THE ORIGINAL MAGAZINE FOR MODEL ENGINEERS

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MODEL ENGINEER

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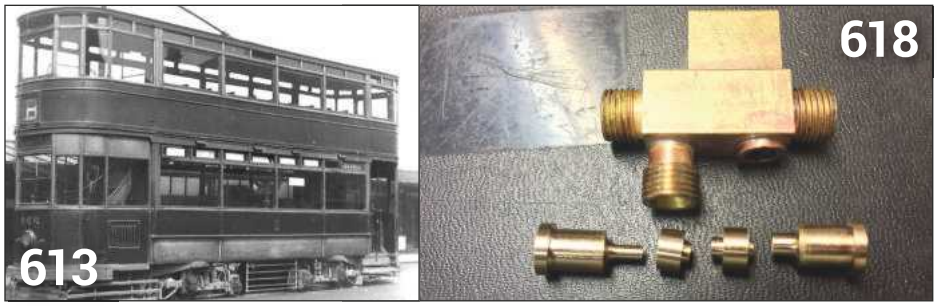

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IN THIS ISSUE

ON THE COVER...

Dave Benyon and his excellent Jubilee **Ajax** *await departure from Harvesters station, at the 7¼ Inch Gauge Society AGM hosted by the Echills Wood Railway (photo: John Arrowsmith).*

SILVER CREST
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The GWR King Class

Designed by C.B.Collett the King Class was introduced in 1927. The introduction of the King allowed GWR to trumpet, once again, that they possessed the most powerful locomotives in Britain. The weight of the King did, however, initially restrict it to just three routes, Paddington/Plymouth, Paddington/Bristol and Paddington/Birmingham. The Kings always headed the most prestigious trains until their withdrawal in 1962. A variety of liveries were carried including GWR green, BR blue and BR lined green.

"Along with the GWR Castle Class the King Class is one of the most iconic locomotives ever to grace Britain's railways. The build of a top of the line 4 cylinder Great Western engine certainly presents a number of technical challenges. After 18 months in development we are pleased to announce the batch build of a small number of models. Available in a choice of names and liveries this 5" gauge locomotive is set to take pride of place in any collection. This is an opportunity not to be missed by the serious GWR enthusiast. As an award winning professional model maker I am delighted to have been involved in this very satisfying project"

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Summary Specification

Approx length 73"

- Stainless steel motion
- Boiler feed by axle pump, injector, hand pump
- Etched brass body with rivet detail
- GWR Pattern Safety valves
- Choice of liveries
- Painted and ready-to-run
- Reverser
- Coal-fired live steam
- 5" gauge
- 4 Cylinder
- Piston Valves
- Walschaerts valve gear
- Drain cocks
- Mechanical Lubricator
- Silver soldered copper boiler
- Multi-element Superheater

Approx Dimensions:

- (L) 73"x (W) 10"x (H) 13"
- Weight: 97kg

The 5" Gauge Model

Silver Crest Models has been building large scale live steam models since its formation in 2010. By the time the King is delivered we will have manufactured over 600 models in 5" gauge. This experience is your guarantee of quality. A 4 cylinder live steam locomotive in 5" gauge will never be cheap. However, at £12,495.00 + VAT the model represents tremendous value-for-money. You would be hard pushed to find a second-hand model built by a private builder at less than twice the price we are asking for a brand new King Class. The model is fully guaranteed and is supplied with a 12 months warranty. Whether you are inclined to collect and showcase your models, or drive them, the King Class fits the bill. It is a handsome display model and one capable of pulling substantial loads around your local club track.

The model comes complete with a silver soldered copper boiler, hydraulically tested to twice working pressure. All boilers will be UKCA marked and supplied with a manufacturer's shell test certificate. *Order reservations will be accepted on a first come, first served basis.* We are pleased to offer a choice of names and liveries.

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Please send, without obligation, my free 5" gauge GWR King Class brochure.

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Address:_____

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SMOKE RINGS

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Polly Open Day

On Saturday, 16th October, I had the pleasure of attending Polly Model Engineering's Open Day, marking the launch of their latest 5 inch gauge kit locomotive, *Atlas* (**photo 1**). The weather was kind, the sun came out and there was a steady stream of people admiring the wide range of Polly locomotives on show, one of them finished in a very tasteful glittery purple (*Cadbury*'s purple, I was told). I was also told that it was *her* locomotive and she could have whatever colour *she* wanted. That's the beauty of Polly locomotives – they are true chameleons and can be dressed up to be affiliated to any railway you want – even the GWR! Trevor Wootton had brought along his *Polly VI*, which, with a few modifications – chiefly, a lower cab and steps added to the tender and the front of the locomotive – was doing a passable impression of an LMS Mogul (**photo 2**).

The workshop was open for inspection and seemed to contain a rather wide range of machines, from the antique to the latest CNC machinery – truly *Ancient and Modern*. While I was there, one CNC machine was busily turning out wheels. I was told it was a 12-axis machine – rather mind-boggling really. I didn't stop to count.

Outside, a track had been set up and various Polly locomotives could be seen steaming gently to and fro. Also in attendance was a burger van, providing traditional model engineer food – cheeseburgers, hot dogs but not, I'm sorry to say, cheesy chips.

W. www.pollymodelengineering.co.uk

Pembroke

Gerry Martyn writes with an update on the arson attack at the Pembroke club early last year:

Pembroke's new club house.

'A long time ago, back in the spring of 2020 I had to, sadly, report on a highly destructive arson attack on Pembrokeshire Model Engineers clubhouse. An update about our recovery is now long overdue.

'After the fire we received some insurance money and some very generous donations, sufficient to allow us to rebuild. With the necessary paperwork done at homes during lockdowns and real work at our track site when allowed we are now back to our new normal. It was decided that security had to be no. 1 priority and so have now installed a new rest room/clubhouse, made from a converted and fully fitted-out shipping container (**photo 3**). Whilst some may consider this a bit small there is also a secure storage container which contains all the other things we need to manage the site and run our railway, freeing space that would have been used for this purpose in our old building. It would be fair to say that we are now back on our feet and again able to welcome visitors and new members. The full story, for the record, is given on our new website at pembsme.wordpress.com

'To finish then we must again say thank you to all the kind people who gave us their support during this troubled period.'

Ted Jolliffe

It is with great sadness that we have to report the death of Ted Jolliffe, former editor of *Model Engineer* magazine, who died on Thursday morning, 14th October, peacefully at home. He was 82 years old. Ever the editor, he wrote his own obituary, which appears on the next page.

Polly's latest locomotive, Atlas*, with the team.*

Trevor Wootton's Polly VI *impersonating an LMS Mogul.*

Obituary

Ted Jolliffe

Ted was born in Kinson, Bournemouth in 1939. His father, Jack, was in a reserved occupation as a skilled potter; the whole male family worked in heavy clay (bricks and salt glazed drain pipes). Many of the wartime airfields had drains made from the firm's products laid along the runways.

As a youngster he was taken under his grandfather's wing and initiated into working on the large twin cylinder steam engine which powered the works. Electricity came from an ex-WW1 dynamo powered by an early Tangye hot bulb engine delivering DC to the plant, later supplemented by an ex-German submarine diesel engine and generator. From this he got his lifelong love of steam and mechanical work.

Ted was the only pupil in his junior school to win a scholarship to the local Grammar School. After a short spell in retail sales he joined the Metropolitan Police Cadet Corps. in 1956, later serving as a PC. He was for many years an area car driver and during the later years of service worked as part of an accident investigation and prevention team. He retired in 1984 to take over as editor of *Model Engineer* magazine, a post he held until retiring in 1999. This made him, apart from the founder Percival Marshall, the longest serving editor in the 120+ year history of the magazine.

He had always been involved in modeling and engineering, as editor for The Southern Federation of Model Engineers for several years, as well as secretary at Chingford MEC for some years prior to the move into publishing. He was instrumental in introducing battery powered electric locomotives to the passenger hauling stud and served for several years on an HSE committee dealing with many aspects of the safe operation of public passenger hauling miniature railways. Many older model engineers will remember Ted and family travelling at weekends to their sites, hauling his ancient caravan behind his overworked Skodas, a marque he was faithful to for over a million miles.

Following a short lived first marriage in 1962, in 1968 he met and in 1974 married Mary. Their younger son John is a graduate engineer (many will remember his efforts as a youngster in providing many front covers for the magazine). John is currently living in Vietnam where he set up a major workshop in the textile and footwear industry.

In his second retirement Ted was extremely active in the Bedford MES, having moved there from Enfield, to be closer to the office, but following a heart attack in 2008 he stood down. He concentrated attention to health issues, serving on the board of the local NHS monitoring group ('The Link') and later as secretary of Hearts in Beds Cardiac Support Group, a post he held for over 12 years.

Other interests included a love of nature, bird watching and interest in birds of prey, as a volunteer at the Raptor Foundation near St. Ives and secretary of the local gardening society.

Following many holidays on the Isle of Man with Mary, where they built up lots of enduring friendships, latterly because of distance, allegiance changed to the Isle of Wight where they became supporters of the Donkey Sanctuary and part of the preservation group for red squirrels. The Island boasts a large colony of these enchanting animals.

Never quite sure how it came about, he served for many years on an advisory panel for the DVLC, an activity done online, suiting his later life mobility issues.

He loved his workshop and freely admitted to a love of tool making and repairing rather than locomotive building. He wrote many articles for the model engineering press and during the covid pandemic wrote regular construction articles for the Chingford MEC newsletter, claiming that this diversion kept him sane during the various lockdowns. When failing mobility restricted access to the workshop he set up a small one in the garage adjacent to the kitchen, buying and installing a Unimat SL lathe to go with the Sherline mill. He was then able to continue with his project of building components of a typical medieval siege train based on research and several designs from the Leonardo da Vinci drawings.

Latterly he was diagnosed with terminal throat cancer; the last few months of his life were owed in large part to his wife Mary, for her devoted care. They tried hard to pack in as many experiences as possible having regard to the increasing difficulties of getting about.

Ted died peacefully at home on Thursday 14 October, aged 82.

The demonstration line and locomotive in the station yard.

The AGM of the 7¼ Inch Gauge Society

John Arrowsmith returns to the Echills Wood Railway for the annual meeting.

As will be familiar to many members of clubs and societies, the last AGM for members to attend was 2019, the 2020 meeting being cancelled due to the Covid problems. However, this year the 7¼ Inch Gauge Society AGM was held at the Echills Wood Railway (EWR) in Kingsbury Water Park near Tamworth over the weekend of the 17/18 September. This large railway was the perfect setting and attracted 68 locomotives and their drivers. The main station was suitably decorated with a wide range of national flags and the forecourt space was used by a useful range of traders and their products. A short section of rail was also laid so that one of the traders could demonstrate the latest battery electric locomotive and trackwork (**photo 1**). It promised to be a very busy event!

Being busy also provided good opportunities to see a wide variety of locomotives from diminutive battery powered ones to the very large steam engines like the 2-6-0 Baldwin owned by Bob Whitfield (**photo 2**). EWR staff worked very hard to ensure everyone who wanted to drive had access to suitable stock, if they wanted it, or they could use their own if preferred.

For those of you who have never been to EWR, the track is approximately 1.25 miles long with two main stations, Harvesters and Far Leys, with an intermediate request stop at Picnic Junction Halt. Locomotives are prepared in a large semi-circular steaming bay area (**photo 3**) which has full access to a large turntable and additional storage areas. Here, visitors can get up close and see all the different techniques used for raising steam and getting

The imposing front end of Bob Whitfield's American 2-6-0 mogul.

The busy steaming bays at the start of the day.

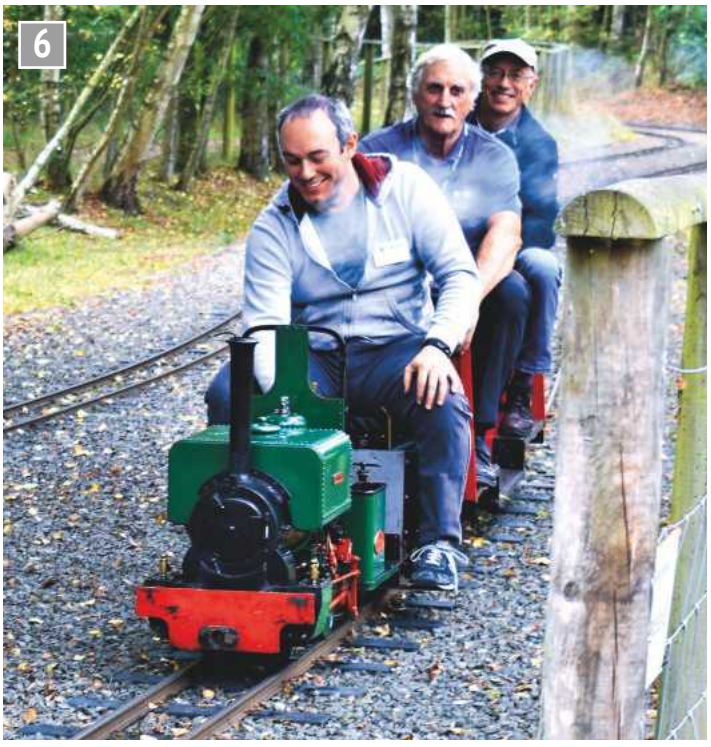
In the marshalling yard Phil Owen has plenty of steam as he awaits his departure.

The Class B Darjeeling 0-4-0 arriving back at Harvesters with Tony Bickerstaffe driving.

the engines ready for the track. The unloading system is also connected directly to the turntable enabling large engines and stock to be easily positioned onto the railway prior to being used. These facilities provide good access for members and visitors.

A set routine tends to be in place whereby the locomotives are prepared and then proceed out onto the track either to enjoy the circuit on their own or there's the option of adding a couple or more carriages and taking passengers as well. As a visitor you can spend all day enjoying railway trips with a wide selection of locomotives doing the work. Of course, in 7¼ inch gauge some of the narrow gauge prototypes are quite large machines and are extremely powerful. Trains are prepared in the adjacent marshalling yard which again provides some good entertainment when it is busy (**photo 4**). One of the larger locomotives, the 0-4-0 Darjeeling Class B built and owned by Gordon Roberts, was resplendent in its traditional blue livery and just purred round the track under the control of Tony Bickerstaffe (**photo 5**).

One member visitor, Sam Del-Greco came from Dublin and it was the first time he had steamed his locomotive on another track, so to come to EWR must have been quite an experience for him. I spoke to him and his dad and they were both thoroughly enjoying the experience (**photo 6**). The interesting track layout at EWR takes the trains out into the country to the large station at Far Leys; here passengers



Sam Del-Greco from Dublin with his Wren approaches Wren Tunnel.

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can alight and then walk back through the woods to the main station at Harvesters. Locomotives at Far Leys can take on water or stop for a blow up if they need to and, with four platforms able to take a couple of trains each, there is always available track space. The approach to the station has an interesting string girder bridge which provides variety on the journey (**photo 7**). My photo shows Josh Allen with his 0-4-0 Hunslet running backwards with his train into Harvesters. Operations like this continue throughout the day.

The meeting took on its usual format and as this was the first one in almost two years there was plenty of information forthcoming from the committee. Introduced by chairman, Frank Cooper he informed the meeting that president Brain Reading could not be present this year but a recorded message from Brian was played to the meeting where he apologised for his absence, hoped everyone would enjoy the day and the rally and asked everyone to support the work of the committee with all they do.

Each member of the committee stood and described their role in the Society. The state of the Society's finances is always an interesting section of the meeting and treasurer, Jilly Rainer informed the meeting that because of the lockdown restrictions, revenue from the usual activities had been severely curtailed. The overall situation, however, was good and some revenue had been received through the good offices of the Trade Liaison officer, Bob Whitfield for advertising etc. As a result of all this there would be no change to subscription rates but the special rates in operation for the Covid problem would continue for this year. Chairman, Frank Cooper invited comments or questions from the floor and only one was forthcoming which was answered satisfactorily and the accounts were duly accepted by the meeting with a show of hands. Nick Deytrikh explained to the meeting that he was preparing a special 50th Anniversary booklet for members and requested information regarding the early years of the Society to be sent to him directly. Another announcement was made by acting secretary, Tony Knowles who told the audience that he would be standing down from his position at the end of the weekend. A further change to the committee was presented to the meeting with the inclusion of a new post for the Society - that of training officer. It had been decided that the Proficiency Scheme needed to be revitalised and updated so a trained advisor was needed. To fill this post the meeting was introduced to Janet T. Royston who has the necessary qualifications to do the job and who is now a full committee member.

One of the highlights of the meeting is the presentation of awards but because of the restrictions in place over the last 12 months or so there was only one that could be considered. This was for the Brian Reading Award for the best locomotive at the rally and in steam. The winner this year was Simon Mulford from the Oxford Society who had brought his fully refurbished Bagnal 0-4-2. This engine was in a very poor, almost derelict state when received and Simon has completely stripped it down - to the last nut and bolt - and then painstakingly rebuilt it before completing a super paint job on it. It was a very worthy winner and Simon received his trophy from Doug Kempton to the acclaim of the meeting (**photo 8**).

Two other presentations were also made; one to the Echills Wood Railway for hosting the meeting weekend and this was received on their behalf by secretary, Jeff Stevens (**photo 9**). The second one was for one of the most important features of the weekend, the catering team. They all worked extremely hard throughout, providing endless drinks and snacks as well as excellent packed lunches. In addition to this there was the hog roast on Saturday night. A couple of very nice real ales on draught were also available and, as they say, they went down a treat! The catering team led by Roger and Audrey Edmonds provide this service, always with a smile and sometimes a good deal of banter which was much appreciated. The team was duly presented with a fine bouquet of flowers by Jilly Rainer to the approval of the meeting (**photo 10**).

That concluded the formal part of the weekend but train running continued into the evening and again on Sunday when members of the public were allowed to join as passengers. One aspect of large gatherings like this, which is often overlooked, is the time and effort needed by tired participants to get their locomotives and equipment ready for departure. It is quite a process, especially for the largest engines, and a lot of work is needed to get everyone home safely.

My thanks as always to Jeff Stevens and the EWR members for their help and information, and to the 7¼ Inch Gauge Society for staging an excellent weekend.

ME

"I'll go in reverse" - Josh Allen crosses the girder bridge on his way to Far Leys.

Simon Mulford receives the Brain Reading award from Doug Kempton.

Jeff Stevens receives the thanks of the Society from Frank Cooper.

The catering team accept the applause from the meeting.

Bolton Corporation No. 140 in 1:16 Scale

PART 2

Ashley Best builds a model of the first of the fully enclosed Bolton trams.

Continued from p.564
M.E. 4676, 22 October 2021

*In 1927, Bolton Corporation Tramways took delivery of twelve new large bogie tramcars. These were built by the English Electric Company and were of interest in more ways than one. They were Bolton's first totally enclosed tramcars and the last trams in England to use the Brill designed 22E trucks and were almost the very last traditional style tramcars to be built by English Electric. One of these trams, number 140, forms the subject of this article (**photo 1**).*

The model

At the outset I have to say that this model has been constructed by unashamedly traditional methods involving hand-skills with only minimal contributions from the computer. It is a truly scratch-built effort. Eventually I decided to attempt the model in the 'as delivered' livery of 1927. This would include the lower saloon sliding door with glass blanked out save for a circular peephole and the nearside bulkhead window also blanked out with notices about keeping the car tidy applied (**photo 11**). Both these features, designed to keep light reflections away from the driver, were soon abandoned. Another feature was the triple guard rails behind the curved seat at the end of the upper saloon (**photo 12**). They soon went as well.

Bolton Corporation No. 140.

First stages

The first requirement was a general arrangement working drawing. I like to do this full size. It is not easy to acquire much suitable reference, but I was able to use photographs of the cars and, most useful of all, a reproduced maker's plan from which I found it possible to work out main dimensions. The plan is shown in **fig 1**.

The advantages of making the trucks first should be obvious as it means the

The platform.

Guard rails.

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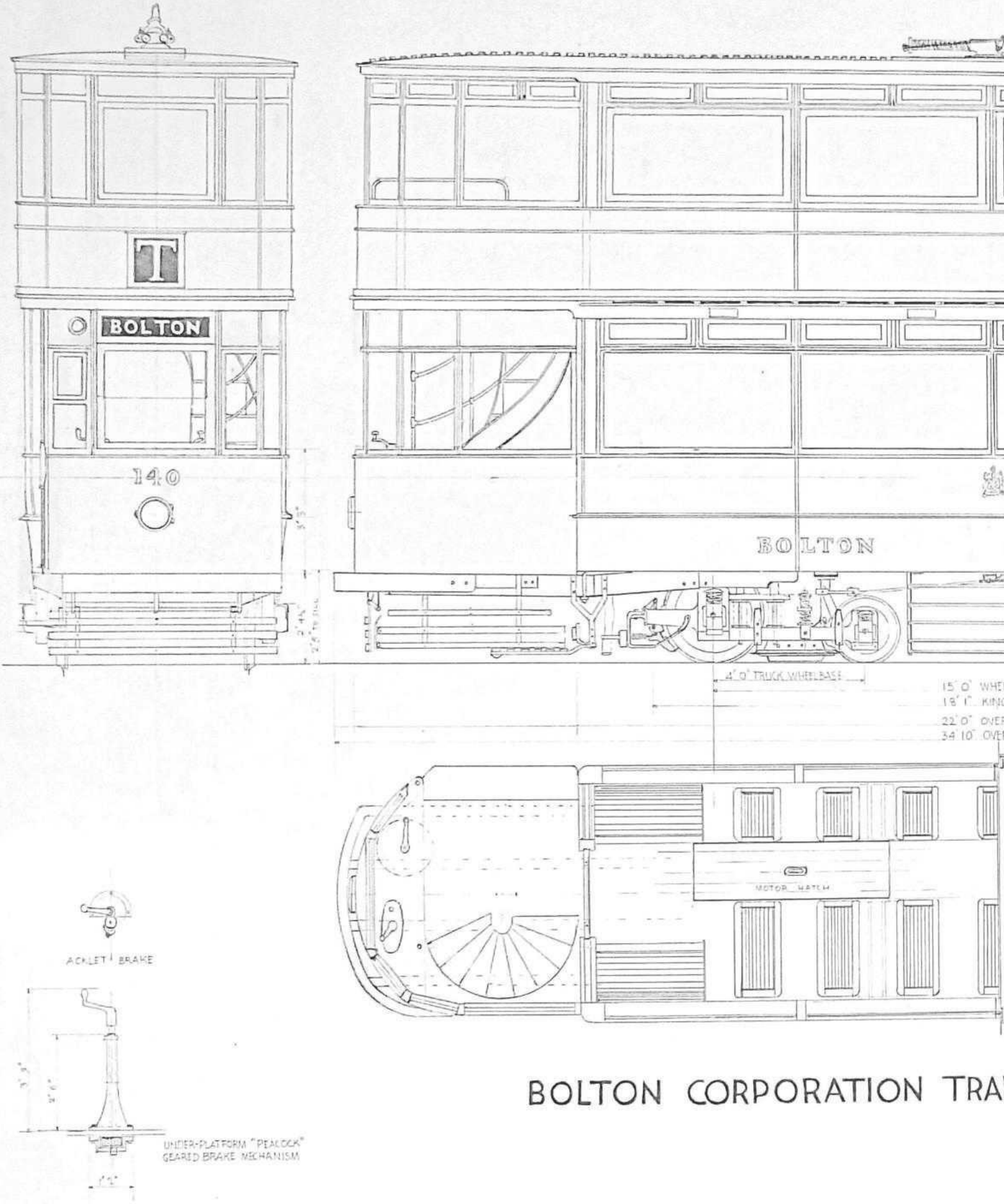
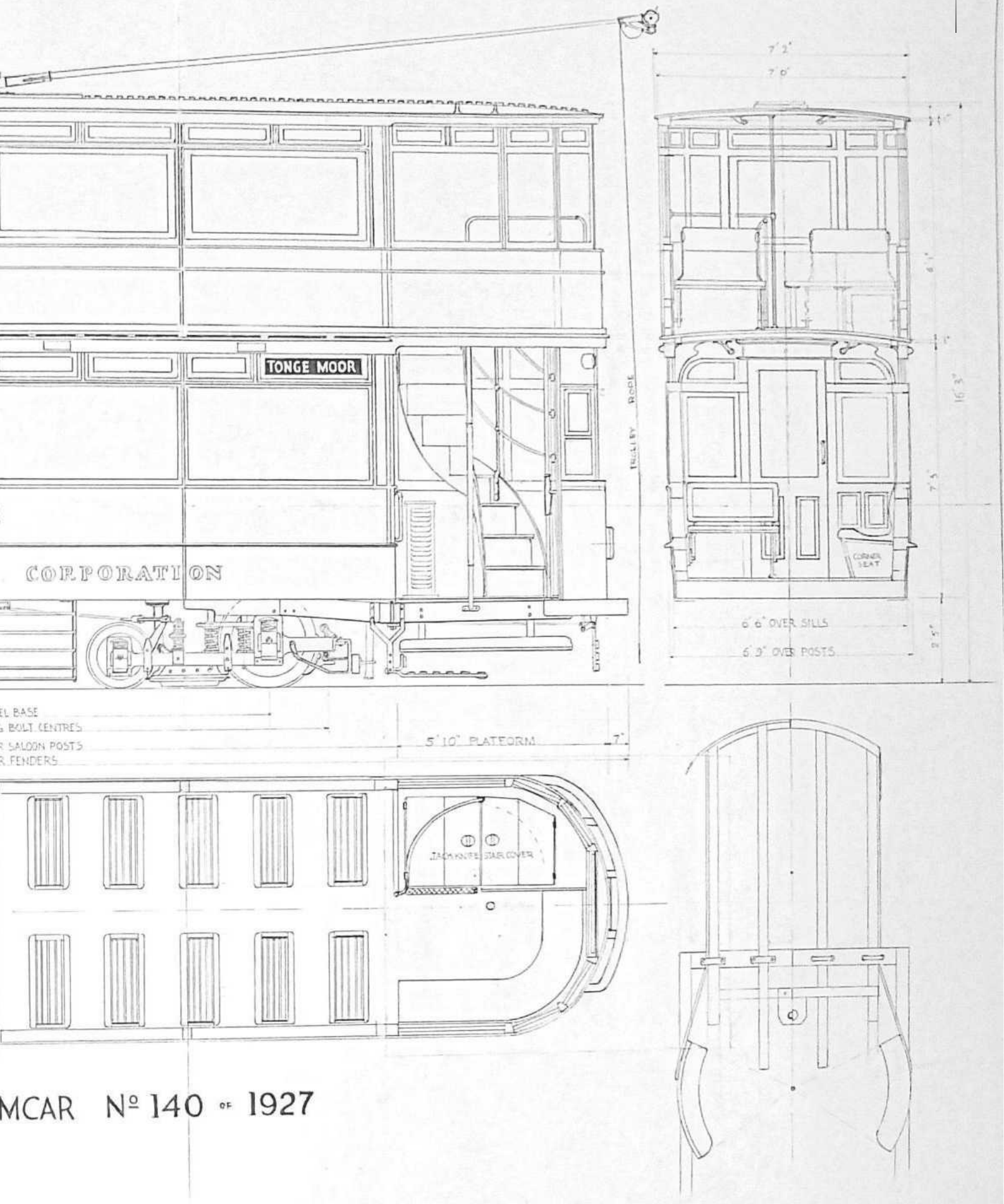
Fig 01



General arrangement.

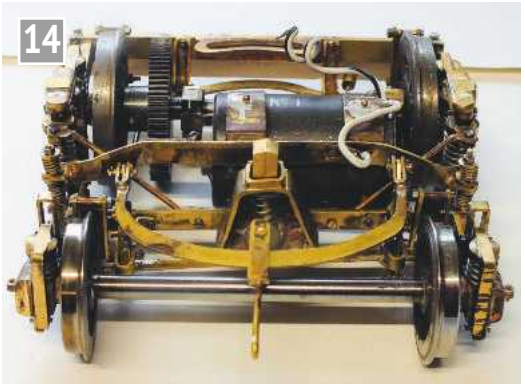


MCAR Nº 140 OF 1927

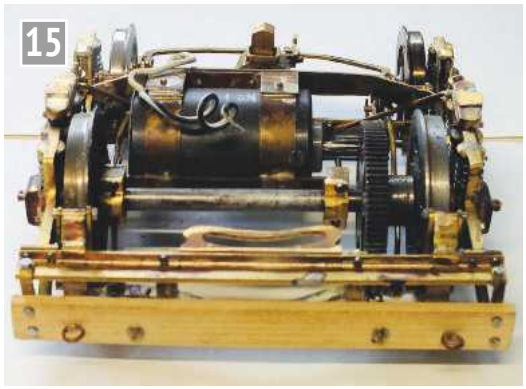
BOLTON CORPORATION ENCLOSED 8 WHEEL TRAMCAR
BUILT BY ENGLISH ELECTRIC Co 1927/8
TRUCKS - BRILL DESIGN BRUSH BUILT 22E
NOS 139 - 150 1927, 101-106 1928.
CONTROLLERS EE K33C
RESISTANCE BOX EE TYPE FR PEDESTAL STYLE
DRAWN BY ASHLEY BEST. APRIL 2019.

SCALE 1:16

Track brake parts.



22E truck – rear view.



22E truck – front view.

Track brake fitted.

Side bearer.

King post.

underframe can be produced accurately with cross members in the right place from the start. My trucks were as fully detailed as possible with working hand brakes, but needing track brakes. I remember back in 1946, lying in bed at night in my grandmother's Bolton house on a warm summer's evening and hearing the trams on Chorley New Road, half a mile away, as they pulled up with the wonderful groan of the magnetic brake. On the model, of course, such brakes in this scale have to be dummies. These were made and fitted before going further (**photo 13**).

Underframe

The underframe was made of wood with metal flitch plates for the platform bearers. The bearers were fitted as on the real tram with U-bolts and L-bolts and were made, again as in a real tram, with the potential to be adjusted if necessary, to maintain correct alignment. I intended to make the entire underframe and all its main fixtures completely - before attempting the bodywork. This would go as far as a test run for the motors, the braking system and lifeguard mechanism and sprang from the experience of working on the underside of an upturned model which was awkward. The underframe on this model needed the fenders at each end secured, but the side dog gates, front life guards and side guards were made detachable. Fixtures for these items were 10BA and 12BA bolts fitted as required into drilled holes filled with epoxy resin glue, and allowed a long time to set really well. Parts were numbered with corresponding discrete numbers on the underframe to ensure parts went back in the right place. I find this to be necessary because, however carefully made by hand skills, getting every part truly identical is, to say the least, difficult.

Trucks

The 22E trucks are such an important feature of this model and although described in a previous *Model Engineer* article, perhaps brief reference is necessary here and **photos 14** and **15** are of the basic truck where the main features can be seen and **photo 16** shows the track brake fitting which is supported by a pair of bolt-on brackets; the one near the driving wheel bolted to the main frame and the end bracket next to the pony wheel is simply clamped round the frame. Apart from the track brakes which are dummies, the rest of the truck incorporates fully functional compensated wheel brakes. Bolton's bogie cars all had electromagnetic brakes, but other tramways in the area relied on simple handbrakes, operating on the wheels. Even Manchester, with its large bogie cars, relied mostly on the hand brake. Frequently stopping a 16 ton tramcar by this method would do much to maintain physical fitness.

Fitting the trucks

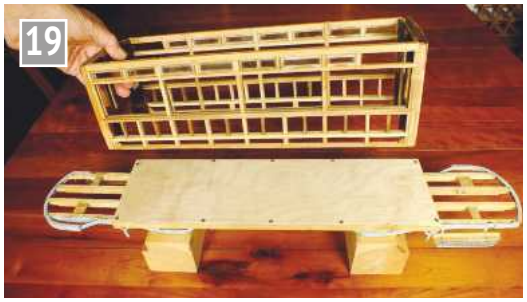
Brill 22E trucks are 'maximum traction' which means most of the weight bears very close to the large diameter driving wheels and the truck lacks a king pin, but has a curved guide through which a king post passes to transfer power. Side bearers running in curved guides take the weight of the body and maintain the truck in place (**photo 17**). The lack of a king pin makes room for a single large powerful motor. These side bearers were quite complicated and I first drew out the plan view and made card replicas to test alignments. When this had been done the parts were fabricated and fixed to the underframe together with the bracket holding the king post (**photo 18**). I used brass and silver solder to make these items and included mostly dummy rivets as seen on photographs of the cars. The rivets were the final additions and were soft soldered in place. Some rivets were not applied as dummies, but helped to hold the parts in place attached to the wooden frame with epoxy glue. Last of all, the lower saloon floor was fixed to the underframe and later, small holes drilled for fixing screws to attach the bodywork (**photo 19**). I used small countersink screws to fix the floor so, if

I remember back in 1946, lying in bed at night in my grandmother's Bolton house on a warm summer's evening and hearing the trams on Chorley New Road, half a mile away, as they pulled up with the wonderful groan of the magnetic brake.

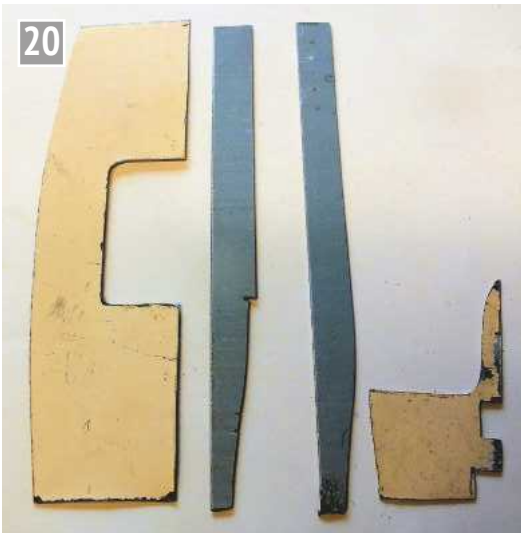
necessary, it could be lifted should any adjustments be needed to the mechanism or wiring during construction. The final attachment of the car body would make this impossible.

Bodywork

To aid the construction of the bodywork of both upper and lower saloons, I first drew out full size elevations of the framework with all the parts including window frame positions and horizontal beams, taking care with placing the beams that will support the panelling. This plan was then used to lay out all the parts and cut the joints ready for assembly. Jointing is very important for the main beams and verticals as absolute rigidity is essential. PVA glue was used for all joints. On the lower saloon, the verticals that form the main window pillars have to be carefully shaped to follow the profile of the tumblehome. I made a mild steel template to aid the cutting of these parts (**photo 20**). Similar templates were made for other repetitive parts. Other additional bits of the framing were fitted without being jointed. On the lower saloon, the waist panel and tumblehome lower panel were applied as separate pieces (0.9mm ply) with a small gap between to accept the rubbing strip.

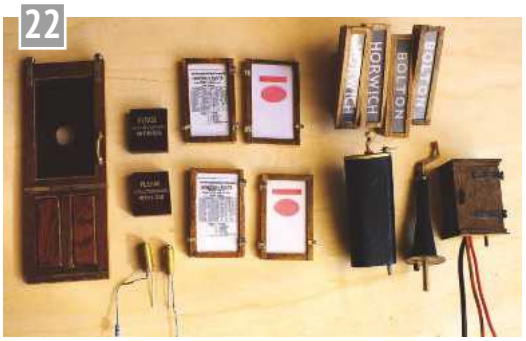


Floor fixed.



Templates.

Bulkhead.



Various parts.

Tool cupboard switches.

Tool cupboard.

Both bulkheads were made and completed before fitting to the side frameworks (**photo 21**). This was necessary as finishing interior details after assembly with restricted access would be difficult. I made sure the bulkhead sliding door worked and the glazing rebates and notice board panels were finished and even the varnish applied. The outside of the bulkhead – platform side was left to be treated later.

Many parts are made in advance of assembly and some of these can be seen in **photo 22** – a sliding door, saloon notices, a controller, destination indicators, a tool cupboard, brake pedestal, used ticket boxes and a pair of diode tail lights with resistors.

A feature of tramcars is that they are double-ended so there is a requirement to make two of most things and to make them identical. A small difference is that one end platform contains a tool cupboard and the other a resistance box. Both of these go under the stairs. I use the tool cupboard to house the switch gear for the lights and motor (**photos 23** and **24**). The switches need a little rod to operate them and the cupboard requires small working hinges to be made.

●To be continued.

REFERENCES

English Electric Tramway Album, Geoff Lumb.
Bolton Corporation, Harry Postlethwaite.
Tramways in Bolton, Tony Young and Derek Shepherd.

Injector Wars! PART 2

Warwick Allison relays the stories of the three Aussie protagonists, James Sanders, Simon Collier and Andrew Allison.

Continued from p.589
M.E. 4676, 22 October 2021

These are the stories of three model engineers from a land far, far away, vying to make the best injector.

The challenge!

Utterly meaningless!
Everything is meaningless.....
What has been will be again,
what has been done
will be done again;
there is nothing new
under the sun.

Ecclesiastes 1

Dramatis Personae

James

James is a young passionate model engineer who works at a furious pace with many locomotives already evidence of his work. He is new enough not to be worried by those things that would make more experienced model engineers shy away from the challenge! He leads with such pioneering enthusiasm that others are left behind in his wake.

Simon

Simon is a meticulous model engineer who can focus on precision and making things correctly. He discards his failures and pushes on to achieve that which is often unachievable! A technical challenge is Simon's big come on! Like a dog with a bone he carries on until the impossible is achieved!

Andrew

Andrew is a model engineer romantic, dreaming of that perfect prototypical miniature that performs superbly. He is something of a wily Mr Fox, hanging back and watching the successes and failures of those that go before him, while simultaneously building up an armament of jigs, reamers and fixtures ready for a late but substantial push into the unknown.

Simon's Tale

I have always thought injector making was the preserve of only the most accomplished model engineers, amongst the elite of the hobby. I had read various articles in the magazines over the years but none so clear or compelling as to tempt me to have a go. Then in 2010 a book was published, *Miniature Injectors Inside and Out*, by Derek Brown. I immediately bought the book and it gave very clear instructions on how to go about making working injectors. The author cautioned that it would test man and machine and stressed the need for very sharp and accurate lathe tools, cone reamers and drills. In other words, bodgers need not apply! He said that you would be spending the first two weeks making tooling before you got to 'cut brass'. I found the book quite beguiling but was not ready to make the commitment at that time and thought 'one day...'.

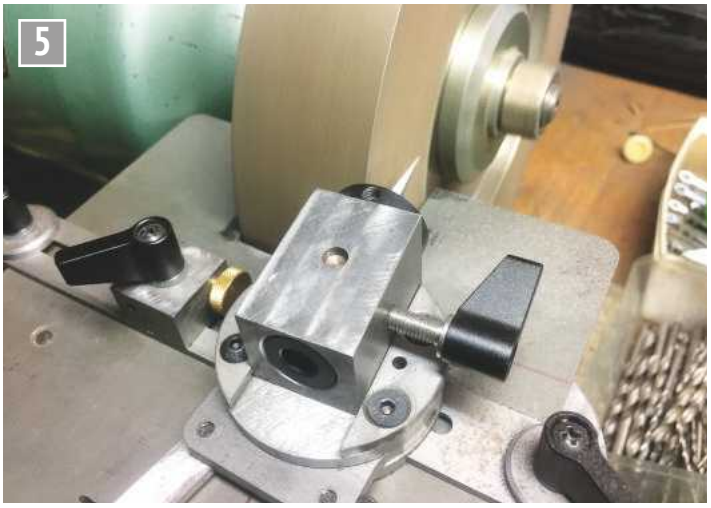
Fast forward a few years and, fairly recently, James Sanders borrowed the book and quickly ordered his own copy. In true Sanders style, familiar to most members, James immediately started making injectors. Success was not long coming and James churned out a few very good injectors including, significantly, a couple of 12-ounce injectors.

The difficulty of making injectors is inversely proportional to their size, that is, the smaller they are in ounces per minute, the harder they are to make. The reason is that the smallest hole to be drilled in the injector, the delivery cone, requires tiny drills and injectors are often named by the number drill required to make the delivery cone, so a number 69 uses a 69 drill for the smallest hole. The smallest injector described in the book is the 4 oz and, with a number 80 drill required, i.e. 15 thou or 0.34mm, is only for the true optimist.

The largest is 40 oz but the detailed instructions feature the 26 oz, a size regularly used on our 5 inch gauge locomotives, and the commonest commercially available from our suppliers. The smallest drill needed is about 0.7mm, so not too scary. The sight of this drill held in the 13mm keyless chuck in the rather hefty 3MT tailstock on my 300 x 900 Hafco lathe does not promise great feel when drilling! But this proved not to be the difficult part.

Injectors are a marvel of physics and operate because of the Venturi Effect and the Bernoulli Effect. Very simply, when the water and steam are turned on at their valves, the high velocity steam at nearly boiler pressure enters the convergent steam cone which increases the velocity further and lowers the pressure to below atmosphere when it enters the combining cone, drawing water through the critically sized annular gap between the outside diameter of the end of the steam cone, which just enters the combining cone, and the internal diameter of the latter. The water is entrained in the flow and condenses the steam, hence the need for coolish water. The combined flow jumps the gap into the delivery cone, which is divergent. This exchanges velocity for pressure and the now higher than boiler pressure but slower flow enters the boiler through the check valve. The two-part combining cone allows water to flow out of the gap, through the ball valve chamber and

The nine-degree reamer.



Grinding a three-sided reamer.

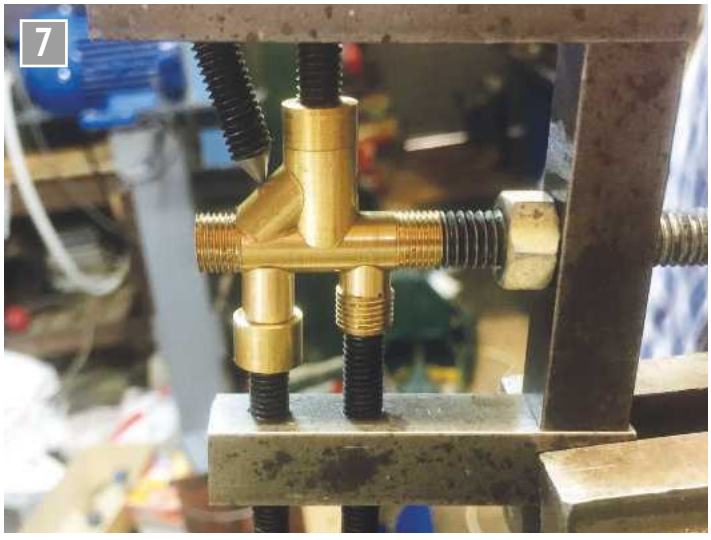
out of the overflow until the combined flow is established, the relative vacuum sucks the ball onto its seat and the injector starts.

To make the cones, you need two taper reamers, a 9 degree (**photos 4** and **5**) and a 13 degree. The book specifies 'D' bit style reamers, turned to the taper then halved, hardened and tempered in the familiar way that we use for 'D' bits for ball seats or parallel reamers for a size we don't have. The 9-degree reamer, in particular, needs to be exactly nine degrees as critical dimensions depend on this. This means setting the top slide over to 4.5 degrees, using the scale as a starting point, then adjusted accurately using the dial test indicator and trigonometry. The tip needs to be smaller than the smallest hole it will enter and about 15 thou is suggested. This demands a very sharp lathe tool exactly on centre height. An equally demanding task is milling the reamer to just more than half thickness and, to top it off, you then have to harden and temper it without overcooking the tip or otherwise spoiling the job. I think I attempted three before I got a good one. The 13-degree reamer is a little more forgiving as its exact angle isn't critical.

So far, I have made four 26 oz injectors. As fiddly as the cones are, I had a surprising amount of trouble making the bodies as shown in the Brown book. The Brown bodies are rather dainty, using the minimal amount of brass, with a 5/16 barrel to which are silver soldered the water intake, the overflow outlet, the valve chamber and the problematic overflow cover (**photo 6**).

The instructions are to drill the bodies 5.3mm before soldering up, then using a hand 7/32 inch reamer afterwards. Initially, I left the final drill, and machine reamer, in my case, until after brazing up the body. It is then in a very soft, annealed state and there is no way to safely hold it for these operations. The results were visibly bent bores, with

Injector body components.



Injector body soldering jig.

Injector, showing cones.

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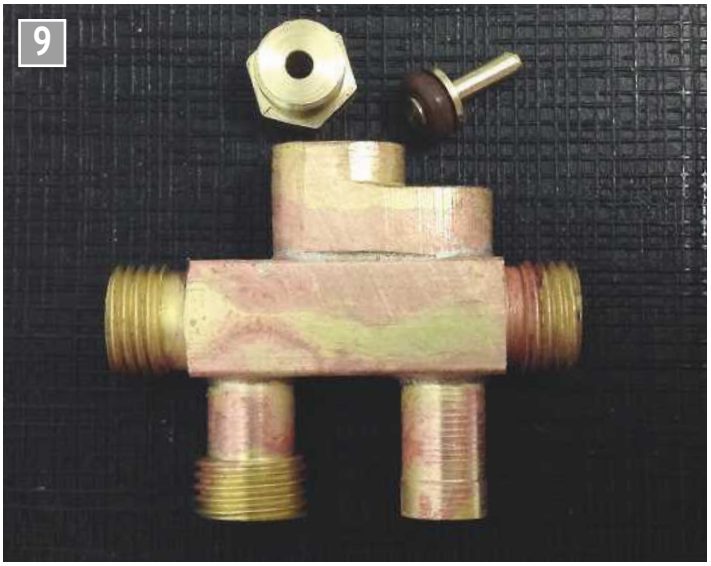
I have gained a good understanding of how injectors work and which bits are the most critical. For example, oversized holes and eccentric holes are killers. Before this whole exercise, I really didn't have much of a clue what was inside them or how they worked. These fascinating little squirts really are quite addictive.



Simon's 12 oz injector with 'O' ring seal in lieu of a ball.

the reamer coming out of the delivery side eccentrically, rendering the body a scrapper.

This body requires a silver soldering jig to hold it all together, as the fittings are scalloped to the body outside diameter and just butt against it (**photo 7**). I remember Ray Lee showing such a jig at the club some years back. More than a sparing application of solder will find its way into the bore and, again, a scrapped body results, as any attempt to drill out the much harder silver solder from the soft brass bore will fail. You definitely want to be using 1/32 silver solder wire here. In the book he uses silver solder paste, which I have never come across.

It is much easier to make the bodies from 3/8 inch square brass rather than 5/16 inch round (**photo 8**). A jig is not really necessary as the bottom fittings can be made a press fit in a slightly counter bored hole and sealed around the outside with a touch of silver solder. The valve chamber can be another bit of 3/8 inch square, with a groove milled into the underside to connect it to the overflow hole in the body, and the ball seat cut slightly into the main body section. I use a 7/32 inch slot drill to make the seats and the caps are threaded 1/4 x 40. The downside is that the square injectors are ugly and bulky compared to the Brown style. I tried to refine the appearance on injector 3 by rounding off some of the square corners. Injector 2 has an overflow cover made from a bit of rectangular brass milled at right angles to conform to the valve chamber and body diameters.

Now to the important bit - how did they work? My first injector picked up but spilled a large amount of water from the overflow. Various attempts at remediation resulted in only modest improvement, although it would fill the boiler. Today, ANZAC Day, I steamed my Simplex at home to retest this injector and three untried new ones. Number two picked up straight away cleanly, with no dribbling. Success! Number three picked up but immediately something changed and it then refused to work - the combining cone had been moved by the flow, something that had happened to number 1 weeks earlier.

It is extremely difficult to get the light interference fit of these cones that you need as it is in the range of microns. A speck of Loctite is the remedy but it is permanent, not that combining cones should ever need removal. Injector 4 was a beauty, like number 2, and would still pick up down to at least 40 psi as I let the fire die. I should say that the only true test is running day operating when the injector must work at a variety of pressures and water tank levels etc. and not need too much coddling and coaxing.

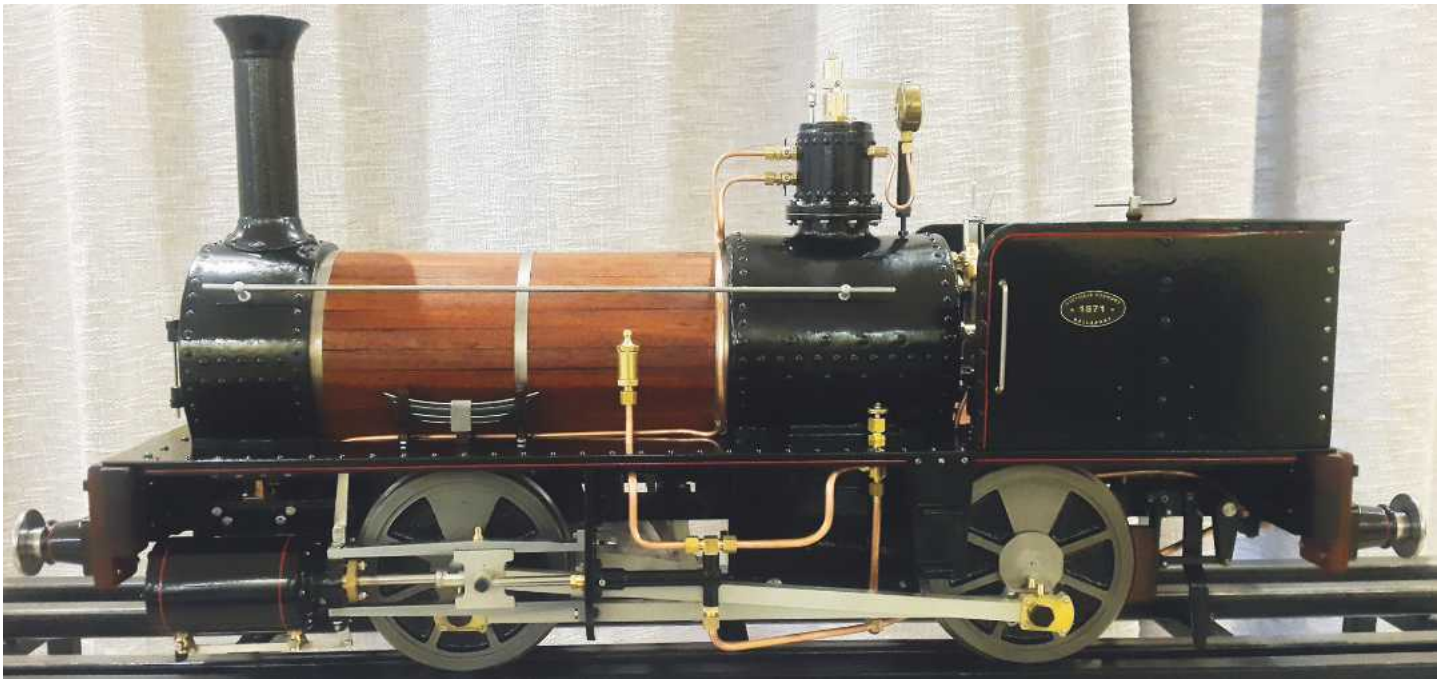
To conclude, I'm pretty happy with the results. I can now make a 26 oz injector and be confident that it will most probably work. Equally valuable, I have gained a good understanding of how injectors work and which bits are the most critical. For example, oversized holes and eccentric holes are killers. Before this whole exercise, I really didn't have much of a clue what was inside them or how they worked. These fascinating little squirts really are quite addictive. Infectious too, as I caught it from James, and now Andrew is showing symptoms, tooling up for a production run.

Addendum: Since I wrote the above, I have made a 12 oz injector. The #73 (0.53mm) drill looked even more ridiculous in my 13mm chuck. I used new drills, drilled one size smaller and then the size drill and fitted an 'O'-ring valve rather than a ball valve, with its spindle constrained and guided by a hole drilled in the cap (**photo 9**). This injector was tested on the track on our Members' Day and performed flawlessly whether steam or water was turned on first, a very pleasing result.

●To be continued.

NEXT TIME

Finally, Andrew tells his story.



Ballaarat PART 5

A 5 Inch Gauge 0-4-0 Aussie Locomotive

Luker describes a simple but authentic small locomotive.

Continued from p.502
M.E. 4675, 8 October 2021

The Gooch type valve gear

The Gooch type valve gear (**fig 9**) is comparable to the Walschaerts valve gear in that it has constant lead regardless of the cut-off. In other words, unlike the Stephenson's valve gear (interestingly D. Gooch used to work for Mr Stephenson's company), as you back notch the lead remains constant. The valve gear links are also more compact and don't require as much clearance top and bottom because the expansion link isn't moved for different amounts of cut-off. Unfortunately, this link system results in some angularity between the radius rod and the centre line of the valves causing die-slip and interesting geometric calculations for the valve events. This can be minimized by optimizing some of the link dimensions using dynamic simulation tools. The fact that the expansion link is swung from the bottom did not make life easy, to say the least, but the prototype was like this and I had no intention of changing something fundamental like that!

The valve links

One of the advantages of my method of building is time. With extensive use of modern laser cutting methods the build time is drastically reduced. Most modellers are enthusiastic in the beginning but this enthusiasm is corroded with time. If the build time is reduced, and the enthusiasm levels are kept high, you're far more likely to finish. Having said that, all the valve gear links can be brushed off in an afternoon and the assembly can be finished over a weekend.

Before I get there here's a few tips for laser cutting. Remove any holes or slender cut-outs that are smaller than the plate thickness and add a centre mark to be engraved. All critical holes larger than plate thickness can be cut 0.5 mm undersize and opened up on the drill press.

On the drawings supplied to the laser cutters (typically DFX) give two overall dimensions on each part for them to check scaling when transferring the files to their format, with a note next to the part including the quantity, material and thickness. I specify that a neat finish is required with no fettling (this just adds cost and they muck it up anyway). I normally go one step further and ask that it doesn't go past the QA department because I've found it just adds cost to the job with no added value.

To make sure you getting a good deal I paid £225 (beginning of 2020 before the great CR19 debacle) for two sets of laser cutting (one for me and one for the young lad who's building with me). This included all the laser cutting

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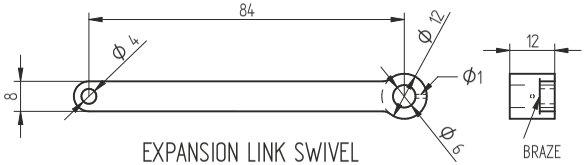
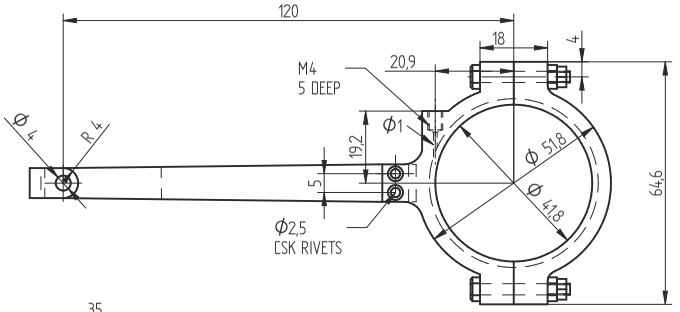
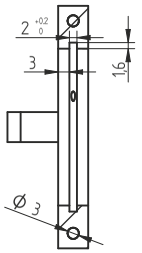
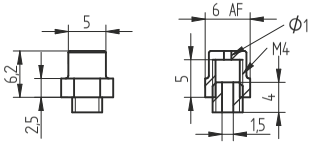
Fig 9



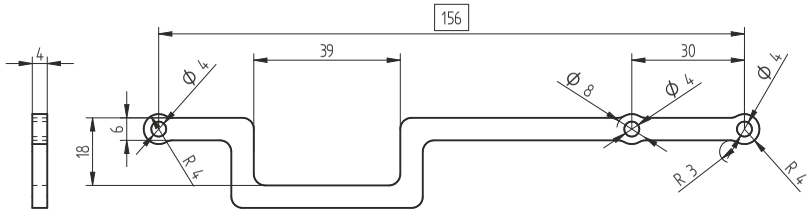
EXPANSION LINK SWIVEL
MATERIAL: LC MS



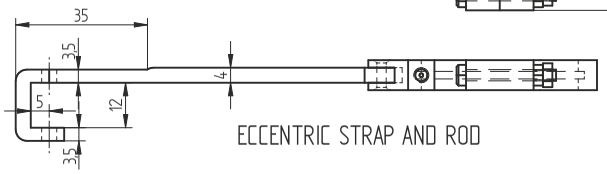




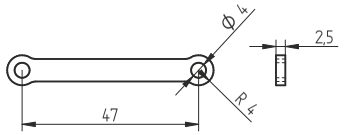
ECCENTRIC STRAP OILER



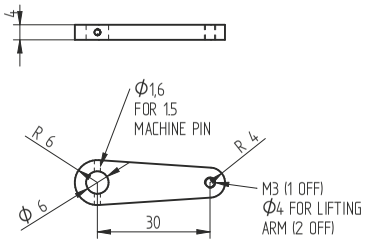
REVERSING ARM
MATERIAL: LC MS



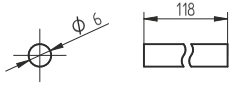
ECCENTRIC STRAP AND ROD



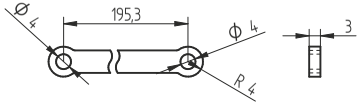
LIFTING LINK
MATERIAL: LC MS



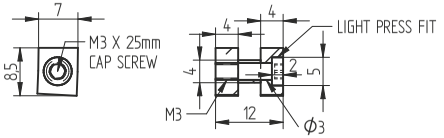
REVERSING AND LIFTING ARM
MATERIAL: LC MS



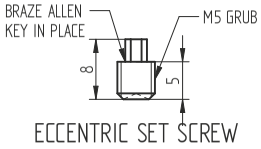
REVERSING SHAFT
MATERIAL: EN8



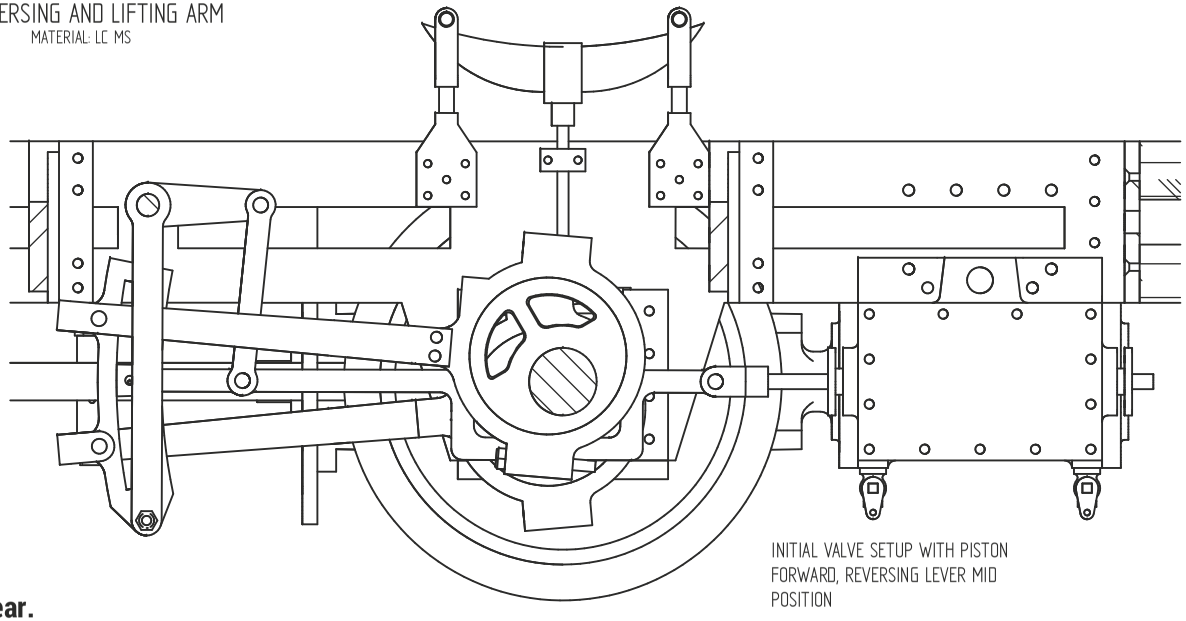
REACH ROD
MATERIAL: LC MS



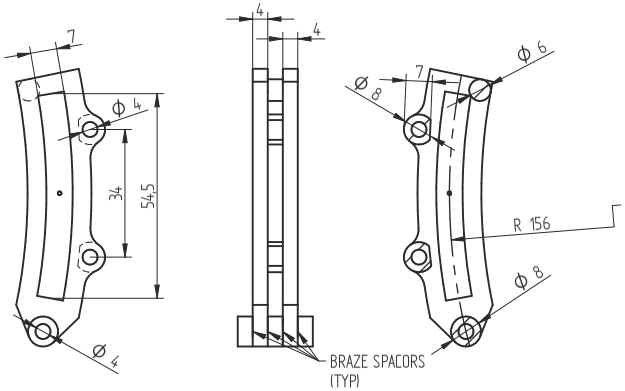
DIE BLOCK ASS
MATERIAL: BEARING BRONZE
SPACER: SILVER STL



ECCENTRIC SET SCREW



INITIAL VALVE SETUP WITH PISTON FORWARD, REVERSING LEVER MID POSITION



EXPANSION LINK
MATERIAL: LC MS

Valve gear.

and plate rolling for the boiler. Incidentally, while we're on the topic of build time, each boiler was knocked off in a weekend.

Most of the links only require centre punching (use the engraved centre to find the mark) and drilling (**photo 26**). What I normally do is drill the holes 0.5 mm undersize with all twin components match drilled using the methods described previously; then finally all holes opened up to the correct size. Drilling like this improves the quality of the hole drilled and prevents clover leaf drilling and oversized holes.

The expansion link and expansion link swivel are a brazed (silver soldered) assembly and there are a few tricks here. All the spacers are simple lathe turning and drilling operations but the hole needs to be drilled smaller - 3mm for a M3 stud in all cases. On the sides of the spacers that will be brazed, lightly dimple the surface in three spots; this is to force a gap for the solder to penetrate the joint.

Everything needs to be cleaned and Tipp-ex is applied to the holding studs that go through the holes to keep everything in place. Tipp-ex ensures the solder won't take to the stud, converting the job from a few minutes to a few hours.

With everything assembled to drawing mix a little silver solder flux and water to the usual paste consistency and apply to all the joints that will be brazed. Heat the lot up and run the solder on all the joints. The job can then be pickled and the joints cleaned up with some light filing. You should end up with a clean metal part with feint golden lines where the solder is holding everything together. Finally, all the holes can be drilled out to size with the part clamped down (**photo 27**). Don't forget to put a spacer between the expansion link sides to prevent deformation with the clamping.

The die block assembly

The die block assembly consists of 4 components: the two bearing sides, the silver steel sleeve and the cap screw holding the lot together (**photo 28**). The rod can either be held in a small chuck that runs true, or a collet, or the home-made collet system I described earlier in the series. The end of the rod should be faced, centre drilled and opened up to size with a little cutting fluid applied to the drill flute as you go to keep everything cool. The hole size should be the actual size of the cap screw, typically 2.9mm.

The cap screw can be cut from one of the longer lengths to take advantage of the unthreaded section, that should be around 8mm. You may need to run a die for a few mm. The threaded part can stop just flush with the back end of the assembly when tightened. Using the DIY collet, the Allen key side of the cap screw can be skimmed to a light press fit and shortened so that it doesn't protrude from the block and foul the swivel link.

The bronze part of the die block assembly is best done on a rotary table (this is typically what I use because I'm fortunate enough to have one) or one of the many fine expansion link slot cutting devices printed over the years in *Model Engineer*. Alternatively, this little block could be hand filed and scraped to fit the expansion link - in this case, I suggest clamping the two sides back to back and filing them as a set. Applying a marker to the surfaces will highlight the spots that need a little more scraping. With filing something like this remember - slowly, slowly catchee monkey!

The eccentric strap and rods

The straps are one of the components that probably require a little more description for the beginner. Before any metal removal it's important to understand that the straps require a round hole, the clamping surfaces need to be flat and true, and the fit on the bearing surface is a free-rotation with a no-rattle fit. The sequence of machining needs to ensure that those requirements are met.

Firstly, the sides of the strap are skimmed to drawing. Holding on the inside as-cast surface is good enough but the casting needs to be aligned to the chuck face using parallels to make sure you end up with a uniform thickness. Never machine with the parallels in place unless you use the fixed parallel method of cylinders bolted directly to the chuck and skimmed in place. Incidentally, parallels don't need to be fancy expensive bought items - I most certainly don't have that luxury. Any square or rectangular bar stock of the same batch will be close enough.

Next, the ears of the straps need to be skimmed by aligning either side with the ≫

Valve gear links.

Brazed link assemblies.

Die block assembly.

Skimming the eccentric strap ears.

top of the vice (**photo 29**). Don't worry too much about the end dimension here; this is a reference cut, but you do need to leave at least 1-1.5 mm extra for splitting and cleaning up the clamping surface. All the clamping holes should be drilled and preferably reamed before splitting the straps. Mark and drill both clamping holes without removing the strap from the vice to make sure they are parallel. Because the straps are gunmetal remember that auto feeding is a problem with a heavy spindle and backlash on the rack, so add a little friction to the spindle to avoid a nasty plunge into the part. Finally, the part can be marked and split into halves. I normally use a hack saw and the top of the vice as a cutting guide (**photo 30**).

Cleaning the cut edges can be done in two ways - I'll go through the easiest first. Take the cut strap and hold the parts together like they will be fitted (because you marked them before they were split). Now place them back to back like you were closing a book, and flip one of them. Hold the parts together like this and clean the cut surface using a fine file and finish off on a flat top with some water paper. Viola! You'll get a good clean mating surface. Alternatively, the cut surface can be skimmed on the mill but both components need to be placed in the vice with the orientation mentioned above to ensure any parallel setup issues on the vice aren't compounded.

The studs holding the two straps together are best made from silver steel and this is a simple threading operation on the lathe - remember the root shortening to save your dies. The whole lot gets assembled and the sides checked with a straight edge to make sure they're parallel.

Now we can machine the bearing surface and groove. Strictly speaking, the strap should be held in the four-jaw chuck but my castings include the material removal for splitting the halves so by the time all that's done the outside as-cast surface is very close to round, allowing the part to be held in the three-jaw chuck.

The inside bearing surface is machined using a boring bar with the eccentric jig, described previously, used as a gauge for fitment to the straps (no need to remove the strap from the chuck during machining). The groove in the center of the strap is machined with a homemade grooving tool; I normally reverse the direction of the lathe and machine on the reverse side when doing the groove so that I can see what's going on (**photo 31**). If everything is done to drawing, using the gauges and methods described, all eccentrics and straps should be interchangeable. On the off-chance one is tight you can place a shim on the parting line or, alternatively, if it's too loose, the clamping surfaces can be skimmed slightly using a fine file.

The oil cup can now be lined up, drilled and tapped to drawing. Remember the pre-drilled cap screw drilling guides described previously for the 1mm oil hole.

To bend the rods a holding point is necessary to prevent the end from slipping during bending. A hole at the expansion link pin, for a M3 holding bolt, will keep the bend position relative when forming over a piece of 12 mm square bar (**photo 32**). After some panel beating in the vice the 3mm hole can be used as a pilot to drill through both sides. The end of the rod can be finished off nicely with a fine file and radius guides.

To fit the rods to the straps a jig is the way to go, forcing each assembly to have the same length. Before assembling the rods, make sure the bend is the correct

Splitting the eccentric straps.

Machining the eccentric strap groove.

Bending the eccentric rod ends.

Eccentric strap assembly jig.

Assembled eccentric strap and rod.

The prototypes eccentrics and straps (www.busselton.wa.gov.au).

way; the bottom and top straps are mirrored. A 4mm slot is milled (or filed) to the end of the strap, after marking out the rivet hole position and centre punching. A 4mm end mill will cut the slot slightly oversize but don't worry too much - after riveting the rod in place this gap will close up free of charge. With the assembly in the jig, drill the holes through the rods for the rivets and countersink both sides (**photo 33**).

For my rivets I used iron nails that were roughly 2.5mm in diameter. Strictly speaking, you should make a set and former but for countersunk rivets like these I cut them 2mm longer on both sides and using a ball peen hammer caress the ends to fill the countersink. The cheap iron nails are easily cold worked and with a little practice you can coax the metal to move where you want it. Finally, the excess can be cleaned with a fine file or flapper disk to finish the assembly off neatly (**photo 34**).

Valve link pins

Suitable side clearance is needed on the pins to clear adjacent moving parts, with this linkage system consisting of multiple links moving within one another. The easiest way to do this without using fixed peened pins (like the prototype – **photo 35**) is to countersink the link at the end of the pins, tap the pin M2.5 and use two countersunk screws with a little thread locker to keep everything in place.

The lifting link will need a peened silver steel pin to clear the eccentric rods at the bottom but this is an easy task. The three links will become tight with the peening but can be loosened by placing a washer under the assembly that clears the peened head and tapping the top of the pin until the radius rod moves freely.

Lifting link assembly showing peened pin.

All other pins are made from 4mm silver steel machined and cut to a length slightly longer (+0.2 mm) than the link assembly. Each side is drilled and tapped for M2 or M2.5, a screw screwed in tight with a nut fitted, cut with a side cutter and cleaned off neatly in the lathe. When the nut is screwed off, the thread is cleaned free of charge and the end of the threaded stud makes the pin look like a machined component.

And with that all the valve gear was licked in a weekend (**photo 36**)!

●To be continued.

Milling Topics

In Defence of the Oriental Milling Machine

PART 2

Nick Feast finds that currently available Far Eastern machines offer good value for money.

Continued from p.583
M.E. 4676, 22 October 2021

The risks of using far eastern machine tools for precision applications became apparent in an application I was involved in a few years ago. As a volunteer at a local heritage railway I was seconded to help create a flycutter to remove metal from the bearing faces of locomotive hornguides. This machine was to be mounted on a substantial girder clamped across the locomotive frames so that the horn faces could be machined dead true to the axis of the engine.

A vital part of the process was the accurate measurement of any discrepancies in the vertical, horizontal or axial alignment of the horn guide faces. For many years this was done by mechanical means, using wires, straight edges and adjustable tubes to set up the cylinders and axles. This was the standard throughout the UK right up until the end of steam but only one workshop in this country had truly achieved precision in this area. So Swindon was the inspiration for this particular project and the engineering team at the West Somerset Railway had produced a portable machine, which was used as the basis for my design.

Swindon had standardized on optical alignment to identify where metal needed to be removed, so that when locomotives came into the shop they were simply placed in the bay where the grinding fixtures were located in the correct positions relative to the axle centres and the hornguides were 'squared up' relatively quickly. Without the degree of locomotive standardisation achieved by the Great Western it was virtually impossible for other railways to use this regime, as so many GWR designs use the same axle spacing.

The length of the frames on a Pacific is apparent on the rear half of a Canadian Pacific being overhauled at Eastleigh.

The locomotive that was the subject of this trial machine had the added complication of an oil bath between the frames in such a position as to make fitting a cross beam to support a cutting machine more difficult. Another unique feature of the unmodified Bulleid Pacific! Applying this working method to heritage railways has considerable advantages in reduced wear and maintenance and of course better performing locomotives. On miniature locomotives we can of course just bolt the frames together and mill them as a pair, even at overhaul time with frames more permanently connected horns can be filed to take out uneven wear and oversize axleboxes fitted.

Although there may be some benefits to having a little flexibility in full size locomotive chassis design, the target is to keep the frames in the best alignment possible. The very best designs towards the end of steam were the one-piece cast steel beds incorporating as much of the locomotive as possible in one rigid unit. This included cylinders and smokebox saddle, such as the French 'Mountain' 2-8-2s initially produced in the USA. Compare this with the frames of a Merchant Navy or a Britannia with frames of 1⅛ inch steel plate some 45 feet long assembled with various stretchers and castings to provide a semblance of rigidity. **Photograph 14** shows a Canadian Pacific at Eastleigh under overhaul recently; the rearmost parts of the frame are doubled

up because of the shallow section but still prone to flexing.

Every main line locomotive ever designed for the UK rail network was hampered by both the lack of investment in manufacturing and the limitations laid down by the Civil Engineer's department in terms of axle loadings. Therefore, it's hardly surprising that locomotives that have run a million miles or more in service and then been dumped in a scrapyard for years will have frames that are in need of attention.

Several locomotives under overhaul were carefully measured using optical alignment equipment to establish the amount of work needed to get all the axlebox working surfaces square to the centre line of the frames and the axes of the cylinders. Unsurprisingly the older locomotives with the greater mileages needed more attention. A Merchant Navy built during world war two worked hard every day right up until the end of its life on the main line, rarely taking less than 11 coaches on express trains. A West Country built in 1950 could frequently be seen in the depths of Devon and Cornwall ambling along a secondary route with just a couple of coaches in tow. Both classes of locomotive were built with virtually identical running gear.

Photograph 15 shows part of the setup to check the alignment on 34105 at Ropley on the MHR (Watercress line). The prism is basically an optical set square set up on the rear horn guide face of the left hand driving axle. This is viewed through a telescope mounted on the cylinder, having first established that the cylinder bore is in correct alignment with the locomotive frames. This is repeated on all the hornguides so that the correct amount of material can be removed from each one.

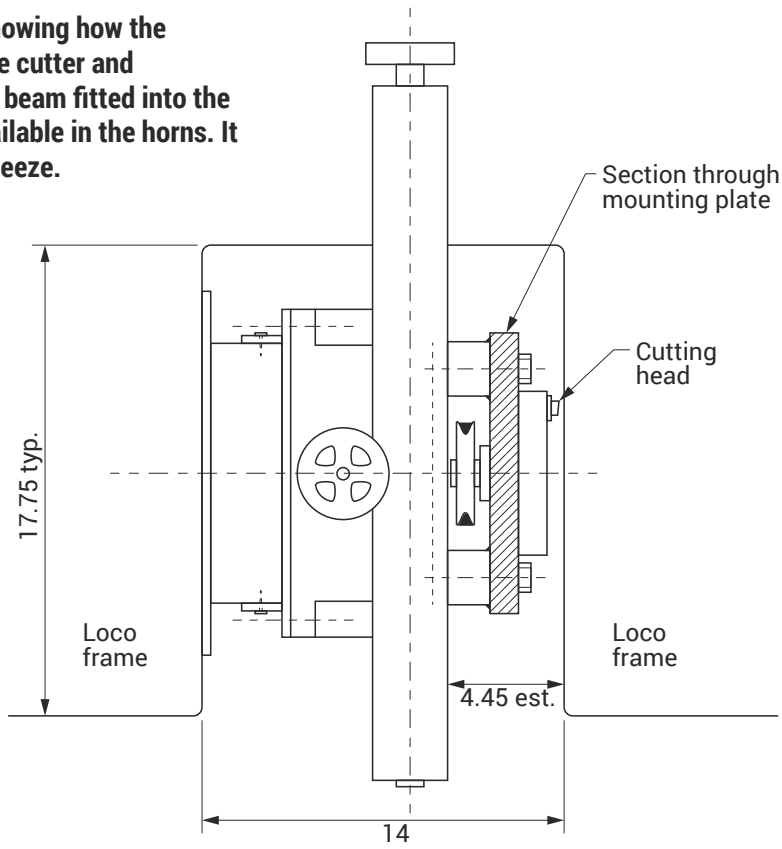
Photograph 16 shows the business end of the horn guide cutter removing some metal from one of the horn plates

The optical prism is set at right angles to the axis of the locomotive and sighted through a telescope mounted on the cylinder.

Bogie hornguides being machined to correct the alignment viewed from between the frames.

Sketch showing how the horn guide cutter and mounting beam fitted into the space available in the horns. It was a squeeze.

Fig 1



Side View Of Horn Guide Cutter On Loco

As the old saying goes 'You get what you pay for' but in the case of these engineering items from the Orient there is so much of it on the market it is difficult to avoid.

on a Bulleid Pacific bogie. The mounting girder is in the foreground and the bulk of the cutting machine is out of sight behind the red bogie frame. The belt driven wheel in the centre of the photograph carries a very small adjustable cutting head fitted with a 10 mm indexable cutting tip.

The vital connection between the support girder and the cutter was a 26 x 12 inch milling table of Chinese origin sourced, as usual, via the Internet. Secondhand higher quality items of British or European origin were either not available or came complete with a milling machine attached at considerably greater expense!

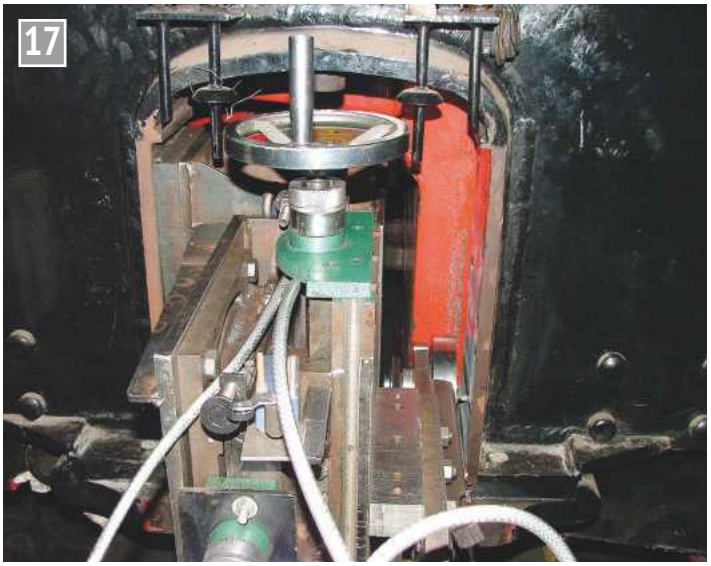
Work proceeded on a suitable design to power what was basically a belt driven flycutter narrow enough to be fitted onto the Y axis of a milling table mounted vertically, which could pass between the faces of locomotive horn guides. I had around 14 inches to play with but this included the space needed for the substantial cross beam and the mill table. The width available for the cutting head, mounting plate and belt drive was a mere 4½ inches - and there had to be an absolute minimum of deflection when cutting. A 180 Watt geared motor was used to drive the cutting head at a speed of 120 rpm but this was subsequently increased to around 200 rpm by changing pulley ratios. Provided light cuts were taken there were no problems with overloading. Cutting lubricant was always used of course.

Figure 1 shows how the cutter fitted between the horn faces. It may surprise readers to discover that the distance between the horn faces on the locomotive driving axles is actually almost identical to the bogie axles, so all the testing was carried out on the bogies prior to doing the locomotive.

However, before we got to this stage there was the matter of getting the machine to cut accurately. Checking the performance of the milling table was done by Ropley machine shop whose comments were definitely unprintable, in essence pronouncing the item only fit for the skip! Unfortunately, we had to work with what we had as milling tables of European or US origin were just not available at an affordable price, bearing in mind the limited uses for the end product. So, the decision was made to try and improve on the accuracy this table could provide. The quality of any heat treatment was suspect, perhaps even non-existent, so the table was stripped down and sent away for heat treatment and regrinding. This I believe cost more than the initial purchase price!

Various fettling was carried out, rough edges removed and bearings and gib strips carefully reassembled. The improvement was dramatic; now the table would keep within the required tolerances throughout its travel, although some reinforcement of the mounting plate was required to reduce flexing.

Photograph 17 shows the cutting machine in its final form with the manual feed on the Y-axis replaced by a powered feed. Once again, a geared motor was used and limit switches fitted so that the machine could theoretically be left unattended. **Photograph 18** shows the same operation, working on the leading axle horn guides of an unmodified Bulleid. The red painted casing inside the frames is the oil bath for the valve gear and inside big end, which prevents the use of a similar



Locomotive hornguides being machined. The cutting tool can be seen lower right, with the swarf being sprayed against the valve gear oil bath behind it. In the centre of the photograph one of the limit switches can be seen.

General view of the machine in position, after the addition of the powered cross feed and associated controls.

machine mounted between the frames, as would be the case for locomotives such as two outside cylinder ex-GWR types.

As the old saying goes 'You get what you pay for' but in the case of these engineering items from the Orient there is so much of it on the market it is difficult to avoid. Unfortunately, one sometimes needs to be prepared to re-engineer, and then it is possible to end up with a very serviceable product at the end of the journey.

ME

Doug Hewson says why have any old driving truck when you can have one that looks the business?

Doug's Y4 coupled to the driving truck.

Building a Driving Truck for 5 Inch Gauge

PART 1

I have had immense pleasure from using my driving truck over the many years I have been driving an engine. It was originally designed by Ron Bray for his ground level railway which was begun in 1948 and all of his driving trucks are still on the go so that says a lot for his design. I just thought that I would improve on the design a little to make the bogies a little more to scale so that they look like standard LNER diamond framed wagon bogies.

I do not like the two axle designs as I just feel that the weight of a person puts too much pressure on the track. These driving trucks are built to look like a railway wagon and can be used for tender locomotives as well as the small tank locomotives that they were originally designed for. If you make the seat as a separate unit, it can be moved backwards or forwards to suit the driving position required. If you need a water tank in your driving truck, then you will have to decide where you want the water tank and then fix it in position because of the pipework.

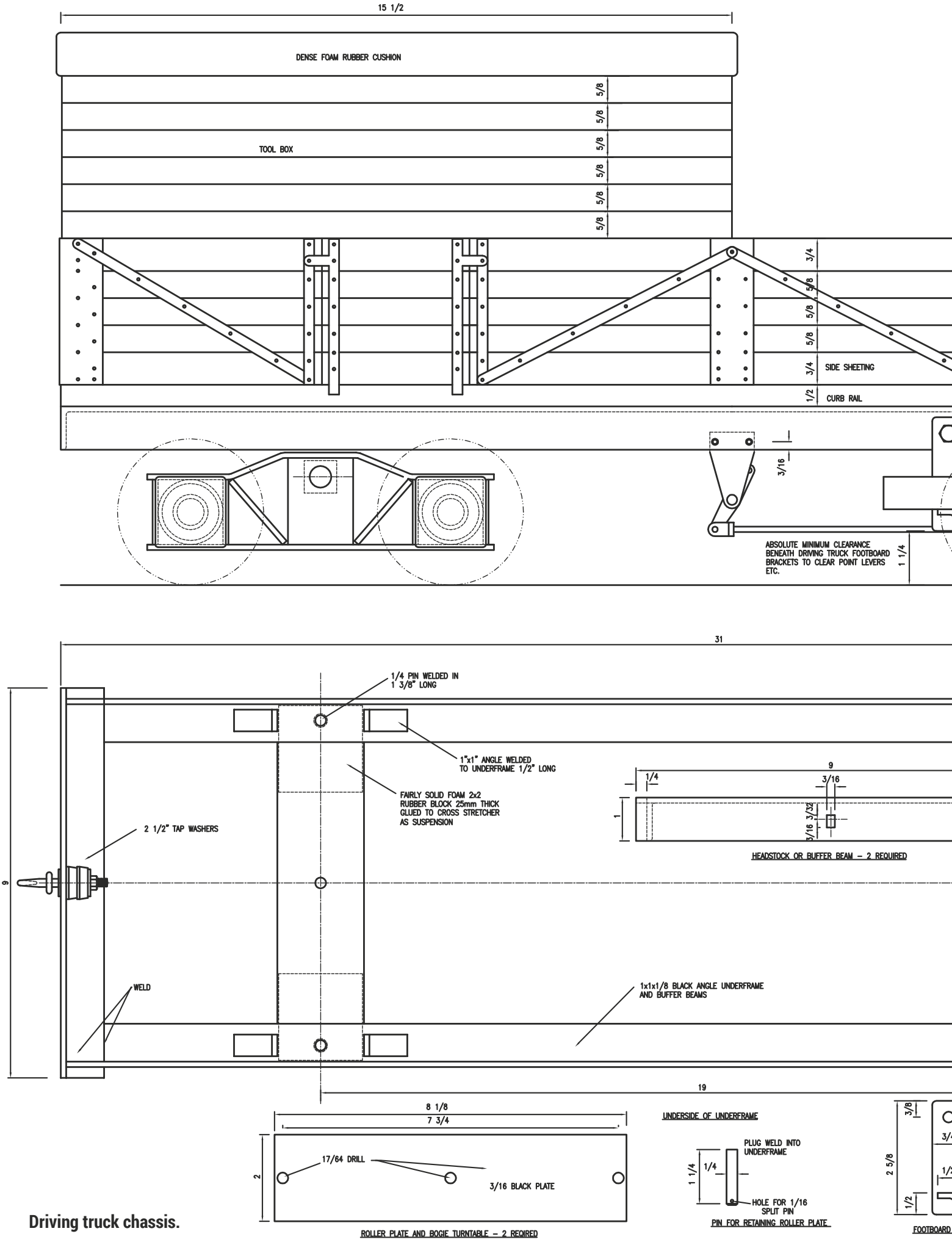
Doug's Y4 heading in the opposite direction.

I twice went down to the Ascot track (before they had to move it) and there was only one other shunting engine there so I ended up sitting on my driving truck all day with just a break for lunch. I had recently fitted a much stiffer foam cushion, thank goodness, but I was so comfortable with the position I could have sat on there for a week. I just love shunting, especially with my little Y4!

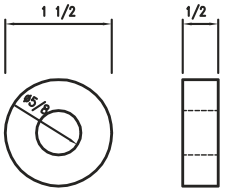
Photograph 1 is my Y4 and driving truck showing it with the fixed seat. You can see now how it is made to look like a wagon. In fact, it was designed to look like the LNER bogie brick trucks which were built to carry bricks from Fletton near Peterborough to London. **Photograph 2** shows

≫

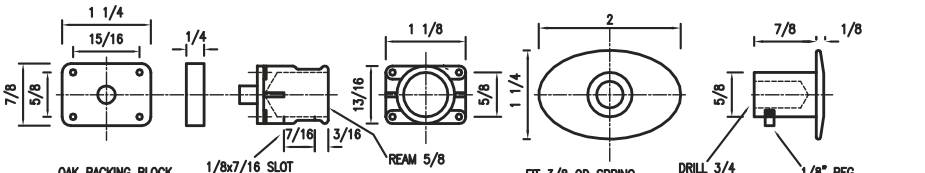
Fig 1



Driving truck chassis.



NYLON "6-6", OR BRASS ROLLER – 4 REQUIRED



OAK PACKING BLOCK

1/8x7/16 SLOT IN BOTTOM

REAM 5/8

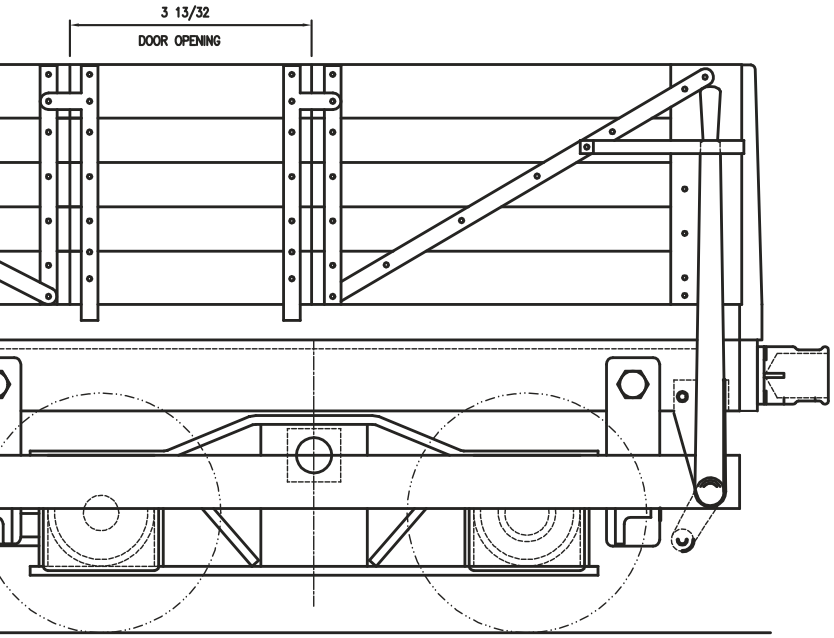
BUFFER GUIDE CASTING (FROM LMS 20T BRAKE VAN)

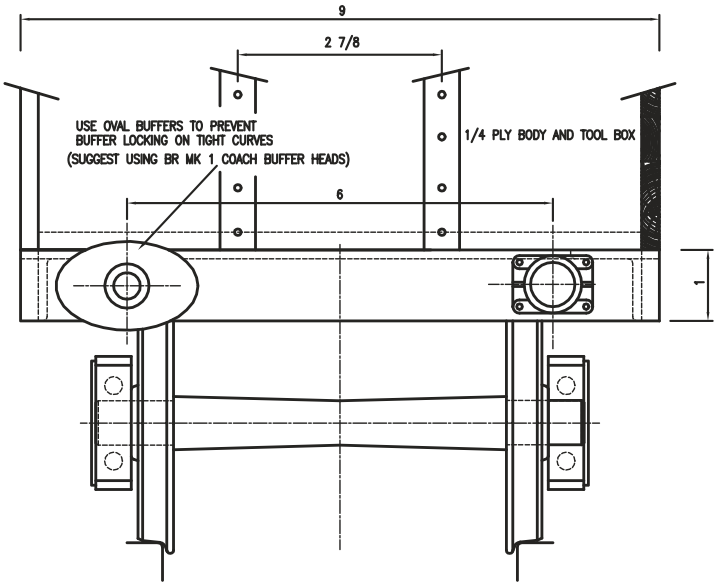
FIT 3/8 OD SPRING 1 1/4" LONG 16swg 12 COILS

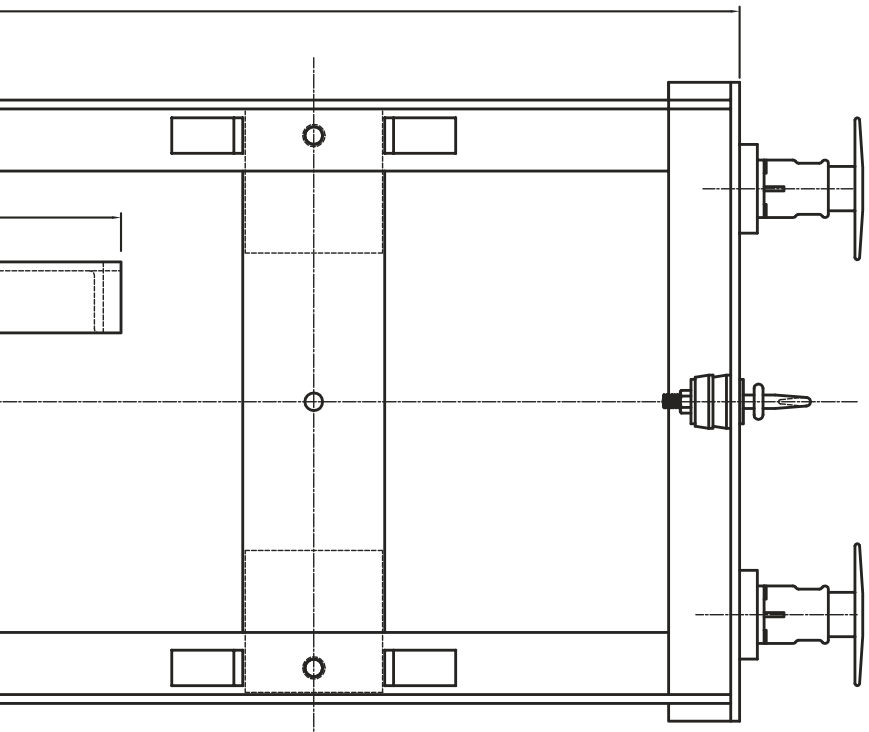
DRILL 3/4 X 3/4" DEEP

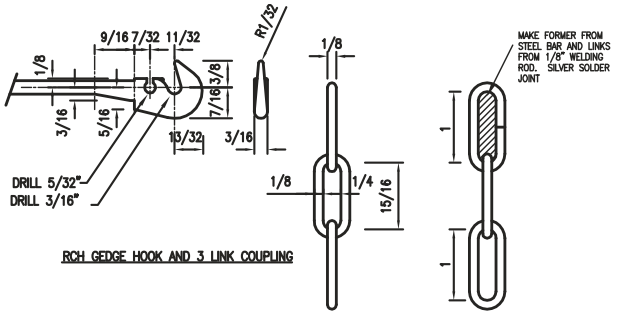
1/8" PEG SCREWED IN TO RETAIN BUFFER HEAD

BUFFER HEAD – MS.

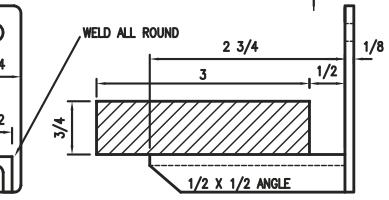




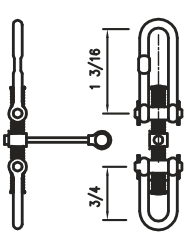




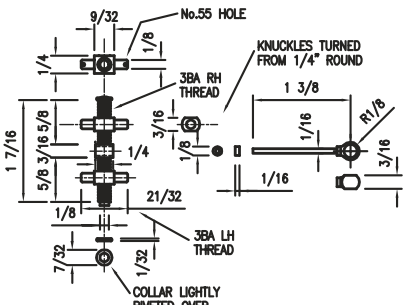
RCH GEDGE HOOK AND 3 LINK COUPLING



BRACKET 2 LH AND 2 RH REQ'D



SHACKLES CAST STEEL



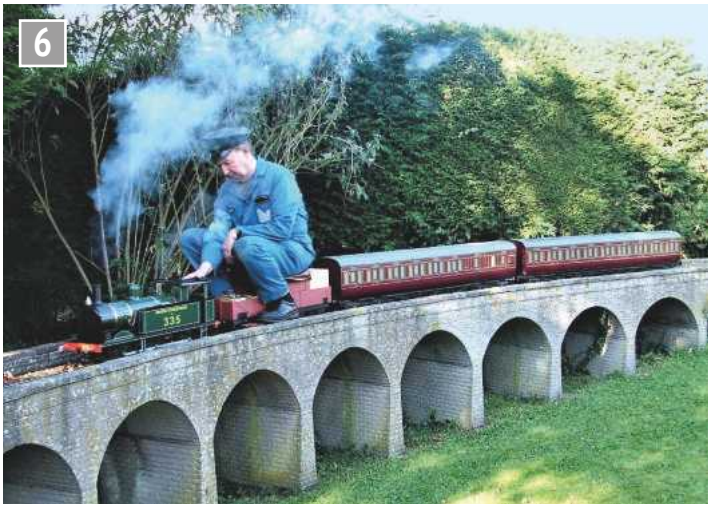
WAGON TYPE SCREW COUPLING

WHEN USING SCREW COUPLINGS MAKE SURE THAT THEY ARE SCREWED SO THAT BUFFERS ARE NO MORE THAN 1/16 APART TO PREVENT SHACKLE FROM COMING OFF THE HOOK.

This is Frank's GWR pannier tank and driving truck.

Geoff Boothby driving Graham Cooling's 08 shunter.

Geoff Boothby heading in the opposite direction, this time driving Ballan Baker's Y4.



Stuart Laidler crossing the viaduct.

a slightly better view of my driving truck along with my GER/LNER Y4 in our Coton Hill Yard where I had been shunting for most of the day. **Photograph 3** shows Frank with his brand-new pannier tank and his driving truck, which has a water tank in there, but he has arranged his truck to suit his long legs and is shunting in our Peak Forest Yard. Geoff Boothby is seen here in **photo 4** driving Graham Cooling's 08 and Graham has made a much higher seat for his driving truck. The flatrol in the photograph also uses a couple more of our bogies as these also had similar diamond frame bogies. In **photo 5** we now see Geoff driving Ballan Baker's Y4 on Malcolm Gregory's driving truck and Ballan has his seat about the same as mine, if not slightly lower. In this case one can see the brake lever on the right-hand side of the truck and it can easily be transferred to the other side if necessary as the cross shaft is designed especially for that. Geoff is also shunting in our Peak Forest Yard.

To make a start on the driving truck (**fig 1**) the main underframe consists of 1 x 1 x ⅛ inch steel angle frame which is 31 inches long and 9 inches wide. In the corners, the solebars need notching into the buffer beams and welding there, so that means that the overall length of the solebars needs to be 30¾ inches long. The sole bars need to be 8½ inches wide overall. The buffers can be pieces of tube, but we always favoured fitting proper buffers on all of our wagons, including our driving trucks, so that they are all in keeping with the theme.

Next you need a couple of pieces of 2 x ⅛ inch plate by 6½ inches long to weld between the solebars at 19 inch centres to form the bogie mountings. We then need a couple of ¼ inch pegs welding in, 1⅜ inches long, to locate the bogie bolster plate. This is one place where we had to add a couple of pieces of similar angle ½ inch long and weld them either side of the bogie bolster with a bit of clearance either side as we found that when we had a derailment these ¼ inch pins snapped off. You then need to use some 2 inch squares of foam rubber. This foam rubber needs to stand your weight on it so it needs to be fairly dense. What I usually buy for this job is some multi coloured stuff 1 inch thick and that then does for the seat cushion as well.

One thing I always use on my own driving truck is a screw coupling. If you screw the coupling up so that the buffers just touch the locomotive buffers it will never come unhooked and that is exactly what they were designed for. When I am shunting, I am usually busy firing the locomotive, using the steam brake, turning an injector on or off or opening the fire hole door a little crack to stop it blowing off - all manner of jobs, so I often have one hand in the cab anyway. That is to say nothing of blowing the whistle occasionally! This usually only happens when I have been standing around in the yard for a while so I just give a pop on the whistle to say that I am going to be on the move. Details of either a screw coupling or just a plain three link coupling are both shown on the drawing. One thing we never use is one of those silly bar couplings which some people seem to favour. All of our ground level vehicles

have three link or screw couplings on them so you can just couple them up without any fuss.

Photograph 6 shows Stuart Laidler crossing our viaduct with one of our driving trucks and he favours his seat amidships. He is on a two coach 'Up Passenger Train'. I hadn't realised how our viaduct had weathered in so nicely now! **Photograph 7** shows Elizabeth Cooling having just pulled forward to take water at the special GER signal for that purpose. Elizabeth is driving her *Maid of Kent*, so she has her seat forwards and higher and a couple of full-size brake blocks in the back to hold the driving truck down.

The only thing left to do now is to make a pair of footboard brackets and they are made from ¾ x ⅛ inch black flat bar 2⅝ inches long with a 17/64 inch hole in the top. This needs a piece of ½ x ½ inch angle 2¾ inches long welded on the bottom, face up. However, you must have these angles at a minimum of 1¼ inches high to avoid any point levers etc.

The footboards can be any length really but I would recommend that they are about 12 inches long (or 306mm if you must!) and they need a couple of holes tapping to suit any type of set screw (¼ inch or 6mm) about ¾ inch long to bolt them in place. This is so that the driving truck can easily have its footboards removed at the end of the day so that you can pop it in its box, which I would highly recommend. The space at the back of the footboards is just right to drop a shunting pole in there.

I keep all of my steaming gear in my seat box and this includes my blower, a box spanner to undo my safety valves to fill the boiler, three lamps, one tail lamp and two for the head code, my firing shovel and rake, a long rake for emptying the ash pan and, not least, one can of steam oil and another one for lubricating oil for the axle boxes and valve gear and a blow down key. All of these have little racks on the insides of the sides, made to suit. I also carry a red flashing tail lamp in there for use when I am driving a Diesel locomotive. I have some spare gauge glasses in a match box and a Primus pricker for my blower, which I have had to use on occasions. In Malc's driving truck he also has a battery in there for use with his blower and the inevitable pieces of rag!

Elizabeth Cooling heads off after taking on water.

Next time we will go on to describe the bogies.

●To be continued.

NEXT ISSUE

Bolton Tram
Ashley Best constructs the interior of his 1:16 scale model of Bolton tram no. 140.

Workshop Disposal
Roger Backhouse shows that a workshop can live on even after the departure of its owner.

Gauteng Spring Meet
Luker reports from South Africa on the spring live steam meeting at Gauteng.

We Visit Chesterfield
John Arrowsmith travels to Derbyshire to visit a well-established club at Chesterfield.

3½ Inch LNER Prairie
Robert Hobbs rolls up a smoke box and makes a couple of safety valves for his LNER Prairie.

Content may be subject to change.

ON SALE 19 NOVEMBER 2021

Robert Hobbs ventures into unfamiliar territory.

Continued from p.571
M.E. 4676, 22 October 2021

PART 2

Recycling a 3½ Inch LNER Prairie

LBSC's tender body.

With the main components cleaned and prepared in part 1 it was decided to tackle the tender next, the sheet metal work being a calming sequence before tackling the wheels and their associated misconfiguration. The machining of the missing components would follow on later.

The tender sole plate is a rectangular slab of thick, galvanised steel; the sides, ends, partitions, coal chute and front frame and doors are galvanised steel sheet. The profiles were cut to shape, using the bench guillotine and profiled using the six inch rotary sander. These were formed in the bench-mounted folder, usually with a half inch flange on one edge or the ends to assist fixing and assembly.

Constructing the tender to the LBSC drawings produced a squat, uninteresting tender as shown in **photo 8.** Upon consulting F. J. Roache's splendid book, *Historic Locomotive Drawings in 4mm Scale*, the 4200 gallon Thompson tender for the V2 was adopted and the sprucing up of the tender commenced. An additional partition was included and these were extended with a curved top edge, the coal chute was modified and the front plate pimped to include coal doors and tool boxes. A hinged water filler cap, a nice little project in its own right, was mounted on the rear platform, producing an altogether more attractive tender as shown in **photos 9** and **10**.

The tender wheels together with the leading and trailing bogie wheels were cleaned up and the bent axle replaced, primed and painted as shown in **photo 11.**

The new tender braking system was next on the

A more interesting tender body, based on reality.

Tender wheels and bogie wheels.

Tender brake shoe ring casting and hanger blanks.

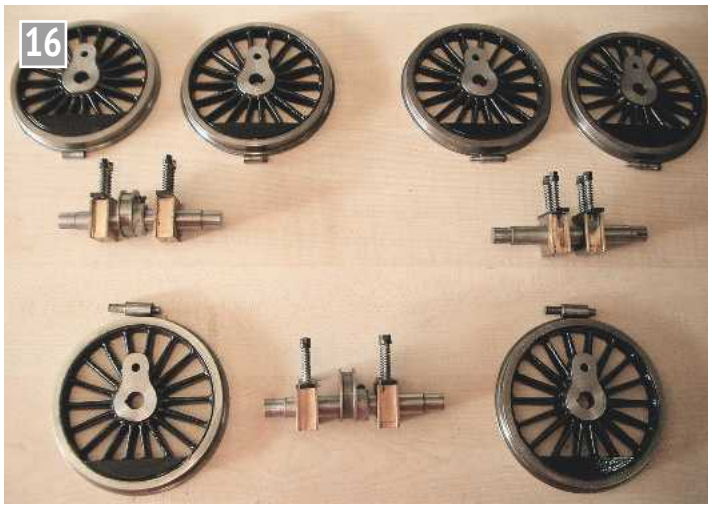
list and the newly designed hangers were formed from ¼ x ⅛ inch BDMS (Bright Drawn Mild Steel) (**photo 12**) and hung from spacers within the tender frames. The cross bars, pull rods and fittings were designed and made from stock materials (**photo 13**). The brake shoe profiles were turned from the ring casting using the Myford; **photo 14** shows the set-up on the mill used to machine the slot for the hanger in the brake shoe. Incorporating the brakes as part of the improvements was definitely a success and again improved the overall appearance of the tender. **Photograph 15** shows the trial assembly of the new brake system.

The coupled and driving wheels of the locomotive were dismantled by gently warming the wheel castings and drifting out the axles, making sure the castings were fully supported before raising the hammer. The dismantled, cleaned, primed and painted wheel sets are shown in **photo 16** together with their axle

Tender brake components.

Machining the slot in the brake shoe.

The assembled tender braking system.



Driving wheels, axles and axleboxes.

The wheelsets are united with the frames.

Coupling and connecting rods.

≫

New weighshaft.

Replacements for the missing motion parts.

boxes, eccentrics and crank pins. The axle boxes were numbered 1 to 6 and were re-positioned in the main frames and the alignments checked; only one pair were out of sequence - so far so good. The two coupled sets of wheels were easily refitted on two axles. The driving wheels, however, once allocated to their correct position could not be so easily accommodated. **Photograph 17** shows the wheels in the frames before determining the final positions. The coupled and driving wheels were quartered. The wheels were reassembled in the main frames fitted with the coupling rods and the assembly checked for easy rotation on the bench. Thankfully all was okay so the locking pin holes were drilled and the pins driven in place with a touch of Superglue for good measure.

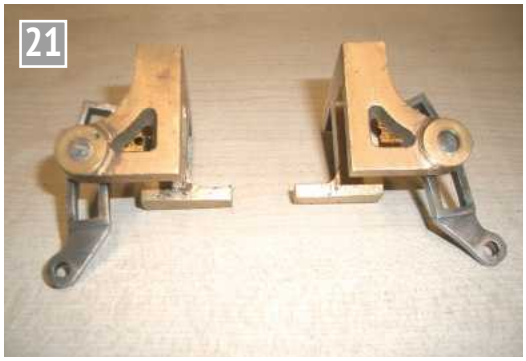
The locomotive arrived with odd pieces of motion and valve gear requiring new or matching pairs to be manufactured. The coupling rods were acceptable and were fitted with new bushes and, after cleaning up with wet and dry emery cloth, the rods were painted and are shown in **photo 18** together with the new connecting rod which was made from BDMS stock, the profiles being cut in the mill and the radiuses on the ends finished using the rotary table, again on the mill.

The reverse shaft was too short and a new one made together with the lifting and reverse arms (**photo 19**). The union links, radius rods, return cranks and combination levers that were missing were made from stock materials and are shown in **photo 20** while **photo 21** shows the expansion links on the motion brackets which only required a little adjustment to bring them to size. The pump body supplied with the frames was checked over and the piston and eccentric strap assembly made to suit; the finished pump being shown in **photo 22.**

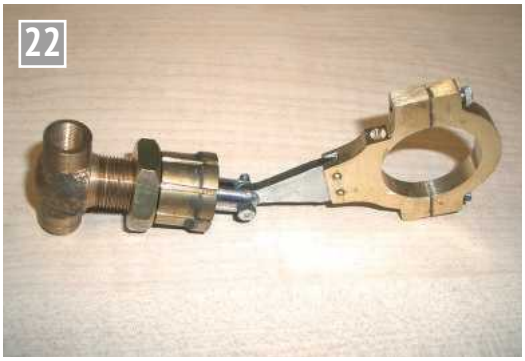
Two new crossheads were made from castings that were in my 'bits box' (it's quite amazing what one acquires during the course of a hobby - probably enough to produce a really ugly locomotive!). The crossheads were sized to suit the accompanying guide bar assemblies, one of which was modified and the other newly fabricated (**photo 23**).

The cylinder blocks and valve components were tackled next; the first job was to drill out and re tap the broken studs/bolt. This was achieved by using the end cover as a drill guide. Fortunately, there were no broken taps in the castings, only mild steel threads. The redrilled holes were tapped with the appropriate thread and the castings cleaned up. The front covers were lightly skimmed in the lathe and the rear covers had the mounting shoulder for the new slide bars milled to finished size. The glands for the piston and the valve rods were turned and threaded in the Myford, the castellations being filed by hand. These items are shown together with the new pistons in **photo 24.** This completes part two of the Prairie saga.

●To be continued.



Expansion links and motion brackets.



Axle pump.

Crossheads.

Cylinders, covers and pistons.

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CAD and 3D Printing in Model Engineering PART 2

Luis Trincao finds that 3D CAD opens up a whole new set of possibilities.

Continued from p.575
M.E.4676, 22 October 2021

Selecting a 3D printer

Once I'd started to use CAD, it was time to buy a 3D printer. Which one to choose? Again, I turned to the usual sources - people already using 3D printers and the Internet. There are many options. I ended up selecting a Chinese made printer from Creality, model Ender3 V2 (**photo 4**). Although I purchased the printer from a Spanish website and I live in Portugal, delivery to my door took 26 hours, which, in Covid19 lockdown times, is excellent. I paid around €280, shipping included. The filament (3D ink), which is the most usual type, is about €20 per 1kg reel and was bought locally.

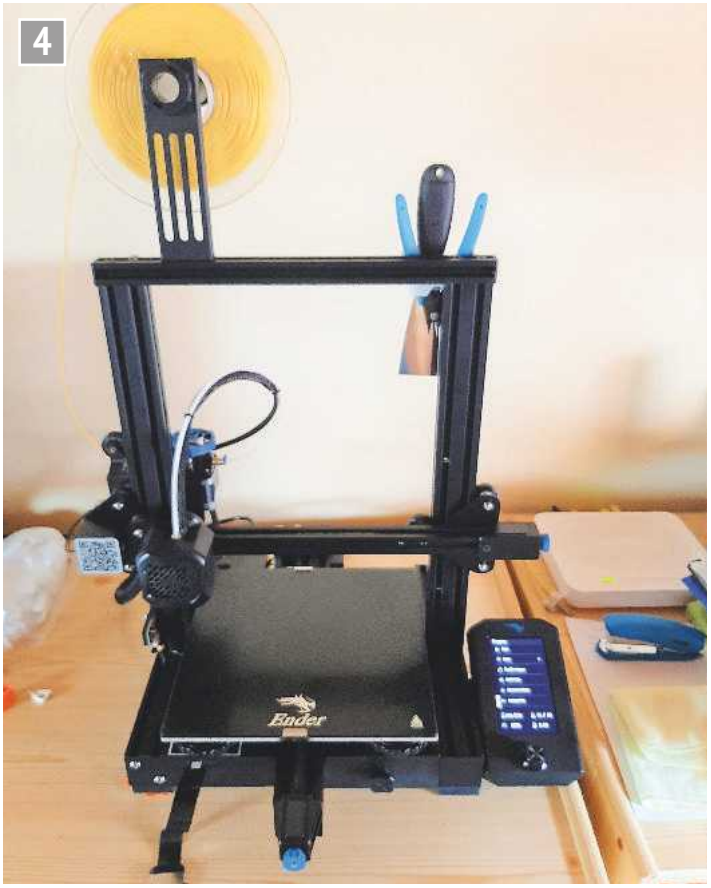
There are many videos about this and other printers on the Internet, which comforted me, because I found answers to almost any doubt I had.

The printer works in millimetres, so CAD was configured accordingly.

Assembly and initial experiments

This printer comes partially assembled and with instructions for completing assembly and set-up. Nothing that should scare a model engineer - but my advice is to look for videos on the subject. They can help more than the attached instructions. There are also many hardware and software upgrades possible. Upgrading software is a must if the latest software version does not come with the printer. A warning: some dexterity is required to perform some of the operations. Luckily, there is a lot of information available. I've done it with no problem.

To find the best place to install the printer, one must consider a few factors such as:



Creality ink jet printer, model Ender3.

Noise – A 3D printer is usually noisy and 3D printing is slow.
Moisture - Affects the filament. A moist filament will have printing issues.
Dust - Makes printing difficult and is harmful to the printer mechanics and electronics.
Light and temperature - The printer can operate without light; direct sunlight exposure and high temperatures can be harmful.
Power supply – Interrupting a 3D print due to a power failure may force you to start printing the part from the beginning. This is very annoying if we are almost at the end of several hours of 3D printing. Some printers can save their work and resume where they left off.

Before the first use, and from time to time, you will need to level the printing bed and adjust the stepper motor belts. These are simple operations. Some printers come with a bed auto-levelling device.

Main parts on a typical printer

Power supply **–** Provides DC power to electronics and stepper motors.
Mainboard **–** The brain of the printer.
Display and controller **–** This is where we receive information from other parts of the printer and send commands.
Bed **–** This is where the part is printed. Can be heated in most printers.

Mini drill holder.

Edge finder box.

Bed levelling screws **–** One in each corner of the bed.
Stepper motors **–** Control extruder and axis movement.
Extruder **–** Pushes the filament to the hot-end.
Bowden tube **–** Creates a path for the filament from extruder to the hot-end.
Hot-end **–** Receives and heats the filament. Ends in the nozzle.
Fans **–** Used to cool the mainboard, hot-end and printed part. This is where most of 3D printer noise comes from.
X axis **–** Movement left/right. Uses a stepper motor coupled by belt.
Y axis **-** Movement front/back. Uses a stepper motor coupled by belt.
Z axis **–** Movement up/down. Uses a stepper motor coupled by leadscrew.

For more detailed description, please consult specific printer information.

Required software

3D printer operation is based on successive layer deposition of melted plastic (filament) with a pre-set thickness to obtain the desired volume. Between each layer, the hot-end (where the filament is melted and placed over the previous layer through the nozzle) moves away from the printing bed, typically by 0.2mm.

To start printing, we need an 'STL' (from 'STereoLithography') format file of our part. This is exported from the part drawn in the CAD program. In my case, using Onshape, this file is generated from a Part Studio.

Then we need to send that file to another program called the 'slicer'. After research and advice, I selected Ultimaker Cura, hereinafter referred to as Slicer. It's free to install and widely mentioned on the Internet. There are many other slicer programs you can choose from.

The Slicer needs to be set to the printer being used. For each part to be printed, several parameters will be configured. Here are some of them:

Build plate and printing temperature – It depends on the type of filament used and other factors.

Layer height - Influences the final quality of the part. Typically, between 0.12 and 0.28mm.
Infill density – Usually ranges from 10% to 100%. In most cases, the parts are hollow to save filament and printing time.
Print speed - Usually around 50mm/sec. Higher speeds can affect the final quality.

There are numerous other configurations that can be set by users.

Slicing the 'STL' file, we get a 'g-code' type file, which is what we need for the printer to understand. We also get an estimate in meters and grams of filament to be used and the approximate printing time. Do not be surprised by long printing times as 3D printing is a slow process, at least on non-professional printers.

Before sending the g-code file to the printer (on a micro SD card in my case), one can simulate in the Slicer how the print nozzle will work layer by layer.

For those more curious, you can edit the g-code file in any text editor. Then you need a list of g-code commands and their meanings to understand what the printer will do with them. Interesting ... but good luck and be patient.

Filament

There are several types of filament available. The so-called PLA (polylactic acid) is one of the most used. There are many colours, even fake wood or metal. The usual diameters of filaments are 1.75mm and 2.85mm.

In the filament table (**table 1**), a comparison is made between some different types. For each type, the slicer/printer must be configured accordingly. Bed and nozzle temperature are two of the most important settings. Please note that the temperatures shown on the table are for reference only. The ideal printing temperature for a certain type of filament can vary from brand to brand.

There may be limitations on certain types of printers for some filaments.

3D printings

Here are some parts printed in 3D, indicating their origin and any specific features. For some parts, a way to access the generated CAD files is provided for you to use at will.

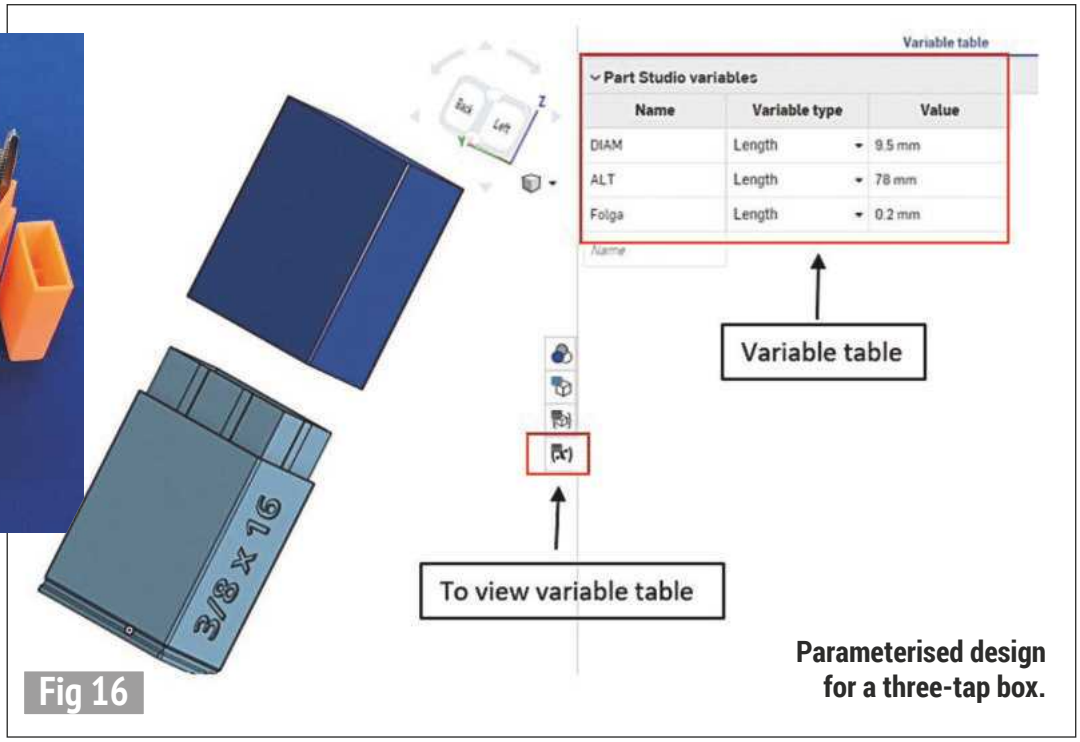
Support for mini drill **(photo 5)** Particularly useful for cutting small stock at right angles. STL files are available at www.thingiverse.com. This site is free to use. Try searching for 'Dremel' or 'Myford' and you'll find several interesting prints. The files provided are 'STL'

Table 1. Filament types

Filament	Properties/Uses	Durability	Strength	Typical Temperature (°C)	
				Nozzle	Bed
PLA	Easy to use and biodegradable	Medium	Medium	200	60
PETG	Flexible and durable	High	Medium	230	70
Nylon	Strong, flexible and durable	High	High	240	85
ABS	Durable and impact resistant	High	Medium	230	80
TPE	Very flexible, rubber-like	Medium	Low	230	45
Wax	Lost wax castings	Low	Low	150	80

Three tap box.

format, so they will have to be submitted to Slicer to generate the g-code file for the printer. The three parts shown took more than 16 hours to print.



Parameterised design for a three-tap box.

Edge finders box **(photo 6)**
My design. The project is available on the Onshape website with the name 'TAPBOX_LT' (TAPBOX_LT->Edge Finder). If you have access, feel free to search for this file name, make a copy and use as you wish.

Three tap box **(photo 7)**
Also my design and available in the file TAPBOX_LT-> Tap_box-> 3TAP. Here, one must insert the variable values (in millimetres) as follows to set the size of the box (**fig16**):

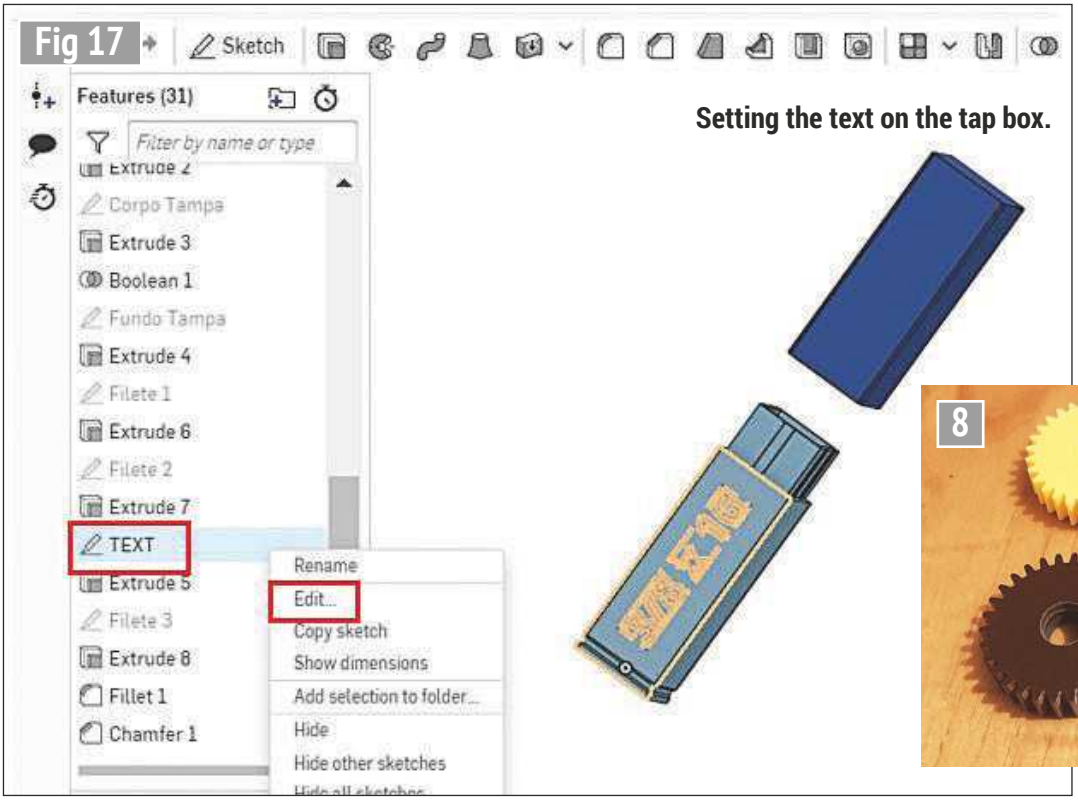
* DIAM - Larger diameter of the tap.
* ALT - Tap length.
* Folga – You can leave as it is (0.2mm). It sets the gap between the base and the cover. Without a gap, the box will not close. Do not ask how I know.
* To set the text on the side of the box (**fig 17**), select edit on the TEXT feature, placing the desired text and changing its dimensions if necessary. This text will appear in low relief and it can be painted with a marker - but be careful, if the paint is too thin it will blur. Using different colour filaments helps to identify the type of tap.

When 3D printing with PLA, the parts tend to shrink a little, so in my drawings I include a shrink factor of about 3%.

Myford tumbler gears **(photo 8)**
From www.thingiverse.com. I have never tried them on the lathe and I hope I never have to. In the photograph, my spare set is in Tufnol and those printed by the 3D printer are in yellow.

Identification labels
(photos 9 and **10)**
An upgrade to the former handwritten paper labels. The first layer of 1mm is printed in white with black letters in high relief of 0.6mm.

Here we print two colours of filament in sequence in the same part.



Setting the text on the tap box.

Myford tumbler gears.

Do not be surprised by long printing times as 3D printing is a slow process, at least on non-professional printers.

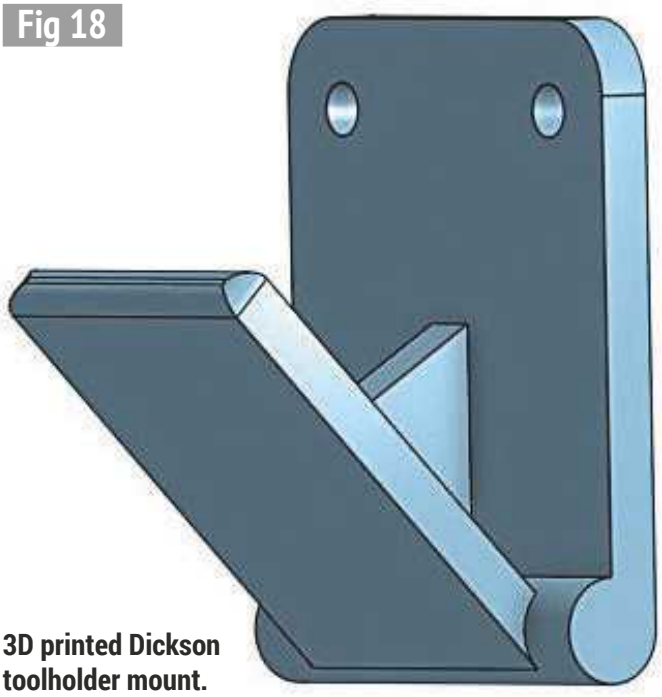
Proceed as follows.

* Design your label in CAD.
* Generate an 'STL' file and send it to the Slicer.
* In the Slicer, insert a g-code command that will order the printer to pause when it finishes printing the white base.
* Generate the g-code file for the printer and start printing with white filament. The printer will stop as soon as the pause g-code command is reached after printing the white base. Then change to black filament and order the printer to continue printing.

To change the filament, the extruder must be sufficiently hot, otherwise the filament is trapped. After changing it, you should push out any remaining white filament until black filament appears.

I will not give details on the insertion of the g-code command to pause the printer because it depends on the slicer used. I find it easier done than said. Usually, it is a menu driven operation, so no programming skills are needed. I struggled initially because my printer did not have the latest software version and did not pause as wanted. Once the software was upgraded it worked right away.

Fig 18



3D printed Dickson toolholder mount.

Dickson style toolholder mount (**fig 18** and **photo 11**)
My design. Also available in the file TAPBOX_LT-> QC. It is different from what is generally available because it is inclined at 45 degrees. I found it easier to use. In the drawing provided, the angle of inclination can be changed. The first one was printed using white filament but oil stained it immediately. The next ones were printed in black.

Conclusion

This article is only an introduction to CAD and 3D printing (and a large part of my knowledge). I hope it is helpful. The seeds are sown. As for me, I will continue to learn.

Acknowledgment

To my dear friend Alexandre Rodrigues, specialist in Computer Aided Design, amongst other things, for his help with suggestions and correcting the English version of my article.

ME

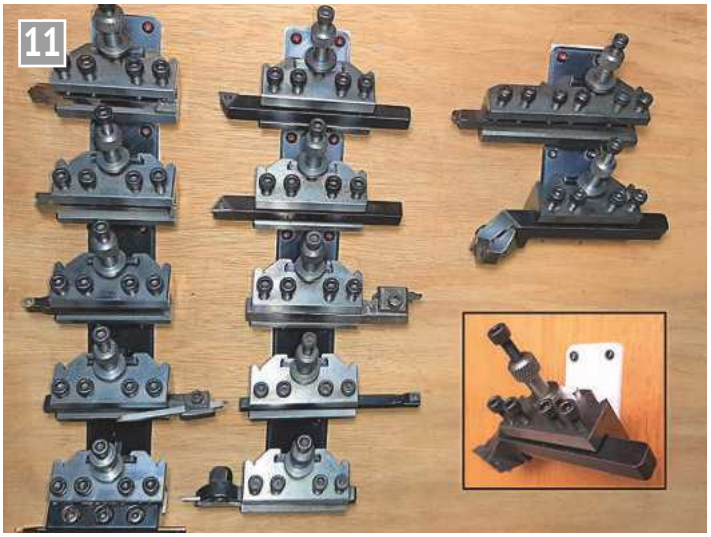
9

Indentification labels.

10

More identification labels.

11



Dickson toolholder mounts.

An Astronomical Bracket Clock PART 15

Adrian Garner makes a bracket clock showing both mean and sidereal time.

Continued from p.556
M.E. 4676, 22 October 2021

Assembling the sidereal train

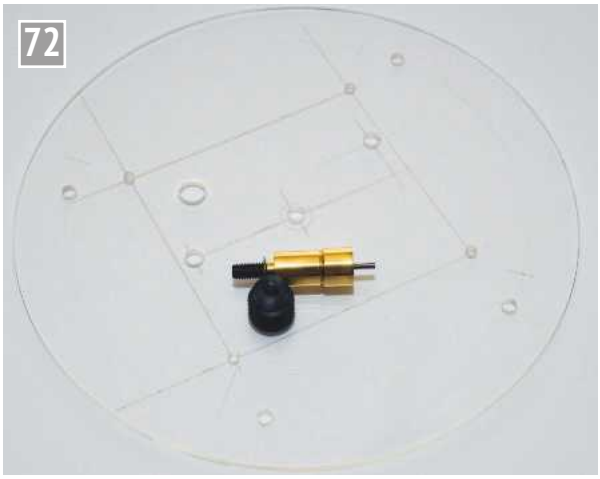
The sidereal chapter ring now needs to be mounted on the front plate. To do this a jig is required to ensure it is mounted concentrically with the centre arbor hole. The jig consists of a ⅛ inch thick disc of Perspex turned to fit the inside of the sidereal chapter ring. A central hole secures it to a 1 3/32 inch long brass pillar tapped 2BA at one end and reamed 3/32 inch (recessed about 1/16 inch) at the other to take a short silver steel peg. The diameter of the pillar is not important - around ½ inch is fine. Four further holes in the Perspex allow the screws on the support arms to be adjusted (**photo 72**).

(Note, my jig has additional holes which were only used during the design stage.)

With just the centre arbor in position between the plates, mount the four support arms leaving the 4BA securing screws loose. Position the sidereal wheel on the ball raced pulley wheels and then add the jig to centralise its position. It is a bit fiddly and a little wooden stick is needed to push the supports into the correct position (**photo 73**). Once in the correct position secure the screws ensuring one of the top pair is really tight. Dismantle all but the support you especially tightened. Drill through the two holes in the support, undo the screw and add taper pins. Repeat for the other upper support arm.

With the position of two of the four support arms now fixed it will be found that it is necessary to undo the 8BA screws securing the ball raced pulley wheels on the lower two supports in order to mount/dismount the sidereal wheel. Add the taper pins to the lower two support arms. Ensure there is a little play to allow the wheel to turn freely.

The mild steel hour extension to the center arbor can now be secured with Loctite. To ensure alignment the arbor was held in the lathe in a four jaw chuck with the extension held in a collet in the tailstock during curing of the Loctite. A drill chuck could be



Sidereal chapter ring jig.

used if tested for accuracy.

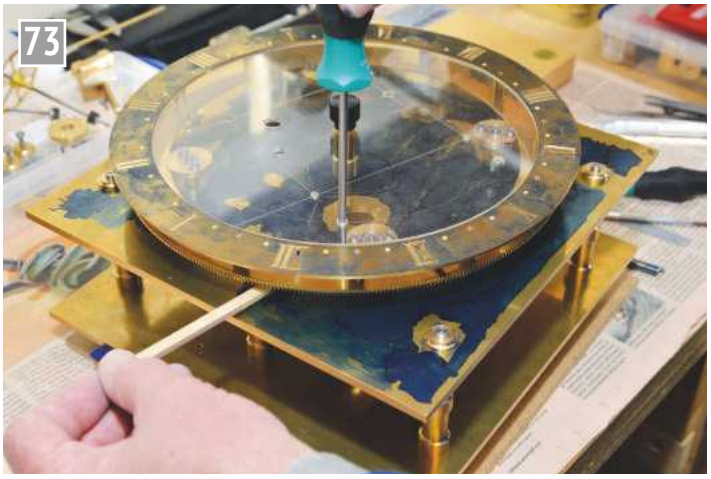
Unfortunately, the position of the sidereal arbor with its 30t pinion cannot be determined using the usual clock maker's depthing tools as few will accommodate the 400t wheel. A theoretical calculation of the distance from the centre of the sidereal drive arbor to the centre arbor can be made (5.078 inch) but this will not take account of any variations in the size of your wheels. In my case, as I had already made a mock-up of the clock, my solution was to drill a ¼ inch diameter hole in the mock up Tufnol clock plates at this distance and then fit a nylon plug with a 5⁄32 inch reamed hole offset by 0.015 inch. This was fitted with a short length of silver steel and the so formed nylon eccentric rotated until the 30t and 400t wheels meshed smoothly. The 400t wheel was centered on its peg using the Perspex jig described above. The brass and Tufnol plates were then registered with a peg through the centre arbor holes and a sharp pointed peg used in the nylon eccentric to mark on arc on the front brass plate.

Whilst it is not suggested that a mock-up of the clock is made, I do suggest a 'one off' special depthing tool is made consisting of a length of plastic or aluminium drilled for two pegs as above so that the correct distance can be found.

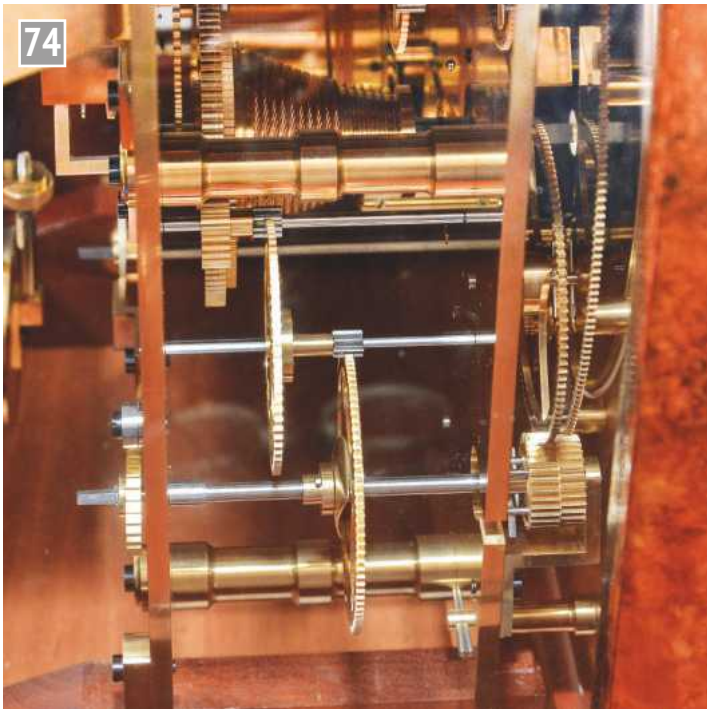
The intersection of the above arc and a line 5⁄8 inch from the side of the clock determines the position of the sidereal drive arbor. The cock is mounted by drilling and tapping the 4BA hole for the cock and then, with its centre line over the mark for the arbor hole, the cock is secured in the correct position with two taper pins. The pivot holes are formed by drilling through both plates and the cock. The drill size will depend on your supply of blued steel for the pivot in the cock. After separating the plates the hole in the rear plate needs to be opened up to 5⁄32 inch and the front plate drilled and bored to form the 5⁄8 inch clearance diameter hole. A ¼ inch wide slot permits the installation of the arbor from the side. This may be sawn and filed or milled with a slot drill.

The sidereal arbor can now be fitted. Saw the arbor to just over length, face to length and drill and Loctite the pivot made from blued steel. The sidereal first and second intermediate arbors can now be planted using conventional depthing tools.

The positioning of the wheels on the sidereal drive and related intermediate arbors is critical as it needs to be possible to remove the sidereal drive arbor by removing just the sidereal cock without the need to part the plates from their pillars i.e. the 100t wheel must not foul the front plate when angled to insert into the rear plate. I suggest a dry run before Loctiting the collets and pinions to the arbors. The collet lengths shown should work out fine with the 24t wheel on the sidereal first intermediate arbor ≫



Mounting the chapter ring onto the jig.



Assembly of the sidereal drive.

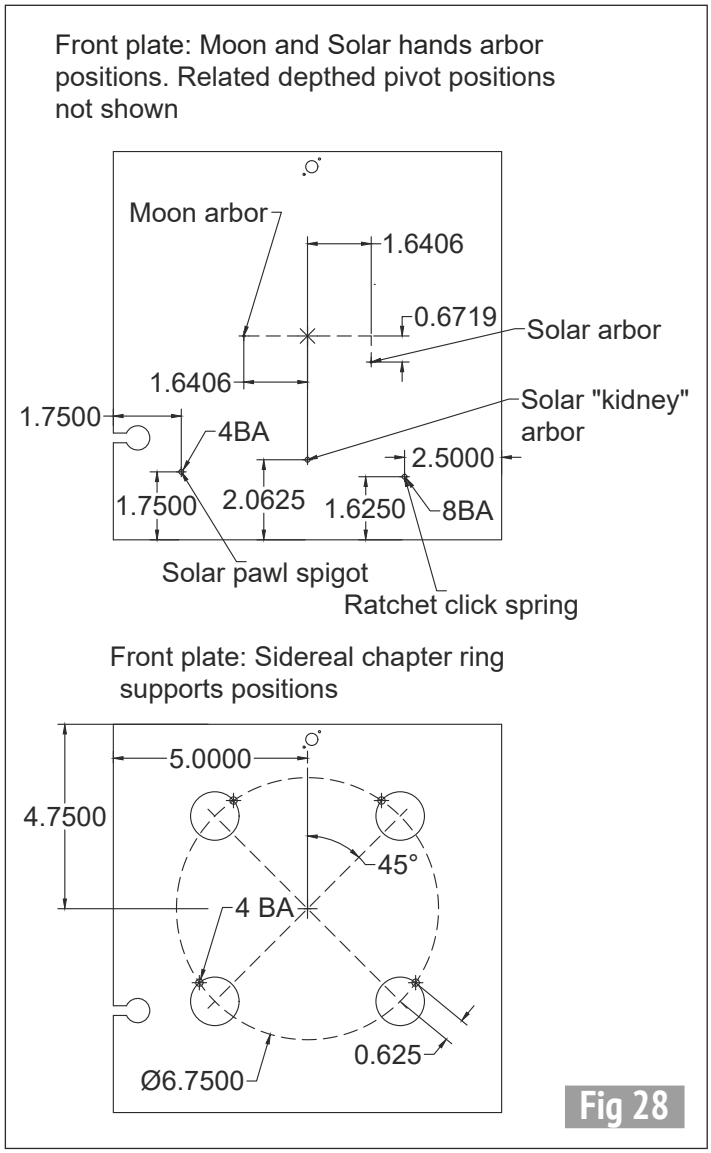


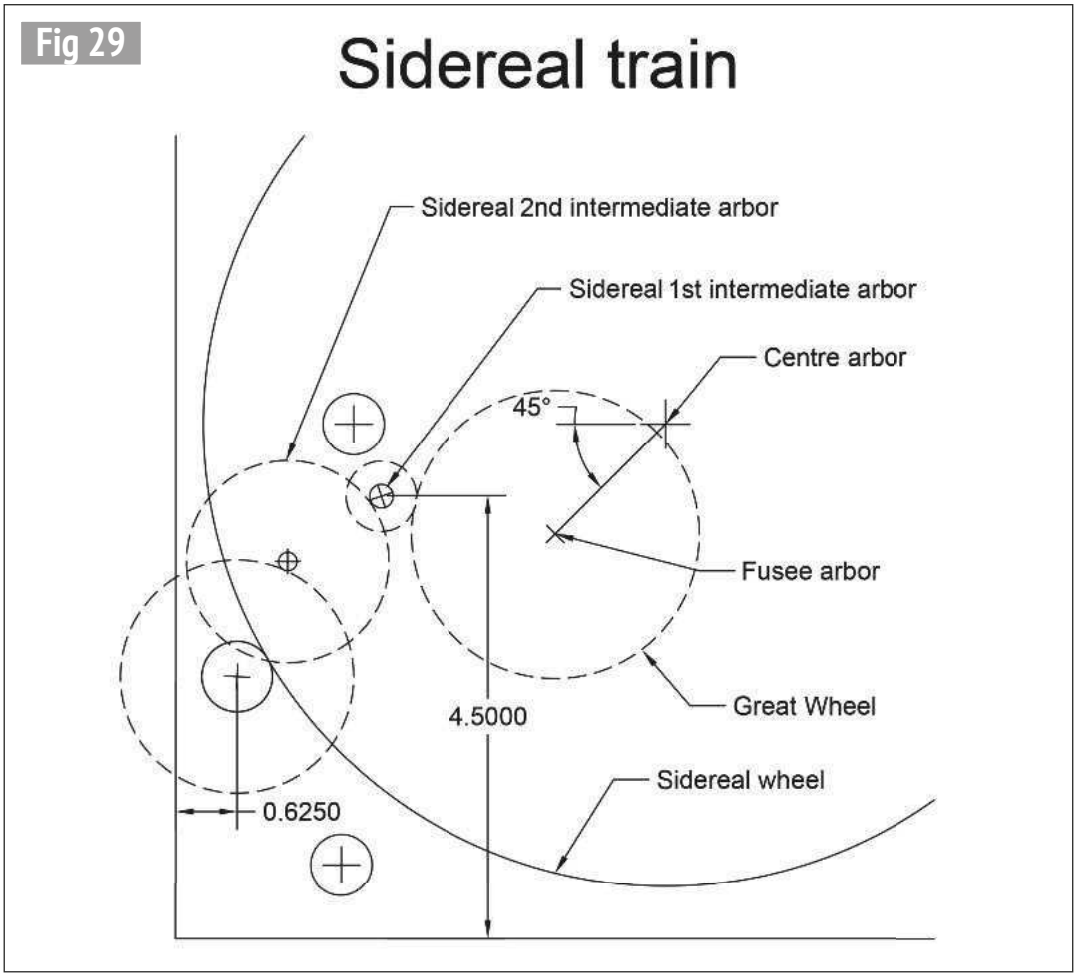
Fig 28

centered on the great wheel teeth but do check on your clock (**photo 74**).

Do not fix the 30t/32t wheel into position yet as it will make the sidereal arbor difficult to hold whilst drilling the cross hole for the taper pin securing the spring washer. Drill this cross hole next. The pressure of the spring can be adjusted by judicious bending of the spring washer or varying the thickness of the washer between the taper pin and the spring washer. The 30t/32t wheel can now be Loctited into position.

At the rear of the clock the pawl for the sidereal ratchet wheel was made from mild steel to help reduce wear (the large barrel ratchet pawl is rarely moved and hence that was made of brass). I opted to make the bush on which the pawl turns from mild steel but it could be made of brass. Either way it is secured with a 5BA screw to the rear plate, the head of which also keeps the pawl on the bush.

Fig 29



Planting the moon and solar work

The moon and solar cocks are difficult to secure for drilling as they are not near to the side of the front plate (**photo 75**). My solution was to scribe faint lines on the front plate where the moon and solar pivot holes and cocks will be positioned. As two separate exercises I then aligned each scribed line with the X axis of the vertical mill. After clamping the plate and locking the Y axis with the drill point directly above the scribed line I used the DRO on the X axis to position and drill the pivot hole and drill and tap the 4BA hole to secure the cock. Without removing the plate from the mill, the cock was fitted and held sufficiently tightly by the 4BA screw to allow both the pivot and the taper pin holes to be drilled.

The 'drive' of the 80t solar ratchet wheel, which is secured to the same collet as the solar kidney wheel, is from a pawl operated by the three pins on the rear face of the 32t/30t wheels on the sidereal arbor. The system is similar to that in many in clocks of the 18th century. Gravity is used rather than springs to return the pawl to its home position. The length of the pawl is determined after fitting the ratchet wheel (below). At this stage it was made overlong by about 1/16 inch. The precise angle of the end of the pawl is not critical.

The 5/32 inch diameter silver steel arbor for the sidereal ratchet and kidney wheel collet allows the wheel to be reset if the clock has been stopped. The square at the rear end should be made first and filed to match the square on the sidereal wheel arbor. The collet at the rear is secured to the arbor by a 6BA screw which registers with a dimple made with a centre drill. The arbor was held in a collet to turn down the front end to 1/8 inch diameter so that when the rear collet is fitted the arbor has a small amount (say 0.005 inch) back and forth play when fitted to the plates. I added a short steel collar between the collet and the front plate. After securing with Loctite I turned the faces of the collar to ensure all was square both to the plate and to the wheel collet. This may have been unnecessary but the ratchet and kidney are large and any deviation of the truth will show.

Construction of the stop to prevent the pawl falling out of position if the clock is moved is identical to that of the spigots. I filed the spanner flats. The position is not critical. Mine is 2 9/16 inch from the left edge of the plate and 1 3/4 inch from the lower edge.

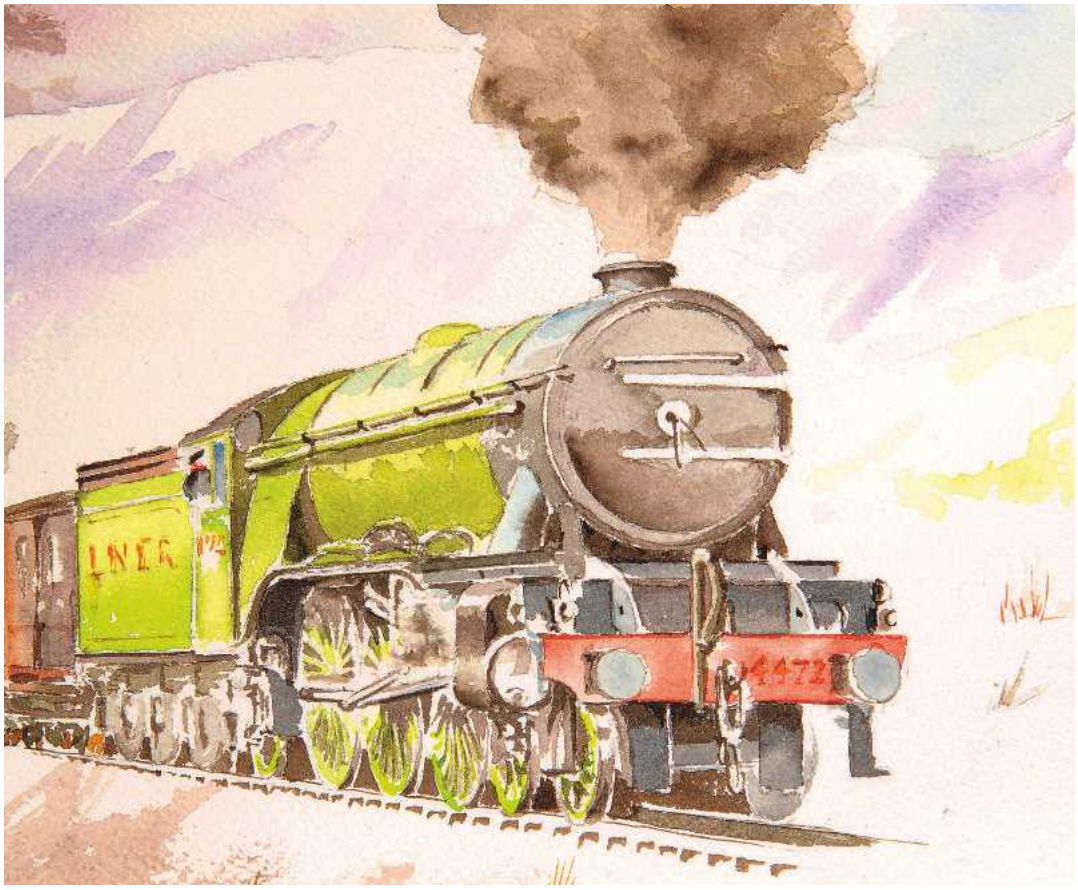
The length of the pawl can now be reduced by filing so that it advances one tooth and then drops back into the next tooth when released.

●To be continued.

Moon and solar work.

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

Continued from p.586
M.E. 4676, 22 October 2021



Painting by Diane Carney.

PART 21 - MOTION BRACKETS, VALANCES, PLATFORMS AND SPLASHERS

Flying Scotsman in 5 Inch Gauge

Motion brackets

The outside motion brackets are tricky little beggars. To start with, the castings are not identical - they have many surfaces to keep an eye on for size and also on deciding what to use for a datum.

As these are important for the motion I decided to first tidy up what I'll call the slide bar slipper edges as these need accurate placement on the frames - the rest is not so important other than the distance from the frame to the valance and its height.

Valances

I decided to get on with the valances next to get an idea of where and how the various

1. The mounting face was first machined to size and while in this position I also squared off the back edge of the slipper. The other surfaces were then machined or filed. To drill the mounting holes to accept the 7BA bolts I made up a drilling jig. This was from ⅝ inch copper (I happened to have some the right size). I marked and drilled the first two holes on the mill, bolted the plate to the back of the frames and transferred the hole centres ready for drilling back on the mill.

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2. This picture shows the laser cut parts assembled, I did the curved top sections by hand using whatever radius bar was nearby to help shape the parts to match the valance profiles.

3. Next was to solder all the parts together. I was in two minds here whether to use soft or silver solder, silver being the best option for its strength and soft being the safe option in that these are very long (nearly 4 feet) delicate parts that could well twist/buckle if not very careful with the heat. I bit the bullet and went for silver solder. I had to do this in a number of steps due to the valances being far longer than my heating hearth, which made things even more tricky. As can be seen the valance is held at either end by a clip/weights and bricks were laid at intervals along the length to hold everything in place. All joints were given a good coating of flux and 0.75mm 55% solder was cut in strips and laid spaced out along the length. I wanted to be able to see the solder flow and also have easy access to the job so I first set the heating board up high on the hearth and I also heated the job from what really is the wrong side, that is heat to the side with the solder on. However, by being careful in heating, starting first from one end at the back just to get things going, it was a straight forward exercise to heat the job without too much heat directly on the solder as I moved along. To be extra safe I didn't allow the steel to heat too much where it was hanging over the edge of the board. Each section was left to cool and then the job was moved along the board to the next section.

4. To complete the job, the valance needed curving so that it sits under the cab floor and attaches level to the top of the drag beam, The mounting holes also need drilling for the 17 or so 8BA bolts to attach the valance in seven areas: front buffer beam, outside motion bracket, expansion bracket, main running board support, boiler stay outrigger, rear trailing frame stay and the aforementioned bolts to the drag beam - so plenty of holes to get in the right place. Continuing with the valances I had now done one side except for the outrigger which was be fitted once I had marked and drilled the 1/16 inch holes to attach it to the boiler stay. I took my time in getting the valance to look right as it's such an important part for achieving the beautiful lines of a Gresley Pacific. I drilled and tapped all of the 8BA mounting points, leaving only the outriggers to do.

5. Moving along we come to the mounting points on the expansion link and the central running board brackets.

6. And here we have the rear section. The outriggers when fitted will sit in the 'S' bend. During construction I kept a close eye on the valance position to ensure that it was matching up to where the rivets sit along the running boards. In the picture the valance disappears under the cab floor and this needs to align so that the rivets/screws that run along the cab floor are central to the top of the valance plate.

running boards will sit and also to take note of what may be the best order of doing things.

Platforms

Both valances have now been fitted, all running boards have been drilled, countersunk and rolled to match the valance. I secured the cab floor first and then worked my way to the front. I checked the position of the running board where it fixes to the expansion link bracket, checked that the drilled holes ran down the centre of the valance angle,

7. Lastly for the valance fixing, this picture shows how the valance curves around the back of the cab floor and is secured behind the drag beam.

8. Once the bracket was back in position I laid out the running board sections and the long valve travel cover to see how things were going. The rivet holes are running down the valance nicely so I know that these parts will all go together as they should. The front edge of the running board matches the inner section for overhang so the extra length of the boards to allow for the curves is spot on.

9. This picture shows a start being made on securing the rear running board.

10. Here is the front support for the curved section of the forward running board. All parts like this are made from ¼ x ¼ x 1/16 inch brass angle. First, I tackled the curved section that needed to match the curve of the valance. I selected an offcut of brass bar that was slightly smaller in radius than required and fixed it to some thermalite board. I took a 12 inch length of angle, heated it up in the middle, being careful not to heat it too far, and, holding either end, bent it around the bar, wearing welding gloves – of course.

I did this process a couple of times, checking it against the outer valance on the model. Once happy with the shape, I cut off the ends allowing for the other two parts to fit correctly. The picture shows the part at its required curvature - the other two parts can also be seen ready for silver soldering.

11. Using some rusty blocks I clamped the sections in place for two of the axes with the third curved part lying flat on the board. I mixed up a semi-thick flux paste and silver soldered the parts together, ensuring that the curved section was at the correct angle. I drilled the mounting holes for securing to the frames first and the 10BA tapped holes for the boards will be done in situ.

12. I haven't bolted the part in place here yet as I'll need to remove the valance/boards first to drill the holes but I will show how the part fits as an aid for anyone else at a similar stage on their own builds. Mind you, I'm sure that this can be done a number of different ways - this is just my chosen method.

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noted the amount of overhang at this point and selected a suitably sized piece of BMS to use as a spacer to ensure the boards run true along the length of the valance - in fact I have two spacers as the rear section widens just before it curves down to match the width of the cab floor.

Splashers

I then made a start on the splashers. First I made the supports for the leading and driving wheel splashers – for the trailing splasher I still needed to do a little more R&D to work out the correct size of the angle support. There's a bracket that runs along the outside of the splasher above the running board rather than just underneath like the other two - I suspect this to be a smaller size 'L' section than the others. The driving wheel support is straightforward, being a straight piece of right angle but the leading and trailing supports curve to match the valance. The leading support drops down following the forward curve and then curves back to follow the lower board.

●To be continued.

13. I thought I'd remind everyone of the laser cut parts that I have for the splashers, kindly drawn up by John and cut by Malcolm so we can see the parts involved.

14. The lady has a name! I got these from Diane Carney a good few years ago now. I have a complete set including name board and the unfinished tender plates can be seen in earlier photographs. I haven't ground the plate down to size yet, the bottom doesn't have a brass lip as seen here and the other 3 edges need cutting down.

15. All six splashers have now been fabricated, the bulk with silver solder with the front trims attached with soft solder. I still have a lot of work to do here to complete this stage, more than I imagined as the closeness of the parts makes drilling impossible without taking everything apart first. The trailing splasher is further advanced than the others as hopefully can be seen in the picture. The front lip has been trimmed to size, drilled and countersunk to accept the two 10BA screws that secure it to the running board. The rear lower edge of the face trim has been cut to fit the curve of the running board as it slopes back, the back supports have been cut and drilled to accept the 8BA bolts and the main support that runs under the board has been riveted in place using 1/16 inch alloy countersunk rivets and bolted to the splasher with 8BA bolts.

16. This picture shows the rear brackets ready for fitting to their respective supports. Note that I have already marked the other side ready for cutting. I need to take everything apart again to fit the right-angled supports and so will probably do all of the supports together once all the other parts involved have been done. The top inner corner of the rear splasher needs to be cut back at an angle to allow clearance of the boiler and its cleading. Since this is a very close fit with next to no gap I'll leave this until the boiler has been placed on the frames and checked for clearance. The driver and leading splashers aren't as close to the boiler and thus do not need cutting back.

17. Here we see the front of the splasher. The alloy rivets running along its front face have been filed flush and any dips/ marks will be filled before painting, I have gone over the countersunk holes to make them a little deeper so that the mounting screws sit as flush to the running boards as possible

18. Here we have the long valve cover in place to check for position. I needed to shorten it a little along the rear edge as it was a little long. Later I'll fabricate the upright sections but for now it's just sitting on some steel stock so I can check all is as should be.

19. Lastly, the extra right angle along the splasher/running board joint. I have used 12BA bolts but may change these to 14BA as they look a little large to me. The bolts are fitted as dummies with the drilled holes countersunk from underneath and filed down.

20. Continuing on with the rear splasher exterior brackets. I had to reshape a new section of brass right angle as naturally the holes for the previously used 12BA screws were too big for the now preferred 14BA items. I drilled the countersunk holes, curved the angle and fitted the screws/nuts, then soft soldered them in place with the threads, then cut down.

CLUB NEWS

Geoff Theasby reports on the latest news from the Clubs.

Good morning fellow readers! How are we this morn? Well, I'll soon stop that…

Now, think about it, however old you may be, however long you have been reading Club News, this is the umpteenth (about 264th) issue under my jurisprudence. The first edition of the rest of your readership. 'Test' of your readership? "Rest, Darling, rest." Oh thanks, I don't mind if I do.

Just to illustrate how life deals you things you weren't expecting, 'out of left field' as they say, some bad, some good, here is one of the good ones. I replaced an item of electronic test equipment with a better one, bought on eBay, and was overjoyed to find that its settings went up to 11! Fans of *Spinal Tap* will recall that Nigel Tufnel's amplifier was similarly equipped. Mine was a piece of equipment first marketed in 1964, twenty years before *Spinal Tap*. Never let it be said... (Never let what be said?) I don't know, I never let it be said (**photo 1**).

My 'better' version was sold on a 'parts only' basis and when I first switched it on nothing happened. The meter was part way over, rather than at the zero point on the left-hand end of its scale. So, first, remove the meter. This entailed removing all the knobs and the front panel. The meter screws were very hard to access but I managed, working in a gap of about 3cm, which put me in mind of 'keyhole surgery' or lock picking. Only later did I discover that releasing two screws enabled the entrails to be spread open on the bench, like a bible on a lectern. Anyhow, I sorted out the meter and, in doing so, a wire came away. Out with the circuit diagram - ah yes. Wire reattached. Now it works! Nothing more to be done. Yippee! That wire must have had a 'dry joint'. Everything now tests fine. What cost me about £30, is now worth over £100, checking other sources. It is on a soak test as I write

It goes up to 11…

and I find that there are certain postures I adopt which appear to cancel out the signal but, if I turn my head, it reappears. A 'room resonance'…

In this issue, a box, a little roller, fifty years for a drive, a ballista, a Carette, British Leyland, and the White Pass.

Unfortunately, several photographs failed to arrive before I sent this edition to editor Martin. I like to keep them topical, if possible, so I run the deadline close and sometimes they don't turn up in time. Possibly the person concerned is on holiday - still, I claim that 'you can't see the join'.

Raising Steam, summer, from the **Steam Apprentice Club of the National Traction Engines Trust,** welcomes the partial reopening of the rally season. Chairman Nick Bosworth reports that his maintenance on the Garrett living van is turning into a rebuild! So many parts of the chassis were found to be rotten that they had to be replaced. Also, a page of delightful pictures of young apprentices working on miniature engines, some bigger than the 'Sorcerers Apprentices' themselves. This applies to adults too, when they graduate to the real things… 'Unusual Engines No. 6' covers the Box Patent Engine, a means of avoiding difficulties when using a sprung rear axle. However, simpler designs were available - only a few Box engines were made and none survive. This was followed by a very instructive and informative article by Nick on 'What Went Wrong' and what to do next, taking as an example the failure of a gasket on a mudhole door. Then, Toby and Oliver Reynolds write an item on Sentinel steam wagons. The back page has a fine photograph of a line-up of ex- W. Buncombe rollers taken at Highbridge in 2019. On behalf of diesel roller enthusiasts everywhere I should also mention that a Wallis & Steevens 2½ ton roller, first introduced in 1933, also features in the photograph. One day, I hope it will be as well preserved as its fellows.
W. www.ntet.co.uk/sac

Sheffield & District Society of Model and Experimental Engineers' July *Steam Whistle* reports that their Open Weekend on the third/fourth of July was a great success. Alan Thorpe and Andy Hunter put on a fine display of Mamod engines, whilst Chesterfield's Dave Penney ran his 7¼ inch gauge industrial saddle tank *Sheepbridge No. 28*. He had driven in the full-size version when he was 15 so he HAD to build his own… Dave also produced a 7¼ inch gauge Markham 0-4-0 vertical boiler which didn't run much due to sudden torrential rain. The August issue pictured Dave Parker driving the 10¼ inch gauge 4-4-2 *Vanguard*, fifty years after he first saw it at the

Poole Park Railway, and writes about the mixed fortunes of this attraction, which is due to reopen this autumn. Mike Peart discusses the Hawthorn-Kitson and other valve gears in *It Wasn't All Walschaerts*. GWR 1338 has been preserved and is at Didcot. 'Murray's Thoughts' turn to electric car range. Once regarded as a joke, electric cars are now on general sale, although not cheap.
W. www.sheffieldmodelengineers.com

Andy Probyn, of T**aunton Model Engineers,** thanks me for using his picture of *Alice* on his Austin Pearl and sends another, this time sheltering on the wing of a Model 'T' Ford. Andy says, "*Alice* is on a luggage rack that folds out from the back of the car. Here is Alice again on the running board luggage rack fitted to a 1924 Ford Model 'T'. These were sold as a bolt on extra and were very common 'back in the day''. Thank You, Andy (**photo 2**).
W. www.tauntonme.co.uk

Worthing & District Society of Model and Experimental Engineers' *Newsletter*, autumn, is back up and running (says the headline) followed by some fun medical definitions: Bacteria – back door to cafe, Labour pains – getting hurt at work and (my favourite) Outpatient - a patient who has fainted. Then, a match between EDF and the Society over the interpretation of their electricity bills resulted in a WIN for Worthing and refund of nearly £800. Meanwhile, Leigh Gibbins has been producing 'Garden Art' out of scrap metal, i.e. 'sculptures' made with a keen eye and a welder. Dereck Langridge regales us with a 'Small World' item about a seventy-year-old, two inch scale model mentioned in a recent *Model Engineer*. It was built by Ted Budd, who just happened to be… Well, read it for yourself!
W. www.worthingmodelengineers.co.uk

Oops! **Andover & District Model Engineering Society's** summer *Centre Punch* was filed in the wrong place and so I missed it. *Mea culpa*. At least I don't make 'V'-signs at the computer, as one of my colleagues was wont to do. I see that GWR 4079 *Pendennis Castle* is to be returned to steam, after being returned from its busman's holiday in OZ. I remember its UK tour before the imminent departure in 1977 - it passed by my workplace and we ferro-equinologists asked for time out to photograph it. As one of my senior colleagues was also a sufferer, this was promptly given. The old turntable had a safety problem in that there was no protection from passing trains and so a traverser replaced it. As it said, 'for those who haven't been to Specsavers recently', a set of pop-up buffers has been installed to cover the gap in the track when the traverser is traversing. (That is a traverse-ty of the original article by Rex Hanman.) Rex goes on to say that in the process of installing it, the approaches (Latin *ballista* - there's one still in place at Leeds Bridge) were raised in order to deter freely rolling vehicles from emulating the train in the new Tom Cruise film. In addition, the table had developed a distinct curve, due to its position in the site, and defied attempts to straighten it so it has been left as a further deterrence to would be base-jumping runaways. A good overhang also allows easy transfers from car boot to track. It is clear that much thought has gone into this device. An informal gathering of some members from www.bulleidlocos.org.uk/intro.aspx was recently held at ADMES, who are known as the Bulleid Builders Group. ('Club' surely? Think of the initials… - Geoff) Tony Willmore writes of one of his 'Top Five Worst Ever' (sights that he encountered): a garden railway locomotive which ran, or was lit up, dry. The gas burner flue tube collapsed, saving a boiler explosion and worse. Keith Searle felt that an electric locomotive would be easier to drive than his Polly 5 and did a deal with Maxitrak, swapping it for a Baldwin. Doug Rundle did a similar thing with his workshop. It was feeling its age and a new, slightly larger shed appeared, just as, in one of those serendipitous moments, a local young man wanted a shed, so more coin of the realm changed hands and it was removed. Alan Wood was contacted by an overseas reader of the newsletter. He had bought an old turret clock in the UK and needed it repairing before being sent to him. It appeared to be a Thwaites design - some parts were missing, were redesigned using a best estimate and drawn with Fusion 360. The article goes on to cover the thought process of designing and making the replacement parts, including an aluminium dummy wheel to prove the design. Jon Godfrey made a strainer for his locomotive water tank after a member encountered a slug, causing injector problems.
W. www.admes.org.uk

The Gauge 3 Society *Newsletter* for autumn proclaims 'Thirty years of Gauge 3 in photos!' and has on the front page a rather good-looking *Rocket* model, which began as a cardboard model in a picture book. Jim Clement translated this into a brass version, taking as few liberties as possible. Shying from casting his own wheels, he used a pair of conventional driving wheels and milled away the balance weights. Chris Partner built a GRS 4F kit, whilst David White found a

Andy Probyn's horseless carriages (photo courtesy of Andy Probyn).

derelict Carette single wheeler for sale privately, to go with a set of Carette casting patterns obtained some time ago. (No excuse now! - Geoff) A new addition to the Kingscale range is the A4 in blue. Here it is on Robert Miller's line (**photo 3**). (I see Southern carriages, but no headcode discs - Geoff) The Southern region did briefly use A4s on the Waterloo-Bournemouth train in the 1950s. Eric Sanders writes about his small garden railway. Beginning as an indoor 'O' gauge shunting layout, he moved it into the garden at his wife's suggestion. (Did he fall or was he pushed? - Geoff) Mike Huddart discusses private owner wagons. Most owners had more than 10, 50 were not unusual and some collieries had more than 5000. He claims that very few people nowadays can have seen a newly-lettered and varnished wagon. Here is a GWR container wagon at Blackgang in 2016. Not a 'private owner' but the opportunity was not lost on the publicity department, thinking on the same theme (**photo 4**). A.G. Thomas authored three books containing over 500 'sketches' of such wagons fifty years ago, noting that it was not unknown for spoked and disc wheels to be used on one wagon, tare weights to vary on 'identical' vehicles and different tares on either side of the same one. Shades of British Leyland horror stories from the same period! The G3 society's 30th anniversary gathering was held on 18th September. I hope to report on this bash in their next newsletter.

Gauge 3 A4 on test (photo courtesy of Ted Sadler).

W. www.gauge3.org.uk

Romney Marsh Model Engineering Society *Newsletter*, August, amid much about the AGM, bears a poem by Sheila Percival, finding no synergy betwixt railways and her favourite sights, and John Shrubsole writes about his third hand (nothing to do with Zaphod Beeblebrox – Geoff) which is a foot(?) switch for his mini-drill. Most such drills need both hands to operate them, so what happens if it jams in the material? Drop the thing, which may come free on landing, when it would not be under control, or it burns out. A footswitch gives a way of dealing with this matter. Charles Smith visited the White Pass & Yukon Railroad for his 85th birthday. The modern carriages had a restaurant 'downstairs' and an observation lounge upstairs, with lifts for wheelchair users. This was followed by a sternwheeler trip up the Yukon River.

W. www.rmmes.co.uk

A footnote from our Motoring Correspondent, Pert Olysaliva, who says he saw this in Sheffield in May (**photo 5**).

Trackerjack, August, from **Teeside Small Gauge Railway**, has a good picture of *Evening Star*'s polished copper piping below the cab, a novel subject as pictures go. John Palmer obtained an 'LBSC' Maisie which did not conform to current build standards. Fortunately, the boiler succumbed to his blandishments, saving the cost of a new one or a silver soldering kit. John also visited the NRM, re-opened after lockdown, finding that the viewing gallery over the workshop was closed (it is being redeveloped). Not much in the way of contributions from the membership, or comments/replies as feedback, even on the crossword, which takes him about 8 hours to compile, complains editor, John.

W. www.tsgr.co.uk

And finally, from *On Track*, Richmond Hill LS: When I was young, my mother used to load up a spoon and say "There's a train coming, a train coming" and I would always eat it, because if I didn't she wouldn't untie me from the railway line.

No steam locomotives were harmed in the production of this review but I can't say the same for the slug...

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Container shipping, GWR style (photo courtesy of Ted Sadler).

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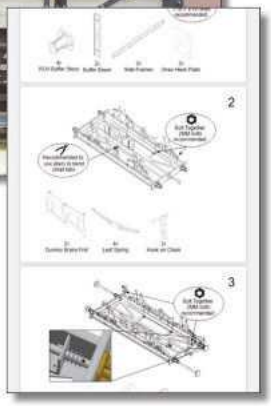

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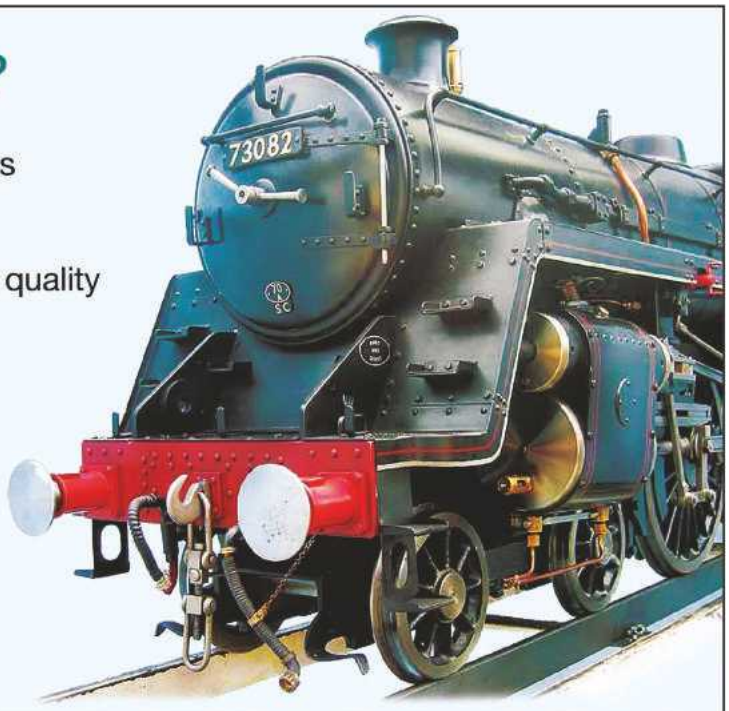

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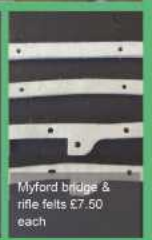
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