

GWR PANNIER TANK IN 3½ INCH GAUGE

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Vol. 233 No. 4752 20 September – 3 October 2024

MODEL ENGINEER

THE ORIGINAL MAGAZINE FOR MODEL ENGINEERS

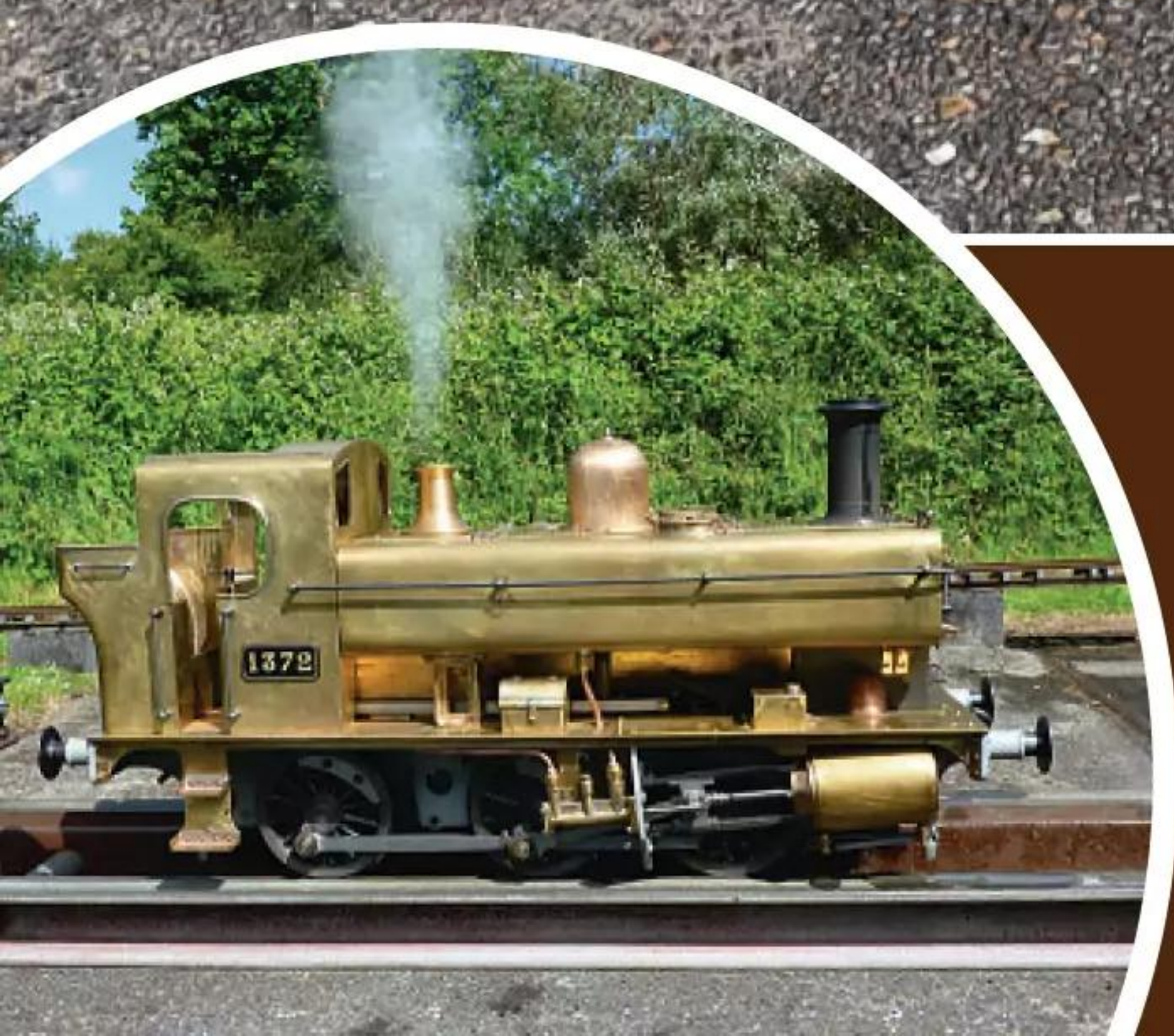


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Published by Mortons Media Group Ltd,
Media Centre, Morton Way, Horncastle, Lincs LN9 6JR
Tel: 01507 529589 Fax: 01507 371066
© 2023 Mortons Media ISSN 0026-7325
www.model-engineer.co.uk

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SUBSCRIPTION

Full subscription rates (but see page 434 for offer):
(12 months, 26 issues, inc post and packing) –
UK £132.60. Export rates are also available,
UK subscriptions are zero-rated for the purposes
of Value Added Tax.

Enquiries: subscriptions@mortons.co.uk

PRINT AND DISTRIBUTIONS

Printed by: William Gibbons & Son, 26 Planetary
Road, Willenhall, West Midlands, WV13 3XB
Distribution by: Seymour Distribution Limited,
2 East Poultry Avenue, London EC1A 9PT

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This issue was published on September 20, 2024.
The next will be on sale on October 4, 2024.

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Midlands show tickets

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Martin Parham glided ('glode'?) sedately around the Ruddington track on his very handsome 7¼ inch gauge Stirling Single.



Another trainload departs for a trip around the Dringhouses track (photo: Roger Backhouse).

FMES Rally

This year's Federation of Model Engineering Societies rally was hosted by the Nottingham model engineers at their track in Ruddington on Saturday August 31st. The event was very well attended with getting on for about two dozen locomotives in steam, covering a wide variety of gauges. Two presentations were made. The first was the Australia Shield, awarded to Les Brimson for his beautiful 5 inch gauge SE&CR 'L' Class locomotive. The second was the FMES Award, awarded this year to Stephen Bennet for his RNLI lifeboat and its trailer, hauled by a 'steam lorry' converted from a mobility scooter.

An excellent lunch was provided by the ladies of the Nottingham club, followed by

an equally excellent BBQ after the presentation of the prizes.

We hope to include a more detailed report in a forthcoming issue.

York

York Model Engineers raised over £1070 for St Leonard's Hospice at their summer charity event on Sunday 18th August. A team of members operated steam and electric trains at their Dringhouses track next to the East Coast main line. Over 200 people visited including many families enjoying the afternoon. Members donated prizes, put on a barbecue and arranged teas, home made cakes and ice creams. Chairman Brian Smyth says "Several of our members know first hand the excellent work of St Leonard's Hospice. We were pleased to be able to help such an excellent cause. Visitors really enjoyed themselves and gave generous donations."

Midlands Show Reminder

Here is a final reminder that the ever popular Midlands Model Engineering Exhibition takes place at the Warwickshire Events Centre from the 17th to 21st of October. Over 30 clubs and societies are expected to attend, along with nearly 40 of the leading model engineering suppliers. In addition, there is a full programme of lectures along with plenty to see in the display and competition classes. Avoid the queues by buying your tickets online in advance (meridienneengineering.seetickets.com)! A day in the show costs £13 for adults (£5 for children over 4). However, if you can squeeze in a 65th birthday before the show, you can get in for a mere £12.



Les Brimson is handed the Australia Shield by FMES chairman Bob Polley at the FMES rally.



York ladies dispense tea and cakes at the York summer charity event (photo: Roger Backhouse).

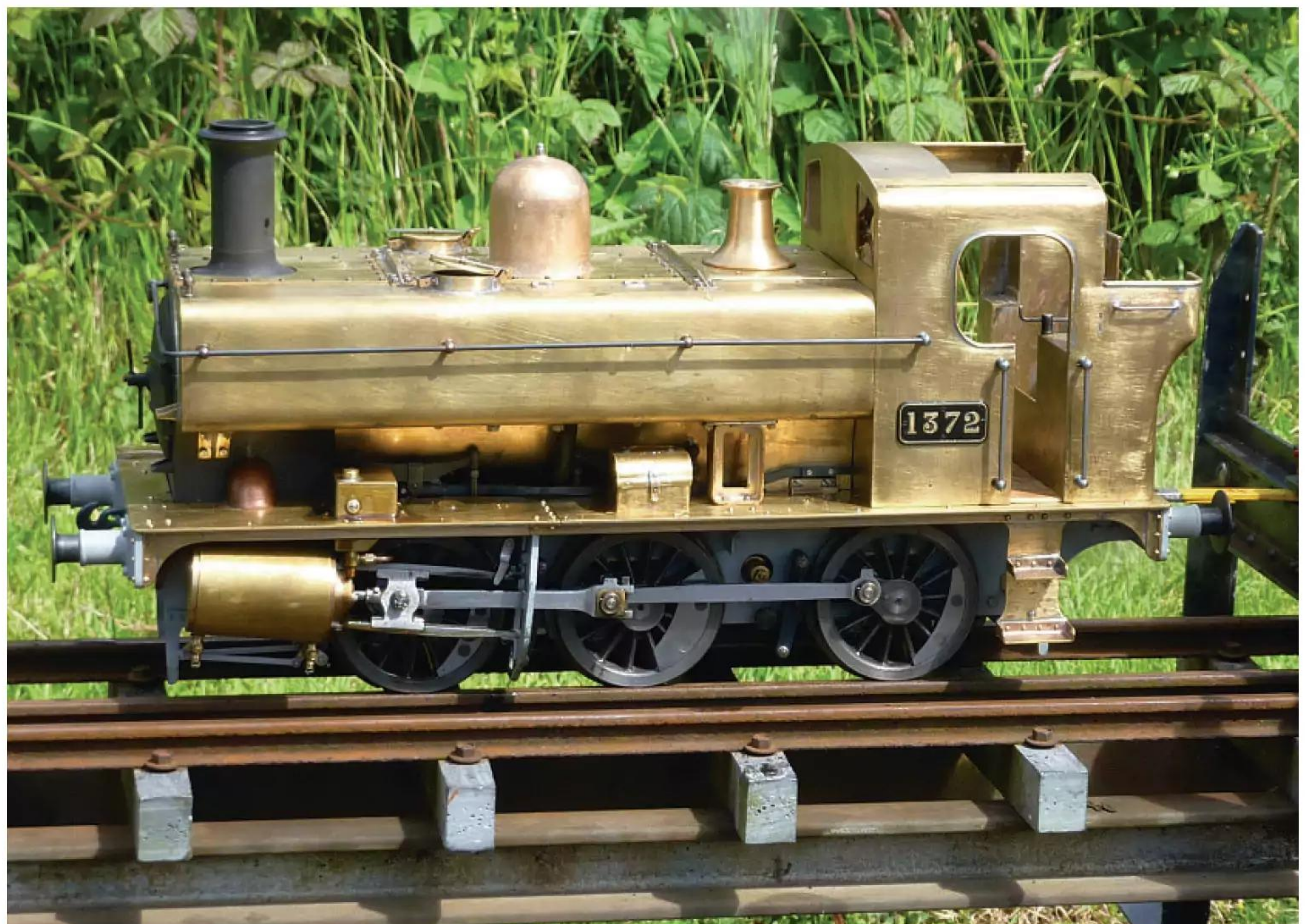
A GWR Pannier Tank in 3½ Inch Gauge

PART 1 – INTRODUCTION

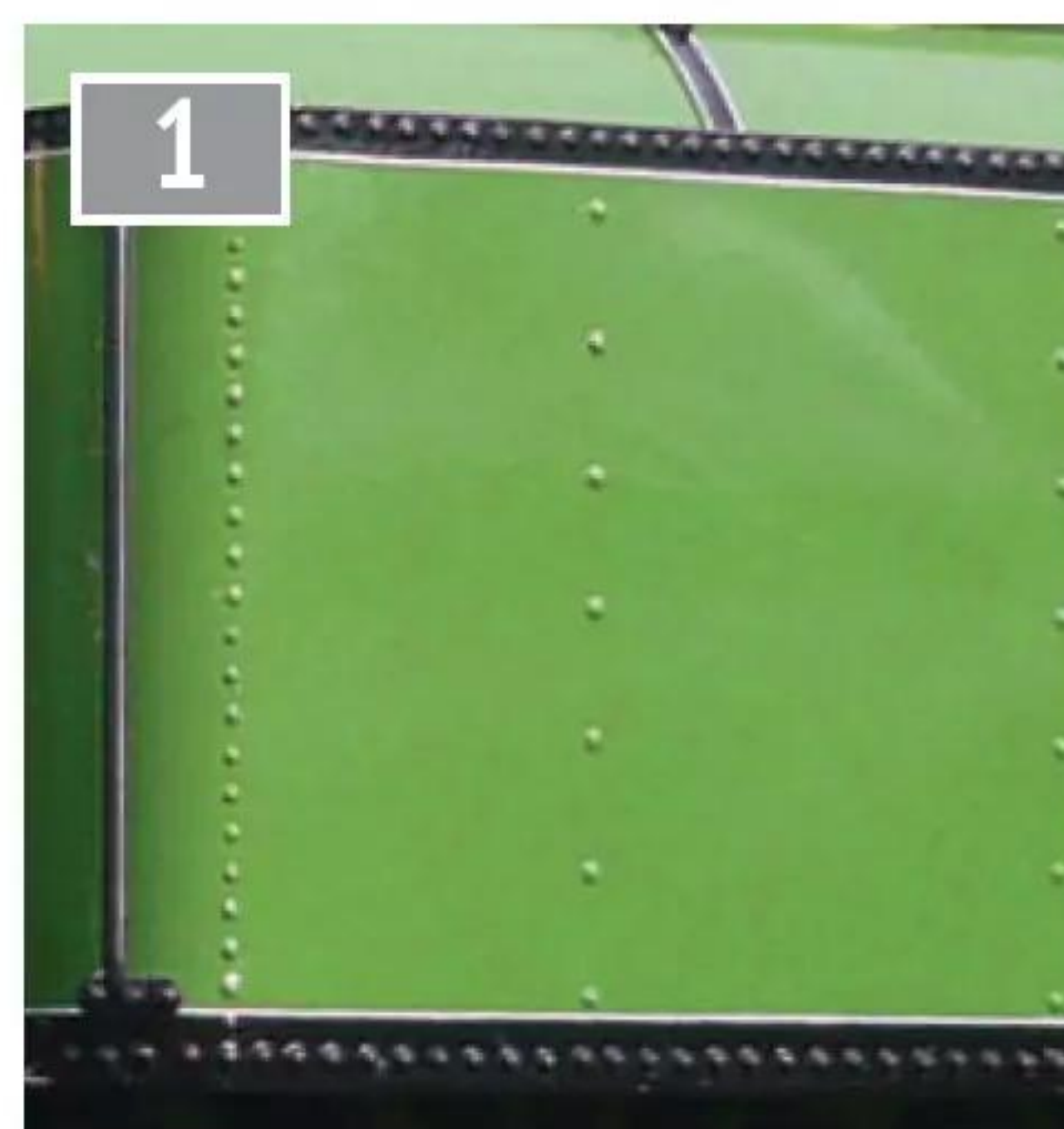
Gerald Martyn decides to build a locomotive that he can lift.



Model Engineers Laser



Age catches up with us. My last model locomotive, that I once thought was manageable, I can now barely lift. It has, too, around 1500 mostly cosmetic rivets in the platework (**photo 1**). I felt a need to return to making something more basic as well as a lot smaller. In the past I've built in 3½ inch gauge and when I run one of my smaller models often someone will say how they wish they had something similar as their King/B1/monster, whatever, is too heavy now they're getting old. And what of beginners who are perhaps, after purchasing some expensive tools, more conscious of the costs of a



Rivets on side tank.

bigger engine and looking for something cheaper and relatively simple that still looks like a real one?

It seems to me, too, that our suppliers are less likely to provide castings for new designs in the same way as

they have in the past because with so many other designs already available (as well as complete engines) the market will perhaps be small. In the past I've used pre-existing castings and repurposed them to make something else, and using this approach fooled the judges into awarding my 3½ inch gauge Beattie well tank a silver medal in the 1998-99 show.

So, my latest idea is to return to where I started in the 1970s, with Rob Roy castings. Some may sneer at Rob Roy but mine went pretty well and the nice man who loaned me his boiler flanging plates used his to passenger haul during our annual open days in the



Pannier tank 1370 at Weymouth (photo: The Transport Treasury).

1970s when it was all hands to the pumps and models were mostly small anyway - proof that small engines can give a good account of themselves. There's been very little published about these smaller designs in 3½ inch gauge for quite a few years and maybe it's time to put this right too. Models in this gauge are not only cheaper to make, they need less capable machinery and many of the parts can be easily cut and filed by hand. If you make a nice job of it then permission may even be granted to display it in the living room!

Some of the larger designs and super scale models, and the serious machinery used to make them, published in recent years, must have appeared quite daunting to newcomers. Of course, I occasionally have problems when driving a small

one but at least then I can use the excuse 'I'm only little'. What's not to like? There are negatives, of course. The main one is that a small boiler needs a lot more frequent attention than a larger one and so is reckoned to be harder to fire consistently well. Checking water level and little and often firing are the norm. Also, running sessions tend to be shorter as the fire gets choked more quickly than on a large engine. Perhaps this is not so bad after all, as sitting for too long in a slightly uncomfortable position behind an engine may not be terribly good for some of our creaking joints.

The design

The hunt for a prototype began. It had to be a recognisable outside cylinder 0-6-0 from a main line company, about the same size as Rob Roy and,

most importantly, not already available either as a design or commercially in this gauge. I already knew that GWR had a little cracker - the 1366 class shunting locomotives - and it didn't take long to eliminate the alternatives. These engines, six of which were built, are fairly well known and there are some nice pictures of them taken on Weymouth quay in the 1950s and 60s, for example (**photo 2**). Scheme design work was started.

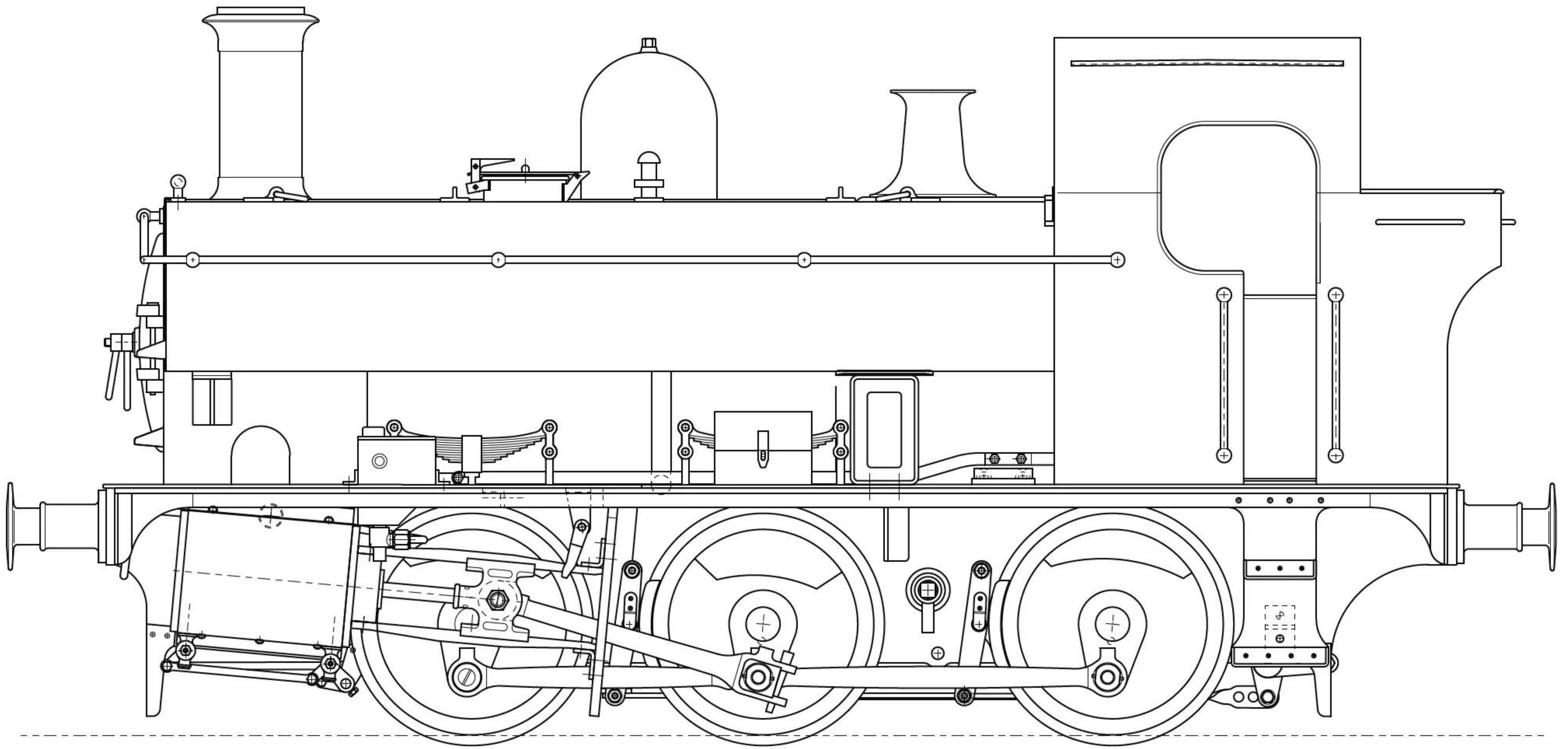
My main sources for detail are a general arrangement drawing from the National Railway Museum and a couple of top quality works photographs from 'Steam', Swindon. These had to be hunted out but I see they are now added to the listing on the 'Steam' website, if you want one. I'm afraid there are a fair few tiny rivets for people to

count, if you want to put them in. On the original the tanks are all welded but the cab and smokebox are littered with the little nuisances. This is something I would have liked to avoid but the prototype is so obviously dying to be made that it won the argument.

In terms of size then it is a little smaller than Rob Roy but has proved to be quite capable of pulling me around my local club track. In the past model designs by LBSC and others have been given cute names but I've fallen in line with the modern full size new build movement and given my design the next number in the original class series, '1372'. In keeping with full size practice this allows me to use modern materials and redesign as necessary (!).

The design is targeted at a similar level of weight, cost and

Fig 1



General arrangement.

difficulty as Rob Roy but with maximum use of laser cutting to speed the build. Rob Roy castings will be used where castings are normally needed, excepting for the dome which is sourced from another model design. The wheels are not quite right but most likely few would notice if I hadn't told you. The boiler is round-top as per Rob Roy, rather than a prototypically correct Belpaire type, and not superheated. Dispensing with superheaters allows more tubes and greater heating surface and is simpler to make. The round-top will be completely hidden by the tanks and a rear cover shaped as for a Belpaire type. The firebox is small but deep so the usable coal volume and heating surface are similar to Rob Roy. The valve gear is Allen straight-link, similar to the full-size engines - more (laser cut)

bits but easier to make than Stephenson's and, when you study it, quite versatile.

My plan is to design and build a basic version then follow-up with some enhancements such as all the lamp brackets and other sticky-out bits and rivets etc. for those who wish to make a more detailed model. It has to be said, though, that these don't make it go any better and some can be a nuisance, catch on things and get in the way when cleaning after a run. Due to the curved bunker corners and suchlike it may be a bit more difficult than Rob Roy, but I found the curves were easily made using simple wooden tooling. I've built and proved the basic design and corrected errors found before publication, slightly to our editor's annoyance as he wanted it sooner.

This is my first model designed from the outset with laser cutting in mind and, while I can proudly say that the frames for all my previous ones, including two in 5 inch gauge, were all cut using hand tools, times change. Laser cut parts are reasonably priced, save many hours work, and the accuracy is excellent. I will not be providing fully dimensioned drawings for these parts, just those needed to finish them off. Model Engineers Laser (www.modelengineerslaser.co.uk) have all the necessary models and will be happy to provide parts. The only downside, so far as I can see, is that you don't end up with a box full of useful offcuts to make other things with. I will say, also, that whilst laser cutting is good for flat parts there is still lots of work to do and plenty of other bits to

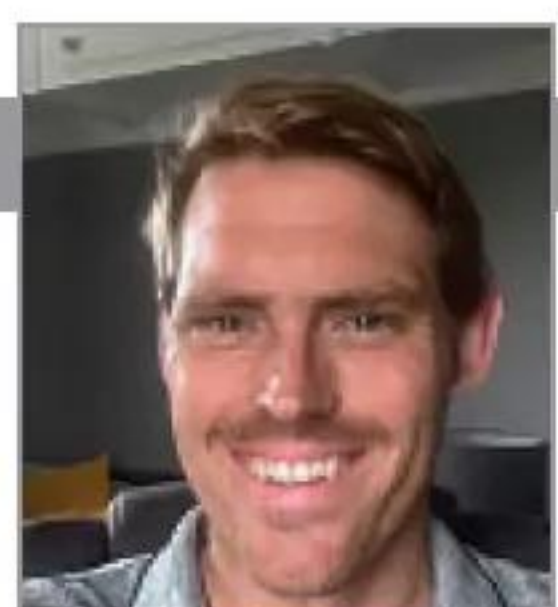
make, and it all needs to be put together, so you can still say "yes, I made it".

To end this introductory article, I will say that I find making things immensely satisfying and I hope I can convey some of that in my words. The final illustration this time is the side view general arrangement (**fig 1**) so you can contemplate it and become enthusiastic for the next episode.

● To be continued.

The Changing Face of Model Engineering

Tom Parham wonders where new directions in our hobby will take us.



I have been considering writing this article for quite some time, and some recent events, coupled with a bit of spare time, have prompted me to give it a go...

I suppose the best place to start is with the origins of the hobby. I will lead on to where we are and what has prompted this article. Now this is where my knowledge is shady at best, however all will have their own memories of what the hobby has been for them, or have talked to others who have longer associations with the hobby.

For me, I am a second generation model engineer, with my father having been involved since the late 60's. With me now approaching 40, between us we have seen the changes over at least 55 years and probably almost 30 years collectively.

During dad's early days, there were probably only two places that you could buy a second hand model away from a private sale. These



Polly VI, built by Andy/Luke Bridges – a first time build and a very successful locomotive.

were a dealer in London, or an auctioneer. This meant that generally if you wanted a locomotive then you would have to build one. At that time most people would have been taught some sort of metalwork or woodwork at school or through readily available evening classes, often in schools. I have heard tales of materials being available at

the classes, where participants only paid for the material as it left the room, priced by weight, so any mistakes that were thrown away and any swarf removed would not need to be paid for... a bonus. This would have been the introduction for many of the long standing members who are still in the hobby today.

Over the years many things have changed, the manual skills are rarely and barely taught these days, as engineering companies with apprenticeships have become fewer and there are, it seems, no readily advertised evening classes. This has made it more difficult for a newcomer to learn the skills needed to build a model. Add to this, factors like the increase in the cost of living, ever increasing prices of materials, not to mention the machines, it gets harder to get started... Even if someone was in a position to start out, with house prices and mortgages the way they are now, new homeowner housing being smaller by design, with even



A pair of 3D printed tank wagons, made with minimal machining, almost entirely 3D printed.

smaller gardens, it's becoming more unlikely that they would have the space to start a workshop.

For those that do manage to make a start, despite the setbacks mentioned, where does the skill and the learning come from these days?

I know many will be too shy to ask, fearing that what they are asking will seem too basic, so they turn to places like YouTube or Facebook, to name but two, which can be a hive of differing opinions and not always the best advice. I have heard recently of someone really struggling for a smooth surface finish while facing off a steel bar in the lathe, having followed a tutorial on YouTube. After a while he did ask for help, but sadly he had already lost some motivation. It was pointed out that the videos viewed were turning brass and aluminium, which naturally give that better finish. This is where clubs are so beneficial, but it could be so easy for someone to be put off completely by talking to the wrong person, in the same way as social media can be.

Over the years the introduction of kits, from the likes of Maxitrak and Polly, has made it easier for people to get started with an end in sight, while still giving the opportunity to improve upon the original design (a Polly has been taken as far as to win IMLEC). This starting point gives the knowledge of how a locomotive works, in order to be able to maintain it properly, and indeed in time many people starting this way have gone on to become accomplished model engineers building from scratch.

Unfortunately, there have been in the past other kit manufacturers, where the kits being produced with the tag line 'bolt together on the dining table', weren't quite to the same mechanical standard. This led to many kits not being completed and potentially putting people off the hobby altogether. That said, in the hands of a competent engineer and significant work, these kits could be turned into exceptional locomotives.

Again, one of these has been transformed into an IMLEC winner.

This does lead me to a personal annoyance with some of the latest kits. They are very well finished to a high level of detail, leaving little cosmetically for the beginner to have a go at to improve the model, which could lead to newcomers not being encouraged to have a go at all to develop those skills. (Maybe that is just a bit of old school mentality in me still, but it can be annoying to spend a long time building and attempting a high level of detail, only to turn up to a rally and someone brings something of a similar standard which was bought off the shelf.) But I digress...

These days many pre-build or part-built models are sold off as part of an estate or due to financial concerns or space issues. Add to this the increase in availability of more ready-to-run models and the entry point to owning a locomotive is far easier than ever. That said, the expectation might not always meet reality. For the newcomers to the hobby who buy a locomotive, they might not always appreciate the need for the maintenance involved on a regular basis. A bit like, for example, how we all buy cars either new or used, but not all of us have the skills or time to maintain them and rely on skilled mechanics to do that. Some may not appreciate to work that goes in between runs to maintain their locomotives. This is where some good advice is important to share.

Unless they get lucky or use a reputable dealer who provides a full test, they might purchase something that has minor or even severe faults. It has always been my opinion that few people manage to buy a great locomotive, unless top money is involved. Often a locomotive is sold because it may have an issue which the owner is not able to rectify, which a newcomer would then have a similar issue with. Personally, even if sold with a new boiler certificate, I would always recommend getting



A heavily modified Winson 'Brittania', on its way to winning IMLEC.



My own Jinty, built over a period of 20 years - my first scratch build, proving to be a rewarding locomotive.



Skills such as boilermaking being done at the club passes on skills.

a fresh one, just to be sure of what's just been bought. Digression once again, my point being that someone buying a locomotive does not need to have the space for a workshop just to own one, so this may be the only entry point for them (and they may

not have been involved to know what is required just to maintain a running locomotive).

On the other hand, there are still many people building models; It is hard to say if this is as many as ever, but the build process is often very different these days.



Keeping the hobby alive by passing on experiences and teaching new members.

Historically everything was cut out by scratch and there are still many who will do this. However, making use of modern technologies, starting with CAD design, laser/water jet cutting, etching etc. can save a considerable amount of time and effort. Furthermore, CNC machining can give very good, quick results with some components. More recently the introduction of 3D printing gives many options for the progression of the hobby, either printing waxes for lost wax castings, patterns for traditional casting methods, or even, as I have done, 3D printing the components to build a whole wagon. In fact, in the smaller gauges, I have seen complete 3D printed locomotives.

Although possibly not in the spirit of 'traditional' model engineering, building on the skills with CAD which are taught these days, this is an area where some may find an entry into the hobby, and that may be as far as they take it, or it could be a stepping stone to get the enthusiasm to then build more traditionally.

These can also bring small specialist suppliers into the hobby and indeed have enabled the ready-to-run makers to do what they do. Think back to how cars used to be predominantly made by hand until a certain Henry Ford came along with his Model 'T'.

I'm sure you are wondering if I'm aiming towards some sort of point with all of this, and

yes, my point is that the world has changed. People's attitudes towards hobbies have changed. The hobby itself is changing. Whether this is for the better is all dependent on the opinions and maybe attitudes of those of us in the hobby already.

It could be so easy to dismiss new ideas, and the younger next generation, but where does this leave the future of the hobby? If we have any ambition for the hobby to continue then we need to encourage all new members, by whatever route they choose to enter the hobby. One of the biggest issues I see with model engineering, model railways, and I assume preserved railways (although I do not have personal experience) is that the younger generation, although they would like to get involved, find that competing against computers and on-line content, streaming etc. is increasingly difficult for these activities. Furthermore, probably from about 17-30+ they will most likely be lost to job demands, social lives and courting. Maybe when they have settled down and look to pick up a hobby again, it can be difficult to get involved for the before mentioned reasons, added to finding time once families grow with children.

So, it's my opinion that the children who are interested at the younger age need to be encouraged so much more so, to ensure that they remember the enjoyment and are keen to get involved once more.

I hope my club is not unusual in having a variety of club locomotives, which are available for any member to use, so newcomers need not be made to feel that they must have their own locomotive before they can join. I would much rather teach on a locomotive I know rather than a locomotive I've never seen before (plus it's a bonus to have relief drivers around).

I know very well that there's a lot of work needed to keep the club going, with maintenance of the site, and the track, not to mention station duties to allow public running to happen, as well as boiler testing, etc. It shouldn't always be left to the 'old guard' to do this but there is a fine line between teaching and encouraging the newcomers to start getting involved and the possibility of pressing them too hard too soon and putting them off altogether - not everyone will have the time to commit the hours that others can. Someone I know looked at joining a local club and was told at the first hello "well you'll need to come along on Tuesdays or Thursdays for maintenance work, not just come to run" - clearly not noticing the age of the person, which would place them way before retirement. Personally I would always encourage any attendance to build enthusiasm and then encourage helping out and developing that side of the hobby.

In the same vein when they do start getting involved, if they get things wrong it can be easy to push them away by 'telling them off' rather than steering them into the right way of doing things. Never forget that however much emphasis a club has to put on public running, possibly based on what they need to do to remain on their site (whether that be a condition of the lease by a council, or in order to raise revenue to pay for rent), the members are taking part on a voluntary basis, as a hobby, and wish to enjoy being a part of it.

I hope I haven't rambled too much, and that some of this is a point that clubs can take on,

but I think where I'm heading is that I've seen too many people over the years start to get involved but for whatever reason lose the enthusiasm, or have it driven out of them; some leave the hobby altogether, others are lucky and manage to find another club (usually those with a longer history with the hobby) who are more welcoming.

Maybe I'm being selfish because I hope to have a few more decades in the hobby and I want it to still be around but I do sometimes worry about the future of the model engineering community and sometimes fear that if some attitudes don't change a bit towards new/young members, then there may not be enough to keep the clubs going.

Many thanks if you've managed to get through all of this, and I hope that it may have given food for thought amongst some clubs. Looking forward, what do we need to keep going?

For survival of the hobby I believe it is essential to encourage the newcomers, young or old, to be accepting of all, regardless of background, and provide help for them to develop into model engineering hobby as far as they wish and evolve to incorporate modern technologies and ways of thinking.

As a parting thought, why is it that so many think that they must own a locomotive prior to joining a club? Or indeed have to be a potential owner/builder? There are all sorts needed in a club and sometimes the guys you need to rely on to run on a weekly basis just want to be a part of a community and help out, with minimal interest in running or building locomotives...

Many thanks if you've managed to get through all of this and I hope that it may have given food for thought amongst some clubs. I do hope that our paths cross over the coming years - I'd always be happy to sit down with a cuppa (or a pint) for a chat.

ME

Brandon's Steam Weekend

Kevin Baldwin and Martin Evans

report from the Brandon Society's steam up at Weeting.



Given the British weather's well-known tendency not to cooperate on summer bank holiday weekends, you might think that such a weekend would not be a good choice for a model engineering club's Steam Open Day. The Brandon and District Society of Model Engineers, however, were not to be put off and, true to form, the weather did its best to dampen the proceedings.

The Society occupies a field in Weeting, a village just outside Brandon, which lies on the border between Norfolk and Suffolk. Weeting is well-known for its annual Steam Rally, one of the largest in the country, and the Society, with its miniature railway, always plays a prominent part. Although the club's own Open Day was inevitably not on the scale of the Weeting Rally it was, nevertheless, well attended despite the rain, demonstrating that people from north Suffolk and south Norfolk are equally uninclined to be put off by the vagaries of the East Anglian weather. Some enthusiasts even came from as far afield as Bedfordshire!

Fortunately, a small marquee was put up for the event, which contained a display of members' work (**photos 1 and 2**), tea and coffee, and a very large quantity of cake. The marquee was made good use of, while outside a haze of smoke and steam from the visiting engines presented stiff competition to the rather persistent rain.

It was very much a road locomotive event and there was no activity on the railway track. Proximity to Thetford, the home of the Burrell traction engine, tends to make the Society rather road locomotive oriented. An notable exception was a very nicely made mill engine, built by Eric Strawson, a former member of the club, and now in the care of Peter



1 Part of the display of Society member's work – here are three models by John Merrett.



2 A model of HMS Chatham by chairman, Dave Moore. The prototype was built in 1911, saw action at Gallipoli and was scrapped in 1926.



3 Peter Baldwin in charge of Eric Strawson's mill engine.



4 David Etheridge brought along a 4 inch Foden steam lorry.

Baldwin (**photo 3**). Next to him was David Etheridge, with his long wheel base Foden steam lorry, built about ten years ago from a Steam Traction

World kit (**photo 4**). Out in the rain, Chris Hazel was firing up his 3 inch 'Minnie', scaled up from the well-known 1 inch engine and named Scallywag



Chris Hazel's 3 inch 'Minnie', called Scallywag.



Roger Venni's 6 inch Foden timber tractor.



Doug and Bev Fleet and their 4 inch Burrell showman's engine.



Ben Tregear drives his 4 inch Fowler Kitchener.



A 4½ inch Foden steam 'bus' belonging to Phil Barrett.

(photo 5). Nearby was another six inch Foden tractor, again built from a Steam Traction World kit, owned by Roger Venni (photo 6).

Doug and Bev Fleet brought along two young Dalmatian dogs and a four inch Burrell showman's engine (photo 7).

This was built about ten years ago and has just been retubed and had a hydraulic boiler test. The next job is to overhaul the motion work. Running around the field was *Kitchener*, a four inch Fowler road locomotive belonging to Ben Tregear and Darcy Stroud (photo 8).



A 4 inch Burrell road locomotive belonging to Mike Turner.



A row of engines waits patiently while beer and chips are consumed by their owners.

The prototype has a rather interesting history, starting life as *Kitchener* but ending up as a showman's engine called *Iron*

Maiden. The model represents its earlier incarnation!

Photograph 9 shows a 4 inch Burrell road locomotive, built



Geoffrey Bethell's torpedo boat at full throttle on the pond (photo: Geoffrey Bethell).

by Mike Turner from a Steam Traction World kit in 2018.

Lastly, here is a rather unusual model (**photo 10**). The prototype started life as a long wheel base Foden steam lorry but was converted into a 'bus, to be used for conveying the company's brass band to events. The model, in 4½ inch scale, was built in Scunthorpe in 1997 and now belongs to Phil Barrett.

At the end of the afternoon, while the rain was taking a rest, there was the usual pub run into Weeting village to visit 'The Saxon' and George's Fish and Chips (**photo 11**). Then it was back to the marquee and the cake. The weather cleared by the evening and after dinner, everyone gathered around the campfire to enjoy conversation and refreshments. Doug's 4 inch Burrell Scenic was seen generating and providing lights which made a very fine sight. I think he finally put the engine to bed at about midnight!

Sunday dawned much brighter than Saturday, with

clear blue skies and a very welcome sun.

Steam was soon raised by the visiting engines, with even a steam locomotive in the shape of Geoff Ellis's 5 inch Sweet Pea having a turn on the track. Many electric locomotives joined Geoff in trundling around the track for the rest of the day.

Visitors and engine drivers mingled happily, with much chugging about. A few participants even found time for another quick trip to The Saxon pub in the village!

Activity on the boating pond was brisk (**photo 12**), with several boats having a sail, from a small pond sail yacht, to Dave Moore's wonderful steam-driven warship *HMS Chatham*.

The refreshments had themselves been refreshed, with many more donations of cakes and nibbles to keep visitors fuelled. We certainly thank all those who donated such lovely treats.

At 2pm there was a Grand Parade with the participants



An impressive line-up after the parade (photo: Geoffrey Bethell).

circumnavigating the site for a few laps before forming a neat and very impressive line up (**photo 13**). The prize giving ceremony then took place. Kevin Baldwin had made a few surprise awards to be given out to deserving winners. These consisted of two miniature golden shovels, and a wood-mounted golden spanner!

The Best In Steam By Popular Vote Award and the first inductee to The Order Of The Golden Shovel was Clive and Emily Randlesome (**photo 14**) with their magnificent 4 inch McLaren road locomotive *Magic*. Clive was awarded this accolade after the engine owners and exhibitors had been consulted as to which engine was their favourite. A very worthy winner indeed, as Clive presented the engine superbly, and was generous enough to let others have a drive throughout the weekend.

The winner of the Golden Spanner for Best Engine Built By The Owner was Chris Hazel (**photo 15**) for his 3 inch Minnie *Scallywag*. Chris had made this engine in its entirety by scaling up the original 1 inch scale drawings, making his own

patterns and then machining the resulting castings, completing the engine in a very fine style. The engine always runs faultlessly.

The second inductee to The Order Of The Golden Shovel was Jonas Bailey (**photo 16**). He is a young man who shows great promise in our hobby. Not only did he bring along and run his impressive collection of Mamod and Wileco engines, but he was also seen ably driving his grandmother Marian's 4 inch Burrell traction engine for most of the weekend. He was also lucky enough to have a drive of Clive's McLaren, and demonstrated great skill for a lad of his young age in piloting this handsome engine.

Kevin Baldwin gave a vote of thanks to all that had made the weekend such a relaxed and pleasurable success and everyone received a well-deserved round of applause.

All too soon preparations were being made for exhibitors to pack up and make their way home after a truly splendid event.



Clive and Emily Randlesome receive their Golden Shovel (photo: Geoffrey Bethell).



Chris Hazel gets a Golden Spanner for Scallywag (photo: Geoffrey Bethell).

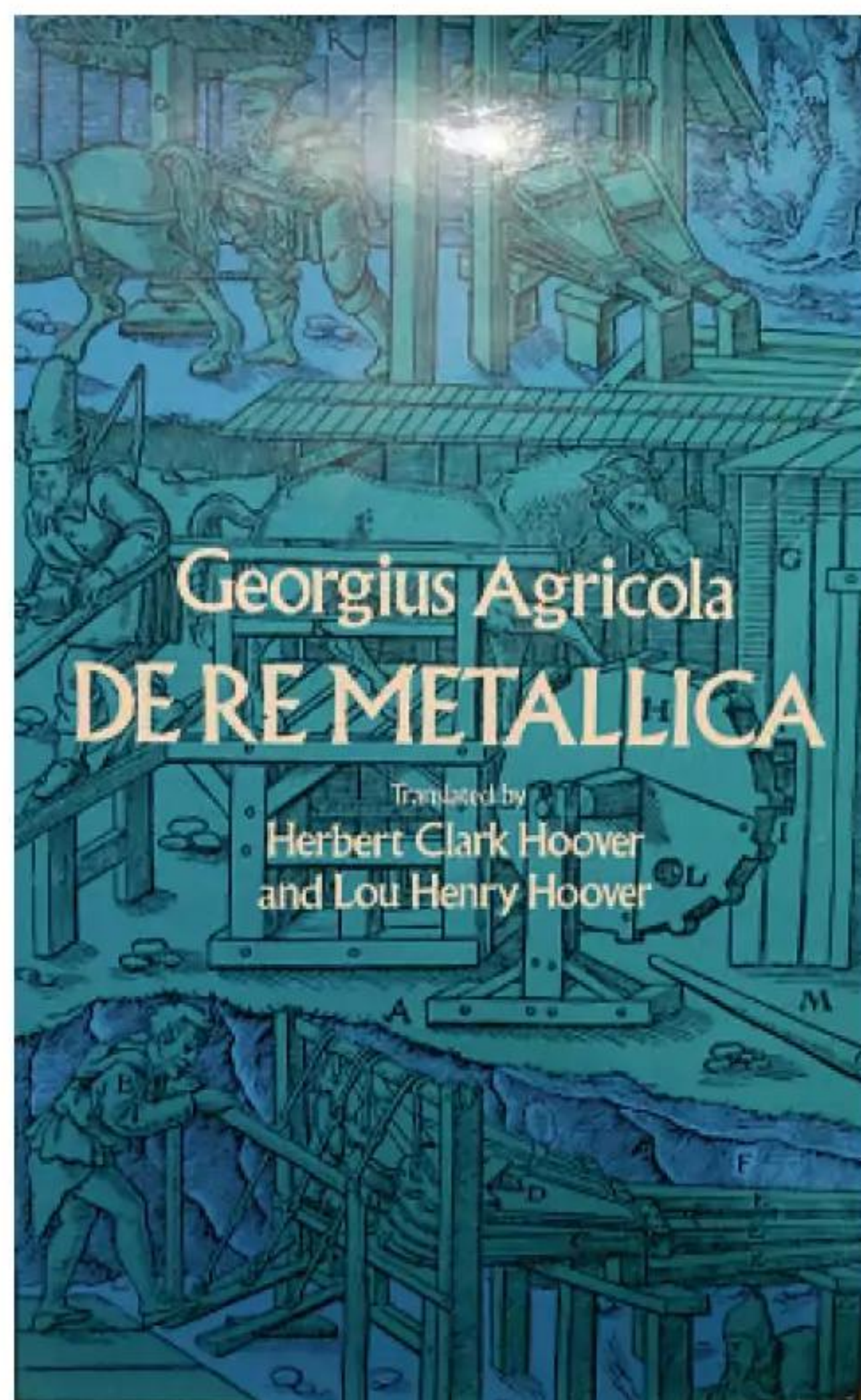


Jonas Bailey is also inducted into the Order of the Golden Shovel (photo: Geoffrey Bethell).

Book Review

De Re Metallica

'Agricola', Translated by Herbert and Lou Hoover



This book has the most remarkable history. Originally published in Latin, in 1556, it was not translated into English until 1912, by the Mining Magazine, despite being the standard work in its subject throughout that time. It was otherwise translated only into Italian and German.

Georgius Agricola wrote his *vade mecum* after field studies and observation of his subject, mining, making this the first book bearing detailed technical illustrations. It was the most referred-to book in the history of mining, despite the language. Agricola was born in Saxony in 1494 and died in 1555.

Herbert Hoover, yes, THAT Herbert Hoover, having made his fortune in mining, was retired and looking for a project to occupy him. Ably assisted by his wife, Lou, both Latin scholars, he began the translation of this masterpiece.

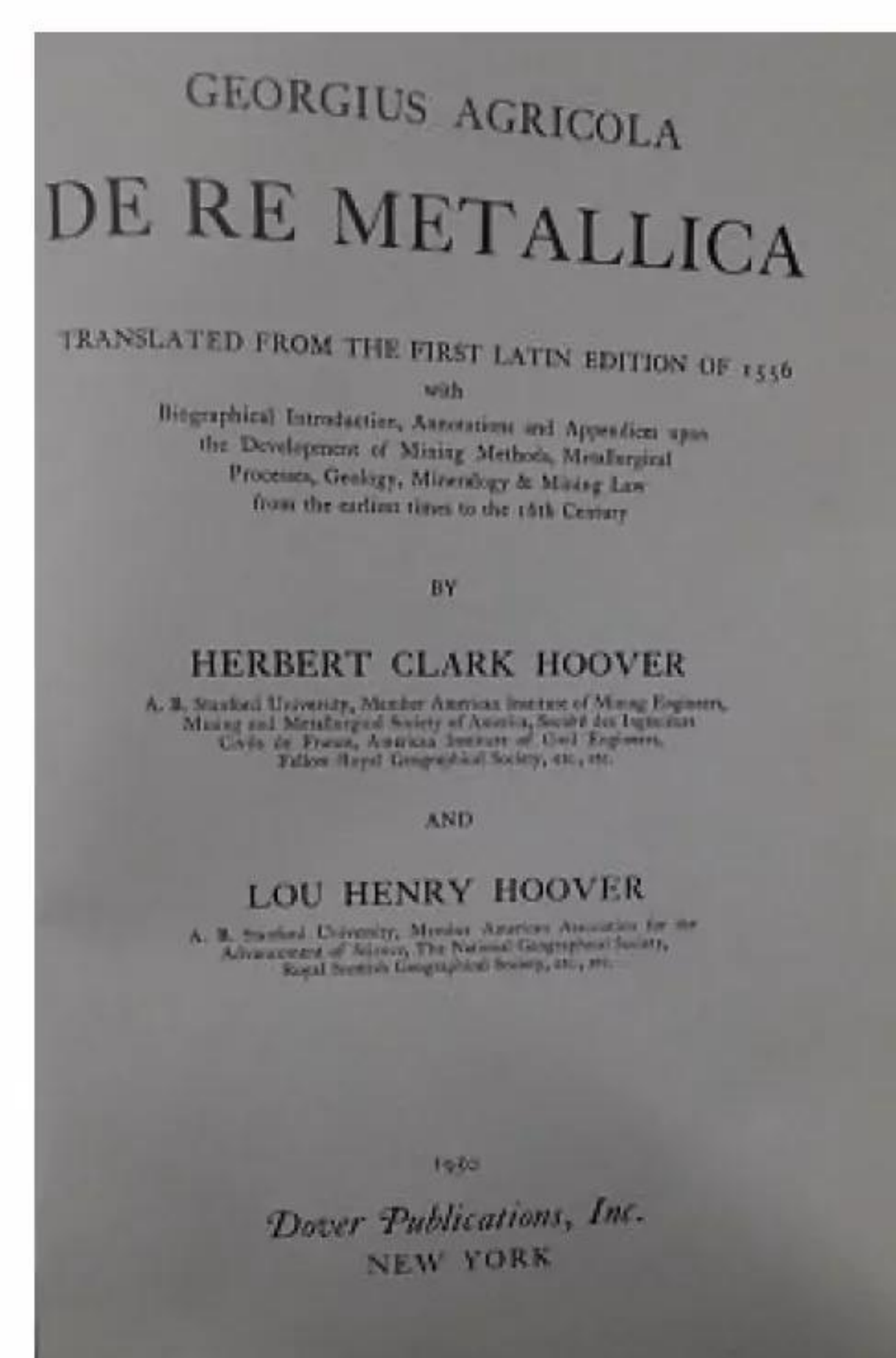
The book is divided into 12 sections, plus appendices. It begins by offering the work to the nobles of the area, possibly sponsors, or owners of mines. Mr Hoover notes that, despite being conducted in Latin, his translation suffers by the fact that mining science has moved on in the last 1000 years. We now have concepts which did not occur to the ancients. Mr. Agricola therefore invented several Latin phrases, not all of which were translatable. Mr. Hoover goes on to describe mining, not as a lowly trade, but a very important, practical endeavour worthy of the greatest respect. **Book 2** explains how minerals can be prospected by noting the

natural world and by its sight, look and even taste may be recognised. The power of divining also stood them in good stead. The work is illustrated showing how veins and deposits of minerals, including lodestones, may differ, and why, without the knowledge we now have of geology. **Book 3** handles how the deposits may be found and identified. **Book 4** deals with mining areas and methods of marking a mine's limits, plus the officials who manage such agreements. This continues into **Book 5** dealing with surveying. **Book 6** concerns tools and drainage of the mine. The wheeled travelling wagon, used to remove minerals and waste is guided in its path by a rigid iron pin, not unlike a model slot car. The machinery is not ignored. Clear drawings show pumps driven by cranks and forms of water power. Pumps often were arranged in threes, since they offered a smoother turning moment. Wind- and water-mills are also seen, as blowing engines and bellows, creating draughts for the smelting furnaces. Whilst we are perusing the pictures, look for the minor characters; dogs, other miners etc., one of whom wears striped knickerbockers or pantaloons. Sometimes mines were abandoned, citing three of the reasons - 1) the vein is exhausted 2) demons and gnomes, belief in these was widespread, 3) bad air. **Book 7** covers assaying or measuring the purity and worth of a sample. The methods and chemicals and their methods and origins were all considered. **Book 8** handles the extraction and separation of the valuable

minerals from the dross. (One story describes a keen young surveyor and assayer who used to descend the mines himself, collecting samples and smelt.) **Book 9** continues, with three crucibles, as at Abbeydale Industrial Hamlet, Sheffield. **Book 10** extends this to gold, silver and copper, frequently found together in nature. This continues in **Book 11**, whilst **Book 12** deals with observing the content of waste water and other runoff, and refining them - sulphur, salt and glass, notably. Appendix C is quite interesting, describing the weights and measures of the period.

Recommended for any engineer's bookshelf.

Geoff Theasby



Facsimile Edition, 1930
ISBN 978-0486600062
638pp, hardback, £30

The Leufortin Project

PART 6

Ian Bayliss
presents
an internal
combustion G-scale
locomotive.



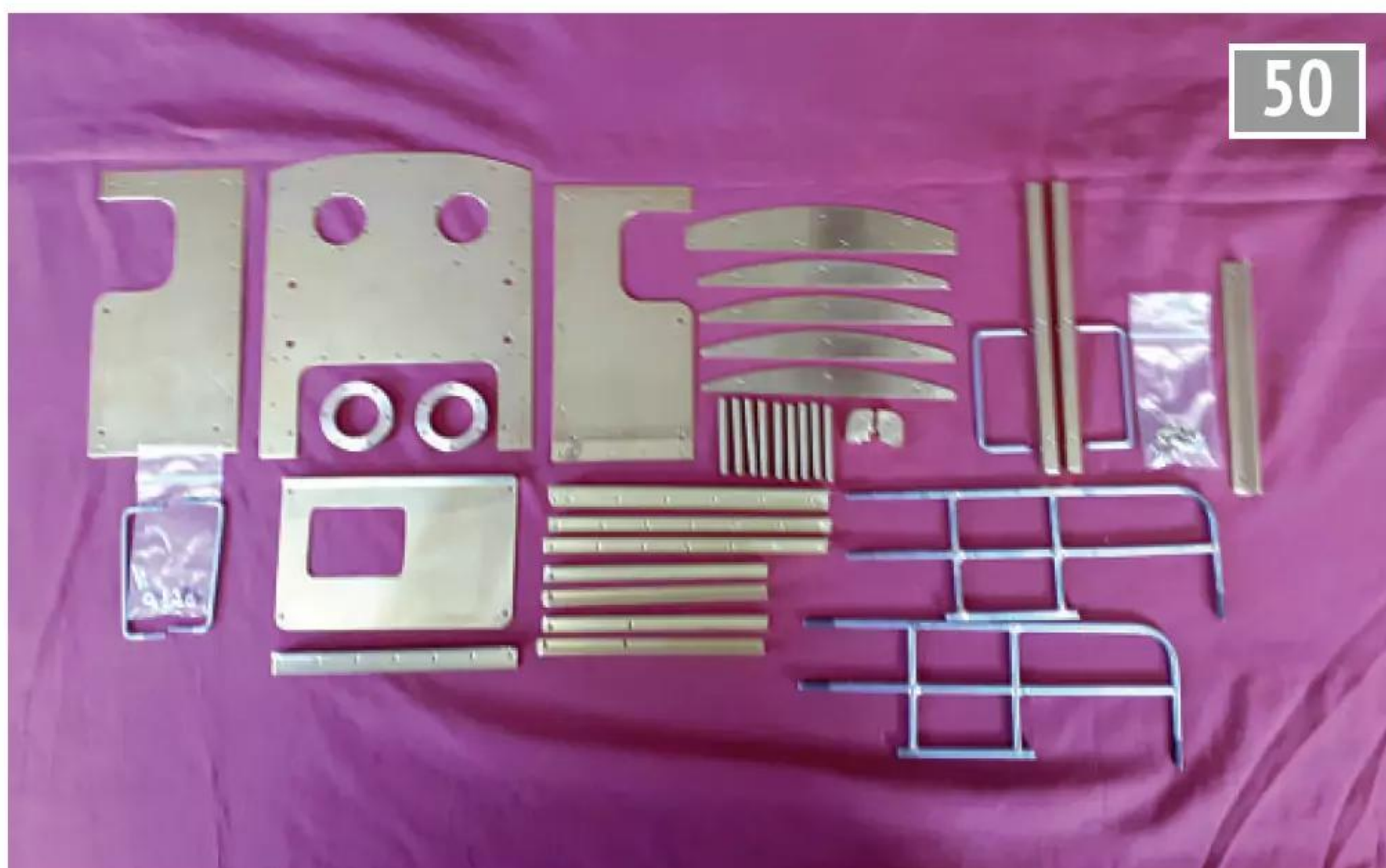
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The cab

The space problem for the cab had really reared its head by now. The aluminium alloy footplate so carefully planned previously had to be remade to give some extra width, taking the model up to a full 6 foot 6 inches scale width and the front mounting feet of the cab structure had to sit on the front gearbox mounting feet and be all bolted through together. The cab itself is a riveted structure with the sheets guillotined from 1mm brass sheet and the final shapes marked out and cut with a jewellers' piercing saw (**photo 50**).

A riveting table was knocked up from scrap ply that had the rivet set just clear of its top when sat firmly in the bench vice so I did not need to grow any additional hands to complete the riveting (**photo 51**).

The sequence had to be worked out to ensure all rivets could be closed internally leaving the best head on the exterior. Sides, corner and side rails first and then



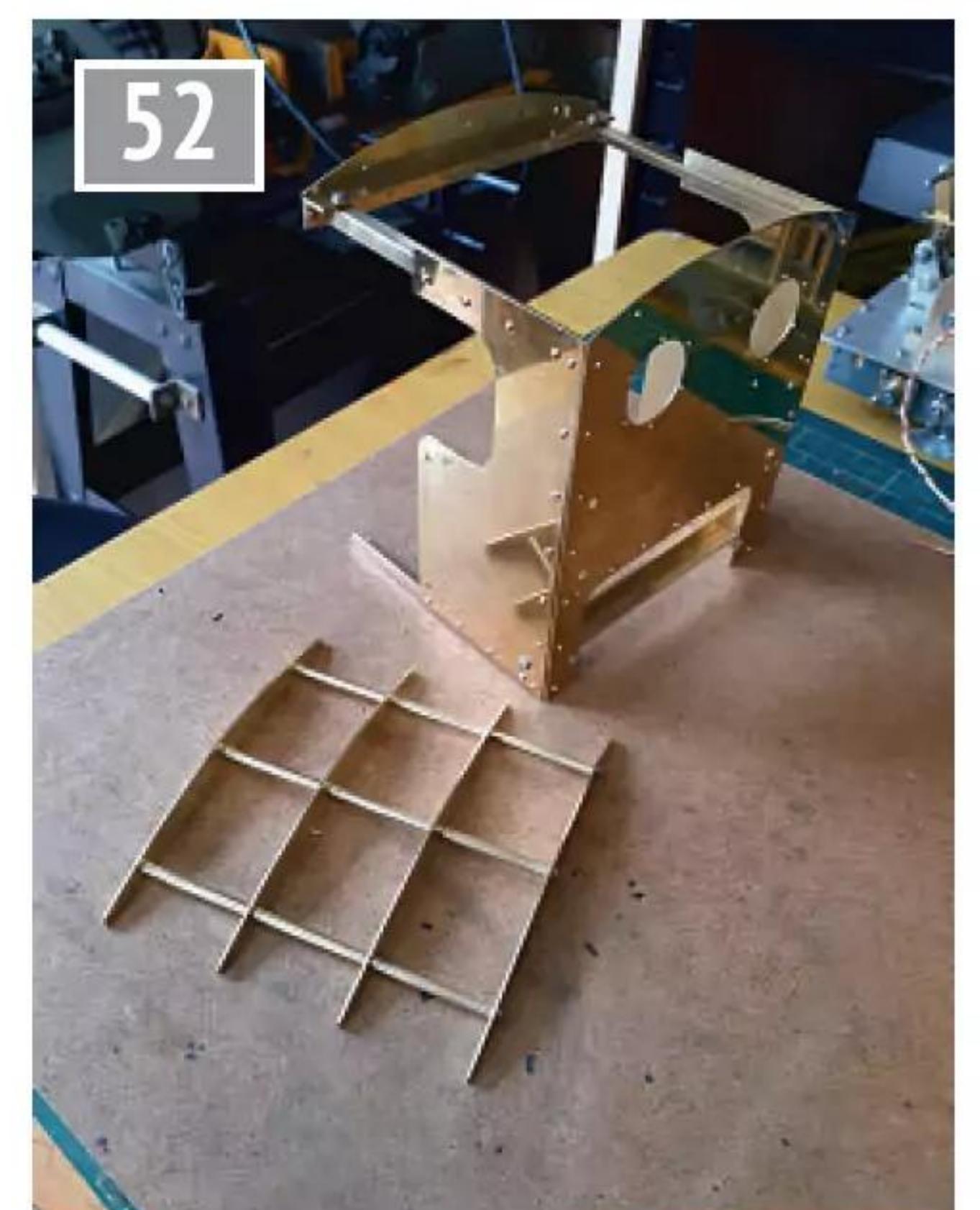
The full set of cab and bodywork components.



Riveting 'table' for cab alleviating the need to grow an additional hand.

the spectacle plate with a hardened and tempered piece of silver steel as a punch to give a flat head internally (**photo 52**). A template for the cab mounting hole centres was needed and this can just be seen in the aperture for the gearbox in the spectacle plate. This is an off-cut of brass angle trimmed to length and two holes at the gearbox foot hole centres drilled in it. This was bolted through the cab mountings before riveting of the spectacle plate was commenced.

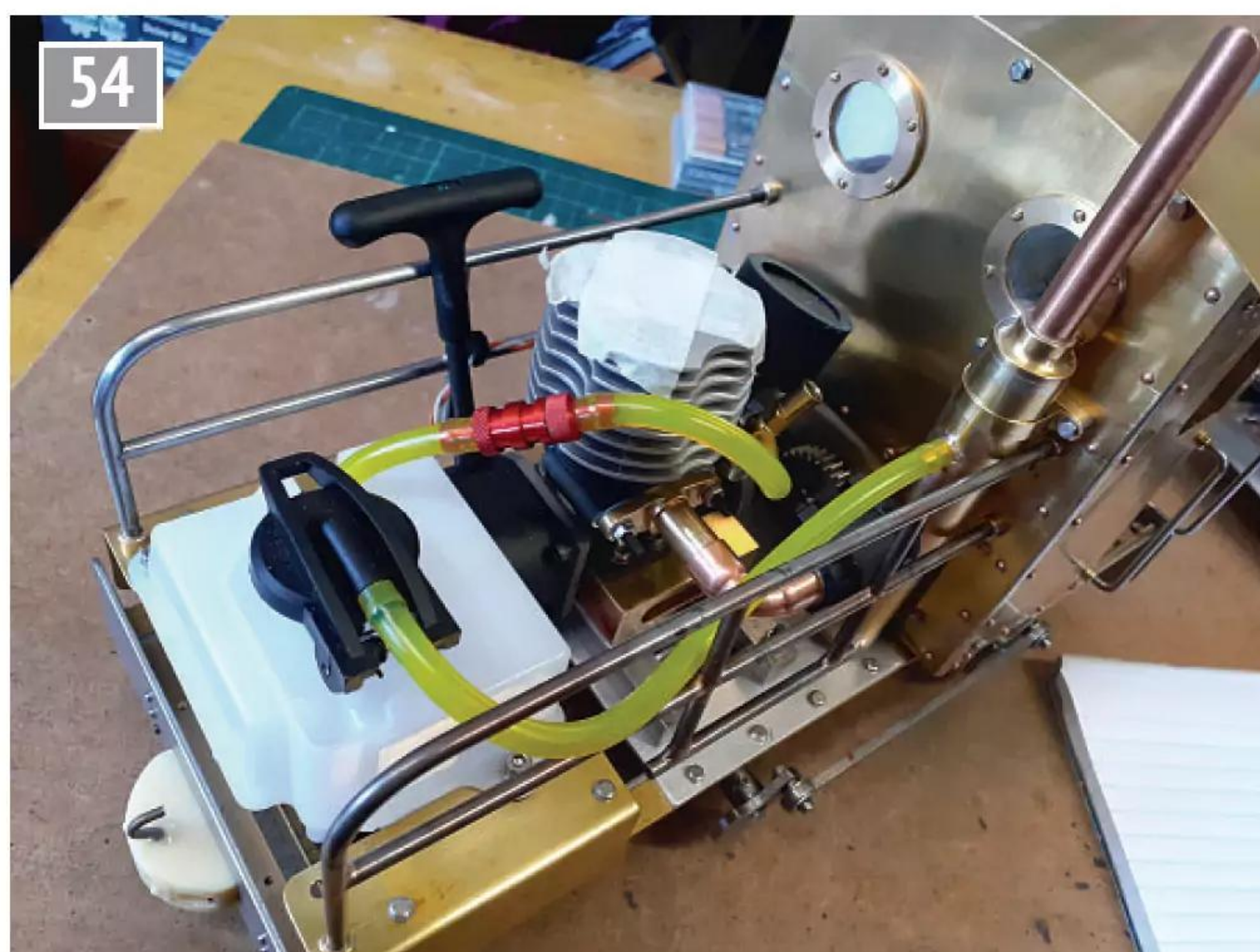
Photograph 52 also shows the roof frame. It is 1mm brass sheet with the beams shaped and drilled as a group to an accurately made steel template. The spacing pillars are stock brass, drilled and tapped each end M2. M2 studs are used to clamp the whole assembly together. The whole is soft soldered and distortion turned out to be minimal. The roof itself is rolled slowly to match and the whole assembly is designed to be detachable as complete unit (**photo 53**).



Assembled cab and roof support skeleton.



Cab roof finished and trial fitted.



Bodywork assembled and spectacles fitted.



Rear view of finished item minus RC receiver.

The cab spectacles are simple turned frames from brass stock with a bored rebate on the inside. The glass is real. They are 24mm diameter flat mineral watch glasses 1.5mm thick sourced in a small quantity from a jewellers' suppliers for the previously mentioned Bagnall project. They are fixed by cyanoacrylate clear adhesive and the bolt holes are spotted through (photos 54 and 55).

The drag beams and couplings were added along with a grille to cover up what had become a not-so-good view. I had thought I would get away with it until the fuel tank had to be raised.

Finally, the cab is fitted with square rear posts (silver soldered in handrails of 2.5mm diameter mild steel - they are one and a half inch tube in real life) and the rear sheet is only a half sheet as



Well here is the first tragic iteration finished with the added 'radiator' grille.



Dumb buffers, moulds, tools and coupling hooks.

access is needed to change direction of drive manually. The 2.4GHz radio control receiver is mounted in a little bespoke wooden carrier on this back sheet (photo 56).

Standing back to admire the job now fitted up, the realisation had dawned that the front looked terrible. What had been thought of as just about acceptable across the front, now the fuel tank had been lifted to suit the new

engine arrangement, looked awful. Some sort of tin work had to be dreamt up to be in keeping with the ethos of this project. A slotted grille of the simplest design seemed to be appropriate and one was duly made from 1mm brass sheet, proving to be really difficult to fit into some existing tapped holes in the end frame stretcher but not impossible. This late addition can be seen in photo 55.



Milling operation for dumb buffers.

The coupling system is simple and based upon the early 16mm Narrow Gauge type. A hook and three links to the inch chain. I have standardised throughout all my stock now - the exceptions being my live steam locomotives, although they will use the same principles - with this system once fitted.

I cast the dumb buffers here in house to my own patterns and silicone rubber moulds (**photo 57**). The resin material is polyurethane 'FastCast' from CFS in Redruth, Cornwall. The dimples are cast-in to centre the drill holes. A very therapeutic process. Casting into an open mould to just full gives a concave meniscus which may give the finished casting unpredictable dimensions. Slightly over filling the mould will give a convex meniscus and this is the route I take. The photograph shows finished castings, moulds (I

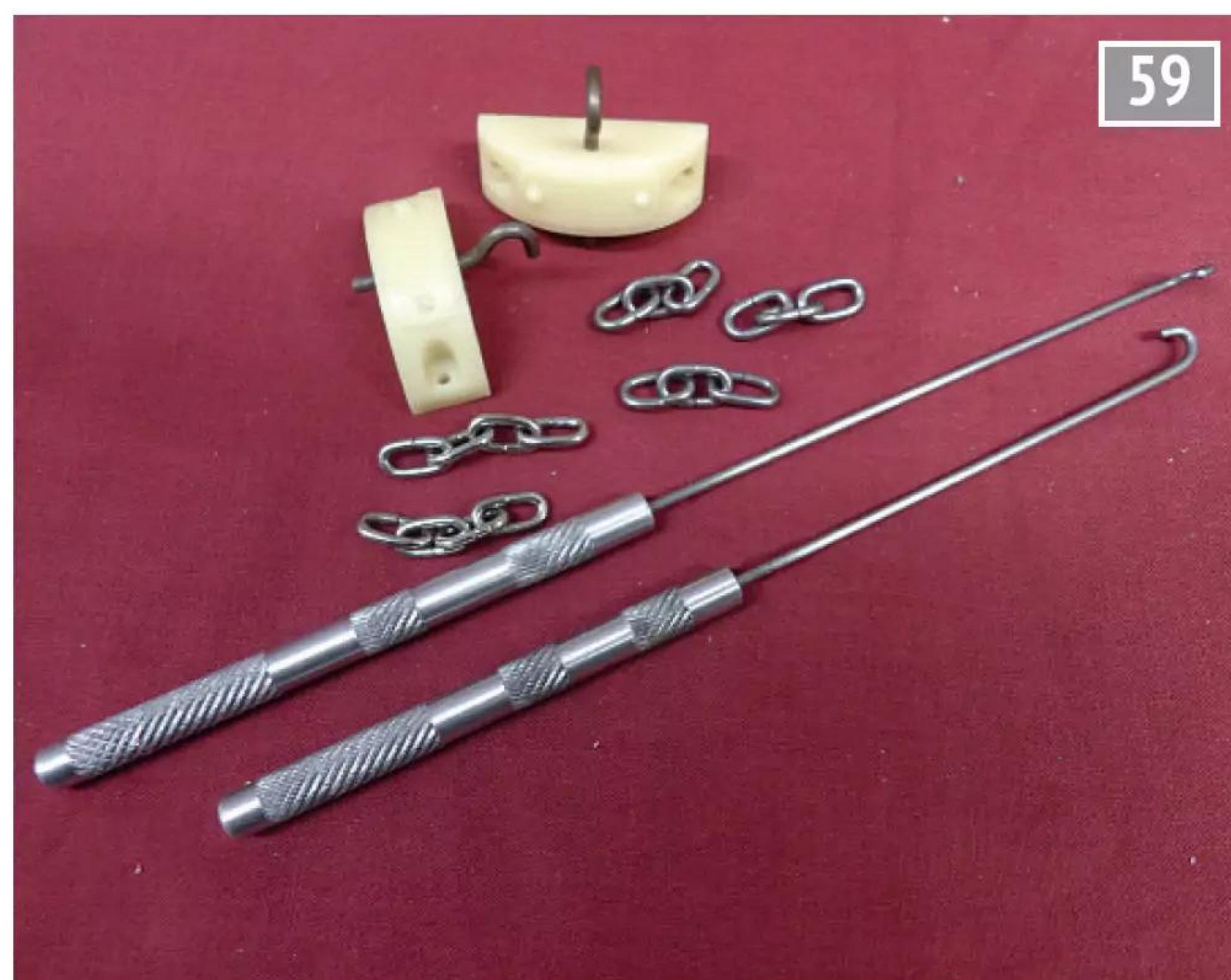
made four in all to cast a stock) and the pattern. To stabilise the dimensions, also seen in photo 57, is a block with two upright posts. These are a snug fit in the bolt hole recesses of the casting.

Mount up in the mill vice and face off the back with an indexable tip face mill of 16mm diameter kept for the job. Hence a flat bolting surface and stable dimensions are generated in one pass.

The hooks are bent from 2.5mm diameter mild steel rod using - yes, you guessed - a fixture ensuring conformity to a known working pattern. Also all seen in photo 57.

The operation in the mill is basic and shown finished (**photo 58**).

Making up a train is then simple using a home made shunting pole (fancy words for a long hook set in an alloy knurled rod). The coupling hooks are set into the dumb



Coupling system with shunting poles.



Simple drag beams.

buffers with a spot of epoxy adhesive. Chain is steel three links to the inch. The best I can find is clock chain from a jewellery materials supplier. It is supplied in lengths which is then split off three links at a time.

I do carry some with four links as some models will have differing heights, even with the best intentions (**photo 59**).

Drag beams are just basic 2mm thick mild steel in keeping with the design ethos. They mount to the frame stretchers with round head 10BA screws but the buffer mounting bolts have to be M2 slotted cheese head or pan head machine screws. To use hexagon heads and the allowance for a nut runner/socket in the

recesses would have meant a dumb buffer that was far too cumbersome (**photo 60**).

The railway used to use cast white metal jaws (home brew again) in a 'link-and-pin with chain' set-up, needing two sets of needle nosed pliers and agile fingers. Previously mentioned loss of agility in the hand area meant a forced change to something much simpler and easier.

● To be continued.

Part 20:

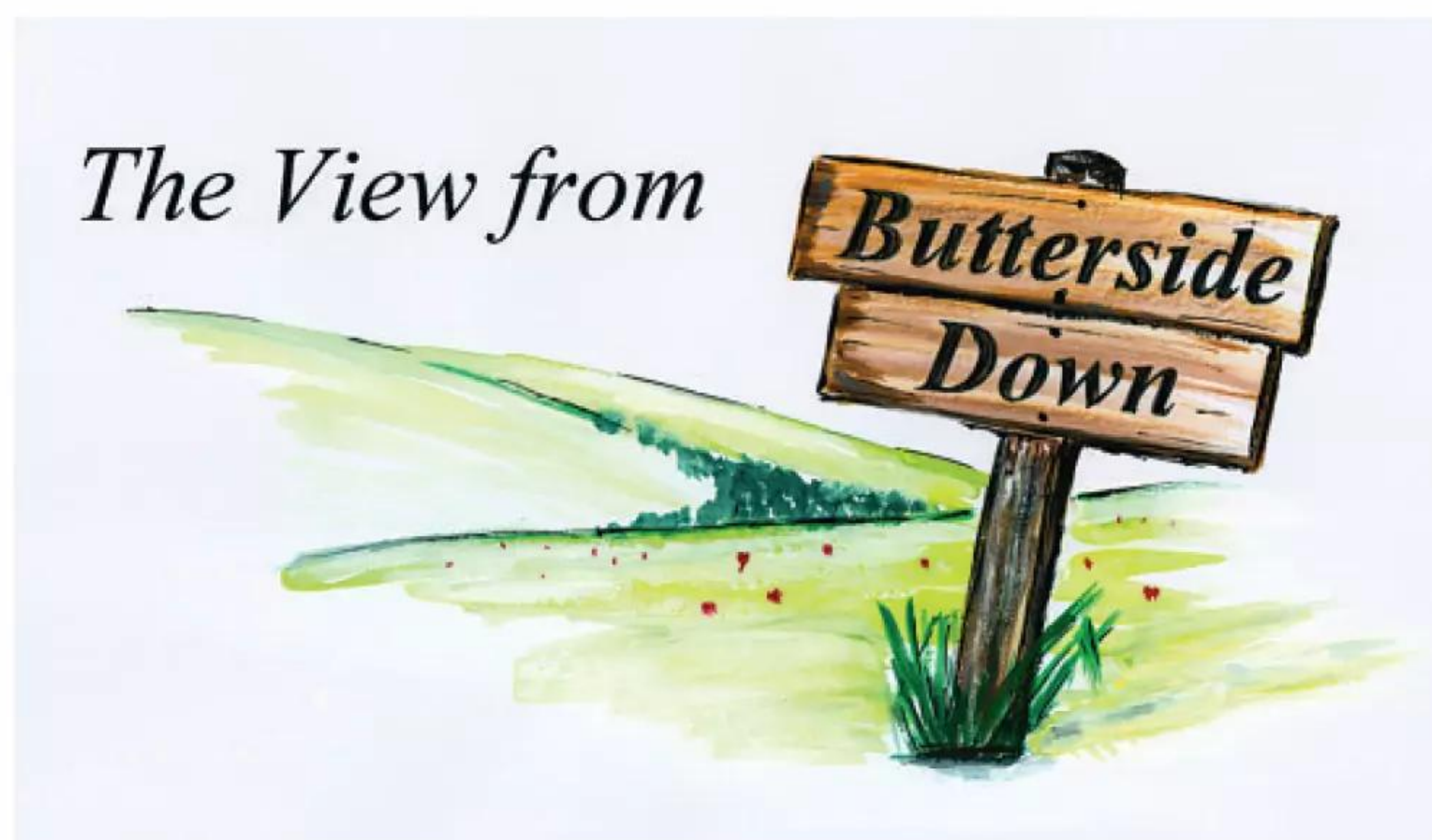
Pastures New - Part 4

The Finishing Touch

Steve Goodbody takes a random walk through model engineering.



Continued from p.397
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Having turned on the lights, tested the heating, filled the voids and promoted a radio station – all in one episode would you believe - we return to discover that the author's double-stacked shed is nearing completion. And about time too.

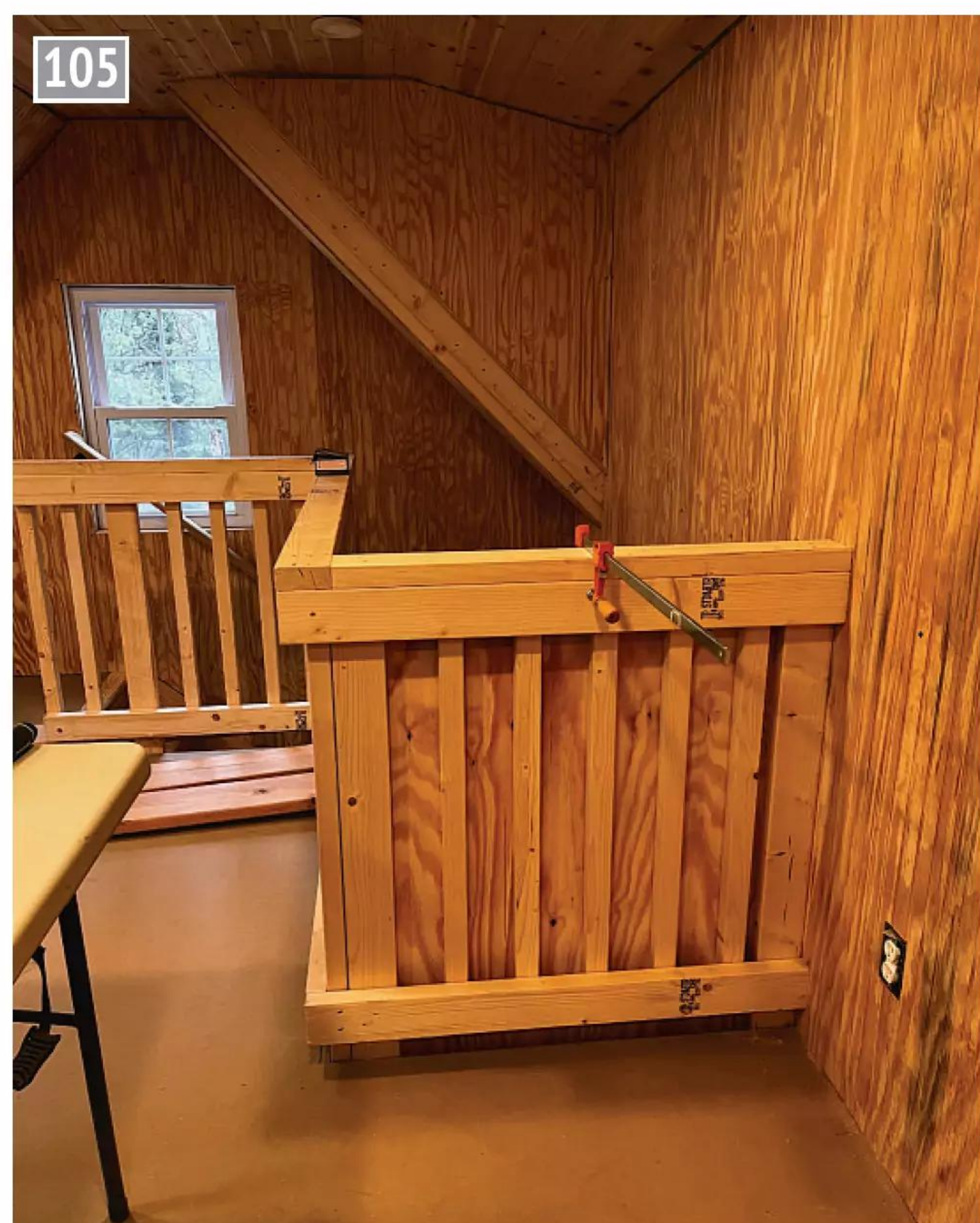
In praise of plywood

Now I don't know about you, broad-minded Reader, but there are some things in life which, while stirring whole multitudes to frenzied excitement, leave me wholly unmoved. Cricket (the game, not the insect, for you know my feelings about BALBs), a sport which achieves the miraculous feat of making even baseball seem thrilling, is but one example and baseball wholly relies on statistics – *statistics, for heaven's sake!* – to elevate it to the heady heights of abject tedium. I am, you may have guessed, not a devoted fan of baseball either.

My reason for mentioning this, other than to annoy any misguided cricketers or baseballers who may be lurking amongst our otherwise sensible readership, is because

never, not once, have I seen anyone – not even cricketers - get excited about plywood. And that's a shame.

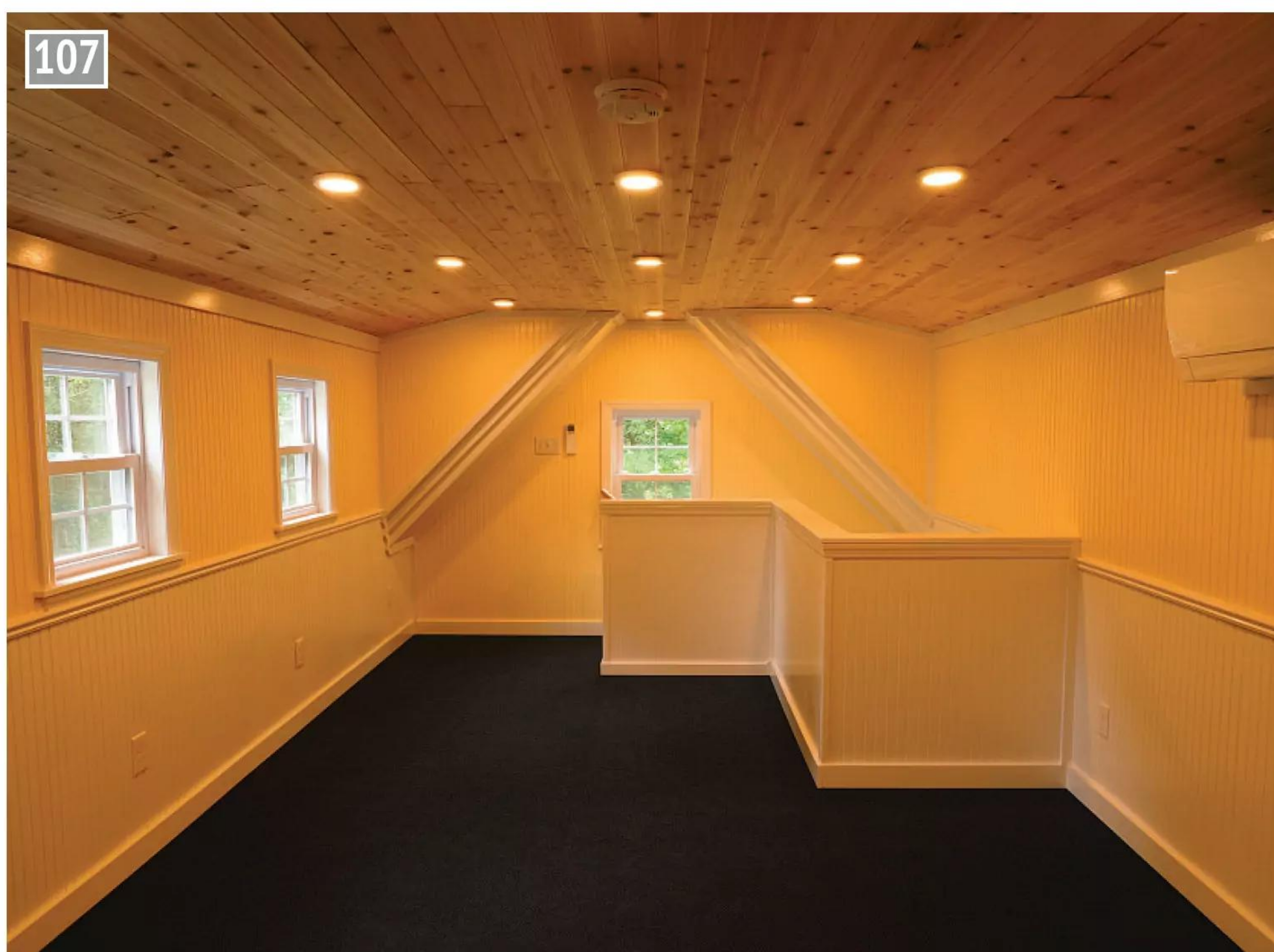
But before you roll your eyes, crumple this otherwise fine magazine into a tightly packed ball and fast-bowl it vigorously at the nearest wall, let me explain that, if said wall is made from the same gypsum-based sheeting which lines the vast majority of the houses in my part of the world, it will undoubtedly leave a dent, possibly a hole, and you will likely regret your temper tantrum shortly thereafter. However, if the targeted boundary is of plywood construction, then, even if you are a minor-league pitcher or, God forbid, county bowler,



Sheets of durable and strong beadboard begin to cover the interior walls.



In the eventual workshop, plywood beadboard provides both a knock-resistant perimeter and a sturdy substrate for the shelving to come.



Upstairs in the library-come-office-to-be, the trimmed and painted beadboard is topped by a cedar-planked ceiling.

then your magazine will simply rebound, hit you squarely on the nose, and the wall will be none the worse for the experience. That, as they say, is karma.

With this said, and as you may have guessed by now, having carefully considered the potential interior walling

materials for my shed, and despite its acknowledged downsides – flammability being one (addressed by careful adherence to the appropriate construction codes) and higher cost being the other (addressed by a sharp intake of breath and a depleted bank balance) – I

decided to use a plywood-based product for the interior walls of both workshop and office, specifically 3/8-inch thick plywood ‘beadboard’ (as it is known) with its regimented strips of simulated planking (**photo 105**). And while you may find this a surprising choice, in my defence there were three

main reasons for this decision: (a) plywood’s strength and resilience should leave the walls unharmed by the knocks, bumps and scrapes they will inevitably receive when I am clumsy in the workshop, (b) I can hang sturdy shelves and other heavy items wherever I want on a plywood wall, a difficult feat with gypsum-based wallboards, and (c) once finished and painted and neatly surrounded by trim, plywood beadboard is, in my view, a very attractive material.

And with all that said, doubting Reader, I’ll leave it to you to judge whether my decision was wise (**photos 106 and 107**).

Decent exposure

If you look carefully at photo 106 you may spot, perhaps with surprise, that the ceiling of the ground-floor workshop, unlike the office above with its tongue-and-groove planked version, is notable by its absence. And you are indeed correct, observant Reader, for nothing but bare joists adorn the space immediately above my head when I am in the workshop. Of course, on re-reading that last sentence, I realise that the aggrieved cricket or baseball fans among you immediately added: ‘*and nothing at all adorns the space immediately between your ears, wherever you may be*’, probably with a snort of derision. But I’m not about to erase it, so *touché* quick-thinking sports fan, you assuredly won that round.

While you may have assumed the missing ceiling to be a prime example of slap-dash corner-cutting on the part of yours truly, I will say in my defence that a ceiling-free workshop was a wholly intentional decision – one borne from long experience – for over the years I have discovered there are certain benefits provided by a set of bare joists in a workshop which should not be ignored.

Perhaps you need to store some long materials? No problem: simply hang a few brackets from the joists and put them up there.

108



A fearsome machine which I vow never to touch again!

109



The patio base, completed by hand following a half-day of mechanical-digging terror.

Maybe you have a heavy boiler to lift onto its chassis? Simple: attach a hoist to the joists and haul away.

Need a paint booth? Well, grab an armful of plastic-sheeting and a gun full of staples, attach the former to the joists with the latter, add some curtain rails when that's

done, and hang a host of shower curtains to enclose the space below.

Discover you need some additional lighting? That's an easy fix when there's no ceiling to get in the way.

In short and to summarise, in my opinion *no ceiling* is the ideal workshop ceiling,

provided you've got a good layer of insulation somewhere between you and the outside world above.

Barely civil engineering

With the interior complete and the arrival of drier and more temperate May, the time came to venture outdoors and finish

the earthworks. In my plans, I had bravely decided upon a substantial patio to the front where I could park the trailer when not in use and, with a bit of careful positioning, load and unload it directly from the shed's double doors to make life a lot easier. Furthermore, a sideways extension of this concrete-block-paved area would form a gently sloping pathway and provide rapid access between shed and house when the wind is a-howling and the snow is a-blowing.

Having done the sums, I calculated that this paved area would measure fully 550 square feet (51 square meters) and, having hand-dug more of the stuff in my past than I would freely care to admit, I also knew that this would mean the excavation and distribution of 275 cubic feet (nearly 8 cubic meters) of the brutal mixture of clay, shale, roots, rocks and boulders – we are positioned upon glacial deposits from the last ice age – which forms the strata beneath our feet. And knowing these things, and the magnitude of the task, I decided that, for a change, I would not dig this by hand but would instead rent a mechanical digger for the job. And so it was that, after minimal instruction and a white-knuckle ride home with a weighty trailer attached behind Jenny's overstressed automobile, I found myself in unwise possession of a large and intimidating monster, painted bright orange: presumably to be easily spotted and tranquilised were it to escape and rampage through the neighbourhood unchecked (**photo 108**).

Now truth to tell, while this beast proved ideal for the job, the combination of its fearsome power and my woefully inexperienced handling has left me mentally scarred. While nothing *actually* went wrong during that four-hour excavation session, so much *could* have gone wrong, and so quickly and so seriously, that I have vowed never, ever to touch one again. Mechanical



110

Ten tonnes of concrete pavers patiently await the author's attention.

digging is, in summary, a job best left to the well-insured experts; trust me on this.

But despite the nervous sweats and recurring nightmares that have followed, the fact remains that the worst of the digging was finished in a fraction of time it would otherwise have taken; I was, however, very relieved when it was over.

Returning gratefully to pickaxe, shovel, wheelbarrow

and rake – tools with which I am far, far more comfortable – before long the remainder of the formation had been completed (**photo 109**), all ready for the concrete paviours which were by now awaiting my attention in an orderly little row (**photo 110**). Thus, with a carefully-profiled layer of crushed-granite laid down - a task greatly aided by a few lengths of galvanised electrical conduit and a piece of wood



111

A few lengths of galvanised pipe and a straight-sided screed board help create a carefully contoured bed for the patio pavers.

for a screed-board as I had been taught when building our little railway at Bentley many years before (**photo 111**) – all that remained was to painstakingly set each block in place, give it a couple of whacks with a rubber mallet to settle it firmly, cut all the edge-pieces that wouldn't otherwise fit, sweep and vibrate bag-upon-bag of fine sand into the little gaps between, plant a few plants, add some mulch,

spread some topsoil and lastly re-seed the grass to make everything neat and tidy for the first time in nearly a year. That was all.

And with that done I stood back, admired the result, took a very hot bath and sat motionless in a comfy chair for an entire week until the aches and pains finally subsided (**photo 112**).

●To be continued.



112

With the paviours laid and some greenery planted, it was time for a long, hot bath and a seven-day sit-down.

SMEE News Why SMEE?

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



SMEE

August is a quiet month for SMEE as members take time off for holidays. So as a relatively new member I thought maybe I could tell you a little about how and why I came to join the Society and how I've settled in.

I am an electronics engineer for a living, now semi retired at three days a week. Making things has always interested me, from woodwork and throwing pots at school to a Saturday job swinging a fly press. I began assembling my own workshop 30 odd years ago having made a clock in my friend Barrie's workshop and have been at it ever since making several clocks, a lot of workshop equipment largely of the George Thomas design, a Quorn and a very slowly progressing 5 inch GWR King.

Not having any statistics as to how model engineers arrange their lives or even how many of us there are (who does?), I would still hazard that for much of my time I was fairly typical of the breed. I consider myself competent but of average ability, I mainly worked alone, was not part of a club and was largely self-taught. I did however have my friend Barrie who introduced me to the hobby and later Chris who also lived locally and was primarily a clock maker. We would generally attend all the exhibitions together and eventually we began meeting on a weekly basis to chew the fat and I guess we became a kind of mini club of our own.

Barrie had never joined a club but Chris had, being a member of the Cambridge society, but

his main interest was clocks rather than railways and so after some decades he left and joined SMEE in 2018. To cut a long story short my two friends sadly died within a short space of one another which left me in a kind of limbo. I had got used to chatting about what I was up to in the workshop and hearing what the other two were doing so I decided to take the plunge and in 2020 joined SMEE.

I knew from Chris that SMEE produced a really good journal and living in Cambridgeshire I could see myself attending the occasional meeting at Marshall House. I was a little apprehensive joining a new group and perhaps like others assumed that SMEE was geared to the more illustrious in our hobby. SMEE can perhaps have something of the air of the 'learned society' to those outside the society, partly because of its long history and indeed some past members have had a very high standing. However, like most assumptions nothing could be further from the truth and I found SMEE very far from elitist. SMEE certainly still has many members with a wealth of knowledge but I found everyone to be very welcoming and easy to approach and very willing to share knowledge. There are plenty of members who are just starting out too.

My joining coincided with covid so visits to Marshall House were impossible. But fortunately the pandemic prompted the Society to move nearly all their activities to Zoom during lockdown which was perhaps one of the rare benefits of this strange period and one I really appreciated at the time. As normal service resumed I got more involved with the society joining the Engine Builders Group and the Digital Group and eventually offering to write SMEE news for *Model Engineer*.

For me joining SMEE has been just what I needed. We don't have a track so our interests are probably further ranging than the more railway based clubs and the option of being able to join in meeting on Zoom makes SMEE really accessible wherever you live and many SMEE members are also members of local societies. I have enjoyed the many and varied talks and trips out and certainly have made friends and learnt a lot of new and interesting things. Above all it has inspired me to get out in the workshop more and progress my projects. All this for a subscription of a pound a week.

If some of this has resonated with you I would encourage you to think about joining SMEE either through our website or coming and talking to us at the Midlands Model Engineering Exhibition in October. We would be only too pleased tell you more. If you are not going to the exhibition and would like a tour of Marshall House or join a zoom meeting as a guest please drop a line to meetings@sm-ee.co.uk.

After last years 'retrospective' the SMEE stand this year will look to the future, featuring current activities, with demo's designed to interest newcomers to the hobby and more complex activities of interest to the more experienced, focussing particularly on useful tooling designed by George Thomas. There will also be examples of models and work in progress from current members and a number of running models. In addition two SMEE members, Brian Neale and Bob Reeve are giving talks at the show as part of the programme organised by Neil Wyatt of *Model Engineer's Workshop*.

We look forward to meeting you there.

ME

The Joy of Model Submarines



I have collected a small fleet of these subs over the years (**photo 1**) and they are spectacular but I have yet to see one perform as advertised. The best of them will give you one dive and barely surface, if you're lucky, and then wallow around as if the rum found the helmsmen. My goal was to build something simple, much like what you would get when purchasing a cheap toy sub, at least diving and surfacing twice during one wind-up, and not rely on complex mechanisms, timers, movable ballast and all that.

Building and operating R/C subs over the years gave me a leg up on finding a solution by running the R/C models and observing the forces and the sub's reaction to them. A pre-nuclear style sub model will gently try to surface when running under water because all the deck infrastructure creates a lot of drag, pulling the bow up somewhat. A modern nuclear sub model will be easier to maintain a level run under water for obvious reasons.

Joe Rothwell relives the excitement of wondering whether his model will ever re-emerge from the depths.



A piece of driftwood, a sturdy reed for a mast and a tattered bit of rag for a sail and Youth is off for great adventure! The pond boat has been around for thousands of years; a couple were even found in King Tut's tomb. When the submarine became a viable warship, circa 1900, the toy pond-boat manufacturers were quick to capitalize on it by offering small tin subs with a variety of propulsion systems, each becoming a highly prized possession of its young owner.

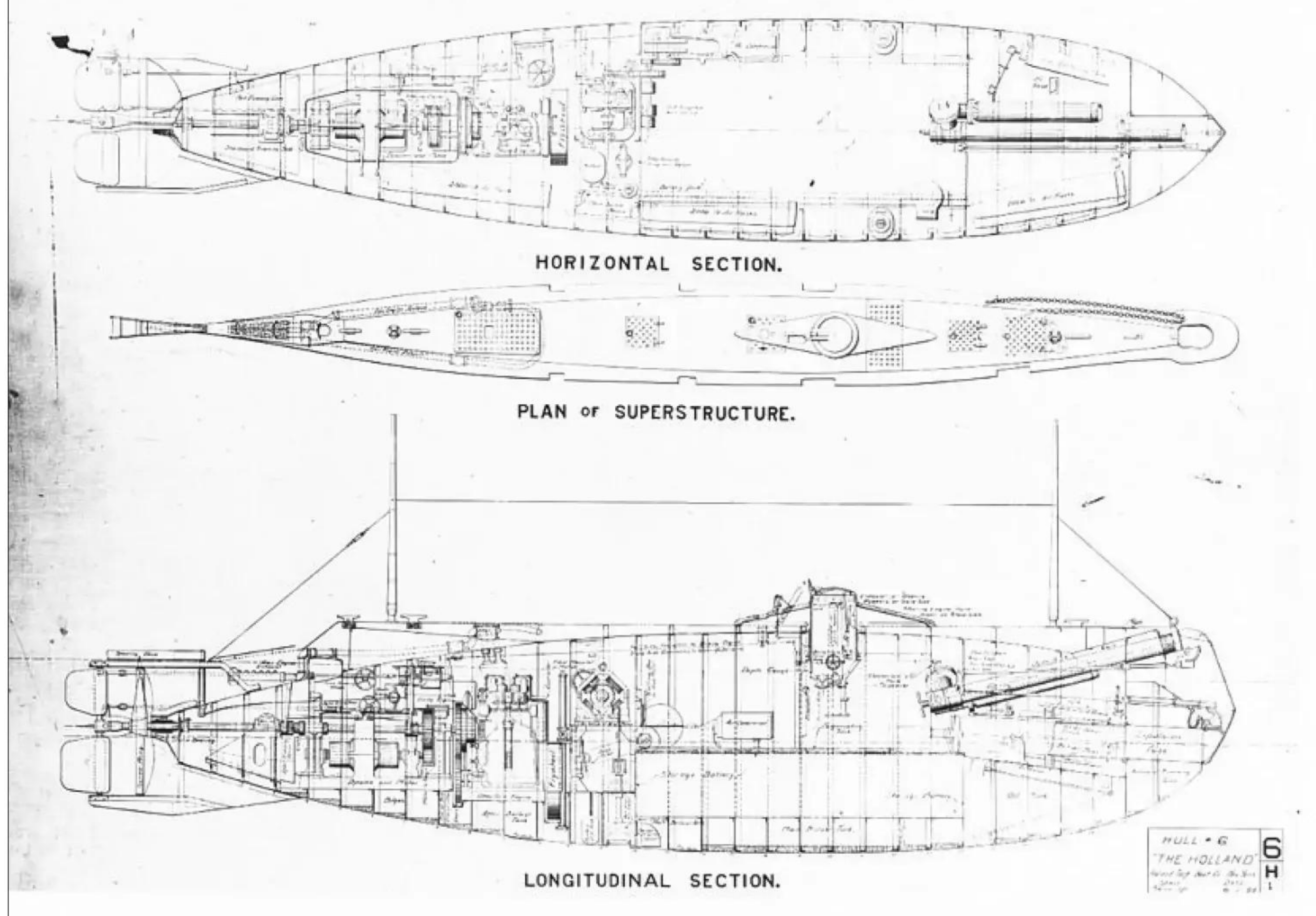
Most of these model subs did not survive, submerging beneath the dark waves while its captain and first mate wait excitedly on shore for the little ship to surface and return home but, sadly, never to see it again. These rusting hulks sparsely littered the bottom of lakes and ponds, forever awaiting rescue and sunlight. The fault lay not with the anguished captain and crew, nay, but with the manufacturer's poor

engineering of the yacht. The toy manufacturers will have to hire a vile, blasted Sea Lawyer to get them exonerated from their misdeeds. The dried-out old reptile will argue that the victim's paltry sum spent on the sub was insufficient to get the complex engineering that a proper model submarine needs to dive and surface repeatedly on its own.



The usual suspects with the hefty Holland.

Fig 1



Holland submarine general arrangement.

These characteristics are the main design factors and will be exploited for maximum benefit. The submarine of choice to model is the submersible boat Irishman John Phillip Holland had designed for Britain and the US, circa 1900, called the *Holland-1* and the *Holland*, respectively (**fig 1**). It was one of the first to use batteries while under water and an internal combustion engine when running on the surface and, apparently, launch a torpedo while submerged.

Even though the *Holland* has a very futuristic hull shape for its time, more like a modern nuke, it does have the deck structure that is needed.

For our model, we'll use the 'Buck Rogers' spaceship floor-toy (**photo 2**), circa 1934, for the hull. Luckily, the toy is still reproduced, using the original tooling by the overseas company that bought them, reducing the cost from over \$750 for an original old example today, down to \$20 for the re-pop. And the

toy matches the *Holland* hull perfectly.

The toy is stripped down and the only thing kept are the two hull halves and a small disk (**photo 3**). The tail fins will be soldered to this small disk and drilled for mounting bolts. You'll find the stamped hull pieces tail-end comes squared off but this will simplify mounting the complex tail fins that the *Holland* sports. A plan and profile drawing was found and adjusted to scale on a copier machine to match the

hull pieces, which turns out to be 1/48th scale, same as our beloved 'O' scale. The overall length is 16 inches and this makes a decent size model without being cumbersome.

After gluing a plan sheet to card stock, the shapes are cut out, leaving a little extra 'meat' on the bottom edge of the deck sides for trimming purposes. Assemble the pieces into a structure by using tape and then the card stock structure is trimmed along the bottom edge of the deck sides with scissors until a decent fit with the hull is achieved. The card stock shapes are separated and transferred to brass sheet and cut. Simplifying the deck and tail-fin structures for ease of assembly was foremost when developing the design.

The fins are strengthened with K&S angled brass strip like on the full-size boat. Make them longer than necessary and trim them to size after fin-tip bushings are soldered on. The cross-bushings are soldered last but must be in place before rudders or dive planes are soldered onto their respective shafts. Rudder and dive plane fin-tip bushings are made up from a square tube on the outside, followed by a round tube that just fits inside the square tube and the rudder or dive plane shaft fits inside the round tube. The rudder shaft and dive plane shaft are *in situ* when soldering the square bushings to the fin-tips (**photo 4**). Careful soldering here will prevent the shafts from being



Both of these are re-production toys from days of old.



These parts save time and money for this simple project.



Of note is the single bolt holding the rear deck on and the sheet metal screw in the tab fastening the hull halves together



Sprocket gear is mounted on drive axle with JB Weld epoxy.



These parts were the only thing kept from the original toy.



The brass wire holding the wind-up unit to the bottom of the hull is visible here.

soldered tight. Two screws and one bolt fasten the deck to the hull. Four bolts fasten the tail fins only to the lower hull half, allowing removal of the top hull half for service without having to un-bolt the fins.

Soft soldering the pieces together can be done with either a good iron or a small flame. I used a small butane torch for this project and employed the spot technique where a small piece of solder is cut and laid on the joint with flux and heated until it

flows. Let cool and then do another spot (**photo 5**) an inch or so away, until the seam is soldered from one end to the other. This takes a little longer but affords great control especially in curved shapes and also eliminates un-soldering earlier work. My three rules for soldering are clean, bright pieces, lots of heat and lots of flux; if it's weak in any one of those three, difficulties may be encountered.

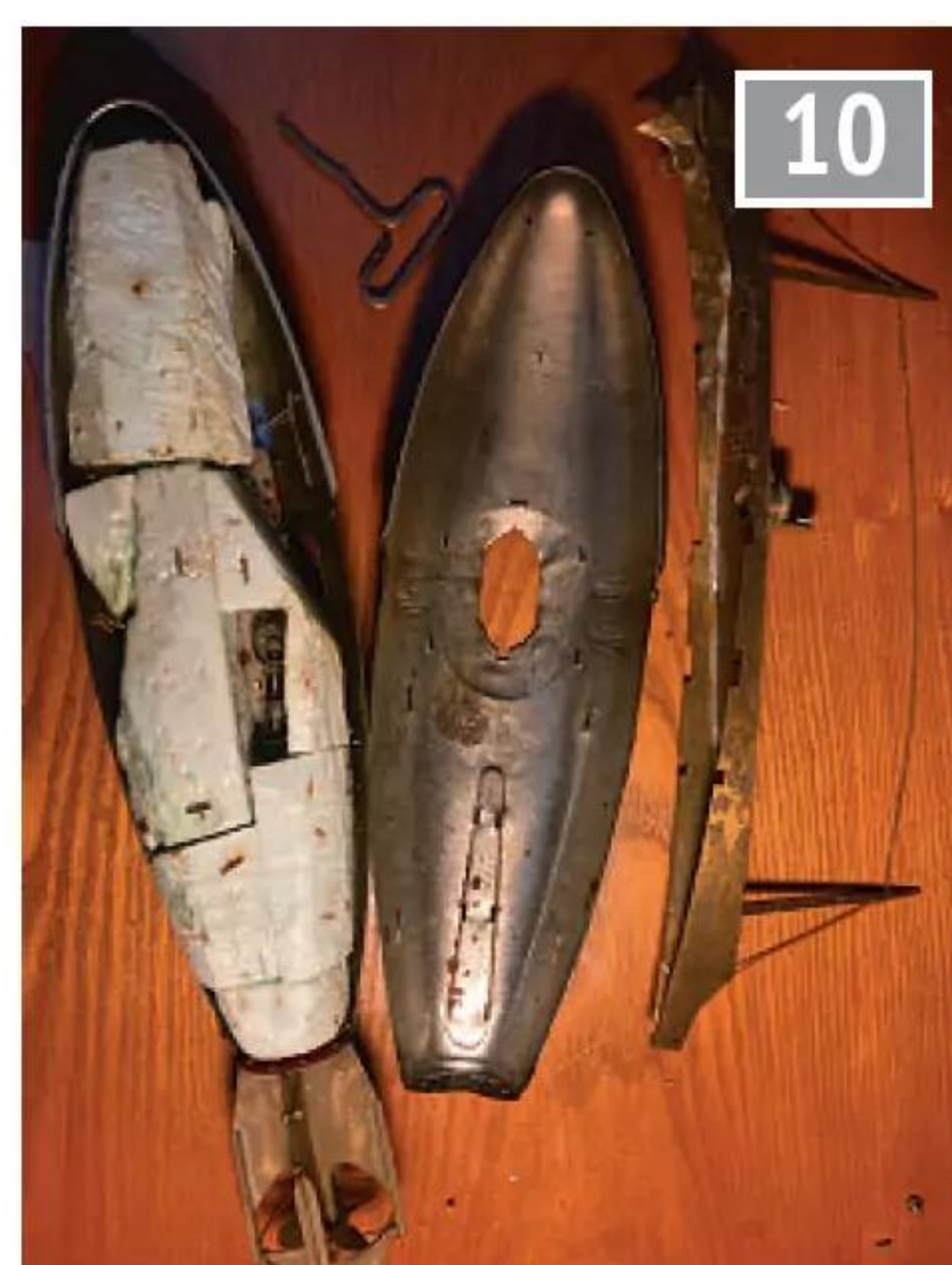
Most of the better antique tin subs used a clockwork



The two mounting tabs on the bow can be seen here and these are for mounting the deck to the hull.



The drive system is simple and low maintenance.



This foam lasted quite awhile but eventually failed and was replaced.

motor, so a 'Marx' locomotive wind-up unit (**photo 6**) was modified for the power plant on the little Holland. The sprocket gears (**photo 7**) from a re-po helicopter floor-toy were liberated and used to vector the prop shaft aft. A brass bracket holds the prop shaft gear to

the sprocket gear (**photo 8**) and silicone tubing is used for U-joints. The propeller is very thin brass sheet, cut with scissors and a wheel collar is soldered on for mounting to the prop shaft. Twist the prop blades until the blades hold their pitch. The prop shaft housing-tube is soldered to the fin's intersection, not dead centre, but offset into one of the two lower 'quadrants'. Two pieces of brass wire hold the wind-up unit tight to the bottom of the hull. The sub gains stability with most of the weight low in the hull.

The entire sub is free-flooding, including the engine room... this has raised many eyebrows but water acts like a lubricant on the wind-up motor and, so far, rust has not been a big problem - submarines were the rustiest ship in the Navy anyway. The hull has two large holes (**photo 9**) on the bottom where the wheels for the floor-toy protruded. The holes allow quick flooding and draining of the hull and are in the same area as the wind-up motor, making access to the motor easy. After a day's running, spray-lube is liberally applied on the clock work and the sub is left to dry. Now, the key...

Floatation for the sub comes from blue construction foam. This was a not the best choice because after 25 plus years' service, it had dried out and shrunk somewhat (**photo 10**) and now has been replaced.



T-pins and a little bit of brass wire hold the blocks together.



Ready for patrol!



Holland in drydock, simple wood cradle shows off finished model.

Blue foam is 'open cell' and will slowly absorb water whereas a 'closed cell' type of foam (**photo 11**) is far superior and will last almost forever. I bring this up because installing the foam is the most tedious part of the whole project, so 'one and done' is better.

The sub must be balanced fore and aft and also in list (vertically) when sitting in the pond. Before adding foam, put two small lead weights, one in front of the motor (about an ounce) and one behind ($\frac{3}{4}$ ounce), both fastened on the hull floor, just for added stability. Start adding foam blocks cut with a hot wire or sharp knife. Where and how much? This requires removing the deck, opening the hull and adding more foam here or there or maybe removing some foam

elsewhere, then reassembly, back in the test tank, over and over, until the boat sits right. At least 12 sessions were required to get it right.

The back half will need more foam than the front half, due to the tail fins. Only the foam should give floatation, so no air pockets are allowed when installing the foam. I used brass wire and T-pins to fasten the foam inside, but glue is also an option. A slightly positive buoyancy is what to aim for and when the flat top of the deck is above the water (**photo 12**) a little less than a quarter inch and level all around, then it is ready for sea trials. It is normal for this kind of sub model, called a 'dynamic diver', to sit low in the water.

Once balance is achieved, you'll see that every pool of



Early version of the Holland makes a sleek model.



Very thin brass sheet for the coamings makes bending much easier.



One of the two screws that hold the deck down on the bow is evident here.

water is a little different, mostly due to water temperature. This can be adjusted out with a combination of rear dive planes setting and small magnets stuck on the bottom outside of hull for final fine-balancing at the pond. The first run is always a test dive and then adjustment follows suit. She doesn't like choppy water, so, the smoother, the better. To make the model dive and surface twice and achieve complete Nirvana, set the rear dive planes at the ¼ up position. There is enough friction in the dive plane and rudder bushings to hold whatever setting is needed. Wind it up with the spring brake set, ease the boat into the pond and let the model completely flood. Check to see if it is 'sitting on her marks', or at least, close. Release the spring brake and let the tiny ship go...

The model will smoothly dive and pick up speed, allowing the drag to build up on the deck and generating more 'bite' on the rear dive planes, thus

pulling the bow up until she surfaces. The drag-pressure is released once she surfaces, so down she goes again, only to repeat the behavior and then motor on the surface, until the spring runs out. The model can perform one long, deep dive and surface when the rear dive planes are set correctly and with a little practice, she'll hold periscope depth for most of a run too! If she refuses to dive, put less 'up' on the dive planes and some magnets on the bottom outside and *vice versa* for too quick of a dive. The rear dive planes and rudder are near scale in size and I have found no need to make them over-scale like you'll find on most pond boats.

For closing notes I'll add that the *Holland's* deck arrangement changed many times over her lifespan and I chose earlier versions in her career when she had a full-length deck (**photo 13**) and masts. The hull halves fasten together at the front using the toy factory's original design and the sides

use four sheet metal screws, taking advantage of the tabs. A good quality black primer for the hull and since this is a functional toy (photo 14) and not a display model, I left the brass work unpainted. The brass will get darker with age and will have polished areas from handling...someone in the future will greatly benefit from this decision... most likely, though, they'll paint it... knuckleheads...

I left the main hatch open (**photo 15**) to increase drag when underway and it also helps in allowing air to escape while diving. Trapped air will make operations difficult and tiresome. The masts and cable also contribute drag. The nose piece (**photo 16**) is thin brass

sheet with a square brass tube for reinforcement. The foam blocks must not shift around when underway or interfere with the drive system. When doing the initial balancing, take the time to get the sub to sit correctly on the water and this will pay off when sailing this pond boat. This can't be stressed enough; it is the key to this model's success. If submerged when power runs out and being slightly buoyant, she should return slowly to the surface and never sink. Smooth sailing and may your environment be target rich!

ME

Table 1: Vital statistics.

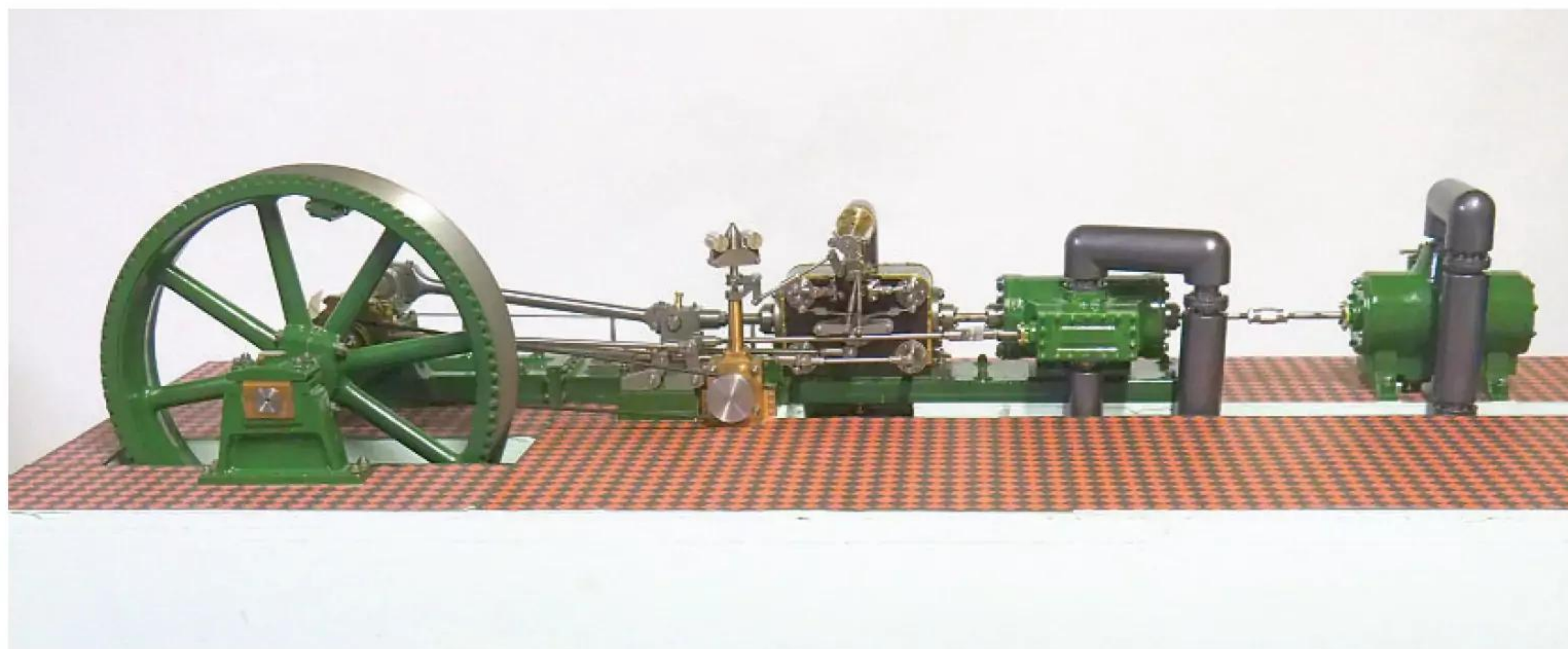
Holland Submarine Vital Statistics	
Length	16 inches
Weight	1lb 5oz
Motor Duration	45 seconds
Approx. Cost	\$85
Hours	Well Spent

Table 2: Materials list.

Materials List	
Floor toy for hull	
Sprocket gear for prop shaft	
Wind-up motor and key	
0.025 inch brass sheet for deck structure, rudder and dive planes (0.020 is lighter and maybe be better)	
0.010 inch brass sheet for fin structure	
0.005 inch brass sheet for propeller, anti-fouling ring around the propeller, hatch fairings and nose piece on bow which is reinforced with 1/16 inch square brass tube, bent and soldered to bottom edge	
1/8 inch L-shaped brass strip to strengthen the fin structure and hold square bushings	
Square (5/32 inch) and round (various diameters) brass tubing for bushings, hatch and prop-shaft housing	
3/32 inch diameter solid brass rod for prop-shaft, rudder and dive plane shafts	
3/16 X 1/8 inch rectangle brass tubing for masts	
Silicone tubing for u-joints	
Closed-cell foam for flotation	

A Tandem Compound Mill Engine

PART 3



and set up the joint surface aligned to the mill x-axis so as to split the barring teeth evenly between the two halves (**photo 21**) and clean up both sides. Getting the barring teeth to match up correctly was tricky and they needed adjustment later, after the wheel was together.

I was puzzled as to why Throp had drawn the teeth as '10 DP'; after all, the barring on this engine was manual and something simpler would be fine for that. However, in his book (**ref 7**) he explains that in full size the flywheel rim was machined by setting it up on a shaft over a pit and driving it from a portable steam engine using the barring teeth. A portable cross-slide was

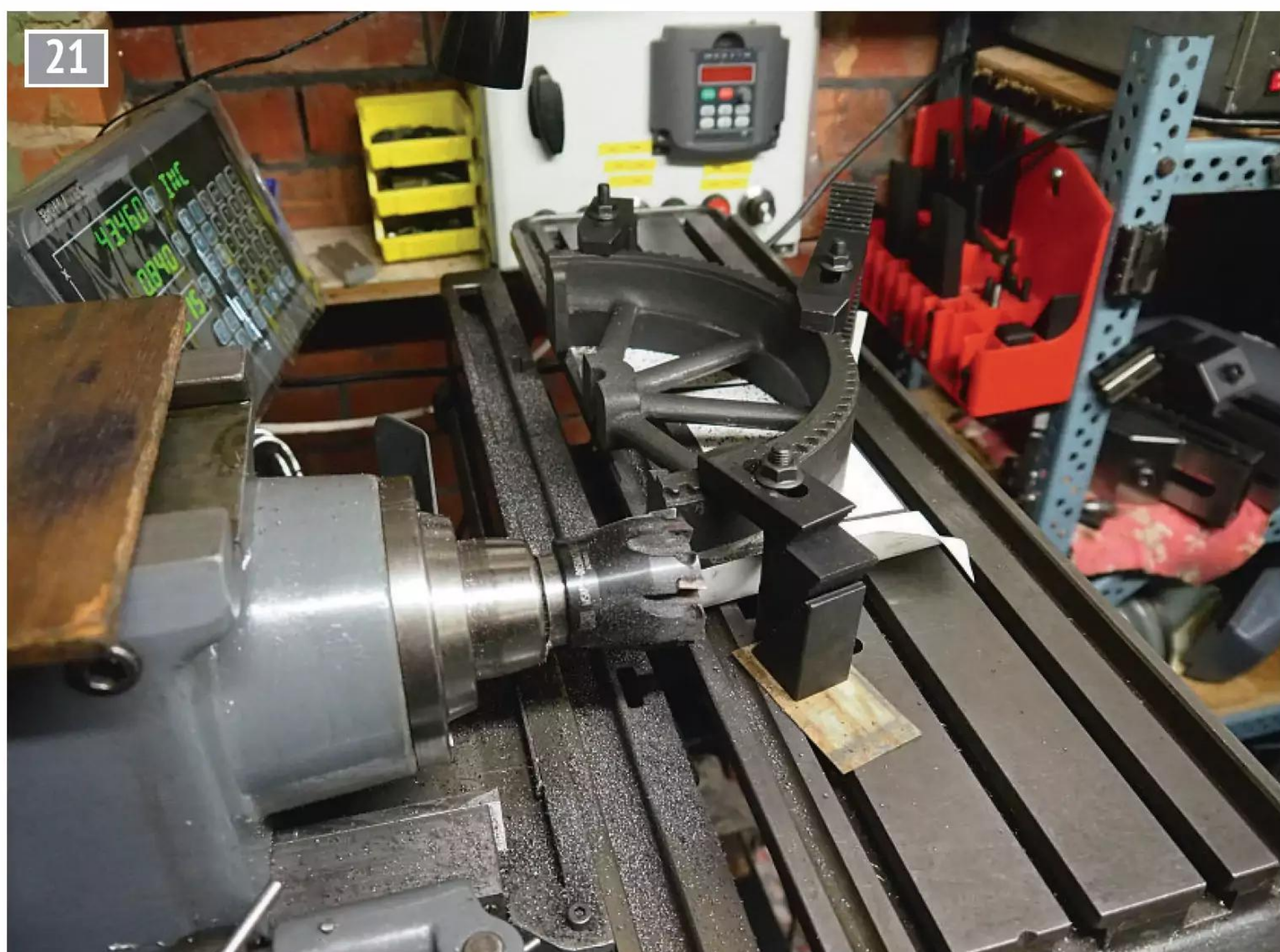
David Thomas
builds

Arnold Throp's model of a Corliss mill engine.



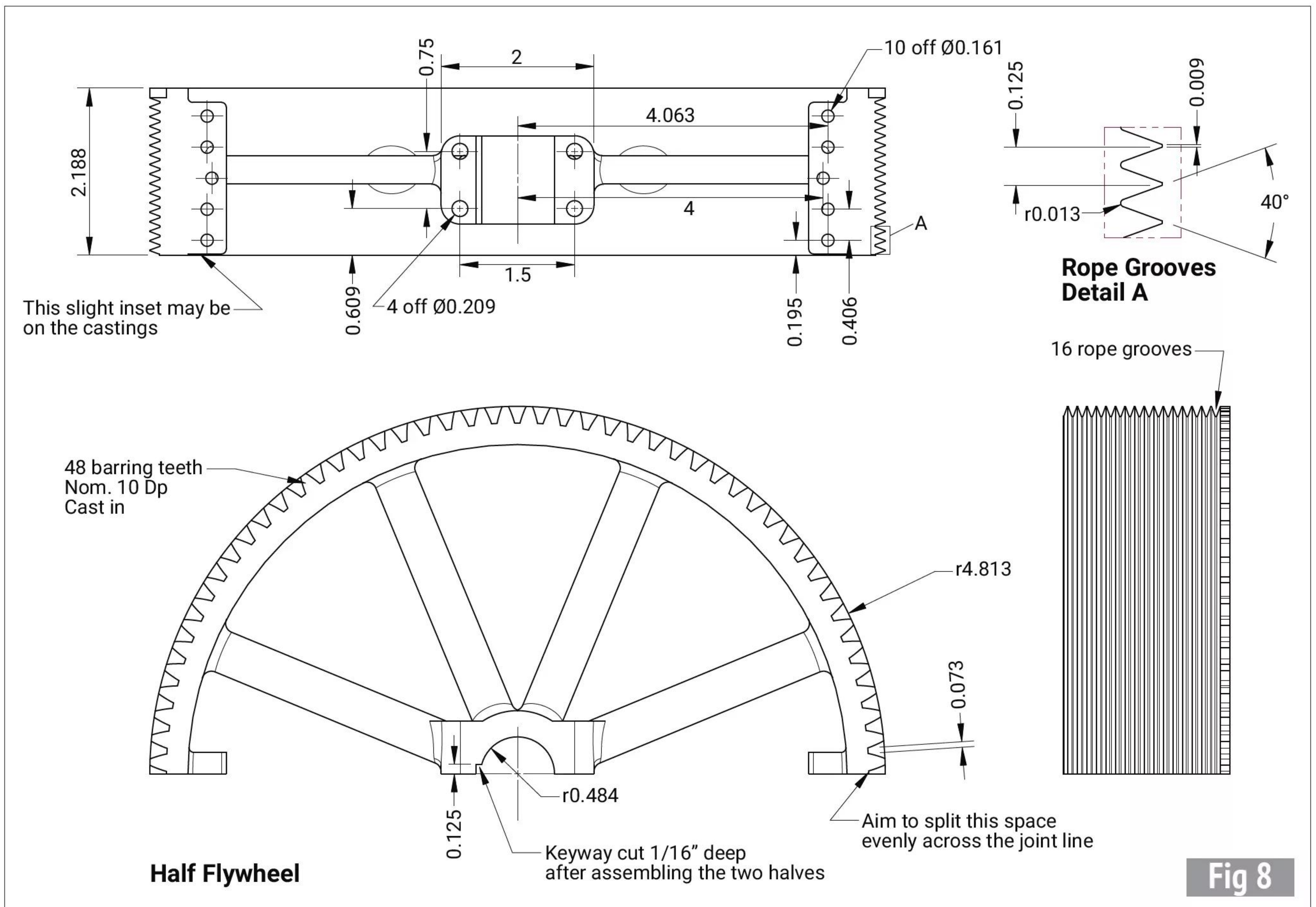
The flywheel (**fig 8**) is supplied as castings of the two halves which is true to prototype for an engine of the size we are modelling. Until the keyway is formed the

two halves are identical but whilst it would be possible to machine them separately, it would be a challenge! The castings were smooth enough to use one face as a datum



Machining across the diameter of a flywheel half casting to produce the joining face.

Continued from p.383
M.E.4751 September 6



Flywheel.

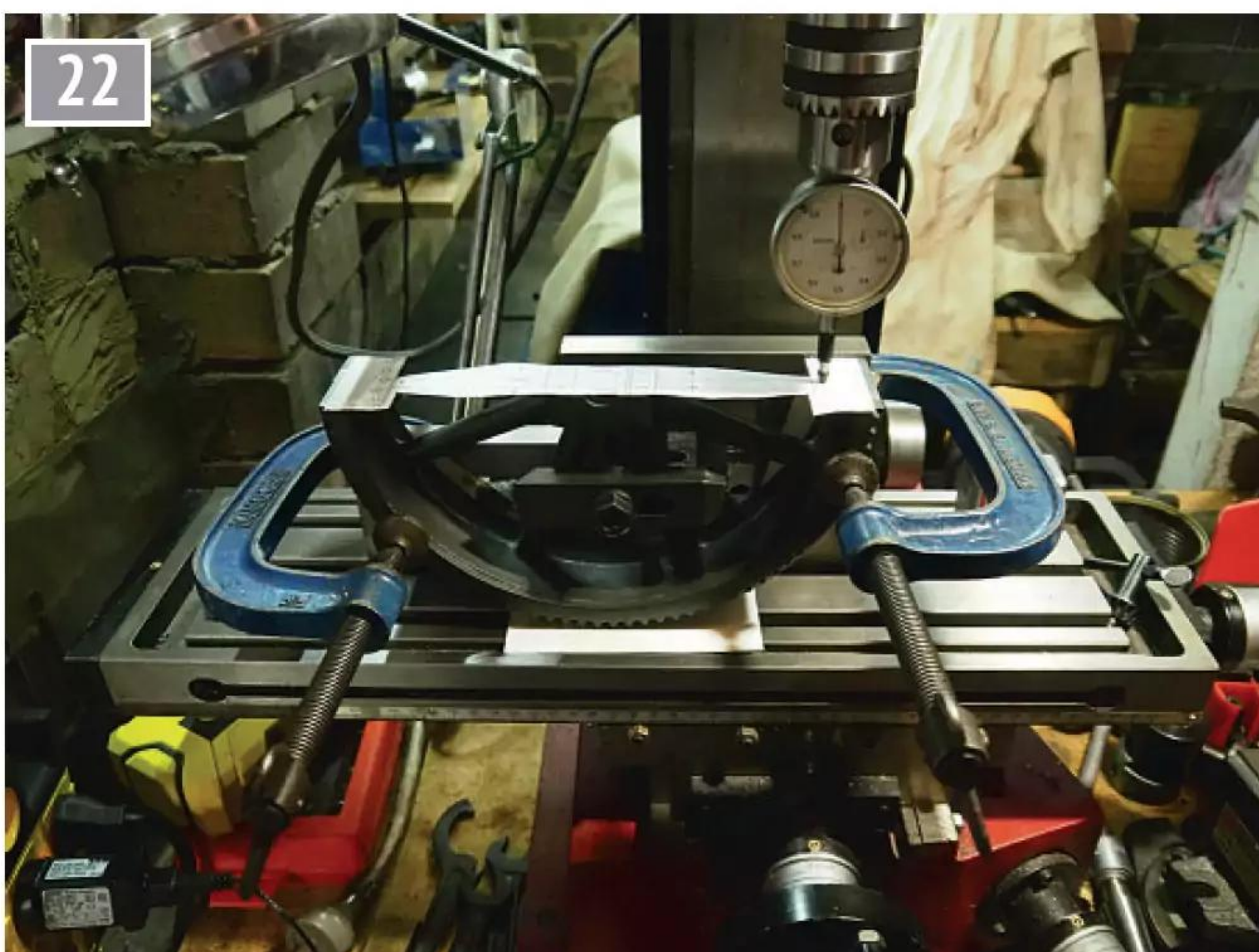
geared to the engine as well to provide power cross-feed. Several twelve-hour shifts were needed for the turning then a lot of work for the labourers to dig the mass of chips out of the pit by hand.

With the mating faces smooth and to size they can be marked out and drilled for

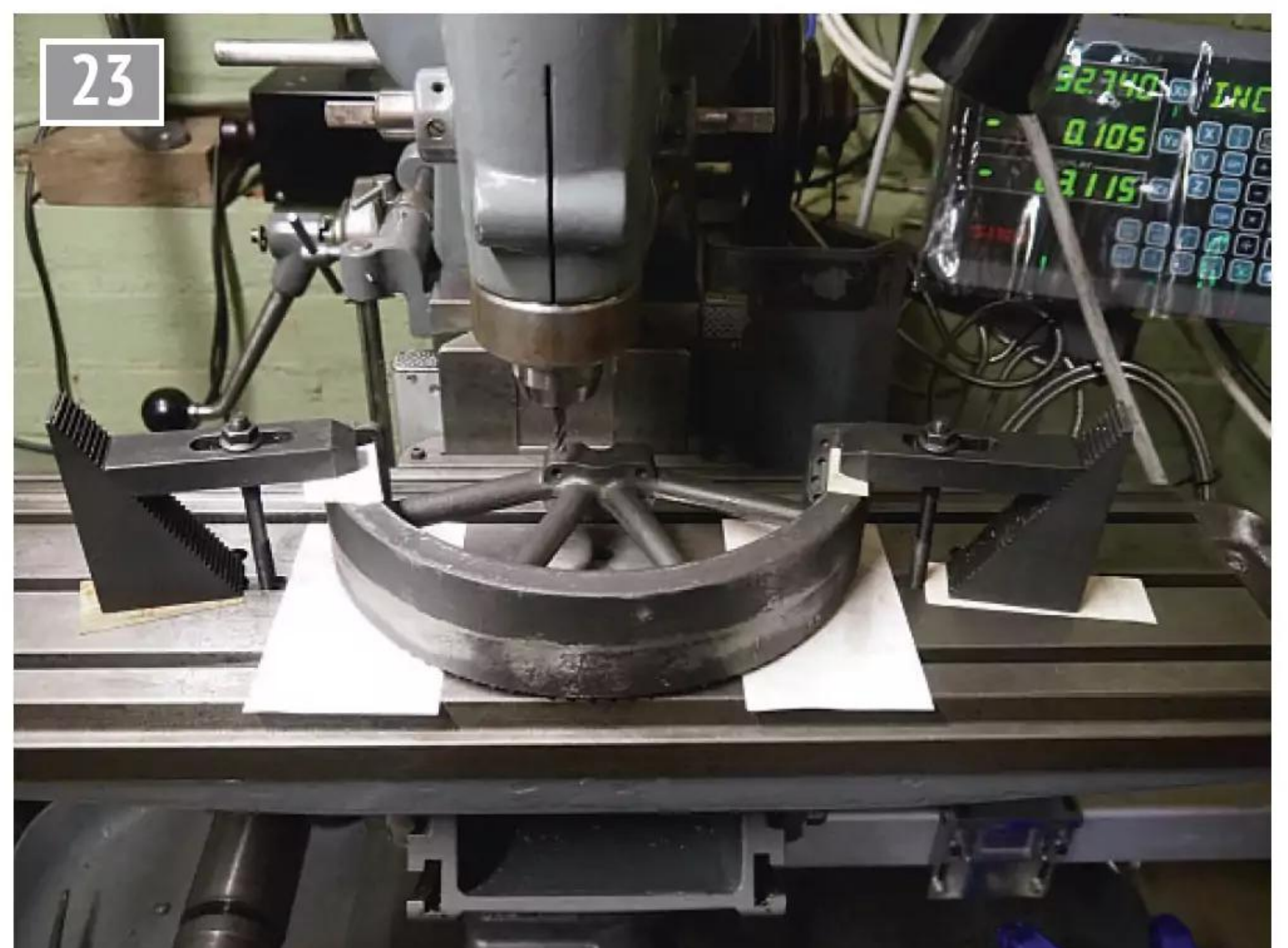
the stud holes, ten at the rim at 4BA and four at 1BA (could be M5 x 0.8) for the hub, which will require a bit of juggling as there's only one datum surface (**photo 22**). Whichever surface was the datum used for machining the mating faces is clamped against an angle plate (or, in my case two

angle plates, as I don't have one big enough to do the job on its own) and the face set horizontal. These holes could be marked out on each half, but a more certain method is to make a steel drilling jig and turn it over between sides (note that the hub is not on the midline). After drilling for the studs, the

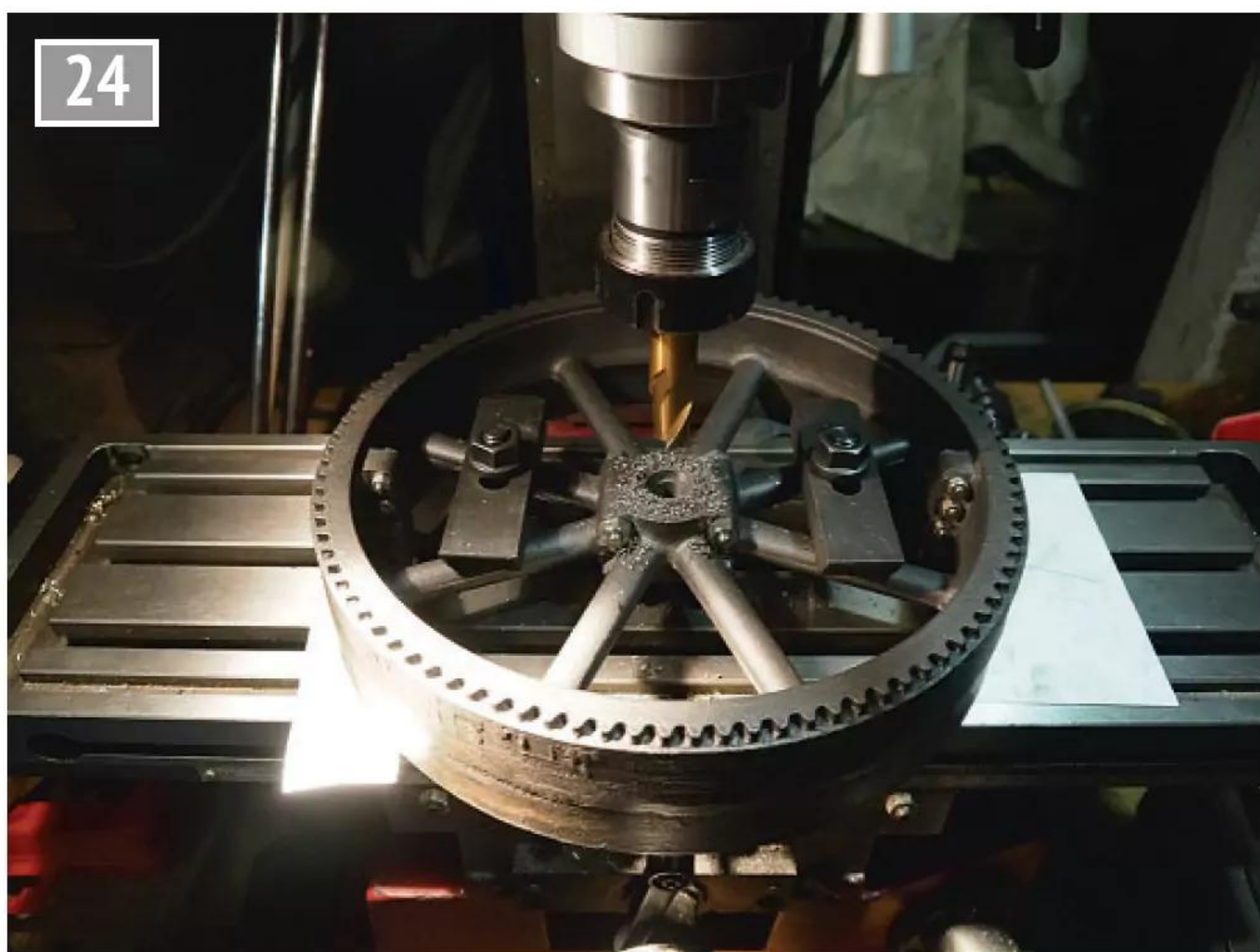
bearing surfaces for the nuts at the rim were smoothed with a file and those at the hub with the side of an end mill (**photo 23**). With the halves bolted together the bore looked rough and it wasn't going to be easy to set up in the lathe for boring using the outside surface of the flywheel for



Drilling stud holes.



Facing off nut seats.



Pre-drilling before boring for the crankshaft.

reference so I juggled it into the best position I could find under the vertical mill and cleaned up the bore with a 16mm slot drill (**photo 24**). It was then possible to use a rotating centre to locate the flywheel on the face plate to bore the hole to size (**photo 25**). With the bore a firm fit on the crankshaft, and with the practical size centres still in the crankshaft, the shaft was used between centres as a mandrel for turning the outer face and edges of the flywheel (**photo 26**). Care with alignment

was necessary as none of the castings had much machining allowance on them, possibly due to the patterns being cast from the originals (see Part 1 for some of the history of the model) and having lost some of the shrinkage allowance in the process.

At this stage everything was looking good (**photo 27**) but the fit didn't last over a break for Christmas so perhaps more caution is needed and the machining needs to be done in two stages with a month or



Using the pre-drilled hole to align the flywheel on the faceplate for boring.

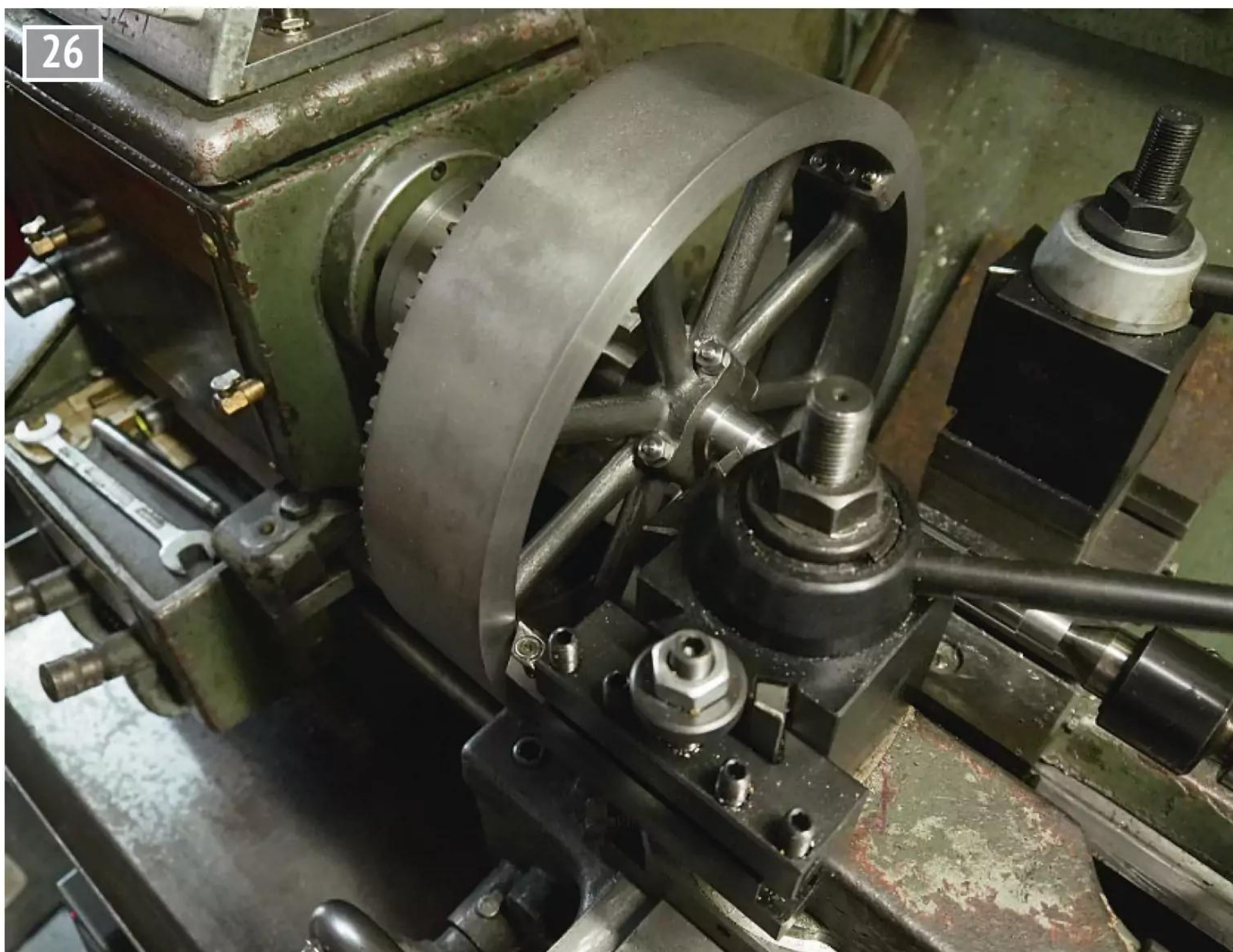
more pause to allow for the casting relaxing before final finishing?

Some of the barring teeth were not very well cast with metal in tooth spaces where it shouldn't have been. I set the flywheel up on the rotary table, worked out the alignments and angles, then re-cut the teeth to approximately the correct form (**photo 28**). This really wasn't a good idea as it took a lot of time, was stressful and didn't, in the end, produce the best teeth. A much simpler idea is to

grind out the extraneous metal with a rotary tool which should produce a similar quality effect after painting. If you want a really smart looking result, machine off the old teeth and cut and fit a new ring gear in steel.

There are sixteen rope grooves in the flywheel rim and, assuming these are for 1½ inch ropes, the full-size engine would have been about 16 x 25 = 400HP (**ref 8**). Cutting the grooves (**photo 29**) was tricky on a 260mm swing lathe. The toolpost had to be turned around and the tools (**photo 30**) held in a boring bar. The first cut was with a grooving tool, almost to full depth, followed up with a form tool ground to the drawing. Not too surprisingly chatter was a problem and, whilst the lead and Blotack visible around the boring tool shank in photo 29 did help, it was still necessary to take the machining slowly. A larger lathe would have been very handy!

The final operation was to cut the keyway (**photo 31**) to fit a piece of 1/4 x 1/8 inch key steel. I rarely use the slotting attachment on the mill, but it makes tasks like this one much easier (note the packing under the flywheel to give the tool somewhere to run into). The angle plate not only resisted lateral movement, it was set at right angles to the mill table then a square off it set the joint line in the flywheel correctly. Lacking a slotting head, the



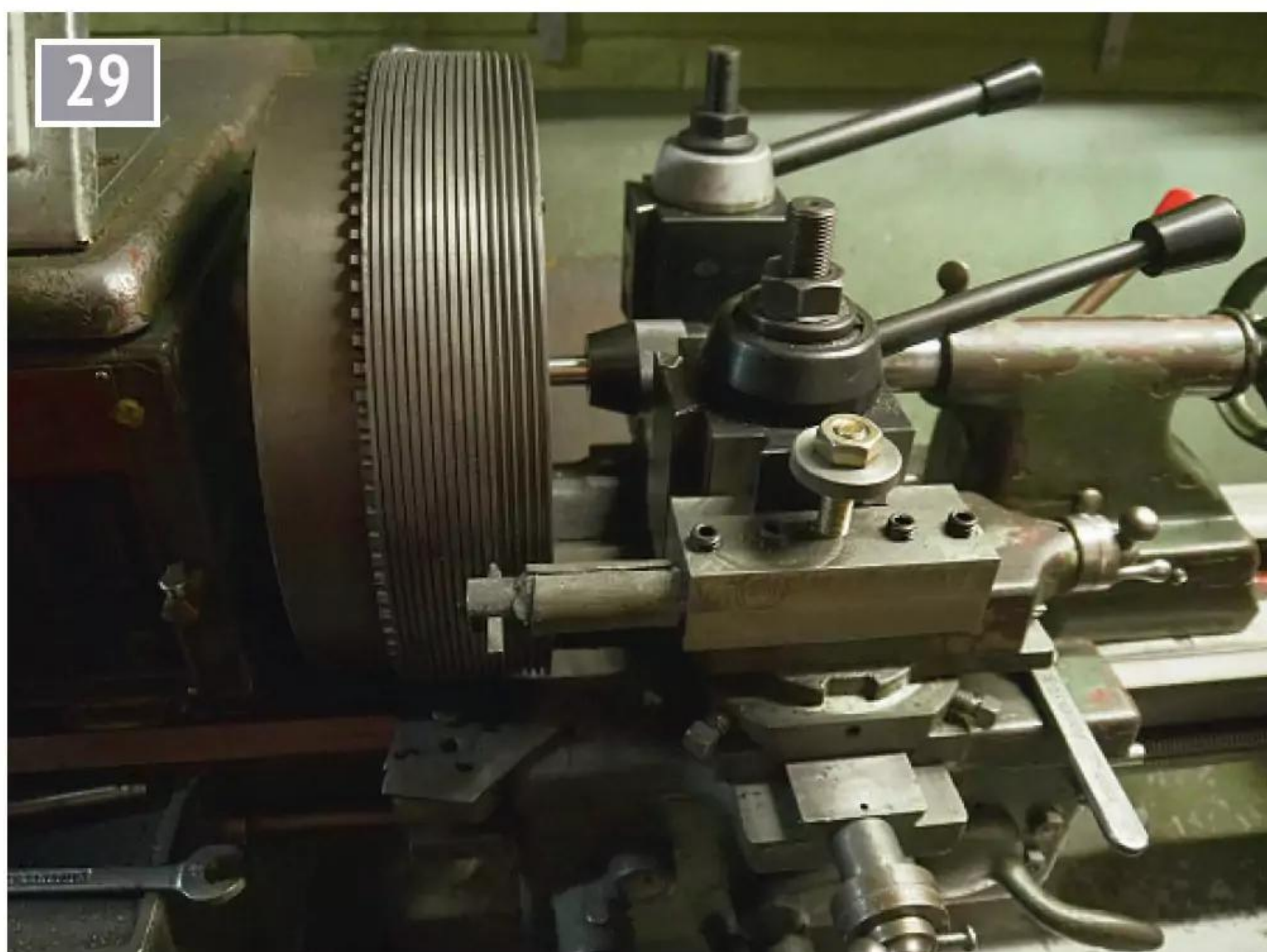
Turning the periphery and edges of the flywheel using the crankshaft as a mandrel.



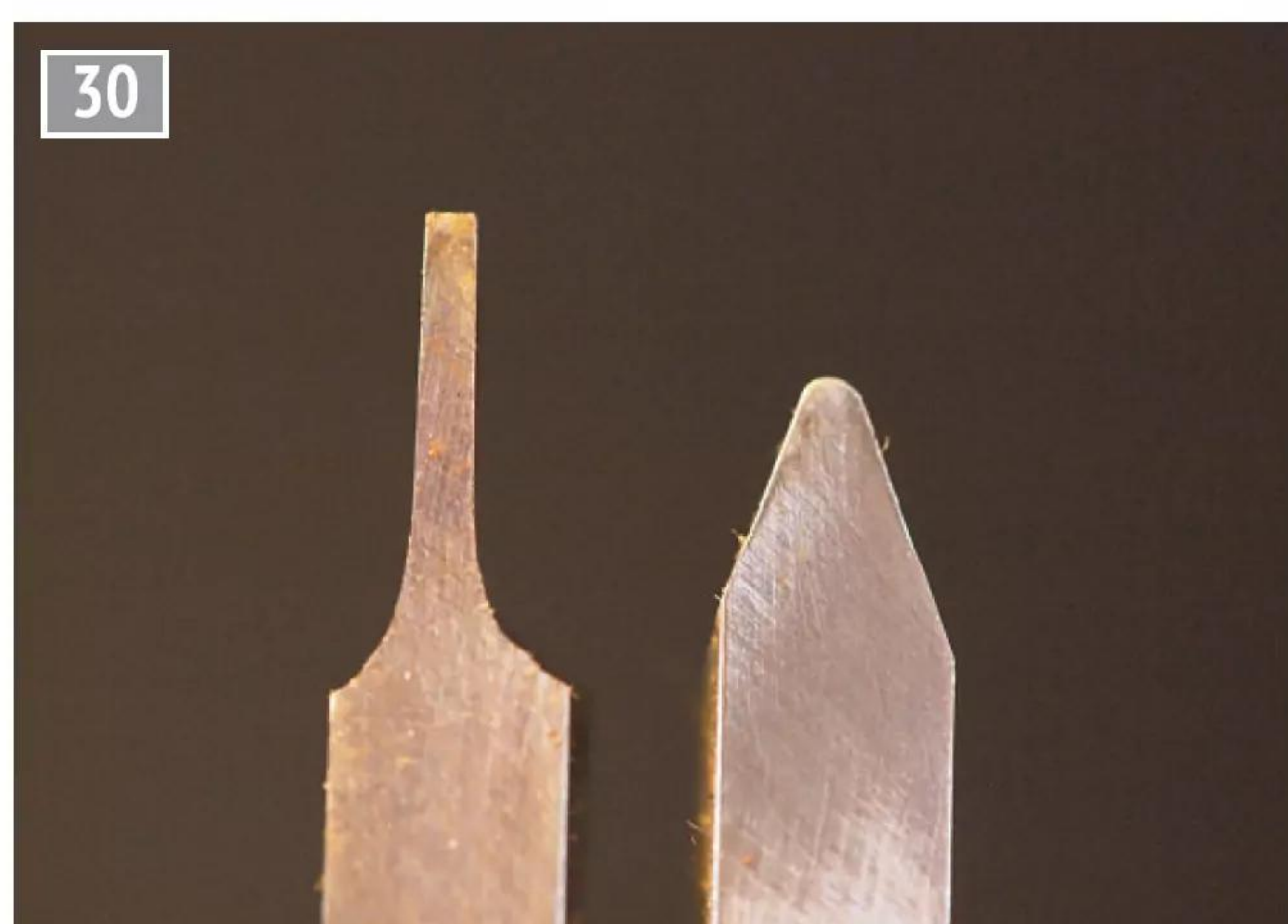
27 Crankshaft and flywheel fitting together as they should, but it didn't last.



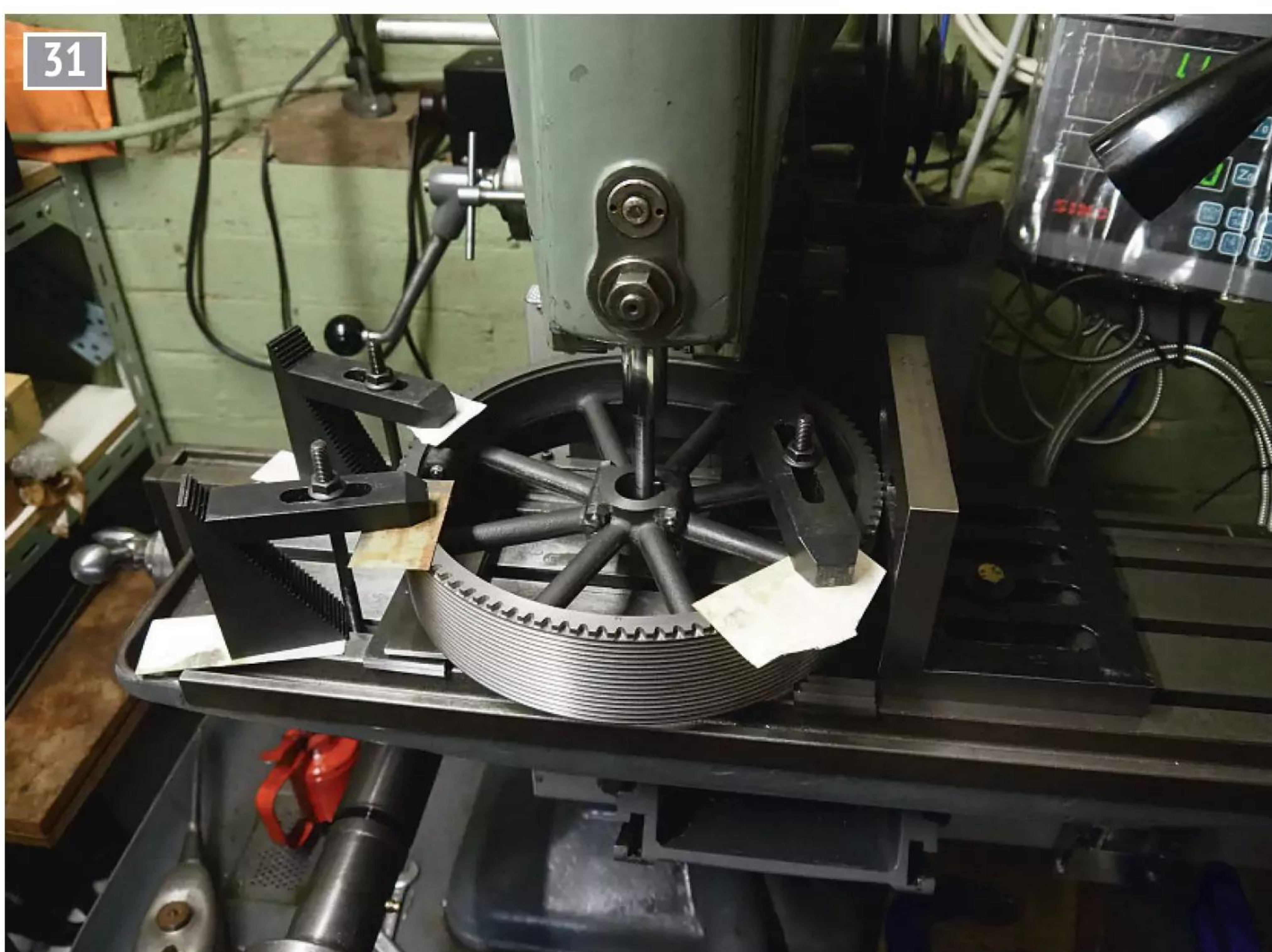
28 Re-cutting barring teeth the slow way.



29 Cutting rope grooves in the flywheel, pilot slots to the left, the final form tool in use to the right.



30 Tools for cutting the rope grooves. The grooving tool on the left is 1/32 inch wide.



31 Slotting the flywheel keyway.

flywheel could be left on the faceplate and the keyway cut by racking the apron to-and-fro. Real experts would file this out by hand but that isn't me!

● To be continued.

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Kinematics

PART 1

Rhys Owen
presents
a readers'
guide to the laws of
motion.



Displacement, velocity, acceleration and time

Engineers often wish to predict what will happen under certain circumstances and mathematics is a useful tool for making such predictions. I have known highly competent workshop engineers who were very wary of mathematics but, as I have found with machine tools, practice makes, if not perfect, at least less nervous!

This article will examine the equations of motion under constant acceleration, looking later at one of the most powerful tools in the mathematical workshop.

The equations of motion under uniform acceleration

Most people are probably happy enough with the following expression:

$$\text{Speed} = \frac{\text{Distance travelled}}{\text{Time taken}}$$

However, to treat this subject formally, we note that speed is a scalar quantity (i.e. direction is not specified) whereas velocity is a vector quantity (i.e. its definition includes direction).

We should also use the term displacement, this also being a vector quantity while distance is a scalar quantity. So, more formally:

$$\text{Velocity} = \frac{\text{Displacement}}{\text{Time}}$$

The letter 's' is used as a symbol for displacement (probably to prevent confusion with another symbol) so, in symbols the above equation is expressed like this:

$$v = \frac{s}{t}$$

So, we could define velocity as the rate of change of

displacement with respect to time.

If we travel at 100 km/hr for three hours we shall have travelled 300 kilometres. We can express this as:

$$\text{Displacement} = \text{Velocity} \times \text{Time}$$

We can get to this from the equation for velocity given above by multiplying both sides of the equation by t :

$$vt = \frac{s}{t} \times t$$

Note that on the left-hand side of this equation vt standing together means, by convention, that v is multiplied by t .

On the right-hand side, we can cancel the two t 's and turn the result round so that we get:

$$s = vt$$

This is the same as:

$$\text{Displacement} = \text{Velocity} \times \text{Time}$$

But takes up far less space!

If you were asked how long it would take to travel 200 km at a constant speed of 100 km/hr you would almost certainly say two hours. That is:

$$\text{Time} = \frac{\text{Displacement}}{\text{Velocity}}$$

We can get to this as follows:

$$s = vt$$

Divide both sides by v and turn the result round:

$$t = \frac{s}{v}$$

Should you be adept at mathematical manipulation then you could short-cut the process:

$$v = \frac{s}{t} \Rightarrow t = \frac{s}{v}$$

Where " $\Rightarrow$ " is a cabalistic sign used by mathematicians that means "implies".

Mathematics is concerned with rigour. This is perhaps a good moment to relate the story of the astronomer, the physicist and the mathematician who, during a hike in the Berwyn mountains, saw a black sheep.

The astronomer said: "All the sheep in the Berwyn mountains are black."

The physicist said: "There is a black sheep in the Berwyn mountains."

The mathematician said: "There exists in the Berwyn mountains a sheep, at least one side of which is black."

The point here is that mathematicians take nothing for granted. They also look for counterexamples that disprove general assumptions!

Acceleration

Acceleration is the rate of change of the velocity of an object with respect to time, i.e.:

$$\text{Acceleration} =$$

$$\frac{\text{Increase in velocity}}{\text{Increase in time}}$$

Using symbols this becomes:

$$a = \frac{(v - u)}{t}$$

Here the symbol u stands for the initial velocity and v stands for the final velocity after time t has elapsed.

For example, if a car starts from rest and gets to 60 miles per hour in 10 seconds then it has an average acceleration of 6 miles per hour per second. Using the above Eqn:

$$a = \frac{(60 - 0)}{10} =$$

6 miles per hour per second

This may be fine for a motoring magazine but the use of two different units of time is going to cause problems if we are doing engineering calculations.

We make our units consistent by converting miles per hour into feet per second as follows:

1 mile = 5280 feet

1 mile per hour =

5280 feet per hour

1 hour = 3600 seconds

∴ 1 mile per hour =

$$\frac{5280}{3600}$$

= 1.46666666 feet per second

Here the sign ∴ stands for 'therefore'.

So '6 miles per hour per second' is really '8.8 feet per second per second'.

For those who find Imperial units mystifying I should point out that:

12 inches = 1 foot

3 feet = 1 yard

22 yards = 1 chain

10 chains = 1 furlong

8 furlongs = 1 mile

Professional engineers in the United Kingdom almost invariably use the metric system although I once saw a Malaysian lady engineer looking with trepidation at a drawing created by the London Brighton & South Coast Railway (which became part of the Southern Railway in 1923) that featured the above units.

Curiously, highway engineers in the UK still refer to a distance along a road as a 'chainage' although the unit of measurement they use nowadays is the metre.

But we digress! Back to:

$$a = \frac{(v - u)}{t}$$

This defines acceleration as the increase in velocity divided by the time take for that increase to occur.

If we now multiply both sides of the equation by t , remove the brackets (no longer needed to indicate the priority in which we carry out operations) and turn the result around we get the following:

$$v - u = at$$

We can rearrange this to get our first equation of motion:

$$v = u + at$$

Example 1

A train travelling in a straight line at 72 km/hr accelerates for 20 seconds at an acceleration of 0.5 ms^{-2} (metres per second per second). What velocity does it reach?

Solution

The first step is to ensure that the units are consistent, so we convert 72 km/hr into ms^{-1} (metres per second) as follows:

$$72 \frac{\text{km}}{\text{hr}} =$$

72,000 metres per hour

$$= \frac{72,000}{3,600} \text{ metres per second}$$

$$= 20 \text{ms}^{-1}$$

So, $u = 20 \text{ms}^{-1}$, $a = 0.5 \text{ ms}^{-2}$ and $t = 20 \text{s}$. We now put these into the equation:

$$v = u + at$$

$$v = 20 + (0.5 \times 20)$$

$$v = 20 + 10$$

$$v = 30 \text{ms}^{-1}$$

We can see that the velocity has increased by half so, without missing a beat, we can say that the train is now travelling at $(72 \times 1\frac{1}{2}) = 108 \text{ km/hr}$.

If there is a steady, constant, acceleration then we can derive the average velocity by the following expression (the symbol u is normally used for initial velocity and the symbol v is used for final velocity):

$$\text{average Velocity} = \frac{u + v}{2}$$

We can move further forward by saying that, under constant acceleration:

Displacement =
average velocity x time

When expressed in symbols this becomes:

$$s = \frac{(u + v)}{2} t$$

We can dismantle the above expression as follows:

$$s = \frac{ut}{2} + \frac{vt}{2}$$

We can now substitute for v , using our first equation of motion, as follows:

$$s = \frac{ut}{2} + \frac{(u + at)t}{2}$$

Giving:

$$s = \frac{2ut}{2} + \frac{at^2}{2}$$

Where t^2 stands for " t multiplied by t ".

This becomes our second equation of motion:

$$s = ut + \frac{1}{2} at^2$$

Example 2

An electric multiple unit train can accelerate at 0.8 ms^{-2} (i.e. 0.8 metres per second per second, sometimes also written m/s^2). If its initial velocity is 10 ms^{-1} and it accelerates for 30 seconds at 0.8 ms^{-2} how far will it travel during this period of time?

Solution

The units are consistent so we can put the values into the our second equation of motion equation immediately. Here, $u = 10 \text{ ms}^{-1}$, $a = 0.8 \text{ ms}^{-2}$ and $t = 30$ so the expression becomes:

$$s = (10 \times 30) +$$

$$\left(\frac{1}{2} \times 0.8 \times 30^2 \right)$$

$$s = 300 + 360 = 660 \text{m}$$

So the displacement s is 660m. The train has travelled 660m during the 30 second period of acceleration.

There is a third equation of motion which we shall

derive after a short algebraic digression.

Algebraic digression

Let us look at the following algebraic identities:

$$(a + b)^2 = (a + b)(a + b)$$

$$= aa + ab + ab + bb$$

$$= a^2 + 2ab + b^2$$

i.e.

$$(a + b)^2 = a^2 + 2ab + b^2$$

And similarly:

$$(a + b)(a - b) = aa - ab + ab - bb$$

$$= a^2 - b^2$$

i.e.

$$(a + b)(a - b) = a^2 - b^2$$

We shall now use the latter – very useful – identity to derive an equation that will allow us to work out the final velocity if we know only the initial velocity, the acceleration and the displacement. We recollect that:

$$s = \frac{(u + v)}{2} t$$

By multiplying both sides by 2, dividing both sides by t , swapping sides and swinging $u + v$ around to give $v + u$ this can be rewritten as follows:

$$v + u = \frac{2s}{t}$$

Rearranging our first equation of motion we get:

$$v - u = at$$

Now for some mathematical cunning! We multiply the left-hand sides of the two equations together and also multiply their right-hand sides together, thus:

$$(v + u)(v - u) = \frac{2s}{t} \times at$$

As shown earlier, the left-hand side becomes:

$$(v + u)(v - u) = v^2 - u^2$$

On the right-hand side the t 's cancel out:

$$\frac{2s}{t} \times at = 2as$$

So that we derive the third equation of motion:

$v^2 - u^2 = 2as$

Example 3

The UK Highway Code gives typical thinking and stopping distances for different speeds (we shall assume them to be displacements and velocities) and these are shown in

table 1. What is the implied thinking time and the implied deceleration (i.e. negative acceleration)?

As before, the first thing to do is to make the units consistent by multiplying the velocities in km/hr by 1000 and then dividing by 3600 to give the velocities in metres per second (ms⁻¹). We then divide the resulting velocity by the displacement to obtain the time.

This gives us table 2.

The ms⁻¹ values are rounded recurring decimals which arise because of the division by 3600 but this is dealt with by the spreadsheet I used. In all cases, the implied thinking time is 0.675 seconds.

What is the implied deceleration?

The information we have to hand is the displacement s, the initial velocity u and the final velocity v. There is no mention of time t so we use the third equation of motion that we derived above:

In all cases the final velocity v is zero (i.e. the vehicle has come to a halt), so we get:

$-u^2 = 2as$

We now divide throughout by 2s and swap sides to get:

$a = - \frac{u^2}{2s}$

This acceleration is negative because a deceleration is a negative acceleration.

This gives us table 3.

So we can see that the implied acceleration is around - 6.5 metres per second per second, or, if you prefer, a deceleration of about minus two-thirds that of gravitational acceleration (which is 9.81 ms⁻²).

The above deceleration value and the Eqn could be used when investigating an accident. For example, suppose a police investigator finds a tyre skid mark whose length is 100m before the vehicle becomes stationary, then the calculation would go like this:

In this case v is zero, a is assumed to be -6.5 ms⁻² and s is 100m. So:

$v^2 - u^2 = 2as$

$v = 0$, so

$-u^2 = 2as$

$u^2 = - 2as$

Since a is negative (a deceleration) we can proceed without worrying about taking the square root of a negative number.

$u^2 = - 2as = -2 \times -6.5 \times 100$

$u^2 = 1300$

$u = \pm \sqrt{1300} = \pm 36.06$

In this case we are interested only in the positive square root, in other words that the velocity at the beginning of the skid was 36 ms⁻¹.

In case you are wondering about positive and negative square roots, please note that a minus quantity times a minus quantity gives a positive quantity. The square root of a positive quantity, then, has two possible values, one positive and the other negative. So, for example, when we are looking for the square root of 4 there are two possible answers, +2 and -2.

Going back to the velocity we have just derived:

$36 \text{ ms}^{-1} = 36 \times \frac{3600}{1000} =$

$129.6 \frac{\text{km}}{\text{hr}}$

Which is 81 mph (handsomely exceeding the British national speed limit of 70 mph!).

Another possible use of this equation would be to compute the length of runway required for an aeroplane to take off. The acceleration of the plane could be determined

Table 1

Speed (mph)	Speed (km/h)	Thinking distance (metres)	Stopping distance (metres)
20	32	6	6
30	48	9	14
40	64	12	24
50	80	15	38
60	96	18	55
70	112	21	75

Highway Code stopping distances.

Table 2

Velocity (km/hr)	Velocity (ms ⁻¹)	Thinking displacement (m)	Thinking time (s)
32	8.889	6	0.675
48	13.333	9	0.675
64	17.778	12	0.675
80	22.222	15	0.675
96	26.667	18	0.675
112	31.111	21	0.675

Highway Code thinking times.

Table 3

Velocity (km/hr)	Velocity (ms ⁻¹)	Stopping displacement (m)	Acceleration (ms ⁻²)
32	8.889	6	-6.6
48	13.333	14	-6.3
64	17.778	24	-6.6
80	22.222	38	-6.5
96	26.667	55	-6.5
112	31.111	75	-6.5

Highway Code decelerations.

by considering the engine thrust, the plane’s mass and the various resistances. The plane would have a known take-off velocity (this would be relative to the air rather than to the ground so that the wind velocity would need to be allowed for). Thus, v and a would be known, so the Eqn would be derived as follows:

$v^2 - u^2 = 2as$

$u = 0$, ∴

$v^2 = 2as$

$s = \frac{v^2}{2a}$

Owing to the use of the letters s, u, v, a and t, the above three equations of motion in a given direction under uniform acceleration are sometimes referred to as the SUVAT equations.

●To be continued.

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We Visit the Newport Society of Model Engineers

John Arrowsmith visits a club occupying a large riverside site in Newport.



My visit to Newport MES was the third along the South Wales coast which shows just how active all these societies are. The Newport Society is located on the Glebelands Country Park just outside the City of Newport. They have been there for quite some time and have made some real progress over the last few years. The early years of this club, however, were far from easy; a couple of tracks were built but a lot of vandalism finally forced a move to Glebelands where they are today.

The first moves to form a model engineering club in Newport started in 1946 when an advert was placed in the local newspaper, *The Argus* asking anyone interested to get in touch. Nine people showed up at a meeting arranged in the local TOC-H club room in Dock Street Newport. (For those not familiar with 'TOC-H', it was an international Christian organisation - Talbot House - which was formed during WW 1 to offer a haven; a 'quiet' meeting place for

all ranks and denominations involved in the conflict.) From this initial meeting it emerged that a number of 3½ inch gauge locomotives were being built but there was nowhere to operate them. Further time passed and the need for a running track was becoming a pressing problem but about 1949 a proposal was put to the members that a piece of land owned by a Squire Williams from Rumney in Cardiff might be available to them. It was adjacent to an old derelict church hall and the deal was that if the members of the Newport club could refurbish the hall they could use the land. Twelve months of work on the hall progressed, alongside building a new raised 3½ inch gauge track, when a lady presented herself to the group asking what they were doing to their Church Hall. Further discussions and haggling took place which resulted in the club having sole use of the building on Saturdays. The new track was subsequently finished and opened by Squire Williams.

As with many things, time passes and further developments by the local authority created a regrettable situation; a new housing development adjacent to the site proved disastrous for the club, with continued vandalism and disruption which was very disappointing, after all the hard work that had been put into the site. Eventually after a great deal of talking with the local authority in Newport, the club was offered the Tredegar Park or the Glebelands Sports Ground on which to build a new track. This proposal was accepted so the dismantling of the existing track at St. Mellons started and another new track was built in Newport. On this site can be seen the development that exists today and I hope that the club will continue to expand upon what is now a first class organisation.

Located next to the M4 motorway on one side, a main line railway on another side and the River Usk on a third side (**photo 1**) you might think it was all completely 'hemmed



Aerial view of the current Glebelands site.



One of the new self gauge widening turnouts.

in' so to speak - but no! The Newport Model Engineering Society has a very spacious feel to it and the members here have progressed the club into a great example of a successful miniature railway operated by a model engineering club.

The work they have done, and are continuing to do, is quite amazing and I was impressed by what they have achieved. It is more or less a square piece of ground totalling about five acres which they have used very well. There's a large 7¼ and 5 inch gauge ground level track running round the periphery of the site, around 600 metres in length, with an inner loop branching off to serve the main station and all the facilities needed to run a railway. All in all there is probably another 200 metres which provides a very good, long drive for any locomotive. The track is heavy weight bull head section and is fixed to plastic sleepers throughout and there are some very innovative features built into it. For example, with a large track capable of supporting heavy locomotives, curved turnouts or points can sometimes cause problems during running but here, a very clever means of automatic gauge widening on the points means that the track can accommodate almost all types of wheel formations without difficulty. If you look at **photo 2**, you can see that there are no fixed frogs on the points. This part of the mechanism is

moved by a series of cams and rods underneath the flat plate on which the rail is fixed.

I am hoping that the designer of these points will provide an article for *Model Engineer* as I am sure it will be of interest to many other clubs. Another interesting feature is that these points are electrically operated through trackside motors but if there should be a power failure at one particular location, the movement of one small trackside lever ensures full manual control of that point without any disruption to all the others (**photos 3 and 4**). These motors themselves are another interesting detail as following a series of tests, trying different types on the point, the designer found that discarded electric motors from recliner chairs had sufficient power - around the 1025 lbs mark - to move them quite easily using a 24 volt power supply. Each motor is fitted with limit switches which can be easily adjusted to suit each point movement, as each can be slightly different from the others. Each point is fitted with an indicator plate to show whether it is being manually operated or not. A series of timing tests has been thought through to ensure the operational limits of the motors does not impact their running timetable. All the metalwork for these points has been made on site by members and as chairman, Tony Hall explained, it was designed to be as simple as possible. All the associated electrical work used for the signalling system and points has been designed and built by John Abbot along with Tony Hall and they have built a really strong working facility which should keep the club going for a long time. John, in fact, built a complete duplicate at home so that he could check out the operations of switches and relays etc. before assembling them on site.

We then come to the superb signal box built by members. It is based on a GWR prototype that has an upper floor for the lever frame and signalman and a lower floor for equipment and signal spares (**photo 5**). The



The underside of one of the new points showing the cams and operating levers.



The motor attachment to the point mechanism with the indicator plate horizontal showing it is being manually operated.



The new signal box with the protective roller shutters in the working position.



The station approach view from the signal box.



A view of the main station with its splendid new roof structure.



Work on re-building the old water tank support into a ticket office.



Eddie Attree working on the new carriage shed traverser.



Substantial foundations for the new engine shed.

signalman has commanding views over all the site (**photo 6**) so that he can see exactly how operations are being conducted. A ceiling fan has also been included in the box

for periods of hot weather. When it is finally completed it will be a superb example of a railway structure.

The next phase of signalling infrastructure is currently

being planned and it is being modelled on that used by Network Rail. For each signal and point, track circuit detection will be employed and will be operated through a system of detection boxes linked to a master box which will, in turn, be controlled by a microprocessor showing the signalman exactly the positions of everything on the track. The signalman, therefore, will be virtually in charge of all track operations as soon as the box is switched on. I find it quite an extraordinary and exciting development for a model engineering club to be thinking in those terms. When you think, though, about how the modern world is advancing with A.I. handling many every-day operations now, programmes like this may encourage the

younger generations to look again at model engineering in the future, because that is what they are growing up with.

Since my last visit to the club a splendid new canopy has been fitted to the station platforms (**photo 7**) and the original brick built water tower base is being rebuilt and refurbished to become a fine new ticket office (**photo 8**). As part of their continuing development, a new carriage storage shed has been put in place and this will connect directly to the track via a front traverser and track which was being worked on during my visit (**photo 9**). I have reported before about the club's large, innovative locomotive traverser which is self-propelled and can move both locomotives and carriage stock on to the

11



The inside of the well appointed clubhouse.

12



A happy group of working day members.

main track without any lifting by operators at all. It will also service the large new engine shed currently under construction. I was told that they are planning on storing around 20 locomotives in this shed when completed (**photo 10**). The shed will be

48 feet long by 24 feet wide; indeed all the components to complete the building are on site at the moment. It will also have an additional traverser inside, along with a suitable A-frame lifting device to assist in the movement of engines within the shed. When all this

is completed it will be, I'm sure, one of the largest locomotive facilities in the model engineering world in the UK.

No club of this size would be complete without a useful club room for members to meet and congregate and the Newport club room is just that. A good

size with a kitchen area and full toilet facilities, it is well appointed with typical, familiar model engineering artefacts and photos of times gone by (**photo 11**).

The club's location does not have the benefit of mains power but that has not deterred them! A large generator facility has been constructed which provides all the power they need so that they are completely independent and self contained - which is perhaps quite a good thing as they have total control over their power usage. Of course all these developments and buildings need maintenance and the club has a good range of equipment available to enable the members to do the work. A couple of workshops are available for smaller, more detailed model making, along with a larger store and suitable equipment for any heavy duty site work, so they are very well set up to continue pressing on with the current plans. There is quite a large raised track at this club, which is not as popular as the ground level railway, but it is useful for testing etc.

It was a most interesting time spent with the members of the Newport club (**photo 12**) and I think it is remarkable that a club with only 50 or so members has achieved so much in such a relatively short time. I thoroughly enjoyed my time there and must thank chairman, Tony Hall and president, Dave Lewis along with John Abbott and Eddie Attree for all their time and for the information provided with great humour. Indeed, achievements to date, combined with the plans that are currently in hand, augur very well for the future of this club. They have a great site which is evolving very sensitively and is a great asset for the City of Newport. Thank you all - I look forward to my next visit.

ME

The Development of Motor Cycle Engineering Before WWI

PART 1

Patrick Hendra, of Eastleigh Young Engineers, takes a look at the design of early motor cycles.



I attempt to explain the very different approaches taken by the engineers behind the development of motor cars and motor cycles – strange because they started together in the evolution of their industries back in the Victorian era. In another article, we'll describe the efforts of Terry Brown and myself to restore a relic, starting with about half the pieces missing.

Why am I writing this piece? The reason goes back about 18 months to the arrival at my workshop of a heap of very rusty iron - see **photos 1** and **2** - and the restoration of an ancient Royal Enfield motorcycle. The restoration required a great deal of fascinating research into motorcycling over a century ago. It was another world and I thought you might be interested in what I found.

Some readers might ask whether the pages of *Model Engineer* are appropriate for pieces on a subject well covered elsewhere. In **ref 1** it is quite clear that cycling and motorcycling were to be included in the earliest editions of our magazine. Also, it is not as easy as one would expect to find material on the history of **motorbikes**. The history of the car is ubiquitous.

The start of motoring in the UK

The trigger point to my interest was a 'barn find' offered on eBay. My son bought it and had it delivered 'to give the old man something to do'. When



Half of a Royal Enfield.



Looks daunting.

it arrived it appeared to be a Model 201 21/4 h.p Royal Enfield two stroker of about 1924 - or, to be more correct, about half of one.

Shortly after starting the rebuild, I came across a fascinating book on the Royal

Enfield Company (**ref 2**) and found out a great deal of detail about the origin of the Model 201. I also haunted the Sammy Miller Museum at New Milton (**ref 3**) who have two examples of the beast. This, in turn, led to me investigating the

During WW1 considerable progress was made in designing and building lightweight petrol aero engines. Unfortunately, they did not benefit the motorcycle industry because aero engines became very large and are low revving machines capable of producing constant power for long periods - exactly the opposite requirements for a motorcycle engine. Airframes of the period were basically wooden.

engineering that was available to pioneers in the early part of the twentieth century.

Early motorcycles and motorcycling

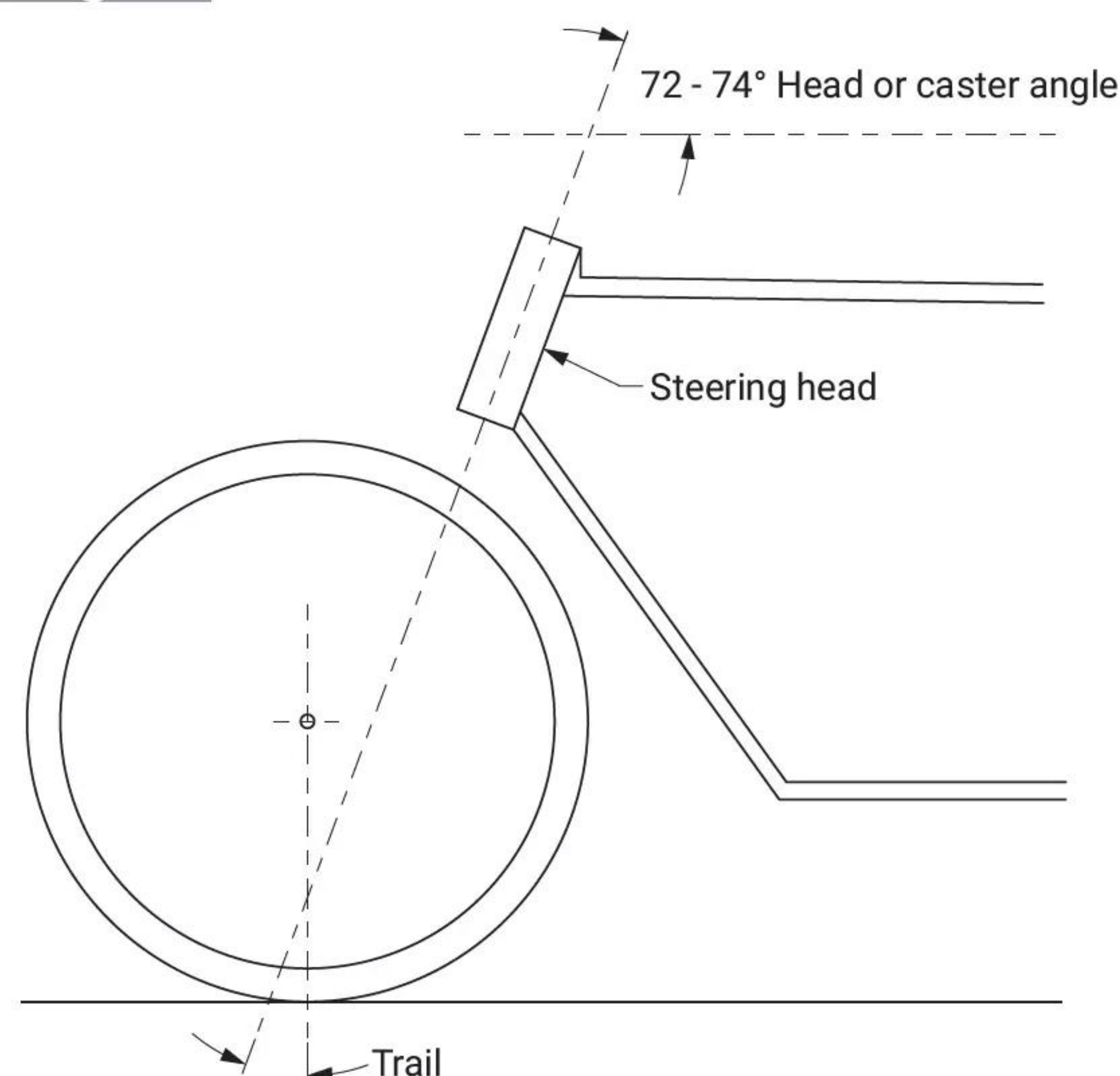
Steam powered road vehicles had appeared many years before but a 'practical' steam bike first appeared in 1867. The internal combustion engine was patented by Otto in 1876 and the 'safety' bicycle appeared four years later. The Motorwagen (**fig 1**) was

patented by Benz in 1886 and was a tricycle. Benz's car was preceded by Butler's machine which incorporated a 600cc flat twin engine and was also a tricycle but the capital to develop it was not available-- reasons are discussed below. Within a very short period people were fitting petrol motors to bicycles.

The Motorwagen is interesting for several visually significant reasons. You will see from fig 1 that the front steerable wheel has no trail (**fig 2**). All bikes do, as do all steerable vehicles such as supermarket trolleys. Trail makes steering easy, safe and is self centring. Why did Benz miss the trick? The safety bicycle was the first vehicle to incorporate trail and an inclined steering head although it was known about a little earlier. Pedal powered cycling took off in the mid 1880s. Benz would probably not have been aware of trail in 1885/6.

The Motorwagen looks unstable. With its two weatherbeaten passengers

Fig 2



Steering geometry.

perched on top, the centre of gravity is dangerously high. The machine weighs only 265 kg. The bicycle type wheels are very large and are fitted with thin solid rubber tyres. The engine is mounted with a vertical crankshaft so the drive has to run through belts and chains to drive the rear wheels through a differential. The reason is that Benz used a single cylinder engine with a huge flywheel. The chassis is based on cycle engineering - tubes joined by brazed fittings etc.

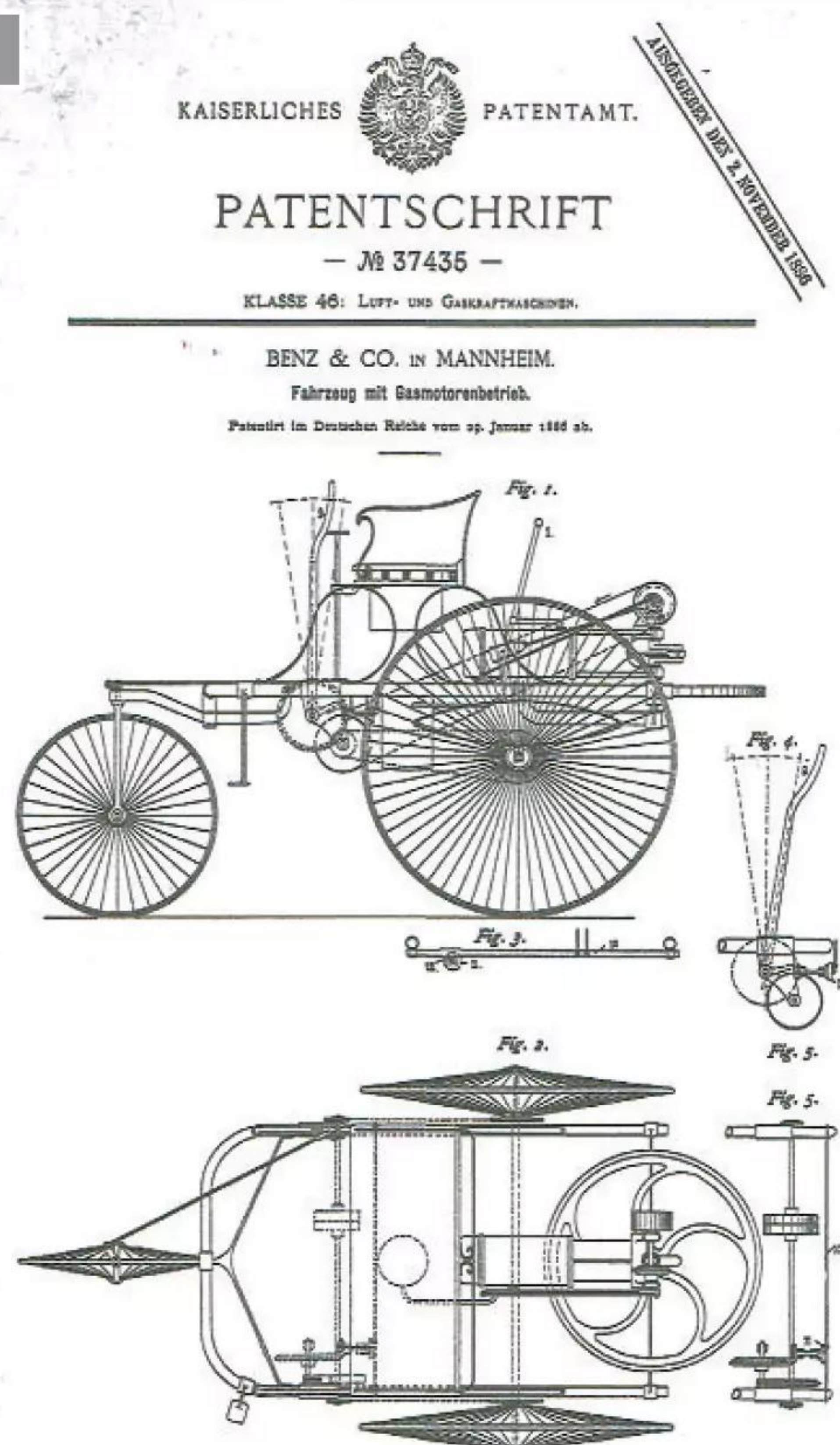
Royal Enfield was a significant bicycle maker and joined in the fun in 1899 with

motor tricycles and then, in 1901, their first motor bicycle (**photo 3**). The first British motorcycle - by Excelsior - had appeared in 1896 followed by Triumph.

Like many pioneers, Royal Enfield developed larger horseless carriages as well.

The first motorbikes were literally bicycles with a motor attached. Horseless carriages were developed from carriage designs and inevitably, from the start, were aimed at a wealthier clientele. The tricycle was based on cycle engineering and provided almost no weather protection. The motor tricycle almost died before WWI but

Fig 1

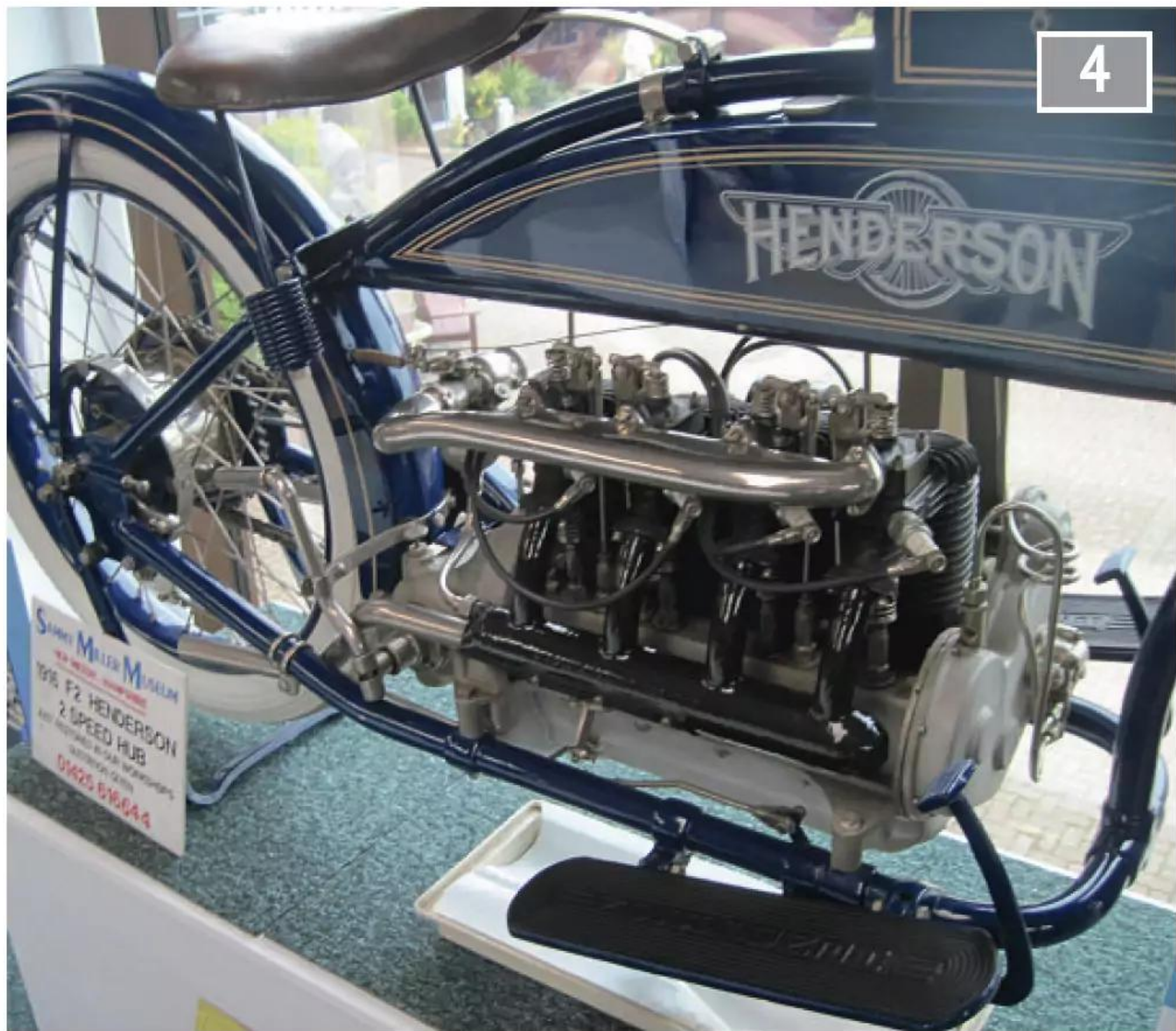


Benz Motorwagen.

3



Very early motorcycle.



American Henderson-sort of car on two wheels.



Radial engine in a bike!

Morgan kept it going as their three-wheeler, still offered new today.

This separation between cars and bikes/trikes was not inevitable. Benz produced his Motorwagen as we have seen, using classic bicycle techniques. Very quickly, potential customers with enough cash demanded a level of enclosure and comfort associated with their familiar horse drawn carriages so the rapid development of the motor car became enclosed and heavier and much more luxurious. This, in turn, led to the production of more powerful and heavier engines and shaft driven power trains

and the use of rubber tyres on heavy wooden (later steel) rims from 1895. Steam and battery/electric power plants were feasible and popular in early car engineering because weight was not too much of a problem. However, through the period up to the 1920s, several makers offered 'cycle cars' - lightweight two seaters powered by a motorcycle engine providing a modest level of comfort and some weather protection. They died away but reappeared in the 1950s. Some of us can remember the Bond three-wheeler or the various bubble cars. In fact, motor cycle design prior to WW1 was more akin to the almost

Table 1 – UK speed limits

UK Speed Limits	MPH in Town	MPH in Country	Conditions
1865	2	4	Man with red flag in front
1878	2	4	Red flag but no man
1896	14	14	
1903-1931	20	20	
1931-1933	No limit	No limit	

[Road deaths in 1931: 7305, in 2022: 1700!]

contemporaneous aircraft engineering. In both domains, light weight engines giving high power to weight ratios and tubular construction were thought at the time to be highly significant but aero engineering failed to have an impact on motorcycles (see box text.)

Most, but not all, early motorcycle makers stuck strictly to the 'pushbike plus an added motor' formula (**photos 4 and 5**). Thus, early manufacturers did as has happened recently with the electric bike.

The debates then current amongst early potential purchasers were - where should the motor be? - down low within the bicycle frame, behind the rear wheel or high up at the handlebars? The answer seems obvious to us now, but not then. This phenomenon happened again in the frugal 50s. Some of us can remember the noisy two stroke motor *behind* the bicyclist driving, and hence rapidly wearing through, the rear tyre using a roller on the crankshaft of the power unit and also the BSA Winged [rear] Wheel and other monstrosities like the Velo Solex which had its small two stroke engine mounted above the front wheel, so old (bad?) ideas never quite die.

Thus, the evolution of the motorcycle was from the earliest days totally different from the car and commercial vehicle manufacture. Firms tended to specialise and makers of both cars and motorbikes are rare today. BMW springs to mind but their factories are well

separated - by no less than 485km! Peugeot were in at the beginning making both cars and motorbikes and still are.

Cars were expensive in the late Victorian period but mass-production as developed by Henry Ford produced the Model 'T' in 1908 at a price of \$850/£188 (or £21000+ in today's money) so the motorcycle which cost £35-70 was primarily aimed at a more penny-pinched clientele. This persists to this day.

Also before WW1, and perhaps more concerning to motorists in general, was the need to cope with UK national speed limits. Crazy laws restricted motor vehicles to ridiculously low speeds to satisfy the horse and pushbike lobbies (**table 1**). Was it worth buying a car or motorcycle if you were not allowed to ride/drive legally at a reasonable speed? The disastrous effect of speed limits on development of a UK motor vehicle industry should have been obvious to everyone at the time.

The RAC Horsepower formula was another uniquely British absurdity. This 'horse power' was defined in 1910 and was not measured but calculated using:

$hp = (\text{diameter of cylinder in inches squared}) \times \text{number of cylinders} / 2.5$

It disastrously favoured long stroke engines and did not reflect engine performance. The UK Government used it for taxation and fuel rationing purposes and stuck to it until after WWII. Madness!

Another area of debate concerned power transmission.



Belt Drive. Note the 2 gallon petrol cans.

The low-performance i.c. engines of the day (frequently imported from France before WWI) were very flexible—they would happily function at 500rpm or even less. Simplicity and confidence in belt power transmission throughout steam driven industry led to a simple belt connecting the motorcycle engine crankshaft and the rear wheel (**photo 6**). A belt tensioner then provided a rudimentary clutch. Variable 'gear ratios' could be devised using interlocking cones as the driven pulley and thus providing a range of pulley diameters but were limited in range - typically 5:1 up to 3:1. Already, by 1912, engineers were developing the use of a countershaft chain driven off the engine and multi-speed transmissions - the Sturmey-Archer two and three-speed gearbox became very popular just before and, more so, after WWI. Many readers will remember push bikes of the 1950s and beyond which often sported an epicyclic hub gear from Sturmey-Archer. I had a Raleigh with a four speed version.

Why did belt drive persist? It seems that it provided a 'smoother ride'.

In 1914, the Army invited manufacturers to bid to supply motorcycles for various military uses and especially for dispatch riding. Triumph and Douglas were awarded large contracts - Douglas with their 2 3/4 h.p. horizontally opposed design supplied 48000 machines and Triumph supplied 30000. (The British Expeditionary Force had only 1200 motor vehicles including only 179 motorbikes in 1914.) Triumph bagged the publicity. Their Model H was powered by a 500cc side valve engine driving a three speed gearbox and then A BELT. How that performed in the mud of Flanders is thought provoking. The machine became the Trusty Triumph! The Americans became involved in WWI late in 1917 but brought 50000 Indians and 20000 Harley Davidsons.

How did the rider get these ancient machines to start? Belt drivers had to push, engage the transmission jump on and away you went - or try again. The performance was called the 'bump start'. Kickstarters were introduced once a free engine - **neutral** today - and a clutch appeared.

By 1919, electric starters were available on cars but they were not necessarily fitted to the cheaper machines. They only became ubiquitous on the few remaining British motorbikes in the 1970s.

And then there were the roads. What were they like before WWI? Dreadful but not necessarily better or worse than most roads in Europe. British ones were usually of 'rolled macadam'—what we would call unmade roads. The road outside my house improved from 1900-1914 but that was probably because a philanthropist bought the village and spent a fortune on it. Most rural roads had completely loose surfaces and were covered in mud when wet. Grip must have been in short supply. The road surface was also variable in the extreme because surfacing was not centralised. It seems hard to believe but macadam roads were the norm until 1902 when the idea of spraying the loose surface with tar was invented. A thin layer of tar, a coal gas product which we now know was very carcinogenic, was squirted on the surface. A mix of aggregate and tar laid and

consolidated by rolling as a top surface began to be introduced in the 1920s.

Perhaps the most dangerous surface for motorcyclists was the much dreaded wood blocks in cities. Square wooden blocks about 5 inches in width were set in tar with the grain vertical as a road surface. The idea was that the noise of passing iron rimmed wheels was much reduced - just like the coefficient of friction when wet! *I can remember these surfaces in London in the 1950s.* And there were the tram lines!

Horse manure was also another early hazard. The roads, especially in cities, were covered with a layer of horse poo! Smelly, especially in the summer, and hideous when wet because the coefficient of friction between block and tyre lubricated by a film of wet horse excrement tended to zero.

Road signs were hopelessly poor and frequently inconsistent. Road numbering did not come in until the 1930s. Stopping and asking a passer-by for directions was normal. Traffic management was rudimentary and based largely on the police controlling intersections using hand signals.

In a phrase—motoring was dangerous in the extreme. Motorcycling was lethal.

●To be continued.

REFERENCES

- Ref 1** Royal Enfield - The Early History 1851-1930, Peter Miller, FWtoC Publishing 2019.
- Ref 2** R. Fitzgerald, Model Engineer Vol. 231 498-502 and 549-556 (2023).
- Ref 3** Sammy Miller Motorcycle Museum, New Milton, Hampshire.

A BR Standard Class 4 Tender Engine

PART 3

Doug Hewson

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



Continued from p.394
M.E.4751 September 6

We can now get on with something a bit more interesting - the frame stretchers (fig 4).

Starting at the front of the engine we need a set of angles to fit inside the buffer beams (fig 5). The problem here is

that when I ordered twenty lengths of brass angle from one of the wholesalers last time, none of it was square so I had to put it all through the milling machine and some of it was only 1/32 inch thick at the outside edge, which I thought

was rubbish. Couldn't someone have checked this at the depot don't you think? - or did they think that it wouldn't matter that much! Anyway, it might be as well if you milled the outside square and then used it as 7/32 inch angle. It would certainly



Buffer beam support bracket (later type). photo: Gloucestershire and Warwickshire Railway



Another view of the support bracket. photo: Gloucestershire and Warwickshire Railway

In part 2, photos 5 to 8 were reproduced by courtesy of Toddington Standard Loco Ltd.

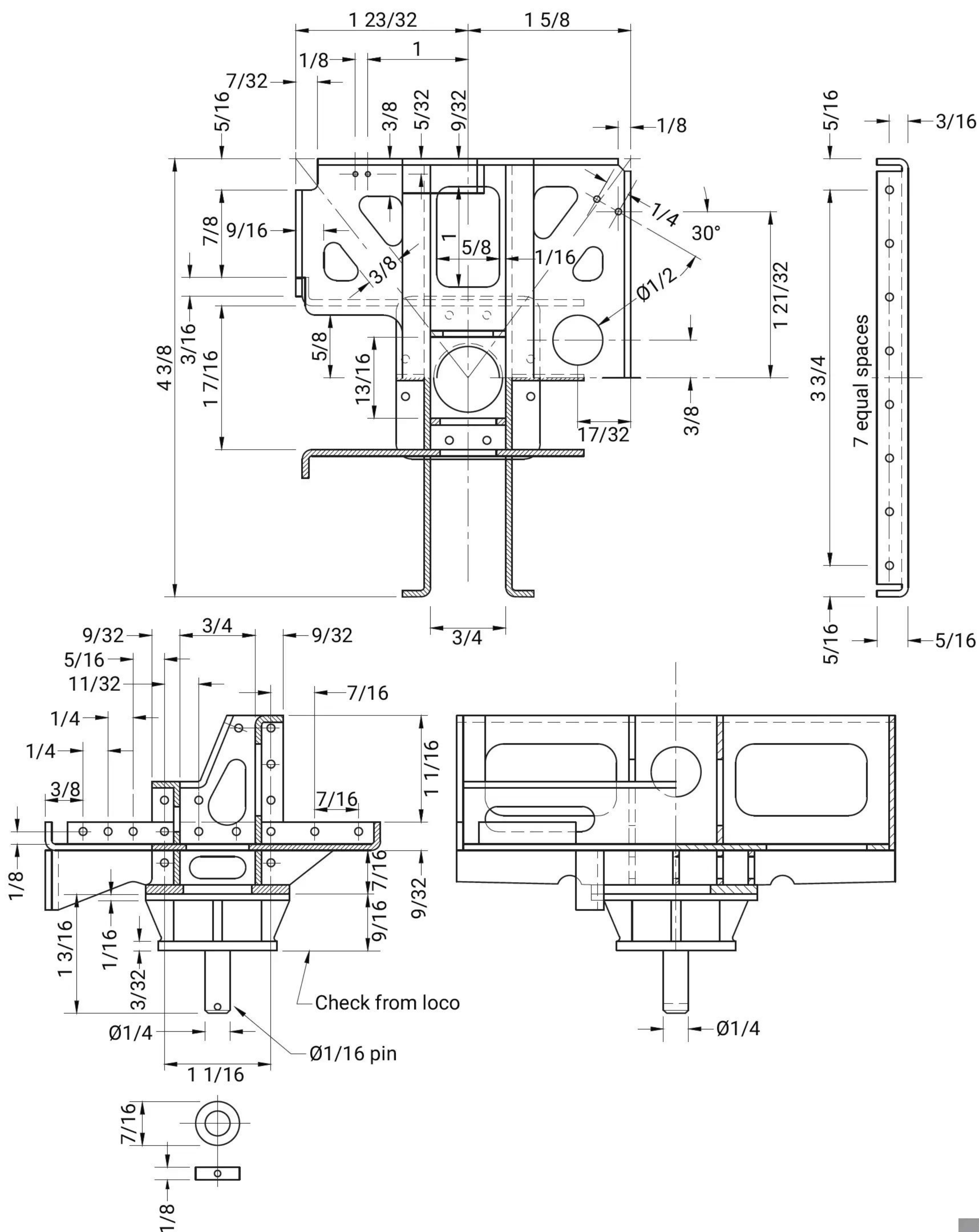


Fig 4

Stretcher No. 1.

look better for that as the actual angle scales down to about $\frac{1}{32}$ in thickness anyway.

Rant over.

The same goes for the sloping angles which support the front platform steps as they are only $2 \times 2 \times \frac{1}{4}$ inch angle.

After the buffer beam (**fig 6**) there are two channel sections

and a thick round plate. On the outside of the frame plates there are two triangular fabrications, but they are dated. I think if you look at 76017 on the Mid Hants Railway, you might see that it has two separate plates at each side but on our engine 76077 it is a one piece pressing. My works

drawing shows the earlier type. I have drawn both types so you can choose which one you want. The earlier type probably applied to the first twenty locomotives only but otherwise I have no idea when the modifications took place. The only photographs I have are for the later type of

bracket and **photo 10** shows it just having been riveted in place. **Photograph 11** shows it from a different angle but rather hidden by the rest of the steelwork in front of it.

Next, we can deal with stretcher No. 1. This is a shortened version of the one on my 4MT. However, it is



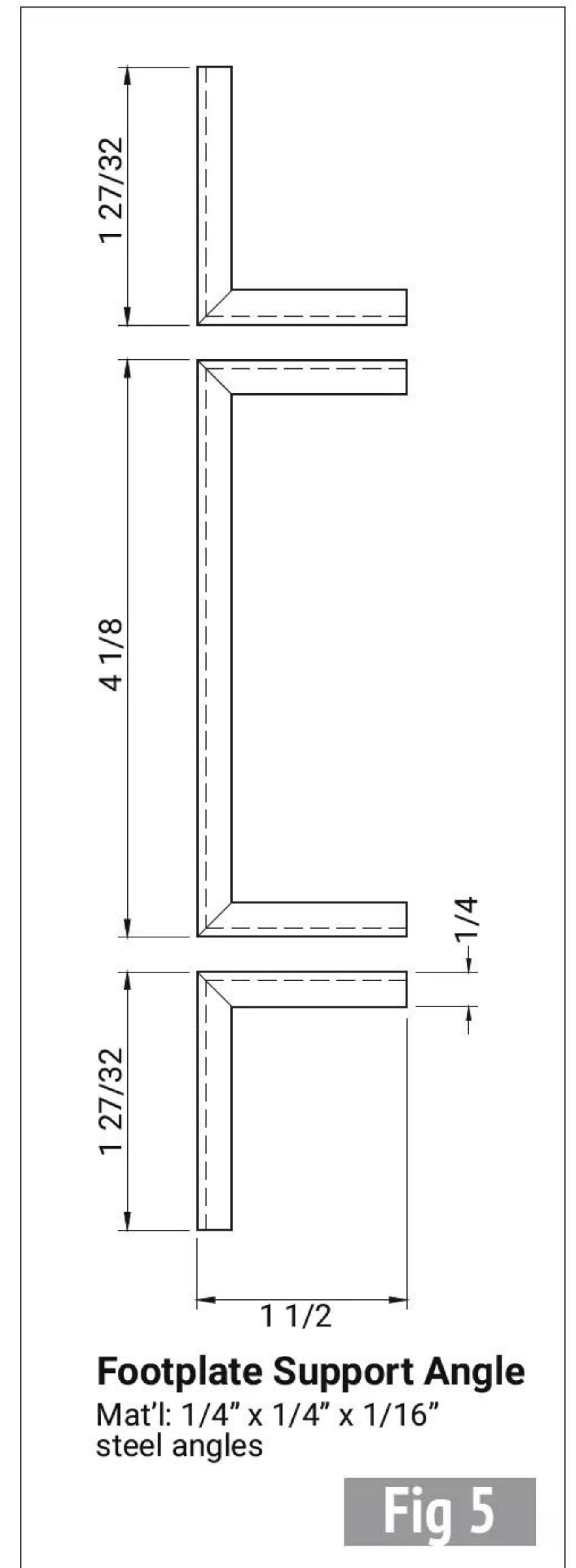
Frames – front left-hand corner. photo: Gloucestershire and Warwickshire Railway



A view of stretcher No. 1. photo: Gloucestershire and Warwickshire Railway



Pony truck pivot support. photo: Gloucestershire and Warwickshire Railway

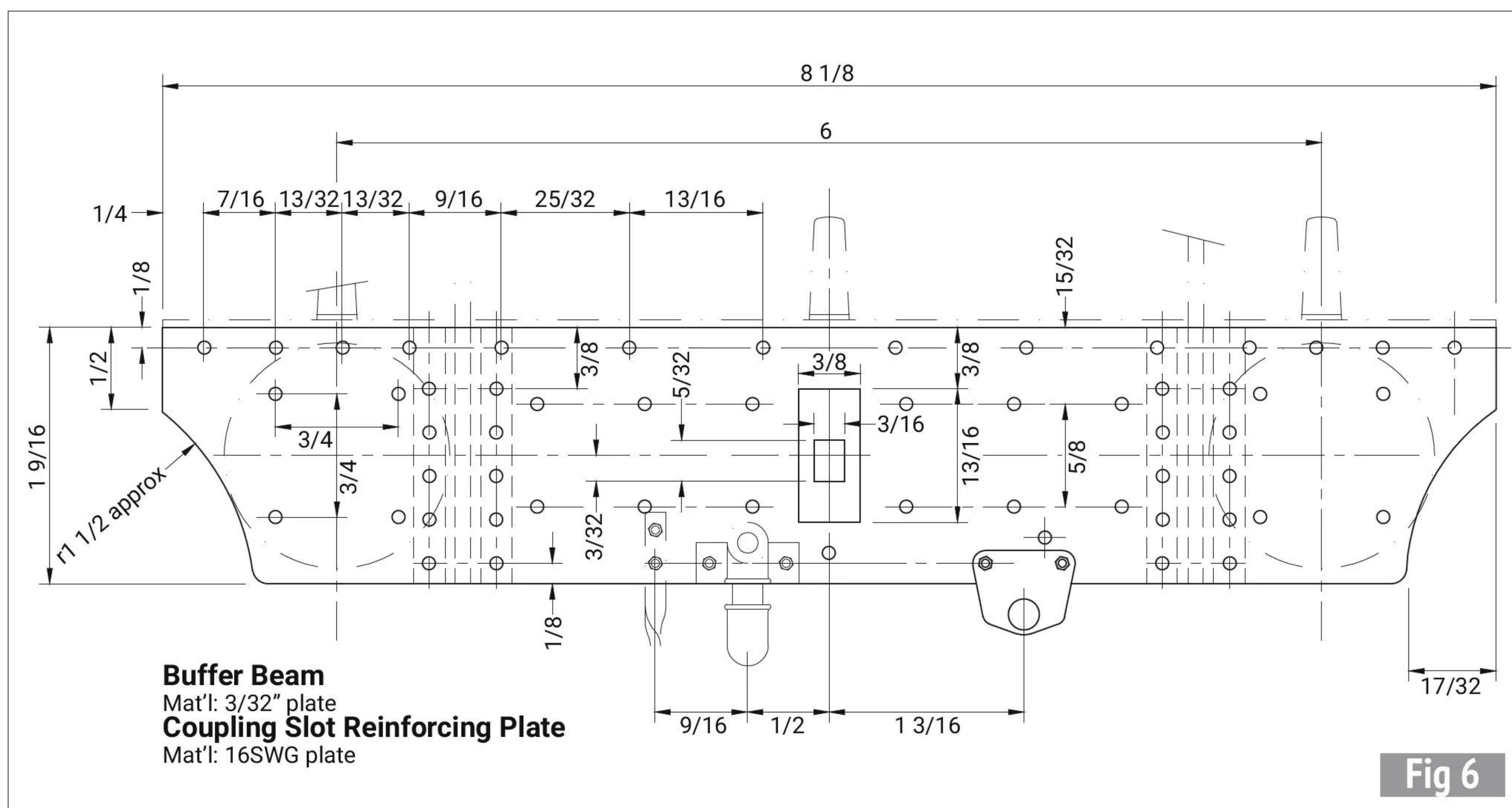


Footplate support angles.

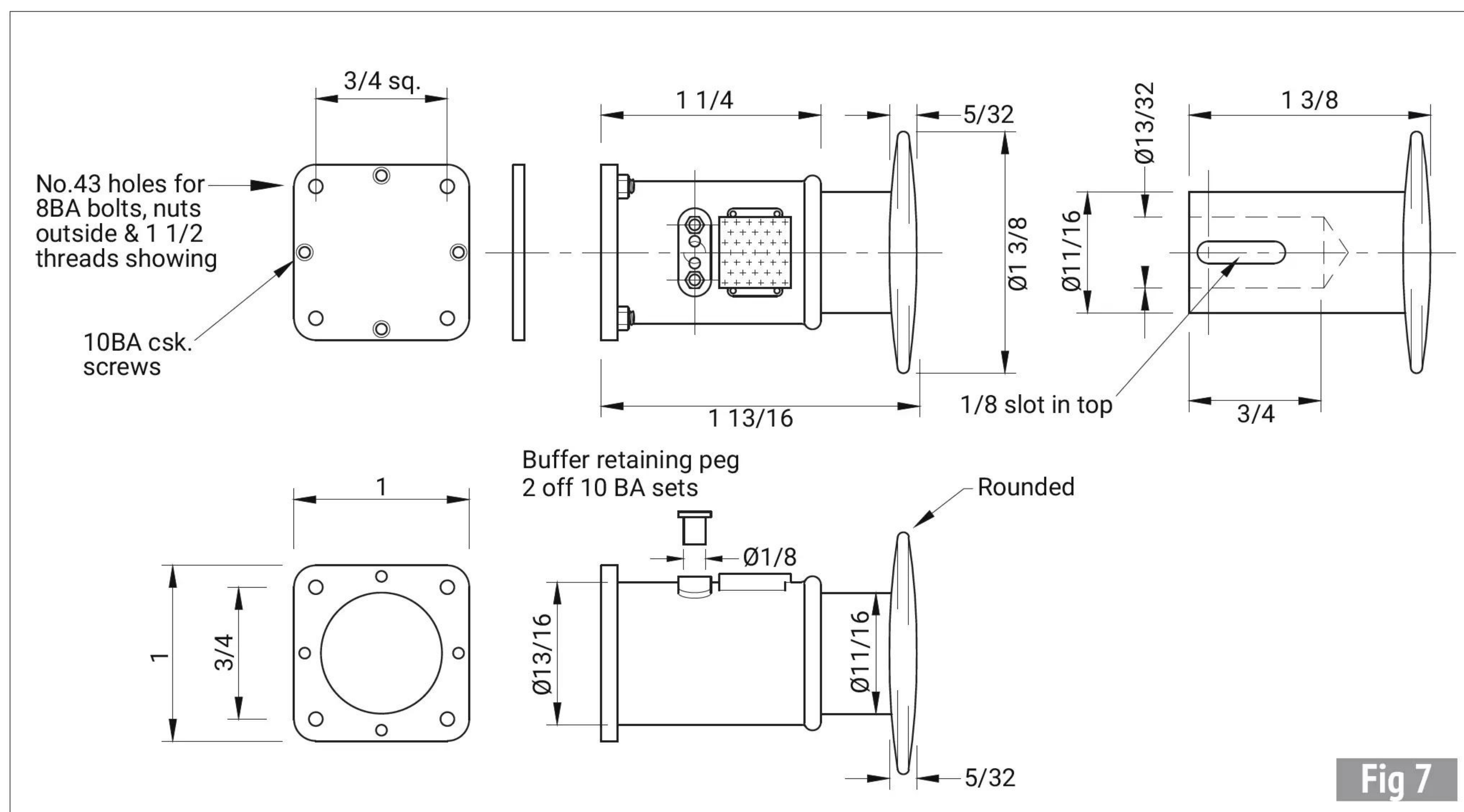
obviously closely related. With all the stretchers the width is all important and if the pressing is slightly over then please machine it so that it is dead on $4\frac{3}{8}$ inches, otherwise you may find that other things are slightly out too. The angles around the insides of the buffer beam and the frame plates can be milled from $\frac{1}{4}$ inch square BMS but if you want to use brass that will be fine. I just think that they will make a better job. You have only got to do it once!

After the buffer beam there are two pieces of channel section and on the back of those there is a substantial round plate but it does not have a spring on it. Stretcher No. 1 supports the pony truck but you may need to shave a little off the bolster to ensure that the driving wheels are all on the rails within the spring limits. It should be fine but that is where it needs adjusting if required.

Photograph 12 is the front left-hand corner of the frames and I think that you will recognise



Buffer beam.



Buffers.

this part. The plate where the buffer beam angle goes is quite obvious with its five vertical holes down the front. **Photograph 13** is also quite obvious and shows all the main platework of stretcher No. 1.

One thing I have added for this session is the pony truck

pivot support. This has had to be replaced completely so I have included a photograph of it (**photo 14**). It is shown vertically, ready to be riveted in place. This whole lot should come as part of a laser cut kit. You might also like to fit the buffers, so I have also

included the drawing for those (**fig 7**). They are BR Standard locomotive buffers as used on lots of engines such as the 08s, 31s, early 37s etc. These need some very close machining as we don't want to see any sagging buffers. Just behind the step is a small plate with a

peg on the underside to hold the buffer head in place. The springs for the buffers need to be 16 swg steel wire (and 1 1/4 inches long.) If you can press them in with your fingers they will be useless.

●To be continued.

Geoff Theasby
reports on
the latest news from the
clubs.



Roses are red, violets are blue, here is another Club News for you...

In this issue: the outburst of doggerel above was occasioned by a fit of enthusiasm, transcending my creativity. (It says here...) Rolling your own, the biggest ploughing engine ever, steam courses and driving tuition, a visit by a steel girder, a black cab in disguise.

I'm going to start this time with the dead tree newsletters in my recent letter box.

The Stephenson Link, summer, from **Chesterfield & District MES**, has a picture of an unremarkable locomotive on the front cover. What scale? is the question. Well, it is resting on its wheel flanges for one thing and is pictured indoors. Apart from that... The school that shares the site at Hady Hill with the Society helped in a fund-raising event for Ashgate Hospice. Donations reached £350 and the school raised another £2,150. Later in the month, trains were run for Peter & Paul school, entertaining 120 children and teachers, who enjoyed the day. After this, an Open Day was held, on a Bank Holiday, and queues were the order of the day despite competition from some sport or other that day, or maybe the customers were avoiding it, as in the best regulated quarters. The Society also provides miniature trains at Papplewick pumping station - always an interesting visit. The next item concerned itself with who can drive at Hady. Editor John Walker writes on the Stationary Engine evening, notable to me for Peter Nash's mystery engines. Alan Ord had made a *Lady Stephanie* beam engine, designed by Tubal Cain, published in *Engineering in Miniature* 1981. The castings are from Reeves. Pete Nixon made an Atkinson cycle engine, designed in order to circumvent Otto's four cycle patents. Stephen Baker built a small oscillating engine and complains that the Mamod fuel tablets used to fire the

boiler are becoming difficult to obtain. (Easily available from Amazon - look for 'camping stove fuel tablets'.) Pete Nash also showed a compound vertical engine, a 'barn find'. There is no documentation and it is very rusty (**photo 1**).

W. www.cdmes.co.uk

Worthing & District Society of Model Engineers' Newsletter for autumn celebrated 50 years at Field Place. Congratulations also as the Society has now been included in the local council's list of community assets. Nine years ago, a Victorian lamp post was rescued from the scrap man and restored to original condition, including the damaged etched glass panel. After exposure to the seaside air, it needed a bit of attention and this was administered by Dave Parsons and Glen Payne. W. www.worthingmodelengineers.co.uk

Raising Steam, from the **Steam Apprentice Club**, part of the NTET, reports that chairman, Nick Bosworth, has been out and about, to wit, an NTET driving course, then the

Sheffield rally, then Rempstone. The lane next to his house was looking neglected, with potholes and so on, and a friend was passing in May with his roller, so some stone was ordered and they did a spot of road rolling. From the archive is a picture of Wallis & Stevens showmans engine supplied to Wm. Cole of Yate, Glos. No W&S showman's engines or road locomotives have survived. Two traction engines photographed in the 1950s took part in a race at Appleford, at which the preservation movement was said to begin. Now, to conclude this quartet, an Aveling & Porter ZRSD ploughing engine pictured in 1911 bound for Turkey weighed 31 tons and was the largest ever built.

W. www.ntet.co.uk

Welling & District MES Aug-Sept, shows us how railways have changed, with a Brighton 'Terrier' hauling an LNWR observation coach on the Bluebell Railway. As schools no longer seem to offer practical tuition skills, industry is experiencing an acute shortage of qualified engineers. Some



Pete Nash barn find (photo courtesy of John Walker).



Finningley radio rally goodies.

model engineer clubs have organised school visits or short courses and Welling is one such. Beginning with a short talk on how steam engines work, each group was taken to an electric Intercity 125 model train and given a circuit of the track. Then the controls were explained and each student allowed to drive. This was repeated for all students and followed by a similar session with a steam driven locomotive. The school was buzzing with excitement the following day. Success! Next term, electric racing cars! Bob Underwood writes on the difficulty of finding a suitable blower (or sucker) to raise fire in a model locomotive. Motors are not really a problem, but metal impellers?? The River Cray and its mills are described in a multipart article by Roy Cornel, with Tony Riley. I found this a fascinating subject of which I knew little (papermaking). Bob Underwood then describes a fail-safe method of cross drilling a hole in a metal rod. **W.** www.wdmes.co.uk

The Open Day produced 18 locomotives according to *Steam Whistle*, the newsletter of **Sheffield & District Society of Model & Experimental Engineers**, July. There were five on the garden railway, and a steam roller. More updated transport was an unexpected Lotus Europa. SR 'Schools' Eton was a well presented locomotive brought by Phil Ashworth and Geoff Hoad from Grimsby brought his

GP40 and an interesting trailer based on a pierced steel girder. A short (5 minute) video by Mick Savage gives a taster of the event. As a change from endless pictures of mechanical devices, fascinating and brilliant as they are, here is a picture taken at Finningley radio rally 1 July (**photo 2**). See www.youtube.com/watch?v=q1ENoE0X5ic&t=130s **W.** www.sheffieldmodelengineers.com

Model & Experimental Engineers, Auckland tells us that Ross Purdey's 1/5 scale, 'Nome' engine is technically finished. Ross is creating a mounting and a wooden propeller. This engine was very advanced for 1913 and, being a rotary rather than a radial, the torque reaction of the spinning engine made it easy to turn one way in flight, but almost impossible to turn the other. Following a conversation one club night, several members were unsure how dial gauges worked. Having investigated, Michael Cryns uncovered three such gauges and found out the details. A 1/48 scale engine from 1859, *HMVS Nelson*, was made for the Australian War Memorial Museum in Canberra.

PEEMS from Pickering Experimental Engineering & Model Society, July, celebrates their success in winning the Bradford Challenge. The last item in the newsletter is this magnificent *Hot Rod*, owned by Phil May and with some parts made by Pickering members (**photo 3**).



Hot Rod, PEEMS (photo courtesy of Brian).

The Daresbury Gazette, July, from **Warrington & District Model Engineering Society** says the Steam Fair went well, except for the wet weather, which caused several drivers some difficulty when pulling a loaded train out of the station. Things learned: the helpers were somewhat overloaded on popular events, a proper rota should be introduced, the seats on guards trucks need improvement and the trucks should be numbered to assist in servicing them.

W. www.wdmes.org.uk

Adrian Banks of the **Old Locomotive Committee**, provides a comprehensive obituary for Jan Ford, a remarkable woman, of great ability and maybe a little eccentric. She was steeped in railways and drove and fired several locomotives, from *Lion* herself and *Flying Scotsman* to name but two. Jan also helped fund and run a school and

medical centre in Burma.

W. www.lionlocomotive.org.uk

I encountered a short video online, featuring an 'Imperial Viscount' custom car for wedding hire, etc. I had not heard of this make so I went digging. It is made by The Imperial Motor company and is built on London 'Black Cab' underpinnings. The company has made several of these cars, all slightly different, according to the buyer's tastes. www.theweddingcarhirepeople.co.uk/wedding-car-datasheetitem=11221&make=Imperial%20Viscount&model=1930s%20Limousine&county=&town=

Another vehicle spotted on the motorway was a Saracen. This turns out to be a Ssang Yong Musso in disguise. Another case of doubtful identity was this exhibit at SYTM. I say its an Austin 'Champ', but DVLA says its a Rover. This is a radio truck version (**photo 4**).



Radio truck at SYTM.



US tractor at Dogdyke.

Bradford Model Engineering Society's Monthly Bulletin, August, reports that the exhibition at Bradford Industrial Museum was a great success and had better weather than before. Of note was the Children's Area, close to reception, where Lego and Meccano parts were available for some freelance modelling. The clubhouse roof has been fitted with corrugated panels, which led to a conundrum. How to find the joists underneath the metal panels, which usually requires a metal detector but in this case the foil on the insulation confused it. A magnet was found to be successful but, before the job was done, the 'reefers' had to cope with the new corrugated sheets being metric and the retained old ones Imperial. In Road Vehicle News, David Jackson spotted three interesting models, a Scammell 'Scarab' 6 ton articulated truck, taking brothers Malcolm and Tony Wiese three years to build, a tethered car, using a single cylinder i/c engine, and a (thought to be) flash

steam powered sports car. Jim Jennings writes on filling a boiler with water prior to steaming. The methods used ranged from removing a safety valve to filling a can with water, piping it down to the boiler, then striking a pose with the can held high, but settled finally on the can being left in the toolbox and fitted with an electric screen washer pump. Access to the safety valve on his Crompton is difficult so he used the blow-down fitting. A continuing problem is pump failure after several steamings, which may be water getting into the motor. (I found this problem with my electric toothbrush – Geoff.)

W. www.bradfordmes.uk

'Shed Fest' was a great success, says *Shoulder to Shoulder*, July, published by the UK Mens Sheds Association. Over 500 shedders learnt much, talked and listened, met old friends and made new ones. Baroness Gillian Merron, the new Minister for Mental Health, visited, in her first ministerial visit, Sunnyside Mens Shed and the Openhouse Mind Centre, in

Tower Hamlets. The minister was suitably impressed, both with the quality of work done and the mental benefits of participating. David Barclay spent the day of the AGM manning a stand on behalf of the Warm Welcome Campaign and on the journey home was mulling over the day and the characters he met. As an example, a partially sighted man went to a Shed meeting but didn't say much. After the meeting was over, he encountered the man at a bus stop and tried to encourage him. It transpired that he had had a stroke and found speech difficult. He was persuaded to return and he began to come out of his shell. Now he is the one who welcomes new members. In another success story, a man called at a repair centre and asked if they could sew two buttons on his shirt. Sharon, of the shed, said I'll sew on one, you watch me and then you can do the second. Result! Not only have they made a new friend but the man gained a new skill. Sheds and similar organisations are

establishing contact with other similar groups like 'Talk Club', and 'At a Loss', who all have the same objective in mind.

W. www.warmwelcome.uk

Okehampton Shed built a soapbox shed - a new BBC sitcom, 'Shedites' is on the way. Menshed Kenya, Naivisha, founded in 2016, was the first in Kenya and there is already another. They have 15 members, meet three times a week, practice group farming and help each other. They have already built one house, share food, clothes and transport. Dave Purvis of Ripon Shed is an experienced coracle maker. He has run a course in coracle making and he is not the first. Several Mens sheds have already built these little craft. In 1912 two coracleers, the Morgan brothers, discovered caves in Wales that are now the Dan-yr-Ogof show caves.

W. www.ukmsa.org.uk

One of this issue's contributors has made an egregious mistake in that 'comprises of' was used whereas 'comprises' should have been the '*mot juste*'... like this: 'the team comprises of him, him and him' and it should have been 'the team comprises him, him and him'. Knowing how careful some model engineers are about the detail and getting their model 'just right', readers shouldn't object to a little gratuitous assistance. (Hear, hear! - the proofreader!) (There, there! - Ed.)

Case A1367 USAAF military tractor at Dogdyke, earlier this year (**photo 5**).

And finally, some Citroëns have rear wheel drive and some avant.

ME

CONTACT

geofftheasby@gmail.com

Club Diary

20 September 2024 – 24 October 2024

September

20 Rochdale SMEE

Auction Night. Castleton Community Centre, 19:00. See www.facebook.com/RochdaleModelEngineers

22 Cardiff MES

Open Day at Heath Park, Cardiff. Contact : secretary@cardiffmes.co.uk

22 Guildford MES

Open day – charity day, 14:00-17:00. See www.gmes.org.uk

26 Sutton MEC

Afternoon run from 13:00. Contact: Paul Harding, 0208 254 9749

28 Bromsgrove SME

Open Day – all gauges are welcomed – 5, 3½, 2½, Gauge 1 and 16mm. Contact: Doug Collins, 01527 874666. See www.bromsgrovesme.co.uk

28 Westland and Yeovil MES

Track running day 11:00. Contact : Michael Callaghan, 01935 473003

28/29 St Albans MES

Club exhibition, Townsend School, St Albans. See stalbanmes.com

29 Sutton MEC

Diamond Riding Centre Fete. Contact: Paul Harding, 0208 254 9749

October

2 Bradford MES

Meeting: 'Bits and Pieces', 19:30, St James' Church, Baildon, BD17 6HH. Contact: Russ Coppin, 07815 048999.

3 Cardiff MES

An evening with Tony Bird. Contact : secretary@cardiffmes.co.uk

3 Sutton MEC

Bits and Pieces evening 20:00. Contact: Paul Harding, 0208 254 9749

4 Rochdale SMEE

Models Competition Night. Castleton Community Centre, 19:00. See www.facebook.com/RochdaleModelEngineers

6 Bradford MES

Public Running Day. Members from 11:30, public from 13:30, whatever the weather, Northcliff. Contact: Russ Coppin, 07815 048999.

6 Guildford MES

Small Model Steam Engine Group, 14:00-17:00. See www.gmes.org.uk

10 Cardiff MES

Bring and buy. Contact : secretary@cardiffmes.co.uk

13 Cardiff MES

Open Day at Heath Park, Cardiff. Contact : secretary@cardiffmes.co.uk

13 Sutton MEC

Track Day from 13:00. Contact: Paul Harding, 0208 254 9749

17-20 Midlands Model

Engineering Exhibition Warwickshire Events Centre, See www.meridienneexhibitions.co.uk

18 Rochdale SMEE

Annual General Meeting. Castleton Community Centre, 19:00. See www.facebook.com/RochdaleModelEngineers

20 Guildford MES

Open day, 14:00-17:00. See www.gmes.org.uk

24 Sutton MEC

Afternoon run from 13:00. Contact: Paul Harding, 0208 254 9749

NEXT ISSUE

BR Standard Mogul

Doug Hewson continues his description of the Mogul's frames with a look at the smokebox saddle.

Helicopter

10-year old Freya Hempenstall, of Eastleigh Young Engineers, builds Nelly the helicopter.

Erewash 50th

John Arrowsmith joins in the 50th birthday celebrations of the Erewash Valley Model Engineering Society.

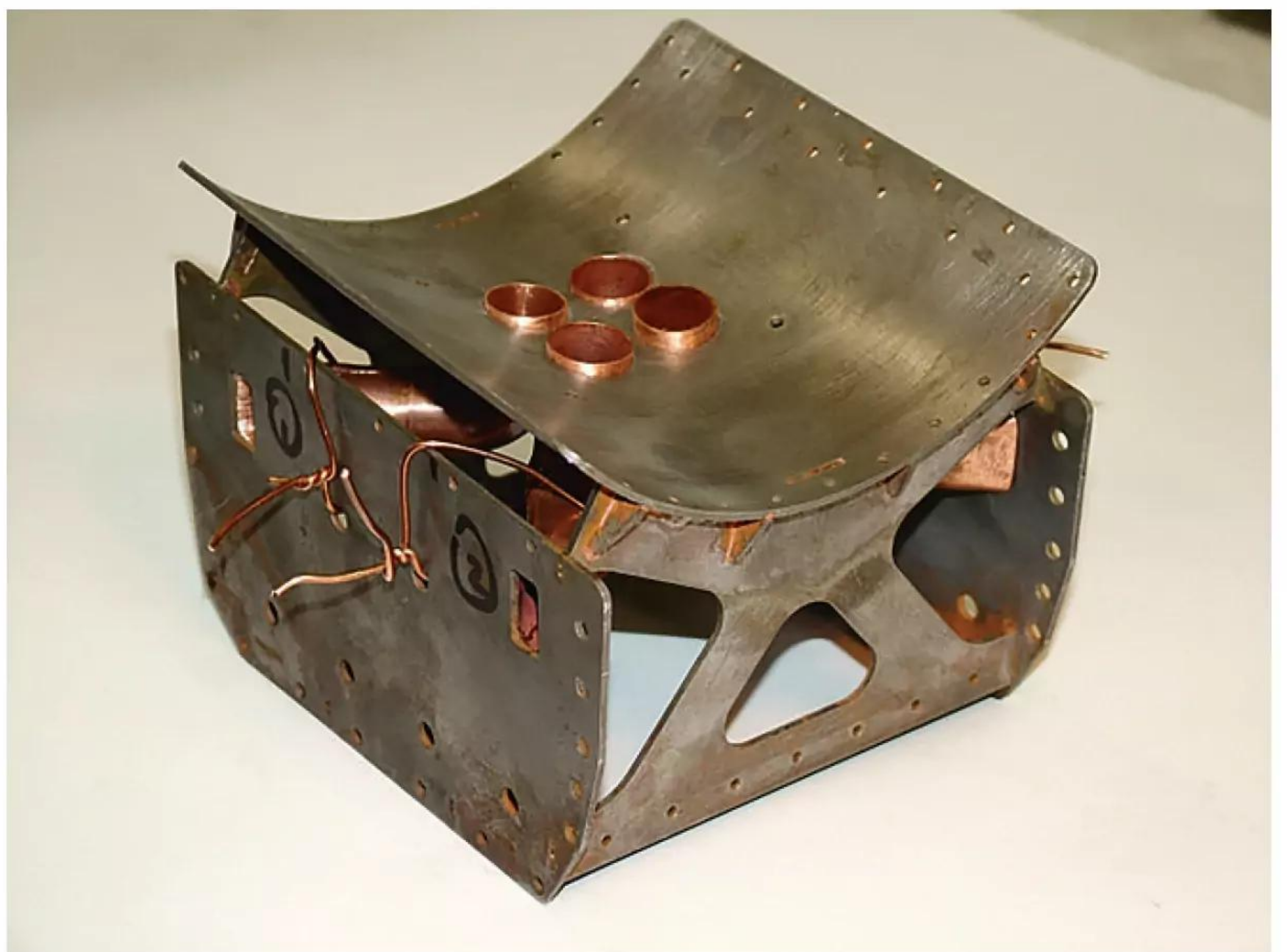
Kinematics

Rhys Owen provides a tutorial in the mathematical relationships between distance, time, velocity and acceleration.

Butterside Down

Steve Goodbody finally moves all his kit into his brand new two storey workshop.

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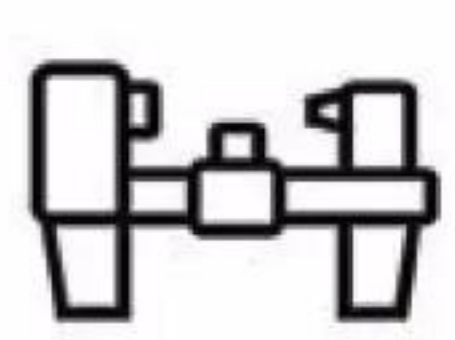
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BR STD Class 4 2-6-4T
BR STD Class 5 4-6-0
BR STD Class 7 4-6-2
BR STD Class 9 2-10-0
L.M.S Coronation Class 8 4-6-2
(Duchess)

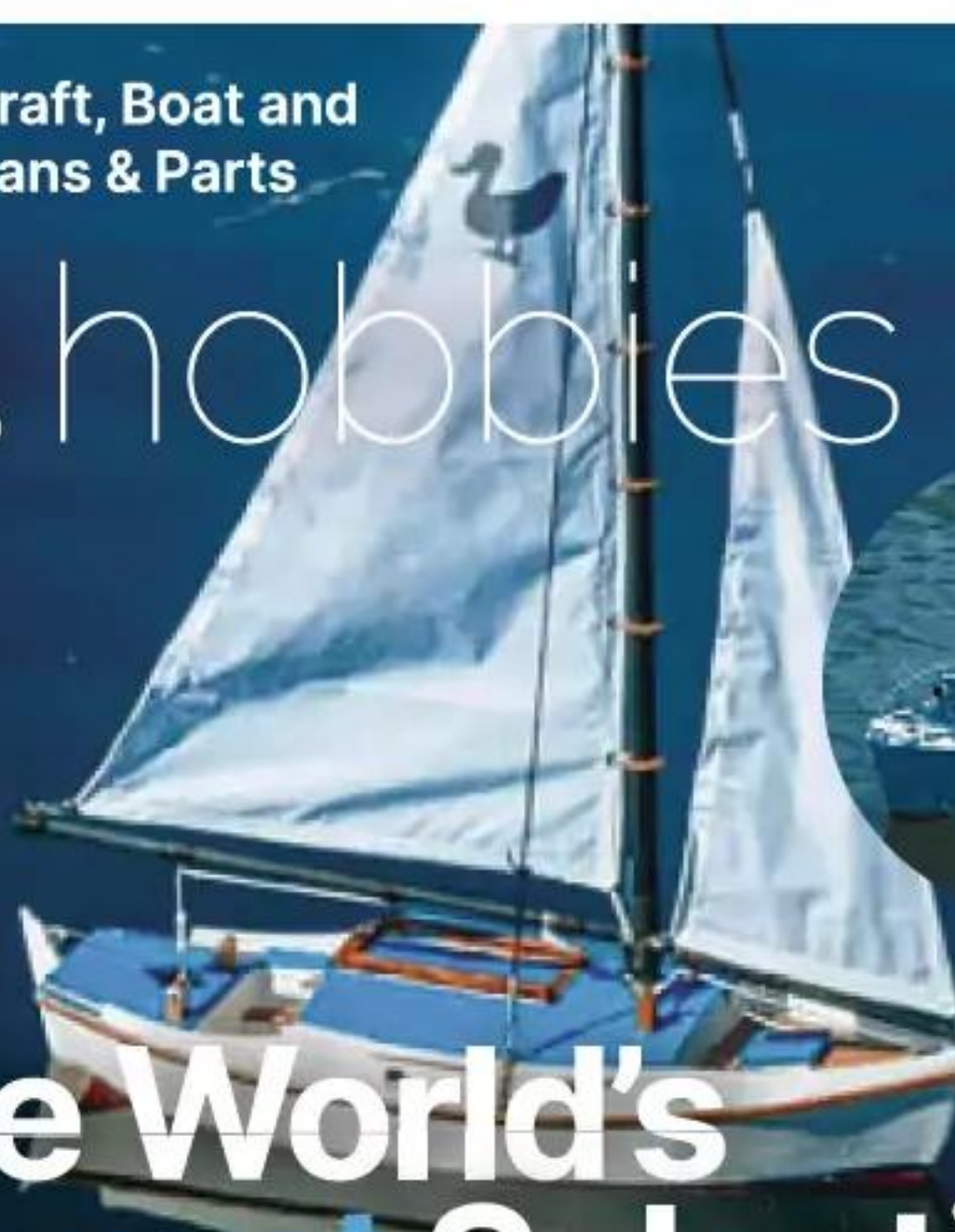
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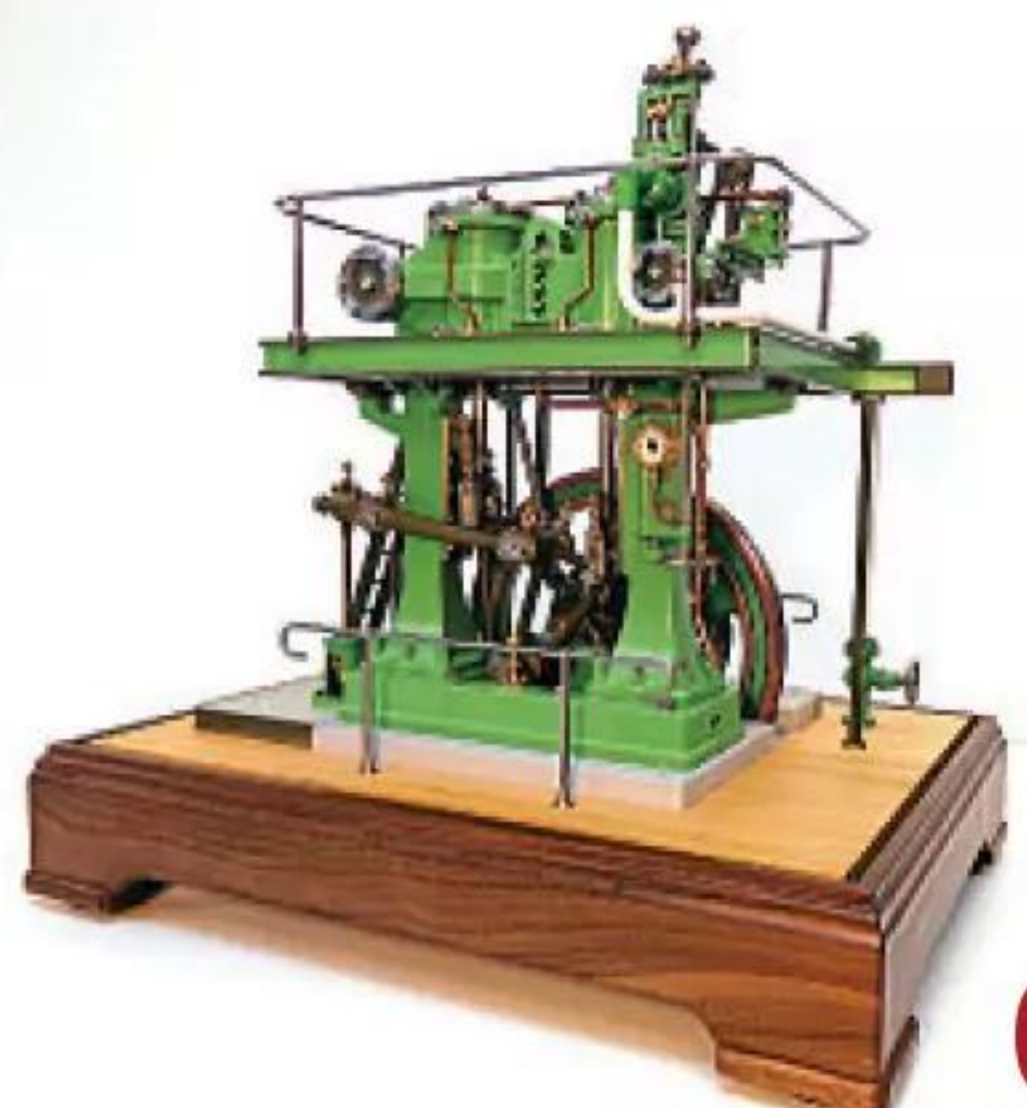

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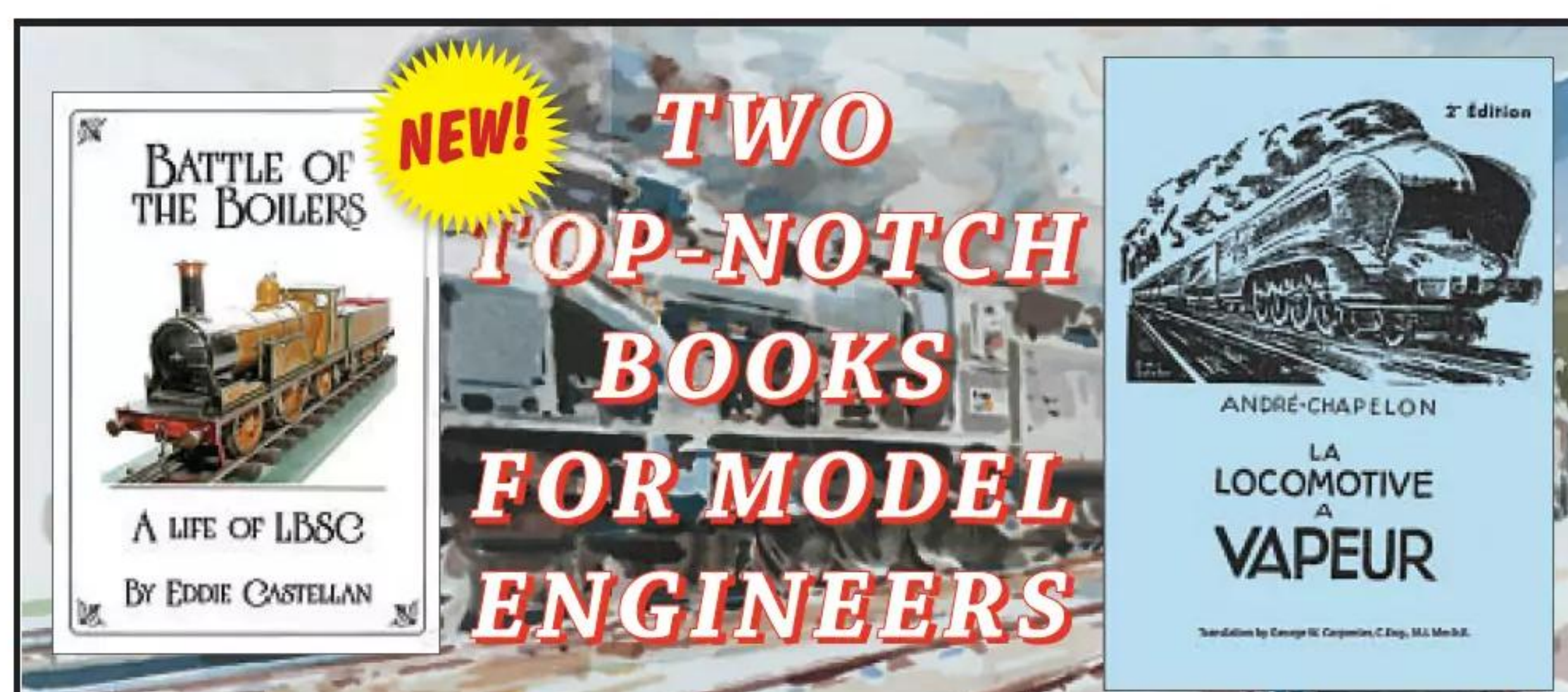
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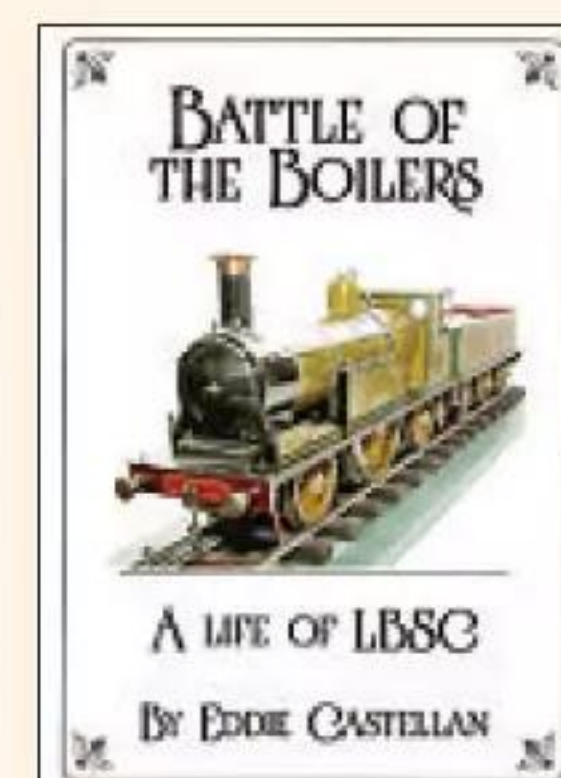
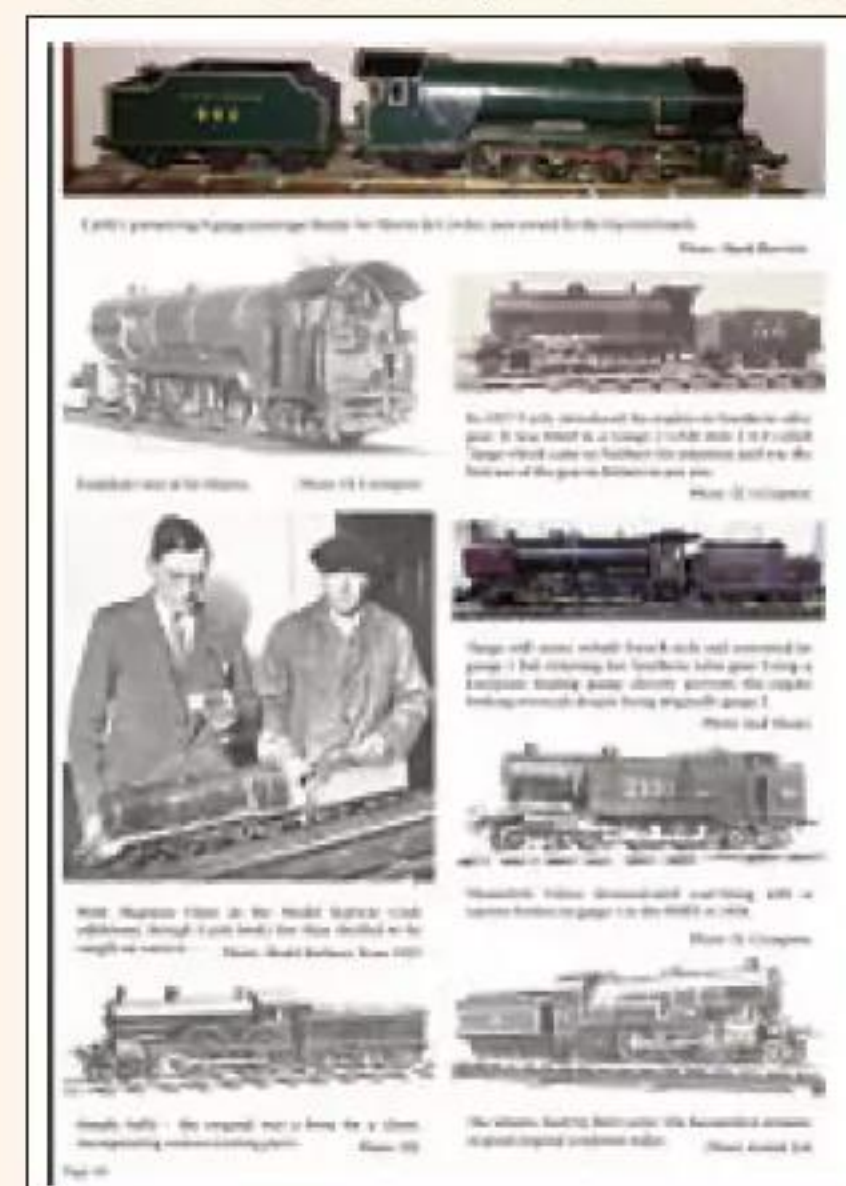


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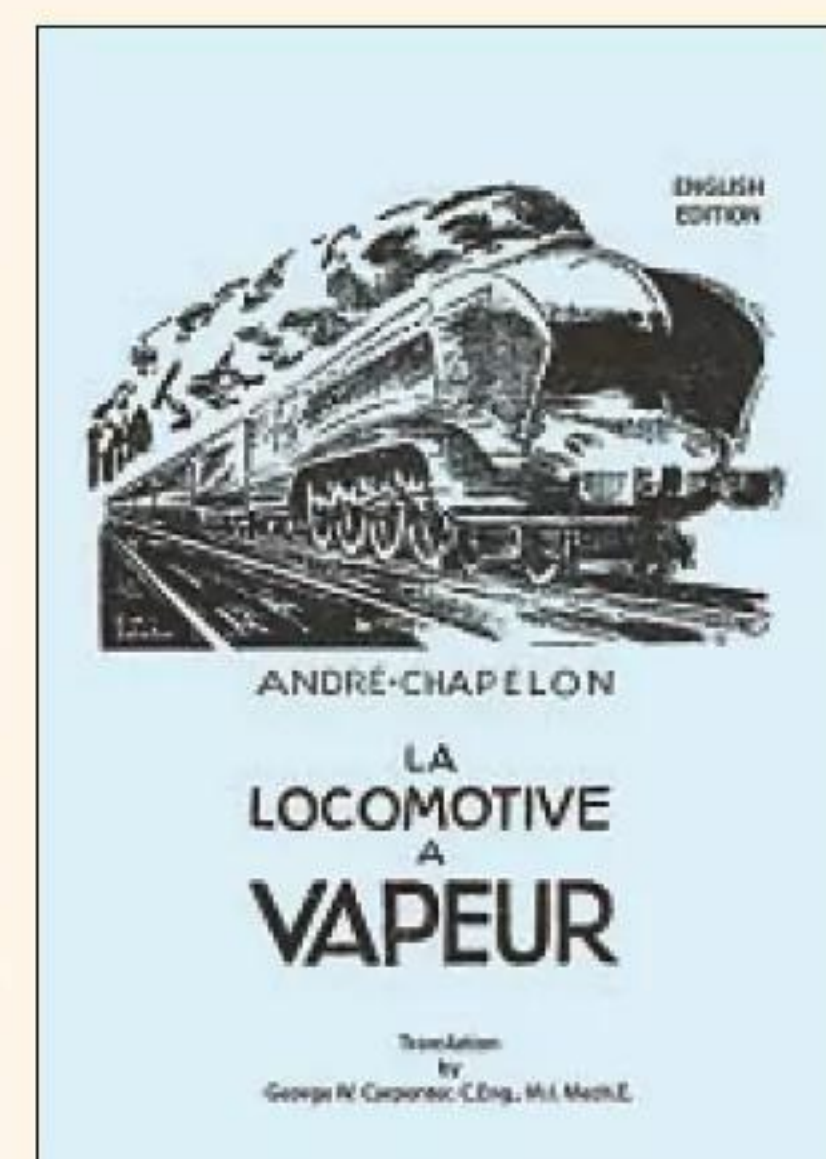


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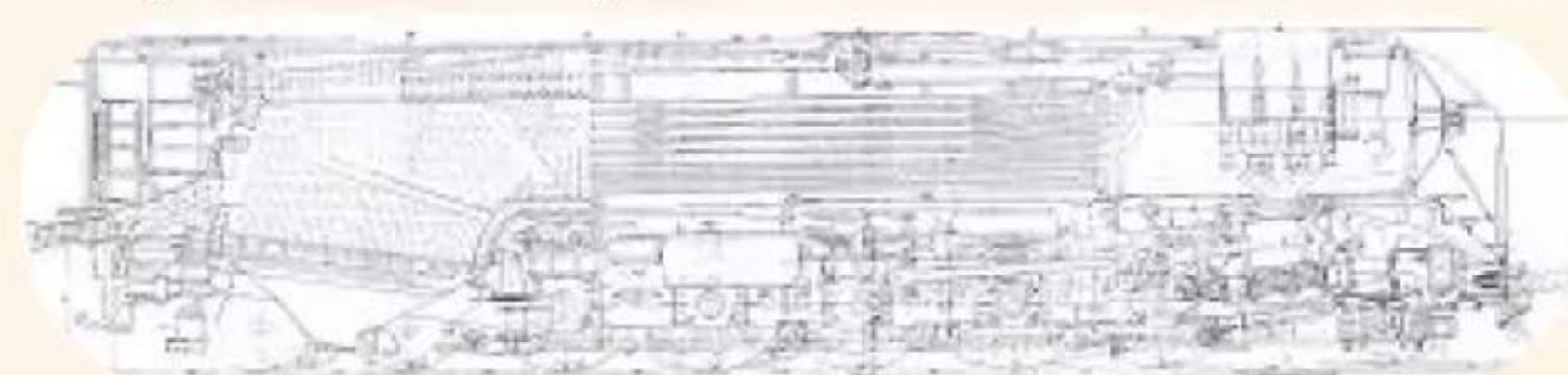
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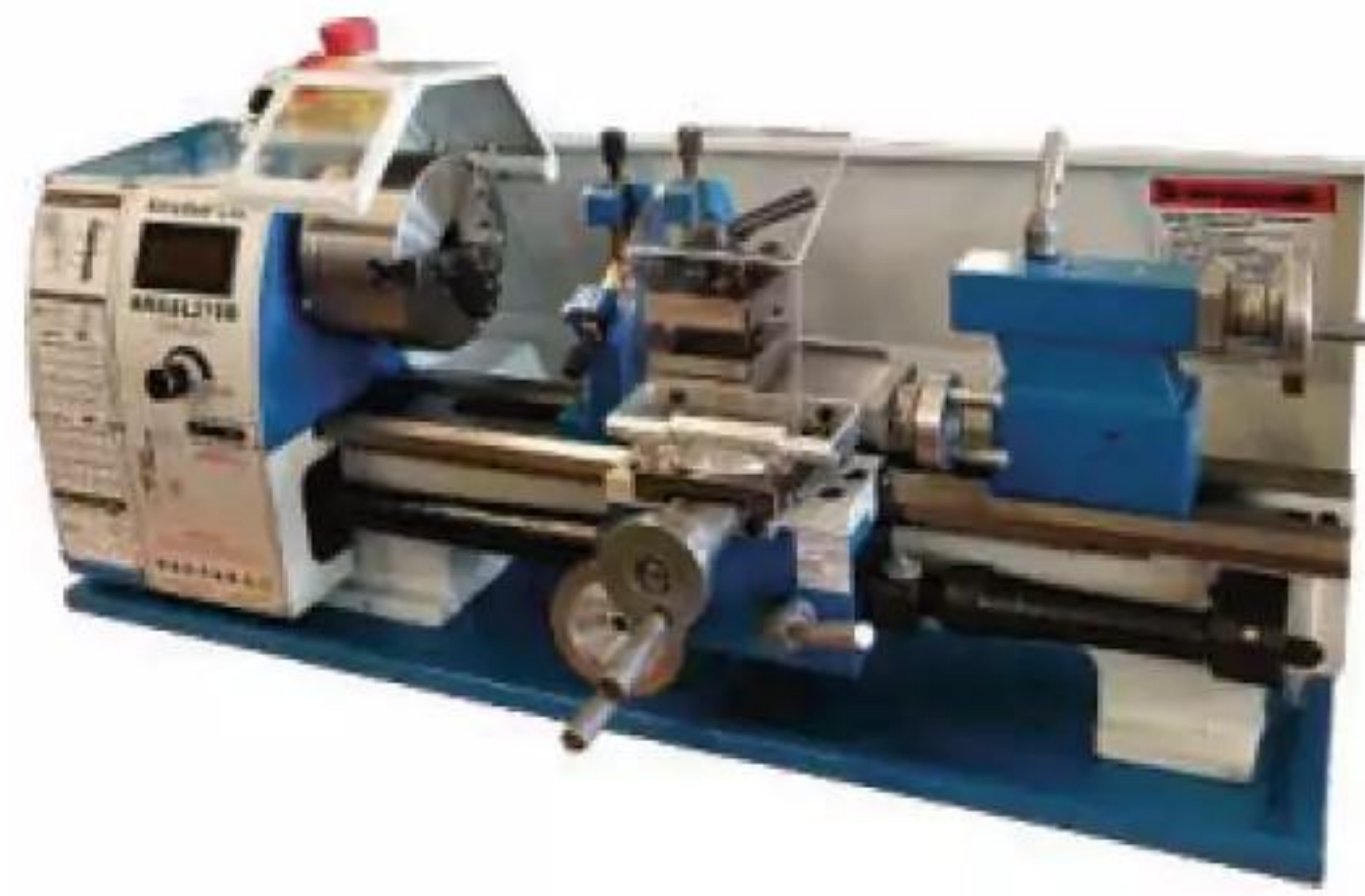


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Spindle bore: 20mm
Spindle speed: 50-2500mm
Weight: 43Kg

Price: £595



AMABL210D BRUSHLESS MOTOR 8x16- LARGE 38mm spindle bore

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Taper of spindle bore: MT5
Spindle bore: 38mm
Number of spindle speeds: Variable
Range of spindle speeds: 50~2500rpm
Weight: 65Kg

Price: £1,185



AMABL250Fx750 Lathe (10x30) Variable Speed - Power Crossfeed - Brushless Motor

SPECIFICATION:

Distance between centers: 750mm
Taper of spindle bore: MT4
Spindle bore: 26mm
Number of spindle speeds: Variable
Range of spindle speeds: 50~2500rpm
Weight: 140Kg

Price: £1,904



VM25L Milling & Drilling Machine Belt drive & Brushless Motor

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Model No: AMAVM25LV (MT3) / (R8)
Max. face milling capacity: 63mm
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T-slot size: 12mm
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Width of bed 135mm
Taper of spindle bore MT4
Spindle bore 26mm

Price: £2,555



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SPECIFICATION:

Model No: AMAVM32LV (MT3) / (R8)
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Table size: 840x210mm
T-slot size: 14mm
Weight: 240Kg

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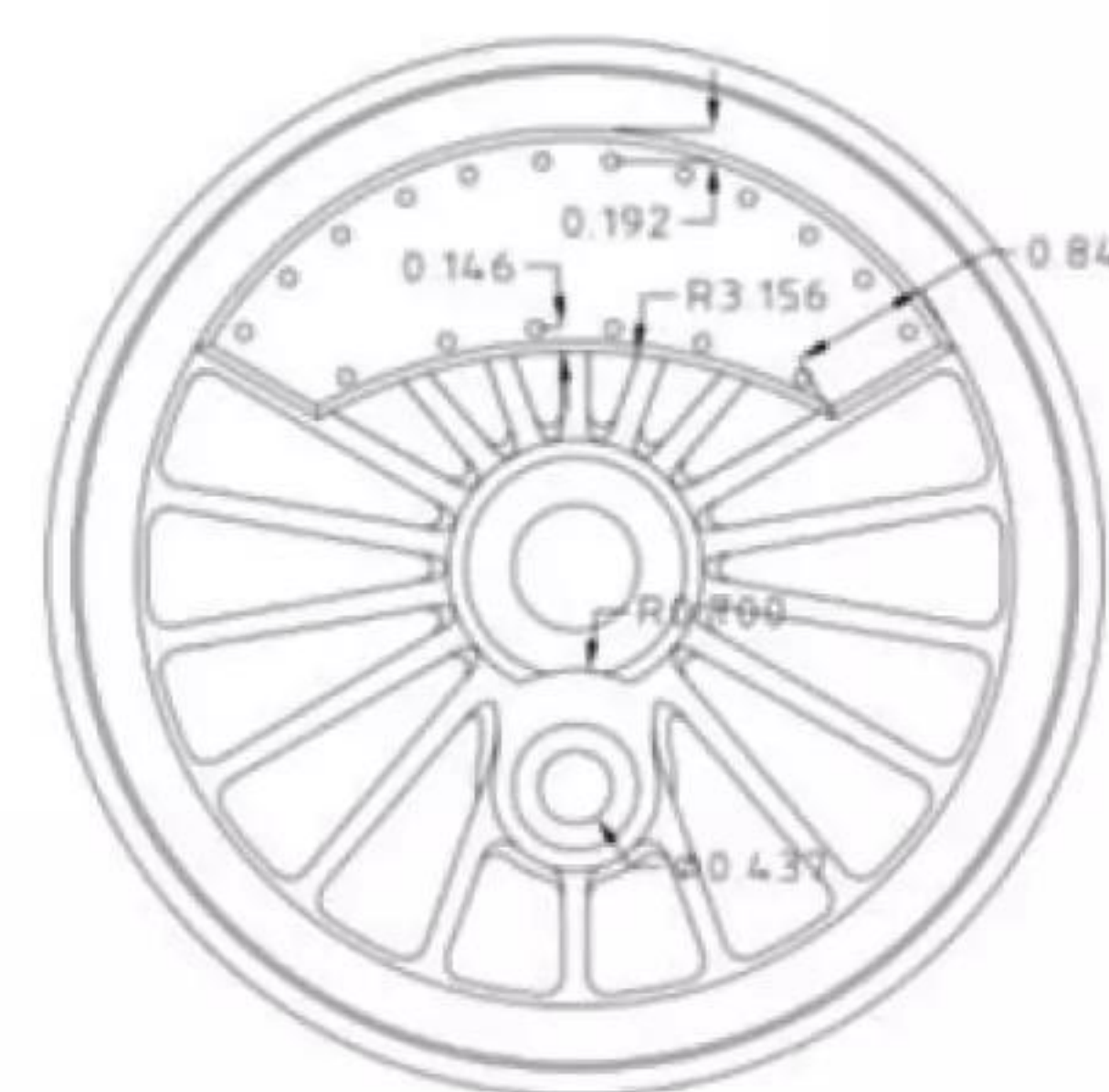


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