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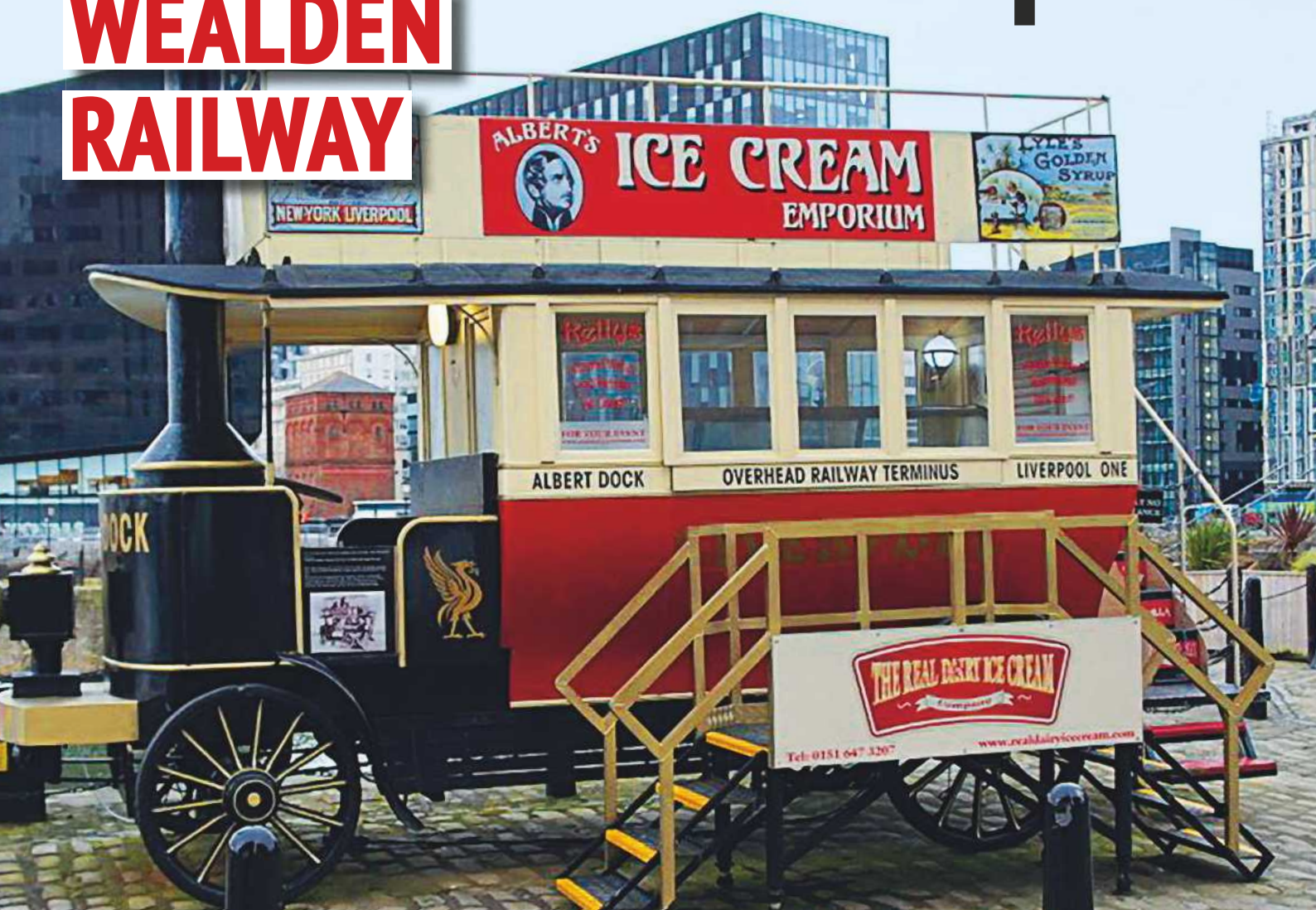
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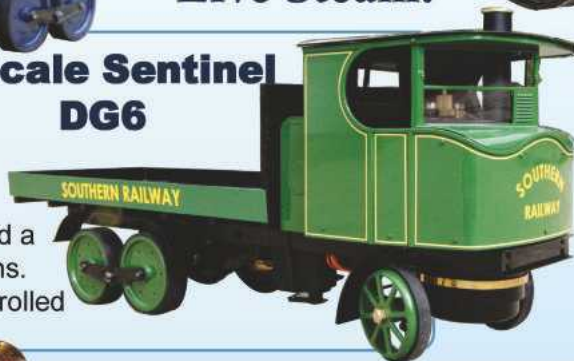
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Summary Specification



Approx length 80"

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|---|----------------------------|---------------------------------|-----------------------------|
| • Stainless steel motion | • Choice of liveries | • Piston Valves | • Superheater |
| • Boiler feed by axle pump, injector, hand pump | • Painted and ready-to-run | • Walschaerts valve gear | • Reverser |
| • Etched brass body with rivet detail | • Coal-fired live steam | • Drain cocks | Approx Dimensions: |
| • 4 Safety valves | • 5" gauge | • Mechanical Lubricator | • (L) 80"x (W) 10"x (H) 14" |
| | • 4 Cylinder | • Silver soldered copper boiler | • Weight: 116 kg |

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MARTIN EVANS
Editor



DIANE CARNEY
Assistant Editor



YVETTE GREEN
Designer

Mystery Model

A reader writes:

'A friend of ours is clearing out her late mother's house prior to sale and has found a box of *Model Engineer* magazines, mainly from 1946, 47, 48 (these would have been her father's). Near the box she found what appears to be a model crane, in a rather sorry state. I wondered whether there might be any association between the model and the magazine and/or whether any of your subscribers might be able to identify it. I attach a photograph.'

I don't have a clue – does anyone else (it's clearly seen far better days...)? If anyone is interested in acquiring the magazines please let me know and I will pass on the enquiry. They are located in North Somerset.

Machine Mart

The new Machine Mart catalogue is packed full of all the tools and equipment you need whether it is for a hobbyist, DIY enthusiast or professional. Featuring over 400 price cuts and new products, the new 500-page autumn/winter catalogue is a 'must have' for anyone seeking a huge choice of tools and equipment at unbeatable value.

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Model Search

Barry Cole writes to ask:

'This locomotive (below) was built by my father Len Cole and ran mainly at the Guildford club at Stoke Park. It's a 3½ inch gauge Britannia – 70016 *Ariel*. I had the locomotive for many years and then sold it a few years back, along with a 3½ inch Black 5, to a member of the Beach Hurst model club. I understand that he sold the model and I have now lost track of it. I would love to find out if it is running again as my grandson is very keen on steam locomotives, both full size and miniature. I wonder if it would be possible via your magazine to trace the model.'

Well – has anyone seen this locomotive lately?



IMLEC RESULTS

The International Model Locomotive Efficiency Competition (IMLEC) took place on the weekend of 20th-

22nd August at the Maidstone Model Engineering Society's Mote Park track and here are the results.

1st Overall:	Billy Stock, from Urmston, driving a 5 inch gauge BR 'Britannia', <i>William Wordsworth</i>
2nd:	David Mayall, from Bracknell, driving a 5 inch gauge GWR 1500 to the 'Speedy' design
3rd:	John Cottam, from Chesterfield, driving a 5 inch gauge LNER P2, 2006 <i>Wolf of Badenoch</i>
1st 3.5 inch gauge:	Paul Tomkins, from Tiverton, driving an LMS 'Duchess', 46329 <i>City of Chester</i>

Full results are available at bridges82.uk/imlec and we hope to include a full report next time.

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

Roger Backhouse takes a nostalgia trip to a much changed city.



Liverpool's former docks are overshadowed by the Anglican Cathedral. The Maritime Museum is on the right in a former warehouse.

An Engineer's Day Out Liverpool Waterfront and the Merseyside Maritime Museum

Visiting Liverpool brings back many memories. My father took me to Liverpool as a six year old and whilst there we rode on the trams and Overhead Railway. Despite fine views of the riverside, I remember

little of the Overhead except the tunnel at Dingle, forgetting the numerous docks that then lined the Mersey, docks where cranes and man power loaded traditional cargo ships.

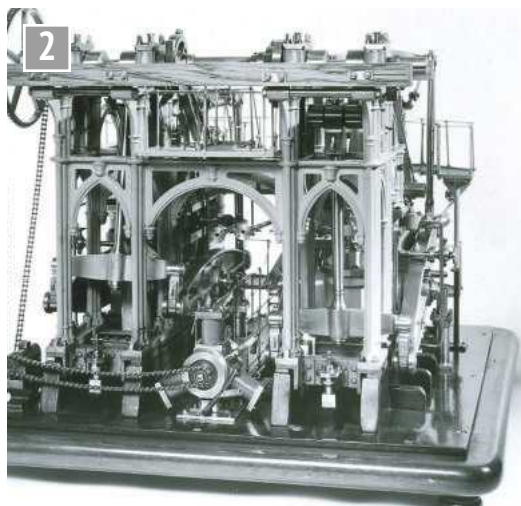
Most shipping activity has now left Liverpool for Seaforth container terminal and the transport systems I rode on have long vanished but relics do survive in the excellent Maritime Museum and Museum of Liverpool. Tourist publicity rather focuses on the Beatles' story but there is much to see in a city which boasted several engineering firsts.

These were amongst the early 'fireproof' warehouses designed by Jesse Hartley and Philip Hardwick in 1846.

As with many museums, galleries can be closed and replaced with fresh exhibitions so what is described here may have changed should you decide to pay a visit. During my visit in March 2020 displays included Liverpool's unsavoury involvement in the slave trade, the city's role in emigration and maritime disasters like the sinkings of the *Lusitania* and the *Titanic*.

Commander Barker's steam engine models are the highlight for any model engineer. He was a SMEE member who modelled different ages of ships' engines, starting with a side lever engine and concluding with a triple expansion engine. ➤

Commander Barker's indirect acting side lever ship's engine completed in 1924. The original engine had a jet condenser. His are among the finest engine models ever built. Courtesy of National Museums Liverpool/Museum of Liverpool.



Port development and Maritime Museum

Liverpool's port development is well presented in the Maritime Museum, which is set in original Albert Dock dock buildings (photo 1).

During my visit three were displayed with two others in store. They are among the finest engine models ever made (**photos 2 and 3**).

Nearby, the pump house (**photo 4**) housed machinery that provided hydraulic power for lock gates and swing bridges, also powering hydraulic hoists like the portable 'jigger' (**photo 5**). Hydraulics developed by Lord Armstrong provided a distributed power system with no risks to wooden ships from steam engine sparks.

At the time of writing there was a Thornycroft steam bus nearby, but serving as a mobile ice cream shop (**photo 6**).

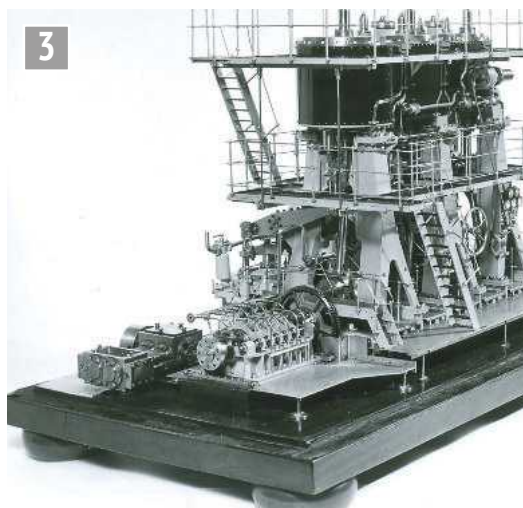
Railways and the Museum of Liverpool

Liverpool's importance as a port and Manchester's growing cotton industry made this a natural route for the world's first intercity railway. After debate about the merits of stationary engines and horses, the Rainhill Trials held outside Liverpool established the primacy of the steam locomotive. George and Robert Stephenson triumphed with their *Rocket* (now in the National Railway Museum, York).

The classic Liverpool and Manchester Railway 0-4-2 locomotive *Lion* has an honourable place in the Museum of Liverpool (**photo 7**). Built in 1838 by Todd, Kitson and Laird of Leeds, it survived to feature in the 1952 film *Titfield Thunderbolt*.



Liverpool and Manchester Railway's Lion of 1838. It starred in the film Titfield Thunderbolt.



Triple expansion engine made by Commander Barker and completed in 1946. It is worth visiting Liverpool just to see his models though some are in store. Courtesy of National Museums Liverpool/Museum of Liverpool.



Hydraulic 'jiggers' provided portable lifting power around the docks when connected to hydraulic mains.

Merseyside had an early underground railway though the filthy tunnel environment was matched by the murky financial arrangements of the Mersey Railway. Intended to enrich

a small group of promoters rather than shareholders, it opened in 1886 running from James Street Station, under the river to Birkenhead. Later it was extended to join the Wirral Railway and Liverpool Central. With 1 in 27 gradients up to Liverpool and 1 in 30 to Birkenhead it was difficult to work. Tunnels were smoke filled despite extractor fans and condensing locomotives. Passengers preferred the ferries. The railway had hydraulic lifts and the substantial lift tower remains at Birkenhead Hamilton Square Station. The line was bankrupt from 1887 to 1900 but was the first railway converted from steam to electric traction in 1903 using 650V DC with Westinghouse motor carriages

and air brakes. Compressors recharged brake reservoirs at terminal stations.

Steam locomotives were sold off and the outside framed 0-6-4 condensing tank engine, *Cecil Raikes* went to Shipley Colliery, Derbyshire where it worked for fifty years. Now it resides in Merseyside Museums' storage but can be visited by special arrangement (**photo 8**).

The Mersey Railway has since flourished with British Rail opening a loop line under Liverpool in 1977. Other improvements have followed under the auspices of Merseyrail.

A highlight of the Museum of Liverpool is the Overhead Railway motor carriage, the first electric elevated line in



Thornycroft steam bus subject to an undignified use!



Mersey Railway condensing locomotive Cecil Raikes, built 1892 and currently in store. Courtesy of National Museums Liverpool/Museum of Liverpool.

Britain (photo 9). Liverpool's version was the nearest to the American 'El' that opened in Chicago in 1892. That used steam power but then converted to electricity. Nicknamed the 'Docker's Umbrella' the first section opened in 1893 linking Herculaneum to Alexandra on tracks 16 feet above street level. Electrically operated from opening it was a solely passenger line. Extended to Seaforth Sands in 1894 it reached Dingle via a tunnel in 1896. A 1905 extension linked to the Lancashire and Yorkshire Railway's recently electrified lines to Ormskirk and Southport.

Although only 6.5 miles long the Overhead had Britain's first automatic semaphore signalling and in 1921 converted to automatic colour light signalling, another first (photo 10). The first station escalator was introduced at Seaforth Sands Station in 1901. The company promoted the line with attractive posters and remarkably cheap fares. Reproduction posters and postcards make good souvenirs, available from Museum shops.

The line was never nationalised. After heavy damage during the Liverpool Blitz it restored services but then suffered from competition from road transport. As the steel decking needed replacement the line closed in December 1956.



Liverpool Overhead Railway colour light signal: the line pioneered automatic colour light signalling.

Automotive engineering

Liverpool never developed an engineering industry like Manchester's. Commercial enterprise focussed on docks, sugar refining and transport instead. However, there were shipbuilding and engineering businesses on Merseyside. The AER motorcycle (photo 11) was built by A. E. Reynolds in 1938. A Vulcan car was made nearby by the Vulcan Motor and Engineering Co. of Crossens, Southport. That firm made cars between 1902 and 1928 but then focused on commercial vehicles (photo 12).

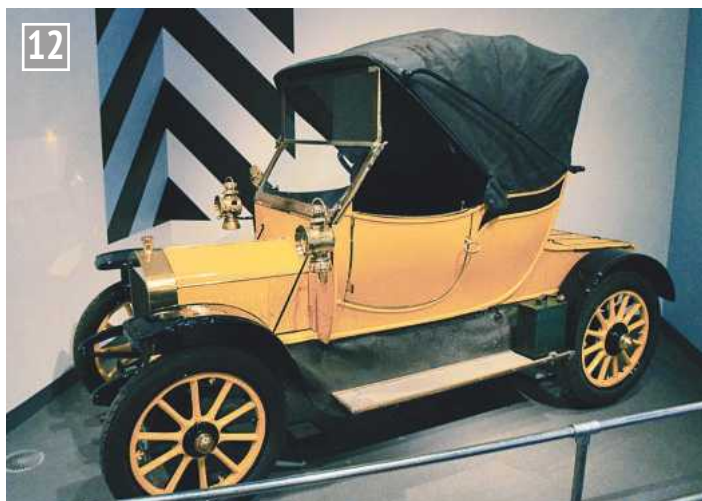
Production automotive engineering came to Liverpool when Ford opened their Halewood works in 1963. Cars assembled there included the Ford Anglia (photo 13) and the Escort. Now owned by Jaguar Land Rover the factory



Liverpool Overhead Railway car from the first all-electric elevated railway in Britain.



AER 250cc motorcycle made in 1938. Albert E. Reynolds was a motorcycle retailer who branched out into making bikes like this with a 250cc Villiers engine. He supported the TT races and did well with these high quality machines.



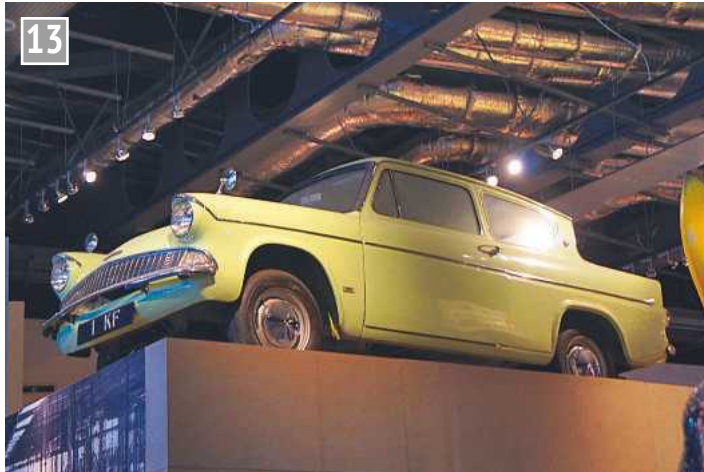
Vulcan car made nearby at Southport circa 1910.

currently produces the Land Rover Evoque.

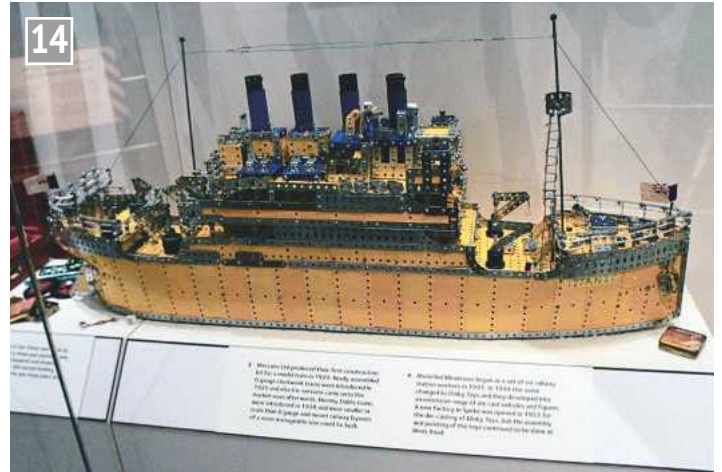
Meccano

A Liverpool clerk, Frank Hornby (1863-1936), invented Meccano as *Mechanics Made*

Easy in Liverpool. He added Hornby O-gauge railways, Dinky toys and Hornby-Dublo electric trains among other models still avidly collected. The factory in Binns Road closed in 1979 (photo 14)



13
Ford Anglia made at Halewood from 1963-1967. A one-time best seller, such cars now seem very small.



14
The construction toy, Meccano was one of Liverpool's greatest exports and gave many young people an interest in engineering.



15
St. George's Church Everton was one of the first to use cast iron frames in construction, an impressive use of a relatively new material. (Photo courtesy of the Rev. Adam Maynard, Vicar, St. George's Everton)



16
Few cities can match St. George's Hall opened in 1854. It is a Grade 1 listed building.



17
Lime Street Station is a fine gateway to the city with a magnificent sickle truss roof.



18
The Mersey Ferry is a good way to see the waterfront. The Royal Liver building (left) and the Liver Birds atop are symbolic of the city. It was also one of the first large buildings to be built using reinforced concrete.

Buildings and civil engineering

Liverpool can claim several building and construction world firsts like the enclosed wet dock opened in 1716 allowing ships to enter and

leave at all tide levels, also improving security when pilfering from ships was rife. Special tours run by the Museum of Liverpool show visitors the remains of the original Old Dock.

More enclosed docks were built later but most are now disused as ships became too large. Seaforth Container Terminal ensures Liverpool retains its status as one of the busiest ports in the UK.

Merseyside Museums holds a largely unique collection of cargo handling equipment, from sack trucks to large cranes, although it's mostly in store.

St. George's Everton was consecrated in 1814 using

iron for interior columns and window frames with sandstone walls. It remains a fine example of how a relatively new material could be used (**photo 15**).

Sefton Park has an attractive iron framed glasshouse and a statue of Eros like that in Piccadilly Circus, an early use of cast aluminium.

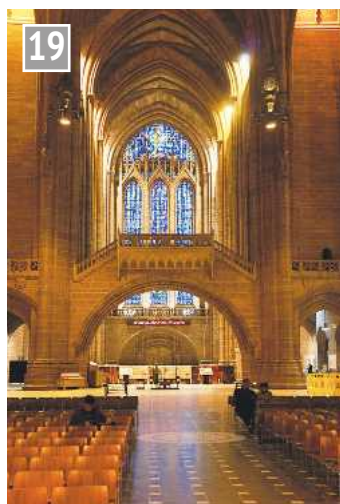
St. George's Hall was an early, symbol of civic pride opened in 1854. Still a spectacular building it claims the world's first use of an air conditioning system that filtered the city's polluted air (**photo 16**).

Nearby Lime Street Station had the world's largest span station roof in 1849. Built of wrought iron stretching 153 feet (47 metres) it was surpassed five years later at Birmingham New Street. Lime Street's roof was replaced in 1867 with a sickle truss type still standing today. Simon Jenkins says of it 'The impact is sensational' and he's right. (*Britain's 100 best railway stations*) (**photo 17**).

At Liverpool's Pier Head the Royal Liver Building, completed in 1911, was one of the first large buildings to be built using reinforced concrete; it's probably best seen from Mersey Ferries (**photo 18**).

Perhaps most impressive are the two cathedrals. The Anglican Cathedral – the largest in Britain and the fifth largest in the world – was designed by Sir Giles Gilbert Scott as the last stone cathedral in Britain, though also using iron and concrete in construction. Completed in 1978 it houses the largest peal of bells in the UK and it dominates the Liverpool skyline (**photo 19**).

A mile away is the Roman Catholic Metropolitan Cathedral. Sir Edwin Lutyens designed a vast romanesque brick building described as 'the largest building never built' (**photo 20**). Though the crypt was finished construction ceased during the Second World War and completing the cathedral became financially impossible. Ilford born Archbishop Dr. John



The crossing in Liverpool Anglican Cathedral, one of Britain's largest, it houses the largest peal of bells in the UK.

Heenan organised a design competition choosing Sir Frederick Gibberd's design which is now recognised as a triumph of 20th Century architecture (**photo 21**). Models of what might have been are in the Cathedral's Archive.

If walking between the two cathedrals visit the Philharmonic Dining Rooms on Hope Street for a restorative; an amazing pub and a Grade 1 listed building.

Liverpool has indeed much to offer visitors even if, like me, you were never a great fan of the 'fab four'.

Website:

www.liverpoolmuseums.co.uk

Merseyside Maritime Museum

Royal Albert Dock, L3 4AQ
Tel. 0151 478 4499

Museum of Liverpool

Pier Head, L3 1DG
Tel. 0151 478 4545

Western Approaches HQ Museum

War-time command bunker.
1-3 Rumford Street,
Liverpool L2 8SZ
W www.liverpoolwar-museum.co.uk
Tel: 0151 227 2008

AMONG MANY OTHER PLACES OF INTEREST:

Tidal predictors

The Tide & Time exhibition in the National Oceanography



'The greatest building that never was', Sir Edward Lutyens design for the Roman Catholic Cathedral. Model in the Museum of Liverpool. Models of later designs in the Metropolitan Cathedral Archives.



The Metropolitan Cathedral of Christ the King was designed by Sir Frederick Gibberd and consecrated in 1967. Both Anglican and Roman Catholic cathedrals demonstrate dramatic architecture.

Centre has two tide predictor machines; early analogue computers once used to predict tides for the Normandy landings. It is hoped to feature these in a future article.
Joseph Proudman Building
6 Brownlow Street
Liverpool L3 5DA
Tel. 0151 795 4800 (9am–5pm weekdays)

W. www.tide-and-time.uk

Open monthly by appointment.

Birkenhead

Several attractions lie across the water. Mersey Ferries give an excellent view of the waterfront and Cammell Lairds shipyard or try one of their all day trips along the Manchester Ship Canal.

One of only four German U Boats preserved is on show near the Woodside Terminal

W. www.merseyferries.co.uk/about/u-boat-story/

Wirral Tramway & Wirral Transport Museum Trams run on selected days
1 Taylor Street
Birkenhead
Merseyside
CH41 1BG
Tel: 0151 647 2128

ACKNOWLEDGEMENTS

Thanks to the following for their help with this article:

Rev. Alex Maynard, St. George's Church, Everton, Liverpool.
Neil Sayer, Archivist, Liverpool Metropolitan Cathedral.
Rebecca Smith, Curator of Maritime Art, National Museums Liverpool.
Sharon Brown, Curator of Land Transport, Industry and Work, National Museums Liverpool.

ME

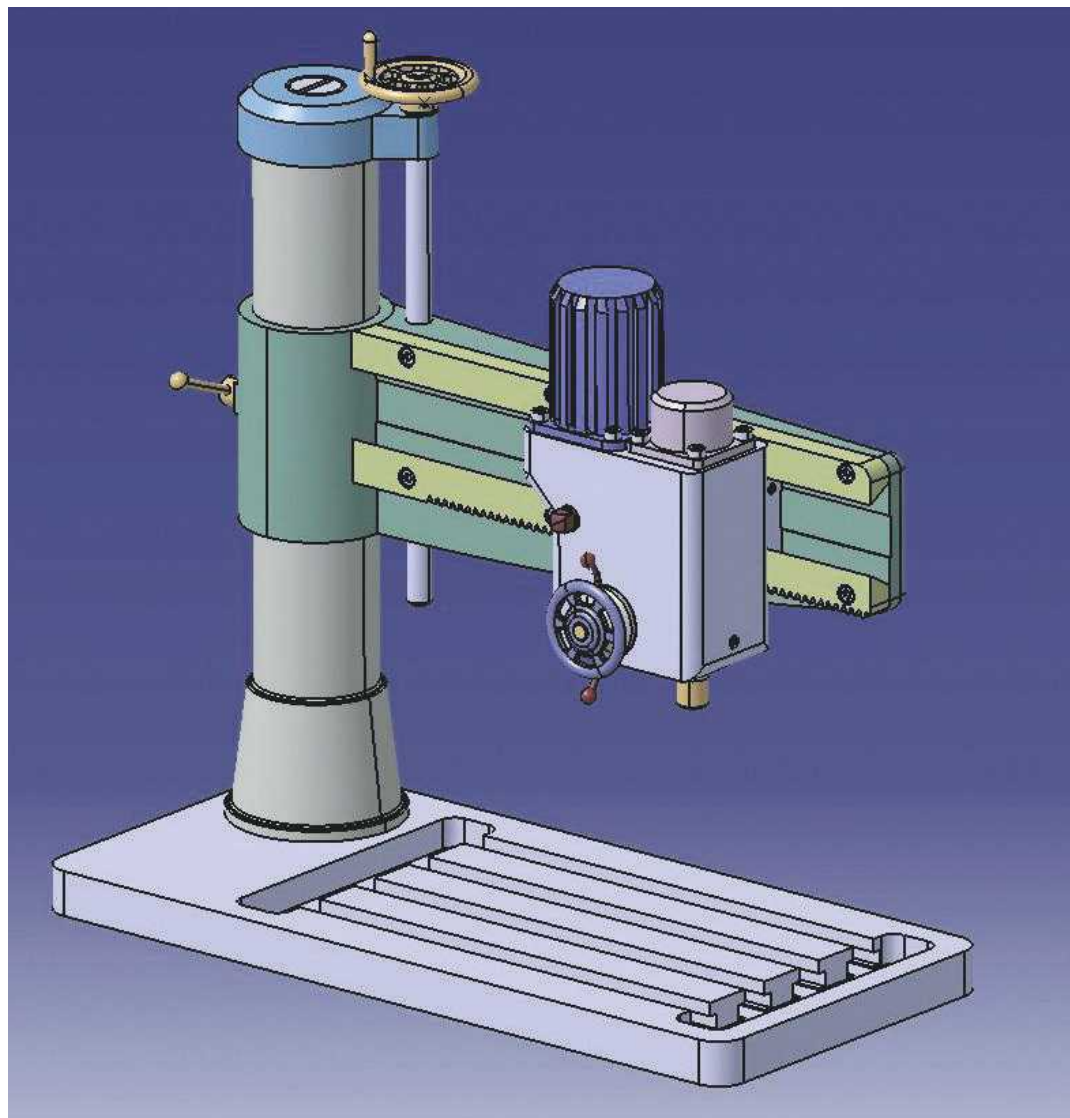
Philipp
Bannik
presents his
own radial boring tool.



A Radial Borer

PART 4

Continued from p.314
M.E. 4672, 27 August 2021

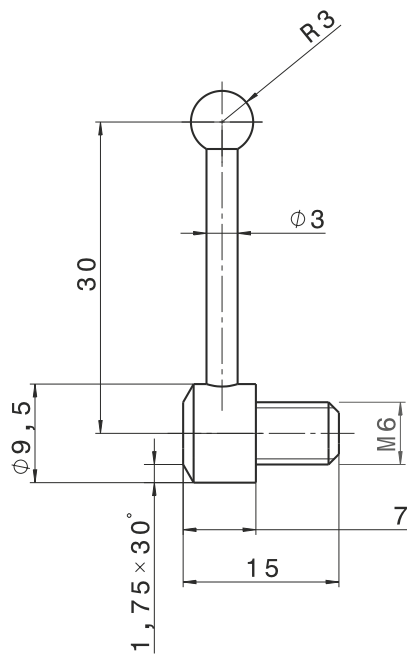


The raw material for the column.

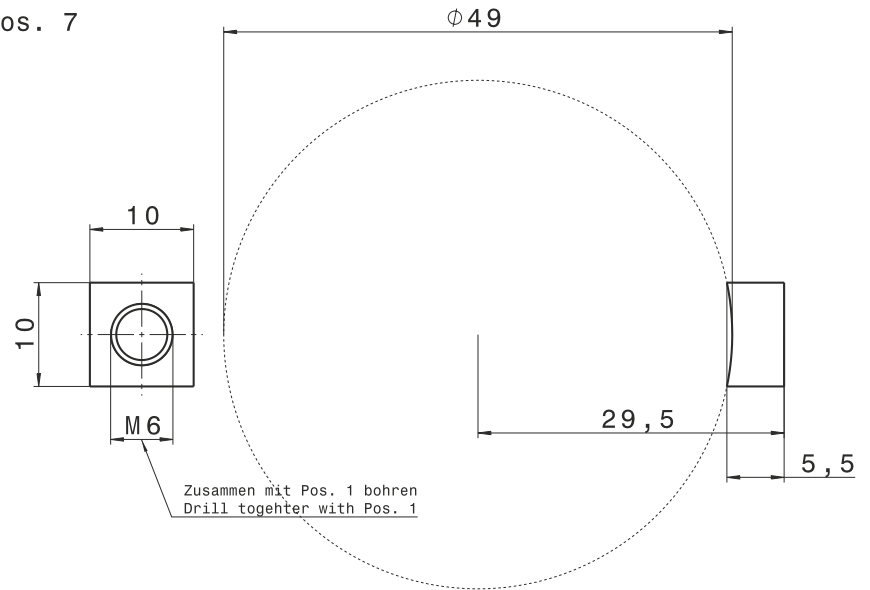
The column

The very stout column, even more massive than the base, is made of an old truck tow bar (photo 26). The shape is quite simple but machining the length of over 200mm was a challenge. While I was turning down the diameter I checked the diameter at three points along the column and got a difference of 0.15mm. So I adjusted the tailstock of my lathe a little bit to the side, did a further cut, checked the size and adjusted again until I achieved a difference of 0.01mm over 200mm (photo 27).

Fig 22

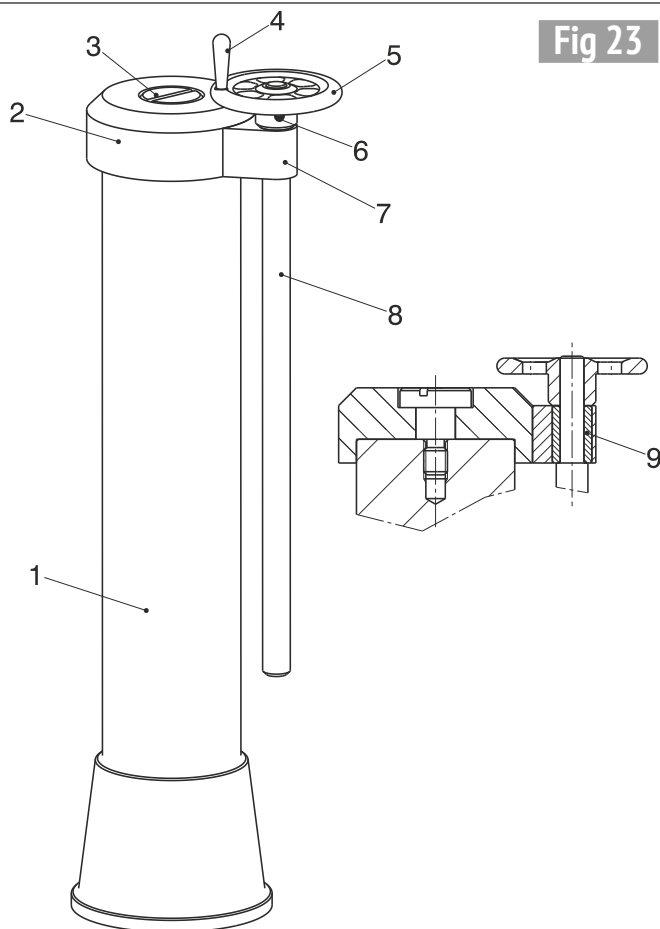


Pos. 7



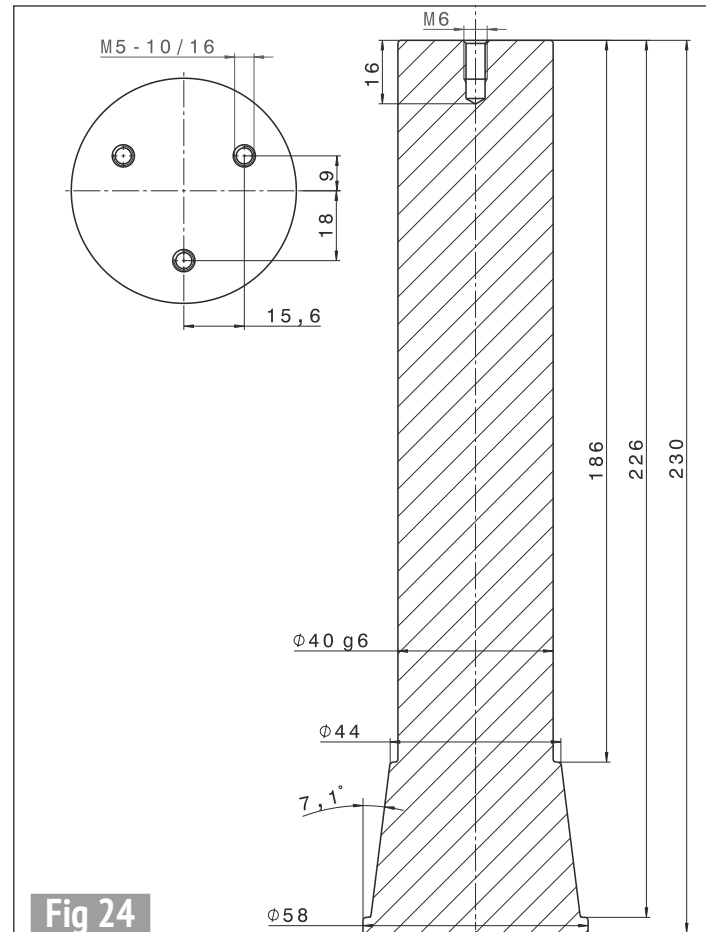
Baugruppe Assembly	Ausleger / Arm							
Allgemeintoleranz/ Tolerances NORM EN 22768 m	gezeichnet/ designed	Name Philipp Bannik	Datum/Date 24.08.2017		Zeichnungsname/Title: Klemmblock / Clamping Block Klemmhebel / Clamping Lever			
Projektion	Maßstab 1:1 Scale	A4		Zeichnungs-Nr./Drawing-No.: 22		Index: 06/07		

Fig 23



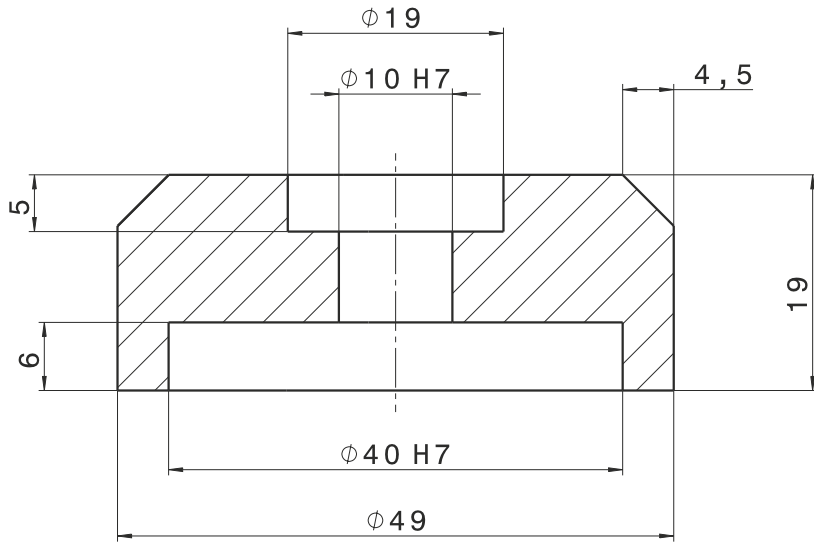
Allgemeintoleranz/ Tolerances NORM EN 22768 m	gezeichnet/ designed	Name Philipp Bannik	Datum/Date 26.08.2017		Zeichnungsname/Title: Säule / Column			
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						Index: 03		

Fig 24



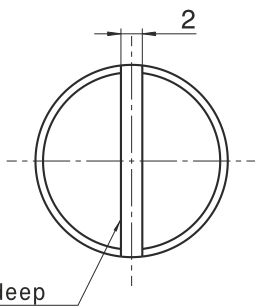
Baugruppe Assembly	Säule / Column				S235			
Allgemeintoleranz/ Tolerances NORM EN 22768 m	gezeichnet/ designed	Name Philipp Bannik	Datum/Date 27.08.2017		Zeichnungsname/Title: Säule / Column			
Projektion	Maßstab 1:2 Scale	A4				Zeichnungs-Nr./Drawing-No.: 23		
						Index: 01		

Fig 25

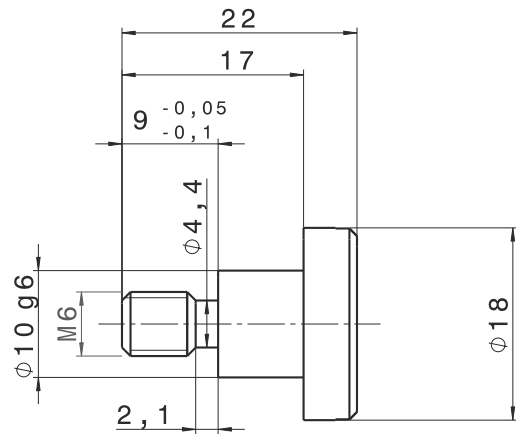


Baugruppe Assembly		Säule / Column							
Allgemeintoleranz/ Tolerances NORM EN 22768 m			Name		Datum/Date		Zeichnungsname/Title: Kopfplatte / Head Plate		
		gezeichnet/ designed	Philipp Bannik		27.08.2017				
Projektion	Maßstab						Zeichnungs-Nr./Drawing-No.: 25 Index: 2		
	2:1 Scale	A4							

Fig 26



2mm tief / deep



Baugruppe Assembly		Säule / Column							
Allgemeintoleranz/ Tolerances NORM EN 22768 m		Name		Datum/Date		Zeichnungsname/Title: Kopfschraube / Head Screw			
		gezeichnet/ designed	Philipp Bannik	27.08.2017					
Projektion 	Maßstab 2:1 Scale	A4			Zeichnungs-Nr./Drawing-No.: 26				Index: 3

Here is a test fit on the base to check if the proportions look good (**photo 28**).

The column is fitted with a cap, which is fixed with a bolt that allows the cap to rotate (**photo 29**). The cap incorporates a small block that holds the spindle of the rail height adjustment. The block is TIG welded to the cap with two small tacks to minimize distortion. The gap will be smoothed out with filler later (**photo 30**).

●To be continued.

NEXT TIME

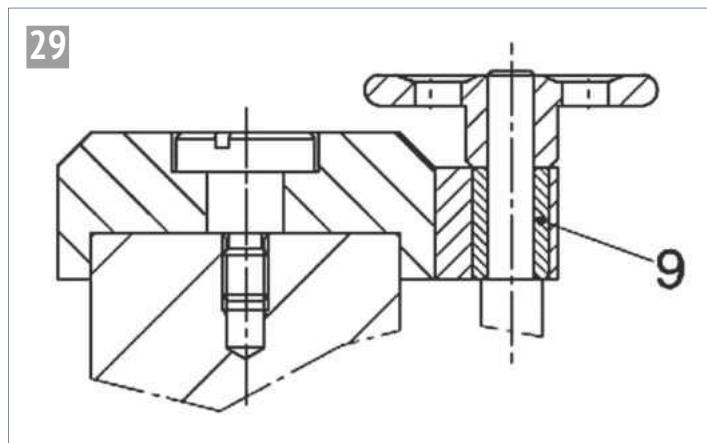
We make the last major item for the radial borer - the 'T' slotted base.



Turning down the column.



Checking the proportions (base to be described later).



Rotating cap for the column.



Tacking the two parts of the cap together.

No.308

Look out for the October issue,
helping you get even more out of your workshop:

MODEL ENGINEERS'
WORKSHOP



Stewart Hart presents a high speed drilling attachment.



Mike Cox details a spindle back stop.



Stuart McPherson explores his scrap box.

On Sale 17th September

Steam Turbines of the LMS Locomotive 6202

PART 7 - FINAL PART OF THE TRANSMISSION

Mike Tilby investigates the design of the LMS turbine powered locomotive 6202.



Continued from p.318
M.E. 4672, 27 August 2021

Intermediate gears

There is not much to say about the gears that connected the high-speed pinions of Turbomotive to the final drive but it might be worthwhile pointing out a complication of using a gear change mechanism to achieve reverse. Fredrik Ljungström filed several patents relating to such mechanisms that were suitable for reversing high power drives as used in locomotives (e.g. [ref 48](#)). The main invention involved a robust arrangement for moving two gears apart and inserting an idler gear between them so as to reverse the direction of rotation. If spur gears with straight teeth were used, everything would be relatively simple but, with helical gears, the directions of the helices



LMS No.6202 (Turbomotive) on arrival at Euston with an express from Liverpool Lime Street in c1935 (photograph: J.N. Hall/Rail Archive Stephenson at Rail-Online.co.uk).

in a pair of mating gears have to be opposite to each other. Consequently, when two gears are separated and an extra gear inserted between them, if the extra gear meshes properly with the first gear, its teeth will be slanting the wrong way for it to mesh with the second ([fig 26](#)). To overcome this problem, Fredrik Ljungström cut teeth on the idler gear in both directions so as to leave a series of diamond-shaped pegs as illustrated in [fig 26](#). I wonder if the complexity of this arrangement influenced the decision to use a separate reversing turbine in LMS 6202.

Flexible drives

In the early decades of the last century designers of diesel, electric and turbine locomotives sought ways to transmit power from motors and associated shafts mounted on the main frames, to the axles. Of course, the challenge here is that while a locomotive is moving, its

axles constantly move relative to the frames in both their vertical position and their angle of tilt. Chain drive has been used for some narrow gauge locomotives while for transmission of higher powers a common approach was for the motors to power a jack-shaft with a crank at each end which transmitted power to the wheels via a connecting rod. e.g. the TGOJ turbine locomotives (photo 9 and [fig 21B](#) in Part 6).

Another approach has been to use the well-known cardan shaft ([fig 27A](#)). This mechanism is thought to have been invented in the 16th century by an Italian polymath called Gerolamo Cardano and was employed on some geared steam locomotives such as the Shays and Heislors ([ref 49](#)). It is widely used on modern diesel and electric locomotives such as the British 225 Inter-City class 91 locomotives. More recently, the weight of electric motors has been sufficiently

Fig 26

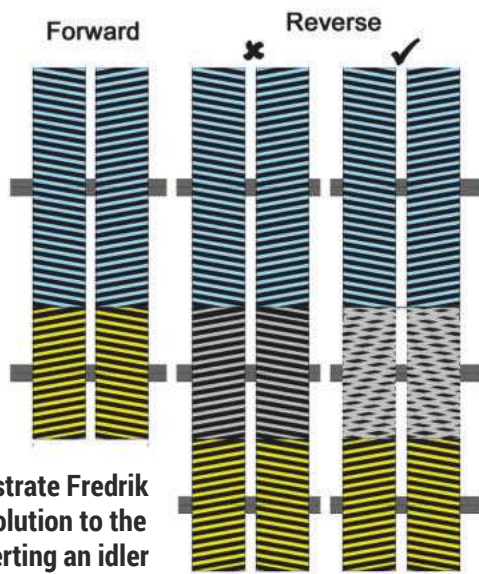
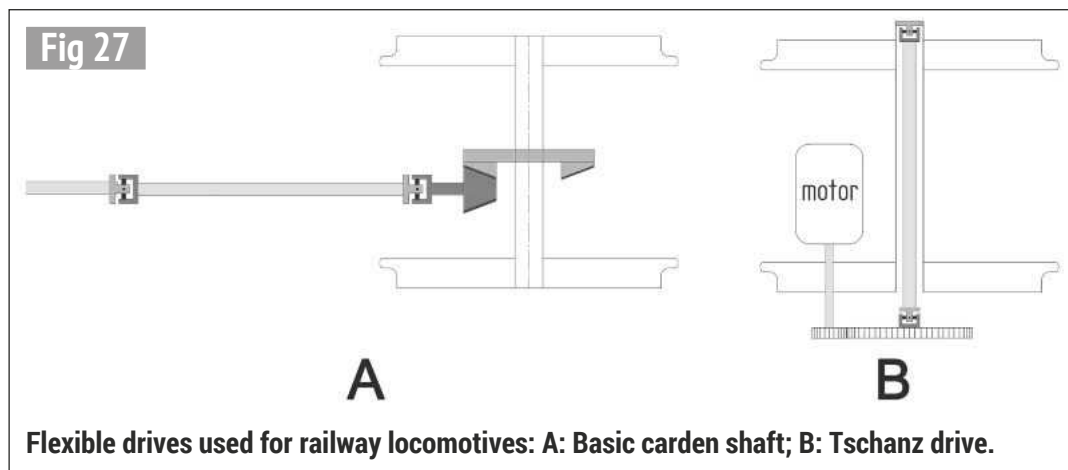


Diagram to illustrate Fredrik Ljungström's solution to the problem of inserting an idler gear between two double helical gears so as to reverse the direction of rotation.

reduced that they can be mounted directly on the unsprung axles, thereby avoiding the need for a flexible drive.

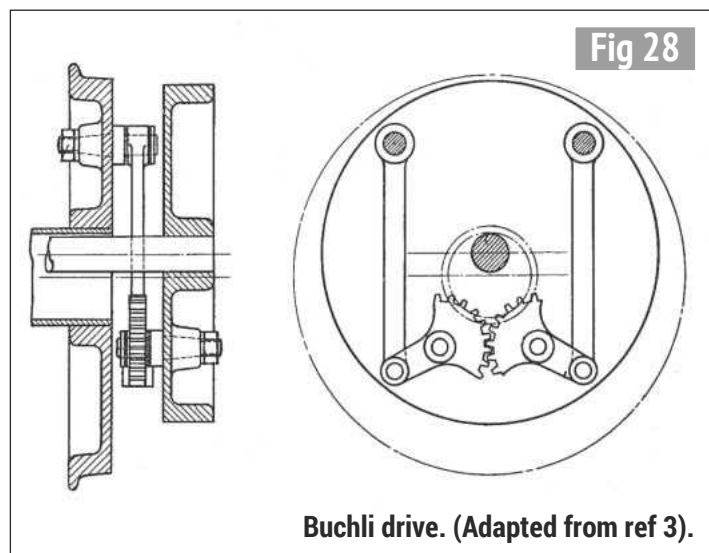
In the 1910s and 1920s several quill-type direct drive mechanisms were invented for electric locomotives. In a mechanism used in the USA, the motors drove a hollow tube surrounding the axle and extensions from the ends of this quill projected between the spokes of the driving wheels. The extensions were separated from the spokes by springs which gave resilience to the drive.

Universal joints as used in carden shafts are most efficient when the angle of the joints is small. This condition is most easily attained by making the shaft long, but that is not always convenient. In Switzerland in 1916 Otto Tschanz filed a patent (ref 50) in which a relatively long carden shaft was incorporated into a compact drive by passing it through the centre of a driving axle (fig 27B), forming a type of quill drive. The universal joint at one end of the shaft was connected to the power source and the joint at the other end was connected to the wheel and axle. The clearance around the carden shaft was sufficient to allow the wheels and axle to move relative to the frames according to the locomotive's suspension. This patent was published a few years before Fredrik Ljungström filed his



patent for the flexible drive used on the high-speed pinions, as was described in Part 6 of these articles. The two designs have very clear similarities, differing mainly in the nature of the flexible joints.

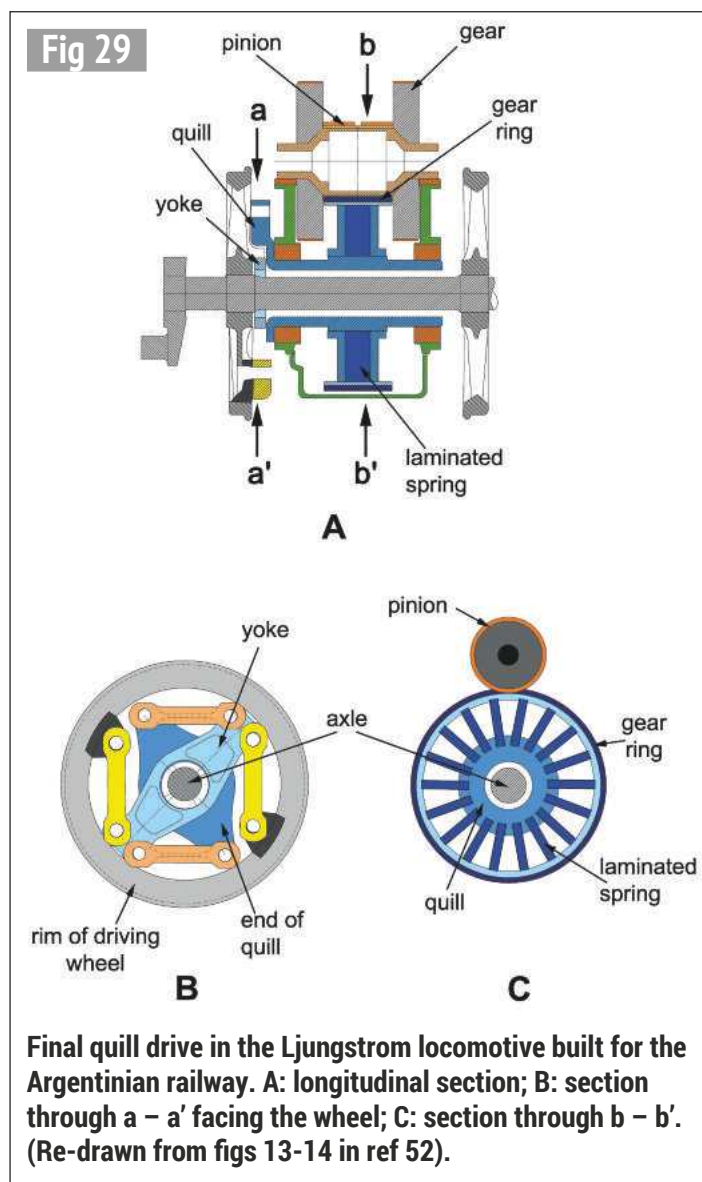
In 1917 another Swiss engineer, Jakob Buchli, filed a patent for a completely different type of flexible drive coupling (ref 51) in which power was again transmitted from a central drive shaft to the axle and driving wheels. However, in this case the flexibility was achieved by using two pairs of links. The links in one of these pairs were geared together at one end as can be seen in fig 28. An animation of the working of this drive can be seen in the Wikipedia page at: https://en.wikipedia.org/wiki/File:Animation_of_Buchli_Drive.gif#/media/File:Animation_of_Buchli_Drive.gif.



These last two drives, particularly the Buchli, have been quite widely used in electric railway locomotives.

In the Ljungstrom locomotive for Argentina another type of drive was used. (fig 29). This seems to

be a novel mechanism but I've not found any of Ljungström's patents that describe it. The last pinion in the train of gears from the turbine meshed with a gear ring fitted around the outside of a large quill, that surrounded the axle. This gear



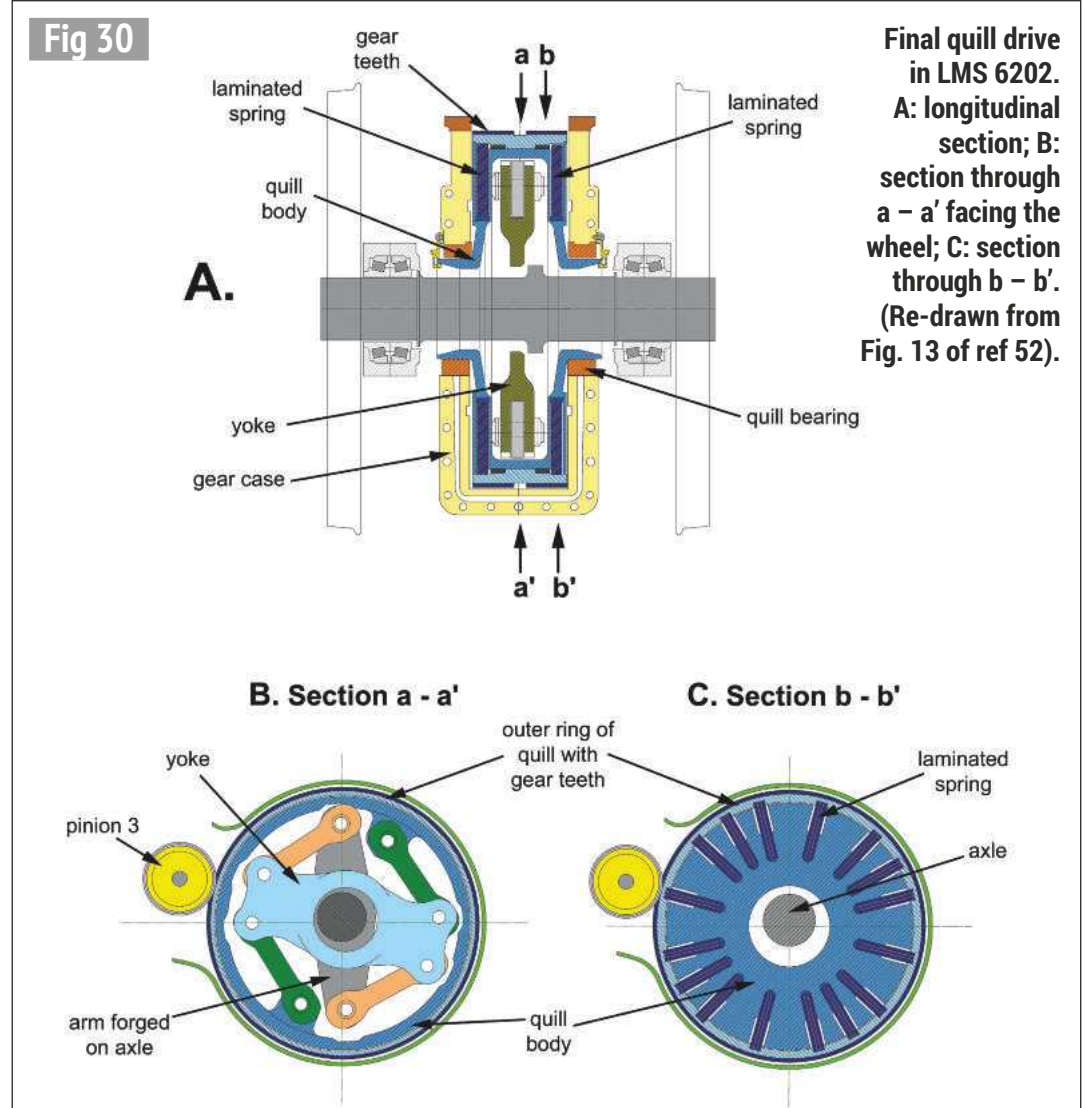
ring was not rigidly joined to the quill but transmitted power to it via a number of laminated springs positioned like spokes in a wheel. These would have absorbed much of the variations in torque resulting from irregularities in the track. Power was then transmitted from the quill to the wheels and axle by a system involving two pairs of linkages that bore some resemblance to the Buchli drive but seem simpler and more robust. Two of the linkages connected the quill to a yoke that was otherwise free-floating. Two more linkages coupled the yoke to lugs on the back of one of the driving wheels.

Drive to the leading axle of Turbomotive

In LMS 6202, transmission of power from the gear train to the locomotive's leading axle was via a quill drive that closely resembled the drive in the Argentina locomotive (fig 30). As before, the final pinion in the gear train meshed with a gear ring around the quill and was connected to the quill by a similar set of laminated springs. The quill drove a yoke but in this case the yoke transmitted power directly to lugs forged on the axle, instead of to the back of a wheel. This was necessary because, unlike the Argentina locomotive, the axle bearings of LMS 6202 were inside the wheels. Also, this design allowed all the linkages to be protected from ingress of dirt because they were completely housed within the gear case.

Conclusion

The design of the turbines and the transmission system in LMS 6202 show a very great dependence on the work of Alf Lysholm and Fredrik Ljungström. There is clear evidence that Alf Lysholm designed the turbines and it seems to me that he either also designed the transmission system or that Rupert Struthers learnt so much from his period of working at ALA that he was able to replicate many details that had originally



been developed by Fredrik Ljungström.

We have now completed the path of power transmission from the turbines down to the wheels of Turbomotive and so have reached the end of this series. I have found the investigations very interesting and just hope some other people find points of interest (and not too many errors) amongst the details that have been described.

Acknowledgements

I thank Ingvar Arvidsson for providing information about the preserved TGOJ locomotive and for the photo in part 5. I also thank fellow SMEE members, Bob Bramson and Roger Backhouse; Bob for providing information about drive systems in modern locomotives and Roger for first arousing my interest in LMS

6202. In doing so he triggered an investigation that became more revealing and time-

consuming than either of us might have predicted.

ME

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The Great Wealden Railway at Biddenden

What Enthusiasm and Passion can achieve

Paul Carpenter looks back at a gloriously wonderful railway.



Plaque to commemorate Michael Cadiz's generous donation to the Kent and East Sussex Railway.



Michael Cadiz with his commemorative plaque.

Since the 1800s railways have been a fundamental part of the fabric of our country and a major contributor to the wealth of the nation. Not everyone loves railways; Dickens, for example, truly hated them but then he had a terrible experience due to an horrific derailment which he was lucky to survive. The average person probably just sees them as a necessary and convenient means of

travelling but for those who find themselves attracted, fascinated and indeed intrigued by them, they offer a rich tapestry of creativity and design, encompassing many disciplines including architecture, mechanical and civil engineering.

Michael Cadiz is a man who spent many years working out of the country in the world of banking – a far cry from the world of railways which he loved from an early age. Michael is a man bursting with energy and enthusiasm for railways so, on returning to England, he wasted no time in building an OO gauge train set for his young son. Unfortunately, his son was not to share his passion, so this first layout was soon sold on. Undeterred, he set about building a large room over his garage to allow the construction of a new layout, this time in O gauge.

He has a very keen eye for detail and this first became evident with the quality of the station buildings and scenery he built for this second layout.

It was based on the local Kent and East Sussex Railway and featured the stations of Headcorn, Biddenden and Robertsbridge. He was invited to exhibit his model of Biddenden station at a local village show and it was here that Michael was introduced to another local O gauge modeller, Max Dunstone. Max had his own layout which featured prototypical operation with full signalling.

Max was able to help Michael with electrical issues with his KESR layout and they often shared visits to preserved lines and exhibitions – happy days!

Whilst visiting a local exhibition in Maidstone, Michael first came across a 5 inch gauge display featuring a beautiful Class 33 outline diesel locomotive and three highly detailed wagons. This was a real turning point and Michael found himself deep in conversation with Harry Warner, who had built these excellent models. It was Harry's attention to detail, together with the ability to sit



Coaling stage and yard at Bugglesden.



Hugh Topham shunts a train at Bugglesden yard.



View from Bugglesden yard.

on and drive in this scale that immediately fired Michael's imagination – he was hooked!

Out went the O gauge layout and, together with Harry and Max, he drew up plans to build a simple 5 inch gauge ground level railway at Michael's home. The drawing initially showed a basic loop around just one part of the exceptionally large garden. Inspired and enthused, this led to the purchase of a Shire Class steam locomotive and a few lengths of straight track. With its large driving wheels, this engine was not only extremely powerful but also had quite a turn of speed and acceleration. It quickly became clear that the layout had to grow. Every week, Harry would take home bundles of aluminium rail and return a week later with several more track panels ready to be laid. The clay ground was cleared, ballast was laid and the layout grew ... and grew. The art of track and turnout construction



7823 Hook Norton Manor – clear road ahead.



A busy scene at Bugglesden yard.

was quickly mastered and the various turnouts and sidings were added to allow shunting.

After a couple of years of fun and successful running, the local Romney Marsh Model Engineering Society were invited to bring locomotives for a visit. Several engines turned up and it quickly became apparent that the railway required control of the turnouts and signals. Max took it upon himself to develop a system for controlling the points and signals in such a way that full interlocking, as in full size

practice, could be achieved.

Country style station buildings, goods sheds and a locomotive Shed were built by Michael with as much attention to detail in 1 inch to the foot scale as he had achieved in O gauge. Those buildings added a real air of authenticity to the railway. As the track layout grew so too did the ever-expanding control system, eventually leading to the need for two signal boxes.

The railway became part of the GL5 collection of miniature railways and with regular

monthly open days, the fame of the railway spread. Many locomotive owners and friends were now enjoying the delights of this now extensive railway. Many also helped to manage the ever-increasing burden of maintenance.

Hugh Topham and Dick Dickson discovered that a great way to spend their recent retirements was to help with the maintenance and upkeep of the line. Regular work parties were held on Wednesdays and Fridays and this core gang of enthusiasts battled to



Idle stock awaiting a job.



Warehouse at Topham Yard.



Up train approaches Bugglesden signal box.

keep ahead of what was now becoming a major commitment to keep the line operational. Heaving clay, roving cattle, heavy rains and scorching summers are no friends to a ground level railway, but this

gallant and loyal group of friends managed to keep ahead of nature for almost twenty-five years. What an achievement!

Unfortunately, age is also not a friend to a ground level railway and so that dreaded

day was looming when closure had to be contemplated.

Finally, the pandemic and subsequent lockdown sealed the fate of the railway as the garden grew like mad during that last, long, hot summer when no-one was allowed on site.

It took some six weeks to dismantle this wonderful railway and everyone involved did so with great sadness – truly 'Gone With Regret'.

Michael, though, being the passionate and enthusiastic man his is, was keen for this not to be the end of the line for the railway – 'Perchance not dead but sleepeth'.

He donated most of the track to the Kent and East Sussex Railway and they have committed to rebuilding this wonderful railway at one of their sites along their beautiful line.

The plaque will eventually be displayed at the railway's new home and reminds all who may come to enjoy this railway in the future who made it possible. The new location also forges a link between the full size and miniature worlds.

The GWR has given great pleasure to certainly hundreds and possibly thousands of enthusiastic visitors and kept our hobby very much alive for future generations. Michael is certainly an inspiration to us all.

● To be continued.

NEXT TIME

Hugh Topham will tell us more about the history of the Great Wealden Railway.



Railway line at the bottom of our garden.



Eager pannier awaits the road.



Drivers pause to swap railway anecdotes.



1400 meets Class 14.

An Astronomical Bracket Clock

PART 11

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



Continued from p.323
M.E. 4672, 27 August 2021

Remontoire, escape wheel and pallets

The three 0.6 module 60t wheels and the related 30t wheel were cut along with the other wheels.

The swing arm assembly is essentially an L-shaped $\frac{1}{16}$ inch brass plate with an attached cock. It also has a 6BA arm which carries a balance weight. My weight is in two parts so that its position can be locked. Both parts have knurled rings. I suggest an off-cut of brass rod is initially drilled and tapped to assess the weight needed for your clock. It is better to use a heavier weight only a short way out on the arm than a lighter weight further along the arm. Both can be made to counterbalance the excess weight not needed to drive the pendulum but the former will have a lower moment of inertia and thus require less torque to generate the needed rotation. My weights total about 9 grams.



53



A set of parts for the remontoire.

The parts of the remontoire (figs 21, 22 and 23), still to be polished, are shown in the accompanying photograph (photo 53).

Cutting the 30t dead beat escape wheel has been described by both John Wilding in his book on making a long case regulator and by Alan Timmins in relation to his design of regulator (ref 14). In this design use a Thornton's type A cutter.

The only additional comments to previous writings I would add are:

1. Cut three escapement wheels whilst you are about this task (photo 54). The set-up will be more rigid, the wheels are very delicate and you may well damage one. If you don't, you are ready to build two more regulators!
2. A rate of rotation of the cutter of about 1200 rpm seems to be a good compromise.
3. I marked the circumference of the wheels to be cut with a black marker pen. When taking cuts to alternate teeth I could see the black



54 Cutting the escape wheel.

line of metal gradually disappear. I found trying to measure the tip thickness difficult so instead I compared the black line to feeler gauges using an eye magnifying glass. When about 0.008 inch was reached, I milled all the other teeth.

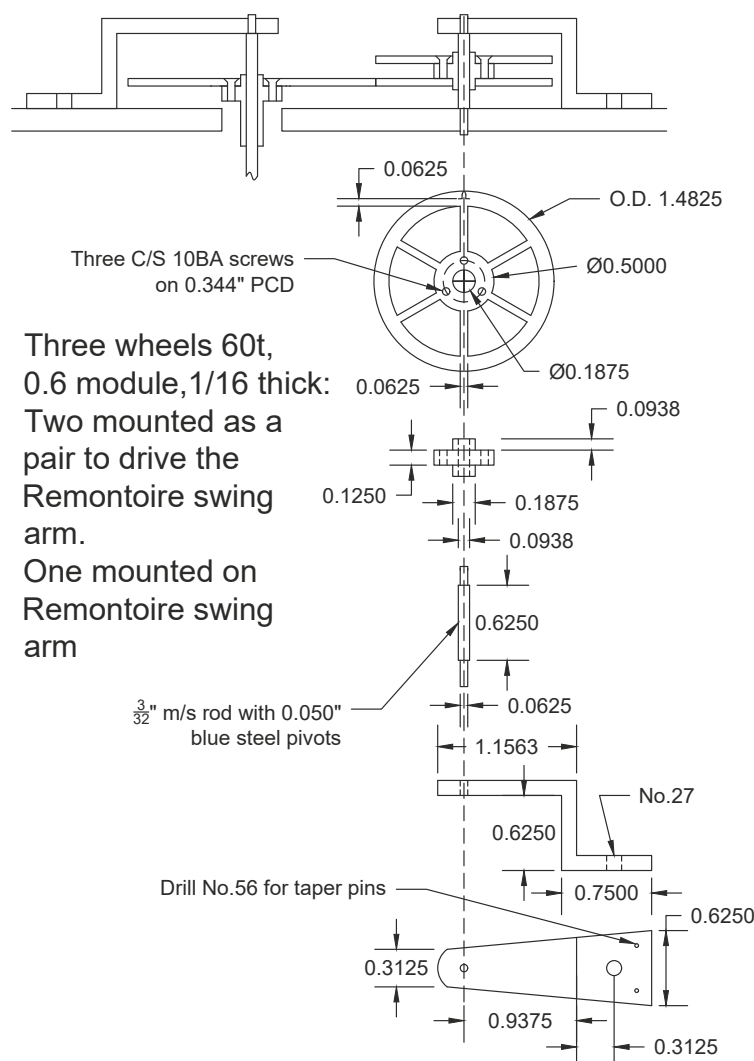
In your author's view the pallets are one of the most difficult areas of construction. English regulator practice would be to make these from gauge plate as has been excellently described by both John Wilding and Alan Timmins. Your author prefers, however, the Villaimy style pallets which were often used in Vienna regulators. This type has separate pallets held in a brass rocking arm. This structure allows both the inside and outside curves of the pallets to be turned to precise dimensions. They can also be replaced when worn or if an error occurs in generating the impulse faces. These are real advantages over the solid form used in English regulators where any error in making the pallets requires the whole piece to be remade, a tedious process of cutting and filing high carbon gauge plate.

To make Villaimy pallets start with a 2½ inch wide by ⅛ inch thick piece of gauge plate and mark out the inside and outside diameters of the pallets. This ring needs to

be cut out with a generous allowance for machining. I chain drilled with a 3mm drill followed by using my Hegner piecing saw. It is miserable work; do not get bothered by piercing saws breaking, they are a consumable item. I then used a small belt liner to remove some of the excess metal before the ring was soft soldered to a ¼ inch thick brass disc which in turn was mounted on a wheel holder held in the three jaw chuck. HSS tools will bring the inside and outside diameters to size provided the speed is kept slow (**photo 55**). About 60 rpm is fine and use plenty of cutting oil. Whilst in the lathe it is also worth carrying out the first stage of polishing

Remontoire drive

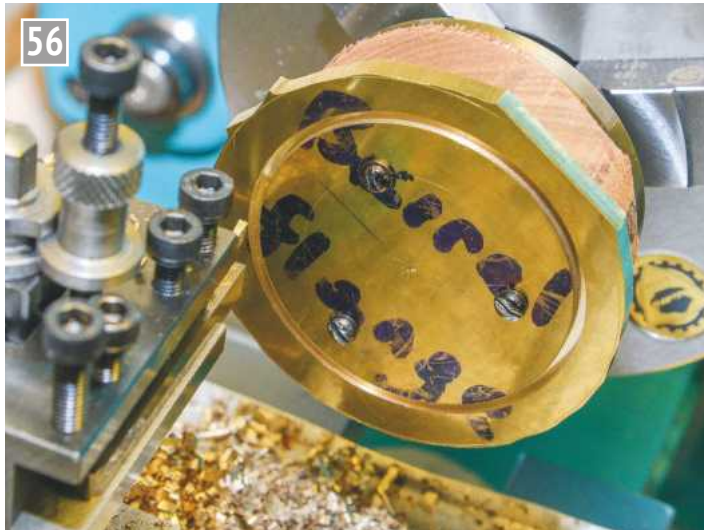
Fig 21



Three wheels 60t,
0.6 module, 1/16 thick:
Two mounted as a
pair to drive the
Remontoire swing
arm.
One mounted on
Remontoire swing
arm



55 Turning the gauge plate ring for the Villaimy pallets.



Machining the recess for the pallets.



Tapping the holes for securing the pallet keeper plates.

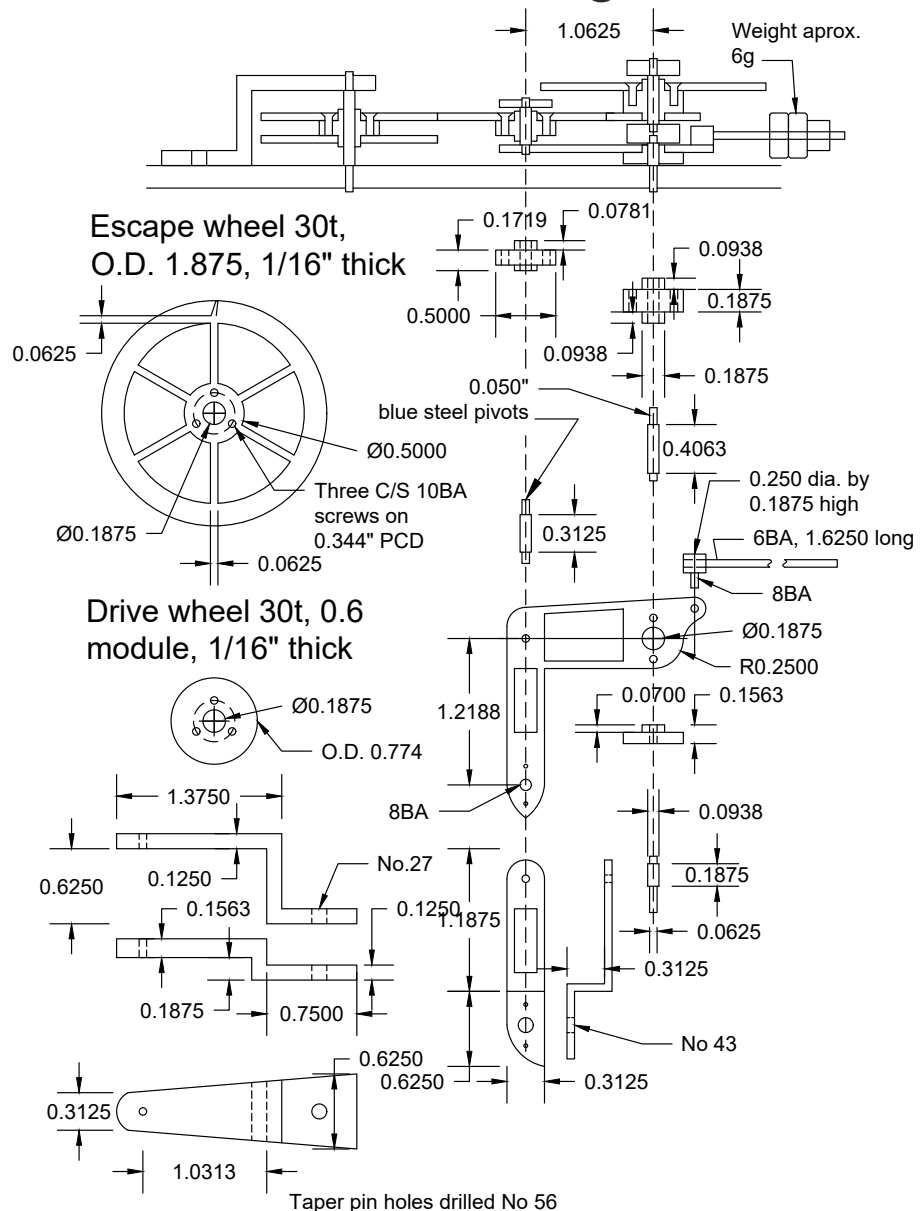
the outside of the ring with a fine worn file followed by 600 grit paper (do not forget the newspaper over the lathe bed).

The ring can now be unsoldered from its back plate and both the inside and outside polished. Some slight change in dimension will occur in this process. On the drawings I show the theoretical dimensions for the ring and, in brackets, the final polished size of my ring. The effect is to slightly increase the drop of the escapement. The theoretical figures shown allow for a drop of 10% of the distance between the escapement wheel teeth. This is the minimum for safe operation and some texts indicate that up to 20% is allowable. The slight increase is well within this range.

To make the pallet arms mount a disc of $\frac{3}{16}$ inch brass on a wheel holder with three screws. These need to be well clear of the needed recess for the pallets. Grind up a tool from $\frac{1}{4}$ inch square HSS. Mine is 0.0625 inch wide with a square end and plenty of side relief which allowed me to take fine cuts to bring the groove to the precise width of my ring. Start by centre drilling the disc and aligning the inside edge of the cutter with the centre of the disc. Check with a lens, precision is needed. Now wind out the cutter so that the inside of the cutter is set to the inside dimension of your ring. Run the lathe at about 60 rpm

Fig 22

Remontoire swing arm



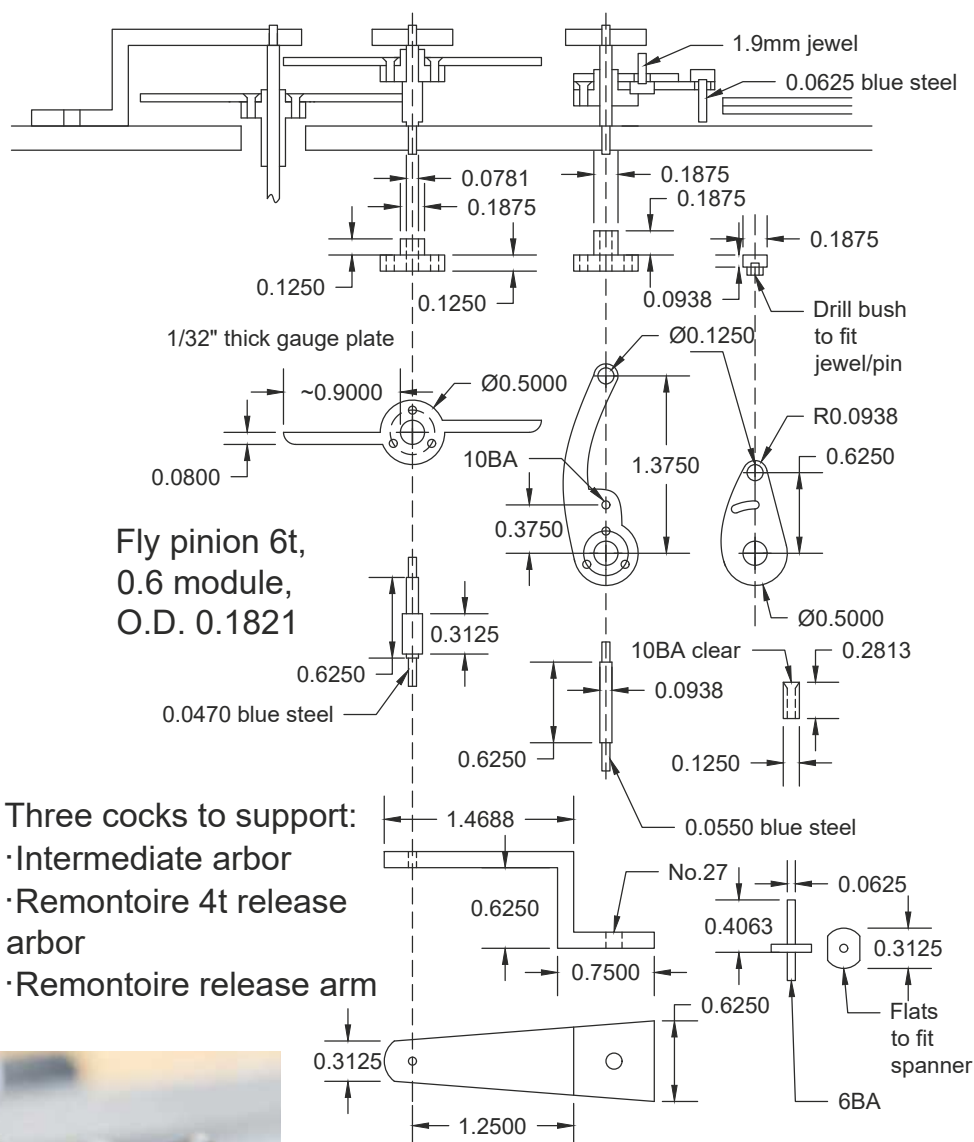
and feed in the tool to a depth of 0.0120 inch, i.e. about 0.005 inch less than the thickness of the ring (**photo 56**). Wind the tool out no more than 0.001 inch each time and take successive cuts until your ring just fits, preferably tightly. The rest is easy; drill/bore/ream the central $\frac{3}{16}$ inch hole and turn the disc to leave a $\frac{1}{8}$ inch wide outer shoulder.

Remove the disc from the lathe and mark out the arms. I suggest that the four 10BA holes to secure the pallet keeper plates are drilled and tapped at this stage whilst the disc is easy to hold (**photo 57**). The two No. 50 10BA clearance holes to secure to the collet can also be drilled.

To shape the arms I cut away the smaller waste section with my Hegner fret saw and then milled the sides of the arms whilst holding the material in a vice. I used a $\frac{1}{2}$ inch diameter end mill running at 700 rpm. Mill to the marked out line leaving a small excess amount near to the central $\frac{1}{2}$ inch boss. The larger segment of waste was then cut away and the other side of the arms milled with the first side resting on a $\frac{1}{8}$ inch thick parallel. Take light cuts and occasionally remove to check the arm width – better

Fig 23

Remontoire release



58



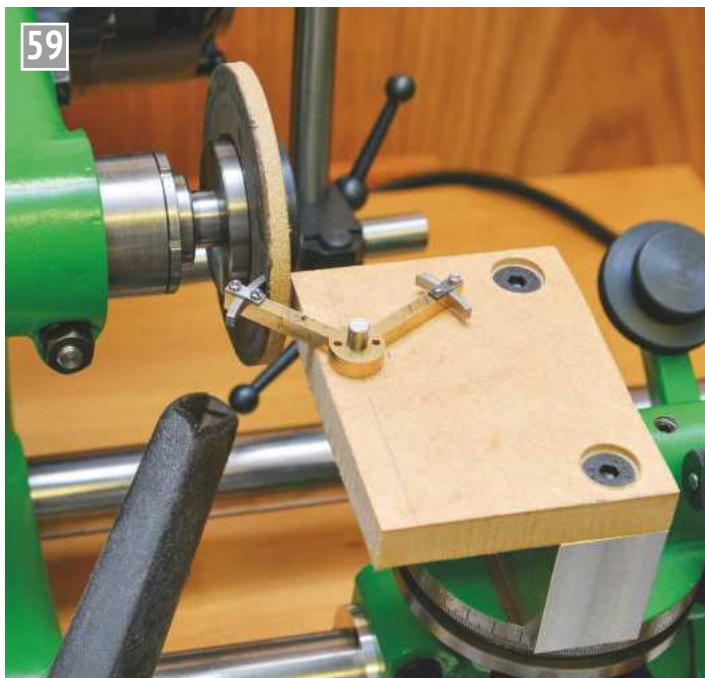
Using filing buttons to form the boss on the rocking arm.

too wide than too narrow. After completing the milling I filed the central boss to shape between two $\frac{1}{2}$ inch diameter steel buttons aligned through the central hole with a short length of $\frac{3}{16}$ inch silver steel rod (**photo 58**).

The two keeper plates to hold the pallets in place were cut from $\frac{1}{32}$ inch steel. I used gauge plate as it was to hand but mild steel will do just as well.

Two pieces of the steel ring about $\frac{5}{8}$ inch long need to be cut and mounted in the rocker arms to leave a gap of about 1.3 inch and their pallet faces ground to shape. John Wilding

recommends - and I concur - that a rectangular section of wood with an appropriately placed $\frac{3}{16}$ inch diameter pin is mounted in such a way that that the pallets can be ground whilst held in the rocker arms (**ref 12**). I used my Quorn. I cut and drilled three 3 inch diameter discs from Tufnol and Perspex sheet to fit a mandrel on the Quorn. They were between $\frac{3}{16}$ inch and $\frac{1}{4}$ inch thick. Spray mount glue affixed 120 grit, 600 grit and 2000 grit papers to the discs. To hold the work a small attachment was used consisting of a $3\frac{1}{4}$ inch wide by $1\frac{1}{2}$ inch deep by



Grinding a pallet face.

1 inch wide block of aluminium milled flat on the ends and the upper and lower edges. Two C/S M6 by 50mm screws at 1½ inch centres secured this to the Quorn (photo 59). (I have milled a flat and added two screw holes to the rotating base of my Quorn to secure a number of such attachments). On top of this a rectangle of 12mm thick MDF measuring 3¼ by 2⅝ inches was secured with two further C/S M6 screws. A ⅜ inch hole drilled part through the MDF held the needed silver steel pin 1¼ inch from one end and ⅝ inch from the edge.

The set-up was positioned so that the centre of the pin was, as near as I could measure, 0.608 inch from the front facing cutting grit surface. The entry pallet was then ground by gently rotating the rocker arm around the pin. After reversing the plastic cutting disc and resetting the pin to be 0.608 inch from the now rear facing cutting grit surface, the exit pallet was ground. The escape wheel and pallets were then tried in the depthing tool with the arbors set 1.490 inch apart (photo 60). Further small cuts were made until the wheel could just escape. The last few cuts were with the fine grades of emery.

Unless your workmanship has been perfect it is quite

likely that the lock on each side will not be the same. If the drop is too small on the exit side, reduce the arbor centre distance by a very small amount. Conversely if smaller on the entry side. It should only be necessary to change the dimension by a few thousandths of an inch. The locks should each end up being about 0.020 inch.

Once satisfied, measure the gap between the pallets. Also note the distance between the arbors which can be measured by subtracting half the arbor diameters from the measurement over the outside of the arbors. Check the answer by measuring the distance between the arbors and adding back half the arbor diameters. The depthing tool will, of course, be used



Setting up the escape wheel and pallets in the depthing tool.

to lay out the position of the pallet arbor hole on the small plate previously made for the pendulum bridge provided it is not moved. This is the time to put the tool somewhere where it will not be touched!

Remove the pallets, polish to 8000 grit and harden. Leave glass hard and re-polish. Reset the pallets into position in their arms using the noted measurement.

●To be continued.

REFERENCE

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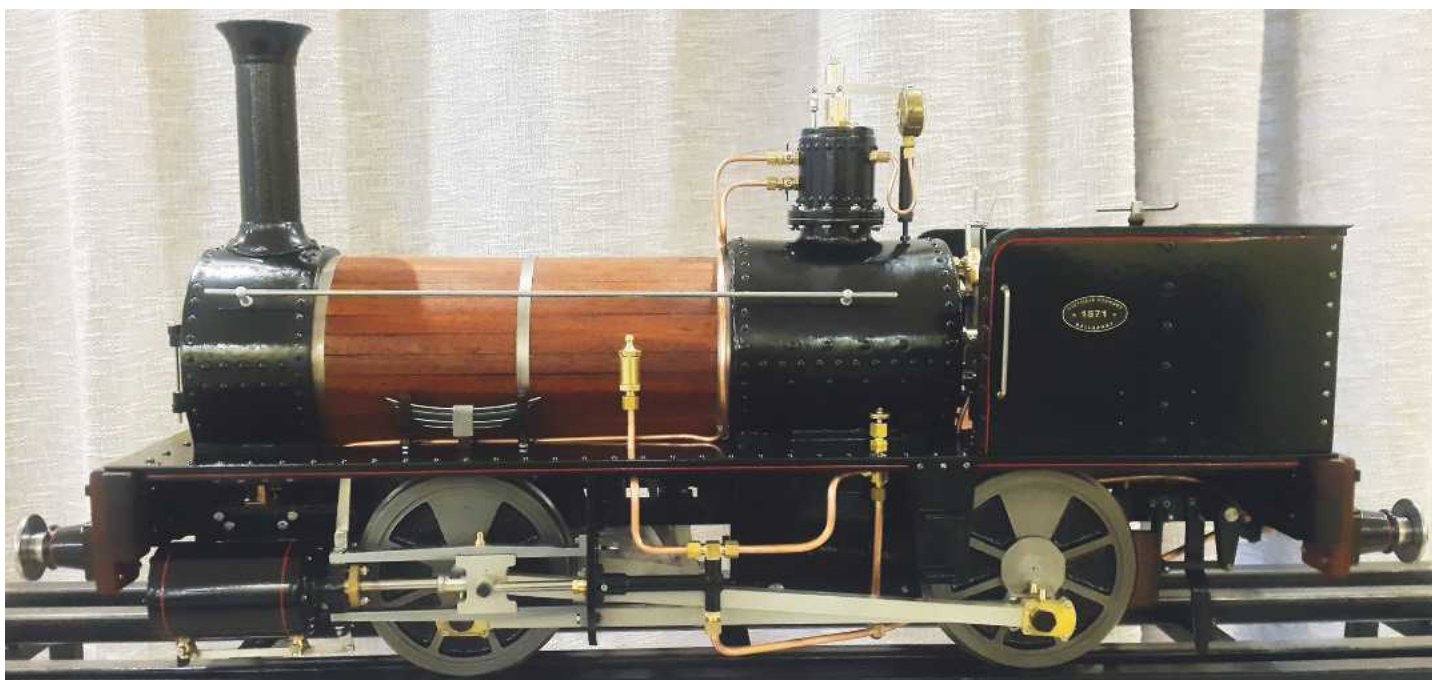
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Ballaarat PART 3

A 5 Inch Gauge 0-4-0 Aussie Locomotive

Luker
describes
a simple
but authentic small
locomotive.



Continued from p.274
M.E. 4671, 13 August 2021

Spring assembly

When I designed the spring assembly (fig 6) for this little locomotive I was worried about the offset from the axle boxes - it just looked a little wonky. The large prototype had this configuration and I was actually quite surprised by how well it worked. I thought the spring push rod would lock up with the unbalanced moment arm but when driving the locomotive on our track you can clearly see the springs just doing their thing.

On the plus side the whole assembly is actually very simple to make. The square for the push rod is made using 6mm square bar cut to the correct length and the ends cleaned on the lathe, with the two holes marked and drilled, and the one side tapped for M3. The front and back springs have different dimensions with the front springs extending over the running boards to clear the boiler, just like the prototype.

The thin silver steel push rod requires a little lateral thinking when dealing with limited machinery. For modellers with a modest workshop, lathe chucking and machining a 3mm rod is a problem. The likelihood of chatter or the rod climbing onto the tool is great, simply because the average chuck wasn't designed to hold such small diameters. You could of course use a collet but it's unlikely you'll have one when starting out and I personally still don't have a commercial collet for 3mm. The easiest and quickest way to hold the smaller diameter rods is to make a small clamping collet (**photo 13**).

Start by drilling a piece of BMS bar roughly 20mm deep. Mark No. 1 Jaw for repeatability and accuracy. Flip it around and drill a 5mm hole into the 3mm hole for back clearance. Remove from the chuck and saw a slot in the vice. With a simple 'V'-clamp as shown in

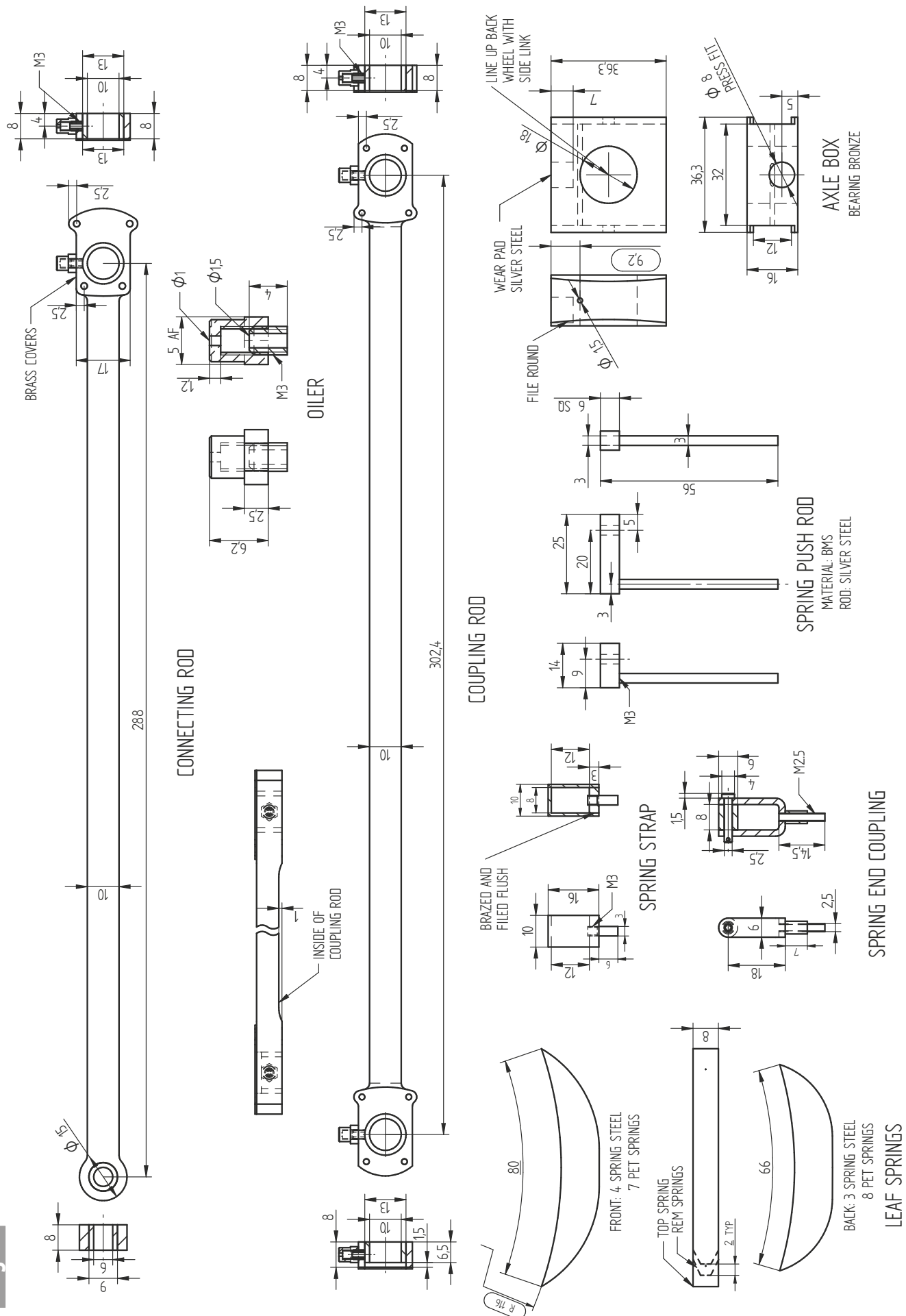


DIY collet and clamp.

the picture and - *voila!* - you have a simple/accurate collet. I have a few of these ranging from 1.6mm to 4.5mm.

A piece of 3mm silver steel can now be clamped in the DIY collet and this is in turn clamped in the three

Fig 6



Spring assembly.

jaw chuck. The end can be cleaned and the bar skimmed by ~0.05-0.1mm for the thread shortening. With a M3 die in a die wrench against the tailstock chuck to keep it square, and to advance the die, the thread can be cut.

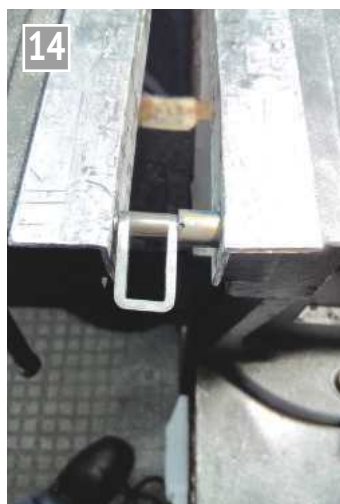
The spring strap is made by bending some 1mm plate around an 8mm former with the legs a millimetre or two longer than needed. The square threaded piece can be drilled and tapped in the lathe and here you can try your hand at parting off.

The **trick with parting** is to make sure the chips don't get stuck in the gap behind the cutting edge. Make sure the tip of the parting tool is ground straight and not at an angle. This ensures the cutting edge is the same size as the slot you're cutting and the chips can escape. If you grind the tip at an angle the cutting edge is larger and the chips are wider than the slot; this is looking for a jamming (and not the sweet kind). Ironically most people get away with this because the top relief isn't ground straight and the chip comes off the tool at an angle, so the chances of jamming is lowered, but the one day you grind the relief perfectly... and JAM!

Another thing to look out for is how the swarf leaves the slot. If it rolls up in the slot the top relief is too sharp and you're likely to jam the tool. The swarf needs to leave the slot completely without rolling or getting stuck.

Finally, the part is clamped in a toolmaker's clamp and **brazed** (actually silver soldered but brazing seems to be the accepted term for silver soldering ferrous metals, and this is the terminology used throughout the series. I actually very seldom use spelter for joining ferrous components). After brazing and removing the flux in the pickling solution the edges can be filed flush and the part given the usual beautification.

The spring end coupling looks like it will take forever to make but you can knock all eight out before morning



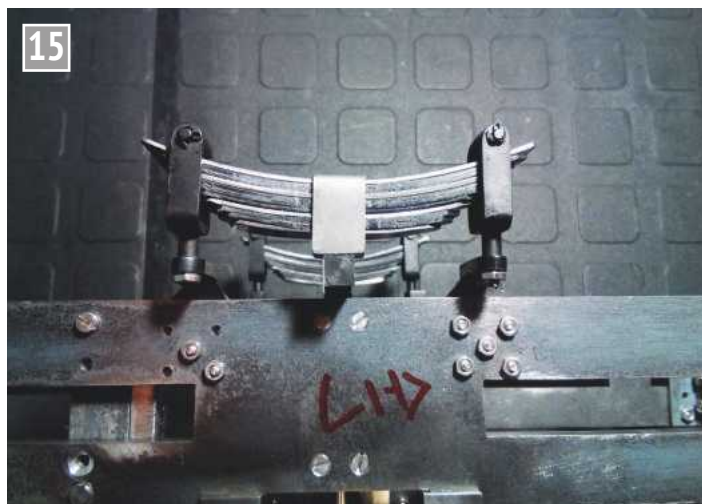
Spring assembly top pin drilling jig.

tea. The top pin is a 2.5mm nail or panel pin with the head cleaned up using a DIY collet and clamp. The other end is drilled using a drilling jig (**photo 14**) for the split pin, the material for which comes from any old steel brush. The drilling jig itself is a simple lathe drilling operation with the cross-hole drilled using the drill press. To get the hole plumb centre chuck a pointer and bring it to the jig with a piece of flat plate between the two. With the plate horizontal the spindle is centred. Back to the lathe and the end is skimmed until you're just on the hole.

The bottom M2.5 is simple threaded rod cut to size with a 4mm collar drilled and parted on the lathe. Incidentally, long 4mm nails worked well; I didn't really want to use my good silver steel for this collar. The coupling is folded around some 8mm square scrap, with the holes marked and drilled and finally the rounds made using radius guides. The whole assembly can then be heated red hot and dunked in oil to blacken. Time for tea...

Leaf springs

I find it particularly difficult to source proper leaf spring material in South Africa but one of my clients straps wooden crates with 1mm high tensile strapping. This tends to break frequently when it's pulled and they always have loads of scrap that they're happy to donate to my cause at scrap prices. It's nice and springy,



Spring assembly

cuts really well on a small guillotine and can be drilled with a sharp drill - perfect for the models! I was born long after Tufnol or Bakelite were the only plastics on the market and for some reason they are incredibly expensive nowadays. I prefer to use black PET sheet for the intermediate springs and it seems to work rather well (**photo 15**).

Axle boxes

For the axle boxes I cast rectangular bars to the size I'm looking for using my special bearing mixes. The outside can be cleaned up on the milling machine or in the four jaw chuck. The slots for the horns are machined using the milling machine along the entire length but this can be done using the lathe. With the slots and outer dimensions on size the individual axle boxes are cut using a hack saw with a little extra material for final machining in the four jaw chuck or milling machine. Each box is tried in the pedestals and the best fitting ones are left in place and the odd one that gets stuck filed to size. Don't machine the centre holes just yet.

Once all the axleboxes have found their homes mark the position of the wear pad, drill the hole and press a slightly longer piece of silver steel into the hole. Remember the silversteel will need a lead in of no more than 35µm (+0.035mm on a digital vernier) oversize. Now the top and

bottom of the axle boxes can be machined neatly to size, blending the wear pad nicely. This is where we need to hang ten with the axle boxes...

The coupling rods are laser cut with the bearing bush holes either marked or cut slightly smaller for accurate opening to size. With the coupling rods made to drawing we need to take up the inevitable tolerance stack on the frames somewhere else. What you want to do is take up the frame and coupling link tolerance in one part, the back axle box, while keeping all other components as close as possible to drawing. Therefore, before we can finish the axle boxes the coupling rods need to be machined.

The coupling and connecting rods

The rods are needed at this point and you could just as well finish them off while you're at it. Luckily for us, these are laser cut items with just the end holes drilled and the bushes pressed home. With the rod bearing holes I suggest drilling a pilot hole of at least 6mm, then opening up the hole to 0.5mm undersize and finishing off the hole with the correct size drill. This will give you a close to round hole without the use of a reamer.

The bushes are a little more difficult and tend to autofeed into the job, i.e. grab and bugger up everything. You should be using a PhBronze or a good quality tin Bronze here;

personally, I like to use bronze risers for these bearings. One trick to stop the drill from autofeeding is to grind the relief flute angle of the drill to zero but who wants to mess up their drills? I normally get around the grabbing problem by drilling at a slightly faster speed with a little resistance on the spindle lock.

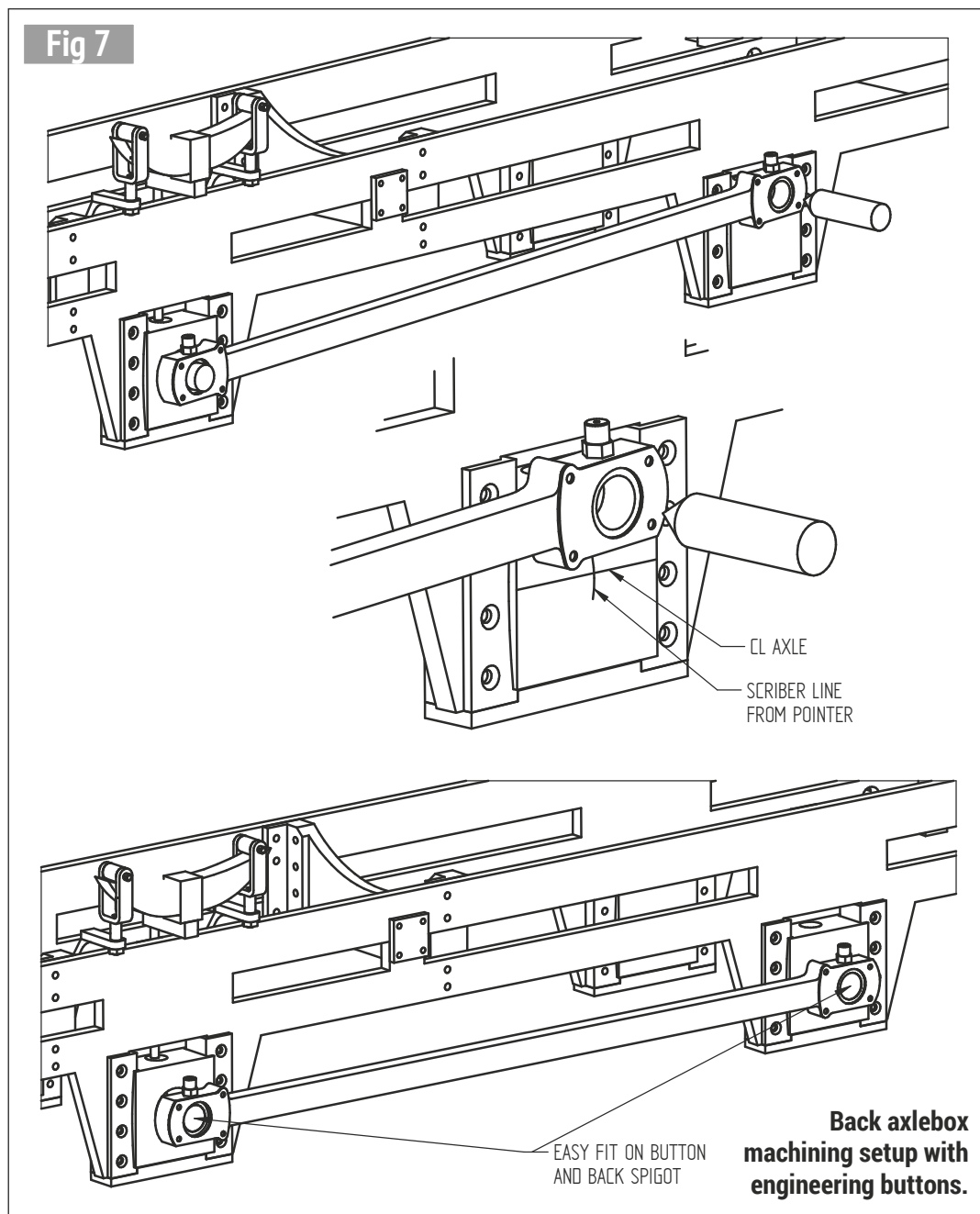
Either way the bearings will need to be opened up a little after pressing them home to clean the press burr and the inevitable deformation (press fit roughly 35-40µm). I normally just use the correct size drill to finish off these bearings. The inside of the hole **does not** have to be perfectly smooth in fact the drill scratches hold the lubricating oil in place where a perfect surface will just allow the oil to be squeezed out (tribology 101).

For interest: in the old days when journal bearings were common on the main lines and a journal ran hot one of the hacks the shop would use to correct the situation is to scratch the bearing surface with a file to improve lubrication. This is of course if all else was good and the bearing was still on size, just polished in service.

The oil cup hole is a simple drilling and tapping operation in the drill press but rather leave the 1mm oil hole for the hand drill. The easiest and safest way to drill the oil holes is with a drilling guide. Easily made from a short cap screw drilled through the centre on the lathe. A normal hand drill can turn at a much higher RPM and the feel is better than a press drill so you're less likely to break drill bits.

The brass covers can be made by clamping them between two rods and using the rods as a drilling jig. The edges can then be filed again using the rods as a filing guide.

The insides of the coupling rods are thinned slightly to give a little clearance for the wheel rims. This can either be done using the side of an end mill or even hand filed. It's hidden from the judging eye so no one will be the wiser.



The oiler cup is standardised for most of the locomotive and it fits to the eccentrics, slide-bar and rods. This is all done in the lathe with 8mm hex bar clamped, the outside skimmed, drilled and tapped to the required depth. Finally, the 1mm hole is drilled a few mills and the part is parted off. The threaded stub can be made from any threaded bar or scrap screw, cut to length and drilled through.

Finally, we can come back to the axle boxes. The hole for the front wheel shaft can be set up in the four jaw chuck making sure the front face is parallel to the chuck and the

hole is drilled centre. Some scrap brass pieces need to be fitted in the horn slot to stop the chuck jaws from damaging the shoulders. If you want to match machine both axleboxes in the same set-up a little soft packing (hard wood or plastic) will be needed on two opposing jaws to take up any preferential clamping. Drill the hole out but leave at least 0.5mm for finishing off with a boring bar.

With all the axle boxes fitted in the frame you make an easy fit shaft with a step that goes through the front wheel axle box hole and the coupling rod. This doesn't need to go

through both axle boxes; one at a time with a short shaft will work fine. On the other side of the rod, fit a machined shaft with a small sharp dimple. All fits need to be an easy fit, but without any rattle. Assembling the coupling rod to the front axle box onto the stepped shaft; you can now scribe a line on the back wheel axle box with the dimpled shaft (**fig 7**). Where this crosses the centre line of the axle box is the crosshairs for a punch mark. Punch, drill and tap a small hole, say M3.

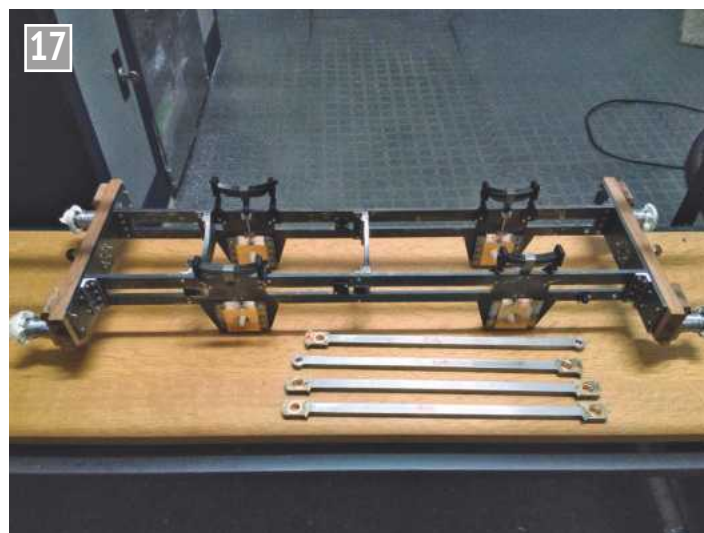
You then need to make a button which is an easy fit to the side link with a 3mm hole



Setting up the shaft hole for the back axleboxes.

straight through, around 10mm long. This gets tightened onto the back axle box with the coupling rod in place. With the button securely tightened, the side rod should slide nicely on and off the button and front stepped shaft. If not, you'll need to make the button hole slightly larger and refit. The

back axle box is then moved to the four-jaw chuck and the button is trued up using a DTI (**photo 16**). You should also check the DTI along the front face to make sure the hole you're about to machine is perpendicular to the front face. Remove the button and machine the back axle box to



Axleboxes drilled and rods completed.

size. Repeat for the other side using the matching coupling rod (**photo 17**).

Finally, the inner lips of the axle boxes need to be rounded, to allow vertical movement of the wheels without locking the shaft, but I leave this till last. I first make sure the shaft rotates freely with the springs

in place before finishing off this radius. Incidentally, this radius is a filing operation done by eye, using a file with the bottom teeth removed using a fine flapper disk and angle grinder.

●To be continued.

NEXT ISSUE

We Visit West Huntspill

John Arrowsmith travels down from Yorkshire to Somerset to visit the club at West Huntspill, situated firmly in Somerset & Dorset territory, but finds it anything but 'Slow & Dirty'.

Biddenden

Hugh Topham continues the story of the Great Wealden Railway at Biddenden with a look back at the end days of the railway.

Turbine

Bob Hayter builds himself a steam turbine based on a set of castings from Cringle Model Engineering.

Radial Borer

Phillip Bannick machines the base for his radial boring machine.

North Bay

Mark Smithers tells how a narrow gauge 'dream factory' was established at Darlington.



Content may be subject to change.

ON SALE 24 SEPTEMBER 2021

Frank Cruickshank finds a novel way to surprise his friends and relations.



A Working Van de Graaff Generator PART 3

Continued from p.337
M.E. 4672, 27 August 2021

The base plate

This was made from $\frac{1}{2}$ inch thick aluminium (from the scrap box, hence a few unnecessary holes in the photographs) and was 200mm x 150mm. The generator base was located at one extreme end of the baseplate and on the centreline. Clearly there had to be enough room for the electric motor and the counter electrode. This latter allowed the spark gap to be set reproducibly. The layout of the baseplate is shown in **fig 3**.

The counter electrode

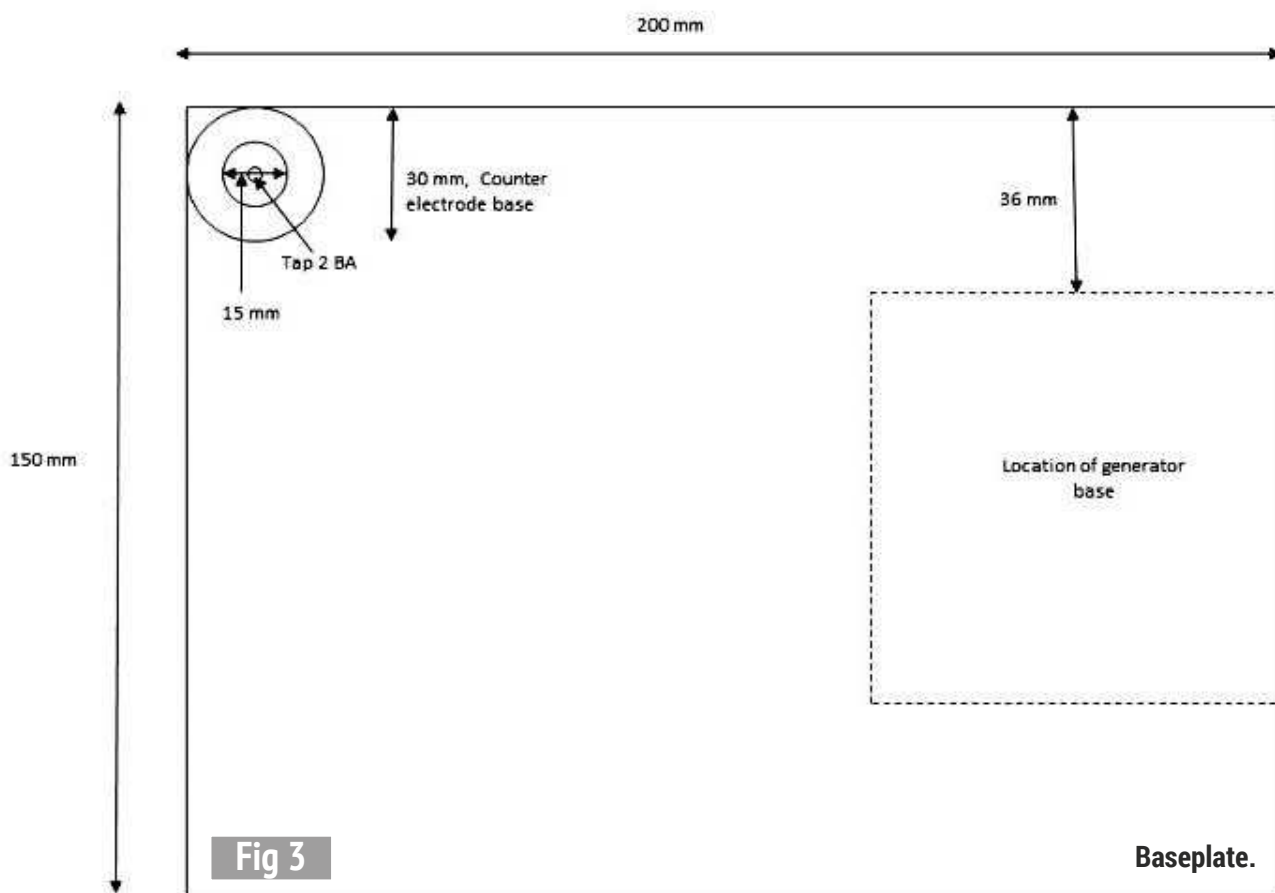
It consisted of a turned brass base, soft-soldered into a 410mm length of 12.5mm water pipe and topped by

a domed, brass insert. The turning of the base is shown in **photo 11**. Sizes are not critical, of course, but the base should be wide enough to prevent instability in the rather long water pipe. In my case, I made the base 30mm diameter x 6mm thick, reducing to a fit in the water pipe over a distance of 10mm. 12mm of the base was inserted in the water pipe.

The base (**photo 12**) was tapped 2BA for a cap head Allen screw which was a counter-bored clearance fit in the base plate (inserted from underneath). This allowed correct orientation of the counter electrode on the baseplate, so that the spark

gap could be varied over an appropriate distance. It was essential that the water pipe was attached to the base at 90 degrees to its lower face and this was ensured by using the set up in **photo 13**. Fortunately, the pipe was a good fit in the tailstock!

A brass plug was turned to a close fit in the upper end of the water pipe over a distance of 25mm. It was given a hemispherical, domed end to match the outside diameter of the pipe and was soft-soldered into position. A cross drilling, 15mm from the upper end of the water pipe, was tapped $\frac{1}{4}$ inch x 40 t.p.i. to allow a $\frac{1}{4}$ inch brass threaded rod to be inserted.



Cross drilling on a true diameter can be difficult to ensure and so the set-up in **photo 14** was used. The two vee blocks were accurately aligned with the milling machine table longitudinal axis by holding a long point in the chuck and ensuring that it bottomed at each end of each vee block. Copper sheet was used to protect the work from the vee block clamp set screws. A 15mm diameter brass ball was pressed on to the unthreaded end of the $\frac{1}{4}$ inch threaded rod (**fig 4**) and it forms the end of the spark gap opposed to the copper sphere.

A blind, knurled nut (12mm x 10mm diameter) was screwed on to one end of the rod and made for easy finger adjustment. A locknut (7mm x 13mm diameter) permitted the spark gap to be fixed at the chosen value which can be varied from 0mm to 21mm.

Assembly

The upper bearing support and lower half of the copper sphere together with the lower column support were attached to the column with the 2BA nylon screws. The upper shaft assembly was inserted into the upper column support with the silicone belt over the aluminium pulley. The ball bearings were located in the correct position and secured with the set screws. The side of the lower bearing support next to the gear was temporarily removed and the lower shaft assembly inserted in the opposing side, with the ball bearing correctly located and secured by its set screw.

The belt was pushed on to the Tufnol pulley and the lower bearing support side replaced with the belt now under tension. If the force is considerable here, the belt tension is almost certainly too high, which is why the column height must be compatible with the belt length and its elasticity, which, in the case of silicone rubber, is extremely limited. During this task, to support the column and to protect the copper hemisphere, a large vee-block is very useful.



Turning the base for the counter electrode.



The finished counter electrode base.



Using the lathe to align the water pipe with the base.



Cross drilling to secure the pipe to the base.

The generator, with gear reattached, was then screwed on to the baseplate. The motor, gearing and counter electrode were added, followed by the motor cover, constructed as described in *Model Engineer*, issue 4646 p.326 (28th August 2020).

I have not given details of the motor or its case, since these will depend on what you have available. If you are buying a motor, I would still advise a synchronous motor for quiet running, but something more powerful than mine, say about 100 W. This would remove the need for gearing and allow the generator to run faster, making the spark larger. This still assumes ball bearings and carefully adjusted belt tension.

One way to fine-adjust the belt tension is, of course, to alter the pulley diameters. The combs are easily adjusted to compensate for this. Be sure that the motor terminals and any bare wiring screws etc. are covered. The mains cable should be earthed to the base plate and well anchored to it (**photo 15**). As stated above, respect the high voltage generated and do NOT charge Leyden jars or a condenser, since these could be lethal. Handled sensibly, the model will provide sizeable sparks and can be used to demonstrate the properties of static electricity, for instance, small pieces of paper dropped on to the globe will stick upright and then fly off as

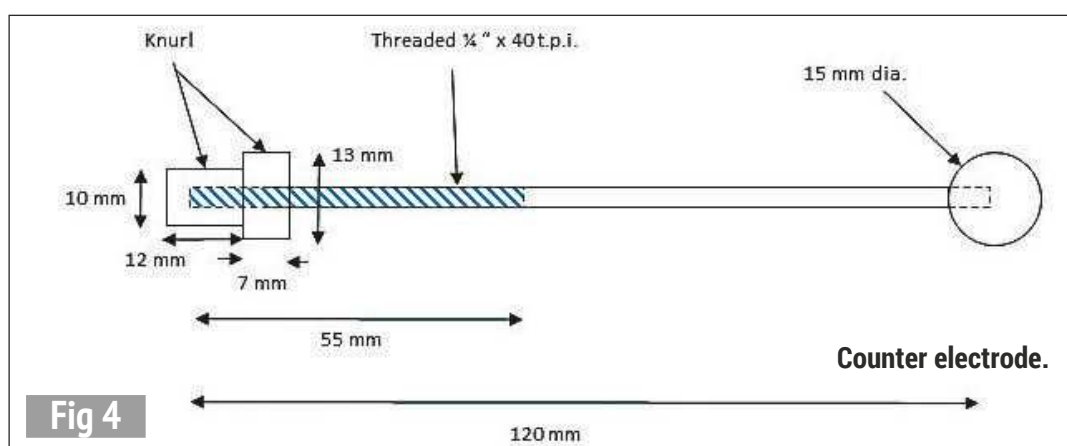
they charge up (like charges repel).

Given suitable ambient conditions, the model should need to run for only a few minutes before sparks are generated.

ME



Ready to generate sparks.





Drawings

Dear Martin,
The standard of drawings that appear over the decades in

Model Engineer is a vexed one. There have been some real shockers (I've written on this before) over the years and, on the other side, some excellent drawings, usually not many. As I've spent the last four plus decades producing a few thousand mechanical detail and design drawings, I have at times struggled to understand some drawings appearing in these pages - so what hope do others have who are not as well versed in reading engineering drawings as I? Generally, they are not to the standard expected in industry. As David Proctor (Postbag, M.E.4661, 26 March) has rightly suggested - in my opinion - not many conform to any relevant British or in my case Australian Standard

I do envy - a little - those who can make a model just from their thoughts without committing to paper or even those who work off a sketch on the back of an envelope. My training as a machinist and later as a mechanical designer has unfortunately made me reliant on proper drawings. In the jobbing shop where I did my apprenticeship as a turner it was necessary to be able to read and understand a drawing. The business had a drawing office and for most of the work we did there were the necessary drawings. The exception was if someone came in off the street with a broken or worn part requesting a new one to be made from their sample.

I would think it would be fair to say that most contributors to *Model Engineer* who present an article - or series - that have sketches or drawings attached are self-trained and have some modicum of an idea of what they are wanting to convey graphically. As the old saying goes, 'a picture is worth a

thousand words' but the picture needs to be correct and understandable.

I write from my own industrial experience - 20 odd years in Australia's only newsprint paper mill using hardwood chips - where we worked strictly to the relevant Australian Standard (AS1100). We had 12 or thereabouts in the drawing office. Every drawing was checked for accuracy by another draughtsman (later me), further checked by the section leader on behalf of the chief draughtsman and finally by the Senior Design Engineer. Even so, missing dimensions or some incorrect dimension sometimes crept through. The drawing or drawings would be revised, with the corrections being noted in the 'Revisions' section of the drawing title block. I've seen some drawings that have been revised so many times over the years for various reasons that the revision column has encroached into the drawing area. In the drawing body there would be adjacent to the corrected information a small circle with short lines extending the outside of the circle at 45 degrees and a number within the circle, this being the revision number. Some organisations would do similar but using a small triangle with a number or letter within, or others would draw a squiggly line (like a cloud) around the whole view that had been altered or revised. Also, part of the drawing number would reflect the latest revision so that you knew at a glance you had the latest drawing.

The above scenario is probably not practical for someone who is writing up an article or series for *Model Engineer* and especially if you are on a deadline with perhaps the editor breathing down your neck. Who is going to check your drawings? You can check yourself if time is on your side. Because you are familiar with what you have drawn, checking straight away will usually not pick up much - only the obvious as you see in your mind the correct

shape of the feature even if not dimensioned. I've found if you leave the drawing for a week or so and then check, it is amazing how many dimensions are missing or not correct.

In another life, I taught engineering drawing at college to paraprofessionals part-time (three nights a week) for about 13 years. Initially these were trades people - who had some engineering (mechanical) and reading of drawings experience - wanting to get off the tools. Later they were straight year 11 or 12 from school who had none of the above. During this time, I became the state (Tasmania) examiner - I set the exam for all colleges in the state (four colleges) and the marking schedule they were to follow.

For my students, they had to purchase the mechanical engineering drawing handbook (HB7) produced by the Institution of Engineers Australia and Standards Australia. HB7 set out the relevant requirements as per AS 1100, which included sheet sizes, sheet border dimensions, scales to be used (1:1 1:2 1:2.5 1:5 1:10 1:20 1:25 1:50 and 1:100), text height (all upper case) and line thicknesses (outlines, centrelines, hidden detail, dimension lines etc.) for each sheet size, the method of orthographic projection (third angle only) and relevant symbol sizes (weld symbols, geometrical tolerancing etc.) and much more. One thing I used to regularly tell my students was that an engineering drawing should be an aid to production, not a hindrance. Views should be clearly shown, sections included where necessary for clarification and not to rely too much on hidden detail (it can confuse), give space between the feature and its dimensions so as not to clutter (this being a hindrance) and show hidden detail when thought the only way to clearly define the feature. I used to show them a drawing of a 1950's steam locomotive - from either Robert Stephenson's or the

Write to us

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Responses to published letters are forwarded as appropriate.

Vulcan Foundry - of a steam brake cylinder with a huge (and unnecessary) amount of hidden detail. This drawing certainly was not an aid to manufacture.

Since the mid 1980s I've used AutoCAD and now I model everything in Inventor before producing my working 2D drawings. As Martin Robinson (M.E.4645, 14 August 2020) mentions in his 'Queens Messenger' series, 3D modelling is invaluable in setting out components and checking for clashes and clearances and the like whereas, in the good old days of last century, working on the board, you might have three or more views to work on at once, perhaps over more than one drawing sheet. AutoCAD didn't improve the paper drawing scenario as above much, just made it easier to navigate around the various views but 3D is the game changer in this respect. Not everybody has access to either 2D or 3D electronic draughting and has to make do with what is to hand and just because some electronic draughting method has been used to produce a drawing, doesn't mean to say it is correct - the human feeding the information in has to be correct. Don't forget the adage 'rubbish in, rubbish out'.

I can see there not being much incentive for an organisation to correct old drawings with possible known mistakes, they have to be told about them first and have the time to do the corrections, or be inclined to do so - they may have no draughting equipment or consider it not worth the effort. I've got drawings bought from several UK suppliers over the years and not one of these drawings has a space to list 'Revisions' or appears to have been revised. I'll find out as I progress through these projects - a long long story! I'll probably model them in 3D - it's then when I may find mistakes on the original Imperial drawings - and re-dimension them in metric

I do sympathise with David Proctor and would not hold

much hope for anything to happen any time soon and there will be continued frustration mentioned in the pages of *Model Engineer* for years to come. John Roberts (M.E.4659, 26 February) is to be congratulated for taking an initiative in making a start in logging errors or inconsistencies for future model engineers.

**Regards, Tony Reeve
(Tasmania)**

Lubricators

Dear Martin, I fear both Rhys Owen and Nick Feast have missed the main issue with hydrostatic lubricators. Referring to Rhys's fig 8, issue M.E.4666 (4 June), the tank is mounted in the cab well below the condenser, which on GWR locomotives was in the cab roof (I think). Where Rhys has 'extra steam was supplied to help the oil on its way', steam as always supplied off the jockey valve, there was a restrictor downstream of the connection where oil was fed in. At first sight it would appear that there is the same pressure both sides of the oil but in reality there is a column of water from the condenser down to the oil tank, the mass of which is sufficient to push the oil through the system. Boiler pressure and indeed steam chest pressure have no effect, as it is this constant (static) column of water (hydro) which pushes the oil through. Without the atomiser steam and restrictor, when the steam chest pressure was low, there would be a high-pressure differential pushing the oil through.

Roy Amsbury got this system to work in a 5 inch gauge model, where there would be only a few inches head of water. I must admit that surprised me but he was a very good model engineer - if he said it worked I believe him. No doubt someone who is good at searching indexes (indices?) will find the articles he wrote in *Model Engineer* way back.

Duncan Webster

Chemical Blacking

Dear Martin, I noted in Postbag (M.E.4670, 30 July) a question from Andrew Cliff for more detail on the black chemical process I used that was briefly mentioned in my *Flying Scotsman* series of articles in issue M.E.4668

(2 July). Here is a more complete description concerning my experience with the black metal process. I will add that this was a first for me and I was very pleased with the result, a result which has remained unchanged in more than 10 years now although the model is still being built and thus not tested in all weathers yet.

I bought my kit from Frost Restorations after they were recommended to me by my eldest son (he runs/owns a car repair/restoration business). The kit includes all you need except gloves and safety glasses, and included in the chemical kit are three 2 litre tubs for using the chemicals in. I spent most of the day doing the brake parts (**photo 1**) which isn't bad considering how many parts they consist of.

Photograph 2 shows my little set up for the process. Order of play, left to right, is: degreaser for 10 mins, rinse in water, dipped in black solution for 4:30 (instructions said not to go over 5 mins), final rinse in water, dipped in dewatering solution for 10 mins and then left to air dry.

To conclude, the kit seems to have worked very well. It is advertised as suitable for iron and steel and comprises three parts: light alkaline degreaser, chemical black and dewatering oil - much the same as most cold kits out there. Full instructions are given with timing instructions which I followed religiously.

Hope this is of some help.

Kind regards, Peter Seymour-Howell



Backyard Foundry

Dear Martin, There was quite a flurry of letters a while back in Postbag of readers interested in DIY foundry casting. For those interested, there is an excellent FACEBOOK group 'BackYard Metal Casting & Foundry Work'...

simply join and enjoy! And for the ultimate DIY foundry project take a look at this fascinating video on ancient craft skill: www.youtube.com/watch?v=VE_4zHNcieM
**Kind regards, Andre Rousseau
(Auckland South, New Zealand)**

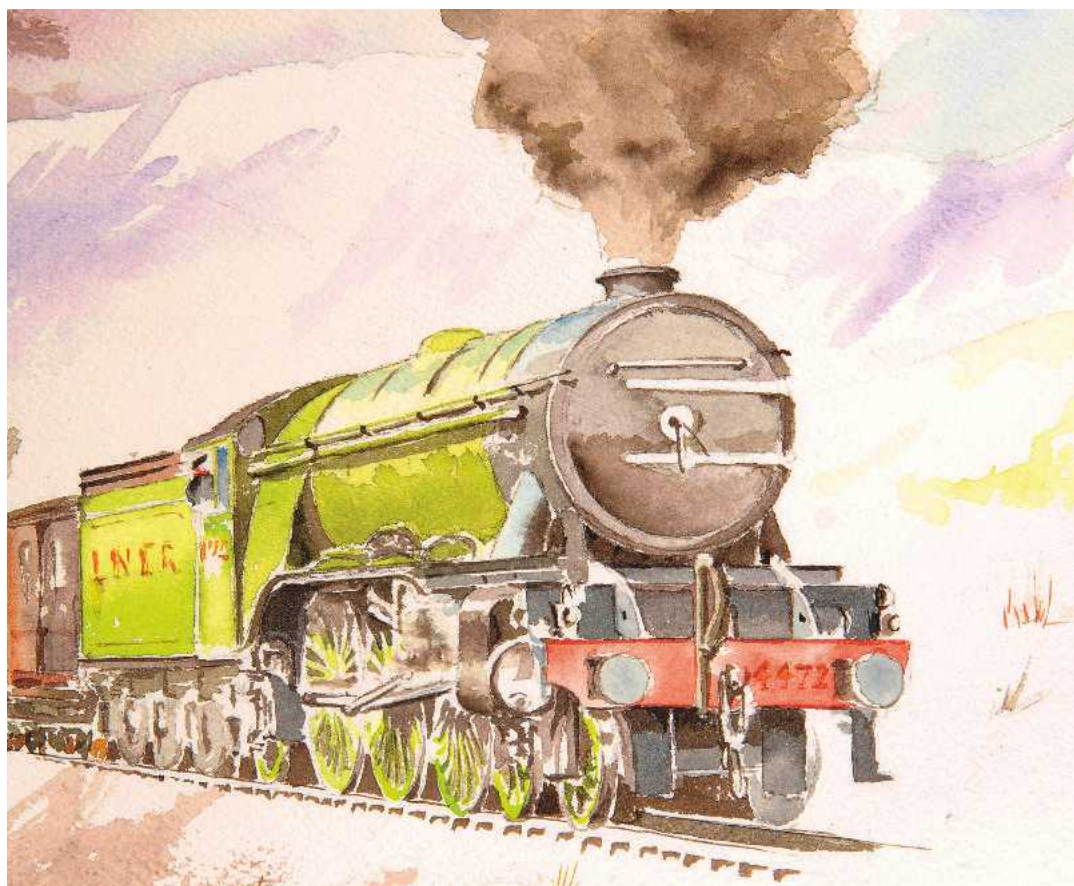
Peter Seymour-Howell

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



Continued from p.328
M.E. 4672, 27 August 2021

PART 18 - CARTAZZI AXLE: HORNS AND AXLEBOXES



Painting by Diane Carney.

Flying Scotsman in 5 Inch Gauge

The Cartazzi (some say Cortazzi) trailing wheel system is one of those things that, for me, was a delight to make and also unusual when compared to most other locomotive solutions for the rear trailing wheel.

The principle of operation is that the axleboxes are angled and swing as one in an arc to pivot the rear trailing wheel and axle rather than the more common rear pony truck. They are designed so that the whole axle is 'self centering' utilising wedges that are incorporated in the top of the axleboxes and under the spring plates - they

act in unison with each other. It's a bit difficult to explain in just words but hopefully by the end of this article these things will become clearer to those not familiar with the design.

I'll start with the Cartazzi horns, as these are another of those parts where there's an awful lot of machining set ups. One thing to note is that the horns are angled to match the axleboxes.

●To be continued.



1. I started by running a file over the outside edge of the rivet to frame face to create a datum to start from. I don't really like relying on a hand filed face for this but it was reasonably flat anyway and looked pretty square to the other faces.



2. With the machine vice checked for squareness to the mill head (I tend to do this now and then for peace of mind), I packed up the horn castings from underneath and behind and machined the opposite edge square.



3. Next was to machine the last of the three edges. As can be seen the casting was packed out either side of the horn stay supports and also had packing underneath. It didn't matter that the horn supports hadn't been machined square yet, the important thing was to have all three faces machined so far square to each other. With those three faces done I then moved on to the step to fit the frames. This left the one main face to machine, that being the 17 degree running face for the axle box. The castings were cut into singles and in turn set up in the tilting vice set to the required angle. I left these slightly oversize until the axle boxes were done, then fitted them to the trailing frames and trued them up. It was then back to the machine vice to finish all the other parts.



5. I then held the other horn of the matched pair for the one side and placed the horn already drilled on top, aligning it by placing steel blocks to the side and back. This was just to get the hole in its correct position height-wise - its depth is determined as with the first by being held by its machined step in the machine vice. All holes were centre drilled first. I then drilled all of the mounting holes except for those that are on the leading horn closest to the horn cheek as it's not possible to drill these from above due to the angle of the horn.



4. On to some drilling. First, I drilled the two holes in two opposing horns for the hornstay bolts to fit into.



6. I then lined one horn up with its frame, clamped it in position (ensuring it was held tight against the frame opening via the machined step) and drilled through from behind from the two holes mentioned, riveted it in place and then did the same with the other horn, checking height using a depth gauge with a suitable drill bit placed through two of the horn stay bolt holes. Once happy with the horn positions I drilled another hole in each, this time from the front, and riveted in place. It was then back to the machine vice and this time the holes closest to the leading horn cheek were marked out and drilled from the back. With these holes drilled it was a simple task to turn the frame over and drill all remaining holes through the pre-drilled holes in the horns. ➤



7. The last few jobs were to mount the horns with their proper bolts, spray on a coat of acid 8 and fit the trailing frames to the main frames. When fitting the 7BA bolts, I first fitted two on each horn, chiselled off the backs of the rivets temporarily holding the horn in its correct position, removed them and then fitted the remaining bolts.



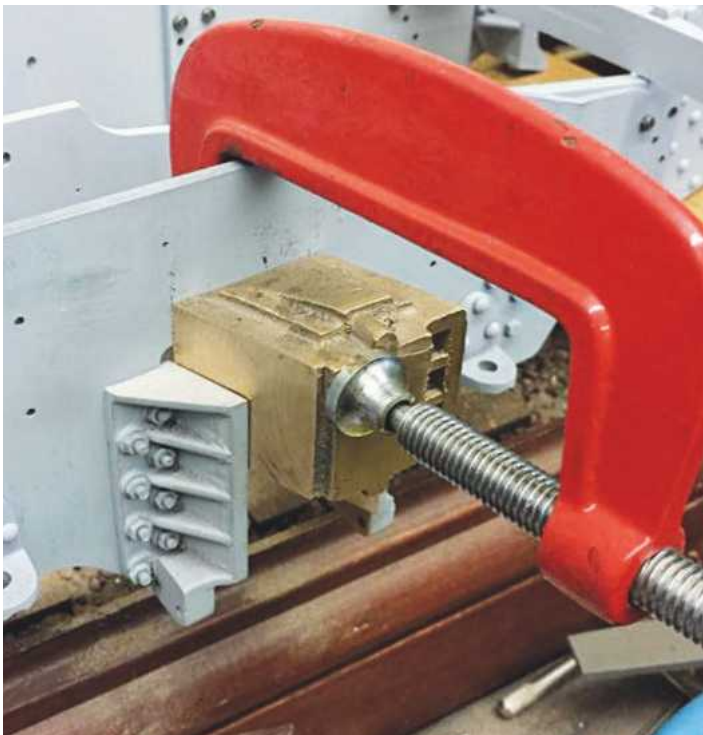
8. Having done that lot I decided that I needed a break from the mill and did a little turning instead - some light relief, shall we say. This is the trailing axle - very similar to the tender axles although slightly longer.



9. Having first checked the angle of the box working faces with the horns I filed flat what one could call the trailing face and then held the box in the machine vice and machined the leading edge face flat and to size.



10. Both boxes were machined until the middle of the oil tray cover spigots lined up with the height gauge set to the dimension on the drawing. With a datum now set for ensuring that the axle is bored in its correct location width-wise I machined the opposite face until the axlebox was a good fit in between its horns. An important check here is that the back of the axlebox (not yet machined) is parallel to the chassis centre-line; this is critical or the axle bores will not run square to each other when later set up in the machine vice for drilling. The way that I approached this was first to get the axleboxes sitting snugly within their horns with their back face square to the chassis. It's highly unlikely that once the axle is in place it will be running square as the trailing frames are two separate entities with angled horns that could not be joined back to back for machining. My thinking is that some clearance needs to be allowed for the axle to operate properly, the most obvious method being to radius the horn faces.



11. Here we have an axlebox held in its horns higher than normal to check the back face is square to the chassis.



12. We now move on to the serious side of machining these axleboxes. The picture shows a start has been made on machining the axle boxes to their correct depth. The front was machined flat as shown here and then the back was machined down to final size. Note that one casting has a flaw showing where the oil cover will sit. This was filled with JB Weld and machined as normal once cured.



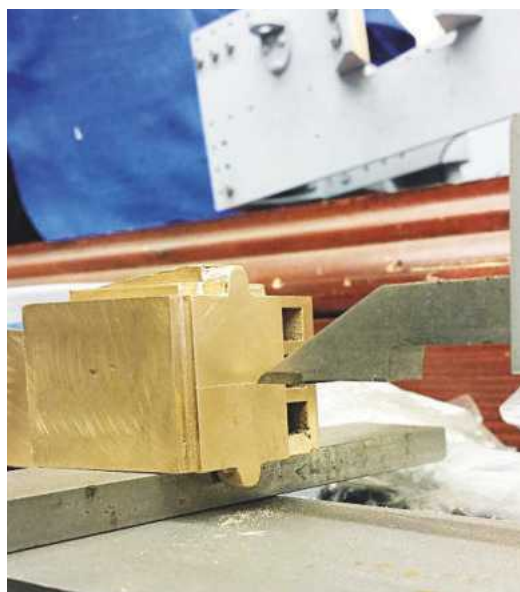
13. Using packing to clear the lower spigots I held both axle boxes in the machine vice to ensure they are both the same size. I was surprised that I only needed to take a couple of thous of the top to keep the wedge at the correct height clear of the step below.



14. The last job for that day was to file off all burrs and clean up the spigots/wedges a little. I finished these once the oil tray covers had been made, using the covers as a jig to get both spigots the same.



15. The next day, I cleaned up the spigots a little more using a 2mm cutter – the smallest that I had at the time. The spigots are still about 20 thou oversize which will be taken care of once the covers are finished. Mind you these parts won't actually be visible - the prototypes seem to have a dust shield that hangs down from the wedge control plate that sits above. It looks like they are made out of some sort of material, perhaps rubber, I'll see what I can find that's suitable. There's also a metal dust shield that's bolted to the leading horn - I plan to add this detail later too.



16. On to the 1/2 inch axle bores. The first job was to mark out both centres using the height gauge, the idea being that this should make both axleboxes the same (not wanting to set up in the four-jaw chuck with all the angles involved). In hindsight perhaps this wasn't the best way to do this as when both were done they were out a little when placed back to back. When I say slight I mean very slight - I wasn't worried about this as the Cartazzi axle needs some slack to work properly anyway but it's still a little annoying. Height-wise both were spot on, just fore and aft were out a little. I'm guessing that the cast angles, although they looked good when compared to the horns, must have been very slightly different. When finished this didn't show up as a problem so all good.



17. Then I did a little 'old school' work using an optical punch to spot the centres. There is an axlebox under there somewhere - honest...



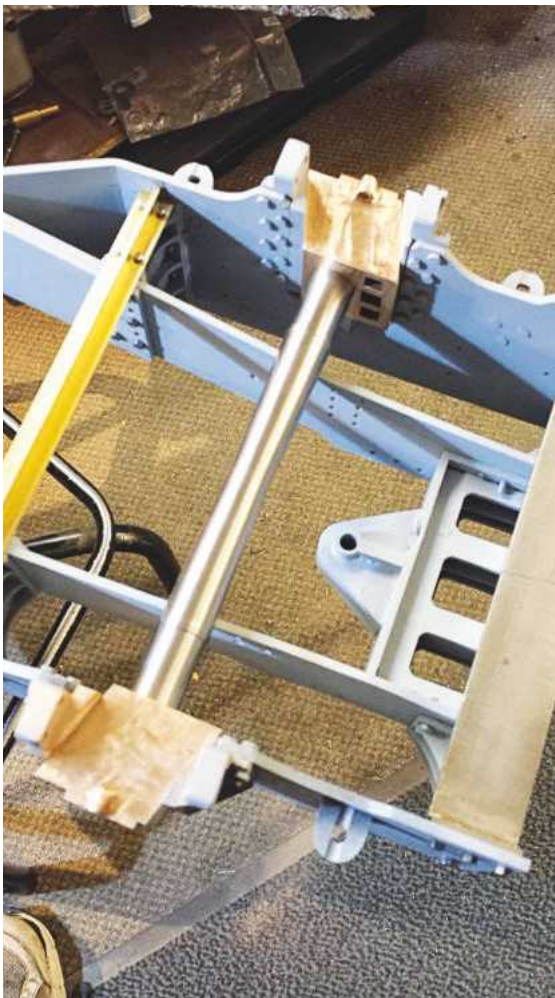
18. With each box in turn back in the machine vice, I drilled the $\frac{1}{2}$ inch hole, first using a centre drill followed up by a series of drills and then the bore finished to size with the reamer.



19. Once the bore had been reamed to size it was time to open up each end of the journal for the axle to fit in. This involved using a 'D' bit (I managed to find the same bit as used for the tender boxes), doing the front first and then the back.



20. Here's one of the axleboxes with its oil tray recess machined using a 6mm long series cutter. For those not familiar with this design the axles have to be pushed in at an angle and then locked in place when they are parallel with the journal. Once the oil tray is in place everything is locked down, so to speak.



21. Here is the trailing axle assembly sitting in situ. I've put a couple of blocks under the boxes (actually on top as we are looking upside down) at roughly running height. I was surprised to find that there is sideways movement with very little fettling. I needed to remove a little more from the horns nearest camera which had around $\frac{3}{16}$ movement to the left as viewed. The other side was clear and would slide about $\frac{3}{4}$ inch out - in fact it would slide out altogether. I believe the reason for it being tight on the left was due to the misposition of the bore on that side putting the axle a tiny bit further forward. It sits squarely as seen in the picture when in mid position but may need a little fettling to allow more movement if needed. I won't do any more to this until the main drivers have been fitted and I've tested the chassis on the club track. I suspect it will be fine as it is but it will be an easy fix if it needs more movement. All in all I'm pleased with it, especially after messing up the bore on one box - it's one of those jobs where you don't really know the state of play until the main parts are assembled. Now that the chassis has been tested on the track I can confirm that this Cartazzi axle works very well, requiring little extra work. What I did find beneficial was to file a slight arc on the horn face to encourage the axle to move freely over its supposed arc movement. It now has more than enough movement to negotiate the usually tighter bends experienced in miniature compared to those in full size.



22. Finally we have the hornstays. The drawing has these as steel but I have cheated with suitably sized telescopic brass tube doubled up (two tubes telescopic) both for extra strength and to bring it up to the size needed. I believe this is more than adequate for the job, being held between very substantial horns. Here are the various parts before being silver soldered together.



23. Finally the stays are bolted to the horns. I have fitted them with the threads towards the rear. Prototype pictures show them in both orientations so I've followed good mechanics practice - always fit threads to the rear to avoid dirt build-up. I'm sure the same should apply to a locomotive but I stand to be corrected of course...



LNER B1 Locomotive.

Showcase David Murray's Engines

David is a member of the Staines Society of Model Engineers and has built several locomotives. Showcased here are two of his locomotives, both in 5 inch gauge. The first (**photo 1**) is an LNER B1 4-6-0 to the Martin Evans *Springbok* design, in this case no. 1011 *Waterbuck*. The full-size

engine was operated out of the Gateshead yard (and later the Gorton yard) during the 1950s, before being retired and scrapped in 1962. The second (**photo 2**) is a GWR 5600 Class 0-6-2T locomotive, no. 5688. This engine was built from David's own drawings and is based on an engine that

operated out of the Merthyr Tydfil yard during the 1940s. Both models can often be seen in full steam at the Staines Society.

David reaches his 80th birthday this month and his family, and *Model Engineer*, wish him a very happy birthday.



GWR 5600 Class locomotive.

Lithium Ion Cells in the Workshop



A single 18650 lithium ion cell compared to an AA battery.

Malcolm High finds that Li ion cells provide a compact and convenient source of electricity.



Everyone will have heard of lithium ion batteries but maybe only used them in power tools, as supplied by the manufacturer. Well, they can be used in all sorts of equipment useful to model engineers.

The first thing to say is they have to be treated with the greatest of respect. They do not like being shorted, overcharged or discharged to below a set voltage. Treated correctly they are reliable sources of power. Single cells are 3.7 volts nominal but fully charged they will be 4.2 volts. They must not be discharged

below 2.5 volts. The capacity varies but I have some as high as 3,500 mAh - the greater the capacity the more expensive the cell will be. The maximum discharge current is another factor to consider - some are as low as one amp. So there are a number of factors to consider when buying these cells.

The most common cell size is 18650 (**photo 1**). These are 18mm in diameter and 65 millimetres long. Used in electronic cigarettes they are certainly the size easiest to source. Other sizes are available from a number of suppliers. These are single

cells with and without protection. The latter comes in the form of an electronic board housed in the end of the battery that monitors the charging and the output of the battery. Come what may you have to use the charger recommended for that battery.

A button cell I have used is the 2032 (**photo 2**). These are used in digital callipers etc. but I do find that they need to be slightly discharged before they will work in my new callipers. I guess that is because the lithium button cells are 3 volts and fully charged the lithium ion cells are 4.2 volts. I have six cells which I charge as soon as I change them, they then sit waiting to be used for 4-5 weeks, losing some of the voltage. These cells are totally unprotected so have to be charged in a dedicated charger. They are available on the Internet for just a few pounds, often with a number of cells.

To get more voltage using a single cell charge pumps are an option. These are small electronic devices that raise the output voltage at the expense of more current. They have a limited application but are ideal if you have limited space, say in a small lamp, and only need a few milliamps but a higher



3032 cells and charger.

voltage than the single cell will provide (**photo 3**).

Most applications will require a higher voltage than a single cell. To achieve this the cells are put in series, with three cells being referred to as a 3S battery. My experience is with 3S batteries so that is what I will refer to but a 4S battery would be just the same so long as you use the correct protection board and charger.

It is possible to buy 3S battery packs and I have a number of these but one has to be very careful. Many will only give one amp continuous, two amps surge. So not good for my six amp pump unit! How did I find out? Don't ask! Okay though for an LED floodlight.

Before sourcing any cells one has to know the duty required, the current and hence the capacity. I have generally settled for a six amp cell of over 3,000 mAh capacity. These are available tagged or not tagged and there are two options on the tags. I always go for tagged, normally where the tags are set at 180 degrees to each other. I find these to be the easiest to build.

The next option is the electronic control board. This will be a 3S with a six amp output (**fig 1**). They are available as a rectangular or triangular shape. I normally go for the rectangular shape but it depends on where the batteries are to be used. Sometimes the triangular shape fits the space better.

With the batteries sourced the first thing to do is put them

in a pack. A few options here - good old electrical tape or some heat shrink. Whichever option is used the tags need to be set so the batteries can be coupled in series. I find it best to cut the tags to length at this point and cover them up to reduce any risk of shorting. The tags can now be soldered such that the batteries are in series. I then tend to put some insulation tape around the batteries to insulate the tags from any potential shorting. The electronic board sits on the end of the batteries and has connections to each one, plus an input/output set of wires.

First, I solder on the input and output wires, then the main battery tags. These are normally designated as Bat + and Bat -. The electronic board monitors all three batteries during charging and discharging so the two junctions have to be connected to the board. I do not know but I suspect the maximum current these have to deal with is only one or two amps, so the wires do not

have to be very thick. On the board these points are usually designated as B1 and B2. You have to get them round the right way so consult the circuit diagram that comes with the electronics. It is now time to test the battery so put a volt meter across the output and - hey presto - no volts. It is quite likely one of the cells is low so the battery needs charging.

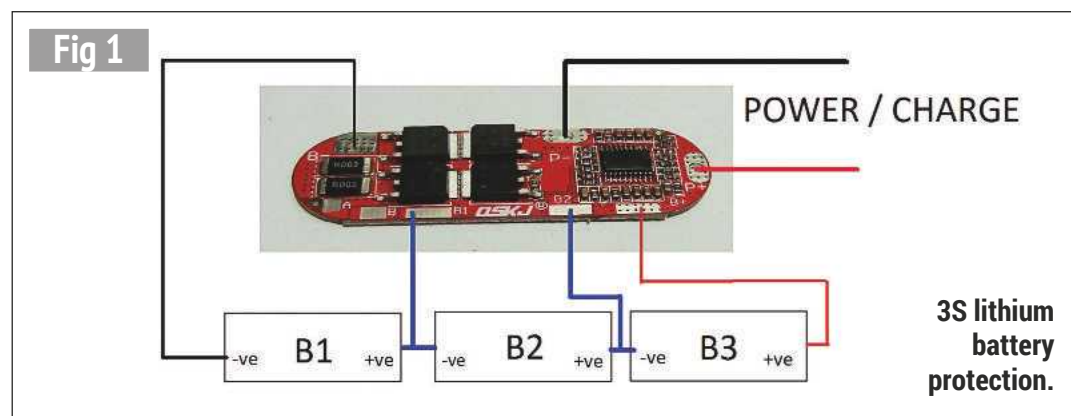
Make sure you use the right charger for the batteries you have. For a 3S it needs to be 12.4 volts. The charge current depends on the specification of your batteries; if in doubt use a one amp unit. Better to be on the low side than try to put in too much. The chargers normally run off the mains but it is possible to get a unit that works off 12 volts. Insert the charger into the mains socket and the LED is normally green. On connecting the battery (hopefully you will have it the correct way round) the LED will turn red until fully charged when it will go green. Check the batteries are not getting hot and that the charger

is getting warm - all good signs. Once the batteries are charged they should give out 12.4 volts.

If all is well the pack can be put in a shrink wrap tube. This is available in metre lengths from various suppliers. Make sure you get the right one. Use a fabric tape to measure the circumference of your pack and get the next size up. If in doubt go another size up - it shrinks well. I tend to print a box for the cells; this way you can include a speed control and level indicator or just give it more protection (**photo 4**).

Lithium ion cells are the immediate future for a number of power packs but will not supply the high currents required for model planes and high-speed power boats. For these you need LiPo batteries, and that is completely different ball game - unprotected cells, dedicated chargers and currents of one hundred amps. Awesome pieces of kit.

ME



A 12 volt LED with charge pump attached to run on a single cell.



A home-made battery pack, battery checker and speed control.

The Stationary Steam Engine

PART 25 -
THE SEARCH
FOR AN
ALTERNATIVE

Ron Fitzgerald takes a look at the history and development of the stationary steam engine.

Continued from p.259
M.E. 4671, 13 August 2021

The delegation from Boulton and Watt that viewed Fisher's engine might condemn it as a gross infringement of the firm's rights but they were forced to admit that it was well made. The castings were of good quality although it emerged that the cylinder at least had been cast by Walker & Co., of Rotherham. James Watt jnr. was characteristically churlish but acknowledged the threat that Murray posed:
... Murray is pushing himself everywhere into employment

for Mill Work & Engines & he must succeed by dint of impudence, if not by ability as I see no way of opposing him but by countenancing the establishment of a small foundry here [in Leeds] in opposition to him as his local advantages must otherwise deprive us of all chance of competition. The fellow reports that he has still orders for several Engines, but I believe they are all in buckram as no names are mentioned except Marshalls for whom he says he is to erect one here and one at Shrewsbury.

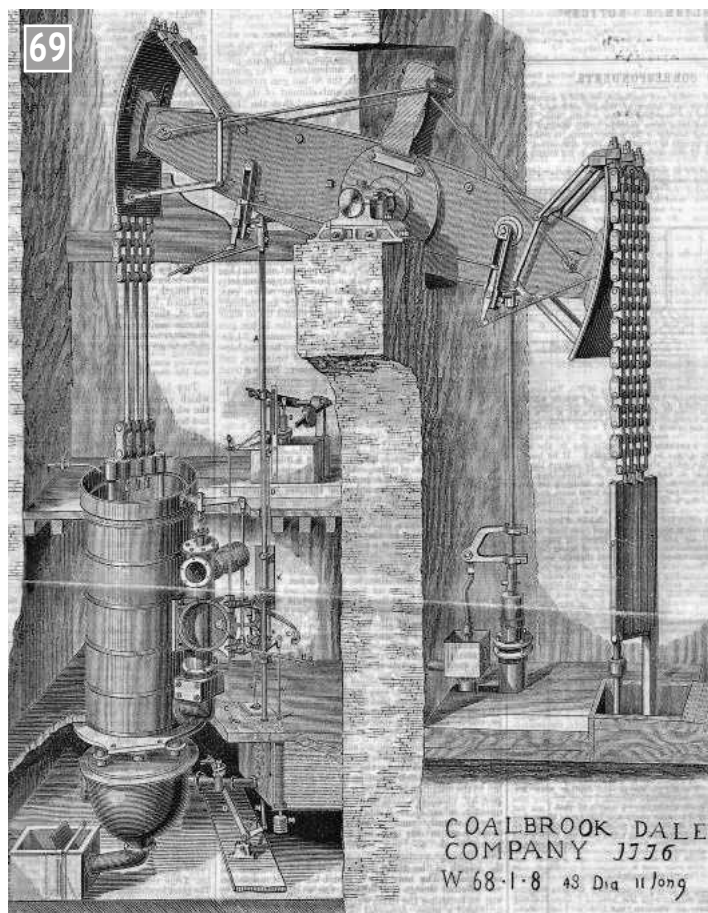
As Watt junior observed, Murray had two more orders for Marshall's mills, one for the extension of the Ditherington Mill and the other for a further engine for his Leeds Mill - engines that were to be copies of the Boulton and Watt machines without sanction or apology. Perhaps the most significant implication of this was that both Marshall and Murray saw Watt's system as representing the best path to be followed in future engine building. Marshall and Murray were by no means alone in recognising this but the scope of Watt's patents effectively stifled any attempt to build an engine that even loosely resembled Watt's machine.

The separate condenser and the air pump are usually assumed to have been central to Boulton and Watt's grip upon the market for advanced steam engines but this view is too limited. The superior efficiency of Watt's engine was certainly owed to these inventions, but it was perfectly possible to build an acceptable engine without condensing

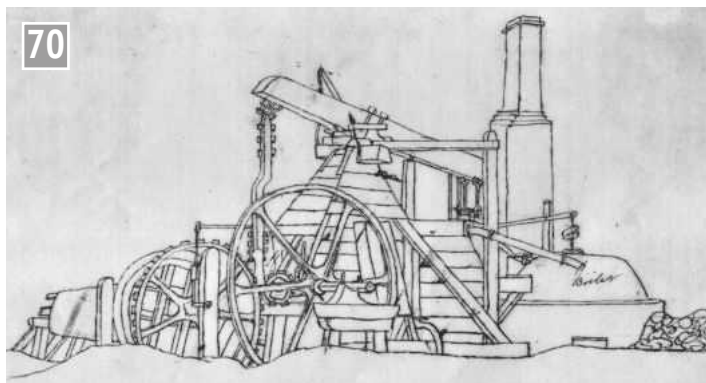
gear. The condenser, working with steam at 7 p.s.i., made a saving of about 17% in fuel consumption. Whilst this was not inconsiderable, cheap coal and a bigger whip to flog the fireman with could partially compensate for the absence of a condenser and any increase in steam pressure reduced the loss proportionately.

It was also the case that further improvements in the atmospheric engine were still taking place. Smeaton, whose work, it is often forgotten, was exactly contemporary with Watt's, had attained a creditable increase in the efficiency of the atmospheric engine and others were attempting to develop the machine. Some sought to employ the principle of the separate condenser but disguised its use by various stratagems such as incorporating a condenser in the cylinder itself or in the exhaust system. Ultimately, the picklepot condenser emerged which, it was dubiously argued, did not contravene Watt's patent as no air pump was used.

The *The Engineer* in January 1880 illustrated (photo 69) an engine fitted with a picklepot condenser which was then still in use pumping at the Staveley Company's pits at Old Handley Wood. This engine had been moved to this site in 1849 but the cylinder carried the cast-in inscription *Coalbrook Dale Company 1776*. The author of the *The Engineer's* article confidently stated that the condition of the engine was largely as originally built, at the same time contradicting



A Coalbrookdale cylinder fitted with a picklepot condenser.
The Engineer, 30 January 1880.



An atmospheric winding engine with a cast-iron connecting rod for additional weight on the downstroke at the crankshaft end of the beam. Reynold's Sketchbook, drawing 62. Science Museum Library.

himself by acknowledging that he saw evidence that in its earliest condition, the cylinder would be mounted directly over a boiler. In fact, it is obvious that the engine had been very radically rebuilt and the picklepot condenser must have been a modification of unknown date.

Expedients such as this offered partial redress for the lack of full Watt condensing facilities but none was as effective. Unfortunately, even if the loss of efficiency could be tolerated, the restrictive possibilities of the Watt patent were not confined to the master concept of condenser and air pump. By virtue of the fourth and sixth clauses, the patent secured to Watt the principle of both expansive working and, also, the idea of using steam on both sides of the piston. Soho argued that these provisions could be legally extended to include the practice of closing the cylinder at both ends and accordingly a double-action piston stroke within a single cylinder was apparently unattainable without Boulton and Watt's sanction. This skillful piece of patent drafting had monopolised the most obvious ways of developing a rotative steam engine, the direction in which the most dynamic expansion of the steam engine market lay.

Again, it was possible to build a rotative atmospheric engine avoiding Watt's patent but as long as the cylinder remained single-acting, the unpowered return-stroke was

problematic. The low piston speeds that condensing the steam in the cylinder dictated always posed the danger of failing to generate sufficient flywheel momentum to carry the crankshaft over the non-power stroke. Irregular rotational velocity and the risk that the engine would reverse unintentionally were virtually unavoidable. A partial solution to this problem was to increase the inertial mass of the moving parts on the output side of the engine by weighting the beam, the connecting rod or the flywheel. Such machines became widely used as colliery winding engines in the last decade of the eighteenth-century (**photo**

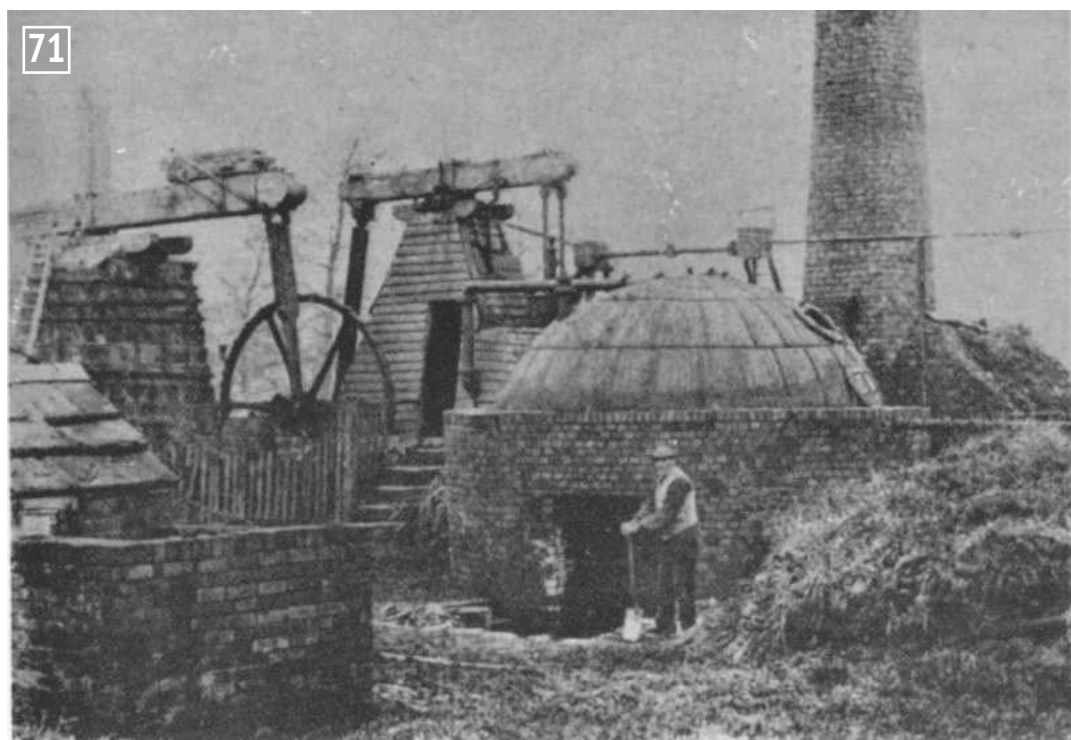
70) where cheap coal reduced the importance of thermal and mechanical inefficiency; as John Farey pointed out, their simplicity and cheapness was a major advantage over the Boulton and Watt engine.

The well-known Bassett Pit engine (**photo 71**) photograph shows a variant on this theme. For many years this was thought to show a pair of independent, atmospheric engines with weighted connecting rods and power strokes phased at 180 degrees applied to either end of a single crankshaft. The recent discovery of a second photograph disproves this interpretation as the beam and connecting rod in the left hand part of the photograph is actually part of a pumping system. Nevertheless, the heavily weighted connecting rod end of the beam and the enlarged connecting rod clearly demonstrate the use of the counterweight concept.

Counterbalanced engines continued to be built through the first two decades of the Nineteenth Century and the Farme Colliery engine of 1809 with its massive cast-iron connecting rod and over-size cast-iron flywheel spokes is now preserved at Summerlee Museum of Scottish Industrial Life after continuing to work for well over one hundred years.

Amongst others who had been considering the problem of the unpowered return stroke of the atmospheric engine was Dr. Falk. His first ideas date from 1779 but they do not seem to have achieved practical application until 1794 when Bateman and Sherratt installed one of his engines in Thackray's cotton mill at Garratt in Manchester. Bateman and Sherratt subsequently built a number of engines using Falk's principle of two atmospheric cylinders located side-by-side with straight rack piston rods that meshed on

Irregular rotational velocity and the risk that the engine would reverse unintentionally were virtually unavoidable.

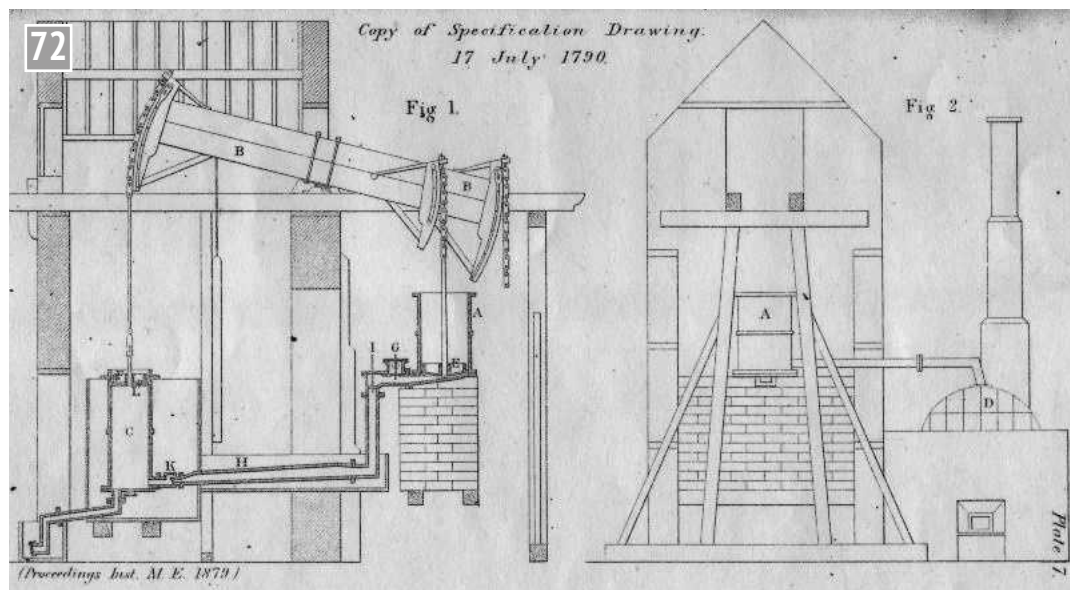


The two cylinder atmospheric engine at Bassett Pit near Denby in Derbyshire.

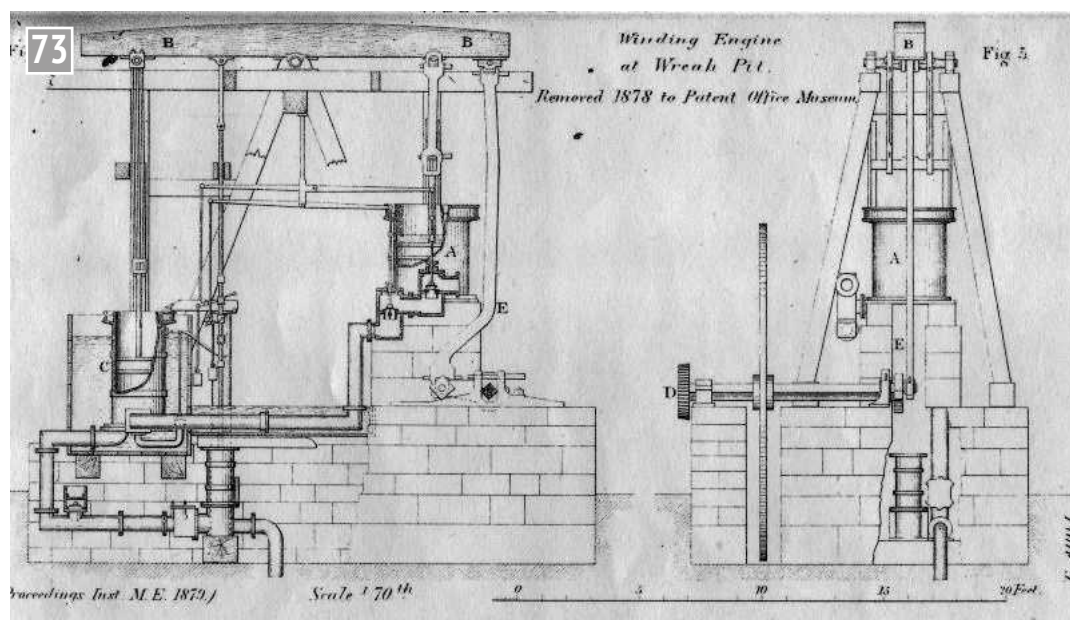
either side of gear a wheel causing it to oscillate. To the gear wheel was attached a rocking beam coupled by a connecting rod with a crank mounted on the end of a flywheel shaft. The machine's mechanical shortcomings rapidly became apparent and it died a quiet death.

More success met the efforts of Adam Heslop who, after training as a blacksmith in Workington at Seaton Ironworks, went to Reynold's works at Coalbrookdale and there, in 1790, took out a patent for his two-cylinder engine arranged to give a double-acting motion to the beam (**photo 72**). The cylinders were located at opposite ends of the beam and were of different diameters. One operated in much the same way as a conventional atmospheric engine cylinder, the piston being raised by slight steam pressure and returned by the weight of the pump spears in the shaft. A second, smaller, vacuum cylinder was immersed in a tank of cold water and the communicating pipe between the two was also immersed in cold water. A water jet injecting into the second cylinder completed the condensation of the steam, drawing down the second piston and raising the pump spears.

Heslop's engine was taken up by the Coalbrookdale Company and several were built, both by Coalbrookdale and by William Reynolds at Ketley and Madeley Wood. Heslop moved back to the North-West shortly after taking out his patent for the machine, founding the Lowca Ironworks in 1798 or 1799 with several others including his two brothers and William Stead. Stead's elder brother John was an accomplice of Wasborough and Pickard at Snow Hill, Birmingham in the crank experiments there and claimed to have experimented with a crank drive for a steam engine as early as 1767. In the North-West, Heslop built at least fifteen double-cylinder rotative and pumping engines.



The Heslop Engine as shown in the patent specification of 1790.



The Kells Pit Heslop Engine preserved in the Science Museum.

Of these, one is currently preserved by the Science Museum (**photo 73**). This engine began life at Kell's Pit in 1795, passed from there to Castlerigg, finally settling at Wreak Pit in 1837. Here it remained for forty years having been rebuilt by fitting a new timber beam, solid linkages from the piston to the beam and an air pump. In its latter condition it was presented to the Patent Office Museum.

The other significant exponent of the use of two opposed atmospheric cylinders was Francis Thompson. Most of the known facts concerning Thompson are explored by

Frank Nixon's paper, *Early Steam Engines in Derbyshire* (**ref 134**). Thompson's engine was a purely atmospheric machine with two cylinders placed one above the other on the same axis and at the same end of the beam (**photo 74**). The upper cylinder was closed at its top end and the lower cylinder at its under end. Thus, the cylinder mouths, which were open to atmospheric pressure, faced each other. Both pistons were connected by a common rod which was fastened to a pair of link chains and arch head so arranged that each chain was in tension successively with the up and down strokes.

Because of the slow operating speed of the cylinders Thompson separated the crankshaft from the flywheel shaft, driving the flywheel shaft by a gear and pinion which gave a 2½ to 1 step-up velocity ratio to the flywheel shaft; possibly the first instance of an arrangement that was to become common.

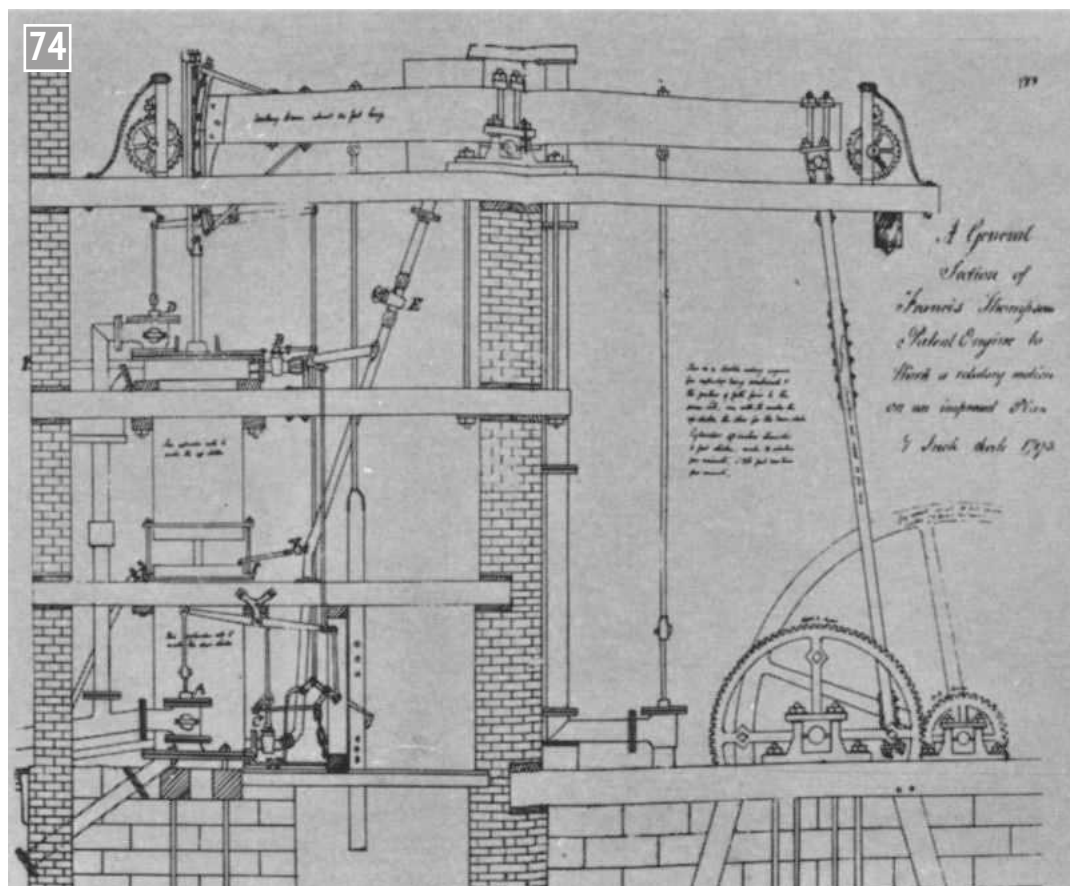
Nixon's list of Eighteenth Century Derbyshire steam engines identifies a total of ten Thompson double-cylinder engines. Of these, the engine built for the Arnold Mill of Messrs. Davison and Hawksley is the best known and David Hulse has built one of his superb models to show this,

the apogee of Thompson's engine building. The date of the Arnold mill engine has been variously given as 1793-4 and 1797, confusing its significance (ref 135). If the date is 1793-4, then not only was it the first example known to have been constructed after Thompson's patent No. 1884 of 1792 was taken out, it was also the largest documented Thompson double-cylinder engine, with two 40 inch diameter cylinders. Alternatively, should the date 1797 be correct then, conversely, it may well be one of the last of his double-cylinder machines as eight of the other nine engines of this type listed in Nixon's table are all concentrated into the period 1793-4 (ref 136).

Thompson's double-cylinder engine seems to have enjoyed only a short-lived popularity which might support John Farey's judgement that they were extravagant consumers of coal and:

... found to be as difficult to keep in order as Mr. Watt's and very inferior in performance; hence they were only adopted in a few instances and have long since been laid aside.

Similar strictures could be applied to the other varieties of the two-cylinder atmospheric engine but notwithstanding the obvious inadequacies of such engines, Boulton and Watt regarded almost any departure from the purely atmospheric cycle as a threat. As their agents and employees reported what they observed in the field, so the firm was quick to threaten legal action but, in truth, these bellicose gestures concealed an underlying fear on the part of Soho that an attempt to defend the patent in court might reveal it to be more fragile than was generally supposed. Action was only precipitated after increasingly flagrant transgressions forced Soho to respond. Injunctions were issued as an interim deterrent, but full court action became unavoidable. When, finally, the matter was arraigned before the Court of Chancery the result was



Francis Thompson's double-cylinder engine.

indecisive and had to be referred eventually to King's Bench. A final judgement, in Watt's favour, was not made until 1799, leaving the patent only months to run. Even then, John Farey, a leading authority in the realms of patent law, was convinced that the ruling was unsound.

●To be continued.

NEXT TIME

Satisfying an increasing demand.

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133. The Heslop Engine, A Chapter in the History of the Steam Engine. H. A. Fletcher. P. I. M. E. Jan. 1879 p. 85 et seq.
134. Early Steam Engines in Derbyshire. Frank Nixon. T.N.S. Vol. XXXI 1967-69).
135. Derbyshire Steam Engines, Nixon, op. cit., Table E. No. 36. Two Engineers, Francis Thompson & Richard Trevithick. David K. Hulse T.E.E. Publishing 2008. (Hulse's date appears to be based upon a drawing of the Arnold engine which he reproduces.)
136. Nixon, op. cit., in his Table gives Farey as source for this group of machines but this is to misrepresent Farey's text, A Treatise on the Steam Engine. John Farey, op cit., p. 662.

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Geoff Theasby reports on the latest news from the Clubs.



Hudswell Clarke E1 hiding in the foliage at Peak Rail.

I am having to be quite ruthless in my current selection, as I have so many newsletters to review. This must be in response to the relaxing of restrictions on our activities, causing a surge in the publication of clubs' intentions in what remains of the summer.

Debs and I spent a weekend in Derbyshire and experienced serendipity in spades, when we discovered, quite by chance, that we were staying near the end of Peak Rail's line at Rowsley so, being free then, we paid a visit. Gosh, I had no idea the place was so big! The day was very wet, however, indeed a thunderstorm and

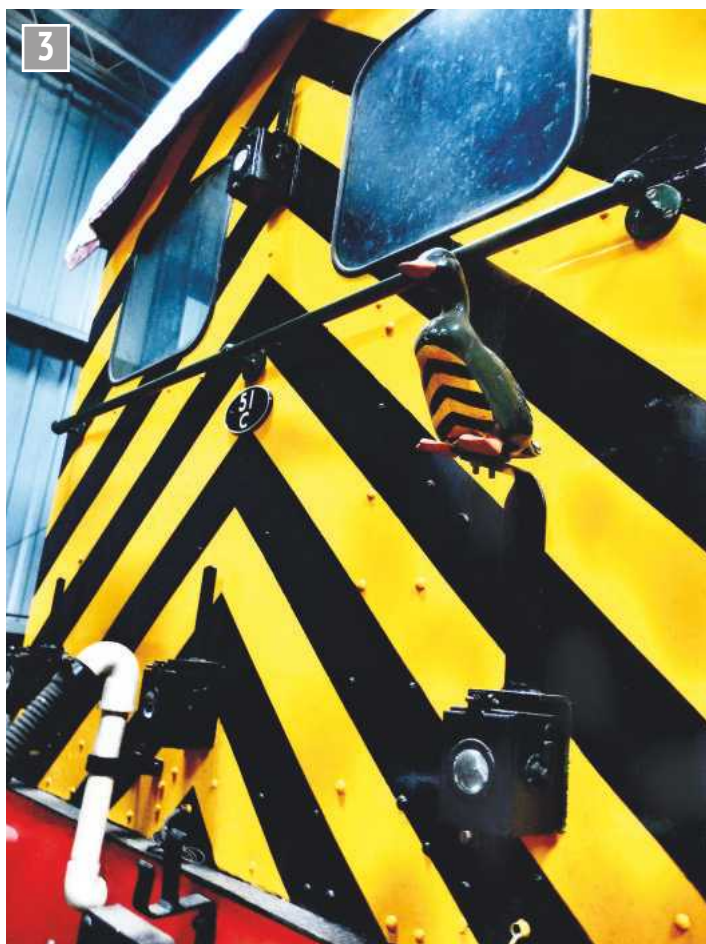
cloudburst, so that I will refer to it as Peak Rain... The station buffet, bookshop and cafe were run by smiling, cheerful people who welcomed us despite the weather. The railway bookshop at Rowsley is the finest I have seen since I last visited the renowned Embsay & Bolton Abbey Railway establishment. I asked a gentleman in overalls if I could see round the engine shed and was rebuffed, for safety reasons, but I could be shown round it by a guide, for a consideration, so I crossed his palm with silver (for the funds!) and got a personal tour of the shed by John Wade, who revealed himself as

virtually a neighbour of mine, living less than 1 mile away from me in Sheffield. Small world, we agreed! John said nothing about himself, so I was unprepared for the vast amount I found online, that he is one of the 'movers and shakers' at Peak Rail. There is little locomotive information on the website, instead we are urged to buy the stock book, which gives comprehensive details. Concentrating on industrials, they have an example of all BR diesel shunting locomotives from Class 1 to Class 9. This little scene developed as I walked towards the shed. Hudswell Clarke E1 *Castlefield* (**photo 1**) waited whilst an immaculate CEEB-liveried, RS&H *Eustace Forth* No. 15, was preparing to pull the train (**photo 2**), doing so in silence, so fine was its mechanical condition. Quietly surveying the scene from a lamp bracket was this (Sergeant?) duck, found, said John, in a scrapyard, not that many people spot her (**photo 3**). This exquisite video needs no more from me (**ref 1**). First time I've heard a steam locomotive with an aero engine sound effect...

W. www.peakrail.co.uk



CEGB No. 15, Eustace Forth also at Peak Rail.



Nice weather for ducks ...

Midway through writing this, my keyboard failed and, having no spare, I dismantled it with a view to repair. 18 screws! Thank goodness for the electric screwdriver. Everyone should have one.

In this issue: smoke, rainbow, conductivity, names, Oliver Bulleid, granite, 'piggyback' trucks, medical view of Covid, the Mull railway, *Caliban*, paper wheels? And a 'green' 4x4.

On with the motley! **Bradford Model Engineering Society's** June *Monthly Bulletin* says that the Marine group have returned their craft to the water, whilst a piece on Electrical Theory by Joseph Lucas, Prince of Darkness (whom God preserve) originally appearing in the Norton Owners Club newsletter, was based on the 'smoke' theory, i.e. 'smoke' makes electrical items work and if the smoke escapes, the item ceases to work. Simple! Road Vehicle News discusses traffic lights, encouraged by the 'stop-go' advice on

foreign travel and illustrated by a Dennis fire engine and a green traction engine. (Insert old Pepsodent advert here... Geoff.) President, Jim Jennings continues his tale of the museum ship in Denmark. Details are online - look for 'Fregatten Jylland'. It is notable for its length - a Viking tradition, no doubt. This is followed by Dominic Scholes continuing the details of his very small steamboat. Interestingly, he says that the conductivity of water changes by a factor of ten, between 15 degrees C and boiling point.

W. www.bradfordmes.uk

The Journal, from the **Society of Model & Experimental Engineers**, June, begins with chairman, Alan Wragg pondering the matter of meeting by Zoom. Whilst it has been a great help in keeping members in touch during the pandemic, he realises that there will be a continuing need for the service even if 'life returns to 'normal', in that members who could

never gain physical access to Marshall House now have a method of observing the talks and meeting other members, albeit electronically. The previous items on place names rumbles on; all very interesting to me, as my name is thought to have originated in Wensleydale, at a now lost village. Mike Tilby advises that a good source of older books etc. on engineering matters can be found on the Internet (ref 2) and Guy Gibbons continues his very interesting series on clock lines, which suggests that the very modern Kevlar might be a significant advance on previously used materials, but there is little practical experience in its use to date. Several items relate to personal encounters with the late Prince Philip in engineering situations, from MEX to London Bridge rebuilding. Many noted that he needed no introduction to mechanical matters and was abreast of current developments in the field. Duncan Webster explains Baker valve gear, whilst Neil Read, in an item about shortening screws, asks, "How do you eat an elephant?" (A bit at a time, should you be wondering.) Roger Backhouse reviews *Oliver Bulleid's Locomotives* by Colin Boocock. I might buy this book, since I have found Mr. B's thoughts and reasoning intriguing to say the least. Despite the opprobrium heaped upon him from some quarters, he remained an innovative engineer. 'Original and adventurous' says Roger.

W. www.sm-ee.co.uk

On Track, June, from **Richmond Hill Live Steamers** begins with an article on the Huron Central Railway, a 173 mile line North of Toronto, the threat to the future of which has been averted, again. Several models are for sale, including a 7¼ inch gauge electric locomotive and riding car which is very nicely liveried and powered by a 24 volt wheelchair motor. Yours for C\$11,000. And, for want of anywhere to go, a free-spirited

train... <https://www.itemfix.com/v?t=ayfxjy>

W. www.richmond-hill-live-steamers.tripod.com

Ryedale Society of Model Engineers' May *Newsletter*, contains another informative item from Doug Hewson, this time on the duties of a Yardmaster and pilot. When Doug was YM he would recruit a couple of pre-teen onlookers to help him. Two of these now hold positions in Anglia Rail and 'La'al Ratty'. (The Ravenglass & Eskdale Railway, M'Lud.) The YM contribution would also oversee the pilot, which, when having nothing to do, should sort out the rolling stock into separate sidings making them easy to find when required. Six pages later, now you know! And, some Triang TrixTwin models for sale, see editor, Bill. W, www.rsme.org.uk

The Prospectus, June, from **Reading Society of Model Engineers** begins with John Spokes writing about the winning of granite from Cleve Hill, Salop, near where he once lived and the remains of the old rope-worked inclines and trackbed. Much of the granite was used in road building, even in Reading and can still be seen in Reading's many potholes... Terry Wood remembered an old Gauge 'O' clockwork tinplate railway still in his attic and resurrected it during lockdown. Making a baseboard from offcuts, with a simple station building, a little paint *et voila!*

W. www.rsme.org

Chingford & District Model Engineering Club continues its reprints of the club *Echo* from 1954. Falling attendance was blamed upon television, amongst other distractions, occupying the thoughts of our elders and betters, just as computers and smartphones do now. This item closes with the news that the World non-stop 5 inch gauge steam locomotive distance record had been broken by a Mr. Clark, achieving 60 miles! Next an article very close to home, by Ted Joliffe, quondam editor of this august journal you see before you. His photo of shed/ ➤

sometime nerve centre of M.E. is very thought-provoking (photo 4).

W. www.cdmec.co.uk

Grimsby & Cleethorpes Model Engineering Society's *The Blower*, June, carries an item by Mike Gray on 'Rollbocke' and 'Rollwagens', or vehicles of one gauge being designed to carry, on top, those of another gauge. In this case the Brocken railway is featured.

W. www.gcmes.com

Maritzburg Matters, June, from **Pietermaritzburg Model Engineering Society** has an interesting, non-railway item regarding the Covid virus currently changing the world. An eminent biochemist briefly explains how the virus works and how it can be guarded against. Producing the vaccines the old way was slow and expensive, but modern methods can do the job much more quickly.

W. www.pmes.co.za

As I write this, I find that 'ShedFest 2021' has just been held (virtually) by the UK Men's Sheds association. Not only that, but eleven separate items on Men's Sheds were noted in the June news media.

W. www.ukmsa.org.uk

Steam Chest, July, from the **National 2½ inch Gauge Society** starts with an unusual locomotive, described by 'LBSC' and named *Caliban*. It looks highly unconventional, to say the least and the v-grooves in the driving wheels are said to give greater traction. To my mind, it will do the track no good. We shall see. This machine is completely new to me so I have no idea how it performed. Cedric Norman made a machinist's hammer, the type with two different, replaceable heads, in his case brass, plastic and aluminium; perm any two... Tom Barnes, growing up in a York railway family but working in another career, took up model engineering in earnest on his retirement, producing an O Gauge Pacific, an LNER P1 (winning a prize at MEX 2013) and a Thompson B2 named, not quite accurately, *York City*, ('Footballers' were B17s)



The M.E. nerve centre for Ted Joliffe. (Photo courtesy of the said Ted.)

gaining a 2nd at the Doncaster exhibition in 2018. Next is a piece by Chris Cruickshank about the shortest and most remote industrial railway in the British Isles, that on the Mull of Kintyre, built to carry the indifferent local coal (mined since the 1400s), much of which went to Belfast and the balance to distilleries at Cambeltown, and which closed in 1933. One of the locomotives was *Princess*, from Kerr Stuart, to their Skylark design. Don Searle built a 'lockdown' scratch, Baguley-style locomotive using a 120 watt motor and a 12 volt, 12 Ah battery. That system will power my *Deborah* so I am encouraged that it works well. Another item by Chris Cruickshank records his build of a Julius de Waal Decauville engine; details are available if you search online for 'modelengineeringwebsite' Look for the G3 version by Gerard Versluys. Cedric Norman found an article on 'Paper Wheels', yes really! They were made in the USA from 1867 and similar to Maunsell wheels, but using highly compressed paper. Quiet in operation, they were fitted to sleeping and Pullman cars, but discontinued in 1915.

W. www.n25ga.org

Our Motoring Correspondent, Antonio Gelopi writes: "Passing the local Lexus showroom, I noticed prominent

advertising for their Chelsea Tractor which, I swear, I kid you not, thought was the 'Lexusux'. I immediately thought of the withdrawn vacuum cleaner slogan, 'Electrolux sucks'". On an unrelated topic, in a recent teleconferencing event, I learned that several people had owned Land Rovers, following which I saw an item in the weekend paper for a 'green' imported version, which was quite highly praised. Look up the 'Spartan EV', based on a Russian UAZ platform. UAZ, formed in 1941, are experts in dealing with difficult terrain. The vehicle is wholly electric with a motor in each wheel www.mwmotors.cz2 If Readers think that is an improvement on older Russian motor vehicles, they may well be right (ref 3). A comment on one of them is 'Only one was made, thank God'. In the same vein, here's another side of life (ref 4) plus, whilst we are surfing 't'interweb' an historic minute of film (ref 5), quite remarkable in view of its age. It dates from

1898 and shows the Irish Mail picking up water on the move, eventually overflowing. Note the non-corridor carriages, probably wooden. It was filmed from a train running on a parallel track. Bear in mind that moving pictures on film only date from 1888 (Louis le Prince's Leeds Bridge) 1891 (Edison) and the Lumiere brothers from 1895.

Next time, dear Reader, Club News is at the mercy of John Arrowsmith. Compliments, solicitors' letters and lawsuits to Martin in the first instance.

And finally, at a rally: "Does your dog bite?"

"No."

So I patted the dog and was bitten.

"I thought you said your dog didn't bite!"

"That's not my dog."

CONTACT

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3. <https://123vs.ru/en/samye-neobychnye-sovetskie-avtomobili-unikalnye-i/>
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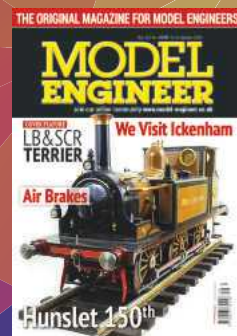
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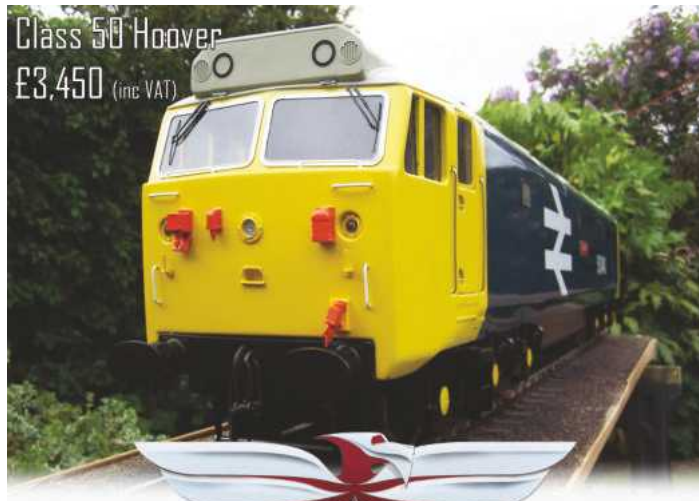
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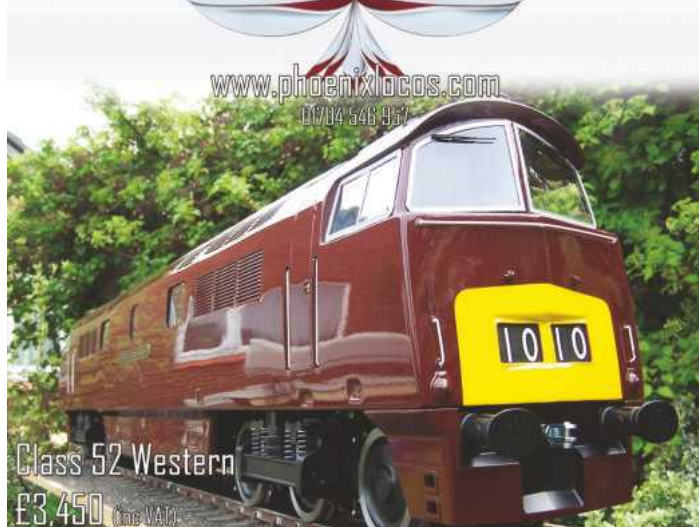


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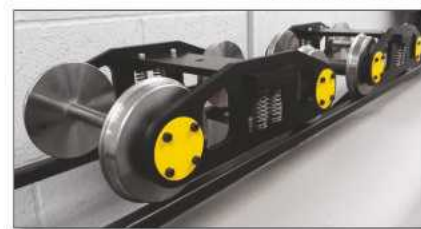
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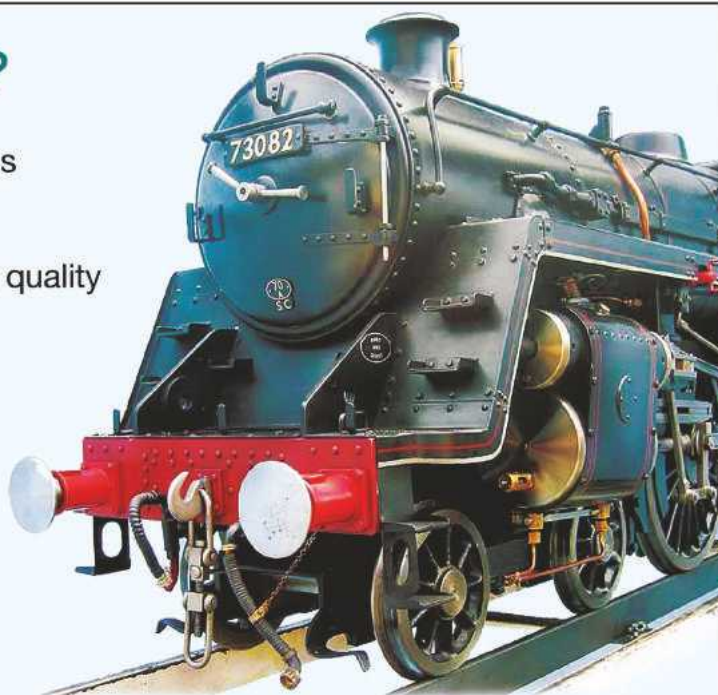
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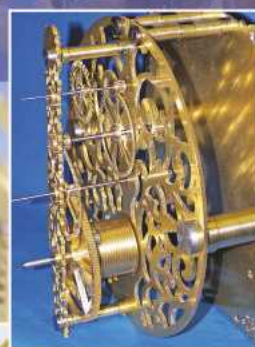
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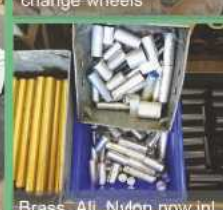
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