THE ORIGINAL MAGAZINE FOR MODEL ENGINEERS

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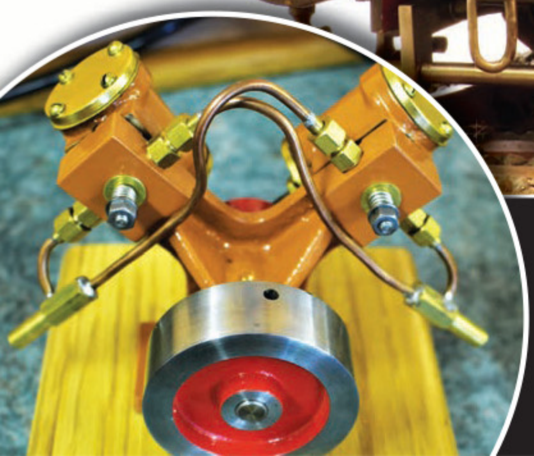

WE VISIT ROCHDALE

A club celebrates its 90th Birthday

MODEL ENGINEER

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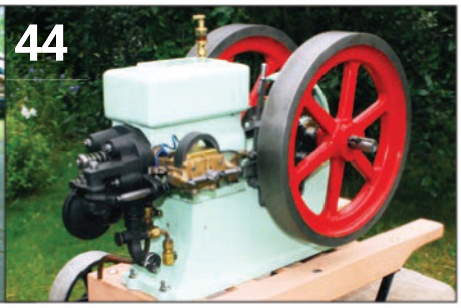

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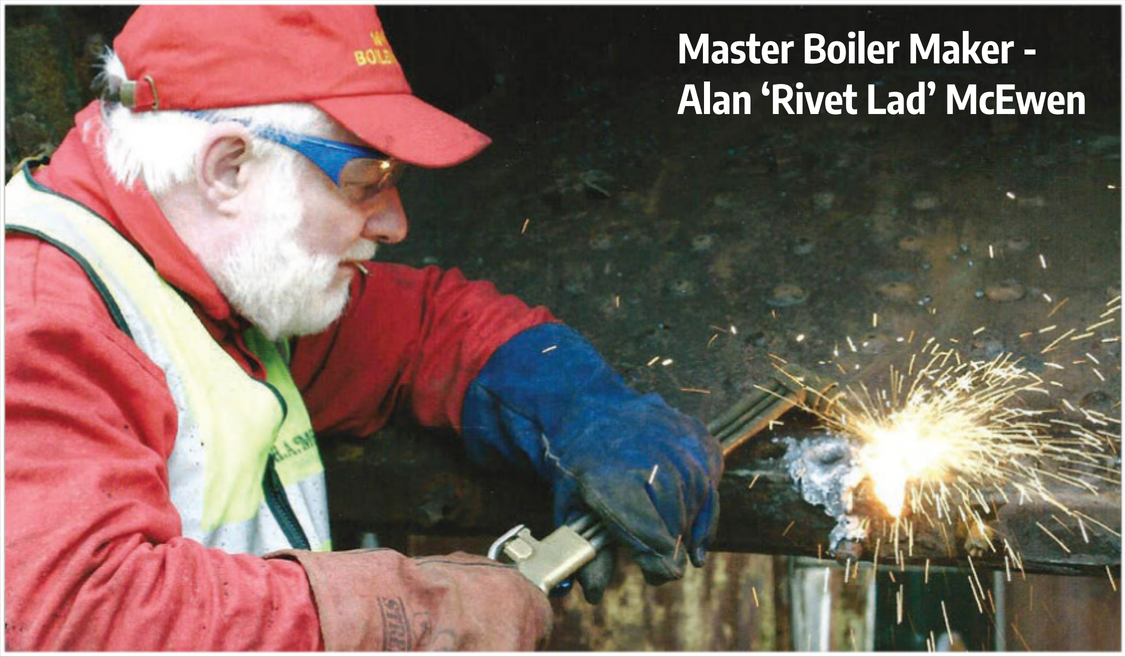
See page 6 for details.

ON THE COVER...

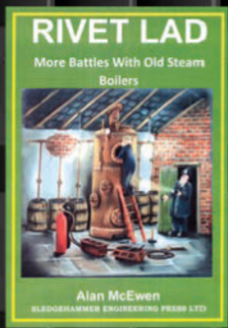
Steve Goodbody's **Rob Roy**, *a 3½ inch gauge Caledonian Railway locomotive (photo: Steve Goodbody).*

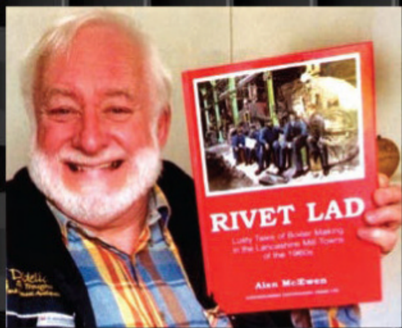
This issue was published on December 16, 2022.
The next will be on sale on December 30, 2022.

Bringing British industrial history to life



Master Boiler Maker - Alan 'Rivet Lad' McEwen





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

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

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

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Jaw Regrinding - Pete Barker

SMOKE RINGS

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Merry Christmas

Yvette, Diane and I, and everyone at Mortons Media, would like to wish everyone a very merry Christmas, so far as the rather straitened situation we currently find ourselves in allows.

Young and Junior Engineer Awards 2022

The Northern Association of Model Engineers invites nominations from member clubs for this year's Young and Junior Engineer Awards, for young engineers aged between 8 and 26. Note that there is nothing to stop a previous entry that did not win from being entered again - some of the entries last time were just simply 'pipped at the post' so give them a second chance.

Please enclose as much detail as possible, written, photographic etc, with the application. This award is not just for the building of models but also for the young members' conduct and helpfulness within the club so that should also be mentioned.

Please send nominations to Mr A. Budd, 39 Langford Rd, Arnold, Nottingham, NG5 7HR or at **alan.budd@hotmail.co.uk**

Boiler Stamp

I have been asked if perhaps one of our readers could identify the maker or perhaps tester of a boiler from its stamp. The boiler belongs to a 5 inch gauge Midland locomotive. The stamp is '560 2 89 GM'. Presumably '2 89' refers to the date of the test and the 'GM' part of the stamp refers to either the builder, the boiler tester or perhaps the club where the boiler was tested. Any ideas?

Bassett-Lowke

Bassett-Lowke Stationery – The Making of an Identity
By Christine Sanderson

Wenman Joseph Bassett-Lowke was the co-owner of the famous Northampton based Bassett-Lowke company that he started with his friend and business partner Harry Folder Franklin in the 1890s. The company was famous not only for its locomotives, model ships, stationary engines and architectural models but also for Bassett-Lowke's interest in art and design.

When Bassett-Lowke and Franklin set up their fledgling model engineering company, they could not have known how art and design would also play such a large part in the company's future, as good design was a key word and was used not only in their catalogues, brochures and advertisements, but also in everyday office stationery. How much of the artwork designs were the artists' ideas and how much they were influenced by Bassett-Lowke's interpretation of his own ideas is unknown. This book looks at many questions surrounding the company such as the likelihood of fonts and the images on each piece of ephemera shown in this publication having been designed by the same artist?

Stationery in those early days of the twentieth century would have been far more important than today's Internet age. In those days it would have been very important that the company brand was instantly recognisable, meaning distinctive stationery was vital. Yellow and black featured prominently in their designs as these were the company colours.

This third book in Christine Sanderson's series covers the stationery designed for the company, including letterheads, envelopes, invoices and acknowledgement cards. Information on the designer behind the images, where known, is included together with original artwork and additional information from stickers found on the stationery advertising fairs and exhibitions the company attended.

This book will appeal not only to those interested in the history of the Bassett-Lowke business but also to people interested in art and design. With 70+ pages and over 100 colourful images, this A5 sized book is full of fascinating facts about the ephemera of the Bassett-Lowke company.

Printing was generously funded by the 'Friends of 78 Derngate' enabling all proceeds from the book to go directly to 78 Derngate. Priced at £7.50+pp it is now available to buy at 78 Derngate or via the website www.78derngate.org/shop

The first book in the series *Bassett-Lowke Art: The Making of an Identity* is now **sold out.**

The second book in the series *Bassett-Lowke War Work – The Making of an Identity* is still available from 78 Derngate at £9.99+pp. This book covers the amazing work produced by the company during both world wars for the Ministry of Defence.

Cock-up Corner

Special Christmas bonus - two for the price of one!

Firstly, on the contents page of the last issue (4705) I credited two articles – *An Engineer, His Book and the Owner* and the Midlands Model Engineering exhibition report to John Arrowsmith. The first of these two articles should have been credited to Roger Backhouse. My apologies are due to both gentlemen.

Secondly in *Smoke Rings* for issue 4704 I credited the organisation of LOWMEX to the Halesowen club whereas it should of course have been the Halesworth club. Oh dear – geography weak, needs attention.

Steve Goodbody finds some things are best tackled in small helpings.

Continued from p.757
M.E. 4705, 2 December 2022

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Rob Roy in retirement, posing for the camera.

The Eating of Elephants

PART 3 - ROB WHO?

As we rejoin the story, the 1970s had given way to the 1980s and, in the first few months of 1981, John Lennon was topping the charts having mercifully knocked St. Winifrid's School Choir from their Christmas number one spot. On Saturday mornings, every self-respecting British child watched Noel Edmonds' Multi-Coloured Swap Shop on the TV while still in their pajamas, even though it was nearly eleven o'clock and they'd been told three times to eat their breakfast, brush their teeth and go and get dressed or they'd be in real trouble. At least that's how I remember it. Incidentally, if any of those children happen to be reading this article, I bet they can still remember the Swap Shop's telephone number. You can, can't you?

With Bluebell finished for more than a year, my now twelve-year-old self had begun thinking about what to build next. While I loved Bluebell, I had to admit that she didn't have everything I was looking for in a steam locomotive. There was a limit to the excitement of running up-and-down a few meters of track and the smell of meths wasn't really a smell which I associated with real steam engines and she couldn't pull much behind her. No, what I really wanted was something that would run for longer than ten minutes at a time, would pull me along a track as well and which ran on coal. Above all else, I secretly yearned to shovel coal onto a real coal fire - I had never driven a proper steam engine but I knew that it involved coal. In short, I wanted to build a locomotive like those I had ridden behind at Beech Hurst Park on our occasional trips to Haywards Heath.

Radio Sussex to the rescue

Now it just so happened that, while my parents and I were eating lunch at the kitchen table one Saturday afternoon in February of 1981 and listening to the local BBC radio station, the perky presenter mentioned an upcoming model exhibition to be held later that month in Brighton. My ears pricked up and I calmly suggested that a late-February trip to the Brighton seaside would be an excellent idea for a family outing. Seeing through my less-than-subtle proposition, mum and dad agreed that we should pay a visit to Brighton Modelworld,

»

as the exhibition was called and see what it was all about.

As is always the case when you are young and are really looking forward to something, the day of the visit seemed to take forever to arrive. But arrive it did and my parents and I finally bundled ourselves into the car for the long journey from Crowborough to the coast.

Now, Brighton in February is usually cold and wet and windy and this day exceeded all expectations. The wind howled across, the rain dumped upon and the sea flooded over the promenade in a way I had not seen before and have rarely seen since. Dramatic stuff, I tell you! Anyhow, mum, dad and I sprinted from the parked car, mum's legs moving in an astonishing blur and we raced to the venue at a speed that far outshone Sebastian Coe's and Steve Ovett's Olympic accomplishments in the prior year, at least in our minds. Ignoring even the many shoe shops that would normally waylay our more temperate trips to the county metropolis, we burst through the doors of the Brighton Centre's lobby and assessed our surroundings.

Captivating the customers

To briefly pause the narrative, if the reader will permit an aside, I admit to disliking casinos. I have little interest in gambling but have attended many industry tradeshows over the years and Las Vegas is a common destination for such things, unfortunately. As a result, I have walked through more gambling halls than I would care to remember - the casino hotels arrange things that way of course and you can't go anywhere in Las Vegas without passing through a gambling hall - and I have noticed that they usually employ certain interior design features beyond the endless succession of slot machines and blackjack tables. Specifically, they usually have low ceilings and thick carpeting. The result, intentional to be sure, is that every sound is quickly adsorbed and muffled to a murmur, creating a cozy and inviting sense of intimacy and warmth. And it certainly works, at least judging by the typical popularity of those gambling floors.

My reason for mentioning this here is that the lobby of the Brighton Center and hence our first impression of the Modelworld exhibition, was of a low ceilinged, heavily carpeted, highly muffled and very inviting place. The brutal weather blew frantically outside but we were warm and cozy inside, a contrast which I liked and evidently so did mum and dad. In short, it dawned on me that we were going to have plenty of time to see Modelworld because none of us would be eager to leave, even to go shopping. This boded well.

And so, having paid our entrance fee, up the stairs we went to the exhibition hall proper.

And what a hall! No matter where I looked, I saw things that were truly amazing. Finished models heavy with detail and the sparkling of brass and copper. Part-built models, some just-started and some almost-finished, with exposed workings ready for careful examination. Small models, big models, even bigger models, traction engines, railway locomotives - the quantity and variety seemed endless. My goodness, there was even a portable railway track, giving up-and-down rides to eager children, propelled by some of those same steam locomotives!

But I was no longer interested in riding with the kids – I felt much too grown-up for that - what interested me more was to stand alongside the barrier fence and watch what the engine driver was doing to make things happen. After a while I began to see a pattern of cause-and-effect. To start off, I saw the driver move a lever in the cab forwards and some complicated-looking rods at the side of the locomotive move downwards as a result. He then rotated a handle on the boiler, steam hissed from beneath the cylinders and off went the train. At the end of the track, he moved the lever backwards, the complicated rods moved upwards, he rotated the handle again and back went the train towards the station. I had figured out that the handle was turning the steam on-and-off to the cylinders, but what were all those rods doing to cause the direction to change?

Now, one of the wonderful things about this exhibition was that I could watch what the driver and locomotive were doing on the track and, with that in mind, carefully inspect the part-built models on the adjacent displays to try and figure out what was going on. I soon realised that not all the locomotives had those complicated-looking rods on the outside; in fact, it seemed to me that the locomotives which didn't have the rods on the outside had a heck of lot more rods on the inside between the wheels. Dad and I looked together and, after a while, deduced that in each case these rods probably had something to do with controlling the steam so it reached the proper end of the cylinders when it should. However, that was as far as our deduction went and so dad suggested it was time to ask an expert.

A plea to all experts

Poor, patient Reader; this is where I must beg your indulgence for another departure from the tale.

Picture the scene: you are on your club's stand at an exhibition and you are tired. You are also hungry and probably thirsty and your feet ache from all the standing around. In short, you are looking forward to a nice sit down, some lunch and the chance to wander the exhibition yourself in the afternoon. But horror! Along comes a youngster, perhaps twelve years old, trailed by his mum and dad and, after a brief hello, the boy stammers out a plainly ignorant question about valve gear which he calls, laughably, 'rods'. What to do?

Now you, as the unfortunate target of the question, may not know much about valve gear. In fact, you may have been unable to answer many of the myriad (and frequently non-sensical) questions you have been asked that morning by other visitors. "Heavens!" you think, "why don't any of these darned people ask me something intelligible that I can answer?". Well that, dear Reader, is simply the way of the world and you are not alone in your frustration, but, to the visitors, you are The Expert and that is the role you are fated to play. At least it's only for a few days. But what to do? Let's explore a few scenarios.

In scenario one, miracle of miracles, the visitor asks you a question to which you know the answer! If so, I am sure that you will give a concise and interesting explanation, liberally sprinkled with amusing and relevant anecdotes and you will pause, every now-and-then and ask a few questions of the questioner to check that you are being understood. Assuming this all holds true, as I am sure it does, then you are to be much admired as a knowledgeable and patient Expert and truly a prince among the breed!

Alternatively, in scenario two, the visitor asks a question to which you do not know the answer. In this case, being the patient and kindly person that you are, you admit as much to the questioner, apologise and politely call to a colleague who answers the question in the previously described ideal manner, while you listen and learn something new too. Excellent job, both of you!

Scenario three begins as the second scenario but, as fate often decrees, you turn to discover that your colleague, who had been hanging around the stand all morning and hoping that someone asks this very question, has chosen that precise moment to disappear. Probably upstairs tucking into a nice lunch, the lucky swine … you perhaps think, uncharitably. In this case I am sure that, thinking quickly and taking a leaf out of the politician's playbook, you smile engagingly, answer a slightly different question, one which wasn't asked but which was perhaps more coherent and, importantly, one to which you confidently knew the answer. Further, I am sure that, after finishing your interesting if slightly-off-topic explanation, you will suggest that the questioner return to the stand in an hour and ask for Trevor (for that is the miscreant's name), who will be back from lunch by then and gladly able to answer their original question. In this case you again deserve full marks for effort. Good for you!

Unfortunately, like the violent storm raging outside the Brighton Center that day in 1981, a darker and less clement scenario exists. This alternative, which brings neither happiness nor enlightenment to any of the participants, does not of course describe you, most excellent Reader; however, you should be aware that not everyone is possessed of your admirable qualities. In this shameful case, it matters not whether the Expert does or does not know the answer, for this Expert, while undoubtedly a true expert, is aloof. This Expert cannot be bothered wasting valuable time in answering a plainly ignorant question - it's a fool's errand and would do no good so the questioner is either ignored, or quickly dismissed, or, horror of horrors, belittled for their lack of knowledge! Either way, the questioner probably departs confused, frustrated, hurt or angry, or a combination of these feelings, but one thing is for certain – they want nothing more to do with model engineers or model engineering. And that is a real shame.

And so, my plea to all those engaged in public-facing roles, whether at exhibitions or running days or workdays at the track, is that you set the gold-standard example for your colleagues. Take that deep breath, answer those questions as best as you can and see what else you can show or explain to the visitors while their interest is captured. Who knows, you may inspire a new generation of model engineers and that is good for everyone involved.

Now back to the story!

Our Expert opines

Given the four potential scenarios, I only wish that I knew the name of the kindly gentleman (henceforth 'Our Expert') who fielded my question that day in 1981. Unfortunately, I do not, but I still wish to publicly, if belatedly, record my thanks to him for his time and patience and consideration, albeit anonymously. As it transpired, Our Expert personified the gold standard and was everything one could hope for – patient, clear, jargon-free and, above all, interested and interesting. We got to chatting, the four of us and at some point, mum mentioned both Bluebell and my apparent desire to start another project – a proper locomotive running on coal.

"There are lots of options - which engine are you thinking of building?" he asked, turning to me.

Now this was a surprise. Up until then, I had assumed that these bigger engines were built in the same manner as Bluebell – the builder starting with a blank sheet of paper and making it up from there. The idea that there were ready-made designs just hadn't occurred to me, but it certainly explained why some of the engines looked very similar to each other. I confessed that I didn't know anything about the available designs, adding that I would appreciate his advice and dad further noted that we didn't have a workshop and I would be starting from scratch on all fronts.

Not being put off, Our Expert explained enthusiastically that very little equipment was needed to begin an engine, the first step being to make and assemble the mainframes and this mostly involved marking out, sawing, filing and drilling and tapping holes, all of which he assumed, correctly, that I had experienced with Bluebell. He felt sure that, although I must be careful to work accurately, the frames would be within my ability and, when complete, we could then decide whether to invest in the lathe which would be needed to take things further. Mum and dad made approving noises and looked pleased.

At this stage in the conversation, seeing mum and dad's apparent approval, it dawned on me that building a real coal-fired engine might, unexpectedly, be within my imminent reach! In the haze of youthful excitement, the word 'lathe' was completely ignored of course - heck, I had no idea what a lathe was, or why I would ever need one; we didn't need one for Bluebell, after all. My focus was now on the burning question of the moment: which design?

Our Expert thought deeply and turned to a friend who was passing. The situation explained, they began one of the strangest conversations I had ever heard between two grown adults:

"Tich?" - "Too basic."
"Juliet?" - "Too small."
"Simplex?" - "Too Freelance."
"Speedy?" - "That valve gear."
"Doris?" - "Too big."

They went on like this for a while, a random word, a mysterious statement, an apparent rejection. What on earth were they doing? As the gaps between new words became longer, both

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A rear three-quarters view of Rob Roy, a Caledonian Railway tank locomotive in 3½ inch gauge.

gentlemen scratched their heads and cast their gaze along the rows of models arrayed on display, seemingly for inspiration. Time passed.

"How about Rob Roy?"

I waited for the mysterious statement and the summary rejection, but for the first time none came.

"Good design and nice lines", said Our Expert.

"Not freelance", his friend replied, "....and a manageable size" he added.

"And there's the book – he'll need that", responded Our Expert.

"Rob Roy?"

"Yes, Rob Roy"

With the strange conversation seemingly over, Our Expert turned his attention back to mum, dad and me. With a beaming smile, he explained that each design had a name and that some designs were generally considered better for beginners than others. He further explained that they had narrowed down their recommendation to one design and pointed to an attractive six-wheeled tank engine displayed on a neighboring stand. "That engine over there is called a Rob Roy and you can buy a book that explains how to build it", he began, then continuing "It's not too big, but it's big enough to pull a couple of people behind. It's based on a real engine and quite a few have been built". Finally, bending down and speaking directly to me, "It's your choice and we can show you some of the other options, but we think you should seriously consider building a Rob Roy" he concluded. I looked across at the engine in question and, liking what I saw, nodded agreement.

And so, just like that, the decision was made; Rob Roy, a Caledonian Railway 0-6-0 tank locomotive for 3½ inch gauge track, was to be my first solo project (**photos 17, 18** and **19**).

Car, overloaded

With the decision made, things began falling into place rather quickly. Our Expert pointed to a nearby trade stand, telling us that we could get the Rob Roy book and the drawings and possibly even have the materials for things he called 'frames', 'buffer beams' and 'stretchers', from there if we asked. He went on to explain that I would need a proper benchtop pillar drill - dad's hand-held Black and Decker was not the right tool for the job – and a metalworking vice and a decent set of drill bits and a few files of different shapes and sizes and he pointed to another stand which apparently sold such things. Mum delved into her handbag and produced a pen and paper so that I could write everything down. Thanking everyone profusely and with me beaming from ear to ear, I set forth clutching the best shopping list ever!

Within the space of the next hour and thanks once again to mum and dad's willingness to spend their hard-earned cash on their son's burgeoning hobby, we visited the recommended vendors and purchased everything on the list. And goodness it was heavy! Fortunately, dad was allowed to bring the car to the rear of the building where our purchases were duly loaded.

And so, we departed in our little blue Austin Metro, all 998cc's of it, which complained bitterly as it dragged two tired parents, one ecstatic boy and a boot-full of iron, steel and tools back up the Sussex hills to home.

Postscript to Part 3

Now, to put several of you out of your misery, Swap Shop's number was of course 01 811 8055. You should be ashamed of yourself if you forgot that.

Regarding our missing Expert, I have picked on poor old Trevor because, frankly, I don't know (and have never known) any Trevors so hopefully this won't cause any offence. If your name is Trevor, then please rest assured that I am not talking about you – you can return to your lunch in peace. Don't be too long though, because your colleagues are waiting for you down on the exhibition floor and are beginning to mutter about your prolonged absence.

●To be continued.

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"498" Class

[Photo: The Railway Magazine

Type 0-6-0 tank Engine No. 534 (see note)

Leading Dimensions

Cylinders, 17″ × 22″. Coupled wheels, 4′ 0″; leading-driving, 5′ 0″; driving-trailing, 5′ 0″; engine wheelbase, 10′ 0″; length over buffers, 26′ 9¾″.

Boiler pressure, 160 lb. per sq. in.; boiler diameter, 4′ 4½″; height of boiler centre, 7′ 1″ above rail. Water, 1,000 gallons. Coal, 2 tons.

Heating surface: Tubes, 786 sq. ft.; firebox, 74 sq. ft; total, 860 sq. ft. Grate area, 14.25 sq. ft.

Weight of engine, 47 T. 15 C. Tractive force at 85% B.P. = 18,014 lb.

The "498" class were specially designed for use in Dockyards where sharp curves have to be traversed, the coupled wheelbase was therefore made as short as possible.

These engines had the distinction of being the only type on which McIntosh designed the cylinders outside the frames.

The two engines were followed by a further 21 locomotives of the same design built by Pickersgill between 1915 and 1922. They proved a useful class and were a great advance on the four-coupled saddle tank engines previously employed in the Dock sidings.

Engine Numbers: **498 & 499. Built by C.R. at St. Rollox. 1911.**
Total in class: 2 engines.

Brake.—Steam.

Painting.—Goods Black.

(**Note.**—See Appendix C on page 48 for the engines of this type built by Pickersgill, 1915–1922. No. 534 shown in the illustration is one of those built in 1918 and is identical with the two McIntosh engines.)

Rob Roy's prototypes were the 498-class shunting engines, built to bustle around the busy Scottish docks. (From: The McIntosh Locomotives of the Caledonian Railway 1895 *– 1914 by A. B. MacLeod M.I.Loco.E, published in 1948 by Ian Allen Ltd. and reproduced with kind permission from Crecy Publishing).*

NEXT TIME

The framing of Rob Roy.

Midlands Model Engineering Exhibition

Clubs and Displays

John Arrowsmith rounds off with a look at the club stands and displays.

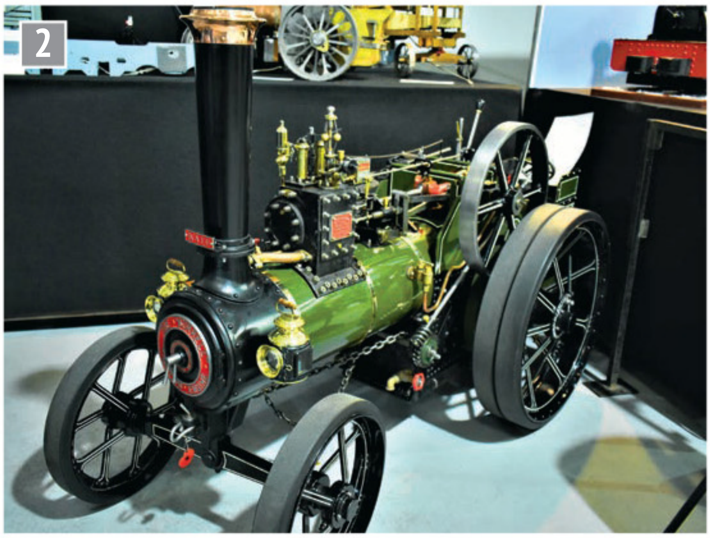
Being the first exhibition for two and half years, there was quite a nervous wait for the opening of the 2022 show but after the first ten minutes everyone knew it was going to be a successful event. The queue was back to the car park and soon after opening, the halls were filled with the familiar sounds of an exhibition in full swing. The layout was roughly the same as in previous years and provided a good mix of society displays and traders. The competition entries are always popular and, along with the club displays, are what the exhibition is all about. The competition has already been covered, so this report is about the clubs, the displays and the whole exhibition atmosphere.

From the societies' point of view there is a competitive element; which will win Best Club Display? It's always keenly contested and this year was no different. The winning display is voted for by the clubs themselves, making the decision completely impartial, and the accolade went to the **Melton Mowbray Society of Model Engineers.** It was a comprehensive presentation covering, I would say, most model engineers' interests (**photo 1**). Locomotives, traction engines, rolling stock, workshop equipment etc. all laid out so that each item was easy to see. It was a worthy winner. In second place was the **Kingsbury Water Park Model Boat Club** who again provided a wide range of marine craft which showed the diversity of models currently operated and built by members. The display was also very colourful and added to the spectacle of the main hall. The third prize went to the **Hereford Society of Model Engineers** who had a good variety of models on show including a section of both finished and unfinished work by their enthusiastic Young Engineers section. This display, quite rightly, created a lot of interest from other clubs and visitors alike, keeping them very busy!

The winning display in the Club competition was the Melton Mowbray & District MES.

Overall, there was an excellent range of club displays which indicates that in general the model engineering world is alive and very much kicking.

Looking at the **Melton Mowbray** stand there was a fine selection of models including an excellent example of a 4 inch scale Burrell agricultural engine built by Peter Fairhurst from a Steam Traction World kit (**photo 2**). This engine contrasted nicely with Bob Fawcett's 2 inch scale Fowler BB1 ploughing engine (**photo 3**). There were two other traction engines under construction on the stand, both of which were showing some



Part of the Melton Mowbray display was this fine 4 inch scale Burrell built by Peter Fairhurst.

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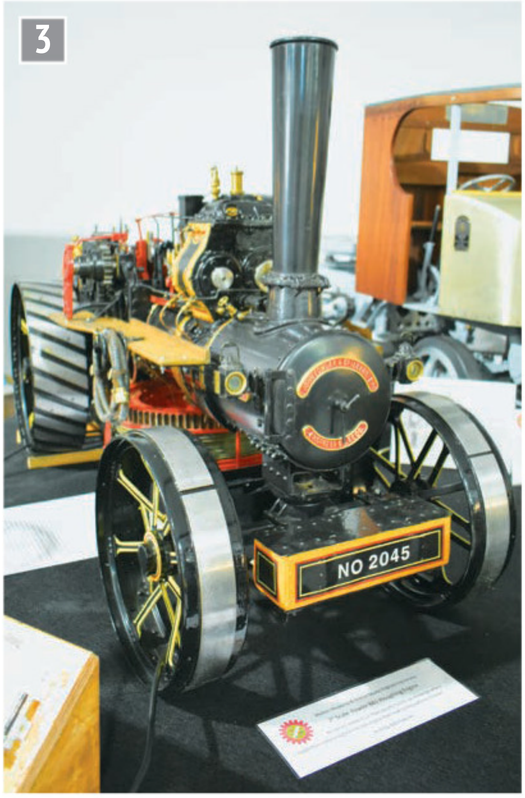
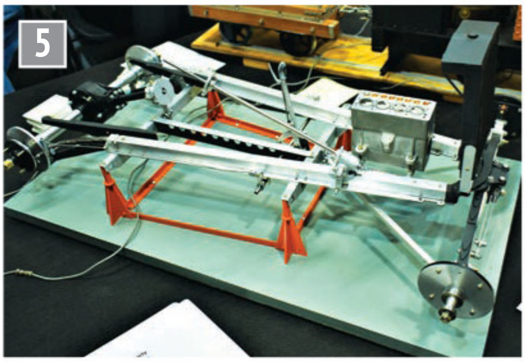


Bob Fawcett's 2 inch scale Fowler BB1 ploughing engine.

The Girl Pat, *a 70ft long Seiner fishing boat built by Graham Farrow.*



An exact scale model of an Austin 7 car chassis in ⅓ scale.

good workmanship. I liked the little 5 inch gauge buffer stop, which would enhance any railway system, and the 5 inch gauge 7 plank open wagon built by Scott Gregg.

The **Kingsbury Water Park** stand was in complete contrast to the Melton display with its colourful selection of boats. I liked the little steam coaster (**photo 4**) which had lots of fine detail work, alongside the classic model of the only steam powered, sea going paddle steamer still in existence - the twin funnelled *Waverley*. On the third placed stand the **Hereford Society** provided an excellent little segment of a typical GWR Branch line along with a mix of stationary engines, locomotives, marine craft and, as mentioned above, examples of the work of their Young Engineers section. The **City of Oxford** always have an interesting display of their members' work with the centrepiece being Simon Mulford's 0-4-2 Bagnal tank locomotive. On the smaller scale was a nice line up of the LBSC designed Tich locomotives and Brian Holland's colourful James Booth rectilinear engine added to the overall display. On the adjacent National 2½ Inch Gauge Association stand was an extensive display of locomotives in this popular, smaller gauge.

The Society of Ornamental Turners presented another fascinating display that included working lathes and exhibits showing the intricacies of this very specialised branch of engineering.

A large display by the **Coventry Model Engineering Society** showed off just about every aspect of model engineering with examples of clocks through to machine tools and locomotives in a number of different gauges. The exact one third scale model of an Austin 7 car was an excellent piece of work; it will be interesting to see the finished vehicle (**photo 5**).

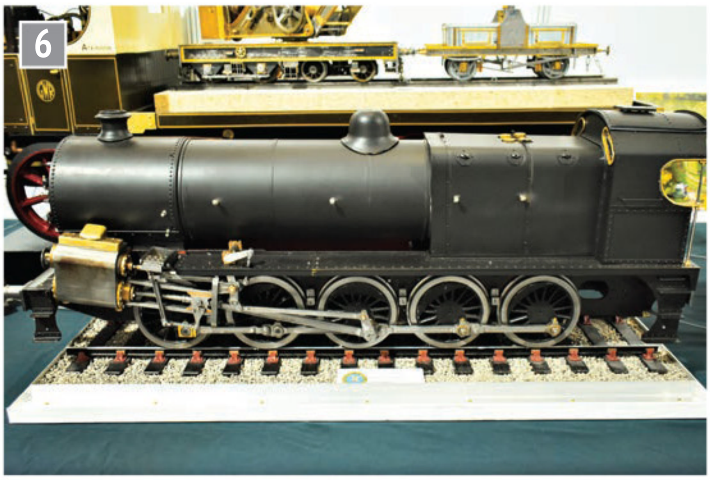
On the **Bromsgrove SME** display was a rare model of the Licky banker *Big Bertha,* an 0-10-0 LMS locomotive in 5 inch gauge under construction by Martin Morris (**photo 6**).

The **I/C Engine Builders Group** had a good display of these complex engines on show and included in the display was a very nice model of a de Havilland Gypsy Major engine (**photo 7**) of which over 14000 were made from 1932.

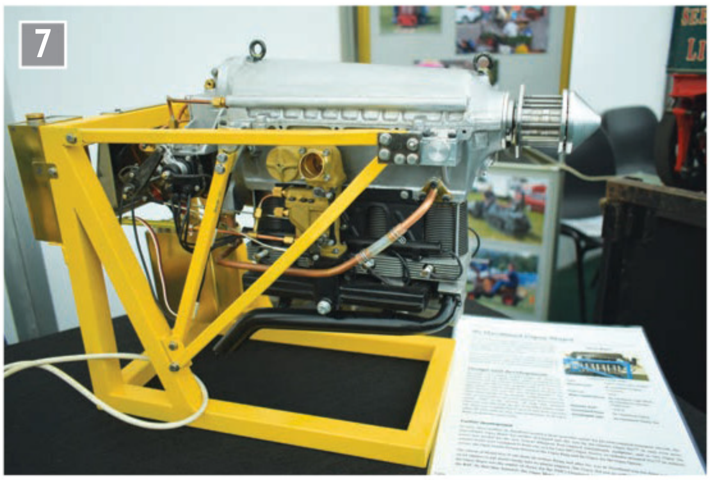
The **Stirling Engine Society** always has a vast array of models on show covering many different applications. This year Julian Wood, the doyen of hot air and Stirling engines, was showing me his latest creation - a Stirling engine powered hair dryer (**photo 8**). I can just imagine the conversations back home ...!

The Steamboat Association of Great Britain provided a full-size exhibit of a steam powered boat which created a lot of attention (**photo 9**). A good array of typical boat engines was also on display.

The **Gauge 1 Model Railway Association** provided a good variety on their stand with locomotives of both UK and Continental prototypes on show



A rare model of a rare prototype; the 0-10-0 Big Bertha *was part of the Bromsgrove MES display.*



A de Havilland model of a Gypsy Major engine from the I/C Engine group.

complimented by a selection of informative leaflets.

The only practical demonstration taking place inside the exhibition this year was regular attendee, Noel Shelley who this year was not demonstrating his usual foundry and pattern making work but drill sharpening instead (**photo 10**). Using a Brierly ZB 32 drill grinding machine, Noel was demonstrating that this can handle drills up to and including 1.25 inch or 32mm diameter with parallel shanks, or 1, 2, and 3 Morse taper shanks. It can also handle right or left-handed drills and most point forms can be produced with the right set-up. Taps can also be ground on this versatile machine. The finished drills are very sharp indeed.

Fortunately, the weather during the show was fine and warm so that the **Fosseway Steamers** could enjoy some good steaming days. To demonstrate the power of their engines Richard Kew had his 6 inch scale SD Ruston Proctor Tractor powering a large circular saw which was cutting large planks from baulks of timber (**photo 11**). Steve Lee made an impromptu speech on behalf of the Steamers - to fellow members and visitors, including the Deith family - where he paid tribute to the late Chris Deith for all his work and help in organising the Exhibition over the years. It was quite an emotional moment for many people, so thank you Steve.

Julian Wood shows off the latest hot air powered hair dryer.

The engine compartment on the full size steam boat.

Noel Shelley hard at work demonstrating the Brierly cutter/grinder.

Richard Kew's 6 inch scale Ruston Proctor operating the large circular saw.

The display by the **Model Steam Road Vehicle Association** (**photo 12**) demonstrated the vast array of models that members of this association have within its ranks, from Graham Sadler's delightful Atkinson tractor (**photo 13**) to *Nelson,* a prototypical road tractor based on a 3T Savage traction engine built by Chris Stubbings.

The **Midlands Meccano Guild** (**photo 14**) are another old favourite who always attend the Midland show and this year

The larger engines on the MRSV display.

The other end of the MSRVS display with Graham Sadler's Atkinson steam lorry in pride of place.

The Midlands Meccano display with the huge model of the USS Missouri*.*

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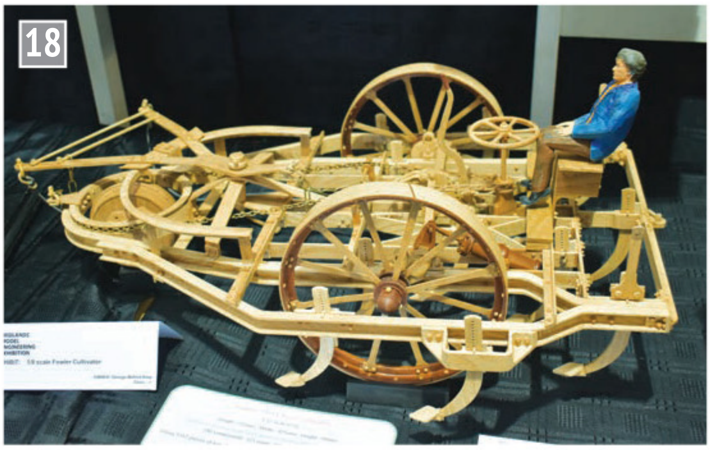
The useful Tom Jacobs gear cutting machine.

An impressive model of a Sherman tank built by Ian Bellamy from Wolverhampton.

A large display from the Knightcote Model Boat Club.



George King's amazing wood working skills are shown in this ⅛ scale Fowler cultivator.

their display featured a large model of the *USS Missouri* built by Steve Briancourt.

Another group of regular attendees is the **Society of Model and Experimental Engineers** (SMEE) who provided a splendid display of members' work. One machine that stood out was the Jacob's gear cutting machine (**photo 15**) designed, built and used by SMEE member, Tom Jacobs. The machine was last displayed at an M.E. exhibition in the 1980s which shows the quality of the build.

The large models on the 7¼ Inch Gauge Society stand, backed up by a good video and photographs, clearly demonstrated the scope of the activities of this group.

Adjacent to them was the **Northern Association of Model Engineers** illustrating the support given to member clubs. There is an emphasis on encouraging young engineers as much as possible and the annual Young Engineer competition really does reward the chosen young person very well.

The well-presented display by the **Birmingham Society of Model Engineers** again showed the variety of members' interests. The 7¼ inch gauge B1 *Klipspringer* was an excellent example and sat well besides machine tools and a fine tug boat in 1/32 scale, built and owned by Don Spence. This society really does offer something for everybody.

A selection of large LMS prototypes was the attraction on the **Gauge 3** display. Gauge 3 members model 2½ inch gauge railways from a more 'scenic' point of view. Two Coronation Pacifics, one streamlined the other not, and a Stanier 2-6-0 Mogul accompanied by suitable stock made for an attractive stand.

There was a real assortment of models and scales on the **Wolverhampton & District MES** display, from a selection of railway slate wagons to a large vertical boiler. It also included a 1/5 scale model of a Sherman M4A3 75 dry stowage tank built by Ian Bellamy from his own scaled drawings. A really excellent model (**photo 16**). He also exhibited a frame of individual parts showing how the track was built up and how many operations it took to make all the parts - over 4000; quite amazing!

Opposite the Wolverhampton display was the **Erewash Valley MES** who always support this exhibition and their colourful display was full of interest. The **Knightcote Model Boat Club** had a very comprehensive selection of vessels on show from old style sailing galleons to modern high-speed craft including a selection of Royal Navy prototypes (**photo 17**). The winner of Class 10 in the competition section, John Elliott is a member here so that gives you some idea of the quality that was on show. Another old favourite in the exhibition was the **London & North Western Railway Society** with their interesting collection of nostalgic photographs and some fine models depicting examples of LNWR locomotives and rolling stock.

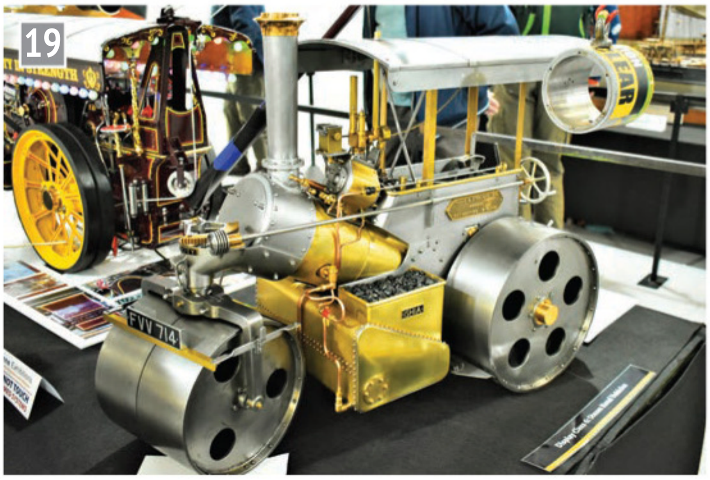
A comprehensive and colourful display by members of the **Welwyn Garden City SME** saw a range of models from r/c road vehicles through to marine craft, locomotives and traction engines. With the demise of the Guild of Model Wheelwrights, horsedrawn and wooden vehicles were brought to the fore by George King with his collection of hand-built wooden farm machinery. I thought there were some outstanding examples of woodworking on this display with both the range of different woods used and the intricacies of the build. The ⅛ scale Fowler 11/13 tyne cultivator is just one machine which shows up these features very well (**photo 18**).

A new organisation had a stand here for the first time;

Train4Rail is led by Peter Dickson, created to encourage anyone interested in railways, including all its disciplines, to get involved. Young people are the focus and the models on show had all been made by younger people, some with special needs. There has been great interest in this initiative; both the Heritage Rail sector and Network Rail are involved. It will be interesting to hear how much progress is made over the coming months. (Hopefully more to come in these pages! … Ass. Ed.)

In the independent display area there was a good variety of quality models to be enjoyed. In Display Class 6 the excellent Simplicity road roller built by Richard Folwell was unpainted but the excellent workmanship stood out (**photo 19**). In Display Class 3 was another example of superb quality work and attention to detail provided by Tony Bickerstaffe with his outstanding model of an LNER A4 in 7¼ inch gauge still under construction. Built using works drawings and reference to the full-size engine, the inner details on the chassis were impressive (**photo 20**). Alongside the engine was the double Kylchap blast pipe assembly and again the detail on this was exemplary. Paul Pavior's GNR O1 looked a fine sight in its traditional livery of apple green (**photo 21**). The Display Class 8 for Internal Combustion Engines showed an example of a Seal four cylinder engine built by Mike Tull (**photo 22**) and in Class 5 for Stationary Engines, David Arnold had made a nice job of a little horizontal steam engine (**photo 23**).

It was so pleasing to see the number of younger visitors attending the exhibition and one of the trade stands had a couple of the latest technology motor control units on show, which demonstrated a number

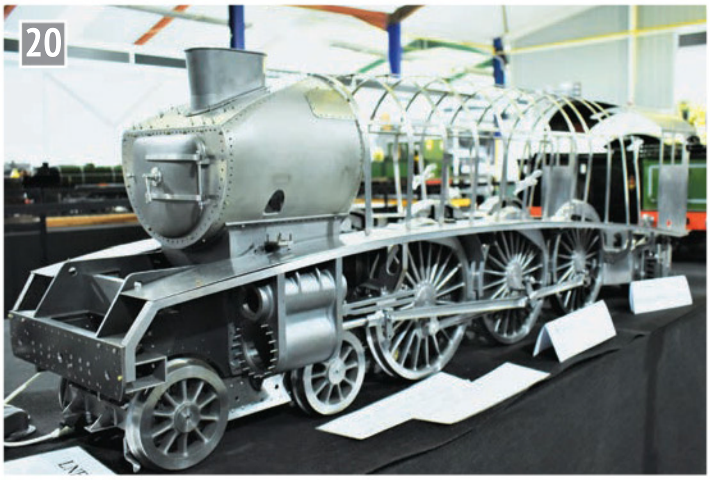


An excellent example of a Simplicity road roller built by Richard Folwell.

of different aspects of its control. It was an attraction for young people and I caught one young man and his friend thoroughly enjoying the experience and the exhibition.

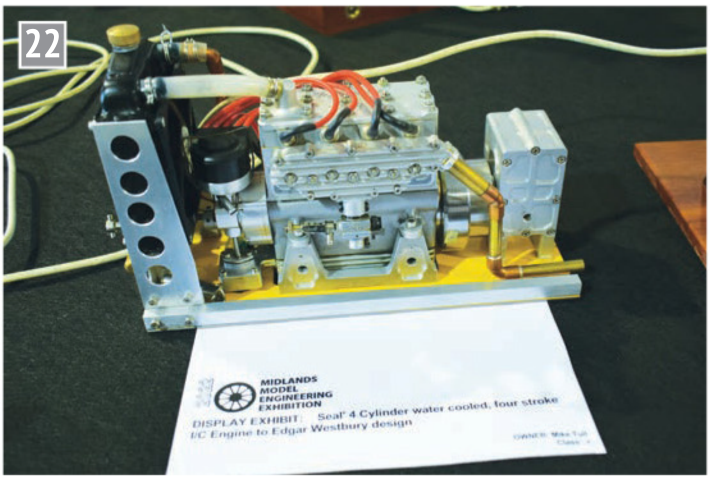
I think that just about covers everything. It only remains for me to say a big *thank you* to everyone who brought models for competition and display and to all the traders who took part, because without each and every one of you there would be no exhibition at all. The same applies to all the visitors and club members who took part. My thanks to the organisers for putting on the exhibition and next year's event will be from the 12 to 16 October, so put that in your diary now.

ME

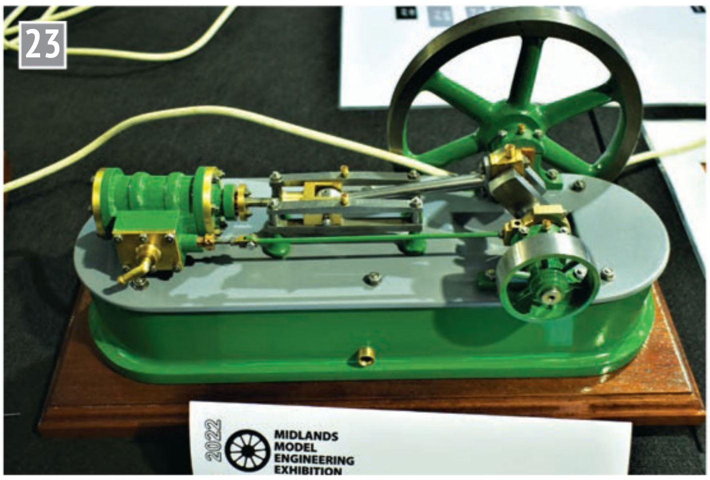


Tony Bickerstaffe is building this superb A4 to works drawings.

Immaculate in GNR livery was this Class 01 2-8-0 displayed by Paul Pavior.



In Display Class 8 was this Seal engine to the Edgar Westbury design.



David Arnold displayed this horizontal engine in Class 8.

Eise Eisinga Planetarium in The Netherlands

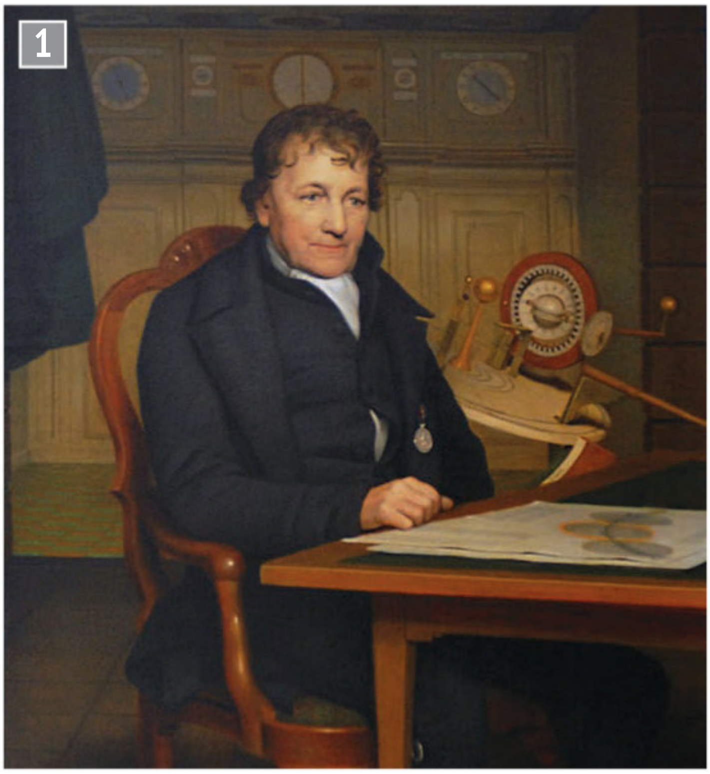
Henk-Jan de Ruiter pays a visit to the oldest working planetarium in the world.

Since I was a young boy I have always been impressed by the sky at night; a dark sky lit up by the moon and stars. I think many of us, when looking at this, will ask themselves, *how was it made, what is its origin, what is its past and what will be its future?* My approach will be to start to consider several scenarios and ideas about how all this could have developed and why it is there.

For centuries these unanswered questions inspired people all over the world to explore the universe. In ancient Mesopotamia, between the rivers Euphrates and Tigris, astronomers were already practising calculations relating to the movement of stars. The Greeks and the Egyptians also played their part in the discoveries of the universe. Evidence of this was found in 1901 when an object of calculation and navigation - the Antikythera-mechanism, a kind of orrery, the workings of which were like an ancient analogue computer was discovered in a shipwreck in Mediterranean waters near Greece. It was found to date from around 200 BC!

It was important to the Egyptians to know when it was the right time to work the land along the river Nile for certain agricultural purposes. They not only had a good understanding of the universe but also a great deal of awe and respect. This was the beginnings of astronomy.

Later, in medieval times, mechanical clocks were invented and became more precise instruments to measure time. There arose a fierce competition between clockmakers, especially the English, French and the Dutch, all of whom have an impressive heritage in this field.



Portrait of Eisinga by Van der Kooi, 1827.

Besides the scientific approach to discovering the universe, various religions had a rôle too. Religious doctrines held an assumption that the earth was flat and the earth was the centre of the universe - the so called geocentric theory (being the opposite of today's heliocentric model). There was a lot unknown and an ever-present desire to widen the human horizon.

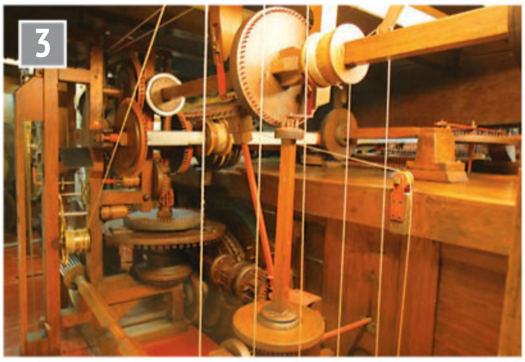
Schools and universities taught lessons in mathematics and astronomy, but only to a socially advantaged group of students - those who could afford tuition and to buy books. In this somewhat privileged intellectual environment, the so-called autodidacts stood out. In one particular region, in the North of The Netherlands in the Province of Friesland, these autodidacts, often farmers, were teaching themselves to build astronomical instruments such as telescopes and sundials. Destined to become the most famous of all was Eise Eisinga (**photo 1**), born in 1744 in Franeker.

From a young age he had to work in his fathers' business as a wool carder but, despite not being allowed to go to school, he became interested in mathematics and astronomy. He was very gifted and not only studied books on mathematics such as those by Euclid, but also, as a teenager, wrote several books on these subjects.

In this period of the eighteenth century, rumours suddenly started to gain

For more info:
www.planetarium-friesland.nl
www.wikipedia.org
www.interestingengineering.com

The exterior of the planetarium in 2011.



The mechanism of the planetarium.

The living room of the planetarium.

The 'optical part' of the planetarium.

The present-day museum at the planetarium.

Telescope by Van der Bildt.

ground that on 8 May 1774, a rare and terrifying phenomenon would occur, namely that the planets of the universe would collect into a constellation in a close formation, all lined up together, and would extract the earth out of her natural orbit, pulling her towards the sun, with dire consequences. A reverend preached that the end of the world was nigh and people were starting to panic, not knowing what to believe.

This Doomsday scenario became a matter of intrigue to Mr. Eise Eisinga so he came up with the idea to build a planetarium in their house in Franeker to teach people about the universe (**photo 2**). With the approval of his wife he started to construct the technical part of it in the attic in 1774.

This mechanical movement was made using wheels and gears made out of wood, as he couldn't afford metal parts, but he used 10,000 hand-forged nails. The whole movement was driven by a Frisian clock (**photo 3**).

On the ceiling of their parlour he built the illustrative part, showing the sun and all the then known planets revolving in their own orbits around the sun in an orderly and peaceful manner and each moving at their correct speed (**photos 4** and **5**). He opted for a scale of 1 to one trillion and finished the planetarium in 1781.

By constructing his orrery he demonstrated that, firstly, there was no reason to panic and secondly, that it was naïve to believe everything one was told straightaway. He wanted people to start to develop their own thoughts, to ask questions, explore things and most importantly, to cherish one's freedom to do so. This reasoning was also encouraged, of course, by the Age of Enlightenment based on the work of philosophers such as Montesquieu, Rousseau and Descartes.

After his death in 1828, Eisinga's Planetarium became a museum (**photos 6** and **7**). Today the Eisinga Museum shows not only the orrery but also incorporates a large collection of astronomical objects such as telescopes, sundials and space related artefacts, especially from the 18th and 19th centuries, often made by autodidacts. It is still the oldest working planetarium in the world and to the visitor today, it exudes the same atmosphere as it did back then.

Special thanks to Mr. Adri Warmenhoven, Curator of the Royal Eise Eisinga Museum for permission to use these photo's.

ME

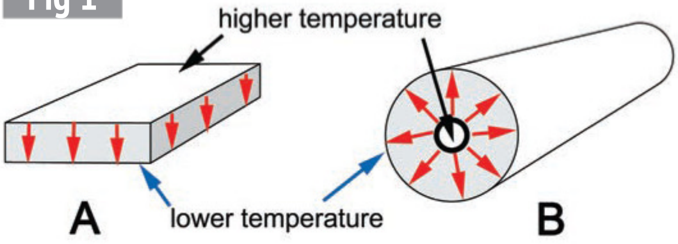
Is it Possible to Insulate Small Steam Pipes Effectively? PART 1

Mike Tilby discusses options for reducing heat loss from models.

Some time ago, good friend Peter Gale mentioned an observation that when he lagged the 5/32 inch outside diameter copper pipe that connected a boiler to a small model marine engine, instead of the hoped for decrease in heat loss there actually seemed to be an increase. This assertion surprised me but Peter has a knack of generally being correct in technical matters so later I searched the Internet for relevant information.

Websites such as *engineering toolbox* (**ref 1**) provide tables of heat loss data for pipes of various diameters and various thicknesses of insulation but these give a limited range of data and only for pipes ½ inch diameter and larger. However, the search also led to a very helpful and concise article (**ref 2**). This gave an example where lagging a pipe 3 inches in diameter did actually increase the rate of heat loss, so it seemed highly relevant to Peter's comment. I suspected that the theory described in that article was somewhat simplified for educational purposes. However, the website explained that the author, Dr. A. Stevens, was a highly experienced specialist in mathematical modelling and simulation who had worked in the submarine division of Rolls Royce dealing with heat transfer and fluid flow behaviour of nuclear reactors used to power the Royal Navy's submarines. Therefore, the article seemed a good starting point although, as will be described later, I eventually came to realise that, to gain a reliable picture of the effects of insulating very small pipes, the calculations it described needed to be augmented.

Fig 1



Thermal conduction.

Why lag steam pipes?

Of course, whether or not lagging is effective depends on the reason for applying it. In full size plant and machinery there are several potential reasons but two main ones are to reduce heat loss and to reduce risk of injury to people. In models, in addition to hopefully reducing heat loss, I guess that lagging is most frequently used to reproduce the appearance of the prototype and, perhaps, to reduce the risk of burning one's fingers while fiddling with a working model. Nice white lagging certainly looks good on a model steam plant but, if reduction of heat loss is the main reason for lagging a pipe, then you might be better off not bothering with it. Now I must try to justify that statement and explain Peter's observation.

How heat loss occurs

Heat loss from a pipe depends on three key processes:

1. Heat conduction from the inside surface of the pipe to the outside surface of the lagging (or to the outside surface of the pipe itself, if no lagging is used).
2. Heat loss by convection from the outside surface of the lagging (or bare pipe) to the surrounding air. This involves conduction of heat to the air adjacent to the pipe surface and either the forced or natural movement away of the warmed air.
3. Emission of infra-red radiation from the outer surface of the lagging (or bare pipe).

The rate of conduction depends on the difference in temperature between the inside surface of the pipe and the outside surface of the lagging. The rates of heat loss by convection and by radiation are both dependent on the difference between the temperature of the outer surface of the lagging and the ambient temperature.

As superheated steam flows along a pipe, its temperature will drop with time spent in the pipe. Therefore, it will also drop with distance moved in a manner dependent upon flow rate. With wet steam, the temperature will remain approximately constant since heat loss leads to condensation at the boiling temperature of water. (This will decrease slightly as the steam pressure falls along the pipe.) However, heat loss may be affected by the presence of condensate on the inside surface of the pipe.

We can simplify matters by assuming that the temperature of the steam is constant and the internal temperature of the pipe is the same as the steam temperature. However, the temperature of the outside surface of the lagging will not be the same as the surrounding air. Its temperature, and hence the overall rate of heat loss, will depend on a balance between a) the rate of heat moving outwards by conduction through the pipe and lagging and b) the rate of loss of heat from the outside surface.

Conduction

The rate of heat transfer through a slab of material (**fig 1** - A) increases with increased area of the slab and with increased temperature difference across the slab. On the other hand, if the thickness of the slab is increased the rate decreases. Lastly, the rate is dependent upon the ability of the material to conduct heat and that is characterised by the value known as its 'thermal conductivity', commonly abbreviated as lambda (λ) or k. [It is defined as the rate of energy transfer (measured in watts) through a slab one metre thick and one square metre in area, when the temperature difference across the slab is 1 K. Note that the absolute temperature scale (units = Kelvin) is used but temperature differences will be the same as differences measured in degrees C]. The greater the value of λ, the greater the rate of conduction (see **equation 1** below).

$R = (\lambda \times T \times A) / t$ ... eqn. 1
where:
R = rate of conduction
λ = thermal conductivity
T = temperature difference
A = area
t = thickness

Insulation acts by restricting the flow of heat energy and is analogous to a resistor that restricts the flow of electricity. In the same way that voltage drop across a resistor depends on the current flowing, the temperature drop across the layer of insulation will depend on the overall rate of heat movement and, for pipe lagging, that will be influenced by all stages in the flow of heat out of the pipe.

First problem for lagging small pipes

Equation 1 demonstrates the first of two problems facing anyone who wishes to insulate a model, namely that the ability to retard heat flow depends on the thickness of the lagging. You cannot scale nature so, if you wish to retard conduction of heat to the same extent as in the prototype then you need the same thickness of insulation, no matter how small your pipe (or boiler etc). The only way to achieve good insulation performance while using lagging at a scale thickness would be to use lagging material that has a thermal conductivity value much lower than was used on the prototype. However, as we shall see, only a limited range of options are available.

This article was previously published in *The Journal* published by The Society of Model and Experimental Engineers (SMEE) and sent free to our members. After its appearance Duncan Webster told me about a very interesting post on the *Model Engineer* Forum by 'Silly Old Duffer' (**ref 3**). He thought that thin insulation on models was ineffective and carried out an experiment which confirmed this suspicion.

Pipe wall and lagging

The conductivity of copper is over 3,000 times higher than that for typical lagging materials. Because of this, and because it is relatively thin compared to the insulation, the pipe wall will offer very little resistance to heat flow and so there will be very little temperature drop between the inside and outside of the pipe. Therefore, in our calculations, we only need to consider the rate of conduction through the lagging material

Equation 1 is fine for calculating rate of conduction across a parallel-sided slab with parallel edges but in the pipe-lagging situation the area through which the heat is conducted increases with distance from the inner surface since, of course, the circumference increases with radius (fig 1 - B). Account of this needs to be taken in equations upon which pipe heat loss calculations are based.

Heat transfer to air

The rate of heat loss from the surface of the insulation by convection is proportional to the area of the surface and to the temperature difference between the surface and the air. However, it also depends on other factors, the most important being the rate of air movement. In air that is normally still, the effective rate of spontaneous air flow over the pipe is influenced by factors such as the temperature difference between pipe and air together with the size, surface finish and orientation of the pipe. These factors are more difficult to quantify and their overall effect is given a value known as the 'heat transfer coefficient' abbreviated as ***h***. The basic equation to calculate rate of heat transfer from a surface was first described by Sir Isaac Newton – see **equation 2**.

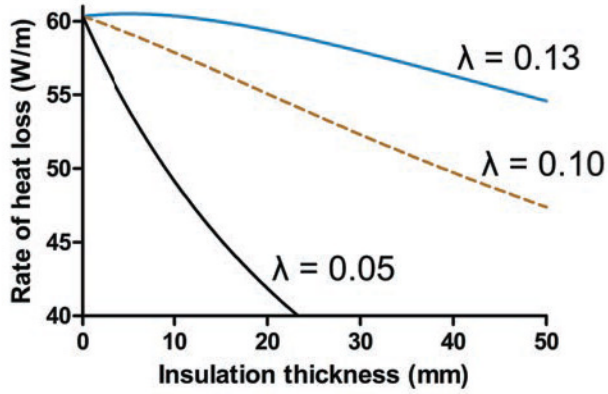
$R = h \times A \times T$ ... eqn. 2
where:
R = rate of heat loss by convection
h = heat transfer coefficient
A = area
T = temperature difference

The value of ***h*** depends on all the factors mentioned above and so a wide range of values can be found for pipes depending on, for example, the air velocity, the pipe's diameter, the surface temperature and whether it is vertical or horizontal. It is possible to calculate appropriate values for pipes and flat surfaces but the procedure is quite complicated. **Reference 4** provides a tool to perform the calculation of ***h*** for various circumstances in still air. From that web page it can be seen that ***h*** tends to increase as pipe diameter is reduced and also as pipe temperature is increased.

Overall rate of heat loss

The third process by which heat energy is lost from a pipe is radiation but the article by Dr. Stevens (ref 2) ignores this mechanism, as do websites

Fig 2



Rate of heat loss per metre from a pipe 120mm diameter covered in insulation of varying thickness and three different thermal conductivities (λ = 0.05, 0.10 and 0.13 W/mK). Data calculated using the equation in box 1.

such as *engineering toolbox* (ref 1). Because of this, I initially assumed that loss by radiation must be insignificant compared to convection and I created a spreadsheet that incorporated the equation in ref 2. We need not bother with details of the equation, but, just for the record, it is shown in **box 1**. Although the equation may look complicated, it was quite straightforward to write it into a spreadsheet and that made it easy to investigate the effects of various types of lagging on heat loss. The top (blue) line in **fig 2** shows data generated with the spreadsheet set up to reproduce the conditions used for the example calculation that was presented in ref 2. The spreadsheet results agreed very well with the article and that indicated that the spreadsheet functioned properly. The blue line (fig 2) shows that lagging can increase heat loss, just as Peter had seen, although in this case the effect was very slight.

How can lagging increase heat loss?

Adding lagging to a pipe increases the resistance to heat movement by hindering conduction. However, it also ***decreases*** resistance to heat loss by convection (and radiation) because the surface area is increased. If the decrease outweighs the increase then overall resistance is reduced and heat loss will increase. Figure 2 shows that whether or not lagging a pipe increases heat loss depends very much on the conductivity of the insulation material used. For the 120mm diameter pipe in this example, the possibility of increased heat loss was demonstrated by using lagging that was a relatively poor insulator. If more effective lagging is used (i.e. its conductivity is lower) then there is no increase in heat loss, as shown by the lower two lines in fig 2.

Second problem for lagging small pipes

The increase in heat loss in fig 2 was very small, but the effect of lagging depends on pipe diameter and this brings us to the second of the two problems facing anyone who wishes to lag a model. With a small diameter pipe, adding even a modest thickness of insulation causes a large percentage increase in circumference (and hence in surface area), whilst providing only a small resistance to conduction. Therefore, compared to a larger pipe, it seems more likely that the rate of heat loss will be increased. However, before moving on to analyse the effectiveness of lagging small diameter pipes, we should first deal with the issue of heat loss by radiation.

BOX 1

Equation for the calculation of heat loss from an insulated pipe (from ref 2)

$$P = \frac{2\pi \cdot (T_{steam} - T_{air})}{\left[\frac{1}{\lambda} \cdot \ln\left(\frac{R+t}{R} \right) + \frac{1}{h \cdot (R+t)} \right]}$$

where:
P = heat loss (W) per metre of pipe
T_{steam} = temperature of steam (K)
T_{air} = temperature of air (K)
R = outside diameter of pipe (m)
t = thickness of insulation (m)
λ = insulation thermal conductivity (W/mK)
h = heat transfer coefficient (W/m^{2}K)

Is radiation important?

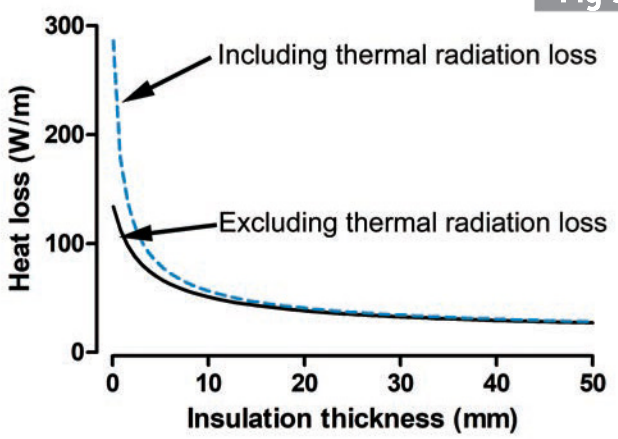
Prompted by comments from Peter, some rough calculations indicated that radiation could make a significant contribution to heat loss from a small pipe. That raised the question of why radiation had not been included in the calculations used in refs 1 and 2.

Fortunately I was able to make contact with Dr. Stevens, the author of ref 2. He explained that the calculation presented in his article was tailored for educational purposes and was intended as an example to illustrate the principle that design variations do not always have the effects that one might expect. He also said that he thought radiation was not important. However, he directed me to another web page (**ref 5**) which gives a more detailed account of heat loss processes and provides a spreadsheet with a much more sophisticated analysis of heat loss from pipes. This analysis does include radiation as well as convection and conduction.

An outline of this analysis will be described in the second half of this article but, for now, let's just look at a few results from using it for a ½ inch diameter pipe (**fig 3**). The solid black line shows how the rate of heat loss per metre of pipe varies with thickness of the insulation when there is no heat loss by radiation and the dashed blue line shows the rate when radiation is included in the calculation. Clearly, under these conditions, at insulation thicknesses greater than 20mm the effects of radiation make no significant difference to heat loss.

For pipe temperatures higher than 100 degrees C the *engineering toolbox* website (ref 2) only provides data for insulation thicknesses above 25mm. This presumably reflects the range of lagging thicknesses used in full-size plant. Hence, in such situations the effects of radiation make no significant difference. Also, the data is provided to enable engineers to predict heat loss from insulated pipes and not to compare that with what it would be for a bare pipe. When only very thin lagging or no lagging at all is used, as in models, radiation loss does seem to be significant and allowance for radiation is important. However, inclusion of radiation loss makes the calculations more complicated.

Fig 3



Heat loss from insulated pipes calculated with and without loss through thermal radiation (based on the analysis in ref 5) for insulation thickness between 0.1 and 50mm. Pipe diameter = ½ inch (12.7mm), conductivity of insulation = 0.036 W/mK; temperatures: steam = 300 degrees C, ambient = 20 degrees C. Emissivity of lagging surface = 0.8.

Although in full-sized machines radiation loss from pipes can generally be ignored, in miniature lagged steam pipes it can contribute significantly to heat loss. Also, in assessing the effectiveness of lagging it can be important to compare the results to un-lagged pipes.

Thermal radiation

At temperatures above absolute zero, molecules and/or crystals within solid materials constantly vibrate and this vibration increases as temperature is increased. At the surface of solids, these vibrations can lead to the generation of electro-magnetic (i.e. light-type) radiation which is emitted into the surrounding space. The frequency (i.e. colour) as well as intensity of this radiation increases as temperature is increased. This will be familiar to anyone who has heated metal in a gas torch and seen the appearance gradually change to dull red and then through to bright yellow and white. At temperatures of pipes in model steam engines, thermal radiation is still emitted but, being in the infra-red, it is invisible to the human eye.

The rate at which energy is radiated from a surface is proportional to the area of the surface and increases with temperature. However, the surface also absorbs radiation that reaches it from the surroundings so that the net rate of energy loss depends on the difference in temperature between the surface and those surroundings.

As explained above, rate of loss by convection increases in proportion to the difference in temperature between the surface and the surrounding air, so that doubling the temperature difference results in a doubling of heat loss. However, with radiation, as the temperature difference increases, the rate of loss increases at an ever-steepening rate (**fig 4**). You need not worry about details of the equation for calculating thermal emission, but just for the record it is shown in **box 2**. An important thing to note about this equation is the value known as the 'emissivity'. When two different objects are at the same temperature, they may have very different levels of emission and 'emissivity' is a measure of how the actual emission of a surface compares to the theoretical maximum possible emission (which is for an object known as a black body at the same temperature).

When infra-red radiation reaches the surface of an object, and assuming it cannot pass through that object, it is either absorbed or reflected. The proportion of the radiation that is absorbed by a surface is known as its 'absorptivity'. An interesting feature that simplifies calculations is that the emissivity and absorptivity of a surface are always equal. Emissivity (and absorptivity) of surfaces such as typical insulation materials are generally quite high but the emissivity of a metal can vary greatly and depends on how polished or oxidised and dirty it is.

As mentioned above, with efficient pipe lagging the surface temperature is so low that heat loss through radiation is insignificant compared to loss by convection. However, because of the shape of the graph of emission versus temperature (fig 4), if the surface temperature is high, then radiation overtakes convection as a cause of loss. As described above, when lagging is at a scale thickness, even the best insulation material provides only a weak barrier to conduction of heat and so surface temperatures of the lagging tends to be much higher than in full-size machines. Therefore, although in full-sized machines radiation loss from pipes can generally be ignored, in miniature lagged steam pipes it can contribute significantly to heat loss. Also, in assessing the effectiveness of lagging it can be important to compare the results to un-lagged pipes, and that also requires inclusion of radiation loss in the calculations.

The second part of this article will outline very briefly how the more complicated calculation of heat loss by all three processes is performed and will then attempt to answer the question posed in the title.

●To be continued.

BOX 2

Equation for the calculation of heat loss from a surface by radiation:

$$P = \varepsilon \times \sigma \times (T_h^4 - T_c^4) \times A$$

where:

P = heat loss (W) per metre of pipe

ε = emissivity

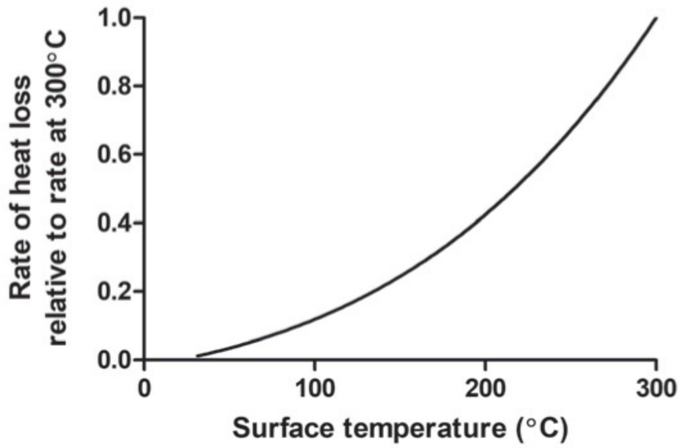
σ = Stefan-Boltzmann constant (5.6703 x 10-8 W/m^{2}K^4)

T_h = temperature of hot surface (K)

T_c = temperature of surroundings (K)

A = area (m^2)

Fig 4



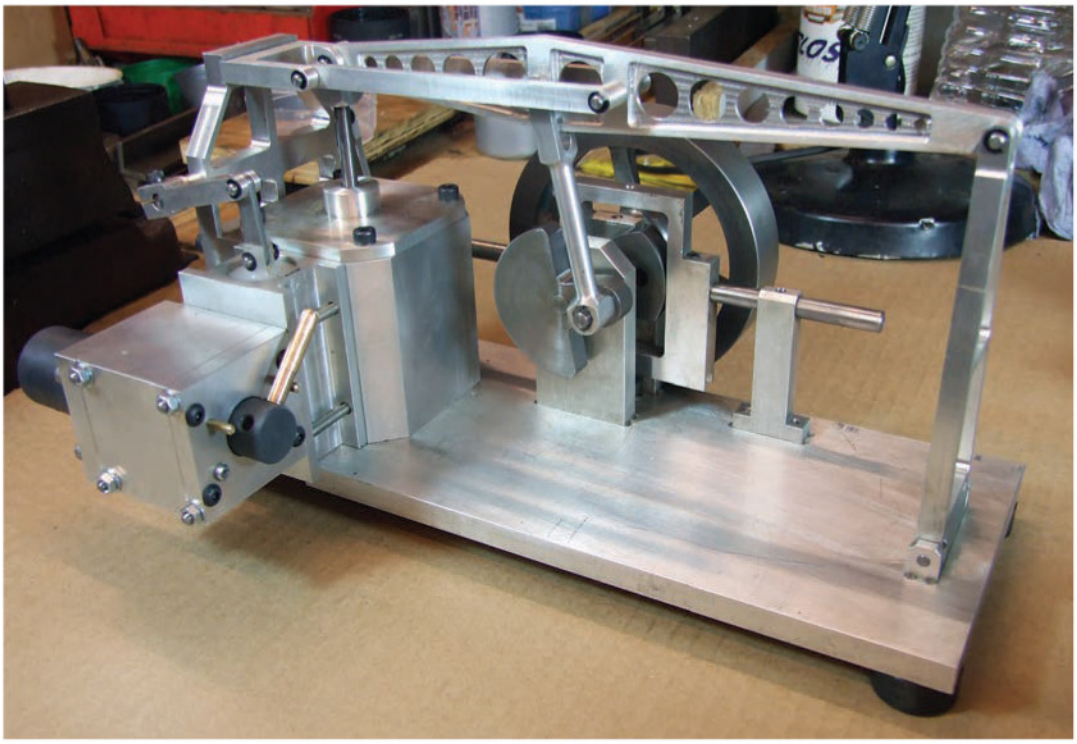
Change in rate of heat loss by thermal radiation with change in surface temperature, when ambient temperature = 20 degrees C.

REFERENCES

1. www.engineeringtoolbox.com/heat-loss-insulated-pipes-d_1151.html
2. Stevens, A., *Steam Pipe Insulation*. www.raeng.org.uk/publications/other/2-steam-pipe
3. Heat insulation testing with an Arduino. www.model-engineer.co.uk/forums/postings.asp?th=172911
4. Heat transfer factors: quickfield.com/natural_convection.htm
5. cheguide.com/heat_loss_insulation.html

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

Continued from p.733
M.E. 4705, 2 December 2022



PART 9

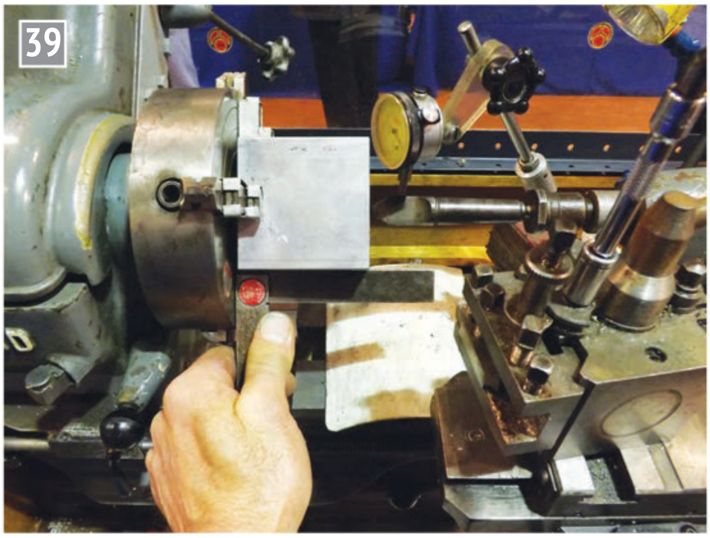
Grasshopper Beam Engine

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) ±0.1mm
Functional (i.e parts having to match) ±0.02mm

Item 16 – Cylinder Block (fig 27)

3 x 3 x 3 inch 6082 aluminium
There are many ways in which to tackle this item depending on your experience and capacity of equipment available. The following is a suggestion that has been proven to work for those operating with only the basic of both commodities.

Boring the cylinder block.

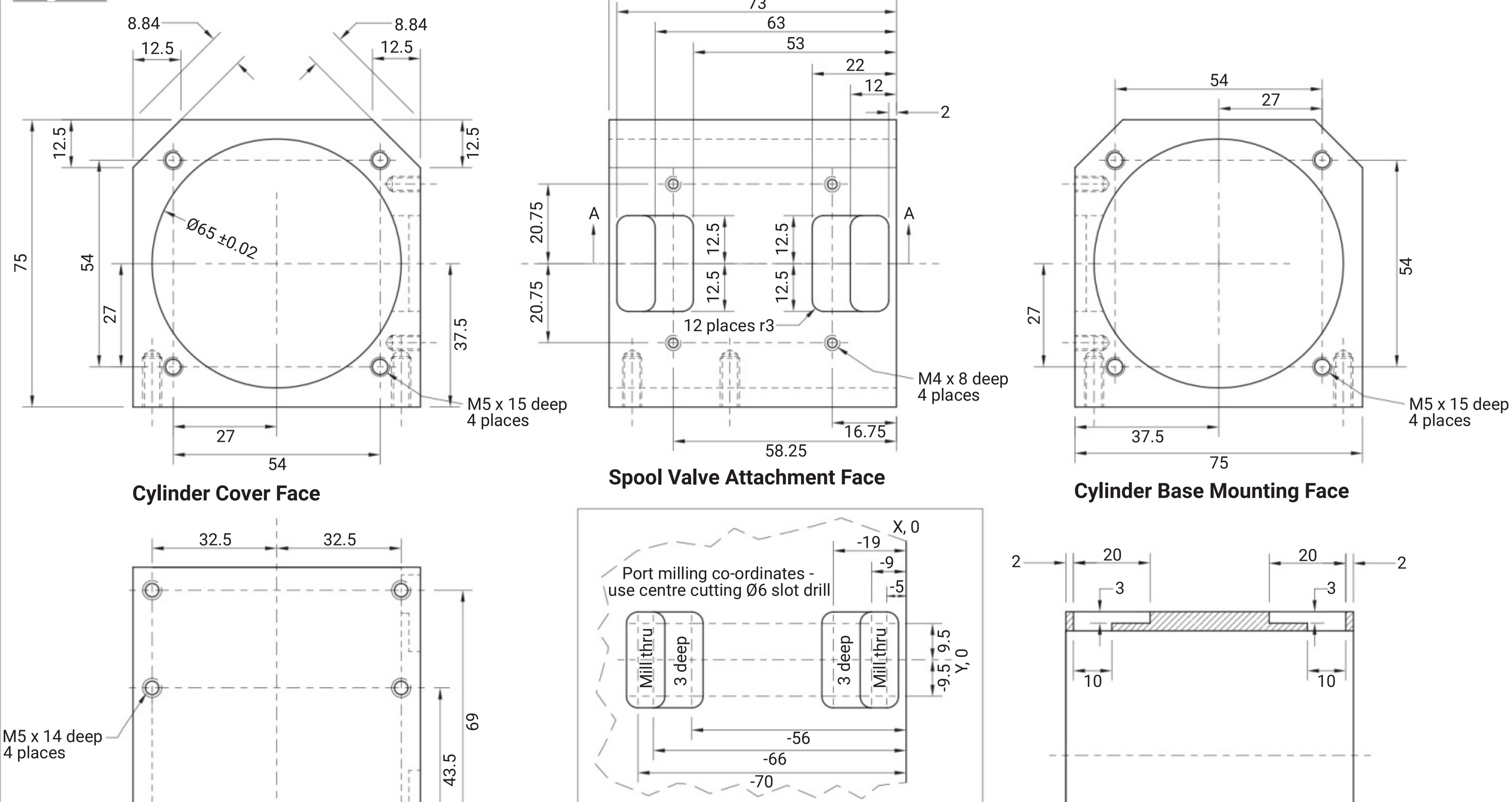


Squaring up the cylinder block in the four-jaw chuck.

Machining bore and end faces

* Mark out the centre on one end as accurately as your equipment will allow and centre punch.
* Set to run true using the wobbly centre method, in a four-jaw independent chuck. Use smooth pads between the jaws and the blank to prevent marking the side faces of the blank. Hold the blank at least 5mm away from the chuck body and take particular care to ensure that the side faces are all at 90 degrees using an engineer's square against the chuck body, whilst also running true when fully tightened (**photo 39**).
* Drill using a succession of drills until able to use your heaviest boring bar. Rough bore out to Ø60.
* Sharpen the tool bit to include a honed small radius at the cutting tip and, using a slow feed and lubricant, take several light cuts to achieve the best finish possible bringing the bore to Ø65 ± 0.02 (**photo 40**).
* Skim the face to ensure truth to the bore removing only enough metal to get a continuous cut (**photo 41**).
* Turn the blank end for end and set to run true using a DTI against the bore whilst ensuring the face end is in

Fig 27



3 deep (recess) (Base)	1	Start at X-5,Y-9.5 mill X-5 to X-19
	2	At X-19,Y-9.5 mill Y-9.5 to Y9.5
	3	At X-19 Y9.5 mill X-19 to X-5
	4	At X-5,Y9.5 mill Y 9.5 to Y-9.5
3 deep (recess) (Cover)	5	Move to X-56, Y-9.5 mill X -56 to X-70
	6	At X -70 Y -9.5, mill Y-9,5 to Y9.5
	7	At X -70 Y 9.5, mill X -70 to -X 56
	8	At X -56 Y 9.5, mill Y 9.5 to Y -9.5
Mill port through (Base)	9	Start X-5,Y-9.5 mill X -5 to X-9
	10	At X-9,Y-9.5 mill Y-9.5 to Y9.5
	11	At X-9 Y9.5 mill X-9 to X-5
	12	At X-5,Y9.5 mill Y 9.5 to Y-9.5
Mill port through (Cover)	13	Move to X-66, Y-9.5 mill X -66 to X-70
	14	At X -70 Y -9.5, mill Y-9,5 to Y9.5
	15	At X -70 Y 9.5, mill X -70 to -X 66
	16	At X -66 Y 9.5, mill Y 9.5 to Y -9.5

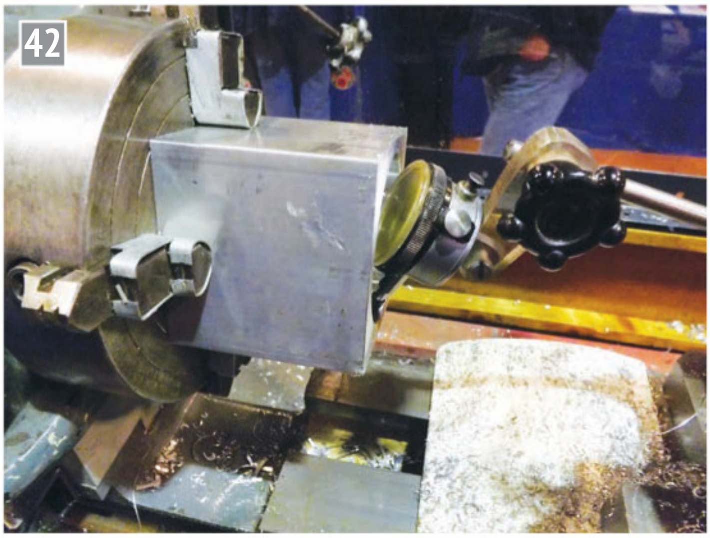
Item 16. Cylinder Block
Port Detail And Hole Locations

Cylinder block.

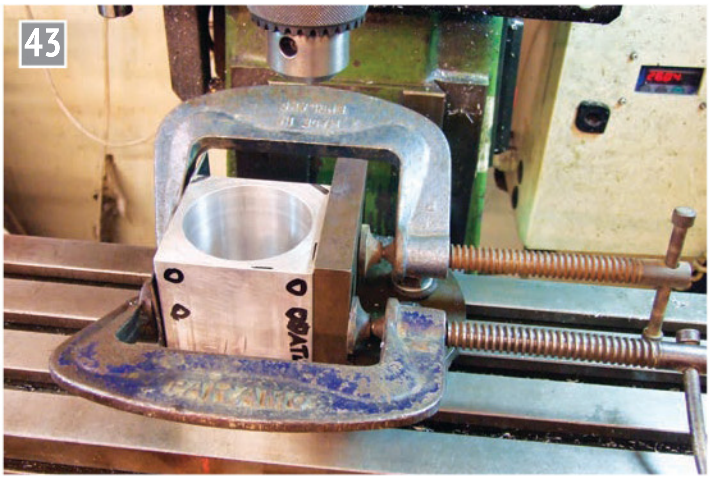
18+

WHAT IS AVAXHOME?

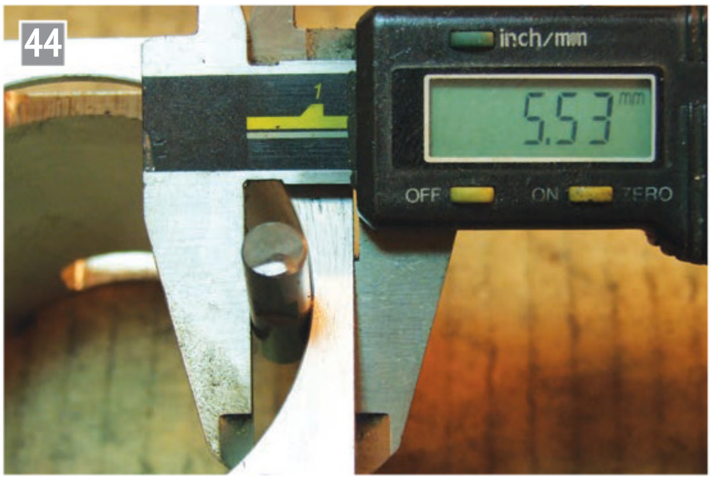
Skimming the face of the cylinder block.



Setting the block to run true after turning it round end for end.



Securing the block before drilling and tapping the cover securing holes.



Measuring the wall thickness of the bore.

full contact with the chuck body when fully tightened (**photo 42**).

* Face off, bringing the length to 75.

Drilling and tapping end faces

I suggest using an angle plate for the next machining operations, as the dimension of the blank will most likely exceed the capacity of many constructors' machine vice. Also, disaster can be averted if you take the time to use a permanent marker and write/sketch on each face an identifier as to what machining operation should be taking place, particularly with a big item such as this as starting again because you've just machined the ports in the wrong face would be a real pain!

* Set the spindle to the centre of the bore and zero the X and Y axes. Centre drill then drill and tap M5 x 15 at the four positions indicated for the cylinder cover face.
* Keeping the same side face against the angle plate, turn the blank end for end and reclamp. Check the spindle is still central and repeat drilling and tapping at four locations indicated for the cylinder base mounting face (**photo 43**).

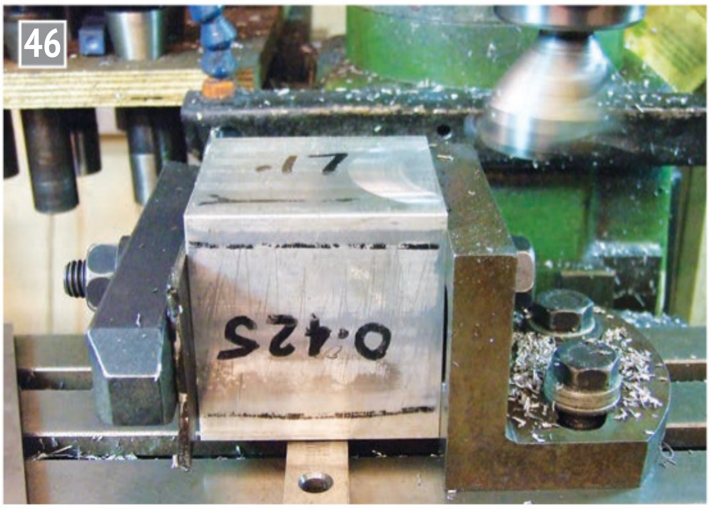
The reason behind choosing an imperial size for a metric blank is because the material was most likely produced by extrusion and may have slight dimensional variations but is slightly over the finished size required, allowing any errors in the bore's initial location to be corrected. This is important as the centre of the bore is the datum for the valve gear attached to two of the adjoining external faces.

Truing up

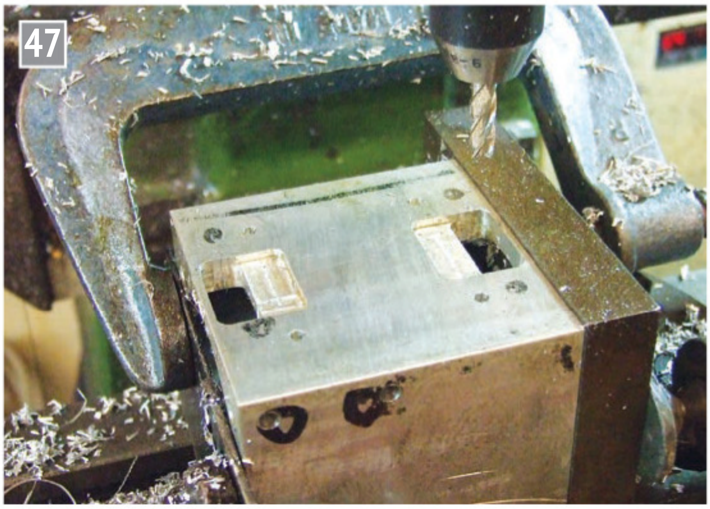
As the blank has now been bored and this important datum has been fixed, we need to ensure that the side faces are all the same distance away from the bore which is easily done using a small length of silver steel completely free from burrs and a digital caliper (or, I find easier/more accurate, a micrometer).

* Zero the caliper whilst it is holding the silver steel and then measure the minimum thickness of the walls at the four points around the bore (**photo 44**).
* Note each of the figures obtained on the end face (**photo 45**).
* The required wall thickness may be obtained by subtracting your actual finished bore size from 75. Divide the result by 2. Take the resulting figure away from each size noted and write with permanent marker the final figure on each side face. If the figures differ slightly it would have been caused by a slight error in the initial marking out but it is catered for by the oversize material.
* Clamp the blank to the angle plate with a bolt through the bore. Use soft packing between the clamp bar and blank and place on a suitable

Wall thicknesses should be carefully recorded!



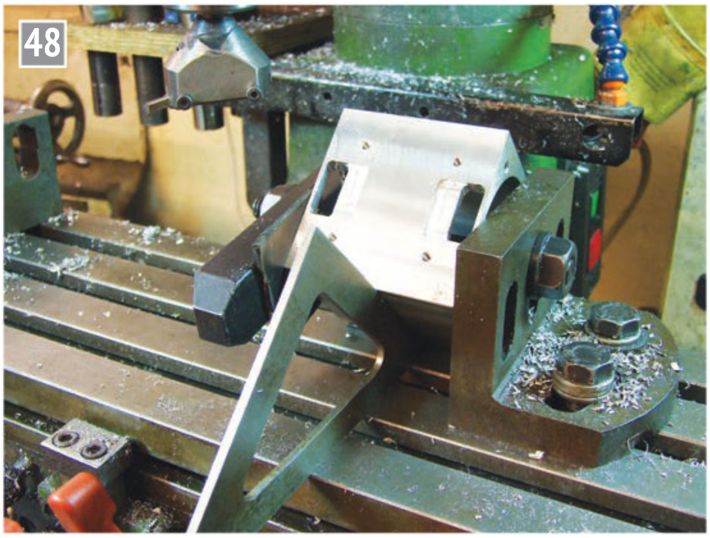
Skimming the cylinder block faces to size.



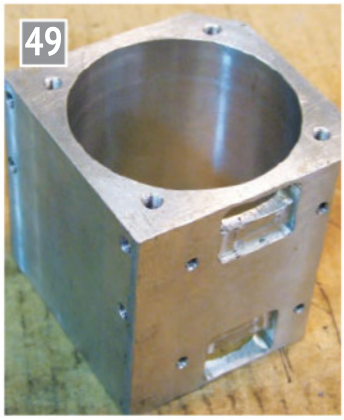
Milling the ports into the cylinder block.

parallel packing piece to raise the top face above the angle plate, before skimming off the noted amount from each of the four faces in turn (**photo 46**).

Note - as mentioned earlier, past experience has told me that silly mistakes can be avoided if machining detail/orientation is marked on each relevant face of the blank as applicable with a permanent marker before continuing! That is particularly relevant here.



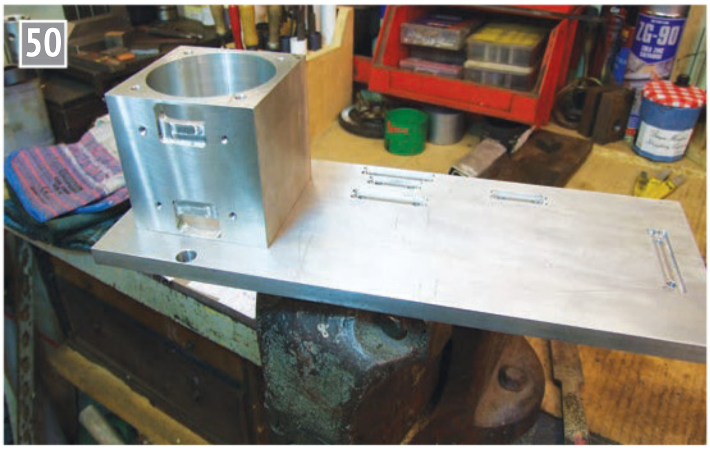
Setting up for machining the chamfer on the edge.



Completed cylinder block.

Drilling and tapping external attachment faces

* Making sure the table and blank are clean, use the same set-up but without the packing strip. Zero the X axis to the base mounting face and Y axis to the centre of the face width. Centre drill then drill and tap M4 x 8 at the four locations indicated for the link carrier attachment face.
* Reset the blank around 90 degrees (make sure you go the right way! See previous note!). Zero the X and Y axes with the spindle centred to the length and width of the face. Centre drill then drill and tap M4 x 8 at the four locations indicated for the spool valve attachment face.



Cylinder block mounted on the base.

Milling ports

In addition to a section view showing the port depth is a scrap view on **fig 27** showing the centre co-ordinates for milling the port and recess with Ø6 end mill and a listing, intended to prevent climb milling.

* Using a Ø6 slot drill, mill the 20 x 25 x 3 deep recess at the two locations indicated, removing the waste within the ring produced by following the co-ordinates given, followed by the 10 x 25 port into the cylinder bore at the two end locations indicated (**photo 47**).

Chamfering corners

* Finally, with the aid of a 45 degree set square clamp the blank with one of the indicated edges uppermost and machine a 45 degree x 12 chamfer by skimming off 8.84 depth after touching the corner. Repeat the process for the second edge (**photo 48**).
* Remove all burrs and check all threads and the ports/recess edges are chamfered (**photo 49**).
* Attach the cylinder block to the base using M5 x 12 countersunk bolts (**photo 50**).

Item 17 – Cylinder Cover (fig 28)

3 x 3 x 1 inch 6082 aluminium

The following operations are carried out on the lathe.

* Mark out the centre on one end of the blank as accurately as your equipment will allow and centre punch.
* Set to run true using the wobbly centre method, in a four-jaw independent chuck with the jaws reversed. Use smooth pads between the jaws and the blank to prevent

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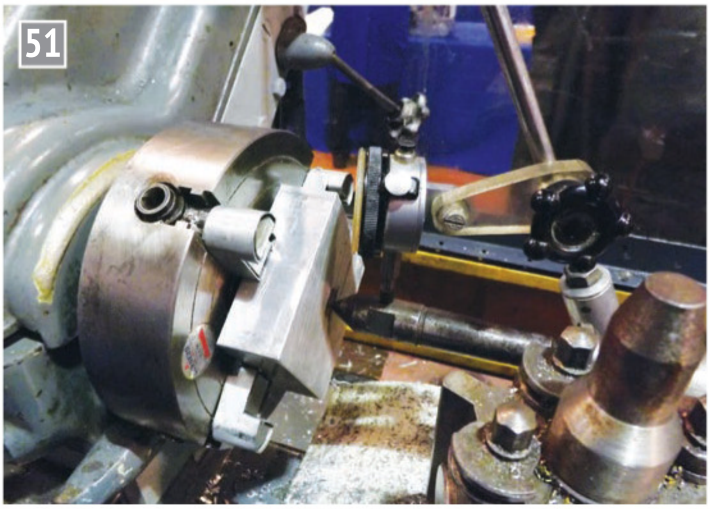
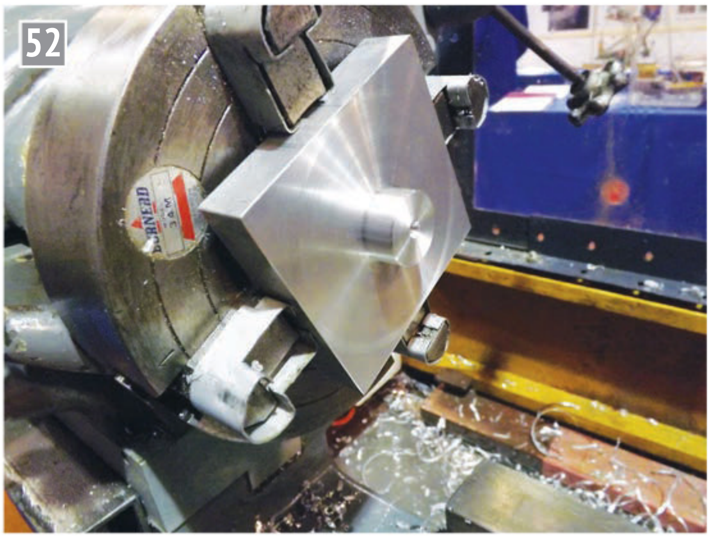
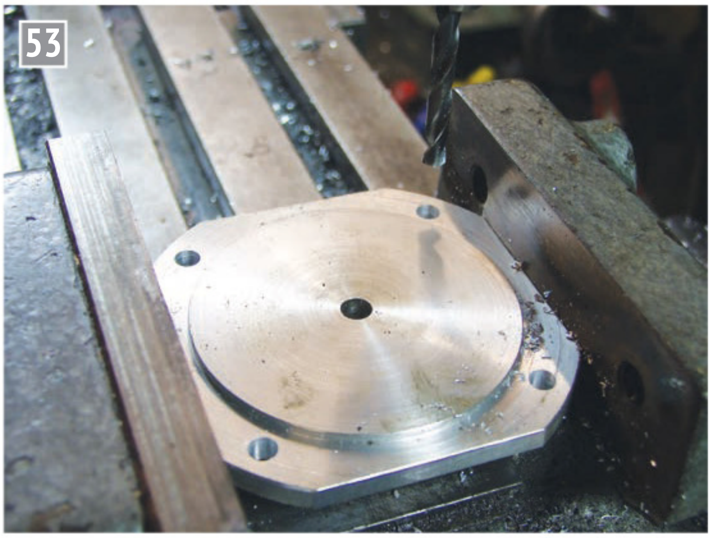


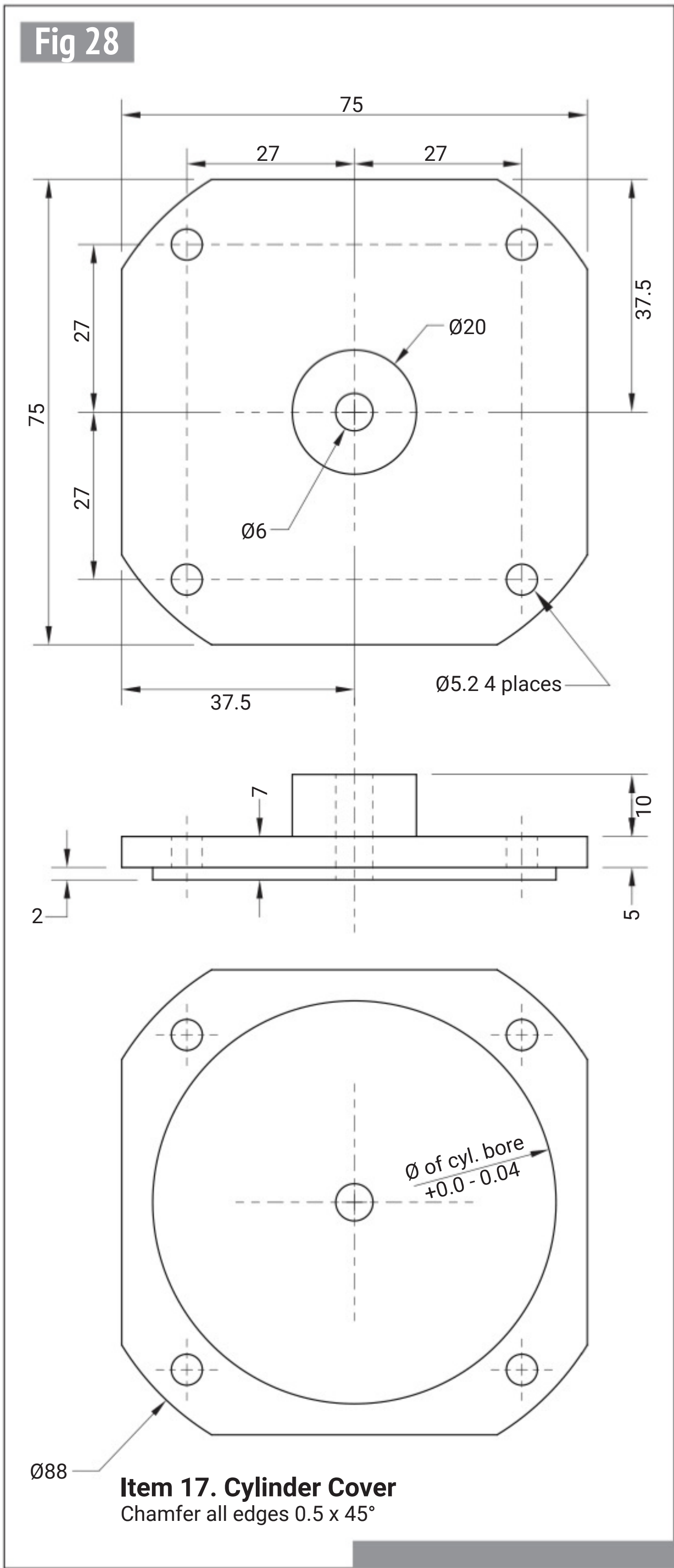
Setting the cylinder cover to run true.



Cylinder cover after facing.



Finishing the cylinder cover.



marking the side faces of the blank (**photo 51**).

* Face off and turn the Ø20 x 10 stub. DO NOT drill and ream the hole indicated at this stage (**photo 52**).
* Hold the cover blank in a self-centring chuck by the stub with protection around the stub to prevent marking by the jaws.
* Taking light cuts face off to 7 thick. Centre drill then drill Ø7.8 and ream Ø8.
* Turn the register to fit the cylinder bore + 0.00 – 0.04. Check fit.
* Turn Ø88 to remove corners.
* Transfer the work to the mill.
* Clamp on suitable parallels with register uppermost. Zero spindle to reamed hole or register.
* Centre drill then drill Ø5.2 at the four places indicated (**photo 53**).

●To be continued.

NEXT TIME

We make the piston and piston rod.

MODEL ENGINEER

Incorporating Mechanics, English Mechanics and Ships & Ship Models

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Wainwright's Swansong
The End of an Era PART 5

Nick Feast builds a 3½ inch gauge version of one of the last of the elegant Edwardian locomotives.

Continued from p.767
M.E. 4705, 2 December 2022

The designer of this engine was keen to follow full size practice in as much of the design as possible, so it was no surprise that all the axleboxes were split type, allowing future replacement to be made without pulling the wheels off the axles. This is pretty unusual in 3½ inch gauge.

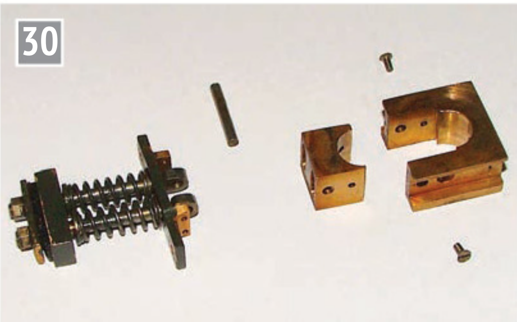
Photograph 30 shows the springing components of the driving coupled axle, with coil springs fitted as on the prototype. The pin retaining the spring rods is held captive when the axlebox assembly is fitted to the hornguides.

Photograph 31 shows the trailing axlebox arrangement. The leaf springs on the locomotive are dummies and a single coil spring is concealed within the leaf spring casting.

Photograph 32 is a view of the right-hand side of the frames from below footplate level just to show the interesting detail of the journal for the reverser cross shaft, the footplate and brake lever support casting and the front sandbox casting. At this stage many of the frame parts were in a muddy grey colour that had been the designer's interpretation of 'Great War Grey'. I felt that the elegant lines of this locomotive should benefit from its original livery, which was Indian Brown for most of the frame parts. There is also some bracketry for the footstep assemblies visible.

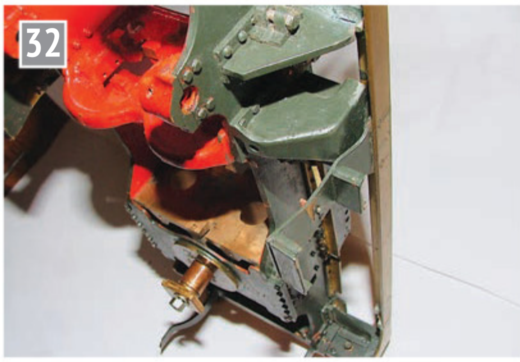
Moving to the back of the locomotive, **photo 33** shows the view under the cab, where the trailing axle springs and mountings can be seen. The twin brake cylinders were intended to be vacuum operated, hence the size. However, they are non-operating; any braking that is required will be provided by the screw down handbrake on the tender, which is very effective. The two vertical live steam injectors can be seen in the correct position tucked behind the driver's footsteps. These were some of the last produced by the late Gordon Chiverton.

Photograph 34 shows the view from behind the cab, the drag beam castings being quite intricate and a true replica of the real thing. Not like the real thing is the manual screw reverser, but a compromise

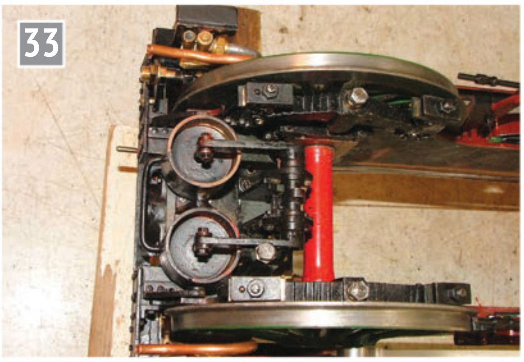


The driving axle axleboxes dismantled, showing the correct pattern of attaching the spring rods to a pin in the lower half of the bearing.

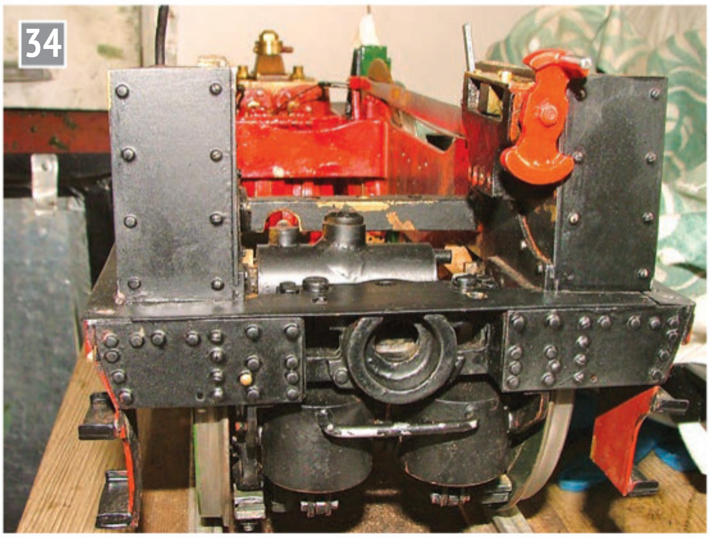
The trailing axle uses the same arrangement as the driving axle. It is reassuring to think that the rather fine wheel castings will not need to be pulled off in the future to repair a bearing.



More of the many cast items produced specifically for this locomotive are visible in this view; in total for the engine and tender over 250 were made.



The dummy cast leaf springs and vacuum brake cylinders can be seen here. The hexagon nut just ahead of the lower brake cylinder in the picture is the water drain for the displacement lubricator.



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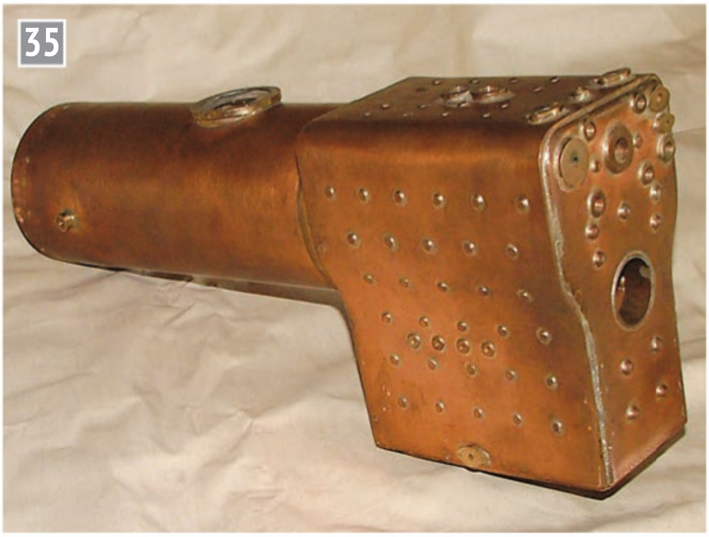
The rear of the box splashers is clear in this view; wooden seats are placed on the top. The reach rod from the reversing screw goes forward between the right hand splasher and the boiler casing so care was needed to fit it into the space available.



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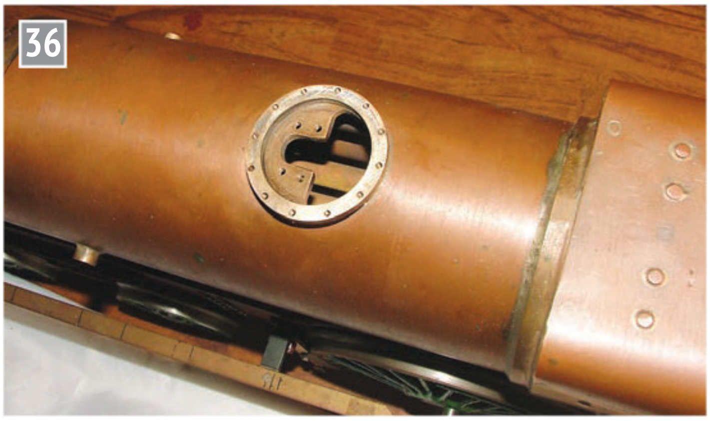
Close to scale dimensions the boiler looks the part. Silver soldered throughout, with rod firebox roof stays as per full size. It will operate at 80 psi, hydraulically tested to 160 psi.

had to be made here as the steam-operated reverser of the full size would not have worked well in this scale. All sorts of problems with condensation and sealing would no doubt have scuppered it.

Also visible is the oil supply tank for the displacement lubricator, which neatly fitted under the cab floor.

I reached the stage where all the chassis components were together and the locomotive had run successfully on air, proving that the valve gear dimensions and valve setting were correct. There is a short video of this on my YouTube channel, search for 'Nick 33006'.

This was something of a milestone. I could now press on with the rest of the locomotive. The cab and splashers needed a bit of planning as the commercially made boiler came as part of the initial purchase. This was made pretty much to scale, meaning once again that the clearances around it were going to be tight. Before detailing construction of these parts, I will describe some unusual features of the boiler.



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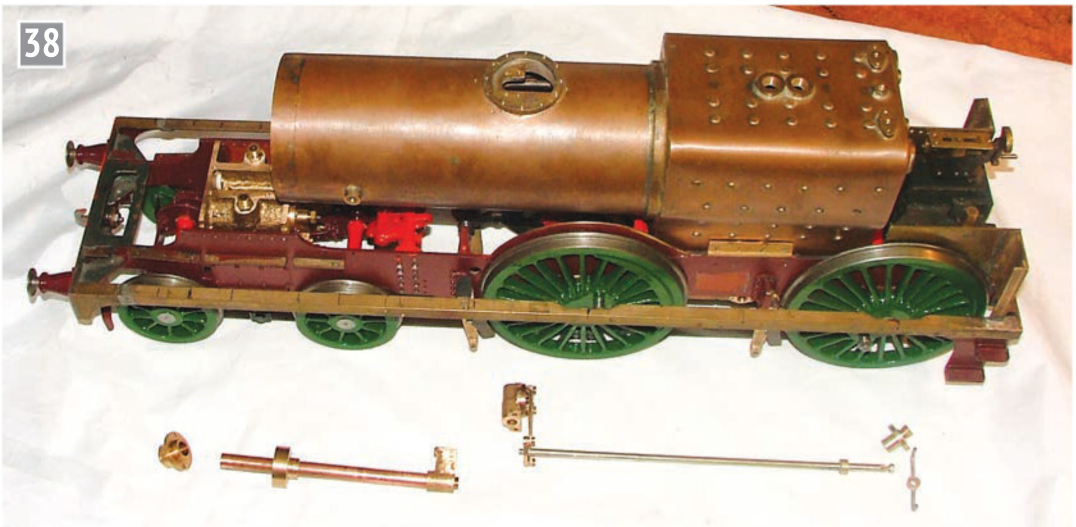
LEFT: regulator support cast integrally with the dome ring makes a neat job; a joining ring was also cast to mate the boiler barrel to the front of the firebox. RIGHT: The regulator is in place ready for the hydraulic test. The boiler capacity is 1.5 litres.

Photograph 35 shows how a silver soldered copper boiler should look! Beautifully put together by Helen Verrall in 2000 it was part of the appeal of the engine when I bought it. It was built more or less to the designer's specification including some bronze castings supplied by him. It has 12 fire tubes of $\frac{3}{8}$ inch O.D. and two superheater tubes $\frac{11}{16}$ inch O.D. Three of the connections on the backhead are for internal pipes that pass through the boiler to flanges on the smokebox tube plate, one each for the blower, cylinder lubrication and vacuum supply for the brakes. The last, as already stated, will not be used so is blanked off at both ends.



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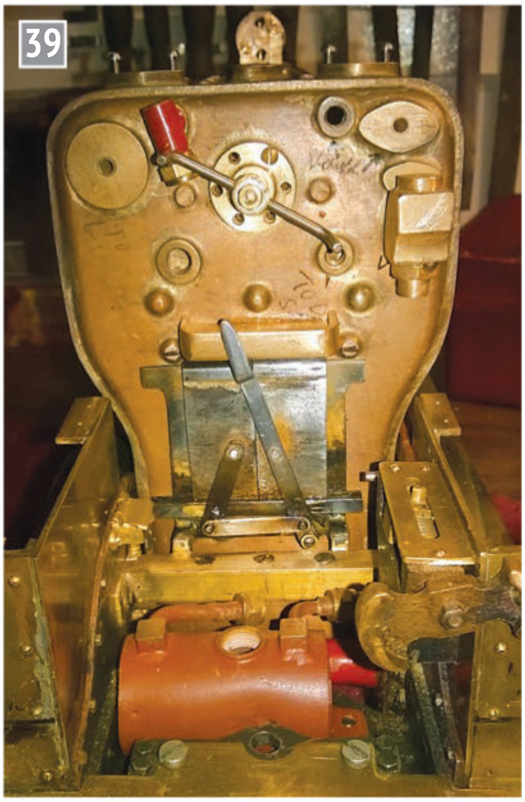
Having worked out what the various castings were, it was then simple to arrange them in the correct order! Using O-rings to seal the steam pipe into the tube plate bush is a method I have used on all the locomotives I have built and works well.

The small flanged connections on the top of the firebox are used to mount the valves for the two live steam injector feeds. **Photograph 36** shows the combined dome flange and regulator bracket and **photo 37** shows the Stroudley type regulator in position.

Photograph 38 shows the various parts of the steam circuit laid out next to the engine. From the right there is the regulator handle, the regulator bush with gland packing that will be fitted to the boiler backhead then a retaining collar fixed to the regulator shaft. This collar will face up against the back of the gland housing and reduce the pressure acting on the gland packing, reducing the leakage rate. The mating faces, therefore, need to be lapped in to each other. The end of the regulator shaft is square and engages in the bottom bar of the regulator and its end machined round so that it is supported by a suitable hole in the lower regulator casting.

This casting supports the main steam pipe that passes through a bush attached to the smokebox tube plate. Finally, the steam header is bolted to this bush, sealed by an O-ring.

Photograph 39 shows the boiler backhead while I was planning how to fit all the parts into quite a narrow cab. The rear driving wheels take up a lot of space at each side and the tops of the splashers are used as tool boxes and seating for the driver and fireman. The correct style of sliding fire doors has been fitted but the warming tray above will be removed later as the whole of the backhead will be lagged and clad along with the rest of the boiler.



39

Solid bushes had been soldered into the sides of the firebox so that the support bracket holes could be drilled and tapped 6BA. The final setting of the boiler was slightly higher than shown. The oil tank was also replaced with a slightly smaller one, which was a better fit in the frames.

40

The circular smoke box is not huge so some ingenuity was required to fit the plumbing in. Flat plates were added above the valve chests so that an airtight seal could be made on final assembly. Note the pillar nuts, which can easily be accessed if the superheaters ever need to be removed. The petticoat pipe will be removable so that the whole assembly can be pulled out of the smokebox door.

Photograph 40 shows most of the pipework in the smokebox. Not shown is the connecting pipe from the main pipe to the snifting valves which are fitted each side of the smokebox, just behind the chimney. The blower pipe emerges from the boiler on the lower left side and the oil connection from the lower right. The small manifold in front of the blastpipe is intended as an oil reservoir with the aim of trying to feed oil equally to both valve chests. The blanked off vacuum connection can also be seen and the boiler has now been lagged and clad.

●To be continued.

NEXT ISSUE

Dynamometer

Graham Astbury describes the dynamometer he built to determine the output characteristics of his rewound single-phase electric motor.

Guinness Engine

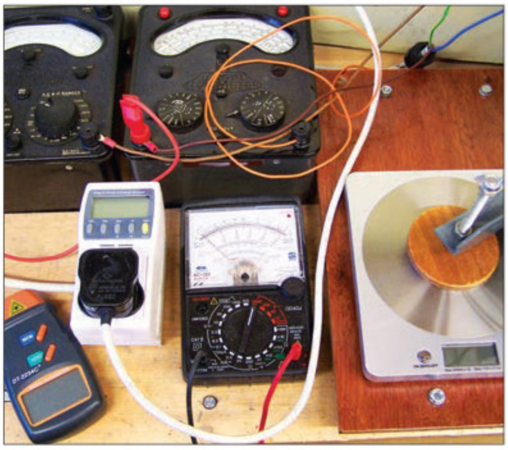
Cliff Almond considers how to tackle the motion of his 7¼ inch gauge 0-4-0T Guinness locomotive *William Spence*.

LOWMEX

Julie Williams reports from the Lowestoft model engineering exhibition organised by the Halesworth Model Engineering Society.

A4 Locomotive

Robert Hobbs builds a 2½ inch gauge model of Gresley's streamlined A4 locomotive *Mallard*.



Content may be subject to change.

ON SALE 30 DECEMBER 2021

Rewinding a Two Speed Motor PART 12

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.760
M.E. 4705, 2 December 2022

Discussion

Was it worth the effort for the final result? In a financial way – possibly, as the cost of the wire, electrical insulating paper, varnish, steel mesh and the terminal strip and box was less than that of a new three-phase 240 volt delta connected motor and a variable speed drive. I made the dynamometer from items that I already had in 'The Stores' so that did not cost anything. As regards time – probably it wasn't worth it at all as it took up many hours in the workshop as well as the time taken undertaking literature searches and understanding how single-phase motors work.

This rewind has taken around two years on and off from start to finish, with the motor languishing under the bench at times. I didn't make any note of the actual workshop time in total at all as it would have probably depressed me too much! A lot of time was spent correcting errors brought about by inadequate research and lack of forethought. I ended up rewinding the eight-pole coils twice as initially I wound them with full pitch coils without thinking out clearly how much room the end turns required, until I found I didn't have enough room for all the four-pole windings. I also had to rewind the four-pole speed twice, as I ended up with a shorted turn which severely reduced the power output and I had to strip the windings out to eliminate it, as discussed before.

This is a piece of cake. It is definitely not a rewound motor!

I learned so much about how to search for elusive information using the Internet - without which I would have made even more errors (**ref 25**). Would I do another rewind on this particular motor to improve it more? No, as it definitely wasn't a piece of cake (**photo 52**) and any improvement would be marginal.

However, for me it was a most interesting learning exercise and I thoroughly enjoyed it despite the many setbacks that occurred. In the words of Albert Einstein *'...I have tried 99 times and have failed, but on the 100th time came success...'*.

Certainly, I now know a great deal more about the workings of electric motors, particularly single phase motors. I have my 12 speed lathe with no annoying gaps in the speeds, which now run from almost 1000 rpm down to 28 rpm with sufficient torque on all speeds, unlike electronic speed control where the torque is constant and does not increase as the speed reduces. It can be seen that the above 'design method' produced a *workable* design – it was not intended to be the best that can be obtained from any given motor. It was also notable when undertaking the 'reverse engineering' calculations, just how well the original designer did his job!

Using pole-changing methods is a simple and elegant method of obtaining two speeds using a three-phase supply and it does indeed work well because of the balancing-out of third harmonics. For a single-phase supply, this is not the case and pole-changing methods are not at all simple – it does appear to be possible but requires extremely complex calculations; careful design of the shape of the laminations; and finite element analysis of the resultant magnetic fields – strictly not for amateurs!

Winding a larger motor frame with two completely separate windings can allow various combinations of speeds to be wound but there will be a restriction on the power output that can be obtained as only half of the copper windings are actually being used for any one speed, so less than half the original rated power would be possible because as the number of poles increases, the efficiency reduces. The number of slots in the stator will restrict the choice of the number of poles, as the number of slots per pole per phase must be a whole number. Hence using a very common 36 slot stator will mean that only two, four, six, twelve or eighteen pole speeds can be produced for a two-phase (capacitor) motor. Note that the stator that I used had 32 slots, so it would be possible to wind it for two, four, eight or sixteen poles – two and sixteen as the original and four and eight for my rewind. There is the additional problem that using only half the winding area for each winding results in a much lower flux density which also means that the slip increases. Attempting to wind for a high flux density may result in too high a current for the number of turns in the windings that can be fitted in.

As the original motor had been wound with full-pitch windings in the 16-pole speed, the fringing is less than would occur with fractional-pitch windings, so it would have been better had I used full-pitch windings. However, I might not have got the full winding in because of restrictions on room. The much greater temperature rise on the eight-pole speed is indicative of the lower efficiency that resulted in using fractional pitch windings where one tooth on each pole does not take part in the magnetic circuit. This is because the eight-pole winding goes around only three teeth per pole, rather than four teeth for a full-pitch winding.

If a motor originally wound as a two-speed motor is available, as I had, then rewinding for two different speeds is perfectly feasible, providing that the mistakes that I made are avoided. However, the number of stator slots will determine the numbers of poles for which the stator can be wound. Whilst the method I used for determining the number of turns in a set of windings is rather crude, it does allow a workable design to be made. It will not necessarily provide the optimum power output for the motor frame size and improvement may be possible. If using a permanent capacitor design, careful selection of the windings will allow the same capacitor to be used for both speeds, particularly for a two-to-one speed ratio.

At various points throughout the article, there have been many constraints and limitations on rewinding motors. In general, if you choose to rewind a motor for anything other than on a 'like-for-like' basis, then there are some 'rules' that you should observe to avoid disappointment when you rewind. These can be summarised as follows:

- If you are winding for a higher speed (i.e. fewer poles) then it may be necessary to limit the power output to the original output to avoid saturating the iron around the outer part of the stator.
- The number of slots in the stator divided by the product of the number of poles and the number of phases must be a whole number, i.e. Slots / (Poles x Phases) = a whole number.
- To avoid a noisy motor, the constraints of Appleman (ref 3 – see M.E.4695, July 15) and Hildebrand (ref 12 - see M.E.4697, August 12) should be observed where possible. Generally, most commercial motors will have suitable slot arrangements in the stator and the rotor to allow for a quiet motor.
- Dual wound motors are the most practical method of obtaining two speeds for motor for a single-phase supply, but finding a motor with the appropriate number and size of slots may be difficult.

I hope that this article has not been too difficult for an enthusiastic reader to follow, as I am sure that there will be some readers 'out there' who have understood the 'design' process and maybe they too will rewind a motor, either for one or two speeds. I did find out that for a permanent capacitor motor, the motor itself is fairly tolerant of choice of capacitor value. Clearly, in a commercial situation, the choice of capacitor and windings is down to economics but for an amateur seeking as I did to simply rewind the motor to obtain two speeds, the motor is pretty tolerant of the actual value. I found that the eight-pole winding was the most demanding and hence I chose the appropriate capacitor for the eight-pole speed as the optimum one. Finally, it is worth remembering that a well-known Liverpudlian song-writer started out his working life in the coil winding department of an engineering company in Liverpool (ref 26), some years before writing 'The Long and Winding Road' – so this rewind could lead me to a new career in song-writing.

Conclusions

- It is difficult to use pole-changing techniques to provide two speeds on a single-phase motor, although it has been done using specially designed non-standard stator stampings with differing slot sizes and differing numbers of turns in each slot.
- The calculations using 'reverse engineering' from an existing motor provide an acceptable performance, even though huge liberties have been taken with the design procedure.
- The use of two independent windings allows the motor to be wound in the best way for each of the two speeds.
- Care is required to minimise the noise of the motor by avoiding certain combinations of the numbers of poles and slots as recommended by Appleman and Hildebrand.
- Small pole-pitch windings result in a high flux leakage and reduced efficiency.
- By winding for approximately the same power on both speeds, more torque is available at the lower speed.
- The two speeds can be in any ratio of practical pole pairs and are not limited to a two-to-one ratio as a pole changing motor would be.
- The different numbers of pairs of poles that can be used depends on the number of slots in the stator.
- The number of slots per pole per phase must be a whole number.
- Careful design allows the same value of capacitor to be used for both speeds if desired.
- Permanent capacitor motors are reasonably tolerant of the choice of capacitor value.
- Different power outputs can be designed for the two windings in the same frame if required.
- Using identical windings for the main and auxiliary phases allows for simpler reversing.
- The output power on both speeds is about midway between the estimated power output of the two speeds on the original motor and is acceptable for the duty for which I am using it.
- The use of a positive temperature thermistor as a thermal cut-out sensor in each set of windings is simple to install and will offer good protection to the motor from burning out.
- Providing that a stator with the right number of slots is available, it is a quite straightforward procedure to design the rewind of an induction motor for two speeds based on the original windings, once the correct method is understood.
- A method of detecting shorted turns in an induction motor stator winding has been demonstrated, irrespective of the number of coils or phases on the stator.

Acknowledgements

I would like to thank the late Graham Done and Robert Priest, both of Bradford Model Engineering Society, for their helpful comments, particularly concerning the nuances of the design of two-pole and eight-pole three phase electric motors, without which I would have probably made even more mistakes. Also, I would like to thank our editor, Martin Evans, for his patience in waiting for this long-promised article and for actually publishing it. ME

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26. Carlin, Peter Ames, *Paul McCartney – A Life*, Simon & Schuster, p.58 (2009).

A Miniature Oscillating Steam Engine PART 13

Hotspur constructs a three-cylinder reversible oscillating engine.

Continued from p.680
M.E. 4704, 18 November 2022

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

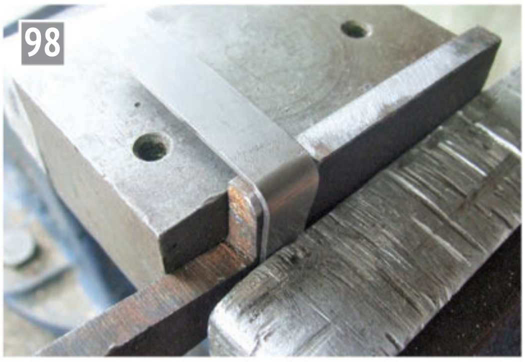
Making the fire hole frame and door

This task can be started by making the simple curved cover plate for the fire hole opening and mounting it on the four 6BA tapped bushes. This may be all that is needed for those that will be adding a gas fired arrangement and I have some ideas for a plate for the firebox with some pan type gas burners (which will be described later, all being well). Now, then, the proper opening for the door itself is required with a hinged and latched door. My drawing (**fig 17**) shows the design I have used for the door frame but of course builders can adopt alternatives if they wish.

Start by cutting out the piece of 18 swg stainless steel plate and form it to a radius that goes over the bushes. I found that a kitchen pot was good match for the 2$\frac{5}{8}$ inch radius curve required. I have indicated the dimensions I used, especially around the curve and, as the bolts are added in a radial direction, it is best to use a generous clearance hole size, say a No. 30 drill. **Photograph 97** shows the result. Next, cut off a strip of stainless steel of the same thickness and around $\frac{7}{16}$ inch wide by about 5$\frac{3}{4}$ inches long. The idea is to fit the strip to the curved surface and have a join inside at the top. Working from the mid-point, file away the

The fire hole cover plate bolted in place on the boiler barrel.

width so it fits snugly against the curved plate for a length of about 1$\frac{1}{2}$ inch. Do this carefully as the fit is important and the task can be undone with too much enthusiasm! Bend down each side equi-distant from the centre of the curvature making a small radius in the top corners and repeat the bends for the lower corners before again reducing the width of the strip towards the centre point. I found it useful to file up a scrap piece of rather rusty steel bar to ensure each side was the same length. **Photograph 98** shows the task in progress. Note how packing was used to hold the nearly formed shape to do the two closing corners. **Photograph 99** shows the packing used to keep the door frame square but unfortunately my strip was slightly too short so I had to gain a little length from the other plain side corners by using the forming plate radius to move in both sides to the same extent. Allowing a millimetre clearance on the radius of



Here the strip is centrally located on a forming bar for the two upper corners to be made.

The final corner bend for the door frame with sufficient 'random' packing being used to keep the outline square in the vice. An adjustment was required on the two opposite corners.

Here the lap strip has been riveted in place and the frame positioned on the cover plate for fluxing and soldering.

This shows the door frame silver soldered to the fire hole cover plate and ready for cleaning up.

each corner was sufficient to close the gap. This made the overall height dimension a bit taller but the effect was not critical. **Photograph 100** shows the lap strip riveted in place and the second arc of material filed away to fit the curved plate. Make sure the outer edge of the frame is flat before adding the lap strip. It was tempting to silver solder the strip joint first after riveting, but then properly cleaning the frame sufficiently for the major soldering operation onto the cover plate was not thought to be realistic. A pair of old toolmaker's clamps were used to hold the frame strip in the centre of the cover plate and flux for stainless steel was added to the inside with short pieces of silver solder placed along the inside faces and in the corners. **Photograph 101** shows the appearance after the silver soldering.

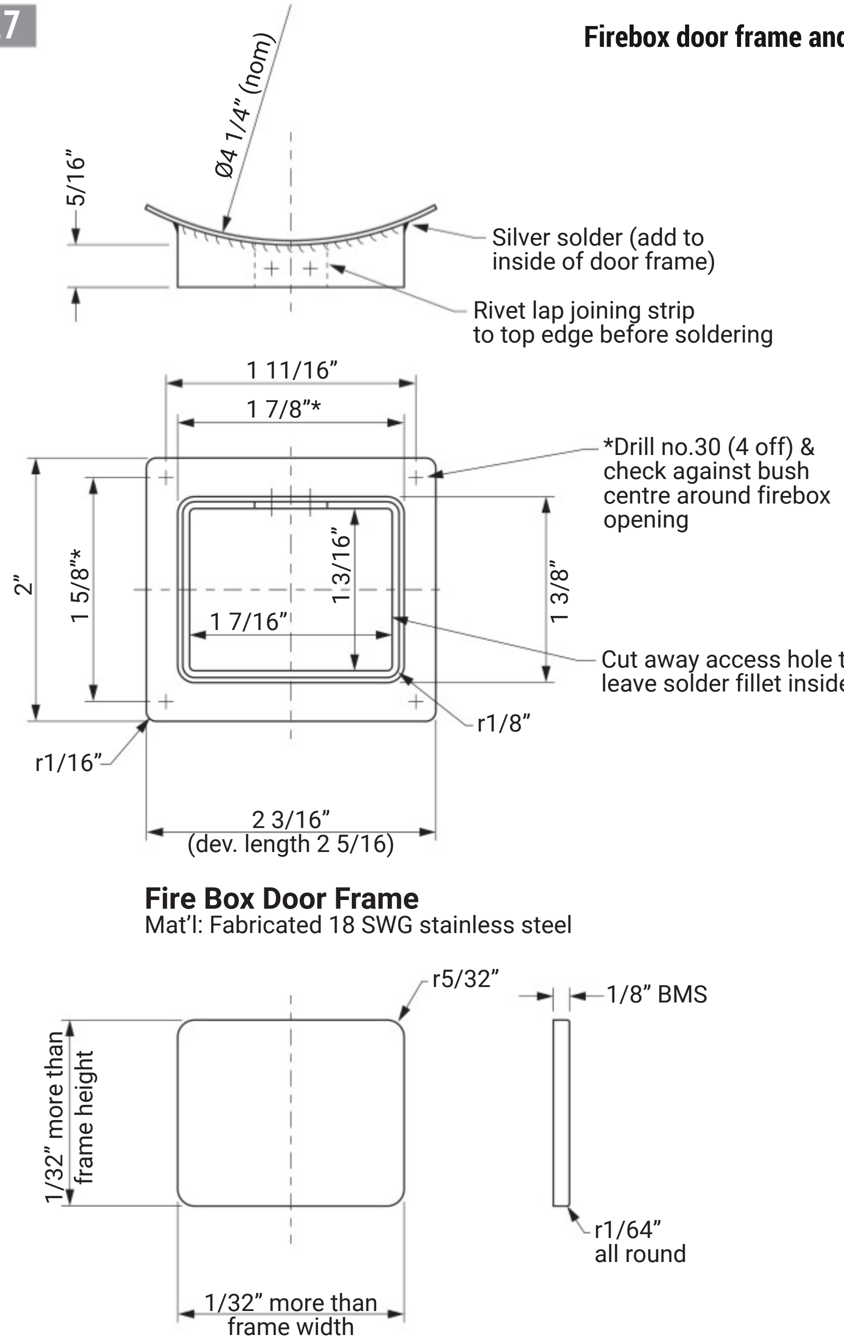
Using very hot water to remove the flux was simple enough and even cleaning up the outer faces with fine emery paper took very little time and **photo 102** shows the result.

The next task was to remove all the unwanted material from inside this new edging. I began by drilling a ³⁄₁₆ inch diameter hole in each corner sensibly away from the frame edges. While holding the frame in a drilling vice by the top and bottom edges, four lines of hole centres can be marked out on the back face and these can be drilled out the same size. The bridges between the holes can be filed out to produce a rectangular centre opening clean and square with a ¹⁄₃₂ inch lip to leave the solder fillet. The task needs care as at this stage there has been a lot of effort put in which could be easily ruined. **Photograph 103** shows the result.

Making the door itself was a task that needed some consideration as a simple door from flat plate would not look right. Neither was the task of fashioning a door with formed edges from stainless steel considered to be easy with the material being very prone to work hardening around the

Fig 17

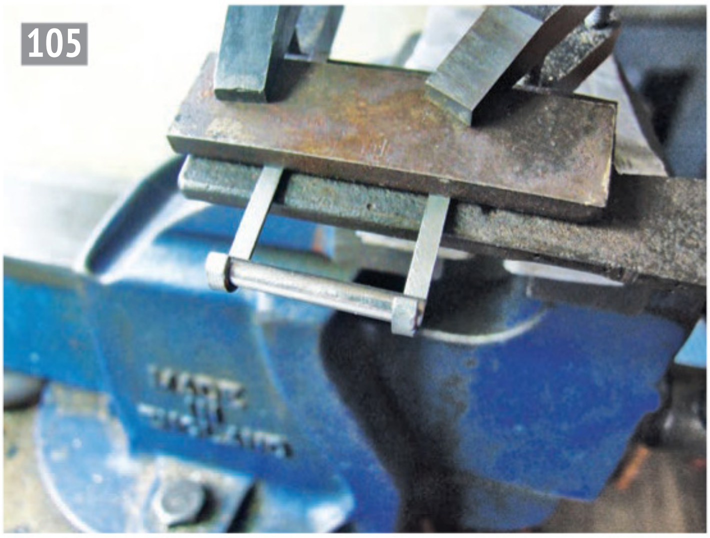
Firebox door frame and former.



The fabrication looking bright again with the required solder joint all round.

Here the centre of the curved plate has been removed by drilling through each corner and filing up to the edges to the surrounding frame.

The door made from copper sheet with the forming plate alongside.



The two straps prepared with the hinge tube positioned for silver soldering.

Two views of the door frame hinge bracket silver soldered to the tube.

corners where it would crack. A door made from copper, therefore, was decided upon, which would lend itself to being fashioned in a similar way to a boiler plate and the forming operations would add to its stiffness. First, a steel former was made that was around a 1/32 inch larger than the door frame all round so the door would be an easy fit over the frame opening and all the edges were given a small radius over which to swage the annealed copper plate. A piece of copper plate of 16 swg thickness was cut out to overlap the steel plate by around 5/32 inch and placed squarely over the former to begin the operation. Several heating and quenching operations were needed and the plate was made a good fit over the forming plate. As expected, the material bunched up in the corners during the process and needed filing away to produce a tidy shape. Whilst still in place, the swaged edges were filed down flush with the plate so the upstand was even all round. **Photograph 104** shows the result of this operation.

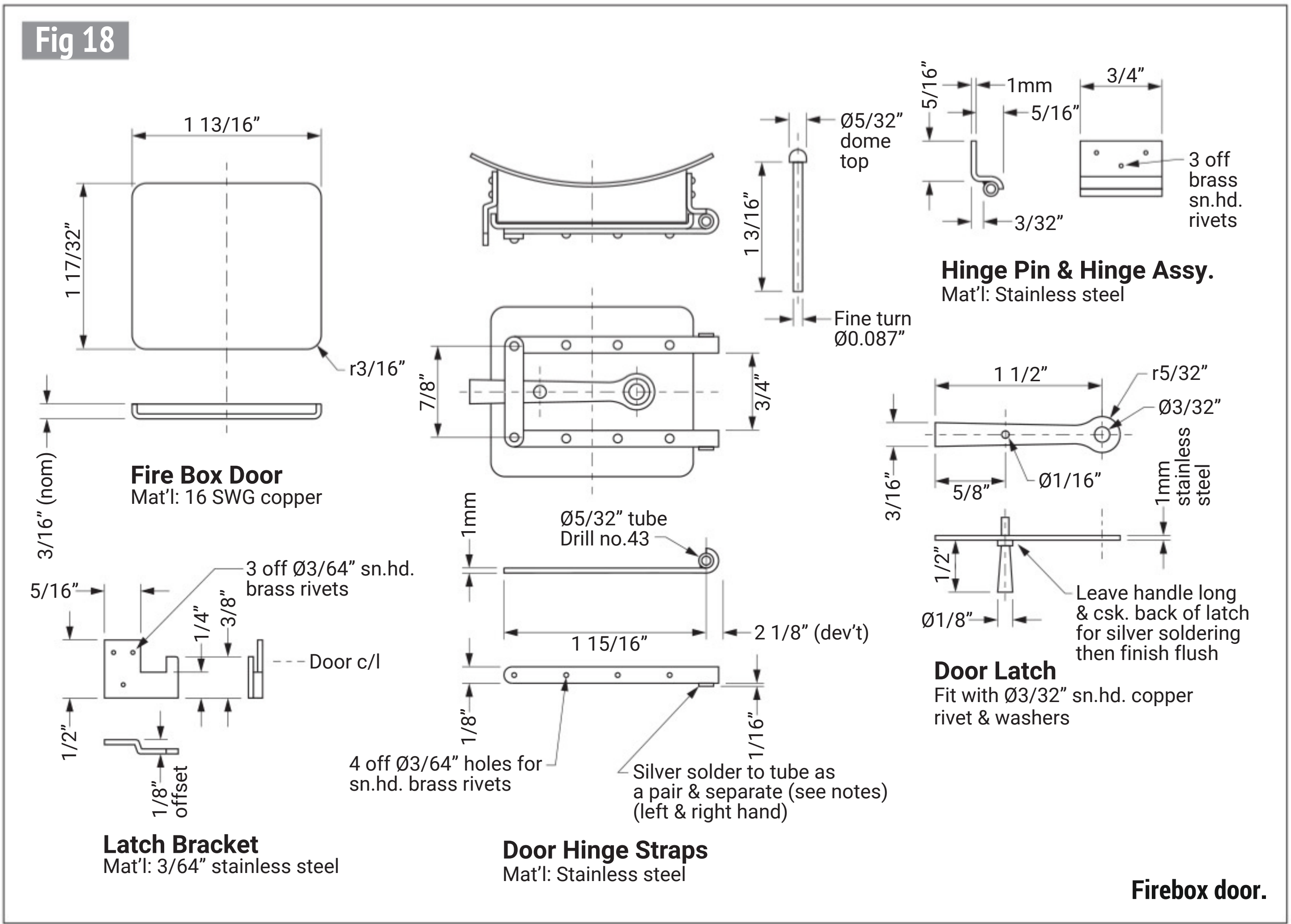
Adding the door furniture

The hardware for the door hinges consists of 1/8 inch wide strips of 1 mm stainless plate, cut to be 2⅛ inch long initially and shaped at one end around a 5/32 inch diameter rod to hold the tube for the bosses. My second drawing (**fig 18**) shows the details but as I did not have a suitable piece of tube, a 5/32 inch diameter stainless steel rod was drilled to a depth of 1¼ inch in the lathe with a No. 43 drill. To do the silver soldering the straps were clamped squarely onto a piece of bar and spaced to be just less than 1 3/16 inch apart so the length of tube could sit across them for the soldering operation. **Photograph 105** shows the parts set up for fluxing and soldering and after cleaning up, the two straps were cut off the tube and the cut ends were filed flat and square. The same treatment was given to the remaining piece of tube that will form the fixed part of the hinge on the side of the door frame.

Next, the support bracket for the hinge pin can be made and initially I thought about bending a piece of stainless plate to have 'ears' top and bottom to be drilled for the pin, but I was concerned about positioning the bends and the holes to ensure it was all square - so this is why we have an extra piece of pivot tube that can be silver soldered to a bracket that sits vertically against the right hand side of the door frame. My drawing shows the detail and **photos 106** and **107** show the result after soldering the tube to the bracket.

The fabricated bracket can be held against the door frame with suitable packing above and below the frame (**photo 108**). In this photo the straps have been positioned and marked out for rivets to be added. I have left a drill in the pivot bushes for the checks and once it is clear that the door will open and shut squarely, the outer edge of the door frame can be marked with scribed lines top and bottom to attach the hinge bracket itself. It needs to be very carefully positioned on the right side of the door frame and drilled for the three 3/64 inch snap head brass rivets that attach it. Make sure there is ample clearance for the door to close. The two remaining rivets at the outer end of the door are for the addition of a strap for the latch. This strap will need to be curved upwards slightly in the centre to allow the latch free movement. The pin to act as the door pivot is a simple turning operation to machine just ¼ inch at a time from 5/32 inch stainless rod, finishing the

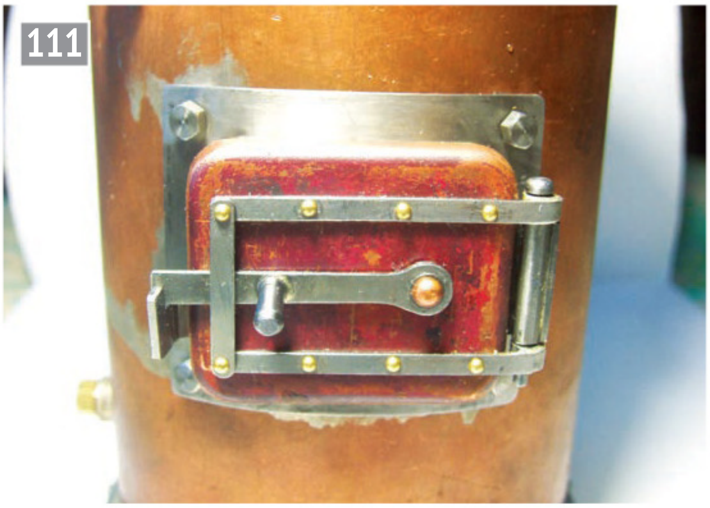
The parts for the door assembly clamped to the frame to check the closing action of the door and rivets added once the alignment is correct.



Firebox door.

Turning the handle for the latch and leaving extra material for the silver soldering operation.

The latch and the embryo handle set up for the soldering whilst still attached to the rod.



The door frame with the latest parts in place on the boiler.

surface with a fine file before moving the bar out for the next cut. Add a small, domed top to finish it off.

The latch itself is cut from another piece of 1mm stainless plate and has a handle which is turned to be silver soldered in place while the turned outline is still on the parent material. **Photograph 109** shows the part being turned and **photo 110** shows how the latch is supported for the soldering operation. Note the countersunk hole for the silver solder on the rear face of the latch. To attach the latch to the door, I used a 3⁄32 inch snap head copper rivet with washers under the head, between the latch and the door and on the inside of the door, and the rivet is 'lightly' peened down to leave free movement for the latch.

The bracket to allow the latch to close the door can be made from 18 swg stainless steel and formed into the shape shown. I allowed just a 1⁄32 inch clearance for the latch to drop between it and the bracket, otherwise, when hot, the expansion of all the parts might make it too tight to use.

Finally, **photo 111** shows the door on its frame and mounted on the boiler.

NEXT TIME

I will start to add the fittings to the boiler.

●To be continued.

POSTBAG

Atmospheric Railway

Dear Martin,
Please can I add some further detail to Roger Backhouse's article on Brunel's Atmospheric Caper in issue 4702 as, living in Torquay, I have the advantage of local knowledge.

Roger listed the locations of the surviving pumping stations but he omitted Totnes from the list. In fact, the building there still survives but it is shorn of its chimney which disappeared many years ago. That it survives is due to a campaign as recent as 2008 to have it given listed building status when it was threatened with demolition by its then owner, a dairy company. The relevant authorities were successfully lobbied by a local campaign group and it appears to be safe now as it has been granted grade II listed status. Both of the other two surviving pumping stations are also listed buildings.

That at Starcross is probably the most obvious to the rail traveller being built of the local red stone and sited in a photogenic location alongside the Exe estuary. Today it retains a shortened tower and it is currently used by Starcross Fishing and Cruising Club. In the latter part of the last century it housed a museum dedicated to the atmospheric railway. At the time of the museum's opening I was working at Devon County Council and one of my jobs was the administration of a fund giving start up grants to small businesses. I had to assess each applicant's business plan and viability so I made a visit to the museum and was shown round. One of the then attractions was a short length of scaled down track upon which ran a ride on trolley powered by a domestic vacuum cleaner. I was invited to take a ride – I recall that the acceleration was most impressive!

The Torquay pump house is actually sited at Longpark and it is the most complete remaining building, retaining its Italianate chimney. Between the 1880's and 1950's it housed a pottery using the local red clay (which incidentally was originally extracted from a site very close to Watcombe Hall - 4977 for trainspotters). Longpark items (many of the designs being 'motto-ware') are very collectible and I have a few myself. Later the pump house was used as a fruit and vegetable warehouse and it is currently used by an online ink cartridge supplier.

There is an excellent book on the South Devon Railway by the late Roy Gregory (ISBN 10: 0853612862 or ISBN 13: 9780853612865). Finally, although the atmospheric system failed, the railway itself remains as one the most scenic in the UK and, of course, it retains the notorious Dainton, Rattery and Hemerdon banks around the south of Dartmoor.

Kind regards,
Andrew Fiderkiewicz

Dear Martin,
Is Roger Backhouse aware that an atmospheric railway was actually built at Crystal Palace between the Sydenham and Penge entrances, 600 yards long? It was also considered as a means of control for the steep switchbacks on the Great Indian Peninsular Railway out of Mumbai (Bombay) but was rejected. Incidentally, this line's construction was supervised by Alice Tredwell after her husband died just a fortnight after the families' arrival. She took over and completed the task but sadly died at the early age of 44.

Regards,
Mike Joseph

Dear Martin,
I was interested to read the articles in recent issues of *Model Engineer*, about the South Devon Railway (atmospheric) as originally built by Brunel and later converted to use normal steam locomotives. I was also interested to read about the pneumatic or Lamson tubes that were, and apparently still are, in use in large shops and other applications. Many years ago, when as a family we lived in Islington, north London, at least till I was in my early 20s, I can remember at approximately the age of 5 or so going shopping with my mother in the Caledonian Road. A shop we went to was the Co-op on the corner of Frederica street opposite Pentonville Prison. When you paid for your shopping your money and bill were put into a container and it went up to accounts and a couple of minutes or so later your bill and change came back down along with your divvy tokens.

As Roger quite rightly says even today similar systems are in use in large stores like Tesco, Sainsbury's etc, to transfer excess cash from the tills to accounts. This is obviously a lot safer for the supervisor to do rather than have a safe cart with them along with a security officer. They do the cash lift with a slip saying how much and the till number and put it into a container and off it goes, so it goes directly and a lot more safely to the cash office rather than having someone trundling around with a safe cart which can be stolen.

Obviously, such systems are best fitted when the building is being put up at the construction stage rather than being put in as an afterthought later.

Yours sincerely,
J.E. Kirby (London)

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Tools and Machinery

■ Myford ML7 on makers stand, single phase, 3 and 4 jaw chucks, £1,325.
T. 01246 556330. Chesterfield.

■ Harrison horizontal Milling Machine vertical head 30 int, vice chucks 3 axis read out, 30'x8" table, 3 phase, £800.
T. 01257 452736. Preston Lancashire.

■ Myford ML7 Lathe Imperial, 1960's, history known from 1972, gearbox chucks, vertical slide 4-way tool post, new electrics and belts, measuring equipment, hand tools, offers near £950, collection from Maulden.
T. 01525 750916. Bedford.

Models

■ I have several ex-civil service clocks for sale (£20.00 each, see Scribe a Line). All are normally 48 volt dc powered, 30 second steps, but a slightly reduced voltage also will operate. A suitable pulse supply unit is available on e-bay.
I would prefer payment on collection, to enable purchaser to select his/her choice, confirm operation, ensure safe delivery.
E. kenmackenzie@live.co.uk. Glasgow.

■ Powerful 3 ½" gauge Mountaineer by Don Young. Copper boiler with full current certification, September 2022, full set of drawings, £3295 buyer collects, good running order.
T. 01924 250061. West Yorkshire.

■ Workshop for sale Lathe, Milling Machine, Surface Grinder, Chop Saw, Vertical Band Saw and lots of extras see tab J www.ritasears.blogspot.com.
T. 01258 860975. Dorset.

Parts and Materials

■ Various parts including main casings, cylinders cylinder heads, spark plugs etc for Bentley BR2. Please phone for more info. **T. 07873 104731. Perth**.

■ Kit of fully machined parts for the assembly of a 5"gauge 9F "Black Prince" locomotive with full assembly instructions, includes unused boiler. Sensible offers sought. Buyer collects. Ditto an A4 Pacific. **T. 01342 311540 East Grinstead W.Sussex**.

Magazines, Books and Plans

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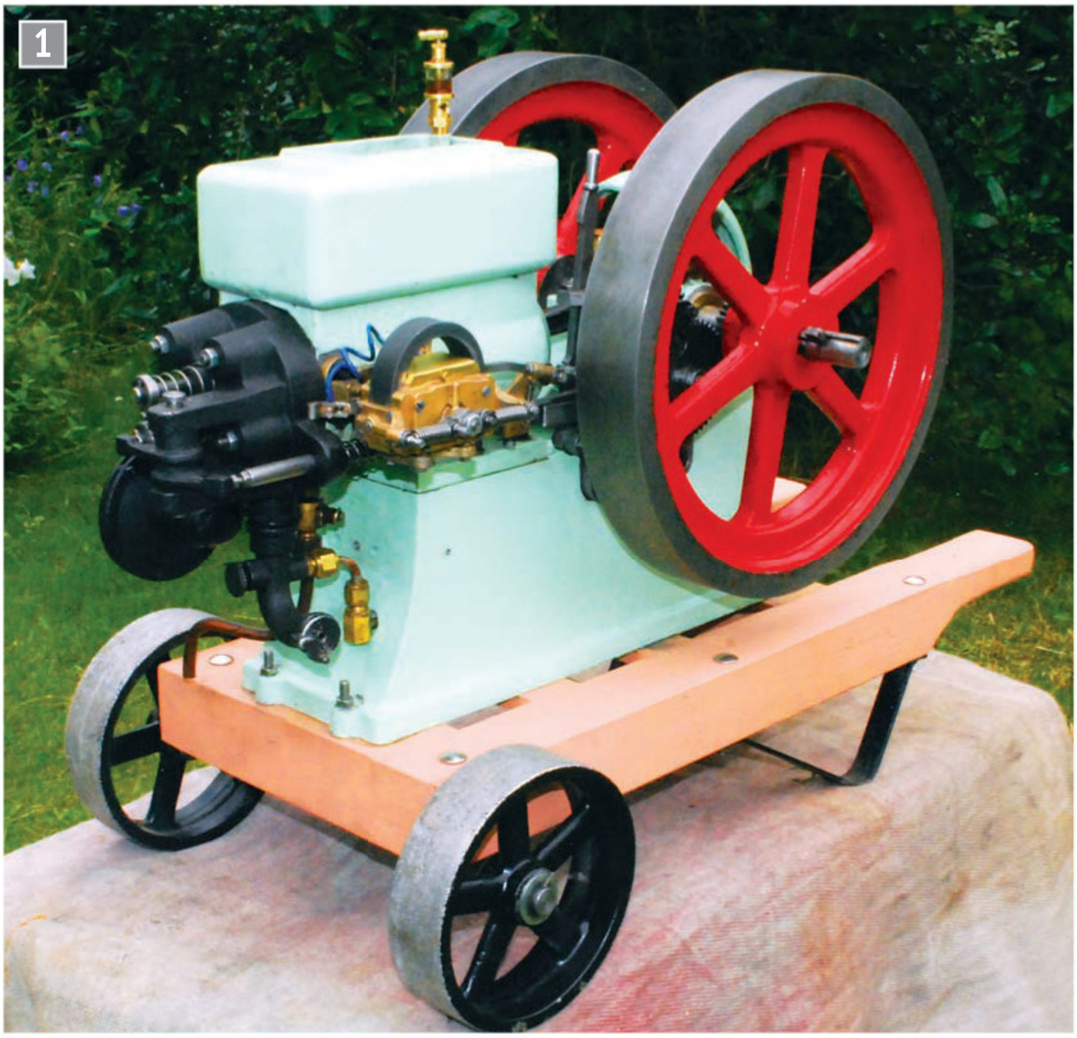
Ian Couchman tries something a little different.


The completed 'hit and miss' engine.

'Hit and Miss' Internal Combustion Engine PART 1

Okay, I admit it. I've gone over to the dark side. I built an infernal combustion engine. I didn't want to. I was bored.

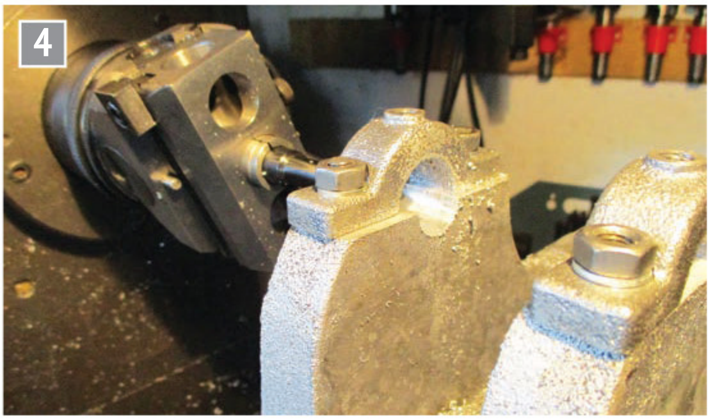
Now that's out in the open, here's what happened. Being locked down, all projects complete, I was browsing through a well-known model engineering magazine (this one, if you must know) and came across an advertisement placed by the Engineer's Emporium, which included details of a half-size 'hit and miss' engine, the *Economy.* Looking at the details and comparing with pictures on the 'interweb', it seemed to be a reasonably accurate model of the prototype (**photo 1**). Never having made one of these diabolical machines (steam is the true way!) I was seduced and placed an order.

There were a couple of castings which were not quite up to standard and these were promptly replaced by the suppliers. They come with a very detailed set of drawings, in book form. Looking through, I found a few areas which I thought could be a bit closer to prototype but I've always been fussy like that - gives me an excuse to be different!

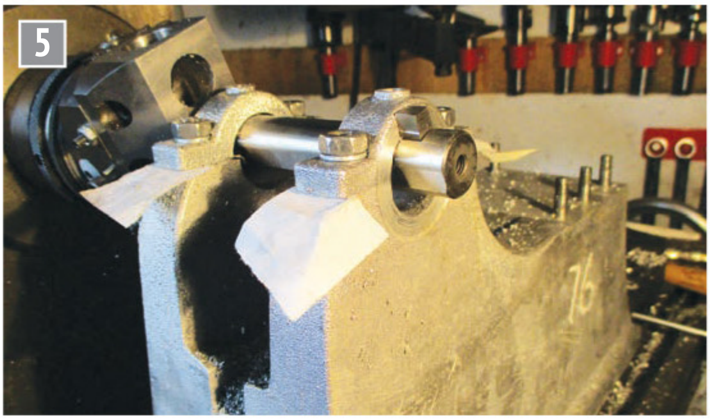
So now I'm going to describe the build. I suspect most people attempting something like this will have reasonable experience in machining and the like so, rather than get bogged down with a blow by blow account of

The newly cast bearing caps.

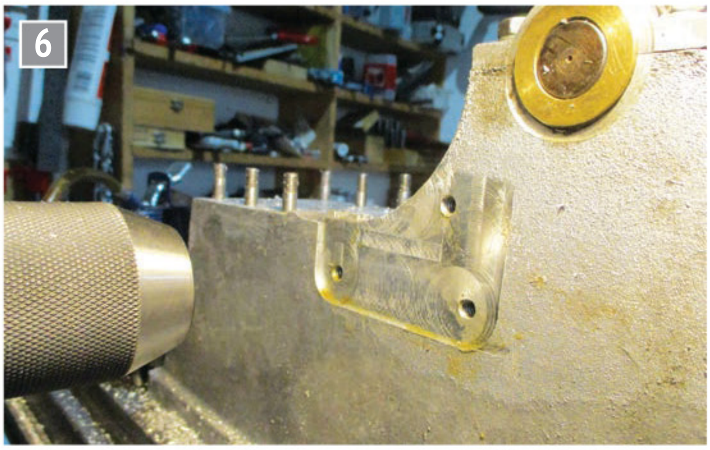
Machining the base.



Boring the bearing caps.



Final machining of the holes for the bearings.



The mounting face for the timing gear.

Further drillings in the base.

the machining, I'll skip through the 'run of the mill' bits and just concentrate on the bits I did differently.

The base

This is an aluminium casting and the machining is quite straight forward. The only really critical area is the relationship between main bearings and timing plate, as this controls the mesh of the timing gears.

So, let's make a start at the obvious point, the main bearing caps. Supplied with the kit was a casting to be cut in two to make these. While functional, I didn't think they looked the part so I cast new, individual parts (**photo 2**). The caps will later be bored *in situ* for the main bearings.

Next, the bottom was skimmed to give a flat reference surface. Then, turned over, the top faces were machined, drilled and tapped for the cylinder casting and main bearing caps, which were fitted ready for boring (**photo 3**). Moving to the horizontal spindle on the mill, the holes were bored slightly undersize (**photo 4**) then the caps were spaced off with paper (this would ensure that the main bearings were securely clamped), the holes bored to size and the side faces machined to size (**photo 5**).

At this point, the X and Y axes were zeroed, ready for the timing plate fixings. The timing plate carries the cam gear, which must mesh correctly with the timing gear on the crankshaft. The mounting face was machined, then drilled and tapped (**photo 6**). All these operations were carried out without moving the casting on the mill bed, ensuring that everything was square. The last job on the base was to drill holes for the fuel pipes and mounting faces for things like the crank guard (**photo 7**).

●To be continued.

NEXT TIME

The next jobs are the crankshaft and the cylinder.

John Arrowsmith visits a long-established club near Manchester.

We Visit the Rochdale MES

Arriving at the track just before lunchtime I found the members were busy arranging locomotives on the steaming bays and generally preparing their work tasks for the afternoon. Before getting into the different tasks of the day, I think a little about the club itself would be appropriate.

This society was formed in 1932 after a couple of short-lived attempts at starting a club in Rochdale in 1922 and again in 1927, so they have been in existence for a long time. The present society, which, according to my reckoning, is now 90 years old was, as I said, founded in 1932 when a workshop was set up at Lea Hall in Smith Street. It appears, from the records, to have been well financed at the time which is always a good sign and must have been encouraging for the fledgling club. The primary interest in those days was model boating and the annual regatta was held on the Syke Pond, which was a major attraction in those days, and was nearly always attended by the Mayor of Rochdale. In 1937 *Model Engineer* magazine reported that member, David Woolfenden had been awarded the Kershaw Cup for his model boat, *Jubilee* which attained a top speed of 27.3 mph during the regatta. David had built a vertical face camshaft engine for the boat, which obviously worked very well for him. The Kershaw Cup is still awarded today but for the best marine model, not for the fastest.

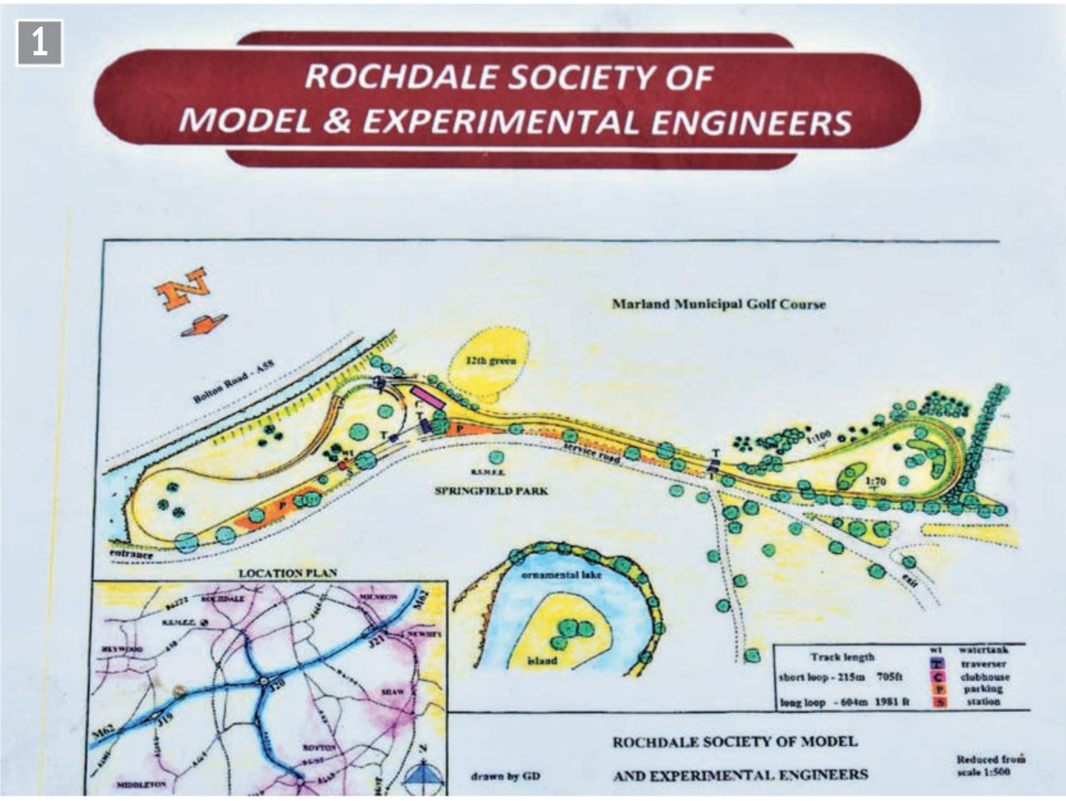
Progress continued at the club with the building of their first track, a 2½ inch gauge raised level circuit but details of this are scarce.

The track in Springfield Park was started in 1959 with a permanent 725 foot raised track which took the members two years to complete and was officially opened by the Mayor on a very wet Sunday afternoon in 1961. Further improvements were made to the site, including a new club building during the winter of 1962/3. The following year the curved tunnel was added.

Members continued to enjoy their facilities and in 1975 a certain editor of *Model Engineer* magazine came to visit. Martin Evans enjoyed his time with the club and did take the regulator of one of his own designs, the LNER 2-8-0 O1 which he had named as *Nigel Gresley*.

Moving on to 1993, an extension to the track was started and this was another two-year project, completed in 1995. This extension more than doubled the length of the previous circuit to 1981 feet long. It involved some extensive earthworks as well as needing co-operation from the council to acquire a strip of land next to the golf course in order to complete the works (**photo 1**). With this additional track length, they hosted a couple of the Narrow Gauge IMLECs organised by the Northern Association and both were very successful and popular. They also took part in the Manchester Exhibitions organised by both the Northern Association and Meridienne where they were well received.

1



A track plan of the site.

During this visit I was able to catch up on the developments at the club and talk to some of the members I had met on previous visits. In the shipping container, which they have converted into a club house and workshop, a small display of stationary engines had been arranged by member, Keith Sharp. These engines had been made to an excellent standard but what really made me take notice was the incredibly short time it takes Keith to build them. For example, the very nice table engine (**photo 2**) was completed in just three weeks. The double diagonal engine (**photo 3**) took about four weeks which, when you consider the time needed for the accurate machining of the Brunel castings etc. and the quality of the finished engine, I find quite remarkable. That Keith could achieve such a quality model in such a short build time is commendable. The little Blackgates twin oscillating engine was another excellent example made in just a week (**photo 4**). While I was talking with Keith the other members were busy getting a couple of engines in steam - one for a boiler test, the other for my benefit - and one of the little tram engines they have was on the track. This powerful little engine has a scale driver who, I was reliably told, was Barbie's boyfriend, Ken (**photo 5**)!

On the steaming bays were a couple of very nice club engines. Firstly, this Hughes Crab (**photo 6**) built by David Woolfenden, one of the founder members and whose estate donated the engine to the club. It has been a stalwart locomotive for them over many years as David passed away about 40 years ago. The other powerful locomotive on the bay was the 3½ inch gauge Coronation Class Pacific, *Duchess of Buccleuch* (**photo 7**). Again, built by David Woolfenden to the Clarkson design, this four cylinder engine is another stalwart of the club's locomotive fleet.

I enjoyed a long conversation with member, Bob Hayter who explained that about two years ago, the local council, with whom they have an excellent relationship, told the club that they had to become a 'notable organisation' in order for them to receive council grants etc.

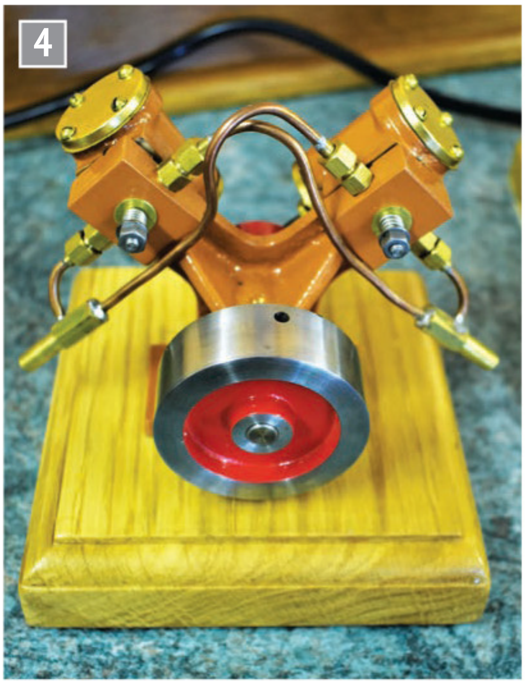
2

The table engine built by Keith Sharp.

3

A double diagonal engine by Keith Sharp.

4



This little twin oscillating engine was built by Keith Sharp in a week.

5

The club's little tram engine.

6

Club stalwart is this 5 inch gauge Hughes Crab, built by David Woolfenden over 40 years ago.

Another David Woolfenden engine is this 3½ inch gauge Coronation Pacific.

Geoff Hilton and John Schofield preparing the Koppel for the track.

so, about 18 months ago they became a Charitable Incorporated Organisation or CIO (which was a new one on me). This works like a charity but it also means that the members are protected from any indemnity that might arise should the club close or become bankrupt. This sounded like a good deal to me and Bob went on to explain all the ramifications of this change. It immediately influenced the council because they have given the club a 99 year lease for the site with a peppercorn rent, so they are very secure in their tenure now. The council said it was because the club gives and provides such a good amenity for the park. Wouldn't it be great if all councils in the UK adopted the same approach to model engineering so that clubs could work *with* them, instead of the more usual attempt to extract as much money from clubs as possible? I think we all know of councils that are guilty of that.

Moving on and now the steaming bays were coming to life with John Schofield busy lighting up a Polly Koppel (**photo 8**) and another locomotive from the LBSC stable, *Mona* which was being prepared for a steam test. This was being carried out by Rod Hartley who is also the secretary, and one of the club trustees, Dave Ingham (**photo 9**). With the widespread discussions taking place both in model engineering clubs and in heritage railway circles about 'bio coal', the ingenious Geoff Hilton and other members at Rochdale have built a clever coal crusher for this new fuel. Having tried the usual large hammer to break the large lumps of the new coal into smaller pieces, and finding it made more dust than small lumps, they have developed a very ingenious device to carry out this task (**photo 10**). Basically, it is a couple of spiked rollers working together and chain driven from a redundant caravan mover motor, all contained in a substantial wooden box. They have used this type of motor because it provides a high torque at a slow speed. It is all battery powered and can demand up

Up to pressure with the boiler inspector checking the safety valves.

The new experimental coal crusher.

Inside the locomotive storage shed.

Large traverser outside the carriage storage shed.

The mainstay of the workshop is this centre lathe.

The club's large bench drill in the workshop.

A happy group of members who were present during my visit. Thank you all!

to 60 amps, just for an instant on start-up, so a good quality battery is needed. The coal crusher was demonstrated and proved the claims it can crush this modern fuel leaving a minimum quantity of dust and the lumps that are collected are just right for 5 inch gauge models. The large coal lumps are dropped into the rollers through the top inlet and a shute at the outlet just rolls the broken coal out into a bucket. All very simple but very effective.

The track system has all the necessary facilities that are needed to operate a successful railway with traversers, good storage accommodation for both stock and locomotives (**photos 11** and **12**), a useful little workshop area (**photos 13** and **14**) and the ability to make a good mug of tea! The track itself runs very well and having been able to drive the Koppel myself, I can vouch for the attention needed to complete a full circuit.

They have a good rake of fully braked passenger carriages fitted with the current health and safety requirement between carriages and they are fully used on open days. With a membership of about 50 they really achieve a great deal and are a good example for other clubs, with, perhaps, larger memberships, of what can be achieved with hard work and teamwork (**photo 15**).

I thoroughly enjoyed my visit to Rochdale and must thank Bob Hayter, John Schofield and all the members present on the day for their hospitality and information; it was most rewarding and interesting.

Rochdale is a well-established club with a good approach to model engineering but, like all clubs, they wish they could attract some younger people as members. Incidentally, Bob Hayter is now the official Northern Association's Boiler Registrar so if you use the NA boiler code and regulations, Bob is your point of contact for any queries.

ME

An Engineer, his Book and the Owner

Sir Guilford Lindsey Molesworth PART 2

Roger Backhouse examines a Victorian volume well known to most engineers.

Continued from p.743
M.E. 4705, 2 December 2022

Sir Guilford Lindsey Molesworth as president of the Institution of Civil Engineers. He holds a copy of Molesworth's Pocket Book of Engineering Formulae *in his left hand. Thanks to Carol Morgan, Archivist, Institution of Civil Engineers, for this photograph. Thanks to the ICE for permission to use the image.*

Mechanics

Gearing is important and Molesworth offers formulae to enable an engineer or millwright to calculate the horsepower that may be transmitted with different velocities and pitches of gear teeth made of cast iron. There are rules for pitches and diameters with dimensions for chain gearing. Should you require such information there are details of the form of epicycloidic teeth.

If not gearing then there's advice on using pulleys and their estimated velocity. The merits of leather and high-speed belting, or perhaps hemp rope gearing, are discussed. Shafting goes with gears and pulleys and Molesworth is ready to help determine the strength of wrought iron shafts. Oddly, steel shafting is not treated as the main material though surely it had taken over most uses by the 1890's? But using Molesworth you can work out the power absorbed by shafting and the sizes of any keyways on the shaft. There are drawings of adjustable bearings for the shaft. All useful if you want to lay out a mill or workshop.

Of course, Whitworth's screw threads feature and there's a brief reference to American thread forms but in this edition of Molesworth BA and metric threads don't exist - yet BA threads were first formulated in 1884 and standardised in 1903. According to Wikipedia, metric thread development began in Switzerland in 1876 with a metric thread having an angle of 47.5 degrees developed for the clock screw market. So why isn't this mentioned in what is otherwise a seemingly comprehensive book? Perhaps they were just too small - yet elsewhere apothecaries weights are given.

Friction is both a help and an enemy of engineers. Molesworth states that 'the laws of friction are not fully understood' and follows with an explanation of how friction arises with graphs showing friction at different speeds with various lubricants including olive oil, rape oil and sperm [whale] oil. (You just can't catch the whales these days.) Although Molesworth lists mineral grease as an alternative there is no mention of this nor other mineral oils on the graph although tough mineral oil is mentioned in a table.

Cranes and winding

Molesworth follows with details of stresses on cranes with a formula and A.J. Lander has added a neat drawing of a crane hook (**photo 15**):

$N = (W \times B)/(D \times P)$

where:

N is the number of revolutions,
P is the power applied to the handle in pounds,
W is the weight to be raised in pounds,
B is the diameter of the barrel,
D is the diameter of the circle described by the handle.

Simple when you know how, and this assumes each man working the crane handle inputs a pressure of about 15 to 20 pounds. The possibility of a mechanically worked crane doesn't feature although Armstrong's hydraulic cranes at least would have been well known.

Winding engines were well known to Victorian engineers particularly in collieries. Molesworth offers a formula to calculate the diameter of a winding barrel with flat ropes coiled on a drum. For metal ores as in Cornish tine mines and Pennine lead workings the book advises on the weight of stamper heads and their required lift. For crushing rolls there are figures for the optimum speed.

Metal joining

There is advice on brazing with recipes for various fluxes. They were clearly not something an engineer was expected to buy off the shelf.

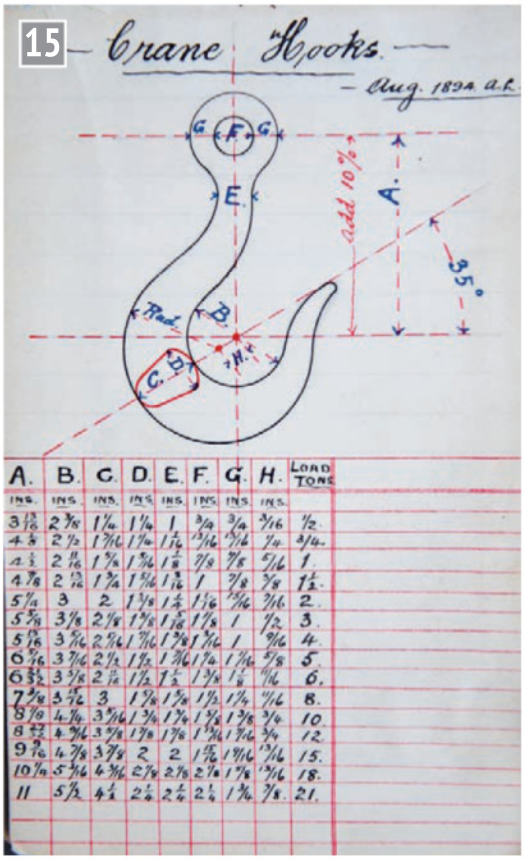
For testing steel and iron it seems nitric acid will produce a black spot on steel and the darker the spot the harder it is.

Regrettably, not all Victorian engineers made things to fit exactly. There are various workshop recipes including two for what was once euphemistically called 'fitters glue' but Molesworth calls 'rust-joint' cement. The slow setting version is two parts of sal ammoniac, one part flowers of sulphur and 200 iron borings leaving a mystery of how the borings were counted.

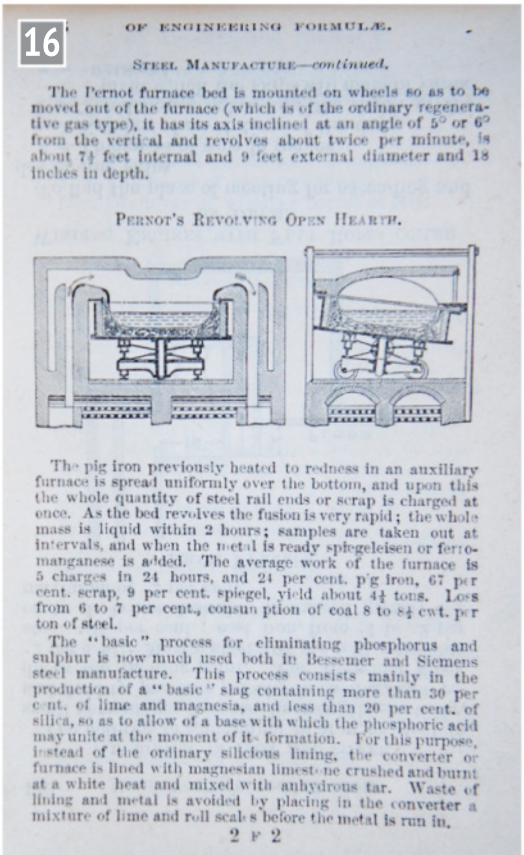
Boiler problems solved

Not every remedy appears to have been thoroughly tested. Page 418 lists some remedies for boiler incrustation including, bizarrely, potatoes (1/50 of the weight of water in the boiler) and a report that 13lb of molasses fed occasionally into a boiler prevented scale for six months. Furthermore, while 'slippery elm bark has been used with some success', 'pieces of oak wood, suspended in the boiler and renewed monthly, prevent a deposit'.

Metalworking, blast furnaces and cutting tools



Crane hook drawn by A J. Lander. Was it draughtsman's training that made him such a neat illustrator?



OF ENGINEERING FORMULÆ.

STEEL MANUFACTURE—*continued.*

The Pernot furnace bed is mounted on wheels so as to be moved out of the furnace (which is of the ordinary regenerative gas type), it has its axis inclined at an angle of 5° or 6° from the vertical and revolves about twice per minute, is about 7½ feet internal and 9 feet external diameter and 18 inches in depth.

PERNOT'S REVOLVING OPEN HEARTH.

The pig iron previously heated to redness in an auxiliary furnace is spread uniformly over the bottom, and upon this the whole quantity of steel rail ends or scrap is charged at once. As the bed revolves the fusion is very rapid; the whole mass is liquid within 2 hours; samples are taken out at intervals, and when the metal is ready spiegeleisen or ferro-manganese is added. The average work of the furnace is 5 charges in 24 hours, and 24 per cent. pig iron, 67 per cent. scrap, 9 per cent. spiegel, yield about 4½ tons. Loss from 6 to 7 per cent., consumption of coal 8 to 8½ cwt. per ton of steel.

The "basic" process for eliminating phosphorus and sulphur is now much used both in Bessemer and Siemens steel manufacture. This process consists mainly in the production of a "basic" slag containing more than 30 per cent. of lime and magnesia, and less than 20 per cent. of silica, so as to allow of a base with which the phosphoric acid may unite at the moment of its formation. For this purpose, instead of the ordinary silicious lining, the converter or furnace is lined with magnesian limestone crushed and burnt at a white heat and mixed with anhydrous tar. Waste of lining and metal is avoided by placing in the converter a mixture of lime and roll scales before the metal is run in.

2 F 2

Who now knows of Pernot's revolving open hearth? Metals and metal working take up many pages in Molesworth.

Almost on the next page there are recommendations for milling cutters and the best speed for cutting tools. There is a summary of the yields of different iron works and the power required and speed for rolling different types of iron. For example, armour plate requires a speed of 150 feet per minute but merchant bar rolls (whatever they were) need 400 feet per minute.

It seems there were at least three different types of blast furnace used in Britain alone and Molesworth gives their specifications. Steel making has several pages including Pernot's revolving open hearth, probably not now well known (**photo 16**). For steel making there are drawings of pot (crucible) steel furnaces and of Bessemer converters. There's information about the advantages of small quantities of aluminium in iron and steel.

Steam

In Molesworth the subject of steam and steam engines takes up considerable space. Steam mattered greatly to Victorian engineers. Knowing the temperature (T) of steam you can use the book's formula to work out a velocity (V) in feet per second. There is a table for the properties of saturated steam and of course here is the mechanical equivalent of heat - 779 foot pounds for each unit of heat.

There is advice on making boiler joints and about Lloyds and Board of Trade rules for boiler construction and maintenance. You can find here information about expansion of steam and the effects of cut off with several formulae applicable to compound engines showing graphic representations of the expansion curve.

Ships

Whether Molesworth was ever used by shipbuilders is not known but, ever ready to help, he includes a section about stability of floating bodies, adding a complex formula to determine stability. Ships are affected by wave lines of which details are given together with the results of William Froude's experiments. Aided by his son Edmund Froude he tested various ship forms in an experimental tank making the counter-intuitive discovery that a 'blunt' hull form generated less resistance than a sharp form. Further information enables calculation of floats on paddle steamers and the pitch of propellers.

Those were the days when the Royal Navy ruled the waves (perhaps led by W. S. Gilbert's Sir Joseph Porter?). There is a section on gunnery and the work done by exploding powder. A table gives details of modern guns in British service, and another provides information about velocity and armour penetration. For defence, there are dimensions of field earthworks, submarine mining and then the more peaceful topics of buoys and moorings.

Miscellaneous

Many readers will recall blueprints, once the standard method of reproducing engineering drawings. Ever

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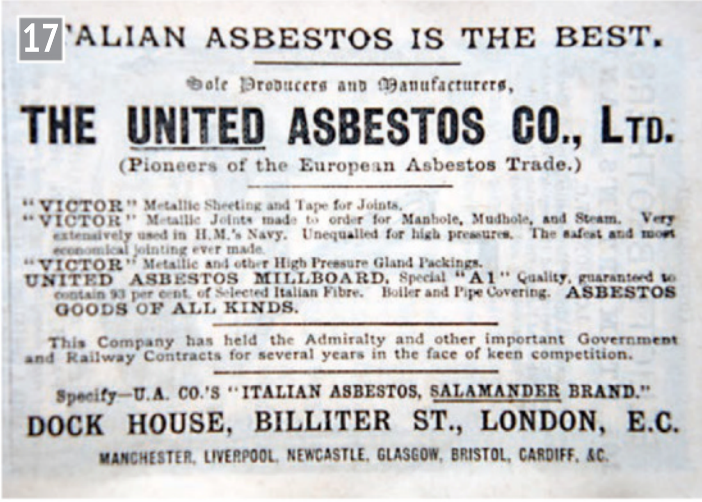
eclectic, Molesworth describes using the ferrotype process to make blue prints.

Should you wish to set up a corn mill Molesworth has the answers including the power needed, stones and rollers. You can find out the weight of a quarter of corn and various other measures.

Advertisements

The advertisements are also an insight into the needs of a Victorian engineers. We may now shudder at the suggestion that 'Italian asbestos is the best' (**photo 17**) but we can be reassured by the information that Bullivant's wire ropes were used in the erection of the Forth, Sukkur and Tay Bridges (**photo 18**). Peter Brotherhood were engineers until near the end of the 20th century and their London advertisement informs us of their engines and compressors, suitable for torpedo and balloon service (**photo 19**).

Advertisers nearly always give a London address and, though the capital was once a significant manufacturing centre, locations in Queen Victoria Street and Delehay Street, Westminster suggest offices rather than factories. Was a London address considered more prestigious? But Ruston and Proctor give their address simply as Lincoln - obviously well-known enough to need no further direction there. Their advertisement shows they could produce a remarkable variety of engines, probably most of them specially made; production engineering had not then taken hold of the engine market (**photo 20**).



Not a claim that could be made now but asbestos was once seen as the wonder insulating product.

Safety with Bullivant's wire ropes obviously used world-wide.

Brotherhoods were one of several engineering firms advertising. Obviously a versatile range of products.

Similarly, Rustons of Lincoln were well known manufacturers.

Discovering the owner

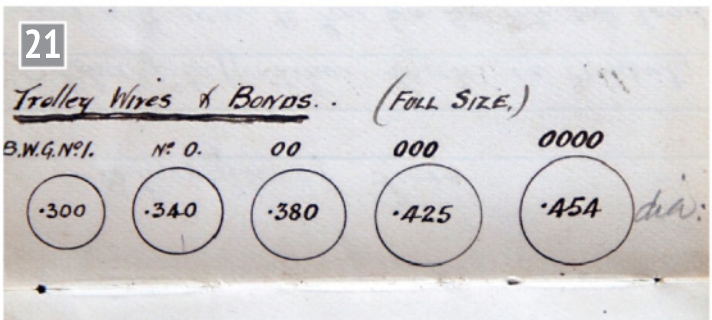
Drawings of tramway related items and notes thereon suggested the former owner could have been involved in tramway engineering, and tramway networks were fast growing in the early 20th century (**photo 21**).

If the owner was a professional engineer it seemed likely he was a member of one of the professional engineering institutions. Their membership applications often amount to a highly detailed CV giving education, jobs held and work experience. (My grandfather's application to join the IMechE in 1943 gave details of his past employment that no-one in the family knew and confirmed that he'd worked for Vickers at Barrow as a millwright on submarines during the First World War.)

Using ancestry.com Mike Tilby found Mr Lander's application to join the Institution of Mechanical Engineers as an associate member in 1910. Membership then cost £2 10s plus a joining fee of £1 so joining was an expensive business, probably equivalent to £300-£400 now.

Mike's census and other research found Albert Jesse Lander was born 20th January 1876 at Flaxley, Gloucestershire. The 1881 census showed Albert living with parents James and Emma along with two brothers and two sisters in Westbury on Severn - East Dean, Gloucestershire. His father, like their next door neighbour, was a coal miner in one of the Forest of Dean's coal pits.

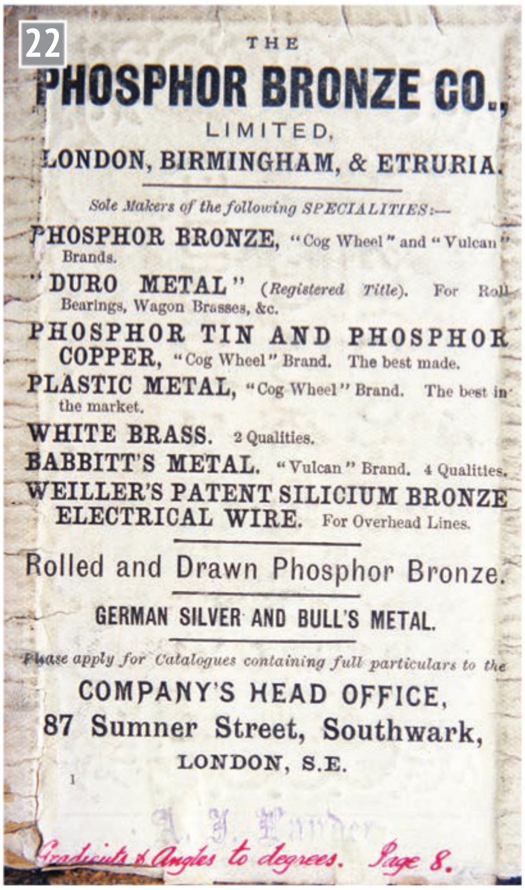
The IMechE membership application shows he was educated at a Newport (Monmouthshire) public school (In this context probably meaning a Council school). Newport was some distance from the Forest of



This drawing of trolley wires was made by the owner A. J. Lander and gave clues to his occupation, confirmed by Mike Tilby's research using ancestry.com.

A chance discovery and a generous loan led to finding out about a distinguished but forgotten engineer, and of another, perhaps not so distinguished, who was working at the cutting edge of tramway engineering at a time of British tramway's greatest growth.

22



The Phosphor Bronze Company made overhead wires as used on tramway systems.

23

Seeing this advert there could be no doubt what Avery made!

Dean but his family probably moved after 1881. Albert did not show up in the 1891 census but in the 1911 census his father, James, was living along with his wife and two of their daughters in 6 Beaufort Terrace, Newport, where his father's occupation was then insurance agent and grocer.

The IMechE membership records also state that in 1889, aged 12, Albert started a seven year apprenticeship at the Isca Foundry, Newport working in the drawing office with supervisory powers in the pattern shop and other workshops. The Isca Foundry also did other engineering work and specialised in railway parts, notably switches and crossings.

Albert then worked at the foundry as an engineering draughtsman until 1898, then joining the British Electric Traction Co as chief engineering draughtsman where he worked until 1901. Here he was engaged in preparing contracts for electric tramways in many towns including Dudley, Kinver, Merthyr Tydfil, Poole and Bournemouth, Glasgow, Greenock and West Hartlepool. He was also resident engineer supervising the construction of Swansea Tramways and Depot (**photo 22**).

From 1901 to 1906 he worked for Middlesex County Council, based at the Middlesex Guildhall in Parliament Square. Here he was partly responsible for that Council's development of electric tramways including road widening to cope with the new lines. He stayed in this employment at least up to when he joined the IMechE in 1906.

In 1906 he filed a patent with a Mr Wakelam for 'Improvements in Rail Joints of Light Railway and Tramway Tracks to Prevent Looseness and to Secure Immovability'.

The 1901 census shows Albert and wife Elizabeth as one of two families living at 5 Tregarvon Road, Battersea. The 1911 census shows the family moved out further to 13 Kirkstall Road, Streatham, along with children Iris Gwendolen Lander, Geoffry James Lander and Jean Elizabeth Lander, plus two servants, so he was clearly reasonably well-off by then and could enjoy a more middle class lifestyle (**photo 23**).

The IMechE record shows he was erased from their membership list in 1919 as he'd been in arrears since 1917.

Albert Lander survived the First World War as he appears in the 1921 census living in Wandsworth with his family. A 1920 street directory shows him living at 246 Amesbury Avenue, Streatham. In the 1922, 1928, 1929 and 1932 electoral registers he remained at the same address with his wife Elizabeth.

In 1939 Albert J. Lander is listed in a directory as living with his wife Elizabeth at 250 Park Road, Peterborough. His occupation is given as 'Engineer's Designer – Draughtsman, Bakery Machinery Ovens'.

In 1949 the death of Albert Jesse Lander of 3 Sunnybank, Cross-in-Hand, Sussex is recorded in the probate record. That this was the correct person is shown by probate being granted to Geoffry James Lander, technical engineer, the same names for his son as shown in the 1911 census. Albert's effects were valued at £447 3s.

The light of other days?

A chance discovery and a generous loan led to finding out about a distinguished but forgotten engineer, and of another, perhaps not so distinguished, who was working at the cutting edge of tramway engineering at a time of British tramway's greatest growth. Both contributed to transport development. But how many more unsung engineers also deserve a place in history?

Sir Guilford Molesworth left a remarkable book. Original copies are still available at reasonable prices online and there appears to be a recent reprint available.

Grateful thanks for help with this article to: Carol Morgan (Archivist - Institution of Civil Engineers), Gareth Hughes, Neil Read and Mike Tilby (SMEE).

ME

Geoff Theasby reports on the latest news from the Clubs.

Another one for the pot!

Recently, after our attendance at the Newark radio rally, we headed for the air museum. It is co-sited, but via another entrance. On arrival, we were greeted with an apology and it was closed. The gremlins hadn't finished their dastardly work. The museum had to close because the water supply failed. Water supply? This was the Air Force, not the blooming Navy! However, this meant no tea, so everything came to a shuddering halt. I bought an air band radio receiver and plugged it in at the hotel and it worked. A couple of hours later it stopped and tests revealed no volts. With a menacing mien, screwdriver in hand, I began to check the components around the power inlet. Eventually it dawned on me that the plug-in power supply connector was the culprit, so I powered the receiver from my home-built bench supply. Bingo! It works again! I tried another wall-wart, still no joy, so I'll use the 12 volt ring main around the workshop - that is, after all, why it is there.

My newspaper of 21 October mentions a road-rail 'Sand-Rover' which Network Rail is trialling in Devon to clean the rails of leaf debris. In an experiment, delays so caused were cut by 80%.

Urdu/Arabic? On trailer hoarding.

On 2 October I ordered some electronic components, which could not be found when required, despite a thorough search of the workshop. On 25 October Debs found them in the pocket of my dressing gown. I have no explanation for this…

I have been labouring over a variable voltage bench power supply, off and on, for several weeks, and incorporating a new (to me) idea. However, I found out the hard way that an inventor's path is not a happy one ('…happy one…') and several semiconductors expired in the process, some emitting the 'magic smoke', without which they do not function. Maybe I should stick to the day job.

This advertising trailer parked in a field by the motorway intrigued me. Using Google Translate, if it is Arabic, it says 'Hump' and, if Urdu, it says 'Gift'. Please accept my apologies if I got it wrong - I would love clarification (**photo 1**). Not allowed on motorways, this electric milk float was at the Sheffield canal festival (**photo 2**). Float? Canal? Oh well, please yourselves.

Milk float at canal festival.

In this issue: new design? queueing, German models, Ezekiel's locomotive? (Ez 10:10), another old lathe, wot? No aluminium? and steam guns...

Worthing & District Model Engineering Society *Newsletter*, winter edition, contains a missive by President Andrew Breese on a momentous week for the club. It experienced the loss of a PM, and his replacement, the ousting of local football manager, HM Queen Elizabeth died, and we gained a King. Plus a well attended bits & pieces evening. Now, only one thing missing, though not in the seven days to which Andrew referred. Now, hmmm, what would that be??? Maybe the old Chinese curse applies - 'May you live in interesting times'. Editor Dereck Langridge was tasked with revarnishing the kitchen table in the midst of a heatwave. Having stripped, sanded and varnished two out of three sections, the sounds of a large agricultural vehicle permeated the heavy, still air. Paying it no heed, he continued with his work, thinking of the song, 'Among the fields of barley…' over which the west wind blew. In this case it was a south west wind, and said machinery was to his south west! Guess what? A new kitchen table decorative style, not available in any shops - 'varnished chaff'. Are you listening, Habitat?

W. www.worthingmodelengineers.co.uk

Steam Whistle, October, from **Sheffield & District Society of Model and Experimental Engineers** opens with an aerial photograph from the 1930s, of nearby Dore station in its full form, including five carriage sidings. Having been reduced in size since, it is now being restored to provide a second track and platform. Mike Peart writes on railcars. Following discussions held by

Pinzgauer 716.

the GWR in 1903, and also by the LSWR, another interested party, railcars, railmotors or self-propelled carriages were trialled. The response was good and travellers reported the speed and comfort were very acceptable. The smaller stations were known as 'Haltes', from European tramway practice, soon changed to 'Halt'. Many model engineers have a Bridgeport milling machine so The American Precision Museum in Windsor, Vermont, has m/c no. 1, made in 1938. The company was set up in 1846 to provide precision tool making equipment in order to make fully interchangeable parts for military rifles. They also have a large collection of miniature versions of their equipment. 'Murray's Thoughts' this time concern queueing theory, prompted by the ten mile queue to pay respect to the body of the Queen lying in state.

W. www.sheffieldmodelengineers.com

After spotting a Haflinger in Sheffield (see M.E.4703) I saw this Pinzgauer 716 while we were *en route* to the Newark radio rally. Pinzgauer was also made by Steyr-Puch, but rather bigger - the Haflinger weighs 600kg and the Pinzgauer weighs 2 tonnes (**photo 3**).

PEEMS, September/October, the newsletter of **Pickering Experimental Engineering & Model Society,** begins with the news that the planned Harrogate MEX is proposed for 10/11 March next year. It will not be at Doncaster as the original promoters had retired. Paul Gammon explained the principles of clamping and his talk was transcribed for the newsletter. Ivan Shaw gave a talk on the subject of 'design your own aircraft', covering the many options available. His first flight in his own-built aircraft was in 1992. Originally a private and commercial pilot, with over 1000 planes sold since, he is now in the aviation business. In a story regarding the DTI accountant, who oversees that the money grant is spent correctly, he had a flight with Ivan over the North Yorkshire Moors. This is uncontrolled airspace and can be quite busy. They encountered an RAF Tornado and tried a few aerobatics. The look on the accountant's face was priceless and he later wrote an article for the DTI house magazine. This came to the attention of Michael Heseltine, the minister at the time. The aircraft was subsequently displayed in the Millennium Dome, with its registration G-ODTI. See www.youtube.com/watch?v=2W4foTmO6SY. If you're thinking to design your own, Ivan listed the requirements and used software called X-Plane. He also described flight tests, one of which could have been disastrous. The Society visited Darlington to see North Road Museum and the P2 locomotive progress. Note - this is not the similar locomotive under construction in Doncaster. The Cartazzi truck wheelset was inspected - this allows the truck to pivot without a centre bearing. The design is here: www.youtube.com/watch?v=D74LqHeyPME. There are several other features similarly covered. Another visit was to Dick Craven's motorcycle collection near York.

W. www.bisarchtest.wordpress.com

Stamford Model Engineering Society's October newsletter has Keith showing two vintage steam engines, both 1930s German, by Falk and Doll, being a vertical type and an overtype, respectively. Two further engines were featured in previous issues. A Mercer traction engine and a steam plant boiler were also presented, which took some work to make presentable. This edition reports that on 19 October, a cement train of 14 wagons derailed near Carlisle. Some fell into the nearby river but no more is known as yet. (Anyone want a very large brick? - Geoff)

BDSME News, from **Bournemouth & District Society of Model Engineers**, says the FunLEC competition was a success, won by Phil Mortimer with his 'Golden Britannia' *Bodge of Oman*. Phil says, "I remember seeing the original Britannia at the Festival of Britain in 1951 whilst on a school trip. It was named by my family, because, being the first locomotive I had built, there were many mistakes being made, some mine and some on the drawings. Moving to Dubai for work, it came with me so the making continued. The company had a machine shop I could use at the weekends which was very convenient. It was completed and had its first boiler certificate issued in 2004. I decided not to paint it until all the problems were sorted. Children of all ages wanted to ride on the 'Gold One' so I decided to polish it instead and it has been that way ever since (**photo 4**)".

FunLEC winner, 'Golden Britannia' Bodge of Oman *at Bournemouth & District MES (photo courtesy of Phil Mortimer).*

Caterpillar at B&DSME (photo courtesy of William Powell).

Andrew Henstridge suggests that the proposed purchase of new bogies for the carriages is premature. It may be that the problem is not with the bogies but with the track. Hard info. on the track is not easily available, so he suggests a method of obtaining this. Here also, is LBSC's *Caterpillar,* not a popular choice for model makers (**photo 5**).
W. www.littledown railway.org.uk

Sheffield's Kelham Island Museum was the venue for a half day symposium on steam turbines for marine propulsion and generating power. I went to the afternoon talk, marine turbines, by Geoff Horseman of Parsons, who virtually invented the subject. Amongst the audience was Sheffield Model Engineers' librarian, Tony Ward, and I had a long chat with David Byrne, of the Doncaster P2 Locomotive Trust. This is the new locomotive being built in Doncaster, a copy of Sir Nigel Gresley's *Cock o' the North*, and named *Prince of Wales.* This is not to be confused with the P2 being built in Darlington by the A1 Steam Locomotive Trust, also called *Prince of Wales*, which is intended to include the actual and the proposed improvements resulting from their use in the Second World War. David edits his group's newsletter and agreed to send me copies, so watch this space. In a reconstruction of a machine tool works, driven by flat belts from overhead drives, was this 'SuperRelm' listed under 'Relm' on Tony Griffiths' superb index, www.lathes.co.uk (**photo 6**).

'SuperRelm' lathe at Kelham Island museum, Sheffield.

Model & Experimental Engineers, Auckland's October newsletter begins with a picture of Ray Brown's ploughing engine in a trial assembly. This issue reports that the October meeting was cancelled at short notice due to a covid scare. The Foden boiler was given concentrated attention by a group of members in a meeting which had been planned for some time. A subsequent pressure test revealed several leaks, which was disappointing. Murray Lane has a set of Brunel's tandem compound horizontal mill engine drawings, with which he is NOT impressed. The model will be built from materials which are convenient to use, and 'to hand', as importing a block of aluminium, the material suggested, from the UK could be too expensive. (What? No raw aluminium ingots in the whole of NZ? 'Gosh' - Geoff) Also, his Mono engine is proving very tricky to assemble, not helped by a piece of hypodermic tubing which broke in mid-assembly, meaning a journey for more, in horrendous holiday traffic, which took three hours and would normally take two.

Welling & District Model Engineering Society's Tony Riley is impressed by the way that members responded in order to move from their previous site to the new one and have trains running in only a year and a day. Bob Underwood discovered that a number of people notable in the railway world had resided in Eltham, from E. Nesbit to Sir Josiah Stamp, 'saviour of the LMS'. Handy-Andy Houston describes some details of knuckle or buckeye couplings used (mostly) in USA, including the fact the rotary wagon emptying gear was only possible if the centre of rotation was aligned with the couplers, which should also have been free to rotate. Janner couplings are one such design. Nowadays the tractive effort of modern locomotives exceeds the ratings of the couplers and this is why there are locomotives distributed along the train, in order to protect the couplings. In addition, modern bulk handling equipment allows a 100 ton wagon to be unloaded whilst still attached to its fellows, including dealing with the air brake pipe. Furthermore, when carrying long trains of motor vehicles which were stacked nose up/nose down either side of the transporter cars, they were specially designed to retain all necessary oils and fuel whilst in this posture, yet could be driven directly off the unloading ramp. Tony Riley, also, in a piece that I suspected was lifted from a 1 April source, describes steam powered guns. Not those loaded and traversed by steam power but using its expansive properties to hurl a projectile at the enemy. Aircraft carrier catapults, perhaps? One of these mad ideas was a rotary machine gun... the ammunition was fed into the centre and centrifugal force sent the bullets to the breeches. Some were practical and used in the Second World War, the Holman projector for instance.
W. www.wdmes.co.uk

And finally, following on from M.E.4705, as promised, WDMES told us the following. Ozymandias, having spent his money fighting the Hittites, had to sell his last bit of treasure, a diamond, the *Star of the Euphrates.* The pawnbroker offered him 100,000 dinars. Ozzy protested, "It's worth a million and I am the King!" The pawnbroker said, "when you wish to pawn a Star, makes no difference who you are".

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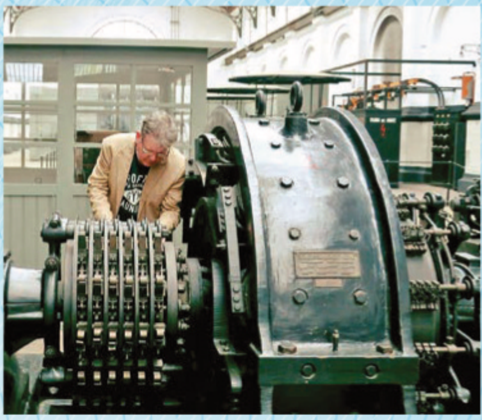

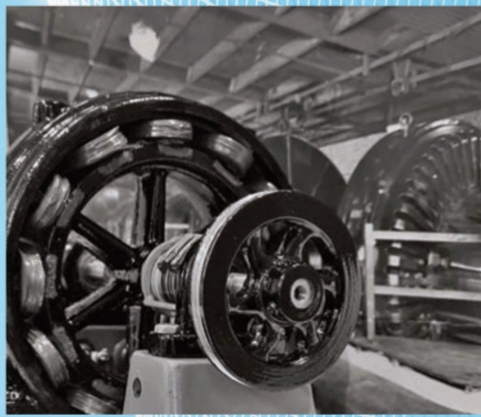

Managing director George Newton, originally from the British Steel industry where he worked with 20,000 HP rolling mill drives is also a skilled machinist and uses his own lathes to design and refine speed controllers especially for the Myford ML7 & Super 7

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