

THE ORIGINAL MAGAZINE FOR MODEL ENGINEERS

Vol. 221 No. 4594 • 31 August - 13 September 2018

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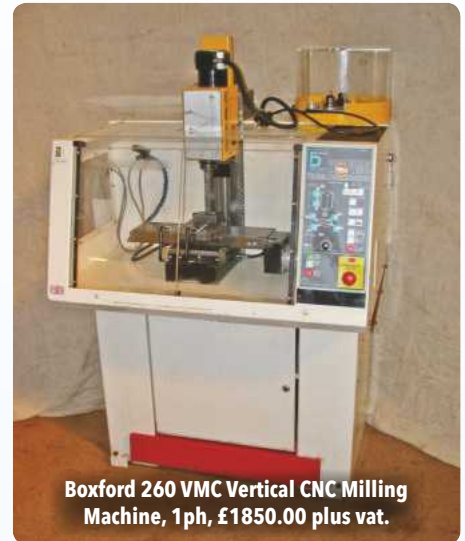
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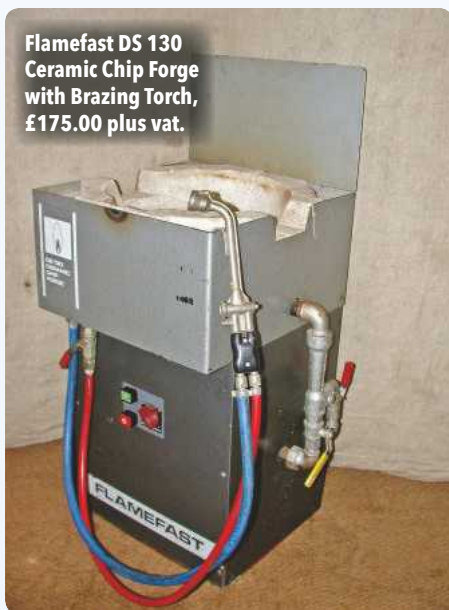
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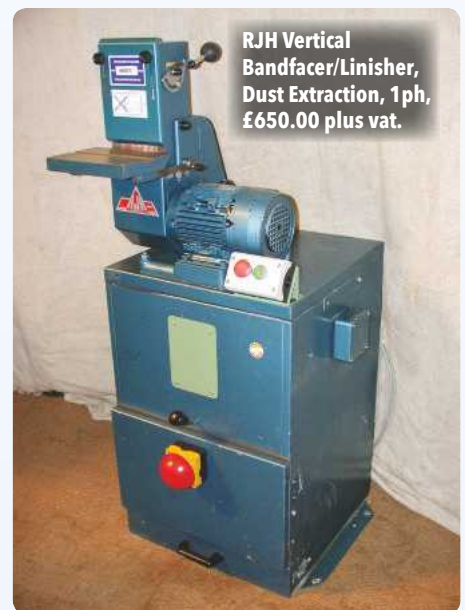
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MODEL ENGINEER

Published by **MyTimeMedia Ltd.**
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Edenbridge, Kent TN8 6HF
+44 (0)1689 869840
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Model Engineer, ISSN 0026-7325, is published fortnightly with a third issue in May and October by MYTIMEMEDIA Ltd, Enterprise House, Enterprise Way, Edenbridge, Kent TN8 6HF, UK. The US annual subscription price is 93.00GBP (equivalent to approximately 132USD). Airfreight and mailing in the USA by agent named Air Business Ltd, c/o Worldnet Shipping Inc., 156-15, 146th Avenue, 2nd Floor, Jamaica, NY 11434, USA. Periodicals postage paid at Jamaica NY 11431. US Postmaster: Send address changes to Model Engineer, Worldnet Shipping Inc., 156-15, 146th Avenue, 2nd Floor, Jamaica, NY 11434, USA. Subscription records are maintained at dsb.net 3 Queensbridge, The Lakes, Northampton, NN4 7BF. Air Business Ltd is acting as our mailing agent.



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A GWR lower quadrant bracket signal made and photographed by Doug Hewson.

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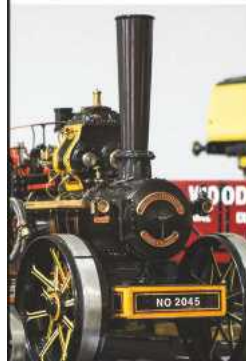
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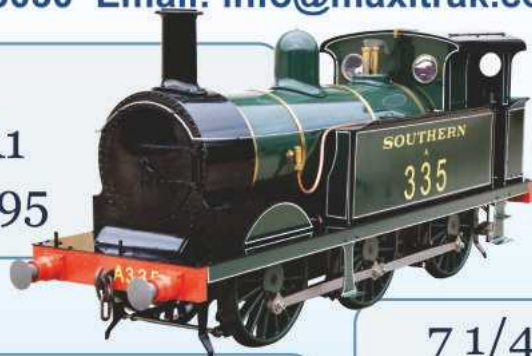
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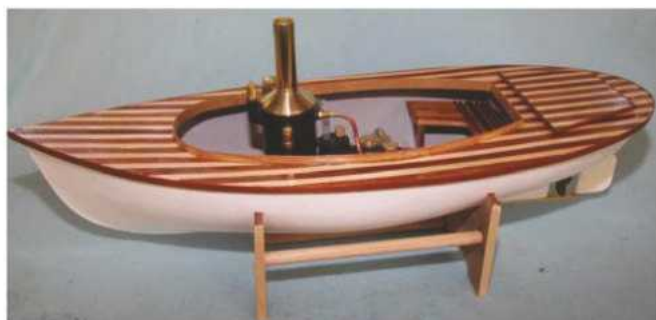
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(IMP Boat Kit)

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Final (landed) Cost
(Tyne Steam Plant)

UK £ 413.00

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Carvel design GRP hull, 620mm L, 210mm W. Kit includes clean cut-outs for all components, except deck cladding, making assembly mainly a glue & paint job. Three engine options for steam plants - Avon - reversing (left), Tyne non-reversing (right), Graham Industries TVR1 (not shown) supplied by customer. The steam plants are designed to "drop in" - only require fixing of mounting tray to mounting blocks (supplied) and making propeller drive shaft connections. Appropriate assembly and operating instructions and spare parts list supplied with each order. RC equipment not included. Free email support for any operating problems. Landed costs are based on Commonwealth Bank exchange rates at 8 August 2018.

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Bradford Track Reopening

Bradford Model Engineering Society goes back a long time, certainly to the 1900's and perhaps before, and is recorded as being the fourth oldest model engineering society in the world.

In the late 1940's their first permanent railway track was built at Thackley, near Bradford, but after nearly 20 years, in 1966, agreement was reached with the then Shipley Council to relocate to their present home in Northcliff Woods, Shipley. A raised 3½ and 5 inch gauge track was built in front of the original Edwardian bandstand which became their clubhouse. This track was formally opened on the 7th September 1968 by the then editor of the *Model Engineer* magazine, Martin Evans (Mk!!). Exactly a year later on September 7th 1969 an impressive 60 mile non-stop run by a 5 inch gauge freelance locomotive called *Pamela* was achieved on the newly constructed track.

After half a century it was decided that a rebuild of the track was required and this was carried out over the winter of 2017/18 by a band of twelve hard-working volunteers (see photograph). The re-opening ceremony will be held on the 15th September and the ribbon will be cut at noon by Diane, followed by an inaugural lap of the newly opened track. A report of the event will appear in due course in *Model Engineer*.

If you would like to be present at the reopening you can find directions to the Bradford track at www.bradfordmes.co.uk

under the 'Rail' tab or contact Russ Coppin on 07815-048999.

The Ashton Court Railway

The Bristol Society of Model Engineers faces the prospect of losing its track at Ashton Court. The Bristol City Council is proposing not to renew their lease on the site; instead they propose to use the land for 'alternative activities'. The Bristol Society is a volunteer run, charity based, organisation that has built and operated the railway at Ashton Court over the last 45 years. Over this time, it has given countless hours of enjoyment to the wider community in and around the city of Bristol.

A Bristol City Council spokesperson said: "We are looking for new income generating opportunities at Ashton Court, and the miniature railway site is one of the sites being considered. This is because it brings in very little money and the site does not currently pay for itself. However, no decision has been made and we are still working with BSME to try to find a solution that is acceptable to everyone. Current options being discussed include continuing to run the railway at Ashton Court using a new business model, or looking at opportunities to move the railway to other Bristol parks."

Most readers of *Model Engineer* will appreciate that the considerable time and expense involved in moving a club track, along with the rebuild of the associated

facilities, would stretch the resources of any club. Yet this is a prospect already faced by a number of clubs, as well as Bristol, and, the way things are going, could face many others in the future.

For Bristol City Council, like so many others, it seems that their first priority, beyond anything else, is to 'work their assets' to the maximum. They need to though, don't they, in order to pay the enormous salaries of their chief executives (often twice the Prime Minister's – why?). Their evident inability to see beyond the 'bottom line' appears to blind them to the effect this has on the communities they are supposed to serve.

The Society needs your support and is setting up an online petition. For further details please follow the Ashton Court Railway on Facebook, Twitter and Instagram:

facebook.com/AshtonCourtRly
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ERRATUM

We suffered a slight mix-up with captions in the Bloxham Steam Rally report (M.E. 4592, p. 218, 3rd August). The captions for photos 5 and 6 were inadvertently swapped over so that the MTB became the coaster and *vice versa*. I'm sure most of you spotted this but, for those who didn't, I'm sorry for any confusion caused.

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

07710-192953

mrevans@cantab.net

Wandong Live Steamers PART 2

Les Phillips tells the story of the Wandong Live Steamers, based in Victoria, Australia.



Continued from p.241
M.E. 4592, 3 August 2018

I am quite sure that by now the Editor is getting impatient with me to 'get on' so let's turn to the run now and I hope the following pictures and commentary show something of our site as well as some interesting locomotives.

The run

Considering our lack of facilities, we felt for some years we were in no position to host an invitation run as other clubs were doing but we began to hear of people wanting to come just the same. So, it was decided to host our first and it was agreed it would be a one-day affair, as a trial. Numbers were quite reasonable for this first run and we felt that it was a success so it was then decided to hold it bi-annually. Successive runs saw numbers increase, plus interstate visitors heard about it and wanted to come so the event increased to two, then three days. Last year's, 2017, was our 7th.

Having announced to the model railway fraternity that it was 'on' again we soon began to get the feeling that we could almost be overwhelmed as we had received word that a largish contingent was coming from New South Wales clubs. With our membership generally only around the thirty mark there was a lot to be done and with the interstate numbers envisaged we felt it had to be a three-day event as it was a



day's journey to get here! And as it is somewhat limited as to what our marvellous ladies can do as regards catering, those attending would have to fend for themselves other than the Saturday lunch which the girls would provide. It was finally resolved to be the Friday, Saturday being the main day and the Sunday. But as it turned out some visitors arrived earlier!!

Here I digress very briefly, 'fessing up' I am a sort of 'ghost writer' as I was too ill to attend! But having offered to do it for the Editor long before the event, the following is what I have learned by 'pumping' my fellow members and drawing on those in and outside our club who have a 'photographic bent'.

As a lead in to the story and photographs, here's a few statistics.

We had approximately 125 attendees of which I estimate 100 were visitors. To my nearest reckoning (from the attendance book) there were twelve plus from N.S.W., two from South Australia and the rest country Victoria and metropolitan Melbourne. And of course the 'Wondongers'.

There were twenty six steam locomotives and fourteen Diesels in attendance.

One hundred and ten lunches were supplied and of course morning and afternoon teas along with endless cups of 'the engineman's best friend' as LBSC called it.

There were approximately twelve campers all told with caravans and tents.

Those photographers who offered pictures will be acknowledged at the finish. Finally, some of the infrastructure pictures were taken by the author on other occasions in an endeavour to give some appreciation of what those early members achieved and if I had nothing suitable. After that long preamble - to the run itself.

The run - really

Quite a few had come a long way for this and had arrived Wednesday afternoon! I do not have any detail of the Thursday running so will move on to the Friday.

A member informed me it was cold to bitterly cold but fine. However, this did not seem to dampen anyone's enthusiasm and they were on the track early making the most of the dry conditions, particularly the 'interstaters'.

With the following photographs and description, I have endeavoured to capture some detail of our site to complement the pictures.

With the wattles starting to bloom behind, here's Jason Schmidt's New South Wales 59 Class 2-8-0 and train sitting for the photographer on the main line adjacent to the Mesa yards (photo 9). Just a little later (photo 10) we have Greg Coleman, also of N.S.W., also





on a 59 Class steaming past the mesa yards.

In **photo 11** the young driver (unknown) of a V.R. Diesel is crossing the girder bridge observing the 5km per hour speed limit and taking in his surroundings.

Having left the west creek crossing girder bridge and on the gradient approaching the Mesa, a Southern Railway 4-4-0 (**photo 12**) waits for the road with the steep hill on its left and the creek on its right, with a Diesel close behind and also waiting.

On the other side of the creek the driver of Ben McGuire's N.S.W. 5906, Greg Szock, with a long goods train (**photo 13**) is attentive to his charge as it climbs the approximately 1:100 gradient from the east creek crossing truss bridge to the yards and refuge.

With **photo 14** the photographer has really 'hit his straps' with this picture of a very nice N.S.W. 33 Class 4-6-0 in the foreground and a freight with three Diesels at the front in the background on the Sydney/Melbourne main line.

A colourful and busy scene as we move to the yards area (**photo 15**) with a green pannier tank, Bob Smith's black South Australian 700 Class 2-8-2 and a blue N.S.W. 35 Class 4-6-0.

It is Saturday morning, the weather is holding and further visitors are arriving but some were already on the track. Bob

Smith's S.A.R. 2-8-2 (**photo 16**) is in the yards and waits for its owner. Obviously raring to go, a N.S.W. 35 Class 4-6-0 sits briefly on the turntable (**photo 17**) with Greg Coleman of the N.S.W. club Illawarra Live Steamers looking on.

Whilst on N.S.W. locomotives another 35 Class (**photo 18**), owner unknown, is ready for the road and sits waiting in its light green livery, whilst a very nicely detailed blue N.S.W. 3602 4-6-0 (**photo 19**) is stabled for the moment.

Almost a 'piece-de resistance', Reg Watters magnificent G.W.R. coaches, including a slip coach which actually does 'slip' (**photo 20**), are parked for the moment on one of the two 'run on' tracks whilst waiting for his King Class *King Edward 1* (**photo 21**) to be 'fired up' and backed onto the coaches.

A busy scene at lunch time (**photo 22**) with the BBQ area overflowing with people, the yards area full of parked locomotives and supplier Ben De Gabriel's tent full of customers.

Nigel Alexander of Victorian Bluescope Westernport Club with a passenger leaves the west creek crossing girder bridge on his Britannia Class *Iron Duke* (**photo 23**) and starts up the 1:100 grade heading for the Mesa. Then Nigel and *Iron Duke* have to come to grips with the 1:40 approach to top the Mesa plateau to either turn off into the yards or proceed to the east creek crossing.

Jason Schmidt with his N.S.W. 59 Class 2-8-0, 5901, and long goods train (**photo 24**) also leaves the girder bridge and faces the same challenges as Nigel and *Iron Duke*.

The photographer has really captured the moment (**photo 25**) under difficult photographic conditions, with this night scene of Wandong member Greg Pepperell presenting an atmospheric scene on his locomotive in the yards.

S.L.S.V. member Josh Whitney is in charge of fellow member David Smith's ex Somerset & Dorset 2-6-0





in B.R. colours (**photo 26**) approaching the main yard to either turn out or continue on.

And now to round things off - three pictures of locomotives of Wandong members. Residing in the roundhouse (**photo 27**), Ian Davies' magnificent Victorian Railways 'H' Class 4-8-4, locally known as *Heavy Harry* (only one was produced) rests in front of Mel. Skinners V.R. highly detailed K Class.

The penultimate picture and giving full credit due to the photographer for a great result, (**photo 28**) is Anthony Daniel's V.R. A2 Class 4-6-2 looking absolutely resplendent.

The last picture has to be of our late foundation member Neville Levin's V.R. 'J' Class (**photo 29**) now owned by his son Robin. I chose this picture because of the immaculate detail but what you cannot see is equally good!

So, at this point I have a red signal and have come to a stop apart from acknowledging the fantastic effort our ladies put in to make this run the huge success I have been told about!

I hope you have enjoyed reading of our formation and run as much as I have enjoyed putting it together. Happy modelling at whatever is your forte.

Acknowledgements

Wandong Secretary, John Johnston, who answered many queries.

Larry Hazel for many of his photographs.

Sam Daly, Victorian Representative of the A.A.L.S., for photographs.

Wandong member, Ian Davies, for photographs. ME



Garrett 4CD Tractor PART 47

in 6 inch scale

Chris Gunn makes a start on the various guards required for the tractor.



Continued from p.227
M.E. 4592, 3 August 2018

This article has been written to guide the builder through the construction of the 6 inch scale Garrett 4CD tractor designed by Chris d'Alquen. The writer has previously built a 4 inch scale Garrett and a 6 inch scale Foden wagon so has the benefit of considerable experience in larger scale modelling. Most machining can be done in the average home workshop but the supplier from whom the castings and drawings are currently available is able to provide a machining service for the largest items if required.



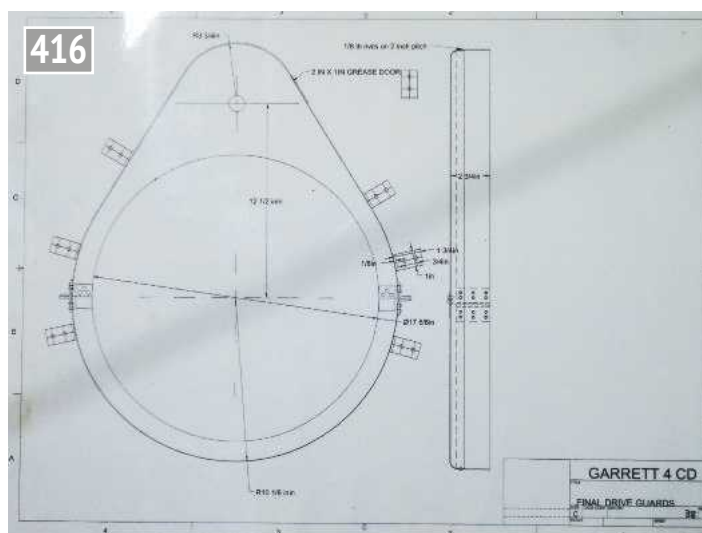
With most of the details made and test fitted, it was time to make sure all items that needed guarding were in place so I could start making the guards and covers. These were all shown in the

drawings supplied with the casting set but, as always, I prefer to use the drawings as a guide particularly in the case of covers as there always seems to be something unforeseen in the way.

I assumed the drawings were all correct for the purposes of obtaining the material, so I made a cutting list and went to visit my local sheet metal company with it. I had allowed a little extra on the sizes of the sheets that would provide the outer faces of the guards and I had some strips cut to the right width for the edges of the guards. I planned to cut the outer guard face to the right profile, then weld an edge all around and add dummy rivets to make the guard look better.

The engine and tender were on the trolley and the wheels and flywheel were off and out of the way. I started off with the final drive gear guard which was the simplest, as shown in **photo 416**.

I have mentioned before that I dislike sheet metal work for some reason. For me,



Guard drawing.

Drawings, castings and machining services are available from A. N. Engineering: Email: a.nutting@hotmail.co.uk



Trimmed guard blank.



Trimming the guard blank.



Rolling the guard rim.

sheet metal never seems to behave as I expect. Maybe it is because the company where I did my apprenticeship did not have a sheet metal department so I was never taught the basics. However, I did work for two companies after that in which sheet metal work played a significant part in their business but I was working as a designer by then and did not get involved on the shop floor. I was well aware of the manufacturing techniques of course but I was, and am, missing the hands on experience which is the best way to learn.

The method I used to make the guards was within my capabilities but I am aware that some folk may want to make the guards as drawn with a rolled edge if they have access to the right equipment to produce the rolled edge - namely an English wheel - or are prepared to beat the edge



Guard ready for welding.

over a former. I guess a simple press tool could be made to produce a dished front in the same way as the sides for the tender or the ends of the belly tank were produced.

What I did was to mark out the profile of the guard on my sheet of 1.5mm thick steel - or



Tacking guard rim.

16g in old money. I made the profile about $\frac{1}{4}$ inch bigger all round than it needed to be. I also allowed about $\frac{1}{4}$ inch extra between the two halves of the guard so I could split it later to make the joint needed so the guard can be fitted. **Photograph 417** shows

the guard marked out and trimmed.

Once the blank was trimmed it was then cut into two sections along the joint and the joint faces cleaned up as shown in **photo 418**.

The next step was to roll the section of the rim as shown in **photo 419**. Then the blank was placed face down on my welding trolley and the rim positioned to the marking out and clamped. I used magnetic welding clamps to keep the rim square to the blank and a piece of flat bar and some 'G' clamps to hold it all in position as shown in **photo 420**.

Once everything was clamped firmly in place, a pre-requisite in my view for successful welding, I tacked around the outside of the rim to hold everything together as shown in **photo 421** and then I welded all around the inside of the rim which is where the real welding was done, as shown in **photo 422**.



Welded guard rim.



Guard cleaned up.



Part-rolled rim.

Once the main weld was done on the inside, unseen when fitted, I hoped I could clean up the outside edge flush and without too many holes. **Photograph 423** shows the completed cleaned up section.

A few small holes can be seen here and there but these would be filled when it got to the painting stage.

I followed the same procedure with the top half of the guard, which is pear shaped. I had to roll a tighter radius for the top of the guard and a looser one for the sides, which was not easy to gauge, so in the end I concentrated on the top radius and got that right, then welded around that and, when that section was done, I opened up the sides of the rim and welded them. **Photograph 424** shows the initial set up and **photo 425** the second stage in the welding of the sides of the guard.

I repeated the set up shown in photo 425 a couple of times until the edge was finished and then cleaned the edge up as shown in **photo 426**.

When both sections were complete to this stage, the next operation was to cut the centres out to match the drawing and this was done using a thin cutting disc in my angle grinder. After this the cut edge was cleaned up with a sanding disc and my power file. **Photograph 427** shows the set up for cutting



Welding guards.



Final drive guard cleaned up.

out the centre section, which is clamped to my temporary worktop while supported with a block and then the cut can be made in safety without trying to hold the workpiece in one hand and the grinder in the other.

The guards were tried in position and were basically



Cutting final drive guard.

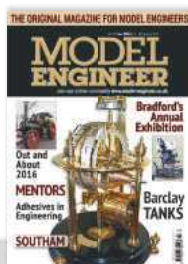
fine but would need some additional cut outs and notches before the guards could be pushed back to the

hornplates and the brackets could be fitted.

●To be continued.

Next time I will continue with the primary drive guard and then deal with the brackets etc.

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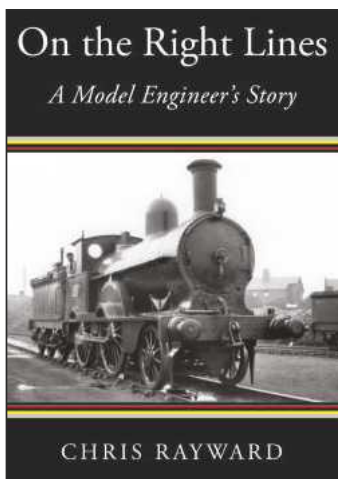
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Book Review

On the Right Lines

By Chris Rayward

This is a most informative book, being an honest and intriguing account of one who is well known in model engineering circles and also to the reviewer.

Chris sketches his own progress through life, which has always had a strong bias towards engineering. Born during the early years of the Second World War, in the North Riding of Yorkshire, his early years were influenced very much by Meccano, an obsession which was fostered when his family moved to GWR territory in Harlington, Middlesex. That merely increased the opportunity for influence of things mechanical and of railways in particular.

His father's difficult adjustment to peacetime living dictated a move to Australia, which provided Chris not only with his first experience of life at sea, but conditions which developed his aptitude for engineering. Brands such as Meccano, Hornby and Dinky Toys were to be found the other side of the world and contributed to a happy childhood. The Australian life was not to last, however, and

a move back to Blighty saw the family firmly settled in the West Country, in Somerset and Dorset territory. Chris's interests were enriched by the engineering of the railways he had got to know and by naval hardware, in particular by the power sources for both means of transport. Thus, contact with things near the seaside and a fascination for both steam and diesel engines influenced his career path.

Meanwhile model engineering and in particular model boat building were near the top of the pile in his interests as he entered into apprenticeship at Aldermaston. This went well and led eventually to degree studies at what became the University of Bath. The direction which Chris eventually took was perhaps influenced by his experiences in Australia: he joined the merchant navy and found himself deeply immersed in heavy diesel engine work, even learning about maintaining equipment when a long way from base. Again, the model making thread shone through, with ship modelling the

obvious influence, as well as the lure of stationary steam engines.

A career in the merchant navy was not to be Chris's long term objective and, after two tours of duty around the world he looked for another opportunity more particularly in engine research. What better destination could he have found than Ricardo in Sussex, where he settled into diesel engine research, tempered of course as always with some model engineering. Even then, the lure of the sea was still present and he did his duty as a member of the RNR; happy coincidence led him to meet his future wife, this forming the catalyst for moving jobs to one in a different part of the country, where they might more easily afford to buy a house.

So dawned the part of his career at Perkins of Peterborough, still well known as innovative manufacturers of diesel engines. The family settled in the village of Nassington, not far from Peterborough, where it stretched to three children after a few years. Meanwhile Chris built a ground level track in his garden and made an LNWR *Jumbo* to run on it. His career at Perkins went well, including production management and technical service, before he eventually found his real calling in the field of quality assurance. This went on for a few years until the arrival of his third child (a daughter). This event led to the need to move to a bigger house, which was duly found at Ryhall, just north of Stamford, where he set up yet another workshop and energetically joined in the



A 5 inch gauge industrial Peckett R4 locomotive.

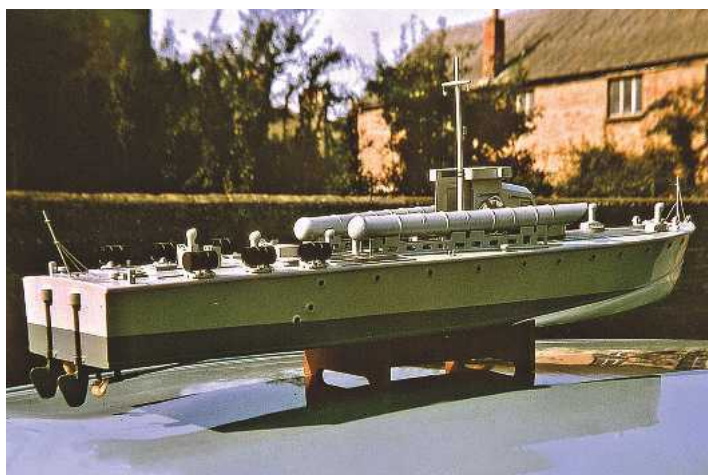
Matador Publishing, 2018.

ISBN 978-1-78803-807-2

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Chris Rayward's model of a motor torpedo boat (MTB).

activities of the local model engineering society.

Just when things seemed to be going well, his infant third child, Sophie, was diagnosed with leukaemia; this terrible blow required immediate treatment at Great Ormond Street hospital, a burden which was borne primarily by Chris's wife for a number of weeks before an eventual happy return to good health and a cure which has lasted until the present day. An irony which comes over in the book is that, before the diagnosis, Chris had taken part in some significant fund-raising for Great Ormond Street Hospital together with some of his work colleagues. He could never have known that his family would shortly be on the receiving end of the services offered by this wonderful establishment.

No sooner had Sophie's health settled down after her long course of treatment, than Perkins declared a major redundancy, in which Chris lost his job. A redundancy package cushioned his time searching for another job, which would inevitably mean a relocation to elsewhere in the country. He found the opportunity to teach physics at Stamford School to bring in some money while looking for a permanent job. After a short while he found a good job in his chosen field with Lucas Car Braking Systems in Pontypool and settled some 20 miles away in

Monmouth where, not for the first time, he built a shed for the magic hobby and was able to work on his Coal Tank locomotive which was to be published in serial form in *Engineering in Miniature*. The automotive industry was at that time enduring a period of great turmoil which led to him taking on the Quality Manager's position. Eventually things in Lucas were not looking promising, so Chris found another suitable post with ABB in Telford. This required him again to live away from home for the benefit of family stability until it was possible to move to a new house (yes with yet another workshop shed!) in Worcester. In its wake this move caused problems with his daughter's education and his wife ended up staying in a flat in Monmouth during each week so that Sophie could return to the school where she had been happy.

Chris's life at ABB, having started well, began to go sour with implants from the company's headquarters causing trouble in this country, so he was delighted to find another job, this time with another arm of his old company Ricardo, in Worcester of all places. This assignment too, started well until this branch of the company was sold to a German outfit who promptly declared the Worcester staff redundant. In these circumstances Chris



Chris Rayward's model of the LNWR Lady of the Lake 2-2-2 passenger engine.

challenged them legally and secured some useful compensation which stabilised his living while he cast around for a change of career direction.

He decided to go out on his own with his track record in quality assurance and soon built up a small portfolio of customers in small businesses not too far from home. It was, however, at this time that TEE Publishing were looking for a new technical editor for *Engineering in Miniature*, so this was a job which he fitted with great ease and for some time he split his time comfortably between QA and model engineering. In this field he had finished the LNWR Coal Tank and was well on with the design of the Beattie Well Tank. After that he started on the *Lady of the Lake* series, which of course cements his credentials in the field of model engineering.

In the book Chris explains how, down the years, he has made use of the time available to construct various models, from simple wooden children's toys to ornamental mantelpiece examples and one is left wondering where they will all end up. It also reflects how a sound engineering education lays the foundation for not only an interesting and challenging professional life, but also gives one the tools for making a mark in the world of model making. Chris's life has not always been easy but he has always risen to the occasion and the bitter sweet nature of his journey through life becomes obvious as one turns the pages. The book is illustrated with the author's own pictures from his infancy until the present day and, whether you know him or not, it makes an interesting read.

D A G Brown



A 7 1/4 inch gauge model of the Adams version of the LSWR 2-4-0 Beattie Well Tank based on Chris Rayward's design.

The Barclay Well Tanks of the Great War

PART 39

Terence Holland describes and constructs two appealing, century old locomotives.



Continued from p.223
M.E. 4592, 3 August 2018

This constructional series addresses Andrew Barclay 0-4-0 and 0-6-0 narrow gauge locomotives supplied for use in the First World War. Built without the use of castings, the 0-4-0 design is described as two versions; as-built for the British Admiralty in 1918 and as rebuilt and currently running on the Talyllyn Railway as their locomotive No.6, *Douglas*. The 0-6-0 engines described were built in 1917 and operated on 60 centimetre gauge track at the Western Front in France. These were small, spartan machines of which only 25 were supplied and none have survived into preservation.

Steam test

The steam test is an important part of boiler testing and my intention was to combine this with a bench test of the locomotive. I anticipated no problems with the boiler, as I had tested it many times before and the chassis was successfully tested some time ago on compressed air. There were plenty of incentives for getting the engine 'back on track', as it now has many improved features along with some new items. The main items of improvement, the appropriate ones of which have been incorporated into the current design, are as follows:

- double PTFE piston rings;
- correct Barclay-type expansion links;
- redesigned and rebuilt crosshead feed pump;
- new injector systems;
- new injector clack valves;
- improved smokebox vacuum;
- reseated cylinder steam valves;
- triple drain cocks;
- new steam brake;
- improved ports on regulator;
- additional axlebox springs.



Awaiting the steam test.

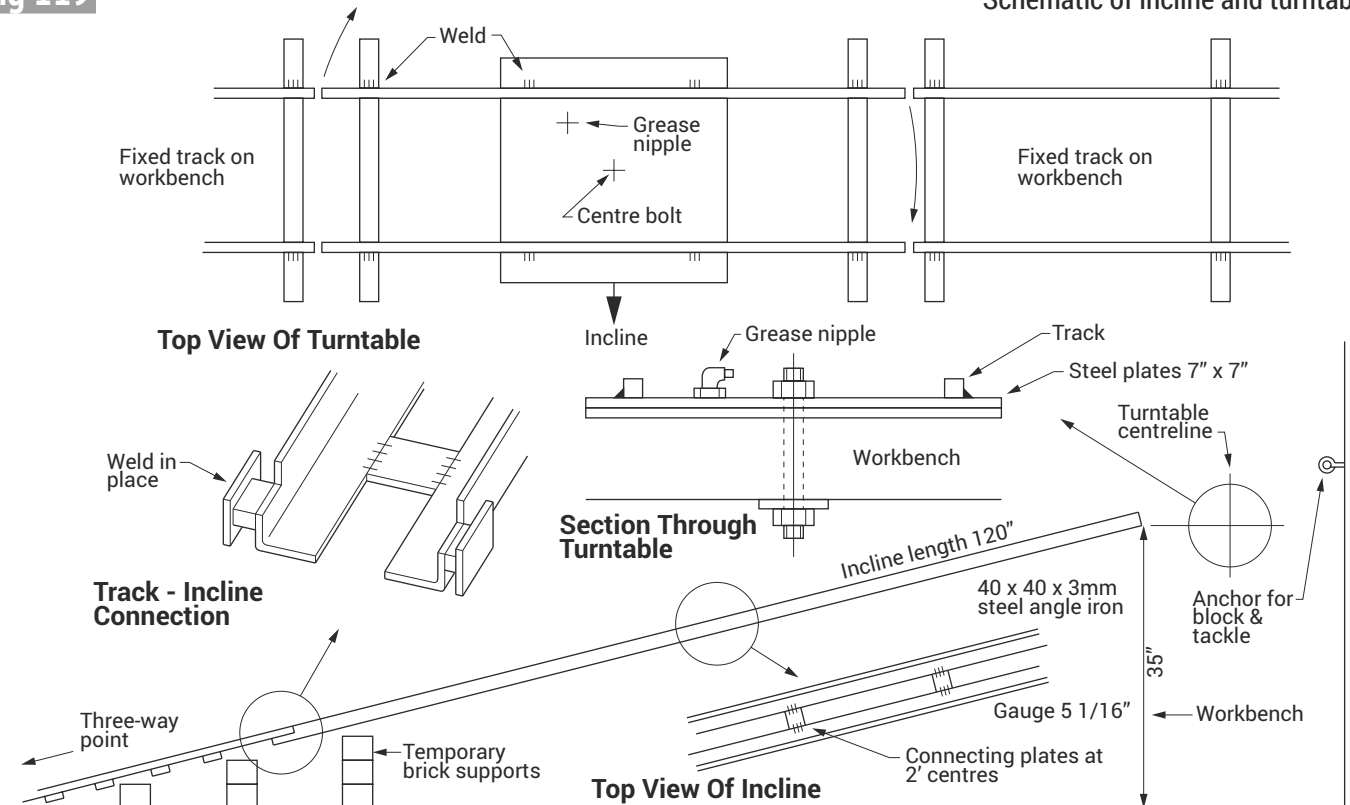
That's only the ones I remember, so plenty to be getting on with and, bearing in mind that the locomotive performed well before the rebuild, it should run now like a Rolls Royce! **Photograph 186** shows the rebuilt engine awaiting steam test but lacking the Douglas nameplates, which have yet

to be made. I will make these from 1/8 inch thick brass, etched with ferric chloride solution using 'Letraset' purchased on the Internet – more details of this later.

Photograph 187 shows the original engine undergoing its first bench test in 1982 – hence the poor quality of the photograph. The engine was named *John Thomas* after the 'hedger and ditcher' on the Talyllyn Railway at the time. John Thomas was the brother-in-law of Dai Jones, the senior driver in those days. Dai was the son of Hugh Jones, who was driver on the line in the days when the Talyllyn was owned by the local MP, Sir Henry Haydn Jones. Since then, Dai's son David has followed in the footsteps of his father and grandfather as a permanent member of the railway staff. He has now been joined by his son Thomas, who makes it five generations



The first bench test in 1982.

Fig 119**Schematic of incline and turntable.**

of Joneses who have served the railway. I fired many times to Dai – the perfect Welsh gentleman who was known to be very forgiving of his novice, volunteer firemen!

A useful inclination

I have been thinking for a long time now that, before getting the locomotive up on the bench for the steam test, some device would be useful to enable me to raise the engine alone. I've struggled in the past, but now it needs at least two healthy *hombres* to do the job, as I'm getting to the age now when I'm not invincible! So, some sensible engineering solution was required and not before time!

The first thing that came to mind was an inclined plane worked using a gun tackle, which is a block and tackle with a 2:1 advantage – so it was off down to the 'Chino' to purchase some suitable rope and some plastic pulleys. And, in addition, some sort of turntable would be extremely helpful, so I could turn the engine once it was up at

bench height, allowing work to be carried out on both sides. The incline, turntable etc. would be made from mild steel stock of which I had plenty available.

The INCLINE and WORKBENCH TURNTABLE

Once up the incline and onto the bench the simple turntable enables work to be carried out by one person at bench height, on either side of the engine; it's such a heavy, bulky item that it's not an easy task to turn it around as required.

Details of the incline and turntable are shown in **fig 119**. Note that the dimensions are specific to my layout and locomotive but the figure gives the general idea.

For locomotives with a large overhang, such as the Barclay 0-4-0, it is essential to protect the drain cocks when moving from level track to the start of the incline and such moves have been done many times before – see **photo 188**, which shows *Glyder* being rerailed recently from a low-loader at Beamish museum.



Glyder arriving at Beamish (Beamish Museum).

At some stage of design it makes sense to address the likely weight of an engine, particularly as 5 inch narrow gauge locomotives tend to be big and heavy. This information is normally difficult to acquire without having an engine to actually weigh but in this case one exists with an estimated weight of 80 kilos and I have to admit that, as a young man, I did lift it unassisted onto the workbench once - and once only!

Via the incline I managed to get a fairly good weight measurement. For this I measured the length and height of the incline and determined the weight of the engine on it using a spring balance of the type used for hand luggage, which weighs a maximum of 32kg. These balances are presumably fairly accurate, airport weight restrictions being what they are.

With an incline 10 feet long, 35 inches high and a

balance weight measurement of 25kg, the total engine weight comes out at just under 86kg – a considerable weight for two men to lift. This value compares well with the calculated value of 64kg based on the stated Tallylyn weight of 8 tonnes. As most components on a working model are significantly oversize I think the measured value is perfectly reasonable. As an example, the original boilerplate thickness of $\frac{3}{8}$ inch equates to a $\frac{1}{8}$ inch thickness of copper on the model; a factor of 3 not 5. Similarly, the $\frac{3}{8}$ inch thick frames are $\frac{3}{16}$ inch thick on the model; a factor of 2.

The engine is easily moved up and down the incline using the block and tackle, requiring a force of approximately 12kg, and the operation can be safely carried out by one person working alone.

Once the locomotive is on the bench, the rail section on which it sits at the top of the incline is easily rotated. In addition, it is possible to raise the foot of the incline on a stanchion to provide a fairly long section of raised angle iron track and this allows for easy access to all parts of the locomotive, see **photo 189**.

Three-way point

To access the incline and bench from the ground level track I removed a nearby standard point and replaced it with a three-way stub turnout. The stub point work during installation is shown in **photo 190** – dogs are so nose-y!

The track nearest the wall in **photo 191** leads to a door in the 'engine shed', which just happens to be a space under the sink in the utility! The door can be seen to the right of the photograph. On the extreme left the garden wall had to be cut away to allow the engine to pass without scratching the nice, new paintwork. Part of the cut-out, before rendering, can be seen on the left-hand edge of photo 191.

The track in the foreground is the main line, temporarily raised an inch or so in sympathy with the centre road



The incline raised for working access.



Installation of the three-way point.



Locomotive on the interface between incline and centre road.



Close up of the interface.



Close up of the top joint and turntable.



Locomotive on its way up.

from the three-way point. No problem there, of course, as the line operates with 'one engine in steam' by default!

Once the three-way point was in place it was a simple matter to temporarily elevate the centre lane with suitable bricks to line up with the incline. See photos 191 and 192. **Photograph 193** shows the top joint and the turntable in close-up; the incline is in the raised position as shown in photo 189.

Photographs 194 and 195, respectively, show the unrebuilt engine on its way up the incline near the top joint and on the turntable – note the spring balance attached for carrying out the weight measurement.

Sand box

The sand box (**fig 120**) is one of those items that is easily forgotten and, as it is part of the boiler assembly, should be considered now before



Locomotive on turntable.



The sand box.

For locomotives with a large overhang, such as the Barclay 0-4-0, it is essential to protect the drain cocks when moving from level track to the start of the incline and such moves have been done many times before...

moving on to the boiler fittings. Construction is simplicity itself with no fancy techniques required. Figure 120 shows what's involved. The job is silver soldered together and fits on top of the boiler cladding plates behind the steam dome cover.

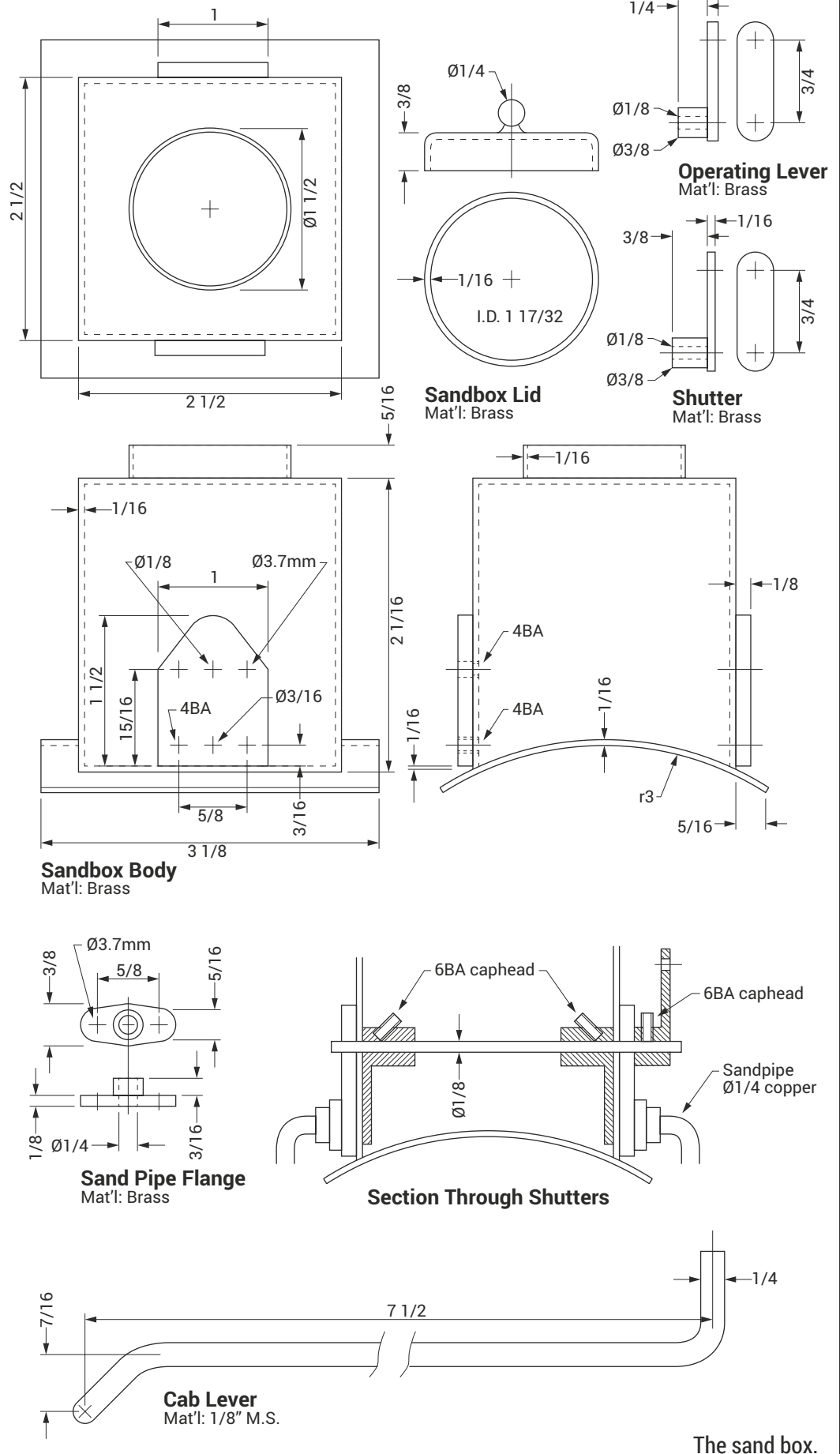
A simple operating lever extends into the cab, which allows sand to be delivered between the driving wheels. It works of course but is not used in practice as you might expect – I don't get the locomotive out when it's raining!

The finished item is shown in **photo 196**. The sand box is attached to the boiler cladding with transparent silicone sealant; note the dummy rivets (see text regarding the fixing of the steam dome cover).

● To be continued.

Next time we will start making the steam fittings.

Fig 120



Steam Turbines

Large and Miniature

PART 4

Steam in nozzles and early power generation

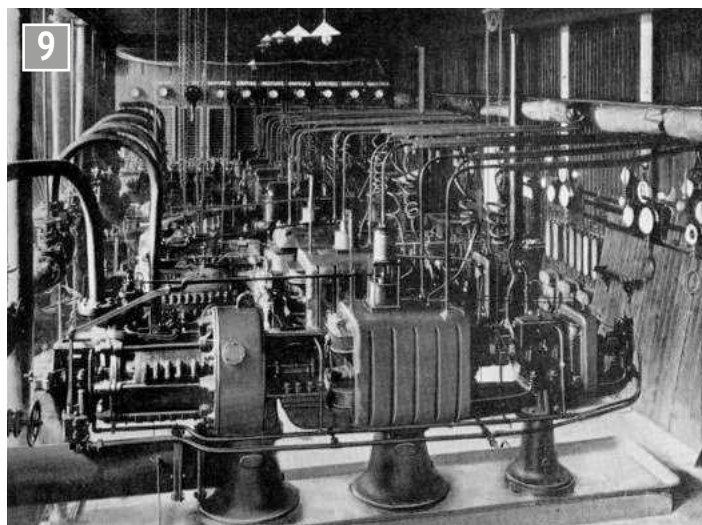
Mike Tilby explores the technology, history and modelling of steam turbines.



Early electric power generation

Soon after moving up here to Newcastle upon Tyne I was wandering around backstreets behind the main railway station looking for a builders' merchant when I was surprised to notice, on an old building, a plaque which stated that the *Rocket* had been built on that site by George and Robert Stephenson in 1829. Unwittingly I was standing beside one of the remaining buildings from the world's first railway locomotive factory in Forth Street. Not far away on the road called Forth Banks there used to stand another building of comparable importance for engineering history. This was Forth Banks power station which was the world's first power station to use turbo-generators (**photo 9**).

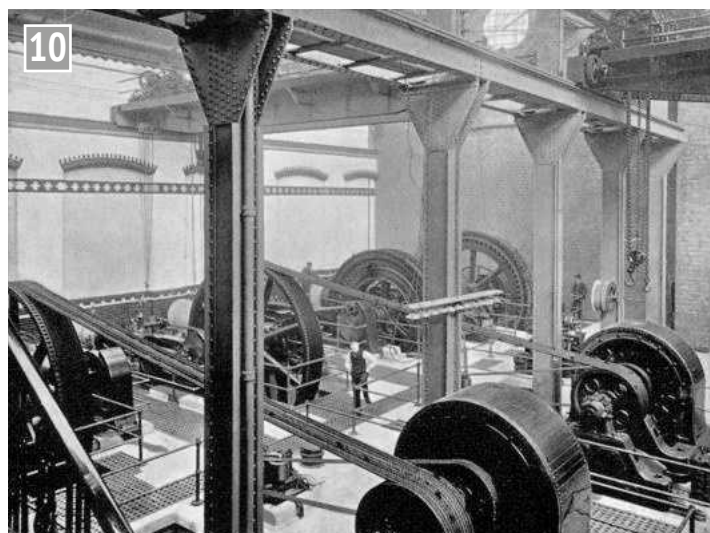
It was established in 1890 by Charles Parsons and business partners, just five years after



The world's first power station to use turbogenerators, on Forth Bank, Newcastle upon Tyne, photographed in 1892, two years after its opening.

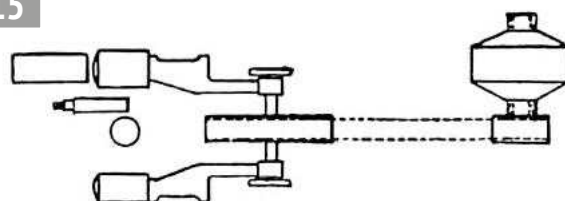
Parsons built his first small turbo generator. In those five years about 300 small turbo-generators had been built, mainly for electric lighting on ships. The efficiencies of these early machines were poor but this was offset by their ability to run non-stop reliably and with very little maintenance. Another important advantage was their very steady output voltage compared

to generators powered by reciprocating engines. This stability greatly prolonged the life of the lamps which, at that time, were very expensive items. During those five years, Parsons had increased the power of his turbo-generators from about 10kW up to 75kW which was large enough to use for a public electricity supply, power requirements then being so modest.



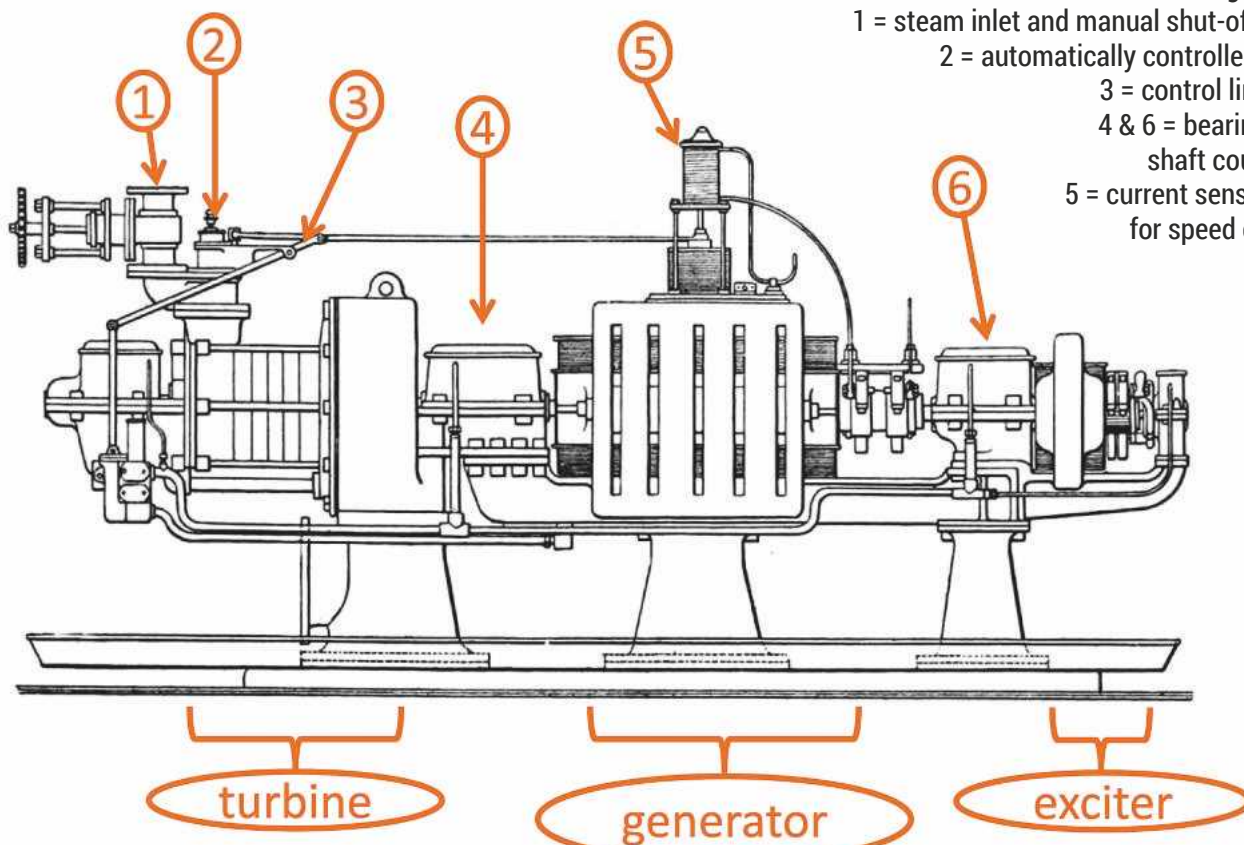
Conventional generating station, Islington, London, at its opening in 1893.

Fig 15



Plans of turbine and reciprocating powered generators of similar outputs, about 1893.



Fig 16

Parsons turbogenerator
installed in Cambridge, 1892.

- 1 = steam inlet and manual shut-off valve.
- 2 = automatically controlled valve.
- 3 = control linkages.
- 4 & 6 = bearings and shaft couplings.
- 5 = current sensing coil for speed control.

The great improvement in size and simplicity of power generation made possible by Parsons' turbo-generators can be seen from **photo 10** which shows a generating station opened in 1893 in the London borough of Islington using typical technology for that time. Each engine and generator in photo 10 had a power output only slightly greater than the turbo-generator visible in the foreground of photo 9. The turbine of the latter generator was similarly constructed to the one shown in photo 7 of the previous article in this series (part 3). Footprints of this turbo-generator and a typical generator of the era are compared in **fig 15** and details of the turbo-generator are shown in **fig 16**. In addition to the turbine and the electrical generator themselves, the parts labelled 2 – 6 in fig 16 were all of completely novel designs and had to be invented and developed by Parsons in order to achieve a workable machine.

This use of turbo-generators in a central power station was a major step which led to the rapid further increase in size and efficiency of turbines such that large turbo-generators are now rated in hundreds of megawatts and even a large proportion of railways are powered by steam turbines - through the use of electric traction. It is interesting that railway locomotives and turbo-generators were both pioneered a few hundred yards apart in Newcastle upon Tyne. Because of the general reliance of the modern world on electricity for powering everything from heavy industry to domestic gadgets, it can be understood why Charles Parsons has been dubbed 'the man who invented the 20th century'.

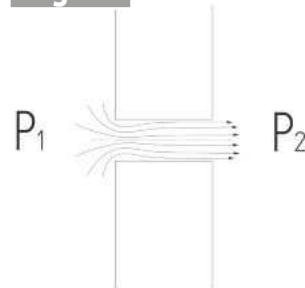
Acceleration of steam in nozzles

By 1892, tests on a ground-breaking turbo-generator supplied by Parsons Ltd. to the Cambridge Electric Lighting

Co. showed it had better efficiency than reciprocating engine-driven generators of similar capacity. This is the machine shown in photo 7 of part 3 and it is preserved in the London Science Museum. So, by the turn of the century, turbines were beginning to be considered more widely for power generation, as shown by their use in Lots Road Power Station (see the first article of this series).

Despite these advances, several aspects of the behaviour of steam in turbines were still poorly understood. Nowadays the behaviour of steam can be fully explained by reference to scientific principles; however, anyone not familiar with the subject might be surprised by some of the ways that steam behaves. An example of this is seen in the flow of steam (or other vapours and gases) as it passes through a plain hole or nozzle from a higher to a lower pressure (**fig 17**).

This seemingly simple process is actually rather complicated since, during its passage to lower pressure, the steam expands in volume, its temperature decreases, its density decreases and its velocity increases. Also, the velocity of the steam differs at different distances from the side of the hole due to the combined effects of frictional drag and the momentum of steam flowing around the nozzle entrance. Furthermore,

Fig 17

Flow of steam through a simple orifice.

the pattern of flow changes along the length of the nozzle. As the steam velocity increases along the steam path, all the other above-mentioned properties change simultaneously.

Now let's ignore the fine detail in the pattern of flow and just focus on the overall rate of flow through a nozzle. Also, let's forget about friction - for the time being.

Imagine we have tank A containing steam maintained at a fixed high pressure P_1 and tank B containing steam at a pressure P_2 which is kept constant at whatever pressure we wish to set it. Our nozzle is a simple short pipe connecting the two tanks (**fig 18**). If we start with tank B at the same pressure as tank A then, of course, there is no net flow of steam through the nozzle. As we gradually lower the pressure of tank B, steam will start flowing and the lower we make that pressure the greater is the mass of steam that flows per second. Consequently, the volume of steam flowing per second also increases and this means the velocity of the steam increases since, at any point along the nozzle:

steam velocity = volume flowing per second / cross sectional area

Since the pressure of the steam decreases as it moves through the nozzle from P_1 to P_2 , so does its density. This means that the volume occupied by a given mass of steam increases and therefore its velocity has to increase

even further. Now, as described in the 2nd article in this series, if the steam accelerates, a force must act upon it and this force results from the difference in pressure between inlet and outlet of the nozzle. Hopefully this explanation of increase in flow rate with decrease in pressure in tank B all seems as expected.

However, what may seem surprising is that, when the pressure in tank B is reduced beyond a certain value, any further reduction in its pressure causes **no** further increase in the mass flow rate of steam moving through the nozzle.

This behaviour of steam was first reported in 1867 by the Scottish engineer, R.D. Napier. His father and grandfather were renowned pioneers of iron shipbuilding and of applying steam to power ships. The family was associated with several famous firms carrying the name Napier, including shipyards on the Clyde and at Millwall on the Thames. For a few years, Mr. Napier worked at Birkenhead and while there he carried out experiments into the rate at which steam escapes through orifices, since no measurements of this important subject had ever been made before. His painstaking experiments were made using a boiler in a steam boat and published as correspondence (**ref 1**) in the journal *The Engineer*. (Many volumes of this journal have been digitised and are freely available at the web-site given in ref 1.)

Napier's results have since been confirmed by others and the pressure in P_2 below which the flow rate does not increase any further is called the '**critical pressure**'. Napier's discovery and its underlying cause were to have major implications for the design of steam turbines (and also safety valves) but it was a few years before the theory underlying this seemingly strange behaviour was explained.

Professor Osborne Reynolds is widely stated to be the originator of this theory

(**ref 2**) although he may not actually have been the first to propose it. Professor Reynolds worked at the fore-runner of Manchester University and he made many major advances in the study of fluid dynamics. When a pressure wave, such as a sound wave, passes through a substance, the speed at which that wave moves is fixed by the properties of the substance through which it is passing. Professor Reynolds proposed that, when the pressure in tank B is at or below the critical pressure, steam accelerates as it flows through the nozzle but only until it attains a velocity equal to the speed at which a pressure wave passes through the steam. In other words, its velocity increases until it attains, but does not exceed, the velocity at which sound passes through the steam (i.e. its velocity does not exceed Mach 1).

To understand why this is the case, first imagine the situation where tank B is at a pressure **higher** than the critical pressure. In this case, any change in the pressure in tank B has an effect on the pressure of the flowing steam just inside the outlet of the nozzle. The pressure of steam at that point influences the pressure and acceleration experienced by steam at a point immediately ahead of it and this pattern is repeated going back along the path of flowing steam. In that way the whole pattern of gradation in pressure, density, velocity etc through the nozzle becomes adjusted to the new pressure in tank B and that whole pattern determines the overall flow rate attained by the steam.

Now imagine the situation where tank B is at **less** than the critical pressure. The steam velocity at the outlet of the nozzle now equals the rate at which a pressure change moves through the steam, so the effects of any drop in pressure cannot be transmitted back along the rapidly flowing steam. Therefore, any further decrease in pressure in tank

B makes no difference to the pressure of steam immediately inside the nozzle and the pattern of pressure drop and the flow rate throughout the nozzle does not change. When the pressure in tank B is **less** than the critical pressure, the pressure just inside the end of the nozzle **equals** the critical pressure and as the steam leaves the end of the nozzle it simply expands in all directions as its pressure drops to P_2 . Since such expansion is not as a directed jet the energy released cannot be utilised by a turbine and it is wasted.

Text books show how the critical pressure for steam at any initial condition can be calculated from physical principles. This is a little complicated but we need not bother with it since, for steam at pressures and temperatures relevant to model engines, the final result is given approximately by the following simple equation:

*critical pressure =
0.58 x initial pressure*

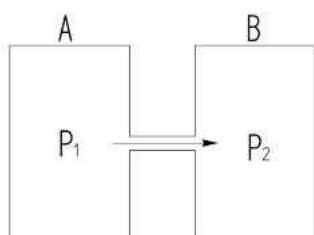
It is important to remember that the pressures in this formula are absolute pressures rather than gauge pressures. So, if a nozzle delivers steam to the atmosphere, P_2 is 14.7psi. Therefore, if P_1 is any higher than 25.3psi absolute (i.e. just 10.6psi gauge) then the P_2 will be less than the critical pressure. Therefore, any increase in P_1 above 10.6psi gauge pressure would mean that a simple nozzle would not give maximum acceleration of the steam.

Turbine nozzles

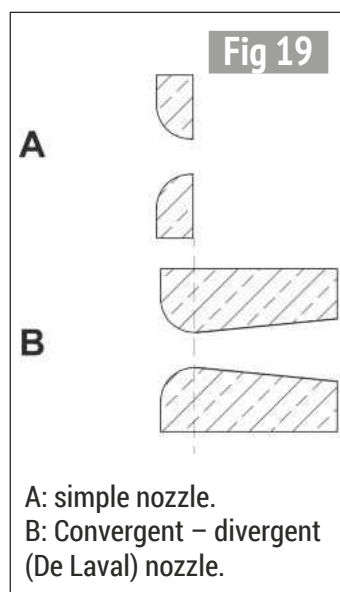
Let's now think about the consequences of all this for the design of steam turbines.

Firstly, since critical pressures are just over half the inlet pressure, if the steam undergoes a large pressure drop, a large fraction of the energy in the steam cannot be converted to useable kinetic energy in a simple nozzle. Clearly this is not ideal for a machine that relies on just such a conversion.

Fig 18



Flow of steam
between two tanks.



Secondly, as described below, this phenomenon is the first indication of the very different properties shown by flowing steam depending upon whether its velocity is less than or greater than the speed of sound.

In Parson's first turbo-generator, expansion of steam from 80psig inlet pressure down to atmospheric pressure was divided into 42 separate stages. As described in the previous article, each turbine stage consisted of a ring of fixed nozzles and a ring of blades on the rotor. In essence, each pair of nozzle/blade rings formed an individual turbine and, since the pressure drop across each of these was small, the steam never reached very high velocities. Parsons reasoned that, with small drops in pressure, the behaviour of the steam would resemble the behaviour of an incompressible fluid such as water. Much was known about designing highly efficient hydraulic turbines, as outlined in part 3 of these articles. (With water jets, the complication of critical pressure does not arise because water is virtually incompressible. As a consequence, the velocity of sound in water is extremely high and, unlike steam, water contains no available internal energy that can drive its own acceleration to high velocities.)

De Laval nozzles

About the time that Parsons was developing his first turbine, the Swedish engineer Gustav De Laval was experimenting with ways to drive a cream separator in a dairy. For this he needed to attain high speeds of revolution and after trying various methods he eventually developed a steam turbine. The U.K. patent that he filed in 1889 (De Laval 1889) shows that he was well aware of the existence of a critical pressure and that this prevented the majority of the energy in steam being utilised by a turbine. After much experimentation and in what appears to be a stroke of pure intuition, he tried using a nozzle which opened out again towards the end (**fig 19B**) and discovered that this gave the full steam velocity that he needed to attain the maximum kinetic energy. This type of nozzle is now known as a De Laval nozzle or a convergent-divergent nozzle and formed part of De Laval's patent.

When such a nozzle is used, if the outlet pressure is less than the critical pressure, the steam can attain velocities much higher than the velocity of sound and consequently nearly all the energy available in the steam can be converted into utilisable kinetic energy in one stage. As steam flows through the first section of a De Laval nozzle its velocity increases up to the speed of sound and this is attained at the narrowest part - the throat. Up to this point steam behaves as if it is in an identical plain nozzle (**fig 19A**) and it is only this section that determines the mass flow rate of steam through the nozzle.

At the throat, the flow is said to be choked. Beyond the throat the nozzle widens out again in a gentle taper and in this section the steam accelerates further as a directed jet. This change of nozzle shape is crucially important because it is now known that the behaviour of a gas flowing at sub-sonic velocities is markedly different to the same gas flowing super-sonically. For sub-sonic velocities (i.e.

below Mach 1) a converging passage serves to accelerate the flow and is called a nozzle while a diverging passage causes the flow to slow down and the pressure to increase. Any passage or duct in which velocity decreases and pressure increases is called a diffuser. However, when the velocity of steam (or any other compressible fluid) exceeds the velocity of sound, everything is reversed since a converging passage acts as a diffuser and a diverging passage acts as a nozzle (**fig 20**).

Nearly all published model steam turbines have been based on a single stage using De Laval type nozzles. This choice of nozzle seems appropriate since steam pressures are usually higher than 10psig. However, from the above discussion on nozzles and diffusers we can see that if, for any reason, steam passing through a De Laval nozzle does not quite reach Mach 1

at the nozzle throat, then the diverging part of the nozzle will act as a diffuser and will actually slow down the steam rather than accelerate it.

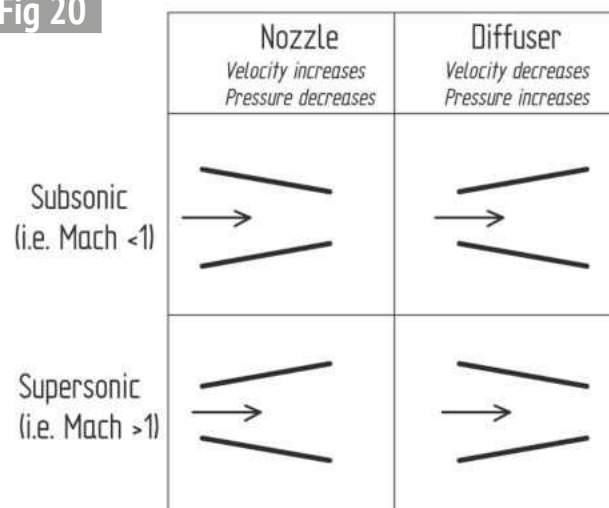
There are additional reasons why use of De Laval nozzles might encounter significant problems and there are a couple of observations that have been reported in articles in *Model Engineer* that might indicate that De Laval nozzles do not always operate as expected in models, at least for steam pressures generated by conventional (i.e. not flash) boilers. All this will be discussed in detail later, after losses due to friction, turbulence and shock and the effects of condensation have been outlined. However, first we need to see how to calculate the actual velocities that can be attained by steam as it passes through a nozzle under various conditions and this will be covered in the next article.

●To be continued.

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Fig 20



Subsonic versus supersonic flow through ducts.

What is Model Engineering?

Some thoughts from our Man in a Shed, **James Wells**.

The various letters and comments on the subject make interesting reading but there is one category of would-be model engineer who seems to rarely get mentioned and that is those who have only the minimum of facilities.

My own experiences were early formed by my apprenticeship instructor. As the new intake began their basic workshop training it was with the wise words of that same instructor: "By using machinery, at the end of your time here you would all be machinists so you will learn how to use hand tools first".

Without that long basic hand tool training it is doubtful if I would ever have joined the ranks of model engineers. During my later professional life in different areas of the world, only rarely was access to machinery possible but I was usually able to set up a modest bench and vice then design my projects around available materials and involve as much hand work as possible.

My present facilities are of the basic garden shed variety and limited to 12v power supplies, including a hand-held electric drill and a simple drawing board. Without those originally taught basic hand skills my output would have been very limited indeed.

So where does that modern invention, the electronic calculator, fit into model engineering? On my bench at the moment there is a calculator and a metalworking file. These days I offer a groan when remembering the former hours with logarithm tables and slide rules trying to calculate an answer, all of which is now rapidly done on a calculator and to a much higher standard of accuracy.

The bottom line is that all these are tools to be used with some prior experience and expectation of the final results. I seem long ago to have lost



Photograph: Julia Wells.

my slide rule (I still have mine! – Ed.) and I doubt that I would even consider starting a new project without the aid of a calculator as a design tool.

New electronic manufacturing processes have been invented and, like the motor car, cannot be un-invented. It really is a case of waiting to see just how popular these new processes become in the world of model engineering.

As far as I can recall nobody seems to have mentioned welding. Where does the modern lightweight CO2 welding plant fit into the model engineering world?

When considering a new project it is always worth looking at previous efforts and the commercial kits. In viewing these I was surprised at just how flimsy some of these seem to be and of course there was the high cost. A set of good quality kit castings is an excellent route to producing a workable model but, at the end of the day, it is still somebody else's design.

My own early design philosophy was to familiarise myself with basic principles and scratch around for scrap materials. Doing this has allowed me, mostly with hand tools, to produce several of the bespoke projects published in past issues of *Model Engineer*.

Without any significant direct contact with CNC

machining I can only offer a comment. Not having gone beyond single and twin cylinder design I got great pleasure from steadily machining one or two items from formerly scrapped materials. If I was considering say a seven or even fourteen cylinder radial engine though it would be a considerable temptation to set up some form of CNC to cope with the large number of similar parts to be machined, possibly assuming these to be machined from solid.

The Jeremy Buck comment about having a frame laser cut rather than laboriously hand cut isn't to be denigrated. This is almost in the same category as having a casting produced by a foundry. Nothing detracts from the interest, commitment, skill and effort in assembling the produced items.

Perhaps I can leave my final word on this subject to Mike Burt who organises the model engineering evening class at Meridian School, Hertford. Mentioning to him that I'd originally had misgivings about submitting the recently published 'Tiki' article, Mike endeared himself to me by commenting "Model Engineering is making things".

Very true but everybody seems to be using computers these days.



Everybody seems to be using computers these days.



Pressure Gauges

Dear Martin, I found Stewart Hart's recycling of a pressure gauge (*M.E.4591*, 20th July) quite interesting and, since I have a similar redundant gauge with damaged internals, I might do the same. However, I would like to point out to him that gauges with parallel threads on the stem should not be sealed with PTFE tape. Parallel threads are sealed using a flat washer on the bottom of the gauge stem against the flat-bottomed socket used for the gauge. Similarly, I would advise any gauge users that gauges are precision instruments and should not be dropped or tightened into their mounting socket by gripping the case - always use a spanner on the square or hexagon at the top of the stem to tighten the gauge into its mounting socket. The sealing washers can be bought from gauge manufacturers or even made from a small offcut of thick gasket. Thick gasket is preferred so that there is some 'give' in it to allow the gauge to be tightened sufficiently to make a leak-tight joint yet orientate the gauge so that the face is visible. Sometimes it may be necessary to use more than one washer to get the gauge orientation correct.

Some smaller gauges, particularly small back-entry gauges, do have tapered threads and these should be sealed with PTFE tape into tapered sockets. Such gauges are typically used on pressure regulators for compressed air supplies and on gas cylinder regulators.

Yours sincerely,
Graham Astbury

Steam Turbines

Dear Martin, I was intrigued by the reference to the 'apparent' French measurements of work around 1820 in Mike Tilby's informative article on Steam Turbines in *M.E.4592*. I guess the reference is to Sadi Carnot who proposed his well-known

thermal/work cycle at this time, though the importance of this was not recognized until taken up by Prescott Joule and William Thomson (later Lord Kelvin) from the 1840s onwards. It was Joule who firmly established the equivalence of heat and work, among other ways by measuring the difference in water temperature between the top and bottom of a waterfall. Kelvin was instrumental in laying the foundations of the Laws of Thermodynamics (along with the German scientist Rudolf Clausius).

Though born in Belfast Thomson lived most of his life in Scotland. The SI unit of temperature is named after him. Equally justly the unit of work is named after Joule but despite his French sounding surname he was a Lancastrian, born in Salford, from a brewing family. In the 19th century the development of thermodynamics as a science became focussed in the UK and the French connection slipped away.

Yours sincerely,
Dr Mike Gray (Louth, Lincs.)

Engineering Projections

Dear Martin, I very much doubt if I would meet the standards expected by Tony Reeve from model engineers (*Postbag, M.E.4592*, 3rd August), most of whom do things on a limited budget or limited space and possibly limited experience.

I think it would be a shame if you demand that all magazine contributions must be to Mr Reeve's very high standards. I would fail and so would some others, so the end result could be very few articles getting to the editor. This could mean the magazine ends up as very elitist and only prints perfection in drawing quality. It could also mean the engineering projects end up as perfect as the drawings, so people with lesser skills and equipment will not be good enough. Using a file and a hacksaw instead of a milling

machine would not be good enough.

I do not think this would do much good to the magazine circulation figures; remember that model engineering was never as highly followed as football, tennis or golf. If it became as highly professional as Mr Reeve would prefer it to be, I think you would hasten the demise of a wonderful magazine and end a lifetime hobby for lesser mortals like me. I would have to hang my head in shame because I was not good enough to do anything. The next step would be to sell the lathe and complete workshop, then take up knitting, provided no-one ever saw any of it!

Martin Ranson

The editor replies: Don't worry - we don't expect contributors to be expert draughtsmen. Most of the drawings we receive are redrafted before publication. This is mainly to ensure a uniform style and presentation but it also allows us to accept any kind of drawing, from a pencil sketch up to Rolls Royce standards! This is after all a hobby and not everyone has a formal engineering background so professional draughting standards are not generally to be expected. *Martin*

Electrical Connections

Dear Martin, I would suggest that David Hockin blames the manufacturer of the item with rusted crimp terminations. They have obviously not specified the correct material/finish for their application or have used the cheapest that they can find. Few terminals are made from steel unless subject to high temperature use i.e. heating elements. The raw material can be unplated, plated or tinned. If necessary they are plated after stamping, be it with tin, silver gold or whatever is appropriate to their end use.

Regards, Dick Pool

Write to us

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Roger Holland at the start of his run.



Steve Eaton at the regulator just out of the tunnel.

Stephen Harrison reports from this year's IMLEC, held at the Birmingham club.



50th IMLEC PART 1

This year was a special year for the IMLEC competition as it was the 50th IMLEC. The first ever IMLEC was held at the Birmingham Society of Model Engineers at Illshaw Heath back in 1969 and it seemed only fitting to return the event back to the place where it all started all those years ago.

The society has also been host to the competition in 1987 as well as being host to the SuperLEC competition in 1998 to mark the centenary of *Model Engineer* and also the 30th IMLEC.

The competition was held on the 6th-8th July with 25 applicants accepted to enter the competition from up and down the country. The weather for the event was impeccable with soaring temperatures and sunny skies being the order over the whole weekend. Unfortunately, just prior to the event, three of the competitors had to withdraw which left 22 runs.

Unlike previous events held at the Birmingham SME, the decision was made to run the competition in reverse direction to normal running to make things a little interesting; although it meant a slight

downhill gradient to start it was soon onto a relatively sharp right-hand bend and then onto a uphill gradient along the back straight until entering the tunnel where it levelled off to a slight downhill gradient back through the station. The normal track speed limit was also increased from the 6 mph to 8 mph for the event.

Before we start on the weekend's events, on behalf of the Birmingham SME I would like to say a big thank you to the Leyland SME for the loan of their dynamometer car and the Bromsgrove SME for the loan of a passenger car (although unfortunately it could not be used due to clearance issues around the track) and their track cleaner (aptly named *K9* by club members) for the sterling job it did of cleaning the track at the end of each day to keep the track as clean as possible.

I would also like to thank all of the members of the Birmingham SME who helped make the event happen and allow it to run as smoothly as it did. We must also not forget the kitchen staff, who were on hand all weekend with breakfast bacon rolls, teas and coffees and for producing

a lovely spread of food especially with the Saturday evening meal.

Friday's running

Run 1

First up was Roger Holland from Chesterfield & District MES with his 5 inch Gresley A4 Pacific *Wild Swan* (**photo 1**). Roger has had mixed results in past IMLEC's that he has entered with the locomotive but this year he did not disappoint and, after getting off with a slightly slippery start, put in a nice steady run hauling 16 passengers. He achieved an efficiency of 1.027%.

Run 2

Next up was Steve Eaton from Chesterfield & District MES with his 3½ inch LNER V4 *Bantam Cock* (**photo 2**). Steve is a well-versed competitor and has won best 3½ inch three times and has won IMLEC three times with other 5 inch locomotives in the past. Taking a load of eight passengers, Steve had some wheel slippage at the start of his run whilst accelerating but, once underway, got the load going well. He produced good consistent lap times throughout the run and the



John Cottam with his 3 1/2 inch Britannia.



Judith Bellamy appearing out of the tunnel.



Roger Hopkins with his 5 inch Jubilee Trafalgar.

locomotive was running like a sewing machine! He completed 15 laps in the 30 minute time window with an average speed of 6.032 mph and a 159,720 ft-lb work done figure and all done with just 0.6875lb of coal, giving him an efficiency of 2.059%. This put a massive lead onto the score board which would remain at the top until Sunday's runs.

Run 3

John Cottam from Chesterfield & District MES was next to run, flying the flag again for the 3 1/2 inch gauge locomotives with his BR Britannia *Firth of Forth* (photo 3). Unfortunately, on John's initial run he suffered a derailment just after leaving the station part-way on the bend due to a binding coupling linkage between the tender

and dynamometer car. The issue could not be resolved quickly and the decision was made to abandon the run and allow a re-run later in the day once the coupling issue could be resolved. On his second attempt John got off to a good start. However, 12 minutes into his run he had to stop due to a lack of steam pressure. Pressure was regained but shortly afterwards he stopped again. After a total stoppage time of 7:52 minutes he was able to get the locomotive back underway and complete one more lap giving him an efficiency of 0.564%.

Run 4

Judith Bellamy from Leeds MES was driving her BR 9F *Brayton Star* (photo 4) which was part built by Arthur Bellamy



David Shephard mid-way through his run with his Polly 5.

and completed by David Mayall to the Doug Hewson design. With a load of 11 passengers, Judith got off to a slow steady start but after a couple of laps had to stop to raise steam. She managed to recover things and continued for a few more laps before stopping a second time, yet this time was unable to recover the fire so unfortunately had to retire.

Run 5

This run was the first ever IMLEC for driver Roger Hopkins from Nottingham SMEE with his 5 inch Jubilee *Trafalgar* (photo 5), despite being involved in model engineering for the best part of 40 years. The locomotive is a Silver Crest Models Jubilee locomotive with a few modifications made by Roger.

With a load of 11 passengers and only 34 seconds of stoppage time, he managed to complete 12 laps whilst burning 2.793lbs of coal, resulting in a final efficiency of 0.531%.

Run 6

The final run of the day was David Shephard from the Bracknell Railway Society with his Polly 5 locomotive (photo 6) which has proved to be a reliable locomotive during passenger hauling service. David got off to a good start pulling six passengers round for 14 laps in 30:07 minutes with good consistent lap times, producing a work done figure of 152,722 ft-lb with 1.419lb of coal burnt, giving him an efficiency of 0.954%.

● To be continued.

ME Vertical Boiler - Constructing the Boiler

PART 12

A project aimed at beginners wishing to develop their skills or those requiring a robust vertical boiler for the running or testing of small steam engines. **Martin Gearing** drills the tubeplates and offers a tip for ensuring good solder penetration.



Drilling the tubeplates

May I repeat that all the drilling and tapping operations required in the materials specified will be made a great deal easier if original green Swarfega is used as a lubricant, with the benefit that unlike some cutting lubricants it doesn't compromise any silver soldering to be done later.

The method I have chosen for drilling the tubeplates has the benefit of saving the fag of marking out what is a fairly difficult shape to deal with whilst guaranteeing accurate results on two separate components quickly. Also, for a successful silver soldered joint to be achieved, there needs to be a 0.1mm (ideally) radial gap between the firetube and tubeplate meaning a hole that is 0.2mm larger than the firetube. Coincidentally, standard drills when used on copper generally cut about 0.15 to 0.2mm oversize which works to our advantage if using standard drills. Drilling copper can also

present problems with the drill grabbing on a drilling machine if the work is not held securely. The normal fix for this is to flatten off the cutting edges of the drill with a small stone.

Frankly, if I have a drill that cuts well, the last thing I really want to do is to make it blunt for one job on copper before having to re-sharpen 10 minutes later before I can use it for other materials. Using the following setup on a milling machine rather than a pillar drill, I can use standard drills without any issues as the feed into the work is always under control, particularly if the feed is by means of raising the table on the Z axis.

Setting up the dividing device

Set a rotary table (or dividing head with the spindle set vertical) with the device spindle centre in line with the milling machine spindle. Clamp the X and Y axis slides and zero the feed dials. Zero the graduations on the angular scale of the rotary table. Clamp the dividing device spindle/table.

Securing the work to the rotary table so that it runs concentrically can be achieved in a variety of ways. The easiest method is to use a three-jaw chuck, if it will open out sufficiently to accommodate the flanged disc, and a disc of scrap wood between the disc and the chuck body. This chuck should be checked that it runs true with the rotary table axis after securing it to the table.

Failing that, the disc, with a piece of scrap wood between it and the rotary table, can be clamped directly to the rotary

table, after setting the disc to run true. Make sure the clamps do not either.

- Damage the flange, by over tightening, or
- Hang too far into the depression bounded by the flange, with a chance of getting in the way of the drilling.

Figure 28 shows the drilling process divided into three stages. Each stage is accompanied with tables of coordinates and drill sizes. The first disc, which will become the lower/firebox tube plate, is subjected to stage one and stage two. The second disc, which will become the upper/smoke box tube plate, is subjected to all three stages.

Firebox tubeplate

STAGE ONE

- Central small firetube hole x 1

Op. 1: Centre drill in the centre (zero X), drill $\frac{5}{16}$ inch diameter (7.92mm) or 8mm diameter.

- Ring of 6 small firetube holes

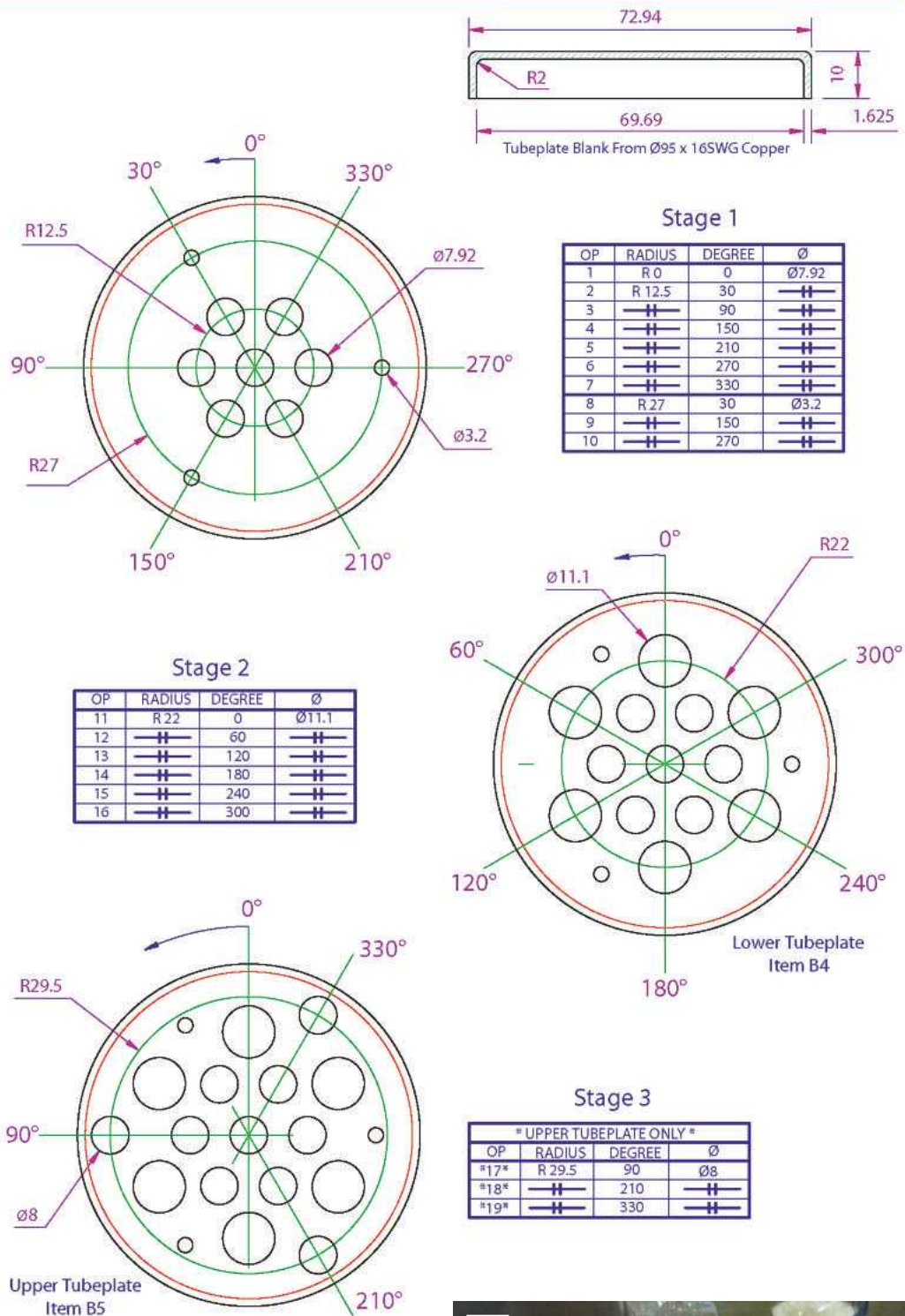
Op. 2 – 7: Move mill table on the X axis to 12.5mm and clamp the table. Centre drill at the six specified angular locations, making sure the rotary table is clamped after each movement. Leave the table clamped at Op. 7. Drill $\frac{5}{16}$ inch diameter (7.92mm) or 8mm diameter at Op. 7, going on round to Op. 2 and continuing through to Op. 6. This ensures that the rotary table feed mechanism is always working in the same direction (**photo 60**).



Inner Firetube holes drilled.

Continued from p325
M.E. 4593, 17 August 2018

Fig 28



• Stay holes x 3

Op. 8 – 10: Move mill table on the X axis on to 27mm and clamp the table. Centre drill at the three specified angular locations, making sure the rotary table is clamped after each movement. Leave the table clamped at Op. 10. Drill

3.2mm diameter at Op. 10, going on round to Op. 8 and continuing on to Op. 9 (photo 61).

STAGE TWO

- Outer ring of 6 large firetube holes

Drilling for stays.



Op. 11 – 16: Move mill table on the X axis on to 22mm and clamp the table. Centre drill at the six specified angular locations, making sure the rotary table is clamped after each movement. Leave the table clamped at Op. 16. Drill $\frac{7}{16}$ inch diameter (11.1mm) at Op. 16, going on round to Op. 11 and continuing through to Op. 15. This produces a completed firebox tubeplate (photo 62).

Remove, deburr and chamfer all holes on both sides. Check fit of tubes and if tight ease carefully with a round file. Put to one side.

Smokeybox tubeplate

All the operations described previously for *STAGE ONE* and *STAGE TWO* need to be repeated on the second flanged tubeplate blank in addition to:

STAGE THREE

- Ring of 3 flanged bush holes

Op. 17 – 19: Move mill table on the X axis on to 29.5mm and clamp the table. Centre drill at the three specified angular locations, making sure the rotary table is clamped after each movement. Leave the table clamped at Op. 19. Drill 8mm diameter at Op. 19, going on round to Op. 17 and continuing on to Op. 18. This produces a completed smokeybox tubeplate (photo 63).



Completed firebox tubeplate.



Completed smokeybox tubeplate with additional bush drillings.



Holes after filing three nicks.



Internal threading.

Remove, deburr and chamfer all holes on both sides. Check fit of tubes and if tight ease carefully with a round file.

'NICKING' HOLES IN TUBEPLATE

To ensure that a fillet of silver solder forms on both sides of the tubeplate, bearing in mind the solder is only applied on one side, it helps if three nicks at 120 degree intervals around all the holes are filed 0.1mm

deep using a medium cut triangular needle file (photo 64 and fig 29). This may seem tedious but the results more than justify the effort. Put to one side.

Flanged bushes – Item B6

$\frac{3}{8}$ inch diameter PB102 (fig 30) Hold a length of 10mm or $\frac{3}{8}$ inch diameter PB102 phosphor bronze rod in a self-centring or collet chuck with 20mm protruding. Face

off. Centre drill, drill 5.6mm diameter x 10mm deep. Tap $\frac{1}{4}$ x 32 ME, finishing with a plug tap (photo 65) to ensure that there is at least 7.5mm of full thread ($9\frac{1}{2}$ turns).

Machine the 8mm diameter +0.00-0.1 x 4mm section and break the sharp corner on the end with a small chamfer (photo 66).

Part off 7.5mm long. Put to one side. Repeat a further two times.

Fig 29

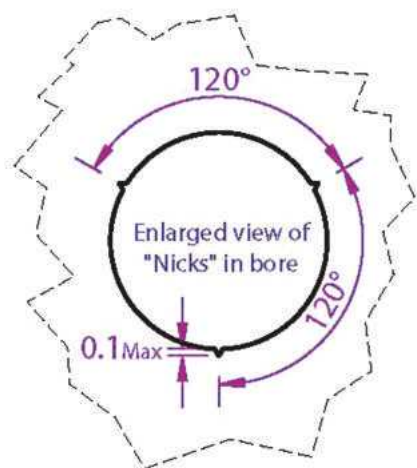
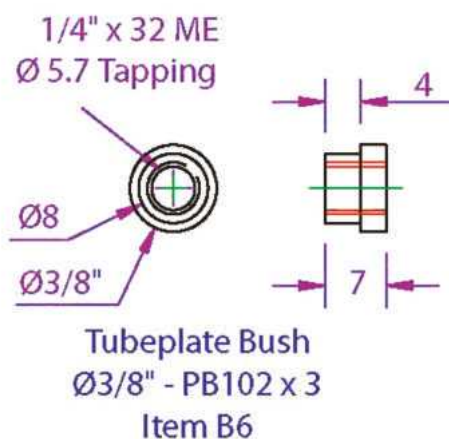


Fig 30



Hold the bush on the 8mm diameter section, pushing the flange against the jaws as you tighten the chuck. Face off the flange to 3mm thickness. If the saddle is clamped after getting the flange dimension correct on the first one, it is only a case of bringing the tool clear (using the cross slide) and exchanging a faced off bush for the next one and facing off **slowly** at the same setting. This will make all the flange thicknesses the same. Put to one side.

Outside threaded bushes – Item B7

$\frac{3}{8}$ inch diameter PB102 (fig 31) Hold a length of 10mm or $\frac{3}{8}$ inch diameter PB102 phosphor bronze rod in a self-centring chuck or collet with 20mm protruding. Face off. Centre drill, drill 5.6mm diameter x 12mm deep. Tap $\frac{1}{4}$ x 32 ME, finishing with a plug tap to ensure that there is at least 9.5mm of full thread (12 turns).

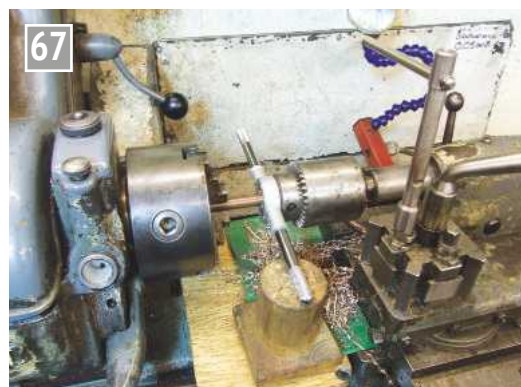
On the 9.53mm outer diameter, thread for a length of 4mm, $\frac{3}{8}$ x 32 ME - you should get five full turns of thread (photo 67).



Turning flanged bush.

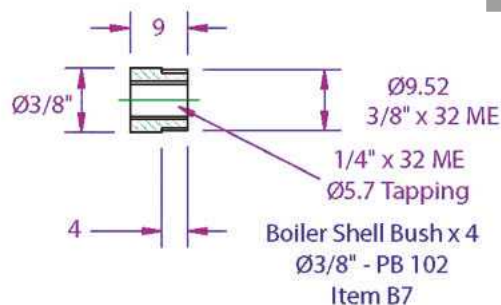
Part off 9.5mm long. Repeat a further three times.

The most reliable method of bringing an item such as this to length is to run 8mm of $\frac{1}{4}$ x 32 ME thread onto the end of a length of $\frac{1}{4}$ inch diameter stock, which is then repositioned in a self centring or collet chuck with 6mm protruding. Screw the bush, outside threaded end first, onto the threaded stub. Taking **light** cuts, bring the overall length to 9mm and chamfer the faced end 0.5mm x 45 degrees. Repeat for the remaining three bushes. Put to one side.



External threaded bush.

Fig 31



Next time we will make the stays and stay nuts.

●To be continued.

ISSUE NEXT ISSUE NEXT ISSUE NEXT ISSUE NEXT ISSUE NEXT ISSUE NEXT ISSUE NEXT ISSUE

● We Cross the Solent

John Arrowsmith visits the Isle of Wight Model Engineering Society.

● IMLEC Day Two

Stephen Harrison reports on the locomotive efficiency competition runs from day two.

● Engineer's Day Out

Roger Backhouse takes a ride on the Manx Electric Railway.

● Superheaters

Martin Johnson considers the effect of superheaters on boiler performance.

● Garden Railway

Martin Evans describes the signals he built for his garden railway.

Content may be subject to change.



ON SALE 14 SEPTEMBER 2018

Building Signals for 5 inch Gauge PART 1

Doug Hewson adds realistic detail to the running lines.



I thought I would write about some of the GWR Signals (and others) I have built in 5 inch gauge for our railway but I will begin with a bit of background as it is important that you know where to put the signals and what they all mean. We have named all of our Stations, Signal Boxes and Junctions on our railway so we each know what we are talking about when it comes to discussing anything on the Railway. If anyone mentions a problem with the Down Starter at Chinley Junction, everyone knows immediately where it is. The railway is all 5 inch gauge and is divided into four different regions; each region has its own signals but mainly so that everyone's locomotive is 'at home' somewhere on the railway. Each region also has its own goods yard.

Also, I wanted to build the signals, lever frames (yes two of them - one has 40 levers and the other has 48 levers) and generally all the Signal and Telegraph (S&T) equipment. We also have block bells between the two



The 48 lever box at Belle Isle.

and the telephones, of course. There are also telephones at other strategic places on the railway, particularly in each of the four yards. **Photograph 1** shows the 48 lever box at Belle Isle where there are three different routes, all converging, and a triangular junction. This was my home until I had my stroke. **Photograph 2** shows the detector instruments in the box, which I will talk about

later, and **photo 3** shows one of the detector boxes in position. **Photograph 4** shows one of the detectors in the making and **photo 5** shows four completed units.

The signals I am going to describe in this article are all at Coton Hill Goods Junction and, therefore, are all GWR lower quadrant which means that they all rotate downwards to show 'Clear'. This was named



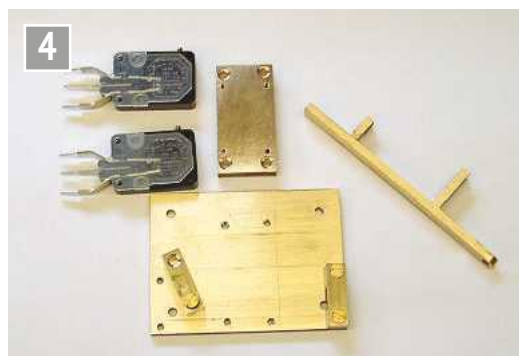
The detector instruments.



A detector box in position.

after Shrewsbury, of course, as that is what the layout of the lines represents. There is the Main Line which runs through it (Crewe to Euston) and then there is the end of Coton Hill Yard where we have the Goods Avoiding Line and the goods loop which comes in from the left (the line to Gobowen etc.) In Coton Hill Yard there is a fan of exchange sidings and there and a water column at each end of the yard so trains can pick up water when travelling in either direction. As the pointwork cannot be seen from either signal box I have fitted the two points with detectors so that you can see which way the pointwork is set. It is very reassuring, when you pull a point lever, to hear the detector go 'Tink'. They are very sensitive and will show 'Wrong' if there is the smallest twig dropped in the blades.

Photographs 6 and 7 show the business end of the signal from both the front and the rear.



One of the detectors' component parts.

When the signal or point is pulled it is said to be 'reversed' - but what we normally call 'pulled off' - and when it is put back in the frame it is said to be 'Normal'. All of our signals are electrically interlocked and the 'Normal' or 'Off' theme runs all though the interlocking tables, which I will not bother you with at the moment, although **photo 8** shows the wiring under the frame for Belle Isle Signal Box in the making. Having said that, there is only one wire going to each signal so it is not half as bad

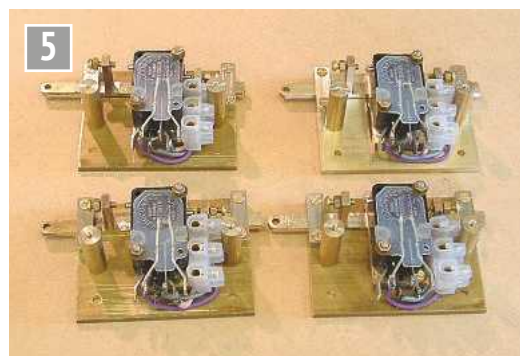
as you might think, although I can assure you it is all very essential. Also, it is important to know that all the signals approaching the signal box are called 'Home Signals' and all the signals after the 'box' are called 'Starters'. There are also Starters and advanced Starters and inner Homes and outer Homes to differentiate whether there are one or two of them.

The post and gantry

The first signal is a combination of two signals, one for the avoiding line and

one for the Goods Loop. It was really made as a bracket so that I could hang it over a gap in the line.

It also had to be positioned there so that a reasonably sized engine with a driving truck behind it had room to take water and still be behind the signal. The main post is made from 7/8 inch x 18 swg brass tube, about 16 inches high and I cut four slots in it to fit the four stiffeners to mount it on the base (**photo 9**). The base was made from a piece of brass plate 2 1/2 inches square.



The finished set of assembled detectors.



The signal from the front.



Looking at the rear of the signal.



Making the wiring under the frame for Belle Isle Signal Box.



Four slots to accommodate the four stiffeners.

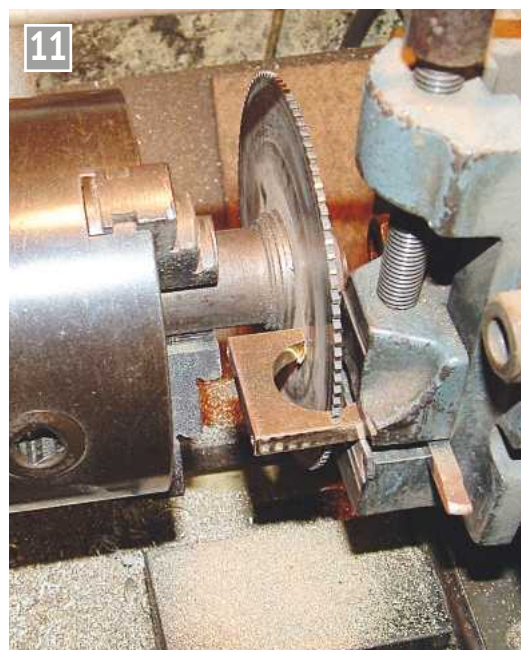
This was silver soldered onto the base. For the little gantry I used $\frac{1}{4}$ inch brass angle so I cut four pieces $9\frac{3}{4}$ inches long and then cut the verticals out of the same material at $1\frac{5}{16}$ inch long. They were not drilled on the centre line but at the 'Standard Back Mark' for a $\frac{1}{4}$ inch angle. These are the standard structural dimensions which must be adhered to for bolting on such things as gusset plates and other angles etc. In our case this is $\frac{5}{32}$ inch from the back of the angle and then the holes end up on the centreline of the inside of the angle where they should not present a problem when getting 10BA nuts in there.

Photographs 10, 11 and 12 show the sequence of producing the clamps for the post to the gantry. **Photograph 13** shows the other signal in the group; this was obviously made at the same time having all the standard fittings for a GWR signal.

I then needed a couple of pieces of 20 swg brass, 2 inches wide, $1\frac{5}{16}$ inch deep plate to form the two ends of the gantry. There are also four bracings which can be cut from 20 swg x $\frac{5}{32}$ inch strip. In the middle of this structure there is some machining to do to make

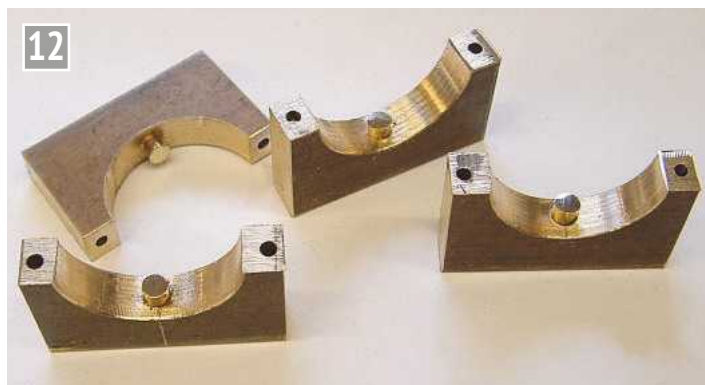


Making the post clamps.



Slitting the parts in two.

all the clamps for the main post and the two dolls. These were all made from $1 \times \frac{1}{4}$ inch brass bar. They need boring out for these six half clamps. Whilst I was at it though, I also used the smaller clamps as patterns to make some casings from white metal. The through bolts for them all were made from some lovely nickel silver wire, of which I happen to keep a stock. It is 0.065 inch in diameter which is perfect for threading 10BA, of course. **Photograph 14** shows the first stage in building

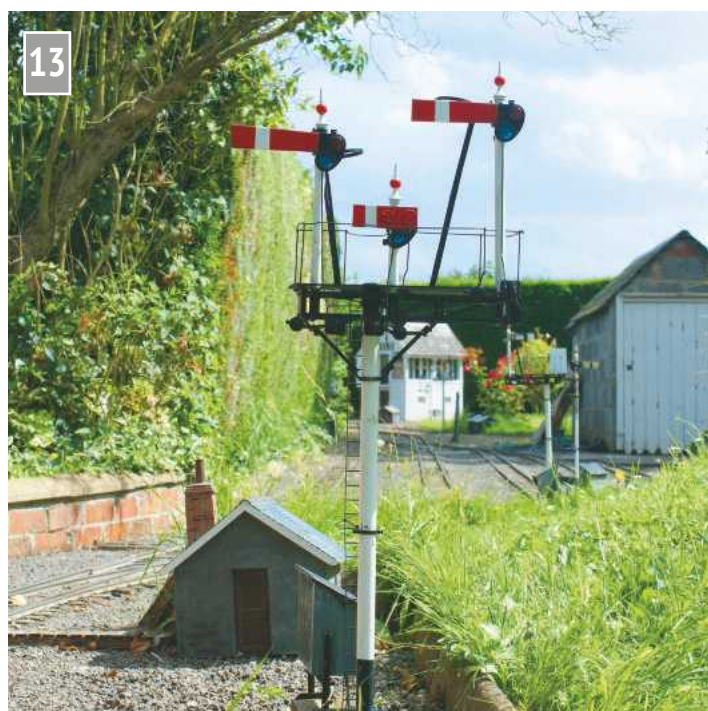


The finished clamps.

up the gantry and **photos 15, 16, 17 and 18** show the building up of the rest of the three-doll gantry which signals the way into the yard.

The other thing you need to do is to make a cap for the top of the main post. This can be turned from a piece of 1 inch diameter brass bar (**photo 19**); turn it to the shape shown on the drawing, bore it out to $\frac{7}{8}$ inch diameter and fix it on with

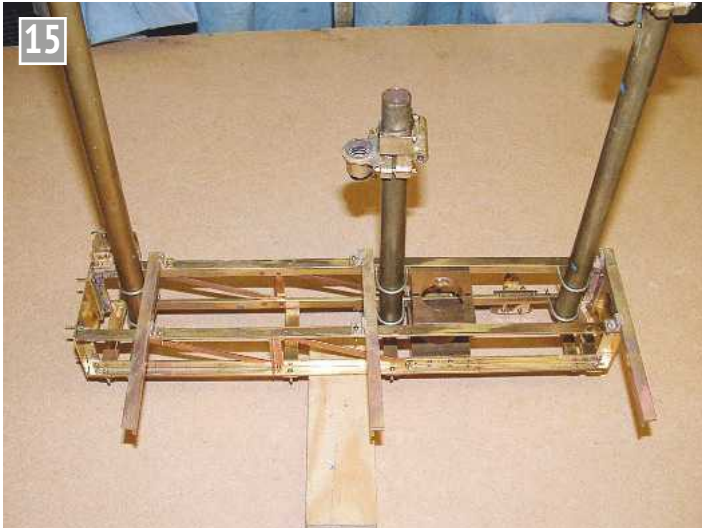
a 10BA bolt straight through. You can use some $\frac{1}{16}$ inch diameter brazing rod for the clamps but that of course is very slightly undersized. Some of the rodding needs making into U-bolts for clamping the dolls to the framing. The dolls need clamping to both the upper and lower stringers (if you hadn't worked that out already). There was one more little thing to do as well and



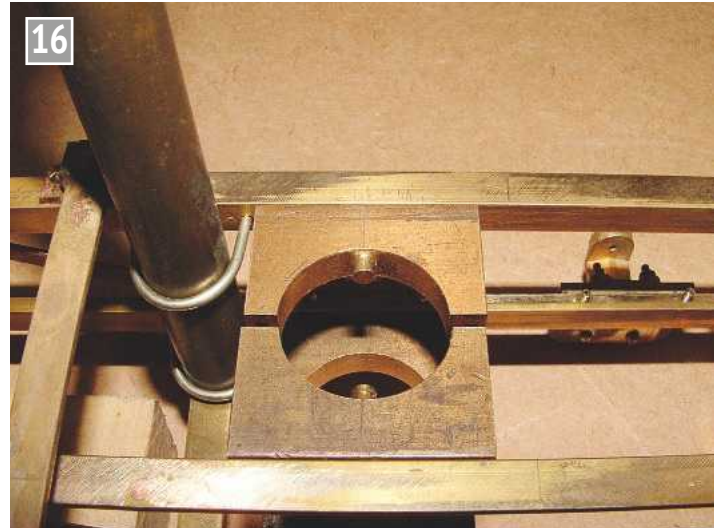
The other signal was made at the same time.



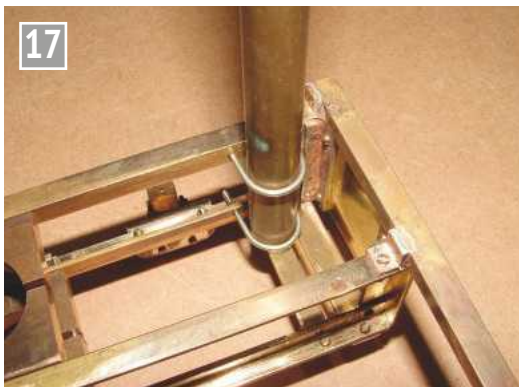
Building up the gantry – the first stage.



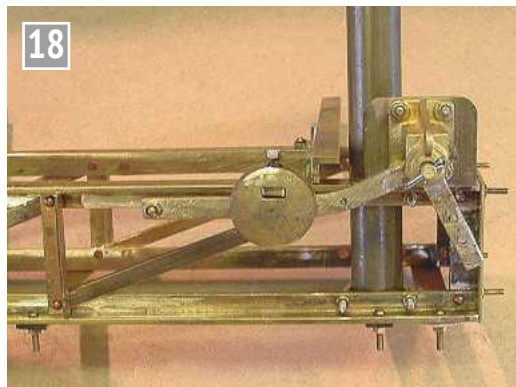
Further additions to the gantry.



The location of the signal post.



U-bolts.



The balance lever.



Making the cap for the post.

that was to insert a couple of $\frac{1}{8}$ inch pegs into the clamps for the post to prevent the whole gantry from sliding down the post. You can see one of them inside the clamp in photo 16. Also, as a belt and braces exercise, I bolted a piece of $\frac{1}{4}$ x $\frac{1}{16}$ inch flat bar across the bottoms of all the dolls.

The next thing that you need is a brace on the post to support the gantry. The

ones on the GWR signals are a tee section with the 'stalk' of the tee uppermost so I made mine by silver soldering the two pieces together (photo 20). You then need a couple of pieces of $\frac{3}{8}$ inch x 16 swg flat bar cut to the correct angles to form the brace. I also made some lost wax castings for the semi-circular pipe clamps, so you then need to silver solder one of those

onto the tee piece. The other end just requires a piece of flat bar across it to align with the bottom stringers. You can quite easily silver solder the clamps on by propping them up on a fire brick (photo 21).

For the two dolls you need a couple of lengths of $\frac{1}{2}$ inch x 18 swg brass tube; one needs cutting to $4\frac{7}{16}$ inches long and the other one 10 $\frac{3}{16}$ inches long. These can be clamped on to

the gantry or, if not, finish them off first with all their finials, arms and any other bits which need to go on there.

Speaking of the finials, they are provided as lost wax castings although I haven't made them hollow as they should be, so when you have painted them red you can paint the black crescent shapes on them afterwards.

●To be continued.



The set-up for silver soldering.



The flatbar propped up.

The Restorer PART 2

In the first of an occasional series, **Mitch Barnes**



brings a forgotten and neglected model back to life for future generations to enjoy. Restored six years ago and now a century old, this is its story.

Continued from p.253
M.E. 4592, 3 August 2018

I have a set procedure for restoring model engines. Following this to the letter, I gingerly started dismantling the engine and, as I always do, methodically placed all the parts in clearly labelled resealable bags with all their fixings, all of which I would keep together in a single (where possible) clearly labelled box. If it's more than one box, they are labelled as such and always, without fail, kept together. But why am I so fussy about this? Because while doing the odd restoration over the years, I have been constantly reminded how easy it is to unintentionally allow parts to be separated, never to unite again and I have seen so many models where bits have evidently once been there, that now are not... You have to make a conscientious effort to make sure that the parts are reunited at every opportunity or some of them will go astray and invite disaster! Also, by the time reassembly would begin I'd probably have forgotten where individual fixings went.

Careful to avoid this, over the next few months I would take certain bits with me to work, so that I could restore the model as and when appropriate

facilities were available to me. This was because I was rather busy with other things in life. I was trying to buy my own house after decades of renting hell and, as a freelance modelmaker *sans* workshop, you just have to make the most of what you have available to you, when you have the chance.

I also wanted to make sure that as much of the original model, including all the fixings, would go back where they had been ever since the model was built. This is very important if the artefact is to retain its originality and authenticity.

Part of this thoroughness also applies to retaining the patina of age; I hate seeing an old model or object buffed up to 'as new' appearance, usually mechanically, which removes the sharp or precise edges so carefully created by the original craftsman. Buffing on a wheel does not constitute restoration; it merely removes patina and fine finishes along with value as far as the collector is concerned. Unfortunately, some of the edges of this model had been so treated long ago; you can see them on the steam chest edges. Once metal has been

removed, that's it I'm afraid, the only solution is to have an initial visual impact that draws the attention away from these aesthetic *faux pas* and hope that most viewers won't notice (photo 5).

If the object has always been kept pristine (as per exhibits in the London Science Museum or Birmingham's ThinkTank for instance) it will still gain a certain patina over time. That patina is part of the object's history and experience and it helps define the artefact's age, character and dignity. By all means clean it up but don't erase its experience, its history. I'm not talking about dirt and corrosion here. Any serious collector of any genre will tell you that an antique artefact is a witness to history; that history and age is why people value original artefacts over identical reproductions. I realise that I could take this philosophical proposition further and say: "Why restore at all – surely its degradation is also part of its history?" but then I don't want to see any artefact rot to nothing. To allow further degradation is to regard it with such disdain that the keeper of the object (we are guardians of these things - they should outlive us) doesn't deserve in my opinion, to own it.

I know that this is a huge philosophical issue which could generate reams of correspondence but all I am asking is for the restorer to have some respect for the artefact they are working on and to return it to the way the original builder left it or would have wanted it to be, which is why it exists at all. Without his or her original dream and desire it would never have existed in the first place.

When separating the rear standard from the boxbed/soleplate and from the



Missing screws, overzealous mechanical polishing, dented cladding and coats of two different coloured paints; all in a day's work for the restorer - and a third colour existed under all this!



T. K. Tilston's little maker's plate revealed more than his name and date.

cylinder assembly I found that there were vestiges of dark olive green on the joining surfaces. Also visible in some of the photographs is the second colour applied, a lighter olive green, where the later bilious green had bubbled off – the model had evidently been painted before assembly and thankfully, while being ‘restored’ on previous occasions, this hadn’t involved dismantling. The lighter olive green colour residing in corners here and there, when carefully removed, revealed more of the dark olive paint, so I surmised that it had originally been painted dark olive as separate parts before initial assembly and repainted at least twice, the last being the rather throwy bright bilious green mentioned earlier, on top of the lighter olive. It was almost 95 years old by this time, so periodic repaints would not be out of the question, especially as it had been demoted in its life from proudly made Apprentice Piece to lowly toy for TKT’s son to play with, then passed onto his own son, at least one of whom had attempted a ‘restoration’ during the intervening years! Very revealing was that luckily the aforementioned maker’s plate (**photo 6**) appears not to have been removed and under it was dark olive green paint. In fact, that paint had virtually glued the plate in place! Great, now I knew exactly what the original colour scheme was!

I rather liked the dark olive colour, in fact the next place I worked had a supply of old cellulose paints and I was told I was welcome to use whatever I liked to mix some up as a ‘colour-matching exercise’. I’d only need a couple of hundred ccs of it anyway. I really appreciated this kind gesture from an employer who also rather liked the look of the model. We wondered if it may have been a colour used on military contracts as the model was completed during WW1.

Having matched the colours, the various parts were left in a bath of cellulose thinners for a day or so. This soon



deals with the old paint but doesn’t remove the patina of age that the artefact has, which is rather nice to retain. Cellulose thinners is also a good degreaser and, even though bronze and brass are hopeless for paint adhesion, degreasing at least gives you a fighting chance of making a good attempt at refinishing. Young Tilston had in fact taken some care with his work; there was evidence of fillers used to create a good paint surface so I made sure that I reproduced this when repainting time arrived. Removing the flywheel paint revealed black in crevices and corners underneath, above a layer of primer, so I decided that this model now really could be returned to its original colours and standard of finish.

Another factor that made this model interesting was that it had sustained a bit of damage somewhere in its chequered history. No doubt all sorts of stories could be invented of being rescued from a blitzed house during WW2 but none of this was forthcoming from the seller. Rather than sell cheaper because of the damage, an unscrupulous dealer would make up such a yarn to bump the price upwards!

What was I to do with these parts that were a hindrance to future running? The crankshaft and the turned front column were both very slightly bent and the engine does not turn over easily. In fact, it barely turns over at all! I had a go at gently straightening the crankshaft in my lathe but

only succeeded in a minor improvement. At this point I felt that because the model will spend the rest of its days in a display case, this outwardly fine but actually untrue part could remain part of the engine’s history for now, until I possess the necessary skills to straighten it out.

The front column was suffering from surface rust but thankfully wasn’t deeply pitted and I managed to remove it easily. Collets and a tailstock centre came to the rescue. Holding the threaded upper end in a collet so as not to crush the thread and the foot end with a live centre in the tailstock, I managed to pretty well straighten it and remove the rust, certainly enough that it no longer looks unsightly. This rust pitting is part of the engine’s history too.

While I was working on this model, the freelance job I was earning my crust with came to an end but fortunately, in this uncertain world, I soon found another project. I moved onto another company, creating props for the 2012 London Olympics opening and closing ceremonies. My brief was the huge baby head opening up as if from the pages of a book and that appeared on the front page of the world’s papers the next day. Following that was the vast *Octopus* (**photo 7**) used in the closing ceremony; when fully extended it was almost the biggest model I have ever worked on.

The No7 suffered from a period of neglect at this point while I worked as part

of a team with seemingly impossible deadlines on that baby head and the *Octopus* to meet. Not helping matters was that we were doing the final assembly of the *Octopus* in a vast car storage park in East London, which seemed to have its own weather system (rain, mainly) and every time those clouds emptied, the whole place flooded to a depth of 2 to 6 inches! The production team christened it ‘Lake Dagenham’. There were about 10 of us involved with this prop and many others too. We all averaged 100+ hours per week for 12 weeks on the trot so the poor No7 lived in its box at home much of the time, together all of the time but still in pieces! During this frantic period, I was also asked if I could produce something for the SMEE stand at the Model Engineer Exhibition at Sandown in November... of course! I always like to show something so I agreed. After all, it was almost finished and there was plenty of time...

The house I was buying fell through at this point so my search started again and the No7 still lived in its box, coming out at lunchtimes where I’d spend 5 minutes or so rubbing down paint or filling here and there to ease my stress. I also decided I needed to unwind a bit at the end of each work day once the Olympics was over, so I’d spend an hour or so on it before going back to my rented home.

Model Engineering is for me a marvellous therapy.

● To be continued.

Real paid work this time! A team effort, posed on ‘Lake Dagenham’, this entirely scratchbuilt vehicle for the 2012 Olympics closing ceremony was the Octopus and it occupied much of my time during the No7 restoration. On cue, the sides burst open allowing a vast inflatable octopus to spread out into the arena, while DJ Fatboy Slim performed on its roof!

The MSRVS Rally 2018

John Arrowsmith visits this joyful, family orientated annual event.



The Model Steam Road Vehicle Society held their annual rally at Tewkesbury in Gloucestershire over the weekend of the 23/24 June and was blessed with glorious weather for this year's event. The rally is held on the grounds of the Tewkesbury Rugby club which is an excellent site for the event; plenty of room for camping and caravans and lots of operating room for the large number of miniature steamers that attended. I visited on Sunday but the public attendance was down due to a certain football match being played in the afternoon. However, that did not stop all the arena events and fun that this rally always enjoys. One feature I must mention was the 'Try your hand at driving a steam traction engine'. This was a resounding success; around a dozen engines were needed in the main arena to cope with the demand! This new aspect of the rally gave both adults and youngsters the chance to drive a variety of engines, under supervision of course. The look on the faces of all these 'would be' engine men and women was a most enjoyable sight to see. The organisers were highly delighted with the response both from the public and the traction engine owners. I can



A 4 inch scale Burrell double crank compound waits for its turn in the parade ring.



The engine and drive system on Paul Nind's 18 foot steam boat which is fitted with both a tiller and a side mounted steering wheel.



This 4 inch scale Garrett Agricultural Engine is owned by Andy Compton.



Sunshine and shadows on Bert Boughton's 4½ inch scale Foden D type steam lorry.



David Smith's well turned out 3 inch scale 6 nhp Burrell Agricultural Engine.



A superb trio of stationary engines sparkle in the sunshine.

see this becoming a regular feature of this event and probably other rallies.

During the day I spoke to many people about their engines and rallying and all, without doubt or exception, were really enjoying themselves. I spoke to one young man who was driving a 4 inch scale Burrell and asked him how old he was. "Eight" he replied and in response to how long had he been driving he said with a large grin on his face "10 years". "That's clever" I said as his responsible driver laughed at his comment. It turned out it was nearer to 3 years but even so he was a very able young man in charge of, for him, a large engine. This to me is one of the reasons why the traction engine world of model engineering always has a better intake of young people than traditional model engineering clubs. Young people are allowed to get involved at a much younger age and it is also partly due to their families being involved as well.

I talked to a number of mums who love their children being involved and getting dirty, as they said it introduces them to a new environment that they would not find anywhere else. It teaches them discipline and respect for other people and introduces an aspect of adult life was that they can be part of whilst still being children. One young lady in particular was driving a 3 inch scale Case with consummate ease but what I didn't know until she showed me that she was also cooking her family's Sunday lunch at the same time. Three good sized baking potatoes were in the smokebox gently cooking away as she drove the engine round the rally site. I bet they tasted good as well!

The rally continued with a number of different activities in the main arena and the lorry pulling, with two Foden Steam lorries double heading, was an unusual combination which provided the miniatures and drivers with a real test of their ability and pulling power.



Les Riley's 4 inch scale McLaren road locomotive.



The 4 inch scale Foster, Morticia, which was awarded the M. J. Engineering trophy.



Brian Marsh with his 4½ inch Foden steam lorry.



This pair of 4½ inch scale Foden Lorries show off their pulling power by towing this loaded lorry around the parade ring.

There was also a good selection of marquees with a wide range of exhibits. The model tent had some good models on display which provided a welcome contrast to all the traction engines on show. One display had a large collection of customised Mamod models, one of which had been refurbished by the owner's eight-year-old daughter. This young lady told me she loves engineering and she knew all about her model and what she had done to repair and finish it off. It was quite an unusual chat with her as she told me how she used the lathe and drilling machines to complete the model. It just reinforced what I previously said, that this branch of model engineering really

does encourage the younger members of society to get involved. You never know but this young lady may turn out to be a fine model engineer, she certainly has good skills for one so young.

Later, on Sunday afternoon a small presentation ceremony took place with three awards being made: the M. J. Engineering trophy was presented by Alan Barsby to Geoff and Sue Organ for their engine, *Morticia*; the Andy Brown Cup went to Graham Swales for his unfinished engine and the Frank and Mary Pocket Shield was presented to Paul Nind for his 18 foot Steam Boat, *Kathleen Ann*.

In concluding my notes, I must mention the small display of stationary engines



A young driver takes Brain Pearce's 6 inch scale McLaren round the outside of the parade ring with a very well behaved dog enjoying the ride!



A pair of Clayton & Shuttleworth engines take a rest.

that always add to the traditional traction engine rallies. This little group were absolutely immaculate - I don't think I have ever seen such a well-presented selection of engines and pumps.

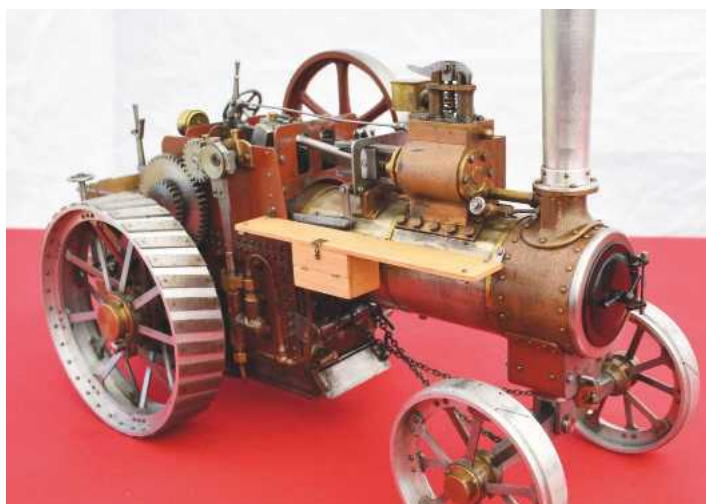
All in all, this was an excellent event which I would think had taken a great deal of work to plan but the end result was a happy, well organised and fun weekend which hopefully will be repeated again next year. If you enjoy miniature traction engines performing to the best of their abilities then this is the show for you.

My thanks to you all - I enjoyed your company and exhibits very much.

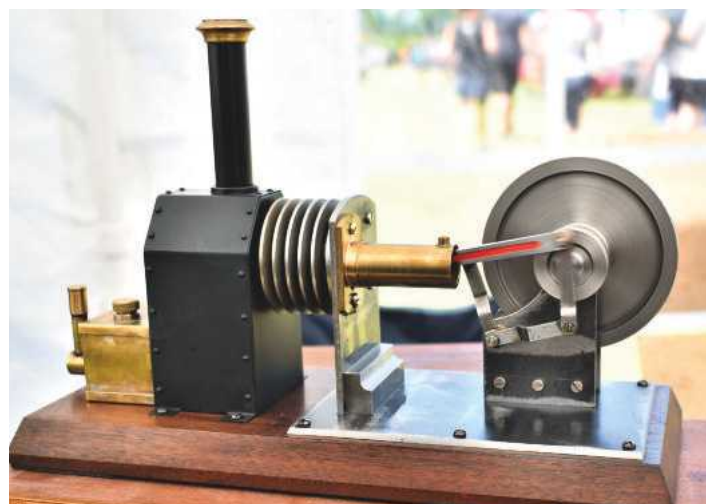


The baking potatoes well protected and cooking in the smoke box of the 3 inch American Case traction engine.

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A nicely made Minnie traction engine on display in the model tent.



This well-made basic hot air engine was working very well.



Kathleen Ann, the steam boat built by Paul Nind.



A good example of a Maxitrak 3 inch scale Aveling & Porter Engine owned by Ian Sparrowhawk.



Having cooked the lunch in the smokebox, Rob Gibbons gives the 3 inch Case a spin round the site.



A regular visitor to the rally is John Bagwell's 2 inch scale Durham and North Yorkshire engine.



The Stroud Society of Model Engineers provided a ground level track Gardner locomotive to give rides to the visitors.



This young lady is going well driving Richard England's 4 1/2 inch Burrell road locomotive.

One Good Turn Deserves Another

Mike Cook finds a way of relieving the tedium of turning painted parts while they dry.



This article arises from a chance thought after reading Chris Vine's Excellent book, *How (Not) To Paint A Locomotive*. In the book Chris describes the benefit of turning parts to prevent paint runs. He describes how he spent two hours turning his boiler barrel on a commercial turnover stand and this produced excellent results. **Photograph 1** shows my alternative to turning by hand. For those that have read Chris Vine's book, or seen his locomotive, *Bongo* at an exhibition, they will know what I mean. For those that wish to see examples of his excellent work, do a search in your favourite search engine and find some great examples of his work. His wonderful series for children, *Peter's Railway* is a good starting point.

I was introduced to this rather addictive hobby via a set of castings for a horizontal Stuart Ten by a friend about five years ago and, not having any engineering background - unless you count an O' Level in Engineering Workshop Theory and Practice ('metalwork' really) - I had no idea how to start. After lots of help, loans of machinery and



My alternative to turning by hand.

encouragement I recall vividly when the completed engine was persuaded to start and I was hooked. Several years on I found I had to learn the art of painting as I made progress with my locomotive, which is a Holmside variant using the Martin Evans design.

Having come to the point where I was ready to paint parts of my locomotive I had read Chris Vine's book to the point of committing aspects of it to memory. (My wife is well used to me moving about the house muttering or not speaking at all as I search for life's hidden meanings. I have noted this peculiar

aspect amongst many model engineers and am curious as to whether this is a result of cutting fluid ingress or just normal for model engineers (NFME)... maybe?)

By chance I was looking at how to utilise some vouchers from a well-known supermarket and in the clearance section (always an eye to a bargain) I noted an electric barbecue rotisserie stand. Could this be utilised to turn over my own boiler barrel cleading? I decided that yes, possibly and committed to investing my vouchers; a package was delivered a few days later.



A holding solution.



The boiler barrel ready for painting.

Health and safety advice

I was lucky to have secured quite a robust piece of kit with a sensible water resistant housing at the electrical end. I was not too keen on spraying paint around electrical housings. Chris Vine warns against the mix of electricity and highly flammable solvents in atomised form. He has managed to stay alive using sensible precautions and I have adopted the same, that is, adequate ventilation and the use of sealed lights and switches of the outdoor type. Using the rotisserie is simple and saves hours of manual turning. Plus, of course, it makes it a one-person process. I have heard stories of partners and friends of model engineers being persuaded to help by turning items on broom handles and the like, sometimes without adequate respiratory protection such as a mask. I am sure though that these are just rumours.

The first stage is to determine the length of any components that will be painted and ensure that the square bar that sits between the 'holder' and the electric housing is long enough. Being a short boiler (Holmside) and having produced the cleading in two parts, mine was fine. You may have to source a longer piece of square. It seems, though, that most model engineers have a 'scrap box' that resembles Mary Poppins' bag - at least according to all the articles that use 'scrap' one sees in



The awkward pieces.

the pages of *Model Engineer*. For many like me without a bottomless scrap box (albeit one is magically developing in my workshop: how does that happen?) sourcing a longer piece of appropriate square bar should not cost a fortune. Mine is 8mm square.

The second job is to dismantle the rotisserie and reassemble using a stout frame. Mine is rather solid, and possibly some would say over engineered but I can vouch for its stability and am less worried about it falling over at any critical point. I am sure that the more experienced engineers will use a much better thought out (engineered) construction.

The next job is to work out a holding solution that enables easy assembly and disassembly. I cut circular discs, albeit quite rough, and drilled four small holes to accommodate the spike attachment as can be seen in



Cylinder cleading had to be painted by hand.



The cleading remained stable set up like this.

photo 2. Two of these discs were sufficient to support the cleading. I drilled four small holes along the edge of the cleading to accommodate small plastic cable ties that could be cut off once the paint had hardened sufficiently. I had thought of wire at first but I assumed that this could scratch the painted surface when removing. Whilst scratches may not have been seen on the final assembly, I did not want to take the risk and had some cable ties anyway.

The next job was to spray paint, having practised on countless cardboard boxes previously. **Photograph 3** shows the unpainted boiler barrel ready for painting. The green item at the bottom of the photograph is a fan heater. No doubt many readers will be familiar with warming items to be painted but, just for those like me that are still learning, this was a piece of advice given to me that certainly works. Several test pieces demonstrate more positive results from warmed items than cold. I hasten to add that my results are still a long way off the likes of Chris Vine's, but they are slowly improving.

The second piece to be painted was more awkward as I had not thought of producing the boiler barrel cleading in one piece. (Note to self for next one.) Two supporting pieces were cut from thin wood and this time wired in place as my cable ties were not long enough. Next, a small piece of round bar was used

to support the wood with two grooves machined into the bar to stop the wire from moving. See **photos 4** and **5** for the set-up. This worked well and the cleading remained stable during spraying. I am sure this could be improved upon, but it worked for me.

Finally, I had painted the cylinder cleading by hand a little while ago and was not happy with the result. I rubbed them down and mounted them on wood and card using the natural spring in the cleading to retain the parts. I managed to get away with this, but only just. It would have been wiser to have fixed these in position with ties as per the larger pieces, despite the smaller size (**photo 6**).

In summary, this is a simple idea that allows me to spend time at the lathe making boiler fittings and other parts while the rotisserie does its job, quietly turning painted parts for a few hours.

Finally, I want to thank all those that have taken the trouble to share their expertise through the pages of *Model Engineer*. The magazine is an excellent resource and I hope my small contribution may be useful to others. After all, one good turn deserves another.

ME

REFERENCE

Vine C 2006 *How (Not) To Paint A Locomotive*. Amadeus Press, Cleckheaton
ISBN 978-0-9553359-0-7

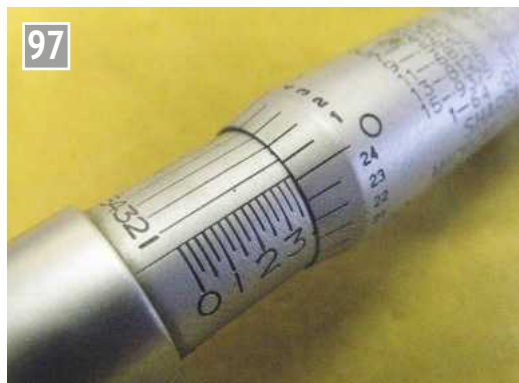
Lathes and more for Beginners

PART 21

Graham Sadler chats briefly about the use of micrometers before going on to make indexing gear for his tool post.



Continued from p.311
M.E. 4593, 17 August 2018



Imperial micrometer 0.0001 resolution.



Depth and inside micrometers are numbered from the left.

Measurement

Up to now we have been using only the digital caliper. These wonderful and versatile devices do have their limitations due to their poor resolution and accuracy. Any measurement with them should always be checked for error as it is so easy to twist them so the measuring faces are at an angle to the work so giving an enlarged reading. Another problem is regulating the pressure one applies to the slider wheel.

The only way to ensure accuracy is to use a micrometer. The ratchet on them ensures equal pressure on the work every time it's used and the round measuring anvils are wider and a lot easier to keep square to the work. My first micrometer was a Shardlow, which had a vernier scale allowing measurement to tenths of a *thou* (thousandths of an inch). This is now rarely used as I prefer the digital micrometer which, like the caliper, can be used for both imperial and metric measurement. It also means that I now don't turn shafts exactly 25 thou too big or small...

Resolution

Resolution is the level to which the instrument will measure and the *accuracy* of the measurement is down to the quality of manufacture. My digital micrometer has a resolution of 0.001mm but an accuracy of plus or minus 0.002mm. Care needs to be exercised with depth and inside micrometers as they are numbered in descending order, the opposite to a normal micrometer. The reason is simple - the direction of rotation is the same in both instruments so the more one screws the thimble in, the deeper the reading (**photo 98**).

A vernier (named after its inventor, Pierre Vernier) takes the form of an additional scale which enables a coarse graduation to be split into smaller units. The additional scale is shorter than the coarse scale, typically by 10% or 1%, but is divided into the same number of graduations. See **photo 99** of my vernier height gauge which has a resolution of 0.02mm (or 0.001 inch on the other scale). The vernier is read by looking

for the graduation on the additional scale (on the left) most closely coincident with a graduation on the coarse scale. The graduation on the additional scale then supplies the extra decimal places. Looking carefully at photo 99 and imagining what happens as one scale moves slowly against the other should make the principle clear.

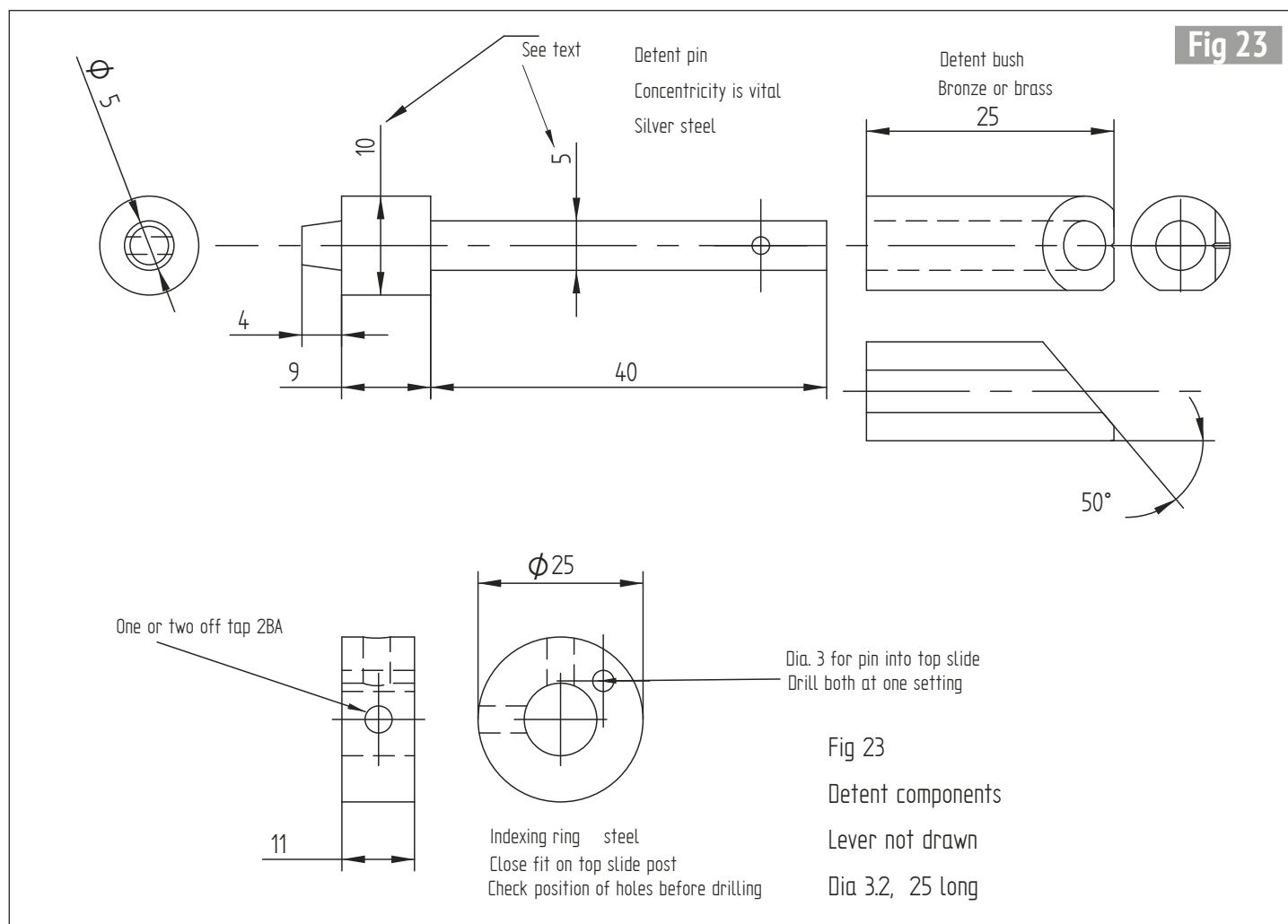
My first vernier caliper, which was used for ten years, had a very short vernier scale, perhaps only 12mm long. It could only be called a 'very near caliper'. The accuracy of a vernier is helped when it is longer. My height gauge vernier scale is 49mm long and it's still not easy to read.

How do you read micrometers?

For the Imperial one, the thread is 40 TPI which has a pitch of 25 thou. The barrel is graduated in numbered 0.1 inch increments (above the graduation line) with 4 sub divisions so it's 25 thou per turn i.e. 0.025 inch per division. To get the *thous*, the thimble which is rotated is divided into 25, so it's



Vernier scale on a height gauge reading 54.36mm (0.02mm resolution).



0.001 inch per division. Some micrometers, like my Shardlow, have a vernier scale enabling measurement to 1 tenth of a thou. i.e. 0.0001 inch. (Working to this tiny size is another matter!).

To get a reading, look firstly at the numbered tenths (on the barrel) (say 4), then how many 25 thou divisions (say 1) and add the reading on the thimble (say 12) giving a measurement of $0.4 + 0.025 + 0.012 = 0.437$. The vernier (if present) can then supply the fourth place. Test yourself with photo 97. You should get 0.3753 inch (the vernier is reading 3 - it must be viewed straight on).

For the metric version, the pitch of the screw is 0.5 mm and the thimble has 50 divisions so it has a resolution of 0.01mm or 0.39 thou. The barrel is numbered in fives, with whole mm divisions above the gauging line and half mm divisions below.

Making the indexing gear

The post will function quite well now but we still cannot have any repeatability after a tool change so we need to make indexing gear to go with it (**fig 23**). For making this, as I had a lot of Imperial silver steel stock, I used $\frac{3}{8}$ inch rather than the 10mm in the drawing, and substituted $\frac{7}{32}$ inch for the detent pin. 5mm will work but 6mm would be better. $\frac{1}{4}$ inch is too big as there's not enough room for the spring. The results will be the same so in here I will be indicating the Imperial dimensions.

My earlier tool post, which from now on will be used only on the top slide, not the more solid replacement block, was reasonably accurate and served me well for 20 years but it was not quite good enough. The block did move a trace, making repeatable setting on tool changing in the order of a maximum error of 0.04mm on diameter. This is the main

reason for making the enlarged block; the extra 5mm on the width and length makes the indexing detent much longer, which I thought was the main reason for the lack of accuracy. I will be giving you two methods of producing the detent; the first is the most accurate but it does take a lot more time and effort. The simpler way is the one I used previously and it worked well.

After producing the block I pushed the $\frac{3}{8}$ inch silver steel material into the reamed hole. While the fit was good, there was wobble. The $\frac{3}{8}$ inch diameter should be 0.375 inch and on measuring it was 0.3748 inch in diameter - just under size and what would be expected. The problem was obviously to do with the reamed hole and the manufacturing tolerance of the H8 category - this if you remember will yield a hole which is a trace oversize but never smaller. I needed a push

fit, which in this size needs a clearance of 0.3 thou. (0.0003 inch clearance).

It was obvious that the hole tolerance was too big. I decided to *lap* a gauge to match the reamed hole then produce the detent pin to the new dimension. After carefully turning a test gauge and lapping it to the required fit, measuring it with the digital micrometer gave me 0.37535 inch. These dimensions are not easy to measure with basic equipment but the same results can be obtained by cut and try methods. This confirms an earlier point I made about making standard hole gauges and now, in addition, matching pin gauges for all my reamer collection. Note this gauge is not really needed by you - I just did it to find out what was happening.

Start by machining the indexing collar which fits on the top slide post. This is a simple turning job. It needs to be a



100
Finished indexing ring showing positions of holes - ensure the pin hole will not hit any of the tapped holes in the top slide. If using the pin, only use one grub screw.

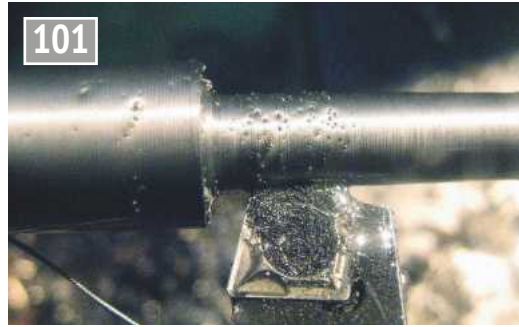
slack fit in the central pocket so go for 24.5mm diameter. It needs to be 11mm to 11.5mm thick. Mark the flat faced side so that, when assembled, the bore and face are perfectly at right angles to each other. Face and bore through again to a good fit on the post (nominally $\frac{7}{16}$ inch), using the plug gauge to be sure of the fit. Drill and tap for one (with a vertical pin) or two grub screws.

It is fixed in place by tightening the grub onto the top slide post at the tailstock end then pinning in place (**photo 100**). File a small angle in two spots on the bottom to make it easy to remove at some future date. Fit this onto the post. Tighten the grub, then use the pillar drill to fit a pin into the top slide to secure it.

Next is turning the rear guide bush. Do this from a larger size of bronze or brass to a very close fit in the tool post hole. Drill and ream $\frac{7}{32}$ inch. You will need to do this using the Myford clamp so the size can be tested in the mating hole in the new tool post.

Indexing pin

The indexing pin was turned in the three-jaw chuck from $\frac{7}{16}$ inch (11mm) silver steel with a projection of 61mm, to be 1.5 thou (0.03mm) oversize prior to the lapping. In order to minimise the lapping the outer section was first turned to $\frac{7}{32}$ inch using the bush to check the sizing but, as I mentioned before, 5mm or even 6mm would be OK provided you can find a spring. Face the end first



101
The fourth cut on the slender spindle still took dust off.

(we will need a flat end on this later) then turn the 40mm long shaft. This should really be supported with a half centre if you have one. I did it without using one as the method had to be tested but it did need several cuts to remove the increased diameter due to the work flexing (**photo 101**). Turn the main diameter but make it 20mm long at this stage, turning right up to the jaws of the chuck.

We are now ready for the lapping. This is a simple process. Get two strips of wood, preferably hard wood - I used 18mm plywood offcuts. These are drilled 6.5mm and bolted together with two pieces of card in between them. Drill on the card joint, which is then removed. Lightly oil the hole and use some fine valve grinding paste in the hole. Run the lathe at about 400rpm, finger tighten the bolt close to the lap hole and lightly grip the other end. Keep the lap moving all the time. Take care! Stop, clean and try until it's a smooth completely shake-free fit (**photo 102**). Cut the bar off at the end of the turning.

For the simpler way that I mentioned, use the four-jaw chuck. A piece of $\frac{3}{8}$ inch silver steel with a projection of 45mm is set to run true with the DTI - and it must be true, no movement at all of the needle. Turn it to the $\frac{7}{32}$ inch 40mm long.

Tapered socket

Now we need to make a taper reamer. The tapered socket is needed so that the post pulls itself into the correct position. It is critical that the fit is perfect and the dimensions are very tight with small tolerances.

Chuck some $\frac{7}{32}$ inch silver steel with about 15mm protruding. Set the top slide over to 8 degrees and turn a taper with a fine finish. Face it so the taper is no more than 6mm long. Cut it off then put it into the left-hand side of the vice with at least 15mm protruding. Use a coarse then finally a smooth file to get the 'D' bit reamer to exactly half the full diameter. We do this on the left of the vice so that any burr will not be formed on the cutting edge but on the trailing edge. File a little clearance at the front in two directions so it can cut on the end. Harden this by heating to red hot and quenching. Polish and temper to pale straw by heating the shank and allowing the heat to get to the end. Finish it with a fine slip stone.

Make the reamer to be about 120mm long, face the end and centre drill it. Without changing the setting of the top slide angle, grip the pin by the extension in the four-jaw chuck and set it to run perfectly true - zero wobble on the DTI needle again. Face the end and turn the pin to the same diameter as the reamer ($\frac{7}{32}$ inch), leaving the $\frac{3}{8}$ inch section 9mm long. Face the end to extend about 4.5mm before taking the final sizing cut and stop the lathe when the tool has just undercut the shoulder. This will eliminate some of the radius found on the end of the tool. Lock the saddle.

Note the setting of the cross slide, withdraw the cross slide and use the top slide to move the tool back. Now the taper can be turned until the noted cross slide setting is reached which will ensure the taper is full length and on diameter at



102
Lapping in progress.

the big end. Use a very fine feed to get a quality finish, and lightly polish the end (**photo 103**). For jobs like this I use an Arkansas whetstone, a hard white slip stone about 10mm square. It has an extremely fine cutting action. I got it many years ago at the Wembley Exhibition (building now gone as part of the new stadium) and it's still flat. I've just had a shock looking up the current price! Break the sharp corner so the edge of the mating socket is not damaged in use.

Now make a $\frac{3}{8}$ inch diameter bush which will be used to guide a pilot drill, about 25mm long, drilled so that the reamer will just and only just enter at the small end. Two other bits are now needed. Firstly, a depth stop of at least 20mm diameter (mine was a bit small and it made things a little difficult later) about 12mm thick, reamed $\frac{7}{32}$ inch, faced on one side with a short lock screw. Finally, we need a special support bar. Drill the end of same diameter bar as the depth stop about 8mm deep with a size that will allow the reamer to go almost all the way in so it wants to be about 0.2mm to 0.3mm under the reamer diameter. I worked up in 0.1mm steps until it was correct.

●To be continued.



103
Accurately centre the detent pin before turning the taper.

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Geoff Theasby reports on the latest news from the Clubs.



Here we go again with more tales of the unexpurgated. I've been burning the mid-day oil, visiting the Sheffield Steam Rally (see previous issue), Sheffield SMEE's Open Weekend, Doncaster market - where I bought the collected works of the Rev. W. Awdry (a present for my step-grandson) - and I failed to indulge in the K&WVR celebrations of 50 years in preservation which, like the rally, was also on 30th June. I travelled on the second weekend in 1968, where I met an old work colleague but she was accompanied by her boyfriend...

Work continues on my Indian 'bare bones' radio transceiver. I have acquired a case for it and am designing the front panel whilst I wait for certain bits to arrive, like a signal strength meter, pcb mountings, etc. and making sure all the holes are in the right place or, if not, at least covered up by something else...!

In this issue: tinworm, 'LBSC', insurance, a 'Knockometer', the high road and the low road, ICE, spray-on grass, a rolling road, a sea fret and Nemesis.

Steam Chest, July, from the **National 2½ inch Gauge Association** brings another 50 shades of Brunswick Green personified by a fine picture of a Class 35 Hymek, taken from buffers height, giving a natural 'look' to the shot. This was built by John Pickering, of Taunton Model Engineers, in 7¼ inch gauge but he speculates, with some good suggestions, on a possible 2½ inch gauge version. A letter on combating the dreaded tinworm has brought several suggestions, spread throughout the magazine. (Citric acid, Fertan, Mike Sander rust prevention, Chain Spray oil.) 'LBSC' continues his series on live steam models. On finding that he could not afford £1 a week for a new lathe (this was pre-WWII) he went to see Mr. Drummond and explained his intentions, being rather pleasantly confounded



De Winton at Norwich & DSME. (Photo courtesy of Mark Rhodes.)

when he was allowed to pay only half that as a regular sum. Thus began a lifetime's interest in model making, to all our collective benefit. At this point, Editor, Cedric Norman includes a plea for more articles, saying, 'Imagine where we would all be if 'LBSC' had kept his mouth shut and his pen idle!' Cedric also reports on the Tingley Rally and on making a water-pump bypass valve. Some photos taken at the Nantwich rally include a siding full of various rolling stock on static display, accompanied by a similar photo of two gentlemen reclining on a grassy bank, also on 'static display...' William Powell attended the Andover club's opening of their extended track and, being the first to raise steam in his *Freya*, found himself the object of all eyes and cameras when 'christening' the new track quite inadvertently.

W. www.n25ga.com

Stamford Model Engineering Society, *Newsletter*, June, reports a talk by Colin Furze who told a capacity audience of his ideas and demonstrated some of his projects, including

a spring-framed bicycle, a ducted fan, radio-controlled scooter and a flame-throwing guitar. Colin has a unique style and humour. If readers wish to know more, he has several videos on YouTube.

Norwich & District Society of Model Engineers' eBulletin, June, held a Maxitrak meeting at which two *Planets* turned up and a 7¼ inch gauge De Winton (photo 1).

W. www.ndsme.org

Blast Pipe, July, from **Hutt Valley & Maidstone Model Engineering Societies** says that the recent AGM was over in 19 minutes! (I have known faster but very few - Geoff.) Peter Targett took his *Rob Roy* to the eponymous rally at the Andover club in England. All was well, except getting an insurance valuation for the trip. The insurers had not been asked to insure such an item before and the comparable models currently on sale at dealers could only be valued from photographs. Fortunately a valuation was agreed and his trip went ahead without problems.

W. www.hvmes.com

Steam Lines, from **Northern Districts Model Engineering Society (Perth)**, July-August, reports that they held a Vertical Boiler Day which is a new idea to me. Six boilers were on show and part-manufactured, together with sundry engines. I am drawn to VB engines ... no idea why. For those who query the usefulness of membership surveys, this event was one of the ideas produced. Those readers with a delicate disposition are advised to look away now, as the Boiler Group was treated to the use of a 'Calibrated Knockometer' to cure the slight run-out in the crank axle of a Lion. Supporting the axle in V-blocks and finding the point of maximum deviation from the ideal, using a dial gauge, it was walloped at that point with a hammer and measured again. This was repeated until the run-out was reduced to a couple of 'thou'. Using a hammer is easy; knowing how hard to wallop with it takes a lifetime! In 1938, Lyall Austin's father scratch built a horizontal steam engine, 1 inch stroke, $\frac{3}{4}$ inch bore. After many years, Lyall has resurrected it - although the boiler was beyond reviving - and got it running again on air. He has also built a new boiler so the item is again powered by steam, as nature (and Dad) intended (**photo 2**). Tom Hardy visited the UK, including the Doncaster Exhibition and the Institution of Mechanical Engineers, to see Cherry Hill's models. He has the fine book by David Carpenter but (he says) nothing beats examining the models 'in the flesh'.

The Link, July-August, from **Ottawa Valley Live Steamers & Model Engineers**, in its 'Notes from the Prez' says that it has been suggested that the Elevated Track be so named, rather than the 'Highline' to avoid confusion by the users of legalised cannabis. 'Take a trip on the Highline', 'Have we got the Rail Joints for you!' Hmmm, maybe not. At the Members Only steaming day, said Prez was allowed to take

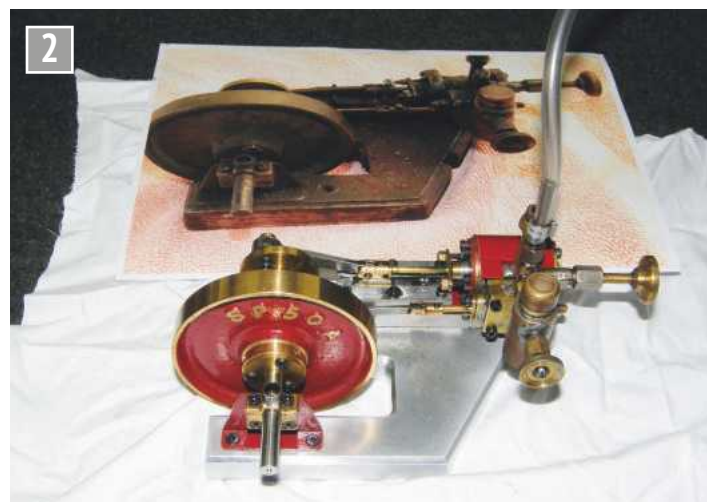
out John Bryant's locomotive, 'to see if you remembered where the coal went'. 'About 80% in the firebox and 20% on the ground seems to work okay', says the Prez. French ex-pat member, JF, says his local club runs two steam locomotives and the whole operation is run like SNCF (minus the strikers...)

W. www.trainweb.org/ovlsme

In *Newslink*, summer, from **Sutton Model Engineering Club** we learn that Secretary, Richard Burkett visited the Belmond British Pullman depot near Waterloo station, which is shared with Gatwick Express. Never heard of the BBP depot? Try Stewarts Lane... Sadly, the club has lost Derek Tidbury, Jo Milan and George Swallow in the space of a few weeks, all movers and shakers in the organisation.

W. www.suttonmec.org.uk

Otago Model Engineering Society sends *Conrod*, July, in which we learn that Ron Johnson has another hobby; fishing. He recently caught a 12 kg trout in Lake Ruataniwha, where the average is $\frac{1}{2}$ to $1\frac{1}{2}$ kg. John Knight has a static grass applicator, which uses up to 15kV static electricity when spraying flock 'grass' onto a model railway layout. This makes the 'grass' stand on edge, making it more realistic. It wasn't working very well, until it was realised



Lyall's Dad's engine from *Steam Lines*. (Photo courtesy of Jim Clark.)

that it was negative earth, not positive earth. It works much better now...

W. www.omes.org.nz

The News Sheet, July, from **North London Society of Model Engineers** says that they have been entrusted with 'LBSC's papers. The Council have yet to decide how best to deal with them, allow access, etc. The Members Day of the Marine section attracted many wives and families who are not really interested in railways. They thoroughly enjoyed the day and may well come again. The Gauge 1 Group showed a Prussian State Railways T3 0-6-0 by Aster, which I found most interesting. 1300 of the originals were built from 1882. A project has been launched for a rolling road to be installed

in one of the steaming bays. Not a commercial one but a more comprehensive, fully adjustable version, designed 'in house'. An exhibition at Elstree & Borehamwood Museum celebrates 150 years of railways in the town. Although the exhibition ran from last January to 21st July, I was not previously aware of this.

W. www.nlsme.co.uk

Sheffield Society of Model & Experimental Engineers' Open Weekend 7/8th July was held on a very hot day with wall to wall sunshine. Ivan and Mike Law showed their two LD&EC Railway locomotives but not in steam (**photo 3**). Dave Wood was running his Durham & North Yorkshire traction engine, behind which



Ivan & Mike Law's LD&ECR locomotives at Sheffield SMEE.



Dave Wood's D&NY at Sheffield SMEE.

I had a ride - my first for a T.E.! I didn't quite realise that there is a substantial incline from the car park to the station and it made the little beast work hard, hauling two grown men. It was definitely 'The little Traction Engine that could' (photo 4). I also promised Dave a copy of the picture I submitted to a photography competition, of his previous model, a Ruston & Proctor. It took me some time to track it down as it was back in 2013! The Garden Railway was busy; an unusual model was this German Inter-City Express, now in widespread use across Europe, including Russia and China, which looked very

smart (photo 5). The driver of this very shiny pannier tank (Holmside?) decided to run a goods train, so got out a mixture of vans and wagons and hung them on the back. A fundamental error was spotted by several observers however, in that the last vehicle was not a brake van, although there was one in the consist. This Hubristic behaviour was rewarded by a series of derailments which drew comment from the observers... (photo 6). I met Alan Thorpe and enquired after his absent guide dog, Velvet. He said she doesn't like the heat and flops down at the door, so his sister brought him. Murray's Thought



Gauge 1 ICE train, Sheffield SMEE.

concerned shadow boards, originally attributed to the RAF (Happy Centenary!) to avoid leaving tools loose inside an aircraft. Modern toolboxes are 'intelligent' and allow access only to authorised people. Visual recognition systems mean no RFID tags need to be attached to the tools, yet it 'knows' when a tool has not been returned and will not allow the toolbox to close until it is replaced.

W. www.sheffieldmodelengineers.com

Ryedale Society of Model Engineers' Monthly Newssheet, June, reports that recent driver training went well. After familiarisation with the track

layout, Mike Aherne's 30854, *Queen Guinevere* was brought out with 12 Mk1 coaches and training proper began, having a local passenger, goods trains and the signals to contend with, as well as keeping the fire fed and the water level up. June 10th began with a 'sea fret', unusual so far inland but it burned off by midday. These are formed when rising air over the warm land encourages an onshore breeze. This, picks up moisture from the cold North Sea, which condenses as fog or *haar*, locally known as a sea fret.

W. www.rsme.org.uk

And finally, in a change to our usual programme, look at the front cover photograph of M.E. 4591. It's mine! Thanks to Deborah's superb memory for song lyrics, I offer Dr Hook, '... the thrill that'll gitcha when you get your picture on the cover of the *Rollin' Stone*... Wanna see my picture on the cover, wanna buy five copies for my mother...' Written by Shel Silverstein.

I also wrote a Haiku. 'Model Engineer, original Maker mag, 1898.' Debs said, 'That's not very exciting' and I replied, 'It's not supposed to be exciting, it's supposed to be Zen. Well, now and Zen...'



This Holmside danced with the devil, Sheffield SMEE.

Contact:
geofftheasby@gmail.com

SEPTEMBER

- 1 Saffron Walden DSME.** Picnic Field Railway – ‘Steam and Sausages’ – running day. Contact events@westonstar.org.uk
- 1 Tiverton & District MES.** Running day at Rackenford track. Contact Bob Evenett: 01884 252691.
- 1/2 North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-5pm. Contact Ken Parker: 07710 515507.
- 2 Chingford DMEC.** Public running at Ridgeway Park. Contact secretary cdmec@gmail.com.
- 2 Grimsby & Cleethorpes MES.** Public running, Waltham Windmill, noon-4pm. Contact Dave Smith: 01507 605901.
- 2 Lancaster & Morecambe MES.** Public running at Cinderbarrow. Contact David Wilson: 07721 020489.
- 2 Northampton SME.** Open to the public 2 - 5pm. Contact: secretary@nsme.co.uk
- 2 Oxford (City of) SME.** Running day. Contact: secretary@cosme.org.uk
- 2 Portsmouth MES.** Public running, Bransbury Park, weather/participant dependant, 2-5pm. Contact Roger Doyle: doyle.roger@sky.com
- 2 Plymouth Miniature Steam.** Public running, Goodwin Park (PL6 6RE), 2 – 4.30pm. Contact Malcolm Preen: 01752 778083.
- 3 Peterborough SME.** Bits & Pieces, 7.30pm. Contact Terry Midgley: 01733 348385.
- 4 Romney Marsh MES.** Track meeting, 1pm visitors/spectators.

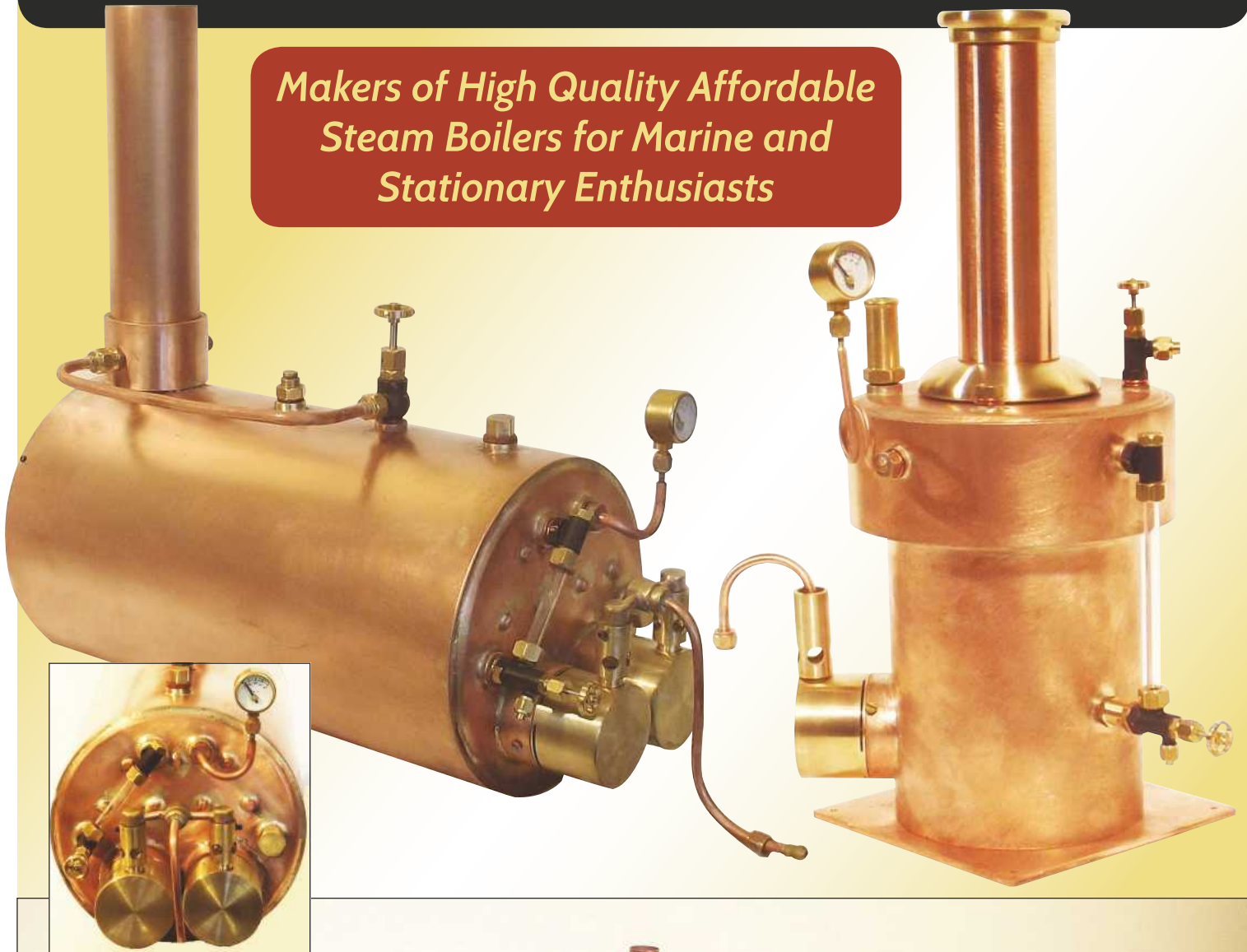
- Contact Adrian Parker: 01303 894187.
- 5 Bradford MES.** Live skills demonstration, 7:30pm, Saltaire Methodist Church. Contact: Russ Coppin, 07815 048999.
- 5 Brandon DSME.** Meeting at The Ram Hotel, Brandon, 7.45pm. Contact Mick Wickens: 01842 813707.
- 5 Bristol SMEE.** ‘On the Table’. Contact Dave Gray: 01275 857746.
- 5 Leeds SMEE.** Meeting night – ‘The Leeds Grammar School Loco’ – Mark Batchelor. Contact Geoff Shackleton: 01977 798138.
- 6 Sutton MEC.** Bits and pieces. Contact Paul Harding 0208 2544749.
- 7 North London SME.** Auction. Contact Ian Johnston: 0208 4490693.
- 7 Portsmouth MES.** Dioramas: an introduction and their construction, Tesco Fratton Centre, 7.30pm. Contact Roger Doyle: doyle.roger@sky.com
- 7 Rochdale SMEE.** ‘Tramways Around Rochdale’ – Bob Hayter, at Castleton Community Centre, 7.30pm. Contact Rod Hartley 07801 705193.
- 8 Bromsgrove SME.** Open day – 16mm, G1, 2½, 3½ and 5 inch gauge tracks. Contact Peter Maybury: peter.maybury@outlook.com
- 8 Cambridge MES.** Southern Federation rally, 10am onwards. Contact Tim Coles: 01954 267359.
- 8 Westland & Yeovil DMES.** Track running day 11am – 4.30pm. Contact Bob Perkins: 07984 931 993.
- 9 Bracknell Railway Society.** Public running

- 2-4.30pm. Contact Paul Archer: 07543 679256.
- 9 Chingford DMEC.** Public running at Ridgeway Park. Contact secretary cdmec@gmail.com.
- 9 Grimsby & Cleethorpes MES.** Public running, Waltham Windmill, noon-4pm. Contact Dave Smith: 01507 605901.
- 9 Lancaster & Morecambe MES.** Public running at Cinderbarrow. Contact David Wilson: 07721 020489.
- 9 Leeds SMEE.** Public running, Eggborough track from 10am. Contact Geoff Shackleton: 01977 798138.
- 9 North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-5pm. Contact Ken Parker: 07710 515507.
- 9 Portsmouth MES.** Public running, Bransbury Park, weather/participant dependant, 2-5pm. Contact Roger Doyle: doyle.roger@sky.com
- 9 Plymouth Miniature Steam.** Members’ day – visitors welcome, Goodwin Park (PL6 6RE), noon – 4pm. Contact Malcolm Preen: 01752 778083.
- 9 Sutton MEC.** Sunday track day from noon. Contact Paul Harding 0208 2544749.
- 9 Welling DMES.** Public running at Falconwood 2-5pm. Contact Martin Thompson: 01689 851413.
- 11 Romney Marsh MES.** Track meeting, 1pm visitors/spectators. Contact Adrian Parker: 01303 894187.
- 13 Sutton MEC.** Club Night: ‘Constructional Toys – Lego, Meccano, Mamod

- etc.’ Contact Paul Harding 0208 2544749.
- 14 Tiverton & District MES.** Club meeting at Old Heathcoat Community Centre, Tiverton, 7.30pm. Contact Chris Catley: 01884 798370.
- 15 Bradford MES.** Raised track re-opening ceremony, 11am, Northcliff track. Contact: Russ Coppin, 07815 048999.
- 15 Cardiff MES.** Steam up and family day. Contact Rob Matthews: 02920 255000.
- 15 North Wiltshire MES.** Invitation Saturday, Coate Water Country Park, Swindon, 10am-5pm. Contact Ken Parker: 07710 515507.
- 16 North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-5pm. Contact Ken Parker: 07710 515507.
- 16 Chingford DMEC.** Public running at Ridgeway Park. Contact secretary cdmec@gmail.com.
- 16 Grimsby & Cleethorpes MES.** Public running, Waltham Windmill, noon-4pm. Contact Dave Smith: 01507 605901.
- 16 Guildford MES.** Charity Day 2-5pm. Contact Mike Sleight: pr@gmes.org.uk
- 16 Lancaster & Morecambe MES.** Public running at Cinderbarrow. Contact David Wilson: 07721 020489.
- 16 Oxford (City of) SME.** Running day. Contact: secretary@cosme.org.uk
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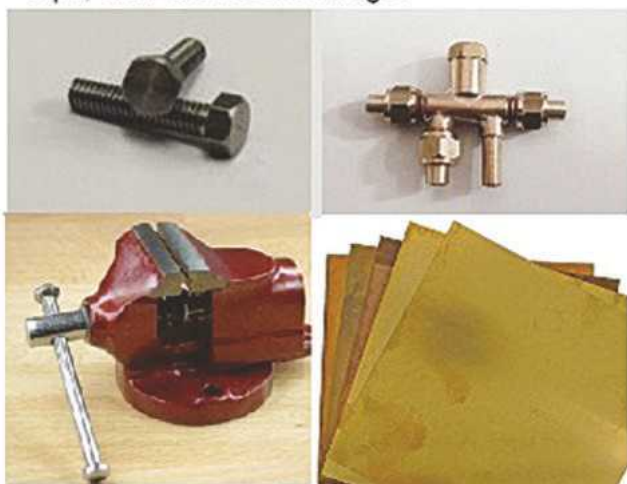
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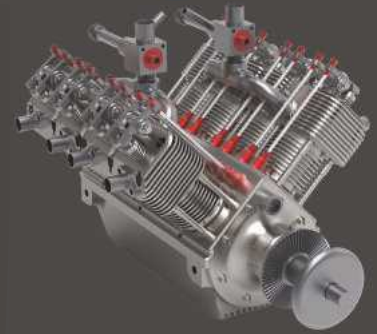
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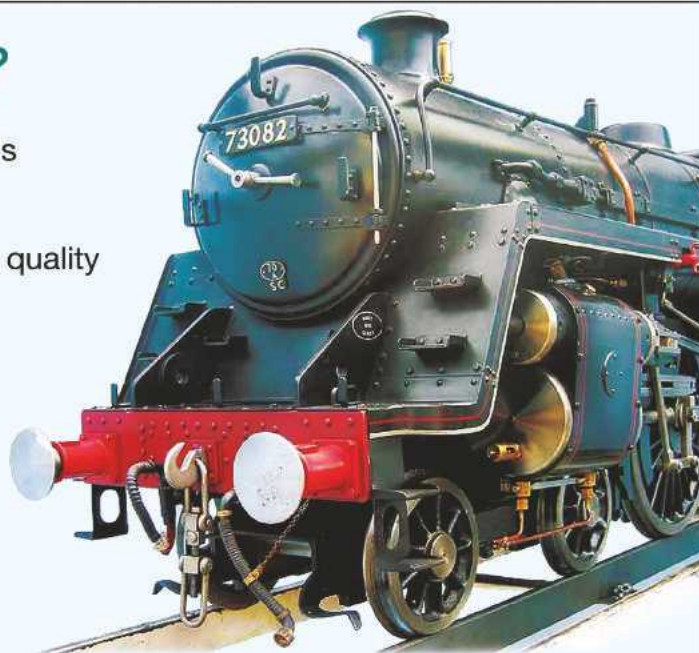
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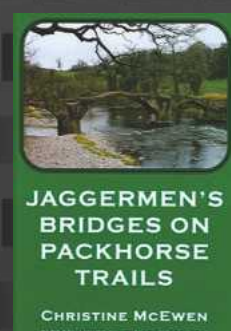
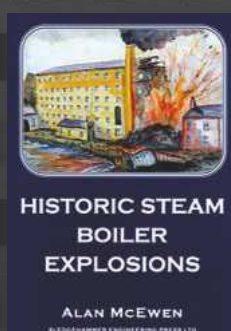
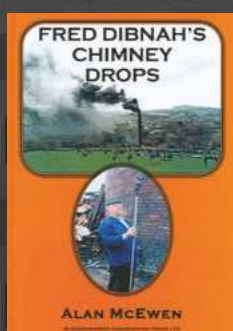
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