

THE ORIGINAL MAGAZINE FOR MODEL ENGINEERS

Vol. 229 No. 4700 • 23 September - 6 October 2022

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Grasshopper
Beginners' project

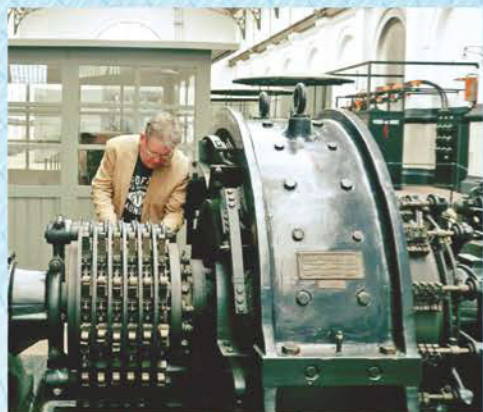
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Martin Gearing guides us through the construction of this grasshopper beam engine (photo: Martin Gearing).

This issue was published on September 23, 2022.
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The Brunels - Father and Son • Burton • £28.95

Anthony Burton has been writing on the history of transport and technology for many years, but had never written on Isambard Brunel or his father, Marc. In this book he writes on both men and their achievements, especially showing how each influenced, helped and inspired the other; in particular how Marc's example and support was there for much of Isambard's life. The broad stories are well known, but Burton adds another dimension to them, making this a thoroughly interesting, and readable double biography. 221 pages with many B&W illustrations, including photographs. Hardbound.



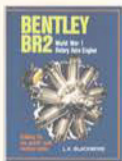
RADIO CONTROL FOR MODEL RAILWAYS - trains, cranes and automobiles • £27.80

Fancy something different to build (and one you can largely do in the house)? Giles Favell relates how he started building radio controlled commercial vehicles, cranes, cars, people, gates, fork lifts, a traction engine and other items which work very realistically on his 7mm gauge layouts. More to the point he gives instructions and guidance as to how you can also add this considerable uplift to layout realism yourself. More easily done still in Gauge 1, G scale and similar, but the author's YouTube offerings suggest he is experimenting on doing the same thing for 4mm scale! 112 A4 pages, with numerous colour photographs, drawings, wiring diagrams etc. Paperback. Totally Fascinating!



DIGITAL EDITION Building the Bentley BR2 World War I Rotary Aero Engine • £9.00

Now Out-of-Print as a physical book, Lew Blackmore's 1986 work on building the model he had won the Duke of Edinburgh Challenge Trophy with at the 1982 Model Engineer Exhibition, is now available as a Digital Edition. Modelling the BR2 makes a fascinating and challenging project for the more experienced model engineer; it is also a popular one, as the number of examples that can be seen at exhibitions evidence. The book contains full drawings, as well as a detailed description of the construction methods used by the author, with numerous B & W photos of set-ups, parts and so on. 96 pages. (Sorry, but this is not available to EU customers)



Metal Finishing Techniques • £18.90

Alex Weiss looks at the various methods of getting that 'right' finish on metal, be it for fit, or for aesthetic reasons. 10 chapters cover: Grinding, Sanding, Buffing and Polishing, Honing and Lapping, Reaming, Broaching, Burnishing and Scraping, Bare Metal Finishes (these include plainishing and peening, chasing and repoussé, engraving, knurling, oil or grease coating, other rust barriers and etching), Metal Colouring and Painting. You won't learn every last-thing on these subjects from this book but there is a huge amount of relevant information here, which any model engineer will find useful. 120 page paperback, full of B&W photos, and diagrams, plus a listing of useful contact and suppliers.



The Drummond 4in. Lathe • £ 5.05

Before the Myford ML 7 lathe sprang to prominence during the late 1940s and early 50s, the model engineer's lathe of choice for many years had been the Drummond 4", 'A' Type, Cylindrical Bed Lathe, many of which remain in use today. Intended for use by model makers and apprentices in particular, the cylindrical bed made this a very versatile machine, even when treadle powered, and many fine models were made on them. This 12 page brochure from the mid 1920s which we have reprinted is largely promotional in nature, but does include 2 pages showing machining operations, some using the unique height adjustment feature. 11 illustrations in all, photographs and drawings. Softcover.



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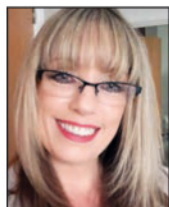
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Postbag

There are a couple of contributions to our Postbag that I'd like to draw your attention to.

The first, from George Winsall, asks whether any readers might have material to contribute to an IMLEC (International Model Locomotive Efficiency Competition) online archive which he is assembling. There are more details in his letter and the archive may be found at imlecarchive.com

The second, from Des Adeley, is an appeal for technical information, ideally a set of drawings, for the tender for a Stirling Single design marketed by W. Martin and Co. early in the last century. This is a bit of a long shot, I know, but I never cease to be surprised at what may be waiting to be discovered! Again, more details are available in Mr Adeley's letter, as well as his contact details.

Lastly, Tony Dyer wonders about the true fate of LBSC's *Ayesha*. The popular view is that she would run for two thousand years and then collapse into a pile of dust. Mr Dyer contends that this is contrary to the narrative in the book, in which *Ayesha* shrinks, when exposed to the mystic flame, into the form of a wizened monkey. That set me wondering about the fate of a steel, copper and brass *Ayesha*. Would she begin life as a 7½ inch gauge model and then shrink, progressively, until she ended up at '00' gauge?

In Memoriam – James Rizzo

Adam Harris writes with the following:

'James Rizzo died on the 17th July 2022 at his home in Malta, a country he had served over his working life in its foreign service, including a spell as Minister for Tourism. James had two great passions in life; Scouting in his younger years - he was Chief Scout of Malta at one time - and modelling Stirling

Thank you, Ma'am

Truly, this is the end of an era.

The majority of our readers, I imagine, have known no other monarch than Queen Elizabeth the Second. This is certainly true in my case, having been born just two months after her accession.

Someone (I forget who) named her 'Elizabeth the Great' and I believe that is no exaggeration. During her reign, we in the United Kingdom have lived through a time of great upheaval, from the aftermath of the Second World War, through the loss of Empire, the Cold War, radical social change and economic uncertainty. Throughout all this, our Queen has been a constant presence, the rock, as Liz Truss our new Prime Minister has said, on which modern Britain was built. She has held this nation together as few others could and earned the love and respect, on our behalf, of the rest of the world. I have no doubt that history will judge her as one of our greatest monarchs.

On top of all this, she has secured the succession for the foreseeable future, leaving us three kings who, God willing, will see us safely through to the end of the present century. We are most fortunate to have lived in the second Elizabethan era.

Rest in peace, your majesty.



engines in his later life. He was extremely resourceful and most of the engines he made came from scrap metal he found.

'All of his three sons turned out to be engineers but he was of a different breed. Just like his father before him in the wartime years, he was completely self-taught and self-made, learning everything in a cluttered workshop and never setting foot in a classroom.

'Most model engineers and proponents of the Stirling engine will have known James through his writings on hot air engines, both from articles in the model engineering press and the five books he wrote, from *Modelling Stirling and Hot Air Engines* published in 1985 to *Stirling Engine Projects*

Volume 1 published 31 years later. In all these contain nearly forty designs, the vast majority of which James had designed and built himself. His books awoke an interest in hot air engines amongst many model engineers and continue to do so. James was elected the first President of The Stirling Engine Society when it started in 1997 and was always busy answering questions whenever he was on the Society's stand at Exhibitions.

'His Christian faith was deep and helped him through his final illness. He will be much missed by those who had the pleasure of knowing him and especially by Stirling Engine enthusiasts worldwide. Our condolences go to his three sons and his wider family.'

Martin Evans can be contacted on the mobile number or email below and would be delighted to receive your contributions, in the form of items of correspondence, comment or articles.
07710-192953
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Peter Seymour-Howell

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



Continued from p.400
M.E. 4699, 9 September 2022

PART 43 – SANDBOXES (PART 1)



Painting by Diane Carney.

Flying Scotsman in 5 Inch Gauge

Having given this some thought, I decided that the next job that must be done is to make the sandboxes as these will get rather difficult to fit as the

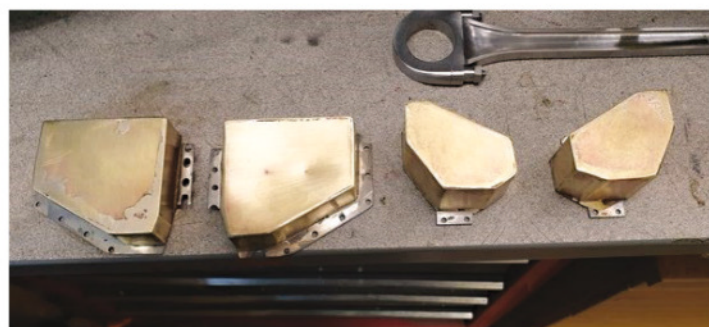
build progresses. As these are fully working sandboxes and of two types – steam and gravity – I shall need a couple of 'episodes' to describe them.

Sandbox bodies

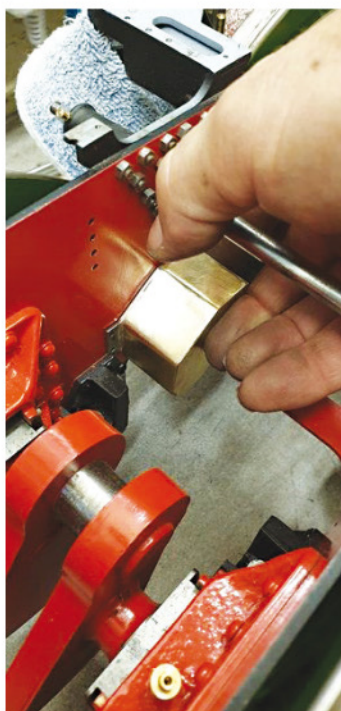
First, I cut up some wood to make dummy boxes to check for the fit and also to use as templates. These boxes were



1. Wooden template for one of the sandboxes.



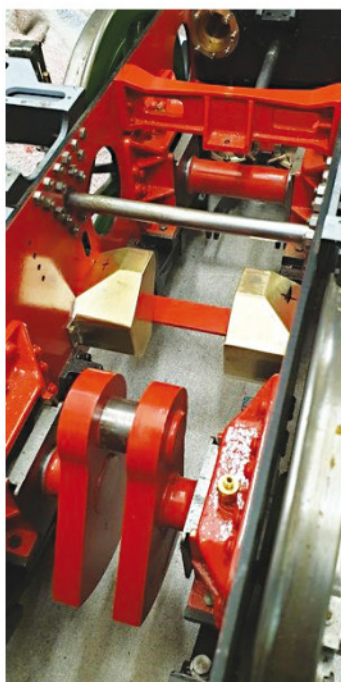
2. Here are the sandboxes, soldered to their backing plates and cleaned up – still a little 'rough and ready'.



LEFT: 3. This picture shows why I felt it necessary to make the boxes now. As can be seen, the boxes will fill a large part of the area either side of the crank and once the rod is fitted I doubt that I would be able to get to these. RIGHT: 4. This picture shows a start being made on filing the angled face to blend in with the rest of the box.



LEFT: 5. Here is the first steam box, now shaped according to the drawing. RIGHT: 6. I needed to plot the exact positions for the various holes. The ones in the bottom were just marked as in the drawing but for the top ones I decided it would be prudent to fit the boxes and check that the positions lined up with the holes that they needed to go through. Here I have temporarily bolted the right-hand gravity box in place.



7. Here are the steam sandboxes in position to check that the hole positions line up with the elongated slots. You can see the slot on one side in this picture. I now know that there is no way of fitting these boxes with the connecting rod in place.

scaled allowing for my chosen materials to fit around them.

The boxes were then made by folding up the sides of the boxes from brass sheet and



8. All four sandboxes in primer.

silver soldering them to their backing plates. The angled faces to the steam boxes were then added by cutting away the relevant part and soft soldering an oversized piece to plug the hole. I also took care of any gaps in the silver solder. The part was then filed to blend in with the rest of the box and the shaping of the boxes completed. The filler tubes were then added.

The mounting holes on the backing plates were spotted through to the frames and the

boxes secured in position. The boxes were then coated in acid primer, ready for their topcoat - black for the gravity and red for the steam boxes.

Filler lids

To do these parts I first needed to make two tools, one for the recess underneath and the other for the dish on top. For the first tool I used an old endmill, heated to red, allowed to cool naturally and then machined in the lathe. I began with a large centre drill to open

up the taper which sits inside the sandbox filler tube. Once happy with the cutting edge for the outer edge I then needed to shape the inner edges to be able to cut the cone shape that sits in the middle and allows for the dish to be machined above. I basically did this with the Dremel using a cutting disk to grind the shape trying to keep the four prongs as equal as possible. I used an oil stone to sharpen the edges and also a triangle and round needle file to finish the inner edges.



LEFT: 9. Checking the fit with the filler tube.



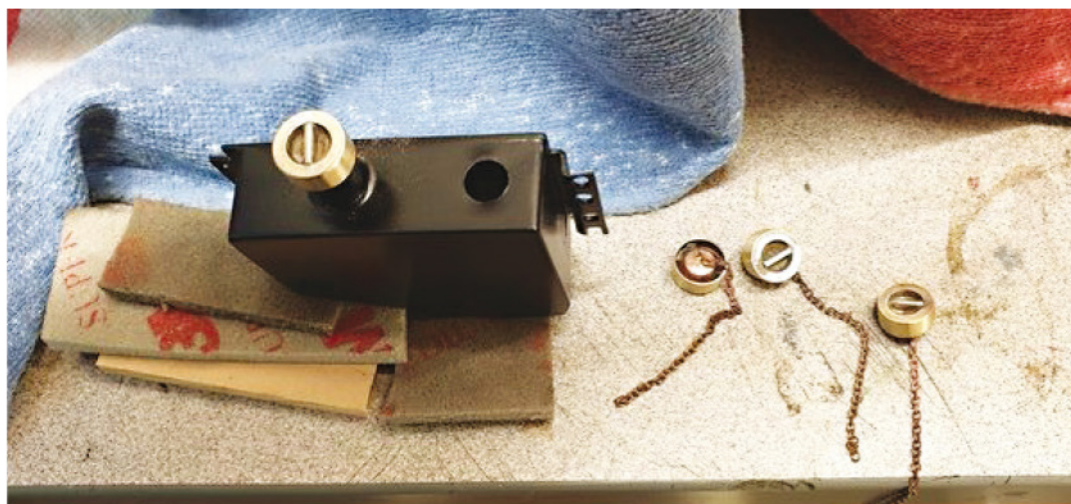
RIGHT: 10. Here's the recess tool before filing and final polishing/sharpening.



LEFT: 11. Here's the first lid recess machined. As the centre needs to be slightly recessed in the lid, before using the profiled tool I machined a slight recess with a smaller endmill. RIGHT: 12. Here is the dish being formed in the top of the filler lid.



13. Here are the five filler lids (four plus a spare), with the chain that will be used to stop them getting lost. The handles will be added later with soft solder.



14. One of the gravity sandboxes with its lid, painted in satin black to match the frames.

The second tool, for the dish on top, started life as a slot drill. The edges were angled to a taper using the belt finisher and oil stone.

The lids, once machined, were finished by soft soldering the handle in the dished top. A chain is used to secure each lid to its sandbox to prevent loss. For the gravity sandboxes, I'll fix a length of round bar to the other end of the chain and drop it into the box, which should stop it coming out easily. The steam sandboxes are not so

easy as the lids feed a long tube so I'll find another way to secure these chains. All lids have to be removable from their respective boxes as I don't think that they will fit through the holes in the running boards after being painted.

Mounting plates

The filler neck for the steam sandboxes is somewhat more involved than the short straight section on the gravity boxes. It is a press fit into a flanged plate on the top of the sandbox and curves through an aperture in the frames to a mounting plate under the

running board. The flanged plate is simply a two mounting hole type with the excess removed and filed to shape.

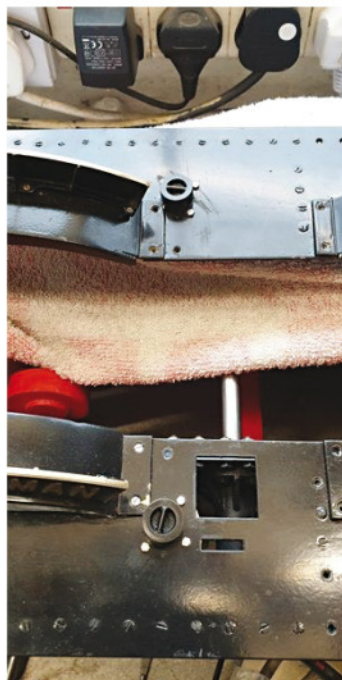
The filler neck of the mounting plate protrudes from the top and the spigot beneath accepts the filler neck. The filler neck is a press fit into both the mounting plate and the flange plate so that it can be disconnected and

15. Here is the mounting plate in the lathe to machine the cone in the top - this is where the sand enters. I ground up some tool steel and set the cross-slide to 30 degrees for machining.





LEFT: 16. It was then the turn of the underside which is tapered also at 30 degrees, this being the last turning operation, done last as I wouldn't have been able to do the top if doing this taper first. RIGHT: 17. I then drilled/tapped 10 BA the holes around the flange using the rotary table and transferred them to the running boards. I have offset the hole positions, they are mirrored both sides but not square to an axis.



LEFT: 18. Here is the filler tube pushed into the flanged plate on the sandbox. RIGHT: 19. Here's the filler tube as seen from outside. I've angled the shot so that you can see the mounting plate bolted under the running board.



removed to allow removal of the sandbox without extensive dismantling of the inside motion or for clearing of a blocked filler.

The last job for the tubes was to fix a retaining hook to secure the lid chain. To do this I cut a small slot in the lip and soft soldered some fine brass wire in the slot reaching about halfway into the tube. Once cooled this was cleaned up with the protruding part of the wire filed flush with the outside of the tube. The wire was then bent to secure the chain.

Sand traps

The steam sandbox sand traps are in three parts; two body parts which need silver soldering together and the shield which bolts on.

I'm pretty confident to say that no way could anyone build this by Don's 'words and music' alone unless they were familiar with the parts concerned. The eureka moment occurred when I found an image for the sand trap off 'Patriot' when everything clicked into place.



20. The sand trap from 'Patriot' which made sense of everything.



21. Here we have the main parts for the two sand traps. Still to do on this part is the four holes around the flange to bolt to the bottom of the steam sandbox.

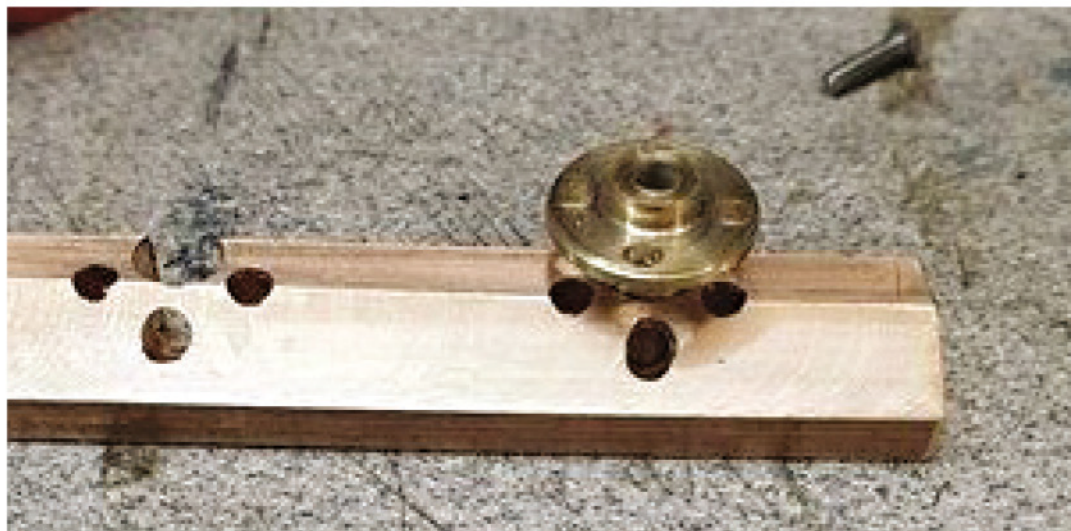


22. The main body of the sand trap was made from a length of copper bar. Here, the main part of the trap is fitted into a hole drilled in the bar.

●To be continued.



23. Next up was to machine a 30 degree angle across the top face until it's just touching the edge of the large hole. Once happy with that I needed to work out the angle for the hole that connects both parts of the trap body together. As can be seen, I've used a drill to get an idea of which angle was required. Before getting to this stage I had assumed that it may just be a case of drilling down after machining the angled face but I could see that this wouldn't work as there needs to be an allowance for the bottom of the other part with its tapped 8BA hole. I therefore played around with the angle by eye until I had what looked right.



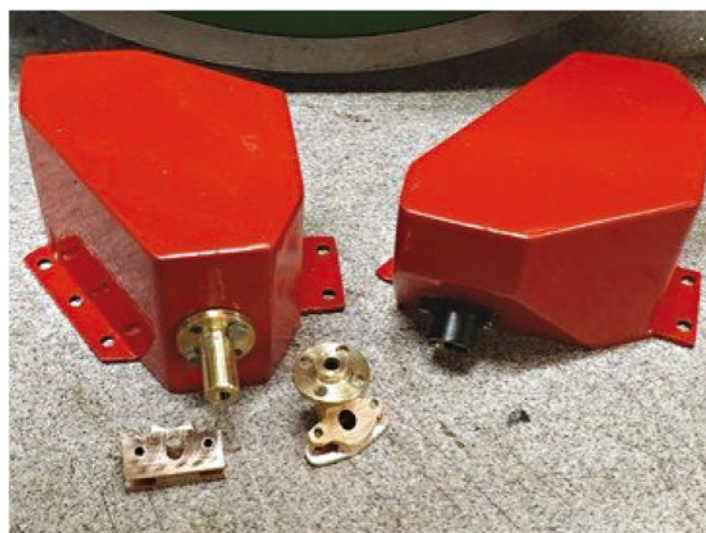
24. Progress so far...



LEFT: 25. I now have the two parts still very much rough and ready to set up for some tricky machining to match full size as seen in photo 20. RIGHT: 26. Here's a picture to show the tabs split - this was done with a 1 mm cutter, machining the base first, removing the rear part and then the angled top tabs. With that done I then removed some of the excess material around the tabs and also the metal that was left in between. I have left the front of the lower tab as that's angled into the front face in Don's drawing but I may remove this and match the photo from Patriot.



LEFT: 28. Here they are bolted to their respective sandboxes. This is only temporary to show how they will look. I have only used the two rear mounting bolts to hold them in place - once the shields are fitted I'll have better access to get the front bolts in. RIGHT: 27. The rear of the tabs are now near to the size - I will remove more from the front area to get them as small as possible after getting the second one to the same stage. I'll then finish the profiling which I suspect will take me some time. The shield tabs are going to be pretty small but as they hold no weight I'm sure that they will be up to the job in hand. The sand pipe tabs are about twice the size so will have more meat around them and all are tapped 10 BA. Note that the main flange has had its holes transferred to the sandboxes ready for fitting when finished. Once most of the profiling is done I'll silver solder the two parts together and then give them a final going over.



A Century of An Engineer's Day Out

Roger Backhouse looks back over his first 100 days out.



It now seems a long time ago that this series started. Mike Chrisp was editor of *Model Engineer* at the time and he published an article about Darlington's Tees Cottage Pumping Station in 1999. Subsequently, four successive editors have indulged my taste for engineering travel writing. I am grateful to them all. The series reached the hundredth subject with the Centre for Alternative Technology.

Some readers have been kind enough to say they've enjoyed articles and have suggested places to visit. Sadly, I've not been able to follow up all their ideas. Readers have asked how I can travel to so many places but my trips often fitted in with family or holiday visits taking in many places *en route* like the Forest of Dean and Papplewick Pumping Engines. Scotland has featured quite frequently thanks to several holidays north of the border.

Most visits featured heritage engineering though a few have been more contemporary, such as Drax Power Station, the London Eye and the Morgan car factory. The criteria for an article is that it is a place of engineering or skills interest and that it is open to the public, if only for guided tours such as at Bermondsey silversmith's workshop, visited in 2009.

Some museums have been Local Authority run, like Lancashire's Queen Street Mill. I have often found these to be very good but inadequate marketing budgets following Government cuts mean they are not as well known as they should be. Several are now run by volunteers, sometimes for

charities, and these are often the most interesting places. Enthusiasm shines through!

The National Railway Museum, York (visited twice) and *Locomotion* at Shildon are, of course, national museums and the Welsh National Woollen Museum is run by the Welsh Government. Despite good collections, however, they are often lacking in atmosphere. The NRM management especially seems to lack understanding of engineering heritage resulting in their appalling decision to close the workshop and make almost all the resident engineers redundant. Too few statutory sector museums really understand how to present technology - this is an area where enthusiastic amateurs often do well and this can be seen at places such as, for example, Internal Fire in Cardiganshire; a truly great collection of internal combustion engines.

There were chance findings too. A Scarborough visit to look at St. Martin's Arts and Crafts church led to the discovery of the UK's oldest working cliff lift and finding the world's oldest working diesel hydraulic locomotive at North Bay Railway! That led to two further articles. Likewise, a trip to Petworth House in Sussex to see the Backhuysen painting in the gallery sparked an article about water, fire and kitchen engineering in country houses - a surprisingly involved subject.

Norman Billingham organised a SMEE visits to the Kirkaldy Testing Works and York U3A took me to Drax Power Station and to Lion Salt Works. My thanks to those organisations.

There are some places I haven't described, despite their intrinsic interest. Although I visited Ironbridge Gorge museums many times as a youth, I haven't been back to write it up and similarly, I have never featured Beamish Museum in County Durham. Yorkshire Waterways Museum with its unique hydraulic lift for 'Tom Pudding' coal boats, closed before I could visit - a fate that befell several good museums. Despite forty years living in London I never managed to see Crossness Pumping Station nor the great engine at Kempton Park. Maybe one day. (Two treats in store! *Ed.*)

Back in the days of 35mm film an entire reel of photographs taken at Quarry Bank Mill in Cheshire vanished in the post when sent for processing, hence no article ... and I've never returned. It is, however, a good place to see with a very old working Boulton and Watt engine.

Mr. and Mrs. Backhouse prefer to enjoy the great variety found in Britain rather than making trips abroad so the Continent hasn't featured greatly. In my defence, m'lud, I have visited almost every part of the UK for articles, even reaching Northern Ireland and Ulster, certainly, and East Anglia are parts that deserve revisiting. Some attractions, like the Great Orme Tramway, have been excellently covered by others.

Which were the best visits? I love steam on the water so my favourite was the trip on a Clyde Puffer but I've also enjoyed the paddle steamer, *Waverley*, triple expansion screw steamer *Sir Walter*

Scott on Loch Katrine plus the paddlers *Lötschberg* and *Blümlisalp* in the Bernese Oberland.

Authenticity appeals. Yorkshire Air Museum, visited on a cold winter's day, hinted at the atmosphere of a wartime RAF base very well. At the Denny Ship Tank in Dumbarton it seemed as if workmen had just downed tools for the day. Farnborough Air Sciences Trust made a good impression because of their enthusiastic and knowledgeable volunteers - some had worked at the former Royal Aircraft Establishment. It wasn't expensively presented but it was genuine. As a local authority, Birmingham City Council ran an excellent Museum of the Jewellery Quarter.

Now for a confession. Readers may be shocked, but I have not always visited the places I have described and not all photographs are my own work. One example was the cast iron framed St. George's church in Everton, Liverpool. Even though it was clearly of structural engineering significance I was unable to visit. Thankfully the vicar provided a good photograph in exchange for a donation to church funds. A fellow SMEE member, Alan Dawes, provided some excellent photos of Manx transport to supplement my own. My thanks to him too.

Here is a highly selective list of my ten favourites:

- Clyde Puffer VIC 32 (**photo 1**) - the real thing and it was good to meet Nick and Rachel Walker who saved the vessel.
- Ravenglass and Eskdale Railway - 15 inch gauge steam in glorious scenery.
- Hereford Waterworks Museum - good collection, well presented and run by highly professional amateurs.
- Farnborough Air Sciences Trust - run by enthusiasts and has an excellent library; it's very important to back up a collection with research facilities.



Clyde puffer VIC 32 arrives at Crinan Quay ready for a trip round the bay.



Hook Norton brewery - the last commercially working steam engine (now steamed occasionally) made by Buxton and Thornley.

- Hook Norton Brewery - Brewing much as it was in the 19th Century with the original tower building and steam engine (sadly, not working) ... though I remain teetotal. Readers who like a pint will enjoy a tour even more (**photo 2**).
- Queen Street Mill, Burnley and Helmshore Textile Museum - two of the few survivors of Lancashire's once great cotton industry.
- Milestones at Basingstoke (**photo 3**). This breaks the authenticity rule - a brilliantly done pastiche with original exhibits; it's all under cover and an ideal visit on a very wet Saturday.
- London Museum of Water and Power - formerly Kew Bridge Engines - magnificent original pumping engines and more added.
- Newport Transporter Bridge (**photo 4**) - I overcame my dislike of heights to cross the



View from the top deck of Newport Transporter Bridge - it vibrates alarmingly when the car crosses.



Milestones at Basingstoke is a glorious pastiche but there is plenty to see including this steamroller built by Taskers of Andover.



Cruquius engine was one of three built to drain the Haarlemmermeer in the 1850's. Cornish technology by Harvey's of Hayle and Dutch installation. Globalisation is not new.

top walkway. (To reopen in Spring 2023.)

- Cruquius Engine, Haarlem Netherlands (**photo 5**). Unique engine and a fine example of successful international project management when it was built. Excellent tour given by Adrian Strik.

Hopefully I can continue writing for as long as readers and editors tolerate my articles. There is no copyright in the series title 'An Engineer's Day Out' so other readers may wish to describe their own favourite places. Good luck.

ME

Master Builders of South Africa – Leon Kamffer

Luker highlights another of South Africa's master model engineers.



Introduction

It's tradition to take a gift when visiting someone for the first time and, like any gift, if a little thought and time goes into making it, it's all the more welcomed. I asked my beautiful wife to bake a 'melk tert' for the upcoming master builder visit. This is a traditional South African dessert made from thickening cinnamon-infused sweetened milk - our tea-time treat. I have yet to meet a South African who doesn't like 'melk tert' so it was bound to be a winner!

I have met up with Leon many times at his first and second homes (Centurion Society of Model Engineers - CSME - and Rand Society of Model Engineers - RSME) but never where he lives! This abysmal oversight needed correcting and writing a master builder's article provided the perfect opportunity.

Before setting off to Leon's abode, I realised that 'melk tert' recipes are handed down from mother to daughter in secret rite-of-passage ceremonies and I'm sure the Kamffer's have their own secret family recipe. I hope our humble slightly-modified Internet-recipe-attempt goes down well!

Uncle Leon: the man

Leon grew up on a farm, which I can imagine was a very rewarding childhood, but hard. There was no time for extra-mural activities because the lands needed tending after school. From a young age Leon could fix farm engines, fabricate, grind and do whatever else was needed to get any farming implement moving again. Leon then proceeded to get a degree in chemical engineering and

has spent most of his career 'making chrome', from ore beneficiation to smelting. Dealing with chrome ore is challenging; it's heavy and abrasive, so everything from the crushers to materials handling needs to be designed for high loading and abrasive wear. Even the smelters are designed for a lumpy ore with only part of the bath liquid. These experiences, no doubt, helped shape Leon's approach to model locomotive design.

I've known Leon for as long as I've been a member at the RSME. We've had more casual chats around the steaming bays than I can count, on topics ranging from the local social-economic conditions to worldly affairs and of course my favourite, engineering. I have walked away from a number of these chats with a different perspective and normally more enlightened on the particular topic. I've always enjoyed Leon's stories - apart from being incredibly logical and insightful, Leon is well versed in the art of storytelling. As the story progresses, Leon becomes more and more animated, both with his movements and voice all adding to the experience. On the other hand, if Leon feels your point of view is wrong he's not afraid to let you know. I find this an endearing trait that is far too uncommon nowadays.

Leon is our club's (RSME) boiler inspector; he has tested all of my boilers and I still insist he checks my designs before I start fabrication. My very first copper boiler had a few minor leaks (actually weeps) and instead of telling me to reheat the lot to fix the leaks he suggested I leave them. He was of course right;

that boiler is still a regular steamer and those leaks have long since sorted themselves out. I think a lesser boiler inspector may have insisted these leaks be fixed, resulting in a leak-chasing exercise leading to loss of interest and yet another unfinished model engineering project.

Leon is also the chairman of the CSME. Unfortunately, the CSME was financially ravaged by the lockdown and then hit by no fewer than two catastrophic floods (2019 and 2021), just to add insult to injury. Under Leon's leadership the team has managed to turn things around. Currently, the funds look good and they are looking at expanding the existing infrastructure by adding a raised track to the grounds.

If all this wasn't enough, Leon's locomotives are regular passenger haulers for both the RSME and the CSME, with dedicated drivers to pull the crowds (figuratively and literally) and bring in the loot.

Uncle Leon's locomotives

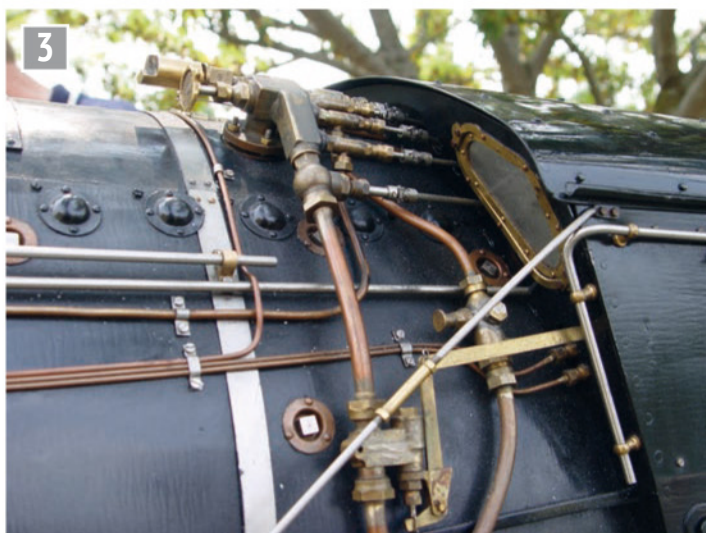
Those readers who have been following the master builders' series would know that 'master builder' is not a term bantered about lightly. Leon's locomotives are just astonishing; there is no other way to describe them. The designs for his later locomotives (the ones I chose to showcase) are from the original plans, with the experience gained from the chrome industry used to improve maintenance and longevity of the locomotives. Most of the bearings are needle rollers with the shafts either sleeved or properly hardened, including the side rods. Leon's locomotives



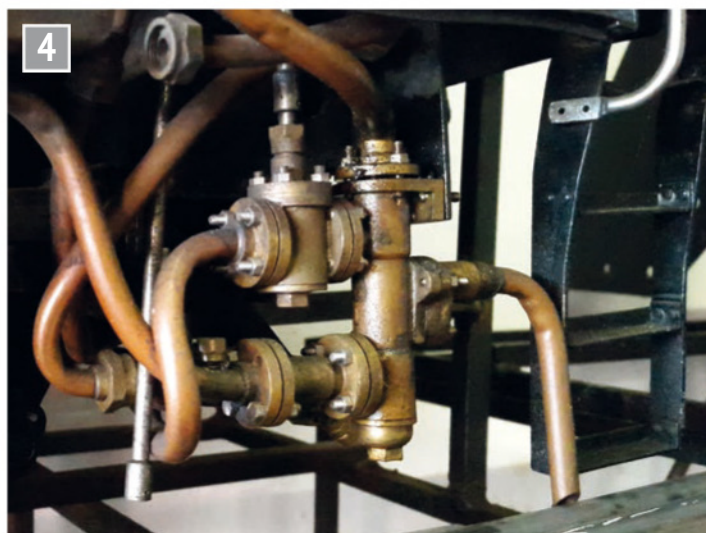
A cylinder fabrication made by combining simple geometric forms into a complex cylinder assembly (photo courtesy Leon Kamffer).



Leon as a younger man firing up his amazing 15F (photo courtesy Hannes Paling).



Some detail of the 15F: the main turret with all the universal joints and the sellers valve for the injectors (photo courtesy Leon Kamffer).



The SAR type injectors. Leon makes all his own cones etc. and fabricates the body of the injector to match the prototype. You can just see the steps slightly bent from when the engine and tender jack-knifed due to the collision with the car.

work incredibly hard and he runs them like the large ones were run, hauling a number of carts weekend after weekend. The fact that there are very seldom breakdowns and only minimal maintenance shows how the lessons in heavy industry have influenced the manufacture and design of these locomotives. This, most certainly, doesn't mean the locomotives aren't to scale - quite the opposite. Even the steam 'pipes' are drawn down (using the lathe) to perfect scale, work-hardening and straightening the tubes in the process.

Leon uses fabrication and soldering techniques extensively to make complicated geometries to limit

the expense of getting castings made. A good example is the cylinders (**photo 1**). The CAD model is simplified into flat shapes and cylinders, then a combination of TIG welding and silver solder is used to create the required form. The steam passages are included in the geometry and when the general form is complete, cast iron sleeves are fitted for the piston and valve bores.

The odd casting is sometimes required, with the patterns cut in the CNC, and a small jobbing foundry used to cast a batch for the current model (and a few spare for anyone who wants to join in on the build).

It's incredible how many locomotives Leon has

managed to build over the years, bearing in mind this is only a hobby. This includes a hydraulic locomotive for the Secunda live steamers' club, passenger carts, a Super Simplex (Leon's first locomotive) and even a 5 inch gauge King Class that was sold to finance some of Leon's beautiful machinery. I had to be selective with the locomotives I share with the readers, so I decided to focus on the prototypical locomotives where Leon had a share in the design.

15F

The star of the show (although not my favourite) is Leon's 15F SAR modelled for 5 inch gauge (**photo 2**). It was meticulously

scaled, took 7 years to build, and made a home for itself at the RSME, pulling hundreds of passengers for 15 years. It even survived a railway crossing accident when a visitor decided to play 'chicken' by illegally crossing our track. The car came off second best and the driver had to make a hasty retreat, with the car's wheel alignment not looking very good. The 15F made it back to the station and after a little maintenance was ready to go the next weekend.

Like a true engineer, Leon keeps an accurate logbook for his locomotives, with the 15F steamed for the first time on the 9th of October 2003 and the last time on the 2nd of October 2018. It did 566 hours

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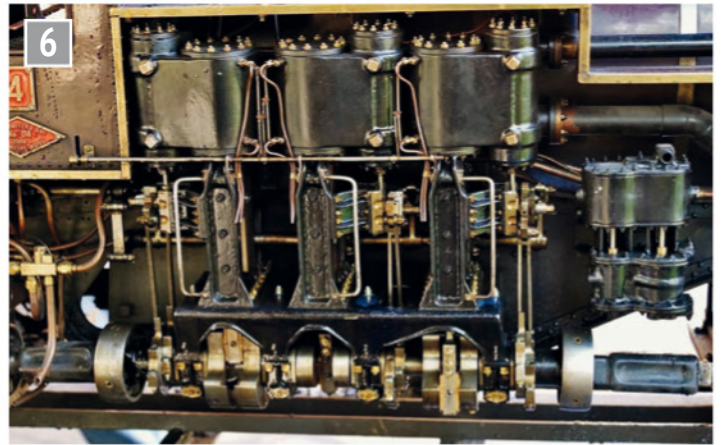
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Leon's 7 1/4 inch Shay at the Pietermaritzburg Model Engineering Society – cylinder side (photo courtesy Hannes Paling).



Leon's 7 1/4 inch Shay – a close up of the cylinders etc. that took eight months to build and was recently overhauled (photo courtesy Hannes Paling).



Leon's articulated locomotive, the Garratt (photo courtesy Hannes Paling).

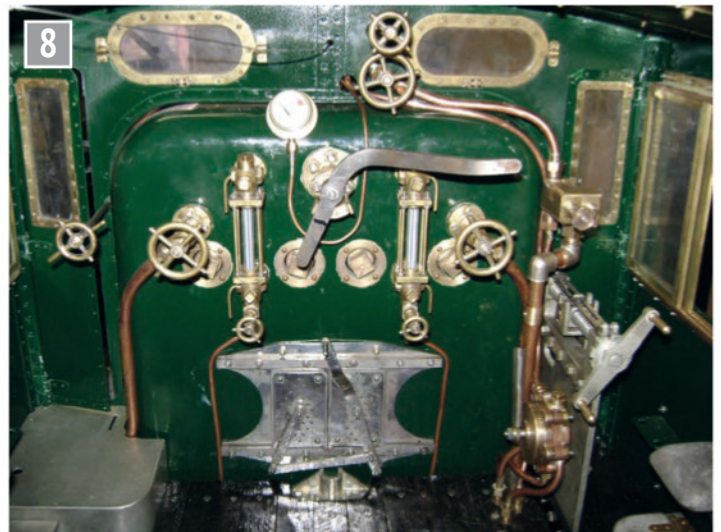
of heavy passenger hauling before a tube leak parked her for some maintenance. In all likelihood the boiler is still good to go; just the tubes need to be removed and new tubes expanded in place - but when you have so many locomotives there's no rush!

The detail of the 15F is eye catching. Everything from the turret universals (photo 3) to the fully functioning SAR type injectors (photo 4) is present and made in Leon's home workshop. Although the outsides of these injectors are prototypical, the internal flow

and delivery characteristics match the boiler design and I have yet to see one of these injectors give trouble.

Shay

Leon's Shay is my favourite of all of his locomotives (photo 5). It's very different to normal locomotives and required everything from gear calculations and cutting to clever shaft coupling for articulation around our curved tracks, to finish the model. This locomotive took the better part of four years to complete with the cylinder assembly



The prototypical backhead of the Garratt with all controls easily accessible for the driver (photo courtesy Leon Kamffer).

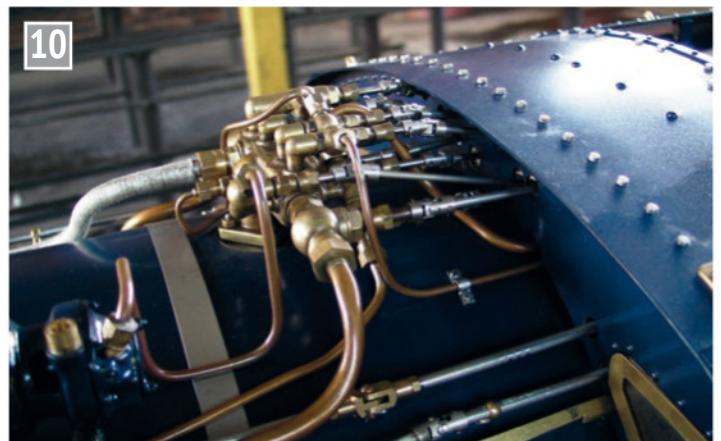
taking all of eight months (photo 6).

This locomotive can haul large loads with ease and is a regular passenger hauler at the CSME. In the 2019 floods it was completely submerged in floodwater. Unfortunately, the floodwater displaced the

critical wear-preventing oil and replaced it with a nice grinding compound. Nonetheless it still ran for another few years before the engine had to be overhauled (at the end of 2021). When Leon stripped the engine and valve gear there were still signs of that fateful flood.



The 16DA which is similar to the 15F with one less coupled wheel set; a regular passenger hauler at the RSME. This locomotive is an outlier, because the frame and some of the valve gear was started by another builder and Leon finished the build to his exceptional standard. Leon's build time was three years (photo courtesy Hannes Paling).



The 16DA main turret, similar to the 15F, with part of the steam generator just visible to the left of the view.

The Garratt, 16DA and the 5 class

Leon's Garratt (**photos 7 and 8**), 16DA (**photos 9 to 11**) and 5 Class (**photos 12 and 13**) are further fine examples of prototypical locomotives used for heavy passenger hauling every Sunday. Each locomotive is built to an incredible standard with the backheads (**photos 8, 11 and 13**) following the prototype very closely but still easy and comfortable to drive.

Uncle Leon's workshop

For Leon, building these locomotives close to prototype, low maintenance and robust is only part of the fun. Modern manufacturing techniques are applied to all his builds, optimizing the time in front of the machines as well as setup.

Many tools have been made to improve turnaround time in the workshop as well as numerous tool holders, jigs and fixtures.

Leon's workshop sports a CNC lathe for the steam fittings, etc. and two CNC milling machines. The smaller CNC machine is typically used for engraving his locomotive name plates (and everyone else's) and the larger CNC for machining valve gear, like the expansion links, which are typically made from gauge plate. There's also a beautiful Colchester student and a large Mitco milling machine that stands proud for all the other jobs (**photo 14**).

There's enough place to work comfortably in the workshop and it's not so large that cleaning is a big job. The wide range of

manufacturing techniques possible in this small place is impressive; everything from CNC machining to TIG welding can be done very quickly in this space. When I visited (June 2022) there was a 7¼ inch gauge Bagnal on the table being built 'quickly' for the CSME to be used as a light passenger hauler or for new members to play a little with a simpler locomotive.

Special thanks to Uncle Leon

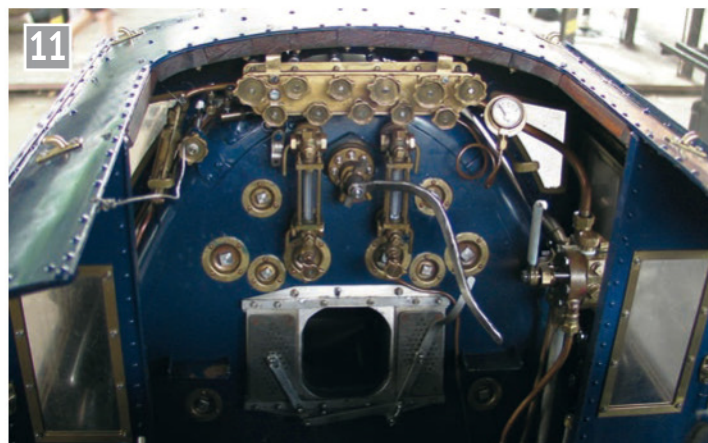
You would be hard pressed to find somebody that contributes as much to our hobby locally than Leon. He's always willing to help fellow builders with advice or even finishing off the odd component that was just insurmountable. His dedication to both clubs in

terms of his time and use of his locomotives for passenger hauling is unmatched!

Thanks to Leon for his time, information and pictures I used to complete this tiny glimpse into how he tackles his amazing builds. My heartfelt personal thanks for all the conversations, advice and the debates that have made me question my own preconceptions on certain topics. May we have many more for years to come!

Post script: Leon liked the 'Melk tert' and sent my wife and me off with a generous helping of biltong, another South African favourite!

ME



The 16DA backhead showing the incredible detail of the locomotives but all controls still easily accessible for the driver.



Leon's latest masterpiece, the 5 Class SAR Karoo. This was steamed for the first time in December 2021 and has been a passenger hauler at the CSME ever since (photo courtesy Hannes Paling).



The 5 Class backhead on steam with a roaring fire. Note how something small like the valve handles are perfectly matched and are different for each prototype (photo courtesy Michael Eykelhof).



A panoramic view of Leon's workshop. From left to right: the Colchester, the large Mitco, the smaller engraving CNC (hidden behind the Mitco), the larger milling CNC (far corner), Bagnall frame on working table and on the far right the CNC lathe with roughly the same swing as a Myford.

LNER B1 Locomotive

PART 10 – FRAME STRETCHERS

Doug Hewson presents an authentic 5 inch gauge version of Thompson's most successful locomotive.



Continued from p.339
M.E. 4698, 26 August 2022

We will carry on with some more of the frame stretchers and make a start on the steam brake stretcher (**fig 30** and **photo 65**). This consists of two side plates which are 2.5 mm plate and the rest is all cut out of 16 swg CR4 steel plate. On the top plate is a little triangular piece of angle plate which is for the front damper and it also has a slot through the front flange to accommodate the rod which passes through it.

The only photographs I have of the brake cylinder stretcher (**fig 31**) are from a colleague of mine who took some of it when it was in pieces being overhauled but they a bit blurry. Whilst you are at it you might also fit the brake cylinder and the arm which goes with it. It is of course exactly the same as the one on the tender so I hope that you have made the two together! The brake shaft is just a plain piece of $\frac{3}{16}$ inch BMS bar with a 2BA thread and nut on each end. However, on the shaft is a substantial



Steam brake stretcher.

bell crank which is cut from a piece of $\frac{3}{16}$ inch plate with one horizontal arm at $1\frac{29}{32}$ inches long and a vertical arm at $\frac{9}{16}$ inch long. This crank can just be threaded through the two plates at either side of the stay and furnished with a 2BA nut on either end. If you have made your rod the correct length you should be able to tighten the nuts up without it trapping the crank in between. It would also be a good idea to silver solder the two spacers and the brake arm on as well.

The stretcher and all the other bits and pieces are all included in the laser cut kit of course and it is all fixed together with slots and tabs. If you have to take a skim off the sides of the stretcher to make it the correct width then all well and good.

The next one is the stretcher next to the weighshaft and it is a bit more straightforward, or can be (**fig 32** and **photo 66**). It consists of all CR4 steel plate and I should say that these are all included in the laser cut kits which Geoff Stait

Fig 30

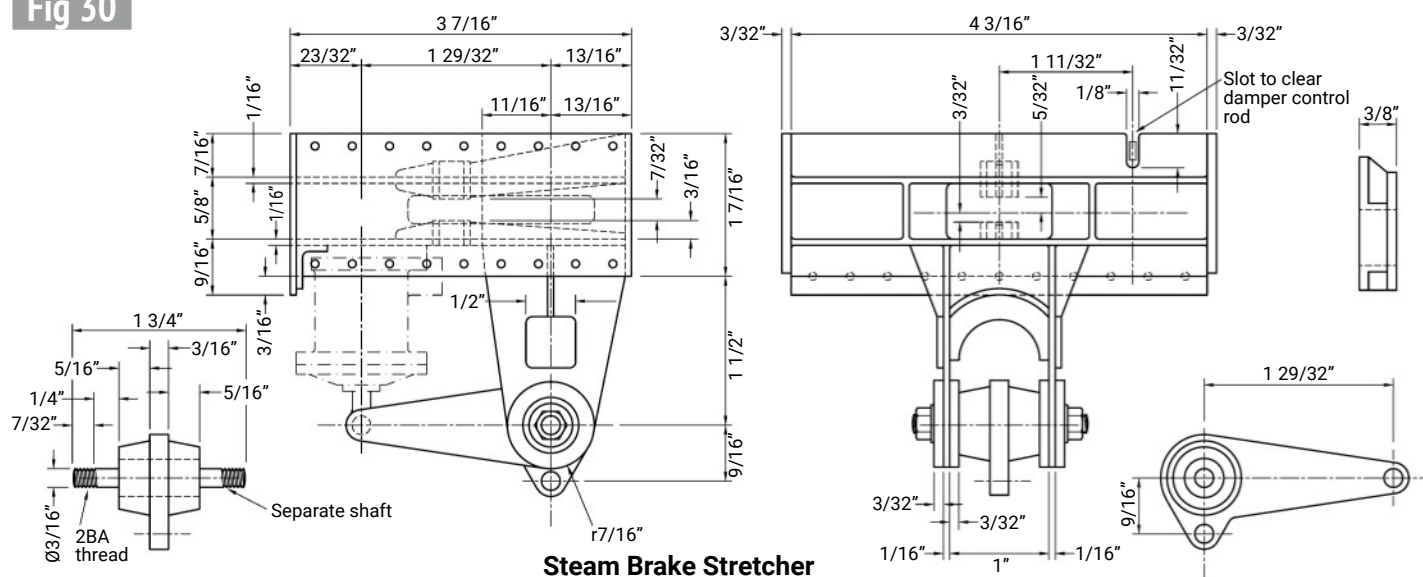
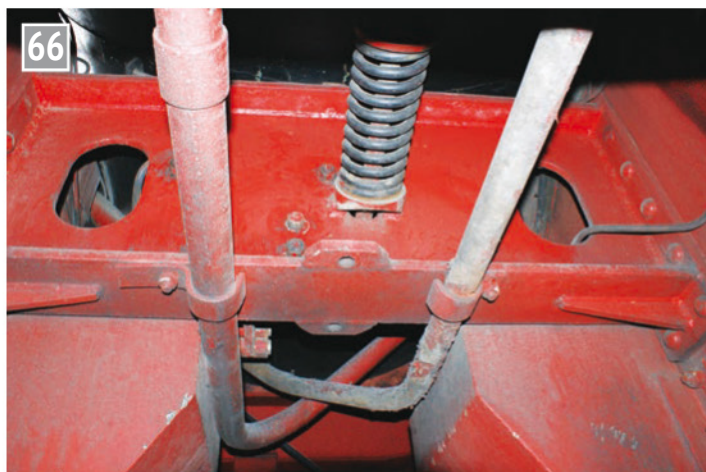
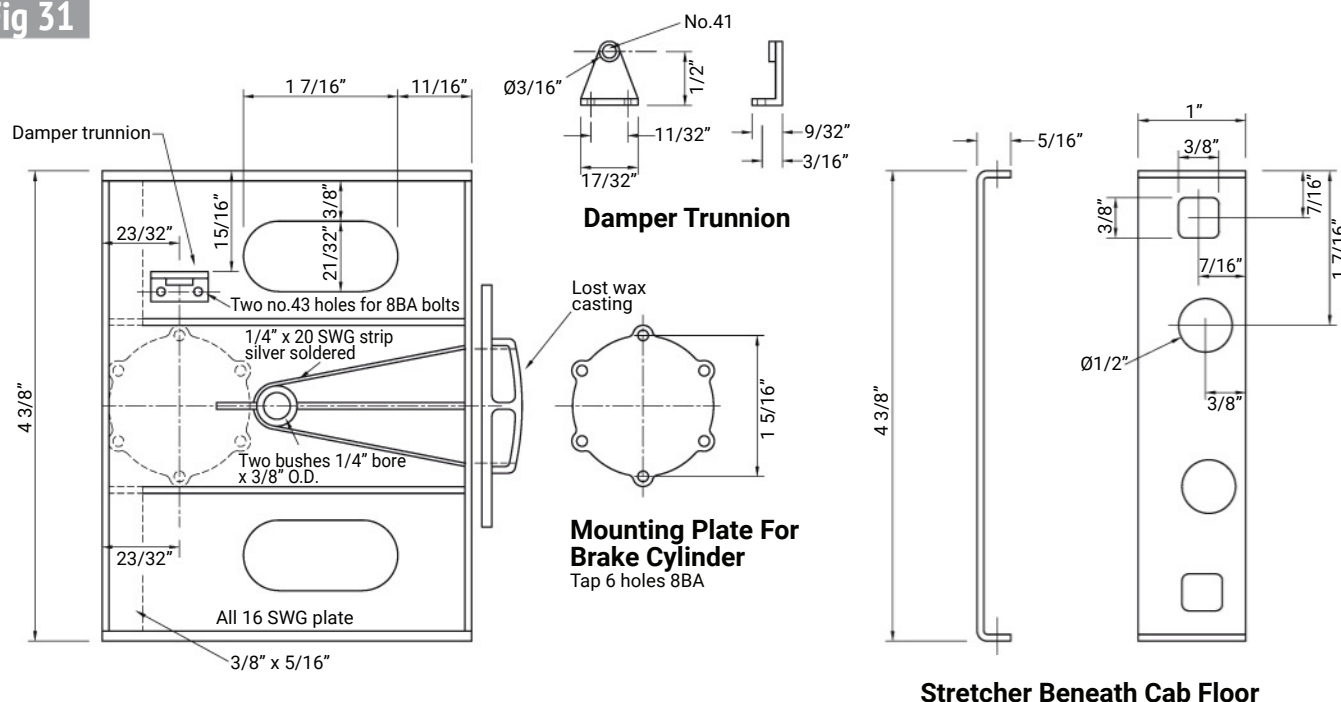
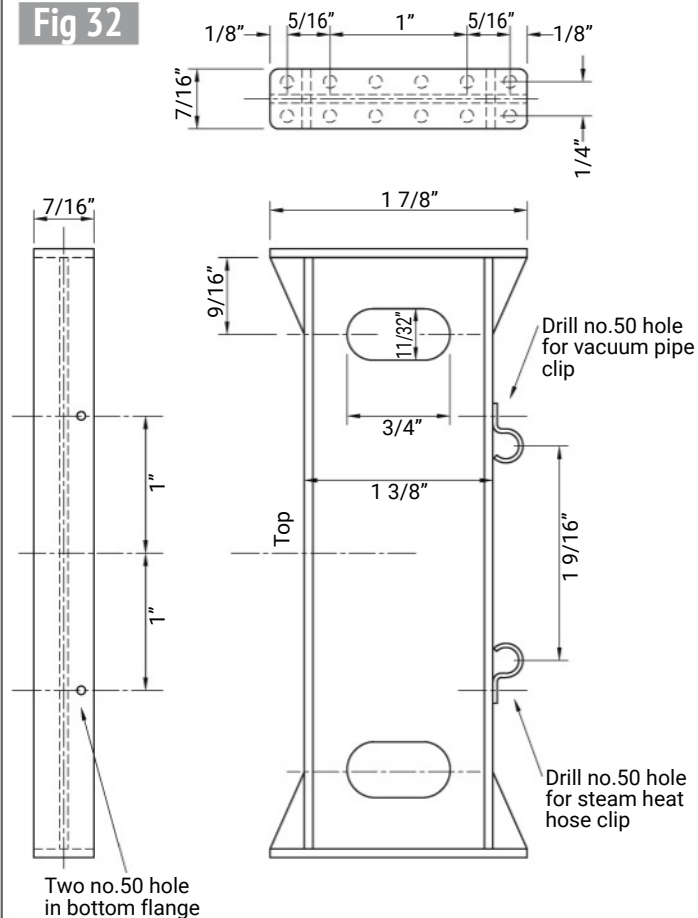


Fig 31*Weighshaft stretcher.**Weighshaft brake.*

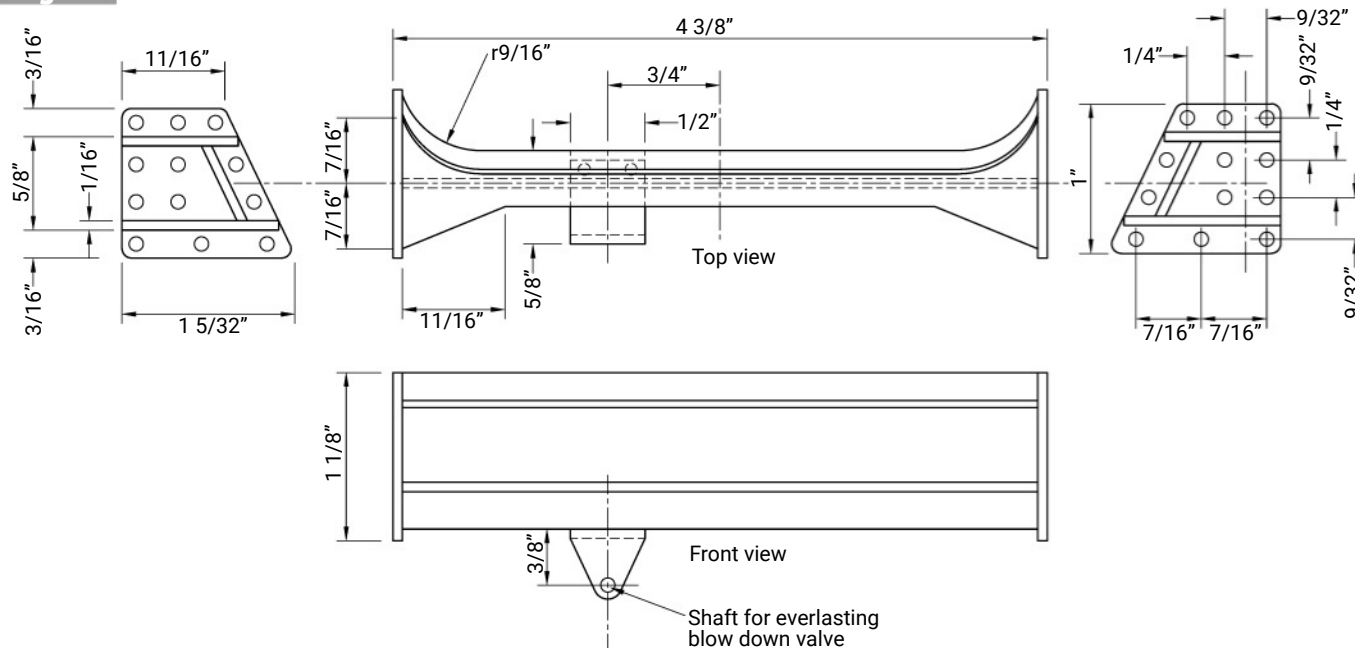
should have by now. It just consists of two end plates, a top and bottom flange and a web. There are a couple of

lightening holes in it but, if you want to make a proper job of it, on one side of it there is a brake on the weighshaft

Fig 32**Intermediate Stretcher Above Weighshaft**

(photo 67) and on the other side of it is a coil spring to help restore the weighshaft to its mid gear position (photo 68).

On the P2s this is operated by a vacuum operated brake band on the weighshaft and on John Heslop's engine at Gilling

Fig 33**Stay In Front Of Firebox**

Mat'l: Steel fabrication

**68**
Weighshaft spring.

this all works with a little arm on the back of the reverser stand on his locomotive! I have published some photographs of the B1 but, shame on me, I have not detailed it. If you want to add this on your B1 that is fine by me. However, I will want to see a photograph of it! In any event it is all hidden away.

This next stretcher goes just beneath the firebox throat plate and it has plates which slope to match the sloping throat plate of the 100A boiler - there is a drawing which shows all that (**fig 33**). On the underside of this stretcher there is a mounting for the

everlasting blowdown valve which is low down on the centre line of the throat plate (**photo 69**). I will describe this when I get around to working on the boiler. The bracket for the linkage can be just bent up into a 'U' shape but if you want to make a proper job of it I have shown it on my drawing as it is a little bit more complicated than that. There is just one more small stretcher to make and this is just a folded piece of plate 1 inch wide and it has a flange

at each end $\frac{5}{16}$ inch wide, and a few holes in it (**fig 31**)! I have not designed the rocking grate yet but there will be another stretcher to add just above the brake cylinder stay with the operating arms for the grate attached to it.

● To be continued.

NEXT TIME

We have another stretcher to make and the tender draw bars.

**69**
Blowdown valve and operating linkage.

A 1.4cc Two Stroke Petrol Engine

Patrick Cubbon raids the scrap box to build an engine of varied parentage.



This article describes the construction of a 1.4cc two stroke petrol engine utilising Milford Mite model aircraft diesel engine components, combined with parts from a second engine, both owned since the late 1950's. Selected parts are shown in **photo 1**.

The result of this project is shown nearing completion in **photo 2**. 'Mite' is stamped on the cylinder block flange and a Hall effect sensor is in place.

The Milford Mite is described by Adrian Duncan in great detail (**ref 1**) and seems to have been judged as England's worst ever. Its capacity is 1.409cc with a bore diameter of 15/32 inches and a stroke of 1/2 inch. The project incorporates the Milford cylinder block, cylinder, piston and cylinder head. **Photograph 3** shows a production version of this engine.

Crankshaft, con rod, and carburettor come from the second engine, with a stroke conveniently of 1/2 inch, the

Table 1	Milford	Westbury
Power	TDC-111	TDC-115
Exhaust	111-249	115-245
Transfer	116-244	125-235
Compression	249-TDC	245-TDC
Induction	308-52 ATDC	310-150 ATDC

same as the Milford, and a capacity of 0.91cc, and shown in **photo 4**. This engine was the work of a family member and dates back to the time of a very brief spell with a control line model aircraft. The aircraft though was later fitted with an ED Bee engine and sold.

Before committing to workshop time the engine compression ratio, port timing and component condition needed to be carefully considered to establish project feasibility.

The compression ratio was set at around 7:1.

Port dimensions and position within the cylinder were measured then multiplied by 4 and transferred

to a paperwork exercise.

The timing results, in crank degrees, were found to be broadly in line with published data for petrol engines and the results are shown in the table above, which compares them to an E.T. Westbury engine (**ref 2**).

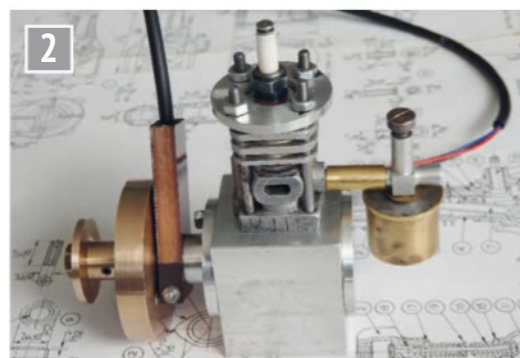
It is anticipated that exhaust ports will be fully open at BDC and inlet ports at TDC. The wear of cylinder bore, piston, big and little ends is significant. The project was judged viable but very much identified as a 'will it or won't it work' engine.

Next time we move to the workshop phase of the project.

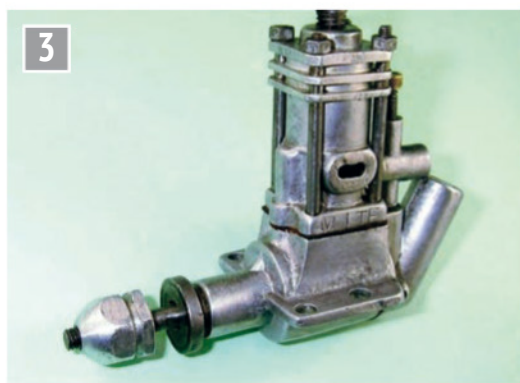
● To be continued.



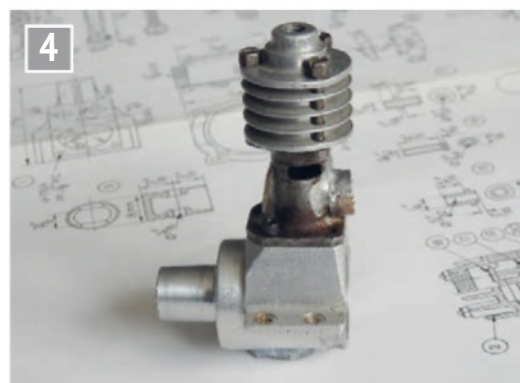
Components at project start.



Project engine.



Milford Mite.



Second donor engine.

REFERENCES

1. *The Milford Mite: England's Worst Ever*, Adrian Duncan (www.modelengineneers.org/m.mite)
2. *Model Petrol Engines*, Edgar T Westbury, Tee Publishing (Port timings page 75, Lubrication page 159)

John Arrowsmith resumes his tour of the North West with a visit to Stockport.



A fine group of Stockport members.

We Visit the Stockport & District SME

Following on from my Urmston visit (M.E. 4694, 1 July), I made my way to the Stockport & District SME which is located in Cheadle Hume at South Park on Grove Lane.

The club was first formed in 1946 so 2021 saw them celebrating their 75th Anniversary which, these days, is quite an achievement. Their first meeting was held at the Dyers and Bleachers

Club in Tiviot Dale, Stockport on 30 August 1946 where twelve founder members formed the club. There are 57 current members (photo 1) and they have a good working relationship with their Local Authority which again is a very welcome situation these days.

Today the club have an excellent set-up in South Park where a usefully sized members' clubhouse has been constructed from a

secure shipping container. This features some innovative ideas along with the traditional fittings found at most model engineering clubs (photos 2, 3 and 4). Because the club is located in a public park and has no access to a mains power supply (without a great deal of expense), they have fitted a couple of solar panels to the roof of the clubhouse. To accommodate the necessary control and



The main clubhouse and storage building.



The useful storage spaces in the storage shed.



Traverser operating shed with compressor and battery storage.

converter gear for these panels and to provide a secure storage and small workshop, they have located a second container adjacent to the first one. A purpose-built pitched roof over both containers has provided a very strong and good-looking building. One member explained to me that, formerly, the club was using generators to provide power; this was sufficient but a bit limiting. Another member then suggested that they consider using solar panels which he could acquire (**photo 5**), so during the lockdown period they were installed along with two batteries which now store the power coming from the panels. With this benefit, they were able to fit some LED lighting in the container. As it happened, however, there was so much power that a 3kW inverter (**photo 6**) was added to use this power more efficiently. The power through the inverter provides 220 volts so the clubhouse is now fully fitted with lighting and all the electrics needed, including mini circuit breakers for protection. There is sufficient supply for the multi-gauge OO and Gauge 1 layouts, tea making facilities and a small oven to warm the lunchtime pies! They are indeed very well set up. Charging facilities for the club's battery powered locomotives (**photo 7**) are also provided. The next piece of equipment being considered is an electric compressor to



Control gear and inverter for the solar panels.

replace the existing petrol driven one that operates the track traverser. The considerable advantage of this system, of course, is that their power supply is free and they are not reliant on a local supplier.

The multi-gauge raised track - 2½, 3½ and 5 inch gauge - is around 1100 feet in length and provides a good test for drivers. There is quite a downward incline of about 1:200 on leaving the station and this provides drivers with a good start but, obviously, a corresponding climb has to be made on the return which, I was told, makes for some interesting driving at times. The track itself (**photo 8**) could be described as a roughly 'dumb bell' shape, laid on a standard design of



Solar Panels on the clubhouse roof.



An assortment of stock inside the shed.



An aerial view of the club site with track outline shown white.

concrete posts supporting concrete beams onto which are fixed plastic sleepers and aluminium rails with a continuous anti-tipping rail. This is a railway where ground contours and trees obscure

views to all other parts of the track, making it quite interesting for passengers. It is also a very good riding track as I found out when I travelled with chairman, Dave Waggett behind his superb 5



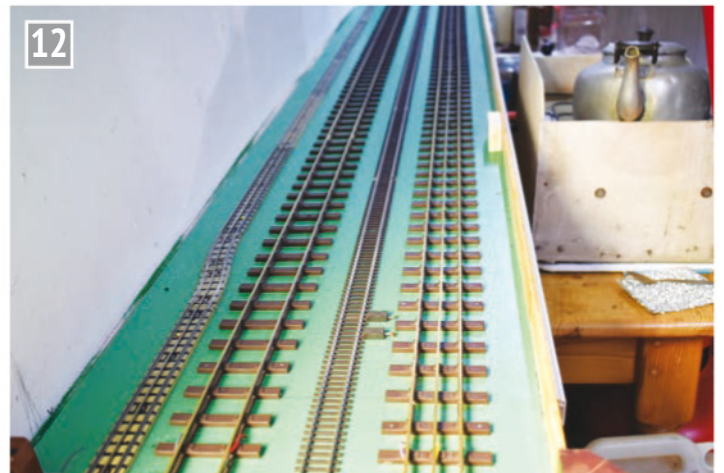
Chairman Dave Waggett preparing his 5 inch gauge Jubilee, Camperdown for some track time.



The cab layout of the Jubilee.



Dave Waggett backs into the station with his Jubilee.



Inside the clubhouse is this perimeter set of model railway tracks, 3 rail Hornby, O-gauge, OO-gauge and 3 rail O-gauge.



Track controller for all tracks.



The 3 rail O-gauge track about to receive its first train of the day.

inch gauge Jubilee (photos 9, 10 and 11). The curves are nicely super elevated and the alignments are very good. The overall appearance of the track was a credit to the members; with so much grass to cut and lots of trees to look after it might be easy to let things

drift a little, but the members here maintain an excellent standard.

I mentioned above that the clubhouse has a continuous multi-gauge model railway circuit round the periphery of the walls, and this again provides some interesting

running at times (photos 12 to 15). The four different tracks and gauges mean it would be possible to see four different trains running together. The members involved with this part of the club were very enthusiastic about their layout and it does provide a

different perspective from the larger outdoor lines. It also means you can see different locomotives and stock as well as a multitude of different liveries.

Another member, Jim Lane, had brought along a couple of the boats he is presently

constructing; one a traditional sailing ship (**photos 16 and 17**) and the other a fast hydroplane type of craft (**photo 18**). The sailing ship is a Danish Man of War of circa 1750 and is, basically, a Billings kit which Jim has substantially modified. All the deck planking, for example, has been refitted along with the addition of many other details including the rudder.

As usual in concluding my visit I must thank all the Stockport members for making me feel most welcome and for all their kind hospitality. It was a very interesting and enjoyable visit and the solar panel installation demonstrates a perfectly feasible way forward for model engineering clubs without mains power - or, for those who do have mains, to improve their 'green' credentials as well as providing a regular power supply (once the initial costs have been absorbed)



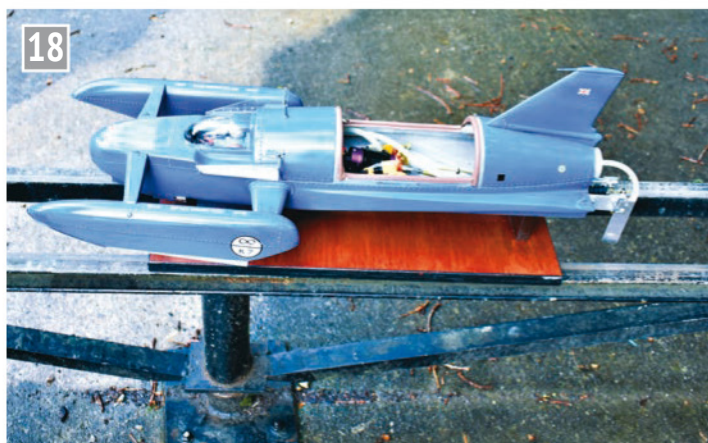
This LMS Coronation Pacific and coaches made a fine sight on the OO-gauge track.

free of charge! They will not be hit with the recent rises in costs and that is definitely something to provide food for thought for many clubs I would think. Again, if you happen to be in that area, call in and see them - you would be most welcome.

ME



Another section within the club are the boat builders; this fine Man of War is under construction by Jim Lane.



This high-speed boat has also been built by Jim Lane.



The stern end of the Man of War.



Stan Bray

Dear Martin,

I was sorry to read of the death of Stan Bray. 'Bray's Bench' in *Model Engineer* was favourite reading for many years, where he covered a wide variety of topics.

Stan had the gift of being able to write clear instructions. For example, those for making a simple pipe bender were a model of clarity. Furthermore, once completed it worked well (*Model Engineer* volume 157, pages 196-7).

He will be much missed but thankfully he left a rich legacy of writing still valuable for model engineers.

My sympathies go to his family.

Yours sincerely,
Roger Backhouse (York)

Rolls Royce

Dear Martin,

I have much enjoyed the correspondence on Rolls Royce Merlin engines in *Postbag* (M.E.4969, July 29). Mr J.E. Kirby's letter gives fascinating details of 'Miss Schilling's Orifice' as a means of reducing the problem of carburetted Merlins cutting out under negative 'g' forces. As there was not too much detail of this device in the article I turned to Dr Google to find all one needed to know - what a clever lady Miss Schilling must have been!

Mr Kirby states that early Merlin engines cut out under negative 'g' in loops and barrel rolls. In fact, in well flown loops and barrel rolls positive 'g' is maintained at all times, so no cut out problem. However, as Mr Kirby states, when pushing into a dive from level flight negative 'g' is incurred. Spitfire and Hurricane pilots minimised this problem by rolling inverted and then pulling into a dive - thus maintaining positive 'g' and avoiding the fuel cut out problem. This did however waste time and the ME109 fuel injected aircraft, which did not have this negative 'g' problem, had more time to escape.

Later versions of Merlin engines did not have this

negative 'g' problem. What an amazing engine this was over so many years of development.

Yours sincerely, P Clayton
(Edinburgh)

Ayesha

Dear Martin,

I was prompted to write by the two articles on LBSC and his wonderful little engine *Ayesha* featured in *Model Engineer* (M.E.4690, May 6). What a strange and enigmatic man this guy really was but aren't we lucky to have had him?

My concern is the story of how the little engine got her name. This tale has been told a number of times and it is always consistent, namely that Mr Henry Greenly stated that for so small an engine to be used for passenger hauling it would be worn out in a week. A supporter of LBSC countered this, saying that, just like *Ayesha* in Henry Rider Haggard's novel *She*, the little engine would run for two thousand years and then collapse in a pile of dust.

This has always troubled me as, at least in the copy of *She* that I read, that is not the fate suffered by *Ayesha*. In the book, after standing in the mystic flame she shrinks and shrivels until her corpse resembles that of a little wizened monkey. The word 'dust' does not appear at all.

How can we reconcile this anomaly? Is there perhaps another edition of the book that does feature the turning to dust narrative or is it simply the case that LBSC and his friend had never read the book?

Is there a bibliophile among the *Model Engineer* staff or readership who could offer a solution to this riddle?

Thanks as ever for a great magazine.

Kind regards, Tony Dyer
(Stroud)

Oddity

Dear Martin,

I think the 'oddity' (M.E.4697, August 12) is a pointer from a nautical azimuth plate - its function is to give bearings

of other ships or shore targets. The plate is about 10 inches diameter fixed to the starboard structure of a warship (horizontally) with the centre line of the disc/drum from 0° through the centre bearing of the indicator to the 180 point. This azimuth plate would have had a companion plate on the port side the same distance from the centre line of the ship, thus covering 360° of the horizon. Target sighting would have been transmitted electrically or verbally to the Detector Room, where all bearings and distances were to be collated with distance by range finder. The disc shown in *Model Engineer* has been exposed to direct weathering - the ship which it served in was possibly scrapped soon after the 1939-1945 conflict.

Perhaps a Royal Navy historian or a guns/torpedos officer or a Royal Navy historian in Plymouth with model engineering habits could help.

D.W. Baxendale
(South Shields)

IMLEC

Dear Martin,

I thought you might be interested in a little project I've been working on for a while. I'll give you a brief bit of background first. I've been involved in IMLEC since I can remember; my dad and grandad both entered numerous times starting from 1974 and I have continued that trend, missing only one IMLEC in my lifetime.

Having received my memento from IMLEC 2022 - and what a great weekend and event it was, credit to the Guildford club - I went through everything we have as a family from previous IMLECs (there was a lot of stuff) and I realised there is nowhere online to preserve the history of the event, so I set about to create an online 'archive' of everything from results, to souvenir programmes and pieces of memorabilia to archive footage. I have managed to collate all the results from 1969 to

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present into one spreadsheet and have included each year as a download on the website I've built.

I hope you find this interesting and I hope other followers of IMLEC may be able to contribute photos of memorabilia or programmes etc. so we can preserve and enjoy this fascinating event in the model engineering calendar. Here is the link to the website: www.imlecarchive.com

Thanks, George Winsall

Stirling Single

Dear Martin,
In the Museum in Salisbury is a Stirling Single which was built by Sir Walter Alcock, who was the organist here from 1917 till late 1947. He also built a Midland Single which is shown on *Model Engineer*, page 81 May 1899.

The Stirling Single locomotive was donated

to the Museum in 1978 but was missing its tender. The Salisbury & District MES have volunteered to build a new tender and exhibition plinth, at no cost to the museum.

Though it is not numbered, the locomotive is No 776, the second Stirling 8 footer to be rebuilt by Mr H.A. Ivatt. This was a design marketed by W. Martin & Co, East Ham, London. Their advertisements appear in the 1898 *Model Engineer* but I understand they ceased trading in 1910. There are photographs of an identical model built by Rev T.B. Parley shown in the October 1899 issue on pages 212 and 213.

The locomotive in the museum is quite good but not built to what we would call modern exhibition standards. There are no plans to restore it to running order. It is built to 4¾ inch gauge for a start and relied on a tender hand pump as the sole means of feeding the boiler. Our plans are to

build the tender to a standard that matches the locomotive, so that it all appears as one exhibit.

Could you possibly make a mention in your editorial that we are looking for a copy of the W. Martin & Co tender drawings for the Stirling Single? I can be contacted by e-mail or telephone 01722 718463.

Yours sincerely, Des Adeley

Tether Cars

Dear Martin,
Sacred Blue Mezz Amiz! (as Sergeant Luck of the French Foreign Legion would say).

This is the Black Country translation from my misspent childhood for *Sacre Bleu, mes amis* often spoken by said character in the *EAGLE* comic.

I digress - the article *Tether Cars* by Henk-Jan de Ruiter (M.E. 4698, August 26) was so intriguing. It brought back memories from long ago and probably prodded one of those

raw nerves we all accumulate. The *EAGLE* comic was the only one allowed in our house so a diet of Dan Dare, the Treens, Storm Nelson and Luck of the Legion et al. was a staple diet from short trouser days. Each year the *Eagle Annual* appeared at Christmas and I think it was in Number 10 (but would love to be corrected) that a chapter was dedicated to what are now called tether cars. I remember that it published the drawings and design for a car with a wooden chassis and probably flawed memory records it also being the 'Kitten' design.

Boy, did I lust after such a beast but it was forbidden at a time when treats were quite hard to come by. But it was part of the inspiration that brought me to the world of models and model engineering which has remained all these years.

I hope that the article has brought back memories for others of a similar age.

Kind regards, Ian Bayliss

SHOWCASE

HAGGIS

I built my Rob Roy *Haggis* (photo 1) in the 1970's and it has travelled some miles over the years. Even now with some decent coal it can still frighten me with its turn of speed.

I designed the 3½ inch gauge riding car without using sprung suspension to run on ground level track. Although I say it myself it gives a remarkably stable ride, if a little firm.

I made the 100ft 3½ inch gauge portable track from floorboards recycled from a 150 year old house being demolished locally. Pity about the house but I'm told that's progress!

The disgruntled passenger is William, my American grandson who lives in Los Angeles. I decided to settle the matter by building him his own locomotive so he can 'ride the rails' to wherever he likes (photo 2).

Bryan Mellem



Ballaarat Copper Boiler PART 2

Ron Collins offers an alternative copper boiler for *Luker's Ballaarat* locomotive design.



Continued from p.391
M.E. 4699, 9 September 2022

The second part of this series provides the details of the boiler flanged plates. There are a total of five flanged plates but fortunately the backhead and throat plate are identical in shape, and likewise the firebox throatplate and firebox backhead are also identical. The smokebox tube plate is a simple round flanged plate.

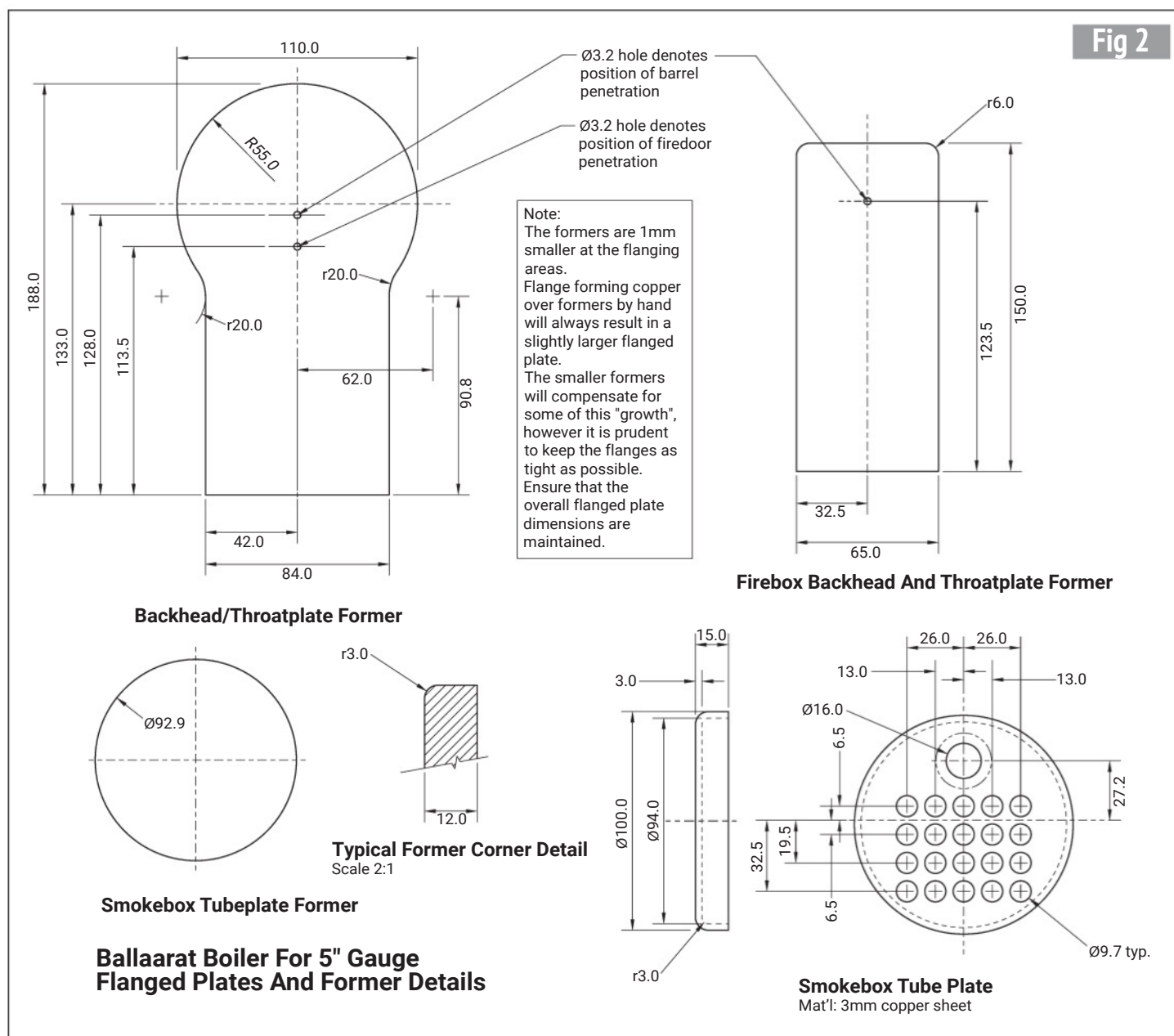
The fabrication of the flanged plates will therefore only require three formers (fig 2). The former sizes are

detailed on the drawings and it is noteworthy that the formers are 1mm smaller each side than the inside dimensions of the flanged plates. The reason for the smaller sized formers is that annealed copper will grow slightly when hand formed over formers, as it is not possible to hand form the copper flange perfectly tight to the former.

The formers can be fabricated by various methods. A hardwood or plywood former is quick to make but it is

generally not robust enough to produce more than one or maybe two flanged plates. When using wooden formers, the flanged plates will require annealing multiple times to ensure the copper is soft enough to form over without damaging the wooden former.

An alternative and more robust former is to cover the top of the wooden former with a 3mm thick metal plate, complete with a suitable edge radius. The metal plate is glued and screwed



to the wooden former with countersunk wood screws.

The best formers are 12mm thick steel formers (**photo 1**). These formers need not be daunting. In today's high-tech world the easiest way to fabricate the formers is by laser cutting, which is cheap and accurate, and the laser cutting service will supply the material. If you are CAD savvy, produce a DXF file

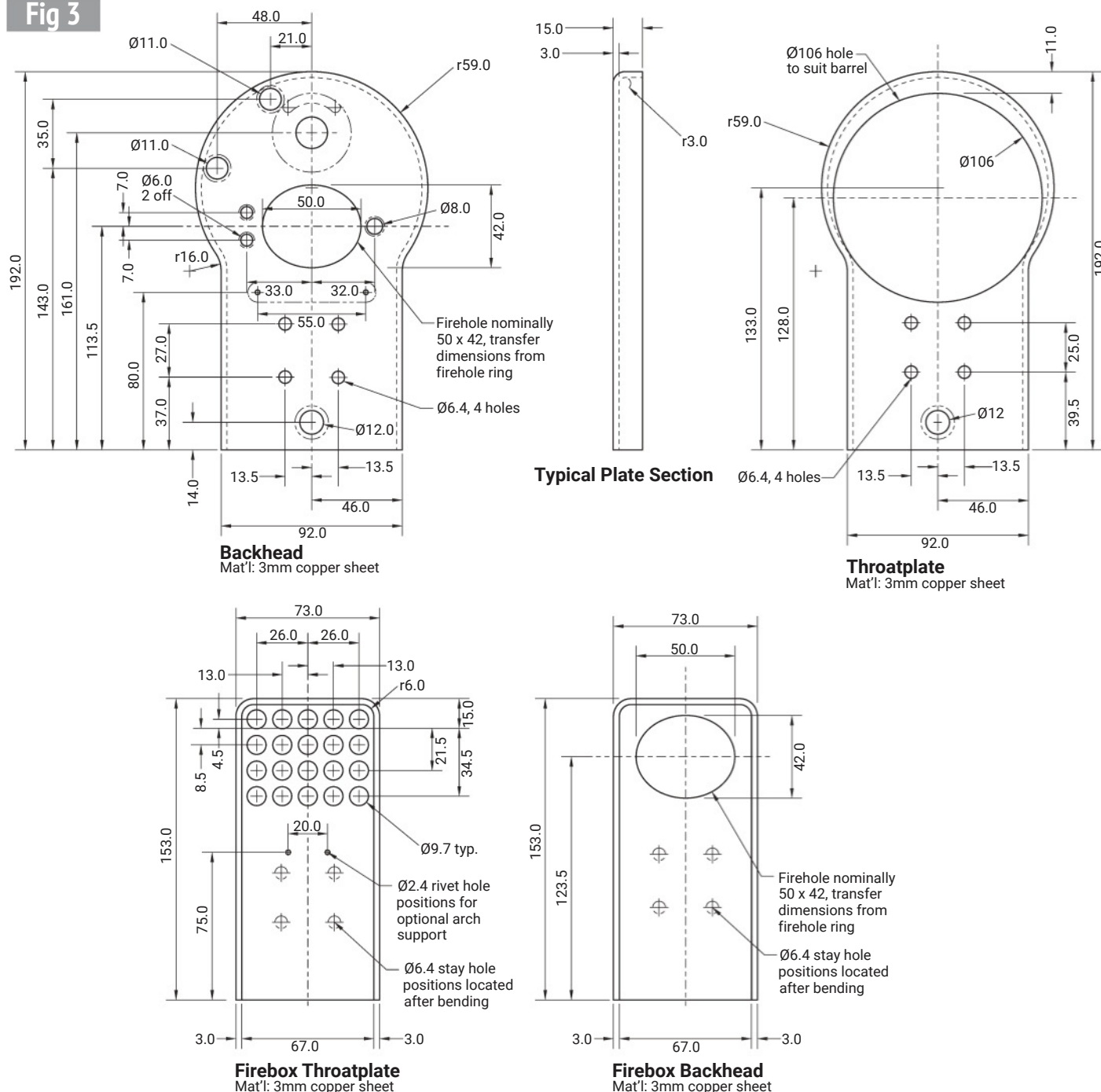
of the formers and locate your nearest laser cutting facility, who will provide the material neatly cut to close tolerance. All that is required to complete the formers is to file or grind the 3mm radius on the top edge. If you are not proficient in CAD, the laser cutting facilities will generally digitally produce the cutting files for you at a small additional cost.

The copper sheet can then be cut into blanks. Each blank should be cut about 14-16 mm oversize to the forming plate. The copper blanks are then annealed by heating the copper to a dull to medium red all over. Once the blanks have been heated they can be dropped into cold water or allowed to air cool - either method is fine. Water cooling has the advantage of cooling

it quickly and flushing some of the black oxide off the surface. The cheapest and easiest heating method is to use an LPG gas burner such as a Sievert torch or similar.

Once you have decided what method you will use to make your formers, you will require a clamping plate about 6mm smaller all round than the former. If using a laser cut former, you can have the

Fig 3



**Ballaarat Boiler For 5" Gauge
Flanged Plates And Former Details**



01 Laser cut steel boiler formers and the backing plates (photo: Jim Clark).

10mm or 12mm clamping plate cut at the same time.

The clamping plate sandwiches the copper sheet between itself and the former and is held firmly in the vice or in a press. You can then commence dressing down the flange. The flange should be dressed down slowly with small close-spaced blows from a soft-faced hammer, working slowly around the entire former.

Initially, you may be able to get around the former twice with the hammer blows before the copper begins to work harden. You will notice when the copper begins to work harden, as there is slight ring to the copper as it hardens and of course it won't flange over any further. The partially flanged copper blank should now be removed and re-annealed. It may be necessary to anneal the blanks six to eight times; patience is a virtue. The need for repeated annealing will be especially noticeable with the backhead and throat plate near the re-entrant curves and the corners of the firebox plates.

Once the flanged plates

have been closed over with the soft-faced hammer it is then necessary to use a smooth flat-faced steel hammer to tap the flanges in tight against the former. This action may raise the corner radius of the blank off the flat former surface, so

it will be necessary to dress down the raised edge with a soft-faced hammer and continue to tap the flanges tightly to the former until the face is flat and the edges are tight against the former. The excess material can then be cut off the flange edges to provide the overall flanged plate dimension of 15mm.

It is imperative that the finished flanged plates maintain the specified overall dimensions and have not 'grown' during the hand forming process. If the plates have grown slightly oversize, the 3mm material is sufficiently thick that a small amount - no more than 0.5mm - can be filed off to bring the flanges back to size. The most important area to keep within dimensions is around the boiler support/expansion angles, as this part of the boiler has to fit between the frames and there is little room for error.

Assuming all is well with flanging of the plates, the next stage of the process is accurate placement and drilling of all the holes (**fig 3**). All holes regardless of size should be accurately marked out, centre popped and then centre drilled with a 3.15 mm diameter centre drill on the

larger holes and a small 2.0 mm diameter centre drill on the small rivet holes.

The smoke box tubeplate and firebox tubeplate firetube holes should be drilled slightly oversize with a 9.7 mm diameter drill. This drill is not standard but it provides about 0.18 mm (0.007 inch) clearance on the 9.53 mm diameter ($\frac{3}{8}$ inch diameter) copper fire tubes. It should be readily available from any good tool merchant.

A stepped shoulder drill is ideal for drilling the 12 mm diameter and larger holes.

The throatplate with the large barrel hole will require some work, either chain drilling, cutting and filing, or alternatively accurately setting it up in the mill and boring out the hole. Do not cut the firehole in either the backhead or firebox backhead until you have fabricated the firehole band, then you can trace your fabricated firehole shape onto the two plates and cut them out to suit (**photo 2**).

This completes the fabrication of the flanged plates; the next step will be the forming of the inner and outer wrappers and the barrel.

●To be continued.



02 Set of flanged boiler plates (photo: Jim Clark).

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Tools and Machinery

■ **WARCO BV20-1** lathe 8" swing over bed 13" between centers. 3 jaw and 4 jaw chucks, face plate, quick change tool post with 6 toolholders. Full set inch and metric screw cutting gears. £600.

T. 01457 856413. Glossop.

■ **FREE LATHE** - Many years ago I was given an old 'PORTASS' lathe by a reader in the North: I am now prepared to pass it on again, but transport costs have increased so much, that I must ask the successful party collects it.

T. 01480 531667. St Ives, Cambridgeshire.

■ **Universal Miller** screw cutting lathe, 3 wood lathes, £150 each. Large 2 speed Bandsaw, £300. Rotary Inverter 7HP, £300. Back geared Pillar drill, £200, accessories to fit all of above makes, height vernier, inside vernier + depth angle vernier.

T. 01142 334758. Sheffield.

■ **80mm 4 jaw** chuck, 65mm three jaw chuck, 12 hole indexer all 3 with 1/2" 20 TPI thread. Vertical slide and vice, 8 single tool holders. All suitable for use on an old Cowells lathe. Photos available.

T. 01329318033. Fareham.

■ **Smart and Brown Sabel** lathe headstock and spindle, in fine condition together with bull wheel and thrust bearing. The 4-step pulley is not included; £100 buyer collects. Also available are several headstock related castings for £30.

T 01845 526435. Thirsk North Yorkshire.

■ **Dean Smith and Grace** lineshaft driven lathe, 18" swing, 32" gap, 6' very good condition, 92mm bore, this Rolls Royce of lathes was new to Levant Mine in 1920 mining work from then to today, 3 tons interest?

T. 01803 557107. Torquay.



■ **Atlas BGSC** Lathe c/w 4 jaw independent chuck, 3 jaw c/c chuck, powered cross-slide, change gears, stand, spare motor, f/r, stop/start. cutting tools, £695 Also various single phase motors, 1 ton chain block, beam trolley. **T. 07542113567. Holywell.**

Models

■ **Locomotive LMS**, black, 5 built to Don Young drawings in 5" gauge exhibition standard, little wear and extras like vacuum, engine, brakes, full boiler certs for 4/1 years, price £10k.

T. 01202 813366. Bournemouth.

Parts and Materials

■ Lot of 3mm eutectic arc welding rods. Box of aluminium sheet offcuts. Vintage as-new 6V-12V battery charger. Clarke MIG welder, 150 Amp gas type. Call or text for more info.

T. 07909 766687. Bury St. Edmunds.

■ **Stuart Turner**, No 9 casting set inc Governor and water pump as supplied by ST with drawings, £400.

T. 01202 813366. Bournemouth.

Wanted

■ Top slide for Colchester or Harrison Lathe.

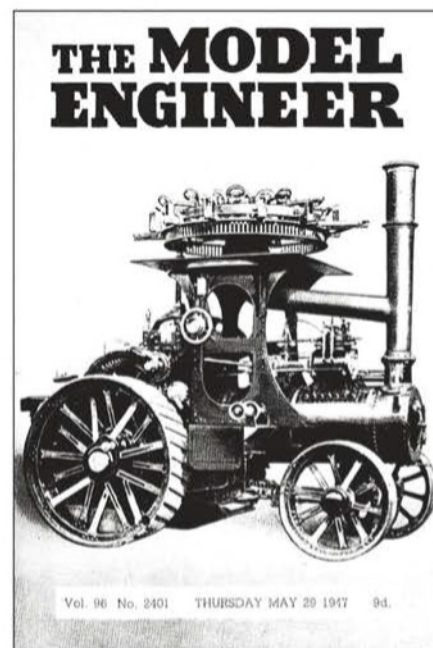
T. 3530872020628. Cork City, IE.

■ Service handbook for Excel Swing Die Grinder. **T. 07947 606525. Urmston.**

■ **Prestacon** press spares, punches, guide bars etc. or complete press considered, or detail drawings for tools and guides.

T. 07497 634128. Sutton Coldfield.

■ Free holiday for two in exchange for either a Myford Super Seven or Cowells ME lathe. Must be in mint condition. Sensible adverts did not work, hopeful this time. **T. 01986 835 776. Norwich.**



The *Little Demon* Supercharged V8

PART 14

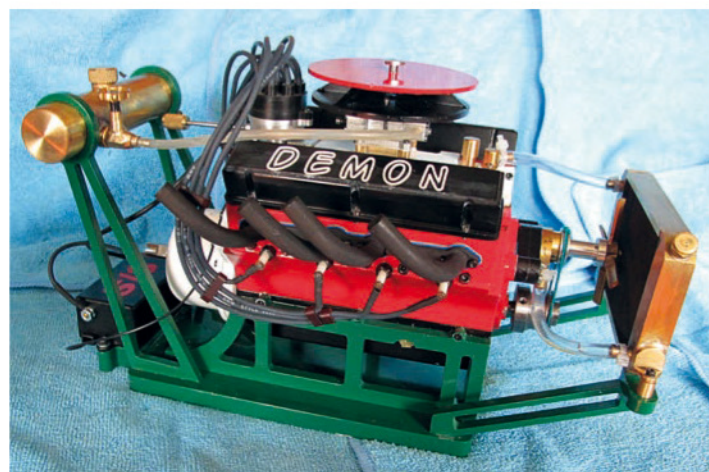
Mick Knights describes the construction of a supercharged V8 internal combustion engine.



Continued from p.395
M.E. 4699, 9 September 2022

We're now getting to the point where all the jobs I've been putting off for one reason or another now have to be tackled. I stressed at the outset that all the machining needed to be as accurate as possible and here's a good 'for instance' as I set about drilling the fixing holes in the rocker covers and the corresponding 10BA tapped holes in the cylinder heads.

There are seven radial relief features in the side of the covers that allow the screw heads to enter the clearance holes in the base. Once these have been machined the resulting web thickness between the inside of the rocker cover and the outside of the radial relief is only 0.0075 inch - that's of course if all the other elements of the rocker cover are exactly to the drawing dimensions. The diameter of the head of the 10BA cheese head screws I'm using is just under 3mm which is 0.118 inch and that's 0.025 inch above the 0.093 inch diameter of the UNF screw specified for the diameter of radial relief. This would mean the relief breaking through on



both banks of holes. There's not a lot of spare room on the base of the cover to increase the spacings but I increased the hole centre distance by 0.025 inch giving an extra 0.0125 inch a side and hoped for the best. Anyway, with so little room for error the best plan is to drill the cylinder head and the rocker cover together at the same setting.

There are two ways of approaching this. The first would be to drill the clearance holes in the base directly after producing the reliefs in the cover and using the resulting 'V' of the

clearance drill in the cylinder heads as a centre guide for the 10BA tapping drill. With the hole being positioned to the outer edge of the cover locating lip, though, the drill would have to enter at the half way point between the lip and the cover locating recess. With this area being so thin it could well end in tears. The second - and the method I selected - was to produce each aspect of the rocker cover securing holes as a separate operation.

As we've established, the centre line of the fixing holes is directly on the outside lip of the upstanding location for the rocker cover, which means a semi-circular clearance needs to be produced before drilling the tapping holes. I used a 1.5 mm diameter solid carbide cutter to produce these features (**photo 170**). Next, the centre positions were established (**photo 171**) followed by the tapping drill to a depth of 0.250 inch (**photo 172**). The rocker cover can now be placed in position on the head and secured by a finger clamp ready to mill



Semi-circular cut-out.



Centre drilling.

the radial reliefs. This is best achieved by using a milling cutter but all my milling cutters up to and including 10 mm are disposable solid carbide and the shank diameter needs to be relieved from 4 mm to just under 3 mm in order for it to clear the semi-circular relief it's just produced. This would be quite straightforward with a green grinding wheel, which I don't currently have in my available kit, so rather than order one and wait for it to be delivered I set about reducing the diameter by using diamond files while rotating at 100 rpm in the lathe - it took about half an hour, but it worked (**photo 173**). The centre drill for the clearance drill also needed to have its body reduced in order to clear the sides of the radial relief but being HSS this wasn't such a mission as the solid carbide (**photo 174**).

Once the clearance holes had been drilled in the base flange the cover was removed and while the front reliefs looked sound the rear ones showed signs that it wouldn't take much for the web to break through, so I reinforced the internal face around the weak areas with a little JB Weld (the machinist's friend) which, when cured, would be milled flat to leave about a 0.010 inch to 0.015 inch raised thickness on the inside face. All that was left then was to tap all the holes 10BA. A quick word about tapping very small threads. Of course only use sharp taps - carbon steel taps tend to keep their edge longer than HSS on softer materials, but they don't last that long on harder and dense materials. Only use the tap when it's freely cutting the material. As soon as there's any resistance it's time to bin it and use another - this saves tears before bedtime. Rather than use a regular 'T' handle tap wrench I use pin drill chucks to hold small taps as the pressure is always directly downwards and if the tap meets any resistance it should slip inside a pin chuck (**photo 175**).

Back to the distributor and cam shaft for the final fitting of the mitre gears that supply the



Drilling for 10BA fixing thread.



Producing radial relief.



Centring for clearance hole.



Pin chucks for small diameter tapping.

drive from the camshaft to the distributor rotor.

These two small mitre gears truly are worth their weight in gold. I was somewhat taken back when I saw the cost of a stock pair of gears from the recommended supplier in the States - if memory serves me they were about the £55 mark for a pair which would also have carriage and tax added. I was also quoted \$100 for two brass versions, also to be sent from the States. To have two specially made by HCP was also off the scale and they needed more information than was supplied with the plans. I was tempted to use Delrin, as a pair could be bought online for £35 + p&p. After several evenings trawling through the results from a well-known search engine I was about to give up and bite the bullet and order the super expensive ones from across the pond until one last search through the well-known auction site's online shop produced a result from a German model site, where a set of steel mitre gears with identical dimensions could be purchased for £12.72 plus £8.26 p&p. Their website

is quite interesting as they specialise in producing very small gears of all types primarily designed for Lego models and the like but if you ever get stuck for small gears or worm drives that the big boys don't produce this site might be worth a visit.

There was one small difference between these gears and the ones specified - they had 20 teeth compared to the 18 specified but as the ratio was still 1:1 this wouldn't make any difference. Once ordered they arrived five days later, if anyone is interested the details are:

Part No.193194524709
Hohn-modellbau
info@hoehn-feinmechanik.de

One gear fits directly to the distributor drive shaft and is secured by a M2 grub screw. The other gear fits on the end diameter of the camshaft, which has to be reduced from 6 mm to 4 mm in order to accept the gear. The gear itself has a 3 mm bore which has to be drilled and reamed 4 mm. Once reamed the diameter of the hub has to be turned to a press fit to suit the inside diameter of the rear ball race. **Photograph 176** shows the



Turning the gear hub.



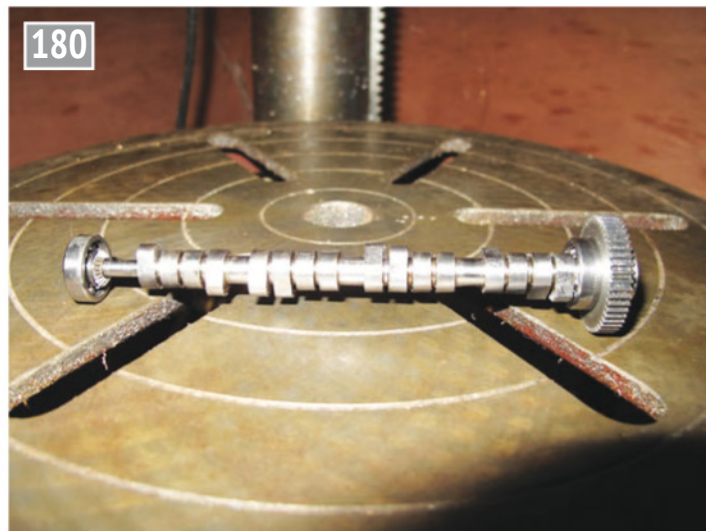
Producing the location flat.



Drilling 1.60 diameter hole for the grub screw.



Bearing/gear assembly.



Completed camshaft.

turning of the gear hub while supported on a taper mandrel.

The distributor drive shaft needs to have a flat milled for the M2 grub screw to locate and secure on to. (photo 177) while the gear is drilled to be tapped M2 (photo 178). The drawing calls for two flats to be milled at either end of the drive shaft but I only milled the gear end flat, as from past experience of installing Hall sensors I've found it handy to be able to fine adjust the position of the rotor arm in relationship to the position where the magnets fire the sensor when finally setting the timing.

Establishing the exact position of the bearing/gear assembly on the camshaft can only really be done by introducing it to the gear on the distributor drive. With

the camshaft fitted in the cylinder block and the timing gears in mesh, so rotation could be achieved by rotating the crankshaft, I set the distance of the bottom face of the distributor gear to just clear the 4 mm diameter of the camshaft, then gently tapped the bearing/gear assembly towards the distributor drive until they both meshed. Checking that they rotated smoothly when the crankshaft was rotated, I took a measurement from the back face of the block to the outer rim of the bearing, which was 0.025 inch. With the distributor and the bearing/gear assembly removed a little Loctite 648 was run around the camshaft diameter and the bearing/gear assembly was tapped back onto the camshaft until the 0.025 inch

dimension from the back face was obtained. As we've previously established, this particular bonding agent is a slow cure type which allows time to position the parts correctly but, once cured, it's very unlikely you'll separate the parts without considerable damage. On final assembly there is still a degree of adjustment available to ensure both gears are in mesh before locking the camshaft in position. **Photograph 179** shows the bearing/gear assembly and **photo 180** shows the finished camshaft.

There's one more thing that needs to be done to the distributor and that's to mill a 1.5 mm wide slot to take the Hall sensor. When the rotor plate holding the eight magnets is correctly positioned the south poles of

the magnets should rotate no more than a couple of thou above the bottom face of the distributor pocket, so the top face of the Hall sensor needs to be no more than 0.002 or 0.003 inch below the bottom face of the distributor pocket - so its positioning is critical. The depth of the slot has to position the sensor directly beneath the entire diameter of the rotating magnet. The Hall sensor I'm fitting is 4 mm wide and also has sides in the shape of a 'V' rather than square. If the width of the slot is made exactly 4 mm, the corner radius will hold the 'V's of the sensor in exact position where it can be finally bonded in position a little nearer the end of the build (photo 181). **Photograph 182** shows the completed distributor with mitre gear in position.



Machining position of the Hall sensor.

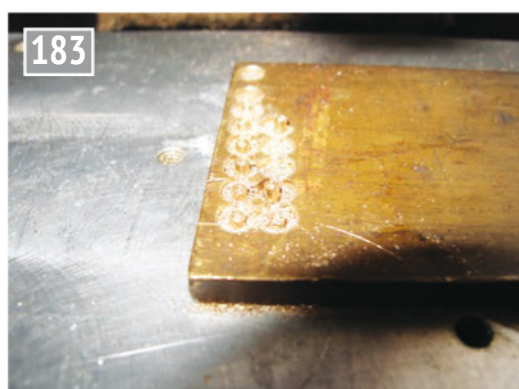


Completed distributor.

Nine high tension leads are required, one to deliver the charge from the CDI unit to the distributor and eight for the spark plug connections. The nine holes in the distributor cap were made a sliding fit to the lead. Nine brass connectors are required, which in turn will be soldered to the leads. The bottom face of these connectors needs to be positioned a few thou above the distributor's rotor arm.

The connectors have a double diameter – one, at 0.097 inch, is a press fit to the distributor cap and the other is the main body that's in fresh air inside the distributor cap and is finished at 0.125 inch diameter. To provide a 0.002/0.003 inch clearance between the face of the connectors and the rotor arm the shoulder lengths on the connectors need to be identical. The most accurate means at my disposal was to generate them on the CNC mill from a piece of ¼ inch thick brass plate. As these components are again exceedingly small the final cut circle cycle was to depth of 0.246 inch leaving a 0.004 inch web to retain the part after machining. I used a 1.5 mm centre cutting solid carbide end mill for all the cycles, the first being to drill a central hole 0.156 inch deep into which the H/T lead would be soldered (photos 183 and 184).

To solder the leads to the connectors I stripped back about ⅜ inch of the outer



Generating a batch of connectors.



The finished connectors.



Set up to solder lead to connector.



The connectors inside the distributor cap.

cable casing to expose the wire and folded it double. The connector was placed inside a clearance hole drilled in a convenient piece of plate and a small piece of solder placed in the central hole (photo 185). A gentle flame was played around the plate surrounding the connector until the solder completely melted. The doubled-up bare wire was then placed in the central hole until the solder cooled (photos 186 and 187).

●To be continued.



The leads protruding from the connector bores.

Rewinding a Two Speed Motor

PART 6

Graham Astbury learns a lot about single-phase induction motors and describes 'The long and winding road that leads to a 2-speed single-phase motor'.



Continued from p.405
M.E. 4699, 9 September 2022

Sizing the capacitor: eight-pole speed

The original 16-pole speed used a 10 μ F capacitor which provided 0.92 A to feed the auxiliary winding. Similarly, it provided 1.49 A to the two-pole auxiliary winding so, as it is now required to provide 1.30 A to the new eight-pole windings, it would appear that the original 10 μ F capacitor might be acceptable. However, Trickey (ref 13 – see M.E.4697, August 12) gave a method of determining the impedance Z of the capacitor as $Z = V / (I \times \cos \phi)$ where V is the supply voltage, I is the phase current and $\cos \phi$ is the power factor of the winding. Since the two windings are the same, they should be at quadrature (90 degrees to each other) with one leading and the other lagging, so the power factor angle ϕ for one winding will be half, say 45 degrees which corresponds to $\cos \phi$ being about 0.7. Substituting into the equation gives the impedance as $Z = 240 / (1.3 \times 0.7) = 236 \Omega$. Since the impedance of a capacitor is $Z = 1 / (2 \times \pi \times f \times C)$, the required capacitance is given by re-arranging the last equation to give: $C = 1 / (2 \times \pi \times f \times Z)$ which equates to $C = 1 / (2 \times$

$3.142 \times 50 \times 236) = 0.0000135$ Farads, or 13.5 μ F. As the capacitor has an impedance of 236 Ω and a current passing through it of 1.3 amps, the voltage across it will be given by $V = Z \times I$ which equals $V = 236 \times 1.3 = 307$ volts.

On the other hand, it could be reasonably argued that as the power input to the motor was being increased by 50% from 250 watts to 375 watts, then the current drawn would increase in proportion and so the capacitance would also increase in proportion, requiring a capacitance of 15 μ F. Since I had a 12.5 μ F capacitor in my 'stores', I decided to try that as a first approximation. However, once completed the motor can be tested and if there is a significant imbalance of current between the windings, then the variation of balance with capacitance at the design output power can be determined. If the capacitor is too small, then the performance of the motor suffers in that the output power is low as the two windings will be out of balance. Increasing the capacitance will bring the two windings into balance and as the capacitance increases further, the auxiliary winding will supply more power and the main winding less power, again upsetting the balance. The optimum capacitor value can be determined by test when the motor is completed.

Magnetising current: eight-pole speed

The last calculation to carry out is to determine the magnetising current for the

eight-pole winding. The magnetising current per phase can be estimated based on the air-gap dimension and increasing the current by a small factor to compensate for the iron of the stator where the ampere turns required are small by comparison to those required for the air gap. I measured the air gap using feeler gauges (**photo 17**). Naturally, the feeler gauges that can be fitted in between the rotor and stator are twice the radial air gap. The value of magnetising current can be estimated using a method given by Kemp (ref 10 – see M.E.4696, July 29) from the magnetic flux density, the air-gap and the turns per pole using $I_m = (0.45 \times 10^3 \times I_g \times H) / N$, where I_g is the air-gap dimension, H is the flux per pole and N is the number of turns per pole. The 0.45 is a factor to take account of the peak flux to average flux and the 10^3 is the conversion from Wb to mWb. Using the measured value of 0.4 mm for the air-gap, 0.45 mWb for the flux and 165 for the turns per pole, the magnetising current per pole for the air gap is given by $I_m = (0.45 \times 10^3 \times 0.4 \times 0.45) / 165 = 0.49$ A. For small motors, the magnetising current for the iron part of the magnetic circuit will be anything from 0.1 to 0.3 times the air gap magnetising current. Where the slot opening is fairly large compared with the stator teeth (as in the case of this motor), the additional current for the iron will be towards the top end, so the total magnetising current per phase will therefore be around $0.49 \times 1.3 = 0.64$ A which



Measuring the air-gap using feeler gauges.

seems credible. The total magnetising current drawn will be $\sqrt{2} \times 0.64 = 0.90$ A which is about half the current drawn at full load. The magnetising current is that which would be drawn if the rotor were rotating at synchronous speed and hence did not have any current passing through its rotor bars.

The four-pole winding

There are two ways to base the calculations for this winding - from the eight-pole winding or from the two-pole winding. As the number of poles is only a factor of two from the two-pole winding, this is probably the most appropriate basis. As the eight-pole winding was based on a factor-of-two from the 16-pole winding and it would be a factor-of-four for the four-pole winding, this would seem less appropriate as a basis for the four-pole winding. Looking at fig 16 again (M.E.4699, September 9), the likely turns per phase for a four-pole motor would be between 717 and 948 turns. Again, cross-checking with fig 15 (M.E.4699), the likely input power for 948 turns would be about 480 watts, which is a bit more than the desired power input.

Adjustment of the turns per phase to say 1100, gives the power input around 450 watts which is nearer the originally desired 375 watts input power. However, the copper losses of the four-pole winding will be more than that of the eight-pole winding as the mean length of a turn is greater as the coils now span six teeth

on average (actually five teeth for one coil and seven teeth for the second coil) rather than the three teeth of the eight-pole winding, so a greater input power would be needed to compensate. On the contrary, as the coil span includes more teeth in the four-pole winding than the eight-pole winding, magnetic fringing (flux leakage) from coil to coil will be less in the four-pole winding than the eight-pole winding. As these values cannot easily be estimated, it can be assumed that the figure of 450 Watts and 1100 turns will be acceptable and all that remains is to check the wire size and the current density.

Taking the number of turns per phase as 1100, the turns per slot are now $1100 / 8 = 137.5$ which can be rounded down to 135 giving a total turns per phase as 1080. As the available area for the windings in the slot is 34 mm^2 (half the 68 mm^2 of the entire slot), the maximum cross-sectional area of the wire that can be wound in is $34 / 135 = 0.25 \text{ mm}^2$, and this corresponds to a diameter, including the enamel, of $\sqrt{(0.25 \times 4 / \pi)} = 0.56 \text{ mm}$, so the actual wire diameter is 0.5 mm taking 0.06 mm off for the enamel. As the power input is assumed to be 450 watts, and the power factor is taken to be same as the eight-pole winding as assumed before, the total current drawn will be $450 / (240 \times 0.85) = 2.20$ A and the phase current will be $2.2 / \sqrt{2} = 1.56$ A. For a current density of $7.5 \text{ A} / \text{mm}^2$,

the cross-sectional area of the wire will have to be $1.56 / 7.5 = 0.208 \text{ mm}^2$ and the diameter will be $\sqrt{(0.208 \times 4 / \pi)} = 0.51 \text{ mm}$. This will give a current density slightly greater than that desired but less than that calculated for the eight-pole winding so will be acceptable.

In practical terms, with the four-pole winding, there are twice as many slots wound for each pole as in the eight-pole winding and as each pair of slots is fitted with one coil, there are two sets of windings crossing over at the end, as between slots 2 and 3. This is shown in Fig 19. Therefore, the winding will have to be fractional pitch as in the eight-pole winding. As there are 1080 turns per phase, the turns per pole will be $1080 / 4 = 270$ which is divisible by two and since there are four slots per pole and each coil occupies two slots, the conductors per slot will be 135 giving the total turns per phase as 1080.

The previous formula as before can be used to calculate the flux per pole: $B = V / (p \cdot f \cdot n)$, where B is the magnetic flux per pole in webers, V is the supply voltage, p is the number of poles, f is the supply frequency in Hz and n is the total number of turns per phase. For the four-pole speed, the flux would be $B = 240 / (4 \times 50 \times 1080) = 0.0011 \text{ Wb}$ or 1.1 mWb . Where there is a restriction on space at the ends of the windings, fractional pitch coils are used as they have a smaller overlap at the ends. Again, if full-pitch

windings were used on the four-pole windings there would be four coils crossing over at the ends of the windings which would occupy a lot of space. Using fractional-pitch windings means that there are only two coils crossing over at the ends and the windings are much more compact.

Again, for full-pitch (hemitropic) windings, the pole area is given by the total area of the stator bore divided by the number of poles. The stator bore area was previously calculated at 11624 mm^2 . However, if the windings are fractional pitch, the pole area is one tooth less than the full-pitch one, so the number of teeth embraced by the four-pole coils is $32 / 4 - 1 = 7$ and the pole area is $11624 \times 7 / 32 = 2542 \text{ mm}^2$, so the flux density is therefore $1.1 \times 1000 / 2542 = 0.43 \text{ T}$ which is almost the same as the 0.41 T for the eight-pole winding. Hence for this motor, the flux densities appear to be acceptable.

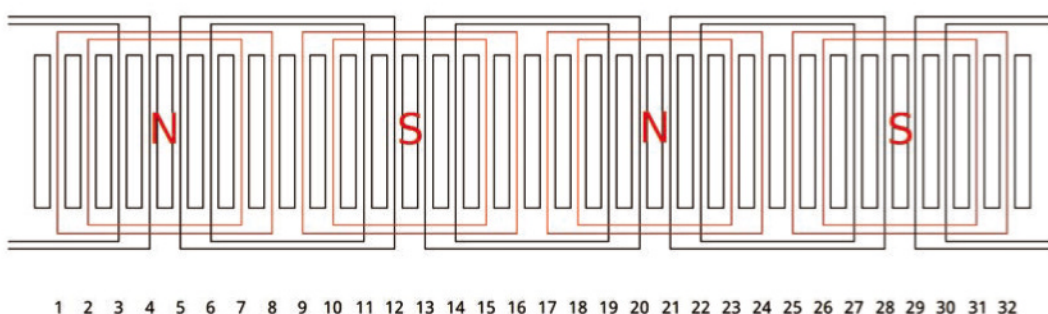
Sizing the capacitor: four-pole speed

The capacitor will now have to provide a current of 1.56 A to the auxiliary winding, so the capacitance will need to increase by $1.56 / 1.3 = 1.2$ so a value of $13.5 \times 1.2 = 16.2 \mu\text{F}$ is needed and $16 \mu\text{F}$ is the nearest size. The voltage rating will be the same.

Magnetising current: four-pole speed

This is the same calculation as that for the eight-pole windings. Using the value of 0.4 mm for the air-gap, 1.1 mWb for the flux and 270 for the turns per pole, the magnetising current per pole is given by $I_m = (0.45 \times 10^3 \times 0.4 \times 1.1) / 270 = 0.73 \text{ A}$ and adding the factor for the slot width the total magnetising current per phase will be $1.3 \times 0.73 = 0.95 \text{ A}$, so the total current drawn would be $0.95 \times \sqrt{2} = 1.34 \text{ A}$ which seems credible.

Fig 19



Four-pole fractional pitch winding.

●To be continued.

A Miniature Oscillating Steam Engine

PART 10

Hotspur constructs a three-cylinder reversible oscillating engine.



Continued from p.321
M.E. 4698, 26 August 2022



Here the inner firebox assembly has been located and secured with a few nuts and bolts ready for the group of rivets to be added.

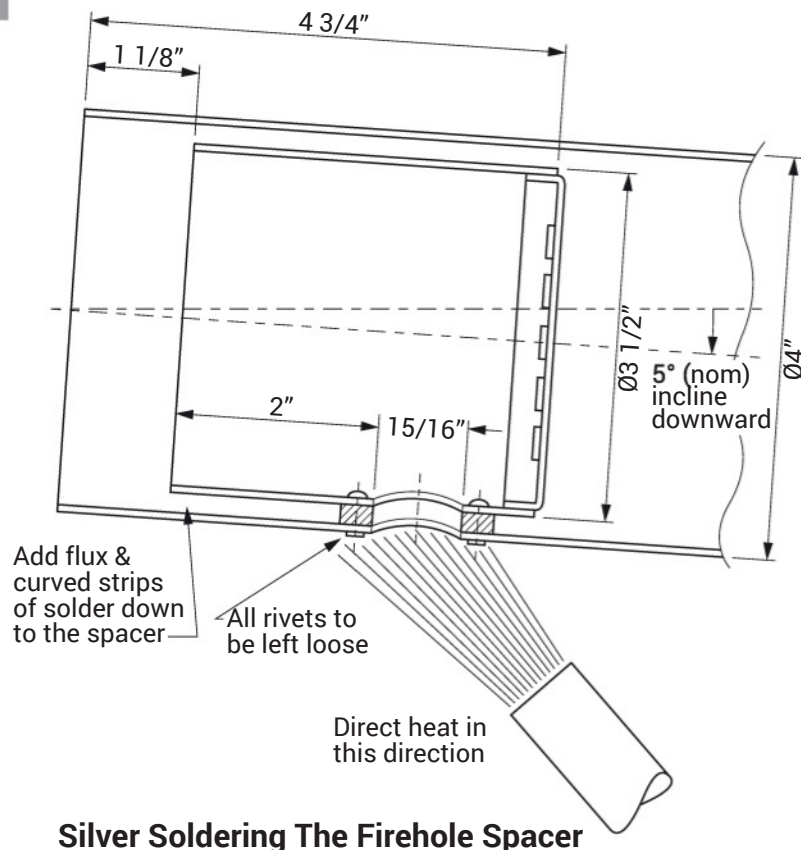
Continuing the boiler construction

Both parts of the boiler assembly were thoroughly cleaned and the inner fire box and tube assembly was fitted from the top and the rivet holes for the fire hole ring lined up so the spacer could be pulled up tight with bolts and nuts as shown in **photo 70**. The rivets were now added starting with the upper ones first, so the heads could be supported with a strong rectangular bar on the inside. This meant that the lower rivets would not get in the way but a couple of bolts could be left till last to maintain the alignment. I

left the rivets slightly loose so they could move endways as this would encourage the silver solder to penetrate and the progress was recorded in **photo 71**.

Carrying out the silver soldering operation to secure the fire hole spacer against the barrel required careful thought as the space down between the inner fire box and the outer barrel is only around $\frac{3}{16}$ inch. I decided that if sufficient flux and some curved lengths of solder could be offered down around the lower edge of the spacer and the boiler was laid on its front with the fire hole facing downwards, then

Fig 12



Hotspur may be contacted on 01600-713913 or hotspurengines@gmail.com



71
The riveting in progress with the ends peened over but not hammered down tightly so that the rivets were still loose and the silver solder could penetrate.

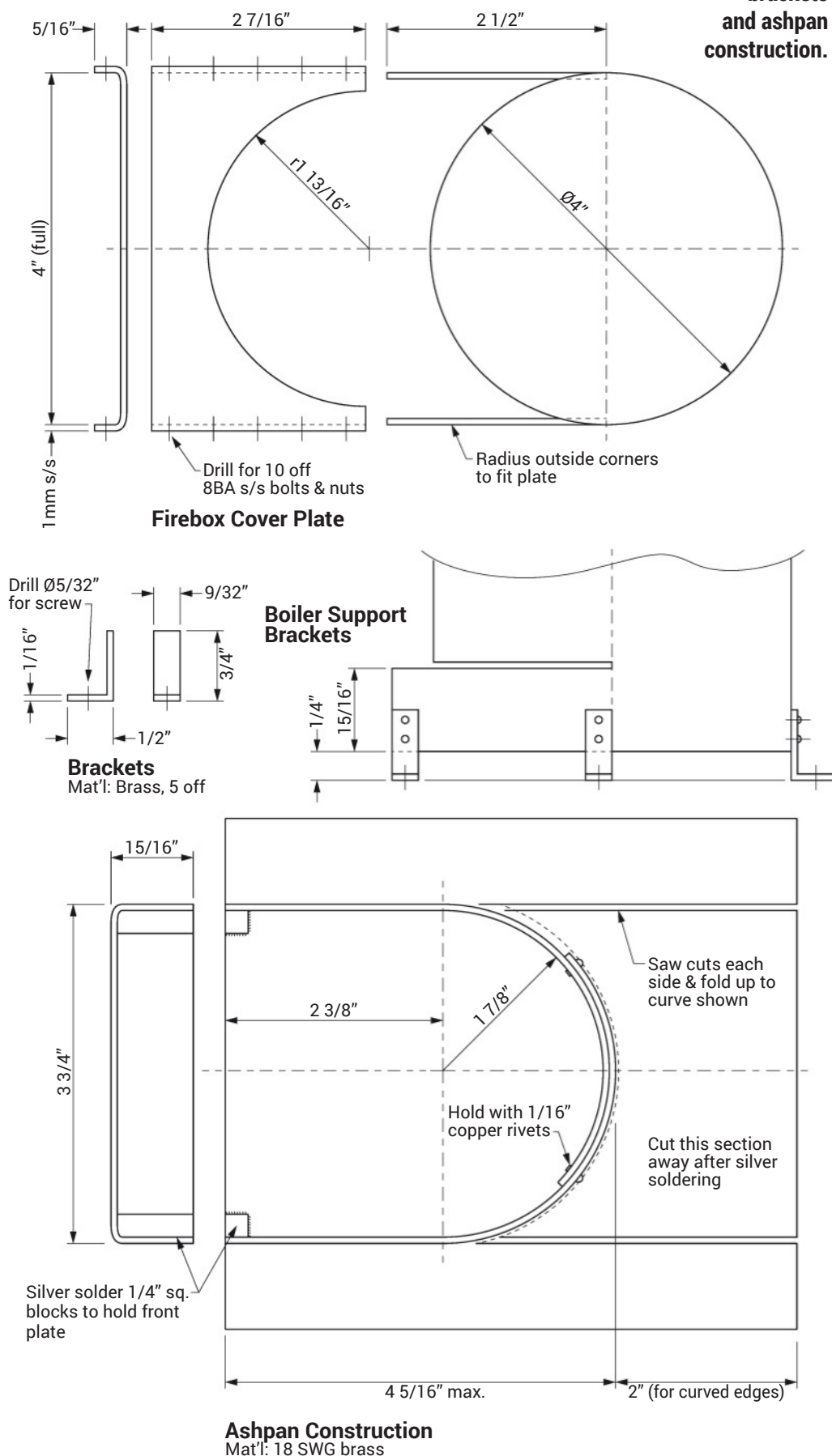
if sufficient heat was applied underneath, the flux and solder should work round the oval ring. The task was undertaken on a brazing stand in the centre of my empty garage with the boiler barrel sitting securely up on the 'V'-shaped knees of two half bricks to prevent it rolling off! These bricks were jacked up on two ordinary bricks so the flame from my large Sievert torch could be played up from below onto the lower edge of the fire hole. There is no picture for this but I have added a sketch (fig 12) that I trust our worthy editor can reproduce to confirm my description. The area became very hot but did not interfere with the lower tube plate. The result was that a circle of solder had penetrated the curved face of the spacer and all of the rivets showed that solder had entered down the clearance space left following their loose-fitting operation.

The set of four plain bronze bushes which fit around the fire hole were made from bronze and pre-tapped 6BA for some stainless bolts. These were given a small shoulder and they were inserted to rest on the inner fire box. A simple additional soldering operation secured these bushes and the result is shown in **photo 72**.

After a good clean the top tube plate flanged plate was soldered in by sitting the barrel vertically and surrounding it with bricks to form a small furnace enclosure for the

Fig 13

Boiler support brackets and ashpan construction.



heat retention. It required considerable heat and plenty of solder. A similar task was done once the foundation ring had been chamfered on its outside and inside corners and added at the base of the firebox. **Photographs 73 and 74** show the results. A pressure test could be carried out now, but I am going to wait until the top steam heating coil has been added a bit later.

Adding the ash pan

Plenty of head scratching took place before the design for the ash pan was finalised. I had mentioned previously that I wished to either use coal or gas for the source of heat so some discussion took place with various friends and I located a source for some gas burners (more of this later). They are only 1 ¼ inches in diameter and probably only

one would not be enough to heat the boiler efficiently, so I obtained three as they could be spaced in a triangular shape in the firebox and, with a single regulator valve, the heat could be varied.

So, to begin with, I obtained an 84mm diameter 6mm thick steel disc to be a trial layout for a 'rosebud' grate for the coal. The means of heating will be assembled under the boiler

through the opening for the ash pan.

To start the construction an opening was required at the base of the boiler and **fig 13** gives the details for this and the construction of the ash pan cover plate. The cuts to the base of the boiler can be undertaken with a hacksaw and the two side pieces made 1 ⅞ inches long by 1 ⅝ inch wide. **Photograph**



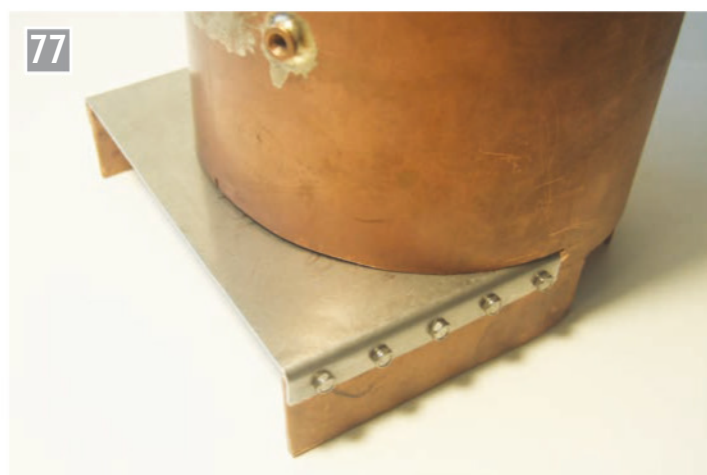
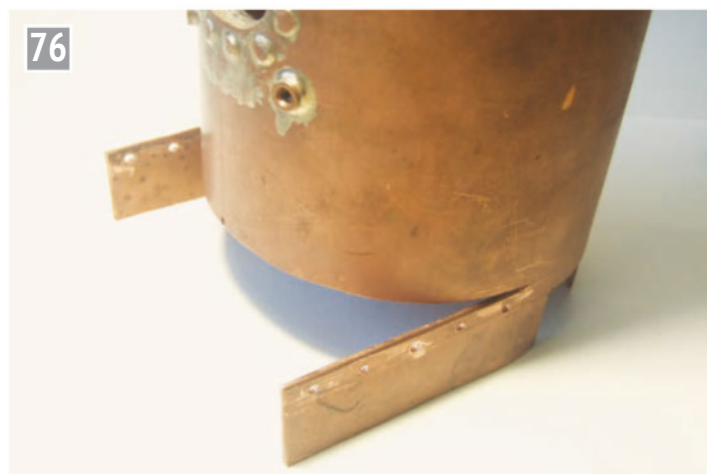
The four simple bushes in place on which to mount the fire door frame assembly.



These views show the soldered joints for the top tube plate flange and the foundation ring.



Here the opening has been made for the ash pan.



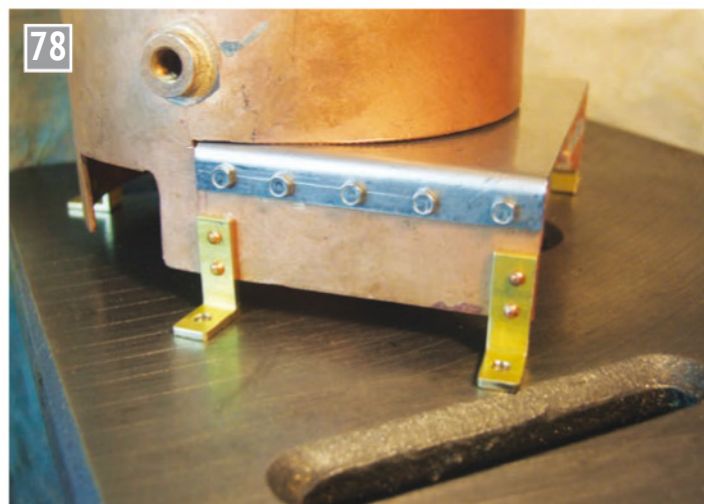
A radius has been added to the top outer edges to accept the angle on the stainless plate which is then attached with 8BA stainless bolts and nuts.

75 also shows the opening ready for the flanged 1mm thick stainless-steel plate to be added. Forming stainless plate of this thickness is best done with a folding machine but, as I do not have one, I used a thick steel bar and added a small radius to the edge for the angle to be made by hand with a mallet and a wooden block. The flange was then drilled for the ten stainless-steel 8BA bolts and nuts but the side strips require a radius on their outer top corners to allow the steel plate to fit snugly. **Photographs 76 and 77** show the result.

Before making a start on the ash pan, the boiler assembly requires five brackets to lift it up and add a $\frac{1}{4}$ inch gap around the base for ventilation. These can be made from stout brass angle by cutting slices a full $\frac{5}{32}$ inch wide and riveting them onto the skirt where shown on my drawing. I used $\frac{3}{16}$ inch long $\frac{1}{16}$ inch copper rivets to secure the brackets and, if the front pair and the single rear one are attached first, then the assembly can be placed on a flat surface like a drilling table to position the two on either side. Note that the last pair of brackets should be fitted in front of the vertical centre line so they are on a straight portion of the side section. This will enable the rectangular base plate for the ash pan to slide in without having to cut it to shape. **Photograph 78** shows what I mean.

The ash pan itself really needs to be made from a piece of brass sheet with the floor plate being longer than required to start with. My drawing offers this information. Mark out the two sides but, before flanging them, cut down as 'straight' as possible on the inside of each fold line as far as the intended centre point. Next, form the bends for the flanged sides and then bend the narrow sides inwards to make the radii, such that they will fit inside the boiler shell

diameter. Hold them in place with some small copper rivets. Silver solder the joint and use a weight to keep the assembly from distorting; if necessary, add some scraps of brass strip to fill any gaps. The waste section at the front can then be cut away and the edge filed up to the solder line. To complete the fabrication two sections of $\frac{1}{4}$ inch square brass need to be added to the outer front corners and these will have threaded holes added to attach the front plate. **Photographs 79 and 80** show the result but it may be made in any way to suit the builder's preference.

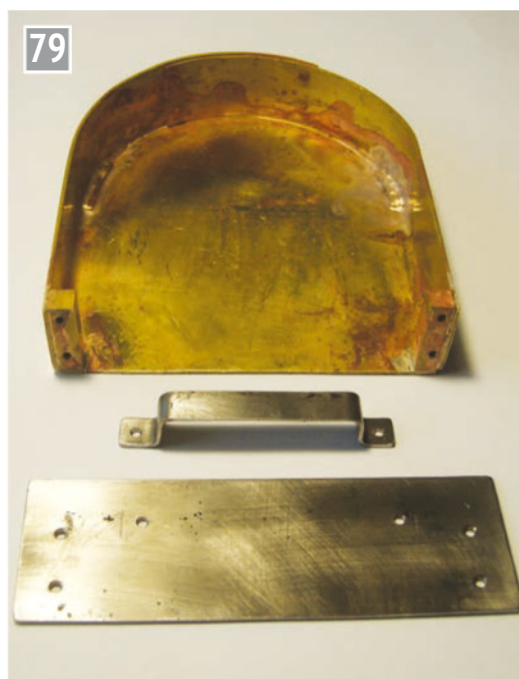


Here the five supporting brackets have been riveted to the lower edge of the boiler shell.

●To be continued.

NEXT TIME

I will describe the rest of the ash pan parts with the grate operating mechanism and the coal grate.



Two views of ash pan with the front plate and handle.

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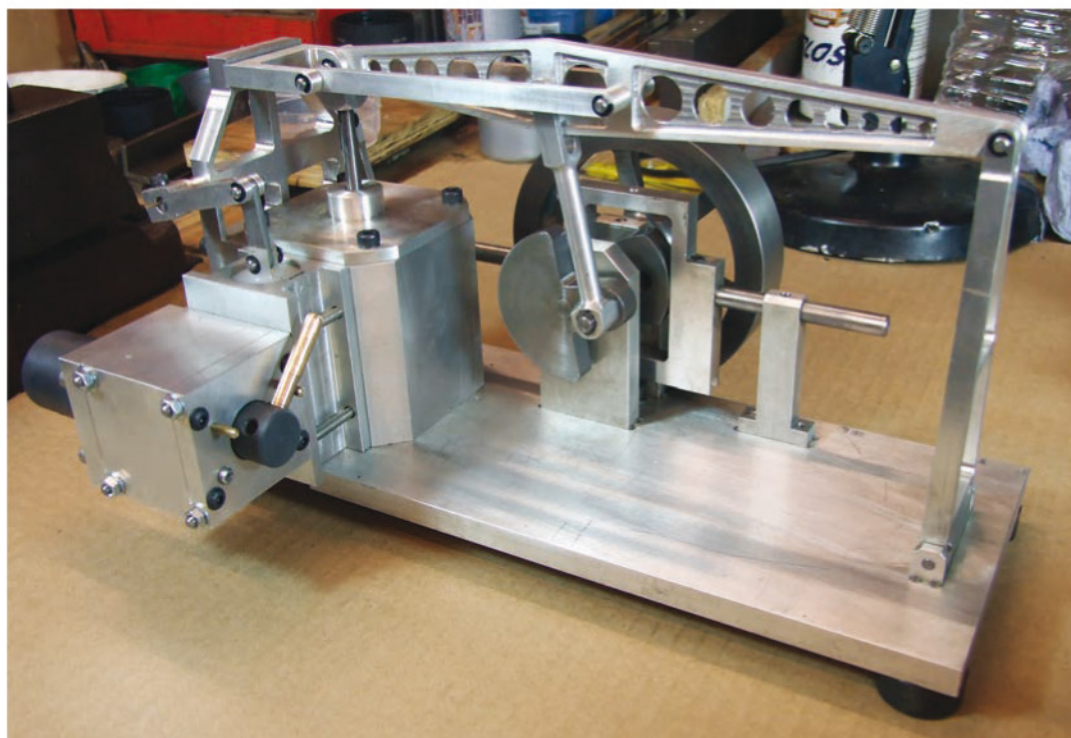
If you don't want to miss an issue...



Martin Gearing presents an ideal beginner's project with great potential for the more experienced builder.



Continued from p.379
M.E. 4699, 9 September 2022



Grasshopper Beam Engine PART 3

Item 1 - Base (Fig 5)

Preparing the blank

- * Lay the blank on a suitably sized piece of good quality plywood about 6 mm thickness or similar manufactured board (I find laminate flooring ideal for the purpose) to protect the table. Clamp to the table adjusting the position if possible so as to allow a long edge to clear one tee slot and still be able to work on both long surfaces with an end mill of at least Ø8, with the best long edge

parallel to the table edge.

- * After clamping, remove only enough to clean up the entire long surface edge. Machine the opposite edge to 120 ± 1 .
- * Remove the clamps from the end having the best surface and replace one clamp on the side and machine the end taking only sufficient to clean up the entire end surface edge.
- * Replace the two clamps and remove those from the opposite end replacing one on the side and machine the opposite end to 300 ± 1 .

If you followed the layout suggested using the blank provided by Noggin End you will already have one long and one short edge virtually finished requiring only the minimum of material to be removed on the opposite edges to clean up (**photos 2 and 3**).

The machining operations are best broken down into four separate stages to reduce confusion.

Stage 1 - Machining the base detail

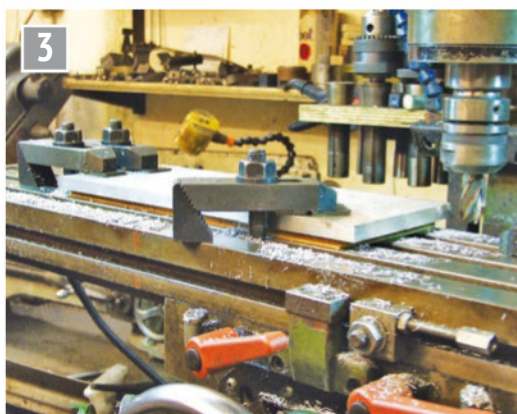
To ensure the accurate positioning on assembly to the base with the minimum of effort, the six rectangular components are located in 2mm deep pockets, of which I have 'overshot' the machining of each of the pocket lengths, to allow the components square corners to fit unimpeded, whilst leaving a small 'protruding lands' to locate the part at each of its ends.

All dimensions are in mm
Tolerance for all parts in the article - unless otherwise stated:

Non-functional (i.e parts that do not fit all match) $\pm 0.1\text{mm}$
Functional (i.e parts having to match) $\pm 0.02\text{mm}$



Nearside edge cleaned up.



Clamp moved to clean up right-hand edge.

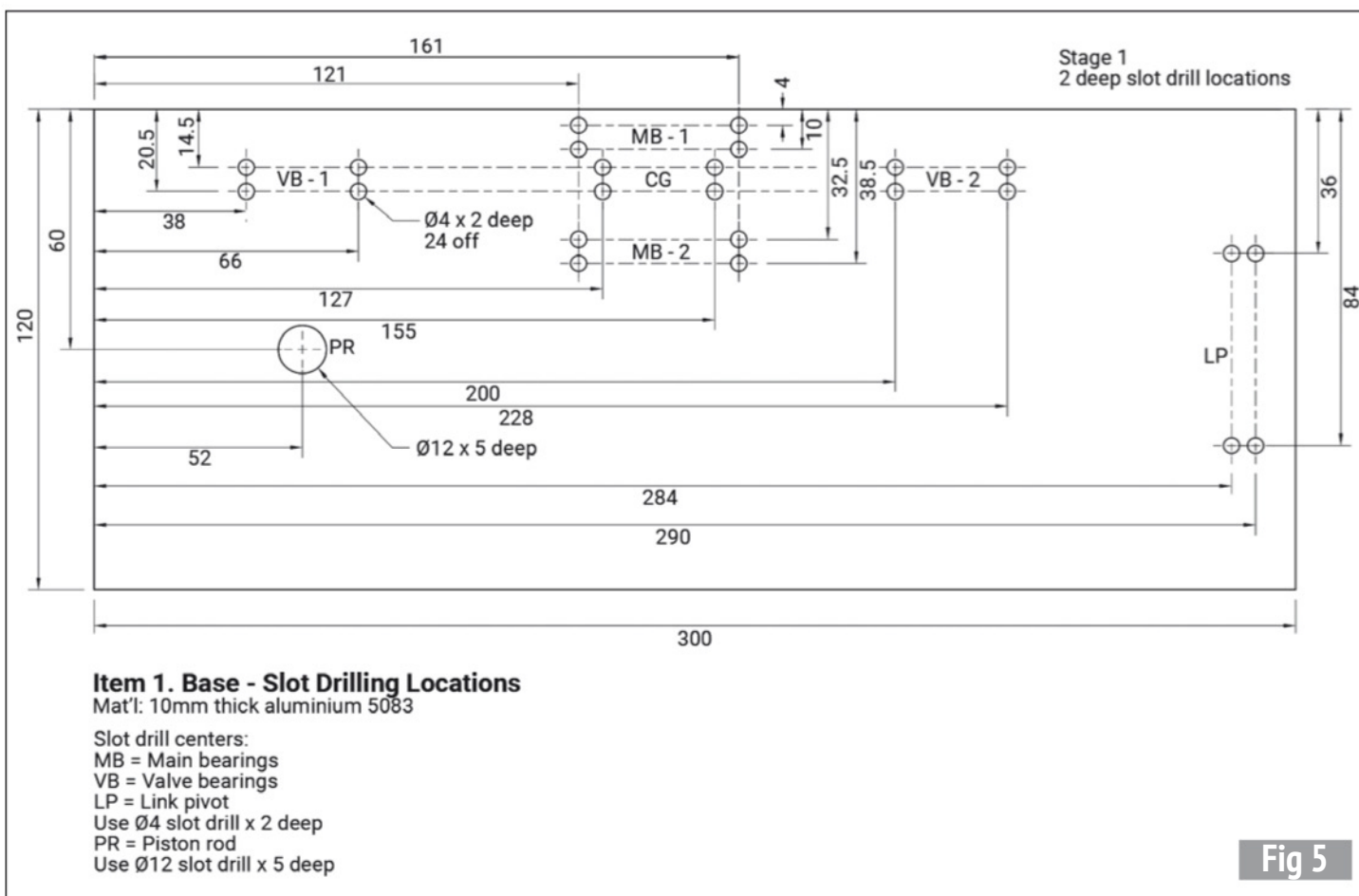


Fig 5

Table 4. Machining the base detail.

Ref	X Axis	Y Axis
<i>Base Ø4 x 2 deep Hole Coordinates</i>		
MB1	121 & 161	-4
	121 & 161	-10
VB1	38 & 66	-14.5
	38 & 66	-20.5
CG	127 & 155	-14.5
	127 & 155	-20.5
VB2	200 & 228	-14.5
	200 & 228	-20.5
MB2	121 & 161	-32.5
	121 & 161	-38.5
LP	284	-36 & -84
	290	-36 & -84
<i>Base Ø12 x 5 deep Hole Coordinate</i>		
PR	52	-60

* Zero the spindle to the rear and left-hand corner, zero X and Y axis feed screw dials/DRO. Use a Ø4 slot drill to drill 2 mm deep recesses at the 24 locations indicated.

Table 5. Milling out the pockets.

Ref	X Axis	Y Axis
<i>Base Ø4 x 2 deep - Pocket Coordinates</i>		
MB1	123	-4 to -10
	159	-4 to -10
VB1	40	-14.5 to -20.5
	64	-14.5 to -20.5
CG	129	-14.5 to -20.5
	153	-14.5 to -20.5
VB2	202	-14.5 to -20.5
	226	-14.5 to -20.5
MB2	123	-32.5 to -38.5
	159	-32.5 to -38.5
LP	284	-38 to -82
	290	-38 to -82

Feed into the plate slowly using lubricant as excessive force will cause the drill to 'wander'. This is followed by one 5 mm deep recess using a Ø12 slot drill as indicated (**photo 4**). A check list of the slot drill centre coordinates taken from the left-hand end



Drilling the base.

and rear edges is listed in **table 4**.

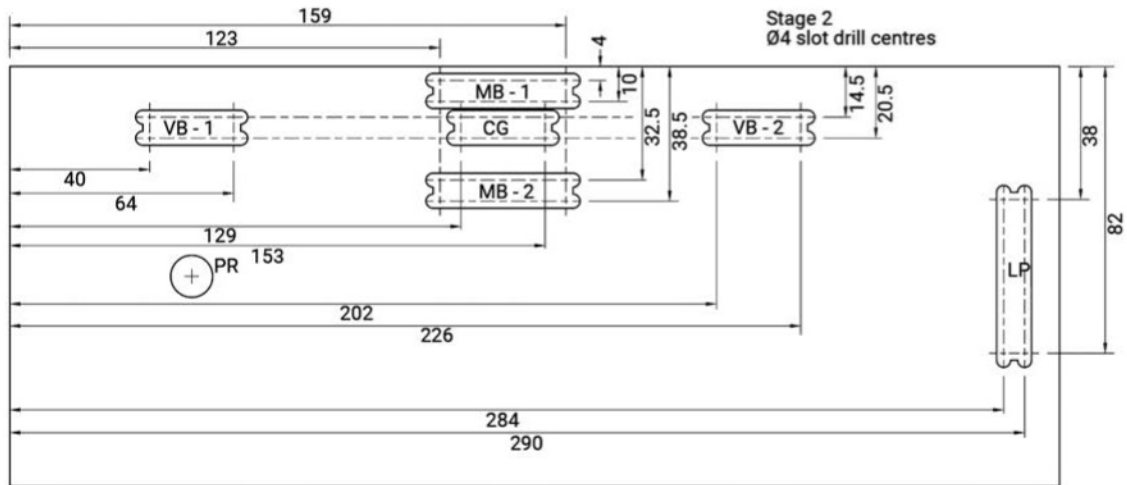
Stage 2 - Milling out the pockets (**Fig 6**)

* Using a Ø4 slot/drill, mill out the rectangle of the pocket followed by the 'internal' waste to produce the six 2 mm deep pockets as shown. Note that the LENGTH of each completed pocket does

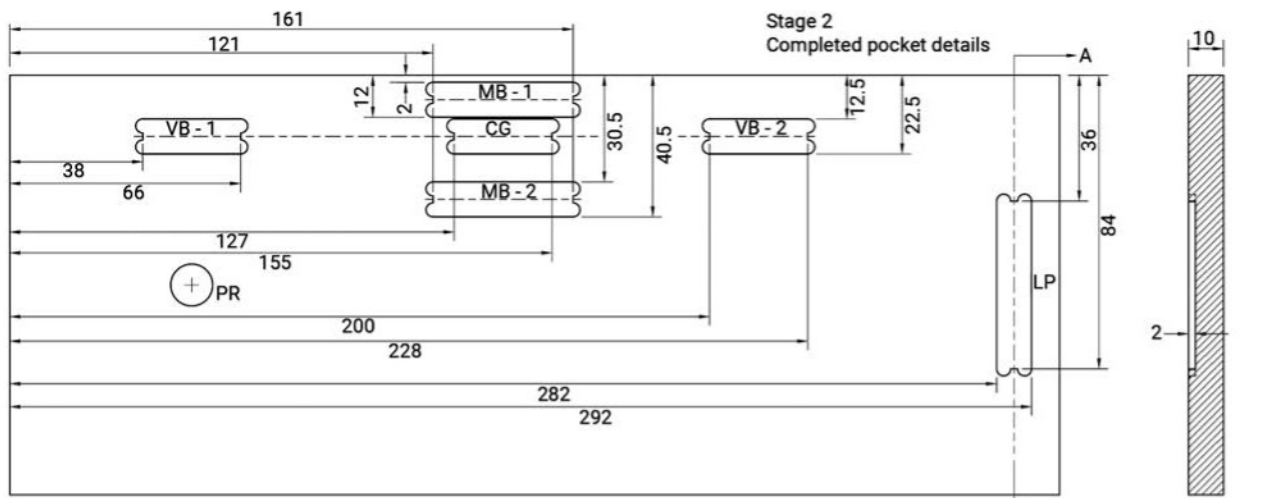
NOT go to the FULL EXTENT of the holes previously drilled for the purpose of clearing the corners of the component to be installed into the pocket (**photo 5**).

A check list of the slot drill centre coordinates to produce the rectangular outer boundary of each pocket is listed in **table 5**.

Fig 6

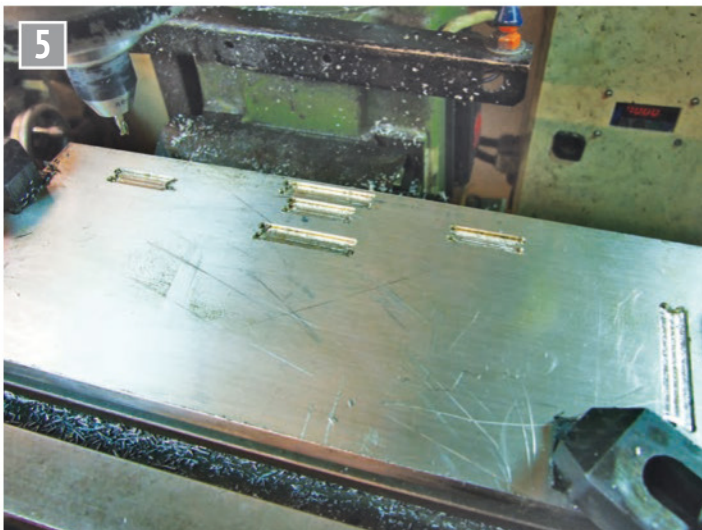


Pockets:
Use Ø4 slot drill x 2 deep
MB = Main bearing (2)
VB = Valve bearing (2)
CG = Cam guide
LP = Link pivot



Base - Pocket Details

Pockets:
MB = Main bearing (2)
VB = Valve bearing (2)
CG = Cam guide
LP = Link pivot
PR = Piston rod



Slotting the base.

Table 6. Drilling base for securing bolts.

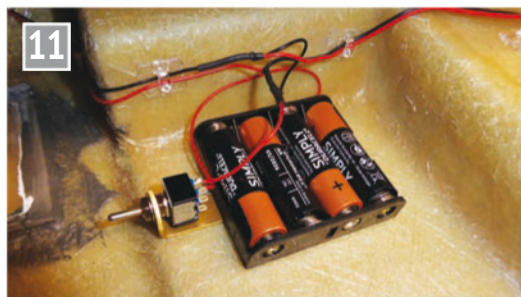
Ref	X Axis	Y Axis
<i>Ø4 Hole Coordinates</i>		
MB1	125 & 157	-7
VB1	42 & 62	-17.5
CG	131 & 151	-17.5
VB2	204 & 224	-17.5
MB2	129 & 153	-35.5
LP	287	-47 & -73
<i>Ø5 Hole Coordinates</i>		
Securing Bolts	25 & 79	-33
	25 & 79	-87
<i>Ø25 Bored Hole</i>		
Vent	52	-114

The Joy of Scrounging PART 2

Brian Baker tells the long story of the building of a Class 08 0-6-0 battery powered locomotive in 7¼ inch gauge.



Continued from p.371
M.E. 4699, 9 September 2022



11 Batteries and switch mounted in fuel tank recess, with Christmas light cable clips used to hold cables in place.



12 Chassis, cleaned up and primed, with the Mk 1 motor mount.

I think that working lights add a little extra to a model of this kind and I considered using the later type lamp epoxy moulding, drilled out to take an 8mm red or warm white LED, worth doing. I took data from a recent article in *Model Engineer* about using LEDs and calculated the resistor required, which was soldered into the wiring and covered with heatshrink. They were fastened to the body carefully and the dummy conduit - a piece of 3mm brass tube - fitted into a hole drilled into the lamp side. The number, type and position of the lamps varies considerably from locomotive to locomotive so working from a photograph is a good idea.

I could have powered these LED lamps from the main traction batteries but that would have required a power lead from the chassis to the body and I have found, by watching others with a similar system, that the lead

was always in the way, and decided to power the lamps from their own dry batteries which I mounted in a suitable box, and with an adjacent switch within the body. So far it has worked without any problem (**photo 11**).

With the body now completed, what of the 'works'? I had told John that I thought the model should be geared for a top speed of about 8 mph but with plenty of haulage capacity. I had provided him with several scrounged, powerful, 24 volt motors, of which more later.

I should say that I am not keen on the idea of a number of smaller traction motors since I have seen other models, arranged in this fashion, where one motor has failed for whatever reason, putting more strain on the remaining motors, another of which fails ... and so on. I preferred the larger, single motor. The railcar set in **photo**

12 has one 750 watt Bosch 24 volt motor and happily hits 8 miles an hour with six adults aboard, and has been doing so for many years, whilst a four car set will haul ten adults in a slightly more geared down bogie at 5 mph using the same motor.

I also wanted all the driving wheels connected together with internal chains, rather than relying on the external coupling rods, since the original design used overlapped joints (for simplicity) for the rods, rather than the more usual forked joints, which I eventually opted for anyway. John rejected belt drive for the axles and decided to use chain throughout the model, selecting 10mm chain.

The chassis had suffered a bit during a move and 20 odd years of storage but a good wire brushing and a coat of etch primer, plus a little paint stripper, prepared the basic chassis for further work (**photo 12**). Cleaning up the axles, and with chain wheels installed, the wheels were pressed onto their axles and John painted the frames and added the spring hangers and brackets (**photo 13**).

Most of the railways that I am involved with seem to use vacuum brakes and I had scrounged a 24 volt ex-lorry compressor/vacuum pump so all we needed was a locomotive reservoir as large as possible to avoid



13 Wheels, spring hangers, brackets, connecting chains and a coat of black added.



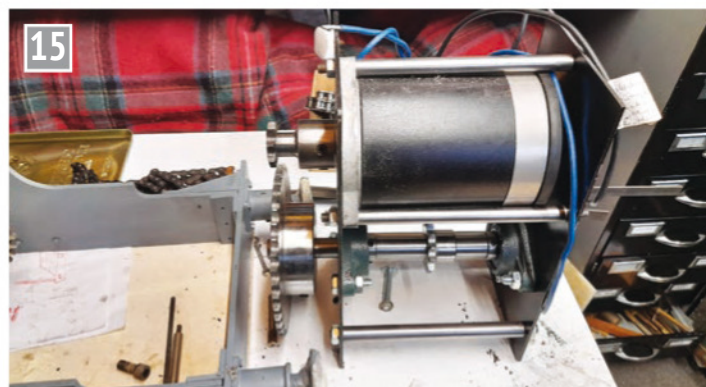
Large vacuum reservoir mounted under the main base plate.



Battery mounts and vacuum pump.

the compressor 'hunting' - switching rapidly on and off with tiny pressure variations in the train pipe - and somewhere to mount it. Both it and the twin electric horns were found room under the main base of the locomotive. With the chain wheels offset the cylinder fitted in nicely, the horns being added later between the frames behind the front buffer beam (photo 14).

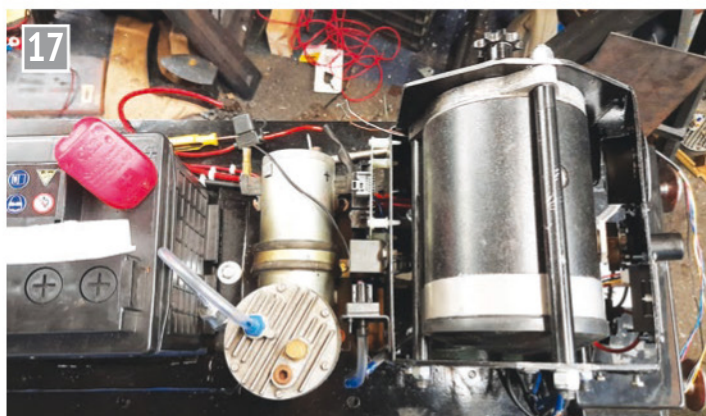
The motor that we had decided to use turned out to be supplied as a 24 volt winch motor, rated at about 2kW, acquired from a club jumble sale. It would give plenty of power but, sadly, we had no



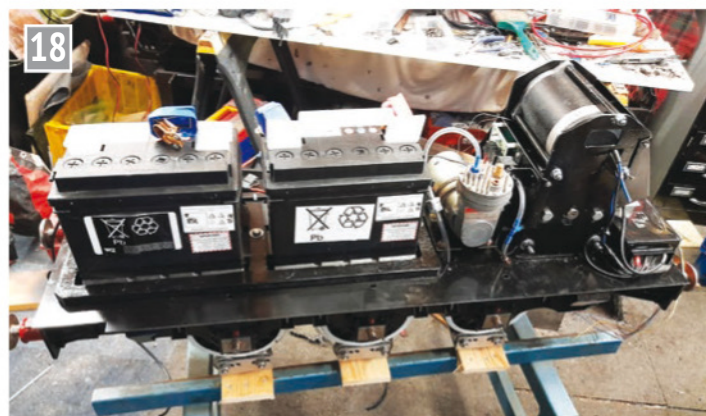
The Mk 1 motor and mounting, also carrying the intermediate shaft.

idea of its operating speed. It had three wires protruding from it, a common negative, and it rotated forwards or back depending which of the other two were supplied with 24 volts, but its output shaft was very short so John made a simple extension to take the first, primary chain wheel which drove the large chain wheel driving the intermediate shaft. The motor was mounted sandwiched between two outer plates, which also carried two self-aligning bearings for the intermediate shaft, the whole assembly being mounted on the main base with angle brackets (photo 15).

Now, John, using card templates, was able to be sure all the necessary parts could be fitted into the main base, inside the body and still accommodate the two 85 amp hour leisure batteries we had decided to use. They were mounted on the main base but with a plywood frame to locate them (photo 16). Also, we needed to fit in the motor controller, horn control board and relays and some battery monitoring meters. However, John kept working away and managed to fit all the various parts in place (photos 17 and 18).



Horn control and reversing relays in place, with the 4QD controller at the rear.



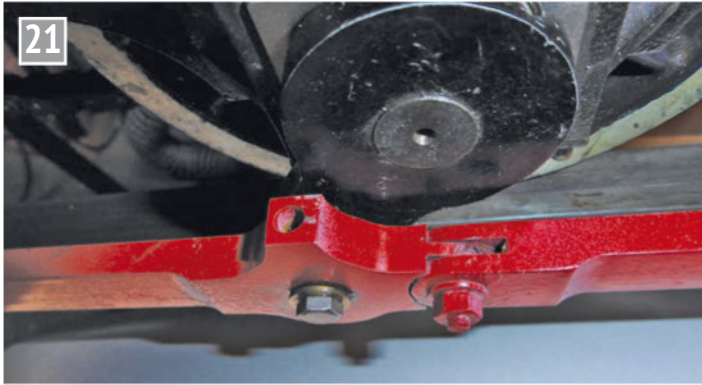
The whole chassis undergoing wiring and batteries tested in position.



Completed Mk 1 chassis.



First time on the rolling road.



21
Coupling rod forked joint.

Not knowing quite what was in store for us, the chassis wiring was completed (**photo 19**), married to the body for the first time and run on his rolling road (**photo 20**). All went well, although the double chain drive was sounding a bit noisy, possibly amplified by the fibreglass body. With

no steps or coupling rods, and with other parts to complete, I took the model away and fitted the cranks and rods. I opted to make the correct fork joint (**photo 21**) exactly like a steam locomotive coupling rod joint, rather than the 'as drawn' overlapped joint between the front and rear rods.



22
Clint driving on the first ever lap at Eaton Park. (Photo courtesy of Mike Fordham.)

Our first chance of a run was at Eaton Park, home to Norwich & District Society of Model Engineers and the photo shows a friend, Clint, driving for the very first lap (**photo 22**). One of the objectives in this build - something that I have not yet mentioned - was to make it easy for disabled drivers

to operate and Clint certainly managed perfectly well ... and enjoyed himself, particularly when he had to push me home to the yard when I ran out of steam with my A3 through talking too much!

● To be continued.

NEXT ISSUE

Atmospheric Railway

Roger Backhouse looks at the history of a fast, silent – but short-lived – Victorian railway.

Concrete Sleepers

Stephen Wessel updates us on the use of concrete sleepers in his garden railway and extends his methods to include pointwork.

Annie

Robert Knox constructs a 7¼ inch gauge version of the Lister petrol electric engine.

Two Stroke Engine

Patrick Cubbon takes two incomplete two stroke engines and uses the parts to create a single engine.

Scotsman Sanders

Peter Seymour-Howell continues the production of a set of steam and gravity sanders for his 5 inch gauge *Flying Scotsman* locomotive.



Content may be subject to change.

ON SALE 7 OCTOBER 2022

The Story of Annie

PART 1

Robert Knox constructs his own Lister petrol electric locomotive.



Back in 2015 a gentleman called Colin Edmondson was in the process of designing and building a small petrol electric locomotive called *Scamp* to be used on seven and a quarter gauge railways. As it turned out his design was very successful and to date there are over a hundred happy owners out there, of which I am one. I own number 63 which I named *Annie* in memory of my late wife.

Scamp can be obtained in either of two ways; it can be bought from CMD Engineering (I have no connection to this company other than as a satisfied customer) ready to run, in a colour and finish of your choice, or you can buy a kit of laser cut parts and a shopping list for the rest of the parts needed to build the locomotive - this is the route I went down. There is also a comprehensive set of instructions about how to build the beastie. A lot of major parts such as the engine, the motors, the chains and sprockets and suchlike can be



Annie, ready to go.

obtained from a well-known online auction site. One other thing - on Facebook there is a *Scamp* Owners Club, which is made up of a fine bunch of the most helpful folk you could ever hope to encounter and they know all the answers to any problems that may arise and where to get stuff from.

Photograph 1 shows the newly finished locomotive at our club track at Drumawhey Junction near Belfast on its first day out and, to be honest, I was very happy about how it performed up and down the gradients of our track. The engine is a Loncin 97cc four

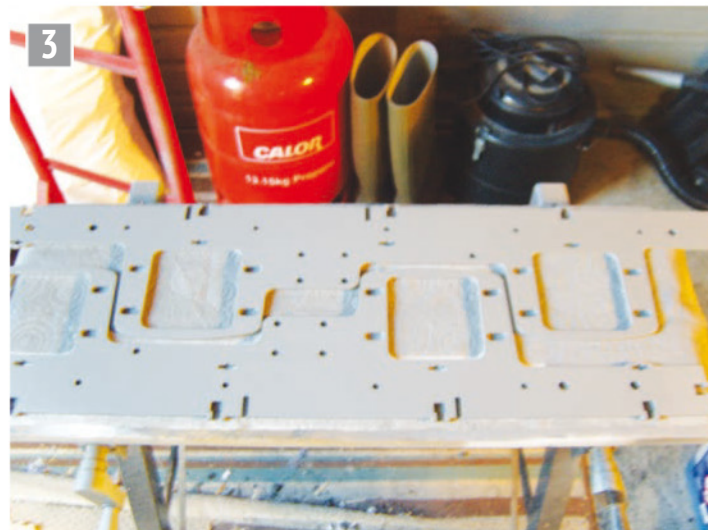
stroke engine which produces about 1.5 hp (the locomotive was originally designed for a Suffolk Colt engine) driving an 800 watt, 36 volt permanent magnet DC motor as a dynamo to provide power to an identical motor underneath which drives the axles via chains. They are controlled by a cheap Chinese PWM (pulse wave modulation) controller and a reversing switch.

As I said previously, I bought the laser cut kit, so I will sound a word of warning here for anyone contemplating doing the same. The parts are all cleanly cut and accurate but they all have **VERY SHARP EDGES** which need to be rounded off before going any further. I used a Dremel rotary tool with a number of small grindstones for most of the work and an emery block for the places that the grindstones wouldn't reach. I spent a number of hours on this work but it is worthwhile to save cutting your hands.

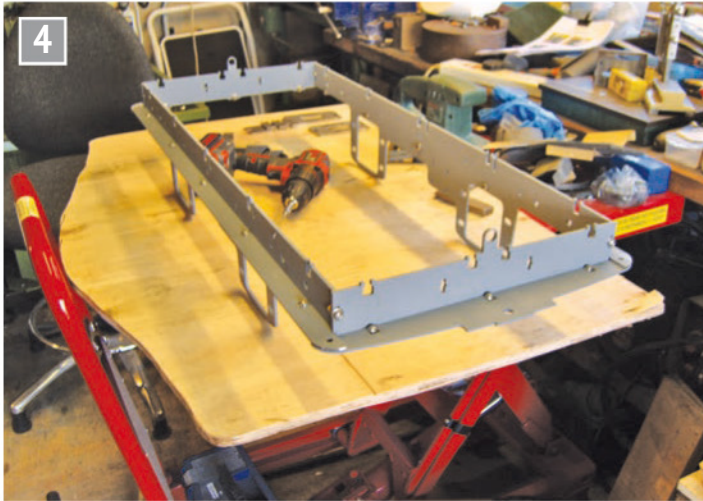
So - we move on to the construction and **photo 2** shows the top plate in its primer coat. I decided to at least get a couple of coats of self etch primer on everything before starting assembly. **Photograph 3** shows the



Main chassis plate.



Side plates.



Starting to assemble the chassis.



Front of the bonnet.



Bonnet, folded and painted.



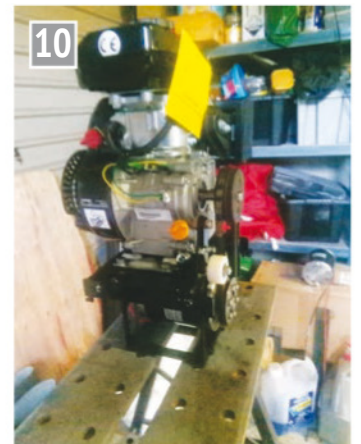
Side ballast weights.



Chassis assembled with colour added.



Wheels and axles.



The engine.

side plates, again in primer. **Photograph 4** shows the sides and ends of the chassis loosely assembled on a flat surface. At this point you should decide whether you want to face right or left when you are driving the locomotive - it's just a matter of flipping the top plate over to get everything facing the right way for you. To put it all together insert the tabs on the sides and ends into slots in the top plate and put the bolts through the top plate into the nuts underneath.

You will find that everything is bolted together in an ingenious way. I left the fronts off the coupling boxes for now because I was going to paint them a different colour.

Photograph 5 shows the front of the bonnet in bare metal. I rubbed it down with 600 grade emery paper and cleaned it with solvent. If you look closely you will see narrow slots down the left

and right sides about 12mm in from the edge. These are to allow you to fold the steel using nothing more elaborate than a Workmate and a block of wood about 75 x 75 x 400 mm. I have also attached the letters to form the word 'Autotruck'. **Photograph 6** shows the same plate, now folded, and it has had primer and white top coats applied (I used an aerosol can of radiator paint from a well-known DIY store). The lettering is picked out in black paint so it's now ready for fitting. **Photograph 7** shows the side ballast weights in bright metal with the letters to form the word 'Lister' attached. I haven't used them as yet because I find it easier to lubricate the drive chains without them fitted.

Photograph 8 is the chassis assembled and sprayed in its undercoat. I finished painting it in its topcoats before going any further. **Photograph**

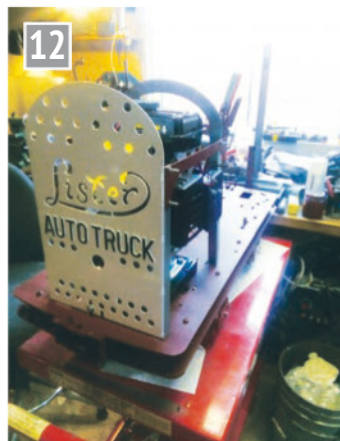
9 is the wheels and axles complete with the final drive sprockets and locating collars. I bought the axles with the wheels welded on from CMD Engineering because my welding is badly out of practice. They can also supply the countershaft with the sprockets welded on.

Photograph 10 is the Loncin engine and the dynamo on their mounting cradle which will attach them to the top plate with the engine above and the dynamo underneath. It's a neat arrangement which allows the whole unit to be readily taken out for maintenance or to lighten the locomotive for transportation.

Photograph 11 shows the chassis with the brake and clutch levers in place. The Bowden cables from these are routed underneath the top plate along with all the electrical wiring. **Photograph 12** is looking along the locomotive from the front;



Chassis with engine fitted.



Front view of the chassis.

the engine is in place and the frame of the bonnet is being tried for size.

Photograph 13 is a picture of one of the axleboxes with the drive motor behind it. The axleboxes use a commercial ball bearing snugly fitted into a laminated assembly which is bolted together. It is recommended that the axle end is lightly greased before it is finally fitted into the axlebox. Above the axlebox (if it was the right way up) if you look carefully you will see a small

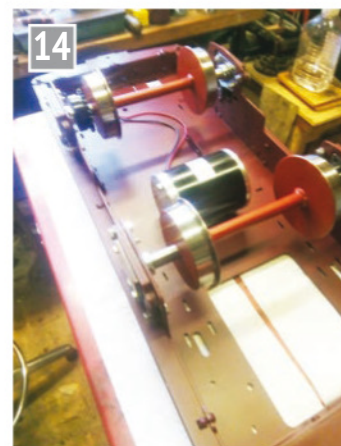
rubber anti-vibration mounting. This acts as a simple and satisfactory spring.

Photograph 14 is taken looking along the underside of the locomotive from the front; the large rectangular hole to the right is where the engine/dynamo cradle comes through the top plate. The drive motor and both axles are in place but no chains or countershaft fitted yet.

● To be continued.



Axle and drive motor.



Both axles fitted to the chassis.

Club Diary 23 September - 13 November 2022

September

23-25 East Somerset SMEE

Open Weekend at the Bath and West Railway near Shepton Mallett. See openweekend@essmee.org.uk or contact: Michael Malleon, 01747 860719

23-25 Llanelli and

District Rally

Pembrey Country Park, Llanelli. See llanellianddistrictmodelengineers.wordpress.com

24-25 St Albans and District MES

The Big St Albans Model Show, Townsend CoFE School, St Albans. Contact : Mike Collins, 07774 125870

25 North Wilts MES

Public Running, Coate Water Country Park, Swindon 11:00 – 17:00. Contact: Ken Parker, 07710 515507

25 York Model Engineers

Open Day. Contact: Bob Polley, 01653 618324

October

2 Bristol SMEE

Public Running, Ashton Court Railway, BS8 3PX, noon – 17:00. Contact : secretary@bristolmodelengineers.co.uk

2 Guildford MES

SMSEG Open Meeting, Stoke Park, Guildford 14:00 – 17:00. See www.gmes.org.uk

2 North Wilts MES

Public Running Coate Water Country Park,

Swindon 11:00 – 17:00

Contact: Ken Parker, 07710 515507

5 Bradford MES

October Meeting Saltaire Methodist Church 19:30

Contact: Russ Coppin, 07815 048999

5 Bristol SMEE

'On the Table', Begbrook Social Club BS16 1HY.

Contact : secretary@bristolmodelengineers.co.uk

6 Cardiff Model

Engineering Society

Talk: Mining Disaster at Risca, Heath Park, Cardiff. See www.cardiffmes.co.uk

9 Cardiff Model

Engineering Society

Public running, Heath Park, Cardiff 13:00 - 17:00.

See www.cardiffmes.co.uk

9 North Wilts MES

Public Running, Coate Water Country Park, Swindon 11:00 – 17:00. Contact: Ken Parker, 07710 515507

13/16 Midlands Model

Engineering Show

Warwickshire Event Centre. See www.meridienneexhibitions.co.uk

16 Bradford MES

Running Day, Northcliff Railway 13:30 – 16:00. Contact: Russ Coppin, 07815 048999

16 Guildford MES

Open Day, Stoke Park, Guildford 14:00 – 17:00.

See www.gmes.org.uk

16 North Wilts MES

Public Running, Coate Water Country Park, Swindon 11:00 – 17:00. Contact: Ken Parker, 07710 515507

19 Bristol SMEE

ZOOM Meeting – Holden F5 Locomotive Trust.

Contact : secretary@bristolmodelengineers.co.uk

22 Cardiff Model

Engineering Society

Steam-up and Family Day, Heath Park, Cardiff. See www.cardiffmes.co.uk

23 Bristol SMEE

Public Running, Ashton Court Railway, BS8 3PX, noon – 17:00. Contact : secretary@bristolmodelengineers.co.uk

23 North Wilts MES

Public Running, Coate Water Country Park, Swindon 11:00 – 17:00. Contact: Ken Parker, 07710 515507

27 Guildford MES

Open Day, Stoke Park, Guildford 10:00 – 13:00. See www.gmes.org.uk

29 North Wilts MES

Hallowe'en, Coate Water Country Park, Swindon. Contact: Ken Parker, 07710 515507

30 Bristol SMEE

Public Running, Ashton Court Railway, BS8 3PX, noon – 17:00. Contact : secretary@bristolmodelengineers.co.uk

30 North Wilts MES

Public Running, Coate Water

Country Park, Swindon 11:00

– Dusk. Contact: Ken Parker, 07710 515507

November

2 Bradford MES

Autumn Auction, Saltaire Methodist Church 19:30.

Contact: Russ Coppin, 07815 048999

2 Bristol SMEE

Talk : 'The Camerton Line', Begbrook Social Club BS16 1HY. Contact : secretary@bristolmodelengineers.co.uk

4 Guildford MES

Open Day, Stoke Park, Guildford 11:00 – 15:00. See www.gmes.org.uk

5 York Model Engineers

Fireworks, Running and Supper. Contact: Bob Polley: 01653 618324

6 North Wilts MES

Public Running, Coate Water Country Park, Swindon 11:00 – Dusk. Contact: Ken Parker, 07710 515507

10 Cardiff Model

Engineering Society

Talk: Five Boys and a Pasty, Heath Park, Cardiff. See www.cardiffmes.co.uk

12 York Model Engineers

Evening Talk – 7pm. Contact: Bob Polley: 01653 618324

13 North Wilts MES

Public Running, Coate Water Country Park, Swindon 11:00 – Dusk. Contact: Ken Parker, 07710 515507

Geoff Theasby reports on the latest news from the Clubs.



After my pointed remarks last time about signage at G1 North in Bakewell, I am pleased to say that, once in, the event was very friendly, with lots of animated discussions, seemingly brisk trading and the travelling Ridings layout. I met Alan Bullock, who lives quite near to me, and will visit his GTG in a few weeks. We were also greeted enthusiastically by a gentleman on one stand who informed us that his was the finest display. I said I could not consider making a judgment until I had seen the others... In the matter of signage, we went to a radio rally in Lincolnshire the following day and it was signposted from the M180 two miles away. Debs said it gave her more confidence that the day would go well and so it proved. One of these radios (WWII 19 set) sold for £280 - I was there at the time! This is another one at another rally (photo 1). Fifty years ago, I bought one for £1.50. These pictures show L&Y 'pug' 51218 doing a bit of shunting (photo 2) and this YEC *Janus* on the ALD models stand, amongst others (photo 3).

My locomotive *Deborah* is taking shape. I now have the driving trolley attached,

via my own design of spring coupling, branded *Travois Perkins*. The electronics have survived a few weeks in the air-conditioned garage (it's full of air and it's not in good condition...). Now for connecting everything together.

The American clock I bought on Chesterfield market some years back definitely likes the warmer weather. In the July record-setting heatwave, it kept almost perfect time 'within the meaning of the Act' whereas it is usually slow every morning when I wind it up.

In this issue, wall of death again, too many photographs, a fast lady, paddling,

toothbrush, a wedding, music and railways, the cubit, Martin Baker's new fairy cake mix?, old electronics and a few Crossley words.

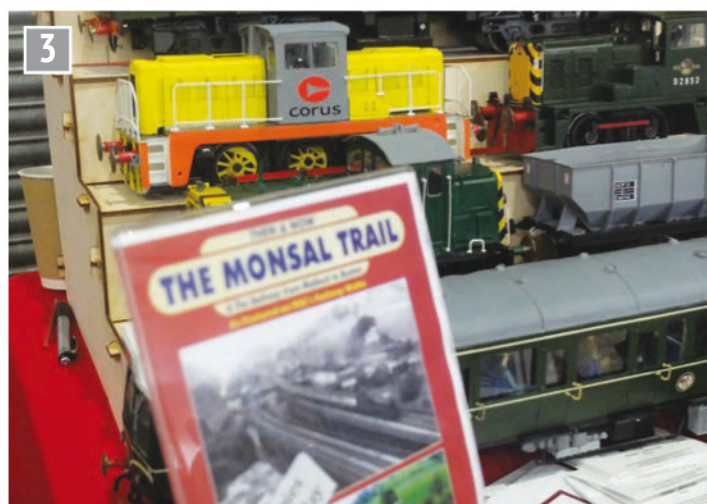
In the **Northern Districts Model Engineering Society** paragraph last time, I referred jocularly to a traction engine on the Wall of Death, after which up came one of those magic, unpredictable moments referred to as 'serendipity'. Retiring to our car after visiting the lifeboat, we encountered a new (to us) bookshop (Kelham Island Books and Music). It was wonderful! I spent too much and we shall return as soon as we've saved up a bit more money. One of my



WWII 19 set at rally.



L&Y Pug at SSMEE Open Day.



YEC 'Janus' at G1 North in Bakewell.

literary purchases was Guy Martin's *When You're Dead, You're Dead* in which was that very subject, including a mathematical formula for the speed required to stay on the Wall. Investigating further online, I found several healthy discussions on the subject. Now, how about that?

W. www.ndmes.org.au

The Stephenson Link, issue 2022, from **Chesterfield & District Model Engineering Society**, quarter three, says the Open Weekend went well. Editor John Walker received many photographs (excellent they are too – Geoff) and apologies for leaving out many of them. In consoling those would-be Eric Treacys, he didn't use any of his own either! 25 years ago, Alec Morley wrote an article about his hobbies and here it is again. He began with balsa wood model aircraft. Joining the RAF, he found that the activity was officially encouraged. Sailing boats followed, including those big enough to contain his family, but too many occasions when he was wet and cold put an end to that. Bee-keeping occupied his time after a friend asked him to make a hive. Woodworking again! A job change, working in metal, began another interest, renewing that glorious feeling when your creation first flies or sails across the boating lake.

W. www.cdmes.co.uk

July's *The Prospectus*, from **Reading Society of Model**

Engineers, reports that LittleLEC was a great success, won by William Powell with his 2½ inch gauge *Ayesha*. She fairly streaked around the track, setting a standard that will be hard to beat. The bad news is that twice the club has been burgled, by people who were determined to gain access, on the second attempt, using angle grinders. Stephen Millward describes a holiday on the *PS Waverley*, around the Clyde estuary and the Western Isles. I travelled on this last remaining sea-going paddle steamer in my youth, and the sight of its huge steam engine driving the paddles was very impressive.

W. www.rsme.org

Leeds Society of Model & Experimental Engineers' *Leeds Lines*, July, starts with chairman John Hunt discussing the entrails of a Braun electric toothbrush - gears and cranks-a-plenty. In contrast, a cheap £4 device I took apart after it failed (the motor rusted up due to the holder storing it head up and the shaft not being sealed) to find that this had no cranks but a rotating spring wire engaged with the moveable head to give an oscillating motion. Nigel Bennett was asked to help remove a stuck Myford chuck, which was resisting all persuasion. They tried gripping a steel bar in the chuck, wedging it in place on the bed and switching on, then applying the Great Frown, only to find that the key tying

the spindle to the pulleys had sheared - but this was not the end. The backplate could not be removed, even after applying the magic word, 'NINNNNGGG!' as the effort was applied. Turning away the chuck backplate was the only answer. The cause appeared to be swarf trapped in the thread and completely jamming it up. Here endeth the first lesson.

W. www.leedsmodelengineers.org.uk

Steam Whistle, July, from **Sheffield Society of Model & Experimental Engineers**, begins with Alan and Sandra Thorpe's belated wedding celebrations. Both registered blind, their carriage (Bradford Tramcar) was decorated with tactile decorations. Congrats too, from Debs and me. Mike Peart writes on music and railways - Elgar was born into GWR territory and regularly took part in the Three Choirs festival. This event attracted Antonín Dvořák from Prague, who was a keen steam enthusiast, regularly visiting Prague station and gaining inspiration therefrom. Composer Vivian Ellis wrote *Coronation Scot* whilst travelling to Taunton by rail. The piece languished until used for the radio series *Paul Temple*. Murray's *Thoughts* are a stroll through his sources of inspiration, see above...

W. www.sheffieldmodelengineers.com

Sheffield's National Emergency Services Museum has acquired a Tyne class

RNLI lifeboat, a major acquisition, which led to an interesting situation. Its length is quoted as 42 feet but it was not realised that shipping uses 'waterline length' and only when the 26 ton vessel was swinging from a crane was this realised. Eventually it was shoehorned in and it now fills their small yard, already occupied by numerous appliances. I clambered all over it, fascinated, and immensely pleased and grateful that a British institution like the RNLI should design such a practical vessel. The crew cabin is very tight, with secure armchairs for everyone, seat belts, lots of handholds and everything accessible, including cup-holders! It was quite difficult to get into such chairs but once in I felt that no violent or rough seas would dislodge me (photo 4).

I recently needed to compare the seat heights of two chairs without easy access to a rule so I used the length of my forearm (called the 'cubit'). This is similar to the 'rule of thumb' used for 000's of years in the Middle East and still used in the country craft of laying a hedge. So, if you think 64ths of an inch are old hat, the cubit is a much older item of historic millinery.

Observed by my peripatetic pedestrian publishing persona, a Lamborghini *Huracan 610*, lime green, visible from the other side of Firth Park, well



Engineers' panel, RNLI Lifeboat in 'Sheffield Bah't Shore'.

away from its natural habitat (double parked outside Harrods). There have been several stylish, exotic or customised cars around - they don't come much more exotic, do they?

B&DSME News, July, from **Bournemouth & District Society of Model Engineers**, begins with editor Brian Merrifield's plea for centenary events ideas, to be conducted two years hence. He suggests a cake baked in a smokebox whilst being driven round the track. Peter Burton has a different approach to his hobby - he has rebuilt two aircraft cockpits. One was a Blackburn Buccaneer, bought at an aerojumble event and restored with the help of many friends and his workplace facilities. The company could hardly object since the MD was restoring an E-Type Jaguar alongside... Many parts came from RAF redundant stock but he wasn't allowed to take one particular panel, used in the nuclear strike role (see 'YouTube XK527'). His M-i-L categorically refused to try out the M-B ejection seat, despite his earnest entreaties... Later he bought a Sea Vixen cockpit, and, having a spare ejection seat, used it at work, probably spending more time in it than any pilot. One official visitor, ex-USAF, was most impressed.
W. www.littledownrailway.org.uk

Stamford Model Engineering Society's July Newsletter reports mainly on the visit to Lincolnshire Aviation Centre, East Kirby, where Lancaster *Just Jane* is housed. Also on site, being restored, are a Mosquito and a Hampden. It is proposed that the 'Lanc' be returned to flight worthiness - it currently only performs ground runs. The cost is estimated to be about £4m, which is about what it cost to restore *Flying Scotsman*. I have been to LAC, and I would say 'no' to the plan. The RAF has a flying Lanc but you cannot get up close to it. This one you can, for instance, inspect the rear turret, the undercarriage and the bomb bay. Plus,



Tim Gage's locomotive at Brighton (photo courtesy of Tim Gage).

without the resources of the modern RAF, which recently fitted a new main spar to theirs, maintaining it in flying condition would be fraught with problems.

The Lobby, summer, from **Brighton & Hove Society of Model Locomotive Engineers**, notes 71 years of running the Hove Park miniature railway. The club electric locomotive *George I* died early in the season. The control unit was original and very, very old. A request for service from the manufacturer met with laughter. John Coleman says 'Keep the muck out' in an article on fitting expanding bellows for use with the mill, etc. A build-up of swarf here can block the leadscrew and cause problems. (There was a claim in many parts of the North that 'the pigeons fly backwards to keep 't muck out their e'en' (eyes - Geoff)). Also, 18-year-old member Adam Windsor was pictured in the Daily Telegraph as he has been awarded a grant to study millwrighting. This fine picture by Tim Gage of his newly repainted locomotive *Wellesbourne* graces the back page (photo 5). Tim says 'The engine was made by John Drury in 2006 (winner of the first IMLEC). As the only other Southern narrow-gauge engines are named

after local rivers, I felt as a resident of Brighton and Hove the same should be done here. The *Wellesbourne* is a (now underground) river that runs through the centre of Brighton next to the Royal Pavilion. I painted the loco in Southern Malachite Green in the style of late Southern Isle of Wight locomotives. It is an 0-4-0 engine with a dual gauge set up running on both 5 and 7 1/4 inch gauge. Members of the B&HSMLE have been really helpful with helping me getting it to this stage.'

W. www.hoveparkrailway.com
Engineering Heritage Australia magazine, May, has been sent to me, noting that 19th March was the 90th anniversary of the official opening of Sydney Harbour bridge, followed by a detailed article of its construction. A small company, formed in the aftermath of the Great Depression, won a contract to supply nearly 300 lamps with which to illuminate said bridge. Modern replicas of the 1932 lights have been made, now sporting LEDs, and recently some of the originals were discovered, *in situ*, still lighting the bridge after 90 years. Several awards were given, one for the preservation of No 21 dredger in Victoria. An abandoned, 1907, Crossley XA gas engine was recovered from

an old gold mine in the 1980s to protect it from pilfering and vandalism. Its parts, beginning to be forgotten, suffered many vicissitudes - fire, flood etc - before rescue by a collective of organisations. Components arrived from all directions, some from as far away as South Australia. Several were obtained from an elderly gentleman who had kept them safe for 23 years. Almost all have now been obtained but more are needed and help with reassembly, of course. Hope springs eternal for the last of its kind worldwide. A monochrome picture of the Crossley as it was discovered in the 1980s looks very sad but it may yet enjoy a second life. A video on the Parkes radio telescope, structure designed by Barnes Wallis, is noted on YouTube, together with many more interesting website URLs to keep readers occupied - www.youtube.com/watch?v=Fe8GOLj8RvY

And finally, why do the Royal Norwegian Navy have a barcode on their ships? So that when they return to base, their Admiralty can 'Scan the Navy in'.

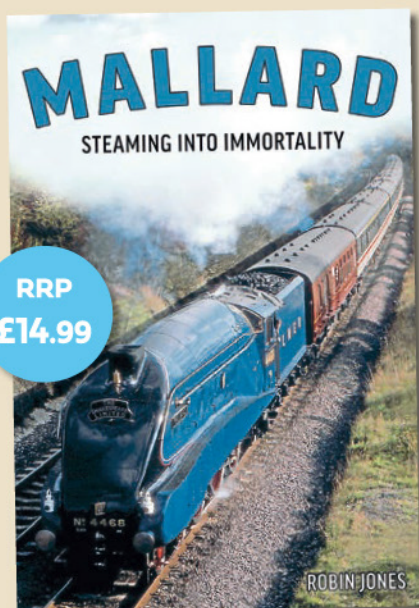
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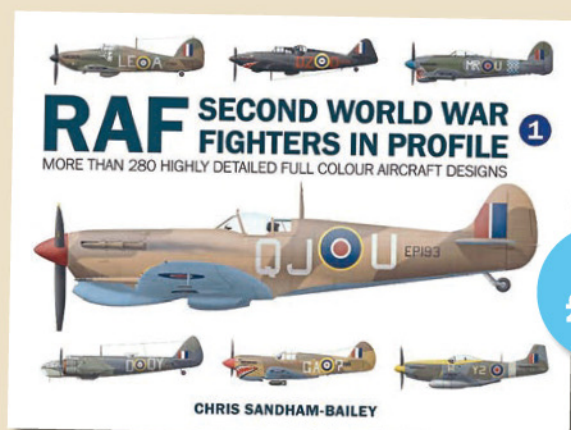
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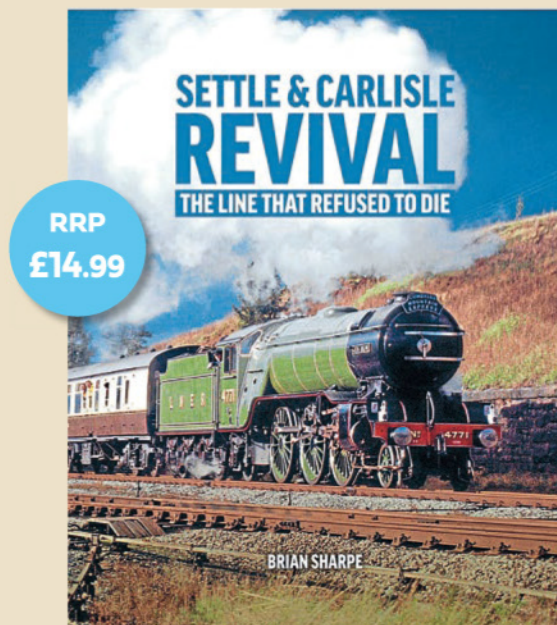


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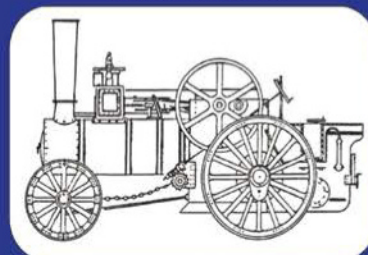
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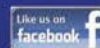
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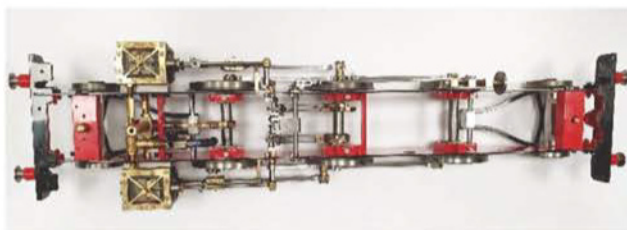
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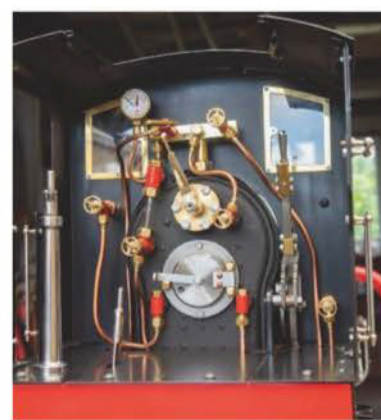
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Number of spindle speeds: Variable
Range of spindle speeds: 100-2250mm
Weight: 43Kg

Price: £694



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Spindle bore: 26mm
Number of spindle speeds: Variable
Range of spindle speeds: 50~2500rpm
Weight: 140Kg

Price: £1,904

W 2 Axis DRO - Price: £2,280



AMABL290VF Bench Lathe (11x27) - power cross feed - BRUSHLESS MOTOR

SPECIFICATION:

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Taper of spindle bore: MT5
Taper of tailstock quill: MT3
Motor: 1.5kw
Weight: 230Kg

Price: £2,395

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Max. face milling capacity: 63mm
Table size: 700x180mm
T-slot size: 12mm
Weight: 120Kg

Price: £1,360.00

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