk

More from the Broadcast museum - video tape machines (photo 4).

Blastpipe, October, from **Hutt Valley and Maidstone Model Engineering Societies**, Bill Phillips has made an artefact, powered by a nearby stream, of a figure winding away at the waterwheel made from yoghurt pots. Editor, Claude Poulsen apologises for the lack of text in this issue, which he has filled with varied photographs.

W. www.hvmes.com

The Lobby, summer/autumn, *Special Waverley Edition*, from **Brighton & Hove Society of Model Locomotive Engineers** has editor, Mick Funnel telling

us why the newsletter was late. He has had no contributions! As soon as he replied in this vein to those who enquired of its whereabouts, copy was forthcoming. Hef Jones took a day trip on the *Waverley* from Southampton around the Isle of Wight. A photo from the engine room at full speed shows the thrashing steel rods, driving the paddle wheels. They were shadowed by the Royal Navy, a steam gunboat, *Steam Pinnacle*, 199 and passed close to the Solent seaforsts, known as Palmerston's Follies; building starting in 1859 when a French invasion under Napoleon III was feared. John Coleman writes on Standardisation, mostly pertaining to the GWR.

W. www.hoveparkrailway.com

I have just watched a video on YouTube that I found most enjoyable. Called *A History of Live Steam and Model Engineering* it was filmed mostly in Sweden, Germany and Holland and it is mercifully free of the banal and infuriating commentary normally encountered in similar videos from America.

The Monthly Bulletin, October, from **Bradford Model Engineering Society**, has an item by Jim Jennings on mending and retempering a spring, which involved plunging it, red hot, into molten lead and then cold water. It seems to have worked. Road vehicle enthusiasts, without a section this time, will be pleased to see that I spotted a Triumph TR6 on the M1 recently; also, as we peeled off at the 'Meadowhall' turn-off we were overtaken by a 'Gronk', BR Class 8 (on a low-loader...) I couldn't get the number.

W. www.bmes.uk

GMES News, September, from **Guildford Model Engineering Society** welcomes Peter Shakespeare as editor and I am pleased to see that at the 2024 Gala, a stand publicising amateur radio was provided by Guildford and District Radio Society. Peter, who is ex-army, then joined the trade journalism industry, culminating in the media section of the Royal Logistics Corps. He was a



Video tape decks, at BMEG.



Bond Bug at Gainsborough Old Hall.

junior member of GMES whilst at school, rejoined after leaving the Army and is building a Marshall S-type traction engine. He has also spent 20 years driving locomotives on the Mid-Hants railway. Brian Whicher made the trip to Smethwick for the Mamod closing event. A combination of rising prices and undercutting by the competition, drove the company out. A sad day. Trevor Coombes writes on working with junior members. He was a Cub Scout leader in the days before CRB checks were required. Then, as now, the movement had problems with those wishing to get much closer to their youngsters than was proper. (I saw the same thing in my Troop – Geoff.) The individual concerned was told never to darken our doors again and the Scout movement still thrives.

W. www.gmes.org.uk

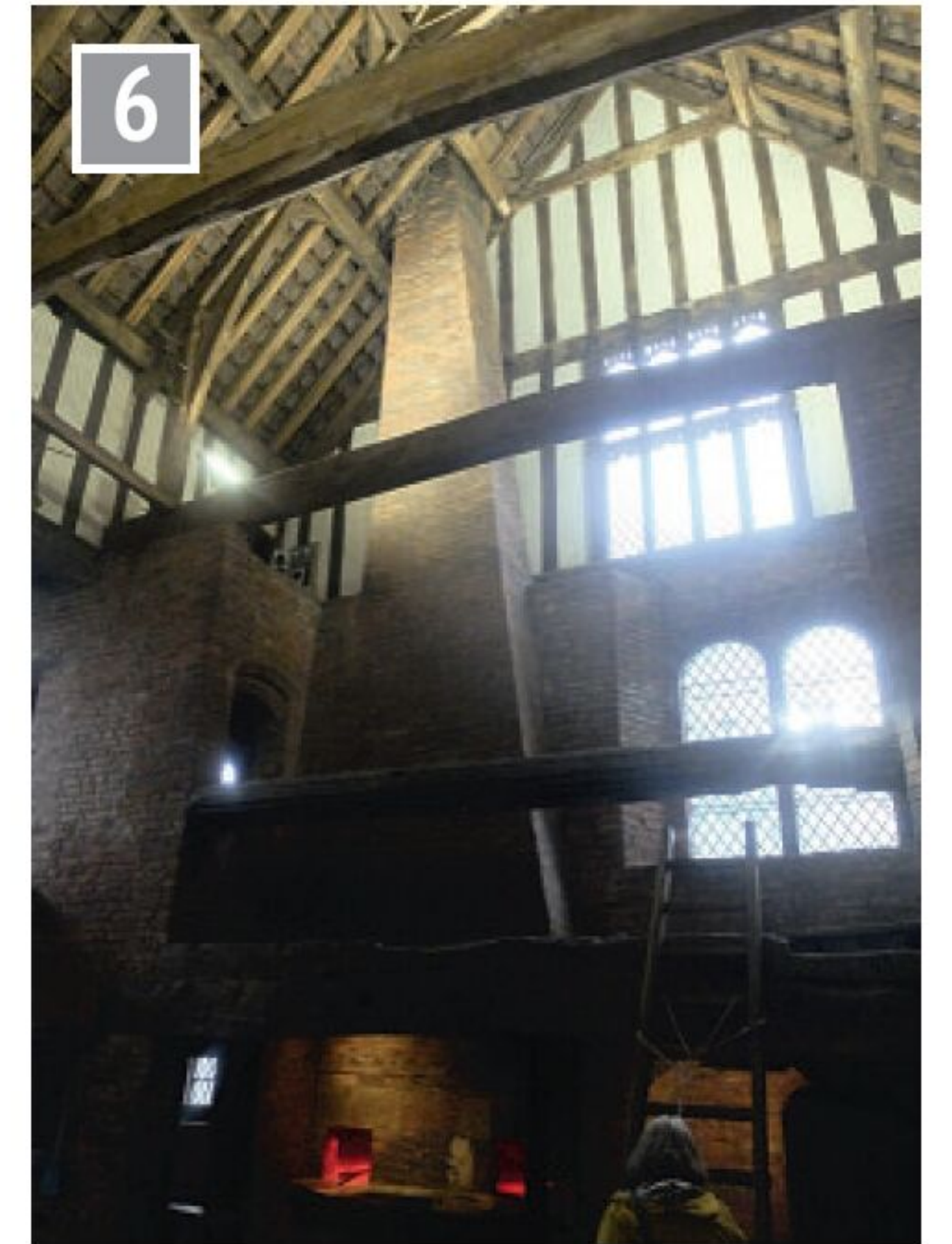
St Albans & District Model Engineering Society, had not sent any Newsletters to me for a while, 'for reasons which are irrelevant and boring' says chairman and editor, Mike Collins. (Ooh! Some juicy scandal? - Geoff.) A talk on miniature jet engines given

recently by Roger Stephen prompted Mike to reprint an article in the NL from 10 years ago. (I visited a local jet engine manufacturing company in Rotherham - since closed - and was fascinated by the whole system. Just when you think it can't turn any faster, it is just reaching its idle speed and generates almost no thrust - that was 40,000 rpm. 'Full chat' is about 140,000 rpm. At full power it generates about 70 Newtons). In this form it is relatively inefficient. Mounting a free turbine after the jet exhaust, driving a propeller, makes it into a turbo-prop, which is rather better and generates about 220 Newtons. Mike Collins (him again!) writes on getting visitors to try driving his remote controlled German Tiger tank. He found that the under-6s were generally hopeless at it but those over 6 got the hang of it quite quickly.

W. www.stalbansmes.com

This is the wonderfully conceived Bond Bug, sadly now out of production (photo 5) and this is the kitchen at Gainsborough Old Hall, open to the roof, helping to reduce the heat from the three fireplaces (photo 6).

The Blower, from **Grimsby & Cleethorpes Model Engineering Society**, October, has on the front cover a young boy speaking to the driver of a locomotive. Now, either the boy is massively overgrown or it was taken on the RH&DR. The August Bank Holiday weather behaved as always, it rained... However, Andy Giffen ran his 32mm gauge radio controlled Garewatt, a number of which he has produced commercially. It is a little tight on the corners and points but he does not have his own domestic test track. His locomotives have been featured in the 16mm society newsletter. Investigation later showed that the radii of the curves which caused Andy's Garrett such distress, were at 6 feet 8 inches and 8 feet 10 inches, when they should have been 10 feet. *Ahem!* To assist in rectification work, James Clarence has made a laser cut stainless steel template of the right dimensions. Editor, Neil, visited Sheffield SMEE Open Day, taking his Sandy River locomotive and a rake of freight cars. Pre-covid, readers will remember that the Society was asked to make



Inside Gainsborough Old Hall.

two window units for a tram at Crich. For various reasons, not all covid related, the finished tram was officially introduced on 13 September. The praise heaped upon this unique tram was magnificent. It is as new. Even the windows are indistinguishable from their fellows, apart from the patent number not being engraved on the latches.

W. www.gcmes.com

The Bristol Model Engineer, from guess who? (**Bristol Model Engineers**) reveals the cause of all the problems with Brunel. It was all caused by a grub screw falling out. The new 4QD controller was giving constant warnings, which were not heeded, but turned out to be newly installed pvc-covered wire, used to replace the old ones which were becoming stiff. This led to them sagging under their own weight and shorting to the wheel flanges below. When the wires were re-routed, the problem went away. This year the BRIMLEC competition was resurrected. And the winner, is... (oh I do hate that artificial pause) Geoff Smith of BME!

W. www.bristolmodeengineers.co.uk

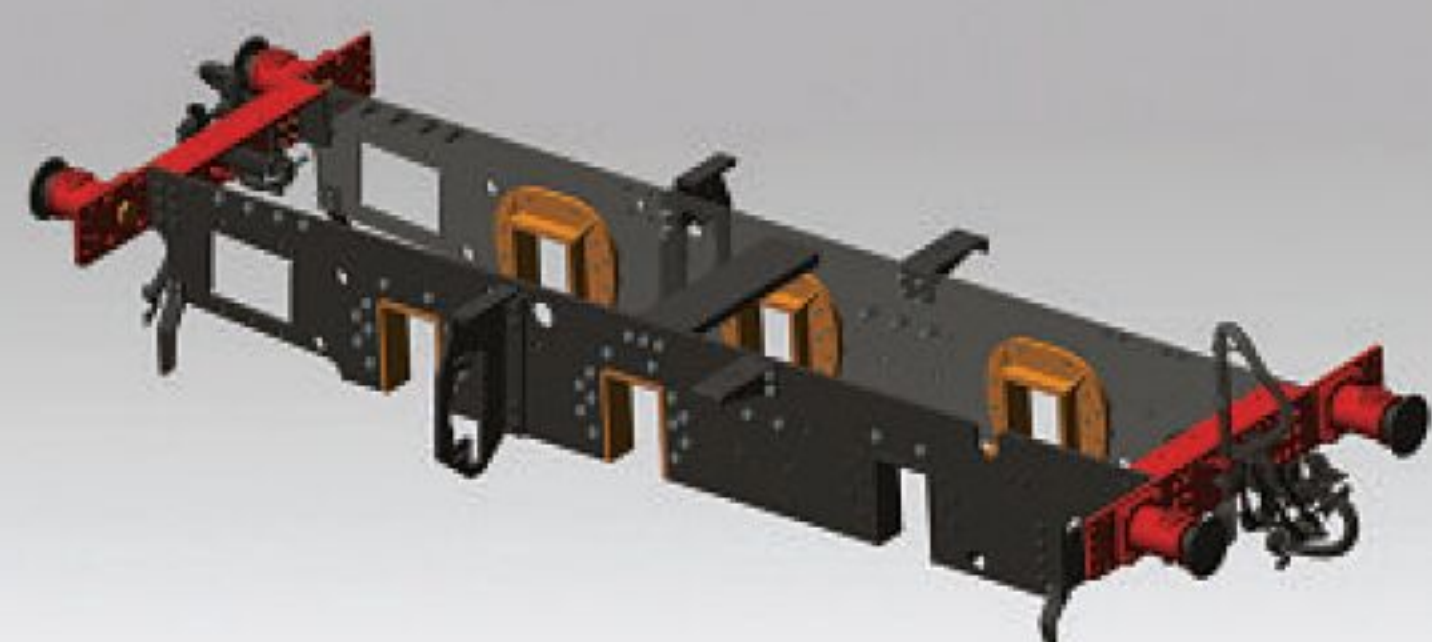
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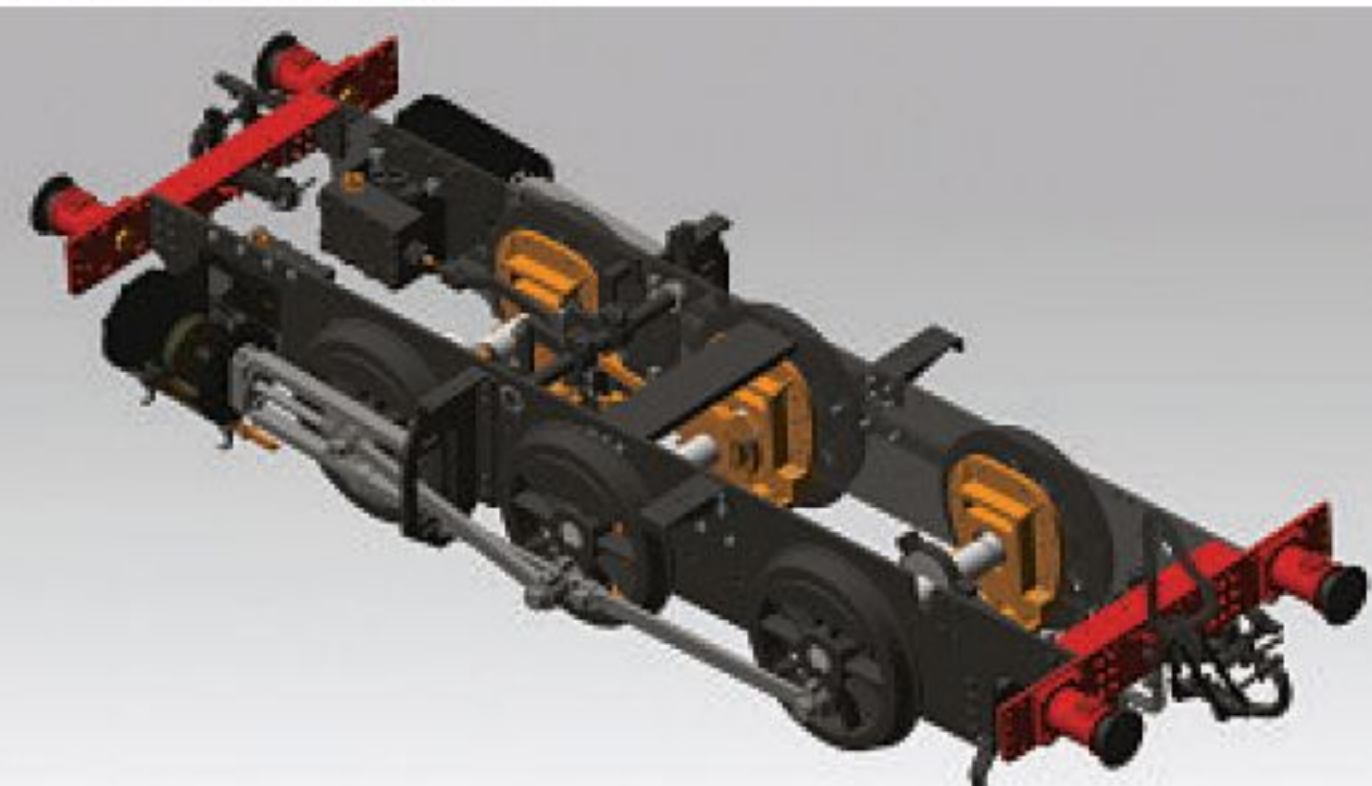
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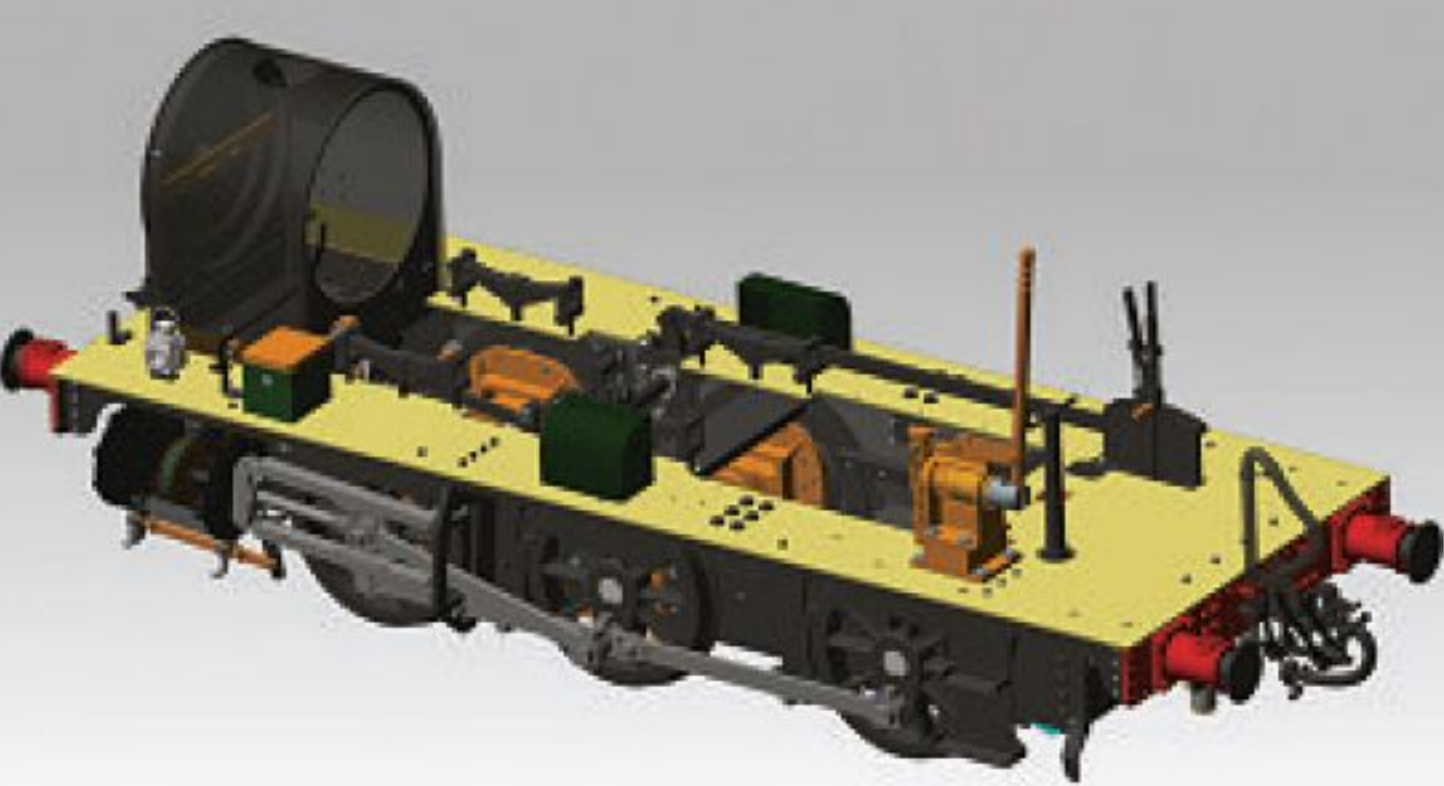
MARKET LEADER IN
LARGE SCALE LIVE STEAM
MODELS AND KITS



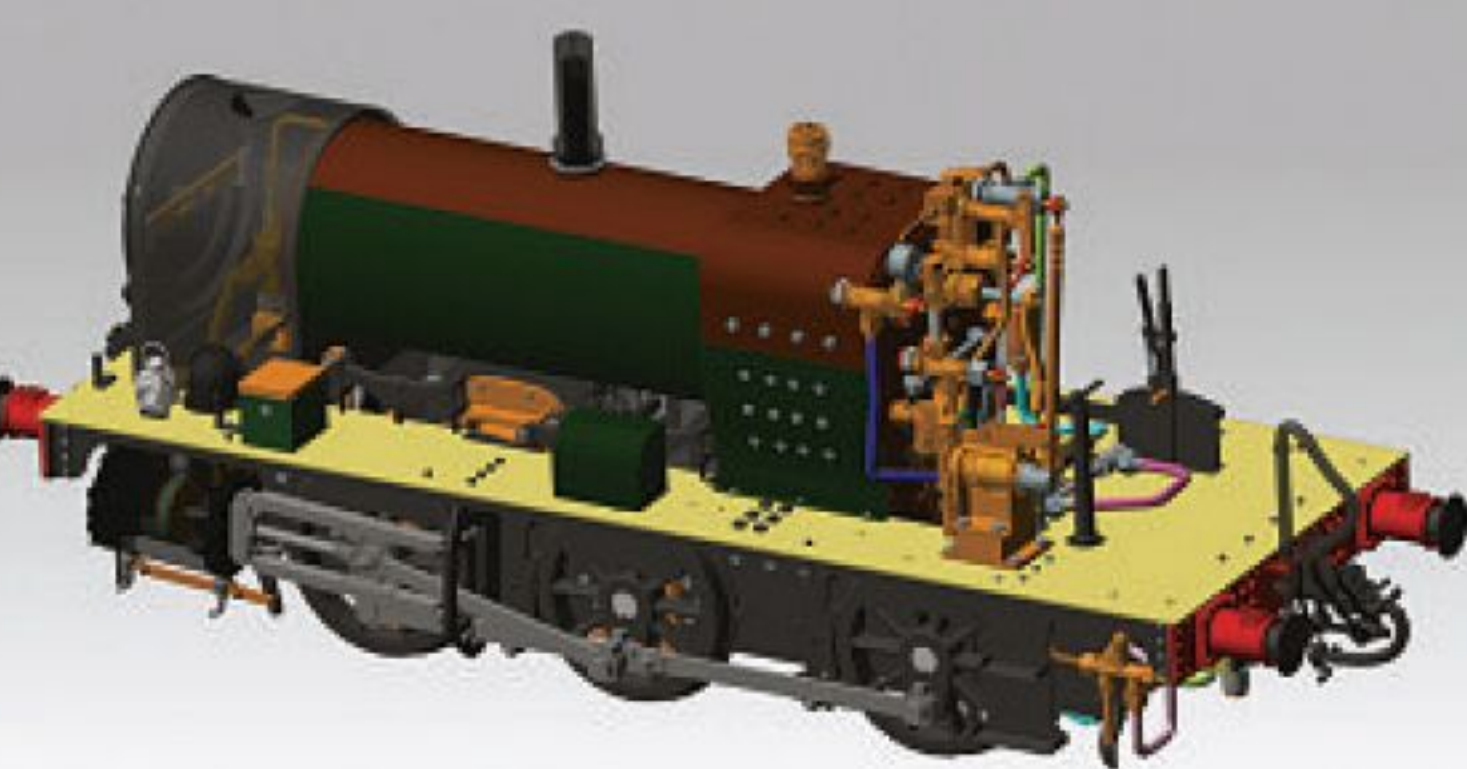
Kit 1 Shown Assembled



Kit 1 & 2 Shown Assembled



Kit 1, 2 & 3 Shown Assembled



Kit 1, 2, 3 & 4 Shown Assembled



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



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

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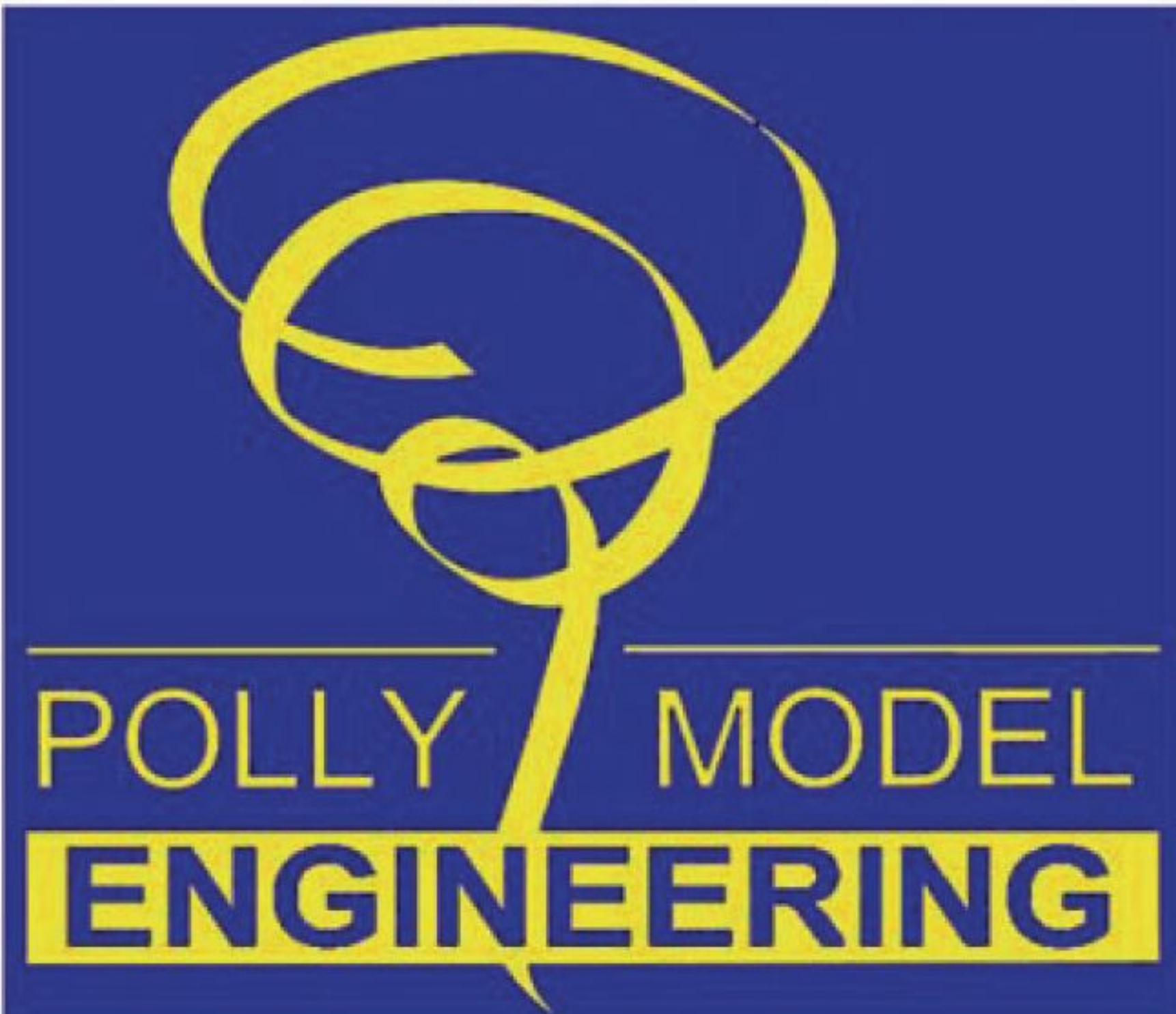
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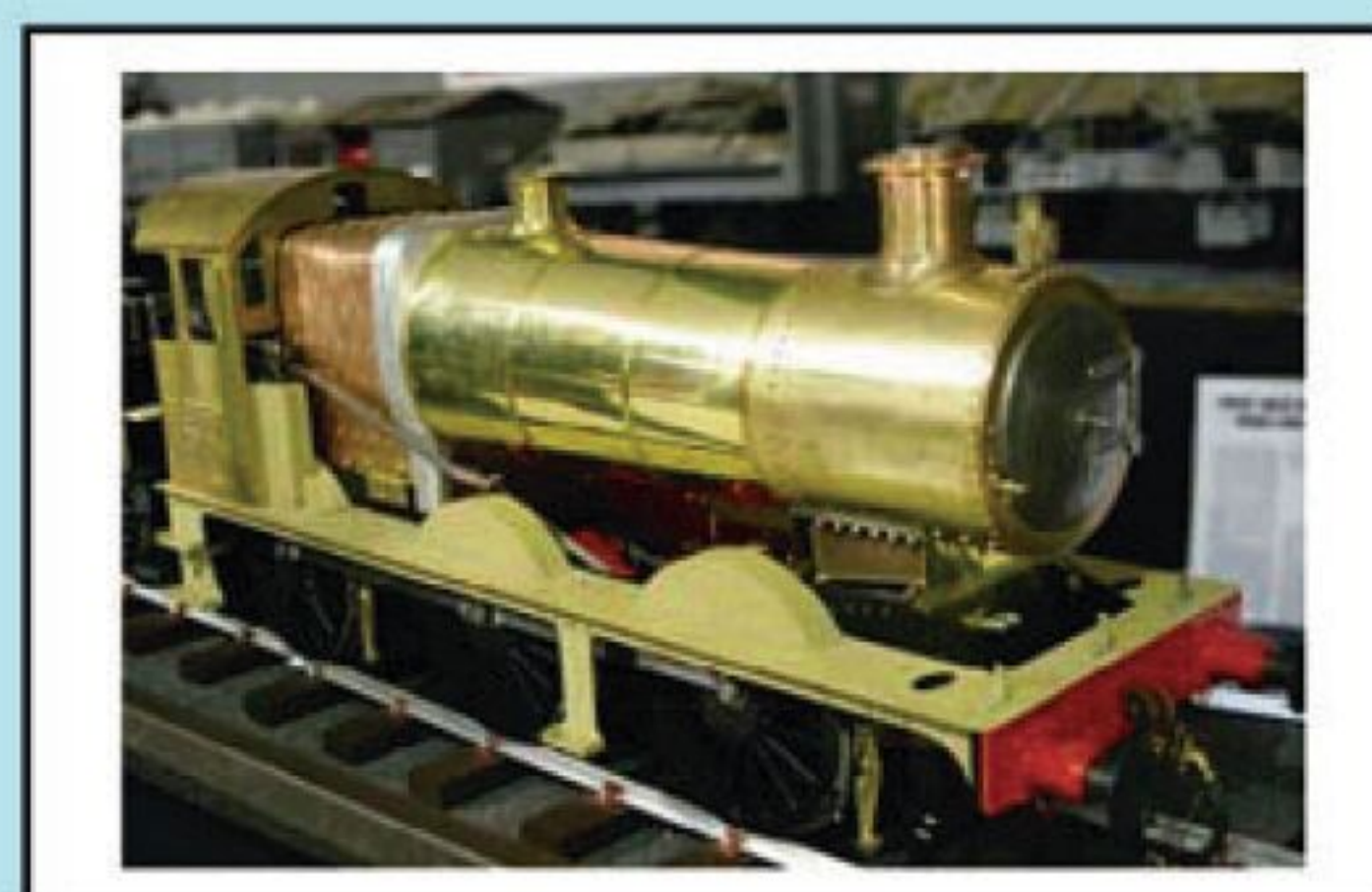
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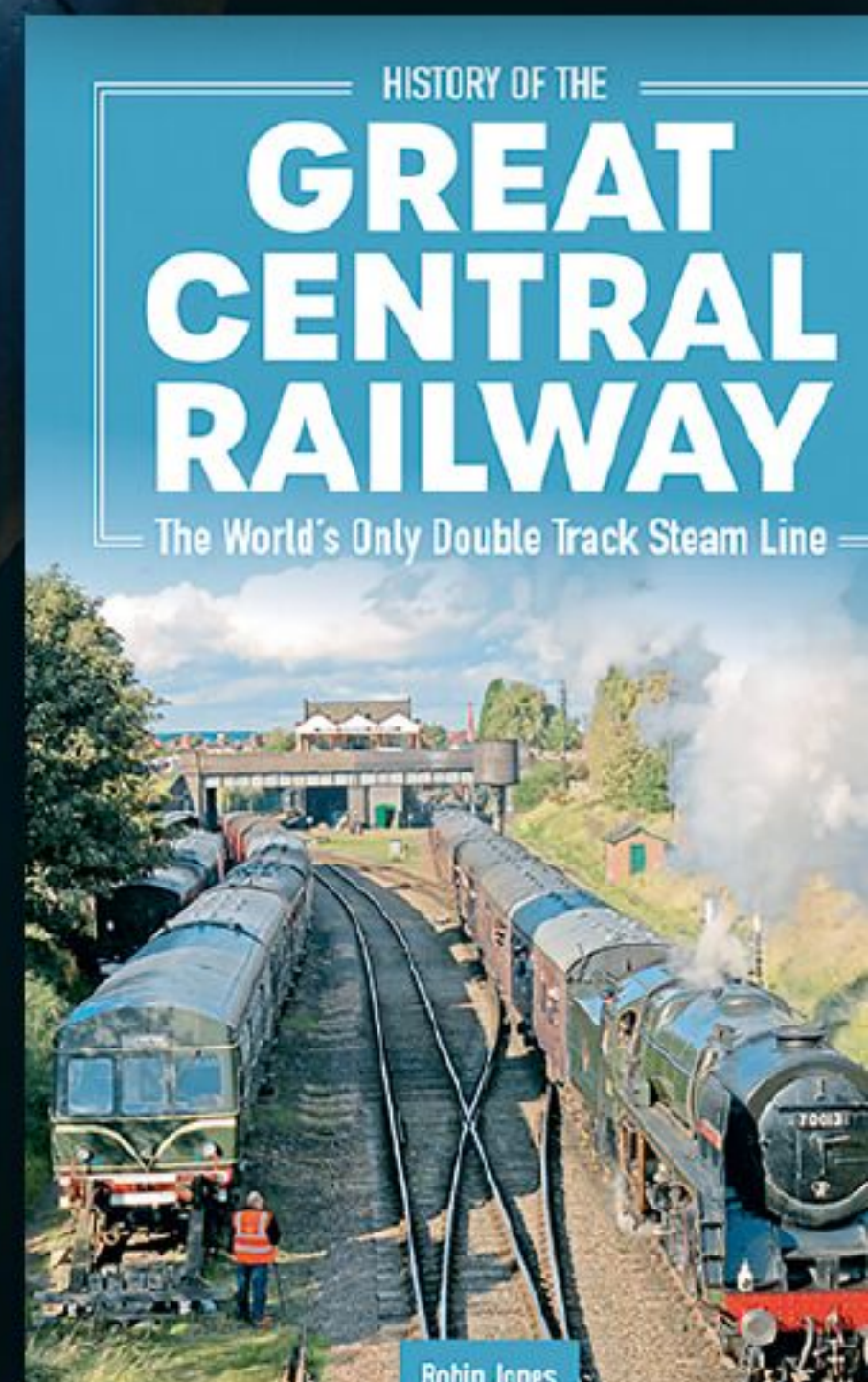
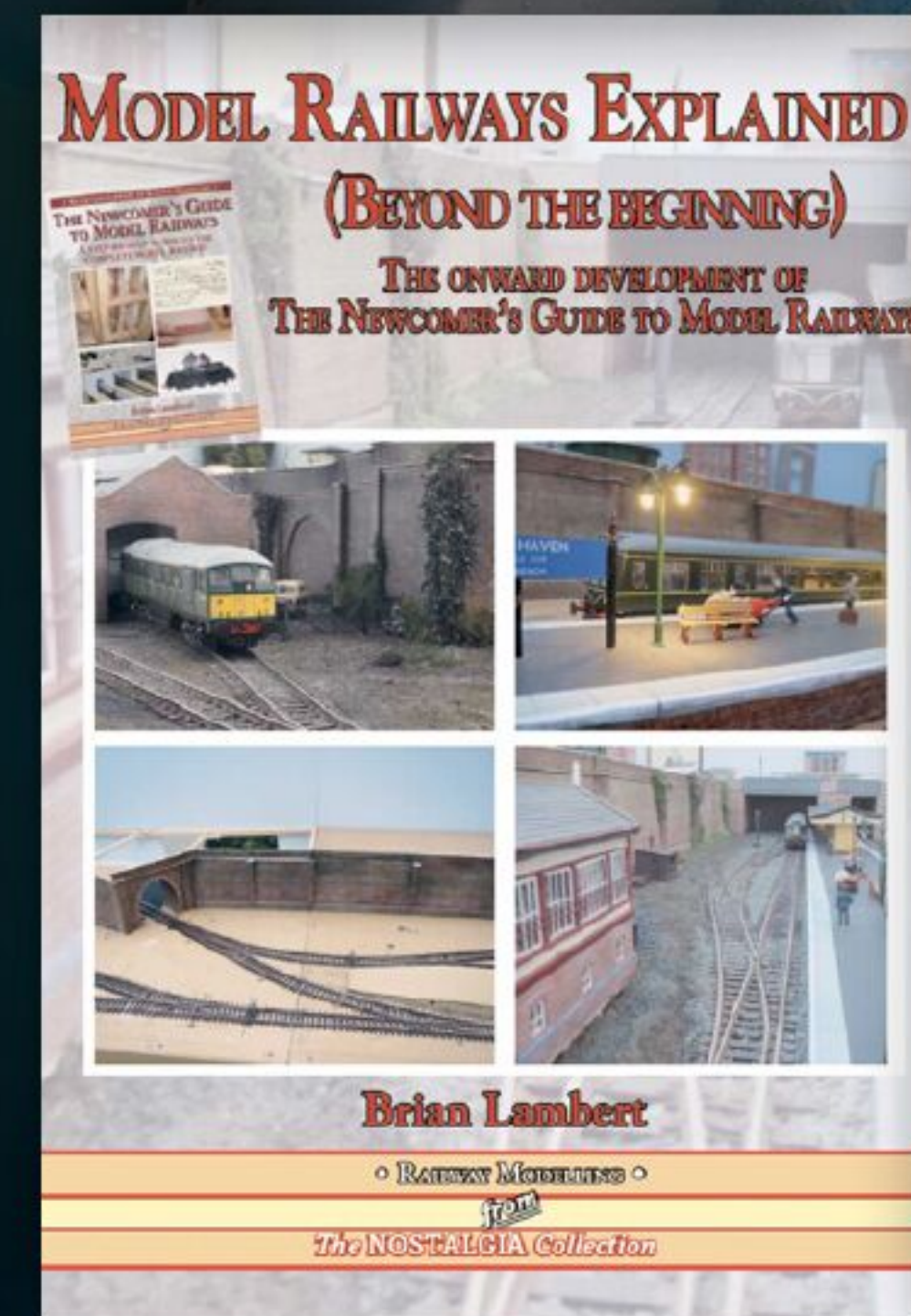
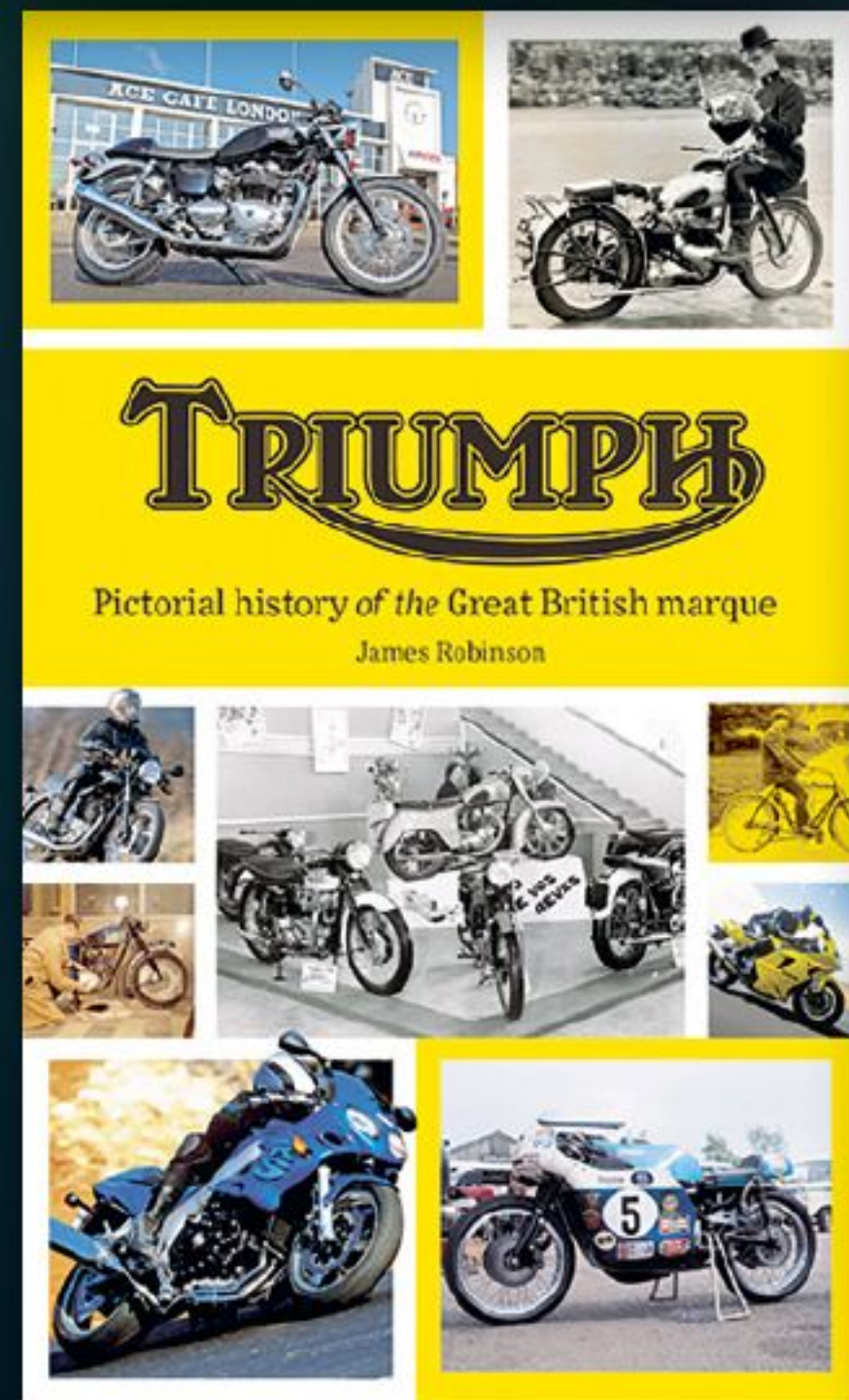
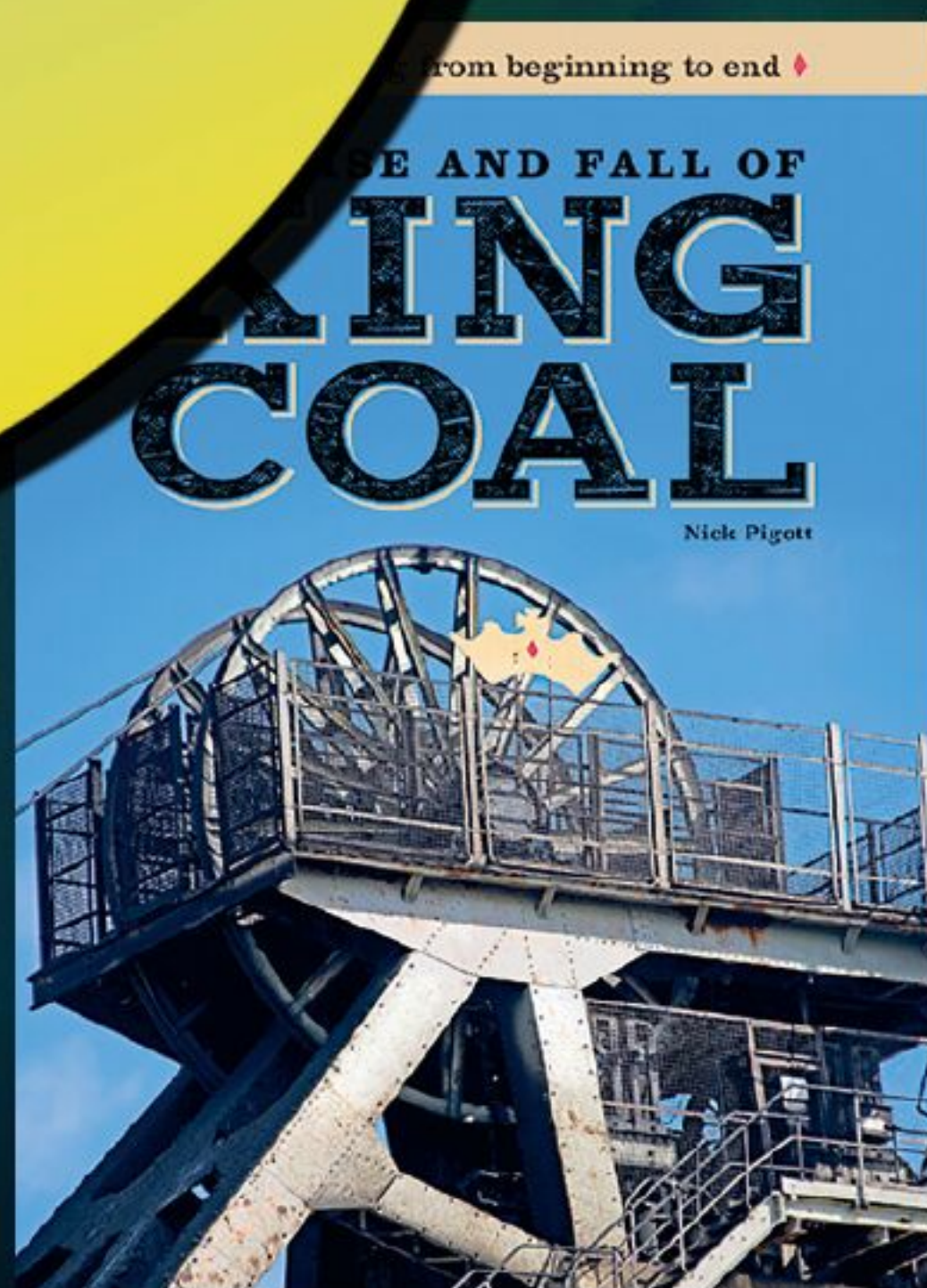
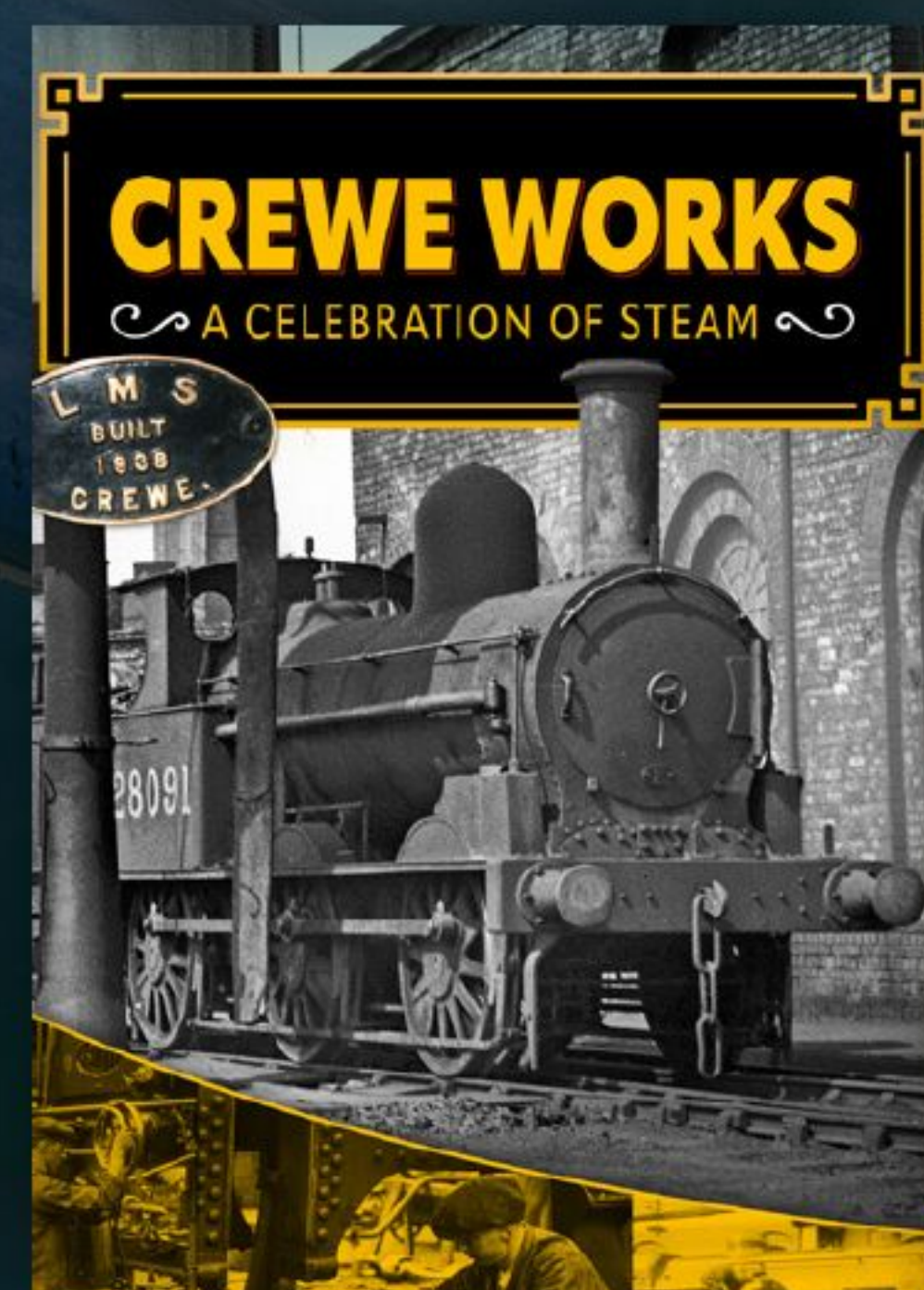
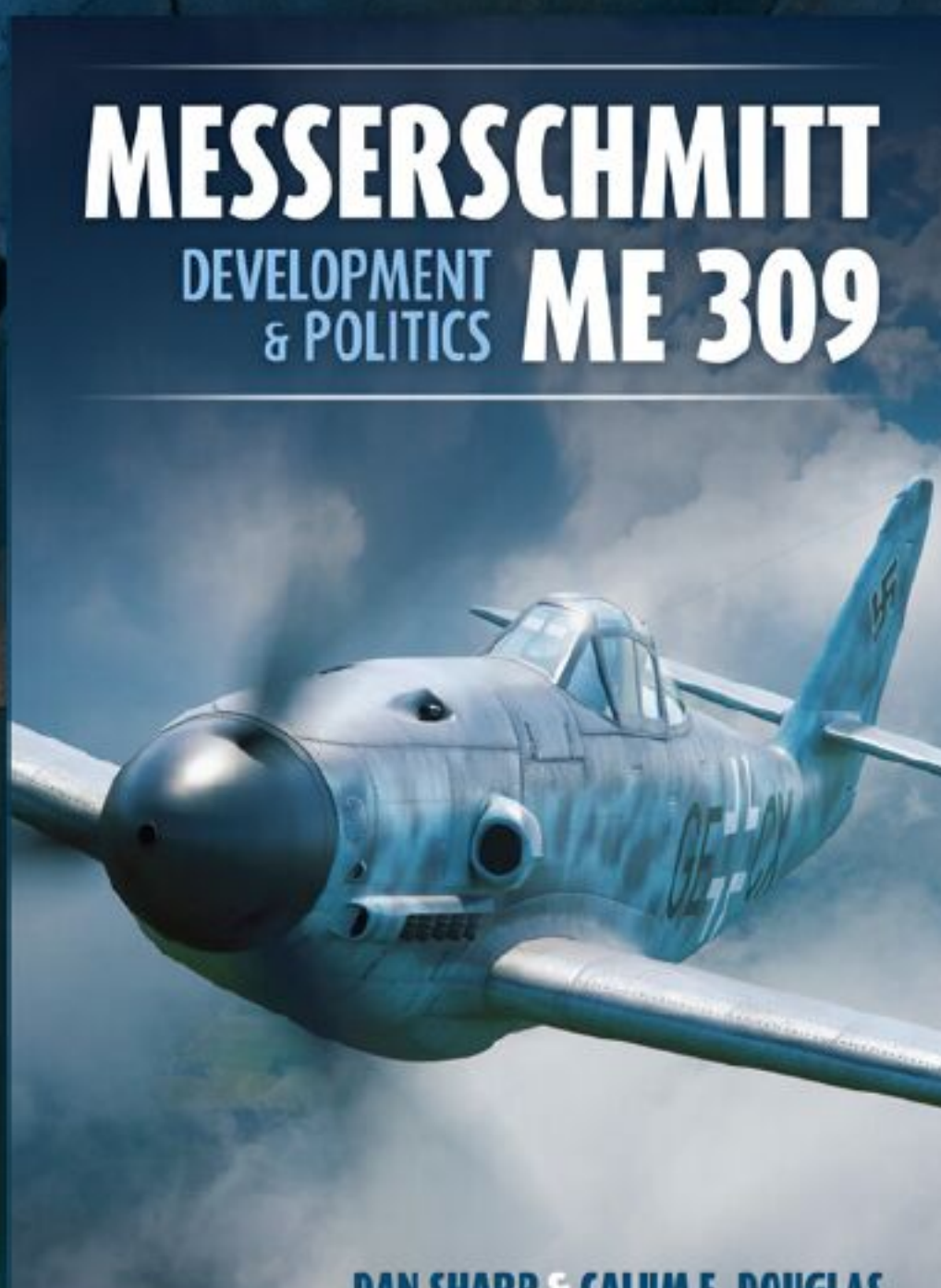
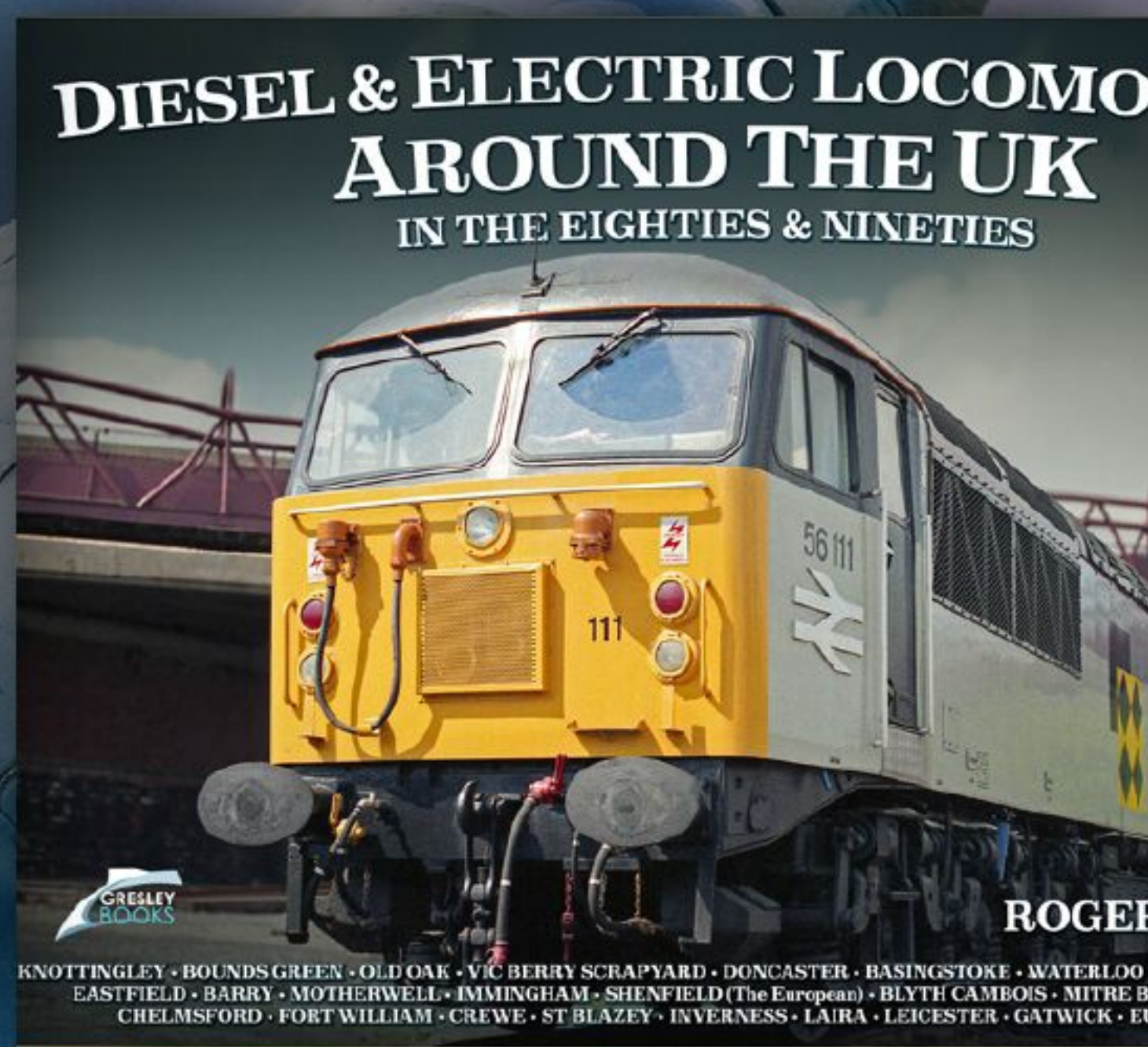
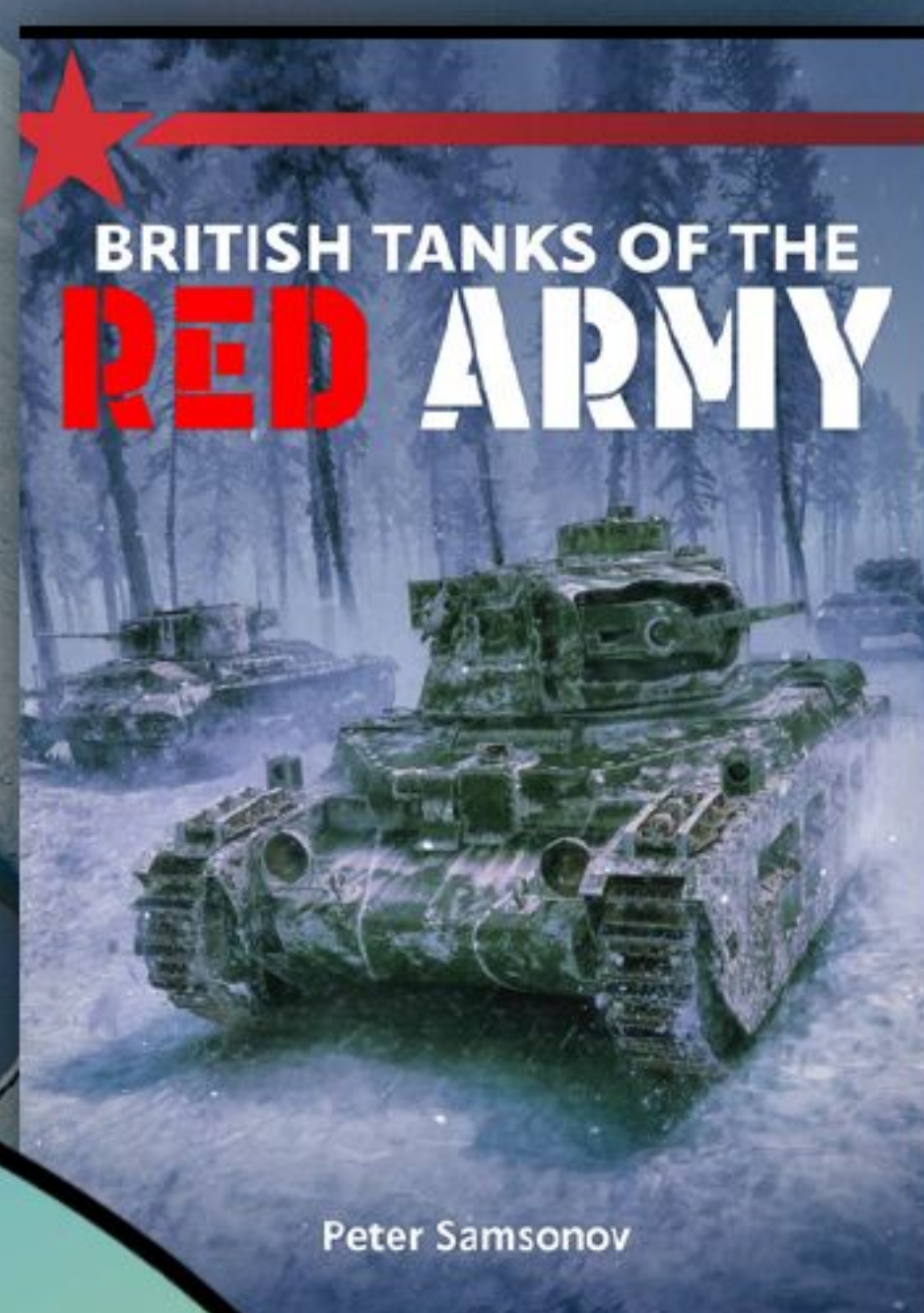
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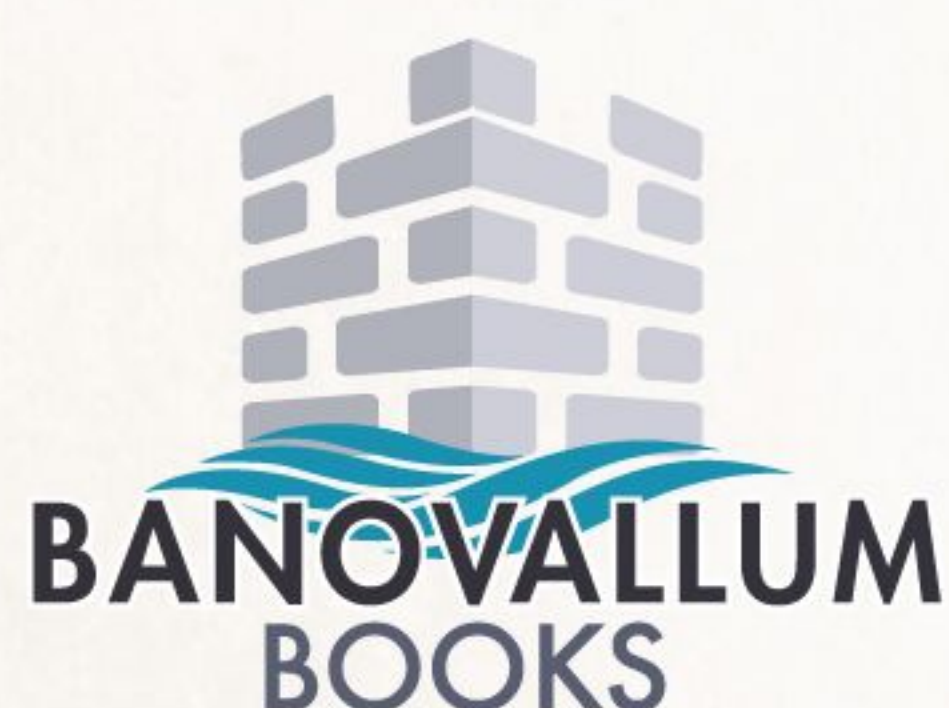


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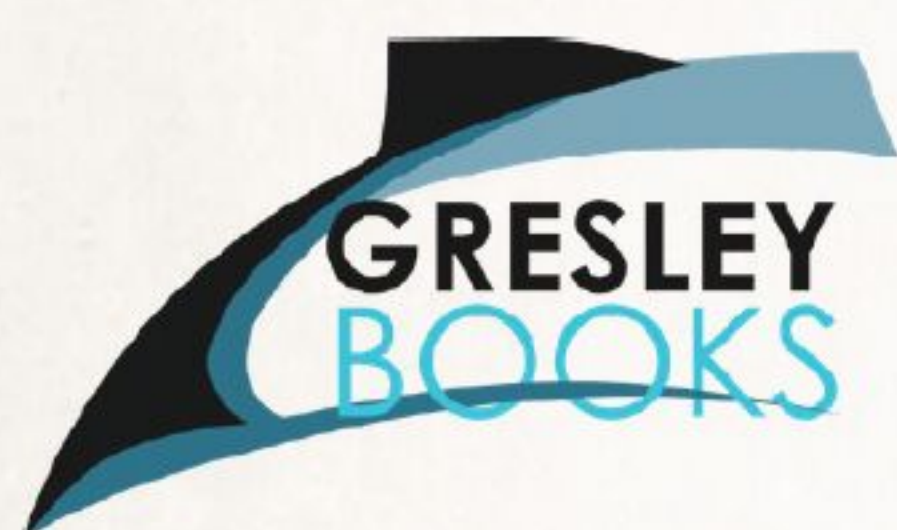
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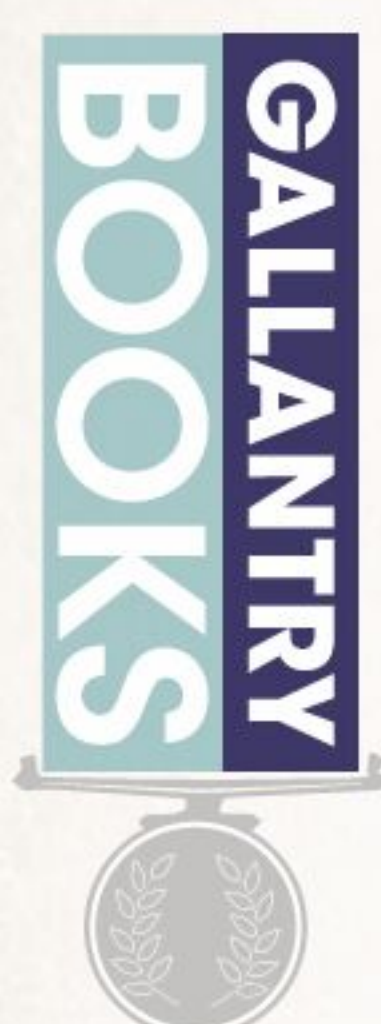
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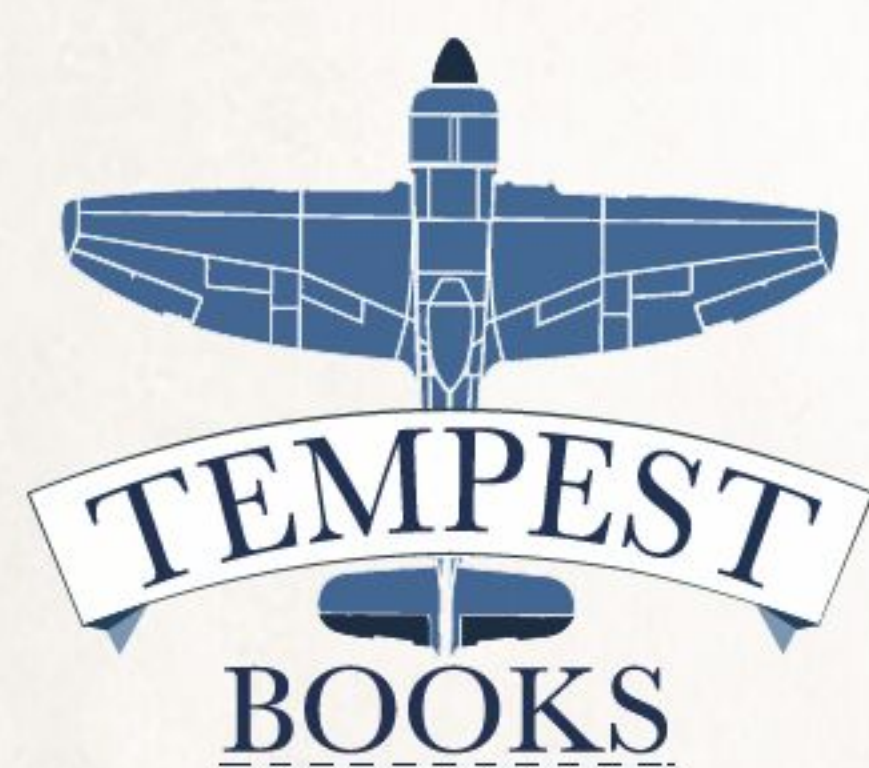
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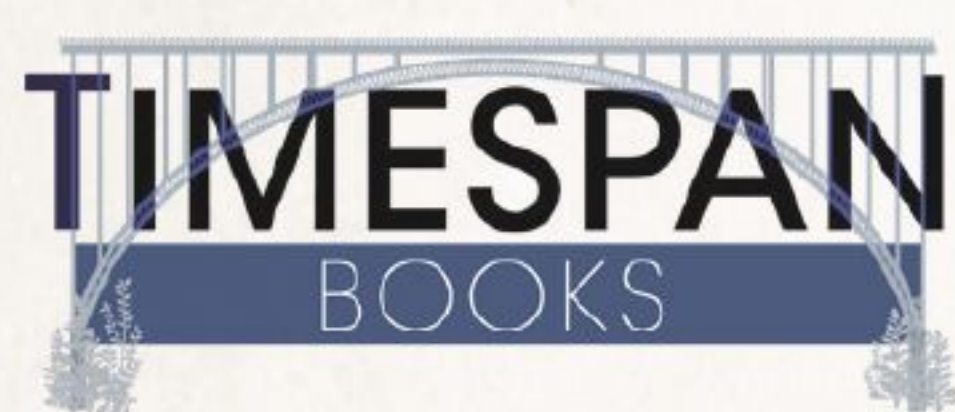
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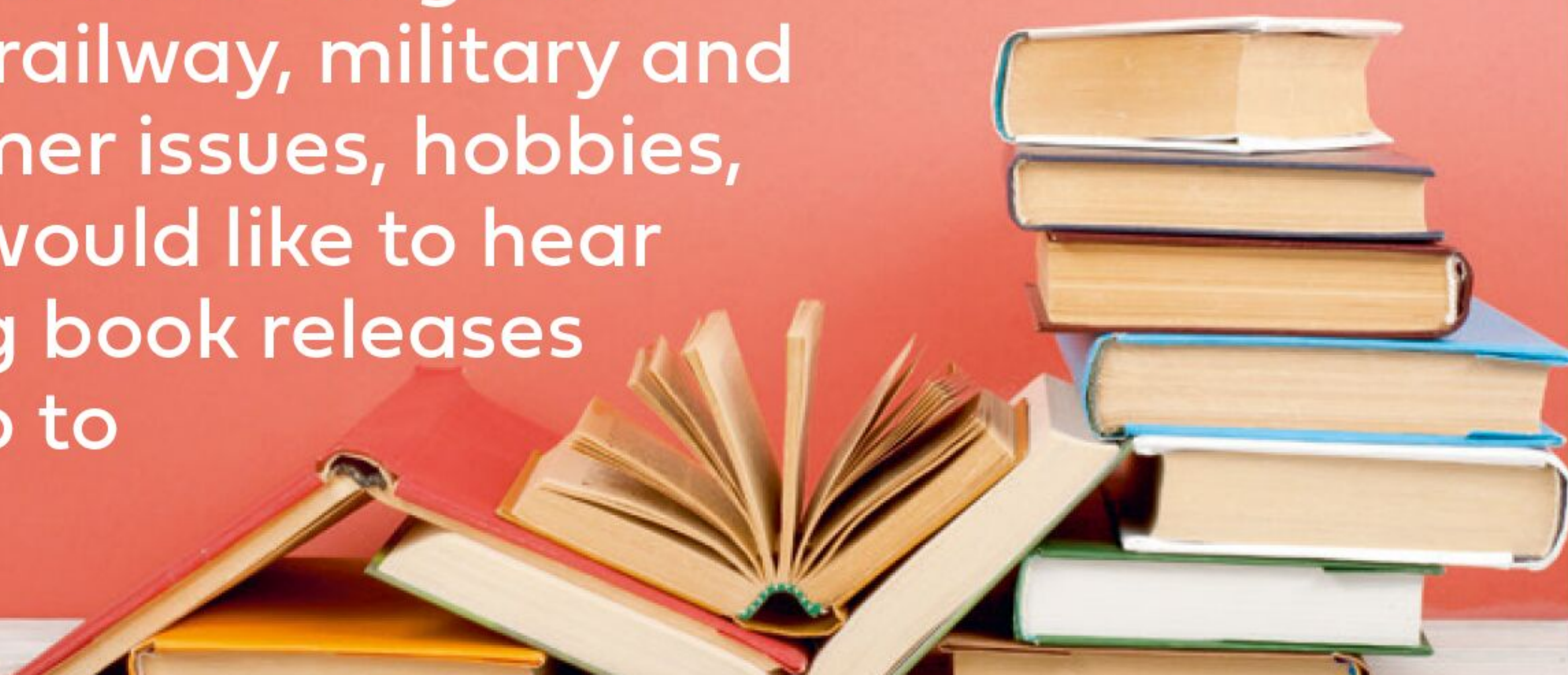
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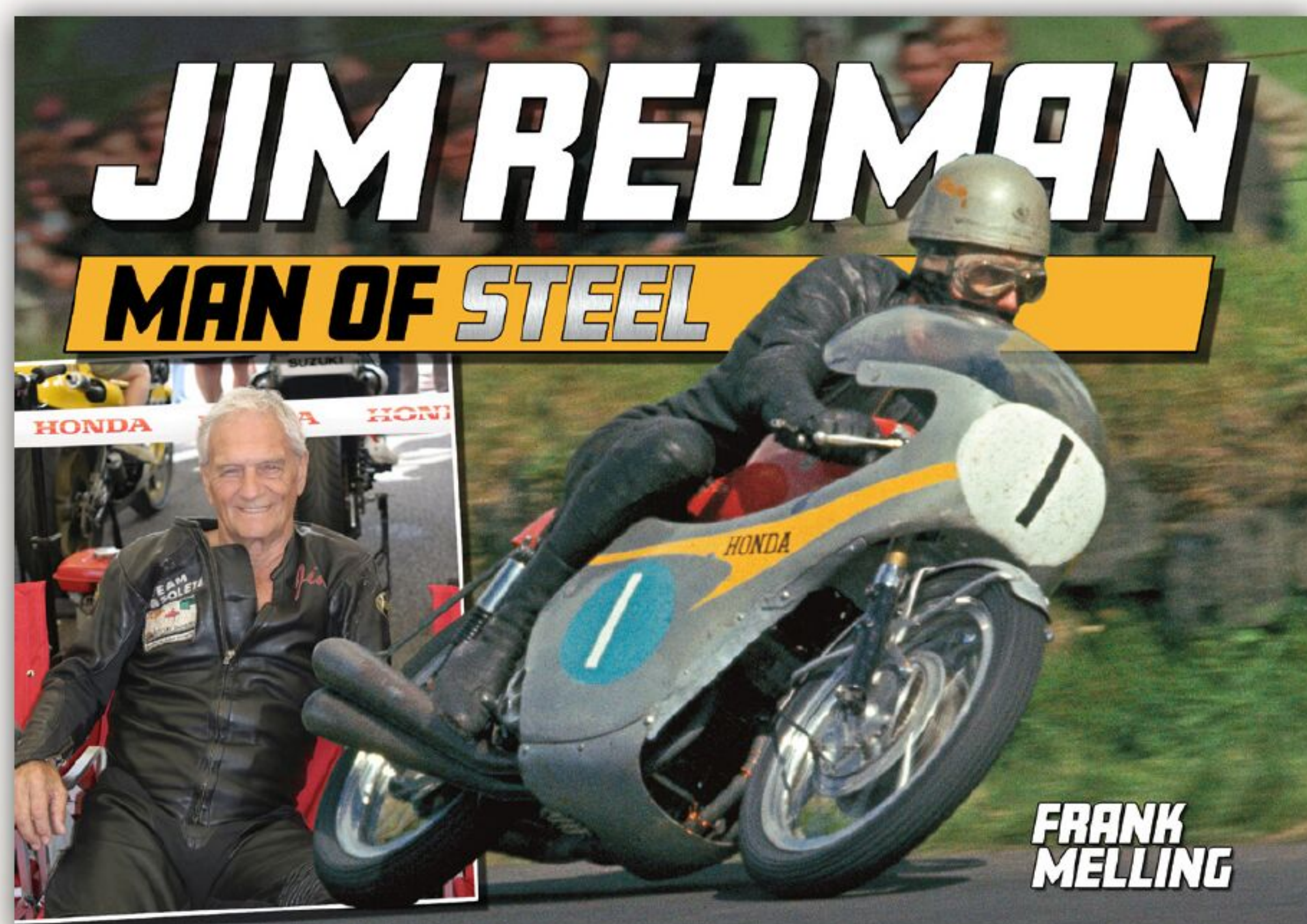
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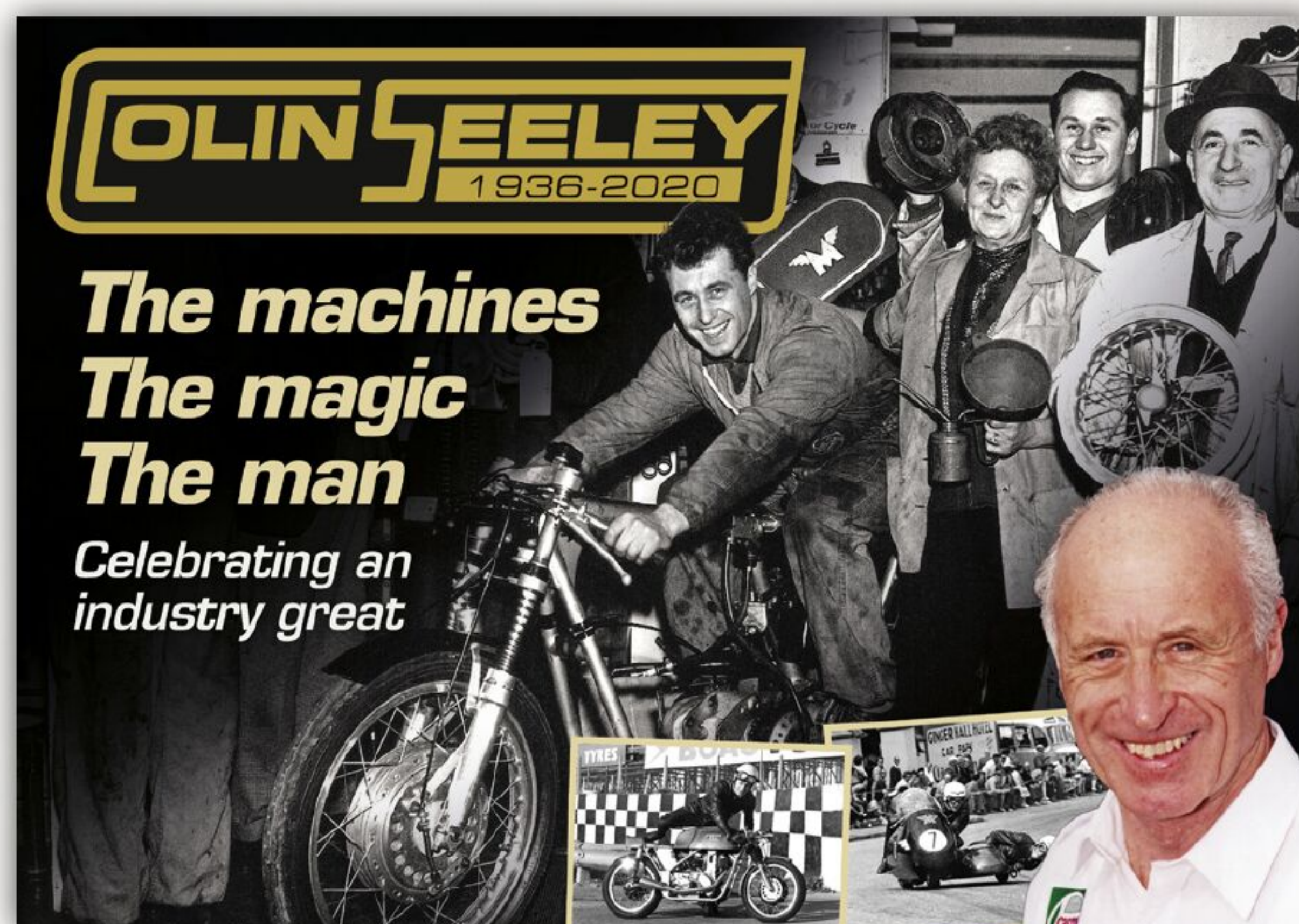
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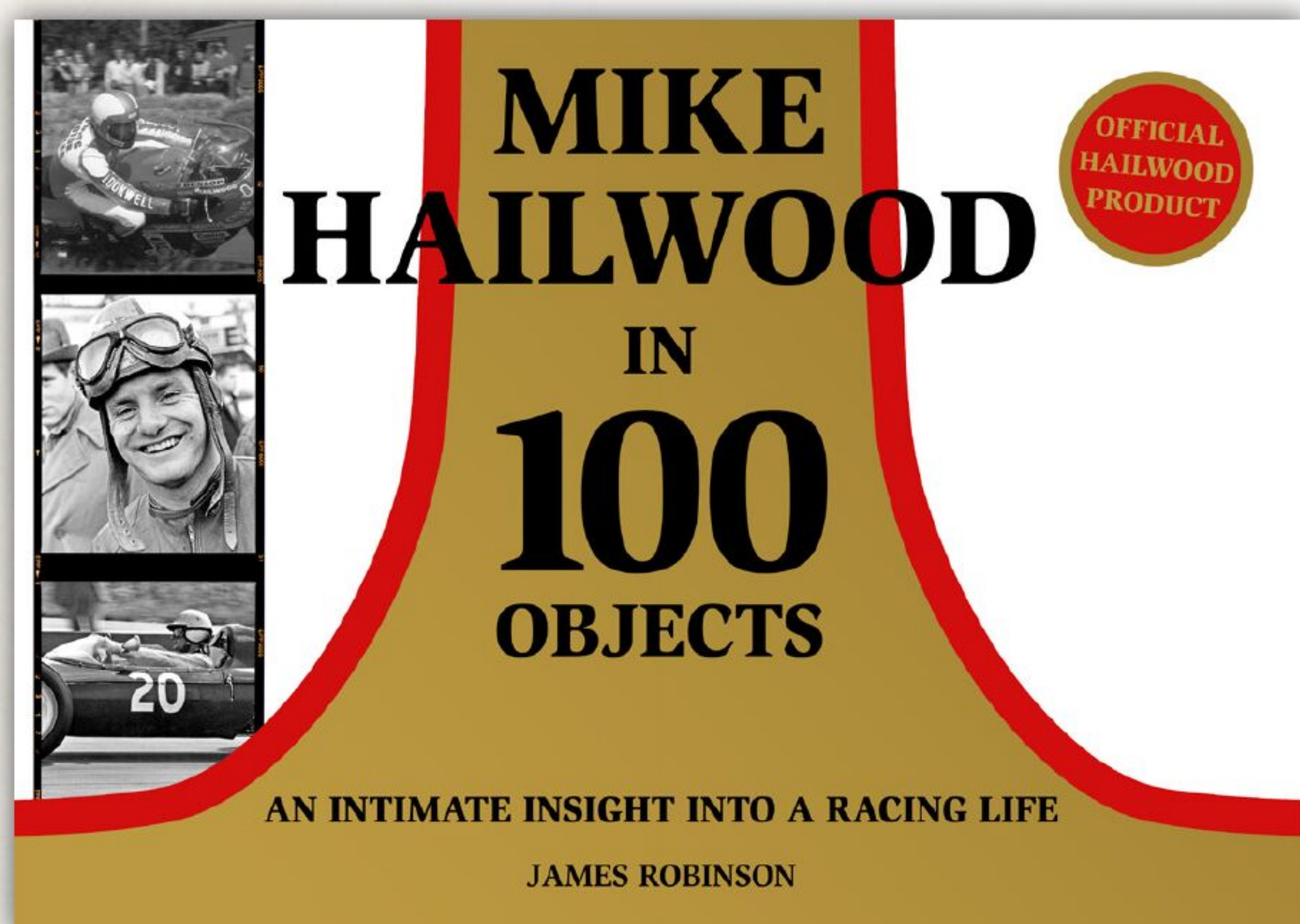
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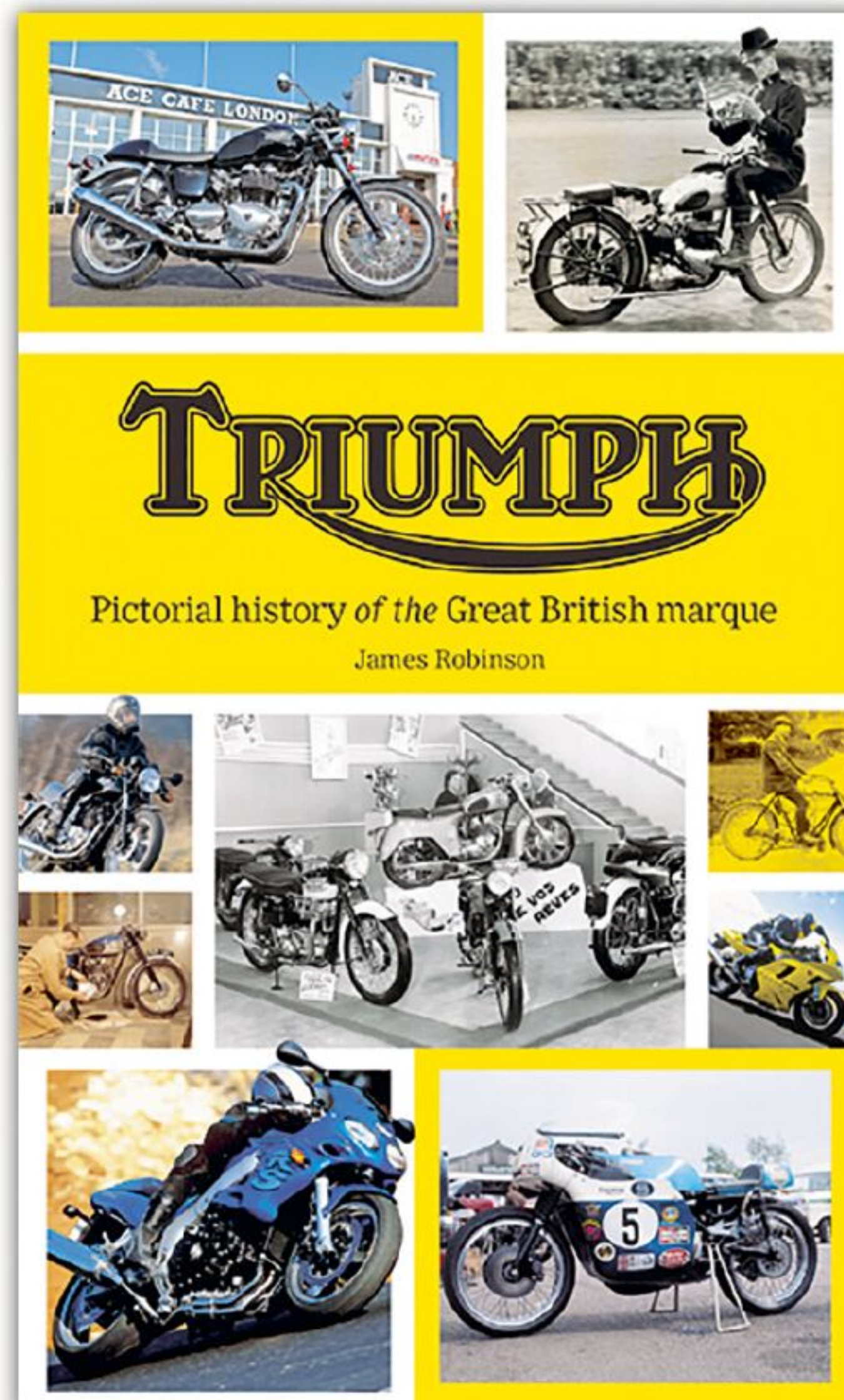
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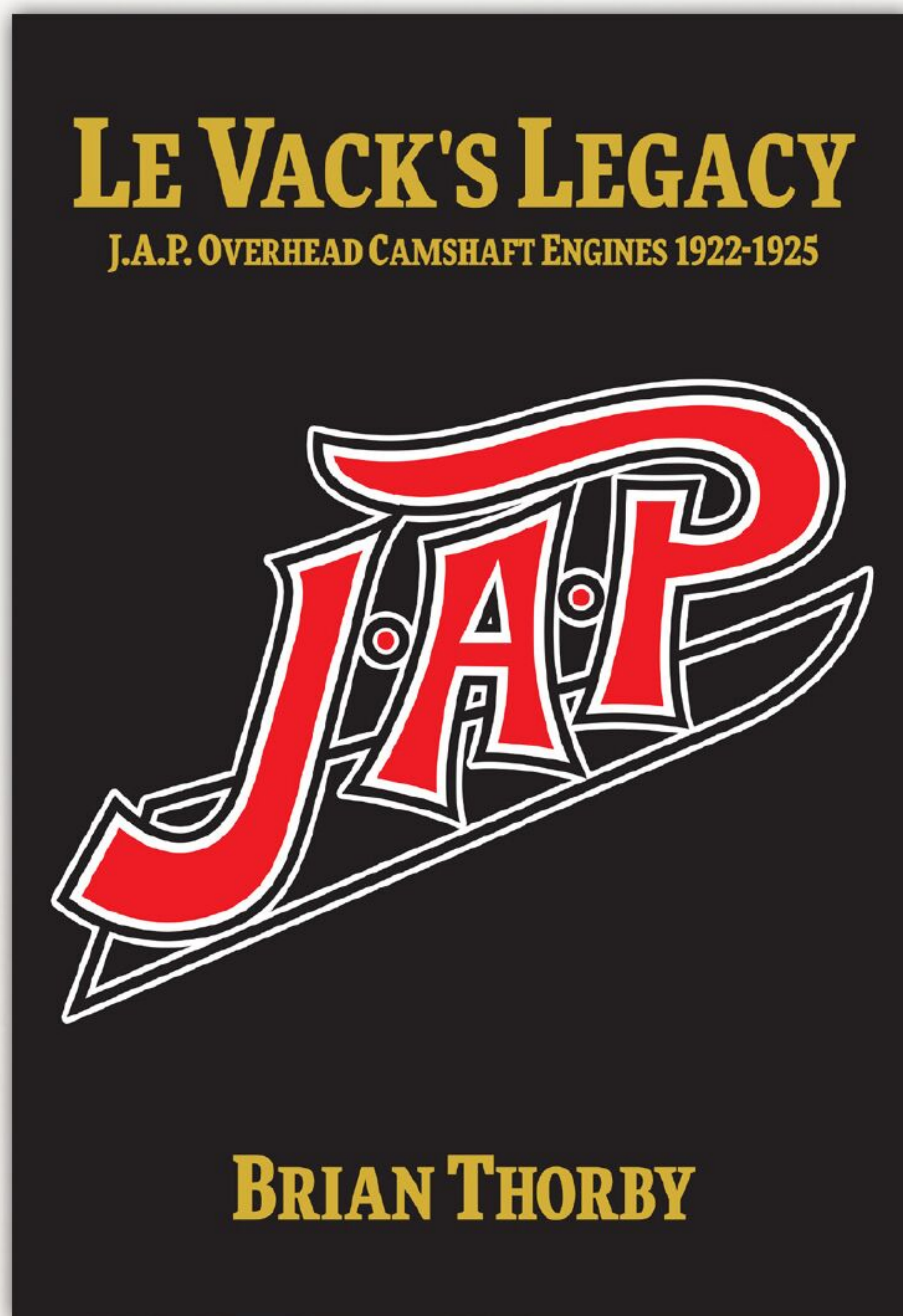
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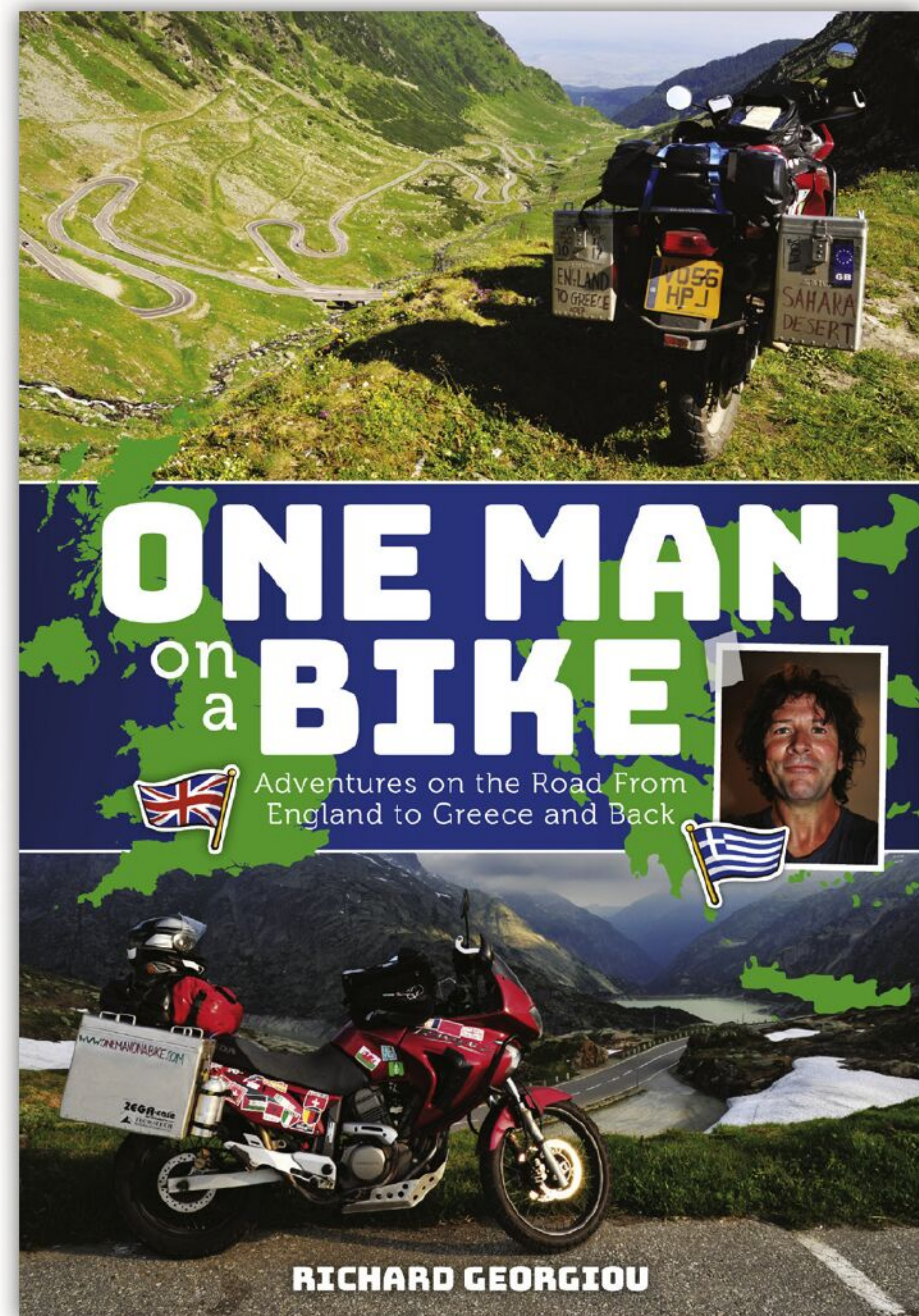
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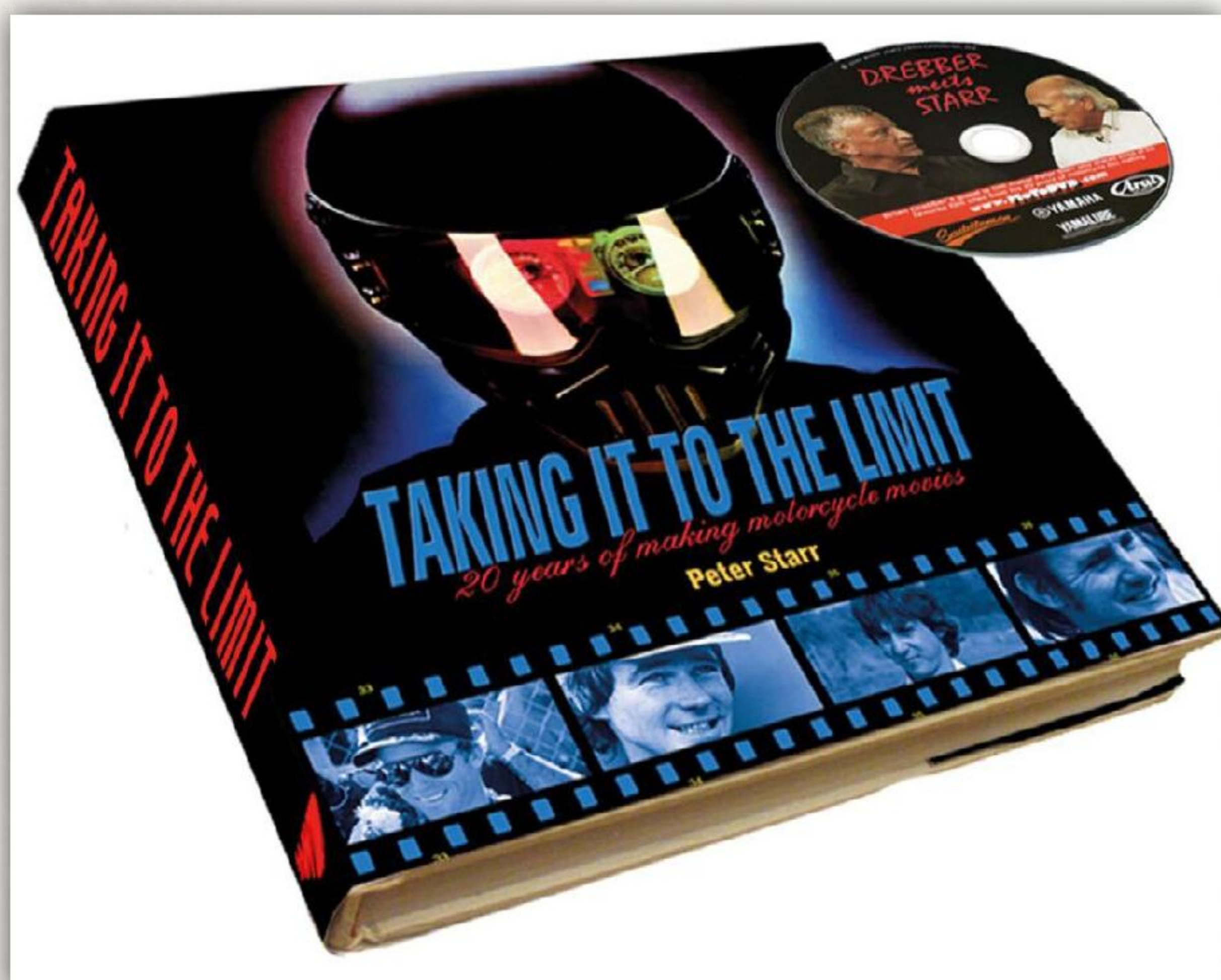
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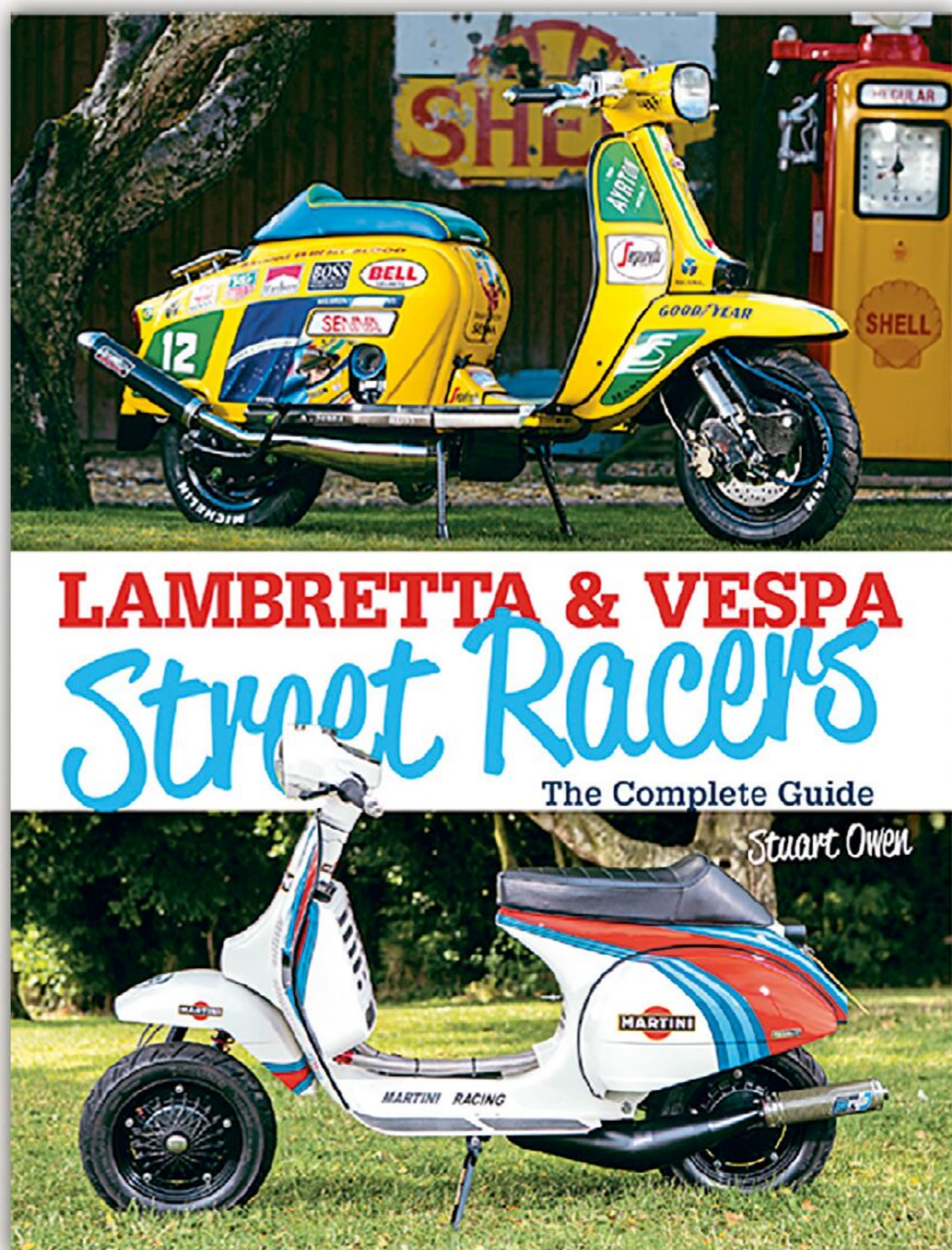
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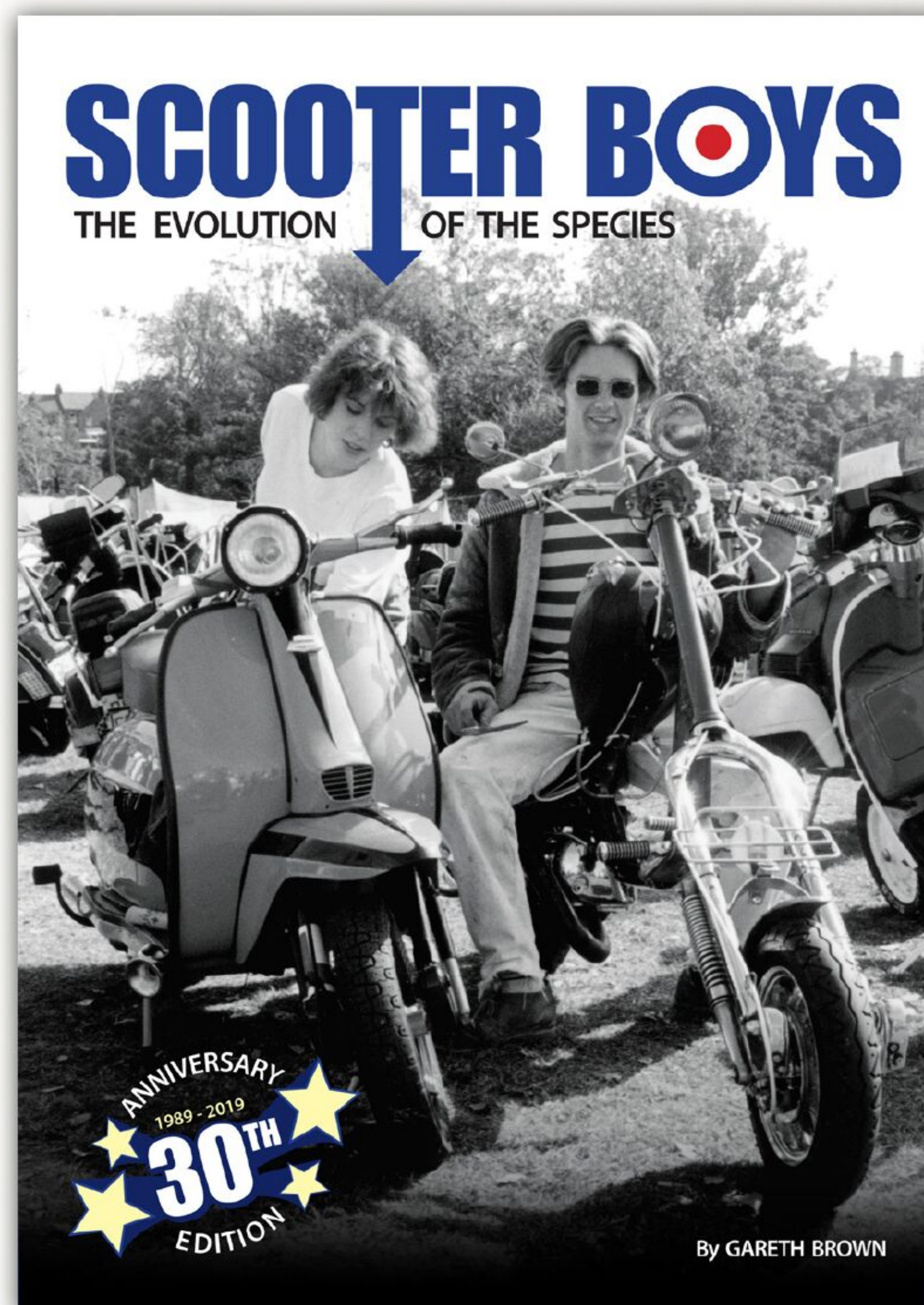
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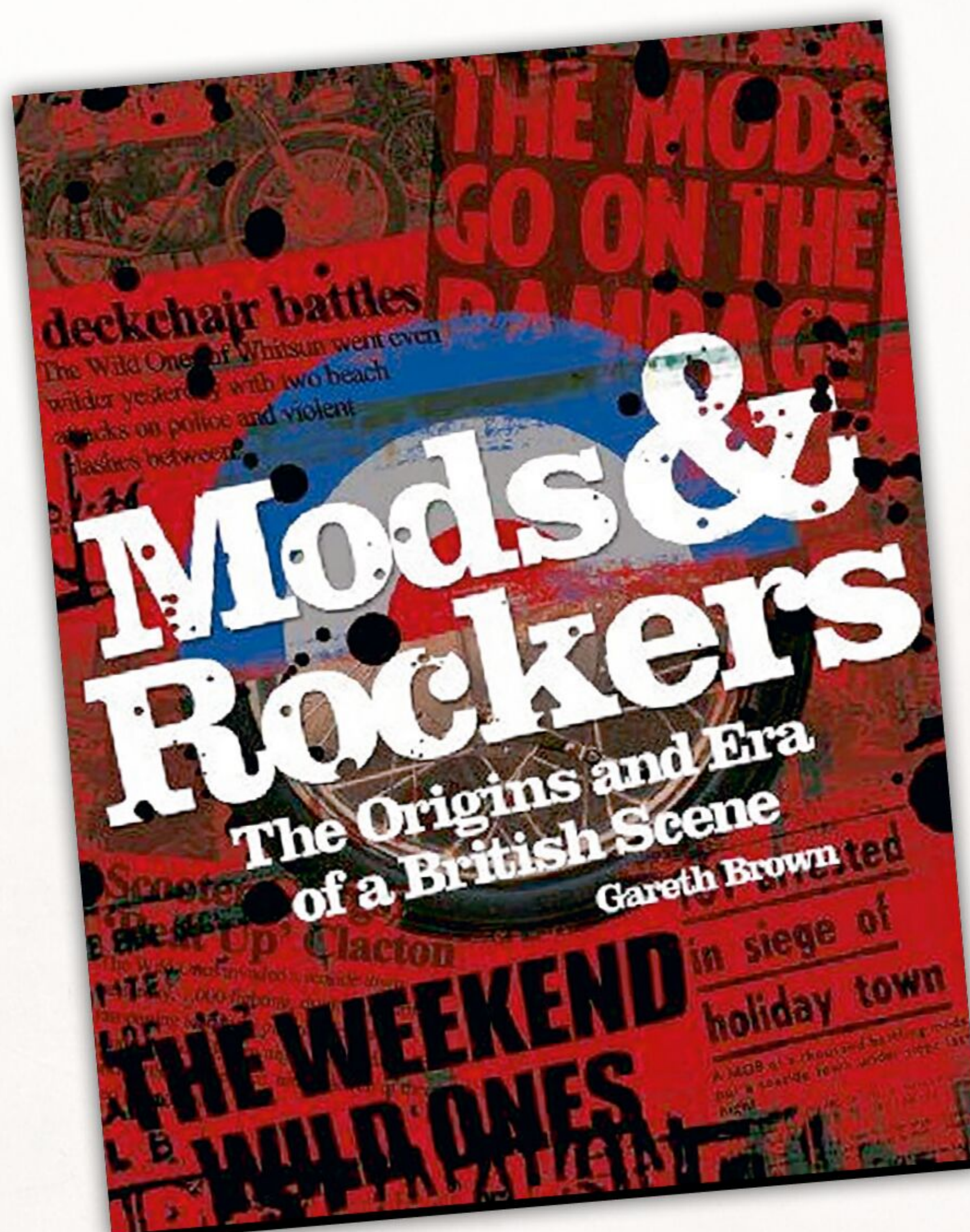
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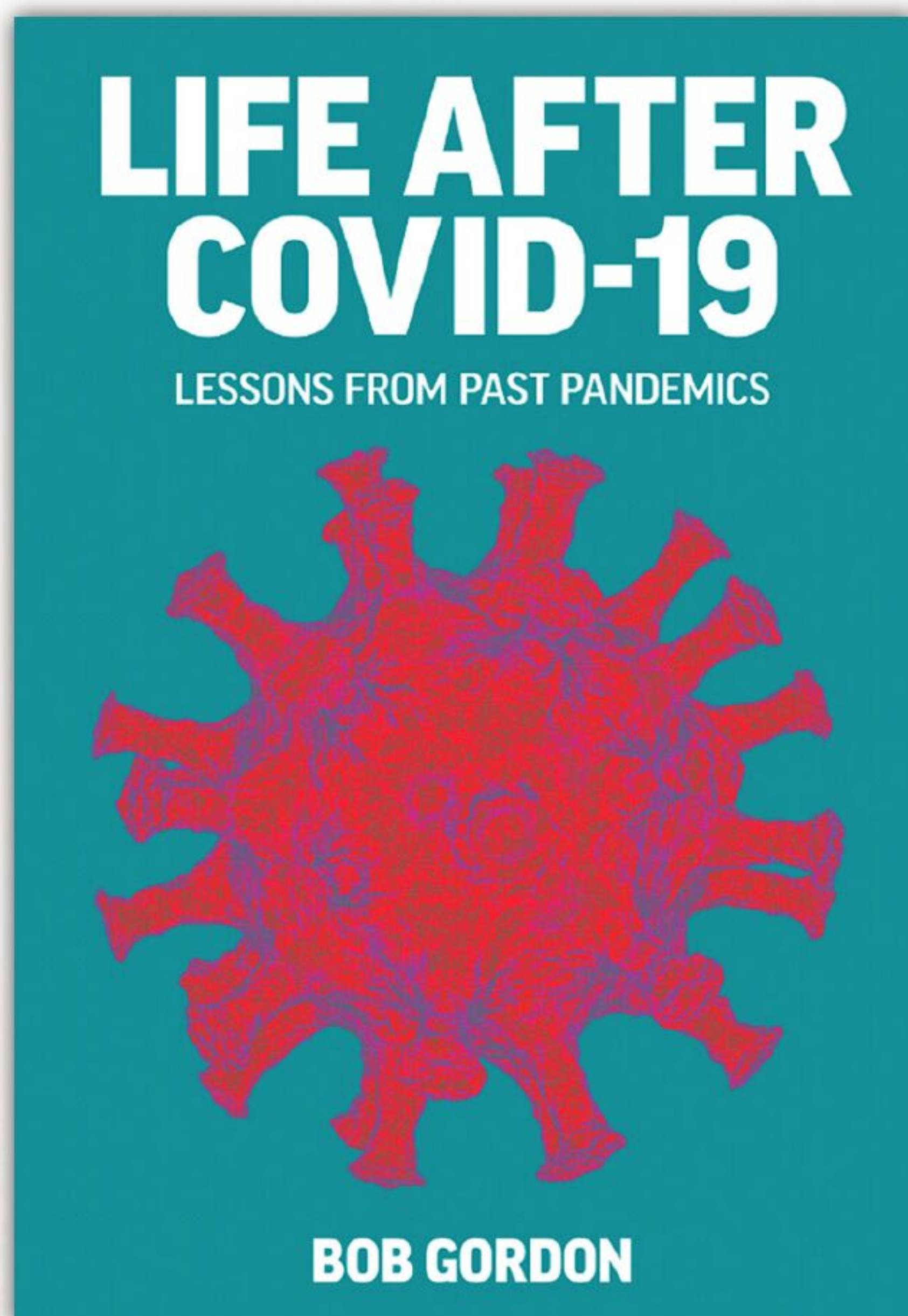
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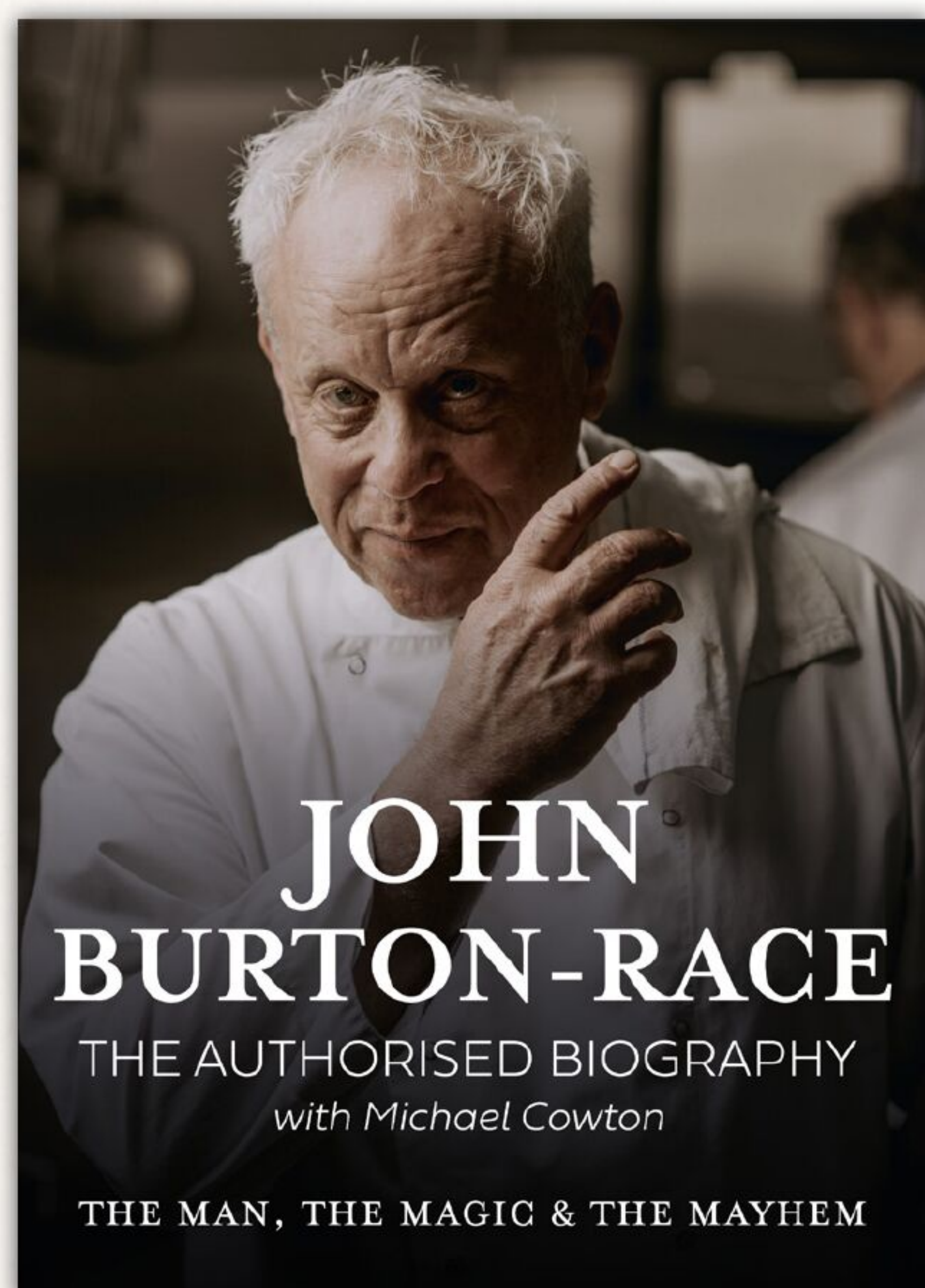
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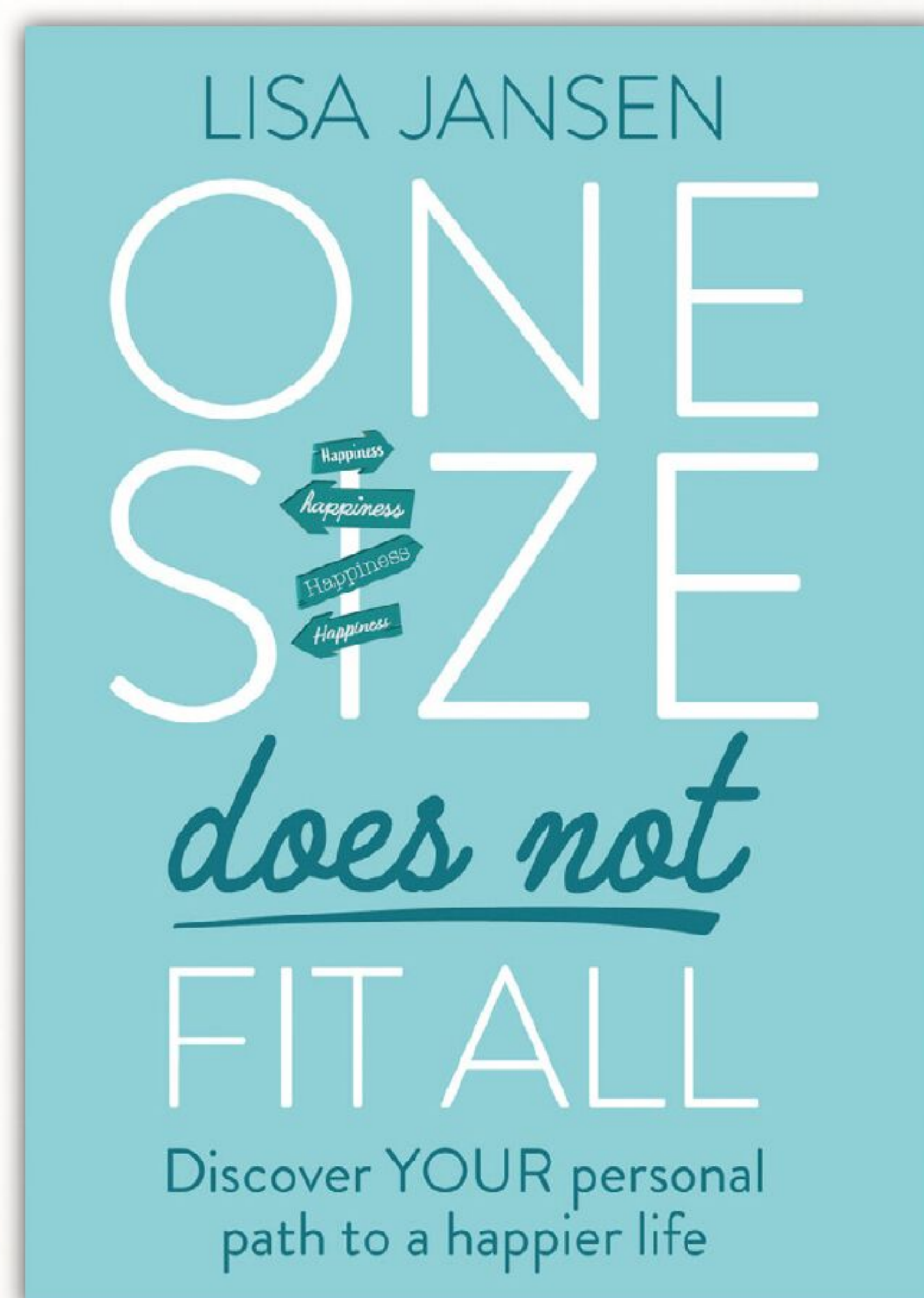
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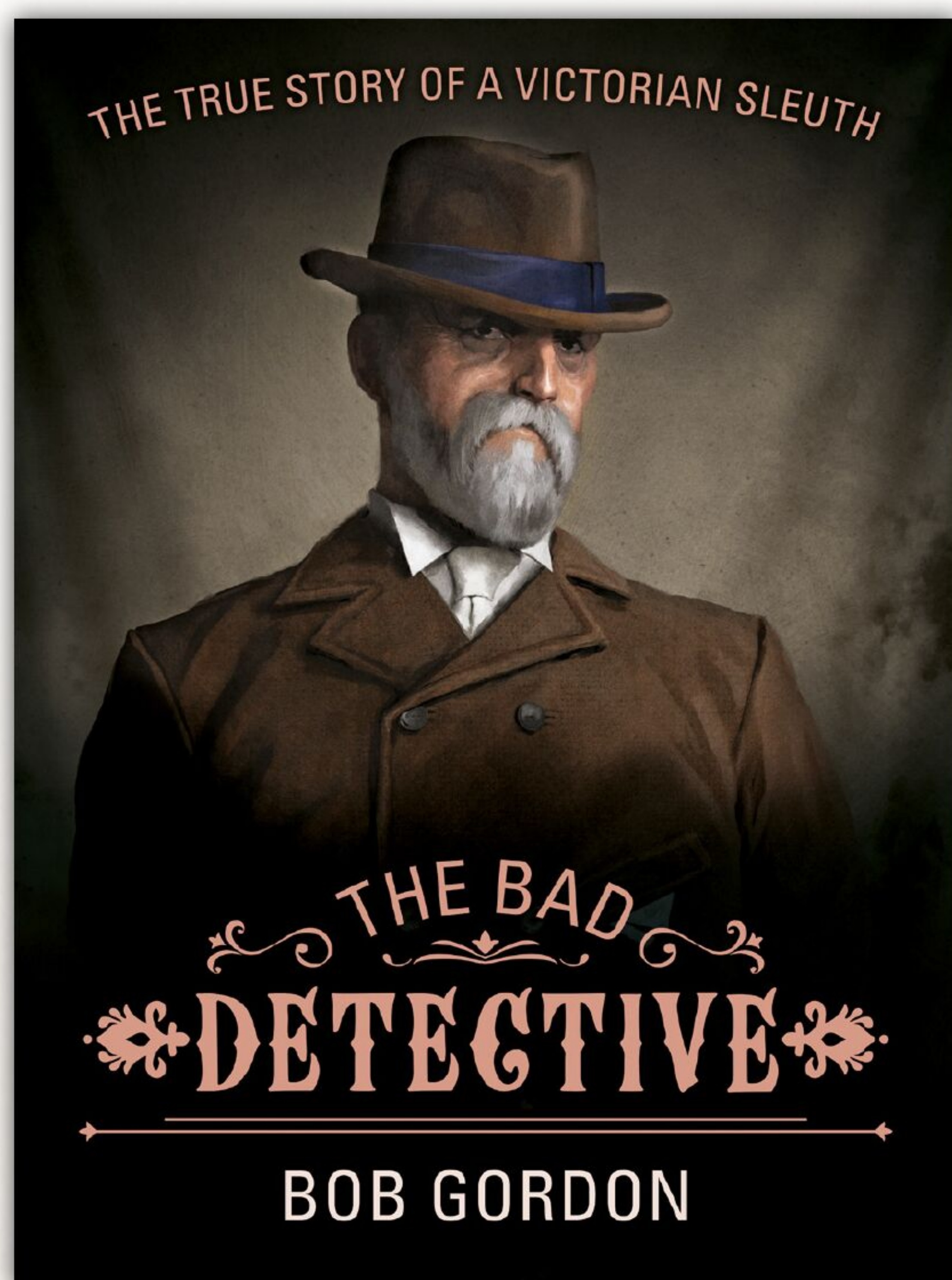
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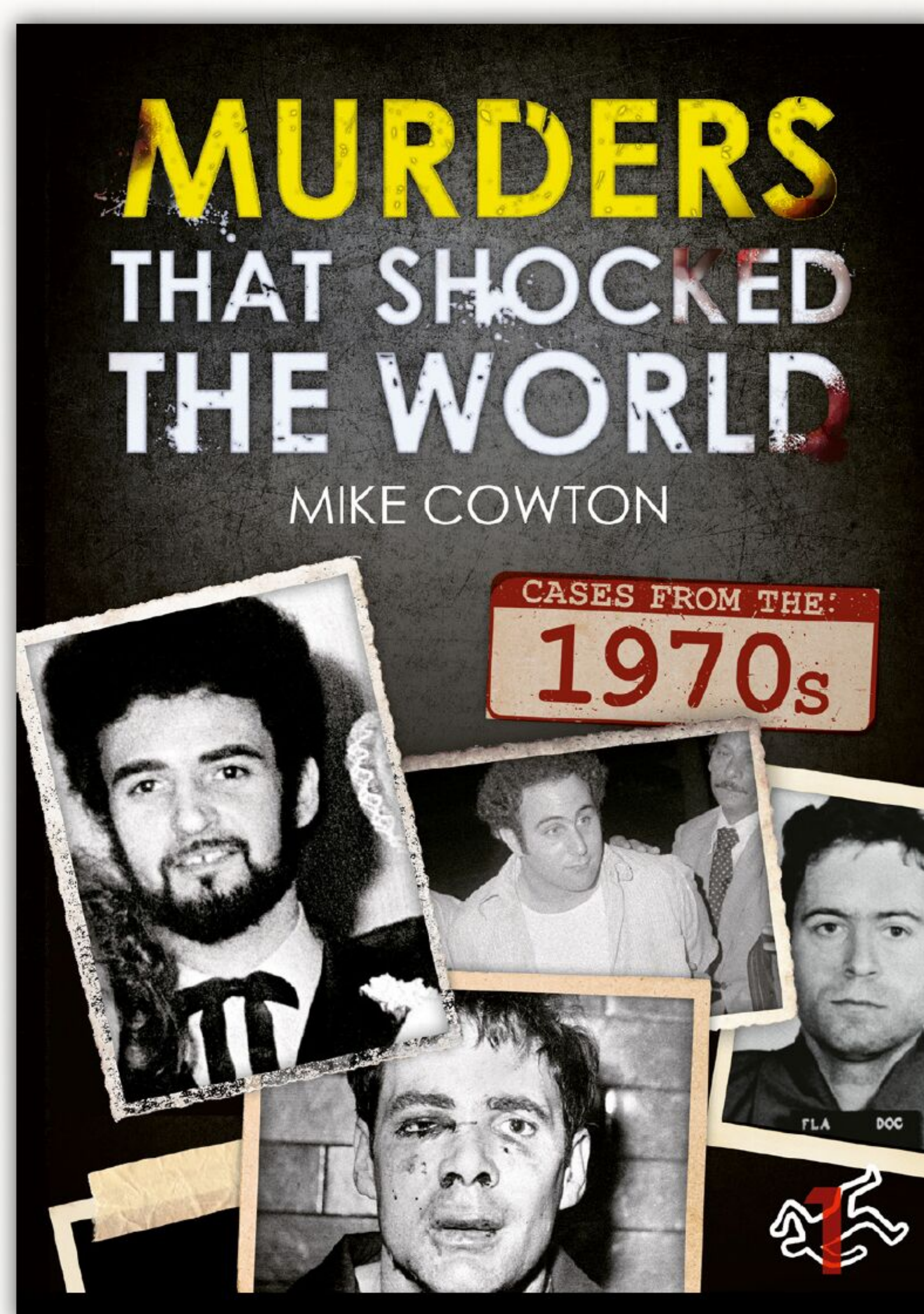
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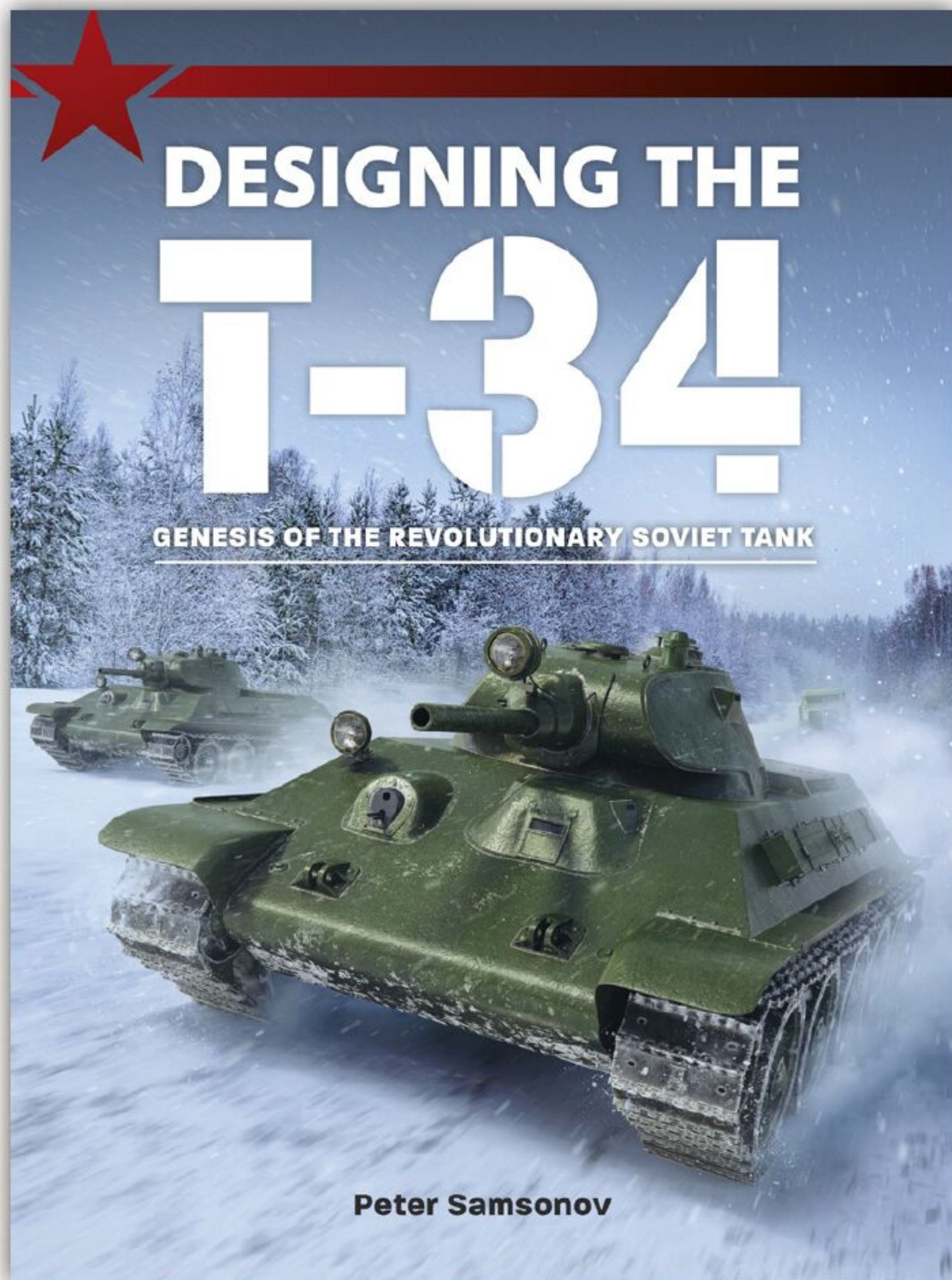
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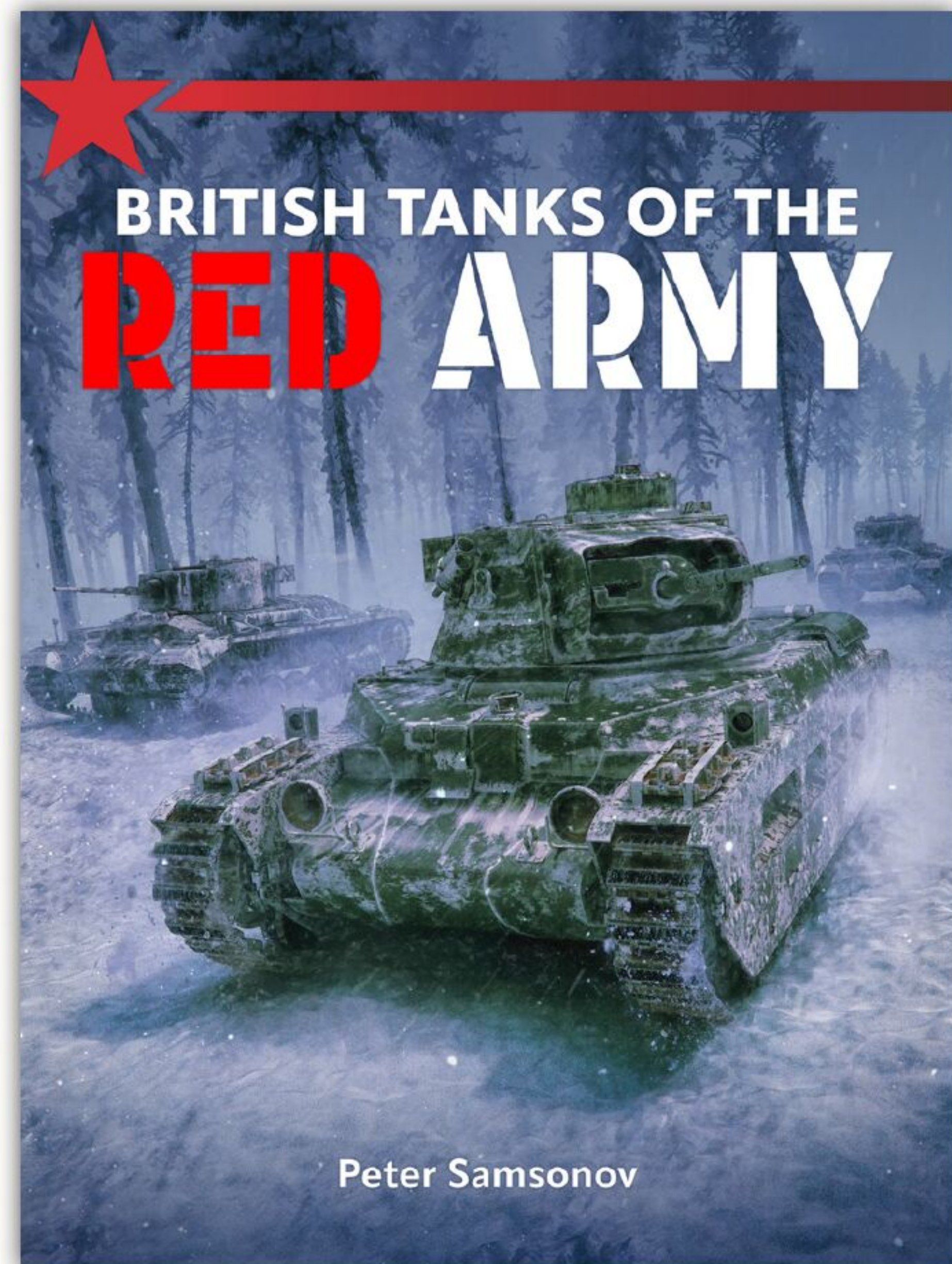
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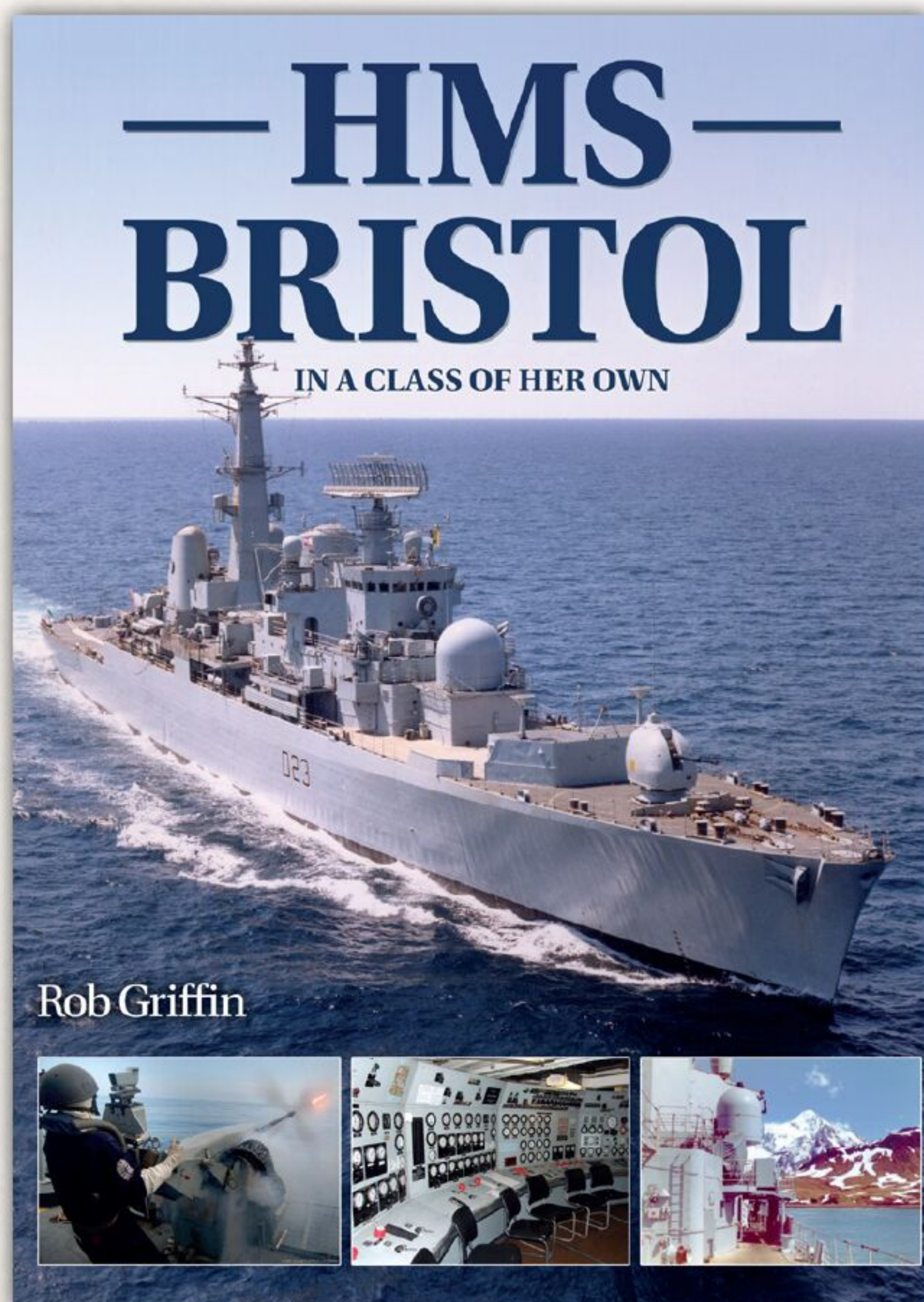
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The first encounter between British armour and the Red Army was not on friendly terms – with the British sending surplus tanks to reinforce the pro-monarchy White Army in the Russian Civil War. When the Reds won, war trophy Mark V heavy tanks as well 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.

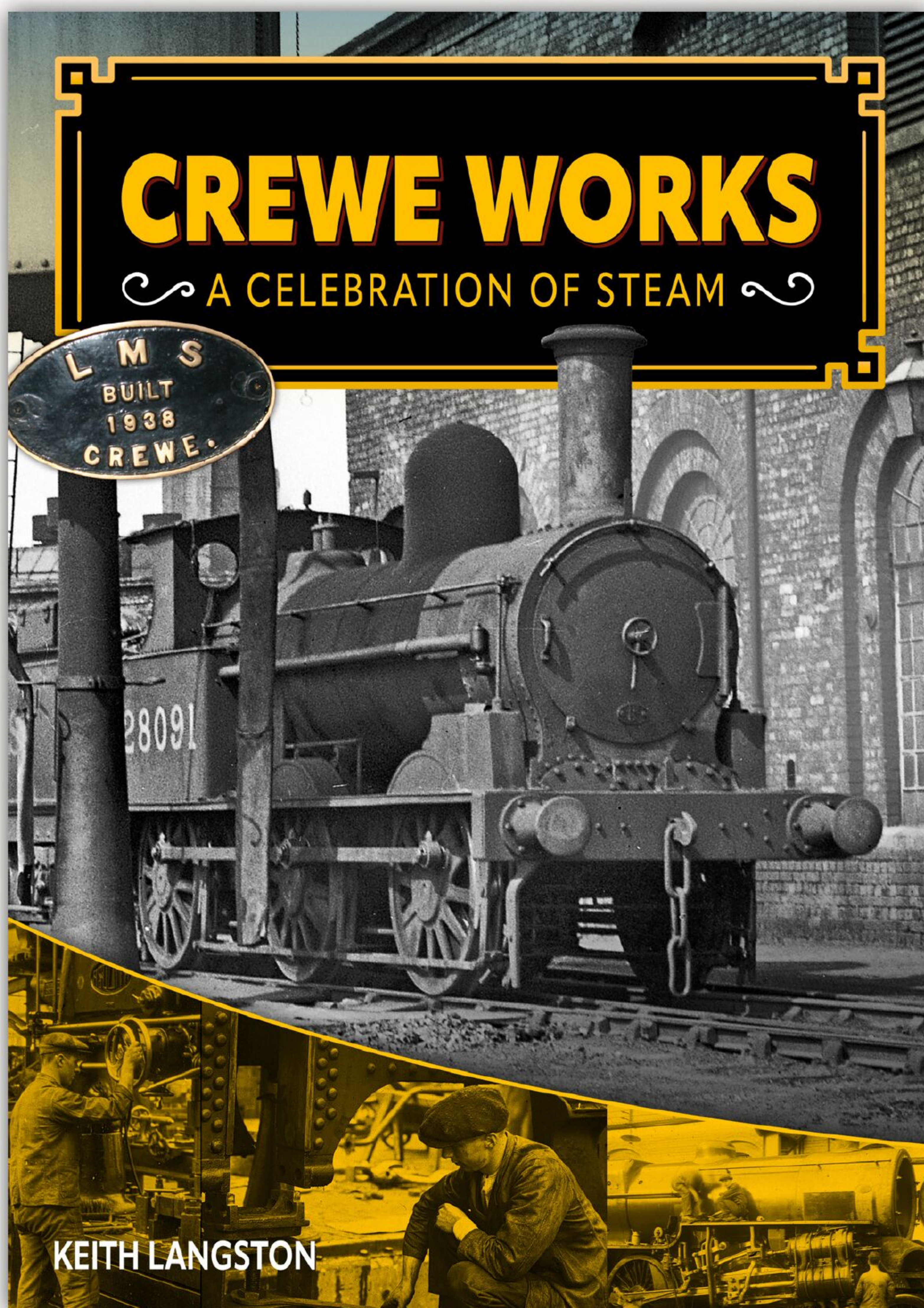
Locomotive No 32 Tamerline became the first steam locomotive to be completed at Crewe Works on 10 March 1843. One hundred and fifteen years later BR 9F No 92250 became the 7,331st steam locomotive to be built at the Cheshire works, when completed in December 1958. This publication is a tribute to the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



CREWE WORKS - A CELEBRATION OF STEAM

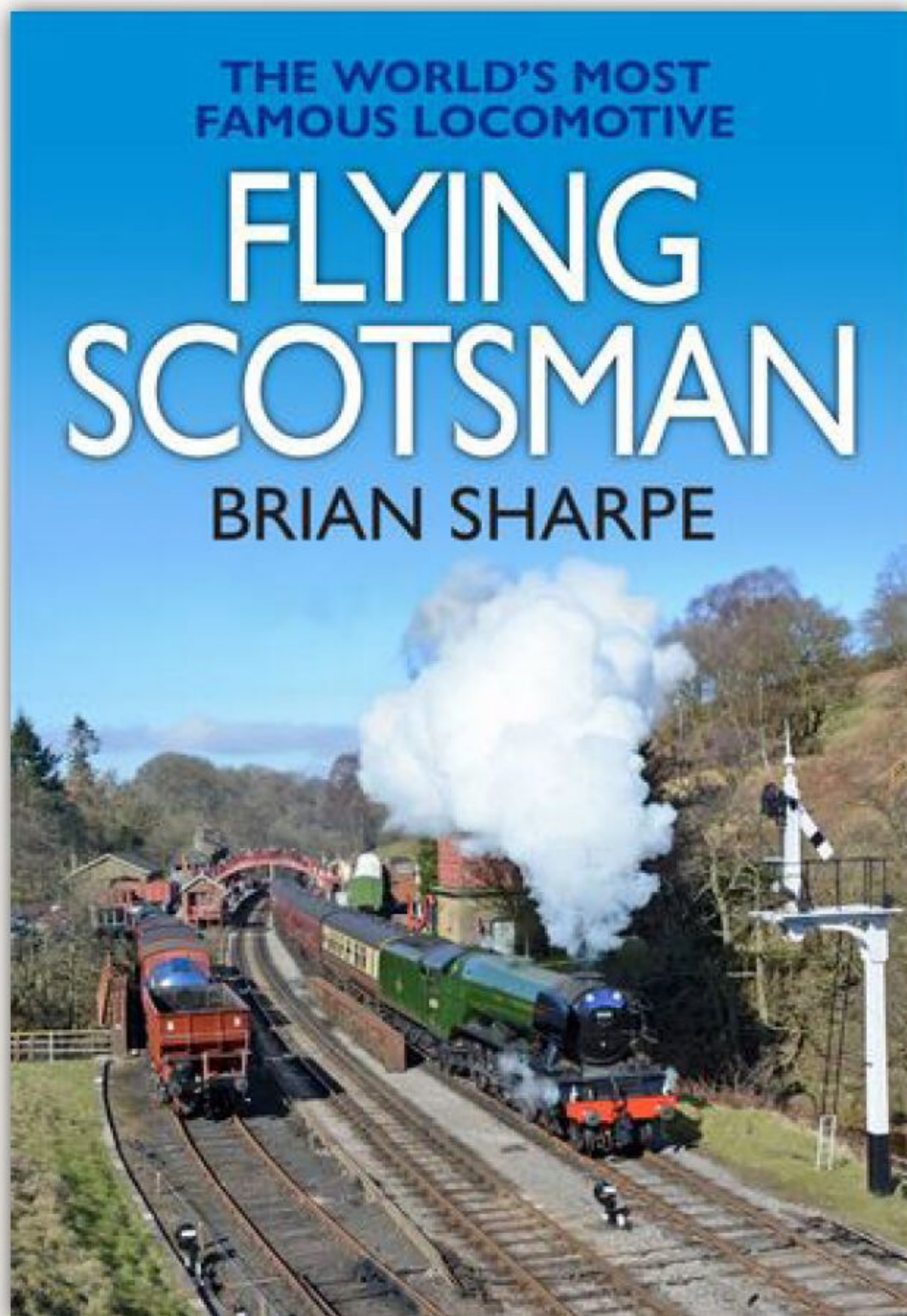
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Langston is not intended to be a source of detailed steam engineering practices, but is a comprehensively illustrated record of steam locomotive building and maintenance at Crewe Works. Fortunately, important engineering work was still carried out 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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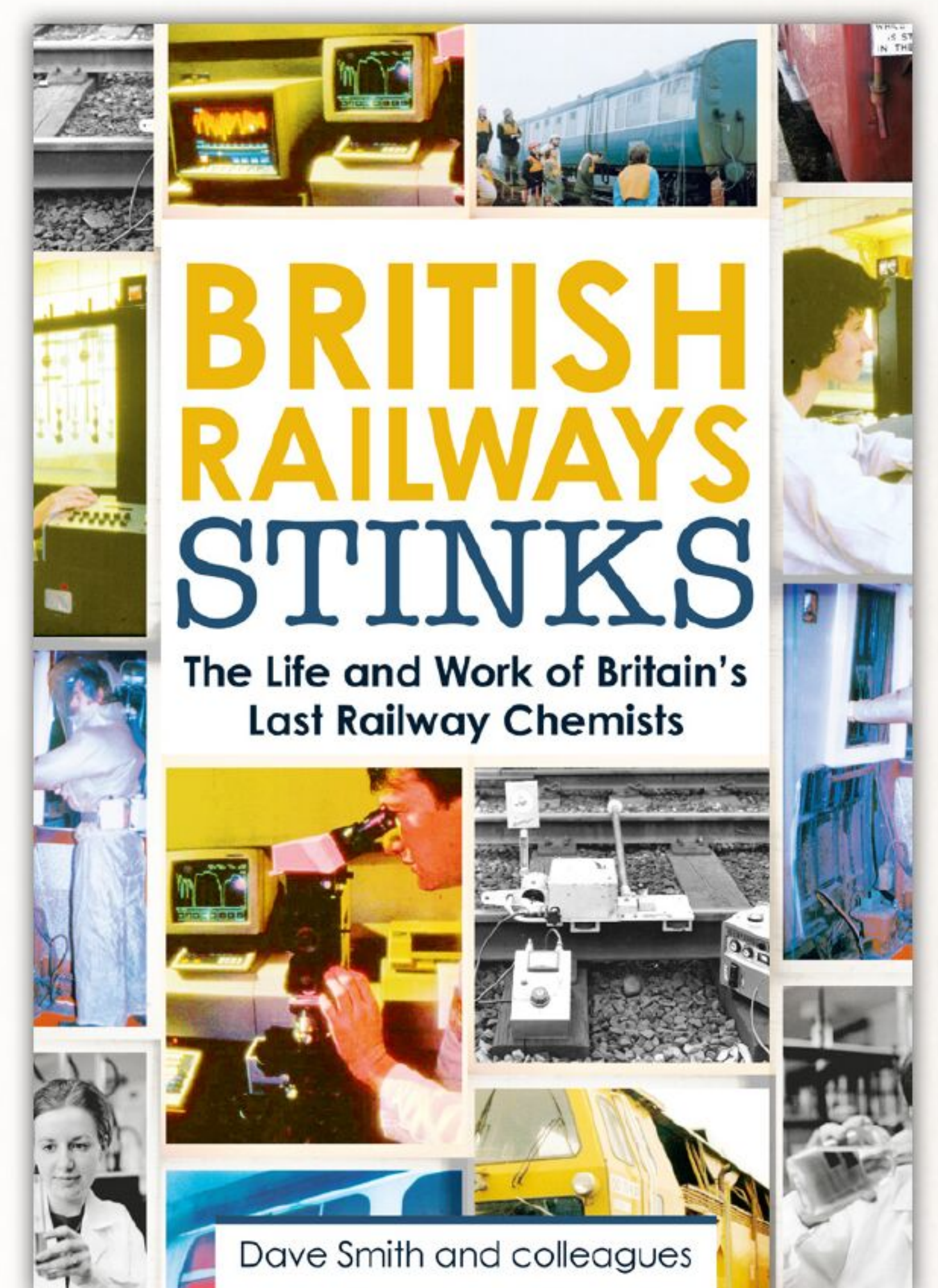
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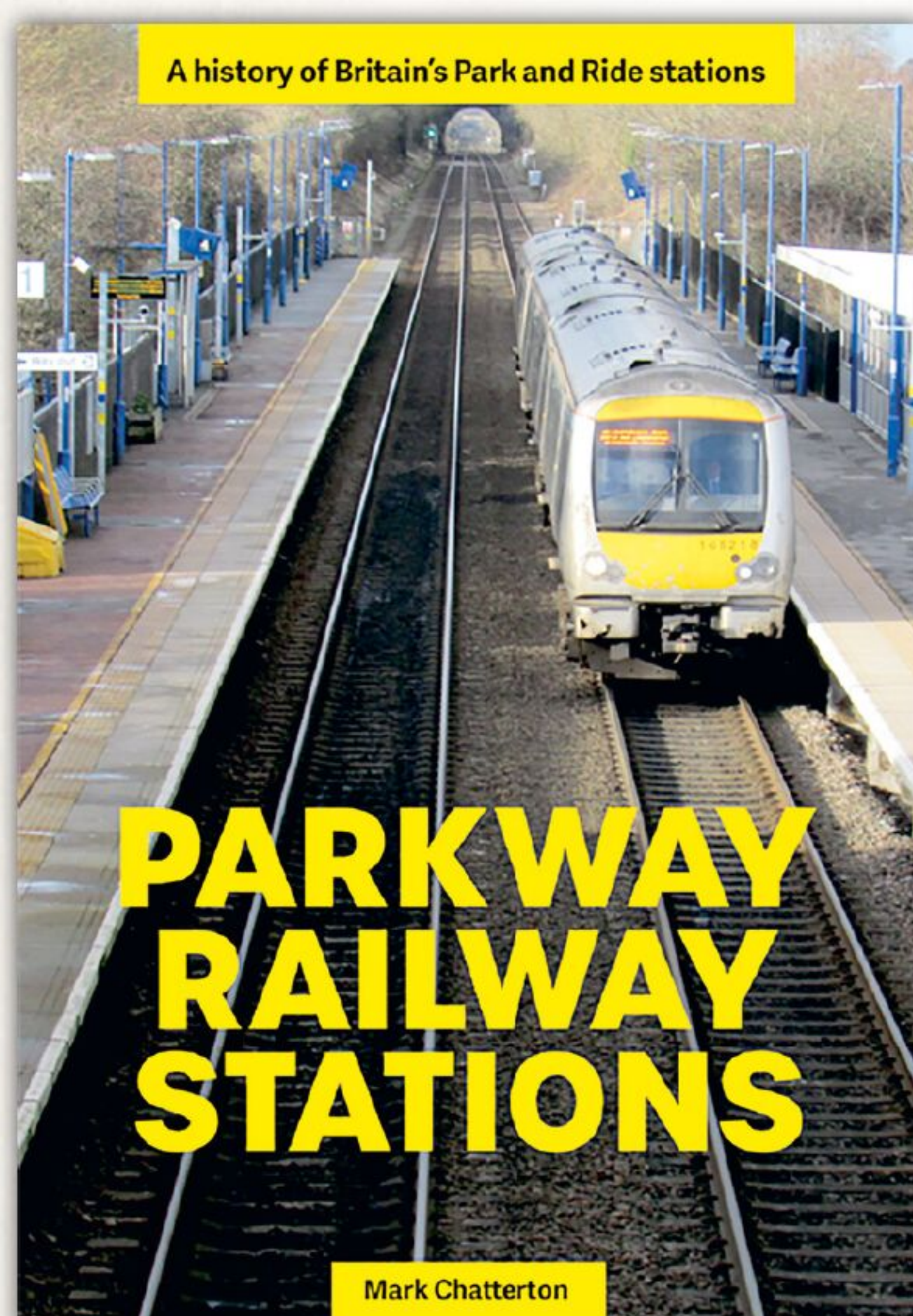
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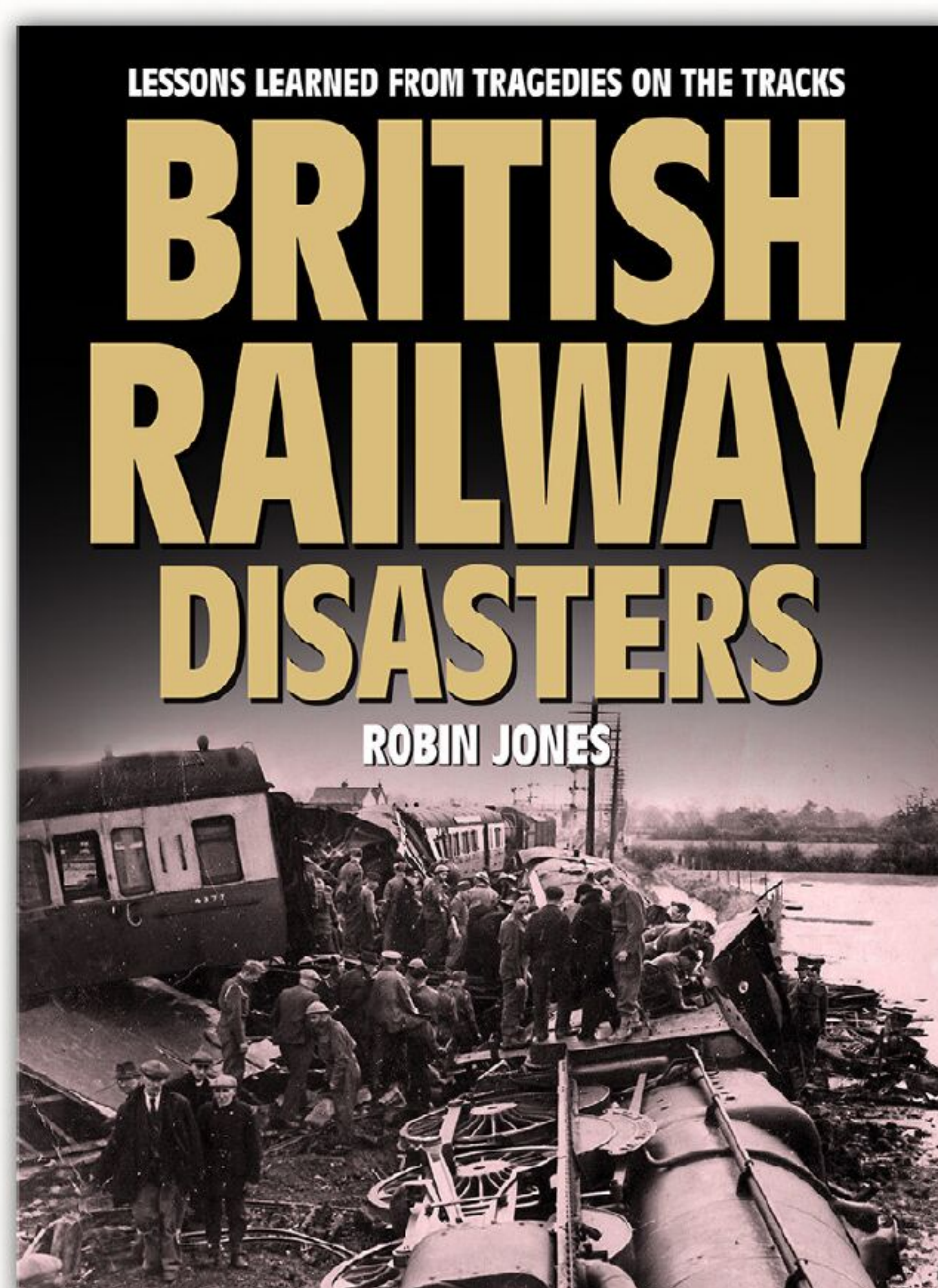
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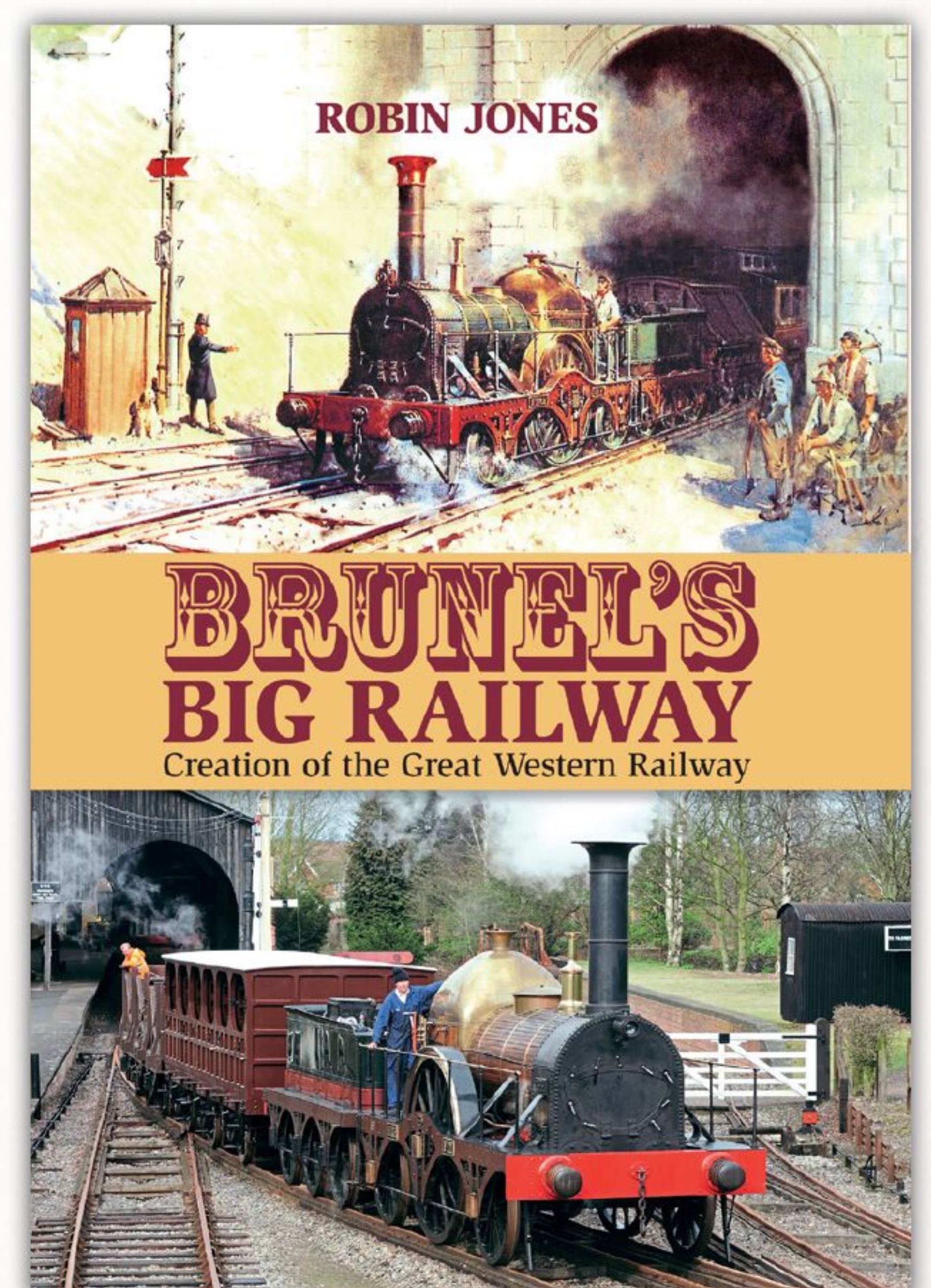
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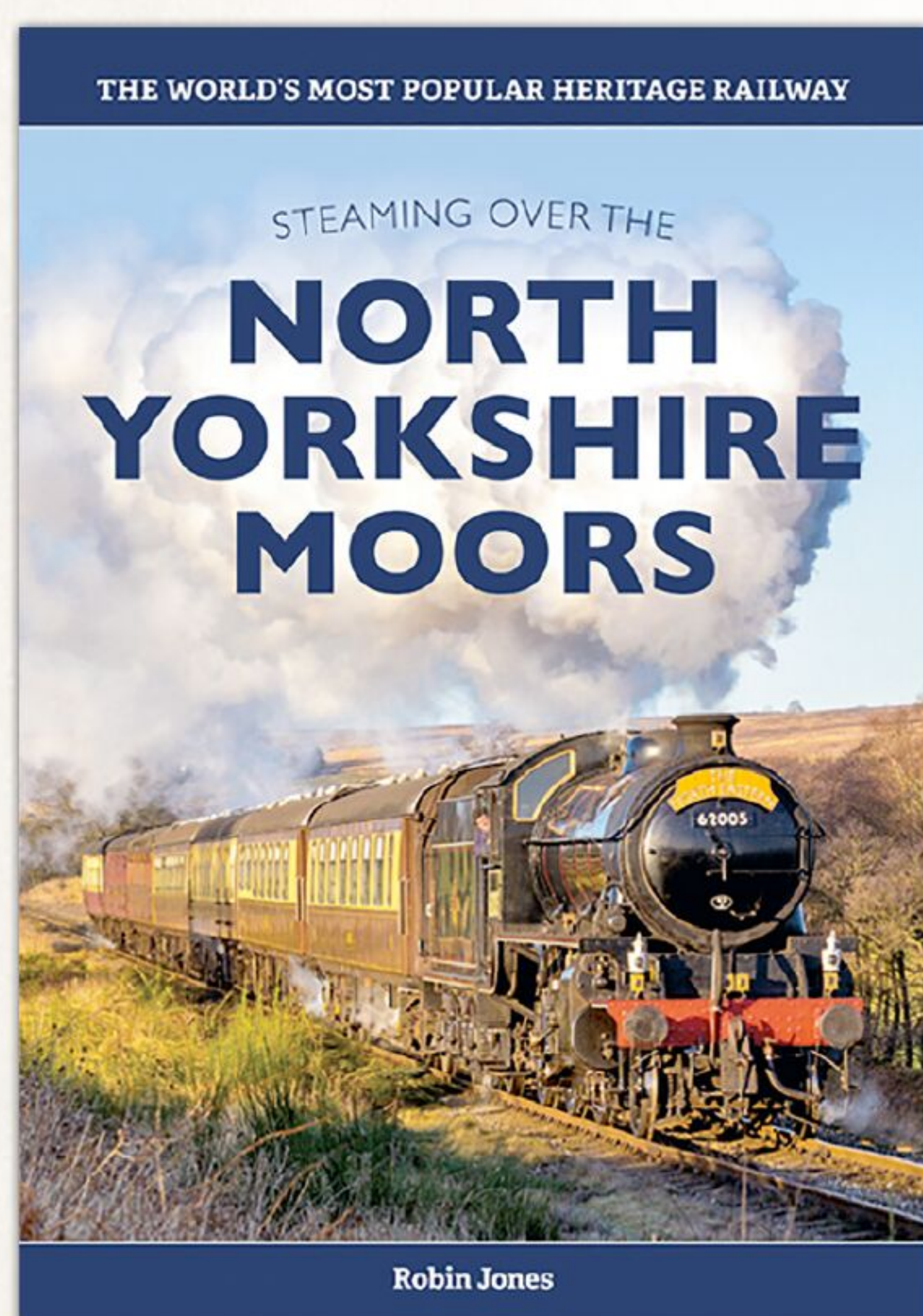
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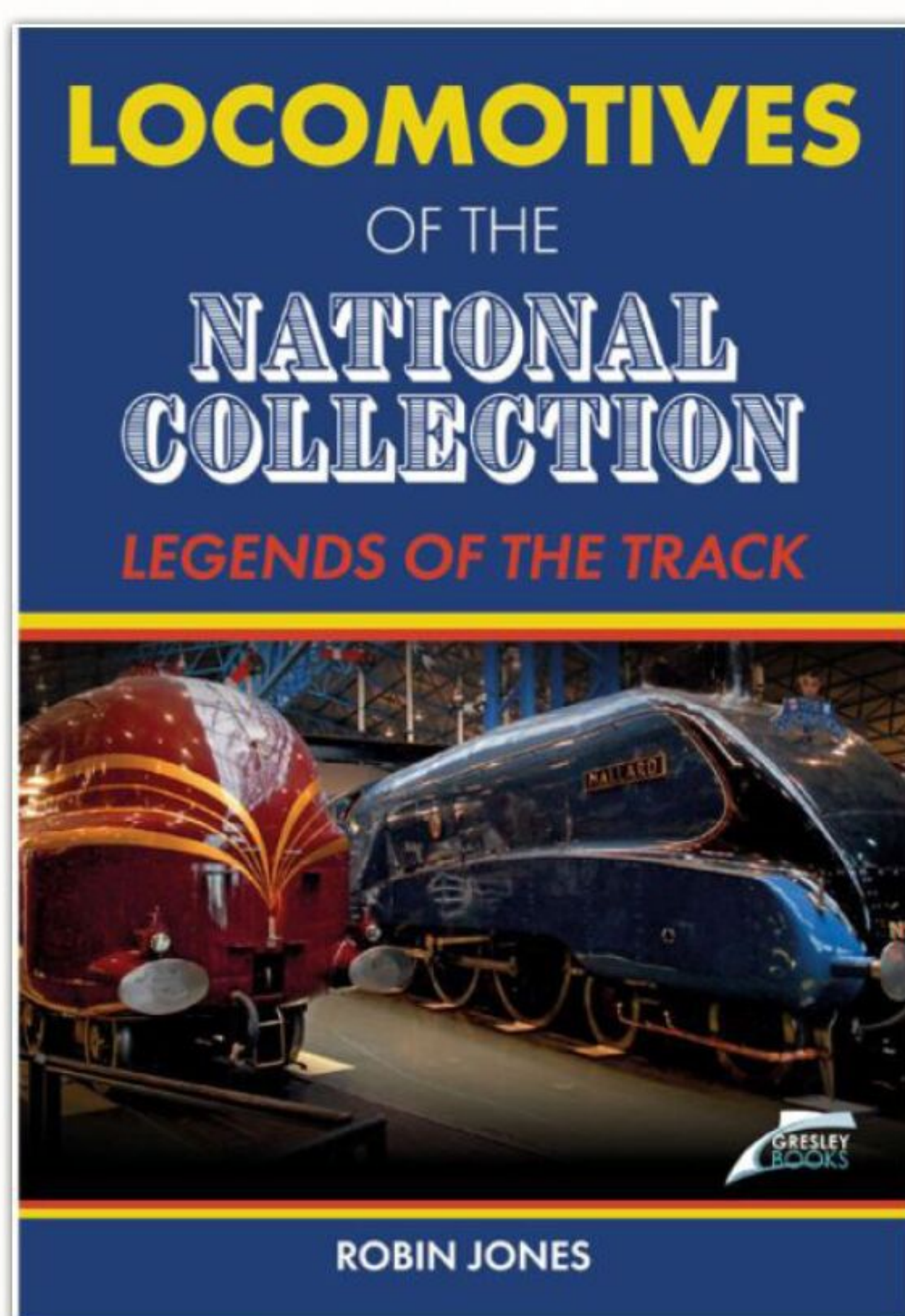
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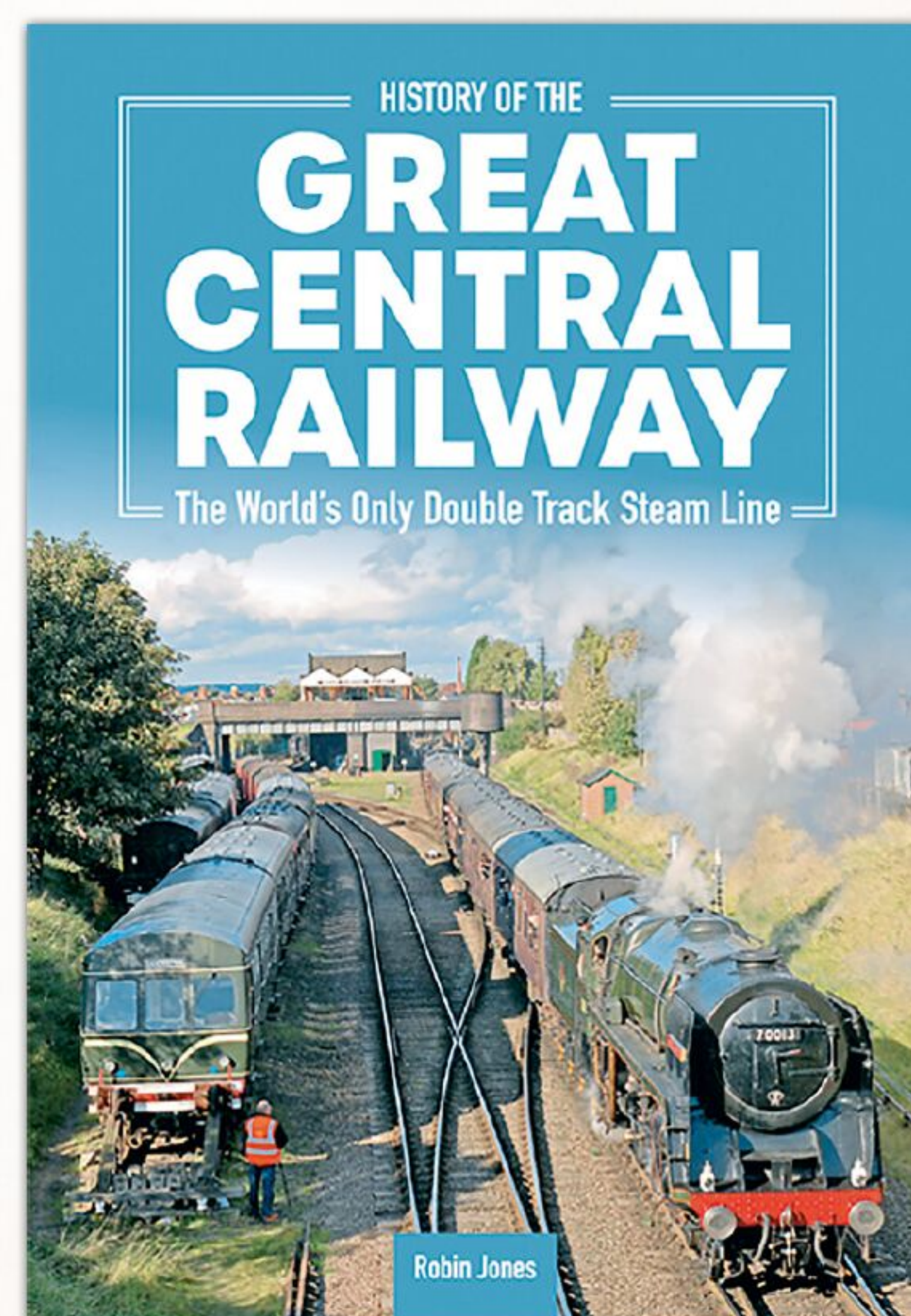
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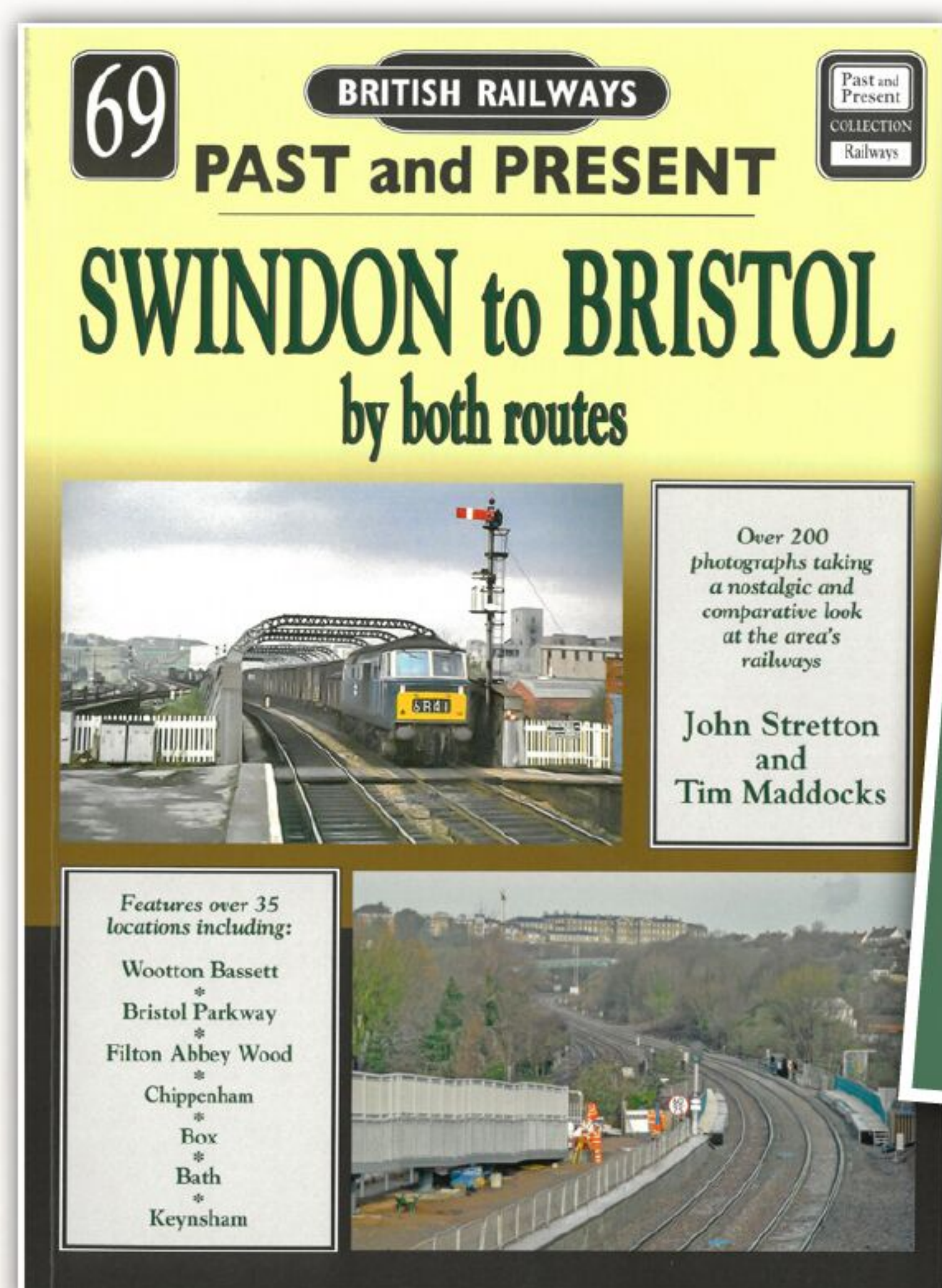
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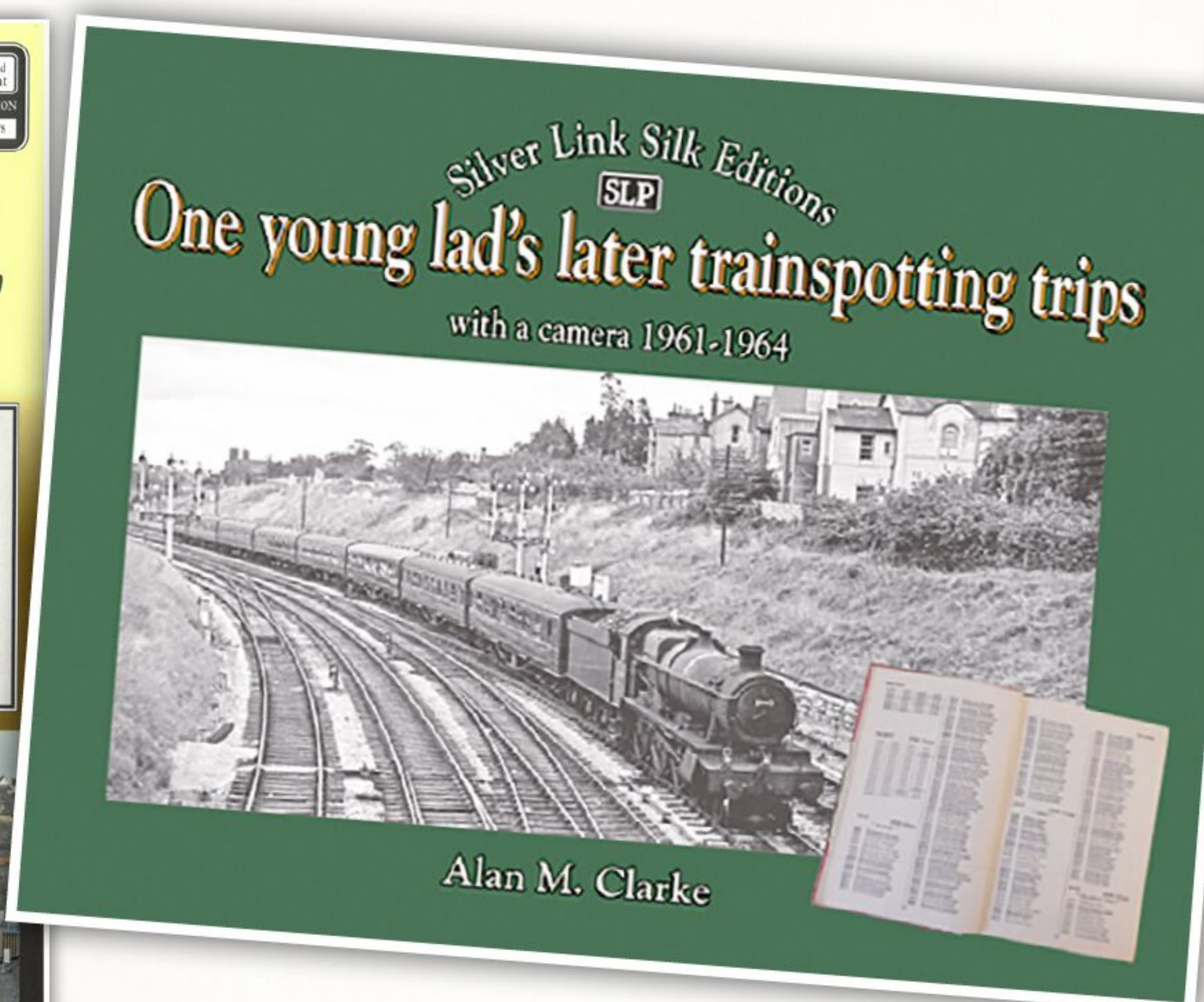
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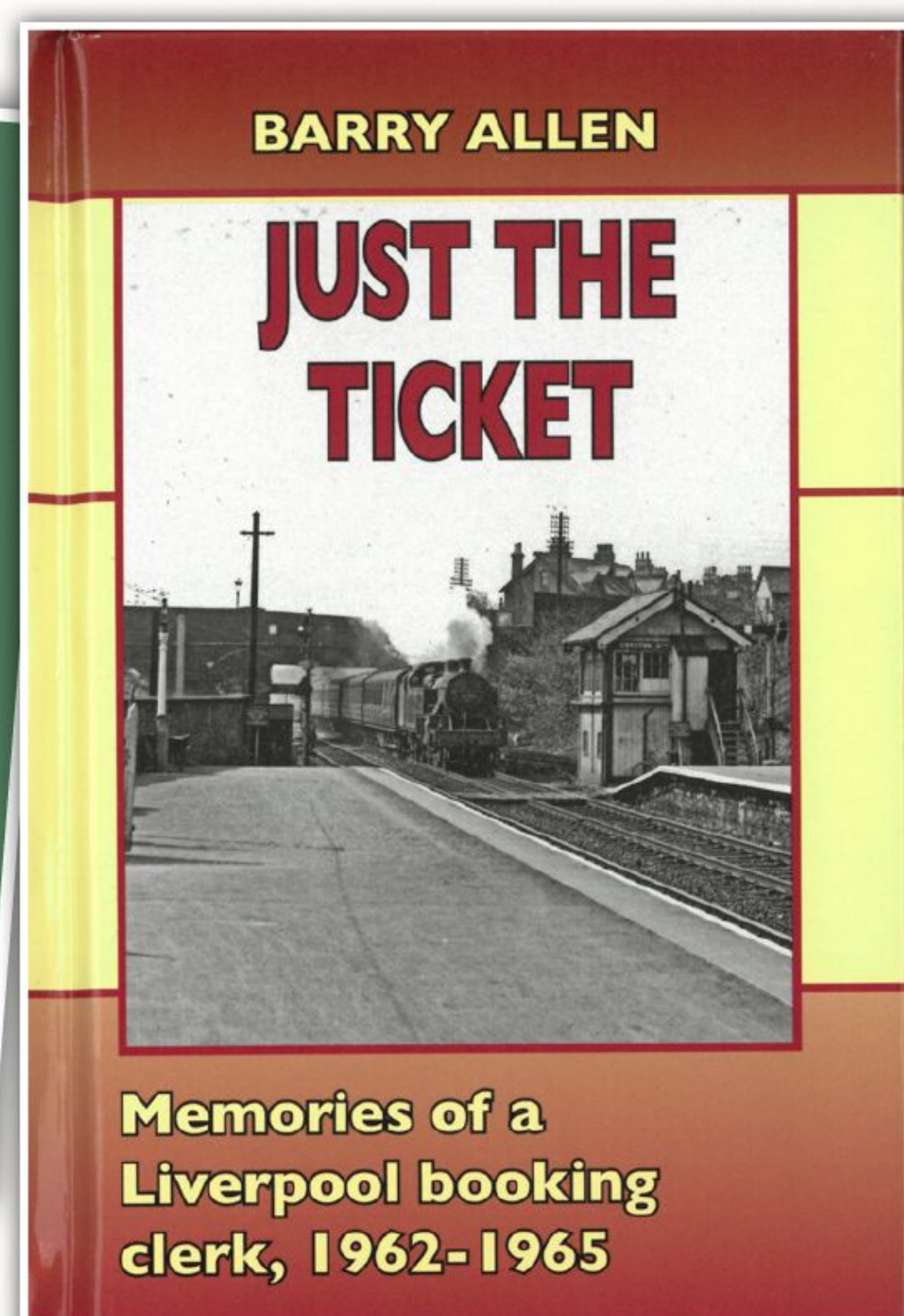
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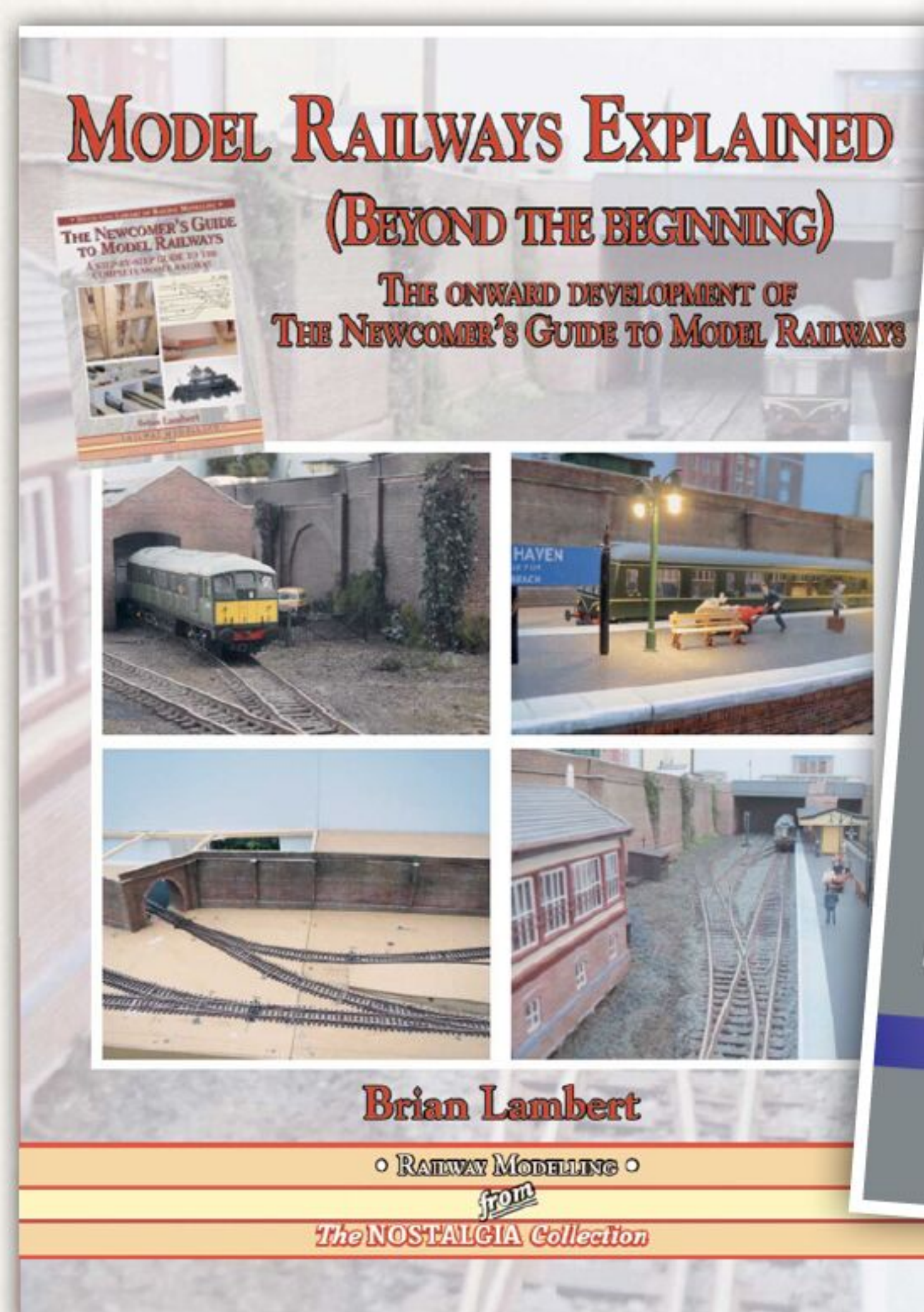
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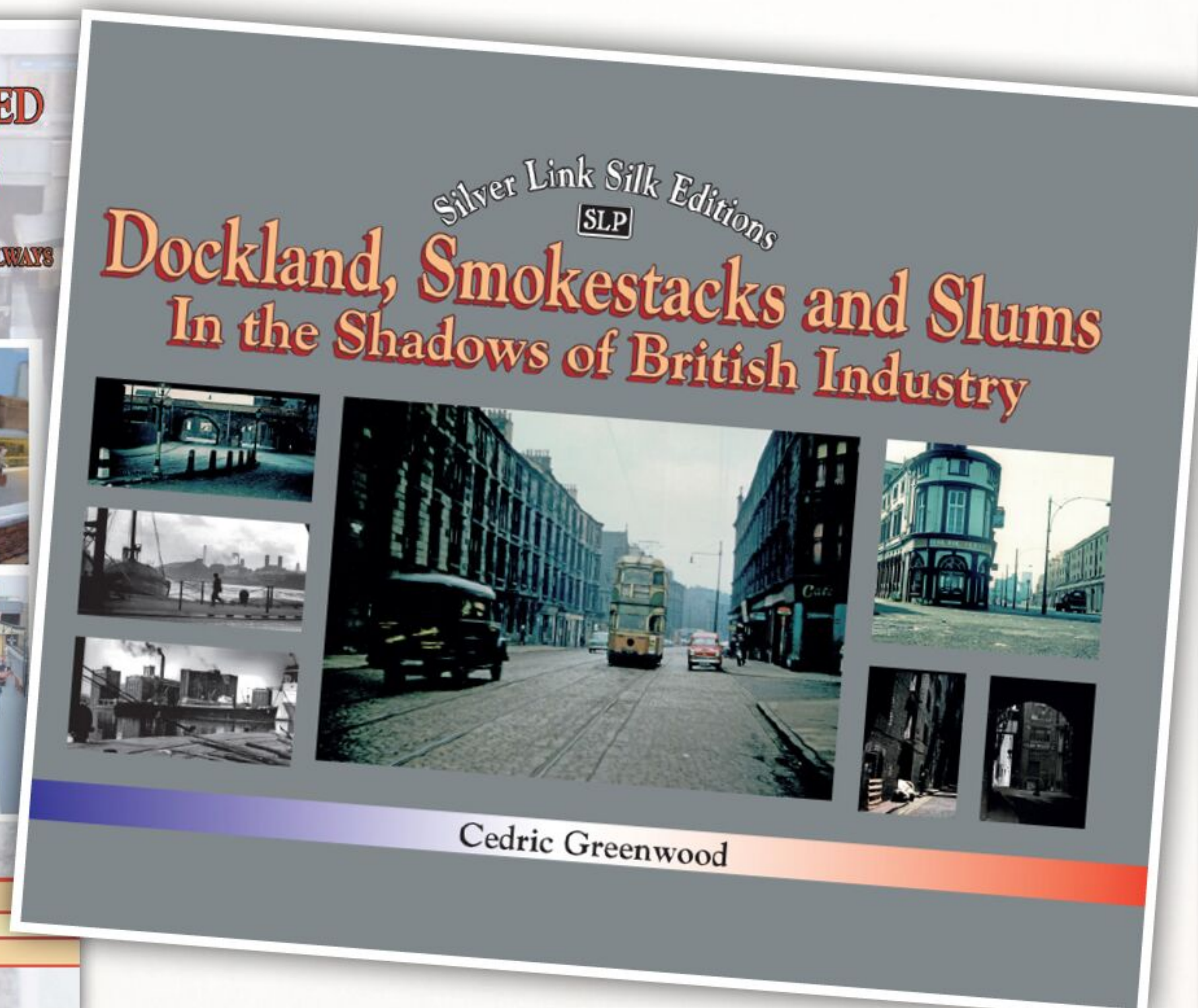
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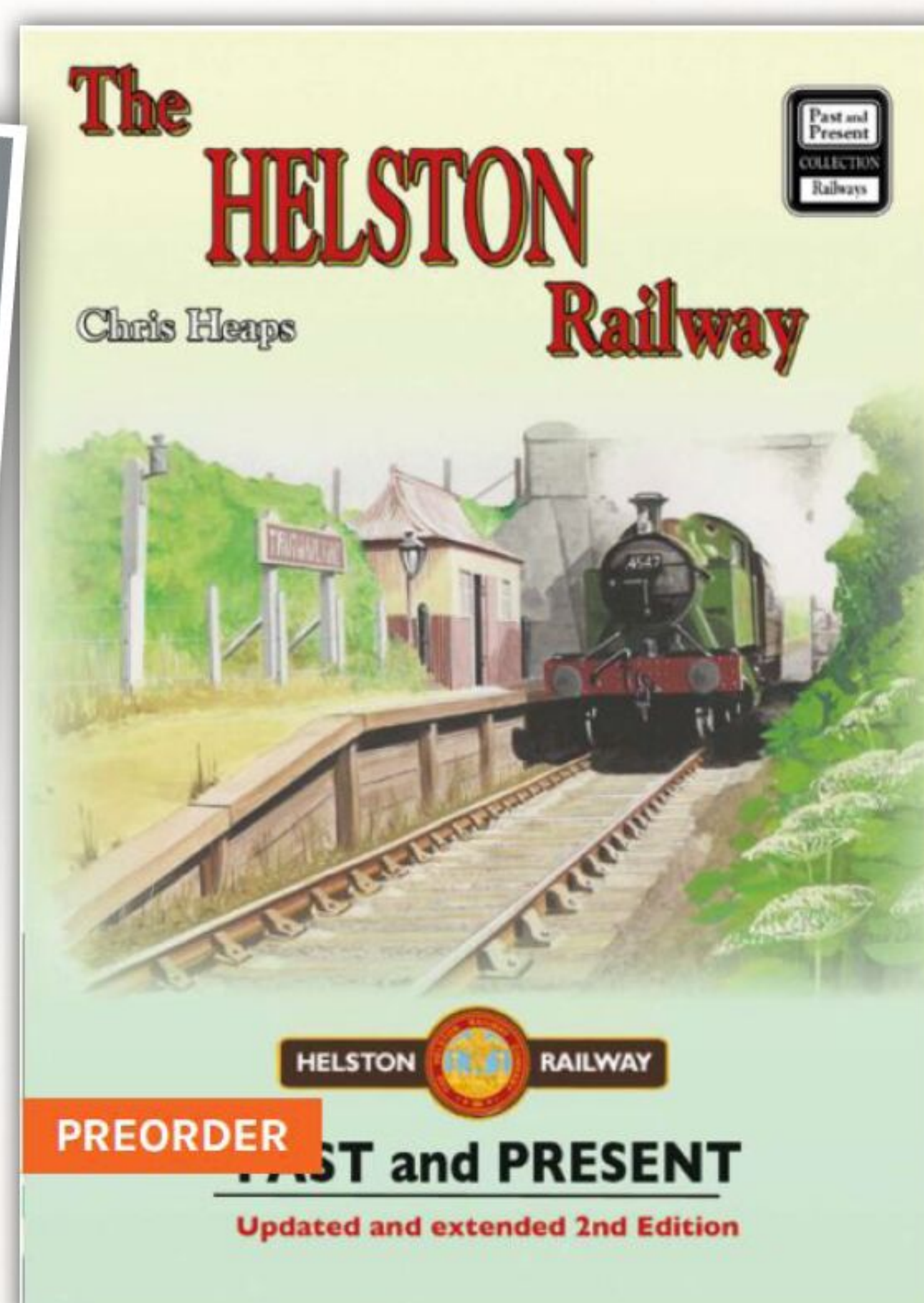
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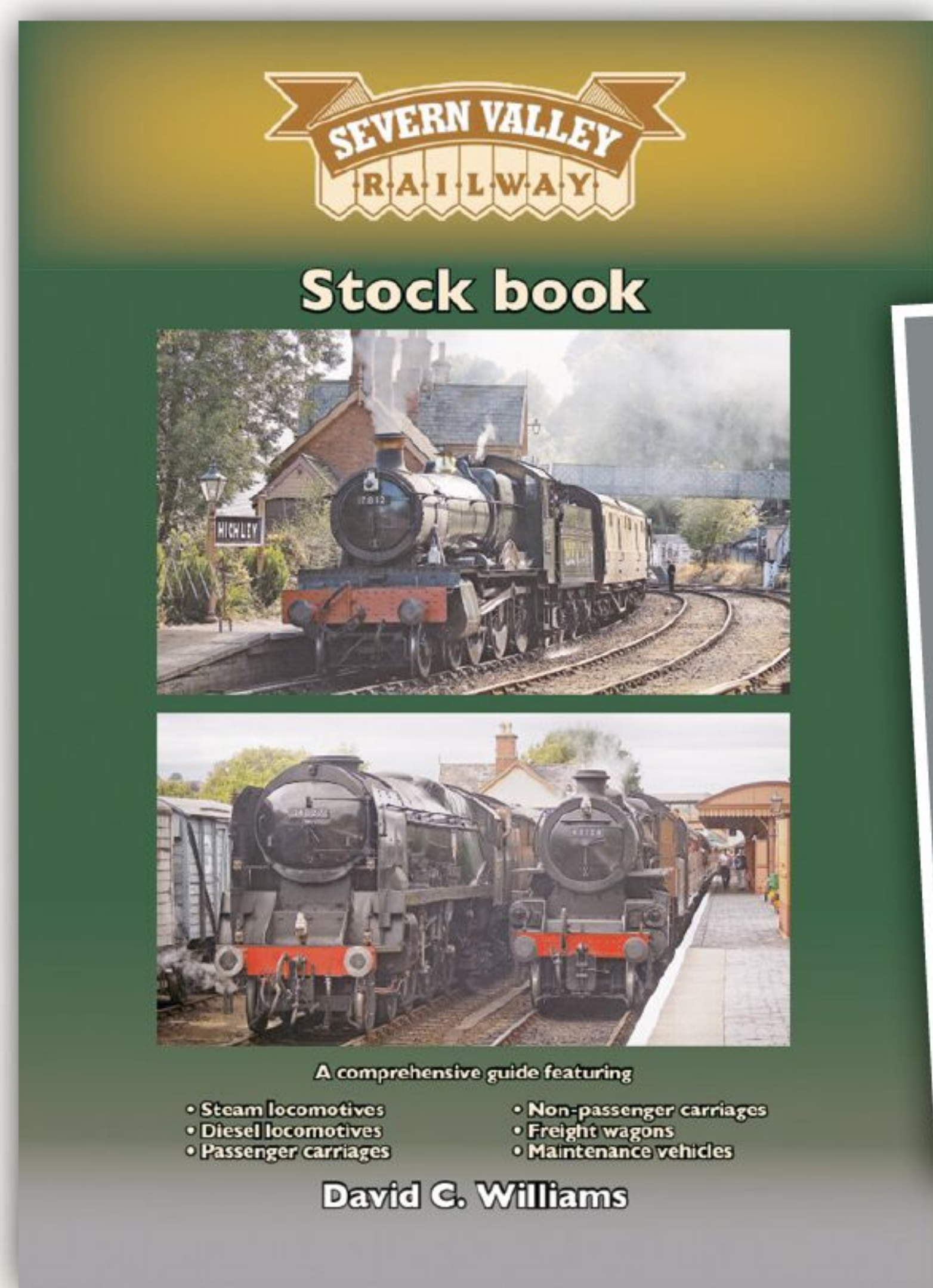
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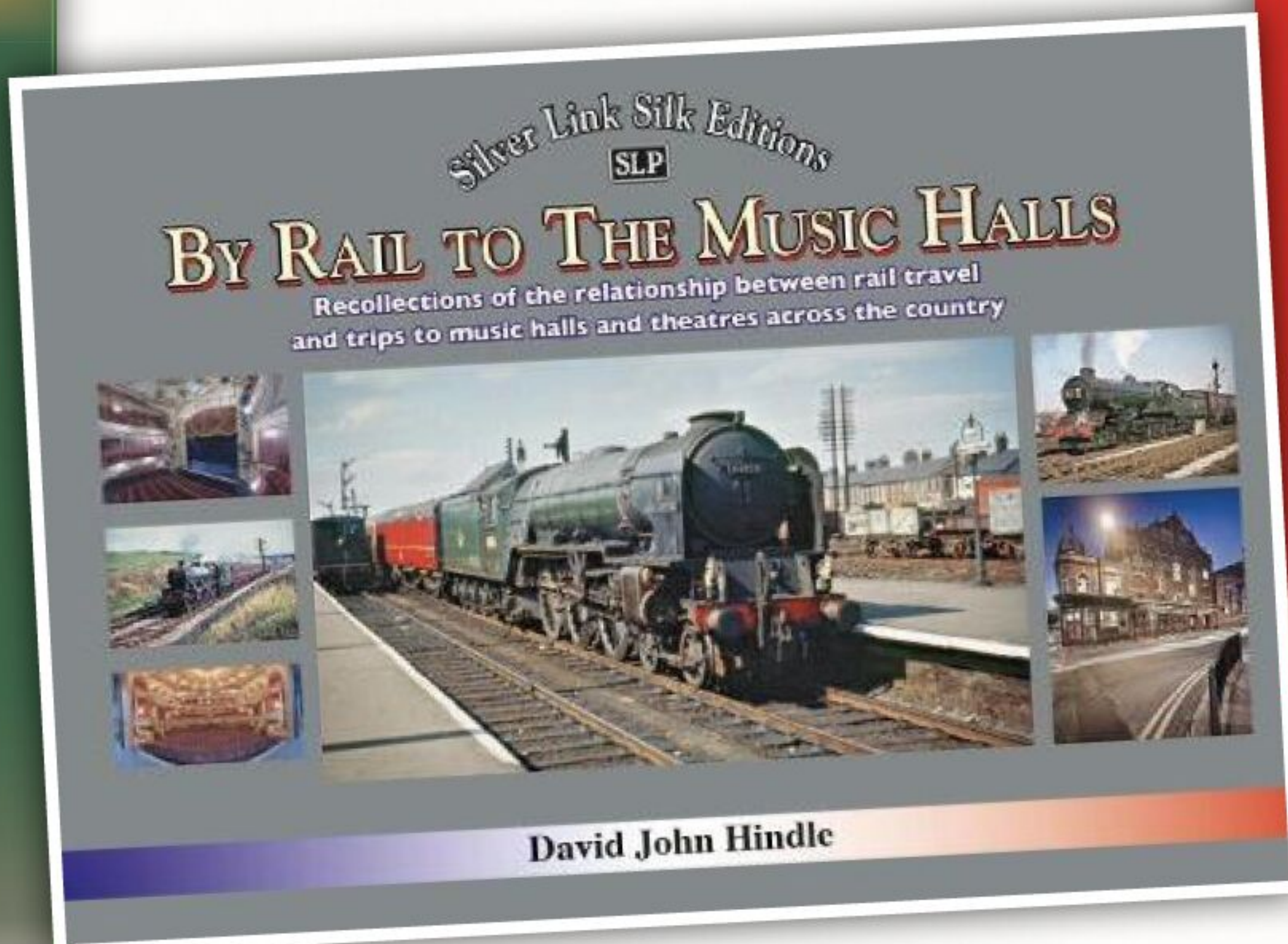
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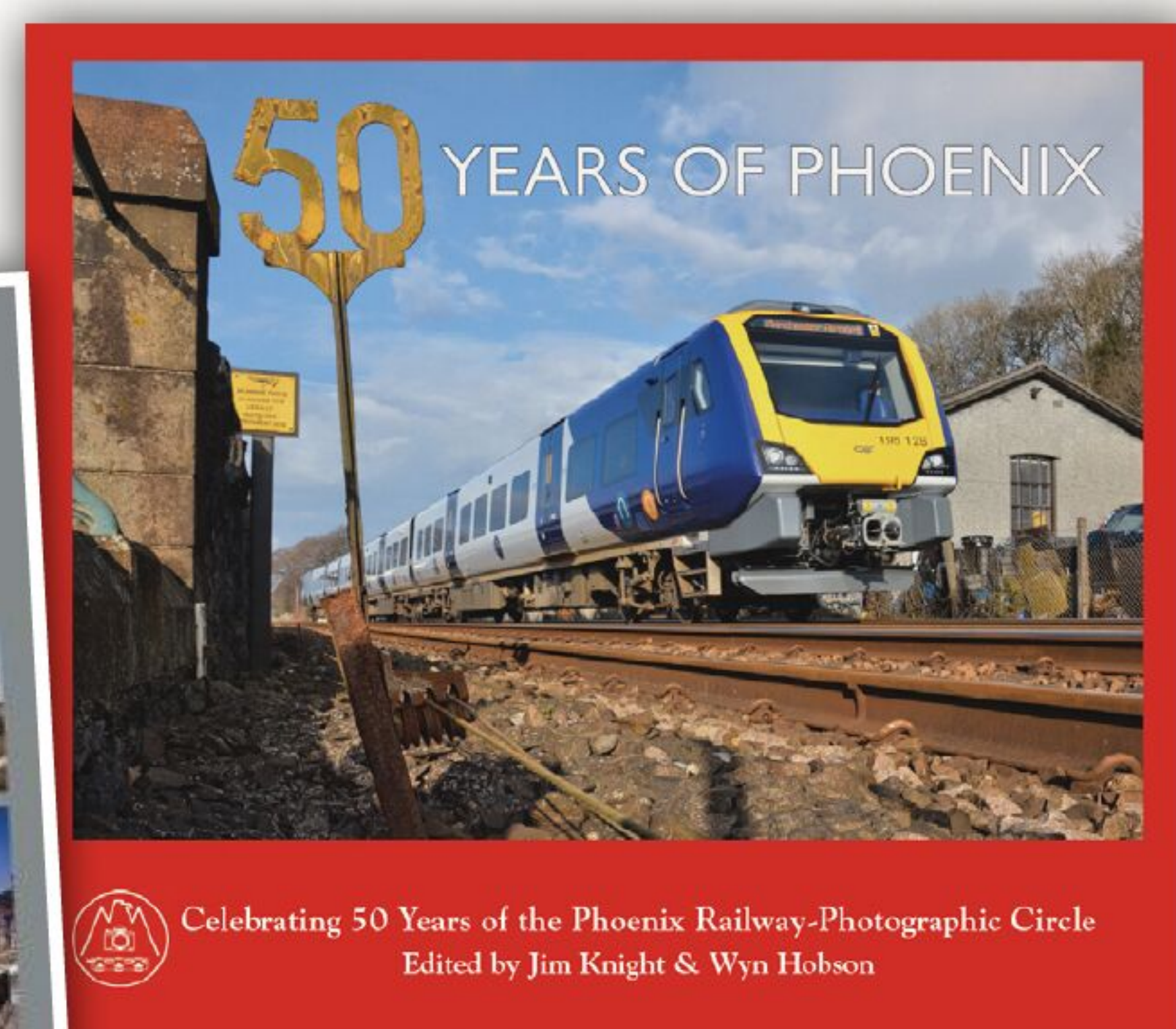
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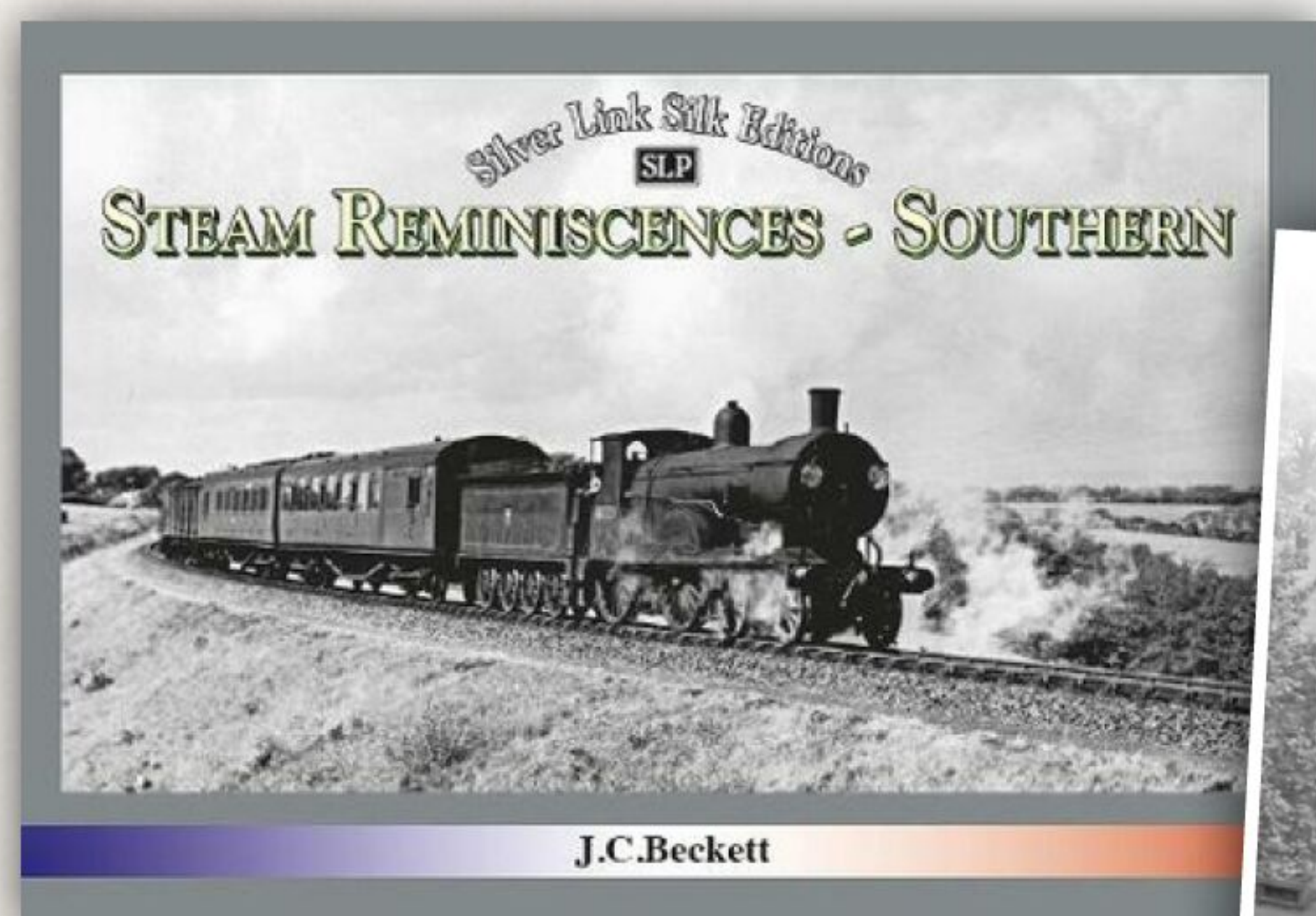
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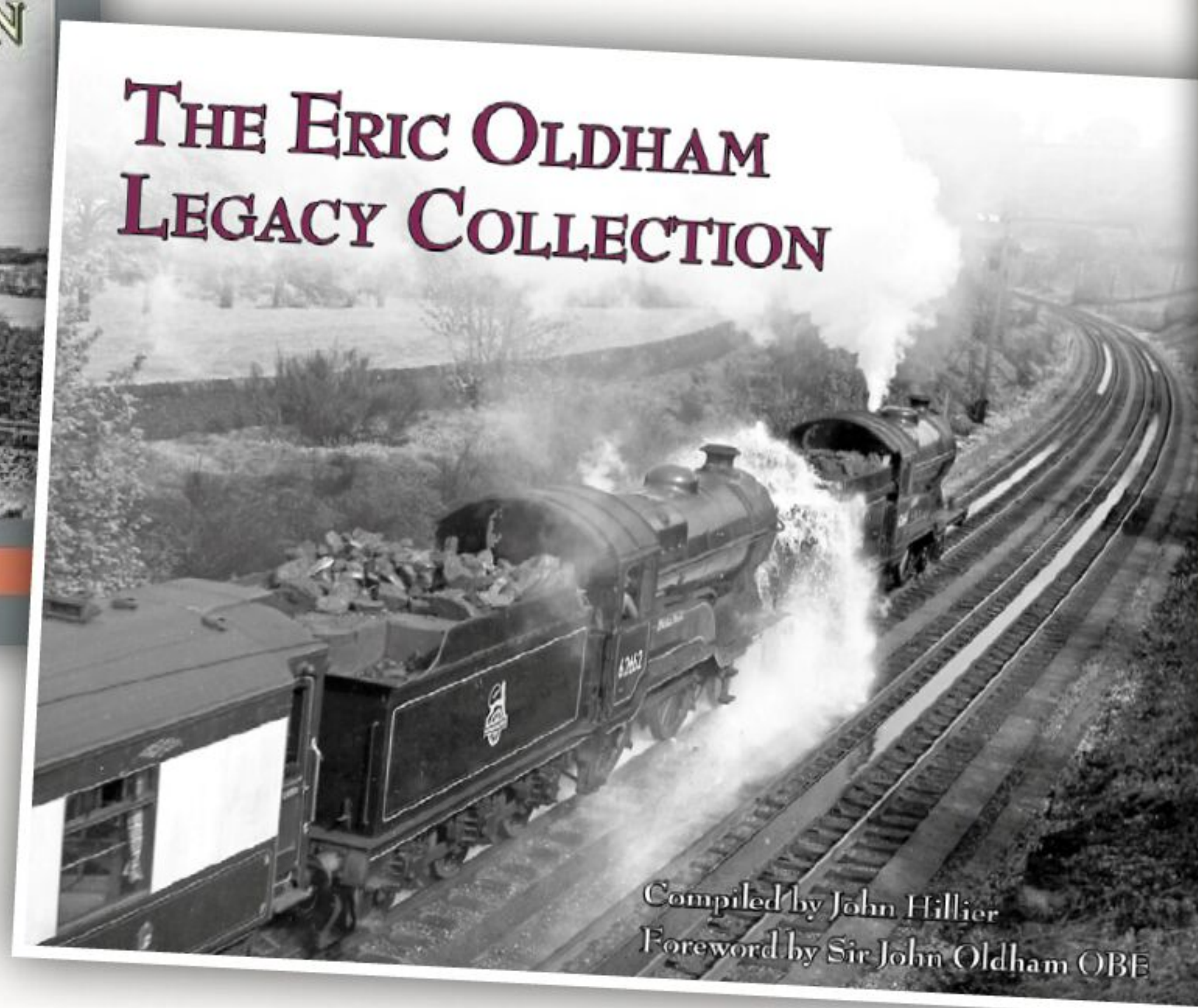
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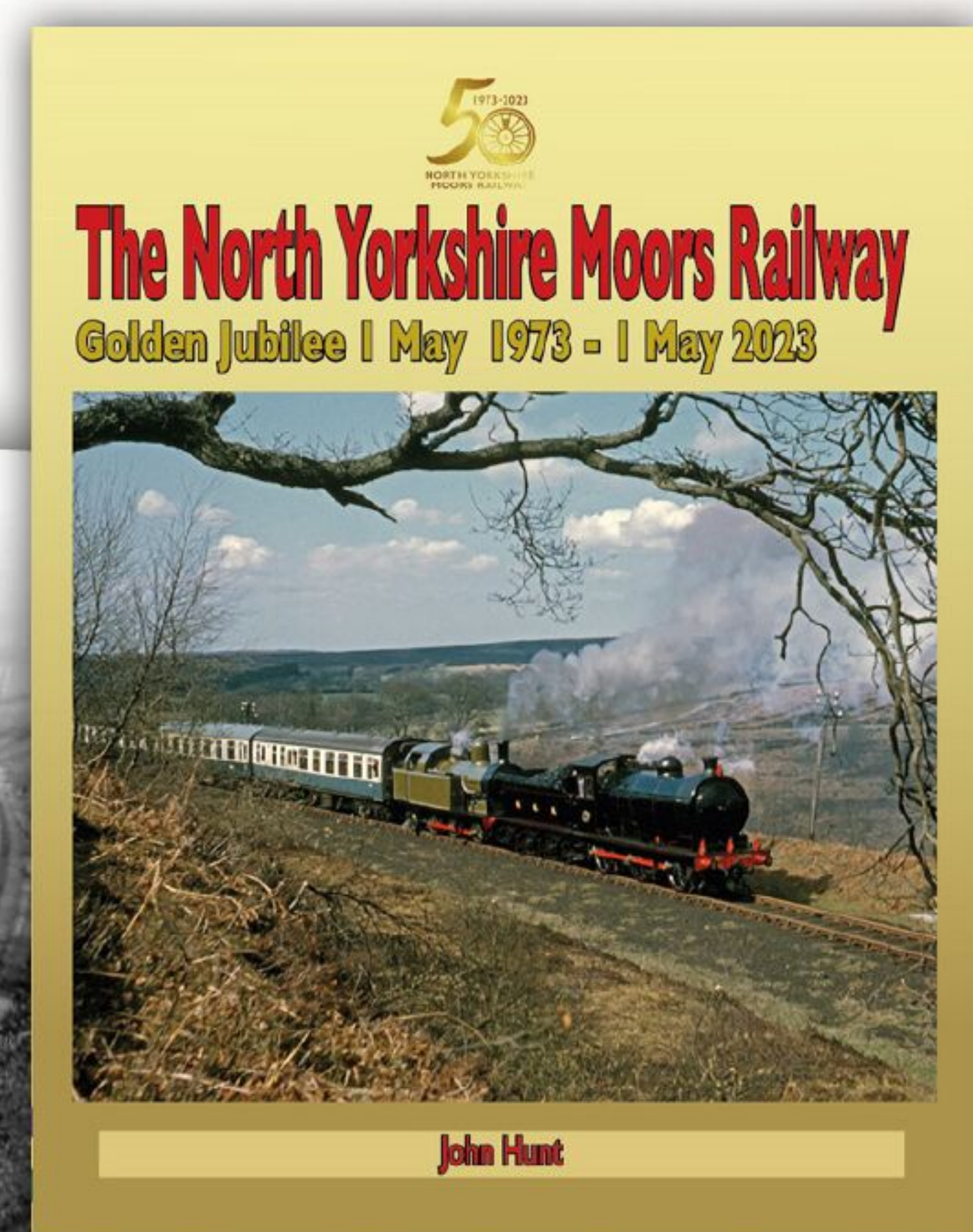
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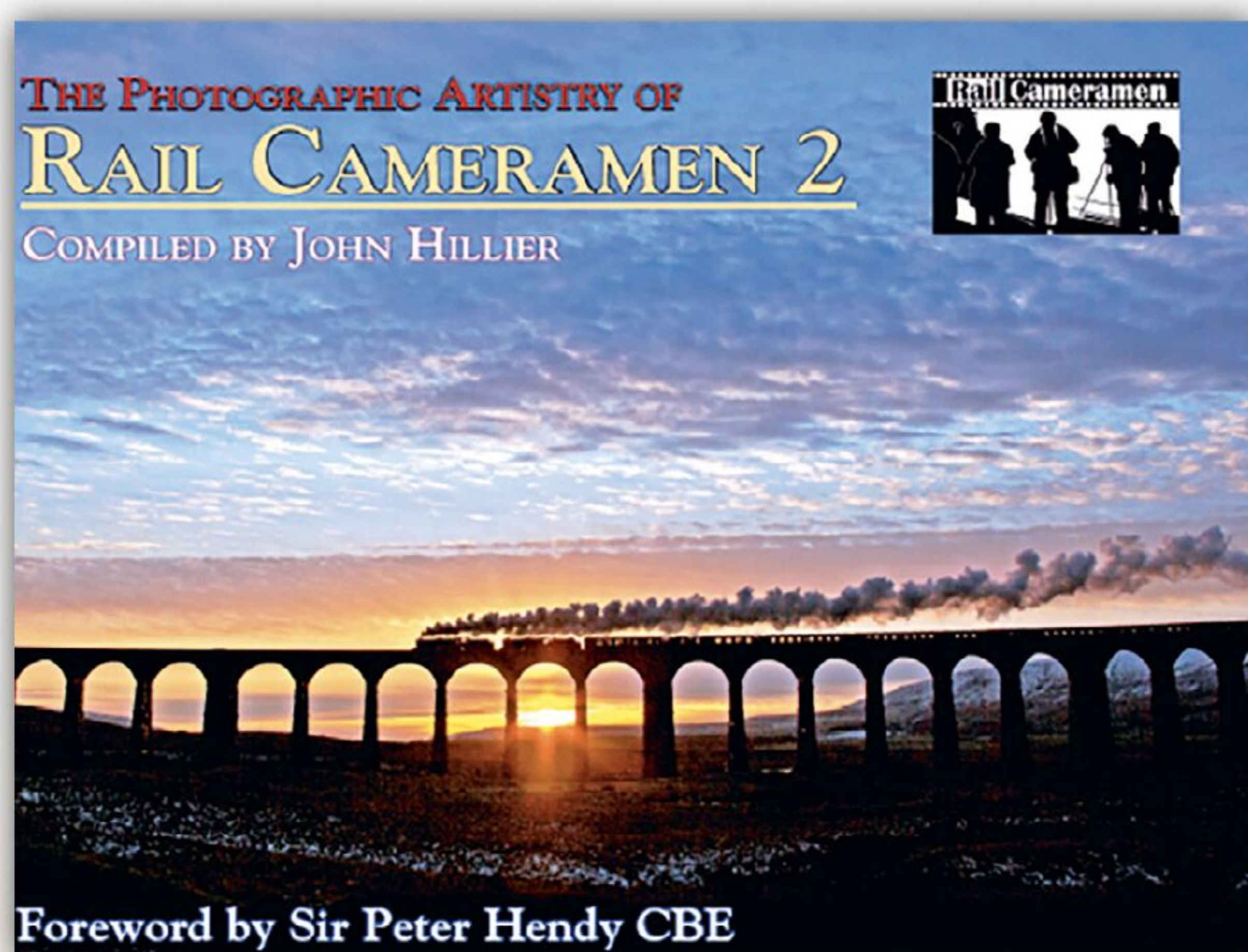
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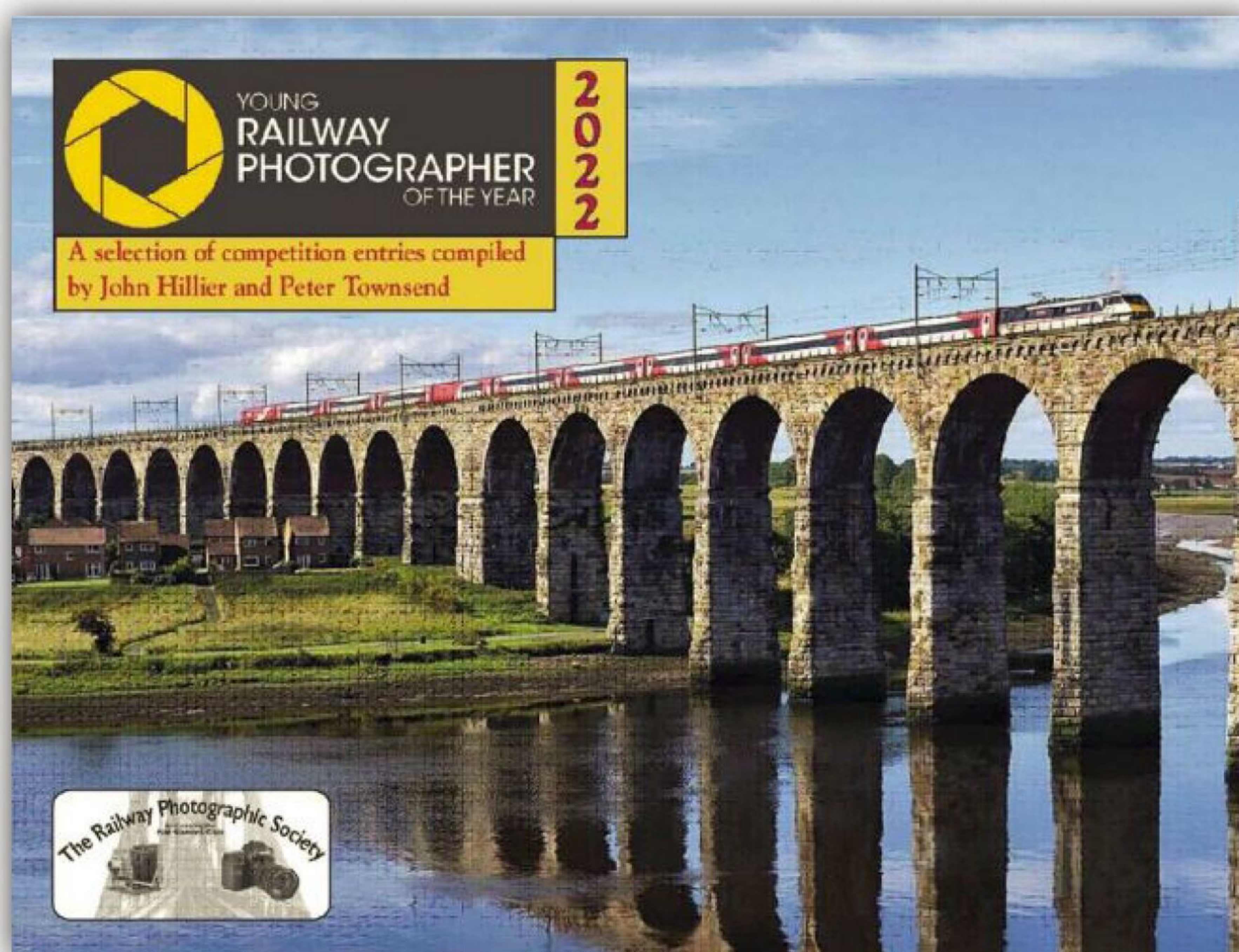
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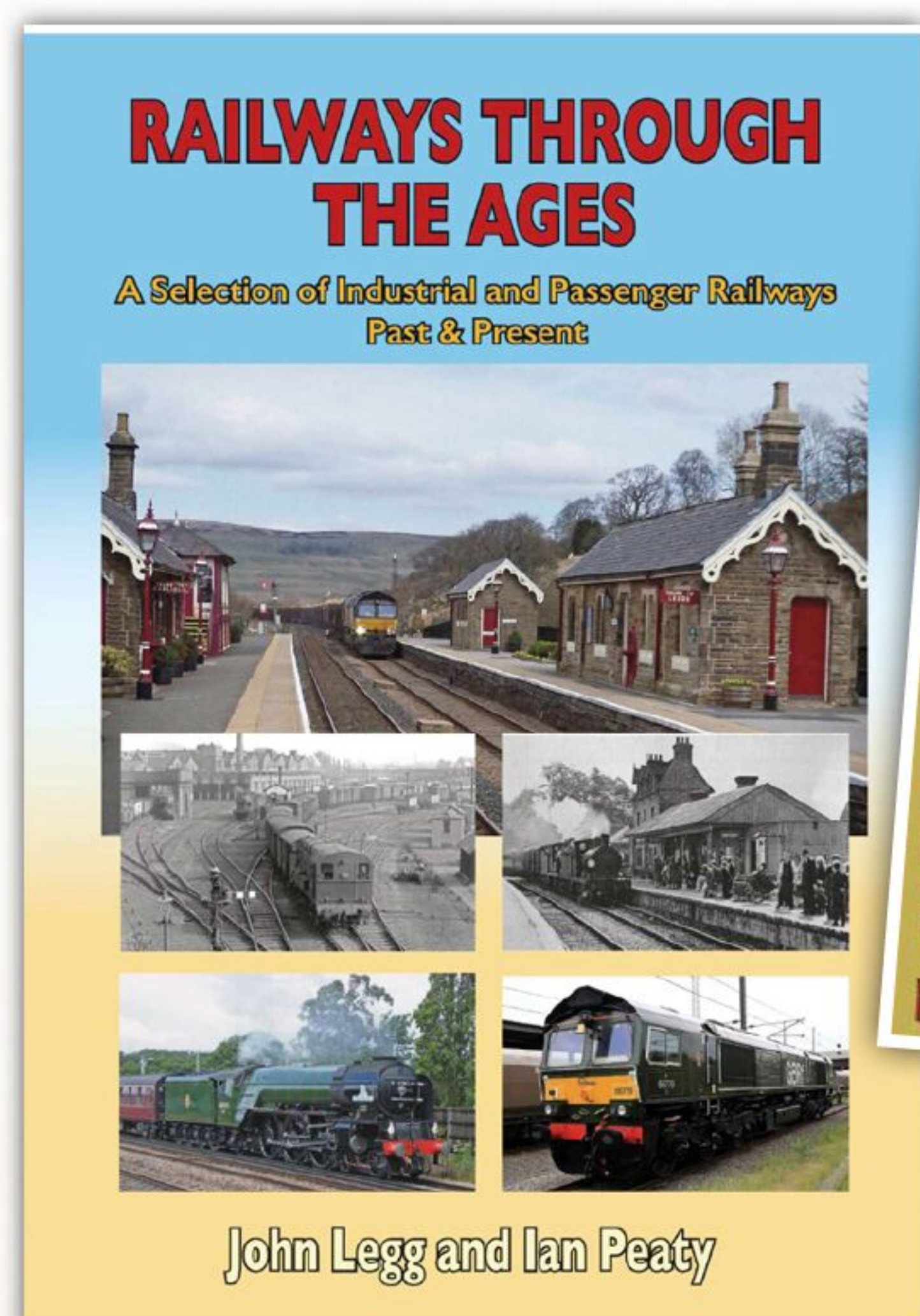
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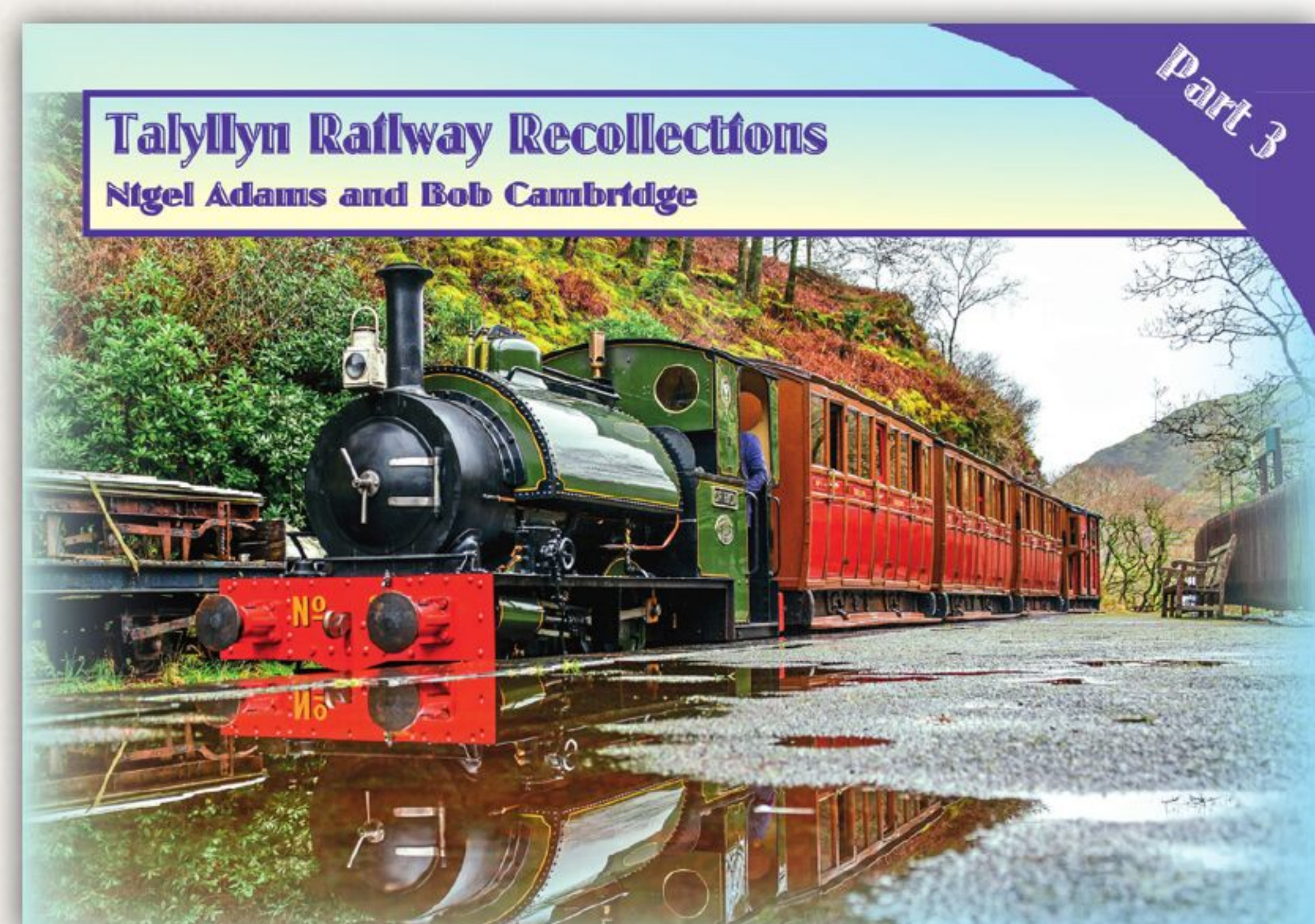
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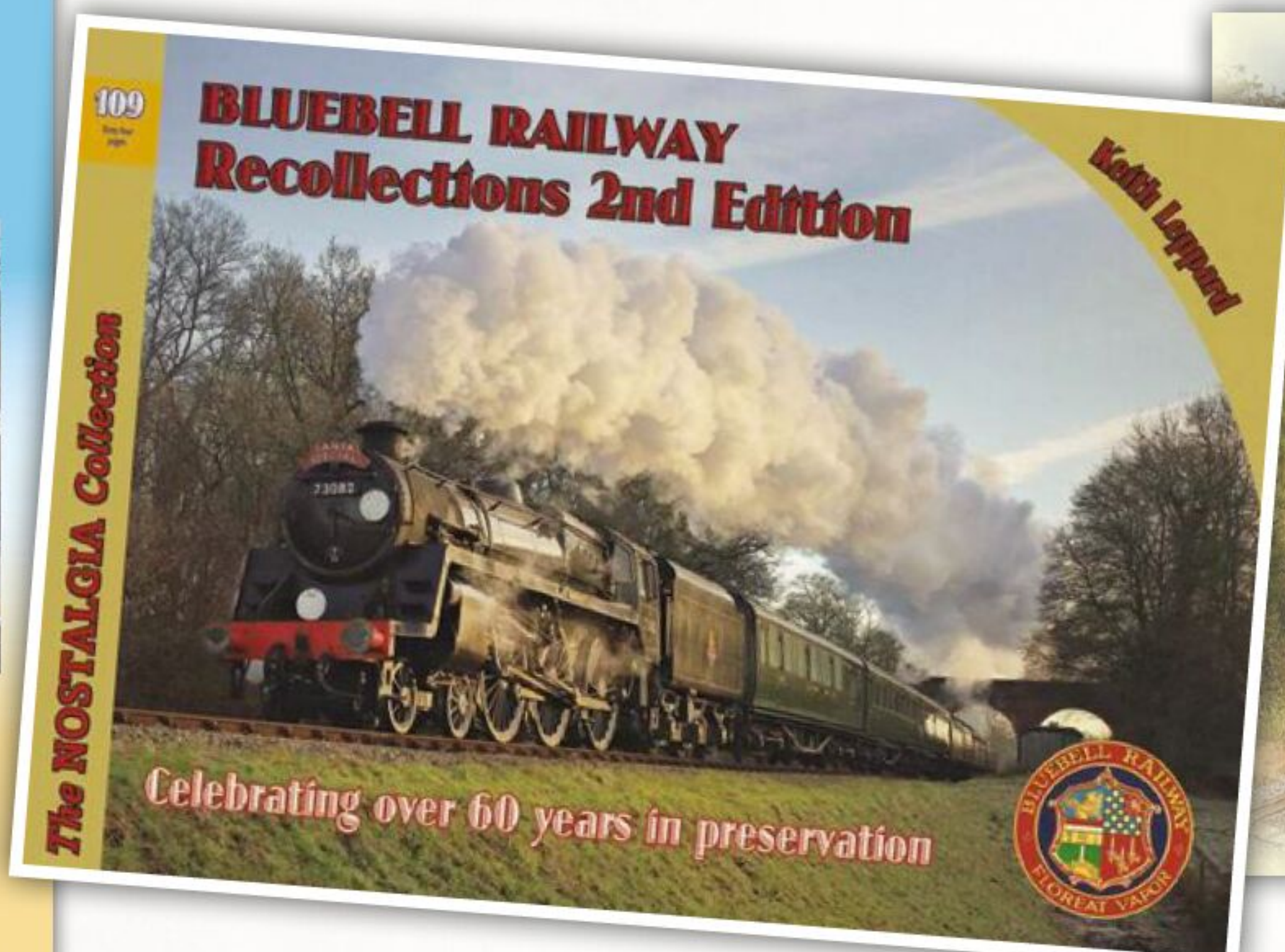
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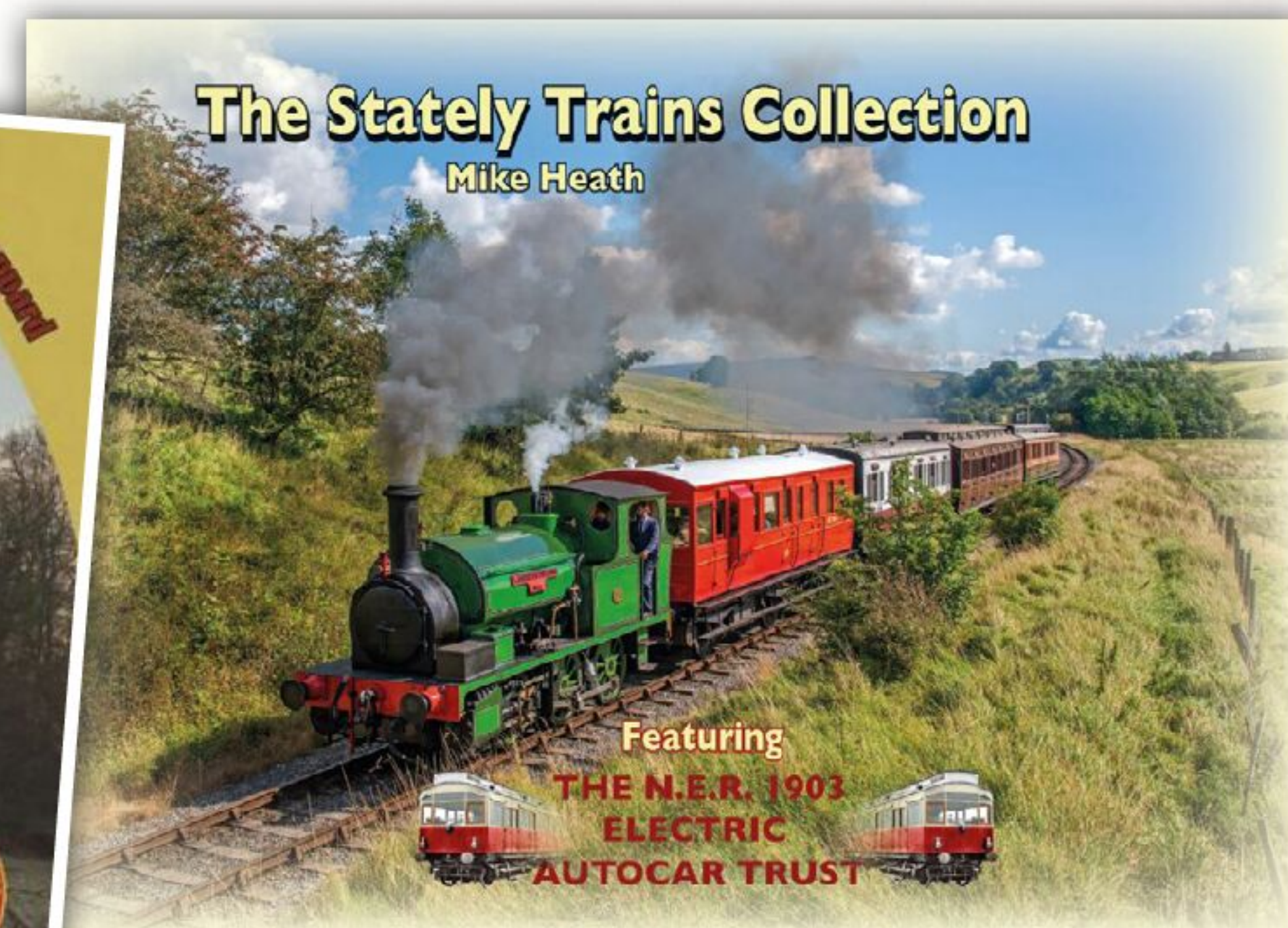
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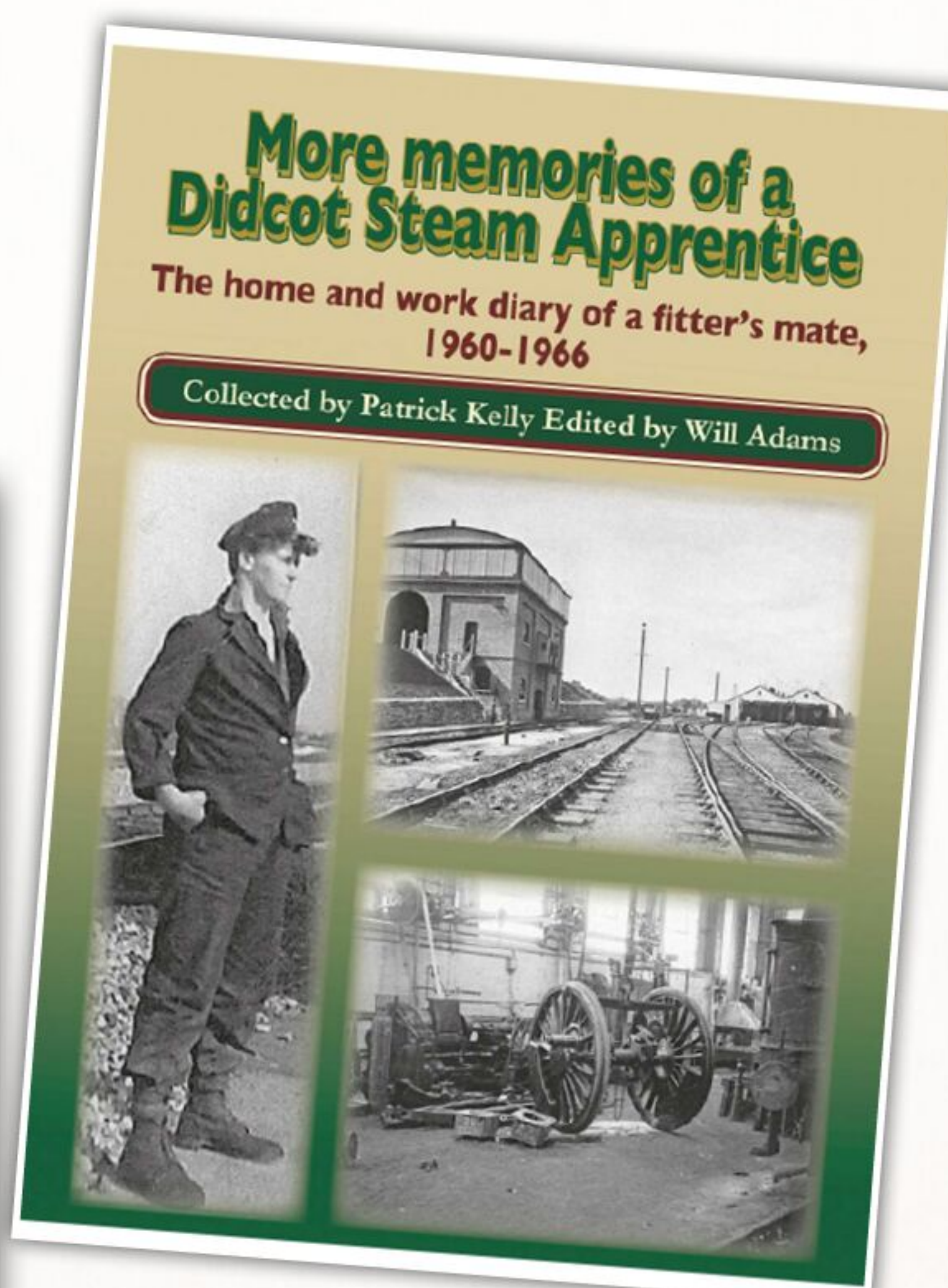
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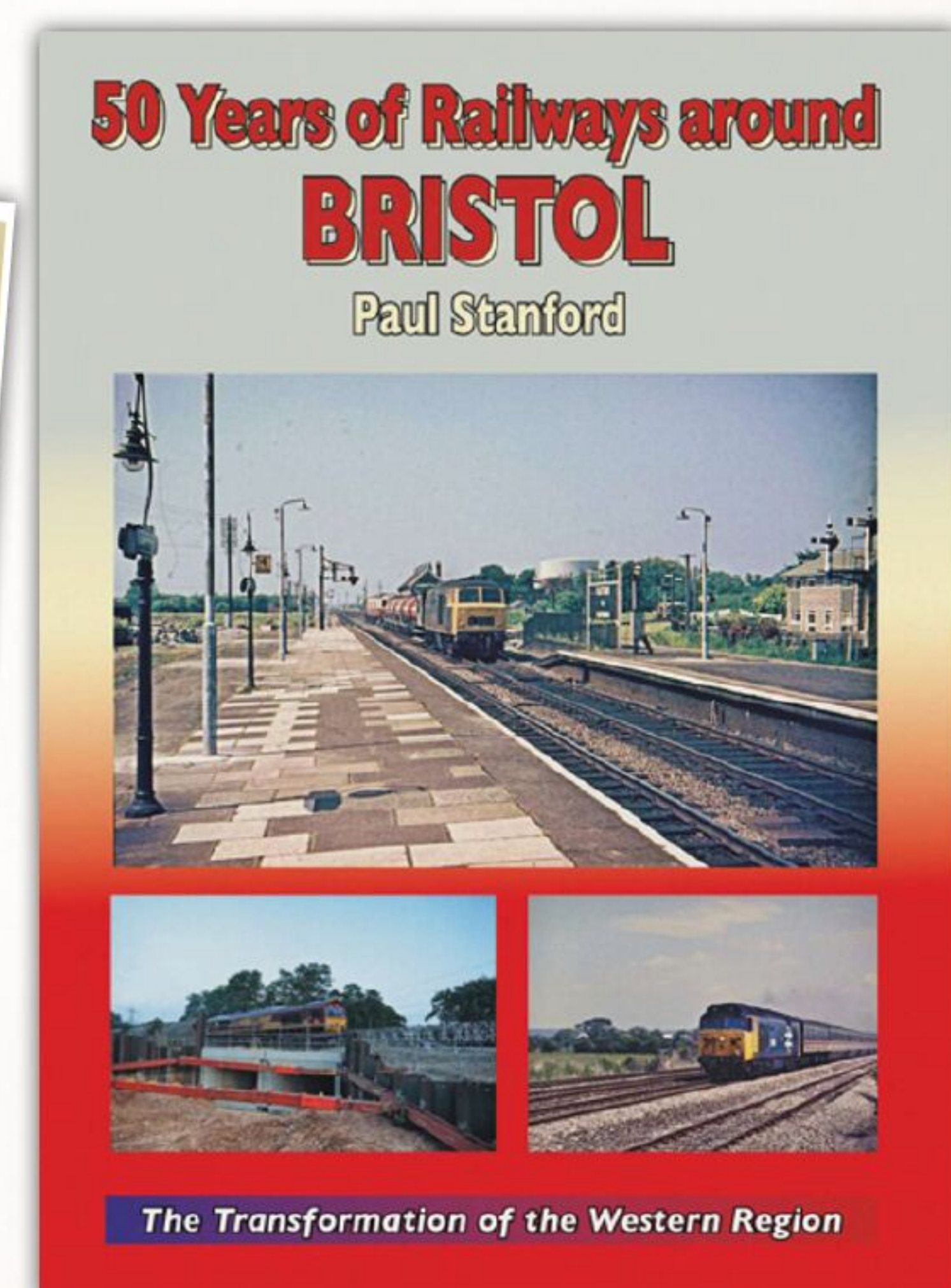
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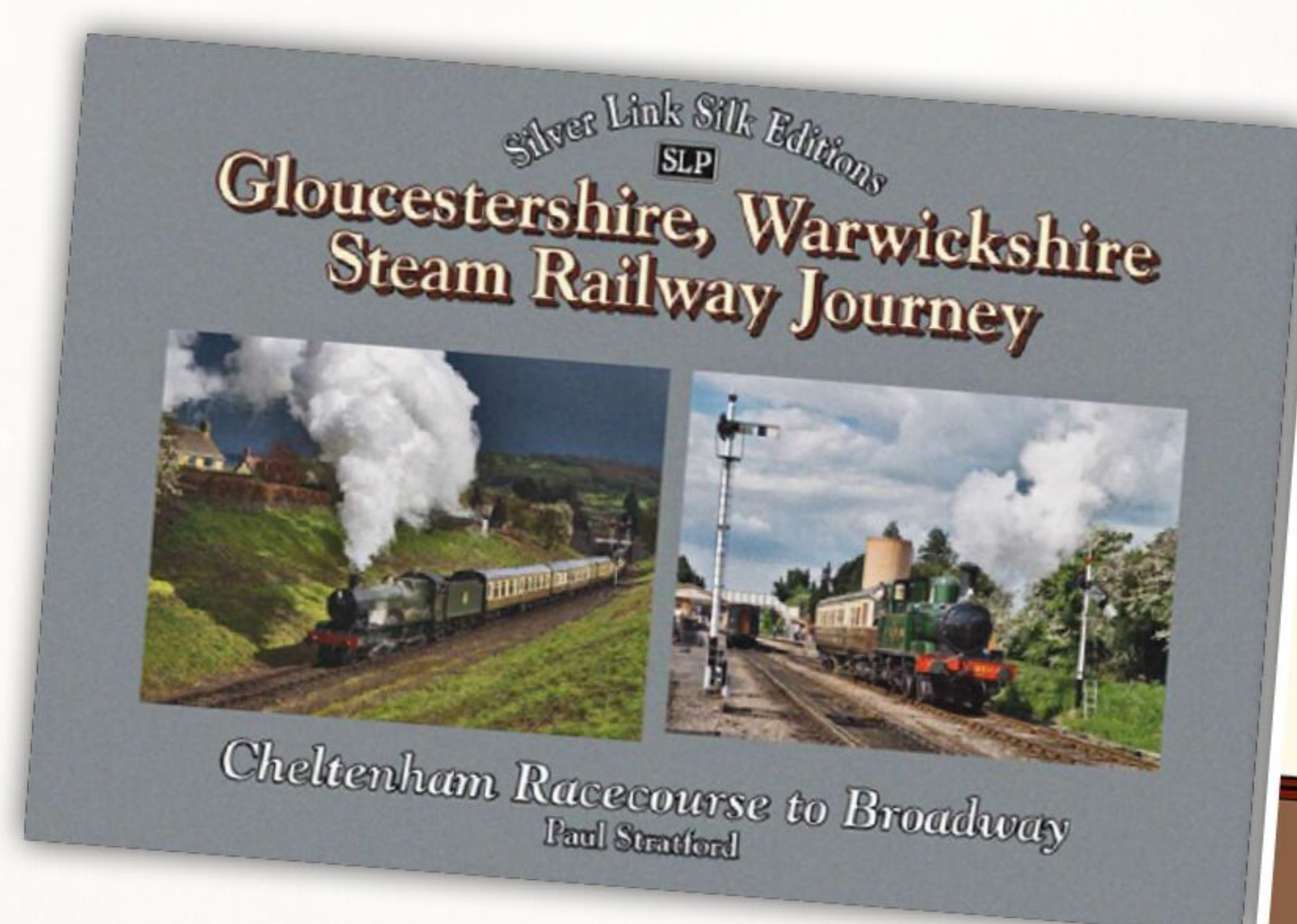
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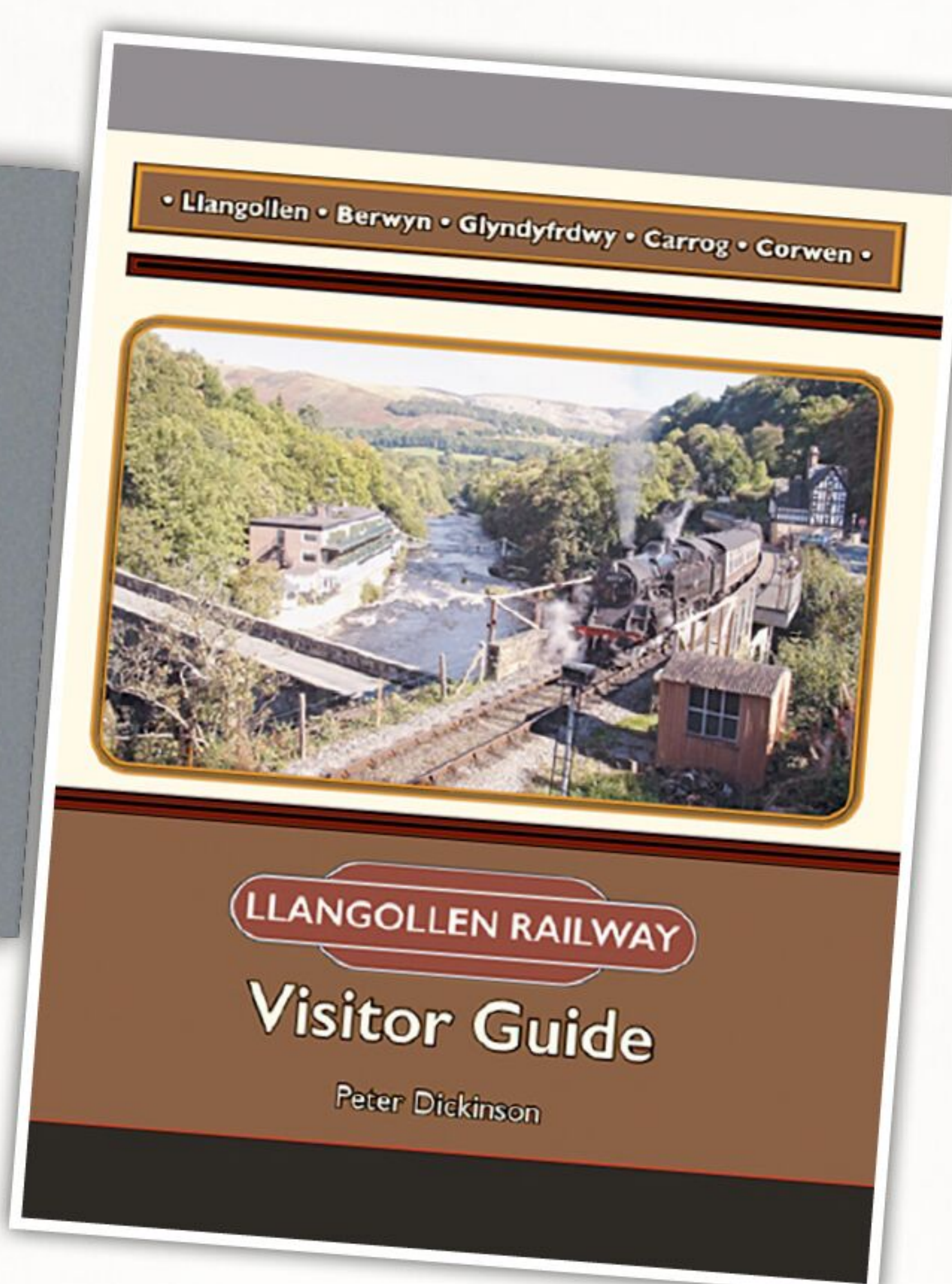
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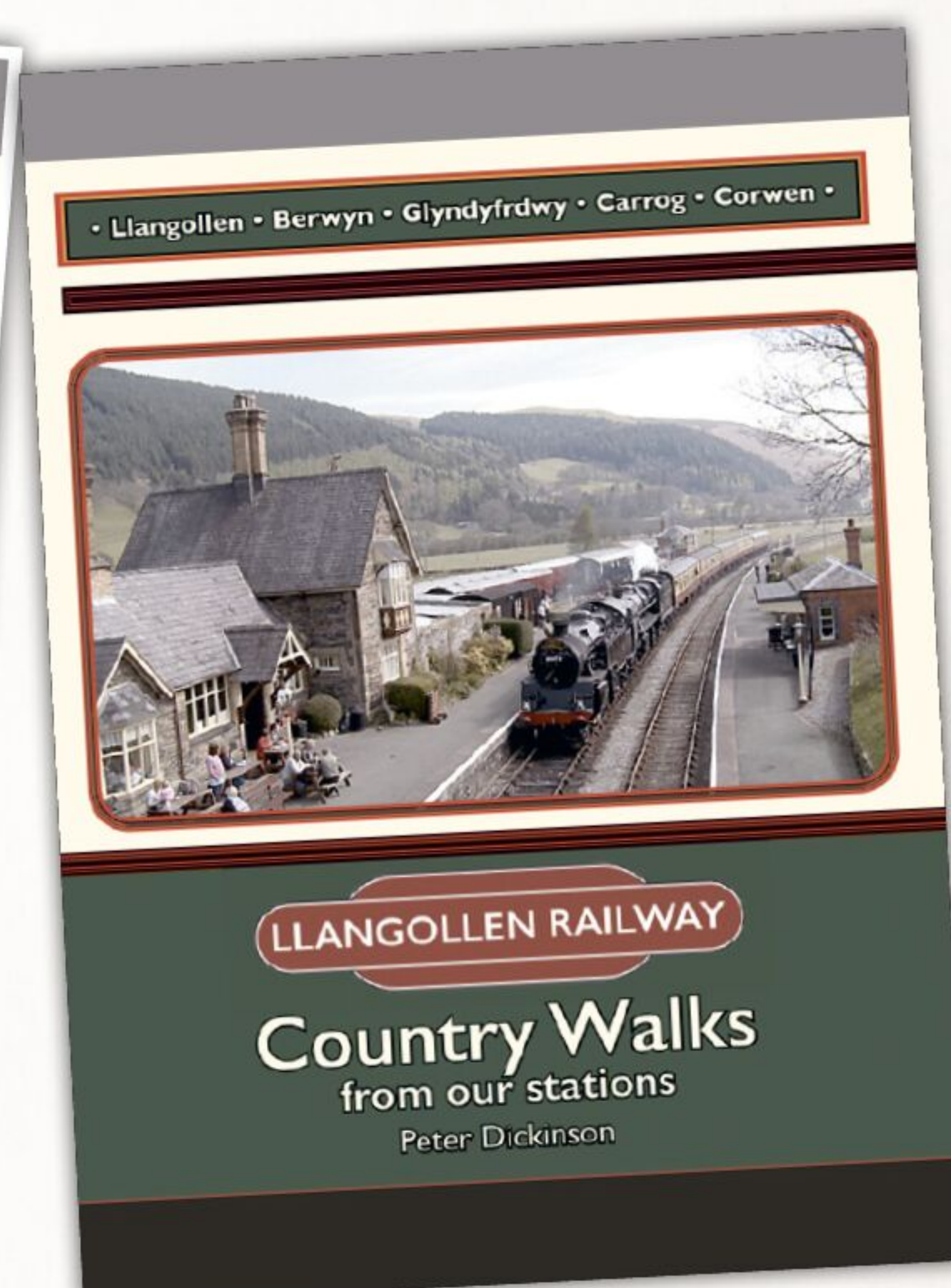
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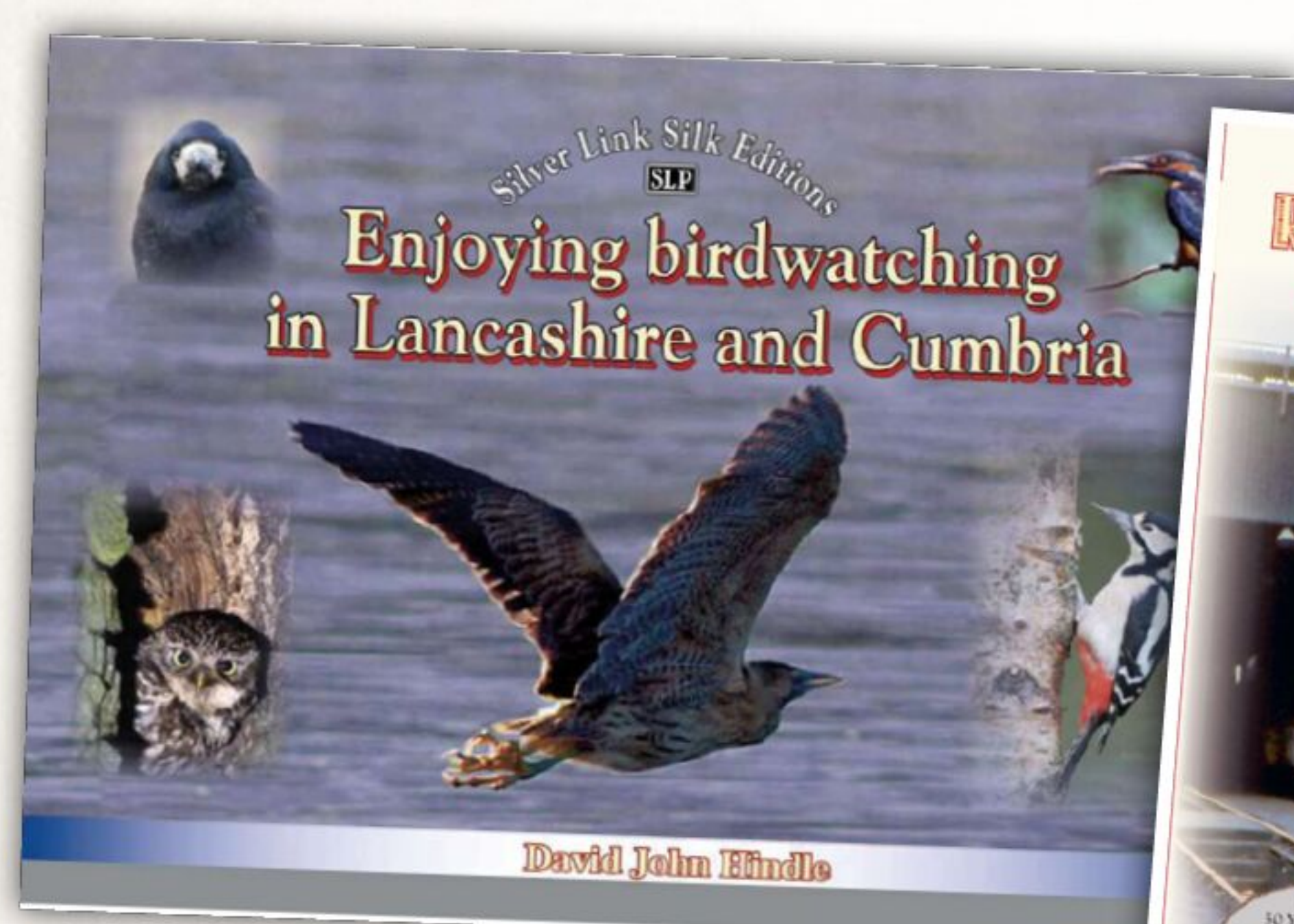
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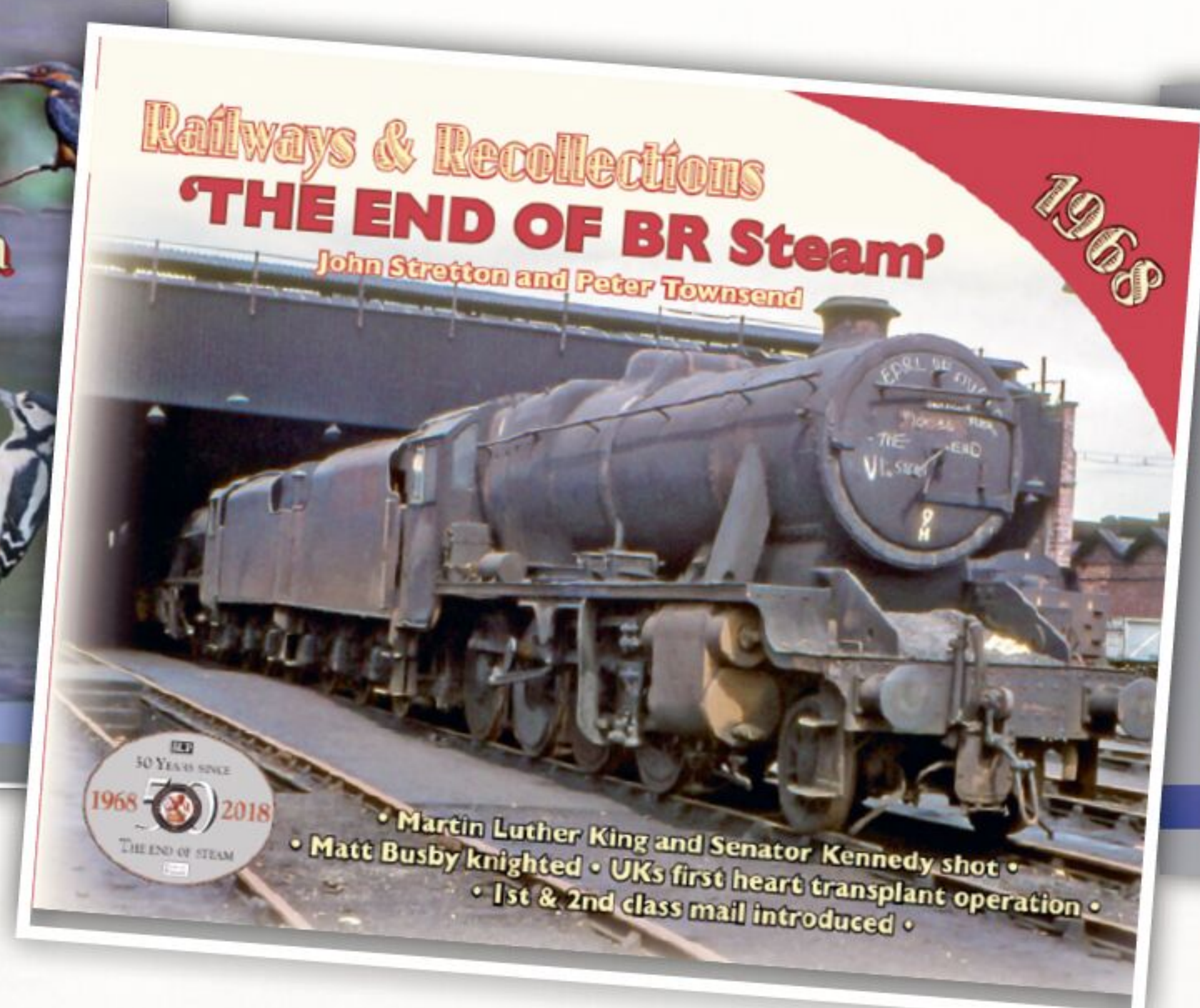
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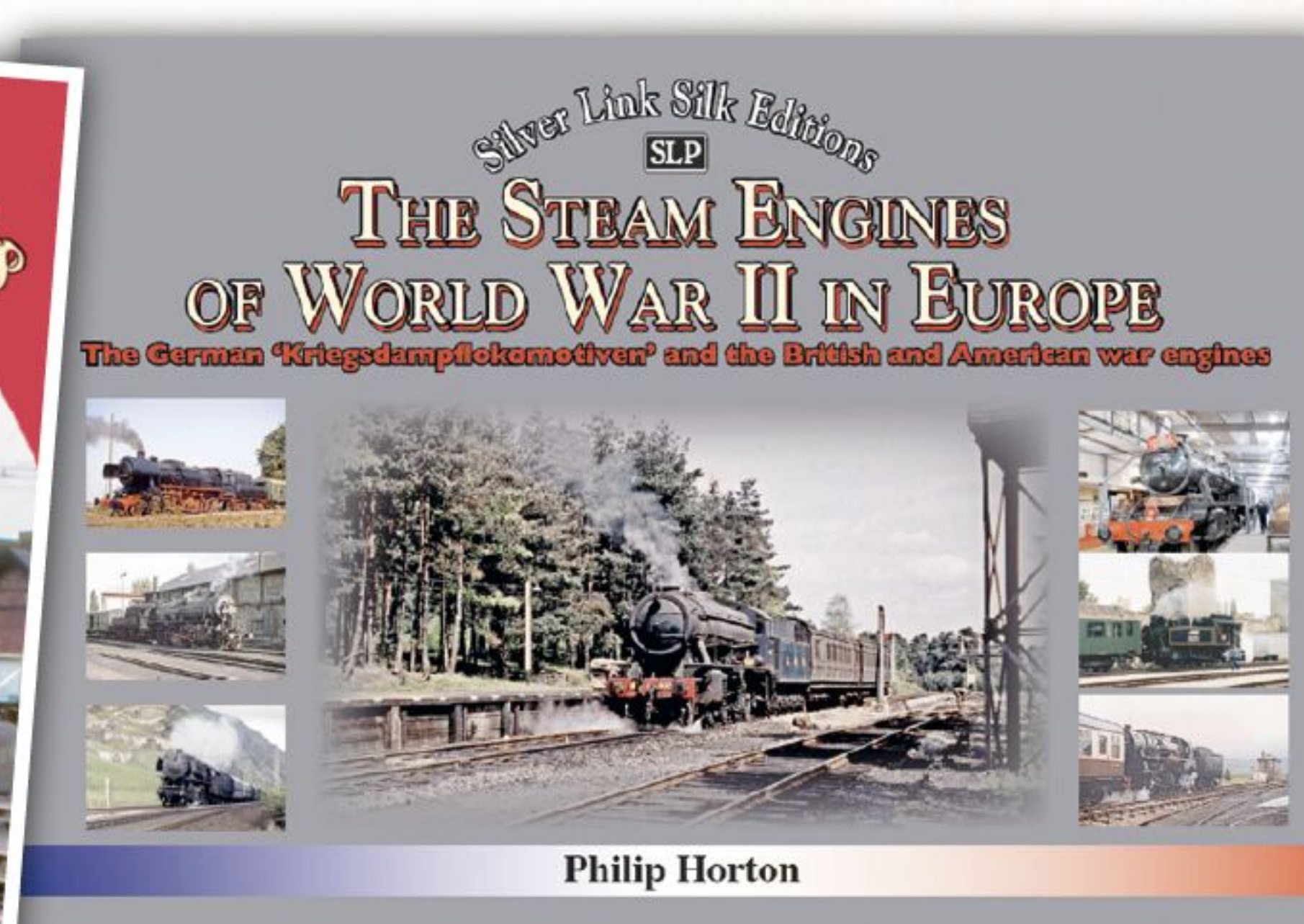
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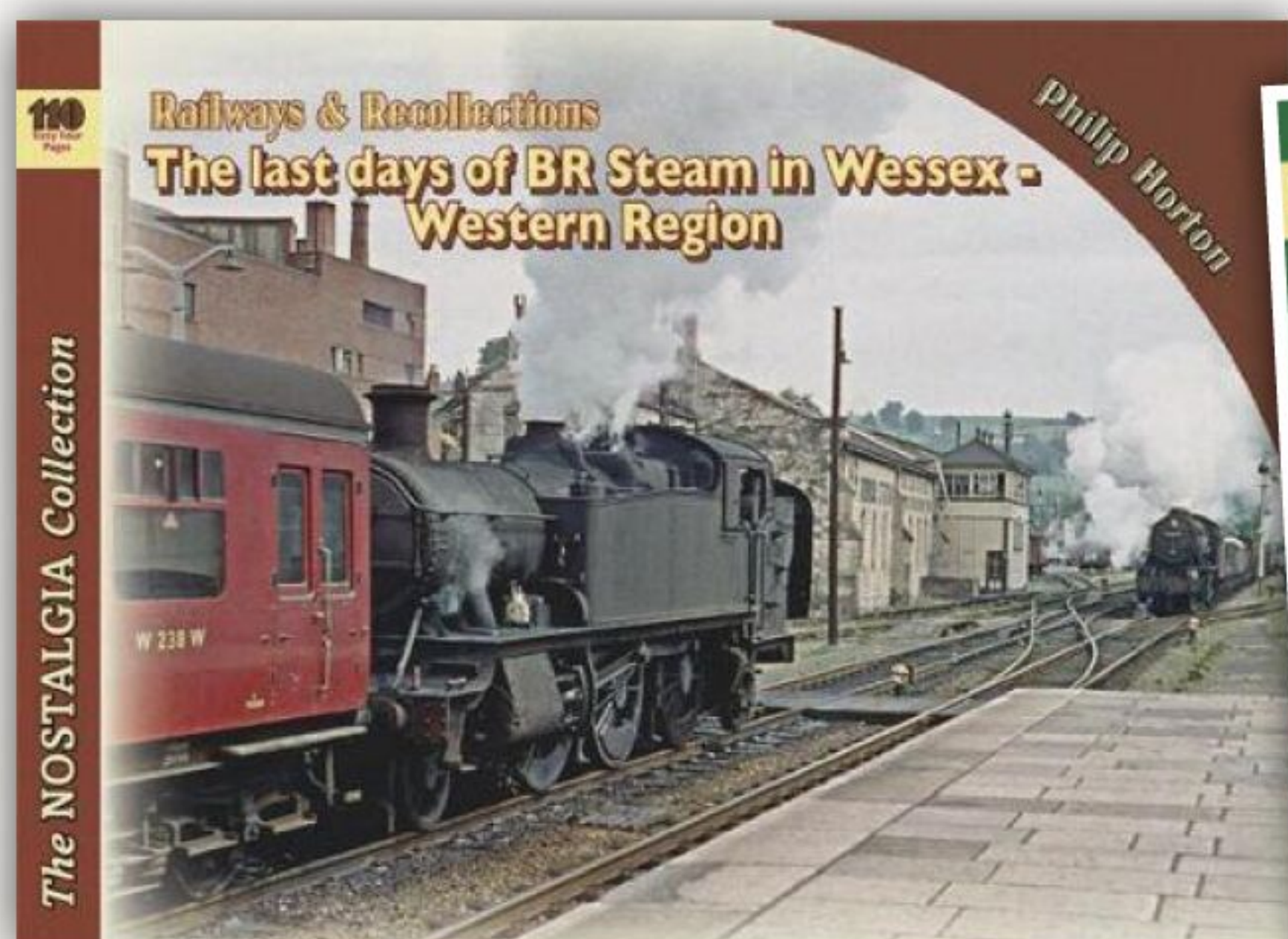
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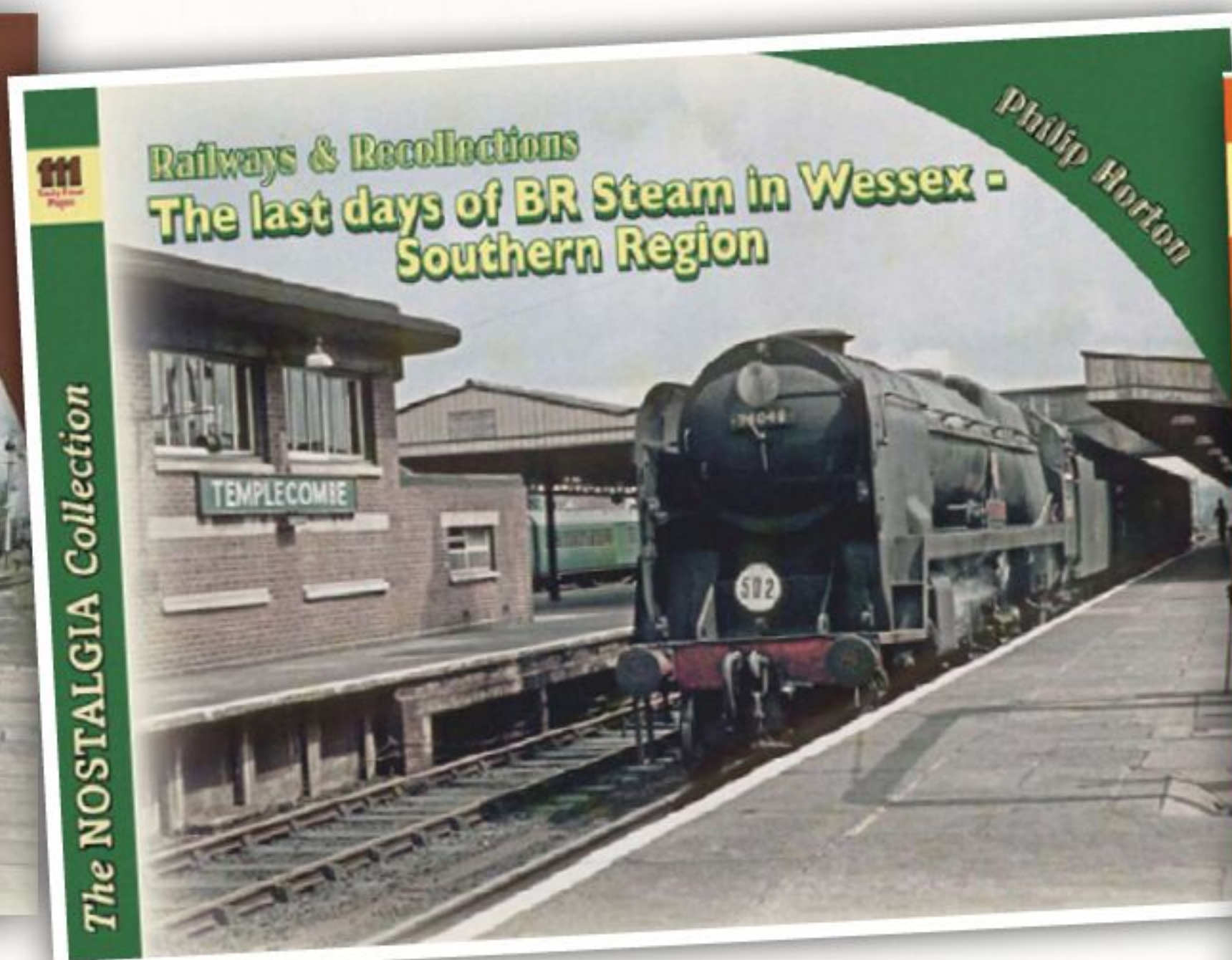
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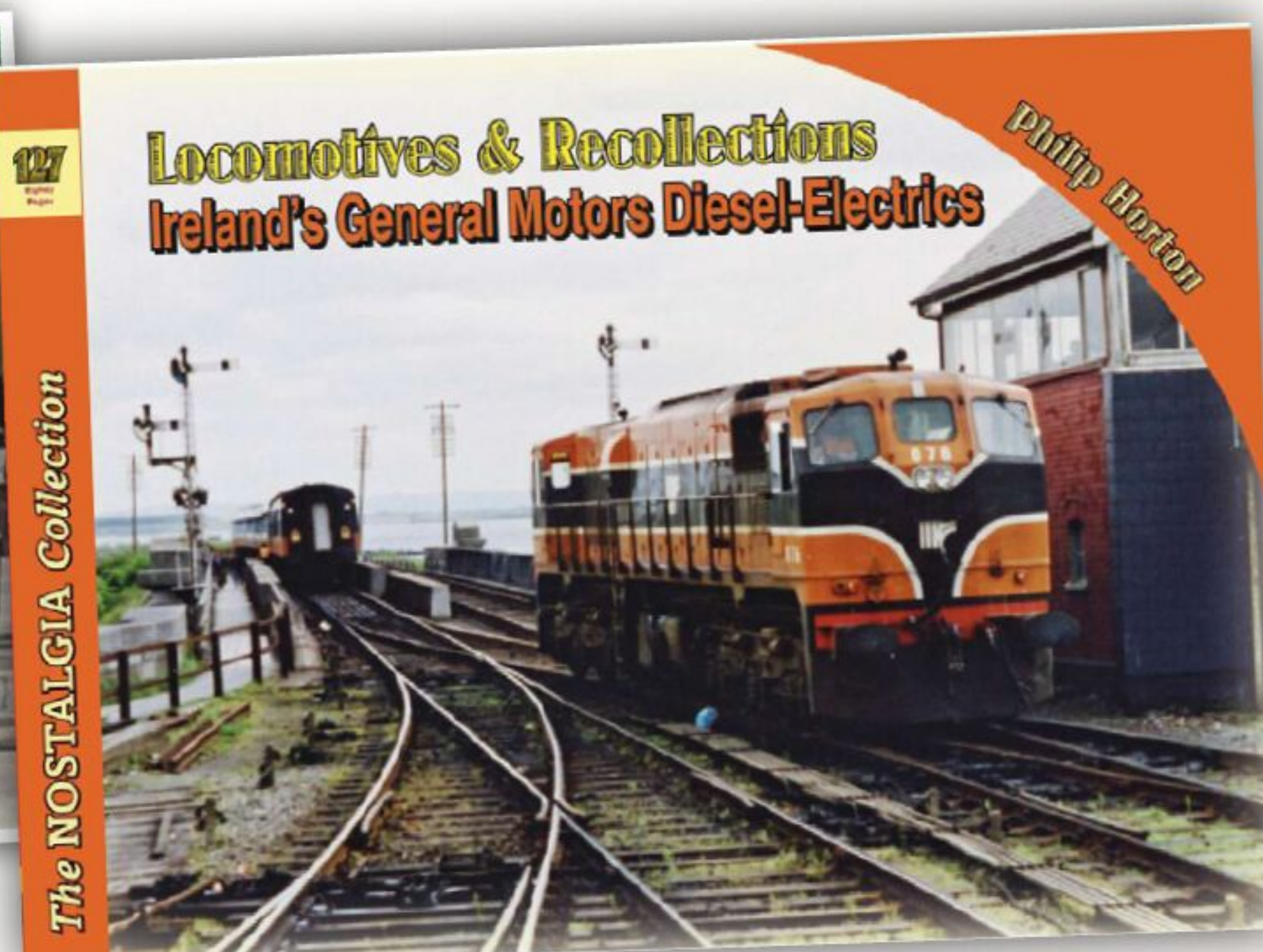
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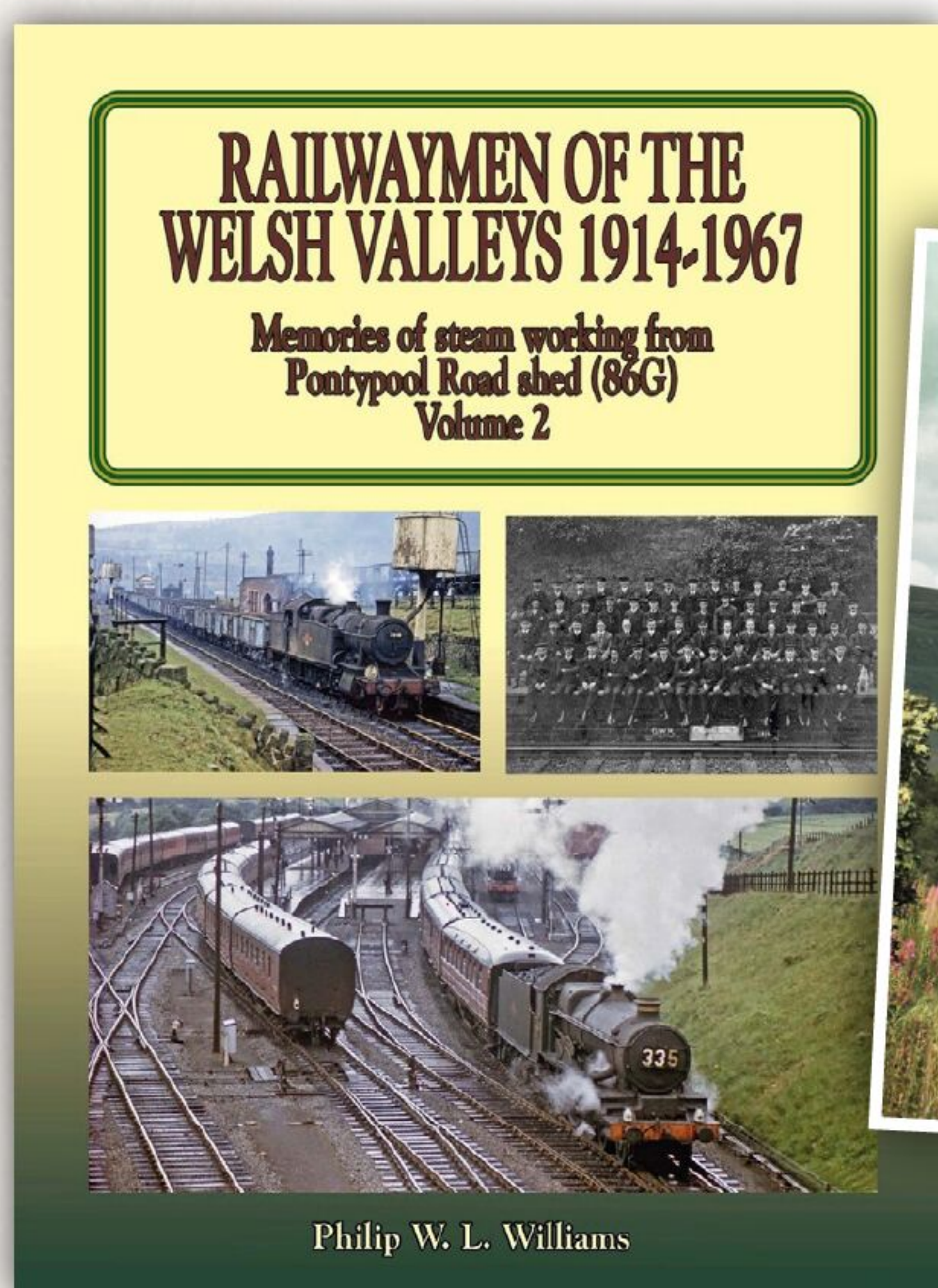
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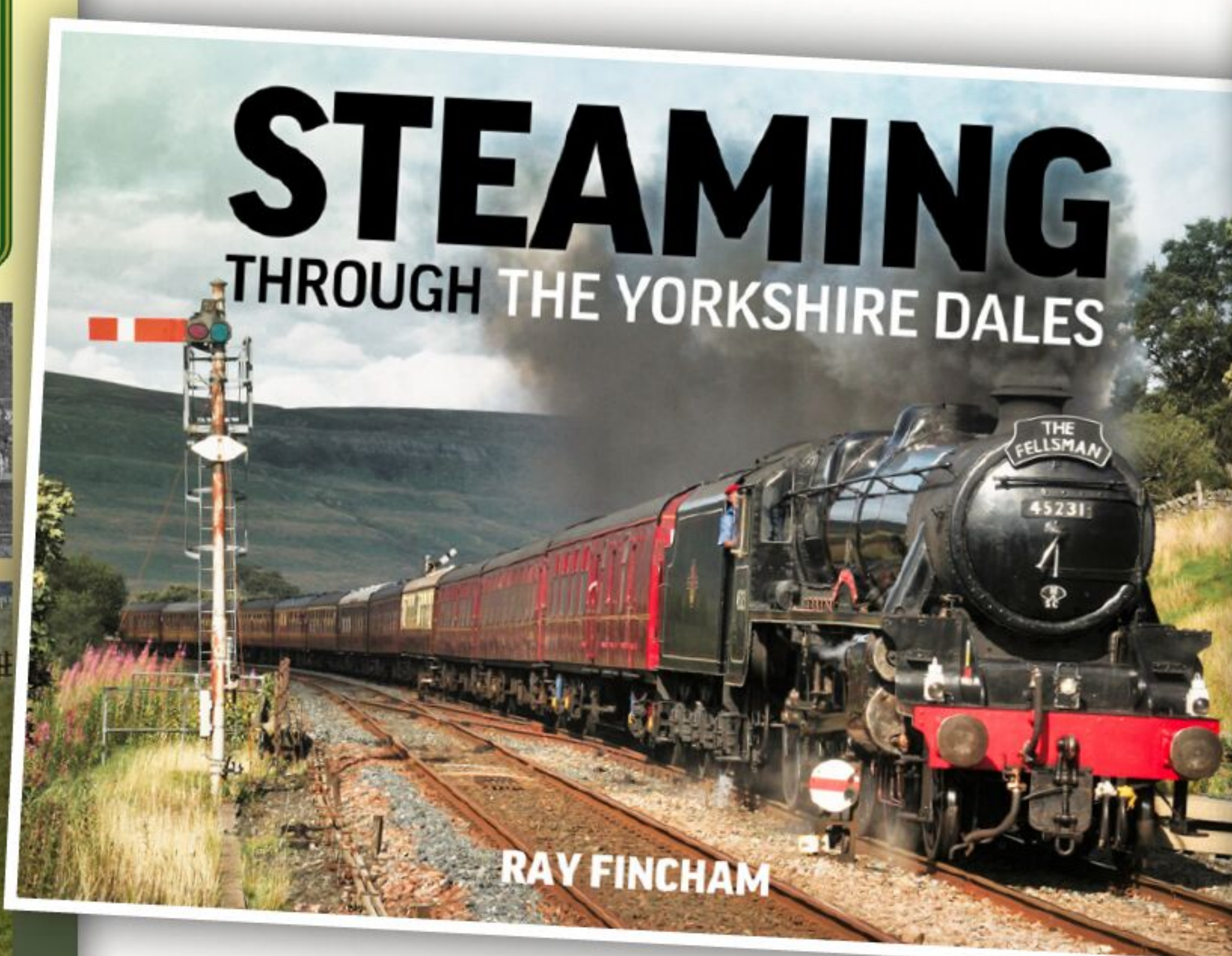
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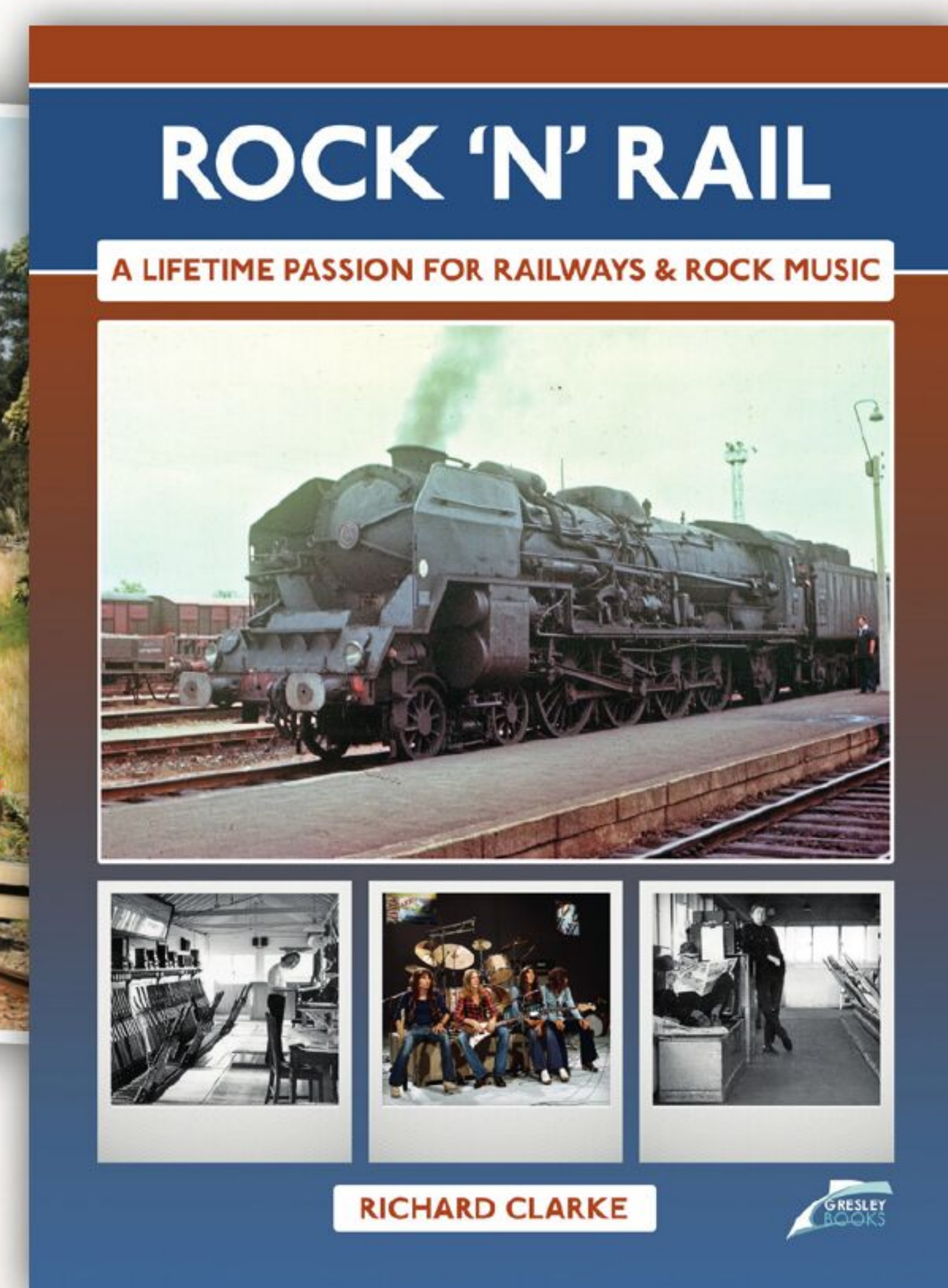
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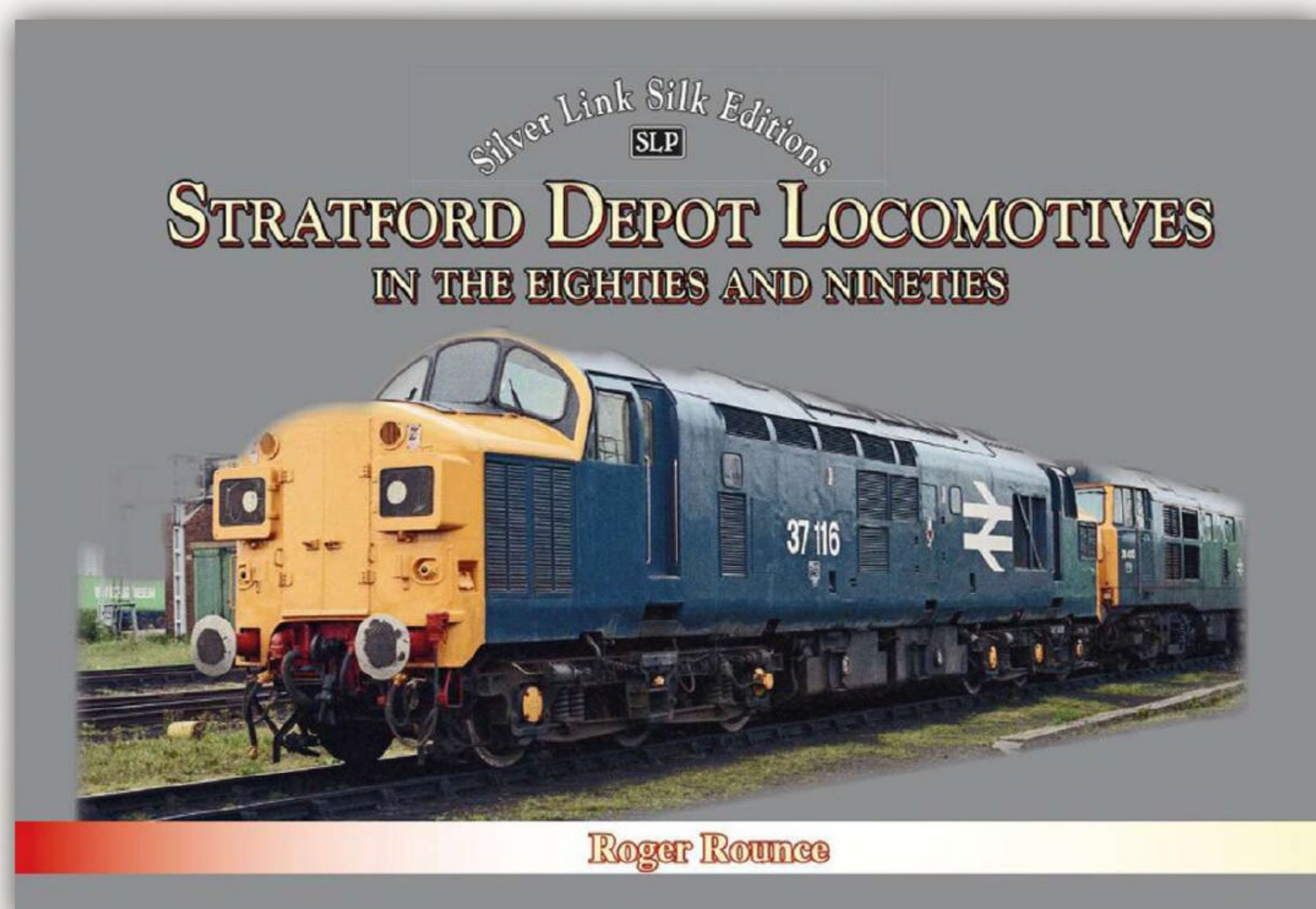
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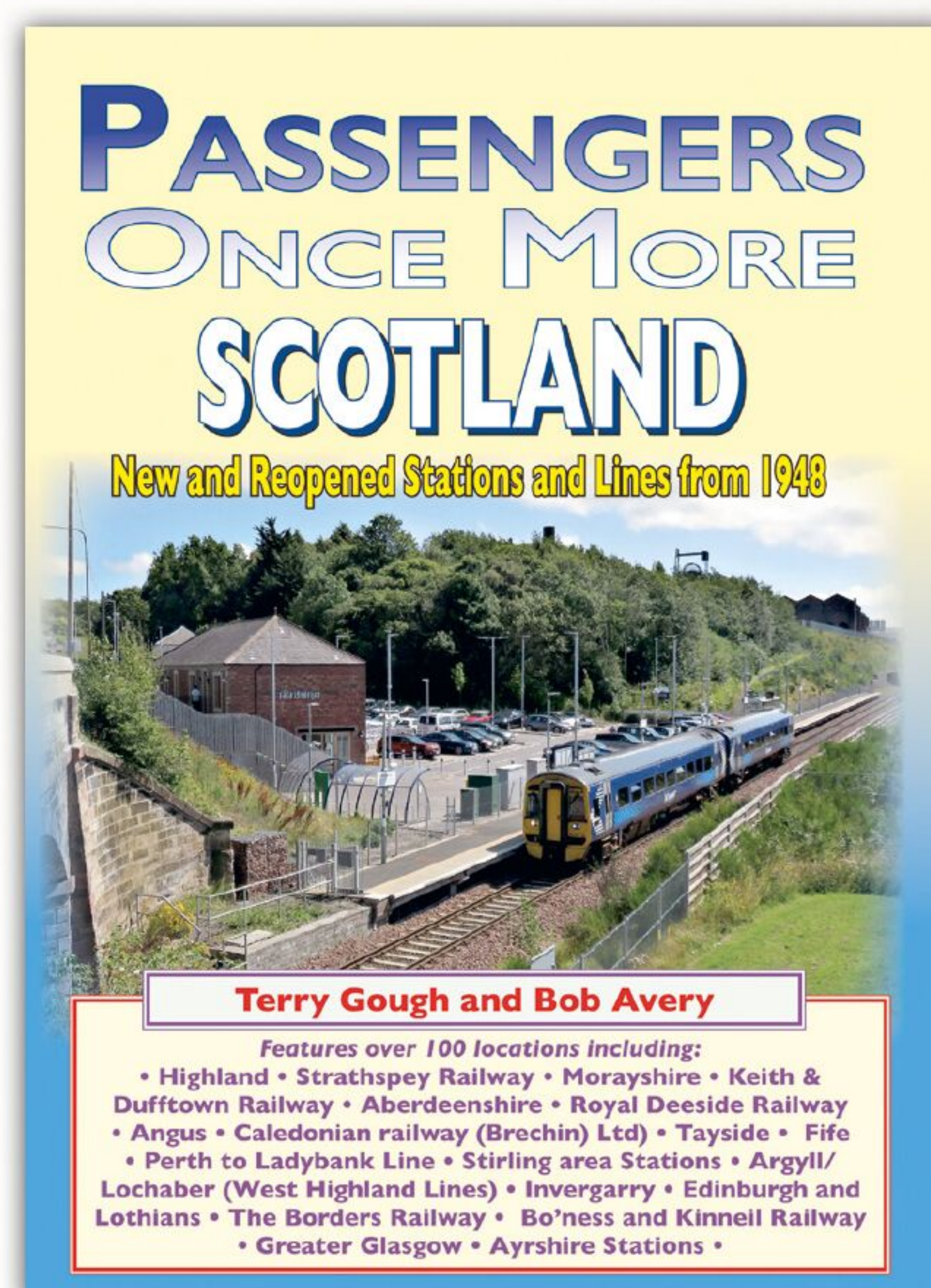
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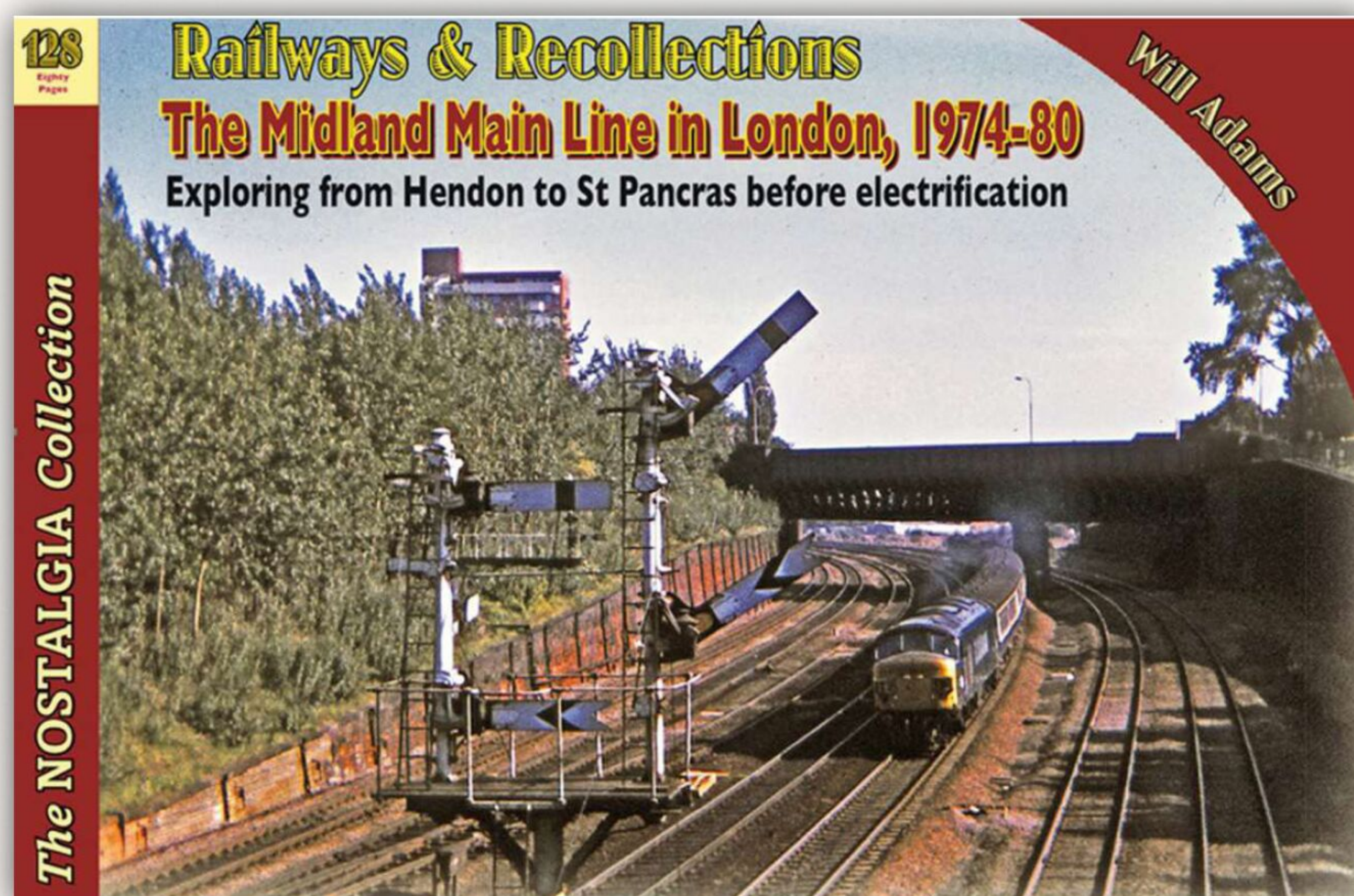
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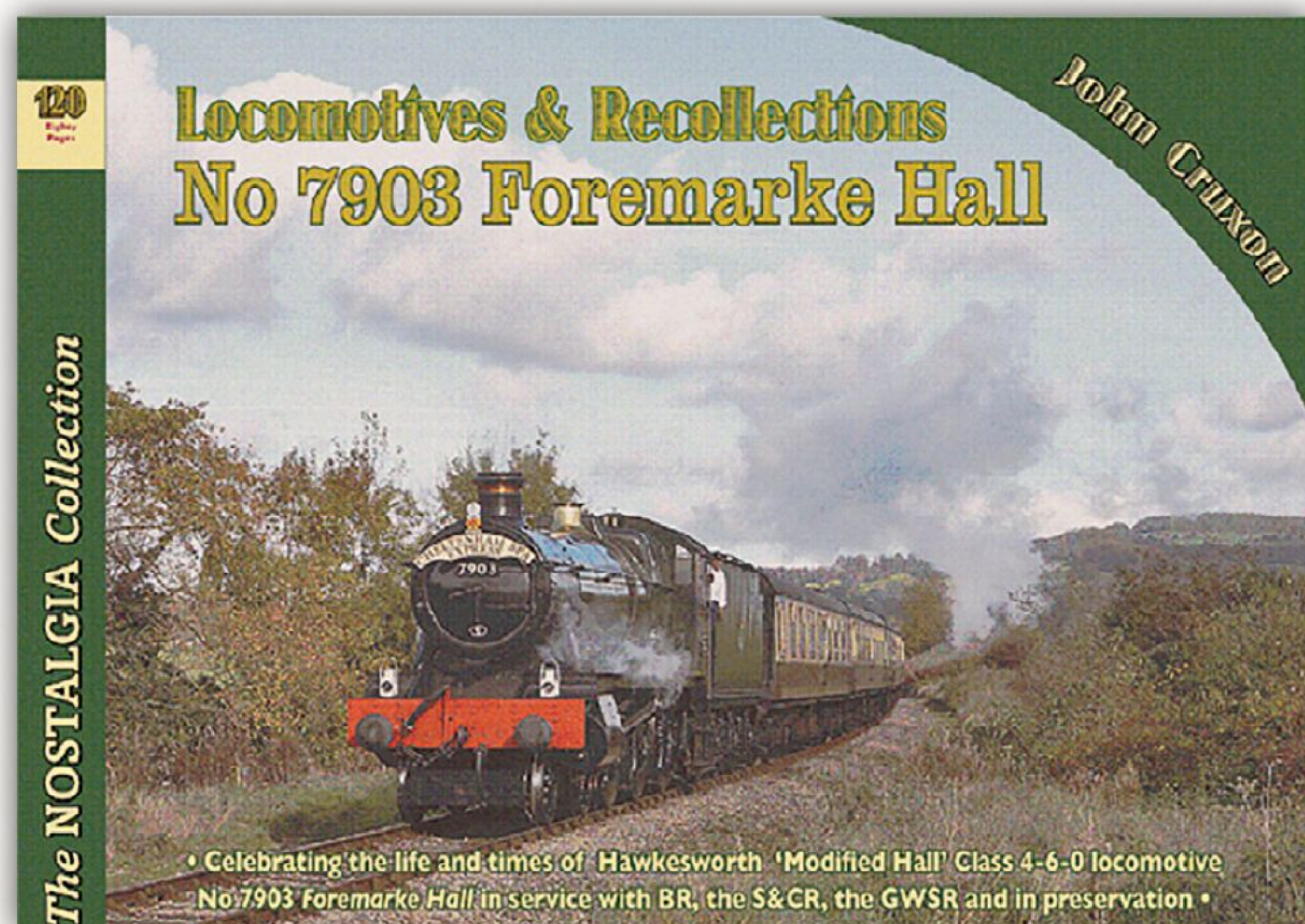
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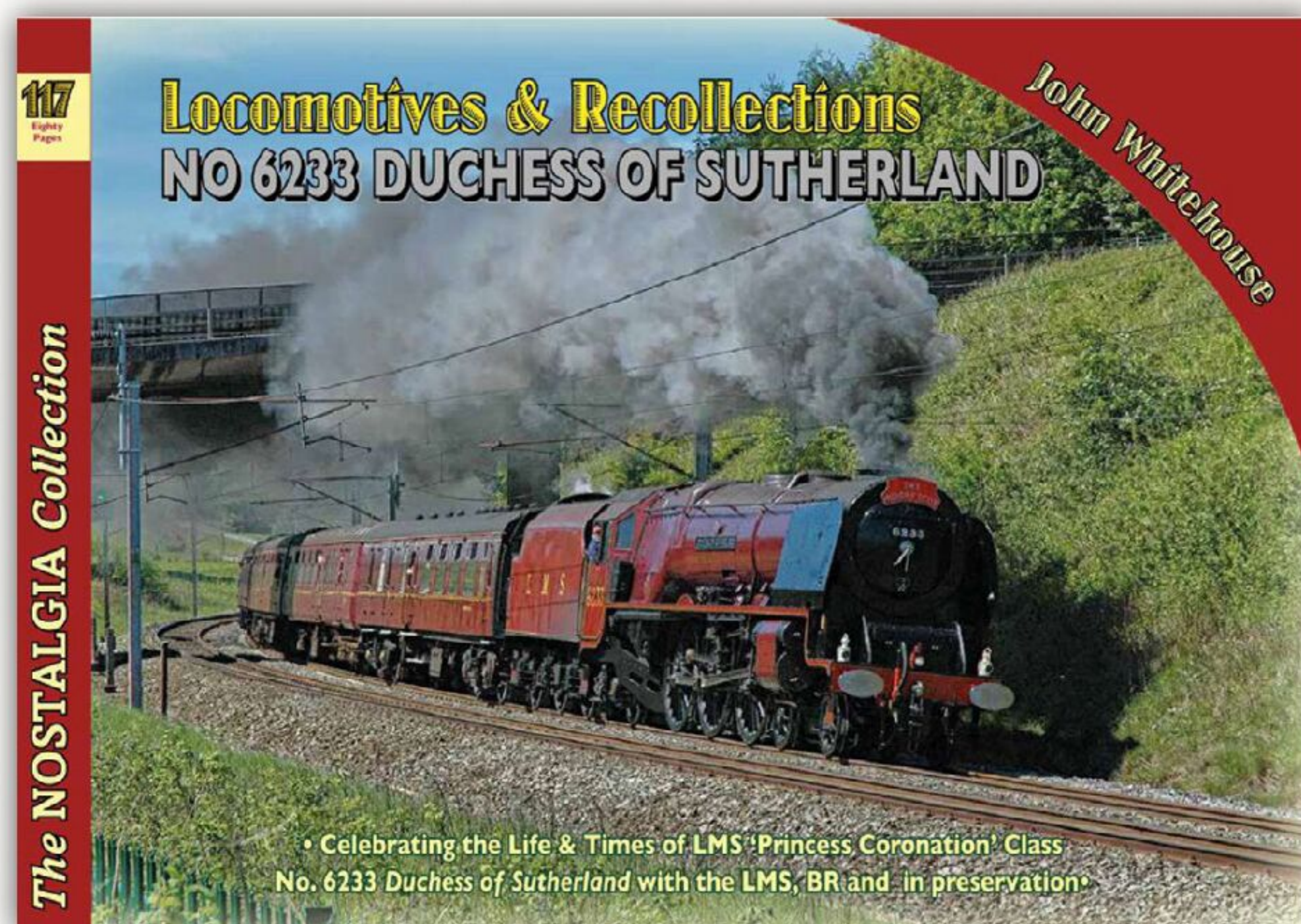
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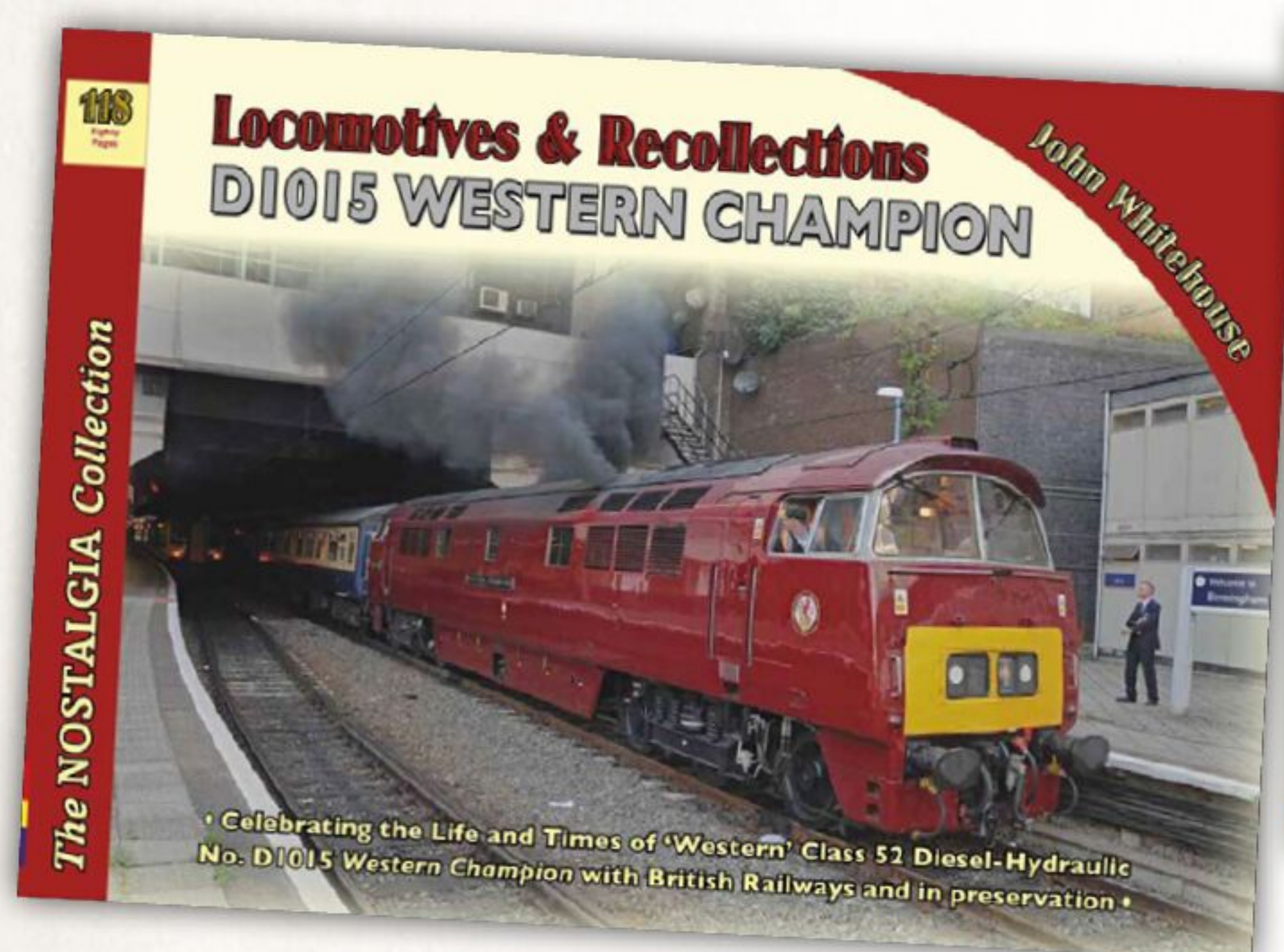
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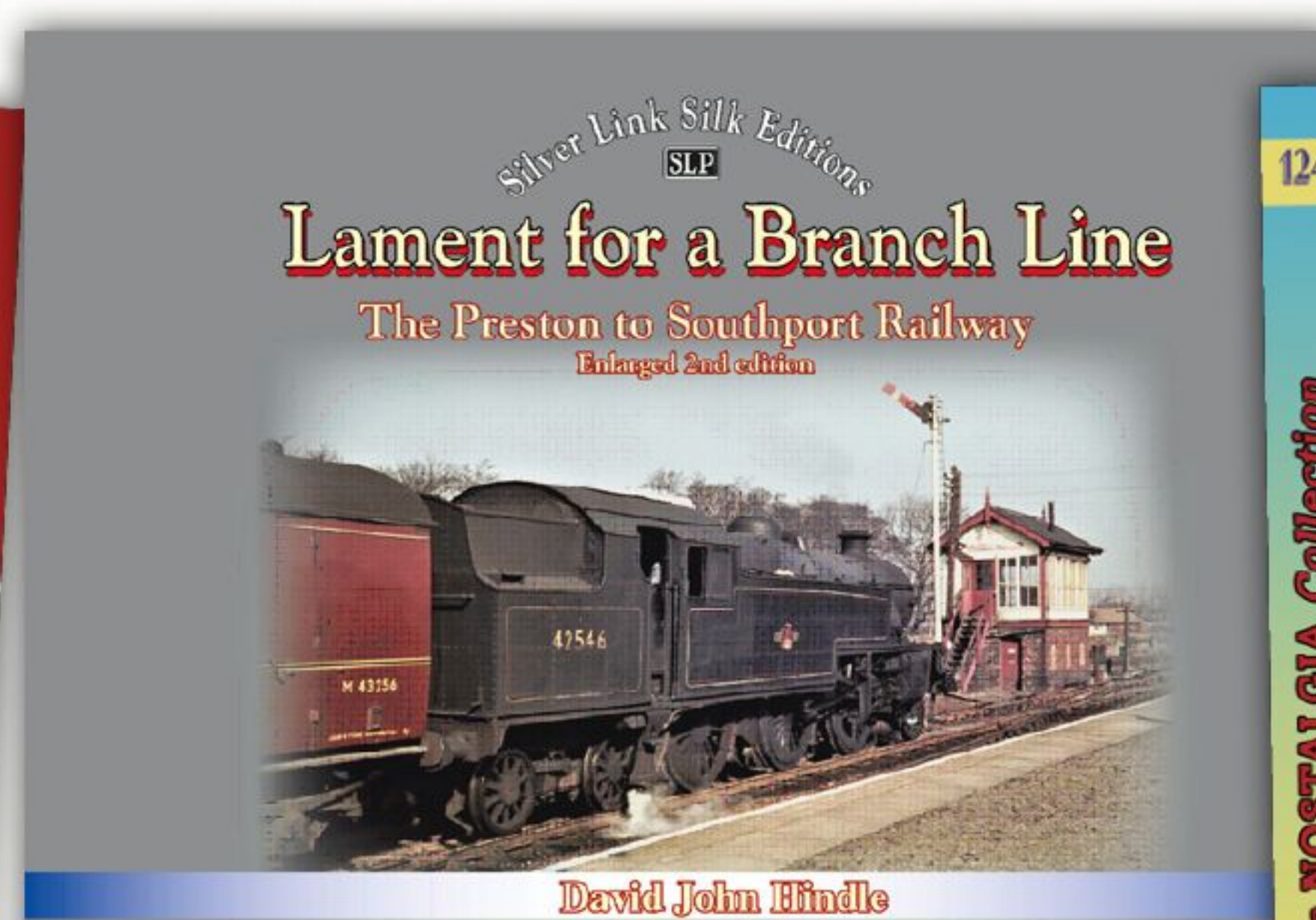
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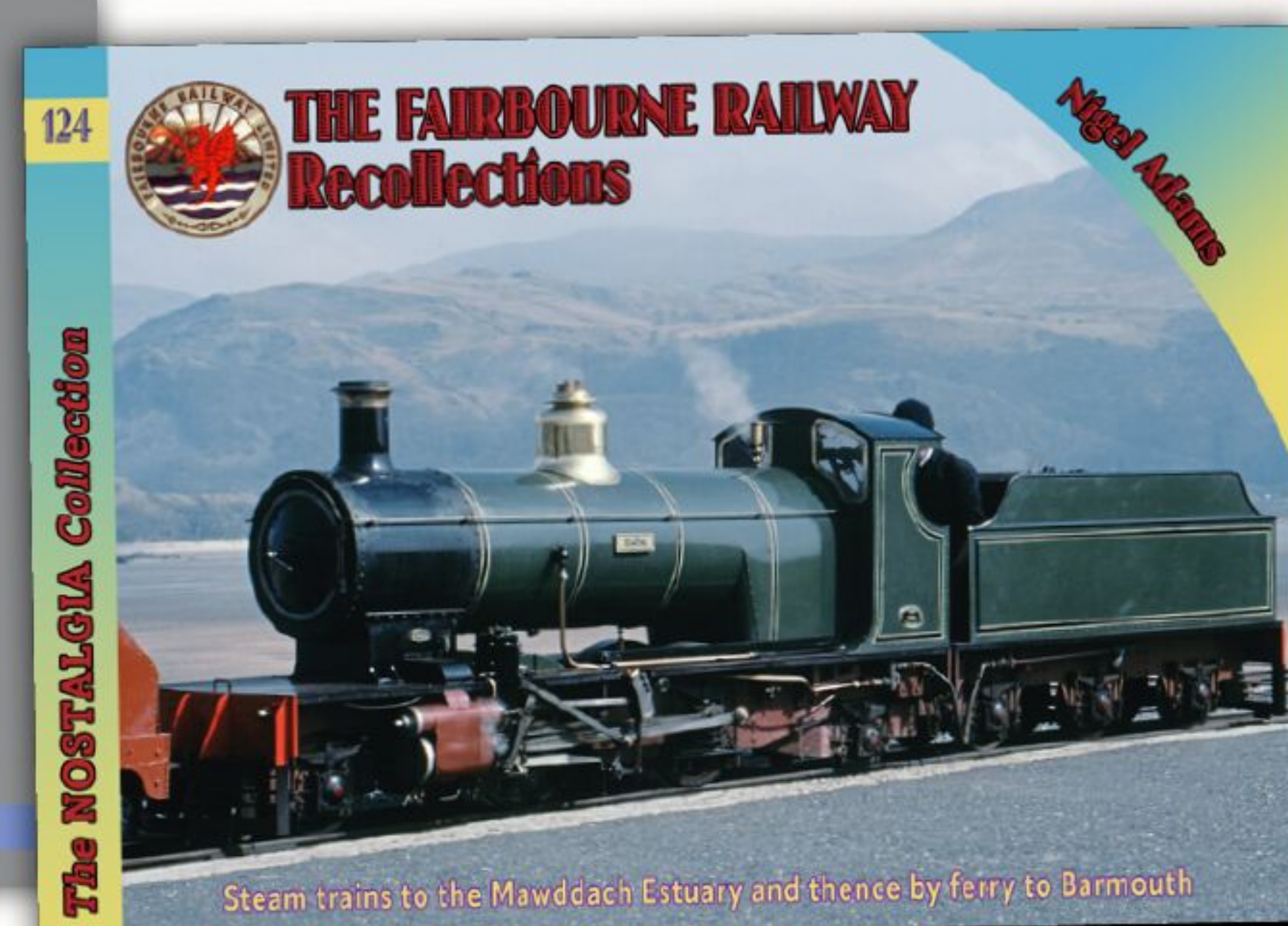
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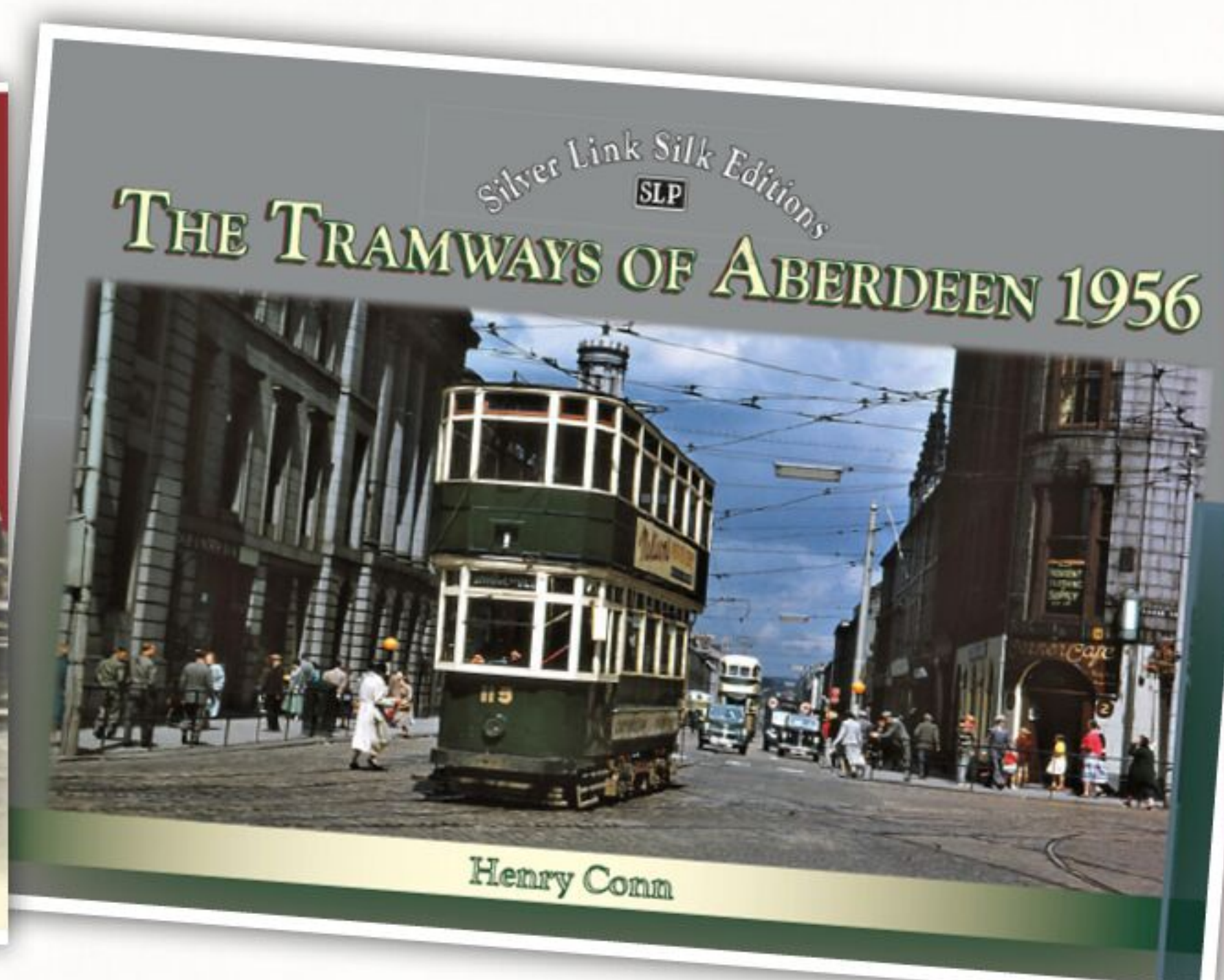
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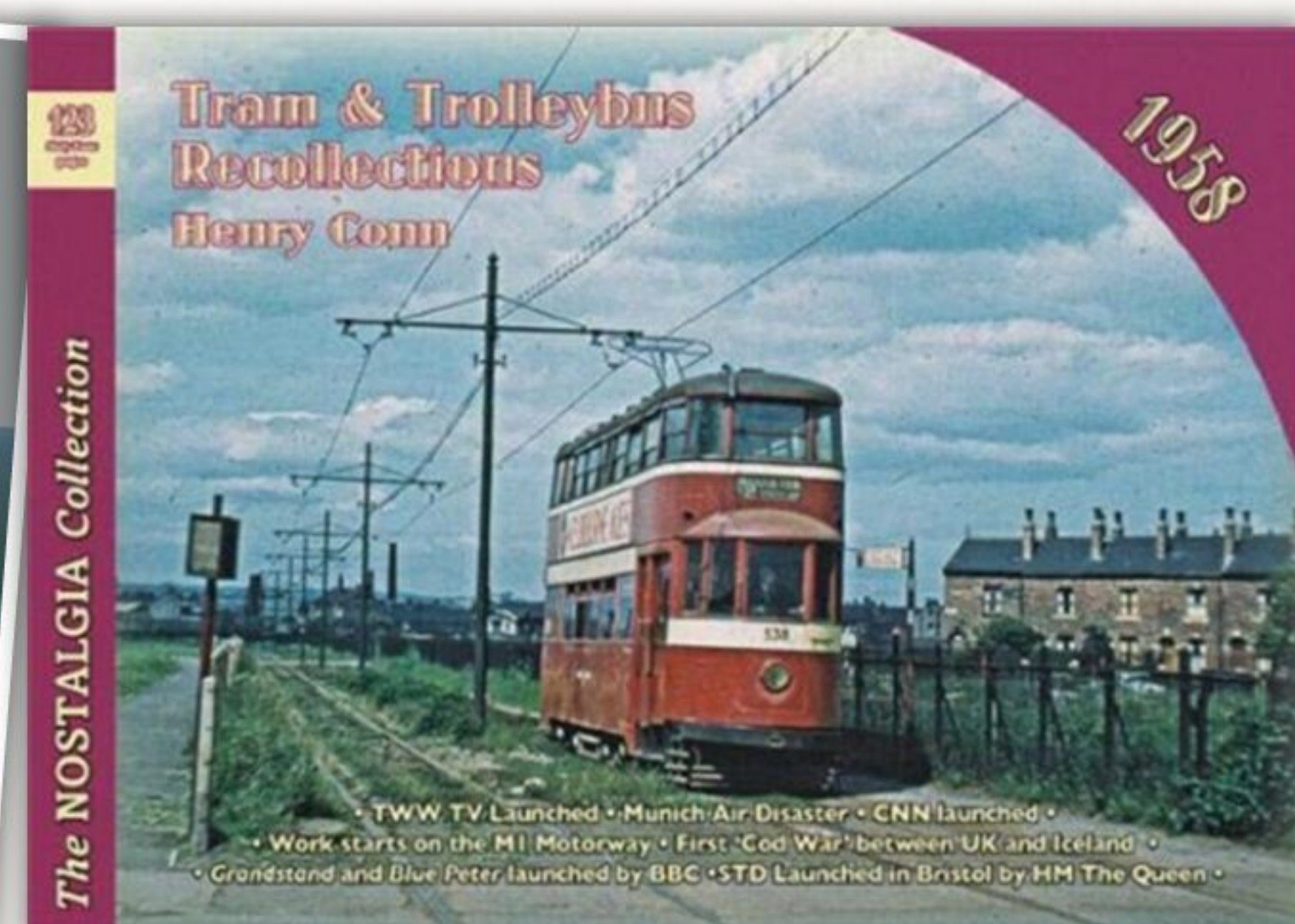
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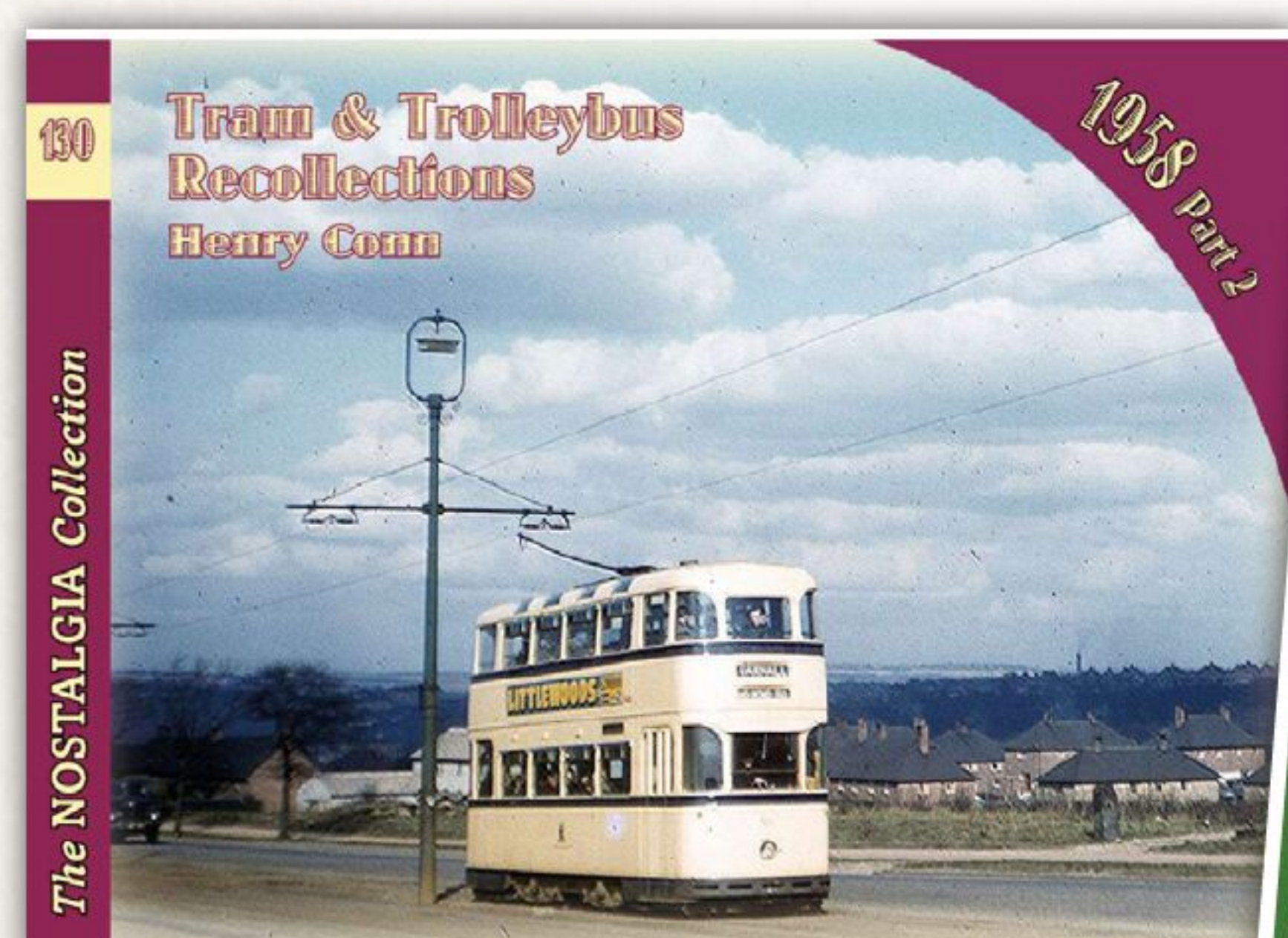
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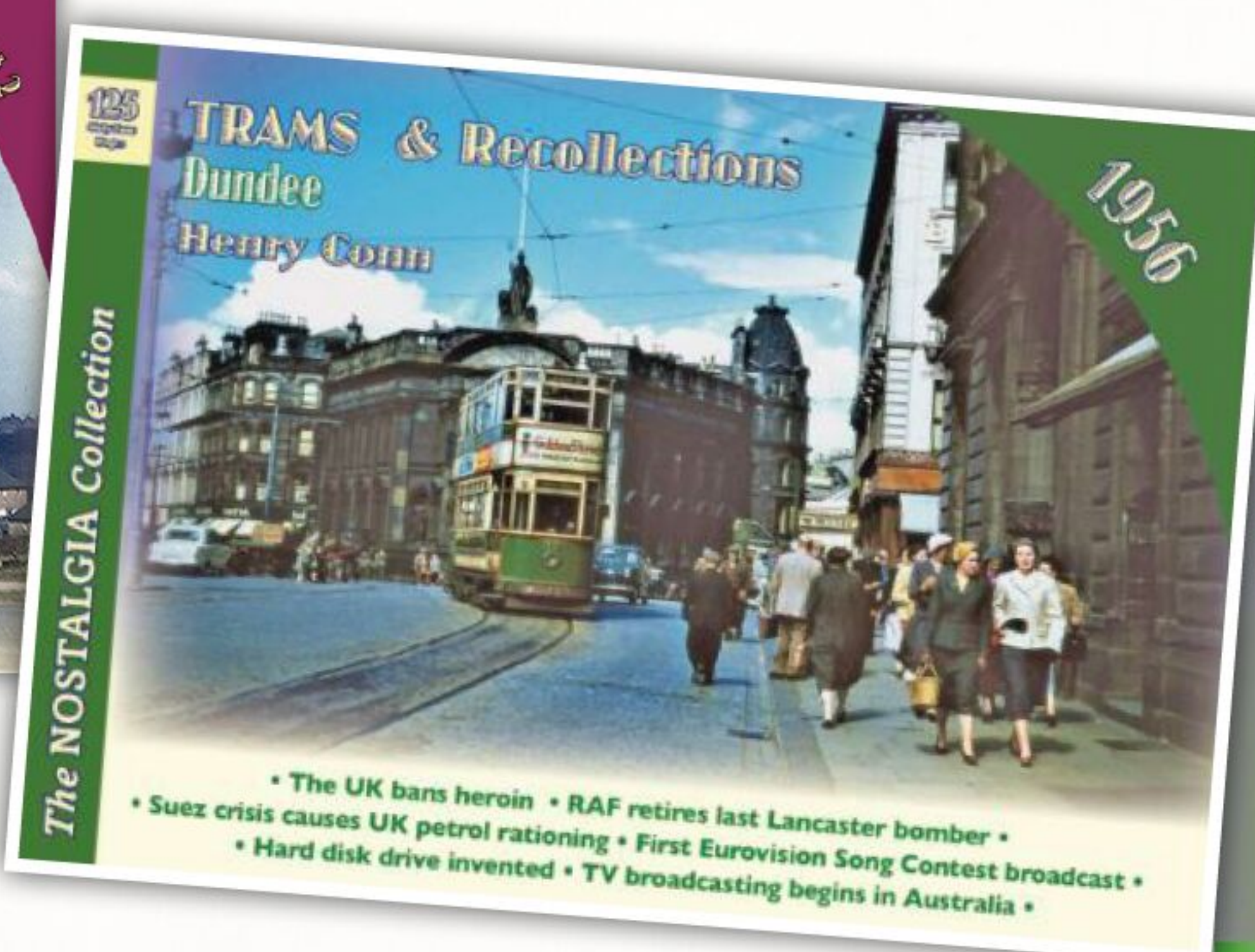
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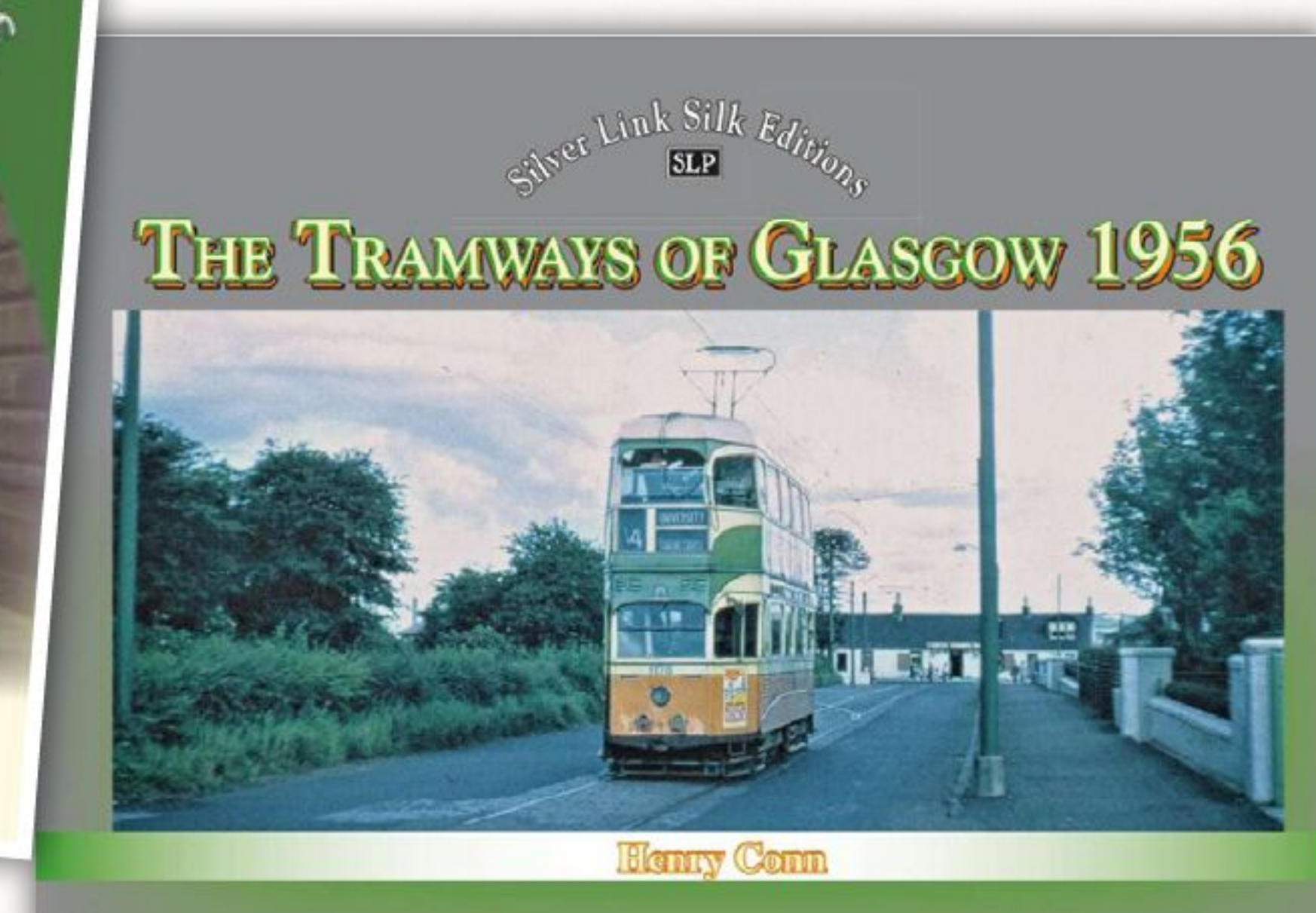
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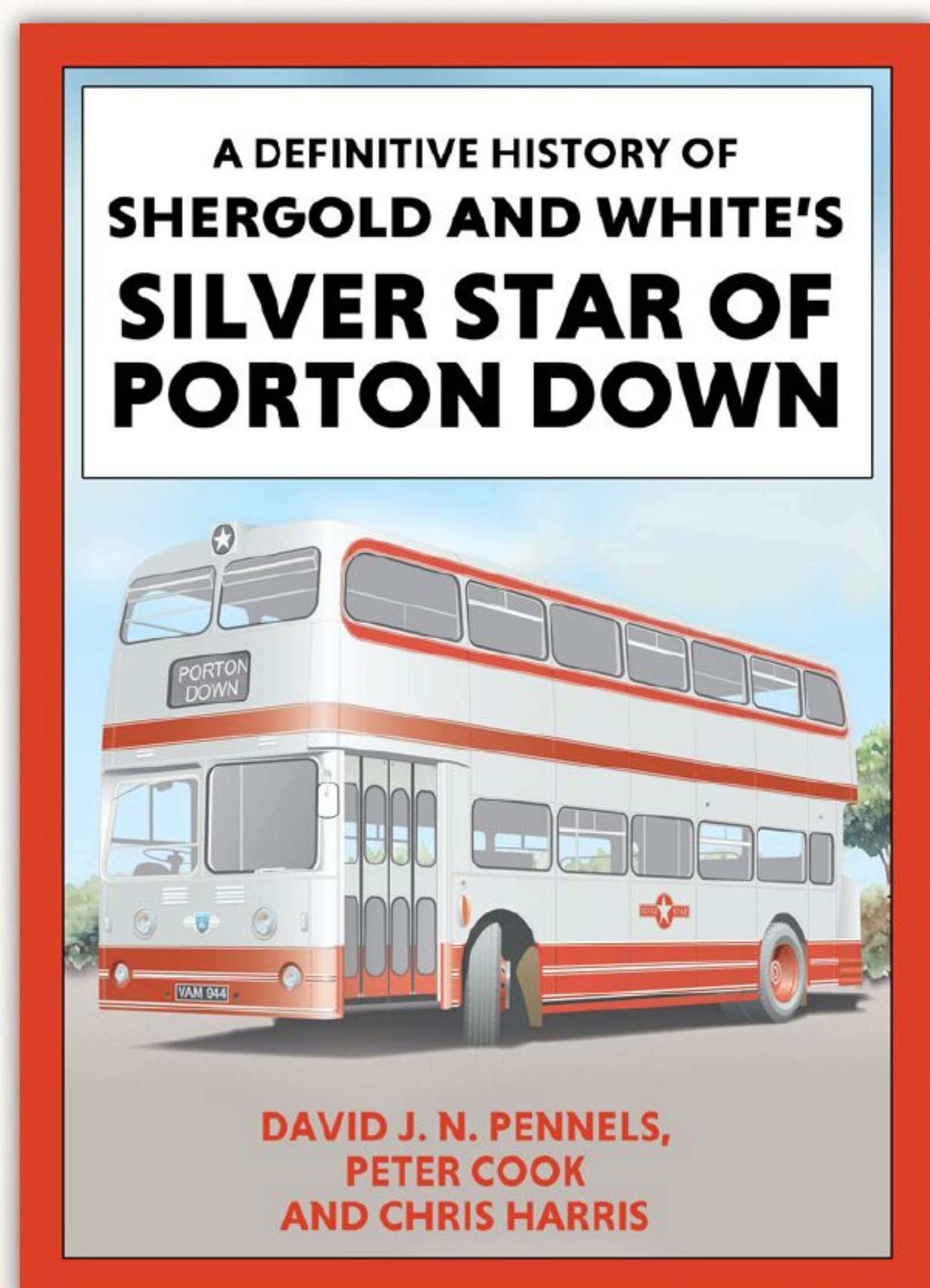
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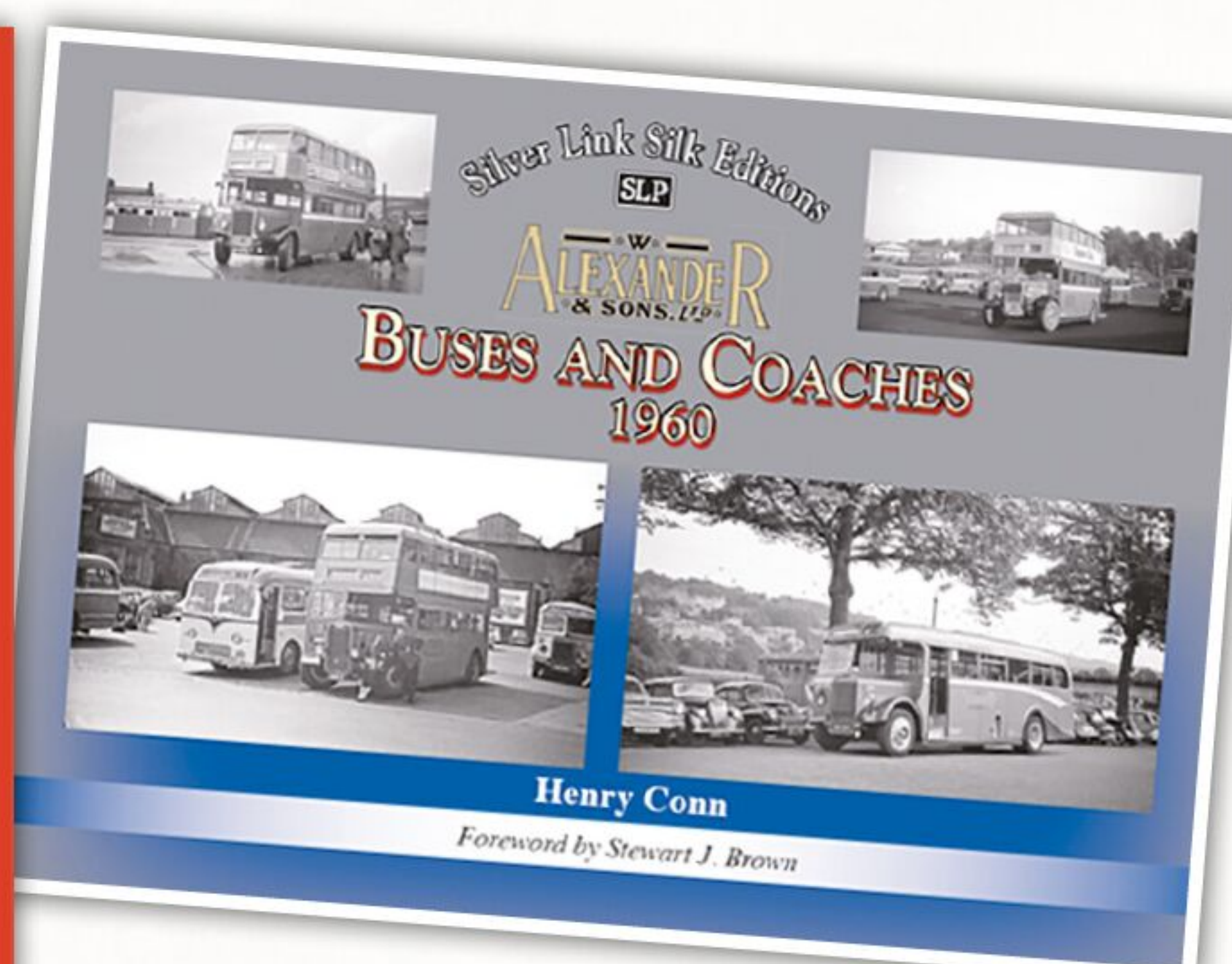
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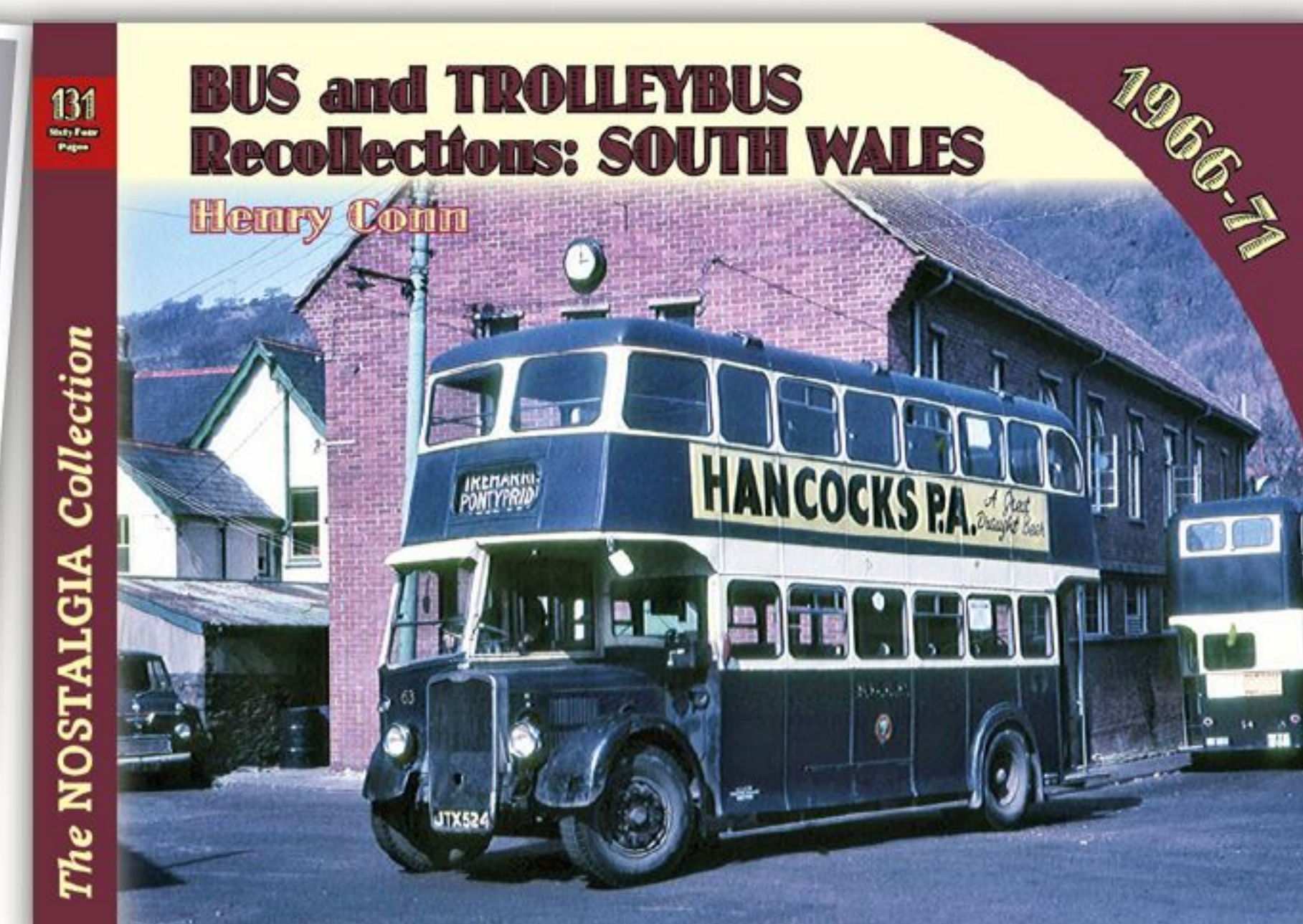
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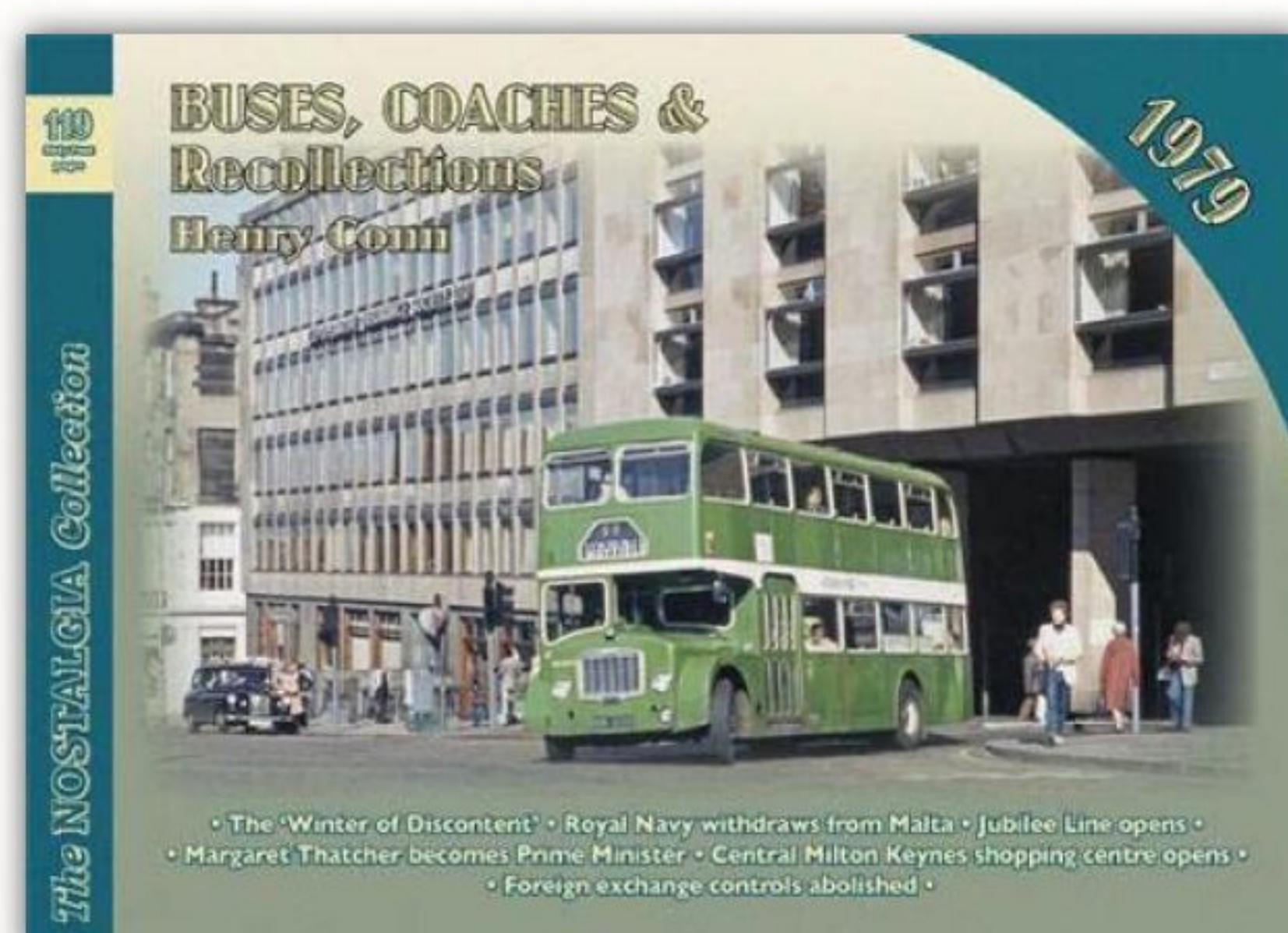
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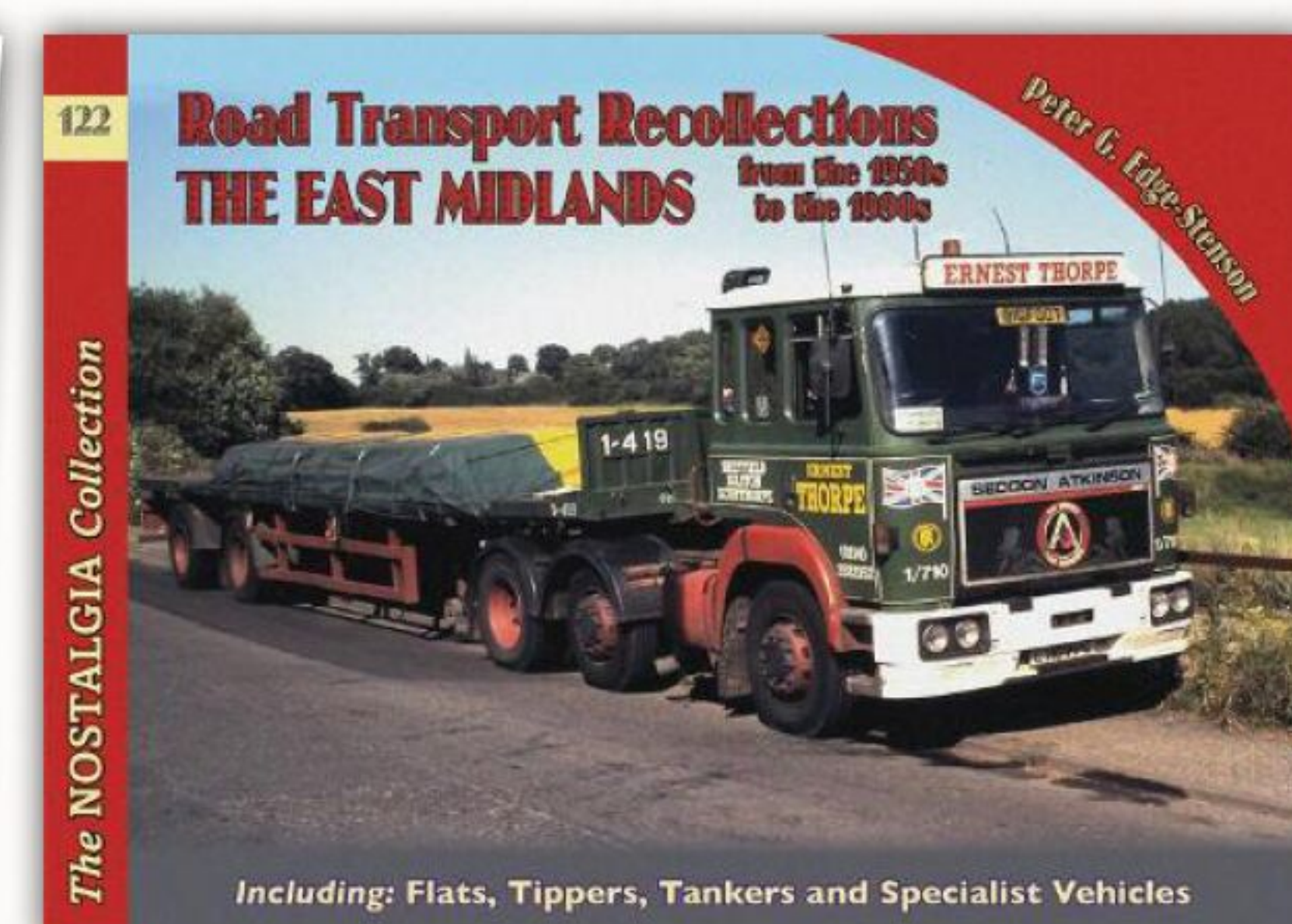
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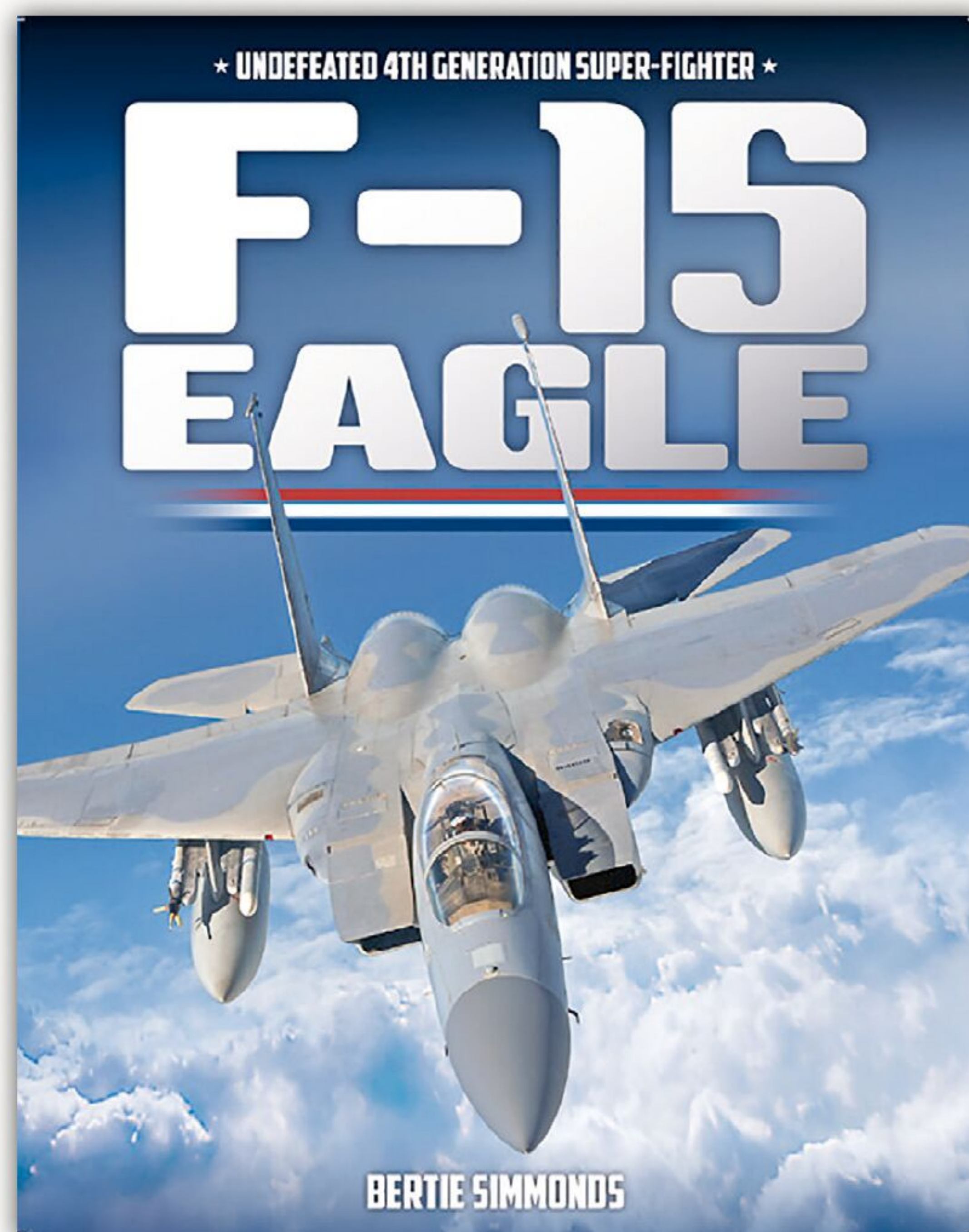


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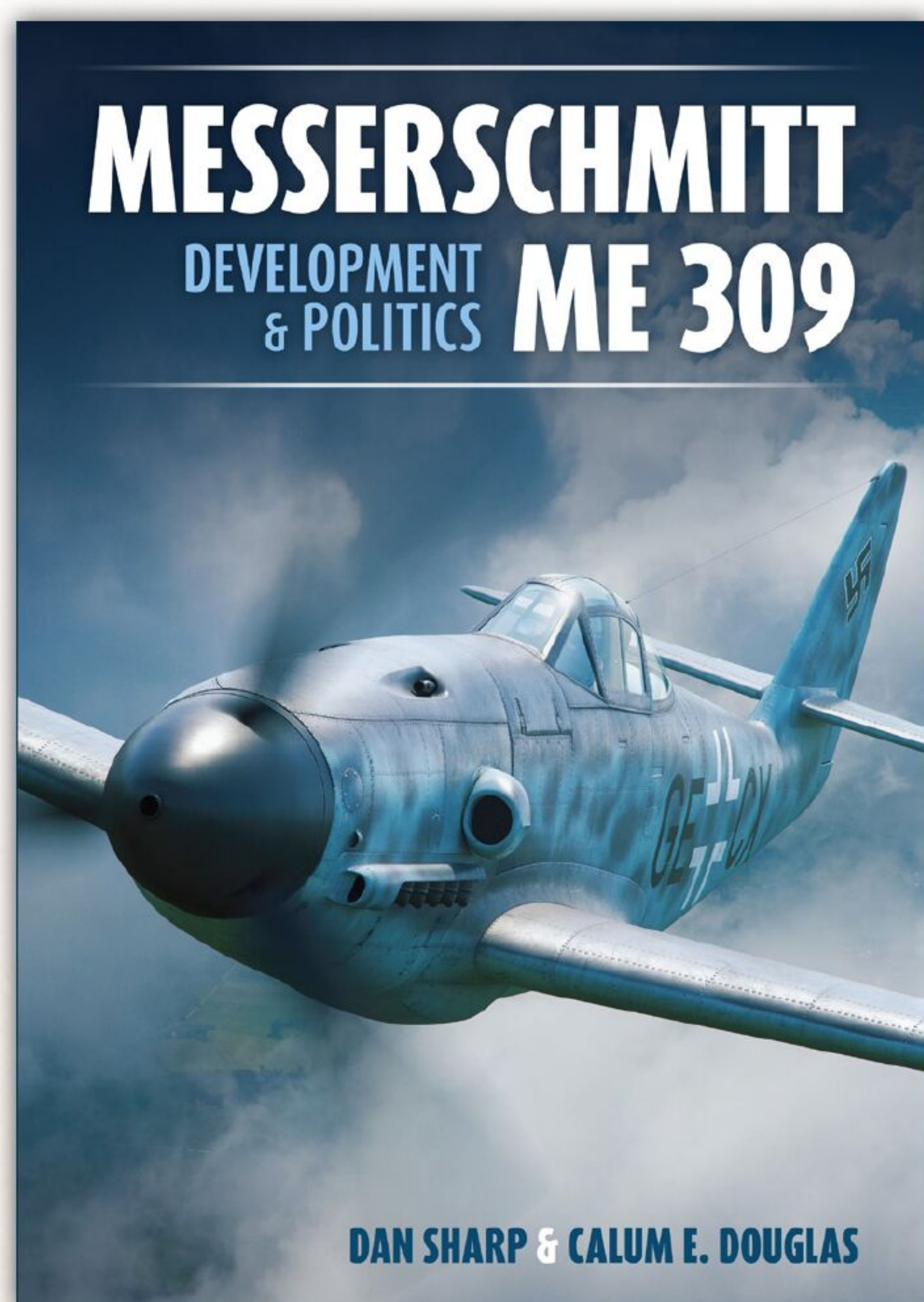
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Chosen in 1941 to replace the Bf 109 as the Luftwaffe's standard front-line fighter, Messerschmitt's innovative Me 309 embodied a wealth of hard-won experience from the Battle of Britain. Its sturdy tricycle undercarriage would make landings safer, its capacious wings could accommodate much heavier weaponry, its retractable radiator would make it aerodynamically clean, its pressure cabin would allow high-altitude operations and its ejection seat would help preserve the Luftwaffe's most precious asset – its pilots.

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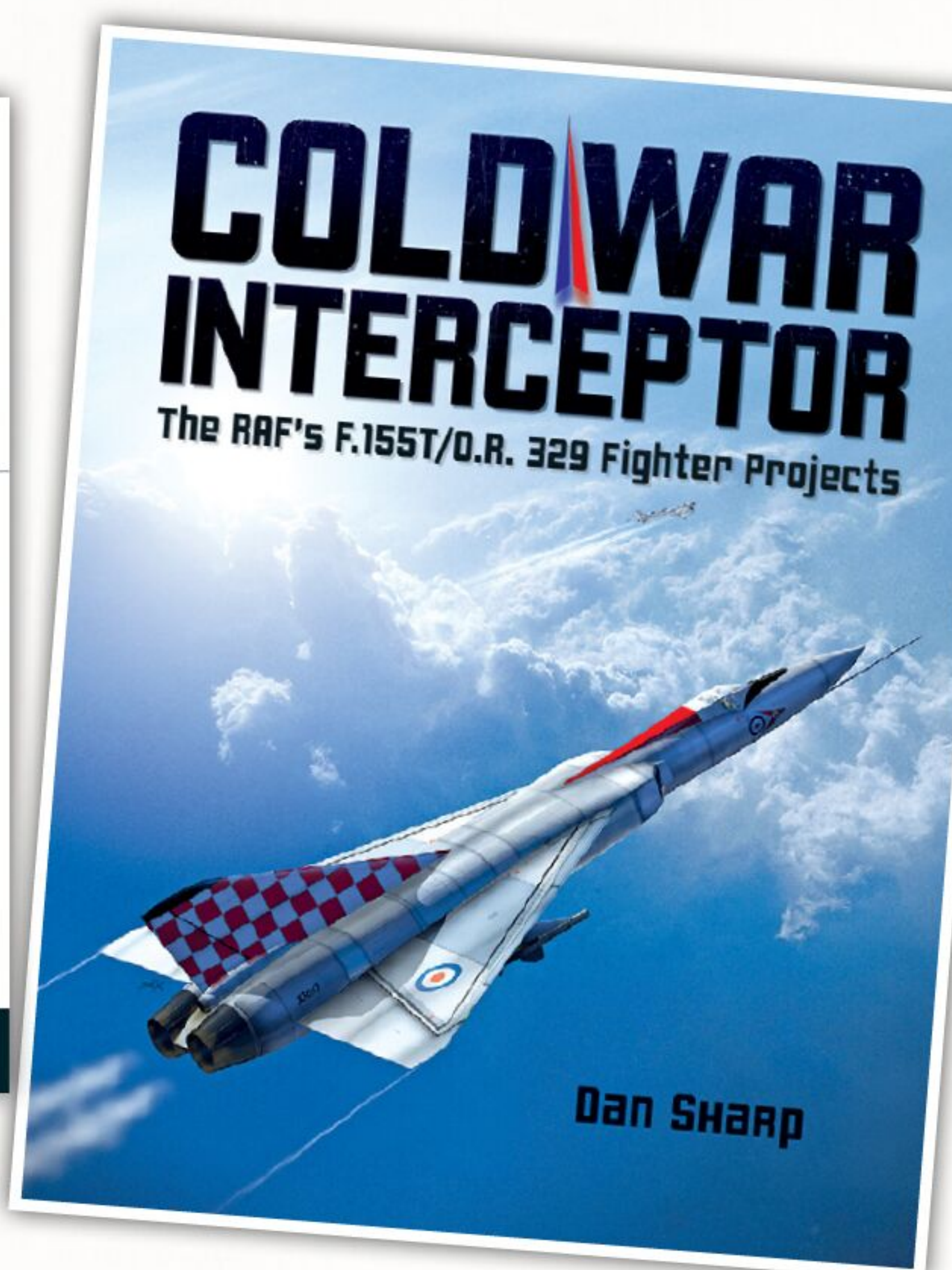
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The first jet fighter to enter service and see combat anywhere in the world, the Messerschmitt Me 262 was a deadly technological marvel – yet it was also difficult to produce, dangerously unreliable and extremely vulnerable during takeoff and landing. 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 Interceptor I-III, Aufklärer I-II and Schnellbomber I-III.

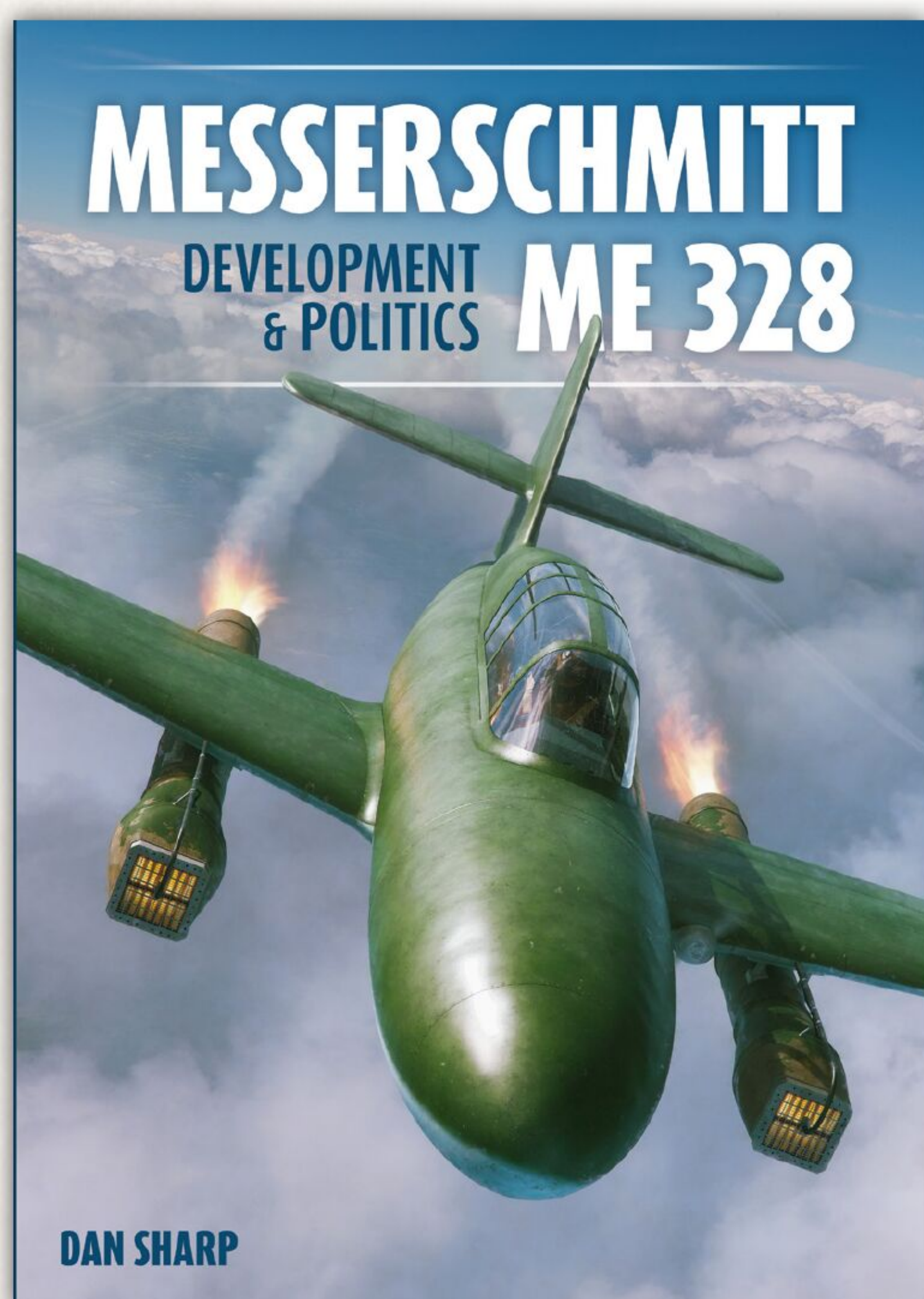


MESSERSCHMITT Me 328 DEVELOPMENT & POLITICS

DAN SHARP

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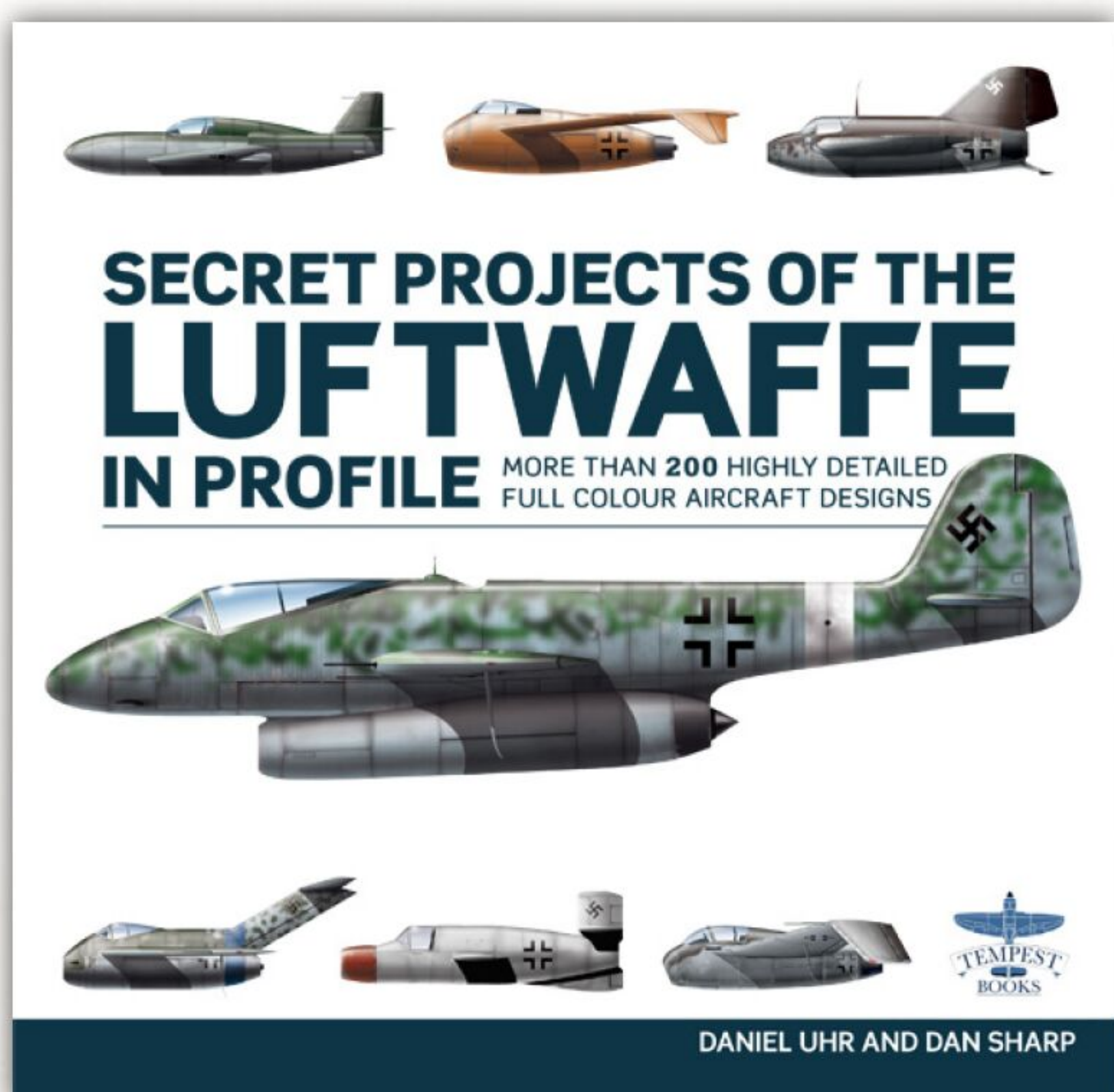
ISBN: 9781911704201



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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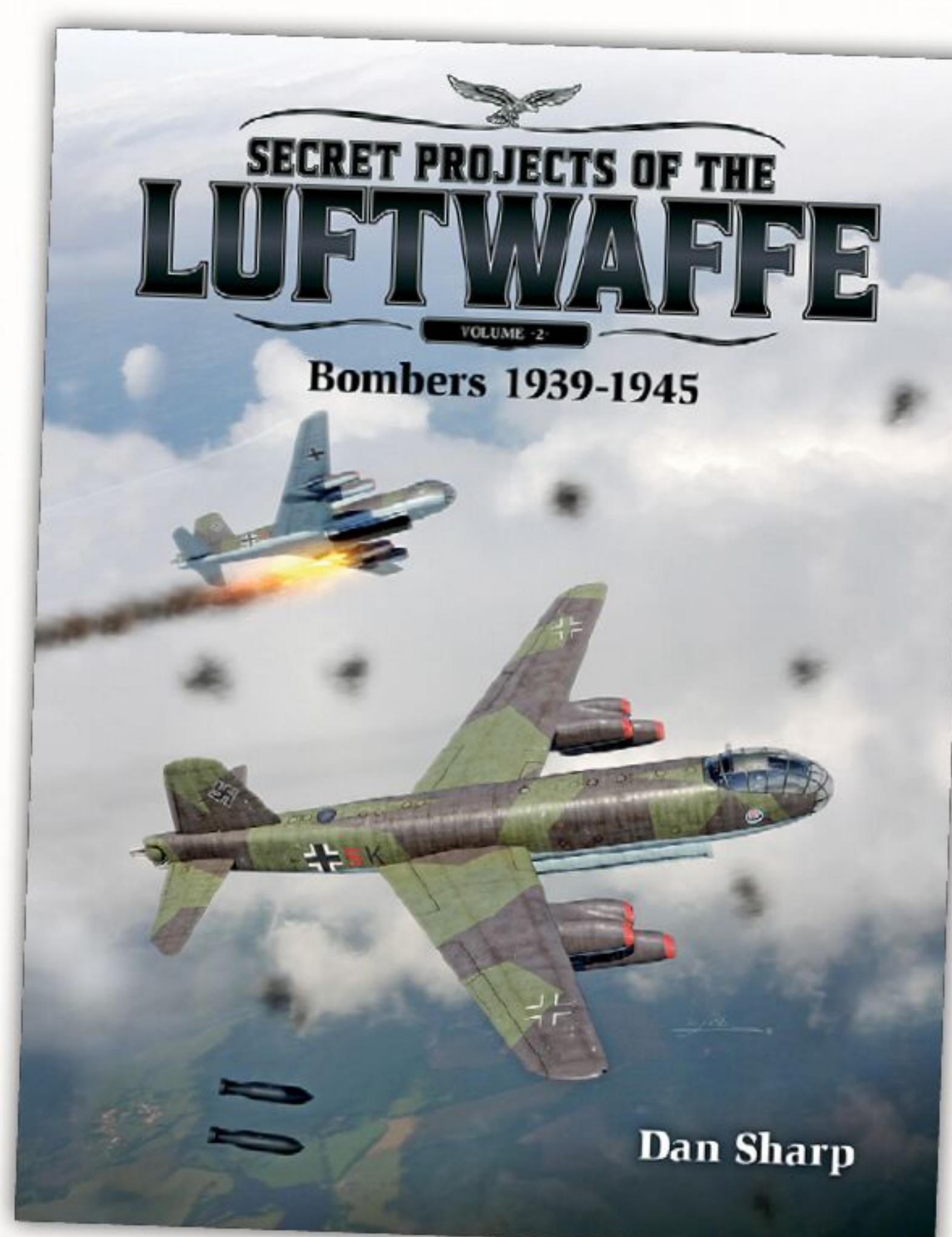
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HOTOL: BRITAIN'S SPACEPLANE

DAN SHARP

On sale: SEPTEMBER 27, 2024

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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.

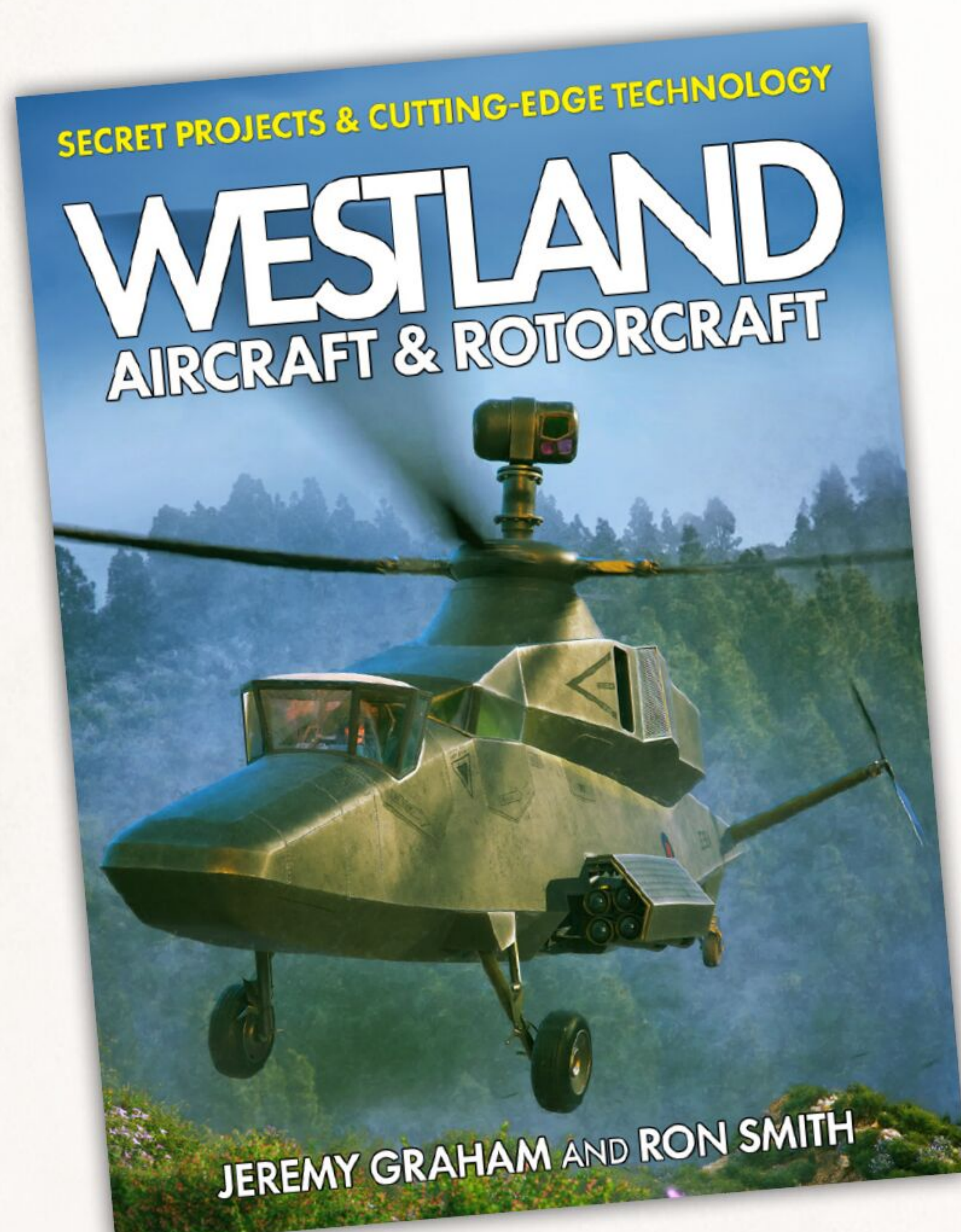
So when rocket scientist Alan Bond and aerospace engineer Bob Parkinson attended a British Interplanetary Society lecture on the proposed non-reusable Ariane 5 rocket in 1982, they began to discuss possible alternatives and concluded that the best solution was... an aerospaceplane.

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.



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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.

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.

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.

THE BATTLE OF BRITAIN MEMORIAL FLIGHT IN PHOTOS

LISA HARDING

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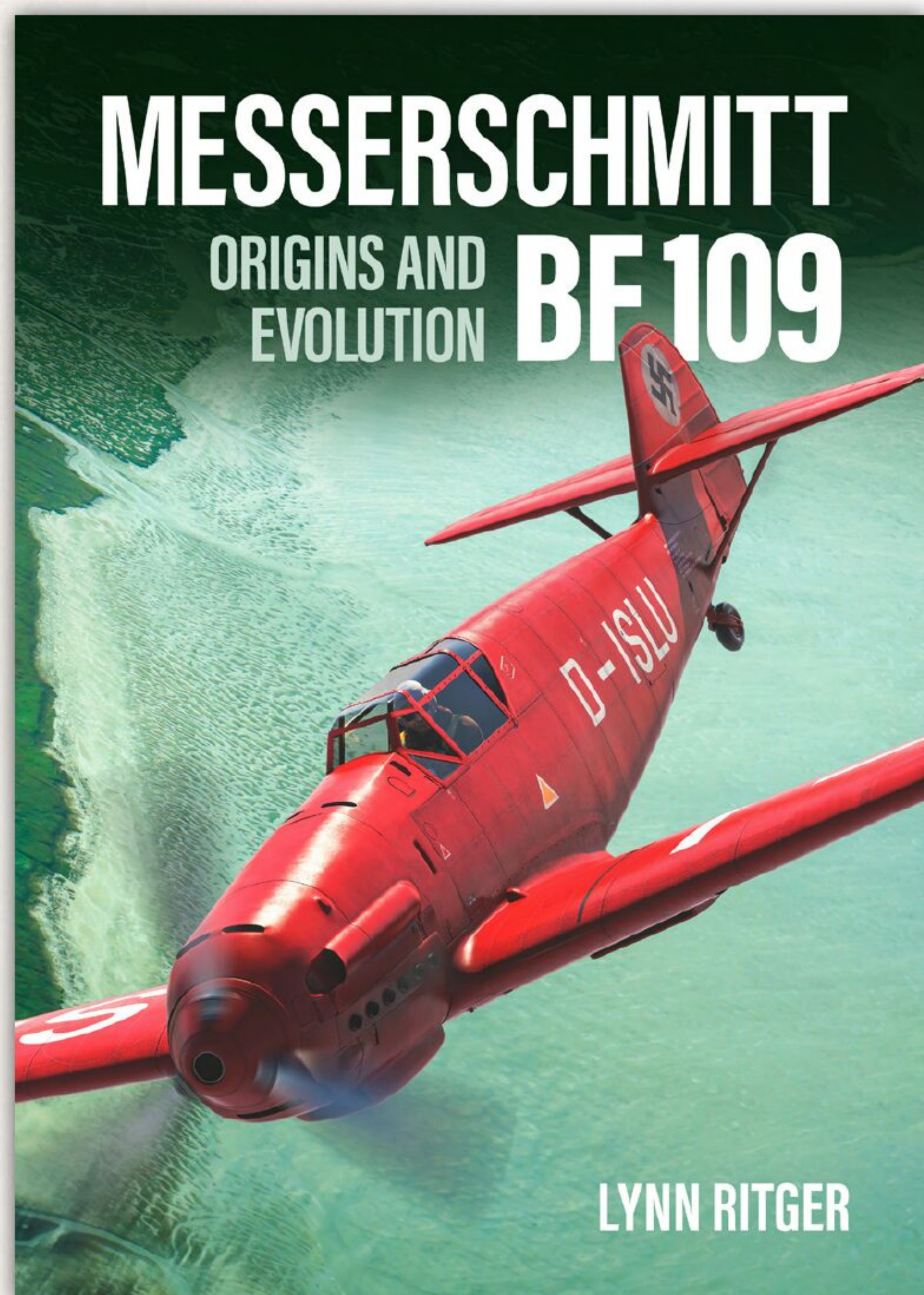
MESSERSCHMITT Bf 109 ORIGINS AND EVOLUTION

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.



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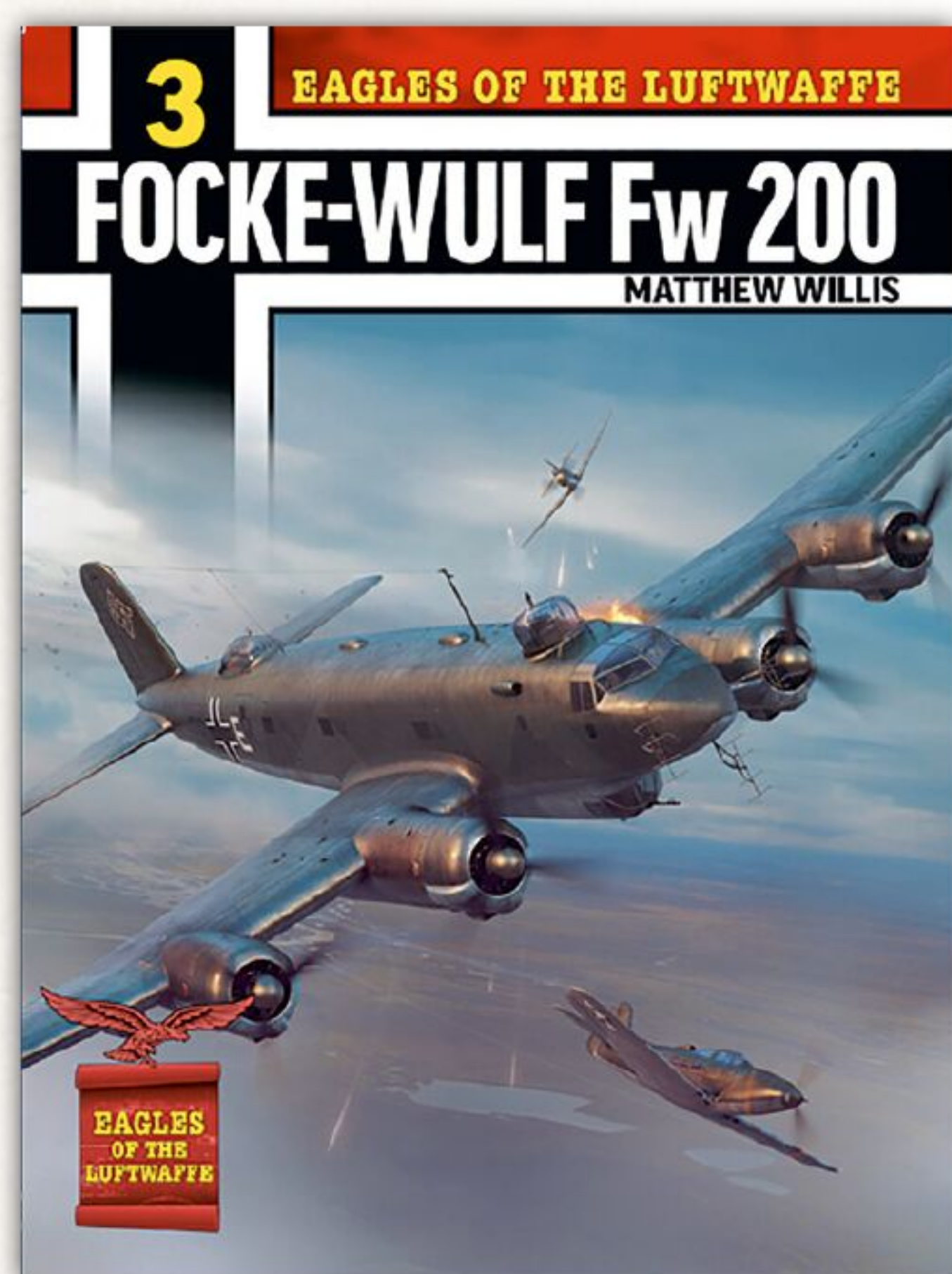
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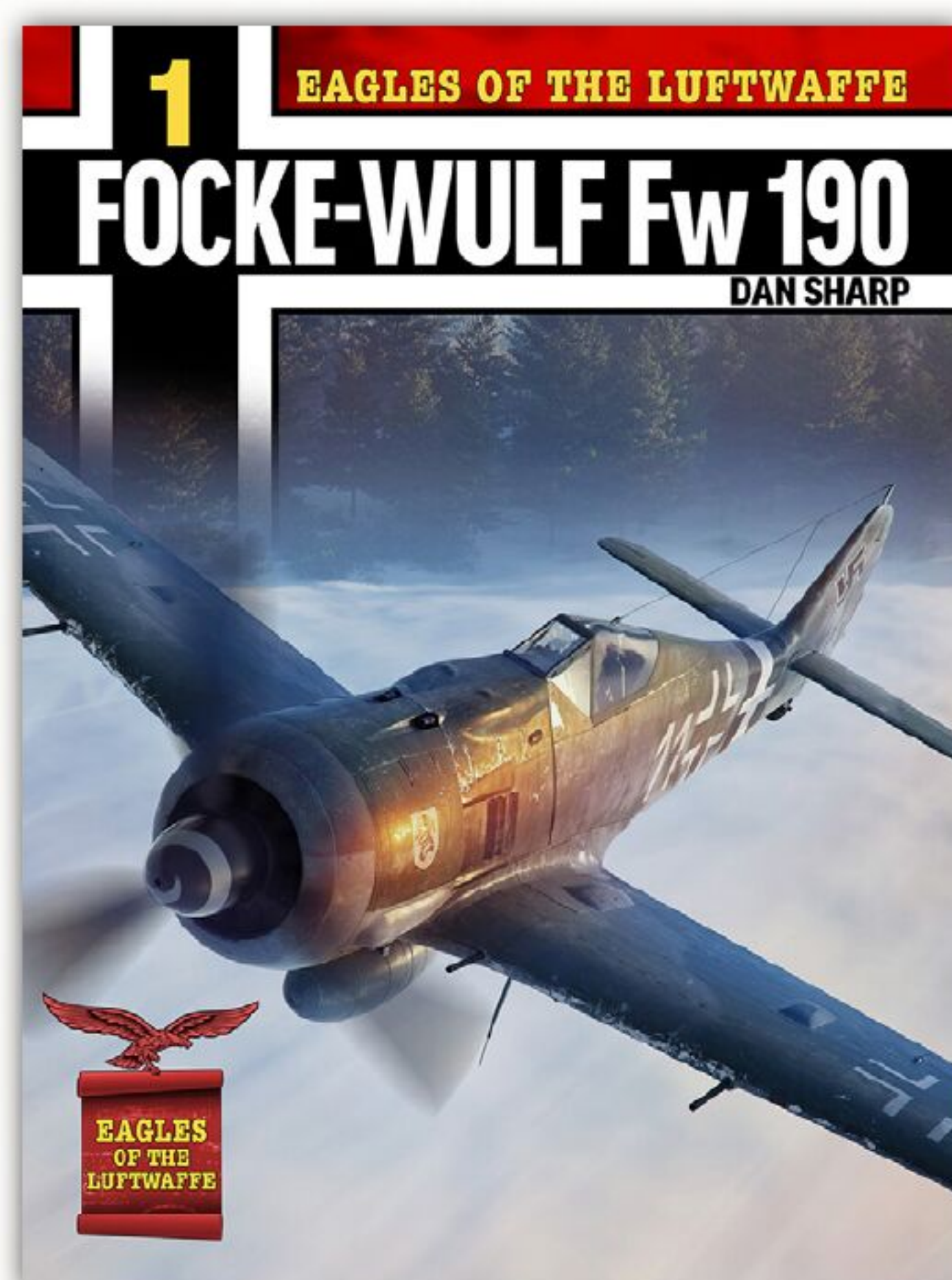
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HOME OF THE UK'S INTELLIGENCE, SURVEILLANCE, TARGET ACQUISITION AND RECONNAISSANCE



MIKE HILEY

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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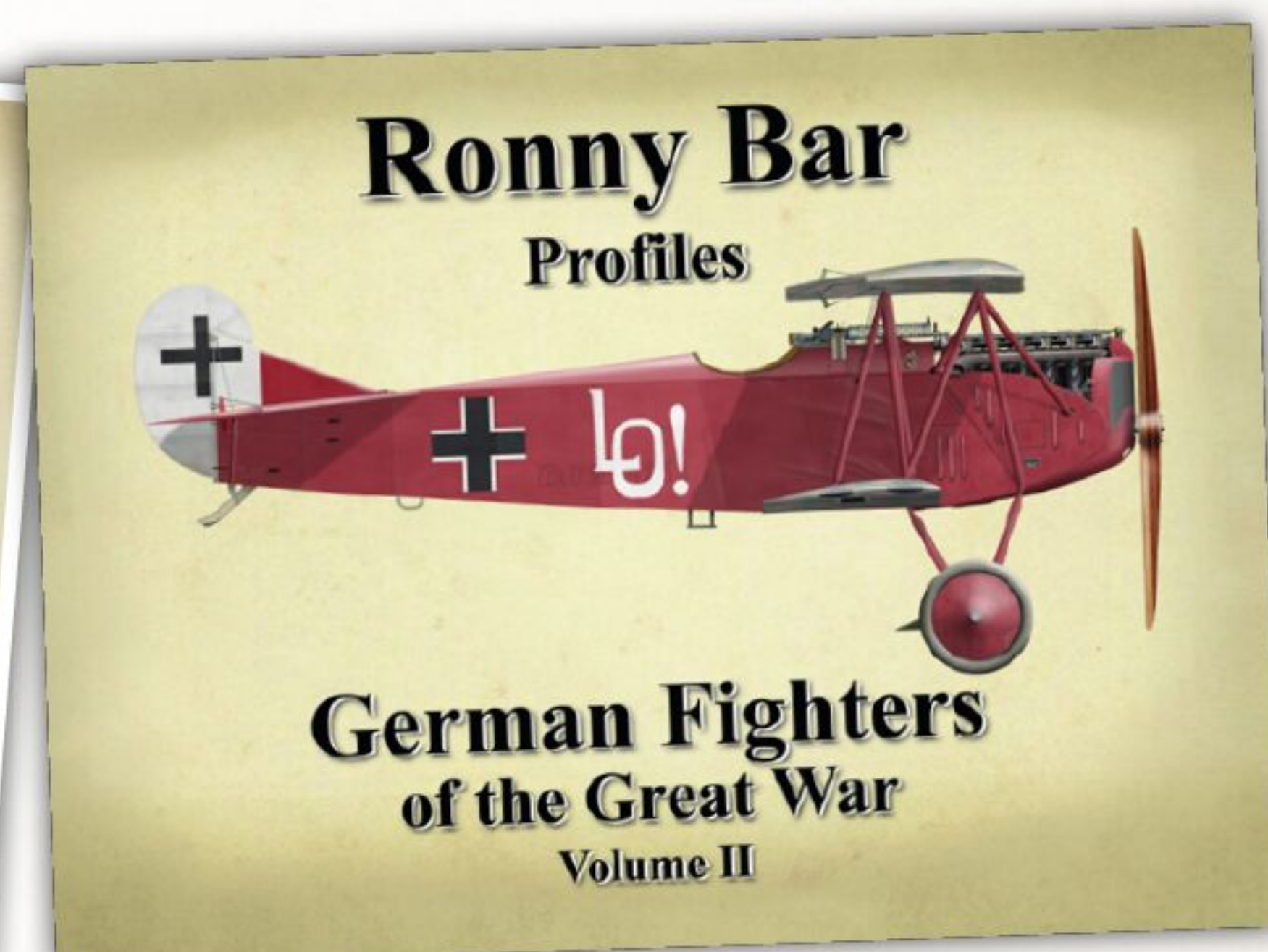
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RONNY BAR PROFILES - GERMAN FIGHTERS OF THE GREAT WAR VOL 2

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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

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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

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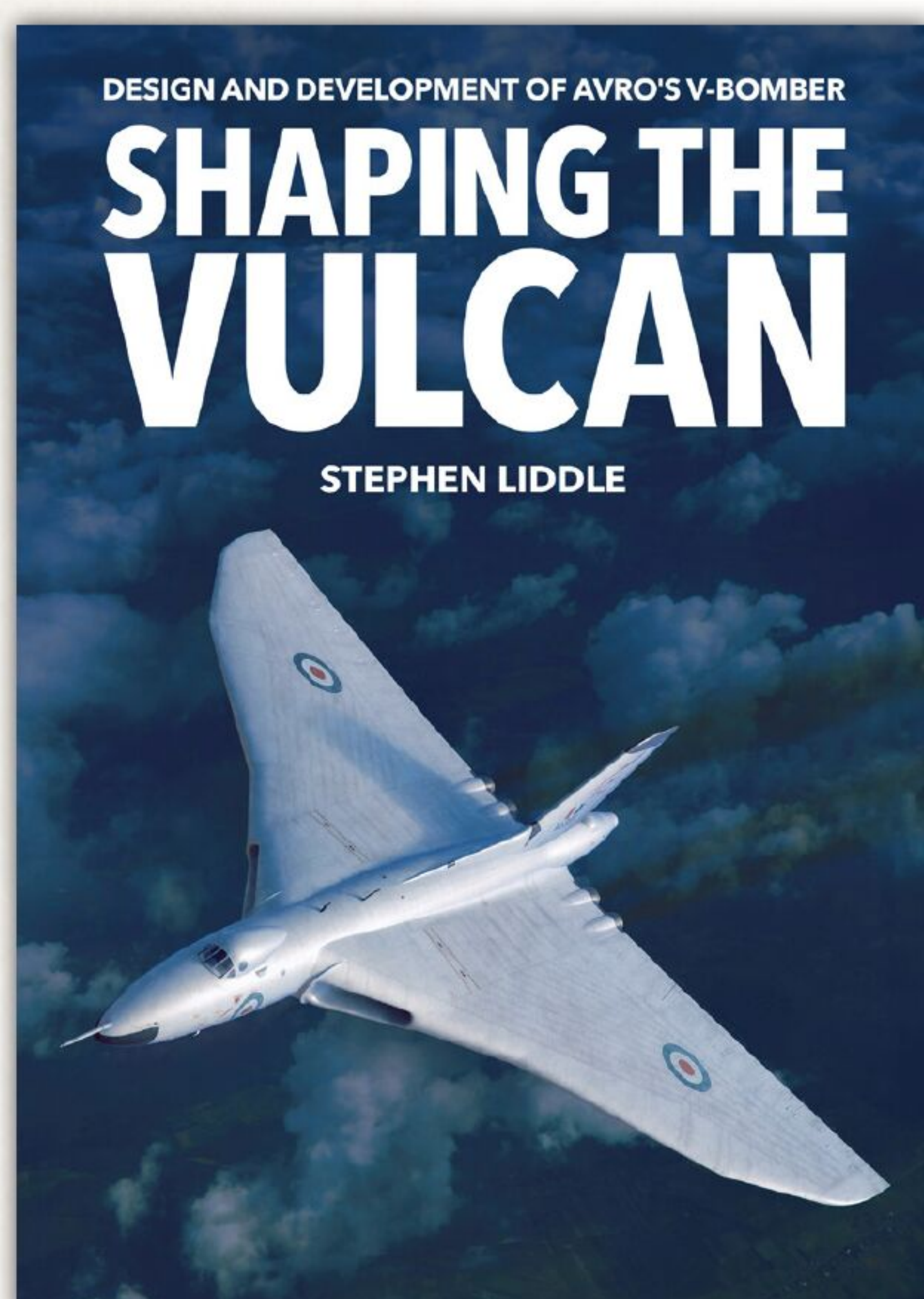
With a top speed approaching Mach 3 and equipped with both powerful sensors and air-to-air weaponry, the two-seater MiG-31 interceptor has proven to be one of the Cold War's most formidable survivors – finally coming into its own during the Ukraine War. Development began in 1975 with a design based on that of the MiG-25 Foxbat and progressed to the point where, although it bore a superficial similarity 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

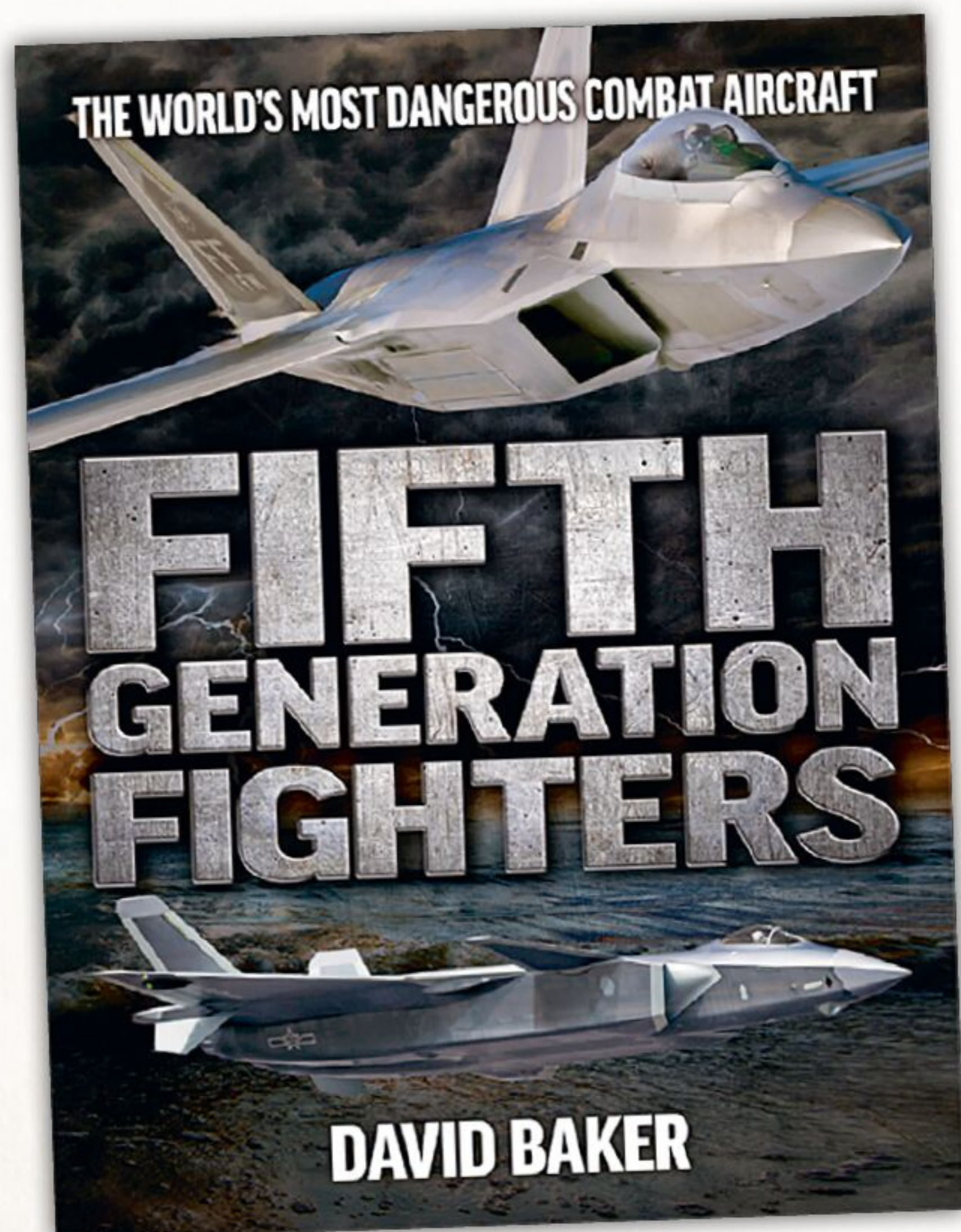
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The Avro Vulcan is one of the most striking aircraft ever made – its enormous wing stretching back from an improbably thick leading edge marked by cavernous wing root engine intakes. Perhaps even more incredible, its first flight was made just over 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.

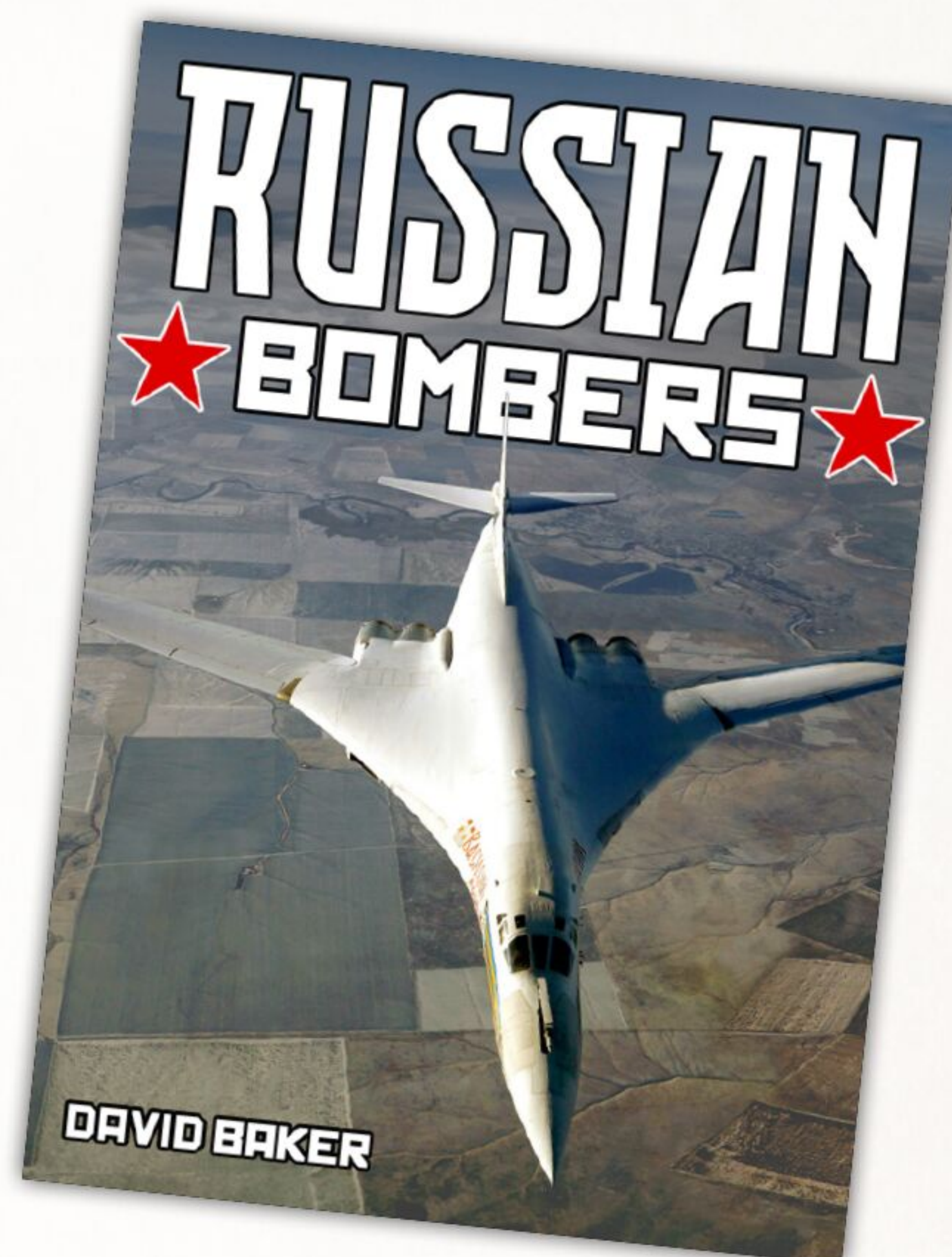


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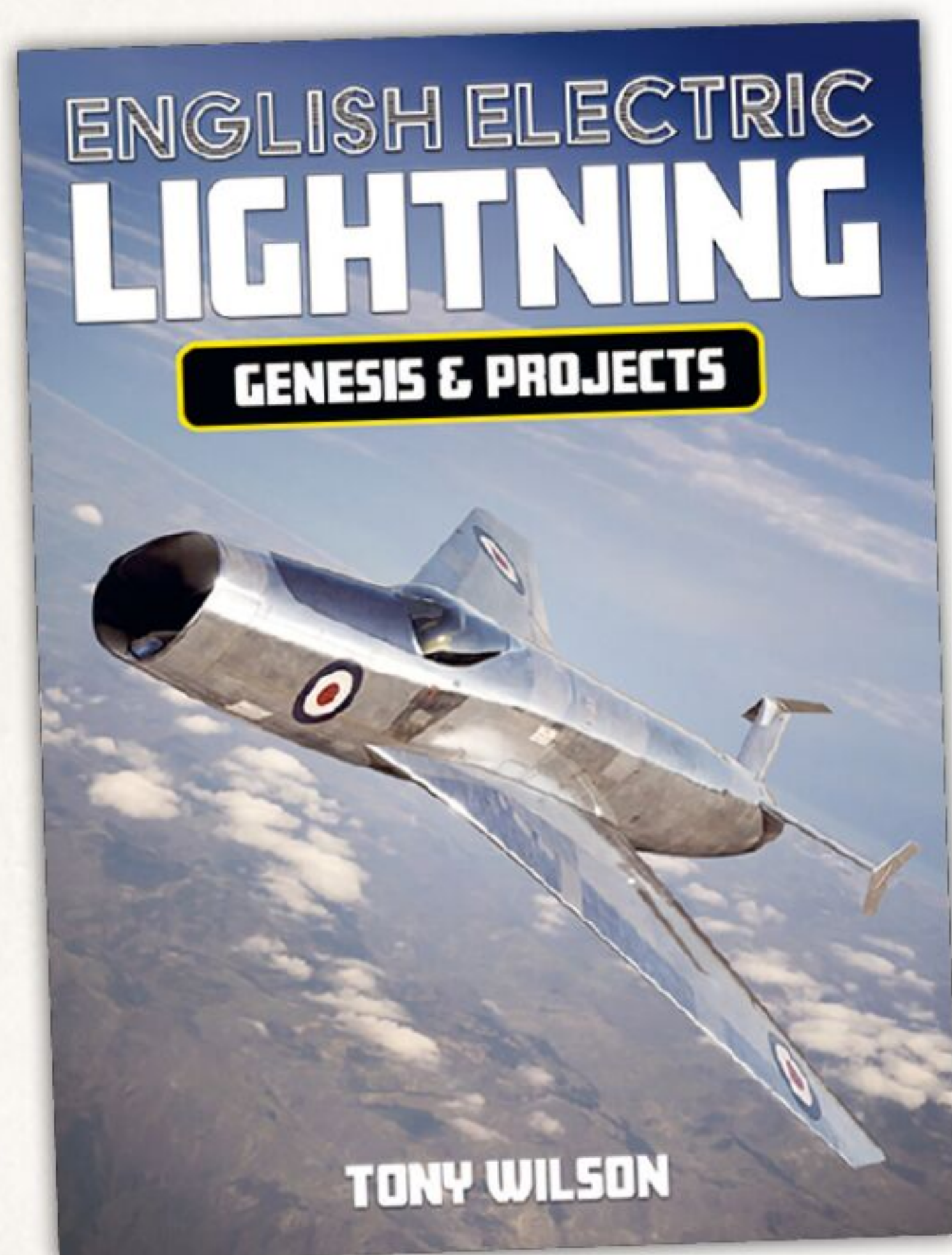


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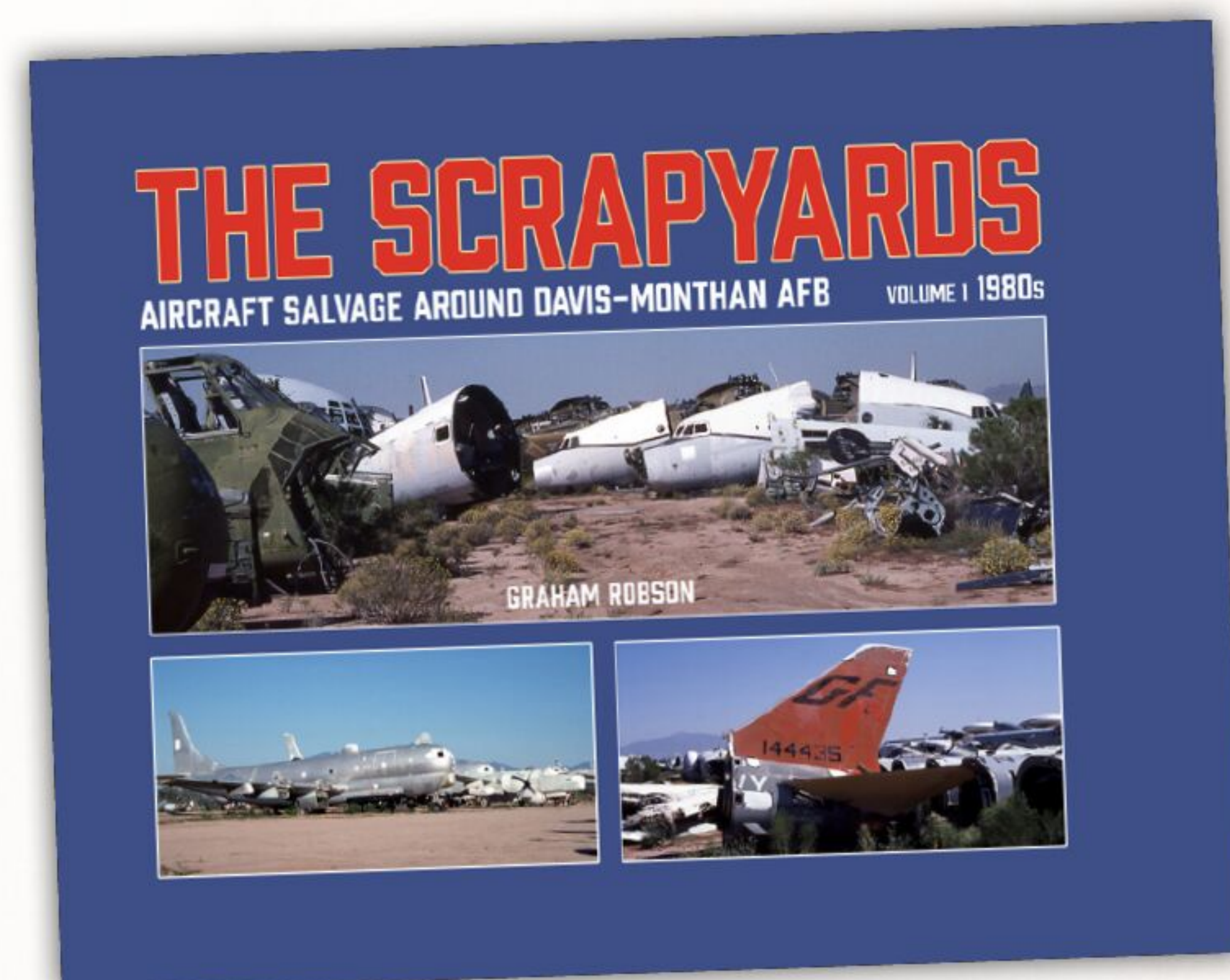
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