

THE ORIGINAL MAGAZINE FOR MODEL ENGINEERS

Vol. 221 No. 4601 • 7 - 20 December 2018

MODEL ENGINEER

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Macclesfield Mills

Road Steam 2018

COVER FEATURE

Midlands Competitions



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lathe tools 12mm
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SPECIFICATION

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Maximum swing..... 280mm
Swing over cross slide..... 158mm
Distance between centres 600mm
Bed width..... 150mm
Longitudinal travel 560mm
Spindle taper 4MT
Spindle bore 26mm
Maximum tool size..... 12mm
Range of spindle speeds rpm (12) 45 - 2000
Range of metric threads 0.25 – 5.0mm
Range of imperial threads 4 – 96 tpi

Tailstock taper..... 2MT
Tailstock quill travel..... 60mm
Top slide travel..... 65mm
Cross slide travel 130mm
Headstock bearings..... Taper roller
Compound slide swivel..... 360°
Chuck mounting..... Flange
Motor 1.1kw
Power supply 240v
Dimensions L x W x H to end of handle grips
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MODEL ENGINEER

Published by MyTimeMedia Ltd.
Suite 25S, Eden House, Enterprise Way,
Edenbridge, Kent TN8 6HF
+44 (0)1689 869840
www.model-engineer.co.uk

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print & digital media publishers

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

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ON THE COVER...

David Lee's 3 1/2 inch gauge Tich, which gained a Commended certificate at the Midlands Model Engineering Exhibition (photograph: John Arrowsmith).

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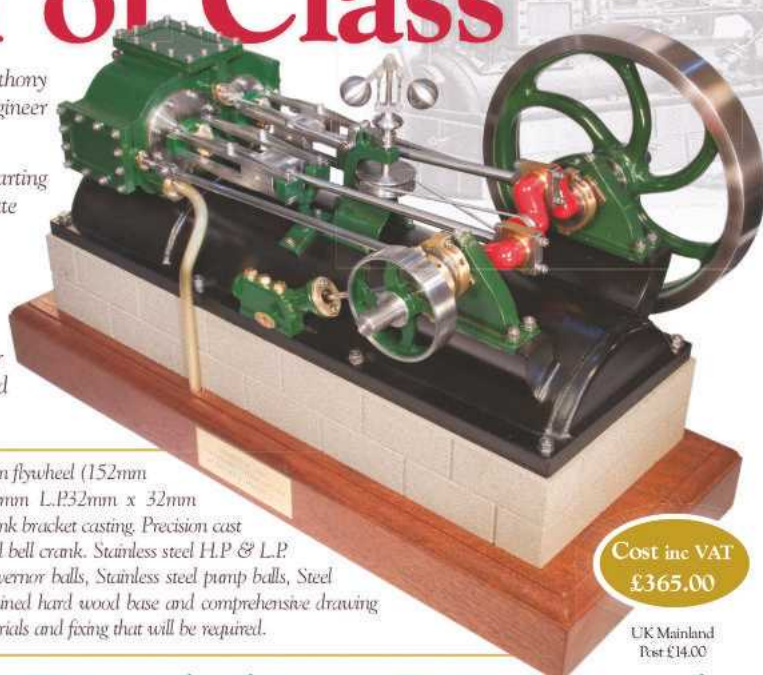
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Following extensive research with leading authority Mr. Anthony Mount we are pleased to offer our latest release for the model engineer to machine and build. **The Garrett Royal Show Compound.**

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Ken Swan

Adrian Morley writes:

'It is with great regret that we record the death of Ken Swan on Friday 26th October 2018.

Ken was the founder of the Beamish Model Engineering Group and its designer of engines, carriages and track. He will be greatly missed by his many friends in the model engineering fraternity throughout the world. We shall miss him for his forceful personality, as well as his encyclopaedic engineering know-how. Above all we shall miss his friendship and presence at our lunch and tea breaks. Our sympathy to his family who looked after him in his last illness.'

Adrian's obituary of Ken appears on page 841.

London Model Engineering Exhibition

Christmas is looming up on the horizon; we've already had 'black Friday' and no doubt 'purple Wednesday' will be along soon. With all this excitement it is easy to forget about the new year. Perhaps this would be a good time to get out your diary and reserve the weekend of the 18th – 20th January 2019 for a visit to the London Model Engineering Exhibition at Alexandra Palace.

Now in its 23rd year, the show is the must attend event for all active model engineers and engineering enthusiasts. Visitors can

come along and see the full spectrum of modelling from traditional model engineering, steam locomotives and traction engines through to the more modern gadgets including trucks, boats, drones, aeroplanes and helicopters.

Model engineering is about to take a leap in the cool stakes as the South's Major Showcase of Modelling today announces 'The Ministry of Steampunk' as the show's newest exhibitor. The London Model Engineering Exhibition welcomes The Ministry to the show for the first time with an amazing display of art pieces, costumes and never-before-seen models that will leave visitors spell-bound.

Steampunk takes the past and wraps it in a new imagination, creating a history that should have been. The Ministry of Steampunk is a collective of designers, engineers and artists who recreate totally unique and original versions of some of history and popular culture's favourite shows, stories and moments.

Mark Goodman, designer and engineer at The Ministry of Steampunk says: "We want to encourage a new generation in to modelling, engineering and design; joining an event like the London Model Engineering Exhibition allows us to help do that; to show modelling is cool; to encourage future modellers and creators to pick things up and have a go - from Lego to Meccano, to finding old pieces

of 'junk' and turning them into something fabulous. That is what modelling is about. That is what Steampunk is about. We're over the moon to be showcasing at the London Model Engineering Exhibition and excited to let everybody see what we have on offer."

All of the leading suppliers will also be present showcasing new products and special promotions and giving hobbyists an excellent opportunity to see and compare products under one roof. You will be able to purchase virtually anything you need for your next model or project or to get you started in a hobby.

If you are an active model engineer this is a key event in the calendar to meet other hobbyists and see the leading suppliers. Full of inspiration, this unmissable exhibition promises a brilliant day out for the whole family!

Tickets are £12.50 (adults), £11.50 (OAPs and students) or £4.50 (children) but you can save £1 on these prices by booking online in advance. More information is available at www.londonmodelengineering.co.uk

Home and Workshop Machinery

Will you be at a loose end after Christmas, devising new and original recipes for the remains of the turkey while waiting for 2019 to arrive? Never fear, all is not lost... Home and Workshop Machinery are having two open days on Friday 28th and Saturday 29th December with some special deals from 10am till 4pm. You are invited to take a look round with a cup of tea thrown in! No cold turkey. www.homeandworkshop.co.uk



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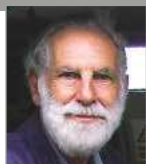
Martin Evans can be contacted on the mobile number or email below and would be delighted to receive your contributions, in the form of items of correspondence, comment or articles.
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A 1/3 Scale GWR Swindon 8 inch Water Crane

PART 3

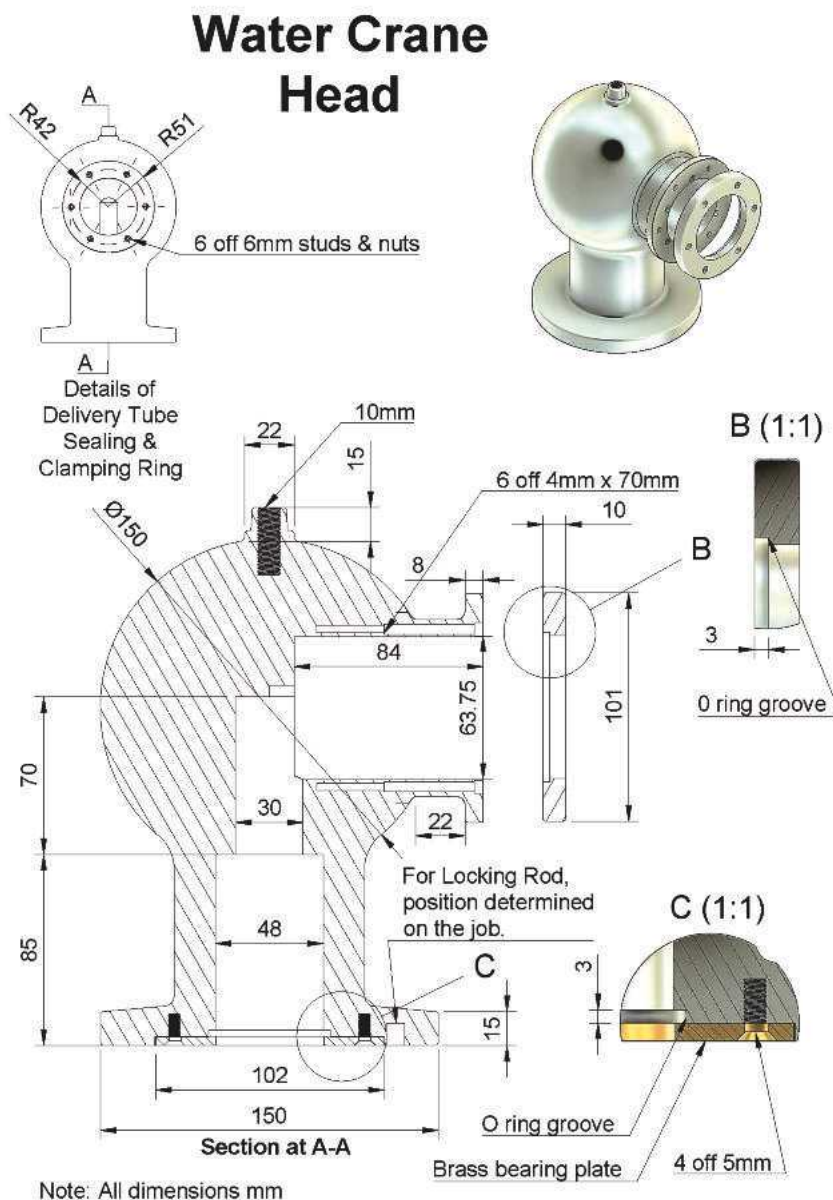
Canon Roger

Davis felt that there must be better ways of watering a locomotive than sticking a piece of old hosepipe into the tank and decided to do something about it.



Continued from p.727
M.E. 4599, 9 November 2018

Fig 4



The water crane head (fig 4)

It was anticipated that the spherical head unit would present the greatest challenge to this very amateur machinist and so it proved. A carefully planned series of machining

operations was mapped out on a sheet of paper trying to anticipate how the developing and complex component could be held safely and securely at each stage.

The first operation in the lathe was to roughly define

the lower flange and the upper section of the 150mm diameter bar from which (hopefully) the sphere would emerge, making allowance for the top spigot that would take the vertical upper brace support for the arm. Then,

with the workpiece firmly clamped upside down on the mill table, the central vertical hole was drilled and milled ready to take as a press fit the 48 x 4mm stainless steel (SS) tube that would eventually give both pivoting and structural integrity to the assembly. This hole was then extended through to the planned centre of the sphere at a reduced diameter to give a water channel where it would eventually meet the bore that would hold the horizontal arm tube (**photo 14**).

Whilst still clamped on the mill a shallow cavity was bored (and drilled for the fixing screws) to take the 100mm diameter flush fitted brass bearing plate together with a further shallow bore for installing a 48mm O-ring beneath it (**photo 15**). This O-ring was intended to give a good seal between the head unit and the SS tube but – belt-and-braces – it would be supplemented by another similar O-ring inserted into the head and then trapped between head and the top end of the tube when it was press fitted (with Loctite for luck) on final assembly.

Now it was time to consider how to achieve the 6 inch diameter sphere. Clearly the first stage would be to roughly define the sphere with a series of turned stepped cuts which have often been described in



these pages. These can be defined by calculation with a spread sheet or more crudely by using squared graph paper. Either way, when cutting metal it is vital not to lose count of where you are in the overall operation. Again, immense amounts of swarf were generated and more visits to the local tip scheduled (**photo 16**)!

I don't know whether there are any spherical turning tools capable of working at 6 inch



Spherical head brass bearing plate.

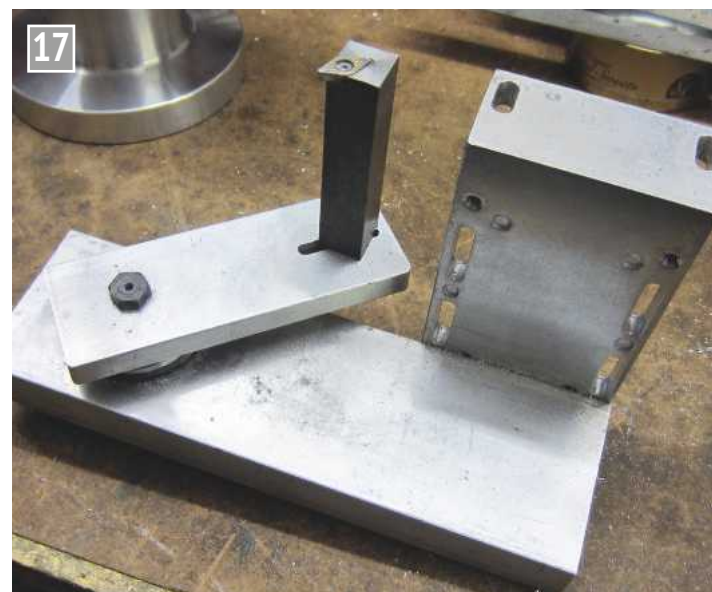
First boring of head spherical component.

diameter generally available but, anyway, it is always an interesting challenge to 'roll your own'. My solution, using what came to hand in my workshop, can be seen in **photo 17**. The angle bracket to be held in the lathe quick change toolpost was cast aluminium, originally supplied for installing digital readout sensors but never needed. The mild steel vertical holder was specially made to take a spare GT cutting insert

at my lathe's centre height. This is horizontally rotated on its arm being supported by a 50mm diameter thrust ball race mounted on the substantial aluminium base block. **Photograph 18** shows the tool doing the business of reducing the previously turned steps to the intended smooth profile. The tool holder was actually very slowly and carefully swept round to shape the profile using both hands with two spanners gripping



Roughing the head sphere.



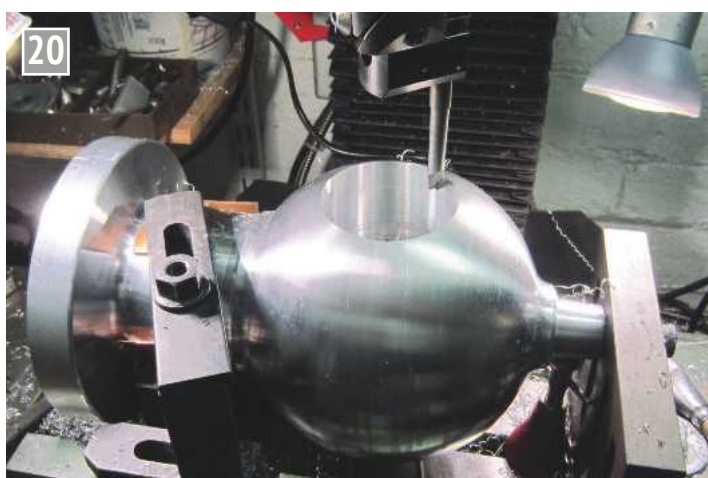
Spherical turning tool.



Spherical turning tool in action.



Finished head sphere component.



Boring head for delivery pipe.

the square section upright to minimize chatter. With the lathe Y axis locked off on the sphere's equator the lathe X axis controls the depth of cut, the tool being very cautiously advanced a little at a time to avoid dig-ins. With patience and some final fettling with files and emery the end result was felt to justify the effort (**photo 19**).

On the original water crane the whole head would have been one hollow casting. With this fabricated scale model the next stage was to make the flanged collar that would provide support for the SS 2½ inch water delivery pipe. This second component of the head unit was firstly part turned from the 50mm off-cut (from the same 4 inch thick-wall pipe used for the main column) to form the flange. Enough metal was left behind the flange for eventual blending into the sphere.

It was then necessary to drill and bore into the side of the main sphere such that, with later judicious blending and fettling, the join between collar and sphere would be completely concealed (**photos 20 and 21**). This was done on my Warco WM 18 mill before its CNC conversion recently described in these pages. The sphere and collar components form the finished head unit



Boring head for fitting collar.

and are secured together with six countersunk 4 x 70mm socket head bolts (**photo 22**). A further ring matching both the diameter, thickness and drilling of the flange was made. This is secured by six 6mm studs and nuts and serves to conceal the heads of the 4mm bolts, hold in place a sealing O-ring around the delivery pipe and complete the correct appearance of the

prototype (**photo 23**). By these means the long horizontal delivery water pipe with 90 degree elbow (with silver soldered sleeve joint) is firmly secured into the head unit and a completely water-tight connection made between the 48mm vertical pipe through the swinging arm to the leather bag.

● To be continued.



Method securing collar and sphere components.



Completed head unit with sealing ring.

A Diversion into Rotary Broaching

PART 3

Ray Griffin concludes his description of the construction of a rotary broach from a kit of parts by cutting a square hole with it.



Continued from p.730
M.E. 4599, 9 November 2018

Broaches are made from 8mm diameter silver steel rod, supplied in the kit. I required a broach to cut a square hole with 4mm sides. With the 8mm stock, the largest square broach possible is 5.5mm across the flats (AF), while hexagon broaches up to 6.9mm AF are possible.

Making the broach

I started by facing the end of the rod, in the lathe, to a good finish. I used a dividing head mounted on the table of the mill to make the four sides, with a downwards tilt of 2.5 degrees providing a clearance angle for the cutting-edge. Before starting work, it is important to ensure that the axis of the dividing head is parallel to the table of the milling machine and that the 2.5 degree angle is correct. I checked mine by putting a test bar with a number two Morse taper in the socket of the dividing head with a DTI held in the spindle of the mill touching the side of the test bar (**photo 12**).

The table was traversed, and the dividing head swivelled



Alignment of dividing head to axis.

until it was possible to travel full length of the test bar without movement of the DTI. The holding bolts for the dividing head were then tightened. I then checked that the test bar was horizontal by traversing the DTI along the centre of the top surface of the bar and adjusted the tilt until I travelled from end to end of the bar without movement of the DTI pointer (**photo 13**). In each of these photographs, readers will note a positive

number indicated on the DTI. The DTI does not show a negative movement past zero, so a plus or minus movement is only seen by setting a positive initial reading.

My dividing head has divisions on the body to indicate movement from the horizontal position. To ensure accuracy, I attached a Wixey digital angle gauge to the test bar and adjusted the body to obtain the required 2.5 degrees (**photo 14**). A small endmill



Alignment of dividing head to horizontal position.



Setting 2.5 degree tilt.

was used to cut the four sides. With this type of cutter, it is advised to make the maximum length approximately twice the length of the diameter across the flats to ensure that the base of the cutter is not thin and fragile. In my case the length could be 8mm and I used a 10mm endmill.

A small flat was milled on the side to correspond with the position of the grub screw in the shaft, then the cutter was parted from stock. The cutter was hardened by heating to bright red and then plunging into water. It is only small, so a hand-held gas torch worked well. I followed the advice in the instructions and left the cutter hard and did not follow with tempering. As with all cutters, this one needs to be sharp. A good milling cutter will ensure sharp sides but these do not do the work. Cutting takes place at the four corners.

As it is essential that the sharpening treatment does not round off the corners, the cutter should be held in the vertical position when an abrasive is applied. I held mine in a Tap True tapping device and rotated fine wet and dry paper in a figure of eight motion on the table (**photo 15**). The cutter could be held in the chuck of a bench drill or milling machine and an alternative abrasive used. A fine natural or synthetic stone could be used but the table of the machine would need protection and the stone would need to be flat. Used cutting stones often have a concave surface and would make the corners round. I also passed a fine diamond file over the sides; keeping the file as flat as possible. The finished cutter (**photo 16**) was installed in the tool and ready for work.

Putting the broach to work

The tool works by cutting faces to the shape required, in a pre-existing round hole. To help start the broaching, the hole needs a 90 degree countersink with an outside diameter just larger than the maximum diameter of the broach. As mentioned



Polishing the cutting face of broach.

earlier, my broach was 4mm AF, so it was necessary to use a hole 4mm in diameter and a chamfer made with a countersink. To make the connection piece for the outboard motor, I held a short length of round brass bar in my ER 40 collet chuck and drilled through with a 3mm drill, to fit the round shaft of the new motor. I then enlarged the hole to 4mm, and a depth of 10mm and cut the chamfer. The tool was held in the tailstock of the lathe. I used an ER 32 collet chuck with a two Morse taper (**photo 17**).

The broach was introduced to the work and the lathe started at a slow speed. As noted in the instructions, I had not fully tightened the screws securing the body to the shaft. It was suggested that this would allow the body and broach to centralise in the chamfer. My first attempt did not work; it was apparent that the broach was not cutting. I was not sure how much pressure to apply, though common sense suggested that, if it was going to cut, it should do so freely.

I stopped the lathe and examined the contact between broach and workpiece with a magnifying glass. It was clear that the broach was off centre and would not enter the hole. I was puzzled as I was sure that I had followed the plan carefully. I concluded that small differences in the offset of the holes necessary to give the correct tilt when securing the body



Final broach.

to the shaft had aggregated to my disadvantage. The counterbored screws did not allow sufficient movement.

My solution was to elongate the holes in the shaft allowing more lateral movement and replace the counterbored screws with screws and washers. This looked a bit clumsy but I persuaded myself that I would, in the future, if the tool worked, make a replacement shaft with a more elegant arrangement of screws.

Once I had provided more lateral movement it was easy. I made the broach concentric with the hole, tightened the holding screws and started the lathe. The broach did not need much pressure, to cut swiftly into the hole. It was fascinating to watch the broach cut into the work, as they work rotated together. I was puzzled to understand how the broach could cut if it rotated at the same speed as the work. The Hemingway instructions suggest that the

easiest way to understand the action of a rotary broach is to build one. I made one and it worked but watching it offered no explanation.

As usual, I looked to the Internet for clarification. The extract below, taken from www.polygonsolutions.com/how-rotary-broaching-works was helpful:

'Rotary Broaching, also known as Wobble Broaching, is unlike the conventional broaching method. The conventional method has a sequence of polygon or other forms that increase in size and are pushed through a hole until the desired form size is achieved. Rotary Broaching can achieve this in one pass by cutting the full form, one corner at a time, often eliminating the need for a secondary operation. This works exceptionally well on Horizontal or Vertical Spindle Machines such as Lathes, Mills, etc.

'Rotary Broaching is a precision method for producing internal polygon forms at an

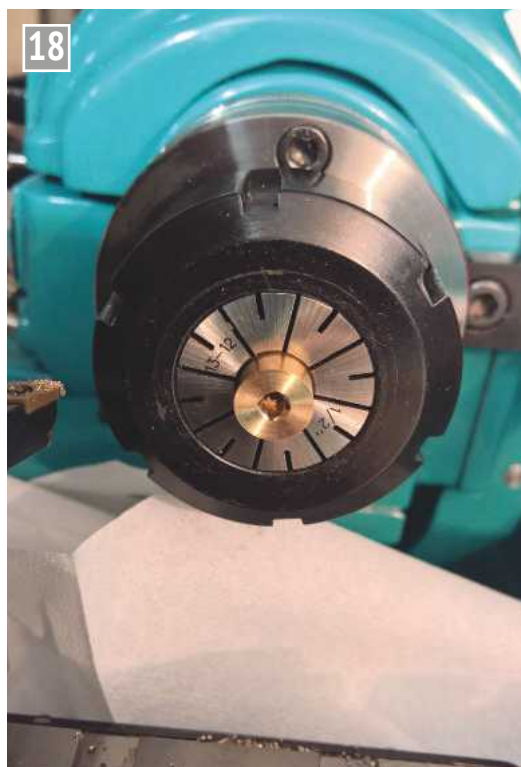


Rotary broach ready for action.

extremely fast rate. The entire operation can be completed within seconds and can produce forms to 0.0005 inch accuracy or better. This advanced engineering has caused Rotary Broaching to become increasingly popular; especially in the medical, automotive, aerospace and plumbing industries.

'The principle that makes this process work is the 1° angle of the cutting tool to the centreline of the work piece. This causes the Rotary Broach to shear into the work piece, with a chisel or scalloping effect, as the broach is fed into the part to the depth required. The Rotary Broach Tool Holder has a live spindle that holds the broaching tool, allowing the spindle to spin freely within the tool holder. In a lathe, the spindle is driven by contact with the rotating work piece. With Rotary Broaching it is possible to broach such forms as Hexagon, Square, Torx, Serration, Keyway, Double Keyway, Double Square, Double D, Double Hex, Involute, Spline, Spur Gear, J500, Numbers, Letters and Other Polygon Forms.'

When the broach had cut to maximum depth, I faced the end of the work to remove the



Removing countersink.

counter sink as I wanted to have maximum depth of hole in contact with the square shaft (**photo 18**). The broach was again reinserted into the hole and allowed to cut to full depth. The connector was removed from the chuck and

a hole drilled and tapped in the side for a 5BA grub screw, to secure the motor shaft. The final assembly minus the motor mounting is shown in **photo 19**. Jeff told me that the coupling accepts the full power of the electric motor,

allowing the boat to travel at very high speed. All thanks to this interesting diversion into rotary broaches.



Final assembly with new coupling piece.

ME

No.276

THE JANUARY ISSUE, NUMBER 276,
OF MODEL ENGINEERS' WORKSHOP
WELCOMES THE NEW YEAR:

MODEL ENGINEERS'
WORKSHOP



Chris Gill makes a Fixed Steady for a Harrison lathe that can be easily adapted to suit many other machines.



Pete Barker makes worm gears for his Versatile Dividing Head.



Katrina Bhowruth reports on a skills workshop with Gateros Plating.

On Sale 28th December 2018

ME Vertical Boiler - Constructing the Boiler PART 19

A project aimed at beginners wishing to develop their skills or those requiring a robust vertical boiler for the running or testing of small steam engines. **Martin** adds the lagging and banding to the boiler shell.



Continued from p.766
M.E. 4600, 23 November 2018

Lagging and banding – Item 21 x 3 Ø5 x 8 Brass (fig 51)

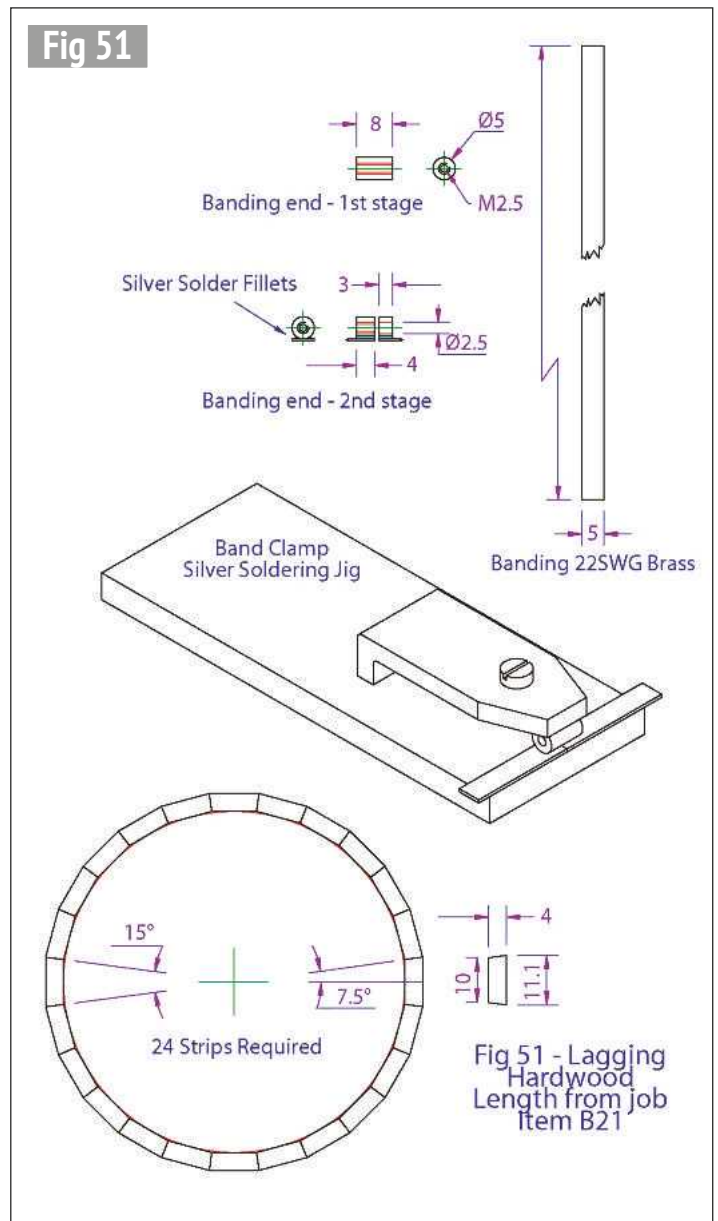
Fit the smokebox and firebox to the ends of the boiler barrel and measure the distance at several locations around the circumference between the edges of these two items. Take the smallest measurement and cut 24 strips of 4mm thick hardwood 11.1mm ($\frac{7}{16}$ inch) wide to this length. Taper the edges (see drawing) by rubbing them on abrasive paper laid on a flat surface. Both sides need to be tapered by the same amount resulting in one side being reduced in width to 10mm.

This profile will result in no gap being visible when the strips are placed side by side around the circumference of the boiler barrel. Also, you will find the horizontal distance between the boiler bush centres will fall on the edge of a strip.

Fitting the lagging strips

With the four boiler barrel bushes facing you:

- Lay a lagging strip vertically against the barrel and push sideways to the right against the left-hand pair of boiler bushes.
- Mark a half circle at the point of contact in pencil.
- With a round file remove the waste checking frequently for a neat fit so that the strip surrounds the bush for half its diameter. Keep in place with a rubber band in the middle.
- Repeat fitting a strip to the right-hand side of the left-hand pair of bushes.
- Fill in with complete strips, holding with the elastic band, until you arrive at the next



- strip that needs profiling on its right-hand side to fit around the right-hand pair of bushes and repeat.
- Fit a strip to the other side of the bush and profile in the same manner on its left-hand side so that it meets the adjacent strip with no gap.

- Continue filling in whole strips until you arrive at the last strip.
- It may be necessary to adjust the fit of the whole set of lagging strips by lightly sanding the edges of the straight strips so that there are no gaps.

- Cut a strip of paper 10mm wide along the length of A4 paper. Wrap this around the outside of the wood lagging and mark to give the actual circumference. From this figure deduct 4mm which is the length that the banding will need to be cut (**photo 110**).

With the four boiler barrel bushes facing you, carefully remove the strip to the left of the left-hand vertical pair of bushes. Number its back to maintain its orientation, continue working to the right sliding them out one by one from the rubber band, numbering as you go.

Apply two light coats of good quality yacht or similar varnish (**photo 111**). Allow to dry thoroughly.

Cutting the banding

12 x 1 inch Brass 22SWG
Hold the 22swg brass strip

down to a clean flat surface with masking tape along one edge, and with a sharp scriber carefully mark three lines 5mm apart. Using a pair of sharp snips, which I find are best controlled with one leg clamped in a bench vice, cut three 5mm wide strips from the length. Mark off and trim to length each of the strips to the figure calculated from the paper strip (length between end of paper strip and mark less 4mm). Wear a pair of stout gloves and with abrasive paper remove any sharp edges that may have been formed by the cutting. Put to one side.

Machining band clamp

Ø1/4 inch Brass

Hold in a self-centring or collet chuck with 12mm protruding. Face off, centre drill, drill 2.1mm diameter x 10mm deep, drill 2.5mm diameter x 4mm

deep. Turn 5mm diameter x 10mm. Part off 8mm long. Repeat twice. Put to one side.

Silver soldering band clamp to band

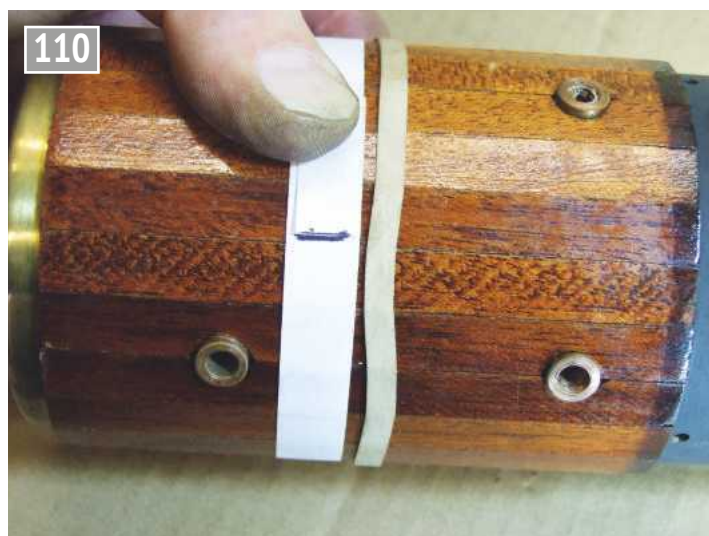
A simple jig made from mild steel comprising of a finger that is held to a piece of flat plate by a M6 screw will be required to hold the band clamp to the band for silver soldering (see fig 51). The drawing shows the general layout and proportions required and, as it will most likely be made from what is available, no sizes are given.

To prevent the silver solder from flowing between the article being held and the jig guide bar and clamp surfaces, I find coating the holding/aligning faces with Tippex (or equivalent) very successful. Alternatively, Jan-Erik Nyström suggests 'blackening the clamp area with soot from a

candle flame as a precaution – silver solder won't flow and adhere to a sooty surface' and the technique seems to work very well for him.

Place the band clamp on top of the two ends of the band so that it is central to the width of the band and the ends of the band are midway along the length of the clamp. Check with a straight edge that the band edge forms a straight line (**photo 112**). Apply flux to both sides of the band clamp/band ends and stand the jig so that the joint is accessible at the top. Drop a 4mm length of 1.5mm silver solder (55%) into the groove formed between the round clamp and band. Heat the flux to boil off the water keeping the silver solder in position with your scratch stick (**photo 113**).

Apply the heat from below directing the flame mainly



Lagging strips all cut and varnished.

Strips held with rubber band.



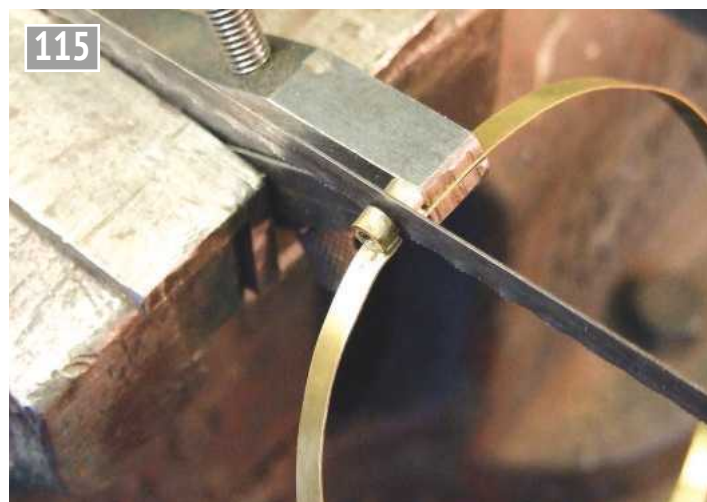
Setting up banding on jig.



Setup for silver soldering.



114 Silver soldering completed.



115 Cutting band apart.

To prevent the silver solder from flowing between the article being held and the jig guide bar and clamp surfaces, I find coating the holding/aligning faces with Tippex (or equivalent) very successful.

at the body of the jig in the area of the finger. Directing the flame for too long at any part of the band will destroy the thin material. Continue until the solder flows. Allow to cool. Remove from the jig and pickle for 10-15 minutes, then rinse in clean water. Repeat for the remaining two bands (photo 114).

Tap the pre-drilled 2.1mm hole to M2.5. Hold the band close to the joint, cutting through with a junior hacksaw, so that the side with the 2.1mm hole measures 4mm long and the remaining side with the M2.5 thread becomes 4mm less the width of the saw cut. Deburr with a fine file. Repeat for the remaining two bands (photo 115).

Clean up the bands using fine abrasive paper.

Fitting lagging and bands

Confirm the varnish has thoroughly dried. Replace the lagging onto the boiler barrel, following the numbered order and holding them in place with a rubber band temporarily.

Fit one brass band flush to each end and the third in the middle of the lagging with the joints inline vertically at the rear, securing each one with a M2.5 x 10 stainless set screw, trimming to length as required (photo 116).

●To be continued.

Having completed the boiler itself we shall now make a start on the boiler fittings.



116 Lagging installed.

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arrange for a copy of each issue to be reserved for you. Some stores may even be able to arrange for it to be delivered to your home. Just ask!

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A 7¼ Inch Gauge Riding Trolley

PART 8

Jon Edney makes a riding trolley for his garden railway.



Continued from p.724
M.E. 4599, 9 November 2018



A wonderful way to spend a Sunday afternoon.

The superstructure

For the visitors and passengers of the railway the frame and suspension are not seen – and of no interest. What they see and sit in is the superstructure. At the start of this series I told how I went through some iterations to get to the current design – especially regarding height. The current size seems to work well for one adult or two (or sometimes three) children. It is just a wooden box and when I completed the first one and painted it blue I decided it looked very boring. So, I added a number of cosmetic features to give a rather attractive truck-like exterior. More of that later. First, we need to build our box. The basic construction of the box is shown in **fig 10** and the detail plan in **fig 11**.

This is a wood-work project requiring pretty basic tools and skills. The box floor and seat are made from plywood and the sides from MDF (medium density fibreboard). The structure is held together and mounted on softwood battens. The first step is to cut out all the pieces as shown in **photo 39**. These are then joined together using the

battens. Panels are attached with screws and glue to form the basic box as shown in **photo 40**.

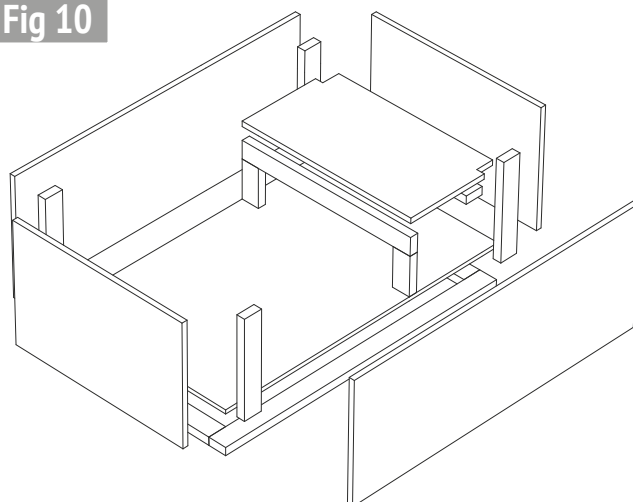
At this stage the upper edges of the box have been rounded using a router. The corners are not filled and the joint would be visible if painted. However, this does not matter because eventually the corners will be covered over (and protected) by the external cosmetic metalwork.

Once constructed the box can be painted. Special attention needs to be given

to the upper edges of the MDF which soak up paint like a sponge. One good coat of wood primer is sufficient for the sides but these edges need three coats to prevent the top coat disappearing when applied! I painted the box with simple non-drip gloss paint. You can use something stronger if you prefer.

The couplings are mounted on two 'buffer beams' which are just pieces of softwood suitably painted and bolted to the front of the frame, as shown in **photo 41**.

Fig 10



At this stage a trial construction can be made to the frame and the cosmetic features can be added. I almost need to apologise for the simple method of getting the planking effect. I just used a long ruler and a felt-tip pen (e.g. Sharpie). This took about three minutes but it is quite effective in practice. This trial assembly is shown in **photo 42** and the cosmetic metalwork in **photo 43**. This metalwork comprises four pieces of (1) 40 x 40 x 3mm angle suitably cut, drilled, countersunk and painted prior to attaching to the four corners and (2) four pieces of 3mm x 20mm bar with 45 degree ends to provide a truck like side appearance. The exact size of these features is not too important providing they are all the same.

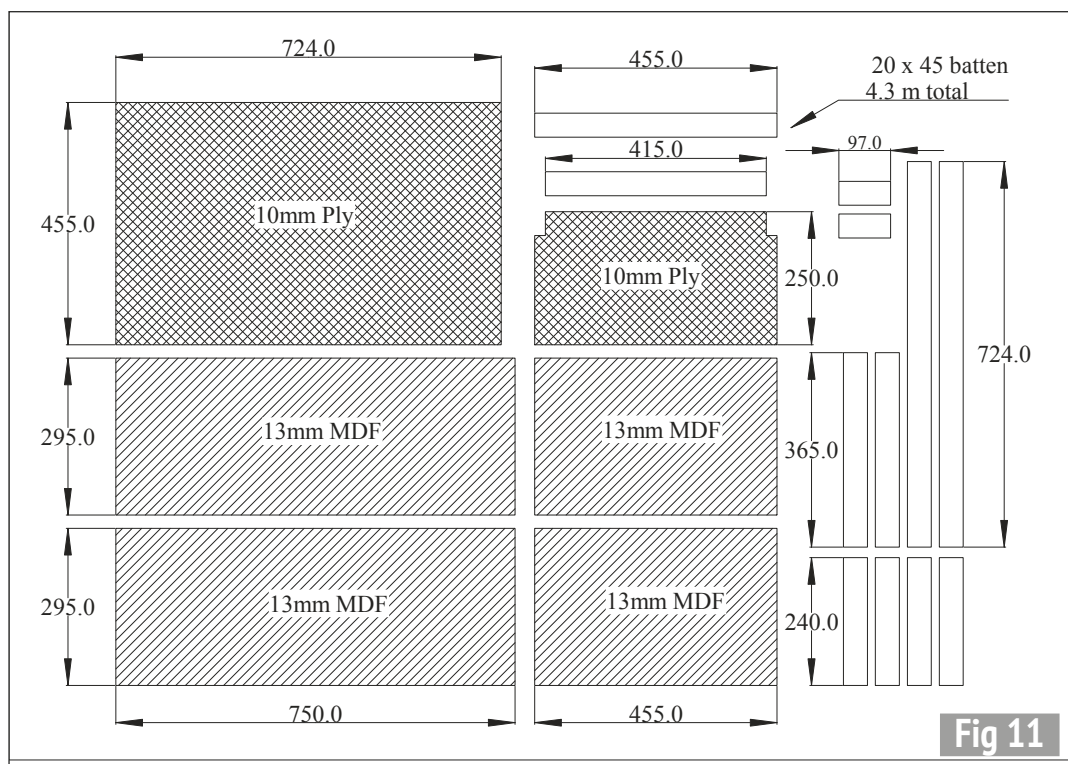


Fig 11



The main parts of the superstructure.



The basic box.



Adding the buffer beams to the frame.



Planking the easy way!



Decorative metalwork.

I painted with red oxide primer and then sprayed with regular black satin aerosol paint as shown in the photograph.

Final adjustments

Once assembled the wheels should run freely in the roller bearings. It helps to smear a bit of grease on the bearing during assembly. Ideally there should be a small clearance between the end of the axle and the end plate of the suspension unit. Because of the use of black steel angle, there is the potential for lack of clearance due to the fact that the mounting might not be precisely square. This occurred

on one of my axles and I resolved the issue by inserting shims between the end plate and the support angle pieces. This is shown in **photo 44**.

Once adjusted the truck should be literally ready to roll (**photo 45**). I now have three matching trucks and a driving truck based on the same frame. That has reached the limit of traction for my battery powered locomotive which means I have another project to upgrade it. And so it goes on. But I am looking forward to seeing a lot of happy children next summer.



Using shims to restore squareness to the axles.

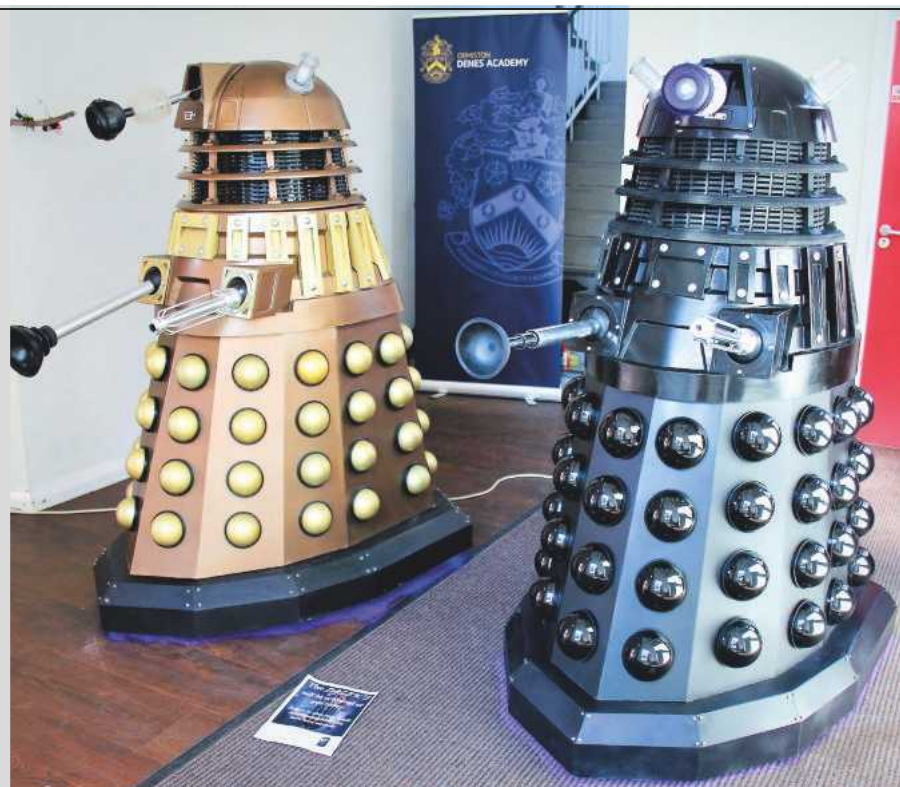


ME The riding trolley awaits its first passengers.

ISSUE NEXT ISSUE NEXT ISSUE NEXT ISSUE NEXT IS
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- **Great Orme Tramway**
Graham Astbury takes a trip on the unique cable hauled tramway in Llandudno, North Wales.
- **Echills Wood**
Brian Baker looks back at the Standard Gauge Locomotive Rally held at the Echills Wood Railway during the summer.
- **Vertical Boiler**
Having completed the main structure of the Model Engineer vertical boiler, Martin Gearing moves on to discuss the boiler fittings.
- **LOWMEX 2018**
Julie Williams recalls the highlights of the recent Lowestoft Model Engineering Exhibition, the biggest and most varied exhibition of its kind in East Anglia.

Content may be subject to change.



ON SALE 21 DECEMBER 2018

Ken Swan 1930-2018

Adrian Morley recalls the life and key contributions to model engineering of Ken Swan.



Kennedy Swan was born on 19th of April 1930 in Blaydon near Newcastle upon Tyne, the only son of Florence and Tom Swan. His father worked as an engineer/fitter at Hawthorn's, a locomotive building firm, and at a number of locomotive sheds. At an early age Ken built boats and aeroplanes and then moved into making locomotives. His father, a model engineer, built locomotives to 3½ inch gauge and deplored Ken's move into 7¼ inch. His wish to join Blaydon locomotive shed was vetoed by his mother and he started work at Hawthorn's on Forth Bank. Too young to train as a draughtsman, he became an office assistant. He seems to have gained plenty of practical experience and recalled working a lathe in a machine shop largely staffed by women. Within a short time he was setting up their lathes.

When National service loomed he opted for the merchant navy where he trained as a ship's engineer in the Ellerman Line. He served some five years on steam driven vessels and his early model locomotives were largely made at sea. Ken

married Doris in 1953 and bought a new house in Dipton Way, Lowfell in which they remained throughout their married life.

He started work at Vickers-Armstrong's in Newcastle as a fitter and subsequently trained as a draughtsman. He seems to have gradually moved into design and was called on to design the more difficult parts. Model engineering remained his major interest and he recalled how one of his models was spotted at local exhibition by someone on the staff of Wallsend Polytechnic who said that he wanted the man who designed and built this to teach their apprentices. He remained as a lecturer at Wallsend until retirement at the age of 58 following a mild stroke from which he made a complete recovery.

For many years Ken and his wife Doris ran a model engineering supply business centred on models he had designed and built (*Sheila, Bridget, Jessie, Wren, Koppel*). He tended to part build locomotives and to pass them on to others for completion but not before he had published plans noted for their meticulous attention to detail and lack of the errors which he deplored in the works of some other well-known designers. His engines were made to last and he recalled going around tracks picking up parts which had fallen from other designers' engines. His Koppel ran for some 20 years until the wheel treads were concave and he put on new tyres.

In the 1990s Ken was approached by the Friends of Beamish to build a miniature railway. The wooded steep slope was clearly unsuitable for a conventional 7¼ inch railway but there were possibilities, despite a slope of 1:10. Ken had already designed and built a rack

locomotive based on Koppel and Orenstein plans which had been successful tested on a rack track at Buxton so work started on a rack railway.

Throughout the 25 years of Beamish Model Engineers Group (BMEG) Ken has provided both leadership and design. His memory for engineering detail and of locomotives was prodigious. The unique achievement of the 7¼ inch rack railway is widely recognised in the model engineering world and the visit of the prestigious Heywood Society was an indication of their regard for Ken.

In the early days of BMEG Ken's wife dispensed refreshments as well as running part of Ken's materials, castings and plans business from which many of us benefitted. Tragically he lost two of his four children but has been fortunate in the support of his son John in the illnesses which clouded his last few years. Despite loss of memory he retained an encyclopaedic fund of information about his locomotives and their function. He will be missed by those of us who relied on him for advice and materials willingly given and the lunch breaks at which we discussed everything from the future of BMEG to the failings of Webb Compound locomotives. His plans and castings have gone throughout Europe, Australasia and America. *Bridget, Wren* and *Koppel* are the most popular and have been taken on by Polly Engineering. There can be no better memorial than the fact that these examples of his skill as a designer will continue steaming around tracks throughout the world for years to come.

With thanks to Ian Spencer, John Lambard, Jim Duncan, Les Paul and James Mountjoy for information and corrections.

ME



Renewing the Raised Track at Bradford MES

Graham Astbury reports on the trials and tribulations of rebuilding their ageing raised track.



The new track foundation

We employed a contractor with a small excavator to pull out the old steel 'A' frames along with their concrete footings and, following the line of these 'old' track supports, excavate a rough foundation trench (**photo 8**). Members then followed behind, hand trimming the trench as required, to fix the shuttering necessary to establish the required levels and transition curves, to allow the foundation concrete to be poured (**photo 9**). Whilst this was carried out, it became evident that we had a blocked land drain and this had to be excavated and a replacement drain pipe installed (**photo 10**). With this all complete, a start could be made on the rebuilding (**photo 11**).



Pulling the old 'A' frames out of the ground.

Shuttering was placed all around the track in a quite straightforward manner, until there was a small problem of tree roots. The issue of the tree roots was identified at the survey stage. The roots

located were very substantial and advice was sought to avoid cutting these as it would in all likelihood lead to subsequent and costly failure of the tree(s). The approach taken to bridge the roots was made so as to allow continued tree and root growth whilst isolating the track foundation from the associated ground movement as far as reasonably practicable. Therefore, we decided to bridge the roots with concrete lintels and avoid a lot of potential trouble (**photo 12**). Provision was made for fitting the expansion joints, regularly distributed along the track (**photo 13**).

Finally, with all the shuttering in place it was time to pour the concrete. There was a (very) brief thought that the members could wheelbarrow it all round the track but since the estimated quantity of concrete amounted to 14 cubic metres, it was agreed that not only could we not find enough wheelbarrows to shift this quantity in one morning but also there were not enough members left to tamp it. As the



Setting out the levels for the foundations.



Digging out the old land drain.



Setting the height for the shuttering to align with the turntable.



Shuttering to bridge the large tree roots.

track is around 400 yards from the entrance to the woods and the ground is somewhat soft, it was decided that it would be worthwhile to hire contractors who would use a concrete pump to deliver the concrete all around the track (**photo 14**). The decision to hire the labour and the pump proved to be a wise one, as the entire job was completed in less than four hours. The pump arrived along with the contractors early in the morning and pumping soon started, moving all around the track, starting at the station, passing the clubhouse and returning to the steaming bays, tamping as the concrete was laid (**photo 15**). The concrete had been poured just two weeks after the initial demolition had started and was then allowed to cure for several days.

The block-work

The concrete blocks were delivered to site at the end of October. The concrete had now set, so the alignment of the track on the foundation was marked out so that the block-work wall could follow the transition curves from the straights to the curves. After the location of the wall was marked out, we employed a contractor to build the wall who, despite no experience of building railways, was well versed in block-laying. He started at the station so that it would be aligned with the



Shuttering for one of the expansion joints.



The concrete pump arrives.



Laying and tamping the concrete up to an expansion joint.



Starting the block work from the turntable.

existing turntable leading to the steaming bays (**photo 16**). The wall continued all around the track foundation, with two small bridges over the tree roots being built in with lintels (**photo 17**).

The laying of the blocks proceeded in both directions away from the station and gaps were left in the wall at regular spaces. The track is located in a large area of woodland, which is rich in wildlife, so the holes were

left in the lowest level of the wall for the benefit of the wildlife, allowing multiple points of access and egress from within the track 'circle' (**photo 18**). Again, the decision to use a contractor proved to be beneficial as the building only took a few days. This was fortunate because at this time the weather decided to become rather unsympathetic to our cause and we had some early snow. However, this did allow us some time

to continue making fishplates and rail chairs indoors, as well as drilling the plastic sleepers and making the super-elevating spacers.

●To be continued.

Next time, we finally get around to laying the sleepers and track!



The bridges over the tree roots.



The gaps at the base of the wall for the wildlife.

Out and About 2018



1

Amongst the demonstrations at Beamish was wood sawing; note the period costumes worn by the driver and operator.

Martin Wallis takes his annual look at the summer season of road steam on the rally field.



Road steam 2018 started earlier this year with the Beamish Great War Steam Fair, a four-day event in early April with road vehicles, engines and trains in steam from the period up to 1918 (photos 1 and 2). The Beamish site was an admirable setting to get a flavour of the roads and railways of the Home Front during the Great War. Displays included a school,

field hospital and canteen.

Predating the Great War was Fowler No. 8726, WD Boer War B5 engine (photo 3). The restoration was excellent, not overdone, with it still carrying many of its 'war wounds' – bent spokes, dents in the belly tanks and worn fairlead rollers – and without doubt the engine had had an extremely hard life. Research and restoration suggested that

during its military life parts of perhaps ten different engines were swapped about to keep it going. No. 8726 was never an armoured engine but it had back wheels taken from an armoured engine and the front wheels from another engine.

The Great War theme at Beamish was considered incompatible with model road steam so there were no models to photograph but it was certainly an impressive day out nonetheless (photo 4).

Another interesting 'away day' was an early spring visit to the Thursford collection in North Norfolk. Thursford, originally founded as a road steam and mechanical organ museum, has very successfully expanded in to the 'Christmas Market experience'. As a consequence, a portion of the museum, that was occupied by the 'reserve' collection, was treated to a deluge of large snowmen, Father Christmases and a whole host of similar paraphernalia. This area of the



2

Driving the wood sawing was Marshall No. 17134 of 8NHP built in 1889.



3 *Fowler No. 8726 build in 1900 and exported to South Africa for the Boer War.*



4 *Part of the road steam display at Beamish.*



museum retains its Christmas theme all year around. Out of season the reserve collection is closed to visitors but, happily, is open for enthusiasts on 'Founders Day' where a large collection of 'hedgerow condition' engines may be viewed.

The second Bank Holiday in May is the traditional date of the Strumpshaw Steam rally near Norwich; a good rally for Model Engineers, there were over 50 models in attendance! A model I have not photographed before was a very fine Fowler BB1 4 1/2 inch scale ploughing engine, *Victory* (photos 5, 6 and 7). Dave Edwards started the engine many years ago but only patterns, boiler and gears

were completed before it was sold. Happily the building recommenced in 2010, the majority of the work being undertaken by Mick Cox. Mick quickly discovered that only a portion of the drawings were with it, the remainder having to be sourced from The Museum of Rural Life (MERL) at Reading University. The model is owned by J. Mann.

The 2018 Weeting rally was special as it marked the 50th Anniversary of the show, a memorable weekend not only for the great show but also for the very hot weather.

Your author was very pleased at the Weeting rally to renew his acquaintance with Burrell 3130 (photo 8). The engine was built in 1909, has three



Detail of the motion work.

A beautiful 4 1/2 inch scale Fowler ploughing engine at Strumpshaw.



The bevel gear and reduction drive to the winding drum under the boiler.

speeds and is rated at 10 NHP for direct ploughing in New Zealand. Other duties included thrashing and road haulage. No. 3130 was previously rallied

in Great Britain in 1996 – 98; its current return to this country is to encompass a major overhaul and to attend the Great Dorset Steam Fair - also holding its



Burrell 3130 built at Thetford to 'special order' and exported to New Zealand.

50th Anniversary in 2018. The engine was bought in 1942 by the Hawkins family for forestry work and driving a sawmill and has remained with the family ever since.

Previously photographed in *Out and About* is another Burrell, this time a 4 inch scale model of *Dolphin* built by Dave Tucker (photo 9). The workmanship and attention to detail on this model is superb and it ran every bit as well as it looked. The model is scaled from Burrell 10 NHP Showmans Scenic No. 4030, *Dolphin* built in 1925 to drive the new Orton and Spooner Diving Dolphins scenic ride. Few models can have been so carefully researched and executed, an example of which is in the colour in which it is painted. What was believed to be the correct Burrell maroon was used first, then subsequently it was discovered that Mike Dreelan, the owner of the full size engine, had had his own paint specially blended to match some original coloured paint found under a fitting during his restoration. The model was duly repainted!

Your Author made a very pleasant visit to a West Country rally at Powderham Castle near Exeter, run by the Crash Box and Classic Car Club of Devon. There was an excellent steam section together with a number of vintage vehicles.

A large model in 6 inch scale at Powderham Castle was a single cylinder Burrell built in three and a half years by David Greenshields (photo 10).

The model has a 'Page' boiler purchased when he ceased trading and has a cylinder and other assorted castings using the Ragsdale patterns. It is good to see the way a variety of castings and components have been grafted into a fine looking model.

Model traction engine enthusiasts are likely be familiar with Steam Traction World (STW) models who manufacture kits for home assembly with just hand tools. STW purchased the road



A superb 4 inch scale DCC scenic showmans engine; the canopy signwriting is directly scaled from the prototype, Dolphin.

steam side of Modelworks, who did kits for both traction and railway engines. STW very successfully re-worked the original Modelworks 4 inch Burrell and went on to expand their range to include both a 4 inch scale DCC Showmans engine and the 6 inch Foden steam wagon. **Photograph 11** is a very fine example of an original Modelworks Burrell. The model is called *Missy* which is Cornish for 'Our Engine' and was finished 12 years ago. She is owned by

Buzz Hope-Inglis who also built the water bowser and drop side wagon.

There were plenty of full size engines at Powderham Castle; of particular interest was Burrell 5 NHP three speed engine built in 1912 as a convertible (photos 12 and 13). Usually such engines survive in roller form with the agricultural or road haulage wheels removed many years ago, but in this case surviving in the road haulage guise.

● To be continued.



This single cylinder Burrell built from parts from a variety of sources was a great credit to the builder.



A very fine 4 inch scale Modelworks Burrell which pre-dates Steam Traction World.



Burrell 3381 built in 1912 as a convertible, being provided with two sets of wheels, one for road rolling and the other for general haulage work.



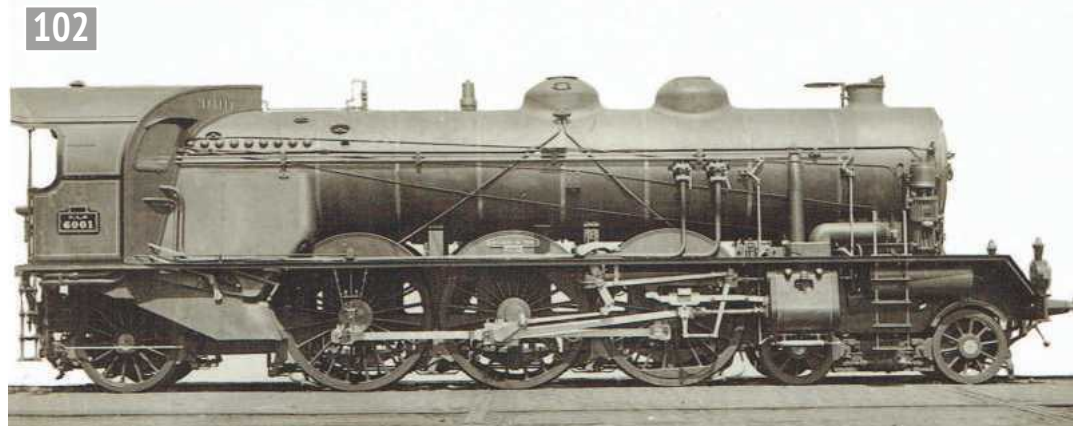
Note the spigots to fit the rear roller scrapers.

Technologie sans Frontières PART 22

Dr. Ron Fitzgerald looks at English and French locomotive design in the second half of the nineteenth and early years of the twentieth century.

Continued from p.711
M.E. 4599, 9 November 2018

'The Nord, the Midi, Paris-Lyons-Mediterranean, the Ouest and the Est have adopted six coupled types... The Baden lines are worked by these engines... It was for these lines, indeed, that I designed the first of the six-coupled types. The Gotthard expresses are worked by four-cylinder compounds of the same type built at Winterthur; Roumania has also ordered some twenty engines of the same general type... The locomotive drawings were made by the Société Alsacienne de Constructions Mécaniques (S.A.C.M.) and the engines were built at their works at Belfort.' Alfred de Glehn to Charles Rous Martin.



P. L.M. Pacific 6001

In 1909, the Paris workshops of the P.L.M. constructed two Pacifics intended to evaluate the merits of the compound versus superheated-simple expansion question. The compound, 6001 (photo 102), was built to the established pattern of de Glehn outside high pressure cylinders and inside low-pressure, each driven by its own Walschaert's valve gear. Piston valves with inside admission controlled the steam distribution but the low pressure cylinder cut-off continued to be fixed at 63%. The boiler had a round-topped firebox with a wide grate.

The second machine, Pacific 6101 (photo 103), had four simple expansion cylinders placed *en batterie* above the bogie and under the

smokebox. The valve motion was again Walschaert's and the cylinders had piston valves although the diameters were considerably smaller than those used in the P.O. 4500 and 3500 series. The boiler had the same characteristics and dimensions as the sister Pacific 6100, but was fitted with a Schmidt fire-tube superheater of 28 elements. The boiler pressure was reduced from 16 bar to 12 bar (227 p.s.i. to 171 p.s.i.).

The two locomotives operated from Laroche depot which enabled comparative tests to take place. At first these tests favoured the simple expansion machine which showed combustion economies of 13.5% at 95 km/h hauling 750 tons falling to 5% with 1,000 tons at 80 km/h. On the basis of these results thirty more simple locomotives of the type followed but at this point it was decided to apply the superheated boiler to the compound 6100. The superiority of superheated steam and compound cylinders was demonstrated overwhelmingly, coal consumption was 31% less

and the water consumption 30%. These spectacular economies were not accepted unequivocally and it was felt that in part they might be attributable to the higher boiler pressure of 6100. For this reason a second series of simple-expansion, four-cylinder Pacifics were constructed but with the boiler pressure raised to 14 bar. They still could not equal the superheated compound and in 1912, a series of compounds were built numbered 6011-6030 incorporating 6100's pattern of boiler and superheater with pressure raised to 14 bar. The compound cylinders however were rearranged *en batterie* over the bogie and below the smokebox. Subsequently the earlier simples were rebuilt to the same pattern. These locomotives formed the template for all subsequent P.L.M. Pacifics which ultimately reached the satisfying total number of 462. The same design became the basis for a 4-8-2 version which, after initially falling short of expectations, became one of the three classic *Mountain Francaises* classes.

● To be continued.

P. L.M. Pacific 6101

Lathes and more

for Beginners

PART 28

Graham Sadler makes the second useful item - a slitting saw holder.



Continued from p.782
M.E. 4600, 23 November 2018

Slitting saw holder

Slitting saws are simple discs of high speed steel with a bore, having teeth cut in the outside. They need a slow speed. A typical saw is about 80mm diameter and would be rotated at about 100rpm with a lot of cutting oil. Their small mass causes a rapid build-up of heat which will rapidly degrade the saw. You should apply a gentle yet positive feed to avoid snatching and **never** stop the

saw in the cut - a sure way to damage the blade. They should not be used for climb milling. Many have a keyway for extra force when rotating but I have never had any problems without the use of a drive key. They are used to slit and cut off material but are also useful to make slots in say the end of rod type components. They are purchased according to width - my stock ranges from a fragile 0.4mm to the thickest at about 2.5mm.

Photograph 141 shows three different forms of holder. The first is a commercial R8 holder. The second I made a long while back as soon as I got a miller by using a commercial No. 2 Morse taper arbor (a bar which is used to mount a cutter or some piece of work), which had a shank fitted with a *roll pin* (a pin used for fixing component by being forced into a tight hole; they are hollow, and split, so they can always spring to fill the hole).

All taper tooling used in milling machines or in the lathe spindle must always be locked with a *draw bar*, a long bolt which passes through the spindle locking the arbor in place. This is especially true when using Morse taper tooling. A lot of force is needed to eject the arbor, which is the main reason I got milling machines with R8 tapers in the spindle. Unlike any Morse taper, these only require a gentle tap to dislodge them. Many good quality milling machines with Morse taper spindles now have some means of ejection without the use of a hammer to eject the arbor.

The third example in the photograph is a small commercial product. This has a set of sprung centre tubes to enable it to cater for slitting saws with bores other than the standard 1 inch (25.4mm) or $\frac{7}{8}$ inch (22mm) diameter. The sprung one has the disadvantage of not quite holding the saw on centre due to the clearances needed in the tubes.

Smaller bore saws tend to have a smaller outside diameter, limiting their depth of cut, so in my opinion the bigger ones are best. I have some small saws which are only the same diameter as the body but most of my saws have 1 inch bores. As slitting saws usually do not cut on the full periphery (they should) anything which induces extra eccentricity should be avoided. For this reason, ours will be to a fixed size. I had to remake mine as the eccentricity was bad and, in addition, the countersunk cap screw securing the saw had disintegrated and I had to saw through it to remove the saw - obvious in the photograph.

While an arbor can be purchased you have probably realised that I feel it's better to make what equipment you can and save your money for things you can't make, like the saw itself! In any case it's a good turning exercise.

The width of the cap and body in **fig 31** can be made bigger to cater for wider saws. This design allows for saws up to 5mm but if you get the saw type which resembles a side and face cutter then multiple cuts can be made



Slitting saw arbors, Morse taper, R8, ours and the failed telescopic type.

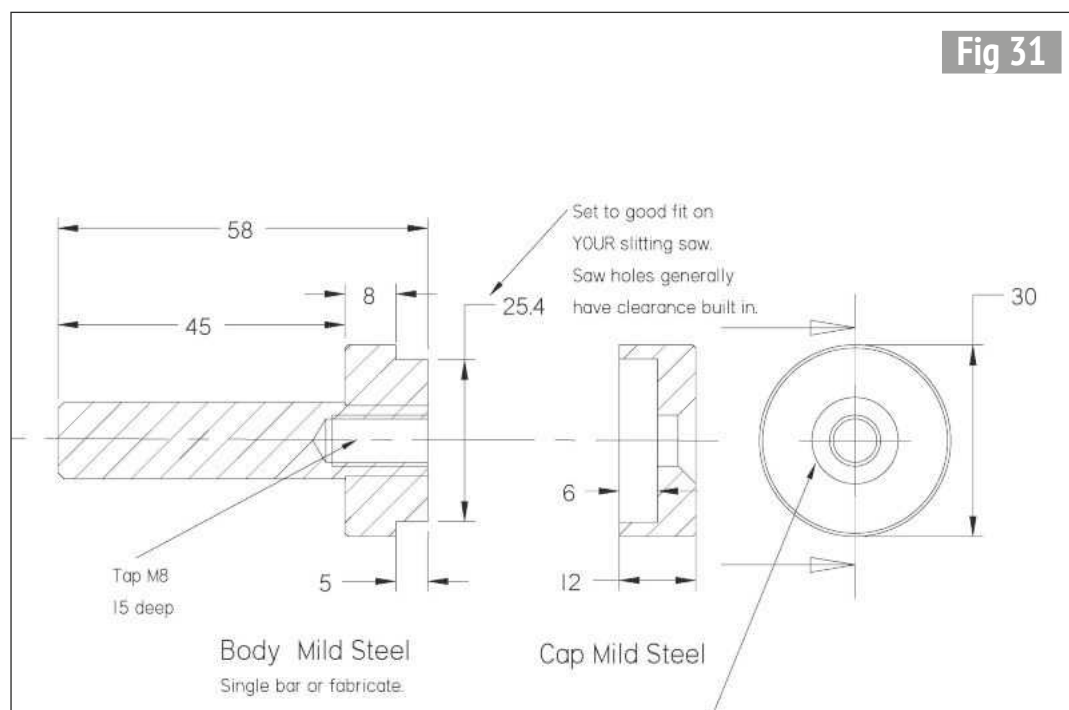
to make a slot wider. I would suggest your first saws should be 1.5mm and 3mm ($\frac{1}{16}$ inch and $\frac{1}{8}$ inch).

As with many projects, there's more than one way of doing it so either turn the cap and body from one piece or do as I did and fabricate.

To make the body as one piece use a piece of 30mm diameter steel 60mm long. Face then centre drill for tailstock support. Use your new roughing tool followed by a knife tool to turn the shank down to 12mm. The length is not too important. For the fabrication, I faced the body then drilled 11.5mm. The 12mm shank was skimmed to fit this. Doing it this way provides a small location shoulder and makes the silver soldering easier.

I cleaned the lot with new abrasive and then cleaned with cellulose thinners, before fluxing well using Tenacity No. 5 flux (formulated for higher temperatures and stainless steel). I find this flux for steel fabrications is better than the Easy Flow (slightly lower temperature type). I left a gap between two firebricks and stood the assembly over the gap allowing heat to be concentrated underneath. Always try to avoid direct heating of the solder when applied as a cut length as its small mass will cause it to melt quickly and some of the alloy can boil away causing the melting point to increase and reduce fluidity of the solder, which can result in a poor joint.

The solder was cut to a small length and set on the boss next to the shank. My Sievert propane 2942 burner made short work of the heating to dull red hot. When the flux flows like water it's almost ready and you will see the solder *flash* (suddenly melting and penetrating the joint). **Photograph 142** shows the front face and the penetration of the solder. Perhaps I made a mistake here by not fluxing the front face but the full penetration by the solder is obvious



The penetration of silver solder on the face of the body.



Drilling the 11.5mm hole for fabrication, showing how a sharp drill cuts.

(although the photograph does not quite show this). Avoid the temptation of quenching the assembly to rapidly cool it as this can cause micro cracks in the joint, seriously reducing its strength.

Clean up with abrasive tape. Grip the shank in the three jaw, drill and tap M8 (**photo 143**) then turn the shoulder to 5mm long and a good fit on a slitting saw or get it to 25.38mm or 0.999 inch or, dependant on your slitting saw, just a trace over 22mm. When turning the boss part, angle the tool 5 degrees towards the chuck and cut into the shoulder, then feed outwards. It is better to go to within 3mm of the edge so

making a slight dishing. This will ensure the saw is clamped by the outer edge, and it will run true, and remove the possibility of a thin blade fouling on the root radius - previously discussed with relation to tool grinding.

For the cap, begin with a length of 30mm diameter bar 14mm long. Grip in the three jaw chuck and face it. Reverse, bed down on a parallel and face again. Drill the centre 8mm diameter then use our boring bar to turn the pocket as we did for the die holder. Grip internally by the bore to produce the countersink, which is best done by setting over the top slide to 45 degrees and boring to avoid chatter, inevitable

for a countersink of this size without an expensive tool. We use a countersunk cap screw to secure the saw as it fits below the surface and makes the tool more versatile. Fit a decent quality cap screw. I purchased a pack of 5 from eBay and will discard any as soon as it becomes worn by the hex key. I don't want this arbor to be ruined getting the saw out!

● To be continued.

The last of our three useful items will be a simple headstock dividing attachment.

L&NWR 0-8-2T Heavy Shunting Tank Locomotive PART 3

Chris Rayward describes the construction of his 'D' tank locomotive.



Continued from p.695
M.E. 4599, 9 November 2018



The slide shaft material set up in the lathe to turn the oval section.



The set of handed slide shaft slides milled in steel with a CNC mill by a kind colleague. They required cleaning-up prior to assembly but the accuracy was superb.

Completing the valve gear

Making the yokeshaft or slideshaft was quite daunting as it requires some significant milling for the slides themselves and their slippers or sliders (**fig 2**). The first task

was to machine a piece of $\frac{3}{4}$ inch diameter steel bar to be an oval in section and this was done in the lathe between the four jaw chuck and the tailstock running centre. After marking out and drilling the

holding centres in the outer end, I set the round bar up to be offset in the chuck. Then I incrementally adjusted the chuck jaws as I ran a clock gauge down the length till it gave a zero reading all the way along. I machined an equal amount from each side and finished the meeting point with a fine file and smoothed the surface (**photo 13**).

The next parts to make were the four slides and here I sought the help of a willing expert. I was talking to a SMEE man at the Doncaster exhibition about the task and he kindly volunteered to make them for me. He is a keen CNC exponent and thought the exercise would be interesting. So, I supplied Nigel's sketch and, after letting me have two alloy samples, he made the set of four as handed pairs (**photo 14**). These also had the location holes in them for the centre bearing and the outer pivot shaft extensions. Once to hand, the parts were cleaned up and I then machined the four sliders from some $\frac{1}{4}$ inch thick bronze plate (**photos 15 and 16**). I did this task as a continuous cut with an end mill

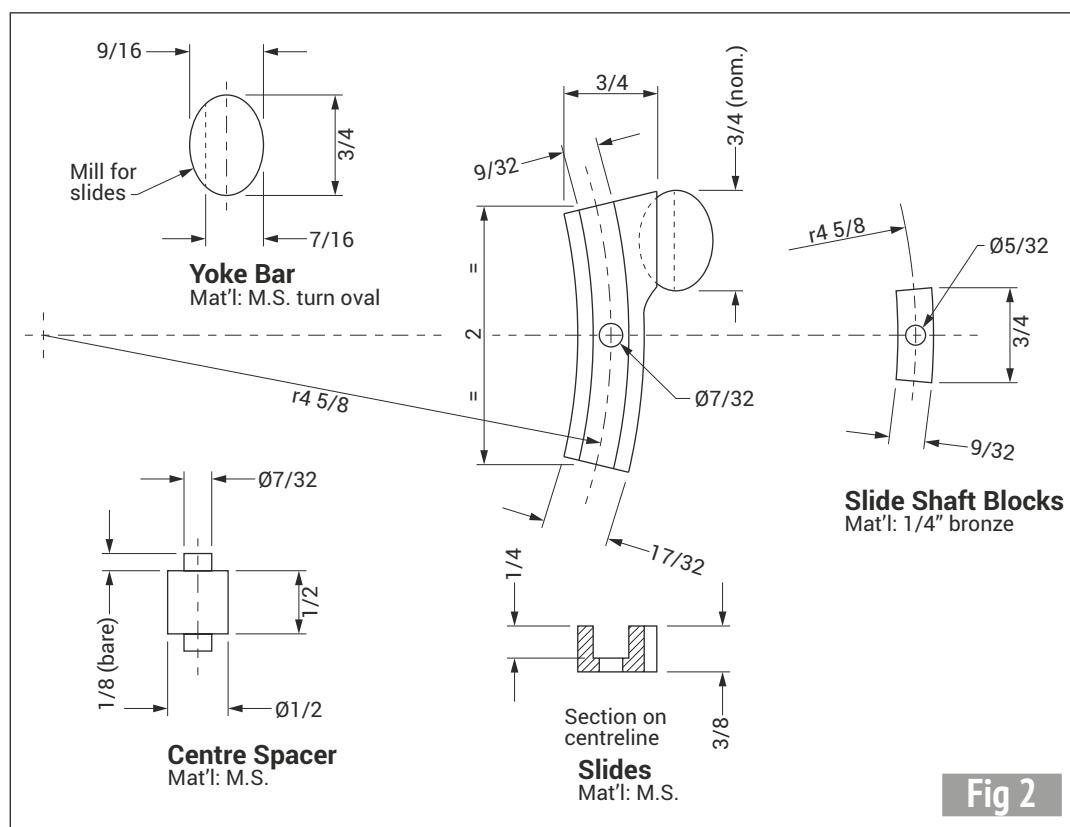


Fig 2

on my milling machine using a rotary table with a large plate on top as a work table. It was 'fun' setting it up but the result was fine. When completed, I adjusted the arc radius and used a drill and reamer to make the pivot holes.

The next task was to set the yokeshaft in the milling machine and mill the four registers for the slides to be attached with 8BA bolts for silver soldering, remembering to add the shouldered centre bearing first.

All went well but the cleaning up operation took some time with all the corners and slideways to access. It was now time to add the two end stub shafts and check the concentricity of the assembly (**photo 17**). Happily, all looked good but notice how much additional material had to be removed from the shaft between the pairs of slides to allow the valve gear to function for both forward and reverse gear positions. At this point I also made and fitted the reversing lever extension and fitted it with a bolt and two dowels to the left-hand end slide.

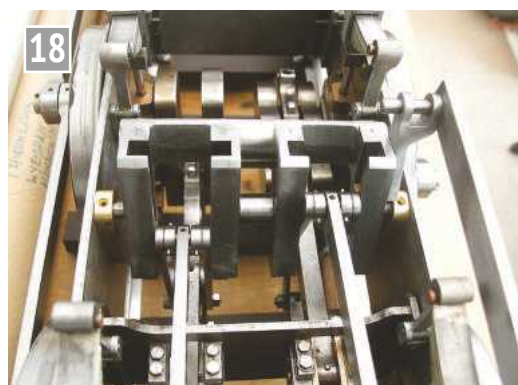
Setting the slide shaft in the chassis frame to do the trial setting for the parts was much more awkward than I had been made aware of, as with such cramped access any conventional round bearing bushes could not be held with the usual small toolmaker's clamps. So instead, I made two bearing blocks, $\frac{1}{4}$ inch thick and about $1\frac{1}{2}$ inches long with a $\frac{1}{4}$ inch reamed hole near their ends. These allowed me to hold the blocks horizontally further along the top of the chassis. Eventually, I also made two 'Z' shaped brackets from brass angle and added forked ends to go over the shaft stubs to hold the ends of the shaft. These enabled minute changes in position to be tried and after succeeding in obtaining the right setting, the main blocks were placed vertically and marked through the sides of the frame for the fitting of permanent holding bolts (**photo 18**).



The author using a rotary table with a hefty plate bolted to it to hold some bronze plate for milling the slide slippers. A small radial offset also allowed the four pivot holes to be drilled and reamed.



The silver soldered slide shaft assembly being checked on the lathe for concentricity. The extra clearance for the valve gear was started by milling but completed with a file, due to the close proximity of the slides themselves.



A close up view of the slide shaft and the valve gear fitted to the locomotive chassis. The simple lever on the right side is a temporary means to adjust the forward and reverse settings as the actual reverser is later attached to the inside of the left-hand side tank.

The criteria for the exact setting of the slide shaft centre line is that when both the pistons are at the front and back dead centres, there is no movement of the valves themselves when the reversing

lever is turned from forwards to backwards gear. Eventually the 'golden' check was achieved. Eureka! Spotting through holes in the frame to secure the bearing material was easy enough and then

the two slide valves could be positioned on their valve rods to give the timing and all inlet ports were uncovered just as the pistons left the TDC position (**photo 19**).

●To be continued.



Another view of the chassis as taken to the Bristol ME exhibition once the valve setting had been achieved.



Write to us

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Responses to published letters are forwarded as appropriate.

Small Hole Gauges

Dear Martin,
I have two sets of Moore and Wright small hole gauges which I have not used for a very long time. When I came to use one recently I was unable to rotate the adjuster. I tried to dismantle it by rotating the slotted collar with a micrometer adjusting 'C' spanner which happened to fit – no luck. Then I tried making a tool as shown in the photograph. Even this wouldn't rotate the collar when holding the main barrel by hand. So I drilled a hole in a piece of wood whose diameter was a tad less than the barrel then cut across the diameter. Using this over the barrel, gripped with pliers, allowed the collar to be rotated with some effort. I was horrified by the black gunge in the threads. It was only after heating with a hot air gun that I managed to remove the adjuster from the barrel, revealing the extent of the gunge. I tried just about every liquid in my workshop to soften the gunge namely Gunk, lighter fuel, white spirit, isopropyl alcohol and meths to name a few. A soft baby sized tooth brush and cotton wool buds removed some of the gunge on the internal threads helped a little by screwing the adjuster in and out when soaked in Gunk. To make matters worse some of the gunge penetrated a little way down the barrel to the left of the adjuster in the photograph. And I can see no way of removing the rod which adjusts the measuring balls.

I am wondering if anybody else has experienced this problem? And can anybody please suggest some other cleaning liquid which might be better? I can only think that the gunge was originally some form of lubricating oil or grease which has congealed almost to the point of being solid. At the moment the gauges in each set are unusable.

Roger Castle-Smith



Gear Cutting

Dear Martin,
During the last weekend I was looking up a dividing problem in a number of my several 'gear cutting' reference books (I keep being tempted by yet another book). I spotted an appalling error and, on looking at the others, found that in about ¾ of them (including the 'Model Engineer' reference book, but NOT in Alexander du Pre's book) there is the same error. The error is that advice on setting the dividing means sector arms is commonly some version of 'set the sector arms to embrace the number of holes required on the suitable circle of holes on the plate'. The error as you will certainly be aware is that this should be 'SPACES' not 'HOLES' – for example, if the setting is referred to as '15 holes on a 48 hole circle' – and if setting the sector arms to 15 'HOLES' (14 SPACES) the result will be more, thinner teeth with an 'oops' at the end. The sector arms in that case should be set for 15 holes AFTER the one with the detent pin in it against which a sector arm will rest, therefore they 'embrace' 16 holes but indicate 15 SPACES, which is what is wanted. Whether anyone will take notice is debatable, but I wonder how many ruined gears those errors have caused.

Peter King

Grinding Tools

Dear Martin,
Reading Graham Sadler on grinding cutting tools and studying his photographs of the resultant chip formations reminds me of a humorous event we pulled years ago at college. We were given a workshop technology project to investigate tool cutting angles and chip formation for different materials.

This was duly done but three of us went on and produced a second thesis entitled 'Chip Technology' that had involved visiting all the local fish and chip shops and compiling a report of size, colour,

consistency etc of their potato-based products. I believe it was well received by the college staff, even reaching the principal.

Peter Howell

The editor comments: This reminds me of the reaction I sometimes used to get when describing myself as a 'chip designer'.

Oxy-propane

Dear Martin,
I am currently constructing a boiler for *Columbia*, a Baldwin 4-8-4 of Martin Evans's design that ran as a construction series in *Model Engineer* from October 1978 to June 1981. Because of the size of the boiler, I am using oxy-acetylene as recommended by Alec Farmer in his book *Model Locomotive Boilermaking*, published in 1988.

Recently, a number of people have recommended that I use oxy-propane instead of oxy-acetylene. I am unfamiliar with oxy-propane, particularly as to how it would be used in copper boilermaking.

So I thought I would write to *Model Engineer* and ask for comments from the many experts in copper boilermaking who write for the magazine. I would appreciate any and all comments on the relative merits of oxy-acetylene and oxy-propane in the construction of copper boilers. Indeed, an article on this topic might be of interest to many.

Please don't hesitate to contact me via e-mail at jrhanum1@gmail.com.

J R Hannum

Propane as a Fuel

Dear Martin,
I was reviewing a past issue of *Model Engineer* (M.E.4553, 3rd February 2017) and came across a letter from Graham Astbury in the Postbag section addressing issues arising from a proposal from James Wells in an attempt to employ propane as a fuel gas in two-stroke engines.

His pronouncement that propane is soluble in engine oil is not entirely correct. He omitted a very important qualifier. What he should have said is that propane is soluble in *mineral* oil. Today there is a vast range of synthetic motor oils formulated for internal combustion engines (see <http://www.exol-lubricants.com/c/fully-synthetic-motor-engine-gear-lubricants-oils>) including two-stroke engines and which are now widely used. Indeed, some manufacturers exclusively recommend these lubricants. Synthetic oils having predominantly ester bases exhibit little, if any solubility of propane gas whilst those having polyolefin (PAO) Group IV bases will absorb propane usually to a slightly lesser extent than pure mineral oils. And of course, there are mineral/synthetic blends... Suffice to say, it's very much an experiment to use synthetics in a two-stroke engine but careful selection of the grade might be successful. There is no formally named index that reports these solubility levels and the major lubricating oil producers do not routinely test for this characteristic so you're on your own.

The chemical solubility of propane gas in engine lubricating oil will likely pale into insignificance compared to mechanical entrainment of the gas in the frantic aerosolised environment of a closed engine crankcase whilst it is operating (see www.enginebuildermag.com/2012/02/recent-advancements-in-racing-oils, www.hotrod.com/articles/ctrp-0601-motor-oil-tech-terminology, www.highpowermedia.com/blog/3733/oil-aeration and www.dtic.mil/dtic/tr/fulltext/u2/a801096.pdf).

Clearly Mr. Wells is a man who seeks to 'have his cake and eat it' i.e. a wet-sump 2-stroke fuelled with propane gas - well, if you're reading this Mr. Wells, "GOOD NEWS!!" - I can offer you three experimental alternatives that

may allow you to fulfil your objectives:

- i. a Kadenacy (Michel Kadenacy - Russian inventor) 'Direct-Induction two-stroke engine', i.e. there is no transfer port, the inlet port is direct into the working cylinder (see: www.freepatentsonline.com/2431266.html, [patents.google.com/patent/US2130721?q=ininventor:Kadenacy](http://patents.google.com/patent/US2130721?q=ininventor:Kadenacy&patents.google.com/patent/US2131959?q=ininventor:Kadenacy) and patents.google.com/patent/US2131959?q=ininventor:Kadenacy),
- ii. direct injection of the propane into the cylinder after exhaust port closure - this would require manageable injection pressures if timed early enough after 'EC',
- iii. construct a 'Scotch yoke' two-stroke engine; in one fell swoop the difficult-to-lubricate gudgeon pin is entirely eliminated but, importantly, the underside of the piston can be completely sealed and therefore can operate 'dry' albeit that a small, metered oil bleed will have to be provided for piston-cylinder lubrication.

There is no shortage of engine inventors attempting to 'civilise' the two-stroke and one of my past 'Postbag' letters detailed many of these so I will not repeat any of them here. One not mentioned I recall employed 'end-to-end' lubrication with extensive sealing of all bearing elements. I vaguely recall that cylinder lubrication was achieved by controlled bleed from the gudgeon-pin although, of course, this is not directly into the area of the demanding thrust-face of the piston so I can't vouch for any problems. If you wish to learn more, contact the S.A.E. and they may be able to index-search their published papers.

One recent novel two-stroke engine that has appeared in the constellation is the Ryger engine and, rarely, has

managed to achieve a degree of commercialisation in the form of a go-kart powerplant: rygerengine.com/ryger-kart-engine. The patent is more revealing on the principle of its internal operation: patents.google.com/patent/EP3128149A1.

Speaking of patents, a previous 'Postbag' letter of mine (M.E.4493, 17th October 2014, page 575, upper left) was 'amputated at the knee' (editing is a brutal game!) which may have left some readers a little puzzled since it reads a little dis-jointed. So if space permits I'd like to include the 'missing' block of patents herein. This list, however, will not be the bottom of the well! No, no, no - there are many, many more intriguing mechanisms that have been proposed over the decades, the hey-day being the 1930's through to the 1940's (yep, the arrival of the gas turbine snuffed much of it out). To this end, I have compiled the following list of relevant US patents (not exhaustive by any means). Note: many of the stated inventors worked for the major aero-engine manufacturers of the day (often the nominated assignee) which begs the question - how many of these clever mechanisms progressed to the hardware stage and where are the prototypes now? 657,662A 1,639,333A 1,962,246A 1,962,530A 1,967,596A 2,044,581A 2,068,750A 2,077,157A 2,092,639A 2,093,442A 2,104,599A 2,122,745A 2,160,444A 2,166,909A 2,174,981A 2,184,839A 2,188,118A 2,199,655A 2,206,526A 2,209,014A 2,235,486A 2,256,094A 2,259,102A 2,264,484A 2,442,875A 2,533,558A 2,584,098A 2,675,791A 2,877,663A 3,123,058A 3,308,797A 4,194,404A 4,336,723A 6,062,176A 6,769,384B2

These can all be viewed in their entirety by googling 'Google Advanced Patent Search' Note that you'll need to use the Chrome browser

otherwise they won't render properly on-screen.

And speaking of things 'aero' I'm hoping someone might be able to help me. I am researching a rather obscure pioneering aviation subject: multi-speed propellers (**no**, not variable-pitch!) i.e. driven via a change-speed reduction-gearbox, as in a car! Does anyone have any info (patents, photographs, drawings, articles, etc)?

Also, I am researching a very rare German aero-engine, the WW1-era RUMPLER 1,000hp, 28-cylinder radial aero-engine. Again, all information greatly received.

Please contact me direct at: pyralog@yahoo.co.nz

Kind Regards, Andre Rousseau (Auckland, NZ)

Odd Threads

Dear Martin,
Several (many?) years ago I wrote 'a letter to the Editor' asking if anyone knew what a 17tpi external thread hand chaser was for - I have a slowly increasing collection of these antique tools for 'inside and outside threads'. There were no replies and there the matter rested. Then recently whilst discussing a matter with a client, I asked what the thread was on a fitting and got the answer "17tpi Whitworth Left Hand - Fuel Gas Thread". Closer examination than previously of the 'outside chaser' in my collection showed that it was indeed for a left hand thread. Even closer examination showed that the top cutting face angle to the front was clearly for work on brass - the angle being about 85 degrees or so. I understand that there are a very few other 'odd' left hand pitches that are/were used for hazardous gases/liquids - I have 23tpi, 25tpi and 27tpi, though what they are for I do not know. Anyone who has got these and is also puzzled now knows what they are for.

Regards, Peter King

Macclesfield's Paradise Mill and Silk Museum

Roger Backhouse discovers the amazing Jacquard Loom amongst other fascinating exhibits.



Once, Macclesfield had over fifty mills, mostly working in silk employing up to 12,000 workers (**photo 1**). The town's remarkable textile history is well told at the Silk Museum, with the world's largest collection of hand operated Jacquard looms in the adjacent Paradise Mill. Besides machines there's much here about textiles and clothing with a good archive behind the scenes. Taken together they make a fascinating visit with much to interest engineers and non-engineers alike.

History

Always a luxury product, silk was much used for trimmings, ribbons and buttons. Indeed, button manufacture was the main industry in Macclesfield in the 18th Century, making and wrapping holly wood buttons (**photo 2**).

Charles Roe established silk throwing to supply yarn at a local water powered mill in 1744. Weaving was carried out in the garrets of weavers' homes where light was better but factories gradually took over most production. Powerlooms were introduced in the 1820's, slightly later than they were for cotton, and Jacquard looms from the 1830's.



Once mills like this dominated Macclesfield. Most processed or wove silk.

Raw material

Silk was known in China from early times and that country remains the world's largest producer. The Asian silk moth, *Bombyx Mori*, is one of several insects that produce a strong, light, filament thread (**photo 3**). Originally only wild silk was available but the Chinese began cultivation feeding silk worms on white mulberry leaves. Later cultivation spread to other countries, notably Thailand and Italy. UK produced silk was not economic.

The silk moth's thread surrounds a cocoon and is carefully unwound. Silk threads came to mills as 'books' weighing around

2kg. Threads can be several kilometres long but are thin - only 2.5 denier which is almost impossible to see. (For comparison, a human hair is about 20 denier.) Whereas wool or cotton have relatively short fibres that must be combed, carded and spun together, silk spinning (known as throwing) is a less complex process.

Art School

Appropriately, the museum is housed in the former Macclesfield School of Art founded in 1852. It had close links with the silk industry as teaching was shaped by the tenets of the British Arts and Crafts movement, which



Traditional local industry, making and wrapping holly wood buttons.



The life cycle of the silkworm shown in a display. Silk is a natural fibre, light and very strong.



Design for weaving on a Jacquard loom. School of Art students learned about how to design for industry. It was a complex process.

began with William Morris and his colleagues, who believed that artists should understand process and making as well as design. A technical school opened alongside in 1886.

To design patterns for weaving, students had to understand weaving processes and the nature of fabric. Several of the museum's machines and models were made to help students at the School. (Do any art schools teach like this today? Visiting a textile firm in southern Scotland I was told that many young people came to design, but only one had ever shown interest in the factory workings.) Macclesfield's Art School gave an in-depth understanding of process although it also produced artists such as the notable countryside painter, Charles Tunnicliffe.

Students prepared designs for fabrics but then made point paper designs with each square representing an intersection of warp and weft threads (**photo 4**). These point paper plans could be ten times the design size. Points had to be evenly distributed or the cloth would be unstable. Designers had to take into account size of repeat, number of picks (i.e. threads per inch), colours and the weave construction.

Throwing

There are several stages in making silk fabrics, even before weaving starts. The first stage is 'throwing' which involves twisting filaments together to make a thread. Usually six filaments make one thread for use in a loom. Threads on bobbins go to warping machines.

Warping and beaming

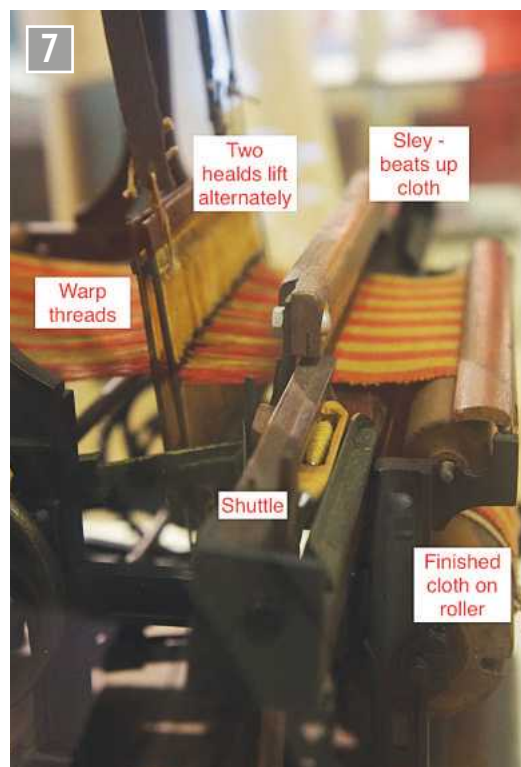
The warp in a piece of silk cloth can have up to 15,000 threads which must be parallel and tensioned evenly. A creel holds a number of bobbins and threads are wound onto the warping mill passing through combs and a reed to ensure even spacing (**photo 5**). From the warping mill threads are



5 Winding silk thread (barely visible) on to the warping beam. Threads are then transferred to the weaver's beam.



6 Eyelets in the heald (or heddle). This is the complex set-up for a Jacquard loom. Warp threads could be lifted according to the program on the cards.



7 A simple loom. The frame like healds are lifted alternately to form a shed. The shuttle housed in the drop box in front passes across with the weft. This is then 'beat up' by the sley.



8 Classic hand operated Jacquard loom. The Jacquard mechanism controlling the weave is at the top. Weaver's beam to the right, finished cloth to the left.

then transferred to the warp beam to go onto the loom for weaving. Weaving has three basic processes. Every warp thread is threaded through an eyelet in the healds that lift warp threads in the loom. (**photo 6**). With warp threads stretched out, the first is 'shedding' where the warp threads are separated allowing the shuttle with weft thread to pass through. In a simple loom, warp threads are lifted alternately to form the 'shed' by the 'healds' or 'heddles' (**photo 7**). Then the shuttle passes through the 'shed'

placing the weft (or 'pick') thread. The pick is then packed tightly against the previously woven cloth using a 'sley' in a process known as 'beating up'.

Jacquard looms

If one machine dominates silk weaving it is the Jacquard loom, a complex device for weaving elaborate patterns. Many were hand operated and can be seen in working order in Paradise Mill next door (**photo 8**). Marie-Joseph Jacquard invented this technological wonder in Lyon and patented it in 1801. By

1812 it is said 11,000 such looms operated in France alone. The idea was developed, however, by Basile Bouchon, also in Lyon. From his father - an organ builder - he knew about the use of punched paper to mark out holes on cylinders controlling tunes on organs. Such cylinders were common in France and the Low Countries playing a tune automatically on carillons and organs. One of Bouchon's coworkers, Jean-Baptiste Falcon, used punched cards tied together. These could be altered quicker than a paper

roll (photo 9). The Jacquard uses a belt of punched cards linked together to control the lifting of healds (photo 10). To summarise; in operation a card is held between the cylinder, best described as a square section, and needles (photo 11), of which there is one for every possible hole in the card. The cylinder rotates by a quarter turn in every operation presenting a different card. If there is a hole the needle goes through the card into a corresponding hole in the cylinder. It then lifts hooks, attached via the healds, to each warp thread according to the pattern on the card. This makes the shed. If there is no hole the needle cannot pass through and the hook is pushed aside and is not raised. The weaver then sends the shuttle across through the shed. Apart from varied coloured warp threads, different shuttles held in 'drop boxes' to the side can hold different colours.

Card cutting

Jacquard cards were cut using a special machine, and there were machines to copy or replace cards (photo 12). Different areas used different sizes of card. For example, Germany's silk weaving centre at Krefeld used its own size of card. The museum also has power operated Jacquard looms (photo 13). The Jacquard was used in various forms across the textile industries, not only for silk. Less complex versions of the Jacquard loom, sometimes known as a 'Jacqualette' were used in the cotton industry for weaving simple patterns or lettering (photo 14).

Punched card uses

Charles Babbage wanted to use punched cards to operate his Analytical Engine conceived around 1834 but never built. He owned a woven silk picture of Jacquard made with instructions from about ten thousand cards. Herman Hollerith pioneered the use of cards for data sorting in the US Census and his cards



Jacquard cards controlled lifting warp threads to weave complex patterns, the first programmable device.



Belt of Jacquard cards. Each card is presented to a cylinder controlled by the yolk mechanism just visible. Needles then insert into card holes to determine which heald to lift, thereby making a pattern.



Example of card on cylinder. Needles penetrating the card allow the gripper bar controlled by a treadle to lift the hooks holding healds. Weights visible below hold healds in tension.



A MacMurdo repeater used to copy or replace damaged cards.



Modern Jacquard looms are power driven. This one was used for weaving several small tapes at once as labels.



'Jacqualette' controls visible top right on a loom at Queen Street Mill Burnley, used for simpler patterns, in this case lettering. The 'dobby' loom used an even simpler control system with wooden 'cards'.

lasted in computing until the 1980's. Punched cards are still used to operate fairground organs. A derivation uses

a punched paper tape to control player pianos. On the best reproducing pianos it is claimed you hear a piece

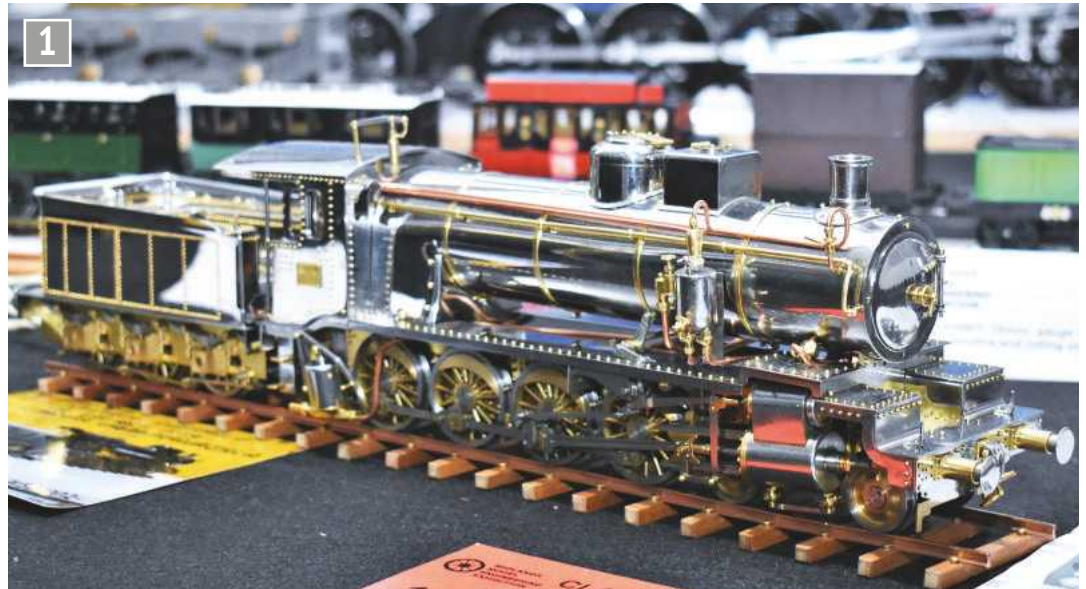
played exactly as it was cut by the original player, though that is disputed.

●To be continued.

Midlands Model Engineering Exhibition 2018

PART 1

John Arrowsmith looks back over the competition classes at this year's show.



Giancarlo Mastrini again took the First Prize in Class 1 with his superb 4-8-0 locomotive.

This year the 41st Midlands Exhibition had a truly international aspect to its presentation with both exhibitors and traders attending from overseas. The competition entries were in most cases well supported with the Young Engineers class 14 attracting eighteen entries which was a splendid sight to see. There were three notable tributes and anniversaries celebrated at the show with visitors being

greeted by a beautifully made example of an Avro Lancaster bomber aircraft in 1/6th scale, as they entered the exhibition area, which was celebrating the 100th anniversary of the RAF. In addition to this, the record-breaking feat of LNER A4 Pacific *Mallard* down Stoke Bank in 1938, was also commemorated. Finally, a tribute to that fine model engineer, Gordon Smith, showed off the work he had done over the years and the contributions he had made to improving so many different aspects of model locomotive details as well as being a true gentleman and friend to so many people. Overall, another excellent presentation by all concerned provided a really interesting and enjoyable exhibition.

As is the norm I will start my report by covering all the competition classes to indicate the high quality of model engineering still being produced in today's very busy and increasingly electronic and demanding world.

Class 1: Locomotives up to and including gauge 1

First Prize in this class went again to that creator of amazing gauge 1 locomotives, Giancarlo Mastrini from Italy with his *Mastodon 4-8-0 vapore saturo dopia espansione* locomotive. Finished in his traditional highly polished trim, this was another superb example of miniature locomotive building (photo 1). A regular competitor in this class is David Viewing and he again produced another excellent example of his skills with an interesting double headed train of vintage Victorian locomotives and rolling stock. David gained the Second Prize for his efforts (photo 2).

Class 2: Locomotives – 2½ and 3½ inch gauges

David Lee's entry of a standard *Tich* in 3½ inch gauge to the LBSC design gained him a Commended certificate (photo 3).



Second Prize in Class 1 was awarded to David Viewing for his double headed Victorian goods train.

Class 3: Locomotives – 5 and 7½ inch gauges and above

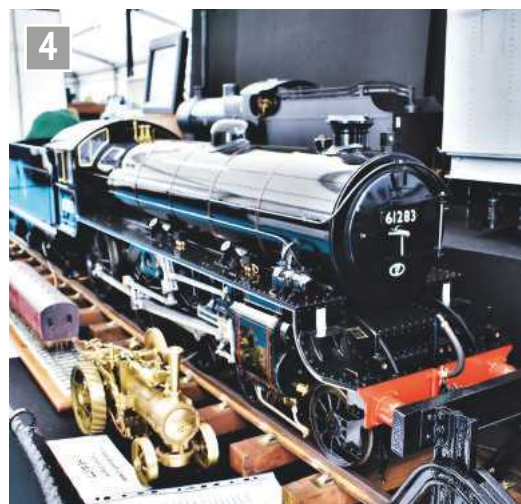
A strong competition here with some very good entries to consider. I think the judges had a difficult time in deciding the winner but they did, and the First Prize and winner of the Reeves Challenge Trophy was Alan Gent from the Nottingham Society for his superbly built model of an LNER B1 4-6-0. Finished in a gloss black finish it was a worthy winner (**photo 4**). However, the Second Prize awarded to Alan Boot was also very well deserved. His example of a Midland Railway Johnson Single 4-2-2 locomotive was another example of a beautifully finished and presented locomotive which really caught the eye (**photo 5**). A Very Highly Commended certificate was awarded to Brian Holland from the City of Oxford club for his 7½ inch gauge example of the popular 0-6-0 *Sweet William* to the Jack Buckler design (**photo 6**). A Commended certificate was presented to J. L. Figureau from France for his example of an American 4-4-0 to the David Piddington design (**photo 7**).

Class 4: Rolling Stock any gauge

Sadly there were no entries in this class although there were some fine examples on show on various club stands.



A nice example of LBSC's Tich gained a Commended certificate for David Lee in Class 2.



First Prize in Class 3 was this superb 7½ inch gauge LNER B1 built by Alan Gent.



Second prize in Class 3 was awarded to Alan Boot for this splendid example of a Midland Railway Single 4-2-2 locomotive.

Class 5: Stationary engines

A good entry in this class provided the judges with some food for thought. An excellent example of a mid

19th century beam engine built by Norman Johnson from the Northampton Society gained the First Prize and the Phoenix Precision Paints Trophy. There was good detail

and a fine paint finish along with a detailed explanation for visitors to read about the original (**photo 8**). Second Prize went to Peter Wardle from the Birmingham Society



J. L. Figureau from France built this fine 5 inch gauge American 4-4-0 and gained a Commended certificate.

In Class 3 Brian Holland's 7½ inch gauge Sweet William was Very Highly Commended.

for his twin cylinder flame licker engine (**photo 9**). Third Prize for his well made Stothert & Pitt beam engine went to David Rhodes (**photo 10**). A Highly Commended certificate went to Martyn Shenton for his Woodroffe's Verto engine circa 1880 (**photo 11**).

Class 6: Steam road vehicles (static)

There was just one entry in this class from Jonathon Gittings who gained a Very Highly Commended certificate for his 4 inch scale Foster traction engine (**photo 12**).

Class 7: Machine tools and workshop equipment

There were two awards in this class, both being Very Highly Commended certificates to Mr R. Tilly for his nicely made and presented turret milling machine and to Andy Hopwood for his retracting screw cutting tool.

Class 8: Internal combustion engines

There were only two entries in this class and both were very well made and presented models. First Prize and the Engineering in Miniature Trophy was presented to Neil Bottle for his excellent example of a V Twin Hoglet dry sump I/C engine (**photo 13**). The Second Prize was awarded to Jonathon Gittings for his Redwing Hit & Miss engine on an iron truck (**photo 14**).

Class 9: Horological, scientific and automata

There were no entries in this class but as before a number of very good examples were to be seen on a number of club displays.

●To be continued.

Next time, we shall continue with the marine models and the young engineers class.

Neil Bottle gained the First Prize in Class 8 for his V-Twin Hoglet dry sump I/C engine.



First Prize in Class 5 was won by Norman Johnston for his working beam engine.



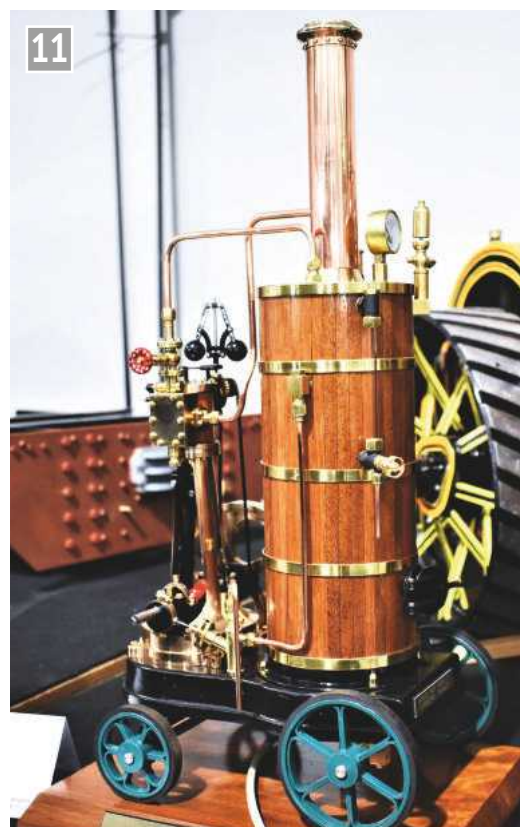
Third Prize in Class 5 went to the Stothert & Pitt beam engine built by David Rhodes.



This Royal Mail coach circa 1830 built by Eric Keggans was awarded First Prize in Class 12.



This fine twin cylinder flame licker engine gained the Second Prize in Class 5.



An example of Woodroffe's Verto Engine circa 1880 gained a Highly Commended certificate for Martyn Shenton.



The attractive Redwing Hit & Miss engine gained the Second prize in Class 8 for Jonathon Gittings.

Martin Young's Engines PART 2

Alan Barnes meets a prolific engine builder who moved up a scale.



Continued from p.699
M.E. 4599, 9 November 2018



The newly finished Burrell at the Aln Valley Railway June 2018.



Six inch Burrell at Aln Valley.

With a backyard full of engines you would have thought that Martin would have taken a well earned rest from model making. Far from it and June 2018 saw the debut at the Corbridge Rally of his latest creation. Work on this model, a 6 inch scale Burrell Showman's engine, began in September 2014 although it had been Martin's initial intention to complete the model as a road locomotive.

As with his previous Burrell the drawings came from Live Steam Models as did many of the castings while Tony Baldwin at AJB Engineering again supplied the boiler. Apart from the flywheel and the final drive gear all the machining was done by Martin in his home workshop. Work started with the wheels, which has become Martin's usual start point. 'I can make the wheels up from sheet steel and steel rod which I have in stock while I am waiting for castings and other parts to be delivered so no time is lost. When finished the rear wheels were sent to Reliant Rubber for the tyres

to be fitted but for the smaller front wheels I use Aqua Seal.

'The boiler was delivered in June 2015 and by this time I had made up the hornplates and tender from EN3B mild steel. With the hornplates fitted and the engine set on its wheels the project had a sudden change of direction when I decided that the Burrell would be completed as a Showman's engine rather than a road locomotive. That decision meant that I had a lot more parts to make and yet another larger overall canopy to build. Fortunately, the LSM drawings cater for both types of engine and they were also able to supply the ornate brass twists which would be needed.

'The major downside of the build was that everything was outside in the yard and the growing engine had to be carefully sheeted up each time I worked on her just to keep out the rain. The Burrell



was being built alongside the Fowler B6 so there was not much room to squeeze between the two engines. The actual build was fairly straightforward and the



Cylinder block on the milling machine (photo Martin Young).

The part built Burrell December 2015 (photo Martin Young).

machining and preparation of the castings threw up few problems. I also had the benefit of a large stock of 'odds and ends' from my previous models and most of

the parts for the motion were made from odd pieces of metal which I had accumulated over the years. Never throw anything away - you never know when it will come in



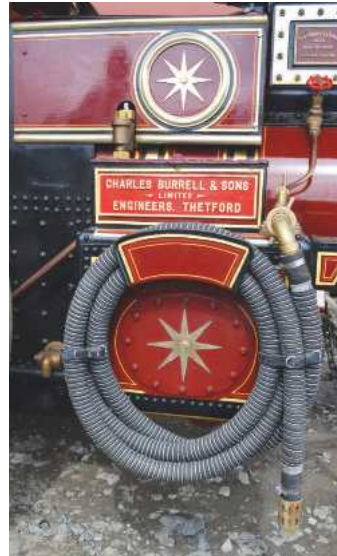
The Burrell crank being machined (photo Martin Young).



Burrell crank completed with gears (photo Martin Young).



Burrell June 2017 nearing completion (photo Martin Young).



The hose and the nameplates on the Burrell are superb details.



Burrell generator.



Burrell cylinder detail.

handy. I used tool steel for the expansion links while for some of the parts which would be prone to heavier wear I used bronze.

'For the canopy I made the cross members out of plywood and used seasoned ash for the rest of the woodwork and the whole canopy was covered with waterproof sailcloth. All the support stanchions and twisted brass were obtained from LSM and I machined the roundels at the end of the twists and the centre rings out of brass which I had in stock.

'The whole engine was brush painted and hand lined although this time I used 23 carat gold leaf for some of the decorative areas. This was a new technique for me and although it took a little practice I am pleased with the end result which I think gives a much better look than gold paint. While I felt comfortable handling the painting and lining I felt that the canopy lettering should be handled by a professional and called in the services of Phil Anderson. He completed a superb job despite having to work in some rather cramped conditions.

'The new Burrell was steamed for the first time in September 2017 but after that it remained in the garden for several months until it finally emerged for its rally debut at Corbridge in June 2018. Apart from a loud knock on the water pump, which proved to be an alignment problem and was soon sorted, the Burrell's first real run out

went extremely well. The only other issue to deal with was the main bearing which came loose as the adjuster came undone but this was fixed the following weekend when the engine made its second public appearance at the Classic Vehicle Day at the Aln Valley Railway in Alnwick.

'The Burrell is now back at home in the garden enjoying a bit of space just for once as the Fowler B6 has now gone to a new home. However, with space in the workshop and room in the garden it probably won't be too long before my thoughts turn to the next project – I might just get around to the Burrell road locomotive.'



Burrell footplate detail October 2017 (photo Martin Young).

My thanks to Martin for taking the time to provide details of his engines and for allowing the use of some of his photographs.

All photographs, unless otherwise stated, are supplied by Alan Barnes.

ME



The new Burrell in the yard at the Aln Valley Railway June 2018.

Sieg SX2 Plus Miller CNC Conversion

Graham Sadler explains how he converted his Sieg milling machine to CNC operation.



Continued from p.705
M.E. 4599, 9 November 2018

Home and limit switches

Many people it seems rush to get the machine completed and then leave the limit switches until later. With such a small machine as this and when we are pushing the envelope they are essential, and in use they have proved indispensable; if you make a wrong move, which is very easy, they will protect the machine from damage. In addition, they enable the use of G53 – G59 (fixture offsets) to locate the positions of vices and sub plates etc. As these are located in machine co-ordinates, referencing to a home position is essential (homing is always the first action on machine start-up). I will cover this later when we come to operating the machine. In any case, while the machine

is in bits and clean, it's so much quicker to do it now.

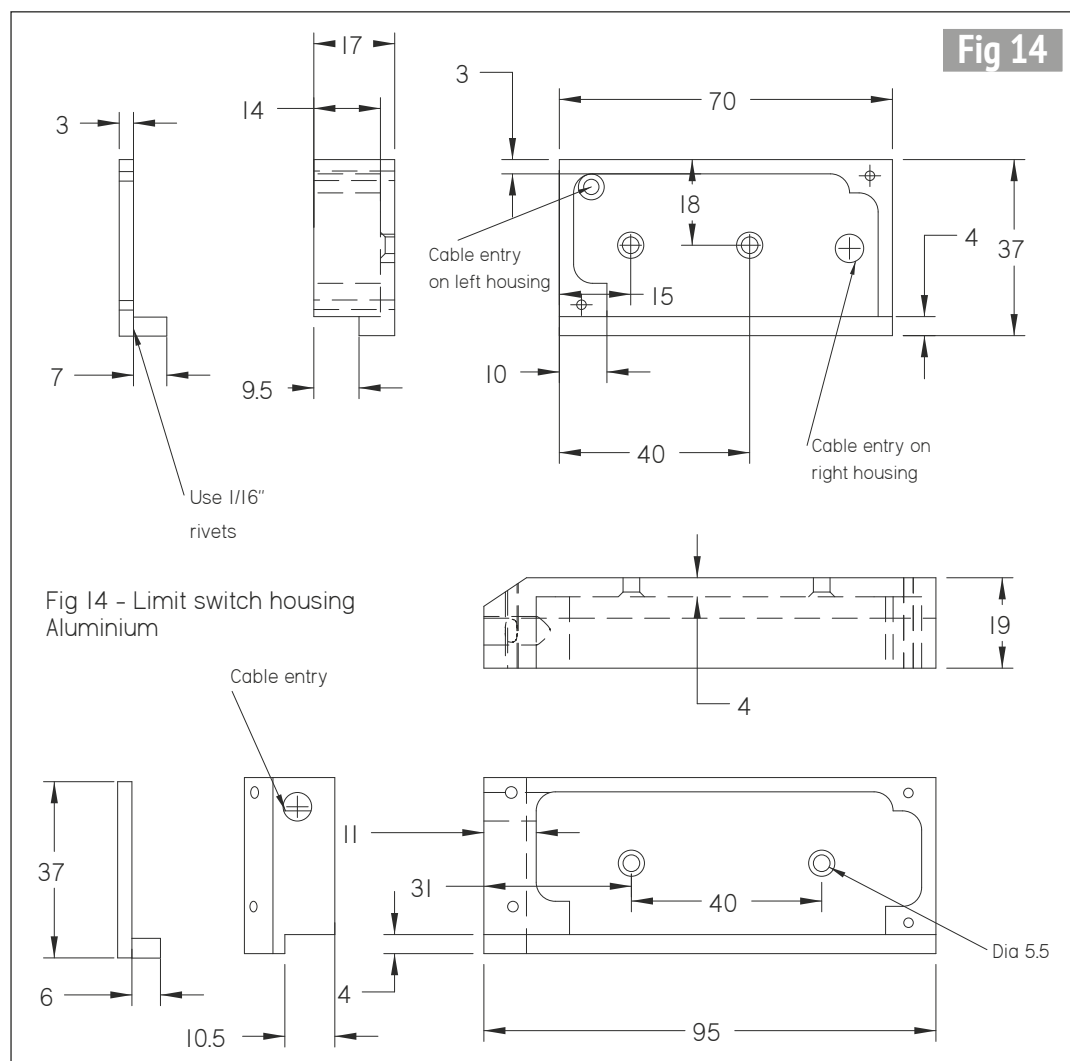
One thing which was required was to have the micro switches fully enclosed, if possible, as it was intended to have flood coolant. Here again a lot of schemes were devised but the difficulty was with the positioning and mounting. The task would be a lot easier with the switches mounted with the rocker upwards but that invited entry of the coolant. The chosen method keeps the rubbish out but again with this machine there is just and only just enough room to fit them in.

The enclosures (**fig 14**) are simple exercises in slot milling pockets using coordinate methods. Start by machining the outside boxes almost to size then grip them high

in the miller vice and make swarf! Use an 8mm slot drill to minimise the radius in the corners. Coordinate drill the 3 x 5mm holes for the mounting screws and countersink them.

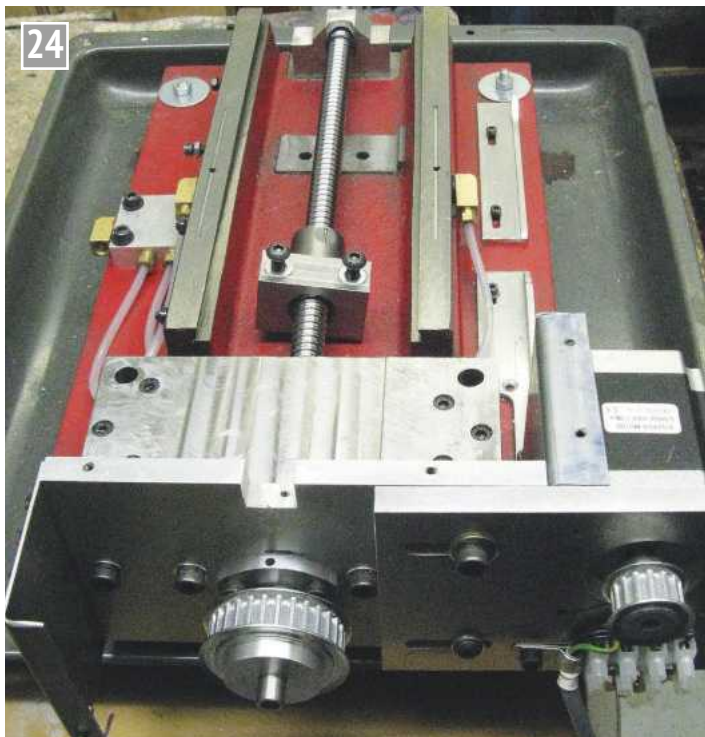
The little step piece on the covers was riveted in place and they will need a scallop to clear the rocker. They are fixed in place with 6BA cap screws. Why? I bought a job lot of a fifth of a kilo of assorted BA caps for £5 from an auto jumble! There was a huge number of them, lasting for years, and there's still a big pile left. Where the drawings specify M5 fittings, I used 2BA, no real difference. By the way, for fun, I did a fitting count on the machine and it was over 250!

With the covers in place the outside edges can be skimmed





22 Milling the limit switch housing, shortened later in redesign, as only one micro switch is needed.



24 The finished base in oven drip tray! Note oiling system.



23 Finished saddle components.

to bring both to the same size. The boxes are designed for Omron micro switches from CNC4YOU and are mounted with 6BA x $\frac{3}{8}$ inch screws. The boxes would be a perfect CNC milling project... (photo 22).

The mounting posts for the Y axis, which just clear the oiling fittings, are simple but don't forget that the X left and right boxes are handed (fig 15). The blades for Y are from 25 x 3mm angle (front about 150mm long, back 125mm long). Fix with 6BA cap screws in slots for adjustment. The X blades are from 12 x 1.5mm brass angle.

In order to tame the cable, a tube was fitted in the step under the front of the table. This needs thin wire and the smallest tube possible as

access to the gib screws is very difficult; I use a BA box spanner with a long hex key through it. A screened cable was routed to the right housing and then two cores were extended through the tube to the left housings, which were sealed with silicone.

Originally I made the Y axis hold two switches at the front and back limit but later realised that, as they were connected in series to the same input to Mach 3, there was only need for one so the housing was cut in half and resealed. It makes a much neater arrangement and the drawings are for the single version.

The blades are set so that they are activated 4mm (one turn) before the hard limits are hit. When you hit the limit switch there's a bit of a bang and the motor stops dead - a shock at first, I didn't think the switches were working and the hardware limits had been crashed into!

The saddle components are shown in photo 23, which shows the longer double switch housing and the blades are awaiting shortening (only one switch is needed). The bent bar is to lock a rubber sheet over the front to shield swarf and the finished base unit is shown in photo 24. The old oven failed recently and the grill pan made a perfect starting point for the drip tray but at this time it awaits extending with sheet metalwork. The X switch could also be a single unit mounted on the flat extension of the saddle but it would need to be removed and reset along with all fixture offsets every time the gib needs adjusting.

Design thinking for the Z axis and motor pulley

On completion of the X and Y components the Z axis was plain sailing as there was so much clearance, except for deciding on the position of the ball screw. Here there were three options:

- 1) Inside the column.
- 2) At the side or back of the column.

Fig 15

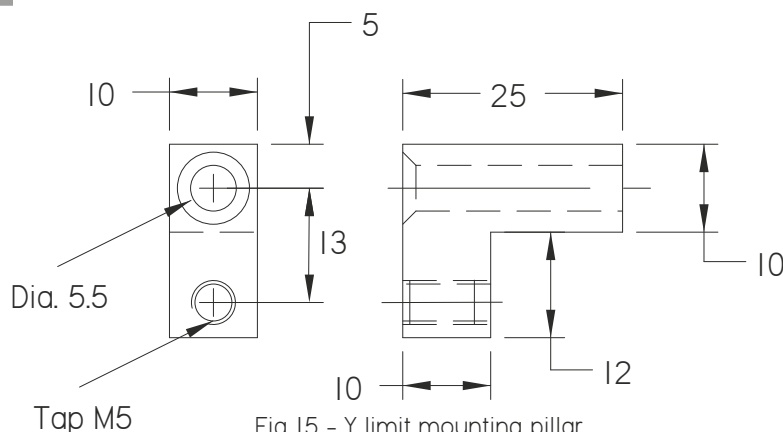


Fig 15 - Y limit mounting pillar
2 off - steel, one without M5 tapped hole for support of oil tubes

The motor pulley was produced by methods recommended by the late John Stevenson from Nottingham. He used a tooth profile which is modified by reducing the outside diameter of the pulley by 0.8mm but keeping the same pitch circle for the belt pockets. The result is a belt which runs in the pockets just clear of the outside of the pulley itself.



New motor pulley, note clean seating for clocking in the four jaw chuck later.

3) In front of the column with an anchor bar on the head mounting dovetail base with the screw locked solid to it to stop rotation. The ball nut revolves and thus moves the fixed screw. There is no mounting at the top.

Option 2 was immediately discounted as the screw should be mounted as close to the dovetail as possible and should be in fairly central in order to give smooth movement. The head weighs 20kg and if the screw is at the side it will cause a twisting moment. Option 1 seems good until the mounting of the screw onto the head is considered; it would need to be connected at the top of the screw - a basically inverted 'U' shaped connecting mechanism over 450mm high going down inside the column to the nut then up over the top and down the front. No thanks! This left option 3 but there just wasn't the room between the motor mounting (which turned out to be plastic) and the column but it was the best option. After a lot of cogitating this scheme was adopted and all will be made clear later.

What was needed was to move the motor forward

and away from the column by about 25mm. It involved making a new motor mounting to enable a shorter 330mm T5 HTD (5mm pitch High Torque Drive) belt to be used in place of the 350mm belt. At the same time a larger drive pulley (of 26 teeth replacing the original 20 tooth) could be fitted in order to increase the top speed from 2500rpm to 3250rpm, suitable for a 2mm end mill in steel, with the bottom speed increased from 100 to 158rpm, which is still okay for a 30mm diameter fly cutter in steel. I would have liked the top speed to be higher but - remember - as one gains speed torque is lost.

Use of online HTD calculators revealed the centre distance would be 81mm as opposed to the original 98mm. Extra space was obtained by removing the rack which is no longer needed. The motor pulley was produced by methods recommended by the late John Stevenson from Nottingham. He used a tooth profile which is modified by reducing the outside diameter of the pulley by 0.8mm but keeping the same pitch circle for the belt pockets. The result is a belt which runs in the pockets just clear of the

outside of the pulley itself. The pitch circle diameter (pcd) of the belt shown in these calculations is not the same as the pulley diameter as the pcd of the belt is 1.14mm bigger than the pulley. The reduced pulley diameter has the effect of making the slots simple semicircles rather than U shaped and means the pulley can be produced by drilling 3mm diameter holes in an initially oversized blank rather than using a tiny ball slot drill, tiny fly cutter or radiused slitting saw type cutter as must be used in industry (or are they planed or broached?). The calculations work like this:

- Circumference, $C = \text{no. of teeth} \times \text{pitch} = 26 \times 5 = 130$.
- This is divided by π to give pcd of the belt centre; $C = \pi \times \text{pcd}$, or $\text{pcd} = C / \pi = 41.38\text{mm}$.
- But we need to realise that the belt pcd is larger than the outside diameter of the pulley as it runs in the centre of the belt, so we subtract this from the belt pcd, i.e. $41.38\text{mm} - 1.14\text{mm}$ to get the theoretical outside diameter of the pulley = 39.98mm .
- Subtract the Stevenson reduction giving $39.98 - 0.8 = 39.18\text{mm}$ actual pulley outside diameter.

- Pcd for the 3mm diameter holes which will form the pockets will be the same as this = 39.18mm .
- Minimum outside diameter of pulley blank is $39.98 + \text{drill (3mm, or 1.5mm on each side of the pulley)} = 43\text{mm}$, let's say realistically 47mm so use 50mm diameter material.

Bore the hole as a push fit on the spindle and cut the keyway. Transfer the chuck without removing the work to the dividing head. An edge finder is used to centre the bore and offset to the spindle by 19.59mm to drill the 3mm holes but be careful with backlash here. Use a new drill for this with plenty of pecking and cutting oil. Note (photo 25) in the setup for drilling the belt 'holes' a tiny truing of the large diameter outside diameter next to the chuck, turned immediately after producing the bore. This is essential for clocking the blank in the four jaw chuck by the boss to turn the outside diameter to size. Remove the burrs with a fine needle file (tedious). All other dimensions match the original 20 tooth pulley.

●To be continued.

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Quarter Scale Bentley BR2 Rotary Aero Engine PART 7

Mick Knights tackles a major part of the rotary engine; the thrust box.



Continued from p.702
M.E. 4599, 9 November 2018

Time now to move on to a couple of the more interesting pieces of machining on this engine, the thrust box and its cover and the crankshaft. If you're lucky enough to enjoy a workshop where the machine capacity isn't an issue then these components are a bit more straightforward, but with limited machine capacity a bit of lateral thinking may be required. We'll begin with the thrust box.

I have already mentioned that I have completed a nine cylinder radial engine. This type of engine came to prominence during the Second World War, where the delivery of the fuel/air mixture, along with lubricating oil, is achieved by conventional means via a carburettor and mechanical oil pump driven by the rotating crankshaft. This rotary engine however is a product of the First World War and was 'cutting edge' at that time with some ground breaking innovations, not the least of which was a stationary crankshaft and a revolving crankcase. The main reason for this configuration was of course lack of space in the air frame but, more importantly,



Bentley BR2 aero engine.

the materials available at the time were not capable of withstanding the tremendous amount of heat an engine of this size would generate so by rotating the crankcase the engine is cooled by cutting its path through the air. This produces its own problems, such as how to deliver the air fuel mixture and supply lubricating oil under pressure

to all the moving parts. The solution was to deliver both through the stationary crankshaft and then to distribute the fuel air mixture to the cylinders by means of the thrust box. The mixture is sucked into the thrust box, aided by vanes and pockets in the thrust box cover plate; it is then forced round a radial chamber where it exits through the bottom outlet manifolds and via a delivery tube to the cylinder heads. I hope that all makes sense. It's a pity that I can't illustrate this aspect of the engine using the drawings but copyright must be observed. The configuration of the ports and transfer tubes, however, can be seen in the introductory photos.

As with all things, the first stage is to securely mount the billet in the lathe and proceed to rough out all bores



Roughing out the back diameters.



Establishing the transition point with a face grooving tool.

and diameters to 0.040 inch above and under finished size respectively, while leaving 0.020 inch on all face and shoulder depths (**photo 105**).

There's an angled internal face that's roughed out before a face grooving tool is used to establish the transition point of the angled face and the back face of the thrust box (**photo 106**).

The main diameter, along with the corner radius and the angled face, is finished in one continuous turning operation; particular attention needs to be given to the surface finish as well as the diameter as an 'O'-ring will seal the cover plate when assembled. The angled face is to encourage the flow of the air fuel mixture on its eventual journey to the cylinders. Using a suitable internal undercutting tool the remainder of the thrust box cavity was machined. This will be the radial cavity where the air fuel mixture finally arrives prior to exiting to the cylinder heads (**photo 107**). The internal bearing locating diameters are finished turned and the locking nut thread is screw cut (**photo 108**) before the thrust box is reversed and set true ready to turn the front detail (**photo 109**).

With the front bearing bore machined, the base diameter of the front angled face is turned. The angled face is then turned until it blends with the base diameter. Again this angled face is to encourage the mixture flow. The crankcase location diameter was also machined at this stage. **Photograph 110** shows the finished front face.

The thrust box is then transferred to the conventional milling machine and set true to the spindle. The first operation is to pitch out and drill a three hole pattern around the bottom face of the front bearing bore. These are bearing push off holes but are important as they will be used to set up different operations and will ensure the correct orientation of all the other hole patterns and milled details.



Turning the internal undercut area.



Screw cutting the locking nut thread.



Reversing the thrust box.



Front face detail finish turned.



Drilling the first three hole pattern.



The thrust box cover plate securing holes.

The bearing push off hole drilled at 12 o'clock will be directly in line with the centreline of cylinder No. 1 and so becomes the reference hole for all the subsequent hole patterns and machining operations (**photo 111**). The first hole pattern to be pitched out is the set thrust box cover plate securing holes. In order to ensure the correct position of the cover plate vanes inside the thrust box this series of holes starts on the centreline at ninety degrees, which is the centreline of cylinder No. 1 (**photo 112**). With the

thrust box reversed the central position is obtained by lining up the previously drilled three hole pattern and using the bearing push off hole at 12 o'clock as the reference (**photo 113**). The crankcase securing holes are pitched out with the first hole offset from the centreline and are a mirror image to the hole pattern used on the back face of the crankcase. The series of nine through bores is also pitched out and established using a deep centre cone to a good start for the drill on the angled face.

The series of nine through bores is produced in three stages: firstly the holes are pilot drilled using the largest stub drill available (**photo 114**); next the holes are taken out to 0.010 inch beneath finished size using a milling cutter then finally bored to finish size in order to ensure a smooth surface finish to aid the fuel mixture flow (**photo 115**).

The last milling operation is to establish the nine outlet positions around the periphery of the thrust box along with the manifold securing screw holes. The first outlet bore

is positioned at minus 3.75 degrees from the vertical centreline, so the easiest option was to produce a spigot which was a close fit to the front bearing bore, mount it in the dividing head, which was in the horizontal plane and set at zero, then pitch out a hole at minus 3.75 on the same PCD as the previously utilised three hole pattern for bearing push off and return the dividing head to the vertical. When the thrust box is mounted on the spigot and the reference hole is located, using a drill shank, with the angular hole, the centre of the outlet bore will be at zero, making the indexing a bit more straightforward (**photo 116**). The indexing itself did require a set of holes to be added to the home-made indexing plate, which can be seen in the photograph. The two tapped holes which secure the outlet manifolds are twelve degrees to either side of the centreline of the bore, which means the first indexing move had to be 12 degrees. The next move was 16 degrees, which is the first screw hole of the next manifold; the next move was 24 degrees, to the second fixing hole of the second manifold, after which it was a repeated 16 degrees followed by a 24 degree move. I figured that the best, and simplest, way of indexing was to create a nine hole pattern on the indexing plate; that way with a 40:1 ratio dividing head, the distance between each hole would be exactly one degree. This plate has subsequently become so very handy that I can't think why I didn't produce one years ago.

Each hole was centred, drilled and tapped at each indexing but before committing to removing any material, all positions were first indexed and identified with a pencil line (**photo 117**).

The final operation was to produce the main outlet bores, gradually enlarging them until finishing with a size milling cutter (**photo 118**). On final assembly it was found that these round bores - having been machined in the vertical plane because it wasn't possible to



Reversing the thrust box and re-establishing centre position.



Finish boring.



Centring the hole position.

incline the head on a mill/drill - had to be elongated into ovals in order to match the angular bores in the bottom outlet manifolds. Obviously, this will be covered when we reach that stage of the build.

Just to be sure that everything is in the correct position, a quick assembly of the thrust box to the crankcase, plus one cylinder demonstrates that the transfer tube is in line with the cylinder head inlet manifold and the bottom outlet manifold (**photo 119**). The manufacture of these manifolds will be covered later on.

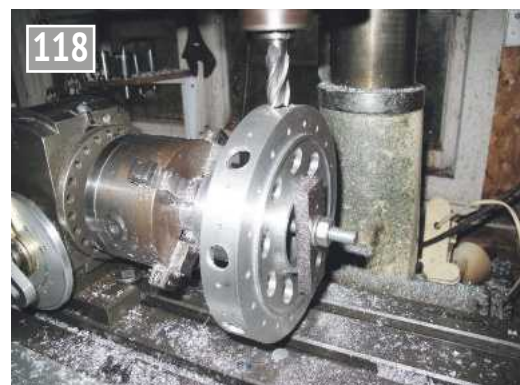
●To be continued.



Pilot drilling the thrust box through holes.



Producing the holding and locating fixture.



Producing the finished size outlet bore.



Peripheral tapped holes present the outlet manifold at the correct orientation.

Next time, we move to the centre of the engine and tackle the crankshaft.

CLUB NEWS

Geoff Theasby reports on the latest news from the Clubs.



Update on the dial caliper mentioned in Club News 4600. Mitutoyo say it is beyond economic repair.

Not only that but they said, 'Non-Mitutoyo product'! It's counterfeit! Oh well, it was worth a try. In the interests of authenticity, I suppose I ought to destroy it, as I did with the wild animal leg-trap I found once, a filthy, cruel thing.

Also updated from Club News 4600 is my miniature CCTV camera. I found, online, a 'Mini AV to HDMI converter'. Composite video in, HDMI compatible TV out, £8.99. Simple! (Don't worry about the acronyms, the only one worth remembering is PCMCIA: 'People can't memorise computer industry acronyms'.) I also noted a half-second delay between performing an action before the camera and seeing it on the TV screen. This is why: www.axis.com/files/whitepaper/wp_latency_live_netvid_63380_external_en_1504_lo.pdf

I visited Hack Green 'Secret Nuclear Bunker', near Nantwich, staying over at the 400-year-old Grade 1 listed, *Crown Hotel* afterwards. The bunker is magnificent - I could have stayed all day! It is full of electronics, radio, telephone etc. communications equipment, radar, broadcasting and accommodation, including fresh water, filtered air-conditioning, sewage disposal,

etc. for a regional seat of government. Now we get some idea of where our taxes went in the Cold War. As an example, step from a concrete corridor into the broadcasting studio. Lined with acoustic panels, it sounds 'dead' compared to the rest of the building, in which voices, doors closing, footsteps and other background make it 'lively'. Incidentally, there is a remote-controlled radio receiver on site for anyone to use from their own home computer, go to hackgreensdr.org:8901 and see what we amateur radio enthusiasts find so interesting (photos 1 and 2).

At a co-incident amateur radio rally, I bought a 12 volt, 10 Amp switched-mode power supply (see Wikipedia) 'as seen' for £5. They normally retail at about £80. Plugged it in, switched on, nothing. Tested the fuse, OK. Tested the fuse in the mains plug. Blown. Cover off, no obvious burning, discharge, misshapen components, so I replace the fuse, it works! On test for the next few days, no misbehaviour, but I'll run something non-important on it until I am happy.

In this issue, boggy areas, boiler glass protectors, a young celebrity, spotting oddities, knitting, an unusual clock, a Wallace & Gromit generator, an iguana, vital safety and troublesome passengers.

Peveril, September, from

Manx Steam & Model

Engineering Club, mentions the track cleaning machine at Birmingham model engineers (IMLEC). It is autonomous, which makes it much easier to implement on railed vehicles. The new wheelchair carriage is convertible to normal railway use, thought to be unique in this gauge. This carriage also allows access to the boggy areas of the *Curraghs* (Wildlife Park) otherwise inaccessible to less mobile visitors.

W. www.archive.mers.org.im/orchidline.htm

The News Sheet, October, from **North London Society of Model Engineers**, reports that Tim Watson took his 4 inch scale Burrell traction engine to the Great Dorset Steam Fair. Not just took it, he drove it, three days from leaving St Albans! Paul Funk has opted to make his boiler gauge glass protectors from 30mm square-section Lucite/Acrylic/Plexiglass. Costing £8 for ½ meter, against £-hundreds for toughened glass, will they stand the heat? Time will tell.

W. www.nlsme.co.uk

Conrod, October, from **Otago Model Engineering Society**, begins with Chairman, Russell Clarke, enjoying the talk from one of the Lego Users Group Otago, who uses Lego Technics to teach innovation and creativity to his more challenged students. Exhibits ranged from a VW 'Beetle' to a space rocket. Myles Thayer writes on Arthur Beverly (1822-



Hack Green bunker.



Nantwich, very pretty.

1907) of Dunedin, who made several self-winding clocks using the diurnal differences in temperature to provide the going force (photo 3).

W. www.omes.org.nz

Port Bay Express, October, from **Portarlington Bayside Miniature Railway**, features Ashleigh Myers' visit to Altona Miniature Railway, Melbourne, which he made with an eye to collecting ideas which may be of use at Portarlington Bayside. 2018 passenger numbers are up by 25% and for the fiscal year by 67%

W. www.miniaturerailway.com.au

The Whistle, October, from **British Columbia Society of Model Engineers**, reveals that the railway has carried its 1 millionth passenger! She is 18-months-old Ada Zhu, who, with her parents, received a plaque, 100 ride tokens, a wooden train set, a 'Burnaby Central Railway' bear and a 'Thanks a Million' dark chocolate coin. All other riders on her train, which was pulled by the Society's Hudson steam locomotive, received five ride tokens and a chocolate coin. The family lives locally and has visited the line previously. The Great Northern Railway Historical Society visited and everyone said what a great visit it had been and how welcomed they felt.

W. www.bcsme.org

The York Model Engineer, September, from **York City & District Society of Model Engineers**, tells of Melvyn O'Connell, on his visit to the Thornbury Exhibition, who noticed a Newcomen Society stall, at which visitors were invited to identify several unusual items. Due to the various members who bring odd objects to club meetings, he was able to exercise his knowledge so gained and won, with a score of 58%! Editor, Paul Howard spotted a lathe at Statfold Barn so big that even fitting a steady to it required a chain hoist.

W. www.yorkmodelengineers.co.uk

Welling & District Model Engineering Society's

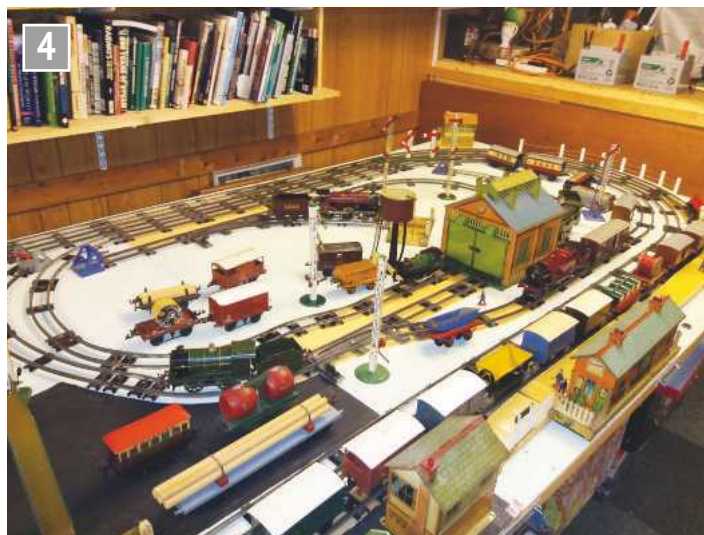


Arthur Beverly's clock from Dunedin (photo courtesy of Myles Thayer).

Magazine, October-November reports that 'Tinplate Night' produced a fine layout from Laurie Arthur and Dave Marshall (photo 4). Bob Underwood writes on making square holes. Then, he writes on having discovered the Treffry viaduct near Luxulyan, which carried rails AND a waterway on the same structure. A well-illustrated article on railways in WWI concentrated on the 600mm gauge used by all sides. Many of the locomotives have been preserved.

W. www.wdmes.co.uk

In *The Journal*, October, from the **Society of Model & Experimental Engineers**, Neil Read discusses the vicissitudes of the milling operation, such as finding when all the setting up has been completed that the clamps etc. get in the way of the cutter path. At such times he longs for a less stressful hobby 'like knitting'. Neil, you should talk to my wife, Deborah, a keen and adventurous knitter. She once designed and knitted up, on a flight to NZ, a shawl, which was then published in 'Scarves' by The Guild of Master Craftsmen, page 48. Allen Berman's latest restoration project is a 34 year old, ex-police motorcycle. He says, "You should see the traffic part in front of me!". Jim Cahill discusses spherical turning on the lathe



Welling & DMES tinplate evening (photo courtesy of Malcolm Brown).

whilst Mike Tilby writes on an electronically controlled boiler.

W. www.sm-ee.co.uk

The Bristol Model Engineer, autumn, from 'guess who?', begins with a photo of member Davinder Matharu who won 'Best in Show' for his Fowler Showman's Engine. He is now learning how to drive it. A modern touch is provided by the LED coloured lights under the canopy. The display of stationary engines included Steve Birch's Lister VA 'Startomatic'. Many remote (and not so) houses had these, where switching on a light started the generator and switching off closed it down. (One of my 1960s Scout friends lived in such a house only a couple of miles from the centre of Keighley but it was isolated down a long farm track.) Member John Whales' 10-year-old granddaughter, Neve Jeffrey, won the Primary Leader Engineers' Award (www.primaryengineer.com) out of 2700 entrants by suggesting a pair of binoculars fitted with a memory bank, so arranged that a bird seen in the 'bins' would be identified.

W. www.bristolmodelengineers.co.uk

The Prospectus, October, from **Reading Society of Model Engineers**, begins with '61249' moving on from railway operations to pastures new, more connection with research and more relations with the 'outside world'. He goes on

to consider the increasing demands placed upon the contact between rail and wheel, the size of a 5p piece, by faster, heavier traffic.

W. www.rsme.org

The Aylesbury Link, autumn, from **Vale of Aylesbury Model Engineering Society**, has Roy Urquhart being offered a part built locomotive, which turned out to be a 5 inch gauge Stirling Single. The late maker had been a Technical Instructor at Rolls Royce. This was likely to be a well-made model, so he accepted it. It is now finished and the benefactors were pleased to see it finally running. Editor Robin Howard, visited a garden railway in Kent, which featured a novel distraction. What do you do while you work in the shed? This Gauge Three Gathering host had a large iguana (Iggy) a couple of feet long and the weight of a medium dog. Unlike prattling DJs on the radio, Iggy listened, but never spoke (like the Wise Old Owl – Geoff). Robin also relates a cautionary tale, in which a young man at work visited the loo and felt a severe pain in a delicate place. Leaping up, he discovered a dormouse sinking its teeth into him. It fell back into the bowl, so he grabbed it and tried to wash it in the hand basin. It bit him again, drawing blood. To add insult to injury, the recipients of this tale of woe could hardly



Kevin's conservatory (photo courtesy of Kevin Rackham).

suppress their laughter and had to leave the room for fear of causing further hurt. To cap his embarrassment, he had to fill in an Accident Report, thus retaining the fascinating details of the injury to his posterior for posterity... Chris Hallaway writes about the French work on high speed railways in the 1950s. He describes the bogies, which were rather complex but were a key to the high speeds obtained - 204 mph. A good idea from Germany; a designated place for smokers, not inside a warm, glazed shelter, oh no, the wettest, windiest spot available. That'll larn 'em!

W. www.vames.co.uk

Ryedale Society of Model Engineers' September *Monthly Newsheet* relates that Mike Merrick fitted a sound chip to an '08' shunter. Interesting hearing a diesel shunter 'chuffing' but it raises other possibilities. Gas turbines, galley slaves, dog sleds...?

W. www.rsme.org.uk

Grimsby & Cleethorpes Model Engineering Society's *The Blower*, October, reports that George Stephenson's 1822 notebook has been discovered in Network Rail's archive in York. This was also mentioned in today's (Oct 20th) paper. (That's quite a time difference, the jungle drums must be on a work-to-rule at the moment. Perhaps there was a dispute about a guard... - Geoff) The notebook had not been seen

since the 1950s

W. www.gcmes.com

City of Oxford Society of Model Engineers, CoSME *Link*, autumn, has John Winn visiting the 46th steamboat rally in New Hampshire, USA. For a video featuring some of the attending boats see '2018 Lees Mills Steamboat Meet'. He also visited the Clark's Trading Post, also in NH, and describes the locomotives they have. The Dreaming Spires Rally combined with the Northern Association Rally was expected to be larger than usual but 'twas not to be. Twenty locomotives visited from as far afield as Derby and Romney Marsh. A cautionary tale from Richard Brown concerns a golf club, the volunteer manager of which set out, at night, with no safety gear, and a chainsaw, to do some tree pruning. He was found dead next morning. The club was heavily fined for neglecting to train its people and not enforcing the proper use of equipment. David Price describes a Pole Road logging locomotive of 1885 (before Shay & other locomotives were properly developed) which ran on tracks made from trees (poles) using double-flanged wheels. David also writes on a ploughing engine boiler explosion of 1886. The cause was locked-down safety valves and lack of regular inspections, not helped by the fact that the inspection manhole was

covered by the cylinders...

W. www.cosme.org.uk

Halesworth & District Model Engineering Society's *Autumn Newsletter*, has a small item which says, 'It happens'. Things go wrong, we make a mistake, or are not concentrating, and damage ensues. Fess up! It isn't a capital offence, it has happened to us all. I remember the owner of an engineering company, where I briefly worked, finding a broken tool in a quiet corner. The force required to break it must have been immense but he was more disappointed that the perpetrator chose to hide it rather than come clean. Colin Walton has rebuilt a 1932 Riley, making the aluminium bodywork himself on an English wheel, which he also built himself, finding the commercial examples too expensive. The engine is a 1087cc twin cam, crossflow engine, still common in vintage racing and capable of being highly tuned. On a visit to Hemsby 7¼ inch gauge track, Dale Mitchell encountered a goods train driver who said he didn't like backseat drivers, so he eschewed hauling passengers in favour of 'less

troublesome' trucks... Kevin Rackham is building a full-size replica of one end of the *Titfield Thunderbolt* carriage (the bar end, obviously...) in his conservatory. A brilliant (!) idea was that the internal lights were LEDs inside the cut-off thumb of a latex glove. This was placed inside a wire frame covered by a crepe bandage, imitating gas mantles, which looks very good. This is the rest of his conservatory (photo 5). W. www.hdmes.co.uk

I have not written up two newsletters as I could find nothing in them which I thought might interest my readers. If a favourite is not mentioned, it could be yours! No names...

Also from Hack Green, bureaucracy, like cockroaches, will survive a nuclear war... (photo 6).

And finally, 'one liners' from Norwich - I've always liked one-liners. That's why I'm a fan of monorails.

Contact:
geofftheasby@gmail.com



No comment!

DECEMBER

- 5 Brandon DSME.** Meeting at The Ram Hotel, Brandon, 7.45pm. Contact: Mick Wickens, 01842 813707.
- 5 Leeds SMEE.** Christmas dinner at The Owl at Hambleton. Contact Geoff Shackleton: 01977 798138.
- 6 Cardiff MES.** Talk: 'Confessions of a Private Eye' – George Braby. Contact Rob Matthews: 02920 255000.
- 6 Sutton MEC.** Bits and Pieces. Contact Paul Harding 0208 2544749.
- 7 North London SME.** Festive gathering. Contact Ian Johnston: 0208 4490693.
- 7 Portsmouth MES.** Club quiz, Tesco Fratton Centre, 7.30pm. Contact Roger Doyle: doyle.roger@sky.com
- 7 Rochdale SMEE.** Auction Night, at Castleton Community Centre, 7.30pm. Contact Rod Hartley 07801 705193.
- 8 Rochdale SMEE.** Santa Special at Springfield Park, 7.30pm. Contact Rod Hartley 07801 705193.
- 8 Romney Marsh MES.** Xmas lunch at the Masonic Hall, Dymchurch, 12.30pm. Contact Adrian Parker: 01303 894187.
- 9 Bradford MES.** Northcliff Santa special, 11am – 3pm, Northcliff track. Contact: Russ Coppin, 07815 048999.
- 9 Cardiff MES.** Santa special. Contact Rob Matthews: 02920 255000.
- 9 Guildford MES.** Christmas Event 11am-3pm. Contact Mike Sleigh: pr@gmes.org.uk

- 9 North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-dusk. Contact Ken Parker: 07710 515507.
- 9 Sutton MEC.** Bits and Pieces. Contact Paul Harding 0208 2544749.
- 9 Worthing & District SME.** Public running with Santa, 10.30am – 2.30pm. Contact Geoff Bashall: 01903 722973.
- 11 Northampton SME.** Talk: Andrew Lounds – 'Soho Foundry (Boulton & Watt Black Country)', 7.30pm. Contact: secretary@nsme.co.uk 07907 051388.
- 11 Romney Marsh MES.** Members' social afternoon, 2pm. Contact Adrian Parker: 01303 894187.
- 13 Sutton MEC.** Quiz night. Contact Paul Harding 0208 2544749.
- 13 Worthing & District SME.** Club meeting – video evening, 7.30pm. Contact Geoff Bashall: 01903 722973.
- 16 North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-dusk. Contact Ken Parker: 07710 515507.
- 16 Rochdale SMEE.** Santa Special at Springfield Park, 7.30pm. Contact Rod Hartley 07801 705193.
- 16 Westland & Yeovil DMES.** Track running day 11am – 4.30pm. Contact Bob Perkins: 07984 931 993.
- 16 Tiverton & District MES.** Running day at Rackenford track. Contact Bob Evenett: 01884 252691.
- 18 Grimsby & Cleethorpes MES.** Monthly meeting and Christmas social, Waltham Windmill, 7.30pm. Contact Dave Smith: 01507 605901.

- 18 Northampton SME.** Christmas social evening 7.30pm. Contact: secretary@nsme.co.uk 07907 051388.
- 18 Nottingham SMEE.** Talk: 'Experiences Big and Small in Railway Insurance' - Anthony Taylor. Contact Pete Towle: 0115 987 9865.
- 18 Romney Marsh MES.** Members' social afternoon, 2pm. Contact Adrian Parker: 01303 894187.
- 18 Wigan DMES.** Bring & Buy with mince pies. Contact Kevin Grundy: 01942 522303.
- 19 Bristol SMEE.** Members' night. Contact Dave Gray: 01275 857746.
- 19 Leeds SMEE.** Meeting night – 'Quiz Night'. Contact Geoff Shackleton: 01977 798138.
- 19 Salisbury DMES.** Christmas social. Contact Jonathan Maxwell: 01722 320848.
- 20 Sutton MEC.** Club night. Contact Paul Harding 0208 2544749.
- 23 North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-dusk. Contact Ken Parker: 07710 515507.
- 26 Grimsby & Cleethorpes MES.** Boxing Day charity run, Waltham Windmill, 11am-3pm. Contact Dave Smith: 01507 605901.
- 26 Leeds SMEE.** Public running and Boxing Day steam-up, Eggborough track from 10am. Contact Geoff Shackleton: 01977 798138.
- 26 Sutton MEC.** Boxing Day run, 10am-2pm. Contact Paul Harding 0208 2544749.
- 26 Worthing & District SME.** Post Christmas

steam-up. Contact Geoff Bashall: 01903 722973.

- 27 Bradford MES.** Mince pie steam-up, 12:30pm until frostbite sets in, Northcliff track. Contact: Russ Coppin, 07815 048999.
- 30 North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-dusk. Contact Ken Parker: 07710 515507.

JANUARY

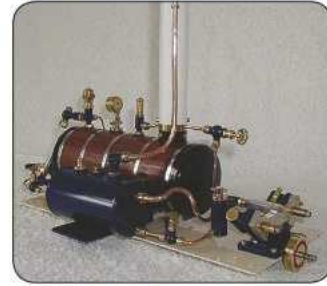
- 1 Grimsby & Cleethorpes MES.** New Year's Day charity run, Waltham Windmill, 11am-3pm. Contact Dave Smith: 01507 605901.
- 1 Romney Marsh MES.** New Year's Day track meeting, 11am onwards. Contact Adrian Parker: 01303 894187.
- 2 Bradford MES.** Bits and pieces evening, 7:30pm, Saltaire Methodist Church. Contact: Russ Coppin, 07815 048999.
- 2 Brandon DSME.** Meeting at The Ram Hotel, Brandon, 7.45pm. Contact: Mick Wickens, 01842 813707.
- 3 Sutton MEC.** Bits and Pieces. Contact Paul Harding 0208 2544749.
- 4 North London SME.** Videos, slides and photographs evening. Contact Ian Johnston: 0208 4490693.
- 5 Tiverton & District MES.** Running day at Rackenford track. Contact Chris Catley: 01884 798370.
- 5 Westland & Yeovil DMES.** Frostbite run 11am – 4.30pm. Contact Bob Perkins: 07984 931993.
- 8 Romney Marsh MES.** An evening with Andy Nash, 7.30pm. Contact Adrian Parker: 01303 894187.

The Best of **BRITISH STEAM**

Beautifully Crafted Models Handmade to Order by John Hemmens

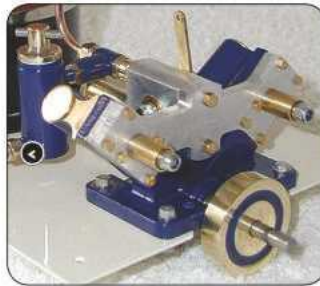
My Ribblesdale and Wharfedale plants are individually made to the highest standard demanded by my customers around the world. They are recognised as wonderful collector's pieces that over time will increase in value as have many of my other models I have made over the last 48 years.

I can proudly state that my models are "Made in Yorkshire" the birthplace of many of the best Engineers in the world



The illustration shows the "Ribblesdale" boiler mounted on a common bedplate with the "Richmond" twin cylinder steam engine and a steam oil separator. The "Ribblesdale" boiler is constructed from copper components and silver soldered. The boiler is stoved with high temperature paint at 175 degrees C. The boiler is lagged with individual hardwood planks and held by stainless steel bands. To improve the boiler performance it is fitted with a ceramic burner. The finished boiler is pressure tested to 150 psi for continuous working pressure of up to 80 psi. A test certificate is supplied with the boiler confirming the test and guarantee of quality. The boiler is fitted with a water filler bush, pressure gauge, water gauge glass and blowdown valve, safety valve, vacuum valve, steam on/off valve, ceramic gas burner, gas pipe and gas on/off valve. The white/cream stove painted chimney is pre-drilled for the exhaust pipe bracket should you wish to extend the exhaust pipe alongside the chimney.

This plant is priced at £1550



The illustration shows the "Wharfedale" boiler mounted on a common bedplate with the "Richmond" twin cylinder steam engine and a steam oil separator. The boiler can be fitted with either the "Richmond" engine or "York" engine and a steam oil separator. These can be purchased as single items. The "Wharfedale" boiler is constructed from copper components and silver soldered. The boiler is stoved with high temperature paint at 175 degrees C. The boiler is lagged with individual hardwood planks and held by stainless steel bands. To improve the boiler performance it is fitted with a ceramic burner. The finished boiler is pressure tested to 150 psi for continuous working pressure of up to 80 psi. A test certificate is supplied with the boiler confirming the test and guarantee of quality. The boiler is fitted with a water filler bush, pressure gauge, water gauge glass and blowdown valve, safety valve, vacuum valve, steam on/off valve, ceramic gas burner, gas pipe and gas on/off valve. The white/cream stove painted chimney is pre-drilled for the exhaust pipe bracket should you wish to extend the exhaust pipe alongside the chimney and also includes a polished brass flared top. This plant is suitable for installation in all my boat products with ample power to drive your boat satisfactory.

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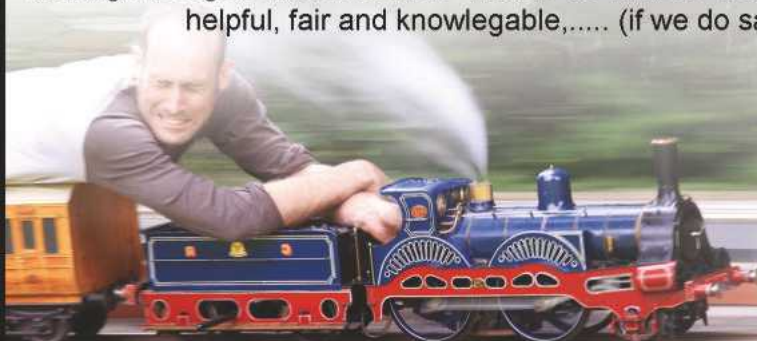
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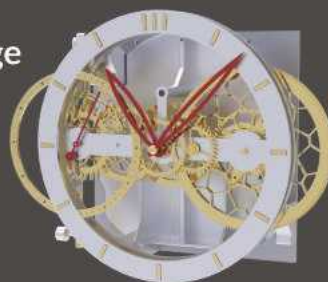
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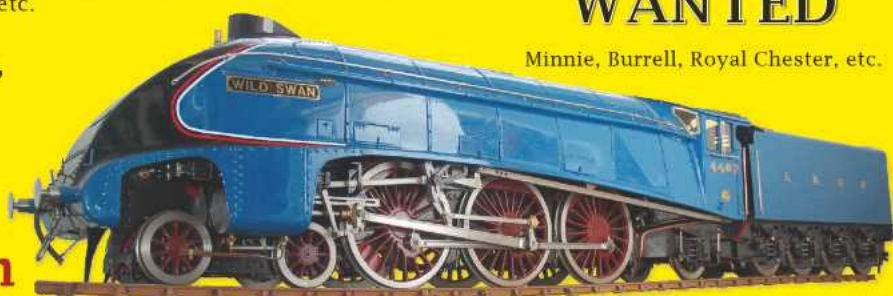
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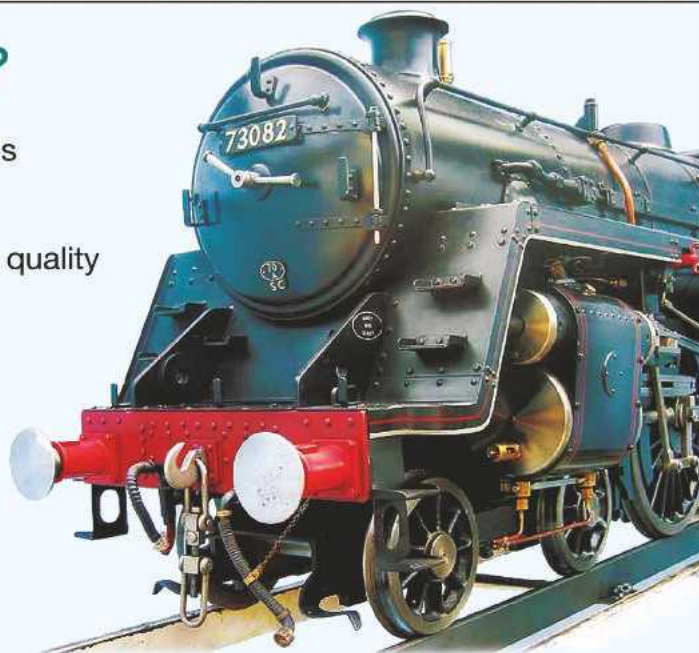
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£1725

Boxford MK111 CUD 5" x 28" long bed



£165

Tool cabinet complete



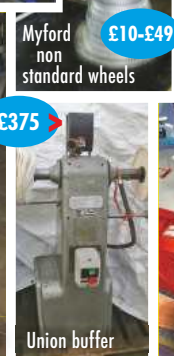
£1475

Myford VMC mill



£375
very nice example!

Startrite Mercury drill



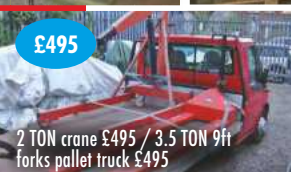
£375

Union buffer



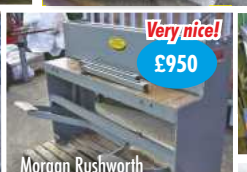
£325

Hegner Multicut-1 blades



£495

2 TON crane £495 / 3.5 TON 9ft forks pallet truck £495



Very nice!
£950

Morgan Rushworth 50" x 16g



£3950

Denford Turn 270 Pro CNC



£30 each

Myford chuck & nose collets



WD-40

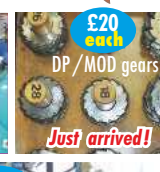
£20 each

WD-40



£425

Clarke 917 vacuum forming machine



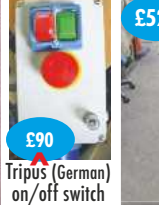
£20 each

DP/MOD gears



Special 5 for £20

Myford ML7 Super 7 Rifle Bridge bed felts



£90

Tripus (German) on/off switch



£525

Union 10" pedestal grinder



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



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Harrison M300 lathe + gap



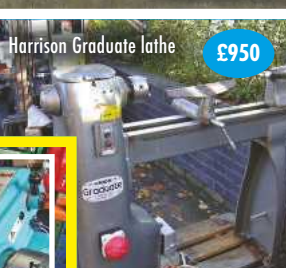
£195
Back in!

Stanier 55mm precision swivel machine vice from NEW ZEALAND 'Finest Engineering'



£325

SIP stratus 41050 3HP compressor



£950

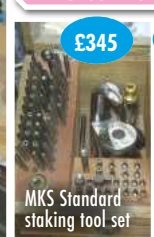
Harrison Graduate lathe



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Mitchell 10 1/2" x 72" + gap lathe

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MKS Standard staking tool set



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WV150

Yorkleen WV150 extractor



£240V
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RJh buffer



240volts!
£5950
Nottingham

Myford Super 7 Sigma Big Bore lathe + Tesla 750 inverter, excellent example



240volts!
£6950
Nottingham

Myford Super 7B Plus Big Bore lathe + Tesla 750 inverter, cabinet stand excellent example



£375

RJh grinders grinder/buffer



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Diamond grinding wheels



£725

Blacksmiths anvil (tinmans) stakes!



Myford ML10 lathe



£20 Each

Bench + 2 vices



£345
original as new!

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Tom Senior Mill



£225

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240volts!
£425

Boxford Little Giant toolpost grinder



£345

Waltons jenny



Nice
£375

J & S 4" swivel/tilt machine vice + handle



£845

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