THE ORIGINAL MAGAZINE FOR MODEL ENGINEERS

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MODEL ENGINEER

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PC40	3.5HP	20Amps	£269.00	£322.80
PC60	5.5HP	32Amps	£319.00	£382.80

Clarke ARC / TIG INVERTER WELDERS

NEW

- Efficient inverter technology
- Variable output current

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MODEL	MIN/MAX OUTPUT CURRENT	ELECTRODE DIA. (mm)	EXC. VAT	INC. VAT
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MMA140	20A-140A	1.6-3.2	£119.00	£142.80
MMA200	20A-200A	1.6-4.0	£159.00	£190.80
AT133	10A-130A	2.5/3.2	£129.98	£155.98
AT135	10A-130A	2.5/3.2	£169.98	£203.98
AT162	10A-160A	2.5/3.2/4.0	£149.98	£179.98
AT165	10A-160A	2.5/3.2/4.0	£199.98	£239.98

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Quality machines from Britain's leading supplier

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135TE

FROM ONLY £194.99 EXC.VAT £233.99 INC.VAT

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Clarke MILLING DRILLING MACHINE - CMD300

- Bench mountable, tilts 45° left & right from vertical
- Table travel 100x235mm
- Table Effective Size LxW: 92 x 400mm

CMD10

£599.00 EXC.VAT £718.80 INC.VAT

Clarke MICRO MILLING & DRILLING MACHINE

- Bench mountable
- MT2 Spindle Taper
- Face mill capacity 20mm, end mill 10mm
- Table cross travel 90mm, longitudinal travel 180mm

£399.00 EXC.VAT £478.80 INC.VAT

MODEL	MOTOR	SPINDLE SPEED	EXC.VAT	INC.VAT
CMD10	150W/230V	100-2000rpm	£399.00	£478.80
CMD300	470W/230V	0-2500rpm	£599.00	£718.80

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BEST SELLER

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CV100B	100mm	Fixed	£20.99	£25.19
CVR100B	100mm	Swivel	£24.99	£29.99
CV125B	125mm	Fixed	£31.99	£38.39
CVR125B	125mm	Swivel	£36.99	£44.39
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CMV140	140mm	Swivel	£79.98	£95.98

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B = Bench mounted
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CDP152B

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CDP202B	450 / 16	£189.00	£226.80
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CDP352F	550 / 16	£229.00	£274.80
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8/260

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- 'V' Twin Pump

MODEL	MOTOR	CFM	TANK	EXC.VAT	INC.VAT
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7/250	2 HP	7	24ltr	£94.99	£113.99
11/260 NEW	2.5HP	9.5	24ltr	£109.98	£131.98
8/550 NEW	2HP	7.5	50ltr	£119.98	£143.98
11/550 NEW	2.5HP	9.5	50ltr	£139.98	£167.98
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16/1010*	3 HP	14.5	100ltr	£259.98	£311.98

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BEST SELLER

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DEVIL 6003

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DEVIL 7003	230V	3	£59.98	£71.98
DEVIL 6005	400V	2.5-5	£69.98	£83.98
DEVIL 7005	400V	5	£84.99	£101.99
DEVIL 6009	400V	4.5-9	£109.00	£130.80
DEVIL 6015	400V	5-10-15	£169.00	£202.80
DEVIL 7015	400V	15	£199.98	£239.98

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CBB213B	3 Dr Cabinet	£199.98	£239.98

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- Bending angle 0-90°

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SBR610	610mm (24")	£439.00	£526.80
SBR760	760mm (30")	£529.00	£634.80

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HP	SHAFT SPEED	EXC. VAT	INC.VAT
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1/2	2 pole	£69.98	£83.98
3/4	4 pole	£79.98	£95.98
1	2 pole	£79.98	£95.98
2	2 pole	£94.99	£113.99
3	2 pole	£119.98	£143.98
4	2 pole	£139.98	£167.98

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MODEL	DESCRIPTION	EXC.VAT	INC.VAT
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CM180	0-25mm Micrometer	£10.99	£13.19
CM145	150mm/6" Digital Vernier	£17.99	£21.59
CM265	300mm/12" Digital Vernier	£34.99	£41.99

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CFC1000LR	1 ton long reach	£219.00	£262.80

BEST SELLER

- Folding and fixed frames available
- Robust, rugged construction
- Overload safety valve

CFC100

Clarke HYDRAULIC LIFTING TABLES

- Ideal for lifting & moving models
- Foot pedal operated

HTL500

FROM ONLY £299.00 EXC.VAT £358.80 INC.VAT

MODEL	MAX. LOAD	TABLE HEIGHT MIN-MAX	EXC. VAT	INC. VAT
HTL300	300kg	340-900mm	£299.00	£358.80
HTL500	500kg	340-900mm	£319.00	£382.80

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CBG6RZ	PRO	150mm	£42.99	£51.59
CBG6RSC	HD	150mm	£54.99	£65.99
CBG6SB#	PRO	150mm	£56.99	£68.39
CBG6RWC	HD	150mm	£59.98	£71.98
CBG8W* (wet)	HD	150/200mm	£58.99	£70.79

Clarke ROTARY TOOL KIT

FROM ONLY £29.98 EXC.VAT £35.98 INC.VAT

Kit includes: • Height adjustable stand with clamp • Rotary tool • 1m flexible drive • 40x accessories/consumables

CRT40

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IN THIS ISSUE

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ON THE COVER...

Ian Morris, winner of the Leonard Crane trophy at the Midlands show, with his 6 inch scale Ruston Proctor SD tractor An Calliach *(photograph John Arrowsmith).*

THE MOST VERSATILE TOOL FOR TURNING & FACING

It's easy to see why our best selling turning tool is the SCLCR. It can turn and face a bar without altering the toolpost, and the 80° nose angle gives much more strength than a 60° (triangular) insert. The NJ17 insert cuts steel, stainless, cast iron, phosphor bronze, aluminium, copper, brass etc. Please state shank size required - 8, 10 or 12mm square. Spare inserts £6.86 each for 8-10mm tools, £7.99 for 12mm.

SPECIAL OFFER PRICE £20.00

USE THE OTHER 2 CORNERS FOR ECONOMY!

Our SCRCR rough turning tool uses the same inserts as the SCLCR tools above. The good news is that it uses the other two corners! These very strong 100° corners are rigid enough for rough or intermittent turning. The insert is mounted at 75° to the lathe axis. 10mm sq section (for CCMT06 insert) and 12mm section (for CCMT09 insert).

SPECIAL OFFER PRICE £31.90

PROFILING WHEELS or SHAPING AXLES & PILLARS?

If you need to create complex shapes, our SRDCN button tool is invaluable. The 10mm square shank holds a 5mm dia cutting insert, and gives great versatility, superb strength and excellent tool life. The late Mr D Hudson of Bromsgrove SME used these tools for many years to profile the special form of tyre treads for his self-steering wheel sets with great consistency. Spare inserts just £5.79 each.

SPECIAL OFFER PRICE £34.00

TURN SMALL DIAMETERS with LIVE CENTRE IN PLACE!

The SDJCR tool uses a 55° insert, allowing access to small diameter components when using a tailstock centre. It can also profile back-angles. The NJ17 insert cuts steel, stainless, cast iron, phosphor bronze, brass, copper, aluminium etc. Shank size 8mm or 10mm square section. Spare inserts just £6.86 each.

SPECIAL OFFER PRICE £20.00

A TOP QUALITY BORING BAR FOR YOUR LATHE

Bar Dia.	Min Bore
8 mm	10 mm
10 mm	12 mm
12 mm	16 mm

Here's your chance to own a top quality boring bar which uses our standard CCMT06 insert. Steel shank bars can generally bore to a length of approx 5 times their diameter. Please state bar dia required - 8, 10 or 12mm. Spare inserts just £6.86 each.

SPECIAL OFFER PRICE £20.00 ea or buy all 3 sizes for just £55.00!

INTRODUCING THE GROUNDBREAKING NEW KIT-QD PARTING TOOL!

The new and innovative KIT-QD parting tool has a more secure insert location, stronger body and improved insert design compared to the original KIT-Q-CUT. It has an increased maximum reach of 23mm, giving over 1.3/4" parting capacity in solid bar. As previously, the tool fits the vast majority of ME lathes, including ML7 & ML10 machines, regardless of toolpost type. It comes complete with the key to locate and eject the tough, wear resistant insert. Cuts virtually all materials. Spare inserts just £10.75 each.

SPECIAL OFFER PRICE £69.50

EXTERNAL THREADCUTTING TOOL

These tools use the industry standard 16mm 'laydown' 3-edge inserts. With tough, tungsten carbide inserts, coated with TiAlN for wear resistance and smooth cutting, threads can be cut at very slow speeds if required. Tools are right hand as shown. 55° or 60° insert not included - order separately at £5.65. See our website for more info.

SPECIAL OFFER PRICE £36.50

INTERNAL THREADCUTTING TOOL

These tools use the industry standard 11mm 'laydown' 3-edge inserts. With tough, TiAlN coated tungsten carbide inserts, quality threads can be cut with ease. Tools are right hand as in picture. 10, 12 and 16mm dia's available. 55° or 60° insert not included - order separately at £5.65. See our website for more info.

SPECIAL OFFER PRICE £36.50

DORMER DRILL SETS AT 60% OFF LIST PRICE!

All our Dormer drill sets are on offer at 60% off list price. The Dormer A002 self-centring TiN coated drills are also available to order individually in Metric and Imperial sizes. Please see our web site for details and to place your order.

TURNING, BORING & PARTING TOOLS COMPLETE WITH ONE INSERT.

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* Tickets are available via our website at discounted prices until midnight Tuesday 14th January 2020.
** Full price tickets are available on the day from the ticket office.

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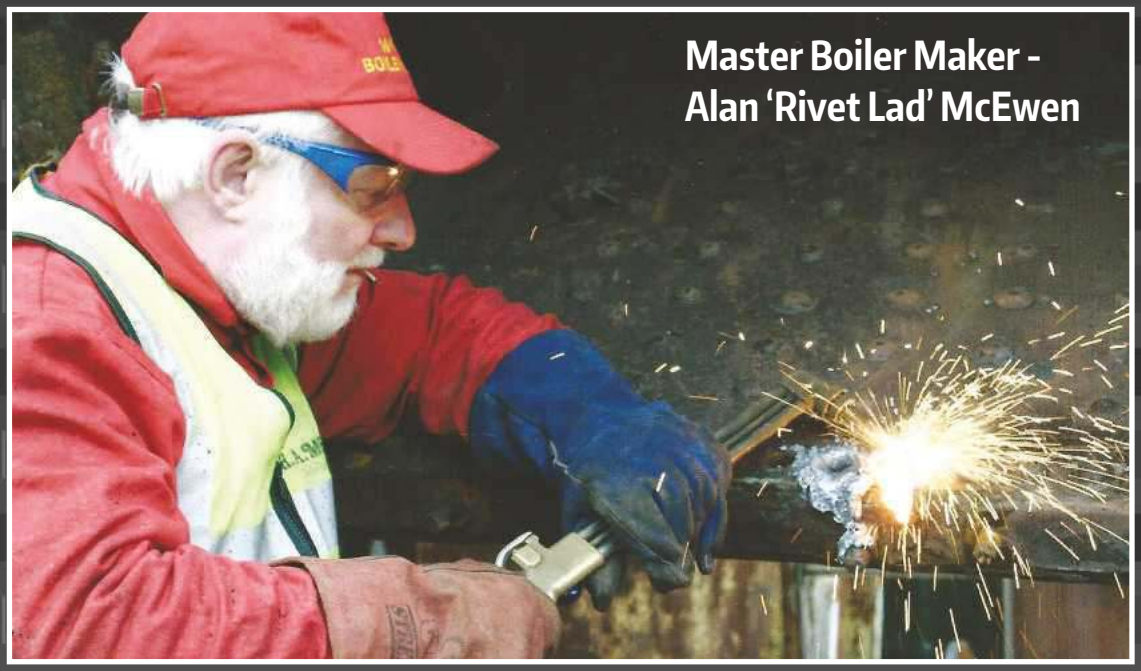
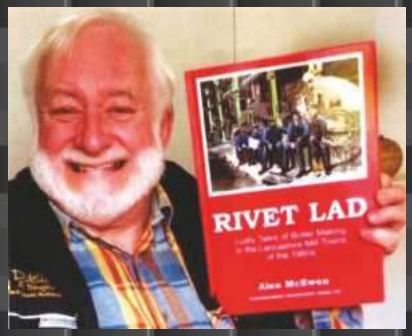


Master Boiler Maker - Alan 'Rivet Lad' McEwen

When Master Boiler Maker and author, Alan McEwen was a young sprog, he loved banging and hammering on rusty old boilers; now that he is an old hog, he just prefers others to bang and hammer!



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

Alan's second RIVET LAD book: *RIVET LAD – More Battles With Old Steam Boilers* was published in September 2018.
Now priced at £20 including postage and packing to UK addresses.
This latest book chronicles Alan's story from leaving Phoenix Boiler Makers and establishing his own firm: H.A.McEwen (Boiler Repairs) on the 4th August 1968. In those early days Alan battled with a great variety of old steam boilers in town and country, where he met some extremely interesting and rather bizarre characters, such as the 'Piggers'. The book is hard back and contains 128 pages of text and numerous amazing photographs.

BOOK BUNDLE SPECIAL OFFER

Both RIVET LAD books can be purchased together for £35 including postage and packing to UK addresses.
To place an order please telephone 01535 637153 / 07971 906105. All our books can be ordered on our website www.sledgehammerengineeringpress.co.uk or email: lankyboilermaker@btconnect.com.
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Richard Guthrie

It is with great regret that we have learned of the death of Richard Guthrie, treasurer of the Northern Association of Model Engineers. His obituary appears on page 852.

Wenford

You will remember that in our previous issue (M.E. 4626) Graham Sadler gave a few examples of the use of his Sieg CNC milling machine to manufacture parts for the *Wenford* 7¼ inch gauge Beattie well tank that he is building to *Hotspur*'s design. I am pleased to say that, in this issue, *Hotspur* takes up the ongoing story of the construction of this rather interesting and good-looking locomotive. I am told the castings mentioned in this short series will be available from Blackgates Engineering.

Christmas Gift Cards

If you are fortunate enough (!) to have a model engineer in the family you may well be stuck for ideas about a suitable Christmas present. Your worries are now over! How about a Christmas Gift Card from Machine Mart? These cards can be of any value from £20 to £500 and are available in Machine Mart stores, at www.machinemart.co.uk or by telephone at 0115-9565555. If you buy one of these you will not only have a happy model engineer but you will also get him (her?) out of the house for a couple of hours while he or she explores the aisles of the local Machine Mart store.

Machine Mart

Gun Article

Perhaps you are wondering where the promised article about the construction of a semi-automatic pistol has gone. After taking advice about this, I have decided to withdraw the article. This is, I think, rather unfortunate as it was an excellent article. However, in the current climate, I believe, it would be unwise to print it. In my opinion this is a rather sad reflection of the rather paranoid society we currently live in and reminds me (rather appropriately in panto season!) of the story of *Sleeping Beauty*. You will remember that she was cursed at birth by a Wicked Fairy who put a death spell on her if she should ever prick her finger on a spinning spindle. All possible precautions were taken by the King to prevent this but, in the end, could not. In the same way, I do not believe publication of this kind of article would have had any effect at all on the incidence of gun crime in this country. Caution, though, must be the keyword.

Alexandra Palace

It's not yet Christmas (despite what the shops may claim!) and January may seem a long way away. However, it will be here all too soon so it is perhaps time to mark the dates for the London Model Engineering Exhibition in your diary. It takes place from the 17th to the 19th January at Alexandra Palace, London.

This leading exhibition for model engineers continues to enthral visitors and enthusiasts alike with thousands of scale models from the early age of steam engines right up to today's modern marvels.

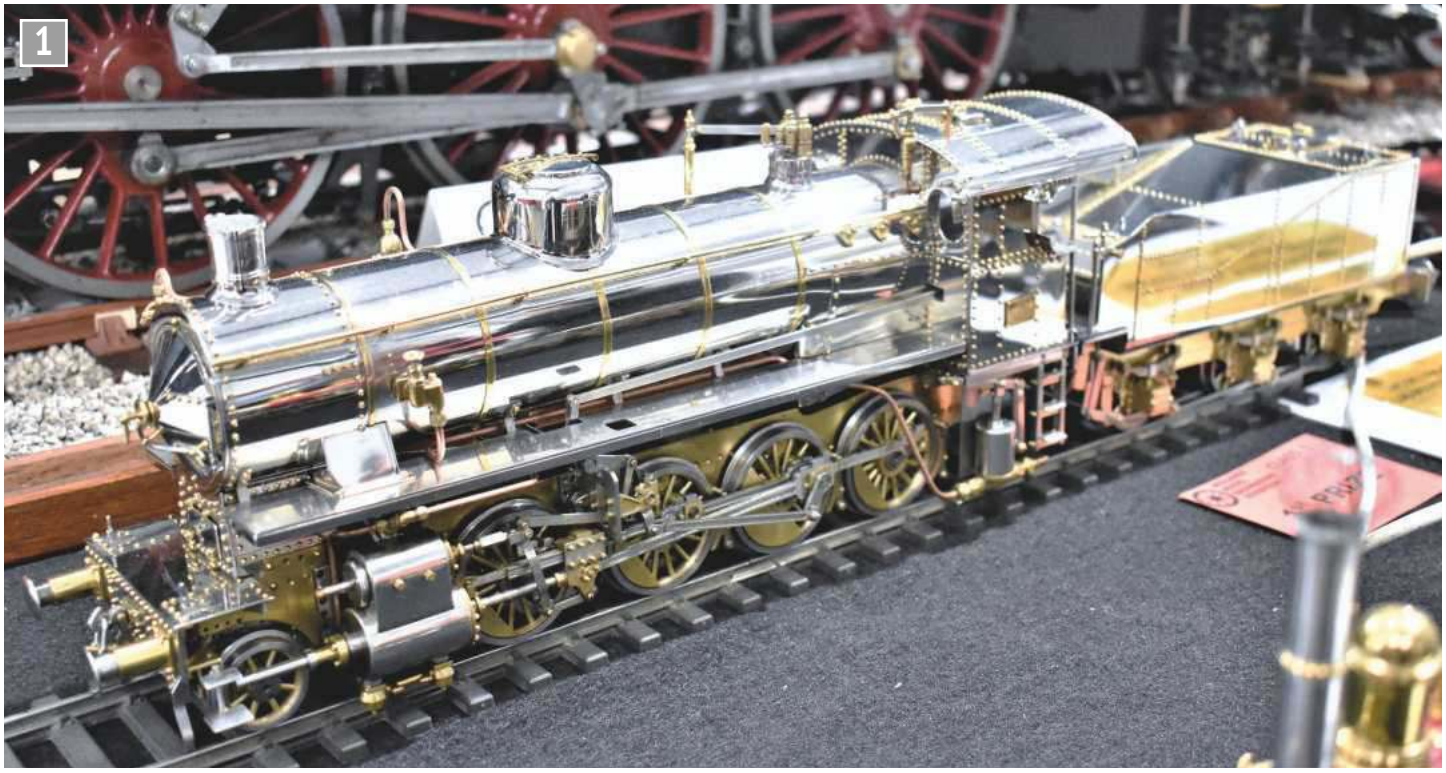
The 2020 event will be packed with over 2,000 models built by individuals, clubs and societies, from traditional model engineering like locomotives, train layouts and traction engines to large collections of scale model ships, aircrafts, tanks and militaria to remote controlled trucks and even James Bond models and memorabilia!

This year's show pays a special tribute to the emergency services and armed forces. Over 500 emergency services and armed forces models will be displayed throughout the hall. Representatives from London's Air Ambulance Charity will be in attendance with their Helivan featuring a replica of the interior of London's Air Ambulance aircraft plus demonstrating their HELIMED app to inspire young people to pursue STEM careers and raise awareness of their lifesaving work. All Blue Light, NHS or Armed Forces Discount card holders are entitled to discounted entry to the exhibition.

In commemoration of the 80th of the Battle of Britain, IPMS Barnet Model Club will showcase a display of model tanks, tri-planes, Fokker planes and associated military British and German infantry figurines, plus armoury and battle machines. The Surface Warship Association also return with a large collection of scale model warships representing all periods, types and nationalities - many of which built by retired or current service personnel.

The event is always keen to encourage and highlight the works of young engineers. There are plenty of 'hands on' activities for children to participate in, from creating a large LEGO mosaic at the Fairy Bricks stand to taking part in model experiments at the Imagineering Foundation stand science lab or even a treasure hunt!

Further information is available at www.londonmodelengineering.co.uk



Winner of the First Prize in Class 1 was this superb Italian Railways Consolidation locomotive built by Giancarlo Mastrini.

Midlands Model Engineering Exhibition

John Arrowsmith reports on the Competition Classes at this year's exhibition.

The exhibition this year was the scene of yet another excellent assembly of models and traders, fulfilling the needs of the purist and casual model engineer alike. The competition entries were an improvement over last year with only one class not having an entry. A fine set of models in Class 14 showcased the steady progress of the many young engineers who now attend the show. There were a number of anniversaries being celebrated, which added to the overall atmosphere of the exhibition, so the organisers had once again achieved their objective of presenting an exhibition with something for everyone.

I am covering the Competition Classes in this report. These provided some challenging dilemas for the judges to resolve in all classes except one. I hope you all enjoyed this element of the exhibition and I look forward to seeing standards maintained next year.

Class 1: Locomotives - up to and including Gauge 1

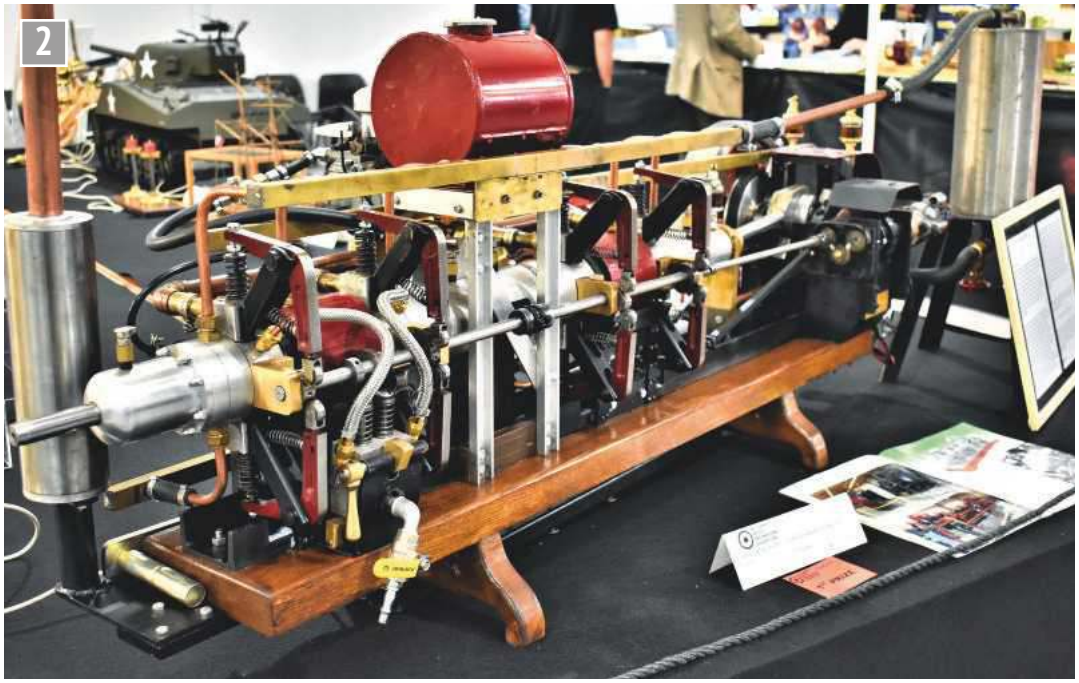
There were three entries here which provided an interesting little class. The winner of the First Prize was a familiar figure from Italy, Giancarlo Mastrini, whose Gauge 1 Italian Railways 2-8-2 Consolidation locomotive was an outstanding model (**photo 1**). With excellent detail and finish, it was a worthy winner. A Commended certificate was presented to David Viewing for his G1 L&NWR 4-2-0 locomotive. The third entry in this class, an OO gauge 0-4-0 Southern Railway Class 14 shunting engine owned by David Bolton, did not receive an acknowledgement.

Class 2: Locomotives - 2½ and 3½ inch gauges

Dave Lee's 3½ inch gauge 0-6-0 locomotive *Mona* to the LBSC design was Very Highly Commended. This was a good example of the design and was well made and finished.

Class 3: Locomotives - 5 and 7¼ inch gauges and above

There was just the one entry in this class this year with a fine 7¼ inch gauge GNSR 4-4-0 locomotive No. 49 *Gordon Highlander* built by Alasdair Milne being awarded a Very Highly Commended certificate. Well finished and made, it looked a splendid example. ≫



The tandem double acting stationary engine which won First Prize in Class 5 for Royce A. Limb.

John Dickenson won First Prize and the Staffordshire Joinery Cup for his 3 inch scale Foden C Type wagon with a van body.

Second Prize in Class 6 went to Peter Lee for an excellent example of a Savage Little Samson *tractor.*

Mike Sayers took the honours in Class 8 with his 4½ litre Blower Bentley engine and gearbox.

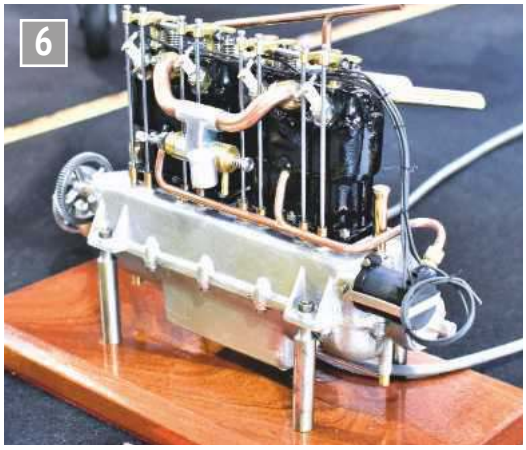
Class 4: Rolling Stock etc. - any gauge
A Highly Commended certificate was awarded to the only entry in this class with Dave Lee's well made example of a contractor's open coal wagon in 5 inch gauge being the recipient.

Class 5: Stationary Engines
There were five very different engines in this class, all receiving an award. First Prize and winner of the Phoenix Paints Trophy was Royce A. Limb who had built a large tandem double acting stationary engine (**photo 2**). With 2 inch diameter cylinders and 4 inch stroke it was by far the largest engine in the class. Second Prize went to David Rhodes for his version of a duplex stationary engine and Third Prize went to Peter Wardle for a 4 cylinder vacuum engine. Two Very Highly Commended certificates were awarded to John Wing for a Trojan stationary engine and to David Rhodes for a nicely made twin cylinder 'A' frame engine.

Class 6: Steam Road Vehicles
There were two excellent quality models in this class which really gave the judges a headache. First Prize and winner of the Staffordshire Joinery Cup was John Dickenson with a superb model in 3 inch scale of a Foden C Type wagon with a van body (**photo 3**). The Second Prize was awarded to Peter Lee for an excellent example of a Savage Little Samson tractor to 4 inch scale (**photo 4**). Both models fully deserved their accolades.

Class 7: Machine Tools and Workshop Equipment
Unfortunately there were no entries in this class but some excellent examples were to be seen on various club stands.

Class 8: Internal Combustion Engines
There were just two entries in this class but what quality entries they were. The First Prize and the Engineering in Miniature Trophy went



Second place in Class 8 was this little Mercedes D4F 60HP aero engine built by Steve Gosling.

An masterpiece from John Moorhouse with his amazing little bird automaton which won Class 9.

Mike Macey's working Skelton style wooden mantle clock was second in Class 9.

to Mike Sayers for his outstanding model of a Birkin 4½ litre Blower Bentley engine and gearbox. The superb workmanship and finish really stood out on this model (**photo 5**). Winner of the Second Prize was Steve Gosling with an excellent example of a Mercedes D4F 60 hp aero engine circa 1909 (**photo 6**).

Class 9: Horological, Scientific and Automata

There were just three entries in this class but each model fully deserved the award it gained. First Prize and the Clockmakers Trophy was awarded to John Moorhouse for a quite amazing example of an automaton. A small violin case contained a silver enamelled violin instrument including 18ct gold strings, which all went together beautifully, but when the bottom spike on the instrument was gently pushed the back sprung open and two small twittering birds emerged from within (**photo 7**). A Second Prize was awarded to Mike Macey for a skeleton type wooden mechanical mantle clock. All the gears for this working model were hand cut to produce another outstanding model (**photo 8**). The Third Prize in this class went to Nicholas Farr for his well made and finished basic magnetic compass.

Class 10: Marine Models – Scale (over 50% scratch built)

A good range of craft in this class resulted in six Commendations being awarded. A well made four mast barque rigged steel hulled sailing ship built by Trevor Orton caught the eye and, in complete contrast, the Grimsby crab/fishing boat by Ray Farrow was a well detailed model in 1/12 scale. Clive Dent had two models Commended: a flat bottom rowing skiff full hull model and a radio controlled New England lobster fishing boat. Michael Nicholson's 1/12 scale WWII Finnish Navy minelayer had a full camouflage finish which looked very authentic and Roderick Milne's 32ft naval cutter to a 1940's design was another attractive little craft.

Class 11: Marine Models – Kit (standard or modified)

Graham Farrow's Watson Class lifeboat in 1/12 scale was another well detailed model and gained a Commended certificate in this class.

Class 12: Model Horse Drawn Vehicles

A good selection of models in this class ensured there was a good competition for the prizes. Chris Biggs was awarded the First Prize and the Lenham Pottery trophy for his well built and detailed Kent & East Sussex Railway wagonette (**photo 9**). The detail on this exhibit was excellent, right down to dirty footmarks on the running boards. Chris also gained the Second Prize for another well detailed van, this time a Waring & Gillow furniture van (**photo 10**). Third prize was awarded to Eric Keggans for a well-made example of a North Monmouthshire farm wagon. Very Highly Commended was Patrick Hall for his hermaphrodite farm wagon which converts to a wheel tipped cart. Also receiving a VHC certificate was Brian Young for his Kessler dump cart.

Winner of Class 12 was Chris Biggs with his Kent & East Sussex Railway wagon.

The Waring & Gillow furniture van built by Chris Biggs.

This superb example of a Westland Wessex Mk 2 helicopter built by Nick Clark won First Prize in Class 13.

Class 13: Scale Model Aircraft
There were just two entries in this class but what quality models they were. First Prize and the Variscale Cup was awarded to Nick Clark for his scratch built model of a Westland Wessex Mk 2 helicopter XT604 of 22 Squadron in ⅛ scale. Full of authentic detail, it included a powerful gas turbine engine (**photo 11**). The Second Prize was awarded to Anthony Hooper for an excellent model in ¼ scale of a Corsair F4U which included a 250cc radial engine, 14 servos and a scale four blade Biela propeller. The hydraulically folding wings were controlled by a specially designed motor (**photo 12**).

Class 14: Young Engineers
Once again, this class outshone all the other classes in terms of the number of entries. It is very pleasing to see the number of young people who now want to be part of the show and display their work, not only in competition but on club stands as well. This year the thirteen entries were all acknowledged for their efforts in order to encourage them to maintain their interest in model engineering.

The winner of the First Prize and the Stuart Models Shield was 13 year old Rosemary Turner, a member of the Eastleigh Young Engineers Club. Rosemary's *Chitty Chitty Bang Bang* car was a well balanced and delicately made model with some excellent bodywork panelling (**photo 13**). The judges awarded seven Second Prizes, such was the quality of the entries. Luke Mason gained three of these awards for his two horizontal engines (**photo 14**) and a versatile mini vice. Matthew Kenington gained two Second Prizes for his Stuart S50 horizontal engine (**photo 15**) and for his very well made well wagon driving truck. There were also Second Prizes for Lucas Hall for a very well made Formula III racing car circa 1950's and Zahra Webb for her fire engine.

Second prize in Class 13 went to Anthony Hooper for his excellent ¼ scale model of a Corsair F4U aircraft.

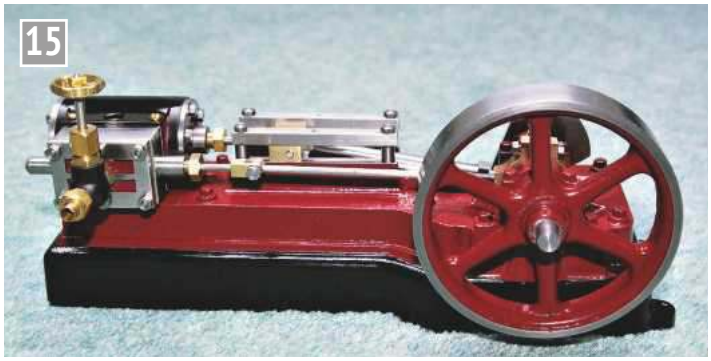
Ryan Philo gained a third prize for his Fordson tractor and mower, which was radio controlled. Two other Third Prizes went to Archie Bell for a nicely made skimmer Boat and to Rubin Stannah for another well made radio controlled speedboat. Two VHC certificates went to Luke Mason for a well made plumb bob and to Peter Allen for a useful centre punch. Congratulations are in order to all these young people and to all their mentors and helpers who, between them, have contributed so much to the high quality of the exhibits. Everyone hopes that these standards will be maintained and we look forward to another good competition next year.

Class 15: Miscellaneous
There were seven good entries in this class, covering a wide range of exhibits but this does cause a few headaches for the judges, simply because of the diversity. Ian Bellamy was awarded First Prize for a superb example of a 1942 Sherman M4A3 tank which was complete with a recoiling 75mm gun. Excellent detail and finish (**photo 16**).

Brian Swann's excellent little Peugeot L76 racing car circa 1912 was awarded the Second Prize (**photo 17**) with another fighting machine taking the Third Prize - Eric Keggans 1942 WWII Grant tank was well made and detailed and included a set of patterns used for the making

First prize in Class 14 went to 13 year-old Rosemary Turner for her Chitty Chitty Bang Bang *car.*

A Second Prize was awarded to Luke Mason for his oscillating steam engine in Class 14.



The Stuart S50 horizontal engine built by Matthew Kenington was awarded a Second Prize in Class 14.

Winner of Class 15 was the 1942 Sherman tank built by Ian Bellamy.

Brian Swann's delightful little Peugeot racing car.

The delightful Jan Ridders vacuum engine won the First Prize in Class 16.

of various components. A joint Third Prize was made to Frank McCafferty for his very well-made model of an Ulstein reduction gearbox with a variable pitch propeller coupled to a Bergen 6 cylinder engine. Very Highly Commended was Russell Taylor for a well made example of a 10 barrel Gatling gun on a wheeled carriage - it showed excellent workmanship and finish. Two Highly Commended certificates were awarded to John Dickenson for an excellent little acetylene lamp and to Martyn Shenton for a working model of a man on a bicycle pedalling and driving a grindstone.

Class 16: Hot Air Engines. Three very good entries in this class resulted in John Wing being awarded First Prize for his excellent model of a Jan Ridders vacuum engine. First class workmanship and finish made this model really stand out (**photo 18**). Two VHC certificates were gained by Malcolm Green for two hot air engines and elegant carrying cases. Both engines had some very good workmanship and finish.

In addition to all the Competition Classes in the main hall, the Fosseway Steamers were also enjoying some rewards for their splendid efforts outside. The Leonard Crane Trophy for the best working engine went to Ian Morris for his 6 inch scale Ruston Proctor SD tractor *An Calliach* (**photo 19**) and the award for the Best Engine Management Skills decided by the Fosseway Steamers themselves went to Steve Lee with his 4 inch Foster *Tracey Jayne* (**photo 20**).

Alongside all these awards the competition for the best club display was this year won by the Hereford Society of Model Engineers with the Melton Mowbray Society as runners up and in joint Third place were the Rugby Society of Model Engineers and the Knightcote Model Boat Club. This trophy is decided by all the other clubs attending the exhibition.

Congratulations are in order for everyone who took part and who contributed so much to the exhibition. I hope the standards set this year are maintained for next year and we will have a full range of exhibits in every class. My next report will cover all the club stand displays along with the Display Classes. ME

LEFT: Ian Morris, winner of the Leonard Crane Trophy, poses with his engine. BELOW: Steve Lee receives the Best Engine Management Shield from exhibition director Chris Deith.

Building Bridget PART 4

Jon Edney builds the chassis to Ken Swan's design.

Continued from p.726
M.E. 4625, 8 November 2019

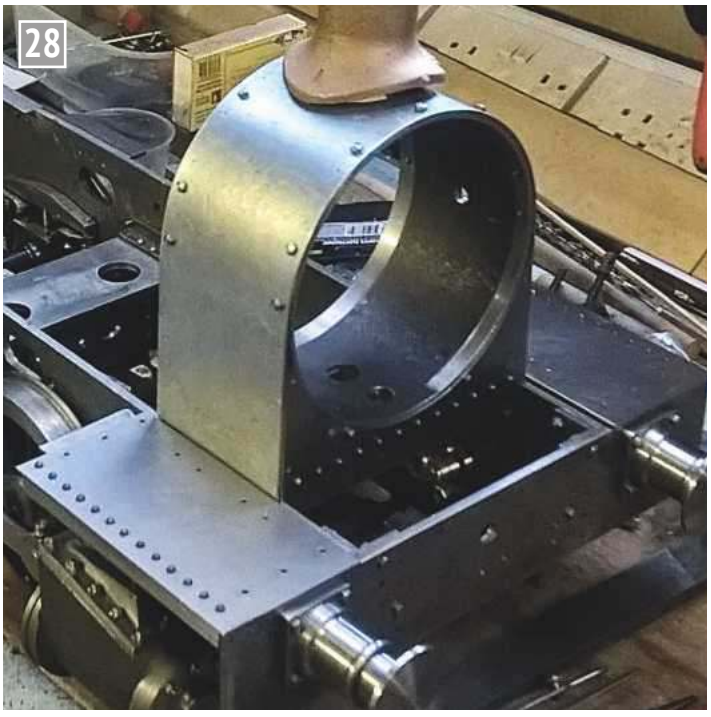
The smokebox

With *Bridget* both the steam supply and (obviously) the steam exhaust pass through the smokebox so it is necessary to get the smokebox in the right position before the appropriate steam plumbing can be put in place.

The steam supply will come from the superheater tubes into the steam column, a vertical gunmetal manifold that passes through the bottom on the smokebox and then out to the cylinder steam chests. The lubricator injects steam oil into the very bottom of this column so that it is carried into the cylinders. This is a reasonably straightforward machining job with some copper pipe work. The supply pipes have to bend through a pretty sharp right angle as they go over the frames and on to the top of the cylinder. I found this pretty hard to do well and, in the end, made a deep groove in a piece of round bar and worked it round as best I could with lots of annealing.

A start is made on the smokebox.

The exhaust pipes are much more of a challenge because they have to be silver soldered together while in place between the cylinders and the smokebox in order to have any chance of fitting and sealing. More of this later.



The partly completed smokebox.

The core part of the smokebox is a piece of 6 inch diameter steel tube and I was pleased to discover that this is easily obtainable from my local metal supplier. **Photograph 27** shows this piece of pipe cleaned up, machined to length and with the steam exhaust and flange fitted. I also drilled the rather large hole on the top for the chimney. Obviously, you can't use a pillar drill to drill these. I mounted the piece horizontally on a boring table on the lathe, drilled each hole and then bored out the chimney hole to the required 40mm diameter.

The body of the smokebox is formed by bending a sheet of steel over the 6 inch tube and riveting the two together across the top half. The sides then extend straight down, supported by small steel blocks, which also support filler pieces front and back. The partly completed smokebox is shown in **photo 28**. Note that only a few of the rivets are inserted at this stage and the rough chimney casting has been placed on top for fun.

When selecting the metal sheet to use for the smokebox I had one of those good ideas that subsequently turned out to be a terrible idea! I happened to have some galvanised sheet about the right size and, though this would be good to prevent corrosion on the unpainted inside of the sheet. This decision caused me much trouble later when I discovered that many paints will not adhere to galvanised steel.

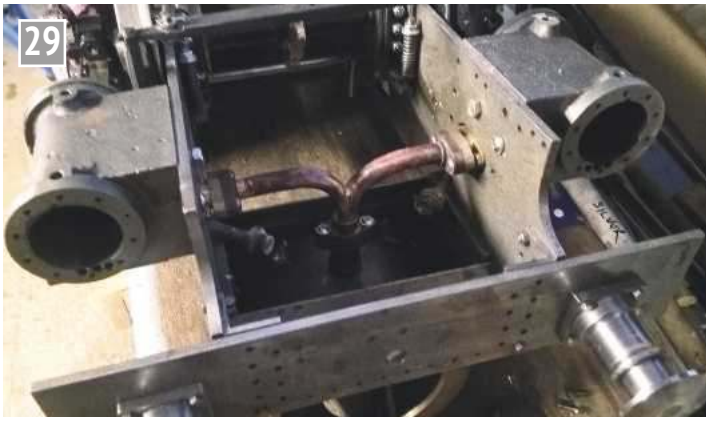
Now that I knew the exact position of the mounted smokebox, and hence the steam exhaust flange, I could move on to complete the exhaust pipework. As mentioned earlier, this is tricky. Each pipe leaves its cylinder horizontally via a bolt-on flange. It then has to turn 90 degrees and join the other side in a tapered joint terminating in an exit flange. All of this has to be silver soldered *in situ* to ensure that the various flanges line up correctly.

The completed pipework is shown in **photo 29** which is taken from underneath the frames (i.e. the locomotive is upside down). The merging of the two pipes is clearly visible. As might be expected, this required a considerable amount of heat to bring the parts up to the required temperature for soldering. I protected the surrounding area with copious amounts of fire-proof lagging.

There was much more work to complete the smokebox, much of which was a series of enjoyable tasks such as cleaning up and fitting the smokebox door and hinges, making the blast nozzle and the blower nozzles. The chimney petticoat is a shaped copper vortex guide below the chimney to cause the escaping steam and smoke to accelerate through the chimney. This was made by starting with a standard copper pipe reducer (42mm x 35mm) and beating the outer edge until it was 50mm wide with a smooth curve down to 35mm for insertion into the chimney.

The chimney itself was a rough gunmetal casting partly visible in **photo 30**. It was actually pretty rough with some large unwanted bronze sprues from the casting process. A major challenge is to machine the saddle so that it is a neat and close fit to the top of the smokebox. This is a very visible feature of the finished locomotive and has to be right.

First, I made a tight fitting wooden plug with a tapered shape to match the interior of the casting. This was hammered in and was very firm because of the rough interior of the casting. I then attached a drive spigot to one end of the wooden plug and made a brass cap with a deep centre hole that was screwed to the other end. This allowed



Exhaust pipework.

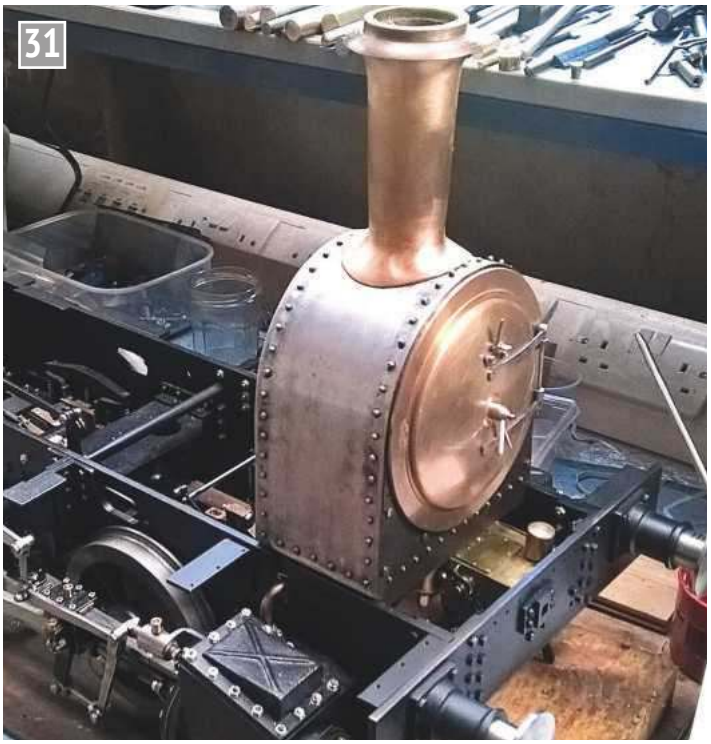
me to mount the casting on the lathe and machine most of the chimney to a smooth round finish. Of course, the saddle at the bottom of the chimney cannot be machined as it is a complex curve and not at all round in cross section. To compound the problem, this was where much of the casting excess was.

Not having any CNC equipment I had no alternative at this stage but to work the saddle freehand. Horrible as it sounds, I started with an angle grinder and carefully cut away the excess bronze until the shape looked more or less right. After that I went at it with a Dremel type mini-grinder. It took ages but I got it close to what looked right.

Now came the important step of cutting the saddle to perfectly match the diameter of the top of the smokebox – which was now slightly larger than 3 inches radius due to the addition of the metal plate. I am not sure of the correct way to do this but what I did was to make a cutter tool by attaching a metal bar to a blank MT3 arbor and then attaching a fly-cutter to the end of the bar. I then mounted the chimney horizontally in the milling machine and slowly took cuts with the rotating cutter working from top to bottom. This is shown in photo 30.

I was not happy about this approach – it felt wrong because the fly cutter blade is not cutting in its intended

Fly cutting the base of the chimney.



A complete smokebox.

>>

plane and the chimney required a lot of extra support (see wedge behind the chimney in photo 30). However, by going carefully I was able to make a satisfactory cut and, in the end, I was very pleased with the fit onto the completed smokebox, as shown in **photo 31**.

Painting

I said at the start of this series that, with the hope that comes from inexperience, I thought I could complete the engine in a year. Fifteen months later I had only just completed the chassis and winter was setting in. My workshop is not heated so I thought it would be a good time to do some painting indoors. I have a very tolerant family and was able to convert our spare room into a spray room by hanging sheets from the roof all around.

Then, of course, I had to dismantle the chassis down to every nut and bolt and begin the process of cleaning, priming and painting, followed by reassembly. I had obtained and read *The Finishing Touch* from Phoenix Paints and now understood the importance of thorough cleaning.

I sprayed most parts with black acid-etch primer, hanging larger parts from the ceiling like slabs of meat at the butcher's. Finally, I sprayed with satin black automobile top coat.

The exception to this approach was with the smokebox and cylinders. I figured that the ideal paint for the smokebox would be the black paint used for wood-burning stoves. That ought to handle the heat, right? This was really expensive and required that the part be held at 250 degrees C after drying to cure the paint. One problem though was that it was too thick to spray and I had no idea what thinner would be needed. So, I just painted it on with a brush. The finish was very disappointing, faithfully retaining all brush strokes.

But there was worse to come. After I had baked the smokebox to cure the paint, it cooled and simply fell off! It turned out that the paint would not adhere to the galvanised metal I had used for the smokebox outer shell. Of course, it didn't all fall off but stuck firm in globs around the rivets! Much work ensued to clean off the paint with a wire brush and various tools. Photograph 31 shows the smokebox after removing the paint and shadows can still be seen. I will say that the paint stuck beautifully to the cast iron cylinders – a surface it was of course designed for. In the end, after more research I elected to use a spray can of 'barbecue paint' from B&Q which went on nicely and, I hope, will take the heat.

Running on air and next steps

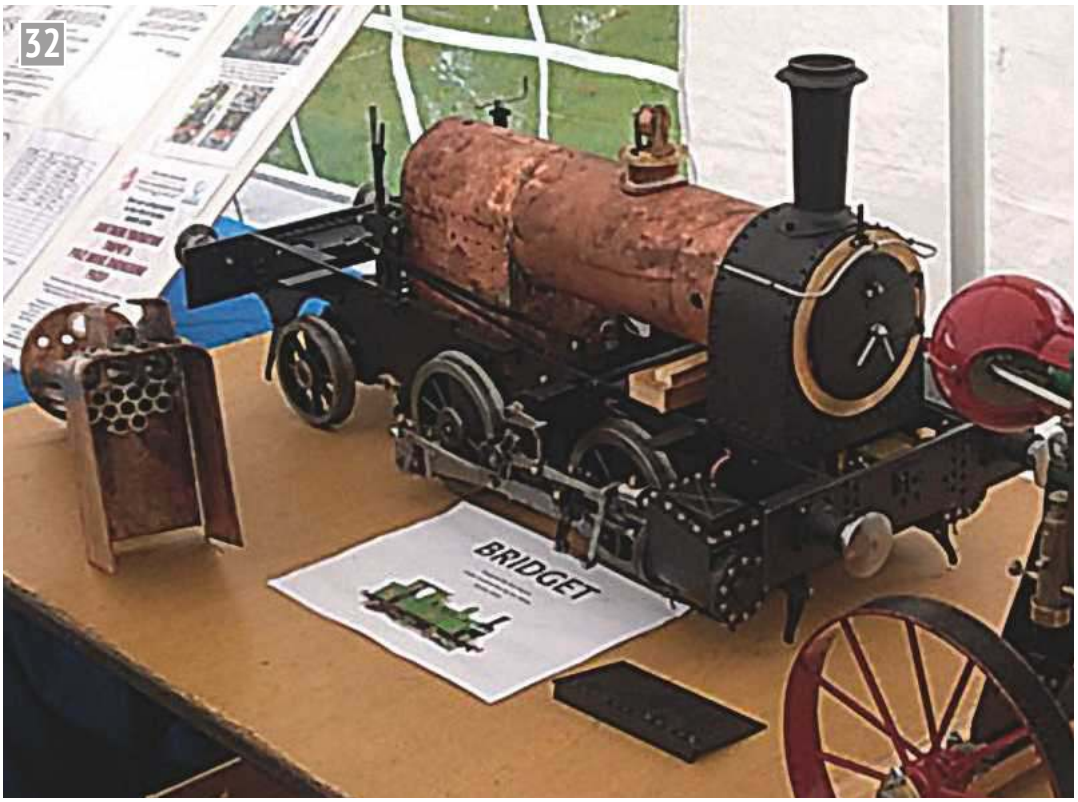
Finally, the day came to try connecting compressed air and see if the engine would turn over. I made final adjustments to the valve positions and hooked up the compressor. I was pleased to see that it did indeed turn over, both forward and reverse. It was lumpy and I made adjustments to the crosshead to get things smoother but it still jolted the bench at end rotation. In the end I found that one of the piston rods (which were not yet pinned) had rotated on its thread, moving the piston forward to collide with the cylinder end cap. *Ugh* – but no damage as far as I can determine. After adjusting the rod (and pinning) I had it running pretty smoothly and on a fairly low pressure. It was a good day!

Early on in the project I decided I wanted to make the boiler myself because the lead time for a professional boiler was so long. I am working hard on the boiler now – and it is very hard. For the first time I have questioned whether I will actually be able to do it but I press on. The irony is that in the time it has taken I probably could have had two professional builds completed. There's a lesson learnt. However, the whole project is about learning lessons – otherwise what is the point?

> I almost dread the day when the locomotive will be finished but then I think of the enormous satisfaction that will come from seeing this creation proudly making its way around the track.

In the past few years I have learned many new skills, solved many hard problems and, time after time, gone to bed happy after completing some little piece and making a step forward. I almost dread the day when the locomotive will be finished but then I think of the enormous satisfaction that will come from seeing this creation proudly making its way around the track.

This summer, as a member of Cambridge Model Engineering Society, I displayed the part completed locomotive at the Southern Federation rally, as seen in **photo 32**. Our Editor, Martin Evans (MkII), spotted the exhibit and suggested I write a short article. I have done my best but, like the project itself, it is not short! ME



The chassis, as shown at the Southern Federation rally, 2018.

Backyard Foundry Techniques

Part 2: Pattern Making

Luker describes how to set up and use your own backyard foundry.

Continued from p.785
M.E. 4626, 8 November 2019

Some misconceptions put to bed

Unfortunately, I have read and heard many fairy tales with regard to casting over the years. Casting is not a black art, it's an exact science and if it's tackled as such the end result will be something special.

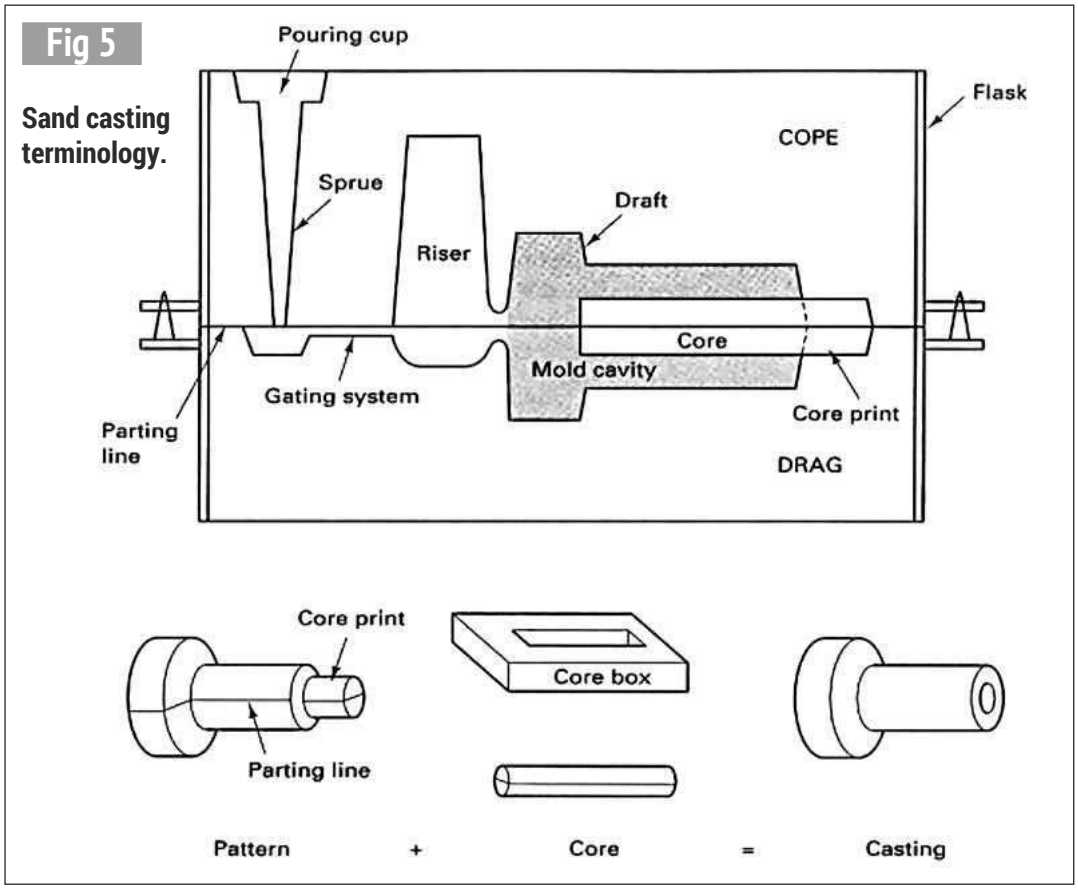
Some things are worth being pedantic about like designing suitable risers while others can be ignored with our size of castings, like shrinkage allowance. Some would argue that risers aren't required and this misconception comes from modern industrial cast iron foundry techniques. For our green sand moulds the expansion phase in cast iron will not be constrained like with the modern phenolic systems (effectively pressurising the mould negating the need for risers). We most certainly do need proper risers, depending on the part being cast.

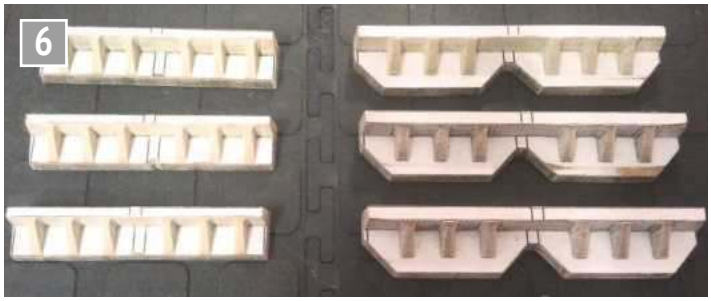
Don't think that because you're casting in your back yard using sand moulds it's not possible to get highly detailed castings with a good surface finish that will add to the aesthetics of any fine model. When a manager at an investment foundry that I do consulting for saw one of my valve handles he refused to believe it was a green sand type casting.

As with most technical fields casting is riddled with technical parlance to try make the subject more complicated for the novice. To make life a little easier the common terminology is shown in the sketch (**fig 5**).

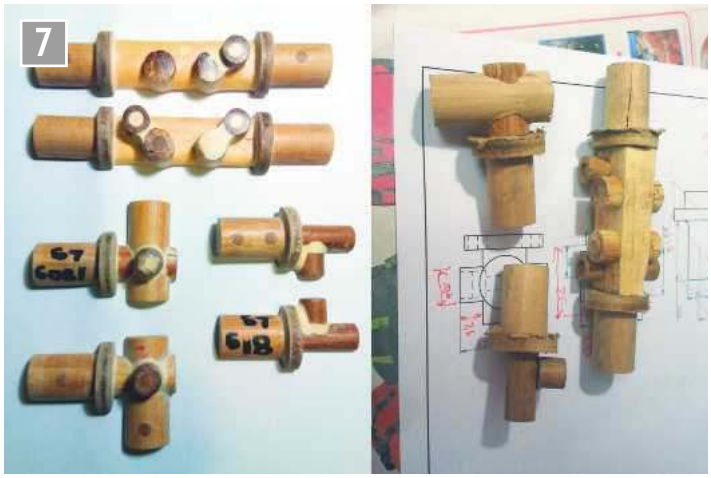
Fig 5

Sand casting terminology.





Wooden hornblock patterns.



Built up steam valve patterns.

Making patterns from wood

The patterns I've made from wood are by no means works of art. I've seen some modellers make polished/veneered patterns that would make a nice desk clock after use. If that's the final resting place for the pattern, by all means, but I make my patterns good enough for ramming the moulds and no more.

All patterns need to come out of the sand cleanly without breaking the sand. This is accomplished by adding a draft angle to the pattern. Before anything is made you need to have a look at how the pattern should be split and the draft angles applied. Typically, I use between 3-5 degrees for my castings with the lower end of the range for shallow sections. As the pattern goes deeper into the sand the greater the draft angle should become. You also need to add some machining allowance on all the machined surfaces and I normally add around 1mm.

Most of my wooden patterns are made from press board found on the side of the road (**photo 6**). I build up the patterns using layers, cutting them with a scroll saw set at the correct draft angle and then gluing them together with any cold wood glue. To make life a little easier I print out a sketch of the pattern, to scale, and stick it to the wood. Any final finishing is done by hand sanding or on my machines, vacuuming the dust up as I go to prevent the slides getting gunged up with wood dust.

Pretty much any shape can be made by breaking it into simple geometries and connecting everything up with dowels and glue (**photo 7**). Don't use screws as it is generally worthwhile to split patterns; it makes ramming a little easier. Avoid sharp corners as they create hot tears or draws when casting. Any corners can be filled with auto body filler and smoothed to the required shape.

Once the general geometry has been made dowel holes can be drilled through the pattern and the pattern can be cut in half using a thin junior saw blade. It is possible to mould an un-split pattern if you're not keen on cutting through your work of art but it does make moulding a little more difficult. I'll explain how to do this in the moulding section.

If you use press wood you need to seal the wood with a sanding sealer to prevent the moisture from the sand damaging your patterns. All patterns need to be sanded down to a smooth finish to aid in getting the patterns out the sand.

The patterns don't necessarily need to look anything like the end product - feel free to add any hold points you might need to help with machining later on. The final steam valves looked nothing like their patterns; with the combined clack and steam valve the left-hand and right-hand sides were combined in the same pattern.

Steam brake valve and injector combination valve.

You could argue that these steam valves could have been built up (**photo 8**) but I wanted them in a good quality tin bronze with no zinc and I had no intention of selling a kidney for the material. But more on mixing metals later…

Making patterns using 3D printing

The availability and cost reduction of 3D printers makes them a viable and cheap alternative to wooden patterns (**photo 9**). I bought an inexpensive 'some assembly and redesign required' 3D printer that has paid for itself many times over. The patterns themselves work out very cheaply and the detail that can be added is impressive.

I use ABS as a printing medium; it's cheap and with the scrap plastic, inevitable from 3D printing, ABS glue and filler can be made. By mixing the scrap ABS with acetone, available from most paint stores, different densities of glues and fillers can be mixed by placing the scrap and acetone in a sealed glass container and leaving it overnight allowing the acetone to fully melt the ABS. The glue is a little difficult to work with in warmer climates; it tends to skin very quickly. This can be overcome by using a syringe to apply the glue exactly where needed (**photo 10**).

3D printing requires a 3D CAD package and there are a number of free programs available, with most of them able to write the required printing output files. The 3D printing software is also free to download.

After drawing up the pattern you need to add a shrinkage allowance for the printing. Typically, 2% will work and while you are at it you could just as well add the correct shrinkage allowance for the metal you are planning on casting. **Table 1** gives some guidance on how much allowance you should add. The values are very generic but I have found they give good results. Bear in mind that 2%

Table 1 Shrinkage allowances	
Material	**Shrinkage allowance in pattern design**
Aluminium	1.3%
Tin bronze	1.5-1.8%
Yellow brass	2.0%
Leaded yellow brass	1.5-1.8%
Aluminium bronze	1.6%
Cast iron	0%

of a 100mm component is only 2mm. The shrinkage allowance for cast iron varies depending on how you mix it but for the grade I make I have found very little shrinkage. Even my large Stirling 7¼ inch gauge wheel came out very close to the pattern size.

With 3D printed patterns remember that you can't 'air print' so you need support for each subsequent layer, with the top layer invariably the best. This will mean that some patterns will be split even though they will be a non-split pattern. Where possible try to print the pattern without a bottom layer. This prevents the shrinkage from the solid layer on the printing bed pulling in, destroying the draft angle you need for casting. A good example is a solid wheel; the one in the picture (**photo 11**) is for a 5 inch gauge Ballaarat 0-4-0 which I'm busy designing and building.

For those model engineers sold on buying a 3D printer, here's some tips. Cover the heat bed with glass; the thinnest you can find and make sure it doesn't extend over the edge. Use crocodile paper clamps to hold it in place. Print using the raft setting as a base; it improves the final dimensions and printing without a bottom layer will be easier. Use hair spray to get the print to stick to the glass on a heated bed. Make an encasing around the bed for printing ABS or put the printer in a cupboard.

As with their wooden counterparts, 3D patterns need to be sanded down to smooth the printing layers. I would not recommend fume polishing or painting over the patterns with acetone as this melts the ABS and you'll lose some of the detail. You'll also have less control and you could end up destroying the prints.

Patterns in general

With all split patterns you need to have dowels aligning the two halves. These dowels need to locate only and should release easily when the casting boxes are split. If the dowels stick you're likely to damage the sand imprints.

3D printed pattern and casting.

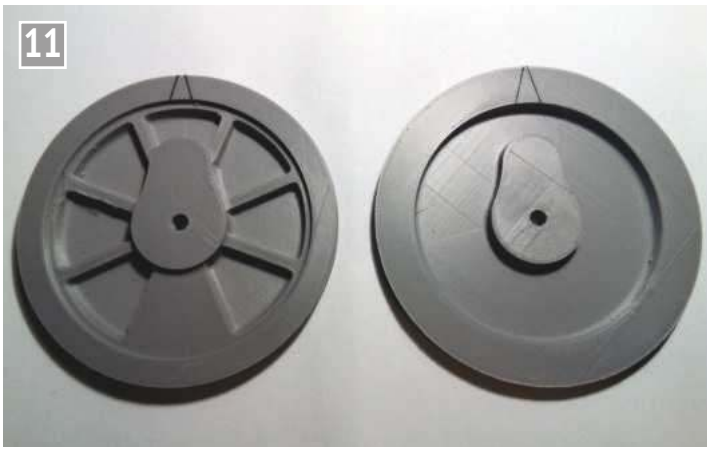
You also need to be able to lift the patterns out of the sand. With the wooden patterns I just drill a small hole into the back and use two picture frame hooks to lift the patterns free but with the ABS patterns you would need to print dedicated holes that can be tapped later. I have found two or so M3 screws will lift most patterns out.

If the final component requires a core the pattern will need core prints. The prints should stick out 1x the core diameter and the sand mould split line will need to be through the centre of the core so that it can be properly fitted in the sand. Including proper cores drastically improves the casting by decreasing the molten metal volume - which brings us to risers and riser design.

Risers

I use the bottle (modified for model engineering castings) type riser as they are easy to make and come out of the sand very easily (**photo 12**).

Gluing the halves of patterns together.



Ballaarat wheels.

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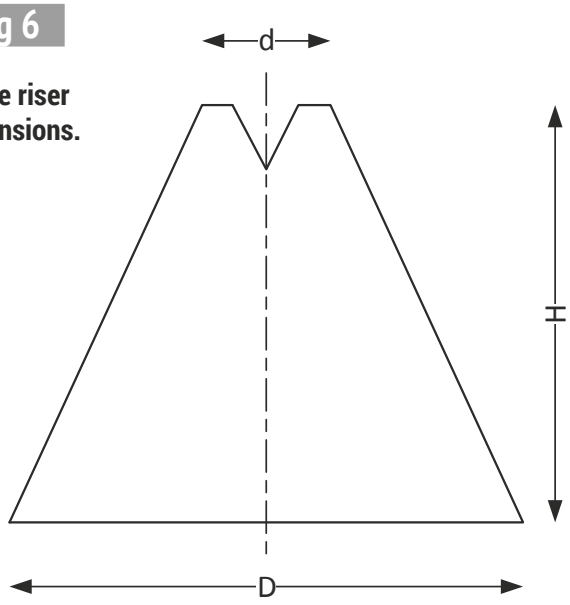
Fig 6

Bottle riser dimensions.



Bottle risers.

It's a blind riser meaning it is completely covered with sand, with only the breather holes extending to the top of the moulds.

The problem with casting is simple; as the molten material cools the last bit to solidify will have nowhere to shrink to, creating the dreaded blow hole or casting cavity. The idea of the riser is to feed this volume as it shrinks, preventing a cavity. With this in mind, the design of the riser must be such that the riser stays molten longer than the section of the casting it's feeding.

The heat loss is from the surface of the casting into the sand so if we take the volume of the casting and divide it by the surface area we have a number (let's call it a 'casting modulus') that describes the heat loss area in terms of the casting volume. All we need then is to make sure the riser is designed with this ratio in mind making sure it doesn't freeze prematurely:

Casting modulus(μ) = V/A
where
V = Part (section) volume
A = Part (section) surface area

In my castings I have found that all components with a casting modulus above 2mm required a riser. Below this the casting can be fed directly from the ingate. When working out the surface areas of cored castings the core will not always remove the same heat as the outside surfaces. If the core has a volume of less than a third of the casting the core surface can be neglected. Anything between ⅓ and ⅔ assume 50% and greater than ⅔ the entire surface needs to be included.

I compiled a lookup table based on my calculations to aid in designing the risers (**photo 13**). This will be more than sufficient for most model engineering applications. All that is required is to find the closest weight of the casting section, work out the modulus and read off the bottom riser

d (mm)	5	5	5	6	6	6	8	8	8	10	10	10	12	12	12
13 Casting modulus μ(mm)	D (mm)	H(mm)	Max section weight (g)	D (mm)	H(mm)	Max section weight (g)	D (mm)	H(mm)	Max section weight (g)	D (mm)	H(mm)	Max section weight (g)	D (mm)	H(mm)	Max section weight (g)
2	13	32.5	116	14	42	217	16	64	587	18	90	1290	20	120	2477
2.2	13.8	34.5	124	14.8	44.4	229	16.8	67.2	616	18.8	94	1347	20.8	124.8	2576
2.4	14.6	36.5	131	15.6	46.8	241	17.6	70.4	646	19.6	98	1405	21.6	129.6	2675
2.6	15.4	38.5	138	16.4	49.2	254	18.4	73.6	675	20.4	102	1462	22.4	134.4	2774
2.8	16.2	40.5	145	17.2	51.6	266	19.2	76.8	705	21.2	106	1519	23.2	139.2	2873
3	17	42.5	152	18	54	279	20	80	734	22	110	1577	24	144	2972
3.2	17.8	44.5	159	18.8	56.4	291	20.8	83.2	763	22.8	114	1634	24.8	148.8	3071
3.4	18.6	46.5	167	19.6	58.8	303	21.6	86.4	793	23.6	118	1691	25.6	153.6	3170
3.6	19.4	48.5	174	20.4	61.2	316	22.4	89.6	822	24.4	122	1749	26.4	158.4	3269
3.8	20.2	50.5	181	21.2	63.6	328	23.2	92.8	851	25.2	126	1806	27.2	163.2	3368
4	21	52.5	188	22	66	341	24	96	881	26	130	1863	28	168	3468
4.2	21.8	54.5	195	22.8	68.4	353	24.8	99.2	910	26.8	134	1921	28.8	172.8	3567
4.4	22.6	56.5	202	23.6	70.8	365	25.6	102.4	939	27.6	138	1978	29.6	177.6	3666
4.6	23.4	58.5	210	24.4	73.2	378	26.4	105.6	969	28.4	142	2035	30.4	182.4	3765
4.8	24.2	60.5	217	25.2	75.6	390	27.2	108.8	998	29.2	146	2093	31.2	187.2	3864
5	25	62.5	224	26	78	402	28	112	1027	30	150	2150	32	192	3963
5.2	25.8	64.5	231	26.8	80.4	415	28.8	115.2	1057	30.8	154	2207	32.8	196.8	4062
5.4	26.6	66.5	238	27.6	82.8	427	29.6	118.4	1086	31.6	158	2265	33.6	201.6	4161
5.6	27.4	68.5	245	28.4	85.2	440	30.4	121.6	1115	32.4	162	2322	34.4	206.4	4260
5.8	28.2	70.5	253	29.2	87.6	452	31.2	124.8	1145	33.2	166	2379	35.2	211.2	4359
6	29	72.5	260	30	90	464	32	128	1174	34	170	2437	36	216	4458

Riser design table.

Risers doing the job.

diameter (D), top diameter (d) and height (H). It sounds complicated but if you break the casting down into simple shapes and volumes it's easy. Also, you don't need to calculate the casting modulus for the whole part. When I cast wheels, for example, I work out the casting modulus for the hub and the balancing weight and I put two different risers to feed those sections of the mould; the spokes don't need to be risered.

The base of the riser needs to be at least as high as the top of the pattern in the mould. Typically, with a two part split pattern I place the riser directly on the section I want to feed and just grind it away afterwards. If you want to put the riser on the mould split line you would need to prop the riser up so that the base of the riser aligns with the top of the pattern by extending the base of the cone.

Wheels properly risered with no defects.

The notch at the top of the riser is important but the size isn't critical. It's there to promote piping through the riser, which just improves the feeding. If the risering is done properly the final shrinkage cavity will be in the riser and the entire cast component will be clear of any defects (**photos 14** and **15**).

You may have noticed I left out sizing the ingates, pouring funnel (sprue) etc. Normally I do these in the sand moulds and typically I size them based on the size of the component and where I feed, so this will be included in the next section - sand moulding...

●To be continued.

PART 3

Brill 22E Tram Truck

Ashley Best describes an American design of tram truck that was widely used on British trams.

Continued from p.717
M.E. 4625, 8 November 2019

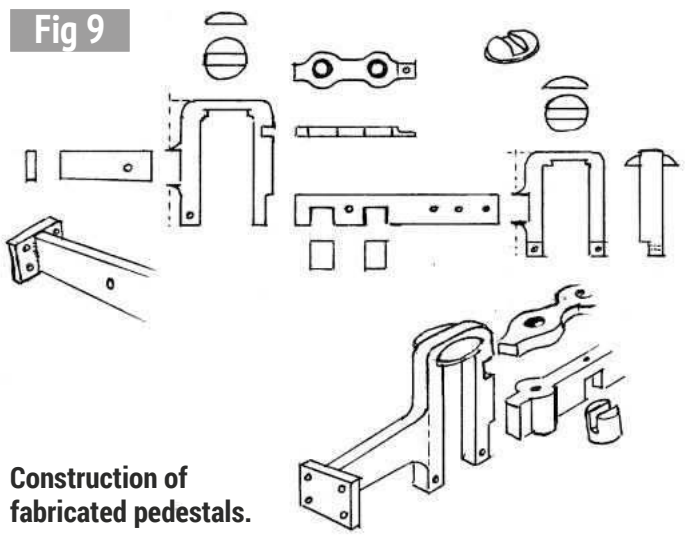
The typical British electric tramcar had become established early in the 20th century. Mostly they were double deckers on either four wheel single trucks or, for larger cars, a pair of four wheel bogie trucks. It is interesting to note that most of these trucks were American designs. Britain was only later to develop its own successful truck types. Of the makers that supplied these early trucks, the most successful was the Brill Company of Philadelphia. Their two most prolific products for the British market were the 21E four-wheel truck and the 22E maximum traction truck for eight-wheel cars. This latter design forms the subject of this article.

Typical trams.

Side frames

The Brill catalogues offered truck frames as either cast or solid forged and recommended the latter as a superior product. These cannot have been easy to make and how it was done would indeed be interesting. At that point, the Brill Company was clearly and rightly proud of their ability to do this. In model form it would no doubt be possible to mill the entire frame from the solid and I have been so advised. However, apart from the need for a good milling machine and necessary skills, there is the issue of waste to consider. My preferred method has been fabrication. Even here there can be several approaches, but all require the use of silver solder to join a number of parts. I made mine as can be seen in the photographs and sketches by using 3mm brass flat bar of suitable sections, filed and milled to size. First, with the aid of a hacksaw and a piercing saw, I cut the four pedestals required for one truck (two side frames). These were cut as shown in **fig 9**. Note the recesses for effecting non-slip joints. Of course this can be avoided if you have enough confidence in your soldering skills, but better safe than sorry. This joined the main horizontal bars to the pedestals with high melting point solder. The remaining joints could have

Fig 9



Construction of fabricated pedestals.

Source for motors, gears, castings and plans:
Model Engineering Secretary,
Tramway & Light Railway Society,
9, Manor Close,
Bognor Regis,
West Sussex
PO22 7PN
Or e-mail: **tlrs.mesecretary@tramwayinfo.com**

used a lower melting point solder but I didn't find this necessary. The top bar for the main body support springs was fabricated with high melt silver solder as shown in **photo 16** and the lower side frame bar is thickened where the spring post guide holes are drilled through. Fitting the already drilled top bar (**photo 17**) was tricky and required a careful set-up on the hearth. All measurements and fitting had to be done with great care and frequent checking as alignments were critical. The front end of each side frame had to have a flange for bolting to the cross beam. This was done as shown in **photo 18** by standing the frame on end and silver soldering the flange in place. Axle box spring support caps on the pedestal tops were fitted last of all. These can be attached with silver solder or with soft solder. I used silver solder as it is more robust and stands up better to subsequent filing.

Spring post top bar.

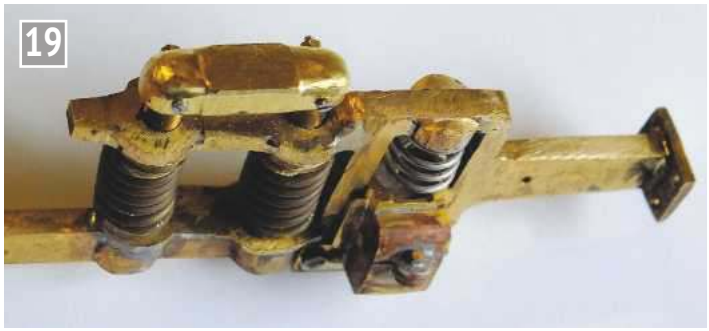
Side frames.

Spring posts

The spring post assembly has, on each side frame, the top bar with large diameter holes aligned exactly with the small diameter holes in the lower frame. **Figure 10** shows the way it all works. The double springs are surmounted by a rubbing plate which supports the weight of the car body and can slide in the curved side bearing fixed to the car body. These rubbing plates (**fig 11**) proved difficult to make. In the end, I fabricated the set of four – for both trucks – having toyed with and rejected the idea of casting them. Making them involved a lot of shaping with files. To fix the items onto the tops of the spring posts needed them to be cross-drilled and held by 14BA bolts. See **photo 19** and refer again to fig 11. This allows a limited flexibility should the tram run over less than perfect track. There is room here for a simplified approach as the rubbing/bearing plate is invisible on a finished tramcar. I put it on my trucks in the interests of accuracy. In the absence of a kingpin, this rubbing or side bearing plate fulfils the function of aligning the truck as it runs in the curved channel guide attached to the underside of the car body.

The springs required spring cups top and bottom to keep them aligned accurately. On the model these are shown in **photo 20** and the function in **photo 21**. The bottom end of each post had a drilled 1/32 inch diameter hole to accommodate a split pin retainer. As can be seen, the posts were made double-ended and cut to size later (**photo 22**).

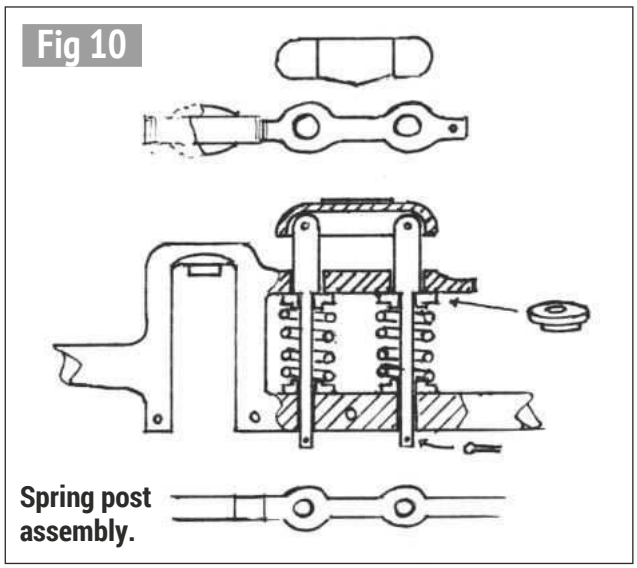
Front flanges.



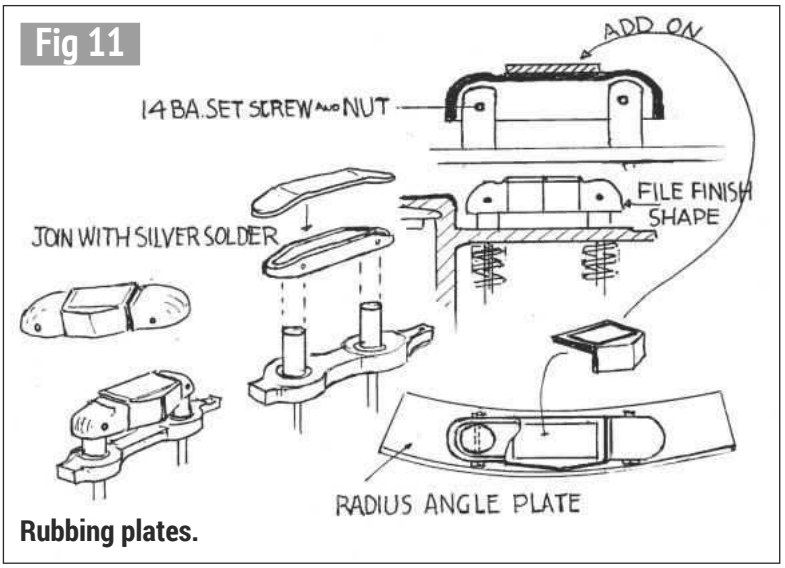
Rubbing plates.

Springing

I have made three other tram models with 22E trucks and found it difficult to get realistic springing. The body springs on a model in this scale really do not need to be too soft as most



Spring post assembly.

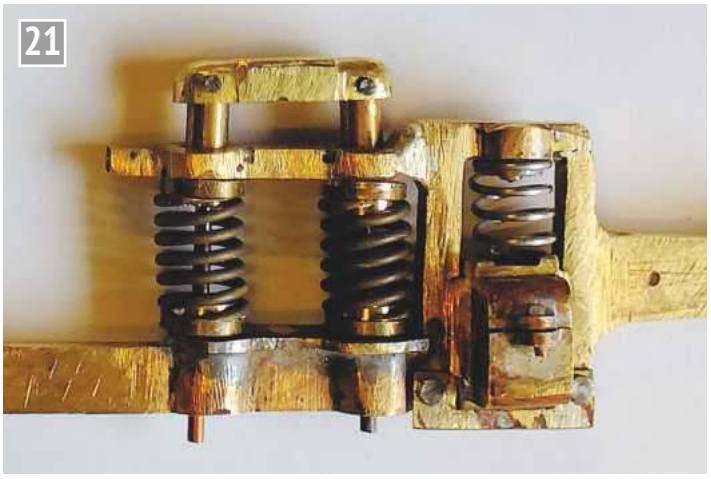


Rubbing plates.

of the springing that matters is in the wheel/ axle box springs which do have to work properly - but again not too soft. I decided some time ago that the body springs should look right but didn't have to have more than the minimum flexibility and so, for this 22E truck I wound the springs from wire that was of more or less the correct appearance but of low flexibility. There is however, limited, but sufficient movement. **Photograph 23** shows how these springs appear. The axle box springs act as primary springs to fulfil most of the suspension requirements. To keep them in alignment, the top of the axle box has a recess into which the spring fits. At the pedestal top a short stub to the internal spring diameter is soft soldered in place (**fig 12**).

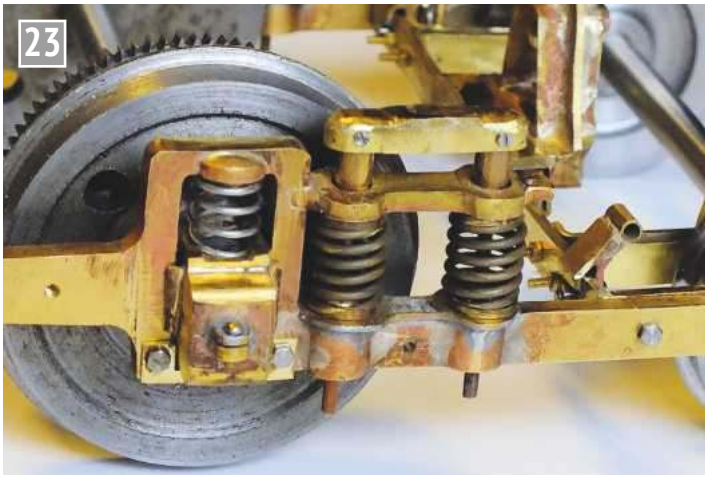
With the side frames close to being finished and just the additional small details of pilot board bracket and the motor beam support post to be added, I decided on the next stage. This is where different methods of construction became possible. I chose to make and fit the axle boxes as I realised that this would make possible easy fitting of the wheel-sets into the side frames for testing.

Springs and cups.



Springs.

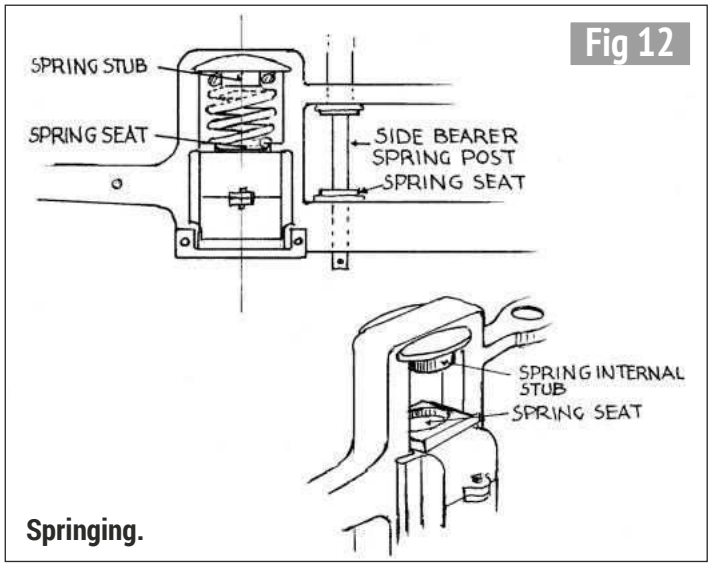
Spring posts.



Posts in use.

Axle boxes

It is in the making of axle boxes that major alternative methods become apparent. Over the years, I have tried and successfully produced axle boxes using different construction techniques. Obviously the type adopted should be chosen to suit individual preference.



Springing.

The boxes I now make are fabricated from brass and are not difficult to produce. They are designed, exactly as in the prototype, to accommodate an oil soaked pad in a hollow end to keep the axle well-lubricated for a considerable time. This, in the model avoids the need to apply oil externally which can be a bit messy. The construction is illustrated in **fig 13**. All the jointing can be done with a single grade of silver solder, but is perhaps a little less nerve-wracking with high and low temperature grades. The first requirement is a brass block a little thicker than the pedestal. This forms the running surface of the axle box as it moves up and down. This block is then laid onto one, not both, of the flanges that will act as keepers to maintain alignment. After soldering, the block and flange are drilled through to axle diameter. Only then can the second flange be soldered and, guided by the initial hole, drilled through.

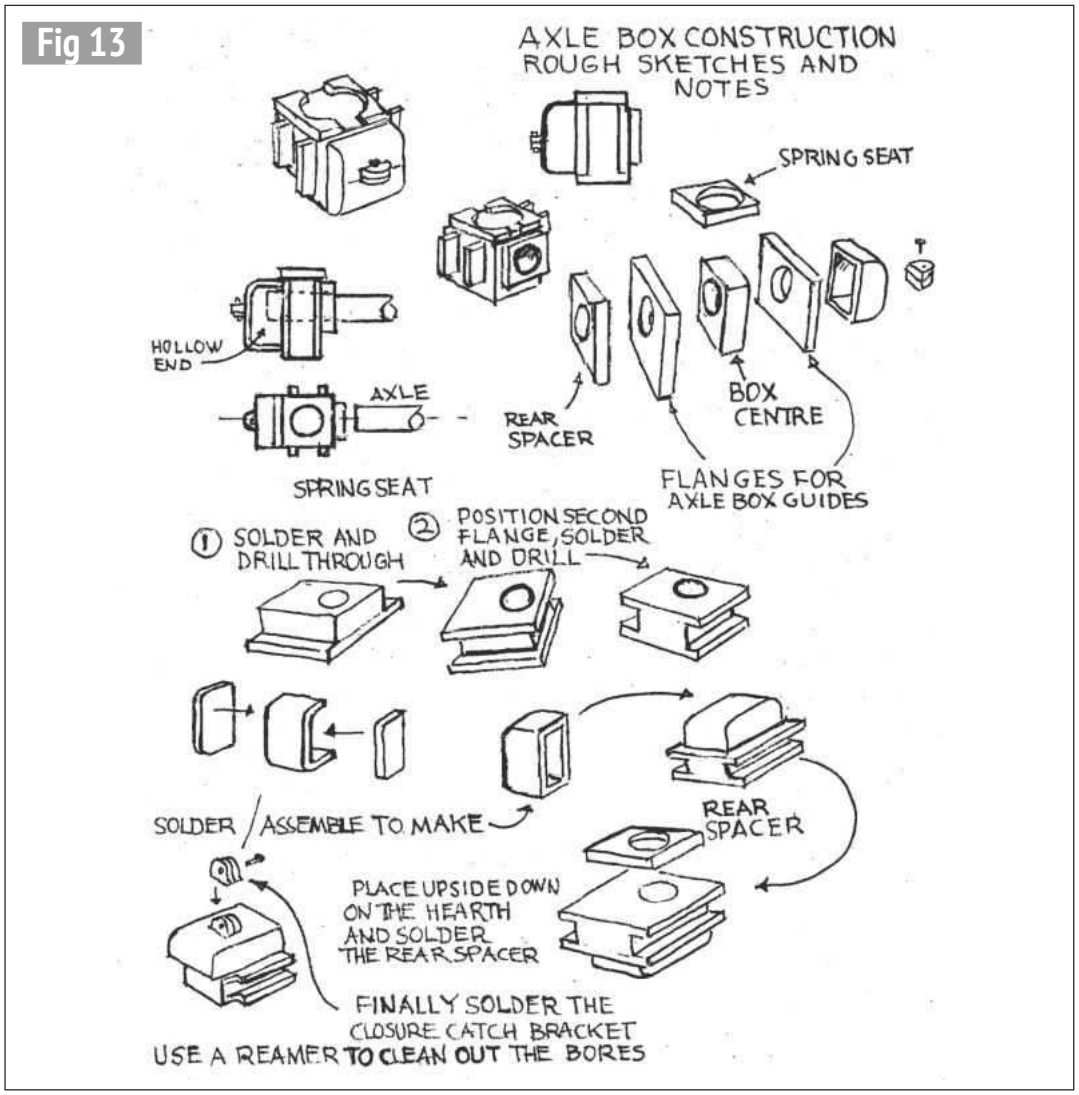
This helps to ensure an accurate bore. I realise that both flanges could be soldered and then the whole assembly drilled through, but the method described really does ensure accuracy. Test fitting in the pedestal is then possible and, if necessary, a bit of filing can effect adjustment (**photo 24**). A thickened spacer plate or washer with an oversize hole can be soldered on the rear at this stage.

The front and visible part of the box is tackled next. It consists of a profiled front and silver soldered sides. I made a very simple jig (**fig 14**) to make sure all the profiles were the same. This could probably be achieved by careful use of pliers and a hammer, but the jig ensured accuracy (**photo 25**). The sides were then soldered in place. I used slightly oversized plates for

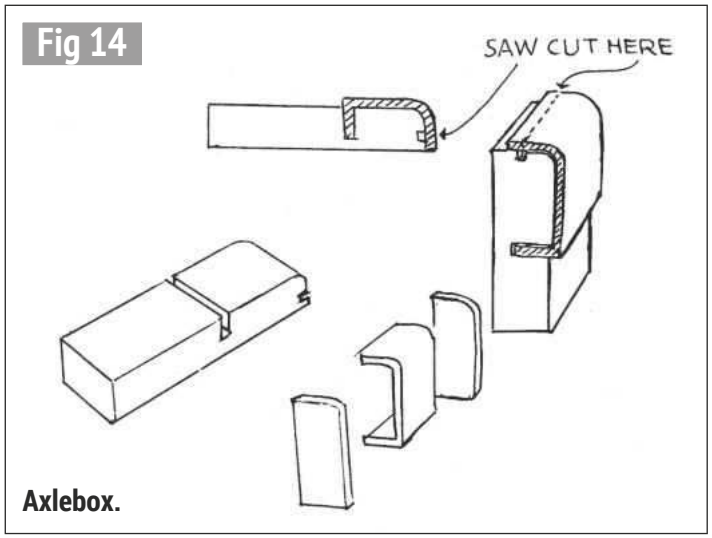
Test fitting.

this which then allowed the parts to be filed exactly to the right shape. All this is clear in the illustration. The hollow front part can be soldered onto the flanged centre when perhaps a low melting point solder might be preferred. I didn't find it necessary. The final application is the catch for the lid of the box. Brill used a large number of different systems – some with a catch each side and others with a single catch as I used on this model. Both types are acceptable but it is easier to fit the single type. It was filed to form a D-section and simply soldered on the front of the box. This is one place where soft solder could be used but better with silver solder. When all is finished, the box will certainly require to be reamed or have a milling cutter or D-bit run through to get a good fit on the axle. One small but important 'extra' was a fine piercing saw cut across and through the catch and the front of the box to simulate the join between lid and body. This is shown in **fig 15**.

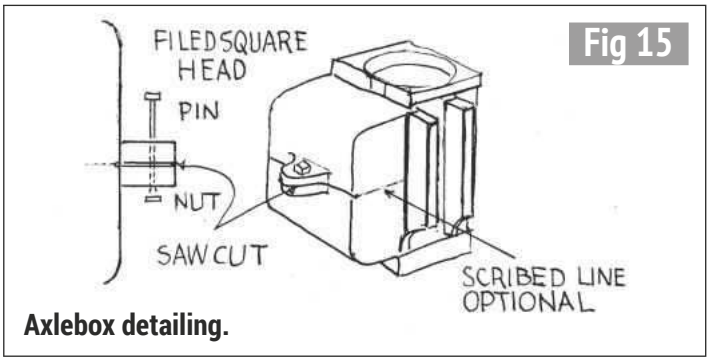
●To be continued.



Jig.



Axlebox.



Axlebox detailing.

Beam Engine

Dear Martin,
I have been following David Haythornwaite's article on building this model with interest, so much so, that I decided to build one myself and ordered a kit from A. J. Reeves on Monday morning and surprisingly it arrived Tuesday lunch time - this compared with David's delivery of three weeks.
I was very impressed with the drawing package but as with David I will be converting the fractions to decimal and maybe the fastenings to metric. The castings were all well-made with no distortions or rust. I am well pleased - I just need to finish the twin launch engine I started in 1987! It's been on the back burner since then.
Barry Milliner (Aberdeen)

US/UK Lexicon

Dear Martin,
I was amused to see the variety of reactions to my brief dictionary of engineering terms British and American.
The diversity of reactions to the article makes it clear that there is a need for an explanation of some of our common terms and indeed that the correspondence between them is not simple and depends on context. For example, the gun metal/red brass correspondence I had in mind was for castings for models. Mr. Bauer chose to consider the use of the metal as a bearing material, where the whole correspondence differs. Similarly, I defined a Tufnol-Bakelite correspondence based on applications of the material, while Mr. Hockin defined it based on their composition, independent of application.
I am prepared to admit that some of the 'translations' I noted might be in error, or could use additional clarification, but again, I say that this points out that there really is a need to define these correspondences.
As two countries separated by a common language, we continually need to keep our terms straight - a challenge that is hard enough within a single dialect. Thank you to all those, *pro* and *con*, who found enough interest in the article to write and comment about it.
G. P. Widin

Midlands Show

Hi Martin,
In your latest *Model Engineer* editorial you refer to MMEX, as the Midlands Model Engineering Exhibition could be called. Whilst there is no problem with this it could cause confusion. MMEX has been the Manchester Model Engineering Exhibition for the last four years. The website mmex.co.uk is that of the Manchester exhibition, sponsored by the Northern Association of Model Engineers (NAME).
Whilst I am writing to you I would like to tell you that at the October NAME delegate meeting it was decided that the Association would sponsor an exhibition in the South West in spring 2021. As this would be close to the next Manchester exhibition it was decided to put that back to February 2022, subject to getting volunteers for the organising group.
Regards, Bob Hayter (Chairman, MMEX organising group)

Track Construction

Dear Martin,
As a retired chartered civil engineer with some knowledge of concrete mix design I was very interested to read, in recent issues of *Model Engineer*, about Stephen Wessel's research into, and practical application of, the use of concrete for sleepers for his ground level miniature railway. His methods are to be commended and should be of particular interest to clubs engaged in the building or relaying of long lengths of ground level track with an objective of long life and minimal maintenance. For such situations, the use of concrete looks to be an economical alternative to the increasingly common use of recycled plastic. However, as Mr Wessel acknowledges, the manufacture of concrete sleepers is rather more involved than sourcing timber or plastic sleepers, and this will probably deter most builders of small garden railways. Fortunately, timber sleepers remain a cost effective and serviceable option for such a builder.
My own 5 inch gauge garden railway includes about 40 metres of ground level track, comprising 16mm aluminium rail on hardwood sleepers. Twenty years after they were installed, the sleepers are beginning to show signs of needing replacement, especially in the shady side of the garden where moss is a perennial problem. Contrariwise, the softwood sleepers (ex 38mm x 19mm tiling batten) of the elevated section, built at the same time, show no significant deterioration.
My own experience is that screwing timber sleepers down to a concrete bed below the track is not necessary. I do agree that heavier sleepers can only be beneficial to the stability of ground level track, especially on curves, but I have found very little need for fettling of my track which is laid on 50mm of 10mm limestone ballast on a minimum of 150mm of free draining hardcore on a mainly clay subgrade. Containment of the ballast up to the top of sleeper level by concrete block kerbs on either side of the track undoubtedly helps to maintain lateral alignment. Of course, my track is comparatively lightly used and the only passenger is the driver – so axle loads are generally low, which aids the maintenance of vertical alignment.
I expect to get 30 years' life out of the railway, with essentially single handed maintenance, before advancing years necessitate that it is dismantled. I suspect that few garden railways last much longer.
Best regards, Jeremy Buck

Write to us

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Responses to published letters are forwarded as appropriate.

Locomotive Oddity

Dear Martin,
Please can any reader of *Model Engineer* suggest reasons why the GER J65 class, designed as a 0-6-0, often ran with the front half of the connecting rods removed as a 2-4-0? I'm starting my model engineering activities by assembling a kit J65, chosen because I'm from Suffolk and the last J65's worked on several docks in East Anglia. Comments about the class, and photographs taken at the time, show that many of these engines ran as 2-4-0s instead of the designed 0-6-0 and I wonder why.

Thank you for your time.
Yours sincerely, Duncan Bell

Content of Model Engineer

Dear Martin,
The latest copy of *Model Engineer* I have to hand to read was No. 4608 which contained comments on content in the magazine. Over the 40 odd years I have been a subscriber I have seen a great variation on content. Back then there were many steam locomotive designs serialised, mainly by the 'other' Martin Evans. I suppose then the majority of model engineers still vividly remembered steam railways and that perhaps naturally was the interest of many because of the times they had lived in.

With the passing of time nostalgia for steam has perhaps diminished somewhat due to the method of railway traction of today. Having said that, I don't seem to remember too many series on the building (in the serialised form of the Martin Evans or LBSC style) on how to build a Diesel or electric outline locomotive. But we do still have the odd steam locomotive being serialised, there is Terry Holland's Barclay tank engine and a new series by Doug Hewson. The only time I have read an LBSC article has been when it was republished in *Model Engineer*. I noticed we moved on a lot with our processes that we have at the disposal today since LBSC's time (thank goodness).

Back then in the 70's and 80's we could read a series on the construction of a traction engine – today the best we get is Chris Gunn's Garrett – or the making of some machine tool or tooling by Arnold Thorp, George Thomas and Professor Chaddock among others.

But I suppose *Model Engineer*'s content is moving with the times we live in with articles now on CNC machining by people like Peter King and Mick Knights and machine tool conversion to CNC operation by Graham Sadler and others over the past few years.

I read every article. Some I like, some not so much and others - to my mind - I find absolutely fascinating like Mike Tilby's treatise on turbines, which takes me back to college days of 40 years ago and the study of fluid mechanics. I really liked the well-researched articles by Ron Isted and the recently concluded series by Dr. Ron Fitzgerald. Although I will never build a model of a tram, I like to read Ashley Best's most fascinating constructional series and the Roger Backhouse articles are to my mind extremely interesting.

Of course, the odd technical article such as water treatment is not only of interest but of immense use if you have a boiler water problem. A left field article is Doug Hewson's on signalling - I had no idea how much model engineering there is in building the 'correct' signalling infrastructure. And I know all about Coventry Dieheads, having spent months using one when I was a first-year apprentice - the article on these bought back 50-year memories.

Another article recently printed was the visit to Snowdon by a locomotive from the Brienzer Rothorn Bahn. I've had the pleasure of travelling twice over about six years on this Abt railway. The first was a work trip and the second when on holidays with my wife on one our several visits to Switzerland. The work trip came about in 2006. The Tasmanian Government owned business enterprise (GBE) responsible to managing the state's forest were at that stage in their life building tourist attractions to entice people into the bush/forests and the wilderness. One such proposal was to build an above ground cable-car called the Maydena Hauler. It was to be about 1km long and to go to the top of a mountain about 1000 metres above sea level where excellent views of Tasmania's world renowned south west wilderness could be viewed. The company I was working for, in conjunction with another local company, won the contract for the track. We were to fabricate the trestles and track panels and the other company were to do the site work construction. Due to one thing and another, the cost of this project was escalating well past the original budget, so it was decided that perhaps we should have a look overseas to see what could be done to claw back the costs and save the project. Hence the visit to Brienz and also Lucerne where we studied the Mt. Pilatus Locher system, among others. In the event, the report we wrote killed off the project even after we had manufactured about 20 plus six-meter track panels.

Rack railways - all Abt systems - are not new to us in Australia with at least three, of which two are still working. One was to a mine in Queensland and is I believe defunct. Another, the Skitube Rack Railway, began operating in the Mt. Kosciusko National

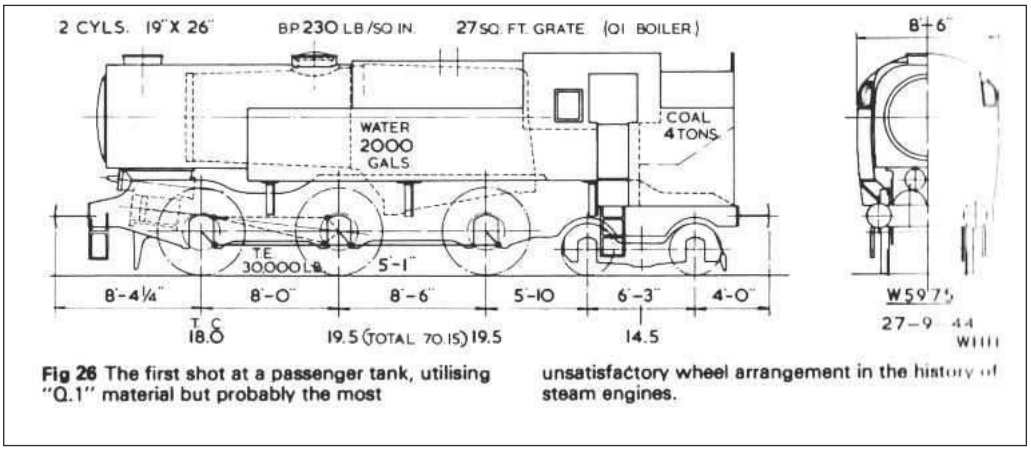


Fig 26 The first shot at a passenger tank, utilising "Q.1" material but probably the most unsatisfactory wheel arrangement in the history of steam engines.

Proposed Q1 tank engine.

Q1 Tank

Dear Martin,
Having just read Nick Feast's reasoning behind his building of a tank locomotive version of the Southern Railway Q1 class locomotive (ME4623, page 573) I thought he, you and *Model Engineer* readers might be interested in seeing a copy of an actual diagram prepared for a proposed full-size version. The original diagram no. W5975 was prepared in Brighton Drawing Office in September 1944. My copy is taken from *Bulleid of the Southern* by H. A. V. Bulleid and published by Ian Allan Ltd. in 1977.
Mike Johns (Taunton)

Park in 1987 and is electric. The third is on Tasmania's wild and wet West Coast and dates from the 1890's. This railway was built to service the Mt. Lyell copper mine at Queenstown with a port at Regatta Point on Macquarie Harbour some 34 km away. The railway had to climb from the Queen River valley at Queenstown over a hill via a 2.2 km rack section at a grade of 1:16 and drop via a 4 km rack section of 1:20 grade into the King River valley and follow the river to its entry into Macquarie Harbour. The railway closed in the early 1960's and fell into disrepair. Mt. Lyell had five quite unique locomotives in that they were rack adhesion 0-4-2 tank engines with four cylinders, two for adhesion and the other two for the rack. Four of the five locomotives went into captivity. The locomotives were built by Dubs in Glasgow and No. 1 (1896) went a museum at Zeehan (near-by), No. 2 (1898) is in the Tasmanian Transport Museum at Glenorchy in Hobart, No 3 (1898) was undercover on display in Queenstown, No 4 (1901) was cut up by Mt. Lyell at some stage (I don't know when) and No. 5 (1938 – North British) was on open display at Menzies Creek on the Puffing Billy line in Victoria.

In 2000 a Federal Government initiative allowed the rebuilding of this railway along with the complete restoration of two of the locomotives, No's 1 and 3. I had the extremely good fortune – because of my so-called steam knowledge - to be taken on by a Hobart local general engineering company to tender for this work, which we won (I stayed with them for the next 16 years before retiring). As for my steam knowledge, it was from all the articles I'd read in *Model Engineer* over the years - I knew reading Martin Evans or Keith Wilson was to come in useful one day. This was a dream job and to be paid for doing it! Nowadays in Australia to get a job like this one would have to live at least two lifetimes if not three!

Our first locomotive, No. 3, took nine months to be completely rebuilt including a new boiler (designed by the Ffestiniog CME). At any one time we had up to six to eight tradesmen working on the locomotive. As the responsible Mechanical Engineer, I had the daily issue of problems to solve along with detail design work to bring the locomotives back to better than original condition. It was a great moment when, in January 2001, Abt No. 3 was delivered on the back of a semi-trailer to the railway, steam was raised and it trundled off down the track on steam trials. No. 1 followed about nine months later and, in 2005, No. 5 was retrieved from Puffing Billy and also received the same rebuild treatment.

About 10 years ago we were approached – because of our steam expertise? – by a trust that had taken over the ownership of a 37-metre timber constructed 194 tonne passenger/cargo riverine trade vessel that had made its maiden voyage on the River Derwent in Hobart on New Year's Day in 1913. Originally powered by a Plenty & Sons 500 HP triple expansion engine, this worn out engine was replaced in 1958 by a World War II left over 160 HP Vivian Diesel engine. The original steam engine was still in existence and it was this the trust wanted us to restore. A long story but to date, as funds have become available, I've designed a new crankshaft (which we built) and the bed casting has been re-machined and the crankshaft fitted. The old crankshaft was beyond economical repair. It had a central runout of over 6mm and the intermediate pressure crankpin had at sometime been welded to the crank web (1958 or earlier welding *in situ*). All the main journal bearings were basically scrap bronze and were up to 3mm out of round. I might see the Plenty restored and in steam in my lifetime but I'm not counting on it.

Turbines

Dear Martin,
The articles about steam turbines and some mention of gas turbines are interesting. Hopefully Mike Tilby can be persuaded to include details of 'Free Piston' gas turbines. The one example that I encountered of this kind of engine was almost uncanny for lack of vibration.

The standard reference on the subject was by the late Professor Judge and is available online.
Best regards, James Wells

I've spent a lifetime working in mechanical engineering and, as I said above, my knowledge on steam has basically come from the varied articles that have appeared in *Model Engineer* over the years. At college we did practically nothing on steam when I studied thermodynamics.

I believe the content in *Model Engineer* is right for the present day - there is a broad base of articles of which a least some should appeal to most model engineers. Keep up the good work.
Tony Reeve (Tasmania)

Dear Martin,
I was pleased to read your comment (Smoke Rings, 8th November) about the possibility of broadening the type of engineering that is covered by the *Model Engineer* because one aspect of our model engineering hobby that I sometimes ponder is how it does not seem to keep up with the times. I don't mean to imply there is anything wrong with traditional steam engines etc. but, as you mentioned, in the early days of the magazine there were articles about all sorts of topics, including what were then the latest technologies.

These days, in the real world, for the past few decades, almost every mechanically functioning object of any complexity seems to consist of close integration between mechanical and electronic engineering, be it cars, planes or washing machines. This trend does not seem to be reflected in model engineering activities, with the exception of those people who make their own CNC machine tools (although even then, much use seems to be made of pre-made modules and software) and Les Kerr's soldering iron timer that was described recently.

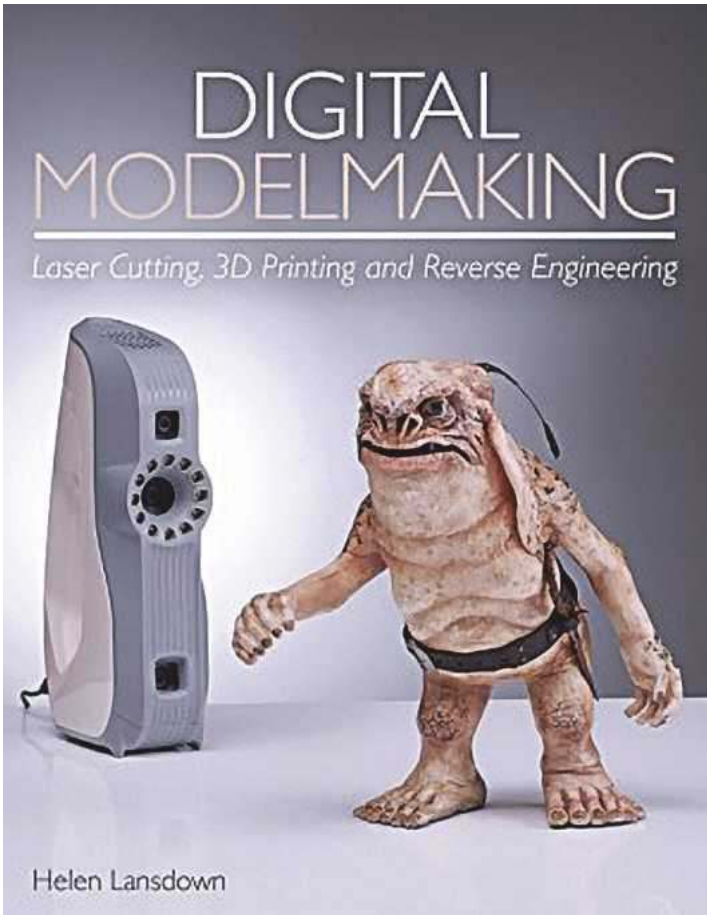
The only examples I am aware of where electronics has been combined with mechanical engineering in the design and construction of actual models is a steam engine fitted with electronic sensors built by the late Bill Hall ('The effect of superheat on cylinder condensation', *Model Engineer* 187 (4161): p.592 – 594, 2002) and an award-winning electronically controlled flash steam plant made several years ago by Ian Gerrard ('Monotube boiler control system', parts 1 and 2, *Engineering in Miniature*, February p.262 – 265 and 269, March p.328 – 330, 2012). Ian's project inspired my own fumbling efforts at integrating electronics with mechanical engineering.

Of course, such activities might only appeal to a minority of readers (as with many other topics) but I have gained much pleasure from combining the two disciplines and so perhaps might others. Another thought is that, from time to time, people express concern about the need to encourage younger people to take up our hobby and I wonder if the occasional inclusion of descriptions of electronic controls alongside mechanical engineering might help achieve that goal.
I've probably missed other hybrid projects. If so, I would be very interested to hear about them.
Regards, Mike Tilby

Book Review

Digital Model Making

By Helen Lansdown



The author started working as a model maker in 1987 in product design, moving onto architectural models and making props for TV. As she states in the introduction, the book is aimed at students and recent graduates in the model making industry and those with a passion for model making. As such it does overlap with some of the skills and techniques we as model engineers have. I would suggest though that it would be of more use to the model railway enthusiast and possibly model boat builders than model engineers.

The book is well laid out with separate chapters on fundamental skills: laser cutting, 3D printing, CNC reductive machining and reverse engineering. The use of examples is extensive and, in my view, makes it an interesting read for anyone thinking of using one of the aforesaid techniques. Whilst some of the equipment used is far too expensive for us to consider, there are cheaper options and free software is available on the Internet.

The first chapter, 'Fundamental Skills' is, as it says, fundamental. It covers basic equipment, glues, moulding and casting (resin) and finishing. Metal is not considered; it is not in the scope of the book. However, there are some interesting sections especially on adhesives and paint.

Laser cutting is limited to smaller machines that will not cut metals but the technique for producing the file is the same. Engraving is covered in some depth (no pun intended) and there are several excellent examples in various materials. The chapter concludes with a number of high-quality models produced by students and professional model makers.

A number of 3D printing techniques are covered. The only one we would probably use in our workshop is Fusion Deposition Modelling where molten plastic is extruded through a nozzle, building the object vertically. Creating the file is the same for most techniques and the examples at the end of the chapter show just what can be done.

Chapter four of the book is on CNC reductive machining. This is basically a routing operation but in three dimensions. It's not something that many of us would do but interesting to read about. The technique is not limited to wood; polyurethane, plastics, metals and wax are also possibilities. Again, there are some excellent examples to conclude the chapter.

The fifth chapter is on reverse engineering and covers 3D scanning and photogrammetry. Basically, it is a method of converting a physical object into a digital file. Laser scanning is out of our price range but there is some really good advice on how to use a digital camera to achieve the same result. Again, links to free software and advice on how to use it are followed by some practical examples.

Finally, the author discusses a number of different software packages available, from the very expensive to the free to download.

This is a well laid out reference book with lots of sound advice and excellent examples to demonstrate what can be done. If you are into the smaller scales, I am sure it will be well worth a read.

Malcolm High

Crowood Press Ltd,
£20. 192pp.
ISBN 978-1-78500-585-5.

Walchaerts Valve Gear For *Sweet Pea*

PART 2

Frank Birchall explains how he upgraded the Hackworth valve gear on his Metre Maid to Walschaert's.

Continued from p.711
M.E. 4625, 8 November 2019

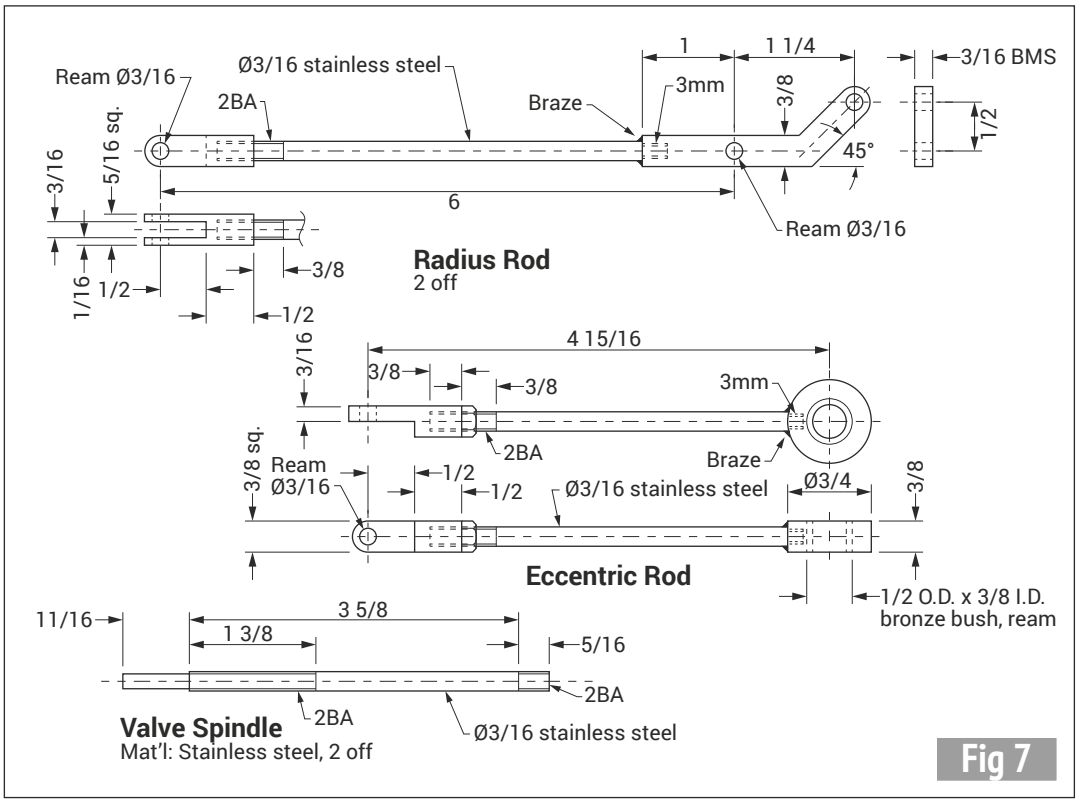
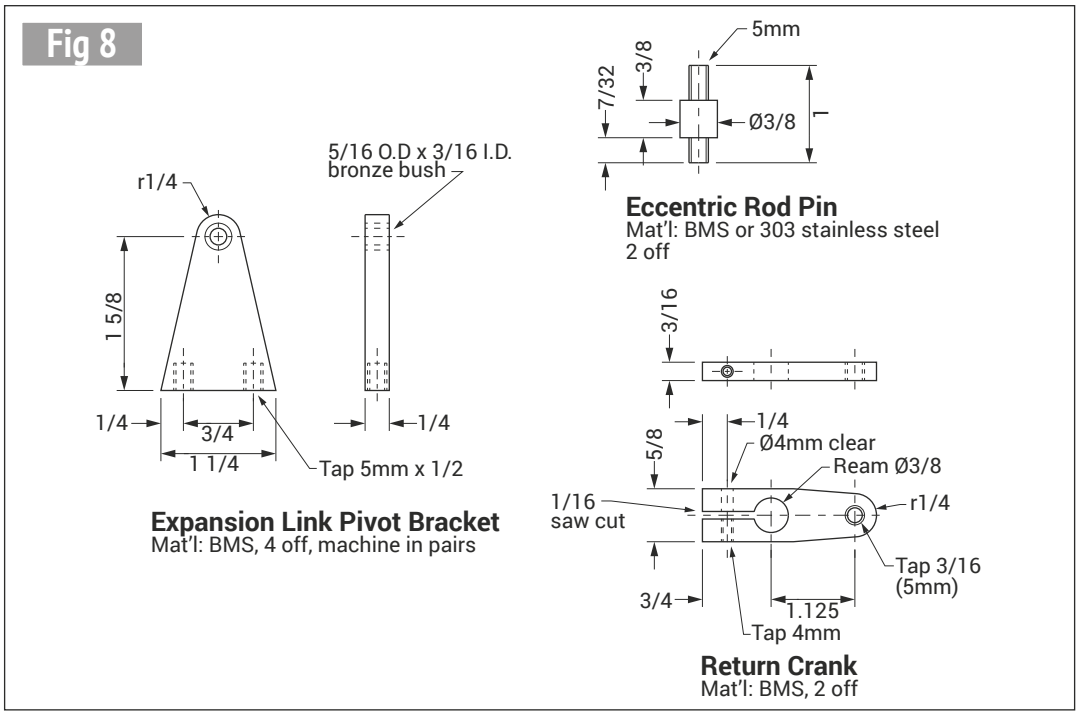


Fig 7

Fig 8



Radius rod

We next need the radius rod on **fig 7** to complete the assembly with two bronze sliders and the block pin.

The other two items on fig 7 - the eccentric rod and the valve spindle – could also be made at this stage. Make and assemble to the dimensions given. Fine adjustments can be made when we finally set up the gear later on.

The expansion link pivots on **fig 8** should be made next. Here again the holes are best made whilst the material is in a rectangular form, say 2 x 1¼ x ¼ inches, and marked and drilled in pairs. The bushed hole is best finished when the two halves are bolted in the support frame as shown in fig 4 (see part 1). Fit the expansion

link with its radius rod in place, ensuring that it swings freely.

Also on fig 8 is the return crank, which is fairly straight forward. Here I have moved to 4mm bolts to avoid thread stripping as we need a good grip before fitting.

Fit the return crank pivot pin and peen over the thread to secure.

The combination lever

On **fig 9**, the combination lever has a tight offset, requiring heat. Don't drill any holes until this is done as these are critical dimensions which set the correct lap and lead. Also shown is the anchor link, with a bit of fancy work which can be left out.

You should make extra pivot pins, as they are easily lost. 1/16th inch stainless steel split pins are best if you can get them. I find grade 303 stainless steel easy to machine and it wears well.

Parts to connect the reverser to the expansion link are shown in **fig 10**. The crossbar fits under the boiler and is supported by two brackets located from the driving wheel centre line. It is positioned with two collars held with 2BA grub screws so the reverser levers line up with the expansion links. These also are secured with grub screws until the linkage has been tested. Then secure with 5/32 inch taper pins. Use a spiral flute reamer, which is less likely to break.

Setting the Walchaert's gear

As detailed in **fig 11**, determine the 'true' front dead centre. Rotate the driving wheel until the crosshead is close to the end of its forward movement, say ¼ inch and mark its position on the sidebar crosshead. Mark the position of the driving wheel against the brake shoe.

Move the crosshead through T.D.C. (top dead centre) and back to the mark on the slide bar, then mark the position of the driving wheel. True T.D.C is exactly halfway between the two marks as shown in **fig 12**. Mark this clearly on the wheel and the shoe as this position will be used many times in its life. Centre pops are best. Do both sides.

The return crank is fastened to the reduced diameter at the end of the crank pin and must be set 90 degrees in advance of the crank pin - see fig 1 (part 1) - and its pin set ½ inch from the wheel centre. Its pin needs to impart a total movement of 1 inch to the eccentric rod for one rotation of the driving wheel. It is best measured at the rod's connection to the expansion link from the pin support bracket. Keep the grub screw tight at this stage. If you get the movement exact, then pin the crank with a 5/32 inch taper pin and mark its position on the crank pin to help when re-assembling.

The eccentric rod can now be fitted. With the expansion link in a vertical setting, move the reversing lever full forward and full reverse. The pin securing the two bronze sliding blocks should appear equally in the top and bottom sight holes of the expansion link. Adjust the reach rod to correct.

With all other links fitted, move the reverser to full forward. Rotating the driving wheel should give ½ inch movement to the valve rod.

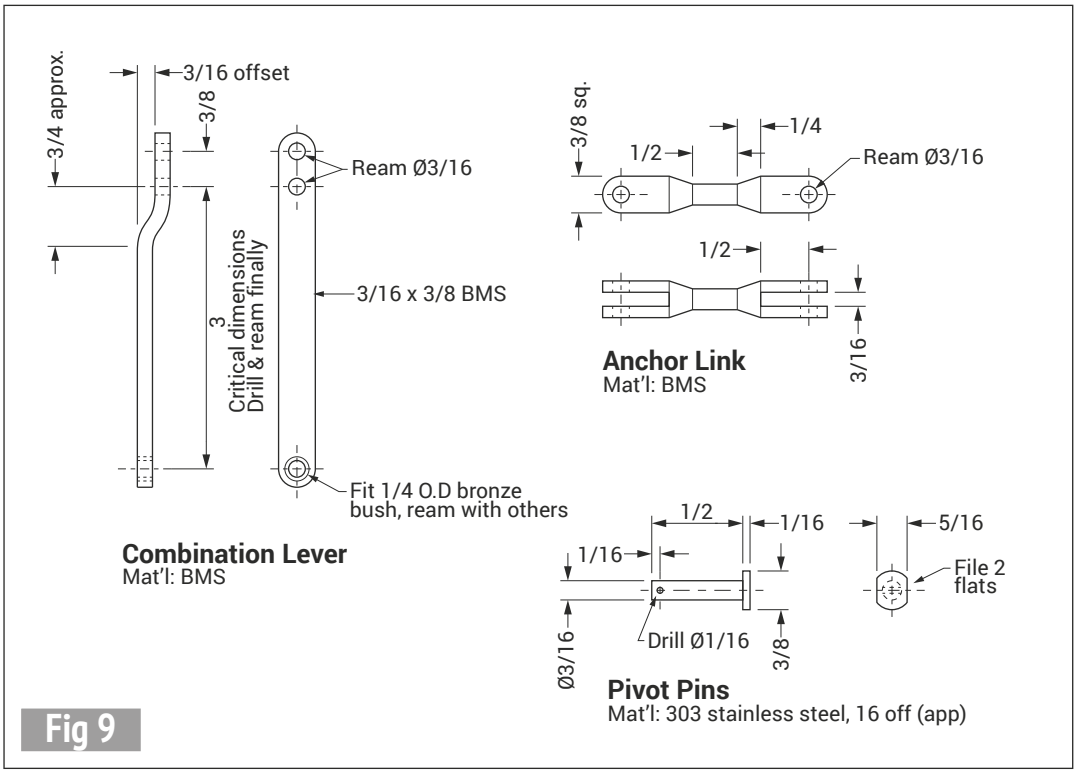


Fig 9

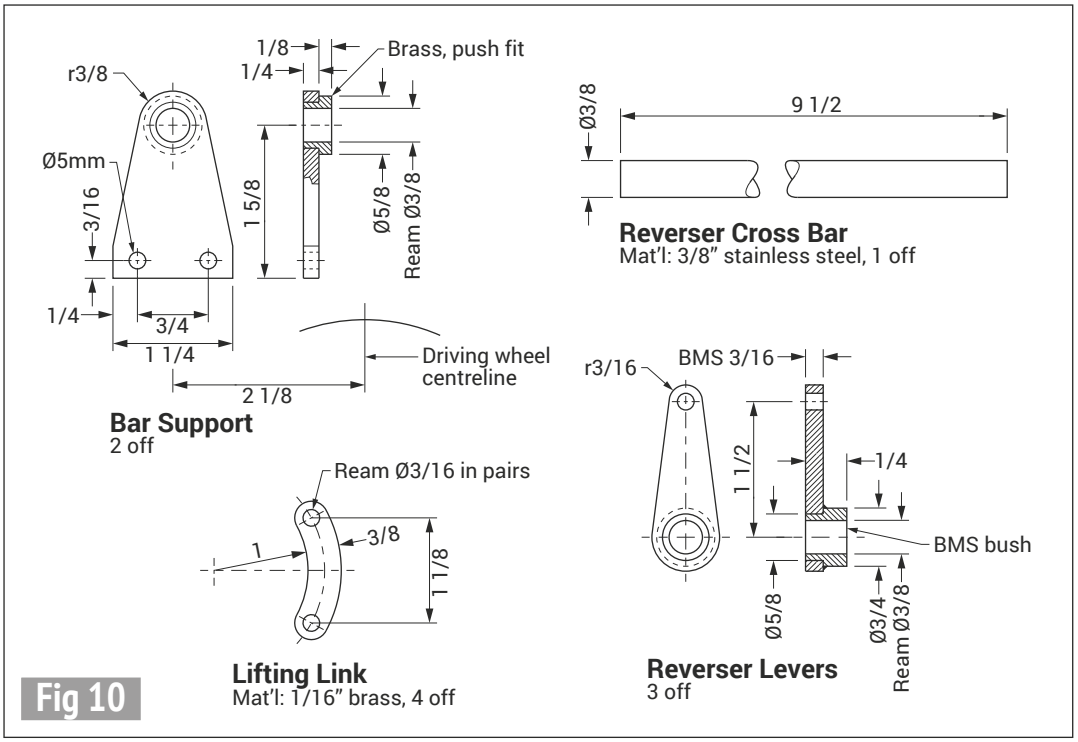
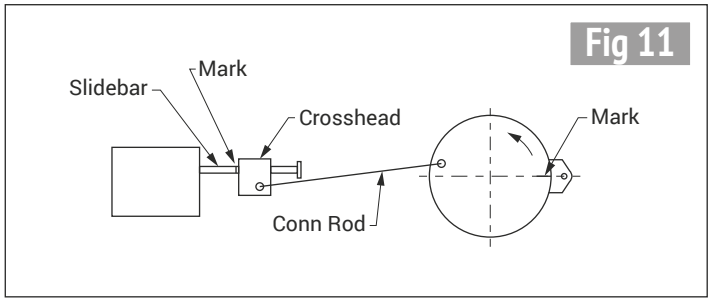
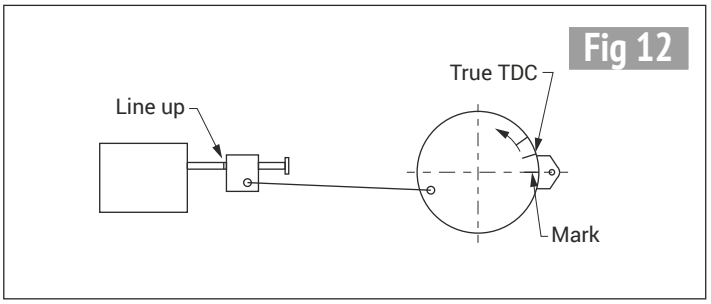


Fig 10





It is important to check for looseness if not so. The two 5/16 inch rod ends attached to the combination lever may need a little filing to relieve them. Repeat on the other side.

With the reverser full forward and the piston at true front T.D.C., move the lever to full reverse and back again. There should be no movement of the valve rod. Adjust the eccentric rod if need be until it stops.

Now, uncover the valve and observe its movement when rotating the driving wheel. Adjust to give equal port openings back and front. Set both sides of the chassis.

Testing

Once these checks are okay, try the motion on compressed air. It should run in forward and reverse. Don't forget to oil. I only use steam oil - things don't rust! Don't run fast and don't move anything by hand to start it if sticking - use a screwdriver or pliers or you could lose a finger!

I always drill two 13/16 inch diameter holes in the middle of the axles at 90 degrees to each other so I can slowly observe the motion and valve movement using a screwdriver.

With the piston at front T.D.C., the valve should be just opening at the front port and vice versa at back T.D.C. - if this is so, it will run.

The only difference with the *Metre Maid* is that the length of the eccentric rod is longer!

ME

Obituary
Richard C. Guthrie

Richard Guthrie was a colourful character, with his smile, a glint in his eye and those decorative braces holding up his jeans. He was known to many as the treasurer of the Northern Association of Model Engineers and for his appearances on their stand at Exhibitions. He was a keen backer of young engineers, always helpful and supportive. He regularly attended the NAME young engineer presentations at the NRM.

As a lad he was apprenticed to the famous Suffolk steam engine builders Richard Garrett & Sons where he learned his workshop skills. An incredible start in life for any engineer. At the end of his training he moved to Manchester to work for Beyer Garrett before transfering into the insurance business.

In 2015 he proposed that the Association should fill the gap in model engineering exhibitions in the North West. Thus, the Manchester Model Engineering exhibition was born. Richard acted as both treasurer and liaison with traders whilst also organising the floor plan, putting on exhibitions in 2016, 2017 and 2019.

Always a keen model engineer, he was a long-time member of Rochdale SMEE. With his engineering background he always had good equipment and, following the death of Tubal Cain, he bought Tubal's Myford Super 7, going to Cumbria to collect it. He also supported the full-size railways at the East Lancashire Railway where he led the Tuesday Team in the Signal Engineering Department, carrying out maintenance and modifications. He became a qualified signalman trained to work the level crossings at Rawtenstall and Townsend Fold. Even after he became ill he would still work an occasional evening for a diner's special.

His passing is a great loss to our hobby and leaves our world a less colourful place.

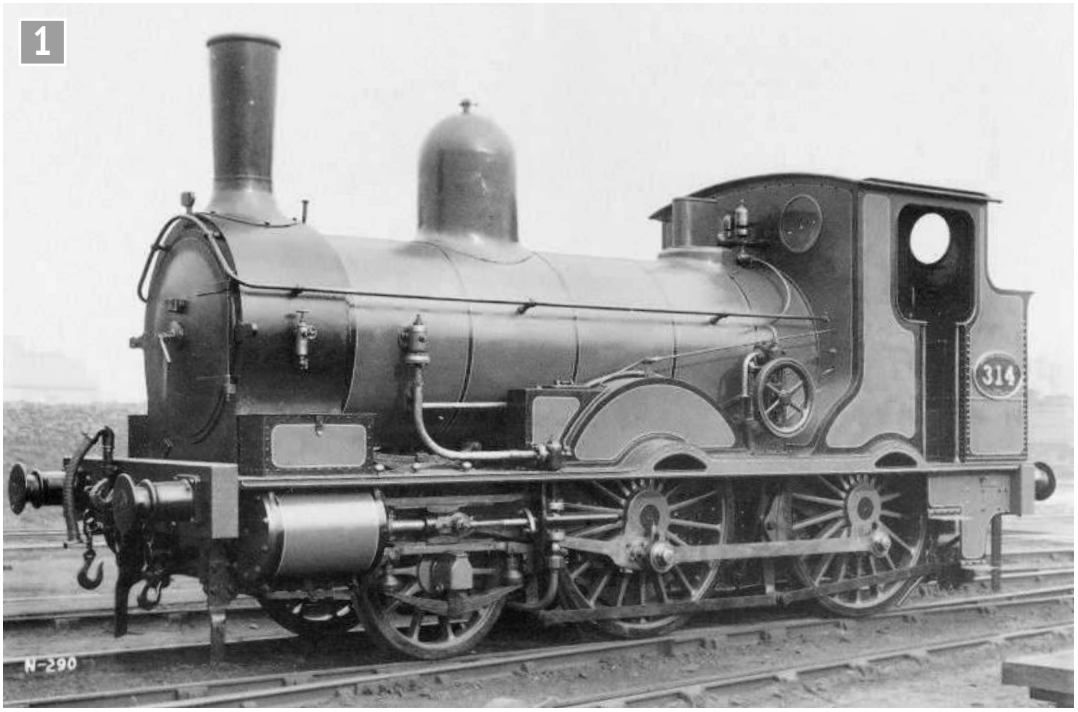
Bob Hayter

Wenford

PART 1

A 7¼ Inch Gauge 2-4-0 Beattie Well Tank

Hotspur catches up on the description of his Beattie well tank.



A view of the prototype 'well tank' in 1880 and used for the writer's locomotive (photograph courtesy of the late D. L. Bradley).

Introduction

It has been some time since I offered any further guidance on building this locomotive model design but I am aware that the two much modified full-size prototype locomotives are to be seen running on preserved lines and there are several models being built. Some of the finishing details for my version may well be applicable for those nearing completion elsewhere.

For those readers who are not familiar with the prototype I adopted, I am including a picture (**photo 1**) of the version of the well tank I am building. This has the Adams design of boiler and was in service from 1874 till 1962, though in a much changed appearance. This was one of the last to have the crosshead pumps and the donkey pump and, if you have not seen it before, Adams used No. 314 to illustrate the new painting scheme he was advocating for the LSWR passenger engine stud at that time. All the others were painted dark green and some had a black lining.

After the bulk of the design was featured in the series in *Engineering in Miniature*, I separately completed the details for the donkey pump itself and the ash pan and grate but I will briefly outline the scope of what I will be describing in this short series. My own locomotive requires the coal bunker water tank. It sits up under the rear casing and has the input pipe for filling the three tanks. There is also all the ancillary pipework to install and I have wanted to make the rear water supply arrangement self- contained so it can be fitted to the chassis as an assembly. This must involve the method of controlling the water supply to the boiler from the two crosshead pumps and the installation of their return pipes. In addition, a method of operating the cylinder drain cocks needs to be installed plus a feed for the injector.

I am sure there will be other items but this will be plenty to start with. Anyone building the model who wishes to contact me for any further details may do so via the editor or via my email if you already know it and I will be pleased to help. As the new drawings are completed they will be made available to Phil Owen at Blackgates Engineering, who already has the design and supplies all the castings for the model, so all commercial dealings should be with them, please. The design general arrangements will be included here but, as with my other models, I recommend having full size original drawings as an A4 size print is a bit limiting. ≫

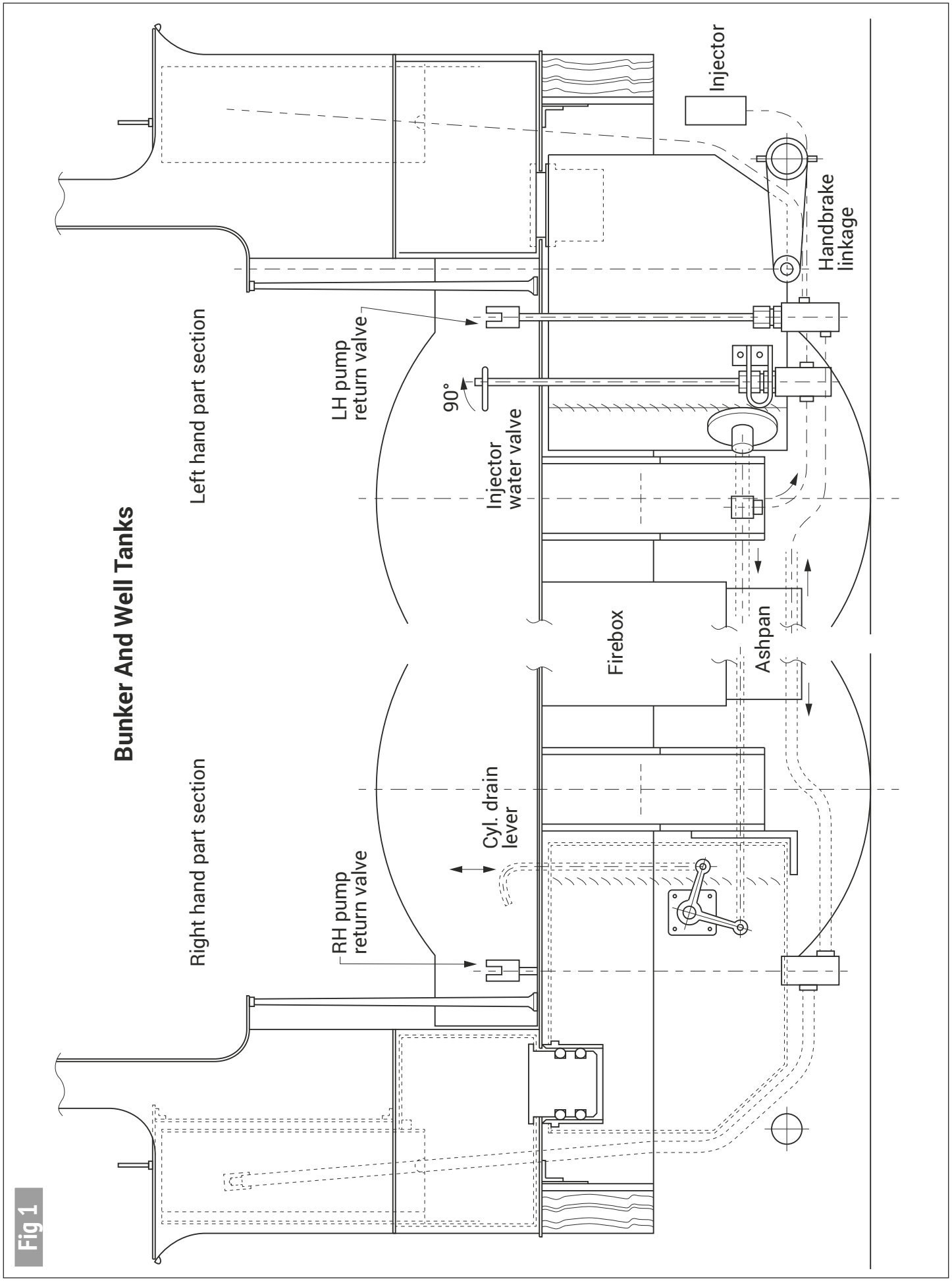

Bunker And Well Tanks
Left hand part section
Right hand part section
Injector
Handbrake linkage
LH pump return valve
90°
Injector water valve
Firebox
Ashpan
Cyl. drain lever
RH pump return valve

Fig 1

The water supply system

Actually finalising how to control the water feeds to the boiler from the two cross-head pumps was not a simple task and deciding how to route the pipes back to suitable water control valves was also puzzling. Although it is a larger gauge model, the original construction was a tight squeeze between the frames and especially behind the boiler. I will of course complete the feed pipes to and from the cross-head pumps into the boiler in due course and, for operating simplicity, both have separate bypass valves located in the cab with water return outlets up into the main filler pipe in the bunker for visibility in service.

Those of you who are fitting a steam brake cylinder and valve may be aware that the original design of rear well tank had to be altered by shortening it about ⅜ inch and I apologise if this meant additional work. I have blanked off the feed point to the injector water valve on the left hand side of the well tank but, due to layout and space considerations, I have had to retain the injector water valve on the left side of the cab, which is not ideal, as it was the fireman's task to control the boiler water level.

So, to begin with I am showing the layout of the rear tanks on the both sides of the engine (**fig 1**) and I will go on and give the design and construction details for both the rear tanks in the next few articles.

The transfer of water between the bunker tank and the well tank beneath it is via a sleeve sealed with 'O' rings but I was concerned for the assembly of the components until I did an amateur isometric view which allowed me to visualise the way the pipes could be routed with suitable junctions. I wanted to ensure that both the rear tanks could be fitted into the chassis from above and that the arrangement of pipes would not clash with the existing components. The drawing shows the outline of the bunker and rear cab structure plus the major parts such as the buffer beam, and the positions of the firebox and ash pan outer skirt with the brake shaft location are added for reference.

There will be a pair of handed water control valves symmetrically placed on each side of the cab inside the coupled wheel splashers and these are shown diagrammatically with the return feed from the pumps being the pipe junction. These valves will be operated by a cross-drive tool and be supported under the base of the tank so the pipework is not under any loading in use. Each will have an angled outlet to avoid the handbrake crank.

My right-hand side view also shows the pivot point for the cylinder drain cock operating linkage to add to the side panel. The handle is also on the right side of the cab, inside, beside the splasher and it works with an up and down movement. It is intended that the handle be up when the drain cocks are open and it will pass through a slot in the cab floor boards with a steady bracket soft soldered on top of the tank.

In the left-hand side view I have also shown the position of the injector water supply valve low down on the well tank towards the front and it is a simple 90 degree on/off feed. This straight-through valve is set at an angle to avoid some pipework clashes and mounted on a special bracket to locate on the top hexagon fitting. Also in this view can be seen the angled face at the front of the tank which has the flanged feed point for the water outlet to the front well tank. This has a filter assembly on the inside and the feed is via a ¼ inch pipe. The pipe also has a 'T' piece joint which connects to the injector valve and goes on alongside the firebox outer skirt with a second connection up to the donkey pump. The outlet from the injector valve is towards the rear as the injector is fitted under the rear buffer beam. This will allow the steam feed to the injector from the right-hand side of the boiler backhead and the delivery will return forwards on the right-hand side and up to the clack valve adjacent to the steam valve. Both pipes are assembled from underneath the tank and the rear axle assembly.

At the rear of the well tank there will be an extra water connection for use with a supply tank sited on a driving truck to top up the locomotive tanks 'on the move'. The water capacity is a bit limited for continuous running and this was the problem with the original engines when they were given longer routes outside London. A threaded plug will also be added underneath the rear tank to drain the system.

To set the scene for those not familiar with the model so far I have included two pictures of the bunker platework (**photos 2** and **3**) showing the water entry casing and the tank space.

●To be continued.

NEXT TIME

I will describe the assembly of the bunker tank parts and the addition of the water pump return pipes.

Two views of the locomotive bunker showing the water entry casing, which passes through the coal space, and the bunker tank space itself underneath. Note how the construction of this assembly left the rivets protruding and so the sizing of the water tank parts has to be carefully determined.

A Visit to the Brecon

Rhys Owen ascends the mountains of South Wales for a ride on a narrow gauge railway.

In the background stands Ty7-1698, built in 1980 for a peat railway in Seda, Latvia by Kambarka Engineering Works, Russia. This is a 400HP Bo-Bo Diesel hydraulic locomotive weighing 24T. The locomotive is fitted with a V12 Bernaul engine and a Kaluga Putmash two-stage torque convertor. Ty7-1698 has been fully rebuilt at the BMR including re-gauging from 750mm to 600mm. Note the new wheel tyres in front of the Diesel locomotive's cab and, to their left, an American style cylinder, valve chest and half-smokebox casting. In the foreground can be seen brake block castings, some of which have had holes machined in them.

In July 2019 I went to Pant, just north of Merthyr Tydfil, to ride on the Brecon Mountain Railway (BMR). This line is stated to be of 603mm gauge (although, in my opinion, the difference between 600mm and 603mm is a little academic) and runs on part of the former Brecon & Merthyr Railway.

After viewing the workshops I got on the train, which was drawn by No. 1, an American tender locomotive that entered service in June 2019 after extensive rebuilding. BMR No.1 *Santa Teresa* was originally built by Baldwin as a 600mm 2-6-0 tender locomotive for the Mogyana Railway (the *Companhia Mogiana de Estradas de Ferro*) in Brazil. Following its sale to the Santa Teresa Sugar Mill it was converted to 762mm gauge. Brought to the UK in 1990, it was acquired by the BMR in 2002. The BMR have extensively rebuilt it, re-gauging it to 603mm, only the original cylinders, main frames, valve gear and some other parts being retained. The BMR workshops built a new boiler, smokebox, cab, wheels and axles, front pilot and new bogie tender as well as the rear subframe and rear truck required to convert the wheel arrangement from 2-6-0 to 2-6-

Just beyond the fence above the stairs can be seen two American style cylinder, valve chest and half-smokebox castings bolted together ready for attachment to bar frames. Also beyond the fence, on the left, is a riveting machine for boiler work.

Mountain Railway

2. Similar conversions were carried out over a century ago by the Sandy River & Rangeley Lakes Railroad in Maine. The original engine would have had a considerable overhang at the rear and the rear truck improves the ride when running tender first.

In line with American practice the engine has equalised spring suspension which extends to the front pony truck and to the new rear truck. As was normal in American practice, before the use of cast steel beds, the engine has bar frames, these being outside the wheels, and the cylinder, valve and half of the smokebox saddle on each side are formed of a single casting, two of these castings being bolted together into one assembly.

The locomotive retains most of the features of an American locomotive of the

Diesel 001 which was built by the BMR in 1987 using parts obtained from the liquidation sale of Baguley, locomotive builders in Burton-on-Trent (these parts were for a locomotive order for Sena Sugar in Mozambique). This is a 140HP 0-6-0 Diesel hydraulic locomotive weighing 13T. The locomotive is fitted with a four cylinder turbo Caterpillar engine and a Twindisc single speed torque convertor. This locomotive is currently undergoing a general overhaul and re-paint.

0-6-2T+T Graf Schwerin-Löwitz *(Arnold Jung works no. 1261 of 1908) with additional tender. This locomotive was built for the Mecklenburg-Pommersche Schmalspurbahn in Germany. This railway closed in 1969 and the locomotive, together with the four-wheel tender with which it ran during its working life on the MPSB, was bought in 1972 and shipped to the UK. It was rebuilt between 1974 and 1981 for use on the BMR. The locomotive is fitted with a new boiler which was built by the BMR in the early 1990s. During its initial service on the BMR it was oil-fired but in 2010 it reverted to coal firing. The locomotive's principal dimensions are:*

Cylinders: 215mm bore x 300mm stroke (~ 8.5 x 11.75 inches). Driving wheel diameter: 630mm diameter (~ 25 inches). Boiler working pressure: 12 atmospheres (~ 170 psi). Weight in working order: locomotive 13T, tender 6T. Note the travelling overhead crane in the background above.

late 19th century, having inside Stephenson's valve gear operating slide valves mounted above the cylinders via rocker arms and slender valve rods. These valve rods are slender because the frictional forces required to move the slide valves are minimised by partial balancing, that is, a certain area of the upper surface of the slide valve is isolated from the live steam, Baldwin's standard practice with slide valves.

The base of the smokebox features a device for disposing of smokebox char. This consists of a tightly sealed aperture which can be opened so that a jet of steam can blow the char away. Near the top of the left-hand side of the smokebox is another aperture whose cover can be removed so that a paddle can be used to move the char into the path of the steam jet. The small smokebox door need only be opened so that the smokebox and internal spark arrester can be inspected.

The railway has another American locomotive. This is No. 2, which is a 4-6-2 Pacific (Baldwin No.61269 of 1930) which was built for the Eastern Province Cement Co. Ltd. in South Africa. This locomotive was imported and rebuilt by the BMR and was in use from 1997 to 2018. No. 2 is currently out of traffic awaiting a 10 yearly heavy overhaul which is due to start in the winter of 2019.

The locomotive's principal dimensions are:

Cylinders:
13.5 inch bore x 18 inch stroke.
Driving wheels diameter:
36 inches.
Boiler working pressure:
160 psi.
Weight in working order:
engine 30T, tender 18T.

The railway traverses the valley of the Taf Fechan river, skirting Pontsticill Reservoir

No. 1 Santa Teresa *(Baldwin Locomotive Works 15511 of 1897) prepares to run round her train at Pant station.*
No. 1's principal dimensions are:

Cylinders: 12.5 inch bore x 16 inch stroke.
Driving wheel diameter: 33 inches.
Boiler working pressure: 180 psi.
Weight in working order: engine 25T, tender 15T.
Note the electric headlamp with the generator behind it. On the left is the caboose.

This is the bottom of No. 1's smokebox which rests on two castings bolted together as seen in photo 2. The brass wheel in the centre of the photograph is used to open and close the cover of the char removal device. The projection in the centre of the plate is part of the pony truck suspension's weight-bearing arrangement.

The left-hand side of No. 1's smokebox showing, lower left, the steam pipe to the char removal device. On each side of the smokebox are bars linking it to the front footplate. Above the three rivets attaching the top end of the left-hand bar to the smokebox can be seen the access hatch for inserting a paddle to move char into the removal device.

and passing through Dolygaer to reach the terminus at Torpantau (on this section of the Brecon & Merthyr Railway a head-on collision occurred in 1916). Only the 1 in 47 gradient on this latter section made No. 1 exert herself and it was clear that she and her crew were on top of the job.

After the engine had run round the train, it drew the train tender first back to Pontsticill station where a picnic site and children's play facilities overlook the reservoir. After a pause here the train continued back to Pant.

This was a very pleasant ride and all the passengers seemed to enjoy the trip.

Many thanks to the BMR's Mr Neil Thompson for his assistance with this article.

ME

On the left can be seen the access hatch allowing a paddle to be used to scrape the char into the char removal device. The two pipes entering the smoke box are probably for the exhaust steam from the air pump and for the steam feed to the blower. The pipe leading to the char removal device can be seen as can the steam feed to the generator behind the headlight. On the right the air pump can be seen, with its brass governor on its left. Below the white-edged upper walkway can be seen one of the air reservoirs. Note the deliberately long air pipe that helps cool the air before it enters the reservoir. The cylinder, valve chest, crosshead, slide-bars and motion are typical of an American locomotive of this era. A displacement lubricator (now purely decorative as the engine is fitted with a mechanical lubricator) projects from the valve chest cover. Note also the brass oil pots on the motion.

Top right can be seen the end of one of the main air reservoirs. Just to this reservoir's left can be seen a safety valve for the air system. The small air reservoir below the lower walkway is the engine's auxiliary brake reservoir, there being a similar one on the tender. To the left of this reservoir is one of the brake cylinders with, below it, a sheath concealing a return spring. This cylinder acts on a lever connected to the brake rigging. Note the rear frame extension bolted to the main frames (with one of the washout plugs visible in the aperture). Bottom left can be seen the equalising beam that connects the trailing truck with the driving wheel suspension.

Low down between the bar frames, just behind the smokebox saddle, the front pony truck pivot can be seen. Also visible is the vertical bar that connects the pony truck equalising beam with the transverse equalising beam between the leading ends of the leading coupled wheelset's springs.

The cab has obviously been conceived with an eye to the comfort of the crew, there being seats and doors opening onto the running plates as well as an air-operated fire-hole door. Note the American-style regulator handle and the fine-toothed reverser rack (the reverser uses a spring between the frames rather than a balance weight to reduce the effort required by the driver).

The coupling system seen from above. This is a well-designed version of the link-and-pin arrangement that uses a link held by a handle and inserted from above, the links being retained in position by French pins with the locking bar pivoted at their ends. The centre buffer forgings were obtained long ago from scrapped Isle of Man Railway vehicles. Originally, they were of the chopper type but have been adapted as shown. The braking system is the two-pipe version of the Westinghouse air brake (the red pipe keeps the auxiliary reservoirs throughout the train charged while the black pipe is the driver's service brake control line). Note the colour-coded angle cocks.

A Bird Automaton PART 2

John Moorhouse designs and constructs a singing bird automaton in the shape of a violin.

Continued from p.795
M.E. 4626, 22 November 2019

Construction

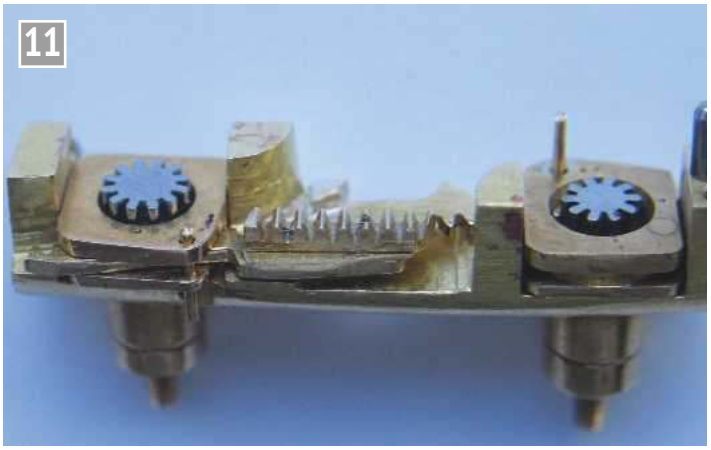
The double-sided rack was 0.8mm thick and 34mm long and the short rack, 8mm long, was made a little thicker to allow adequate depth for its two retaining countersunk screws through from the top side of the main rack. Both racks were in brass and cut with 0.25 module cycloidal teeth (tooth pitch was 0.79mm) with a round bottom wheel cutter (**photo 10**). An important aspect was that because the double sided rack ran across the tangent of the two bird pinions the subsidiary rack had to be attached so as to move normal to its drive pinion. Correct depth of engagement of the main rack with the bird rotating pinions was achieved by each having a pin to retain the rack from behind and this allowed the rear face of the rack to be reduced (parallel with the line of action) until depthing was correct. It was different at each side because I chose to have a 10 leaf pinion on one side and a 12 leaf on the other (2.9mm and 3.4mm diameters respectively) to create different amounts of movement in each bird for the same rack travel. Correct engagement of the small rack with the driving pinion (10 leaf 0.25 module) was achieved by fitting a shim beneath it.

Each bird pinion was made with a short 10BA thread to screw securely into the brass bird stem; the stem ran freely in a round brass insert in the carriage. These inserts, which were each secured with a steel side screw, had around their base a turned slot to locate the rack and allow it to slide easily across the pinions. On the top of each bird stem a 1.2mm thread projected to allow the bird body to be screwed into position (**photo 11**).

Lock and fly springs were cut out from sheet steel and shaped to fit the available space required. After hardening and tempering, considerable patience was required to make them fit and operate correctly with the correct stiffness. As an aid for the fly spring it was fitted with an adjustable and lockable wedge, between it and the base plate, to allow its

The finished piece.

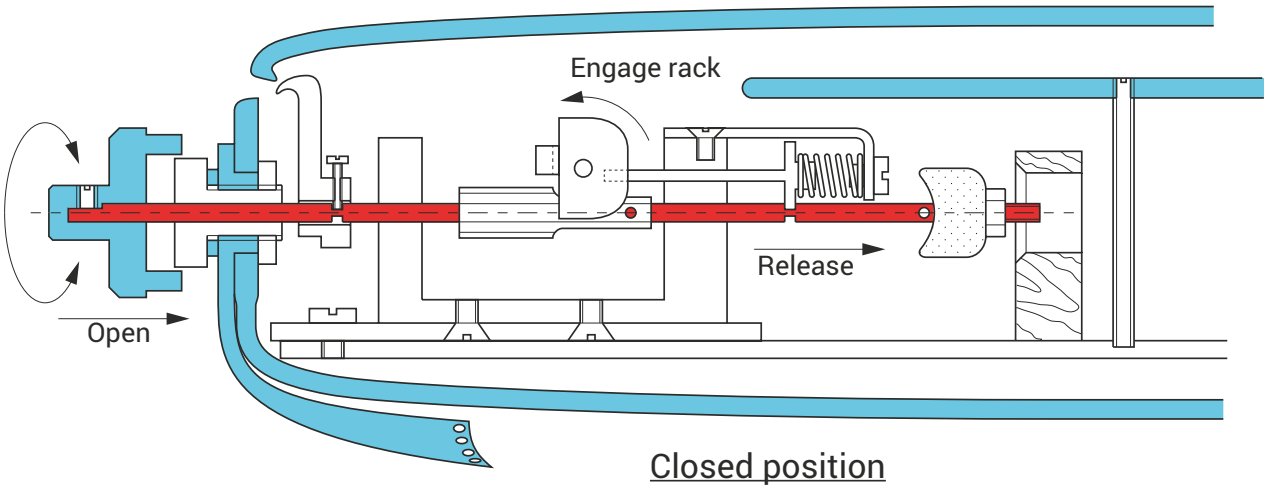
Milling the teeth on the second side of the rack.



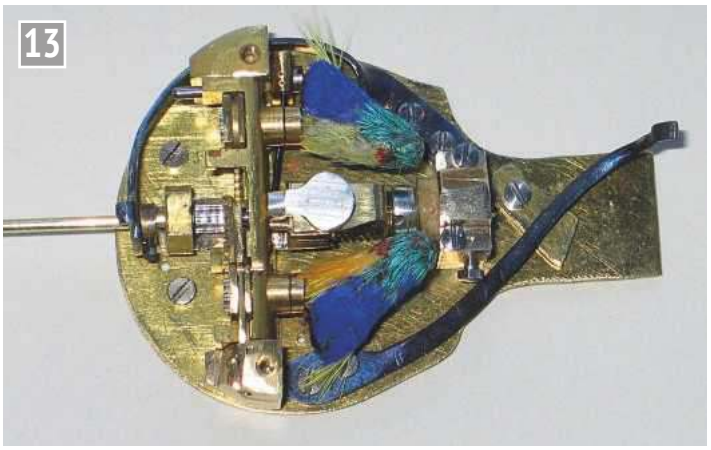
Double sided rack retained by pins and on a tangent to the two bird pinions, with the short rack attached.

Fig 2

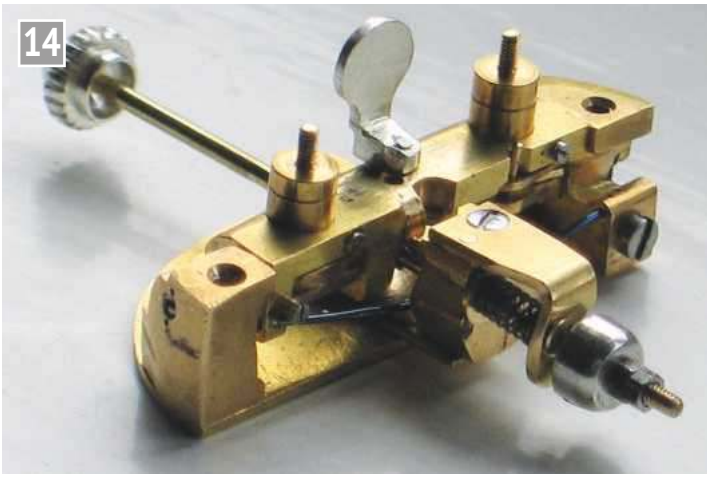
Bird automaton internals – back and carriage release systems.



Main base plate with lock and fly springs screwed in position.



The carriage and birds in the closed position.



The carriage assembly on the sub-base plate, in the open position.

stiffness to be set more easily. Each spring was secured to the base plate with two 10BA steel screws (**photo 12**).

The design of the release and relocking system for the bird carriage was left until the bird rotation system was completed to allow various options linked to the central operating rod to be considered. Available space and reliable operation were paramount (**photo 13**). The method adopted ensured that the carriage was captive by a brass pin driven from behind by a soft coil spring. The pin was located in a hole in the closed carriage and a flange at the other end of the pin located freely in a slot in the central actuation rod, so that when the central rod was pressed the pin was withdrawn releasing the carriage to rise smartly, driven by its strong wire spring (**fig 2**).

The actuation rod ran through the two rigid pillars attached to the sub-base plate and between the pillars the rack drive pinion was pinned onto the rod. Clearly, the position of each component on the central rod was important in order to obtain the correct sequence of actions. During construction, alignment of these pillars and other parts was with a rod running from outside of the case through a central hole in the end wall, allowing the sub plate to be screwed in the correct position on the main plate (**photo 14**).

A final addition to the automaton was a small device to create a bird type noise, a suggestion from a friendly (!!) automata maker and collector. He kindly gave me an original bird call device to study in which a pewter plug rotates and binds in a hard wood block, with a light dusting of powdered wood resin. This binding creates the ≫

tweet noises. I adopted the same approach and fitted a miniature version. A wooden block is screwed onto the base plate, with its hole aligned with the axis of the actuating rod. On the end of the rod is a turned block of pewter, screwed on with a 12BA thread, and secured with a small cross screw to prevent it loosening. Correct positioning of the block is vital to allow adequate engagement on pressing the control rod - and an occasional top up of resin dust does help.

Means of assembly of the mechanism were a consideration during construction and proving the reliability of the complete carriage system on the sub plate was very helpful. On assembly, the main plate was first inserted, secured by a threaded brass rod through the silver inner body. The partly assembled sub plate was then added, followed by individual components such as springs etc.

The strings were made from 18ct gold and drawn down to 0.4mm. They were fitted in the annealed condition so that on fitting they would harden and set and hopefully better retain their position in use.

The bridge was made from 9ct gold, shaped and pierced to look like a miniature of the real thing. Since it could be easily dislodged, two special measures were taken. Firstly, the bridge had a slightly wider than normal base soldered on. Secondly, just below each of the nicks in the bridge for the four strings, a small hole was drilled through which the strings were threaded. This provided a convincing appearance but with increased security for both bridge and strings.

A silver tab was screwed into the top of the carriage to provide a finger piece for use during closure.

The pieced and engraved silver grille serves to hide the mechanism but allows the two birds to appear from their repose. Because the beaks were chosen to be rather prominent, the starting position is with the birds slightly angled outwards to prevent their beaks fouling.

The open position showing silver operating button and the engraved and pierced silver grille.

The birds are solid brass with thin copper wings soldered on, the whole then covered in a layer of thin zephyr, painted an ochre colour. The beaks were filed up from bone and glued in. Layered feathers - lots of very small ones - were glued onto the body followed by attaching mini ruby watch end stones for eyes. One bird is intentionally slightly larger and more brightly coloured than the other and this is a wiser, older bird which has a 12 leaf pinion and moves less.

Safe Operation

The sequence of operation is therefore as follows.

1. Whilst holding the body between finger and thumb, clear of the violin back and avoiding the strings, press the button gently to release the lid catch and allow the lid to fly open.
2. Press the button more firmly releasing the bird carriage (**photo 15**).
3. Rotate the button carefully, being aware of the limits of safe travel to cause rotation of the birds.
4. Press the button firmly and rotate at the same time, engaging the pewter plug and make tweet noses.
5. Rotate the button to bring the birds and rack to the right hand limit.
6. Press the button firmly whilst at the same time pressing on the central finger piece, causing the birds to fall, and engage the carriage lock. The finger piece ensures that there is no need to press on the feathered birds themselves.
7. Release the button.
8. Press on the lid at the tail piece end with two pairs of fingers to engage the case lock spring, taking care to not disturb the strings, bridge or tail piece.

Postscript

To complement and provide protection of the finished piece a violin style case was made (**photo 16**). This was covered in very thin, stained hide, lined with plush velvet and fitted with silver hinges and a special locking clasp. These were all attached to the thin wooden case with 1mm diameter silver nuts and bolts, as a secure means of attachment.

ME

The finished violin case.

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AD OF THE MONTH

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■ Model Engineers' Workshop magazines in good clean condition. Over 150- copies dated from November 2006 to July 2019. Collect only. £10. **T. 02088 454563. Ruislip**.

Wanted

■ Recently acquired BTM watchmaker's lathe WW2 vintage, however some parts missing notably tee-rest holder and small and large tee-rest. Any help would be appreciated. **T. 02892 682512. Belfast**.

■ Issues 261, 263, 265 of Model Engineers' Workshop with parts one, two and three of Milling for Beginners. Costs will be reimbursed. **T. 01769 574 743. Sth Molton**.

■ Castings for SR Schools 3 ½" gauge, three cylinder loco. Wheels, cylinders, axleboxes, hornblocks, cast springs, bogie items, etc., etc., what have you? Unfinished project considered. **T. 01803 329075. Torquay**.

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Building the Model Engineer Beam Engine

PART 13

David Haythornthwaite writes a series on how he built the *M.E.* Beam Engine. This is an old favourite and construction of this engine to 1½ inch scale was serialised in *Model Engineer* back in 1960. Times, methods and equipment have now moved on and the series describes how to build this magnificent engine in 1 inch scale from available castings.

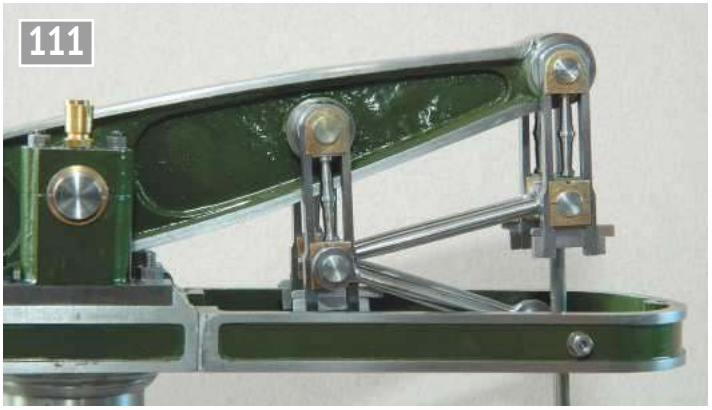
Continued from p.704
M.E. 4625, 8 November 2019

Parallel motion assembly

Most probably the majority of builders will understand the purpose of the parallel assembly on the end of the beam and, perhaps, understand better than I do. However it might be best for me to take a few moments to describe the purpose of this mechanism for the benefit of those readers new to beam engines.

Obviously the end of the beam travels in an arc as it moves up and down, but the piston rod must move in a straight line – unless, of course, the cylinder were mounted so that it could swivel or 'oscillate'. The parallel motion assembly exists to ensure that the upper end of the piston rod can travel in a straight line, but still transmit the energy of the piston into the end of the beam which is travelling in an arc. Basically it carries out the same function as the crosshead/slipper face in other types of rotating steam engines.

The arrangement involves four straps, hanging on the beam pivots and supporting four bearings at the lower end. The strap and bearing arrangement has the bearings fixed into the straps by gauge plate wedges and clips similar to the method employed in the connecting rod, previously described. The lower bearings carry cross members - the crosshead and crossbar - at right angles to the beam and two rods, known as the parallel rods, connect the lower ends of the outer straps and inner straps together, keeping the outer strap and inner strap parallel at all times. The inner strap's lower bearings also support two rods called radius rods, the opposite end of which are attached to swivel points on the entablature which are in vertical alignment with the piston rod. Thus, as the beam and straps rise and fall, the radius rods impart an arc movement to the lower bearings which is in the opposite direction to the arc of the beam end. The result is that the top of the piston rod will move in virtually a straight line when attached to the crosshead between the lower bearings on the outer straps. I hope that the above description and the illustration in **photo 111** make sense to readers.



Parallel motion.

In a full size beam engine, the fixed ends of the radius rods often run in bearings on the engine house wall, but in this instance the entablature is there to ensure a static point for these bearings. The actual geometry and movements of the parallel motion takes a bit of getting your head around, but providing you have followed the plans correctly, then, it should simply work. The radial throw of the radius rods should always equal the radial throw of the inner link from the beam centre (in this case half of the full beam throw). It is important to ensure that :-

The distance between top and bottom bearings is identical on all strap links.

The distance between bearing points on both parallel rods is identical.

The distance between bearing points on both radius rods is identical.

If the above is adhered to, then all should be okay. When assembled, the parallel rods should be horizontal when the beam is horizontal. A fiddly area with lots of parts, but when running, the motion looks fascinating and is one of the reasons that I chose to build this engine.

The parallel links

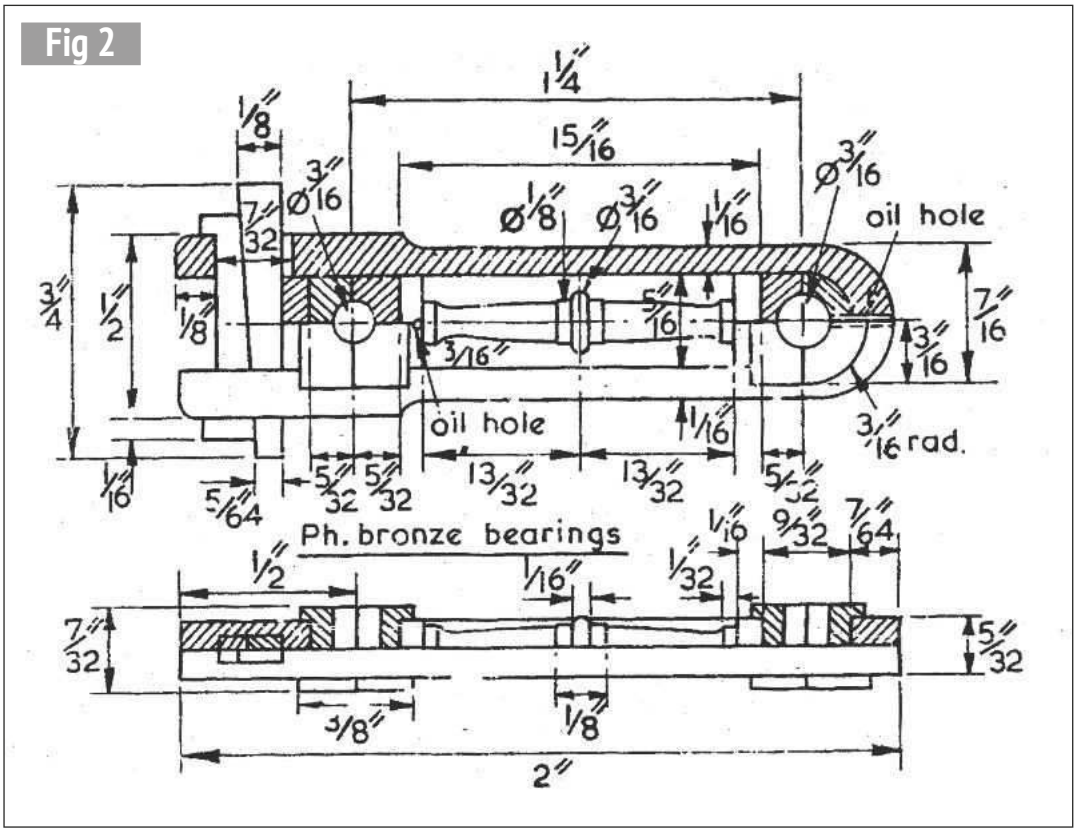
I must point out that there is an error on my drawing. The overall width of the straps is ½ inch and they are 2 inches long. The width is reduced for a distance of $1\frac{21}{64}$ inch (1.328 inch) to $\frac{7}{16}$ inch wide. The $\frac{7}{16}$ inch measurement is shown on the plan from two illogical points and should be from the outside of the strap (in my humble opinion). I have left **fig 2** 'incorrect' as shown on the drawing.

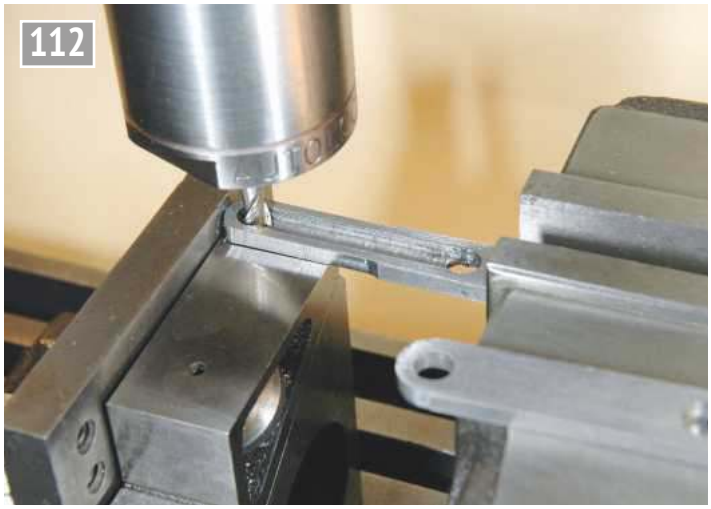
I am lucky to have a DRO on my mill, so it is not too difficult to make identical parts. If readers do not have that facility they may like to consider making the straps truly in pairs, soldering two (or four) together and machining as one. As things are getting quite small for my large, clumsy hands, I decided to make these in pairs, but end on end, from one flat strip, in order to give me something to clamp to and get hold of during the manufacture. The two straps were made with the curved end at each end of the strip to facilitate curving the ends on a rotary table. Flat strip in ½ x 5/32 inch is difficult to come by in my neck of the woods, so I started by cutting two 6 inch lengths of ½ x 3/16 inch and thinned them down to 5/32 inch thick on the milling machine. Each of these was then mounted on parallels in the machine vice and 5/16 inch holes drilled and reamed ¼ inch from each end and 2 inches from each end. The hole ¼ inch from the end is to form the top bearing seat and also to centre on the rotary table to curve the outside contour. The holes 2 inches from the end just mark the end of the part and the part was, later, cut off through the diameter of the hole at the end of machining.

If you wish to make the four straps as I did, first round off the ends of each strip by mounting the items on a rotary table and mill the ends to be semi-circular. In **photo 112** you can see that the nearer strip on the top of the vice has had this carried out. Then mount one of the 6 inch strips on a parallel in the machine vice, leaving almost 50% extending from the vice. Mount an angle plate on the milling table to act as a stop, so that successive straps may be mounted in an identical position. This is shown in photo 112. Mill 1/32 inch (0.0312 inch) from each side, for a length of 1.328 inch, as shown in the photograph. Then mill out the centre slot between the holes, to the width of your bearings. I supported the end of the strip on parallel packing for this operation and, of course, removed the packing for the final breakthrough. This operation is shown in photo 112. I have to admit that for personal reasons I made the bearings, and the central slot, both to a width of 9/32 inch, not the 5/16 inch shown on the drawing, so there is a little more 'meat' on the sides of the forks than there should be. Two almost finished straps are shown in **photo 113**.

The next task is to mill the 1/16 inch slots to take the wedges and clips that hold the whole thing together and will eventually hold the bearings tight in the strap. The exact position of the slot is not shown on the drawing and indeed neither is the 1/16 inch width specified. However, by adding dimensions together, the recessed part of the square bearing should be 1 21/32 inch from the outside of the rounded end of the strap. I therefore decided to start my slot 1 11/16 inch from the rounded end and, as per the drawing, the slot length is 7/32 inch. Therefore, if you are using a DRO, zero the DRO/dials at the rounded end of the link and mill a 1/16 inch slot from position 1.6875 inch to position 1.906. This position is

Fig 2




112

Machining the parallel strap.


113

Part finished parallel strap.

»

not tremendously critical as it leaves room for a 1/32 to 1/16 inch packing piece between the wedge and the bearing. Metric plans would make this sort of calculation so much easier, but as the plans are fractional Imperial, then I do like to work the distances out to decimal, so that callipers and DROs can be easily used.

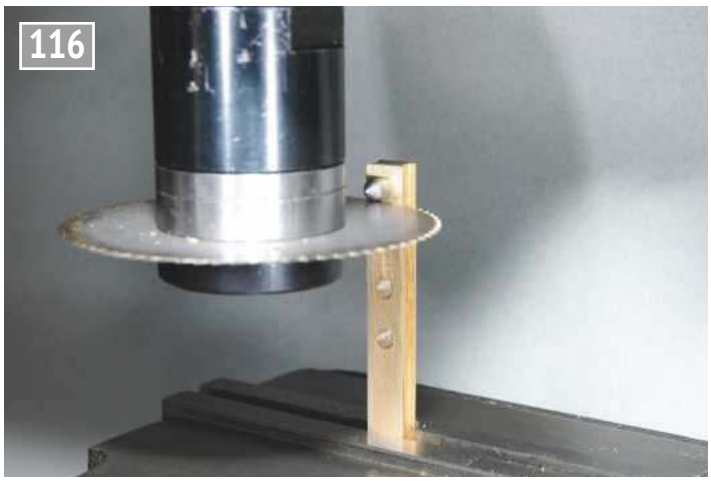
I clamped a stop to the side of the machine vice and set the strip of two forks on a thin parallel in the vice. I located the end stop with an edge finder and found the centre of the width of the fork strip in a similar way. The DRO was zeroed to the centre of the strip width and to the position of the end stop. It was then a simple matter to mill the 'wedge slots' using a 1/16 inch slot drill and using the calculation shown above (**photo 114**). If you do not have a DRO on your mill, then either use your machine dials or careful marking out. With the end clamp in place on the vice it is easy to make four identical forks. The slots should be squared at the ends using a small 1/16 inch flat file. I decided to make and fit the clips that fit into these slots before sawing the fork to length, as the fork is at the correct width with no spring present in the closed fork. The clips were filed up from 1/16 inch gauge plate and made a snug fit onto the forks (**photo 115**). The forks were then marked out to a length of 2 inches from the rounded end of the fork and the forks cut to length. The fork wedges can be left until the bearings and spacers have been fitted between the forks and the wedges then made to fit.

When making the bearings on the fork end of the connecting rod, I had, at the same time, made a strip of brass of the correct dimensions for the bearings on the parallel straps. This had been made with the grooves on the edges of the strip and was shown in photo 75 (see part 8, p. 157, M.E. 4617)'. The top bearings with the curved ends were made exactly as those on the ends of the connecting rod, so I will not go into photographic detail. The method was illustrated in photos 64 to 67 when making the connecting rod (see part 7, p. 27, M.E. 4615)'. Suffice to say that the hole of the bearing was drilled and reamed to size. The bearing was then clamped on the rotary table and the end milled semi-circular. The end was grooved semi-circular using a 5/32 inch woodruff cutter. As I had a strip of parent metal, I made one bearing at each end of the strip and then set up again for bearings 3 and 4.

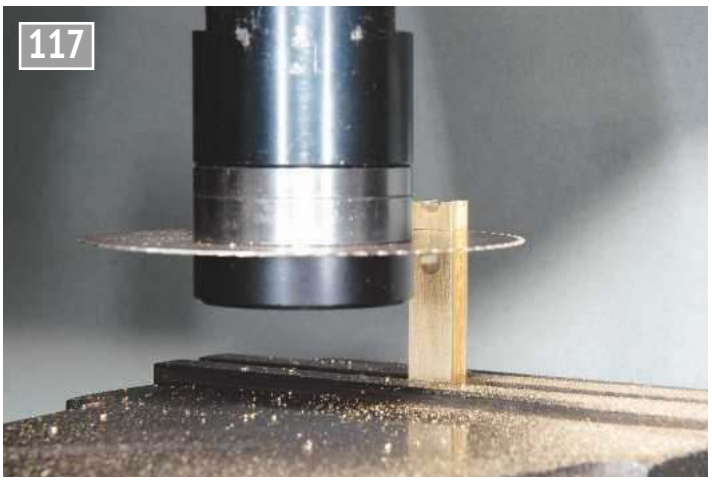
I found it desirable to make a pointer out of a short length of 3/16 inch silver steel. This was turned to a point on the lathe and then used to line up the slitting saw in the mill. As I have a DRO on my mill, I insert the pointer in the bearing hole and then use the slitting saw as an edge finder. Just touching the pointer at the top and at the bottom of the pointer enables you to know the vertical centre of the hole (half the top and bottom readings). Carefully touching the top or bottom of the pointer whilst the slitting saw is rotating gives a clear, audible 'ping' as it comes into contact. Modellers without a DRO can simply line up the slitting saw with the point of the pointer. As you can see from **photo 116** I have drilled the four bearing holes along the grooved brass bar. My thinnest slitting saw is 20 thou' thick or 0.5mm. The drawing shows only the height of the bearing as being 5/32 inch (0.156 inch) for each half. However, the bearing as a whole needs to be larger as the 5/32 inch measurement is the distance to the bottom of the seating groove. I wanted to add 50 thou' to each side in order to form the seating cheeks so I

Slotting the strap.

Parallel forks.



Setting the height for splitting the parallel bearings.



Separating the parallel bearings.

cut each bearing to be 0.412 inch long. However, I was going to lose 40 thou' for the two saw cuts across each bearing. The holes were therefore spaced 0.452 inch apart (0.156 + 0.156 + 0.050 + 0.050 + 0.020 + 0.020) and the top hole was situated 0.206 inch from the end. The maths took a while, but it makes the creation of identical bearings much easier. Obviously, in photo 116, I am locating the underside of the pointer - not preparing to cut the bearing. **Photograph 117** shows the actual cutting of the bottom half of one of the square bearings.

Bearing spreader and other parts.

Once the bearings have been created and fitted into the parallel forks, the next task is to make the ornate spreaders (small pillars) that fit between the upper and lower bearings. The spreaders are shown as being one piece on the drawing and could be made from some 3/16 inch strip, but the job would be very awkward to hold and there would be an awful lot of material to turn off in the lathe – with an intermittent cut. I decided to make these in three parts; two strips of 1/16 inch gauge plate form each end plate, the centre of which had a 1.8mm hole drilled in it, and the central pillar was turned on the lathe from 3/16 inch mild steel using a mixture of a rear mounted parting blade and hand turning tools. A spigot was turned on each end at 70 thou diameter which was a nice press fit into the 1.8mm holes in the end plates. I used the parting blade to form the various flat cylinders on the pillar, bringing these to the desired diameter, and spaced these accurately along the length of the pillar, according to the plan. The whole pillar is very small and fragile and cannot carry a tailstock centre. I therefore held the 3/16 inch bar in a collet chuck and turned it using very light cuts - being unsupported. At the outer (tailstock) end I created a spigot, 0.071 inch and then carefully turned the shape, mainly by eye. It has to be the correct length – and simply look right. The central cylinder was shaped to make a nice curved band by filing carefully with the lathe turning. This is far safer to carry out with a collet chuck but *TAKE CARE!* No loose cuffs or wedding rings please! Once the shape was done, the inner spigot was created at 0.071 inch diameter and the whole thing parted off. The two end plates were finally pressed onto the spigots in the vice. A final strip of 1/16 inch gauge plate was cut to fit into the recess under the bottom of the lower (square) bearing, onto which the wedge will bear.

Important: make the spreader of such a size that the centres of the bearings will be EXACTLY 1.250 inch apart when the whole assembly is wedged together. On one of mine, this distance was 0.015 inch short, so a 15 thou shim was inserted. It was invisible to the eye - only I knew it was there until I wrote this. To this day I am unsure where the discrepancy occurred.

Photograph 118 shows a parallel fork, its two bearings and spreader, ready for assembling with the gib clip and wedge. Once it has been tightly wedged together, I mounted the assembly in the milling machine vice, reamed the top bearing hole to 3/16 inch, moved the table by exactly 0.125 inch and reamed the lower bearing hole. This is, of course, necessary as once the bearings have been split; the bearing hole is no longer round.

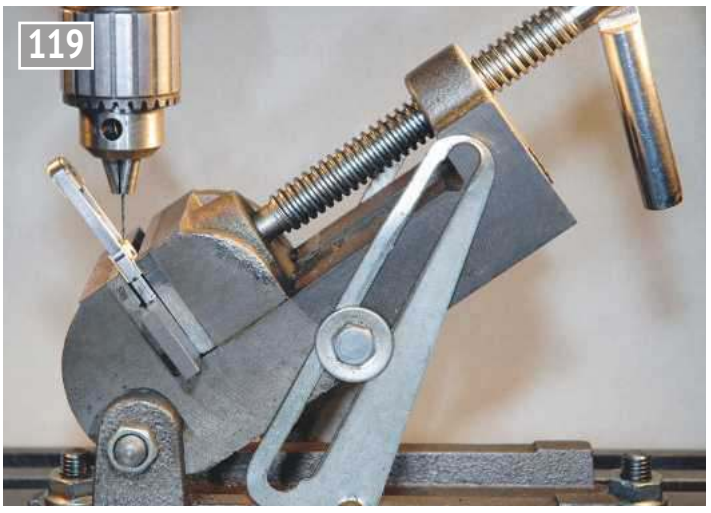
It now remains to create the oil holes to complete the parallel links. Drilling the holes for the top bearings is straightforward but the lower bearing oil holes require care. I decided to drill the holes at 40 degrees to the vertical, which did not quite result in a central hole at the bearing surface, but it ensured that it did not interfere with the steel pad on the end of the spreader pillar. I mounted each bearing in turn on a cheap angle vice as shown in **photo 119** and set the vice to 40 degrees with a protractor.

As the oil hole really requires to enter the bearing on a surface corner it is necessary to mill a small flat on the corner ready to take the centre drill. I used a 1/8 inch slot drill, positioning the edge of the slot drill so that it does not quite break through the brass bearing and therefore does not mark the pad of the spreader pillar. A tiny centre drill was then inserted in the mill chuck, the table moved right (Y Direction - 1.0mm in my case) and the centre drill used to just dimple the milled surface previously made with the slot drill. Changing the centre drill for a 1 mm twist drill, the hole was drilled through to the bearing surface. It was VERY necessary to take things quietly and ensure that the drill did not wander.

Important: if you have made the straps in pairs, ensure that you make one left hand and one right hand strap, each with the oil hole on the outside. My straps were all identical, but I wanted to have all the wedges/clips facing the same way. Think before you drill!

●To be continued.

NEXT TIME
We make the crossbar and crosshead.



Drilling oil holes.

We Visit the Nottingham SMEE

John Arrowsmith goes to Nottingham and discovers a large, lively and very active club.

My latest visit in this series was to the Nottingham SMEE at their impressive site at Little Ruddington about 5 miles south of Nottingham city centre. The club has a large site adjacent to the Nottingham Transport Heritage Centre which includes a bus museum and the northern section of the Great Central Railway. The club has a long history; indeed, a club had been formed in the area in the early 1900s. The present club was formed in 1929 and one of its members is presently compiling records of these ninety years of continuous model engineering into a fascinating document with a view to publishing a book at some time in the future – but he still has a lot of work to do. I did manage to get a photo of the very first club Newsletter published in 1929 (**photo 1**). Membership these days is in excess of 280 at which, no doubt, the original members would be amazed as they might never have envisaged their club expanding to such a large number.

Saturday is the usual work day when the various tasks are undertaken to improve or repair infrastructure. Over the last couple of years a major new project has been undertaken with a new track extension being constructed around the top end of the site; this connects directly to the Parkgate station area making an attractive alternative journey for passengers. My visit also coincided with a group of members from the Cheltenham SME who arrived to enjoy a day with the Nottingham members (**photo 2**). A blustery day with the occasional short shower did not curtail activity, whether working or enjoying the hospitality of the hosts.

It is some time since my last visit here so member Nigel Ball gave me a conducted tour of the club including the impressive new extension. The project was first considered about five years ago when the membership was asked if they wanted to get involved. About 50 or 60 members indicated that they would be willing to help, so all the

The cover of the very first King Pin *newsletter published in 1929.*

preliminary works, such as consultations with the local authority and land owners, planning permissions and health and safety issues were started. This all took about three years to complete, after which the serious construction work was planned out. Actual construction work started in April 2018 and since then a tremendous amount of work has been completed. In the last 12 months or so lots of earthworks, signalling (**photos 3** and **4**), power and water installations (**photo 5**) and, of course, track laying (**photos**

Two of the Cheltenham members depart the main station for a trip round the track.

One of the new colour light signals built and installed by the club for the new extension.

One of the excellent control boxes built for the new track.

At the extremity of the track from the station this new water, air and power box allows drivers to stop and recover without holding up any following traffic.

An impressive double slip installed at Parkgate waiting to be connected to the other trackwork.

The substantial connectors on the moving blades of the points.

A new crossing gate on the extension, note the heavy duty road section.

The simple but effective track transition section connecting the different weights of track.

The signal box lever frame and controls including the super little crossing gate control wheel.

Mr. and Mrs. Copson at Copson Summit's indicator plate.

6 and **7**) have taken place. As the extension includes a couple of new road crossings (**photo 8**) it was decided to use a heavier gauge of track so this required some new special track matching connections (**photo 9**) to ensure a smooth transition from the existing track to the new. A comprehensive signalling and control system has been designed and built by members with Nigel Ball having the task, as project leader, to get it finished on time. I have to say it is an impressive piece of work (**photo 10**). The essential control manual would have been a major job on its own, without having to design the hardware as well. At the moment the club is testing all the controls and systems to ensure members are familiar with how the new sections work with the older, existing track. On public running days, at the moment, use of the extension is restricted to the last hour or so of operations; this is so the neighbouring operators of the park site get used to the crossing gates being closed and, of course, the sight of trains in a completely new section of the circuit! So far everything seems to be working well and, having driven round the circuit myself behind Pete Towle's 7¼ inch gauge Peak class diesel, I can vouch for the quality of the new track. It is a tribute to all the hard work put in by members of the construction team. No doubt there will be a few teething troubles but they won't be anything that this group of dedicated members can't fix.

You will notice one of my photos shows the summit of the new track. As this excavation went through an existing copse, a clever play on words has been created with this sign displaying 'Copson Summit' at the highest point of the track. One of their longest serving members - a gentleman who is also a past President and who, as such, contributed a great deal to the club - is Stuart Copson so it was thought to be a fitting tribute that will remind all members of his commitment over the years (**photo 11**).

During the day other activities were going on, like Andrew Meredith steaming his 7¼ inch gauge GWR small Prairie locomotive for a boiler test (**photos 12** and **13**) which went very satisfactorily. Andrew then proceeded to take out a rake of carriages and

Member, John Lopez helps Andrew Meredith unload his tank locomotive from his car. ≫

Andrew Meredith waits for the pressure to rise on his Prairie.

enjoyed some good running on the track, helping to test the new extension as well. I also had a nice chat with one of the club's younger engineers, 14-year-old Dan Fisher who has been a member for about three years and is really enjoying his membership. He has been involved in lots of club activities and attends on Saturdays, Sundays and Wednesdays when he can. He can drive club locomotives and is also a guard. Dan enjoys his involvement with many different aspects including S&T work. In addition to all this he recently attended a Young Engineers' volunteer week at the Ffestiniog Railway where he spent time working in the Minfford Yard with a number of other young people. He would ultimately like to volunteer on the Welsh Highland Railway and other railways locally. The Nottingham club is an example of one which encourages young people to be part of their team and it pays off as well! They have competent people who can continue the club traditions.

Many readers will, I know, be familiar with the superb workshop facility at Nottingham, available for members to use. It really is an eye-opener, for anyone who has not been before, to see five Bridgeport milling machines located in the workshop alongside all the other machine tools such as lathes, grinders etc. There's a sheet metal area and welding kit all neatly laid out. I told Chairman Nick Harrison I thought it all looked very tidy and efficient and I think it's a credit to the club and its members (**photos 14** and **15**). The signal box here, 'Little Ruddington West', is another excellent feature, affording a good view of the station area and being fully fitted with a well-made lever frame, track diagram and a superb little crossing gate wheel which controls the crossing gates for the elevated track access over the ground level track. All very authentic looking pieces of equipment.

A separate building houses a fine 00 scale layout which depicts the Little Ruddington area as it was when steam railways reigned supreme. Fully scenic, it really is a splendid attraction for visitors (**photo 16**). Outside there are two other layouts; the extensive, well established Gauge 1 layout which is another fine attraction for visitors (**photo 17**) and a three-gauge test track which combines 00, 0-gauge and gauge 1 tracks all together on the same baseboard (**photo 18**). An additional facility - one that I have not come across

Part of the impressive workshop at Nottingham.

Another view of this fine machine shop.

Little Ruddington village, as it used to be in steam days.

The station area on the extensive Gauge 1 track layout.

Maintenance work on the three-gauge test track.

Many of the Nottingham team!

elsewhere - is the second-hand book store which houses a remarkable collection of books and magazines, all of which are available to browse or purchase. It certainly provides a commendable re-cycling feature. I wonder if the club find it a rewarding aspect of club life.

Finally, I must mention the superb clubroom available to members for talks and demonstrations etc.. It is beautifully maintained and I am sure the members here really appreciate such fine facilities.

That just about sums up my visit to the Nottingham SMEE and it only remains for me to thank Chairman, Nick Harrison, Pete and Teresa Towle and Nigel and Jayne Ball for their help and hospitality, along with all the other members who made the day a very interesting and rewarding experience (**photo 19**). I hope my notes give readers an insight into this very active and progressive club which enjoys entertaining visitors, both fellow model engineers and members of the public, at their comprehensive and superb facilities at Ruddington. It really is well worth a visit.

ME

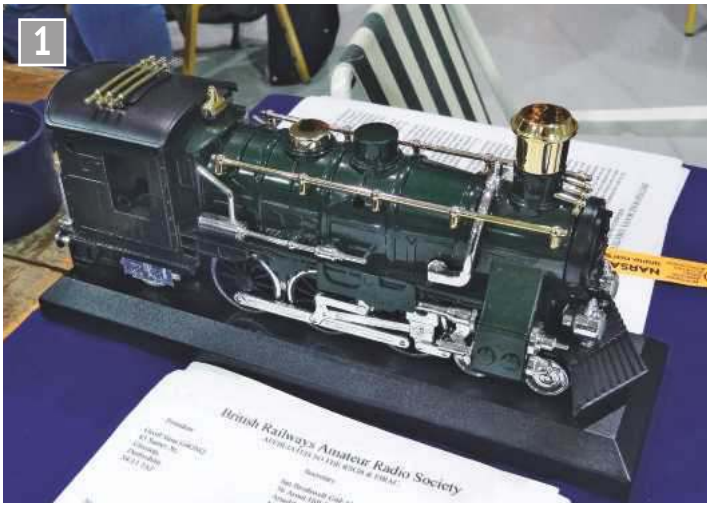
CLUB NEWS

Geoff Theasby reports on the latest news from the Clubs.

I woke up this morning (well, it's better than the alternative) gathering my wits, like an owl. There's one, there's one too, two wits... and hesitantly made my way to the kettle. This is when I feel groggy and disoriented, my eyes don't focus and I need to hold onto things to get my bearings. Perhaps it's the lassitude, or altitude sickness, what with being tall and all that involves. The floor is further away than it was, I'm sure, for one thing, and it is certainly more difficult to elevate myself from it nowadays. Has gravity increased over the years? I need support more than illumination, rather as a drunk uses a lampost. Before you say anything – no, I was not!

Attending the national amateur radio rally in September, I was given a free copy of *Radio User*, which I don't normally read. In it were details of the British Railways Amateur Radio Society AGM, together with a photograph of a model continental locomotive on their stand. In requesting a copy of the photograph, I told the editor that I thought inter-disciplinary contact between hobby clubs a good idea, often leading to cross fertilisation of ideas, which should be encouraged. I feel that opportunities are being missed, if 'we remain in our small corner and they in theirs' (**photo 1**).

In this issue: a tortoise, a 'wooden horse', control towers, Pacifics, locating a blind hole, plastic guns and a 'submarine'.



Locomotive model spotted in Radio User *(photo courtesy of Georg Wiessala).*

Steam Chest, October, from the **National 2½ Gauge Association,** has Eric Rodgers' 1930-built tank engine *Caroline* on the cover, now converted to gas by his son, David. Eric began life at an early age as a pre-WWI car mechanic. Several appreciative comments on the Rugby rally are made; the RMES track now extends to 1 mile, in 12 acres, giving a 10 minute ride. Part 2 of Cedric Norman's 'Regulators' describes different types and the model locomotives on which they are used. John Tomlinson writes on his G&SW 'Big Goods' 2-6-0 made by Paul Bibby in the 1970s.
W. www.n25ga.org

Halesworth & District Model Engineering Society autumn *Newsletter* features a 7¼ inch gauge Stafford industrial ST, built by Bressingham Young Steamers under the supervision of Alan Berry, and just going for its annual steam test. Chairman, Philip Hall visited Mendlesham for their Steam Day and to follow up on the restoration of a Fowler diesel engine from the Shredded Wheat Company, the only one left. Here it is in all its glory, after being restored from almost complete dereliction by Neal and Nigel Davies of HDMES (**photo 2**). A photograph of an un-named Alfred Dodman single crank twin cylinder traction engine took my interest. Its history is fascinating and only one was built. Preparations are well in hand for LOWMEX, one of the better shows I am reliably informed, held on 19/20 October (www.lowmex.co.uk). The Henham event produced a winner for HDMES in the person of Emily Cooper, who completed the Henham Tortoise Race with the slowest time round a course - eight minutes against the more usual six. New member Chris Rackham, by joining the society at Henham, has drastically reduced the average age of the membership!
W. www.hdmes.co.uk

Fowler Diesel at Mendelsham (photo courtesy of Philip Hall).

Stockholes Farm Miniature Railway *News Sheet*, September, reveals that a new mixer has arrived, which is just as well, since the old one looks as though it lost a battle with a train. Work has begun on the tunnel's West Portal and should be completed during the winter.
W. www.sfmr.co.uk

Welling & District Model Engineering Society, *Magazine,* Oct-Nov, says that editor

Tony Riley visited the Spa Valley Railway. He was pleasantly surprised at how busy it seemed but they were operating a Fish & Chips Special! There was a hold-up on the return due to a contretemps 'twixt a horsebox and a bridge, in which the bridge won. As it happens, in a coincidence you would not believe in a novel, the lady train driver 'just happened' to be a qualified engineer and bridge inspector! When the Wooden Horse(box) had been removed from the Iron Horse (bridge) said engineer declared the bridge safe and the trip continued. Well, I do declare! Brian Simmonds spent his holidays in Norfolk, discovering the 100th Bomb Group museum, and its preserved buildings and control tower. This latter building has been fitted with period-clad mannequins and equipment to recreate a wartime appearance. (I have inspected a couple of preserved control towers and find them fascinating. I devoured wartime stories as I grew up and learned all about aviation and the flying stuff but nothing about CTs, except that visiting pilots had to report to the watch office, usually therein. Now there is a website devoted to control towers and I have spent hours on there – Geoff - www.culture24.org.uk/history-and-heritage/military-history/world-war-two/www82240) An item by Bob Underwood about the first criminal to be caught by a railway telegraph message is followed by Tony Riley's account of the development of the GWR telegraph system. A picture of the hectares of diamond crossings outside Newcastle station, possibly taken from the castle still standing defiantly among them, is included to help motivate the designers of the society's new track.
W. www.wdmes.co.uk

Port Bay Express, October, from **Portarlington Bayside Miniature Railway**, contains Ron Griffiths' article on the 'S300' class Pacifics of Victoria Railways. There were four of these, built between 1928 and 1930, and they were designed for the Melbourne to Sydney expresses. Streamlined eight years later and converted to oil fuel in 1951, they had a tractive effort of almost 42,000 lb. After modifying the 'front end,' improving the blast and reducing the back pressure, the DHP improved from 1560 to 1920. More frivolously, lights under the valve gear valances made the polished rods flash as it sped through the night, although the brick station tower at Benalla began to suffer from the vibration of speeding trains and was removed. On the orders of Head Office, the chime whistles were altered to blank off the lower note. This made it sound odd and not all that pleasant. However, all the local dogs heard it and gave voice so that a 'Mexican wave' of howls accompanied the train... The passenger figures continue to increase - up 6% in the current financial year.
W. www.miniature railway.com.au

Sutton Model Engineering Club sends *Newslink*, summer, in which Colin Glanville says, on holiday in Nashville, USA, he heard an unusual aircraft noise. Looking up, he saw a shape that, 60 years ago, was hanging from his bedroom ceiling. A DC-3! (RAF Dakota) Searching for information, he discovered that it was the world's oldest flying example, it was in the area for a few days and rides were available. FAA rules did not allow paying passengers. However, membership of its support group was available and members could fly free! Passengers were invited to the cockpit/flight deck, not that there are many instruments on these old aircraft, but the view was superb. In NTTDS XXI, Eric Upchurch relates the different and unusual items that have been found useful in building models: screw top jar lids, yoghourt pots, plastic milk bottle tops and ball bearings (the individual steel balls.) This last led him to a convenient technique for locating a blind hole within a joint. In a shallow, undersize hole, stick a ball with Blu Tac, then offer up the mating part. A firm blow will press the ball into the new part, leaving a precisely located mark for a hidden dowel with no obvious sign of its presence.
W. www.suttonmec.org.uk

Savage traction engine (photo courtesy of Russ Coppin).

Blast Pipe, October, from **Hutt Valley & Maidstone Model Engineering Societies,** is a short newsletter since editor Peter Anderson is relocating to Christchurch and wishes to relinquish his post. No volunteers yet, apart from Claude, who already seems to do everything. Ben Calcott has made a 'Little Mack' 3½ inch gauge electric switcher kit from Fairweather Foundry. It commemorates the 'Mighty Mack' yard engines, utilising a 24 volt 100 watt motor, with a steel body and several aluminium castings. 'Sparky', a G scale plastic version is available from Hartland Locomotive Works.
See http://www.h-l-w.com
W. www.hvmes.com

Bradford Model Engineering Society's *Monthly Bulletin,* October, says that at the Bradford Industrial Museum event, Lauren, the museum curator, was given a lesson in driving the Savage traction engine (**photo 3**) and very good she was too. In August, several live skills demonstrations were in operation, including resistance welding, four-facet drill sharpening, a pulse width modulated motor speed control, including an oscilloscope display of the varying waveform as the speed control is adjusted, and 3D printing. Michael Hawkridge spoke in September of warships, big guns and model making, revealing the interesting fact that the *Victory*, in Portsmouth, is now equipped with modern guns, of fibreglass! *Road Vehicle News* encountered a Scott *Flying Squirrel*, with sidecar. The m/c was one of the last, made in 1965, and the sidecar is actually a boat, powered by a cordless drill, and capable of 5 mph (surely knots?) (**photo** ≫

Motorcycle combination (photo courtesy of Ian Jackson).

4). David Jackson was out and about and saw the remains of a modern tractor and trailer which had caught fire. His daughter, Sally, was in Otley for the Transport Extravaganza and photographed this fine participant in the Jowett Owners Club parade (**photo 5**). (Sally's green Jowett, if you like [sweet] corny jokes, Ho Ho Ho. – Geoff)

W. www.bradfordmes.co.uk

My colleague John Arrowsmith (whom God preserve) of **Hereford** was talking to that city's **Society of Model Engineers'** newsletter editor and discovered that he does not send that periodical to me. (With my reputation???) This has now been rectified and what a newsletter! Sir, thou hast been hiding thy light under a bushel! *Whistlestop*, summer, is a 32 page, full colour journal on glossy paper, and one would think members would be proud to be published in such a periodical. There is just ONE. A montage of photographs decorates the front cover. Editor, Martin Burgess recalls the moving of their track to its present location. In it were two old railway van bodies, which were to go. Unfortunately, one of them was occupied, or at least they found a bedroll neatly stacked in a corner. Thoughtfully relocating this to a nice, dry hedgerow, they hoped it was reclaimed ere long. John reports on the Much Marcle rally, where the Society display was well supported and received. One of their Young Engineers, Dan Bell, has been awarded

1904 Mors Roi de Belge (photo courtesy of John Arrowsmith).

Sally's green Jowett (photo courtesy of Sally Jackson).

the Messier-Bugatti-Dowty Technology Award, which is only given to outstanding and special pupils. Photographs show a superbly restored 1904 *Mors Roi de Belge* amongst the 'heavy metal' (**photo 6**). Bill Hall has built a model of a GWR 3521 class broad gauge convertible locomotive. It is notable for its original style tender, in contrast to all the pictures he had seen, which had later tenders. Richard Donovan describes the eventful history of the 80 ton *Waimarie*, built on the Thames in 1898, then shipped to Wanganui, NZ (Where Deborah grew up) and operated until sunk in floods in 1952. It was raised and restored in 2000, and fitted with a Yarrow boiler, powering a single cylinder engine using Gooch valve gear, giving a maximum speed of 11 knots at 70 rpm. Martin writes on an odd vehicle he spotted on Jersey this summer; from the rear, it looks like a Morgan three-wheeler but the front looks like this (**photo 7**). It is indeed from a 'grey Fergie', the engine from a Suzuki bike, and the rear was originally a Red Arrows BAE Hawk (saved a lot of metal-bashing, did that). Guernsey resident Nigel Loller built it in only six weeks! New members since the last Journal amount to 13, and three young engineers.

W. www.hsme.co.uk

And finally, If German airlines served waffles, would they be Luftwaffles?

Contact:
geofftheasby@gmail.com

Suzy, in Jersey (photo courtesy of Martin Burgess).

DIARY

DECEMBER

4 **Brandon DSME.** Meeting at The Ram Hotel, Brandon, 7.45pm. Contact Mick Wickens: 01842 813707.

4 **North London SME.** Festive gathering. Contact Ian Johnston: 0208 4490693.

5 **Cardiff MES.** Talk: 'Foundry Experiences' – John Styles. Contact Rob Matthews: 02920 255000.

5 **Leeds SMEE.** Christmas dinner at Drax Sports and Social Club. Contact Geoff Shackleton: 01977 798138.

5 **South Lakeland MES.** AGM in the pavilion, 7.30pm. Contact Adrian Dixon: 01229 869915.

5 **Sutton MEC.** Bits and pieces. Contact Paul Harding 0208 2544749.

6 **Portsmouth MES.** Club night: quiz, 7.30pm, Tesco Fratton Community Centre. Contact Roger Doyle: doyle.roger@sky.com

6 **Rochdale SMEE.** Auction night, 7.30pm at Castleton Community Centre. Contact Rod Hartley 07801 705193.

7 **Tiverton & District MES.** Running day at Rackenford track. Contact Chris Catley: 01884 798370.

7/8 **Bedford MES.** Santa specials – pre-book rides at www.bedfordmes.co.uk/santa-specials.

8 **Bradford MES.** Santa special, 11am-3.30pm, Northcliff track. Contact: Russ Coppin, 07815 048999.

8 **Guildford MES.** Public open afternoon 11am-3pm. Contact Mike Sleigh: pr@gmes.org.uk

8 **Newton Abbot & District MES.** Running day at Lindridge Hill. Contact Ted Head: 07941 504498.

8 **North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-dusk. Contact Ken Parker: 07710 515507.

8 **Sutton MEC.** Sunday track day from noon. Contact Paul Harding 0208 2544749.

10 **Romney Marsh MES.** Members' social afternoon, 2pm. Contact Adrian Parker: 01303 894187.

12 **Newton Abbot & District MES.** Mince pie evening. Contact Ted Head: 07941 504498.

12 **Sutton MEC.** Workers' Christmas lunch. Contact Paul Harding 0208 2544749.

12 **Sutton MEC.** Club night – quiz – partners welcome. Contact Paul Harding 0208 2544749.

15 **Newton Abbot & District MES.** Running day at Lindridge Hill. Contact Ted Head: 07941 504498.

15 **North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-dusk. Contact Ken Parker: 07710 515507.

15 **Rochdale SMEE.** Santa special at Springfield Park, 7.30pm. Contact Rod Hartley 07801 705193.

15 **Westland & Yeovil DMES.** Track running day 11am – 4.30pm. Contact Bob Perkins: 07984 931993.

16 **Leeds SMEE.** Meeting night – quiz night. Contact Geoff Shackleton: 01977 798138.

17 **Romney Marsh MES.** Members' social afternoon and Christmas quiz, 2pm. Contact Adrian Parker: 01303 894187.

17 **Wigan DMES.** Bring and buy with mince pies. Contact Kevin Grundy: 07877 634184.

18 **Bristol SMEE.** Members' night – 'Show and Tell'. Contact Dave Gray: 01275 857746.

19 **Sutton MEC.** Club night. Contact Paul Harding 0208 2544749.

22 **Newton Abbot & District MES.** Running day at Lindridge Hill. Contact Ted Head: 07941 504498.

22 **North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-dusk. Contact Ken Parker: 07710 515507.

22 **Rugby MES.** Public running 3-6pm – visiting locos welcome with boiler certificate. More info. at rugbymes.co.uk.

22 **Tiverton & District MES.** Running day at Rackenford track. Contact Chris Catley: 01884 798370.

24 **Romney Marsh MES.** Members' social afternoon, 2pm. Contact Adrian Parker: 01303 894187.

26 **Sutton MEC.** Boxing Day run, 10am-4pm. Contact Paul Harding 0208 2544749.

27 **Bradford MES.** Mince pie steam-up, 11am until frostbite sets in, Northcliff track. Contact: Russ Coppin, 07815 048999.

29 **Newton Abbot & District MES.** Running day at Lindridge Hill. Contact Ted Head: 07941 504498.

29 **North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-dusk. Contact Ken Parker: 07710 515507.

JANUARY

1 **Plymouth Miniature Steam.** Members' day, 10.30am onwards. Contact Rob Hitchcock: 01822 852479.

3 **North London SME.** Members' videos, slides and photographs. Contact Ian Johnston: 0208 4490693.

7 **Romney Marsh MES.** An evening with Andy Nash, 7.30pm. Contact Adrian Parker: 01303 894187.

8 **Bradford MES.** Bits and pieces evening, 7:30-10pm, Saltaire Methodist Church. Contact: Russ Coppin, 07815 048999.

8 **Brandon DSME.** Meeting at The Ram Hotel, Brandon, 7.45pm. Contact Mick Wickens: 01842 813707.

8 **Leeds SMEE.** Members' current projects. Contact Geoff Shackleton: 01977 798138.

14 **Romney Marsh MES.** Members' social afternoon, 2pm. Contact Adrian Parker: 01303 894187.

21 **Romney Marsh MES.** Talk: 'The Silver City Story' – Paul Ross, 7.30pm. Contact Adrian Parker: 01303 894187.

22 **Leeds SMEE.** Meeting night – 'The First Train in Spain from Warrington' – Richard Gibbon. Contact Geoff Shackleton: 01977 798138.

28 **Romney Marsh MES.** Members' social afternoon, 2pm. Contact Adrian Parker: 01303 894187.

FEBRUARY

4 Romney Marsh MES. Talk: 'Judging Models at Exhibitions' – Harry Paviour, 7.30pm. Contact Adrian Parker: 01303 894187.

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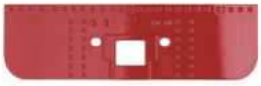

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Guillotine 51" x 16g


Last One!

£14000

Myford Super 7 Connoisseur lathe still NEW from Nottingham' 26-3000rpm

Must buy!


£375

Rapidor late 6" hacksaw


Myford non standard wheels

£10-£49


£625

Union 12" pedestal grinder


Myford Super 7B lathe + inverter

£4250


£10 Each

Cora 'neat cut'


£425

Myford MB4 bench drill


£325

JM Wild milling spindle


£160 Each

30, 32, 50 DP +1/8" CP gear cutter sets


£345


£4500

looked after!

Colchester Triumph 2000 lathe (60" centres)


£345

original as new!

Burnerd D13 8" 4 jaw chuck


Colchester steadies to fit Student, Master, Bantam 2000, Triumph, Mastiff!


nice selection

Blacksmith tooling


Tipped tools + tips


£45 Each

Bridgeport coolant trays


£1475

Union buffer + built in extractor


£1150

Startrite 24-S-5 metal cutting/wood bandsaw (not steel)


£375

Union buffer

Back by Demand!

Home and Workshop Machinery are opening for two special days over the Christmas Season with special offers tea and biscuits!

December Monday 30th and Tuesday 31st December 2019

10am - 4pm

Happy Christmas to all from Home and Workshop Machinery!


£70

Crown granite surface plate 12" x 12"


£295

Abwood 4" swivel tilt vice


£845

Clarkson tool and cutter grinder

late model

£575

Saupe (Hobbymat) lathe

240V

£425

RJh buffer

WD-40

£20 each

£845

Tom Senior Mill

£3950

Denford Turn 270 Pro CNC

£475

Never used

Baileigh 5 TON arbor press

various!

Angle plates + surface plates

Special 5 for £20

Myford ML7/ Super 7 Rifle/ Bridge bed felts

£90

Tripus (German) on/off switch

£525

Union 10" pedestal grinder

£2250 very nice condition!

MEP Shark bandsaw 280 x 200mm

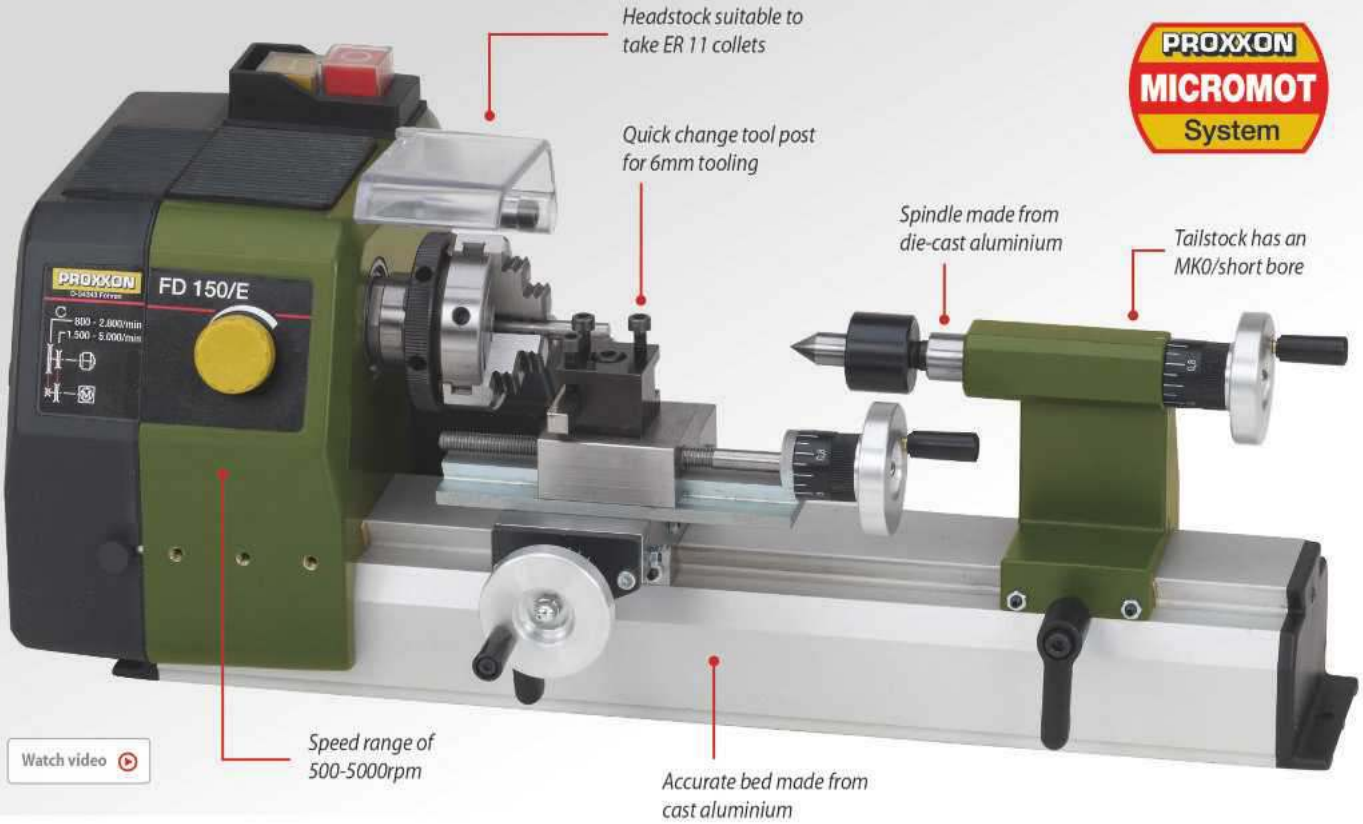
Please PHONE 0208 300 9070 to check availability or to obtain our list

DISTANCE NO PROBLEM! • DEFINITELY WORTH A VISIT • ALL PRICES EXCLUSIVE OF VAT

Just a small selection of our current stock photographed!

We are currently seeking late 'Myford Super 7B' & 'Super 7 large bore' model lathes!

SHIPPING WORLDWIDE



PROXXON MICROMOT System

Precision turning with Proxxon

A light, stable and compact metalworking lathe, perfect for facing and longitudinal turning, boring, taper turning, parting and drilling.

- **Powerful, quiet-running DC motor with 2-stage belt drive and electronic speed control**
- **High maximum speed (5000rpm) allows very small diameters to be machined**
- **3-jaw self-centring chuck supplied**
- **Distance between centres 150mm**

Proxxon FD 150/E Lathe and Turning Tool Set Package Deal

£529.96 Inc.vat

Code **720691**

Sold separately
FD 150/E Lathe – £495.96
Turning Tool Set – £59.50

6 Piece Cutting Tool Set

Made of high quality cobalt HSS steel, the set comes in a handy wooden box and contains a boring, roughing out, parting, finishing, right and left cutting tool. All tools are 6 x 6 x 60mm.

AXMINSTER Tools & Machinery

To see the quality of these products and arrange a demonstration, **visit one of our stores**, search **axminster.co.uk** or call **0800 371822**.

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Price may be subject to change without notice.

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Rated **'Excellent'** on Trustpilot